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1.1 Warning and precaution

1.1.1 Description and operation

1.1.1 Warning and precaution

Definition relating to "Warnings", "Important precaution" and "Notes

Diagnosis and maintenance procedure in this manual include general and specific "Warnings", "Important precaution " and " Notes". Geely takes efforts to provide maintenance information to help after-sales technicians diagnose and repair the system and ensure the vehicle can run normally. But some procedures may present danger to technicians if they do not perform operations following the recommended methods.“Warning”, “Important precaution” and “Notes” are to prevent the occurrence of such danger. Not all risks are foreseeable. They are at apparent position s in the maintenance manual. This information is prepared to prevent the following cases:

– Severe personal injury

– Vehicle damage

– Unnecessary vehicle repair

– Unnecessary replacement of components

– Improper maintenance or components replacement

Definition of "Warning

A "Warning" means a procedure that must be taken or a prohibited procedure. If a "warning" is ignored, it may have the following consequences:

– Severe personal injury

– If a vehicle is not properly repaired, it may cause severe personal injury to the driver and / or passengers.

Definition of “Important precaution”

“Important precaution” requires paying special attention to a procedure which must be taken or a prohibited procedure. If an “Important precaution” is ignored, it may have the following consequences:

– Vehicle damage

– Unnecessary vehicle repair

– Unnecessary replacement of components

– Improper operation of the repaired systems or components and abnormal performance

– Damage to related systems or components

– Damaged to fasteners, tools or special tools

– Engine coolant, lubricating oil or other main fluid leakage

"Notes" definition

"Notes" the statement stressed necessity of diagnosis or maintenance procedure, "Notes" Statement object as follow:

– Clarify the procedures

– Provide additional information for completing a procedure

– Clarify the recommended procedures for operational reasons

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– Provide information help for technicians to complete the repair in more effective way

– Provided empirical information with technician to complete easily process

Warning for lifting vehicle

To avoid any vehicle damage, serious personal injury or death when major components are dismantled from the vehicle and the vehicle is supported by a hoist, support with jack the components standing at the opposite end from which the components are being dismantled of the vehicle.

Warning for ABS system component handling

Warning: Certain components in the anti-lock brake system (ABS) are not intended to be serviced individually. Attempting to dismantle or disconnect certain system components may result in personal injury and/or improper system operation. Only those components with approved removal and installation procedures should be serviced.

Warning for approved equipment for collision repair

Warning: To avoid personal injury because exposed to welding flashes or to galvanized (Zinc Oxide) metal toxic fumes while grinding/cutting on any type of metal or sheet molded compound, you must work in a properly ventilated area, wearing an approved respirator, protective goggles, earplugs, welding gloves, and protective clothing.

Warning for assistant driving

Warning: An assistant should drive the vehicle while the technician inspects the position of the reported condition. Otherwise, personal injury could occur.

Warning for battery disconnection

Warning: unless directed otherwise in the operating procedures, the ignition key must be at the OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable if a tool or any equipment easily comes in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

Warning: Before maintaining airbag, the battery negative shall be disconnected for 90 seconds at least.

Warning of brake dust

Warning: When repairing the wheel brake part, please avoid the following operations:

– Do not polish brake friction lining

– Do not polish brake friction lining by abrasive paper

– Do not clean wheel brake part by dry brush or compressed air

Warning : some model or after-sale retrofitting brake part may has fiber, fiber mix in the dust, some dust with fiber was breathed to cause badly bodily injury, please clean any dust on the brake part by wet cloth.

Warning for brake fluid

Warn: The brake fluid is extremely easy to absorb humidity and moisture. Do not use the brake fluid that may be polluted by water in open container, because the use of improper or contaminated brake fluid may lead to system failure, losing control of the vehicle and personal injury.

Warning for brake fluid irritation

The brake fluid has irritation to skin and eyes. If contact, you shall adopted measures as follow:

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– Eye contact - completely wash with clean water.

– Skin contact – use soap water or clean water to wash.

Warn for brake pipe replacement

Warning: carefully route and retain the brake pipes replacement. Always use the correct fasteners. Otherwise, it may cause damage to the brake pipes and brake system resulting in personal injury.

Warning for suction R134a

Warning: To avoid inbreathing A/C coolant 134a (R134a) and lubrication oil steam or mist, touching them can irritate eyes, nose and throat. It should work in area with favorable ventilation. Qualified maintenance equipment (R134a recycling equipment) that meets the requirements of SAEJ2210 should be adopted when R134a is discharged from air conditioner system. If the system discharges accidentally, ventilate the work area prior to continuing to repair. Other information related to health and safety can be obtained from the coolant and lubrication oil manufacturers.

Warning of brake dust

When servicing clutch components, do not create dust by grinding or sanding the clutch disc or by cleaning parts with a dry brush or with compressed air. A water-dampened cloth (NOT SOAKED) -should be used. Clutch disc may contain fiber, which can be mixed into air if dust is produced during maintenanc; Inbreathing dust containing fiber can damage your health severely.

Warning for collision section

Failure to do so may compromise the structural integrity of the vehicle and cause personal injury if the vehicle is in a collision.

Warning for window crack

If part of glass for vehicle window is cracked but still intact, crisscross the glass for vehicle window with masking tape in order to reduce the risk of damage or personal injury.

Warning: Warning for exhaust maintenance

Warning: In order to avoid scalding, please do not repair exhaust system when it is hot.。

Please perform maintenance after the exha

Warning for window lifting function

Operate the power window switch when working inside the driver door. When operated, the Quick Lifting function allows the window to move very quickly without stopping, which could cause personal injury.

Warning for eye protection

Warning: Please wear permissive eye protective glasses and gloves to minimize health risk when executing this procedure.

Warnings for acoustic insulation foam material

Warning: when fire is to be used during vehicle maintenance, acoustic insulation foam material within range of 152.4mm (6 in) from the fire must be cleared. To avoid inbreathing dust when repacking the acoustic insulation foam material, otherwise it will be harmful to your health.

Warnings for fuel oil and evaporation drain pipe

Warning: In order to minimize fire and health risk, please abide by the follows:

– Replace all fuel pipes that are nicked, scratched or damaged during installation, do not attempt to repair the fuel pipes.

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– Do not hammer directly on the clips of fuel harness body when installing new fuel pipes.

– When using welding gun to conduct operation near fuel steam pipe, it is necessary to use wet cloth to cover the fuel steam pipe. In addition, neither start the vehicle and expose it under the temperature of above 115℃ (239 °F) for more than 1h, nor stay a long time under the temperature of above 90℃ (194 °F).

- Always apply a few drops of clean engine oil to the male pipe ends before connecting fuel pipe fittings. This will ensure proper reconnection and prevent a possible fuel leak. (During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.)

Warning for fuel gauge leakage

Warning: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

Warning for fuel pipe connector

Warning: Always apply a few drops of clean engine oil to the male pipe ends before connecting the fuel pipe fittings in order to reduce the risk of fire and personal injury. This will ensure proper reconnection and prevent a possible fuel leak. During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.

Warning for fuelstorage

Warning: Do not drain the fuel into an open container, never store the fuel in an open container due to the possibility of a fire or an explosion.

Warning for fuel vapor in the evaporative emission components

Warning: Do not breathe the air through the EVAP or hoses. The fuel vapors inside the EVAP may cause personal injury.

Warning for gasoline/gasoline vapors

Warning: Gasoline and gasoline vapor is highly flammable. In order to avoid fire or explosion, please select to keep away from a fire. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical fire extinguisher prepared nearby.

Warning for glass and sheet metal handling

Warning: When handling any glass or metal plate with sharp edges or burrs, please wear permissive safety goggles and gloves to reduce the personal injury risk.

Warning for halogen bulb

Warning: Halogen bulbs contain gas under high pressure. Handling a bulb improperly could cause it to shatter into flying glass fragments. To help avoid personal injury:

– Turn off the lamp switch and allow the bulb to cool before replacing the bulb.

– Leave the lamp switch OFF until the bulb replacement is complete.

– Always wear protective goggles when replacing a halogen bulb.

– Handle the bulb only by its base. Avoid touching the glass.

– Keep dirt and moisture off the bulb.

– Properly dispose of the used bulb.

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– Keep halogen bulbs out of the reach of children.

Warning for injector O-ring dismantle

Warning: inspect the lower (small) O-seal ring of various oil sprayers, which can not be retained on the lower manifold branch to reduce the fire and personal injury risk.

Warning: If the O-ring is not dismantled with the injector, the replacement injector with new O-rings will not seat properly in the injector socket. Improper seating could cause a fuel leakage.

Warning for moving component and hot surface

Warning: Avoid contacting with moving components and hot surfaces while working around a running engine in order to prevent personal injury.

Warning for protective goggle and glove

Warning: Approved protective goggles and gloves should be worn when removing the exhaust system components, or else the sharp edge or the iron rust dropped down from the exhaust system components may cause serious personal injury.

Warning for fluid reservoir cover

Warning: To avoid being burned, do not remove the fluid reservoir cover while the engine is hot.

If the reservoir cap is dismantled when the engine and the radiator are still hot, the cooling system will drainscalding high-pressure fluid and steam.

Warning for cooling system maintenance

Warning: provided that there is pressure in the cooling system, the solution temperature is higher more than the boiling temperature even if the solution in the radiator is not boiling. If pressure cap is removed while the engine is still hot and under pressure during maintenance, the engine coolant will boil immediately and spray into the operator's body, causing serious burns.

Warning ofr drain fuel pressure

Warning: Remove the fuel tank cap and drain the fuel system pressure before servicing the fuel system in order to reduce the risk of personal injury. After you drain the fuel system pressure, a small amount of fuel may drain when servicing the fuel circuit, the fuel injector, or the connections. In order to reduce personal injury

Harmful risk: wrap the fuel system component with a rag prior to disconnection. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.

Warning for road test

Warning: Road test a vehicle under safe conditions and while obeying all traffic laws. Do not attempt any maneuvers that could jeopardize vehicle control. Failure to adhere to these precautions could lead to serious personal injury and vehicle damage.

Warning for safety goggles and fuel

Warning: be sure to wear the safety goggles when processing the fuel in order to avoid the fuel from splashing into the eyes.

Warning for airbag system

Warning: this vehicle is equipped with the SRS system; the following conditions may be caused if not following the correct operation procedure:

– Airbag unfold

– Preloader blister

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– Injured person

– Unnecessary airbag system maintenance

Warning: comply with the following criteria in order to avoid the above situations:

– Refer to airbag system component views in order to determine if you are performing service on or near the airbag system components or the airbag system wiring.

– If you are doing the repair on the airbag system components, surrounding components or the circuits, remove the airbag system.

Warning for high temeprature of deployed airbag module

Warning: After deployment, the metal surfaces of the airbag system component may be very hot. To help avoid a fire or personal injury:

– Allow sufficient time for cooling before touching any metal surface of the airbag system component.

– Do not place the deployed airbag system component near any flammable objects.

Warning for airbag system clock spring

Warning: Improper installation of the clock spring assembly may damage the spiral coil inside the clock spring. This may result in a malfunction of the coil which may make the airbag module do not work normally and cause personal injury.

Warning for airbag system module disposal

Warning: In order to prevent accidental deployment of the safety system and avoid the risk of personal injury, do not dispose of an unexpanded airbag module as normal shop waste. Unexpanded airbag modules contain substances that could cause severe illness or personal injury if their sealed containers are damaged during disposal. Use the following deployment procedures to safely dispose of an unexpanded airbag module.

Warning for taking and storing airbag system module

Warning: When carrying an unexpanded airbag module:

– Do not carry the airbag module by the wires or connector.

– Make sure the airbag opening do not point towards you and others.

Warning: when storing unexpanded airbag module, ensure the opening does not face the surface on which it will be placed. Do not point the airbag opening to the ground. Do not place any items onto the airbag module. Provide free space for the airbag to expand in case of an accidental deployment.

Do not have the unexpanded airbag module soaked in water or come into contact with other liquids.

Do not place the unexpanded airbag module near the fire source or a high-temperature area. Prevent personal injury caused by accidental airbag deployment.

Warning for handling airbag system collision sensor

Warning: Do not hit or shake airbag system collision sensors. Before supplying power to the collision sensors, ensure the collision sensors are firmly tightened. Failure to follow the correct procedures may cause airbag accidental deployment or inoperative, resulting in personal injury.

Important precaution for filling fluid to the brake system

Important precaution: When filling fluid to the brake master cylinder reservoir, use DOT4 brake fluid from a clean, sealed brake fluid container. The use of any type of fluid other than the

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recommended type of brake fluid may cause contamination which could result in damage to the internal rubber seals and/ or rubber linings of hydraulic brake system components.

Important precaution for Anti-corrosion materials

Important precaution: If the power steering system has been serviced, an accurate fluid level reading cannot be obtained unless air is bled from the steering system. The air in the fluid may cause pump cavitation noise and may cause power steering pump damage over a period of time.

Important precaution for belt dressing

Important precaution: Do not use belt dressing on the drive belt. Belt dressing causes the breakdown of the composition of the drive belt. Failure to follow this recommendation will damage the drive belt.

Important precaution for brake caliper

Important precaution: Support the caliper with a piece of wire when removing the brake caliper to prevent damage to the brake line.

Important precaution of brake fluid effects on the paint and electrical parts

Important precaution: Avoid spilling brake fluid onto painted surfaces, electrical connections, wiring, or cables. Brake fluid will damage painted surfaces and cause corrosion to electrical components. If any brake fluid comes in contact with painted surfaces, immediately flush the area with water. If any brake fluid comes in contact with electrical connections, wiring, or cables, uses a clean shop cloth to wipe away the fluid.

Important precaution for damage to fuel tank straps

Important precaution: Do not bend the fuel tank straps. Bending the fuel tank straps may damage the straps.

Important precaution for engine emissions

Important precaution: Modifications made to the following systems can effect the vehicle's emission controls and may cause the Malfunction Indicator Lamp (MIL) or “Inspect Engine Lamp” to illuminate.

- Engine
- Transmission
- Exhuast System
- Fuel system

Important precaution: if the replaced tire is not accorded with the performance standard of the original tire, the emission control of the vehicle may also be affected, which may also result in turning on the malfunction indicator lamp (MIL), and "check engine" indicator lamp.

Important precaution: Modifications to these systems or the installation of tires with incorrect TPC could lead to repairs that are not covered by the manufacturer's warranty. This may also cause a required Emission Inspection/Maintenance test to fail.

Important precaution for engine lifting

Important precaution: When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Lifting the engine in an unapproved manner may cause component damage.

Important precaution for engine bracket

Important precaution: Broken engine bracket s can cause misalignment of certain drive-train components which then will cause eventual destruction of the drive-train components.

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Important precaution: If one engine bracket breaks, the rest engine bracket s will have increased stress put on them. This could cause the rest of the engine bracket s to break.

Important precaution for excessive adhesive on flywheel bolts

Important precaution: Apply the proper amount of the sealant to the fastener when assembling this component. Excessive use of the sealant can prohibit the component from being assembled properly or allow the fastener to loosen. A component or fastener that is not assembled properly can loosen or fall off leading to extensive engine damage.

Important precaution for exhaust manifold and Oxygen sensor

Important precaution: The oxygen sensor may be difficult to remove when the engine temperature is above 48°C (120°F). Excessive force may damage threads in the exhaust manifold or the exhaust pipe.

Important precaution for exhaust system inspection

Important precaution: When inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to prevent overheating of the floor pan and possible damage to the passenger compartment insulation and trim materials.

Important precaution for torque reaction against timing drive chain

Important precaution: A wrench must be used on the hex of the camshaft when removing or installing in order to prevent component damage. Failure to prevent the torque reaction against the timing drive chain can lead to timing drive chain failure.

Important precaution for dismantling external logo

Important precaution: Use a plastic, flat-bladed tool to prevent paint damage when removing an emblem/name plate.

Important precaution for fastener

Important precaution: Use the correct fastener in the correct position . part number of replaced fasteners must be correct. Fasteners requiring replacement of or fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. Do not use paints, lubrication oil, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified.

These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and tightening torque when installing fasteners in order to avoid damage to parts and systems.

Important precaution for fuel pressure

Important precaution: Do not allow the fuel pressure to exceed the specified value because it may lead to damage to the fuel pressure regulator or fuel pressure gauge.

Important precaution on Handling Electrostatic Discharge Sensitive Components

Important precaution: Electrostatic discharge (ESD) can damage many solid- state electrical components. ESD susceptible components may not be labeled with the ESD symbol. Handle all electrical components carefully. Use the following precautions in order to avoid ESD damage:

- Touch a metal ground point in order to remove your body's static charge before servicing any electronic component (especially after sliding across the vehicle seat).
- Do not touch exposed terminals. Terminals may connect to circuits susceptible The ESD damage.
- Do not allow tools to contact exposed terminals when servicing connectors.
- Do not remove components from their protective packaging until required to do so.

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– Avoid the following actions unless required by the diagnostic procedure:

– Make connector jumper and ground

– Connecting test equipment probes to components or connectors. Connect the ground lead first when using test probes.

Ground the protective packaging of any component before opening it. Do not rest solid-state components on metal workbenches, or on top of TVs, radios, or other electrical equipments.

Important precaution for heat-type oxygen sensor and oxygen sensor

Important precaution: Do not remove the leading line from either the oxygen sensor (HO2S). Removing the leading line or the connector will affect sensor operation.

Important precaution: Handle the oxygen sensor carefully. Do not drop the HO2S. Keep the in-line electrical connector and the louvered end free of grease, dirt, or other contaminants.

Do not use cleaning agent of any type.

Important precaution: Do not repair the wiring, connector or terminals.

Replace the oxygen sensor if the leading line, connector, or terminal is damaged.

Important precaution: This external clean air reference is obtained by way of the oxygen sensor signal and heater wires. Any attempt to repair the wires, connectors, or terminals could result in the obstruction of the air reference and degraded sensor performance.

Important precaution: The following guidelines should be used when servicing the oxygen sensor:

– Do not apply contact cleaner or other materials to the sensor or vehicle harness connectors. These materials may get into the sensor to cause poor performance.

– Do not damage the sensor leading line and harness wires in such a way that the wires inside are exposed. This could provide a path for foreign materials to enter the sensor and cause performance problems.

– Ensure the sensor or vehicle lead wires are not bent sharply or kinked. Sharp bends or kinks could block the reference air path through the lead wire.

– Ensure that the peripheral seal remains intact on the vehicle harness connector in order to prevent damage due to water intrusion

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Important precaution for ignition OFF when disconnecting battery

Important precaution: when connecting or disconnecting the battery cable and the battery charger or crossover cable, be sure to turn the ignition switch to the position OFF. Failing to do so may damage the control module or other electronic components.

Important precaution for installing hoses without twists or bends

Important precaution: The inlet and outlet hoses must not be twisted during installation. Do not bend or distort the inlet or outlet hoses to make installation easier. Failure to follow these procedures could result in component damage.

Important precaution for machined surface damage

Important precaution: Do not carve, scratch or damage the sealing surface. The sealing surface is machining surface; and leakage may be caused by the damage to the machining surface.

Important precaution for power system control module and electrostatic discharge

Important precaution: Do not touch the connector pins or soldered components on the circuit board in order to prevent possible electrostatic discharge (ESD) damage to the PCM.

Important precaution for power steering system hose disconnection

Important precaution: Do not start the vehicle with any power steering gear inlet or outlet hoses disconnected. When disconnected, plug or cap all openings of components. Failure to do so could result in contamination or loss of power steering fluid and damage to the system.

Important precaution for ring gear dismantle

Important precaution: Do not pry the gear ring from the differential housing. The gear ring and/or the differential housing may be damaged by prying the gear ring from the differential housing.

Important precaution for sealant

Important precaution: Do not let the room temperature hardening sealant into the threaded blind hole; if the room temperature hardening sealant enters into the threaded blind hole, the fastener produces hydraulic lock-up effect when fastening; the fastener and/or the other compartments may be damaged due to hydraulic lock-up of the fastener; moreover, the fastener will not obtain a correct clamping force when fastening; the part is unable to seal correctly due to wrong clamping force, thereby resulting in leakage; and the fastened can not be properly tightened, so that the part is loose or separates, thereby resulting in serious damage to the engine.

Important precaution for fault diagnosis tester usage

Important precaution: Before perform vehicle diagnostic, pay attention to the following,otherwise it may cause damage to the engine control module.

- The fault diagnosis tester and the software must be up to date.
- Vehicle battery must be fully charged and battery voltage should be 12-14V.
- Fault diagnosis and tester terminals must be firmly connected.
- When programming the engine control module, do not connect the battery to the charger.

Important precaution on steering wheel in the Steering limiting position

Important precaution : do not hold the steering wheel in the steering limiting position longer than 5 s , as damage to the steering pump may result.

Important precaution for test probe

Important precaution: Do not insert test equipment probes (DMM etc.) into any connector or fuse block terminal. The diameter of the test probes will deform most terminals. A deformed terminal will cause a poor connection, which will result in a system failure. Always use approved terminal test kit in order to front probe terminals. Do not use paper clips or other substitutes to probe terminals.

Important precaution: When using the approved terminal test the components, ensure the terminal test adapter choice is the correct dimension for the connector terminal. Do not visually choose the terminal test adapter because some connector terminal cavities may appear larger than the actual terminal in the cavity. Using a larger terminal test adapter will damage the terminal.

Important precaution for using proper power steering fluid

Important precaution: When filling fluid or making a complete fluid change, always use DEXRONⅢ power steering fluid. Failure to use the proper fluid will cause hose and seal damage and fluid leaks.

Important precaution for window edge damage

Important precautions: the window is damaged by bumper due to exposed edge and must be lower 1mm (0.025 in) than the metal plate surface in order to avoid the damage to the window.

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1.2 Vehicle inspection

1.2.1 Description and operation

1.2.1.1 When drive vehicle, first shall be check items

Horn operation

Occasionally press the horn to ensure the speaker is working properly, inspect all the button positions.

Brake system operation

Be aware of any abnormal noise when braking, brake pedal travel increase and repeatedly occurred wheel slip when braking. In addition, if the brake warning light illuminates or flashes, it indicates a fault in the brake system.

Operation of exhaust system

Be aware of the sound change in the exhaust system and odors. These indicate that the system may be leaking or overheating. Inspect the system immediately and repair if necessary.

Tire, vehicle and positioning operation

Be aware of the steering wheel and seats vibration when traveling under normal conditions. It indicates that there may be a need to balance the wheels. In addition, the wheel slip on even roads indicates that there may be a need for tire pressure adjustment or wheel alignment.

Steering system operation

Be on guard against the steering change; when the steering wheel is difficultly revolved, or the free stroke is too long, or there is abnormal sound in steering or parking, need to check. The light pattern shall be observed occasionally for headlamp focusing; if the headlamp focuses wrongly, adjust.

1.2.1.2 Items to be checked during each oil filling.

Any system fluid leak (except the windshield washer) indicates that the system may be faulty. Inspect the system immediately and repair it if necessary.

Inspect engine oil level

Inspect the engine oil level and add the engine oil if necessary. It would be best to inspect when the engine oil is hot.

1. When the engine is shut down, engine oil will flow back to the bottom of the oil pan after a few minutes.
2. Pull out the dipstick.
3. Wipe clean the dipstick and then insert it back.
4. Pull out the dipstick and inspect the oil level.
5. If necessary, add engine oil, so that the oil level maintained between MIN (minimum) line and the MAX (maximum) line. Do not fill an excessive amount of engine oil; otherwise it may cause damage to the engine.
6. After reading the engine oil level, reinstall the dipstick to the engine. If inspecting the engine oil level when the engine is cold; do not start the cold engine. The cold engine oil will not quickly return to the oil pan, thus the correct oil level reading will not be obtained.

Check engine coolant level and conditions

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Check the level of expansion tank and add engine coolant if necessary. Check the engine coolant, replace the dirty engine coolant.

Check the front windshield washer fluid level.

Check the washer fluid level and add fluid if necessary.

1.2.1.3 Check items one time every months at least

Tire, wheel and tire Pressure Inspection

Inspect for abnormal tire wear or damage. Inspect the wheels for damage. Inspect the tire pressure when cold, also inspect the spare tire. Maintain tire pressure as recommended on the label.

Vehicle lamp operation

Inspect the operation of license lamps, headlamps (including the high/low beam lamps), parking lamps, fog lamps, tail lamps, brake lamps, steering lamps, reversing lamps and hazard warning flasher.

Oil and fluid leaks

When the vehicle is parked, regularly inspect whether there is water, engine oil, fuel or other liquids on the ground underneath the vehicle. Water dripping from A/C system after use is normal. If oil leaks or smoke is found, identify the reason and repair if necessary.

1.2.1.4 Check items two times every year at least

Power steering system fluid level

Inspect power steering fluid surface to maintain the correct power steering fluid level.

Brake master cylinder fluid level

Inspect the brake fluid level and maintain the correct fluid level. If the fluid level is too low, it indicates that the disc brake has been worn and needs repairing. Inspect the vent lid to ensure that no dirt and air path blockage.

Clutch pedal free travel

Inspect the free clutch pedal stroke; and adjust if necessary. Measure the distance from the center of the clutch pedal to the floor when not stepping on the clutch pedal. Then, step on the clutch pedal in the end and measure the distance from the center of the clutch pedal to the floor, wherein the difference between the center of the clutch pedal and the floor must be more than 127mm (5.07 in).

Doors and windows seals lubrication

With a clean cloth to apply a layer of silicon lubrication grease coated film.

1.2.1.5 Check items at least once a year

The condition and operation of seat belts

Inspect seat belt system, including the woven belt, buckle, drainbutton, retractor, guide ring and fixtures.

Spare tire and jack storage

Be on guard against quack at the rear of the vehicle; spare tire, all lifting equipment and tools must be always fixed; and the jack ratchet or helical mechanism is lubricated by engine oil after each use.

Key lock maintenance

Lubrication key cylinder

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Body lubrication maintenance

Lubricate all door hinges, including the engine hood, the fuel filler door, compartment (back-door) hinges and locking latch, glove box, console door and any folding seat parts.

Wash the behicle underbody

Firstly, loose the sediment in the vehicle block zones, and then rinse the underbody with clean water. After winter, the underbody is washed at least once a year. The corrosive materials used for deicing and anti-dust will be washed away when we wash the underbody.

Engine cooling system

Warning!

When working around the running engine, avoid contacting with moving components and hot surfaces to prevent injuries.

Inspect the engine coolant. If the engine coolant is too dirty or rusty, drain the engine coolant. Flush the engine cooling system and refill the new engine coolant. Maintain an appropriate concentration of engine coolant in order to ensure the correct antifreeze, anti-corrosion properties and engine operating temperature. Inspect the hoses. Replace the cracked, expanded, or aged hoses.

Inspect fastening clip, cleaning radiators and A/C system condenser outside. Clean filler cap and filler neck tube. Test the pressure in the cooling system and cover to ensure that the system operates properly.

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1.3 Lifting vehicle

1.3.1 Description and operation

1.3.1.1 Lifting vehicle

Warning!

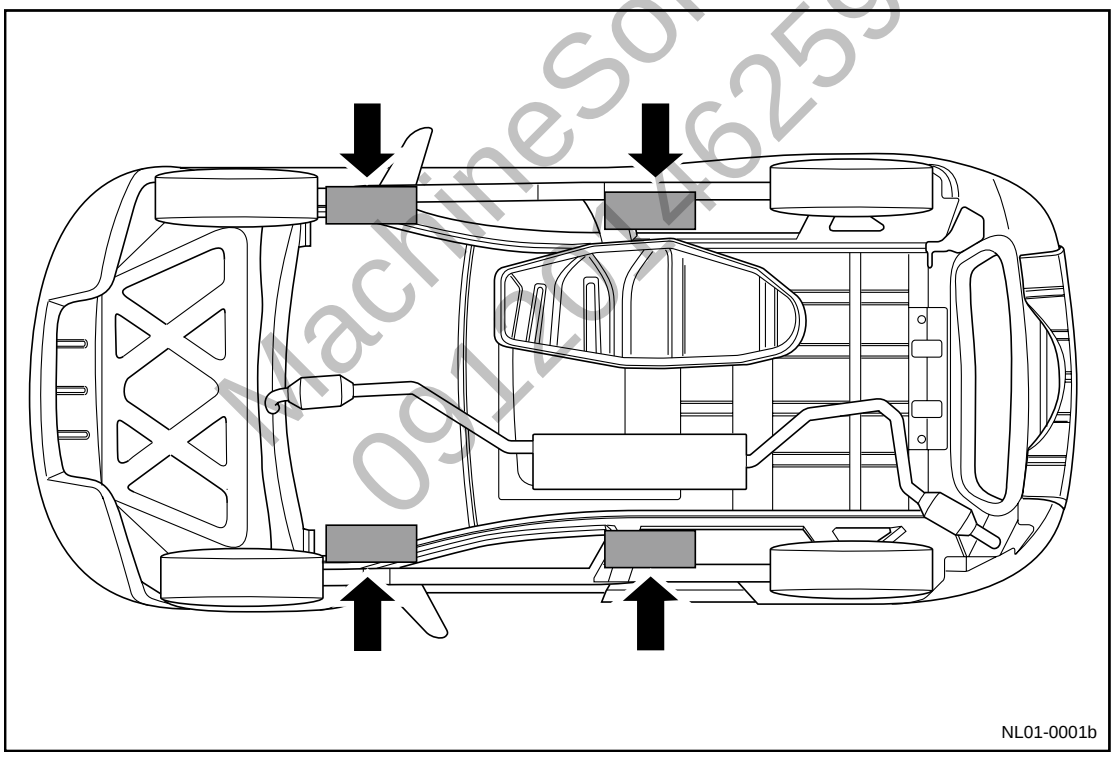
Refer to "warning for Lifting vehicle " in "Warnings and important precaution s".

To avoid personal injury, always use jack stands when you are working on or under any vehicle that is supported only by a jack.

Notes:

When you are jacking or lifting a vehicle at the frame side rails or other prescribed lift points, be certain that the lift pads do not contact the catalytic converter, the brake pipes or the fuel lines. If such contact occurs, vehicle damage or unsatisfactory vehicle performance may result. Before you begin any lifting procedure, be sure the vehicle is on a clean, hard and level surface. Be sure all the lifting equipment meets weight standards and is in good working order. Be sure all the vehicle loads are equally distributed and secure. If you are only supporting the vehicle at the frame side rails, make sure the lifting equipment does not put too much stress on or weaken the frame side rails.

Lifting vehicle positions



Lifting vehicle - Frame contact hoist

Rear hoist pads

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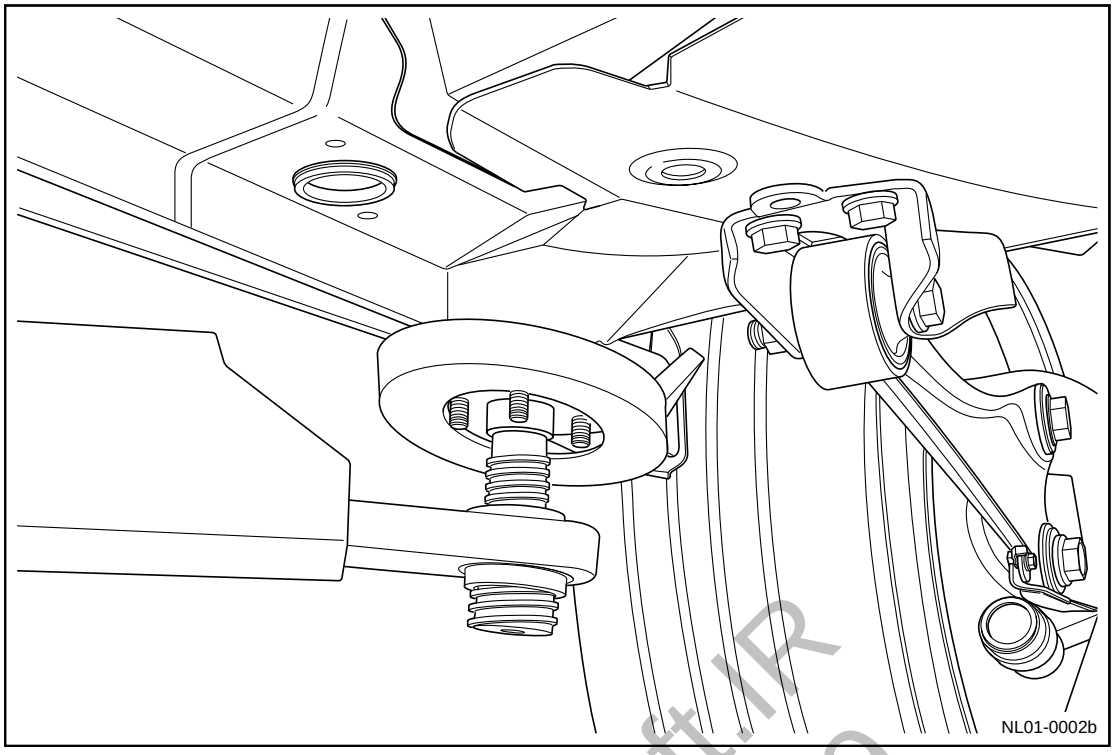
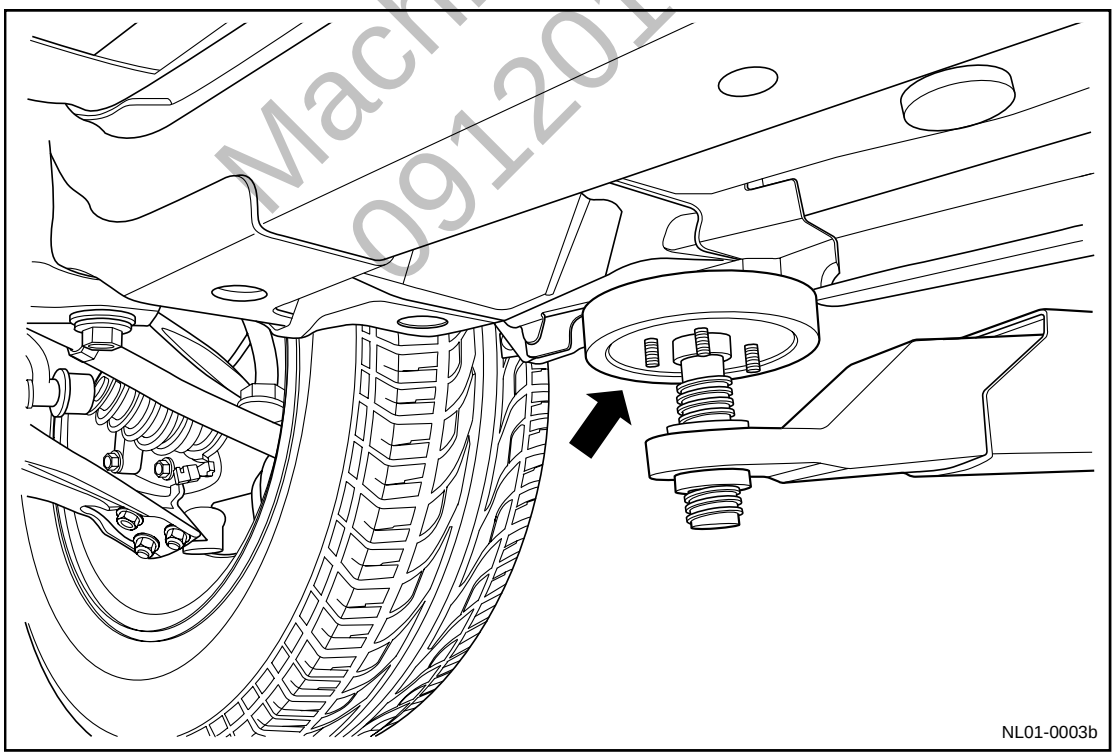


Notes:

The rear hoist pads and arms must not contact the rocker panels to the outside of the side frame rails or the floor pan.

Position the rear hoist pads as follows:

– Under the junction between the rear frame rails and the side frame rails.



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1.4 Maintenance

1.4.1 Specifications

1.4.1.1 Oil and fluid capacity

Applications	Specification
Brake Fluid and Clutch Fluid	0.665L(1.174 pt)
Engine oil(JL4G18-E, JLD-4G20, JLD-4G24)	4L(7.04 pt)
Engine coolant(JL4G18-E, JLD-4G20, JLD-4G24)	6.5L(11.44 pt)
Engine Coolant	6.5L(11.44 pt)
Manual Transmission Axle	2.2L(3.87 pt)
Automatic transaxle	7 . 5L13 . 2 pt)
Power steering system	0.91L(1.58 pt)
Refrigerant	550g(1 . 22 b)
Washer fluid	2L(3 . 52 pt.)

1.4.1.2 Recommended oil lubricating oil

Applications	Oil and fluid/ lubrication oil
Brake fluid and clutch fluid	DOT4 (HZY4)
Clutch linkage pivot grease	Universal lithium grease
Engine coolant	Glycol type engine coolant(coolant), freezing point≤-40℃
Engine oil	SAE10W-30 or SAE15W-40 (SAE5W-30 for cold region in winter), with API quality class of SL or above. SAE15W-40 (quality class of SL or above) or SAE20W-50 (quality class of SJ or above) for tropic region.
Floor shift linkage grease	Universal lithium grease
Hood and truck hinges, fuel filler door hinges, compartment door hinge	Universal lithium grease
Manual transmission axle	Compliant with JT/T 224; API quality class: GL-4; viscosity: SAE 75W-90
Automatic transaxle	Fuch FES 209-3292
Power steering system	ATF DEXRON Ⅲ auto/drive fluid
Doors and windows sealing strip grease	Silicon lubrication grease
A/c refrigerant	R134a

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1.4.2 Description and operation

1.4.2.1 Fluid maintenance schedule.

Notes:

– *1 Refer to the harsh conditions maintenance schedule.

– *2 Only ""Geely produced long-efficiency engine coolant"" or equivalent high-quality ethylene glycol engine coolant can be used. It is not allowed to use common water.

S/N	Oil and fluid name	Maintenance mileage (ehichever comes first)	Remarks:
1	Engine oil *1	First time :5000 km or 3 months replacement ,replace every 5000 km or 6 months (or required according with detail condition)	API SJ grade or above grade as the same time ,replace oil cleaning *1
2	Automotive gear oil	First time:5000km replacement , every 2 years or 40000km later on	
3	Automatic transmission oil	Every 60000km or 3years	
4	Power steering oil	Every 40000km or 2years	
5	Brake fluid	Every 30000km or 2 years	
6	Engine coolant *2	Every 30000km or 1 years	

1.4.2.2 Periodic maintenance schedule under the general condition

Maintenance item:

Notes:

- I: Mean inspection and required adjustment or replace
- R: means replacement.
- *1 Means to inspect the situation of valve noise and engine vibration. If necessray, adjust them.
- *2 Means to inspect once at every 80,000km or 48 months, or every 20,000km or 12 months.
- *3 Means to inspect whether radiator and condenser are blocked by leaf, dust or insect, and then clean the connection of hose.
- *4 Means to inspect once at every 80,000km or 48 months, or every 20,000km or 12 months.
- *5 After initial 60,000km, replace it. Later, after each 30,000km , replace it.
- *6 Only the coolant which is in accordance with SH0521 {freezing point ≤-40℃(-40 °F) can be used.

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Maintenance period (the odometer reading or month number shall be primarily based on the first comer)	**Odometer reading ×1000 kilometers**	**7.5**	**15**	**22.5**	**30**	**37.5**	**45**	**53.5**	**60**	**67.5**	**75**	**82.5**	**90**	**97.5**	**105**	**112.5**	**120**	**127.5**	**Month**
Engine elements																			
1. Valve play		.	.	.	I	.	.	.	I	.	.	.	I	.	.	.	I	.	96
2. CVVT oil duct filter net		.	I	.	I	.	I	.	I	.	I	.	I	.	I	.	I	.	24
3. Driving belt		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	12
4. Engine oil		R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	12
5. Oil Filter		.	.	.	I	.	.	.	I	.	.	.	I	.	.	.I	.	I	24
6. Cooling, heating system hose and connector		.	I	I	I	I	R	I	I	I	I	I	R	I	R	I	I	I	—

7. Engine coolant	.	I	.	R	.	I	.	R	.	I	.	R	.	I	.	R	.	—
8. Exhaust pipe and fixed frame	.	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	12
Ignition System																		
9. Spark plug	.	.	.	R	.	.	.	R	.	.	.	R	.	.	.	R		R
10. Battery	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	12
Fuel and exhaust control system																		
11. Fuel filter	.	.	.	R	.	.	.	R	.	.	.	R	.	.	.	R	.	-
12. Core of air filter	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	I:6R: 24
13. fuel tank cover/pipe/evaporation	.	.	.	I	.	.	.	I	.	.	.	I	.	.	.	I	.	24
14. Activated carbon canister	.	.	.	.	.	.	.	I	.	.	.	I	.	.	.	I	.	60
Chassis and Body																		
15. Brake pedal and parking brake	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	6
16.Brake shoe and brake puck	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	6
17. Brake fluid	I	I	I	R	I	I	I	R	I	I	I	R	I	I	I	R	I	I:6R: 24
18. Brake pipe and hose	.	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	12
19. Power steering oil	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	6
20. Steering wheel, Steering pull rod and gear box oil	.	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	12
21. Drive shaft boot	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	24
22. Ball joint and dust jacket	.	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	12
23 . Transmission oil	.	I	I	R	.	I	I	R	.	I	I	R	.	I	I	R	.	24
24. Front and Rear Suspension	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	12
25. Tire and tire pressure	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	6
26. All the light, horns, wipers and sprinklers	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	6
27 . A/C filter element	.	.	R	.	.	R	.	.	R	.	.	R	.	R	.	.	R	12
28. A/C system and cooling media	.	I	.	I	.	I	.	I	.	I	.	I	.	I	.	I	.	12

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1.4.2.3 Regular maintenance schedule under harsh driving condition

– Harsh driving conditions are listed in the following table. Increase the frequency of service.

– Not otherwise provided items reference

1.4.2.4 Periodic maintenance schedule under the general condition .

A-1: Driving on uneven, muddy, or melting snow road	
– Check brake pad and brake disc	Every 5000km or 3 mouths
– Check brake pipeline and hose	Every 10000km or 6 mouths

– check ball joint and anti-dust cover	Every 10000km or 6 mouths
– Check drive shaft anti-dust bushing	Every 10000km or 12 mouths
– Inspect steering wheel, steering tie rod and transmission oil	Every 5000 km or 3 mouths
– Check front rear suspension	Every 10000km or 6 mouths
A-2: Driving on the dusty section.	
– Replace engine oil	Every 5000km or 3 mouths
– Replace oil cleaner	Every 5000km or 3 mouths
– Check or replace air filter filter element	I:every 2500 km or 3 months
– Check brake pad and brake disc	R: every 1000km or 6 months
– Replace A/C filter element	Every 5000km or 3 mouths
	Every 15000km
B-1: Towing, used camping frame or roof mounting	
– Replace engine oil	Every 5000 km or 3 mouths
– Replace oil cleaner	Every 5000 km or 3 mouths
– Check brake pad and brake disc	Every 5000km or 3 mouths
– Check or replace transmission oil	Check gear oil every 5000km or 3 mouths replace it every 30, 000 km or every 18 months
– Check front rear suspension	Every 10,000km or 6 mouths
– Lock bolt and screw cap between chassis and body	Every 10,000km or 6 mouths
B-2: Repeated short-distance driving within 8km and the outdoor temperature is below 0°C	
– Replace engine oil	Every 5000km or 3 mouths
– Replace oil cleaner	Every 5000km or 3 mouths
B-3: Vehicles always drive for a long distance at idle speed or low speed, such as police cars, taxies or door-to-door delivery vehicles.	
– Replace engine oil	Every 5,000 km or 3 mouths
– Replace oil cleaner	Every 5,000 km or 3 mouths
– Check PCV valve and pipeline	Every 5,000 km or 6 mouths
– Check brake pad and brake disc	Every 5,000 km or 3 mouths
B-4: Frequent high speed driving for more than 2h (80% of the maximum vehicle speed)	
– Replace engine oil	Every 5000km or 3 mouths
– Replace oil cleaner	Every 5000km or 3 mouths
– Replace transmission oil	Every 20000 km or 12 mouths
B-5: Extended period of idle, low speed and frequent acceleration and deceleration, such as a driving training vehicle.	
– Replace engine oil	Every 5,000 km or 3 mouths
– Replace oil cleaner	Every 5,000 km or 3 mouths
– Check PVC valve and pipeline	Every 3000km or 3 mouths

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1.4.2.5Periodic maintenance description

Normal use of the vehicle

Maintenance schedule assumes that the vehicle is used for the following purposes:

– Transporting passengers and cargo according to the tire label at the edge of driver's door.

– Driving within the limits of the proper operation on suitable roads.

Maintenance schedule description

Service items are explained in more details below. When servicing, make sure replace all the parts and complete all necessary repairs before drive the vehicle. Make sure use the suitable oil, fluids and lubrication oil.

Drive belt inspection

Inspect the drive belt for cracking, wear and tear as well as the proper tension force. If necessary, adjust or replace the drive belt.

Replacement of engine oil and oil filter

Engine oil must be used with API quality grades SJ or above grade engine oil,

Engine oil viscosity

Notes:

Using engine oil other than the recommended ones will damage the engine.

Engine oil viscosity (consistency) will affect the fuel economy and operations in cold weather. The lower the engine oil viscosity, the better the vehicle's fuel economy and the better cold weather performance. In high temperatures, engine oil with higher viscosity must be used to achieve the desired lubrication effect. Using engine oil other than the recommended ones will damage the engine.

Cooling system maintenance

Drain, rinse the cooling system and refill the new engine coolant. Refer to 1.4.1.2 Recommended Oil and fluid and lubrication.

Replacement of fuel filter

Replace fuel filter every 30,000 km. The fuel filter is located at the bottom of the rear end of the vehicle, close to the canister.

Replacement of air cleaner filter

Replace air cleaner filter every 1 5,000 km. Under dusty conditions, reduce the replacement of air filter intervals.

Replacement of spark plug

Use only genuine Geely parts for replacements. Refer to 1.4.2.2 regular maintenance schedule under normal driving condition.

Replacement of spark plug high voltage damper

Clean up the spark plug wire and inspect for burnt, cracking or other damage. Make sure the spark plug wire is installed directly on the ignition system module and the spark plug. If necessary, replace the spark plug wire.

Maintenance for brake system

Check disc-type brake lining block every 50000km or 6 months, carefully check thickness of brake lining block. If the brake pads can not last until the next scheduled service, they should be

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replaced. Inspect the brake fluid tank lid vent to ensure that there is no dirt and the path is unblocked.

Maintenance for transaxle

Auto-transmission: Check transmission fluid every 20000km or 12 mouths, replace transmission fluid every 60000km or 36 mouths,,

Manual transmission: first time: 5000km replacement, every 2 years or 40000km later on;

Inspection and rotation of tire and wheel

Inspect whether there is abnormal tire wear or damage. To make tire wear evenly and to extend tire life, rotate the tire positions. If there is abnormal or premature wear, wheel alignment should be Inspected, and then inspect the wheels for damage.

1.4.2.6 Tire rotation descripition

Notes:

If there is obviously uneven tire wear, the faults for this should be eliminated.

When rotating the tires, it is recommended at the same time to inspect the tire and wheel assembly balance.

1. It is recommended that tire rotation be carried out when brake inspections are performed, as per the "maintenance schedule" outlined in the User's Manual or when: Difference in tread depth between front and rear tires exceed 1.5 mm (0.08 in).
2. Lifting and support vehicles, refer to 1.3.1.1 lifting vehicle .

Notes:

Record the original position of each tire and wheel assembly in relation to the vehicle.

3. Remove the tire and wheel assembly, refer to 4.4.5.1 replacement of wheel.
4. Rotate the tire and wheel assembly as shown in the following diagrams.

Notes:

For " No direction of rotation" tires, carry out rotation as shown below.

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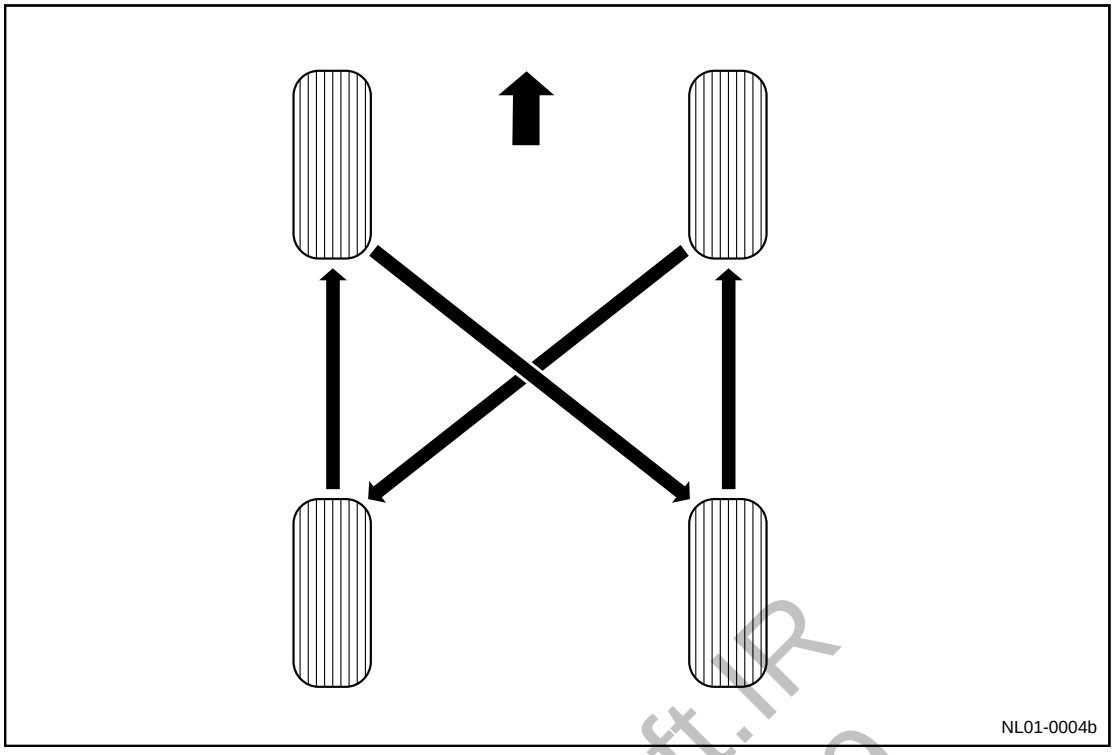
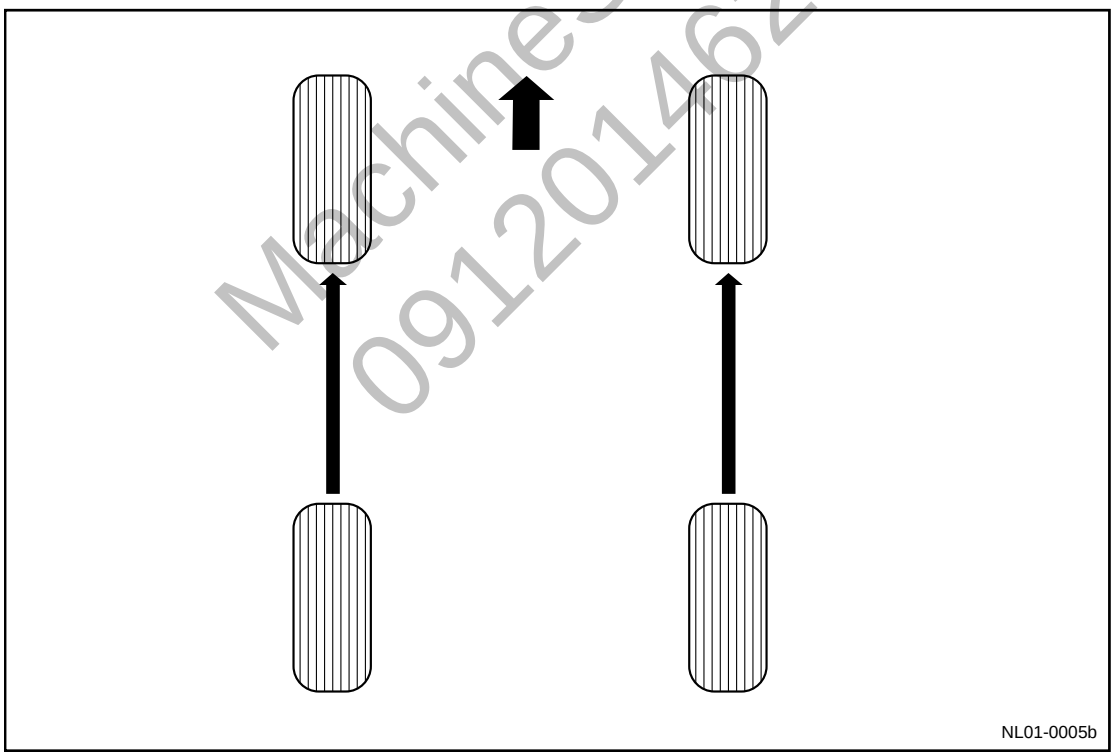


Notes:

For "No direction of rotation" tires, carry out rotation as shown below.



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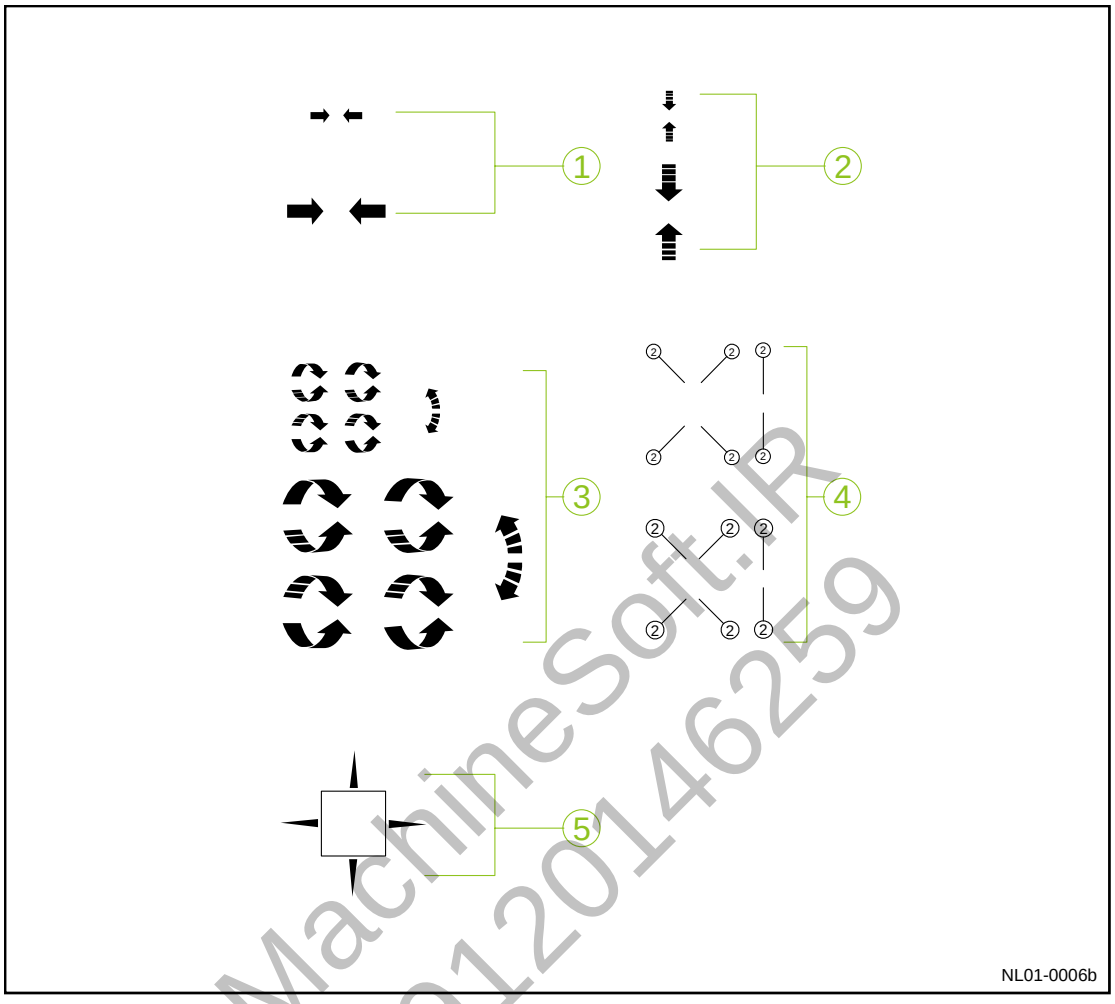
5. Install the tire and wheel assembly, refer to 4.4.5.1 replacement of wheel.
6. Remove the safety stands.
7. Lower the vehicle.
8. Check and adjust the tire inflation pressure.

1.5 Maintenance information system

1.5.1 Description and operation

1.5.1.1 Usage specification of arrow and symbol in the manual



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Legend

1. Arrow
2. Motion direction arrow
3. Rotation direction arrow
4. Component code notes
5. Enlarged area

1.6 Health and safety

1.6.1 Description and operation

1.6.1.1 Specification

Various operations relating to vehicle maintenance and repair may affect on personal safety or health; part of relevant hazardous operations as well as materials and equipment are listed in the section; moreover, safety rules to avoid such hazards are further listed.

This section does not include all the health and safety issues, so that all operations, procedures, and material handling should be carried out, provided that safety and health is to be ensured. Prior to the use of any product, inspect the manufacturer or supplier product instructions.

1.6.1.2 Acids and bases

Refer to 1.6.1.8 battery acid Fluid.

For example, battery has a corrosive sodium carbonate, sulfuric acid.

Batteries and other materials cleaning agent.

Battery has irritation and/or erosion affect on the eyes, skin, nose and throat. It may cause burns in human body and damage to normal clothing. To avoid battery acid fluid splashing in the eyes, skin and clothing, always wear appropriate protective clothing, gloves and protective goggles to prevent inhaling acid fog.

Be sure to be equipment washing equipment nearby, such as: eye washing bottle, shower nozzle and soap, etc. It is convenient to timely help somebody in trouble at any time when splashing. Prominently mark eye danger sign.

1.6.1.3 Airbag

Refer to 1.6.1.15 fire and 1.6.1.10 chemical materials.

For highly flammable and explosive - to comply with the smoking ban.

Airbags are installed in the steering wheel, in the front passenger seat and inside the instrument panel in front of the front passenger as well as the post A, post B, post C as a supplementary safety system.

The airbag expander contains a gas that produces a very high temperature when igniting the high-energy propellant (2,500ºC/4532 ºF).

This propellant is stored in airtight sealed components and fills the airbag when the airbag is deployed. It is prohibited to open airbags during maintenance, as this would lead to dangerous contact with the propellant. If the gas containers happen to break, wear full protective clothing when handling the overflow materials.

After deploying airbags, wear protective goggles and gloves when handling the airbags.

Deployed airbags must be handled according to the relevant local laws.

If come into direct contact with gas derivatives, you must:

– Use clean water to rinse contact position.

– Call for emergency medical help as per condition

Airbag-shall execute operation (for your own safety, please wear the safety appliance to the greatest extent prior to the execution of the following operation; the ignition switch of the vehicle must be turned to "LOCK" status when dismantling the airbag, pull up the key and disconnect the battery negative cable, then dismantle after waiting for 90s).

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Lay the air bag components and store it upwards.

– When storing, keep the air bag components dry.
– When carrying airbag components, do not touch the electrode and keep the airbag away from body as far as possible.
– When placing air bag components, put the protective cover upwards.
– Check if airbag component was damaged carefully.
– Disconnect the battery negative before connecting airbags cable. Wait 60s, standing beside airbag components.
– Correct adjusted and maintenance all equipment
– After deploying an airbag, make sure wash your hands.

Airbag-- operations to be avoided

– Do not store flammable materials and components together with gas generator.
– Do not immerse the airbag assembly in water or let airbag assembly contact with other liquids.
– Gas generator can not be stored under the ambient temperature above 80ºC/176ºF
– Can not stored as an upside-down way
– Can not be try to open gas generator housing
– Do not expose the gas generator to flame or heat.
– Do not place other items on the components cover.
– Can not used damaged module
– Do not touch the component or the gas generator within 10 min of airbag being deployed.
– Do not use electrical probe in the return circuit.

1.6.1.4 A/C refrigerant

Refer to 1.6.1.10 chemical materials.

Skin contact may cause frostbite.

Must comply with the instructions provided by the manufacturer to avoid the exposed lights. Wear suitable protective goggles and protective gloves.

If refrigerant come into contact with skin or eyes, you should immediately wash the contacted area with water.

Apply the appropriate cleaning solution and rinse the eyes. Do not rub, as the case may need to seek medical assistance.

A/C Refrigerant- operations to be avoided

– Do not store refrigerant at a place with direct sunlight or heat sources.
– When filling, the refrigerant bottles must not be upright, keep valves down.
– Refrigerant cylinder can not exposed in the snow area
– Can not be drop off refrigerant cylinder
– Do not.in any case. Directly discharge refrigerant to the atmosphere.

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– Can not be mix refrigerant. For example: R12 (dichlorodifluoromethane) and R134a (tetrafluoroethane).

1.6.1.5 Adhesives and sealant

Precaution of adhesive and sealant

Before applying adhesive/sealant, the surface shall be cleaned and special detergent shall be used to avoid the result of adhesive/sealant. Do not let the room-temperature curable glue into the threaded blind hole when using sealant; if the room-temperature curable sealant enters into the threaded blind hole, the fastener during fastening may produce the hydraulic locking effect, thereby resulting in the damage to the fastener and (or) the other components; moreover, the fastener during fastening is unable to obtain a correct clamping force, so that the sealing effect of the sealant is worse, thereby leading to that the fastener can not be fastened correctly to loose or separate the part and further resulting in seriously damage to the parts of the engine and the like.

Health and safety

The material in adhesive/sealant contains harmful substances. Prolonged exposure may cause acute or chronic intoxication, occupational disease and skin disease. When applying, air ventilation device shall be used to keep ventilated. When operating, it is necessary to wear protective gloves, mask and protective clothing.

– Remove waste adhesive or wastes polluted by solvent. They are not allowed to accumulate for a long time.

– Adhesive/sealant shall be stored in non-smoking area. Before using, clean them and apply them with applicator or container.

Maintenance for adhesive/sealant

When the vehicle faults or has an accident, the body will be deformed, the steel plate will be cracked, and the welding spot will be fallen off; at times, the engine, the chassis and the other assemblies are further locally damaged, thereby resulting in shedding and damage of some adhesive/sealant products. During the course of maintenance, adhesives with the same performance shall be selected according to materials and functions of components. Adhesive/sealant that can be used during the course of maintenance can be used as follows.

Body maintenance

After interior and steel plate is deformed or cracked, adhesive applied on the body falls off or is cracked. During the course of maintenance, the damaged position shall be applied by adhesive again.

– First remove adhesive on the surface of body with a small knife. Remaining adhesive shall be cleaned with alcohol;

– Use special detergent to clean the applied position to avoid any foreign material on the surface to be applied.

– Apply adhesive on the original position again to achieve bonding and sealing result.

Adhesive for body maintenance

Products	Material	Function	Recommended model
Vehicle sealant	Mono-component polyurethane	Bonding of body skin, interior and exterior trim and body structure and other components. The adhesive has strong binding strength and cohesion as well as good adhesion with metal and a	Tianshan TONSAN ®:1922, 1923/

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		variety of painted surface, etc.	
Welded seam sealant	Mono-component polyurethane	1. Room temperature curing adhesive is used for sealing of welding joint inside vehicle body. Use brush to apply adhesive manually. 2. Indoor temperature curing adhesive is used for sealing of foldable end of engine hood, boot and door. Use special glue gun to apply adhesive along the line.	Chinese automotive components industry company:C8802
Chip-resistant primer	Rubber and Resin	Anti-collision glue for protecting the room temperature curing-type chassis forms a permanent anti-aging flexible corrosion-resistant protect coating in the underbody and the wheel guard. Such products can replace the PVC coating and have excellent anti-rusting, sound insulation and rock impact resistance.	Chinese automotive components industry company:C312DW
Windscreen glue	Mono-component polyurethane	Polyurethane adhesive cured at room temperature is used for sealing glass for vehicle window. This glue has good bonding property and can react with moisture in the air. The glue has strong strength, age resistance, vibration and fatigue resistance, low temperature resistance and no corrosion and other good properties after curing.	Tianshan.Kesaier ®: 1956、1924
Detergent	——	Clean all interface contact with base coating and adhesives,	
Pressure-sensitive adhesive tape	Acrylic adhesive tape	It is used for bonding of rubbing strips, nameplates, guard plates, splash guard, door protection, body, various trim strips and so on. This adhesive tape is excellently weather endurable and durable and is mainly used for bonding rubber sealing strip system on a vehicle.	3M 4229P、4215、4221L
Heat-Sensitive Adhesive Tape	Acrylic adhesive tape	This adhesive tape has very strong bonding force which can avoid clearance and corrosion caused by unsecured adhesion and it can provide strong sealing effect.	3M 4237P
Adhesive with primer	——	Different primers are selected for different materials of bonding surface. The bonding surface must	3M C-100、K-500\520、N-200

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		be clean, the primer is uniformly applied on the sticky surface via a brush after completely drying, and the adhesive tape is pasted after driving.	

Component maintenance

After components, engine and transmission are damaged, it is necessary to apply cohesive and sealant again. Before applying, please clean all the surfaces to remove burr and crack.

Adhesive and sealant for components

Description	Function	Recommended model
Silicon rubber plane sealant	Be used for the plane sealing of the large clearance and the flexible connecting piece, such as the box body, the flange, the joint surface of the bottom shell and the end cover and other parts; clean up the adhesive residue of the sealing surface prior to gluing, apply sealing glue line with proper diameter on the sealing surface (or gasket) after cleaning and drying, align and close the part immediately after gluing to avoid misplacing, tighten the bolt, wipe the unnecessary extrusive glue or clean up by the blade after curing. This kind of sealant does not contain solvent and become curing at room temperature, with corrosion resistance, impact resistance, medium resistance and temperature resistance.	Tianshan.Kesaier ®: 1596/1598～1596
Anaerobic thread sealant	Used to tighten and lock bolts, nuts and screws. Before applying, please clean all engaged surfaces. After it becomes dry, apply sealant on engaged surface. After it becomes curing, it has good impact resistance, vibration resistance, no leakage, corrosion resistance.	Tianshan.Kesaier ®: 1243、1242
Anaerobic sealant	Used to seal flat surface which has small clearance and is required to be cured without air, and lock bolts. It has performances such as waterproof, oil resistance and corrosion resistance.	Loctite 204，Tianshan.kesaie®: 1510

Other maintenance materials

Description	Function	Material No.
Locking adhesives	Used to lock tightening thread with maximum dimension M6, like door window regulator handle	Loctite thread locking adhesive
Corrosion inhibitor	It is a kind of corrosion inhibitor that is mainly made of plastic. It is used for soundproof and corrosion resistance treatment for chassis, with corrosion resistance and soundproof.	Fudun

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Precaution for construction

- Adhesive/sealant is mainly used to prevent water and dust from going into the vehicle. In addition, it has corrosion resistance. Original sealing joints are obvious. If they are damaged, it is necessary to apply sealant again. When using adhesive/sealant to close the seam, packing with high viscosity shall be selected. Apply it according to instructions for selected material.
- When applying adhesive/sealant, preventative measures shall be taken to avoid adhesive/sealant from going into openings (such as door lock, window lifting slot, window regulator, seat safety belt retractor) and any moving and rotating components, especially parking brake cable. After applying adhesive/sealant, ensure all drainage holes on the body are opened.
- When applying, it is necessary to wear goggles and gloves to avoid personal hurt.
- Before delivery, all metal plates have been coated. After maintenance and/or replacement, any exposed metal surface shall be painted by primer and then applied by adhesive and sealant.
- After applying, some of adhesives/sealants are required to be dried and cured. Drying conditions are (70~80)℃, 20~30min.

1.6.1.6 Engine coolant

Refer to 1.6.1.15 Fire.

For example, isopropyl alcohol, ethylene glycol, methanol.

Extremely easily fired inflammables.

Used in the vehicle engine coolant circulation system, windshield washer fluid.

When heated, engine coolant (ethylene glycol) may produce steam. Avoid inhaling the vapor.

After direct contact with engine coolant through the skin, directly absorbed dose may reach toxic or harmful dose. If swallowing engine coolant, it may be life-threatening. The person must be taken to hospital and seek medical treatment immediately. These products must not be used in conjunction with the ordinary food processing or connected with the drinking water supply system.

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1.6.1.7 Asbestos

Inhaling asbestos dust likely to cause lung damage, and even cause cancer.

Asbestos waste should be wet before handling. Place in sealed containers and mark clearly at the surface of the container to facilitate safe handling. If you need to try to cut or drill materials containing asbestos, you should make the materials wet first, and only use low-speed hand tools or power tools.

1.6.1.8 Battery acid fluid

Refer to 1.6.1.2 acid and alkali.

The gas released when charging is explosive. Do not conduct fire operations near a charging battery or a recently charged battery.

Maintain good ventilation.

1.6.1.9 Brake fluid

Refer to 1.6.1.15 Fire.

It is a little irritating when comes into contact with the skin and eyes. avoid the brake fluid coming to contact with eyes, skin. The risk of inhaling brake fluid at room temperature is not high, because its pressure is very low.

1.6.1.10 Chemical materials

Pay attention, when using, storing and handling chemical material, such as, solvents, sealants, adhesives, coatings, resin foam, battery acid, engine coolant, brake fluid, fuel, engine oil, gear oil, automatic transmission fluid, lubrication oil and grease. They may be toxic, harmful, corrosive, and irritating or highly flammable, and there is a high risk of odor and dust. The impact of long term exposure to chemicals may be acute or chronic, temporary or permanent, cumulative, superficial, life-threatening, or may affect life expectancy.

Chemical materials - operations to be performed

- Carefully read and follow the warnings on the containers of raw materials and any accompanying leaflets, posters or other instructions. Raw materials health and safety information forms can be obtained from the manufacturer.
- After coming to contact with chemical materials, remove it from the skin and clothing as soon as possible. Immediately replace serious immersed clothing, and clean thoroughly.
- Strictly follow instructions. Wear protective clothing, in order to avoid direct contact with skin and eyes,
- When handling with chemical materials before a break, diet, smoking, or using toilet facilities must wash hands.
- Keep work area clean, tidy and non-chemical material spill.

Chemical materials - operation to be avoided

- Unless there is manufacturer's instruction, do not mix chemical materials; Certain chemicals mixture will form other toxic or harmful chemical substances. When mixing, other toxic and harmful gases may be released and it may cause an explosion and other accidents.
- Do not spray chemical materials in a closed environment.
- Unless there is manufacturer's instruction, do not heat chemical materials. Some chemicals are highly flammable and others may draintoxic and harmful gases.
- Do not keep chemical materials containers open. Emitted gas may accumulate to a toxic, hazardous or explosive level. Some gases are heavier than air and they will accumulate in a closed space.
- Do not store chemical materials in an unlabeled container.
- Do not use chemical materials clean hands and clothing. Chemicals, especially solvents and fuel will make the skin dry. It may cause allergies, skin infection. Chemicals directly contacted with the skin will affect human health.
- Unless the empty container has been cleaned under supervision, do not use the container to store other chemical materials.
- Can not be not free smell chemical materials Short-term exposure to high concentrations of gas may still have the possibility of poisoning or hurt.

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1.6.1.11 Dust

Powder and dust may be irritating, harmful or toxic. Avoid inhaling the chemical material powder stirred up dry friction. If the ventilation is poor, wear a breathing mask protective equipment in order to prevent inhaling dust.

Flammable fine dust may cause explosion. Keep them away from an explosion or a fire.

1.6.1.12 Electric shock

Failure to follow instructions when using electrical equipment or misuse of the equipment in good condition may cause electrical shock.

Maintenance electrical equipments within the specified time and run regular tests.

Failure of equipment should be noted. Move the failed equipment out of working area.

Do not use wires, cables, plugs and sockets that are wear and tear, kink, cut, broken or damaged. Do not let electrical equipment and wiring contact with water.

Make sure the electrical equipment protected by the correct fuse.

Do not misuse electrical equipment. Do not use any faulty equipment, which may affect personal safety.

Make sure mobile electrical equipment cable will not be damaged.

Must provide first aid training to the specialized electrical equipment operator.

In the event of electrical shock:

– Before contacting with the injured, disconnect the power supply.

– If the power can not be switched off, use dry insulation material to insulate the victim.

– If you have received special first-aid training, provide on-site first aid immediately.

– Request medical support error aid help support.

1.6.1.13 Gas

Exhaust contains toxic and hazardous chemicals, such as carbon oxides, nitrogen oxides, acetaldehyde, and lead and aromatic hydrocarbon type material. Only run the engine at a place with good ventilation or an open space.

1.6.1.14 Isolation fiber

Refer to 1.6.1.11 Dust.

Used to isolate the noise and sound.

The surface of the fiber substance and the sharp edges can cause skin irritations.

During operating procedures, follow instructions and wear gloves to avoid excessive skin contact with the fibers.

1.6.1.15 Fire

Many materials related to vehicle maintenance are extremely flammable. Some materials will produce toxic and harmful gases after burnt.

When storing and handling flammable materials or solvents, follow the fire safety rules, especially near the electrical equipment or the welding operation areas.

Before use electric welding equipment, make sure there is no fire hazard.

When conducting welding or using heating equipment, always have an appropriate fire extinguisher ready in the area around the job.

1.6.1.16 Emergency treatment

Not only comply with the law, but also have first aid trained personnel ready in the work area.

If the eyes are splashed, rinse eyes with fresh water for at least 10 min.

If the skin is contaminated, you need to use soap and fresh water to clean the contaminated area.

If you get frostbite, immerse the frostbite body part in ice water or cold water.

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If a staff inhaled toxic gases, that staff should be immediately transported to a place with fresh air. If that staff still has symptoms of inhaling toxic gases, the staff should be immediately taken to a hospital for medical treatment.

If you accidentally swallow the liquid, inform the doctor the information marked on the container label. Unless there are instructions on the label, the affected person can not be guided vomit.

1.6.1.17 Foam- polyurethane

Refer to 1.6.1.15 fire.

Cured foam is used for seat cushion with the decoration.

Comply with manufacturers instructions.

Components that are not treated through chemical reactions may be irritating. They may be harmful to the skin and eyes. Wear gloves and protective goggles when operating.

Staff with chronic respiratory diseases, asthma, bronchial problems, or suffering from hereditary allergies should not deal with or come close to the uncured substances.

Certain spare parts, steam or spray may cause allergy. They may be toxic and harmful.

Remember that do not inhale vapor or spray. These materials must be used at a well ventilated place or with respiratory protection measures. Do not immediately remove the mask after spraying. Wait for the steam and the spray completely dissipated.

Uncured components and cured foam will produce toxic and harmful gases, during the bubble operation. Unless the steam and the spray has been completely removed, do not smoke or use fire and electrical equipment. Any foam material or special foam cutting should be carried out at a well-ventilated place.

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1.6.1.18 Fuel

Minimize direct contact with the skin of fuel. Immediately wash the skin with soap and clean water after direct contact with fuel.

Gasoline

Highly flammable - comply with the smoking ban.

If swallowed, gasoline can cause irritation to the mouth and throat. If absorbed in stomach, gasoline can lead to weakness and unconsciousness. Only a small amount of gasoline will affect the lives of children. If the gasoline enters into the lungs, it is very dangerous.

Gasoline will cause dry skin. Prolonged or frequent contact with gasoline will cause skin allergies and skin infection. Gasoline entering the eye will cause severe eye pain.

Motor vehicle used gasoline contains a large amount of benzene. Inhaling gasoline can cause poisoning. The concentration of gasoline vapor must be kept at low. High concentration of gasoline vapor can cause eye, nose and throat irritation as well as nausea, headache, depression, physical discomfort and drunken behavior. High concentration of gasoline vapor will lead to rapid loss of consciousness.

When handling gasoline, we must maintain good ventilation, with special attention to operate in a confined space. Avoid splashing when pouring gasoline to reduce the risk caused by inhaling gasoline vapor.

Pay special attention when cleaning and carrying out maintenance of gas storage equipment.

Gasoline can not be used as cleaning agents. Do not suck gasoline.

1.6.1.19 Gas cylinder

Refer to 1.6.1.15 Fire.

Oxygen, acetylene, argon and propane-like gas, is usually stored under 13.8 Mpa (2001 psi) pressure in the gas cylinder. When handling these cylinders, you must be really careful. Avoid mechanical damage to the cylinder or valve.

Clearly mark the label with the gas filled inside the cylinder.

Cylinders should be stored in well ventilated areas and avoid placing in snow or under direct sunlight. Fuel gases, such as acetylene and propane should not be stored together with oxygen cylinders.

Pay special attention to the leakage from gas cylinders or pipeline. Avoid a fire source.

Only professionally trained personnel can carry out the gas cylinder related work.

1.6.1.20 Generate workshop tool and equipment

Always keep all of the tools and equipment in good working order. It is also very important to operate correctly.

Do not use tools or equipment for unintended purposes.

The load over the crane, jack, vehicle shaft and chassis frame or suspension line must not exceed the maximum limit that they can bear. The damage caused by overload is not necessarily apparent immediately, being likely to result in severe accident when in use in the next time.

Do not use damaged or improperly worked tools or equipment, especially in certain high-speed devices such as: grinding wheel. Damaged wheel will be broken without a warning and can cause serious injury.

When using a grinding wheel, a chisel or sand blasting equipment, wear proper eye protection devices.

When using a blasting equipment to handle asbestos-containing materials or using spray equipment, wear the appropriate breathing mask.

There must be equipment that can control dust, spray and dust content.

1.6.1.21 Lubrication and grease

Avoid prolonged and repeated contact with mineral oils. All the lubrication oil and grease are irritated to eyes and the skin.

Used engine oil

Prolonged and repeated contact with mineral oils will cause the loss of the natural skin oils, causing dry, irritation and skin diseases. In addition, used engine oil is very likely to contain harmful substances that can lead to skin cancer. Make sure use the skin protective equipment and be equipped with adequate washing facilities.

Do not be used engine oil as lubrication oil, or any other purpose that has direct contact with the skin.

Health and safety rules

- Avoid prolonged and repeated contact with engine oil, especially the used engine oil.
- Wear protective clothing, including impermeable gloves.
- Do not put the cleaning cloth stained with engine oil into the pocket.
- Prevent engine oil contaminating clothing, especially clothing next to the skin.
- Can not be wear cloth and shoes was seriously polluted by engine oil Overalls must be cleaned regularly and kept clean.
- Immediate treatment to open wounds shall be received.

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– Put protective cream on the skin to avoid skin direct contact with the engine oil.

– Wash with soap and fresh water to remove all of the engine oil. Apply the protective agent containing lanolin will help replace the skin's natural oils.

– If a skin disease occurs, you should immediately seek for medical treatment.

– Clear deposited oil and grease as soon as possible before working

– If there is a possibility of direct eye contact with chemicals, wear protective goggles, such as chemical goggles or face masks. Eye wash equipment should also be equipped.

Environment precaution

Used or waste engine oil and oil filter should be recycled by authorized or licensed waste disposal companies. If in doubt, please contact your local authorities.

Pouring used or waste engine oil directly into the ground, sewer or drainage facilities or into water pipe is illegal.

1.6.1.22 Noise

Operating certain equipments will produce high-decibel noise and may cause hearing damage. You should wear appropriate hearing protection devices.

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1.7 Standards and measurement

1.7.1 Description and operation

1.7.1.1 English system/metric unit converter

English system/metric units conversion

English system	Multiply / divide	(Metric)
English system measurement unit's calculation, divided by the number in the middle column.		
Metric measurement unit's calculation, multiplied by the number in the middle column.		
Length		
Inch	25.4	mm^3
Inch	0.3048	m
Code	0.9144	
Mile	1.609	km
Area		
Square inch	645.2	mm^2
	6.45	mm^2
Square foot	0.0929	m^2
Square yard	0.8361	
Volume		
Cubic inch (in^3)	16,387.0	mm^3
	16.387	mm^3
	0.0164	Up
Quart	0.9464	m^3
Gallon	3.7854	
Cubic yard (yd^3)	0.764	
Weight		
Pound (lb)	0.4536	Kg
United kingdom ton	907.18	
	0.907	MT
Force		
Kilogram force	9.807	Newton (N)
Ounce force	0.2780	
Pound force	4.448	
Acceleration		
Inch/ s2	0.3048	m/ s2

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Inch/ s2	0.0254	
Torque:		
Pound Inch (lb-in)	0.11298	N·m
lb ft	1.3558	
Power		
Horsepower	0.745	KW
Pressure (stress)		
Inch water column	0.2488	KPa
Pound/ square inch	6.895	
Energy (Power)		
English system thermal unit (Btu)	1055.0	Joule(1 joule= 1 watt-sec)
lb ft	1.3558	
Kilowatt-hour (kWh)	3,600,000.0	
Light		
Foot-Candle (fc)	10.764	lumen / m^2
Speed		
Mile / hour (mil/h)	1.6093	kg/hour
Temperature		
(°F - 32)* 5/9	=	°C
°F	=	(9/5 *°C + 32)

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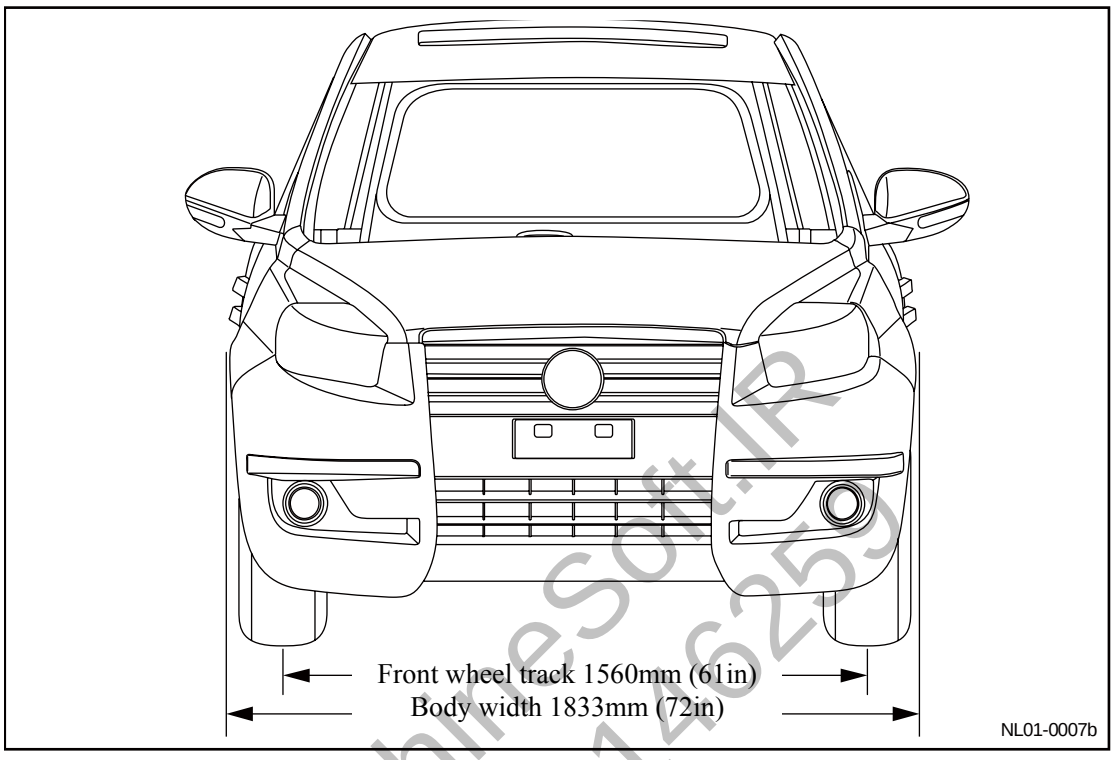
1.8 Complete vehicle specification

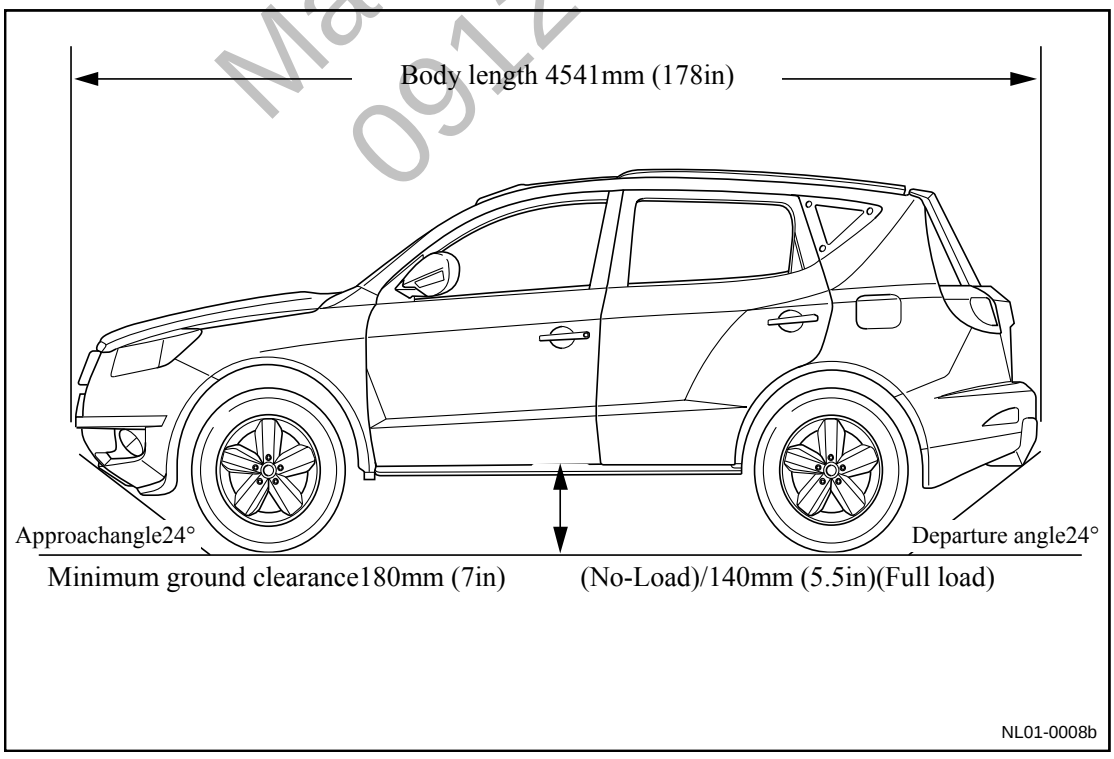
1.8.1 Specifications

1.8.1.1 Complete vehicle size

Front view



Side view



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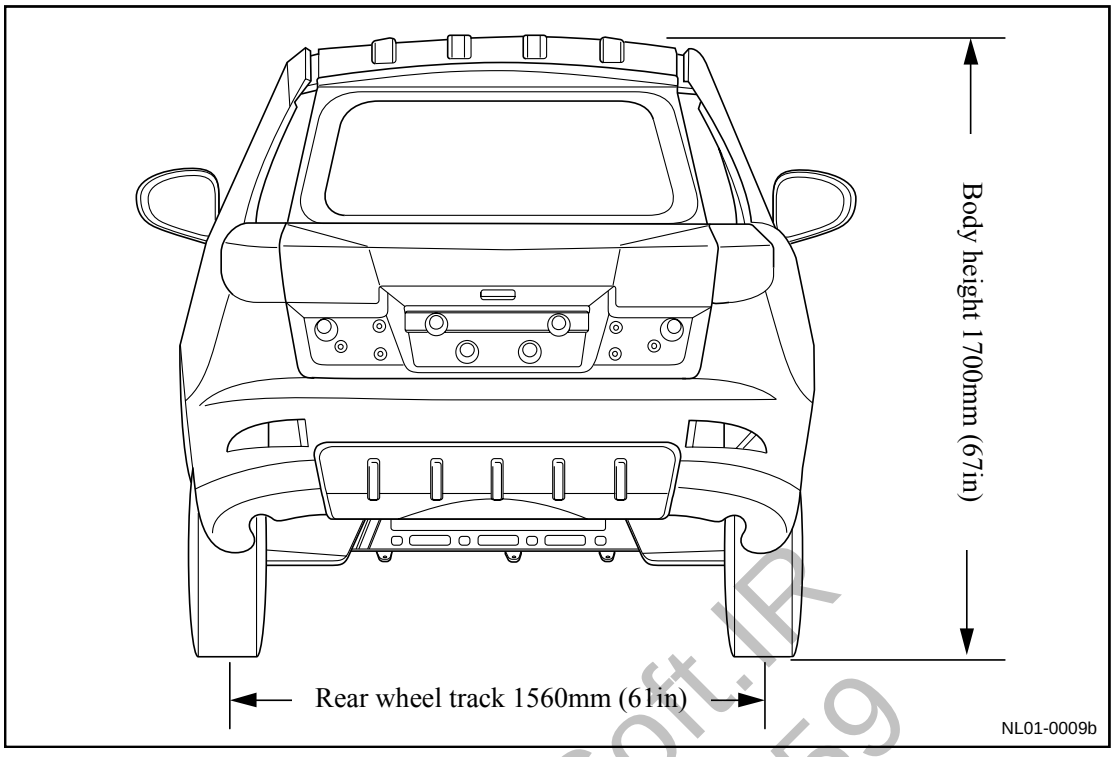
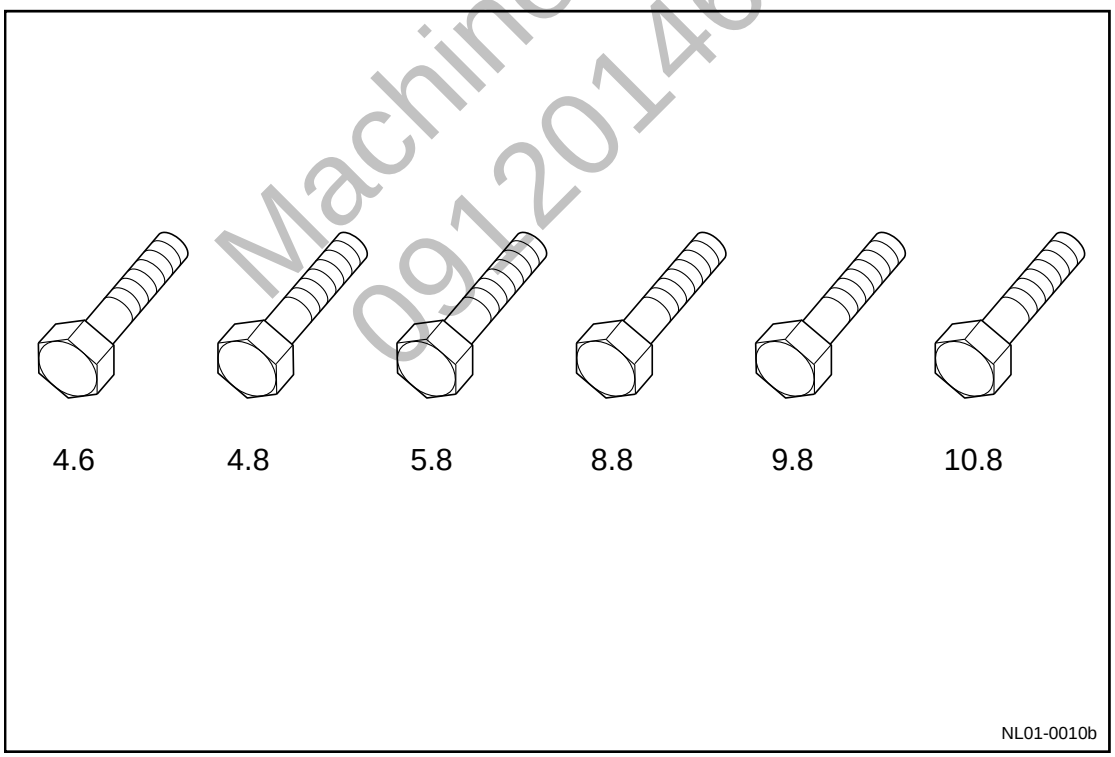
Rear view



1.8.1.2 Fastener specifications

Fasten specification diagram



Geely automotive engineering standards have adopted some parts of the definition of the standard ISO metric fastener dimension with the aimed at reducing the number of different dimension fasteners used while maintaining the best thread quality for each dimension. Metric bolts are shown above, and the intensity level increases as the number increases.

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Fastener specification of complete vehicle

Component name	Application	Model and specification	Torque range	
			Metric (N.m)	English system (lb-ft)
Combination member of hexagon head bolt and spring washer	Better negative grounding wire	M8×20	13 - 17	9.6 - 12.6
Hexagon flange nut	Pipe system assembly	M6	8 - 10	5.9 - 7.4
Hexagon flange nut	Fuse box of front cabin	M6	8 - 10	5.9 - 7.4
Hexagon flange nut	Hexagon flange nut	M6	8 - 10	5.9 - 7.4
Hexagon flange bolt, spring washer and plain washer assembly	Instrument panel harness assembly	M6×16	7 - 9	5.2 - 6.6
Hexagon flange bolt, spring washer and plain washer assembly	Engine harness assembly	M6×16	7 - 9	5.2 - 6.6
Hexagon flange bolt, spring washer and plain washer assembly	Better negative grounding wire	M6×16	7 - 9	5.2 - 6.6
Hexagon flange bolt, spring washer and plain washer assembly	Engine compartment harness assembly	M6×16	7 - 9	5.2 - 6.6
Hexagon flange bolt, spring washer and plain washer assembly	Back door harness assembly	M6×16	7 - 9	5.2 - 6.6
Cross recessed pan head self-tapping screw and plain washer assembly	Front fog lamp assembly	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Combination instrument assembly	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed head self-tapping screw	Defrost switch	ST4. 2×13	2 - 4	1.5 - 3
Hexagon flange nut	Left rear combination lamp assembly	M5	4 - 6	3 - 4.4
Hexagon flange nut	Right rear combination lamp assembly	M5	4 - 6	3 - 4.4

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Hexagon bolt and plain washer assembly.	Central door lock electrical device	M6×16	7 - 9	5.2 - 6.6
Hexagon bolt and plain washer assembly.	Electric anti-theft electrical device	M6×16	7 - 9	5.2 - 6.6
Hexagon flange bolt, spring washer and plain washer assembly	Single disc assembly with MPS main machine	M6×20	7 - 9	5.2 - 6.6
Hexagon flange bolt	Pipe system assembly	M6×12	8 - 10	5.9 - 7.4
Combination member of hexagon head nut and enlarged taper washer	A/C Motor Assembly	M6	7 - 9	5.2 - 6.6
Hexagon head bolt spring washer and flat washer combination member	Base plate harness assembly	M6×16	7 - 9	5.2 - 6.6
Cross recess hexagon head bolts and flat washer combination part	Left front combination lamp assembly	M6×16	7 - 9	5.2 - 6.6
Cross recess hexagon head bolts and flat washer combination part	Right front combination lamp assembly	M6×16	7 - 9	5.2 - 6.6
Cross recessed head self-tapping screw	Front tweeter	ST2. 5×8	1-3	0.7-2.2
Combination member of hexagon head cross recess bolt. spring washer and flat washer	Parking motor main engine	M5×16	3-5	2.2-3.6
Hexagon bolt	Compressor assembly	M8×105	18-22	13.3-16.2
Hexagon flange bolt, spring washer and plain washer assembly	Electric horn device	M8×16	18-22	13.3-16.2
Hexagon flange bolt	Condenser assembly	M6×16	8-10	5.9-7 . 4
Hexagon flange bolt	Main machine device of air conditioning	M6×16	8-10	5.9-7 . 4
Hexagon flange bolt	Pipe system assembly	M6×20	8-10	5.9-7 . 4
Hexagon flange bolt	Pipe system assembly	M6×20	22-24	16.2-17.8

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Cross recessed pan head self-tapping screw and plain washer assembly	A/C control panel	ST4. 2×16	2-4	1.5-3
Cross recessed pan head self-tapping screw and plain washer assembly	Multi-function instrument assembly	ST4. 2×9.5	2-4	1.5-3
Cross recessed pan head screw and flat washer combination part	Left rear fog lamp assembly	ST4. 8×13	4-6	3-4.4
Cross recessed pan head screw and flat washer combination part	Right rear fog lamp assembly	ST4. 8×13	3-5	2.2-3.6
Cross recessed pan head self-tapping screw and plain washer assembly	Single disc with MP main machine	ST5. 5×16	7-9	5.2-6.6
Cross recessed head self-tapping screw	Rear reading lamp assembly	ST4. 2×16	2-4	1.5-3
Cross recessed head self-tapping screw	Front reading lamp	ST4. 2×16	2-4	1.5-3
Cross recessed pan head self tapping screw-F type	Control switch of main driver glass lifter with panel assembly	ST4. 8×13	4-6	3-4.4
Cross recessed pan head self tapping screw-F type	Co-driver glass lifter control switch with panel assembly	ST4. 8×13	4-6	3-4.4
Cross recess cup head square self tapping screw	Control switch of main driver glass lifter with panel assembly	ST4. 8×13	4-6	3-4.4
Cross recess cup head square self tapping screw	Left rear combination lamp assembly	ST4. 8×13	4-6	3-4.4
Cross recess cup head square self tapping screw	Right rear combination lamp assembly	ST4. 8×13	4-6	3-4.4
Combination member of hexagon head nut and taper washer	Wiper device of rear windscreen	M6	7-9	5.2-6.6
Combination member of hexagon head nut and taper washer	Central door lock electrical device	M6	7-9	5.2-6.6
Combination member of hexagon head nut and taper washer	Central door lock electrical device	M6	7-9	5.2-6.6

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Combination member of hexagon head nut and taper washer	Electric anti-theft controller support	M6	7-9	5.2-6.6
locking nut	Engine harness assembly	M6	18-22	13.3-16.3
Hexagon flange bolt	BMBS main engine support	M6×10	8-10	5.9-7 . 4
Hexagon bolt and plain washer assembly.	Rear wiper	M6×25	7-9	5.2-6.6
Hexagon bolt and plain washer assembly.	Engine ECU device	M6×25	7-9	5.2-6.6
Hexagon bolt and plain washer assembly.	wiper motor and connecting rod assembly	M6×25	7-9	5.2-6.6
Combination member of hexagon head nut and enlarged taper washer	A/C system	M6×16	7-9	5.2-6.6
Hexagon bolt and plain washer assembly.	Windshield washer	M6×20	7-9	5.2-6.6
Hexagon flange nut	Terminal wiring of battery	M8	18-22	13.3-16.3
Combination member of hexagon head bolt . hexagon nut with flower washer	Auxiliary instrument subassembly	M6	7-9	5.2-6.6
Hexagon flange nut	Cross beam of instrument panel assembly	M6	8-10	5.9-7 . 4
Hexagon flange nut	Rear spoiler assembly	M6	8 - 10	5.9 - 7.4
Cross recess hexagon head bolt and big flat washer combination	Front bumper device	M6×20	7 - 9	5.2 - 6.6
Cross recess hexagon head bolt and big flat washer combination	Left right mounting support of front bumper	M6×20	7 - 9	5.2 - 6.6
Cross recess hexagon head bolt and big flat washer combination	Upper trim plate of front bumper	M6×20	7 - 9	5.2 - 6.6
Cross recess hexagon head bolts and flat washer combination part	Engine bottom shield	M6×14	7 - 9	5.2 - 6.6
Cross recess hexagon head bolts and flat washer combination	Front bumper assembly	M6×20	7 - 9	5.2 - 6.6

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part				
Cross recess hexagon head bolts and flat washer combination part	Venting cover plate device	M6×20	7 - 9	5.2 - 6.6
Cross recess hexagon head bolts and flat washer combination part	Left rear wheel pipe guard plate	M6×20	7 - 9	5.2 - 6.6
Cross recess hexagon head bolts and flat washer combination part	Engine bottom Shield	M6×20	7 - 9	5.2 - 6.6
Cross recess hexagon head bolts and flat washer combination part	Base guard plate of carbon canister	M6×20	7 - 9	5.2 - 6.6
Cross recess hexagon head bolts and flat washer combination part	Engine right guard plate	M6×20	7 - 9	5.2 - 6.6
Hexagon flange bolt	Auxiliary instrument subassembly	M6×18	8 - 10	5.9 - 7.4
Cross recess hexagon head screw and flat washer combination part	Left side wall rear trim plate	ST4. 8×19	4 - 6	3 - 4.4
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Right side wall rear trim plate	ST4. 8×19	4 - 6	3 - 4.4
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Left rear fender lining plate	ST6. 3×19	10 - 12	7.4 - 8.9
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Right rear fender lining plate	ST6. 3×19	10 - 12	7.4 - 8.9
Cross recess hexagon head bolts and flat washer combination part	Lower trim plate of front bumper	ST4. 8×16	4 - 6	3 - 4.4

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Cross recess hexagon head bolts and flat washer combination part	Front bumper device	ST4. 8×16	4 - 6	3 - 4.4
Cross recess hexagon head bolts and flat washer combination part	Left right mounting support of front bumper	ST4. 8×16	4 - 6	3 - 4.4
Cross recess hexagon head bolts and flat washer combination part	Right installing support assembly of rear bumper	ST4. 8×16	4 - 6	3 - 4.4
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Right installing support assembly of rear bumper	ST4. 8×19	4 - 6	3 - 4.4
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Left front fender liner	ST4. 8×19	4 - 6	3 - 4.4
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Right front fender lining plate	ST4. 8×19	4 - 6	3 - 4.4
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Left outer doorsill lower trim plate	ST4. 8×19	4 - 6	3 - 4.4
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Right outer doorsill lower trim plate	ST4. 8×19	4 - 6	3 - 4.4
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Left rear fender lining plate	ST4. 8×19	4 - 6	3 - 4.4
JQ2235519 Cross recessed cavity hexagon head	Right rear fender lining plate	ST4. 8×19	4 - 6	3 - 4.4

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self-tapping screw and big flat washer assembly				
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Left guard plate of engine	ST4. 8×19	4 - 6	3 - 4.4
JQ2235519 Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly	Engine right guard plate	ST4. 8×19	4 - 6	3 - 4.4
Hexagon bolt and plain washer assembly.	Cross beam of instrument panel assembly	M8×20	18 - 22	13.3 - 16.3
Hexagon bolt and plain washer assembly.	Left center post (with air curtain mark)	M6×16	7 - 9	5.2 - 6.6
Hexagon bolt and plain washer assembly.	Right central post upper trim plate assembly(with air curtain mark)	M6×16	7 - 9	5.2 - 6.6
Hexagon bolt and plain washer assembly.	Left rear pillar upper trim plate assembly (with air curtain mark)	M6×16	7 - 9	5.2 - 6.6
Hexagon bolt and plain washer assembly.	Right rear post upper trim plate assembly(with air curtain mark)	M6×16	7 - 9	5.2 - 6.6
Hexagon bolt and plain washer assembly.	Left center post	M6×16	7 - 9	5.2 - 6.6
Hexagon bolt and plain washer assembly.	Right central post upper trim plate assembly	M6×16	7 - 9	5.2 - 6.6
Hexagon bolt and plain washer assembly.	Left rear pillar upper trim plate assembly	M6×16	7 - 9	5.2 - 6.6
Hexagon bolt and plain washer assembly.	Right rear post upper trim plate assembly	M6×16	7 - 9	5.2 - 6.6
Hexagon flange bolt	Muffler block bolt sheath of door	M8×30	22 - 26	16.3 - 19.2
Hexagon flange face bolt －Enlarged series	Cross beam of instrument panel assembly	M8×16	22 - 26	16.3 - 19.2

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Cross recessed pan head self-tapping screw and plain washer assembly	Shift anti-dust cover frame	M6×20	2 - 4	1.5 - 3
Cross recessed pan head self-tapping screw and plain washer assembly	Mounting support of front door inner trim plate	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Right front door inner trim plate handle mounting support(I)	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Right front door inner trim plate handle mounting support(II)	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Left rear door inner trim plate handle mounting support	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Left rear door inner trim plate handle installing seat	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Right rear door inner trim plate handle mounting support	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Right rear door inner trim plate handle installing seat	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Left upper trim plate assembly of back-door	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Back-door right upper inner trim plate assembly	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Inner trim plate handle of back door	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Lower guard plate assembly of instrument panel	ST4. 8×16	4 - 6	3 - 4.4

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Cross recessed pan head self-tapping screw and plain washer assembly	Auxiliary instrument subassembly	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Right front door inner trim plate handle cover plate	ST4. 8×22	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Left rear post lower trim plate assembly	ST4. 8×22	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Right rear post lower trim plate assembly	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Left rear post lower trim plate assembly	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed pan head self-tapping screw and plain washer assembly	Right rear post lower trim plate assembly	ST4. 8×16	4 - 6	3 - 4.4
Cross recessed head self-tapping screw	Second row intermediate safety belt lock tongue box trim plate	ST4. 8×13	2 - 4	1.5 - 3
Cross recessed head self-tapping screw	Second row intermediate safety belt lock tongue box trim plate	ST4. 8×13	2 - 4	1.5 - 3
cross recessed countersunk head self tapping screw	Right installing support assembly of rear bumper	ST4. 2×16	2 - 4	3 - 4.4
Hexagon flange nut	Back-door trim strip assembly	M5	4 - 6	3 - 4.4
Hexagon flange nut	Engine hood trim strip assembly	M5	4 - 6	3 - 4.4
Square nut	Outer trim plate of back door	M5	4 - 6	3 - 4.4
Combination member of hexagon head nut and enlarged taper washer	Base guard plate of carbon canister	M6	7 - 9	5.2 - 6.6
Hexagon flange bolt	Intermediate right trim plate of instrument panel	M6×16	8 - 10	5.9 - 7.4
Cross recessed head self-tapping screw	Left rear door exterior angle trim	ST4. 2×16	2 - 4	1.5 - 3
Cross recessed head	Right rear door exterior	ST4. 2×16	2 - 4	1.5 - 3

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self-tapping screw	angle trim			
Cross recess hexagon head bolts. spring washer and flat washer combination part	Extinguisher support	M6×20	7 - 9	5.2 - 6.6
Hexagon flange nut	Outer open handle assembly of back door	M6	8 - 10	5.9 - 7.4
Hexagon flange nut	Back door lock cylinder assembly	M6	8 - 10	5.9 - 7.4
Hexagon flange nut	Exterior rear view mirror assembly	M6	8 - 10	5.9 - 7.4
Flush-mounted Plastic Nut with A Through Hole	Left door inner open handle assembly	8. 8×8. 6	—	—
Flush-mounted Plastic Nut with A Through Hole	Right door inner open handle assembly	8. 8×8. 6	—	3 - 4.4
Flush-mounted Plastic Nut with A Through Hole	Left door inner open handle assembly	8. 8×8. 6	—	—
Flush-mounted Plastic Nut with A Through Hole	Right door inner open handle assembly	8. 8×8. 6	—	—
Cross recess pan head flange face self tapping screw	Left door inner open handle assembly	ST4. 8×16	4 - 6	3 - 4.4
Cross recess pan head flange face self tapping screw	Right door inner open handle assembly	ST4. 8×16	4 - 6	3 - 4.4
Cross recess pan head flange face self tapping screw	Left door inner open handle assembly	ST4. 8×16	4 - 6	3 - 4.4
Cross recess pan head flange face self tapping screw	Right door inner open handle assembly	ST4. 8×16	4 - 6	5.9 - 7.4
Hexagon flange face with gear nut	Front door limiter assembly	M6	8 - 10	5.9 - 7.4
Hexagon flange face with gear nut	Front door limiter assembly	M6	8 - 10	5.9 - 7.4
Hexagon flange face with gear nut	Rear door limiter assembly	M6	8 - 10	5.9 - 7.4
Hexagon flange face with gear nut	Rear door limiter assembly	M6	8 - 10	5.2 - 6.6
Hexagon bolt and plain washer assembly.	Engine hood gas spring assembly	M6×16	7 - 9	5.2 - 6.6

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Hexagon bolt and plain washer assembly.	Gas spring assembly of backdoor	M6×16	7 - 9	5.2 - 6.6
Hexagon bolt and plain washer assembly.	Left front seat assembly(manual)and front floor	M10×1.25×30	40 - 50	29.6 - 37
Hexagon bolt and plain washer assembly.	Left front seat assembly(electric heating/waist/electric)and front floor	M10×1.25×30	40 - 50	29.6 - 37
Hexagon bolt and plain washer assembly.	Right front seat assembly (manual)and front floor	M10×1.25×30	40 - 50	29.6 - 37
Hexagon bolt and plain washer assembly.	Right front seat assembly (power)and front floor	M10×1.25×30	40 - 50	29.6 - 37
Hexagon bolt and plain washer assembly.	Left middle seat assembly and rear floor	M10×1.25×25	40 - 50	29.6 - 37
Hexagon flange bolt	Right central seat assembly and rear floor	M10×1.25×25	40 - 50	29.6 - 37
Hexagon flange bolt	Left rear seat assembly and rear floor	M10×1.25×25	40 - 50	29.6 - 37
Hexagon flange bolt	Right rear seat assembly and rear floor	M10×1.25×25	40 - 50	29.6 - 37
Hexagon flange bolt	Filler cap open handle assembly	M6×20	7 - 9	5.2 - 6.6
Hexagon flange bolt, spring washer and plain washer assembly	Back door lock body assembly	M6×12	8 - 10	5.9 - 7.4
Combination member of hexagon flange face bolt. hexagon flange face bolt flat washer	Front door limiter assembly	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Front door limiter assembly	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Rear door limiter assembly	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Rear door limiter assembly	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Engine hood handle and cable assembly	M12×25	68 - 82	50.3 - 60.7
Hexagon flange bolt	Left front door glass lifter assembly	M6×12	8 - 10	5.9 - 7.4

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Hexagon flange bolt	Right front door glass lifter assembly	M6×12	8 - 10	5.9 - 7.4
Hexagon flange bolt	Left rear door glass lifter assembly	M6×12	8 - 10	5.9 - 7.4
Hexagon flange bolt	Right rear door glass lifter assembly	M6×12	8 - 10	5.9 - 7.4
Hexagon flange bolt	Engine hood lock assembly	M6×16	8 - 10	5.9 - 7.4
Hexagon flange bolt	Hood lock second lock	M6×16	8 - 10	5.9 - 7.4
Cross recessed pan head screw	Rear safety handle assembly	M5×35	3 - 5	2.2 - 3.7
Cross recessed pan head screw	Sunvisor buckle	M6×25	7 - 9	5.2 - 6.6
Hexagon spline raised countersunk head screw	Door lock	M6×16	7 - 9	5.2 - 6.6
Hexagon spline raised countersunk head screw	Door lock	M6×16	7 - 9	5.2 - 6.6
Hexagon spline raised countersunk head screw	Door lock	M6×16	7 - 9	5.2 - 6.6
Hexagon spline raised countersunk head screw	Door lock	M6×16	7 - 9	5.2 - 6.6
Hex lobular socket countersunk head screws	Door latch assembly	M8×22	18 - 22	13.2 - 16.3
Hex lobular socket countersunk head screws	Door latch assembly	M8×22	18 - 22	13.2 - 16.3
Hex lobular socket countersunk head screws	Door latch assembly	M8×22	18 - 22	13.2 - 16.3
Hex lobular socket countersunk head screws	Door latch assembly	M8×22	18 - 22	13.2 - 16.3
Hex lobular socket countersunk head screws	Back door latch assembly	M8×22	18 - 22	13.2 - 16.3
Open type countersunk blind rivets	Ex-factory nameplate	φ3×7	—	—
Hexagon flange bolt	Luggage rack	M6×12	8 - 10	5.9 - 7.4

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Cross recess hexagon head self tapping screw and flat washer combination part	Tighten passenger airbag and instrument	ST4. 8×16	4 - 6	3 - 4.4
Hexagon flange Bolt	Fasten the Beams of passenger airbag and Instruments	M8×16	22 - 26	16.3 - 19.2
Hexagon flange bolt, spring washer and plain washer assembly	Fasten Side guard curtain Airbag	M6×16	7 - 9	5.2 - 6.6
Hexagon flange bolt, spring washer and plain washer assembly	Fasten driver knee airbag	M6×16	7 - 9	5.2 - 6.6
Cross recessed pan head self-tapping screw and plain washer assembly	Fasten driver knee Airbag	ST4. 8×16	4 - 6	3 - 4.4
Hexagon flange Nut	Tighten steering wheel and steering column	M12×1.25	36 - 44	26 . 6 - 32 . 6
Cross recess pan head flange face self-tapping nut	Tighten clock spring and steering column	ST4. 8×16	4 - 6	3 - 4.4
Hexagon flange bolt	Tighten front/side crash sensor	M6×30	7 - 9	5.2 - 6.6
Hexagon flange bolt	Tighten airbag electric control unit	M6×20	7 - 9	5.2 - 6.6
Hexagon flange bolt	Engine right damping cushion assembly and body	M12×1.25×20	47 - 57	34. 8 - 42. 2
Hexagon flange bolt	Front cross beam of engine front damping cushion assembly	M10×1.25×22	47 - 57	34. 8 - 42. 2
Hexagon flange bolt	Engine front support and transmission	M10×1.25×22	47 - 57	34. 8 - 42. 2
Hexagon flange bolt	Engine rear support and transmission	M10×1.25×22	47 - 57	34. 8 - 42 . 2
Hexagon flange bolt	Engine right damping cushion assembly and body	M10×1.25×22	47 - 57	34. 8 - 42. 2
Hexagon flange bolt	Left damping cushion assembly and body of engine	M10×1.25×22	47 - 57	34. 8 - 42. 2
Hexagon flange bolt	Left support and transmission of engine	M10×1.25×40	50 - 60	37 - 44. 4

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Hexagon flange bolt	Engine right damping cushion assembly and engine support	M10×1.25×50	50 - 60	37 - 44. 4
Hexagon flange bolt	Engine rear damping cushion assembly and subframe	M10×1.25×70	50 - 60	37 - 44. 4
Hexagon flange bolt	Rear support and rear damping cushion assembly of engine	M10×1.25×90	75 - 85	55. 5 - 62. 9
Hexagon flange bolt	Engine front damping cushion assembly and front support	M10×1.25×90	75 - 85	55. 5 - 62. 9
Hexagon flange nut	Engine rear damping cushion assembly and subframe	M10×1.25	50 - 60	37 - 44. 4
Hexagon flange nut	Engine right damping cushion assembly and engine support	M10×1.25	70 - 90	51. 8 - 66. 6
Hexagon flange nut	Left support and left damping cushion assembly of engine	M14×1.5	110 - 130	81. 4 - 96. 2
Hexagon flange bolt, spring washer and plain washer assembly	Powertrain	M10×1.25×40	53 - 65	39. 2 - 48. 1
Hexagon flange bolt, spring washer and plain washer assembly	Powertrain	M10×1.25×45	53 - 65	39. 2 - 48. 1
Hexagon flange bolt, spring washer and plain washer assembly	Powertrain	M10×1.25×60	36 - 44	26. 6 - 32. 6
Hexagon flange bolt, spring washer and plain washer assembly	JL4G18 type engine assembly	M10×1. 25×80	36 - 44	26. 6 - 32. 6
Hexagon flange bolt	Power assembly (JL4G18-E+JL-S170B)	M12×1. 25×50	96 - 110	71 - 81. 4
Combination member of hexagon head bolt . hexagon nut with flower washer	Engine ECU device	M6	8 - 12	5. 9 - 8. 9
Hexagon bolt and plain washer assembly.	Engine ECU device	M6×25	8 - 12	5. 9 - 8. 9
Hexagon flange bolt, spring washer and plain washer	Exhaust Device	M10×1.25×40	30 - 40	22. 2 - 29. 6

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assembly				
Hexagon flange face with washer shaft bolt	Exhaust device	M10×1.25×58	47 - 57	34. 8 - 42. 2
Combination member of hexagon head bolt . hexagon nut with flower washer	Exhaust device	M6	8 - 10	5.9 - 7.4
Hexagon bolt and plain washer assembly.	Air intake device	M6×12	8 - 10	5.9 - 7.4
B-type worm drive hose hoop	Air intake device	Φ8. 3	3 - 5	2.2 - 3.7
Steel strip—elastic ring hoop	Air intake device	Φ18	—	—
Hexagon bolt and plain washer assembly.	Air intake device	M6×12	8—10	5.9 - 7.4
Hexagon bolt and plain washer assembly.	Air intake device	M6×16	8 - 10	5.9 - 7.4
Hexagon bolt and plain washer assembly.	Engine cooling device (radiator)	M6×20	6 - 12	4. 4 - 8. 9
Hexagon bolt and plain washer assembly.	Engine cooling device (expansion tank)	M6×20	6 - 12	4. 4 - 8. 9
Hexagon flange bolt	Engine cooling device	M8×25	20 - 26	14.8 - 19.2
Hexagon flange bolt, spring washer and plain washer assembly	Fuel tank device	M10×30	40 - 45	29. 6 - 33. 3
Hexagon flange bolt, spring washer and plain washer assembly	Fuel pump assembly	M6×16	7 - 9	5.2 - 6.6
Cross recess hexagon head bolts and flat washer combination part	Fuel level sensor assembly	M5×10	3 - 5	2.2 - 3.7
Hexagon bolt and plain washer assembly.	Carbon canister assembly,	M8×20	18 - 22	13.3 - 16.3
Hexagon flange bolt	Oil filling pipe assembly	M8×16	22 - 26	16.3 - 19.2
Pin shaft	Clutch master pump assembly	Φ8×24	—	—

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Double end stud of hexagon bolt and flat washer combination part	Shift flexible shaft pressure plate	M6×20	6 - 12	4. 4 - 8. 9
Hexagon bolt and plain washer assembly.	Connect rear subframe rear point with body	M14×1. 5×95	180 - 220	133.2 - 162.8
Hexagon bolt and plain washer assembly.	Rear upper swing arm and spindle head mounting bolt flat washer combination member	M12×1. 25×100	82 - 98	60. 7 - 72. 5
Hexagon bolt and plain washer assembly.	Rear upper swing arm and spindle head mounting bolt flat washer combination member	M12×1.25×100	82 - 98	60. 7 - 72. 5
Hexagon bolt and plain washer assembly.	Rear shock absorber, spindle head mounting bolt and flat washer combination member	M12×1.25×25	72 - 88	53. 3 - 65. 1
Hexagon bolt and plain washer assembly.	Rear shock absorber, spindle head mounting bolt and flat washer combination member	M12×1. 25×25	72 - 88	53. 3 - 65. 1
Hexagon bolt and plain washer assembly.	Composite member of front suspension reinforcement plate. body connecting bolt and flat washer	M12×1. 25×30	101	81 . 4
Hexagon bolt and plain washer assembly.	Composite member of front suspension reinforcement plate. body connecting bolt and flat washer	M12×1. 25×30	101	81. 4
Hexagon bolt and plain washer assembly.	Mounting nut of rear upper swing arm and subframe	M12×1. 25×70	72 - 88	53. 3 - 65. 1
Hexagon bolt and plain washer assembly.	Mounting nut of rear upper swing arm and subframe	M12×1. 25×70	72 - 88	53. 3 - 65. 1
Hexagon bolt and plain washer assembly.	Rear suspension reinforcement plate mounting bolt and flat washer combination member	M10×1. 25×26	101	81. 4
Hexagon flange bolt, spring washer and plain washer	Rear suspension reinforcement plate mounting bolt and flat	M10×1. 25×26	101	81. 4

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assembly	washer combination member			
Hexagon flange bolt	Support and body of oil can	M6×30	8 - 10	5.9 - 7.4
Hexagon flange bolt	Connecting bolt of cross beam trailing arm and body	M12×1.25×103	88 - 104	65. 1 - 77
Hexagon flange bolt	Connecting bolt of longitudinal beams and sub-frame	M12×1 . 25×25	79 - 95	58. 5 - 70. 3
Hexagon flange bolt	Connecting bolt of longitudinal beams and sub-frame	M12×1 . 25×25	79 - 95	58. 5 - 70. 3
Hexagon flange bolt	Mounting support mounting bolt of front stabilizer rod	M12×1 . 25×30	79 - 95	58. 5 - 70. 3
Hexagon flange bolt	Mounting support mounting bolt of front stabilizer rod	M12×1 . 25×30	79 - 95	58. 5 - 70. 3
Hexagon flange bolt	Connecting rear tailing arm mounting support with body	M12×1. 25×33	45 - 55	33. 3 - 40. 7
Hexagon flange bolt	Connecting rear tailing arm mounting support with body	M12×1. 25×33	45 - 55	33. 3 - 40. 7
Hexagon flange bolt	Connecting bolt of cross beam and body	M12×1. 25×33	88 - 104	65. 1 - 77
Hexagon flange bolt	Install rear shock absorber and rear subframe	M12×1. 25×65	72 - 88	53. 3 - 65. 1
Hexagon flange bolt	Mounting nut of rear shock absorber and its support	M12×1. 25×70	72 - 88	53. 3 - 65. 1
Hexagon flange bolt	Power steering pump and engine	M10×1. 25×122	48 - 52	35. 5 - 38. 5
Hexagon flange bolt	Connecting bolt of rear tailing arm and mounting support	M14×1. 5×80	135 - 165	99. 9 - 122. 1
Hexagon flange bolt	Connecting bolt of rear tailing arm and mounting support	M14×1. 5×80	135 - 165	99. 9 - 122. 1
Hexagon flange bolt	Front mounting bolt of front lower swing arm	M16×1. 5×100	213 - 253	157.6 - 187.2
Hexagon flange bolt	Front mounting bolt of front lower swing arm	M16×1. 5×100	213 - 253	157.6 - 187.2

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Hexagon flange bolt	Mounting bolt of rear tailing arm and spindle head	M16×1. 5×60	180 - 220	133.2 - 162.8
Hexagon flange bolt	Mounting bolt of rear tailing arm and spindle head	M16×1. 5×60	180 - 220	133.2 - 162.8
Hexagon flange bolt	Lower mounting bolt of front shock absorber	M17×1. 5×62	220 - 260	162.8 - 192.4
Hexagon flange bolt and plain washer assembly	Lower mounting bolt of front shock absorber	M17×1. 5×62	220 - 260	162.8 - 192.4
Hexagon flange bolt and plain washer assembly	Mounting bolt and flat washer combination member of No. 1 swing arm of rear suspension and subframe	M12×1. 25×65	80 - 90	59. 2 - 66.6
Hexagon flange bolt and plain washer assembly	Mounting bolt and flat washer combination member of No. 2 swing arm of rear suspension and spindle head	M12×1. 25×85	80 - 90	59. 2 - 66.6
Hexagon flange bolt and plain washer assembly	Mounting bolt and flat washer combination member of No. 2 swing arm of rear suspension and spindle head	M12×1. 25×85	80 - 90	59. 2 - 66.6
Hexagon flange bolt and plain washer assembly	Mounting bolt flat washer combination member of No. 2 swing arm of rear suspension and subframe	M12×1. 25×95	80 - 90	59. 2 - 66.6
Hexagon flange bolt and plain washer assembly	Mounting bolt flat washer combination member of No. 2 swing arm of rear suspension and subframe	M12×1. 25×95	80 - 90	59. 2 - 66.6
Hexagon flange bolt and plain washer assembly	Front mounting bolt of front sub-frame	M14×1. 5×133	133 - 157	98. 4 - 116. 2
Hexagon flange bolt and plain washer assembly	Front mounting bolt flat washer combination member of rear subframe	M14×1. 5×90	138 - 162	102.1 - 119.9
Hexagon flange bolt and plain washer assembly	Combination part of front mounting bolt of front sub-frame and flat washer	M14×1. 5×95	133 - 157	98. 4 - 116. 2
Hexagon flange nut with lock	Mounting nut of rear shock absorber and rear subframe	M12×1.25	72 - 88	53. 3 - 65. 1

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Hexagon flange nut with lock	Mounting bolt of rear shock absorber and its support	M12×1.25	72 - 88	53. 3 - 65. 1
Hexagon flange nut with lock	Mounting nut of rear upper swing arm and subframe	M12×1.25	80 - 100	59. 2 - 74
Hexagon flange nut with lock	Mounting nut of rear upper swing arm and subframe	M12×1.25	80 - 100	59. 2 - 74
Hexagon flange nut with lock	Mounting nut of No. 1 swing arm of rear suspension and subframe	M12×1.25	80 - 100	59. 2 - 74
Hexagon flange nut with lock	Mounting nut of rear upper swing arm and spindle head	M12×1.25	80 - 100	59. 2 - 74
Hexagon flange nut with lock	Mounting nut of rear upper swing arm and spindle head	M12×1.25	80 - 100	59. 2 - 74
Hexagon flange nut with lock	Front stabilizer rod and connecting rod	M12×1.25	69 - 79	51. 1 - 58 . 5
Hexagon flange nut with lock	Front stabilizer rod connecting rod and shock absorber	M12×1.25	69 - 79	51. 1 - 58 . 5
Hexagon flange nut with lock	Mounting nut of No. 2 swing arm of rear suspension and subframe	M12×1.25	80 - 100	59. 2 - 74
Hexagon flange nut with lock	Mounting nut of No. 2 swing arm of rear suspension and subframe	M12×1.25	80 - 100	59. 2 - 74
Hexagon flange nut with lock	Mounting nut of No. 1 swing arm of rear suspension and spindle head	M12×1.25	90 - 110	66.6 - 81. 4
Hexagon flange nut with lock	Connecting rod of rear stabilizer rod and connecting nut of stabilizer rod	M12×1.25	69 - 79	51. 1 - 58. 5
Hexagon flange nut	Mounting nut of rear stabilizer rod fixing frame	M12×1.25	55 - 65	40. 7 - 48. 1
Hexagon flange nut	Power steering pump and engine	M10×1.25	47 - 53	34. 8 - 39. 2
Hexagon flange nut	Connecting nut of rear tailing arm and mounting support	M14×1.5	140 - 160	103.6 - 118.4
Hexagon flange nut	Connecting nut of rear tailing arm and mounting	M14×1.5	140 - 160	103.6 - 118.4

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	support			
Hexagon flange nut	Rear mounting nut of rear sub frame	M14×1.5	180 - 220	133.2 - 162.8
Full metal hexagon flange lock nut	Power steering gear fixing device	M14×1.5	122 - 128	90. 3 - 94. 7
Hexagon flange nut	Rear mounting nut of front lower swing arm	M16×1. 5	213 - 253	157.6 - 187.2
Hexagon flange nut	Rear mounting nut of front lower swing arm	M16×1. 5	213 - 253	157.6 - 187.2
Automatic pin nut of hexagon flange face	Connecting rod of rear stabilizer rod and mounting nut of No,2 swing nut	M10×1.25	27 - 33	20 - 24. 4
Thicken nut of hexagon flange face	Install nut of post and body	M10×1.25	45 - 55	33. 3 - 40. 7
Thicken nut of hexagon flange face	Install nut of post and body	M10×1.25	45 - 55	33. 3 - 40. 7
Hexagon flange nut	Lower mounting nut of front shock absorber	M17×1. 5	220 - 260	162.8 - 192.4
Hexagon flange nut	Lower mounting nut of front shock absorber	M17×1. 5	220 - 260	162.8 - 192.4
Vehicle wheel nut	Brake and wheel assembly	M12×1. 5	93 - 113	68. 8 - 83. 6
GB9074 . 14M8*35 Hexagon bolt flat washer	Manual shifter	M8×35	17 - 26	12.6 - 19.2
Hexagon head bolt spring washer combination member	Parking brake cable	M6×16	6 - 12	4. 4 - 8. 9
Combination member of hexagon head bolt and spring washer	Parking brake lever	M8×20	17 - 26	12.6 - 19.2
Combination member of hexagon head bolt and spring washer	Brake pedal with support assembly	M8×20	17 - 26	12.6 - 19.2
Combination member of hexagon head bolt and spring washer	Extension shaft and gear shaft	M8×25	22 - 26	16.3 - 19.2
Combination member of hexagon head bolt and spring washer	Universal joint yoke	M8×32	22 - 26	16.3 - 19.2
Hexagon flange bolt	Support and cross beam of column	M8×70	23 - 27	17 - 20
Hexagon flange nut	Spline anti-dust cover and front wall plate	M6	8 - 10	5.9 - 7.4

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Hexagon flange nut	Oil return pipe clamper and steering gear	M6	8 - 10	5.9 - 7.4
Hexagon flange nut	Fixing bolt of shift shaft flexible	M6	8 - 10	5.9 - 7.4
Hexagon flange nut	Electronic accelerator pedal	M6	8 - 10	5.9 - 7.4
Hexagon flange nut	Fixed speed sensor support	M6	8 - 10	5.9 - 7.4
Hexagon flange nut	Parking brake control device	M6	8 - 10	5.9 - 7.4
Hexagon flange nut	Mechanical steering column assembly	M8	23 - 27	17 - 20
Hexagon flange nut	One fixed duplex fitting with support assembly	M8	14 - 18	10.4 - 13.3
Hexagon flange nut	Two fixing HECU controller assembly	M8	14 - 18	10.4 - 13.3
Hexagon with tapper washer nut	Vacuum booster, front wall and brake pedal support	M8	18 - 26	13.3 - 19.2
Hexagon with tapper washer nut	Vacuum booster, front wall and brake pedal support	M8	18 - 26	13.3 - 19.2
Slotted nut of hexagon flange face	Low swing arm round head slotted nut	M14×1.5	123 - 143	91 - 105. 8
Slotted nut of hexagon flange face	Low swing arm round head slotted nut	M14×1.5	123 - 143	91 - 105. 8
Hexagon slotted nut.style 1	Outer-end ball head and knuckle of steering gear tie rod	M12×1.25	31 - 35	22. 9 - 25. 9
Hexagon flange bolt, spring washer and plain washer assembly	Power steering inlet/outlet pipe/hose Assembly	M6×20	8 - 10	5.9 - 7.4
Hexagon bolt and plain washer assembly.	Fixed speed sensor support	M6×18	16 - 20	11.8 - 14.8
Hexagon flange bolt, spring washer and plain washer assembly	One fixed HECU controller assembly,6 fixed brake hose	M8×20	15 - 21	11.1 - 22.2
Flat washer	Fixing bolt of steering gear	Φ14	—	—
Hexagon flange face bolt three stage bolt and flat washer combination part	Fixing bolt of steering gear	M14×1. 5×132	117 - 133	86. 6 - 98. 4

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Hexagon bolt and plain washer assembly.	Rear hook	M12×1. 25×30	56 - 84	41. 4 - 62. 2
Hexagon bolt and plain washer assembly.	Lower assembly of front cross beam	M10×1. 25×25	52 - 78	38. 5 - 57. 7
Hexagon flange bolt, spring washer and plain washer assembly	Body in white assembly	M10×1. 25×25	18 - 22	13.3 - 16.3
Hexagon flange bolt	Right rear door assembly	M8×23	22 - 26	16.3 - 19.2
Hexagon flange bolt	Left rear door assembly	M8×23	22 - 26	16.3 - 19.2
Hexagon flange bolt	Right front door assembly	M8×23	22 - 26	16.3 - 19.2
Hexagon flange bolt	Left front door assembly	M8×23	22 - 26	16.3 - 19.2
Hexagon flange bolt and plain washer assembly	Upper hinge assembly of left front door	M8×30	26 - 38	19.2 - 28.1
Hexagon flange bolt and plain washer assembly	Right front door upper hinge assembly	M8×30	26 - 38	19.2 - 28.1
Hexagon flange bolt and plain washer assembly	Right front door low hinge assembly	M8×30	26 - 38	19.2 - 28.1
Hexagon flange bolt and plain washer assembly	Lower hinge assembly of left front door	M8×30	26 - 38	19.2 - 28.1
Hexagon flange bolt, spring washer and plain washer assembly	Rear cross beam assembly	M8×25	15 - 25	11.1 - 18.5
Hexagon head bolt . spring washer and	Front cross beam Assembly	M8×25	15 - 25	11.1 - 18.5
Hexagon flange bolts of flat washer combination part	Left front door assembly	M6×12	8 - 10	5.9 - 7.4
Hexagon flange bolt	Right rear door assembly	M6×12	8 - 10	5.9 - 7.4
Hexagon flange bolt	Left rear door assembly	M6×12	8 - 10	5.9 - 7.4
Hexagon flange bolt	Body in white assembly	M6×12	8 - 10	5.9 - 7.4
Hexagon flange bolt	Right front door assembly	M6×12	8 - 10	5.9 - 7.4
Hexagon flange bolt	Left/right fender	M6×16	8 - 10	5.9 - 7.4
Hexagon flange bolt	Engine compartment assembly	M6×16	8 - 10	5.9 - 7.4

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Hexagon flange bolt	Body assembly	M6×16	8 - 10	5.9 - 7.4
Hexagon flange bolt	Body in white assembly	M6×16	8 - 10	5.9 - 7.4
Hexagon flange bolt	Left front damper support assembly	M6×20	8 - 10	5.9 - 7.4
Hexagon flange bolt	Left longitudinal beam assembly	M8×16	22 - 26	16.3 - 19.2
Hexagon flange bolt	Right longitudinal beam	M8×16	22 - 26	16.3 - 19.2
Hexagon flange bolt	Back door hinge assembly	M8×16	22 - 26	16.3 - 19.2
Hexagon flange bolt	Left longitudinal beam assembly	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Right longitudinal beam	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Lower cross beam of radiator	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Battery bracket assembly	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Left connecting plate assembly of front wall frame	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Right connecting plate assembly of front wall frame	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Engine hood assembly	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Left /right connecting plate of celling No . 2 cross beam	M8×20	22 - 26	16.3 - 19.2
Hexagon flange bolt	Engine hood right hanger assembly	M8×20	22 - 26	16.3 - 19.2
Hexagon flange nut	Right rear door glass rear guide rail assembly	M6	8——10	5.9 - 7.4
Hexagon flange nut	Left rear door glass rear guide rail assembly	M6	8——10	5.9 - 7.4
Hexagon flange nut	Left connecting plate assembly of front wall frame	M6	22 - 26	16.3 - 19.2
Hexagon flange nut	Right connecting plate assembly of front wall frame	M6	22 - 26	16.3 - 19.2
Hexagon flange nut	Back-door assembly	M6	22 - 26	16.3 - 19.2

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1.9 Vehicle identification number

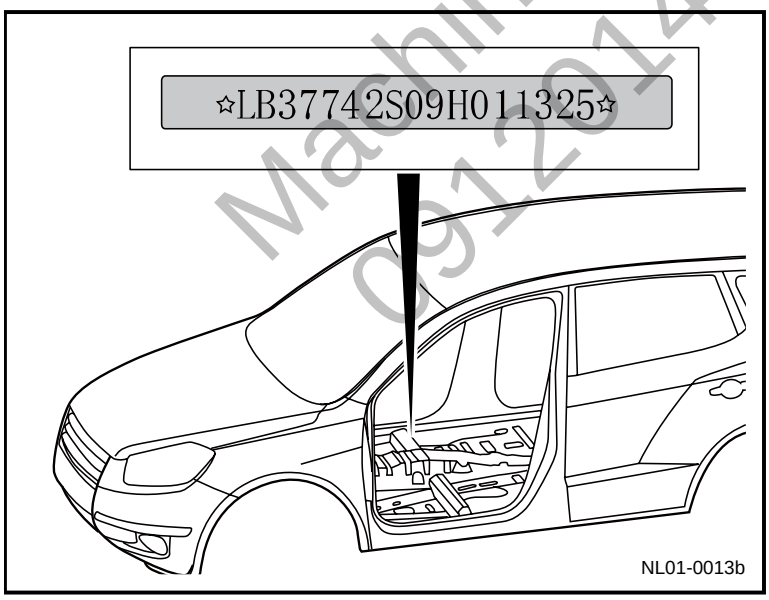
1.9.1 Description and operation

1.9.1.1 Vehicle Identification

Vehicle identification number

Vehicle identification number (VIN) plate is a statutory marker.

Vehicle identification number (VIN) Body Stamping



A vehicle identification number (VIN) is stamped on the top right of the firewall.

Label position

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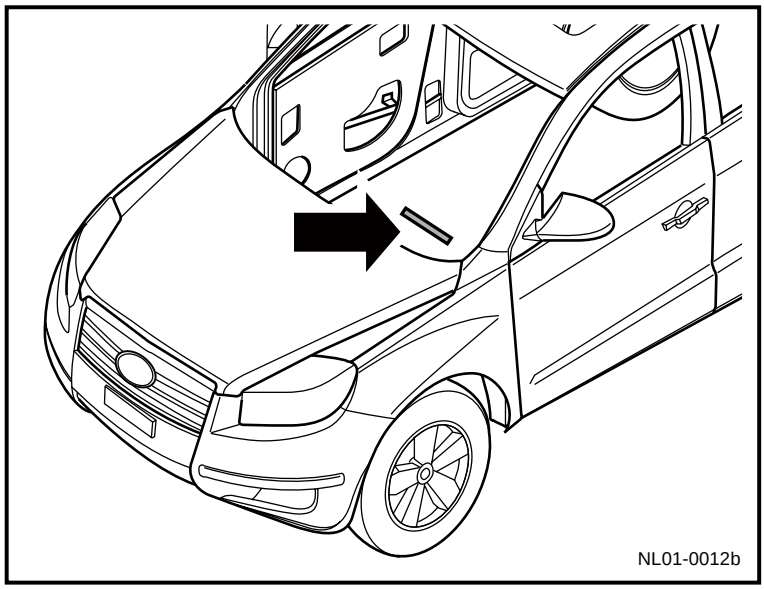
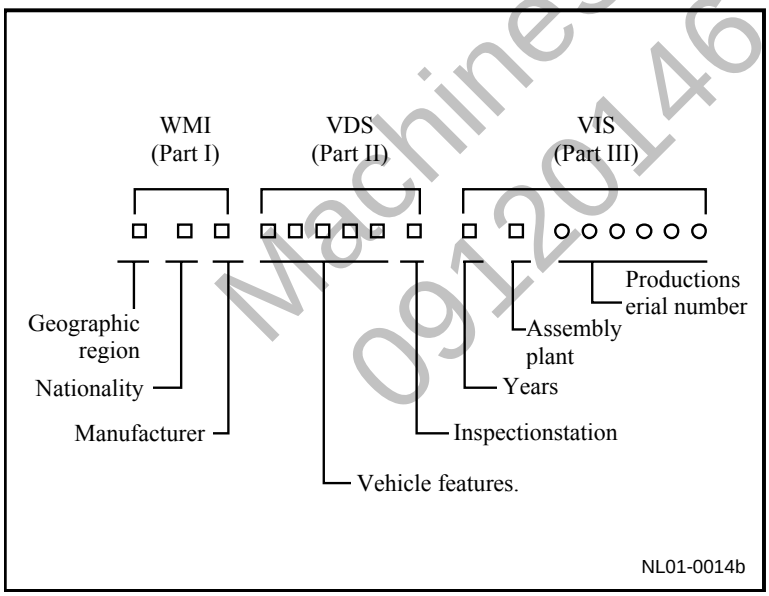


A vehicle identification number (VIN) plate is located at the upper left corner of the instrument panel, viewed through the front windshield.

1.9.1.2 Vehicle identification (VIN) specification

The vehicle identification number consists of:

World's manufacturer identification code (WMI), vehicle description section (VDS) and vehicle parts instructions (VIS) three parts (17 bit), as shown below:



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Vehicle identification number L6T7844S68N138894, for example, the meaning of each figure represents the following table:

Vehicle identification number L6T7844S68N138894, for example, the meaning of each figure represents the following table:

Position	Definition	Number/Letter	Descriptions
1-3	Worldwide manufacturer identification code	L6T	Zhejiang Geely Automotive Co., Ltd.

4	Vehicle type code	7	Passenger car
5	Vehicle main specification code	8	Vehicle longer than 4.6~4.8 m
6	Engine type	4	Front positioned petrol engine, displacement 1.7-1.9 L
7	Body types	4	Sedan/four-door
		2	Hatchback/ 5 Door
8	Drive type	S	Front drive, manual transmission
9	Inspection number	6	VIN check code
	Model year code	8	2008
11	Manufacturer code	N	Geely Automotive Co., Ltd.
12-17	Manufacturer plant code	138894	Plant sequence number

Worldwide manufacturing identification code (WMI)

First part (first-third digit) of vehicle identification number, of which:

L6T - Zhejiang Geely Automotive Co., Ltd.

LJU - Shanghai Huapu Automotive Co., Ltd.

LB3 - Zhejiang Haoqing Automotive Manufacturing Co., Ltd.

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The fourth code specification

Vehicle type code list

S/N	Vehicle type		Code
1	Chassis(non-complete vehicle		0
2	Truck		1
3	Special automobile		5
4	Bus		6
5	Passenger car	Wheelbase＜2.5m	7
6		Wheelbase＞2.5m～2.7m	8
7		Wheelbase＞2.7m	9

The fifth code specification

Main parameter code list of vehicle

Passenger car /bus				Truck /special vehicle			
Length :m	Code	Length :m	Code	Gross weight:kg	Code	Gross weight:kg	Code
≤3.5	0	＞4.0~4.2	5	≤1000	K	＞3000~3500	R

＞3.5~3.6	1	＞4.2~4.4	6	＞1000~1500	L	＞3500~4000	S
＞3.6~3.7	2	＞4.4~4.6	7	＞1500~2000	M	＞4000~4500	T
＞3.7~3.8	3	＞4.6~4.8	8	＞2000~2500	N	＞4500~5000	U
＞3.8~4.0	4	＞4.8	9	＞2500~3000	P	＞5000	V

The sixth code specification

S/N	Engine position	Fuel	Engine displacement :L	Code
1	Front mounting	Gasoline	≤1	0
2			＞1~1.3	1
3			＞1.3~1.5	2
4			＞1.5~1.7	3
5			＞1.7~1.9	4
6			＞1.9~2.1	5
7			＞2.1	6
8		Diesel oil	≤1.3	A
9			＞1.3~2.5	B
10			＞2.5	C
11	Rear mounting	Gasoline	≤1	L
12			＞1~1.3	M
13			＞1.3	N
14		Diesel oil	≤1.3	T
15			＞1.3~2.5	U
16			＞2.5	V

S/N	Power source		Engine displacement :L	Code
1	Hybrid		≤1.3	E
2			＞1.3~3.0	F
3	Double-fuels	Gasoline/quefied petroleum gas(LPG)	≤1.3	G
4			＞1.3~3.0	H
5		Gasoline/ Compressed natural gas gas(LPG)	≤1.3	J
6			＞1.3~3.0	K

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The seventh code specification

S/N	Load type	Coach numbers/door numbers	Drop head	Open-topped	Code
1	Load type	Hatch/double-door	—	—	1
2		Hatch/5-door	—	—	2
3		Hatch+half-coach/5-door	—	—	3
4		Sedan/4-doors	—	—	4
5		Hatch/double-door	√	—	A
6		Hatch/5-door	√	—	B
7		Hatch+half-coach/4-door	√	—	C
8		Sedan/4-doors	√	—	D
9		Hatch/double-door	—	√	R
10		Hatch/5-door	—	√	S
11		Hatch+half-coach/4-door	—	√	T
12		Sedan/4-doors	—	√	U
13		Hatch/double-door	—	—	6
14		Hatch/5-door	—	—	7
15		Hatch+half-coach/4-door	—	—	8
16		Sedan/4-doors	—	—	9
17		Hatch/double-door	√	—	F
18		Hatch/5-door	√	—	G
19		Hatch+half-coach/4-door	√	—	H
20		Sedan/4-doors	√	—	J
21		Hatch/double-door	—	√	L
22		Hatch/5-door	—	√	M
23		Hatch+half-coach/4-door	—	√	N
24		Sedan/4-doors	—	√	P
Notes: “√” means this type:”-“ mean non-thistype					

S/N	Cab type	Coach type	Code
1	Flat head	Rack-body	1
2		Coach-type	3
3	Dolichocephaly	Rack-body	5
4		Coach-type	7

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The Eighth code specification

S/N	Drive type	Transmission type	Code
1	Front drive	Manual transmission	S
2		Auto-transmission	Z
3	Rear drive	Manual transmission	A
4		Auto-transmission	B

The Ninth code specification

It is the value calculated by the manufacture through certain formula according to other 16th-digit values. It may be any number from 0 to 9 or letter "X" and used to verify the authenticity of a VIN code, to ensure the unique and effectiveness of a VIN code.

The Tenth code specification

It is used to distinguish the year. The year code is used according to Table 11 (Repeat in a 30-year cycle).

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Years code table

Years	Code	Years	Code	Years	Code	Years	Code
2001	1	2011	B	2021	M	2031	1
2002	2	2012	C	2022	N	2032	2
2003	3	2013	D	2023	P	2033	3
2004	4	2014	E	2024	R	2034	4
2005	5	2015	F	2025	S	2035	5
2006	6	2016	G	2026	T	2036	6
2007	7	2017	H	2027	V	2037	7
2008	8	2018	J	2028	W	2038	8
2009	9	2019	K	2029	X	2039	9
2010	A	2020	L	2030	Y	2040	A

The 11th code specification

It is used to distinguish different assembly plants.

Code list of assembly plant

S/N	Name	Code
1	Haoqing Automobile Manufacturing Co. Ltd	H
2	Haoqing 1st Subsidiary	L
3	Geely Automobile Manufacturing Co. Ltd	N
4	Huapu Automobile Manufacturing Co. Ltd	S

5	Cixi Automobile Manufacturing Co. Ltd	C
6	Haoqing company-Xiangtan Subsidiary	X
7	Gansu Lanzhou Subsigdiary	G

Specification from twentieth to seventeen code

It is used as vehicle production numbers. According to the sequence of vehicles manufactured in the same year, it starts from 000001 on-ward. The 12th digit of VIN can also be used as the month code.

Refer to the following table:

S/N	Months	Code	S/N	Months	Code
1	January	1		July	7
2	February	2		August	8
3	March	3		September	9
4	April	4		October	0
5	May	5		November	A
6	June	6		December	B

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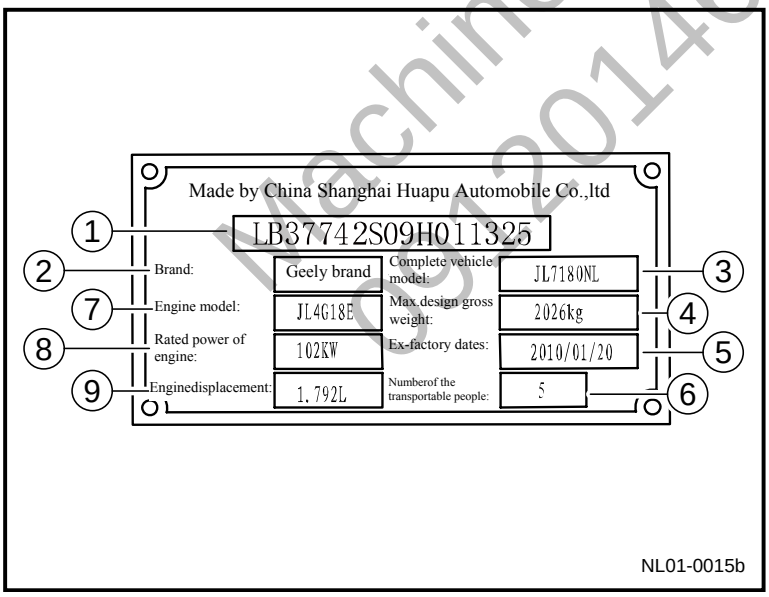
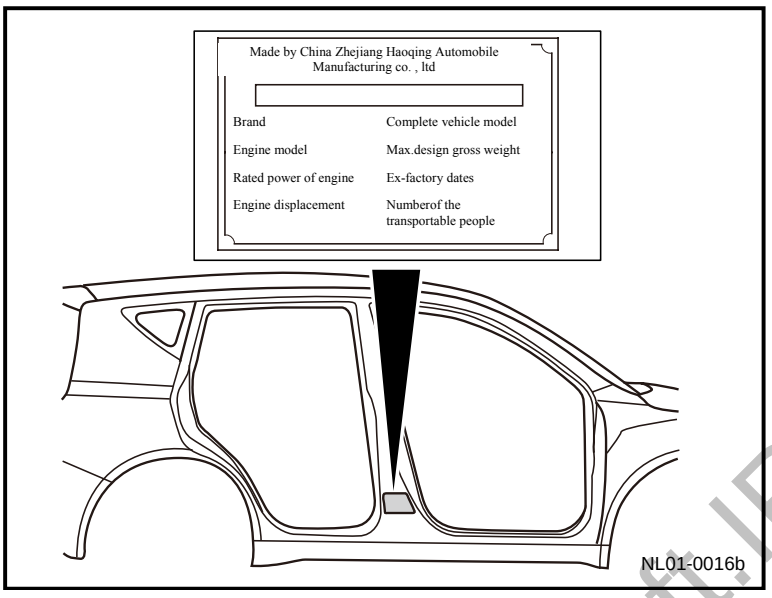
1.9.1.3 Lable—vehicle certificate



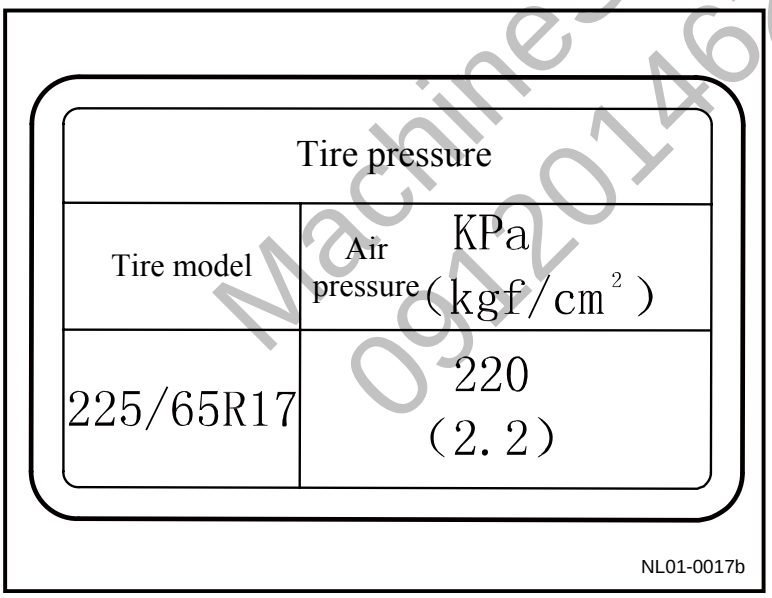
1. Vehicle identification number(VIN)
2. Brand
3. Complete vehicle model
4. Gross weight
5. Manufacturing dates
6. Numbers of passenger

7. Engine model
8. Engine rated power
9. Engine displacement



The conformity certification label is located at the topside of the driver-side front frame plate.

1.9.1.4 Tire message billboard



Tire placard is located on the vehicle body surface under the driver door striker. For tire information. Please refer to tire placard. Wheel and tire dimensions (including spare tire), inflation pressures (including spare tire) and load capacity are specified on a tire placard.

1.9.1.5 Engine mark No.and position

Engine mark No,(JL4G18-E)

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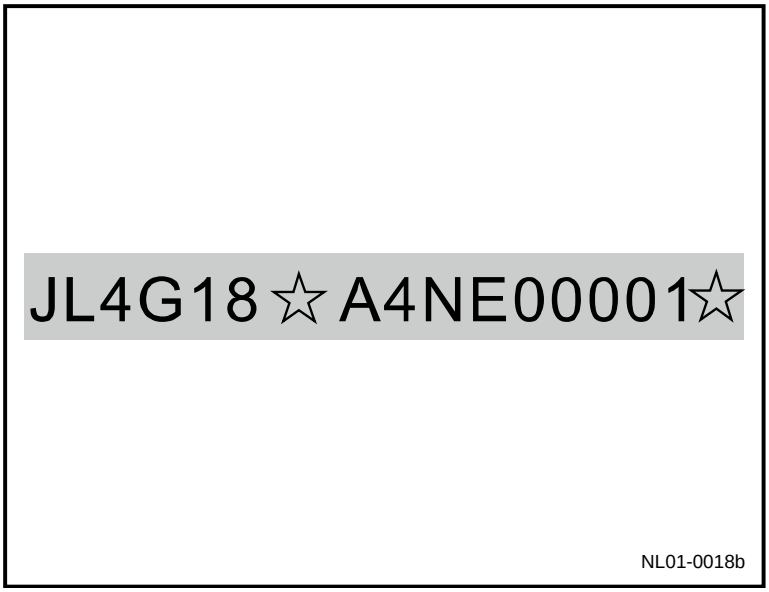
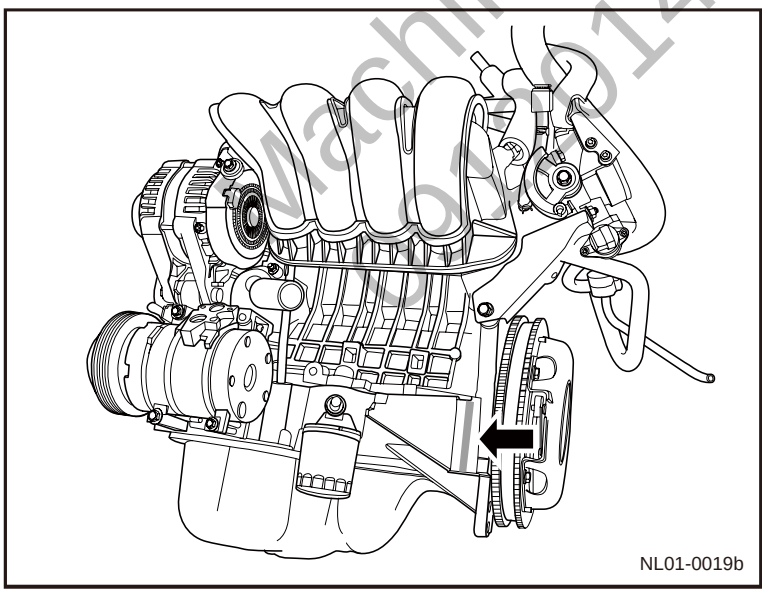


– JL: Enterprise code
– A: years (A means 2010)
– 4: months
– N: Ningbo base
– E: 4G18E
– 00001: S/N

Engine identification number position



Engine identification number is stamped on the platform at the edge of cylinder on the side of air inlet at engine flywheel end.

Notes: JLD-4G20、JLD-4G24 engine mark No. Position is same with JL4G18E.

1.9.1.6 Identification numberand position of manual transmission

Identification number label of manual transmission (JL-S170BⅡ)

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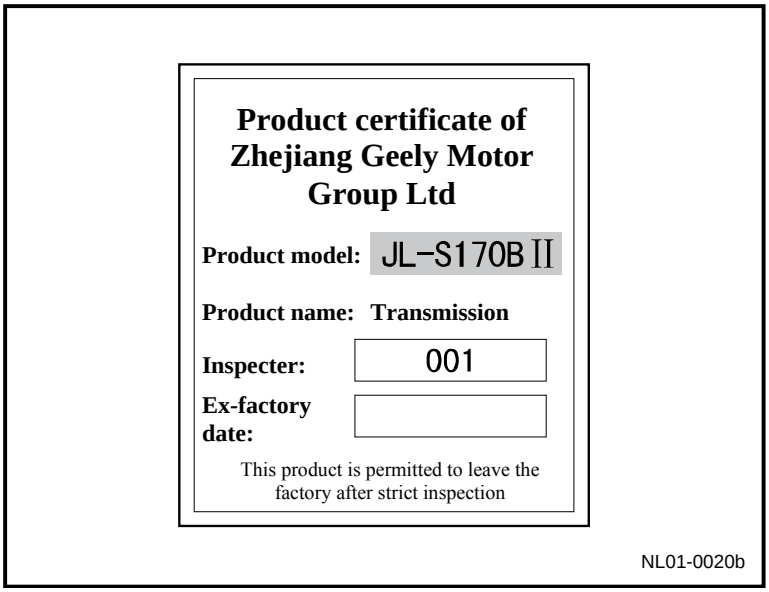
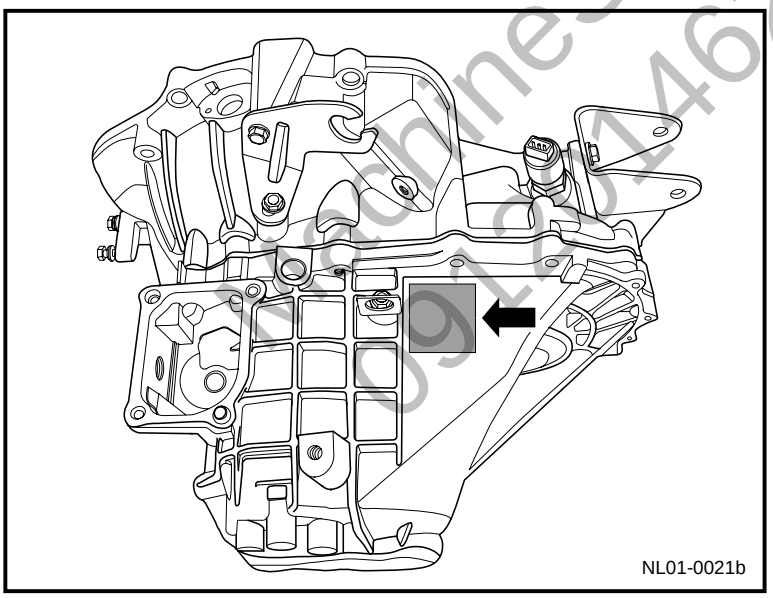


1. JL: Enterprise code
2. S: Operation type
3. 170: Torque number
4. B: Improved code

Manual transmission Identification number label and its position



Notes: DSI transmission mark No. is same with JL-S170BⅡ.

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1.10 Noise, vibration and abnormal sound

1.10.1 Description and operation

1.10.1.1 Diagnostic information and procedures

Wind noise/air sound

Warning!

Refer to "warning on assistant driving" in "warnings and precautions".

Notes:

When the technician checks the fault part to be repaired, the assistant shall drive the vehicle; otherwise, it may cause personal injury.

A test drive is needed in order to identify the position of wind noise. In general, the wind noise includes major leaks and minor leaks. If the repair process does not fix all the leaks, it will only reduce wind noise, but not completely eliminate the wind noise.

A technician must bring the following tools to help diagnose the specific position of wind noise:

– Stethoscope

– Masking tape

– Plug strip

– Marking pen

– Screwdriver

A road test should be carried out as following:

– Select an even and straight road, with an east, a south, a west and a north exit.

– Select a road with minimal traffic and noise in order to avoid affecting the test.

– Test the vehicle at the speed when the noise is most obviously heard. Do not speed above speed limit.

– The noise can be identified as external wind noise, under the following conditions as soon as lowering the windows of the running vehicle; the wind noise can be heard.

• You may hear wind noise when drive vehicle after reduced window glass .

• Internal wind noise is caused by air escaping from the car. The repair should take the following approaches:

– When trying to determine the leak position, attach tapes to the body pressure relief valve.

• With confirm leakage position, Tape was sticked on the relief valve of door lock post. Use stethoscope to identify the leak position.

• Use masking tapes for temporary repair.

• Continue the road test to confirm whether all the wind noise has been eliminated or there are still leaks at other parts.

• Return to workshop after having identified all the leaks during road test.

• Use specialized methods and sealing material to carry out permanent repair,adopted special position method and sealing material to permanent repair

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Vibration

Most of the high-speed vibrations are due to lack of wheel dynamic balance. If there still is vibration after balancing the wheels, the reasons are:

– Tire is output shaft

– Rim is output shaft

– Tire has hardness deviation

Measuring the amount of free jumping of tires and wheels can not determine all the reasons leading to vibration. The above mentioned three reasons are known as the radial load. You must use known good tires and wheels to replace the old ones and carry out the maintenance.

The low-speed vibration which occurred at the speed of 64 km/h is usually caused by free jumping. The high-speed vibration occurring at the speed higher than 64 km/h is usually caused by imbalances or jumping.

Correct uneven tires

There are usually two ways to correct the wheels with right balance but still with tire vibration. One way is to use automatic machine tools. Install the tire onto a tire machine. Grind a small amount of rubber off from the high point of the tire. This method is permanent. If following the operation instructions, it will not affect the tire appearance and tire tread life. Correction using a blade is not recommended, since this method will shorten the tire life and can not fundamentally solve the issue.

Another method is to dismantle the tire and turn the tire 180 ° on the rim. Use this method only after tire and wheel assembly has been confirmed as the cause of vibration. This is because this method may result vibration with good tires, and can not solve the problem completely.

Abnormal sound

At high engine speed, inspect whether the insulation shield comes into contact with the underbody.

– Lifted vehicle and carried out visual inspection

– Slightly bent insulation panels to create a gap between the panels and the underbody.

Squeak sound from the front of the vehicle in cold weather

Inspect the front stabilizer bar isolation sleeve.

– Road test the vehicle when engine is cold and drive the vehicle through potholes to make the front suspension reach the maximum travel limit.

– Dismantle the front stabilizer bar isolation sleeve, wrap tapes around the bar and install the front stabilizer bar isolation sleeve.

Abnormal sound from the rear of the vehicle when the vehicle is bumping

Inspect whether the spare tire is properly secured.

– Opening the rear compartment and inspect the spare tire and the driver’s tools.

– Fixed spare tire and attachment tools again.

– Check if road test vehicle abnormal noise cleared

The rear window percussion sound when driving on rough roads

Inspect whether the rear door buckle is adjusted properly

– Check this condition by road test vehicle

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– Loosed latch nut and adjust latch

Door squish

Inspect whether the inner trim plate harness connector has the squish sound.

– Tap the inner trim plate and carefully observe whether squish sound is heard.

– Dismantle the inner trim plate and wrap foam pad to around the harness connector.

Door squeak

Inspect whether the door hinge is lack of lubrication.

– Operate the door back and forth and listen carefully to the door whether there is squeak sound.

– Use smear grease to lubricate the door hinge.

Manual transmission gearshift squeak (in the cold weather or when the engine is cold)

Inspect the Manual shifter assembly lower sheath of manual transmission

– Switch between gears and verify the squeak.

– Dismantle the floor console gearshift lever, lubricate it and install it.

1.10.1.2 Maintenance guidance

Wind/air noise

External wind noise

The wind noise leak repair is very similar to that of water leaking. Refer to 1.10.1.1 Diagnostic Information and Procedures. The actual maintenance procedure depends on the type of seal elements.

Vibration

Tire and wheel balancing (on-vehicle)

Carry out the balancing on the electronic wheel balancing machine. Dynamic balancing machine is easy to use and can be used both for static balance and dynamic balance. Unlike the balancing on vehicle, the off vehicle balancing can not correct the brake disc imbalance. However, the accuracy of the off vehicle balancing can overcome this issue. Make a cone through the center hole on the back, rather than through the wheel nut holes.

Tire and wheel balancing (off-vehicle)

On-vehicle tire and wheel balancing can correct the imbalance caused by disc brake vibration.

Warning!

Support the control arm at the normal position to avoid damage to drive axle. When the wheels travel to the maximum low position, do not shift the gear lever.

1. Do not dismantle the balance weights during on vehicle tire and wheel balancing.

2. If the balance weight is more than 25g (1lb), divide it into two blocks and install one onto the inner wheel rim and the other onto the outer wheel rim.

3. Engine driven gear and gear assembly.

Tires and wheels directional installation

Tires and wheels are installed at the factory with the radial tires thicker parts (also known as the high point) pointing to the minimum radius wheels (also known as low points).

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Red paint marks or labels are at high points along the outer of the tires when just delivery.

Valve core at the lower position of the wheel.

Before dismantling the tire, mark the position of the valve to make sure it can be installed back to the original position. Before dismantling the tire, mark the position of the valve to make sure it can be installed back to the original position.

Abnormal sound

Abnormal sound repair

Abnormal sound mainly comes from parts that should not have relative motion. To repair abnormal sound, there are three ways:

– Tighten the fasteners components, so that there is no relative motion.

– Separate components, so that components do not contact.

– Isolated parts, so that there is no abnormal noise when components moving.Even low friction surfaces can be used to eliminate viscosity between the sliding components.

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1.11 Water Leakage

1.11.1 Description and operation

1.11.1.1 Diagnostic information and procedures

Water leakages diagnosis

Notes:

Identify all water leaking parts before repair. Random repair may only be a temporary solution and could lead to more difficult repair in the future. Continue testing to identify all water leaking parts.

To repair water leakage , proper testing and diagnosis is needed. Adjust the position of the incorrectly positioned components and use proper materials to carry out the repair.

Firstly, determine in what circumstances there is water leakage. For example: only when the vehicle remains in the slope there is water leakage. Secondly, if the water leakage area has been found, use water hose to locate exact position where water leakage . If water leakage is not obvious, use a water leakages testing machine to identify specific positions. May be dismantle partial interior tram plate or partial component to found water leakage position.

Water leakages test preparation

- The vehicle is designed for running under normal conditions.
- The sealing materials and components design has taken into account the natural environment to achieve the seal strength. But these specification standard can not was took into account by all person as condition
- Water leakages test is related to the natural environment and can be used to determine the vehicle driving performance under normal conditions.
- The first step of the diagnosis process is to determine water leakage occurred under what conditions. If you can determine the approximate water leakage area, you can use a water hose to isolate the exact position. To repair water leakage , you may need to dismantle certain components of the trim plates or components.
- If the water leakage appears in the door, trunk door or window, it is not necessary that the water leakage is created by sealing strip. Adjusting these parts might correct the water leakage .

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Testing with water supply hose

Notes:

Do not use **water supply hose**e with a nozzle.

1. Let an assistant inside the vehicle to confirm the exact position of water leakage .
2. Start testing from the bottom of the window or the windshield.
3. Move the hose slowly upward, until cover the entire roof.

Water supply hose test

Notes:

Ventilation hose test can only be used for completely cured the adhesive. Otherwise, the usage of this method will damage the adhesive layer, leaving increased water leakage spots.

1. Pour liquid cleaning agent into a spray bottle according to a certain percentage, then spray it to window edge. Spray from the bottom, gradually upward and through the entire roof.

Notes:

The pressure of compressed air can not exceed 205kPa (29.75 psi).

2. Let an assistant bring the air hose into the vehicle.
3. Let the assistant use the compressed air targeting suspected leaking area. If there is leakage, air bubbles will appear.

1.11.1.2 Maintenance guidance

Water leaking repair for body

Depending on the position of water leakage, certain components may need to be dismantled.

1. From the inside or outside the vehicle slit open the seam adhesive.
2. Clean and remove all the old adhesive residues from the leaking area.
3. Apply body and joint sealant on the cleaned area.
4. Wait for several hours so that the sealant is fully cured.
5. Inspect whether there are water leakage.
6. Install previous dismantle component.

Fixed water leakage repair for window

Depending on the position of water leakage, certain components may need to be dismantled.

1. Determine the specific position of water leakage .
2. If the front windshield edge water leakage use a dedicated seam adhesive to repair or replace the windshield.
3. If it is fixed windows side-water leakage, use a dedicated seam adhesive to repair or replace the windshield.

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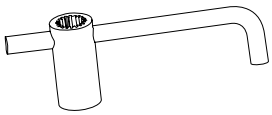
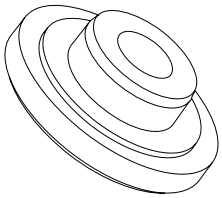
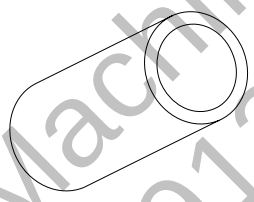
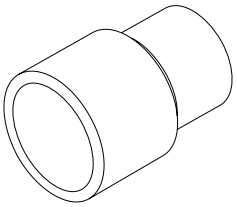
1.12 Special tool list

1.12.1 Special tools and equipment

1.12.1.1 Special tool for powertrain

S/N	Illustration	Tool No.	Description
1	 FE01-2001b	GL201	Tool for tightening input shaft
2	 FE01-2002b	GL201	Tool for installing input shaft oil seal
3	 FE01-2003b	GL201	Tool for installing input/output shaft parts
4	 FE01-2004b	GL201	Tool for installing and removing input shaft transmission head bearing

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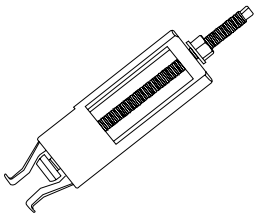
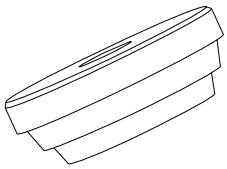
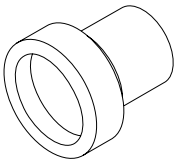
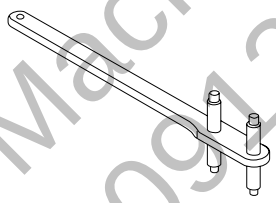
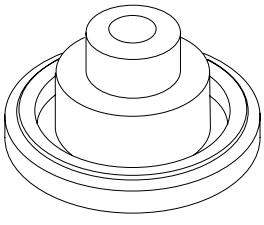
5	 FE01-2005b	GL201	Tool for dismantling output shaft clutch head bearing outer ring
6	 FE01-2006b	GL201	Tool for installing output shaft bearing outer ring
7	 FE01-2007b	GL201	Tool for installing and removing output shaft bearing
8	 FE01-2008b	GL201	Tool for adjusting output shaft
9	 FE01-2009b	GL201	Tool for installing and removing differential clutch housing oil seal

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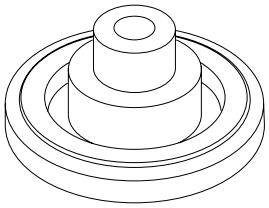
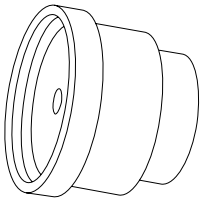
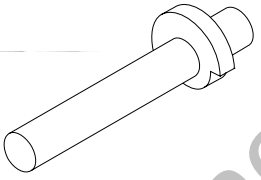
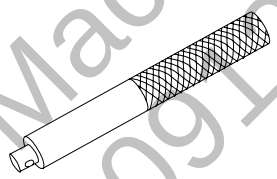
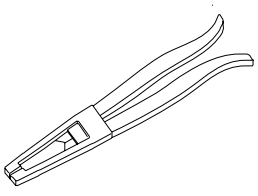
10	 FE01-2010b	GL201	Tool for installing and removing differential transmission housing oil seal
11	 FE01-2011b	GL201	Tool for installing and dismantling differential bearing
12	 FE01-2028b	GL201	Tool for installing manual shifter assembly oil seal
13	 FE01-2014b	GT301	Oil seal handle
14	 FE01-2015b	GT301	Tool for installing and dismantling valve oil seal

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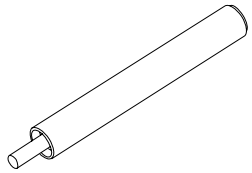
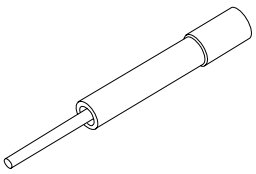
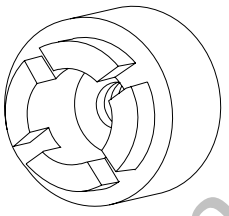
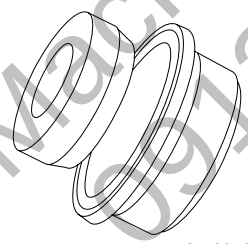
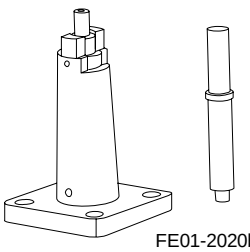
15	 FE01-2016b	GT301	Tool for installing valve oil seal
16	 FE01-2017b	GT301	Tool for installing and removing valve guide pipe
17	 FE01-2018b	GT301	Tool for installing front oil seal of crankshaft
18	 FE01-2019b	GT301	Crankshaft rear oil seal Installation Tool
19	 FE01-2020b	GT301	Tool for installing and removing piston pin

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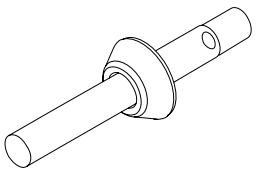
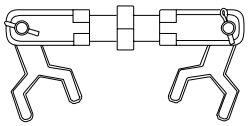
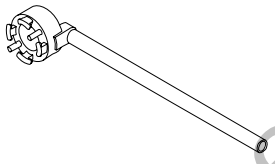
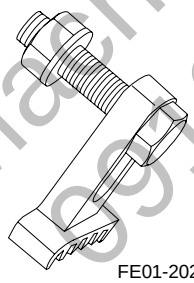
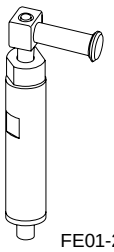
20	 FE01-2021b	GT301	Clutch assembly tool
21	 FE01-2022b	GT301	Tool for locating camshaft
22	 FE01-2029b	GT301	Tool for locating crankshaft belt disc
23	 FE01-2023b	GT301	Tool for tightening flywheel
24	 FE01-2024b	GT301	Tool for tightening timing chain

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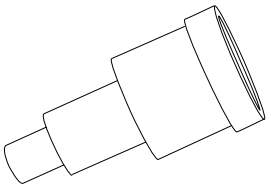
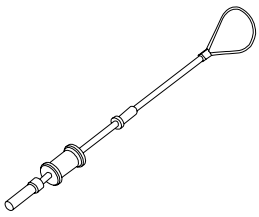
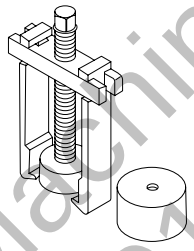
1.12.1.2 Special tool of chassis and body

S/N	Illustration	Tool No.	Description
1	 FE01-2025b	GL401	Front axle wheel hub bearing dismantle
2	 FE01-2026b	GL401	Tool for arc type remover o`f drive shaft
3	 FE01-2027b	GL401	Tool for installing and removing rear axle rubber sleeve

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2.1 Warnings and notices

2.1.1 Warning and precaution

Warning on Battery Disconnection

Warning: Unless directed otherwise in the operating procedures, the ignition key must be at the OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable if a tool or any equipment easily comes in contact within exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

Warning for air exhaust system maintenance

Warning: When air exhaust system is too hot, please do not repaired air exhaust system to avoid scald Please repair it after air exhaust system cooled

Warning for fuel and evaporation air exhaust pipe

Warning: reduce fire and personal injury, please you are comply with ways as follow:

- Replace all fuel pipes that are nicked, scratched or damaged during installation, do not attempt to repair the fuel pipes.
- Do not hammer directly on the clips of fuel harness body when installing new fuel pipes.
- Always cover fuel vapor pipes with a wet towel before using a torch near them. Also, never expose the vehicle to temperature higher than 115℃ (239℉) for more than one hour, or higher than 90℃ (194℉) for any extended period.
- Always apply a few drops of clean engine oil to the male pipe ends before connecting the fuel pipe fittings, which will ensure proper reconnection and prevent a possible fuel leakage. (During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.)

Fuel Gage Leak Warning

Warning: Wrap a shop towel around the fuel pressure connection in order to reduce the risks of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gage. Place the towel in a proper container when the connection of the fuel pressure gage is complete.

Fuel Pipe Fitting Warning

Warning: Always apply a few drops of clean engine oil to the male pipe ends before connecting the fuel pipe fittings in order to reduce the risks of fire and personal injury. This will ensure proper reconnection and prevent a possible fuel leakage. During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.

Warning on Installing Stop Bracket of Fuel Distributing Pipe

Warning: The stop bracket of fuel distributing pipe must be installed on the engine assembly. When vehicle's frontal collision happens, stop bracket can be considered as a guard board of fuel distributing pipe. If stop bracket of fuel distributing pipe is not installed, fuel injection may cause fire and result in personal burn when vehicle's frontal collision happens.

Fuel Storage Warning

Warning: Do not drain the fuel into an open container. Never store the fuel in an open container due to the possibility of a fire or an explosion.

Warning on Fuel Vapors in Evaporative Emission Components

Warning: Do not breathe the air through the EVAP tubes or hoses. The fuel vapors inside the EVAP components may cause personal injury.

Gasoline/Gasoline Vapors Warning

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Warning: Gasoline or gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical fire extinguisher prepared nearby.

Warning on Lower O-ring Removal of Fuel Injector

Warning: Verify that the lower (small) O-ring of each injector does not remain in the lower manifold in order to reduce the risks of fire and personal injury. If the O-ring is not dismantled with the injector, the replaced injector with new O-rings will not be seated properly in the injector socket. Improper seating could cause fuel leakage. When reassembling the injector, replace the lower O-ring together.

Warning relating to the disassemble of radiator cap

Warning: To avoid being burned, do not remove the radiator cap while the engine is still hot. The cooling system will release scalding fluid and steam under high pressure if radiator cap is removed while the engine and radiator are still hot.

Warning on Cooling System Maintenance

If pressure cap is removed while the engine is still hot and under pressure during maintenance, the engine coolant will boil immediately and spray into the operator's body, causing serious burns.

Releasing Fuel Pressure Warning

Warning: Remove the fuel tank cap and release the fuel system pressure before servicing the fuel system in order to reduce the risk of personal injury. After you release the fuel system pressure, a small amount of fuel may release when servicing the fuel circuit, the fuel injection pump, or the connections. In order to reduce the risk of personal injury, cover the fuel system components with a shop towel before disconnection. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.

Road Test Warning

Warning: Take a road test under safe conditions while obeying all traffic laws. Do not attempt any operation that could jeopardize vehicle control. Failure to obey these precautions will lead to serious personal injury and vehicle damage.

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2.2 Control system (4G20/4G24 with Delphi systems)

2.2.1 Specifications

2.2.1.1 Fastener specifications

Fastener Name	Specification	Tightening Torque	
		Metric (N.m)	English system (lb-ft)
Camshaft Position Sensor Bolts	M6×14	8-10	6-7.4
Fixing Bolts of Crankshaft Position Sensor	M6×12	8-10	6-7.4
Fixing Bolts of Ignition Coil	M6×35	7-11	5.2-7.8
Engine Control Module Bolts	M6×16	8-10	6-7.4
Temperature sensor of engine coolant bolts	M12×1.5×6	15	11
Evaporative Emission Canister	M6×20	7-9	5.2-6.7
Evaporative Emission Canister Solenoid Valve Bracket Bolts	M6×20	7-9	5.2-6.7
Fuel Filter Mounting Bracket Assembly Bolts	M6×16	8-10	6-7.4
Fuel Filter Mounting Bracket Bolts	M6×16	8-10	6-7.4
Fixing Bolts of Fuel Distributing Pipe	M6×20	10	7
Fixing Bolts of Fuel Tank	M10×30	38-46	28.1-34
Fixing Bolts of Idle Speed Control Valve	M4×10	2-3	1.5-2.4
Bolts of Knock Sensor	M8×30	15-22	10.7-16
Fixing Bolts of Intake Manifold Absolute Pressure and Temperature Sensors	M6×12	8-10	6-7.4
Oxygen Sensor Bolts	M18×8	44	32.6

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Air-conditioning compressor mounting bracket bolt	M8×80	25	18.2
Spark Plug	M14×1.25×22	20-30	14.8-22.4
Throttle Body Retaining Nut	M8	20-25	14.8-18.5

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2.2.1.2 Relation of temperature sensor temperature and resistance

Temperature (℃) /(℉)	Resistance (Ω)
-30/-22	26000
-25/-13	19000
-20/-4	15000
-15/5	11800
-10/14	9000
-5/23	7000
0/32	5600
5/41	4600
10/50	3600
15/59	3000
20/68	2400
25/77	2000
30/86	1700
35/95	1400
40/104	1180
45/113	950
50/122	800
55/131	700
60/140	600
65/149	510
70/158	425
80/176	320
90/194	240
100/212	180
110/230	140
120/248	110
130/266	90

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2.2.1.3 Relation of altitude and atmospheric pressure

Altitude (m)/(ft)	Atmospheric Pressure (kPa)/(psi)
4200/13780	55/8
3900/12795	58/8.4
3600/11811	61/8.8
3300/10827	64/9.3
3000/9843	66/9.6
2700/8858	69/10
2400/7874	71/10.3
2100/6890	74/10.7
1800/5906	77/11.2
1500/4921	80/11.6
1200/3937	83/12
900/2953	87/12.6
600/1969	90/13.1
300/984	93/13.5
0	100/14.5

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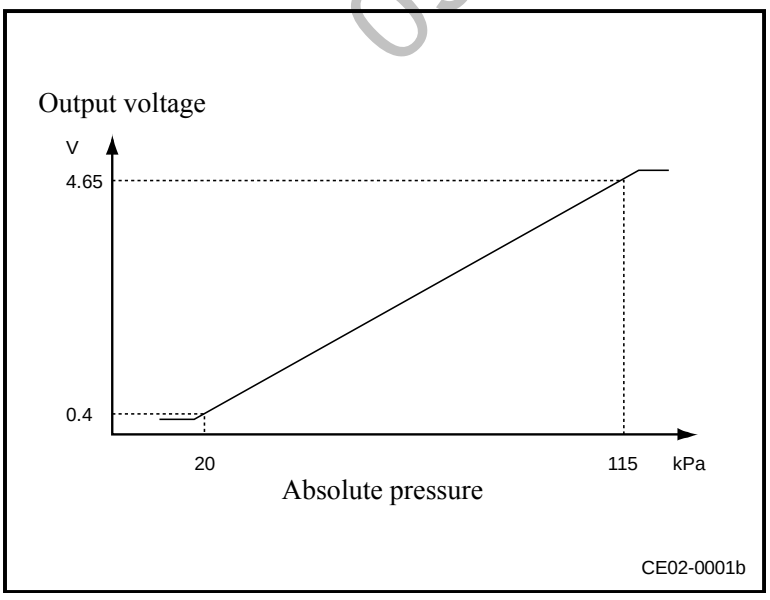
2.4.1.4 Intake Pressure Sensor Voltage and Pressure Diagram



2.2.2 Description and Operation

2.2.2.1 Overview

This engine control system uses Delphi MT22.1 Control System. Its main characteristic is that the engine control module (ECM) acts as the core system. The traditional mechanical throttle pedal and mechanical throttle body are replaced by more advanced electronic throttle acceleration pedal sensor assembly and the electronic throttle body assembly. Due to this advanced system, ECM torque control over the engine is more convenient. In addition, MT22.1 control system also incorporates multi-point sequential fuel injection, group direct ignition without electricity distributions, variable valve timing control and three-way catalytic converter post-processing, capable to meet the increasingly stringent emission regulations.

The system's main functions include:

1. Engine torque output control mode: ECM calculates the gas flow through the intake air temperature sensor and intake manifold pressure sensor signals, making the Air-Fuel ratio closer to the current engine's operating condition demand.
2. Torque control mode: ECM calculates the current required output torque and controls the engine output power, according to the acceleration pedal position sensor signal.
3. Main relay control of Complete Vehicle.
4. Close-loop control multi-point sequential fuel injection: A close-loop fuel control can precisely control the engine air- fuel ratio, and therefore efficiently controls emissions. Close-loop control can effectively eliminate the system and related mechanical component swear and tear due to manufacturing error and improves vehicle consistency.
5. Variable Valve Timing (VVT) control: Variable valve timing control system uses VVT actuator to change the relative positions between intake camshaft and crankshaft. Engine management system calculates the best valve timing based on engine operating conditions, and controls VVT solenoid valve movement, allowing flow and direction of oil pressure in VVT actuator to change, and ultimately promoting the camshaft movement to the desired position.
6. Fuel supply control without fuel return.
7. Fuel pump working control.
8. ECM has built-in ignition drive module and group direct ignition without electricity distributions.
9. Knock Control: When the knock sensor detects a knock occurring, the system will calculate the ignition advance angle delay based on the current conditions, knock intensity and other necessary information, and defers the ignition advance angle, so as to avoid or reduce knock. Electronic Throttle Control: Since the system uses an electronic throttle, highly precise idle control can be achieved. Taking the electrical load compensation as an example, when there is electrical load or the load is cut off, due to the sudden increase or decrease in engine load which results in engine speed fluctuation in a certain range, therefore, we add the electrical load control adjustments. When the load increases or decreases, adjust the air flow rate and /or the ignition advance angle accordingly to make sure that the idle speed remains steady at the best condition.
10. Canister Solenoid Valve Control
11. Cooling fan relay control
12. System self-diagnostic function: After the system enters working condition, ECM controls all system components working, and tests them in real time. Once the system or component malfunction occurs, the system will light up the engine malfunction lamp to remind the driver to repair or service the vehicle on time. In the mean time, ECM will start fault protection mode.
13. System over-voltage protection: When the charging system malfunction causes the voltage

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too high, the system will enter protection mode to restrict the engine speed to prevent ECM damage.

2.2.2.2 Components Description

1. Engine Control Module (ECM)

Engine control module is a microprocessor with a single chip as the core. Its function is to process data from various vehicle sensors to determine the engine's working condition, and controls each engine actuator through various actuators.

ECM Normal work voltage is 9.0 V–16 V

Notes:

Although ECM has the over-voltage and reverse polarity voltage protection function, during the repair process it is prohibited to connect the battery positive and negative wrong or apply voltage higher than 15 V. Otherwise, it will cause damage to ECM and other electrical equipments.

2. Crankshaft Position Sensor

The crankshaft position sensor output can be used to determine crankshaft position and rotation speed. The engine rotation speed and crankshaft position sensor are magnetic-electric sensors installed near the crankshaft. When the crankshaft rotates, they work together with the 58X gear on the crankshaft. The 58x tooth top and the alveolar pass through the sensor in different distances when the crankshaft rotates. The sensor senses the reluctance change; the alternating reluctance generates an alternating output signal. The 58x gear plate gap position aligns with engine top dead center. When the cylinder No.1 reaches top dead center, the sensor aligns with the 20th tooth lower edge. ECM uses this signal to determine crankshaft position and rotation speed.

Resistance Value of the Sensor: 20-30℃（68-86℉）900-1100Ω.

Output Voltage: 400 mV at 60 rpm, the voltage increases as the speed increases.

3. Intake Air Pressure/Temperature Sensor:

This sensor detects intake manifold pressure change caused by engine load and speed changes. These changes will be converted to the voltage output. When the engine decelerates, the throttle body closes to result in a relatively low intake manifold absolute pressure output. Intake manifold absolute pressure and vacuum degree is opposite. When the manifold pressure is high, the vacuum degree is low. MAP sensor is also used to measure atmospheric pressure. This measurement is completed as part of the MAP sensor calculation. When the ignition switch is turned on and the engine is not running, the engine control module reads the intake manifold pressure as atmospheric pressure, and adjusts the Air-Fuel ratio accordingly. With this kind of altitude compensation, the system can maintain a low emission while maintaining maneuverability.

4. Camshaft Position Sensor (CMP)

Camshaft position sensor is a Hall-effect sensor which is installed in the vicinity of the intake camshaft, and works together with camshaft signal wheel. The signal wheel is corresponding to the specific engine position. ECM measures digital voltage signal through this sensor, therefore determining the working cylinder of the engine and implementing one-to-one control. Engine control module then calculates the actual sequence of fuel injection. If the engine is running when the camshaft position sensor signal is lost, the fuel injection system will be converted to the sequential fuel injection mode based on the final fuel injection pulse, while the engine continues to run. If the engine starts after being shut down, the fuel injection sequence will be converted from sequential injection to group injection. Even if the fault exists, the engine can be restarted.

5. Engine Coolant Temperature (ECT) Sensor

Engine coolant temperature (ECT) sensor is used to detect the engine operating temperature. ECM provides the best control scheme depending on the temperature. The sensor uses a negative temperature coefficient thermostat as the sensing element, when the coolant temperature rises, the resistance decreases. At -30°C the resistance is 52,594 Ω; at 130 °C, the resistance is 77.5 Ω. The sensors are installed in the main coolant path. The coolant temperature signal is important to the

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ignition timing and fuel injection adjustment, while the signal is also transmitted to the instrument panel (IP) and used to display the current engine working temperature.

6. Knock Sensor (KS)

Knock sensor is a frequency response sensor, installed at the engine block's most sensitive part to knocking under the intake manifold. ECM uses knock sensor to detect knock intensity, so as to adjust the ignition advance angle to effectively control knocking and optimize the engine power, fuel economy and emission levels. If the engine knocking occurs, ECM will receive this signal, filter out the non-knock signals and make the calculation. It determines the engine's position in the working cycle through the camshaft and crankshaft position sensor signals, according to which the ECM figures out the knocking cylinder and then delays the ignition advance angle for this cylinder until the knocking disappears. Then ECM advances the ignition advance angle until the ignition angle is best suited for the operating conditions at that time. Due to weak sensor signals, the sensor lead has a shielded cable. Its resistance is over 1M Ω (20-30℃) with the output signal greater than 17 mV/g in any case.

7. Oxygen Sensor

Oxygen sensor is an important symbolic component in a close-loop fuel control system, which adjusts and maintains the ideal Air-Fuel ratio, so that three-way catalytic converter achieves the best conversion efficiency. When the Air-Fuel ratio for engine burning becomes thin, the oxygen content in the exhaust increases, and oxygen sensor output voltage is reduced. On the contrary, the output voltage increases to feedback the air- fuel ratio to ECM.

Oxygen sensor sensing material is Zirconia, hollow with an external sensing part. When the Zirconia components are heated (>300℃) for activation, the reference air enters the hollow part of the Zirconia component through the lead wire. The exhaust passes through the outer electrode, and the oxygen ions move from the center of the zirconia to the outer electrode, which thus consists of a simple atomic battery with a voltage between two electrodes; the Zirconia can alternate the output voltage according to the oxygen concentration in the exhaust and therefore determine the oxygen content of exhaust gas. Usually, the oxygen sensor is designed to generate a voltage amplitude jump in the vicinity of the exhaust theoretical Air-Fuel ratio of (14.7:1) to help the ECM determine the Air-Fuel ratio accurately.

8. Fuel Injectors

The injector nozzle's structure is an electromagnetic switch ball valve device. The both electrodes from the coil are connected to the ECM and the power supply through the engine wiring harnesses. When the coil is controlled by ECM to connect to the system ground, the resulting magnetic force overcomes the spring force, fuel pressure and manifold vacuum suction to draw up the valve core. The fuel sprays from the guide hole through the valve seat hole mistily to the intake valve. When the power supply is cut off, the magnetic force disappears. Under the spring force and the fuel pressure, the injector nozzle closes. The top of the fuel injector has the reliable fuel pressure sealing generated by the rubber seal ring and the fuel rail interface; the lower part also uses the rubber seal ring and engine air intake manifold to form the air sealing. Fuel injector resistance is 11.4-12.6 Ω.

Note: When the fuel injector is blocked or not closed tightly, the engine malfunction lamp may be lit, but the detection fault code is: oxygen sensor distortion, erratic signal, abnormal Air-Fuel ratio and other faults. At this time, the failure component should be carefully judged. Because when the fuel injector is blocked or leaking, the amount of fuel injected is not controlled by the ECM pulse width, the mixed air concentration signals of the oxygen sensor feedback to ECM will be very different from the ECM control target. When ECM detects this signal, it will determine whether the oxygen sensor is working properly. But the system cannot determine whether the fault comes from the oxygen sensor itself or other associated malfunction due to the damage of other parts. Therefore, at the service of such malfunctions, the failed components must be carefully identified.

9. Fuel Pump Assembly

The fuel pump is turbine single-stage electric fuel pump under the control of the ECM via the fuel

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pump relay. It has a check valve at the outlet of the fuel pump. When the engine is not running, the remaining oil in the pipeline will not quickly return to the fuel tank, so as to ensure the re-starting performance. Fuel level sensor is a variable sliding resistance type.

10. Ignition Coil

Cylinder 1 and 4 have their ignition coils located at the top of the Cylinder 4's spark plug opening. Cylinder 2 and 3 have their ignition coils located at the top of the Cylinder 2's spark plug opening. Ignition coil primary winding low voltage will be transformed into the secondary winding high voltage. The spark plug discharges spark, igniting the air and fuel mixture inside the cylinder. Ignition occurs when one piston is at the compression TDC and the other is at exhaust TDC. For the internal air pressure in the cylinder near the exhaust TDC is low but the temperature is high. Less energy will enable the ignition through electrode puncture at the spark plug with less energy, known as redundant ignition. While, the cylinder mixture density and pressure is high at the compression TDC, more ignition energy is required for spark plug ignition making the mixture quickly ignited for power. Therefore, this cylinder ignition is called the effective ignition.

11. Electronic Throttle Body (ETC)

The electronic throttle valve assembly opening is determined by ECM according to the driver-controlled throttle pedal control input signals, and other input signals after calculating the vehicle currently needed engine output power to control the fuel supply (spray) amount, and then adjusting the control parameters based on feedback signals to make sure that the engine works under the best controlled status. Electronic throttle valve body adds the drive motor, gear drive mechanism and other components, as well as a throttle position sensor with enhanced functionality and reliability.

12. Canister Solenoid Valve (EVAP)

The canister control valve is located at the side of the engine cylinder head (transmission side) and is used to control the canister purge flow. ECM controls intake manifold gasoline vapor volume through canister solenoid valve. ECM sends square pulse wave. Air flow volume and control pulse square wave relationship is linear.

ECM changes canister working time and rate according to engine speed and load conditions.

Solenoid valve coil resistance: 11 - 22 Ω.

13. Variable Valve Timing Solenoid Valve (VVT)

VVT solenoid valve is located at the intake manifold side near the engine front. VVT magnetic valve is a 4-digit 4-channel solenoid valve with the working power supplied from main relay controlled by ECM. ECM controls VVT solenoid valve grounding with a pulse width modulation signal. The crankshaft to the camshaft timing relations can be continuously changed. The best valve timing control can be achieved at different engine running conditions. This will help to increase engine efficiency, improve idle stability, and provide more torque and power, while helping to improve the fuel economy and lower emissions of hydrocarbons and nitrogen oxides.

Solenoid valve resistance: 7.2 Ω at 20°C (68℉)

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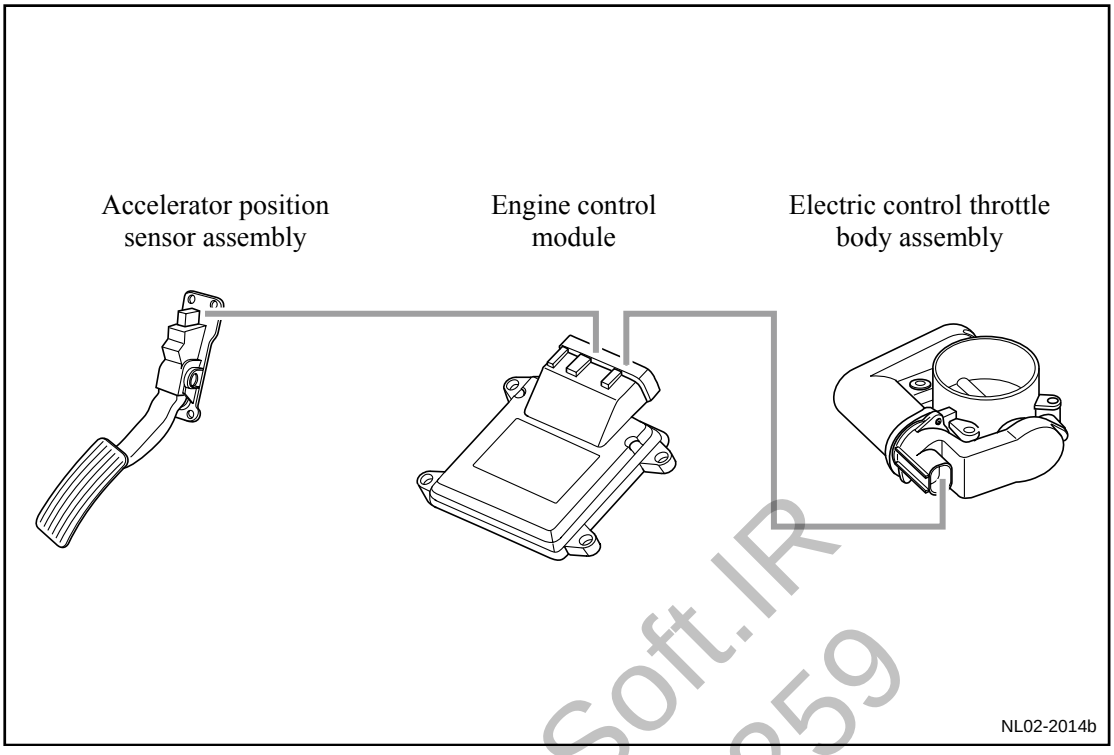
2.2.3 System operating principle

2.2.3.1 Electronic Throttle Body (ETC) Operating Principle



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Electronic throttle body assembly must be used dedicatedly to the engine electronic control module (ECM) with ETC system-driven feature hardware as the core control element. System control software usually uses the computer algorithms mode, basing on the engine torque output control. At the same time, due to the cancellation of the traditional mechanical throttle valve control of mechanical pull cables, ETC is equipped with a acceleration pedal position sensor (APP) with a resistive potentiometer device, in order to provide vehicle handling demand information and other information for the driver to control the vehicle to the engine electronic control module (ECM).

Electronic throttle body opening is determined by ECM according to the acceleration pedal control input signals. With other engines and vehicles sensor input signals, ECM analyzes the driver's intention in advance and calculates the needed engine output power and accordingly adjusts the engine throttle opening and fuel supply (injection) amount. At the same time, the electronically controlled throttle position sensor can detect the actual throttle opening and send the feedback to ECM. ECM then, based on this feedback signal, adjusts the vehicle control parameters. This control process ensures that the engine and vehicle work in the ideally controlled conditions. Due to the rapid development of modern science and technology, High-Speed ECM can quickly analyze the driver's intention and calculate the basic throttle opening parameter values, based on the throttle pedal signal, the signal variation and signal change rate. At the same time, ECM adjusts and optimizes the throttle opening parameter, based on various sensors input signal status, so that the system further calculates the optimum throttle opening control parameters and implements the actual throttle control. ECM sends the output control signal to the ETC motor drive circuit to open the throttle according to the calculated opening parameter, based on the revised throttle opening and pre-determined control strategy. Because of the high speed calculation, the system enables smooth engine speed changes under transition engine operating conditions. The whole control process only requires a few milliseconds, achieving excellent vehicle performance.

The application of automotive electronic technology makes it difficult to directly judge the electronic drive control throttle valve body assembly diagnosis by conventional visual inspection method. In the event of electronic controlled throttle body malfunction, the system needs to provide a Jolt-limited function. It allows the driver to drive the vehicle to a repair station for repair.

Jolt-limited control has the following two kinds of control modes

1. Jolt-limited control with the system unable to control the engine power

ECM will limit the engine power output, and the system can not control the throttle opening and closing. The throttle opening is automatically adjusted to the system pre-determined position.

ECM will shut down the engine ignition output. At this time, the ECM internal fault occurs and the system can not control the engine torque output. The throttle body adjusts the opening to (zero position) off status. The system will fully turn off the ignition control function.

2. Jolt-limited control with the system unable to monitor the driver's intention

ECM will limit the engine power output. At this point, the system loses the ability to determine and monitor the driver's intention. In order to prevent damage to the engine, ECM will limit the engine power output and lower engine power increment and velocity increment. When braking, ECM will adjust the engine speed to idle speed and adjust the throttle opening to the system pre-determined position.

ECM will force the engine working at idle running status. When the system loses the ability to determine and monitor the driver's intention, ECM will force the engine working at idle running status, and system will work at pre-determined position controlled the idle speed.

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2.2.3.2 ECM Controlled Fuel Supply System

1. Fuel Pump Control

When the ignition switch is turned on, the fuel pump will run for 2 s. At this moment, if ECM does not detect the engine speed signal, fuel pump stops running. Once the engine rotates, ECM detects the engine speed signal and then controls the fuel pump running. 0.6 s after the engine speed signal is lost, or the anti-theft device requests to shut down the fuel pump, the fuel pump stops running.

2. Start-up Fuel Injection Control

Pre-injection of starting fuel injection control can inject once during the normal starting procedure. The pre-injection starts when the following conditions are satisfied:

Actuation of oil pump relay

– Fuel pump running longer than the accumulation of pressure's delay time.

– The pre-injection has not yet occurred.

– Once all the above conditions are met, the pre-injection will start in all cylinders at the same time.

3. Fuel Injection Pulse Width Control

A. Air-Fuel Ratio

The startup air-fuel ratio, the normal startup air-fuel ratio, the air-fuel ratio of clearing flooded-cylinder, the air-fuel ratio when the engine is running, the air-fuel ratio in cooling state, the air-fuel ratio in the warm-up state, the theoretical air-fuel ratio, the power enriched air-fuel ratio, the catalytic overheating protection air-fuel ratio and the engine overheating

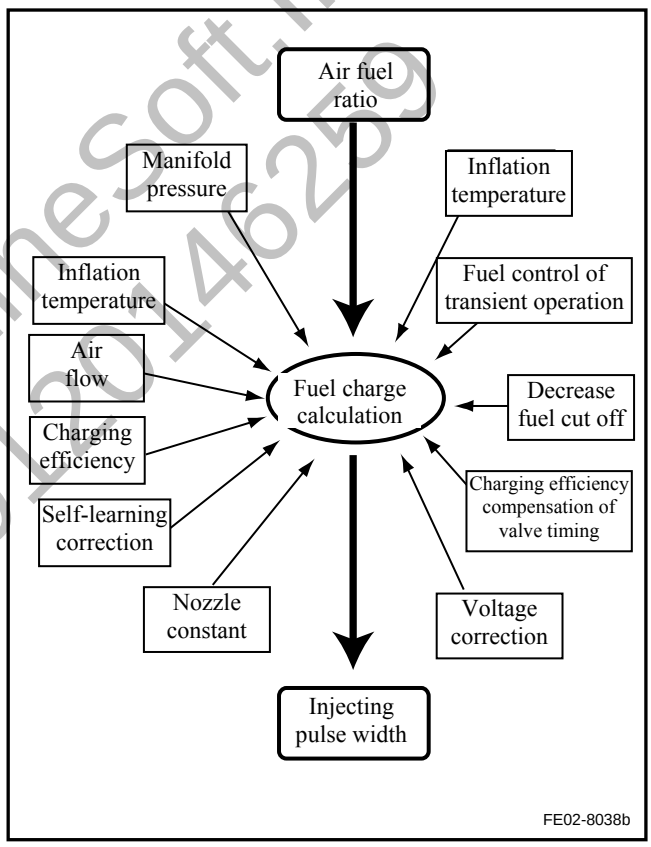
Keep the air-fuel ratio.

B. Intake Manifold Absolute Pressure

Intake manifold pressure is read directly by the MAP sensor installed on the intake manifold.

C. Volumetric Efficiency

Volumetric efficiency is the ratio of actual air flow into the cylinder to the ideal air flow.



D. Valve Timing Volumetric Efficiency

The valve timing changes affect the engine's volumetric efficiency. The basic volumetric efficiency form is set when the valve timing control system has not started to work and the camshaft and the crankshaft are at the initial positions. After port timing control system starts to operate, system carries out corresponding air charging efficiency compensation to ensure accurate calculation of air inlet volume.

E. Self-Learning

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Self-learning does not amend the changes as the engine running time increases, or the engine and vehicle manufacturing errors.

F. Close-loop Feedback Correction

Close-loop feedback correction controls the actual Air-Fuel ratio close to the theoretical Air-Fuel ratio through the oxygen sensor feedback signals.

G. Transition Condition Fuel Control

System uses more complex algorithms to establish the fuel evaporation model to calculate Air-Fuel mixing conditions, taking into account the engine coolant temperature, intake air temperature and engine working condition and the best fuel injection amount. It greatly improves fuel control under various transitional working conditions, including sudden acceleration/deceleration and other working conditions.

H. Protective Fuel Cut-off Control

When any one of the following conditions is met, the system will stop fuel injection:

– Cutting off when the engine speed is higher than 6,500 rpm and resume fuel supply when the engine speed drops below 6,000 rpm.

– When the system detects an ignition system malfunction, it stops the fuel supply.

– When the system voltage is more than 18V, the function of electric valve body will be limited.

Mode (Forced idling mode)

I. Basic Fuel Injection Constant

Whether the basic fuel injection constant indicates the relationship between engine displacement and nozzle fuel flow rate.

J. Battery Voltage Amendment

When the battery voltage changes, the voltage will be amended to ensure the correct amount of fuel injection.

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2.2.3.3 ECM Controlled Ignition System

1. Closed Ignition Angle Control

The length of the closed ignition angle determines the spark plug ignition energy. Too long ignition coil magnetizing will damage the coil or ECM internal ignition coil driving circuit, while too short will cause ignition failure (misfire).

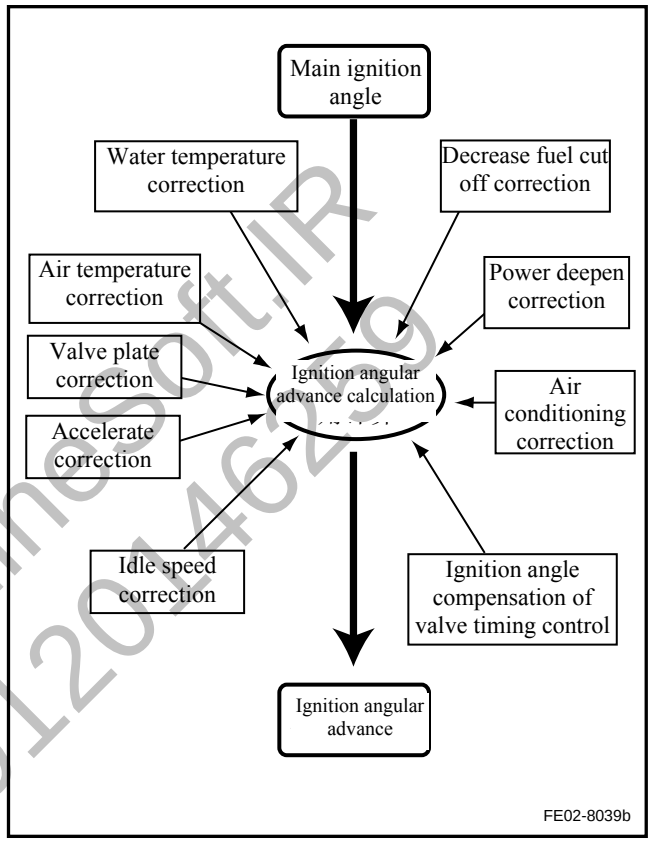
2. Start-up Mode

In the start-up mode, the system uses a fixed ignition angle in order to ensure cylinder mixture is ignited, and provide positive torque. When the engine starts to run, the engine speed increases to the automatically running status while the ignition angle will no longer be in starting mode.

3. Ignition Advance Angle Calculation and Control

A. Main Ignition Advance Angle

When the engine water temperature is normal, with the throttle opening, the main ignition angle is the minimum ignition angle at the optimal torque point or the threshold of knocking. When the throttle is closed, the ignition angle should be less than optimal torque point for idle speed stability. Without affecting the driving with a cold engine, in order to reach the normal operating temperature as quickly as possible, in the catalytic converter heating process, the basic ignition angle can be one angle other than the optimal torque point or the threshold of detonation. This angle should also be delayed as much as possible without affecting the driving ability.



B. Ignition Advance Angle Adjustment

Temperature adjustment, intake air temperature adjustment, altitude compensation adjustment, idle speed adjustment, acceleration adjustment, power-enriched adjustment, deceleration fuel cut-off adjustment, Air-Conditioning control adjustment, exhaust gas recirculation adjustment.

C. Acceleration Adjustment

Ignition advance angle acceleration adjustment is used to mitigate the engine speed fluctuations caused by drive system torque shock, and eliminate possible detonation during acceleration, making the acceleration smoother.

D. Valve Timing-controlled Ignition Angle Compensation

In order to obtain a better power and torque, system will enrich the Air-Fuel ratio to achieve the optimal torque and adjusts the ignition advance to achieve the optimal torque output.

E. Valve Timing-controlled Ignition Angle Compensation

When the valve timing control system works, the engine's intake and exhaust overlap angle

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change will affect the internal exhaust gas recirculation rate and the cylinder temperature. According to different valve timing, system needs to adjust ignition advance angle to ensure that under current valve timing, the actual ignition advance angle can achieve the best.

F. Deceleration Fuel Cut-off Adjustment

When the system exits the deceleration fuel cut-off control mode, the ignition angle will be adjusted to make the throttle close transition smooth.

G. Air-Conditioning Control Adjustment

When the engine is idling, turn off the Air-Conditioner. The ignition angle will be adjusted to make the engine run smoothly.

2.2.3.4 Electronic Throttle Body Function Restrictions

1. Forced Shut Down Mode

When ECM reports a malfunction or that the intake or throttle air flow control has a problem, the control strategy is to stop the fuel supply and the ignition, and to close the throttle as well as to shut down the engine.

2. Forced Idle Speed Power Management Mode

When the engine is idling, ETC system can not reliably use the throttle to control engine power. At this point, the ETC cancels the throttle control. The throttle opening returns to the default position. The engine power control is achieved by stopping one cylinder fuel injection and delaying the ignition angle.

3. Forced Idle Speed Mode

When the driver's intention can not be reliably detected, such as that all pedal signals are lost, the vehicle only maintains cooling, heating, electricity supply and lighting functions with engine idling. If pressing the acceleration pedal, there is no response on the engine, then in this mode the vehicle can not be driven.

4. Restricted Power Management Mode

ETC system can not use the throttle to control engine power. In this mode, the system determines whether the engine is at idle speed or is accelerating based on the acceleration pedal signal. The system controls engine power output by shutting down the engine, or by stopping a cylinder fuel injection, or by delaying the ignition. The engine output fluctuation is obvious. Working a long time in this mode would be harmful to the engine emission system. The model ensures that the vehicle is barely enough to be driven, but difficult to control in normal traffic or climbing on a steep slope.

5. Mode when the reliability of determining the drive intention is decreased or when the system can not achieve high power output

When the two acceleration pedal position sensors input signals have two much difference, the engine's output torque is limited. The engine's response to the pedal position change is much slower. The driver may feel that the engine power output will be significantly weakened, but the vehicle will be still able to drive in normal traffic.

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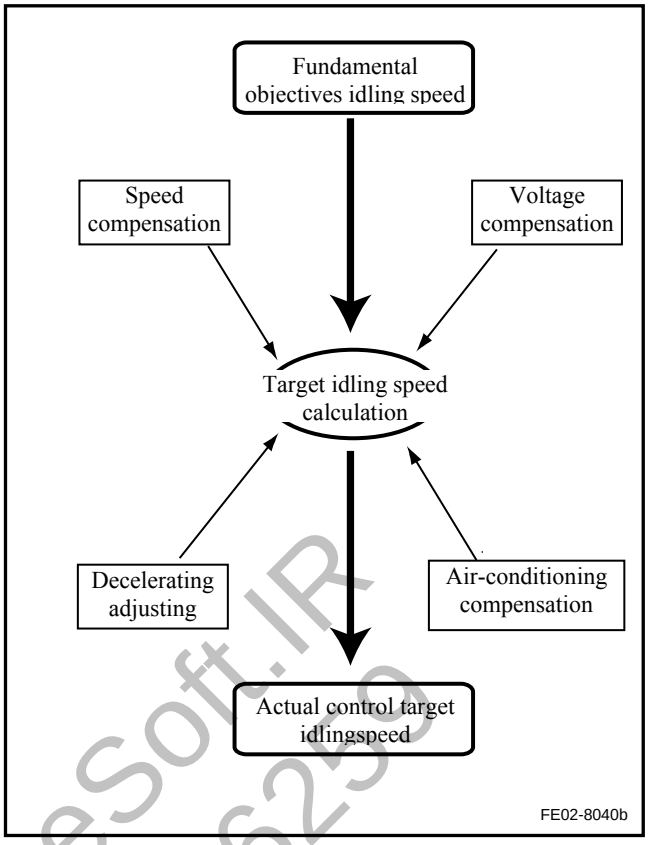
2.2.3.5 Idle Speed Control

Idle speed air flow control is that the engine control system maintains the target idle speed when throttle body is fully closed. The system maintains a smooth transition with the throttle body fully closed to prevent the stall. When the engine load changes at idle speed, system maintains a steady engine speed.



1. Target Idle Speed Calculation

2. Basic Target Idle Speed

At different coolant temperatures, the basic target idle settings are as follows:

Water Temperature/ Atmospheric Pressure	45	55	65	75	85	95	105
-40	1350	1350	1350	1350	1350	1350	1350
-30	1350	1350	1350	1350	1350	1350	1350
-20	1350	1350	1350	1350	1350	1350	1350
-10	1350	1350	1350	1350	1350	1350	1350
0	1250	1250	1250	1250	1250	1250	1250
10	1200	1200	1200	1200	1200	1200	1200
20	1200	1200	1200	1200	1200	1200	1200
30	1150	1150	1150	1150	1150	1150	1150
40	1000	1000	1000	1000	1000	1000	1000
50	950	950	950	950	950	950	950
60	850	850	850	850	850	850	850

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70	750	750	750	750	750	750	750
80	750	750	750	750	750	750	750
90	750	750	750	750	750	750	750
100	750	750	750	750	750	750	750
110	850	850	850	850	850	850	850
120	900	900	900	900	900	900	900

3. Vehicle Speed Compensation and Deceleration Adjustment

To improve the deceleration and stop driving performance, when the vehicle is driving, the target idle speed increases by 50 rpm higher than stopping idle speed. During the deceleration and stopping, the speed gradually decreases to the parking target idle speed.

4. Air-Conditioning Compensation

When turning on the air-conditioner at parking, in order to compensate the power consumption, the target idle speed rises 20 rpm at the coolant temperature < 50℃/122℉; rises 30 rpm at the coolant temperature of 50℃/122℉; rises 40 rpm at the coolant temperature of 60℃/140℉; rises 55 rpm at the coolant temperature of 70℃/158℉; rises 70 rpm at the coolant temperature of 80℃/176℉; rises 80 rpm at the coolant temperature of 90℃/194℉; rises 100 rpm at the coolant temperature of 100℃/212℉.

5. Voltage Compensation

When the system voltage is lower than 12 V, and not restored in 10 s, the system will increase the target idle speed by 300 rpm to increase the generated electricity amount. When the external power load impacts the system, the transient voltage will fluctuate. The system will automatically compensate for the air flow rate in order to curb the engine speed fluctuations.

2.2.3.6 Knock Control

Knock control function is used for eliminating engine knock which would occur during combustion and optimizing power performance of engine and economical efficiency of fuel. System can control different cylinder knocking independently.

1. Knock Control Enable Conditions

– Engine running time is more than 2 s

– Engine coolant temperature is more than 70℃/158 ºF

– Engine speed is more than 600 rpm

2. Knock Control Mode

When a knocking occurs or is likely to occur, the system will quickly delay the ignition advance angle. System basic ignition advance angle is either normal ignition advance angle or safety ignition advance angle. Knock controlled speed is between these two.

– Homeostatic control

When the engine is running as per normal, ECM collects and analyzes engine combustion signals and filters knock signal through the knock sensor. Once the knock intensity is higher than the acceptable limit, the system will rapidly delay the ignition advance angle of cylinder in which the detonation happened, to eliminate knocking in the following combustion. The ignition advance angle will get back to normal angle gradually.

– Transient control

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During a sudden acceleration or engine speed change, knocking is likely to happen. The system predicts the likelihood of knocking, and automatically delays the ignition advance angle in order to avoid a strong knocking.

– Quickly delayed ignition advance angle

Once the system detects a knocking, according to different engine speeds, the system rapidly delays ignition advance angle 3-5 degrees, and resumes to normal controls in 2-3 s afterward.

– Adaptive control ignition advance angle

Due to wear and tear after long-term use, there is certain difference between the engines. When the system and the engine are in initial use or ECM is resupplied with power, the engine knocking may occur. The system will record the knocking, after a period of running-in, the system will automatically generate an adaptive adjustment value of the ignition (self-learning value). When the engine is running in the same conditions, the system will automatically make the adaptive adjustment for the advance the ignition angle, to avoid the knocking occurring.

System adaptive learning is the constantly updating during the engine running.

2.2.3.7 Air-conditioning Switch off Control

In some cases, in order to ensure the engine power or protect the engine or protect the Air-Conditioning system, ECM must stop the Air-Conditioning compressor working or prohibit the Air-Conditioning system to start. At the same time, to prevent the frequently on-off of compressor clutch, once the system enters the Air-Conditioning switch off mode, ECM delays for a specified period of time to control Air-Conditioning clutch pull-in.

– Full-throttle Air-Conditioning Switch off Mode: Ensure the vehicle power.

The engine speed is less than 3,600 rpm.

No TPS fault

TPS is greater than 101%, and since the last time full-throttle air-condition-off, the TPS has been less than this value

– Engine Speed Too High Air-Conditioning Switch off Mode: Protect the Air-Conditioning system.

A/C off, the engine speed should be less than 5,800 rpm before the compressor is allowed to start.

When A/C is on, once the engine speed is greater than 6,000 rpm, the compressor will be switched off.

– Engine Coolant Temperature Too High Air-Conditioning Switch off Mode: Protect the engine.

A/C off, the coolant temperature should be less than 106°C (223°F) before the compressor is allowed to start.

A/C on, once the coolant temperature is greater than 108°C (226°F), the compressor will be switched off.

2.2.3.8 Canister Solenoid Valve Control

Canister solenoid valve controls the opening and closing event and time of the channel between the canister and intake pipe, so as to control the amount and time for fuel vapor entering the cylinders, therefore maximizing the decrease of the vehicle evaporative emissions, while minimizing the impact on engine performance.

1. Working conditions of canister solenoid valve

In order to reduce the impact on the normal combustion and doing work from the fuel vapor entering the cylinder, the following conditions must be met before the canister solenoid valve is open:

– System voltage is less than 18 V but more than 8 V

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– Engine coolant temperature is more than 0℃ (32 °F)
– Engine intake air temperature is higher than 0℃ (32 ºF)
– Non-correlation system fault

- Fuel System Malfunction
- Fuel Pump Malfunction
- Idle Speed Too High/Too Low Malfunction
- Intake Air Pressure Sensor Malfunction
- Engine Misfire Malfunction
- Front Oxygen Sensor Heating Malfunction
- Front Oxygen Sensor Signal Malfunction
- System Voltage Too Low/Too High Malfunction
- Crankshaft Position Sensor Malfunction
- Ignition Coil Malfunction
- Fuel Injector Nozzle Malfunction
- Canister Solenoid Valve Output Malfunction

2. Operating Mode

Canister solenoid valve opening is determined by ECM according to the duty cycle (PWM) signal coming from the engine status. In the non-idling state, the maximum canister solenoid valve opening is determined by the close-loop air flow with a maximum of 100%.

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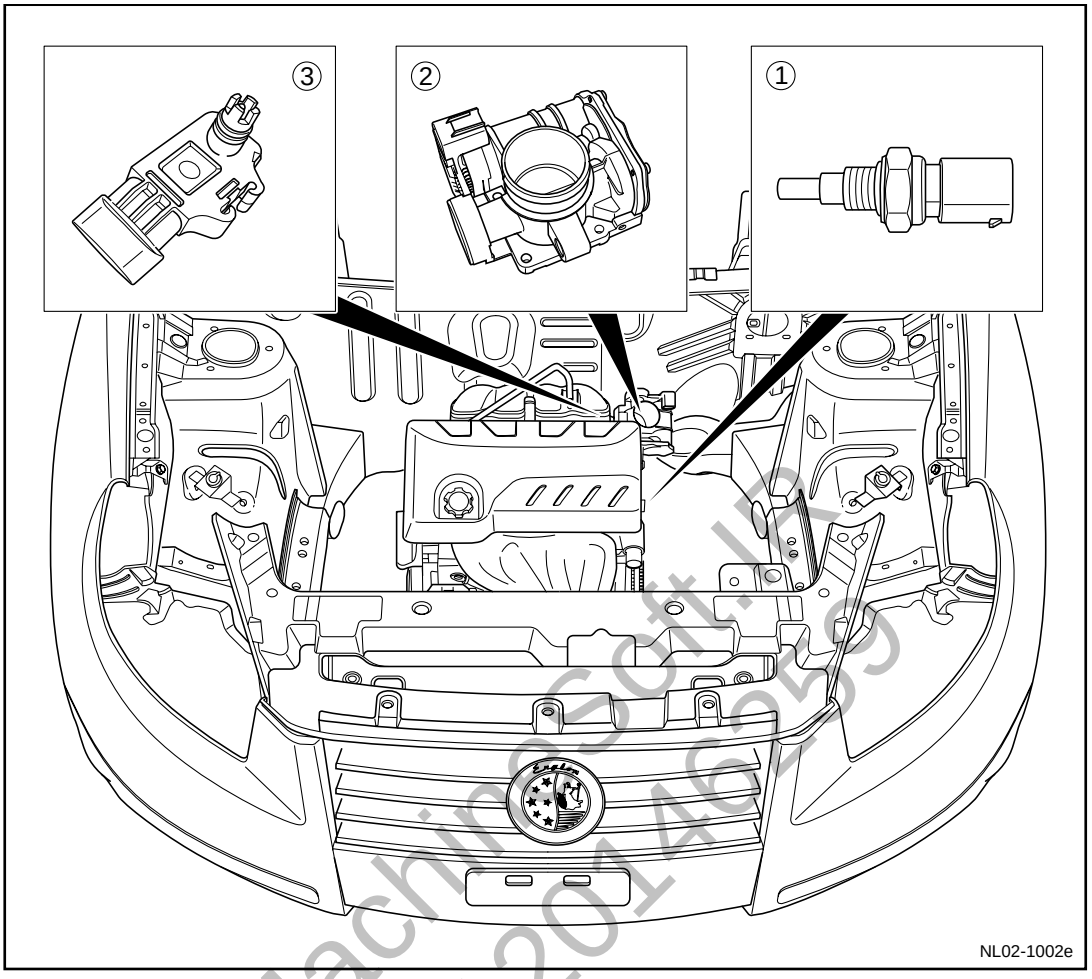
2.2.4 Component Location

2.2.4.1 Engine Coolant Temperature Sensor, Electronic Throttle Body, Intake Pressure Temperature Sensor



1. Engine Coolant Temperature Sensor
2. Electronic Throttle Body
3. Intake Pressure Temperature Sensor

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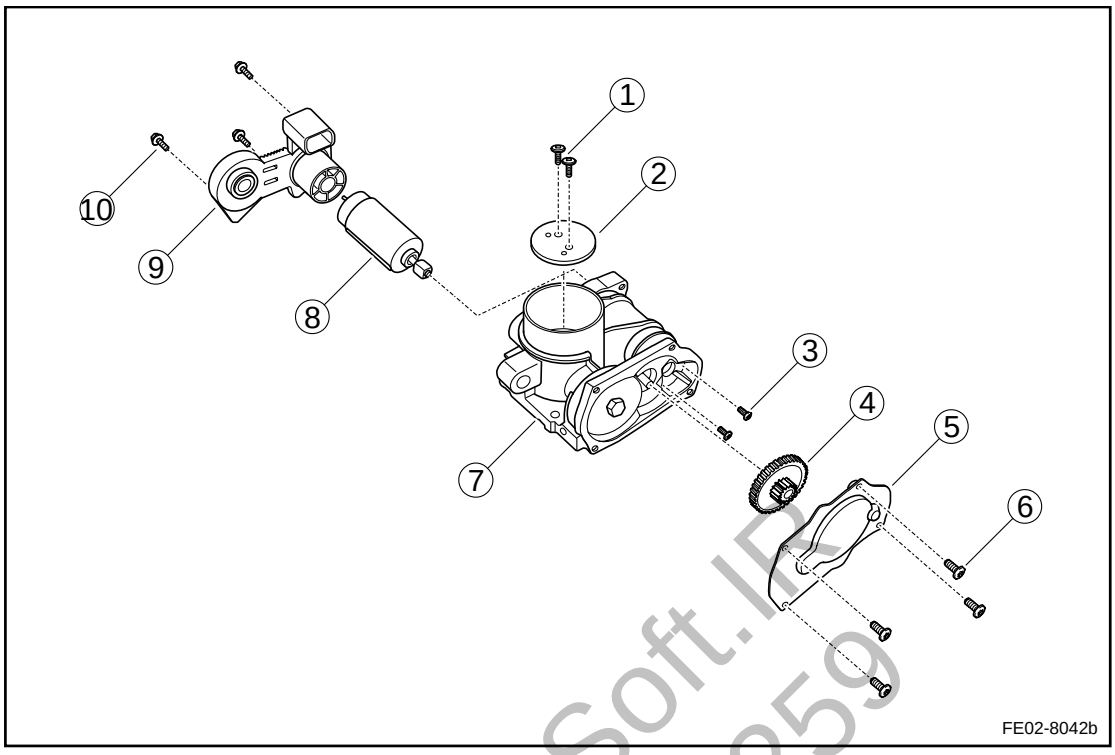
2.2.5 Disassemble drawings

2.2.5.1 Electronic throttle body disassembly drawing



1. Fixing Bolts of Throttle Valve
2. Throttle Valve
3. Fixing Bolts of Throttle Drive Motor
4. Throttle Drive Gear
5. Seal Plate
6. Fixing Bolts of Seal Plate
7. Throttle Body
8. Throttle Drive Motor
9. Throttle Position Sensor
10. Fixing Bolts of Throttle Position Sensor

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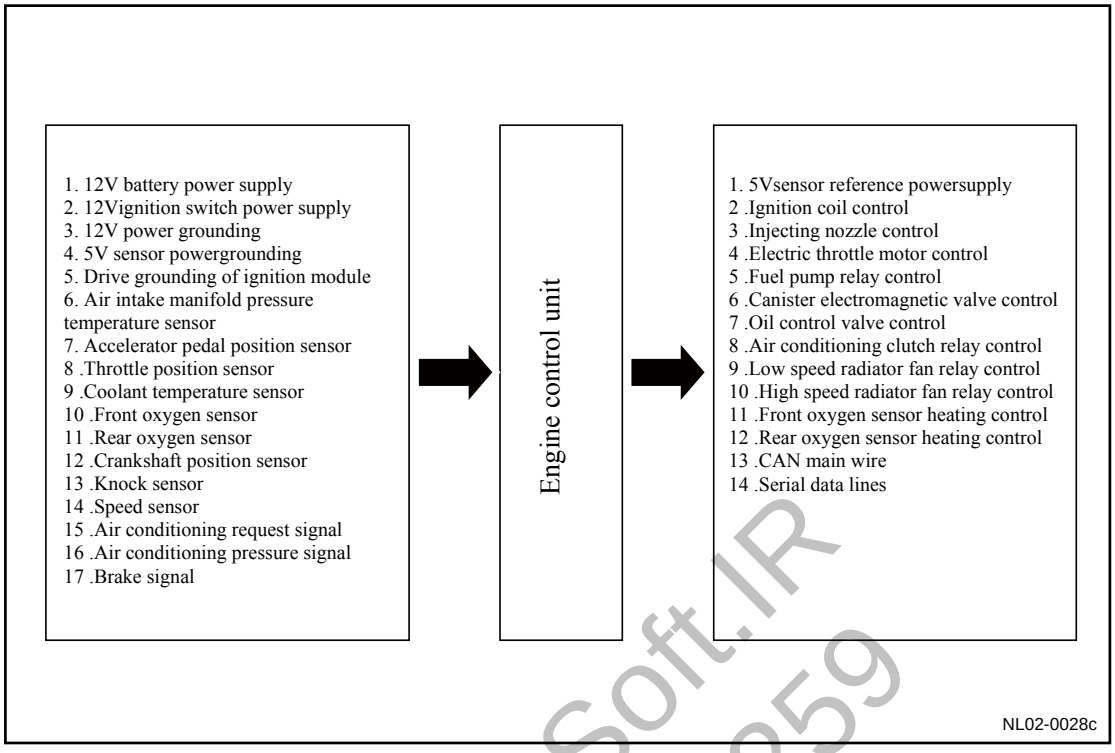
2.2.6 Electrical schematic diagram

2.2.6.1 Electrical schematic diagram



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2.2.7 Diagnostic information and procedures

2.2.7.1 Diagnosis descriptions

Before carrying out the control system diagnostic, refer to “2.2.2 Description and Operation” and “2.2.3 System Operating Principle”. Understand and get familiar with control system operating principle, and then start systematic diagnostic, so that it will help to determine the correct diagnostic steps. More importantly, it will also help to determine whether the situation described by the customer is normal.

Any control system fault diagnosis should start with Control System Inspection. Control System Inspection will guide the service personnel to take the next logical step to diagnose the fault. Understand and correctly use the diagnostic flow chart can reduce the diagnostic time and avoid misjudge on components.

2.2.7.2 Inspection of control system 2.2.7.6 Definition of type of fault diagnosis code

Before inspecting the control system, please do the following primary inspections:

1. Inspect the battery terminal voltage to ensure an adequate power supply and a stable voltage.
2. Inspect the battery cables, clean and tighten.
3. Inspect the system components easy to access or visible to determine whether there are obvious damages that may cause the symptoms, such as the damage to the vacuum tube and the connection reliability of wiring harness connectors.
4. Inspect whether the control module and battery main ground points are normal and whether the copper plates at the ground points have oxidation, loose or other signs.
5. Check whether the control system is equipped with after-sales additional devices which may influence its normal operation.

- Control System Inspection Process

2.2.7.3 Intermittent fault inspection

Notes:

1. Clear DTC
2. Carry out simulation tests.
3. Inspect and shake the harnesses, connectors and terminals.

When DTC inspection can not identify the fault, the fault occurs only occasionally in use. At this point you should confirm all circuits and components that can possibly lead to the fault. In many cases, carrying out the basic inspections shown in the following flow chart can quickly and efficiently identify the fault position, especially for harness connector poor contact and other faults.

Fault Definition: the fault currently does not appear, but the historical record indicates that the fault has appeared before. Or the customer reported the fault, but as the fault is not relevant to the DTC, the fault symptoms do not appear at present.

1	Is the battery voltage normal?

Notes: Turn the ignition switch to OFF position.

Results	**Intake**
11 V or higher	Yes
Less than 11V	No

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No → Inspect the battery.

Yes

2	Inspect visually and physically

This step is an important method to initially identify the fault location before the area detection:

A. Inspect harness for damage, wear and tear.

B. Inspect whether the harness is routed properly. Do not place harness near a device with high voltage or high current running through:

C. Start motor, generator and other motor components. When these components are working, they will introduce great electromagnetic interference, thus affecting the proper signal transmission, resulting in system can not work properly.

D. Ignition coil, ignition conductor, etc.

E. Inspect a vacuum hose for cracking, damage or distortion. Confirm the pipeline's correct connection and routing.

F. Inspect whether there is air intake system leakage. For example, the throttle body installation surface, idle speed control valve, intake manifold sealing surface and so on.

G. Inspect the engine control module (ECM) ground point and the body ground for oxidation, loose, incorrect position, etc. The control system ground point can not be changed at will, as this will affect the proper operation of the control system.

H. Inspect whether the battery positive and negative cable connections are reliable, whether there is loose, oxidation, and corrosion and so on.

Next

3	Inspect the wiring harness and connector.

A. Many intermittent faults are caused by vibration, distortion, uneven roads, and improper operation of components or connectors dislocation.

B. If the circuit resistance is too high, it may result in components can not work properly. Use a fault diagnosis tester to drive the actuators, if not working, inspect whether the resistance in the circuit is too high or other wire faults.

Next

4	Reproduce the fault and use instruments to record engine control module data.

A. Connect a fault diagnosis tester and use the data record function to record road test data during the occurrence of the intermittent fault. After pressing the vehicle data recorder button, the scan tool can record engine control module data when intermittent fault occurs, and then the data can be used to identify the fault location.

B. Another diagnostic method is when the vehicle is driven connect a digital multimeter to the suspicious circuit. Digital multimeter abnormal readings may indicate the fault location.

Next

5	Fault indicator gives intermittent light, but a DTC is not set in the system.

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The following conditions may cause intermittent fault indicator light, but the system does not set the DTC:

A. Electromagnetic interferences are caused by relay, solenoid valve or switch controlled by ECM, which work abnormally.

B. Non-original or after-sale accessories, such as phone, alarm, lamp or radio equipment, are not installed properly.

C. Intermittent fault indicator light control circuit short to ground.

D. Engine control module ground point is loose.

Next

6	Other inspections

A. Test whether Air-Conditioning compressor clutch diodes at both ends and other diodes are in open circuit.

B. Inspect whether there are following conditions existing in charging system:

- Generator rectifier fault within the electrical system may result in the alternating current signal interference.
- Generator output voltage is correct or not. If the generator output voltage is lower than 9V or higher than 18V, repair the charging system.

Next

7	Enter Fault Symptom Table

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2.2.7.4 Fault symptom table

If a fault occurs, but the DTC has not been stored in ECM, and its faulty reason can not be identified in the basic diagnostic, it is suggested to carry out the diagnostic and troubleshooting based on the listed order in the following table.

Symptoms	Suspected Faulty Items	(Refer to the troubleshooting scheme)
Retardation, Engine Speed Decrease, Speed Instability Fault Definition: When pressing the accelerator pedal, there is no immediate response. This fault may occur at any vehicle speed. Start the vehicle for the first time (for example, start after parking), this fault is usually more obvious. In severe cases, this fault may lead to engine stalling.	1. ECM power supply circuit	Refer to 2.2.7.43 DTC P0562 P0563
	2. Intake Manifold Absolute Pressure (MAP) Sensor	Refer to 2.2.7.18 DTC P0107 P0108
	3. Abnormal Fuel Pressure	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	4. Abnormal Injector Working	
	5. Mixture Too Thick	Refer to 2.2.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	6. Mixture Too Thin	
	7. Ignition system: abnormal spark plug, abnormal ignition wires.	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	8. Knock Sensor (KS) system ignition delay is too large	
	9. Crankshaft Position Sensor	Refer to 2.2.7.35 DTC P0335 P0336
	10. Abnormal thermostat	2.8.7 Diagnostic Information and Procedures in the 2.8 Cooling System
	11. Abnormal Working of Generators	Refer to 2.11.7 Diagnostic Information and Procedures in the 2.11 Start and Charging System
Fault Definition for engine stalling during air-conditioning works only: when Air-Conditioning is working, Engine Speed Instability or Stalling	1. Electronic Throttle Body	Refer to 2.2.7.53 DTC P2135
	2. ECM	See 2.2.8.1 Replacement of Engine Control Module.
High Fuel Consumption, Poor Fuel Economy Fault definition: oil consumption	1. ECM power supply circuit	Refer to 2.2.7.43 DTC P0562 P0563
	2. Mixture Too Thick	Refer to 2.2.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	3. Air Filter Blocked	-

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measured by actual road test is obviously high than Expected value In addition, the fuel consumption is also significantly higher than the previous road test.	4. Poor Fuel Quality, Fuel Contamination	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	5. Abnormal Fuel Pressure	
	6. Abnormal Injector Working	
	7. Electronic Throttle Body	Refer to 2.2.7.53 DTC P2135
	8. The driver has the following driving habits: • Air-Conditioning or defroster is always on • Tire pressure is incorrect • Vehicle Overload • Accelerate too Fast, too frequent	-
	9. Air Leakage In Intake System and Crankcase System	Refer to 2.4.6 Diagnostic Information and Procedures in the 2.4 Auxiliary Emission Control Devices
	10. Positive crankcase ventilation valve catching	
	11. Knock Sensor (KS) system ignition delay is too large	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	12. Spark Plug: Incorrect thermal value, damp, crack, incorrect gap, excessive erosion, excessive carbon residue, contaminated by fuel	
	13. Spark Plug Wire Damage	
	14. Ignition Coil Damage	
	15. Coolant Level Too Low, Thermostat Malfunction	Refer to 2.8.7 Diagnostic Information and Procedures in the 2.8 Cooling System
	16. Too Much Oil in Combustion Chamber or Valve Seals Leakage 17. Incorrect Cylinder Compression Pressure Ensure	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
High Fuel Consumption, Poor Fuel Economy Fault Definition: The actual road	1. Valve Catching or Leakage, Broken Valve Spring, Incorrect Valve Timing	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	2. Too much carbon residue in combustion chamber	

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test fuel consumption is significantly higher than expected. In addition, the fuel consumption is also significantly higher than the previous road test.	3. Vacuum Hose Cracking or Kink, Connection Unreliable	
	4. Exhaust Blocked: Three-Way Catalytic Converter Blocked, Muffler Internal Damage	Refer to 2.7.5 Diagnostic Information and Procedures in the 2.7 Exhaust System
	5. Brake System Dragging or Operation Abnormally	Refer to 6.2.4 Diagnostic Information and Procedures in 6 Brake System
	6. Electromagnetic Interference (EMI) in the voltage circuit may lead to engine misfire. Use a fault diagnosis tester to monitor the engine speed to detect electromagnetic interference. Engine speed parameter suddenly increases while the actual engine speed does almost not change, then there is electromagnetic interference. If there is a malfunction, inspect whether there is a high voltage component in the vicinity of the ignition control circuit.	-
Lack of Fuel Supply, Misfire Fault Definition: After the engine speed increases, there is continuous pulsation, or jitter, usually even more noticeable with the engine load increases. When the engine speed is above 1,500 rpm, the fault does not appear.	1. ECM power supply circuit	Refer to 2.2.7.43 DTC P0562 P0563
	2. Air Filter Blocked	-
	3. Abnormal Fuel Pressure	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	4. Abnormal Injector Working	
	5. Mixture Too Thick	Refer to 2.2.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	6. Mixture Too Thin	
	7. Electronic Throttle Body	Refer to 2.2.7.53 DTC P2135
	8. Knock Sensor (KS) system ignition delay is too large	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	9. Spark Plug: Incorrect thermal value, damp, crack, incorrect gap, excessive erosion, excessive carbon residue, contaminated by fuel	
	10. Spark Plug Wire Damage	
	11. Ignition Coil Damage	
	12. Crankshaft Position Sensor	Refer to 2.2.7.35 DTC P0335 P0336

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Lack of Fuel Supply, Misfire Fault Definition: After the engine speed increases, there is continuous pulsation, or jitter, usually even more noticeable with the engine load increases. When the engine speed is above 1,500 rpm, the fault does not appear.	1. Too Much Oil in Combustion Chamber or Valve Seals Leakage	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	2. Cylinder compression pressure is incorrect	
	3. Valve Stagnant or Leakage	
	4. Camshaft Convex Corner Wear	
	5. Valve Timing Incorrect	
	6. Valve Spring Broken	
	7. Too much carbon residue in combustion chamber	
	8. Abnormal Camshaft, Cylinder Hood, Piston, Connecting Rod and Bearing	
	9. Exhaust Blocked: Three-Way Catalytic Converter Blocked, Muffler Internal Damage	Refer to 2.7 Diagnostic Information and Procedures in the 2.7 Exhaust System
Fault definition for badness, instability, error or under speed of idle speed: starting in the course of idling. Engine runs unsteadily. In extreme cases, the engine or the vehicle will tremble. Engine idle speed under the condition that the throttle valve opening is certain The speed may be fluctuated. Any of these circumstances is likely to be serious enough to make the engine stall.	1. ECM power supply circuit	Refer to 2.2.7.43 DTC P0562 P0563
	2. Air Filter Blocked	-
	3. Abnormal Fuel Pressure	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	4. Fuel Contamination	
	5. Abnormal Injector Working	
	6. Electronic Throttle Body	Refer to 2.2.7.53 DTC P2135
	7. Acceleration Pedal Position Sensor	Refer to 2.2.7.54 DTC P2138
	8. Positive Crankcase Ventilation Valve	Refer to 2.4.6 Diagnostic Information and Procedures in the 2.4 Auxiliary Emission Control Devices
	9. Evaporative Emission (EVAP) Canister Solenoid Valve	
	10. Knock Sensor (KS) system ignition delay is too large	
	11. Spark Plug: Incorrect thermal value, damp, crack, incorrect gap, excessive erosion, excessive carbon residue, contaminated by fuel	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System

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	12. Spark Plug Wire Damage	
	13. Ignition Coil Damage	
	14. Crankshaft Position Sensor	Refer to 2.2.7.35 DTC P0335 P0336
	15. Too Much Oil in Combustion Chamber or Valve Seals Leakage	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	16. Cylinder compression pressure is incorrect	
Fault definition for badness, instability, error or underspeed of idle speed: starting in the course of idling. Engine runs unsteadily. In extreme cases, the engine or the vehicle will tremble. With a certain throttle opening, the engine idle speed may fluctuate. Any of these circumstances is likely to be serious enough to make the engine stall.	1. Valve Catching or Leakage, Broken Valve Spring, Incorrect Valve Timing	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	2. Too much carbon residue in combustion chamber	
	3. Inspect engine support seat.	
	4. Electromagnetic Interference (EMI) in the voltage circuit may lead to engine misfire. Use a fault diagnosis tester to monitor the engine speed to detect electromagnetic interference. Engine speed parameter suddenly increases while the actual engine speed does almost not change, then there is electromagnetic interference. If there is a fault, inspect whether there is a high voltage component in the vicinity of the ignition control circuit.	-
Fault Definition for Conflagration and Ignition Knocking: Knocking sound is worsen during accelerating. With the throttle opening changes, the engine will generate a sharp metal beating sound at the cylinder.	1. ECM power supply circuit	Refer to 2.2.7.43 DTC P0562 P0563
	2. Incorrect Fuel No.	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	3. Abnormal Fuel Pressure	
	4. Abnormal Injector Working	
	5. Mixture Too Thin	Refer to 2.2.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	6. Knock Sensor (KS) system ignition delay is too large	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	7. Spark Plug Heat Value Incorrect	
	8. Cooling system: too low oil level, incorrect coolant, coolant	Refer to 2.8.7 Diagnostic Information and Procedures in the 2.8 Cooling

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	leakage, cooling fan does not rotate	System
	9. Too Much Oil in Combustion Chamber and the Valve Sealing Leaking	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	10. Cylinder compression [reassure too high	
	11. Too much carbon residue in combustion chamber	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	12. Abnormal Camshaft, Cylinder Hood, Piston, Connecting Rod and Bearing	
Engine difficult to start Fault Definition: The engine crankshaft rotation is normal, but the vehicle can not be started in a long time. The engine is finally able to start, but may immediately stop. fire.	1. Too Much Oil in Combustion Chamber and the Valve Sealing Leaking	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	2. Excessive Carbon Residue in Combustion Chamber	
	3. Timing Chain Installation Incorrect	
	4. Cylinder compression pressure is incorrect	
	5. Fuel Pump Relay, Fuel Pump, Fuel Injector, Fuel Contamination	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
Engine difficult to start Fault Definition: The engine crankshaft rotation is normal, but the vehicle can not be started in a long time. The engine is finally able to start, but may immediately stop. fire.	1. Ignition System: Ignition Wire, Spark Plug, Ignition Coil	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	2. ECM Power Supply	Refer to 2.2.7.43 DTC P0562 P0563
	3. Engine coolant temperature sensor	Refer to 2.2.7.20 DTC P0117 P0118
	4. Electronic Throttle Body	Refer to 2.2.7.53 DTC P2135
	5. Acceleration Pedal Position Sensor	Refer to 2.2.7.54 DTC P2138
Fault Definition for back fire and blast: Unburned gases entering the intake manifold	1. ECM power supply circuit	Refer to 2.2.7.43 DTC P0562 P0563
	2. Abnormal Fuel Pressure	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	3. Fuel Contamination	

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or the exhaust system will be ignited, producing a very loud cracking sound.	4. Abnormal Injector Working	
	5. Air Leakage in Intake System and Crankcase	Refer to 2.4.6 Diagnostic Information and Procedures in the 2.4 Auxiliary Emission Control Devices
	6. Positive Crankcase Ventilation Valve	
	7. Knock Sensor (KS) system ignition delay is too large	Refer to 2.2.7.34 DTC P0324 P0325
	8. Spark plug: incorrect heat value, humidified, cracked, incorrect clearance, excessive burning Carbon deposit is too much. It is polluted by fuel.	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	9. Spark Plug Wire Damage	
	10. Ignition Coil Damage	
	11. Coolant level is too low, thermostat is faulty.	2.8.7 Diagnostic Information and Procedures in the 2.8 Cooling System
Fault Definition for surge: When the throttle opening is stable, the engine power changes. The vehicle speed changes while the acceleration pedal position does not change.	1. ECM power supply circuit	Refer to 2.2.7.43 DTC P0562 P0563
	2. Air-Conditioning Compressor	Refer to 8.2.7 Diagnostic Information and Procedures in 8.2 Automatic Air-conditioning
	3. Abnormal Heated Type Oxygen Sensor	Refer to 2.2.7.22 DTC P0131 P0132 P0133 P0134.
	4. Poor Fuel Quality, Fuel Contamination	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	5. Abnormal Fuel Pressure	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	6. Abnormal Injector Working	
	7. Mixture Too Thick	Refer to 2.2.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	8. Mixture Too Thin	
	9. Intelligent Variable Valve Timing System	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	10. Vacuum Hose Cracking or Kink, Connection Unreliable	
	11. Spark Plug: Incorrect thermal value, damp, crack, incorrect gap, excessive erosion, excessive carbon residue,	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System

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	contaminated by fuel	
	12.Spark plug guide wire damaged	
	13. Ignition Coil Damage	
Fault definition for insufficient power, viscosity or weakness: The engine power output is lower than expected. Half- press the acceleration pedal, almost no acceleration or no acceleration at all.	1. ECM power supply circuit	Refer to 2.2.7.43 DTC P0562 P0563
	2. Air filter element plug	-
	3. Poor Fuel Quality, Fuel Contamination	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	4. Abnormal Fuel Pressure	
	5. Abnormal Injector Working	
	6. Mixture Too Thick	Refer to 2.2.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	7. Mixture Too Thin	
	8. Knock Sensor (KS) system ignition delay is too large	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	9. Spark Plug: Incorrect thermal value, damp, crack, incorrect gap, excessive erosion, excessive carbon residue, contaminated by fuel	
	10. Spark Plug Wire Damage	
	11. Ignition Coil Damage	
	12. Crankshaft Position Sensor	Refer to 2.2.7.35 DTC P0335 P0336
	13. Too Much Oil in Combustion Chamber or Valve Seals Leakage	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	14. Cylinder compression pressure is incorrect	
	15. Valve Catching or Leakage, Broken Valve Spring, Incorrect Valve Timing	
	16. Too much carbon residue in combustion chamber	
	17. Intelligent Variable Valve Timing System	
	18. Exhaust Blocked: Three-Way Catalytic Converter Blocked,	Refer to 2.7.5 Diagnostic Information and Procedures in the 2.7 Exhaust

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	Muffler Internal Damage	System
Engine does not run. Fault Definition: When the ignition switch is in the ST position, the engine crankshaft is not rotating.	1. Battery	Refer to 2.11.7.4 Engine Unable to Start in 2.11 Start and Charging System
	2. Starter	
	3. Start Relay	
	4. Ignition Switch	
	5. BCM	
	6. Engine Anti-theft Locking System	Refer to 2.5.7 Diagnostic Information and Procedures in 2.5 Engine Anti-theft System.
The engine is unable to start, without Vehicle signs Fault Definition: When ignition switch in the ST position, the engine crankshaft rotates without sign of the vehicle starting.	1. ECM power supply circuit	Refer to 2.2.7.43 DTC P0562 P0563
	2. Crankshaft Position Sensor	Refer to 2.2.7.35 DTC P0335 P0336
	3. Camshaft Position Sensor	Refer to 2.2.7.36 DTC P0340 P0341
	4. Ignition System	2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	5. Fuel Pump Control Circuit	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	6. Fuel Injector Working Circuit	
	7. ECM	See 2.2.8.1 Replacement of Engine Control Module.

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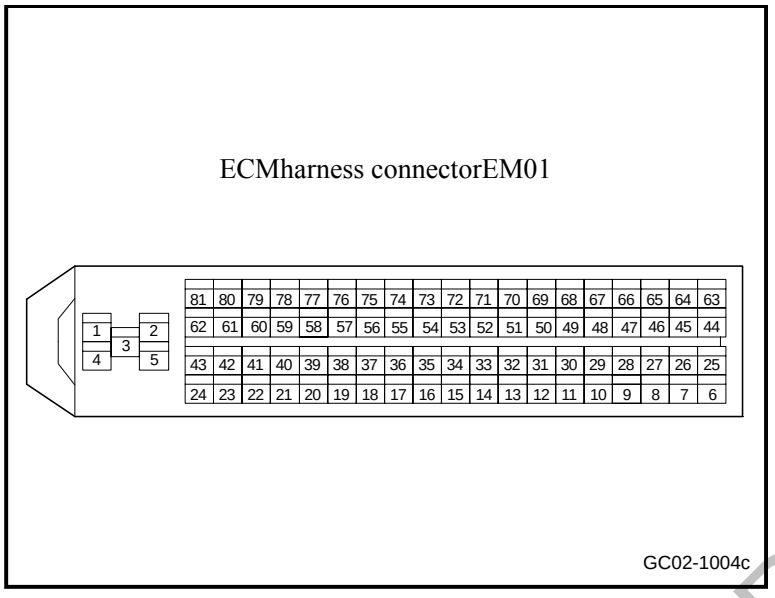
2.2.7.5 List of ECM Terminal Definition



Terminal No.	Wire diameter	Abbreviation	Terminal descriptions
1	0.75	COILB	Ignition Coil B (Ignition Coil III Driven)
2	1.5	GND	Power Ground
3	1.5	GND	Power Ground
4	0.75	COILA	Ignition Coil A (Ignition Coil I Driven)
5	0.75	PROTBAT	Protect ETC Battery (Electronic Throttle Power Supply)
6	0.75	INJA	NJECTOR CYL#A (1 # Cylinder Fuel Injector)
7	0.75	INJB	INJECTOR CYL#B(3 cylinders injector)
8	0.75	INJD	INJECTOR CYL#D(2 cylinders injector)
9	0.5	ACLRY	AC CLUTCH RELAY (Air-conditioning Clutch Relay)
10	0.5	FPR	FUEL PUMP RELAY (Fuel Pump Relay)
11	0.5	58XLO	Crank Position SEMs or Low (Crankshaft Position Sensor Low Signal)
12	-	-	-
13	-	-	-
14	-	-	-

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15	-	-	-
16	-	-	-
17	0.5	FANHI	HIGH SPEEM FAN (Radiator High Speed Fan)
18	-	-	-
19	-	-	-
20	0.75	MTR-	Etc Motor Low
21	0.75	MTR+	ETC Motor High
22	-	-	-
23	0.5	O2BHTR	Post-O2Heater (O2 sensor B) Thermal control
24	0.5	O2AHTR	Pre-O2Heater (Oxygen Sensor A Heating Control)
25	0.75	INJC	INJECTOR Cylinder C (4 # Cylinder Fuel Injector)
26	-	-	-
27	0.5	TPS2	Throttle Position Sensor 2 (Throttle Position Signal Input 2)
28	-	-	-
29			
30	0.5	58XHI	Crank Position SEMs or High (Crankshaft Position Sensor High Signal)
31	-	-	-
32	-	-	-
33	0.5	BRKLP	Brake Lamp Signal
34	0.5	CS	Clutch Switch (Clutch Switch)
35	0.5	ELOAD2+	Headlamp
36	0.5	KNOCKHI	KNOCK SENSOR SIGNAL High (Only high signal when double wires)
37	0.5	KNOCKLO	KNOCK SENSOR SIGNAL Low (Knock sensor/ double wires low signal)

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38	0.5	CANL0	CAN LOW
39	0.5	–CAN Bus	CAN HIGH
40	0.5	MP+	AC Middle Pressure Switch (Middle pressure switch input)
41	0.5	PPS1	PEMal Position Sensor 1 (Pedal position input signal 1)
42	0.5	PPS2	PEMal Position Sensor 2 (Pedal position input signal 2)
43	0.75	VVT1	Intake Variable Valve Timing Variable Valve Phase (exhaust valve) Control
44	0.5	MPR	MAIN POWER RELAY (Main Relay)
45	-	-	-
46	0.5	IMMOREQ	Immobilizer Request (Immobilizer Certification Request)
47	0.5	O2AHI	Pre-O2 SENSOR HIGH (Oxygen Sensor A High)
48	0.5	O2BHI	Post-O2B SENSOR HIGH (Oxygen Sensor B High)
49	0.5O	CTS	Coolant Temperature SEMs or (Coolant Temperature Signal Input)
50	0.5	PCFS	Post Collision Fuel Shutoff
51	0.5	VSS	Vehicle Speed Sensor (Vehicle Speed Signal Input)
52	0.5	TPS1	Throttle Position Sensor 1 (Throttle Position Signal Input 1)
53	-	-	-
54	0.5	MAP	Intake Manifold Absolute Pressure Sensor (Intake Manifold Absolute Pressure Signal Input)
55	-	-	-
56	-	-	-
57	-	-	-
58	-	-	-
59	-	-	-

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60	0.5	PSPS	Power Steering Pressure Switch(power boosting steering pressure switch)
61	-	-	-
62	0.75	COILC	Ignition Coil C (Ignition Coil IV Driven)
63	-	-	-
64	0.75	CCP	Canister Purge SolEMiod (Canister Solenoid Valve Control Signal)
65	0.5	FANLO	LOW SPEEM FAN (Radiator Low Speed Fan)
66	0.5	V5REF2	Reference Voltage Source Supply2
67	0.75	BAT	BATTERY (Battery Power Supply)
68	0.75	IGN	IGNITION SWITCH (Ignition Key Switch)
69	0.5	BRKSW	Brake Switch
70	0.5	V5REF1	Reference Voltage Source Supply2
71	0.5	MAT/IAT	Intake Air Temperature (Intake Air Temperature Sensor)
72	-	-	-
73	0.5	V5RTN3	O2 Sensor Signal Low Common
74	0.5	V5RTN1	V5 Return1
75	0.5	KW2000	Serial Communication (Serial Communication Data)
76	0.5	V5RTN2	V5 Return2
77	0.5	CAMIN	Intake Camshaft position signal 1(Intake Camshaft Position Signal)
78			
79	0.5	ACR+	AC Request Switch(+) Air-conditioning request signal input
80	0.5	TACH	Tachometer
81	0.75	COILD	Ignition Coil D (Ignition Coil II Driven)

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2.2.7.6 DTC Type Definition

In the diagnosis calibration settings, different fault type settings have different fault lamp lighting timing and methods. Fault type is divided into A, B, C, E and Z, with definition and fault lamp.

Lightening principle is as follows:

Fault Type	Emission-related	Definition
Type A:	Yes	Occurring once, MIL lamp will be lit and a DTC code will be recorded
Type B	Yes	Occurring once in each two consecutive strokes, MIL lamp will be lit and a DTC code will be recorded.
E-type	Yes	Occurring once in each three consecutive strokes, MIL lamp will be lit and a DTC code will be recorded.
Type C	No	Record the DTC code when the fault occurs, but the SVS lamps may be lit other than the MIL lamp.
Z-type	-	Record the DTC code when the fault occurs without any lamps being lit.

2.2.7.7 Fault Diagnosis Code (DTC) List

DTC	Descriptions	Type
P0011	Intake VCP Phase Response Lag Behind	A
P0012	Intake VCP Camshaft Phase Error is Big	A
P0016	Intake VCP Camshaft Gear Learn Bias Out of Range	A
P0026	Intake VCP Hydraulic Control Valve Clinch	A
P0068	Electronic Throttle Air Flow Error	A
P0076	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit	A
P0077	Intake VCP Hydraulic Control Valve Coil High Voltage	A
P0105	Intake Air Pressure Sensor Signal Clinch	E
P0106	Intake Pressure/Throttle Position Fault	E
P0107	Manifold air pressure sensor circuit has low voltage or is open	A
P0108	Intake Air Pressure Sensor Circuit High Voltage	A
P0112	Intake Air Temperature Sensor Circuit Low Voltage	E
P0113	Intake Air Temperature Sensor Circuit High Voltage	E

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	or Open Circuit	
P0117	Coolant Temperature Sensor Circuit Low Voltage	A
P0118	Coolant Temperature Sensor Circuit High Voltage or Open Circuit A	A
P0122	Electronic Throttle Position Sensor #1 Circuit Low Voltage	A
P0123	Electronic Throttle Position Sensor #1 Circuit High Voltage	A
P0131	Front Oxygen Sensor Circuit Short to Low Voltage	E
P0132	Front Oxygen Sensor Circuit Short to High Voltage	E
P0133	Slow response of front oxygen sensor	E
P0134	Front Oxygen sensor is open	A
P0135	Front oxygen sensor heater fails	A
P0137	Rear Oxygen Sensor Circuit Short to Low Voltage	E
P0138	Rear Oxygen Sensor Circuit Short to High Voltage	E
P0140	Rear Oxygen Sensor Circuit Open	E
P0141	Rear Oxygen Sensor Heater Malfunction	A
P0171	Mixture Too Thin	E
P0172	Mixture Too Thick	E
P0222	Electronic Throttle Position Sensor #2 Circuit Low Voltage	A
P0223	Electronic Throttle Position Sensor #2 Circuit High Voltage	A
P0230	Fuel Pump Relay Fault	A
P0261	Fuel Injector 1 Low Voltage Fault	A
P0262	Fuel Injector 1 High Voltage Fault	A
P0264	Fuel Injector 2 Low Voltage Fault	A
P0265	Fuel Injector 2 High Voltage Fault	A
P0267	Fuel Injector 3 Low Voltage Fault	A
P0268	Fuel Injector 3 High Voltage Fault	A
P0270	Fuel Injector 4 Low Voltage Fault	A

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P0271	Fuel Injector 4 High Voltage Fault	A/B
P0300	Multi-Cylinder Misfire	C
P0324	Knock Control System Fault	C
P0325	Knock Sensor Fault	A
P0335	No signal from crankshaft position sensor circuit	E
P0336	Crankshaft Position Sensor Circuit Signal Interference	A
P0340	Intake VCP Camshaft Position Sensor Status Diagnosis	A
P0341	Intake VCP Target Wheel Diagnosis	A
P0351	Cylinder 1 Ignition Coil Malfunction	A
P0352	Cylinder 2 Ignition Coil Malfunction	A
P0353	Cylinder 3 Ignition Coil Malfunction	A
P0354	Cylinder 4 Ignition Coil Malfunction	A
P0420	Low transformation efficiency of catalytic converter	A
P0458	Canister electromagnetic valve circuit is shorted to low voltage or open	E
P0459	Canister Solenoid Valve Circuit Short to High Voltage	E
P0480	Low-Speed Fan Malfunction	C
P0481	High-Speed Fan Malfunction	C
P0502	No signal from vehicle speed sensor	E
P0504	Brake Switch Relativity Malfunction	A
P0506	Idle Speed Too Low	E
P0507	Idle Speed Too High	E
P0562	System Voltage is Low	C
P0563	System Voltage is High	C
P0571	The switch state of the brake lamp is not changed when braking.	C
P0601	ROM Error	A

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P0602	ECM Processor Malfunction	A
P0641	ETC Reference Voltage #A Amplitude Fault	A
P0646	Air-conditioning Clutch Relay Circuit Short to Low Voltage or Open	C
P0647	Air-conditioning Clutch Relay Circuit Short to High Voltage	C
P0651	ETC Reference Voltage #B Amplitude Fault	A
P0685	Main Relay Malfunction	A
P0831	Clutch switch circuit at low voltage	C
P0832	Clutch switch circuit at high voltage	C
P1167	Pre-catalytic Oxygen Indicating Mixture Too Thick During Deceleration	E
P1171	Pre-Catalytic Oxygen Indicating Mixture Too Thin During Acceleration	E
P1336	58-Tooth Gear Error Not Learn	A
P1516	ETC-Driver Second-Order Diagnostic Error	A
P2101	ETC-Driver Steady-State Diagnostic Error	A
P2104	Mandatory Engine Idling	A
P2105	Forced engine stopping	A
P2106	Restrictions on Engine Performance	A
P2110	Engine Power Management	A
P2119	Electronic Throttle Return Malfunction	A
P2122	Electronic Acceleration Pedal Position Sensor #1 Circuit Low Voltage	A
P2123	Electronic Acceleration Pedal Position Sensor #1 Circuit High Voltage	A
P2127	Electronic Acceleration Pedal Position Sensor #2 Circuit Low Voltage	A
P2128	Electronic Acceleration Pedal Position Sensor #2 Circuit High Voltage	A
P2135	Electronic Throttle Position Sensor #1 and #2 Circuits Relations Malfunctions	A

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P2138	Electronic Acceleration Pedal Position Sensor #1 and #2 Circuits Relations Malfunctions	A
P2187	Mixture Too Thin When Idling	E
P2188	Mixture Too Thick When Idling	E
P0633	Anti-theft Does Not Learn Malfunction	C
B0010	Collision Fuel Cut-off Reasonability Malfunction	C
U0167	No response of anti-theft device	C
U0426	Anti-theft Device Authentication Malfunction	C

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2.2.7.8 DTC Fail-Safe List

DTC Code	DTC Code Diagnostic Information	Fail-Safe Mode	Restore Conditions
P0068	Electronic Throttle Air Flow Error	Electronic Throttle Position Sensor #1 Circuit Low Voltage	Electronic Throttle Position Sensor #1 Circuit Low Voltage
P0122	Electronic Throttle Position Sensor #1 Circuit Low Voltage	Use TPS signal value that is not expired. If both TPS1 and TPS2 fail, the system will enter the Engine Power Management mode, while reporting P2106, P2110 fault; VCP is inoperative	No malfunction condition is detected.
P0123	Electronic Throttle Position Sensor #1 Circuit Low Voltage		
P0222	Electronic Throttle Position Sensor #1 Circuit Low Voltage		
P0223	Electronic Throttle Position Sensor #1 Circuit Low Voltage		
P0571	The switch state of the brake lamp is not changed when braking.	At this time, if the system enters Restrictions on Engine Performance mode, the system enters the Mandatory Engine Idling mode.	No malfunction condition is detected.
P0606	ECM Processor Malfunction	System enters Mandatory Engine Shutdown mode, the engine can not start and the system will report P2105. Fault	Next key cycle, no malfunction condition detected.
P060A	ECM Programming Errors	Engine Can Not Start	Next key cycle, no malfunction condition detected.
P0641	ETC Reference Voltage #A Amplitude Fault	The system enters the mode of engine power management and submits to P0122, P0223 and P2106 at the same time. P2110 fault ;VCP do not work	Next key cycle, no malfunction condition detected.
P0651	ETC Reference Voltage #B Amplitude Fault	System enters Restrictions on Engine Performance model, while reporting P2106 fault; VCP is inoperative	No malfunction condition is detected.

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P1516	ETC-Driver Steady-State Diagnostic Error	The system enters the mode of engine power management. Meanwhile, report P2106 and P2110 faults; VCP Inoperation	Next key cycle, no malfunction condition detected.
P2101	ETC-Driver Second-Order Diagnostic Error	System enters Engine Power Management mode, while reporting P2106 and P2110 fault; VCP is inoperative	Next key cycle, no malfunction condition detected.
P2104	Mandatory Engine Idling	Refer to ETC TPS, APS relevant diagnosis	Refer to ETC TPS, APS relevant diagnosis
P2105	Mandatory Engine Shutdown		
P2106	Restrictions on Engine Performance		
P2110	Engine Power Management		
P2119	Electronic Throttle Return Malfunction	None	No malfunction condition is detected.
P2122	Electronic Acceleration Pedal Position Sensor #1 Circuit Low Voltage	(1) Single APS malfunction, the system enters Restrictions on Engine Performance mode, while reporting P2106 fault (2) If both APS1 and APS2 fail, the system enters Mandatory Engine Idling mode, while reporting P2104 fault (3) VCP Inoperation	In the next Key Cycle, ECM detects invalidation. Validation conditions
P2123	Electronic Acceleration Pedal Position Sensor #1 Circuit High Voltage		
P2127	Electronic Acceleration Pedal Position Sensor #2 Circuit Low Voltage		
P2128	Electronic Acceleration Pedal Position Sensor #2 Circuit High Voltage		
P2135	Related fault of Electric throttle valve position sensor1#, 2#	The system enters the mode of engine performance limit. Meanwhile, report P2106 fault; the VCP does not work.	No malfunction condition is detected.
P2138	Electronic Acceleration Pedal Position Sensor #1 and #2 Related Malfunctions	System enters Restrictions on Engine Performance model, while reporting P2106 fault; VCP is inoperative	No malfunction condition is detected.

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P0011	Intake VCP Phase Response Lag Behind	None	No malfunction condition is detected.
P0012	Intake VCP Camshaft Phase Error is Big	VCP Inoperation	No malfunction condition is detected.
P0016	Intake VCP Camshaft Gear Learn Bias Out of Range	OCV Cleaning Function Enabled; VCR Inoperative	No malfunction condition is detected.
P0026	Intake VCP Hydraulic Control Valve Clinch	OCV Cleaning Function Enabled; If cleaning failed, VCR is inoperative	No malfunction condition is detected.
P0076	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit	VCP Inoperation	No malfunction condition is detected.
P0077	Intake VCP Hydraulic Control Valve Coil High Voltage	VCP Inoperation	Next key cycle, no malfunction condition detected.
P0340	Intake VCP Camshaft Position Sensor Status Diagnosis	VCP Inoperation, Ignition Angle	No malfunction condition is detected.
P0341	Intake VCP Target Wheel Diagnosis	VCP Inoperation, Ignition Angle	No malfunction condition is detected.
P0106	Intake Pressure/Throttle Position Fault	(1) When Key is in ON position, the system will intake air in default form. Manifold pressure value of 100 kPa (2) When the engine is running, the system uses Manifold pressure value	No malfunction condition is detected.
P0107	Manifold air pressure sensor circuit has low voltage or is open	(1) When Key is in ON position, the system will intake air in default form. Manifold pressure value of 100 kPa (2) When the engine is running, the system uses Manifold pressure value	No malfunction condition is detected.
P0108	Intake Air Pressure Sensor Circuit High Voltage	(1) When Key is in ON position, the system will	No malfunction condition is

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		intake air in default form. Manifold pressure value of 100 kPa (2) When the engine is running, the system uses Manifold pressure value	detected.
P0112	Intake Air Temperature Sensor Circuit Low Voltage	System uses the default intake air temperature 20°C	No malfunction condition is detected.
P0113	Intake Air Temperature Sensor Circuit High Voltage or Open Circuit		
P0117	Coolant Temperature Sensor Circuit Low Voltage	(1) System calculates the engine coolant temperature, up to 98°C, based on intake air temperature and when Key On and the engine running time (2) There is a malfunction present, high or Low-Speed fan turned on.	No malfunction condition is detected.
P0118	Coolant Temperature Sensor Circuit High Voltage or Open Circuit		
P0131	Front Oxygen Sensor Circuit Short to Low Voltage	system enters open loop fuel control.	No malfunction condition is detected.
P0132	Front Oxygen Sensor Circuit Short to High Voltage	system enters open loop fuel control.	No malfunction condition is detected.
P0133	Slow response of front oxygen sensor	None	No malfunction condition is detected.
P0134	Front oxygen sensor heater fails	system enters open loop fuel control.	No malfunction condition is detected.
P0135	Pre-catalytic Oxygen Indicating Mixture Too Thick During Deceleration	Open Loop Control; Front Oxygen Sensor Heater Inoperation	Next key cycle, no malfunction condition detected.
P1167	Pre-catalytic Oxygen Indicating Mixture Too Thick During Deceleration	None	No malfunction condition is detected.
P1171	Pre-Catalytic Oxygen Indicating Mixture Too Thin During Acceleration	None	No malfunction condition is detected.

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P0137	Rear Oxygen Sensor Circuit Short to Low Voltage	None	No malfunction condition is detected.
P0138	Rear Oxygen Sensor Circuit Short to High Voltage	None	No malfunction condition is detected.
P0140	Rear Oxygen Sensor Circuit Open	None	No malfunction condition is detected.
P0141	Rear Oxygen Sensor Heater Malfunction	Rear Oxygen Sensor Heater Inoperation	Next key cycle, no malfunction condition detected.
P0171	Mixture Too thin When Non-idling	None	No malfunction condition is detected.
P0172	Mixture Too thick When Non-idling	None	No malfunction condition is detected.
P2187	Mixture Too thin When idling	None	No malfunction condition is detected.
P2188	Mixture Too thick When idling	None	No malfunction condition is detected.
P0230	Fuel Pump Relay Fault	Vehicle can not start.	(1) Short-circuit or open-circuit fault can't be detected. Failure condition (2) short splice to power supply fault, go to key Cycle, D detect invalid conditions
P0261	Fuel Injector 1 Low Voltage Fault	Prolonged malfunction, reporting misfire (P0300); Open Loop Control for the system;	No malfunction condition is detected.
P0264	Fuel Injector 2 Low Voltage Fault		
P0267	Fuel Injector 3 Low Voltage Fault		
P0270	Fuel Injector 4 Low Voltage		

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	Fault		
P0262	Fuel Injector 1 High Voltage Fault		Next key cycle, no malfunction condition detected.
P0265	Fuel Injector 2 High Voltage Fault		
P0268	Fuel Injector 3 High Voltage Fault		
P0271	Fuel Injector 4 High Voltage Fault		
P0300	Multi-Cylinder Misfire	Catalytic converter damaged, the system enters open loop control. in certain operating conditions, fault lamp flashes.	No malfunction condition is detected.
P0324	Knock Control System Fault	Ignition Back Angle	Next key cycle, no malfunction condition detected.
P0325	No signal from knock sensor	Ignition Back Angle	Next key cycle, no malfunction condition detected.
P0335	No signal from crankshaft position sensor circuit	Vehicle can not start.	No malfunction condition is detected.
P0336	Crankshaft Position Sensor Circuit Signal Interference	Ignition Back Angle; VCP Inoperation	No malfunction condition is detected.
P1336	58-Tooth Gear Error Not Learnt	No misfire diagnosis	New tooth learning successful
P0351	Cylinder 1 Ignition Coil Malfunction	Prolonged Malfunction, Reporting Misfire (P0300)	(1) Open Circuit, No Malfunction Condition Detected. (2) Short to power supply. Next key cycle, no malfunction condition detected.
P0352	Cylinder 2 Ignition Coil Malfunction		
P0353	Cylinder 3 Ignition Coil Malfunction		
P0354	Cylinder 4 Ignition Coil Malfunction		
P0420	Low transformation efficiency	None	No malfunction

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	of catalytic converter		condition detected.
P0458	Canister electromagnetic valve circuit is shorted to low voltage or open	None	No malfunction condition detected.
P0459	Canister Solenoid Valve Circuit Short to High Voltage	None	Next key cycle, no malfunction condition detected.
P0480	Low-Speed Fan Malfunction	None	No malfunction condition detected.
P0481	High-Speed Fan Malfunction	None	Next key cycle, no malfunction condition detected.
P0502	No signal from vehicle speed sensor	Malfunctions Reported, Engine idle	No malfunction condition detected.
P0506	Idle Speed Low	None	No malfunction condition detected.
P0507	Idle Speed High	None	No malfunction condition detected.
P0562	System Voltage is Low	Other Diagnostics Shielded; Idle Speed Increased; VCP Inoperative	No malfunction condition detected.
P0563	System Voltage is High	Other Diagnostics Shielded; VCP Inoperative	No malfunction condition detected.
P0601	ROM Error	Vehicle can not start.	Next key cycle, no malfunction condition detected.
P0602	ECM Processor Malfunction	Vehicle can not start.	Next key cycle, no malfunction condition detected.
P0604	RAM Error	Vehicle can not start.	Next key cycle, no malfunction condition detected.
P0646	Air-Conditioning Clutch Relay Circuit Short to Low Voltage or Open	None	No malfunction condition detected.
P0647	Air-conditioning Clutch Relay Circuit Short to High Voltage	None	Next key cycle, no malfunction condition detected.

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P0685	Main Relay Malfunction	Vehicle may not start.	(1) Open Circuit, No Malfunction Condition Detected. (2) Short to power supply. Next key cycle, no malfunction condition detected.
P0633	Anti-theft Does Not Learn Malfunction	SVS lamp flashing; vehicle can not start.	In the next Key Cycle, IMMO learns successfully. Or no malfunction condition is detected.
U0167	No response of anti-theft device		
U0426	Anti-theft Device Authentication Malfunction		

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2.2.7.9 Data Flow Table

By reading the Data Flow Table on the fault diagnosis tester, you can inspect switches, sensors, actuators working state without dismantling any components. Before the control system diagnosis, observing and analyzing data is the first step, so that the diagnose time could be shortened.

Note: Data under normal conditions is listed in the following table for reference only. Do not determine whether a part is faulty solely based on these reference values. Under normal circumstances you can compare the vehicle that needs to be repaired with a normal working vehicle in the same state to determine whether the current vehicle diagnostic data is normal or not.

1. Run the engine to reach normal working temperature.
2. Rotated ignition switch is OFFposition。
3. Connect the fault diagnosis tester.
4. Rotated ignition switch in the ON position.
5. Select Engine/Read data stream.
6. Refer to the following table and inspect the data of each item.
1. First step: At cold engine, turn the key switch to ON position, inhibit the engine (for about 30s)

Data Stream Name	Ignition Switch ON	Idle speed	2,500 rpm 时
Engine Speed	0 rpm	800 rpm	2,500 rpm
Vehicle Speed	0	0	0
Current Computing Load	0.00%	100%	100%
Coolant Temperature	93℃(199 ºF)	93℃(199 ºF)	93℃(199 ºF)
Current Short-Term Fuel Adjustment (Bank1)	100%	90.62%	93.75%
Current Long-Term Fuel Adjustment (Bank1)	92.97%	92.97%	99.22%
Absolute Boost Pressure	100kPa	47kPa	27kPa
Intake Air Temperature	54℃(129 ºF)	47℃(117 ºF)	52℃(126 ºF)
Absolute Throttle Position A	80.78%	85.10%	82.75%
Ignition Voltage	12.3V	13.3V	13.7V
Oxygen Sensor #1 Installation Location	Yes	Yes	Yes
Oxygen Sensor #2 Installation Location	Yes	Yes	Yes
Front Oxygen Sensor Voltage	0.08V	0.07V-0.81V	0.067V-0.81V
Front Oxygen Sensor Short-Term Fuel Adjustment	100%	92.19%	94.53%

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Rear Oxygen Sensor Voltage	0.71V	1.28V	0.68V
Rear Oxygen Sensor Short-Term Fuel Adjustment	99.22%	99.22%	99.22%
Current Instruction to Cylinder #1 Ignition Advance Angle	4°	2°	33°
Vehicle Driving Distance When MIL Lamp Light	0km	0km	0km
Relative Throttle Position	6.27%	1.57%	3.92%
Absolute Throttle Position B	18.82%	14.12%	16.86%
Acceleration Pedal Position D	14.51%	14.51%	18.43%
Acceleration Pedal Position E	7.06%	7.06%	9.02%
Throttle Position	8.63%	1.96%	5.49%
Vehicle Driving Time When MIL Lamp Light	0Min	0Min	0Min
Air-conditioning pressure switch voltage	0V	0V	0V
Front Oxygen Sensor Hot	78mV	143-706mV	14mV
Rear Oxygen Sensor Heating	703mV	755mV	660mV
Fuel Sensor Voltage	5V	5V	5V
Coolant Temperature (Start)	87℃(189 ºF)	87℃(189 ºF)	87℃(189 ºF)
EVAP Valve Duty Cycle	0%	0%	0%
Fuel Adjustment Cell	19cell	19cell	2cell
Target Idle Speed	935rpm	737rpm	887rpm
Injection	8 . 67ms	2.56ms	1,82ms
Atmospheric Pressure	100,37kPa	100,37kPa	100,37kPa
Air-Fuel Ratio	11.5	14.5	14.5
Engine Running Time	0Second	0Second	0Second
Calculated Catalyst Temperature	600℃(1112 ºF)	498℃(928 ºF)	591℃(1096 ºF)
knocking Delay	0°	0°	0°
Cylinder No.2 Currently Misfire	0count	0count	0count

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Cylinder No.1 Currently Misfire	0count	0count	0count
Cylinder No.3 Currently Misfire	0count	0count	0count
Cylinder No.4 Currently Misfire	0count	0count	0count
Engine Odometer	0km	0km	0km
ETC Acceleration Pedal Position	0%	0%	0%
Intake Valve Opening (As Opposed To LWOT)	8.66%	2.02%	5.55%
ETC Pedal Position Sensor #1	0%	0%	4.16%
ETC Pedal Position Sensor #2	0%	0%	4.16%
ETC Throttle Position Sensor #1	6.62%	1.54%	4.21%
ETC Throttle Position Sensor #2	6.55%	1.54%	4.21%
Fuel Level Output	4.71%	4.71%	4.71%
Front Oxygen Sensor - Rich To Lean Average Time	0.0ms	0.0ms	0.0ms
Intake Air Temperature At Startup	55℃(131 ºF)	49℃(120 ºF)	49℃(120 ºF)
Intake Air Pressure	0.0kPa	0.0kPa	0.0kPa
TEC Attempt To Convert To Lean	0Counts	0Counts	0Counts
TEC ideal Throttle Position	8.82%	2.15%	5.76%
VVT Target Location	0°	0°	0
ETC Underpowered Throttle Position	8.40%	8.44%	8.44%
Front Oxygen Sensor Heating	0.70E	0.80E	0.50E
Rear Oxygen Sensor Heating	0.42E	0.44E	0.34E

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2.2.7.10 Action Test List

With the reading of the action test on the fault diagnostic unit, check the working condition of the relay and the actuator controlled by the ECM without removing any parts. Before the control system diagnosis, carrying out action test is a prerequisite, so that the diagnose time could be shortened.

Note: Data under normal conditions is listed in the following table for reference only. Do not determine whether a part is faulty solely based on these reference values. ***Under normal circumstances you can compare the vehicle that needs to be repaired with a normal working vehicle in the same state to determine whether the current vehicle diagnostic data is normal or not.***

1. Run the engine to reach normal working temperature.
2. Rotated ignition switch to OFF position.
3. Connect the fault diagnosis tester.
4. Turn ignition switch to ON position.
5. Select engine / Action Test.
6. Refer to the following table for positive test.

Radar fault diagnosis tester **Display item**	**Test Component**	**Control Range**	**Diagnostic Description**
Malfunction Indicator	Enable the engine malfunction indicator.	ON/OFF	When the engine is running (or) the ignition switch is turned on, with the signal accepted, the engine control module will request the fault indicator to light through the CAN bus. The fault indicator will be on or off in 3-5s by the instrument.
Fuel Pump Relay	Enable the fuel pump relay.	ON/OFF	***Note: Carry out this test only when the vehicle speed is equal to zero and the vehicle speed sensor has no fault.*** This function controls the fuel pump relay. Fuel pump relay will be ON/OFF within 3-5s.
Canister Control Valve	Enable the canister solenoid valve	ON/OFF	When the command is ON the solenoid valve will be on or off within 3-5s.
Fan 1	Enable Low-speed Cooling Fan.	ON/OFF	***Note: Carry out this test only when the engine coolant temperature is below 100°C and Air-Conditioning is not switched on.*** This function controls the Low-Speed cooling fan relay. When the instruction is received, the cooling fan will be on at high speed for 5 s.

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Fan 2	Enable the High-speed cooling fan	ON/OFF	***Note: Carry out this test only when the engine coolant temperature is below 100°C and Air-Conditioning is not switched on.*** This function controls the High-Speed cooling fan relay. When the instruction is received, the cooling fan will be on at high speed for 5 s.
Air-conditioning Clutch	Enable the air-conditioning compressor clutch.	ON/OFF	***Note: Carry out this test only when the ignition switch is at ON position and the engine is not running.*** This function controls Air-Conditioning compressor relay. When the instruction is ON, the Air-Conditioning compressor relay will be on or off in 3-5 s.
BLM Learn	Indicating Fuel Closed-Loop Learning	ON/OFF	Forbid fuel closed-loop learning, when the ignition switch is ON; Based on the software logic, decide whether to conduct relevant learn when the ignition switch is OFF.
Fuel Injector Nozzle	Disable the fuel injector.	ON/OFF	-
Ignition Delay	Delay the ignition advance angle.	---	---
Fuel Open-Loop Control	ECM Open-Loop Control	ON/OFF	-
Idle Catalyst Monitor	Enable the catalyst monitor diagnosis	ON/OFF	-
ETC Motor	Control electronic throttle body movements	0.50%.100%	-
Reset TPS Learn Value	Clear throttle position sensor learn value	-	-
Intake Camshaft Timing Device	Be used for control the current phase position of the VVT, wherein the control parameter is not a percentage, but Mark the phase.	0. 30%. 60%	-

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Intake Camshaft Timing Device	Be used for control the current phase position of the VVT, wherein the control parameter is not a percentage, but Mark the phase.	0.50%.100%	-
Expected idle	Intake Camshaft Valve Timing Control Device VVT Control Valve Control Signal Duty Cycle Test Ratio Test	0. 700rpm. 800rpm. 900 rpm. 1. 000 rpm	-
BLM Reset	Fuel Closed-Loop Learn	On/off	All fuel closed-loop learn values reset to 1

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2.2.7.11 Learning on Crankshaft Position Sensor (CKP)

Notes:

After replacement of crankshaft position sensor, Replacement of ECM or engine, the crankshaft position sensor adaptive learn must be carried out. Otherwise the fault warning lamp will be always on, while ECM will record P1336 58-tooth gear tolerance does not learn DTC code.

Before the gear learn, the following conditions must be met:

1. Make sure the engine coolant temperature is above 60°C (140 °F)
2. Air-Conditioning switch is not turned on.
3. Start the engine for 10s.

Carry out the following steps when the above conditions are met:

1	Connect a fault diagnosis tester.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Start and run the engine at idle speed to warm up the engine for at least 5 min.

D. Select the engine/gear to learn.

Next

2	Carefully read the instructions attached to scan tool and press confirm button.

Next

3	Enter the learning screen, press start button.

Next

4	Press the acceleration pedal to 80% of the full travel and keep the pedal position.

Next

5	Make the engine speed jumping back and forth between 1,300 rpm and 4,500 rpm 3-5 cycles, maintain the engine speed at above 4,000 rpm.

Next

6	Release the acceleration pedal, turn the ignition switch to OFF position.

Next

7	Complete the learning, clear the DTC code.

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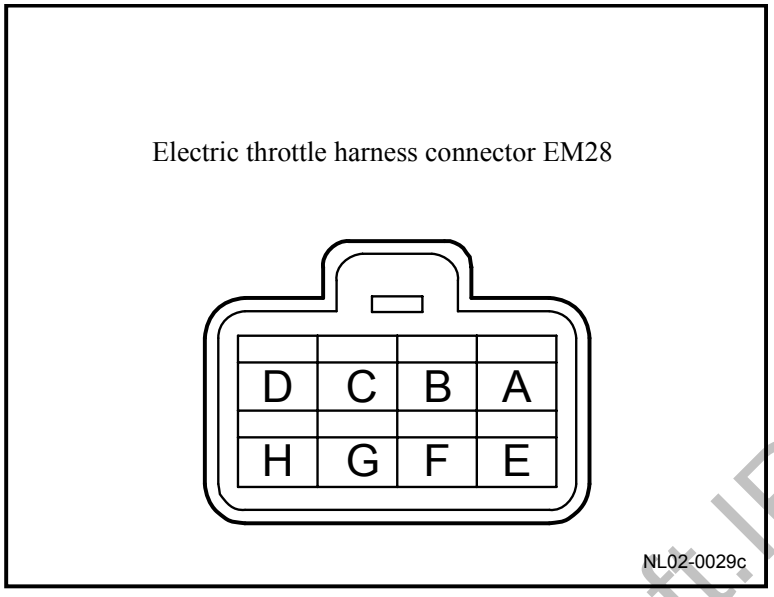
2.2.7.12 Electronic Throttle Body (ETC) Inspection

Electronic throttle body consists of two throttle position sensors and a throttle body drive motor.

1. Electronic Throttle Body Connector View and Functions:



Terminal No .	ECM Related Terminal No.	Function
A	EM01(74)	Low Reference Voltage
B	EM01(52)	TPS1 Signal
C	EM01(27)	TPS2 signal
D	EM01(70)	5V Reference Voltage
E	EM01(21)	Throttle Body Motor Control (Plus)
F	-	Empty
G	-	Empty
H	EM01(20)	Throttle Body Motor Control (Minus)

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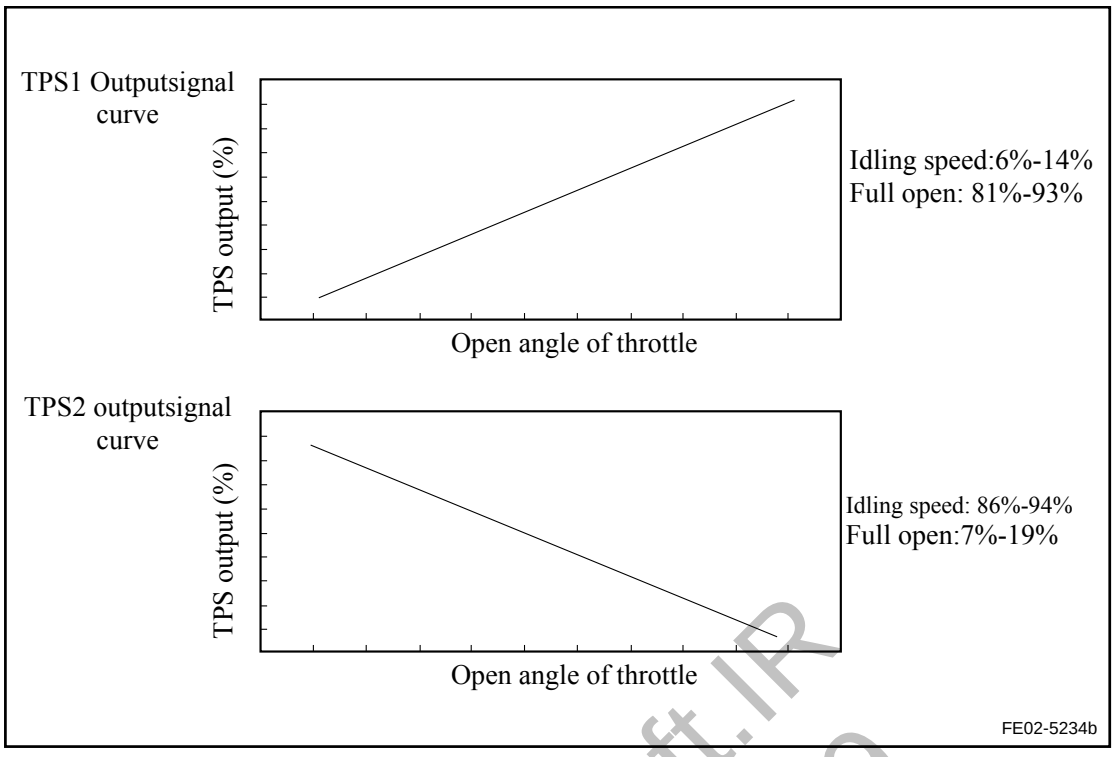
2. Throttle Position Sensor Technical Specifications

As one of the system security measures, the system consists of dual output throttle position sensors. One throttle position sensor output voltage signal increases as the throttle body opening increases, while the other throttle position sensor output voltage signal decreases as the throttle body opening increases.

Resistance Between Terminals A and D: 1.9 ± 0.9 kΩ

TPS Sensor Output Signal Diagram:



Notes:

An oscilloscope can be used for detecting the above TPS sensor output signal, and the output waveform line should be smooth without noise wave! If the output signal zeros or drops suddenly when throttle body rotates at a certain angel, the ETC assembly shall be replaced. ETC is an assembly. Do not disassemble it to repair.

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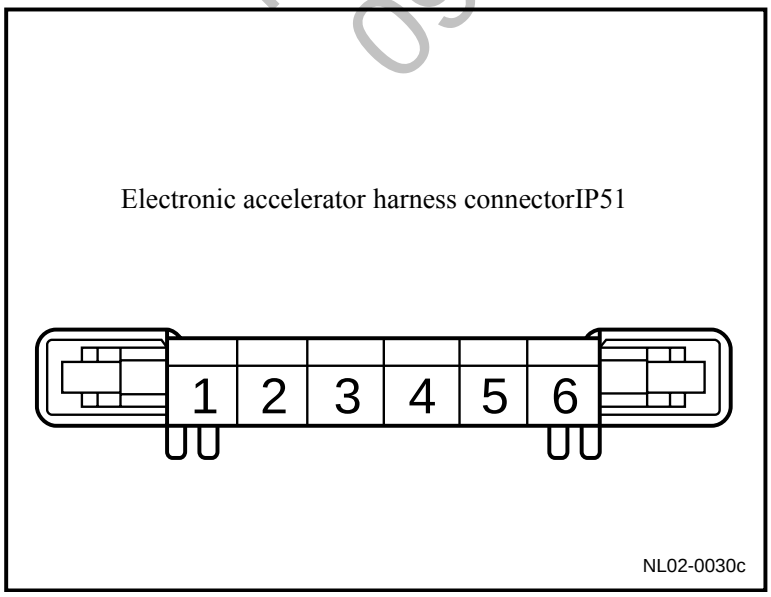
2.2.7.13 Acceleration Pedal Position Sensor (APP) Inspection

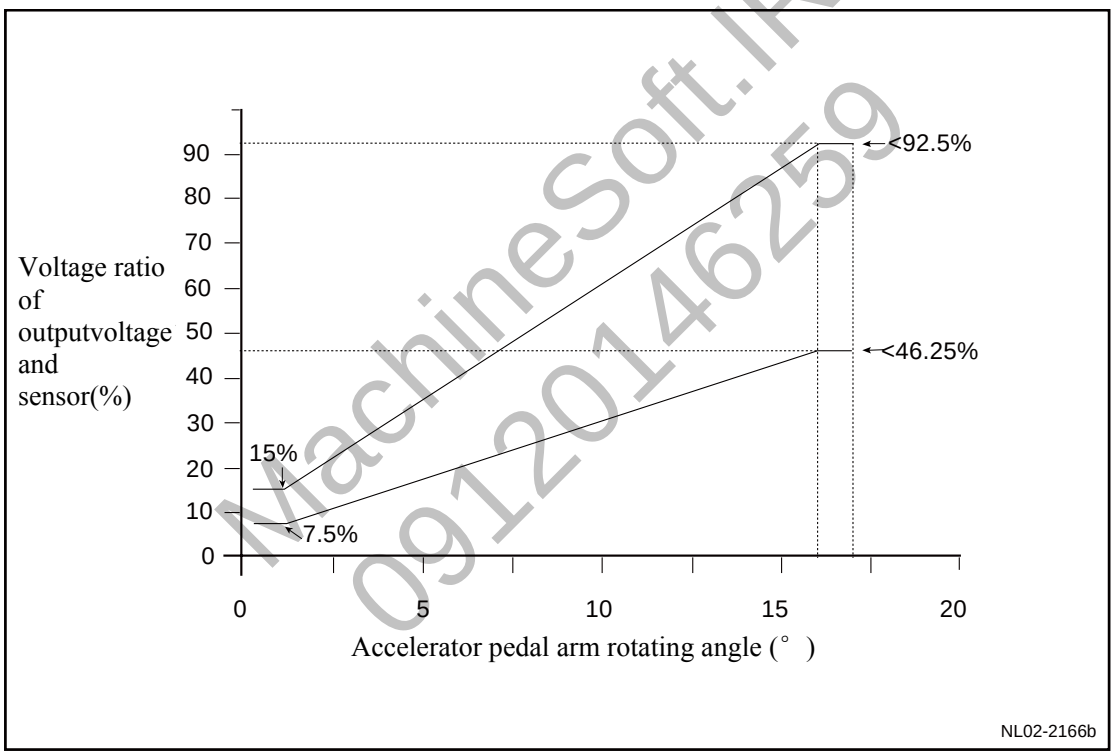
As one of the system security measures, acceleration pedal position sensor is designed to have dual outputs. Two sensors output voltage signals increase as the acceleration pedal position increases.

1. Acceleration Pedal Position Sensor Connector End View and Function



Terminal No .	ECM Related Terminal No.	Function
1	EM01(66)	Sensor No.2 Reference Voltage
2	EM01(70)	Sensor No.1 Reference Voltage
3	EM01(74)	Sensor No.1 Low Reference Voltage
4	EM01(41)	Sensor No.1 Output Signal
5	EM01(76)	Sensor No.2 Low Reference Voltage
6	EM01(42)	Sensor No.2 Output Signal

2. Acceleration Pedal Position Sensor Technical Specifications



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Notes:

An oscilloscope can be used for detecting the above APP sensor output signal, and the output waveform line should be smooth without noise wave! If the output signal zeros or drops suddenly when accelerator pedal rotates at a certain angel, the APP assembly shall be replaced. APP is an assembly. Do not disassemble it to repair.

2.2.7.14 DTC Chapter Index

DTC	Descriptions	Type
P0011	Intake VCP Phase Response Lag Behind	Refer to 2.2.7.15 P0011 P0012 P0016 P0026.
P0012	Intake VCP Camshaft Phase Error is Big	
P0016	Intake VCP Camshaft Gear Learn Bias Out of Range	
P0026	Intake VCP Hydraulic Control Valve Clinch	
P0076	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit	Refer to 2.2.7.17 DTC P0076 P0077
P0077	Intake VCP Hydraulic Control Valve Coil High Voltage	
P0068	Electronic Throttle Air Flow Error	Refer to 2.2.7.16 DTC P0068 P0106
P0106	Intake Pressure/Throttle Position Fault	Refer to 2.2.7.18 DTC P0107 P0108
P0107	Manifold air pressure sensor circuit has low voltage or is open	Refer to 2.2.7.18 DTC P0107 P0108
P0108	Intake Air Pressure Sensor Circuit High Voltage	Refer to 2.2.7.18 DTC P0107 P0108
P0112	Intake Air Temperature Sensor Circuit Low Voltage	Refer to 2.2.7.19 DTC P0112 P0113
P0113	Intake Air Temperature Sensor Circuit High Voltage or Open Circuit	
P0117	Coolant Temperature Sensor Circuit Low Voltage	Refer to 2.2.7.20 DTC P0117 P0118
P0118	Coolant Temperature Sensor Circuit High Voltage or Open Circuit A	Refer to 2.2.7.20 DTC P0117 P0118
P0122	Electronic Throttle Position Sensor #1 Circuit Low Voltage	Refer to 2.2.7.21 DTC P0122 P0123
P0123	Electronic Throttle Position Sensor #1 Circuit High Voltage	
P0131	Front Oxygen Sensor Circuit Short to Low Voltage	Refer to 2.2.7.22 DTC P0131 P0132 P0133 P0134
P0132	Front Oxygen Sensor Circuit Short to High Voltage	
P0133	Slow response of front oxygen sensor	

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P0134	Front Oxygen sensor is open	
P0135	Front oxygen sensor heater fails	Refer to 2.2.7.23 DTC P0135
P0137	Rear Oxygen Sensor Circuit Short to Low Voltage	Refer to 2.2.7.24 DTC P0137 P0138 P0140
P0138	Rear Oxygen Sensor Circuit Short to High Voltage	
P0140	Rear Oxygen Sensor Circuit Open	
P0141	Rear Oxygen Sensor Heater Malfunction	Refer to 2.2.7.25 DTC P0141
P0171	Mixture Too Thin	Refer to 2.2.7.26 DTCP 0171 P0172 P1167 P1171 P2187 P2188
P0172	Mixture Too Thick	
P0222	Electronic Throttle Position Sensor #2 Circuit Low Voltage	Refer to 2.2.7.27 DTC P0222 P0223
P0223	Electronic Throttle Position Sensor #2 Circuit High Voltage	
P0230	Fuel Pump Relay Fault	Refer to 2.2.7.28 DTC P0230
P0261	Fuel Injector 1 Low Voltage Fault	Refer to 2.2.7.29 DTC P0261 P0262
P0262	Fuel Injector 1 High Voltage Fault	
P0264	Fuel Injector 2 Low Voltage Fault	Refer to 2.2.7.30 DTC P0264 P0265
P0265	Fuel Injector 2 High Voltage Fault	
P0267	Fuel Injector 3 Low Voltage Fault	Refer to 2.2.7.31 DTC P0267 P0268
P0268	Fuel Injector 3 High Voltage Fault	
P0270	Fuel Injector 4 Low Voltage Fault	Refer to 2.2.7.32 DTC P0270 P0271
P0271	Fuel Injector 4 High Voltage Fault	
P0300	Multi-Cylinder Misfire	Refer to 2.2.7.33 DTC P0300
P0324	Knock Control System Fault	Refer to 2.2.7.34 DTC P0324 P0325
P0325	Knock Sensor Fault	
P0335	No signal from crankshaft position sensor circuit	Refer to 2.2.7.35 DTC P0335 P0336

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P0336	Crankshaft Position Sensor Circuit Signal Interference	
P0340	Intake VCP Camshaft Position Sensor Status Diagnosis	Refer to 2.2.7.36 DTC P0340 P0341
P0341	Intake VCP Target Wheel Diagnosis	
P0351	Cylinder 1 Ignition Coil Malfunction	Refer to 2.2.7.37 DTC P0351 P0352 P0353 P0354
P0352	Cylinder 2 Ignition Coil Malfunction	
P0353	Cylinder 3 Ignition Coil Malfunction	
P0354	Cylinder 4 Ignition Coil Malfunction	
P0420	Low transformation efficiency of catalytic converter	Refer to 2.2.7.38 DTC P0420
P0458	Canister electromagnetic valve circuit is shorted to low voltage or open	Refer to 2.2.7.39 DTC P0458 P0459
P0459	Canister Solenoid Valve Circuit Short to High Voltage	
P0480	Low-Speed Fan Malfunction	Refer to 2.2.7.40 DTC P0480 P0481
P0481	High-Speed Fan Malfunction	
P0502	No signal from vehicle speed sensor	Refer to 2.2.7.41 DTC P0502
P0506	Idle Speed Too Low	Refer to 2.2.7.42 DTC P0506 P0507
P0507	Idle Speed Too High	
P0562	System Voltage is Low	Refer to 2.2.7.43 DTC P0562 P0563
P0563	System Voltage is High	
P0571	The switch state of the brake lamp is not changed when braking.	Refer to 2.2.7.44 DTC P0571
P0601	ROM Error	Refer to 2.2.7.45 DTC P0601 P0602 P1516 P2101
P0602	ECM Processor Malfunction	
P0606	ECM Processor Malfunction	
P0641	ETC Reference Voltage #A Amplitude Fault	Refer to 2.2.7.46 DTC P0641 P0651
P0646	Air-conditioning Clutch Relay Circuit Short to Low Voltage or Open	Refer to 2.2.7.47 DTC P0646 P0647

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P0647	Air-conditioning Clutch Relay Circuit Short to High Voltage	
P0651	ETC Reference Voltage #B Amplitude Fault	Refer to 2.2.7.46 DTC P0641 P0651
P0685	Main Relay Malfunction	Refer to 2.2.7.48 DTC P0685
P0831	Clutch switch circuit at low voltage	Refer to 2.2.7.61 DTC P0831 P0832
P0832	Clutch switch circuit at high voltage	
P1167	Pre-catalytic Oxygen Indicating Mixture Too Thick During Deceleration	Refer to 2.2.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
P1171	Pre-Catalytic Oxygen Indicating Mixture Too Thin During Acceleration	
P1336	58-Tooth Gear Error Not Learn	Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn.
P1516	ETC-Driver Second-Order Diagnostic Error	Refer to 2.2.7.45 DTC P0601 P0602 P1516 P2101
P2101	ETC-Driver Steady-State Diagnostic Error	
P2104	Mandatory Engine Idling	Refer to 2.2.7.50 DTC P2104 P2105 P2106 P2110
P2105	Forced engine stopping	
P2106	Restrictions on Engine Performance	
P2110	Engine Power Management	
P2119	Electronic Throttle Return Malfunction	Refer to 2.2.7.50 DTC P2119
P2122	Electronic Acceleration Pedal Position Sensor #1 Circuit Low Voltage	Refer to 2.2.7.51 DTC P2122 P2123.
P2123	Electronic Acceleration Pedal Position Sensor #1 Circuit High Voltage	
P2127	Electronic Acceleration Pedal Position Sensor #2 Circuit Low Voltage	Refer to 2.2.7.52 DTC P2127 P2128
P2128	Electronic Acceleration Pedal Position Sensor #2 Circuit High Voltage	
P2135	Electronic Throttle Position Sensor #1 and #2 Circuits Relations Malfunctions	Refer to 2.2.7.53 DTC P2135
P2138	Electronic Acceleration Pedal Position Sensor #1 and #2 Circuits Relations Malfunctions	Refer to 2.2.7.54 DTC P2138

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P2187	Mixture Too Thin When Idling	Refer to 2.2.7.52 DTC P2127 P2128
P2188	Mixture Too Thick When Idling	
P0633	Anti-theft Does Not Learn Malfunction	Refer to 2.2.7.55 DTC P0633 U0167 U0426
U0167	No response of anti-theft device	
U0426	Anti-theft Device Authentication Malfunction	

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2.2.7.15 DTC P0011 P0012 P0016 P0026

1. DTC description:

DTC	**P0011**	Intake VCP Phase Response Lag Behind

DTC	**P0012**	Intake VCP Camshaft Phase Error is Big

DTC	**P0016**	Intake VCP Camshaft Gear Learn Bias Out of Range

DTC	**P0026**	Intake VCP Hydraulic Control Valve Clinch

Intake camshaft position (CMP) actuator is connected to the intake camshaft and operated by the hydraulic pressure, which is provided by the oil pump in order to change the intake camshaft to the CKP (CKP) relative angle. Intake VVT solenoid valve power is provided from the main relay. ECM controls ground with a pulse-width modulation signal to control the engine oil flow to the camshaft position actuator. Oil pressure moves a security slide valve within the camshaft position actuator body at the front of the camshaft. When the safety slide valve moves, the oil is imported to the camshaft position actuator to rotate the camshaft. The intake camshaft actuator change the camshaft working angle up to 50 degrees.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0011	VVT Actual Angle and Target Angle Difference Too Great	1. VVT Actual Angle and Target Angle Difference Too Great 2. Camshaft completed self-learning. 3. Oil Temperature Between -40℃(-40 ºF) and 120℃(248 ºF). 4. Coolant Temperature Between 0℃(32 ºF) and 105℃(221 ºF) 5. Engine Speed Between 600 rpm and 6,000 rpm. 6. No VVT Circuit Fault Set.	1. Valve timing 2. Intake VVT Solenoid Valve 3. Solenoid Valve Filter 4. VVT Actuator assembly 5. ECM
P0012 P0016 P0026	VVT actual angular is not at the default position	1. VVT actual angle and default angle difference greater than or equal to 20 degrees. 2. Camshaft completed self-learning.	

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		3. The engine running time is less than or equal to 1.5s. 4. Oil Temperature Between -40℃(-40 ºF) and 120℃(248 ºF). 5. Coolant Temperature Between 0℃(32 ºF) and 105℃(221 ºF) 6. Engine Speed Between 600 rpm and 6,000 rpm. 7. No VVT Circuit Fault Set.	

3. Circuit figure

Refer to 2.2.7.17 DTC P0076 P0077

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect whether there is any control system DTC code other than DTC P0014, P0015, P0017 and P0027.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes Shown	**To Step**
DTC P0011 P0012 P0016 P0026	Yes
DTC codes other than DTC P0011, P0012, P0016 and P0026	No

No → Refer to 2. 12.7.14 DTC Chapter Index.

Yes

2	Inspect the following:

A. Check whether the oil viscosity is normal and whether the oil is clean.

B. Observe the Engine oil level. Engine oil level should be within the work range.

C. Inspect whether the oil is changed in a timely manner and whether the engine oil contains additives or viscosity is incorrect.

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No → Replace engine oil and oil filter. When necessary, clean the engine lubrication system.

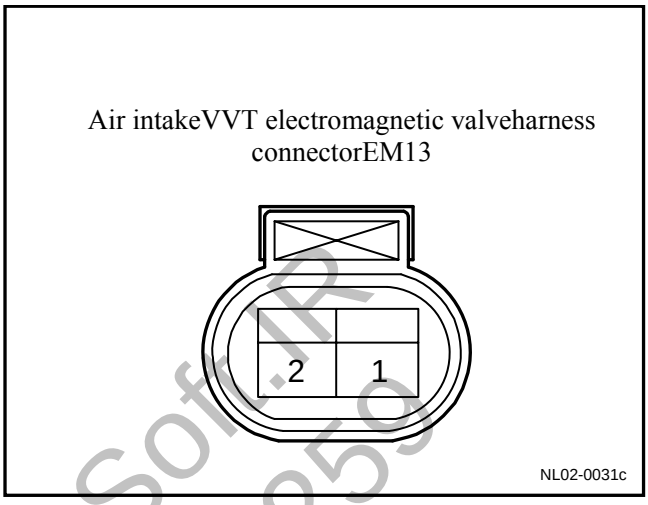
Yes

3	Inspect intake VVT solenoid valve resistance.

A. Disconnect intake VVT solenoid valve harness connector EM13.

B. Measure the resistance between the two intake VVT solenoid valve terminals.

Standard Resistance: 7.2 Ω at 20℃(68 ℉)



No → Replace VVT solenoid valve as per "2.2.8.3 Replacement of VVT Solenoid Valve"

Yes

4	Inspect the intake VVT solenoid valve action condition.

Note: In the testing process, it is strictly prohibited Connect two wires directly together, otherwise it might cause an explosion, fire or other dangers.

A. Connect the battery positive terminal to VVT solenoid valve terminal #1 and the negative terminal to the VVT solenoid valve terminal #2.

B. Inspect the filter movement. Does the filter move?

No → Replace VVT solenoid valve as per "2.2.8.3 Replacement of VVT Solenoid Valve"

Yes

5	Inspect whether the timing system is normal.

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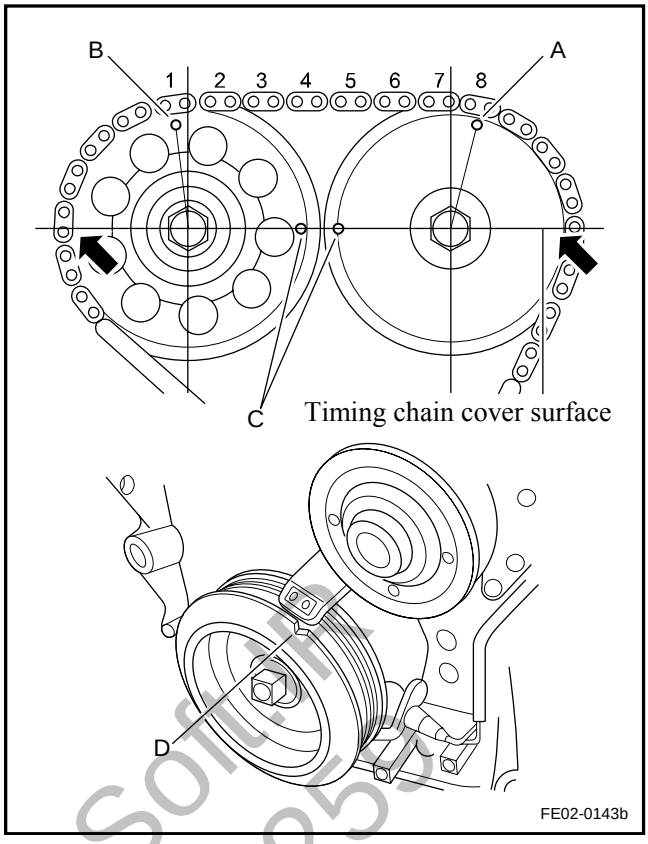
A. Remove the cylinder hood cover.

B. Align point D shown in the graphic. Rotate the crankshaft pulley, so that the timing mark on the pulley groove aligns with 0 marked on the timing chain cover.

C. Inspect points C alignment shown in the graphic. The camshaft timing gear timing marks should be at horizontal positions as shown in the graphic.

D. Inspect points A,B alignment shown in the graphic. Make sure intake, exhaust camshaft gear timing marks distance between A and B is 8 timing chain sections.

E. Reinstall the cylinder hood cover.



Are timing marks shown as in the graph?

No → Adjust the valve timing

Yes

6	Replace the VVT actuator assembly.

Next

7	Inspect control system DTC codes.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position.

C. Select the following menu items:

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Any DTC code?

No → Refer to 2.2.7.4 Fault Symptom Table for intermittent fault.

Yes

8	System gets normal and the trouble is removed.

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5. Maintenance guide :

Intake VVT Actuator can only be replaced as an assembly. Do not disassemble it and repair. Replacement of VVT actuator and Camshaft.

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2.2.7.16 DTC P0068 P0106

1. DTC description:

DTC	**P0068**	Electronic Throttle Air Flow Error

DTC	**P0106**	Intake Pressure/Throttle Position Fault

Intake Manifold Absolute Pressure (MAP) Sensor measures intake manifold pressure changes caused by the engine load, intake manifold vacuum and engine speed changes, and convert these changes into voltage output and send to the engine control module (ECM). At the same time the engine control module (ECM) compares the actual and expected intake manifold absolute pressure changes based on the throttle position opening change, to determine whether the intake manifold absolute pressure sensor responds to throttle position opening change or not. Set DTC P0106 fault accordingly.

Engine control module (ECM) detects air flow based on the intake manifold pressure sensor and intake air temperature sensors measured data and compare the sir flow with expected air flow based on throttle position sensor. If the engine control module (ECM) detects that the intake manifold absolute pressure / temperature sensor detected actual air flow and expected air flow based on throttle position sensor is inconsistent, it will set DTC P0068.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0068	Difference between intake manifold absolute pressure / temperature sensor detected air flow and the expected air flow based on throttle position is 200 g/s.	1. Engine Running 2. No Intake Air Pressure / Temperature Sensor Fault 3. Duration Longer Than 4s.	1. Intake Manifold Pressure / Temperature Sensor 2. Intake Manifold and Vacuum Tube 3. Throttle 4. ECM
P0106	Atmosphere correction pressure value is more than high limit value. Or less than low limit value	1. Engine Running 2. No intake pressure sensor, coolant temperature sensor, ETC throttle position sensor, fuel injector, ignition coil and misfire fault, etc. 3. Coolant temperature is higher than 60°C (140 °F). 4. Duration Longer Than 15s.	

3. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Initial Inspection

Inspect if there are the following conditions:

A. Damaged Intake Manifold Pressure / Temperature Sensor Housing Is, Broken Vacuum Tubes

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B. Damaged Intake Manifold Pressure / Temperature Sensor Seals

C. Intake Manifold Pressure / Temperature Sensor Loose or Improperly Installed

(d) Throttle seals is damaged, causing air leaks.

Next

2	Inspect whether there is control system DTC code other than DTC P0068 P0106.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes Shown	**To Step**
DTC P0068 P0106	No
DTC Code Other Than DTC P0068 P0106	Yes

Yes → 2.2.7.14 DTC Chapter Index

Yes

3	Inspect the atmospheric pressure parameter in the fault diagnosis data list.

A) Compare the atmospheric pressure parameter and the actual atmospheric pressure, refer to the "2.2.1.3 Relationship between Altitude and Atmospheric Pressure" in “Engine Control System”.

Are the two similar?

No → Replace the intake manifold pressure / temperature sensor.

Yes

4	Inspect the intake manifold pressure (MAP) sensor value with the engine running.

A. Start the engine.

B. When idling, observe the intake manifold pressure (MAP) sensor values.

C. During acceleration, observe the intake manifold pressure (MAP) sensor values.

D. Compare the above intake manifold pressure (MAP) sensor values.

Are above intake manifold pressure (MAP) sensor values changed?

Yes → Go to step 7

No

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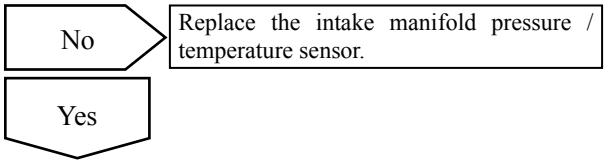
5	Inspect the intake manifold pressure sensor.

A. Shut down the engine.

B. Turn the ignition switch to ON.

C. Without disconnecting the intake manifold pressure sensor wiring harness connector, pull out the intake manifold pressure sensor from the intake manifold and use the vacuum pump. install the vacuum pump tube to the intake manifold pressure sensor.

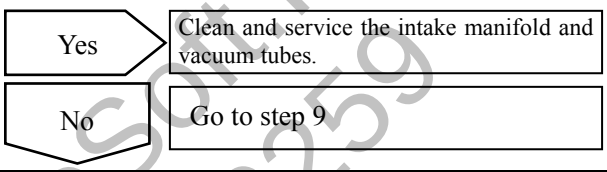
D. Apply 50 kPa pressure on the intake manifold pressure sensor. Observe whether the intake manifold pressure (MAP) sensor value changes?



6	Inspect the intake manifold pressure sensor installation port and vacuum tubes.

A. Inspect the intake manifold pressure sensor installation port and vacuum tubes.

Are the installation port and vacuum tubes blocked?



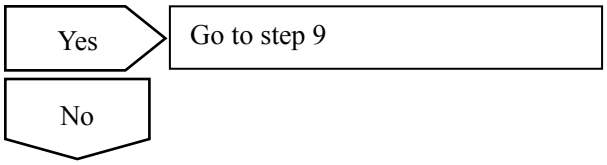
7	Inspect whether the intake manifold pressure sensor parameter responds to changes.

A. Engine Running

B. After changed throttle valve. Stuck throttle valve, look at air intake manifold pipe pressure sensor .

Whether the sensor parameter value is rapidly changed according to the change of the position of the throttle.

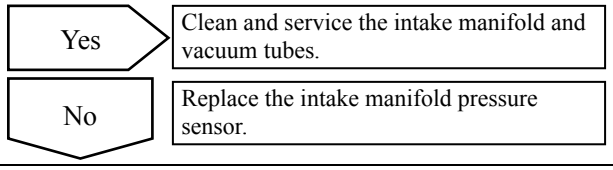
Does intake manifold pressure (MAP) sensor value rapidly change with the throttle position changes?



8	Inspect the intake manifold pressure sensor installation port and vacuum tubes.

A. Inspect the intake manifold pressure sensor installation port and vacuum tubes.

Are the installation port and vacuum tubes blocked?



9	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

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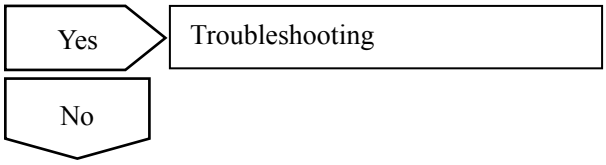
B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

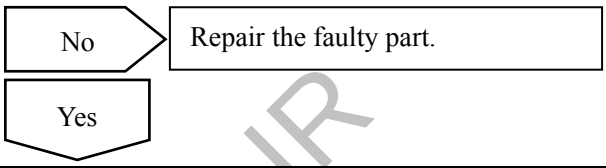
E. Read control system DTC code again to confirm that the system has no DTC code exported.



10	Inspect ECM power supply circuit.

A. Inspect whether ECM power supply circuit is normal.

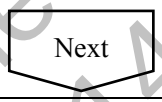
B. Inspect whether ECM ground circuit is normal.



11	Replace ECM

A. Replaces .

B. Carry out the crankshaft position sensor learning, refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learning.



12	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

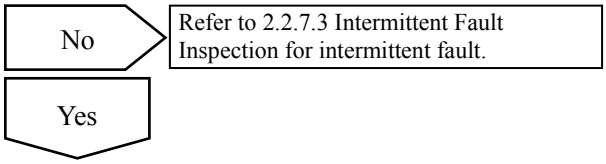
B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.



13	Troubleshooting

5. Maintenance guide :

Replace intake Pressure /temperature Sensor as per 2.2.8.3 “Replacement of Intake Pressure Temperature Sensor”.

Replace ECM. Refer to 2.2.8.1 Replacement of Engine Control Module.

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2.2.7.17 DTC P0076 P0077

1. DTC description:

DTC	**P0076**	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit

DTC	**P0077**	Intake VCP Hydraulic Control Valve Coil High Voltage

Intake camshaft position (CMP) actuator is connected to the intake camshaft and operated by the hydraulic pressure, which is provided by the oil pump in order to change the intake camshaft to the CKP (CKP) relative angle. Intake VVT solenoid valve power is provided from the main relay. ECM controls ground with a pulse-width modulation signal to control the engine oil flow to the camshaft position actuator. Oil pressure moves a security slide valve within the camshaft position actuator body at the front of the camshaft. When the safety slide valve moves, the oil is imported to the camshaft position actuator to rotate the camshaft. The intake camshaft actuator change the camshaft working angle up to 50 degrees.

ECM controls the solenoid valve internal ground through ECM harness connector EM01 terminal No.43. There is a feedback circuit within ECM. Engine ECM monitors feedback signals to determine whether the control circuit is open, short to ground or short to voltage If ECM detects the control circuit voltage is within the specified range when the control circuit is instructed to disconnect, it will set this DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0076 P0077	Hardware Circuit Inspection	1. Circuit Open 2. Circuit Short To Power Supply 3. Circuit Short To Ground	1. Solenoid Valve Circuit 2. Solenoid Valve 3. ECM

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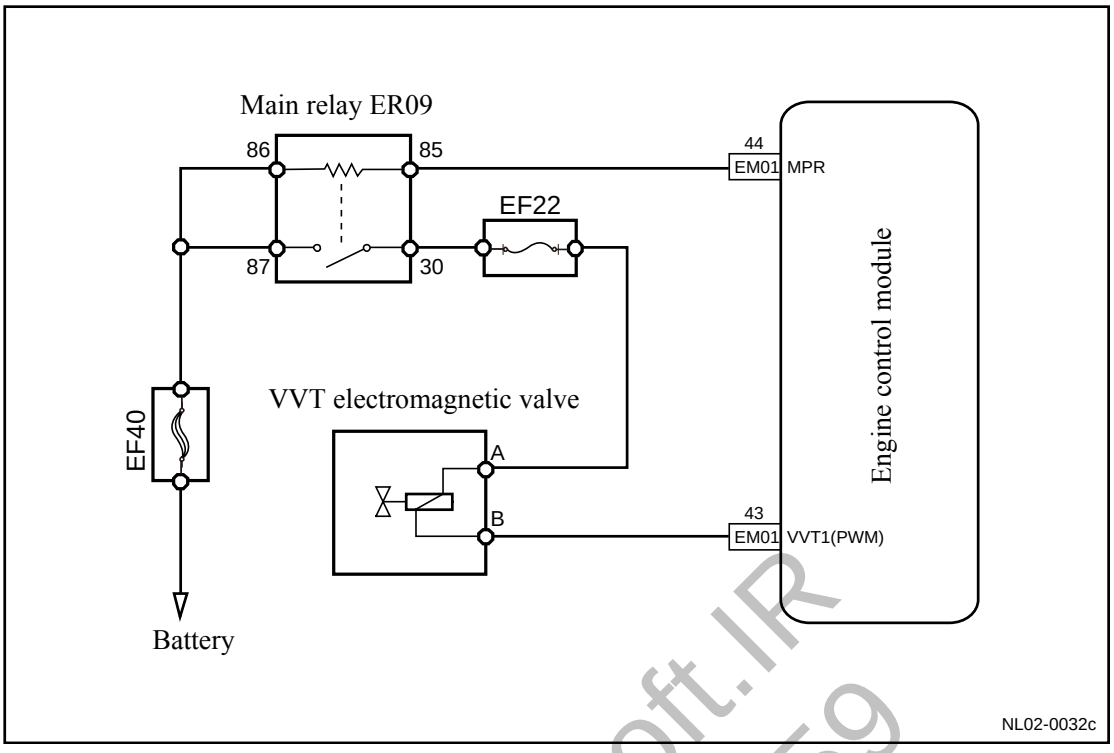
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Measure VVT solenoid valve resistance.

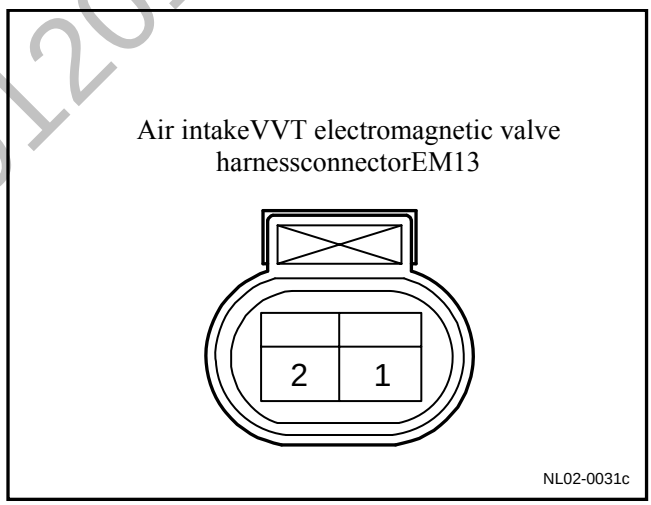
(a) Disconnect intake VVT solenoid valve harness connector EM13.

(b) Measure the resistance between the two intake VVT solenoid valve terminals.

Standard Resistance

It is 7.2Ω with 20℃(68oF)

(c) Connect VVT solenoid valve harness connector.



No → Replace VVT solenoid valve assembly.Go to step 7

Yes

Step 2	Measure VVT solenoid valve working power supply.

(a) Rotated ignition switch to OFF position .

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(b) Disconnect VVT solenoid valve harness connector EM13.

(c) Rotated ignition switch to ON position .

(d) Test EM13 connector terminal A with a multimeter.

Standard Voltage: 11-14V

(e) Connect VVT solenoid valve harness connector EM13.

No → Inspect whether circuit between EM09 solenoid valve harness connector terminal No.A and main relay terminal No.3 is open or short to ground.

Yes

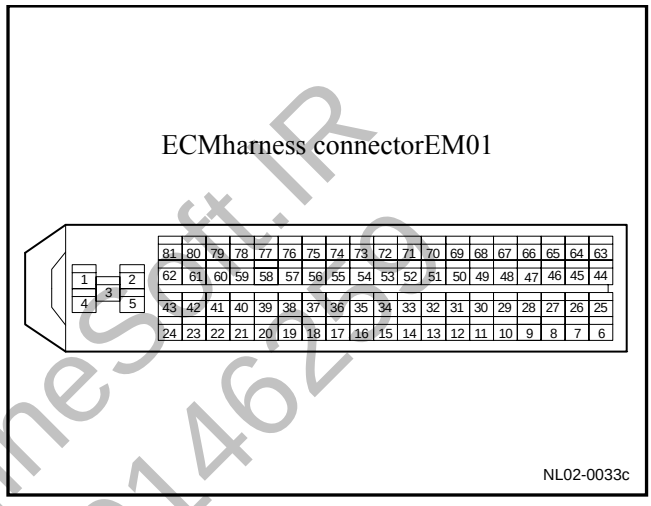
Step 3	Inspect VVT solenoid valve control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect VVT solenoid valve harness connector EM13.

(c) Disconnect ECM harness connector EM01.

(d) Use multimeter to measure the resistance between VVT solenoid valve harness connector EM13 terminal No.B and ECM harness connector EM01 terminal 43. For the Standard Value. Refer to the table below.



(e) Use multimeter to measure the resistance between VVT solenoid valve wiring harness connector EM13 terminal B and the ground. For the Standard Value. Refer to the table below.

(f) Turn the ignition switch to ON position, (Note: At this point EM01, EM13 connectors must be disconnected) Measure voltage between VVT solenoid valve wiring harness connector EM13 terminal B and a reliable ground with a multimeter. the Standard Value is in the table below.

Test Connection	**Standard Value**
Resistance Between EM13(B) and EM01 (43)	Less than 1 Ω
Resistance Between EM13 (B) and Ground	10 kΩ or higher
Voltage Between EM13 (B) and Ground	Less than 0 V

No → Repair or replace harness connector

Yes

Step 4	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

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No → Repair or replace harness connector

Yes

Step 5	Replace ECM. Refer to 2.2.8.1 Replacement of Engine Control Module.

Next

Step 6	Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 7	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again. Verify that the system has no DTC code output.

No → Repair or replace harness connector

Yes

Step 8	Troubleshooting

5. Maintenance guide :

Refer to 2.2.8.5 Replacement of VVT Solenoid Valve and Filter Cleaning to replace the VVT solenoid valve.

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2.2.7.18 P0107 P0108

1. DTC description:

DTC	**P0107**	Manifold air pressure sensor circuit has low voltage or is open

DTC	**P0108**	Intake Air Pressure Sensor Circuit High Voltage

Intake Air Manifold Absolute Pressure (MAP) Sensor responds to the pressure changes within the intake manifold. Pressure varies according to engine load. The MAP sensor circuit consists of the following:

- 5V reference voltage
- Low Reference Voltage Circuit
- Sensor Signal Circuit

ECM provides sensor harness connector EM30 terminal No.1 5 V reference voltage through ECM harness connector EM01 terminal No.66. And, a low reference voltage through EM01 terminal No.76 to EM30 terminal No.4. The sensor provides a signal through EM30 terminal No.2 to ECM harness connector EM01 terminal No.54. This signal is related to the intake manifold pressure change. When the intake manifold absolute pressure is low, such as at idle or during deceleration, ECM detected signal voltage is low. When the intake manifold absolute pressure is high, such as the ignition switch turned on with the engine is turned off, or when the throttle is fully open, ECM detected signal voltage is high. Sensors are also used to determine the atmospheric pressure. When the ignition switch is turned on and the engine is turned off. As long as the engine running with the throttle fully open, atmospheric pressure readings will also be updated. ECM monitors sensor signals in order to determine whether the voltage is beyond the normal range.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0107	Circuit Inspection, Over the Minimum Limit	1. Idle 2. When the sensor circuit is open or short to ground, the sensor signal voltage is 0	1. Sensor Circuit 2. Sensor 3. ECM.
P0108	Circuit Inspection,over the Maximum Limit	1. Idle 2. When the sensor circuit short to power supply or a 5 V reference voltage 3. Sensor A/D initial signal is 99.6%	

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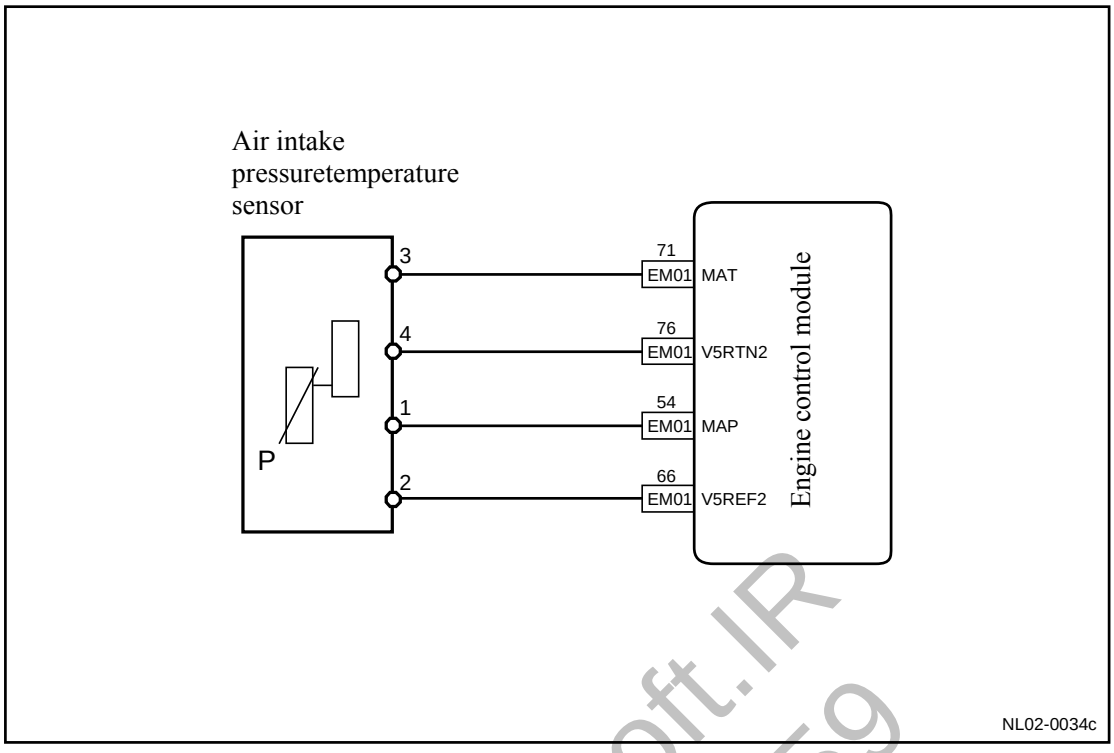
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Next

Step 1	Initial Inspection

Inspect if there are the following conditions:

(a) Sensor housing damage, vacuum tubes broken.

(b) Sensor seal damage.

(c) Sensor loose or improperly installed.

(d) Sensor tube blockage.

Notes:It is not allowed to connect 5 V reference voltage circuit of intake manifold absolute pressure sensor and other components of the vehicle, as this will damage the sensors and ECM.

Next

Step 2	Measure intake manifold absolute pressure sensor 5 V reference voltage.

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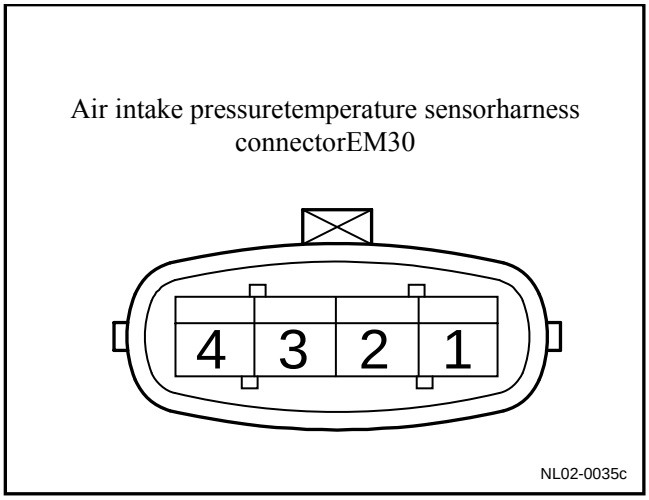
(a) Rotated ignition switch to OFF position .

(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EM30.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between intake manifold absolute pressure sensor wiring harness connector EM30 terminal No.1 and a reliable ground.



Standard voltage: 4.5V-5.5V

(e) Connect intake manifold absolute pressure sensor wiring harness connector EM30.

Is voltage the specified value?

No → Repair or replace harness connector

Yes

Step 3	Measure Sensor Signal Circuit

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EM30.

(c) Rotated ignition switch to ON position .

(d) Connect a 5A fuse cross-wiring between EM30 terminals No. 2 and No.4. With a fault diagnosis tester, observe Actual Intake Manifold Absolute Pressure Sensor Voltage parameter.

standard value: 4.5V-5.5V

(e) Connect intake manifold absolute pressure sensor wiring harness connector EM30.

Is data normal?

No → Go to step 7

Yes

Step 4	Measure intake manifold absolute pressure sensor ground circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EM30.

(c) Rotated ignition switch to ON position .

(d) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EM30 terminal No.4 and a reliable ground.

Standard Value: Less than 3 Ω

(e) Connect intake manifold absolute pressure sensor wiring harness connector EM30.

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Is the resistance normal?

No	Go to step 8
Yes	

Step 5	Replace the intake manifold absolute pressure sensor.

No	Go to step 10
Yes	

Step 6	Inspect the sensor 5 V reference voltage circuit.

(a) Rotated ignition switch to OFF position .

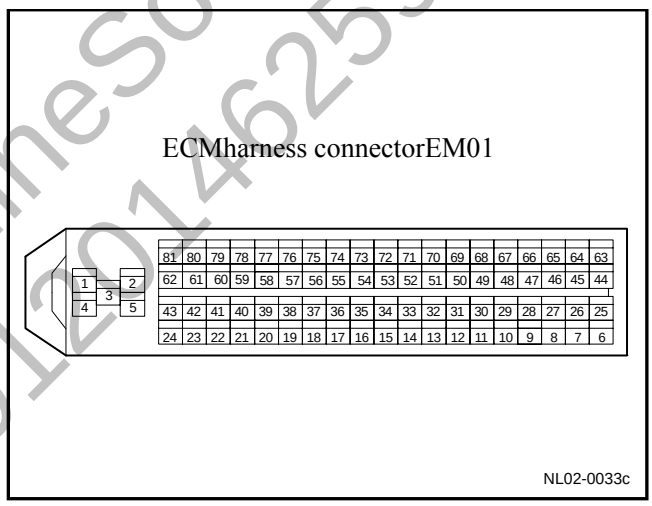
(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EM30.

(c) Disconnect ECM harness connector EM01.

(d) Measure the resistance between intake manifold absolute pressure sensor harness connector EM30 terminal No.1 and ECM harness connector terminal No.66. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.

(e) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EM30 terminal No.1 and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the fault part.

(f) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EM30 terminal No.1 and power supply. Inspect whether the circuit is short to power supply. Otherwise, repair the fault part.



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Test Connection	**Standard Value**
Resistance Between EM30 (1) and EM01 (66)	Less than 1 Ω
Resistance Between EM30 (1) and Ground	10 kΩ or higher
Voltage Between EM30 (1) and Ground	Less than 0 V

No	Go to step 9

Step 7	Inspect Sensor Signal Circuit

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EM30.

(c) Disconnect ECM harness connector EM01.

(d) Measure the resistance between intake manifold absolute pressure sensor harness connector EM30 terminal No.2 and ECM harness connector terminal No.54. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.

(e) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EM30 terminal No.2 and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the fault part.

(f) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EM30 terminal No.2 and power supply. Inspect whether the circuit is short to power supply. Otherwise, repair the fault part.

Test Connection	**Standard Value**
Resistance Between EM30 (2) and EM01 (54)	Less than 1 Ω
Resistance Between EM30 (2) and Ground	10 kΩ or higher
Voltage Between EM30 (2) and Ground	Less than 0 V

Normal → Go to step 9

Step 8	Inspect sensor ground circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EM16.

(c) Disconnect ECM harness connector EM01.

(d) Measure the resistance between intake manifold absolute pressure sensor harness connector EM30 terminal No.4 and ECM harness connector terminal No.76. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.

(e) Measure voltage between intake manifold absolute pressure sensor harness connector EM30 terminal No.4 and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the faulty part.

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Test Items	**Standard Value**
Resistance Between EM30 (4) and EM01 (76)	Less than 1 Ω
Voltage Between EM30 (4) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 9	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

Next

Step 10	Replace ECM

Next

Step 10	Replace ECM

(a) Refer to 2.2.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 11	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 12	Troubleshooting

5. Maintenance guide :

Refer to 2.2.8.3 Replacement of Intake Pressure Temperature Sensor to replace MAP sensor.

Replace ECM. Refer to 2.2.8.1 Replacement of Engine Control Module.

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2.2.7.19 DTC P0112 P0113

1. DTC description:

DTC	**P0112**	Intake Air Temperature Sensor Circuit Low Voltage

DTC	**P0113**	Intake Air Temperature Sensor Circuit High Voltage or Open Circuit

Intake air temperature pressure sensor has a signal circuit and an ECM internal ground circuit. Intake air temperature pressure sensor is used to measure the air temperature entering the engine. ECM provides 5 V reference voltage through ECM harness connector EM01 terminal No.71 to the intake air temperature pressure sensor harness connector EM30 terminal No.3 and an internal low reference voltage through EM01 terminal No.76 to the intake air temperature pressure sensor EM30 terminal No.4. When the intake air temperature pressure sensor in cold, the sensor resistance is relatively high. When the air temperature rises, the sensor resistance decreases. When the sensor resistance is high, ECM detected intake air temperature pressure sensor signal circuit voltage is high. With the decrease of sensor resistance, ECM detected intake air temperature pressure sensor signal circuit voltage also decreases.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0112 P0113	1. More Than the Upper Limit 2. Lower Than the Lower Limit	1. MAT circuit is short to ground. 2. MAT signal voltage becomes 0 immediately.	1. Sensor Circuit 2. Sensor 3. ECM.
		1. MAT circuit is open or short to 5 V reference voltage.	

3. Circuit sketch

Circuit diagram refers to 2.2.7.18 Circuit Diagram in DTC P0107 P0108.

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Inspect if there are the following conditions:

(a) Sensor housing is damaged.

(b) Sensor loose or improperly installed.

(c) Sensor wiring harness connector loose.

It is not allowed to connect 5 V reference voltage circuit of intake manifold absolute pressure sensor and other components of the vehicle, as this will damage the sensors and ECM.

Next

Step 2	Measure intake air pressure and temperature sensor resistance.

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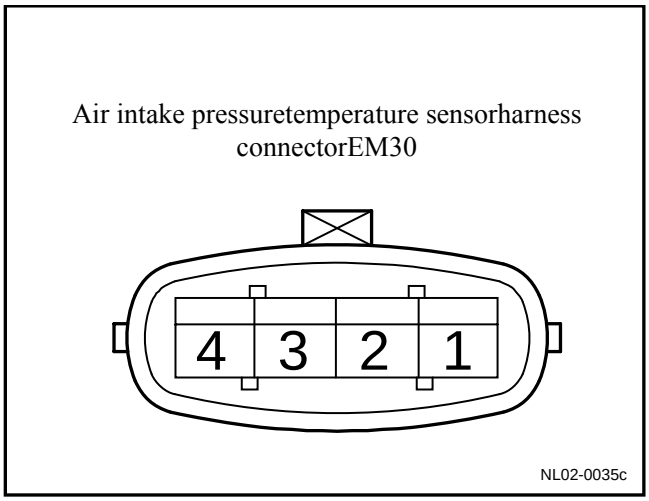
(a) Rotated ignition switch to OFF position .

(b) Disconnect intake pressure temperature sensor harness connector EM30.

(c) Measure intake air temperature sensor resistance.

Standard Resistance: (Refer to 2.2.1.2 Temperature and Resistance Correlation of Temperature Sensor to get the the specific parameters.): 2308.8-2726.8Ω/20°C(68 °F)

(d) Connect intake pressure temperature sensor harness connector EM30.



Is resistance the specified value?

No → Replace the intake pressure temperature sensor.

Yes

Step 3	Measure intake air temperature pressure sensor signal circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake pressure temperature sensor harness connector EM30.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between intake pressure temperature sensor harness connector EM30 terminal No.3 and a reliable ground.

Standard Voltage: 4.7-5.5V

(e) Connect intake pressure temperature sensors connector EM30.

Is the voltage normal?

No → Replace the intake pressure temperature sensor.

Yes

Step 4	Measure intake air temperature pressure sensor ground circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake pressure temperature sensor harness connector EM30.

(c) Rotated ignition switch to ON position .

(d) Measure resistance between intake pressure temperature sensor harness connector EM30 terminal No.4 and a reliable ground.

Standard Resistance: Less than 3 Ω

(e) Connect intake pressure temperature sensors harness connectorE EM30.

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Is the resistance normal?

No	Go to step 6
Yes	Go to step 7

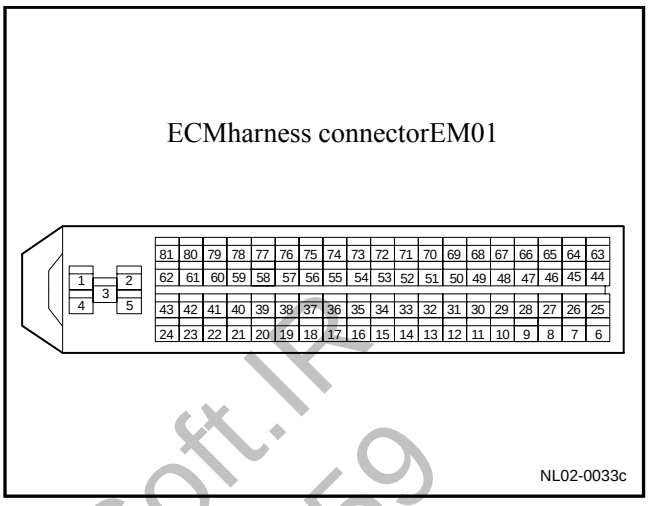
Step 5	Inspect intake air temperature pressure sensor signal circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake pressure temperature sensor harness connector EM30.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between intake pressure temperature sensor harness connector EM30 terminal No.3 and ECM harness connector terminal No.71. Inspect whether the circuit is open.



(e) Measure resistance between intake pressure temperature sensor harness connector EM30 terminal No.3 and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure voltage between intake pressure temperature sensor harness connector EM30 terminal No.3 and a reliable ground. Inspect whether the circuit is short to power supply.

Test Items	**Standard Value**
Resistance Between EM30 (3) and EM01 (71)	Less than 1 Ω
Resistance Between EM30 (3) and a Reliable Ground	10 kΩ or higher
Voltage Between EM30 (3) and a Reliable Ground	0V

Next	Go to step 6

Step 6	Inspect intake air temperature pressure sensor ground circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake pressure temperature sensor harness connector EM30.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between intake pressure temperature sensor harness connector EM30 terminal No.4 and ECM harness connector terminal No.76. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.

(e) Measure voltage between intake pressure temperature sensor harness connector EM30 terminal No.4 and a reliable ground. Inspect whether the circuit is short to power supply. If there is no short circuit, repair the faulty part.

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Test Items	Standard Value
Resistance Between EM30 (4) and EM01 (76)	Less than 1 Ω
Voltage Between EM30 (4) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

(a) Refer to 2.2.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 9	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 10	Troubleshooting

5. Maintenance guide :

Replace intake pressure temperature sensor. Refer to 2.2.8.3 Replacement of Intake Pressure Temperature Sensor.

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2.2.7.20 DTC P0117 P0118

1. DTC description:

DTC	**P0117**	Temperature Sensor of Engine Coolant Circuit Voltage Too Low

DTC	**P0118**	Temperature Sensor of Engine Coolant Circuit High Voltage or Open Circuit A

ECT sensor is a variable resistor with a negative temperature coefficient and used to measure the temperature of engine coolant. ECM provides a 5V voltage through ECM harness connector EM01 terminal No.49 to ECT sensor harness connector EM23 terminal No.3 and a low internal reference voltage through EM01 terminal No.74 to ECT sensor connector EM23 terminal No.1. ECM will always record the length of time the ignition switched off. When starting, if the ignition switched off time reaches the pre-set time, the engine control module will compare the engine coolant temperature and intake air temperature in order to determine whether the difference between the two is in normal working range.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0117	More Than the Upper Limit Lower Than the Lower Limit	1. Idle 2. Coolant temperature sensor circuit is short to ground. 3. Coolant temperature by default changes as the running time changes.	1. Sensor Circuit 2. Sensor 3. ECM.
P0118		1. Idle 2. Coolant temperature sensor signal circuit is open or short to 5V voltage. 3. Coolant temperature by default changes as the running time changes.	

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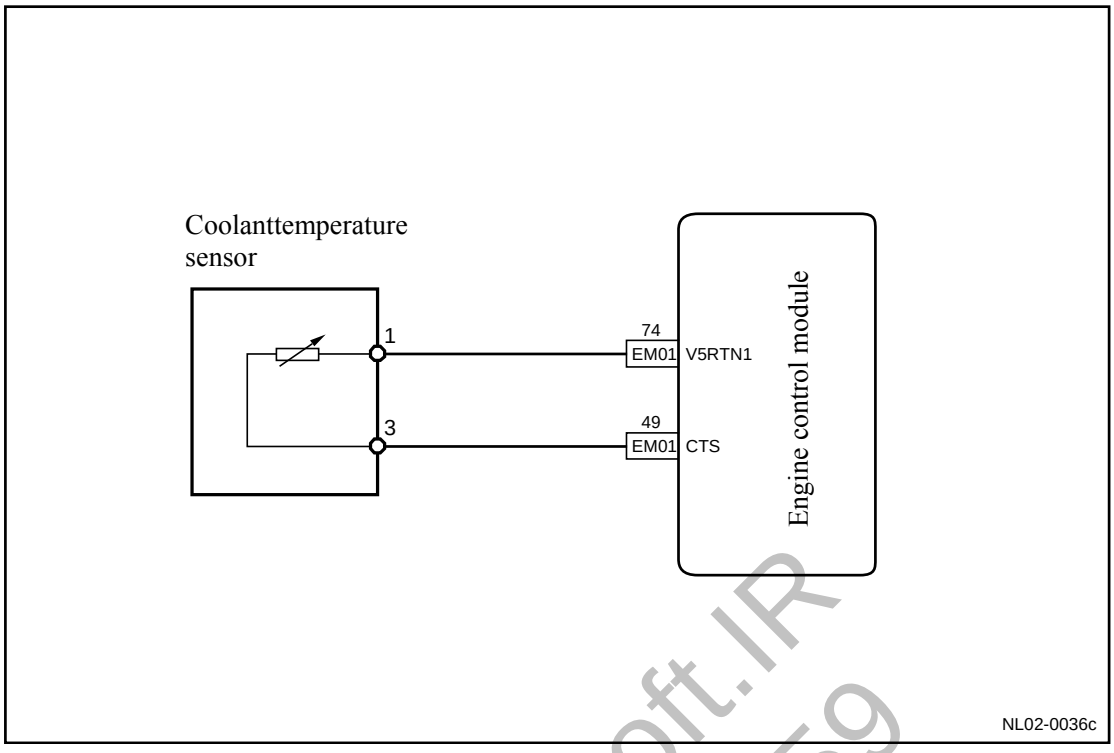
3. Circuit sketch



4. Diagnostic Steps:

Warning!

See Warnings Regarding Cooling System in Warnings and Cautions.

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Note: At any time do not use flammable antifreeze, such as alcohol. Combustible antifreeze can cause serious fires.

Step 1	Initial Inspection

(a) Inspect the temperature sensor of engine coolant for whether there is evidence of corrosion, as well as the engine coolant is leaking through the sensor.

(b) Inspect whether the engine coolant level in the reservoir of cooling system is correct.

Next

Step 2	Measure resistance of temperature sensor of engine coolant.

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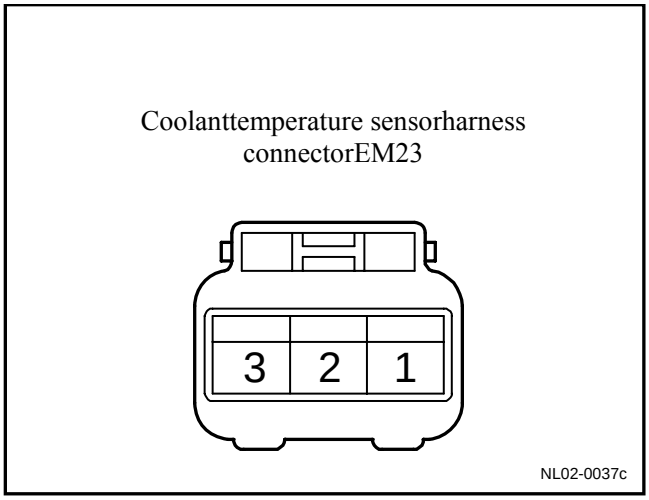
(a) Rotated ignition switch to OFF position .

(b) Disconnect the temperature sensor of engine coolant harness connector EM23.

(c) Measure the resistance of temperature sensor of engine coolant.



Standard resistance value (for detailed parameters, see 2.2.1.2 Temperature-resistance Relationship of Temperature Sensor): 20℃(68°F) 3511±2.6%Ω

(d) Connect the temperature sensor of engine coolant harness connector EM23.

Is resistance the specified value?

No → Replace the temperature sensor of engine coolant, go to step 9.

Yes

Step 3	Measure temperature sensor of engine coolant signal circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the temperature sensor of engine coolant harness connector EM23.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between temperature sensor of engine coolant EM23 terminal No.3 and a reliable ground.

Standard Voltage: 4.7-5.5V

(e) Connect the temperature sensor of engine coolant harness connector EM23.

Is the voltage normal?

No → Go to step 5

Yes

Step 4	Measure ground circuit of temperature sensor of engine coolant.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the temperature sensor of engine coolant harness connector EM23.

(c) Rotated ignition switch to ON position .

(d) Measure resistance between temperature sensor of engine coolant harness connector EM23 terminal No.1 and reliable ground.

Standard Resistance: Less than 3 Ω

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(e) Connect the temperature sensor of engine coolant harness connector EM23.

Is the resistance normal?

No	Go to step 6
Yes	Go to step 7

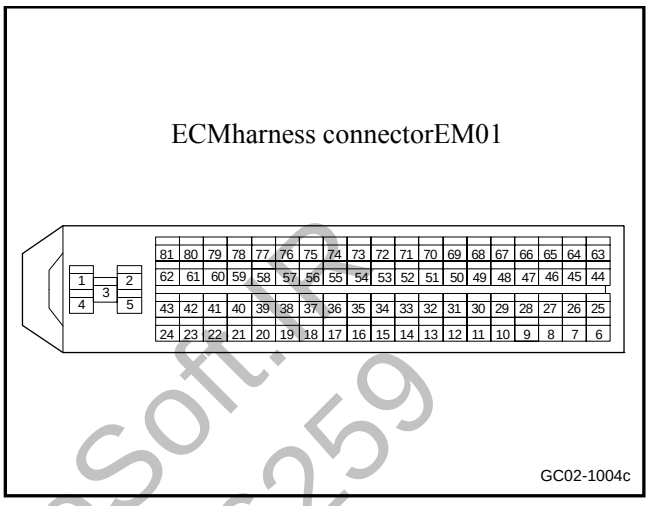
Step 5	Inspect the temperature sensor of engine coolant signal circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the temperature sensor of engine coolant harness connector EM23.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between engine coolant temperature sensor wire harness connector EM23 terminal 3 and ECM wire harness connector terminal 49. Inspect whether there is short-circuit situation.



(e) Measure resistance between engine coolant temperature sensor wire harness connector EM23 terminal 3 and reliable grounding. Inspect whether there is grounding short-circuit.

(f) Measure voltage between temperature sensor of engine coolant wiring harness connector EM23 terminal No.3 and a reliable ground. Inspect whether the circuit is short to power supply.

Test Items	**Standard Value**
Resistance Between EM23 (3) and EM01 (49)	Less than 1 Ω
Resistance Between EM23 (3) and a Reliable Ground	10 kΩ or higher
Voltage Between EM23 (3) and a Reliable Ground	0V

Next	Go to step 7

Step 6	Inspect the temperature sensor of engine coolant ground circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the temperature sensor of engine coolant harness connector EM23.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between engine cooling temperature sensor wire harness connector EM23 terminal 1 and ECM wire harness connector terminal 74. Inspect whether there is short-circuit situation, if yes, repair fault position.

(e) Measure voltage between temperature sensor of engine coolant harness connector EM23

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terminal No.1 and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	**Standard Value**
EM23(3)-EM01(29)	Less than 1 Ω
Voltage Between EM23 (3) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

(a) Refer to 2.2.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 9	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 10	Troubleshooting

5. Maintenance guide :

Replace the temperature sensor of engine coolant. Refer to 2.2.8.2 Replacement of temperature sensor of engine coolant.

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2.2.7.21 DTC P0122 P0123

1. DTC description:

DTC	**P0122**	Electronic Throttle Position Sensor #1 Circuit Low Voltage

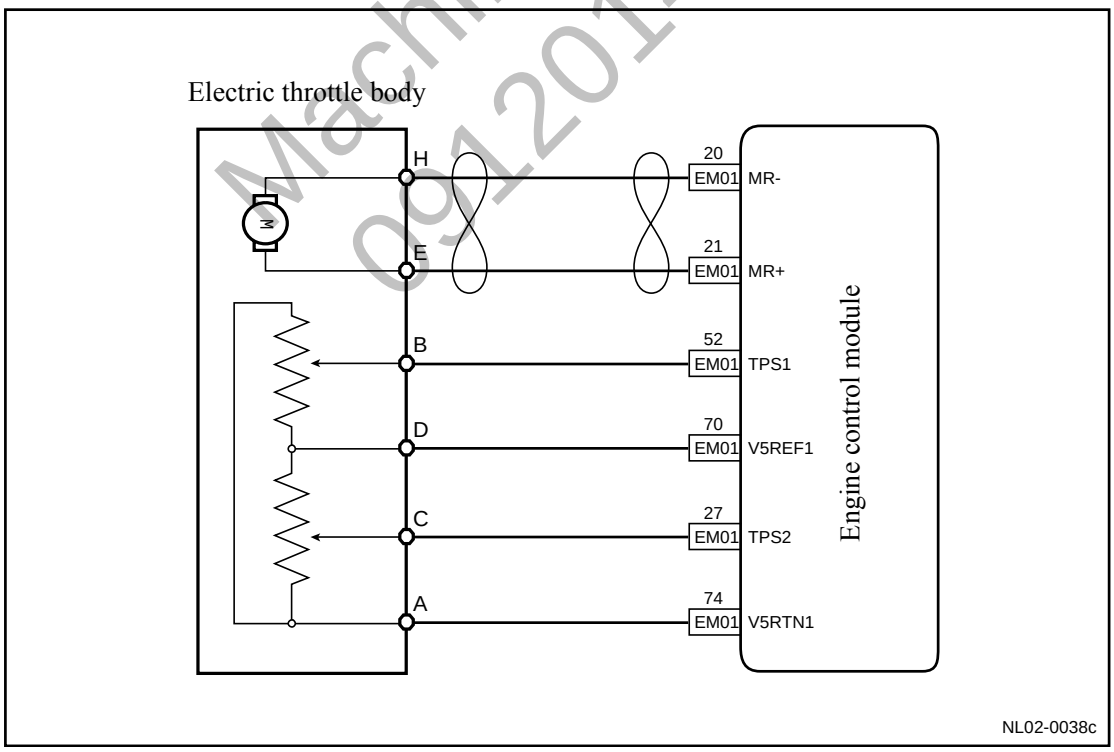
DTC	**P0123**	Electronic Throttle Position Sensor 1 Circuit High Voltage or open

TPS1 sensor sends signal through ECT harness connector EM13 terminal B to ECM through ECM harness connector EM01 terminal No.52. If the TPS1 sensor signal is lost, but ECM is able to receive the normal TPS2 sensor signal, then ECM controls the engine to enter reliability of determining the driver's intention decline or no high power output mode. Engine responds to the pedal changes slowly and engine power output will be significantly weaker, although the vehicle can still be able to drive in normal traffic.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0122	Hardware Circuit Malfunction	TPS signal end short to ground or open, the input signal is less than 3.5%, DTC code set.	1. Electronic Throttle Body 2. Electronic Throttle Circuit 3. ECM
P0123	Hardware Circuit Malfunction	TPS signal end short to power supply, input signal is greater than 96.5%, DTC code set.	

3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

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Step 1	Inspect for DTC code P0641, P0651, P0222, P0223.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Results

DTC Codes Shown	**To Step**
Only P0122 and P0123	Yes
With P0222, P0223, P0641, P0651	No

No → Refer to2. 12.7.46 DTC P0641 P0651

Yes

Step 2	Inspect EM13 terminal B.

(a) Rotated ignition switch to OFF position .

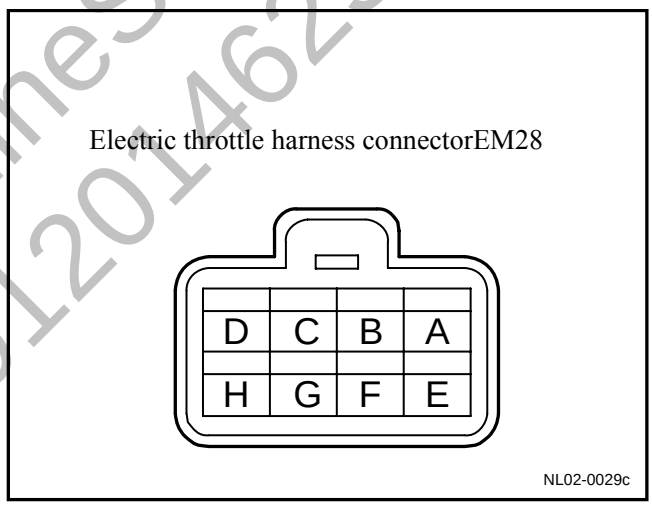
(b) Disconnect ETC harness connector EM13.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between EM13 terminal B and a reliable ground.

(e) Measure voltage between EM13 terminal B and a reliable ground.

(f) Test continuity between EM13 terminal B and EM01 terminal No.52.



Results

Test Items	**Standard Value**
EM13 (B) and a Reliable Ground	10 kΩ or higher
Voltage Between EM13 (B) and a Reliable Ground	0V
EM13 (B) and EM01 (52) Continuity	Less than 1 Ω

Does it conform to the standard value?

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No → Refer to2. 12.7.46 DTC P0641 P0651

Yes

Step 3	Inspect terminal B voltage output signal.

(a) Connect ETC harness connector EM13.

(b) Connect ECM harness connector EM01.

(c) Measure ETC harness connector EM13 terminal B output voltage.

Standard Value: Refer to 2.2.7.12 Electronic Throttle Body (ETC) Inspection.

Is the output voltage value accorded with the standard value?

No → Refer to Replacement of Electrical Throttle Body Assembly to replace the Electrical Throttle Body (ETC).

Yes

Step 4	Inspect ECM Power Supply Circuit and ground circuit.

(a) Refer to 2.2.7.43 DTC P0562 P0563 to inspect ECM Power Supply Circuit and ground circuit.

ECM power and ground circuits normal?

No → Repair power and ground circuits fault.

Yes

Step 5	Replace ECM

(a) Refer to 2.2.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 6	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 7	Troubleshooting

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5. Maintenance guide :

Electronic throttle body (ETC) can only be replaced as an assembly. Do not disassemble it and repair. Refer to 2.6.8.5 Replacement of Electrical Throttle Body Assembly for the replacement of the ETC.

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2.2.7.22 DTC P0131 P0132 P0133 P0134

1. DTC description:

DTC	P0131	Front Oxygen Sensor Circuit Short to Low Voltage

DTC	P0132	Front Oxygen Sensor Circuit Short to High Voltage

DTC	P0133	Slow response of front oxygen sensor

DTC	P0134	Front Oxygen sensor is open

After the vehicle started, ECM works in open-loop mode, in which ECM ignores the front oxygen sensor signal voltage when calculating the Air-Fuel ratio. The control module provides approximately 450mV reference voltage to the front oxygen sensor. When the engine starts running, the front oxygen sensor will be heated and begin to generate a 0-0.1 V voltage. This voltage fluctuates. Once ECM detects that the front oxygen sensor voltage exceeds a preset threshold voltage, ECM immediately enters into the closed-loop mode. Control module determines the Air-fuel ratio using the received front oxygen sensor voltage signal. If the front oxygen sensor voltage increases to over the reference voltage (tend to 1 V), it indicates that the air fuel mixture is too rich. If the front oxygen sensor's voltage decreased to below the reference voltage (tend to 0 mV), the mixture is too thin.

ECM provides a signal through ECM harness connector EM01 terminal No.10 to front oxygen sensor harness connector EM04 terminal B and an internal low reference voltage through ECM harness connector EM01 terminal No.2 to front oxygen sensor wiring harness connector EM04 terminal No. A.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0131	1. Front Oxygen Sensor Voltage Too High 2. Pre-Catalytic Oxygen Sensor Voltage Too Low	1. Engine Running Longer than 60s. 2. Water temperature is more than 70℃(158 ºF) 3. Short circuit of front oxygen sensor to grounding. 4. Duration Longer Than 13s.	1. Sensor Circuit 2. Sensor 3. ECM.
P0132		1. Engine Running Longer than 60s. 2. Water temperature is more than 70℃(158 ºF)。 3. Shortly connect front oxygen sensor signal and	

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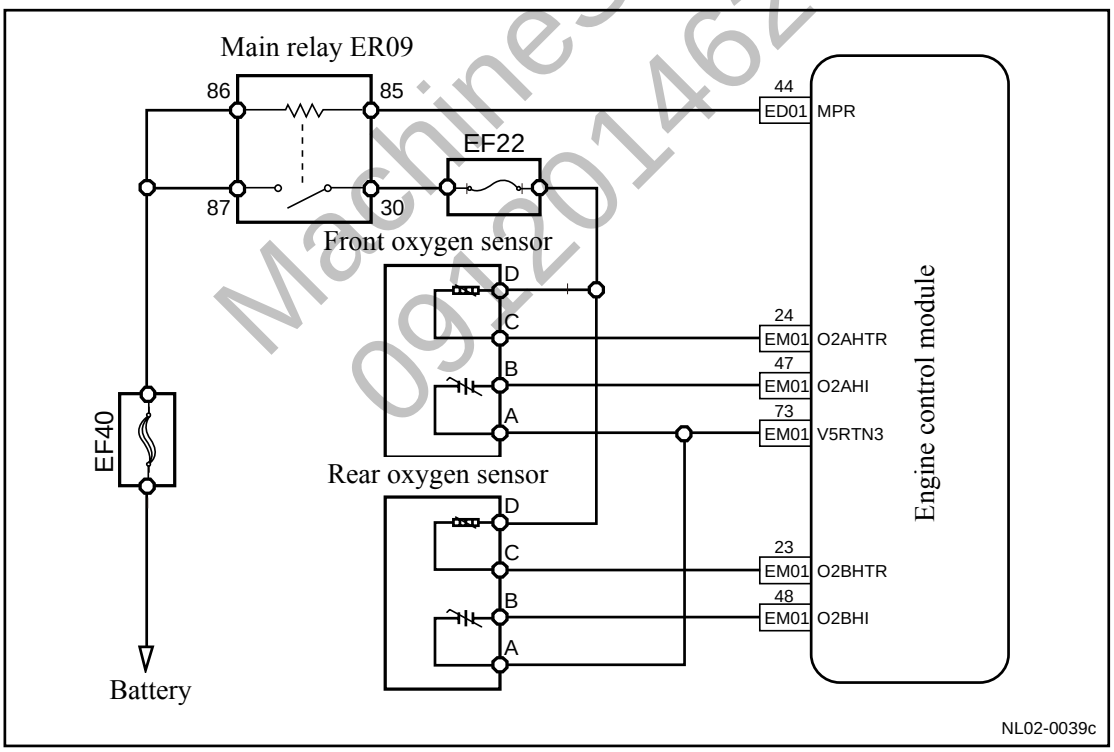
		power supply. 4. Duration Longer Than 13s.	
P0133	The time for the variation of the oxygen sensor against the oxygen concentration in the exhaust emissions exceeds the upper limit. The time for the variation of the oxygen sensor against the oxygen concentration in the exhaust emissions exceeds the lower limit.	1. Engine Running Longer than 60s. 2. Water temperature is more than 70℃(158 ºF)。 3. Engine speed range is 1,700-2,300 rpm. 4. Oxygen sensors to the exhaust oxygen concentration changes responding time longer than the system preset threshold.	1. Sensor Circuit 2. Sensor 3. ECM 4. Mixture is too thick 5. Mixture Too Lean
P0134	1. Signal Circuit Open. 2.Oxygen Sensors High-Temperature and High Resistance.	1. Engine Running Longer than 60s. 2. Water temperature is more than 70℃(158 ºF)。 3. Duration Longer Than 80s.	1. Sensor Circuit 2. Sensor 3. ECM

3. Circuit sketch



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4. Diagnostic Steps:

Step 1	Connect a fault diagnosis tester.

Next

Step 2	Start engine and turn on the fault diagnosis tester.

Next

Step 3	Keep the engine speed at 2,500 rpm for more than 2 min to warm up the engine, until the engine coolant temperature reaches 80°C (176 °F).

Next

Step 4	Select on the fault diagnosis tester: Engine / Read Data Flow / Group 1 Oxygen Sensor Voltage 1 (Front Oxygen Sensor).

Next

Step 5	Observe the pre-catalytic oxygen sensor output voltage. The data stream should fluctuate within 0.1-0.8 V.

Yes → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

No

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Step 6	Test the oxygen sensor signal.

(a) If the voltage data is consistently lower than 0.45 V (mixture too thin), carry out the following inspection steps:

- Spray proper amount of propane gas into the intake.
- Inspect whether the front oxygen sensor voltage data has a significant change, in which case the signal voltage will increase rapidly.

(b) If the voltage data is consistently higher than 0.45V (mixture too thick), carry out the following inspection steps:

- Put the gear into neutral.
- Apply hand brake.
- Press the accelerator pedal so the engine speed suddenly increases to 4,000 rpm and then quickly release the accelerator pedal.
- Repeat the previous step more than 3 times.
- Observe whether there is a significant change in the front oxygen sensor voltage data, as the signal voltage will decrease rapidly.

During the above test, the oxygen sensor signal voltage should have a significant change.

Is voltage changed significantly?

Yes → Inspect the cause for engine air-fuel ratio too lean/too rich. Refer to 2.12.7.4 Fault Symptom Table.

No

Step 6	Inspect there are no other control system DTC codes output.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Results

DTC Codes Shown	**To Step**
DTC other than P0131, P0133, P0134	No
P0131. P0133. P0134	Yes

No → Refer to 2.12.7.14 DTC Chapter Index.

Yes

Step 8	Measure Pre-Sensor Signal Circuit

(a) Rotated ignition switch to OFF position .

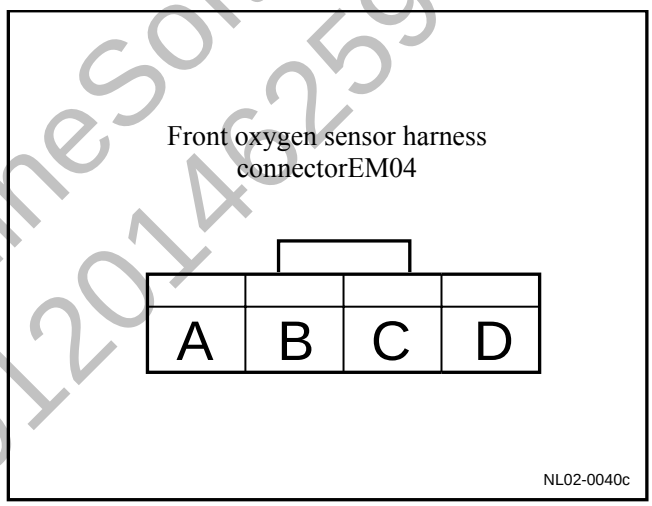
(b) Disconnect front oxygen sensor harness connector EM04.

(c) Rotated ignition switch to ON position .

(d) Measure the voltage value between the front oxygen sensor wiring harness connector EM04 terminal No.B and reliable ground.

Standard Voltage: 0.35-0.5V

(e) Connect front oxygen sensor harness connector EM04.



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Is voltage the specified value?

No → Go to step 11

Yes

Step 9	Measure pre-catalytic oxygen sensor ground circuit.

(a) Rotated ignition switch to OFF position.

(b) Disconnect front oxygen sensor harness connector EM04.

(c) Rotated ignition switch to ON position.

(d) Measure resistance between front oxygen sensor EM04 terminals A and a reliable ground.

Standard Resistance: Less than 1 Ω

(e) Connect front oxygen sensor harness connector EM04.

Is resistance the specified value?

No	Go to step 12
Yes	

Step 10	Refer to 2.4.6.2 “Replacement of Front Oxygen Sensor” to replace the front oxygen sensor

Next	Go to step 15

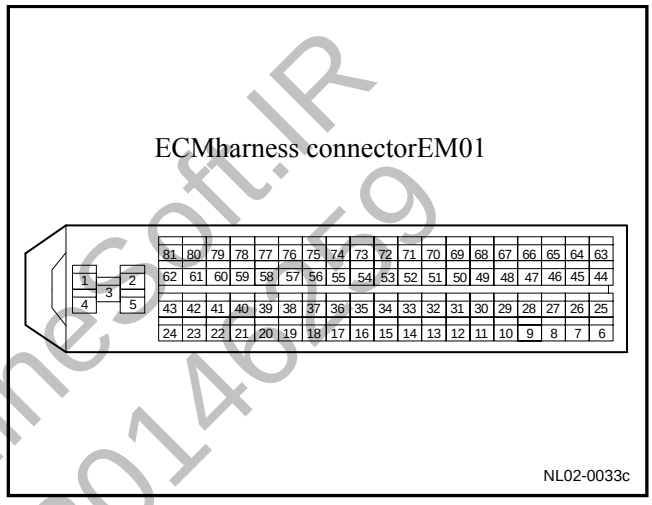
Step 11	Inspect the front oxygen sensor signal circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect front oxygen sensor harness connector EM04.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between front oxygen sensor wiring harness connector EM04 terminal B and ECM harness connector terminal No.47. Inspect whether the circuit is open. Otherwise, repair the faulty part.



(e) Measure resistance between front oxygen sensor wiring harness connector EM04 terminal B and a reliable ground. Inspect whether the circuit is short to ground. otherwise, repair the faulty part.

(f) Measure voltage between front oxygen sensor wiring harness connector EM04 terminal B and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	**Standard Value**
Resistance Between EM04(B) and EM01 (47)	Less than 1 Ω
Resistance Between EM04 (B) and a Reliable Ground	10 kΩ or higher
Voltage Between EM04 (B) and a Reliable Ground	0V

Normal	Go to step 15

Step 12	Inspect the front oxygen sensor ground circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect front oxygen sensor harness connector EM04.

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(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between front oxygen sensor wiring harness connector EM04 terminal A and ECM harness connector terminal No.73. Inspect whether the circuit is open. otherwise, repair the faulty part.

(e) Measure resistance between front oxygen sensor wiring harness connector EM04 terminal A and a reliable ground. Inspect whether the circuit is short to ground. otherwise, repair the faulty part.

(f) Measure voltage between front oxygen sensor wiring harness connector EM05 terminal A and a reliable ground. Inspect whether the circuit is short to power supply. otherwise, repair the faulty part.

Test Items	**Standard Value**
Resistance Between EM04 (A) and EM01 (73)	Less than 1 Ω
Resistance Between EM04 (A) and a Reliable Ground	10 kΩ or higher
Voltage Between EM04 (A) and a Reliable Ground	0V

Execute next step as per normal.

Yes

Step 13	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 14	Replace ECM

(a) Refer to 2.2.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Step 15	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

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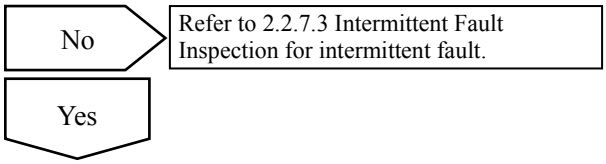

Step 16	Troubleshooting

5. Maintenance guide :

Refer to 2.4.6.1 “Replacement of Front Oxygen Sensor” to replace the front oxygen sensor

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2.2.7.23 DTC P0135

1. DTC description:

DTC	P0135	Front oxygen sensor heater fails

The pre-catalytic heated oxygen sensor (HO2S) is used for fuel control. The sensor compares the oxygen content in ambient air and oxygen content in the exhaust flow. Each heated oxygen sensor has an internal heating element for sensor heating. ECM controls the heated oxygen sensor heating control circuit. This makes the system enter into the closed-loop control mode earlier, so that ECM can calculate Air-fuel ratio earlier. ECM controls the heating control circuit switched on or off, so that heated type oxygen sensor working temperature maintains in the specified range. Engine control module detects the temperature by Measure the heater current.

Front oxygen sensor heating coil voltage is provided by the main relay controlled by ECM, when the ignition switch is turned to ON, EM04 sensor harness connector terminal D will have battery voltage. ECM controls heater working hours through ECM harness connector EM01 terminal No.14.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0135	Hardware Circuit Inspection	1. Engine Running Longer than 60 s. 2. At idle Running Condition. 3. Pre-Catalytic Oxygen Sensor Heating 4. Pre-Catalytic Oxygen Sensor Heating Control Terminal Disconnected. 5. Duration Less Than 20s.	1. Sensor Circuit 2. Sensor 3. ECM.

3. Circuit sketch

Refer to 2.2.7.22 DTC P0131 P0132 P0133 P0134.

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Inspect the existence of following factors that will affect the heated type oxygen sensor working status:

(a) Exhaust system leakage or blockage.

(b) Water enters into the heated oxygen sensor connector.

(c) After engine working in high temperature, whether exhaust pipes are too hot or not.

Next

Step 2	Inspect front oxygen sensor heater resistance.

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(a) Rotated ignition switch to OFF position .

(b) Disconnect front oxygen sensor wiring harness connector.

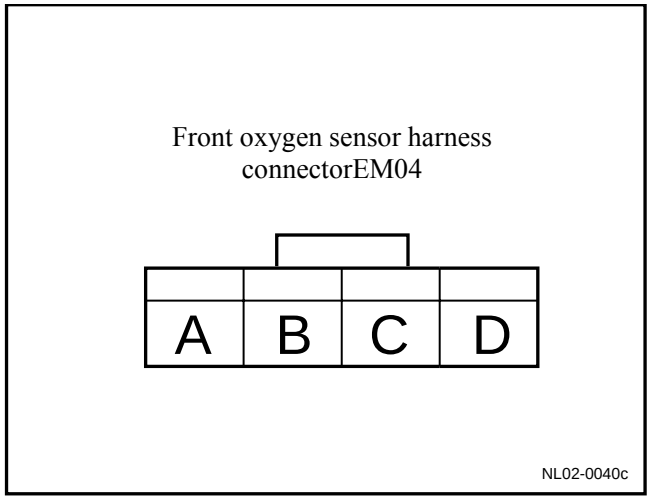
(c) Measure heater resistance between front oxygen sensor terminals C and D.

Standard Resistance

20℃(68ºF) 8.1-11.1Ω

(d) Connect front oxygen sensor wiring harness connector.

Is resistance the specified value?



No → Replace the front oxygen sensor. Go to step 11.

Yes

Step 3	Inspect the terminal No. D to ground voltage.

(a) Rotated ignition switch to OFF position.

(b) Disconnect front oxygen sensor wiring harness connector.

(c) Rotated ignition switch to ON position.

(d) Measure voltage between front oxygen sensor wiring harness connector EM04 terminal D and a reliable ground.

Standard Voltage: 11-14V

(e) Connect front oxygen sensor harness connector EM04.

Is voltage the specified value?

No → Front oxygen sensor heater power supply circuit fault

Yes

Step 4	Inspect the front oxygen sensor terminal heating control signal continuity.

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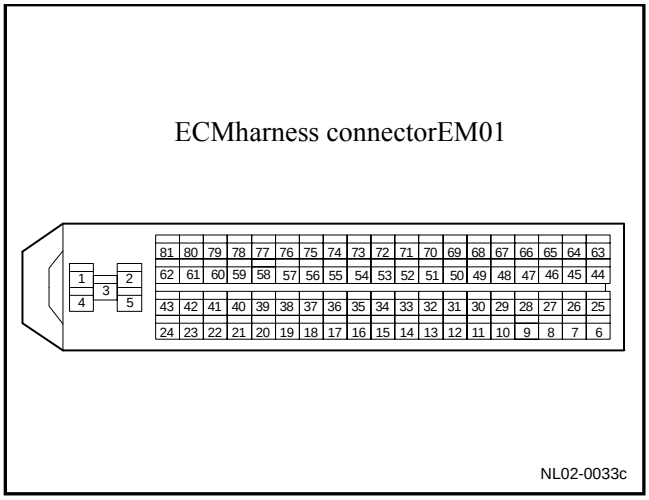
(a) Rotated ignition switch to OFF position .

(b) Disconnect front oxygen sensor harness connector EM04.

(c) Disconnect ECM harness connector EM01.

(d) Test Continuity between front oxygen sensor wiring harness connector EM04 terminal C and ECM harness connector EM01 terminal No.24.



Standard Resistance: Less than 1 Ω

(e) Connect ECM harness connector EM01.

(f) Connect the front oxygen sensor wiring harness connector EM04.

Is resistance the specified value?

No → ECM control circuit malfunction

Yes

Step 5	Inspect ECM working circuit.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 6	Replace ECM. Refer to 2.2.8.1 Replacement of Engine Control Module.

(a) Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Yes

Step 7	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 5min.

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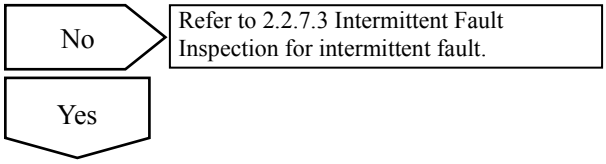
(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 8	Troubleshooting

5. Maintenance guide :

Refer to 2.4.6.2 “Replacement of Front Oxygen Sensor” to replace the front oxygen sensor

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2.2.7.24 DTC P0137 P0138 P0140

1. DTC description:

DTC	P0137	Rear Oxygen Sensor Circuit Short to Low Voltage

DTC	P0138	Rear Oxygen Sensor Circuit Short to High Voltage

DTC	P0140	Rear Oxygen Sensor Circuit Open

After the vehicle started, ECM works in open-loop mode, in which ECM ignores the heated type oxygen sensor signal voltage when calculating the Air-Fuel ratio. The control module provides approximately 450mV reference voltage to the heated oxygen sensor. When the engine starts running, the heated type oxygen sensor will be heated and begin to generate a 0-0.1V voltage. This voltage fluctuates. Once the control module detects that the heated oxygen sensor voltage exceeds a threshold voltage, it will immediately enter into the closed-loop mode. Control module determines the Air-fuel ratio using the received heated oxygen sensor voltage signal. If the heated type oxygen sensor voltage increases to above the reference voltage (tend to 1 V), the mixture is too thick. If the heated oxygen sensor voltage decreases to below the reference voltage (tend to 0mV), it indicates that the air fuel mixture is too thin.

- ECM provides a signal through ECM harness connector EM01 terminal No.48 to rear oxygen sensor wiring harness connector EM03 terminal B.
- ECM provides an internal low reference voltage through ECM harness connector EM01 terminal No.73 to front oxygen sensor wiring harness connector EM03 terminal No.A.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0137	Short to Ground When Cold	1. Engine Running Longer than 60s. 2. Water temperature is more than 70°C（158 ºF)。 3. Rear Oxygen Sensor Short to Ground 4. Duration Longer Than 25s.	1. Sensor Circuit 2. Sensor 3. ECM.
P0138	Post-catalytic Oxygen Sensor Voltage Too High	1. Engine Running Longer than 60s. 2. Water temperature is more than 70°C（158 ºF)。 3. Rear oxygen sensor signal is terminated at the power supply. 4. Duration Longer Than 13s.	
P0140	1. Oxygen Sensor Signal Circuit Open 2. Oxygen Sensor With High	1. Engine Running Longer than 60s. 2. Water temperature is more than 70°C（158 ºF)。 3. Rear oxygen sensor signal	

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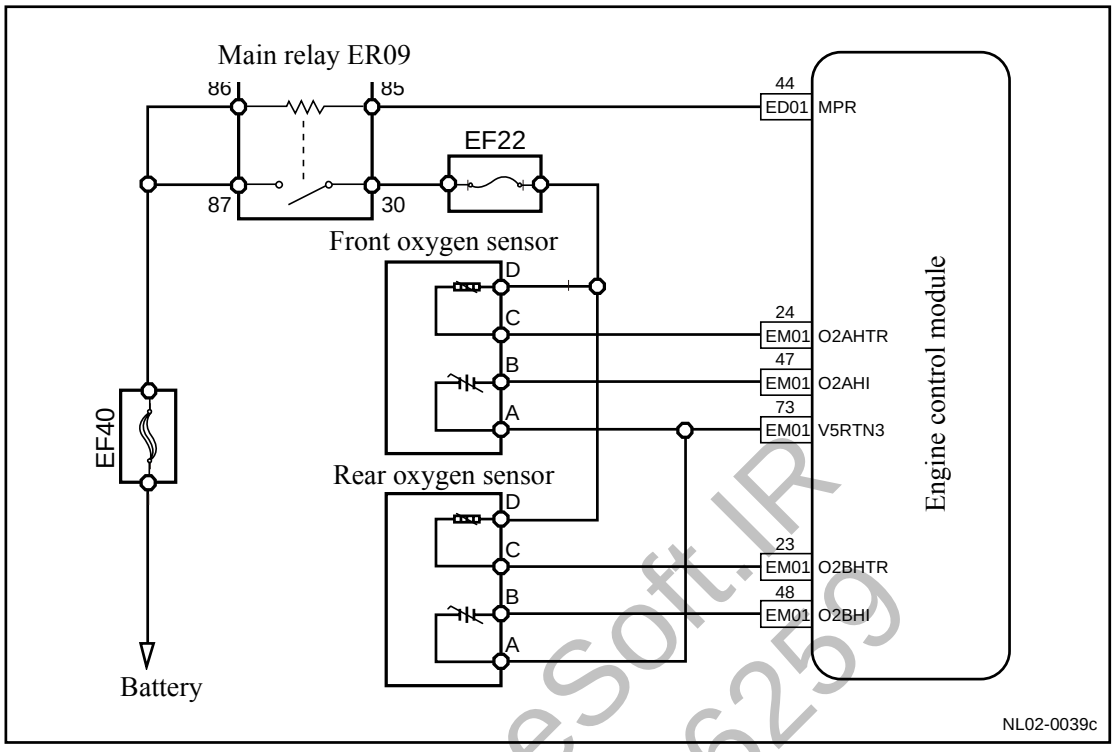
	Resistance at High Temperature	exceeds a reasonable range. 4. Duration Longer Than 165s.	

3. Circuit sketch



4. Diagnostic Steps:

Step 1	Connect a fault diagnosis tester.

Next

Step 2	Start engine and turn on the fault diagnosis tester.

Next

Step 3	(d) Select on the fault diagnosis t / Read Data Flow / Group 1 Oxygen Sensor Voltage 2 (Rear Oxygen Sensor).

Next

Step 4	Observe oxygen sensor output voltage, the data should be within 0.16-0.7V unchanged.

Yes → Intermittent fault refers to 2.2.7.3 List of Intermittent Fault.

No

Step 5	Carry out the oxygen sensor signal test.

(a) If the voltage data is consistently lower than 0.45 V (mixture too thin), carry out the

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following inspection steps:

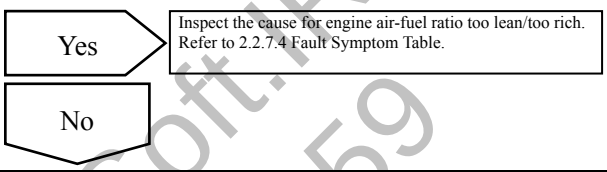
- Spray proper amount of propane gas into the intake.
- Check whether the rear oxygen sensor voltage data has a significant change, as it will cause signal voltage to rise rapidly.

(b) If the voltage data is consistently higher than 0.45 V (mixture too thick), carry out the following inspection steps:

- Put the transmission gear into neutral.
- ?Apply hand brake.
- Press the accelerator pedal so the engine speed suddenly increases to 4,000 rpm and then quickly release the accelerator pedal.
- Repeat the previous steps more than 3 times.
- Check whether the rear oxygen sensor voltage data has a significant change, as it will cause signal voltage to decrease rapidly.

During the above test, the oxygen sensor signal voltage should have a significant change.

Is voltage changed significantly?



Step 6	Inspect there are no other control system DTC codes output.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

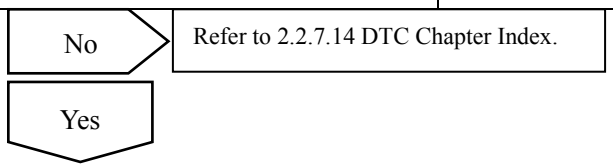
(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

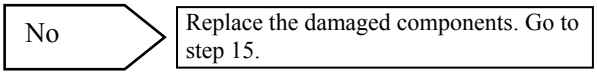
DTC Codes Shown	**To Step**
DTC codes other than P0137, P0138, P0140	No
P0137. P0138. P0140	Yes



Step 7	Inspect the sealing of exhaust system.

(a) Inspect whether the three-way catalytic converter looks good (signs of excessive heat and gasket missing, etc.).

(b) Inspect whether the exhaust pipe is intact and whether gasket is intact.



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Step 8	Measure rear oxygen sensor signal circuit.

(a) Rotated ignition switch to OFF position .

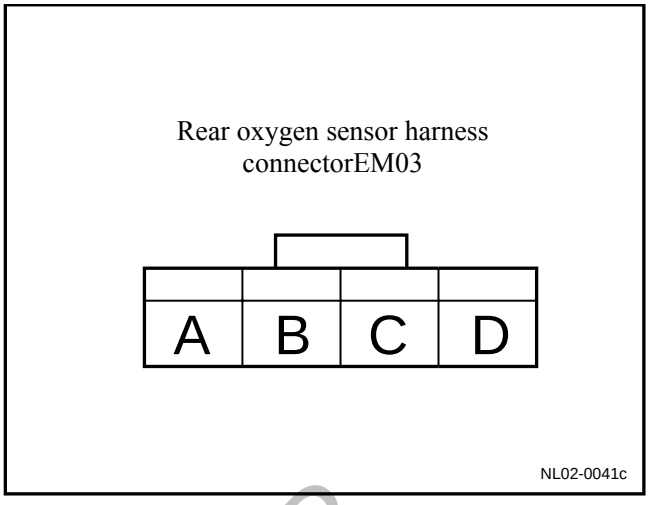
(b) Disconnect the rear oxygen sensor wiring harness connector EM03.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between rear oxygen sensor wiring harness connector EM03 terminal B and a reliable ground.

Standard Voltage: 0.35-0.5V

(e) Connect the rear oxygen sensor wiring harness connector EM03.



Is voltage the specified value?

No → Go to step 11

Yes

Step 9	Measure the rear oxygen sensor ground circuit.

(a) Rotated ignition switch to OFF position.

(b) Disconnect the rear oxygen sensor wiring harness connector EM03.

(c) Rotated ignition switches to ON position.

(d) Measure resistance between rear oxygen sensor EM03 terminals A and a reliable ground.

Standard Resistance: Less than 1 Ω

(e) Connect the rear oxygen sensor wiring harness connector EM03.

No → Go to step 12

Yes

Is resistance the specified value?

Step 10	Replace the rear oxygen sensor.

Next → Go to step 15

Step 11	Inspect the rear oxygen sensor signal circuit.

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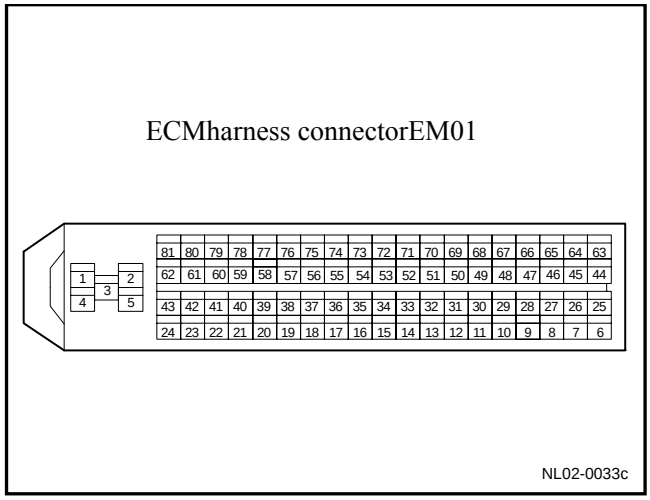
(a) Rotated ignition switch to OFF position .

(b) Disconnect the rear oxygen sensor wiring harness connector EM03.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between rear oxygen sensor wiring harness connector EM03 terminal B and ECM harness connector terminal No.48. Inspect whether the circuit is open. otherwise, repair the faulty part.



(e) Measure resistance between rear oxygen sensor harness connector EM03 terminal No.B and a reliable ground. Inspect whether the circuit is short to ground. If there is no short circuit, repair the faulty part.

(f) Measure voltage between rear oxygen sensor harness connector EM03 terminal No.B and a reliable ground. Inspect whether the circuit is short to power supply. If there is no short circuit, repair the faulty part.

Test Items	**Standard Value**
Resistance Between EM03(B) and EM01 (48)	Less than 1 Ω
Resistance Between EM03 (B) and a Reliable Ground	10 kΩ or higher
Voltage Between EM03 (B) and a Reliable Ground	0V

Normal	Go to step 13

Step 12	Inspect rear oxygen sensor ground circuit

(a) Rotated ignition switch to OFF position .

(b) Disconnect the rear oxygen sensor wiring harness connector EM03.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between rear oxygen sensor wiring harness connector EM03 terminal A and ECM harness connector terminal No.73. Inspect whether the circuit is open. otherwise, repair the faulty part.

(e) Measure resistance between rear oxygen sensor harness connector EM03 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground. If there is no short circuit, repair the faulty part.

(f) Measure voltage between rear oxygen sensor harness connector EM03 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply. If there is no short circuit, repair the faulty part.

Test Items	**Standard Value**
Resistance Between EM03 (A) and EM01 (73)	Less than 1 Ω

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Resistance Between EM03 (A) and a Reliable Ground	10 kΩ or higher
Voltage Between EM03 (A) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 13	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 14	Replace ECM

(a) Refer to 2.2.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 15	Use fault diagnosis tester to confirm if DTC is stored again.

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Repair the faulty part.

Yes

Step 16	Troubleshooting

5. Maintenance guide:

Refer to 2.4.6.1 “Replacement of Rear Oxygen Sensor” to replace the rear oxygen sensor.

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2.2.7.25 DTC P0141

1. DTC description:

DTC	P0141	Rear Oxygen Sensor Heater Inoperation

The post-catalytic heated oxygen sensor (HO2S) is used for monitoring three-way catalytic converter working status. The sensor compares the oxygen content in ambient air and oxygen content in the exhaust flow. Each heated oxygen sensor has an internal heating element for sensor heating. ECM controls the heated oxygen sensor heating control circuit. This makes the system enter into the closed-loop control mode earlier, so that ECM can calculate Air-fuel ratio earlier. ECM controls the heating control circuit switched on or off, so that heated type oxygen sensor working temperature maintains in the specified range. Engine control module detects the temperature by Measure the heater current.

The rear oxygen sensor heating coil voltage is provided by The Main Relay controlled by ECM. When the ignition switch is turned to ON, Post-Catalytic oxygen sensor connector EM03 terminal D will have battery voltage. ECM controls the heater working hours by ECM harness connector EM01 terminal No.23.

2. Conditions for Setting DTC and the Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0135	Hardware Circuit Inspection	1. Engine Running Longer than 60 s. 2. At idle Running Condition. 3. Pre-Catalytic Oxygen Sensor Heating 4. Pre-Catalytic Oxygen Sensor Heating Control Terminal Disconnected. 5. Duration Less Than 20s.	1. Sensor Circuit 2. Sensor 3. ECM.

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3. Circuit sketch

Refer to2.2.7.24 DTC P0137 P0138 P0140.

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Inspect the existence of following factors that will affect the heated type oxygen sensor working status:

(a) Exhaust system leakage or blockage.

(b) Water enters into the heated oxygen sensor connector.

(c) After engine working in high temperature, whether exhaust pipes are too hot or not.

Next

Step 2	Inspect the rear oxygen sensor heater resistance.

(a) Rotated ignition switch to OFF position.

(b) Disconnect the rear oxygen sensor wiring harness connector.

(c) Measure the rear oxygen sensor heater resistance.

Standard Resistance

Connectors C and D, 8.1-11.1 Ω @ 20°C(68 °F)

No → Replace the rear oxygen sensor. Refer to 2.4.7.1 Replacement of Rear Oxygen Sensor.

Yes

(d) Connect the rear oxygen sensor wiring harness connector.

Is resistance the specified value?

Step 3	Inspect the terminal No.D to ground voltage.

(a) Rotated ignition switch to OFF position.

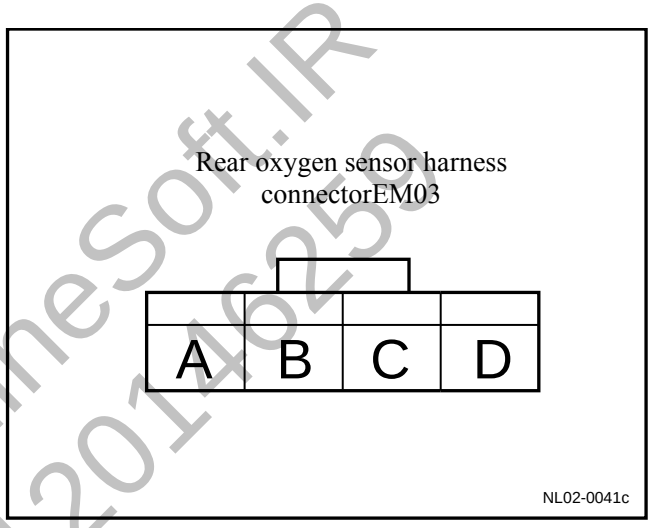
(b) Disconnect the rear oxygen sensor wiring harness connector.

(c) Rotated ignition switches to ON position.

(d) Measure voltage between Post-Catalytic oxygen sensor harness connector EM03 terminal D and ground.

Standard Voltage: 11-14V

(e) Connect the rear oxygen sensor wiring harness connector EM03.



Is voltage the specified value?

No → The rear oxygen sensor heater power supply circuit malfunction.

Yes

Step 4	Inspect the rear oxygen sensor heater control terminal continuity.

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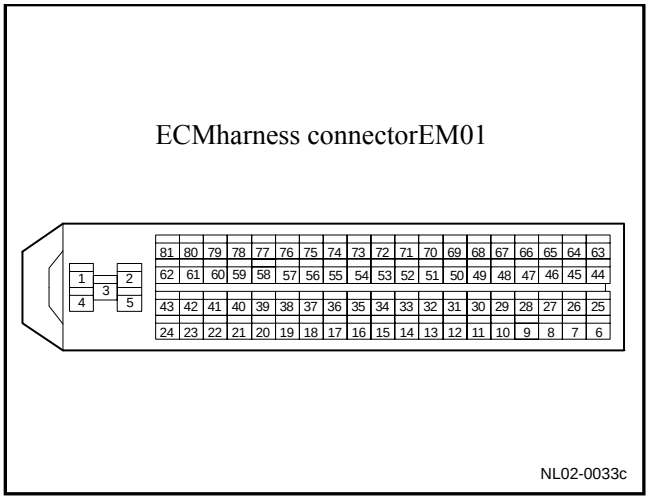
(a) Rotated ignition switch to OFF position.

(b) Disconnect the rear oxygen sensor wiring harness connector EM03.

(c) Disconnect ECM harness connector EM01.

(d) Test Continuity between rear oxygen sensor wiring harness connector EM03 terminal C and ECM harness connector EM01 terminal No.23.



Standard Resistance: Less than 1 Ω

(e) Connect ECM harness connector EM01.

(f) Connect the rear oxygen sensor wiring harness connector EM03.

Is resistance the specified value?

No → ECM control circuit malfunction.

Yes

Step 5	Inspect ECM working circuit.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 6	Replace ECM. Refer to 2.2.8.1 Replacement of Engine Control Module.

(a) Replace ECM.

(b) Carry out the crankshaft position sensor learning; refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Yes

Step 7	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 5min.

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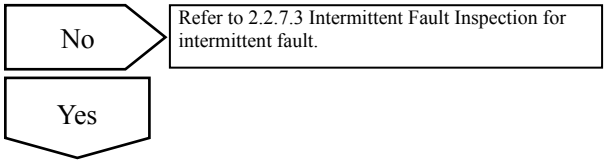
(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 8	Troubleshooting

5. Maintenance guide:

Refer to 2.4.6.1 “Replacement of Rear Oxygen Sensor” to replace the rear oxygen sensor.

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2.2.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188

1. DTC description:

DTC	P0171	Mixture Too Thin

DTC	P0172	Mixture Too Thick

DTC	P1167	Pre-catalytic Oxygen Indicating Mixture Too Thick During Deceleration

DTC	P1171	Pre-Catalytic Oxygen Indicating Mixture Too Thin During Acceleration

DTC	P2187	Mixture Too Thin When Idling

DTC	P2188	Mixture Too Thick When Idling

Engine Control Module (ECM) controls the close-loop Air-fuel ratio Measure system that achieves optimal combination of performance, fuel economy and emission control. In the close-loop mode, the engine control module monitors heated oxygen sensor (HO2S) signal voltage and adjusts fuel supply according to the signal. Changes in fuel supply will change the value of long-term and short-term fuel supply adjustment. Short-term fuel supply adjustment will respond to heated type oxygen sensor signal voltage and rapidly change. These changes will fine tune the fuel supply. Long-term fuel supply adjustment will respond to the trend in shortterm fuel supply adjustment. Long-term fuel adjustment adjusts the fuel supply in order to return to the center of the short-term fuel adjustment value and controls the short-term fuel adjustment. The ideal fuel adjustment value is around 0%. A positive value indicates that engine control module is increasing fuel supply to compensate the lean Air-fuel mixture. A negative value indicates that engine control module is decreasing fuel supply to compensate the thick Air-Fuel mixture.

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2. Conditions for Setting DTC and the Fault Location:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P0171 P0172 P1167 P1171 P2187 P2188	1. Fuel Adjustment Value Higher Than Maximum Limit 2. Fuel Adjustment Value Lower Than Minimum Limit 3. Fuel Adjustment Value Higher Than Maximum Limit (Low-Load Zone) 4. Fuel Adjustment Value Lower Than	1. Engine slows down and enters (DFCO) working condition. 2. ECM detected oxygen sensor signal voltage is higher than 0.55 V. 3. Engine enters power-enriched (PE) working condition. 4. ECM detected oxygen sensor signal voltage is lower than 0.35V.	1、Fuel Injectors 2、Canister 3、MAP 4、TPS 5、HO2S（Front）

	Minimum Limit (Low-Load Zone)	5. Duration longer than 12s.	

3. Circuit figure

Refer to 2.2.6 Electrical Schematic Diagram.

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Inspect there are no other control system DTC codes output.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Are there DTC codes other than P0171, P0172, P1167, P1171, P2187, P2188?

Yes → Refer to 2.3.6.7 DTC Code Section Index

No

Step 2	Read the intake manifold absolute pressure sensor data.

(a) Turn ignition switch to OFF position, connect fault diagnosis tester.

(b) Start vehicle .

(c) Read the intake manifold absolute pressure sensor data.

(d) Read the fault diagnosis tester for atmospheric pressure value, and compare it with table 2.2.1.3 Altitude and Atmospheric Pressure Correlation.

Is fault diagnosis tester atmospheric pressure reading normal?

No → Refer to 2.2.7.18 DTC P0107 P0108

Yes

Step 3	Read the throttle position sensor data stream.

(a) Start the vehicle.

(b) Warm up the engine with normal idle speed and throttle opening is less than 10%.

(c) Use fault diagnosis tester to read throttle position sensor data.

Is throttle position sensor data normal?

No → Refer to 2.2.7.21 DTC P0122 P0123

Yes

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4	Read the front oxygen sensor data stream.

(a) Start the vehicle.

(b) Warm up the engine with normal idle speed.

(c) Read the front oxygen sensor data stream with a fault diagnosis tester.

Front oxygen sensor standard value: 0.2-0.8 V

Is front oxygen sensor data normal?

No → Refer to 2.12.7.22 DTC P0131 P0132 P0133 P0134.

Yes

Step 5	Observe the long-term fuel adjustment parameters.

(a) Start the vehicle.

(b) Warm up the engine.

(c) Observe the long-term fuel adjustment parameter with a fault diagnosis tester.

Is the long-term fuel adjustment parameter normal?

Yes → The system is normal.

No

Step 6	Inspect engine system and its components.

(a) Turn the ignition switch to OFF position.

(b) Inspect the vacuum hose crack, kink or connections.

(c) Inspect the intake manifold, throttle body and fuel injector vacuum leakage.

(d) Inspect the crankshaft ventilation system leakage.

(e) Inspect Fuel Contamination.

(f) Inspect the working station of fuel system when the air-fuel ratio is too lean.

(g) Inspect injector nozzle spray fuel too thin.

(h) Inspect the fuel system working at Air-Fuel ratio too thick.

(i) Inspect injector spray fuel too thick.

(j) Inspect intake manifold collapse or obstruction.

(k) Inspect whether there is excessive fuel in the crankcase.

(l) Inspect evaporative emission control systems working condition.

(m) Inspect working condition of other fault lamps in the instrument.

Is engine System normal?

Yes → The system is normal.

No

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Step 7	Repair engine system and its components.

Next

Step 8	The system is normal.

5. Maintenance guide :

Refer to 2.2.8.5 “Replacement of Fuel Injectors” to replace the fuel injectors

Refer to “2.4.6.3 Replacement of Canister Solenoid Valve” to replace the canister solenoid valve.

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2.2.7.27 DTC P0222 P0223

1. DTC description:

DTC	**P0222**	Electronic Throttle Position Sensor #2 Circuit Low Voltage

DTC	**P0223**	Electronic Throttle Position Sensor #2 Circuit High Voltage

TPS2 sensor sends signal through ECT harness connector EM28 terminal C to ECM through ECM harness connector EM01 terminal No.27. If the TPS2 sensor signal is lost, but ECM is able to receive the normal TPS1 sensor signal, then ECM controls the engine to enter reliability of determining the driver's intention decline or no high power output mode. Engine's responding to the pedal changes becomes slow and engine power output will be significantly weaker, although the vehicle can still be able to drive in normal traffic.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0222	Hardware Circuit Malfunction	TPS signal end short to ground or open, the input signal is less than 3.5%, DTC code set.	1. Electronic Throttle Body 2. Electronic Throttle Circuit 3. ECM
P0223	Hardware Circuit Malfunction	TPS signal end short to power supply, input signal is greater than 96.5%, DTC code set.	

3. Circuit sketch

Refer to 2.2.7.21 DTC P0122 P0123

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Inspect for DTC codes P0641, P0651, P0122, P0123.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Results

DTC Codes Shown	To Step
Only P0222 and P0223	Yes
Oil P0222, P0223, P0641 and P0651	No

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No → Refer to2. 12.7.46 DTC P0641 P0651

Yes

Step 2	Inspect EM28 terminal C.

(a) Rotated ignition switch to OFF position .

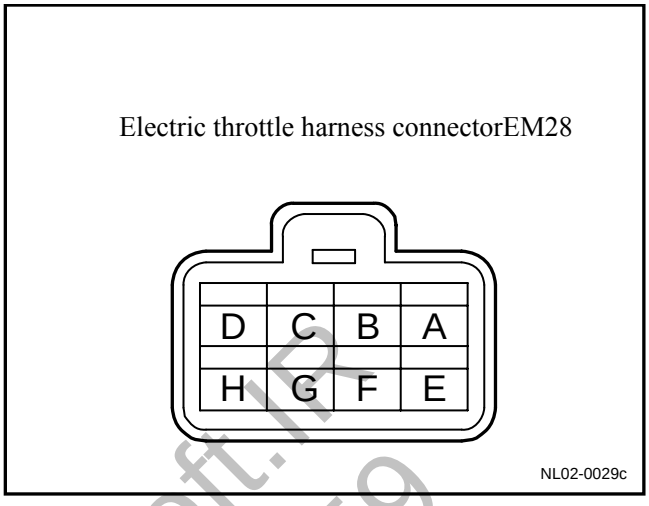
(b) Disconnect ETC harness connector EM28.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between EM28 terminal C and a reliable ground.

(e) Measure voltage between EM28 terminal C and a reliable ground.

(f) Test continuity between EM28 terminal C and EM01 terminal No.27.



Results

Test Items	**Standard Value**
Resistance Between EM28 (C) and A Reliable Ground	10 kΩ or higher
Voltage Between EM28 (C) and a Reliable Ground	0V
EM28 (C) and EM01 (27) Continuity	Less than 1 Ω

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

Step 3	Inspect terminal C voltage output signal.

(a) Connect ETC harness connector EM28.

(b) Connect ECM harness connector EM01.

(c) Measure ETC harness connector EM28 terminal C output voltage.

Standard Value: Refer to 2.2.7.12 Electronic Throttle Body (ETC) Inspection.

Is the output voltage value accorded with the standard value?

No → Circuit malfunction, repair circuit.

Yes

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Step 4	Inspect ECM Power Supply Circuit and ground circuit.

No → Power and ground circuits fault.

Yes

Step 5	Replace ECM. Refer to 2.2.8.1 Replacement of Engine Control Module.

Next

Step 6	Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 7	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again.

Verify that the system has no DTC code output.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 8	Troubleshooting

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5. Maintenance guide :

Electronic throttle body (ETC) can only be replaced as an assembly. Do not disassemble it and repair. Refer to 2.6.8.5 Replacement of Electronic Throttle Body for the replacement of ETC.

2.2.7.28 DTC P0230

1. DTC description:

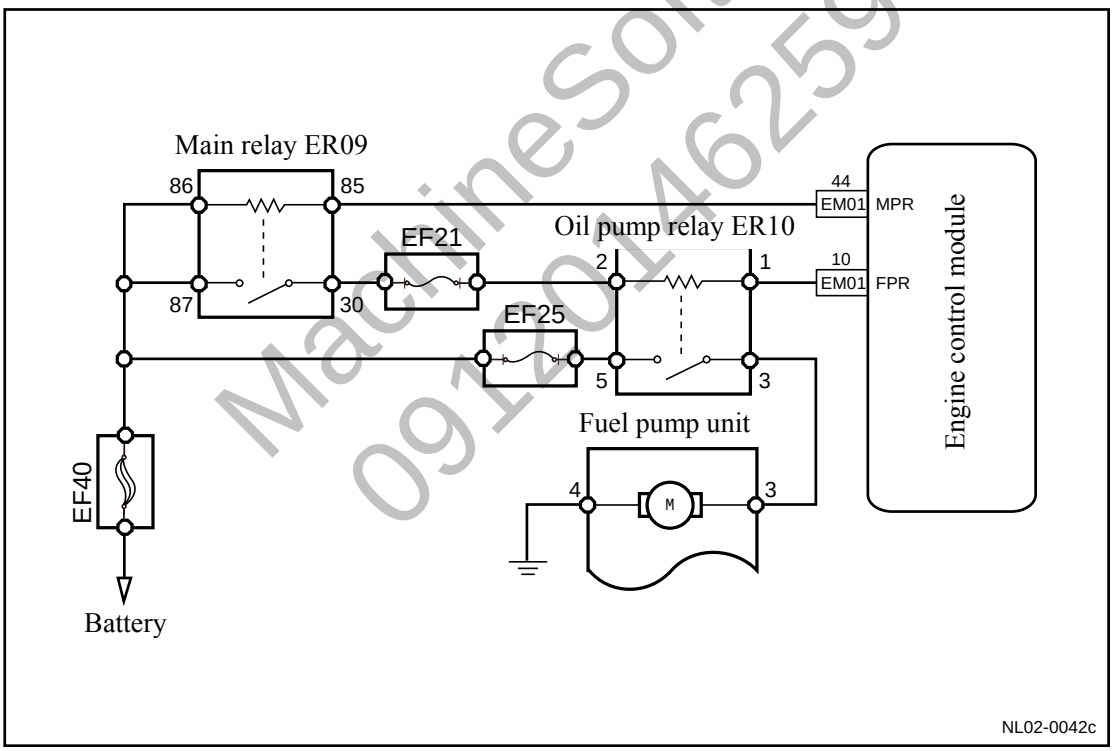
DTC	P0230	Fuel Pump Relay Fault

The power pump relay coil working voltage is provided by ECM. ECM provides power through ECM harness connector EM01 terminal No.71 to pump relay terminal No.1. The fuel pump is grounded through the terminal No.2, fuel pump relay pull-in. ECM has an internal detection circuit. By monitoring the feedback voltage ECM determines whether the control circuit is open, short to ground or short to voltage.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0230	Hardware Circuit Inspection	Fuel Pump Relay Control Circuit Short to Power Supply or Ground or Open	1. Relay Circuit 2. Relay 3. ECM.

3. Circuit sketch



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4. Diagnostic Steps:

Refer to 2.3.2 “Description and Operation” and 2.3.3 “ Operating Principle” to inspect the fuel pump relay circuit.

2.2.7.29 DTC P0261 P0262

1. DTC description:

DTC	P0261	Cylinder No.1 Fuel Injector Circuit Low Voltage Fault

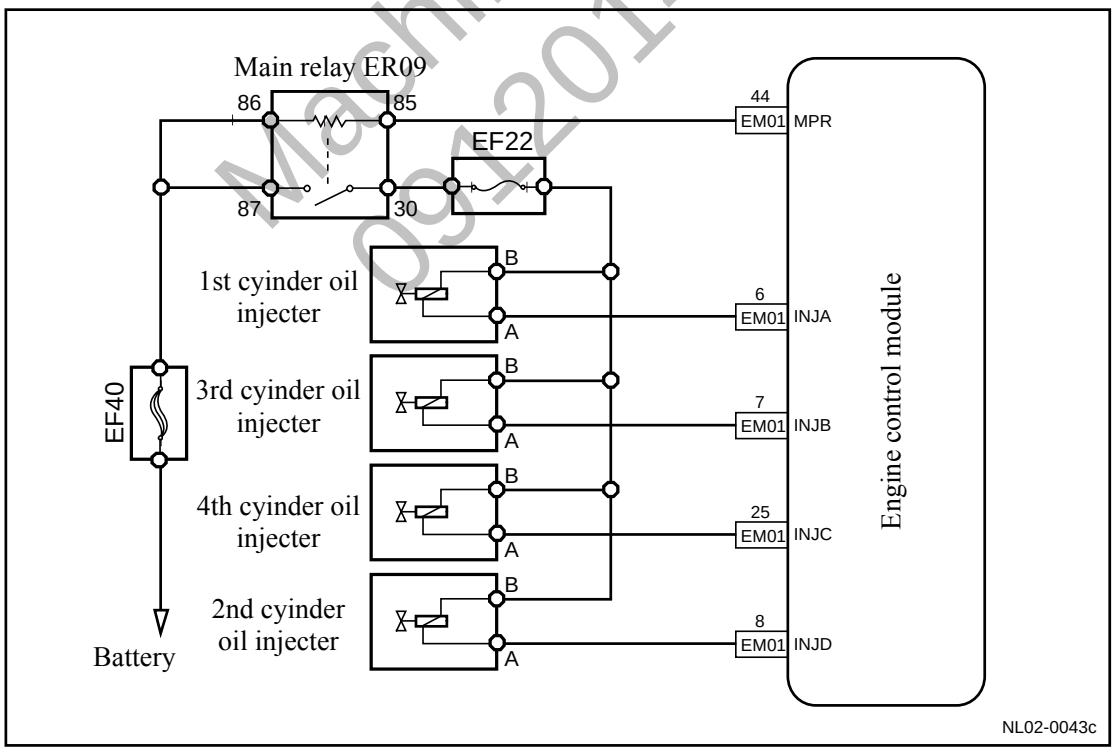
DTC	P0262	Cylinder No.1 Fuel Injector Circuit High Voltage Fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. Battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.1. ECM controls Cylinder No.1 fuel injector internal ground circuit through ECM harness connector EM01 terminal No.6. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0261	Hardware Circuit Inspection	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM.
P0262	Hardware Circuit Inspection	Injector Signal Circuit Short To Power Supply	

3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

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Step 1	Initial Inspection

(a) Inspect the fuel injector harness connector for damage, poor connection, aging or signs of loosening

Next

Step 2	Measure the fuel injector resistance.

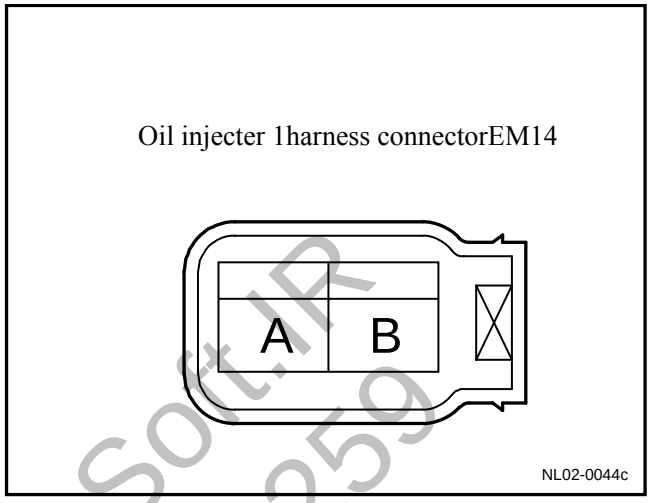
(a) Disconnect the fuel injector wiring harness connector EM14.

(b) Measure resistance between the two fuel injector terminals.

Standard Resistance

11.4-12 . 6Ω @ 20℃(68℉)

(c) Connect the fuel injector harness connector EM14.



No → Refer to 2.2.8.2 “Replacement of Fuel Injectors” to replace the fuel injectors

Yes

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Step 3	Measure Fuel Injectors Working power supply

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.1 fuel injector wiring harness connector EM14.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between cylinder No.1 fuel injector wiring harness connector EM14 terminal No.2 and a reliable ground.

Standard Voltage: 11-14V

(e) Connect cylinder No.1 fuel injector wiring harness connector EM14.

No → Go to step 5

Yes

4	Inspect the fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.1 fuel injector wiring harness connector EM14.

(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EM14 terminal No.1 and 2.

(d) Start the engine.

(e) Observe whether test lamp is flashing.

Is test lamp flashing as normal?

No	Go to step 6
Yes	Go to step 7

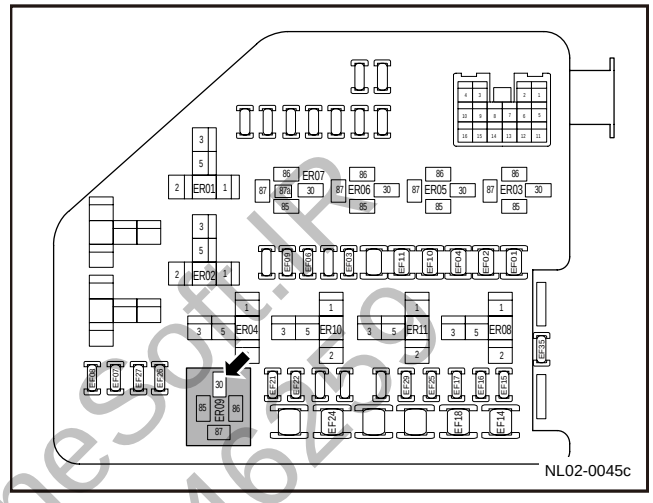
Step 5	Inspect and repair cylinder No.1 fuel injector power supply circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the fuel injector wiring harness connector EM14.

(c) Dismantle the engine main relay.

(d) Measure resistance between cylinder No.1 fuel injector wiring harness connector EM14 terminal No.B and engine main relay terminal No.30.



(e) Measure resistance between cylinder No.1 fuel injector wiring harness connector EM14 terminal No.B and a reliable ground.

(f) Install the engine main relay.

(g) Connect cylinder No.1 fuel injector harness connector EM14.

Exclude the fuel injector power supply circuit fault.

Test Items	**Standard Value**
Resistance Between EM14 (B) and Main Relay Terminal No.30	Less than 1 Ω
Resistance Between EM14 (B) and A Reliable Ground	10 kΩ or higher

Next	Go to step 9

Step 6	Inspect the Cylinder #1 fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.1 fuel injector wiring harness connector EM14.

(c) Disconnect ECM harness connector EM01.

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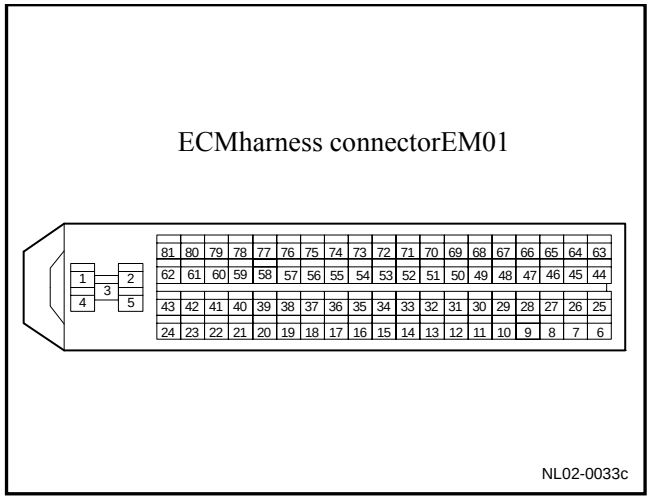
(d) Measure resistance between cylinder No.4 fuel injector wiring harness connector EM01 terminal No.A and ECM harness connector terminal No.6. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.

(e) Measure resistance between cylinder No.1 fuel injector wiring harness connector EM14 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the faulty part.



(f) Measure voltage between cylinder No.1 fuel injector harness connector EM14 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	**Standard Value**
Resistance Between EM14 (A) and EM01 (6)	Less than 1 Ω
Resistance Between EM14 (A) and a Reliable Ground	10 kΩ or higher
Voltage Between EM14 (A) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

Step 9	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

(a) Connect fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

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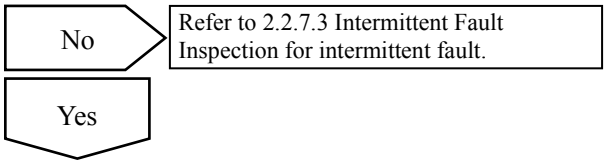
(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 10	Troubleshooting

5. Maintenance guide :

Refer to 2.3.8.5 “Replacement of Fuel Injectors” to replace the fuel injectors

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2.2.7.30 DTC P0264 P0265

1. DTC description:

DTC	P0264	Cylinder No.2 Fuel Injector Circuit Low Voltage Fault

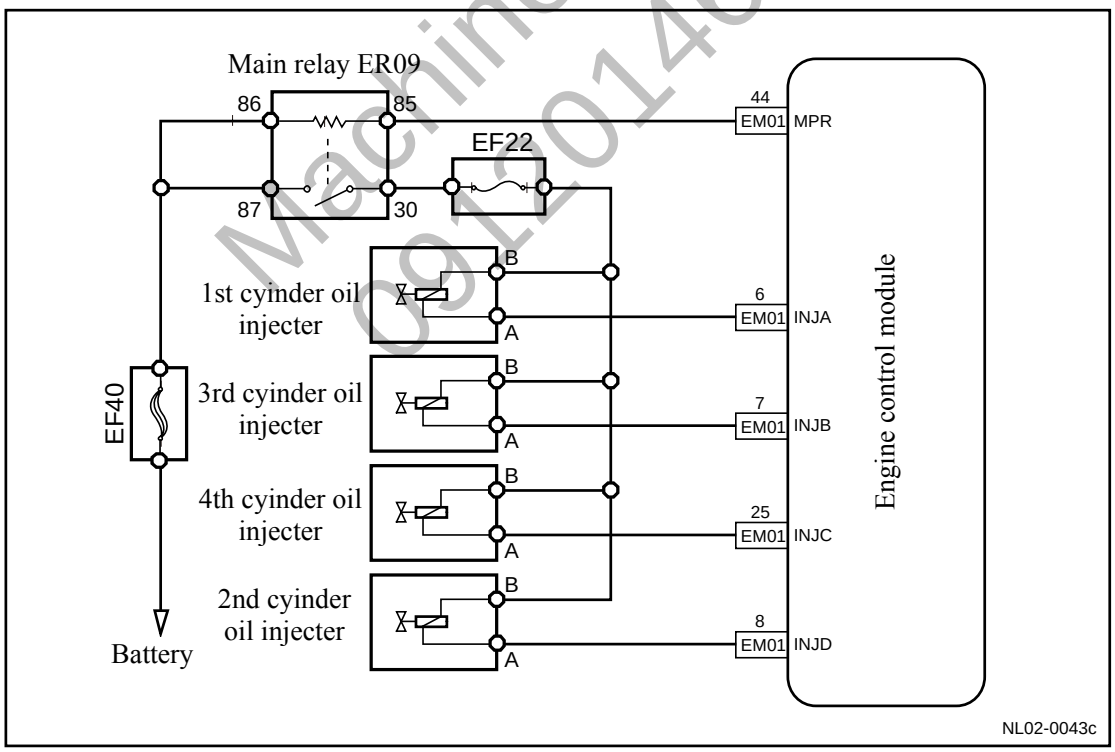
DTC	P0265	Cylinder No.2 Fuel Injector Circuit High Voltage Fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. Battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.A. ECM controls fuel injector ground circuit by ECM harness connector EM01 terminal No.8. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0264	Hardware Circuit Inspection	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM.
P0265	Hardware Circuit Inspection	Injector Signal Circuit Short To Power Supply	

3. Circuit sketch



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4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Next

Step 1	Initial Inspection

(a) Inspect the fuel injector harness connector for damage, poor connection, aging or signs of loosening

Step 2	Measure the fuel injector resistance.

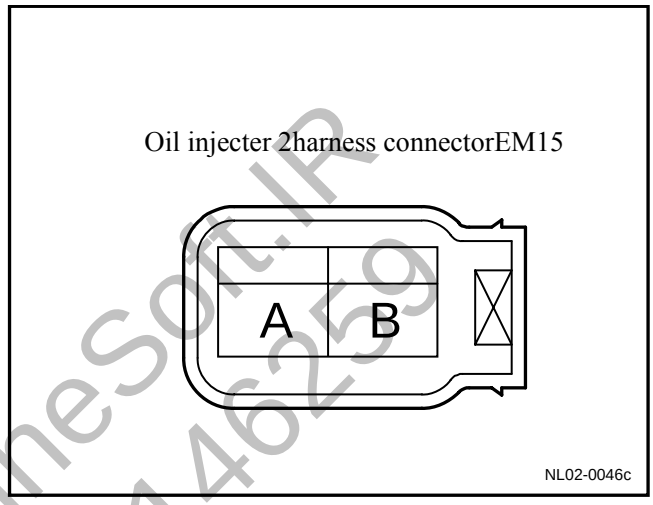
(a) Disconnect the fuel injector wiring harness connector EM15.

(b) Measure resistance between the two fuel injector terminals.

Standard Resistance

11.4-12.6Ω @ 20℃(68℉)

(c) Connect the fuel injector harness connector EM15.



No → Refer to 2.2.8.2 “Replacement of Fuel Injectors” to replace the fuel injectors

Yes

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3	Measure Fuel Injectors Working power supply

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.2 fuel injector wiring harness connector EM15.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between cylinder No.2 fuel injector wiring harness connector EM15 No.A terminal and a reliable ground.

Standard Voltage: 11-14V

(e) Connect cylinder No.2 fuel injector wiring harness connector EM15.

No → Go to step 5

Yes

Step 4	Inspect the fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.2 fuel injector wiring harness connector EM15.

(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EM15 terminal No.A and B.

(d) Start the engine.

(e) Observe whether test lamp is flashing.

Is test lamp flashing as normal?

No	Go to step 6
Yes	Go to step 7

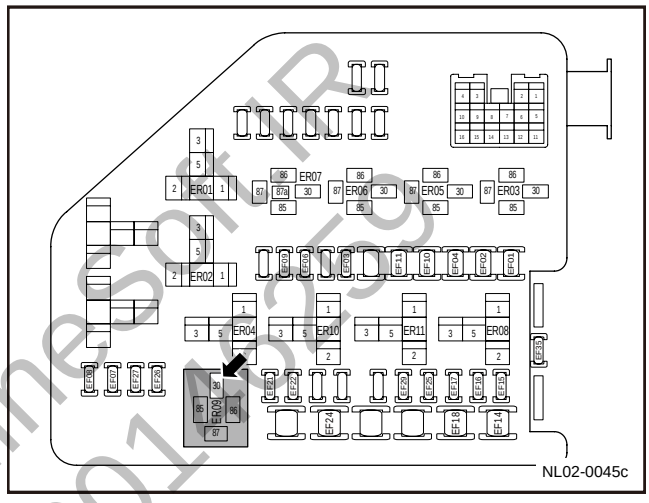
Step 5	Inspect and repair cylinder No.2 fuel injector power supply circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the fuel injector wiring harness connector EM15.

(c) Dismantle the engine main relay.

(d) Measure resistance between cylinder No.2 fuel injector wiring harness connector EM15 terminal No.B and engine main relay terminal No.30.



(e) Measure resistance between cylinder No.2 fuel injector wiring harness connector EM15 terminal No.B and a reliable ground. Standard Resistance

(f) Install the engine main relay.

(g) Connect cylinder No.2 fuel injector harness connector EM15.

Exclude the fuel injector power supply circuit fault.

Test Items	**Standard Value**
Resistance Between EM15 (B) and Main Relay Terminal No.30	Less than 1 Ω
Resistance Between EM15 (B) and A Reliable Ground	10 kΩ or higher

Next	Go to step 9

Step 6	Inspect the Cylinder #2 fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.2 fuel injector wiring harness connector EM15.

(c) Disconnect ECM harness connector EM01.

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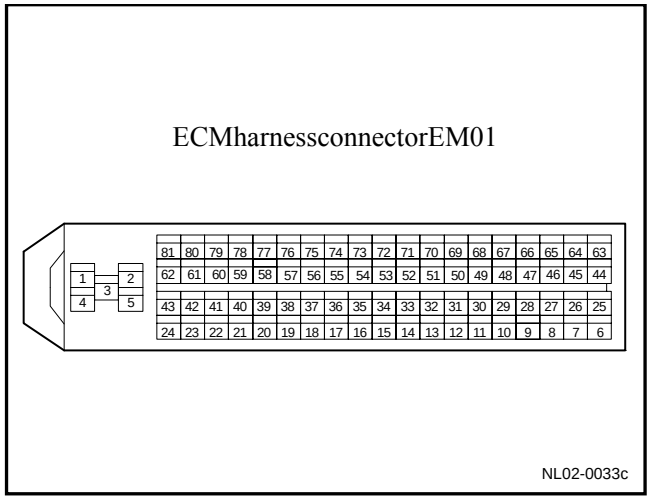
(d) Measure resistance between cylinder No.2 fuel injector wiring harness connector EM15 terminal No.A and ECM harness connector terminal No.8. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.

(e) Measure resistance between cylinder No.2 fuel injector wiring harness connector EM15 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the faulty part.



(f) Measure voltage between cylinder No.2 fuel injector harness connector EM15 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	**Standard Value**
Resistance Between EM15 (A) and EM01 (63)	Less than 1 Ω
Resistance Between EM15 (A) and a Reliable Ground	10 kΩ or higher
Voltage Between EM15 (A) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

Step 9	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

(a) Connect fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

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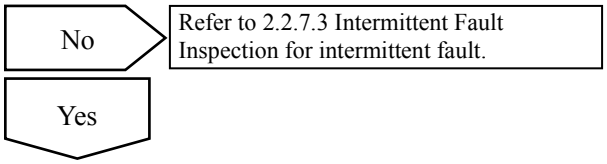
(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 10	Troubleshooting

5. Maintenance guide :

Refer to 2.2.8.5 “Replacement of Fuel Injectors” to replace the fuel injectors.

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2.2.7.31 DTC P0267 P0268

1. DTC description:

DTC	P0267	Cylinder No.3 Fuel Injector Circuit Low Voltage Fault

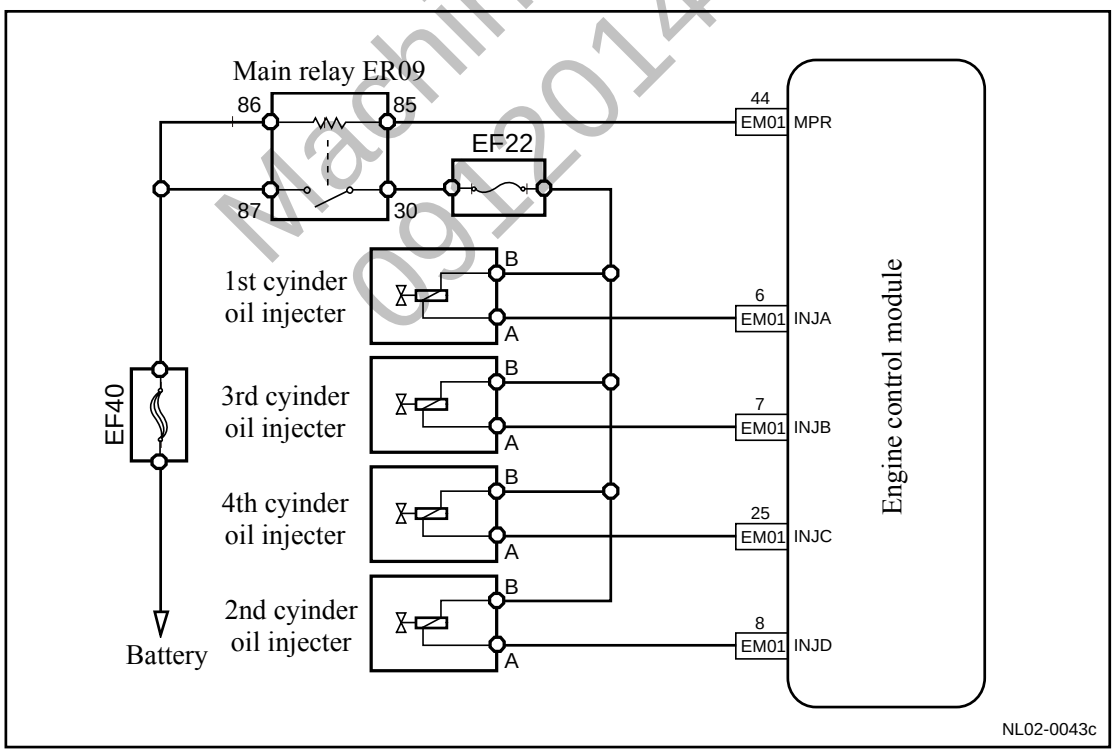
DTC	P0268	Cylinder No.3 Fuel Injector Circuit High Voltage Fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. Battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.A. ECM controls Cylinder No.3 fuel injector internal ground circuit through ECM harness connector EM01 terminal No.7. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0267	Hardware Circuit Inspection	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM.
P0268	Hardware Circuit Inspection	Injector Signal Circuit Short To Power Supply	

3. Circuit sketch



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4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and

analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a)Inspect the fuel injector harness connector for damage, poor connection, aging or signs of loosening

Next

Step 2	Measure the fuel injector resistance.

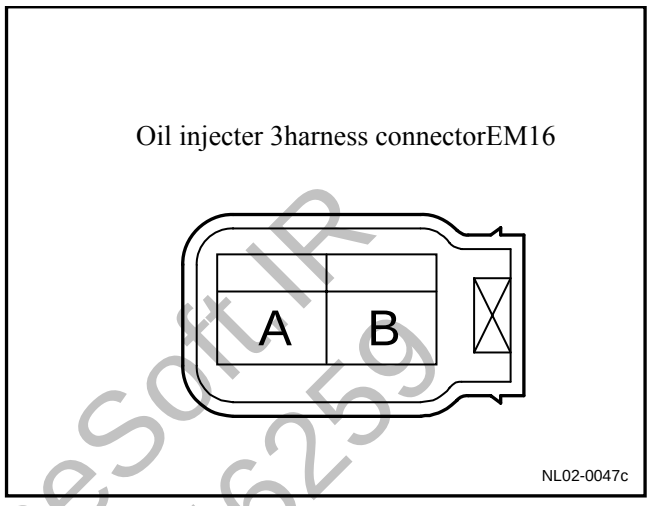
(a) Disconnect the fuel injector wiring harness connector EM16.

(b) Measure resistance between the two fuel injector terminals.

Standard Resistance

11.4-12 .6Ω @ 20℃(68℉)

(c) Connect the fuel injector harness connector EM16.



No → Refer to 2.2.8.2 “Replacement of Fuel Injectors” to replace the fuel injectors

Yes

3	Measure Fuel Injectors Working power supply

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.3 fuel injector wiring harness connector EM16.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between cylinder No.3 fuel injector wiring harness connector EM16 No.A terminal and a reliable ground.

Standard Voltage: 11-14V

(e) Connect cylinder No.3 fuel injector wiring harness connector EM16.

No → Go to step 5

Yes

Step 4	Inspect the fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.3 fuel injector wiring harness connector EM16.

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(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EM16 terminal No.A and B.

(d) Start the engine.

(e) Observe whether test lamp is flashing.

Is test lamp flashing as normal?

No	Go to step 6
Yes	Go to step 7

Step 5	Inspect and repair cylinder No.3 fuel injector power circuit.

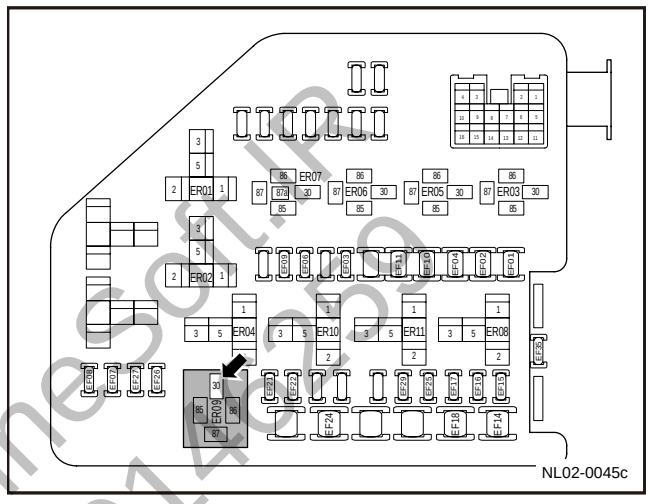
(a) Rotated ignition switch to OFF position .

(b) Disconnect the fuel injector wiring harness connector EM16.

(c) Dismantle the engine main relay.

(d) Measure resistance between cylinder No.3 fuel injector wiring harness connector EM16 terminal No.B and engine main relay terminal No.30.

(e) Measure resistance between cylinder No.3 fuel injector wiring harness connector EM16 terminal No.B and a reliable ground.



Standard Resistance

Test Items	**Standard Value**
Resistance Between EM16 (B) and Main Relay Terminal No.3	Less than 1 Ω
Resistance Between EM16 (B) and A Reliable Ground	10 kΩ or higher

(f) Install the engine main relay.

(g) Connect cylinder No.3 fuel injector harness connector EM16.

Exclude the fuel injector power supply circuit fault.

Next	Go to step 9

Step 6	Inspect the Cylinder #3 fuel injector control circuit.

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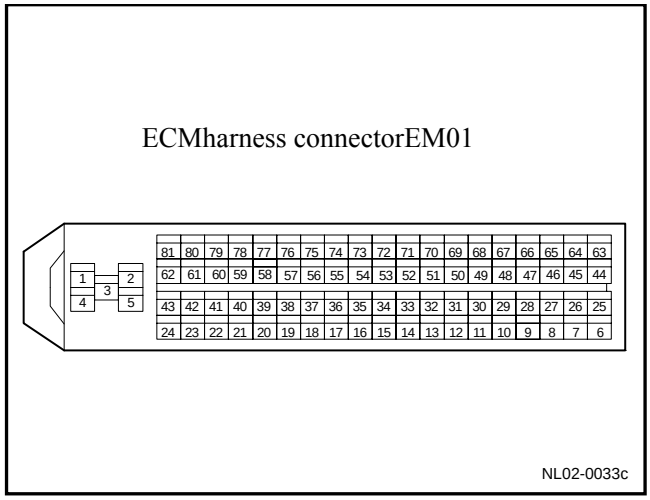
(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.3 fuel injector wiring harness connector EM16.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between cylinder No.3 fuel injector wiring harness connector EM16 terminal No.A and ECM harness connector terminal No.7. Inspect whether the circuit is open. Otherwise, repair the faulty part.



(e) Measure resistance between cylinder No.3 fuel injector wiring harness connector EM16 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the faulty part.

(f) Measure voltage between cylinder No.3 fuel injector harness connector EM16 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	**Standard Value**
Resistance Between EM16 (A) and EM01 (7)	Less than 1 Ω
Resistance Between EM16 (A) and a Reliable Ground	10 kΩ or higher
Voltage Between EM16 (A) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

Step 9	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

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(a) Connect fault diagnosis tester to the diagnostic interface.

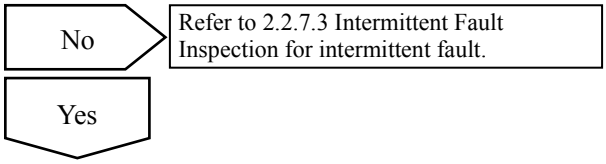
(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 10	Troubleshooting

5. Maintenance guide :

Refer to 2.2.8.5 “Replacement of Fuel Injectors” to replace the fuel injectors.

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2.2.7.32 DTC P0270 P0271

1. DTC description:

DTC	P0270	Cylinder No.4 fuel injector circuit low voltage fault

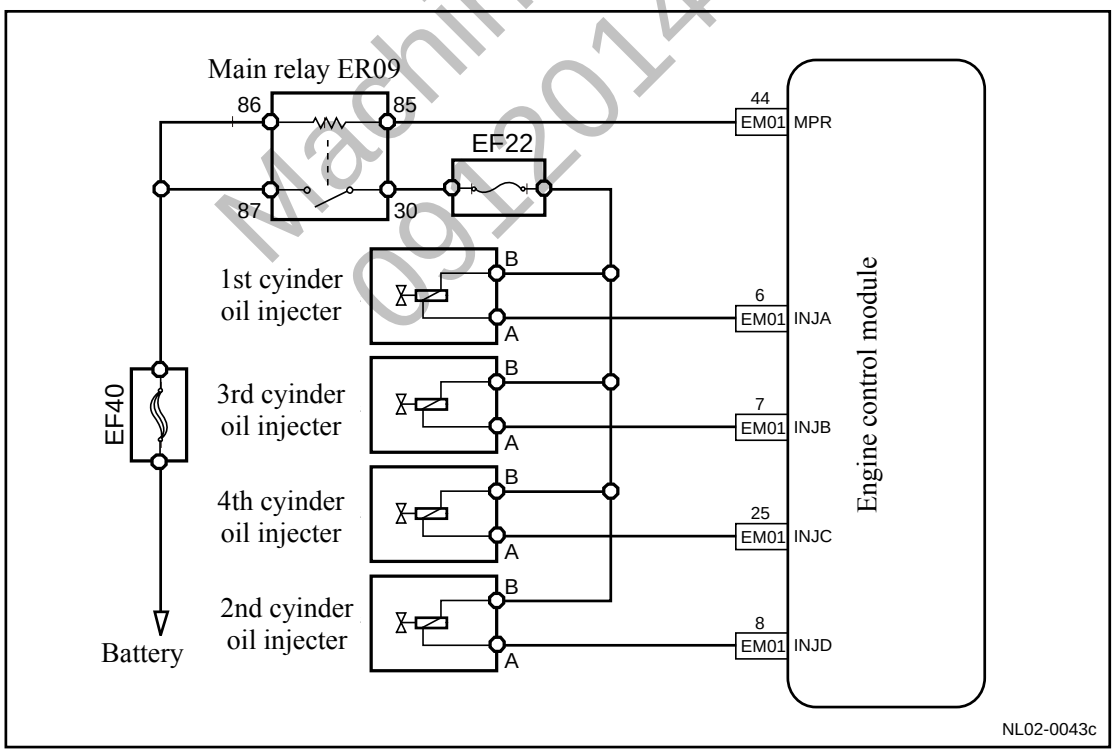
DTC	P0271	Cylinder No.4 fuel injector circuit high voltage fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. Battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.A. ECM controls Cylinder No.4 fuel injector internal ground circuit through ECM harness connector EM01 terminal No.26. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0270	Hardware Circuit Inspection	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM.
P0271	Hardware Circuit Inspection	Injector Signal Circuit Short To Power Supply	

3. Circuit sketch



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4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and

analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Inspect the fuel injector harness connector for damage, poor connection, aging or signs of loosening

Next

Step 2	Measure the fuel injector resistance.

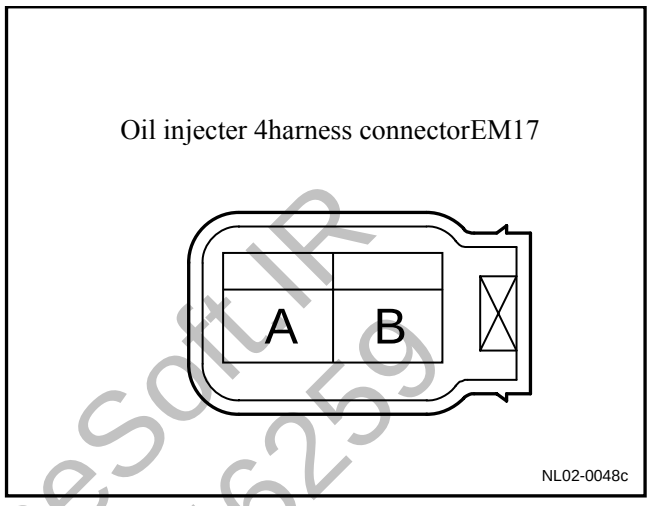
(a) Disconnect the fuel injector wiring harness connector EM17.

(b) Measure resistance between the two fuel injector terminals.

Standard Resistance

11.5-12.4Ω @ 20℃(68℉)

(c) Connect the fuel injector harness connector EM17.



No → Refer to 2.2.8.2 “Replacement of Fuel Injectors” to replace the fuel injectors

Yes

3	Measure Fuel Injectors Working power supply

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.4 fuel injector wiring harness connector EM17.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between cylinder No.4 fuel injector wiring harness connector EM17 No.A terminal and a reliable ground.

Standard Voltage: 11-14V

(e) Connect cylinder No.4 fuel injector wiring harness connector EM17.

No → Go to step 5

Yes

Step 4	Inspect the fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.4 fuel injector wiring harness connector EM17.

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(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EM17 terminal No.A and B.

(d) Start the engine.

(e) Observe whether test lamp is flashing.

Is test lamp flashing as normal?

No	Go to step 6
Yes	Go to step 7

Step 5	Inspect and repair cylinder No.4 fuel injector power circuit.

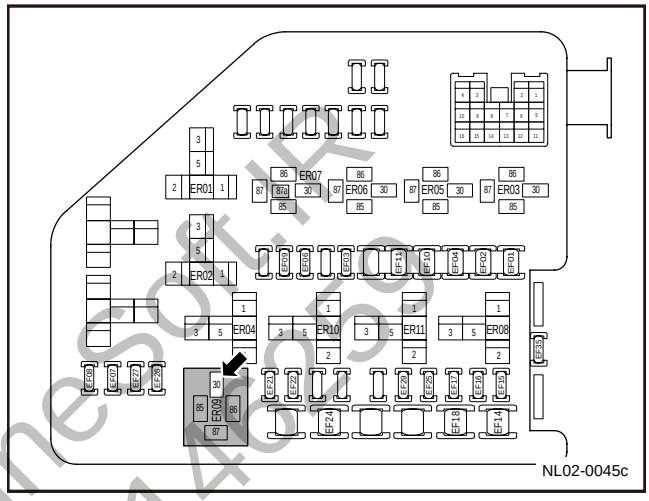
(a) Rotated ignition switch to OFF position .

(b) Disconnect the fuel injector wiring harness connector EM17.

(c) Dismantle the engine main relay.

(d) Measure resistance between cylinder No.4 fuel injector wiring harness connector EM17 terminal No.B and engine main relay terminal No.30.

(e) Measure resistance between cylinder No.2 fuel injector wiring harness connector EM17 terminal No.B and a reliable ground.



Standard Resistance

Test Items	**Standard Value**
Resistance Between EM17 (B) and Main Relay Terminal No.30	Less than 1 Ω
Resistance Between EM17 (B) and A Reliable Ground	10 kΩ or higher

(f) Install the engine main relay.

(g) Connect cylinder No.4 fuel injector harness connector EM17.

Exclude the fuel injector power supply circuit fault.

Next	Go to step 9

Step 6	Inspect the Cylinder #4 fuel injector control circuit.

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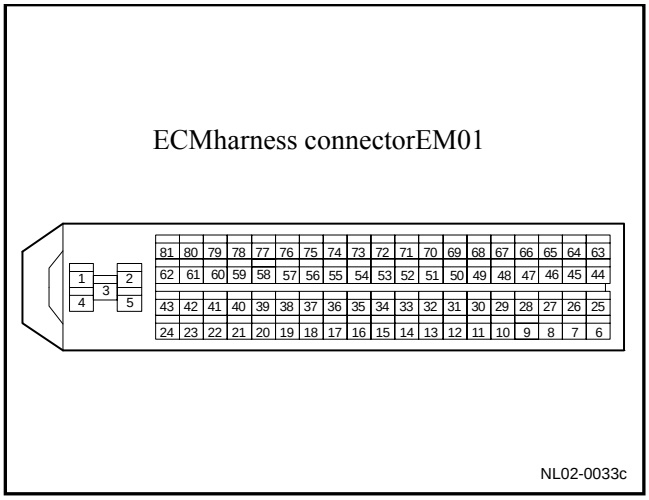
(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.4 fuel injector wiring harness connector EM17.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between cylinder No.4 fuel injector wiring harness connector EM17 terminal No.A and ECM harness connector terminal No.66. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.



(e) Measure resistance between cylinder No.4 fuel injector wiring harness connector EM17 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the faulty part.

(f) Measure voltage between cylinder No.4 fuel injector harness connector EM17 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.

Test Items	**Standard Value**
Resistance Between EM17 (A) and EM01 (26)	Less than 1 Ω
Resistance Between EM17 (A) and a Reliable Ground	10 kΩ or higher
Voltage Between EM17 (A) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

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Step 9	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

(a) Connect fault diagnosis tester to the diagnostic interface.

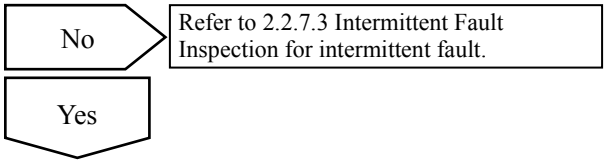
(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 10	Troubleshooting

5. Maintenance guide :

Refer to 2.2.8.5 “Replacement of Fuel Injectors” to replace the fuel injectors.

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2.2.7.33 DTC P0300

1. DTC description:

DTC	P0300	Multi-Cylinder Misfire

The engine control module (ECM) uses information from the crankshaft position (CKP) sensor and the camshaft position (CMP) sensors to determine when an engine mis?re is occurring. By monitoring variations in the crankshaft rotation speed for each cylinder ECM is able to detect individual mis?re events. When a misfire happens, unburnt mixture will be discharged into the exhaust system and burnt in the 3-way catalytic converter (TWC) which will overheat the converter. A misfire rate that is high enough can cause 3-way catalytic converter damage. The malfunction indicator lamp (MIL) will ash ON and OFF when the conditions for catalytic converter overheated are present. A DTC will be set.

2. Setting DTC code and Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0300	Under stable operating conditions, ECM detects the crankshaft rotation speed fluctuations.	Under stable operating conditions, When the ECM detects the crankshaft rotation speed fluctuations exceeding the threshold set by the system: When the fire degree is too low for affecting the exhaust emission, without emergency control scheme, only record the fault code and freeze the data stream as well as turn on the fault indication. Lamp; when the fire degree is too high, which may lead to overheating of the catalyst, compel to entering the fuel open-loop control working condition, and inhibit oxygen correction learning. The fault indicator lamp flickers with the frequency of 1HZ.	1. Connector Loose or Poor Connection 2. Vacuum Tube Hose Broken or Loose 3. Ignition System 4. Fuel Injectors 5. Fuel Pressure 6. Intake Air Pressure Sensor 7. Engine Coolant Temperature Sensor 8. Cylinder Compression Pressure 9. Valve Clearance and Timing 10. Evaporative Emission Control System 11. Purged Crankcase Ventilation System 12. Intake System 13. Poor Exhaust System Ventilation 14. ECM.

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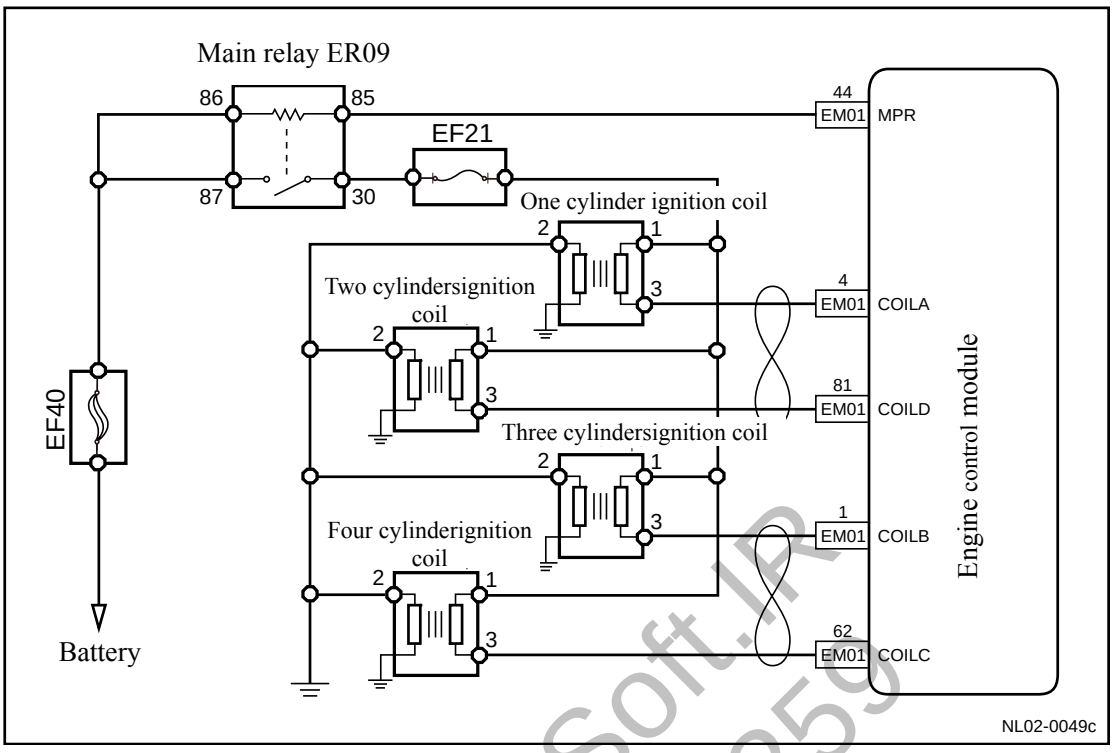
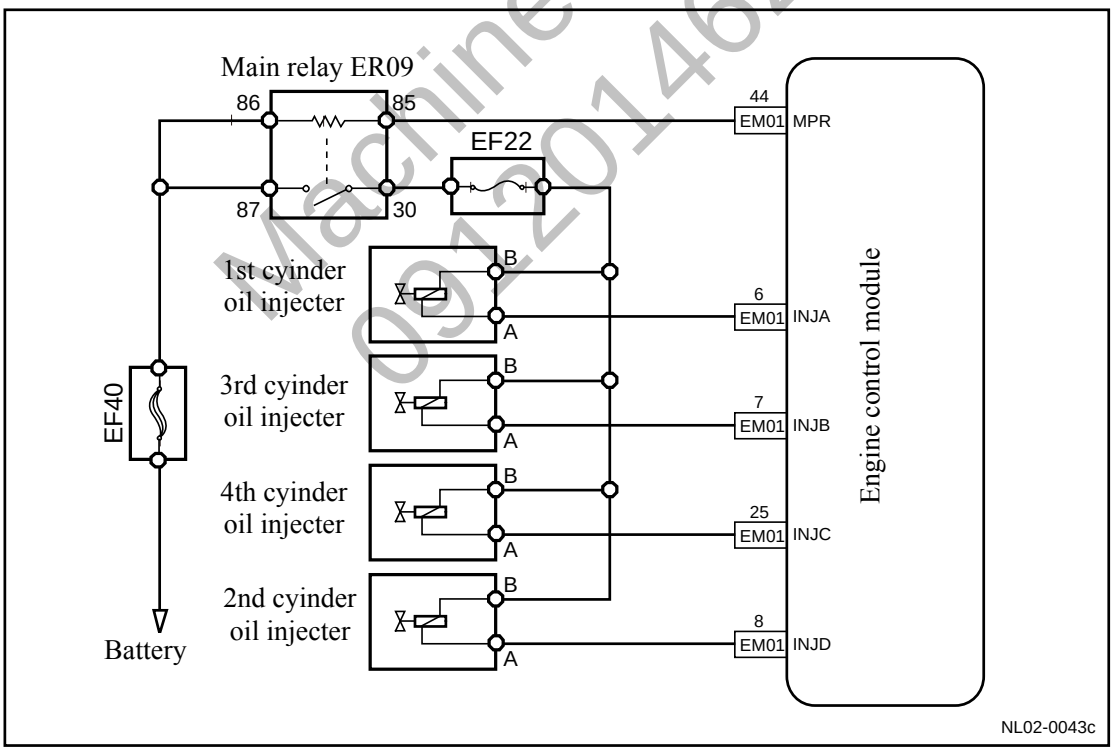
3. Circuit sketch

Ignition System



Fuel Injector Nozzle



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1. Diagnostic Steps:

Notes:

– ***If the control system stores DTC other than misfire, diagnose these DTC first and eliminate the faults.***

– ***If the vehicle does not have a misfire when sent to a service station, road test the vehicle, so that the misfire will occur again. Use fault diagnosis tester to record ECM data when misfire is occurring, in order to facilitate analyzing the cause of the fault.***

– ***If after a long period road test, ECM does not store any misfire associated DTC codes, then the fault may be due to the following reasons:***

- ***Overfill fuel tank and fuel enters the evaporative emission control system, so that the mixture is too thick and causes misfire.***
- ***Use improper fuel caused poor combustion and misfire.***
- ***Contaminated spark plug causes the ignition failure and misfire.***
- ***Carry out basic inspections at fault locations identified by DTC codes.***

– ***Road test the vehicle after repair to confirm no DTC is stored.***

Step 1	Initial Inspection

(a) Inspect the harness connector for damage, poor connection, aging or signs of loosening.

(b) Inspect the vacuum tube for damaged, loose, leakage and so on.

Next

Step 2	Inspect other DTC codes output.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Results

DTC Codes Shown	**To Step**
DTC codes other than P0300	No
DTCP0300	Yes

No → Refer to 2.2.7.14 DTC Chapter Index.

Yes

Step 3	Inspect the vacuum tube and the air intake system.

(a) Inspect vacuum canister solenoid valve connection is correct or not and leakage.

(b) Inspect the vacuum brake booster vacuum tube connection is correct or not and leakage.

(c) Inspect the intake tube pressure sensor connection is correct or not and leakage.

(d) Inspect the positive crankcase ventilation valve, ventilation pipe connection is correct or not and leakage.

(e) Inspect whether there is any leakage in the intake system.

Is there any above mentioned fault?

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Yes → Repair the faulty part. Go to step 17

No

Step 4	Inspect the spark plug

(a) Dismantle the spark plug from the misfire cylinder.

(b) Inspect whether the spark plug clearance is too large or too small.

Standard Gap: 1.0-1.1 mm (0.039-0.043 in)

(c Inspect the spark plug electrode for erosion and damage.

(d) Inspect whether the spark plug and the electrode part skirt is wet or not and Inspect the existence of a serious gasoline leakage.

(e) Reinstall the spark plug.

The existence of the above faults?

Note: Prior to the implementation of this test, the following conditions must be met:

(a) Disconnect all fuel injector connectors.

B. Run the engine for no longer than 5s.

Yes → Refer to 2.10.8.4 Replacement of Spark Plug to replace the spark plug. Go to step 8

No

Step 5	Inspect whether the spark plug arcing is normal.

(a) Test the spark.

(b) Dismantle misfire cylinder ignition wires.

(c) Disconnect all fuel injector cylinder connectors.

(d) Install the spark plug to the ignition wires.

(e) Run the engine (the engine running time no longer than 5s) and inspect the arcing.

(f) Reconnect all cylinder fuel injector connectors.

(g) Install the ignition wires.

Is spark plug arcing normal?

No → Go to step 9

Yes

Step 6	Inspect the misfire cylinder compression pressure.

The specific steps refer to 2.6.7.3 Cylinder Compression Test in 2.6Mechanical System.

Is cylinder compression pressure normal?

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Yes → Go to step 10

No

Step 7	Refer to the 2.6.7 Diagnostic Information and Procedures in the Mechanical System to inspect the cause for the low cylinder compression force.

Step 8	Inspect fuel and misfire cylinder fuel injectors.

(a) Inspect whether there is fuel injectors leakage and stagnate.

(b) Inspect fuel quality.

The existence of the above faults?

Note: Prior to the implementation of this test, the following conditions must be met:

(a) Disconnect all fuel injector connectors.

(b) Run the engine for no longer than 5s.

Yes → Repair the faulty part. Go to step 17

No

Step 9	Use a properly working spark plug and inspect whether there is misfire cylinder jump-spark.

(a) Replace the installed spark plug with a spark plug that works properly.

(b) Test spark plug.

(c) Dismantle ignition guide wire of misfire cylinder .

(d) Disconnect all fuel injector cylinder connectors.

(e) Spark plug was installed on the ignition guide wire .

(f) Run the engine (the engine running time no longer than 5 s) and inspect the arcing.

(g) Reconnect all cylinder fuel injector connectors.

(h) Install ignition guide wire .

Is spark plug arcing normal?

No → Inspect the ignition coil and ignition wire. Go to step 17.

Yes → Replace the spark plug. Refer to 2.10.8.4 Replacement of Spark Plug. Go to step 17

Step 10	Inspect ECM control connector terminal voltage of the misfire cylinder fuel injector.

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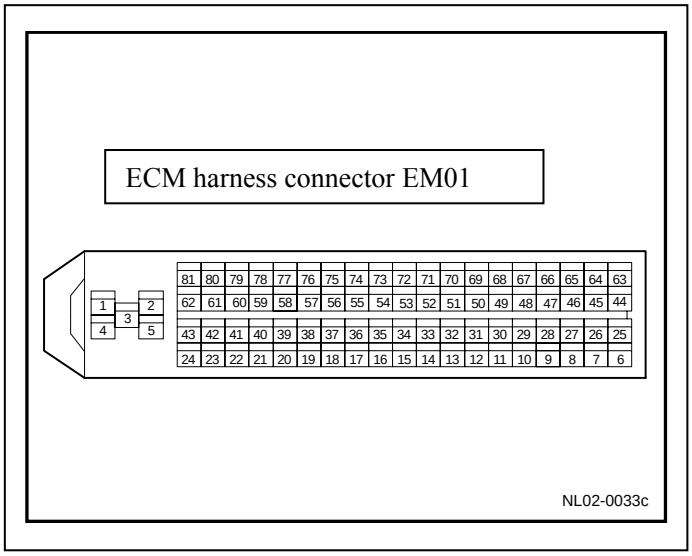
(a) Rotated ignition switch to ON position .

(b) Connect ECM harness EM01.

(c) Measure ECM harness connector EM01 terminal voltage according to the following table.



Connector terminal	Specified Value
EM01(6)	9-14V
EM01(7)	
EM01(8)	
EM01(25)	

Is voltage the specified value?

No → Inspect the fuel injector circuit. Refer to 2.2.7.29 DTC P0261、P0262.

Yes

Step 11	Inspect the misfire cylinder valve clearance.

Refer to the 2.6.8.21 Valve Clearance Adjustments in the Mechanical System, and is valve clearance normal?

No → Adjust the valve clearance. Go to step 17.

Yes

Step 12	Inspect valve timing system.

Refer to the 2.6.8.9 Replacement of Timing Chain Cover in the Mechanical System, and Is valve timing normal?

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No → Adjust the valve timing. Go to step 17.

Yes

Step 13	Inspect the fuel pressure

Refer to Fuel System in the2.3.7.3 Fuel Pressure Testing Procedure, and is fuel pressure normal?

No → Check fuel system: fuel pump, fuel filter, fuel pipe circuit and fuel pressure regulator. Go to step 17

Yes

Step 14	Inspect whether the data in the data flow table is normal.

(a) Inspect intake air pressure sensor data.

(b) Inspect engine coolant temperature sensor data.

(c) Inspect throttle position sensor.

Are these components normal?

No → Replace the damaged components. Go to step 17.

Yes

Step 15	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 16	Replace ECM

Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

Step 17	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

(a) Connect fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

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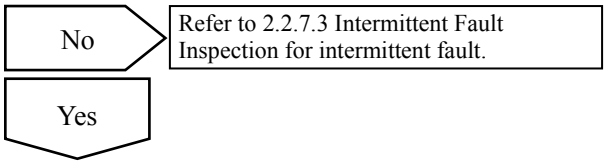

Step 18	Troubleshooting

5. Maintenance guide :

Refer to 2.10.7.4 Replacement of Spark Plug to replace the spark plug.

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2.2.7.34 DTC P0324, P0325

1. DTC description:

DTC	P0324	Knock Control System Fault

DTC	P0325	Knock Sensor Fault

KS sensor to ECM feedback signal helps ECM control the ignition timing to achieve the optimal operation and the ignition system to achieve the best performance, as well as to prevent damage to the engine by a potential knock. KS sensor is located below the intake manifold on the cylinder. KS sensor voltage changes with the AC signal generated by the vibration with running engine. Engine control module adjusts spark timing according to KS sensor signal amplitude and frequency.

ECM receives signals from KS sensor harness connector EM06 terminal No.1 and 2 through ECM harness connector EM01 terminal No.36 and 37.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0324	Knock Control System Fault	1. Engine speed is higher than 1,600 rpm. 2. Certain Load Conditions. 3. Any section of the sensor signal circuit is short to ground.	1. Sensor Circuit 2. Sensor 3. ECM.
P0325	Knock Sensor Fault	1. Engine speed is higher than 1,600 rpm. 2. Certain Load Conditions. 3. Sensor Signal Circuit Open.	

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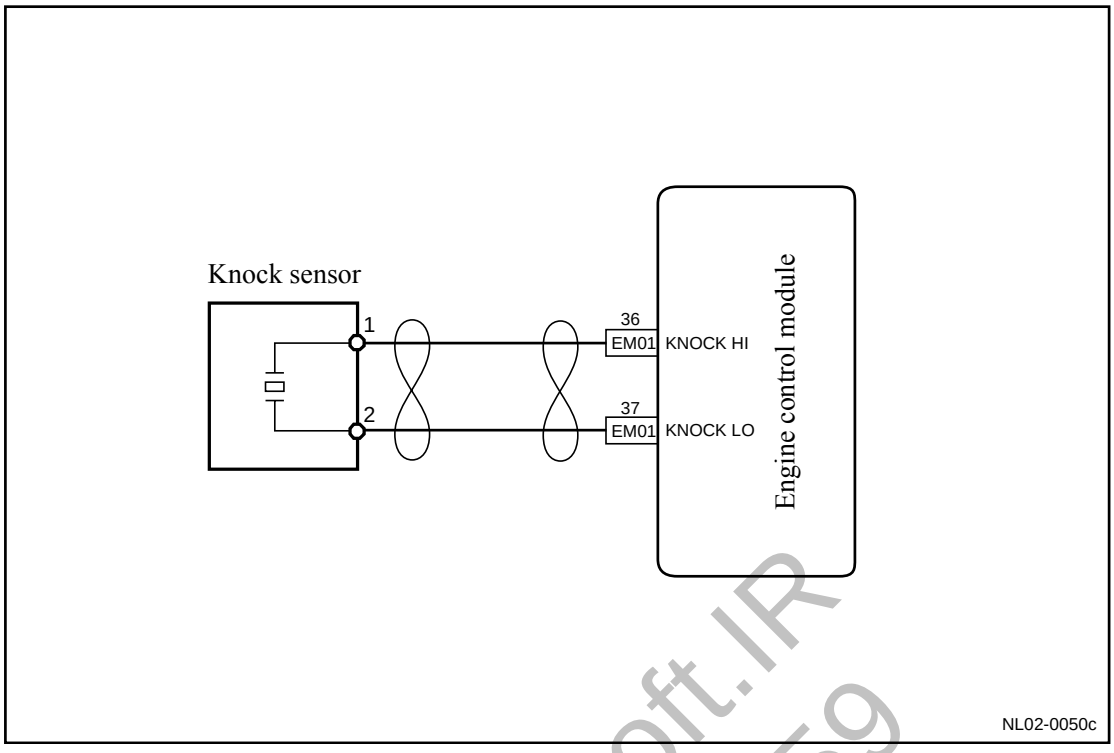
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Inspect whether there is KS sensor physical damage.

(b) Inspect whether KS sensor is installed correctly. Torque is set too tight or too loose will trigger DTC codes.

(c) Check KS sensor installation surface whether there are glitches, casting flash and foreign matter.

(d) Knock sensor must be kept away from hoses, brackets and engine wires.

Are these components normal?

No → Repair the faulty part. Go to step 9

Yes

Step 2	Read the engine data (engine speed) on the fault diagnosis tester.

(a) Connect fault diagnosis tester to diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Select Engine/Read Data/Knock Sensor Signal 1.

(d) Start and run the engine at normal working temperature.

(e) Road test the vehicle and read the engine speed data on the fault diagnosis tester.

Is the data normal?

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Standard Value: Normal data. Refer to 2.2.7.9 Data Flow Table

No → Go to step 4

Yes

Step 3	Refer to 2.2.7.4 Fault Symptom Table for intermittent fault.

Step 4	Inspect Knock Sensor

(a) Rotated ignition switch to OFF position .

(b) Disconnect knock sensor harness connector EM06.

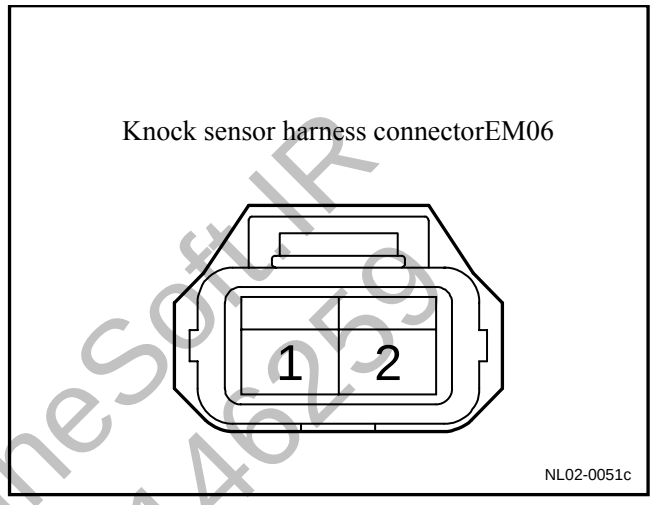
(c) Measure knock sensor resistance.

Standard Resistance

It is above 1MΩ with 1MΩ

(d) Connect knock sensor harness connector EM06.

Is the resistance normal?



No → Refer to 2.10.7.5 “Replacement of Knock Sensor” to replace the knock sensor. Go to Step 9.

Yes

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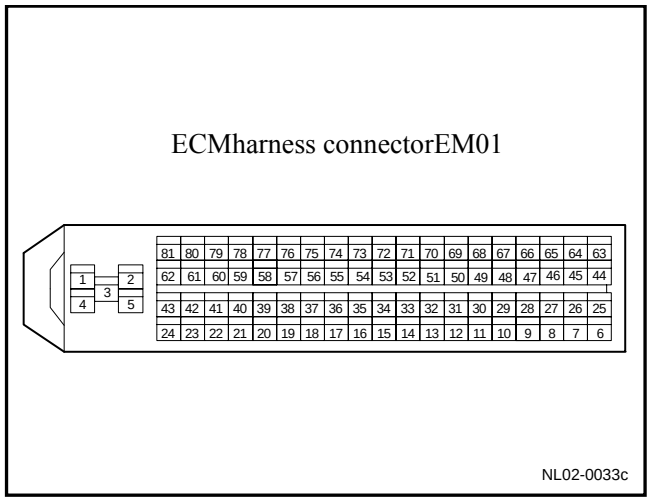
Step 5	Inspect sensor terminal No.1 circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect knock sensor harness connector EM06.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between knock sensor harness connector EM06 terminal No.1 and ECM harness connector EM01 terminal No.36. Inspect whether the circuit is open.



(e) Measure resistance between knock sensor harness connector EM06 terminal No.1 and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure resistance between knock sensor harness connector EM06 terminal No.1 and a reliable ground. Inspect whether the circuit is short to power supply.

Test Items	**Standard Value**
Resistance Between EM06 (1) and EM01 (36)	Less than 1 Ω
Resistance Between EM06 (1) and a Reliable Ground	10 kΩ or higher
Voltage Between EM06 (1) and a Reliable Ground	0V

Are the values specified values?

No → Repair the faulty part. Go to step 9

Yes

Step 6	Inspect sensor terminal No.2 circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect knock sensor harness connector EM06.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between knock sensor harness connector EM06 terminal No.2 and ECM harness connector EM01 terminal No.37. Inspect whether the circuit is open.

(e) Measure resistance between knock sensor harness connector EM06 terminal No.2 and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure resistance between knock sensor harness connector EM06 terminal No.2 and a reliable ground. Inspect whether the circuit is short to power supply.

Test Items	**Standard Value**
Resistance Between EM06 (2) and EM01 (37)	Less than 1 Ω
Resistance Between EM06 (2) and a Reliable Ground	10 kΩ or higher
Voltage Between EM06 (2) and a Reliable Ground	0V

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Are the values specified values?

No → Go to step 12

Yes

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part. Go to step 12

Yes

Step 8	Replace ECM

Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Yes

Step 9	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Repair the faulty part. Go to step 13

Yes

Step 10	Troubleshooting

5. Maintenance guide :

Refer to 2.10.7.5 Replacement of Knock Sensor to replace the knock sensor.

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2.2.7.35 DTC P0335, P0336

1. DTC description:

DTC	P0335	No signal from crankshaft position sensor circuit

DTC	P0336	Crankshaft Position Sensor Circuit Signal Interference

CKP sensor signal provides ECM with current crankshaft speed and position. CKP sensor produces an alternating voltage with different amplitude and frequency. Frequency depends on the crankshaft speed and the AC output voltage depends on the CKP. CKP sensor works with a fixed 58X variable reluctance rotor on the crankshaft. ECM calculates the ignition timing, injection timing, and knock ignition timing based on CKP sensor and camshaft position sensor input signals. CKP sensor is also used to detect misfire and tachometer display. ECM uses CAN network to send the engine speed signal to the instrument.

CKP sensor signal is sent through CKP sensor harness connector EM07 terminals A, B to ECM harness connector No.EM01 terminals No.30 and 11.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0335	Hardware Circuit Inspection	1. During startup, the crankshaft position sensor is disconnected, short to Ground and short to power supply. 2. Fault timer accumulated time is longer than 2 s.	1. Sensor Circuit 2. Sensor 3. ECM 4. Sensor signal disc
P0337	Hardware Circuit Inspection	1. Crankshaft position sensor and the signal tooth gap is too large. 2. The difference between actual identified number of teeth and 58 teeth is larger than a specified value.	

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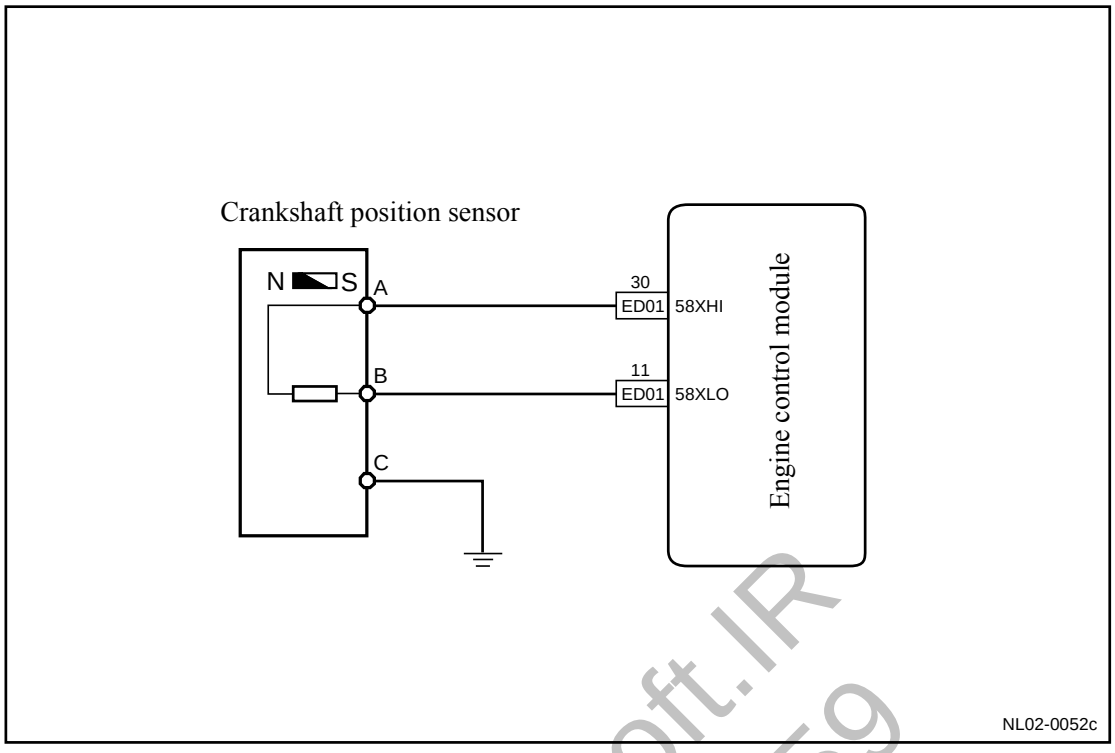
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Inspect the sensor wiring harness connector EM07 whether there is loose or poor connection and so on.

(b) Inspect whether the sensor is installed correctly.

(c) Inspect whether the sensor gap is normal.

No → Repair the faulty part. Go to step 10

Yes

Step 2	Read the engine data (engine speed) on the fault diagnosis tester.

(a) Connect fault diagnosis tester to diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Select Engine/Reading Data/Engine Speed.

(d) Start the engine.

(e) With the engine running, read the engine data on the fault diagnosis tester

Standard Value: Normal data. Refer to 2.2.7.9 Data Flow Table

(f) If the engine does not start, inspect the data with the engine running.

(g) If the engine speed is shown as 0, it indicates the circuit between the crankshaft position sensor and ECM wiring harness open or short.

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Yes → Go to step 4

No

Step 3	Refer to 2.2.7.4 Fault Symptom Table for intermittent fault.

Step 4	Inspect crankshaft position sensor.

(a) Rotated ignition switch to OFF position .

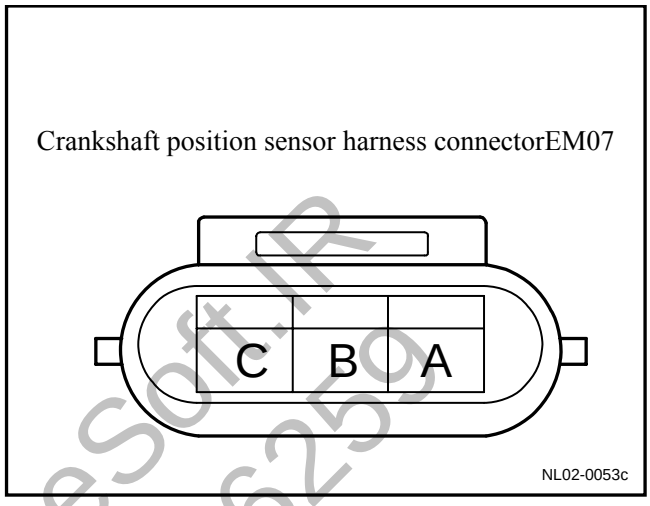
(b) Disconnect the crankshaft position sensor wiring harness connector EM07.

(c) Measure crankshaft position sensor resistance.

Standard Resistance

25℃(77ºF) 900-1100Ω

(d) Connect the crankshaft position sensor wiring harness connector EM07.



Is the resistance normal?

No → Refer to 2.10.7.2 "Replacement of Crankshaft Position Sensor" to replace the crankshaft position sensor. Go to Step 10.

Yes

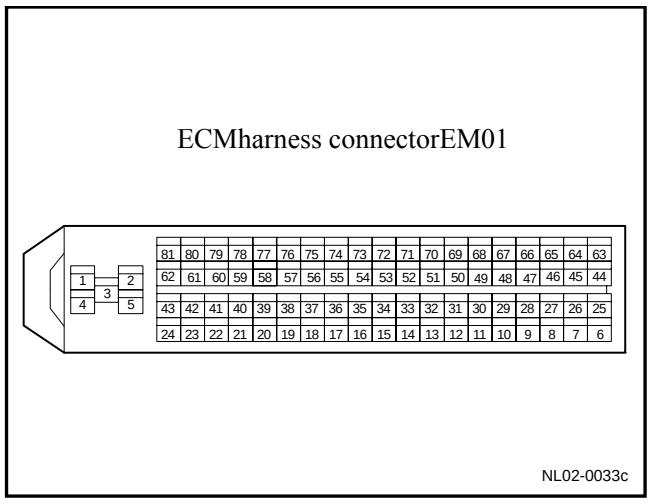
Step 5	Inspect sensor terminal No.A circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the crankshaft position sensor wiring harness connector EM07.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between crankshaft position sensor wiring harness connector EM07 terminal No.A and ECM harness connector EM01 terminal No.30. Inspect whether the circuit is open.



(e) Measure resistance between crankshaft position sensor harness connector EM07 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground.

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(f) Measure voltage between crankshaft position sensor wiring harness connector EM07 terminal A and power supply. Inspect whether the circuit is short to power supply.

Test Items	**Standard Value**
Resistance Between EM07 (A) and EM01 (30)	Less than 1 Ω
Resistance Between EM07 (A) and A Reliable Ground	10 kΩ or higher
Voltage Between EM07 (A) and A Reliable Ground	0V

Are the values specified values?

No → Repair the faulty part. Go to step 10

Yes

Step 6	Inspect sensor terminal B circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the crankshaft position sensor wiring harness connector EM07.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between crankshaft position sensor wiring harness connector EM07 terminal No.B and ECM harness connector EM01 terminal No.11. Inspect whether the circuit is open.

(e) Measure resistance between crankshaft position sensor harness connector EM07 terminal No.B and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure voltage between crankshaft position sensor wiring harness connector EM07 terminal B and power supply. Inspect whether the circuit is short to power supply.

Test Items	**Standard Value**
Resistance Between EM07 (B) and EM01 (11)	Less than 1 Ω
Resistance Between EM07 (B) and A Reliable Ground	10 kΩ or higher
Voltage Between EM07 (B) and A Reliable Ground	0V

Are the values specified values?

No → Repair the faulty part. Go to step 10

Yes

Step 7	Inspect sensor signal plate.

(a) Inspect whether the sensor signal plate is damaged, missing and so on.

(b) Inspect whether the sensor signal plate is installed correctly.

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No → Repair the faulty part. Go to step 10

Yes

Step 8	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 9	Replace ECM

(a) Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

Step 10	Use fault diagnosis tester to confirm whether the DTC Code is stored again.

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 11	Troubleshooting

5. Troubleshooting

Refer to 2.10.7.2 “Replacement of Crankshaft Position Sensor” to replace the crankshaft position sensor.

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2.2.7.36 DTC P0340 P0341

1. DTC description:

DTC	P0340	VCP Camshaft Position Sensor Status Diagnosis

DTC	P0341	VCP Target Wheel Diagnosis

Camshaft position (CMP) sensor is used to detect camshaft position, and is associated with the crankshaft position. It sends signals to the engine control module (ECM) to determine the upcoming fuel injection. Engine Control Module (ECM) also uses the camshaft position sensor output to determine the camshaft to the crankshaft relative position to control the valve timing of camshaft adjustment and conduct emergency operations.

Intake Camshaft position sensor circuit includes the following:

– Reference Voltage: ECM provides a reference voltage to CMP sensor harness connector EM18 terminal C via ECM harness connector EM01 terminal No.70.

– Signal Circuit: ECM receives signal voltage from CMP sensor harness connector EM18 terminal A via ECM harness connector EM01 terminal No.77.

– ECM Low Reference Voltage Circuit: ECM provides a low reference voltage to CMP sensor harness connector EM18 terminal B via ECM harness connector EM01 terminal No.74.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0340	ECM detects the engine running but does not receive the intake camshaft position sensor signal	1. ECM detects the engine running. 2. ECM detects the crankshaft position sensor signal. 3. The intake Camshaft position sensor signal is lost.	1. Sensor Circuit 2. Sensor 3. the intake Camshaft Signal Wheel 4. ECM
P0341	ECM detects the engine running, but receives a the intake camshaft position sensor signal and that does not match calibration.	1. ECM detects the engine running. 2. ECM detects the crankshaft position sensor signal. 3. ECM detected camshaft position sensor signal does not match the reference crankshaft position sensor signal.	

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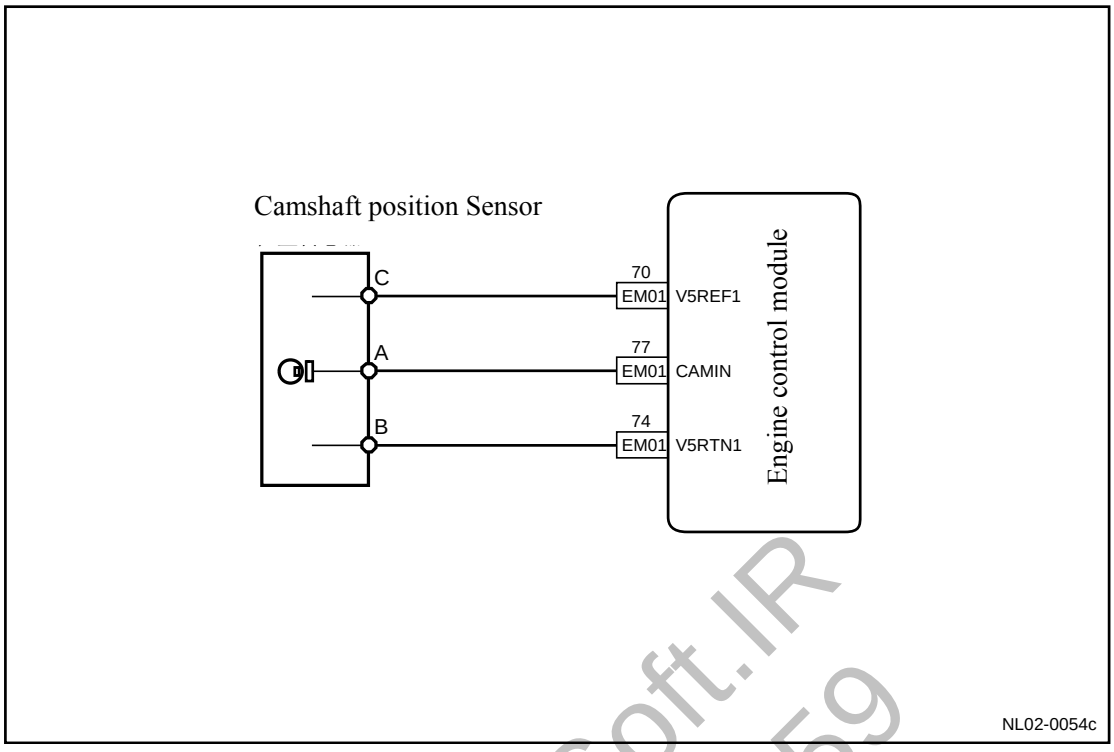
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Inspect the sensor wiring harness connector EM18 whether there is loose or poor connection and so on.

(b) Inspect whether the sensor is installed correctly.

(c) Inspect whether the sensor gap is normal.

Are these components normal?

No → Repair the faulty part. Go to step 9

Yes

Step 2	Measure sensor 5 V reference voltage.

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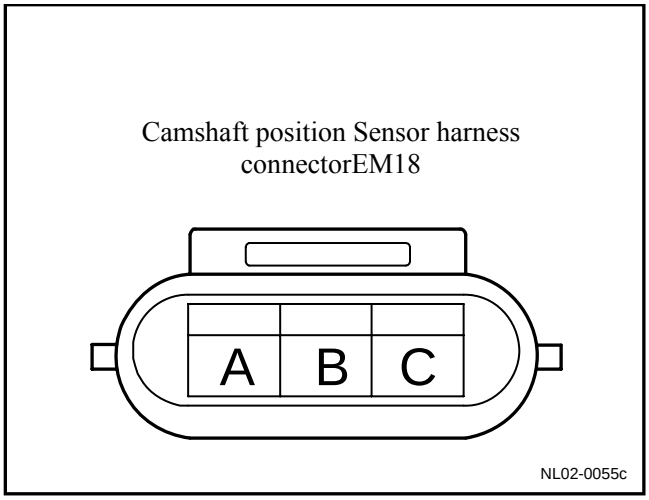
(a) Rotated ignition switch to OFF position .

(b) Disconnect the intake camshaft position sensor wiring harness connector EM18.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between the intake camshaft position sensor wiring harness connector EM18 terminal No.C and a reliable ground.



Standard Voltage: 4.5-5.5V

(e) Connect the intake camshaft position sensor wiring harness connector EM18.

Is the value specified value?

No	Go to step 6
Yes	

Step 3	Measure Sensor Signal Circuit

(a) Rotated ignition switch to OFF position .

(b) Disconnect the intake camshaft position sensor wiring harness connector EM18.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between the intake camshaft position sensor wiring harness connector EM18 terminal A and a reliable ground.

Standard Voltage: 4.5-5.5V

(e) Connect the intake camshaft position sensor wiring harness connector EM18.

Is the value specified value?

No	Go to step 7
Yes	

Step 4	Test sensor ECM internal low reference circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the intake camshaft position sensor wiring harness connector EM18.

(c) Rotated ignition switch to ON position .

(d) Measure resistance between the intake camshaft position sensor wiring harness connector EM18 terminal B and reliable ground.

Standard Resistance: Less than 3 Ω

(e) Connect the intake camshaft position sensor wiring harness connector EM18.

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Is the value specified value?

No	Go to step 8
Yes	

Step 5	Refer to 2.10.7.1 “Replacement of Camshaft Position Sensor” to replace the intake camshaft position sensor.

Next	Go to step 12

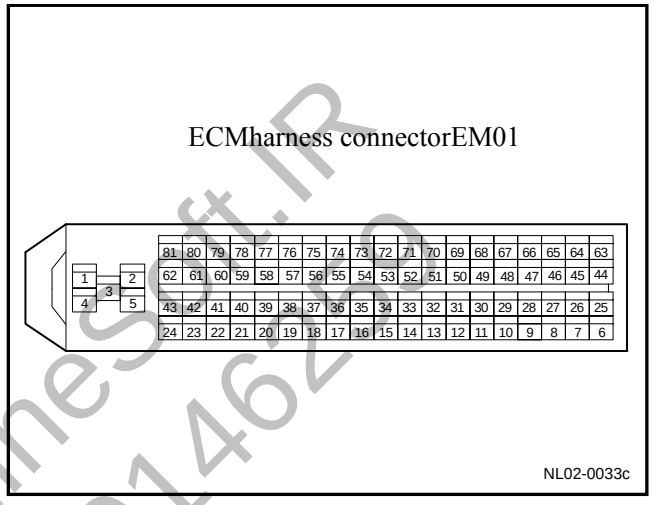
Step 6	Inspect the sensor 5 V reference voltage circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the intake camshaft position sensor wiring harness connector EM18.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between intake camshaft position sensor wire harness connector EM18 terminal B and ECM wire harness connector EM01 terminal 70. Inspect whether there is short-circuit situation.



(e) Measure resistance value between air intake camshaft position sensor harness connector EM18 C terminal and reliable grounding, check if circuit exist short circuit condition .

(f) Measure voltage value of air intake camshaft position sensor harness connector EM18 C terminal and reliable grounding, Check if circuit exist condition of short-circuit of power supply

Test Items	**Standard Value**
Resistance Between EM18 (C) and EM01 (70)	Less than 1 Ω
Resistance Between EM18 (C) and Reliable Ground	10 kΩ or higher
Voltage Between EM18 (C) and Reliable Ground	0V

Execute next step as per normal.

Next	Repair the faulty part. Go to step 12

Step 7	Inspect Sensor Signal Circuit

(a) Rotated ignition switch to OFF position .

(b) Disconnect the intake camshaft position sensor wiring harness connector EM18.

(c) Disconnect ECM harness connector EM01.

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(d) Measure resistance between intake camshaft position sensor wire harness connector EM18 terminal A and ECM wire harness connector EM01 terminal 77. Inspect whether there is short-circuit situation.

(e) Measure resistance between intake camshaft position sensor wire harness connector EM18 terminal A and reliable grounding.Inspect wheter there is grounding short-circuit.

(f) Measure resistance between intake camshaft position sensor wire harness connector EM18 terminal A and reliable grounding. Inspect whether there is power supply short-circuit situation.

Test Items	**Standard Value**
Resistance Between EM18 (A) and EM01 (77)	Less than 1 Ω
Resistance Between EM18 (A) and Reliable Ground	10 kΩ or higher
Voltage Between EM18 (A) and Reliable Ground	0V

Are the values specified values?

No → Repair the faulty part. Go to step 12

Yes

Step 8	Inspect sensor ECM internal low reference circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the intake camshaft position sensor wiring harness connector EM18.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between intake camshaft position sensor wire harness connector EM18 terminal B and ECM wire harness connector EM01 terminal 74. Inspect whether there is short-circuit situation.

(e) Measure voltage value between air intake camshaft position sensor harness connector EM18 B terminal and reliable grounding, check if circuit exist condition of short-circuit of power supply.

Test Items	**Standard Value**
Resistance Between EM18 (B) and EM01 (18)	Less than 1 Ω
Voltage Between EM18 (B) and Reliable Ground	0V

Execute next step as per normal.

Next

Step 9	Inspect whether the intake camshaft signal plate is normal.

No → Repair the faulty part.

Yes

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Step 10	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 11	Replace ECM

Next

Step 12	Use scan tool to confirm whether the DTC Code is stored again.

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 13	Troubleshooting

5. Maintenance guide :

Refer to2.10.7.1 Replacement of Camshaft Position Sensor to replace the intake CMP sensor.

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2.2.7.37 DTC P0351 P0352 P0353 P0354

1. DTC description:

DTC	P0351	Cylinder 1 Ignition Circuit malfunction

DTC	P0352	Cylinder 2 Ignition Circuit malfunction

DTC	P0353	Cylinder 3 Ignition Circuit malfunction

DTC	P0354	Cylinder 4 Ignition Circuit malfunction

Ignition coil #1 initiate the ignition for Cylinder #1; ignition coil #2 initiate the ignition for Cylinder #2; ignition coil #3 initiate the ignition for Cylinder #3; ignition coil #4 initiate the ignition for Cylinder #4. The ignition relay supplies power for the four ignition coils. ECM uses the ECM harness connector EM01 terminal #4 to control Cylinder #1 ignition coil primary circuit to be grounded; uses the terminal #1 to control Cylinder #2 ignition coil primary circuit to be grounded; uses the terminal #62 to control Cylinder #3 ignition coil primary circuit to be grounded; uses the terminal #81 to control Cylinder #4 ignition coil primary circuit to be grounded.

2. DTC Code Set Up and Removal Conditions:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P0351	Hardware Circuit Inspection	Operating at idle, with the ignition coil control end disconnected, short to ground or short to power supply, this DTC code will be set. The fuel injection of the cylinder with this DTC code will stop leading to engine speed fluctuates.	1. Ignition Coil Circuit 2. Ignition Coil 3. ECM
P0352			
P0353			
P0354			

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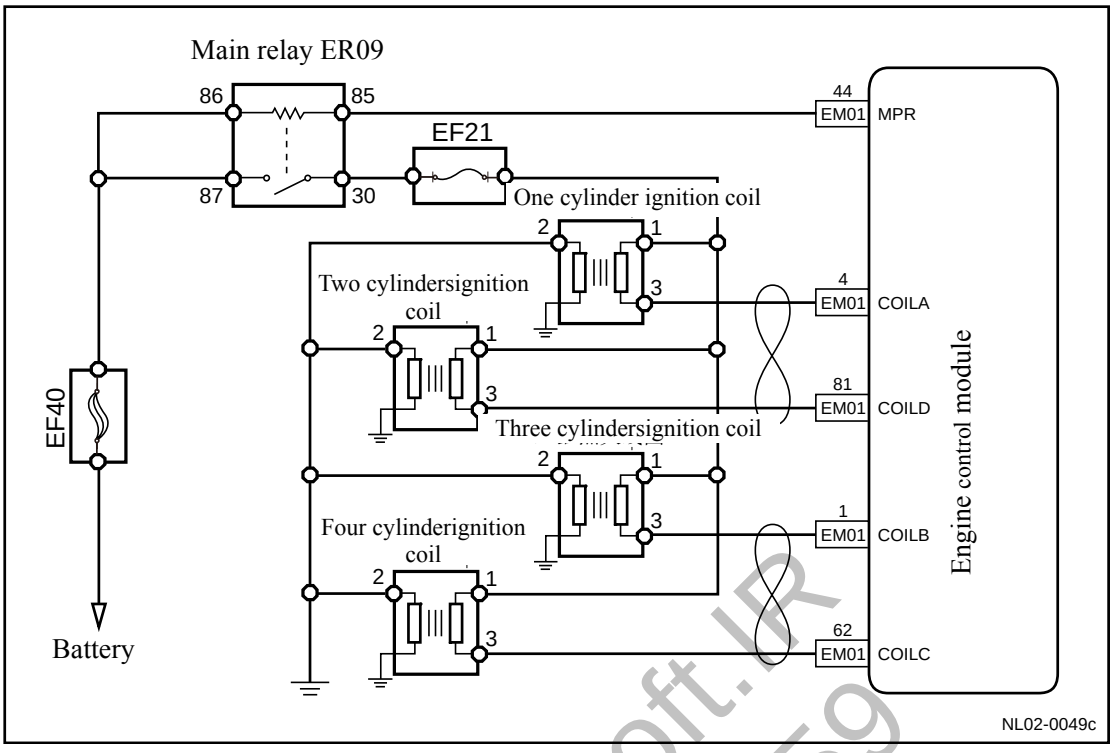
3. Circuit figure



4. Diagnostic Steps:

Refer to 2.10.6 “Diagnostic Information and Procedures” for ignition coil inspection.

5. Maintenance guide

Refer to 2.10.7.3 “Replacement of Ignition Coil” to replace the ignition coil.

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2.2.7.38 DTC P0420

1. DTC description:

DTC	P0420	Three-Way Catalytic Converter Conversion Efficiency Low

ECM uses two oxygen sensors (front oxygen sensor and rear oxygen sensor) installed before and after the three- way catalytic converters to monitor the conversion efficiency of the three-way catalytic converter (TWC). ECM uses front oxygen sensor for Air-fuel ratio close-loop control and monitors oxygen content in the exhaust gas not purified by TWC. The Post-catalytic oxygen sensor sends voltage signal to ECM indicating the oxygen content in the exhaust gas purified by the TWC. ECM compares signals from the two sensors to determine whether the TWC is currently under normal working condition. If the calculated TWC conversion efficiency is too low, the fault lamp will be lit and the DTC code will be set.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0420	Hardware Circuit Inspection	Coolant temperature is higher than 70°C (158 °F), and the fuel system is in close-loop mode. After driving some distance and stop the vehicle, run the engine at idle, the system compares the front and rear oxygen sensor signals to calculate three-way catalyst converter oxygen storing time. When the oxygen storing time is less than the threshold, the system reports a fault.	1. Front Oxygen Sensor 2. Rear Oxygen Sensor 3. Three-way Catalytic Converter. 4. Exhaust Leak.

3. Circuit sketch

Refer to 2.2.6 Electrical Schematic Diagram.

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect whether there are control system DTC codes other than DTC P0420.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position.

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

Read DTC code

Results

DTC Codes Shown	To Step
DTC P0420	Yes
DTC code other than P0420	No

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No → Refer to 2.2.7.14 DTC Chapter Index.

Yes

2	Start engine and turn on the fault diagnosis tester.

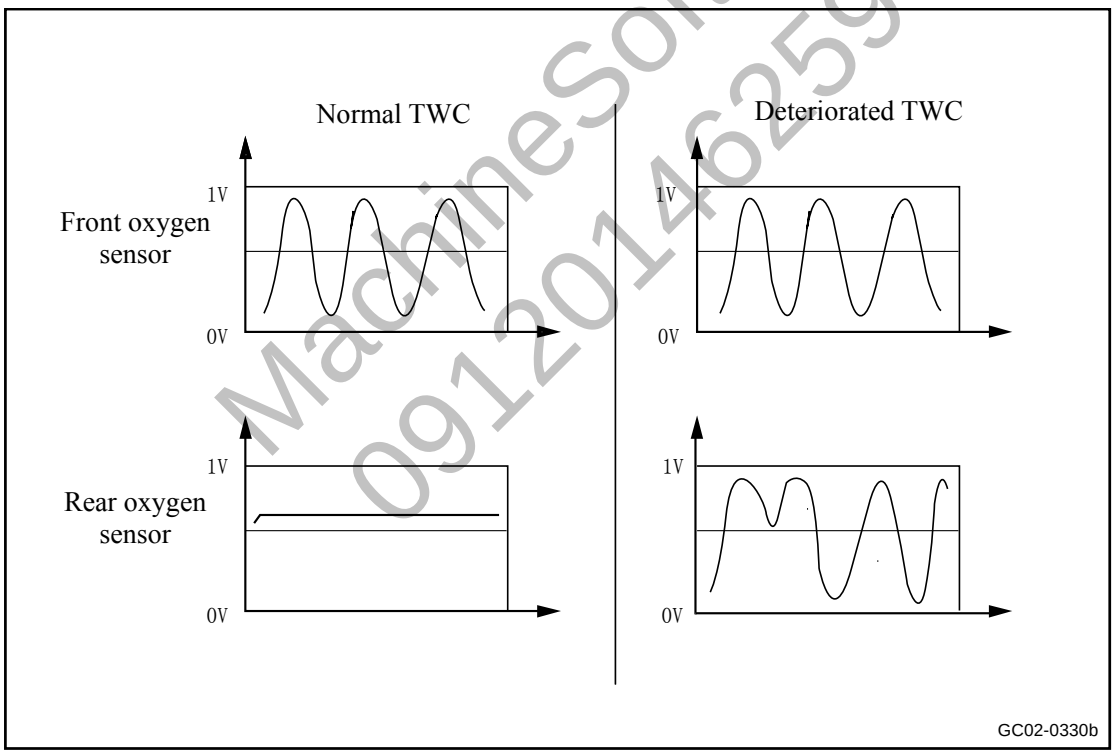
Next

3	Keep the engine speed at 2,500 rpm for more than 2 min to warm up the engine, until the engine coolant temperature reaches 80 °C (176 °F).

Next

4	(d) Select on the fault diagnosis tester: Engine/Read Data Flow/Group 1 Oxygen Sensor Voltage 1 (Front Oxygen Sensor). Group 1 Oxygen Sensor Voltage 2 (Rear oxygen sensor)

Next



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5	Observe front oxygen sensor and rear oxygen sensor output voltages.

Whether front oxygen sensor and rear oxygen sensor signal voltage is matching Normal TWC in the figure?

Yes → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

No

Serious Warning: Propane gas is flammable gas. It is strictly prohibited to operate propane gas near a fire, otherwise it will cause a fire.

6	Carry out the oxygen sensor signal test.

A. If the voltage data is consistently lower than 0.45 V (mixture too thin), carry out the following inspection steps:

- Spray proper amount of propane gas into the intake.
- Inspect whether the sensor voltage data is changed significantly, as the signal voltage will increase rapidly.

Front Oxygen Sensor Signal Voltage	**Rear Oxygen Sensor Signal Voltage**	**To Step**
Obvious Change	No Change	A
No Change	Obvious Change	B
Obvious Change	No Change	C
No Change	No Change	D

B → Refer to 2.4.7.2 “Replacement of Front Oxygen Sensor” to replace the front oxygen sensor. Go to Step 11.

C → Go to step 9

D → Inspect the cause for engine air-fuel ratio too lean/too rich. Refer to 2.2.7.4 Fault Symptom Table.

A

7	Inspect whether there is exhau[illegible]

Yes → Repair the faulty part. Go to step 11

No

8	Refer to 2.7.6.3 “Replacement of Three-way Catalytic Converter” to replace the three-way catalytic converter.

Next → Go to step 11

9	Inspect whether there is exhaust leakage.

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Yes → Repair the faulty part. Go to step 11

No

10	Replace the rear oxygen sensor. Refer to 2.4.6.1 Replacement of Rear Oxygen Sensor.

Next

11	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

A. Connect fault diagnosis tester to the data link connector.
B. Rotated ignition switch to ON position.
C. Clear DTC code.
D. Start and run the engine at idle speed to warm up the engine for at least 5min.
E. Road test the vehicle for at least 10min.
F. Read control system DTC code again to confirm that the system has no DTC code.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

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2.2.7.39 DTC P0458 P0459

1. DTC description:

DTC	P0458	Canister Control Valve Circuit Short To Low Voltage or Open

DTC	P0459	Canister Control Valve Circuit Short To High Voltage

EVAP solenoid valve absorbs fuel vapor from the evaporative emission canister to the intake manifold. EVAP solenoid valve is controlled by the pulse width modulation (PWM). The circuit consists of:

- Operating Voltage: Battery voltage passes through ECM controlled main relay terminal No.3 to reach EVAP solenoid harness connector EM25 terminal A.
- ECM control circuit: EVAP solenoid valve wiring harness connector EM25 terminal B is connected to ECM harness connector EM01 terminal No.64. ECM has an internal driver circuit to control the solenoid valve ground. Drive circuit is equipped with a feedback circuit to ECM. ECM monitors the feedback voltage control circuit to determine whether the control circuit is open, short to ground or short to voltage.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0458	Hardware Circuit Inspection	At idle conditions, when canister solenoid valve is inoperative, make canister solenoid valve circuit short to ground or open, DTC code set.	1. Canister Solenoid Valve Circuit 2. Solenoid Valve 3. ECM
P0459	Hardware Circuit Inspection	At idle conditions, when the canister solenoid valve is inoperative, make anister solenoid valve circuit short to power supply, DTC code set.	

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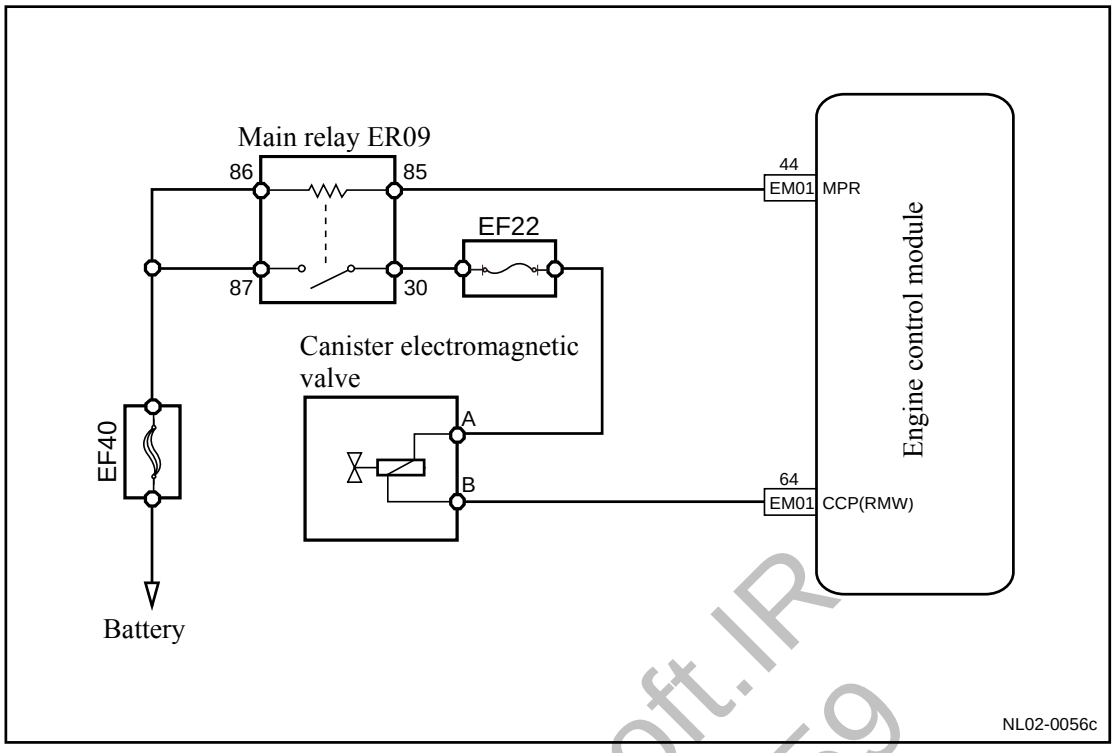
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Use fault diagnosis tester for canister solenoid valve active testing.

(a) Connect fault diagnosis tester to the Data Link Connector.

(b) Disconnect the canister solenoid valve to the Canister vacuum tubes.

(c) Start engine and turn on the fault diagnosis tester.

(d) Enter the following menu: Engine/Action Test/Canister Solenoid Valve

(e) Use fault diagnosis tester to enable the use of Canister Control Valve. Place a finger over the vacuum port solenoid valve and inspect whether there is suction.

Yes → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

No

Step 2	Measure canister solenoid valve resistance.

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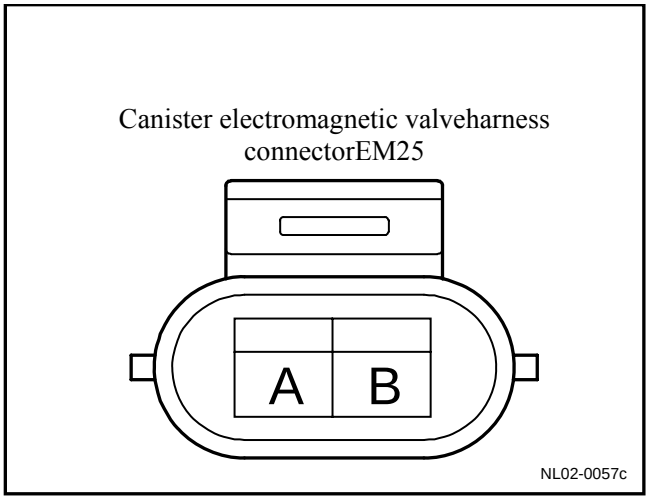
(a) Rotated ignition switch to OFF position .

(b) Disconnect canister solenoid valve harness connector EM25.

(c) Measure resistance between the canister solenoid valve two terminals.

Rated resistance: 20℃(68ºF)11-22Ω

(d) Connect canister solenoid valve harness connector EM25.



Is the value specified value?

Yes → Refer to "2.4.7.3 Replacement of Canister Solenoid Valve" to replace the canister solenoid valve. Go to Step 7.

No

Step 3	Measure solenoid valve working power supply.

(a) Rotated ignition switch to OFF position .

(b) Disconnect canister solenoid valve harness connector EM25.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between canister solenoid valve harness connector EM25 terminal A and a reliable ground.

Standard Voltage: 11-14V

(e) Connect canister solenoid valve harness connector EM25. Is the value specified value?

No → Inspect whether there is an open circuit or a circuit short to ground between solenoid valve harness connector EM25 terminal No. A and main relay terminal No.3. Repair the faulty part. Go to step 7

Yes

Step 4	Inspect canister solenoid valve control circuit.

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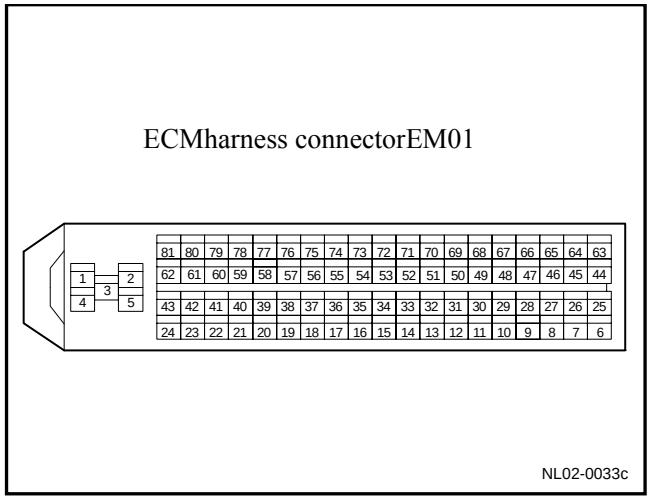
(a) Rotated ignition switch to OFF position .

(b) Disconnect canister solenoid valve harness connector EM25.

(c) Disconnect ECM harness connector EM01.

(d) Measure resistance between canister solenoid valve harness connector EM25 terminal B and ECM harness connector EM01 terminal No.57. Inspect whether the circuit is open.



(e) Measure resistance between canister solenoid valve harness connector EM25 terminal B and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure voltage between canister solenoid valve harness connector EM25 terminal B and a reliable ground. Inspect whether the circuit is short to power supply.

Tester Connection	**Standard Value**
Resistance Between EM25 (B) and EM01 (64)	Less than 1 Ω
Resistance Between EM25 (B) and Ground	10 kΩ or higher
Voltage Between EM25 (B) and Ground	0V

Are the values specified values?

Step 5	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 6	Replace ECM

Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

No → Repair or replace the wire harness connector to step 10.

Yes

Step 7	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

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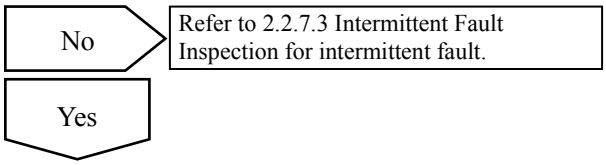
(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.



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5. Maintenance guide :

Refer to “2.4.8.1 Replacement of Canister Solenoid Valve” to replace the canister solenoid valve.

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2.2.7.40 DTC P0480 P0481

1. DTC description:

DTC	P0480	Low-Speed Fan Malfunction

DTC	P0481	High-Speed Fan Malfunction

High or low speed cooling fan relay coil power is provided by ECM controlled main relay. ECM controls the relay via ECM harness connector EM01 terminal No.65 and 17. Drive circuit is equipped with a feedback circuit to ECM. Drive circuit is equipped with a feedback circuit to ECM. ECM monitors the feedback voltage control circuit to determine whether the control circuit is open, short to ground or short to voltage.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0480	Hardware Circuit Inspection	Fan 1 control circuit open or shot, reported as DTC code.	1. Relay Circuit 2. Relay 3. ECM. 4. Cooling Fan
P0481			

3. Circuit figure

Refer to 2.2.6 Electrical Schematic Diagram

4. Diagnostic Steps:

Refer to 2.8.7.2 Cooling Fan Circuit Diagnosis

5. Maintenance guide :

Replace the cooling fan. Refer to 2.8.8.3 Replacement of Cooling Fan.

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2.2.7.41 DTC P0502

1. DTC Description:

DTC	P0502	No signal from vehicle speed sensor

The vehicle speed signal is used to monitor the vehicle speed. The vehicle speed signal is one of the fuel control reference signals during an urgent deceleration. Input through the terminal 51 of ECM harness connector EM21 and further transmit to the instrument at the same time. The vehicle speed sensor signal is sent to the instrument panel used for the vehicle speed display.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0502	No signal from vehicle speed sensor	1. Under hot operating conditions, driving the vehicle at Low-Speed at 3rd gear, Disconnect the vehicle speed sensor. and then press the acceleration pedal hard to accelerate to higher than 4,000 and immediately release the pedal. Engine speed, vehicle speed and MAP values begin to decline. When entering the fault setting window, DTC code will be set. 2. Under hot operating conditions, driving the vehicle at medium speed at 4th gear, Disconnect the vehicle speed sensor. and then press the acceleration pedal to accelerate the vehicle. Engine speed, vehicle speed and MAP values entering the fault setting window, DTC code will be set.	1. Vehicle Speed Sensor 2. Vehicle Speed Sensor Circuit 3. ECM.

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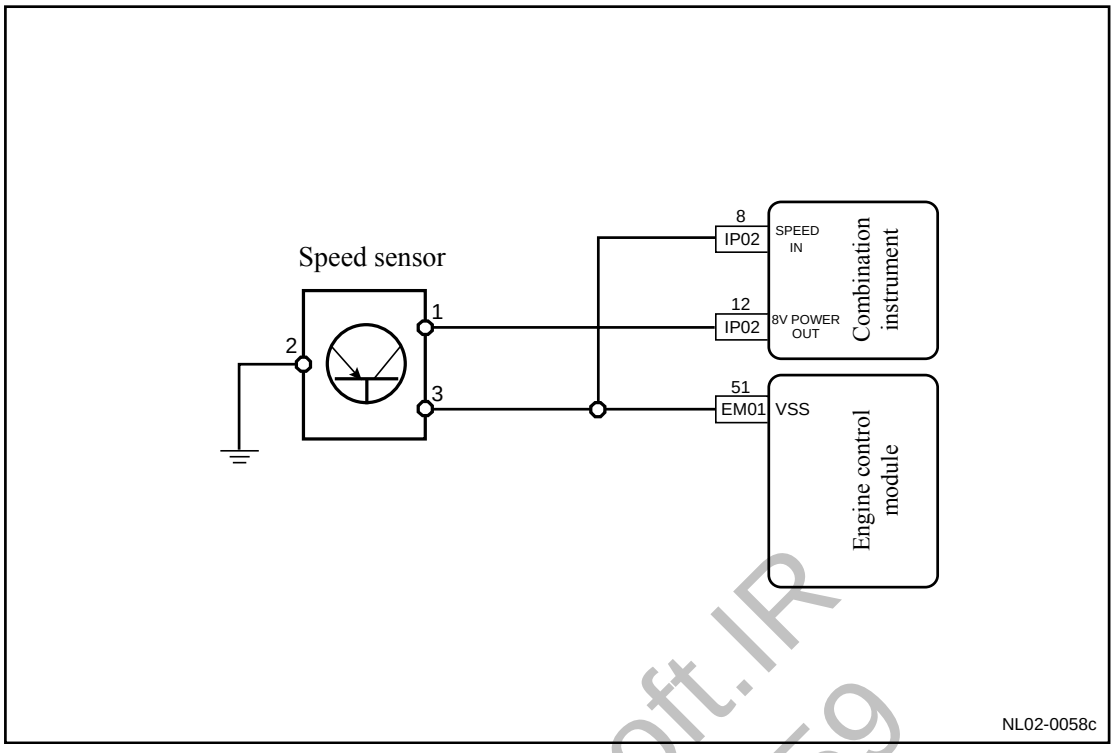
3. Circuit sketch



4. Diagnostic Steps:

1	Road test the vehicle. Is the vehicle speed displayed on the instrument working properly?

A If the instrument displays the vehicle speed as per normal, the vehicle speed sensor is working correctly.

B. If the instrument displays the vehicle speed abnormally, the vehicle speed sensor or the circuit may be faulty.

No — Go to step 4

Yes

2	Inspect the vehicle speed sensor power supply circuit.

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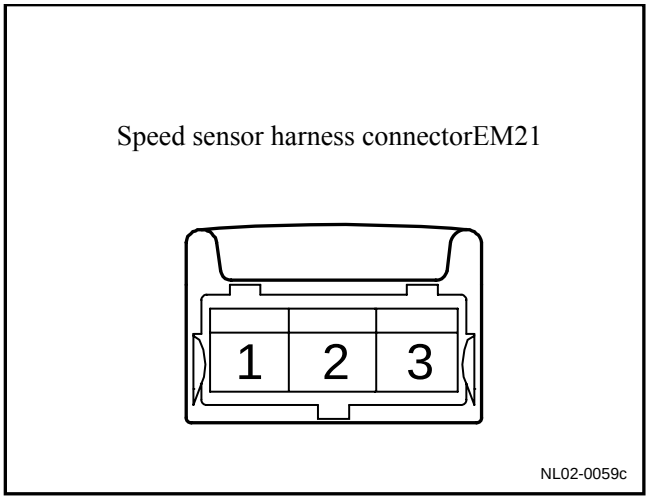
A. Turn the ignition switch to the OFF position.

B. Disconnect speed sensor wiring harness connector EM21.

C. Turn the ignition switch to the ON position.

D. Measure voltage between vehicle speed sensor harness connector EM21 terminal No.1 and a reliable ground.

Standard value :7-9V



Is the value specified value?

No → Repair the circuit between the vehicle speed sensor terminal No.1 and the main relay terminal No.3. Go to step 1.

Yes

3	Inspect the vehicle speed signal circuit.

A. Turn the ignition switch to the OFF position.

B. Disconnect speed sensor wiring harness connector EM21.

C. Disconnect ECM harness connector EM01.

D. Measure resistance between the vehicle speed sensor harness connector EM21 terminal No.3 and ECM harness connector EM01 terminal No.51. Inspect whether the circuit is open.

E. Measure resistance between the vehicle speed sensor harness connector EM21 terminal No.3 and a reliable ground. Inspect whether the circuit is short to ground.

F. Measure voltage between the vehicle speed sensor harness connector EM21 terminal No.3 and reliable ground with multimeter. Inspect whether the circuit is short to power supply.

Tester Connection	**Standard Value**
Resistance Between EM21 (3) and EM01 (51)	Less than 1 Ω
Resistance Between EM21 (3) and Ground	10 kΩ or higher
Voltage Between EM21 (3) and Ground	0V

Are the values specified values?

Yes → Go to step 7

No → Repair or replace the wire harness connector to step 8.

4	Inspect the vehicle speed sensor ground circuit.

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A. rotated ignition switch to OFF position .

B. Disconnect speed sensor wiring harness connector EM21.

C. Rotated ignition switch to ON position .

D. Measure the resistance between vehicle speed sensor harness connector EM21 terminal No.2 and a reliable ground.

Standard Value: Less than 3 Ω

Is the value specified value?

No → Repair or replace the wire harness connector to step 7.

Yes

5	Replace the vehicle speed sensor.

Next → Go to step 8

6	Inspect the ECM Power Supply Circuits.

A. Inspect whether ECM power supply circuit is normal.

B. Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

7	Replace ECM

A. Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

8	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Intermittent fault refers to 2.2.7.3 List of Intermittent Fault.

Yes

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5. Maintenance guide :

Refer to 3.3.6.2 Replacement of Vehicle Speed Sensor to replace the vehicle speed sensor.

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2.2.7.42 DTC P0506 P0507

1. DTC description:

DTC	P0506	Idle Speed Too Low

DTC	P0507	Idle Speed Too High

Throttle actuator control motor is controlled by the engine control module (ECM). Internal DC motor drives throttle body. In order to reduce idle speed and adjust the spark and fuel supply, engine control module commands the throttle to close. By reducing the air flow into the engine, idle speed is lowered. In order to improve idle, the engine control module commands the throttle to open, so that more air flows through the throttle.

Engine control module (ECM) calculates and controls engine idle speed based on coolant temperature, speed compensation, reducing speed, Air-Conditioning compensation and voltage compensation.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0506	Idle speed is lower than the target speed by 100 rpm	1. The engine is at idle speed. 2. The vehicle speed is equal to 0. 3. Engine coolant temperature is higher than 60℃(140ºF) . 4. Duration is longer than 10s.	1. ETC throttle body assembly 2. Intake System 3. Exhaust System 4. ECM
P0507	Idle speed is higher than the target speed by 200 rpm	1. The engine is at idle speed. 2. The vehicle speed is equal to 0. 3. Engine coolant temperature is higher than 60℃(140 ºF). 4. Duration Longer Than 10s.	

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3. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect whether there are control system DTC codes other than DTC P0506 P0507.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes Shown	To Step

DTC P0506 P0507	No
DTC code other than P0506 P0507	Yes

Yes → Refer to 2. 3.6.11 DTC Chapter Index.

No

2	Inspect whether generator is working properly.

A. Use a fault diagnosis tester to observe whether the system voltage parameters are normal. Is generator generating capacity normal?

No → Repair generator fault.

Yes

3	Inspect intake air pressure sensor parameters.

A. Use a fault diagnosis tester to observe whether system intake air pressure sensor parameters are correct. Refer to 2.2.7.9 Data Flow Table. Are intake air pressure sensor parameters normal?

No → Repair generator fault.

Yes

4	Inspect the working condition of the air-conditioner.

A. Use a fault diagnosis tester to observe whether the air-conditioning working status is consistent with the actual air-conditioning working condition. Refer to 2.2.7.9 Data Flow Table.

When the air-conditioning is switched on and the pressure switch voltage is greater than 0 V, does the idle speed increase by about 150 rpm?

Yes → Go to step 7

No

5	Inspect air intake system and exhaust system.

A. Inspect air intake system and exhaust system for blockage and air leakage.

B. Too much carbon residue in throttle.

Any of these malfunctions?

Yes → Go to step 7

No

6	Inspect engine mechanical parts and accessory drive.

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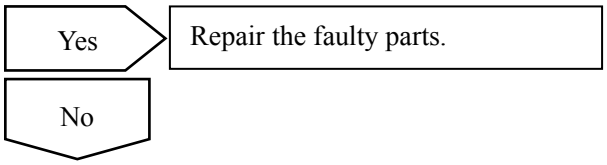
A. Shut down the engine and turn the ignition switch to OFF.

B. Check whether the drive belt of the engine is loosened.

C. Dismantle engine accessory belt, neutral gear. Rotate the engine crankshaft and inspect whether engine mechanical moving components catching.

D. Rotate engine accessory pulley and air-conditioning pump. Check whether engine and other components catching.

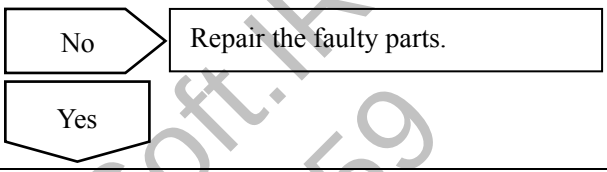
Any of these malfunctions?



7	Inspect ECM power supply circuit.

A. Inspect whether ECM power supply circuit is normal.

B. Inspect whether ECM ground circuit is normal.



8	Replace ECM

A. Replaces .

B. Carry out the crankshaft position sensor learning, refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learning.

9	Use fault diagnosis tester to confirm if DTC is stored again .

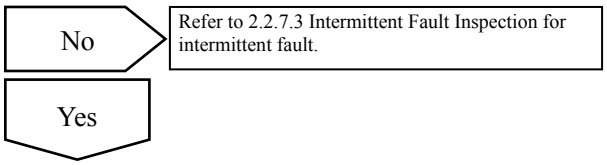
A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.



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5. Maintenance guide :

Refer to 2.6.8.5 Replacement of Electrical Throttle Body Assembly to replace the electrical throttle body assembly.

Replace ECM. Refer to 2.2.8.1 Replacement of Engine Control Module.

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2.2.7.43 DTC P0562 P0563

1. DTC description:

DTC	P0562	System Voltage Too Low

DTC	P0563	System Voltage Too High

ECM power supply circuit consists of the following:

- Battery power passes through fuse EF16 10 A to ECM harness connector EM01 terminal No.67.
- When the ignition switch is turned to ON position, battery power passes through the fuses of EF 35 110A and EF14 30A to the ignition switch, and passes the ignition switch wiring harness connector IP45 terminal No.6 to fuse IF33 10 A and finally to ECM harness connector EM01 terminal No.68.
- When ECM detects that ECM harness connector EM01 terminal No.67 has battery voltage, ECM controls EM01 terminal #2 and #3 connected to internal ground. Because EM01 terminal No.62 is connected to the main relay terminal No.44, the main relay pulls in.

After the main relay pulls in, the battery power passes through the main relay terminal No.30 and the fuse EF22 10A to ECM harness connector EM01 terminals No.5.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0562	Lower Than the Lower Limit	1. Ignition switch is at ON. 2. Battery voltage is less than 11 V. 3. Duration Longer Than 40s.	1. ECM power supply Circuit 2.Generator 3. ECM
P0563	More Than the Upper Limit	1. Ignition switch is at ON. 2. Battery voltage is greater than 16 V. 3. Duration Longer Than 40s.	

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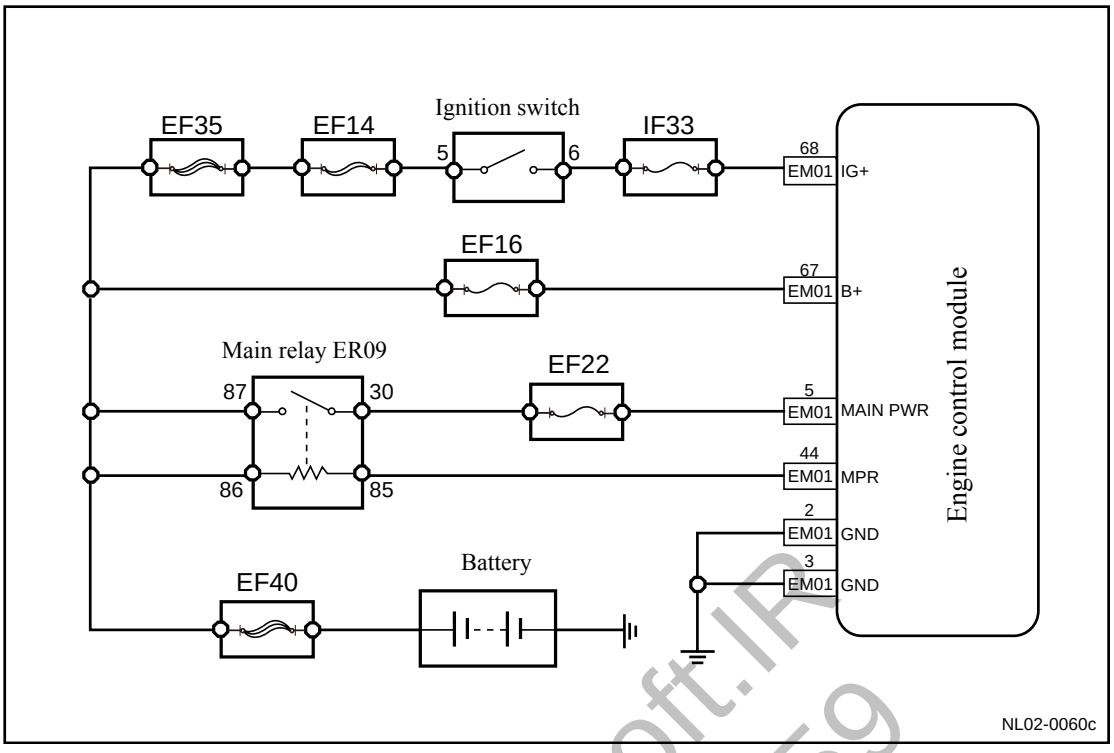
3. Circuit sketch



4. Diagnostic Steps:

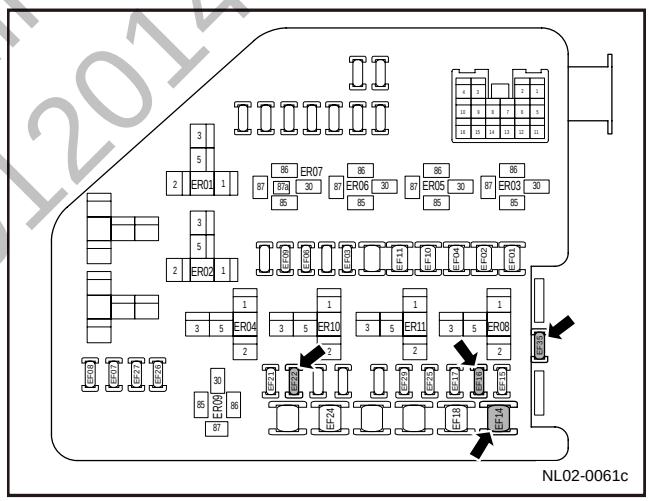
1	Inspect the fuses EF40, EF35, EF14, EF16, EF22.

A. rotated ignition switch to OFF position .

B. Dismantle fuses EF40, EF35, EF14, EF16, EF22 from the underhood fuse block.

C. Test continuity between the two fuses with a multimeter.

Conducted?



No → Inspect whether there are short circuits. Replace the fuses.

Yes

2	Inspect underhood fuse block fuses IF33.

A. rotated ignition switch to OFF position.

B. Dismantle the fuse IF33 from I/P fuse block of the instrument.

C. Test continuity between the two fuses with a multimeter.

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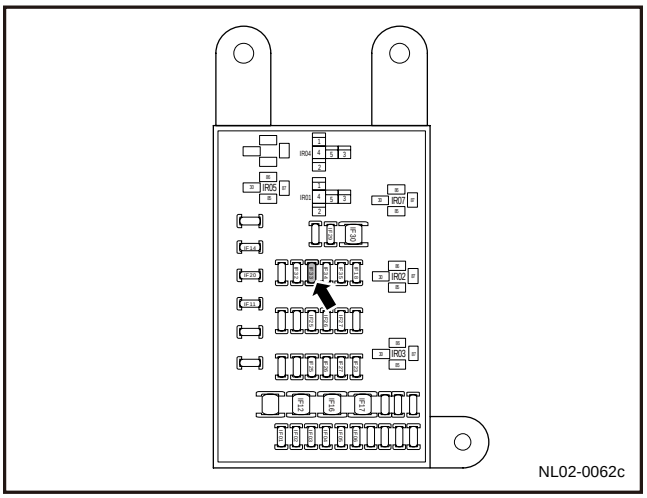
Conducted?



No → Inspect whether there are short circuits. Replace the fuses.

Yes

3	Inspect the ECM Power Supply Voltage.

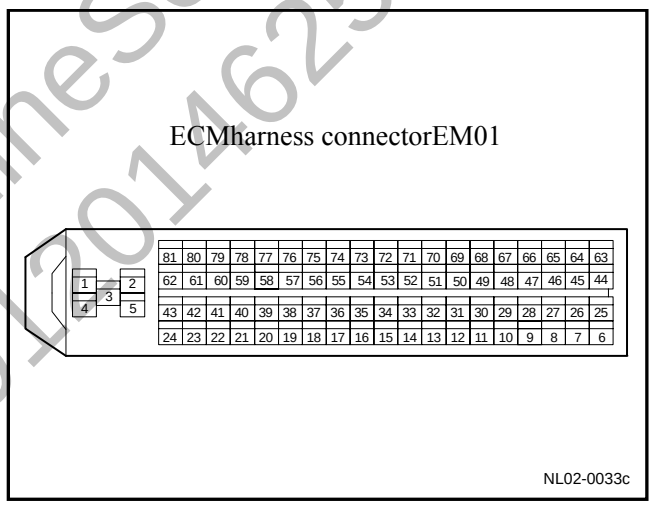
A. rotated ignition switch to OFF position.

B. Disconnect ECM harness connector EM01.

C. Rotated ignition switch to ON position.

D. Measure voltage between ECM harness connector EM01 terminal No.67 and a reliable ground.

E. Measure voltage between ECM harness connector EM01 terminal No.68 and a reliable ground.



Standard value :11-14V

Is the voltage normal?

No → Go to step 5

Yes

4	Inspect ECM ground circuit.

A. rotated ignition switch to OFF position .

B. Disconnect ECM harness connector EM01.

C. Measure resistance between ECM harness connector EM01 terminal No.2 of and a reliable ground.

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D. Measure resistance between ECM harness connector EM01 terminal No.3 and a reliable ground.

Standard Value: Less than 1 Ω

Is the resistance normal?

No → ECM ground circuit malfunction. Repair the faulty part.

Yes

5	Inspect the charging system.

A. Inspect the battery voltage: standard value 11V-14V.

B. Inspect charging voltage of generator: standard value 11.5V-14.5V.

Normal?

No → Repair the faulty part.

Yes → Go to step 8

6	Inspect the circuit from fuse EF16 to ECM.

A. rotated ignition switch to OFF position .

B. Disconnect ECM harness connector EM01.

C. Test continuity between ECM harness connector EM01 terminal No.67 and fuse EF10.

D. Measure resistance between ECM harness connector EM01 terminal No.67 and a reliable ground.

Standard Value

Test Items	**Specified Value**
Continuity Between EM01 (67) and EF10	Continuity
Resistance Between EM01 (67) and A Reliable Ground	10 kΩ or higher

Normal?

No → Circuit malfunction, repair or replace the wiring harness.

Yes

7	Inspect the circuit from fuse IF33 to ECM.

A. rotated ignition switch to OFF position .

B. Disconnect ECM harness connector EM01.

C. Test Continuity between ECM harness connector EM01 No.68 terminal and fuse IF33.

D. Measure resistance between ECM harness connector EM01 terminal No.68 and a reliable ground.

Standard Value

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Test Items	Specified Value
Continuity Between EM01 (68) and IF33	Continuity
Resistance Between EM01 (68) and A Reliable Ground	10 kΩ or higher

Normal?

No → Circuit malfunction, repair or replace the wiring harness.

Yes

8	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

A. Connect fault diagnosis tester to the data link connector.
B. Rotated ignition switch to ON position .
C. Clear DTC code.
D. Start and run the engine at idle speed to warm up the engine for at least 5min.
E. Road test the vehicle for at least 10min.
F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.3.6.3 Intermittent Fault Inspection for intermittent fault.

Yes

9	Replace ECM

See 2.2.8.1 Replacement of Engine Control Module.

Next

10	Carry out crankshaft position sensor self learn.

Refer to 2.2.7.11 "Crankshaft Position Sensor Learn".

Next

11	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.
B. Rotated ignition switch to ON position
C. Clear DTC code.
D. Start and run the engine at idle speed to warm up the engine for at least 5 min.
E. Road test the vehicle for at least 10min.
F. Read control system DTC code again to confirm that the system has no DTC code output.

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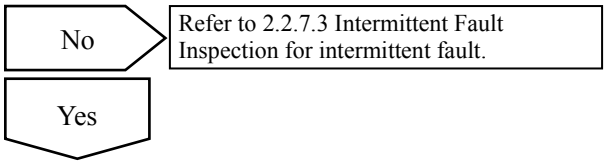

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2.2.7.44 DTC P0571

1. DTC description:

DTC	P0571	The switch state of the brake lamp is not changed when braking.

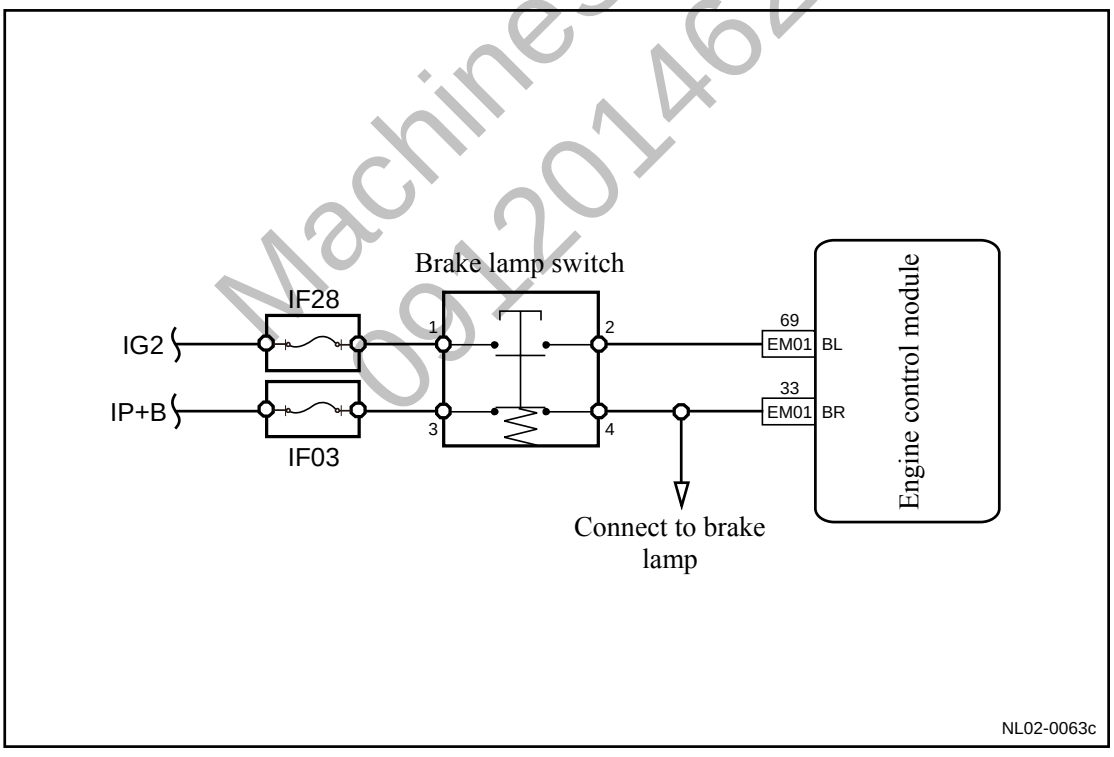
DTC	P0504	Brake Lamp Switch Relativity Malfunction

Disconnect the brake light switch signal. the vehicle braking, system enters the diagnostic window. After multiple braking, DTC code appears. Engine running smooth, the vehicle can be driven.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0571 P0504	ECM receives the brake light switch signal.	1. Brake Light Switch Signal Disconnected. 2. Vehicle braking, system enters the diagnostic window. 3. DTC codes appear after repeatedly braking.	1. Brake Light Switch Circuit 2. Brake Lights Switch 3. ECM

3. Circuit figure



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4. Diagnostic Steps:

Notes:

Before carrying out this diagnosis steps, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect brake lamps are working properly.

No → Refer to11.4.7.8 Brake Lamp Inoperation.

Yes

2	Inspect continuity between brake light switch wiring harness connector IP56 and ECM harness connector EM01.

A. rotated ignition switch to OFF position .

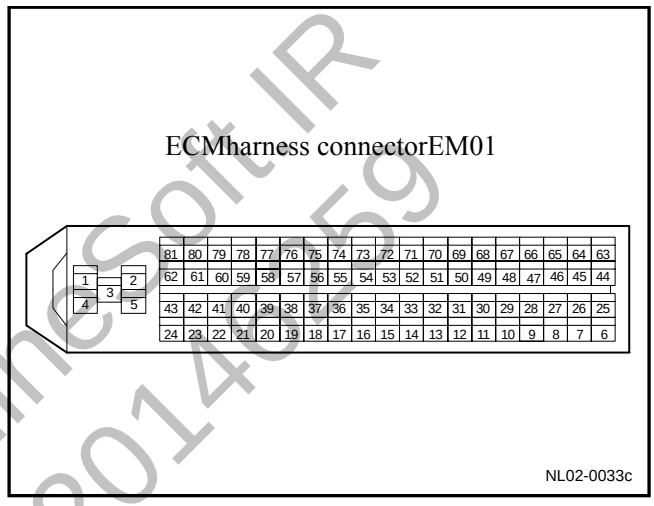
B. Disconnect ECM harness connector EM01.

C. Press the brake pedal.

D. Measure ECM harness connector EM01 terminal No.69 and 33 voltage.

Standard Voltage: 11-14 V

Confirm whether the voltage is normal.



Yes → Refer to 2.2.8.1 Replacement of Engine Control Module to replace ECM.

No

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3	Repair circuit between brake light switch wiring harness connector IP56 and ECM harness connector EM01.

A. Repair circuit between brake light switch wiring harness connector IP56 and ECM harness connector EM01.

B. Confirm the repair is completed.

Next

4	Troubleshooting

2.2.7.45 DTC P0601 P0602 P1516 P2101

1. DTC description:

DTC	P0601	ECM Processor Malfunction

DTC	P0602	ECM Processor Malfunction

DTC	P1516	Diagnostic error for second order of driving electronic throttle

DTC	P2101	Diagnostic error for static state of driving electronic throttle

ECM Internal Program Errors.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0601	ECM Internal Monitoring	——	ECM
P0602		——	
P1516		In a steady-state condition, the throttle expected by the system is located The position is more different from the actual throttle position.	
P2101		In a steady-state condition, the throttle expected by the system is located The position is more different from the actual throttle position.	

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3. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect whether there is any control system DTC codes other than DTC P0601, P0602, P1516 and P2101.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

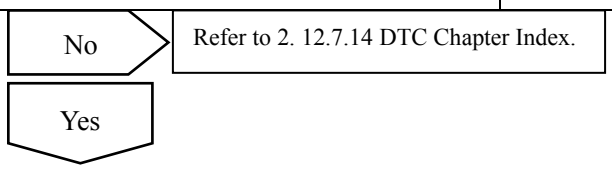
C. Switch on fault diagnostic apparatus power supply

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

DTC Codes Shown	To Step

DTC P0601,P0602,P1516 and P2101	Yes
DTC codes other than DTC P0601, P0602, P1516 and P2101	No



2	Replace ECM

Refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learn” to carry out the crankshaft position sensor learn after replacing the ECM.

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2.2.7.46 DTC P0641 P0651

1. DTC description:

DTC	**P0641**	ETC Reference Voltage A # Amplitude Fault

DTC	**P0651**	ETC Reference Voltage B # Amplitude Fault

As ETC uses two throttle position sensors, its normal working required 5 V reference voltage and low reference voltage is shared with ETC harness connector terminals A and D. Where A and EM01 terminal No.74 is connected as the low reference voltage. Terminal D and EM01 terminal No.70 is connected as the 5 V reference voltage. Malfunction in any circuit will report DTC code P0641 or P0651.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0641	Hardware Circuit Malfunction	Internal chip self-diagnosis	1. Electronic Throttle Body 2. Electronic Throttle Circuit 3. ECM
P0651			

3. Circuit sketch

Refer to 2.2.7.21 DTC P0122 P0123

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect ETC harness connector EM28 terminals A and D.

A. rotated ignition switch to OFF position .

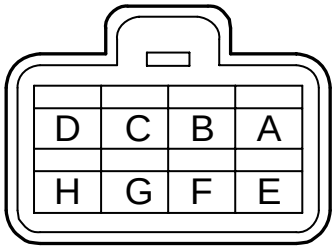
B. Disconnect ETC harness connector EM28.

C. Rotated ignition switch to ON position .

D. Measure resistance between EM28 terminal A and a reliable ground.

E. Measure voltage between EM28 terminal D and a reliable ground.

Electric throttle harness connectorEM28



NL02-0029c

Results

Test Items	Standard Value

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Resistance Between EM28 (A) and a Reliable Ground	Less than 3 Ω
Voltage BetweenEM28 (D) and A Reliable Ground	4 . 8 - 5. 2 V

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

2	Replace the electronic throttle body

Refer to the Replacement of Electronic Throttle Body.

Next

3	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

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4	Inspect ECM Power Supply Circuit and ground circuit.

A. Refer to 2.2.7.43 DTC P0562 P0563 to inspect ECM Power Supply Circuit and ground circuit.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

5	Replace ECM. Refer to 2.2.8.6 Replacement of Engine Control Module.

Next

6	Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Refer to 2.2.7.11 "Crankshaft Position Sensor Learn".

Next

7	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.3.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

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2.2.7.47 DTC P0646, P0647

1. DTC description:

DTC	P0646	Air-conditioning Clutch Relay Circuit Short to Low Voltage or Open

DTC	P0647	Air-conditioning Clutch Relay Circuit Short to High Voltage

The working voltage of the air-conditioning compressor relay is provided by the main relay which is controlled by ECM. ECM controls Air-Conditioning compressor relay internal ground through ECM harness connector EM01 terminal No.9, and relay pulls in. ECM has an internal driver circuit that controls relay coil ground. The driver circuit is equipped with a feedback circuit to ECM. ECM monitors the feedback voltage control circuit to determine whether the there is an open circuit, a circuit short to ground or power supply.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0646	Hardware Circuit Inspection	When air-conditioning is not working, with air-conditioning relay control circuit open or short to ground, the DTC code will be set.	1. Air Conditioner Relay 2. ECM 3. Air-Conditioning Relay Circuit
P0647		When air-conditioning is not working, with air-conditioning relay control circuit open or short to ground, the DTC code will be set.	

3. Circuit figure :

Refer to 8.2.6.2 Air-conditioning System Circuit Diagram

4. Diagnostic Steps:

Refer to 8.2.7.8 Air-conditioning Clutch Inoperation.

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2.2.7.48 DTC P0685

1. DTC description:

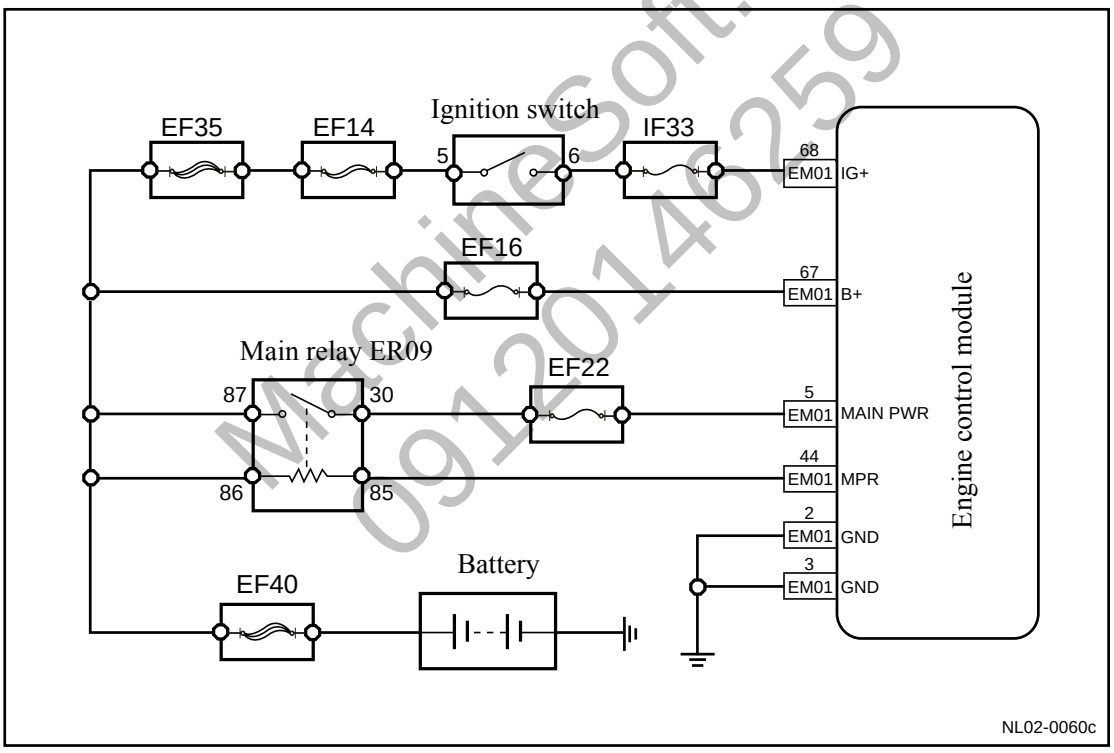
DTC	**P0685**	Main Relay Malfunction

Main relay is used to provide power to fuel injectors and oxygen sensors and other components. Battery provides power to main relay terminal No.86. ECM controls main relay ground through ECM harness connector EM01 terminal No.62. ECM has a detection circuit. By monitoring the feedback voltage, ECM determines whether the control circuit is open, short to ground or short to power supply.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0685	Main Relay Malfunction	The main relay control circuit does not match ECM expected status.	1. Main Relay 2. Main Relay Circuit 3. ECM

3. Circuit sketch



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4. Diagnostic Steps:

1	Appearance Inspection

Inspect main relay for signs of damage.

Yes	Replace main relay ,go to steps10
No	

2	Inspect ECM harness connector EM01 terminal No.62.

A. Turn the ignition switch to OFF position.

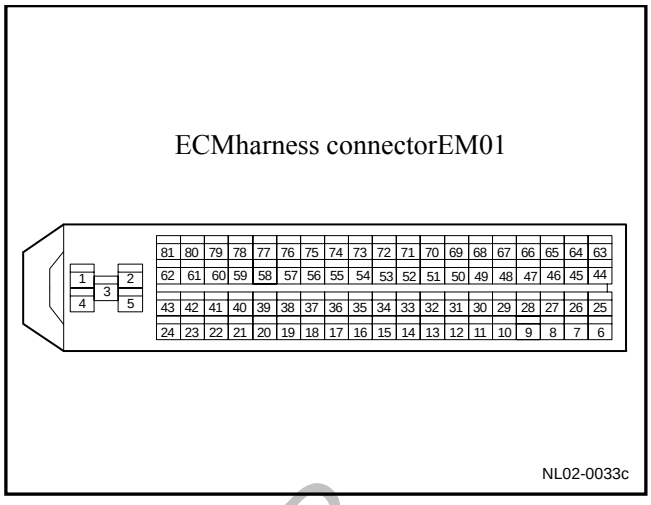
B. Dismantle of ECM harness connector EM01.

C. Measure voltage between ECM harness connector EM01 terminal No.44 and a reliable ground.

Standard Voltage: 11-14V

D. Measure resistance between ECM harness connector EM01 terminal No.44 and a reliable ground.

Rated resistance：10KΩ or higher



Inspect whether according with the standard value?

No → Repair the circuit from the battery to the EM01 terminal #62. Go to step 10.

Yes

3	Inspect ECM harness connector EM01 terminals No.5, 2 and 3

A. Turn the ignition switch to OFF position.

B. Dismantle of ECM harness connector EM01.

C. Measure resistance between ECM harness connector EM01 terminal No.5 and a reliable ground.

Rated resistance：10KΩ or higher

D. Connect EM01 terminal NO.2 and 3 short to ground.

E. Measure voltage between EM01 terminal No.5 and a reliable ground.

Standard Voltage: 11-14V

Inspect whether according with the standard value?

No → Go to step 5

Yes

4	Inspect the ignition switch input signal.

A Turn the ignition switch to the ON position.

B. Measure voltage between ECM harness connector EM01 terminal No.68 and a reliable ground.

Standard Voltage: 11-14V

C. Turn the ignition switch to the OFF position.

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Whether voltage value is normal or not ?

No	Repair the circuit from the battery to the EM01 terminal #3. Go to step 10.
Yes	Go to step 8

5	Inspect the voltage of the main relay terminals No.87 and 86.

A. Dismantle the main relay.

B. Measure voltage between the main relay terminal No.87 and 86 with a reliable ground.

Standard Voltage: 11-14V

C. Measure resistance between the main relay terminal No.87 and 86 with a reliable ground.

Rated resistance：10KΩ or higher

Inspect whether according with the standard value?

No	Repair the circuits from the battery to the main relay terminals #86 and #87. Go to step 10.
Yes	

6	Inspect main relay terminal No.30.

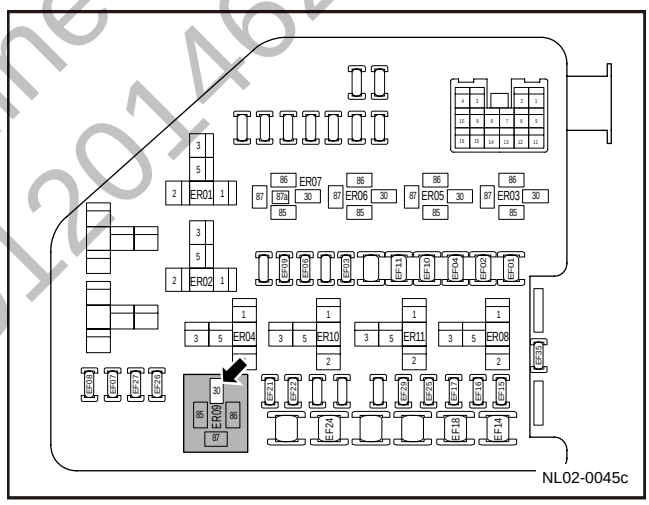
A. Install the main relay.

B. Connect ECM harness connector EM01 terminal No.2 and 3 to ground.

C. Measure voltage between main relay terminal No.3 and a reliable ground.

Standard Voltage: 11-14V

Check if it meet standard value ?



No	Replace the main relay. Go to step 10.
Yes	

7	Inspect continuity between main relay and ECM harness connector.

A. Dismantle the main relay.

B. Measure resistance between main relay terminal No.30 and ECM harness connector EM01 terminals No. 5.

Standard Resistance: Less than 1 Ω

Check if it meet standard value ?

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No → Repair the circuits between main relay and terminals #6 and #22 of the EM01. Go to step 10.

Yes

8	Inspect the ECM Power Supply Circuits.

Refer to 2.2.7.43 DTC P0562 P0563.

Inspect whether the ECM power supply circuit and ground circuit are normal.

No → Repair ECM Power Supply Circuits.

Yes

9	Replace ECM

See 2.2.8.1 Replacement of Engine Control Module.

Next

10	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.
B. Rotated ignition switch to ON position
C. Clear DTC code.
D. Start and run the engine at idle speed to warm up the engine for at least 5 min.
E. Road test the vehicle for at least 10min.
F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

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2.2.7.49 DTC P2104 P2105 P2106 P2110

1. DTC description:

DTC	P2104	Mandatory Engine Idling

DTC	P2105	Forced engine stopping

DTC	P2106	Restrictions On Engine Performance

DTC	P2110	Engine Power Management

When the intake system or throttle body valve air floe control have faults, ETC system can not reliably use the throttle to control engine power.

2. DTC Code Set Up and Removal Conditions:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2104	Protected mandatory idle	When the sensor of the throttle, acceleration pedal or brake has certain fault, it will be forced into the idle mode, and determined as fault.	
P2105	Fault Protection Mandatory Shutdown	When the sensor of the acceleration pedal, brake or ECM has certain fault, it will be forced into engine stalling and determined as fault.	
P2106	Fault Protection Limits	When the sensor of the throttle or acceleration pedal has certain fault, it will be forced into the performance limited mode, and determined as fault.	——
P2110	Failsafe Power Limit	When the sensor of the throttle or acceleration pedal has certain fault, it will be forced into the power manage mode, and determined as fault.	

3. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect whether there is any control system DTC code other than DTC P2104, P2105, P2106 and P2110.

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A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic apparatus power supply

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC code

Results

DTC Codes Shown	**To Step**
DTC P2104 P2105 P2106 P2110	No
DTC code other than DTC P2104, P2105, P2106, P2110	Yes

Yes → 2.2.7.14 DTC Chapter Index

No

2	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

Yes → Diagnostic

No

3	Inspect the ECM Power Supply Circuits.

A. Inspect whether ECM power supply circuit is normal.

B. Inspect whether ECM ground circuit is normal.

No → Repair the faulty part. Go to step 5

Yes

4	Replace ECM

A. Replaces

B. Refer to 2.2.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn.

Next

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5	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

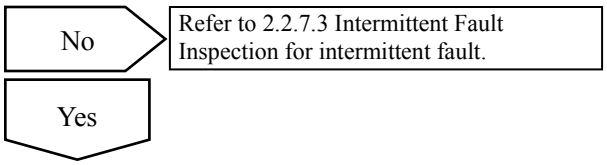
A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.



6	Troubleshooting

5. Maintenance guide

Replace ECM. Refer to 2.2.8.1 Replacement of Engine Control Module.

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2.2.7.50 DTC P2119

1. DTC description:

DTC	P2119	Electronic Throttle Return Malfunction

After the ignition switch is switched off, electronic throttle stays at the initial angle of 14.5 degrees. If the ignition switch is off, the throttle is always off, the DTC code may be recorded it may be accompanied by the engine difficult to start and so on. **2.Conditions for Setting DTC and the Fault Location:**

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2119	Electronic Throttle Return Malfunction	1. Ignition Switch OFF for several times. 2. If throttle can't reach requirement, conduct return test. Proper opening	1. Electronic Throttle Body Dirty 2. Electronic Throttle Body Mechanical Malfunction

3. Diagnostic Steps:

1	Inspect whether there is other ETC system related DTC codes?

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic apparatus power supply

D. Read DTC code

Results

DTC Codes Shown	To Step
Only P2119	Yes
DTC Code Other Than P2119	No

No → Refer to 2. 12.7.14 DTC Chapter Index.

Yes

2	Clean Electronic Throttle Body

A. Refer to 2.6.8.5 Replacement of Electrical Throttle Body Assembly to dismantle the throttle body.

B. Clean electronic throttle body.

Next

3	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

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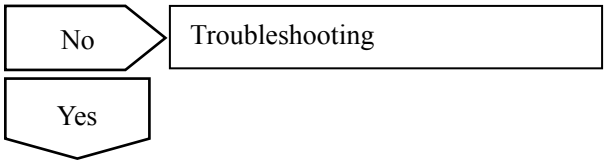
B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.



4	Replace the electronic throttle body (ETC).

Refer to 2.6.8.5 Replacement of Electrical Throttle Body Assembly to replace the electrical throttle body.

5	Use fault diagnosis tester to confirm if DTC is stored again .

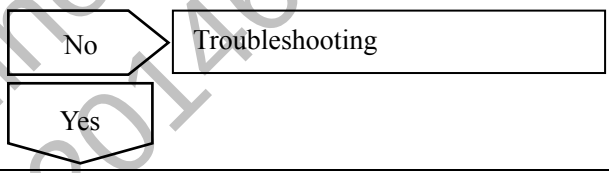
A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

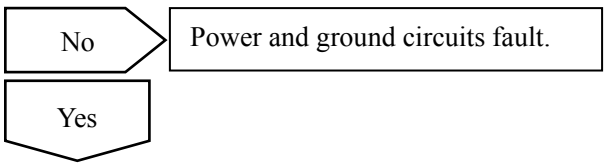
D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.



6	Inspect ECM Power Supply Circuit and ground circuit.

A. Refer to 2.2.7.43 DTC P0562 P0563 to inspect ECM Power Supply Circuit and ground circuit. ECM power and ground circuits normal?



7	Replace ECM. Refer to 2.2.8.1 Replacement of Engine Control Module.

8	Refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learn” to carry out the crankshaft position sensor learn.

9	Use fault diagnosis tester to confirm if DTC is stored again .

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A. Connect fault diagnosis tester to the data link connector.

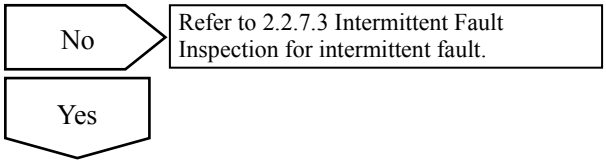
B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.



10	Troubleshooting

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2.2.7.51 DTC P2122 P2123

1. DTC description:

DTC	P2122	Electronic Acceleration Pedal Position Sensor #1 Circuit Low Voltage

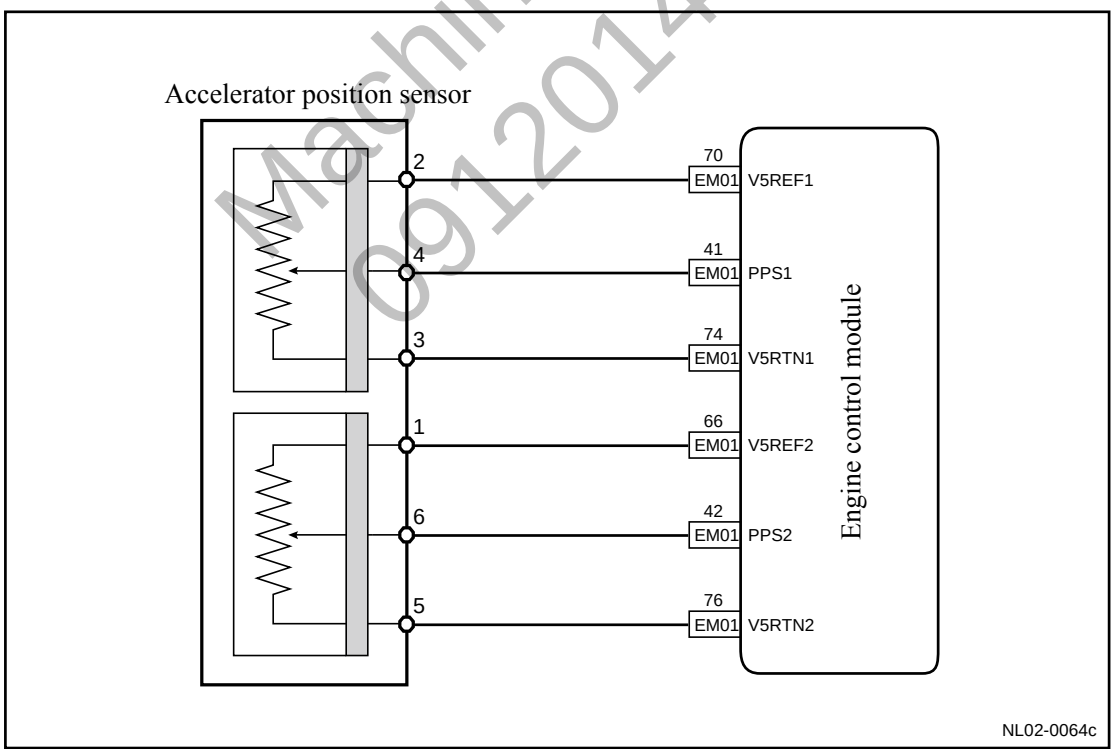
DTC	P2123	Electronic Acceleration Pedal Position Sensor #1 Circuit High Voltage

In order to protect the security of the system, acceleration pedal position sensor (APP) uses a dual-sensor setting, sliding resistive. APP sensor 1 output is IP51 terminal No.4, through ECM wiring harness Connect EM01 terminal No.41 to ECM.

2. Conditions for Setting DTC and the Fault Location:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2122	Hardware Circuit Malfunction	1. APS1 signal terminal grounded or open. 2. Input signal larger than 97.5%.	1. Acceleration Pedal Position Sensor 2. Acceleration Pedal Position Sensor Circuit 3. ECM
P2123	Hardware Circuit Malfunction	1. APS1 signal terminal grounded or open. 2. Input signal less than 3.5%	

3. Circuit figure



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4. Diagnostic Steps:

1	Inspect APP sensor harness connector IP51 terminal No.2 voltage.

A. Turn the ignition switch to the OFF position.

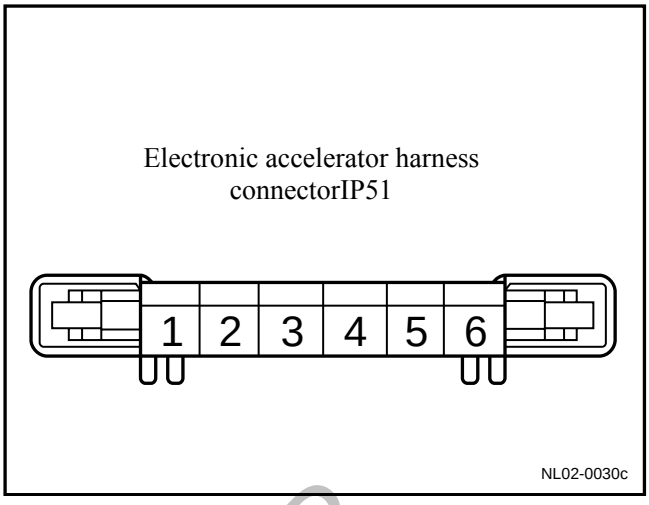
B. Disconnect APP sensor harness connector IP51.

C. Turn the ignition switch to the ON position.

D. Measure voltage between IP51 terminal No.2 and a reliable ground.

Standard Voltage: 4.8-5.2V

Does it conform to the standard value?



No → If the voltage is higher than the Standard Value, the circuit is short to power supply; if the voltage is lower than the standard value, go to step 5.

Yes

2	Inspect resistance between APP sensor harness connector IP51 terminal No.3 and ground.

A. Turn the ignition switch to the OFF position.

B. Disconnect APP sensor harness connector IP51.

C. Turn the ignition switch to the ON position.

D. Measure resistance between IP51 terminal No.3 and a reliable ground.

Standard Resistance: Less than 3 Ω

Does it conform to the standard value?

No → Go to step 5

Yes

3	Inspect APP sensor harness connector IP51 terminal No.4.

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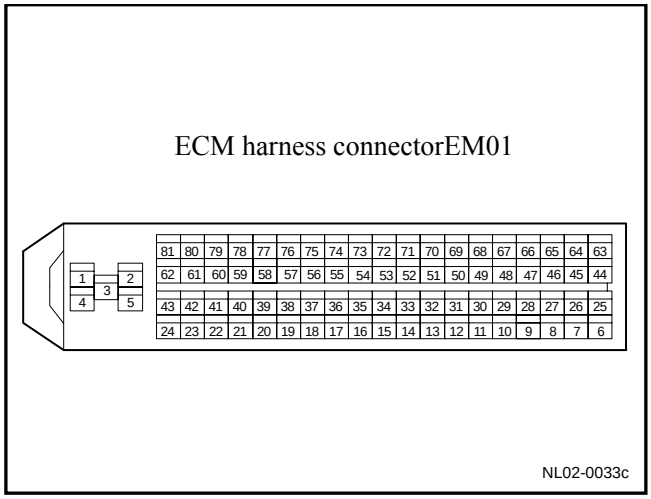
A. Turn the ignition switch to the OFF position.

B. Disconnect APP sensor harness connector IP51.

C. Disconnect ECM harness connector EM01.

D. Measure resistance between IP51 terminal No.4 and a reliable ground.

E. Measure voltage between IP51 terminal No.4 and a reliable ground.



F. Test continuity between IP51 terminal No.4 and EM01 terminal No.41.

Results

Test Items	**Standard Value**
Resistance Between IP51 (4) and A Reliable Ground	10 kΩ or higher
Voltage Between IP51 (4) and A Reliable Ground	0 V
Continuity Between IP51 (4) and EM01 (41)	Less than 1 Ω

Inspect whether according with the standard value?

No → Circuit fault, repair the faulty part.

Yes

4	Inspect APP sensor harness connector IP51terminal No.4 output voltage.

Inspect APP sensor #4 terminal output voltage. Refer to 2.2.7.13 “Acceleration Pedal Position Sensor (APP) Inspection” for the standard values.

No → Refer to 2.2.8.4 “Replacement of Acceleration Pedal” to replace the APP sensor.

Yes → Go to step 7

5	Inspect APP sensor harness connector IP51 terminal No.2 and 3.

A. Turn the ignition switch to the OFF position.

B. Disconnect APP sensor harness connector IP51.

C. Disconnect ECM harness connector EM01.

D. Turn the ignition switch to the ON position.

E. Measure resistance between IP51 terminal No.2 and a reliable ground.

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F. Test continuity between IP51 terminal No.2 and EM01 terminal No.70.

G. Measure voltage between IP51 terminal No.3 and a reliable ground.

H. Test continuity between IP51 terminal No.3 and EM01 terminal No.74.

Results

Test Items	**Standard Value**
Resistance Between IP51 (2) and A Reliable Ground	Lager than 10 kΩ
IP51(2)- EM01(70)Continuity	Less than 1 Ω
Voltage Between IP51 (3) and A Reliable Ground	0 V
IP51(3)- EM01(74)Continuity	Less than 1 Ω

Inspect whether according with the standard value?

No → Circuit fault, repair the faulty part.

Yes

6	Inspect ECM Power Supply Circuit and Ground Circuit.

Inspect ECM Power Supply Circuit and Ground Circuit, and refer to 2.2.7.43 DTC P0562 P0563.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

7	Refer to 2.2.8.1 Replacement of Engine Control Module to replace ECM.

Next

8	Refer to 2.2.7.11“Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn.

Next

9	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

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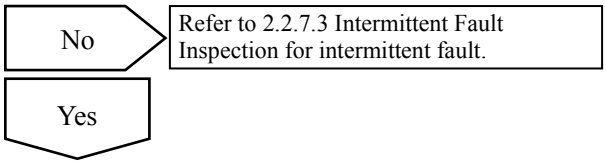

10	Troubleshooting

5. Maintenance guide

Acceleration pedal position sensor can only be replaced as an assembly. Do not disassemble. Refer to 2.2.8.4“Replacement of Acceleration Pedal” to replace the acceleration pedal sensor.

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2.2.7.52 DTC P2127 P2128

1. DTC description:

DTC	P2127	Electronic Acceleration Pedal Position Sensor #2 Circuit Low Voltage or Open

DTC	P2128	Electronic Acceleration Pedal Position Sensor #2 Circuit High Voltage

In order to protect the security of the system, acceleration pedal position sensor (APP) uses a dual-sensor setting, sliding resistive. APP sensor 2 output is IP51 terminal No.6, through ECM wiring harness Connect EM01 terminal No.42 to ECM.

2. Conditions for Setting DTC and the Fault Location:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2127	Hardware Circuit Malfunction	1. APS2 signal terminal grounded or open. 2. Input signal less than 2.5%	1. Acceleration Pedal Position Sensor 2. Acceleration Pedal Position Sensor Circuit 3. ECM
P2128	Hardware Circuit Malfunction	Voltage is higher than the maximum limit, or short to power supply	

3. Circuit figure

Refer to 2.2.7.51 DTC P2122 P2123.

4. Diagnostic Steps:

1	Inspect APP sensor harness connector IP51 terminal voltage of the No.1.

A. Turn the ignition switch to the OFF position.

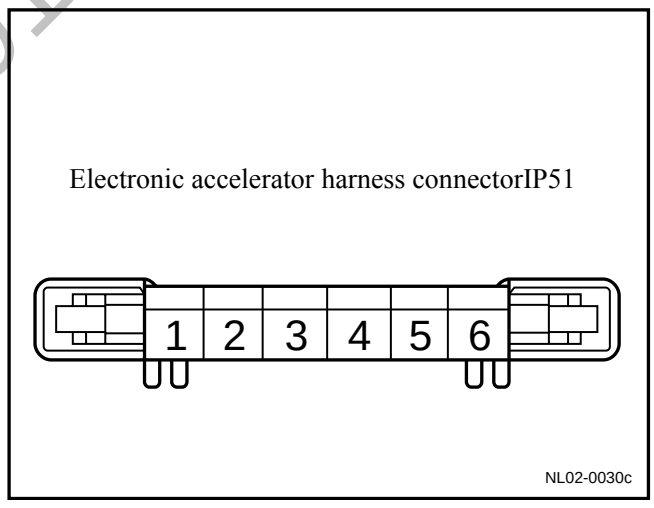
B. Disconnect APP sensor harness connector IP51.

C. Turn the ignition switch to the ON position.

D. Measure voltage between IP51 terminal No.1 and a reliable ground.

Standard Voltage: 4.8-5.2V

Does it conform to the standard value?



No — If the voltage is higher than the Standard Value, the circuit is short to power supply; if the voltage is lower than the standard value, go to step 5.

Yes

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2	Inspect resistance between APP sensor harness connector IP51 terminal No.5 and a reliable ground.

A. Turn the ignition switch to the OFF position.

B. Disconnect APP sensor harness connector IP51.

C. Turn the ignition switch to the ON position.

D. Measure resistance between IP51 terminal No.5 and a reliable ground.

Standard Resistance: Less than 3 Ω

Does it conform to the standard value?

No → Go to step 5

Yes

3	Inspect APP sensor harness connector IP51 terminal No.6.

A. Turn the ignition switch to the OFF position.

B. Disconnect APP sensor harness connector IP51.

C. Disconnect ECM harness connector EM01.

D. Measure resistance between IP51 terminal No.6 and a reliable ground.

E. Measure voltage between IP51 terminal No.4 and a reliable ground.

F. Test continuity between IP51 terminal No.6 and EM01 terminal No.42.

Results

Test Items	**Standard Value**
Resistance Between IP51 (6) and A Reliable Ground	Lager than 10 kΩ
Voltage Between IP51 (6) and A Reliable Ground	Less than 1 Ω
Continuity Between IP51 (6) and EM01 (42)	0 V

Inspect whether according with the standard value?

No → Circuit fault, repair the faulty part.

Yes

4	Inspect APP sensor harness connector IP51 terminal No.6 output voltage.

Inspect APP sensor harness connector IP51 terminal No.6 output voltage.

No → Refer to 2.2.8.4 “Replacement of Acceleration Pedal” to replace the APP sensor.

Yes → Go to step 7

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5	Inspect APP sensor harness connector IP51 terminal No.1 and 5.

A. rotated ignition switch to OFF position .

B. Disconnect APP sensor harness connector IP51.

C. Disconnect ECM harness connector EM01.

D. Turn the ignition switch to the ON position.

E. Measure resistance between IP51 terminal No.1 and a reliable ground.

F. Test continuity between IP51 terminal No.1 and EM01 terminal No.66.

G. Measure voltage between IP51 terminal No.5 and a reliable ground.

H. Test continuity between IP51 terminal No.5 and EM01 terminal No.76.

Results

Test Items	**Standard Value**
Resistance Between IP51 (1) and A Reliable Ground	Lager than 10 kΩ
IP51(1)- EM01(66)Continuity	Less than 1 Ω
Voltage Between IP51 (5) and A Reliable Ground	0 V
IP51(5)- EM01(74)Continuity	Less than 1 Ω

Inspect whether according with the standard value?

No → Circuit fault, repair the faulty part.

Yes

6	Inspect ECM Power Supply Circuit and Ground Circuit.

A. Refer to 2.2.7.43 DTC P0562 P0563 to inspect ECM Power Supply Circuit and ground circuit.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

7	Refer to 2.2.8.1 Replacement of Engine Control Module to replace ECM.

Next

8	Refer to 2.2.7.11“Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn.

Next

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9	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

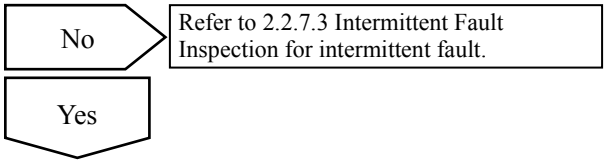
B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.



10	Troubleshooting

5. Maintenance guide

Acceleration pedal position sensor can only be replaced as an assembly. Do not disassemble. Refer to 2.2.8 “Replacement of Acceleration Pedal” to replace the acceleration pedal sensor.

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2.2.7.53 DTC P2135

1. DTC description:

DTC	P2135	Related fault of Electric throttle valve position sensor1# . 2#

ECM compares TPS1 and TPS2 input signals. Two input signals' sum at any time should be close to 5V. If ECM detects difference between the sum of TPS1 and TPS2 signals and the theoretical value is big, ECM will report the DTCs code.

2. Conditions for Setting DTC and the Fault Location:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2122	Hardware Circuit Malfunction	– TPS1 or TPS2 single terminal short connection Power Supply or Ground – Inconsistence in both signals. – signal difference larger than 12%.	1. ETC 2. TPMS Sensor 3. ECM

3. Circuit figure

Refer to 2.2.7.21 DTC P0122 P0123

4. Diagnostic Steps:

1	Inspect whether there is other TPS system related DTC codes?

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes Shown	Go to step
Only P2135	Yes
With P0122, P0123, P0222, P0223	No

No → 2.2.7.14 DTC Chapter Index

Yes

2	Inspect TPS1 and TPS2 output voltage signals.

A. Refer to 2.2.7.12 Electronic Throttle Body (ETC) Inspection for the technical parameters.

Do the TPS1 and TSP2 sensors output signal meet the specified values?

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No → Refer to 2.6.8.5 Replacement of Electrical Throttle Body Assembly to replace the electrical throttle body assembly.

Yes

3	Inspect ECM Power Supply Circuit and ground circuit.

Refer to 2.2.7.43 DTC P0562 to inspect ECM power supply circuit and ground circuit.

P0563" ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

4	Refer to Replacement of Engine Control Module to replace ECM.

Next

5	Refer to 2.2.7.11"Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn.

Next

6	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.
B. Rotated ignition switch to ON position
C. Clear DTC code.
D. Start and run the engine at idle speed to warm up the engine for at least 5 min.
E. Road test the vehicle for at least 10min.
F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

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2.2.7.54 DTC P2138

1. DTC description:

DTC	P2138	Electronic Acceleration Pedal Position Sensor #1 and #2 Related Malfunctions

ECM compares APP1 and APP2 signals. APP2 input signal at any given time should be close to twice the APP1 signal. If ECM detects the APP1 and APP2 signals do not satisfy this condition, ECM will report the DTC code.

2. Conditions for Setting DTC and the Fault Location:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2122	Hardware Circuit Malfunction	– APS1 signal is not keep pace with APS2 Deliver – Input signal difference larger than 8%.	1. APP 2. APP Sensor Circuit 3. ECM

3. Circuit figure

Refer to 2.2.7.51 DTC P2122 P2123.

4. Diagnostic Steps:

1	Inspect whether there is other TPS system related DTC code?

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes Shown	To Step
Only P2138	Yes
With P2122, P2123, P2127, P2128	No

Yes → Refer to 2. 12.7.14 DTC Chapter Index.

No

2	Inspect TPS1 and TPS2 output voltage signals.

(a) For technical specifications, refer to 2.2.7.13 Acceleration Pedal Position Sensor (APP) Inspection.

Do the APP1 and APP2 sensors output signal meet the specified values?

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No → Refer to 2.6.8.5 “Replacement of Electric Acceleration Pedal” to replace the electric acceleration pedal.

Yes

3	Inspect ECM Power Supply Circuit and ground circuit.

A. Refer to 2.2.7.43 DTC P0562 P0563 to inspect ECM Power Supply Circuit and ground circuit.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

4	Refer to Replacement of Engine Control Module to replace ECM.

Next

5	Refer to 2.2.7.11“Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn.

Next

6	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.
B. Rotated ignition switch to ON position
C. Clear DTC code.
D. Start and run the engine at idle speed to warm up the engine for at least 5 min.
E. Road test the vehicle for at least 10min.
F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

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2.2.7.55 DTC P0633 U0167 U0426

1. DTC description:

DTC	**P0633**	Anti-theft Does Not Learn Malfunction

DTC	**U0167**	No response of anti-theft device

DTC	**U0426**	Anti-theft Device Authentication Malfunction

ECM communicates with Anti-theft control module through ECM harness connector EM01 terminal No.46 R-LINE and wiring harness connector EM01 terminal No.75 R-LINE.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0633	Anti-theft Does Not Learn Malfunction	1. Ignition switch ON". 2. Anti-theft device doesn't study or fail to study.	1. Ignition key 2. Ignition Key Incentive Coil 3. ECM 4. Chip Security Module 5. Data Circuit (W-LIN Circuit, R-LIN Circuit)
U0167	No response of anti-theft device	1. Ignition switch ON". 2. Anti-theft Device No Response	
U0426	Anti-theft Device Authentication Malfunction	1. Ignition switch ON". 2. Anti-theft Device Request Authentication Failed	

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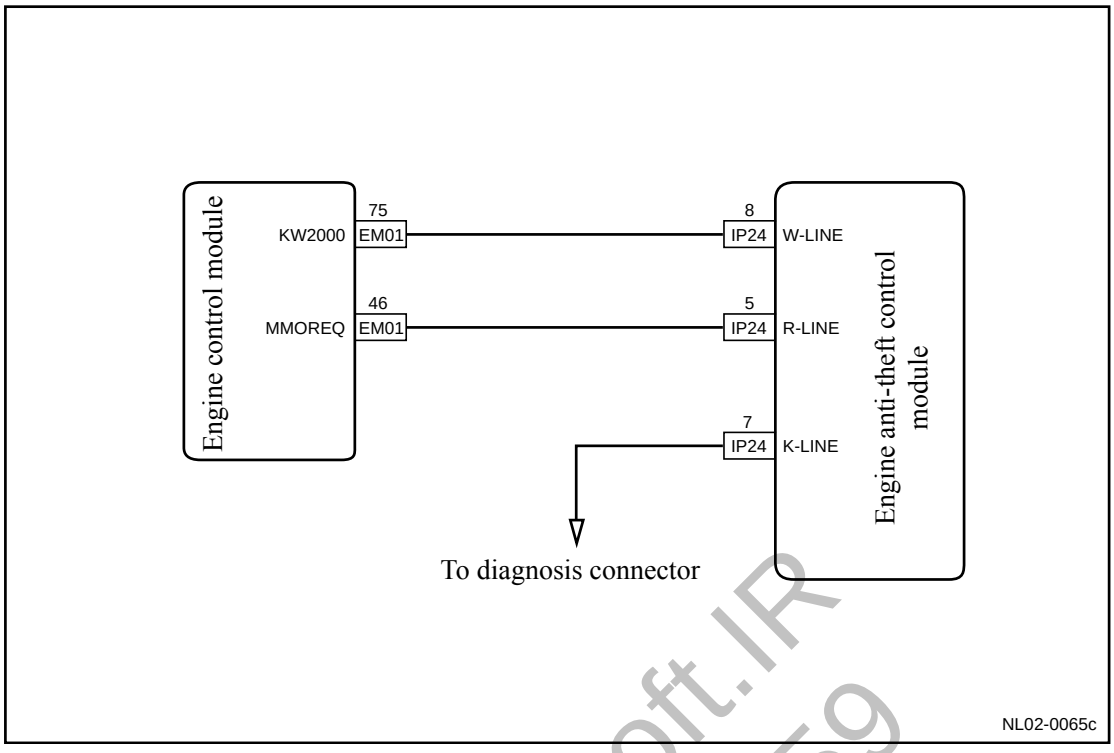
3. Circuit figure



4. Diagnostic Steps:

Refer to 2.5.7.17 Engine Anti-theft Warning Lamp Flashing, Vehicle Can Not Start

5. Maintenance guide :

Refer to 2.5.7 “Diagnostic Information and Procedures” of the engine anti-theft system to repair the anti-theft system.

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2.2.7.56 DTC P0831 P0832

1. DTC description:

DTC	P0831	Clutch switch circuit at low voltage

DTC	P0832	Clutch switch circuit at high voltage

When clutch switch is short to the ground or open (at high voltage), after several times of acceleration from starting-up to >52 Km/h, or deceleration from >52 Km/h to <3 Km/h, the DTC codes appear with the engine running stably, and the vehicle can be driven.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0831	ECM receives the clutch signal	1. Clutch switch signal disconnect or high voltage 2. Acceleration from starting-up to >52 Km/h, or deceleration from >52 Km/h to <3 Km/h. 3. DTC codes appear after repeatedly braking.	1. Clutch Switch Circuit 2. Clutch Switch 3. ECM
P0832		1. Clutch switch signal short. 2. Acceleration from starting-up to >52 Km/h, or deceleration from >52 Km/h to <3 Km/h. 3. DTC codes appear after repeatedly braking.	

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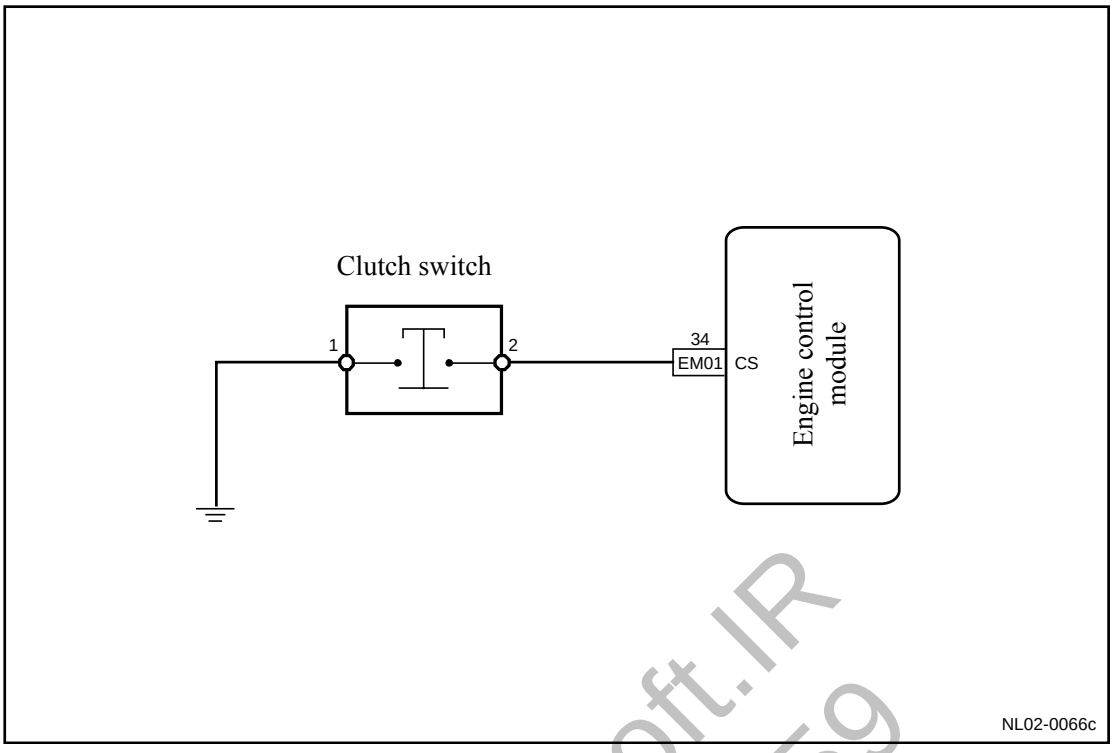
3. Circuit figure



4. Diagnostic Steps:

Notes:

Before carrying out this diagnosis steps, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect for other DTC Codes other than P0831 and P0832.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes Shown	**To Step**
DTC P0831 P0832	Yes
DTC Code Other Than DTC P0831 P0832	No

Yes → Refer to 2. 3.6.11 DTC Chapter Index.

No

2	Is the clutch switch working correctly?

Note: When the clutch switch fails, during emergent acceleration and deceleration, the vehicle

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will vibrate seriously and even push forward.

Yes → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

No

3	Inspect the continuity between clutch switch wiring harness connector IP60 and ECM harness connector EM01.

A. rotated ignition switch to OFF position .

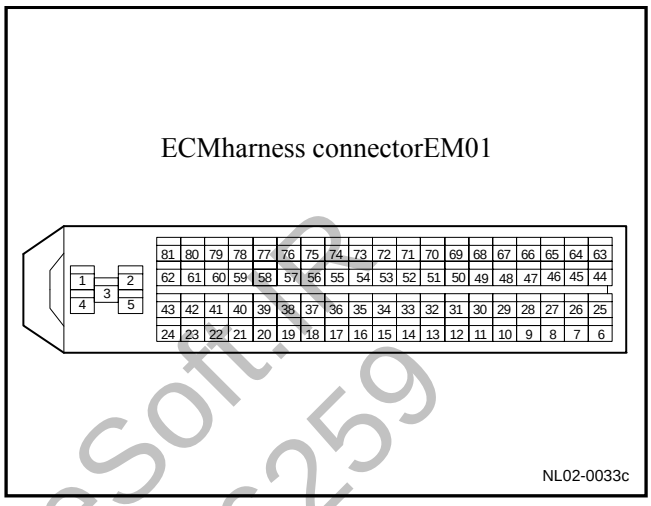
B. Disconnect ECM harness connector EM01.

C. Press the brake pedal.

D. Measure ECM harness connector EM01 terminal No.34 resistance.

Standard Resistance: Less than 3 Ω

Confirm whether the resistance is normal.



Yes → Refer to 2.2.8.1 Replacement of Engine Control Module to replace ECM.

No

4	Repair the circuit between clutch switch wiring harness connector IP60 and ECM harness connector EM01.

A. Repair the circuit between clutch switch wiring harness connector IP60 and ECM harness connector EN01.

B. Confirm the repair is completed.

Next

5	Is the clutch switch working correctly?

Note: When the clutch switch fails, during emergent acceleration and deceleration, the vehicle will vibrate seriously and even push forward.

No → Refer to 2.2.8.7 ”Replacement of Clutch Switch” to replace the clutch switch.

Yes

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5. Maintenance guide :

Refer to 2.2.8.7 Replacement of Clutch Switch to replace the Clutch switch.

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2.2.7.57 Crankshaft can rotate normally, but engine can't be started.

Notes:

Before carrying out this step, make sure the engine oil complies with the manufacturer requirements, the fuel tank has sufficient fuel and battery has enough power for starting engine. Observe the fault diagnosis tester data list, analyze the accuracy of the data, as these will facilitate diagnostic.

Diagnostic Steps:

1	Scan ECM for DTC codes.

A. Connect fault diagnosis tester.

B. Rotated ignition switch to ON position .

C. Scan ECM DTC codes.

D. Refer to 2.2.7.14 DTC Code Index to repair any DTC code faulty part related to fuel system.

E. Clear ECM DTC code.

Start the engine, fault solved?

Yes → The system is normal.

No

2	Inspect fuel pump relay.

A. Connect fault diagnosis tester.

B. Rotated ignition switch to ON position .

C. Choose fault diagnosis tester Action Test then fuel pump relay to drive the fuel pump relay.

Is fuel pump relay working properly?

Yes → Go to step 5

No

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3	Replace the fuel pump relay.

A. Refer to 2.3.2 Description and Operation and 2.3.3 System Operating Principle in the Fuel System.

B. Replace the pump relay.

C. Inspect fuel pump relay circuits and repair the faulty part. Start the engine, fault solved?

Yes → The system is normal.

No

4	Inspect the fuel pump circuit.

A. rotated ignition switch to OFF position .

B. Disconnect fuel pump harness connector SO26.

C. Connect fault diagnosis tester.

D. Turn the ignition switch to the ON position.

E. Select Fuel Pump Relay in Functional Testing of the diagnostic test er to drive the fuel pump relay.

F. Use a test lamp to connect SO26 terminals No. 3 and 4.

Is test lamp lit properly?

Yes	Go to step 7
No	

6	Repair the fuel pump circuit.

A Turn the ignition switch to the ON position.

B. Inspect fuel pump working circuit, repair the pump SO26 terminals No.3 and fuel pump relay terminal No.5 open circuit fault.

Start the engine, fault solved?

Yes	The system is normal.
No	

7	Inspect the fuel pressure

A. rotated ignition switch to OFF position .

B. Install fuel pressure gage, connect fault diagnosis tester.

C. Rotated ignition switch to ON position .

D. Connect the diagnostic tester and select Fuel Pump Relay in Functional Testing.

Compel to drive the fuel pump relay.

Standard Fuel Pressure Value: 350 kPa

Is fuel pressure normal?

Yes	Go to step 8
No	

8	Replace the fuel pump assembly.

A. Turn off the ignition switch and remove the ignition key.

B. Refer to 2.3.6.3 Replacement of Fuel Pump Assembly to remove the fuel pump assembly.

Start the engine, fault solved?

Yes	The system is normal.
No	

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9	Inspect (repair) fuel injectors.

A. Refer to the DTC code 2.2.7.32 DTC P0270 P0271 for the inspect (repair) procedures. If necessary, replace the faulty fuel injectors.

Start the engine, fault solved?

Yes → The system is normal.

No

10	Inspect the ignition coil.

A. rotated ignition switch to OFF position .

B. Dismantle the ignition coil harness connector and connect an intact spark plug with well grounding.

C. Start the engine.

Is spark plug ignition normal?

Yes → Go to step 12

No

11	Replace the ignition coil,

A. Turn off the ignition switch and remove the ignition key.

B. Refer to 2.10.7.3 Replacement of Ignition Coil to replace the ignition coil.

Start the engine, fault solved?

Yes → The system is normal.

No

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12	Inspect crankshaft position sensor and circuit.

A. Refer to 2.2.7.35 DTC P0335 P0336 to inspect crankshaft position sensor.

B. Measure crankshaft position sensor resistance with a multimeter.

Standard resistant value :20-30℃(68-86℉)900-1100Ω

C. Inspect sensor circuit, repair the faulty part. If necessary, refer to 2.10.7.2 Replacement of Crankshaft Position Sensor to replace the crankshaft position sensor.

Start the engine, fault solved?

Yes → The system is normal.

No

13	Test the cylinder pressure.

A. Refer to 2.6.7.3 "Comprehensive Engine Inspections" to carry out the cylinder compression

pressure test.

Standard Cylinder Pressure: 800 kPa

Are all cylinders compression pressure equal to or higher than the specified value?

Yes → Go to step 15

No

14	Inspect timing chain positioning.

A. Turn off the ignition switch and remove the ignition key.

B. Refer to 2.6.8.11 "Timing Chain Inspection" to inspect timing chain positioning.

Is the chain positioned properly?

Yes → Go to step 15

No

15	Install the timing chain.

A. Turn off the ignition switch and remove the ignition key.

B. Refer to the 2.6.8.10 "Replacement of Timing Chain Component" to reinstall the timing chain.

Start the engine, fault solved?

Yes → The system is normal.

No

16	Inspect mechanical parts inside the engine.

A. Dismantle the engine.

B. Inspect engine mechanical parts. If necessary, repair the damaged engine components.

C. identify the engine damaged components repair has been completed.

Next

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2.2.7.58 Electronic Throttle Body (ETC) Self-adaptive Learn Program

Notes:

After the throttle body for cleaning and serving, carry out ETC self-adaptive learn. Otherwise there will be idle instable, jitter and so on.

1	Use fault diagnosis tester "Action Test" function, clear the TPS learn value.

Next

2	Turn the ignition switch to "ON" position, after 3 s to "OFF" position.

Next

3	In 1s turn the ignition switch to "ON" position, after 3 s to "OFF" position.

Next

4	Repeat the above steps 5 times.

Next

5	Initialization completed.

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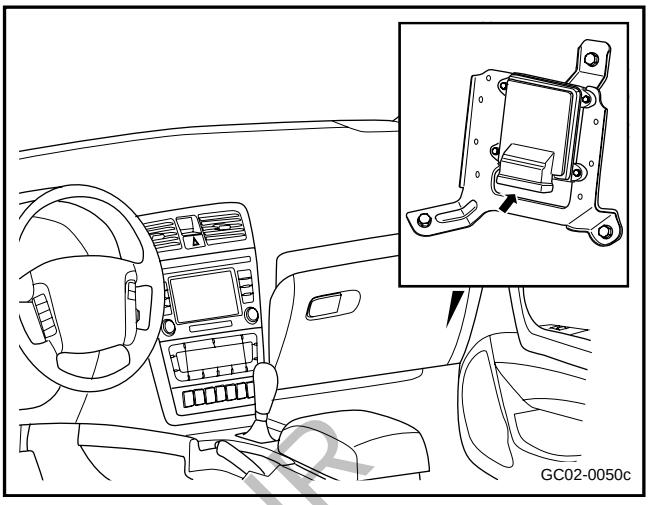
2.2.8 Removal and installation

2.2.8.1 Replacement of Engine Control Module

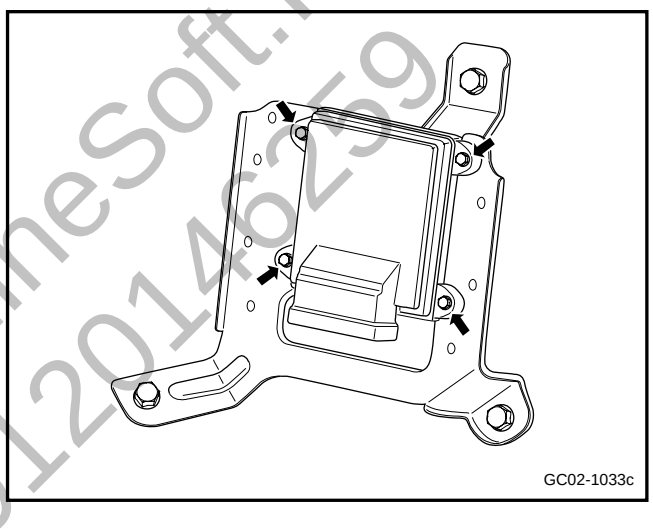
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Refer to the 12.8.3.3 Replacement of Glove Box in Complete Vehicle Maintenance Manual to dismantle the glove box of instrument panel.
3. Disconnect engine control module harness connector .



4. Dismantle the fixing bolts of engine control module.

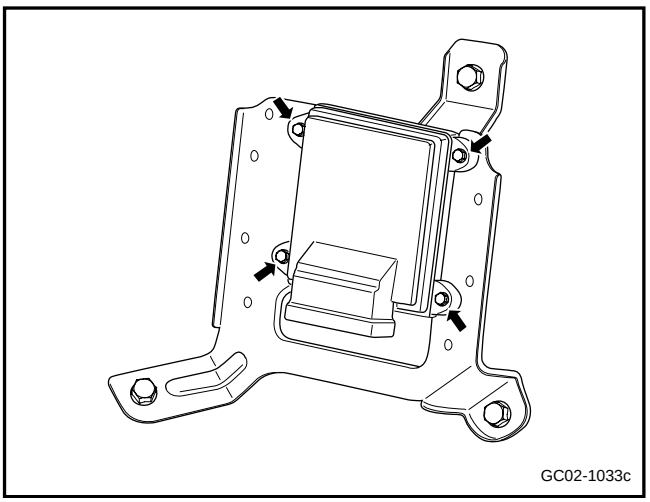


Installation Procedure:

1. Install the fixing bolts of engine control module.

Torque: 9Nm (Metric) 6.66 lb-ft (English system)

2. Connect the engine control module harness connector.
3. Install the glove box of instrument panel.
4. Connect battery negative cable.



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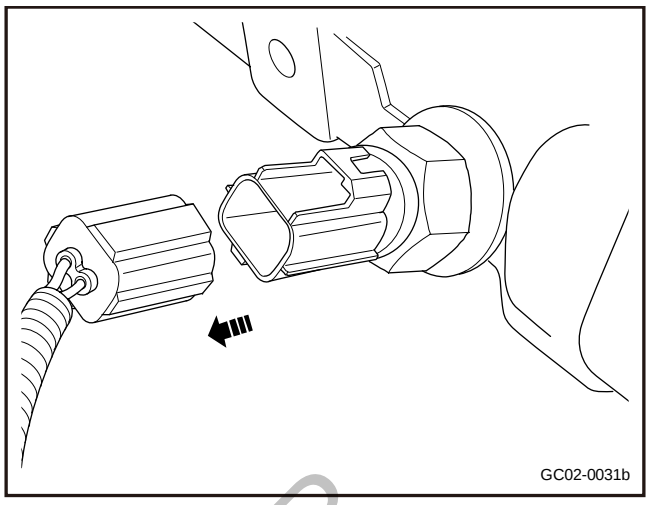
2.2.8.2 Engine coolant temperature sensor

Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Release pressure in the cooling system.
2. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
3. Disconnect the temperature sensor of engine coolant harness connector.
4. Dismantle the temperature sensor of engine coolant.



Installation Procedure:

1. Apply sealant on the temperature sensor of engine coolant thread.
2. Install the temperature sensor of engine coolant.
3. Connect temperature sensor of engine coolant harness connector.
4. Fill the engine coolant.
5. Connect battery negative cable.

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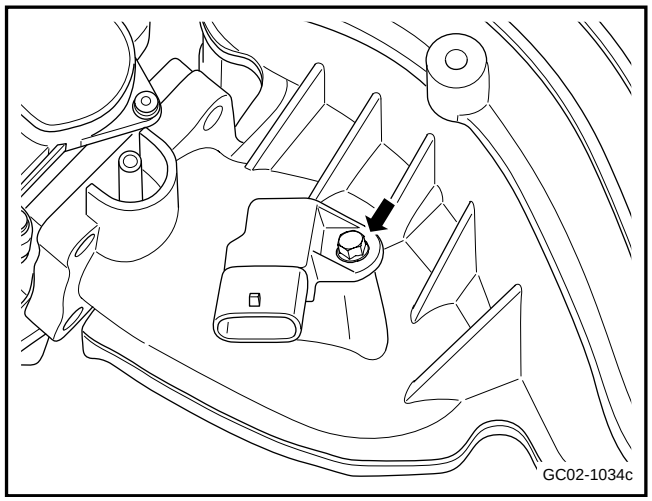
2.2.8.3 Replacement of Intake Pressure Temperature Sensor

Dismantlement Procedure

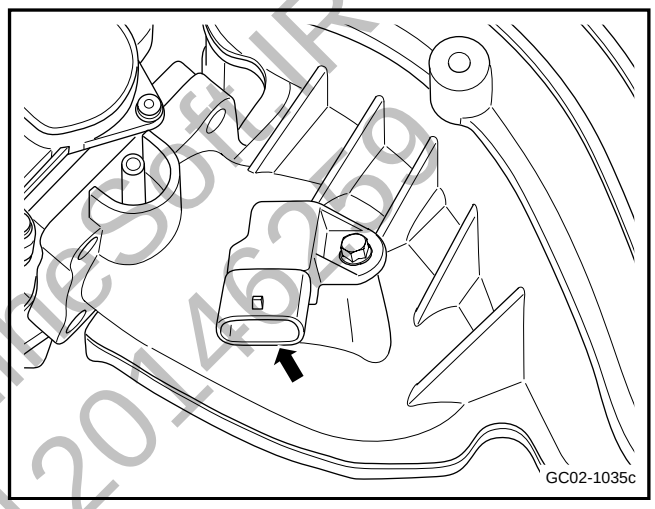
Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Disconnect intake pressure temperature sensor harness connector.
3. Dismantle Fixing Bolts of Intake Pressure Temperature Sensor
4. Dismantle Intake Pressure Temperature Sensor



Installation Procedure:

1. Install the intake pressure temperature sensor and tighten the fixing bolts.
2. Connect the intake pressure temperature sensor harness connector.
3. Connect battery negative cable.



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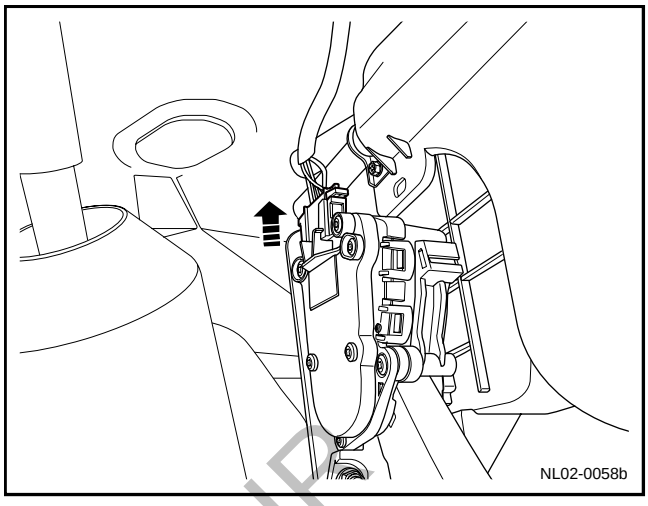
2.2.8.4 Replacement of Electronic Acceleration Pedal Assembly

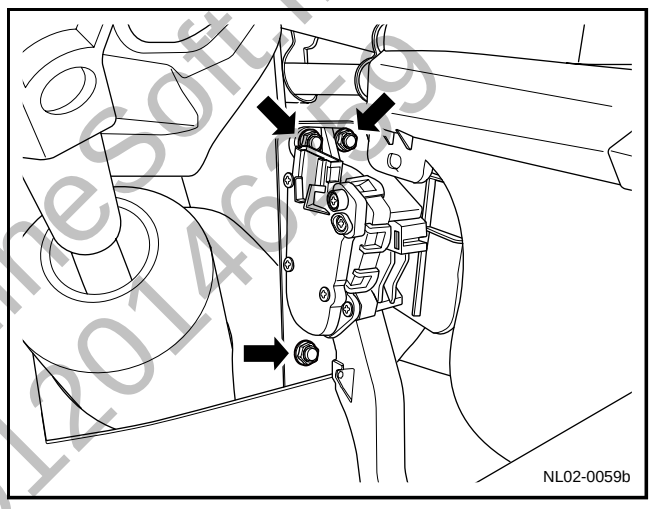
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
2. Disconnect the acceleration pedal assembly harness connector.



3. Dismantle the fixing bolts of acceleration pedal and dismantle the acceleration pedal.

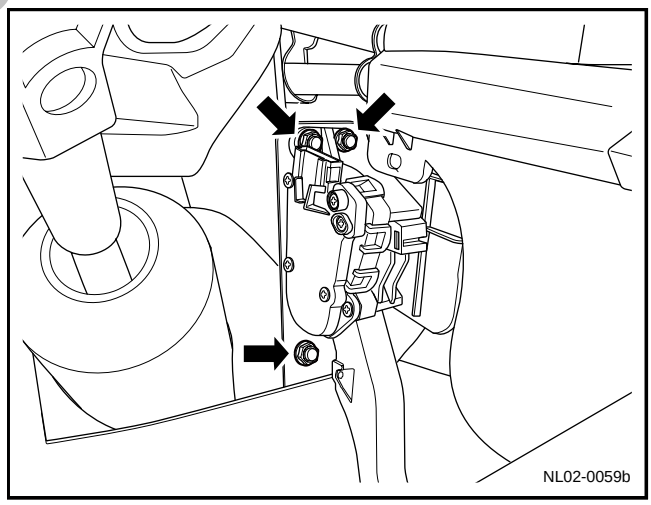


Installation Procedure:

1. Install the acceleration pedal and tighten the fixing nuts.

Torque:15 Nm(Metric) 11 lb-ft(English system)

2. Connect the acceleration pedal harness connector.
3. Connect the battery negative cable .



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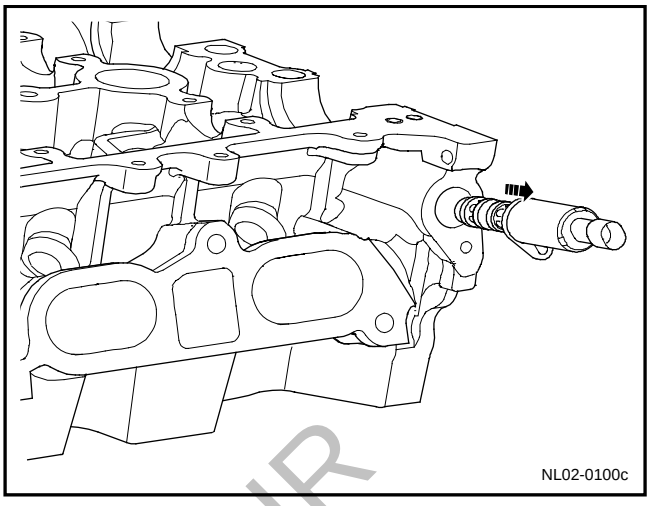
2.2.8.5 Replacement of VVT Solenoid Valve and Filter Cleaning

Dismantle the VVT solenoid valve.

Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions".

1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Refer to 2.6.8.1 "Replacement of Engine Shied" to dismantle the engine shied.
3. Disconnect VVT solenoid valve wiring harness connector.
4. Dismantle fixing bolts of VVT solenoid valve and dismantle the VVT solenoid valve.



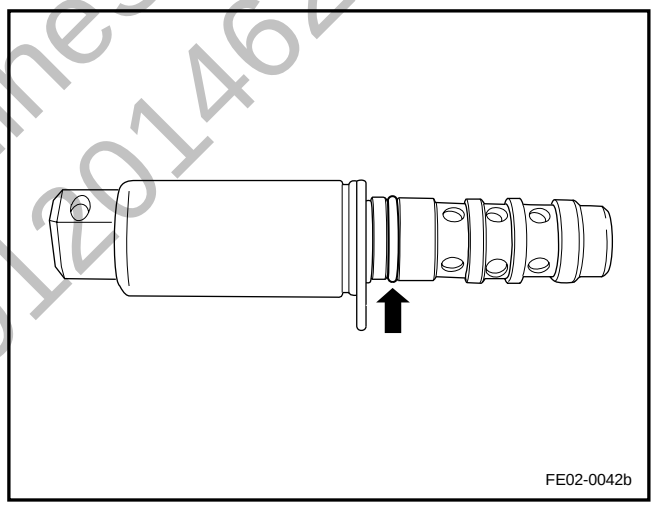
Install the VVT solenoid valve.

Important precaution: after replacing by new VVT electromagnetic value, the procedure of "clean and check the electromagnetic valve filter screen" must be implemented! Otherwise, cause damage to the electromagnetic valve.

1. Make sure the new VVT solenoid valve seals are intact. Apply a small amount of engine lubrication oil on the seal.
2. Install the VVT solenoid valve and fasten the fixing bolts.

Torque: 8Nm (Metric) 6 lb-ft (English system).

3. Connect the VVT solenoid valve wiring harness connector.



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2.2.8.6 VVT Solenoid Valve Cleaning

Precautions:

A. Inoperative near at high temperatures or near a fire to avoid cleaning agents being ignited or exploded.

B. The length of wire should be more than 3m. It is recommended to install the wire relay.

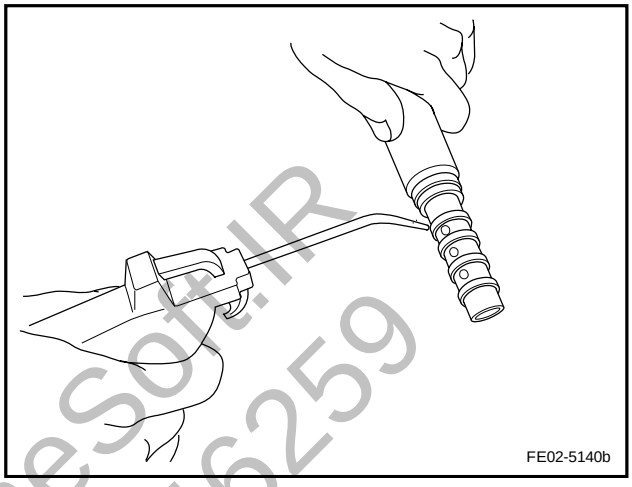
C. During the cleaning process, do not scratch the O- ring, scratch or knock the surface of the valve or drop the valve..

D. After repair, reinstall the valve VVT and tightening the bolt to 10Nm.

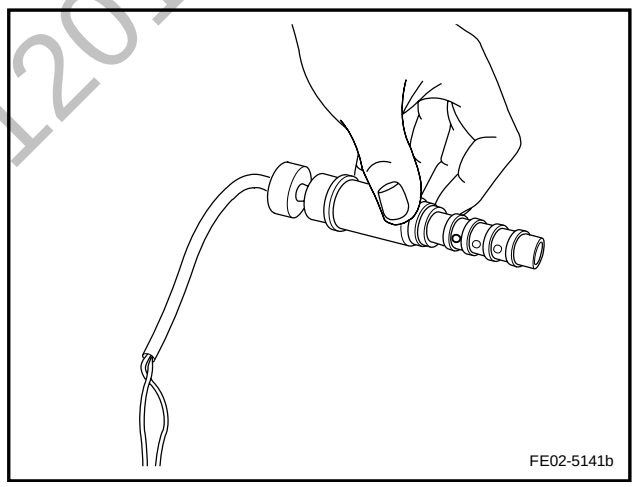
E. Replace repeatedly cleaned VVT valve.

1. For disconnection of negative cable of battery, refer to "2.11.8.1 disconnection process of battery negative cable".
2. Refer to 2.2.8.4 "Replacement of VVT Solenoid Valve and Filter Cleaning" to dismantle the VVT Solenoid Valve.
3. Clean the VVT solenoid valve hole, return hole, the chamber.

Note: During the cleaning process, keep the VVT solenoid valve and wiring harness connector upright, otherwise the cleaning agent will easily enter the VVT solenoid valve and cause internal damage.



4. Use an air gun to clean the VVT valve hole and oil chamber. Clean up the cleaning agent residue.



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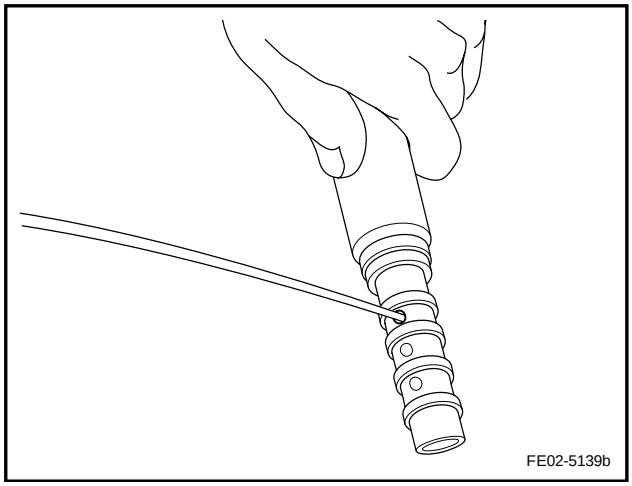
5. Switch on and off the VVT solenoid valve. Clean the valve with an air gun and repeat 2-3 times.

Note: Each time switch the valve on no longer than 2 seconds, otherwise the VVT solenoid valve may be damaged.



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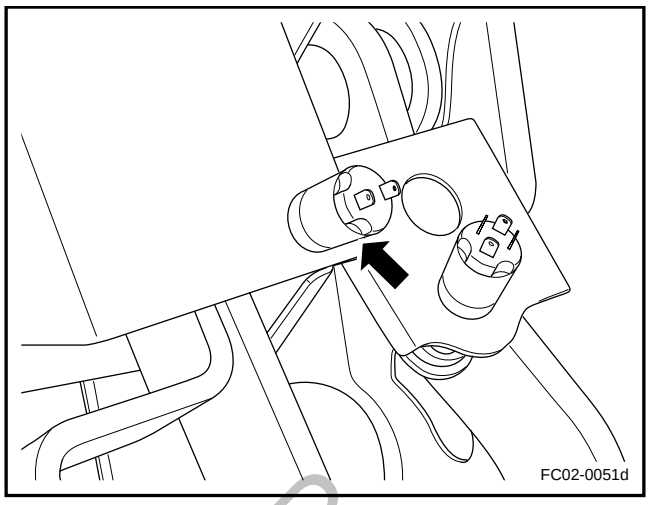
2.2.8.7 Replacement of Clutch Slave Cylinder

Dismantlement Procedure

1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Refer to "Replacement of Instrument Panel" to dismantle the instrument panel.

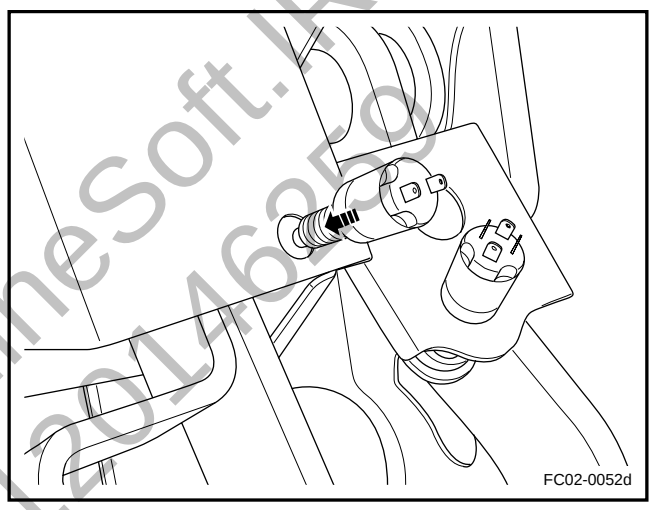
Note: Please use a special tool for body repair when disassembling the trim panel, otherwise, the edge of the interior trim will easily be scratched.

3. Disconnect clutch switch wiring harness connection.
4. Dismantle the clutch switch.



Installation Procedure:

1. Install the clutch switch..
2. Connect all clutch switch harness connection.
3. Install the instrument panel.
4. Connect battery negative cable.



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2.3 Fuel System

2.3.1 Specifications

2.3.1.1 Fastener Specifications

Fastener Name	Model	Torque Range	
		N·m (Metric)	English system (lb-ft)
Fixing Bolts of Fuel Tank	M10×30	40 - 45	29 . 6 - 33 . 3
Fixing bolts of fuel filter mounting bracket	M6×12	8 - 9	5.9 - 6.7
Fixing Bolts of Fuel Pipe	M8×16	20 - 24	14.8 - 17.8
Fixing Bolts of Fuel Injector Oil Rail Assembly	M6×25	8 - 12	5. 9 - 8 . 9

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2.3.2 Description and Operation

2.3.2.1 Description and Operation

The fuel supply system provides a suitable amount of fuel to the engine in a variety of operating conditions. The fuel is sprayed into the engine through the fuel injectors. Fuel tank stores fuel. An electric fuel pump is installed in the fuel tank and it will pump fuel into the fuel distributing pipe assembly. Fuel pump provided fuel pressure exceeds the pressure needed by fuel injectors. Fuel pressure regulator is part of the fuel pump assembly, which keeps fuel supplied to the fuel injectors is under specified pressure. This vehicle fuel system has no fuel return system.

1. Fuel Tank

Fuel tank is made from high-density polypropylene vinyl and other materials. Two metal straps attached to the underbody are used to fasten it in place. And it has a fuel vapor ventilation valve with roll-over protection function.

2. Fuel Tank Filling Cap

Note: In the need for replacing the fuel tank filler cap, use a fuel tank filler cap with the same function as the original one. If the fuel tank filler cap is not correctly installed, it could cause serious fuel system faults.

The fuel tank filling tube filler cover is equipped with a screw thread structure, which allows air coming in once it is turned loose. It uses the structure of the ratchet in order to prevent over-tightening. Ventilation function means the fuel tank internal pressure can be released before dismantling the cap from the vehicle. Instructions are attached to the cap. The filler cap also integrates a security vacuum pressure limiting valve.

3. Fuel Pump

Electric fuel pump is a modular fuel turbo pump located inside the fuel tank. Electric fuel pump is controlled by the engine control module (ECM) through the fuel pump relay. Electric fuel pump will start providing fuel 2s in advance to ensure that the fuel pressure achieve the requirements of the normal system operation. The fuel pump resistance range is 0.2~3.0 Ω. This model comes with electric fuel pump fuel storage in order to prevent the fuel level too low or provide fuel supply in harsh operating conditions.

4. Fuel Pressure Regulator Assembly

Fuel pressure regulator is integrated in the fuel pump assembly. Fuel pressure regulator's main function is to regulate the fuel pipe fuel flow and to control the fuel injectors pressure. When the ignition switch is at ON position and the engine is shut down, the system fuel pressure should be about 400 kPa.

5. Electric Fuel Pump Filter

As a coarse filter, the filter has the following features:

– Filters the pollutants.

– Improves the electric pump service life.

If the pump output pressure is found too low, clean or replace the filter.

6. Fuel Filter Assembly

Fuel Filter Assembly is located at the left side of the underbody and fixed to the vehicle chassis. The filter consists of paper filter element, which can filter the particles in the fuel may damage the fuel system part. Fuel filter can withstand maximum fuel system pressure, temperature changes and fuel additive effect.

7. Fuel Level Sensor Assembly

Fuel level sensor consists of a fuel level float, a wire arm harness assembly. The fuel level sensor is fixed to the fuel tank. According to the location, the sliding chip provides variable resistance to the combination instrument circuit. The resistance range is 40~250 Ω. Circuit wiring harness leads

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from the variable resistance film and extends to and fuel pump harness connector.

8.Fuel Rail

Fuel rail consists of the following:

– Fuel Delivery Pipes to Each Fuel Injector

– 4 Independent Fuel Injectors

Fuel distributing pipe is installed in the intake manifold, and provides fuel to each cylinder through the respective fuel injectors.

9. Fuel Injectors

Fuel injector is a solenoid valve device controlled by the engine control module. When the engine control module provides power supply to the fuel injector coil, normally closed ball valve opens, allowing fuel flow through the diffuser plate to fuel injector outlet. Diffuser plate has a hole, used to control fuel flow and form a double cone-shaped fine spray of fuel at the fuel injector outlet. The fuel is sprayed into the two intake valve channel from the fuel injectors, so that the fuel will be further atomized before entering the combustion chamber. If the fuel injectors have the following conditions, it will lead to various vehicle dynamic performance malfunction:

– If the fuel injector can not be opened.

– If the fuel injector is stuck at the opening position.

– If the fuel injector leaks.

– If the fuel injector coil resistance is too low. The normal resistance range is: 11.6-12.4 Ω.

10. Fuel Pipe O-ring

O-ring seals fuel system screw joints . Fuel System O-ring is made from a special material.

Note: The fuel pipe O-ring is not a serviceable part.

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2.3.3 System operating principle

2.3.3.1 System operating Principle

Intake manifold absolute pressure sensor senses and measures intake manifold vacuum. When the fuel demand is high, the intake manifold absolute pressure is in a low-vacuum state, such as the throttle fully open. Engine control module uses this information to enrich the mixture, thereby increasing the fuel injector opening time and injecting the correct amount of fuel. When the engine decelerates, the intake manifold absolute pressure sensor detects increase in the vacuum degree, the engine control module requests to shorten the fuel injector opening time, reducing the amount of fuel injection according to the change.

1. Starting Mode

When the ignition switch is turned on, the engine control module connects to the fuel pump relay 2 s. Then, the fuel pump fuel pressure is established. Engine control module also inspects the temperature sensor of engine coolant and throttle position sensor to determine the most appropriate Air-Fuel ratio to start the engine. Engine control module controls the fuel supply by changing the fuel injectors opening and closing time. This is achieved by controlling the fuel injectors with very short pulses.

2. Acceleration Mode

Engine control module responds to throttle position and the rapid changes in airflow and provides additional fuel.

3. Deceleration Mode

Engine control module responds to throttle position and gas flow rate changes and reduces the fuel amount. When the speed rapidly decreases, the engine control module can completely cut off fuel supply.

4. Battery Voltage Calibration Mode

When the battery voltage is too low, the engine control module uses the following methods compensate for a weak ignition spark:

– Increase fuel injector pulse width.

– Improved idle speed.

– Increase the ignition duration.

5. Oil cut-off mode

When the ignition switch is turned off, the fuel injector will not provide fuel. This prevents the continued combustion or engine can not shut down. In addition, if the reference pulse is not received, there will be no fuel supply in order to prevent fuel overflow.

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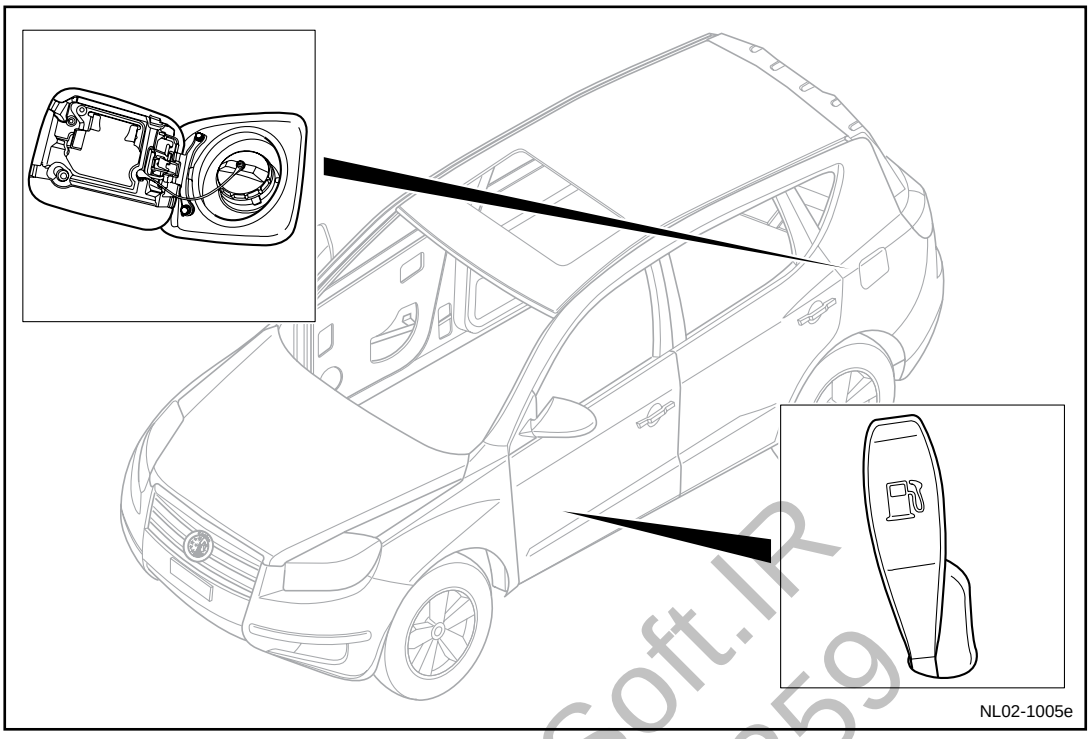
2.3.4 Component position

2.3.4.1 Fuel Filler Position



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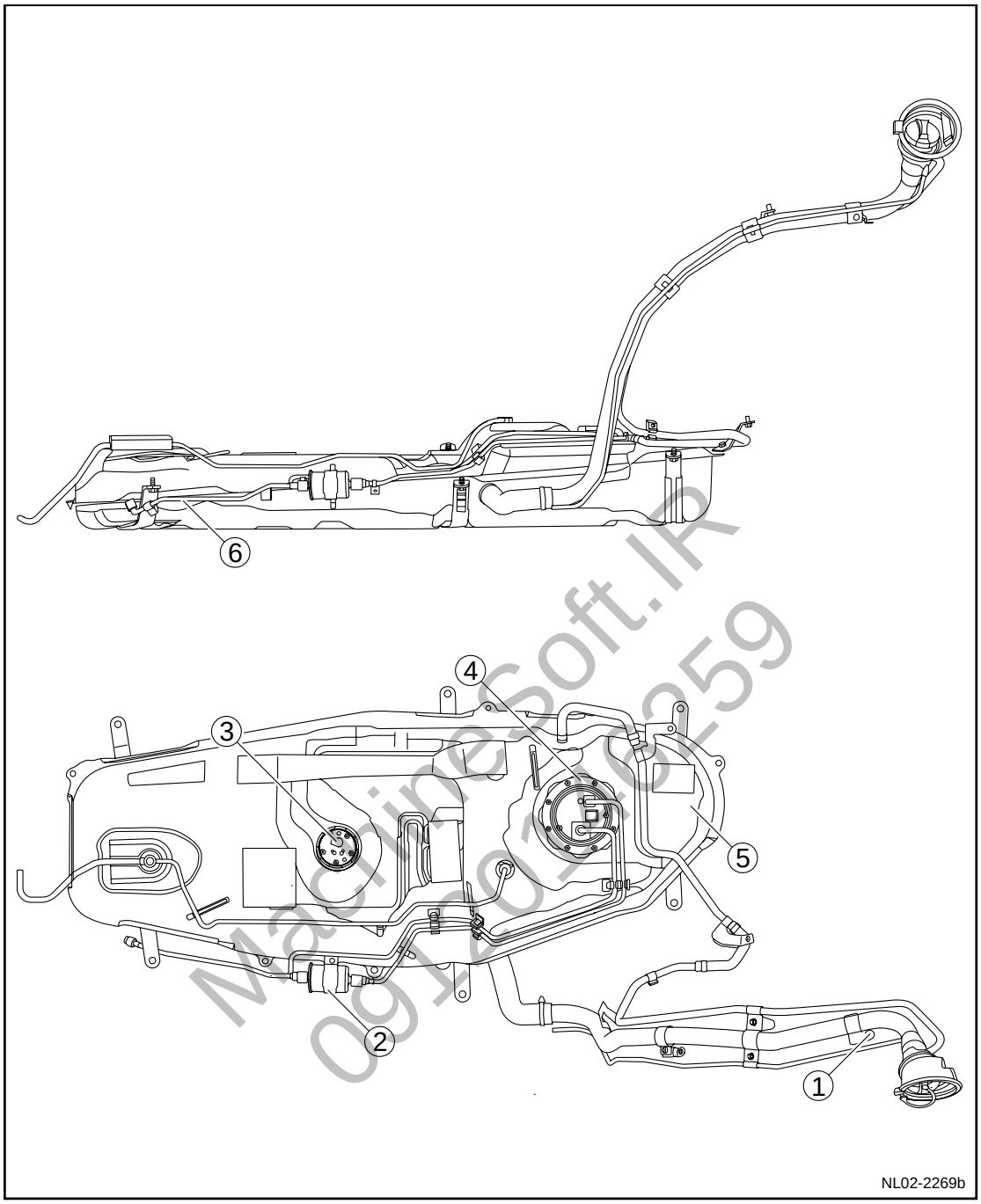
2.3.4.2 Fuel Supply System



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1 Filling Tube

2 Filter

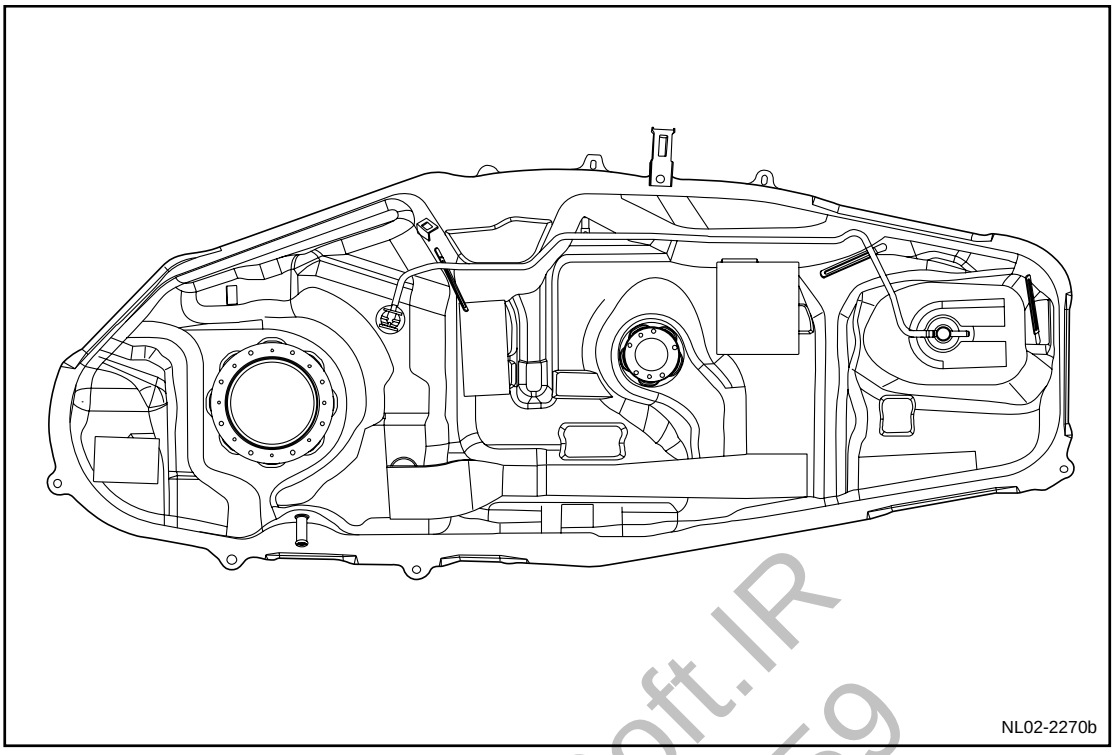
3 Fuel Level Sensor

4 Fuel Pump

5 Fuel Tank

6 Fuel Supply Hose

2.3.4.3 Fuel Tank Assembly



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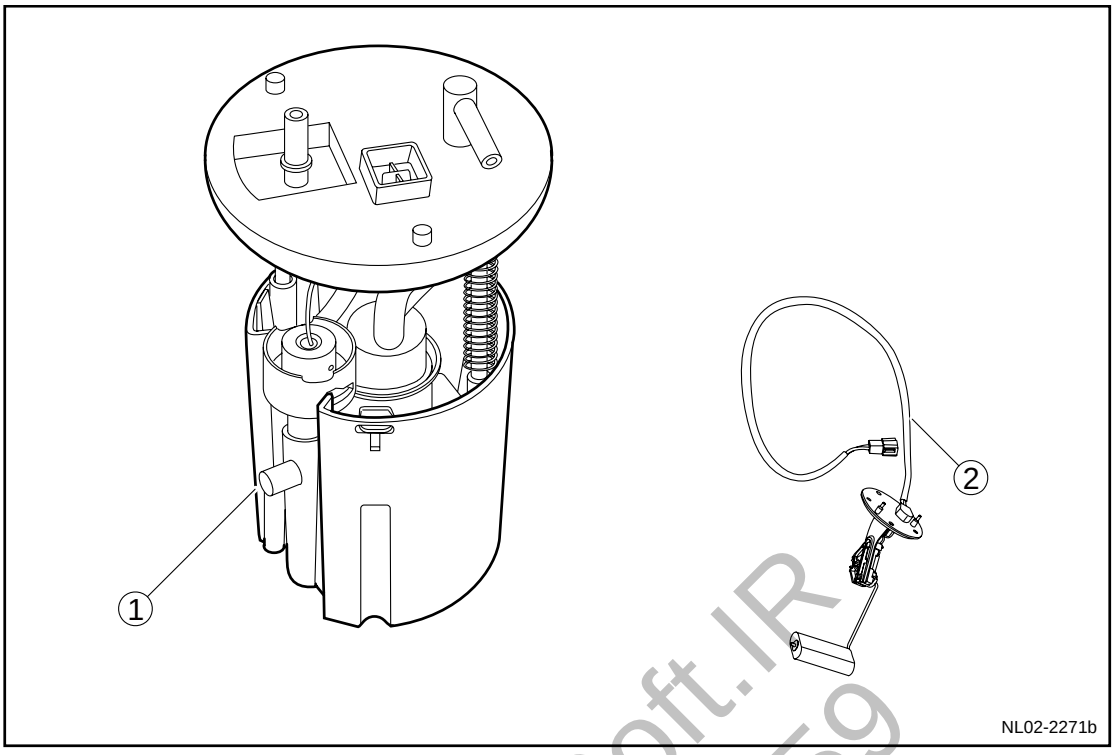
2.3.4.4 Fuel Pump with a Fuel Sensor Assembly



1. Fuel Pump Assembly
2. Fuel Level Sensor

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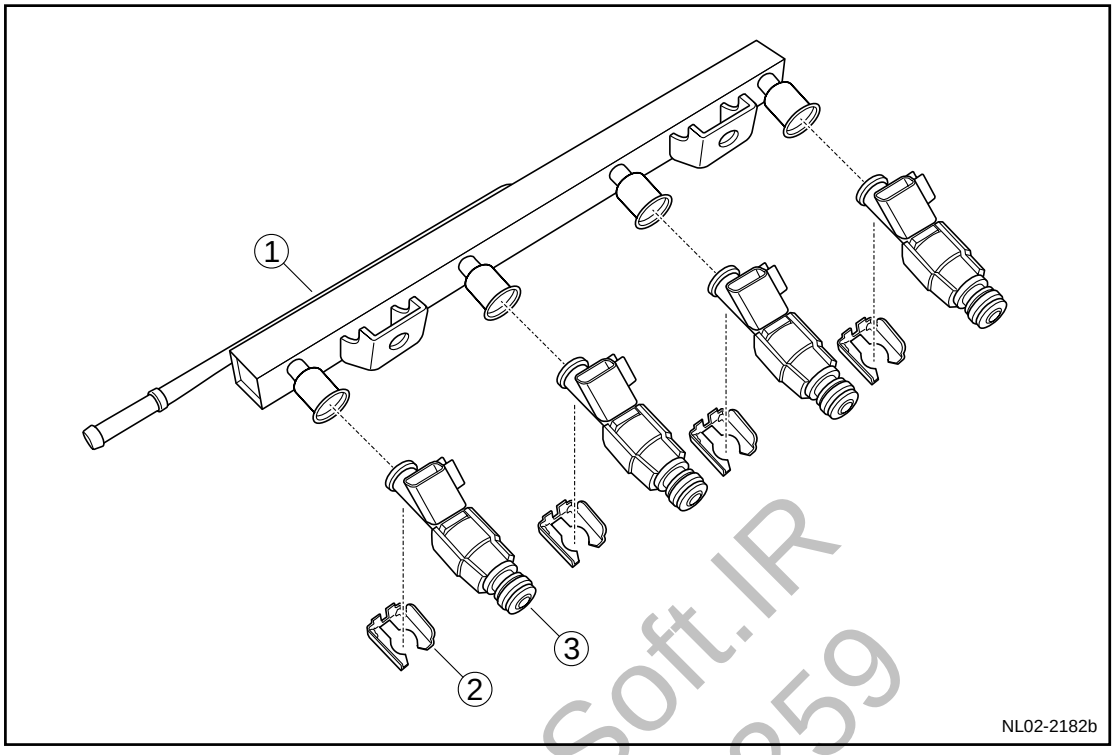
2.3.5 Disassemble drawings

2.3.5.1 Oil rail and injector assembly Disassembly drawing



1. Fuel Distribution Pipe
2. Fuel Injectors
3. Spring Clip

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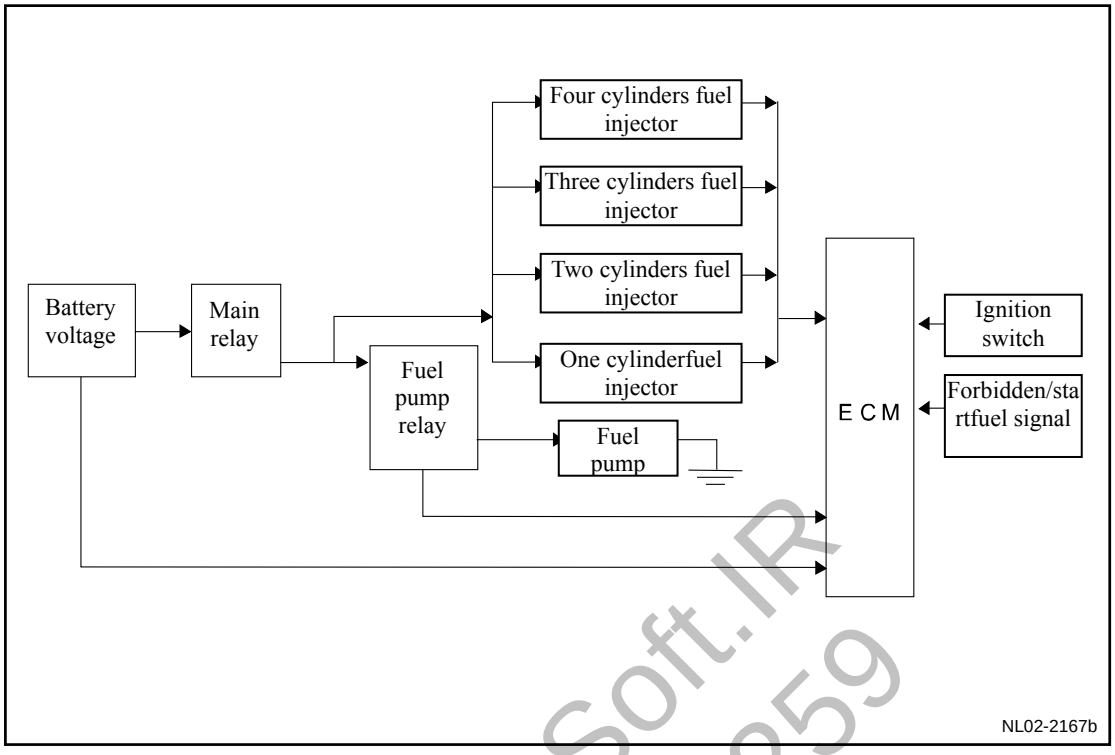
2.3.6 Electrical schematic diagram

2.3.6.1 Electrical schematic diagram



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2.3.7 Diagnostic Procedures and Description

2.3.7.1 Diagnosis descriptions

Refer to 2.3.2 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

2.3.7.2 Visual inspection

- Inspect installed after market equipment that may affect the operation of the fuel system.
- Inspect the easy to access system components to identify whether there is significant damage or the existence of an external leakage.
- Inspect whether the fuel is the recommended type and fill up the fuel tank.

2.3.7.3 Fuel Pressure Testing Procedure

Warning: Gasoline and gasoline vapor is highly flammable. In order to avoid fire or explosion, please select to keep away from a fire. It is prohibited to use mobile phones during this procedure. Do not use open containers to store gasoline or exhaust emissions. Before carrying out this procedure, please prepare a dry-chemical fire extinguisher.

Warning: Wrap a cloth around the fuel pressure gage and fuel distributing pipe joints to absorb leaked fuel when you connect the fuel pressure gage to reduce the risk of fire and injury. Upon completion of testing, place the cloth into the designated containers. Clean the oil pipe connector before dismantling the oil pipe.

Warning: It is prohibited to pour or store fuel in an open container, otherwise it will cause a fire.

1	Install fuel pressure gage in the fuel distributing pipe inlet.

Next

2	Place the fuel pressure gage exhaust hose into a specified gasoline container.

Next

3	Open the valve on the fuel pressure gage to discharge the air from the gage.

Next

4	Turn the ignition switch to the position "ON".

Next

5	Use fault diagnosis tester "Function Test" drive fuel pump fuel pump relay, until all the air expelled from pressure gage.

Next

6	Turn off the exhaust valve on the fuel pressure gage.

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Next

7	Use fault diagnosis tester to connect the fuel pump to inspect whether there is fuel leakage and the leakage location.

Next

8	When there is no leakage in the pipeline, start the engine and the fuel pressure should be 400 kPa (58.01psi).

Next

9	Turn the ignition switch to "OFF" position.i under normal circumstances the system should maintain residual pressure above 250 kPa (36.26 psi). If the fuel pressure continues to drop, inspect the fuel pump or fuel pressure regulator.

Next

10	Finish

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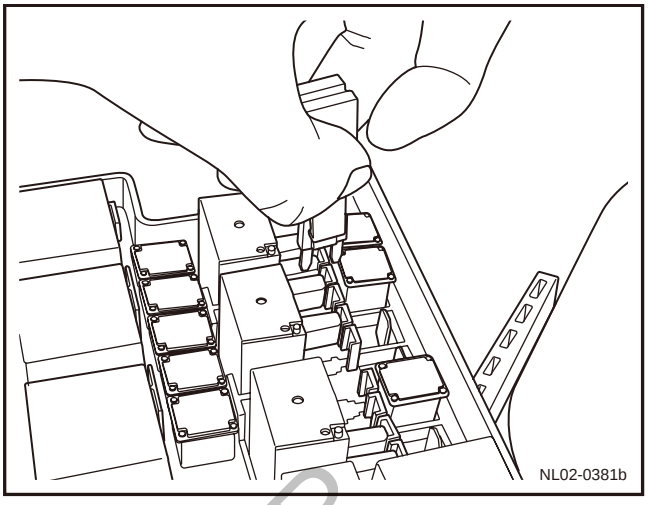
2.3.8 Removal and installation

2.3.8.1 Fuel Pressure Release Procedure

1. Open the fuel tank cap.
2. Open the hood, pull out fuel pump fuse EF25 (15 A).
3. Start the engine until the engine stops running automatically.
4. Start the engine again, so that the crankshaft continues to rotate about 10s.

Note: If you want to dismantle any fuel system components, wrap pipe joints with plastic bags to prevent fuel leakage and prevent the entry of foreign matter.



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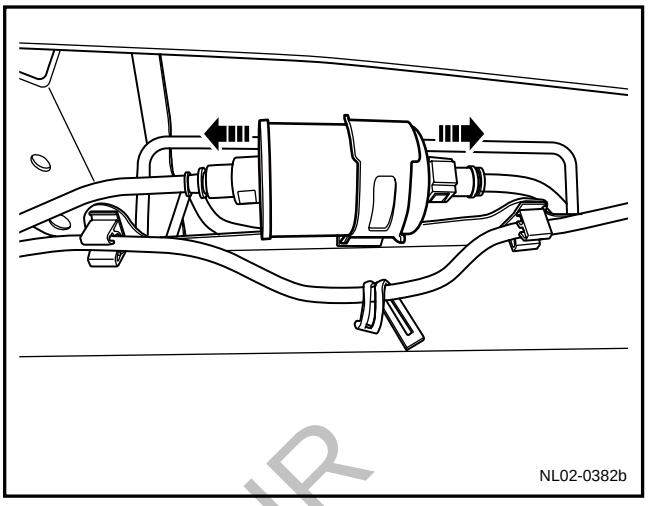
2.3.8.2 Replacement of Fuel Filter

Dismantlement Procedure

Warning: Refer to "Warning on Release Fuel Pressure" in "Warnings and Precautions".

1. Release fuel pressure. Refer to 2.3.6.1 Fuel Pressure Release Procedure.
2. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
3. Lifting and Jacking the Vehicle

Warning: Refer to "Warning on Vehicle Lifting and Jacking" in "Warnings and Precautions".



4. Disconnect the fuel inlet and outlet pipes.
5. Dismantle the fixing bolts of fuel filter bracket.

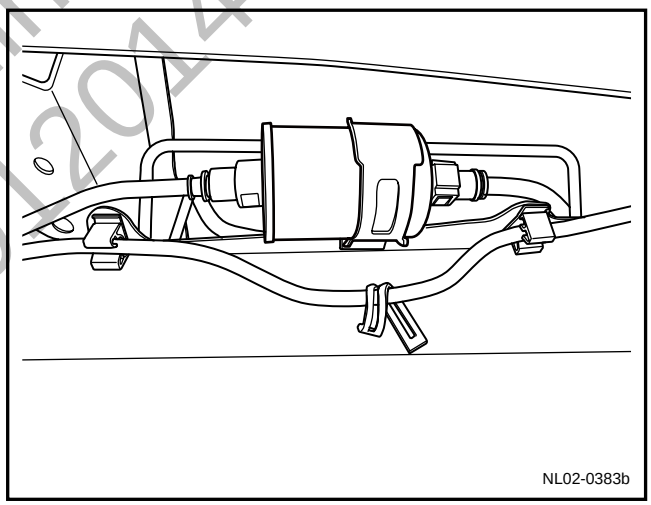
Note: If sand enters into the pipe joints, removal may become difficult. With a wood handle gently knock the filter housing to remove the sand, and then push the pipe toward the filter direction. Press the lock to disconnect the pipe. After that, pull the quick coupling out of the fuel filter joint at the direction shown in the figure.

Installation Procedure:

1. Install the fuel filter to the bracket and tighten the fixing bolts. Pay attention to the direction of the filter.

Torque: 8 Nm (Metric) 6 lb-ft (English system)

2. Connect the fuel inlet and outlet pipes.
3. Connect the battery negative cable .



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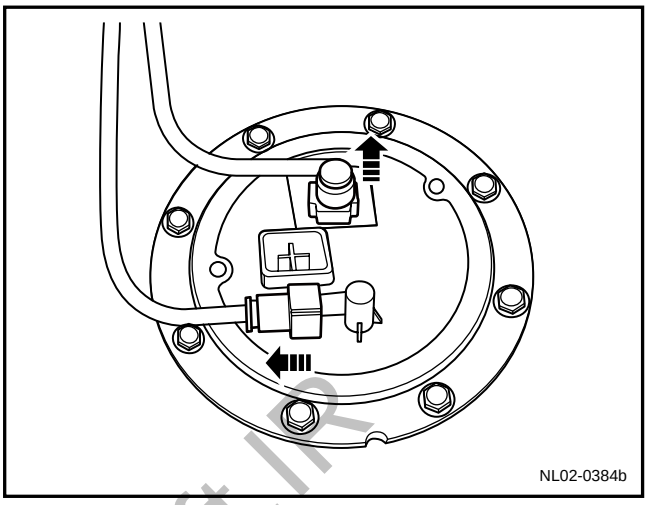
2.3.8.3 Replacement of Fuel Pump Assembly

Dismantlement Procedure

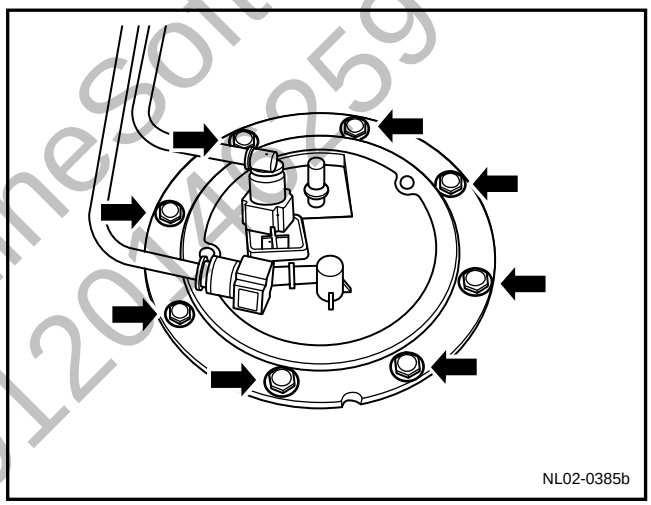
Warning: Refer to "Warning on Release Fuel Pressure" in "Warnings and Precautions".

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Refer to 2.3.6.1 "Fuel Pressure Release Procedure" to exert the fuel pressure release procedure.
2. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
3. Refer to 2.3.8.7 Replacement of Fuel Tank Assembly to dismantle the fuel tank assembly.
4. Disconnect the fuel pump inlet and outlet pipes.

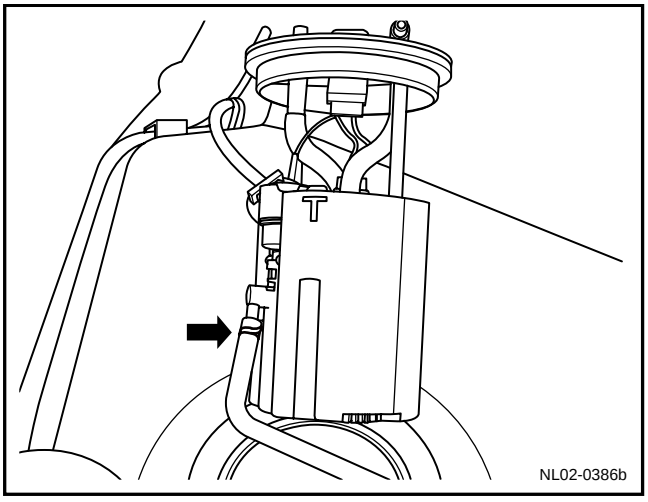


5. Dismantle the fixing bolts of fuel pump press plate.



6. Take the fuel pump out and loosen the hose clamp to dismantle it.

Note: Pay attention not to drop gasoline on the floor and the interior, otherwise it will corrode sealant and the interior.



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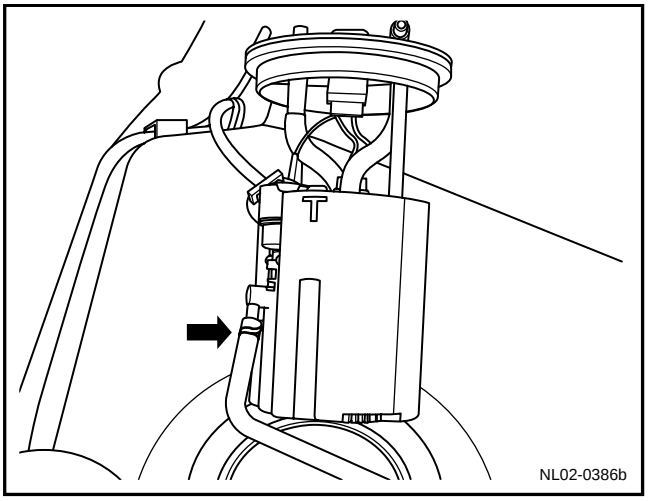
Installation Procedure:

1. Clean fuel pump seals and tank mating surface.
2. Install new fuel pump seals.
3. Connect fuel pump hose and install fuel pump assembly.

Note: During installation, make sure the outlet pipe and return pipe face the rear of the vehicle body, otherwise the pipes can not be installed.



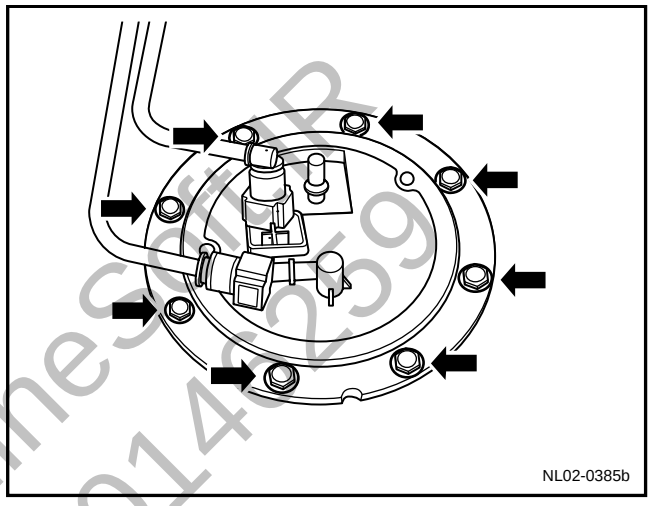
4. Install the fuel pump press plate and tighten the fixing bolts.

Torque:10 Nm(Metric) 7.4lb-ft(English system)

5. Connect the fuel pump outlet pipe and return pipe.

Warning: Refer to "Warning on Fuel Pipe Joints" in "Warnings and Precautions".

6. Install fuel pump assembly.
7. Connect the battery negative cable.



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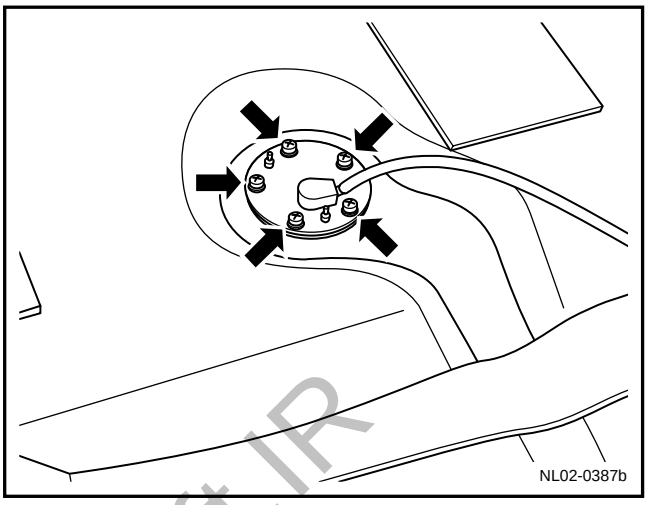
2.3.8.4 Replacement of Fuel Level Sensor

Dismantlement Procedure

Warning: Refer to "Warning on Release Fuel Pressure" in "Warnings and Precautions".

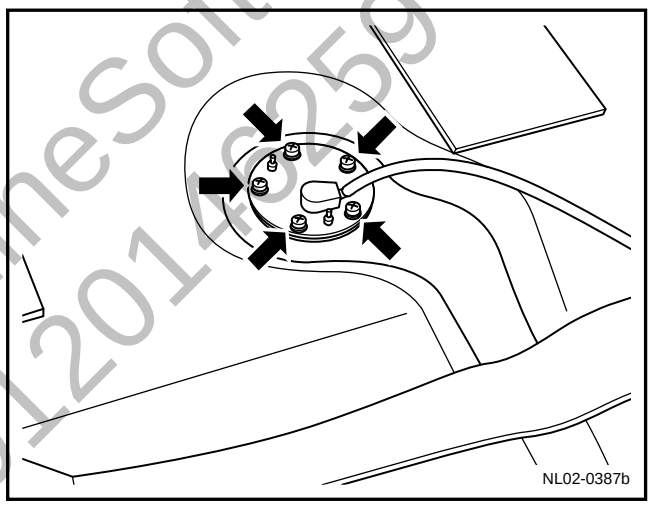
Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Release fuel pressure. Refer to 2.3.6.1 Fuel Pressure Release Procedure.
2. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
3. Refer to 2.3.8.7 Replacement of Fuel Tank Assembly to dismantle the fuel tank assembly.
4. Dismantle the fixing bolts of fuel level sensor.



Installation Procedure:

1. Install the fuel level sensor to the fuel tank.
2. Install and tighten fixing bolts of fuel fluid level sensor.
3. Install fuel pump assembly.
4. Connect the battery negative cable .



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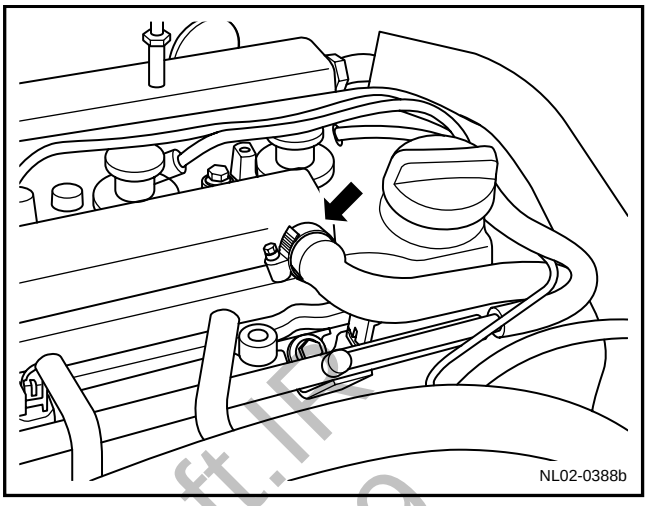
2.3.8.5 Replacement of Fuel Injector

Dismantlement Procedure

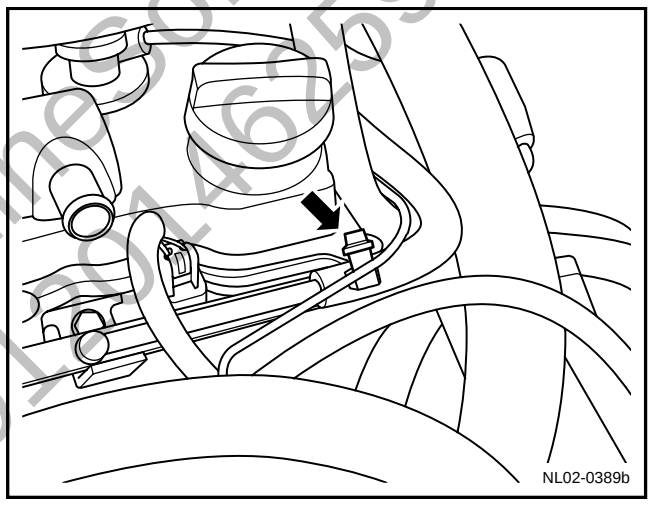
Warning: Refer to "Warning on Release Fuel Pressure" in "Warnings and Precautions".

Warning: warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions"!

1. Refer to 2.3.6.1 "Fuel Pressure Release Procedure" to exert the fuel pressure release procedure.
2. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
3. Dismantle the plastic shield of engine. Refer to 2.6.8.1 Replacement of Plastic Shield of Engine.
4. Disconnect the crankcase ventilation tube from the cylinder hood cover.

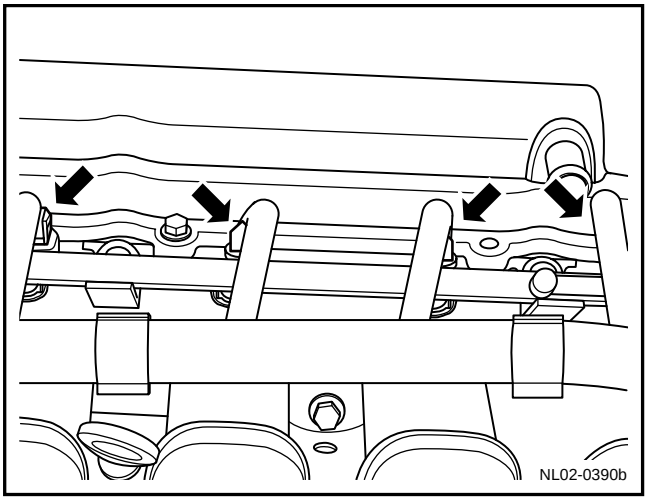


5. Dismantle the fuel distributing pipe from fuel rail.



6. Disconnect the engine fuel injector harness connector.

Note: Pull up the gray self-locking device, and then press to disconnect the connector.



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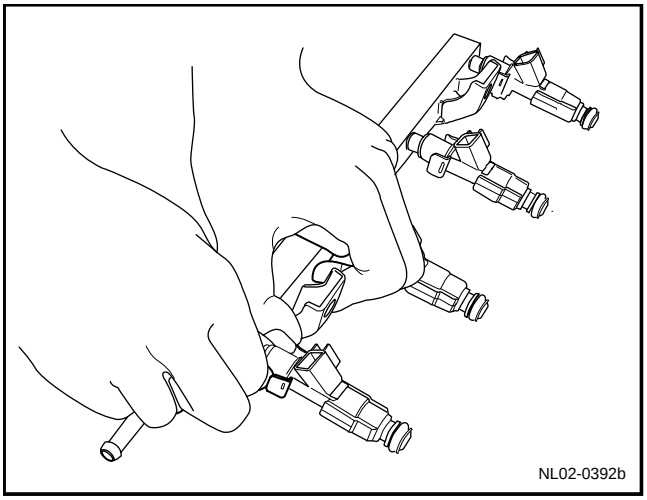
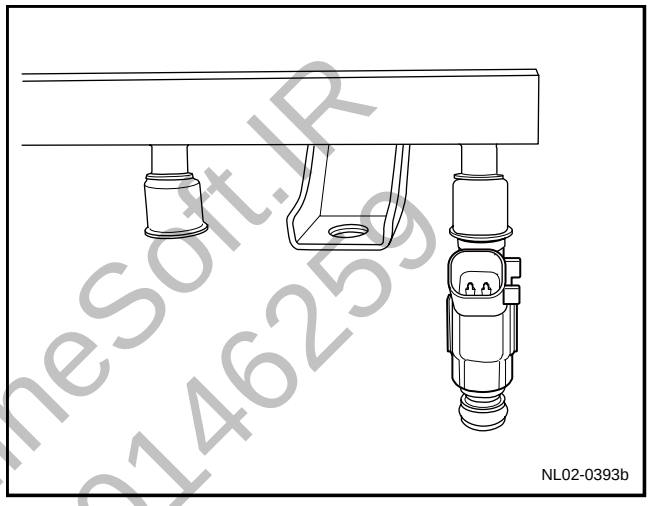
7. Dismantle the fixing bolts of fuel distributing pipe and dismantle the fuel distributing pipe.
8. Dismantle retaining clips of fuel injector and pull out the fuel injector.



Installation Procedure:

1. Apply a small amount of engine lubrication oil to lubricate the fuel injector O-ring.

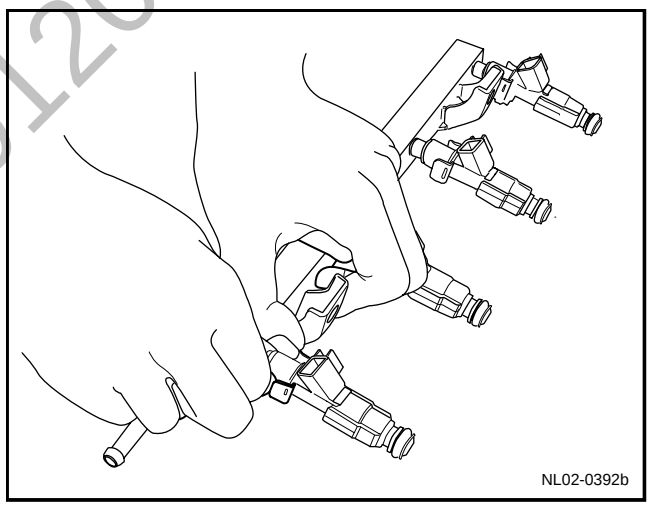


2. Install retaining clips of fuel injector to ensure that the fuel injector harness connector and the fuel rail mounting hole are in the same direction.
3. Install the fuel distributing pipe assembly and tighten the fixing bolts.

Torque:10 Nm(Metric) 7 lb-ft(English system)

4. Connect engine fuel injector wiring harness connector.
5. Connect the fuel distributing pipe into fuel rail.

Note: Fuel pipe must be inserted into the fuel distributing pipe after the second boss and then tighten.



6. Connect crankcase ventilation tube.
7. Install the plastic shield of engine.
8. Connect the battery negative cable .

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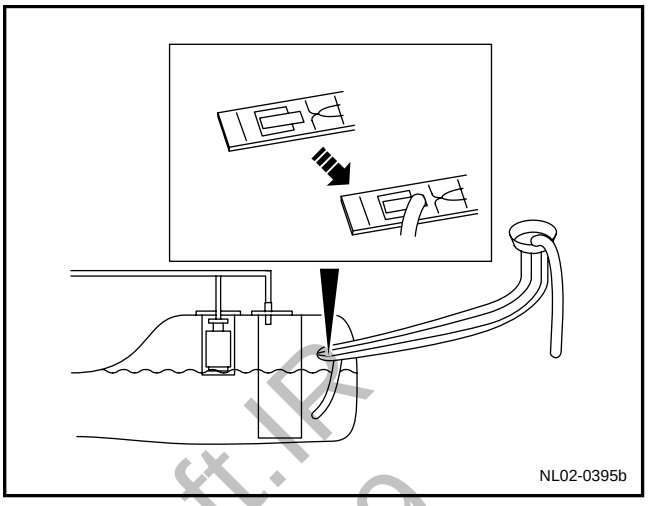
2.3.8.6 Fuel Tank Emission Procedure

Warning: forbid discharging or storing fuel in an open container. Must use the accepted fuel storage container to reduce the potential of fire and explosion.

Warning: prior to the execution of the maintenance procedure on the vehicle, prepare a dry chemical (B) fire extinguisher nearby. Not following these precautions may cause personal injury.

1. Dismantle the fuel filler cap.
2. Install to the fuel pipe and keep the fuel filler cap open.
3. Insert into the fuel tank until the hose touching the floor.
4. Use the pneumatic pump to drain the fuel through the fuel pipe as much as possible.



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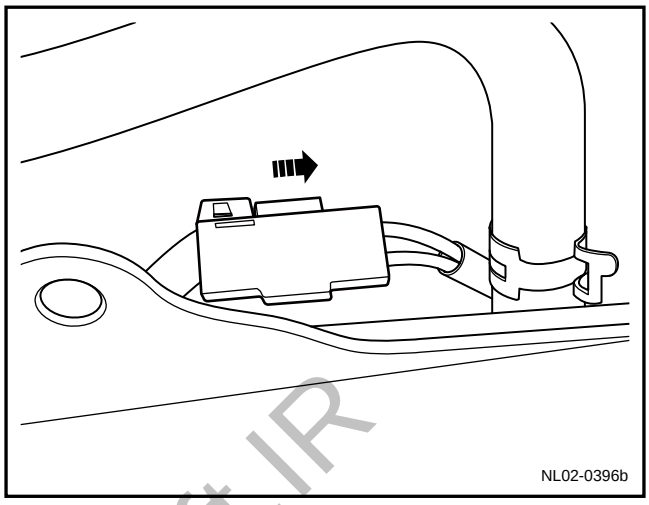
2.3.8.7 Replacement of Fuel Tank Assembly

Dismantlement Procedure

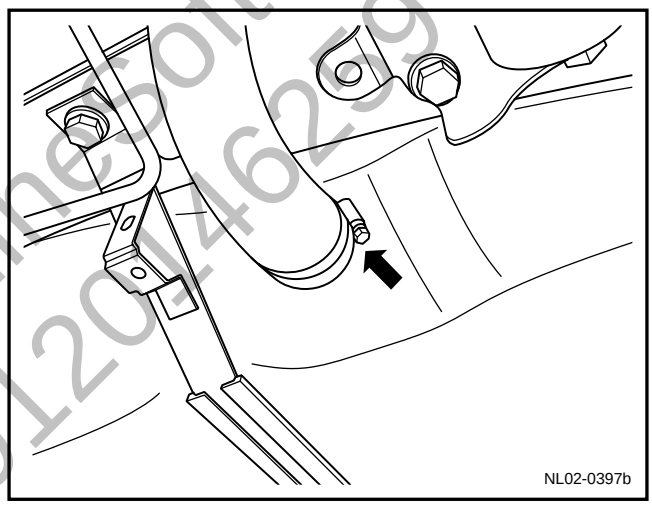
Warning: Refer to "Warning on Release Fuel Pressure" in "Warnings and Precautions".

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

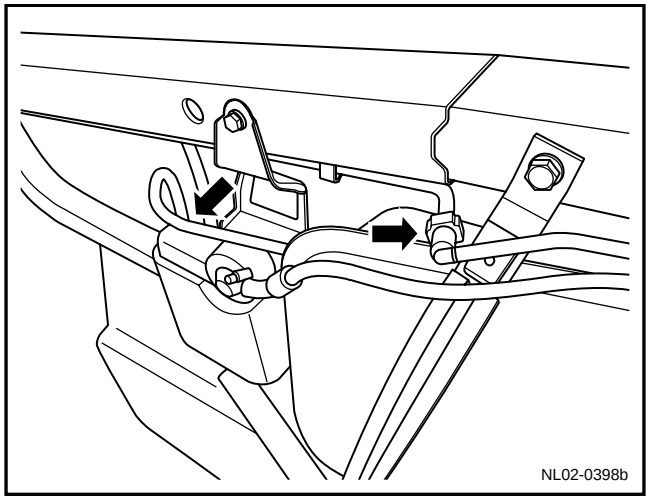
1. Release fuel pressure. Refer to 2.3.6.1 Fuel Pressure Release Procedure.
2. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
3. For exhaust of fuel tank, refer to 2.3.8.6 Exhaust procedures of fuel tank.
4. Disconnect the fuel level sensor wiring harness connector.



5. Loosen the fuel tank inlet hose clamp and separate the fuel tank inlet hose and the fuel tank assembly.



6. Disconnect the left-front fuel tank inlet pipe and canister hose.



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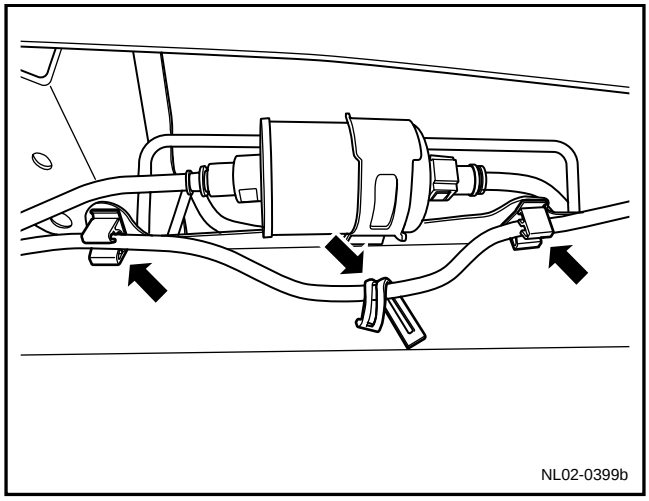
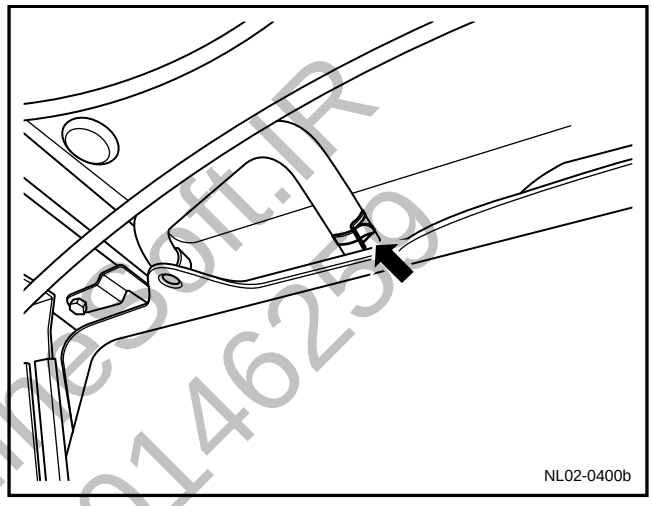
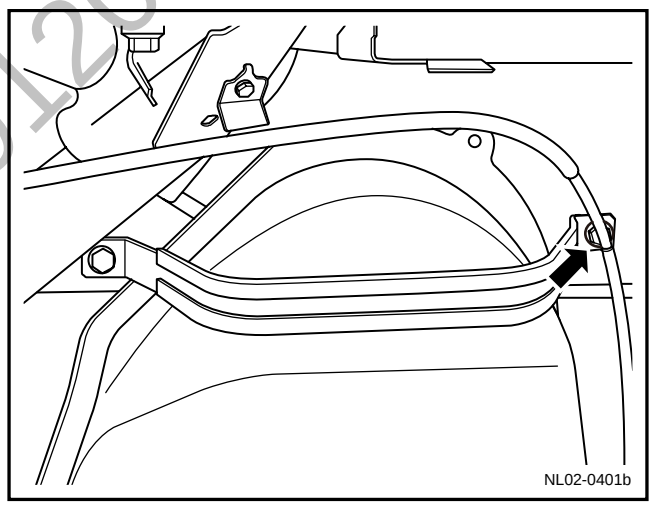
7. Detach the carbon canister pipeline fixed on the fuel tank.



8. Disconnect the front inlet ventilation hose.



9. Support the fuel tank.
10. Dismantle the fixing bolts of the mounting strap in the rear of the fuel tank.



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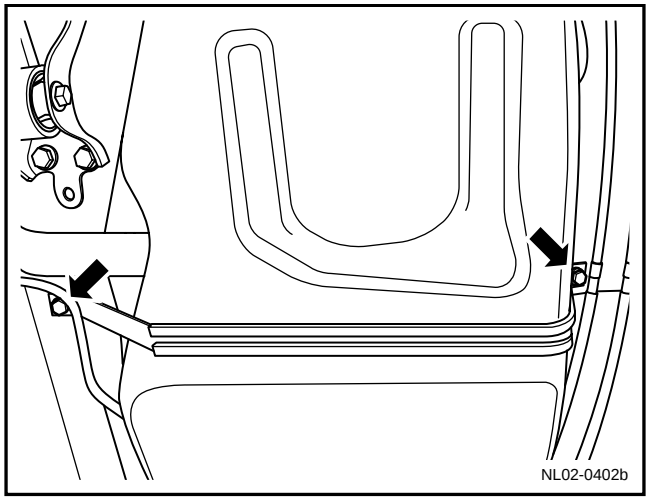
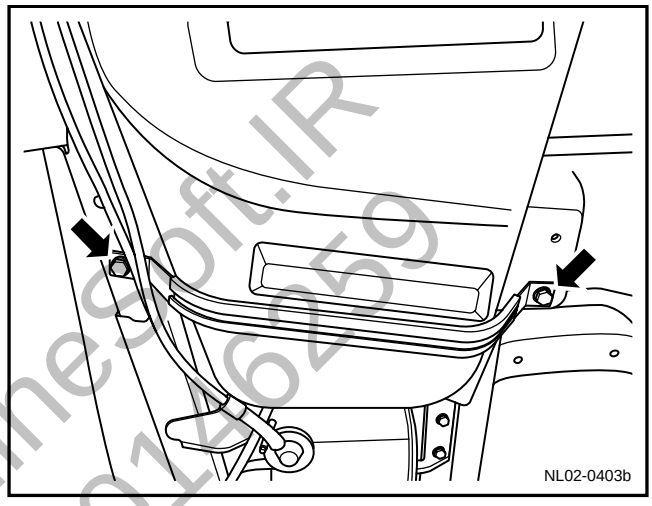
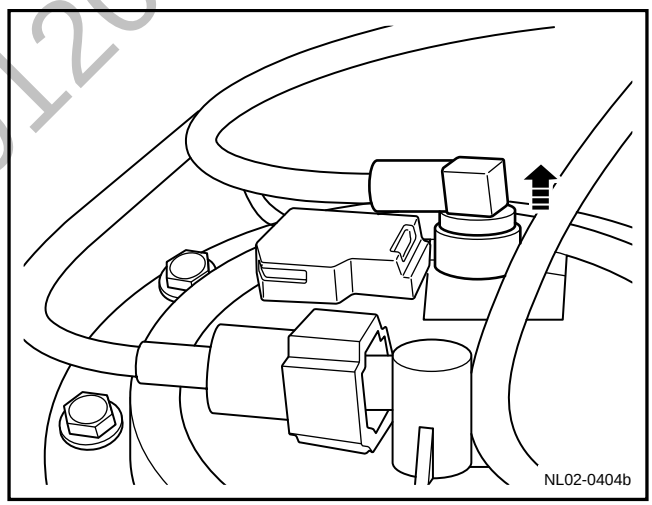
11. Dismantle the fixing bolts of the mounting strap in the middle of the fuel tank.



12. Dismantle the fixing bolts of the mounting strap in the front of the fuel tank.
13. Lower the fuel tank slowly.



14. Disconnect fuel pump harness connector.
15. Carefully put the fuel tank down.



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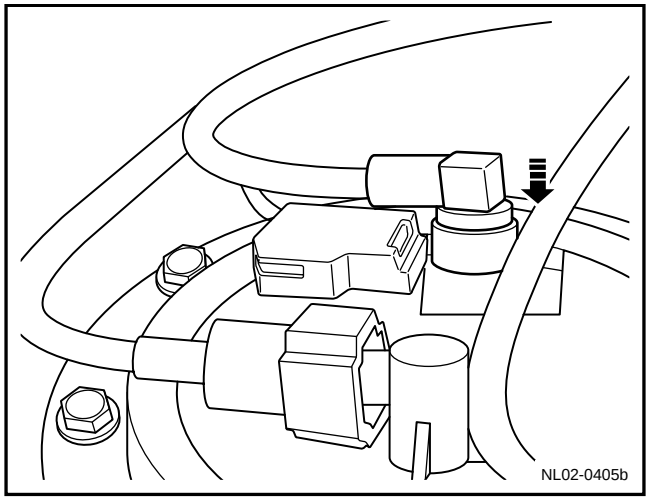
Installation Procedure:

1 Lift fuel tank assembly.

2. Connect the fuel pump wiring harness connector.



3. Install and tighten the fixing bolts of the mounting strap in the front of the fuel tank.

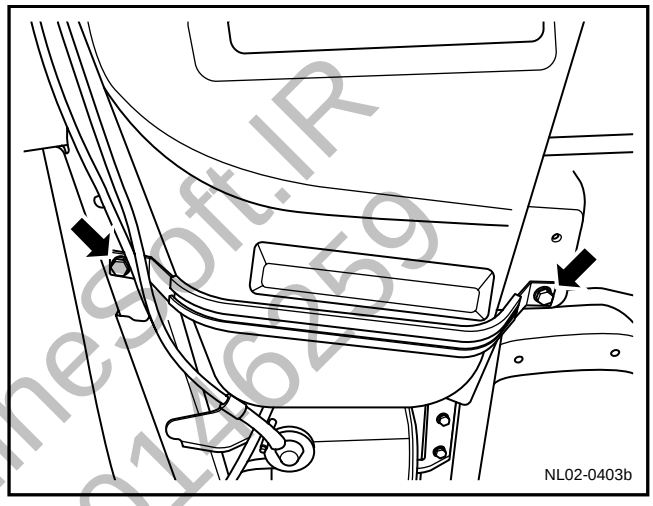
Torque :42 Nm(Metric) 31lb-ft(English system)

4. Install and tighten the fixing bolts of the mounting strap in the middle of the fuel tank.

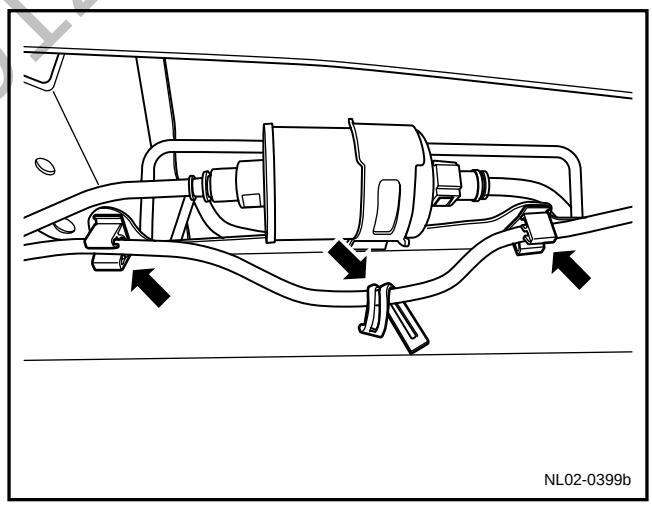
Torque :42Nm(Metric) 31lb-ft(English system)

5. Install and tighten the fixing bolts of the mounting strap in the rear of the fuel tank.

Torque :42Nm(Metric) 31lb-ft(English system)



6. Connect the front fueling ventilation hose and install the fixing clamp.
7. Connect the left-front fuel tank inlet pipe and the canister hose.
8. Fix the canister piping to the fuel tank.
9. Connect the fuel tank inlet hose and fasten the clamp.
10. Connect the fuel level sensor harness connector.
11. Connect the battery negative cable .



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2.4 Auxiliary Emission Control Device

2.4.1 Specifications

2.4.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lb-ft)
Fixing Bolts of Canister Solenoid Valve Bracket	M6×12	8 - 9	5.9 - 6.7
Fixing Bolts of Canister Assembly	M8×20	20 - 24	14.8 - 17.8

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2.4.2 Description and Operation

2.4.2.1 Heated Oxygen Sensor (HO2S)

Heated Type Oxygen Sensor (HO2S) are installed before and after the three-way catalytic converter. Heated oxygen sensor sends signals to the engine control module (ECM) indicating oxygen content in the exhaust. the engine control module controls the fuel injectors to change the engine Air-fuel ratio. The ideal Air- Fuel ratio is 14.7:1, at this time the catalytic converters is the most efficient. As the fuel injection system continuously measures and adjusts Air-Fuel ratio, it is called "closed loop" control.

1. Open-loop

When the engine has just started and the speed is higher than 400 rpm, the system enter "open loop" operation. In the open- loop mode, the engine control module (ECM) ignores the signal from the heated type oxygen sensor (HO2S) signal according to signals from the temperature sensor of engine coolant (ECT) and intake pressure temperature sensor to calculate the Air-Fuel ratio. Sensors will remain in the "open loop" mode, until the following conditions are met:

- Heated type oxygen sensor voltage output changes, showing that the temperature is high enough and the system can enter the normal operation.
- Temperature sensor of engine coolant is higher than the specified temperature.
- The engine has been started for the specified period of time.

2. Closed-loop

In the above mentioned situation, the specific values depend on different engines and are stored in electrically erasable programmable read-only memory (EEPROM). When these conditions are met, the system enters into "closed loop" operation. In the "closed loop", the engine control module calculates Air-Fuel ratio according to oxygen sensor signals (ie, fuel injector connected timing), so that the Air-Fuel ratio is always very close to 14.7:1.

Notes:

Once the engine control module confirms oxygen sensor faulty, the system will be immediately in "open loop" control. The Air-fuel ratio is no longer adjusted according to the oxygen sensor signals.

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2.4.2.2 Evaporative Emission (EVAP) Control System

Evaporative emission control system uses the basic principle of Canister storage method. This method transfers fuel vapor from fuel tank to the carbon storage devices in order to save the steam when the vehicle is not running. When the engine is running, the fuel vapor is sucked out from the Canister and burnt in the normal combustion process. Gasoline vapor from the fuel tank flows into the fuel vapor recovery pipe. The vapor is absorbed by the Canister. After the engine runs the required time, the engine control module provides a ground circuit, so that evaporative canister clean-up solenoid valve is turned on and the air is drawn into the canister and mixed with vapor. The mixture is then sucked into the intake manifold. The evaporative canister clean-up is controlled by the pulse-width modulated solenoid valve (PWM) signal to open or close. According to the operating conditions determined by air flow, fuel adjustment and intake air temperature, evaporative Canister PWM duty cycle changes. The following conditions can cause poor idling, stalling and poor performance:

- Canister Solenoid Valve Inoperation
- Canister Damage
- Hose Disconnected, Cracking, Improperly Connected To The Pipeline

Evaporative canister is an emission control device containing active carbon particles. Evaporative Canister is used to store fuel vapor from fuel tank. When certain conditions are met, the engine control module will provide the canister solenoid valve power, so that the fuel will be sucked into the engine cylinder and burnt off.

2.4.2.3 Positive Crankcase Ventilation(PCV) System

Compressed combustion gases fleeing into the crankcase through the piston rings is known as channeling gas. through the piston rings is known as channeling gas. Channeling gas contains nitrogen oxides, carbon monoxide and hydrocarbons. Crankcase ventilation system prevents the channeling gas entering into the atmosphere. Crankcase ventilation system will force the channeling gas crankshaft back into the intake system and the combustion chamber. Positive crankcase ventilation system consists of the following components:

- Positive Crankcase Ventilation Valve
- Crankcase Ventilation Tube
- Hose and Connectors

1. Operation

The main control device is the positive crankcase ventilation (PCV) valve. Positive crankcase ventilation valve calculates the channeling air flow according to manifold vacuum signal. Lower positive crankcase ventilation valve parts below the O-ring are exposed to a vacuum in the intake manifold, parts located between the lower and upper O-ring are exposed to the crankcase gases. Positive crankcase ventilation valve allows some internal vacuum pressure through the valve orifice, and form the low- pressure condition inside the crankcase. The channeling crankcase gas is then sucked into intake system and burnt in the normal combustion process. The channeling gas entering into the intake manifold must be accurately controlled in order to maintain idle quality. It is necessary to use the correct and proper calibration of the positive crankcase ventilation valve. Relationship between the Channeling air flow and engine manifold vacuum is shown in the table below:

Manifold Vacuum	**Positive crankcase ventilation valve Opening**	**Channeling Air Flow**
Low	Large	High
High	Small	Low

2. The Consequences Of Abnormal Operation

Valve or hose blockage may lead to the following conditions:

- Poor engine idling.
- Engine stalls or engine idle speed is too low.
- Engine crankcase pressure is too high.
- Engine oil leak.
- Engine oil enters into the air filter.
- Engine has sludge.
- Engine oil consumption.
- Excessive exhaust emissions.

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2.4.3 System operating principle

2.4.3.1 Heated Type Oxygen Sensor Operating Principle

- Oxygen sensor has a sensing element, which is a porous ceramic tube, the outer wall surrounded by the engine exhaust and inside connecting to the atmosphere. Sensing ceramic pipe wall is a solid electrolyte that contains electric heating pipes. When the sensor ceramic tube temperature reaches 350°C (662 °F), it will have a solid electrolyte properties.
- The function of oxygen sensor is realized through changing the concentration difference of oxygen ions inside and outside the sensing ceramic tube into the voltage signal output.
- The output voltage level is due to movement caused internal electronic ceramic tubes.
- Meet EOBD vehicles self inspect whether the sensor information is accurate.
- Heated resistor resistance at room temperature is 2.4-4.9 Ω.

Heated type oxygen sensor repair precautions:

1. During the oxygen sensor repair procedure, it is prohibited to use cleaning agent, oily liquids or volatile solids.
2. After the Replacement of oxygen sensor, apply a layer of anti-rust oil to oxygen sensor threads to prevent rust. All the oxygen sensors consist of cables. The electrical connector is at the other end of the cable. The external packaging is anti-fire sleeve. A new oxygen sensor will be coated with anti-rust oil on the thread, during installation do not remove these anti-rust oil.

2.4.3.2 Canister Solenoid Valve Operating Principle

- Canister solenoid valve consists of the electromagnetic coil, armature and valves so on. canister inlet port has a filter.
- On one hand, air flow through the canister solenoid valve is related to ECM output to the canister solenoid valve electrical pulse duty cycle; on the other hand, it is related to the pressure difference between the Canister solenoid valve inlet port and outlet port. When there is no electrical pulses, the canister solenoid valve will be turned off.
- According to the engine sensors provided signals, ECM controls the canister solenoid valve power-on time, indirectly controls the air flow amount.
- When the engine coolant temperature, engine running time and engine load etc. meet the preset requirements, ECM will instruct canister solenoid valve to start working. In the following situations canister solenoid valve will not work:

  (1) Engine cold start after a time.

  (2) Engine coolant temperature is relatively low.

  (3) Engine idling.

  (4) Engine load is high.

  (5) Important sensor in system has fault.

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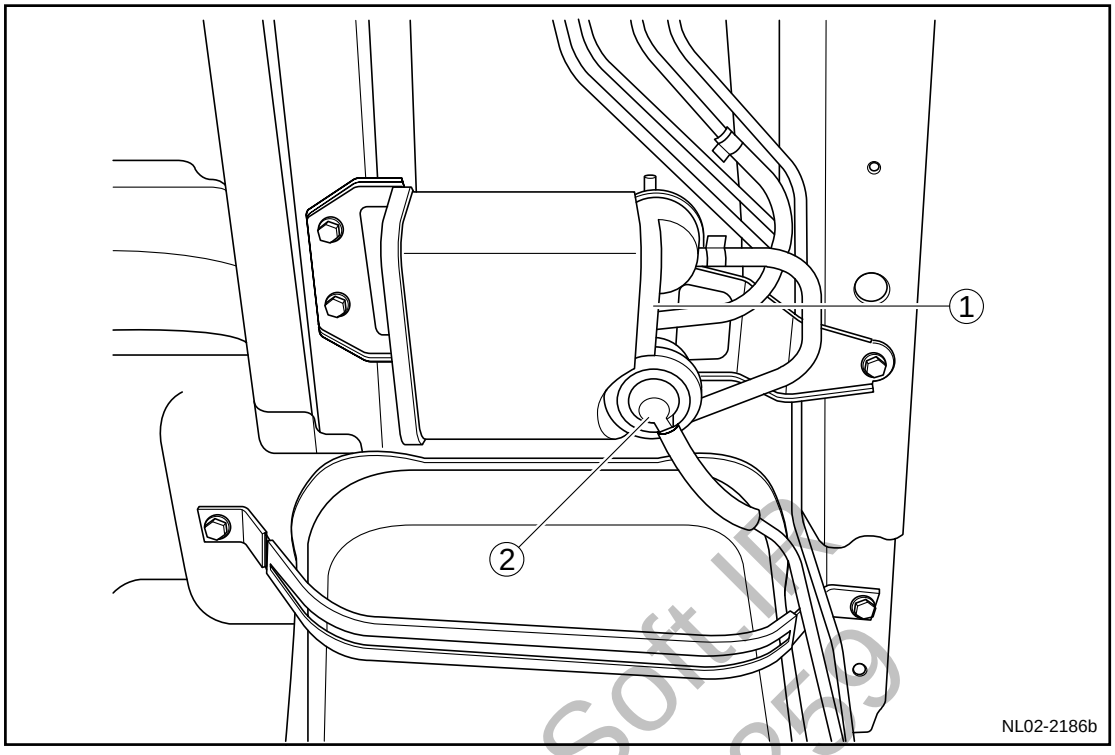
2.4.4 Component position

2.4.4.1 Canister Position Diagram



1. Canister Assembly
2. Canister Ventilation Filter

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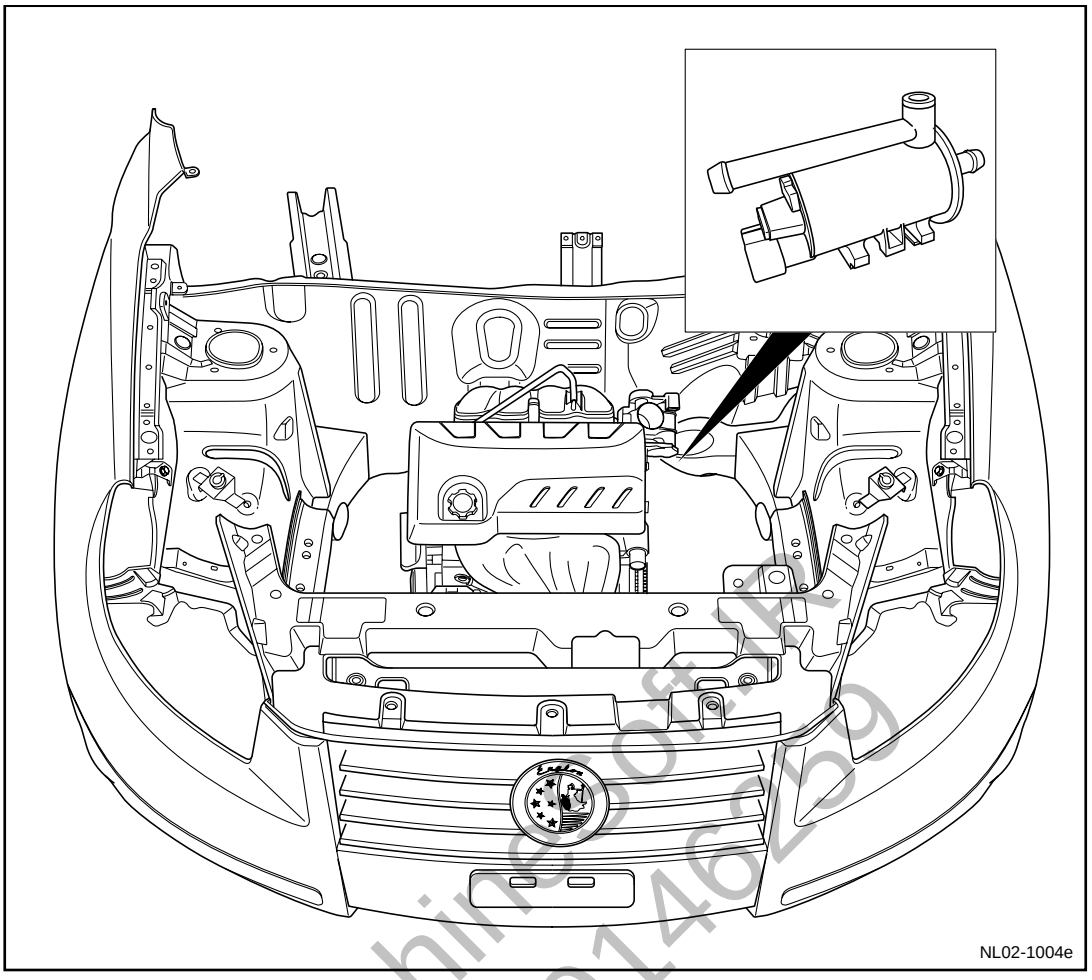
2.4.4.2 Canister Solenoid Valve Position Diagram



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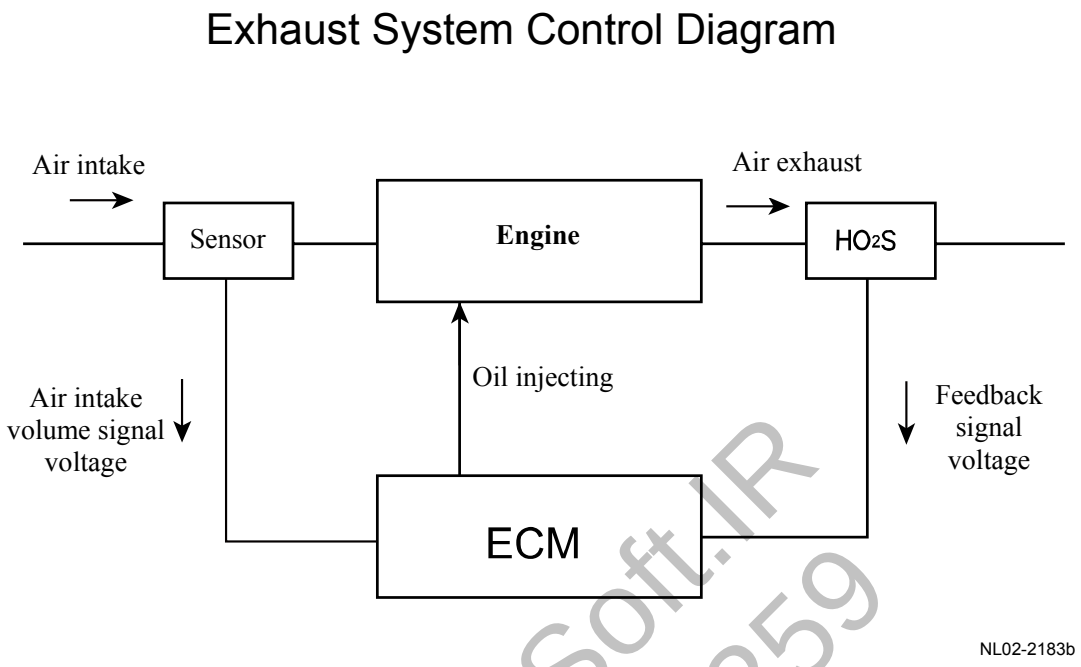
2.4.5 Electrical schematic diagram

2.4.5.1 System Schematic Diagram



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2.4.6 Diagnostic message and steps

2.4.6 Diagnostic information and procedures

2.4.6.1 Diagnosis descriptions

Refer to 2.4.2 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

Precautions on Maintenance of Canister Solenoid Valve:

1. Make sure airflow direction comply with specifications.
2. When particles inside the valve body causing the control valve failure, replace canister solenoid valve and inspect the canister status.
3. During maintenance procedure, avoid water, oil and liquid entering into the valve.

2.4.6.2 Visual inspection

Inspect the after-sales optional device which may affect the normal operation of assistant emission control device.

– Inspect the system components easy to access to identify whether there is significant damage or the existence of an external leakage.

– Inspect whether the fuel is the recommended type and fill up the fuel tank.

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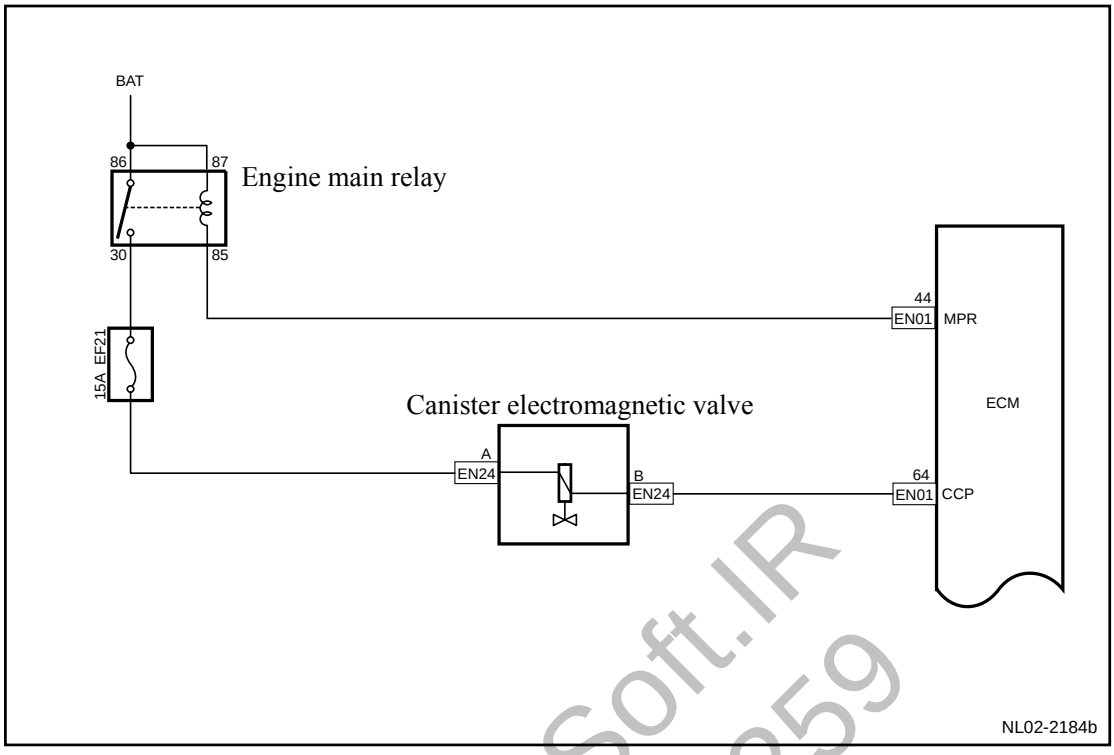
2.4.6.3 Canister Solenoid Valve Inoperation

Circuit diagram:



Diagnostic Steps:

1	Install fuel pressure gage in the fuel distributing pipe inlet.

(a) Start the engine.

Inspect whether the engine emission malfunction warning lamp is lit.

No → Go to step 3

Yes

2	Repair the engine control system fault.

(a) Repair engine control system. For engine emission fault and warning lamp fault, refer to 2.2.7.14 Fault diagnostic code chapter index.

Is canister solenoid valve working properly?

Yes → The system is normal.

No

3	Inspect canister solenoid valve power supply circuit.

(a) Turn on ignition switch.

(b) Measure canister solenoid valve EM24 terminal A voltage with a multimeter.

Standard Voltage: 11-14 V

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Yes → Go to step 6

No

4	Inspect the circuit between the canister solenoid valve harness connector EM24 terminal A and the fuse EF21.

(a) Turn off the ignition switch.

(b) Measure the resistance between the fuse EF21 and the canister solenoid valve harness connector EM24 terminal A.

Standard Resistance: Less than 1 Ω

Does the resistance conform to standard value?

Yes → Go to step 6

No → Go to step 5

5	Repair the circuit between the canister solenoid valve wiring harness connector and the fuse EF21.

(a) Turn off the ignition switch.

(b) Repair the open circuit fault between the canister solenoid valve harness connector EM24 terminal A and fuse EF21.

Is canister solenoid valve working properly?

Yes → The system is normal.

No

6	Inspect canister solenoid valve harness connector and ECM harness connector circuit.

(a) Turn off the ignition switch.

(b) Inspect resistance between canister solenoid valve harness connector EM24 terminal B and ECM harness connector EM01 terminal No.64 with the multimeter and confirm the circuit continuity.

Standard Resistance: Less than 1 Ω

Does the resistance conform to standard value?

Yes → Go to step 8

No

7	Repair canister solenoid valve harness connector and ECM harness connector.

(a) Turn off the ignition switch.

(b) Repair canister solenoid valve harness connector EM24 terminal B and ECM harness connector EM01 terminal No.64 circuit open fault.

Is canister solenoid valve working properly?

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Yes → The system is normal.

No

8	Use the active test function to inspect the voltage between the canister solenoid valve terminals.

(a) Turn off the ignition switch.

(b) Disconnect canister solenoid valve wiring harness connector.

(c) Test Lamp Connection

(d) In the engine active test, connect the scan tool and drive the canister solenoid valve.

Is the test lamp lit?

Yes → The system is normal.

No

9	Replace ECM

(a) Replace ECM and refer to 2.2.8.1 "Replacement of Engine Control Module".

(b) Carry out the crankshaft position sensor learning, refer to 2.2.7.11 “Crankshaft Position Sensor (CKP) Learning.

Is canister solenoid valve working properly?

Yes → The system is normal.

No

10	Replace the canister solenoid valve.

(a) Turn off the ignition switch.

(b) Refer to “2.4.6.3 Replacement of Canister Solenoid Valve” to replace the canister solenoid valve.

Confirm the repair has been completed.

Next

11	The system is normal.

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2.4.6.4 Positive Crankcase Ventilation (PCV) System Inspection / Diagnostic

1	Inspect whether there is vacuum in crankcase ventilation hose. vacuum should be present in the Hose. If not, inspect whether the hose is blocked, leaking or ventilation tube connector blocked.

Next

2	With the engine running, plug the end of the vacuum hose. When the hose end plugged, inspect whether there is collapse in all parts of the hose. If hose collapses, the hose should be replaced.

Next

3	If engine oil is gathered into the intake pipe, inspect whether there is the following situations:

A. Crankcase vacuum hole blocked.

B. Crankcase ventilation hood blocked.

C. Crankcase pressure or channeling gas beyond the acceptable tolerance range.

Next

4	Inspect other items:

A. Fresh air ventilation or vent hose assembly connector blocked or leaking.

B. Throttle body channel blocked.

C. O-ring missing or damaged.

D. Inspect cylinder head covers, oil pan gasket and other sealing parts for leaking.

Next

5	Finish

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The consequences of not working correctly

- If the crankcase ventilation hose is blocked, it will cause the following faults:

  idle instable.

  Engine stalls or idle speed is too low.

  Engine oil leaked.

  Engine oil enters the intake.

  Engine has sludge.

- Ventilation hood or hose leakage may lead to the following faults:

  Unstable idling speed

  Engine stops unexpectedly

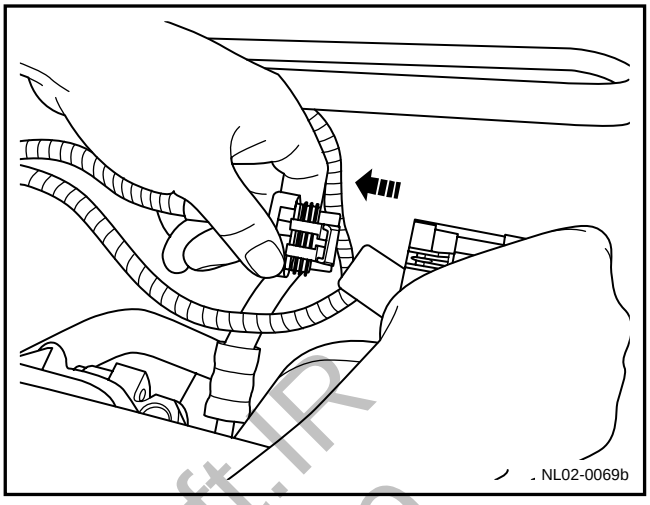
2.4.6 Removal and installation

2.4.6.1 Replacement of Rear Oxygen Sensor

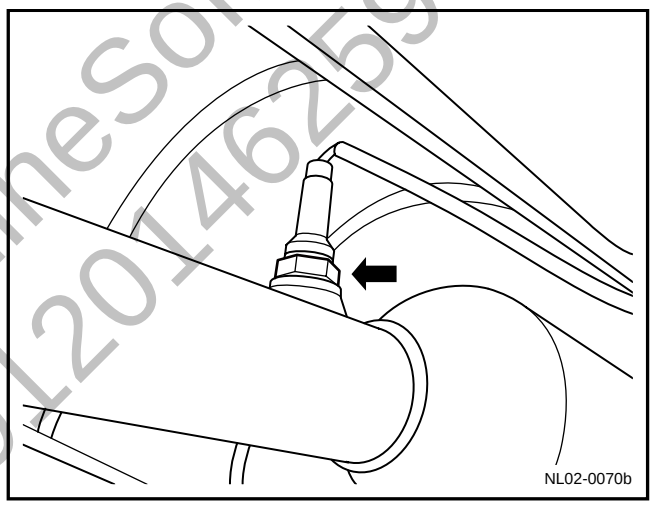
Dismantlement Procedure

Warning: Refer to "Warning on Maintenance of Exhaust System", and "Warning on Vehicle Lifting and Jacking" in "Warnings and Precautions".

1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
2. Disconnect the rear oxygen sensor harness connector.

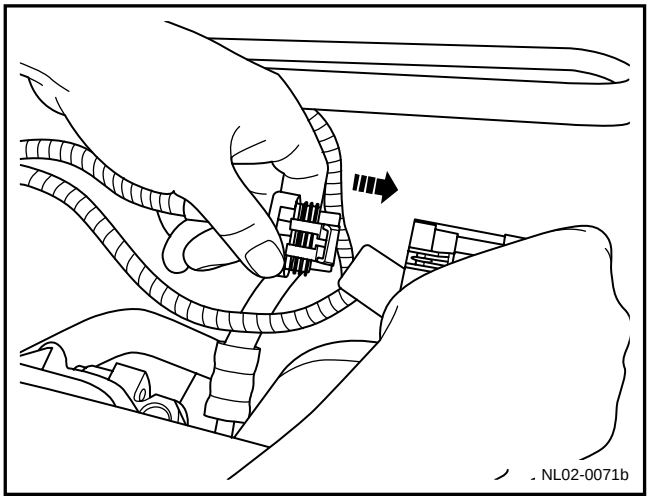


3. Lifting and Jacking the Vehicle
4. Dismantle the heated type rear oxygen sensor.



Installation Procedure:

1. Install the rear oxygen sensor.
2. Lower the vehicle.
3. Connect the rear oxygen sensor harness connector.
4. Connect the battery negative cable .



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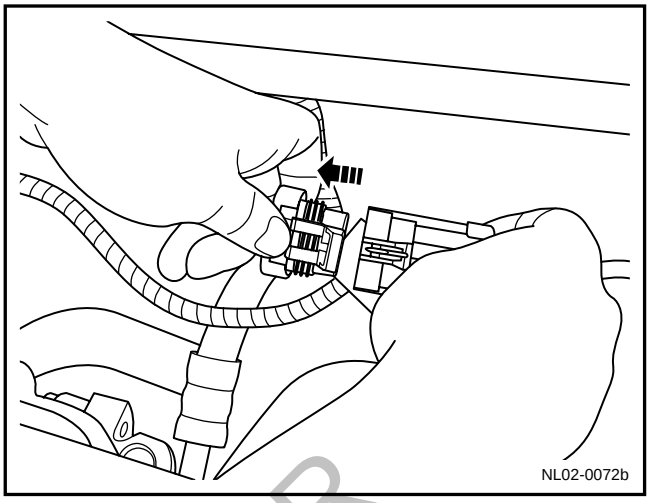
2.4.6.2 Replacement of Front Oxygen Sensor

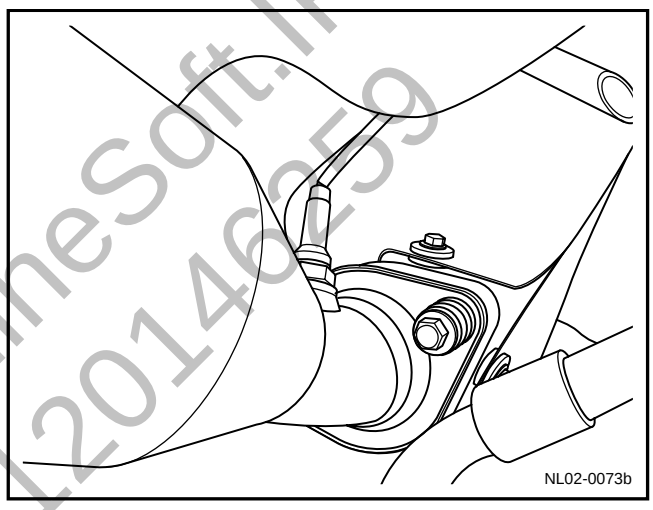
Dismantlement Procedure

Warning: Refer to "Warning on Exhaust System Maintenance" in "Warning and Precautions".

1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
2. Disconnect the front oxygen sensor harness connector.

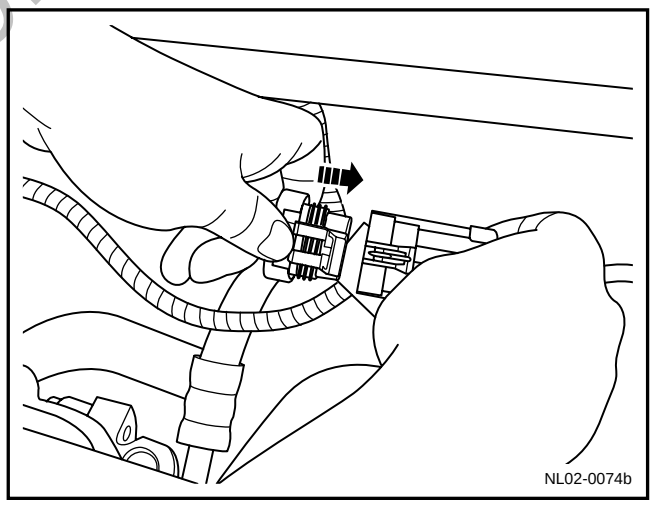


3. Dismantle the heated type front oxygen sensor.



Installation Procedure:

1. Install the heated type front oxygen sensor.
2. Tighten heated oxygen sensor.
3. Connect the front oxygen sensor wiring harness connector.
4. Connect the battery negative cable .



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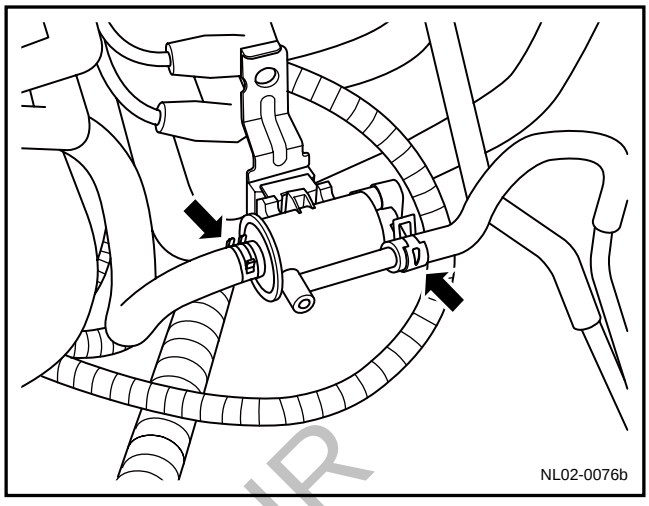
2.4.6.3 Replacement of Canister Solenoid Valve

Dismantlement Procedure

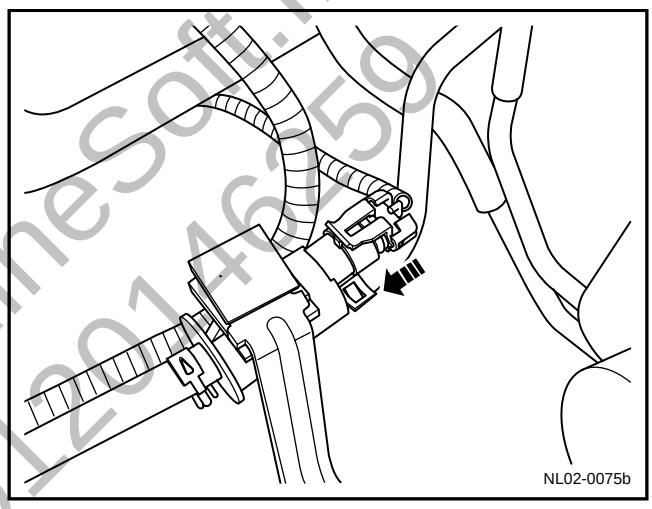
Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Remove the canister solenoid valve from the retaining bracket.
3. Disconnect canister solenoid valve harness connector.
4. Disconnect the canister solenoid valve vacuum tube.
5. Dismantle Canister Solenoid Valve



Installation Procedure:

1. Install Canister Solenoid Valve
2. Connect canister solenoid valve harness connector.
3. Connect canister solenoid valve vacuum tube.
4. Install the canister solenoid valve to the retaining bracket.
5. Connect battery negative cable.



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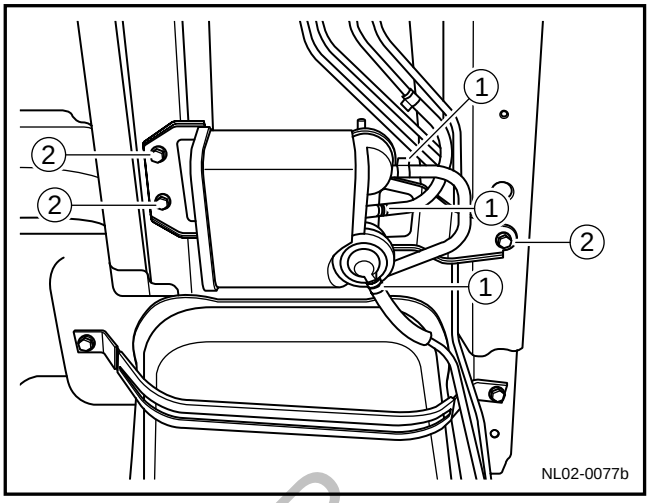
2.4.6.4 Replacement of Canister

Dismantlement Procedure

1. Lifting and Jacking the Vehicle

Warning: Refer to "Warning on Vehicle Lifting and Jacking" in "Warnings and Precautions".

2. Loosen canister hose clamp and separate the hose.
3. Dismantle canister fixing bolt 2.

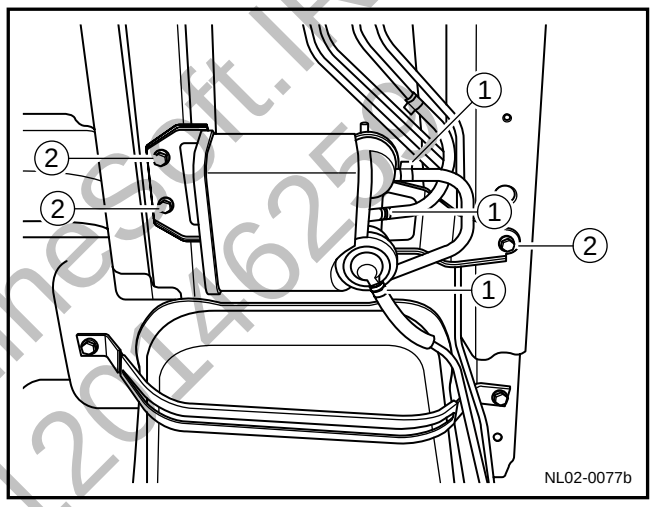


Installation Procedure:

1. Connect canister hose and install hose clamp.
2. Dismantle canister fixing bolt 2.

Torque: 8 Nm (Metric) 6 lb-ft (English system)

3. Lower the vehicle.



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2.5 Engine Anti-theft System

2.5.1 Specifications

2.5.1.1 Fastener Specifications

Fastener Name	Model	Specification	
		Metric (N.m)	English system (lb-ft)
Fixing Bolts of Electric Anti-theft Control Module	M6×16	7-9	5.2-6.6

2.5.2 Description and Operation

2.5.2.1 Description and Operation

The engine anti-theft locking system can prevent the theft of the vehicle via preventing the operation on the engine. The engine anti-theft locking system can prevent the startup of the vehicle. If engine anti-theft locking system cannot identify the transponder code of the ignition key, the operational functions of the engine will be prohibited. Engine anti-theft locking system and remote anti-theft system are operated independently. Engine anti-theft locking system and remote anti-theft system have no interaction.

Engine anti-theft system components are listed below:

– Engine anti-theft system control module (IMMO)

– Engine Control Module (ECM)

– Electronic Anti-theft Coil (Engine Anti-theft System, Antennas)

– Ignition Key (Transponder)

1. Ignition Key (Transponder)

It contains the microprocessor and transceiver coil. Through the magnetic field generated by EAS Coil, it gets the energy and information from the magnetic field, and decrypts and encrypts the information before transmitting the information back to the EAS Coil.

2. Electronic Anti-theft Coil (Engine Anti-theft System, Antennas)

EAS Coil is surround-mounted to the ignition lock core. When the ignition key is inserted into the ignition lock core and turns the ignition switch to the “ON” position, the induced magnetic field is generated to transfer the communication signal between the anti-theft controller and the transponder. Integrated on the electronic anti-theft coil is a light- emitting diode controlled by the interior lighting circuit in order to facilitate the driver to locate the ignition cylinder.

3. Engine Anti-theft System Control Module

The engine anti-theft system control module is arranged below the middle part of the dashboard; after receiving the transponder information transmitted from the electronic anti-theft coil, the engine anti-theft system control module compares the information with the key information read in the memory, so as to decide whether sending fuel commissioning/forbidding command.

Note: If the anti-theft system can not get the ignition key transponder information, it will not send any signal to the engine control module.

4. Engine Control Module

Engine control module is installed under the passenger side of instrument panel, near the air-conditioning blower. Based on the signal received from the engine control module anti-theft system, it sends instruction to enable / disable fuel injection.

Based on the instruction received from the engine control module anti-theft system, engine control

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module will decide whether to send the engine control module to the body lock / unlock status information.

Based on the instruction received from the engine control module anti-theft system, engine control module will decide whether to send to the combination instrument the request of "Light the engine anti-theft system warning lamp".

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2.5.3 System operating principle

2.5.3.1 System operating Principle

When turn the key from “OFF” to “ON”, the electric anti-theft controller assembly output the signal with the carrier frequency of 125 kHz. After passing through the EAS coil to generate the magnetic field, the transponder gets energy and information from here to decrypt and encrypt the information, output the magnetic field through the internal coil with the carrier frequency of 125 kHz. The EAS coil transfer the magnetic field generated by the transponder into electrical signal and transmit this signal to the electronic anti-theft controller assembly. Electronic anti-theft controller assembly decrypts the transponder information after reception and passes the certification if the data match. Otherwise, the certification fails. Turn the key to start position, and the engine ECU communicate with the electronic anti-theft controller assembly via the R and W lines for certification. After passing the certification, the engine can start normally, otherwise, the engine system will be locked.

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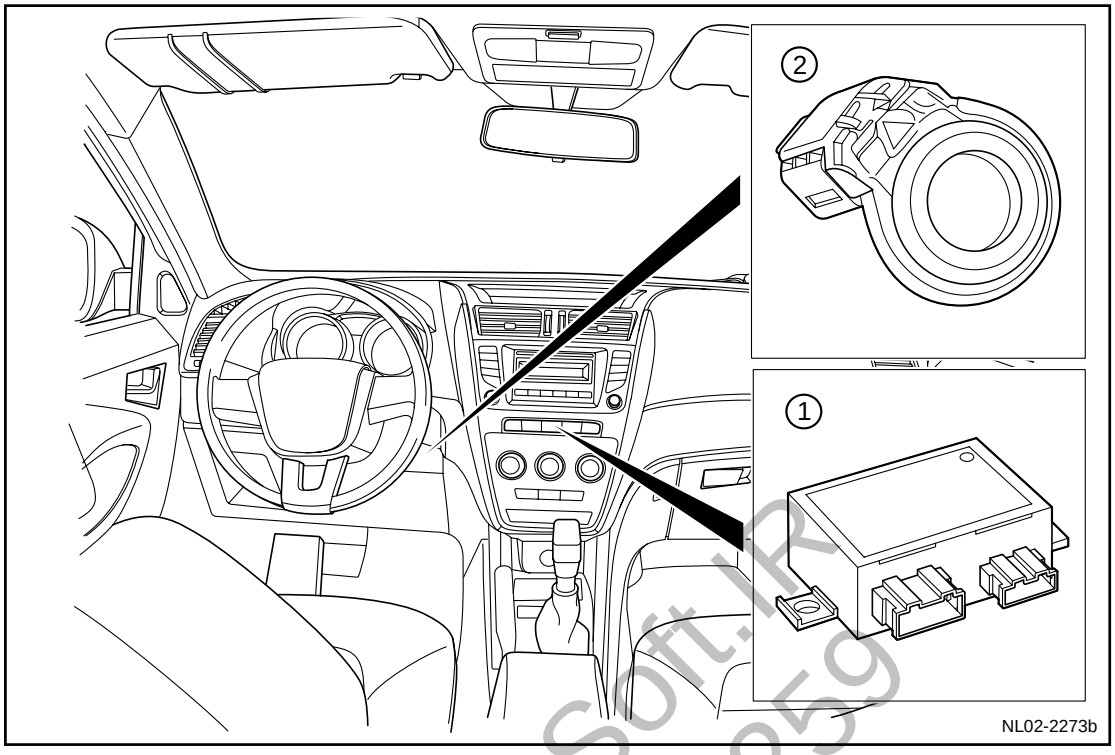
2.5.4 Component position

2.5.4.1 Part position figure



1. Engine Anti-theft System Control Module
2. Electronic Anti-theft Coil

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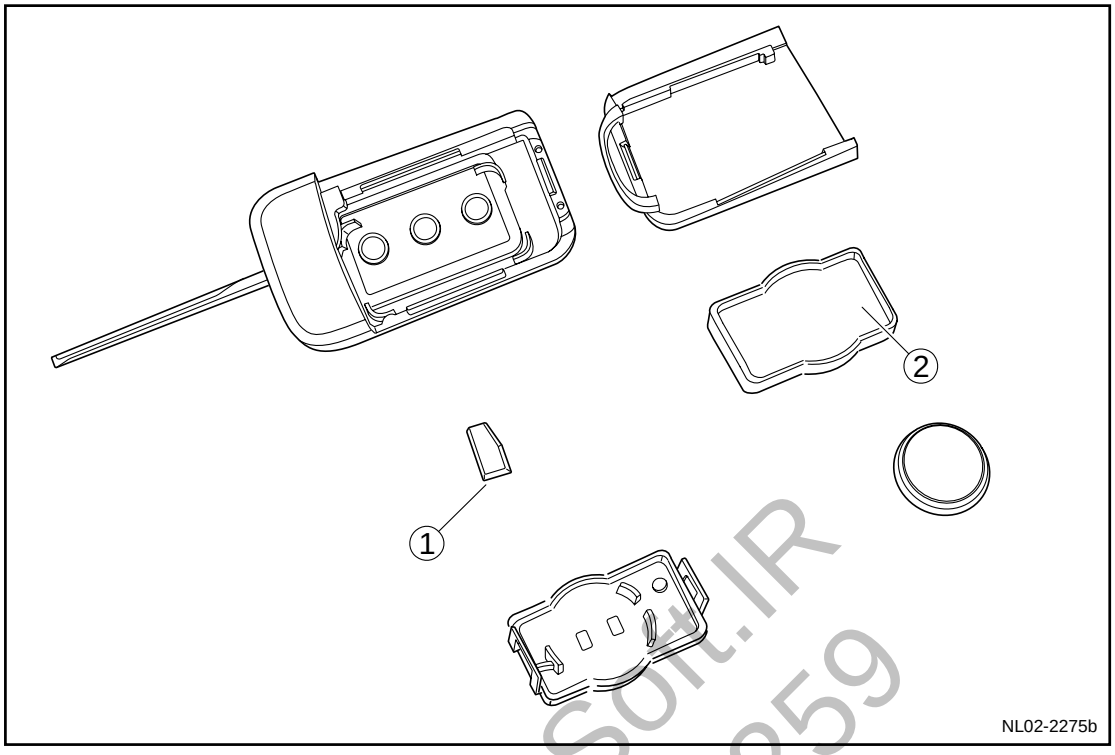
2.5.5 Disassemble drawings

2.5.5.1 Disassembly diagram



1. Transponder
2. Remote Keyless Entry Transmitter

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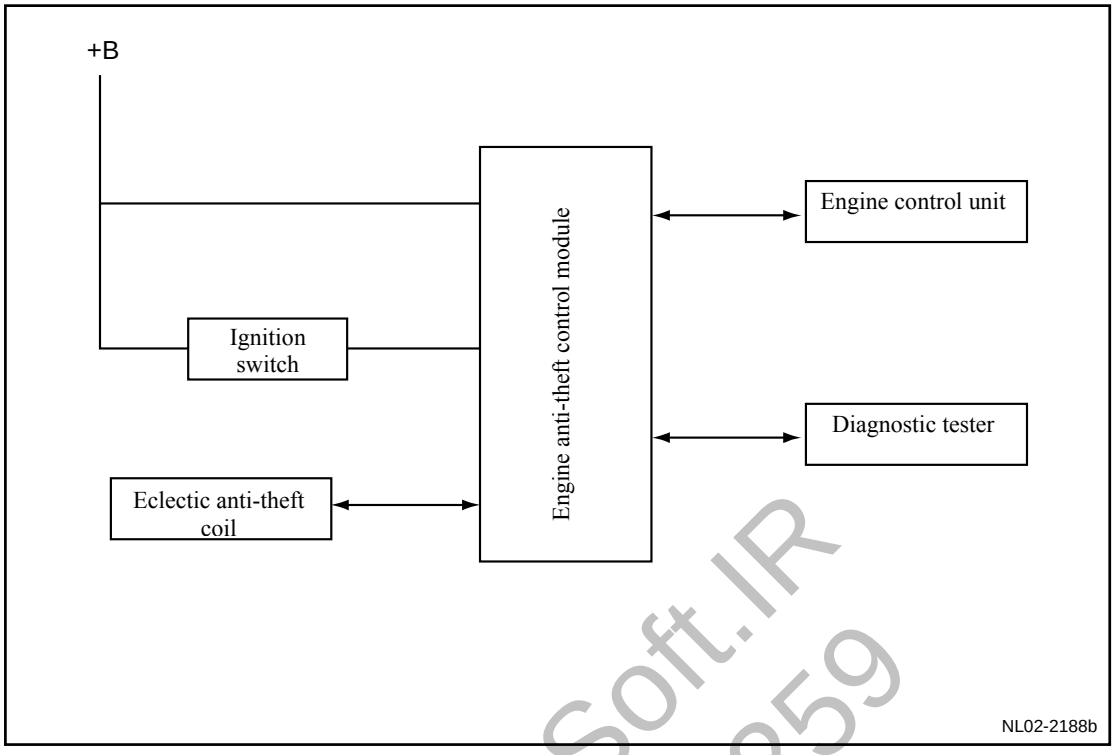
2.5.6 Electrical schematic diagram

2.5.6.1 Electrical schematic diagram



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2.5.7 diagnostic message and steps

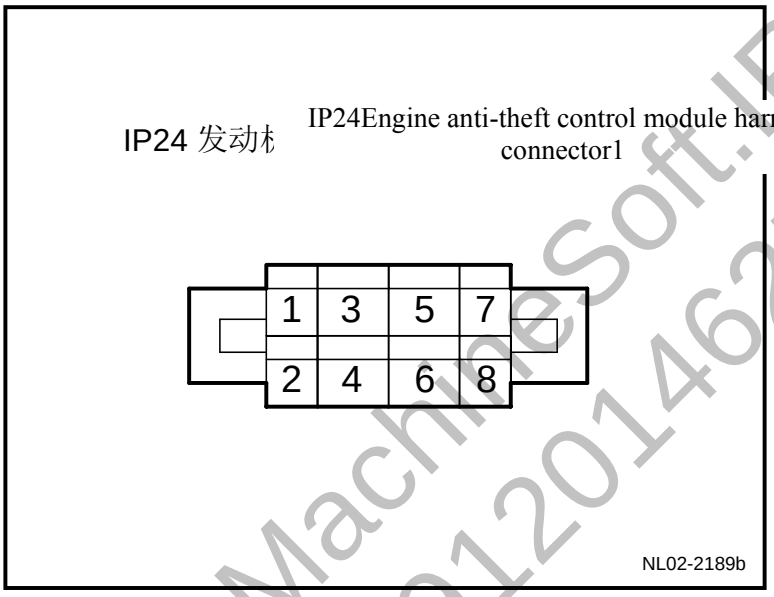
2.5.7.1 Diagnosis descriptions

Refer to 2.5.2 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

2.5.7.2 Visual inspection

- Inspect the after-service retrofitting device that may affect the engine anti-theft system.
- Check the system components that is easy to access to identify whether there is significant damage or potential faults.
- If the system shows the engine is locked, prior to the fault diagnostic Inspect and confirm whether the ignition key completed self learn, otherwise carry out the ignition key learn process.

2.5.7.3 Anti-theft Engine Control Module Connector List



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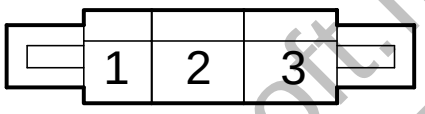
Terminal No .	Terminal Definition	Wiring	Rated Working Voltage	Working Current	Terminal descriptions
1	+B	O/Y	12V	Less than 200 mA	Less than 50 mA
2	GND	B	0V	Less than 200 mA	Ground
3	Ceiling lamp	W/R	12V	Less than 50 mA	Anti-theft indicator of engine
4	ON	G/R	12V	Less than 200 mA	Ignition Switch Signal
5	To R-Line	L	12V	Less than 50 mA	Engine Control Module

					Request Signal
6	—	—	—	—	—
7	To K-Line	Gr/P	12V	Less than 200 mA	Diagnostic Information
8	W-Line	Gr/W	12V	Less than 200 mA	Communication with the Engine Control Module

IP25Engine anti-theft control module harness connector2



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Terminal No .	**Terminal Definition**	**Wiring**	**Rated Working Voltage**	**Working Current**	**Terminal descriptions**
1	COIL A	W/G	125 KHz Modulation Waveform	—	Antenna Signal
2	COIL B	Gr/O	125 KHz Modulation Waveform	—	Antenna Signal
3	GND	B	0 V	—	Ground

2.5.7.4 Fault diagnostic code (DTC) table

DTC	Code Meaning	Fault Cause	Trouble-shooting Method
9000	Antenna Failure (Tested Only at Reading Anti-theft Transponder, other than Continuously Tested).	EAS Coil Open circuit or short; anti-theft controller internal failure.	1. Inspect the connection between the EAS Coil and the Anti-theft controller jointer. 2. Inspect the EAS Coil plug harness for breaking off or collision. 3. Pluck off the EAS Coil plug and measure the resistance between IP25 terminal #1 and IP25 terminal #2 with the resistance scale of the multimeter. The normal value is about 10-20 Ω, and if the resistance value approaches zero, the coil is short. If the resistance coil is open, measure the resistance between IP25(1) and IP25(3), and between IP25(2) and IP25(3). The normal value should be infinity, otherwise the coil is short or leaky. 4. If the coil has no fault, inspect the anti-theft controller with the interchange method to replace a matched new or reset anti-theft controller. Insert the key into the steering lock and turn to "ON" to read the fault code. If no DTC 9000 is shown, it indicates that there is certain fault in the anti-theft controller. Then use the replaced new controller to repeat the matching.
B040	W line Error, no electric injector response	No electric injector controller response was received after anti-theft controller sending the communication request.	1. Inspect whether anti-theft controller IP24 wire harness connector is plugged well. Inspect whether IP24 terminal 8 (W line) and ECM wire harness are well connected, without short-circuit or bad connection. Inspect ECM. 2. Wire harness and connector are connected well. 3. Replace the anti-theft device and Inspect the above mentioned faults. If no fault occurred, the problem can be deemed as within the anti-theft

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			device. 4. Replace the ECM and inspect the above faults. If no fault occurred, the problem can be deemed as within the ECM.
B402	W line short to ground,	W line is short to the ground	1. Inspect the contact between the IP24 plug harnesses of the anti-theft controller; 2. Inspect the short circuit of the harness between the IP24 terminal 8 (W line) and the electric injector. 3. Replace the anti-theft controller and inspect the above mentioned faults. If no fault occurred, the fault can be deemed within the anti-theft controller. 4. Replace the ECM and inspect the above faults. If no fault occurred, the problem can be deemed as within the ECM.
B403	W line short to power Supply	W line is short to the anode of the battery .	1. Inspect the contact between the IP24 harnesses of the anti-theft controller 2. Inspect if the harness between the IP24 terminal 8 and ECM is short to the battery anode. 3. Replace the electric anti-theft controller and inspect the above-mentioned problems. If no problem occurred, the problem can be deemed as within the electric anti-theft controller. 4. Replace ECM, and inspect whether above faults exist. If not, it can be deemed that the electronic fuel injection faults.
B055	No Key was Detected	Missing transponder in the key or damaged transponder or damaged EAS Coil results in that the anti-theft controller can not receive the response from the transponder.	− Inspect whether there is a transponder in the key. − Inspect whether the EAS Coil is normal. − Replace the transponder.

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B056	No key was stored in the anti-theft device	Anti-theft controller has not matched with any key, and therefore no transponder ID is stored in it.	Learn the key again.
B057	No security code has been set .	New or reset anti-theft controller	Set the security code and match the anti-theft controller again.
B059	No electric injector controller request was received	The anti-theft controller didn't receive the communication request from the electric injector controller	1. Inspect the insertion of the harness connector of the anti-theft controller 2. Inspect the connection, open circuit or poor contact of the harness between the anti-theft controller terminal 5 and the ECM. 3. Replace the anti-theft controller and inspect the above mentioned faults. If no fault occurred, the fault can be deemed within the anti-theft controller; 4. Replace the ECM and inspect the above faults. If no fault occurred, the problem can be deemed as within the electric injector.
B060	The current key is not stored in the anti-theft device	The transponder ID is not stored in the anti-theft controller	Use the scan tool to exert the "Key Learning" function
B061	Key is unable to be verified or the communication is disturbed.	Communication between the transponder and the anti-theft controller can not be established or be disturbed. The communication data are abnormal. The electric injector and transponder have inconsistent key.	1. Inspect whether the EAS Coil is normal. 2. Inspect whether the transponder is new or unmatched. If so, match them again. 3. If the transponder is matched, confirm the exchanging of the transponder, or the exchanging and resetting of the electric injector.

Note: DTC (DTC code) is set based on the above-mentioned output sequence. However, at the same time it only shows a maximum of 7 DTC.

Note: DTC code history is code recorded before shown by the scan tool. If a DTC code has no historical features, it only shows the current status. If there are historical features, it can display the status up to 20 ignition cycles.

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2.5.7.5 Data Flow Table

Serial Number	Description	Data
1	Ignition Switch 0	N/OFF
2	Key Detection	YES/NO
3	Ever matched	YES/NO
4	The Current Key Position	Not Programmed/Programmed
5	Key Storage Position 1	Not Stored/Stored
6	Key Storage Position 2	Not Stored/Stored
7	Key Storage Position 3	Not Stored/Stored
8	Key Storage Position 4	Not Stored/Stored
9	Key Storage Position 5	Not Stored/Stored
10	Security Certification	Not Passed/Passed
11	Anti-theft Verification	YES/NO
12	Vehicle Identification Number	Not Programmed/Programmed
13	Password Settings	YES/NO
14	Password Lock	YES/NO
15	Entering The Password	YES/NO
16	Remaining Numbers Of Times Entering The Password	10

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2.5.7.6 Fault Symptom Table

Symptoms	Suspected Parts	Refer to Page
Engine Anti-theft Indicator Always On	Instrument	Refer to 11.6.7.1 Replacement of Combination Instrument Assembly.
Engine Anti-theft warning lamp always on, the engine can not start.	1. Key	Refer to 2.5.7.17 Engine Anti-theft Warning Lamp Flashing, Vehicle Can Not Start
	2. Anti-theft Coil	
	3. Anti-theft Module	
	4. ECM	
	5. Instrument	
	6. Wiring Harness	

	Connector	
Anti-theft system can not detect the valid key.	1. Anti-theft Coil	—
	2. Anti-theft Module	—
Keys do not match	1. Anti-theft Coil	—
	2. Anti-theft Module	—
	3. Key	—
ECM always detects Anti-theft malfunction	1. Wiring Harness and Connector	Refer to 2.5.7.17 Engine Anti-theft Warning Lamp Flashing, Vehicle Can Not Start
	2. Anti-theft Module	
	3. ECM	

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2.5.7.7 Replaced Key Programming

1	Measure VVT solenoid valve resistance.

Next

2	Turn the ignition switch to the position "ON".

Next

3	Enter Anti-theft System

Note: Before enter the security code please contact the manufacturers technical department, as the Anti-theft computer will be locked after the wrong security code entered seven consecutive times.

Next

4	Enter the security code.

Next

5	Learn the key.

Next

6	Key Programming.

Next

7	Place the ignition switch at "OFF" position and wait about 5 min or so.

Next

8	New key learn successful.

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2.5.7.8 Ignition Key Erase

1	Insert the new key.

Next

2	Turn the ignition switch to the position "ON".

Next

3	Enter Anti-theft System

Note: Before enter the security code please contact the manufacturers technical department, as the Anti-theft computer will be locked after the wrong security code entered seven consecutive times.

Next

4	Enter the security code.

Next

5	Key erasing: Choose the previously recorded key positions and erase them, If all erasing is enabled, all keys will be disabled.

Next

6	Place the ignition switch at "OFF" position and wait about 5 min or so.

Next

7	Key erase successfully.

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2.5.7.9 Replaced Security Module Programming

1	Insert the new key.

Next

2	Turn the ignition switch to the position "ON".

Next

3	Enter Anti-theft System

Note: Before enter the security code please contact the manufacturers technical department, as the Anti-theft computer will be locked after the wrong security code entered seven consecutive times.

Next

4	Set the security code.

Next

5	Enter the security code (the preset four-digit security code).

Next

6	Read the ECM to the anti-theft module.

Next

7	Refer to 2.5.7.7 “Replaced Key Programming” to reprogram the key.

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2.5.7.10 Replaced ECM Programming

1	Insert the new key.

Next

2	Turn the ignition switch to the position "ON".

Next

3	Enter Anti-theft System

Note: Before enter the security code please contact the manufacturers technical department, as the Anti-theft computer will be locked after the wrong security code entered seven consecutive times.

Next

4	Enter the security code.

Next

5	Read the anti-theft module to ECM.

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2.5.7.11 Replaced Anti-theft Module and ECM Programming

If the anti-theft controller and EMS controller need to be replaced at the same time, the matched transponder should be replaced at the same time, otherwise the anti-theft system matching can not be achieved. After replacement, the anti-theft system should be matched again.

1	Insert the new key.

Next

2	Turn the ignition switch to the position "ON".

Next

3	Enter Anti-theft System

Note: Before enter the security code please contact the manufacturers technical department, as the Anti-theft computer will be locked after the wrong security code entered seven consecutive times.

Next

4	Set security code (Provided that the anti-theft module is new and without preset security code).

Next

5	Enter the security code (the preset four-digit security code).

Next

6	Read the anti-theft module to ECM.

Next

7	Read the ECM to the anti-theft module.

Next

8	Refer to 2.5.7.7 “Replaced Key Programming” to reprogram the key.

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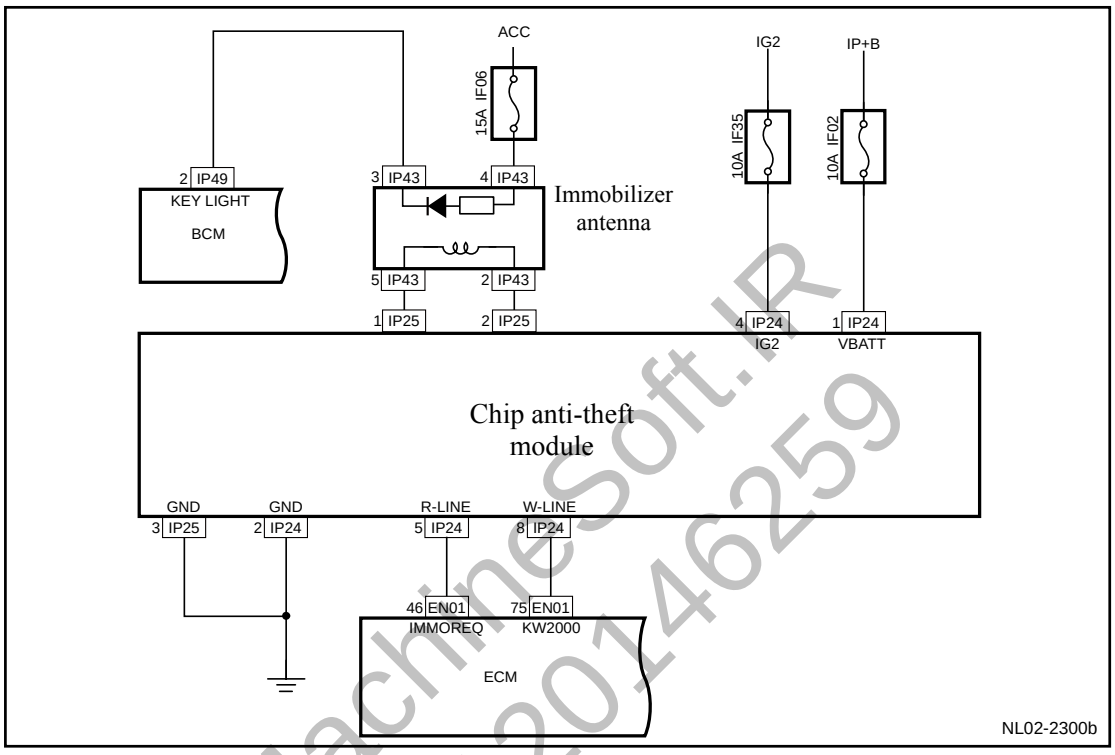
2.5.7.12 DTC 9000 B061

Fault diagnosis code	Descriptions
9000	Antenna Failure (Only When Read Anti-theft Transponder, Not Received During Continuous Test).
B061	Key is unable to be verified or the communication is disturbed.

Circuit diagram:



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Diagnostic Steps:

1	Measure VVT solenoid valve resistance.

(a) Rotated ignition switch to "OFF" position .

(b) Disconnect electronic Anti-theft coil harness connector IP25.

(c) Disconnect engine anti-theft module wire harness connector IP24.

(d) Inspect EAS Coil and engine anti-theft module harness connector.

onfirm whether the harness connector is well inserted and the connector harness breaks off.

Yes → Repair or reconnect the wire harness connector.

No

2	Inspect Anti-theft Coil

(a) Rotated ignition switch to "OFF" position .

(b) Disconnect electronic Anti-theft coil harness connector IP25.

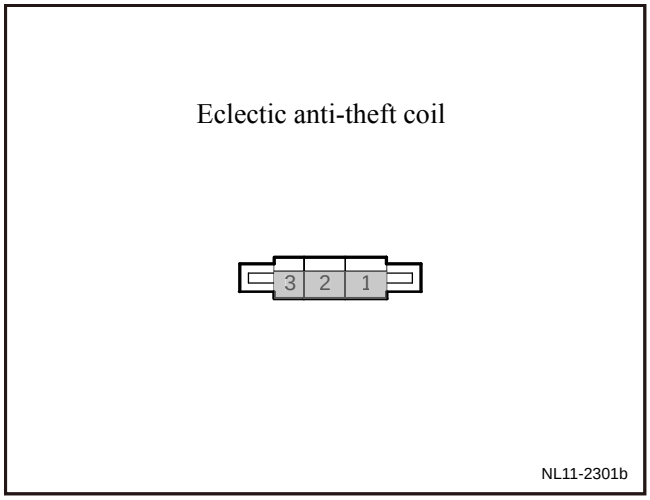
(c) Measure resistance between terminal 1 and 2.

Standard Resistance Value: 10~20 Ω

(d) Measure resistance between terminal 2 and 3.

Standard Resistance: 10 kΩ or higher

Confirm if the resistance conforms to standard value.



No → Replace electronic Anti-theft coil.

Yes

3	Replace engine anti-theft module.

Replace engine anti-theft module and refer to 2.5.8.2 "Replacement of Engine Anti-Theft System Control Module".

(b) Refer to 2.5.7.9 “Replacement of programming after anti-theft module” to match the engine anti-theft system.

(c) Use the Fault Diagnosis Tester to Clear DTC code.

Confirm the completion of repair.

Next

4	The system is normal.

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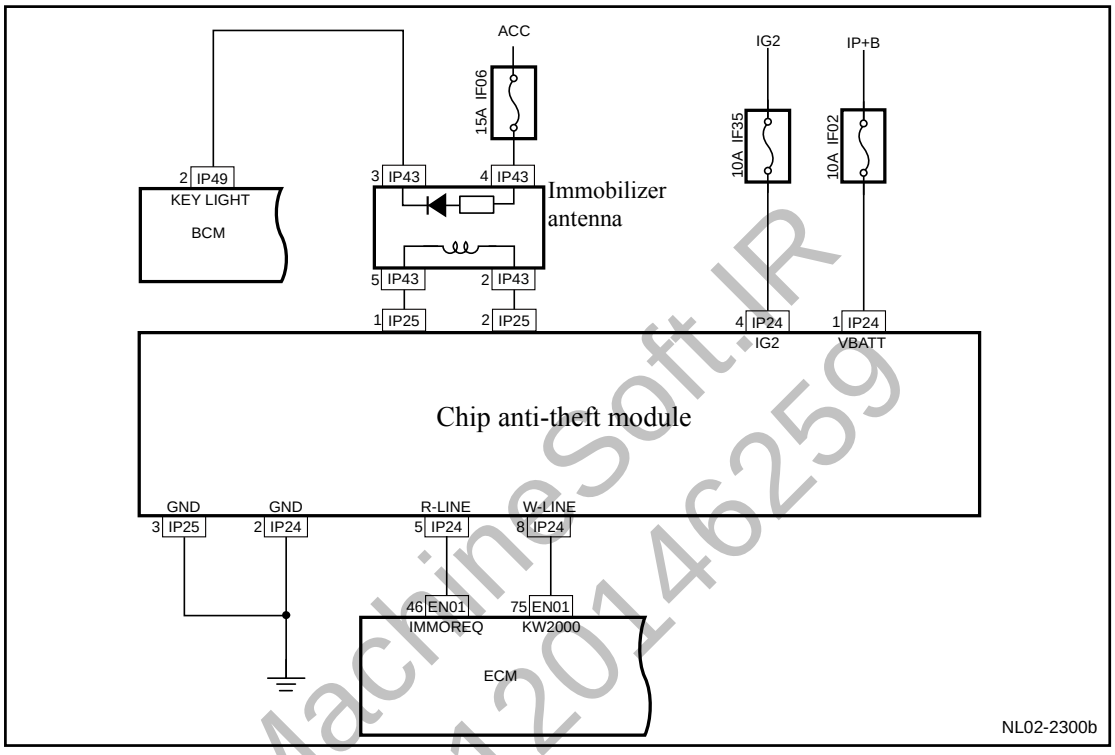
2.5.7.13 DTC B040 B402 B403

Fault diagnosis code	Descriptions
B040	W line error . no response from electric injector
B402	W line short to the ground
B403	W line short to the Power Supply .

Circuit diagram:



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Diagnostic Steps:

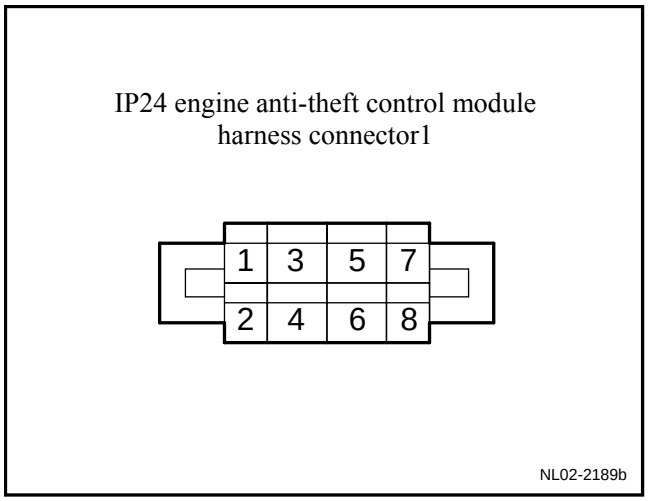
1	Inspect engine chip anti-theft module W line circuit.

(a) Rotated ignition switch to "OFF" position .

(b) Disconnect ECM harness connector EM01.

(c) Disconnect engine anti-theft module wire harness connector IP24.

(d) Inspect the circuit between the ECM harness connector EM01 terminal 75 and the engine anti-theft module harness connector IP24 terminal 8.



IP24(8)-EM01(75)	Less than 1 Ω
IP24 (8) and Body Ground	10 kΩ or higher
IP24 (8) and Body Ground	0V

Confirm whether according with the standard value.

Yes → Repair the wire harness

No

2	Replace engine anti-theft module.

(a) Replace engine anti-theft module and refer to 2.5.8.2 "Replacement of Engine Anti-Theft System Control Module".

(b) Refer to 2.5.7.9 “Replacement of programming after anti-theft module” to match the engine anti-theft system.

(c) Use the Fault Diagnosis Tester to Clear DTC code.

Confirm the completion of repair.

Yes → The system is normal.

No

3	Inspect the ECM Power Supply and Grounding Circuits.

(a) Repair ECM power supply circuit.

(b) Check ECM grounding circuit.

4	Replace ECM

(a) Replace ECM and refer to 2.2.8.1 "Replacement of Engine Control Module".

(b) Match engine anti-theft system, refer to 2.5.7.10 Compilation after replacement of ECM.

Confirm the completion of repair.

Next

5	The system is normal.

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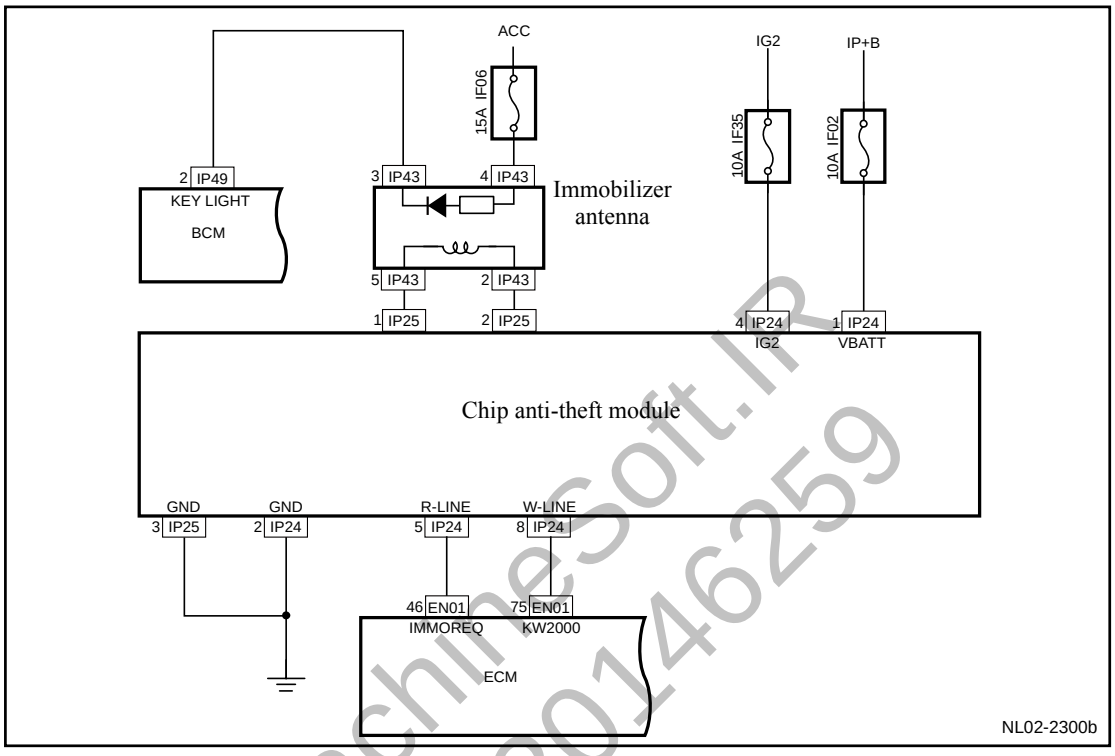
2.5.7.14 DTC B055

Fault diagnosis code	Descriptions
B055	Missing transponder in the key or damaged transponder or damaged EAS Coil results in that the anti-theft controller can not receive the response from the transponder.

Circuit diagram:



Diagnostic Steps:

1	Inspect whether there is a transponder in the key.

(a) Inspect whether there is transponder in the key.

No → Install the new transponder

Yes

2	Inspect EAS Coil

(a) Refer to 2.5.7.12 DTC 9000, B061 to inspect the electronic Anti-theft coil.

Confirm whether the system is normal or not.

Yes → The system is normal.

No

3	Replace electronic Anti-theft coil.

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(a) Refer to 2.5.8.1 “Replacement of EAS coil” to replace the EAS coil.

Confirm the completion of repair.

Next

4	The system is normal.

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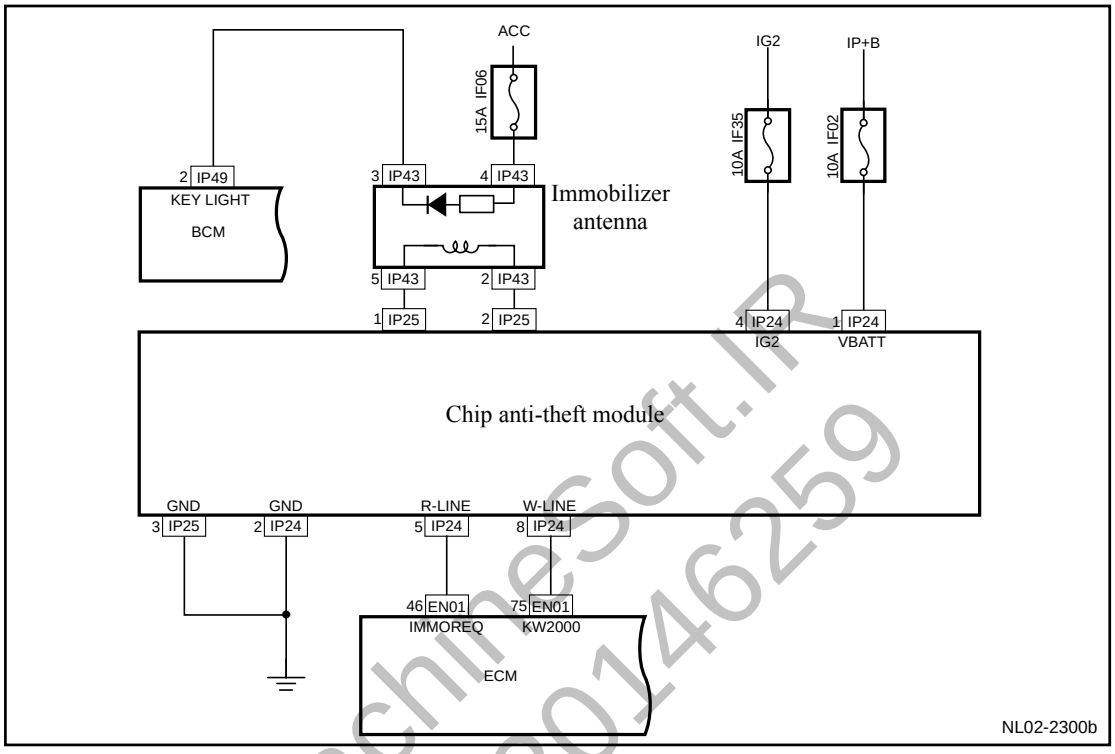
2.5.7.15 DTC B056 B060

Fault diagnosis code	Descriptions
B056	No key was stored in the anti-theft device
B060	The current key is not stored in the anti-theft device

Circuit diagram:



Diagnostic Steps:

For detailed steps, refer to2.5.7.7 Replaced Key Programming

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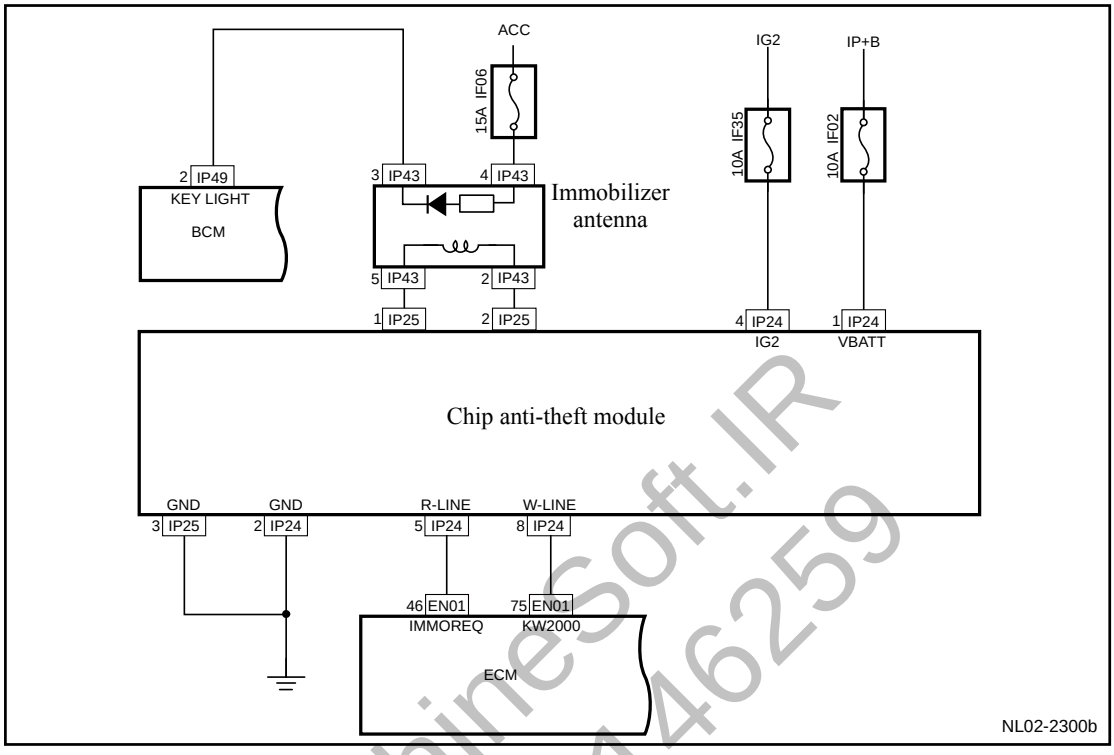
2.5.7.16 DTC B057

Fault diagnosis code	Descriptions
B057	No Security Code has been set

Circuit diagram:



Diagnostic Steps:

Refer to2.5.7.9 Replaced Security Module Programming.

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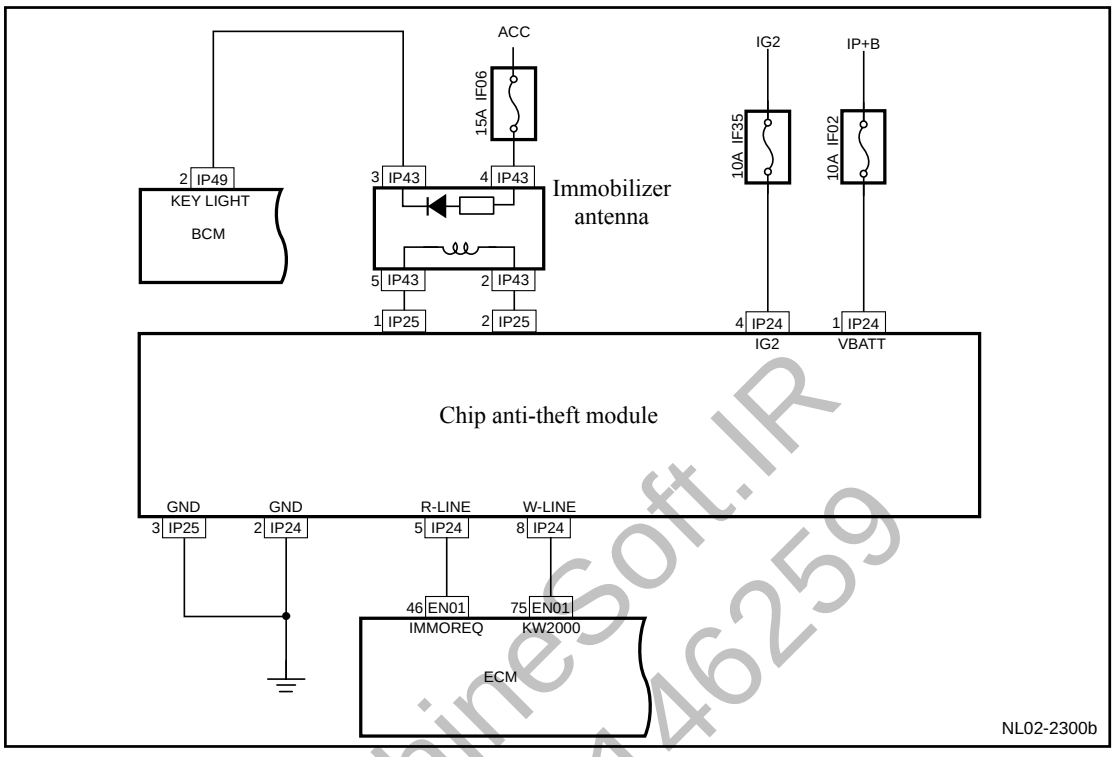
2.5.7.16 DTC B059

Fault diagnosis code	Descriptions
B059	No request from ECM has been received.

Circuit diagram:



Diagnostic Steps:

1	Inspect engine chip anti-theft module R line circuit.

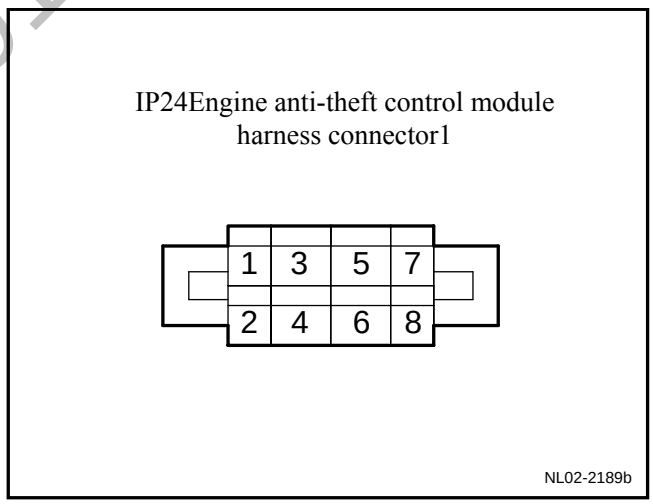
(a) Rotated ignition switch to "OFF" position .

(b) Disconnect the engine chip anti-theft module wiring harness connector IP24.

(c) Disconnect the engine control module wiring harness connector EM01.

(d) Measure the continuity between IP24 terminal No.5 and EM01 terminal No.46..

Standard Resistance: Less than 1 Ω



Confirm if the resistance conforms to standard value.

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No → Repair or replace the harness.

Yes

2	Inspect engine chip anti-theft module power supply and grounding circuit.

(a) Repair engine chip anti-theft module power supply circuit.

(b) Repair engine chip anti-theft module grounding circuit.

Confirm whether the system is normal or not.

Yes → The system is normal.

No

3	Replace Engine Chip Anti-theft Module.

(a) Replace engine chip anti-theft module and refer to 2.5.8.2 "Replacement of Engine Anti-theft System Control Module".

(b) Refer to 2.5.7.9 “Replacement of Programming after Anti-theft Module” to match the engine anti-theft system.

Confirm whether the system is normal or not.

Yes → The system is normal.

No

4	Repair ECM Power Supply and grounding Circuits.

(a) Repair ECM power supply circuit.

(b) Check ECM grounding circuit.

Confirm whether the system is normal or not.

Yes → The system is normal.

No

5	Replace ECM

(a) Replace ECM and refer to 2.2.8.1 "Replacement of Engine Control Module".

(b) Match engine anti-theft system . Refer to:2.5.7.10 replace programming after ECM.

Confirm the completion of repair.

Next

6	The system is normal.

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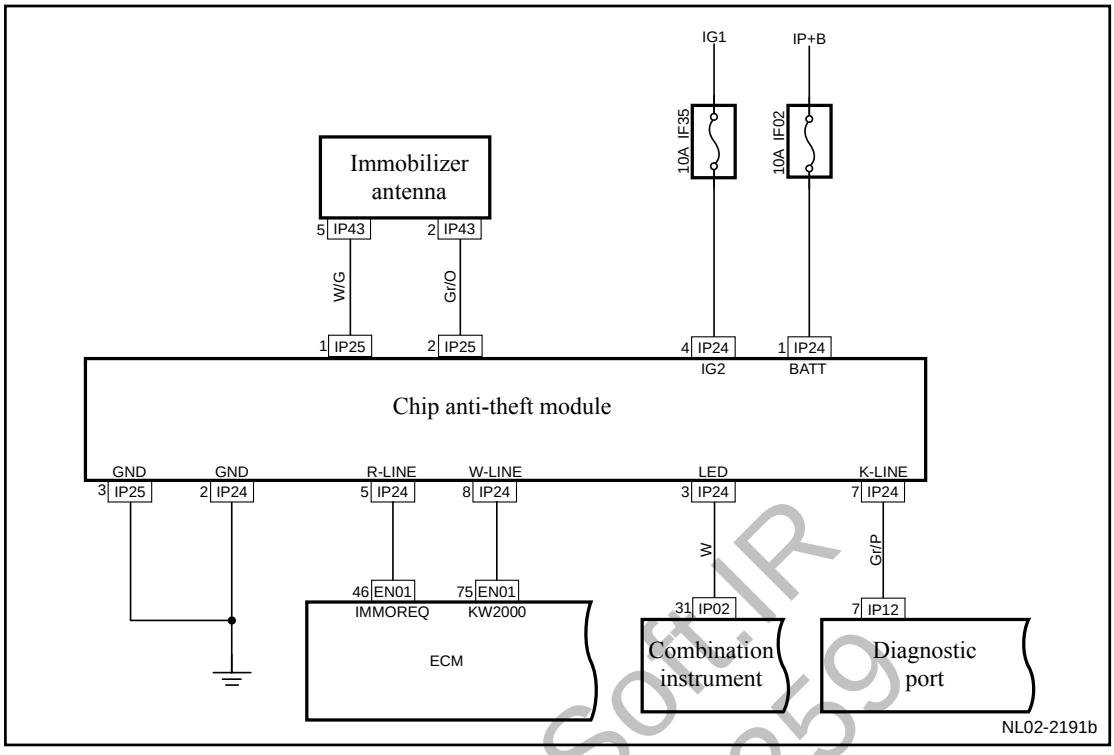
2.5.7.17 Engine Anti-theft System Warning Lamp Flashing

Circuit diagram:

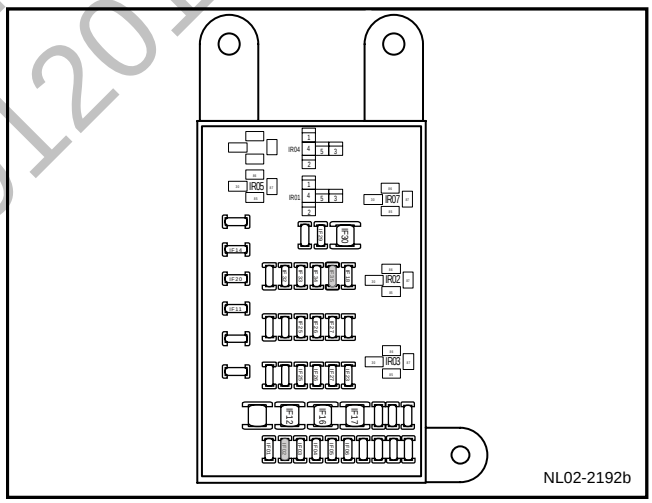


Diagnostic Steps:

1	Inspect the fuse IF02 and IF35.

(a) Inspect if the fuse IF02 and IF35 is blown.

Fuse Rating: IF02 rating is 10 A, IF35 rating is 10 A



No → Go to step 3

Yes

2	Repair the circuit of the fuses IF02 and IF35.

(a) Inspect the fuse IF02 circuit, repair short-circuit fault.

(b) Inspect the fuse IF35 circuit, repair short-circuit fault.

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(c) Replace the fuses with rated current.

Can the vehicle start?

Yes → The system is normal.

No

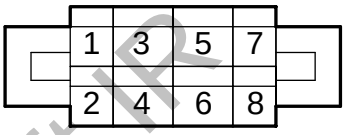
3	Inspect engine anti-theft system control module's grounding.

(a) Measure resistance between engine anti-theft system control module IP24 terminal No.2 or IP25 terminal No.3 and the body ground with a multimeter and determine the circuit continuity.

Standard Resistance: Less than 1 Ω

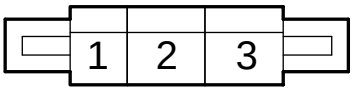
Does the resistance conform to standard value?

IP24 engine anti-theft control module harness connector1



NL02-2189b

IP25 engine anti-theft control module harness connector2



NL02-2190b

Yes → Go to step 5

No

4	Repair the engine anti-theft system control module grounding circuit.

(a) Repair circuit between the engine anti-theft system control module connector IP24 terminal No.2 or IP25 terminal 3 and body ground open fault.

Can the vehicle start?

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Yes → The system is normal.

No

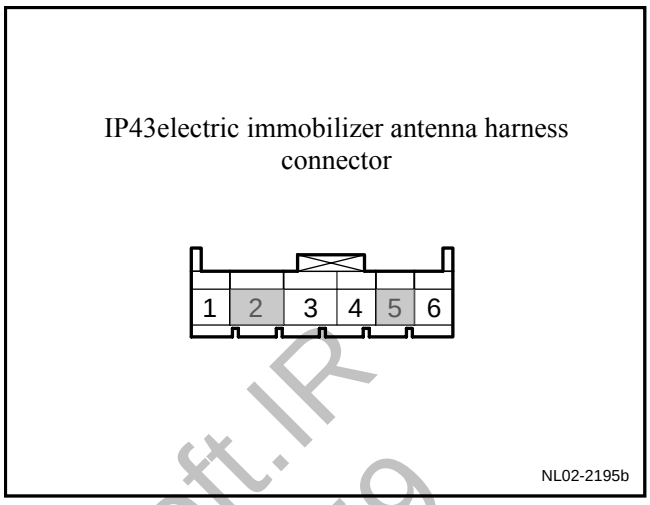
5	Inspect EAS Coil

(a) Disconnect electronic Anti-theft coil harness connector.

(b) Use multimeter to measure resistance of coil.

Standard Resistance Value: 5 Ω at room temperature 20°C(68 ºF)

Is EAS coil resistance specified value?



Yes → Go to step 7

No

6	Replace electronic Anti-theft coil.

(a) Refer to 2.5.8.1 “Replacement of EAS coil” to replace the EAS coil.

Can the vehicle start?

Yes → The system is normal.

No

7	Inspect circuit between EAS coil harness connector and engine anti-theft system control module harness connector.

(a) Measure the resistance between the anti-theft coil harness connector IP43 terminal No.2 and engine anti-theft system control module wiring harness connector IP25 terminal No.2 with a multimeter to determine circuit continuity.

Standard Resistance: Less than 1 Ω

(b) Measure the resistance between the anti-theft coil harness connector IP43 terminal No.5 and engine anti-theft system control module wiring harness connector IP25 terminal No.1 with a multimeter to determine circuit continuity.

Standard Resistance: Less than 1 Ω

Whether resistance meet standard or not?

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Yes → Go to step 9

No

8	Repair circuit between EAS coil harness connector and engine anti-theft system control module harness connector.

(a) Repair the open circuit fault between the electric anti-theft coil wiring harness connector IP43 terminals No.2 and engine control module wiring harness connector IP25 terminal No.2 to determine circuit continuity.

(b) Repair the open circuit fault between the electric anti-theft coil wiring harness connector IP43 terminals No.5 and engine control module wiring harness connector IP25 terminal No.1 to determine circuit continuity.

Can the vehicle start?

Yes → The system is normal.

No

9	Inspect the serial communication circuit between the engine anti-theft system control module and engine control module.

(a) Inspect the serial communication circuit open between engine anti-theft system control module wiring harness connector IP24 terminals No.5 and engine control module harness connector EM01 terminal No.46, to determine the continuity.

Standard Resistance: Less than 1 Ω

(a) Inspect the serial communication circuit open between engine anti-theft system control module wiring harness connector IP24 terminals No.8 and engine control module harness connector EM01 terminal No.75, to determine the continuity.

Standard Resistance: Less than 1 Ω

Does the resistance conform to standard value?

Yes → Intermittent fault. refer to2 . 2 . 7 . 3 intermittent fault inspection

No

10	Repair serial communication circuit between engine anti-theft system control module and engine control module.

(a) Repair the serial communication open circuit between engine anti-theft system control module connector IP24 terminal No.5 and the engine control module connector EEM01 terminal No.46.

(b) Repair serial communication circuit open resistance between engine anti-theft system control module wiring harness connector P24 terminals No.8 and engine control module harness connector EM01 terminal No.75.

Can the vehicle start?

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Yes → The system is normal.

No

11	Replace anti-theft system control module.

(a) Replace anti-theft system control module and refer to 2.2.8.1 "Replacement of Engine Control Module".

(b) Refer to 2.5.7.9 "Replacement of Programming after Anti-theft Module" to carry out engine anti-theft system programming procedures.

Yes → The system is normal.

No

12	Replace engine control module.

(a) Replace the engine control module and refer to 2.2.8.1 "Replacement of Engine Control Module".

(b) Refer to 2.5.7.10"Replacement of Programming after ECM" to carry out engine anti-theft system programming procedures.

Confirm the repair has been completed.

Next

13	The system is normal.

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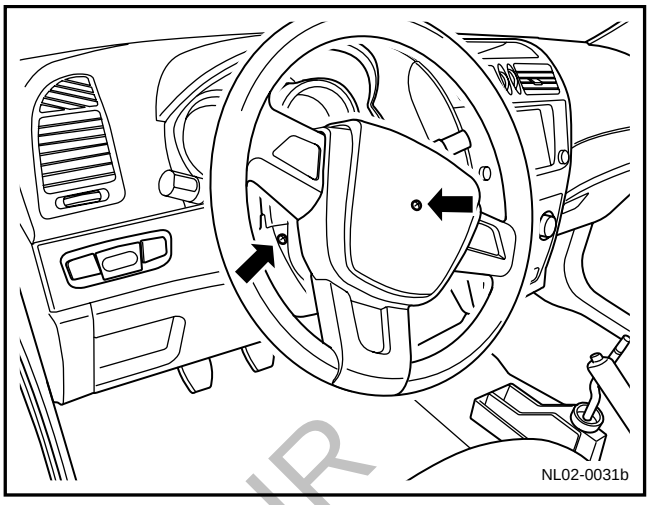
2.5.8 Removal and installation

2.5.8.1 Replacement of EAS Coil

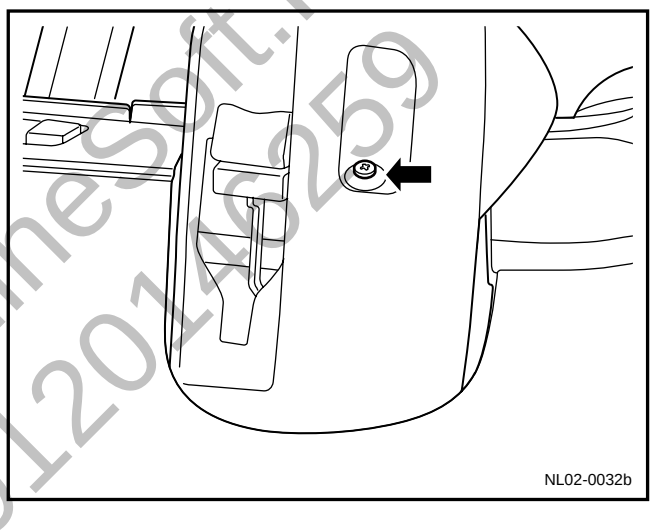
Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

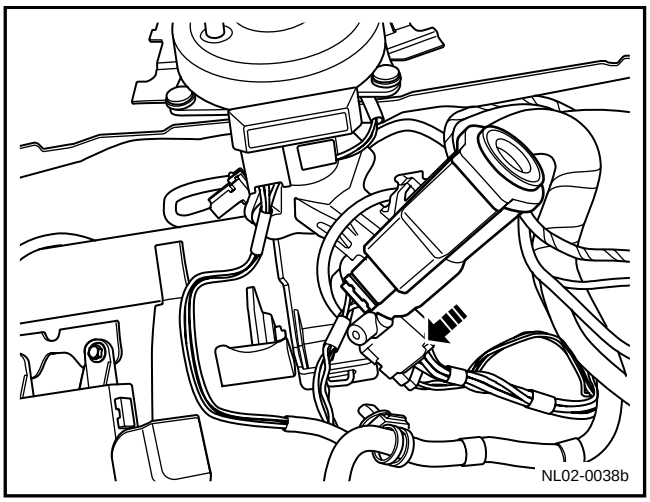
1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
2. Turn the steering wheel and dismantle the upper and lower steering column shield panel retaining screws.



3. Dismantle the lower steering column shield screw.
4. Remove the steering column upper and lower shield panels.



5. Disconnect the electronic anti-theft wiring harness coil connector.



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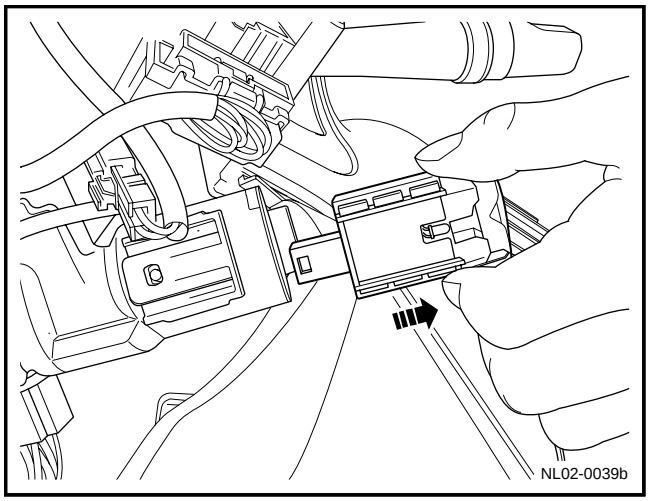
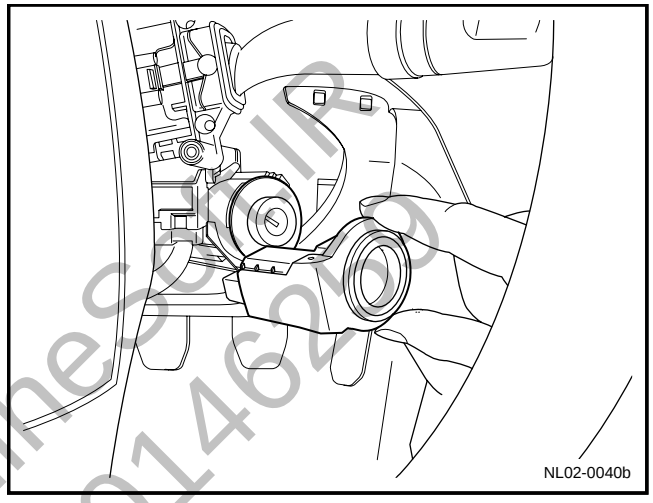
6. Dismantle the electronic anti-theft engine coil.



Installation Procedure:

1. Install the electronic anti-theft engine coil.



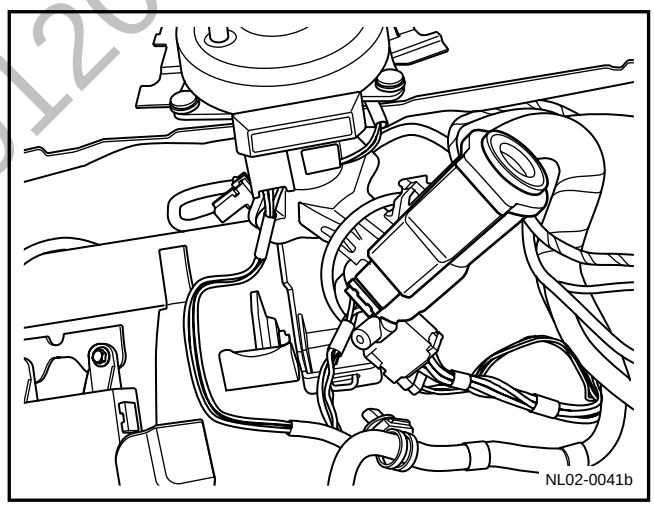
2. Connect the electronic anti-theft wiring harness coil connector.
3. Install the steering column upper and lower protective plates.
4. Install and tighten the left upper steering column shield retaining screw.

Torque : 2Nm(Metric) 1 . 5lb-ft(English system)

5. Install and tighten the lower steering column shield retaining screw.

Torque: 2Nm (Metric system) 1.5lb-ft (English system)

6. Connect the battery negative cable .



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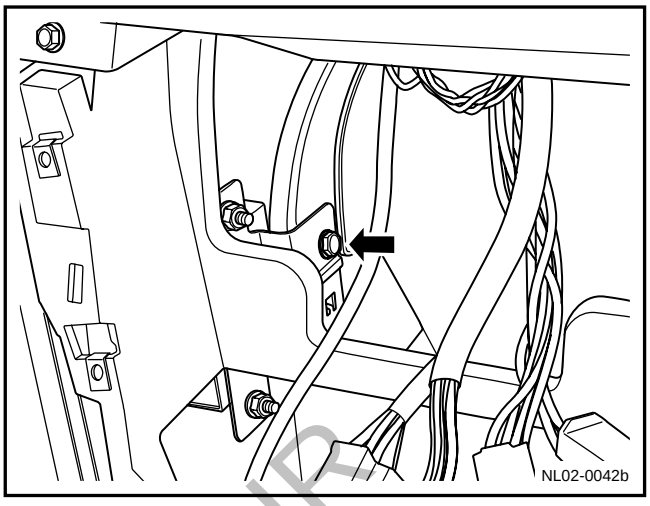
2.5.8.2 Replacement of Engine Anti-theft System Control Module

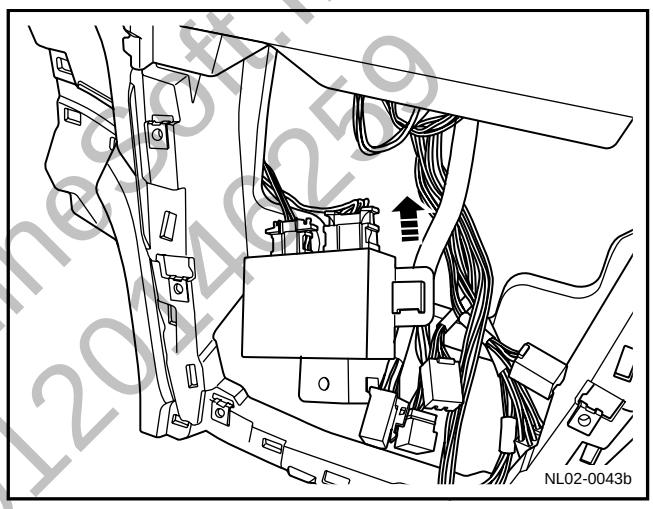
Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantlement of the audio unit, see 11.2.7.4 Replacement of Audio Unit.
3. Dismantle the fixing bolts of anti-theft system control module.



4. Disconnect anti-theft system control module harness connector.

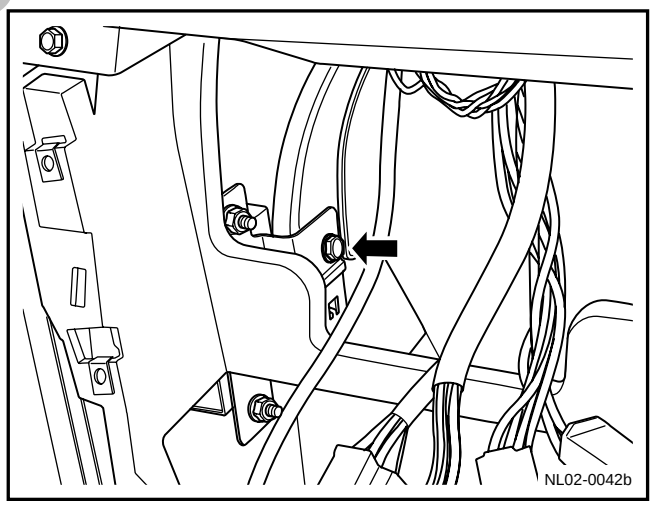


Installation Procedure:

1. Connect anti-theft system control module harness connector.
2. Install and tighten the fixing bolts of engine anti-theft system control unit bracket.

Torque: 9Nm (Metric system) 6.7lb-ft (English system)

3. Install the audio head unit.
4. Connect the battery negative cable .



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2.6 Mechanical system (4G20/4G24)

2.6.1 Specifications

2.6.1.1 Fastener Specifications

Fastener Name	Model	Specification	
		Metric (N.m)	English system (lb-ft)
Intake camshaft front bearing cap bolts	M8×50	30±1	21.3-22.7
Exhaust camshaft front bearing cap bolts	M8×50	30±1	21.3-22.7
Camshaft Bearing Cap Bolts	M6×40	13±1	8.8-10.3
Cylinder Head Manufacturing Hole Plug	M27×1 . 5	86±8	57.2-68.9
Piston Cooling Nozzle Bolt	M6×12 (socket head)	7±1	4.4-5.9
Connecting Rode Bolts	M9×1×45.5	First Pass 20±1	13.9-15.4
		Second Pass 50~55	36.5-40.3
Crankcase Bolts	M8×125 M8×45	24±1	16.9-18.3
Main Bearing Cap Bolts	M10×1 . 5×82 . 5	First Pass 20±2	13.2-16.1
		Second Pass 40±2	27.9-30.8
		Third Pass 60±3	41.8-46.3
Balance Shaft Cap Bolts	M8×60	First Pass 15±2	9.5-12.5
		Second Pass 38±3	25. 7-30.1
Oil Pump Bolts	M8×65	19±2	12.5-15.4
Oil Filter Adapter-Crankcase	M24×1 . 5	30±3	19.8-24.2
Oil Filter- Oil Filter Adapter	UNF3/4-16	20±3	12.5-16.9
Cylinder Hood Bolts	M11×1 . 5×142	First Pass 35±4	22.7-28.6
		Second Pass 70±2	49.8-52.8

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		Third Pass 90±3	63.8-68.2
Water temperature sensor	M12×1 . 5	15±3	8.8-13.2
VVT Bolts	M12×1 . 25×55	60±3	41.8-46.2
Timing Sprocket Bolt	M10×1 . 25×22	50±3	34.5-38.8
Chain Guide Rail Bolts	M6×14	9±1	5.9-7.3
Oil Pump Sprocket Bolts	M9×1×10	30±3	19.8-24.2
Oil Pump Chain Tensioner Pin Roll	M6×12	13±1	8.8-10.3
Chain Tension Rail Pin Roll	M8×16	19±1	13.2-14.7
Oil Pump Chain Tightener Bolts	M5×16	6±1	3.7-5.1
Timing Chain Cover Bolt	M10×40	50±3	34.5-38.8
	M8×30	18±3	11-15.4
	M6×30 . M6 Nut	10±1	6.6-8.1
Chain Tensioner Bolts	M6	9±1	5.9-7.3
Spark Plug	M14×1.25	25±3	16.1-20.5
Oil Pan Drain Plug	M12×1 . 25×10 . 5	25±3	16.1-20.5
Oil Pan bolts and nuts	M6×14	9±1	5.9-7.3
	M6 Nut		5.9-7.3
Camshaft Timing Sensor Bolts	M6×14	9±1	5.9-7.3
Engine Oil Pressure Alarm	R1/8	15±1	10.3-11.7
OCV Filter Oil Duct Plug Screw	M14×12	30±3	19.8-24.2
OCV Valve Bolts	M5×12	6±1	3.7-5.1
Cylinder Hood Cover Bolts and Nuts	M6×60	11±1	7.3-8.8
	M6×33		7.3-8.8
	M6 Nut		7.3-8.8
PCV Valve Bolts	NPT3/8	19±2	12.5-15.4
Ignition Coil Bolts	M6×20	9±1	5.9-7.3
Exhaust Manifold Nuts	M8	30±3	19.8-24.2

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Upper heat shield bolts	M8×22	12±1	8.1-9.5
Lower heat shield bolts	M8×12	12±1	8.1-9.5
Facing Bar – Exhaust Manifold	M10×22	44±4	29.3-35.2
	M10 Nut		29.3-35.2
Bolts of Knock Sensor	M8×40	19±2	12.5-15.4
Intake Manifold Upper and Lower Cover Bolts	M6×14	9±1	5.9-7.3
Intake Manifold Mounting Bolts and Nuts	M8×35	25±3	16.1-20.5
	M8×75		
	M8 Bolt:		
Oil Rail Mounting Bolts	M6×20	9±1	5.9-7.3
Plug and Drain Cock	R1/4	Above 25	Above 42 . 5
Water Pump Component Bolts	M10×1 . 25×60	35±3	23.5-27.9
Engine Inlet Seat Bolts	M6	9±1	5.9-7.3
Water Pump Belt Pulley Bolts	M8×14	22±3	13.9-18.3
Heater Outlet Pipe Bolts and Nuts	M6×14	9±1	5.9-7.3
	M6		5.9-7.3
Chain Frame Cover Bolts	M6×12	9±1	5.9-7.3
Belt Tensioner Assembly Bolts	M8×75	32±3	21.2-25.7
	M10×1 . 25×85	60±5	40.3-47.6
Compressor Bolts	M8×100	25±3	16.1-20.5
Generator Bolt	M8×40	22±5	12.5-26.3
	M10×1 . 25×85	45±5	29.3-36.7
Power Steering Pump Bolts	M10×1 . 25×100	40±5	25. 7-33
Damping belt pulley bolt	M14×1 . 5×39	170±8	118.7-130.5
Flywheel Bolt	M12×1.25	100±5	69 . 6-77
Engine hood bolts and nuts	M6	9±1	5.9-7.3
Engine lifting eye and hook	M10×20	38±4	24.9-30.7

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Right installed support bracket bolt	M10×65	55±5	36 . 7-44
	M10×25	40±4	26.4-32.3
Note: the high-strength bolt is used within limit of 3 times, the bolt is disassembled once as per the specified torque and disassembling specification, i.e., it is used once.			

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2.6.1.2 Mechanical System Specification

Items	Specification	
	4G24	**4G20**
Bore (mm/in)	88.7	85
Stroke (mm/in)	96.2	88
Displacement	2.378	1.997
Compression ratio	10	10.2
Power (km/rpm)	119/5700	105/6000
Torque (N.M/rpm)	220/4000 -4200	186/4000-4200
Idle speed	750±50	750±50
Ignition Sequence	1-3-4-2	1-3-4-2
Minimum Fuel consumption rate (g/KW.h)	≤255	≤260
Fuel grade	Unleaded motor gasoline . 93# or above	
Oil Tank Capacity (L/pt)	(Full filling dry-type) 4L	
Lubrication Oil Specification/Grades	SAE10W-30 or SAE15W-40 (SAE5W-30 for cold region in winter), with API quality class of SL or above. SAE15W-40 (quality class of SL or above) or SAE20W-50 (quality class of SJ or above) for tropic region.	
Spark Plug Model	K6RTC	
Spark Plug Gap (mm/in)	0.8-0.9	
Dry Mass (kg/lb)	≤120	≤119
Overall dimension (LxWxH) mm/in	618×672×655	
Camshaft		
Journal Diameter (mm/in)	23	
Camshaft Axial Clearance (mm/in)	Intake side: 0.04-0.095	exhaust side: 0.08-0.135
Intake Valve Clearance (mm/in)	0.25±0.03	
Exhaust Valve Clearance (mm/in)	0.3±0.03	
Intake VVT Adjustment Range	±25.75°	
Valve Timing		
Intake Valve is Open.	18.5° before TDC	

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Intake Valve is Closed	75° after BDC	
Exhaust Valve is Open	58° before BDC	
Exhaust Valve is Closed	26.5° after TDC	
Connecting rode Journal		
Connecting Rod Bearing Clearance (mm/in)	0.018～0.044	
Connecting Rod Bearing Axial Clearance (mm/in)	0.016～0.342	
Crankshaft		
Axial Clearance (mm/in)	0.04～0.24	
Main Bearing Clearance - All (mm/in)	0.016～0.034	
Main Journal Diameter - All (mm/in)	φ54 . 782～φ54 . 8	
Top Surface Flatness (mm/in)	0.003	
Cylinder Hood		0.02
Machined Minimal Total Height (mm/in)	129-0.1	
Overall Height (mm/in)	129+0.1	
Valve Guide Height (mm/in)	38.5/40.5	
Piston		
Gap Between Piston and Cylinder (mm/in)	0.0275～0.0575	
Diameter (mm/in)	φ88 . 665±0.0075	φ84 . 965±0.0075
Piston Pin		
Gap Between Piston Pin and Piston (mm/in)	0～0.006	
Gap Between Piston Pin and Rod (mm/in)	-0.022～0.016	
Diameter (mm/in)	$\varphi 22^{+0.010}_{+0.004}$	
Length (mm/in)	$56^{0}_{-0.1}$	
Piston Pin Offset - Thrust Side (mm/in)	0.45±0.1	
Oil Pump		
Side Clearance	0.05～0.10mm(0.0020～0.0039in)	

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Tooth Clearance	0.08～0.18mm(0.0031～0.0071in)
Oil pressure alarm device activation pressure	≤40kPa(≤6psi)
Oil Pump Output Pressure	0.77MPa (111.7psi)
Oil Pump Relief Valve Opening Pressure	0.40～0.50MPa(57.8～72.2psi)
Piston Ring	
Oil Ring End Gap (mm/in)	0.20～0.40
Second Compression Ring End Gap (mm/in)	0.30～0.50
First Compression Ring End Gap (mm/in)	0.20～0.40
Sealants and Adhesives	
Cylinder Head Covers Mat Sealant	1596F Flat Silicone Rubber Sealants
Engine Oily Road Cones	1608 Bowl plug seal retaining agent
Oil Pan and Crankcase Mating Surface	1590 Silicone Rubber Immediate Flat Sealant
Crankcase With The Cylinder Block Joints	1596F Flat Silicone Rubber Sealants
Flywheel Bolt	Pre-Rubberizing Bolt (LOCTITE 204)
Valve System	
Intake Valve Diameter (mm/in)	34.5
Exhaust Valve Diameter (mm/in)	29.7
Valve Tube Diameter (mm/in)	5.5
Valve Stem Diameter - Intake Valve (mm/in)	5.5
Valve Rod Diameter - Exhaust Valve (mm/in)	5.5

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2.6.1.3 Specification Table for Tappet Rods of Intake and Exhaust Valves

Packet No.	**Thickness size (mm/in)**	**Packet No.**	**Thickness size (mm/in)**
06	5.06（0.1992）	42	5.42（0.2134）
08	5.08（0.20）	44	5.44（0.2142）
10	5.10（0.2008）	46	5.46（0.2150）
12	5.12（0.2016）	48	5.48（0.2157）
14	5.14（0.2024）	50	5.50（0.2165）

16	5.16（0.2031）	52	5.52（0.2173）
18	5.18（0.2039）	54	5.54（0.2181）
20	5.20（0.2047）	56	5.56（0.2189）
22	5.22（0.2055）	58	5.58（0.2197）
24	5.24（0.2063）	60	5.60（0.2205）
26	5.26（0.2071）	62	5.62（0.2213）
28	5.28（0.2079）	64	5.64（0.2220）
30	5.30（0.2087）	66	5.66（0.2236）
32	5.32（0.2094）	68	5.68（0.2244）
34	5.34（0.2102）	70	5.7（0.2252）
36	5.36（0.2110）	72	5.72（0.226）
38	5.38（0.2118）	74	5.74（0.2268）
40	5.40（0.2126）		

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2.6.1.4 Selection Table for Tappet Rod of Intake Valve

Air intakevalve tappet rod specification list

All installing tappet rod code and corresponding thickness(mm)	Clearance measurement(mm)	0.000~0.030	0.031~0.050	0.051~0.070	0.071~0.090	0.091~0.110	0.111~0.130	0.131~0.150	0.151~0.170	0.171~0.190	0.191~0.199	0.200~0.260	0.261~0.280	0.281~0.300	0.301~0.320	0.321~0.340	0.341~0.360	0.361~0.380	0.381~0.400	0.401~0.420	0.421~0.440	0.441~0.460	0.461~0.480	0.481~0.500	0.501~0.520	0.521~0.540	0.541~0.560	0.561~0.580	0.581~0.600	0.601~0.620	0.621~0.640	0.641~0.660	0.661~0.680	0.681~0.700	0.701~0.720	0.721~0.740	0.741~0.760	0.761~0.780	0.781~0.800	0.801~0.820	0.821~0.840	0.841~0.860	0.861~0.880	0.881~0.900	0.901~0.920
06	5.06												10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
08	5.08										04		12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	
10	5.10									06	06		14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74		
12	5.12								06	08	08		16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74			
14	5.14							06	08	10	10		18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74				
16	5.16						06	08	10	12	12		20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74					
18	5.18					06	08	10	12	14	14		22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	10						
20	5.20				06	08	10	12	14	16	16		24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74							
22	5.22			06	08	10	12	14	16	18	18		26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74								
24	5.24		06	08	10	12	14	16	18	20	20		28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74									
26	5.26	06	08	10	12	14	16	18	20	22	22		30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74										
28	5.28	08	10	12	14	16	18	20	22	21	24		32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74											
30	5.30	10	12	14	16	18	20	22	24	26	26		34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74												
32	5.32	12	14	16	18	20	22	24	26	28	28		36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74													
34	5.34	14	16	18	20	22	24	26	28	30	30		38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74														
36	5.36	16	18	20	22	24	26	28	30	32	32		40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74															
38	5.38	18	20	22	24	26	28	30	32	34	34		42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74																
40	5.40	20	22	24	26	28	30	32	34	36	36		44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74																	
42	5.42	22	24	26	28	30	32	34	36	38	38		46	48	50	52	54	56	58	60	62	64	66	68	70	72	74																		
44	5.44	24	26	28	30	32	34	36	38	40	40		48	50	52	54	56	58	60	62	64	66	68	70	72	74																			
46	5.46	26	28	30	32	34	36	38	40	42	42		50	52	54	56	58	60	62	64	66	68	70	72	74																				
48	5.48	28	30	32	34	36	38	40	42	44	44		52	54	56	58	60	62	64	66	68	70	72	74																					
50	5.50	30	32	34	36	38	40	42	44	46	46		54	56	58	60	62	64	66	68	70	72	74																						
52	5.52	32	34	36	38	40	42	44	48	48			56	58	60	62	64	66	68	70	72	74																							
54	5.54	34	36	38	40	42	44	46	48	50	50		58	60	62	64	66	68	70	72	74																								
56	5.56	36	38	10	42	44	46	48	50	52	52		60	62	64	66	68	70	72	74																									
58	5.58	38	40	42	44	46	48	50	52	54	54		62	64	66	68	70	72	74																										
60	5.60	40	42	44	46	48	50	52	54	56	56		64	66	68	70	72	74																											
62	5.62	42	44	46	48	50	52	54	56	58	58		66	68	70	72	74																												
64	5.64	44	46	48	50	52	54	56	58	60	60		68	70	72	74																													
66	5.66	46	48	50	52	54	56	58	60	62	62		70	72	74																														
68	5.68	48	50	52	54	56	58	60	62	64	64		72	74																															
70	5.70	50	52	54	56	58	60	62	64	66	66		74																																
72	5.72	52	54	56	58	60	62	64	66	68	68																																		
74	5.74	54	56	58	60	62	64	66	68	70	70																																		

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2.6.1.5 Selection Table for Tappet Rod of Exhaust Valve

Air exhaust valve tappet rod specification list

All installing tappet rod code and corresponding thickness(mm)	Clearance measurement(mm)	0.000~0.030	0.031~0.050	0.051~0.070	0.071~0.090	0.091~0.110	0.111~0.130	0.131~0.150	0.151~0.170	0.171~0.190	0.191~0.210	0.211~0.230	0.231~0.250	0.251~0.270	0.271~0.290	0.291~0.310	0.311~0.330	0.331~0.350	0.351~0.370	0.371~0.390	0.391~0.410	0.411~0.430	0.431~0.450	0.451~0.470	0.471~0.490	0.491~0.510	0.511~0.530	0.531~0.550	0.551~0.570	0.571~0.590	0.591~0.610	0.611~0.630	0.631~0.650	0.651~0.670	0.671~0.690	0.691~0.710	0.711~0.730	0.731~0.750	0.751~0.770	0.771~0.790	0.791~0.810	0.811~0.830	0.831~0.850	0.851~0.870	0.871~0.890	0.891~0.910	0.911~0.930	0.931~0.950	0.951~0.970	0.971~0.990	0.991~1.100
06	5.06																10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
08	5.08														04		12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	
10	5.10											06	06		14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74		
12	5.12										06	08	08		16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74			
14	5.14									06	08	10	10		18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74				
16	5.16									06	08	10	12		20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74					
18	5.18								06	08	10	12	14		22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74						
20	5.20							06	08	10	12	14	16		24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74							
22	5.22						06	08	10	12	14	16	18		26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74								
24	5.24					06	08	10	12	14	16	18	20		28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74									
26	5.26				06	08	10	12	14	16	18	20	22		30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74										
28	5.28			06	08	10	12	14	16	18	20	22	24		32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74											
30	5.30		06	08	10	12	14	16	18	20	22	24	26		34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74												
32	5.32		06	08	10	12	14	16	18	20	22	24	26	28	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74												
34	5.34	06	08	10	12	14	16	18	20	22	24	26	28	30	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74													
36	5.36	08	10	12	14	16	18	20	22	24	26	28	30	32	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74														
38	5.38	10	12	14	16	18	20	22	24	26	28	30	32	34	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74															
40	5.40	12	14	16	18	20	22	24	26	28	30	32	34	36	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74																
42	5.42	14	16	18	20	22	24	26	28	30	32	34	36	38	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74																	
44	5.44	16	18	20	22	24	26	28	30	32	34	36	38	40	48	50	52	54	56	58	60	62	64	66	68	70	72	74																		
46	5.46	18	20	22	24	26	28	30	32	34	36	38	40	42	50	52	54	56	58	60	62	64	66	68	70	72	74																			
48	5.48	20	22	24	26	28	30	32	34	36	38	40	42	44	52	54	56	58	60	62	64	66	68	70	72	74																				
50	5.50	22	24	26	28	30	32	34	36	38	40	42	44	46	54	56	58	60	62	64	66	68	70	72	74																					
52	5.52	24	26	28	30	32	34	36	38	40	42	44	46	48	56	58	60	62	64	66	68	70	72	74																						
54	5.54	26	28	30	32	34	36	38	40	42	44	46	48	50	58	60	62	64	66	68	70	72	74																							
56	5.56	28	30	32	34	36	38	10	42	44	46	48	50	52	60	62	64	66	68	70	72	74																								
58	5.58	30	32	34	36	38	40	42	44	46	48	50	52	54	62	64	66	68	70	72	74																									
60	5.60	32	34	36	38	40	42	44	46	48	50	52	54	56	64	66	68	70	72	74																										
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68	5.68	40	42	44	46	48	50	52	54	56	58	60	62	64	72	74																														
70	5.70	42	44	46	48	50	52	54	56	58	60	62	64	66	74																															
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2.6.2 Description and operation

2.6.2.1 Description and operation

Camshaft

Dual overhead camshaft (DOHC) has two camshafts. A camshaft controls the intake valves, the other camshaft controls the exhaust valves. The camshaft is located in the journal in the cylinder hood on the top of the engine and fixed with camshaft bearing cap. The cylinder hood camshaft journal drilling is used for engine oil channel. Engine oil flows to the camshaft under pressure, lubricating each camshaft journal. Engine oil flows through the cylinder hood to return to oil pan. Cam convex corner is formed by machining, at the right time, according to the appropriate amount, accurately open and close intake and exhaust valves. Cam convex is lubricated by high-pressure oil escaped from the engine camshaft.

Crankshaft

The crankshaft has an monolithic structure, and its rough cast is made by one piece of steel material via forge work. The monolithic crankshaft has the features of reliable running and light weight as well as relative high rigidity and strength with little processing area; the monolithic crankshaft is often used with the sliding bearing. The crankshaft has timing gears and belt pulley at the front end, with simple structure and serviceability; the other end has flange where the flywheel attached to the crankshaft via bolts and pin stop. The pin stop can ensure the correct fitting position for the flywheel and the crankshaft during reinstalling the flywheel. Such connection is simple in structure and reliable to use.

Flywheel

The installation of the flywheel can reduce the crank up unevenness. When the output torque is greater than the drag torque, the flywheel can absorb the excessive work to increase its speed. When the output torque is less than the drag torque, the flywheel can release the stored energy to decrease its kinetic energy with the speed of the engine slightly lowered; therefore, the flywheel is an energy storing device, able to adjust the changes of crankshaft speed so as to provide stability.

Piston Components

The piston components include the piston, piston pin and piston ring which are moving fore and after within the cylinder. They are the components working under the most critical conditions in the reciprocating engine. The reliability and durability of the engine depend largely on the running conditions of the piston group. The piston components' lift time determines the repair interval of the engine.

Connecting rode components

The connecting rode components in the internal-combustion engine include connecting rode body, cap, bushing and bolts. The connecting rode components' function is to convert the reciprocating movement of the piston to the pivoting movement of the crankshaft and transmit the force from the piston group to the crankshaft.

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2.6.3 System operating principle

2.6.3.1 System operating Principle

1. Reciprocating Piston Engine Operating Principle:

- Intake Stroke: the crankshaft driven piston moves from TDC to BDC. At this point exhaust valve closes, intake valve opens. In the piston moving process, the cylinder volume gradually increased and the vacuum is formed within the cylinder. ECM controlled fuel injectors spray fuel into the intake pipe. At this time the intake valves open, air and fuel mixture sucked through the intake valve into cylinder and forms a combustible mixture.
- Compression Stroke: At the end of the intake stroke, crankshaft continues to drive the piston from the BDC to the TDC. Intake and exhaust valves are closed. With the piston moving up, the cylinder volume became smaller and smaller. Because gas is compressed, the temperature of the compressed gas rose rapidly.
- Power Stroke: At the end of compression stroke, the primary coil circuit of ignition coil controlled by ECM is disconnected and the secondary sensor produces a high voltage, which passes rapidly through the cylinder hood to the top of the spark plug, and finally the high-voltage breaks through the spark plug gap to generate electric spark, igniting the combustible mixture within the cylinder. Fire spreads rapidly inside the combustion chamber, while releasing a large amount of heat. Combustion gas expands rapidly .The pressure and temperature also increases. Swelling force acts on the piston top, prompting the piston to move from the TDC to the BDC and changing piston reciprocating motion into rotary movement through the connecting rod. At this point, intake and exhaust valves are still closed.
- Exhaust Stroke: At the beginning of the exhaust stroke, exhaust valve opens, intake valve is still closed. the crankshaft connecting rod drives the piston from the BDC to the TDC. After burning, the expanded gas residue will be discharged through the exhaust valve to outside the cylinder by its own pressure and the piston movement. When the piston reaches the TDC, the exhaust stroke ends and exhaust valve closes.

But in the actual process, the intake valve opens before the TDC and closes after BDC. This design is intended to draw more air into cylinder and reduce the power consumed in the intake process. In the exhaust process, the exhaust valve opens before BDC and closes after TDC. The aim is to reduce the mixture within the cylinder and reduce the power consumed in the intake process. Because intake and exhaust valves have a certain overlap angles, namely, at a certain crank angle intake and exhaust valves open at the same time. At this time the gas discharged through the exhaust valve forms a certain amount of inertia and draws the mixture into the cylinder. This will draw more air into the cylinder. But the valve overlap angle is not the bigger the better. In different operating conditions, the valve overlap angle requirements vary, therefore, in this engine there is intake valve variable valve timing, which aims to meet the engine intake valve opening angle requirements at different operating conditions. This function is achieved But the valve overlap angle is not the bigger the better. In different operating conditions, the valve overlap angle requirements vary, therefore, in this engine there is intake valve variable valve timing, which aims to meet the engine intake valve opening angle requirements at different operating conditions. this function is achieved through the VVT system.

2. VVT system working principle

VVT stands for Variable Valve Timing, referring to the variable valve timing system. Where there is mass, there is inertia. The air drawn into the engine cylinders also has inertia, after the intake process the air tends to help enter into the cylinder. At this time if the valve closing time is delayed, more air will be drawn into the cylinder, so that volumetric efficiency will be improved. As a result, the longer the delay in valve closing time, the better the High-Speed performance; On the contrary the more advanced valve closing, the better performance and the more torque at the Low-Speed.

(1) With VVT Valve Timing Diagram

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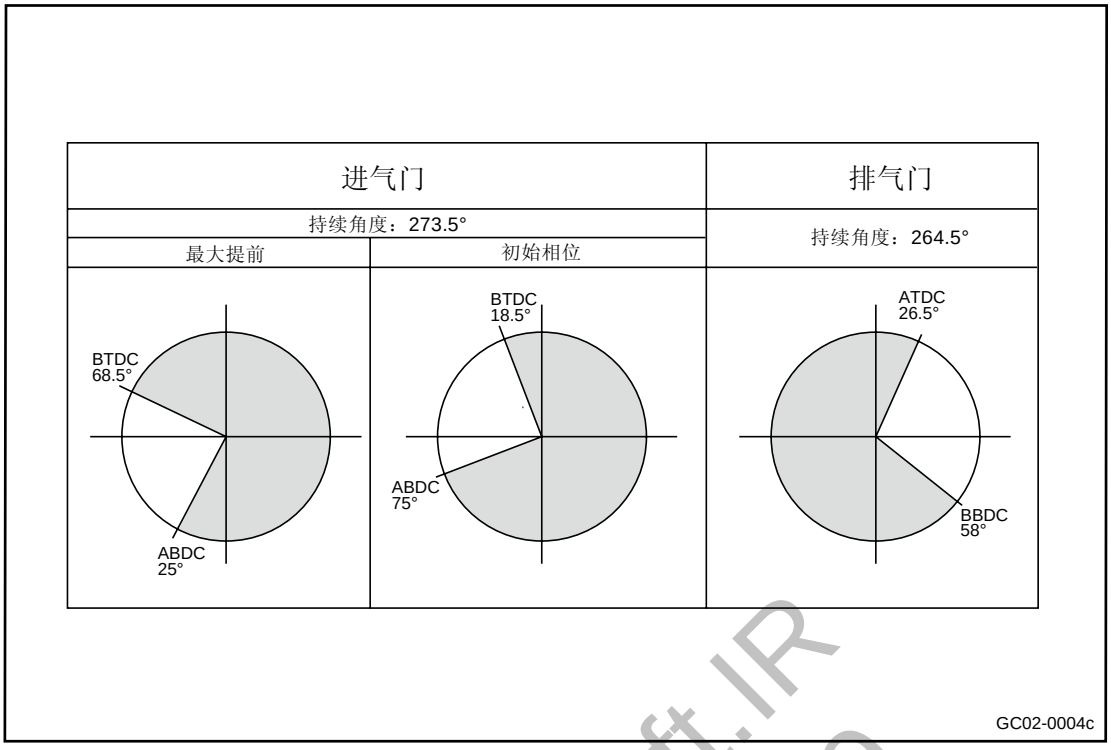
Air intakevalve Air exhaust door



TDC: Top dead center

BDC: Below dead center

ATDC: After Top dead center

BTDC: Before Top dead center

ABDC: After Below dead center

BBDC: Before Below dead center

(2) VVT Control Strategy

Driving Conditions	**Intake Valve Timing**	**Cause**
Low-Load	Lag	Steady Combustion
High Load, High Speed	Lag	Increased Output Characteristics
High Load, Low Speed	Advance	Increased Torque
Medium-Speed Condition	Advance	Improved Fuel Consumption Performance

(3) Advance Process

In normal operation condition, the engine oil pressure that the engine oil pump generated applies on the OCV valves. ECM controls the OCV valve by pulse-width modulation. When ECU needs VVT to adjust the intake valve to the maximum advance position, ECU controlled the VVT solenoid valve opening is 100%. At this point, the engine oil pressure applies to the advance chamber, and the VVT rotor blades generate clockwise movement and eventually stay at the maximum advance position.

During idling without loading, VVT actuator generally doesn't deflect.

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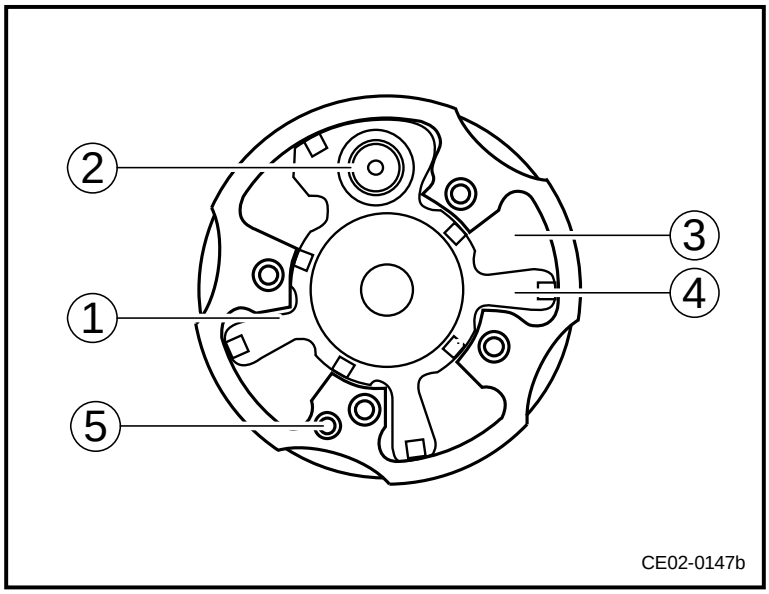

1. Lag chamber 2. Locking pin 3. Advance chamber
4. Rotor blade 5. Stator

(4) Lag Process

JL4G24 Engine intake VVT actuator can only advance the timing, the lag status is the initial timing status.

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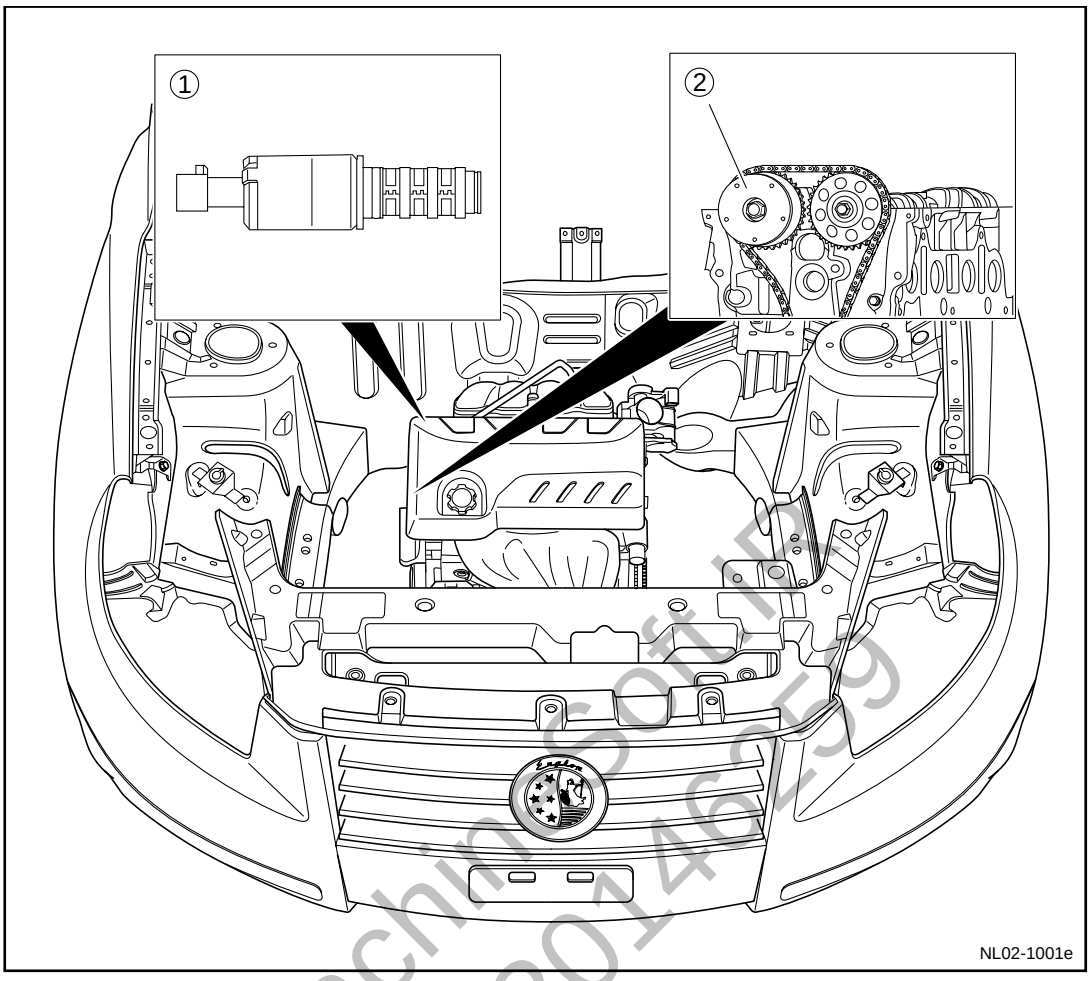
2.6.4 Component position

2 . 6 . 4 . 1 Part position of VVT system



1. VVT Solenoid valve
2. VVT Actuator

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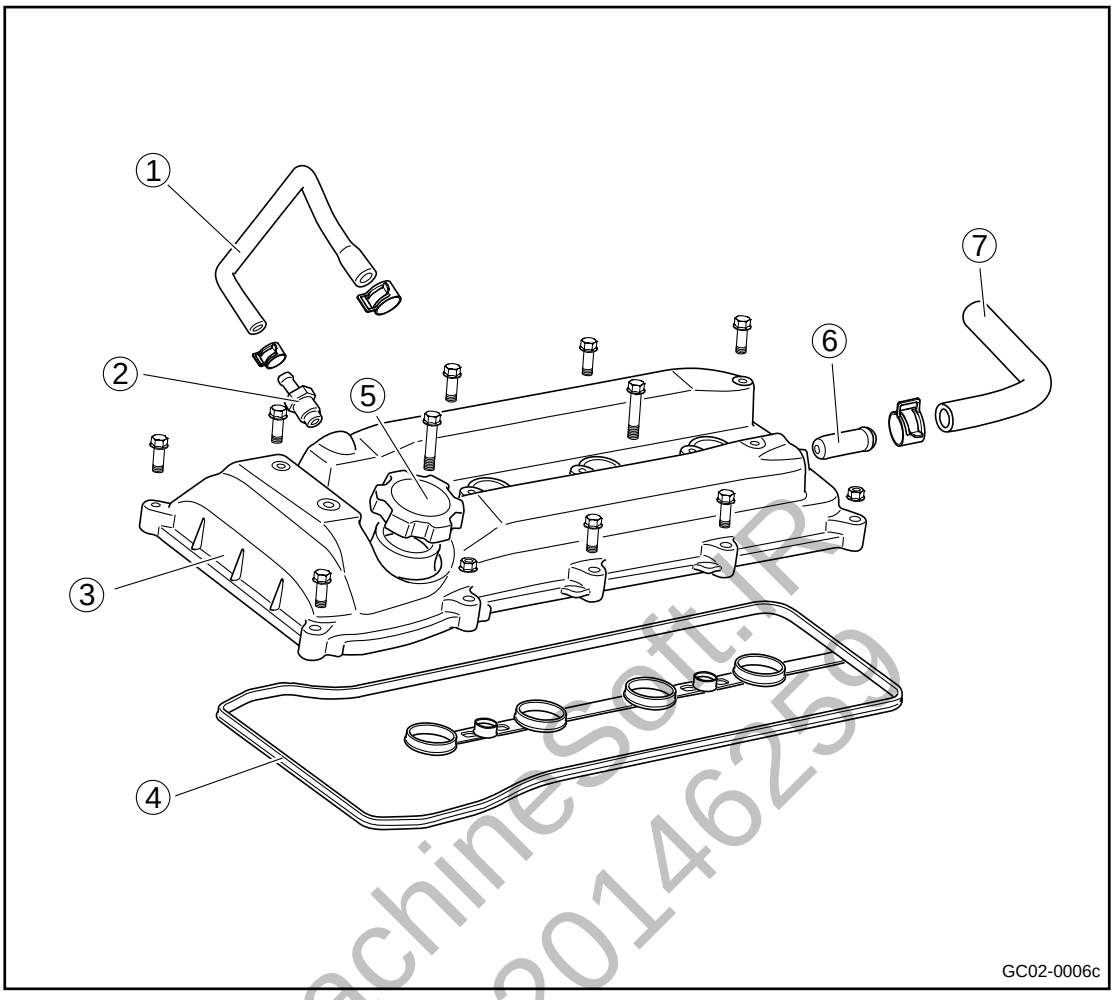
2.6.5 Part disassembly drawing

2.6.5.1 Cylinder Hood Cover Components



1. Venting rubber pipe 1 of crankcase
2. PCV valve component
3. Cylinder head cover
4. Cylinder head cover sealing pad
5. Oil Filler Cap Components
6. Crankcase Bleed Pipe
7. Crankcase Ventilation Hose II

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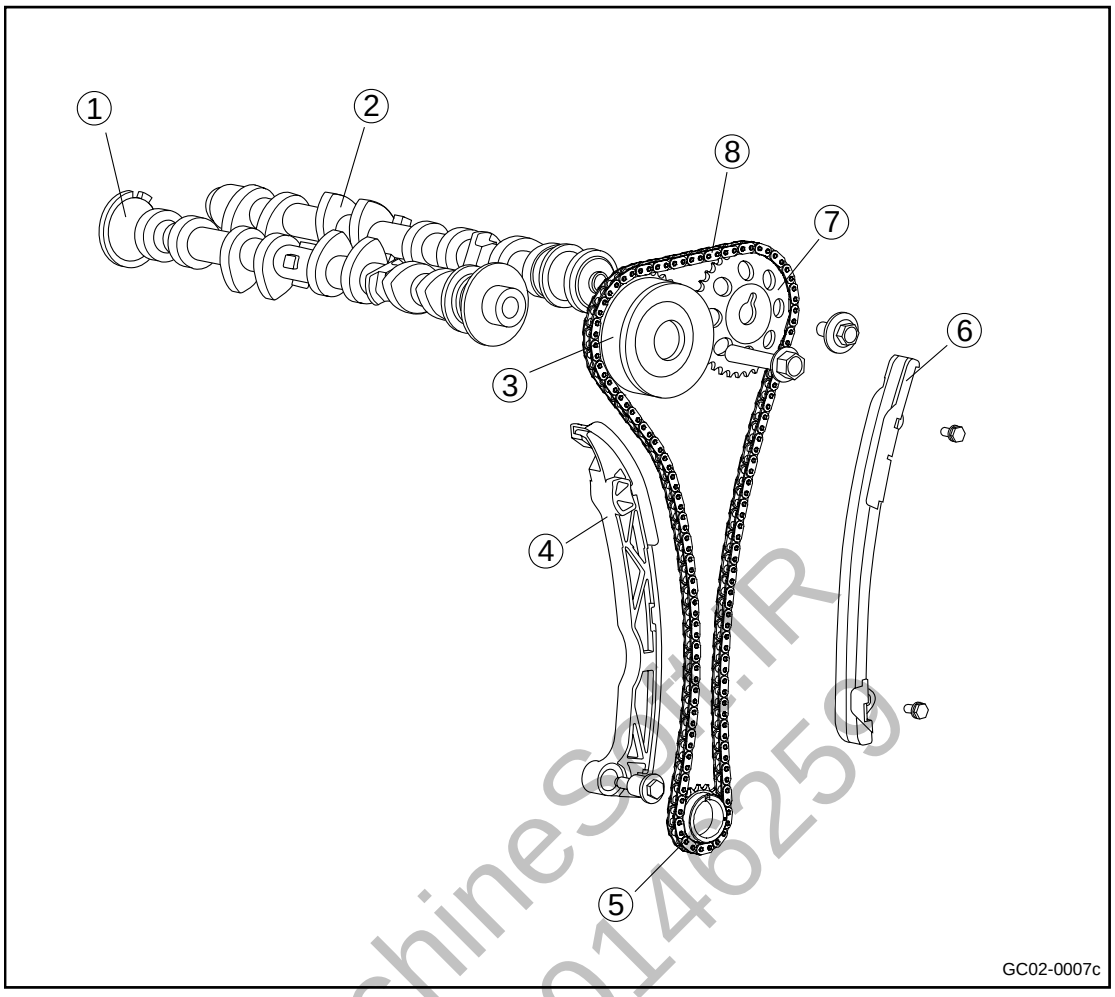
2.6.5.2 Camshaft



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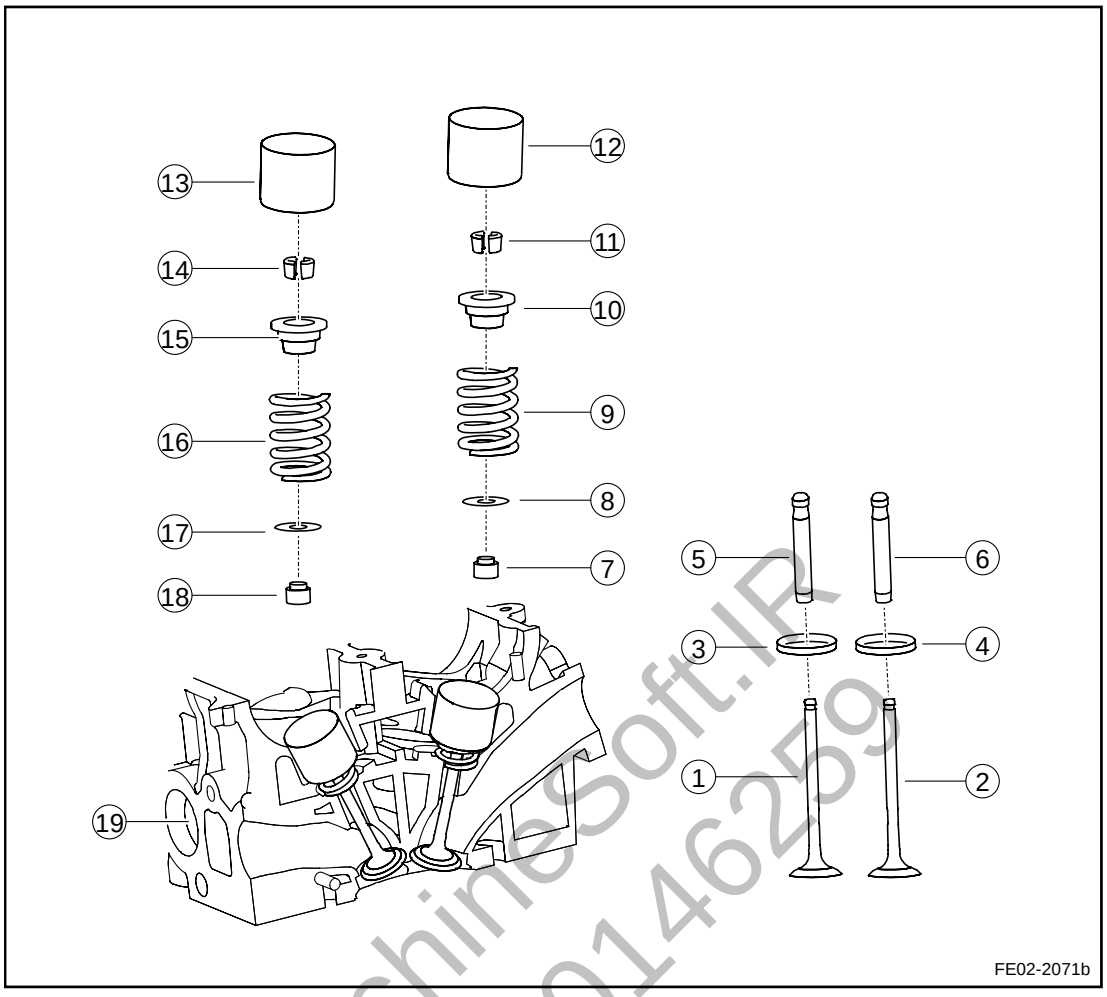
1 Intake camshaft
2. Exhaust camshaft
3. VVT actuator
4. Timing chain tensioning rail
5. Crankshaft timing sprocket
6. Timing chain guide rail
7. Exhaust camshaft timing sprocket
8. Timing chain

2.6.5.3 Cylinder Hood Assembly



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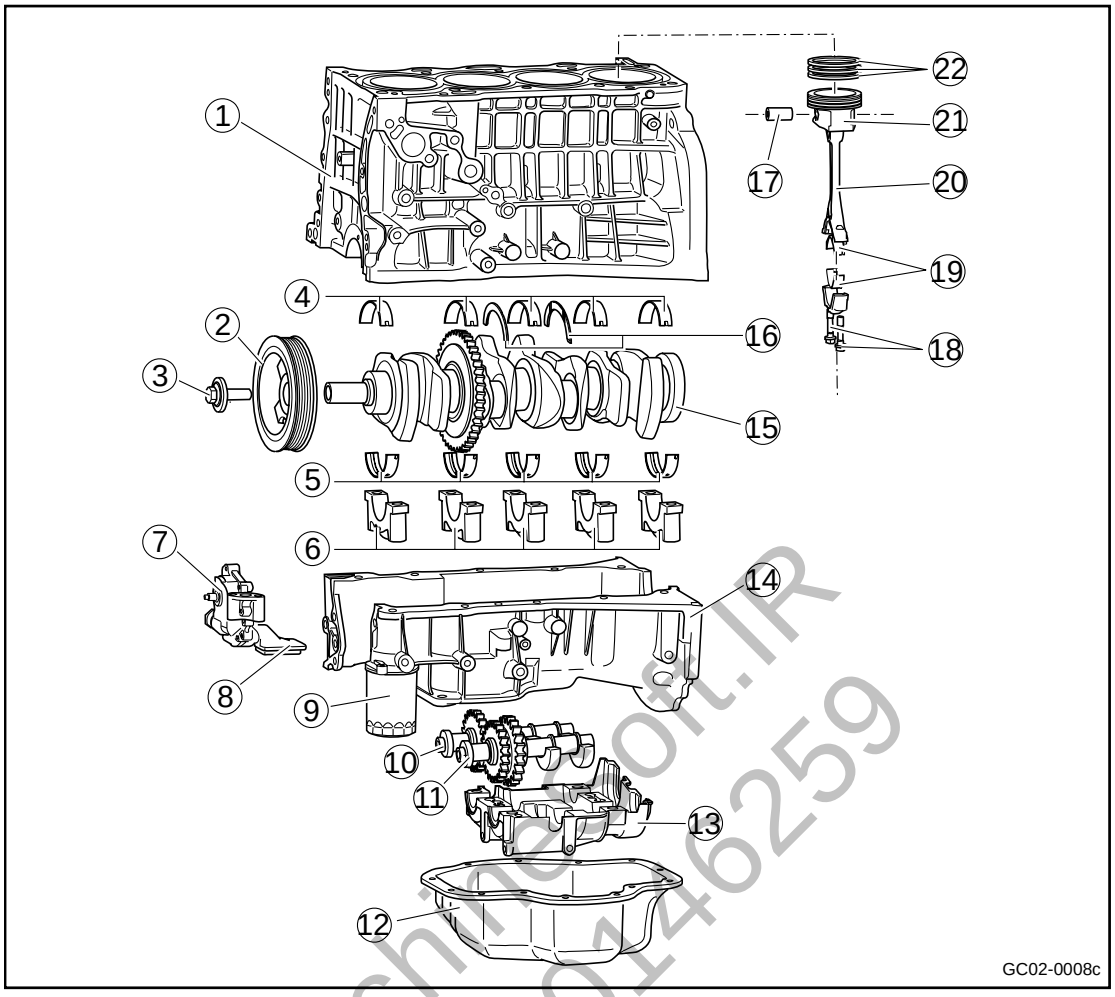
1. Exhaust valve
2. Intake valve
3. Exhaust valve seat ring
4. Intake valve seat ring
5. Exhaust valve duct
6. Intake valve duct
7. Intake valve oil seal
8. Intake valve spring gasket
9. Intake valve spring
10. Intake valve spring seat
11. Intake valve locking plate
12. Intake valve tappet sleeve
13. Exhaust valve tappet sleeve
14. Exhaust valve locking plat
15. Exhaust valve spring seat
16. Exhaust valve spring
17. Exhaust valve spring gasket
18. Exhaust valve oil seal
19. Cylinder Hood

2.6.5.4 Cylinder body disassembly drawing



1. Cylinder Block
2. Vibration damping belt plate
3. Vibration damping belt plate bolt components
4. Main bearing (upper)
5. Main bearing (lower)
6. Main bearing cover
7. Oil pump assembly
8. Oil strainer
9. Oil filter
10. Balance shaft component Ⅱ
11. Balance shaft component Ⅰ
12. Oil pan
13. Balance shaft bearing cover components
14. Crankcase body
15. Crank shaft
16. Thrust bearing
17. Piston pin
18. Connecting rode bolt
19. Connecting rode bearing
20. Connecting rod
21. Piston
22. Piston Rod Component

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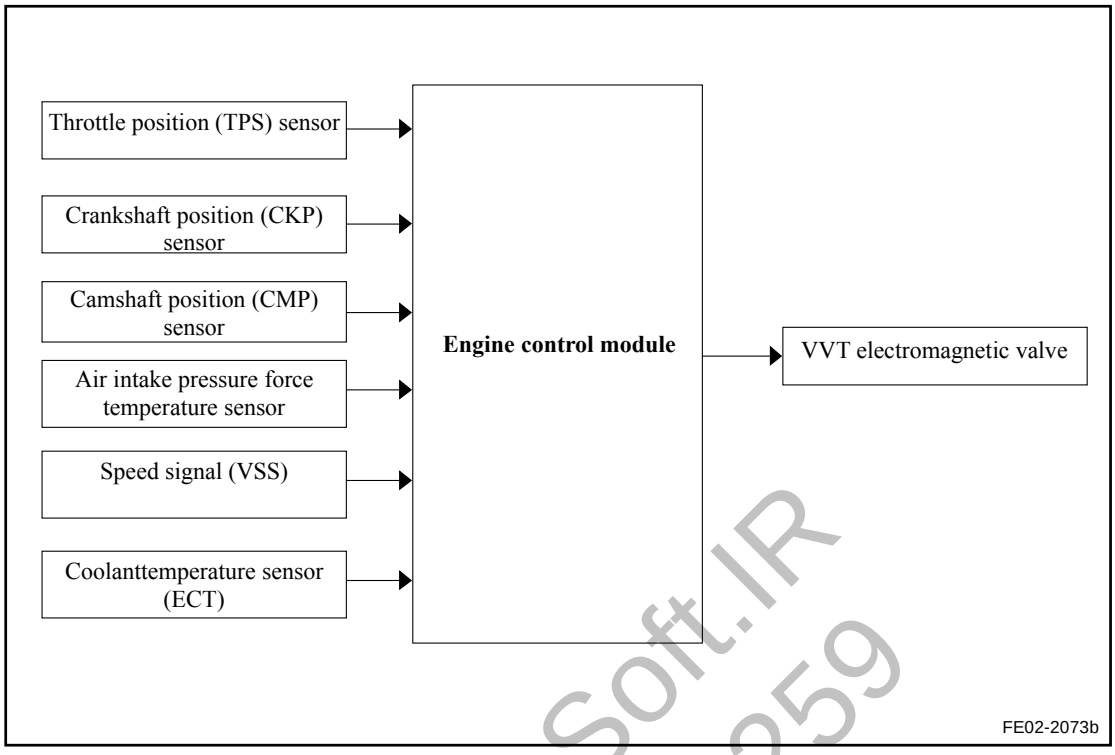
2.6.6 Electrical schematic diagram

2.6.6.1 Electrical schematic diagram



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2.6.7 Diagnostic information and procedures

2.6.7 Diagnostic information and procedures

2.6.7.1 Diagnosis descriptions

Refer to 2.6.3.1 System Working Principle to get familiar with the system functions and operations before starting the system diagnosis, so that it will facilitate the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer described is normal.

2.6.7.2 Visual inspection

- Inspect installed after market equipment that may affect the mechanical systems performance.
- Check the system components that is easy to access to identify whether there is significant damage or potential faults.
- Confirm whether the engine lubrication oil level is normal and whether the engine oil viscosity is normal.
- Record engine speed, ambient temperature and other specific factors.
- Compare with a known good engine to check whether the current engine status is normal.

2.6.7.3 Comprehensive Inspection of Engine

1. Inspect engine coolant.

Refer to 2.8.8.1 Engine Coolant Discharge and Filling.

2. Inspect engine lubrication oil.

Refer to 2.9.7.4 Engine Oil Pressure Diagnostic and Test.

3. Inspect the battery.

Refer to 2.11.2.1 Charging System Description and Operation.

4. Check the spark plug

See "2.10.6.3 Inspection and Diagnosis of Spark Plug".

5. Inspect the air filter.

A. Dismantle the air filter.

B. Inspect the air filter for the dust, blockage or breakage.

1) For dust, clean it with the compressed air.

2) After using the compressed air, if there is still dust or blockage, replace the air filter.

6. Inspect the ignition timing.

Inspect the ignition timing. The following conditions must be met:

- The engine must reach the normal working temperature.

Use fault diagnosis tester to test methods:

1	Connect a fault diagnosis tester.

A. rotated ignition switch to OFF position.

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B. Connect fault diagnosis tester to the diagnostic interface.

C. Start the engine to normal working temperature.

D. Turn off the A/C switch.

E. Select in sequence: Engine / Data List / Cylinder #1 ignition advance angle.

Standard Timing: Standard idling 1° -7° before TDC.

Use the timing light to test:

1	Dismantle the engine hood cover.

Next

2	Pull out cylinder No.1 high-pressure resistor wire.

Connect the clips of the timing lights to the cylinder No.1 high-pressure resistor wire.

Next

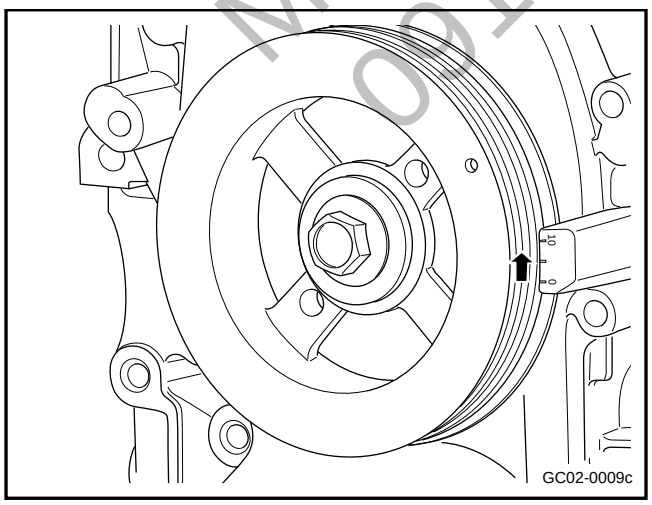
3	Inspect the ignition timing when idling.

Standard Timing: Standard idling 1° -7° before TDC.

Next

4	Inspect the ignition timing during acceleration.

Accelerate the engine; observe the engine ignition timing, which should be moving ahead as shown.



Next

5	Dismantle the timing light and restore high-voltage resistor wire to the installation

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	position.

Next

Test is completed.

7. Cylinder Compression Test

Precautions: Dismantle EF12 fuses. Fuel and ignition systems can not work. After the test clear the DTC code with a fault diagnosis tester.

Before the compression test is done, the following conditions must be met:

- The engine must reach the normal working temperature.
- Throttle in full open.
- Dismantle all four cylinder spark plugs.
- The battery has no phenomenon of the loss of electricity and must be fully charged.

Important precaution : During the start-up test, the ignition switch can not remain at the "ST" position for more than 15 s, otherwise it will damage the starter.

1	Test pressure of each cylinder, pres g may be due to valve closure or piston ring wear.

Next

2	Spray proper amount of engine oil into each cylinder

Next

3	Install the cylinder pressure test gage to the spark plug installation port.

Next

4	Turn the ignition switch to the "ST" position, so that each cylinder runs 4 to 5 compression strokes.

Next

5	Individual cylinder pressure readings should not be less than 75% of the maximum and any cylinder pressure gage reading should not be less than 750 kPa.

Next

6	Inspect the pressure gage readings for each cylinder after the completion of four compression stroke. The readings are explained as follows:

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A Normal Conditions: The cylinder pressure rapidly increases and reaches the required uniform pressure value.

B. Piston Ring Fault: The first stroke pressure is low, increasing in the following strokes, but the pressure has not reached normal levels. Add engine oil in the cylinder, the pressure increased significantly.

C. Valve Fault: The first stroke pressure is low, and can not be increased in the following strokes. Add engine oil in the cylinder, the pressure is not increased.

Next

Test is completed.

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2.6.7.4 Engine Noise Diagnosis

Engine vibration is actually referring to the engine resonance noise. When the engine's vibration frequency is the same as the vibration frequency of a fault, the noise will be perceived. Severe vibrating usually generates big noise, and it is generated by internal parts fracture or serious engine wear and tear. A slight vibration can be heard, but the sound is not big. Slight vibration is due to the engine internal components wear, loose or engine external components broken and it can lead to serious or slight vibration. In the engine noise diagnostic, the resonance noise cause must be found in order to eliminate the fault.

1. There is noise when engine has load.

1	Inspect whether the tension of the drive belt is too tight or strained?

Yes → Replace/adjust the drive belt to the specified value, and confirm whether the fault is fixed.

No

2	Inspect the exhaust system. Whether the system is interfered with the other body components or scraping to ground?

Yes → Relocate and install the exhaust system to confirm whether the fault is fixed.

No

3	Inspect the existence of the flywheel cracking, deformation and other components intervention. Is the flywheel normal?

Yes → Replace the flywheel assembly. Confirm whether the fault is fixed.

No

4	Inspect whether the main bearing clearance is too large, and if it exceeds the specified value.

Standard value (0 . 016 mm ~ 0 . 034 mm)

Yes → Replace the main bearings. Confirm whether the fault is fixed.

No

5	Inspect connecting rod bearing clearance, and does it exceed the specified value?

Standard value (0 . 018mm ~ 0 . 044mm)

Yes → Replace the connecting rod bearings.Confirm whether the fault is fixed.

Next

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6	Confirm that the fault is fixed.

2. Engine shock lightly with warm up

1	Use fault diagnosis tester to read the "Knock" related to data. Is the engine knocking?

Yes → Inspect the engine timing systems and fuel quality, repair the faulty part.

No

2	Inspect whether there is exhaust manifold leakage?

Yes → Replace the exhaust pipe pad and tighten the exhaust pipe again.

No

3	Inspect connecting rod bearing clearance, and does it exceed the specified value?

Standard value (0 . 018mm ~ 0 . 044mm)

Yes → Replace the connecting rod bearings.Confirm whether the fault is fixed.

Next

4	Confirm that the fault is fixed.

3. When it is in idle speed, or warm stage, engine has vibration.

1	Inspect drive belt tension. Is it too loose or worn? Any fault?

Yes → If necessary, replace the drive belt. Confirm whether the fault is fixed.

No

2	Inspect whether the viscosity of the engine lubrication oil is abnormal?

Yes → Refill engine lubrication oil suitable for the current season temperature, confirm whether the fault is fixed.

No

3	Inspect whether the generator and air-conditioning compressor is working properly. Any abnormal sound during working?

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Yes → Replace failed components, confirm whether the fault is fixed.

No

4	Inspect the valve, valve spring and other valve components. Any fault?

Yes → Replace failed components, confirm whether the fault is fixed.

No

5	Inspect the piston pin gap. Does it exceed the specified value?

Standard value (0mm ~ 0 . 006mm)

Yes → Replace failed components, confirm whether the fault is fixed.

No

6	Inspect whether the connecting rod is bent?

Yes → Replace failed components, confirm whether the fault is fixed.

No

7	Inspect piston to cylinder gap value. Does it exceed the specified value?

Standard value (0.0275mm ~ 0 . 0575mm)

Yes → Replace failed components, confirm whether the fault is fixed.

Next

9	Confirm that the fault is fixed.

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2.6.7.5 Drive belt inspection

1. When engine is cooling, or after engine stops for 30min Recheck
2. Visually inspect whether V-belt has serious abrasion or curtain line.

Wear and the like If faults are found, replace the V-drive belt.

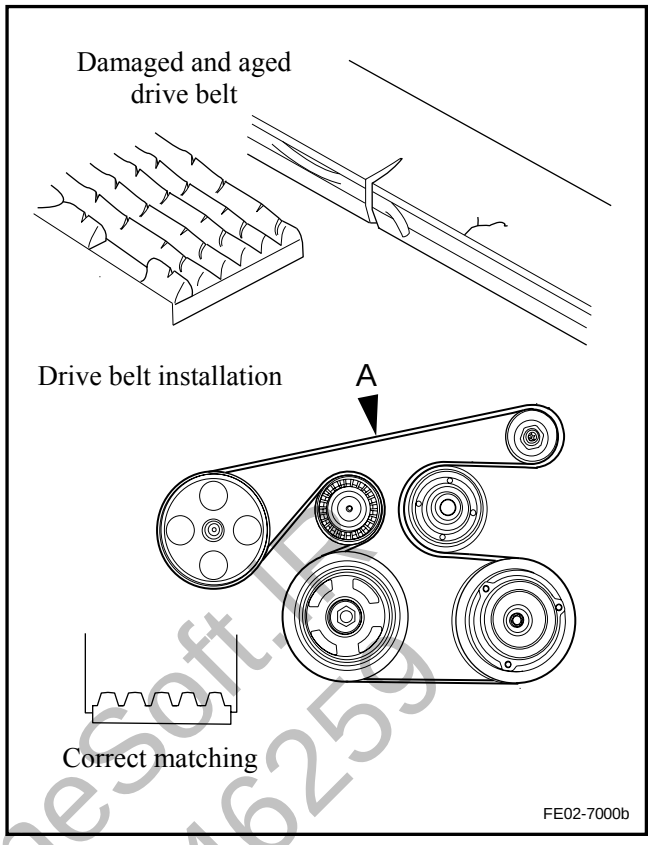
3. Visually inspect whether the interior side and edge of belt have damage and abrasion.

Is there a crack? If yes, replace with new belt.

4. Visually inspect whether there are situation 2 and 3 on belt,

Tension measurement: rotate the crankshaft belt pulley with two circles clockwise to measure

The belt tension between the belt pulleys is uniformly distributed when measuring.



	New belt	Old belt
Belt tension (N/lb)	400±-500/89.9±-112.4	300±-400/67.4±-89.9

5. Measure the belt load with a sound pressure meter (a universal repair tool)

Record the tension and frequency of the point A.

A. Replace with new drive belt. Rotate the crankshaft two laps clockwise, so that the drive belt completely runs through the drive pulley. Measure the tension at marked position A. Refer to the table for the range and replace the drive belt if the measurement is beyond the scope of the table.

B. If the used drive belt (the old belt) has the tension beyond the scope of the table, replace it with a new drive belt.

C. During the drive belt installation, please make sure the correct installation to the drive pulley groove.

D. Do not drop engine oil or engine coolant onto the drive belt.

E. Do not over-wind or bend the drive belt.

1. Drive belt chirp sound diagnosis

Diagnostic Hints: The symptom may be due to wet drive belt or pulley and may be an intermittent fault. Drive belt may need to spray a small amount of water to reproduce customer

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reported fault. If the symptom reoccurs after spraying water, then clean the pulley. Loose or unreasonable installation of body components, suspension components or other vehicle parts can also cause the chirp sound.

Fault Definition: The following conditions are the drive belt chirp sound symptoms

- A chirp jack noise can be heard once the drive belt rotates a lap.
- Noise often happens on a rainy day or in a cold morning.

1	Verify the fault. Does the engine have chirp sound?

No → To Diagnostic Hints

Yes

2	Dismantle the drive belt to confirm whether the giggle does not arise again?

A. Dismantle the drive belt. Refer to 2.6.8.3 Replacement of Drive Belt.

B. Run the engine, but no more than 30 s.

Does the scream disappear?

No → Refer to 2.6.7.4 Engine Noise Diagnosis

Yes

3	Inspect whether the drive belt surface is normal? (do not have ball, crack, etc)

Refer to 2.6.7.5 Drive Belt Inspection

No → Refer to 2.6.8.3 Replacement of Drive Belt to replace the drive belt.

Yes

4	Inspect whether the drive belt pulley is installed correctly? (do not happen misalignment)

No → Reinstall the drive pulley. If necessary, replace the drive belt.

Yes

5	Inspect whether the drive pulley is normal?

Inspect whether the pulley is bent, twisted and so on.

No → Replace the failed pulley.

Yes

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6	Inspect whether all fasteners associated with the drive belt are normal?

No → Tighten loose fasteners.

Yes

7	Replace the drive belt. Confirm the fault is fixed.

2. Shriek diagnosis of drive belt

Diagnostic Hints: Loose or unreasonable installation of body, suspension and other components may cause screams. If there is intermittent noise, inspect the attached components by changing the engine load. It is recommended to inspect whether the air-conditioning system is over filled, power steering hose is clamped, the power steering fluid is correct or whether the generator is faulty.

Fault Definition: The following conditions are the drive belt screams symptoms

- Scream is caused by drive belt slippage.
- Noise appears when a big load added to the drive belt, such as air-conditioning system compressor starting, the running engine with the throttle quickly opening or drive belt skidding in a drive component.

1	Verify the fault. Does the engine scream?

No → To Diagnostic Hints

Yes

2	Dismantle the drive belt. Confirm whether the scream disappears?

A. Dismantle the drive belt. Refer to 2.6.8.3 Replacement of Drive Belt.

B. Run the engine, but no more than 30 s.

Does the scream disappear?

No → Refer to 2.6.7.4 Engine Noise Diagnosis

Yes

Pulley bearings do not appear stuck, loose and so on.

3	Inspect whether the bearings of all accessory drive belt pulleys are normal?

No → Replace the damaged pulley or bearing.

Yes

4	Inspect whether drive belt tensioner device is working properly?

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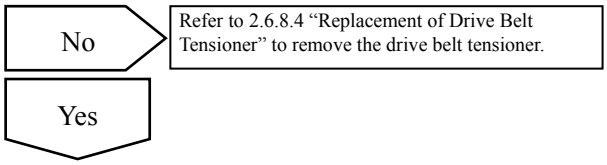
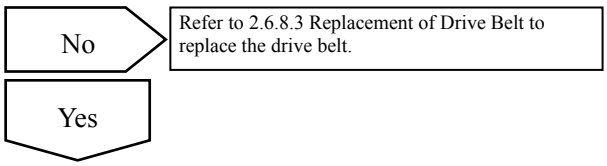
Tensioner pulley bearing should not occur sticking, loose or other conditions. The tensioner should not occur breakage, loose or other conditions.

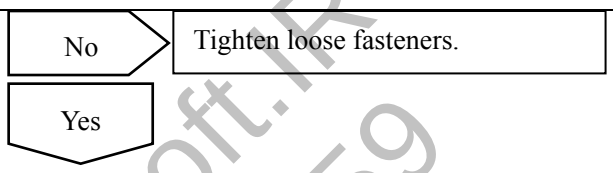


5	Inspect whether the correct drive belt is used?

Refer to 2.6.7.4 “Drive Belt Inspection” to inspect for the extension of the drive belt.

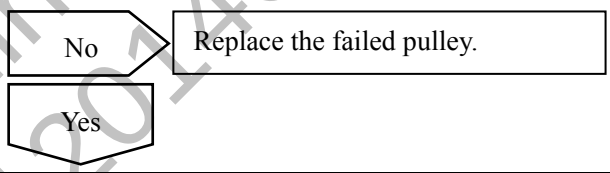


6	Inspect whether all fasteners associated with the drive belt are normal?



7	Inspect whether the drive pulley is normal?

Inspect whether the pulley is bent, twisted and so on.



8	To Diagnostic Hints

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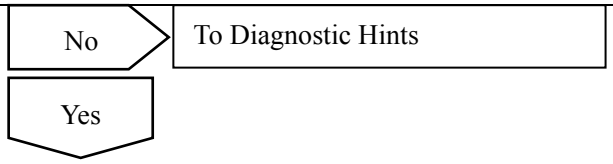
3. Diagnostic for Drive belt with whine

Diagnostic Hints: Drive belt should not produce hum sound. If there is an intermittent noise, inspect the attached parts by changing the load. Make sure that components run until the maximum load. These conditions may be due to (but are not limited to) over filling the air-conditioning system, blocked power steering system or incorrect steering fluid, as well as the generator failure.

Fault Definition: Sustained High-Frequency Noise

1	Verify the fault. Does the engine hum appear?



2	Dismantle the drive belt, confirm whether the hum sound disappears?

A. Dismantle the drive belt. Refer to 2.6.8.3 Replacement of Drive Belt.

B. Run the engine, but no more than 30 s.

Does the hum sound disappear?

No → Refer to 2.6.7.4 Engine Noise Diagnosis

Yes

3	Inspect whether the bearings of all accessory drive belt pulleys are normal?

Pulley bearings do not appear stuck, loose and so on.

No → Replace the damaged pulley or bearing.

Yes

4	To Diagnostic Hints

4. Loosening diagnosis of drive belt

Diagnostic tip: the drive belt dropped from the drive belt pulley repeatedly may be caused by dislocation of the belt pulley. If the attachment drive belt driving components cause the load fluctuates, it may cause drive belt fall off from the pulley. Test whether accessories driving components are working correctly. If the drive belt's length is not proper, drive belt tensioner will not be able to maintain a suitable drive belt tension.

Fault Definition: Drive belt falls off from the pulley, or are incorrectly installed on the pulley.

1	Inspect the drive belt for damage. If necessary, replace the drive belt.

Next

2	Inspect whether the pulley is misaligned. Repair the faulty part.

Next

3	Inspect whether the pulley is bent or depressed. Repair the faulty part.

Next

4	Inspect whether the drive belt tensioner device bracket is bent or cracked. Repair the faulty part.

Next

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5	Inspect whether the drive belt tensioner device is working properly. Repair the faulty part.

Next

6	Inspect whether the drive belt tensioner device is working properly. Repair the faulty part.

Next

7	Inspect whether the attached fasteners loose. Repair the faulty components.

Next

8	Confirm that the fault has been fixed.

5. The transmission belt is subject to excessive wear.

Diagnostic tip: the excessive wear of the drive belt is usually caused by improper installation or the user of the wrong belt. Drive pulley slight misalignment will not cause excessive wear and tear, but it could lead to drive belt noise or loss. Drive pulley misalignment can cause excessive wear and can also lead to drive belt fall off.

Fault Definition: The drive belt is not properly installed which led to the drive belt outer edges worn.

1	Inspect whether there are frictions between drive belt and brackets, harness, hoses and other components?

Yes — Repair the faulty part.

No

2	Inspect all attachments drive belt pulley for whether there are abnormal scratches on the surface, edges and corners and other abnormal conditions?

Yes — Repair the faulty part. If necessary, replace the belt pulley

No

3	Inspect whether the installed drive belt model is correct?

Yes — Replace the drive belt with a correct type.

No

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4	To Diagnostic Hints

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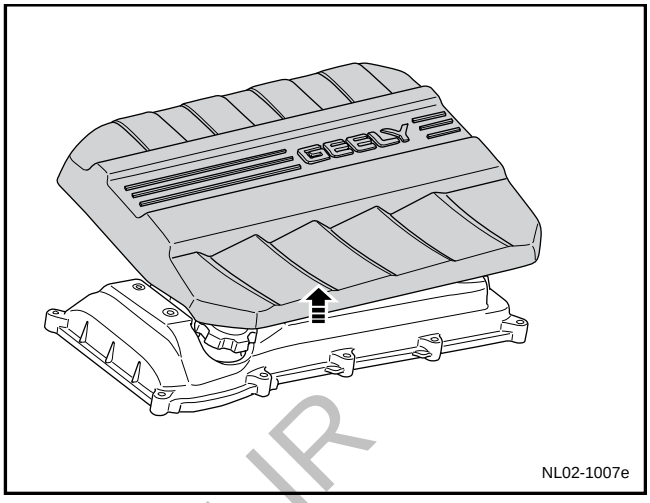
2.6.8 Removal and installation

2.6.8.1 Replacement of Plastic Shield of Engine

Dismantlement Procedure

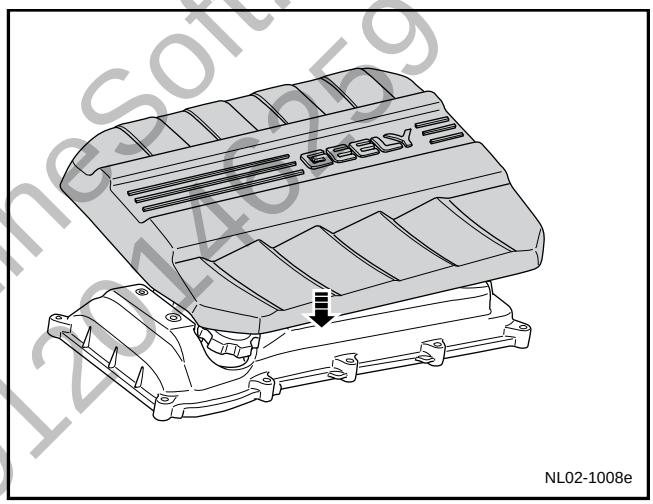
1. Dismantle the plastic shield of engine.

Note: Do not damage the rubber gasket in the plastic shield when disassembling.



Installation Procedure:

1. Install the plastic shield of engine.



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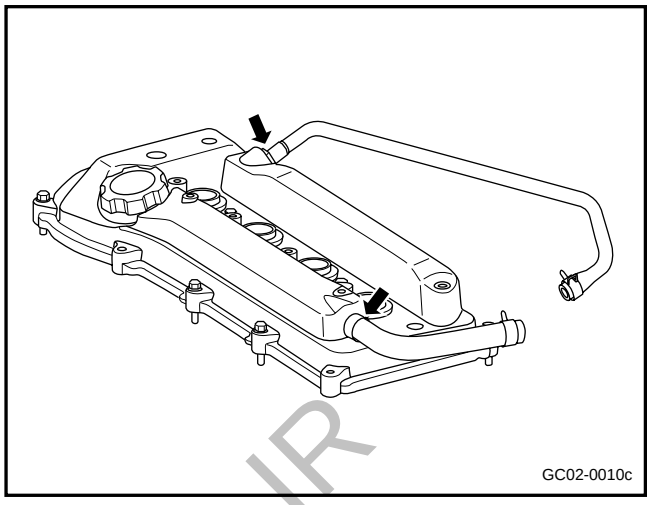
2.6.8.2 Replacement of Cylinder Hood Cover

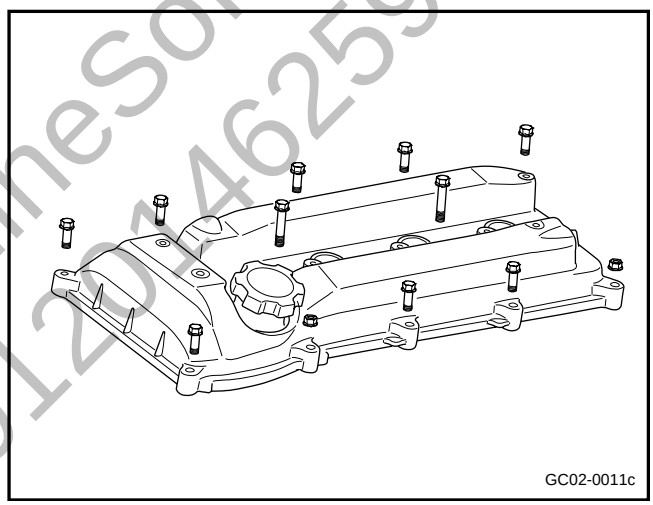
Warning: refer to "warning of battery disconnection" in "warnings and precautions".

Dismantlement Procedure

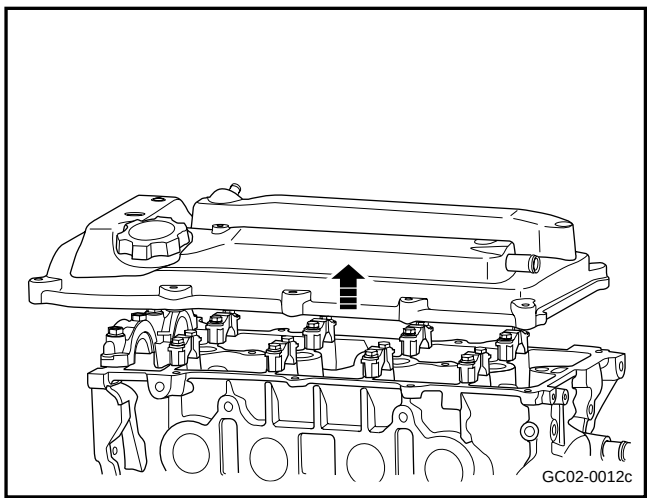
1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Refer to 2.6.8.1 "Replacement of Plastic Shield of Engine" to dismantle the engine shied.
3. Dismantle ignition coil and ignition guide wire, refer to“2 . 10.7.3ignition coil replacement ” .
4. Dismantle forced venting pipe of crankshaft
5. Dismantle the crankcase ventilation tube .



6. Dismantle cylinder hood cover bolts and nuts.



7. Remove the cylinder hood cover.



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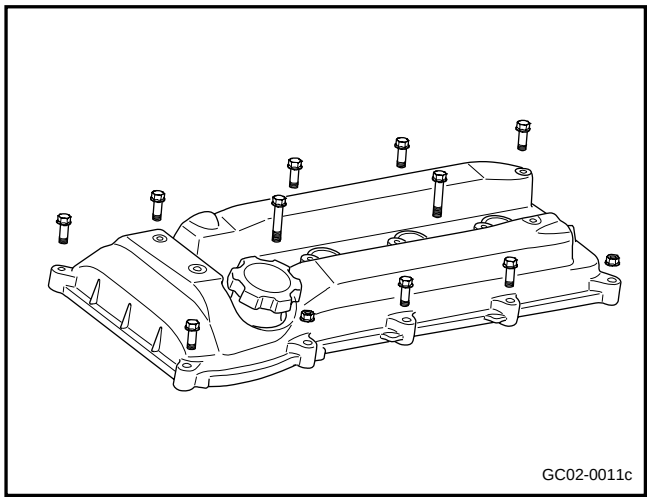
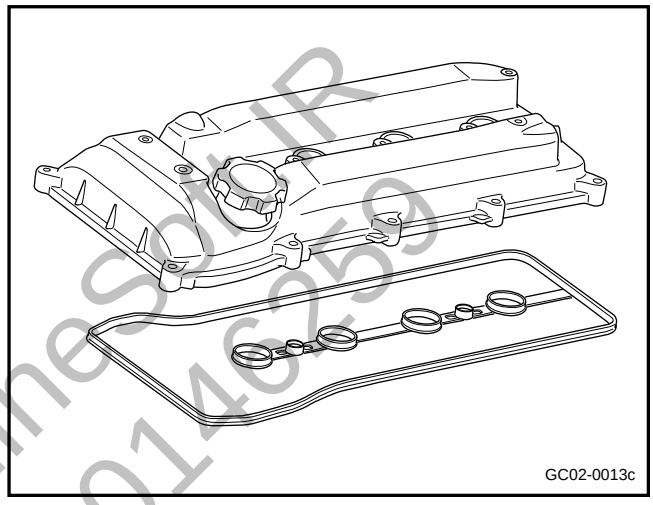
8. Dismantle the cylinder hood cover seal gasket from the cylinder hood cover.



Installation Procedure:

1. Install the cylinder hood cover gasket.
2. Apply sealant evenly in the cylinder hood gasket.
3. Install the cylinder hood cover.
4. Tighten the cylinder hood cover bolts.

Note: When tightening, tighten a single bolt several times, in accordance with the specified torque.



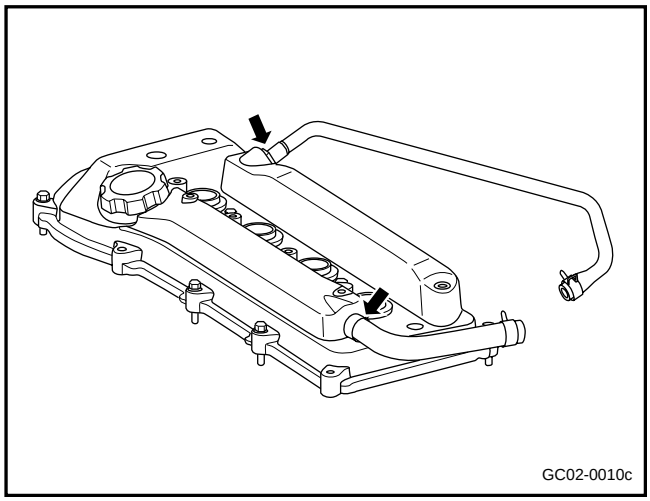
Short Bolts:

Torque: 10-12 N.m (Metric)

Long Bolts, Nuts, Special Bolts:

Torque: 10-12 N.m (Metric)

5. Install the forced ventilation rubber hose of the crankcase.
6. Install the crankcase ventilation vacuum tube.
7. Install the ignition coil and ignition wire.
8. Install the plastic shield of engine.
9. Connect battery negative cable.



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2.6.8.3 Replacement of Drive Belt

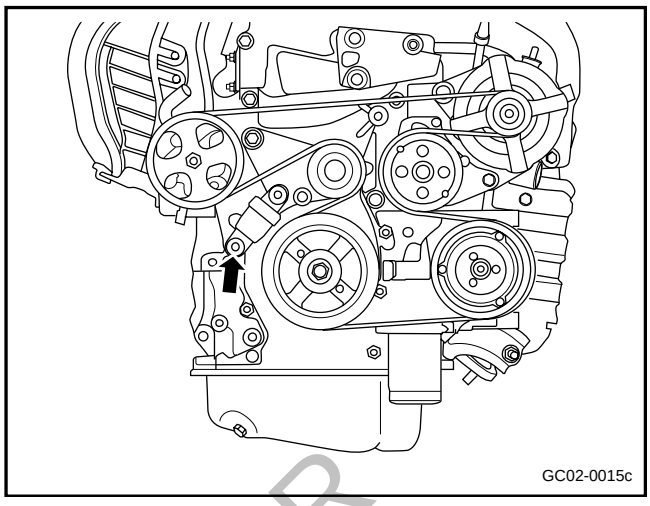
Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions".

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.

Rotate the drive belt tensioner anti-clockwise with a wrench to remove the drive belt.

Note: In the removal process, prevent the wrench slipping causing injury to the operator.

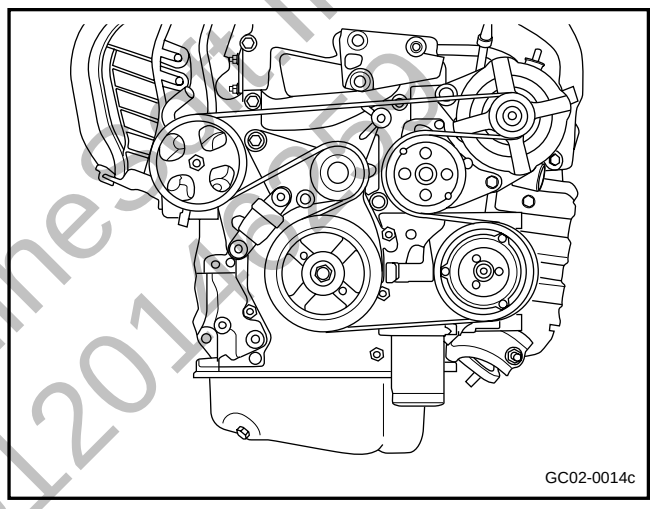


Installation Procedure:

1. Wrap the drive belt as shown.
2. Rotate the drive belt tensioner clockwise with a wrench to install the drive belt.
3. Release drive belt tensioner to normal position.

Important precaution : Before releasing the tensioner device, confirm the drive belt aligned with drive pulley groove, otherwise the drive belt may be damaged.

4. Connect battery negative cable.



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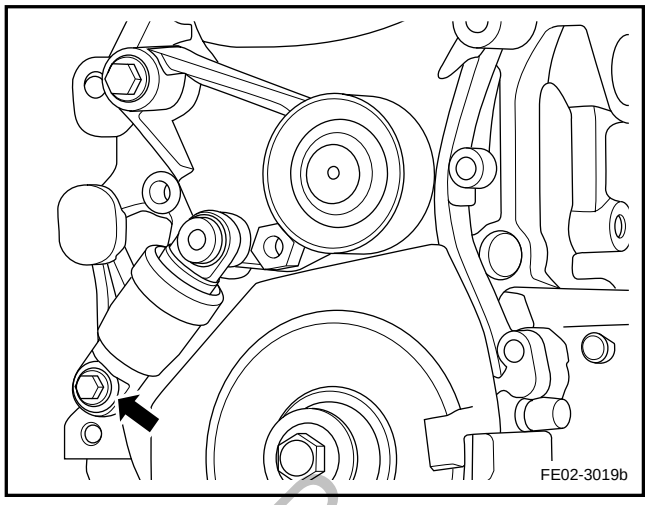
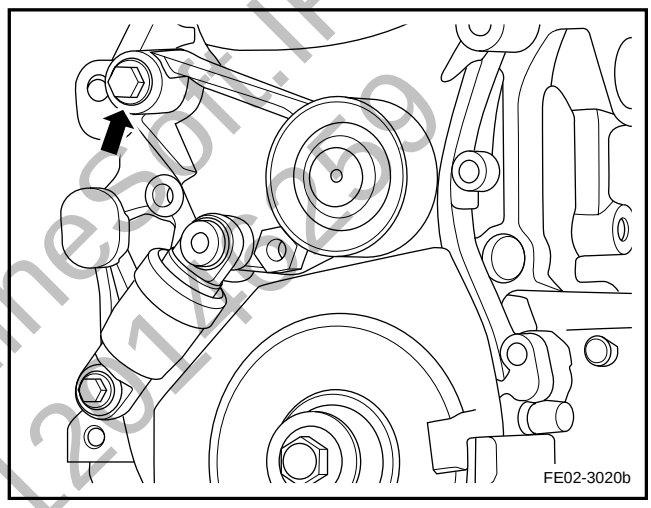
2.6.8.4 Replacement of Drive Belt Tensioner

Dismantlement Procedure

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Refer to 2.6.8.1 "Replacement of Plastic Shield of Engine" to dismantle the engine shied.
3. Refer to 2.6.8.3 "Replacement of Drive Belt" to dismantle the drive belt.
4. Dismantle the fixing bolts at the end of drive belt tensioner hydraulic unit.



5. Dismantle the fixing bolts of drive belt tensioner pulley bracket.



Installation Procedure:

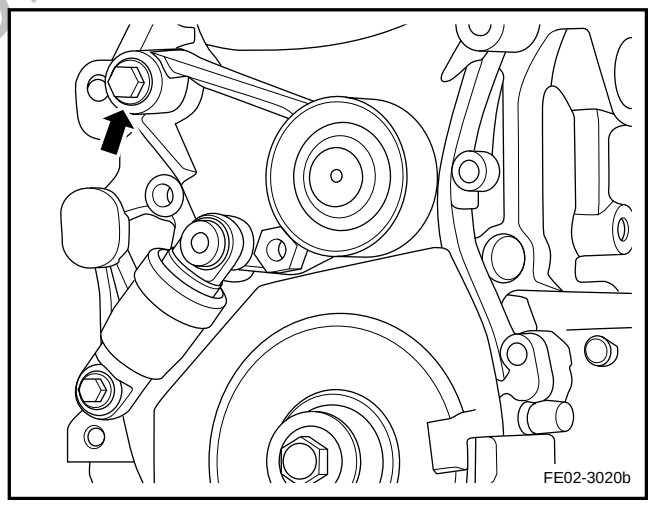
1. Install drive belt tensioner support fixing bolt.

Torque :60N. m(Metric) 44 . 28lb-ft(English system)

2. Install hydraulic unit end of drive belt tensioner Fixing Bolts

Torque: 32 Nm (Metric) 23.62 lb-ft (English system)

3. Install the drive belt.
4. Install the engine hood.
5. Connect battery negative cable.



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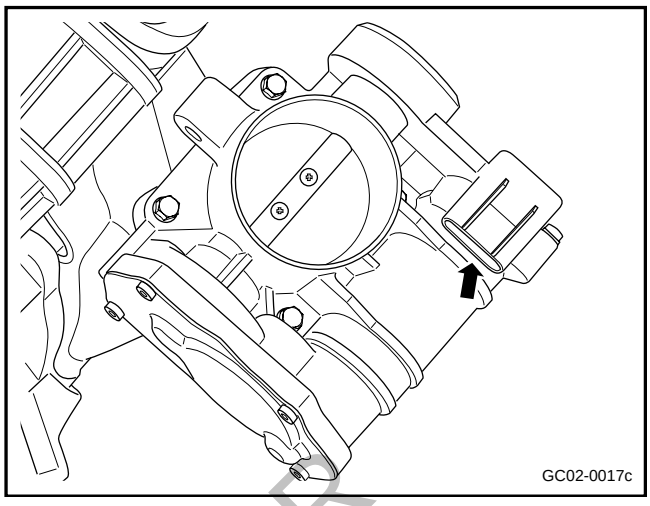
2.6.8.5 Replacement of Electrical Throttle Body Assembly

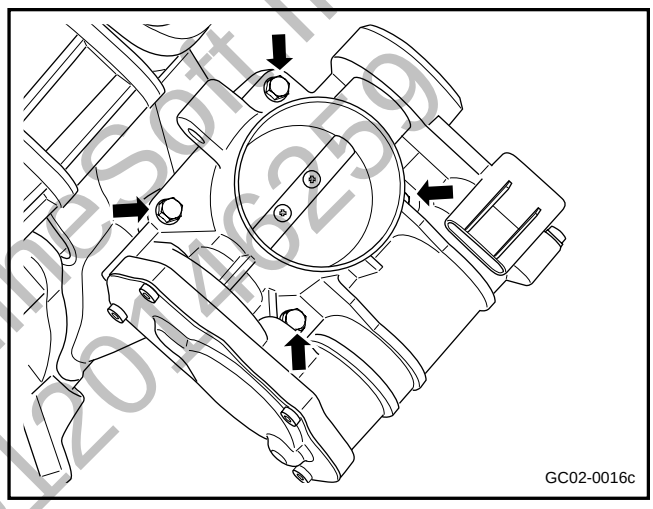
Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions".

1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedure.
2. Disconnect the electronic throttle wiring harness connection.
3. Dismantle intake main pipe from the throttle body.

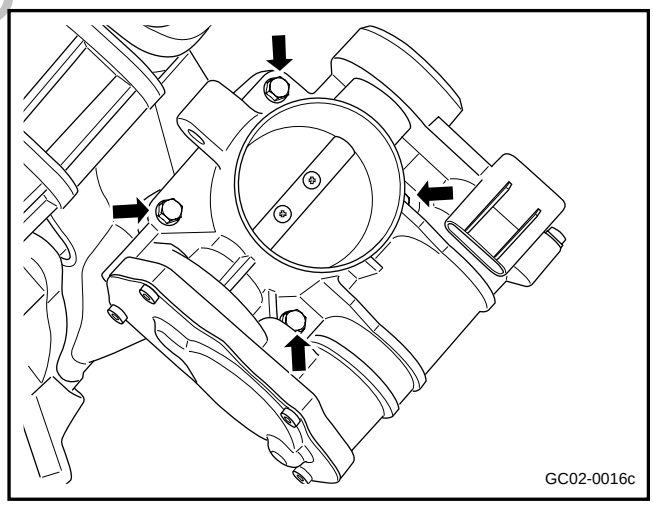


4. Dismantle the fixing bolts and nuts of throttle body from the intake main pipe.
5. Dismantle electronic throttle body.



Installation Procedure:

1. Clean the engine throttle body and the engine intake manifold mating surface and replace the seals.
2. Install the electronic throttle body to the intake main pipe and tighten the fixing bolts and nuts.
3. Connect the idle speed control valve harness connector.
4. Install and tighten the intake main pipe clamp.
5. Connect battery negative cable.



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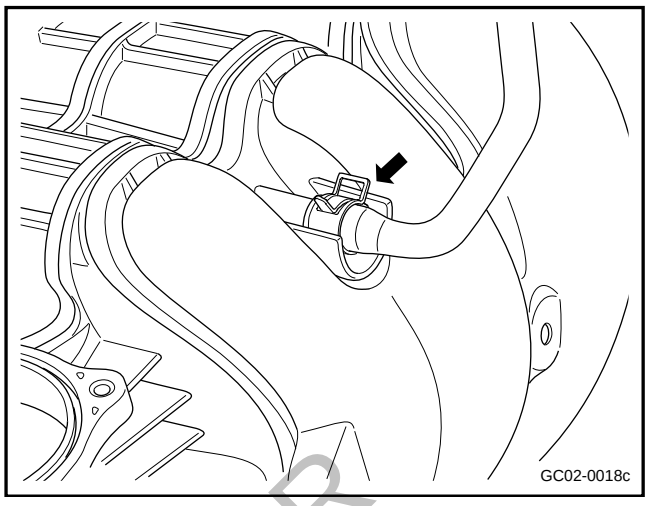
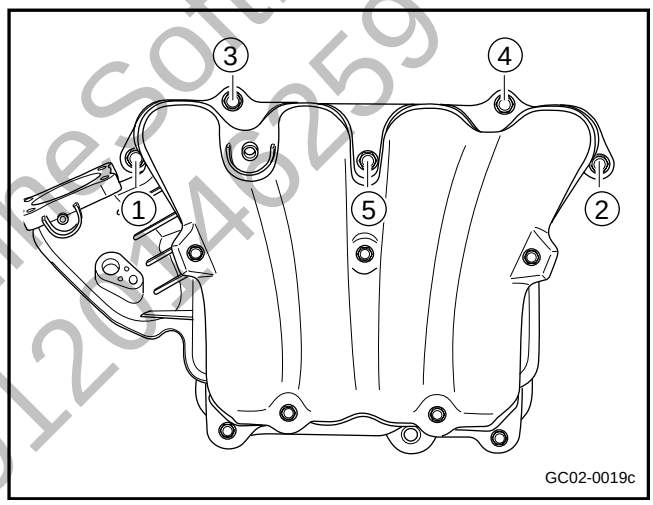
2.6.8.6 Replacement of Intake Manifold Assembly

Dismantlement Procedure

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Refer to 2.6.8.1 "Replacement of Plastic Shield of Engine" to dismantle the engine shied.
3. Refer to 2.6.8.5. "Replacement of Throttle Body Assembly" to dismantle the throttle body.
4. Dismantle the PCV hose.
5. Dismantle the canister solenoid valve vacuum tube.
6. Dismantle the vacuum booster vacuum hose.



7. Dismantle the fixing bolts and nuts of intake manifold in the sequence as shown in the figure.



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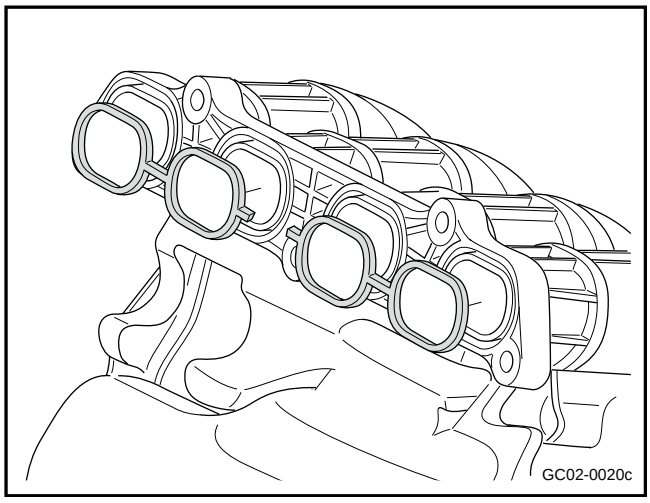
Installation Procedure:

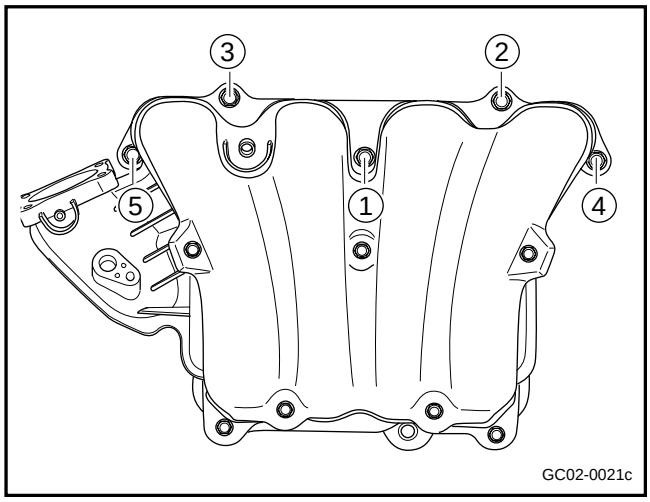
1. Clean the cylinder head intake manifold installation surface.
2. Clean the intake manifold installation surface.
3. Install the intake manifold seals.



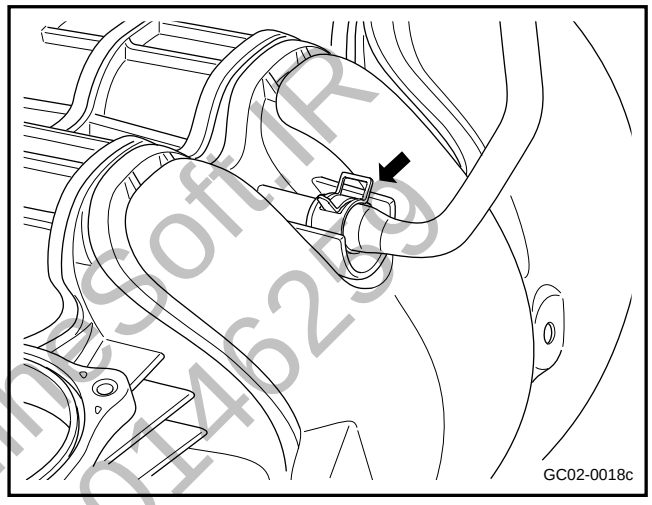
4. Tighten the intake manifold retaining bolts and nuts in the sequence shown in the graph.

Note: The bolts and nuts can not tighten to the specified torque at once, otherwise it will result in the intake manifold leakage. They should be tightened at several stages to the specified torques.

Torque: 30N.m (Metric system)
22.3lb-ft (English system)



5. Install the vacuum booster vacuum hose.
6. Install the canister solenoid valve vacuum tube.
7. Install the forced ventilation vacuum pipe of the crankcase.
8. Install the throttle body.
9. Install the mounting bracket of intake manifold and tighten the fixing bolts.
10. Install the engine hood.
11. Install negative cable of battery.



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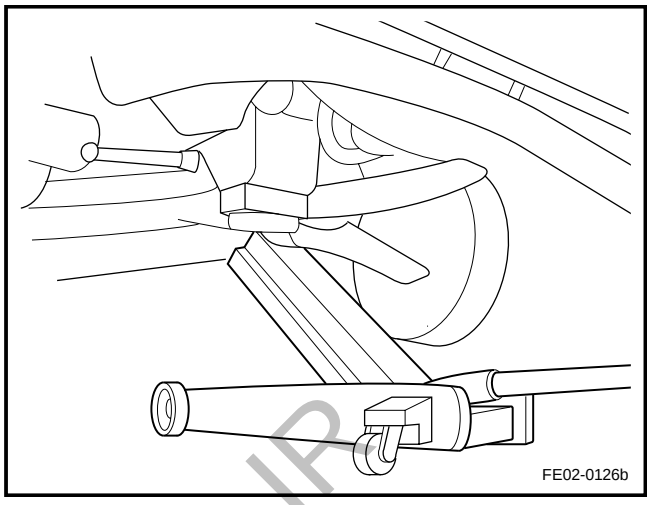
2.6.8.7 Engine supporting seat Replacement

Dismantlement Procedure

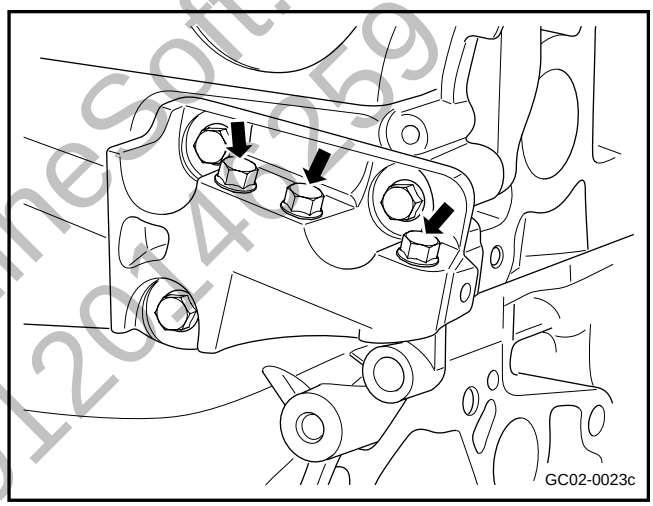
Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions".

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Dismantle the plastic shield of engine. Refer to 2.6.8.1 Replacement of Plastic Shield of Engine.
3. Support the engine assembly with a jack.

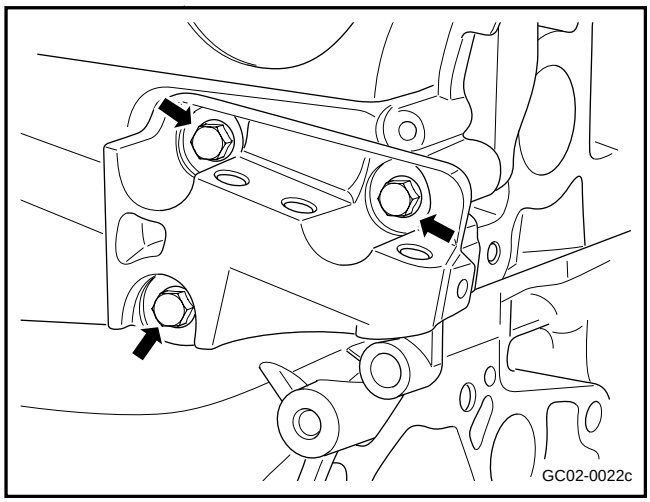
Note: prior to support, a wood block is placed between the jack and the engine sump; otherwise, the engine sump will be damaged!



4. Dismantle the body to engine right suspension bolts.
5. Dismantle the engine to engine right suspension bolts.



6. Dismantle the fixing bolts of engine mount and dismantle the engine mount.



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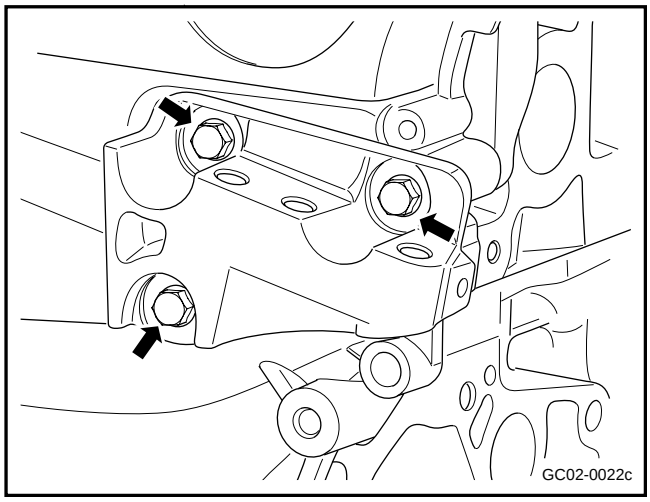
Installation Procedure:

1. Install and tighten the fixing bolts of engine mount to the specified torque.
2. Install and tighten the right engine suspension to the engine retaining bolts and nuts.
3. Install and tighten the engine right suspension to the body bolts.
4. Remove the supporting jack.
5. Install the generator assembly.
6. Install the engine hood.
7. Install negative cable of battery.



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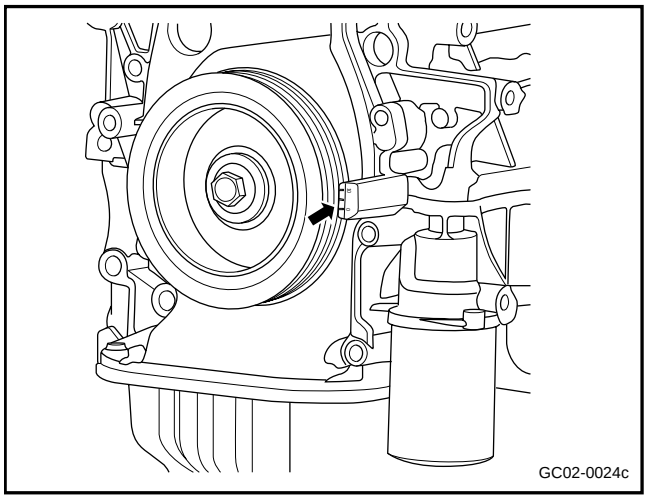
2.6.8.8 Replacement of Timing Chain Tensioner

Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions"!

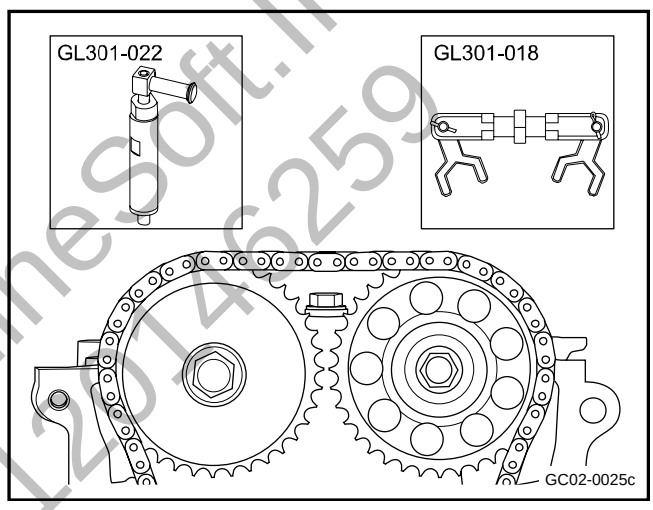
1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Dismantle the plastic shield of engine. Refer to 2.6.8.1 Replacement of Plastic Shield of Engine.
3. Refer to 2.10.8.3 "Replacement of Ignition Coil" to dismantle the ignition coil.



4. Refer to 2.6.8.2 "Replacement of Cylinder Hood Cover" to dismantle the cylinder hood cover.
5. Rotate the crankshaft and make sure the cylinder No.1 is at TDC position.

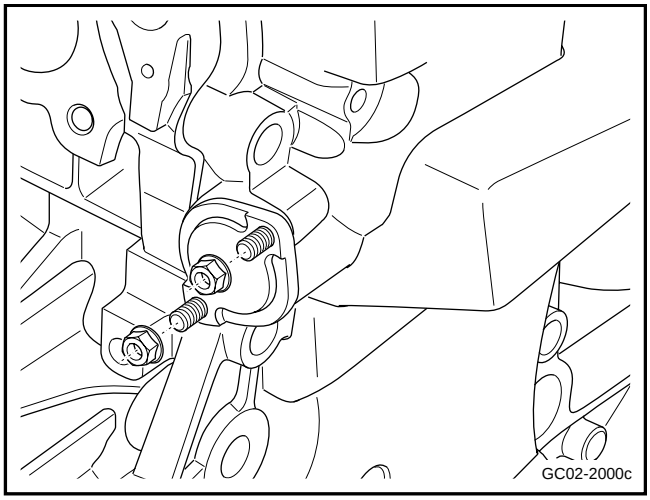
Note: Crankshaft timing mark is aligned with the timing chain cast scale line "0".

6. As shown in the graphic, mark on the intake and exhaust sprocket timing with a marker and use a special tool GL301-022 to fix the timing chain and special tool GL301-018 to fix the camshaft.



7. Dismantle Timing Chain Tensioner Assembly.

Note: At this time do not rotate the crankshaft in order to prevent the timing chain teeth rolling.



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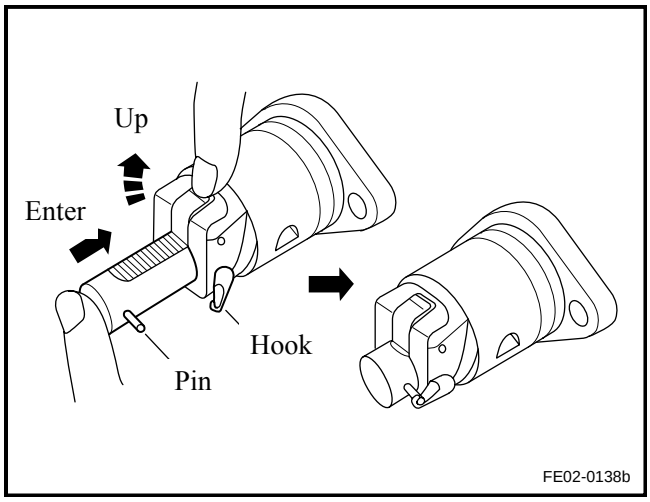
Installation Procedure:

1. Press timing chain tensioner pull rod to keep the tensioner into selft-lock condition as shown in figure.

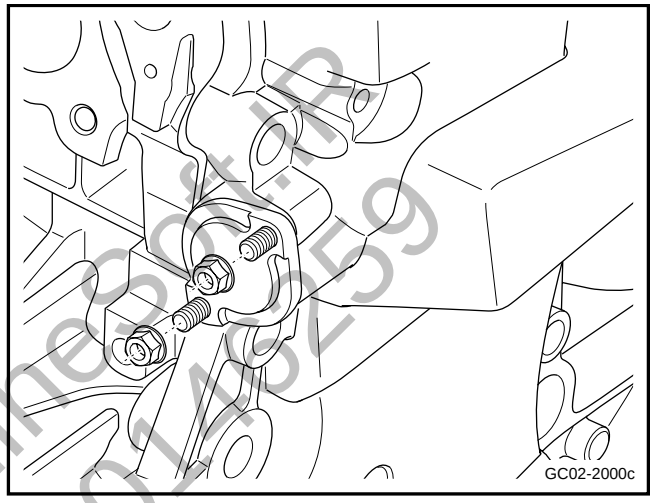


2. Install the timing chain shroud tensioner and tighten the nuts.

Torque:29 Nm(Metric) 21.5 lb-ft(English system)

4. Confirm the tensioner unlocked and the tensioner guide is firmly pressed by the handle.

Note: If not properly unlocked, use a screwdriver to push tensioner in the opposite direction to unlock the guide.



5. Install the cylinder hood cover.
6. Install the ignition coil.
7. Install the engine hood.
8. Connect battery negative cable.

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2.6.8.9 Replacement of Timing Chain Cover

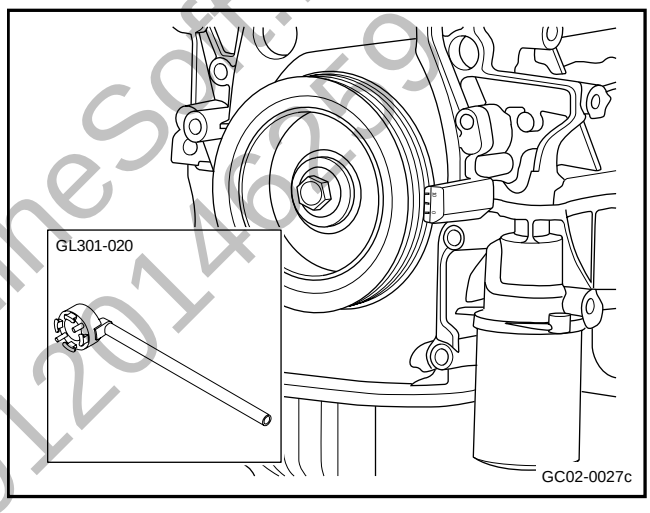
Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" and "Warning on Cooling System maintenance" in "Warning and Precautions".

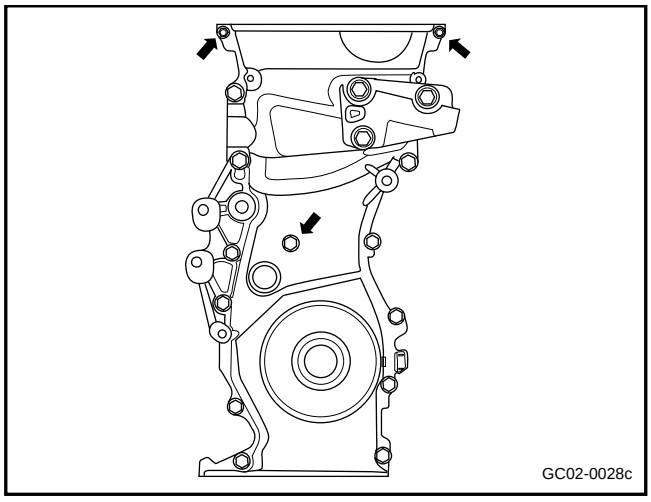
1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Refer to 2.8.8.1 Engine Coolant Discharge and Filling to discharge the engine coolant.
3. Dismantle the plastic shield of engine. Refer to 2.6.8.1 Replacement of Plastic Shield of Engine.
4. Refer to 2.10.7.3 "Replacement of Ignition Coil" to Dismantle the ignition coil.
5. Refer to 2.6.8.2 "Replacement of Cylinder Hood Cover" to dismantle the cylinder hood cover.
6. Dismantle the drive belt. Refer to 2.6.8.3 Replacement of Drive Belt.
7. Refer to 2.6.8.4 "Replacement of Drive Belt Tensioner" to dismantle the drive belt tensioner.
8. Dismantle the power steeling pump.
9. Dismantle oil pan, refer to 2.9.8.3 Replacement of Oil Pan.
10. Refer to 2.6.8.8 “Replacement of Timing Chain Tightener” to dismantle the timing chain tightener.

Note: In the confined operating space, lower the jack to facilitate the operation.

11. Use special tool to dismantle the crankshaft pulley.



12. Dismantle the three timing chain cover M6 tightening bolts and nuts.



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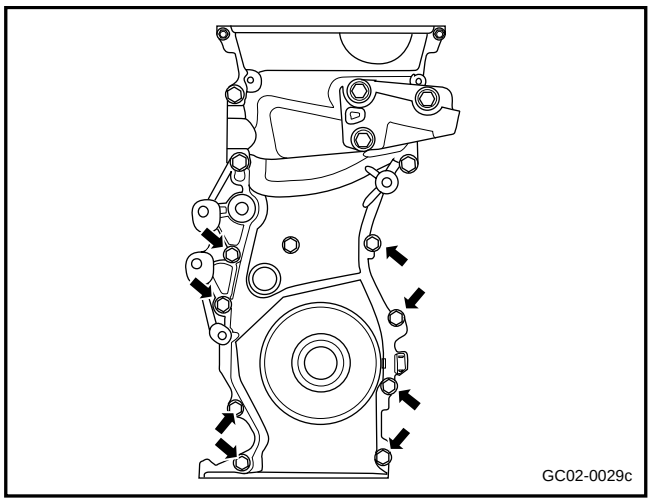
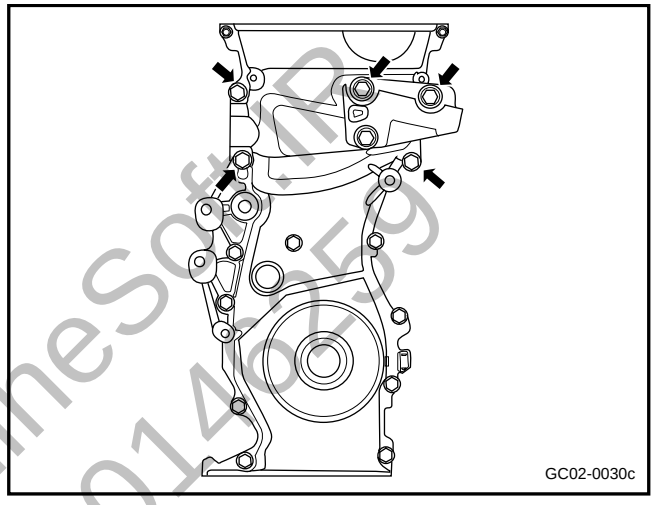
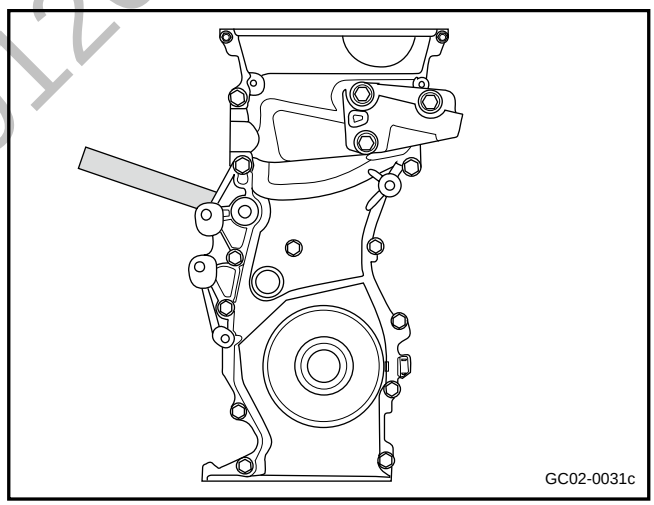
13. Dismantle the eight timing chain cover M8 tightening bolts.



14. Dismantle the five timing chain cover M10 tightening bolts.



15. Pry groove position with a bar to loosen the timing chain cover.
16. Remove the timing chain cover.



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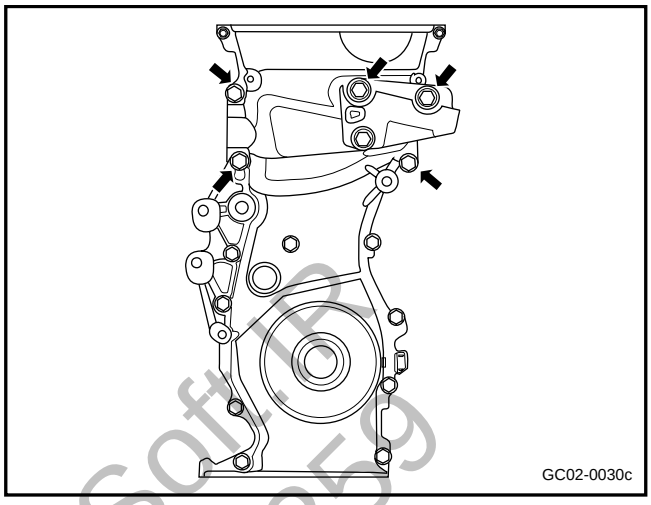
Installation Procedure:

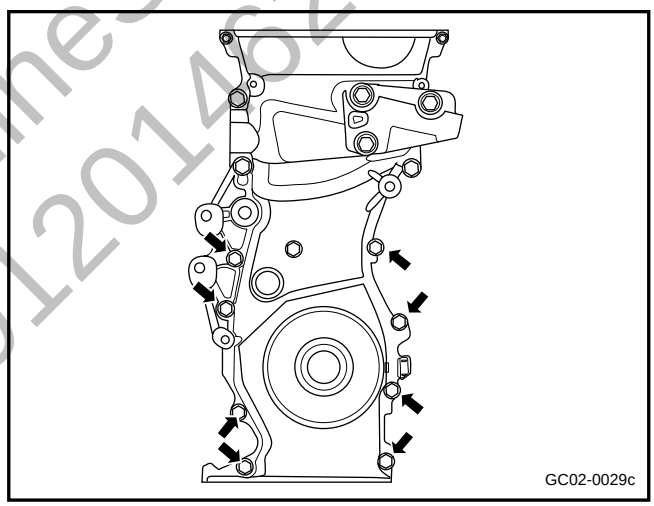
1. Clean the residual sealant on the timing chain cover and cylinder.
2. Apply special sealant on the timing chain cover and cylinder block mounting surface evenly and install the timing chain cover.

Note: prior to the installation of the timing chain cover cap, pay attention to check whether the marks on the timing chain are consistent; if not, please reinstall the timing chain, refer to 2.6.8.10 "Replacement of Timing Chain Component".

3. Install five M10 timing chain cover tightening bolts and nuts, but do not tighten at this stage.



4. Install eight M8 timing chain cover tightening bolts and nuts, but do not tighten at this stage.



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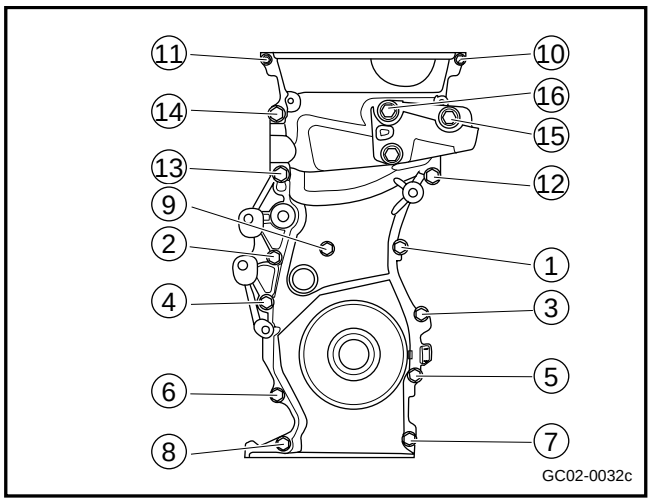
5. Install three M6 timing chain cover tightening bolts and tighten timing chain cover tightening bolts and nuts, total of 16, according to the sequence shown in the graph. The torque values are as following:

M6 bolt and screw cap torque :(10±1)N·m (Metric)

M8 bolt torque :(18±3)N·m (Metric)

M10 bolt torque: (50±3) N·m (Metric)



6. Install the crankshaft belt plate.
7. Use a special tool to install the crankshaft belt plate bolts.

Tightening Torque: (170±8) N·m (Metric)

8. Install the timing chain tensioner.
9. Install the oil pan.
10. Install power steering pump.
11. install drive belt tensioner.
12. Install the drive belt.
13. Install the cylinder hood cover.
14. Install the ignition coil.
15. Install the plastic shield of engine.
16. Fill the engine coolant.
17. Connect battery negative cable.

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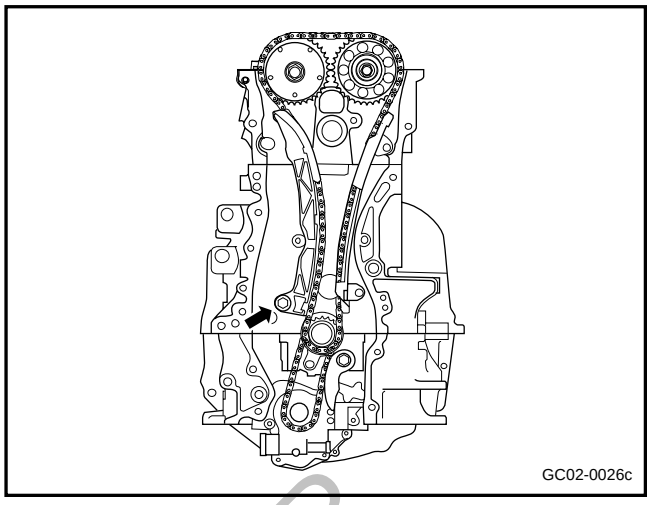
2.6.8.10 Replacement of Timing Chain Component

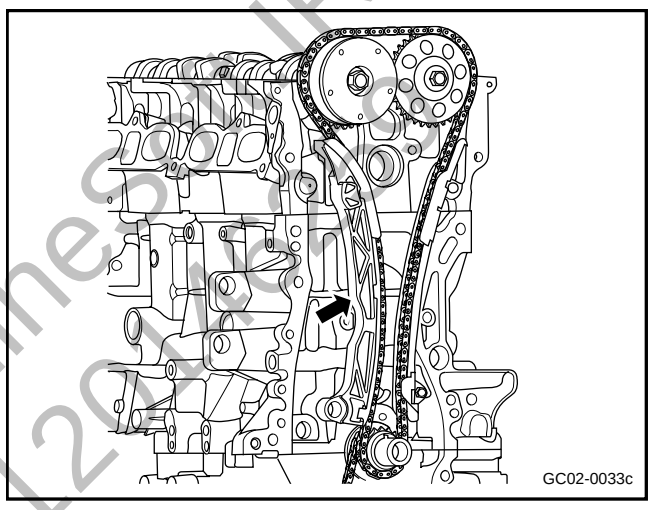
Dismantlement Procedure

1. Rotate the crankshaft so that the cylinder No.1 is at TDC position. Refer to 2.6.8.9 Replacement of Timing Chain Cover to dismantle the timing chain cover.
2. Refer to 2.6.8.8 "Replacement of Timing Chain Shroud Tensioner" to dismantle the timing chain shroud tensioner components.

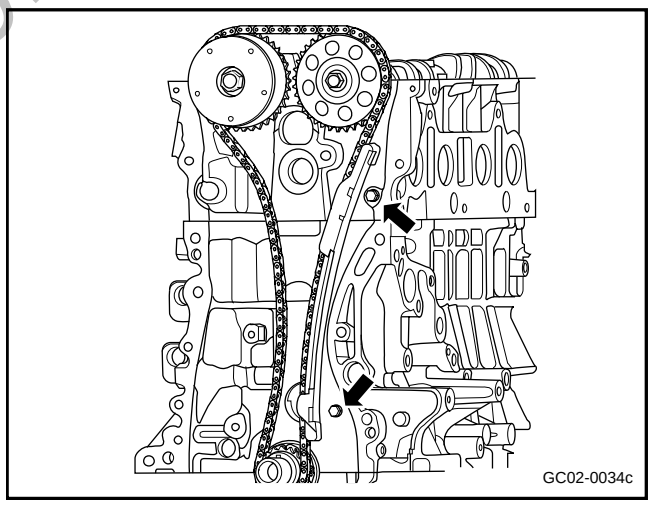


3. Remove the timing chain tensioner rail components.

Note: During getting out, take care to avoid dropping the timing chain tension rail components, otherwise it is likely to damage the components.



5. Dismantle the timing chain guide rail components lower fixing bolts.
6. Dismantle the timing chain guide rail components upper fixing bolt.
7. Dismantle the timing chain guide rail components.



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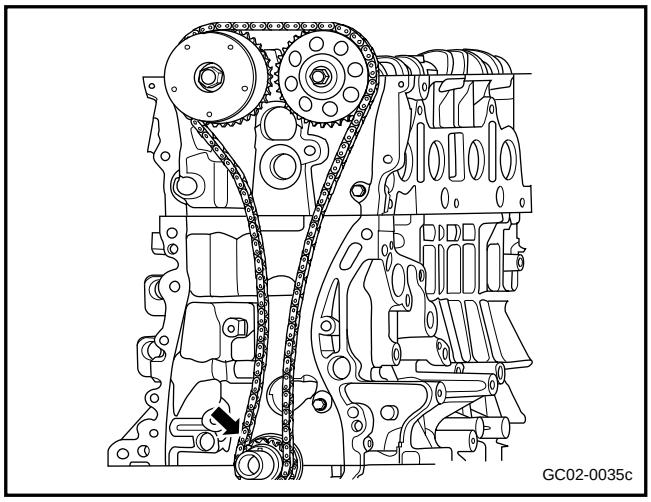
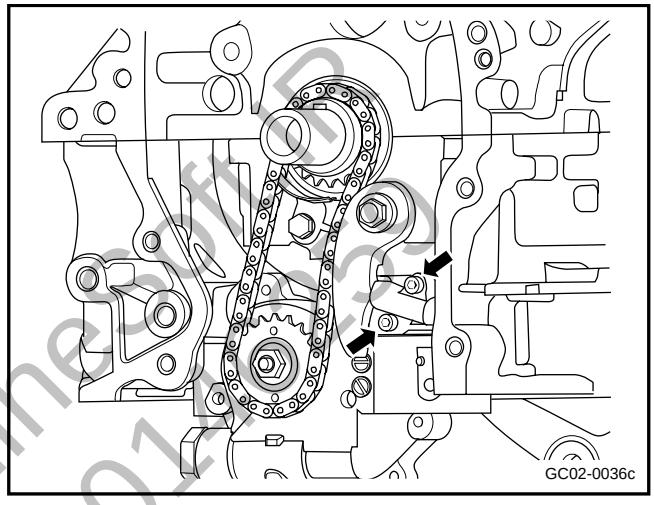
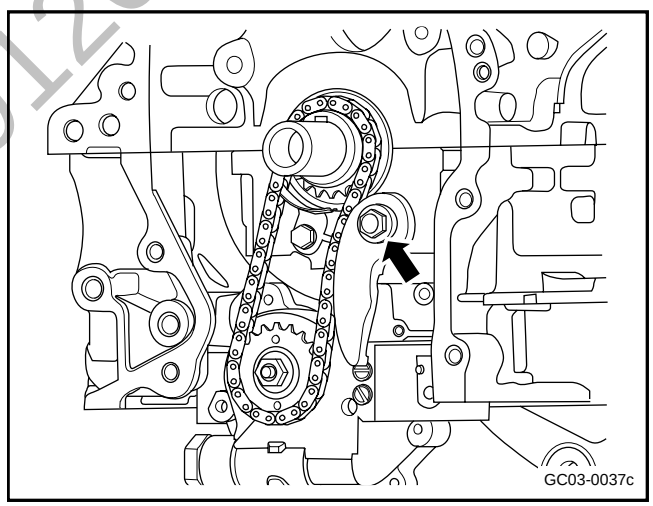
8. Dismantle the timing chain and crankshaft sprocket.



9. Dismantle the oil pump chain tightener components and their mounting bolts.



10. Dismantle the oil pump chain tensioning rail and the installation bolts.



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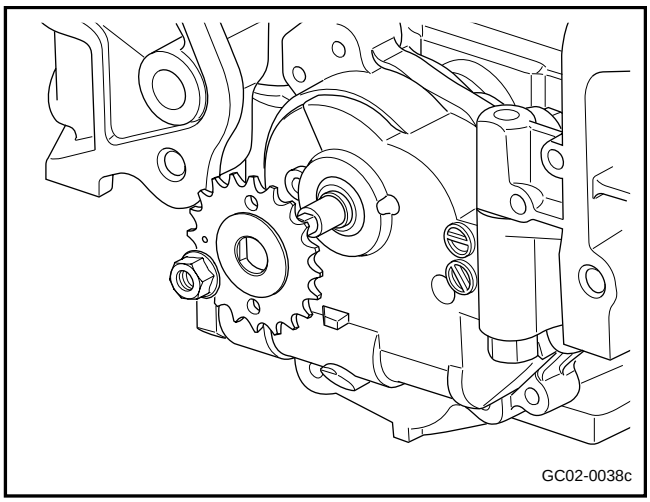
11. Dismantle oil pump nuts.

12. Dismantle oil pump chain, oil pump sprocket and crankshaft oil pump sprocket.

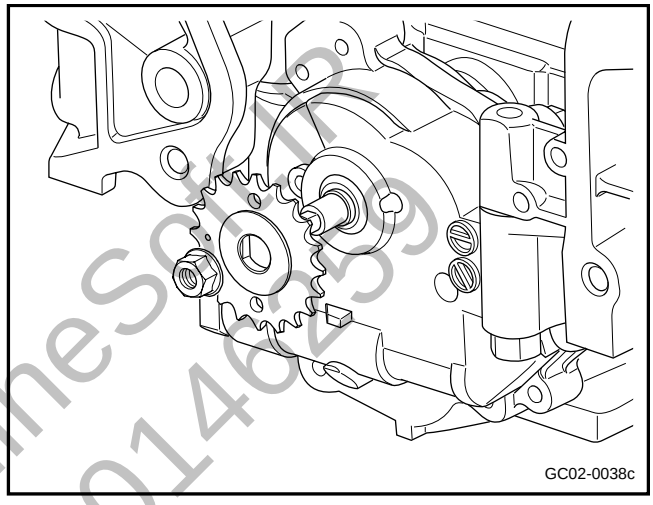


Installation Procedure:

1. Install oil pump chain, oil pump sprocket and crankshaft oil pump sprocket.

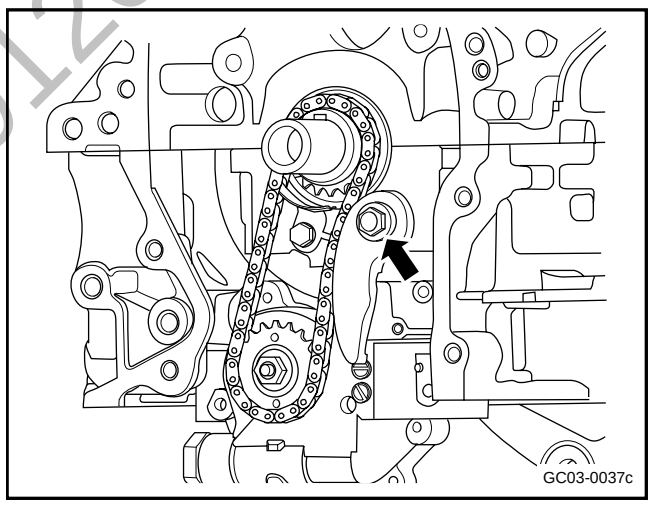
2. Install the oil pump nuts.

Torque:30N . m(Metric) 22 . 14lb-ft(English system)



3. Install the oil pump chain tensioning rail and the mounting bolts.

Torque:13N . m(Metric) 9 . 59lb-ft(English system)



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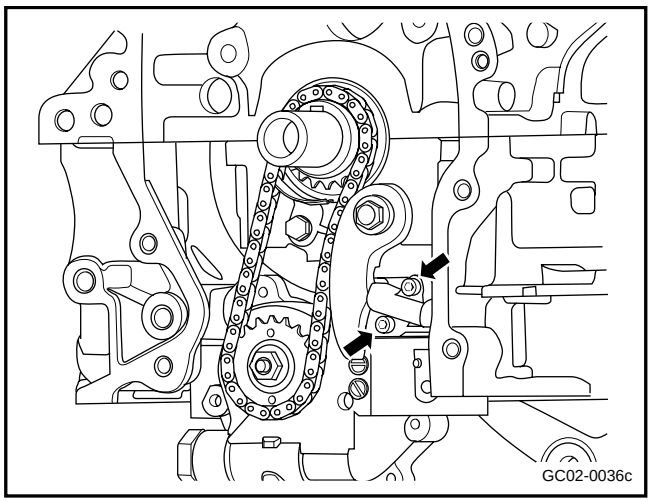
4. Install the oil pump chain tightener components and their mounting bolts.

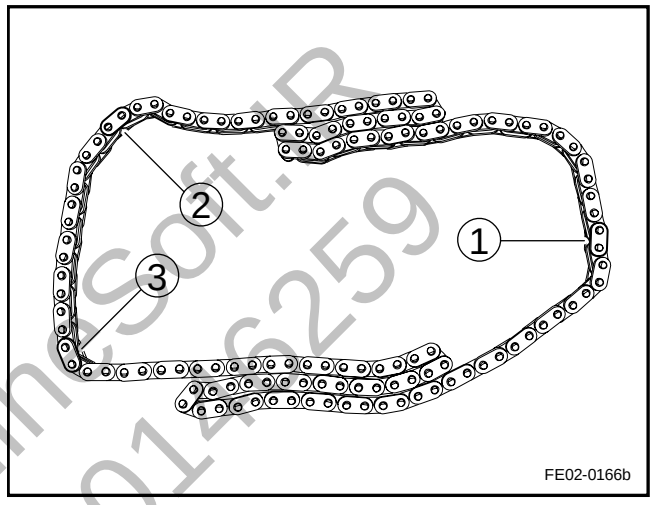
Torque:6N . m(Metric) 4 . 43lb-ft(English system)



5. Confirm the timing chain three yellow sections.

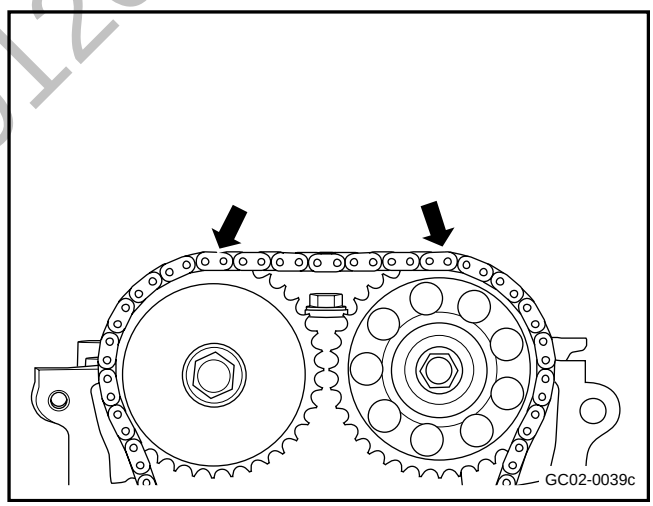
6. Install timing chain and crankshaft sprocket. Align the first blue external chain section with the crankshaft sprocket timing mark.

Note: There are total three external sections on the timing chain, including two yellow external chain section (a difference of 7 sections between the sections) and aligned with the intake and exhaust camshaft sprocket timing marks.



7. Align the second yellow external chain section with the exhaust sprocket timing mark.

8. Align the third timing marking external chain section (yellow) with valve timing controller assembly sprocket timing mark.



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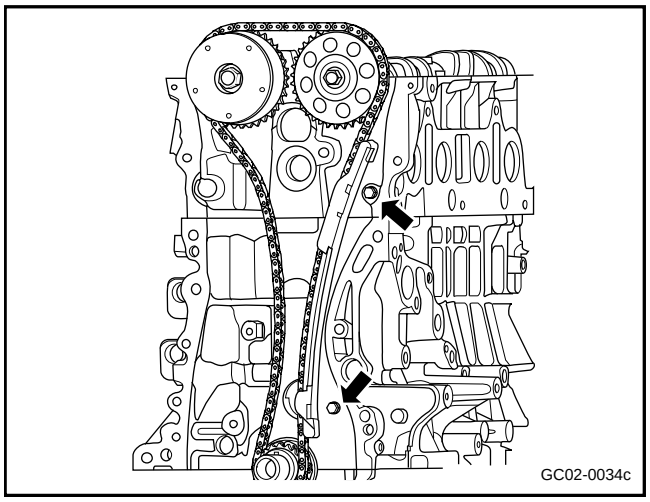
9. Install the timing chain guide rail components.

10. Install the fixing bolts of timing chain guide rail components.

Torque: 9Nm (Metric) 6.64lb-ft (English system)

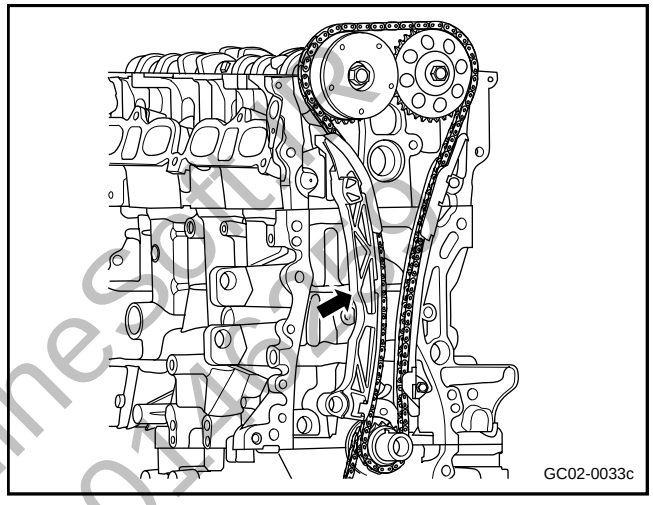


11. Install the timing chain guide rail components.

12. Install the timing chain guide rail components mounting bolts.

Torque:19N . m(Metric) 14 . 02lb-ft(English system)

13. Install the timing chain cover and accessories.



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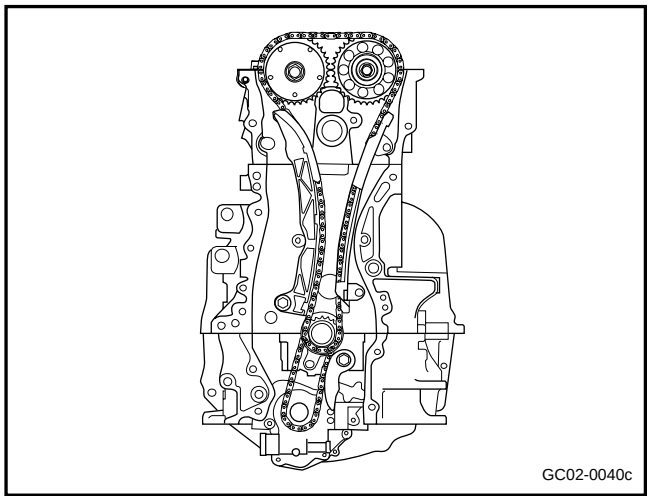
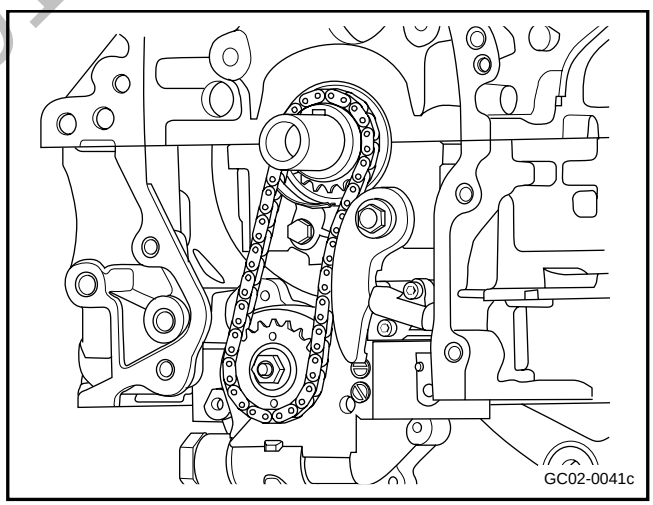
2.6.8.11 Timing Chain Inspection

1. Refer to 2.6.8.9 “Replacement of Timing Chain Shroud” to dismantle the timing chain shroud.
2. Refer to 2.6.8.10 "Replacement of Timing Chain" to dismantle the timing chain.
3. Inspect timing chain guide rail component for cracking, wear and tear.
4. If the timing chain guide rail components surface wear is deeper than 1 mm (0.04 in) then replace the timing chain guide rail components.


GC02-0040c

5. Inspect timing chain tensioner rail component for wear and tear.
6. If the timing chain guide rail components surface wear is deeper than 1 mm (0.04 in) then replace the timing chain guide rail components.
7. Inspect the wear of the oil pump chain tensioning rail.
8. If the oil pump chain tension rail surface wear is deeper than 1 mm (0.04 in) then replace the oil pump chain tension rail.
9. Inspect the wear of the timing chain and valve timing controller sprocket.
10. Inspect the exhaust camshaft timing sprocket teeth and the valve timing controller sprocket teeth and chain for excessive wear, damage or stuck.
11. Inspect the crankshaft timing sprocket teeth and chain for excessive wear, broken, or stuck.
12. Inspect the crankshaft oil pump sprocket teeth, oil pump sprocket teeth and oil pump chain for excessive wear, broken, or stuck with the oil pump chain, etc.
13. Inspect the integrity of the timing chain tightener component. If damaged, replace the timing chain tightener.
14. Inspect the integrity of the oil pump chain tightener components. If damaged, replace the oil pump chain tightener components.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15. Inspect timing chain lubrication nozzles. If necessary, dismantle the oil pump assembly. Inspect the oil channel. Refer to 2.9.8.1 “Replacement of Oil Pump”.

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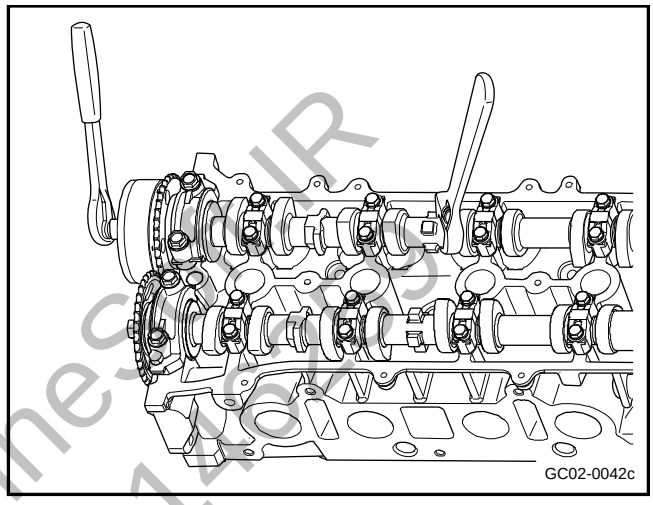
2.6.8.12 Replacement of Camshaft

Dismantlement Procedure

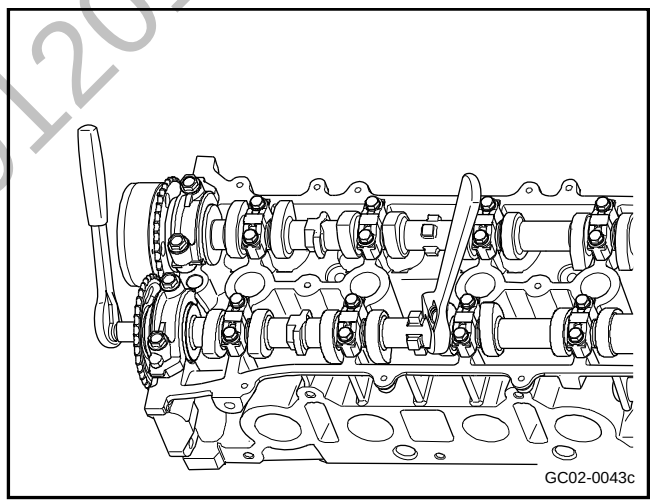
1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Dismantle the plastic shield of engine. Refer to 2.6.8.1 Replacement of Plastic Shield of Engine.
3. Refer to 2.6.8.2 "Replacement of Cylinder Hood Cover" to dismantle the cylinder hood cover.
4. Dismantle the drive belt. Refer to 2.6.8.3 Replacement of Drive Belt.
5. Refer to 2.6.8.9 "Replacement of Timing Chain Cover" to dismantle the timing chain cover.
6. Refer to 2.6.8.10 "Replacement of Timing Chain" to dismantle the timing chain.
7. Dismantle the intake camshaft VVT actuator.

Note: Dismantle the camshaft VVT actuator tightening bolt with a wrench holding the camshaft.



8. Dismantle the exhaust camshaft sprocket.

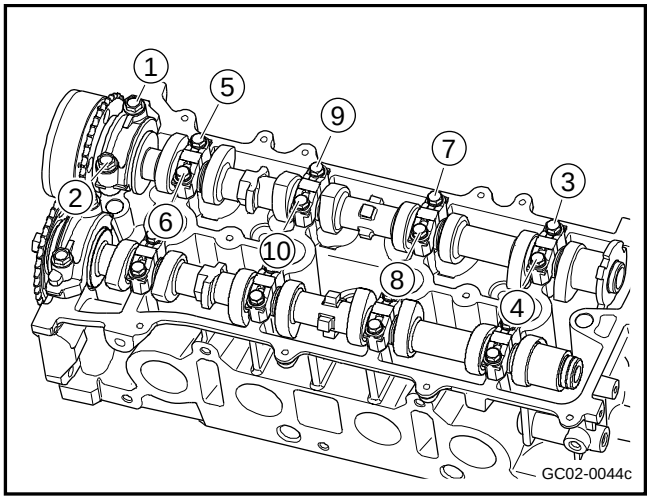
Note: Dismantle the camshaft sprocket tightening bolts with a wrench holding the camshaft.



Machine SN:IR 09120142625

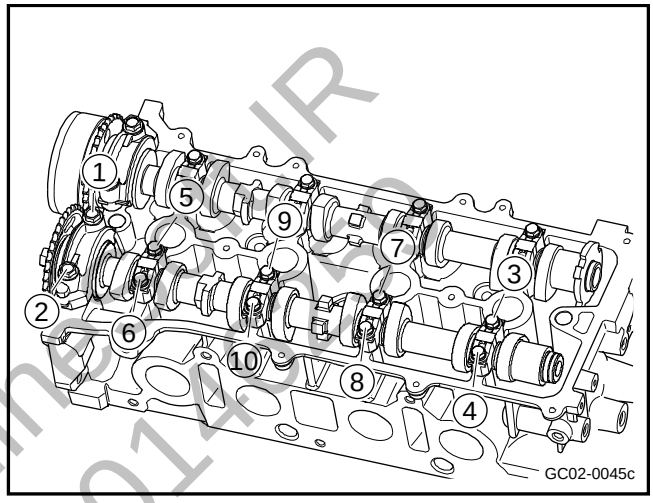
9. As shown in the graphic, gradually release the camshaft bearing cap bolts, rotate half a circle to a whole circle each time.

Special Precautions: Be careful when dismantling the camshaft. Avoid abrasions, scratches or damage to the camshaft surface or bearing surface.



10. As shown in the graph, gradually release the camshaft bearing cap bolts, rotate half a circle to a whole circle each time.

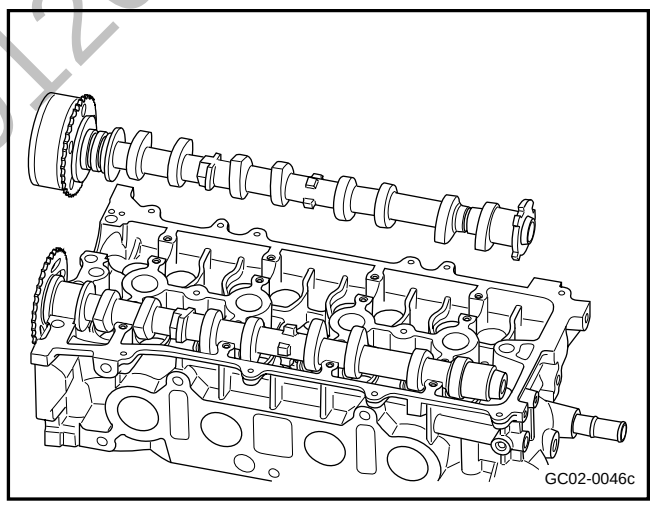
Special Precautions: Be careful when dismantling the camshaft. Avoid abrasions, scratches or damage to the camshaft surface or bearing surface.



11. Dismantle the camshaft.

Important precaution : Camshaft must be withdraw from the bearing in order to avoid abrasions, scratches or damage to the camshaft surface or bearing surface.

12. Inspect for the camshaft and bearing wear. If necessary, replace.



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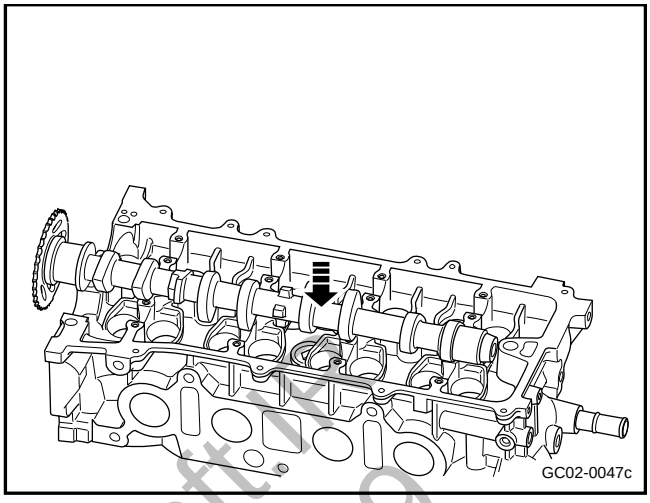
Installation Procedure:

Precaution: be careful to install the camshaft. Avoid abrasions, scratches or damage to the camshaft surface or bearing surface.

Special Precautions: Before installation,apply engine lubrication oil to the camshaft journal and the seal contacting surface.

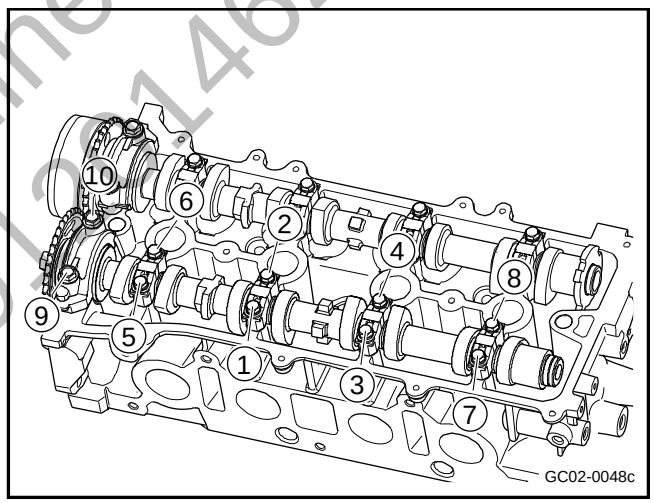
1. Apply a small amount of engine oil to lubricate the journal and camshaft cap.
2. Install the exhaust camshaft.
3. Install the intake camshaft.
4. Install the intake and exhaust camshaft cover.

There are letters on the camshaft cover. Avoid installation errors. For example, "I ↑ 2" indicates that the camshaft cover is the No.2 intake camshaft cover. The arrow is toward the direction of timing chain. E ↑ 2 indicates the No.2 exhaust camshaft cover. The arrow is toward the direction of timing chain.



5. Gradually tighten the camshaft cover bolts according to the sequence as shown in the graph.

Note: Tighten the bolts during several stages. Do not tighten at once which may damage the camshaft and the camshaft cover.



Torque :M6 bolt

13±1 Nm (Metric) 10±0.74 lb-ft (English system)

M8 Bolt

30±1 Nm (Metric) 22 . 1±0 . 74 lb-ft (English system)

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6. Gradually tighten the camshaft cover bolts according to the sequence as shown in the graph.

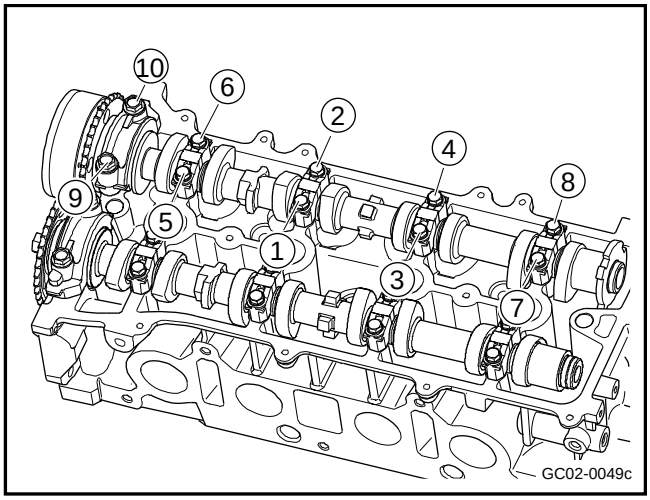
Note: Tighten the bolts during several stages. Do not tighten at once which may damage the camshaft and the camshaft cover.

Torque :M6 bolt

13±1 Nm (Metric) 10±0.74 lb-ft (English system)

M8 Bolt

30±1 Nm (Metric) 22 . 1±0 . 74 lb-ft (English system)



7. Install the exhaust camshaft sprocket.

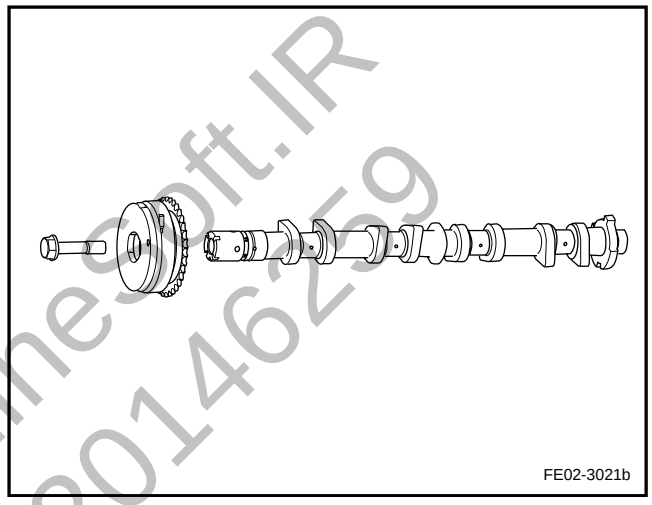
Note: Inspect the sprocket pin wear. If there is wear, replace the sprocket pin. Hold the camshaft with a wrench and then tighten the VVT actuator bolts.

Torque: 50±3 Nm (Metric) 36.9±2.2 lb-ft (English system)

8. Install the intake camshaft VVT actuator.

Note: Inspect the VVT actuator pin wear. Hold the camshaft with a wrench and then tighten the sprocket bolts.

Torque: 60±3 Nm (Metric) 44.2±2.2 lb-ft (English system)



8. Install timing chain
9. Install the timing chain cover.
10. Install the drive belt.
11. Install the cylinder hood cover.
12. Install the plastic shield of engine.
13. Connect battery negative cable.

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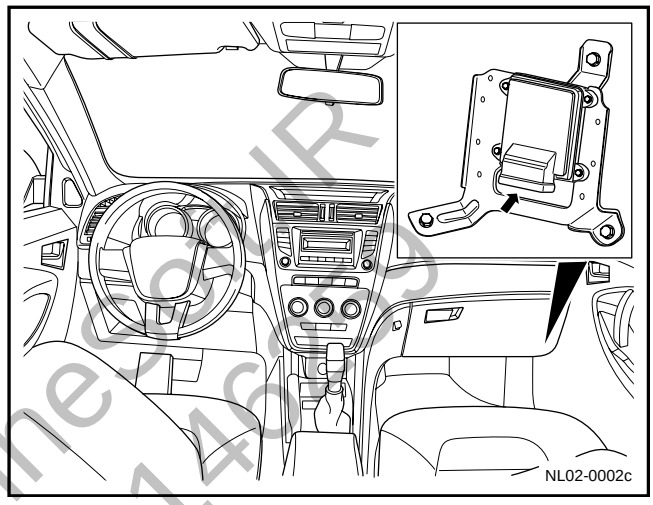
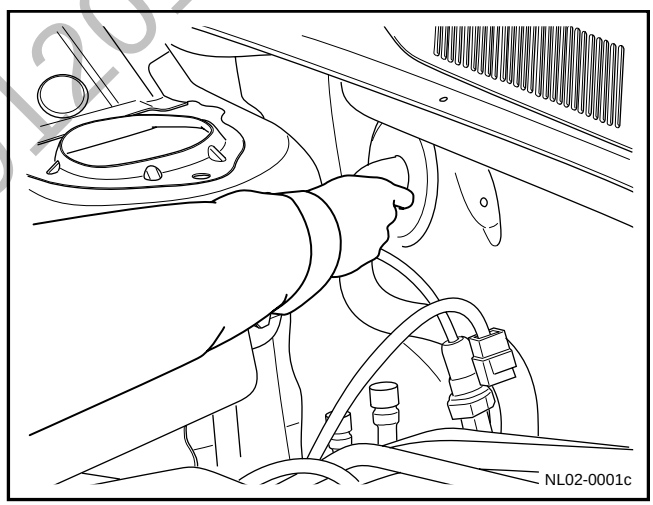
2.6.8.13 Replacement of Engine

Dismantlement Procedure

1. For dismantling of battery negative cable, refer to disconnection procedure of battery negative cable.
2. Release the fuel pressure. Refer to 2.3.8.1 Fuel Pressure Release Procedure.
3. Discharge engine coolant. Refer to 2.8.8.1 Engine Coolant Discharge and Filling.
4. Refer to 2.8.8.2 "Replacement of Coolant Recovery Reservoir" to dismantle the coolant recovery reservoir.
5. Recover the air-conditioning refrigerant. Refer to 8.2.7.12 Air-conditioning Refrigerant Recovery and Filling.
6. Remove battery base plate. Refer to 2.12.6.2 Battery Replacement.
7. Refer to 12.8.3.3 "Replacement of Glove Box of the Instrument Panel" to dismantle the glove box of the instrument panel.
8. Disconnect the engine control unit and engine harness to the instrument panel harness connectors.



9. Pull the engine harness out of the firewall.



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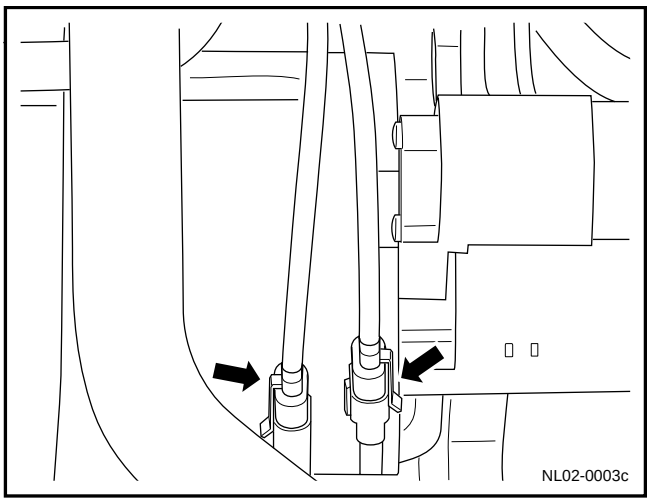
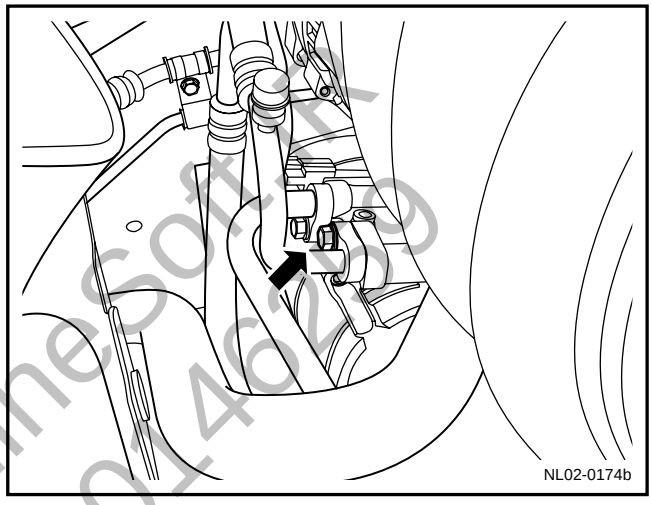
10. Disconnect front and rear oxygen sensor wiring harness connectors.

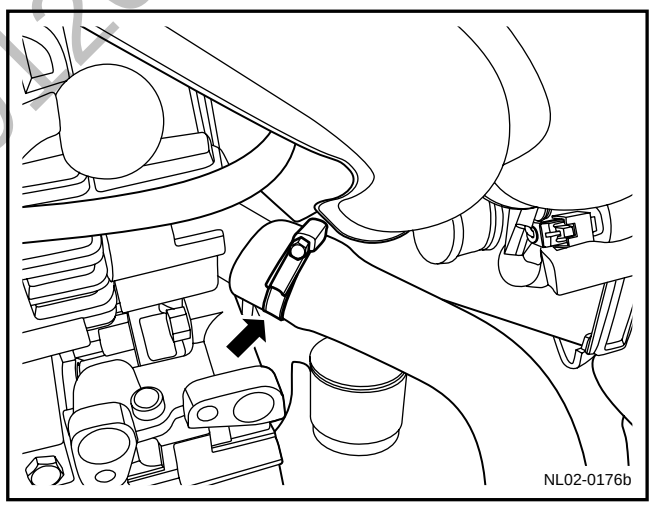


11. Dismantle the air-conditioning compressor high and low pressure connecting tubes.



12. Dismantle intake air pipe assembly.
13. Dismantle the radiator output pipe.

Warning: Refer to "Warning on Maintenance of Cooling System" in "Warnings and Precautions".



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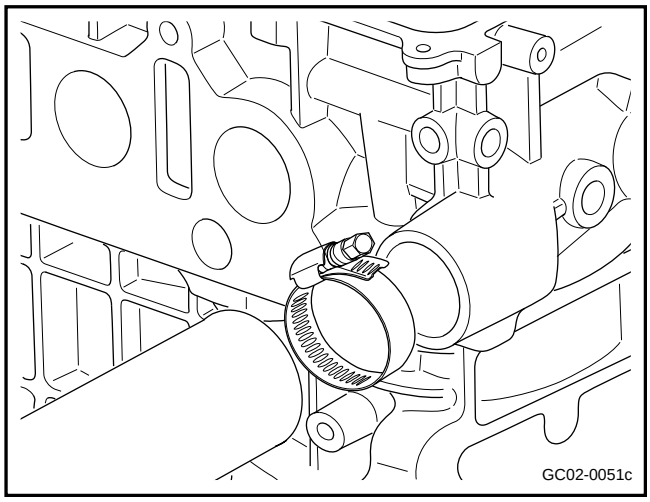
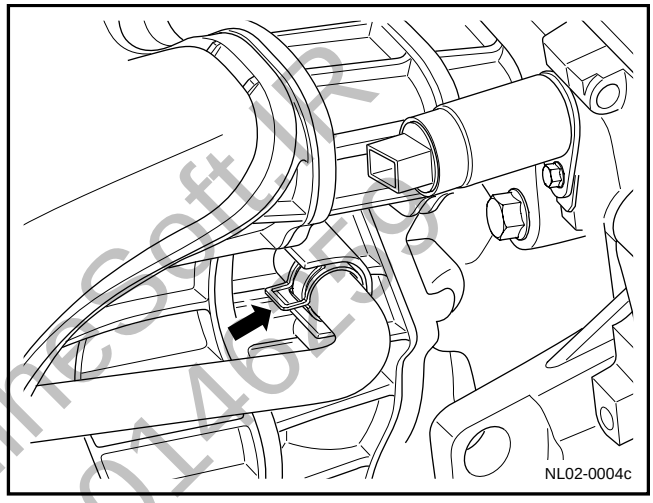
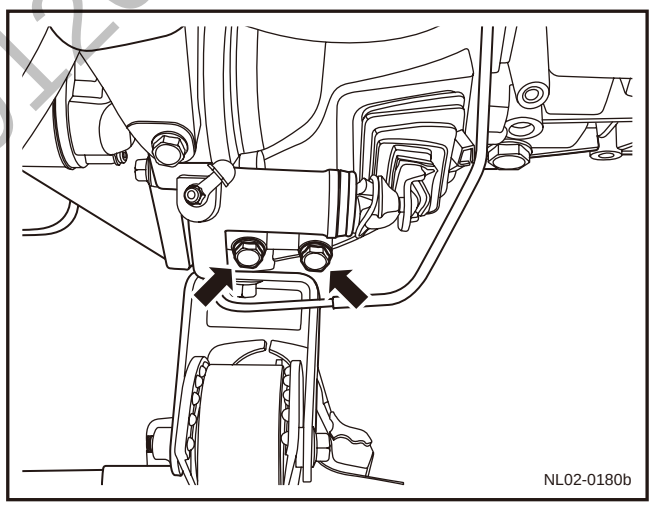
14. Dismantle the radiator inlet pipes.



15. Dismantle the vacuum booster vacuum tubes.



16. Dismantle the fixing bolts of clutch fuel tube bracket.
17. Dismantle fixing bolts of clutch slave cylinder.



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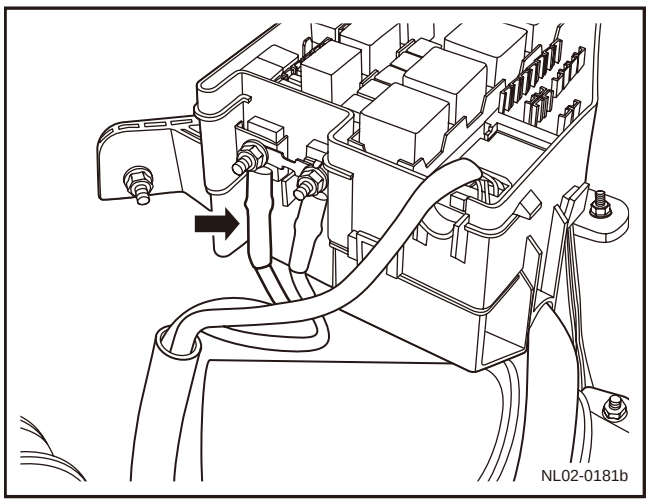
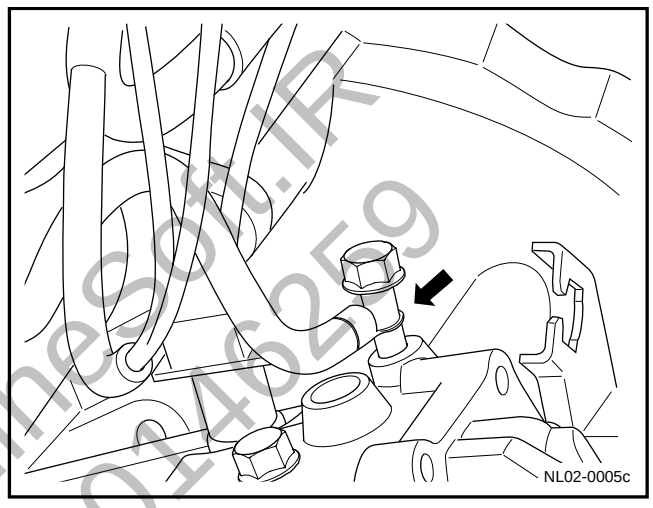
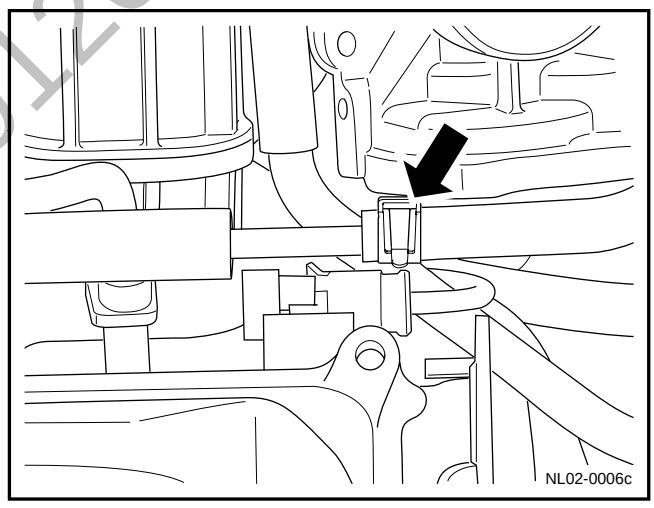
18. Dismantle the engine wiring harness to the engine cabin junction box connecting cables and connectors.



19. Dismantle battery negative cable gearbox shell grounding point.



20. Dismantle the fuel pipe.



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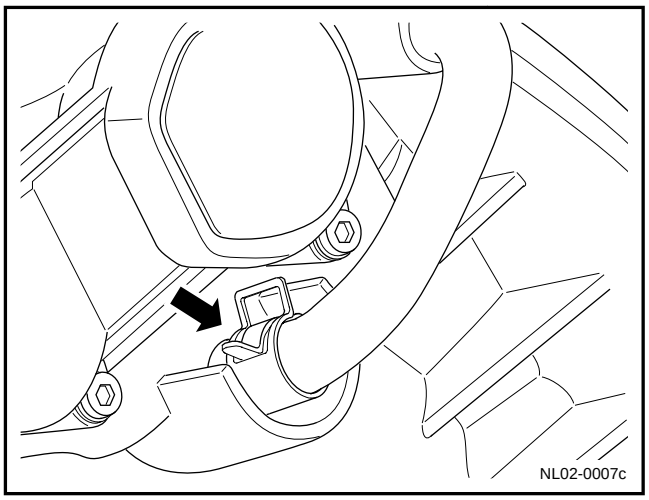
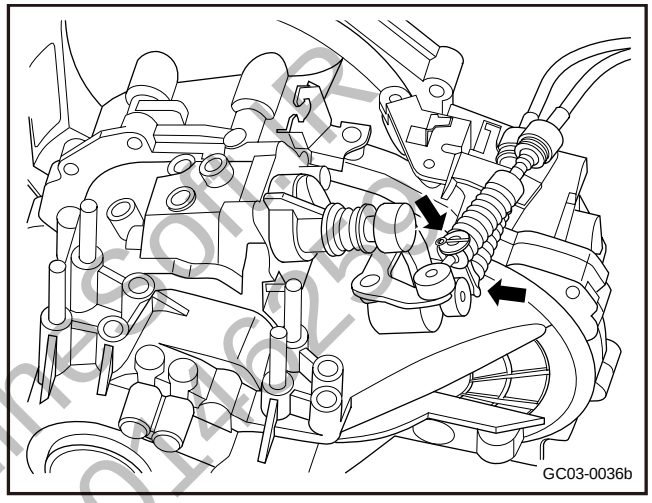
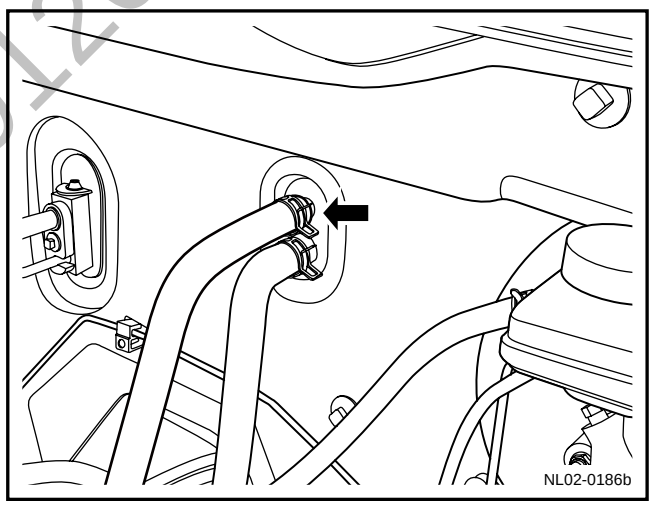
21. Dismantle the canister vacuum tubes.



22. Dismantle gear shift lever cable.



23. Dismantle the heater intake and outlet pipes.



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24. Dismantle the front wheels.

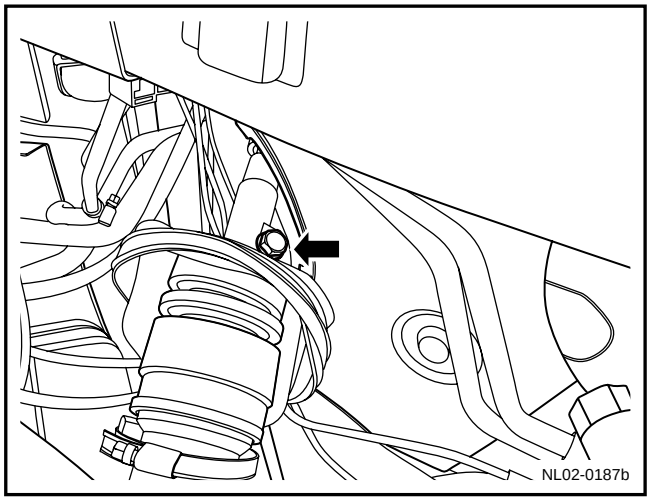
25. Lifting and Jacking the Vehicle

Warning: Refer to Warning on Vehicle Lifting and Jacking in Warnings and Precautions.

26. Dismantle the gearbox oil discharge bolts until all the gearbox oil is discharged and reinstall. Refer to 3.3.6.1 Gearbox Oil Level Inspection.

27. Dismantle the power steering gear tie rod lateral pin bolts.

Warning: Before remove the steering lateral pin bolt, remove the key from the ignition switch first and turn the steering wheel to lock position. Otherwise it will damage the airbag clock spring.

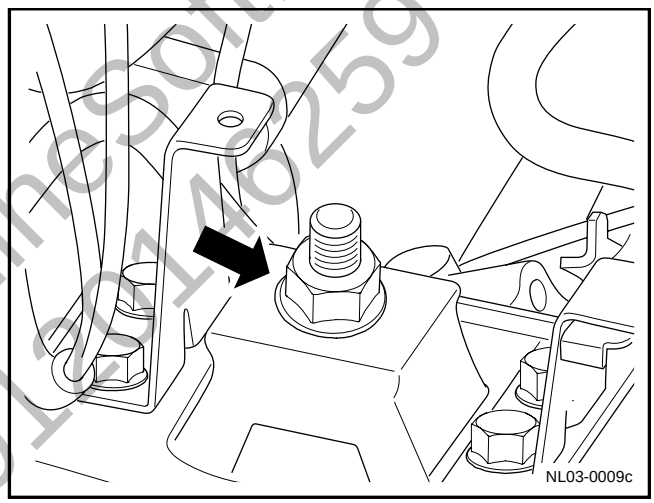


28. Refer to 12.6.4.3 "Replacement of Longitudinal Beam of Front Suspension" and 12.6.4.4 "Replacement of Front Subframe" to dismantle the longitudinal beam of front suspension, subframe and associated connectors.

29. Dismantle left and right drive shaft. Refer to 5.3.4.2 Replacement of drive shaft.

30. Place a mobile working table under the engine assembly to lower and support the powertrain assembly.

Warning: Make sure solid contact between the working table and the powertrain, otherwise it will result in human injury.



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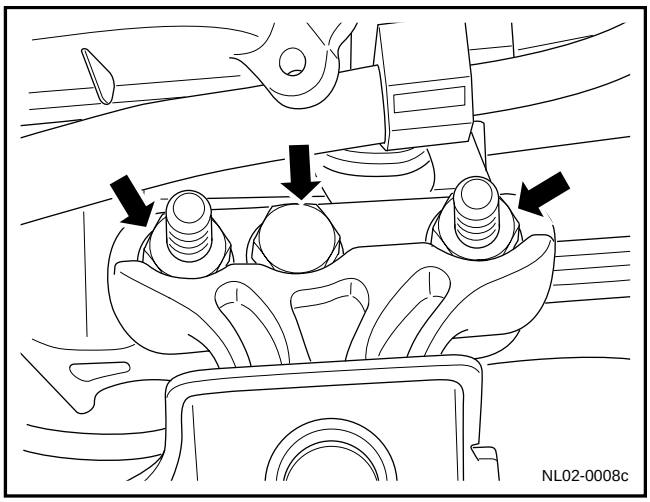
31. Dismantle the engine right suspension assembly .

32. Dismantle the gearbox left suspension assembly .

33. Lift the vehicle slowly to separate powertrain from the frame .

Note: In the lifting process, avoid the powertrain assembly tilt on the working table. Pay attention to the powertrain and vehicle body interference.

34. Use an engine lifting device to support the engine and then separate the engine and the gearbox. Refer to 3.3.6.3 Replacement of Gearbox.



Installation Procedure:

1. Use the engine lifting device to support the engine and then connect the engine assembly and the gearbox assembly.

2. Place the powertrain assembly on the mobile working table, lift the vehicle and move the working table so the powertrain assembly moves back into the vehicle body frame.

3. Slowly lower the vehicle. Pay attention in the lowering process; do not interfere with the vehicle body frame.

Note: Make sure solid contact between the working table and the powertrain, otherwise it will result in personal injury.

4. Install the engine right suspension assembly.

Torque :45Nm (Metric) 33 . 3lb-ft (English system)

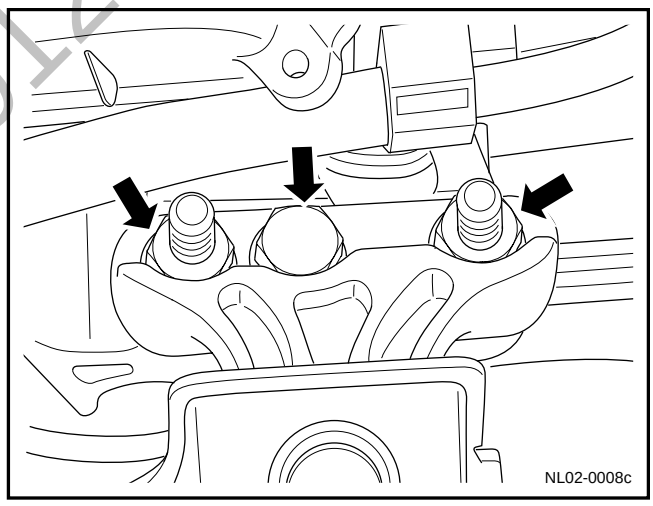
5. Install the gearbox left suspension assembly.

Torque :50Nm (Metric) 37lb-ft (English system)

6. Lifting and Jacking the Vehicle

7. Install the left and right drive shafts.

8. Install the longitudinal beam of front suspension and front subframe.



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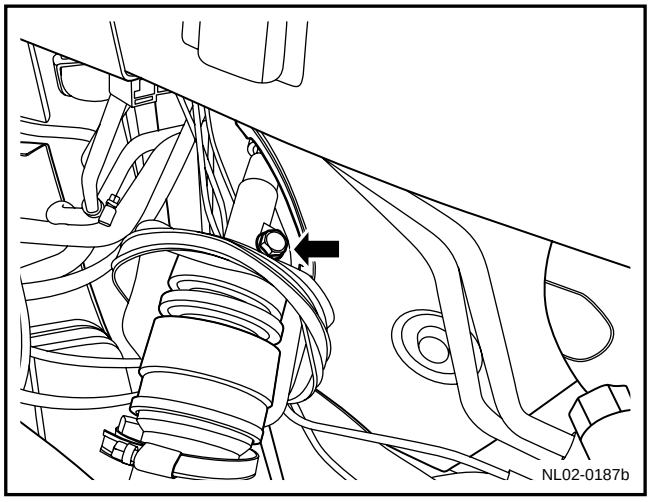
9. Install the power steering gear tie rod lateral pin bolts.

Refer to 3.3.6.1 “Inspect Gearbox Oil and Liquid Level” to inspect the tightness of the gearbox oil exhaust bolts and refill the gearbox oil.

11. Lower the vehicle.

12. Install the front wheels.



13. Install the heater intake and outlet pipes.

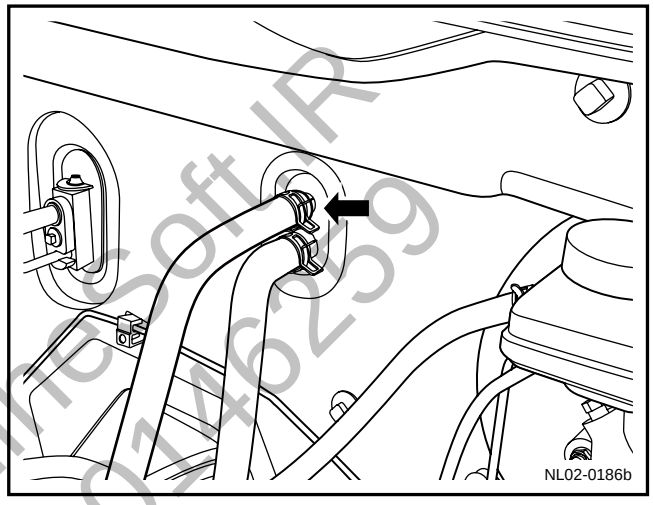
14. Install gear shift lever cable.

15. Install canister vacuum tubes.

16. Install the fuel pipe.

17. Install grounding point of battery negative cable in gearbox housing.

18. Connect the engine wiring harness to the engine cabin junction box connecting cables and connectors.



19. Install fixing bolts of clutch slave cylinder.

Torque :20Nm (Metric) 14 . 8lb-ft (English system)

20. Install and tighten the fixing bolts of clutch oil pipe bracket.

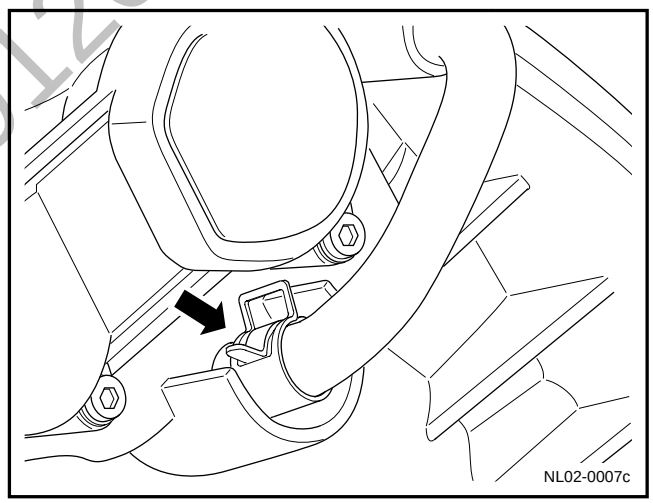
Torque:10Nm(Metric) 7.4lb-ft(English system)

21. Install the vacuum booster vacuum tubes.

22. Install the radiator inlet and outlet pipes.

23. Install radiator water outlet pipe.

24. Install the intake main pipe assembly.



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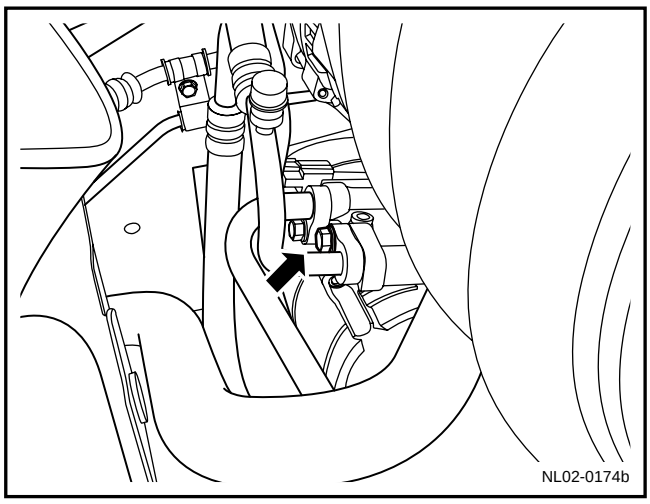
25. Install the air-conditioning compressor high and low pressure connecting pipes.

Torque :18Nm (Metric) 13 . 3lb-ft (English system)

26. Connect the front and rear oxygen sensor harness connectors.
27. Connect the engine control unit and engine harness to the instrument panel harness connectors.
28. Install grove box of instrument desk .
29. Install battery and bottom plate.
30. Install the Coolant Recovery Reservoir.
31. Fill engine coolant.
32. Fill the air-conditioning refrigerant .
33. Connect the battery negative cable .



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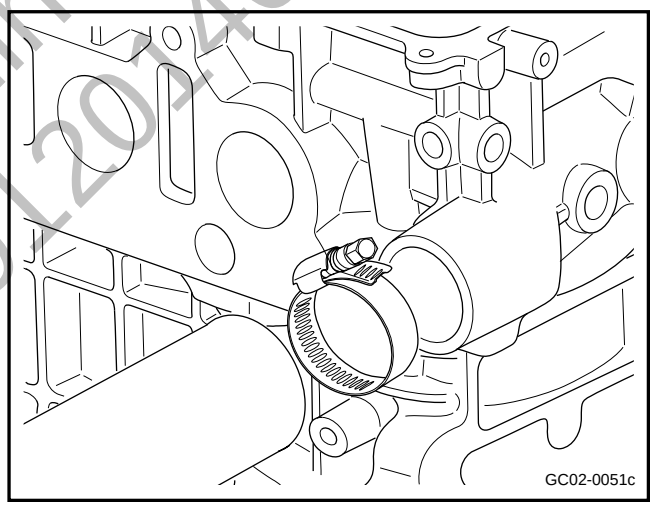
2.6.8.14 Replacement of Cylinder Hood Assembly

Dismantlement Procedure

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Dismantle the plastic shield of engine. Refer to 2.6.8.1 Replacement of Plastic Shield of Engine.
3. Refer to 2.8.8.1 Engine Coolant Discharge and Filling to discharge the engine coolant.
4. Refer to "Replacement of Electrical Throttle Body Assembly" to dismantle the throttle body.
5. Refer to 2.6.8.6 "Replacement of Intake Manifold Assembly" to dismantle the intake manifold assembly.
6. Refer to 2.7.6.1 "Replacement of Exhaust Manifold" to dismantle the exhaust manifold.
7. Dismantle ignition coil and ignition guide wire , refer to“2 . 10 . 7 . 3ignition coil replacement ” .
8. Refer to 2.6.8.2 "Replacement of Cylinder Hood Cover" to dismantle the cylinder hood cover.
9. Refer to 2.6.8.3 "Replacement of Drive Belt" to dismantle the drive belt.
10. Refer to 2.6.8.9 "Replacement of Timing Chain Cover" to dismantle the timing chain cover.
11. Refer to 2.6.8.10 "Replacement of Timing Chain" to dismantle the timing chain.
12. Refer to 2.3.8.5 “Replacement of Fuel Injector” to dismantle the fuel distributing pipe assembly.
13. Refer to 2.2.8.2 "Replacement of temperature sensor of engine coolant" to disconnect the temperature sensor of engine coolant harness connector.
14. Refer to 2.10.7.1 "Replacement of Camshaft Position Sensor" to dismantle camshaft position sensor.
15. Refer to 2.2.8.5 "Replacement of VVT Solenoid Valve and Filter Cleaning" to dismantle the VVT Solenoid Valve.
16. Refer to 2.6.8.12 “Replacement of Camshaft” to dismantle the camshaft.
17. Dismantle the radiator inlet pipes.
18. Dismantle the warm water pipe for the heater tank.



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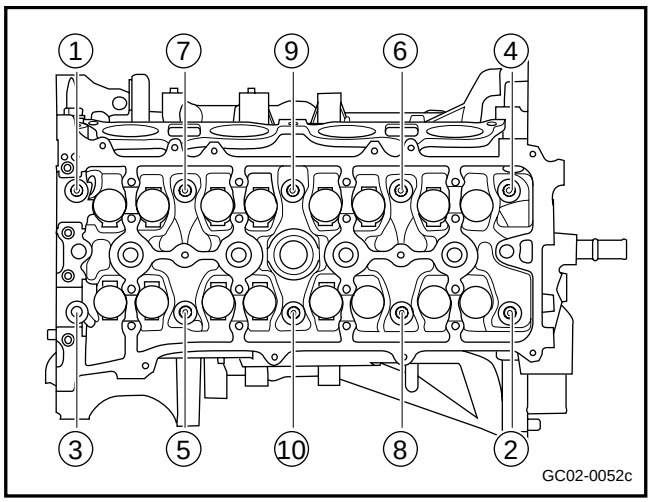
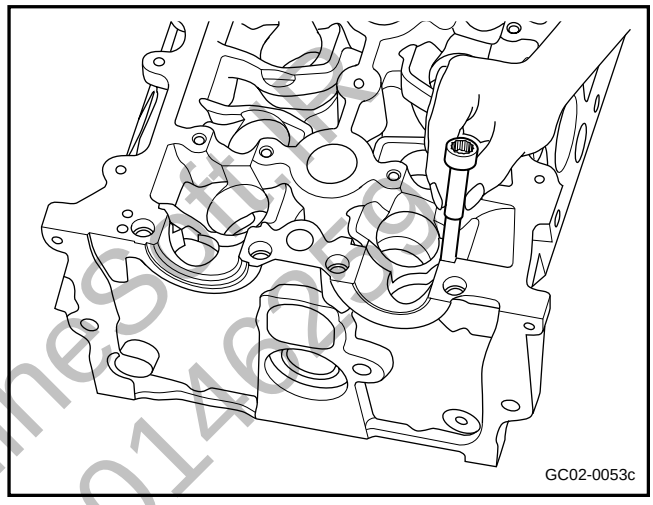
19. Dismantle the cylinder hood bolts according to the sequence in the figure.

Note: When the engine is hot, it is prohibited to dismantle the cylinder hood, as this will cause the cylinder hood distortion.

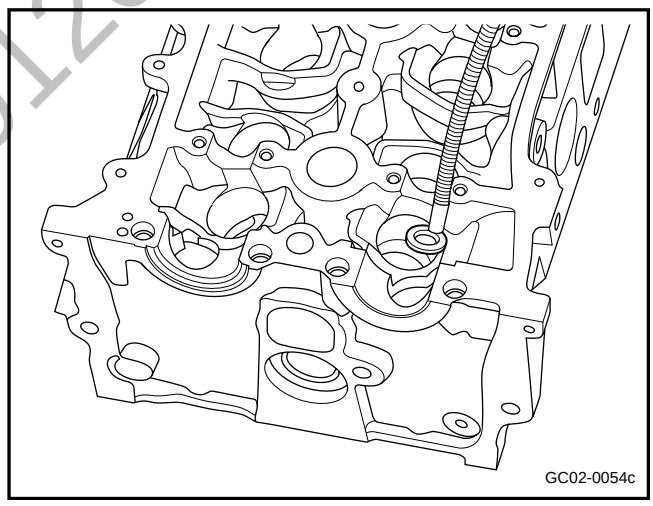


20. Remove the cylinder hood bolts.

Note: Due to confined space, cylinder head bolts and bolt gaskets can not be removed together.



21. Remove the cylinder hood bolt gasket with a magnetic stick.



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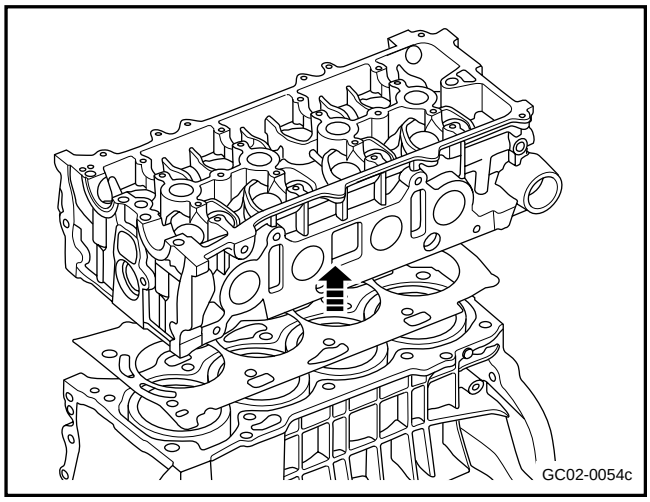
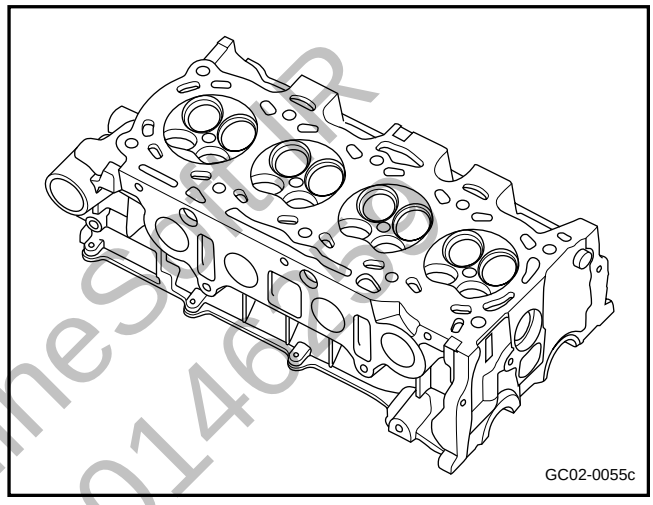
22. Dismantle the cylinder hood assembly.

23. Dismantle the cylinder head gasket component.



Installation Procedure:

1. Clean the seal surface of the cylinder hood and engine block.

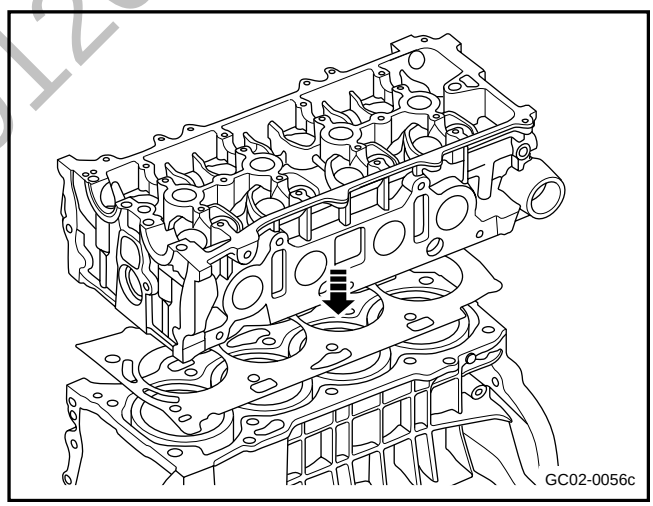


2. Install cylinder head gasket components.

Note: Cylinder head gasket is a single used item and must be replaced with a new component.

3. Install cylinder head assembly.

4. Install the cylinder hood gasket bolt gaskets.



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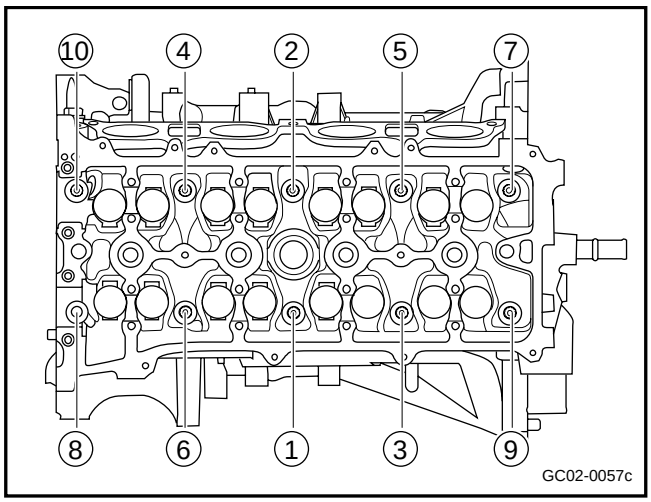
5. Install and tighten the cylinder hood bolts, according to the sequence in the graph.



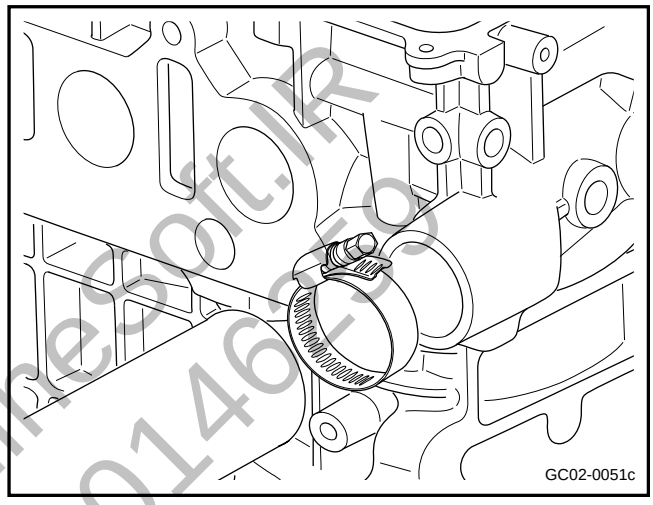
Torque

First31-39N . m(Metric)

Second 68-72N . m(Metric)

Third time 87-93N.m (Metric)

6. Install the warm water pipe for the heater tank.
7. Install the radiator inlet and outlet pipes.
8. Install camshaft.
9. Install the VVT solenoid valve.
10. Install the camshaft position sensor.
11. Install the engine coolant temperature sensor wiring harness connector.
12. Install the fuel distributing pipe assembly.
13. Install timing chain
14. Install the timing chain cover.
15. Install the drive belt.
16. Install the cylinder hood cover.
17. Install the ignition coil and ignition wire.
18. Install the exhaust manifold.
19. Install the intake manifold assembly.
20. Install the throttle body.
21. Fill the engine coolant.
22. Install the plastic shield of engine.
23. Connect battery negative cable.



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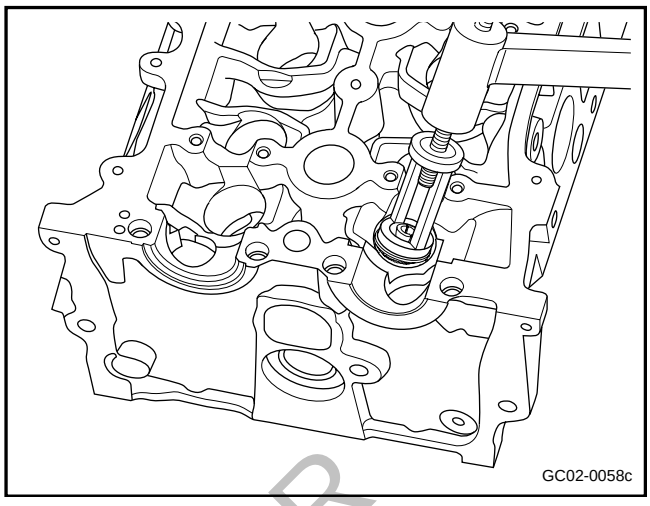
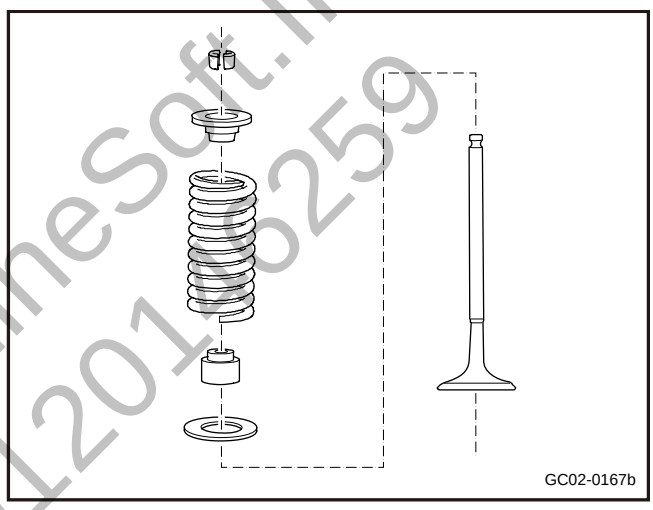
2.6.8.15 Cylinder Hood Assembly Disassembly and Assembly

Dismantlement Procedure

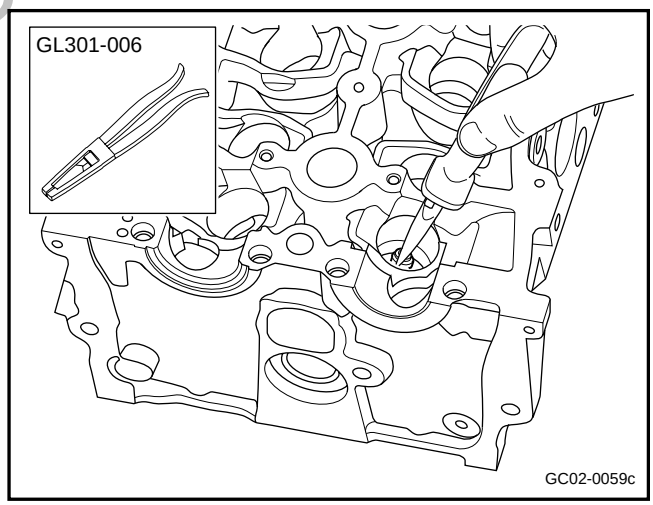
1. Refer to 2.6.8.14 “Replacement of Cylinder Hood Assembly” to dismantle the cylinder hood assembly.
2. Dismantle the valve Lifter.
3. Use a special tool to compress the valve springs.



4. Remove the valve locking plate with a magnetic stick.
5. Remove the special tools and remove the valve spring seat.
6. Remove the valve spring.
7. Remove the valve spring pads with a magnetic stick.
8. Dismantle the valve, mark the original position of the valve in order to re-install.



9. Dismantle the valve seals with the special tool GL301-006.



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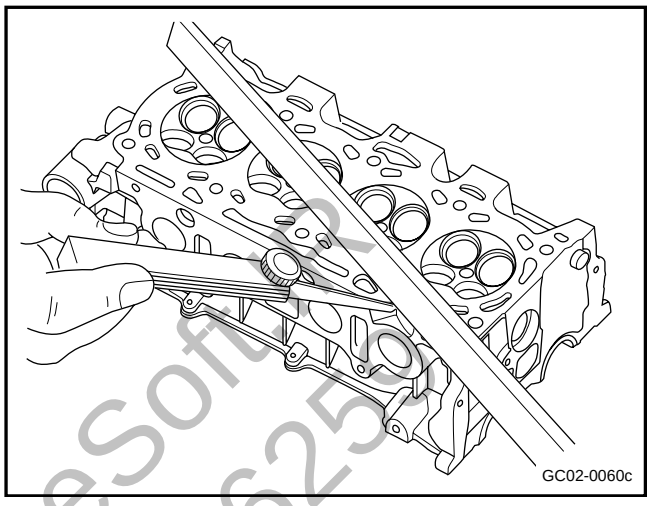
Cleaning for check:

1. Clean the contacting surface with the cylinder gasket.
2. Clean the mating surface with the cylinder hood cover.
3. Inspect and confirm that the cylinder hood and cylinder seal gasket contacting surface has no scratches.
4. Inspect and confirm that the cylinder seal gasket contacting surface has no leakage or channeling gas.
5. Inspect whether there are cracks on the cylinder hood.
6. Refer to 2.6.1.2 "Engine Mechanical System Specification" to measure the height of the cylinder hood within the measurement allowance. If the height is lower than the standard value, replace the cylinder hood.

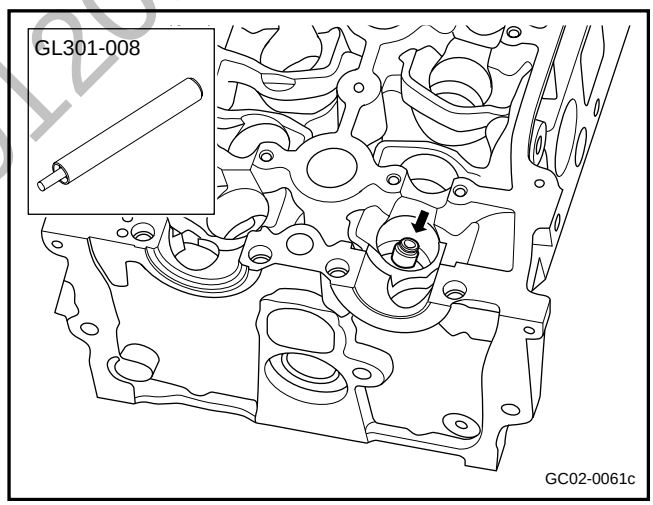


Standard Value: 128 . 9mm

7. Inspect and confirm that the sealing surface has no distortion and warping and the cylinder hood sealing surface flatness must be 0.04 mm.
8. Inspect and confirm that valve seat ring has no excessive wear and burnt places.

Installation Procedure:

1. Use a special tool GL301-008 to install the special valve seals.
2. Install the valves.
3. Install the valve spring pads.
4. Install the valve springs.
5. Install the valve spring seat.



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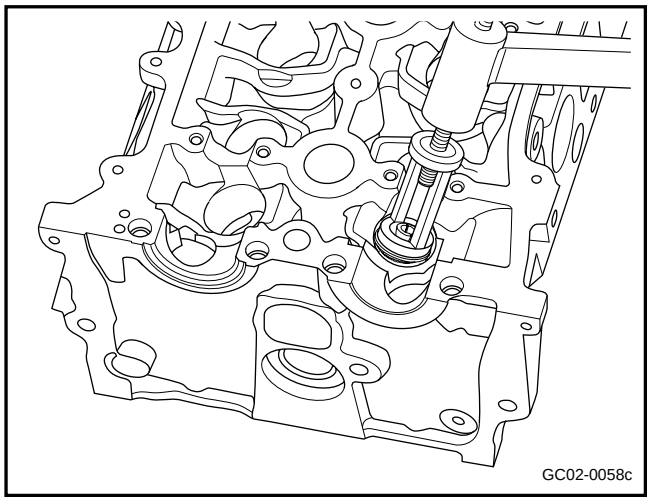
6. Use a special tool to compress the valve springs and install the valve spring locking pieces.

7. Confirm locking pieces is in place. slowly remove the special tool with a wood hammer gently knock the valve, so that the valve is in place.

Warning: Do not apply excessive force, otherwise the valve spring might pop up and cause personal injury.

8. Install the valve lifter.

9. Install the cylinder hood assembly.



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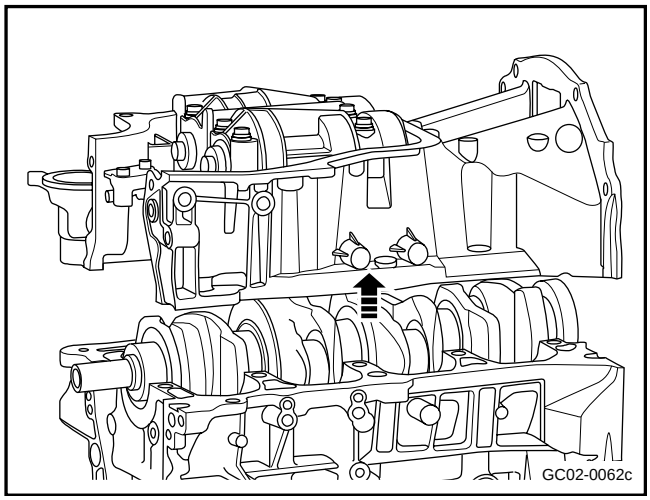
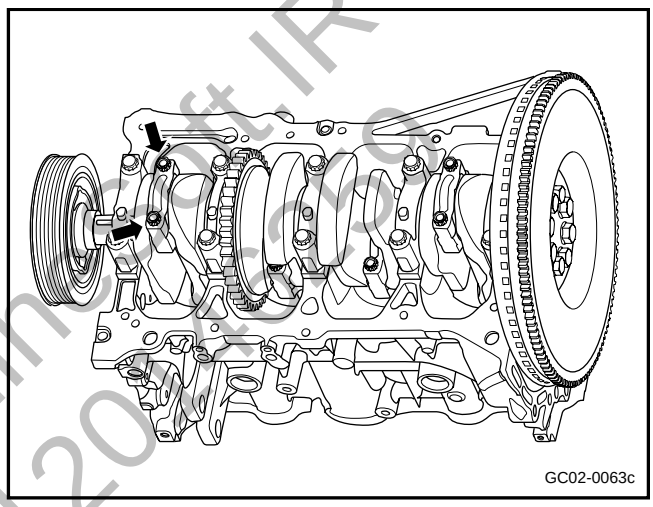
2.6.8.16 Replacement of Piston, Connecting Rod and Connecting Rod Bearing

Dismantlement Procedure

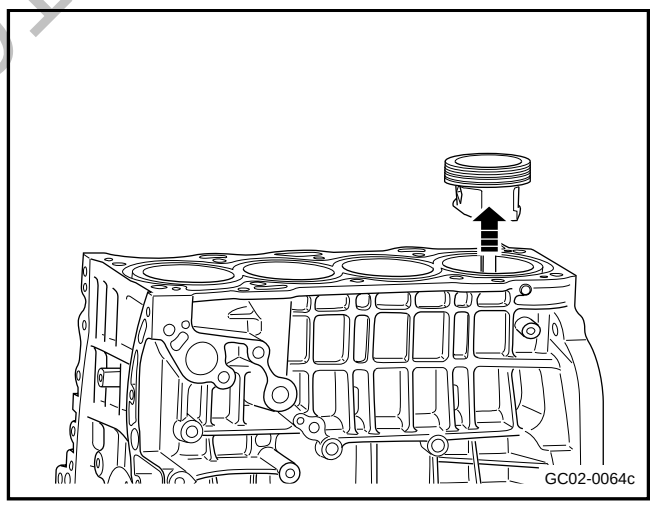
1. Dismantle the engine. Refer to 2.6.8.13 Replacement of Engine.
2. Refer to 2.6.8.14 "Replacement of Cylinder Hood Assembly" to dismantle the cylinder hood.
3. Dismantle oil pan, refer to 2.9.8.3 Replacement of Oil Pan.
4. Dismantle the crankcase.



5. Rotate the crankshaft, so that the cylinder NO.1 and 4 are at BDC positions. Dismantle the cylinder NO.1 rod bearing cap bolts.
6. Hold the connecting rod bolts and take out the Cylinder #1 connecting rode bearing cap and mark the Cylinder #1 position on the bearing cap.



7. Drive #1 cylinder piston and connecting rod assembly with a wooden stick and mark the position of #1 cylinder on the piston and connecting rod assembly.
8. Use the same method to dismantle the piston connecting rod assemblies of cylinders No. 2, 3 and 4 respectively.



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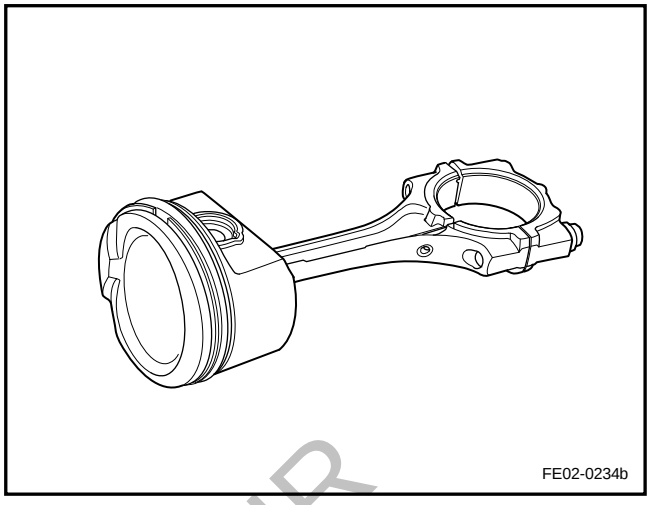
Carry out the following inspection procedures prior to the installation of the piston.

1. Inspect whether the rod is bent or distorted. If the rod is bent or distorted, replace the connecting rod.

Cross degree: 0.03 (basic length range of 100mm)

Distortion: 0.05 (Basic length range of 100 mm)



2. Inspect the connecting rod bearings.
3. Inspect whether the bottom rod is worn.
4. Inspect whether the connecting rod upper end is scratched.
5. Inspect whether there is the crankshaft connecting rod bearing journal wear and tear.
6. Inspect whether the piston is scratched, cracked and worn.
7. Use the caliper to measure the piston pin-hole diameter.

Standard piston pin-hole diameter:

Group mark	Piston pin-hole diameter (mm)
A	22.007. 22.010
B	22.010. 22.013

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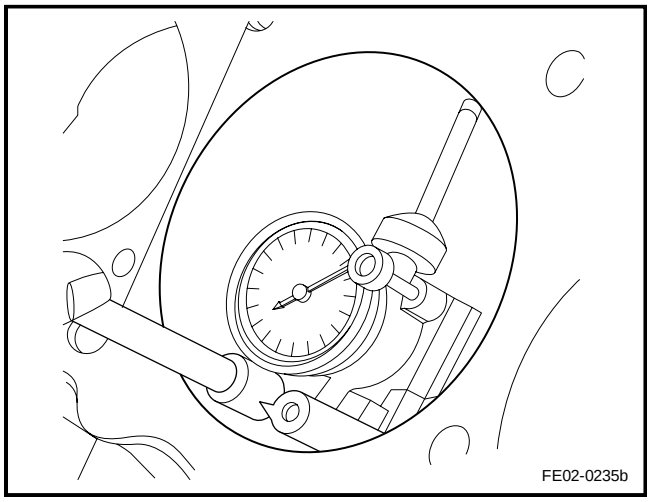
8. Use the micrometer to measure the piston pin diameter.

Standard piston pin diameter:

Group mark	Piston pin diameter (mm)
A	22.004. 22.007
B	22.007. 22.010



9. Inspect the fit clearance between piston pin-hole and piston pin.

Standard value :0 ～ 0 . 006mm(Metric)

Note: If the clearance does not meet

the requirement, replace the piston pin, and replace the piston if necessary.

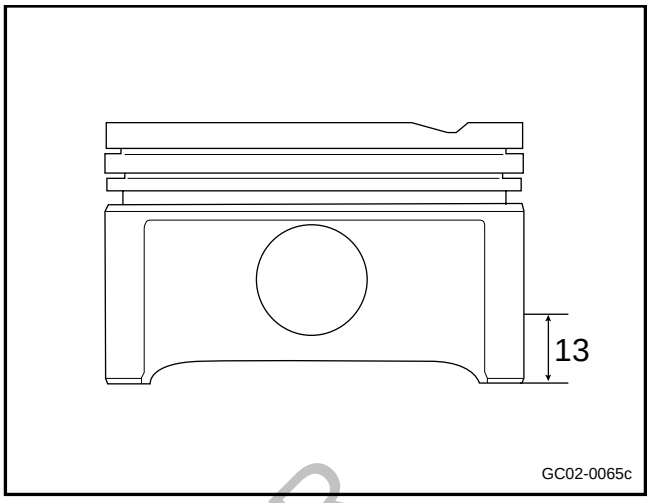
11. Inspect interference fit between piston pin and connecting rod.

12. Inspect engine cylinder block hole diameter.

Standard Value: φ$85^{+0.015}_{0}$ (Metric)

13. Measure the piston diameter with the micrometer perpendicular to the piston pin-hole with a distance to the bottom of the piston of 13 mm.

Standard Value: φ77.75±0.009



14. Inspect the cylinder fit clearance, and subtract the measured piston's diameter with the measured cylinder hole's diameter.

Standard clearance: 0.0275mm~0.0575mm

Note: If the clearance exceeds the range, replace the piston. If necessary, replace the cylinder block.

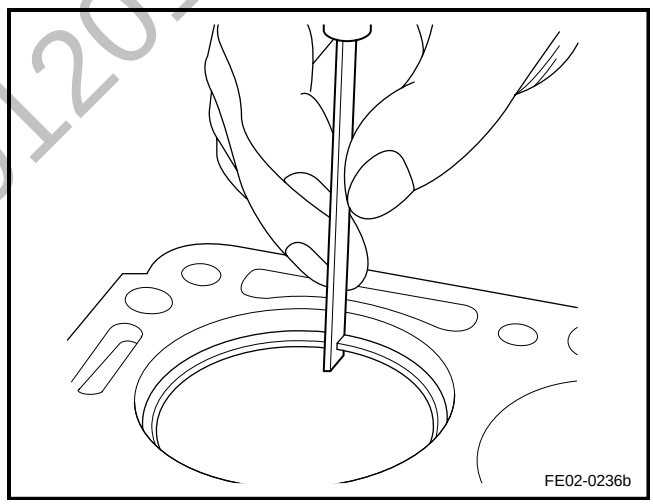
(To replace the piston, the diameter group No. printed on the piston pin and the piston pin-hole diameter group No. printed on the piston can be used to choose the correct piston; the piston diameter group No. = piston pin-hole diameter group No. on the piston)

15. Select a new set of piston rings, use a gap regulator to measure piston ring end gap.

Oil Ring End Clearance: 0.20mm～0.40mm (Metric)

Second Compression Ring End Clearance: 0.30mm ～ 0.50mm (Metric)

The first compression ring end gap: 0.20mm-0.40mm (Metric); 16. Check the fit clearance of connecting rod bearing bush.



(a) Place one plastic gap gauge on the neck of the connecting rode shaft.

(b) Install the connecting rode cap (connecting rode cap's frontward mark should face to the front end of the engine), and tighten the connecting rode bolts as per the specified torque.

(c) Dismantle the connecting rod cap

(d) Use the plastic gap gauge to measure the maximum width along the clearance

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Standard Value: 0 . 018mm～0 . 044 mm (Metric) . Maximum: 0 . 063mm

If the clearance exceeds the maximum value range, replace the connecting rode bushing. To replace the connecting rode bushing, detect the group No. of the large end of the connecting rode printed on the body of the connecting rode with the group No. of the connecting rode Journal printed on the crankshaft to choose the correct connecting rode bushing. (Group No. on the connecting rode cap + group No. of the connecting rode Journal on the crankshaft = connecting rode bushing No. to be used)

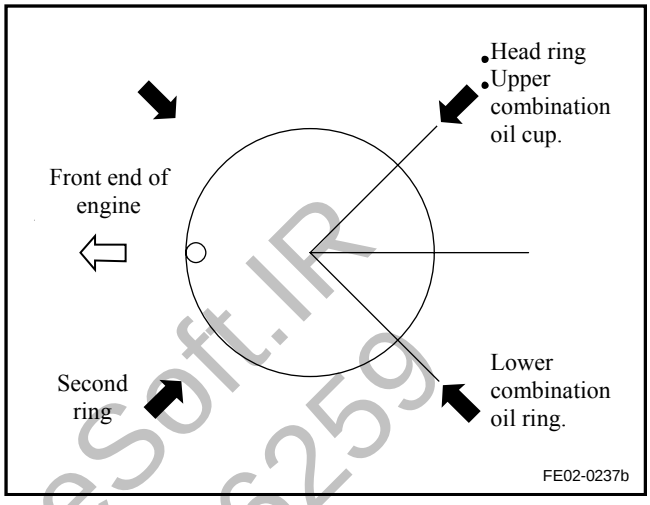
Installation Procedure:

1. install piston rings.

Important precaution : Note when installing the piston rings, do not expand too much, otherwise it will break the piston rings.

2. Install the piston rings to the location as shown in the graphic.

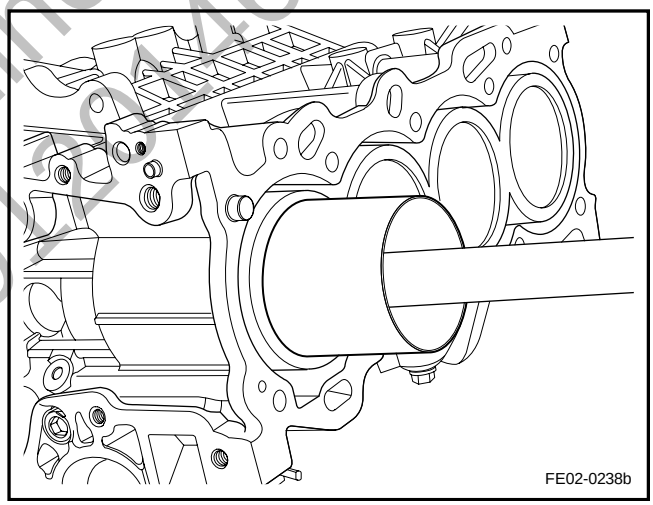
Important precaution : Oil ring opening can not be parallel to the piston pin axis.



3. Lubricate the cylinder wall with the new engine lubrication oil.

4. Lubricating piston of new engine lubricating oil should be used. Use special tool and wooden handle to install cylinder 1 piston connecting rod components marked with position of cylinder.

Note: The dot mark on the piston top surface should face to the engine front end. During installation, pay attention to the lower end of the connecting rod, avoiding damage due to hitting the crank journal.



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5. Install the cylinder No.1 connecting rod bearing cap marked with cylinder No.1 location.

Note: The dot mark on the bearing cap should face the engine front end.

6. Install and tighten cylinder No.1 connecting rod bearing cap bolts.

Torque: 50～55 N.M (Metric)

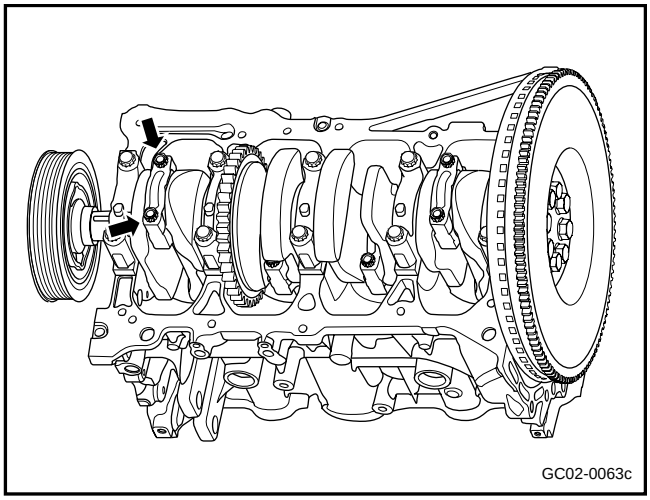
36 . 8～40 . 6 lb-ft (English system)

7. Use the same method to install piston connecting rod components for the rest three cylinders.

8. Install the crankshaft body.

9. Install the oil pan.

10. Install the cylinder hood.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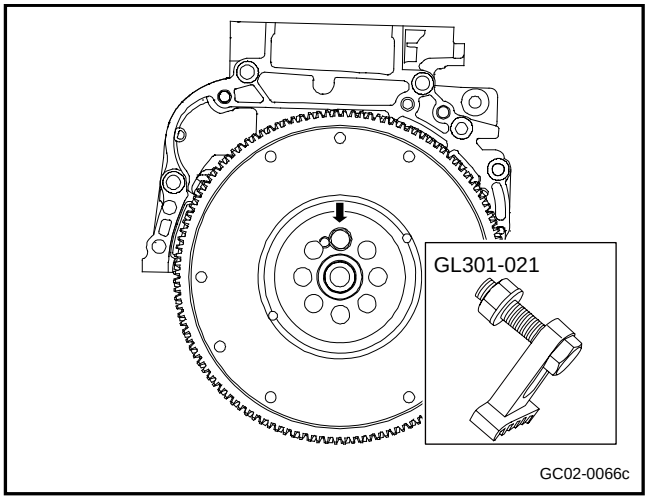
2.6.8.17 Replacement of Flywheel

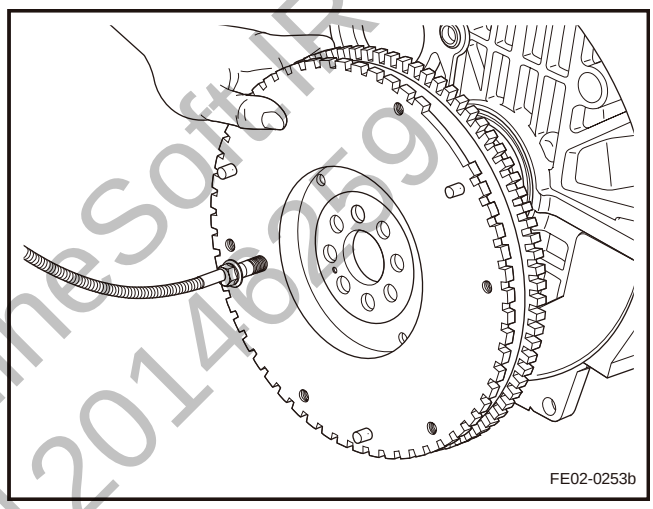
Dismantlement Procedure

1. Use the dedicated tools to fix the flywheel
2. Dismantle the fixing bolts of flywheel, leaving the last bolt at the top of the flywheel in order to stabilize the flywheel.



3. Hold the engine flywheel and remove the last bolt.

Warning: Be careful when remove the last bolt to avoid the flywheel drop.



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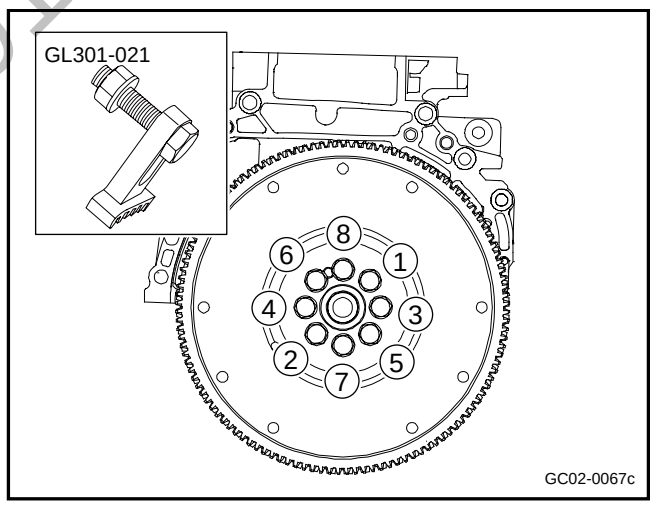
Installation Procedure:

1. Install new bolts to the engine flywheel, but do not tighten at this stage.

Note: Sear the thread locking adhesives to the thread surfaces of the fly wheel bolts.

2. Use the dedicated tools to fix the flywheel.
3. Install the engine flywheel bolts and tighten the eight bolts evenly according to the sequence in the graph.

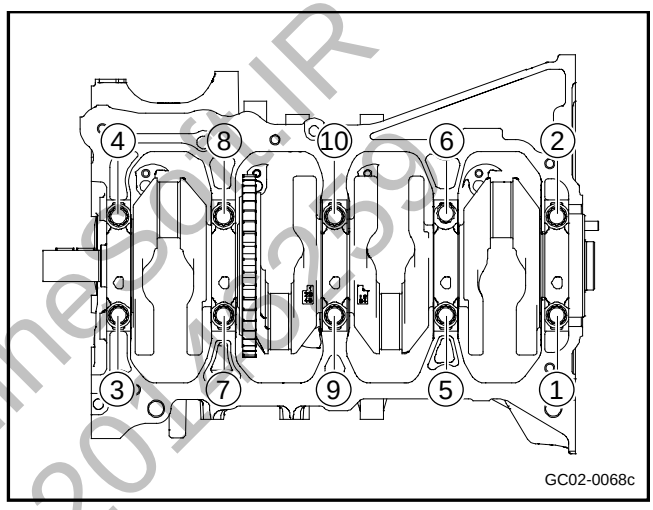


Torque: 100±5N·m

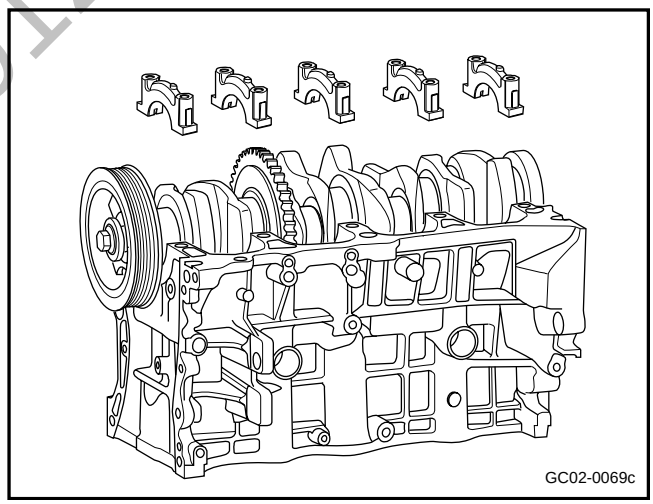
2.6.8.18 Replacement of Crankshaft

Dismantlement Procedure

1. Dismantle the engine. Refer to 2.6.8.13 Replacement of Engine.
2. Refer to 3.3.6.3 "Replacement of Gearbox Assembly" to dismantle the gearbox assembly.
3. Refer to 2.6.8.17 "Replacement of Flywheel" to dismantle the flywheel.
4. Dismantle the crankshaft rear oil seal.
5. Refer to 2.6.8.14 "Replacement of Cylinder Hood Assembly" to dismantle the cylinder hood.
6. Refer to 2.9.8.1 "Replacement of Oil Pump" to dismantle the oil pump.
7. Dismantle oil pan, refer to 2.9.8.3 Replacement of Oil Pan.
8. Refer to 2.6.8.16 "Replacement of Piston Connecting Rod and Bearing" to dismantle the piston connecting rod and bearing.
9. Dismantle the mounting bolts of oil filter.
10. Evenly loosen and dismantle the 10 main bearing cap bolts from both sides to the center, as the sequence shown in the graph.



11. Dismantle the main bearing cap.



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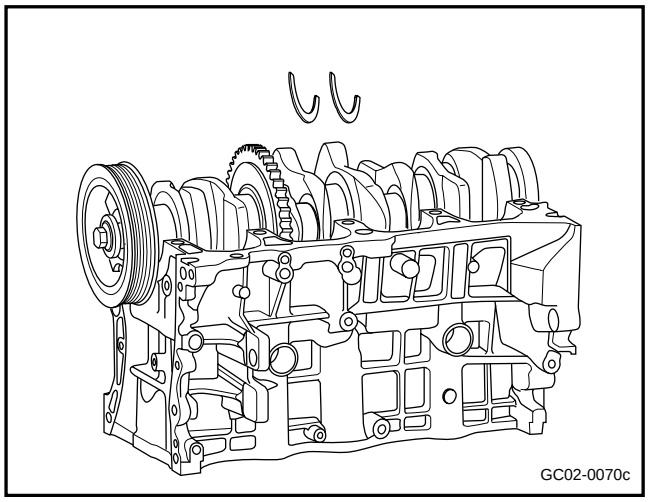
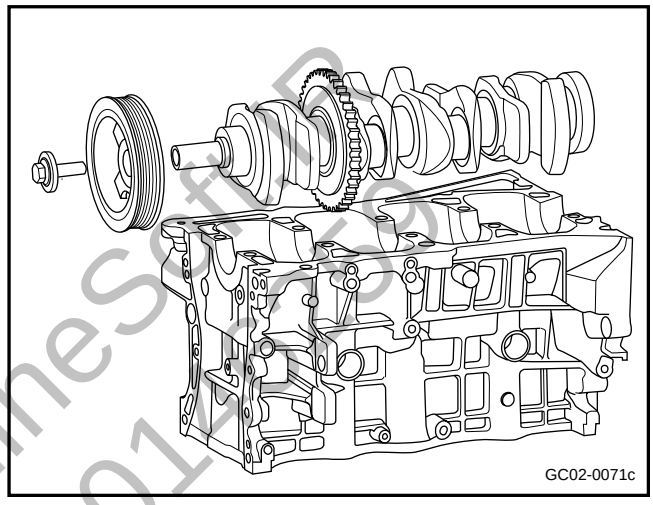
12. Dismantle the thrust film at the third main bearing support.

Note: Rotate the crankshaft during removing, so that the thrust film can exit together to facilitate the removal.


GC02-0070c

13. Dismantle the crankshaft.
14. Dismantle the crankshaft vibration damping belt pulley.
15. Dismantle the crankcase main bearing (upper).
16. Remove the crankcase main bearing from the main bearing cap (lower)

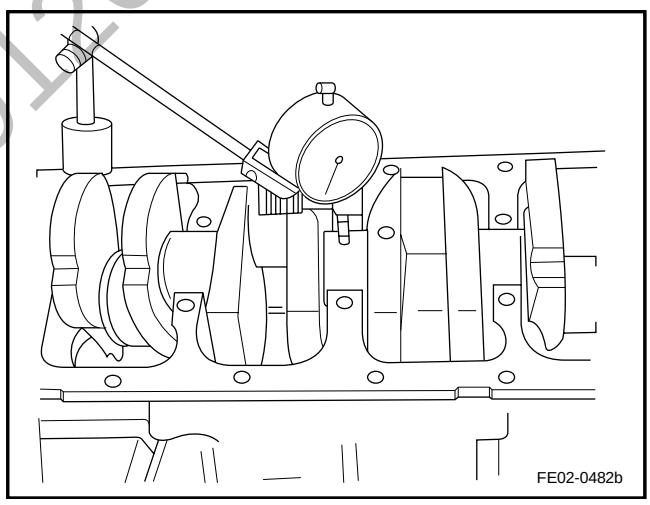

GC02-0071c

Crankshaft inspection, the crankshaft bearing clearance matching inspection procedure:

1. Use the dial indicator and V Block to measure the radial runout at the crankshaft main Journal.

The maximum runout should be: 0.02, if the runout is under the criterion, replace the crankshaft.

2. Inspect the crankshaft thrust clearance.


FE02-0482b

(a) Install the crankshaft.

(b) Install the main bearing cap with lower shaft bushing and the main bearing bolts, making the frontal mark on the main bearing cap facing towards the engine front end.

(c) Use a screwdriver to pry the crankshaft fore and after, and measure the thrust clearance with the dial indicator at the same time.

Standard Thrust Clearance: 0.04mm～0.24mm (Metric)

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If the thrust clearance does not meet the requirement, thrust film should be replaced in set.

3. Inspect the fit clearance of the crankshaft's main shaft bushing.

   (a) Inspect for the corrosive pitting and scratching on the main shaft bushing and main Journal.

   (b) Install the crankshaft's main bearing upper shaft bushing (refer to the "Installation" section)

   (c) Place the crankshaft on the cylinder block.

   (d) Place one plastic gap gauge over each Journal.

   (e) Install main bearing cover with bushing on cylinder body, and make the forward mark of main bearing cover to the front of engine.

   Tighten the main bearing cover bolt to the specified torque (see Installation).

   Do not turn the crankshaft)

   (f) Dismantle the main bearing cap (refer to the "Dismantle" section)

   (g) Use the plastic gap gauge to measure the maximum width along the clearance.

Standard Clearance: 0.016mm~0.034mm (Metric)

If the clearance exceeds this range, replace the main shaft bushing of this crankshaft. If necessary, replace the crankshaft.

To replace the shaft bushing, the main shaft bushing of the same gauge should be chosen. If the gauge of the main shaft bushing can not be identified, the sum of the numbers printed on the cylinder block and crankshaft is the correct main shaft bushing gauge. The calculated gauge can then be used to choose a new main shaft bushing. (Cylinder block main bearing aperture group No. + crankshaft)

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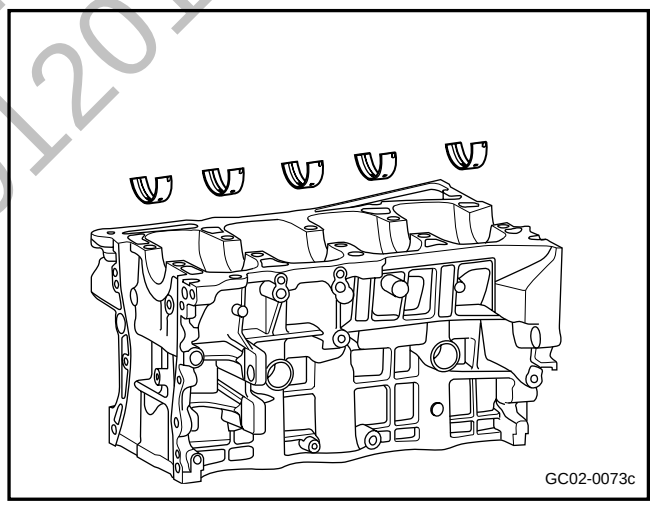
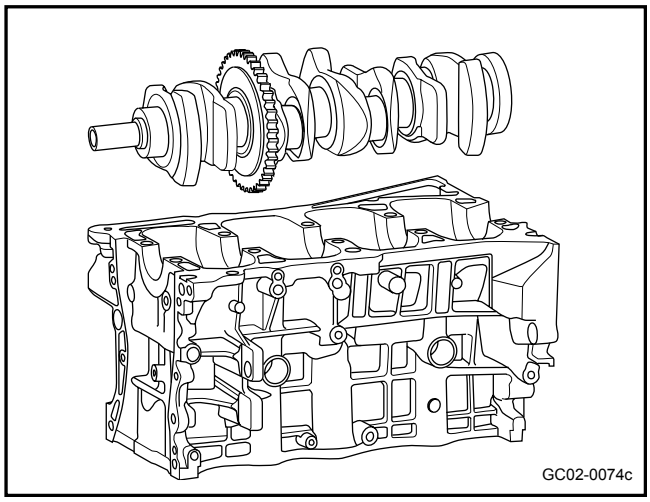
Installation Procedure:

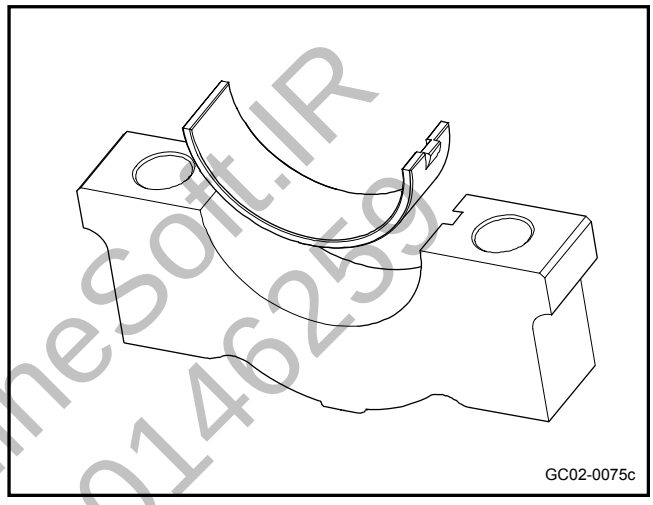
1. Clean all the relevant components.
2. Apply a small amount of engine lubrication oil to the crankshaft bearing.
3. Install the chosen crankshaft main bearing (install the upper shaft bushing with oil sump on the cylinder block)



4. Install the crankshaft.
5. Install the crankshaft thrust film under the bearing #3 of the cylinder block with the grooves facing outside.
6. Inspect the crankshaft axial clearance, to confirm the crankshaft axial clearance is acceptable. Refer to 2.6.1.2 Mechanical System Specification.


GC02-0074c

7. Apply a small amount of engine oil to the crankshaft bearing cap.
8. Install the crankshaft main bearing (lower) to the crankshaft bearing cap.
9. Install the crankshaft bearing cap.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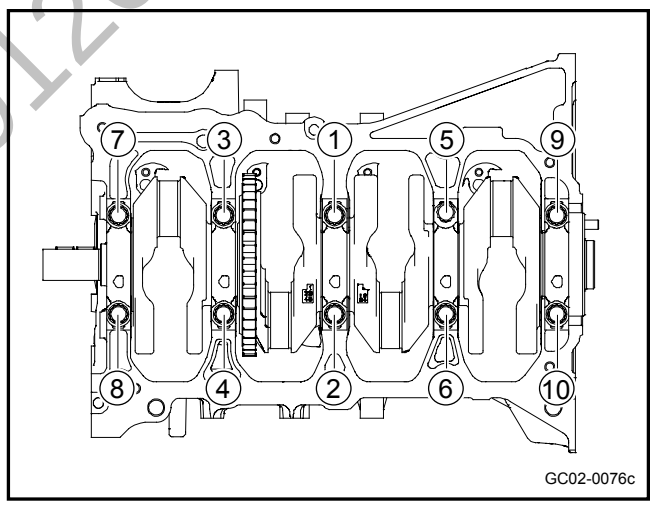
10. Tighten the crankshaft bearing cap retaining bolts according to the sequence shown in the graph.

During the assembly of the cylinder components and the main bearing cap, the main bearing cap bolts should be tightened in three steps with the first tightened torque of (20±2) N·m, the second tightened torque of (40±2) N·m and the third tightened torque of (60±3) N·m.



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11. Install the mounting bolts of oil filter.

    Torque: 20N.m or 14.8lb-ft

12. Install the crankshaft damping belt plate.
13. Install pistons, connecting rods and bearings.
14. Install the oil pan.

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15. Install the oil pan.
16. Install the cylinder hood.
17. Install the crankshaft rear oil seal.
18. Install the flywheel.
19. Install the gearbox.
20. Install the engine assembly.

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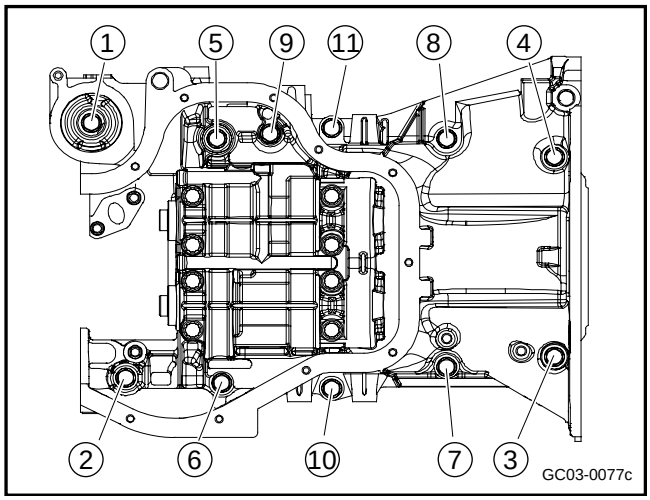
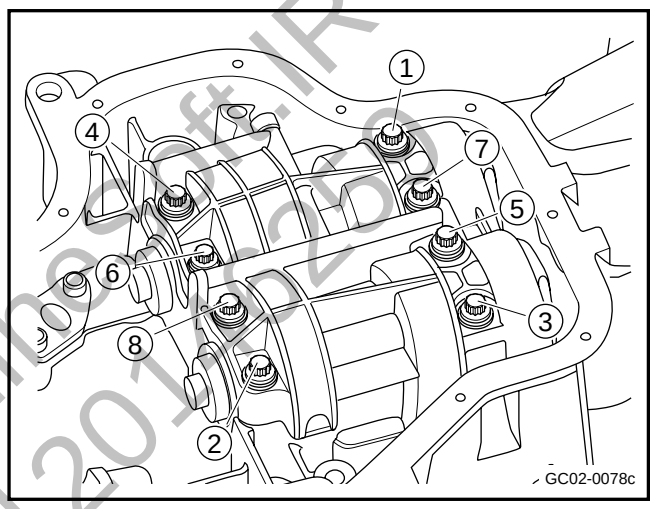
2.6.8.19 Replacement of Balance Shaft

Dismantlement Procedure

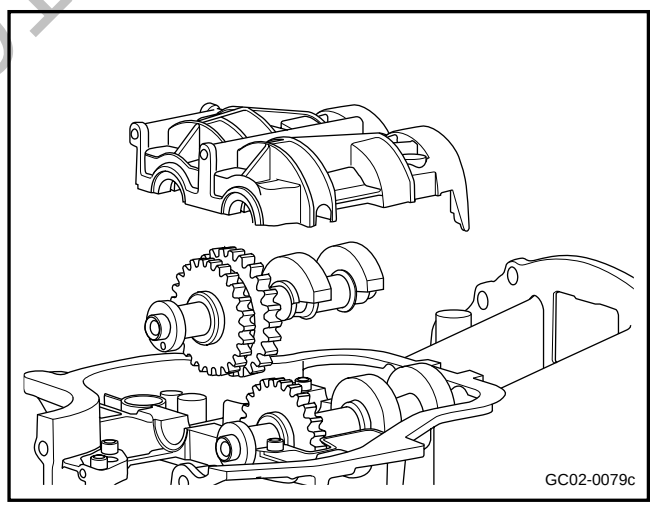
1. Dismantle the engine. Refer to 2.6.8.13 Replacement of Engine.
2. Refer to 3.3.6.3 "Replacement of Gearbox Assembly" to dismantle the gearbox assembly.
3. Dismantle oil pan, refer to 2.9.8.3 Replacement of Oil Pan.
4. Dismantle the fixing bolts of crankcase according to the sequence in the graph.
5. Dismantle the crankcase.



6. Dismantle the fixing bolts of balance shaft bearing cover according to the sequence in the graph.



7. Dismantle balance shaft bearing cover.
8. Dismantle balance shaft component I.



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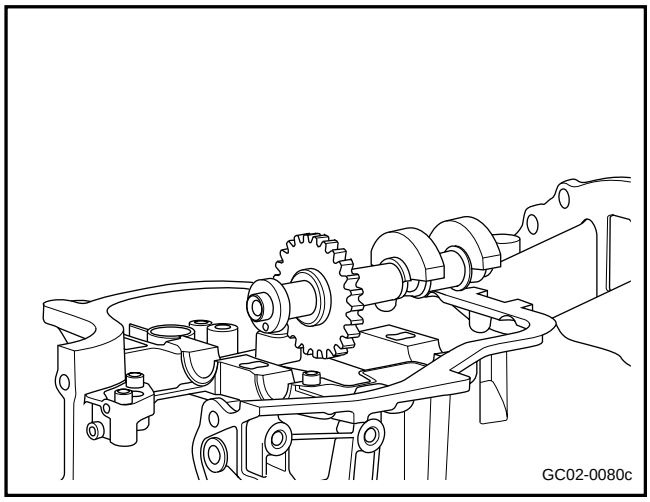
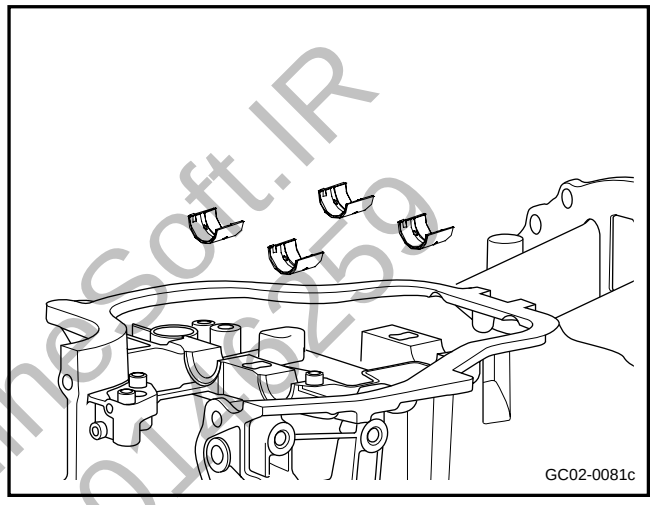
9. Dismantle balance shaft component II.



10. Dismantle the balance shaft bearing.



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Inspect balance shaft thrust clearance and balance clearance:

1. Inspect balance shaft thrust clearance

(a) Install the balance shaft (Refer to the "Balance Shaft Installation")

(b) During moving the balance shaft fore and after, the dial indicator can be used to measure the thrust clearance.

Standard thrust clearance: 0.05mm～0.09mm

If the thrust clearance can not meet the requirement, the balance shaft housing and bushing should be replaced; If necessary, replace the balance shaft.

2. Inspect the balance clearance

(a) Clean each shaft bushing and neck.

(b) Inspect the corrosive pitting and scratching on each shaft bushing and Journal. If damaged, replace the shaft bushing. If necessary, replace the balance shaft.

(c) Place No.1 and No.2 balance shaft on the crankcase.

(d) Place one plastic gap gauge over each Journal.

(e) Install the balance shaft housing (refer to the "Installation" section).

Remarks: Do not rotate the balance shaft.

(f) Dismantle the balance shaft (refer to the "Dismantle" section)

(g) Use the plastic gap gauge to measure the maximum width along the clearance.

Standard Clearance:

0.016mm～0.028mm

Remarks: Totally dismantle the plastic gap gauge after measurement.

If the clearance does not meet the requirement, replace the shaft bushing. If necessary, replace the balance shaft.

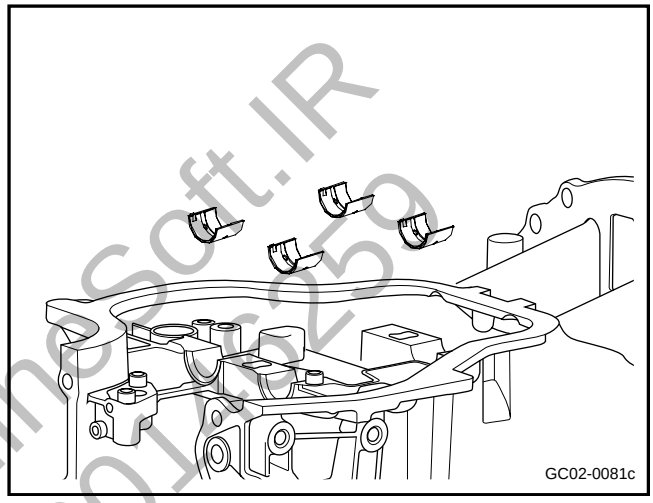
(h) To replace the bearing, the shaft bushing of the same gauge should be used. If the gauge of the balance shaft bushing cannot be identified, the group No. of the Journal aperture dimension of the balance shaft housing and the balance shaft bushing group No. can be used to choose the correct balance shaft bushing. (Group No. of the Journal aperture dimension of the balance shaft housing = Balance shaft bushing group No.)

Installation Procedure:

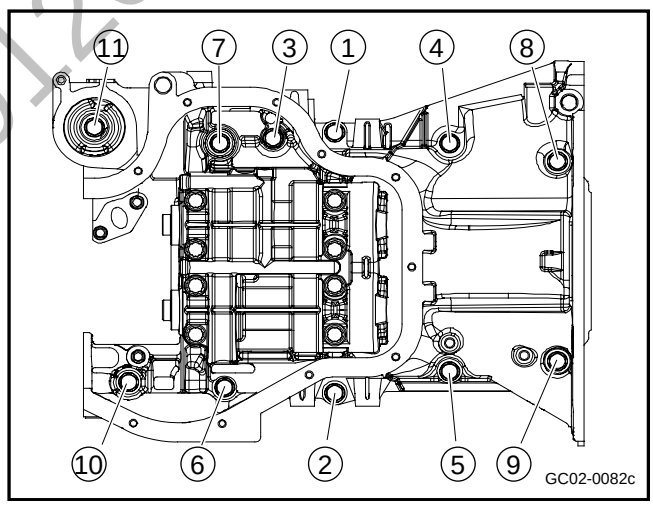
1. Smear the oil on the internal surface of the balance bearing.

Note: Do not smear the oil on the back surface and other contact surfaces of the bearing.

2. Install the balance shaft bearing to the crankshaft housing.



3. Install crankshaft case body . And tighten fixing bolt as per orders in the figure t.



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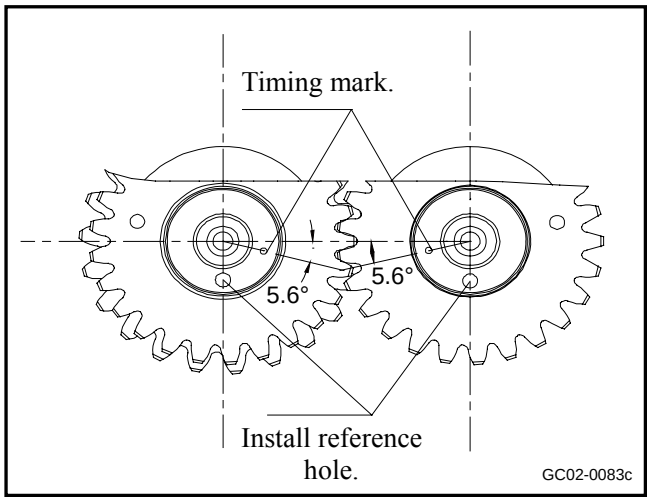
4. Install balance shaft component I.

5. Install balance shaft component II.

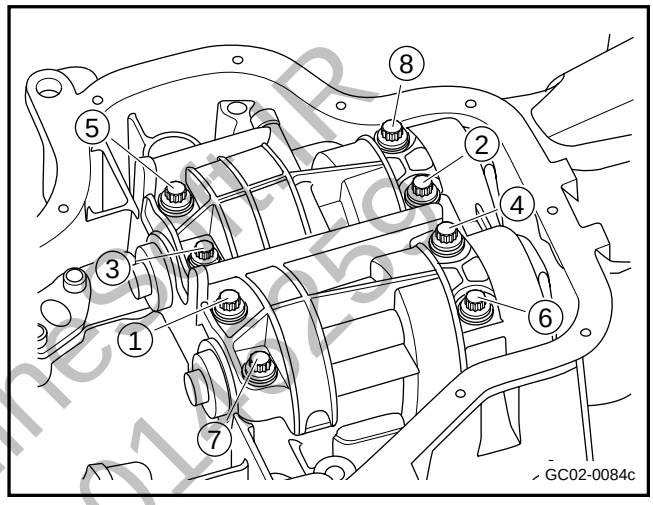
6. Turn crankshaft until the cylinder #1 crank arriving at the bottom.

Note: as shown in the figure, align the No.1 balance shaft and the No.2 balance shaft, so that the mounting hole for reference is located in the vertical plane.

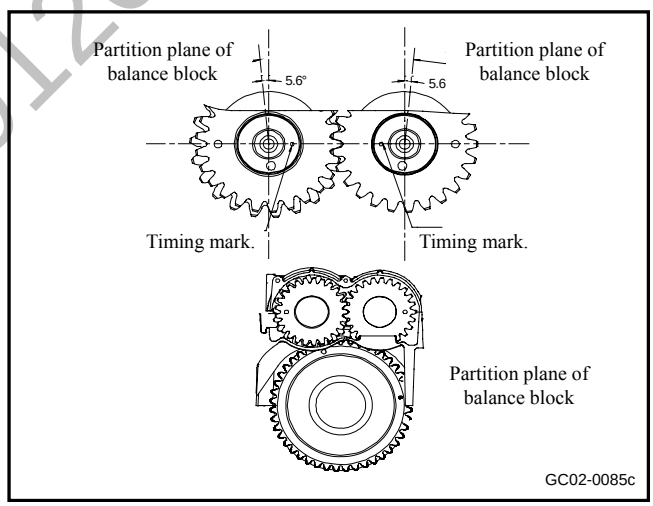


7. Install the balance bearing cover and tighten the bolts by the order shown graph.

Balance bearing cover bolts should be tightened in two steps with the first tighten torque of21.5±2N·m,and the second tighten torque of 38±3N·m。



8. Turn the crankshaft once again to make the crankshaft front end Woodruff key facing toward the top of the engine (at this point, piston of the Cylinder #1 is at the compression TDC position), and then the positional relationship between the crankshaft and the balance shaft is shown as the figure.



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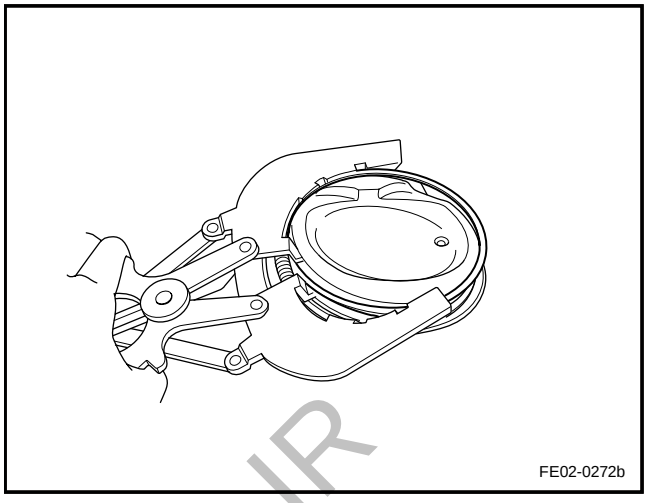
2.6.8.20 Piston Connecting Rod Components Disassembly, Assembly and Inspection

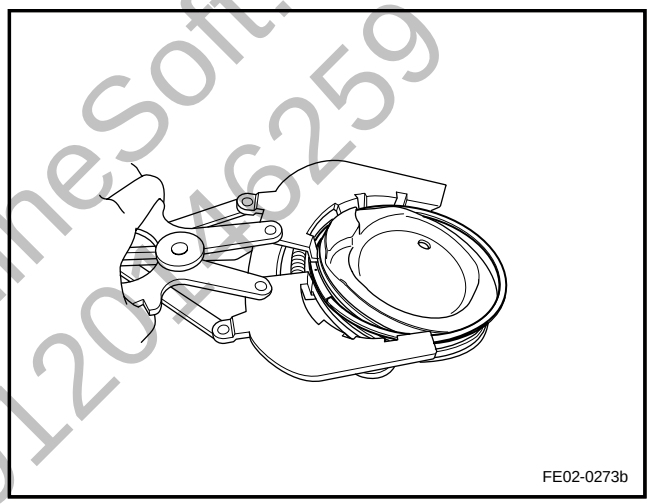
Note: Use the dedicated tools to carry out corresponding removal and installation.

Dismantlement Procedure

1. Dismantle the piston rod components. Refer to 2.6.8.16 Replacement of Piston Connecting Rod and Bearing.
2. Dismantle the first air ring.


FE02-0272b

3. Dismantle the second air ring.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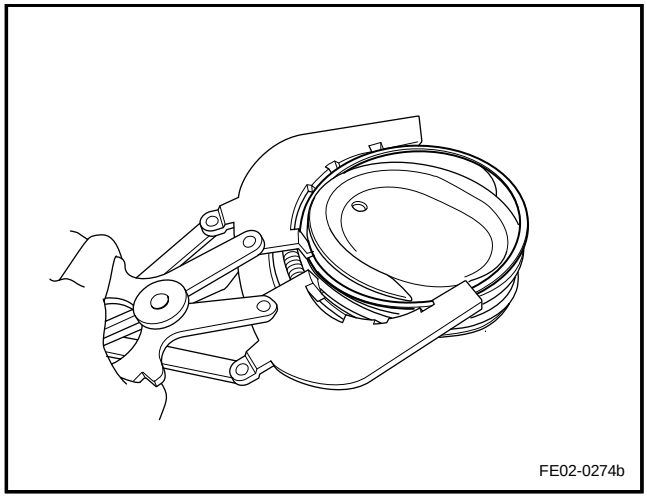
4. Dismantle the oil ring's upper ring combination.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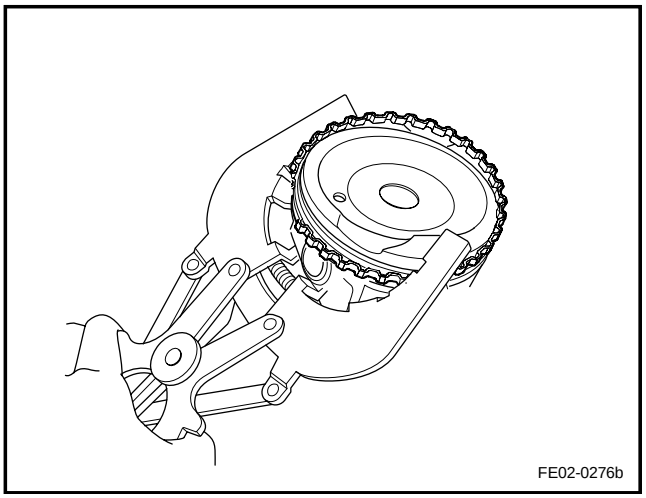
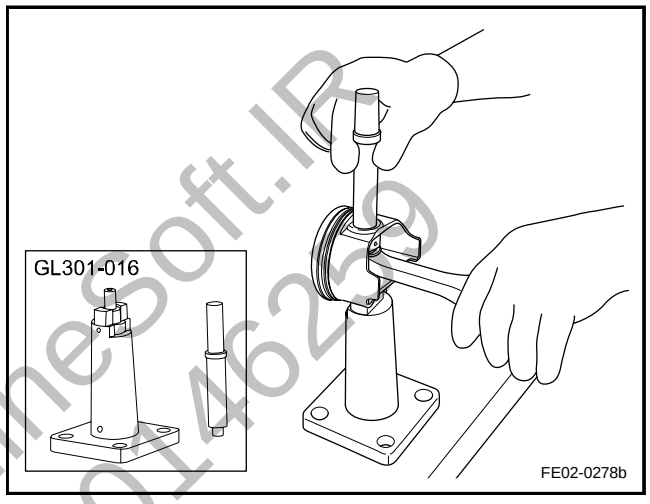
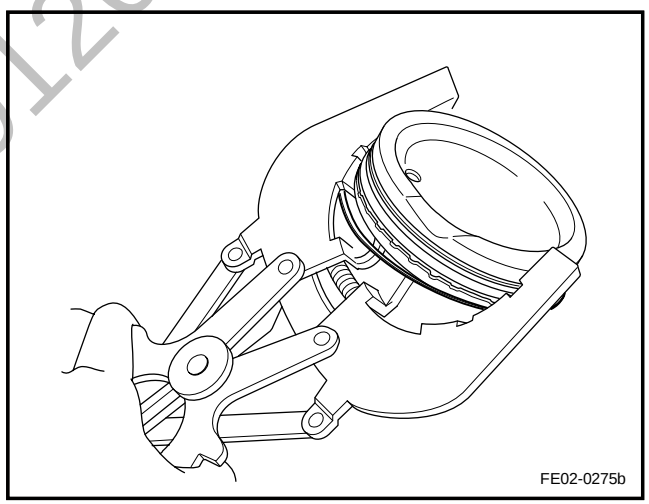
5. Dismantle the oil ring's lower ring combination.



6. Dismantle the lined ring.



7. With a special tool GL301-016, remove the piston pin.



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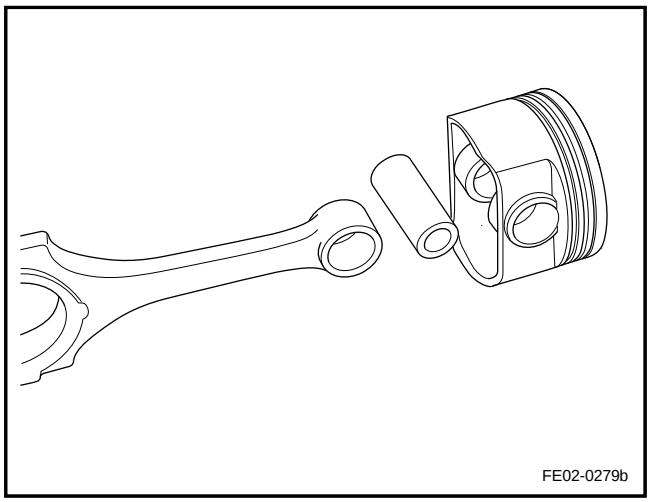
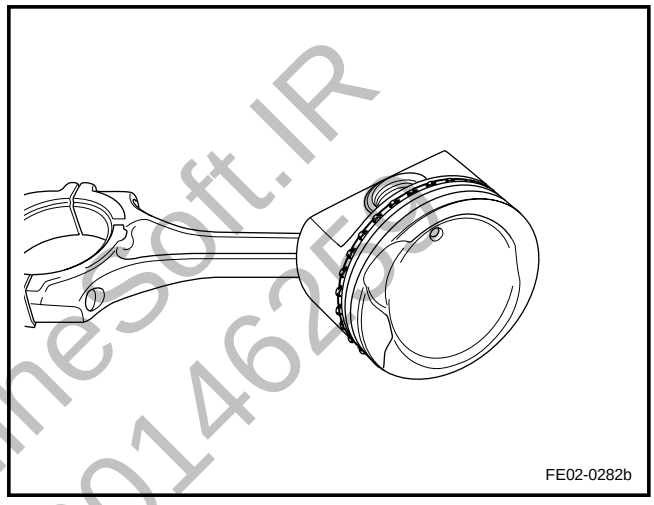
8. Disassemble connecting rod, piston pin and piston are shown in the graph.



Installation Procedure:

1. Install piston pin, connecting rod and piston.

Note: During installation, make the dot on the connecting rod bearing cover facing towards the same direction as the dot mark on the piston.



2. Confirm normal movements between the piston and rod without any interference.
3. Inspect piston pin and connecting rod clearance.

Standard Value

（-0.016）～（-0.033）mm（Metric）

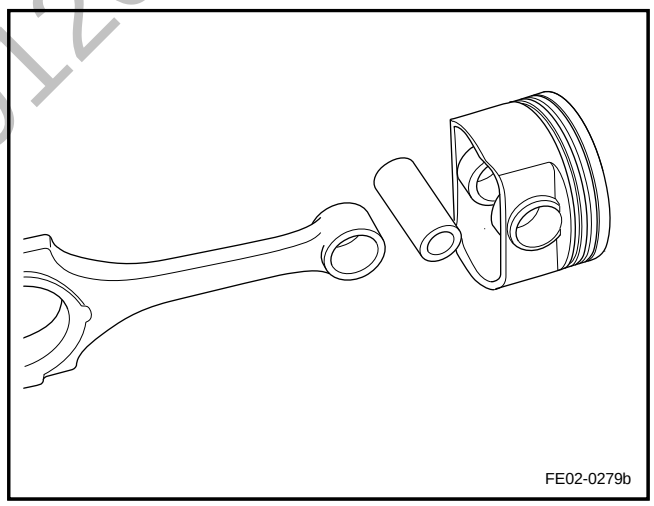
(-0.0006) ～ (-0.0012) in (English system)

4. Inspect the piston and piston pin clearance.

Standard Value

0.0011～0.0018 mm(Metric)

0.0004～-0.0007 in (English system)



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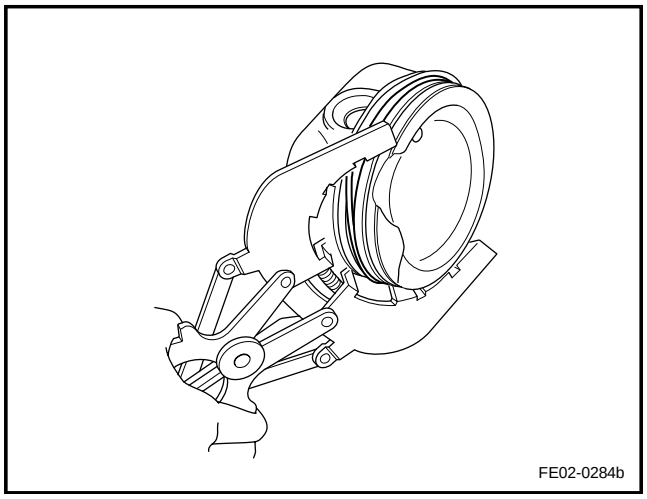
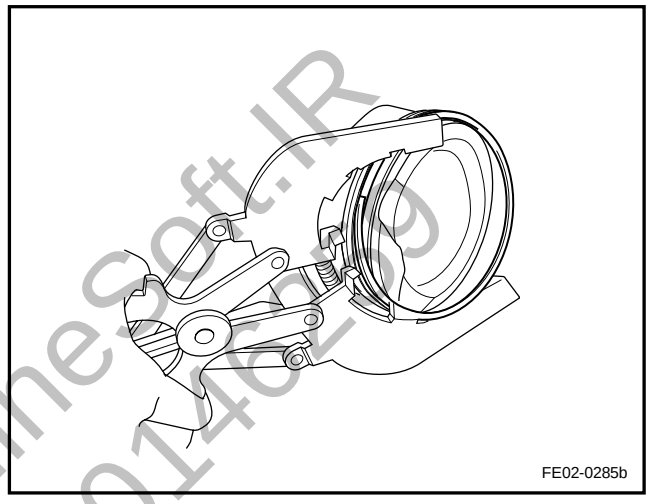
5. Install the oil ring.

6. Install the oil ring's lower ring combination.

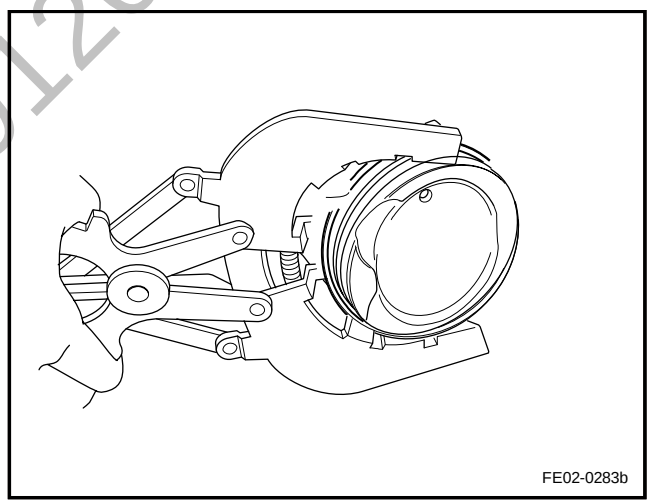


7. Install the oil ring's upper ring combination.



8. Install the second air ring.

Note: The side with marker should face the piston top.



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9. Install first air ring.

Note: The side of the piston ring with marker should face the piston top.

10. Apply the engine oil to the connecting rod bearings and install the connecting rod journal and the bearing cap.

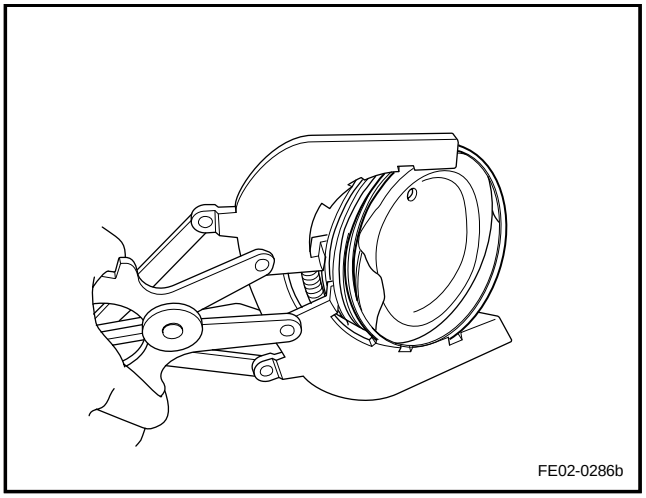
11. Install the connecting rod to the crankshaft. Inspect whether the bearing clearance is acceptable. Refer to 2.6.1.2 "Mechanical System Specification".

Standard Value

0.020～0.044 mm(Metric)

0.0007～0.0017 in (English system)

13. Install and inspect the qualified piston connecting rod components.



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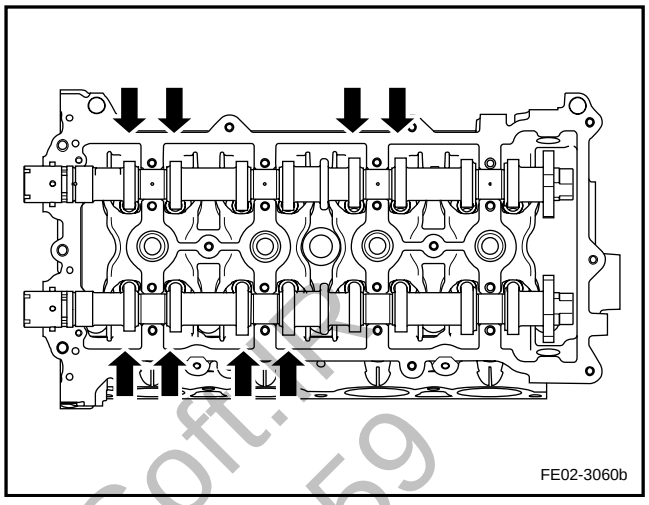
2.6.8.21 Valve Clearance Adjustment

1. Dismantle the plastic shield of engine. Refer to 2.6.8.1 Replacement of Plastic Shield of Engine.
2. Refer to 2.10.7.3 "Replacement of Ignition Coil" to dismantle the ignition coil.
3. Refer to 2.6.8.2 "Replacement of Cylinder Hood Cover" to dismantle the cylinder hood cover.
4. Refer to 2.6.8.9 "Replacement of Timing Chain Shroud" to dismantle the timing chain shroud and rotate the crankshaft making cylinder No.1 at compression TDC position.
5. Inspect valve clearance. Use the plug gage to measure valve clearance value, as arrows shown in the graphic and record the valve location and tolerance that exceeds the tolerance.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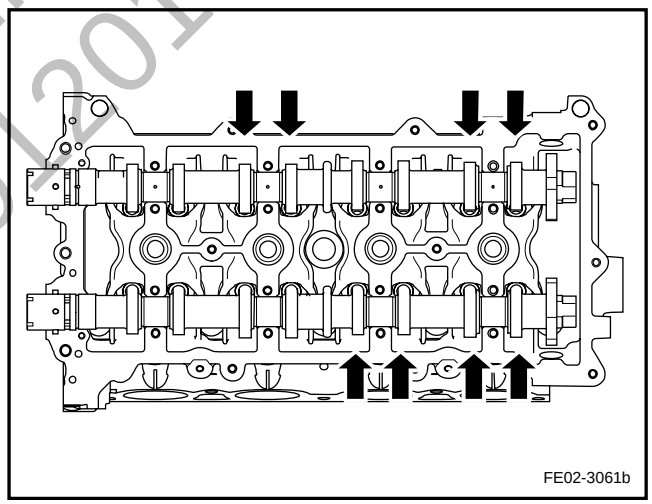
Valve clearance standard value (Cold):

Air intake	0.25±0.03mm
Exhaust:	0.3±0.03mm

6. Rotate the crankshaft one circle (360 °), making the cylinder No. 4 stop at the compression TDC position. Measure the valve clearance as arrow pointed in the graph and record the clearance.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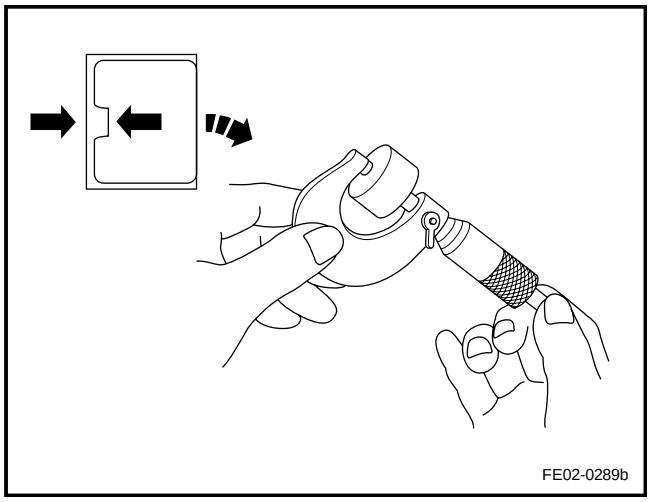
7. Use a jack to support the engine. Dismantle the timing chain. Refer to 2.6.8.10 "Replacement of Timing Chain"

8. Refer to 2.6.8.12 “Replacement of Camshaft” to dismantle the camshaft.

9. Remove the valve lifter that exceeds the tolerances. Use outside diameter micrometer to measure the thickness, according to the following formula calculate the thickness of the new valve lifters.



Intake: A=B+C-0.23 mm(0.01in)

Exhaust: A=B+C-0.32mm(0.13in)

A	Thickness of new valve lifter
B	Thickness of old valve lifter
C	Measured Valve Clearance

10. Selected new valve lifters must be as close as possible to the calculated values. For specifications. Refer to 2.6.1.3 Specification Table for Tappet Rods of Intake and Exhaust Valves for the thickness of the tappet rod of valve.

11. Based on the measurement, according to 2.6.1.4 Selection Table for Tappet Rod of Exhaust Valve, choose the tappet rod of valve to meet the specification.

12. Install intake and exhaust camshafts.

13. Install timing chain

14. Install the timing chain cover.

15. Install the ignition coil.

16. Install the plastic shield of engine.

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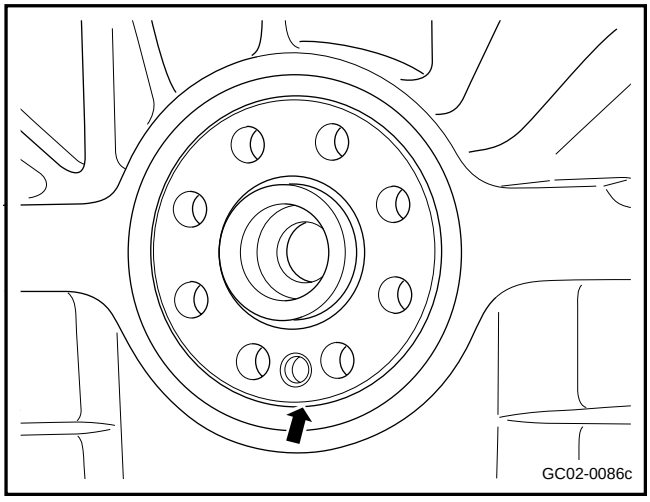
2.6.8.21 Replacement of Crankshaft Rear Oil Seal

Dismantlement Procedure

1. Refer to 2.6.8.17 “Replacement of Flywheel” to dismantle the flywheel.
2. Dismantle the crankshaft rear oil seal.

Note: Be careful not to damage the crankshaft journal during dismantlement.



Installation Procedure:

1. Use a special tool to install the crankshaft rear oil seal.
2. Install the flywheel.

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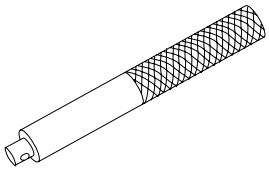
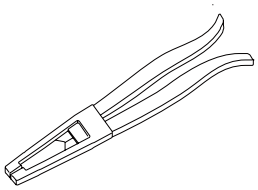
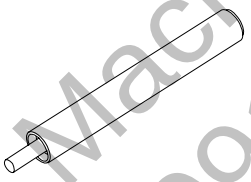
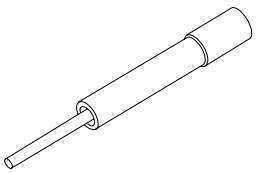
2.6.9 Special Tools and Equipment

2.6.9.1 Special Tools List

Serial Number	Illustration	Tool No.	Description
1	 FE01-2014b	GT301-002	Oil seal handle
2	 FE01-2015b	GT301-006	Tool for installing and dismantling valve oil seal
3	 FE01-2016b	GT301-008	Tool for installing valve oil seal
4	 FE01-2017b	GT301-009	Tool for installing and removing valve guide pipe

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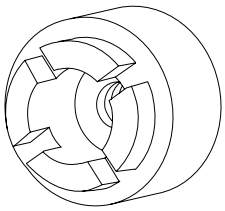
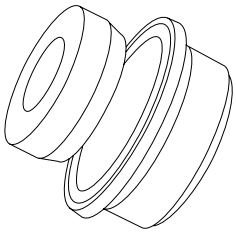
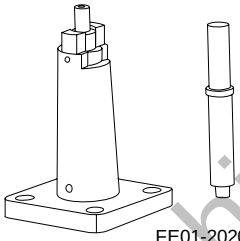
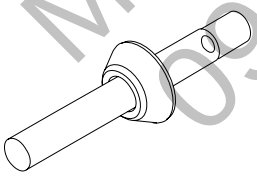
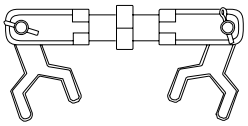
5	 FE01-2018b	GT301-013	Tool for installing front oil seal of crankshaft
6	 FE01-2019b	GT301-015	Crankshaft Rear Oil Seal Installation Tool
7	 FE01-2020b	GT301-016	Tool for installing and removing piston pin
8	 FE01-2021b	GT301-018	Tool for locating camshaft
9	 FE01-2022b	GT301-020	Tool for locating crankshaft belt disc

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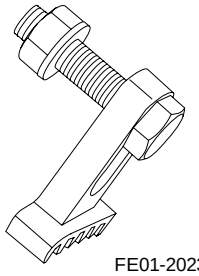
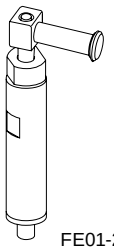
10	 FE01-2023b	GT301-021	Tool for tightening flywheel
11	 FE01-2024b	GT301-022	Tool for tightening timing chain

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2.7 Exhaust System

2.7.1 Specifications

2.7.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lb-ft)
Front exhaust pipe assembly (4G24) and exhaust manifold retaining nuts	M10	35—45	25.8-33.2
Front Exhaust Pipe Assembly and the Three-Way Catalytic Converter Assembly Retaining Bolts	M12	47—57	34 . 8—42 . 2
Three-Way Catalytic Converter And Middle Muffler Retaining Bolts	M12	47—57	34 . 8—42 . 2
Retaining nuts for middle and rear mufflers.	M10	35—45	25.8-33.2

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2.7.2 Description and Operation

2.7.2.1 Exhaust Manifold

Exhaust manifold used in this engine is a monolithic four-port manifold, which can be dismantled from the rear. The function of exhaust manifold is to exhaust gases after combustion with the minimum back-pressure. Front oxygen (HO2S)was installed on the exhaust manifold pipe。

2.7.2.2 Three-way Catalytic Converter Assembly

Three-Way catalytic converter is similar to the appearance of the muffler, however, inside the stainless steel shell there is honeycomb-like ceramic substrate in the direction of the exhaust gas. Ceramic liner carriers have been surrounded by the liner, which is used to retain the ceramic carrier and prevent any contact or collision. Each end of the converter has a mesh seals to prevent air pollution and the pad corrosion.

2.7.3 System operating principle

2.7.3.1 System operating Principle

Inside the three-way catalytic converter, the ceramic substrate exposed to emissions is coated with a catalyst. Catalysts contain platinum, palladium and rhodium, three kinds of precious metals. These catalysts promote chemical reactions.

Catalyst is to accelerate the chemical reaction while remain unchanged itself. Engine exhaust contains carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NOx). When the exhaust gas flows through the ceramic substrate, the chemical reactions in the three-way catalytic converter occur. carbon monoxide and hydrocarbon was transformed into CO2 and H20 by gas. Oxides of nitrogen carried out reduction reaction with CO to transform N2. This three-way catalytic converter is called three-way type, because it turns the three components (CO, HC and NOX) into harmless neutral gas at the same time.

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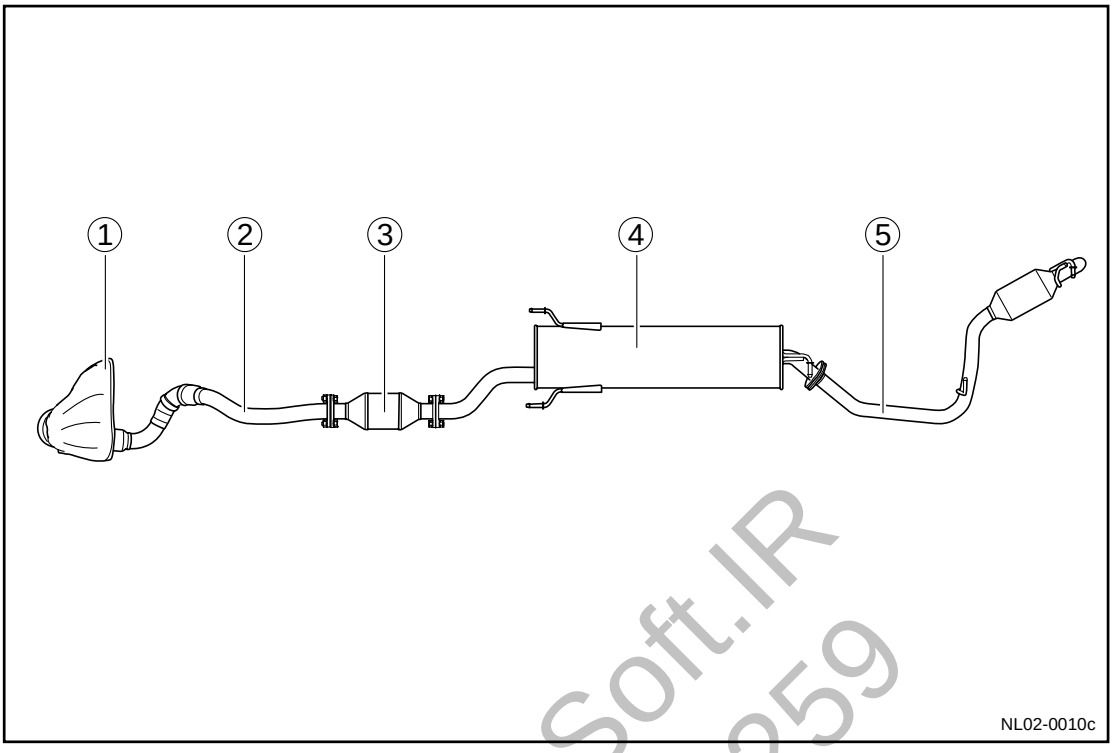
2.7.4 Component position

2.7.4.1 Exhaust Device



1. Exhaust Manifold
2. Front air exhaust pipe assembly
3. Three-Way Catalytic Converter Assembly
4. Middle Muffler
5. Post-muffler assembly

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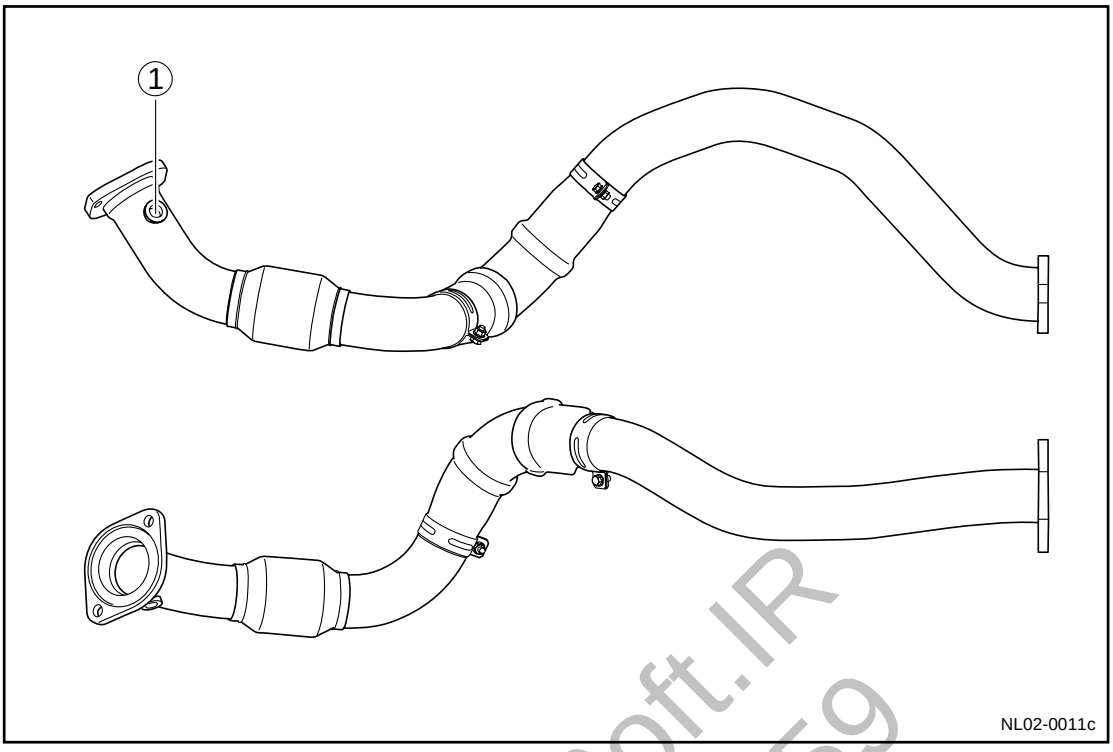
2.7.4.2 Front Exhaust Pipe Assembly



1. Front Oxygen Sensor Seat

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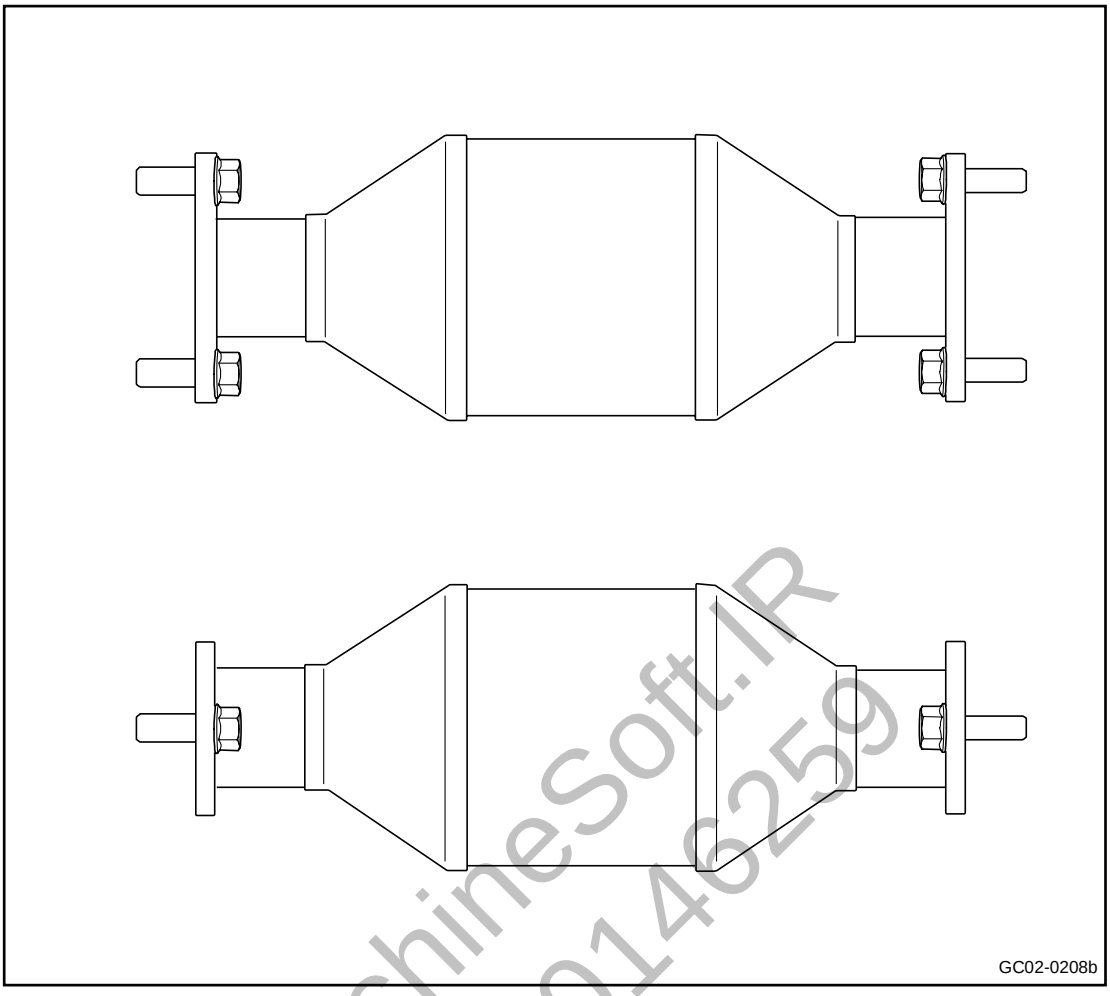
2.7.4.3 Three-way Catalytic Converter Assembly



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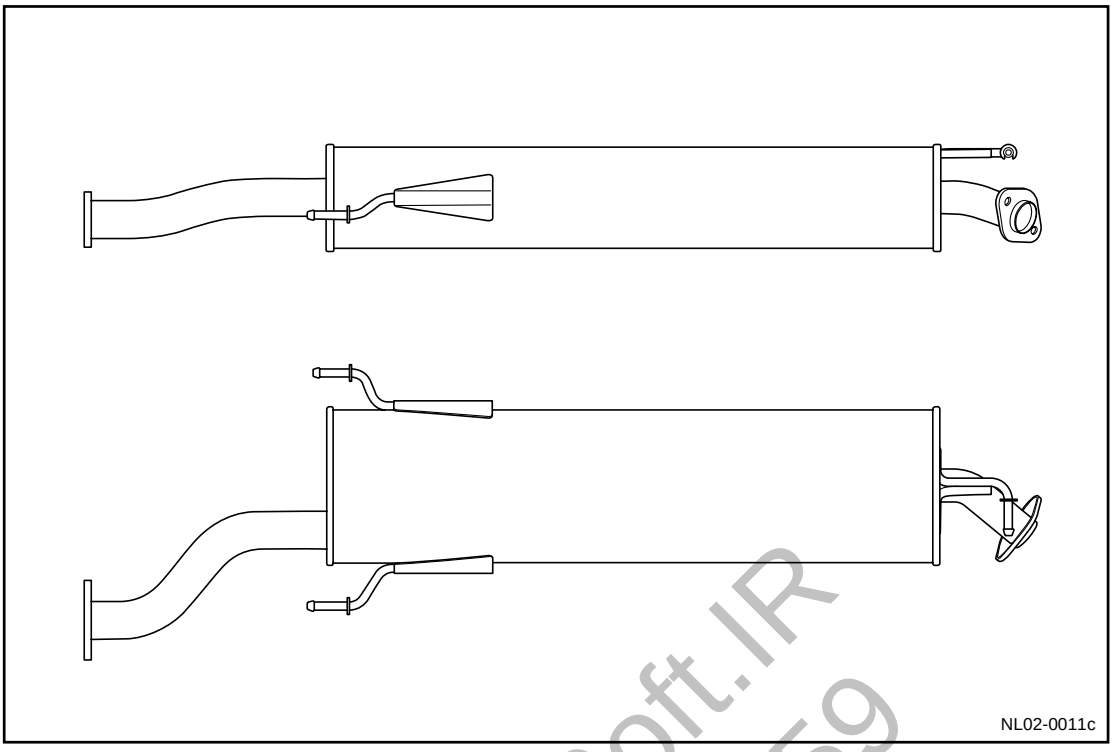
2.7.4.4 Middle Muffler Assembly



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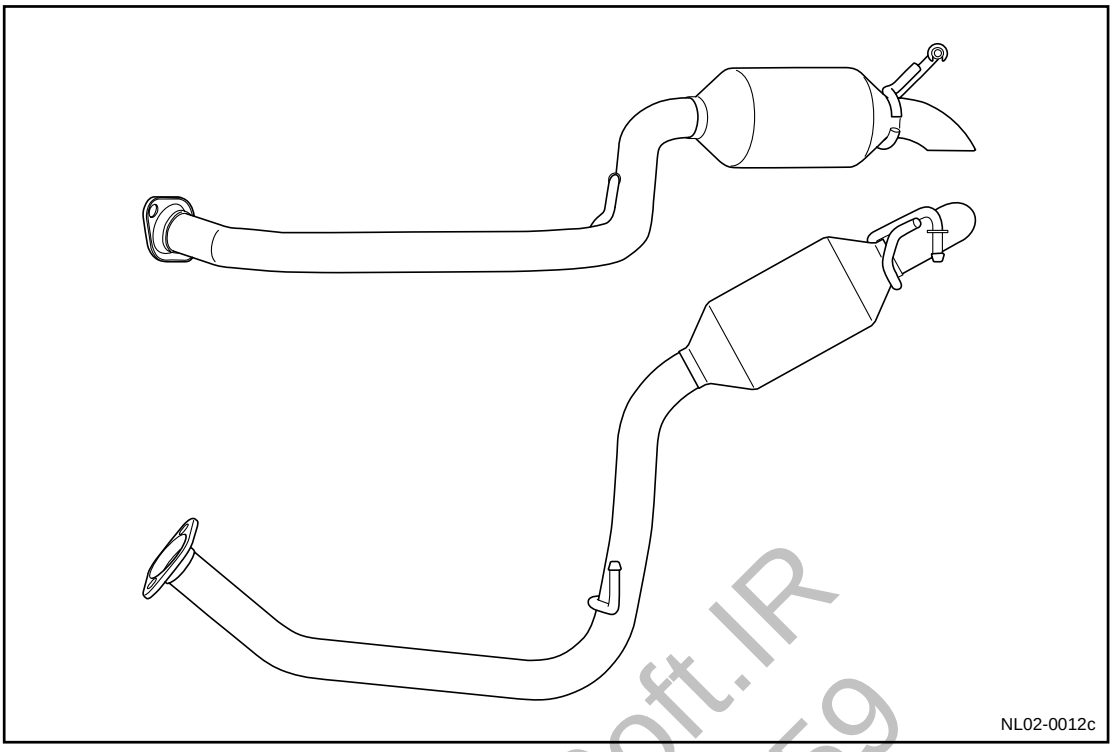
2.7.4.5 Rear Muffler Assembly



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2.7.5 Diagnostic message and steps

2.7.5.1 Diagnosis descriptions

Refer to 2.7.2 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

2.7.5.2 Visual inspection

- Inspect installed after market equipment that may affect the operation of the exhaust system.
- Inspect easy to access system components to identify whether there are significant blockages or leakage.
- Inspect whether the color of the exhaust gas is normal.

2.7.5.3 Exhaust System Blockage

When the engine loses power, fuel economy becomes worse or acceleration performance is poor, inspect whether there is ""exhaust system blockage"" fault, use the exhaust back-pressure to monitor whether the back-pressure is more than 50 kPa to confirm the fault. The fault may be caused by following reasons:

- Exhaust pipe is damaged.
- There are debris in exhaust pipes.
- Muffler or resonator internal faults.
- Exhaust pipe internal corrosion blocks the rear exhaust port.

2.7.5.4 Exhaust System Leakage

If the engine has "hiss" or a burst sound when running, inspect whether there is "Exhaust System Leakage" fault, as shown in the following table:

Misalignment or incorrect installation of exhaust system components	● Position and tighten the exhaust system components to the specified torque. Refer to 2.7.1.1 Fastener Specification ● Make sure that the exhaust pipe hook is in the right place and is not loose.
Exhaust leak at the following connections: ● Exhaust manifold and front exhaust pipe assembly ● Flange	Tighten the related components to the specified torque. Refer to 2.7.1.1 Fastener Specification
Seal or Gasket Leak: ● Exhaust Manifold and Cylinder Hood ● Exhaust manifold and front exhaust device assembly ● Three-Way Catalytic	Replace leaking seals or linings.

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Converter and middle Muffler ● Middle Muffler and Rear Muffler Replace the leaking seals or gasket.	
Flange Irregular Joints	If necessary, repair or replace the relevant components.
Exhaust Manifold Cracked or Broken	Replace the exhaust manifold. Refer to 2.7.6.1 Replacement of Exhaust Manifold.
Exhaust system components welded joints leakage	Replace the leaking components.

2.7.5.5 Exhaust System Noise

When the engine is running, exhaust has noise or unusual sound. Inspect whether there is "Exhaust System Blockage" fault, as shown in the following table:

Cracking or hissing	Exhaust System Leakage Refer to 2.7.5.3 Exhaust System Blockage.
Exhaust sound too large	1. Compare with a vehicle known in good conditions. 2. Inspect the muffler for damage or malfunction. Replace the faulty muffler. 3. Refer to 2.7.6.4 Replacement of Middle Muffler and 2.7.6.5 Replacement of Rear Muffler.
External Noise or Vibration Noise	1. Inspect whether the hook is bent or loose or whether shrouds fasteners are loose. 2. Inspect whether the exhaust pipe is interfered.
Internal Noise	1. With a rubber hammer knock these components to confirm the noise. 2. Replace the faulty three-way catalytic converter or muffler. Refer to 2.7.6.3 Replacement of Three-way Catalytic Converter Assembly or 2.7.6.4 Replacement of Middle Muffler or 2.7.6.5 Replacement of Rear Muffler.

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2.7.5.6 Precautions on Maintenance of Exhaust System

Warning: Warning on Exhaust Service

Warning: The broken three-way catalytic converter must be replaced. It is not allowed to remove the exhaust system of three-way catalytic converter , otherwise, there will be serious air pollution.

Important precaution : In the following conditions, three-way catalytic converter may be damaged or malfunction:

- **Work exceeds the range of closed-loop mixture control system.**
- **Engine burns a large amount of engine oil.**
- **The three-way catalytic converter exhaust temperature is too high (higher than 840°C).**

Precautions:

- **Vehicles with three-way catalytic converter can not use leaded petrol. Lead will pollute the three-way catalytic converter.**
- **Do not drop the three-way catalytic converter, as this may damage the ceramic carrier.**
- **Do not allow water, engine oil or fuel enter into the converter, because this may contaminate the ceramic substrate.**
- **Do not start the vehicle when there is engine misfire or the spark plug wire is disconnected.**

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2.7.6 Removal and installation

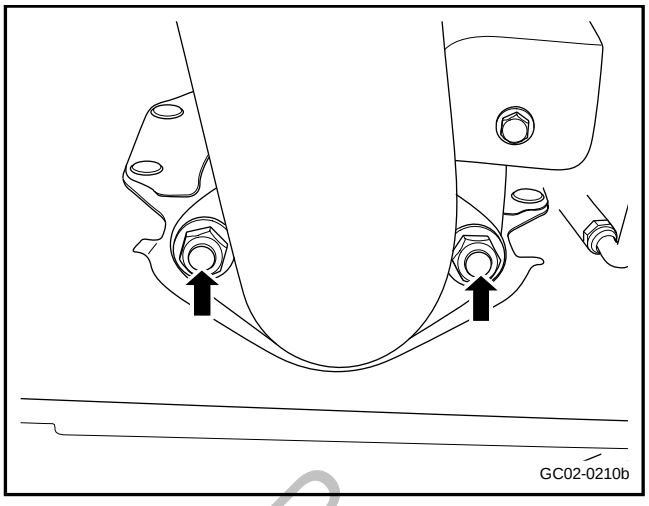
2.7.6.1 Replacement of Exhaust Manifold

Dismantlement Procedure

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.

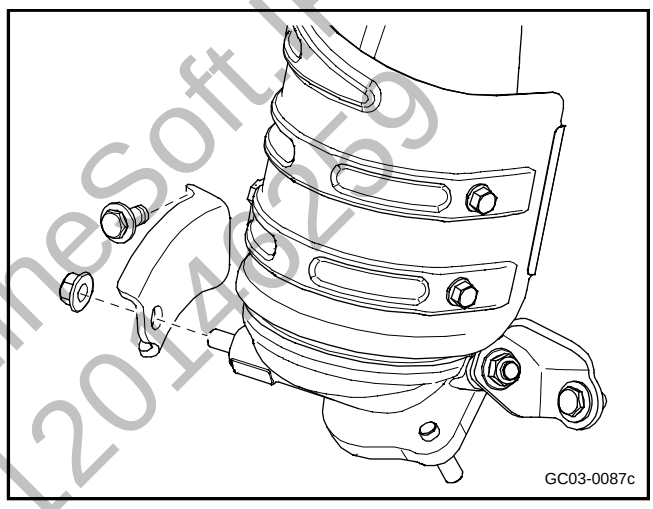
2. Dismantle left right fixing nut of front air exhaust pipe assembly .

Note: Dismantling the bolt when it is hot is likely to damage the bolt or flange nuts weld on the exhaust manifold. Dismantle the bolt when the engine is cooled down.



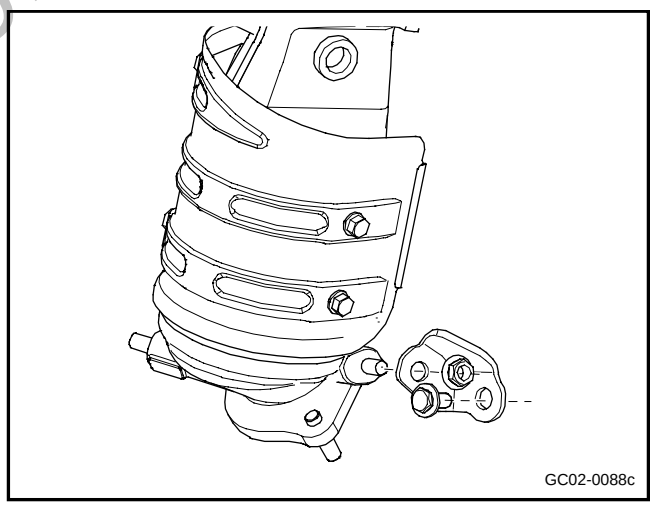
3. Remove the M10×22 bolt from the cylinder block and loosen the M10 nut to remove the left mounting plate of the exhaust manifold.

Note: Dismantling the bolt when it is hot is likely to damage the bolt or flange nuts weld on the exhaust manifold. Dismantle the bolt when the engine is cooled down.



4. Remove the M10×22 bolt from the cylinder block and loosen the M10 nut to remove the right mounting plate of the exhaust manifold.

Note: Dismantling the bolt when it is hot is likely to damage the bolt or flange nuts weld on the exhaust manifold. Dismantle the bolt when the engine is cooled down.



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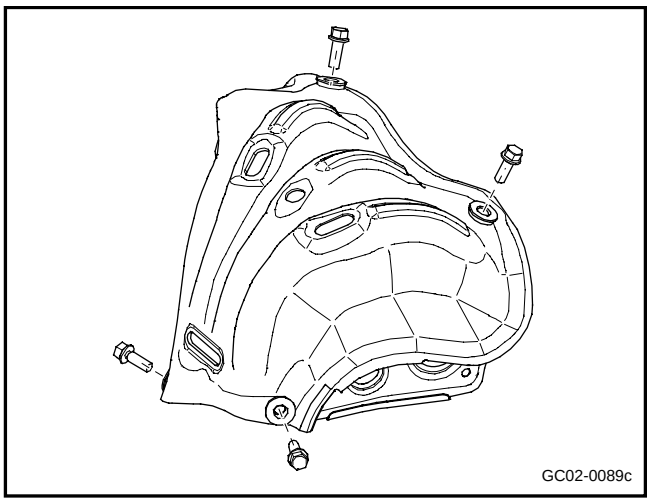
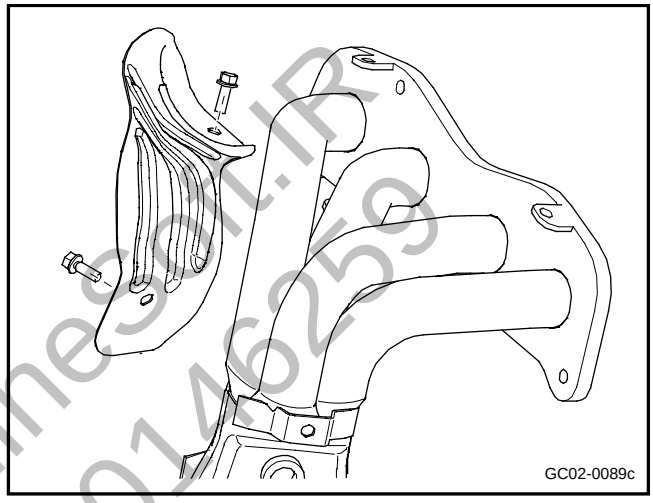
5. Remove the four M8×22 bolts from the exhaust manifold and the exhaust manifold upper heat shield.

Note: Dismantling the bolt when it is hot is likely to damage the bolt or flange nuts weld on the exhaust manifold. Dismantle the bolt when the engine is cooled down.



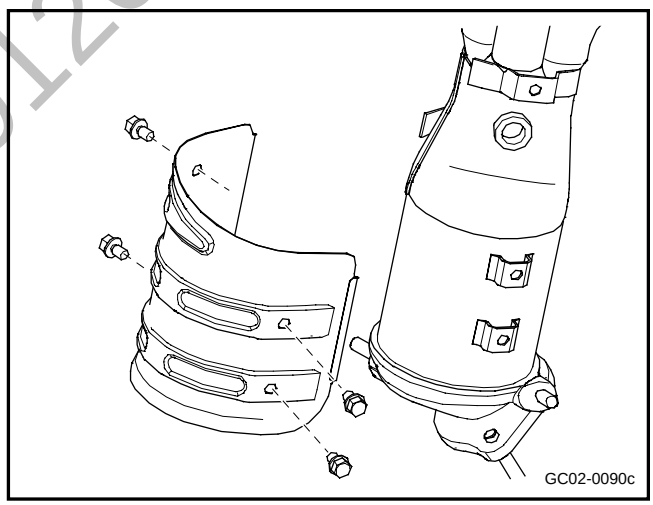
6. Remove the two M8×22 bolts from the exhaust manifold and the exhaust manifold lower heat shield.

Note: Dismantling the bolt when it is hot is likely to damage the bolt or flange nuts weld on the exhaust manifold. Dismantle the bolt when the engine is cooled down.



7. Remove the four M8×12 bolts from the exhaust manifold and the three-way catalytic device heat shield.

Note: Dismantling the bolt when it is hot is likely to damage the bolt or flange nuts weld on the exhaust manifold. Dismantle the bolt when the engine is cooled down.



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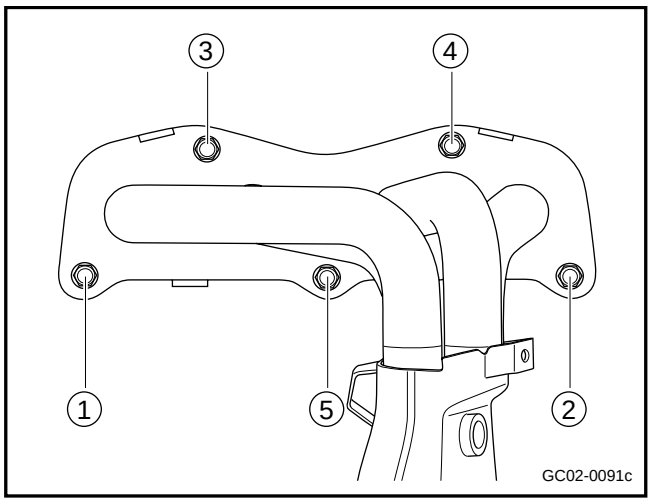
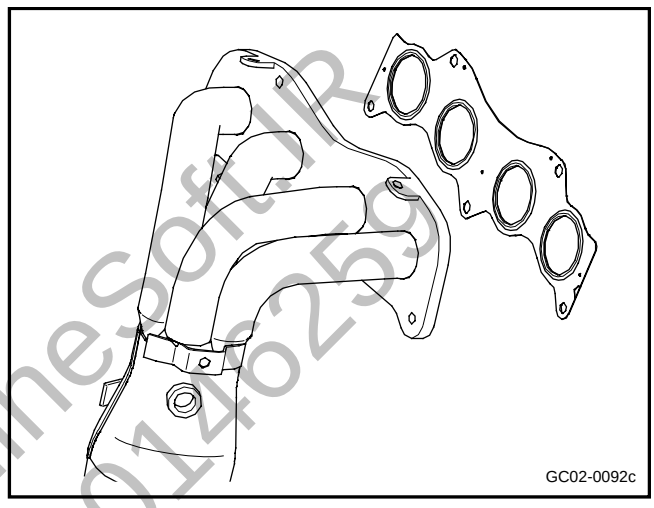
8. Dismantle the exhaust manifold bolts and nuts according to the sequence in the graph.

Dismantling the exhaust manifold bolts at high temperature may damage the bolts or cylinder head. Wait until the engine cooling down before removal.



9. Dismantle the exhaust manifold.

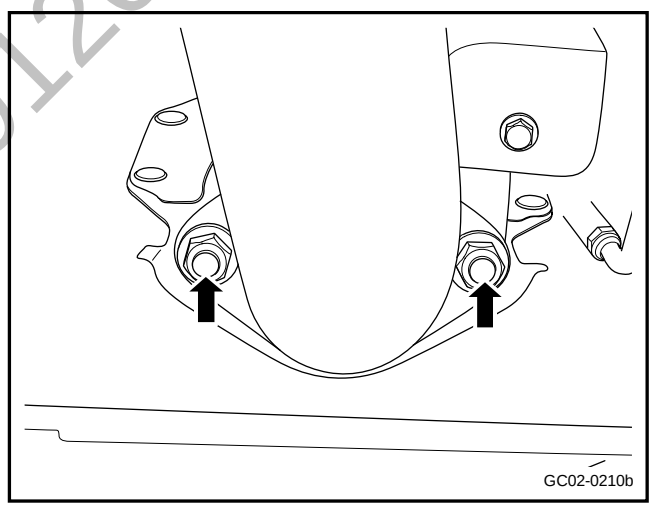
10. Remove the exhaust manifold gasket from the double end stud of the cylinder head.



Installation Procedure:

1. Install the exhaust pipe to engine bracket bolts.

Torque: 35-45 N . m(Metric) . 25. 8-33 . 2 lb-ft(English system)



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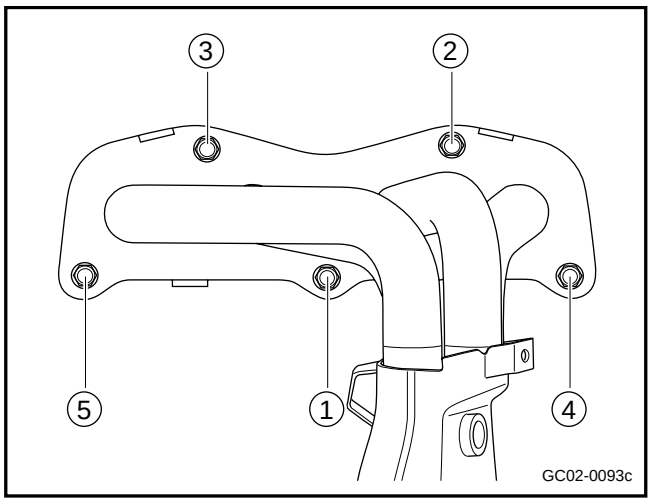
2. Clean the cylinder head cover and the exhaust manifold mating face.

3. Install the exhaust manifold, and tighten the mounting nuts according to the sequence in the graph.



4. Install three-way catalytic converter heat shield and tighten the fixing bolts.

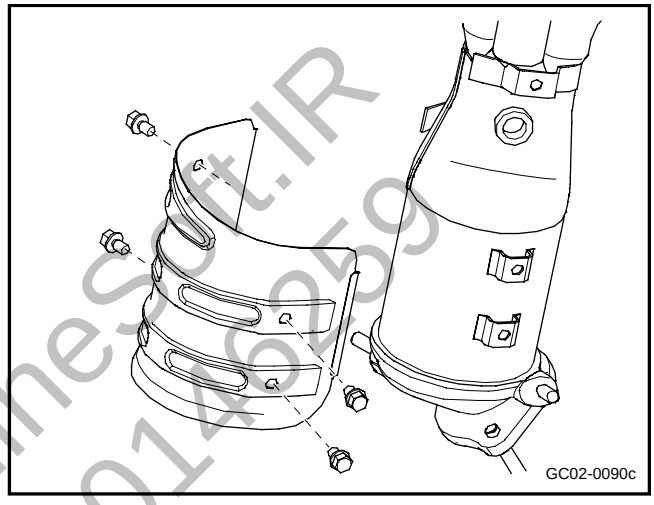
Torque :11-13 N . m(Metric) . 8 . 1-9 . 6 lb-ft(English system)

5. Install the exhaust manifold lower heat shield and tighten the fixing bolts.

Torque :11-13 N . m(Metric) . 8 . 1-9 . 6 lb-ft(English system)

6. Install the exhaust manifold upper heat shield and tighten the fixing bolts.

Torque :11-13 N . m(Metric) . 8 . 1-9 . 6 lb-ft(English system)



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7. Install the right supporting plate for the exhaust manifold and tighten the fixing bolt.

Torque :40-48 N . m(Metric) . 29 . 5-35. 4 lb-ft(English system)

8. Install the left and right exhaust manifold supporting plates and tighten the fixing bolts.

Torque :40-48 N . m(Metric) . 29 . 5-35. 4 lb-ft(English system)

9. Connect battery negative cable.

2.7.6.2 Replacement of Front Exhaust Pipe Assembly

Dismantlement Procedure

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Disconnect the rear oxygen sensor harness connector.

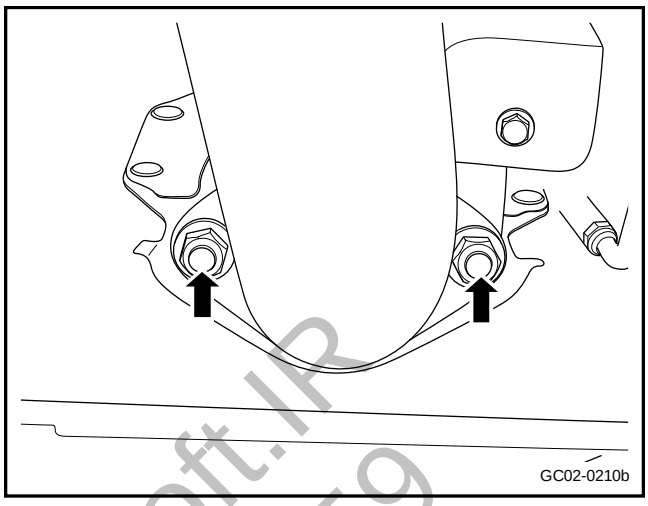
Note: Pull out the red plug to disconnect the harness connector.

3. Lift the vehicle, refer to 1.3.1.1 Lifting and Raising the Vehicle.

Warning: Refer to Warning on Vehicle Lifting and Jacking in Warnings and Precautions.

4. Dismantle left right fixing nut of front air exhaust pipe assembly .

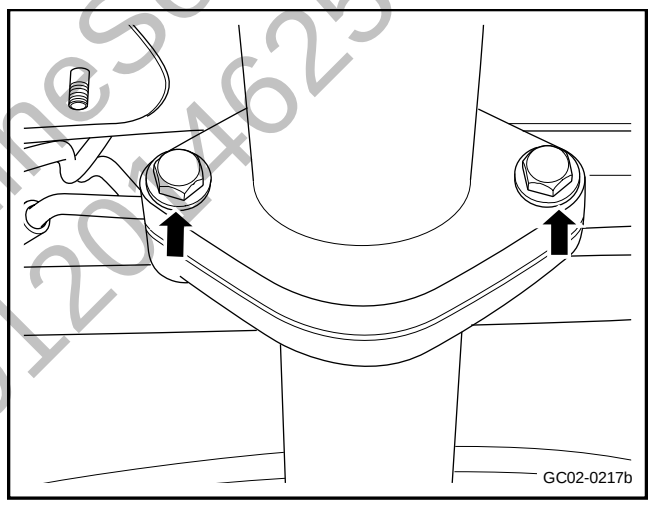
Note: Dismantling the bolt when it is hot is likely to damage the bolt or flange nuts weld on the exhaust manifold. Dismantle the bolt when the engine is cooled down.



5. Dismantle the three-way catalytic converter exhaust pipe connecting nuts.

Note: Do not drop the front exhaust pipe assembly during the removal.

Remove the front exhaust pipe assembly and the exhaust pipe gasket.



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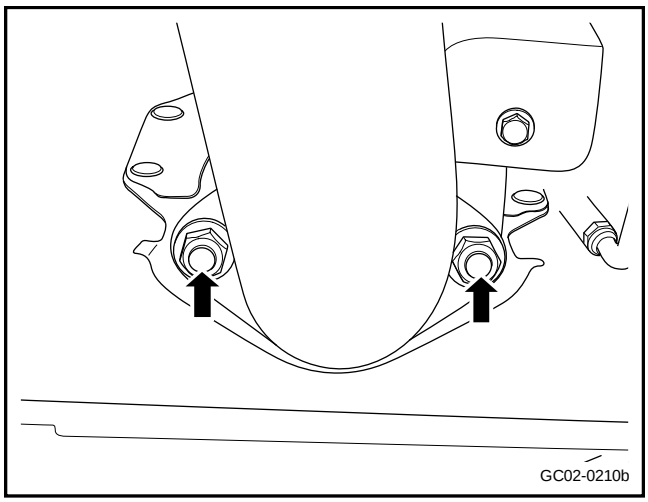
Installation Procedure:

1. Install a new exhaust pipe gasket at the exhaust manifold adaptor and the three-way catalytic converter assembly.
2. Install left and right fixing nut of front exhaust air pipe assembly.

Torque :35-45N . m(Metric) . 25. 8-33 . 2lb-ft(English system)

Note: Before installation, clean the exhaust pipe gaskets and interface.



3. Install the three-way catalytic converter right and left retaining nuts.

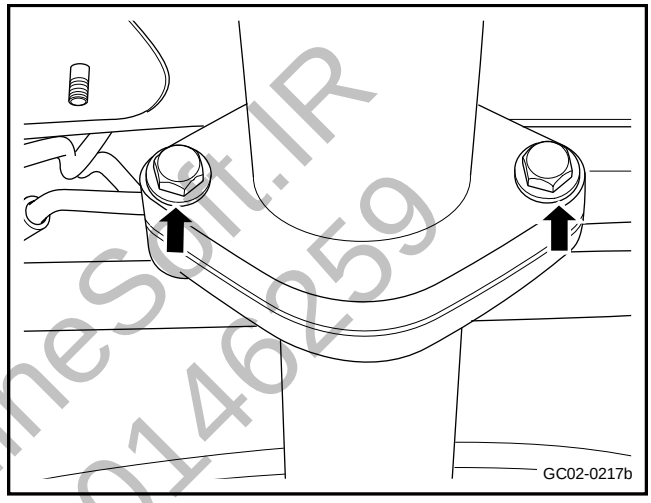
Torque :47-57N . m(Metric) . 34 . 8-42. 2lb-ft(English system)

4. Install fixing rubber support assembly of catalyst, and tighten left and right fixing bolts.

Nut

Torque :16-24N . m(Metric) . 11 . 8-17. 7(English system)

5. Lower the vehicle from the lifter.
6. Connect the rear oxygen sensor wiring harness connector.
7. Connect battery negative cable.



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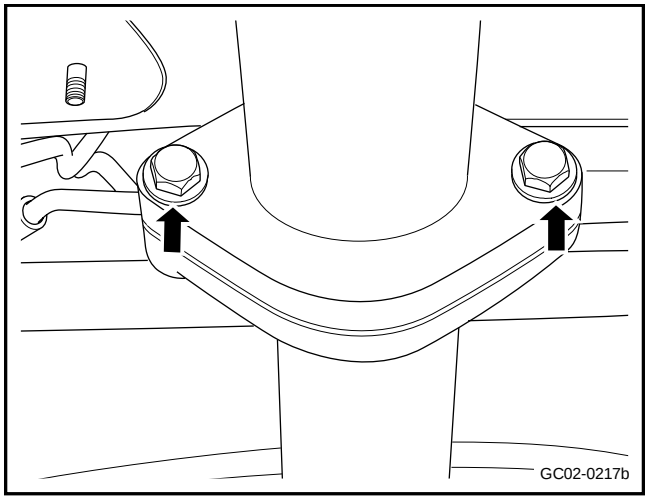
2.7.6.3 Replacement of Three-way Catalytic Converter

Dismantlement Procedure

1. Lift the vehicle, refer to 1.3.1.1 Lifting and Raising the Vehicle.

Warning: Refer to Warning on Vehicle Lifting and Jacking in Warnings and Precautions.

2. Dismantle the three-way catalytic converter left and right retaining nuts.

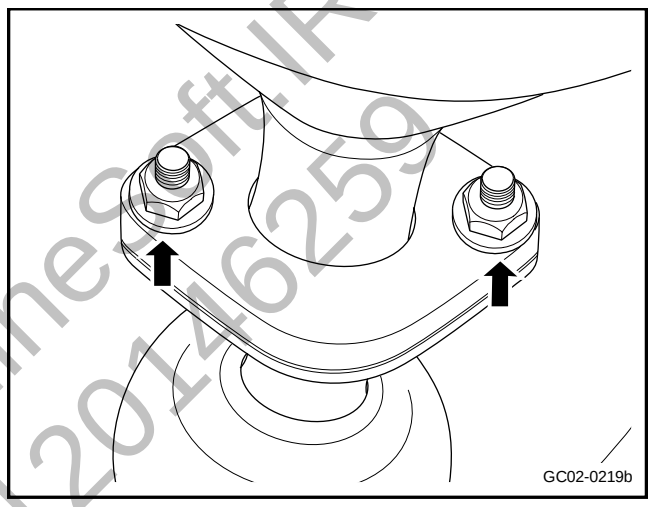


For the three-way catalytic converter has a high operating temperature (500~850 ℃), it is important to wait it cooling down before dismantlement!

3. Dismantle the left and right retaining nuts of the middle muffler assembly.

For the three-way catalytic converter has a high operating temperature (500~850 ℃), it is important to wait it cooling down before dismantlement! During removal, pay attention to the three-way catalytic converter assembly to avoid dropping!

4. Remove the three-way catalytic converter assembly and the exhaust pipe gaskets.



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Installation Procedure:

1. Install a new exhaust pipe gasket at each end of the three-way catalytic converter assembly.

Note: Before installation, clean the exhaust pipe gaskets and interface.

2. Install the three-way catalytic converter right and left retaining nuts.

Torque :47-57N . m(Metric) . 34 . 8-42 . 2lb-ft(English system)

3. Install the left and right retaining nuts of the middle muffler.

Torque :47-57N . m(Metric) . 34 . 8-42 . 2lb-ft(English system)

4. Lower the vehicle from the lifter.

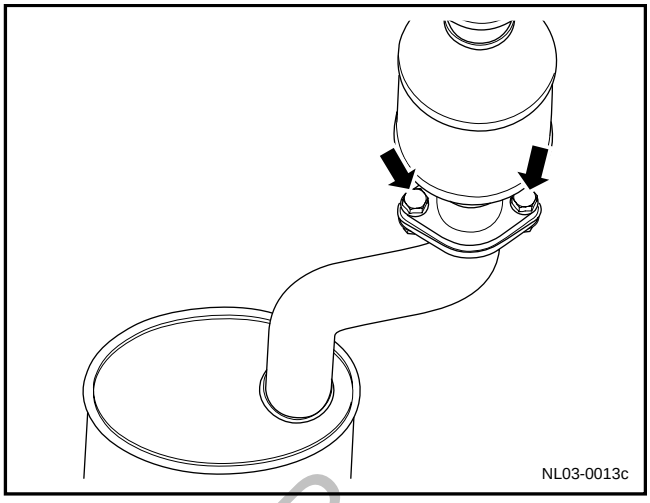
2.7.6.4 Replacement of Intermediate Muffler Assembly

Dismantlement Procedure

1. Lift the vehicle, refer to 1.3.1.1 Lifting and Raising the Vehicle.

Warning: Refer to Warning on Vehicle Lifting and Jacking in Warnings and Precautions.

2. Dismantle the retaining nuts and the exhaust pipe gasket of the middle muffler assembly .



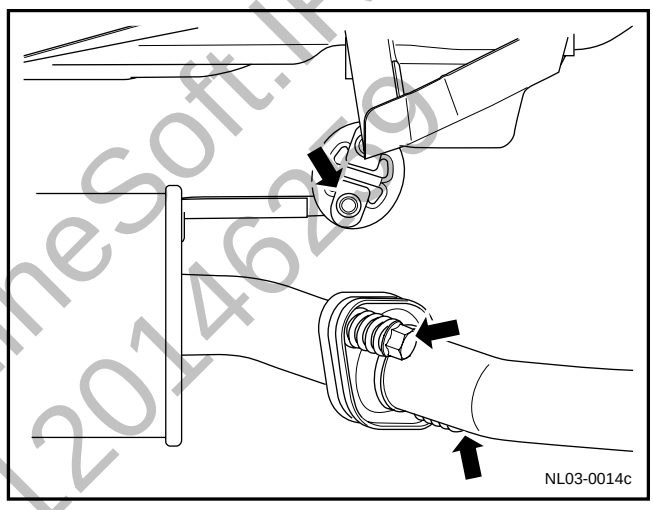
3. Dismantle the middle muffler to the rear muffler retaining bolts and the exhaust pipe gasket.

3. Dismantle the three rear rubber bearings from the Middle muffler.

Note: Do not drop the muffler during the removal.

4. Remove the Middle muffler assembly.

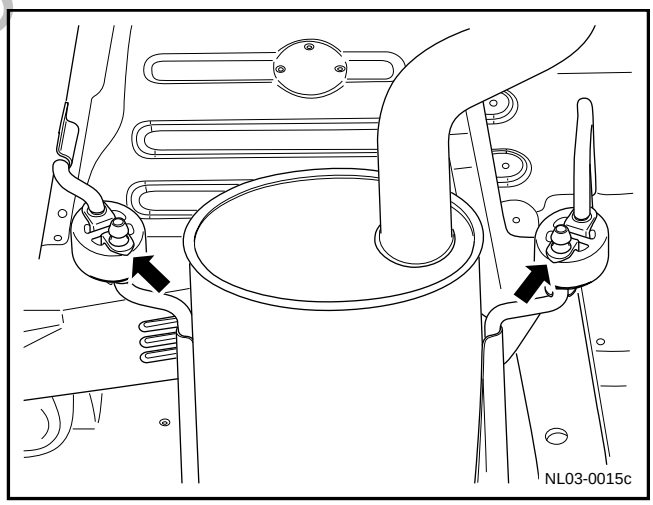
5. Inspect whether the three-way catalytic muffler has holes, damage and cracks.



Installation Procedure:

1. Install three rear rubber bearings to the middle muffler assembly.

2. Install the exhaust pipe gasket between the Middle muffler and the three-way catalytic converter .



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3. Install and tighten the Middle muffler retaining nuts.

Torque :47-57N . m(Metric) .34. 8-42. 2lb-ft(English system)

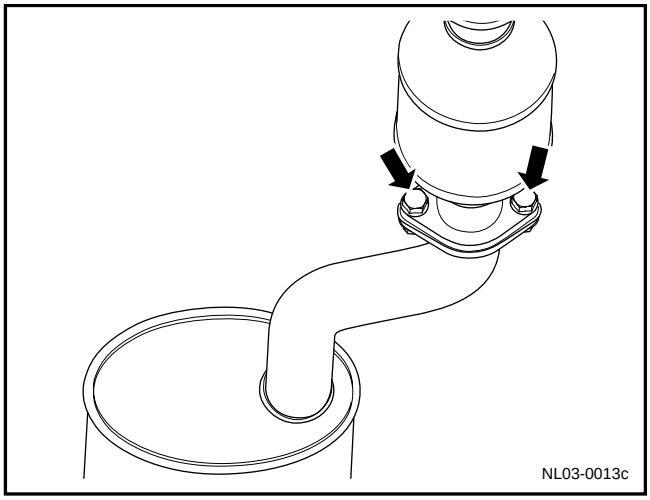
4. Install the front muffler gasket.

5. Install and tighten the front and rear muffler retaining nuts.

Torque :35-45N . m(Metric). 25. 8-33 . 2lb-ft(English system)

6. Lift down vehicle from lifter.

7. Inspect whether the exhaust system leaks air.



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2.7.6.5 Replacement of Rear Muffler Assembly

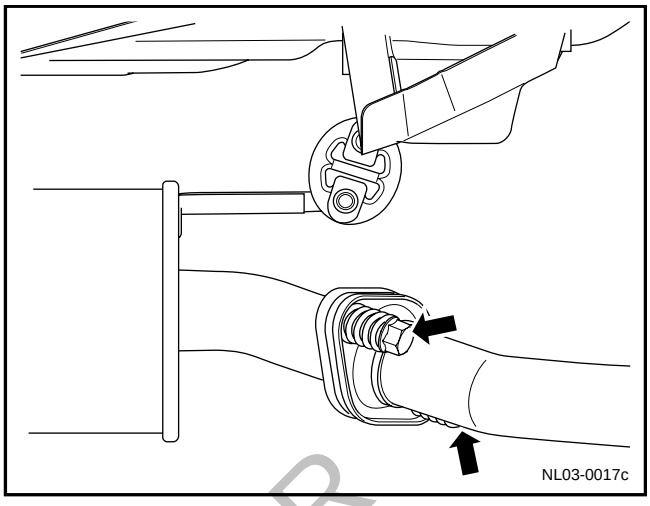
Dismantlement Procedure

1. Lift the vehicle, refer to 1.3.1.1 Lifting and Raising the Vehicle.

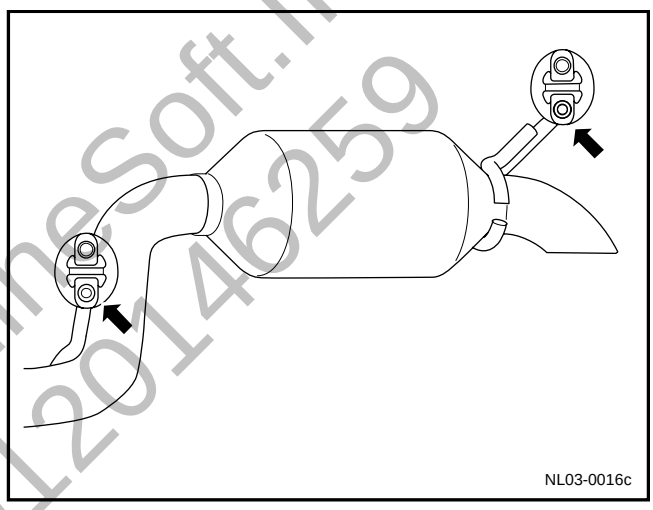
Warning: Refer to Warning on Vehicle Lifting and Jacking in Warnings and Precautions.

2. Remove the fixing bolts, springs and the exhaust pipe seal gasket between rear muffler and middle muffler.

Warning: Do not carry out the dismantlement procedure at warming-up stage, as this may result in burns.



3. Dismantle two front rubber support seat
4. Remove rear muffler
5. Inspect whether there are holes, damage or cracks for rear muffler.



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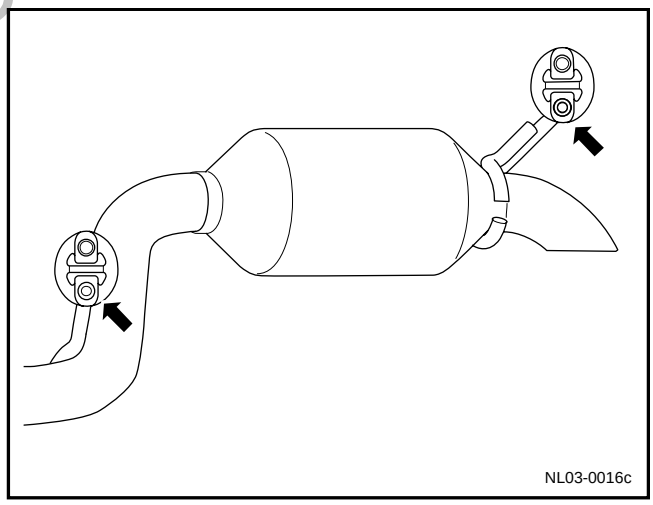
Installation Procedure:

1. Install two front rubber bearings.
2. Install the exhaust pipe seal gasket.
3. Install the fixing bolts and springs of front muffler assembly and rear muffler assembly.

Torque :35-45N . m(Metric). 25. 8-33. 2lb-ft(English system)

4. Lower the vehicle.
5. Inspect the exhaust system for leakage.



2.8 Cooling system

2.8.1 Specifications

2.8.1.1 Fastener Specifications

Applications	Specification	Tightening Torque	
		Metric (N.m)	English system (lb-ft)
Water Pump Long Mounting Bolt	M6×35	9 - 13	6 . 7 - 9 . 6
Water Pump Short Mounting Bolt	M6×25	8 - 10	6 - 7.4
Engine coolant temperature sensor	M12×1 . 5	16 - 24	12 - 17.7
Fan Assembly Mounting Bolt	M6×20	8 - 10	6 - 7.4
Fan Motor Nut	M10	10	7.4
Fan Motor Retaining Screw	M6×18	8 - 10	6 - 7.4
Fixing Bolts of Radiator	M8×25	10 - 11	7 . 4 - 8 . 1
Fixing bolt of expansion tank assembly	M6×20	8 - 10	6 - 7.4
Engine water inlet pipe adapter assembly is installed with nut.	M6	9 - 13	6 . 7 - 9 . 6
Coolant Valve Component	M10×1	Above 25	Above 18.5
Engine Coolant Inlet Pipe Component	M6	9 - 13	6 . 7 - 9 . 6

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2.8.1.2 Cooling System Specification

Applications	Specification
Cooling Type	Coolant
Engine Coolant Capacity (Coolant Recovery Reservoir)	6 . 5 L(11 . 44 pt)
Engine Coolant Specification / Grades	Glycol engine coolant from Geely major plant with the ultra-long acting and the freezing point at (-40 ℃/-40 °F)

Thermostat Type	Wax-Type Thermostat
Pump Type	Open impeller centrifugal pump
Blade Diameter	56 . 4mm
Blades	7
Thermostat Opening Temperature	82℃(179.6℉)
Thermostat Fully Opening Temperature	95℃(203℉)
Low Speed Cooling Fan Turned On	95℃(203 ºF)
Low Speed Cooling Fan Turned Off	92℃(197.6 ºF)
High Speed Cooling Fan Turned On	98℃(208.4 ºF)
High Speed Cooling Fan Turned Off	95℃(203 ºF)

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2.8.2 Description and operation

2.8.2.1 Description and operation

When engine is working, the mixture combustion in the cylinder combustion chamber produces heat, which transfers through the cylinder block. If it is not cooled, the engine will not work. Inside the cylinder block, there is engine coolant path. Through the engine coolant flow, heat exchanges with the outside environment. This keeps the engine operating temperature within a certain range, so that the engine can work effectively in all operating conditions. When the engine is cooled, the cooling system controls the flow amount of engine coolant through the thermostat. This makes the engine warm up quickly. Cooling system includes radiator, expansion tank, cooling fan assembly, thermostat and housing, water pump and water pump drive belt. The water pump is driven by the accessory drive belt. Only when all the above components work properly, can the cooling system work properly. When the engine coolant reaches the thermostat operating temperature, the thermostat opens. At this point, the engine coolant returns to the radiator and gets cooled. Cooling system guides part of the engine coolant through the pipes into the heater core. Used for heating and defrost. Coolant Recovery Reservoir is connected to the radiator assembly for recycling discharged engine coolant, which is expanded due to the heat. The Coolant Recovery Reservoir is to maintain the correct engine coolant level.

Expansion tank is a transparent plastic container, similar to the front windshield washer tank. Expansion tank assembly connects to the engine cooling system and the radiator through two separate pipes. With the vehicle driving, the engine coolant temperature gradually increases and the coolant expands. Part of the engine coolant flows from the radiator into the coolant recovery reservoir as the result of expansion. Resident air in the radiator and engine is also expelled to the Coolant Recovery Reservoir. When the engine is shut down, the engine coolant cools down and contracts, previously discharged engine coolant flows back to the radiator and the engine. This makes the engine coolant radiator maintain a suitable coolant level, and improves cooling efficiency. When the cooling system is cold, the engine coolant level should be kept between the MIN (minimum) and MAX (maximum) marks in the expansion tank.

Cooling fan assembly is installed at the rear of the radiator in the engine compartment. It increases radiator and Air- Conditioning condenser air flow, and thus help accelerate the cooling when idling or at low speed. There are dual fans, high or low speed control modes controlled by two different motors. Cooling fan is controlled by the engine control module (ECM) using Low-Speed cooling fan relay and high speed cooling fan relay. In the Low-Speed circuit, the series connection is used to change the fan speed. When the engine coolant temperature reaches 95°C (203 °F), the engine control module enables Low-Speed cooling fan assembly operation, and when the engine coolant temperature reaches 98℃ (208.4 °F), it enables the High- Speed cooling fan operation. When the temperature is back to 95℃(203 ºF), the engine control module will switch the cooling fan from high to low, when the temperature drops to 92℃(197.6 ºF), the fan will be off.

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Warning: Even if the engine is not running, the cooling fan under the engine compartment may still start and cause injury. Keep hands, clothing and tools away from the cooling fan under the engine compartment.

Warning: If there is any degree of fan blades bending or damaging, do not repair or reuse the damaged components. The bent or damaged fan blades must be replaced. Damaged fan blades can not guarantee the normal balance and continuous use, and may fly off, which is very dangerous.

As long as there is pressure in the cooling system, even though the solution in the radiator is not boiled, the solution temperature will be much higher than the water boiling point. If the engine is not cooled and the pressure is still high, and the pressure cover is opened, the engine coolant will be immediately boiled and will spray onto the engine, fenders and the person opening the radiator pressure cap.

2.8.3 System operating principle

2.8.3.1 System operating Principle

Cold Engine: the engine normal operating temperature is generally around 95°C (203 °F), in this temperature range, all the engine parts running status will be ideal. If the engine can not reach the ideal operating temperature in a long time,it will increase the parts wear and tear. Because of low temperature, the mixture combustion will be inadequate, and there will be excessive carbon residue. The engine heat exchange must be kept minimum so the engine can reach normal working temperatures in a short period of time. At this point the thermostat controls the engine coolant only circulates within the engine block, bringing the heat from the cylinder wall to the other engine parts, so that the temperature increases rapidly. Water pumps makes the engine coolant flow in the cylinder block, then in the engine block water jacket, throttle body and cylinder hood cover. This is called "small loop".

Engine at normal working temperature: With the engine running, the engine coolant temperature quickly increases, when the thermostat reaches 83℃ (181.4 °F), the engine coolant is drawn into the engine block water jacket, intake manifolds, cylinder hood and radiator by the water pump. This is called "big loop".

Thermostat: the thermostat is used to control the flow of engine coolant in the cooling system. Thermostat is installed in the front of the engine and sealed by the engine intake pipe joints components, located in the front of the cylinder hood cover. The thermostat can prevent the engine coolant.

Flow from the engine to the radiator, so as to rapidly pre-heating the engine and adjust the temperature of engine coolant. When the engine coolant temperature is low, the thermostat in the closed position, preventing the engine coolant circulating through the radiator. Starting is only allowed at this time.

Engine coolant is circulated through the heater core to quickly and uniformly preheat the engine. When the engine is warm, the thermostat opens. The engine coolant flows through radiator and exchanges the heat. Thermostat opening and closing, allow sufficient engine coolant to enter into the radiator, maintaining the engine at normal operating temperature range. The wax ball inside the thermostat is sealed in a metal casing. Thermostat wax ball thermal expands when warm and contracts when cold. As the vehicle drives and the engine warms up, engine coolant temperature increases. When the engine coolant reaches the required temperature, the thermostat wax ball expands, puts pressure on the metal shell and opens the valve. This allows the engine coolant to flow through the engine cooling system and engine to cool down, when the wax ball contracts, under the action of the spring, the valve will be closed. The themostat start to open when the temperature of engine coolant reach to 83℃(181.4ºF), and it fully opened when the temperature at 95℃(1203ºF)

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Cooling Fan Low-Speed Circuit Description: Engine cooling fan circuit controls the main cooling fan and auxiliary cooling fan. Cooling fan is controlled by the engine control module (ECM) according to the temperature sensor of engine coolant and air pressure switch inputs.

When ECM monitors conditions that meet the cooling fan Low-Speed running conditions, ECM controls the engine wiring harness connector EM01 terminal No.65 for internal grounding, and the Low-Speed cooling fan relay pulls in. Power passes through the low speed relay 1 terminal No.87 to reach the cooling fan motor 1 and then through the Fan low-speed relay 2 to reach the fan motor 2 within the series connection. Finally the circuit is grounded via the harness connector CA10 terminal #2 of fan motor 2. For the series connection of the fan motors changes the current through the motors, the fan motors run at low speed.

Description of high-speed circuit of cooling fan: the engine control module receives the engine coolant temperature sensor and air-conditioning pressure switch signal; after reaching the condition that the cooling fan rotates at high speed through the calculation of the internal program, the ECM controls the terminal 17 of the engine wire harness connector EM01 to internal ground; at this time, the cooling fan high-speed relay and the low-speed relay 2 are closed; the power supply of the fan 2 reaches the terminal 1 of the wire harness connector CA10 of the cooling fan 2

from the terminal 87 of the high-speed relay and is grounded through the terminal 2 of the wire harness connector CA10 of the cooling fan 2; at the same time, as the low-speed relay 2 is closed, the power supply of the fan 1 reaches to the cooling fan motor from the terminal 87 of the low-speed relay 1 and then is grounded through the terminal 87 of the closed low-speed relay 2. The circuits of the fan motor 1 and motor 2 are connected in parallel from in series, so that the fan motor rotates at a high speed.

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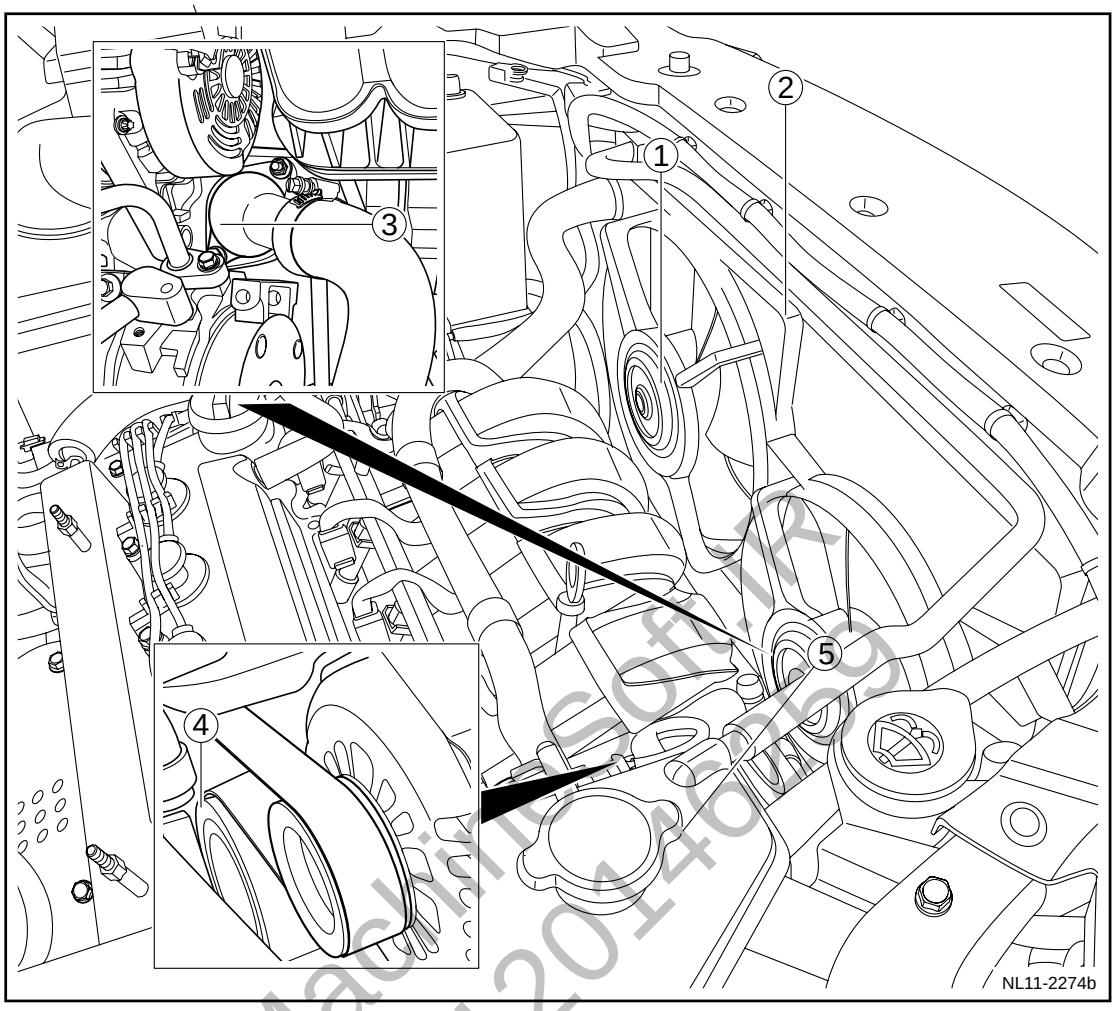
2.8.4 Component position

2.8.4.1 Component position



1. Cooling Fan
2. Radiator Assembly
3. Thermostat
4. Water Pump
5. Expand pod assembly

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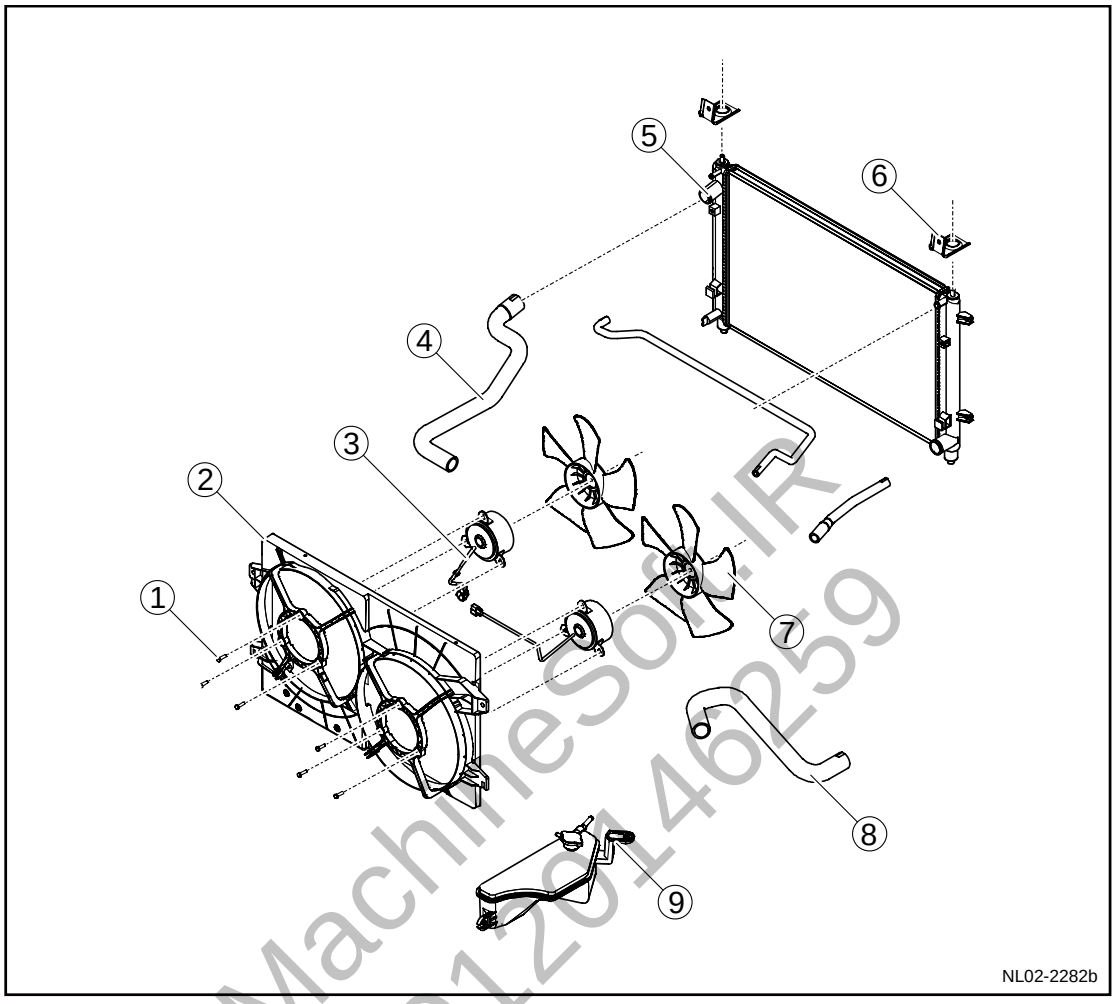
2.8.5 Disassemble drawings

2.8.5.1 Disassembly diagram

Manual transmission



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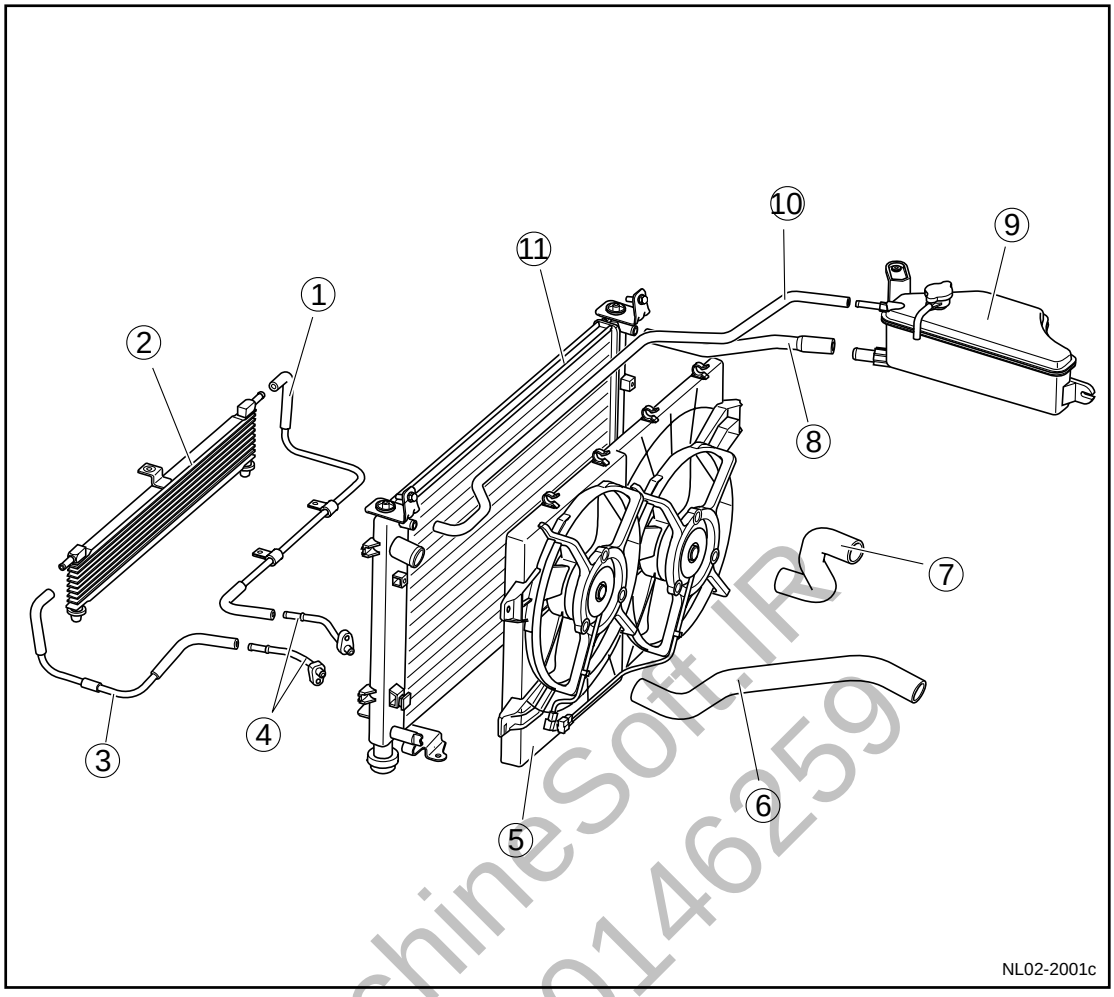
1. Fixing bolts of fan motor
2. Cooling Fan Shroud
3. Fan Motor
4. Radiator Inlet Hose
5. Radiator
6. Radiator Upper Mounting Brackets
7. Fan Blades
8. Radiator Outlet Hose
9. Expand pod assembly

DSIAuto-transmission :



1. Oil cooler oil inlet hose
2 Oil cooler assembly
3. Oil cooler oil outlet hose
4. Oil pipe connector
5. Cooling fan assembly
6. Radiator Inlet Hose

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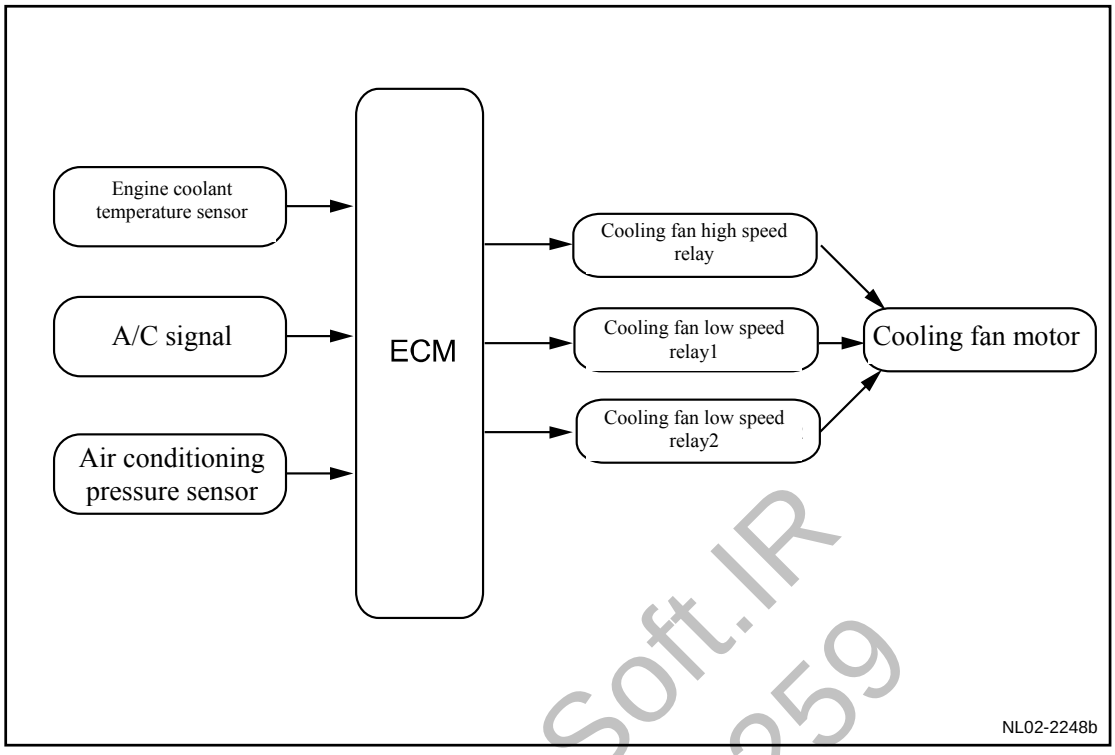
2.8.6 Electrical schematic diagram

2.8.6.1 Electrical Schematic Diagram



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2.8.7 Diagnostic information and procedures

2.8.7.1 Diagnosis descriptions

Refer to 2.8.2 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

2.8.7.2Cooling Fan Circuit Diagnosis

Diagnostic Hints:

- If there is an overheating complaint, verify whether the it is because the engine coolant boiling or the engine coolant temperature gage indicates the coolant overheating. If the engine is overheated, but the cooling fan still runs normally, inspect the engine cooling system.
- If the fuse EF21 in under hood fuse block fuses immediately blows off after installation, inspect whether the circuit between the cooling fan high or Low-Speed relay and ECM is short to ground, or the internal short circuit in the ECM. If the fuse EF11 or EF10 in the fuse box of the engine blows out just at the pull-in of the relay under the control of the ECM, there must be short circuit or cooling Fan motor faults in the Fan relay and Fan motor grounding circuits.
- When the Air-Conditioning system is switched on, the engine control module controls the cooling fan run at low speed. When the Air-Conditioning high pressure is 1,520 Pa (220.5 psi), the engine control module will switch cooling fan from low speed to high speed. When the Air-Conditioning high pressure drops back to 1,450 kPa (210.3 psi), the cooling fan will return to low speed.
- Use the "Function Test" of fault diagnosis tester to drive high or low speed cooling fan relay pull-in to confirm whether the fan works properly to quickly determine the fault.

Note: Before carrying out this diagnostic procedure, inspect whether fuse EF21 works properly, and whether main relay works properly. When using the "action test" of fault diagnosis tester, make sure the fault diagnosis tester communicates with ECM properly.

1	Confirm Fault Symptom

Next

2	Confirm whether the Low-Speed cooling fan runs.

(a) Rotated ignition switch to "OFF" position .

(b) Connect fault diagnosis tester to diagnosis testing interface.

(c) Start the engine to normal working temperature.

(d) Turn off the A/C switch.

(e) Select in sequence: engine/data list/ engine coolant temperature.

(f) When the engine coolant temperature gage displays 93℃ (198.7 °F) Cooling fan should be running at low speed.

Does the low speed cooling fan run?

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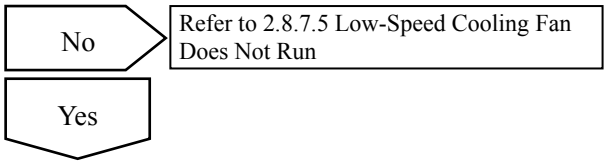


3	Confirm whether the high-speed cooling fan runs.

(a) Turn off the A/C switch.

(b) When the engine coolant temperature gage displays 96℃ (196.6 °F) When the cooling fan should be running at high speed.

Does the high speed cooling fan run?

4	Confirm whether the high-speed cooling fan runs.

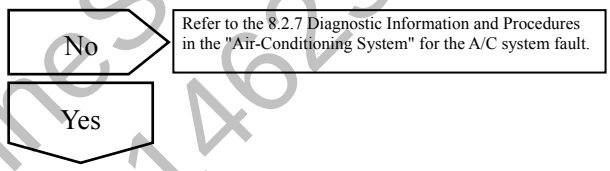
(a) Rotated ignition switch to "OFF" position .

(b) Connect fault diagnosis tester to diagnostic interface.

(c) Select in sequence: Engine / Data List / Engine Coolant Temperature.

(d) When the engine coolant temperature is below 92℃ (196.6 °F), Start the engine, turn on the A/C switch, cooling fan should be running low speed.

Does the low speed cooling fan run?



5	Intermittent fault. refer to2 . 2 . 7 . 3 intermittent fault inspection .

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2.8.7.3 Fault Symptom Table

Fault Symptom	Possible Reasons	Solution
Cooling Fan Does Not Run at High Speed	– Fan relay 2 disabled – Relay 2 coil circuit open fault – ECM – Water temperature sensor signal error	Refer to 2.8.7.4 High-Speed Cooling Fan Does Not Run
Cooling Fan Does Not Run at Low Speed	– Fan relay 1 disabled – ECM Internal Circuit Open – Fan Motor 1 internal coil circuit open fault – Fan Motor 2 internal coil circuit open fault – Relay 2 internal electric shock fault – Open Circuit – Water temperature sensor signal error	Refer to 2.8.7.5 Low-Speed Cooling Fan Does Not Run
Fan 2 Stops Running (Fan 1 Runs at High Speed stop)	– Circuit from fan 1 to relay 2 is short to the ground – Relay 2 has no electric shock return	Refer to 2.8.7.6 Cooling Fan 1 Runs At High Speed (Fan 2 Does not Run)
Cooling Fan Always Runs at High Speed	– Water temperature sensor signal error – ECM internal ground short circuit – The circuit from high-speed relay box to engine is short to the ground	Refer to 2.8.7.7 Cooling Fan always Runs at high Speed
Fan 1 Stops Running (Fan 2 Runs at High Speed stop)	– Fan relay 1 disabled – Fan relay 1 coil circuit and control circuit open fault – Motor 1 internal coil circuit open – Circuit open between motor 1 and fan relay 2 – Relay 2 pull-in contact fault – ECM internal circuit open	Refer to2.8.7.5 Cooling Fan always Runs at Low Speed

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2.8.7.4 High-Speed Cooling Fan Does Not Run

Note: Before carry out this diagnostic procedures, please refer to the2.8.7.2 Cooling Fan Circuit Diagnosis, which will facilitate the Diagnostic.

1	Inspect the power supply circuit between the cooling fan's high- and low-speed relay 2 coil.

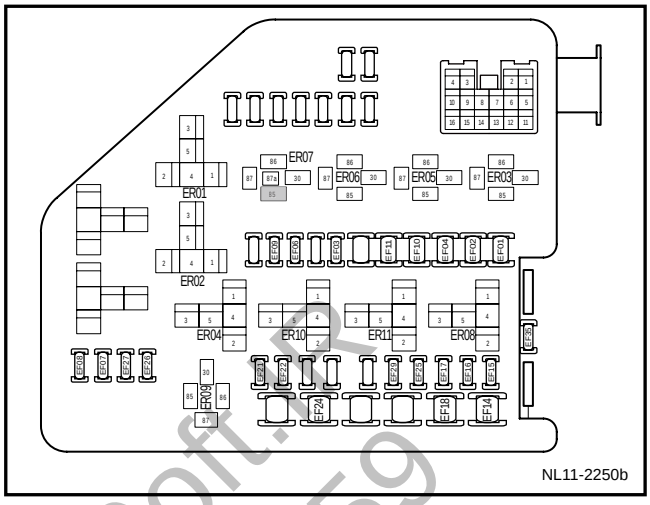
(a) Rotated ignition switch to "OFF" position .

(b) Dismantle the cooling fan high- or low-speed relay 2.

(c) Rotated ignition switch to "ON" position .

(d) Measure voltage between relay socket #85 and vehicle body ground with a multimeter.

Standard Voltage: 11-14 V



Confirm if the voltage conforms to standard value.

No → Fuse relay box in the engine cabin is broken down, and replace if necessary.

Yes

2	Inspect the coil grounding circuit between the cooling fan's high-speed and low-speed relay 2.

(a) Rotated ignition switch to "OFF" position .

(b) Dismantle the cooling fan high- or low-speed relay 2.

(c) Disconnect ECM harness connector EM01.

(d) Measure the continuity between the cooling fan high- or low-speed relay 2 socket #86 and ECM harness connector EM01 terminal 17.

Standard Resistance: Less than 1 Ω

Confirm whether the resistance conforms to standard value.

No → Check circuit fault between cooling fan low speed relay 2 plug No. 86 and ECM harness connector EM01 terminal No. 17

Yes

3	Inspect the voltage of the terminal 17 of BCM wire harness connector EM01.

(a) Rotated ignition switch to "ON" position .

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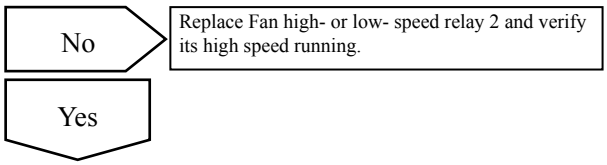
(b) Measure harness connector EM01 terminal No. 17 voltage with a multimeter.

Disconnect ECM harness connector EM01.

(e)Standard Voltage: 11-14 V

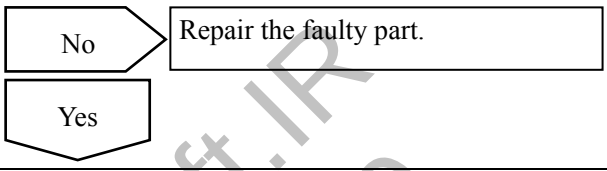
Confirm if the voltage conforms to standard value.



4	Inspect ECM working circuit.

(a) Check if ECM power circuit is normal.

(b) Inspect if ECM ground is normal.



5	Troubleshooting

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2.8.7.5 Cooling fan does not run at low speed

Note: Before carry out this diagnostic procedures, please refer to the2.8.7.2 Cooling Fan Circuit Diagnosis, which will facilitate the Diagnostic.

1	Inspect cooling fan 1 low speed working power supply.

(a) Rotated ignition switch to "OFF" position .

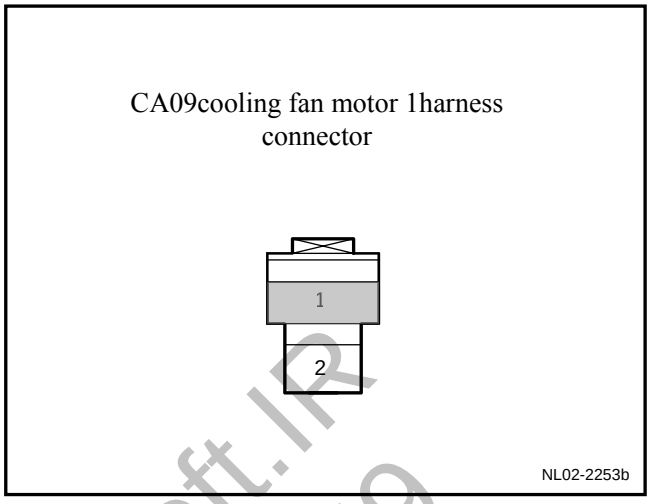
(b) Disconnect cooling fan harness connector CA09.

(c) Rotated ignition switch to "ON" position .

(d) Connect fault diagnosis tester to the diagnostic interface.

(e) Select in sequence: Engine / Action Test /Fan Low-Speed.

(f) Make low-speed relay work.



(g) Measure the voltage between cooling fan harness connector CA09 terminal No. 1 and a reliable ground.

Standard Voltage: 11-14 V

Confirm whether the voltage conforms to standard value.

No → Go to step 6

Yes

2	Inspect the cooling fan ground circuit.

(a) Rotated ignition switch to "OFF" position .

(b) Disconnect cooling fan harness connector CA10.

(c) Measure cooling fan wire harness connector CA10 terminal 2 plug hole and reliable grounding.

Resistance value between

Standard Resistance: Less than 1 Ω

Confirm whether the resistance conforms to standard value.

No → CA16 terminal No . 3 has poor connection to ground , Inspect and repair faulty part .

Yes

3	Inspect the performance of cooling fan 1 .

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(a) Rotated ignition switch to "OFF" position .

(b) Connect fault diagnosis tester to diagnosis testing interface.

(c) Rotated ignition switch to "ON" position .

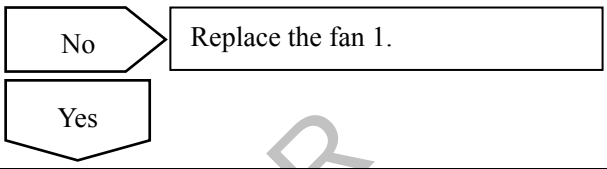
(d) Select in sequence: Engine / Action Test /Fan Low-Speed.

(e) Make low-speed relay 1 work.

(f) Measure the voltage between the cooling fan 1 harness connector CA09 terminal 2 and the reliable grounding (Note: don't disconnect the connection between the harness connector CA09 and Fan 1).

Standard Voltage: 11-14 V

Confirm whether the voltage conforms to standard value.



4	Inspect the power supply for cooling fan 2 .

(a) Rotated ignition switch to "OFF" position .

(b) Disconnect cooling fan harness connector CA10.

(c) Connect fault diagnosis tester to diagnosis testing interface.

(d) Turn ignition switch "ON" position.

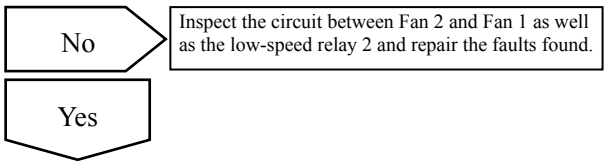
(e) Select in sequence: Engine / Action Test /Fan Low-Speed.

(f) Make low-speed relay 1 work.

(g) Measure voltage between CA10 cooling fan harness connector terminal No.1 and a reliable ground.

Standard Voltage: 11-14 V

Confirm whether the voltage conforms to standard value.



5	Replace the fan 2.

6	Use the "Action Test" of fault diagnosis tester to drive the fan low-speed.

(a) Does the low-speed relay 1 work?

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No → Go to step 10

Yes

7	Inspect the high-speed and low-speed relay 1 socket No.30 input power supply.

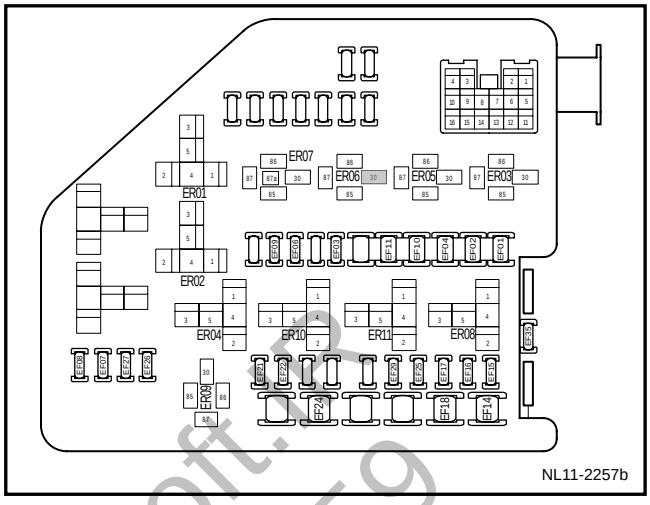
(a) Rotated ignition switch to "OFF" position .

(b) Dismantle the cooling fan high- or low-speed relay 1.

(c) Measure voltage between high- or low-speed cooling fan relay 1 socket No.30 and a reliable ground.

Standard Voltage: 11-14 V

Confirm whether the voltage conforms to standard value.



No → Inspect and repair the faulty locations and replace the underhood fuse relay box if necessary.

Yes

8	Inspect high-speed or low-speed cooling fan relay 1 and cooling fan harness connector CA09 wiring harnesses.

(a) Rotated ignition switch to "OFF" position .

(b) Dismantle the cooling fan high- or low-speed relay 1.

(c) Disconnect cooling fan wiring harness connector CA09.

(d) Test continuity between high-speed or low-speed cooling fan relay 1 terminal No.87 and cooling fan wiring harness connector CA09 terminal No.1.

(e) Measure resistance between high-speed cooling fan relay 1 terminal No.87 and a reliable ground. Inspect whether the circuit is short to ground.

Standard Value

Test Items	**Specified Value**
Cooling Fan High-Speed Relay 1(87)-CA09(1)	Less than 1 Ω
Resistance Between Cooling Fan High-Speed Relay 1(87) and Reliable Grounding	10 kΩ or higher

Confirm whether the measured value conforms to the standard value.

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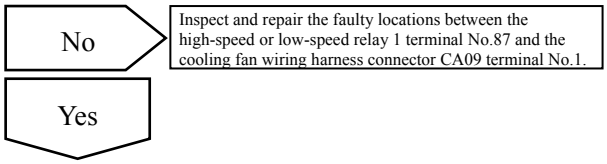


9	Replace cooling fan high-low speed relay 1.

10	Inspect high-speed or low-speed relay 1 coil power supply.

(a) Rotated ignition switch to "OFF" position .

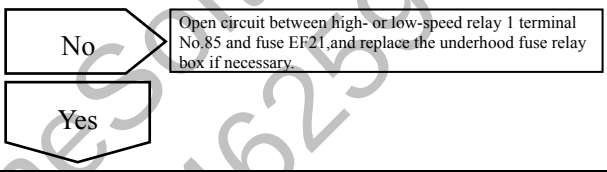
(b) Dismantle the low-speed cooling fan relay 1.

(c) Rotated ignition switch to "ON" position .

(d) Measure voltage between high- or low-speed cooling fan relay 1 terminal No.85 and a reliable ground.

Standard Voltage: 11-14 V

Confirm whether the voltage conforms to standard value.



11	Inspect high-speed or low-speed relay control circuit.

(a) Rotated ignition switch to "OFF" position .

(b) Disconnect ECM harness connector EM01.

(c) Dismantle the high- or low-speed cooling fan relay.

(d) Test the continuity between the cooling fan high-speed or low-speed relay terminal No.86 and EM01 terminal No.65.

(e) Measure voltage between low speed cooling fan relay terminal No.86 and a reliable ground. Inspect whether the circuit is short to power supply.

Standard Value

Test Items	**Specified Value**
High- or Low-speed relay (86)-EM01 (65)	Less than 1 Ω
Resistance Between high- or low-speed Relay (86) and Reliable Ground	10 kΩ or higher

Confirm whether the measured value conforms to the standard value.

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No → Open circuit between high- or low-speed relay terminal No.86 and EM01 terminal No.65.

Yes

12	Inspect ECM working circuit.

(a) Check if ECM power circuit is normal.

(b) Inspect if ECM ground is normal.

No → Repair the faulty part.

Yes

13	Replace ECM

Next

14	Troubleshooting

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2.8.7.6 Cooling Fan 1 Runs At High Speed (Fan 2 Does not Run)

1	Confirm Fault Symptom

No

2	Use the “Action Test” of fault diagnosis tester to drive the fan low-speed.

Is the High-Speed relay working?

Yes → Go to step 5

No

3	Inspect the voltage between the sockets #85 and #86 of the high-speed relay.

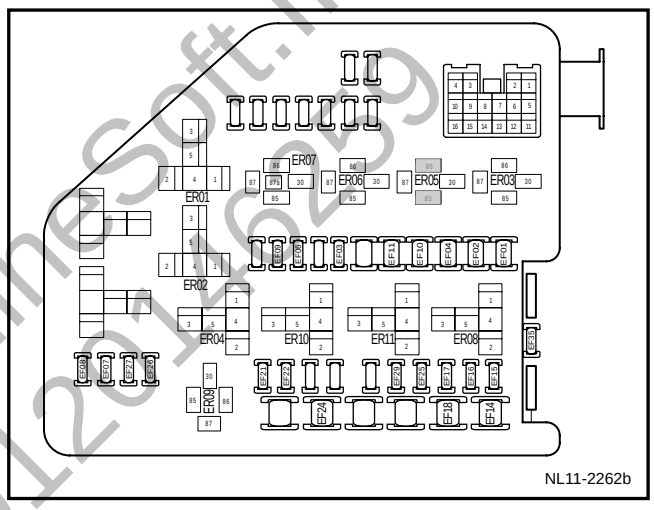
(a) Rotated ignition switch to "OFF" position .

(b) Dismantle high-speed relay.

(c) Rotated ignition switch to "ON" position .

(d) Connect fault diagnosis tester to the diagnostic interface.

(e) Select in sequence: Engine/Action Test/Fan High Speed.



(f) Measure the voltage between the #85 and #86 sockets of the high-speed relay with multimeter.

(e) Standard Voltage: 11-14 V

Yes → Replace high-speed relay

No

Confirm if the voltage conforms to standard value.

4	Repair the underhood Fuse Block Open Circuit fault.

5	Inspect the voltage on the high-speed relay socket #30.

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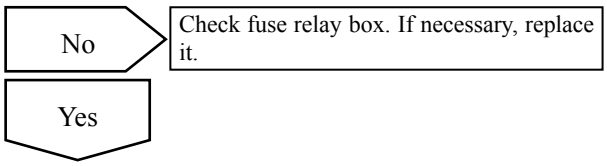
(a) Rotated ignition switch to "OFF" position .

(b) Dismantle high-speed relay.

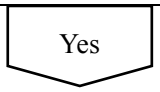
(c) Measure the effective grounding voltage between the socket #30 of the high-speed relay and the vehicle body with multimeter.

(e) Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.



6	Check the open circuit fault between the high-speed relay terminal #87 and the fan motor 2.



7	Troubleshooting

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2.8.7.7 Cooling Fan always Runs at Low Speed

Note: Before carry out this diagnostic procedures, please refer to the2.8.7.2 Cooling Fan Circuit Diagnosis, which will facilitate the Diagnostic.

1	Use the "Action Test" of fault diagnosis tester to drive the fan high-speed. Is low-speed relay 2 working?

Is High- or Low-speed relay 2 working?

No → Go to step 4

Yes

2	Inspect the grounding circuit between the socket #87 of the cooling fan's high-speed and low-speed relay 2 and the vehicle body.

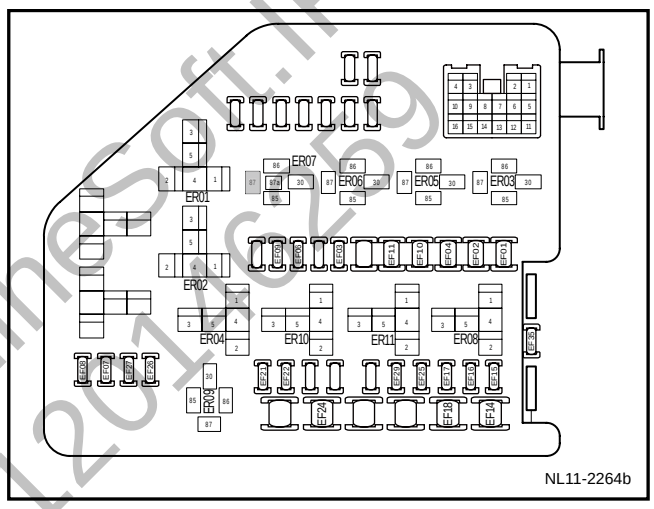
(a) Rotated ignition switch to "OFF" position .

(b) Dismantle the high- or low-speed relay 2.

(c) Measure the grounding resistance between the relay 2 socket #87 and the body with multimeter.

Standard Resistance: Less than 1 Ω

Confirm whether the resistance is normal.



Yes → Go to step 6

No

3	Check the open circuit fault at the grounding with the vehicle body of the socket 87 of the cooling fan's high- and low-speed relay 2.

4	Inspect high-speed or low-speed relay 2 coil circuit.

(a) Rotated ignition switch to "OFF" position .

(b) Dismantle the cooling fan high- or low-speed relay 2.

(c) Rotated ignition switch to "ON" position .

(d) Connect fault diagnosis tester to the diagnostic interface.

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(e) Select in sequence: Engine/Action Test/Fan High Speed.

(f) Measure the voltage between the #85 and #86 sockets of the high-speed relay with multimeter.

(e) Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.

Yes → Replace high- or low-speed relay 2

No

5	Repair the open circuit fault of the fuse relay box in the engine compartment and replace it if necessary.
6	Use the “Action Test” of fault diagnosis tester to drive the fan low-speed.

Is the low-speed relay working?

Yes → Go to step 11

No

7	Inspect the high-speed and low-speed relay 1 socket No.30 input power supply.

(a) Rotated ignition switch to "OFF" position .

(b) Dismantle the cooling fan high- or low-speed relay 1.

(c) Measure voltage between high- or low-speed cooling fan relay 1 socket No.30 and a reliable ground.

Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.

No → Inspect and repair the faulty locations and replace the underhood fuse relay box if necessary.

Yes

8	Inspect high-speed or low-speed cooling fan relay 1 and cooling fan harness connector CA09 wiring harnesses.

(a) Rotated ignition switch to "OFF" position .

(b) Dismantle the cooling fan high- or low-speed relay 1.

(c) Disconnect cooling fan wiring harness connector CA09.

(d) Test continuity between high-speed or low-speed cooling fan relay 1 terminal No.87 and cooling fan wiring harness connector CA09 terminal No.1.

(e) Measure resistance between high-speed cooling fan relay 1 terminal No.87 and a reliable ground. Inspect whether the circuit is short to ground.

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Standard Value

Test Items	Specified Value
High or low-Speed relay 1(87)-CA09(1)	Less than 1 Ω
Resistance High- or Low-Speed Between Relay 1 (87) and A Reliable Ground	10 kΩ or higher

Confirm whether the resistance conforms to standard value.

No → Inspect and repair the faulty locations between the high-speed or low-speed relay 1 terminal No.87 and the cooling fan wiring harness connector CA09 terminal No.1.

Yes

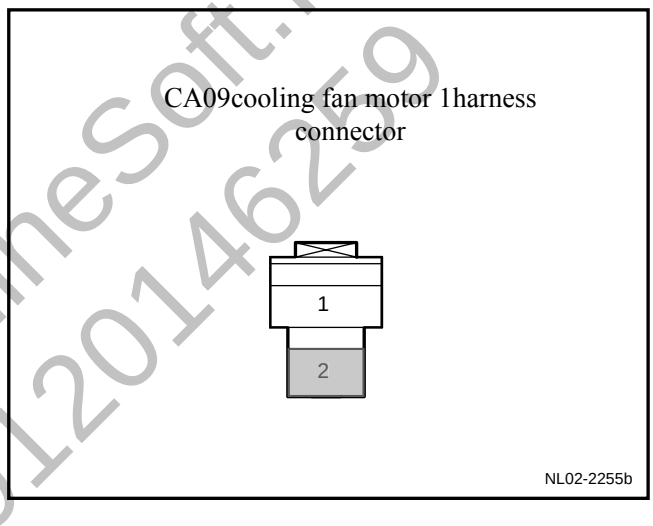
9	Inspect the resistance between the terminal 2 of the harness connector CA09 of the cooling fan 1 and the socket 30 of the cooling fan's high- or low-speed relay 2.

(a) Rotated ignition switch to "OFF" position .

(b) Disconnect cooling fan 1 wiring harness connector CA09.

(c) Dismantle the high- or low-speed cooling fan relay 2.

(d) Use the multimeter to check the resistance between the terminal 2 of the harness connector CA09 of the cooling fan 1 and the socket 30 of the cooling fan's high-speed or low-speed relay 2.



Standard Resistance: Less than 1 Ω

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Confirm whether the resistance conforms to standard value.

No → Repair the circuit fault between the terminal 2 of the harness connector CA09 of the cooling fan 1 and the socket 30 of the cooling fan's high- or low-speed relay 2.

Yes

10	Replace Fan Motor 1

11	Inspect High- or Low-speed relay 1 coil power supply.

(a) Rotated ignition switch to "OFF" position .

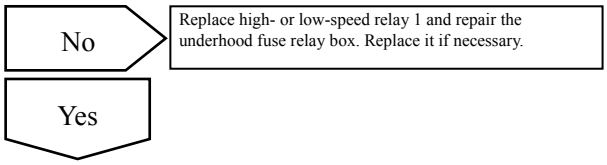
(b) Dismantle the fan high- or low-speed relay 1.

(c) Rotated ignition switch to "ON" position .

(d) Measure the effective grounding voltage between High- or Low-speed relay 1 socket 85 and the body with a multimeter.

Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.



12	Measure ECM harness connector EM01 terminal No.65 voltage.

(a) Rotated ignition switch to "ON" position .

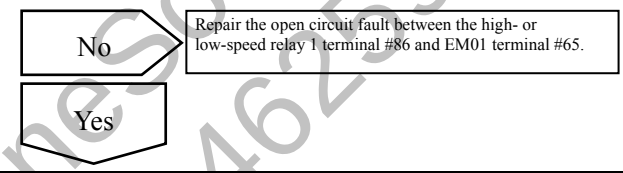
(b) Disconnect ECM harness connector EM01.

(c) Dismantle the high- or low-speed cooling fan relay 1.

(d) Test the continuity between the cooling fan high- or low-speed relay 1 terminal No.86 and EM01 terminal No.65.

Standard Resistance: Less than 1 Ω

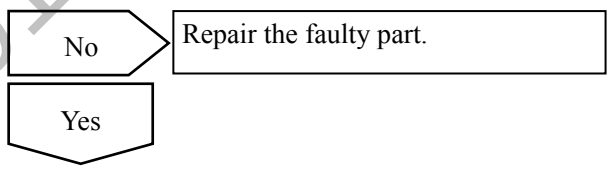
Confirm whether the measured value conforms to the standard value.



13	Inspect ECM working circuit.

(a) Check if ECM power circuit is normal.

(b) Inspect if ECM ground is normal.



14	Replace ECM

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2.8.7.8 Cooling Fan always Runs at High Speed

Note: When this fault is present, it is recommended to carry out diagnostic when engine is completely cooled down.

1	Confirm Fault Symptom

No

2	Inspect the signal of temperature sensor of engine coolant.

(a) Rotated ignition switch to "OFF" position .

(b) Connect fault diagnosis tester to diagnosis testing interface.

(c) Turn off A/C switch.

(d) Turn ignition switch "ON" position.

(e) Select in sequence: engine/data list/ engine coolant temperature.

(f) Observe the temperature displayed on temperature sensor of engine coolant. When the engine is completely cool, the temperature displayed shall be higher than ambient temperature.

Confirm if the temperature displayed is normal.

No → Refer to 2.2.7.20 DTC P0117 P0118 for coolant temperature sensor or circuit malfunction.

Yes

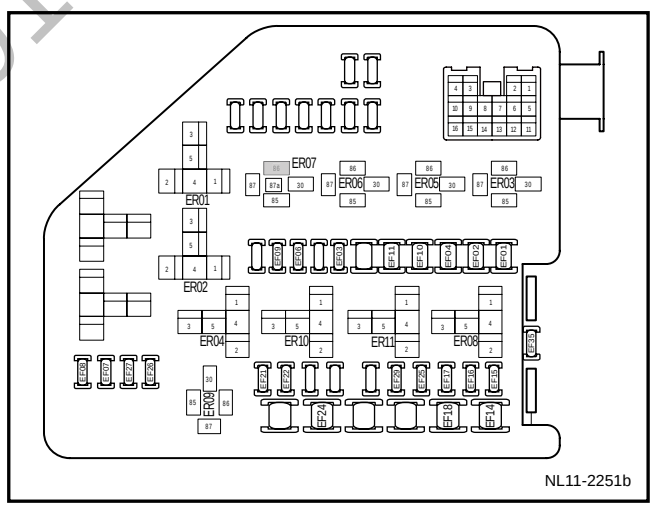
3	Inspect the circuit between the 86 socket of the high- or low-speed relay 2 and the terminal 17 of ECM harness connector EM01.

(a) Rotated ignition switch to "OFF" position .

(b) Dismantle high speed relay 2.

(c) Disconnect ECM harness connector EM01.

(d) Measure the resistance with a multimeter.



Standard Value

Test Items	Specified Value

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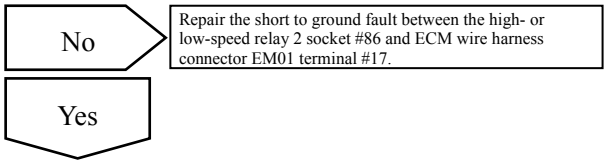
High- or Low-Speed Relay 2 (86)-EM01(17)	Less than 1 Ω
Resistance Between High- or Low-Speed Relay 2 (86) and A Reliable Ground	10 kΩ or higher

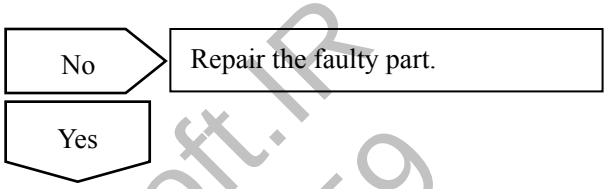
Confirm whether the resistance conforms to standard value.



4	Inspect ECM working circuit.

(a) Inspect if ECM power circuit is normal.

(b) Inspect if ECM ground is normal.



5	Replace ECM

Next

6	Troubleshooting

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2.8.7.9 Thermostat Diagnostic

1	Dismantle the thermostat, see “2.8.8.4 Replacement of Thermostat”

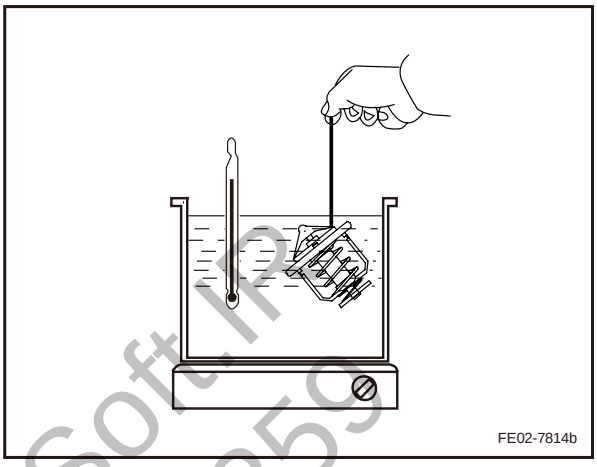
Next

2	Soak the thermostat in water and heat the water.

A. Inspect the thermostat switching on temperature.

Standard value :82℃(179 . 6℉)

Is the thermostat switching on temperature normal?



No → Replace the thermostat, refer to 2.8.8.4 Replacement of Thermostat

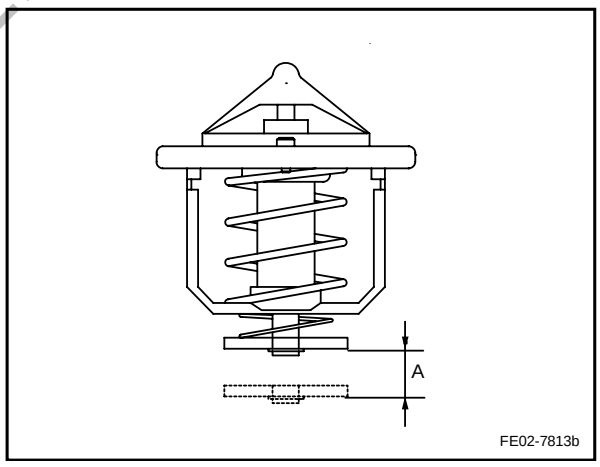
Yes

3	Inspect the thermostat valve lift range.

Standard valve lift:

Be 10 mm (0.39 in.) or more at 95℃ (203°F)

Confirm whether the valve lift is normal.



No → Replace the thermostat, refer to 2.8.8.4 Replacement of Thermostat

Yes

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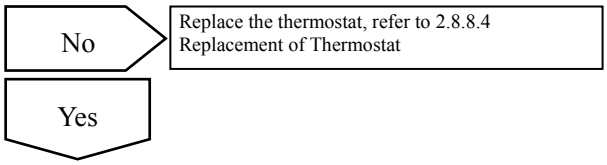
4	Inspect whether the thermostat is completely switched off at low temperature.

When the thermostat temperature is lower than 77 ℃ (171 °F), Inspect whether the valve is completely switched off.



5	Thermostat is normal.

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2.8.7.10 Engine Overheating

Warning: Refer to "Warning on Maintenance of Cooling System" in "Warnings and Precautions".

1	Is there engine coolant loss?

Yes → Add engine coolant.

No

2	Inspect for the sufficiency of the coolant concentration.

Yes → Use Geely Genuine ultra-long-acting engine coolant" or the same level of high-quality ethylene glycol base engine coolant, model or standard number: comply with SH0521.

No

3	Inspect whether there is dust, leaves or insects and other debris at the radiator front?

Yes → Clean up the front of the radiator.

No

4	Inspect for the leakage at the hoses, water pumps, engine coolant inlet components, radiator, core plug and cylinder hood gaskets.

Yes → Replace any damaged components.

No

5	Connect fault diagnosis tester, with the data flow showing the engine coolant temperature reaches 95℃ (203 °F). Inspect the coolant temperature at the radiator inlet and outlet pipes. There should be no temperature difference. Is the temperature difference large?

Yes → 1. Inspect whether the thermostat is working as per normal?
2.Check if radiator was plugged or not .

No

6	Use ignition timing gun to inspect whether the ignition is too late.

Yes → Inspect engine ignition timing, carry out ECM diagnostic.

No

7	Inspect whether the cooling fan is working properly.

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Yes → Refer to 2.8.7.2 “Cooling Fan Circuit Diagnosis Diagnostic” to inspect the cooling fan circuit.

No

8	Inspect whether there is water pump fault.

Yes → Replace the water pump. Refer to 2.8.8.6 Replacement of Water Pump

No

9	Inspect whether radiator cap is faulty.

Yes → Replace the faulty radiator cap.

No

10	Inspect whether there is cylinder hood cover and engine block cracking or blockage. Is the cylinder block gasket sealing poor

Yes → Repair the damaged cylinder hood cover and engine block

No

11	Confirm that the fault has been fixed.

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2.7.7.11Engine Does Not Reach Normal Operating Temperature

1	Inspect whether coolant recovery reservoir coolant level is abnormal?

Yes → Add engine coolant to specified level.

No

2	Inspect the temperature of cooling system.

A. rotated ignition switch to OFF position .

B. Connect fault diagnosis tester to diagnostic interface.

C. Rotated ignition switch to ON position .

D. Select in sequence: Engine / Data List / Engine Coolant Temperature.

E. Maintain the engine speed at 2,000 rpm and observe the data flow for the engine coolant temperature.

Does the engine coolant temperature increase?

Yes → Refer to 11.6.6 Diagnostic Information and Procedures for instrument faults.

No

3	Inspect whether the cooling fan rotates normally?

Yes → Refer to 2.8.7.5 Cooling Fan always Runs at Low Speed

No

4	Inspect whether the thermostat is working normally?

A. Inspect whether the installed thermostat type is correct.

B. Inspect whether the thermostat is stuck at the open position.

Yes → Replace with the correct type of thermostat

No

5	Inspect whether the engine coolant pipes are blocked.

Yes → Flush the cooling system or inspect the radiator flow.

No

6	Road test vehicle, confirm the fault has been fixed.

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2.8.7.12 Excessive Engine Coolant Loss

1	Inspect whether the radiator is leaking?

Yes → Refer to 2.8.8.5 "Replacement of Radiator" to replace the broken radiator.

No

2	Inspect for the leakage at the [illegible] B. Hose

Yes → Replace the fowling components as necessary: Coolant Recovery Reservoir and Hose.

No

3	Inspect whether the radiator hose and joints are loose or damaged?

Yes → Reinstall the hose. Replace the hose and clamp.

No

4	Inspect whether the water pump seal is leaking.

Yes → Replace the water pump seal.

No

5	Inspect whether the cylinder hood cover torque is appropriate.

Yes → Tighten the cylinder hood bolts to the specified torque and replace the cylinder hood gasket if necessary.

No

6	Inspect for leaking at the follows locations:

A Intake Manifold

B. Cylinder Hood Gasket

C. Cylinder Block Bolt

D. Heater Core

E. Radiator Discharge Plug

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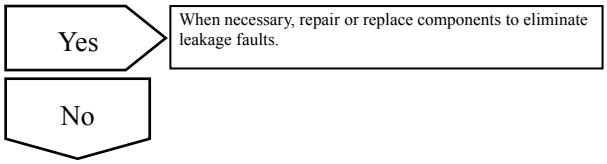

7	Confirm that the fault has been fixed.

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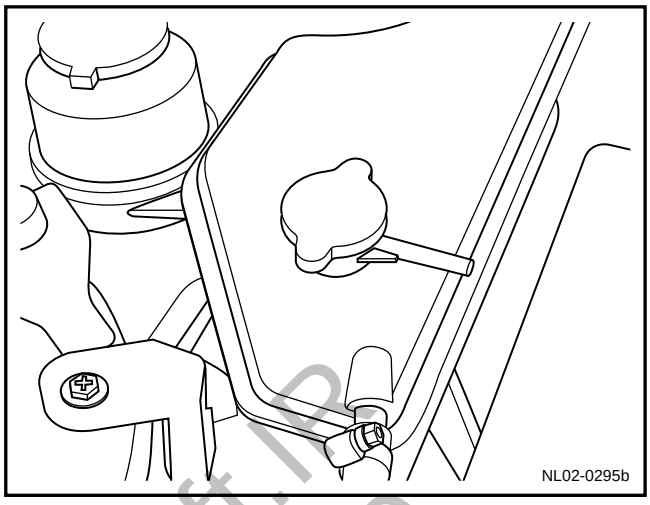
2.8.8 Removal and installation

2.8.8.1 Engine Coolant Discharge and Filling

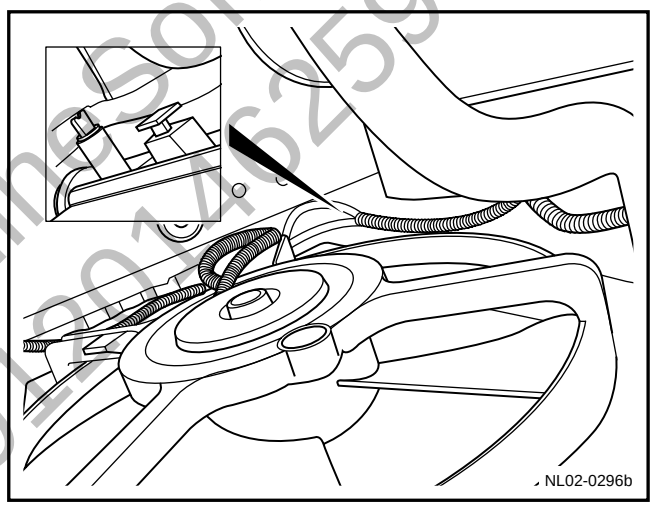
Warning: Refer to "Warning on Maintenance of Cooling System" in "Warnings and Precautions".

1. Place a recycling container under the vehicle to contain the discharged engine coolant.

2. Dismantle expansion tank cover.



3. Dismantle the engine coolant drainage valve.

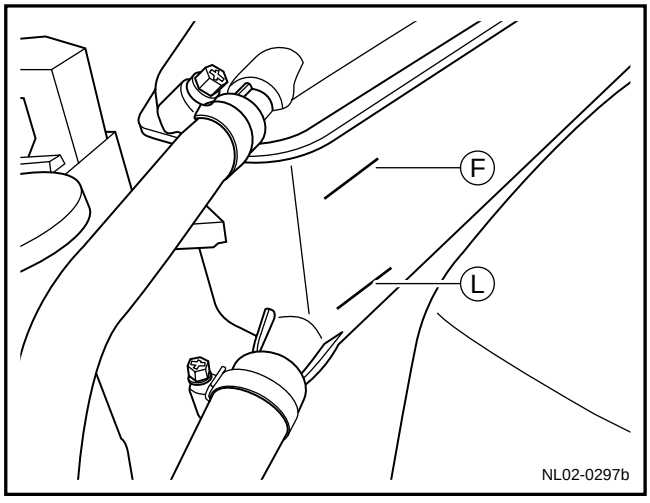


4. Contain the discharged engine coolant with the container.

Note: Handle the recycled old engine coolant, waiting for scrap or recycling. Do not dispose the old engine coolant into the water sewage to protect the environment.

5. Install the engine coolant drainage valve.

6. Refer to 2.8.8.2 Replacement of Expansion Tank Assembly to clean the coolant expansion tank assembly.



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7. Fill engine coolant into expansion tank assembly up to standard scale to discharge air from cooling pipe.

8. Start the engine until the thermostat opens. When two water inlet/outlet pipes of the radiator are hot, it means that the thermostat has been opened.

9. Shut down the engine. Confirm that the engine coolant drainage valve is not leaking. (Repeat the above steps until the discharged coolant is free of bubble.)

10. Fill the engine coolant so that the engine Coolant Recovery Reservoir coolant level reaches the highest scale (F location).

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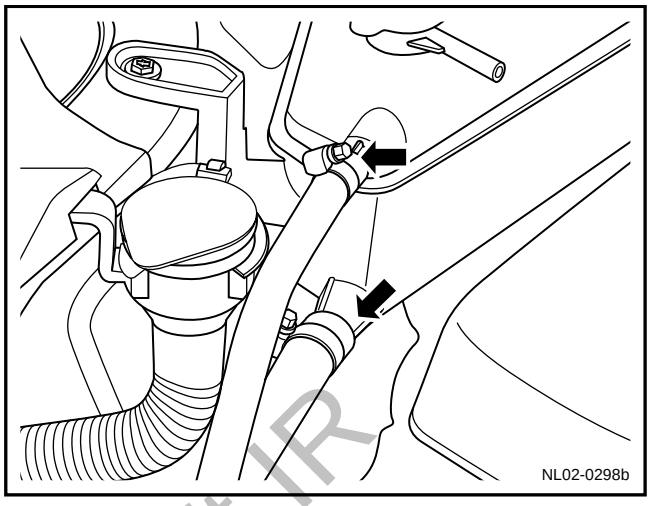
2.8.8.2 Replacement of Expansion Tank

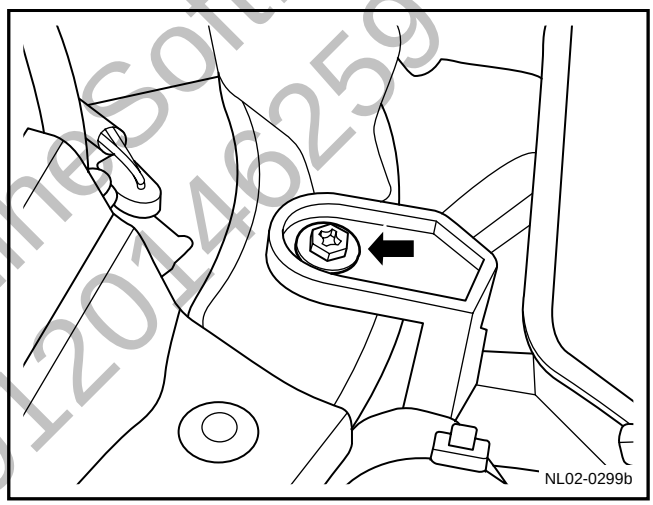
Dismantlement Procedure

Warning: Refer to "Warning on Maintenance of Cooling System" in "Warnings and Precautions".

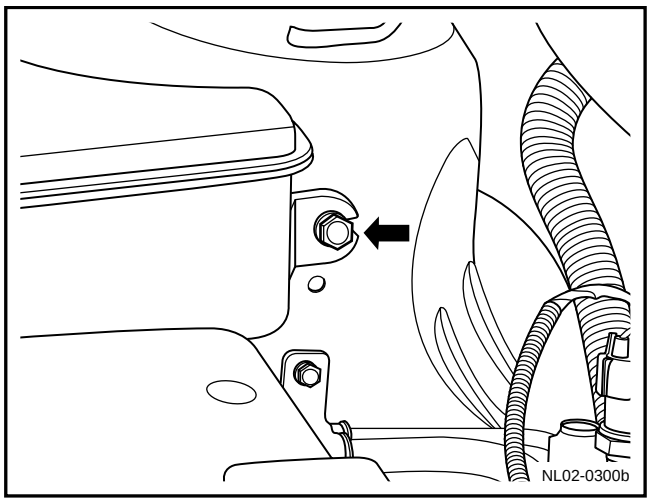
1. Discharge the engine coolant.
2. Dismantle coolant hose on expansion pipe.



3. Dismantle fixing bolt on expansion tank assembly.



4. Dismantle fixing bolt on the right side of expansion tank.



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Installation Procedure:

1. Install upper fixing bolt of expansion tank assembly.

Torque:10Nm(Metric) 7.4lb-ft(English system)

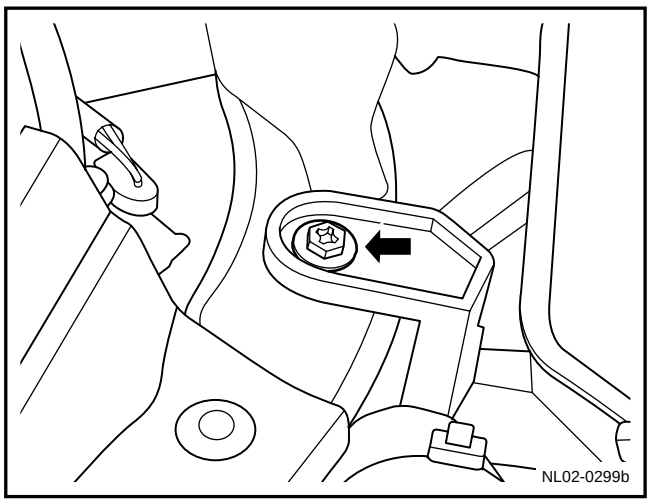
2. Install fixing bolt on the right of expansion reservoir assembly

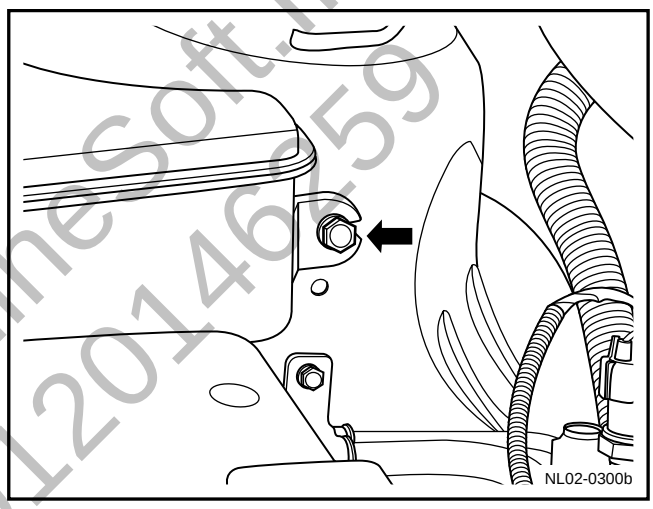
Torque :25Nm(Metric) 18 . 5lb-ft(English system)

3. Connect coolant hose to expansion tank.

4. Fill the coolant to the level between the standard scale lines of L and F.

5. Install the coolant sealed cap.





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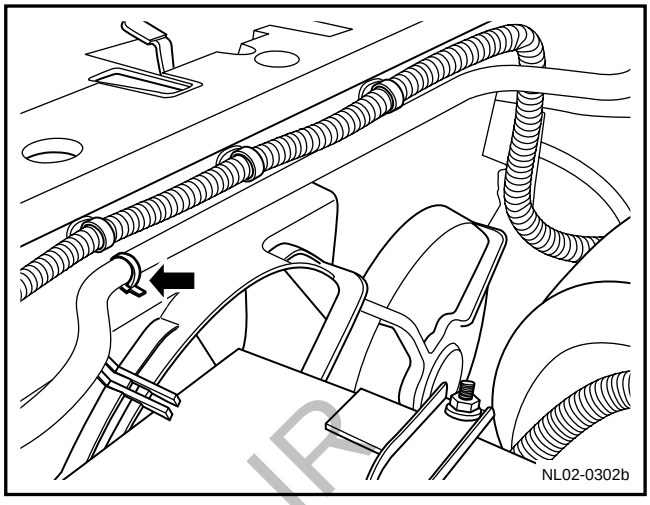
2.8.8.3 Replacement of Cooling Fan

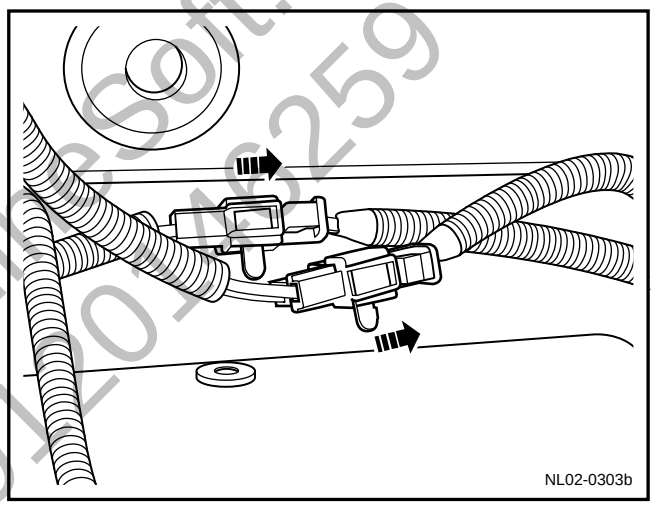
Dismantlement Procedure

Do not place hands in between fan blades running area when the fan is not switched off.

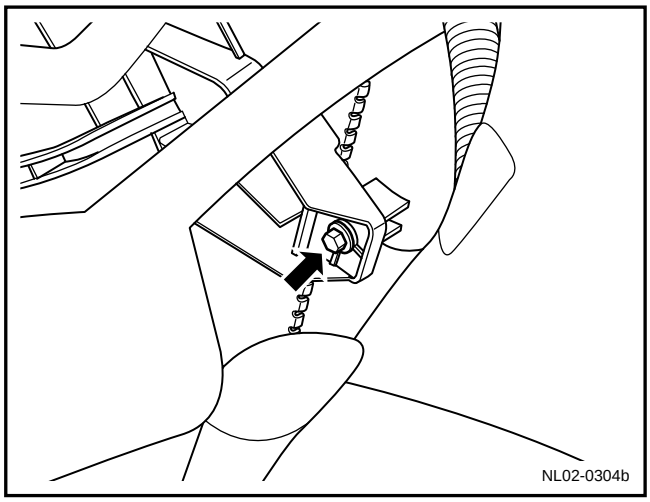
1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
2. Disconnect the fixing clips of the coolant overflowing hose 2 from the fan support of the radiator.



3. Disconnect the Fan wiring harness connector.



4. Dismantle the fixing bolts at the right side of the fan cover.



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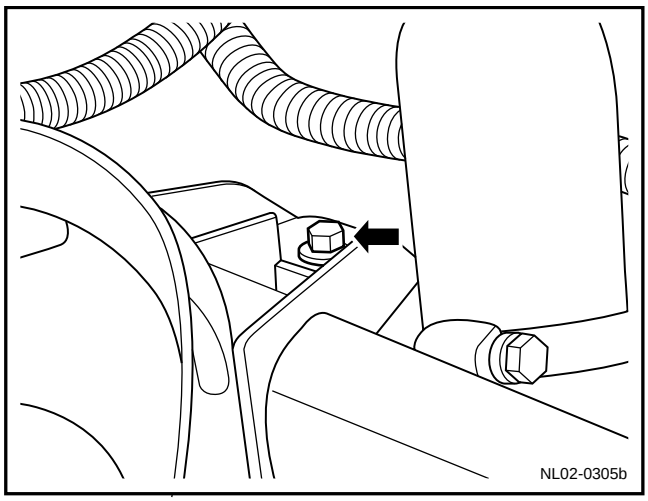
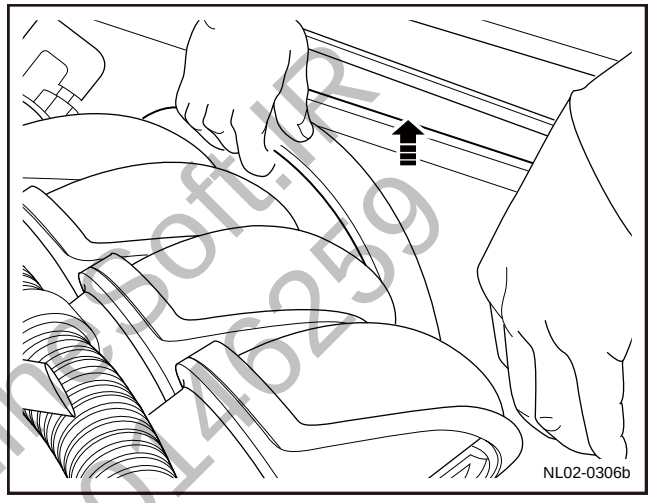
5. Dismantle the fixing bolts at the left side of the fan cover.



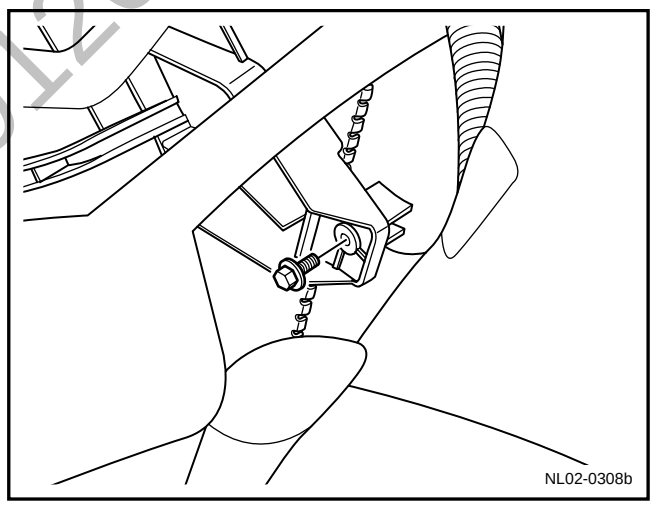
6. Dismantle the fan assembly from the vehicle.



Installation Procedure:

1. Install fan assembly onto the radiator.
2. Install the fixing bolts at the right side of the fan cover.

Torque:10Nm(Metric) 7.4lb-ft(English system)



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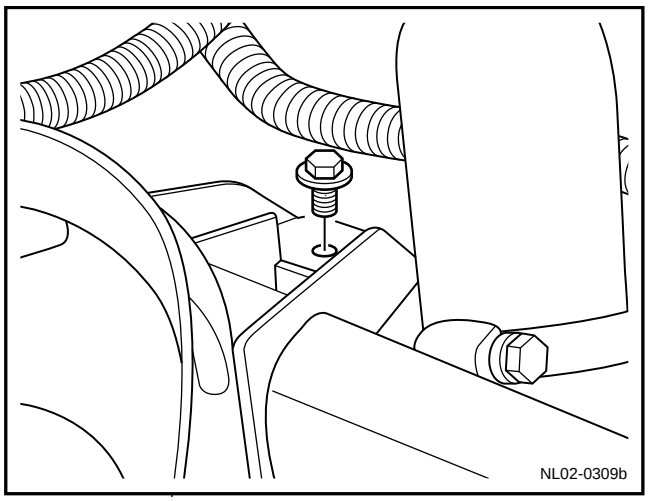
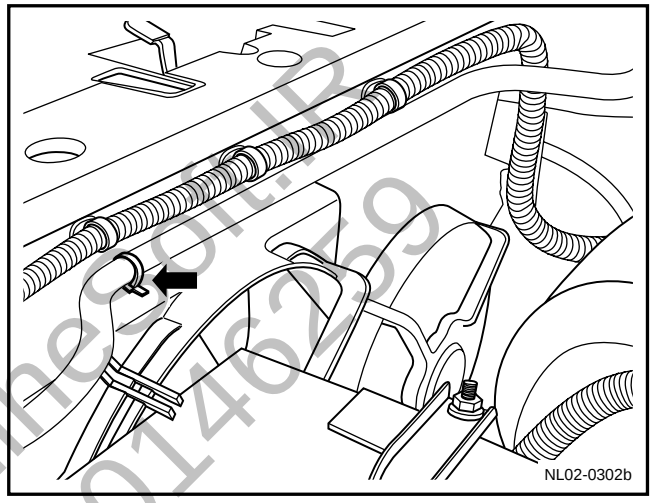
3. Install the fixing bolts at the left side of the fan cover.

Torque:10Nm(Metric) 7.4lb-ft(English system)



4. Connect the cooling fan harness connector.
5. Connect the battery negative cable .
6. Fix coolant overflowing hose.



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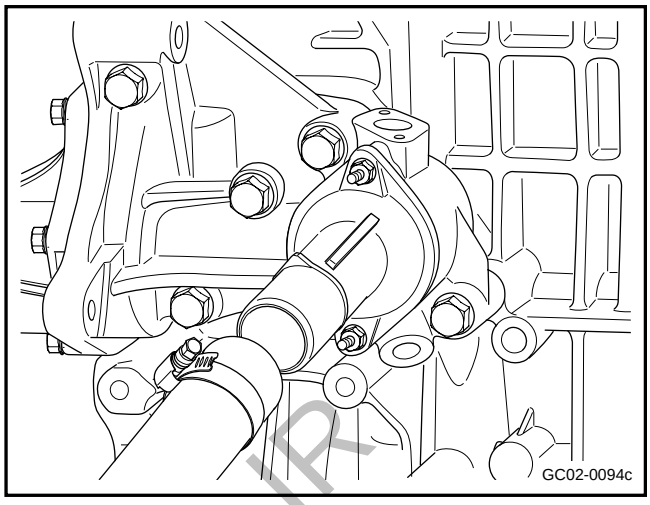
2.8.8.4 Replacement of Thermostat

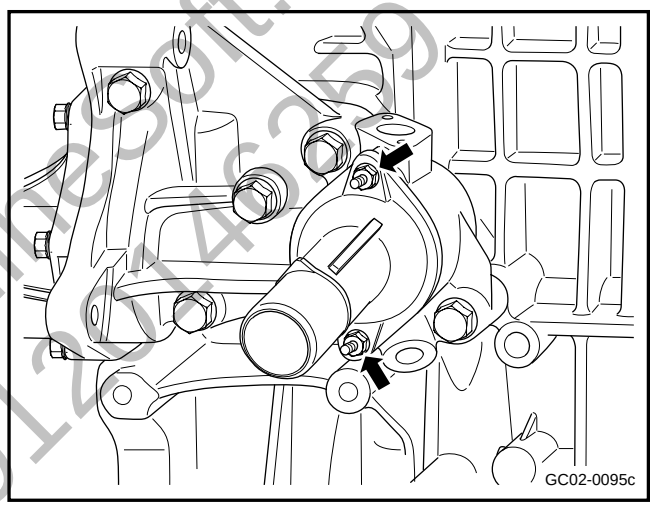
4G20/4G24engine :

Dismantlement Procedure

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Refer to 2.8.8.1 Engine Coolant Discharge and Filling to discharge engine coolant.
3. Loosen the radiator pipe clamp from the engine inlet pipe seat.
4. Disconnect the radiator outlet pipe from the engine inlet pipe.



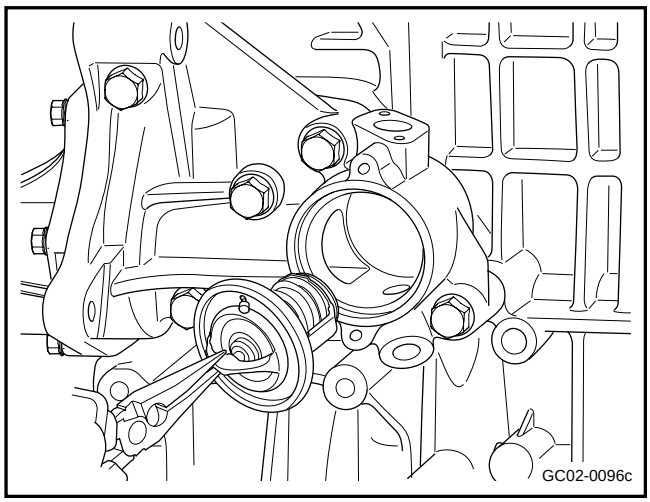
5. Dismantle the engine inlet seat retaining nuts.
6. Dismantle the engine inlet seat.



7. Remove the thermostat component from the water pump housing.

Note: the thermostat and the seal ring are integrated.

8. Clean contact surface between the engine water inlet pipe joint components and cylinder.



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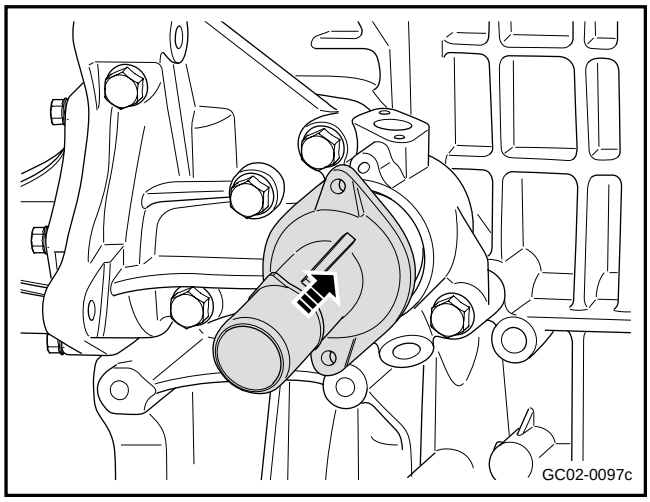
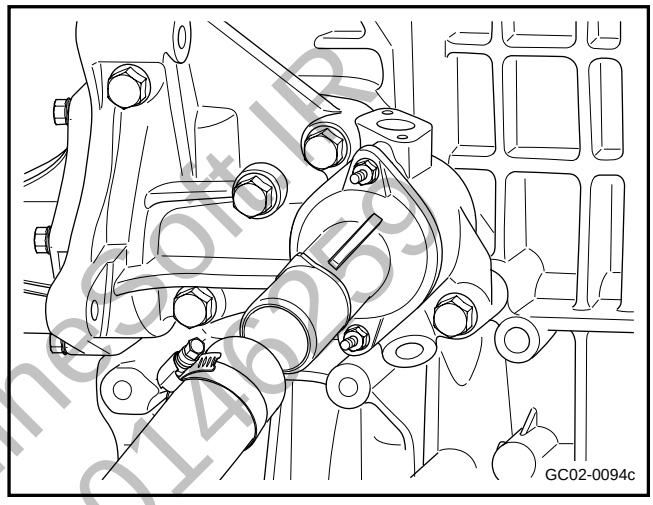
Installation Procedure:

1. Install the thermostat to the water pump housing.
2. Install the inlet seat and tighten the retaining nuts.

Torque: 8-10 N.m (Metric) 5.9-7.4 lb-ft (English system)



3. Connect the outlet pipe of the radiator to the inlet pipe seat.
4. Tighten the radiator outlet pipe clamp.
5. Fill the engine coolant.
6. Connect battery negative cable.



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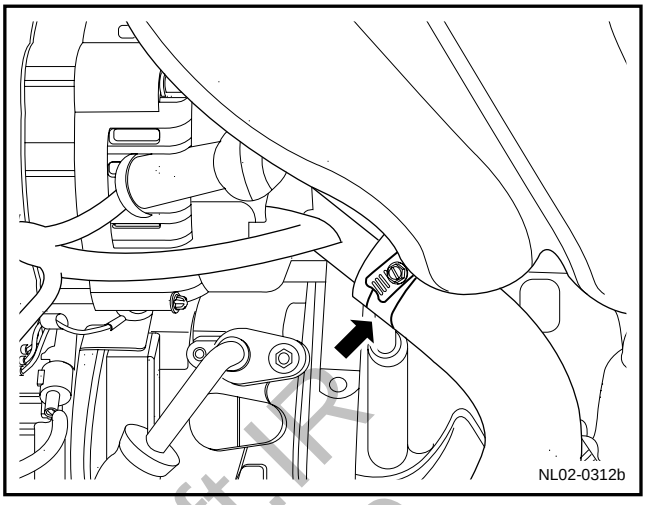
4G18engine

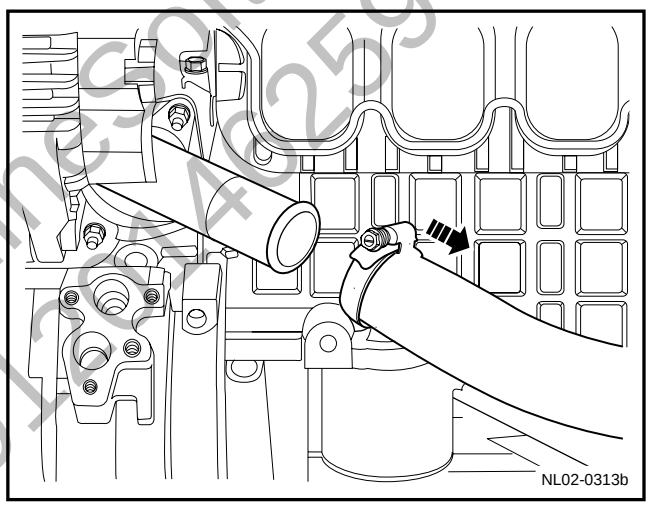
Dismantlement Procedure

Warning: Refer to "Warning on Maintenance of Cooling System" in "Warnings and Precautions".

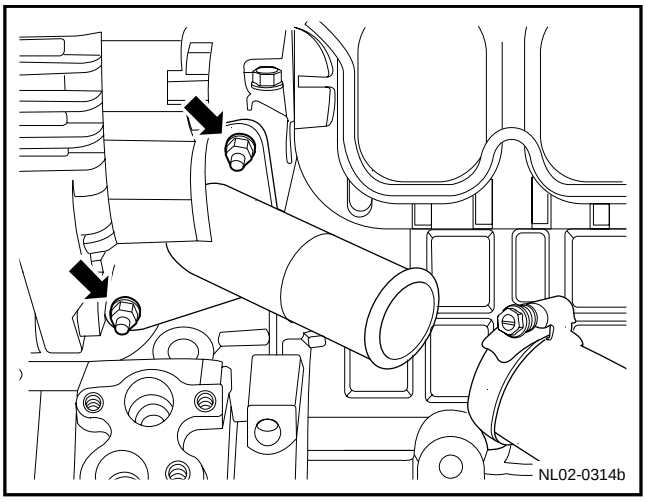
1. Discharge the engine coolant, Refer to 2.8.8.1 Engine Coolant Discharge and Filling
2. Loosen radiator water pipe clamp from engine water intake pipe joint assemblies.



3. Disconnect water outlet pipe of radiator from engine water intake pipe joint components.



4. Dismantle fixing nut from engine water inlet pipe joint components to cylinder block.



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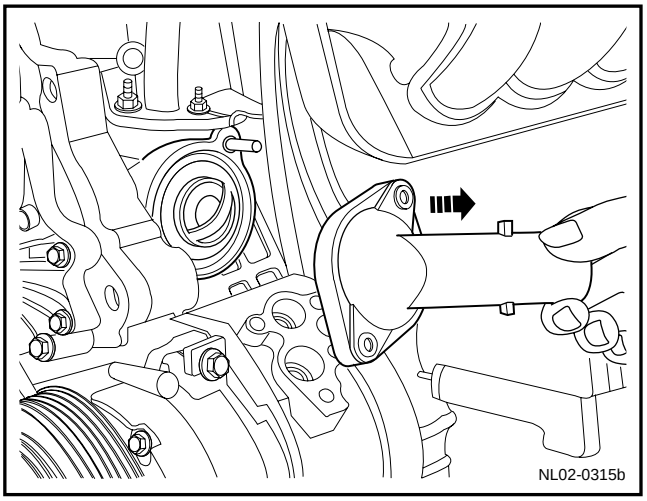
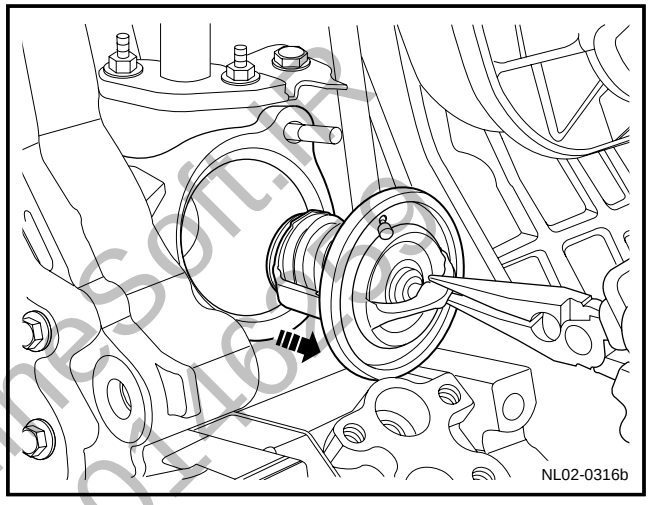
5. Dismantle the engine water inlet pipe joint components from the cylinder.



6. Dismantle thermostat from the cylinder.

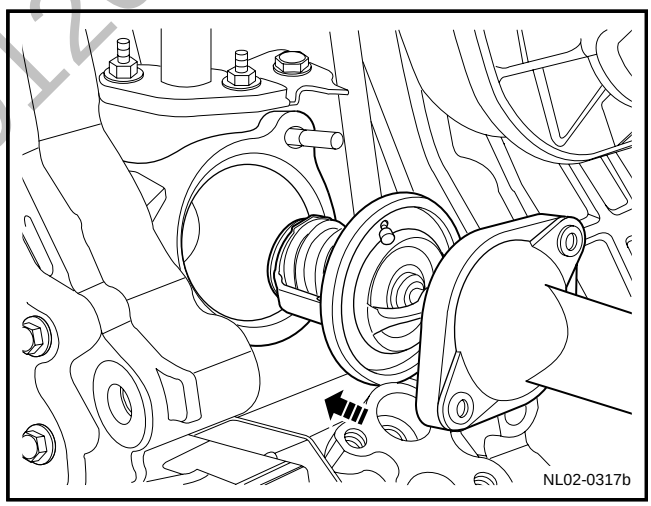
Note: the thermostat and the seal ring are integrated.

7. Clean contact surface between the engine water inlet pipe joint components and cylinder.



Installation Procedure:

1. Install thermostat onto the cylinder.
2. Install the engine water inlet pipe joint components onto the cylinder.



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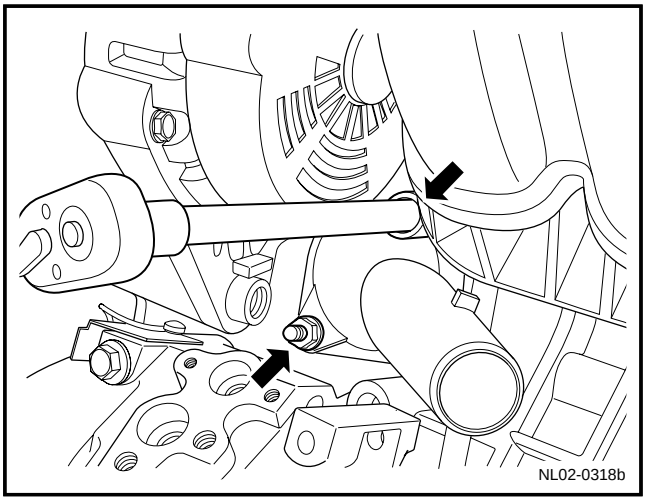
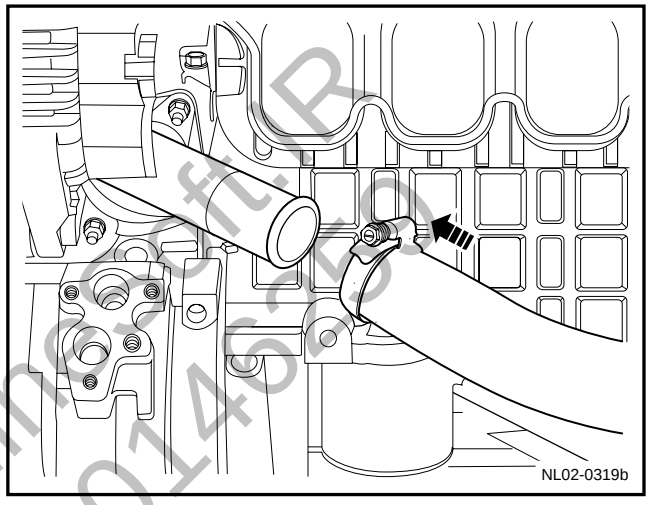
3. Install retaining nut of the engine water inlet pipe joint components.

Torque:10Nm(Metric) 7.4lb-ft(English system)



4. Install components from water outlet pipe of radiator to engine water inlet pipe joint.
5. Tighten the radiator outlet pipe clamp.
6. Fill engine coolant.



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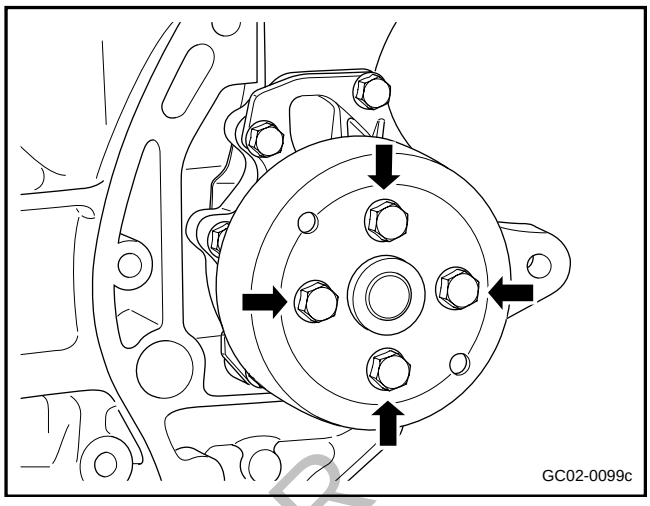
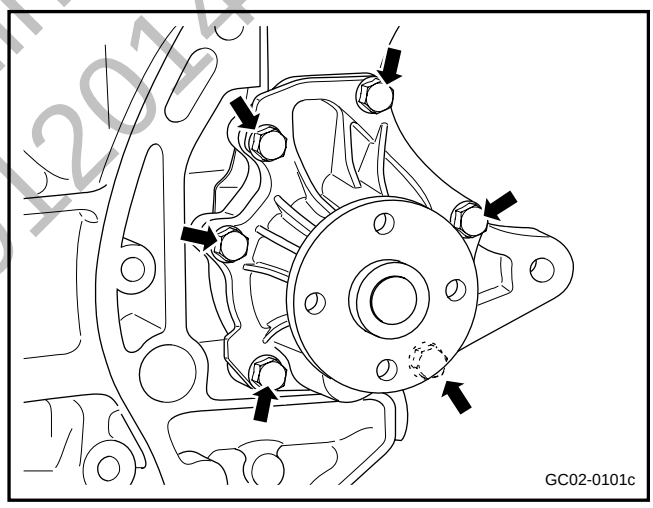
2.8.8.5 Replacement of Water Pump

4G20/4G24engine :

Dismantlement Procedure

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Refer to 2.8.8.1 Engine Coolant Discharge and Filling to discharge engine coolant.
3. Dismantle the drive belt. Refer to 2.6.8.3 Replacement of Drive Belt.
4. Refer to 2.8.8.4 "Replacement of Thermostat" to dismantle the thermostat component.
5. Dismantle the fixing bolts of water pump belt pulley.
6. Remove the fixing bolt for the water pump.
7. Dismantle the water pump belt pulley.
8. Dismantle the fixing bolts of water pump.
9. Dismantle the water pump assembly.





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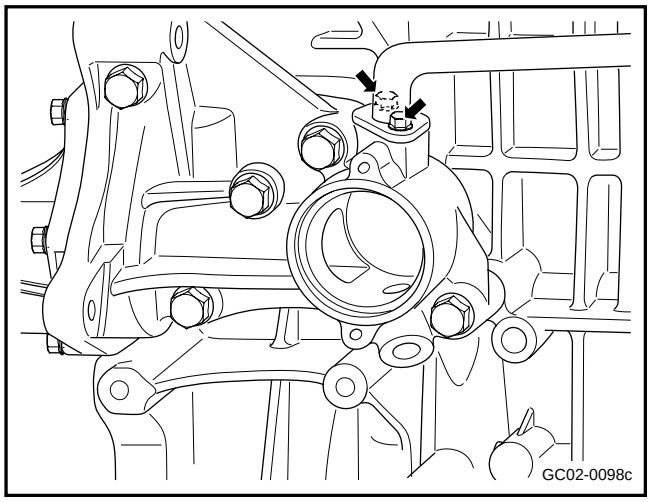
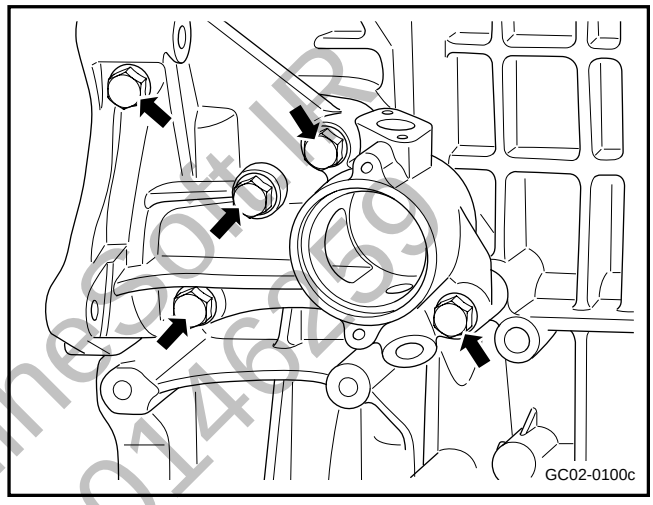
10. Dismantle Heater Outlet Pipe retaining screws.
11. Dismantle the Heater Outlet Pipe.



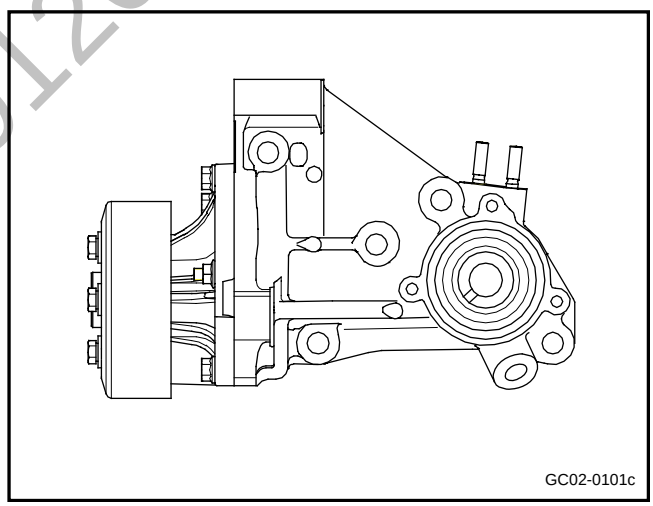
12. Dismantle the fixing bolts of water pump housing.
13. Dismantle the water pump housing.



Water Pump Inspection:

Warning: Refer to "Warning on Safety Protective Eyewear" in "Warning and Precautions".

1. Inspect whether the water pump housing is cracking and leaking.
2. Inspect whether the water pump bearing has a gap or abnormal sound.
3. Inspect for the integrity of the water pump belt pulley. If the water pump is damaged, replace the whole set of the pump housing subassembly.



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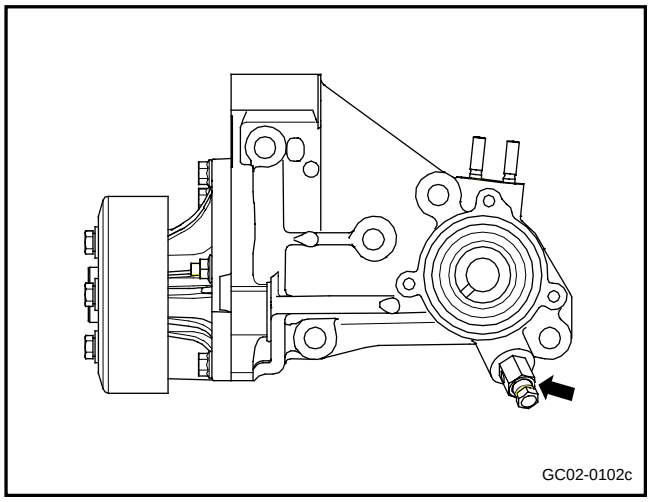
Installation Procedure:

1. Clean the water pump housing O-ring mounting groove and mating surface.
2. Install the drainage valve.
3. Install the pump assembly to the pump housing and tighten the fixing bolts.
4. Install the inlet seats for the thermostat and the engine.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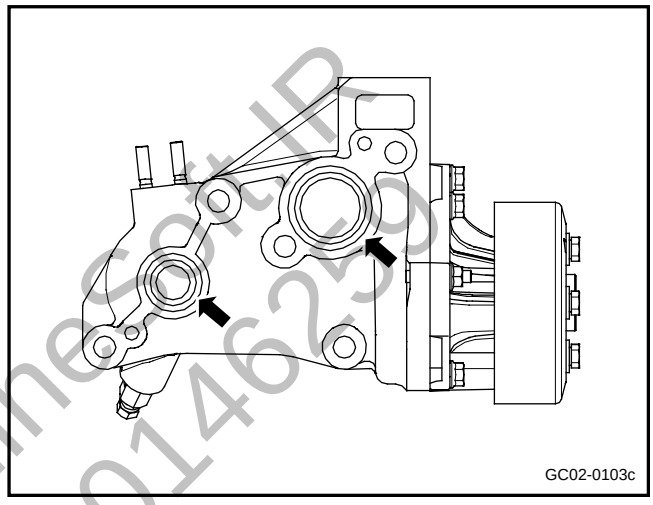
5. Install new water pump housing O-ring.

Note: The water pump housing O-ring is a single used part and must be replaced with new parts after removal.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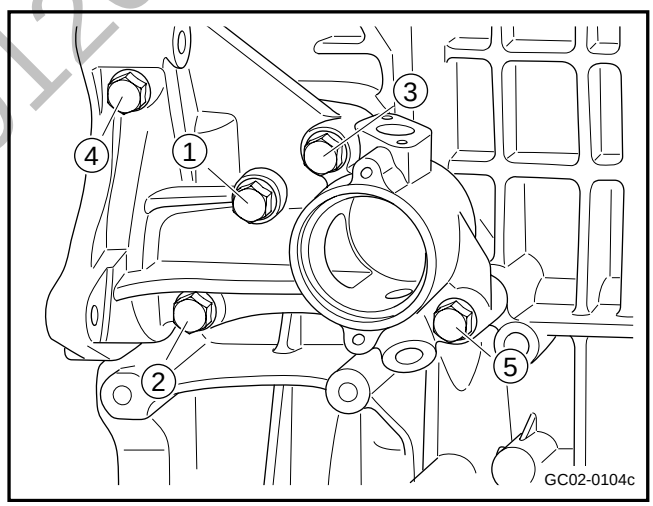
6. Install the water pump housing subassembly and five mounting bolts, but do not tighten at this stage.
7. Tighten the fixing bolts of water pump according to the sequence as shown in the figure.

Torque: 32-38 N.m (Metric) 23.6-28.0 lb-ft (English system)



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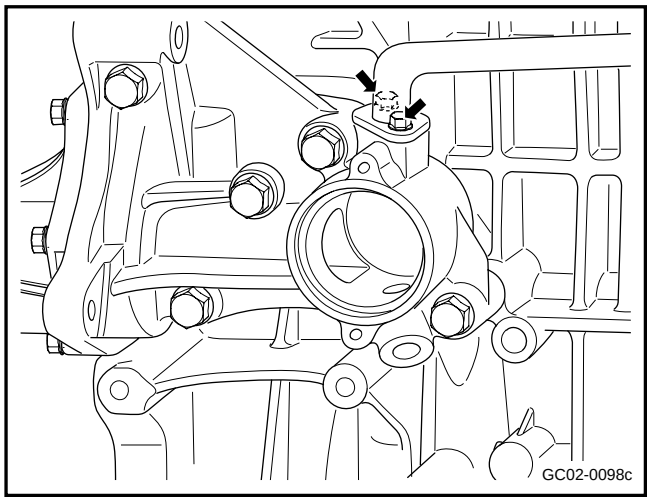
8. Install the water outlet components from heater
9. Install the thermostat components.
10. Install the water pump belt pulley.
11. Install the drive belt.
12. Fill the engine coolant.



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4G18engine :

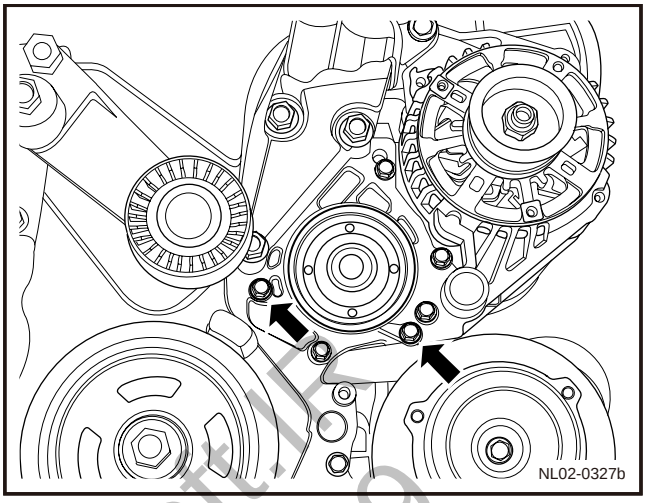
Dismantlement Procedure

Warning: Refer to "Warning on Maintenance of Cooling System" in "Warnings and Precautions".

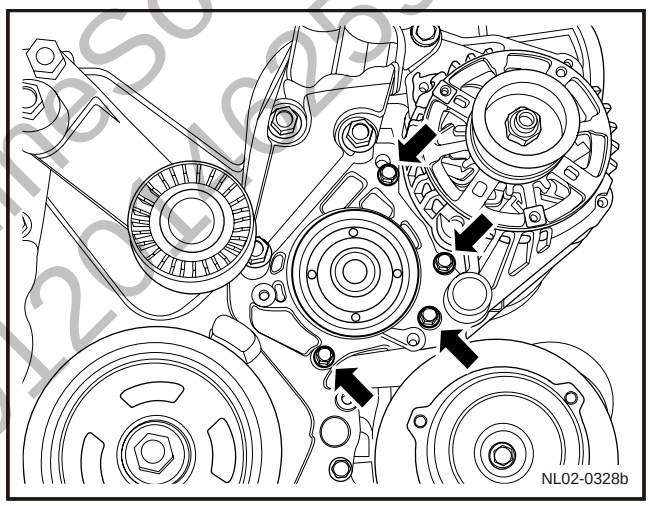
1. Discharge engine coolant. Refer to 2.8.8.1 Engine Coolant Discharge and Filling.

2. Dismantle the drive belt. Refer to 2.6.8.3 Replacement of Drive Belt.

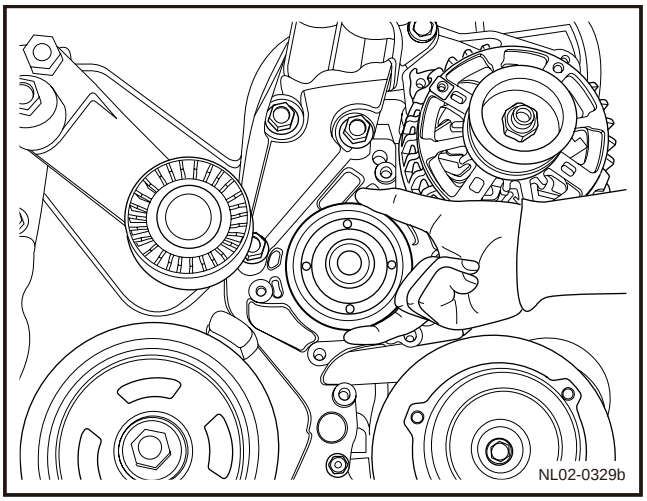
3. Dismantle 2 short fixing bolt of water pump.



4. Dismantle 4 long fixing bolts of water pump.



5. Extract the water pump.



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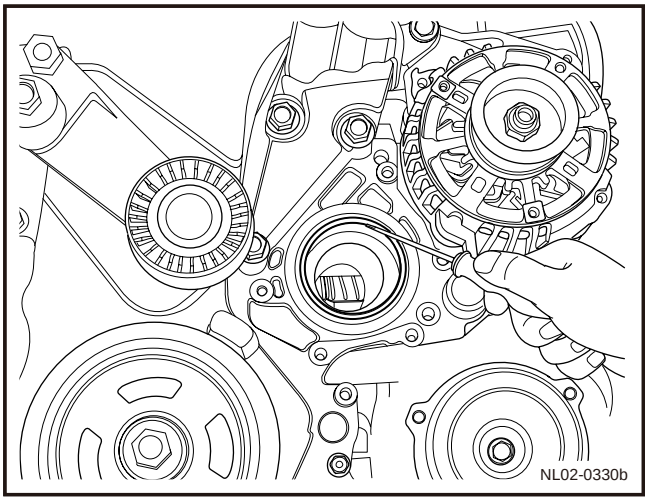
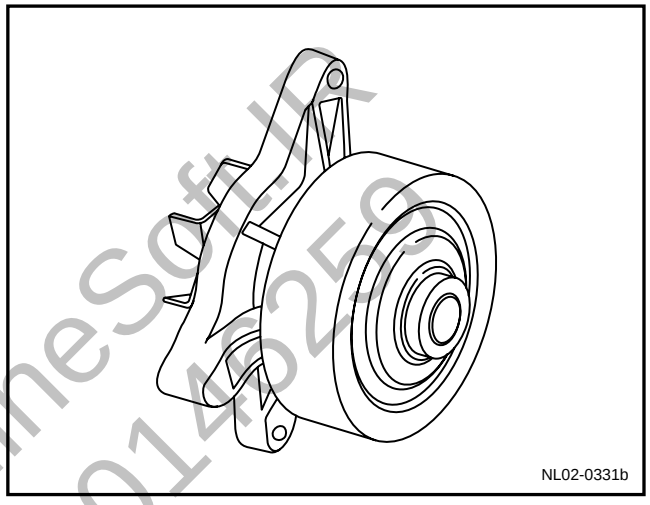
6. Take out seal ring of water pump.



Water Pump Inspection:

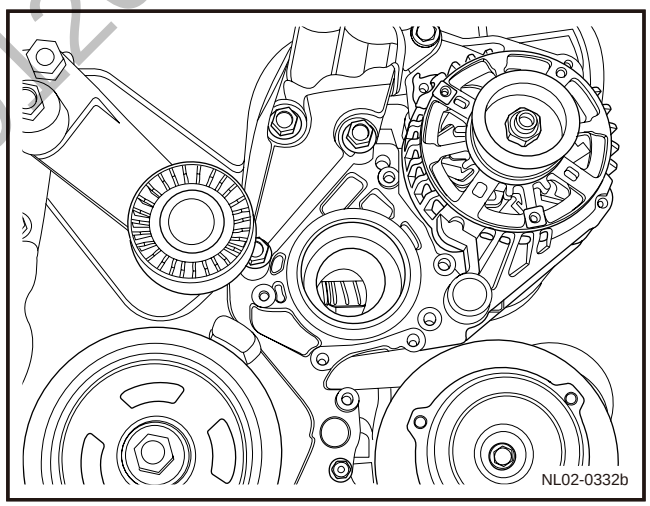
Warning: Refer to "Warning on Protective Goggles" in "Warnings and Precautions".

1. Inspect if water pump is broken or leaks.
2. Inspect whether the water pump bearing has a gap or abnormal sound.
3. Inspect if water pump belt pulley is damaged seriously. If it is damaged, replace it.



Installation Procedure:

1. Clean water pump sealing ring mounting groove and contact surface.



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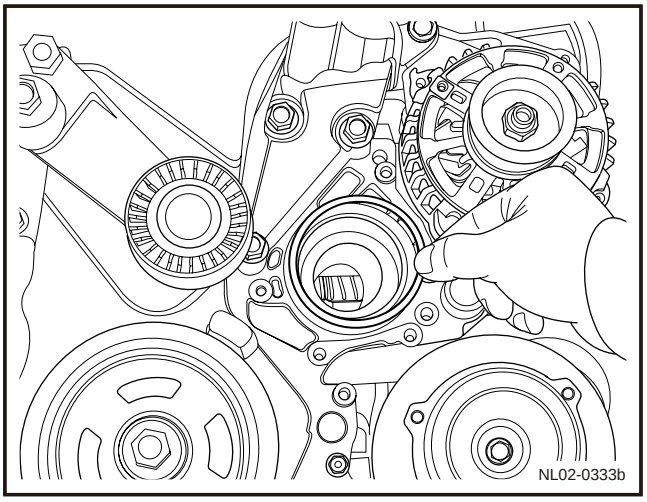
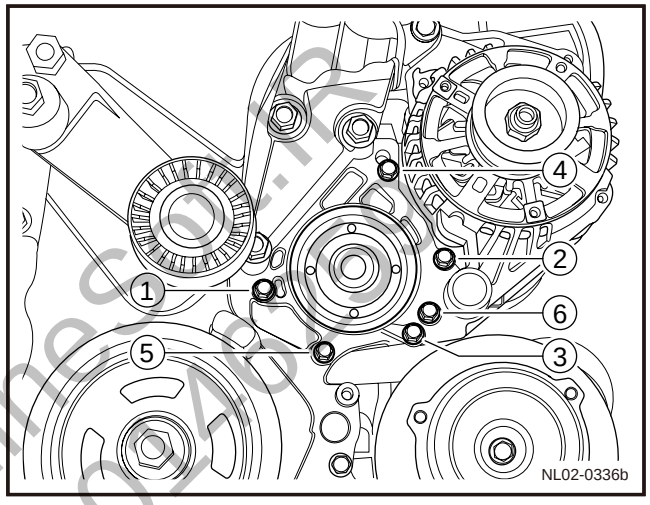
2. Install new water pump seal ring.

Note: the seal ring is a single use piece, which must be replaced by a new one after disassembling at every turn.



3. Install water pump and 4 fixing bolts, but do not tighten them too much.
4. Install 2 fixing bolts of water pump, but do not tighten too much.
5. Tighten fixing bolts of water pump to the specified torque according to the sequence as shown in the figure .



Torque

Short mounting bolt of pump: 8Nm (Metric) 6lb-ft (Inch)

Long mounting bolt of pump: 10Nm (Metric) 7.4lb-ft (English system)

6. Install the drive belt.
7. Fill engine coolant.

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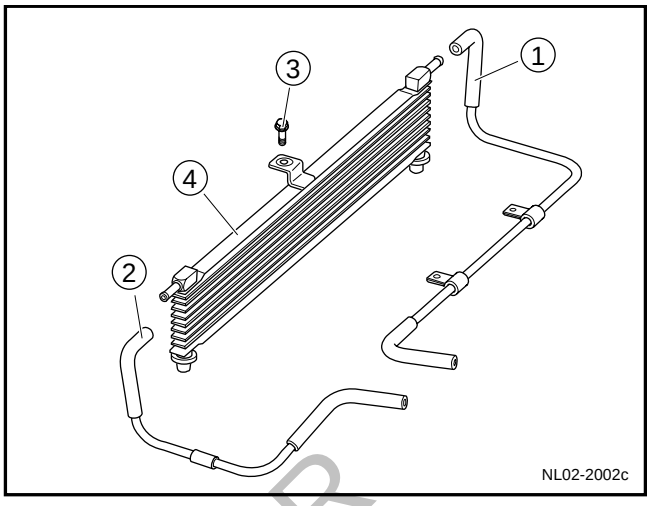
2.8.8.6 oil cooler replacement (with DSIAuto-transmission)

Dismantlement Procedure



1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. For drainage of automatic transmission oil, refer to 3.4.7.3 Replacement procedures of automatic transmission oil.
3. Dismantle oil cooler oil inlet hose 1 .
4. Dismantle oil hose 2 of oil cooler.
3. Dismantle oil cooler assembly fixing bolt 3 .
4. Dismantle oil cooler assembly 4.

Installation Procedure:

1. Install oil cooler and tighten fixing bolt.
2. Connect oil inlet and outlet hose of oil cooler.
3. Filled Auto-transmission oil .

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2 . 9 Lubrication system (4G20/4G24)

2.9.1 Specifications

2.9.1.1 Fastener specifications

Fastener Name	Model	Specification	
		Metric (N.m)	English system (lbf-ft)
Oil Pan and Crankcase Connecting Bolts	M6×14	7-11	5-8
Purge cock	M12×1 . 25×10 . 5	33-37	25-28
Oil Filter Adapter	M24×1 . 5×17	27-33	19-24
Oil Filter Components	UNF3/4	17-23	12-16
Piston injector component and cylinder block Connecting Bolts	M6×12	6-8	4-6
Oil pump component and oil strainer component Connecting Bolts	M6×30	7-11	5-8
Oil pump component and crankcase Connecting Bolts	M8×65	17-21	12-15
Oil Pump Mounting Bolt	M6×14	7-11	5-8

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2.9.1.2 Oil Pump Specification

Side Clearance	0.05～0.10mm(0.0020～0.0039in)
Tooth Clearance	0.08～0.18mm(0.0031～0.0071in)
Oil pressure alarm device activation pressure	≤40kPa(≤6psi)
Oil Pump Output Pressure	0.77MPa (111.7psi)
Oil Pump Relief Valve Opening Pressure	0.40～0.50MPa(57.8～72.2psi)

2.9.2 Description and Operation

2.9.2.1 Description and operation

Oil Pan

The oil pan is installed at the bottom of the crankcase. The engine oil pump draws engine oil from the oil pan. After filtered by the oil filter, the engine oil passes through two oil paths within the main oil path. The upper oil path heading to the cylinder block and cylinder hood cover lubricating the relevant friction pairs and components; while the lower oil path heading to the balance shaft, lubricating its friction pairs. In the main oil path, it has not only five main bearing lubrication paths but also four piston injector components. The five main bearing lubricant paths lubricate the main bearing. The oil is injected to the connecting rod through the engine oil path in the crankshaft to lubricate the connecting rod bearing; the piston injector components take on pump cooling for the pump. In the upper oil path, the engine oil passes through the oil orifices in the cylinder body and cylinder hood cover and heads to the camshaft (including OCV valve). The engine oil passes the internal oil path within the camshaft, lubricating valve assembly, and then finally returns to the oil pan.

Oil Pump

Oil pump draws the engine oil from the oil pan and then pump the engine oil with pressure to the various parts of the engine. Oil pump inlet has an oil filter - set filter. Set filter blockage may damage the oil pump and cause the pump oil inoperative, and the lubricating system will be unable to establish a normal oil pressure, which will cause the engine mechanical damage. Oil pump is driven by the crankshaft concave. As long as the crankshaft rotates, the oil pump will be working. The oil pump displacement is fixed, so when the engine speed is high, the oil pump output pressure will exceed the needs of the engine lubrication system. There is a safety valve in the oil pump assembly. The safety pressure relief valve cavity is connected with the oil pump intake chamber. When the output pressure exceeds 0.40~0.50 MPa (57.8～72.2psi), the security valve is open, the excess oil returns to the oil pump through the valve. With the normal oil supply, the safety valve bypass is closed.

Lubrication Descriptions

The oil filter is installed at the bottom of the crankcase. The engine oil passes through the internal oil path within the crankcase and heads to the filter. After filtering, the engine oil passes through the internal oil path within the crankcase and heads to the cylinder body and balance shaft, etl. The engine oil flows into the cylinder hood cover through the frontal oil path of the cylinder body. The cylinder hood cover oil path is divided into the camshaft and VVT oil path, respectively supplying the oil for the intake and exhaust camshaft lubrication, as well as the control over the OCV and VVT.

Each cylinder hood oil path introduces engine oil into the cylinder hood cover and camshaft bearing journal. Engine oil passes through the main oil path to the VVT solenoid valve, VVT solenoid valve oil cavity, to the VVT actuator. VVT solenoid valve is used to control intake camshaft position actuator. Engine Control Module (ECM) controls the VVT solenoid valve. When the engine control module provides power to the VVT solenoid valve, the solenoid valve guides the engine oil to flow through the cylinder hood cover camshaft front bearing caps. Engine oil passes through the intake camshaft bearing caps into the camshaft journal drilled hole and flows to the intake camshaft front installation surface. Then, the engine oil flows to the camshaft position actuator corresponding oil path. VVT solenoid valve guides engine oil into the system corresponding oil path, so that the engine oil pressure acting on the intake camshaft position actuator internal blades. The intake camshaft (installed on the camshaft position actuator inner rotor) rotates relative to the sprocket (mounted on the intake camshaft position actuator housing). At idle, the internal pin will lock the rotor to the intake camshaft actuator housing. When starting, the cam actuator position will maintain the original position or the default position. VVT solenoid valve guides engine oil hydraulic pressure to loosen the lock pin, so that the intake camshaft position actuator works. Cylinder block contains a small engine oil nozzle, which sprays the engine oil to timing chain components. Engine oil passes through the camshaft timing chain drive

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belt area or cylinder hood cover and cylinder block casting oil return path and returns to the oil pan.

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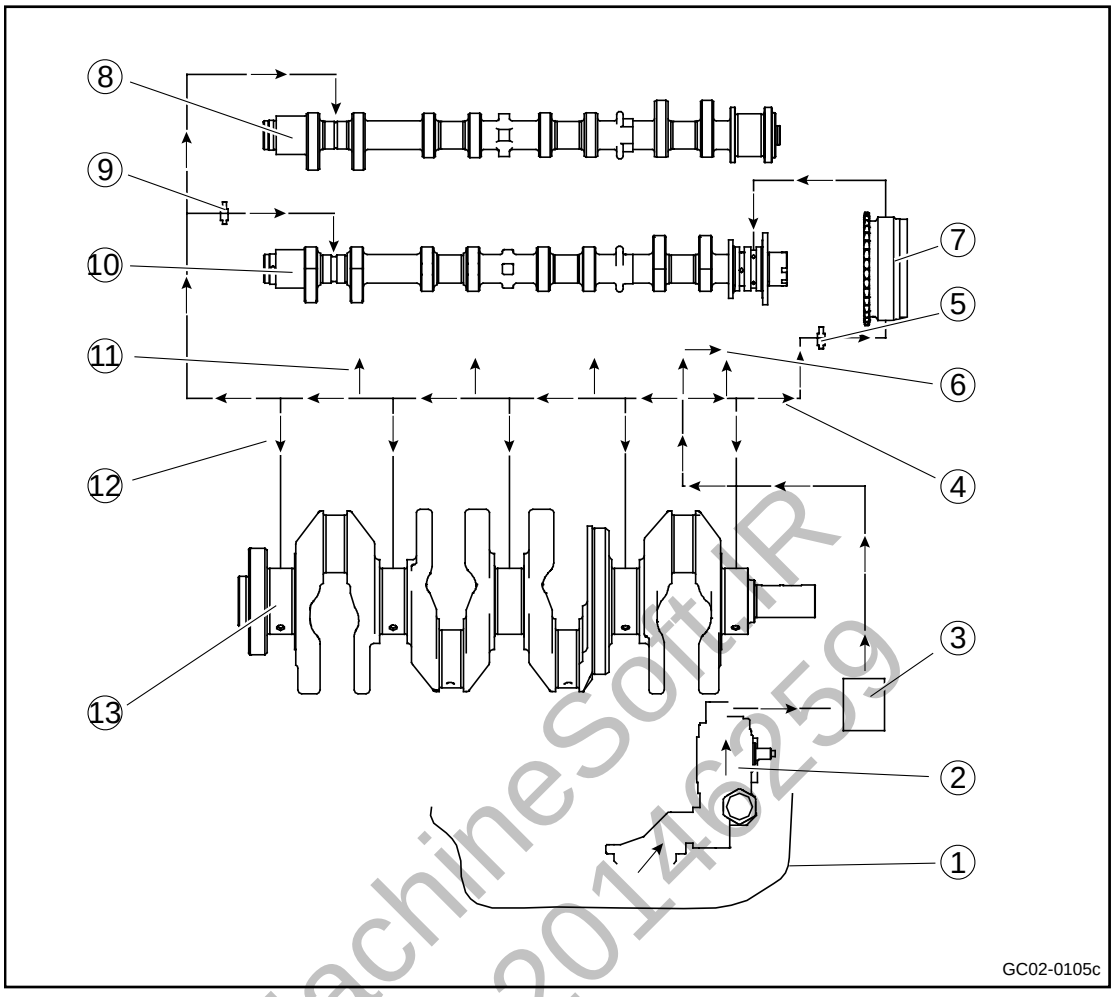
2.9.3 System operating principle

2.9.3.1 Lubrication Oil Gallery Schematic



1. Engine oil pan component
2. Oil pump and strainer subassembly
3. Oil filter component
4. Main oil path
5. OCV valve
6. Balance craft oil path
7. VVT
8. Exhaust camshaft
9. Oil pressure alarm device
10. Intake camshaft
11. Piston injector component
12. Main Journal oil path
13. Crankshaft

2.9.3.2 Engine Oil Pressure Alarm Control Principle

Engine oil pressure alarm is a pressure switch and set on the engine main oil piping. When the engine oil pressure is below the specified value, this switch is switched off and the engine oil pressure warning lamp in the instrument will be on. When the car starts normally, the oil pump transfers the oil pressure to the system, so this switch is switched off and the engine oil pressure warning lamp in the instrument will be off.

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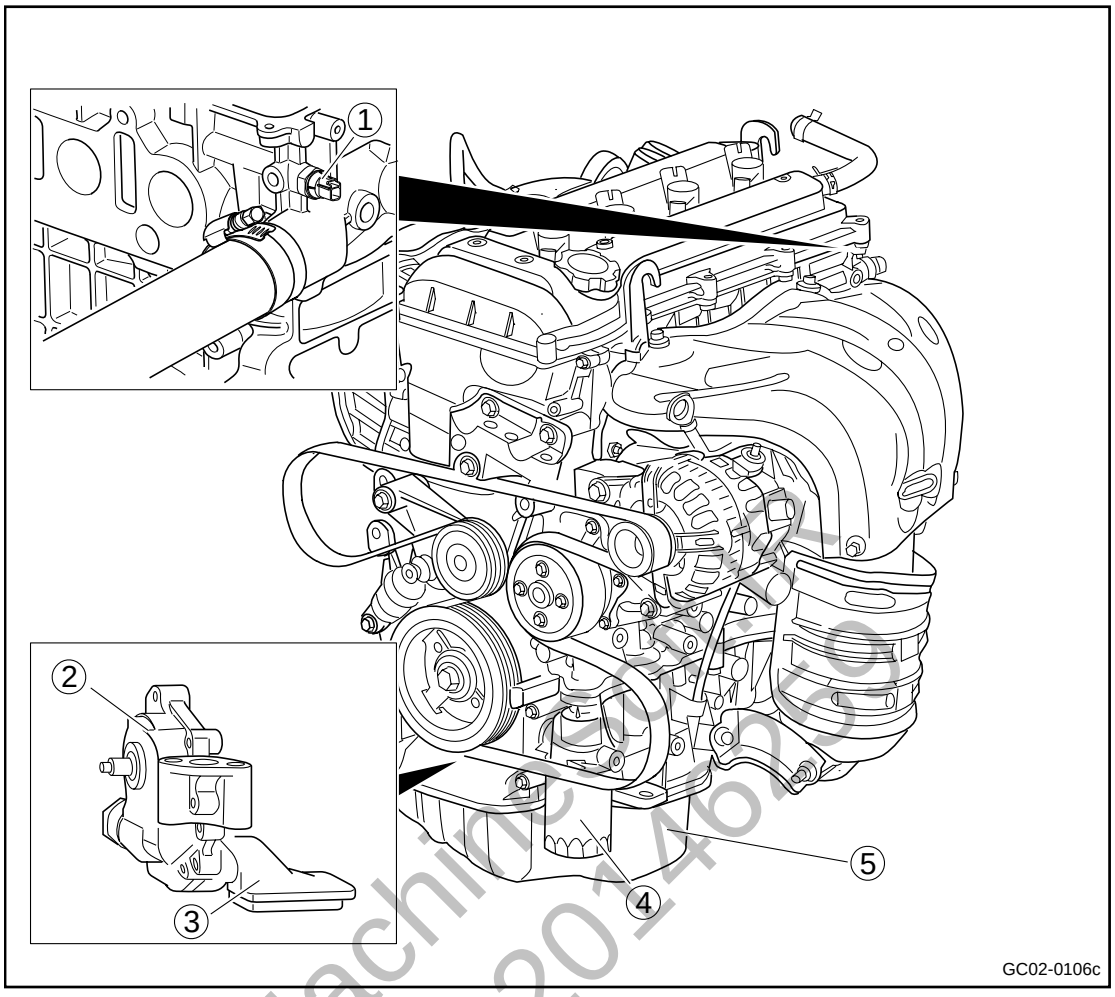
2.9.4 Component position

2.9.4.1 Component position



1. Air-Conditioning Pressure Switch
2. Engine Oil Pump
3. Oil strainer
4. Oil Filter
5. Oil Pan

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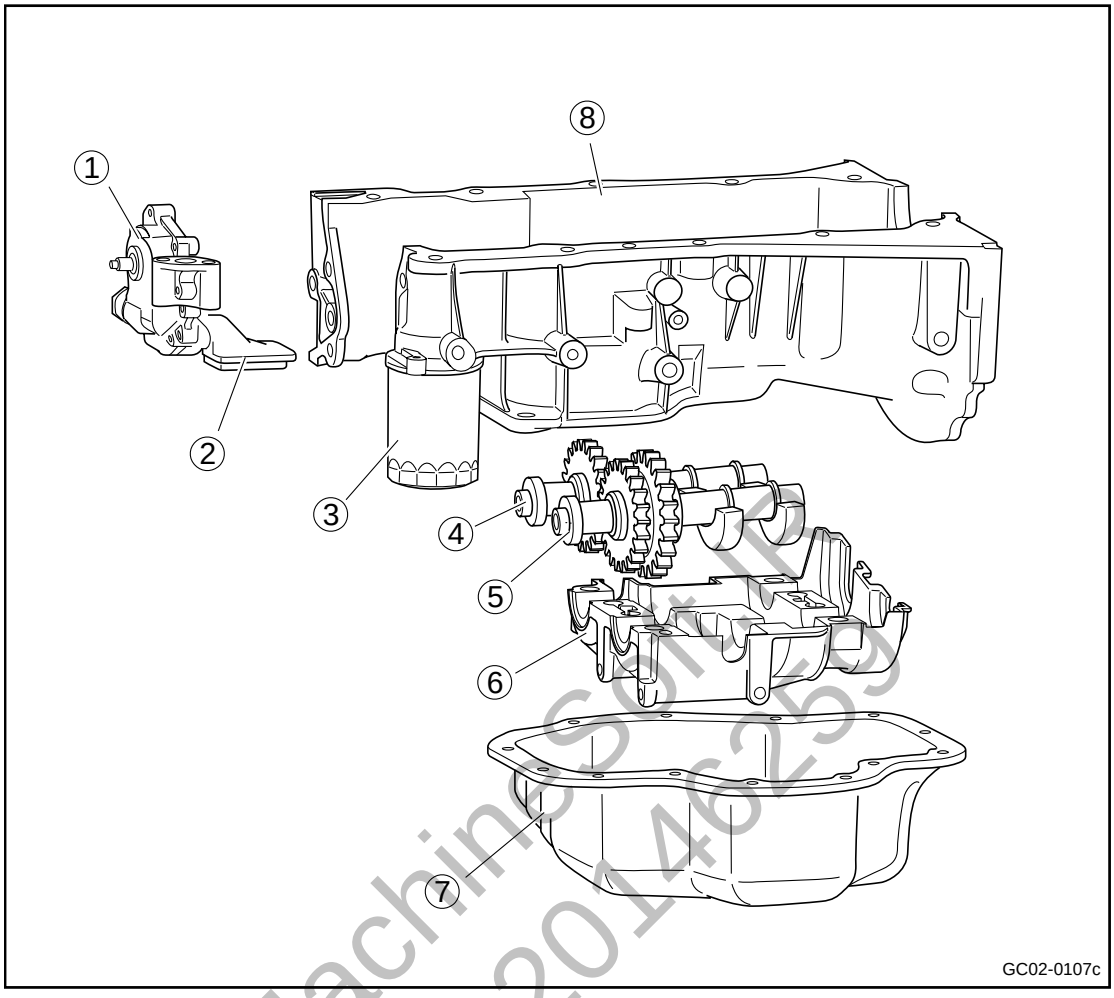
2.9.5 Disassemble drawings

2.9.5.1 Disassembly diagram



1. Engine Oil Pump
2. Oil strainer
3. Oil Filter
4. Balance shaft component II
5. Balance shaft component I
6. Balance shaft bearing cover
7. Oil Pan
8. Crankshaft

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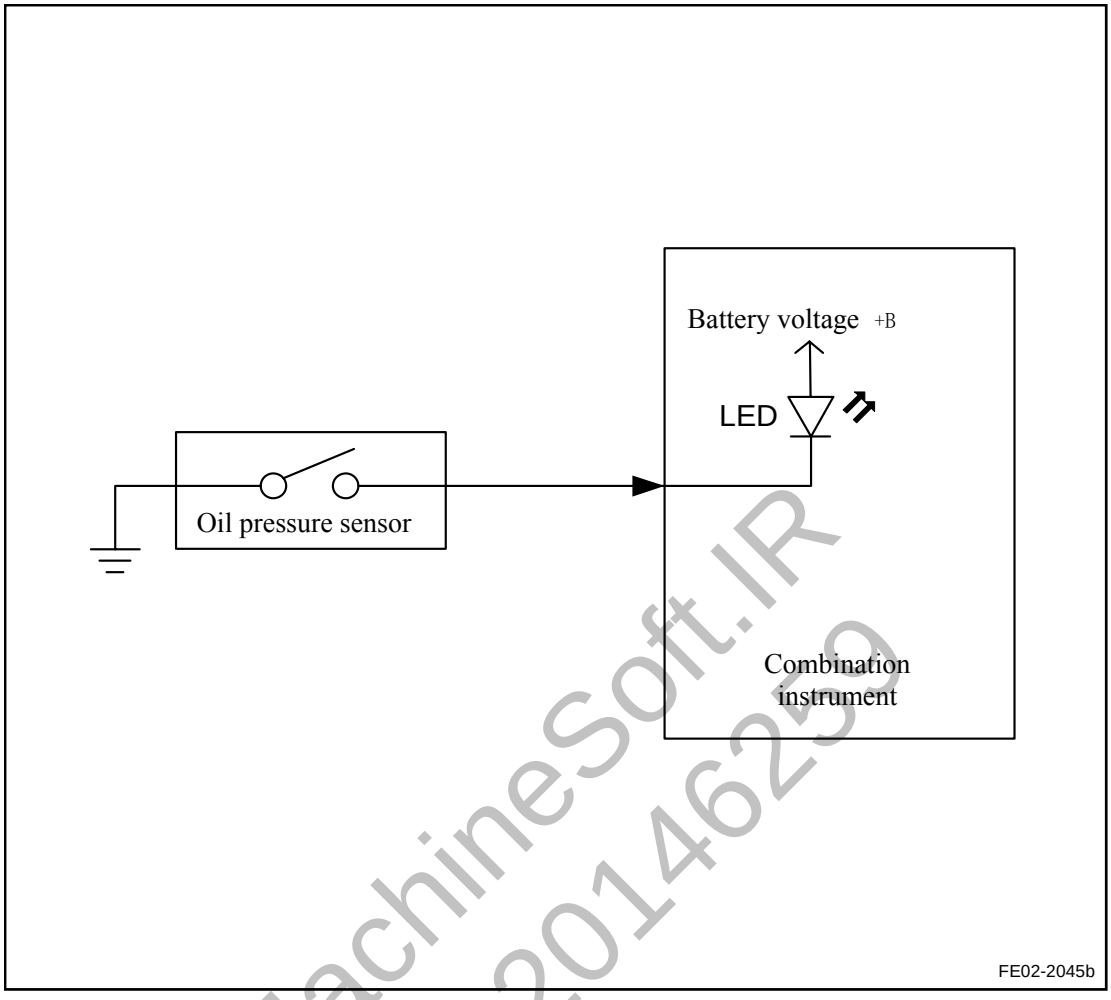
2.9.6 Electrical schematic diagram

2.9.6.1 Electrical Schematic Diagram



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2.9.7 diagnostic message and steps

2.9.7.1 Diagnosis descriptions

Refer to 3.3.2 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

2.9.7.2 Visual inspection

- Inspect installed after market equipment that may affect the operation of the lubrication system.
- Inspect easy to access system components to identify whether there are significant blockages or leakage. If there is leakage, confirm whether it is engine oil leak.
- Inspect whether the oil filter is dirty or blocked. If necessary, replace it.

2.9.7.3 Diagnosis of Engine Oil Abnormal Consumption

When the engine oil consumption (non-leaking) exceeds the acceptable range, abnormal engine oil consumption diagnostic must be carried out.

1	Inspect whether the fuel is no	Yes	Refer to 2.9.7.5 Engine Oil Leak Diagnostic
		No	
2	Inspect whether engine oil viscosity is abnormal. Inspect whether poor quality engine oil is used.		
		Yes	Replace the oil filter and engine oil
		No	
3	Inspect whether the vehicle sustained high speed / or excessive use.		
		Yes	Service the engine.
		No	
4	Inspect whether the positive crankcase ventilation system is blocked and whether the components are working correctly.		
		Yes	Repair the faulty components.
		No	
5	Inspect whether the valve conduit / or the valve rod is worn, whether the valve rod oil		

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	seal is worn, missing or improperly installed.

Yes → Repair the faulty parts.

No

6	Inspect whether the piston and piston rings in the cylinder are improperly installed.

Yes → Repair the faulty parts.

No

7	Inspect whether there is correct piston ring seal, whether there are broken or worn piston rings. If necessary, repair the faulty part.

Next

8	Confirm that the fault has been fixed.

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2.9.7.4 Engine Oil Pressure Diagnostic and Test

1	Inspect whether engine oil viscosity is abnormal. Inspect whether poor quality engine oil is used.

Next

2	Park the vehicle on a level ground and let the engine run for a few minutes, waiting for a long enough period of time (2-3 min) to let the engine oil return.

Next

3	If necessary, add the recommended grade engine oil, until the engine oil level reaches the full scale.

Next

4	Let the engine run for 10-15 s. Confirm the vehicle indicator does not show that the pressure is too low or no engine oil pressure.

Next

5	Check whether there is noise or knock sound in the valve system.

Next

6	Inspect whether there are following conditions:

A. Engine oil has bubbles.

B. Idle speed is too low.

C. Oil filter is blocked.

D. Engine oil is diluted by water or the engine coolant and so on.

E. Oil filter bypass valve is faulty.

F. Oil pressure gauge is incorrect or faulty.

H. Engine oil viscosity is not suitable for the expected temperatures.

Yes → Refer to the user manual, according to local temperatures, use the Geely Automobile recommended grade and viscosity engine oil

No

7	Turn the ignition switch to "OFF" position, remove the oil pressure sensor plug.

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Next

8	Install the engine oil pressure test tool to the oil pressure sensor plug on the oil filter.

Next

9	Start the engine and measure engine oil pressure.

Next

10	Compare the readings with the pressure value in 2.9.1.2 Mechanical System Specification. If the engine oil pressure is less than the specified value. Inspect whether there are one or more of the following conditions:

A. The bolts of oil filter are loose.

B. Oil filter seat O-ring or seal is missing or damaged.

C. Oil pump is worn or dirty.

D. Oil pump to cylinder block bolts are loose.

E. Oil pump filter loose, blocked or damaged.

F. Oil pump filter O-ring missing or damaged.

G. Oil Pump Oil Filter pipes damaged or leaking.

H. Oil pump pressure regulating valve faulty.

I. The engine oil way hole plug is missing or improperly installed.

J. The intermediate drive shaft bolt for camshaft is loosened.

K. The following components bearing clearance exceed the acceptable tolerance range:

   a) Link

   b) Crankshaft

   c) Camshaft

   d) Sprocket of the intermediate drive shaft of camshaft

L. Engine oil channel cracking. There are pores or blockage.

M. Valve tappet rod broken.

When necessary, repair or replace the relevant components.

11	Test is completed.

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2.9.7.5 Engine Oil Leak Diagnostic

Once a vehicle engine oil leak occurs, the following conditions must be inspected:

1	Inspect for the high level of th

Yes → Discharge engine oil to the specified level.

No

2	Inspect whether the engine oil pressure is too high.

Yes → Inspect the engine oil filter or the pressure bypass valve is blocked or faults.

No

3	Inspect whether the engine ventilation system is blocked or malfunction.

Yes → Repair the faulty parts.

No

4	Inspect whether the fasteners are not fastened properly or damaged.

Yes → Replace the damaged components, tighten the torques again as required.

No

5	Inspect whether the related components have gaps or pores.

Yes → Repair the faulty parts.

No

6	Inspect whether the sealing surface is worn. Inspect whether the sealing gasket is installed properly.

Yes → Repair the faulty parts.

No

7	Confirm that the fault has been fixed.

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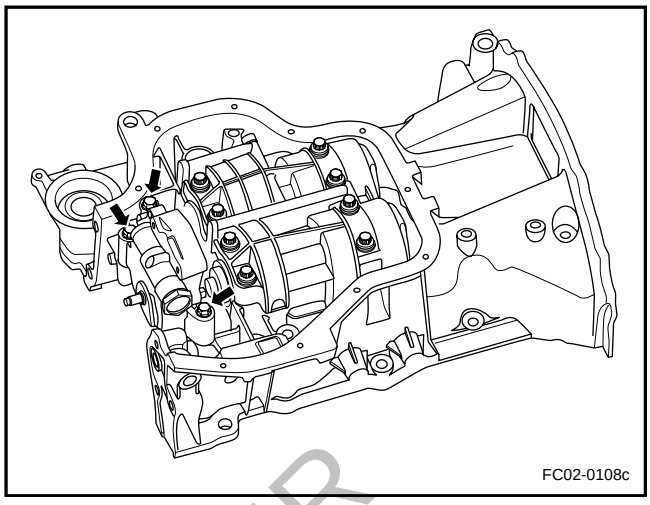
2.9.8 Removal and installation

2.9.8.1 Replacement of Engine Oil Pump and Strainer

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Dismantle the timing chain component, refer to the 2.6.8.10 Replacement of Timing Chain Component.
3. Dismantle oil pan. Refer to oil pan replacement
3. Dismantle the fixing bolts of oil pump.
3. Remove the oil pump and collective filter subassembly (including the oil pump gasket) from the crankcase.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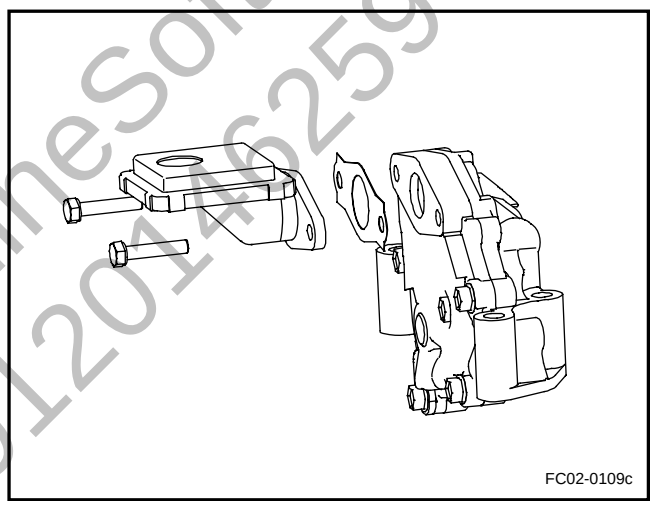
4. Separate the oil pump components, the oil strainer components and the gaskets of oil strainer.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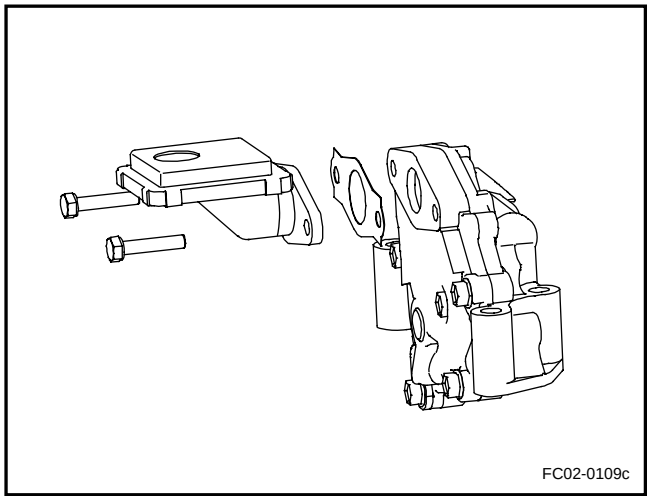
Installation Procedure:

1. The collective filter must be cleaned before installation.
2. Clean the crankcase oil pump installation surface.
3. Assembly the oil pump components, the oil strainer components and the gaskets of oil pump.
4. Install the oil pump gasket.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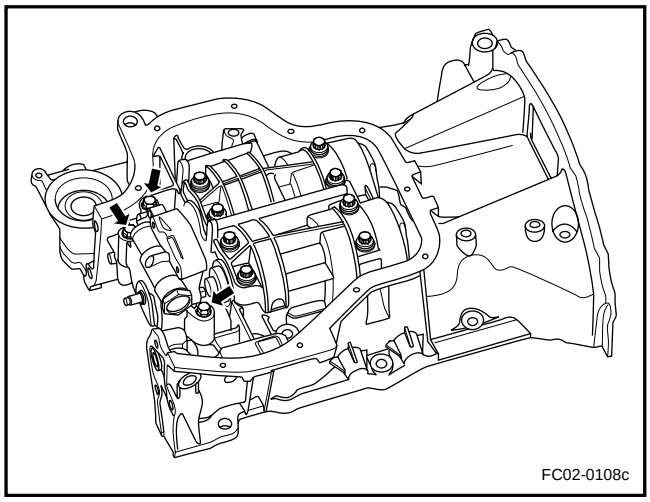
5. Install the oil pump components and the filter components on the crankcase and tighten the fixing bolts of oil pump.

Torque :17～21N . m(Metric) . 12～15b-ft(English system)

6. Install negative cable of battery.



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2.9.8.2 Oil Pump Cleaning and Inspection

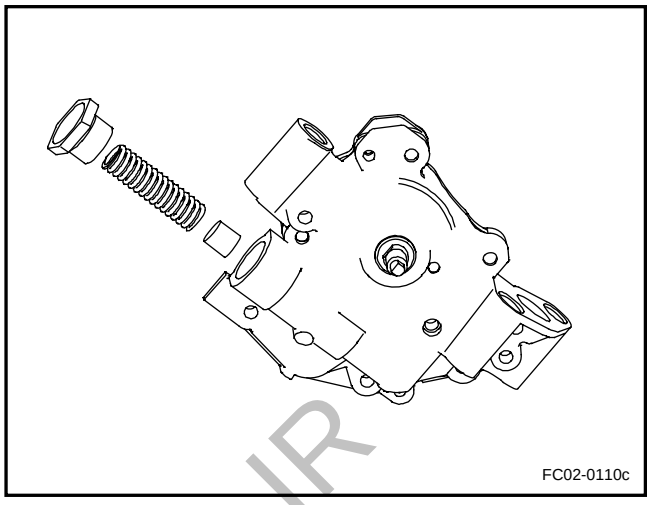
Decomposed cleaning steps:

1. Oil Pump Pressure Limiting Valve Inspection:

A. Dismantle the pressure limiting valve plug screw, and dismantle the springs and the plunger piston.

B. Inspect whether the surface of slide valve is worn. whether the plunger piston wall is worn. Whether the plunger piston and the inner hole clearance is normal.

C. Apply lubrication oil to the plunger piston, and install the plunger piston and spring, and then install the pressure limiting valve bolts.



2. Clean oil pump housing and internal parts.

Inspection Procedure:

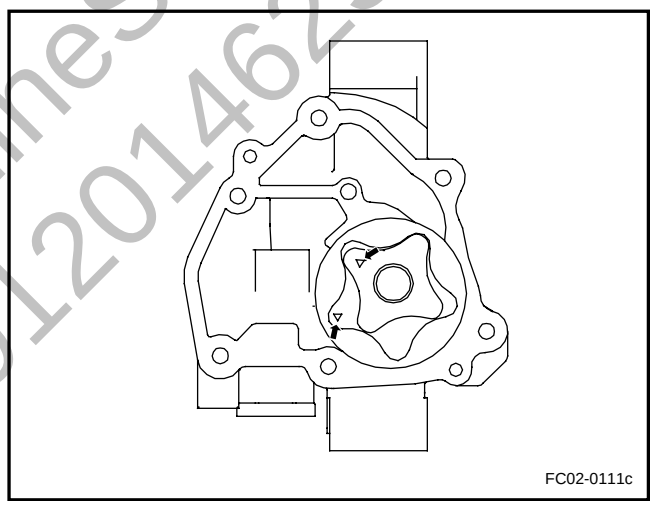
A. Inspect all oil pump parts for worn and torn.

B. Apply clean engine oil to all oil pump parts.

Precautions:

A: Apply lubrication grease to the oil pump gear chamber in order to ensure initial oil pump lubrication.

When :install engine oil pump gea . shall aim at reference position .



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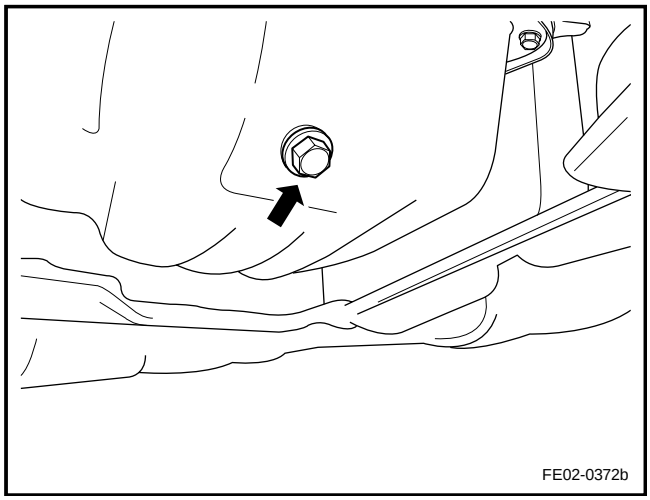
2.9.8.3 Replacement of Oil Pan

Dismantlement Procedure

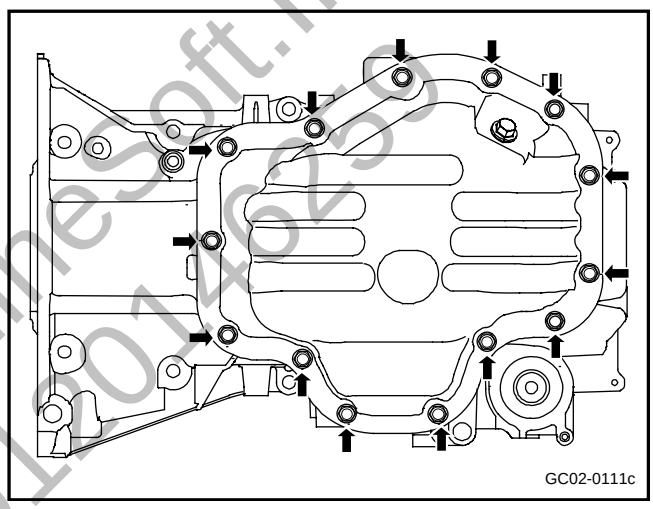
Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

Warning: Refer to Warning on Vehicle Lifting and Jacking in Warnings and Precautions.

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Lifting and Jacking the Vehicle
3. Loosen oil drain plug of engine oil pan, and drain lubricating oil from engine oil pan.

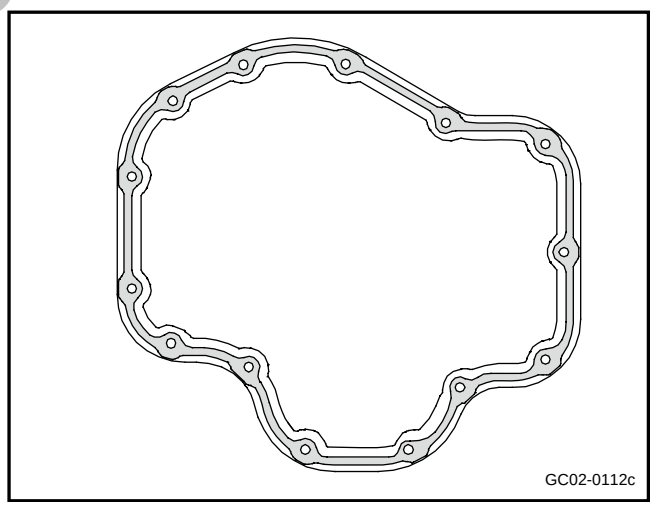


4. Dismantle the fixing bolts and nuts of oil pan.
5. Dismantle the oil pan from the crankcase.



Installation Procedure:

1. Inspect and clean the oil strainer before installing the oil pan.
2. Clean mating surface between oil pa n and cylinder block.
3. Apply sealant uniformly on new oil pan.



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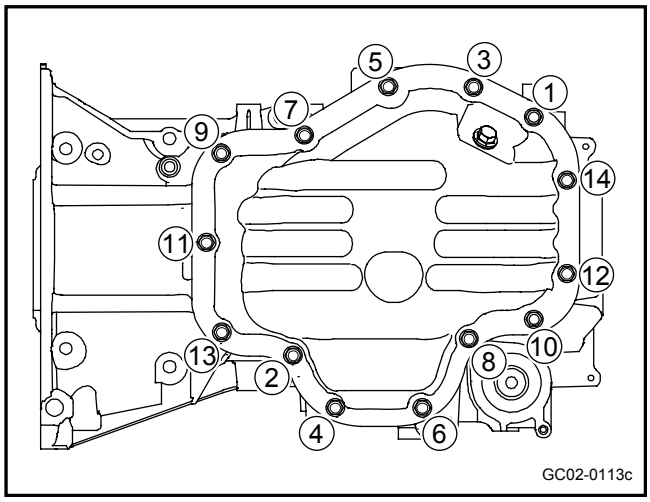
4. Install the oil pan and tighten the fourteen fixing bolts and nuts according to the sequence as shown in the figure.

   Torque: 7～10N.m or 5～8lb-ft

5. Install oil pan purge plug screw gasket and purge plug screw, and tighten the purge plug screw.

Torque :33～37N . m(Metric) 25～28b-ft(English system)

6. Install negative cable of battery.



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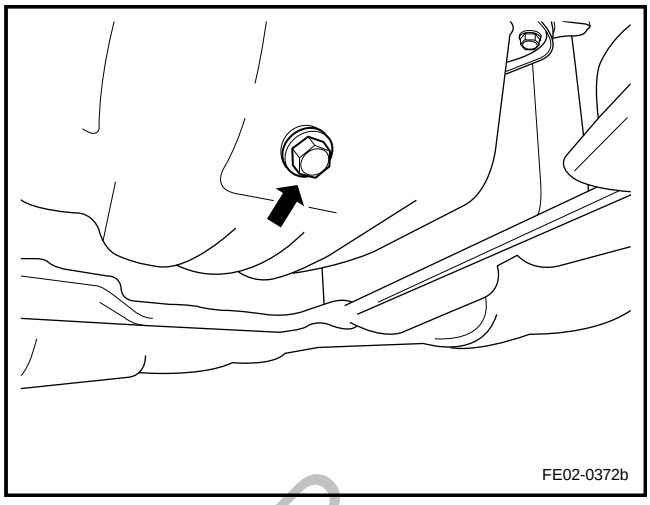
2.9.8.4 Replacement of Oil Filter

Dismantlement Procedure

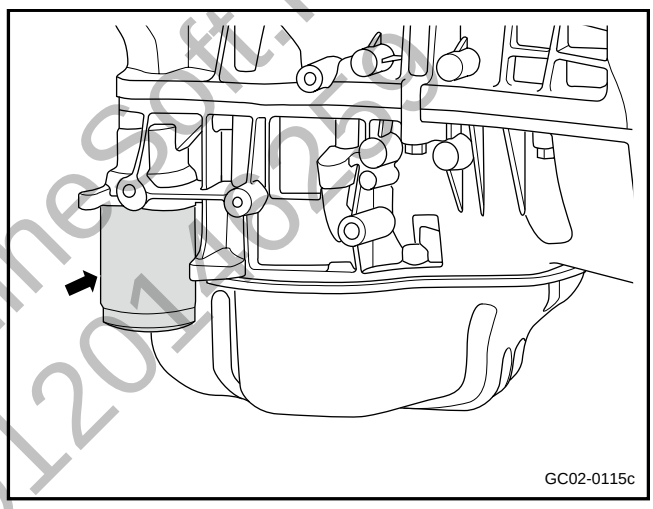
Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

Warning: Refer to Warning on Vehicle Lifting and Jacking in Warnings and Precautions.

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Lifting and Jacking Vehicle
3. Release the engine oil discharge bolt of oil pan, discharge the lubrication oil from the crankcase.



4. Dismantle the oil filter.
5. Dismantle the oil filter adapter.



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Installation Procedure:

1. Install the oil filter adapter.

Torque :27～33N . m(Metric) 19～24b-ft(English system)

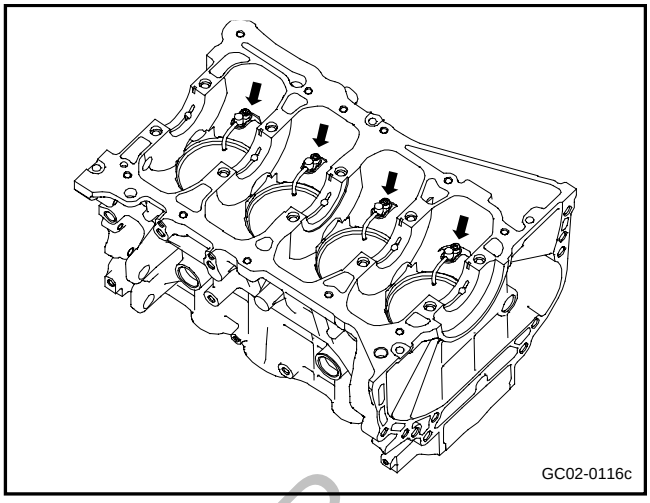
2. Install the oil filter
3. Lower the vehicle.
4. Fill the engine lubrication oil.
5. Connect battery negative cable.

2.9.8.5 Replacement of Piston Oil Injector Components

Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

1. Dismantle the engine. Refer to 2.6.8.13 Replacement of Engine.
2. Refer to 2.6.8.14 Replacement of Cylinder Hood Assembly to dismantle the cylinder hood.
3. Dismantle the crank, refer to the 2.6.8.18 "Replacement of Crankshaft"
4. Dismantle the fixing bolts of piston fuel injector components.
5. Dismantle the piston fuel injector components.

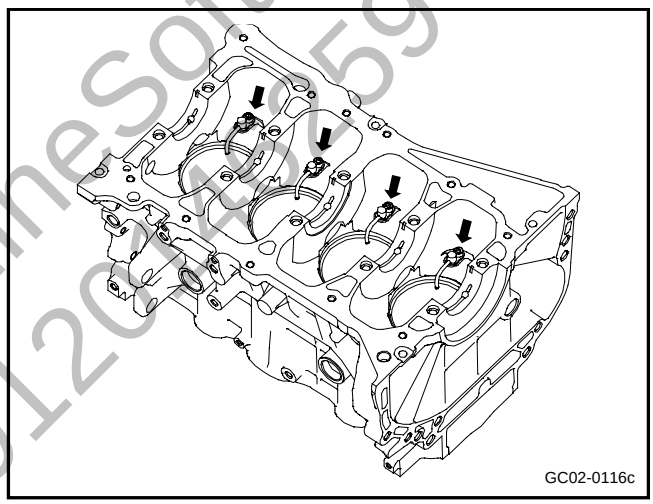


Installation Procedure:

1. Install the piston injector components into the cylinder body piston injector orifice.
2. Install the hexagon socket cap head screws.

Torque :6～8 N . m(Metric)4～6 b-ft(English system)

3. Install the crankshaft.
4. Install the cylinder hood.
5. Install the engine assembly.



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2.10 Ignition System

2.10.1 Specifications

2.10.1.1 Fastener Specifications

Fastener Name	Specification	Tightening Torque	
		Metric (N.m)	English system (lb-ft)
Camshaft Position Sensor Mounting Bolt	M6×14	9±1	6-7 . 4
Fixing Bolts of Ignition Coil	M6×20	9±1	6-7 . 4
Spark Plug	M14×1.25	25±3	16.1-20.5
Knock Sensor	M8×40	19±2	12.5-15.4

2.10.1.2 Ignition System Specification

Applications	Specification
Ignition Sequence	1±-3/-4±-2
Ignition Timing	7° before TDC
Ignition Type	Spark Discharge
Spark Plug Gap	0.8-0.9
Spark Plug Manufacturer	Zhuzhou Torch Spark Plug Co., Ltd.
Spark Plug Model	K6RTC

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2.10.2 Description and Operation

2.10.2.1 Description and Operation

This vehicle uses DLI ignition system for igniting two cylinders at the same time distributor. The ignition voltage is sent directly from the ignition coil to the spark plug. Main system components are ECM, two ignition coils, high voltage damper, spark plug, crankshaft position sensor, camshaft position sensor, knock sensor etc.. This Ignition system without distributor is known as the direct ignition type. Cylinder No.1 is paired with Cylinder No.4 and Cylinder No.2 is paired with Cylinder No.3. When ECM triggers the ignition coil to ignite, spark occurs in both cylinders at the same time. At this time one cylinder is in compression stroke and the other is in exhaust stroke. For the cylinder in the exhaust stroke, because the cylinder pressure is low, the temperature is high, the spark plug only requires minimal energy to break ignition voltage gap. It is an invalid ignition, the remaining energy is used by the spark plug in the compression stroke cylinder.

As a result of using DLI Ignition System without distributor, ECM controls the best ignition timing based on a variety of load conditions, so that the engine output power, acceleration, economy and emission performance have reached the ideal situations. The ignition system voltage does not decrease as the speed increases. In the absence of mechanical components, there is mechanical error.

The ignition coil can not be repaired and it must be replaced as an assembly.

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2.10.3 System operating principle

2.10.3.1 System operating Principle

When the ignition switch is at the “ON” or “ST” position, the #5 terminal and #6 terminal of the ignition switch connector IP45 are connected to supply the power for the #68 terminal of ECM. When the ECM detects the voltage at the #68 terminal, it will be grounded via the #2 and #3 terminals of the ECM harness connectors to control the pull-in of the main relay, generating a complete loop in the primary relay coil. Battery voltage power the ignition coil passing through the EF40 fuse, main relay and EF21 fuse.

Crankshaft position sensor is a magnetic inductive speed sensor. Crankshaft position sensor signal plate and the flywheel is an integrated part. When the engine rotates, so does the crankshaft position sensor signal drive plate. So the sensor produces an alternating signal. This signal is transmitted to ECM. ECM calculates the current crank angle based on this signal in order to determine the piston reaches the TDC, directly affecting the accuracy of the ignition advance angle control. This sensor signal is a crucial input signal in the ignition system. When ECM can not receive the signal, the ignition system can not work. ECM harness connector EM01 terminals #30 and #11 receive crankshaft position sensor input. After calculation, ECM obtains the ignition advance angle. ECM harness connector EM01 terminal No.4 controls cylinders #1 ignition, terminal #81 controls cylinder #2 ignition, terminal #1 controls cylinder #3 ignition and terminal #82 controls cylinder 4 ignition.

Refer to the 2.2.1.2 Temperature and Resistance Correlation of Temperature Sensor for the specific parameters of crankshaft position sensor.

Refer to the 2.2.1.2 Temperature and Resistance Correlation of Temperature Sensor for the specific technology parameters of knock sensor.

Note: When the vehicle Anti-theft alarm system and engine anti-theft locking system are activated, ECM does not allow ignition coil to be ignited. The ignition system is inoperative at this time.

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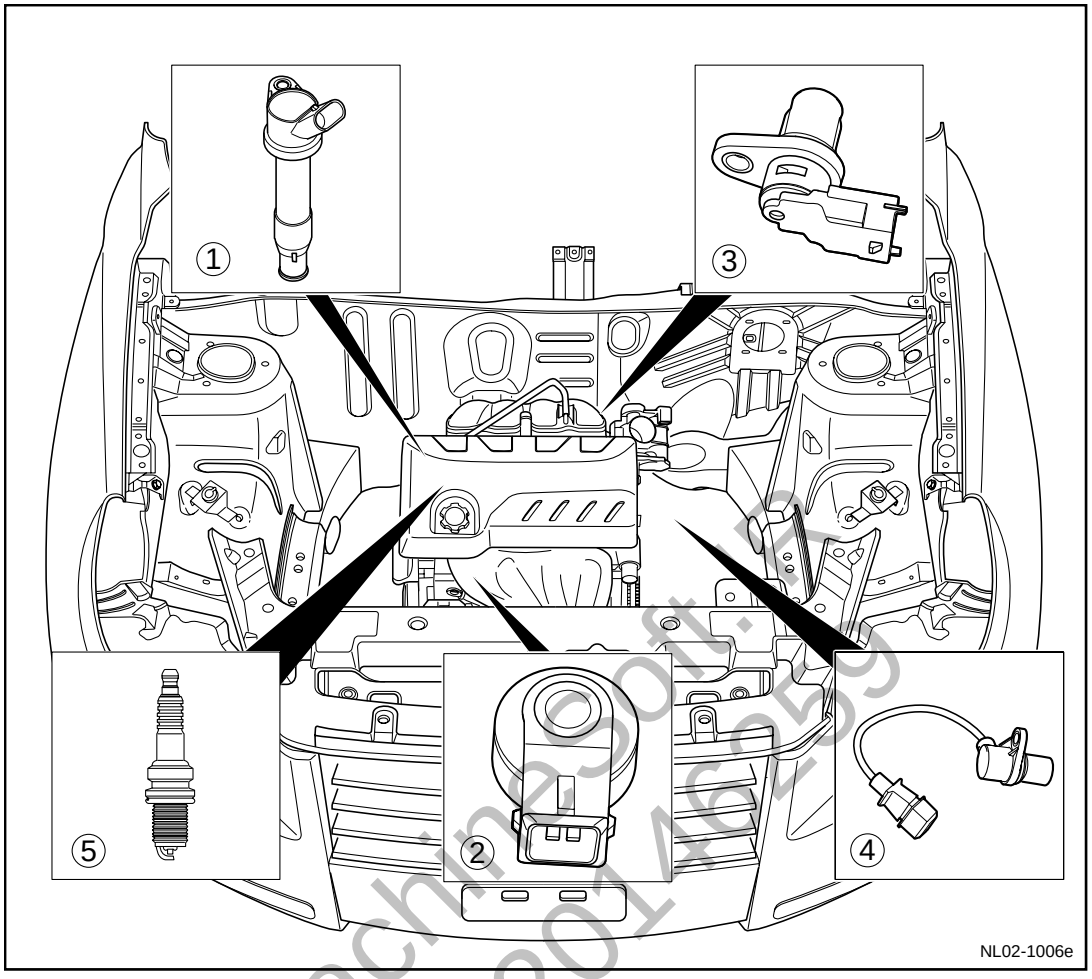
2.10.4 Part position figure

2.10.4.1 Part position figure



1. Ignition Coil
2. Knock Sensor
3. Camshaft Position Sensor
4. Vehicle speed sensor
5. Spark plug

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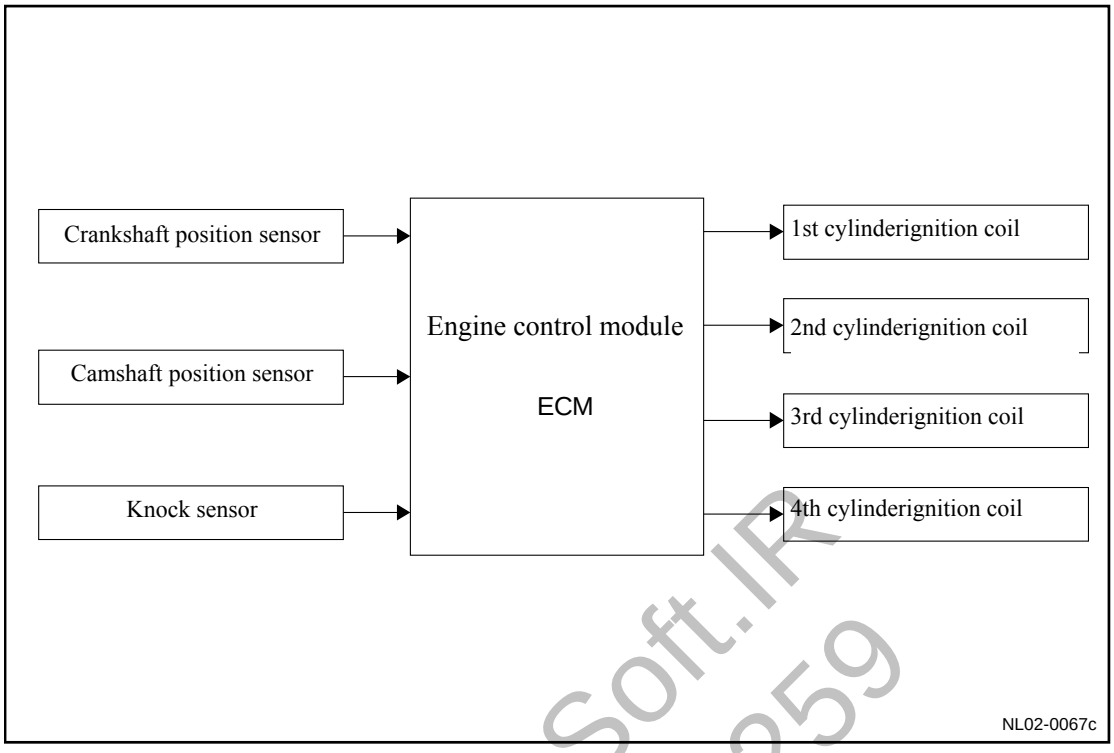
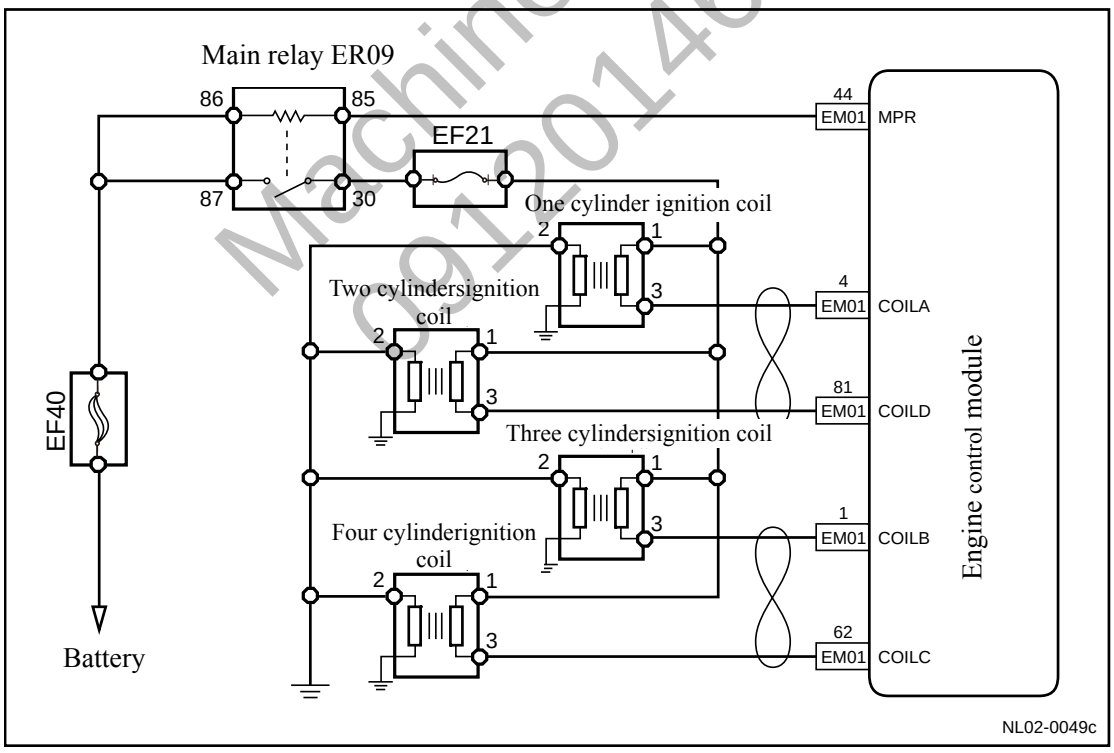
2.10.5 Electrical schematic diagram

2.10.5.1 Electrical schematic diagram





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2.10.6 Diagnostic information and procedures

2.10.6.1 Diagnosis descriptions

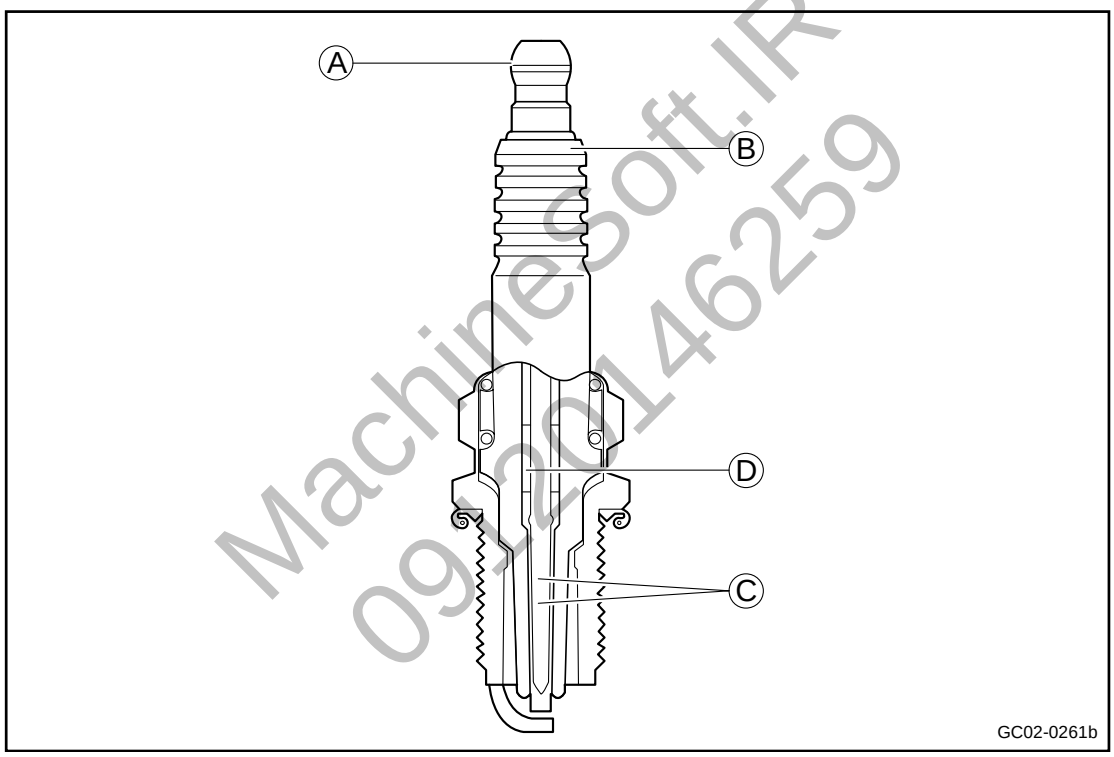
Refer to 2.10.2.1 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

Refer to 2.11.5.1 Diagnosis Description and 2.11.5.2 Diagnosis Description"for the DTC Codes of the ignition system.

2.10.6.2 Visual inspection

- Inspect the after-service retrofitting device that may affect the performance of the ignition system.
- Check the system components that is easy to access to identify whether there is significant damage or potential faults.

2.10.6.3 Spark Plug Inspection and Diagnostic



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1	Refer to 2.10.7.4 "Replacement of Spark Plug" to dismantle the spark plug.

Next

2	Inspect whether the terminal binding post A is bent or cracked. Test the loose of the terminal A via twisting or pulling.

Next

3	Inspect whether the B-insulator has arcing or signs of leakage, which is due to discharging between the two ends of terminal B which lies between terminal A and the

	grounding point.

Inspect whether there are following conditions:

A. Inspect the high-voltage damping line for damage.

B. Inspect whether the cylinder hood spark plug groove is wet. Whether there is engine oil, engine coolant or water. Damped spark plug will cause arc discharge.

Next

4	Inspect whether there is crack on the insulator B, otherwise it will cause discharging.

Next

5	Inspect for the abnormal discharge signs of the center electrode C. Measure the clearance between the center electrodes.

A. Inspect whether the spark plug torque is normal. The tightening torque of the spark plug is 20-30N.m (14.8-22.2lb-ft). If the torque is insufficient, the spark plug will not work normally. Too large tightening torque of the spark plug may lead to the fracture of the insulator B.

B. Inspect for signs of leakage around the insulator tip rather than near the center electrode D.

C. Inspect for the electrode C-side fracture and worn.

D. Inspect the center electrode D fracture, worn or loosen via shaking the spark plug. If there is click sound, the internal part is broken. The loosen center electrode D will decrease the intensity of the spark.

E. Inspect whether electrodes C and D are shorted. If it is the case, the residue on the electrode C will reduce or even the gap will disappear.

F. Inspect whether the electrode is too dirty.

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Next

6	Inspect the cylinder hood slot for debris, otherwise it may damage the spark plug during installation.

2.10.6.4 Common Spark Plug Malfunction

Serious Spark Plug Burn: Spark plug top scars, damage or electrode melting, brunt all indicate that the spark plug has been damaged and should be replaced. Inspect the symptoms as well as color changes when replacing the spark plug, in order to analyze the reasons for malfunction. Refer to 2.10.7.4 “Replacement of Spark plug”

1. Electrode melting and the insulator turning white indicate that combustion chamber temperature is too high. This may be due to there is too much carbon residue in the combustion chamber, so that valve clearance is too small caused by overheating or cooling malfunction. Another possible reason is that the tightening torque of spark plug does not match the specified value.

2. Electrode becomes rounded and the insulator has a scar, indicating that an early engine combustion. It may be due to premature ignition timing, low-octane gasoline or spark plug is too hot.

3. Insulator top is broken. Knock combustion is the main reason for the insulator rupture. Premature ignition timing, low-octane gasoline or spark plug too hot may lead to engine knocking.

4. Insulator top has cinereous strips. Such strips indicate the leakage of the spark plug and it is necessary to replace a new one.

Spark Plug Residue: There is residue between the spark plug insulator top and the electrodes. In severe cases, it can cause the engine inoperation. Cleaning the spark plug can be a temporary solution. In order to maintain good performance, identify the root cause for the malfunction.

1. Oily Residue. Spark plug has oily residues, indicating that lubrication oil enters the combustion chamber. If it only happens to an individual spark plug, the valve rod seals may be damaged. If every cylinder spark plug has oily residue, it indicates that there is cylinder channeling oil. Inspect whether the air filter and ventilation device is blocked.

2. Black Residue. There is black residue on the spark plug electrodes and inside the spark plug, indicating that the mixture is too thick. Increase the engine running speed and continue for a few minutes to burn the layer of black soot on the electrode.

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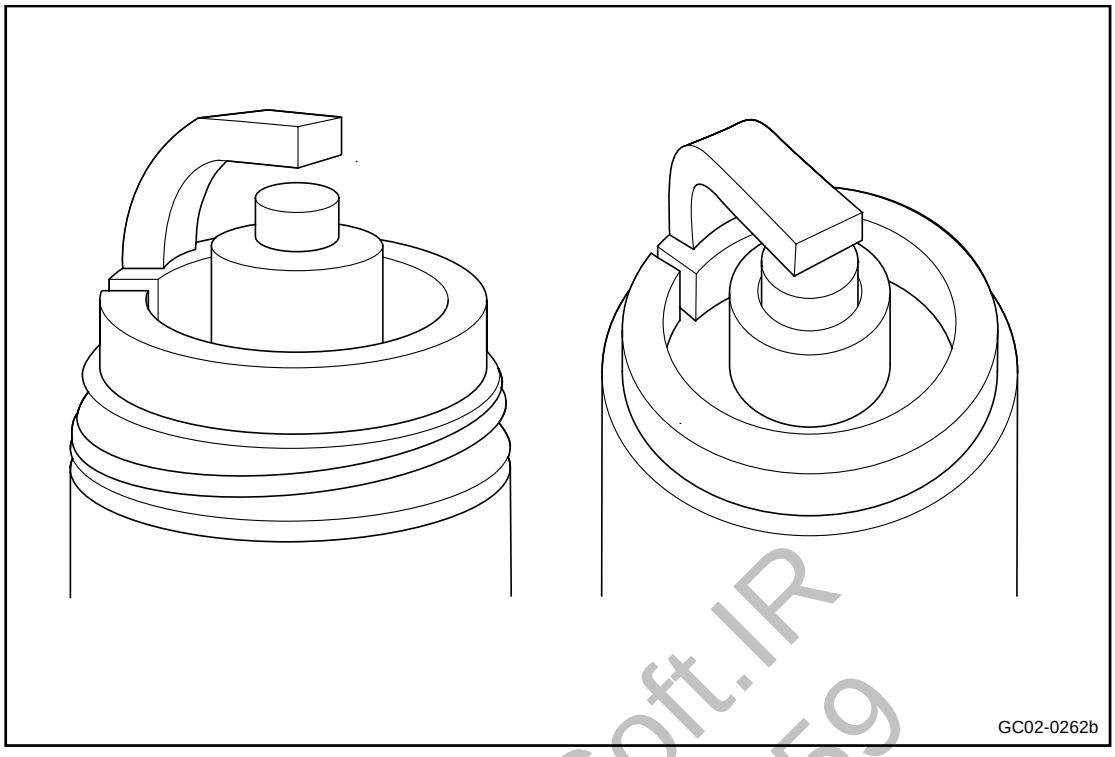
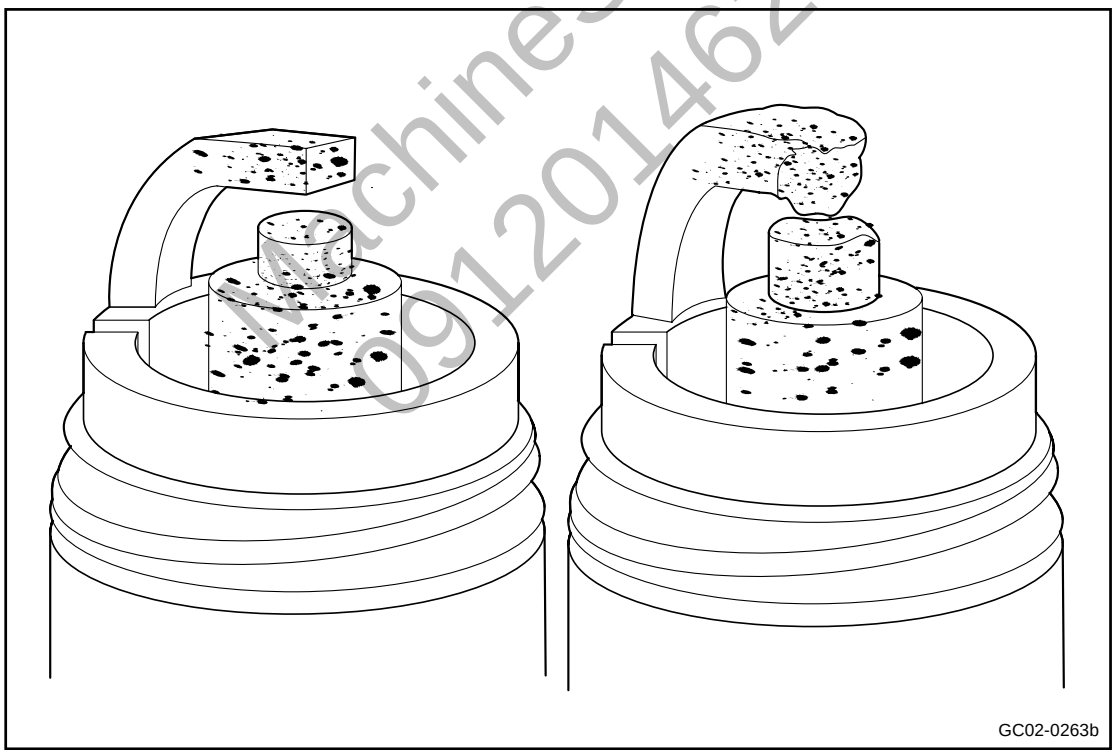
1. With normal spark plug, center electrode is gray or yellow.



2. With excessive fuel combustion, spark plug center electrode has serious corrosion.



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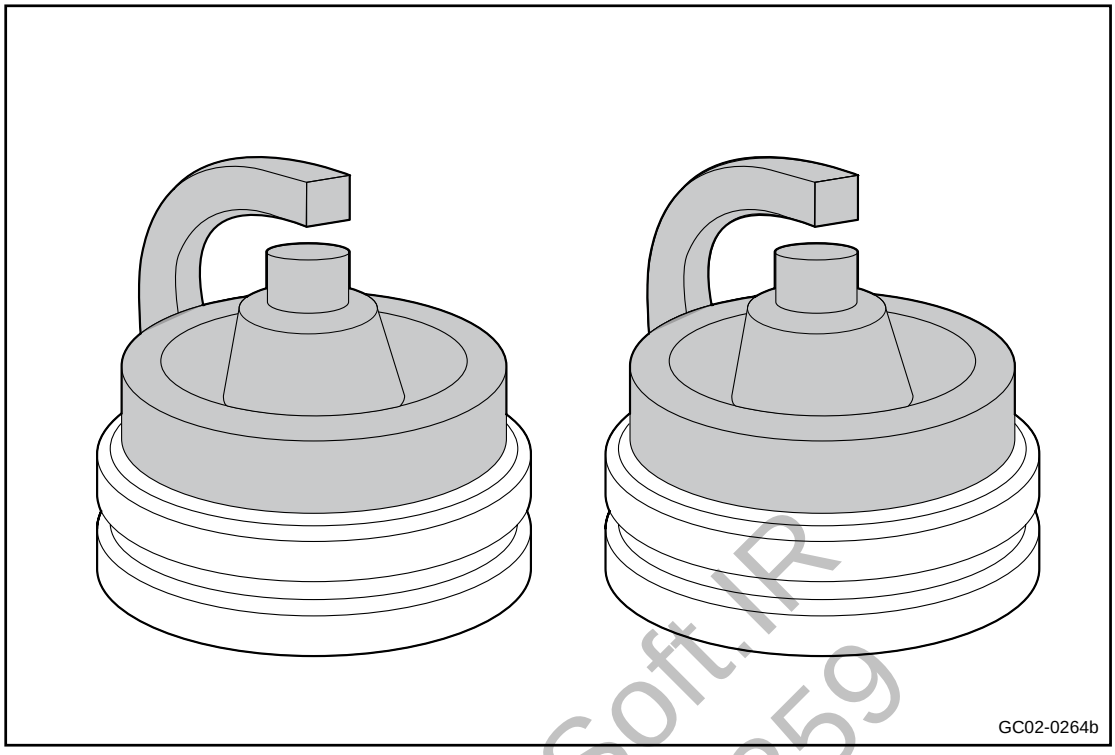
3. With incorrect spark plug heat value or fuel system malfunction, the spark plug center electrode has excessive carbon residue.



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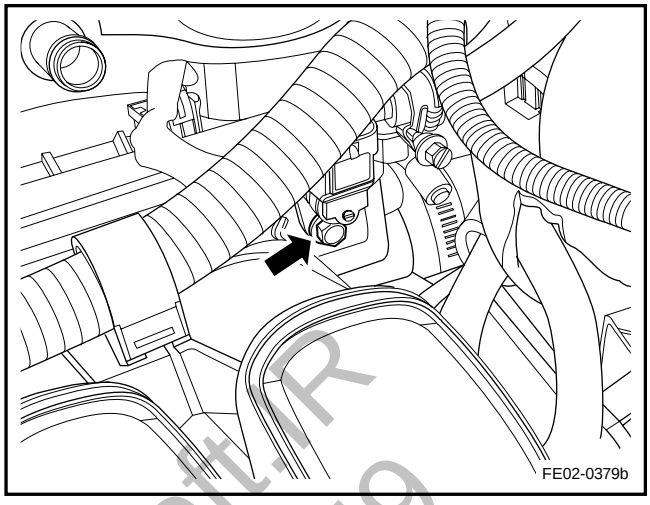
2.10.7 Removal and installation

2.10.7.1 Replacement of Camshaft Position Sensor

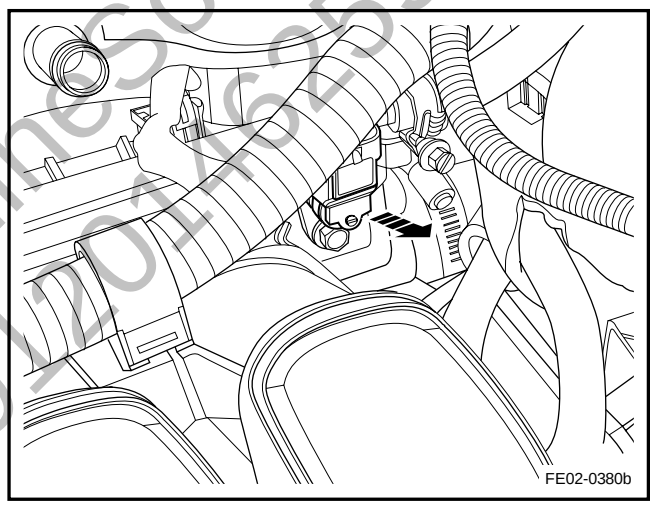
Dismantlement Procedure

Warning! See "Warnings Regarding Accumulator with Oil Pipe Disconnected" in "Warnings and Cautions".

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Disconnect camshaft position sensor wiring harness connector.



3. Dismantle the fixing bolts of sensor .
4. Dismantle the camshaft position sensor.



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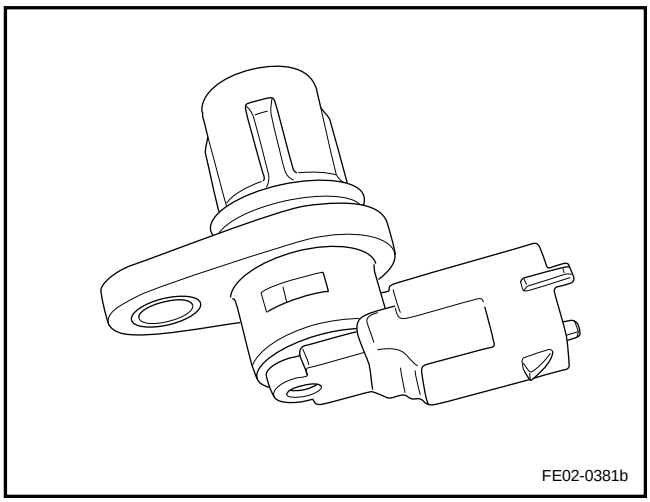
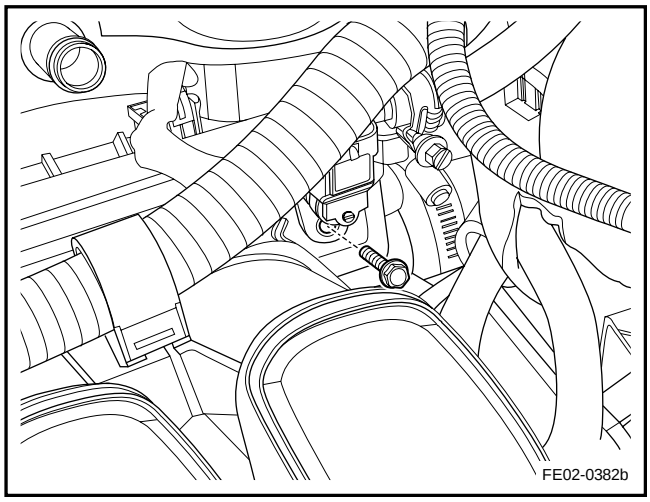
Installation Procedure:

1. Inspect to confirm whether the camshaft position sensor seals are intact.

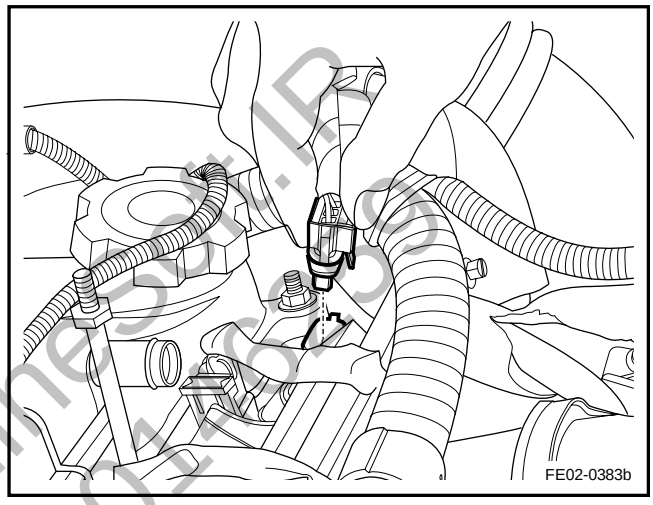


2. Install camshaft position sensor and tighten the fixing bolt.

Torque: 9Nm (Metric) 6.66 lb-ft (English system)



3. Connect camshaft position sensor wiring harness connector.
4. Connect battery negative cable.



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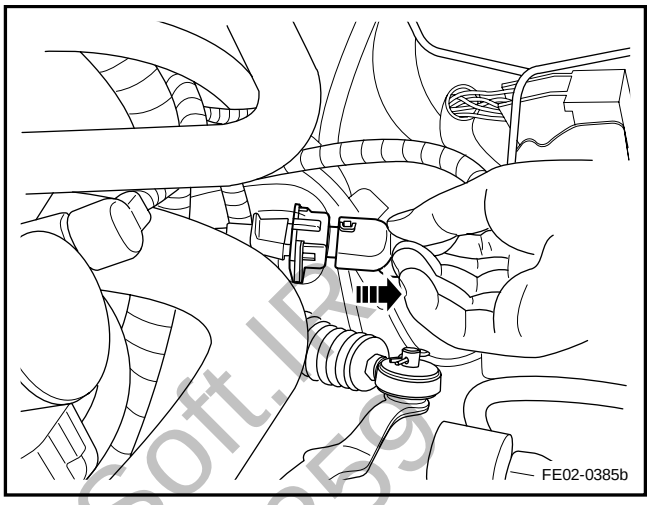
2.10.7.2 Replacement of Crankshaft Position Sensor

Dismantlement Procedure

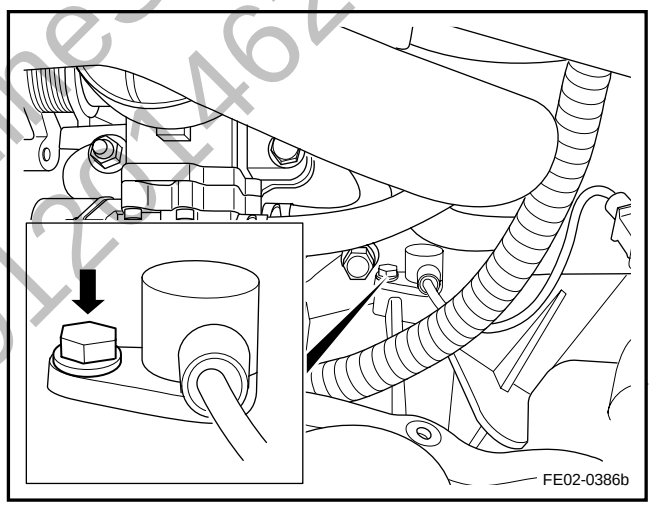
Warning: Refer to "Warning on Oil Pipe Disconnection from Battery" in "Warnings and Precautions".

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Dismantle the air filter.
3. Disconnect the crankshaft position sensor wiring harness connector.



4. Dismantle the fixing bolts of sensor;

Note: After removing the sensor, plug the sensor mounting hole to prevent debris falling into it.



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Installation Procedure:

1. Install the sensor and tighten the retaining bolts.

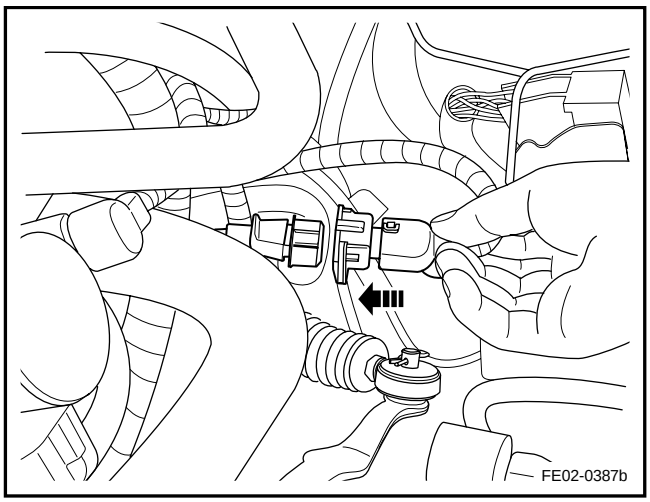
Torque: 9Nm (Metric) 6.66 lb-ft (English system)

2. Connect the crankshaft position sensor wiring harness connector.

3. Install the air filter assembly.

Torque: 9Nm (Metric) 6.66 lb-ft (English system)

4. Connect battery negative cable.



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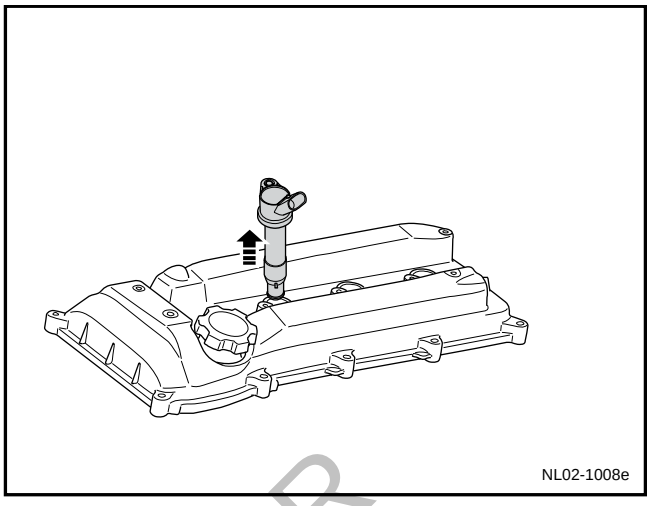
2.10.7.3 Replacement of Ignition Coil

Dismantlement Procedure

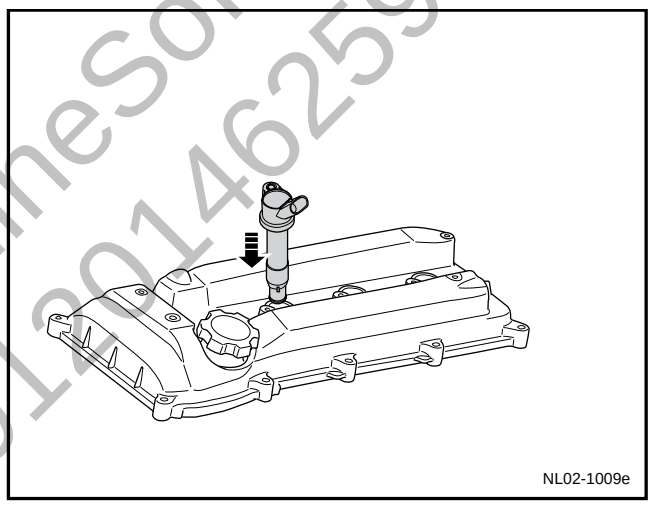
Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Refer to 2.6.8.1 "Replacement of Plastic Shield of Engine" to dismantle the plastic shield of engine.
3. Disconnect each cylinder ignition coil harness connector.
4. Dismantle the fixing bolts of ignition coil.
5. Dismantle the ignition coil.



Installation Procedure:

1. Install the ignition coil and tighten fixing bolts.
2. Connect each cylinder ignition coil harness connector.
3. Install the plastic shield of engine.
4. Connect battery negative cable.



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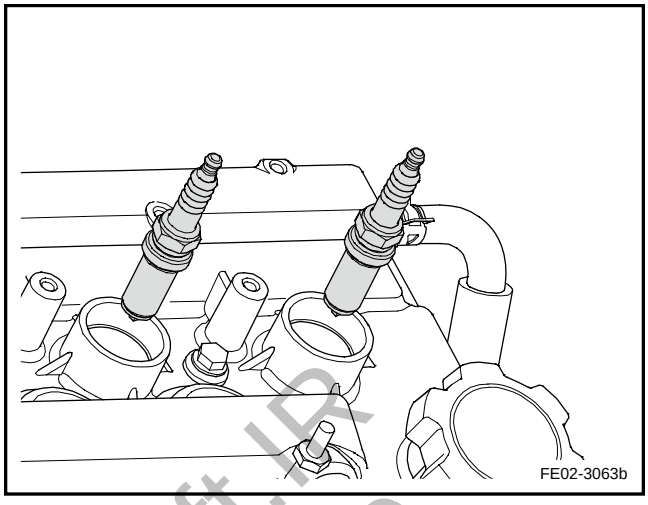
2.10.7.4 Replacement of Spark Plug

Dismantlement Procedure

Warning! Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. For disconnection of negative cable of battery, refer to "2.12.6.1 disconnection process of battery negative cable".
2. Dismantle the plastic shield of engine. Refer to 2.6.8.1 Replacement of Plastic Shield of Engine.
3. Refer to 2.10.7.3 "Replacement of Ignition Coil" to Dismantle the ignition coil.
4. Use spark plug socket to rotate the spark plug counterclockwise to dismantle the spark plug.
5. Remove the spark plug from the cylinder hood .



Installation Procedure:

1. Clean the spark plug and inspect the spark plug electrode gap.

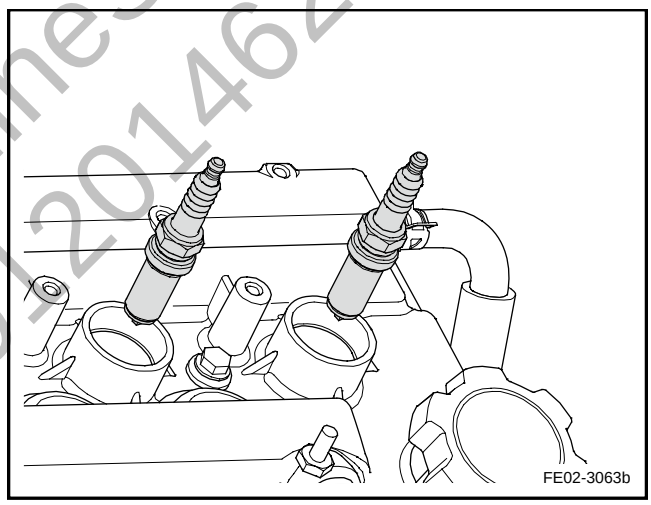
Spark plug clearance: 1.0-1.1 mm (Metric) 0.04-0.043 in (English system)

2. Use spark plug socket to install the spark plug into the engine.

Tightening torque of spark plug:

25N . m(Metric) 18 . 5lb-ft(English system)

3. Install the ignition coil.
4. Install engine plastic protective cover.
5. Connect the battery negative cable.



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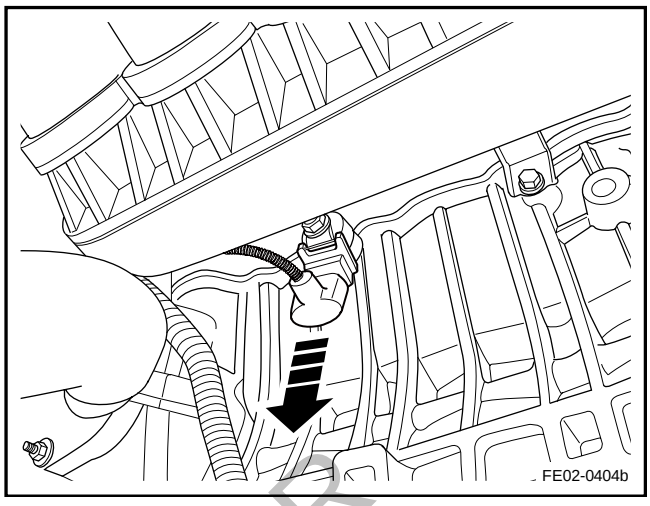
2.10.7.5 Replacement of Knock Sensor

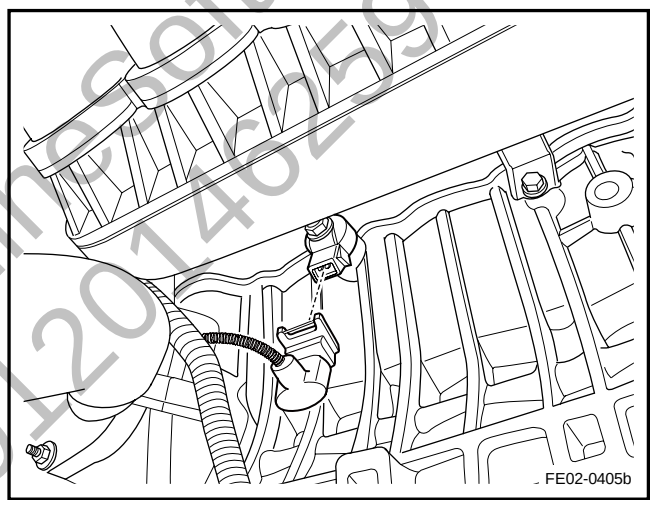
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.



1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Negative Cable Disconnection/Connection Procedures.
2. Refer to "2.12.6.4 Replacement of Starter" to dismantle the starter assembly.
3. Disconnect the knock sensor harness connector.
4. Dismantle the fixing bolts of knock sensor and knock sensor.

Installation Procedure:



1. Install the fixing bolts of knock sensor.

Torque:18N . m(Metric) 13 . 3lb-ft(English system)

2. Connect the knock sensor harness connector.
3. Install the starter assembly.
4. Connect battery negative cable.

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2.11 Start Charging System

2.11.1 Specifications

2.11.1.1 Fastener specifications

Fastener Name	Specification	Torque	
		Metric (N.m)	English system (lb-ft)
Battery cable nut	M6	10-14	7.4-10.3
Generator Bolt	M10×1 . 25×72	49±9	36.1±6.6
Generator Pivot Nut	M24	44±10	32.5±7.4

2.11.1.2 General Specifications

Battery Specification

Applications	Descriptions
Cold start current	660A
Minimum capability	145 min
Rated Voltage	12V

Starter Motor Specification

Applications	Descriptions
Starter	
No-Load Test (12.2 V)	40-90 A
No-Load Test Power Consumption	0.5 KW
Drive Gear Speed	2,600-4,800 rpm
Solenoid	
Keep the Coil (12.2V)	35 A
Draw the Coil (12.2V)	35 A

Generator Specifications

Applications	Descriptions

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Current	90 A
Model	JFZ1906

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2.11.2 Description and operation

2.11.2.1 Battery Description and Operation

Warning: Refer to "Explosive Gas Generated by Battery" in "Warning and Precautions".

Warning

This vehicle uses a maintenance-free battery, which is different from a conventional battery. There is no vent plug in this battery. Apart from a small vent on both sides of batteries, the battery is completely sealed. Vent holes can discharge a small amount of gas generated by the battery. The electrolyte inside the battery generates a small amount of gas after chemical reactions. If there is no exhaust vent, battery internal pressure increases as the gas pressure increases. When the pressure is over limit that the battery shell can withstand, the battery shell will break.

Compared with a conventional battery, this battery has the following advantages:

– No need to fill water during the life of the battery.

– Overcharge protection.

– Electricity leakage is less likely to happen as compared with a conventional battery.

– Lighter, smaller and capacity is larger.

In the entire electrical system, battery has main functions:

– Provide energy to the starter for starting the vehicle.

– Play a role as the electrical system voltage regulator.

– When the generator electrical system capacity can not meet the demand, the battery can provide power in a certain period of time.

Explanation of battery technical parameters:

1. Capability: Indicating the minimum time for the battery to provide the vehicle load working when the charging system is inactivated at night or atrocious weather. Namely, the battery discharging at 25 A under 27℃ (80.6 °F) until the final voltage of 10.5 V lasts 145 min.

2. Cold-start current: Indicating the startup current that the battery is able to provide under low temperature. The battery with 660 A current can discharge over 30 s at the voltage above 7.2 V under the ambient temperature of -18℃ (-0.4 °F). If the battery test is normal, but the battery voltage often appears inadequate, the vehicle can not start at night etc., consider the reasons from the following aspects:

– Electrical equipment in the vehicle remain turned on all night.

– Driving speed is low, stop and start frequently.

– Electric load of vehicle exceeds output of generator, especially when the vehicle is equipped with after-sales optional device.

– Charging system fault, such as electrical short circuit, generators belt slipping, generator malfunction or voltage regulator malfunction.

– Improper use of the battery, including failing to maintain battery cable terminals clean and tighten, or the battery bracket is loose.

– Mechanical failure in the electrical system, such as short circuit or circuit damage.

2.11.2.2 Start System Description and Operation

Start system includes the battery, ignition switch, starter, start relay and related circuits, and all of these components are connected by circuits. When the ignition switch is turned to "ST" position,

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the starter relay pulls-in and provides power to starter motor magnetic switch. After that, the starter motor runs. For specific control principle, refer to 2.11.3.1 Start System Operating Principle.

2.11.2.3 Charging System Description and Operation

Charging system includes the battery, generator, instrument and relevant circuits. Generator consists of the voltage regulator, rectifier, stator and rotor, which are all installed inside the generator. When the engine rotates, the drive belt drives the generator to rotate. The generator rotation generates an alternating current, which is converted to a direct current by the diode rectifier and then transmitted to the charging system. Voltage regulator automatically adjusts the generator field current to control voltage output to keep it within the appropriate charging range. Refer to 2.11.3.2 “Charging System Operating Principle” for the detailed operating principle.

Charging Process:

1. When charging sealing type battery after dismantling from vehicle, it is necessary to equip joint tool components. Make sure that all the charging cables are clean and firm. To achieve best results, charge the battery when the electrolyte and electrode are at room temperature. If the battery temperature is too low, the charger may not start charging after a few hours.

2. Charge the battery until the battery is full or the tested battery voltage is close to full load capacity. Inspect the battery every half an hour during charging.

Refer to 2.11.7.9 "Battery Discharge Current and Parasitical Load Tests" to carry out the load test on the battery after charging.

Charge a fully discharged battery (off the vehicle):

Strictly bey the following procedure, otherwise a good battery might be mistakenly replaced. Follow the following procedures, charge a fully discharged battery:

1. Measure the battery terminal voltage with a precision voltage meter. If the reading is less than 10 V, the charging current will be low. The battery can only be charged with more than a few mA of current after a certain period of time.

2. Set the battery charger at a high value.

3. Continue to charge the battery with 16 V charging voltage for more than 4 hours:

- If there is still no charging current after reaching above time, it is necessary to replace battery.

- If there is charging current measured during charging period, it indicates that the battery is intact and can continue to be charged fully.

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2.11.3 System operating principle

2.11.3 .1 Start System Operating Principle

When the ignition switch is at the "ST" position:

- Power passes through the under hood fuses EF40 and EF29 to the starter relay ER03 terminal No.30.
- Power passes through the under hood fuses EF40 and EF14 to the ignition switch wiring harness connector IP45 terminal No.5.
- When the ignition switch is at the “ST” position, the power passes through the ignition switch wiring harness connector IP45 terminal No.4 to the starter relay ER03 terminal No. 86.
- After energizing, the starter motor solenoid switch closes to provide the close loop between the battery and the starter motor. The starter motor is grounded via the engine cylinder block. Wen the two requirements of power supply and grounding are met, the starter motor begins to run and the engine starts up.

Start motor operating principle: The motor is a DC reduction motor. The stator is a permanent magnet and the rotor is coil windings located in the armature. Through the magnetic field the coil excites the windings. Solenoid core is located inside the drive cover to avoid dust, ice and splash of water. When the switch is closed, the electromagnetic switch coil power results in a magnetic field, causing the core and fork to move and driving gear and the engine flywheel ring gear to mesh. When the electromagnetic switch main contacts are closed, the battery to starter motor circuit is connected. The armature rotates and through a reduction mechanism increases the torque to drive the engine to rotate. With the starter motor rotating, due to the driving gear and the engine flywheel ring gear mesh, so the engine rotates. When the engine starts, the driver gear overdrive in order to prevent the armature speed is too high to damage the starter, at this moment the return spring separates the drive gear. In order to prevent the high speed which may damage the starter, the ignition switch should be immediately released after the engine starts.

2.11.3.2 Charging System Operating Principle

Generator provides DC voltage to the vehicle electrical system and maintains the battery charged. The voltage output is controlled by the regulator integrated inside the generator:

- When the ignition switch is at "OFF" position: battery voltage passes through the I/P fuse EF03 to the generator harness connector EM12 terminal No.1. This voltage is the working power supply of generator.
- When the ignition switch is at "ON" position and the engine is not running:

  A. Generator harness connector EM12 terminal No.1 still has voltage. When the ignition switch is at "ON" position, it provides IG1 relay terminal No.85 voltage. The relay pulls in.

  B. Battery voltage passes through the I/P fuse EF40, EF35 and cab fuse IF02 to IG1 relay terminal No.87. Due to relay pull-in, relay terminal #30 output passes the battery voltage through the cab fuse IF25 to the generator harness connector EM12 terminal No.1. After the magnetizing coil is provided with power, this voltage produces a good magnetic field around the coil.

  C. Generator harness connector EM11 terminal No.1 is connected with the instrument connector IP02 terminal No.10, so the EM11 terminal controls the generator charging indicator lamp. When the engine is not running, the terminal provides a good ground, so the charging indicator lamps.

- When the engine operates: a stator coil generates induction alternating voltage because an exciting coil generates a magnetic field; thus, a voltage regulator inducts the voltage and control current and alternating voltage in the magnetic field that are generated by 3 stator coils. The AC voltage is converted into DC voltage through a current rectifier built in the engine. Adjusted by the voltage regulator, the generator output voltage is applied to the vehicle battery and the battery terminals power circuit. With the generator working, generator harness connector EM11 terminal

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No.1 voltage and the voltage at both sides of charging indicators in the instrument is the same, thus the charging indicator loses ground and off.

- Because the generator harness connector EM12 terminal No.1 and the battery is connected, when the battery is fully charged, the regulator will reduce the magnetic field excitation current, thereby reducing the generator output voltage to prevent overcharging. When the battery discharging or load is big, the voltage regulator increases the magnetic field excitation current to increase the generator output voltage.

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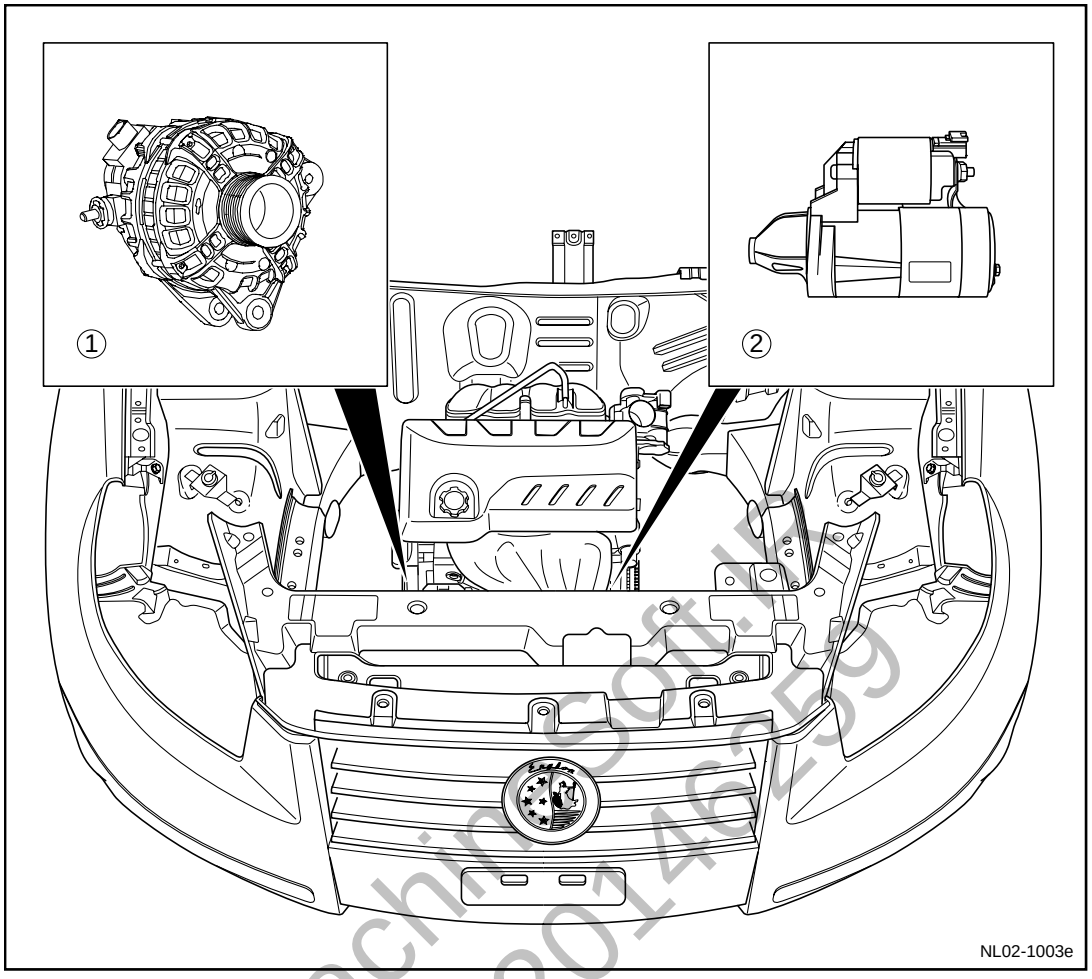
2 . 11 . 4 Part position figure

2.11.4.1 Component position



1. Generator
2. Starter

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2.11.5 Diagnostic information and procedures

2.11.5.1 Diagnosis descriptions

See 2.11.2.2 Description and Operations of Starter System. Start system diagnosis after getting to be familiar with the system functions and operations. This helps the identification of malfunctions in case of malfunctions.

Breaking step, what's more, it is conducive to determining whether the condition described by the customer belongs to the normal operation.

2.11.5.2 Visual Inspection

1. Inspect whether there is after-sales optional device which will affect start, charing or operation of ignition system.
2. Inspect the easy to access system components to identify whether there is obviously damage or potential fault.
3. Inspect whether the battery is installed correctly.
4. Test battery status. Battery voltage is not less than 11V.
5. Inspect whether there is wire damage. Inspect starter motor, starter solenoid switches, ignition switches and battery. Inspect whether all ground connections are reliable.
6. If the battery, wires and switches are normal, and engine functions are normal, dismantle and test the starter motor.
7. When the charging system works properly, turn the ignition switch to "ON" position, the charge indicator lamp will be on. The lamp will be off after the engine starts running.
8. Inspect whether the generator is loose or improperly installed, as well as the drive belt tension is normal, whether there is the possibility of slipping.

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2.11.5.3 Starting Motor Noise Diagnostic

Before the diagnosis, please refer to the 2.11.2.1 Battery Description and Operation, 2.11.2.2 Start System Description and Operation and 2.11.2.1 Charging System Description and Operation, and perform the necessary inspection.

1	Start the engine, while monitoring whether the starter motor starts turning.

When the engine started and the starter remained at the bonding position, whether there is loud "breathing" (If the starter remains in bonding position and further increases the engine speed, the sound may sound as an alarm)?

Yes → Inspect the flywheel ring gear for existence of the following: tooth cracking, tooth loss, tooth wear, flywheel bent or the tooth damage, if necessary, replace the flywheel.

No

2	After starting the engine, during gradually stopping the starter, is there any "rumble", "roar" or in some cases "percussion sound "?

Yes → Go to step 4

No

3	During the startup of the engi… …ing, is there any high-frequency hu… sound?

Yes → Refer to 2.12.6.4 “Replacement of Starter” to replace the starter.

No

4	Remove the starter motor.

Inspect starter motor shaft housing and clutch gear. If the clutch gear or shaft housing has cracking or wear?

Yes → Refer to 2.12.6.4 “Replacement of Starter” to replace the starter.

No

5	Replace the flywheels.

Next

6	Troubleshooting

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2.11.5.4 Generator Noise Diagnosis

Diagnostic Hints: Generator noise may be caused by electrical or mechanical noise. Electrical noise (electromagnetic hum sound) is usually added to the generator with the electrical load changes, which is the normal operating characteristics of all generators. During the service, pay attention to distinguishing, otherwise it will cause unnecessary customer complaints. When diagnosing the mechanical noise of generator, firstly inspect whether there are loose generator components or interference. In some cases even if the sound in engine compartment is light, it can enter the passenger compartment. If this is the case, replacing the generator does not solve the problem, which leads to misjudgments.

1	Stop the generator, and confirm whether the noise disappears.

A. Start the engine, verify that the noise can be heard.

B. Shut down the engine.

C. Disconnect the generator harness connector EM07 from the generator.

D. Start the engine.

Confirm whether the noise disappears?

Yes	Go to step 6
No	

2	Inspect the generator shaft.

1. Shut down the engine.
2. Dismantle the drive belt.
3. Rotate the generator pulley by hand.

Does the generator rotate smoothly without catching and grinding noise?

Yes	Go to step 6
No	

3	Reinstall the generator.

Dismantle and install the generator again. Tighten the mounting bolts of generator to the specified torque. Refer to 2.12.6.3 Replacement of Generator

Start the engine, does the noise disappear?

Yes	The system is normal.
No	

4	Inspect whether the drive belt is loosened.

Yes	Go to step 7
No	

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5	Compare with a known intact vehicle. Is the noise the same?

Yes → The system is normal.

No

6	Replace the generator assembly.

Important precaution : If a clear generator fault has not been found, make sure that all other possible noise sources have been excluded and then replace the generator.

If the noise is part of the normal generator characteristics, after replacing generator, the noise will not disappear.

Yes → Troubleshooting

7	Replace the drive belt or the drive belt tensioner.

Refer to 2.6.8.3 Replacement of Drive Belt or 2.6.8.4 Replacement of Drive Belt Tensioner.

Next

8	Troubleshooting

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2.11.5.5 Battery Discharging Current and Parasitic Load Test

If the battery continues to loss power, perform the following test to inspect whether there are parasitic battery current.

Note: prior to the implementation of the procedure, please firstly check whether there is after-sales adding device in the vehicle, such as DVD, audio frequency amplifier, trunk subwoofer and other non-original accessories, if so, please cut of these system to implement this test procedure.

Warning!

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

1	Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedure.

Next

2	With a digital multimeter, connect one end to the battery negative cable, the other to the negative battery.

Next

3	Select digital multimeter's "current test" maximum range.

Next

4	Open the left front door to observe the meter display readings.

Note: Do not carry out any other operations action at this time, otherwise it is likely to damage the multimeter.

Next

5	If the multimeter has no display, inspect whether the meter is damaged. If there is displayed reading, close the left front door and press down the engine compartment button, and then press the remote control door lock button.

Next

6	Observe the body anti-theft system indicator lamp to indicate the system to enter the warning mode.

Next

7	Wait for more than 10 min to observe the meter readings, (if the multimeter shows an abnormal reading, tune the multimeter to minimum range). The reading should be below 30 mA. If the reading is higher than 30 mA, there may be parasitic current.

Note: When the system parasitic current can not be confirmed, compare the vehicle with a known good vehicle to helping with diagnostic.

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2.11.5.6 Jumper Start Program

Warning! Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1	Properly park the vehicles that will provide bridge connection power, making the bridge connection cable connect the two vehicles' batteries.

Next

2	Turn both vehicles' ignition switches to "OFF" position and turn off headlights and all the accessories power supplies.

Next

3	Press the hazard warning lamp switches to turn on the hazard warning lamps.

Next

4	Strain the two vehicles' parking brakes.

Next

5	Make sure that the gearbox is at the neutral position.

Warning: The bridge connection cable must be intact without exposed wires, otherwise it will cause unnecessary personal injury or vehicle damage.

Next

6	Connect one end of the red cable to the positive terminal of the battery with sufficient capacity providing the power, and confirm that there is no contact with other metal parts.

Next

7	Connect the other end of the red cable to the positive terminal of the flat battery. Do not connect the red cable to the negative terminal of flat battery.

Warning: Do not connect the bridge connection cable directly to a flat battery negative terminal to prevent the spark and possible battery gas explosion.

Next

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8	Connect one end of the black cable to the negative terminal of the battery with sufficient capacity providing the power.

Next

9	Finally, connect the other end of the black cable to the flat battery engine ground, and at least 500 mm (19.7in) away from the discharging battery.

Next

10	Start the vehicle with fully charged battery and run the engine speed at an intermediate speed for more than 3 min.

Next

11	Start the vehicle starter with flat battery.

Next

12	Dismantle the bridge connection cables in reverse order.

Note: During the removal procedure, if the other end of the cable has not been fully disconnected, avoid the cable clamp contact with any metal objects.

13	Procedure completed

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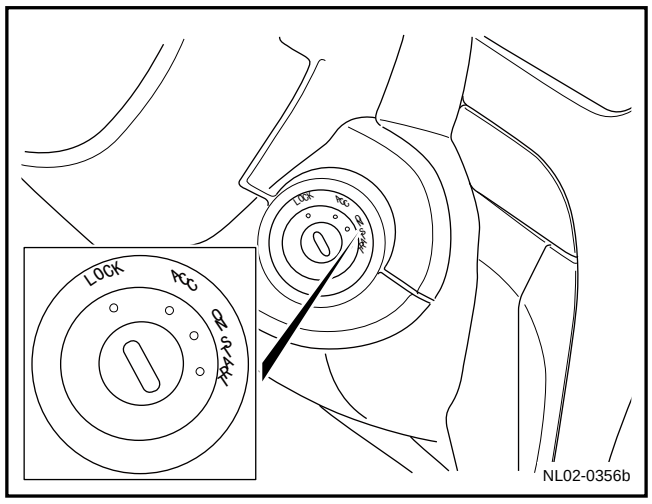
2.11.6 Removal and installation

2.11. 6 . 1disconnect and connect process of battery cable

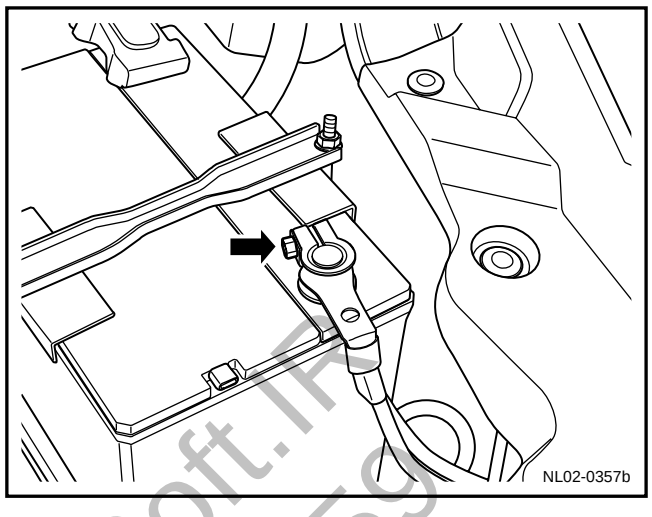
Disconnecting Procedure:

Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions"!

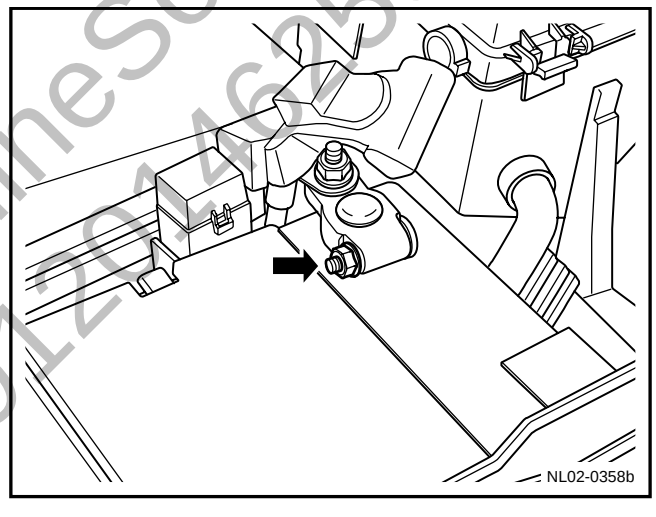
1. Turn off all electrical equipment, and turn the ignition switch to "OFF" position.



2. Release the battery negative cable fixing bolt and disconnect the battery negative cable.



3. Release the battery positive cable fixing bolt and disconnect the battery positive cable.



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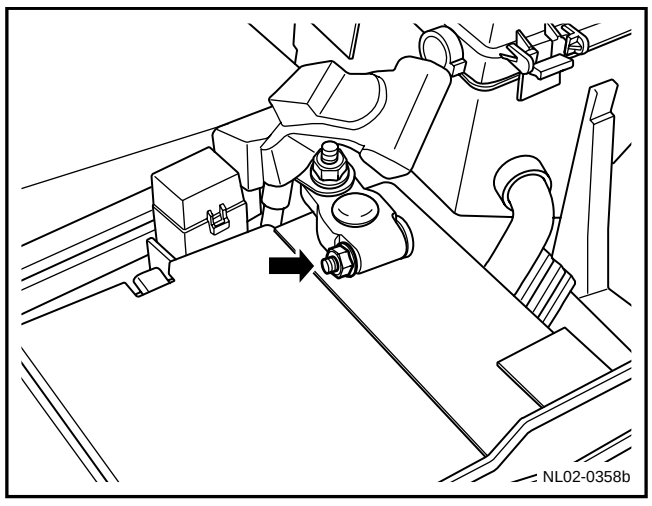
Connecting Procedure:

1. Connect battery positive cable, and tighten the fixing nut.

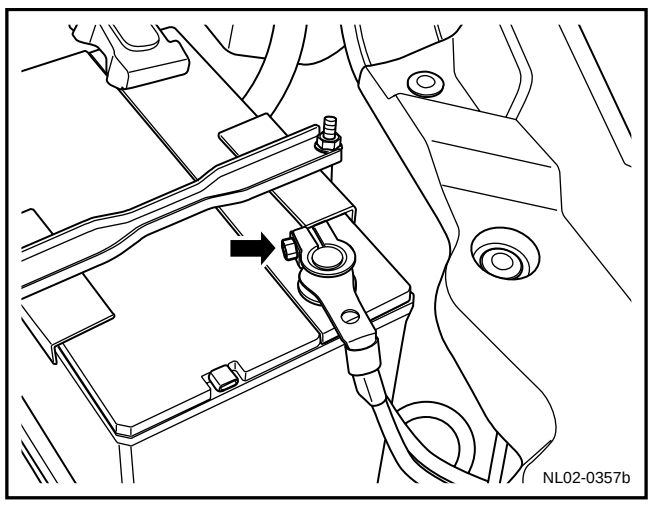
Torque:10 Nm(Metric) 7.4 lb-ft(English system)

2. Make sure the ignition switch is turned to "OFF" position.



3. Connect the battery negative cable.

Torque:10 Nm(Metric) 7.4 lb-ft(English system)



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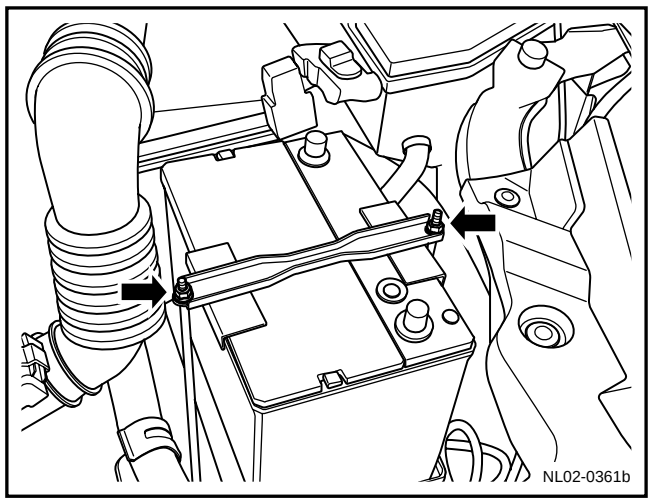
2.11.6.2 Replacement of Battery

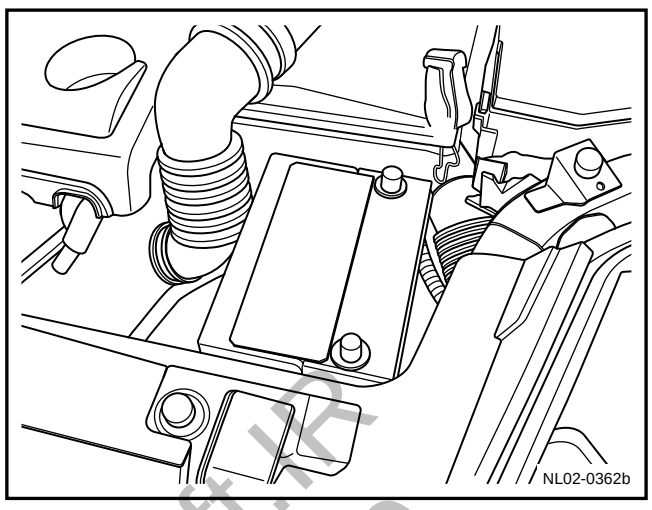
Warning: refer to "warning of battery disconnection" in "warnings and precautions".

Dismantlement Procedure

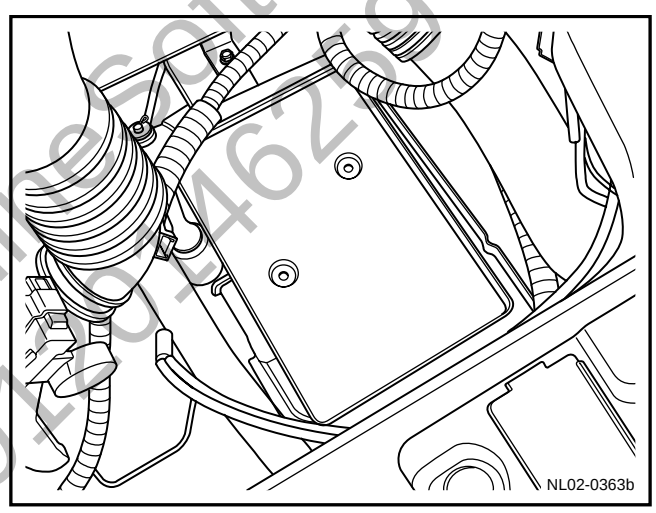
1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
2. Dismantle the battery fixing strap nuts.



3. Remove the battery .



4. Remove the battery base plate.



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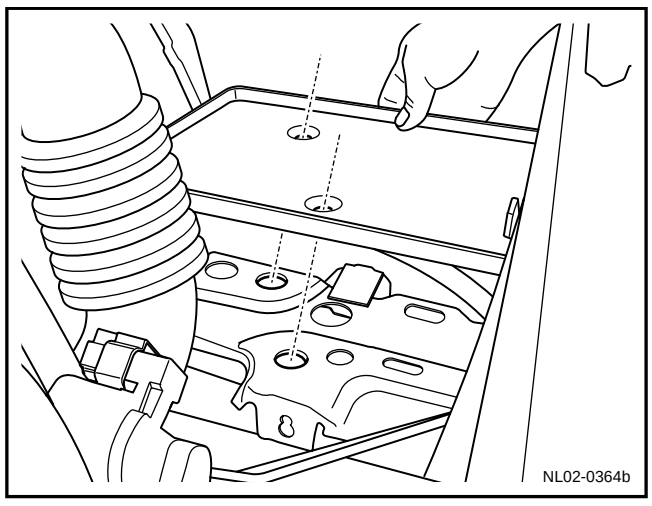
Installation Procedure:

1. Install the battery base plate.

Note: The battery base plate is retained by two convex sets, and pay attention during installation to aligning the convex with the bracket holes.

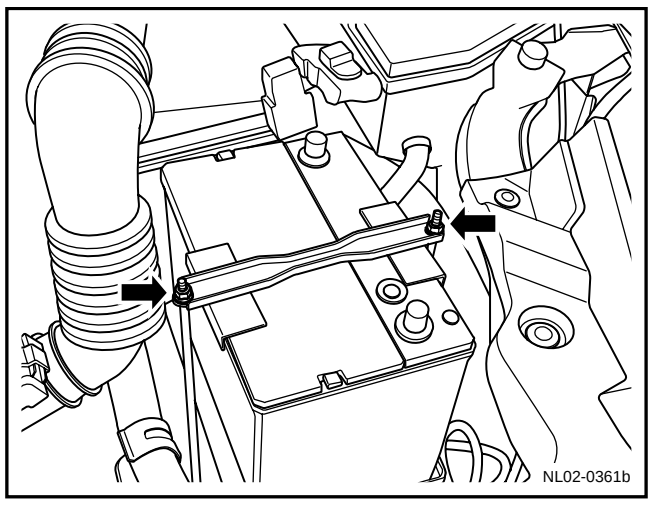
2. Install the battery.



3. Install the battery fastening board and tighten the strap nuts.

Torque:10 Nm(Metric) 7.4 lb-ft(English system)

4. Connect the battery negative cable .



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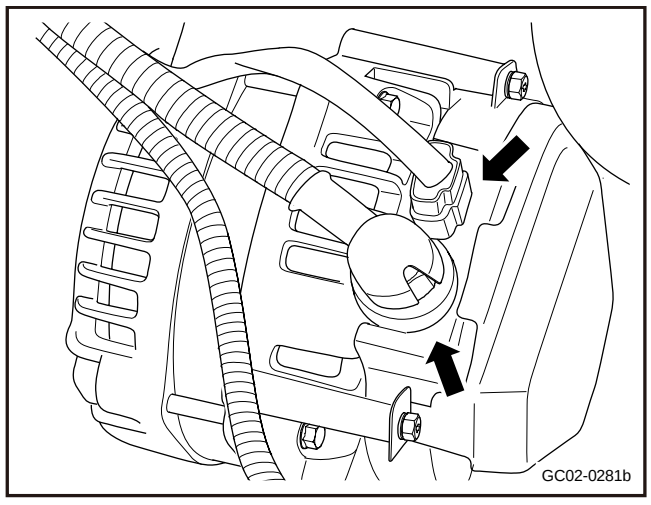
2.11.6.3 Replacement of Generator

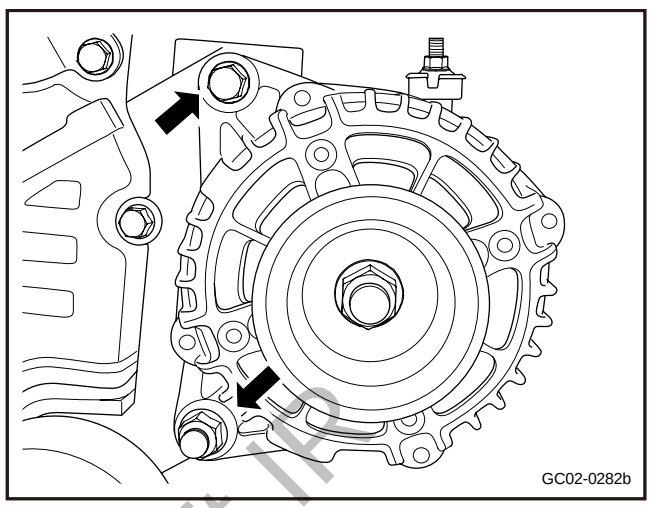
Dismantlement Procedure

Warning: refer to "warning of battery disconnection" in "warnings and precautions".

1. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
2. Disconnect the generator harness connector.
3. Dismantle the fixing nuts of generator charging harness.



4. Dismantle the drive belt. Refer to 2.6.8.3 Replacement of Drive Belt.
5. Dismantle the lower fixing nuts of generator.
6. Dismantle the upper fixing bolts of generator.
7. Remove the generator from the generator bracket.



Installation Procedure:

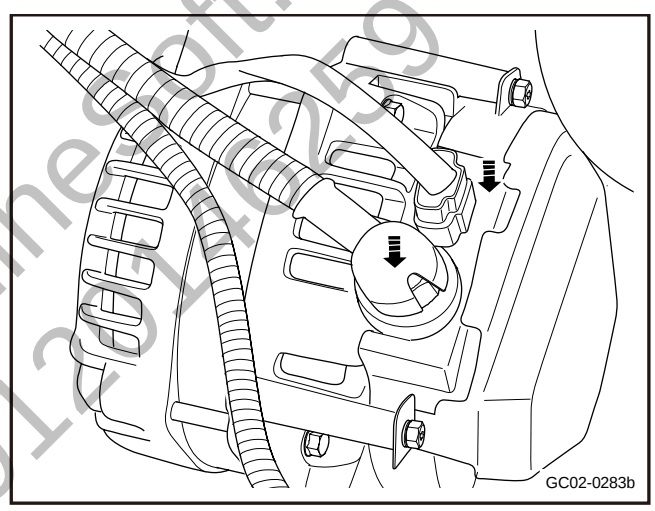
1. Install and tighten the upper fixing bolts of generator.

Torque :49±9N·m(Metric). 36. 1±6 . 6lb-ft(English system)

2. Install and tighten the lower fixing bolts of generator.

Torque :44±10N·m(Metric) .32. 5±7. 4 lb-ft(English system)

3. Install the drive belt.
4. Install the generator charging harness and tighten the fixing nuts of harness.



Torque :25±5N·m(Metric) .18 . 4±3. 7lb-ft(English system)

5. Connect the generator harness connector.
6. Connect battery negative cable.

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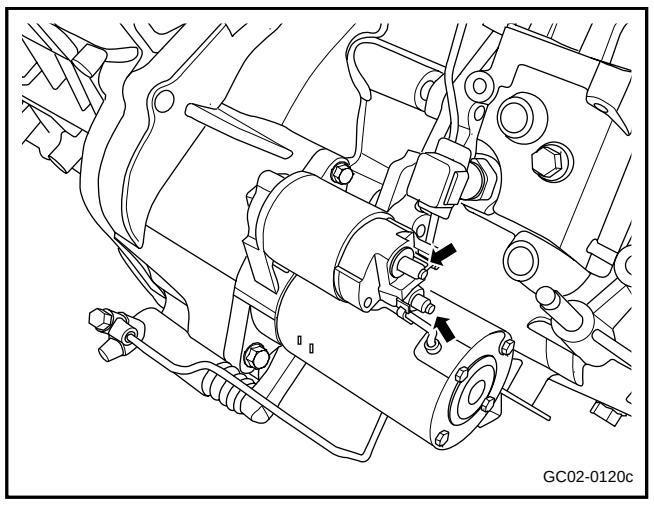
2.11.6.4 Replacement of Starter

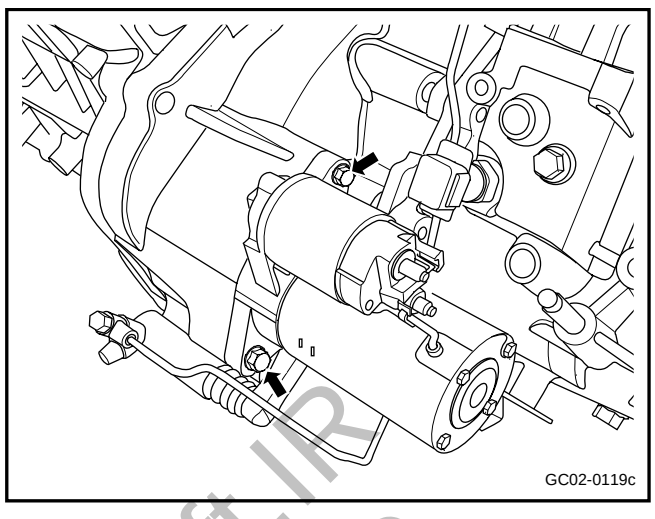
Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions".

1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedure.
2. Disconnect starter control harness connector and power harness.



3. Dismantle the fixing bolts of starter.
4. Dismantle the starter.

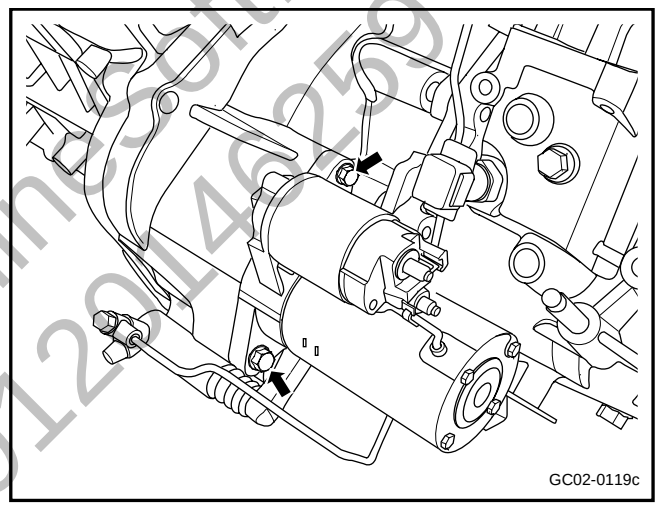


Installation Procedure:

1. Install the fixing bolts of starter.

Torque :26. 5-33 .3N·m (Metric) .19.6-24.6lb-ft(English system)

2. Install the starter power supply harness and tighten the fixing nut.
3. Install the starter harness mounting bracket and tighten the fixing bolts.
4. Connect the starter control harness connector.



5. Connect the negative cable of the accumulator.

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2.12 control system (4G18 with Delphi systems)

2.12.1 Specifications

2.12.1.1 Fastener Specifications

Fastener Name	**Specification**	**Tightening Torque**	
		Metric (N.m)	English system (lb-ft)
Camshaft Position Sensor Bolts	M6×14	8-10	6-7.4
Fixing Bolts of Crankshaft Position Sensor	M6×12	8-10	6-7.4
Fixing Bolts of Ignition Coil	M6×35	7-11	5.2-7.8
Engine Control Module Bolts	M6×16	8-10	6-7.4
Temperature sensor of engine coolant bolts	M12×1.5×6	15	11
Evaporative Emission Canister	M6×20	7-9	5.2-6.7
Evaporative Emission Canister Solenoid Valve Bracket Bolts	M6×20	7-9	5.2-6.7
Fuel Filter Mounting Bracket Assembly Bolts	M6×16	8-10	6-7.4
Fuel Filter Mounting Bracket Bolts	M6×16	8-10	6-7.4
Fixing Bolts of Fuel Distributing Pipe	M6×20	10	7
Fixing Bolts of Fuel Tank	M10×30	38-46	28.1-34
Fixing Bolts of Idle Speed Control Valve	M4×10	2-3	1.5-2.4
Bolts of Knock Sensor	M8×30	15-22	10.7-16
Fixing Bolts of Intake Manifold Absolute Pressure and Temperature Sensors	M6×12	8-10	6-7.4
Oxygen Sensor Bolts	M18×8	44	32.6
Air-conditioning compressor mounting bracket bolt	M8×80	25	18.2
Spark Plug	M14×1 . 25×22	20-30	14.8-22.4

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Throttle Body Retaining Nut	M8	20-25	14.8-18.5

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2.12.1.2 relation of temperature sensor temperature and resistance

Temperature (℃) /(℉)	Resistance (Ω)
-30/-22	26000
-25/-13	19000
-20/-4	15000
-15/5	11800
-10/14	9000
-5/23	7000
0/32	5600
5/41	4600
10/50	3600
15/59	3000
20/68	2400
25/77	2000
30/86	1700
35/95	1400
40/104	1180
45/113	950
50/122	800
55/131	700
60/140	600
65/149	510
70/158	425
80/176	320
90/194	240
100/212	180
110/230	140
120/248	110
130/266	90

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2.12.1.3 Relation of altitude and atmospheric pressure

Altitude (m)/(ft)	**Atmospheric Pressure (kPa)/(psi)**
4200/13780	55/8
3900/12795	58/8.4
3600/11811	61/8.8
3300/10827	64/9.3
3000/9843	66/9.6
2700/8858	69/10
2400/7874	71/10.3
2100/6890	74/10.7
1800/5906	77/11.2
1500/4921	80/11.6
1200/3937	83/12
900/2953	87/12.6
600/1969	90/13.1
300/984	93/13.5
0	100/14.5

2.12.1.4 No-load resistance value temperature characteristics table of air intake temperature sensor

Temperature (℃/℉)	**Resistance (Ω)**	**Temperature (℃/℉)**	**Resistance (Ω)**	**Temperature (℃/℉)**	**Resistance (Ω)**	**Temperature (℃/℉)**	**Resistance (Ω)**
-40/-40	48,153	5/41	4,707	50/122	851	95/203	214
-35/-31	35,736	10/50	3,791	55/131	721	100/212	186
-30/-22	26,885	15/59	3,075	60/140	612	105/221	162
-25/-13	20,376	20/68	2,511	65/149	522	110/230	142
-20/-4	15,614	25/77	2,063	70/158	446	115/239	125
-15/5	12,078	30/86	1,715	75/167	383	120/248	110
-10/14	9,428	35/95	1,432	80/176	329	125/257	97
-5/23	7,419	40/104	1,200	85/185	284	130/266	85

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0/32	5,887	45/113	1,009	90/194	246		

2.12.1.5 Intake Pressure Sensor Voltage and Pressure Diagram

Pressure (kPa)	15	40	94	102
Output Voltage (V)	0.12-0.38	1.52-1.68	4.44-4.60	4.86-5.04

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2.12.2 Description and Operation

2.12.2.1 Overview

This engine control system uses Delphi MT22.1 Control System, Its main characteristic is that the engine control module (ECM) acts as the core system. The traditional mechanical throttle pedal and mechanical throttle body are replaced by more advanced electronic throttle acceleration pedal sensor assembly and the electronic throttle body assembly. Due to this advanced system,ECM torque control over the engine is more convenient. In addition, MT22.1 control system also incorporates multi-point sequential fuel injection, group direct ignition without electricity distributions, variable valve timing control and three-way catalytic converter post-processing, capable to meet the increasingly stringent emission regulations.

The system's main functions include:

1. Engine torque output control mode: ECM calculates the gas flow through the intake air temperature sensor and intake manifold pressure sensor signals, making the Air-Fuel ratio closer to the current engine's operating condition demand.
2. Torque control mode: ECM calculates the current required output torque and controls the engine output power, according to the acceleration pedal position sensor signal.
3. Main relay control of Complete Vehicle.
4. Close-loop control multi-point sequential fuel injection: A close-loop fuel control can precisely control the engine air- fuel ratio, and therefore efficiently controls emissions. Close-loop control can effectively eliminate the system and related mechanical component swear and tear due to manufacturing error and improves vehicle consistency.
5. Variable Valve Timing (VVT) control: Variable valve timing control system uses VVT actuator to change the relative positions between intake camshaft and crankshaft. Engine management system calculates the best valve timing based on engine operating conditions, and controls VVT solenoid valve movement, allowing flow and direction of oil pressure in VVT actuator to change, and ultimately promoting the camshaft movement to the desired position.
6. Fuel supply control without fuel return.
7. Fuel pump working control.
8. ECM has built-in ignition drive module and group direct ignition without electricity distributions.
9. Knock Control: When the knock sensor detects a knock occurring, the system will calculate the ignition advance angle delay based on the current conditions, knock intensity and other necessary information, and defers the ignition advance angle, so as to avoid or reduce knock. Electronic Throttle Control: Since the system uses an electronic throttle, highly precise idle control can be achieved. Taking the electrical load compensation as an example, when there is electrical load or the load is cut off, due to the sudden increase or decrease in engine load which results in engine speed fluctuation in a certain range, therefore, we add the electrical load control adjustments. When the load increases or decreases, adjust the air flow rate and /or the ignition advance angle accordingly to make sure that the idle speed remains steady at the best condition.
10. Canister Solenoid Valve Control
11. Cooling fan relay control
12. System self-diagnostic function: After the system enters working condition, ECM controls all system components working, and tests them in real time. Once the system or component malfunction occurs, the system will light up the engine malfunction lamp to remind the driver to repair or service the vehicle on time. In the mean time, ECM will start fault protection mode.
13. System over-voltage protection: When the charging system malfunction causes the voltage too high, the system will enter protection mode to restrict the engine speed to prevent ECM damage.

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2.12.2.2 Components Description

1. Engine Control Module (ECM)

Engine control module is a microprocessor with a single chip as the core. Its function is to process data from various vehicle sensors to determine the engine's working condition, and controls each engine actuator through various actuators.

ECM normal work voltage 9.0 V–16 V

Notes:

Although ECM has the over-voltage and reverse polarity voltage protection function, during the repair process it is prohibited to connect the battery positive and negative wrong or apply voltage higher than 15 V. Otherwise, it will cause damage to ECM and other electrical equipments.

2. Crankshaft Position Sensor

The crankshaft position sensor output can be used to determine crankshaft position and rotation speed. The engine rotation speed and crankshaft position sensor are magnetic-electric sensors installed near the crankshaft. When the crankshaft rotates, they work together with the 58X gear on the crankshaft. The 58x tooth top and the alveolar pass through the sensor in different distances when the crankshaft rotates. The sensor senses the reluctance change; the alternating reluctance generates an alternating output signal. The 58x gear plate gap position aligns with engine top dead center. When the cylinder No.1 reaches top dead center, the sensor aligns with the 20th tooth lower edge. ECM uses this signal to determine crankshaft position and rotation speed.

Resistance Value of the sensor: 20-30℃（68-86℉）900-1100Ω.

Output Voltage: 400 mV at 60 rpm. The voltage increases as the speed increases.

3. Intake Air Pressure/Temperature Sensor:

This sensor detects intake manifold pressure change caused by engine load and speed changes. These changes will be converted to the voltage output. When the engine decelerates, the throttle body closes to result in a relatively low intake manifold absolute pressure output. Intake manifold absolute pressure and vacuum degree is opposite. When the manifold pressure is high, the vacuum degree is low. MAP sensor is also used to measure atmospheric pressure . This measurement is completed as part of the MAP sensor calculation. When the ignition switch is turned on and the engine is not running, the engine control module reads the intake manifold pressure as atmospheric pressure, and adjusts the Air-Fuel ratio accordingly. With this kind of altitude compensation, the system can maintain a low emission while maintaining maneuverability.

4. Camshaft Position Sensor (CMP)

Camshaft position sensor is a Hall-effect sensor which is installed in the vicinity of the intake camshaft, and works together with camshaft signal wheel. The signal wheel is corresponding to the specific engine position. ECM measures digital voltage signal through this sensor, therefore determining the working cylinder of the engine and implementing one-to-one control. Engine control module then calculates the actual sequence of fuel injection. If the engine is running when the camshaft position sensor signal is lost, the fuel injection system will be converted to the sequential fuel injection mode based on the final fuel injection pulse, while the engine continues to run. If the engine starts after being shut down, the fuel injection sequence will be converted from sequential injection to group injection. Even if the fault exists, the engine can be restarted.

5. Engine Coolant Temperature (ECT) Sensor

Engine coolant temperature (ECT) sensor is used to detect the engine operating temperature. ECM provides the best control scheme depending on the temperature. The sensor uses a negative temperature coefficient thermostat as the sensing element, when the coolant temperature rises, the resistance decreases. At -30°C the resistance is 52,594 Ω; at 130 °C, the resistance is 77.5 Ω. The sensors are installed in the main coolant path. The coolant temperature signal is important to the ignition timing and fuel injection adjustment, while the signal is also transmitted to the instrument panel (IP) and used to display the current engine working temperature.

6. Knock Sensor (KS)

Knock sensor is a frequency response sensor, installed at the engine block’s most sensitive part to

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knocking under the intake manifold. ECM uses knock sensor to detect knock intensity, so as to adjust the ignition advance angle to effectively control knocking and optimize the engine power, fuel economy and emission levels. If the engine knocking occurs, ECM will receive this signal, filter out the non-knock signals and make the calculation. It determines the engine's position in the working cycle through the camshaft and crankshaft position sensor signals, according to which the ECM figures out the knocking cylinder and then delays the ignition advance angle for this cylinder until the knocking disappears. Then ECM advances the ignition advance angle until the ignition angle is best suited for the operating conditions at that time. Due to weak sensor signals, the sensor lead has a shielded cable. Its resistance is over 1M Ω (20-30℃) with the output signal is greater than 17 mV/g in any case.

7. Oxygen Sensor

Oxygen sensor is an important symbolic component in a close-loop fuel control system, which adjusts and maintains the ideal Air-Fuel ratio, so that three-way catalytic converter achieves the best conversion efficiency. When the Air-Fuel ratio for engine burning becomes thin, the oxygen content in the exhaust increases, and oxygen sensor output voltage is reduced. On the contrary, the output voltage increases to feedback the air- fuel ratio to ECM.

Oxygen sensor sensing material is Zirconia, hollow with an external sensing part. When the Zirconia components are heated (>300℃) for activation, the reference air enters the hollow part of the Zirconia component through the lead wire. The exhaust passes through the outer electrode, and the oxygen ions move from the center of the zirconia to the outer electrode, which thus consists of a simple atomic battery with a voltage between two electrodes; the Zirconia can alternate the output voltage according to the oxygen concentration in the exhaust and therefore determine the oxygen content of exhaust gas. Usually, the oxygen sensor is designed to generate a voltage amplitude jump in the vicinity of the exhaust theoretical Air-Fuel ratio of (14.7:1) to help the ECM determine the Air-Fuel ratio accurately.

8. Fuel Injectors

The injector nozzle's structure is an electromagnetic switch ball valve device. The both electrodes from the coil are connected to the ECM and the power supply through the engine wiring harnesses. When the coil is controlled by ECM to connect to the system ground, the resulting magnetic force overcomes the spring force, fuel pressure and manifold vacuum suction to draw up the valve core. The fuel sprays from the guide hole through the valve seat hole mistily to the intake valve. When the power supply is cut off, the magnetic force disappears. Under the spring force and the fuel pressure, the injector nozzle closes. The top of the fuel injector has the reliable fuel pressure sealing generated by the rubber seal ring and the fuel rail interface; the lower part also uses the rubber seal ring and engine air intake manifold to form the air sealing. Fuel injector resistance is 11.4-12.6 Ω.

Note: When the fuel injector is blocked or not closed tightly, the engine malfunction lamp may be lit, but the detection fault code is: oxygen sensor distortion, erratic signal, abnormal Air-Fuel ratio and other faults. At this time, the failure component should be carefully judged. Because when the fuel injector is blocked or leaking, the amount of fuel injected is not controlled by the ECM pulse width, the mixed air concentration signals of the oxygen sensor feedback to ECM will be very different from the ECM control target. When ECM detects this signal, it will determine whether the oxygen sensor is working properly. But the system cannot determine whether the fault comes from the oxygen sensor itself or other associated malfunction due to the damage of other parts. Therefore, at the service of such malfunctions, the failed components must be carefully identified.

9. Fuel Pump Assembly

The fuel pump is turbine single-stage electric fuel pump under the control of the ECM via the fuel pump relay. It has a check valve at the outlet of the fuel pump. When the engine is not running, the remaining oil in the pipeline will not quickly return to the fuel tank, so as to ensure the re-starting performance. Fuel level sensor is a variable sliding resistance type.

10. Ignition Coil

Cylinder 1 and 4 have their ignition coils located at the top of the Cylinder 4's spark plug opening. Cylinder 2 and 3 have their ignition coils located at the top of the Cylinder 2ee's spark plug

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2.8.3 System operating principle

2.8.3.1 System operating Principle

Cold Engine: the engine normal operating temperature is generally around 95°C (203 °F), in this temperature range, all the engine parts running status will be ideal. If the engine can not reach the ideal operating temperature in a long time,it will increase the parts wear and tear. Because of low temperature, the mixture combustion will be inadequate, and there will be excessive carbon residue. The engine heat exchange must be kept minimum so the engine can reach normal working temperatures in a short period of time. At this point the thermostat controls the engine coolant only circulates within the engine block, bringing the heat from the cylinder wall to the other engine parts, so that the temperature increases rapidly. Water pumps makes the engine coolant flow in the cylinder block, then in the engine block water jacket, throttle body and cylinder hood cover. This is called "small loop".

Engine at normal working temperature: With the engine running, the engine coolant temperature quickly increases, when the thermostat reaches 83℃ (181.4 °F), the engine coolant is drawn into the engine block water jacket, intake manifolds, cylinder hood and radiator by the water pump. This is called "big loop".

Thermostat: the thermostat is used to control the flow of engine coolant in the cooling system. Thermostat is installed in the front of the engine and sealed by the engine intake pipe joints components, located in the front of the cylinder hood cover. The thermostat can prevent the engine coolant.

Flow from the engine to the radiator, so as to rapidly pre-heating the engine and adjust the temperature of engine coolant. When the engine coolant temperature is low, the thermostat in the closed position, preventing the engine coolant circulating through the radiator. Starting is only allowed at this time.

Engine coolant is circulated through the heater core to quickly and uniformly preheat the engine. When the engine is warm, the thermostat opens. The engine coolant flows through radiator and exchanges the heat. Thermostat opening and closing, allow sufficient engine coolant to enter into the radiator, maintaining the engine at normal operating temperature range. The wax ball inside the thermostat is sealed in a metal casing. Thermostat wax ball thermal expands when warm and contracts when cold. As the vehicle drives and the engine warms up, engine coolant temperature increases. When the engine coolant reaches the required temperature, the thermostat wax ball expands, puts pressure on the metal shell and opens the valve. This allows the engine coolant to flow through the engine cooling system and engine to cool down, when the wax ball contracts, under the action of the spring, the valve will be closed. The themostat start to open when the temperature of engine coolant reach to 83℃(181.4ºF), and it fully opened when the temperature at 95℃(1203ºF)

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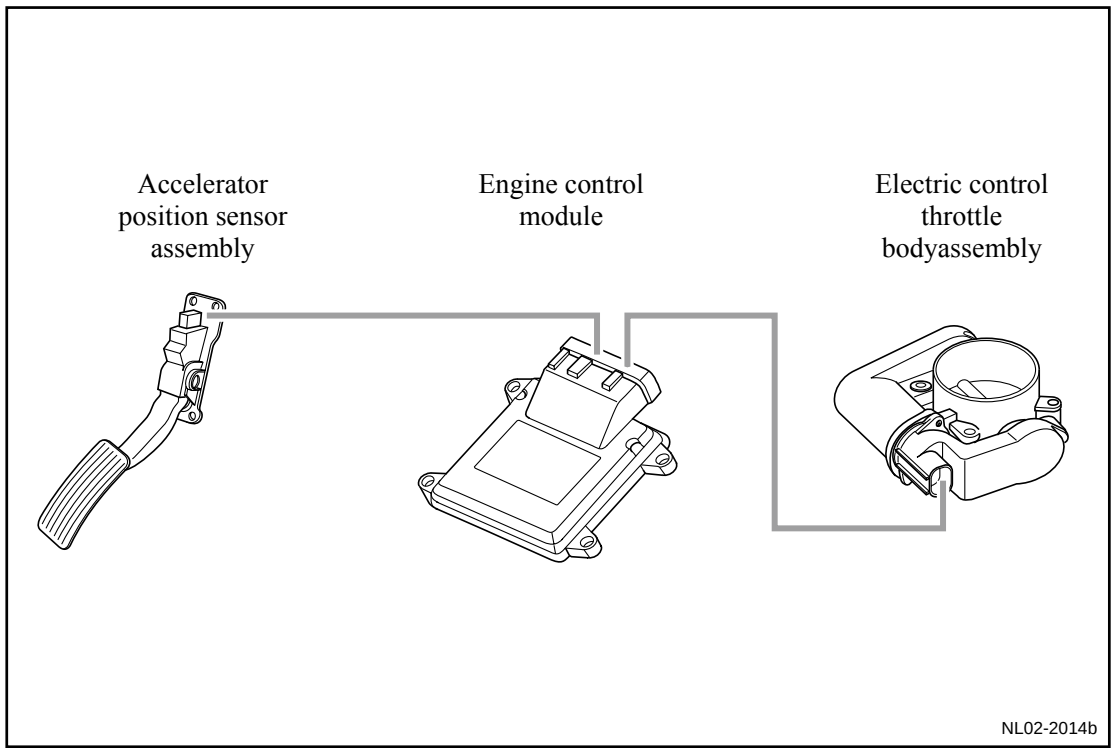
Cooling Fan Low-Speed Circuit Description: Engine cooling fan circuit controls the main cooling fan and auxiliary cooling fan. Cooling fan is controlled by the engine control module (ECM) according to the temperature sensor of engine coolant and air pressure switch inputs.

When ECM monitors conditions that meet the cooling fan Low-Speed running conditions, ECM controls the engine wiring harness connector EM01 terminal No.65 for internal grounding, and the Low-Speed cooling fan relay pulls in. Power passes through the low speed relay 1 terminal No.87 to reach the cooling fan motor 1 and then through the Fan low-speed relay 2 to reach the fan motor 2 within the series connection. Finally the circuit is grounded via the harness connector CA10 terminal #2 of fan motor 2. For the series connection of the fan motors changes the current through the motors, the fan motors run at low speed.

Description of high-speed circuit of cooling fan: the engine control module receives the engine coolant temperature sensor and air-conditioning pressure switch signal; after reaching the condition that the cooling fan rotates at high speed through the calculation of the internal program, the ECM controls the terminal 17 of the engine wire harness connector EM01 to internal ground; at this time, the cooling fan high-speed relay and the low-speed relay 2 are closed; the power supply of the fan 2 reaches the terminal 1 of the wire harness connector CA10 of the cooling fan 2

2.12.3 System operating principle

2.12.3.1 Electronic Throttle Body (ETC) Operating Principle



Electronic throttle body assembly must be used dedicatedly to the engine electronic control module (ECM) with ETC system-driven feature hardware as the core control element. System control software usually uses the computer algorithms mode, basing on the engine torque output control. At the same time, due to the cancellation of the traditional mechanical throttle valve control of mechanical pull cables, ETC is equipped with a acceleration pedal position sensor (APP) with a resistive potentiometer device, in order to provide vehicle handling demand information and other information for the driver to control the vehicle to the engine electronic control module (ECM).

Electronic throttle body opening is determined by ECM according to the acceleration pedal control input signals. With other engines and vehicles sensor input signals, ECM analyzes the driver's intention in advance and calculates the needed engine output power and accordingly adjusts the engine throttle opening and fuel supply (injection) amount. At the same time, the electronically controlled throttle position sensor can detect the actual throttle opening and send the feedback to ECM. ECM then, based on this feedback signal, adjusts the vehicle control parameters. This control process ensures that the engine and vehicle work in the ideally controlled conditions. Due to the rapid development of modern science and technology, High-Speed ECM can quickly analyze the driver's intention and calculate the basic throttle opening parameter values, based on the throttle pedal signal, the signal variation and signal change rate. At the same time, ECM adjusts and optimizes the throttle opening parameter, based on various sensors input signal status, so that the system further calculates the optimum throttle opening control parameters and implements the actual throttle control. ECM sends the output control signal to the ETC motor drive circuit to open the throttle according to the calculated opening parameter, based on the revised throttle opening and pre-determined control strategy. Because of the high speed calculation, the system enables smooth engine speed changes under transition engine operating conditions. The whole control process only requires a few milliseconds, achieving excellent vehicle performance.

The application of automotive electronic technology makes it difficult to directly judge the electronic drive control throttle valve body assembly diagnosis by conventional visual inspection method. In the event of electronic controlled throttle body malfunction, the system needs to provide a Jolt-limited function. It allows the driver to drive the vehicle to a repair station for repair.

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Jolt-limited control has the following two kinds of control modes

1. Jolt-limited control with the system unable to control the engine power

ECM will limit the engine power output, and the system can not control the throttle opening and closing. The throttle opening is automatically adjusted to the system pre-determined position.

ECM will shut down the engine ignition output. At this time, the ECM internal fault occurs and the system can not control the engine torque output. The throttle body adjusts the opening to (zero position) off status. The system will fully turn off the ignition control function.

2. Jolt-limited control with the system unable to monitor the driver's intention

ECM will limit the engine power output. At this point, the system loses the ability to determine and monitor the driver's intention. In order to prevent damage to the engine, ECM will limit the engine power output and lower engine power increment and velocity increment. When braking, ECM will adjust the engine speed to idle speed and adjust the throttle opening to the system pre-determined position.

ECM will force the engine working at idle running status. When the system loses the ability to determine and monitor the driver's intention, ECM will force the engine working at idle running status, and system will work at pre-determined position controlled the idle speed.

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2.12.3.2 ECM Controlled Fuel Supply System

1. Fuel Pump Control

When the ignition switch is turned on, the fuel pump will run for 2 s. At this moment, if ECM does not detect the engine speed signal, fuel pump stops running. Once the engine rotates, ECM detects the engine speed signal and then controls the fuel pump running. 0.6 s after the engine speed signal is lost, or the anti-theft device requests to shut down the fuel pump, the fuel pump stops running.

2. Start-up Fuel Injection Control

Pre-injection of starting fuel injection control can inject once during the normal starting procedure. The pre-injection starts when the following conditions are satisfied:

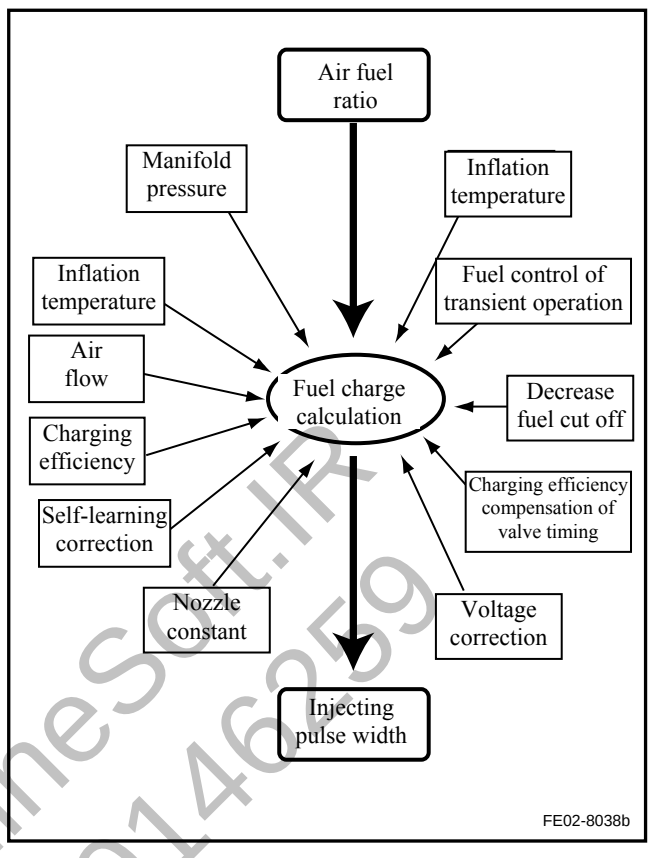
Actuation of oil pump relay

– Fuel pump running longer than the accumulation of pressure's delay time.

– The pre-injection has not yet occurred.

– Once all the above conditions are met, the pre-injection will start in all cylinders at the same time.

3. Fuel Injection Pulse Width Control



A. Air-Fuel Ratio

The startup air-fuel ratio, the normal startup air-fuel ratio, the air-fuel ratio of clearing flooded-cylinder, the air-fuel ratio when the engine is running, the air-fuel ratio in cooling state, the air-fuel ratio in the warm-up state, the theoretical air-fuel ratio, the power enriched air-fuel ratio, the catalytic overheating protection air-fuel ratio and the engine overheating Keep the air-fuel ratio.

B. Intake Manifold Absolute Pressure

Intake manifold pressure is read directly by the MAP sensor installed on the intake manifold.

C. Volumetric Efficiency

Volumetric efficiency is the ratio of actual air flow into the cylinder to the ideal air flow.

D. Valve Timing Volumetric Efficiency

The valve timing changes affect the engine's volumetric efficiency. The basic volumetric efficiency form is set when the valve timing control system has not started to work and the camshaft and the crankshaft are at the initial positions. After port timing control system starts to operate, system carries out corresponding air charging efficiency compensation to ensure accurate calculation of air inlet volume.

E. Self-Learning

Self-learning does not amend the changes as the engine running time increases, or the engine and vehicle manufacturing errors.

F. Close-loop Feedback Correction

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Close-loop feedback correction controls the actual Air-Fuel ratio close to the theoretical Air-Fuel ratio through the oxygen sensor feedback signals.

G.. Transition Condition Fuel Control

System uses more complex algorithms to establish the fuel evaporation model to calculate Air-Fuel mixing conditions, taking into account the engine coolant temperature, intake air temperature and engine working condition and the best fuel injection amount. It greatly improves fuel control under various transitional working conditions, including sudden acceleration/deceleration and other working conditions.

(h) Protective Fuel Cut-off Control

When any one of the following conditions is met, the system will stop fuel injection:

– Cutting off when the engine speed is higher than 6,500 rpm and resume fuel supply when the engine speed drops below 6,000 rpm.

– When the system detects an ignition system malfunction, it stops the fuel supply.

– When the system voltage is more than 18V, the function of electric valve body will be limited.

Mode (Forced idling mode)

I. Basic Fuel Injection Constant

Whether the basic fuel injection constant indicates the relationship between engine displacement and nozzle fuel flow rate.

J. Battery Voltage Amendment

When the battery voltage changes, the voltage will be amended to ensure the correct amount of fuel injection.

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2.12.3.3 ECM Controlled Ignition System

1. Closed Ignition Angle Control

The length of the closed ignition angle determines the spark plug ignition energy. Too long ignition coil magnetizing will damage the coil or ECM internal ignition coil driving circuit, while too short will cause ignition failure (misfire).

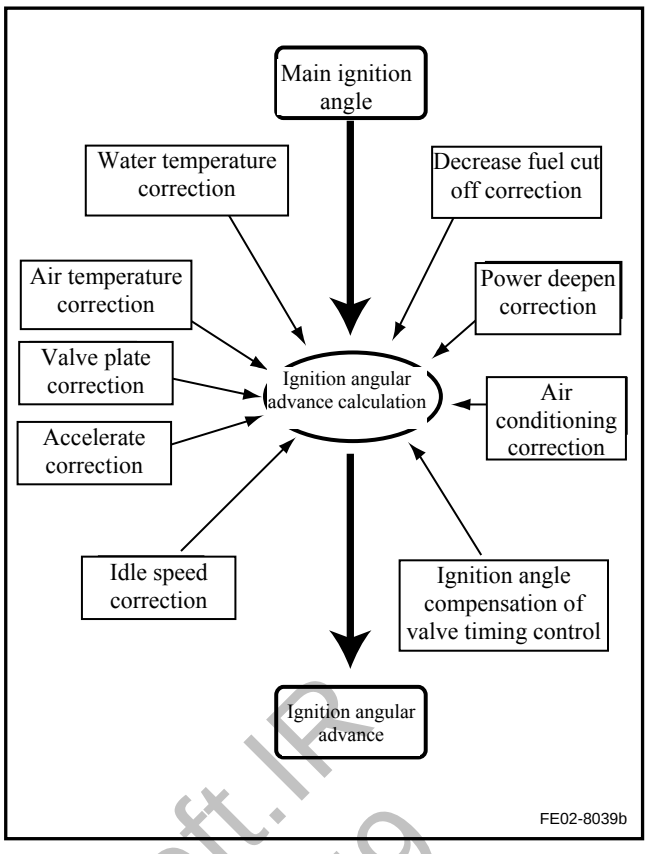
2. Start-up Mode

In the start-up mode, the system uses a fixed ignition angle in order to ensure cylinder mixture is ignited, and provide positive torque. When the engine starts to run, the engine speed increases to the automatically running status while the ignition angle will no longer be in starting mode.

3. Ignition Advance Angle Calculation and **Control**

A. Main Ignition Advance Angle

When the engine water temperature is normal, with the throttle opening, the main ignition angle is the minimum ignition angle at the optimal torque point or the threshold of knocking. When the throttle is closed, the ignition angle should be less than optimal torque point for idle speed stability. Without affecting the driving with a cold engine, in order to reach the normal operating temperature as quickly as possible, in the catalytic converter heating process, the basic ignition angle can be one angle other than the optimal torque point or the threshold of detonation. This angle should also be delayed as much as possible without affecting the driving ability.



B. Ignition Advance Angle Adjustment

Temperature adjustment, intake air temperature adjustment, altitude compensation adjustment, idle speed adjustment, acceleration adjustment, power-enriched adjustment, deceleration fuel cut-off adjustment, Air-Conditioning control adjustment, exhaust gas recirculation adjustment.

C. Acceleration Adjustment

Ignition advance angle acceleration adjustment is used to mitigate the engine speed fluctuations caused by drive system torque shock, and eliminate possible detonation during acceleration, making the acceleration smoother.

D. Valve Timing-controlled Ignition Angle Compensation

In order to obtain a better power and torque, system will enrich the Air-Fuel ratio to achieve the optimal torque and adjusts the ignition advance to achieve the optimal torque output.

E. Valve Timing-controlled Ignition Angle Compensation

When the valve timing control system works, the engine's intake and exhaust overlap angle change will affect the internal exhaust gas recirculation rate and the cylinder temperature. According to different valve timing, system needs to adjust ignition advance angle to ensure that under current valve timing, the actual ignition advance angle can achieve the best.

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F. Deceleration Fuel Cut-off Adjustment

When the system exits the deceleration fuel cut-off control mode, the ignition angle will be adjusted to make the throttle close transition smooth.

G.. Air-Conditioning Control Adjustment

When the engine is idling, turn off the Air-Conditioner. The ignition angle will be adjusted to make the engine run smoothly.

2.12.3.4 Electronic Throttle Body Function Restrictions

1. Forced Shut Down Mode

When ECM reports a malfunction or that the intake or throttle air flow control has a problem, the control strategy is to stop the fuel supply and the ignition, and to close the throttle as well as to shut down the engine.

2. Forced Idle Speed Power Management Mode

When the engine is idling, ETC system can not reliably use the throttle to control engine power. At this point, the ETC cancels the throttle control. The throttle opening returns to the default position. The engine power control is achieved by stopping one cylinder fuel injection and delaying the ignition angle.

3. Forced Idle Speed Mode

When the driver's intention can not be reliably detected, such as that all pedal signals are lost, the vehicle only maintains cooling, heating, electricity supply and lighting functions with engine idling. If pressing the acceleration pedal, there is no response on the engine, then in this mode the vehicle can not be driven.

4. Restricted Power Management Mode

ETC system can not use the throttle to control engine power. In this mode, the system determines whether the engine is at idle speed or is accelerating based on the acceleration pedal signal. The system controls engine power output by shutting down the engine, or by stopping a cylinder fuel injection, or by delaying the ignition. The engine output fluctuation is obvious. Working a long time in this mode would be harmful to the engine emission system. The model ensures that the vehicle is barely enough to be driven, but difficult to control in normal traffic or climbing on a steep slope.

5. Mode when the reliability of determining the drive intention is decreased or when the system can not achieve high power output

When the two acceleration pedal position sensors input signals have two much difference, the engine's output torque is limited. The engine's response to the pedal position change is much slower. The driver may feel that the engine power output will be significantly weakened, but the vehicle will be still able to drive in normal traffic.

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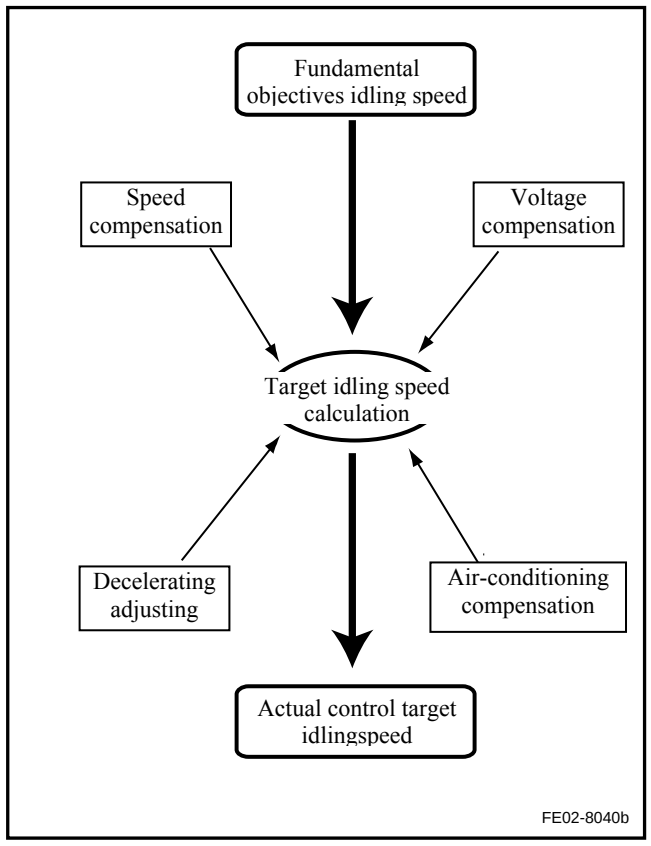
2.12.3.5 Idle Speed Control

Idle speed air flow control is that the engine control system maintains the target idle speed when throttle body is fully closed. The system maintains a smooth transition with the throttle body fully closed to prevent the stall. When the engine load changes at idle speed, system maintains a steady engine speed.



1. Target Idle Speed Calculation

2. Basic Target Idle Speed

At different coolant temperatures, the basic target idle settings are as follows:

Water Temperature/ Atmospheric Pressure	45	55	65	75	85	95	105
-40	1350	1350	1350	1350	1350	1350	1350
-30	1350	1350	1350	1350	1350	1350	1350
-20	1350	1350	1350	1350	1350	1350	1350
-10	1350	1350	1350	1350	1350	1350	1350
0	1250	1250	1250	1250	1250	1250	1250
10	1200	1200	1200	1200	1200	1200	1200
20	1200	1200	1200	1200	1200	1200	1200
30	1150	1150	1150	1150	1150	1150	1150
40	1000	1000	1000	1000	1000	1000	1000
50	950	950	950	950	950	950	950
60	850	850	850	850	850	850	850
70	750	750	750	750	750	750	750

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80	750	750	750	750	750	750	750
90	750	750	750	750	750	750	750
100	750	750	750	750	750	750	750
110	850	850	850	850	850	850	850
120	900	900	900	900	900	900	900

3. Vehicle Speed Compensation and Deceleration Adjustment

To improve the deceleration and stop driving performance, when the vehicle is driving, the target idle speed increases by 50 rpm higher than stopping idle speed. During the deceleration and stopping, the speed gradually decreases to the parking target idle speed.

4. Air-Conditioning Compensation

When turning on the air-conditioner at parking, in order to compensate the power consumption, the target idle speed rises 20 rpm at the coolant temperature < 50℃/122℉; rises 30 rpm at the coolant temperature of 50℃/122℉; rises 40 rpm at the coolant temperature of 60℃/140℉; rises 55 rpm at the coolant temperature of 70℃/158℉; rises 70 rpm at the coolant temperature of 80℃/176℉; rises 80 rpm at the coolant temperature of 90℃/194℉; rises 100 rpm at the coolant temperature of 100℃/212℉.

5. Voltage Compensation

When the system voltage is lower than 12 V, and not restored in 10 s, the system will increase the target idle speed by 300 rpm to increase the generated electricity amount. When the external power load impacts the system, the transient voltage will fluctuate. The system will automatically compensate for the air flow rate in order to curb the engine speed fluctuations.

2.12.3.6 Knock Control

Knock control function is used for eliminating engine knock which would occur during combustion and optimizing power performance of engine and economical efficiency of fuel. System can control different cylinder knocking independently.

1. Knock Control Enable Conditions

– Engine running time is more than 2 s

– Engine coolant temperature is more than70℃/158 ºF

– Engine speed is more than 600 rpm

2. Knock Control Mode

When a knocking occurs or is likely to occur, the system will quickly delay the ignition advance angle. System basic ignition advance angle is either normal ignition advance angle or safety ignition advance angle. Knock controlled speed is between these two.

– Homeostatic control

When the engine is running as per normal, ECM collects and analyzes engine combustion signals and filters knock signal through the knock sensor. Once the knock intensity is higher than the acceptable limit, the system will rapidly delay the ignition advance angle of cylinder in which the detonation happened, to eliminate knocking in the following combustion. The ignition advance angle will get back to normal angle gradually.

– Transient control

During a sudden acceleration or engine speed change, knocking is likely to happen. The system predicts the likelihood of knocking, and automatically delays the ignition advance angle in order to avoid a strong knocking.

–Quickly delayed ignition advance angle

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Once the system detects a knocking, according to different engine speeds, the system rapidly delays ignition advance angle 3-5 degrees, and resumes to normal controls in 2-3 s afterward.

– Adaptive control ignition advance angle

Due to wear and tear after long-term use, there is certain difference between the engines. When the system and the engine are in initial use or ECM is resupplied with power, the engine knocking may occur. The system will record the knocking, after a period of running-in, the system will automatically generate an adaptive adjustment value of the ignition (self-learning value). When the engine is running in the same conditions, the system will automatically make the adaptive adjustment for the advance the ignition angle, to avoid the knocking occurring.

System adaptive learning is the constantly updating during the engine running.

2.12.3.7 Air-conditioning Switch off Control

In some cases, in order to ensure the engine power or protect the engine or protect the Air-Conditioning system, ECM must stop the Air-Conditioning compressor working or prohibit the Air-Conditioning system to start. At the same time, to prevent the frequently on-off of compressor clutch, once the system enters the Air-Conditioning switch off mode, ECM delays for a specified period of time to control Air-Conditioning clutch pull-in.

– Full-throttle Air-Conditioning Switch off Mode: Ensure the vehicle power.

The engine speed is less than 3,600 rpm.

No TPS fault

TPS is greater than 101%, and since the last time full-throttle air-condition-off, the TPS has been less than this value

– Engine Speed Too High Air-Conditioning Switch off Mode: Protect the Air-Conditioning system.

A/C off, the engine speed should be less than 5,800 rpm before the compressor is allowed to start.

When A/C is on, once the engine speed is greater than 6,000 rpm, the compressor will be switched off.

– Engine Coolant Temperature Too High Air-Conditioning Switch off Mode: Protect the engine.

A/C off, the coolant temperature should be less than 106°C (223°F) before the compressor is allowed to start.

A/C on, once the coolant temperature is greater than 108°C (226°F), the compressor will be switched off.

2.12.3.8 Canister Solenoid Valve Control

Canister solenoid valve controls the opening and closing event and time of the channel between the canister and intake pipe, so as to control the amount and time for fuel vapor entering the cylinders, therefore maximizing the decrease of the vehicle evaporative emissions, while minimizing the impact on engine performance.

1. Working conditions of canister solenoid valve

In order to reduce the impact on the normal combustion and doing work from the fuel vapor entering the cylinder, the following conditions must be met before the canister solenoid valve is open:

– System voltage is less than 18 V but more than 8 V

– Engine coolant temperature is more than 0℃(32 ?F)

– Engine intake air temperature is higher than 0°C (32 ?F)

– non-correlation system fault

• Fuel System Malfunction

• Fuel Pump Malfunction

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- Idle Speed Too High/Too Low Malfunction
- Intake Air Pressure Sensor Malfunction
- Engine Misfire Malfunction
- Front Oxygen Sensor Heating Malfunction
- Front Oxygen Sensor Signal Malfunction
- System Voltage Too Low/Too High Malfunction
- Crankshaft Position Sensor Malfunction
- Ignition Coil Malfunction
- Fuel Injector Nozzle Malfunction
- Canister Solenoid Valve Output Malfunction

2. Operating Mode

Canister solenoid valve opening is determined by ECM according to the duty cycle (PWM) signal coming from the engine status. In the non-idling state, the maximum canister solenoid valve opening is determined by the close-loop air flow with a maximum of 100%.

2.12.3.9 Fault Self-Diagnostic and Protection Function

When the system enters into the working condition and the engine runs, the ECM controls all parts of the system and monitors the parts directly connected in real time; and when one or more parts of the system works abnormally, the system will automatically give an alarm. Each fault condition has a corresponding unique fault code. Once a fault occurs, the system will output the code through the diagnostic interface and turns on the engine fault indicator lamp at the same time to remind the driver of timely repairing, and the fault code indicates the part that the fault may be incurred.

When breaking down, the system can further take temporary emergency scheme to control the engine, so as to make sure the user drives the vehicle to the maintenance station for maintenance.

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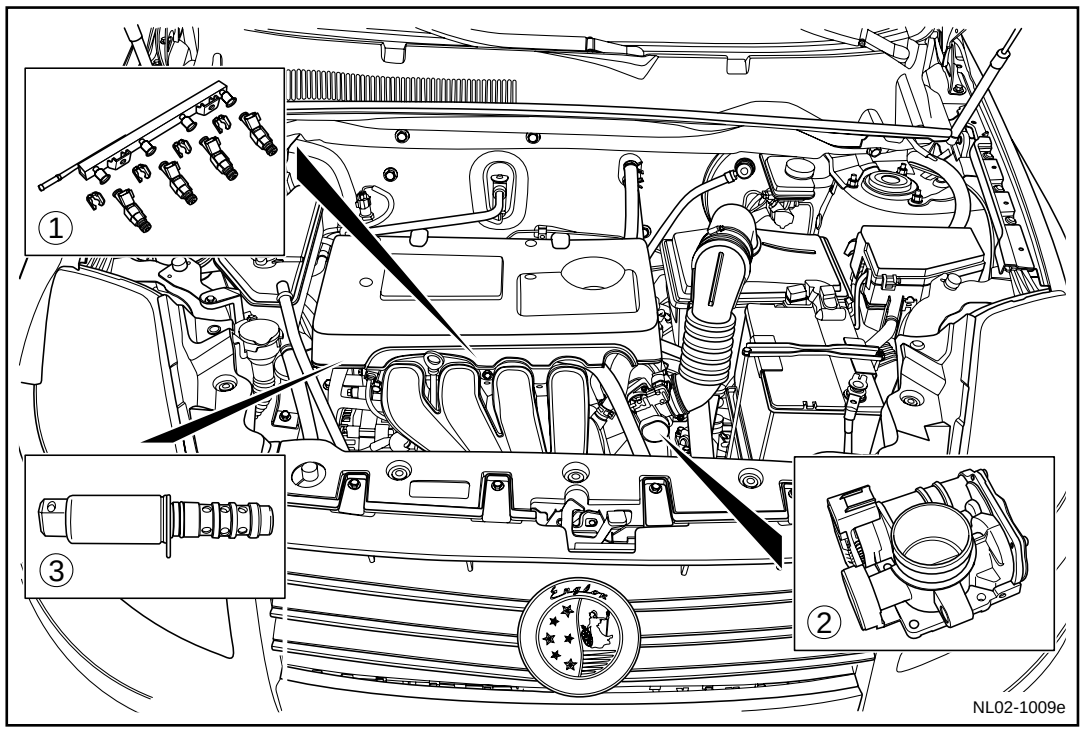
2.12.4 Component Location

2.12.4.1 Engine Coolant Temperature Sensor, Electronic Throttle Body, Intake Pressure Temperature Sensor



1. Injector sub-assembly of oil rail
2. Electronic Throttle Body
3. VVT Solenoid Valve

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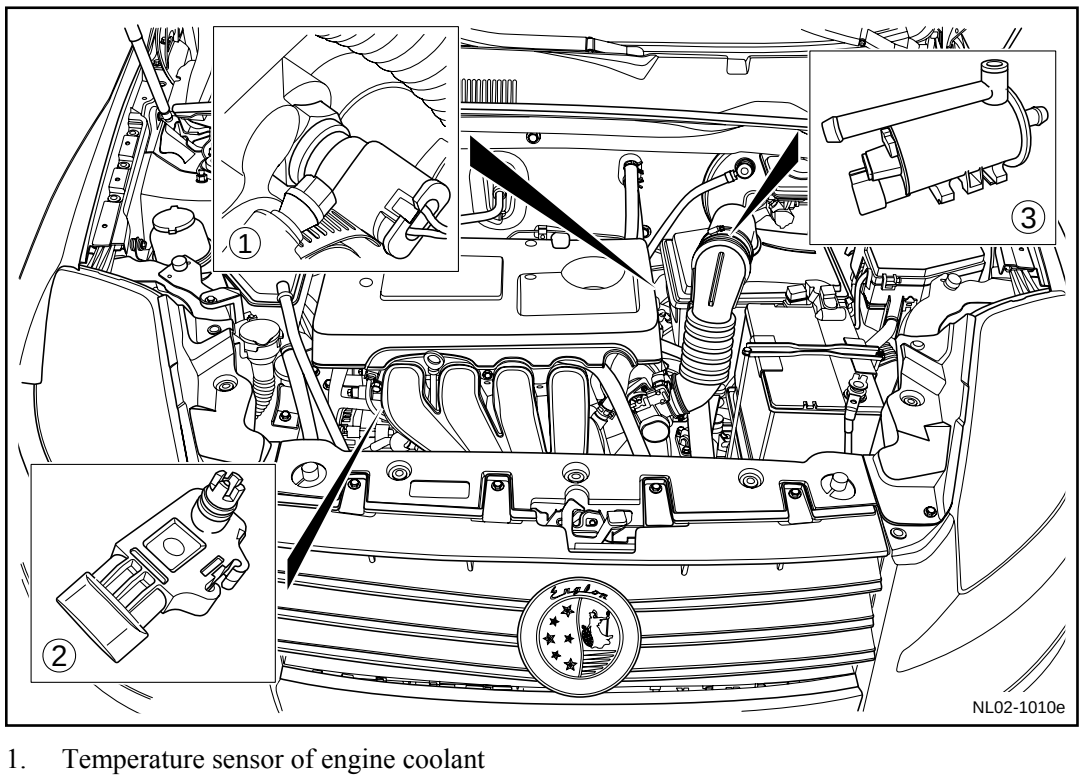
2.12.4.2 Temperature sensor of engine coolant, Intake Pressure Temperature Sensor, Canister Solenoid Valve



1. Temperature sensor of engine coolant
2. Intake Pressure Temperature Sensor
3. Canister Solenoid Valve

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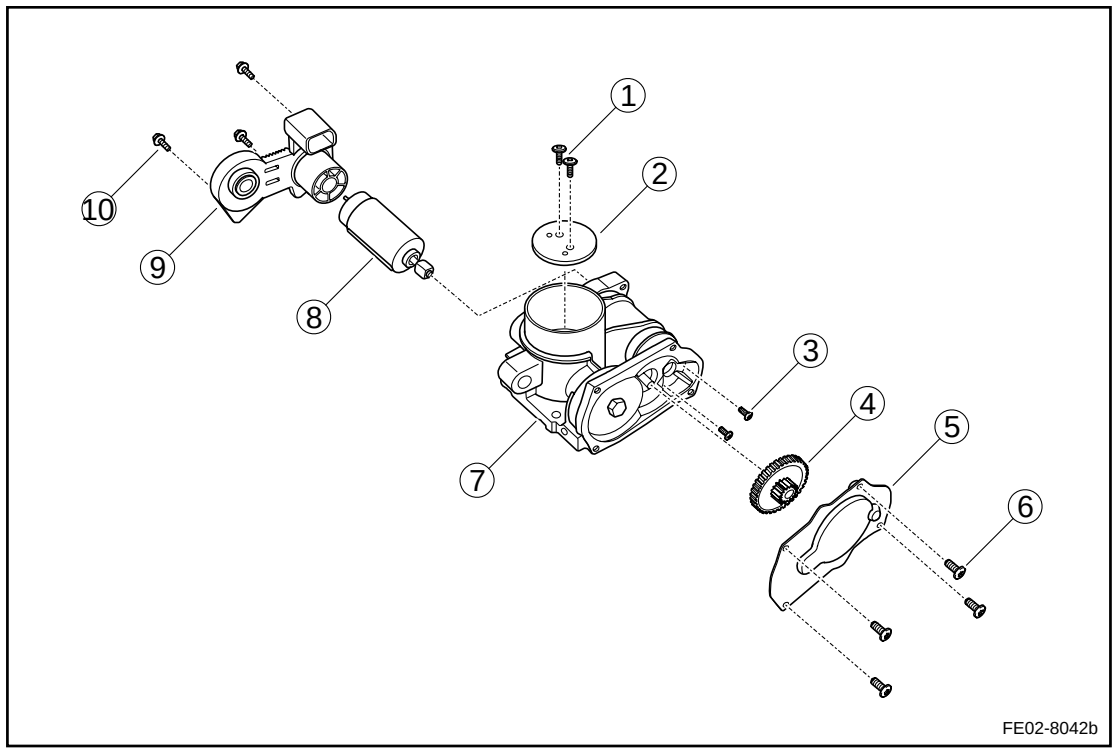
2.12.5 Disassemble drawings

2.12.5.1 Electronic throttle body disassembly drawing



1. Fixing Bolts of Throttle Valve
2. Throttle Valve
3. Fixing Bolts of Throttle Drive Motor
4. Throttle Drive Gear
5. Seal Plate
6. Fixing Bolts of Seal Plate
7. Throttle Body
8. Throttle Drive Motor
9. Throttle Position Sensor
10. Fixing Bolts of Throttle Position Sensor

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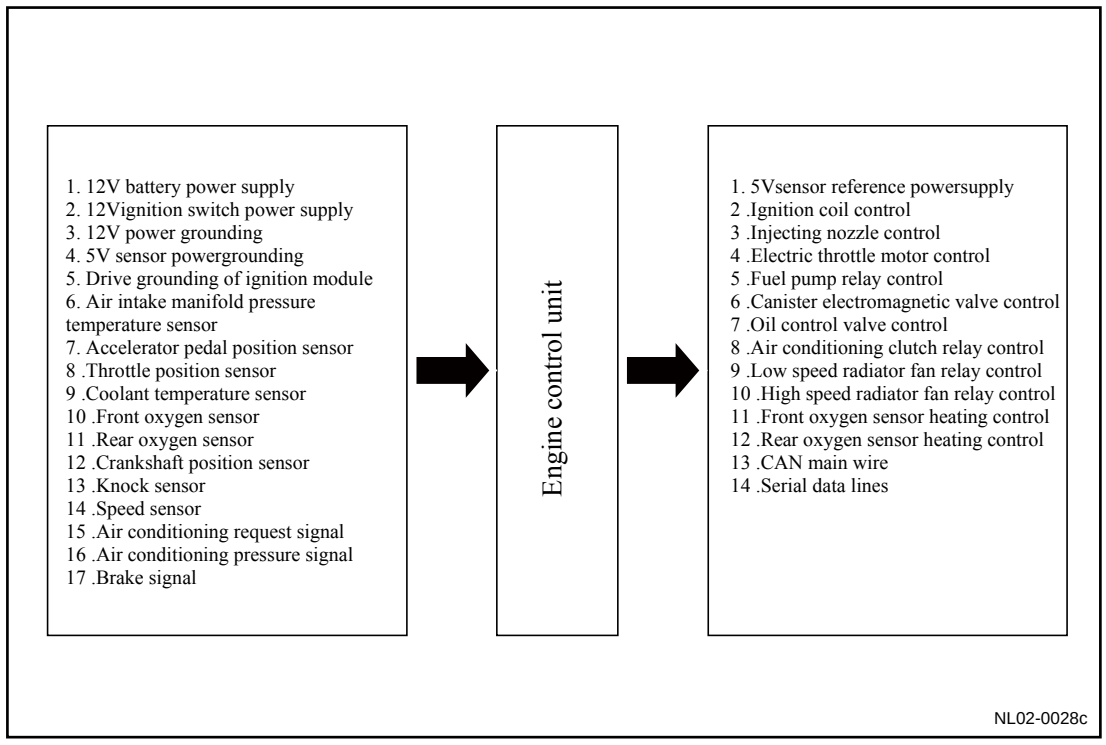
2.12.6 Electrical schematic diagram

2.12.6.1 Electrical schematic diagram



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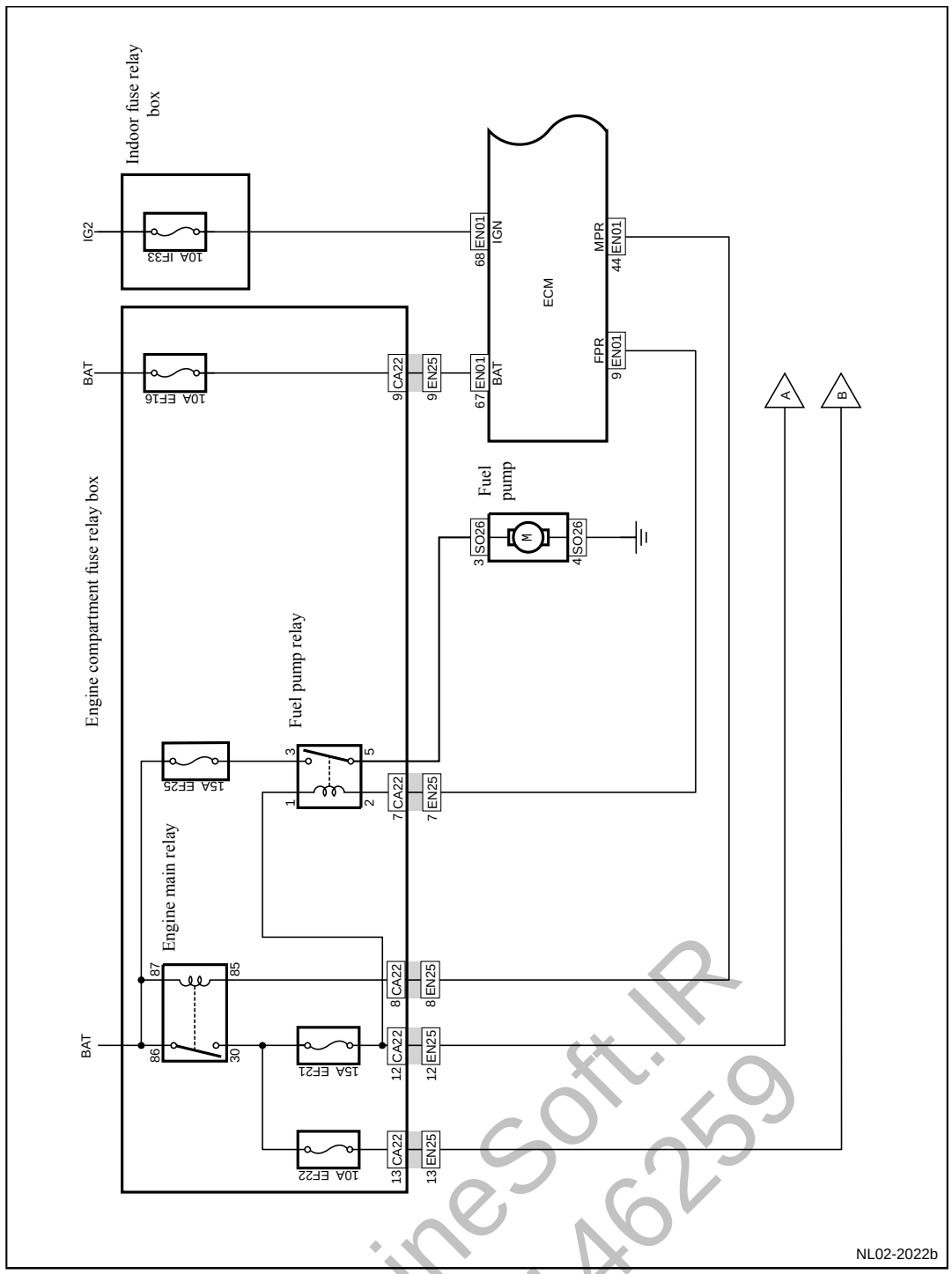

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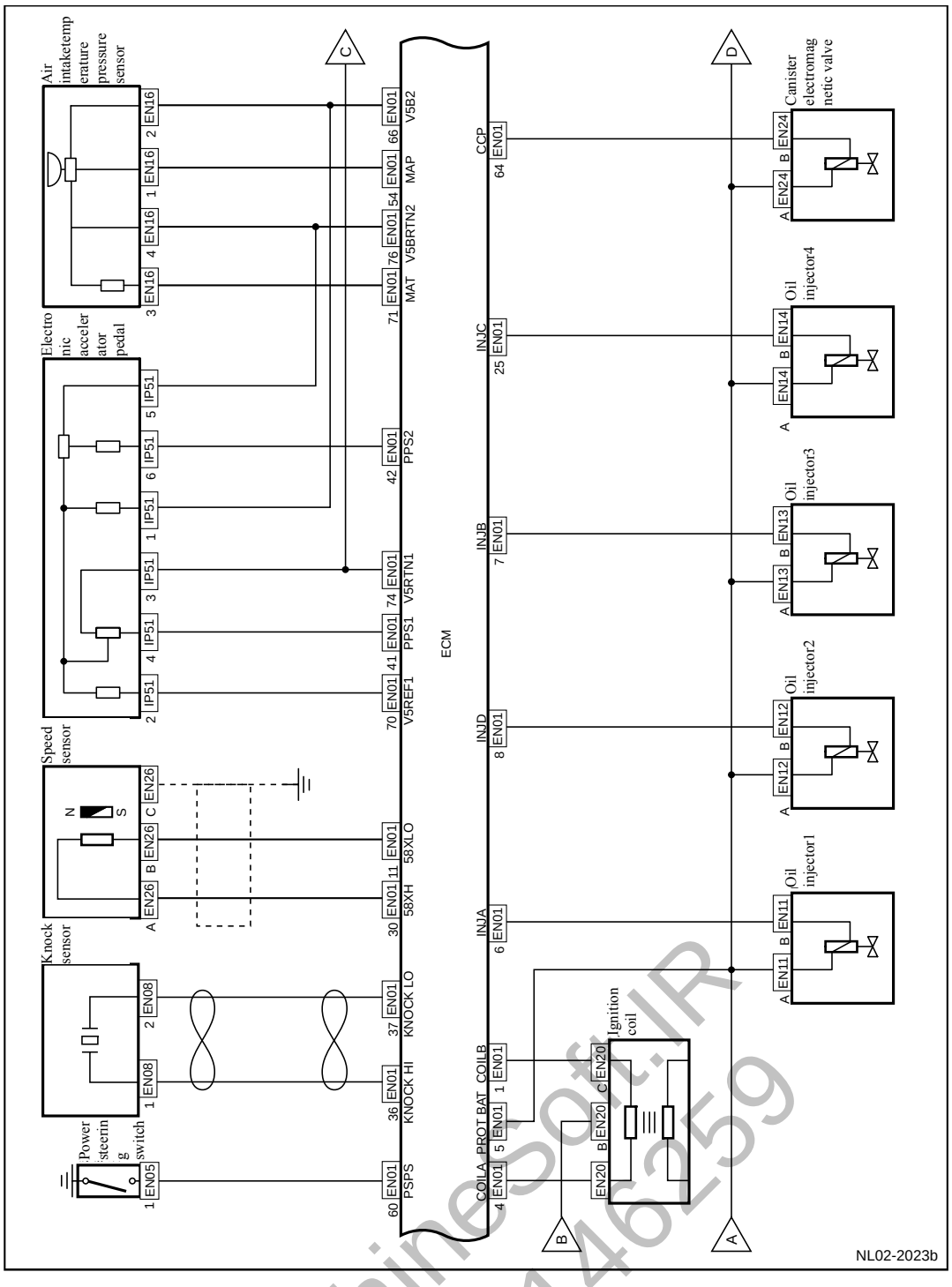

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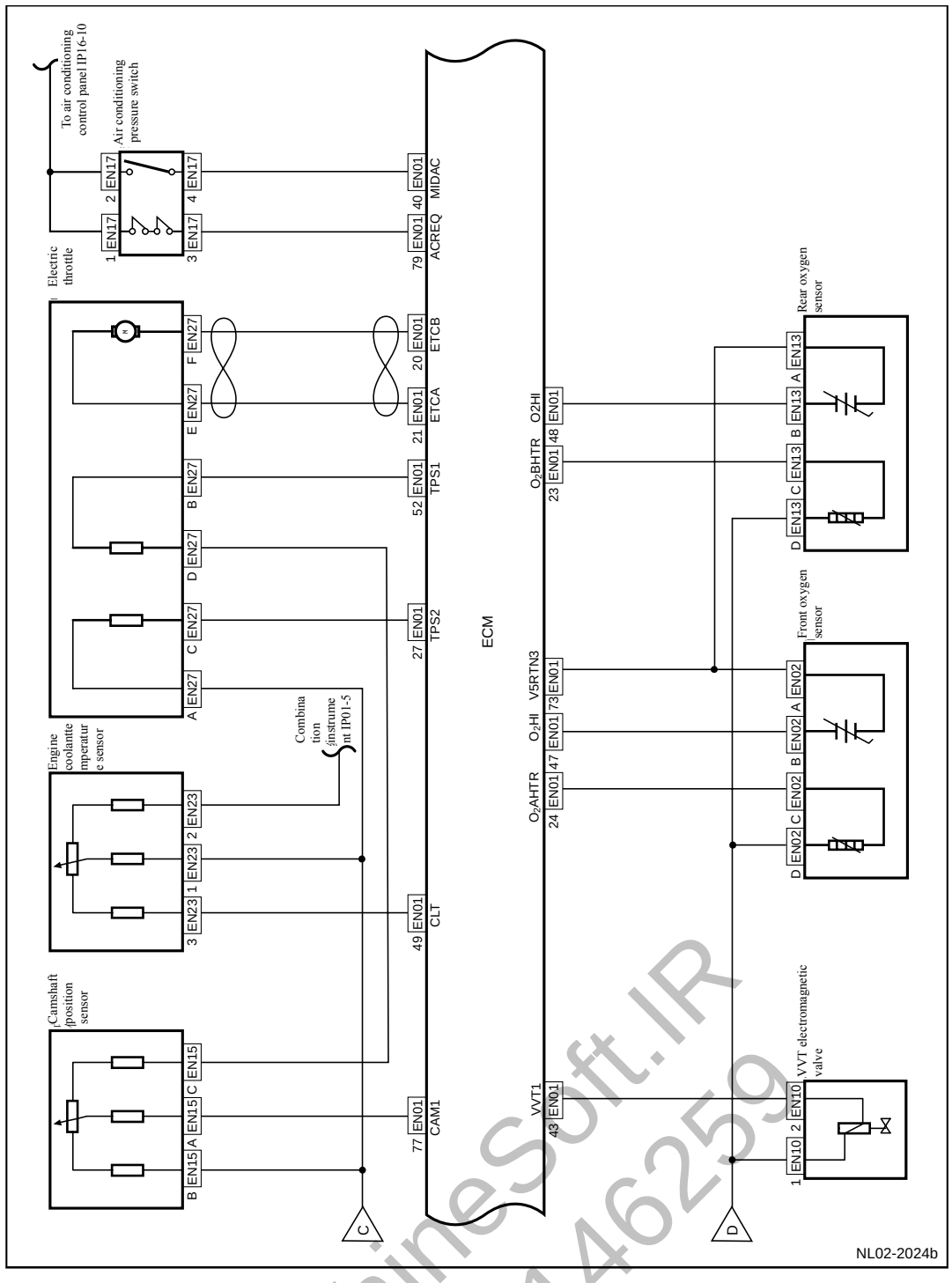

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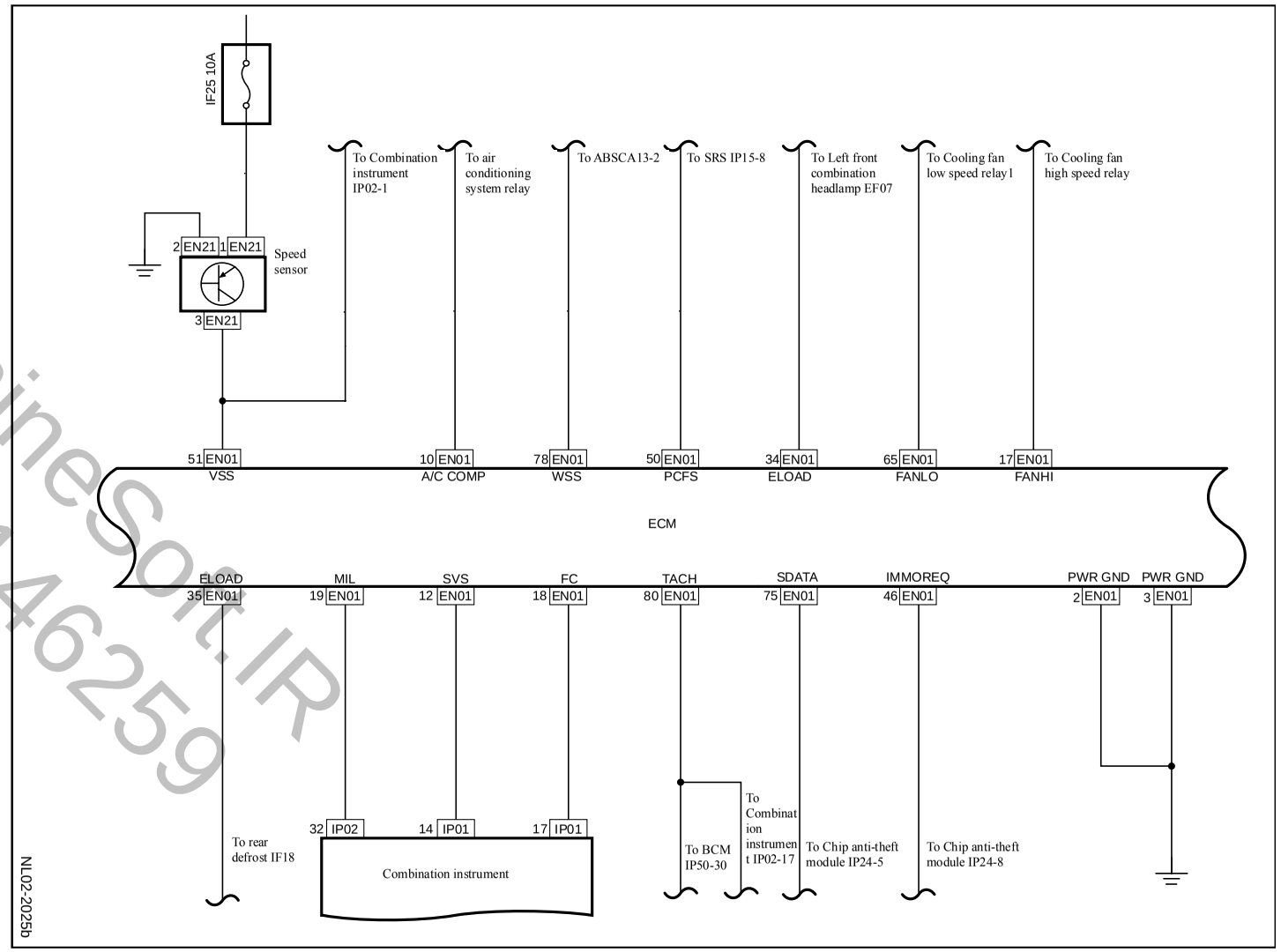

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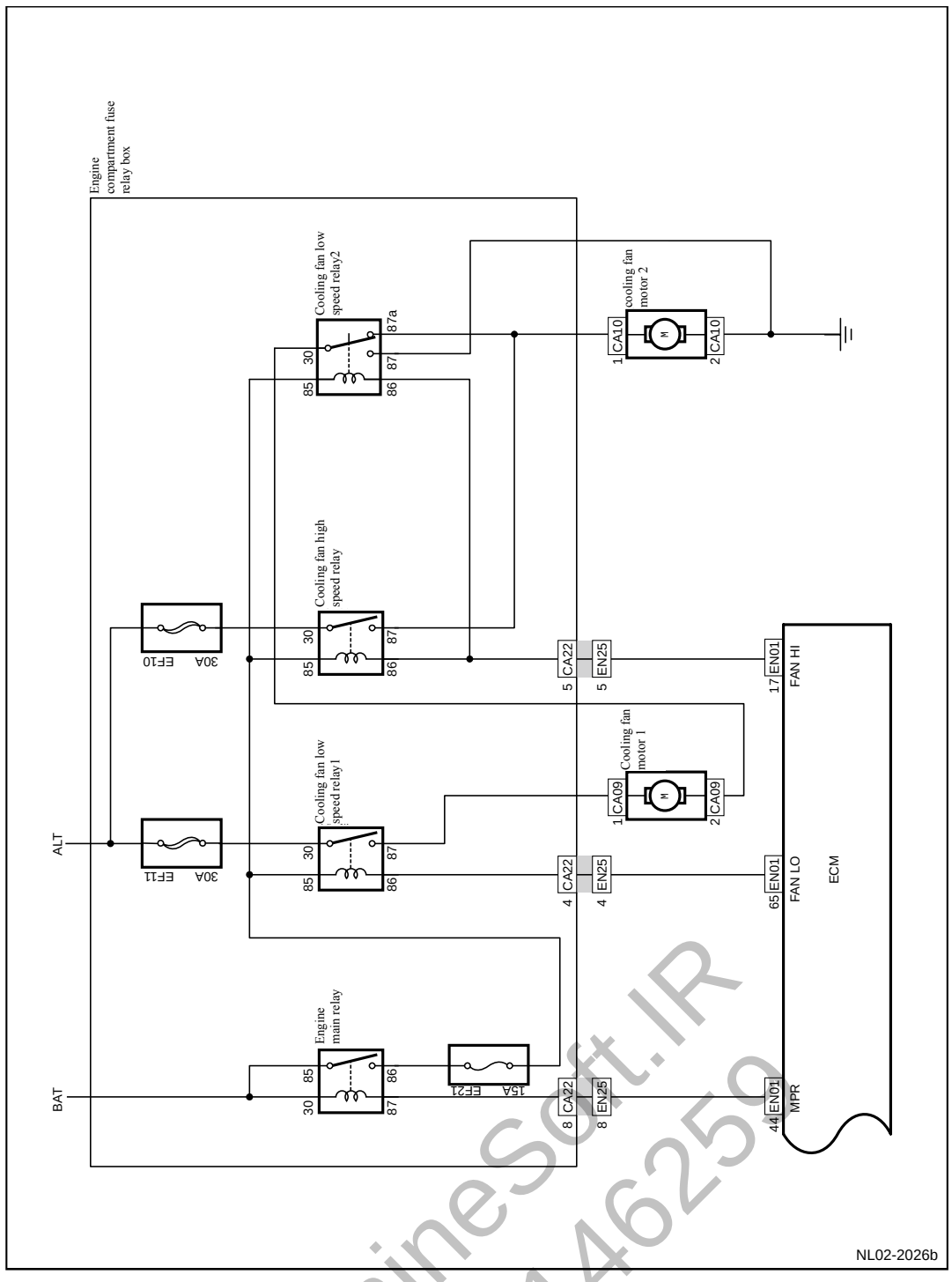

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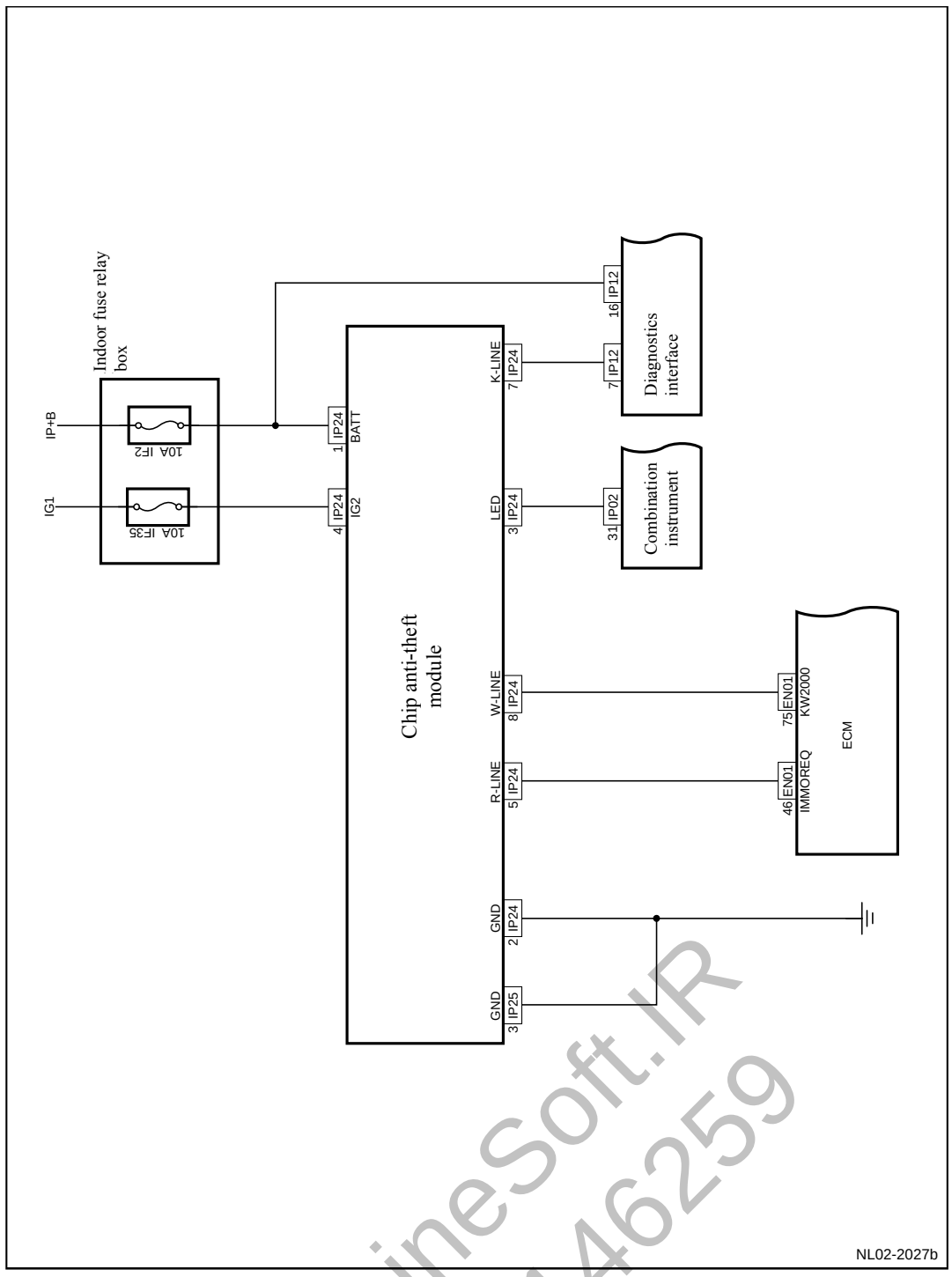

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2.2.7 Diagnostic information and procedures

2.2.7.1 Diagnosis descriptions

Before carrying out the control system diagnostic, refer to “2.12.2 Description and Operation” and “2.12.3 System Operating Principle”. Understand and get familiar with control system operating principle, and then start systematic diagnostic, so that it will help to determine the correct diagnostic steps. More importantly, it will also help to determine whether the situation described by the customer is normal.

Any control system fault diagnosis should start with Control System Inspection. Control System Inspection will guide the service personnel to take the next logical step to diagnose the fault. Understand and correctly use the diagnostic flow chart can reduce the diagnostic time and avoid misjudge on components.

2.12.7.2 Inspection of control system 2.12.7.6 Definition of type of fault diagnosis code

Before inspecting the control system, please do the following primary inspections:

1. Inspect the battery terminal voltage to ensure an adequate power supply and a stable voltage.
2. Inspect the battery cables, clean and tighten.
3. Inspect the system components easy to access or visible to determine whether there are obvious damages that may cause the symptoms, such as the damage to the vacuum tube and the connection reliability of wiring harness connectors.
4. Inspect whether the control module and battery main ground points are normal and whether the copper plates at the ground points have oxidation, loose or other signs.
5. Check whether the control system is equipped with after-sales additional devices which may influence its normal operation.

Diagnostic Steps:

1	Verify customer described faults.

Next

2	Connect a fault diagnosis tester.

(a) Install the fault diagnosis tester.

(b) Connect the power supply of the fault diagnosis tester.

Is power supply of the fault diagnosis tester connected?

No → Go to step 11

Yes

3	Start communication between the fault diagnosis tester and the engine control module.

(a) Turn on the ignition switch, but do not start the engine.

(b) Try to establish communication between the scan tool and engine control module (ECM) .

Can the fault diagnosis tester communicate with engine control module?

No → Go to step 14

Yes

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4	Start the engine and run at idle speed. Can the engine start?

No → See 2.11.7.4 Engine Cannot Be Started Up.

Yes

5	Select ECM DTC code reading function. Is there any system DTC code?

No → Refer to 2.2.7.3 Intermittent Fault Inspection

Yes

6	Record and clear the DTC code.

Next

7	Verify fault symptoms.

Result to step	Result to step
Fault does not appear.	Yes
Fault appears.	No

No → Go to step 9

Yes

8	Simulate fault symptoms.

Next

9	Inspect control system to check whether there is a DTC code.

Result to step	Result to step
Fault does not appear.	Yes
Fault appears.	No

No → See 2.12.7.4 List of Symptoms.

Yes

10	Repair according to the DTC code. Refer to 2.2.7.14 DTC Code Index.

11	Connect the fault diagnosis tester to a proper operated vehicle. Can the fault diagnosis tester be turned on?

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No → The fault diagnosis tester failed. Replace the fault diagnosis tester.

Yes

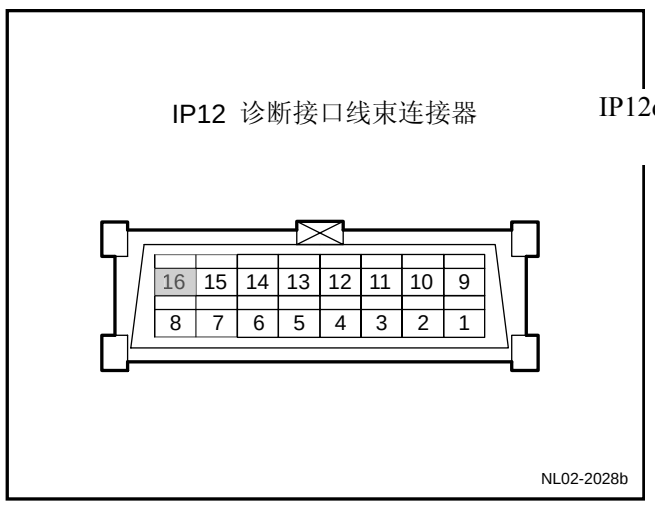
12	Inspect power supply circuit of data link connector

(a) Rotated ignition switch to "ON" position .

(b) Measure the voltage between DLC IP12 terminal No.16 and reliable ground.

Standard Voltage: 11-14V

Is the voltage normal?



No → Inspect open circuit between terminal No.16 and IF02 fuse.

Yes

13	Inspect DLC ground circuit .

(a) Rotated ignition switch to "OFF" position .

(b) Measure the resistance between fault diagnosis interface IP12 terminal 4 and reliable ground.

Standard Resistance: Less than 1 Ω

No → Inspect open circuit between terminal No.4 and ground

Yes

14	Can the engine drive the vehicle?

No → If the engine anti-theft control module and the ECM are in communication failure, check and repair the relevant part. Refer to 2.5.7.18 Engine Anti-theft System Warning Lamp Flickers, the Vehicle is Unable to Start.

Yes

15	Inspect terminal continuity.

(a) Disconnect anti-theft control module IP24 wire harness connector.

(b) Measure terminal continuity with ohmmeter.

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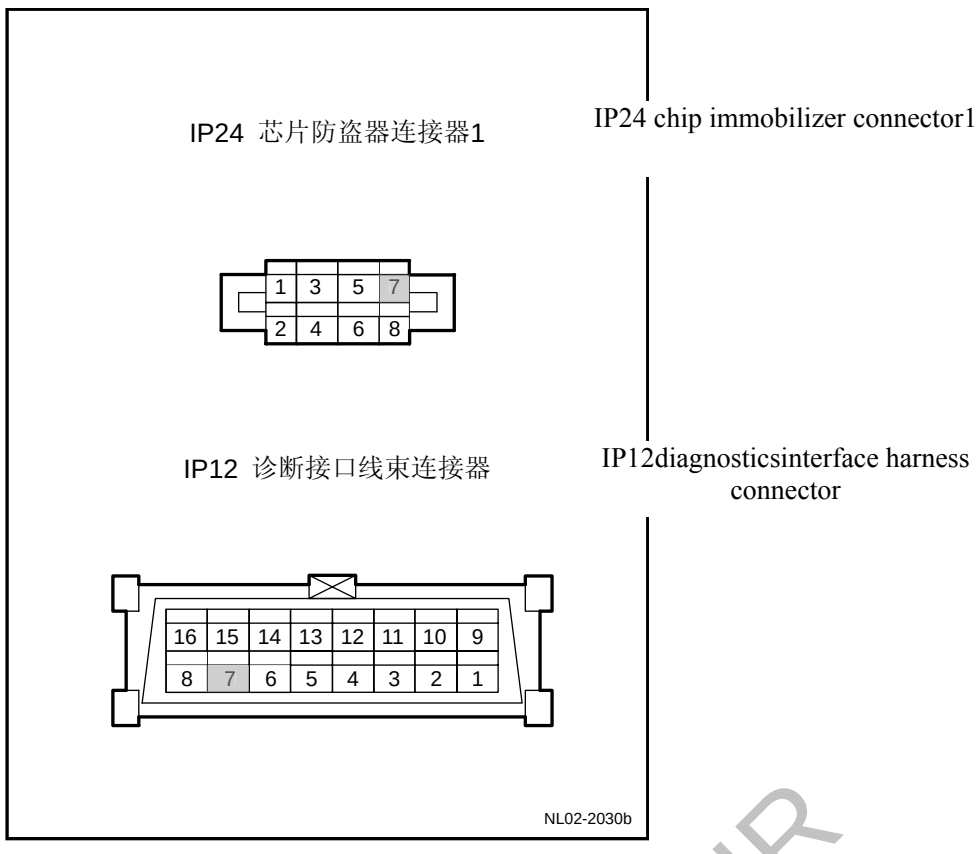
Multimeter Connection	Standard Value
IP12 (7)-IP24 (7)	Less than 1 Ω

(c) Re-connect anti-theft control module IP25 wire harness connector.

Is it normal?



No → Repair or replace harness connector

Yes

16	Test for confirmation.

17	Finish

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2.2.7.3 Intermittent fault inspection

Notes:

1. Clear DTC
2. Carry out simulation tests.
3. Inspect and shake the harnesses, connectors and terminals.

When DTC inspection can not identify the fault, the fault occurs only occasionally in use. At this point you should confirm all circuits and components that can possibly lead to the fault. In many cases, carrying out the basic inspections shown in the following flow chart can quickly and efficiently identify the fault position, especially for harness connector poor contact and other faults.

Fault Definition: the fault currently does not appear, but the historical record indicates that the fault has appeared before. Or the customer reported the fault, but as the fault is not relevant to the DTC, the fault symptoms do not appear at present.

1	Is the battery voltage normal?

Note: Turn the ignition switch to OFF position.

Results	**Intake**
11 V or higher	Yes
Less than 11V	No

No → Inspect the battery.

Yes

2	Inspect visually and physically

This step is an important method to initially identify the fault location before the area detection:

A. Inspect harness for damage, wear and tear.

B. Inspect whether the harness is routed properly. Do not place harness near a device with high voltage or high current running through:

C. Start motor, generator and other motor components. When these components are working, they will introduce great electromagnetic interference, thus affecting the proper signal transmission, resulting in system can not work properly.

D. Ignition coil, ignition conductor, etc.

E. Inspect a vacuum hose for cracking, damage or distortion. Confirm the pipeline's correct connection and routing.

F. Inspect whether there is air intake system leakage. For example, the throttle body installation surface, idle speed control valve, intake manifold sealing surface and so on.

G. Inspect the engine control module (ECM) ground point and the body ground for oxidation, loose, incorrect position, etc. The control system ground point can not be changed at will, as this will affect the proper operation of the control system.

H. Inspect whether the battery positive and negative cable connections are reliable, whether there is loose, oxidation, corrosion and so on.

Next

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3	Inspect the wiring harness and connector.

A. Many intermittent faults are caused by vibration, distortion, uneven roads, and improper operation of components or connectors dislocation.

B. If the circuit resistance is too high, it may result in components can not work properly. Use a fault diagnosis tester to drive the actuators, if not working, inspect whether the resistance in the circuit is too high or other wire faults.

Next

4	Reproduce the fault and use instruments to record engine control module data.

A. Connect a fault diagnosis tester and use the data record function to record road test data during the occurrence of the intermittent fault. After pressing the vehicle data recorder button, the scan tool can record engine control module data when intermittent fault occurs, and then the data can be used to identify the fault location.

B. Another diagnostic method is when the vehicle is driven connect a digital multimeter to the suspicious circuit. Digital multimeter abnormal readings may indicate the fault location.

Next

5	Fault indicator gives intermittent light, but a DTC is not set in the system.

The following conditions may cause intermittent fault indicator light, but the system does not set the DTC:

A. Electromagnetic interferences are caused by relay, solenoid valve or switch controlled by ECM, which work abnormally.

B. Non-original or after-sale accessories, such as phone, alarm, lamp or radio equipment, are not installed properly.

C. Intermittent fault indicator light control circuit short to ground.

D. Engine control module ground point is loose.

Next

6	Other inspections

A. Test whether Air-Conditioning compressor clutch diodes at both ends and other diodes are in open circuit.

B. Inspect whether there are following conditions existing in charging system:

- Generator rectifier fault within the electrical system may result in the alternating current signal interference.
- Generator output voltage is correct or not. If the generator output voltage is lower than 9V or higher than 18V, repair the charging system.

Next

7	Enter Fault Symptom Table

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2.12.7.4 Fault Symptom Table

If a fault occurs, but the DTC has not been stored in ECM, and its faulty reason can not be identified in the basic diagnostic, it is suggested to carry out the diagnostic and troubleshooting based on the listed order in the following table.

Symptoms	**Suspected Faulty Items**	**(Refer to the troubleshooting scheme)**
Retardation, Engine Speed Decrease, Speed Instability Fault Definition: When pressing the accelerator pedal, there is no immediate response. This fault may occur at any vehicle speed. Start the vehicle for the first time (for example, start after parking), this fault is usually more obvious. In severe cases, this fault may lead to engine stalling.	1. ECM power supply circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Intake Manifold Absolute Pressure (MAP) Sensor	Refer to 2.12.7.18 DTC P0107 P0108
	3. Abnormal Fuel Pressure	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	4. Abnormal Injector Working	
	5. Mixture Too Thick	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	6. Mixture Too Thin	
	7. Ignition system: abnormal spark plug, abnormal ignition wires.	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	8. Knock Sensor (KS) system ignition delay is too large	
	9. Crankshaft Position Sensor	Refer to 2.12.7.35 DTC P0335 P0336
	10.Abnormal thermostat	2.8.7 Diagnostic Information and Procedures in the 2.8 Cooling System
	11. Abnormal Working of Generators	Refer to 2.11.7 Diagnostic Information and Procedures in the 2.11 Start and Charging System
Fault Definition for engine stalling during air-conditioning works only: when Air-Conditioning is working, Engine Speed Instability or Stalling	1. Electronic Throttle Body	Refer to 2.12.7.53 DTC P2135
	2. ECM	See 2.12.8.1 Replacement of Engine Control Module.
High Fuel Consumption, Poor Fuel Economy Fault definition: oil consumption measured by actual road test is obviously high	1. ECM power supply circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Mixture Too Thick	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P218
	3. Air Filter Blocked	-
	4. Poor Fuel Quality, Fuel Contamination	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel

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than Expected value In addition, the fuel consumption is also significantly higher than the previous road test.	5. Abnormal Fuel Pressure	System
	6. Abnormal Injector Working	
	7. Electronic Throttle Body	Refer to 2.12.7.53 DTC P2135
	8. The driver has the following driving habits: • Air-Conditioning or defroster is always on • Tire pressure is incorrect • Vehicle Overload • Accelerate Too Fast, Too Frequent	-
	9. Air Leakage In Intake System and Crankcase System	Refer to 2.4.6 Diagnostic Information and Procedures in the 2.4 Auxiliary Emission Control Devices
	10. Positive crankcase ventilation valve catching	
	11. Knock Sensor (KS) system ignition delay is too large	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	12. Spark Plug: Incorrect thermal value, damp, crack, incorrect gap, excessive erosion, excessive carbon residue, contaminated by fuel	
	13. Spark Plug Wire Damage	
	14. Ignition Coil Damage	
	15. Coolant Level Too Low, Thermostat Malfunction	Refer to 2.8.7 Diagnostic Information and Procedures in the 2.8 Cooling System
	16. Too Much Oil in Combustion Chamber or Valve Seals Leakage 17. Incorrect Cylinder Compression Pressure Ensure	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
High Fuel Consumption, Poor Fuel Economy Fault Definition: The actual road test fuel consumption is significantly higher than expected. In	1. Valve Catching or Leakage, Broken Valve Spring, Incorrect Valve Timing	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	2. Too much carbon residue in combustion chamber	
	3. Vacuum Hose Cracking or Kink, Connection Unreliable	
	4. Exhaust Blocked: Three-Way	Refer to 2.7.5 Diagnostic Information

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addition, the fuel consumption is also significantly higher than the previous road test.	Catalytic Converter Blocked, Muffler Internal Damage	and Procedures in the 2.7 Exhaust System
	5. Brake System Dragging or Operation Abnormally	Refer to 6.2.4 Diagnostic Information and Procedures in 6 Brake System
	6. Electromagnetic Interference (EMI) in the voltage circuit may lead to engine misfire. Use a fault diagnosis tester to monitor the engine speed to detect electromagnetic interference. Engine speed parameter suddenly increases while the actual engine speed does almost not change, then there is electromagnetic interference. If there is a malfunction, inspect whether there is a high voltage component in the vicinity of the ignition control circuit.	-
Lack of Fuel Supply, Misfire Fault Definition: After the engine speed increases, there is continuous pulsation, or jitter, usually even more noticeable with the engine load increases. When the engine speed is above 1,500 rpm, the fault does not appear.	1. ECM power supply circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Air Filter Blocked	-
	3. Abnormal Fuel Pressure	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	4. Abnormal Injector Working	
	5. Mixture Too Thick	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	6. Mixture Too Thin	
	7. Electronic Throttle Body	Refer to 2.12.7.53 DTC P2135
	8. Knock Sensor (KS) system ignition delay is too large	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	9. Spark Plug: Incorrect thermal value, damp, crack, incorrect gap, excessive erosion, excessive carbon residue, contaminated by fuel	
	10. Spark Plug Wire Damage	
	11. Ignition Coil Damage	
	12. Crankshaft Position Sensor	Refer to 2.12.7.35 DTC P0335 P0336
Lack of Fuel Supply, Misfire Fault Definition: After the engine speed increases, there is	1. Too Much Oil in Combustion Chamber or Valve Seals Leakage	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	2. Cylinder compression pressure is incorrect	

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continuous pulsation, or jitter, usually even more noticeable with the engine load increases. When the engine speed is above 1,500 rpm, the fault does not appear with running.	3. Valve Stagnant or Leakage	
	4. Camshaft Convex Corner Wear	
	5. Valve Timing Incorrect	
	6. Valve Spring Broken	
	7. Too much carbon residue in combustion chamber	
	8. Abnormal Camshaft, Cylinder Hood, Piston, Connecting Rod and Bearing	
	9. Exhaust Blocked: Three-Way Catalytic Converter Blocked, Muffler Internal Damage	Refer to 2.7.5 Diagnostic Information and Procedures in the 2.7 Exhaust System
Fault definition for badness, instability, error or underspeed of idle speed: starting in the course of idling. Engine runs unsteadily. In extreme cases, the engine or the vehicle will tremble. Engine idle speed under the condition that the throttle valve opening is certain The speed may be fluctuated. Any of these circumstances is likely to be serious enough to make the engine stall.	1. ECM power supply circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Air Filter Blocked	-
	3. Abnormal Fuel Pressure	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	4. Fuel Contamination	
	5. Abnormal Injector Working	
	6. Electronic Throttle Body	Refer to 2.12.7.53 DTC P2135
	7. Acceleration Pedal Position Sensor	Refer to 2.12.7.54 DTC P2138
	8. Positive Crankcase Ventilation Valve	Refer to 2.4.6 Diagnostic Information and Procedures in the 2.4 Auxiliary Emission Control Devices
	9. Evaporative Emission (EVAP) Canister Solenoid Valve	
	10. Knock Sensor (KS) system ignition delay is too large	
	11. Spark Plug: Incorrect thermal value, damp, crack, incorrect gap, excessive erosion, excessive carbon residue, contaminated by fuel	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	12. Spark Plug Wire Damage	
	13. Ignition Coil Damage	
	14. Crankshaft Position Sensor	Refer to 2.12.7.35 DTC P0335 P0336
	15. Too Much Oil in Combustion Chamber or Valve Seals	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical

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	Leakage	System
	16. Cylinder compression pressure is incorrect	
Fault definition for badness, instability, error or underspeed of idle speed: starting in the course of idling. Engine runs unsteadily. In extreme cases, the engine or the vehicle will tremble. With a certain throttle opening, the engine idle speed may fluctuate. Any of these circumstances is likely to be serious enough to make the engine stall.	1. Valve Catching or Leakage, Broken Valve Spring, Incorrect Valve Timing	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	2. Too much carbon residue in combustion chamber	
	3. Inspect engine support seat.	
	4. Electromagnetic Interference (EMI) in the voltage circuit may lead to engine misfire. Use a fault diagnosis tester to monitor the engine speed to detect electromagnetic interference. Engine speed parameter suddenly increases while the actual engine speed does almost not change, then there is electromagnetic interference. If there is a fault, inspect whether there is a high voltage component in the vicinity of the ignition control circuit.	-
Fault Definition for Conflagration and Ignition Knocking: Knocking sound is worsen during accelerating. With the throttle opening changes, the engine will generate a sharp metal beating sound at the cylinder.	1. ECM power supply circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Incorrect Fuel No.	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	3. Abnormal Fuel Pressure	
	4. Abnormal Injector Working	
	5. Mixture Too Thin	Refer to 22.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	6. Knock Sensor (KS) system ignition delay is too large	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	7. Spark Plug Heat Value Incorrect	
	8. Cooling system: too low oil level, incorrect coolant, coolant leakage, cooling fan does not rotate	Refer to 2.8.7 Diagnostic Information and Procedures in the 2.8 Cooling System
	9. Too Much Oil in Combustion Chamber and the Valve Sealing Leaking	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	10. Cylinder compression [reassure too high	

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	11 . Too much carbon residue in combustion chamber	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	12. Abnormal Camshaft, Cylinder Hood, Piston, Connecting Rod and Bearing	
Engine difficult to start Fault Definition: The engine crankshaft rotation is normal, but the vehicle can not be started in a long time. The engine is finally able to start, but may immediately stop. fire.	1. Too Much Oil in Combustion Chamber and the Valve Sealing Leaking	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	2. Excessive Carbon Residue in Combustion Chamber	
	3. Timing Chain Installation Incorrect	
	4. Cylinder compression pressure is incorrect	
	5. Fuel Pump Relay, Fuel Pump, Fuel Injector, Fuel Contamination	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
Engine difficult to start Fault Definition: The engine crankshaft rotation is normal, but the vehicle can not be started in a long time. The engine is finally able to start, but may immediately stop. fire.	1. Ignition System: Ignition Wire, Spark Plug, Ignition Coil	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	2. ECM Power Supply	Refer to 2.12.7.43 DTC P0562 P056
	3. Engine coolant temperature sensor	Refer to2.12.7.20 DTC P0117 P0118
	4. Electronic Throttle Body	Refer to 2.12.7.53 DTC P2135
	5. Acceleration Pedal Position Sensor	Refer to 2.12.7.54 DTC P21388
Fault Definition for back fire and blast: Unburned gases entering the intake manifold or the exhaust system will be ignited, producing a very loud cracking sound.	1. ECM power supply circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Abnormal Fuel Pressure	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	3. Fuel Contamination	
	4. Abnormal Injector Working	
	5. Air Leakage in Intake System and Crankcase	Refer to 2.4.6 Diagnostic Information and Procedures in the 2.4 Auxiliary Emission Control Devices
	6. Positive Crankcase Ventilation Valve	
	7. Knock Sensor (KS) system ignition delay is too large	Refer to 2.12.7.34 DTC P0324 P0325

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	8. Spark plug: incorrect heat value, humidified, cracked, incorrect clearance, excessive burning Carbon deposit is too much. It is polluted by fuel.	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	9. Spark Plug Wire Damage	
	10. Ignition Coil Damage	
	11. Coolant level is too low, thermostat is faulty.	2.8.7 Diagnostic Information and Procedures in the 2.8 Cooling System
Fault Definition for surge: When the throttle opening is stable, the engine power changes. The vehicle speed changes while the acceleration pedal position does not change.	1. ECM power supply circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Air-Conditioning Compressor	Refer to 8.2.7 Diagnostic Information and Procedures in 8.2 Automatic Air-conditioning
	3. Abnormal Heated Type Oxygen Sensor	Refer to 2.12.7.22 DTC P0131 P0132 P0133 P0134.
	4. Poor Fuel Quality, Fuel Contamination	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	5. Abnormal Fuel Pressure	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	6. Abnormal Injector Working	
	7. Mixture Too Thick	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	8. Mixture Too Thin	
	9. Intelligent Variable Valve Timing System	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	10. Vacuum Hose Cracking or Kink, Connection Unreliable	
	11. Spark Plug: Incorrect thermal value, damp, crack, incorrect gap, excessive erosion, excessive carbon residue, contaminated by fuel	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	12.Spark plug guide wire damaged	
	13. Ignition Coil Damage	
Fault definition for insufficient power, viscosity or weakness: The engine power output is lower	1. ECM power supply circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Air filter element plug	-
	3. Poor Fuel Quality, Fuel Contamination	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel

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than expected. Half- press the acceleration pedal, almost no acceleration or no acceleration at all.	4. Abnormal Fuel Pressure	System
	5. Abnormal Injector Working	
	6. Mixture Too Thick	Refer to 2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188
	7. Mixture Too Thin	
	8. Knock Sensor (KS) system ignition delay is too large	Refer to 2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	9. Spark Plug: Incorrect thermal value, damp, crack, incorrect gap, excessive erosion, excessive carbon residue, contaminated by fuel	
	10. Spark Plug Wire Damage	
	11. Ignition Coil Damage	
	12. Crankshaft Position Sensor	Refer to 2.12.7.35 DTC P0335 P0336
	13. Too Much Oil in Combustion Chamber or Valve Seals Leakage	Refer to 2.6.7 Diagnostic Information and Procedures in the 2.6 Mechanical System
	14. Cylinder compression pressure is incorrect	
	15. Valve Catching or Leakage, Broken Valve Spring, Incorrect Valve Timing	
	16. Too much carbon residue in combustion chamber	
	17. Intelligent Variable Valve Timing System	
	18. Exhaust Blocked: Three-Way Catalytic Converter Blocked, Muffler Internal Damage	Refer to 2.7.5 Diagnostic Information and Procedures in the 2.7 Exhaust System
Engine does not run. Fault Definition: When the ignition switch is in the ST position, the engine crankshaft is not rotating.	1. Battery	Refer to 2.11.7.4 Engine Unable to Start in 2.11 Start and Charging System
	2. Starter	
	3. Start Relay	
	4. Ignition Switch	
	5. BCM	
	6. Engine Anti-theft Locking System	Refer to 2.5.7 Diagnostic Information and Procedures in 2.5 Engine Anti-theft System.

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The engine is unable to start, without Vehicle signs Fault Definition: When ignition switch in the ST position, the engine crankshaft rotates without sign of the vehicle starting.	1. ECM power supply circuit	Refer to 2.12.7.43 DTC P0562 P0563
	2. Crankshaft Position Sensor	Refer to 2.12.7.35 DTC P0335 P0336
	3. Camshaft Position Sensor	Refer to2.12.7.36 DTC P0340 P0341
	4. Ignition System	2.10.7 Diagnostic Information and Procedures in the 2.10 Ignition System
	5 . Fuel Pump Control Circuit	Refer to 2.3.7 Diagnostic Information and Procedures in the 2.3 Fuel System
	6. Fuel Injector Working Circuit	
	7.ECM	See 2.12.8.1 Replacement of Engine Control Module.

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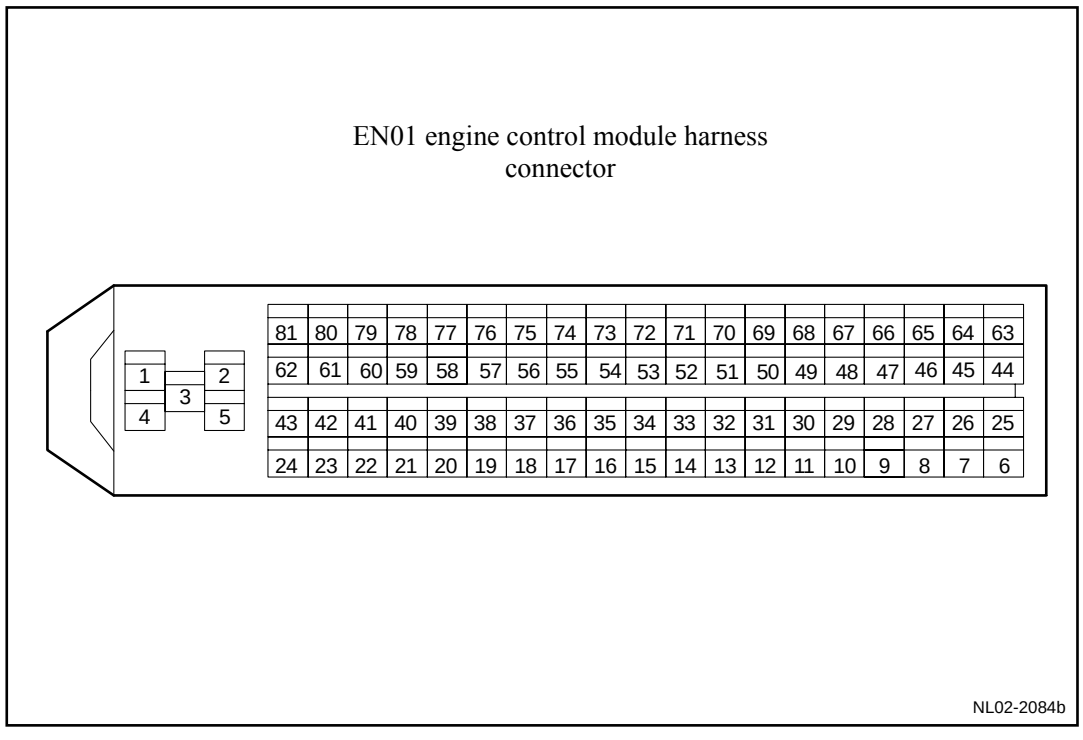
2.12.7.5 List of ECM Terminal Definition



Terminal No.	Wire Gauge	Abbreviation	Terminal descriptions	Terminal current specification
1	0.85O	ESTB /Coil B	ELECTRICAL SPARK Timing B(ignition coil B drive)	Less than(below)12 A for Coil; less less than 2.5 mA for EST
2	1.5B	PWRGNG	Power Ground	Less than(below)5 A
3	1.5B	PWRGNG	Power Ground	Less than(below)5 A
4	0.85W	ESTB/Coil A	ELECTRICAL SPARK Timing A(ignition coil A drive)	Less than(below)12 A for Coil; less less than 2.5 mA for EST
5	0.75B/R	ProtETCBAT/ Recirc	Protect ETC Battery (electronic throttle power supply)/ Recircle return protection.	Less than(below)5 A
6	0.75G/L	INJA	NJECTOR CYL#A (1 # Cylinder Fuel Injector)	Less than(Valve tappet rod) 1 . 5 A
7	0.75Y/V	INJB	INJECTOR CYL#3(3 cylinders injector)	Less than(below)1.5 A
8	0.75Y/B	INJD	INJECTOR CYL#2(2 cylinders injector)	Less than(below)1.5 A
9	0.5G/R	FPR	FUEL PUMP RELAY (Fuel Pump Relay)	Less than(below)0.3 A

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10	0.5Y/R	ACRLY	AC CLUTCH RELAY (Air-conditioning Clutch Relay)	Less than(below)0.3 A
11	0.5L	58XVRLO	58X SIGNAL LOW(58X low signal)	Less than(below)10 mA
12	0.5Gr	SVS	-	-
13	-	-	-	-
14	-	-	-	-
15	-	-	-	-
16	-	-	-	-
17	0.5Lb/R	FAN2	RADIATOR HIGH SPEED FAN Speed fan)	Less than(below)0.3 A
18	0.5Lg/B	FC		-
19	0.5R/Y	MIL		-
20	0.75O	ETCB/IACA HI	Electronic Throttle Control B Electronic throttle body control low Idle Air Control A High idling speed control High Output	Less than(below)8 A for ETC; less than(below)0,3 A for IAC
21	0.75V/O	ETCA/IACA LO	Electronic Throttle Control A Electronic throttle body control high/Idle Air Control A Low idling speed control A high Output	Less than(below)8 A for ETC; less than(below)0,3 A for IAC
22	-	-	-	-
23	0.75B/V	O2BHTR	O2B HEATER CONTROL(oxygen sensor B + Thermal control)	Less than(below)1.21 A
24	0.75B/G	O2AHTR	O2A HEATER CONTROL(oxygen sensor A + Thermal control)	Less than(below)1.21 A

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25	0.75B/L	INJC	INJECTOR CYL#4(4 cylinders injector)	Less than(below)1.5 A
26	-	-	-	-
27	0.5W/P	TPS2	Throttle Position Sensor 2 Input 2)	Less than(below)10 mA
28	-	-	-	-
29	-	-	-	-
30	0.5Gy	58XVRHI	58X SIGNAL HIGH(58X high signal)	Less than(below)10 mA
31	-	-	-	-
32	-	-	-	-
33	0.5G/Br	BrakeLP	Brake Lamp	Less than(below)10 mA
34	0.5	CS	Clutch Switch (Clutch Switch)	Less than(below)10 mA
35	0.5	ELOAD2+	Headlamp	Less than(below)10 mA
36	0.5	KNOCKHI	KNOCK SENSOR SIGNAL High (Only high signal when double wires)	Less than(below)10 mA
37	0.5	KNOCKLO	KNOCK SENSOR SIGNAL Low (Knock sensor/ double wires low signal)	Less than(below)10 mA
38	-	-	-	-
39	-	-	-	-
40	0.5W/V	MIDAC/SPD 2	Mid AC Switch(Middle pressure switch input)/Spare Discrete input2(preset discrete signal input 2)	Less than(below)10 mA
41	0.5G/W	IACBHI/PPS 1	IAC B HIGH(Idling speed air control motor A high)/Pedal Position Sensor 1(pedal position input signal 1)	Less than(below)0 . 3 A for IAC less than(below)10 mA for PPS
42	0.5Gy/R	IACBLO/PPS 2	IAC B LOW(Idling speed air control motor High)/Pedal Position	Less than(below)0 . 3 A for IAC;less

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			Sensor 2(pedal position input signal 2)	than(below)10mA for PPS
43	0.75W/L	VVT1	Variable Valve Timing variable valve phase （air exhaust valve） control	Less than(below)2.5 A
44	0.5B/O	MPR	MAIN POWER RELAY (Main Relay)	Less than(below)0.3 A
45	-	-	-	-
46	0.5W/R	SAICRLY/IMMOREQ	Second Air Intake Charge Relay/Immobilizer Request Requirement)	Less than(below)0 . 3 A for SAICRLY;less than 10 mA for IMMOREQ
47	0.5P	O2AHI	O2A SENSOR HIGH(oxygen sensor A high)	Less than(below)10 mA
48	0.5V	O2BHI	O2B SENSOR HIGH(oxygen sensor B high)	Less than(below)10 mA
49	0.5O/G	CLT	Coolant Sensor	Less than(below)50 mA
50	0.5Y	PCFS		
51	0.5Lb	VSS	Vehicle Speed Sensor (Vehicle Speed Signal Input)	Less than(below)10 mA
52	0.5Gy/W	TPS1	Throttle Position Sensor 1 (Throttle Position Signal Input 1)	Less than(below)10 mA
53	-	-	-	-
54	0.5Br/Y	MAP	Manifold Air Pressure(Air intake manifold pressure signal input)	Less than(below)10 mA
55	-	-	-	-
56	-	-	-	-
57	-	-	-	-
58	-	-	-	-
59	-	-	-	-

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60	0.75Br/R	PSPS/SPD1	Power Steering Pressure Switch(power boosting steering pressure switch)/Spare Discrete Input(preset Scattered signal input 1)	Less than(below)10 mA
61	-	-	-	-
62	-	-	-	-
63	-	-	-	-
64	0.5B/Y	CCP	Carbon tank electromagnetic valve control signal	Less than(below)1A
65	0.5Lg	FAN1/PWMFAN	RADIATOR LOW SPEED FAN(low speed fan of radiator)	Less than(below)0 . 3 A for FAN1RLY; less than(below)1 . 5 A for PWMFAN
66	0.5L/B	V5B2	5V SUPPLY#2(5V power supply#2)	Less than(below)50 mA
67	0.75R	BAT	BATTERY (Battery Power Supply)	Less than(below)50 mA
68	0.75R/W	IGN	IGNITION SWITCH (Ignition Key Switch)	Less than(below)1 A
69	-	-	-	-
70	0.75G	V5B1	5V SUPPLY#1(5V power supply#1)	Less than(below)100 mA
71	0.5G/Y	MAT	MANIFOLD AIR TEMP SENSOR(manifold air intake Air temperature sensor)	Less than(below)10 mA
72	-	-	-	-
73	0.5L/R	V5BRTN3	5V GROUND#3(5V grounding#3)	Less than(below)50 mA
74	0.75L	V5BRTN1	5V GROUND#1(5V grounding#1)	Less than(below)100 mA
75	0.5B/W	SDATA	SERIAL DATA(serial communication data)	Less than(below)10 mA

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76	0.75Y/L	V5BRTN2	5V GROUND#2(5V grounding#2)	Less than(below)50 mA
77	0.5R/B	CAM1	Camshaft position signal1(camshaft position signal 1 input)	Less than(below)10 mA
78	0.5Br/G	WSS	Wheel speed sensor signal input	Less than(below)10 mA
79	0.5V/W	ACREQ	AC REQUEST signal input	Less than(below)10 mA
80	0.5B/P	TACH	Tachometer	-
81	-	-	-	-

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2.2.7.6 DTC Type Definition

In the diagnosis calibration settings, different fault type settings have different fault lamp lighting timing and methods. Fault type is divided into A, B, C, E and Z, with definition and fault lamp.

Lightening principle is as follows:

Fault Type	Emission-related	Definition
Type A:	Yes	Occurring once, MIL lamp will be lit and a DTC code will be recorded
Type B	Yes	Occurring once in each two consecutive strokes, MIL lamp will be lit and a DTC code will be recorded.
E-type	Yes	Occurring once in each three consecutive strokes, MIL lamp will be lit and a DTC code will be recorded.
Type C	No	Record the DTC code when the fault occurs, but the SVS lamps may be lit other than the MIL lamp.
Z-type	-	Record the DTC code when the fault occurs without any lamps being lit.

2.12.7.7 Fault Diagnosis Code (DTC) List

DTC	Description	Type
P0011	Intake VCP Phase Response Lag Behind	A
P0012	Intake VCP Camshaft Phase Error is Big	A
P0016	Intake VCP Camshaft Gear Learn Bias Out of Range	A
P0026	Intake VCP Hydraulic Control Valve Clinch	A
P0068	Electronic Throttle Air Flow Error	A
P0076	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit	A
P0077	Intake VCP Hydraulic Control Valve Coil High Voltage	A
P0105	Intake Air Pressure Sensor Signal Clinch	E
P0106	Intake Pressure/Throttle Position Fault	E
P0107	Manifold air pressure sensor circuit has low voltage or is open	A
P0108	Intake Air Pressure Sensor Circuit High Voltage	A
P0112	Intake Air Temperature Sensor Circuit Low Voltage	E
P0113	Intake Air Temperature Sensor Circuit High Voltage or Open Circuit	E

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P0117	Coolant Temperature Sensor Circuit Low Voltage	A
P0118	Coolant Temperature Sensor Circuit High Voltage or Open Circuit A	A
P0122	Electronic Throttle Position Sensor #1 Circuit Low Voltage	A
P0123	Electronic Throttle Position Sensor #1 Circuit High Voltage	A
P0131	Front Oxygen Sensor Circuit Short to Low Voltage	E
P0132	Front Oxygen Sensor Circuit Short to High Voltage	E
P0133	Slow response of front oxygen sensor	E
P0134	Front Oxygen sensor is open	A
P0135	Front oxygen sensor heater fails	A
P0137	Rear Oxygen Sensor Circuit Short to Low Voltage	E
P0138	Rear Oxygen Sensor Circuit Short to High Voltage	E
P0140	Rear Oxygen Sensor Circuit Open	E
P0141	Rear Oxygen Sensor Heater Malfunction	A
P0171	Mixture Too Thin	E
P0172	Mixture Too Thick	E
P0222	Electronic Throttle Position Sensor #2 Circuit Low Voltage	A
P0223	Electronic Throttle Position Sensor #2 Circuit High Voltage	A
P0230	Fuel Pump Relay Fault	A
P0261	Fuel Injector 1 Low Voltage Fault	A
P0262	Fuel Injector 1 High Voltage Fault	A
P0264	Fuel Injector 2 Low Voltage Fault	A
P0265	Fuel Injector 2 High Voltage Fault	A
P0267	Fuel Injector 3 Low Voltage Fault	A
P0268	Fuel Injector 3 High Voltage Fault	A
P0270	Fuel Injector 4 Low Voltage Fault	A
P0271	Fuel Injector 4 High Voltage Fault	A/B

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P0300	Multi-Cylinder Misfire	C
P0324	Knock Control System Fault	C
P0325	Knock Sensor Fault	A
P0335	No signal from crankshaft position sensor circuit	E
P0336	Crankshaft Position Sensor Circuit Signal Interference	A
P0340	Intake VCP Camshaft Position Sensor Status Diagnosis	A
P0341	Intake VCP Target Wheel Diagnosis	A
P0351	Cylinder 1 Ignition Coil Malfunction	A
P0352	Cylinder 2 Ignition Coil Malfunction	A
P0353	Cylinder 3 Ignition Coil Malfunction	A
P0354	Cylinder 4 Ignition Coil Malfunction	A
P0420	Low transformation efficiency of catalytic converter	A
P0458	Canister electromagnetic valve circuit is shorted to low voltage or open	E
P0459	Canister Solenoid Valve Circuit Short to High Voltage	E
P0480	Low-Speed Fan Malfunction	C
P0481	High-Speed Fan Malfunction	C
P0502	No signal from vehicle speed sensor	E
P0504	Brake Switch Relativity Malfunction	A
P0506	Idle Speed Too Low	E
P0507	Idle Speed Too High	E
P0562	System Voltage is Low	C
P0563	System Voltage is High	C
P0571	The switch state of the brake lamp is not changed when braking.	C
P0601	ROM Error	A
P0602	ECM Processor Malfunction	A
P0641	ETC Reference Voltage #A Amplitude Fault	A

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P0646	Air-conditioning Clutch Relay Circuit Short to Low Voltage or Open	C
P0647	Air-conditioning Clutch Relay Circuit Short to High Voltage	C
P0651	ETC Reference Voltage #B Amplitude Fault	A
P0685	Main Relay Malfunction	A
P0831	Clutch switch circuit at low voltage	C
P0832	Clutch switch circuit at high voltage	C
P1167	Pre-catalytic Oxygen Indicating Mixture Too Thick During Deceleration	E
P1171	Pre-Catalytic Oxygen Indicating Mixture Too Thin During Acceleration	E
P1336	58-Tooth Gear Error Not Learn	A
P1516	ETC-Driver Second-Order Diagnostic Error	A
P2101	ETC-Driver Steady-State Diagnostic Error	A
P2104	Mandatory Engine Idling	A
P2105	Forced engine stopping	A
P2106	Restrictions on Engine Performance	A
P2110	Engine Power Management	A
P2119	Electronic Throttle Return Malfunction	A
P2122	Electronic Acceleration Pedal Position Sensor #1 Circuit Low Voltage	A
P2123	Electronic Acceleration Pedal Position Sensor #1 Circuit High Voltage	A
P2127	Electronic Acceleration Pedal Position Sensor #2 Circuit Low Voltage	A
P2128	Electronic Acceleration Pedal Position Sensor #2 Circuit High Voltage	A
P2135	Related fault of electric throttle position sensor 1#、2# circuit	A
P2138	Related fault of electric throttle position sensor 1#、2# circuit	A
P2187	Mixture Too Thin When Idling	E
P2188	Mixture Too Thick When Idling	E

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P0633	Anti-theft Does Not Learn Malfunction	C
B0010	Collision Fuel Cut-off Reasonability Malfunction	C
U0167	No response of anti-theft device	C
U0426	Anti-theft Device Authentication Malfunction	C

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2.2.7.8 DTC Fail-Safe List

DTC Code	DTC Code Diagnostic Information	Fail-Safe Mode	Restore Conditions
P0068	Electronic Throttle Air Flow Error	Electronic Throttle Position Sensor #1 Circuit Low Voltage	Electronic Throttle Position Sensor #1 Circuit Low Voltage
P0122	Electronic Throttle Position Sensor #1 Circuit Low Voltage	Use TPS signal value that is not expired. If both TPS1 and TPS2 fail, the system will enter the Engine Power Management mode, while reporting P2106, P2110 fault; VCP is inoperative	No malfunction condition is detected.
P0123	Electronic Throttle Position Sensor #1 Circuit Low Voltage		
P0222	Electronic Throttle Position Sensor #1 Circuit Low Voltage		
P0223	Electronic Throttle Position Sensor #1 Circuit Low Voltage		
P0571	The switch state of the brake lamp is not changed when braking.	At this time, if the system enters Restrictions on Engine Performance mode, the system enters the Mandatory Engine Idling mode.	No malfunction condition is detected.
P0606	ECM Processor Malfunction	System enters Mandatory Engine Shutdown mode, the engine can not start and the system will report P2105. Fault	Next key cycle, no malfunction condition detected.
P060A	ECM Programming Errors	Engine Can Not Start	Next key cycle, no malfunction condition detected.
P0641	ETC Reference Voltage #A Amplitude Fault	The system enters the mode of engine power management and submits to P0122, P0223 and P2106 at the same time. P2110 fault ;VCP do not work	Next key cycle, no malfunction condition detected.
P0651	ETC Reference Voltage #B Amplitude Fault	System enters Restrictions on Engine Performance model, while reporting P2106 fault; VCP is inoperative	No malfunction condition is detected.
P1516	ETC-Driver Steady-State Diagnostic Error	The system enters the mode of engine power	Next key cycle, no malfunction

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		management. At some time, commited P2106、P2110 fault； VCP Inoperation	condition detected.
P2101	ETC-Driver Second-Order Diagnostic Error	System enters Engine Power Management mode, while reporting P2106 and P2110 fault; VCP is inoperative	Next key cycle, no malfunction condition detected.
P2104	Mandatory Engine Idling	Refer to ETC TPS, APS relevant diagnosis	Refer to ETC TPS, APS relevant diagnosis
P2105	Mandatory Engine Shutdown		
P2106	Restrictions on Engine Performance		
P2110	Engine Power Management		
P2119	Electronic Throttle Return Malfunction	None	No malfunction condition is detected.
P2122	Electronic Acceleration Pedal Position Sensor #1 Circuit Low Voltage	(1) Single APS malfunction, the system enters Restrictions on Engine Performance mode, while reporting P2106 fault (2) If both APS1 and APS2 fail, the system enters Mandatory Engine Idling mode, while reporting P2104 fault (3) VCP Inoperation	In the next Key Cycle, ECM detects invalidation. Validation conditions
P2123	Electronic Acceleration Pedal Position Sensor #1 Circuit High Voltage		
P2127	Electronic Acceleration Pedal Position Sensor #2 Circuit Low Voltage		
P2128	Electronic Acceleration Pedal Position Sensor #2 Circuit High Voltage		
P2135	Related fault of Electric throttle valve position sensor1# . 2#	The system enters the mode of engine performance limit. Meanwhile, report P2106 fault; the VCP does not work.	No malfunction condition is detected.
P2138	Electronic Acceleration Pedal Position Sensor #1 and #2 Related Malfunctions	System enters Restrictions on Engine Performance model, while reporting P2106 fault; VCP is inoperative	No malfunction condition is detected.
P0011	Intake VCP Phase Response Lag Behind	None	No malfunction condition is detected.

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P0012	Intake VCP Camshaft Phase Error is Big	VCP Inoperation	No malfunction condition is detected.
P0016	Intake VCP Camshaft Gear Learn Bias Out of Range	OCV Cleaning Function Enabled; VCR Inoperative	No malfunction condition is detected.
P0026	Intake VCP Hydraulic Control Valve Clinch	OCV Cleaning Function Enabled; If cleaning failed, VCR is inoperative	No malfunction condition is detected.
P0076	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit	VCP Inoperation	No malfunction condition is detected.
P0077	Intake VCP Hydraulic Control Valve Coil High Voltage	VCP Inoperation	Next key cycle, no malfunction condition detected.
P0340	Intake VCP Camshaft Position Sensor Status Diagnosis	VCP Inoperation, Ignition Angle	No malfunction condition is detected.
P0341	Intake VCP Target Wheel Diagnosis	VCP Inoperation, Ignition Angle	No malfunction condition is detected.
P0106	Intake Pressure/Throttle Position Fault	(1) When Key is in ON position, the system will intake air in default form. Manifold pressure value of 100 kPa (2) When the engine is running, the system uses Manifold pressure value	No malfunction condition is detected.
P0107	Manifold air pressure sensor circuit has low voltage or is open	(1) When Key is in ON position, the system will intake air in default form. Manifold pressure value of 100 kPa (2) When the engine is running, the system uses Manifold pressure value	No malfunction condition is detected.
P0108	Intake Air Pressure Sensor Circuit High Voltage	(1) When Key is in ON position, the system will intake air in default form. Manifold pressure value of 100 kPa (2) When the engine is running, the system uses	No malfunction condition is detected.

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		Manifold pressure value	
P0112	Intake Air Temperature Sensor Circuit Low Voltage	System adopted default air intake temerpature value 20℃	No malfunction condition is detected.
P0113	Intake Air Temperature Sensor Circuit High Voltage or Open Circuit		
P0117	Coolant Temperature Sensor Circuit Low Voltage	(1) System calculates the engine coolant temperature, up to 98°C, based on intake air temperature and when Key On and the engine running time (2) There is a malfunction present, high or Low-Speed fan turned on.	No malfunction condition is detected.
P0118	Coolant Temperature Sensor Circuit High Voltage or Open Circuit		
P0131	Front Oxygen Sensor Circuit Short to Low Voltage	system enters open loop fuel control.	No malfunction condition is detected.
P0132	Front Oxygen Sensor Circuit Short to High Voltage	system enters open loop fuel control.	No malfunction condition is detected.
P0133	Slow response of front oxygen sensor	None	No malfunction condition is detected.
P0134	Front oxygen sensor heater fails	system enters open loop fuel control.	No malfunction condition is detected.
P0135	Pre-catalytic Oxygen Indicating Mixture Too Thick During Deceleration	Open Loop Control; Front Oxygen Sensor Heater Inoperation	Next key cycle, no malfunction condition detected.
P1167	Pre-catalytic Oxygen Indicating Mixture Too Thick During Deceleration	None	No malfunction condition is detected.
P1171	Pre-Catalytic Oxygen Indicating Mixture Too Thin During Acceleration	None	No malfunction condition is detected.
P0137	Rear Oxygen Sensor Circuit Short to Low Voltage	None	No malfunction condition is detected.
P0138	Rear Oxygen Sensor Circuit Short to High Voltage	None	No malfunction condition is detected.
P0140	Rear Oxygen Sensor Circuit	None	No malfunction

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	Open		condition is detected.
P0141	Rear Oxygen Sensor Heater Malfunction	Rear Oxygen Sensor Heater Inoperation	Next key cycle, no malfunction condition detected.
P0171	Mixture Too thin When Non-idling	None	No malfunction condition is detected.
P0172	Mixture Too thick When Non-idling	None	No malfunction condition is detected.
P2187	Mixture Too thin When idling	None	No malfunction condition is detected.
P2188	Mixture Too thick When idling	None	No malfunction condition is detected.
P0230	Fuel Pump Relay Fault	Vehicle can not start.	(1) Short-circuit or open-circuit fault can't be detected. Failure condition (2) short splice to power supply fault, go to key Cycle, D detect invalid conditions
P0261	Fuel Injector 1 Low Voltage Fault	Prolonged malfunction, reporting misfire (P0300); Open Loop Control for the system;	No malfunction condition is detected.
P0264	Fuel Injector 2 Low Voltage Fault		
P0267	Fuel Injector 3 Low Voltage Fault		
P0270	Fuel Injector 4 Low Voltage Fault		
P0262	Fuel Injector 1 High Voltage Fault		Next key cycle, no malfunction condition detected.
P0265	Fuel Injector 2 High Voltage Fault		
P0268	Fuel Injector 3 High Voltage Fault		

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P0271	Fuel Injector 4 High Voltage Fault		
P0300	Multi-Cylinder Misfire	Catalytic converter damaged, the system enters open loop control. in certain operating conditions, fault lamp flashes.	No malfunction condition is detected.
P0324	Knock Control System Fault	Ignition Back Angle	Next key cycle, no malfunction condition detected.
P0325	No signal from knock sensor	Ignition Back Angle	Next key cycle, no malfunction condition detected.
P0335	No signal from crankshaft position sensor circuit	Vehicle can not start.	No malfunction condition is detected.
P0336	Crankshaft Position Sensor Circuit Signal Interference	Ignition Back Angle; VCP Inoperation	No malfunction condition is detected.
P1336	58-Tooth Gear Error Not Learnt	No misfire diagnosis	New tooth learning successful
P0351	Cylinder 1 Ignition Coil Malfunction	Prolonged Malfunction, Reporting Misfire (P0300)	(1) Open Circuit, No Malfunction Condition Detected. (2) Short to power supply. Next key cycle, no malfunction condition detected.
P0352	Cylinder 2 Ignition Coil Malfunction		
P0353	Cylinder 3 Ignition Coil Malfunction		
P0354	Cylinder 4 Ignition Coil Malfunction		
P0420	Low transformation efficiency of catalytic converter	None	No malfunction condition detected.
P0458	Canister electromagnetic valve circuit is shorted to low voltage or open	None	No malfunction condition detected.
P0459	Canister Solenoid Valve Circuit Short to High Voltage	None	Next key cycle, no malfunction condition detected.
P0480	Low-Speed Fan Malfunction	None	No malfunction

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			condition detected.
P0481	High-Speed Fan Malfunction	None	Next key cycle, no malfunction condition detected.
P0502	No signal from vehicle speed sensor	Malfunctions Reported, Engine idle	No malfunction condition detected.
P0506	Idle Speed Low	None	No malfunction condition detected.
P0507	Idle Speed High	None	No malfunction condition detected.
P0562	System Voltage is Low	Other Diagnostics Shielded; Idle Speed Increased; VCP Inoperative	No malfunction condition detected.
P0563	System Voltage is High	Other Diagnostics Shielded; VCP Inoperative	No malfunction condition detected.
P0601	ROM Error	Vehicle can not start.	Next key cycle, no malfunction condition detected.
P0602	ECM Processor Malfunction	Vehicle can not start.	Next key cycle, no malfunction condition detected.
P0604	RAM Error	Vehicle can not start.	Next key cycle, no malfunction condition detected.
P0646	Air-Conditioning Clutch Relay Circuit Short to Low Voltage or Open	None	No malfunction condition detected.
P0647	Air-conditioning Clutch Relay Circuit Short to High Voltage	None	Next key cycle, no malfunction condition detected.
P0685	Main Relay Malfunction	Vehicle may not start.	(1) Open Circuit, No Malfunction Condition Detected. (2) Short to power supply. Next key cycle, no malfunction condition detected.
P0633	Anti-theft Does Not Learn Malfunction	SVS lamp flashing; vehicle can not start.	Next Key Cycle, IMMO learning to succeed， Or no malfunction
U0167	No response of anti-theft device		

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U0426	Anti-theft Device Authentication Malfunction		condition is detected.

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2.12.7.9 Data Flow Table

By reading the Data Flow Table on the fault diagnosis tester, you can inspect switches, sensors, actuators working state without dismantling any components. Before the control system diagnosis, observing and analyzing data is the first step, so that the diagnose time could be shortened.

Note: Data under normal conditions is listed in the following table for reference only. Do not determine whether a part is faulty solely based on these reference values. Under normal circumstances you can compare the vehicle that needs to be repaired with a normal working vehicle in the same state to determine whether the current vehicle diagnostic data is normal or not.

1. Run the engine to reach normal working temperature.
2. Rotated ignition switch is OFF position。
3. Connect the fault diagnosis tester.
4. Rotated ignition switch in the ON position.
5. Select "Engine"/"Read data stream".
6. Refer to the following table and inspect the data of each item.

1. First step: At cold engine, turn the key switch to ON position, inhibit the engine (for about 30s)

Data Stream Name	Ignition Switch ON	**Idle speed**	**2,500 rpm 时**
Engine Speed	0 rpm	800 rpm	2,500 rpm
Vehicle Speed	0	0	0
Current Computing Load	0.00%	100%	100%
Coolant Temperature	93℃(199 ºF)	93℃(199 ºF)	93℃(199 ºF)
Current Short-Term Fuel Adjustment (Bank1)	100%	90.62%	93.75%
Current Long-Term Fuel Adjustment (Bank1)	92.97%	92.97%	99.22%
Absolute Boost Pressure	100kPa	47kPa	27kPa
Intake Air Temperature	54℃(129 ºF)	47℃(117 ºF)	52℃(126 ºF)
Absolute Throttle Position A	80.78%	85.10%	82.75%
Ignition Voltage	12.3V	13.3V	13.7V
Oxygen Sensor #1 Installation Location	Yes	Yes	Yes
Oxygen Sensor #2 Installation Location	Yes	Yes	Yes
Front Oxygen Sensor Voltage	0.08V	0.07V-0.81V	0.067V-0.81V
Front Oxygen Sensor Short-Term Fuel Adjustment	100%	92.19%	94.53%
Rear Oxygen Sensor Voltage	0.71V	1.28V	0.68V

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Rear Oxygen Sensor Short-Term Fuel Adjustment	99.22%	99.22%	99.22%
Current Instruction to Cylinder #1 Ignition Advance Angle	4°	2°	33°
Vehicle Driving Distance When MIL Lamp Light	0km	0km	0km
Relative Throttle Position	6.27%	1.57%	3.92%
Absolute Throttle Position B	18.82%	14.12%	16.86%
Acceleration Pedal Position D	14.51%	14.51%	18.43%
Acceleration Pedal Position E	7.06%	7.06%	9.02%
Throttle Position	8.63%	1.96%	5.49%
Vehicle Driving Time When MIL Lamp Light	0Min	0Min	0Min
Air-conditioning pressure switch voltage	0V	0V	0V
Front Oxygen Sensor Hot	78mV	143-706mV	14mV
Rear Oxygen Sensor Heating	703mV	755mV	660mV
Fuel Sensor Voltage	5V	5V	5V
Coolant Temperature (Start)	87℃(189 ºF)	87℃(189 ºF)	87℃(189 ºF)
EVAP Valve Duty Cycle	0%	0%	0%
Fuel Adjustment Cell	19 cell	19 cell	2 cell
Target Idle Speed	935rpm	737rpm	887rpm
Injection	8.67ms	2.56ms	1,82ms
Atmospheric Pressure	100.37kPa	100.37kPa	100.37kPa
Air-Fuel Ratio	11.5	14.5	14.5
Engine Running Time	0Second	0Second	0Second
Calculated Catalyst Temperature	600℃(1112 ºF)	498℃(928 ºF)	591℃(1096 ºF)
knocking Delay	0°	0°	0°
Cylinder No.2 Currently Misfire	0count	0count	0count
Cylinder No.1 Currently Misfire	0count	0count	0count
Cylinder No.3 Currently Misfire	0count	0count	0count

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Cylinder No.4 Currently Misfire	0count	0count	0count
Engine Odometer	0km	0km	0km
ETC Acceleration Pedal Position	0%	0%	0%
Intake Valve Opening (As Opposed To LWOT)	8.66%	2.02%	5.55%
ETC Pedal Position Sensor #1	0%	0%	4.16%
ETC Pedal Position Sensor #2	0%	0%	4.16%
ETC Throttle Position Sensor #1	6.62%	1.54%	4.21%
ETC Throttle Position Sensor #2	6.55%	1.54%	4.21%
Fuel Level Output	4.71%	4.71%	4.71%
Front Oxygen Sensor - Rich To Lean Average Time	0.0ms	0.0ms	0.0ms
Intake Air Temperature At Startup	55℃(131 ºF)	49℃(120 ºF)	49℃(120 ºF)
Intake Air Pressure	0.0kPa	0.0kPa	0.0kPa
TEC Attempt To Convert To Lean	0Counts	0Counts	0Counts
TEC ideal Throttle Position	8.82%	2.15%	5.76%
VVT Target Location	0°	0°	0
ETC Unpowered Throttle Position	8.40%	8.44%	8.44%
Front Oxygen Sensor Heating	0.70E	0.80E	0.50E
Rear Oxygen Sensor Heating	0.42E	0.44E	0.34E

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2.2.7.10 Action Test List

With the reading of the action test on the fault diagnostic unit, check the working condition of the relay and the actuator controlled by the ECM without removing any parts. Before the control system diagnosis, carrying out action test is a prerequisite, so that the diagnose time could be shortened.

Note: Data under normal conditions is listed in the following table for reference only. Do not determine whether a part is faulty solely based on these reference values. Under normal circumstances you can compare the vehicle that needs to be repaired with a normal working vehicle in the same state to determine whether the current vehicle diagnostic data is normal or not.

1. Run the engine to reach normal working temperature.
2. Rotated ignition switch to OFF position.
3. Connect the fault diagnosis tester.
4. Turn ignition switch to ON position.
5. Select engine / Action Test.
6. Refer to the following table for positive test.

Diagnosis tester Display item	**Test Component**	**Control Range**	**Diagnostic Description**
Malfunction Indicator	Enable the engine malfunction indicator.	ON/OFF	When the engine is running (or) the ignition switch is turned on, with the signal accepted, the engine control module will request the fault indicator to light through the CAN bus. The fault indicator will be on or off in 3-5s by the instrument.
Fuel Pump Relay	Enable the fuel pump relay.	ON/OFF	***Note: Carry out this test only when the vehicle speed is equal to zero and the vehicle speed sensor has no fault.*** This function controls the fuel pump relay. Fuel pump relay will be ON/OFF within 3-5s.
Canister Control Valve	Enable the canister solenoid valve	ON/OFF	When the command is ON the solenoid valve will be on or off within 3-5s.
Fan 1	Enable Low-speed Cooling Fan.	ON/OFF	Note: Carry out this test only when the engine coolant temperature is below 100°C and Air-Conditioning is not switched on. This function controls the Low-Speed cooling fan relay. When the instruction is received, the cooling fan will be on at high speed for 5 s.
Fan 2	Enable the High-speed cooling fan	ON/OFF	Note: Carry out this test only when the engine coolant temperature is below 100°C and Air-Conditioning

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			is not switched on. This function controls the High-Speed cooling fan relay. When the instruction is received, the cooling fan will be on at high speed for 5 s.
Air-conditioning Clutch	Enable the air-conditioning compressor clutch.	ON/OFF	Note: Carry out this test only when the ignition switch is at ON position and the engine is not running. This function controls Air-Conditioning compressor relay. When the instruction is ON, the Air-Conditioning compressor relay will be on or off in 35 s.
BLM Learn	Indicating Fuel Closed-Loop Learning	ON/OFF	Forbid fuel closed-loop learning, when the ignition switch is ON; Based on the software logic, decide whether to conduct relevant learn when the ignition switch is OFF.
Fuel Injector Nozzle	Disable the fuel injector.	ON/OFF	-
Ignition Delay	Delay the ignition advance angle.	---	---
Fuel Open-Loop Control	ECM Open-Loop Control	ON/OFF	-
Idle Catalyst Monitor	Enable the catalyst monitor diagnosis	ON/OFF	-
ETC Motor	Control electronic throttle body movements	0、50%、100%	-
Reset TPS Learning Value	Clear throttle position sensor learn value	-	-
Intake Camshaft Timing Device	Be used for control the current phase position of the VVT, wherein the control parameter is not a percentage, but Mark the phase.	0、30%、60%	-
Intake Camshaft Timing Device	Be used for control the current phase position of the VVT, wherein the control parameter is not a percentage, but Mark the phase.	0、50%、100%	-
Expected idle	Intake Camshaft Valve	0 、	-

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	Timing Control Device VVT Control Valve Control Signal Duty Cycle Test Ratio Test	700rpm 、800rpm 、900 rpm、1,000 rpm	
BLM Reset	Fuel Closed-Loop Learn	On/off	All fuel closed-loop learn values reset to 1

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2.2.7.11 Learning on Crankshaft Position Sensor (CKP)

Notes:

After replacement of crankshaft position sensor, Replacement of ECM or engine, the crankshaft position sensor adaptive learn must be carried out. Otherwise the fault warning lamp will be always on, while ECM will record P1336 58-tooth gear tolerance does not learn DTC code.

Before the gear learn, the following conditions must be met:

1. Make sure engine cooling temeperature is above 60℃(140 oF)
2. Air-Conditioning switch is not turned on.
3. Start the engine for 10s.

Carry out the following steps when the above conditions are met:

1	Connect a fault diagnosis tester.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Start and run the engine at idle speed to warm up the engine for at least 5 min.

D. Select the engine/gear to learn.

Next

2	Carefully read the instructions attached to scan tool and press confirm button.

Next

3	Enter the learning screen, press start button.

Next

4	Press the acceleration pedal to 80% of the full travel and keep the pedal position.

Next

5	Make the engine speed jumping back and forth between 1,300 rpm and 4,500 rpm 3-5 cycles; maintain the engine speed at above 4,000 rpm.

Next

6	Release the acceleration pedal, turn the ignition switch to OFF position.

Next

7	Complete the learning, clear the DTC code.

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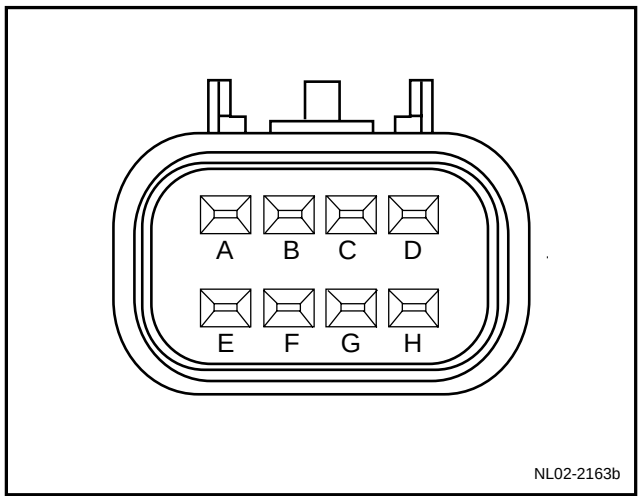
2.2.7.12 Electronic Throttle Body (ETC) Inspection

Electronic throttle body consists of two throttle position sensors and a throttle body drive motor.

1. Electronic Throttle Body Connector View and Functions:



Terminal No .	ECM Related Terminal No.	Function
A	EN01(74)	Low Reference Voltage
B	EN01(52)	TPS1 Signal
C	EN01(27)	TPS2 signal
D	EN01(70)	5V Reference Voltage
E	EN01(21)	Throttle Body Motor Control (Plus)
F	-	Empty
G	-	Empty
H	EN01(20)	Throttle Body Motor Control (Minus)

2. Throttle Position Sensor Technical Specifications

As one of the system security measures, the system consists of dual output throttle position sensors. One throttle position sensor output voltage signal increases as the throttle body opening increases, while the other throttle position sensor output voltage signal decreases as the throttle body opening increases.

Resistance value Between Terminals A and D: 1.9 ± 0.9 kΩ

TPS Sensor Output Signal Diagram:

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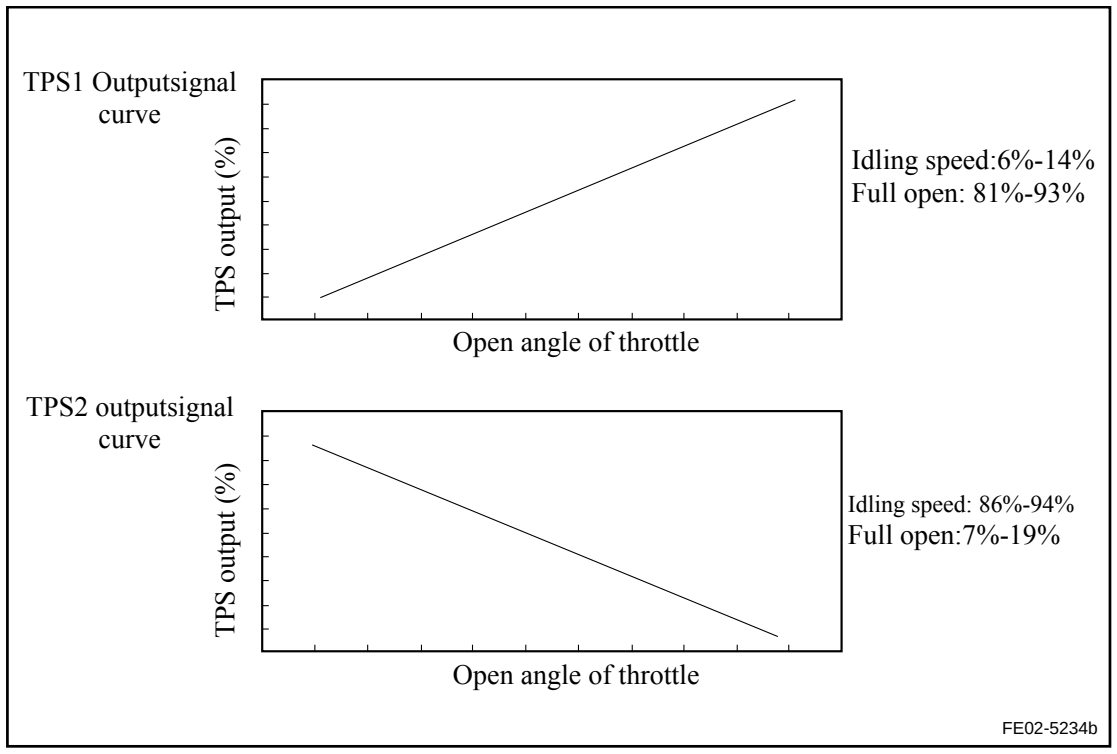


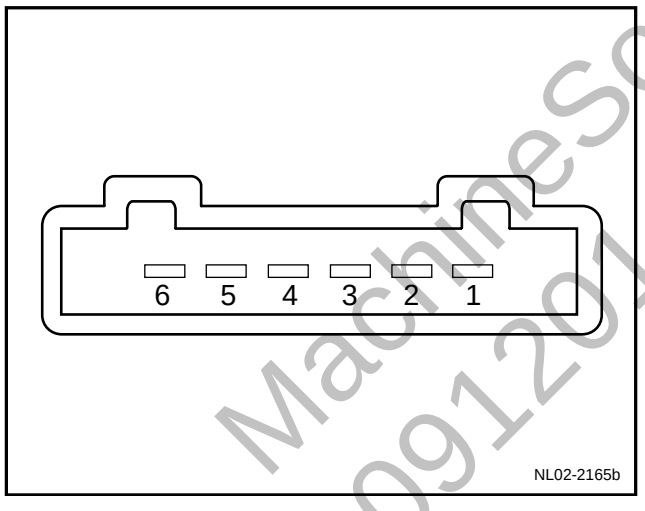
Notes:

An oscilloscope can be used for detecting the above TPS sensor output signal, and the output waveform line should be smooth without noise wave! If the output signal zeros or drops suddenly when throttle body rotates at a certain angel, the ETC assembly shall be replaced. ETC is an assembly. Do not disassemble it to repair.

2.2.7.13 Acceleration Pedal Position Sensor (APP) Inspection

As one of the system security measures, acceleration pedal position sensor is designed to have dual outputs. Two sensors output voltage signals increase as the acceleration pedal position increases.

1. Acceleration Pedal Position Sensor Connector End View and Function



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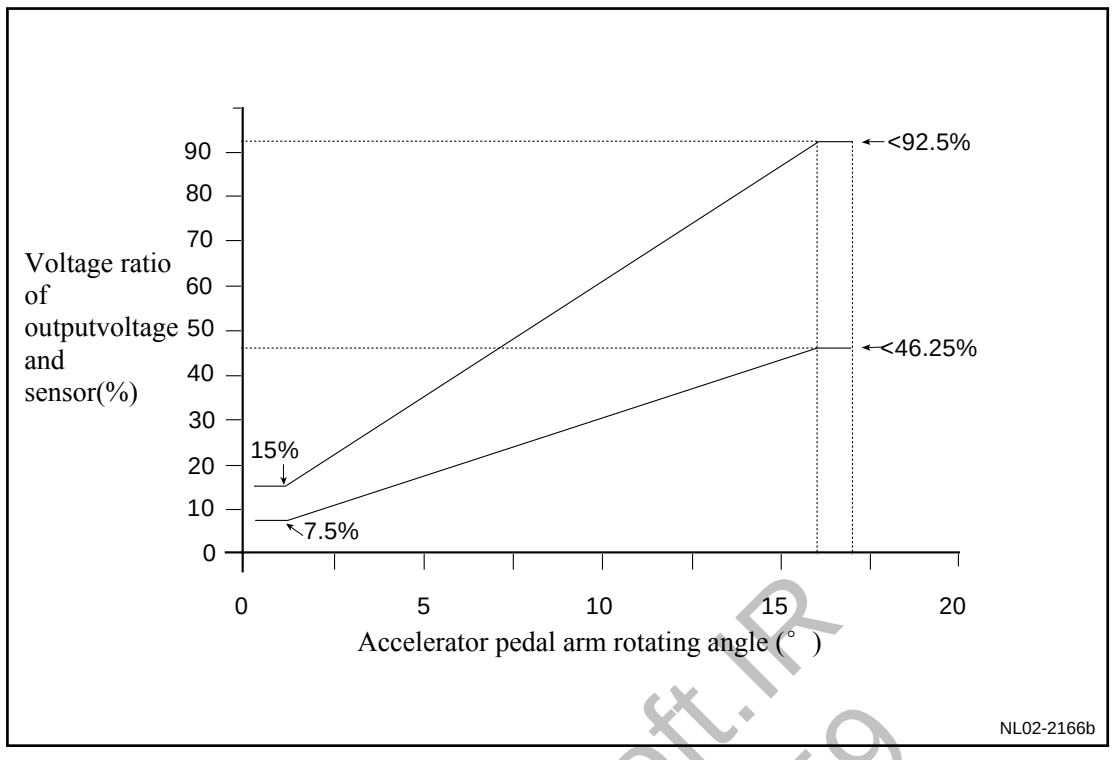
Terminal No .	ECM Related Terminal No.	Function
1	EN01(66)	Sensor No.2 Reference Voltage

2	EN01(70)	Sensor No.1 Reference Voltage
3	EN01(74)	Sensor No.1 Low Reference Voltage
4	EN01(41)	Sensor No.1 Output Signal
5	EN01(76)	Sensor No.2 Low Reference Voltage
6	EN01(42)	Sensor No.2 Output Signal

2. Acceleration Pedal Position Sensor Technical Specifications



Notes:

An oscilloscope can be used for detecting the above APP sensor output signal, and the output waveform line should be smooth without noise wave! ***If the output signal zeros or drops suddenly when accelerator pedal rotates at a certain angel, the APP assembly shall be replaced. APP is an assembly. Do not disassemble it to repair.***

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2.12.7.14 DTC Chapter Index

DTC	Description	Type
P0011	Intake VCP Phase Response Lag Behind	Refer to 2.2.7.15 P0011 P0012 P0016 P0026.
P0012	Intake VCP Camshaft Phase Error is Big	
P0016	Intake VCP Camshaft Gear Learn Bias Out of Range	
P0026	Intake VCP Hydraulic Control Valve Clinch	
P0076	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit	Refer to 2.2.7.17 DTC P0076 P0077
P0077	Intake VCP Hydraulic Control Valve Coil High Voltage	
P0068	Electronic Throttle Air Flow Error	Refer to 2.2.7.16 DTC P0068 P0106
P0106	Intake Pressure/Throttle Position Fault	Refer to 2.2.7.18 DTC P0107 P0108
P0107	Manifold air pressure sensor circuit has low voltage or is open	Refer to 2.2.7.18 DTC P0107 P0108
P0108	Intake Air Pressure Sensor Circuit High Voltage	Refer to 2.2.7.18 DTC P0107 P0108
P0112	Intake Air Temperature Sensor Circuit Low Voltage	Refer to 2.2.7.19 DTC P0112 P0113
P0113	Intake Air Temperature Sensor Circuit High Voltage or Open Circuit	
P0117	Coolant Temperature Sensor Circuit Low Voltage	Refer to 2.2.7.20 DTC P0117 P0118
P0118	Coolant Temperature Sensor Circuit High Voltage or Open Circuit A	Refer to 2.2.7.20 DTC P0117 P0118
P0122	Electronic Throttle Position Sensor #1 Circuit Low Voltage	Refer to 2.2.7.21 DTC P0122 P0123
P0123	Electronic Throttle Position Sensor #1 Circuit High Voltage	
P0131	Front Oxygen Sensor Circuit Short to Low Voltage	Refer to 2.2.7.22 DTC P0131 P0132 P0133P0134
P0132	Front Oxygen Sensor Circuit Short to High Voltage	
P0133	Slow response of front oxygen sensor	
P0134	Front Oxygen sensor is open	

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P0135	Front oxygen sensor heater fails	Refer to 2.12.7.23 DTC P0135
P0137	Rear Oxygen Sensor Circuit Short to Low Voltage	Refer to 2.12.7.24 DTC P0137 P0138 P0140
P0138	Rear Oxygen Sensor Circuit Short to High Voltage	
P0140	Rear Oxygen Sensor Circuit Open	
P0141	Rear Oxygen Sensor Heater Malfunction	Refer to 2.12.7.25 DTC P0141
P0171	Mixture Too Thin	Refer to 2.12.7.26 DTCP0171 P0172 P1167 P1171 P2187 P2188
P0172	Mixture Too Thick	
P0222	Electronic Throttle Position Sensor #2 Circuit Low Voltage	Refer to 2.12.7.27 DTC P0222 P0223
P0223	Electronic Throttle Position Sensor #2 Circuit High Voltage	
P0230	Fuel Pump Relay Fault	Refer to 2.12.7.28 DTC P0230
P0261	Fuel Injector 1 Low Voltage Fault	Refer to 2.12.7.29 DTC P0261 P0262
P0262	Fuel Injector 1 High Voltage Fault	
P0264	Fuel Injector 2 Low Voltage Fault	Refer to 2.12.7.30 DTC P0264 P0265
P0265	Fuel Injector 2 High Voltage Fault	
P0267	Fuel Injector 3 Low Voltage Fault	Refer to 2.12.7.31 DTC P0267 P0268
P0268	Fuel Injector 3 High Voltage Fault	
P0270	Fuel Injector 4 Low Voltage Fault	Refer to 2.12.7.32 DTC P0270 P0271
P0271	Fuel Injector 4 High Voltage Fault	
P0300	Multi-Cylinder Misfire	Refer to 2.12.7.33 DTC P0300
P0324	Knock Control System Fault	Refer to 2.12.7.34 DTC P0324 P0325
P0325	Knock Sensor Fault	
P0335	No signal from crankshaft position sensor circuit	Refer to 2.12.7.35 DTC P0335 P0336
P0336	Crankshaft Position Sensor Circuit Signal Interference	
P0340	Intake VCP Camshaft Position Sensor Status	Refer to 2.12.7.36 DTC

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	Diagnosis	P0340 P0341
P0341	Intake VCP Target Wheel Diagnosis	
P0351	Cylinder 1 Ignition Coil Malfunction	Refer to 2.12.7.37 DTC P0351 P0352 P0353 P0354
P0352	Cylinder 2 Ignition Coil Malfunction	
P0353	Cylinder 3 Ignition Coil Malfunction	
P0354	Cylinder 4 Ignition Coil Malfunction	
P0420	Low transformation efficiency of catalytic converter	Refer to 2.12.7.38 DTC P0420
P0458	Canister electromagnetic valve circuit is shorted to low voltage or open	Refer to 2.12.7.39 DTC P0458 P0459
P0459	Canister Solenoid Valve Circuit Short to High Voltage	
P0480	Low-Speed Fan Malfunction	Refer to 2.12.7.40 DTC P0480 P0481
P0481	High-Speed Fan Malfunction	
P0502	No signal from vehicle speed sensor	Refer to 2.12.7.41 DTC P0502
P0506	Idle Speed Too Low	Refer to 2.12.7.42 DTC P0506 P0507
P0507	Idle Speed Too High	
P0562	System Voltage is Low	Refer to 2.12.7.43 DTC P0562 P0563
P0563	System Voltage is High	
P0571	The switch state of the brake lamp is not changed when braking.	Refer to 2.12.7.44 DTC P0571
P0601	ROM Error	Refer to 2.12.7.45 DTC P0601 P0602 P1516 P2101
P0602	ECM Processor Malfunction	
P0606	ECM Processor Malfunction	
P0641	ETC Reference Voltage #A Amplitude Fault	Refer to 2.12.7.46 DTC P0641 P0651
P0646	Air-conditioning Clutch Relay Circuit Short to Low Voltage or Open	Refer to 2.12.7.47 DTC P0646 P0647
P0647	Air-conditioning Clutch Relay Circuit Short to High Voltage	
P0651	ETC Reference Voltage #B Amplitude Fault	Refer to 2.12.7.46 DTC P0641 P0651

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P0685	Main Relay Malfunction	Refer to 2.12.7.48 DTC P0685
P0831	Clutch switch circuit at low voltage	Refer to 2.12.7.61 DTC P0831 P0832
P0832	Clutch switch circuit at high voltage	
P1167	Pre-catalytic Oxygen Indicating Mixture Too Thick During Deceleration	Refer to 2.12.7.26 DTC P0171 P0172 P1167P1171 P2187 P2188
P1171	Pre-Catalytic Oxygen Indicating Mixture Too Thin During Acceleration	
P1336	58-Tooth Gear Error Not Learn	Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn.
P1516	ETC-Driver Second-Order Diagnostic Error	Refer to 2.12.7.45 DTC P0601 P0602 P1516P2101
P2101	ETC-Driver Steady-State Diagnostic Error	
P2104	Mandatory Engine Idling	Refer to 2.12.7.50 DTC P2104 P2105 P2106P2110
P2105	Forced engine stopping	
P2106	Restrictions on Engine Performance	
P2110	Engine Power Management	
P2119	Electronic Throttle Return Malfunction	Refer to 2.12.7.50 DTC P2119
P2122	Electronic Acceleration Pedal Position Sensor #1 Circuit Low Voltage	Refer to 2.12.7.51 DTC P2122 P2123
P2123	Electronic Acceleration Pedal Position Sensor #1 Circuit High Voltage	
P2127	Electronic Acceleration Pedal Position Sensor #2 Circuit Low Voltage	Refer to 2.12.7.52 DTC P2127 P2128
P2128	Electronic Acceleration Pedal Position Sensor #2 Circuit High Voltage	
P2135	Electronic Throttle Position Sensor 1#, 2# circuit malfunction	Refer to 2.12.7.53 DTC P2135
P2138	Electronic Throttle Position Sensor 1#, 2# circuit malfunction	Refer to 2.12.7.54 DTC P2138
P2187	Mixture Too Thin When Idling	Refer to 2.12.7.52 DTC P2127 P2128
P2188	Mixture Too Thick When Idling	
P0633	Anti-theft Does Not Learn Malfunction	Refer to 2.12.7.55 DTC P0633 U0167 U0426
U0167	No response of anti-theft device	

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U0426	Anti-theft Device Authentication Malfunction	

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2.12.7.15 DTC P0011 P0012 P0016 P0026

1. DTC description:

DTC	**P0011**	Intake VCP Phase Response Lag Behind

DTC	**P0012**	Intake VCP Camshaft Phase Error is Big

DTC	**P0016**	Intake VCP Camshaft Gear Learn Bias Out of Range

DTC	**P0026**	Intake VCP Hydraulic Control Valve Clinch

Intake camshaft position (CMP) actuator is connected to the intake camshaft and operated by the hydraulic pressure, which is provided by the oil pump in order to change the intake camshaft to the CKP (CKP) relative angle. Intake VVT solenoid valve power is provided from the main relay. ECM controls ground with a pulse-width modulation signal to control the engine oil flow to the camshaft position actuator. Oil pressure moves a security slide valve within the camshaft position actuator body at the front of the camshaft. When the safety slide valve moves, the oil is imported to the camshaft position actuator to rotate the camshaft. The intake camshaft actuator change the camshaft working angle up to 50 degrees.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0011	VVT Actual Angle and Target Angle Difference Too Great	1. VVT Actual Angle and Target Angle Difference Too Great 2. Camshaft completed self-learning. 3. Oil Temperature Between -40℃(-40 ℉) and 120℃(248 ℉). 4. Water temperature Between 0℃ (32 ℉) and 105℃ (221 ℉) . 5. Engine Speed Between 600 rpm and 6,000 rpm. 6. No VVT Circuit Fault Set.	1. Valve timing 2. Intake VVT Solenoid Valve 3. Solenoid Valve Filter 4. VVT Actuator assembly 5. ECM
P0012 P0016 P0026	VVT actual angular is not at the default position	1. VVT actual angle and default angle difference greater than or equal to 20 degrees. 2. Camshaft completed self-learning. 3. The engine running time is less than or equal to	

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		1.5s. 4. Oil Temperature Between -40℃(-40 ºF) and 120℃(248 ºF). 5. Oil Temperature Between 0℃(32 ºF)and 105℃(221 ºF). 6. Engine Speed Between 600 rpm and 6,000 rpm. 7. No VVT Circuit Fault Set.	

3. Circuit figure

Refer to 2.12.7.17 DTC P0076 P0077

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect whether there are control system DTC codes other than DTC P0014、P0015、P0017、P0027 .

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes Shown	**Go to Step**
DTC P0011、P0012、P0016、P0026	Yes
other than DTC P0011、P0012、P0016、P0026	No

No → Refer to 2. 12.7.14 DTC Chapter Index.

Yes

2	Inspect the following:

A. Check whether the oil viscosity is normal and whether the oil is clean.

B. Observe the Engine oil level. Engine oil level should be within the work range.

C. Inspect whether the oil is changed in a timely manner and whether the engine oil contains additives or viscosity is incorrect.

No → Replace engine oil and oil filter. When necessary, clean the engine lubrication system.

Yes

3	Inspect intake VVT solenoid valve resistance.

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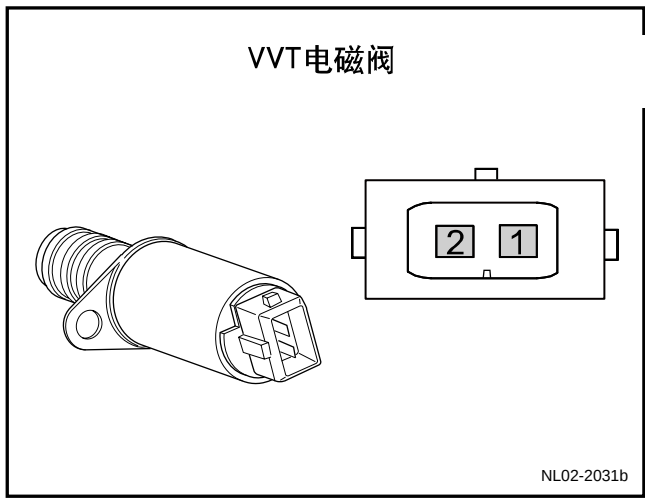
A. Disconnect intake VVT solenoid valve harness connector EN10.

B. Measure the resistance between the two intake VVT solenoid valve terminals.

Standard Resistance: 7 . 2 Ω at 20°C (68 ?F)



VVT electromagnetic valve

No → Refer to “2.12.8.3 Replacement of VVT Solenoid Valve” to replace the VVT solenoid valve.

Yes

4	Inspect the intake VVT solenoid valve action condition.

Note: In the testing process, it is strictly prohibited Connect two wires directly together, otherwise it might cause an explosion, fire or other dangers.

A. Connect the battery positive terminal to VVT solenoid valve terminal #1 and the negative terminal to the VVT solenoid valve terminal #2.

B. Inspect the filter movement. Does the filter move?

No → Refer to “2.12.8.3 Replacement of VVT Solenoid Valve” to replace the VVT solenoid valve.

Yes

5	Inspect whether the timing system is normal.

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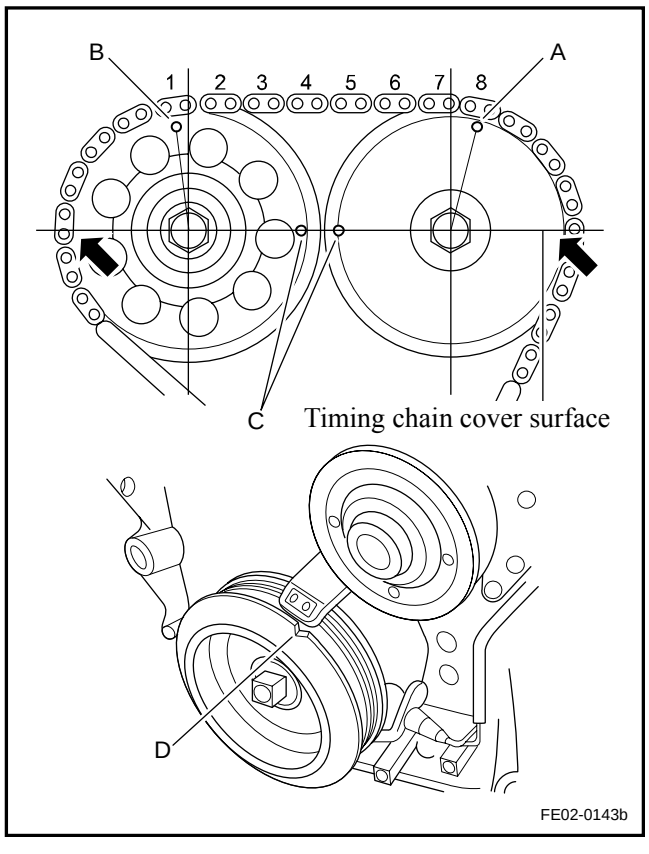
A. Remove the cylinder hood cover.

B. Align point D shown in the graphic. Rotate the crankshaft pulley, so that the timing mark on the pulley groove aligns with 0 marked on the timing chain cover.

C. Inspect points C alignment shown in the graphic. The camshaft timing gear timing marks should be at horizontal positions as shown in the graphic.

D. Inspect points A,B alignment shown in the graphic. Make sure intake, exhaust camshaft gear timing marks distance between A and B is 8 timing chain sections.

E. Reinstall the cylinder hood cover.



Are timing marks shown as in the graph?

No → Adjust the valve timing

Yes

6	Replace the VVT actuator assembly.

Next

7	Inspect control system DTC codes.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position.

C. Select the following menu items:

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Any DTC code?

No → Refer to 2.12.7.4 Fault Symptom Table for intermittent fault.

Yes

8	System gets normal and the trouble is removed.

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5. Maintenance guide :

Intake VVT Actuator can only be replaced as an assembly. Do not disassemble it and repair. Replacement of VVT actuator and Camshaft.

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2.12.7.16 DTC P0068 P0106

1. DTC description:

DTC	**P0068**	Electronic Throttle Air Flow Error

DTC	**P0106**	Intake Pressure/Throttle Position Fault

Intake Manifold Absolute Pressure (MAP) Sensor measures intake manifold pressure changes caused by the engine load, intake manifold vacuum and engine speed changes, and convert these changes into voltage output and send to the engine control module (ECM). At the same time the engine control module (ECM) compares the actual and expected intake manifold absolute pressure changes based on the throttle position opening change, to determine whether the intake manifold absolute pressure sensor responds to throttle position opening change or not. Set DTC P0106 fault accordingly.

Engine control module (ECM) detects air flow based on the intake manifold pressure sensor and intake air temperature sensors measured data and compare the sir flow with expected air flow based on throttle position sensor. If the engine control module (ECM) detects that the intake manifold absolute pressure / temperature sensor detected actual air flow and expected air flow based on throttle position sensor is inconsistent, it will set DTC P0068.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0068	Difference between intake manifold absolute pressure / temperature sensor detected air flow and the expected air flow based on throttle position is 200 g/s.	1. Engine Running 2. No Intake Air Pressure / Temperature Sensor Fault 3. Duration Longer Than 4s.	1. Intake manifold pressure /temperature Sensor 2. Intake manifold and Vacuum Tube 3. Throttle valve 4. ECM
P0106	Atmosphere correction pressure value is more than high limit value. Or less than low limit value	1. Engine Running 2. No intake pressure sensor, coolant temperature sensor, ETC throttle position sensor, fuel injector, ignition coil and misfire fault, etc. 3. Coolant temperature is higher than 60℃(140 ºF)。 4. Duration Longer Than 15s.	

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3. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Initial Inspection

Inspect if there are the following conditions:

A. Damaged Intake Manifold Pressure / Temperature Sensor Housing Is, Broken Vacuum Tubes

B. Damaged Intake Manifold Pressure / Temperature Sensor Seals

C. Intake Manifold Pressure / Temperature Sensor Loose or Improperly Installed

D. Throttle seals is damaged, causing air leaks.

Next

2	Inspect whether there is control system DTC code other than DTC P0068 P0106.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes Shown	**To Step**
DTC P0068 P0106	No
DTC Code Other Than DTC P0068 P0106	Yes

Yes → 2.12.7.14 DTC Chapter Index

Yes

3	Inspect the atmospheric pressure parameter in the fault diagnosis data list.

A) Compare the atmospheric pressure parameter and the actual atmospheric pressure, refer to the "2.12.1.3 Relationship between Altitude and Atmospheric Pressure" in “Engine Control System”.

Are the two similar?

No → Replace the intake manifold pressure / temperature sensor.

Yes

4	Inspect the intake manifold pressure (MAP) sensor value with the engine running.

A. Start the engine.

B. When idling, observe the intake manifold pressure (MAP) sensor values.

C. During acceleration, observe the intake manifold pressure (MAP) sensor values.

D. Compare the above intake manifold pressure (MAP) sensor values.

Are above intake manifold pressure (MAP) sensor values changed?

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Yes → Go to step 7

No

5	Inspect the intake manifold pressure sensor.

A. Shut down the engine.

B. Turn the ignition switch to ON.

C. Without disconnecting the intake manifold pressure sensor wiring harness connector, pull out the intake manifold pressure sensor from the intake manifold and use the vacuum pump. install the vacuum pump tube to the intake manifold pressure sensor.

D. Apply 50 kPa pressure on the intake manifold pressure sensor. Observe whether the intake manifold pressure (MAP) sensor value changes?

No → Replace the intake manifold pressure / temperature sensor.

Yes

6	Inspect the intake manifold pressure sensor installation port and vacuum tubes.

A. Inspect the intake manifold pressure sensor installation port and vacuum tubes.

Are the installation port and vacuum tubes blocked?

Yes → Clean and service the intake manifold and vacuum tubes.

No → Go to step 9

7	Inspect whether the intake manifold pressure sensor parameter responds to changes.

A. Engine Running

B. After changed throttle valve. Stuck throttle valve, look at air intake manifold pipe pressure sensor .

Whether the sensor parameter value is rapidly changed according to the change of the position of the throttle.

Does intake manifold pressure (MAP) sensor value rapidly change with the throttle position changes?

Yes → Go to step 9

No

8	Inspect the intake manifold pressure sensor installation port and vacuum tubes.

A. Inspect the intake manifold pressure sensor installation port and vacuum tubes.

Are the installation port and vacuum tubes blocked?

Yes → Clean and service the intake manifold and vacuum tubes.

No → Replace the intake manifold pressure sensor.

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9	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

Yes → Troubleshooting

No

.

10	Inspect ECM power supply circuit.

A. Inspect whether ECM power supply circuit is normal.

B. Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

11	Replace ECM

A. Replaces .

B. Carry out the crankshaft position sensor learning, refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learning.

Next

12	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

13	Troubleshooting

5. Maintenance guide:

Replace Intake Pressure Temperature Sensor, refer to 2.12.8.3 “Replacement of Intake Pressure Temperature Sensor”.

Replace ECM. Refer to 2.12.8.1 Replacement of Engine Control Module.

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2.12.7.17 DTC P0076 P0077

1. DTC description:

DTC	**P0076**	Intake VCP Hydraulic Control Valve Coil Low Voltage or Open Circuit

DTC	**P0077**	Intake VCP Hydraulic Control Valve Coil High Voltage

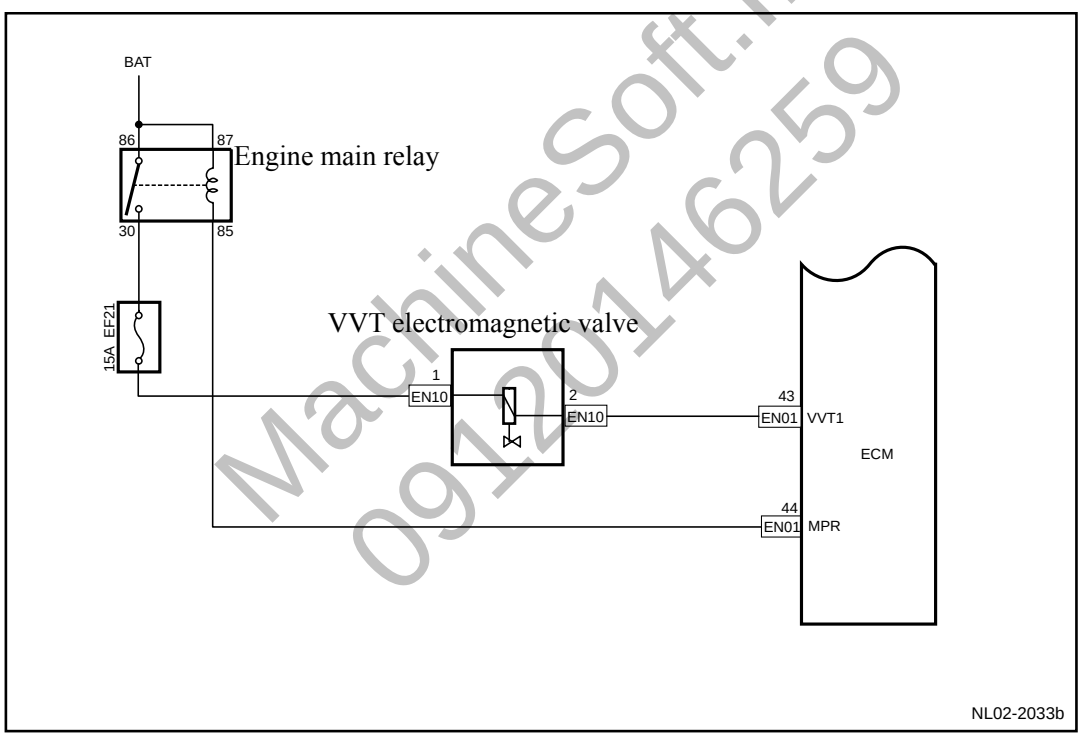
Intake camshaft position (CMP) actuator is connected to the intake camshaft and operated by the hydraulic pressure, which is provided by the oil pump in order to change the intake camshaft to the CKP (CKP) relative angle. Intake VVT solenoid valve power is provided from the main relay. ECM controls ground with a pulse-width modulation signal to control the engine oil flow to the camshaft position actuator. Oil pressure moves a security slide valve within the camshaft position actuator body at the front of the camshaft. When the safety slide valve moves, the oil is imported to the camshaft position actuator to rotate the camshaft. The intake camshaft actuator change the camshaft working angle up to 50 degrees.

ECM controls the solenoid valve internal ground through ECM harness connector EN01 terminal No.43. There is a feedback circuit within ECM. Engine ECM monitors feedback signals to determine whether the control circuit is open, short to ground or short to voltage If ECM detects the control circuit voltage is within the specified range when the control circuit is instructed to disconnect, it will set this DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0076	Hardware Circuit Inspection	1. Circuit Open 2. Circuit Short To Power Supply 3. Circuit Short To Ground	1. Solenoid Valve Circuit 2. Solenoid Valve 3. ECM
P0077			

3. Circuit sketch



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4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Measure VVT solenoid valve resistance.

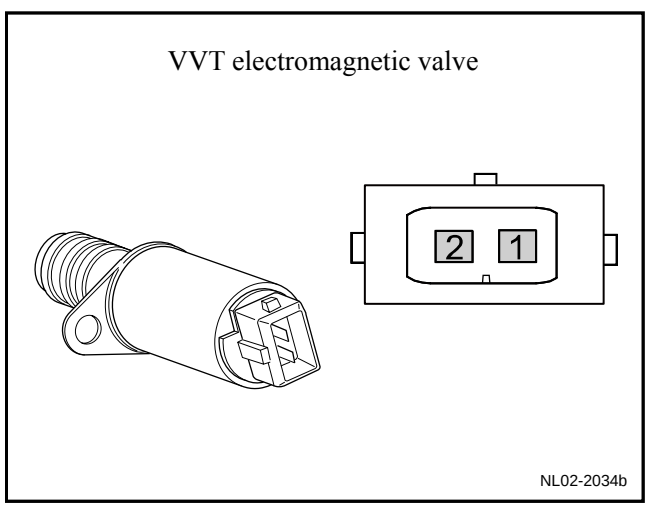
(a) Disconnect intake VVT solenoid valve harness connector EN10.

(b) Measure the resistance between the two intake VVT solenoid valve terminals.

Standard Resistance

7.2Ω with 20℃(68ºF)

(c) Connect VVT solenoid valve harness connector.



No → Replace VVT solenoid valve assembly. Go to step 7

Yes

Step 2	Measure VVT solenoid valve working power supply.

(a) Rotated ignition switch to OFF position .

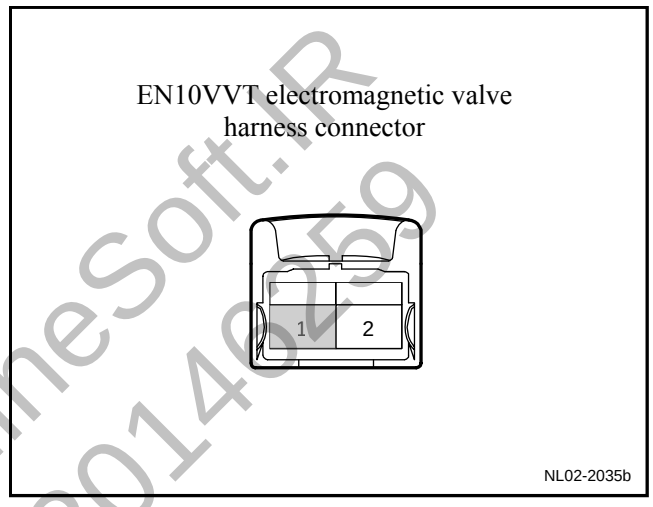
(b) Disconnect VVT solenoid valve harness connector EN10.

(c) Rotated ignition switch to ON position .

(d) Use multimeter to measure EN10 connector terminal 1.

Standard Voltage: 11-14V

(e) Connect VVT solenoid valve harness connector EN10.



No → Inspect whether circuit between EN10 solenoid valve harness connector terminal No.1 and main relay terminal No.30 is open or short to ground.

Yes

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Step 3	Inspect VVT solenoid valve control circuit.

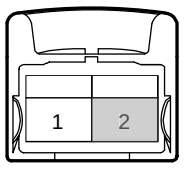
(a) Rotated ignition switch to OFF position .

(b) Disconnect VVT solenoid valve harness connector EN10.

(c) Disconnect ECM harness connector EN01.

(d) Use multimeter to measure the resistance between VVT solenoid valve harness connector EN10 terminal No.2 and ECM harness connector EN01 terminal 43. For the Standard Value. Refer to the table below.

EN10VVT electromagnetic valve harness connector

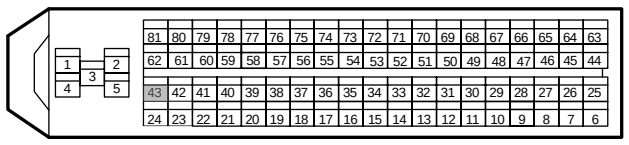


NL02-2036b

(e) Use multimeter to measure the resistance between VVT solenoid valve wiring harness connector EN10 terminal 2 and the ground. For the Standard Value. Refer to the table below.

(f) Turn the ignition switch to "ON" position, (Note: At this point EN01, EN10 connectors must be disconnected) Measure voltage between VVT solenoid valve wiring harness connector EN10 terminal B and a reliable ground with a multimeter. The Standard Value is in the table below.

EN01 engine control module harness connector



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Test Connection	Standard Value
EN10(2)--EN01(43) resistance	Less than 1 Ω
EN10(2)--grounding resistance	10kΩ or higher
EN10(2)--grounding voltage	Less than 0 V

No → Repair or replace harness connector

Yes

Step 4	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair or replace harness connector

Yes

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Step 5	Replace ECM. Refer to 2.12.8.1 Replacement of Engine Control Module.

Next

Step 6	Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 7	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again. Verify that the system has no DTC code output.

No → Repair or replace harness connector

Yes

Step 8	Troubleshooting

5. Maintenance guide :

Refer to 2.12.8.5 Replacement of VVT Solenoid Valve and Filter Cleaning to replace the VVT solenoid valve.

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2.12.7.18 P0107 P0108

1. DTC description:

DTC	**P0107**	Manifold air pressure sensor circuit has low voltage or is open

DTC	**P0108**	Intake Air Pressure Sensor Circuit High Voltage

Intake Air Manifold Absolute Pressure (MAP) Sensor responds to the pressure changes within the intake manifold. Pressure varies according to engine load. The MAP sensor circuit consists of the following:

- 5V reference voltage
- Low Reference Voltage Circuit
- Sensor Signal Circuit

ECM provides sensor harness connector EN16 terminal No.1 5 V reference voltage through ECM harness connector EN01 terminal No.66. And, a low reference voltage through EN01 terminal No.76 to EN16 terminal No.4. The sensor provides a signal through EN16terminal No.2 to ECM harness connector EN01 terminal No.54. This signal is related to the intake manifold pressure change. When the intake manifold absolute pressure is low, such as at idle or during deceleration, ECM detected signal voltage is low. When the intake manifold absolute pressure is high, such as the ignition switch turned on with the engine is turned off, or when the throttle is fully open, ECM detected signal voltage is high. Sensors are also used to determine the atmospheric pressure. When the ignition switch is turned on and the engine is turned off. As long as the engine running with the throttle fully open, atmospheric pressure readings will also be updated. ECM monitors sensor signals in order to determine whether the voltage is beyond the normal range.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0107	Circuit Inspection, Over the Minimum Limit	1. Idle 2. When the sensor circuit is open or short to ground, the sensor signal voltage is 0	1. Sensor Circuit 2. Sensor 3. ECM.
P0108	Circuit Inspection,over the Maximum Limit	1. Idle 2. When the sensor circuit short to power supply or a 5 V reference voltage 3. Sensor A/D initial signal is 99.6%	

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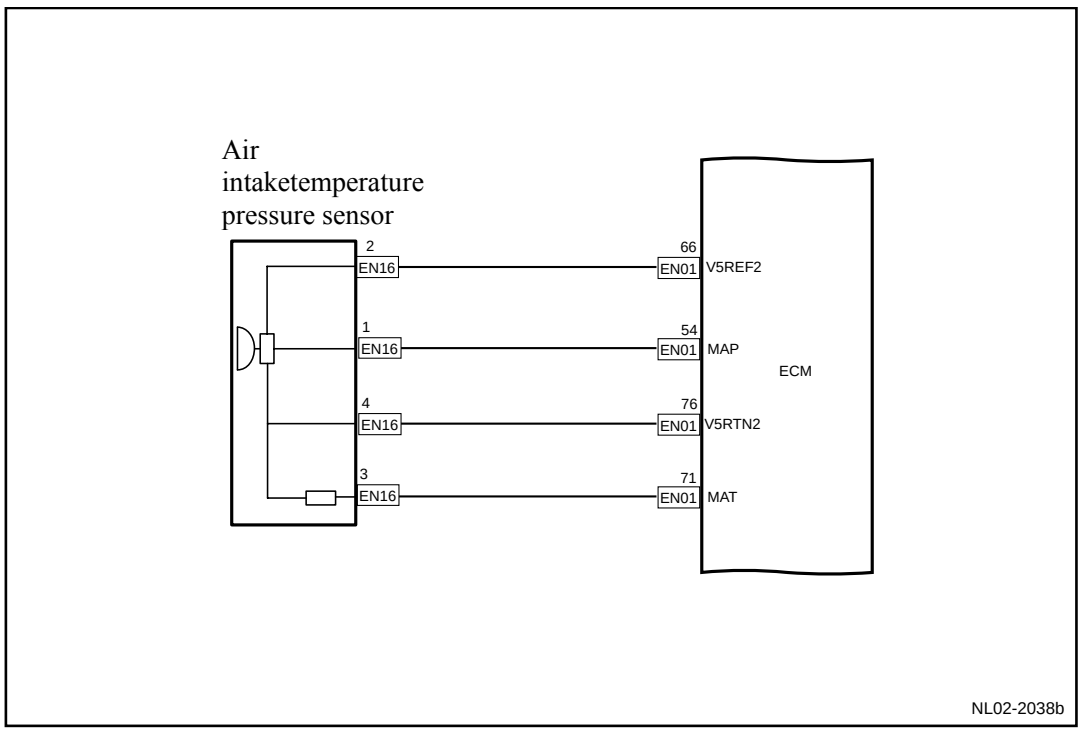
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Inspect if there are the following conditions:

(a) Sensor housing damage, vacuum tubes broken.

(b) Sensor seal damage.

(c) Sensor loose or improperly installed.

(d) Sensor tube blockage.

It is not allowed to connect 5 V reference voltage circuit of intake manifold absolute pressure sensor and other components of the vehicle, as this will damage the sensors and ECM.

Next

Step 2	Measure intake manifold absolute pressure sensor 5 V reference voltage.

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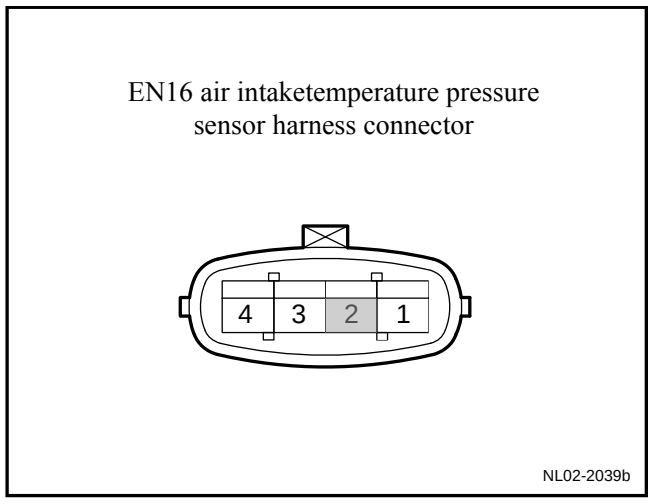
(a) Rotated ignition switch to OFF position .

(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EN16.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between intake manifold absolute pressure sensor wiring harness connector EN16 terminal No.2 and a reliable ground.

Standard voltage: 4.5V-5.5V



(e) Connect intake manifold absolute pressure sensor wiring harness connector EN16.

Is voltage the specified value?

No → Repair or replace harness connector

Yes

Step 3	Measure Sensor Signal Circuit

(a) Rotated ignition switch to OFF position .

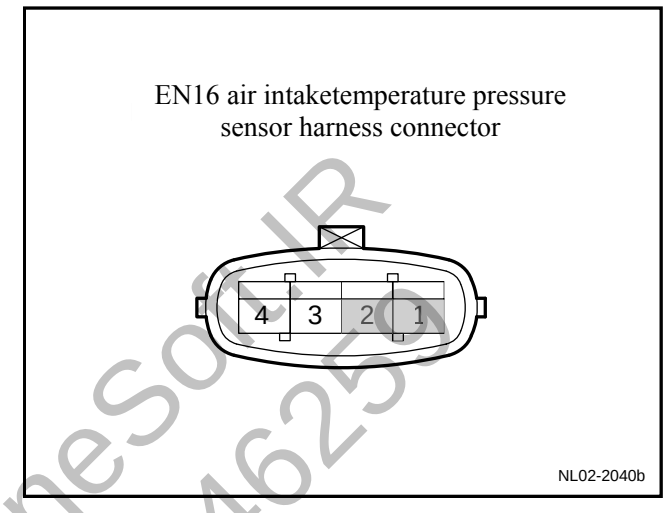
(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EN16.

(c) Rotated ignition switch to "ON" position .

(d) Connect a 5A fuse cross-wiring between EN16 terminals No. 1 and No.2. With a fault diagnosis tester, observe "Actual Intake Manifold Absolute Pressure Sensor Voltage" parameter.

standard value: 4.5V-5.5V

(e) Connect intake manifold absolute pressure sensor wiring harness connector EN16.



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Is data normal?

No → Go to step 7

Yes

Step 4	Measure intake manifold absolute pressure sensor ground circuit.

(a) Rotated ignition switch to OFF position .

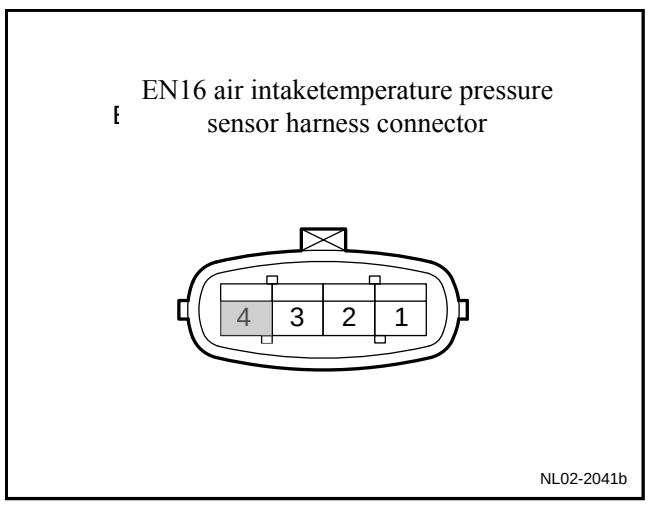
(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EN16.

(c) Rotated ignition switch to ON position .

(d) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EN16 terminal No.4 and a reliable ground.

Standard Value: Less than 3 Ω

(e) Connect intake manifold absolute pressure sensor wiring harness connector EN16.



Is the resistance normal?

No	Go to step 8
Yes	

Step 5	Replace the intake manifold absolute pressure sensor.

No	Go to step 10
Yes	

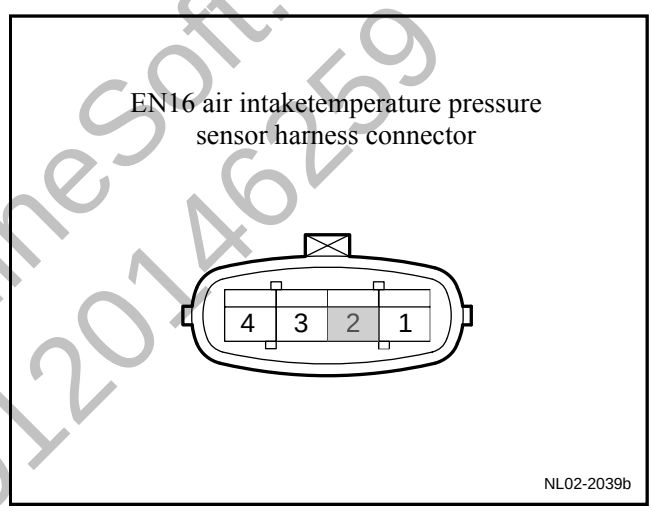
Step 6	Inspect the sensor 5 V reference voltage circuit.

(a) Rotated ignition switch to "OFF" position .

(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EN16.

(c) Disconnect ECM harness connector EN01.

(d) Measure the resistance between intake manifold absolute pressure sensor harness connector EN16 terminal No.1 and ECM harness connector terminal No.66. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.



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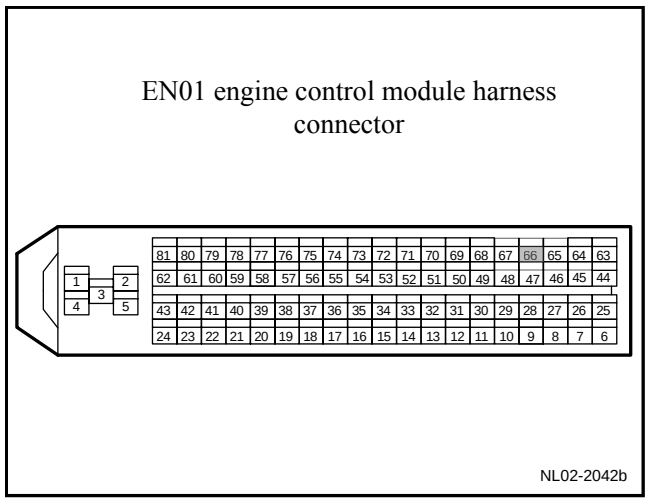
(e) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EN16 terminal No.1 and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the fault part.

(f) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EN16 terminal No.1 and power supply. Inspect whether the circuit is short to power supply. Otherwise, repair the fault part.



Test Connection	Standard Value
EN16(1)--EN01(66) resistance	Less than 1 Ω
EN16(1)--grounding resistance	10kΩ or higher
EN16(1)--grounding voltage	Less than 0 V

No → Go to step 9

Yes

Step 7	Inspect Sensor Signal Circuit

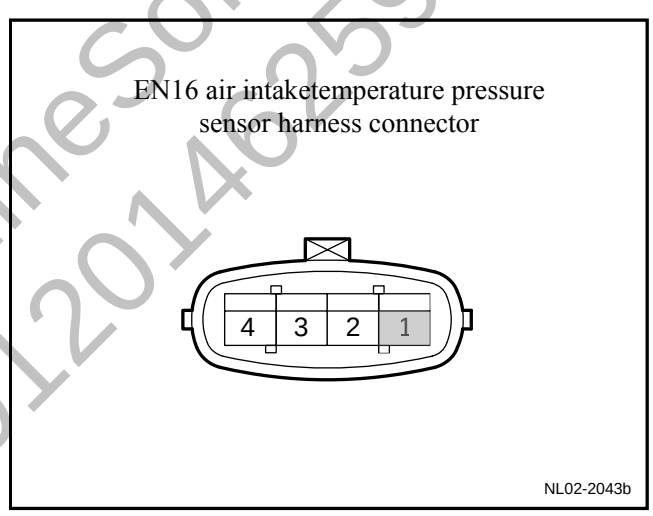
(a) Rotated ignition switch to OFF position .

(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EN16.

(c) Disconnect ECM harness connector EN01.

(d) Measure the resistance between intake manifold absolute pressure sensor harness connector EN16 terminal No.2 and ECM harness connector terminal No.54. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.

(e) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EN16 terminal No.2 and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the fault part.



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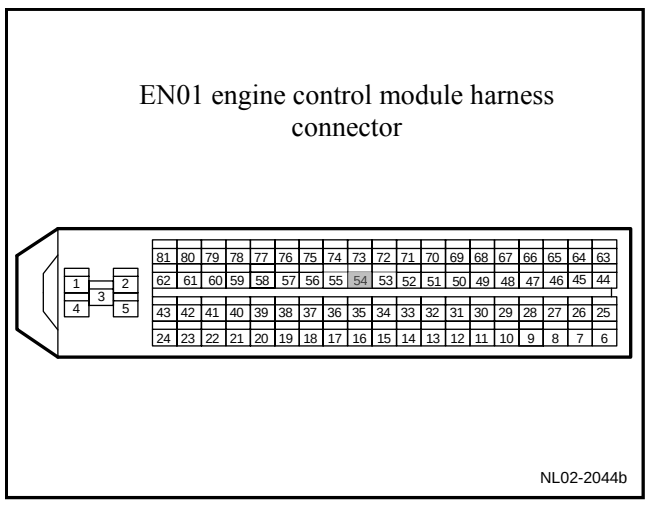
(f) Measure resistance between intake manifold absolute pressure sensor wiring harness connector EN16 terminal No.2 and power supply. Inspect whether the circuit is short to power supply. Otherwise, repair the fault part.



Test Connection	Standard Value
EN16(2)--EN01(54) resistance	Less than 1 Ω
EN16(2)--grounding resistance	10 kΩ or higher
EN16(2)--grounding voltage	Less than 0 V

Normal	Go to step 9

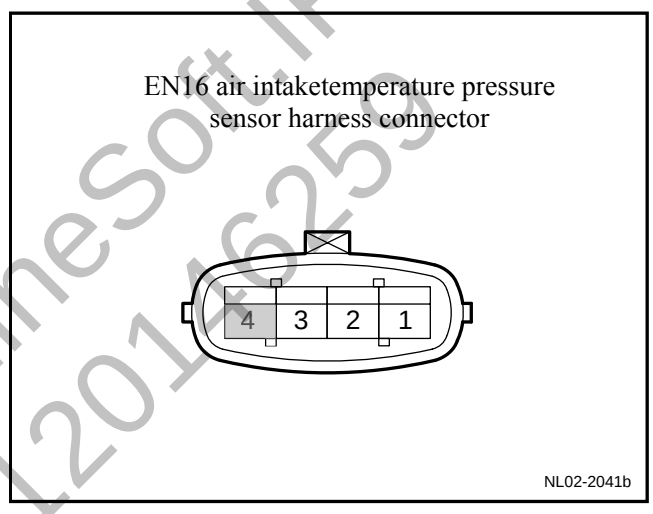
Step 8	Inspect sensor ground circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake manifold absolute pressure sensor wiring harness connector EN16.

(c) Disconnect ECM harness connector EN01.

(d) Measure the resistance between intake manifold absolute pressure sensor harness connector EN16 terminal No.4 and ECM harness connector terminal No.66. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.



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(e) Measure voltage between intake manifold absolute pressure sensor harness connector EN16 terminal No.4 and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the faulty part.

Test Items	Standard Value

EN16(4)-EN01(76)Resistance value	Less than 1 Ω
Voltage Between EN16 (4) and A Reliable Ground	0V

Execute next step as per normal.

Next

Step 9	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

Next

Step 10	Replace ECM

Next

Step 10	Replace ECM

(a) Refer to 2.12.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 11	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 12	Troubleshooting

5. Maintenance guide :

Refer to 2.12.8.3 Replacement of Intake Pressure Temperature Sensor to replace MAP sensor.

Replace ECM. Refer to 2.12.8.1 Replacement of Engine Control Module.

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2.12.7.19 DTC P0112、P0113

1. DTC description:

DTC	**P0112**	Intake Air Temperature Sensor Circuit Low Voltage

DTC	**P0113**	Intake Air Temperature Sensor Circuit High Voltage or Open Circuit

Intake air temperature pressure sensor has a signal circuit and an ECM internal ground circuit. Intake air temperature pressure sensor is used to measure the air temperature entering the engine. ECM provides 5 V reference voltage through ECM harness connector EN01 terminal No.71 to the intake air temperature pressure sensor harness connector EN16 terminal No.3 and an internal low reference voltage through EN01 terminal No.76 to the intake air temperature pressure sensor EM16 terminal No.4. When the intake air temperature pressure sensor in cold, the sensor resistance is relatively high. When the air temperature rises, the sensor resistance decreases. When the sensor resistance is high, ECM detected intake air temperature pressure sensor signal circuit voltage is high. With the decrease of sensor resistance, ECM detected intake air temperature pressure sensor signal circuit voltage also decreases.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0112 P0113	1. More Than the Upper Limit 2. Lower Than the Lower Limit	1. MAT circuit is short to ground. 2. MAT signal voltage becomes 0 immediately.	1. Sensor Circuit 2. Sensor 3. ECM.
		1. MAT circuit is open or short to 5 V reference voltage.	

3. Circuit sketch

Circuit diagram refers to 2.12.7.18 Circuit Diagram in DTC P0107 P0108.

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Inspect if there are the following conditions:

(a) Sensor housing is damaged.

(b) Sensor loose or improperly installed.

(c) Sensor wiring harness connector loose.

It is not allowed to connect 5 V reference voltage circuit of intake manifold absolute pressure sensor and other components of the vehicle, as this will damage the sensors and ECM.

Next

Step 2	Measure intake air pressure and temperature sensor resistance.

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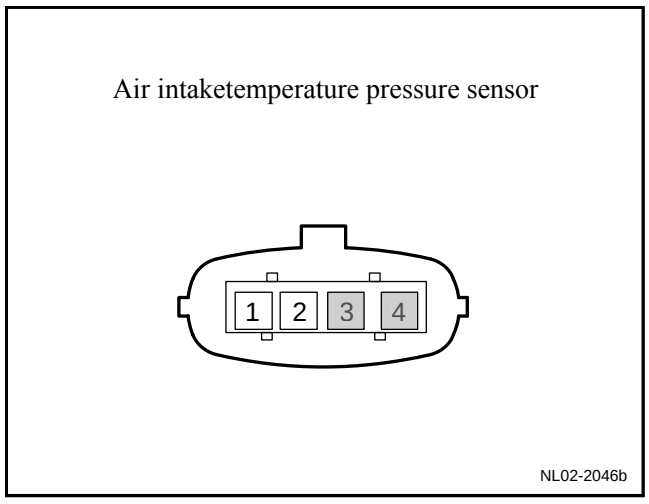
(a) Rotated ignition switch to OFF position .

(b) Disconnect intake pressure temperature sensor harness connector EN16.

(c) Measure intake air temperature sensor resistance.

Standard Resistance: (Refer to 2.12.1.2 Temperature and Resistance Correlation of Temperature Sensor to get the the specific parameters.): 2308.8-2726.8Ω/20°C(68ºF)

(d) Connect intake pressure temperature sensor harness connector EN16.



Is resistance the specified value?

No → Replace the intake pressure temperature sensor.

Yes

Step 3	Measure intake air temperature pressure sensor signal circuit.

(a) Rotated ignition switch to OFF position .

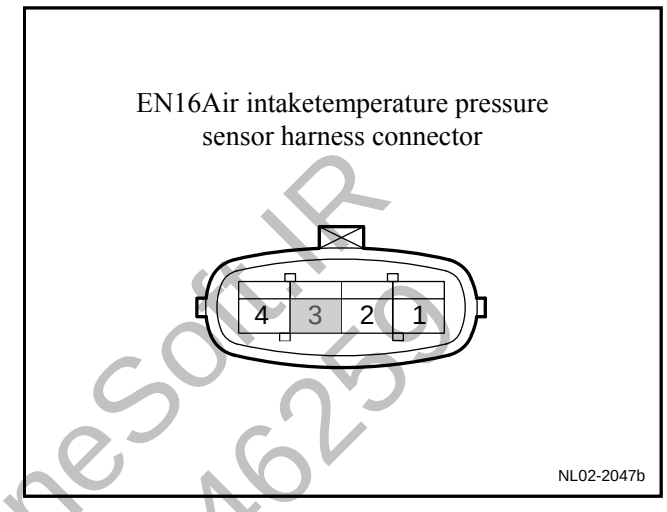
(b) Disconnect intake pressure temperature sensor harness connector EN16.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between intake pressure temperature sensor harness connector EN16 terminal No.3 and a reliable ground.

Standard Voltage: 4.7-5.5V

(e) Connect intake pressure temperature sensors connector EN16.



Is the voltage normal?

No → Replace the intake pressure temperature sensor.

Yes

Step 4	Measure intake air temperature pressure sensor ground circuit.

(a) Rotated ignition switch to OFF position .

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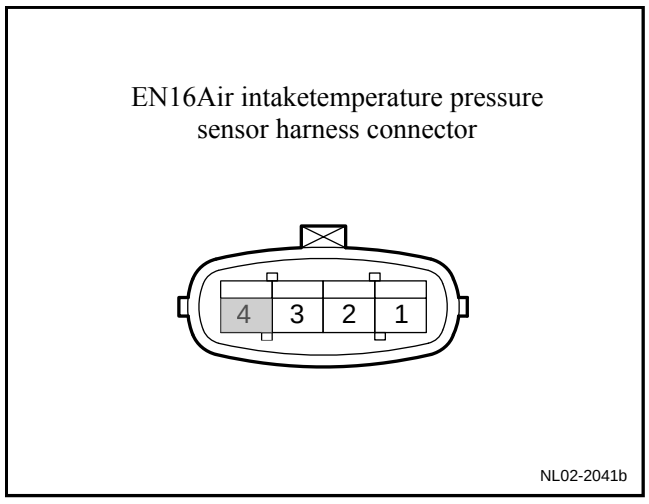
(b) Disconnect intake pressure temperature sensor harness connector EN16.

(c) Rotated ignition switch to ON position .

(d) Measure resistance between intake pressure temperature sensor harness connector EN16 terminal No.4 and a reliable ground.

Standard Resistance: Less than 3 Ω

(e) Connect intake pressure temperature sensor harness connector EN16.



Is the resistance normal?

No	Go to step 6
Yes	Go to step 7

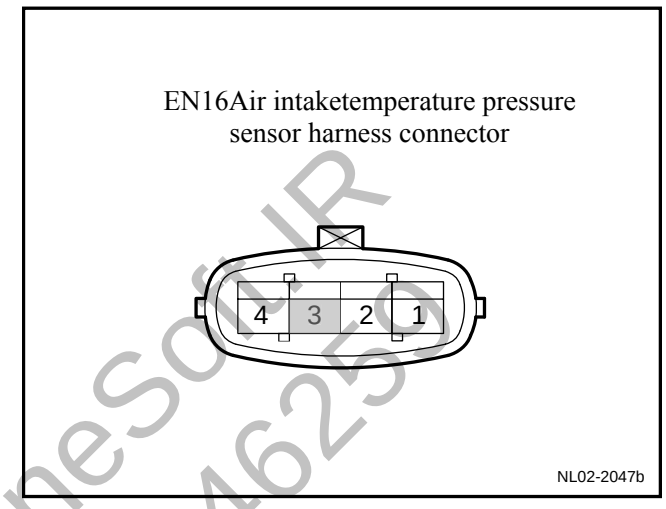
Step 5	Inspect intake air temperature pressure sensor signal circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake pressure temperature sensor harness connector EN16.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between intake pressure temperature sensor harness connector EN16 terminal No.3 and ECM harness connector terminal No.71. Inspect whether the circuit is open.



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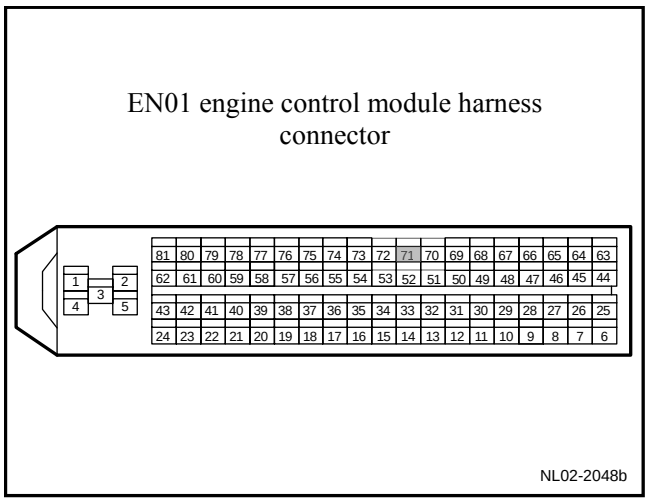
(e) Measure resistance between intake pressure temperature sensor harness connector EN16 terminal No.3 and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure voltage between intake pressure temperature sensor harness connector EN16 terminal No.3 and a reliable ground. Inspect whether the circuit is short to power supply.



Test Items	Standard Value
EN16(3)-EN01(71)Resistance value	Less than 1 Ω
Resistance Between EN16 (3) and A Reliable Ground	10 kΩ or higher
Voltage Between EN16 (3) and A Reliable Ground	0V

Next	Go to step 6

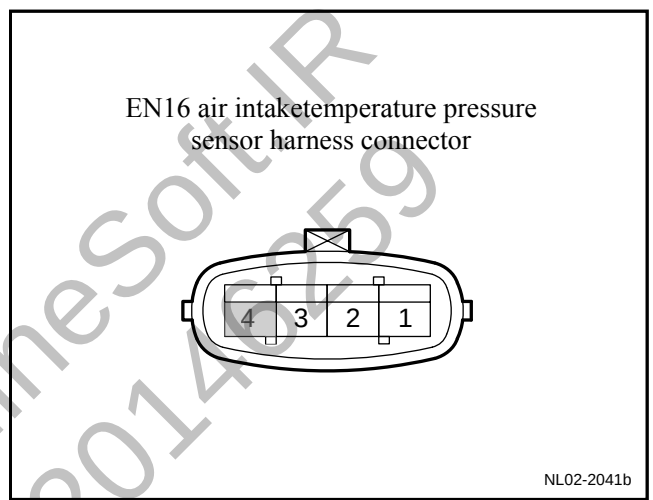
Step 6	Inspect intake air temperature pressure sensor ground circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect intake pressure temperature sensor harness connector EN16.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between intake pressure temperature sensor harness connector EN16 terminal No.4 and ECM harness connector terminal No.76. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.



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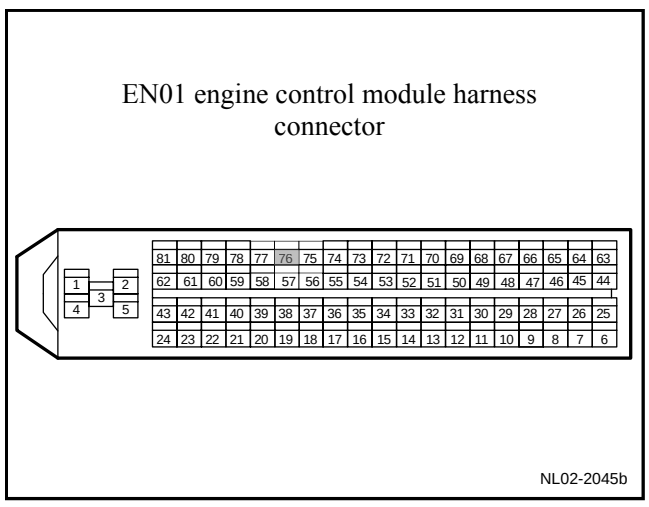
(e) Measure voltage between intake pressure temperature sensor harness connector EN16 terminal No.4 and a reliable ground. Inspect whether the circuit is short to power supply. If there is no short circuit, repair the faulty part.



Test Items	Standard Value
EN16(4)-EN01(76)Resistance value	Less than 1 Ω
Voltage Between EN16 (4) and A Reliable Ground	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

(a) Refer to 2.12.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 9	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.

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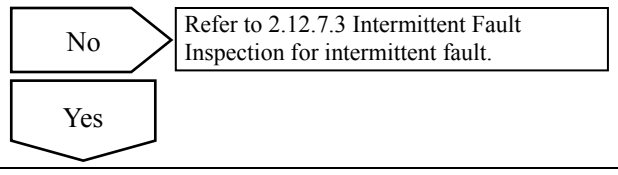

Step 10	Troubleshooting

5. Maintenance guide :

Replace intake pressure temperature sensor. Refer to 2.12.8.3 Replacement of Intake Pressure Temperature Sensor.

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2.12.7.20 DTC P0117 P0118

1. DTC description:

DTC	**P0117**	Temperature Sensor of Engine Coolant Circuit Voltage Too Low

DTC	**P0118**	Temperature Sensor of Engine Coolant Circuit High Voltage or Open Circuit A

ECT sensor is a variable resistor with a negative temperature coefficient and used to measure the temperature of engine coolant. ECM provides a 5V voltage through ECM harness connector EN01 terminal No.49 to ECT sensor harness connector EN23 terminal No.3 and a low internal reference voltage through EN01 terminal No.74 to ECT sensor connector EN23 terminal No.1. ECM will always record the length of time the ignition switched off. When starting, if the ignition switched off time reaches the pre-set time, the engine control module will compare the engine coolant temperature and intake air temperature in order to determine whether the difference between the two is in normal working range.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0117	More Than the Upper Limit	1. Idle 2. Coolant temperature sensor circuit is short to ground. 3. Coolant temperature by default changes as the running time changes.	1. Sensor Circuit 2. Sensor 3. ECM.
P0118	Lower Than the Lower Limit	1. Idle 2. Coolant temperature sensor signal circuit is open or short to 5V voltage. 3. Coolant temperature by default changes as the running time changes.	

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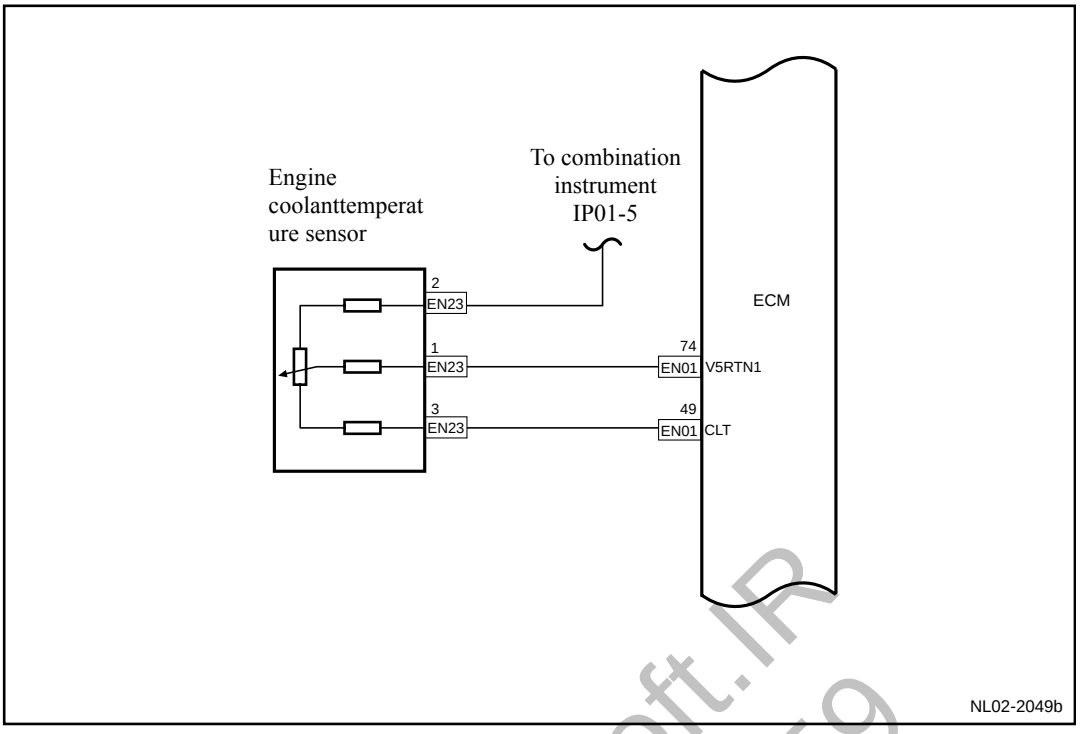
3. Circuit sketch



4. Diagnostic Steps:

Warning!

See Warnings Regarding Cooling System in Warnings and Cautions.

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Note: At any time do not use flammable antifreeze, such as alcohol. Combustible antifreeze can cause serious fires.

Step 1	Initial Inspection

(a) Inspect the temperature sensor of engine coolant for whether there is evidence of corrosion, as well as the engine coolant is leaking through the sensor.

(b) Inspect whether the engine coolant level in the reservoir of cooling system is correct.

Next

Step 2	Measure resistance of temperature sensor of engine coolant.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the temperature sensor of engine coolant harness connector EN23.

(c) Measure the resistance of temperature sensor of engine coolant.

Standard Resistance: (Refer to 2.12.1.2 Temperature and Resistance Correlation of Temperature Sensor to get the the specific parameters.): 3511-2726.8Ω/20°C(68ºF)

(d) Connect the temperature sensor of engine coolant harness connector EN23.

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Is resistance the specified value?

No → Replace the temperature sensor of engine coolant, go to step 9.

Yes

Step 3	Measure temperature sensor of engine coolant signal circuit.

(a) Rotated ignition switch to OFF position .

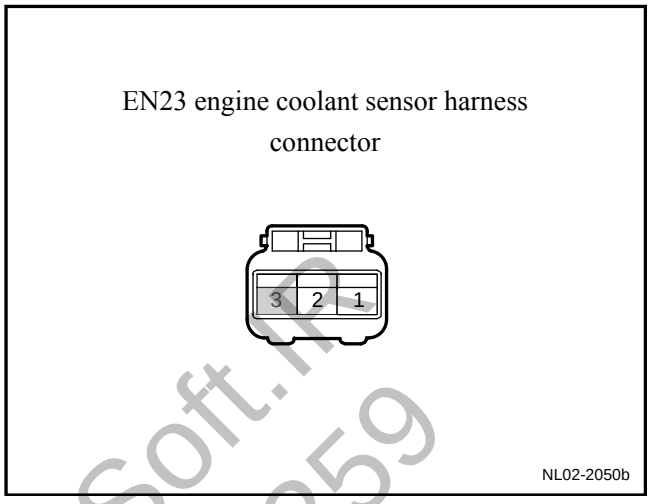
(b) Disconnect the temperature sensor of engine coolant harness connector EN23.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between temperature sensor of engine coolant EN23 terminal No.3 and a reliable ground.

Standard Voltage: 4.7-5.5V

(e) Connect the temperature sensor of engine coolant harness connector EN23.



Is the voltage normal?

No → Go to step 5

Yes

Step 4	Measure ground circuit of temperature sensor of engine coolant.

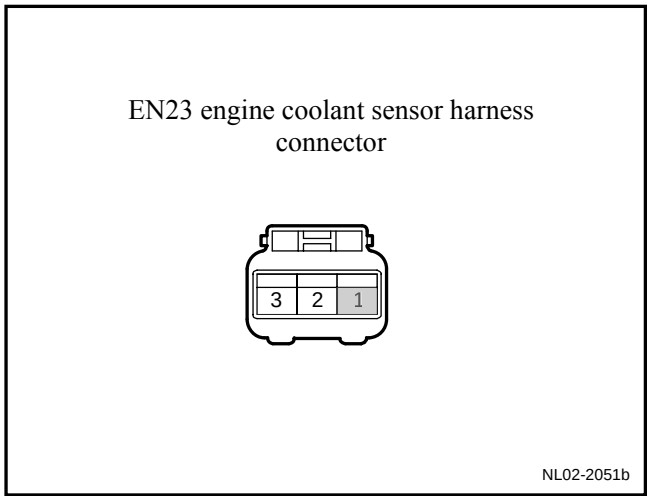
(a) Rotated ignition switch to OFF position .

(b) Disconnect the temperature sensor of engine coolant harness connector EN23.

(c) Rotated ignition switch to ON position .

(d) Measure resistance between temperature sensor of engine coolant harness connector EN23 terminal No.1 and reliable ground.

Standard Resistance: Less than 3 Ω



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(e) Connect the temperature sensor of engine coolant harness connector EN23.

Is the resistance normal?

No	Go to step 6
Yes	Go to step 7

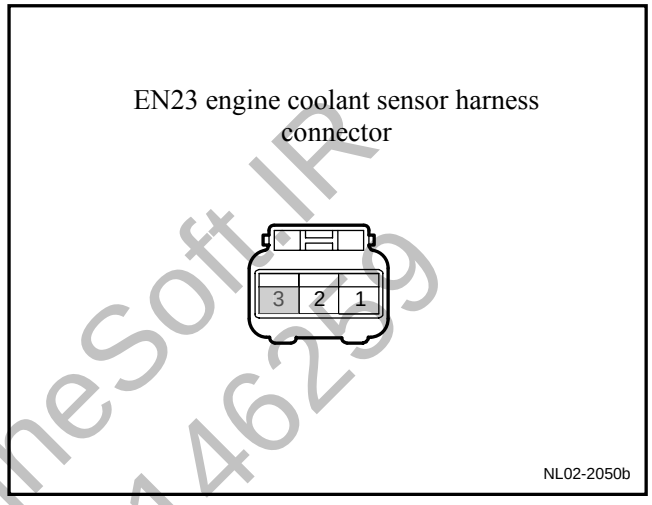
Step 5	Inspect the temperature sensor of engine coolant signal circuit.

(a) Rotated ignition switch to OFF position .

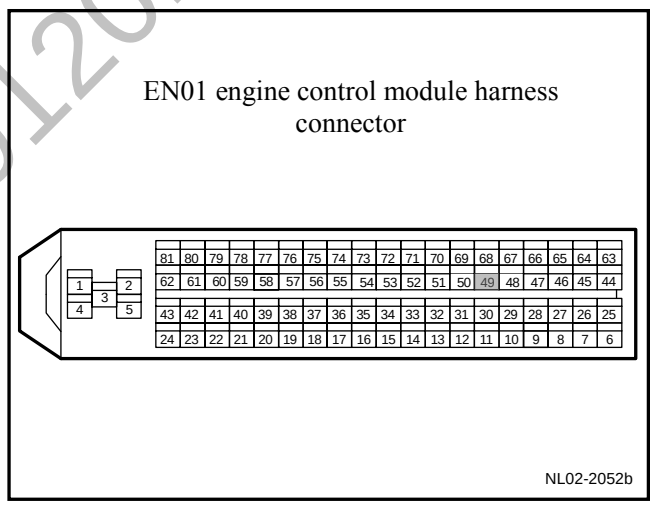
(b) Disconnect the temperature sensor of engine coolant harness connector EN23.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between engine coolant temperature sensor wire harness connector EM23 terminal 3 and ECM wire harness connector terminal 49. Inspect whether there is short-circuit situation.



(e) Measure resistance between engine coolant temperature sensor wire harness connector EN23 terminal 3 and reliable grounding. Inspect whether there is grounding short-circuit.



(f) Measure voltage between temperature sensor of engine coolant wiring harness connector EN23 terminal No.3 and a reliable ground. Inspect whether the circuit is short to power supply.

Test Items	**Standard Value**
EN23(3)-EN01(49)Resistance value	Less than 1 Ω

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Resistance Between EN23 (3) and a Reliable Ground	10kΩ 或更高
Voltage Between EN23 (3) and a Reliable Ground	0V

Next → Go to step 7

Step 6	Inspect the temperature sensor of engine coolant ground circuit.

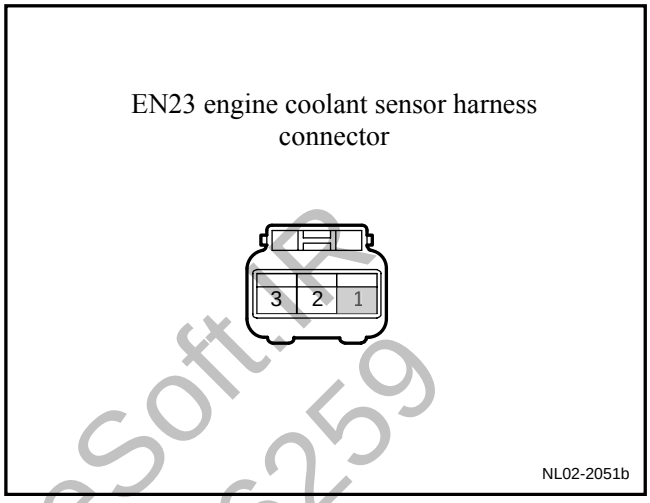
(a) Rotated ignition switch to OFF position .

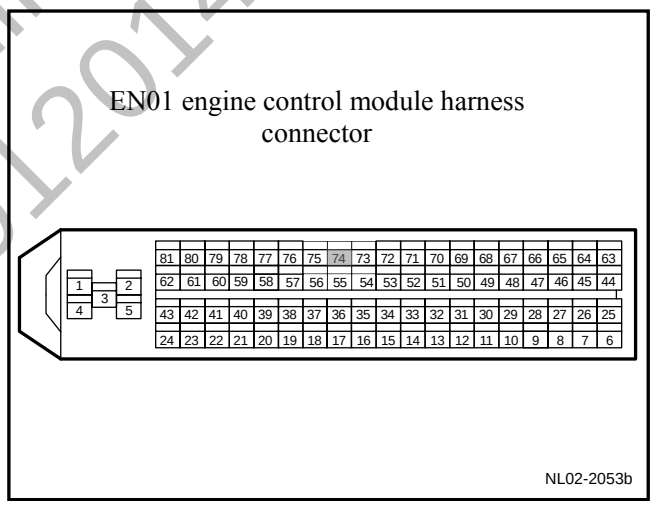
(b) Disconnect the temperature sensor of engine coolant harness connector EN23.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between engine coolant temperature sensor wire harness connector EN23 terminal 1 and ECM wire harness connector terminal 74. Inspect whether there is short-circuit situation, if yes, repair fault position.

(e) Measure voltage between temperature sensor of engine coolant harness connector EN23 terminal No.1 and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.





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Test Items	**Standard Value**
EN23(3)-EN01(29)	Less than 1 Ω
Voltage Between EN23 (3) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

(a) Refer to 2.12.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 9	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 10	Troubleshooting

5. Maintenance guide :

Replace the temperature sensor of engine coolant. Refer to 2.12.8.2 Replacement of temperature sensor of engine coolant.

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2.12.7.21 DTC P0122 P0123

1. DTC description:

DTC	**P0122**	Electronic Throttle Position Sensor #1 Circuit Low Voltage

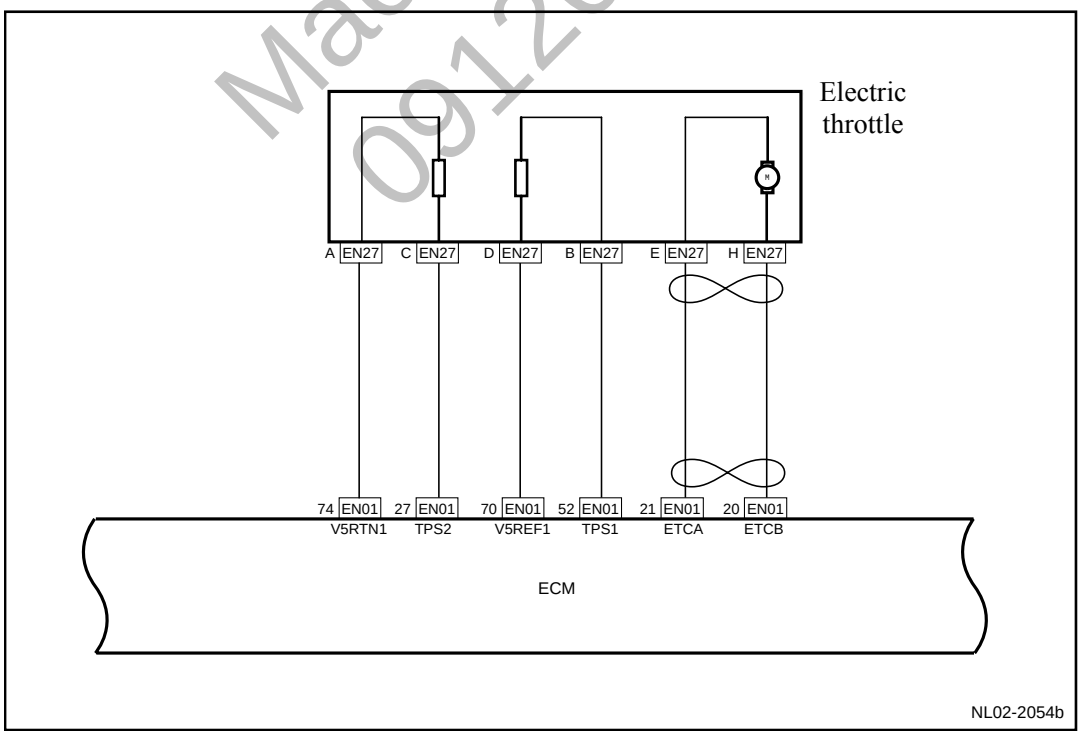
DTC	**P0123**	Electronic Throttle Position Sensor 1 Circuit High Voltage or open

TPS1 sensor sends signal through ECT harness connector EN27 terminal B to ECM through ECM harness connector EN01 terminal No.52. If the TPS1 sensor signal is lost, but ECM is able to receive the normal TPS2 sensor signal, then ECM controls the engine to enter reliability of determining the driver's intention decline or no high power output mode. Engine responds to the pedal changes slowly and engine power output will be significantly weaker, although the vehicle can still be able to drive in normal traffic.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0122	Hardware Circuit Malfunction	TPS signal end short to ground or open, the input signal is less than 3.5%, DTC code set.	1. Electronic Throttle Body 2. Electronic Throttle Circuit 3. ECM
P0123	Hardware Circuit Malfunction	TPS signal end short to power supply, input signal is greater than 96.5%, DTC code set.	

3. Circuit sketch



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4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Inspect for DTC code P0641, P0651, P0222, P0223.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Results

DTC Codes Shown	**Go to Step**
Only for P0122、P0123	Yes
has P0222 , P0223 , P0641 , P0651	No

No → Refer to2. 12.7.46 DTC P0641 P0651

Yes

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Step 2	Check EN27 Nub terminal .

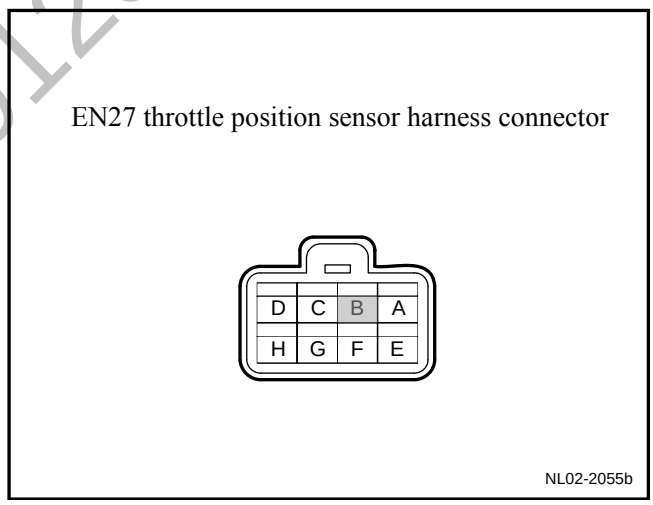
(a) Rotated ignition switch to OFF position.

(b) Disconnect ETC harness connector EN27.

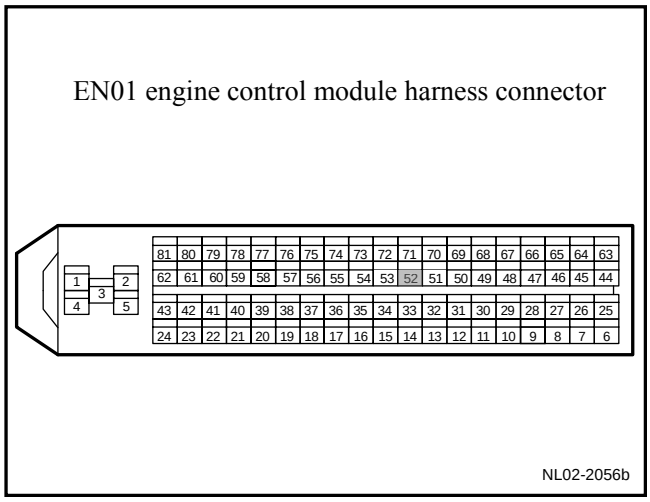
(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between EN27 terminal B and a reliable ground.

(e) Measure voltage between EN27 terminal B and a reliable ground.



(f) Test continuity between EN27 terminal B and EN01 terminal No.52.



Results

Test Items	**Standard Value**
EN27(B)-reliable grounding	10 kΩ or higher
EN27(B)-Reliable grounding voltage value	0V
EN27(B)-EN01(52)Continuity	Less than 1 Ω

Does it conform to the standard value?

No → Refer to2. 12.7.46 DTC P0641 P0651

Yes

Step 3	Inspect terminal B voltage output signal.

(a) Connect to ETC harness connector EN27.

(b) Connect ECM harness connector EN01.

(c) Measure ETC harness connector EN27 terminal B output voltage.

Standard Value: Refer to 2.12.7.12 Electronic Throttle Body (ETC) Inspection.

Is the output voltage value accorded with the standard value?

No → Refer to Replacement of Electrical Throttle Body Assembly to replace the Electrical Throttle Body (ETC).

Yes

Step 4	Inspect ECM Power Supply Circuit and ground circuit.

(a) Refer to 2.12.7.43 DTC P0562 P0563 to inspect ECM Power Supply Circuit and ground circuit.

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ECM power and ground circuits normal?

No → Repair power and ground circuits fault.

Yes

Step 5	Replace ECM

(a) Refer to 2.12.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 6	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 7	Troubleshooting

5. Maintenance guide :

Electronic throttle body (ETC) can only be replaced as an assembly. Do not disassemble it and repair. Refer to 2.6.8.5 Replacement of Electrical Throttle Body Assembly for the replacement of the ETC.

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2.12.7.22 DTC P0131 P0132 P0133 P0134

1. DTC description:

DTC	P0131	Front Oxygen Sensor Circuit Short to Low Voltage

DTC	P0132	Front Oxygen Sensor Circuit Short to High Voltage

DTC	P0133	Slow response of front oxygen sensor

DTC	P0134	Front Oxygen sensor is open

After the vehicle started, ECM works in open-loop mode, in which ECM ignores the front oxygen sensor signal voltage when calculating the Air-Fuel ratio. The control module provides approximately 450mV reference voltage to the front oxygen sensor. When the engine starts running, the front oxygen sensor will be heated and begin to generate a 0-0.1 V voltage. This voltage fluctuates. Once ECM detects that the front oxygen sensor voltage exceeds a preset threshold voltage, ECM immediately enters into the closed-loop mode. Control module determines the Air-fuel ratio using the received front oxygen sensor voltage signal. If the front oxygen sensor voltage increases to over the reference voltage (tend to 1 V), it indicates that the air fuel mixture is too rich. If the front oxygen sensor's voltage decreased to below the reference voltage (tend to 0 mV), the mixture is too thin.

ECM provides a signal through ECM harness connector EN01 terminal No.10 to front oxygen sensor harness connector EN02 terminal B and an internal low reference voltage through ECM harness connector EN01 terminal No.2 to front oxygen sensor wiring harness connector EM02 terminal No. A.

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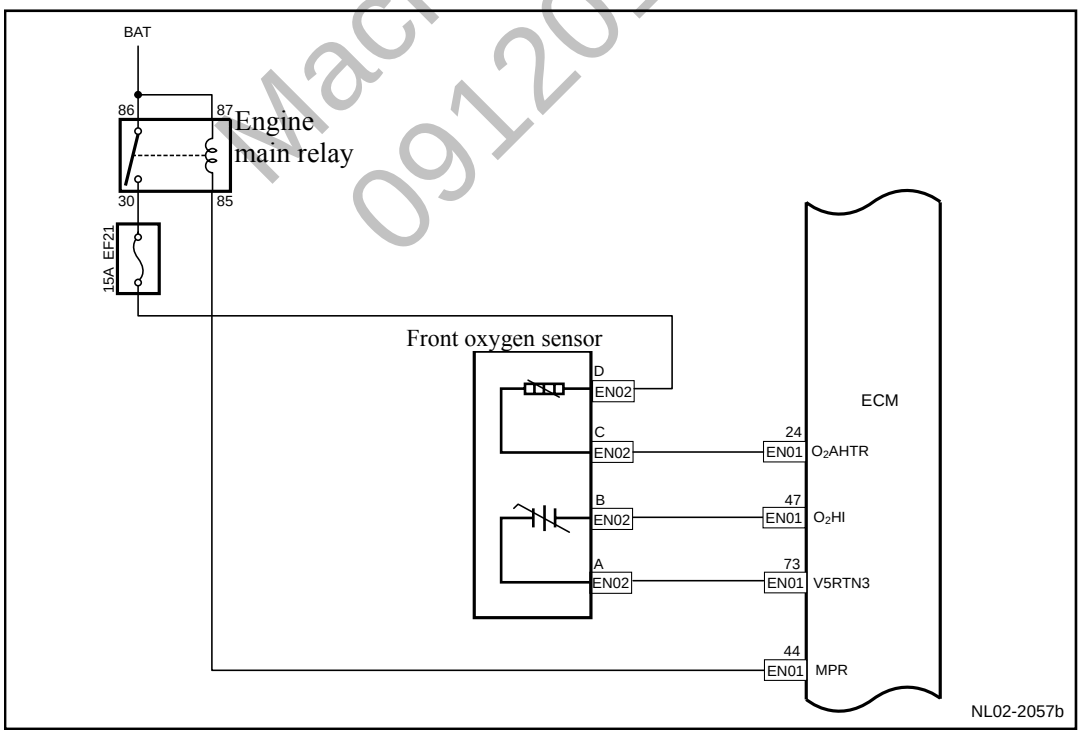
2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0131	1. Front Oxygen Sensor Voltage Too High 2. Pre-Catalytic Oxygen Sensor Voltage Too Low	1. Engine Running Longer than 60s. 2. Water temperature is more than 70℃(158 ºF) 3. Short circuit of front oxygen sensor to grounding. 4. Duration Longer Than 13s.	1. Sensor Circuit 2. Sensor 3. ECM.
P0132		1. Engine Running Longer than 60s. 2. Water temperature is more	

		than 70℃(158 ºF) 3. Shortly connect front oxygen sensor signal and power supply. 4. Duration Longer Than 13s.	
P0133	The time for the variation of the oxygen sensor against the oxygen concentration in the exhaust emissions exceeds the upper limit. The time for the variation of the oxygen sensor against the oxygen concentration in the exhaust emissions exceeds the lower limit.	1. Engine Running Longer than 60s. 2. Water temperature is more than 70℃(158 ºF) 3. Engine speed range is 1,700-2,300 rpm. 4. Oxygen sensors to the exhaust oxygen concentration changes responding time longer than the system preset threshold.	1. Sensor Circuit 2. Sensor 3. ECM 4.Mixture is too thick 5.Mixture Too Lean
P0134	1. Signal Circuit Open. 2.Oxygen Sensors High-Temperature and High Resistance.	1. Engine Running Longer than 60s. 2. Water temperature is more than 70℃(158 ºF) 3. Duration Longer Than 80s.	1. Sensor Circuit 2. Sensor 3. ECM

3. Circuit sketch



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4. Diagnostic Steps:

Step 1	Connect a fault diagnosis tester.

Next

Step 2	Start engine and turn on the fault diagnosis tester.

Next

Step 3	(c) Keep the engine speed at 2,500 rpm for more than 2 min to warm up the engine, until the engine coolant temperature reaches 80°C (176ºF)

Next

Step 4	Select on the fault diagnosis tester: Engine / Read Data Flow / Group 1 Oxygen Sensor Voltage 1 (front oxygen sensor).

Next

Step 5	Observe the pre-catalytic oxygen sensor output voltage. The data stream should fluctuate within 0.1-0.8 V.

Yes — Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

No

Step 6	Test the oxygen sensor signal.

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(a) If the voltage data is consistently lower than 0.45 V (mixture too thin), carry out the following inspection steps:

- Spray proper amount of propane gas into the intake.
- Inspect whether the front oxygen sensor voltage data has a significant change, in which case the signal voltage will increase rapidly.

(b) If the voltage data is consistently higher than 0.45V (mixture too thick), carry out the following inspection steps:

- Put the gear into neutral.
- Apply hand brake.
- Press the accelerator pedal so the engine speed suddenly increases to 4,000 rpm and then quickly release the accelerator pedal.
- Repeat the previous step more than 3 times.
- Observe whether there is a significant change in the front oxygen sensor voltage data, as the signal voltage will decrease rapidly.

During the above test, the oxygen sensor signal voltage should have a significant change.

Is voltage changed significantly?

Yes → Inspect the cause for engine air-fuel ratio too lean/too rich. Refer to 2.12.7.4 Fault Symptom Table.

No

Step 6	Inspect there are no other control system DTC codes output.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Results

DTC Codes Shown	**To Step**
DTC was except for P0131、P0133、P0134	No
P0131、P0133、P0134	Yes

No → Refer to 2.12.7.14 DTC Chapter Index.

Yes

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Step 8	Measure Pre-Sensor Signal Circuit

(a) Rotated ignition switch to OFF position .

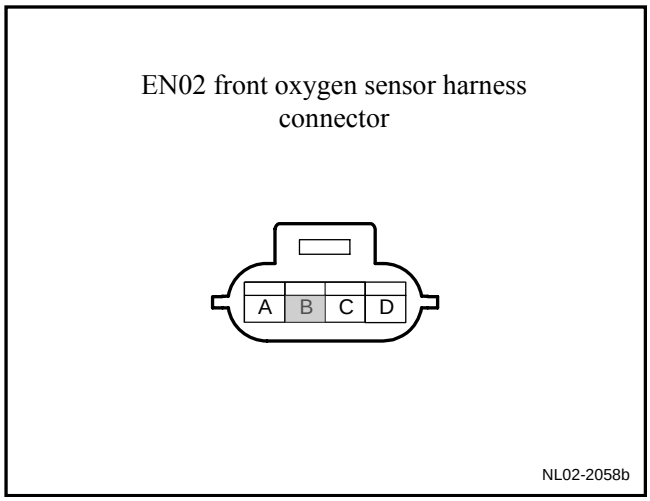
(b) Disconnect the front oxygen sensor harness connector EN02.

(c) Rotated ignition switch to ON position .

(d) Measure the voltage value between the front oxygen sensor wiring harness connector EN02 terminal No.B and reliable ground.

Standard Voltage: 0.35-0.5V

(e) Connect the front oxygen sensor harness connector EN02.



Is voltage the specified value?

No → Go to step 11

Yes

Step 9	Measure pre-catalytic oxygen sensor ground circuit.

(a) Rotated ignition switch to OFF position .

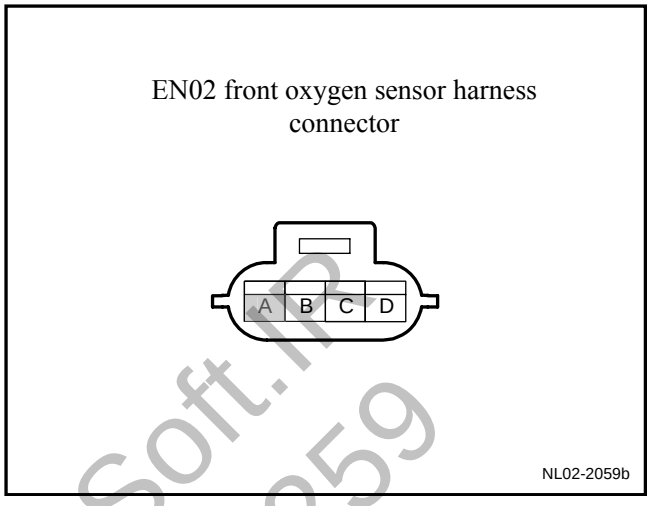
(b) Disconnect the front oxygen sensor harness connector EN02.

(c) Rotated ignition switch to ON position .

(d) Measure resistance between front oxygen sensor EN02 terminal A and a reliable ground.

Standard Resistance: Less than 1 Ω

(e) Connect the front oxygen sensor harness connector EN02.



Is resistance the specified value?

No → Go to step 12

Yes

Step 10	Refer to 2.4.6.2 “Replacement of Front Oxygen Sensor” to replace the front oxygen sensor

Next → Go to step 15

Step 11	Inspect the front oxygen sensor signal circuit.

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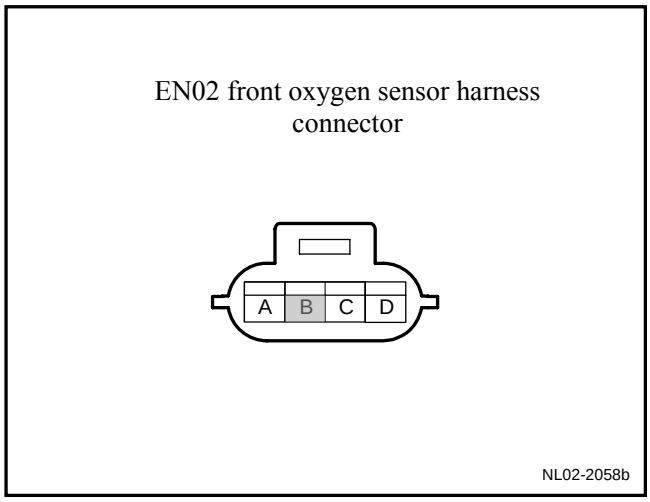
(a) Rotated ignition switch to OFF position .

(b) Disconnect the front oxygen sensor harness connector EN02.

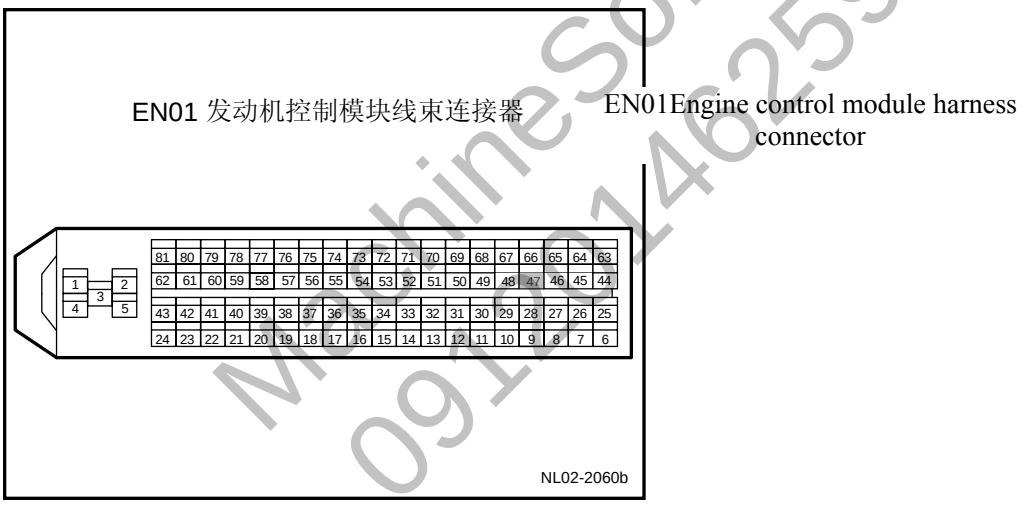
(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between front oxygen sensor wiring harness connector EN02 terminal B and ECM harness connector terminal No.47. Inspect whether the circuit is open. Otherwise, repair the faulty part.



(e) Measure resistance between front oxygen sensor wiring harness connector EN02 terminal B and a reliable ground. Inspect whether the circuit is short to ground. otherwise, repair the faulty part.

(f) Measure voltage between front oxygen sensor wiring harness connector EN02 terminal B and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.



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Test Items	**Standard Value**
EN02(B)-EN01(47)Resistance value	Less than 1 Ω
EN02(B)-reliable grounding resistance value	10 kΩ or higher
EN02(B)-Reliable grounding voltage value	0V

Normal	Go to step 15

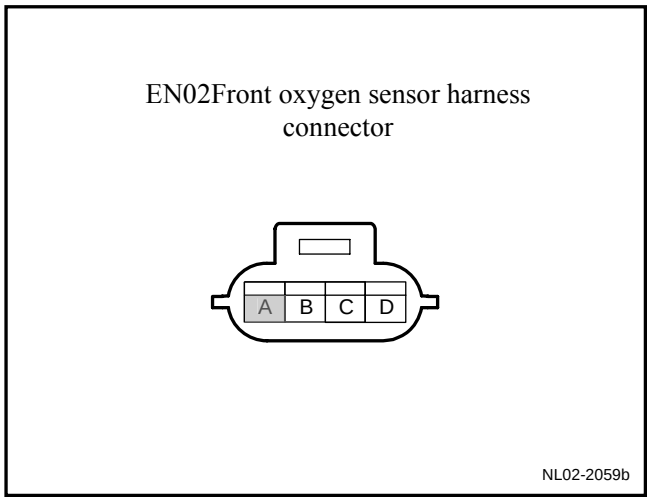
Step 12	Inspect the front oxygen sensor ground circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the front oxygen sensor harness connector EN02.

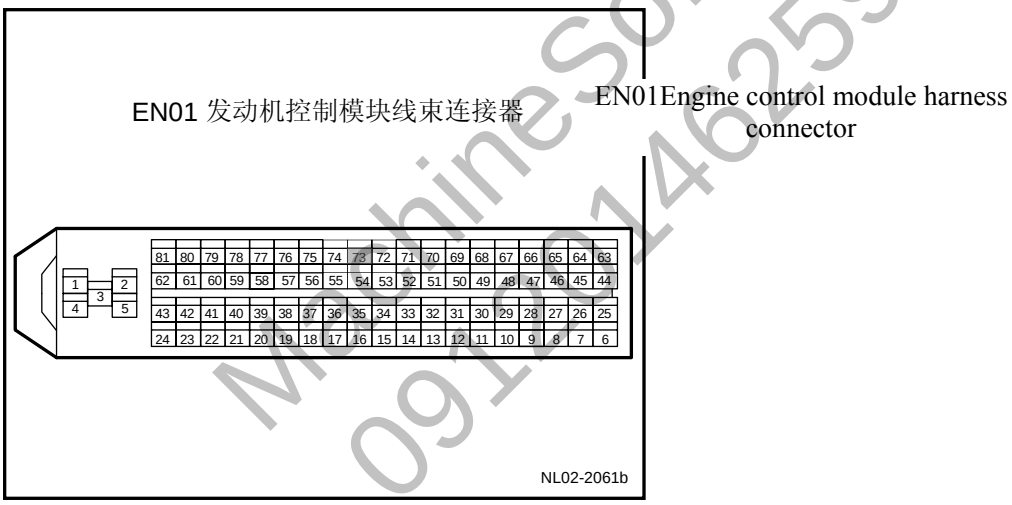
(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between front oxygen sensor wiring harness connector EN02 terminal A and ECM harness connector terminal No.73. Inspect whether the circuit is open. otherwise, repair the faulty part.



(e) Measure resistance between front oxygen sensor wiring harness connector EN02 terminal A and a reliable ground. Inspect whether the circuit is short to ground. otherwise, repair the faulty part.

(f) Measure voltage between front oxygen sensor wiring harness connector EN05 terminal A and a reliable ground. Inspect whether the circuit is short to power supply. otherwise, repair the faulty part.



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Test Items	**Standard Value**
EN02(A)-EN01(73)Resistance value	Less than 1 Ω
EN02(A)-reliable grounding resistance value	10 kΩ or higher
EN02(A)-Reliable grounding voltage value	0V

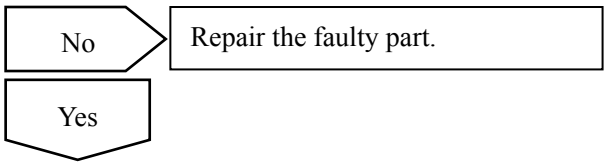
Execute next step as per normal.

Yes

Step 13	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.



Step 14	Replace ECM

(a) Refer to 2.12.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Step 15	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

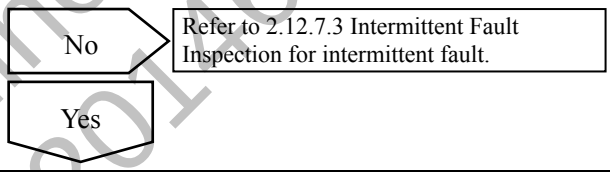
(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 16	Troubleshooting

5. Maintenance guide :

Refer to 2.4.6.1 “Replacement of Front Oxygen Sensor” to replace the front oxygen sensor

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2.12.7.23 DTC P0135

1. DTC description:

DTC	P0135	Front oxygen sensor heater fails

The pre-catalytic heated oxygen sensor (HO2S) is used for fuel control. The sensor compares the oxygen content in ambient air and oxygen content in the exhaust flow. Each heated oxygen sensor has an internal heating element for sensor heating. ECM controls the heated oxygen sensor heating control circuit. This makes the system enter into the closed-loop control mode earlier, so that ECM can calculate Air-fuel ratio earlier. ECM controls the heating control circuit switched on or off, so that heated type oxygen sensor working temperature maintains in the specified range. Engine control module detects the temperature by Measure the heater current.

The front oxygen sensor heating coil voltage is provided by the main Relay, which is controlled by ECM. When the ignition switch is turned to "ON" position, harness connector EN02 terminal No.D voltage is provided by the battery. ECM controls heater working hours through ECM harness connector EN01 terminal No.14.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0135	Hardware Circuit Inspection	1. Engine Running Longer than 60 s. 2. At idle Running Condition. 3. Pre-Catalytic Oxygen Sensor Heating 4. Pre-Catalytic Oxygen Sensor Heating Control Terminal Disconnected. 5. Duration Less Than 20s.	1. Sensor Circuit 2. Sensor 3. ECM.

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3. Circuit sketch

Refer to 2.12.7.22 DTC P0131 P0132 P0133 P0134.

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Inspect the existence of following factors that will affect the heated type oxygen sensor working status:

(a) Exhaust system leakage or blockage.

(b) Water enters into the heated oxygen sensor connector.

(c) After engine working in high temperature, whether exhaust pipes are too hot or not.

Next

Step 2	Inspect front oxygen sensor heater resistance.

(a) Rotated ignition switch to OFF position .

(b) Disconnect front oxygen sensor wiring harness connector.

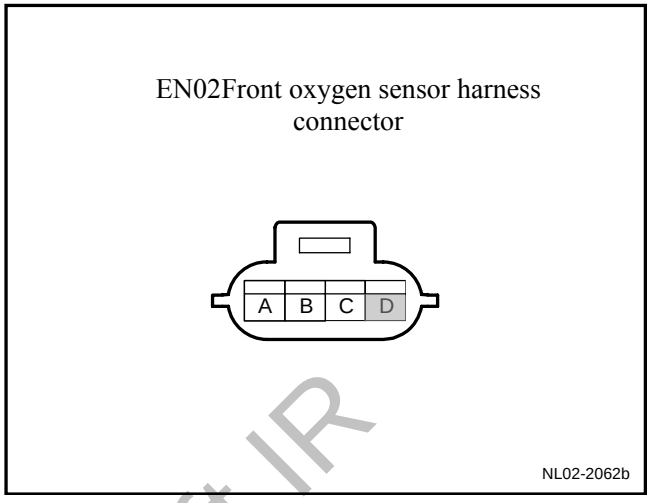
(c) Measure heater resistance between front oxygen sensor terminals C and D.

Standard Resistance

20℃(68ºF) 8.1-11.1Ω

(d) Connect front oxygen sensor wiring harness connector.

Is resistance the specified value?



No → Replace the front oxygen sensor. Go to step 11.

Yes

Step 3	Inspect the terminal No.D to ground voltage.

(a) Rotated ignition switch to OFF position .

(b) Disconnect front oxygen sensor wiring harness connector.

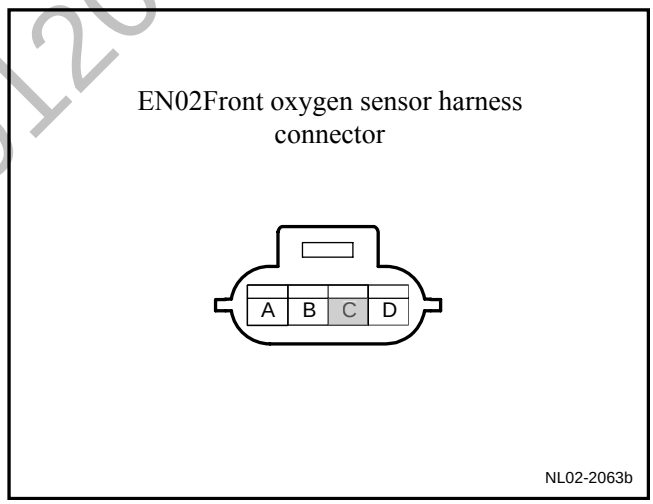
(c) Rotated ignition switch to ON position .

(d) Measure the front oxygen sensor harness connector EN02 terminal No.D to ground voltage.

Standard Voltage: 11-14V

(e) Connect the front oxygen sensor harness connector EN02.

Is voltage the specified value?



No → Front oxygen sensor heater power supply circuit fault

Yes

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Step 4	Inspect the front oxygen sensor terminal heating control signal continuity.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the front oxygen sensor harness connector EN02.

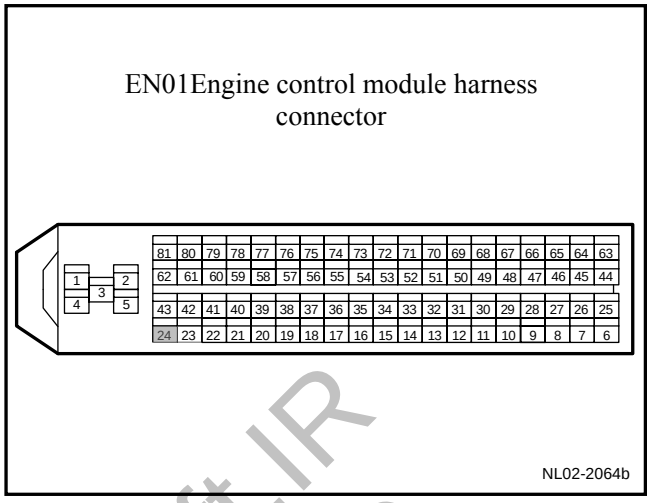
(c) Disconnect ECM harness connector EN01.

(d) Test Continuity between front oxygen sensor wiring harness connector EN02 terminal C and ECM harness connector EM01 terminal No.24.

Standard Resistance: Less than 1 Ω

(e) Connect ECM harness connector EN01.

(f) Connect the front oxygen sensor harness connector EN02.



Is resistance the specified value?

No → ECM control circuit malfunction

Yes

Step 5	Inspect ECM working circuit.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 6	Replace ECM. Refer to 2.12.8.1 Replacement of Engine Control Module.

(a) Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Yes

Step 7	Use fault diagnosis tester to confirm if DTC is stored again .

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(a) Connect the fault diagnosis tester to the diagnostic interface.

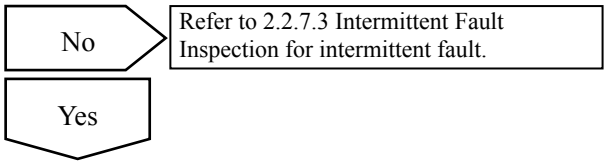
(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 5min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 8	Troubleshooting

5. Maintenance guide:

Refer to 2.4.6.2 “Replacement of Front Oxygen Sensor” to replace the front oxygen sensor

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2.12.7.24 DTC P0137 P0138 P0140

1. DTC description:

DTC	P0137	Rear Oxygen Sensor Circuit Short to Low Voltage

DTC	P0138	Rear Oxygen Sensor Circuit Short to High Voltage

DTC	P0140	Rear Oxygen Sensor Circuit Open

After the vehicle started, ECM works in open-loop mode, in which ECM ignores the heated type oxygen sensor signal voltage when calculating the Air-Fuel ratio. The control module provides approximately 450mV reference voltage to the heated oxygen sensor. When the engine starts running, the heated type oxygen sensor will be heated and begin to generate a 0-0.1V voltage. This voltage fluctuates. Once the control module detects that the heated oxygen sensor voltage exceeds a threshold voltage, it will immediately enter into the closed-loop mode. Control module determines the Air-fuel ratio using the received heated oxygen sensor voltage signal. If the heated type oxygen sensor voltage increases to above the reference voltage (tend to 1 V), the mixture is too thick. If the heated oxygen sensor voltage decreases to below the reference voltage (tend to 0mV), it indicates that the air fuel mixture is too thin.

- ECM provides a signal through ECM harness connector EN01 terminal No.48 to rear oxygen sensor wiring harness connector EN03 terminal B.
- ECM provides an internal low reference voltage through ECM harness connector EM01 terminal No.73 to front oxygen sensor wiring harness connector EM03 terminal No.A.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0137	Short to Ground When Cold	1. Engine Running Longer than 60s. 2. Water temperature is more than 70℃(158 ºF) 3. Rear Oxygen Sensor Short to Ground 4. Duration Longer Than 25s.	1. Sensor Circuit 2. Sensor 3. ECM.
P0138	Post-catalytic Oxygen Sensor Voltage Too High	1. Engine Running Longer than 60s. 2. Water temperature is more than 70℃(158 ºF) 3. Rear oxygen sensor signal is terminated at the power supply. 4. Duration Longer Than 13s.	
P0140	1. Oxygen Sensor	1. Engine Running Longer than 60s.	

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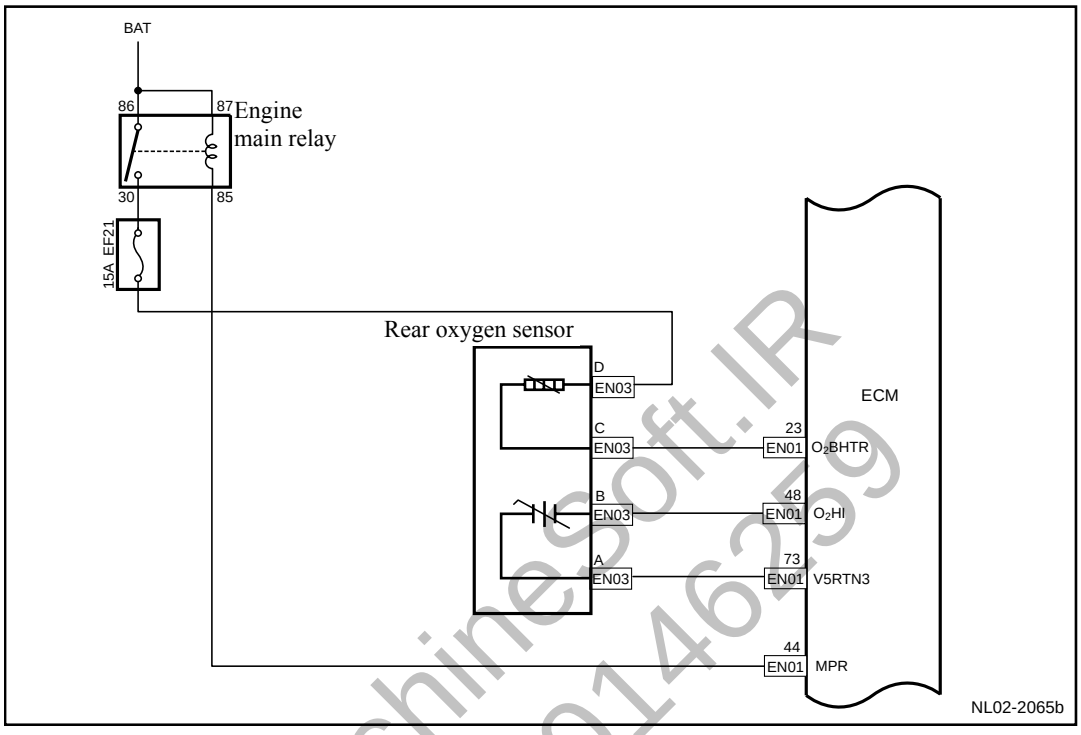
	Signal Circuit Open 2. Oxygen Sensor With High Resistance at High Temperature	2. Water temperature is more than 70℃(158 ºF) 3. Rear oxygen sensor signal exceeds a reasonable range. 4. Duration Longer Than 165s.	

3. Circuit sketch



4. Diagnostic Steps:

Step 1	Connect a fault diagnosis tester.

Next

Step 2	Start engine and turn on the fault diagnosis tester.

Next

Step 3	(d) Select on the fault diagnosis tester: Engine / Read Data Flow / Group 1 Oxygen Sensor Voltage 2 (Rear Oxygen Sensor).

Next

Step 4	Observe oxygen sensor output voltage, the data should be within 0.16-0.7V unchanged.

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Yes → Intermittent fault refers to 2.12.7.3 List of Intermittent Fault.

No

Step 5	Carry out the oxygen sensor signal test.

(a) If the voltage data is consistently lower than 0.45 V (mixture too thin), carry out the following inspection steps:

- Spray proper amount of propane gas into the intake.
- Check whether the rear oxygen sensor voltage data has a significant change, as it will cause signal voltage to rise rapidly.

(b) If the voltage data is consistently higher than 0.45 V (mixture too thick), carry out the following inspection steps:

- Put the transmission gear into neutral.
- Apply hand brake.
- Press the accelerator pedal so the engine speed suddenly increases to 4,000 rpm and then quickly release the accelerator pedal.
- Repeat the previous steps more than 3 times.
- Check whether the rear oxygen sensor voltage data has a significant change, as it will cause signal voltage to decrease rapidly.

During the above test, the oxygen sensor signal voltage should have a significant change.

Is voltage changed significantly?

Yes → Inspect the cause for engine air-fuel ratio too lean/too rich. Refer to 2.12.7.4 Fault Symptom Table.

No

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Step 6	Inspect there are no other control system DTC codes output.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

DTC Codes Shown	**To Step**
DTC except for P0137,P0138,P0140	No
P0137、P0138、P0140	Yes

No → Refer to 2.12.7.14 DTC Chapter Index.

Yes

Step 7	Inspect the sealing of exhaust system.

(a) Inspect whether the three-way catalytic converter looks good (signs of excessive heat and gasket missing, etc.).

(b) Inspect whether the exhaust pipe is intact and whether gasket is intact.

No → Replace the damaged components. Go to step 15.

Step 8	Measure rear oxygen sensor signal circuit.

(a) Rotated ignition switch to OFF position .

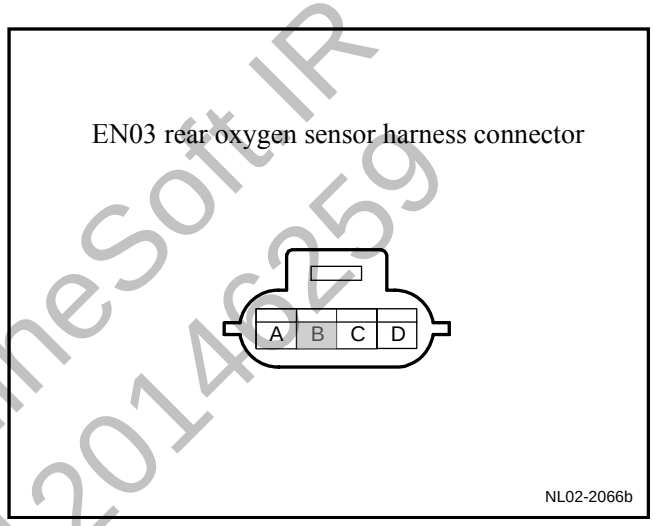
(b) Disconnect the rear oxygen sensor harness connector EN03.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between rear oxygen sensor wiring harness connector EN03 terminal B and a reliable ground.

Standard Voltage: 0.35-0.5V

(e) Connect the rear oxygen sensor harness connector EN03.



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Is voltage the specified value?

No → Go to step 11

Yes

Step 9	Measure the rear oxygen sensor ground circuit.

(a) Rotated ignition switch to OFF position .

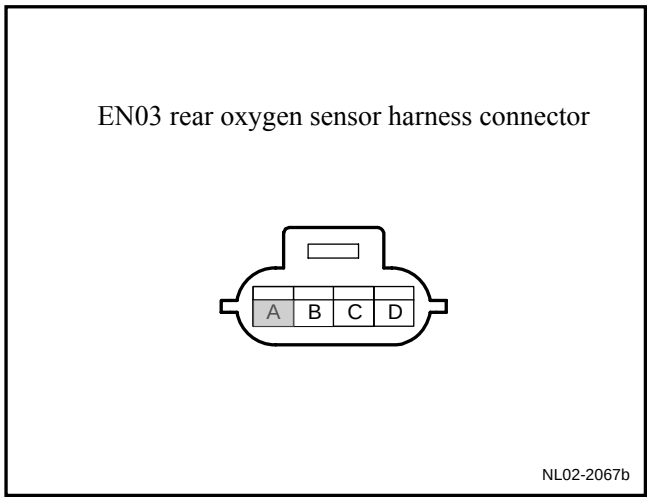
(b) Disconnect the rear oxygen sensor harness connector EN03.

(c) Rotated ignition switch to ON position .

(d) Measure resistance between rear oxygen sensor EN03 terminal A and a reliable ground.

Standard Resistance: Less than 1 Ω

(e) Connect the rear oxygen sensor harness connector EN03.



Is resistance the specified value?

No	Go to step 12
Yes	

Step 10	Replace the rear oxygen sensor.
Next	Go to step 15

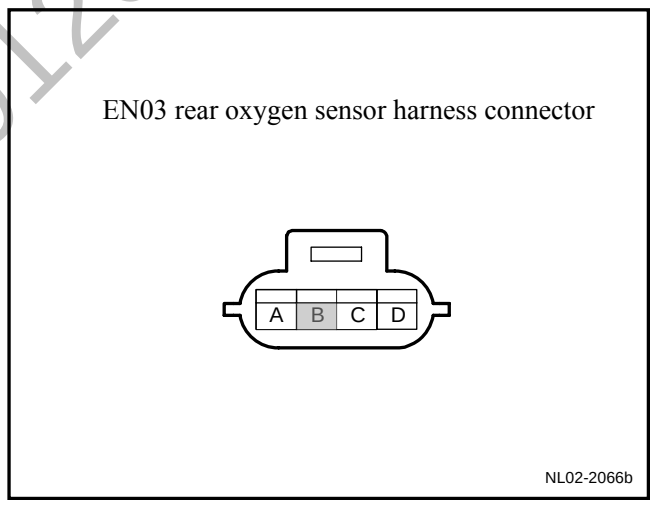
Step 11	Inspect the rear oxygen sensor signal circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the rear oxygen sensor harness connector EN03.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between rear oxygen sensor wiring harness connector EN03 terminal B and ECM harness connector terminal No.48. Inspect whether the circuit is open. otherwise, repair the faulty part.



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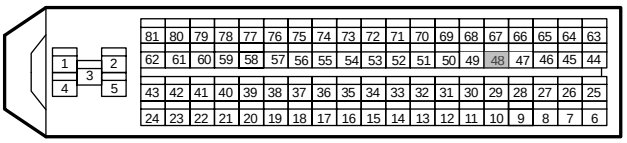
(e) Measure resistance between rear oxygen sensor harness connector EN03 terminal No.B and a reliable ground. Inspect whether the circuit is short to ground. If there is no short circuit, repair the faulty part.

(f) Measure voltage between rear oxygen sensor harness connector EN03 terminal No.B and a reliable ground. Inspect whether the circuit is short to power supply. If there is no short circuit, repair the faulty part.

EN01 engine control module harness connector



NL02-2068b

Test Items	**Standard Value**
EN03(B)-EN01(48) Resistance value	Less than 1 Ω
Resistance Between EN03 (b) and a Reliable Ground	10kΩ 或更高
Voltage Between EN03 (b) and a Reliable Ground	0V

Normal	Go to step 13

Step 12	Inspect rear oxygen sensor ground circuit

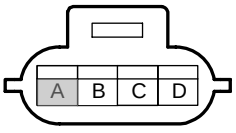
(a) Rotated ignition switch to OFF position .

(b) Disconnect the rear oxygen sensor harness connector EN03.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between rear oxygen sensor wiring harness connector EN03 terminal A and ECM harness connector terminal No.73. Inspect whether the circuit is open. otherwise, repair the faulty part.

EN03 rear oxygen sensor harness connector



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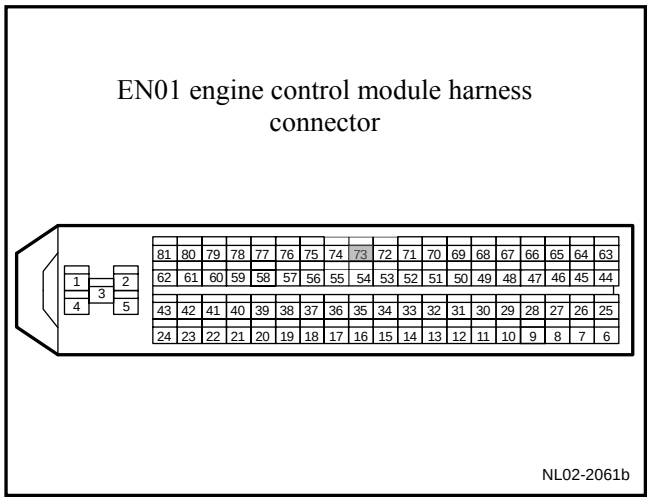
(e) Measure resistance between rear oxygen sensor harness connector EN03 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground. If there is no short circuit, repair the faulty part.

(f) Measure voltage between rear oxygen sensor harness connector EN03 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply. If there is no short circuit, repair the faulty part.



Test Items	**Standard Value**
EN03(A)-EN01(73)Resistance value	Less than 1 Ω
Resistance Between EN03 (a)and a Reliable Ground	10kΩ 或更高
Voltage Between EN03 (a) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 13	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 14	Replace ECM

(a) Refer to 2.12.8.1 Replacement of Engine Control Module to Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 15	Use fault diagnosis tester to confirm if DTC is stored again .

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(a) Connect the fault diagnosis tester to the diagnostic interface.

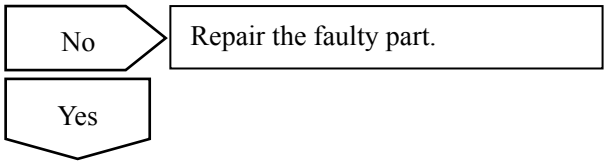
(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 16	Troubleshooting

5. Maintenance guide :

Refer to 2.4.6.1 “Replacement of Rear Oxygen Sensor” to replace the rear oxygen sensor.

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2.12.7.25 DTC P0141

1. DTC description:

DTC	P0141	Rear Oxygen Sensor Heater Inoperation

The post-catalytic heated oxygen sensor (HO2S) is used for monitoring three-way catalytic converter working status. The sensor compares the oxygen content in ambient air and oxygen content in the exhaust flow. Each heated oxygen sensor has an internal heating element for sensor heating. ECM controls the heated oxygen sensor heating control circuit. This makes the system enter into the closed-loop control mode earlier, so that ECM can calculate Air-fuel ratio earlier. ECM controls the heating control circuit switched on or off, so that heated type oxygen sensor working temperature maintains in the specified range. Engine control module detects the temperature by Measure the heater current.

The rear oxygen sensor heating coil voltage is provided by The Main Relay, which is controlled by ECM. When the ignition switch is turned to "ON" position, the rear oxygen sensor harness connector EN03 terminal No.D voltage is provided by the battery. ECM controls the heater working hours by ECM harness connector EN01 terminal No.23.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0135	Hardware Circuit Inspection	1. Engine Running Longer than 60 s. 2. At idle Running Condition. 3. Pre-Catalytic Oxygen Sensor Heating 4. Pre-Catalytic Oxygen Sensor Heating Control Terminal Disconnected. 5. Duration Less Than 20s.	1. Sensor Circuit 2. Sensor 3. ECM.

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3. Circuit sketch

Refer to2.12.7.24 DTC P0137 P0138 P0140.

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

Inspect the existence of following factors that will affect the heated type oxygen sensor working status:

(a) Exhaust system leakage or blockage.

(b) Water enters into the heated oxygen sensor connector.

(c) After engine working in high temperature, whether exhaust pipes are too hot or not.

Next

Step 2	Inspect the rear oxygen sensor heater resistance.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the rear oxygen sensor wiring harness connector.

(c) Measure the rear oxygen sensor heater resistance.

Standard Resistance

Connectors C and D, 8.1-11.1 Ω @ 20°C(68 ?F)

(d) Connect the rear oxygen sensor wiring harness connector.

Is resistance the specified value?

No → Replace the rear oxygen sensor. Refer to 2.4.7.1 Replacement of Rear Oxygen Sensor.

Yes

Step 3	Inspect the terminal No.D to ground voltage.

(a) Rotated ignition switch to OFF position .

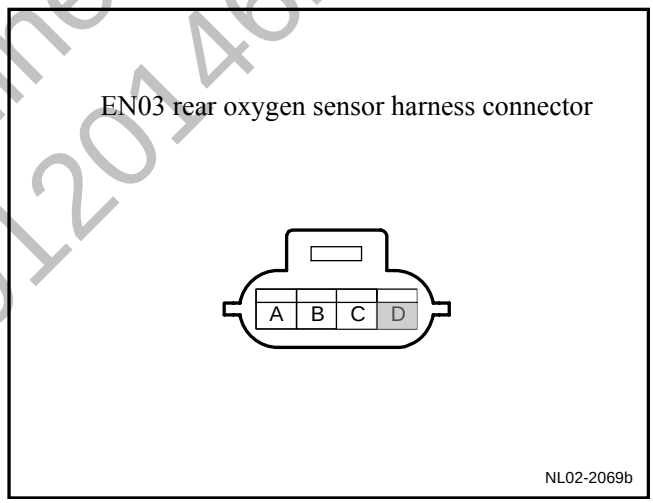
(b) Disconnect the rear oxygen sensor wiring harness connector.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between Post-Catalytic oxygen sensor harness connector EN03 terminal D and ground.

Standard Voltage: 11-14V

(e) Connect the rear oxygen sensor harness connector EN03.



Is voltage the specified value?

No → The rear oxygen sensor heater power supply circuit malfunction.

Yes

Step 4	Inspect the rear oxygen sensor heater control terminal continuity.

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(a) Rotated ignition switch to OFF position .

(b) Disconnect the rear oxygen sensor harness connector EN03.

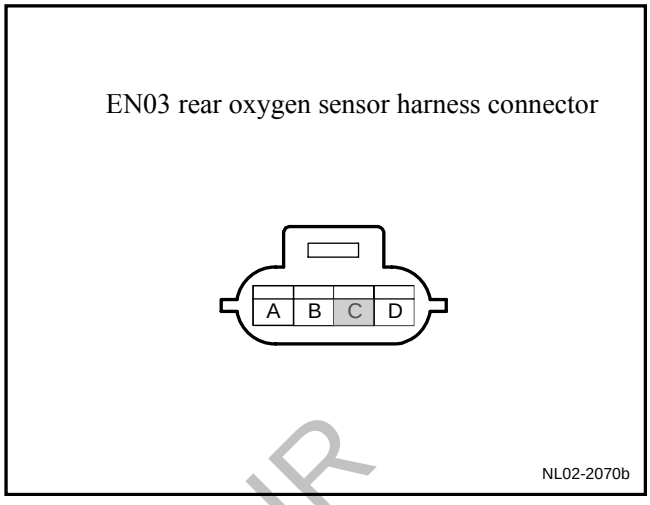
(c) Disconnect ECM harness connector EN01.

(d) Test Continuity between rear oxygen sensor wiring harness connector EN03 terminal C and ECM harness connector EN01 terminal No.23.

Standard Resistance: Less than 1 Ω

(e) Connect ECM harness connector EN01.

(f) Connect the rear oxygen sensor wiring harness connector EN03.



Is resistance the specified value?

No → ECM control circuit malfunction.

Yes

Step 5	Inspect ECM working circuit.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 6	Replace ECM. Refer to 2.12.8.1 Replacement of Engine Control Module.

(a) Replace ECM.

(b) Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 7	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

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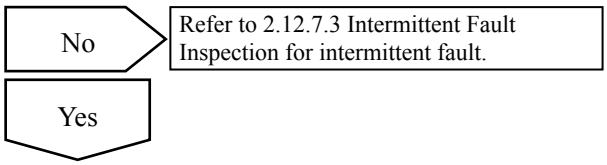
(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 5min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 8	Troubleshooting

5. Maintenance guide :

Refer to 2.4.6.1 “Replacement of Rear Oxygen Sensor” to replace the rear oxygen sensor.

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2.12.7.26 DTC P0171 P0172 P1167 P1171 P2187 P2188

1. DTC description:

DTC	P0171	Mixture Too Thin

DTC	P0172	Mixture Too Thick

DTC	P1167	Pre-catalytic Oxygen Indicating Mixture Too Thick During Deceleration

DTC	P1171	Pre-Catalytic Oxygen Indicating Mixture Too Thin During Acceleration

DTC	P2187	Mixture Too Thin When Idling

DTC	P2188	Mixture Too Thick When Idling

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Engine Control Module (ECM) controls the close-loop Air-fuel ratio Measure system that achieves optimal combination of performance, fuel economy and emission control. In the close-loop mode, the engine control module monitors heated oxygen sensor (HO2S) signal voltage and adjusts fuel supply according to the signal. Changes in fuel supply will change the value of long-term and short-term fuel supply adjustment. Short-term fuel supply adjustment will respond to heated type oxygen sensor signal voltage and rapidly change. These changes will fine tune the fuel supply. Long-term fuel supply adjustment will respond to the trend in shortterm fuel supply adjustment. Long-term fuel adjustment adjusts the fuel supply in order to return to the center of the short-term fuel adjustment value and controls the short-term fuel adjustment. The ideal fuel adjustment value is around 0%. A positive value indicates that engine control module is increasing fuel supply to compensate the lean Air-fuel mixture. A negative value indicates that engine control module is decreasing fuel supply to compensate the thick Air-Fuel mixture.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Set(Control Strategy) Conditions**	**Fault Locations**
P0171 P0172 P1167 P1171 P2187	1. Fuel Adjustment Value Higher Than Maximum Limit 2. Fuel Adjustment Value Lower Than Minimum Limit 3. Fuel Adjustment Value Higher Than	1. Engine slows down and enters (DFCO) working condition. 2. ECM detected oxygen sensor signal voltage is higher than 0.55 V. 3. Engine enters power-enriched (PE)	1. Fuel Injectors 2. Canister 3. MAP 4. TPS 5. HO2S（front）

P2188	Maximum Limit (Low-Load Zone) 4. Fuel Adjustment Value Lower Than Minimum Limit (Low-Load Zone)	working condition. 4. ECM detected oxygen sensor signal voltage is lower than 0.35V. 5. Duration longer than 12s.	

3. Circuit figure

Refer to 2.12.6 Electrical Schematic Diagram.

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Inspect there are no other control system DTC codes output.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Are there DTC codes other than P0171, P0172, P1167, P1171, P2187, P2188?

Yes → Refer to 2.12.6.7 DTC Code Section Index

No

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Step 2	Read the intake manifold absolute pressure sensor data.

(a) Turn ignition switch to OFF position, connect fault diagnosis tester.

(b) Start vehicle .

(c) Read the intake manifold absolute pressure sensor data.

(d) Read the fault diagnosis tester for atmospheric pressure value, and compare it with table 2.12.1.3 Altitude and Atmospheric Pressure Correlation.

Is fault diagnosis tester atmospheric pressure reading normal?

No → Refer to 2.12.7.18 DTC P0107 P0108

Yes

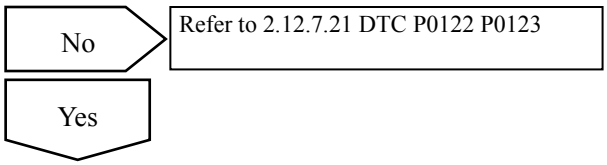
Step 3	Read the throttle position sensor data stream.

(a) Start the vehicle.

(b) Warm up the engine with normal idle speed and throttle opening is less than 10%.

(c) Use fault diagnosis tester to read throttle position sensor data.

Is throttle position sensor data normal?



4	Read the front oxygen sensor data stream.

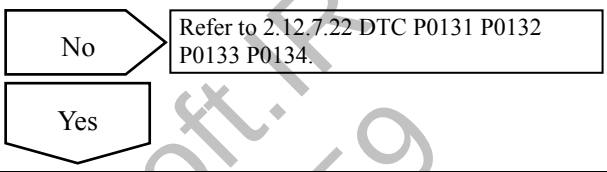
(a) Start the vehicle.

(b) Warm up the engine with normal idle speed.

(c) Read the front oxygen sensor data stream with a fault diagnosis tester.

Front oxygen sensor standard value: 0.2-0.8 V

Is front oxygen sensor data normal?



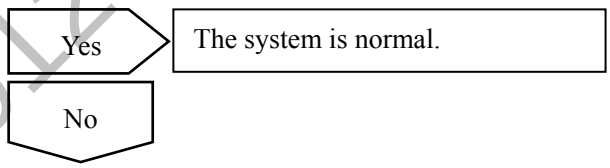
Step 5	Observe the long-term fuel adjustment parameters.

(a) Start the vehicle.

(b) Warm up the engine.

(c) Observe the long-term fuel adjustment parameter with a fault diagnosis tester.

Is the long-term fuel adjustment parameter normal?



Step 6	Inspect engine system and its components.

(a) Turn the ignition switch to OFF position.

(b) Inspect the vacuum hose crack, kink or connections.

(c) Inspect the intake manifold, throttle body and fuel injector vacuum leakage.

(d) Inspect the crankshaft ventilation system leakage.

(e) Inspect Fuel Contamination.

(f) Inspect the working station of fuel system when the air-fuel ratio is too lean.

(g) Inspect injector nozzle spray fuel too thin.

(h) Inspect the fuel system working at Air-Fuel ratio too thick.

(i) Inspect injector spray fuel too thick.

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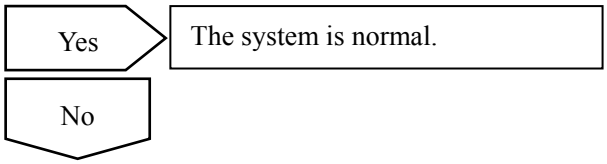
(j) Inspect intake manifold collapse or obstruction.

(k) Inspect whether there is excessive fuel in the crankcase.

(l) Inspect evaporative emission control systems working condition.

(m) Inspect working condition of other fault lamps in the instrument.

Is engine System normal?



Step 7	Repair engine system and its components.

Step 8	The system is normal.

5. Maintenance guide :

Refer to 2.12.8.5 “Replacement of Fuel Injectors” to replace the fuel injectors

Refer to “2.4.6.3 Replacement of Canister Solenoid Valve” to replace the canister solenoid valve.

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2.12.7.27 DTC P0222 P0223

1. DTC description:

DTC	**P0222**	Electronic Throttle Position Sensor #2 Circuit Low Voltage

DTC	**P0223**	Electronic Throttle Position Sensor #2 Circuit High Voltage

TPS2 sensor sends signal through ECT harness connector EN27 terminal C to ECM through ECM harness connector EN01 terminal No.27. If the TPS2 sensor signal is lost, but ECM is able to receive the normal TPS1 sensor signal, then ECM controls the engine to enter reliability of determining the driver's intention decline or no high power output mode. Engine's responding to the pedal changes becomes slow and engine power output will be significantly weaker, although the vehicle can still be able to drive in normal traffic.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0222	Hardware Circuit Malfunction	TPS signal end short to ground or open, the input signal is less than 3.5%, DTC code set.	1. Electronic Throttle Body 2. Electronic Throttle Circuit 3. ECM
P0223	Hardware Circuit Malfunction	TPS signal end short to power supply, input signal is greater than 96.5%, DTC code set.	

3. Circuit sketch

Refer to 2.12.7.21 DTC P0122 P0123

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Inspect for DTC code P0641,P0651,P0122,P0123

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Results

DTC Codes Shown	To Step
Only have P0222、P0223	Yes

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oil P0222、P0223、P0641、P0651	No

No → Refer to 2.12.7.46 DTC P0641 P0651

Yes

Step 2	Check EN27 No . C terminal .

(a) Rotated ignition switch to OFF position .

(b) Disconnect ETC harness connector EN27.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between EN27 terminal C and a reliable ground.

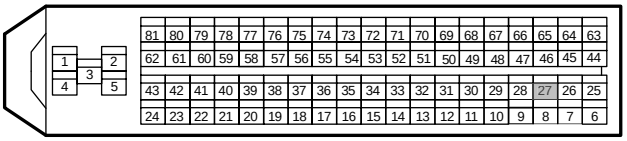
(e) Measure voltage between EN27 terminal C and a reliable ground.

(f) Test continuity between EN27 terminal C and EN01 terminal No.27.

EN27 throttle position sensor harness connector

NL02-2072b

EN01 engine control module harness connector



NL02-2073b

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Results

Test Items	**Standard Value**
EN27(C)-reliable grounding resistance value	10 kΩ or higher
EN27(C)-Reliable grounding voltage value	0V

EN27(C)-EN01(27)Continuity	Less than 1 Ω

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

Step 3	Inspect terminal C voltage output signal.

(a) Connect to ETC harness connector EN27.

(b) Connect ECM harness connector EN01.

(c) Measure ETC harness connector EM27 terminal C output voltage.

Standard Value: Refer to 2.12.7.12 Electronic Throttle Body (ETC) Inspection.

Is the output voltage value accorded with the standard value?

No → Circuit malfunction, repair circuit.

Yes

Step 4	Inspect ECM Power Supply Circuit and ground circuit.

No → Power and ground circuits fault.

Yes

Step 5	Replace ECM. Refer to 2.12.8.1 Replacement of Engine Control Module.

Next

Step 6	Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Next

Step 7	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

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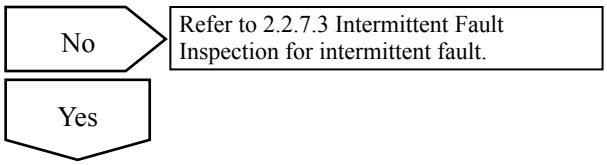
(f) Read control system DTC code again.

Verify that the system has no DTC code output.



Step 8	Troubleshooting

5. Maintenance guide :

Electronic throttle body (ETC) can only be replaced as an assembly. Do not disassemble it and repair. Refer to 2.6.8.5 Replacement of Electronic Throttle Body for the replacement of ETC.

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2.12.7.28 DTC P0230

1. DTC description:

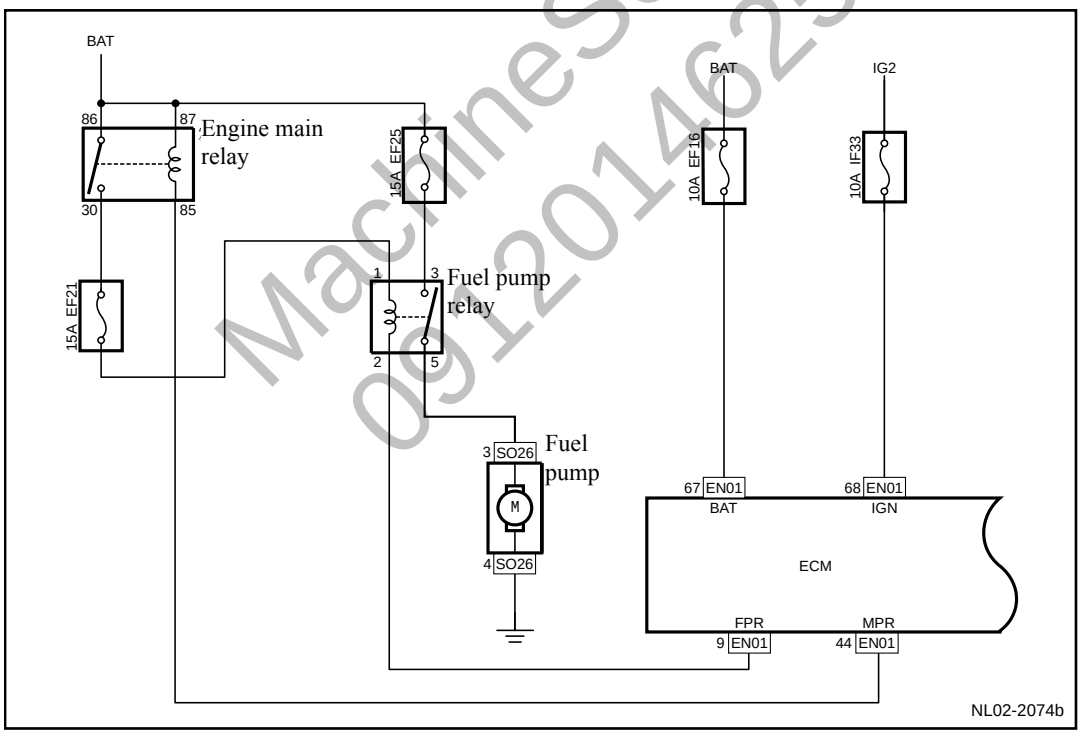
DTC	P0230	Fuel Pump Relay Fault

The power pump relay coil working voltage is provided by ECM. ECM provides power through ECM harness connector EN01 terminal No.71 to pump relay terminal No.1. The fuel pump is grounded through the terminal No.2, fuel pump relay pull-in. ECM has an internal detection circuit. By monitoring the feedback voltage ECM determines whether the control circuit is open, short to ground or short to voltage.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0230	Hardware Circuit Inspection	Fuel Pump Relay Control Circuit Short to Power Supply or Ground or Open	1. Relay Circuit 2. Relay 3. ECM.

3. Circuit sketch



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4. Diagnostic Steps:

Refer to 2.3.2 “Description and Operation” and 2.3.3 “ Operating Principle” to inspect the fuel pump relay circuit.

2.12.7.29 DTC P0261 P0262

1. DTC description:

DTC	P0261	Cylinder No.1 Fuel Injector Circuit Low Voltage Fault

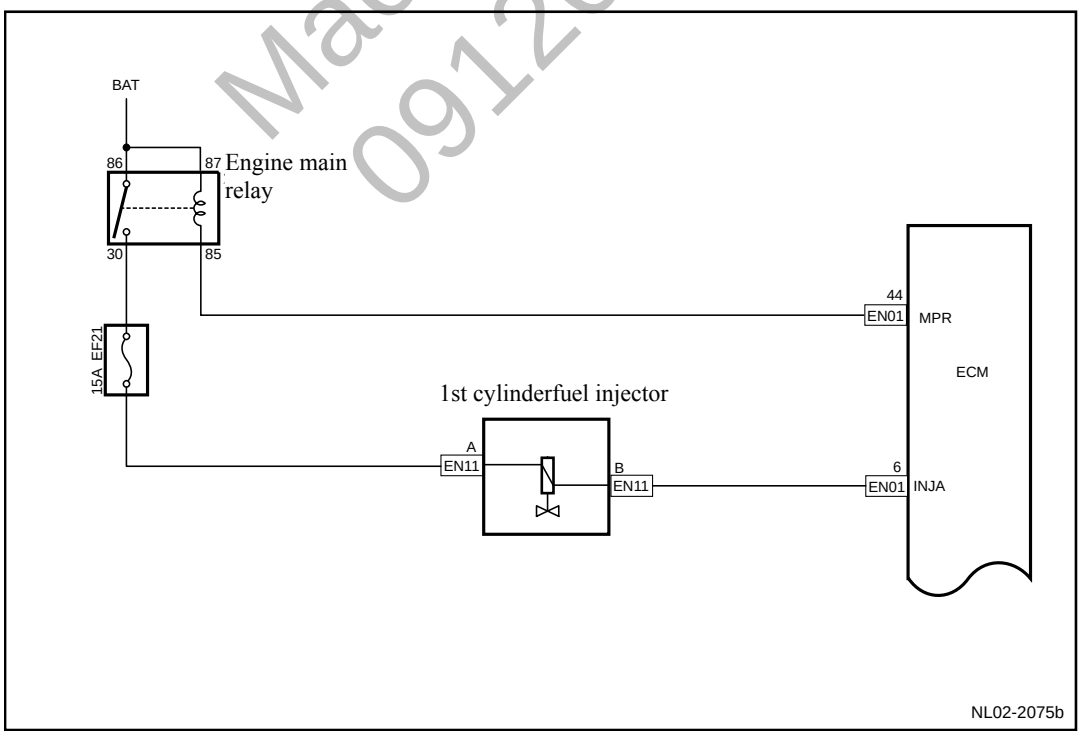
DTC	P0262	Cylinder No.1 Fuel Injector Circuit High Voltage Fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. Battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.1. ECM controls Cylinder No.1 fuel injector internal ground circuit through ECM harness connector EN01 terminal No.6. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0261	Hardware Circuit Inspection	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM.
P0262	Hardware Circuit Inspection	Injector Signal Circuit Short To Power Supply	

3. Circuit sketch



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4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Inspect the fuel injector harness connector for damage, poor connection, aging or signs of loosening

Next

Step 2	Measure the fuel injector resistance.

(a) Disconnect the fuel injector harness connector EN11.

(b) Measure resistance between the two fuel injector terminals.

Standard Resistance

11.4-12.6Ωwith 20℃（68℉

(c) Connect the fuel injector harness connector EN11.

No → Refer to 2.2.8.2 “Replacement of Fuel Injectors” to replace the fuel injectors

Yes

Step 3	Measure Fuel Injectors Working power supply

(a) Rotated ignition switch to OFF position .

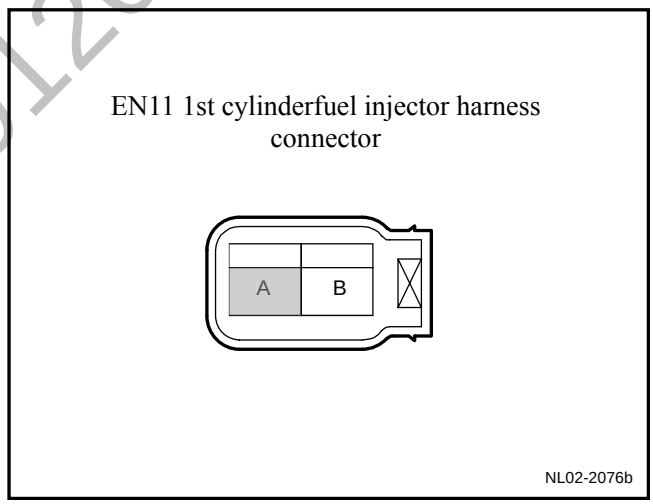
(b) Disconnect cylinder No.1 fuel injector harness connector EN11.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between cylinder No.1 fuel injector harness connector EN11 No.2 terminal and a reliable ground.

Standard Voltage: 11-14V

(e) Connect cylinder No.1 fuel injector harness connector EN11.



No → Go to step 5

Yes

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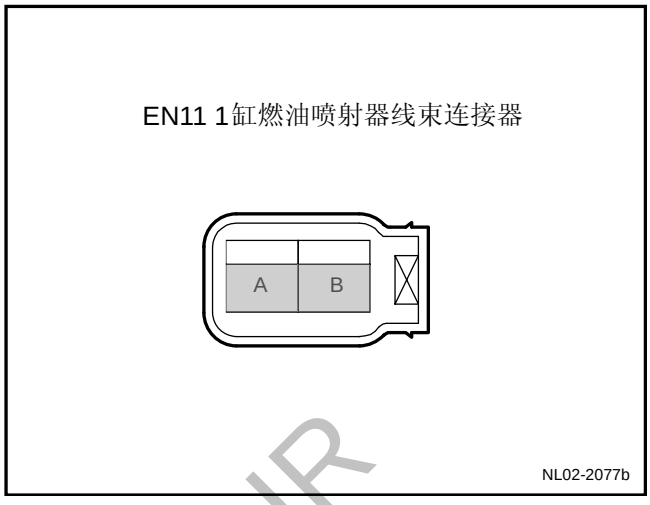
4	Inspect the fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.1 fuel injector harness connector EN11.

(c) Connect test lamp made from light-emitting diodes to the fuel injector harness connector EN11 terminal No.1 and No.2.

(d) Start the engine.

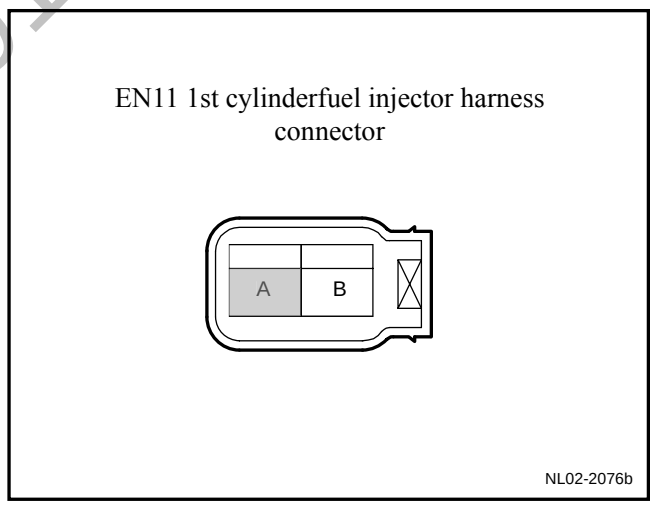


(e) Observe whether test lamp is flashing.

Is test lamp flashing as normal?

No	Go to step 6
Yes	Go to step 7

Step 5	Inspect and repair cylinder No.1 fuel injector power supply circuit.



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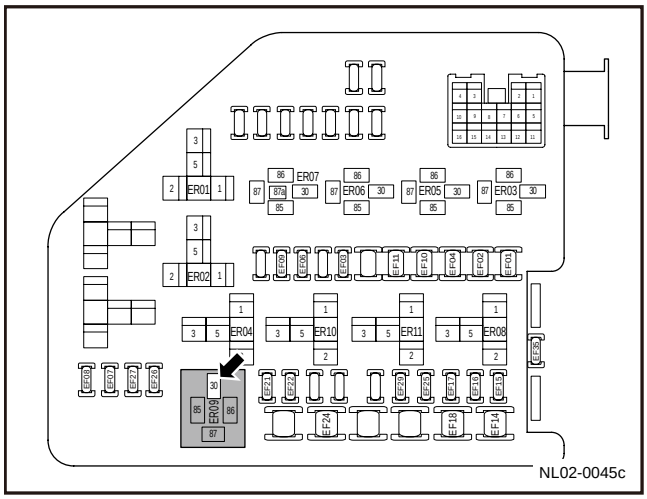
No.B and a reliable ground.

(f) Install the engine main relay.

(g) Connect cylinder No.1 fuel injector harness connector EN11.

Exclude the fuel injector power supply circuit fault.



Test Items	Standard Value
EN11(b) and main relay No,30 terminal	Less than 1 Ω
EN11(b) and reliable grounding	10 kΩ or higher

Next → Go to step 9

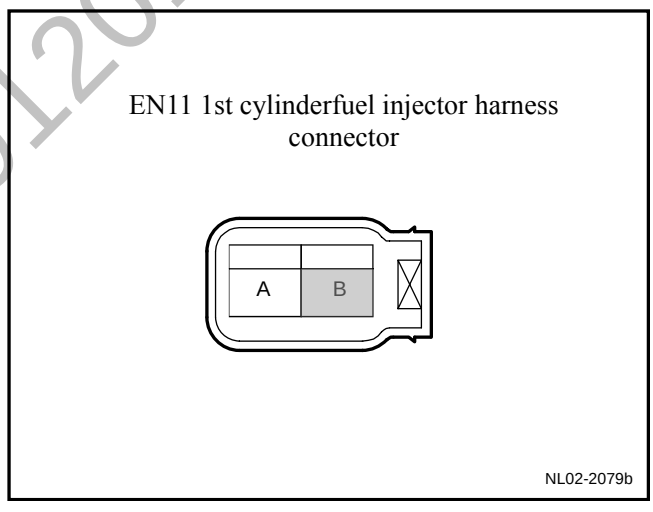
Step 6	Inspect the Cylinder #1 fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.1 fuel injector harness connector EN11.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between cylinder No.1 fuel injector wiring harness connector EN01 terminal No.A and ECM harness connector terminal No.6. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.



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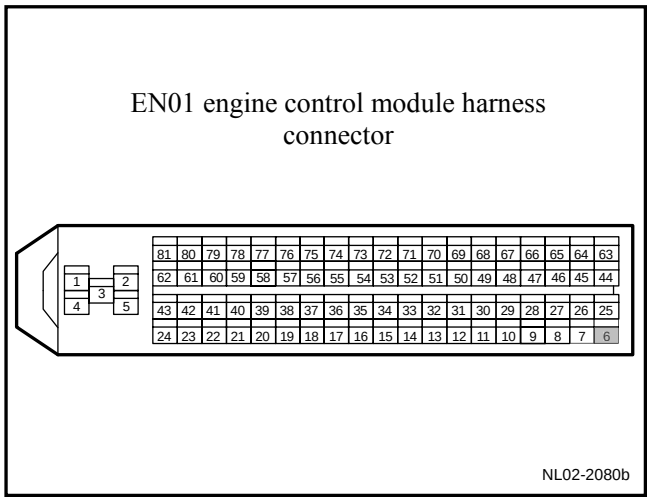
(e) Measure resistance between cylinder No.1 fuel injector wiring harness connector EN11 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the faulty part.

(f) Measure voltage between cylinder No.1 fuel injector harness connector EN11 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.



Test Items	**Standard Value**
EN11(A)-EN01(6)Resistance value	Less than 1 Ω
EN11(A)-reliable grounding resistance value	10 kΩ or higher
EN11(A)-Reliable grounding voltage value	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

Step 9	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

(a) Connect fault diagnosis tester to the diagnostic interface.

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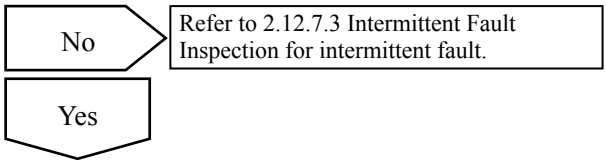
(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 10	Troubleshooting

5. Maintenance guide :

Refer to 2.3.8.5 “Replacement of Fuel Injectors” to replace the fuel injectors

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2.12.7.30 DTC P0264 P0265

1. DTC description:

DTC	P0264	Cylinder No.2 Fuel Injector Circuit Low Voltage Fault

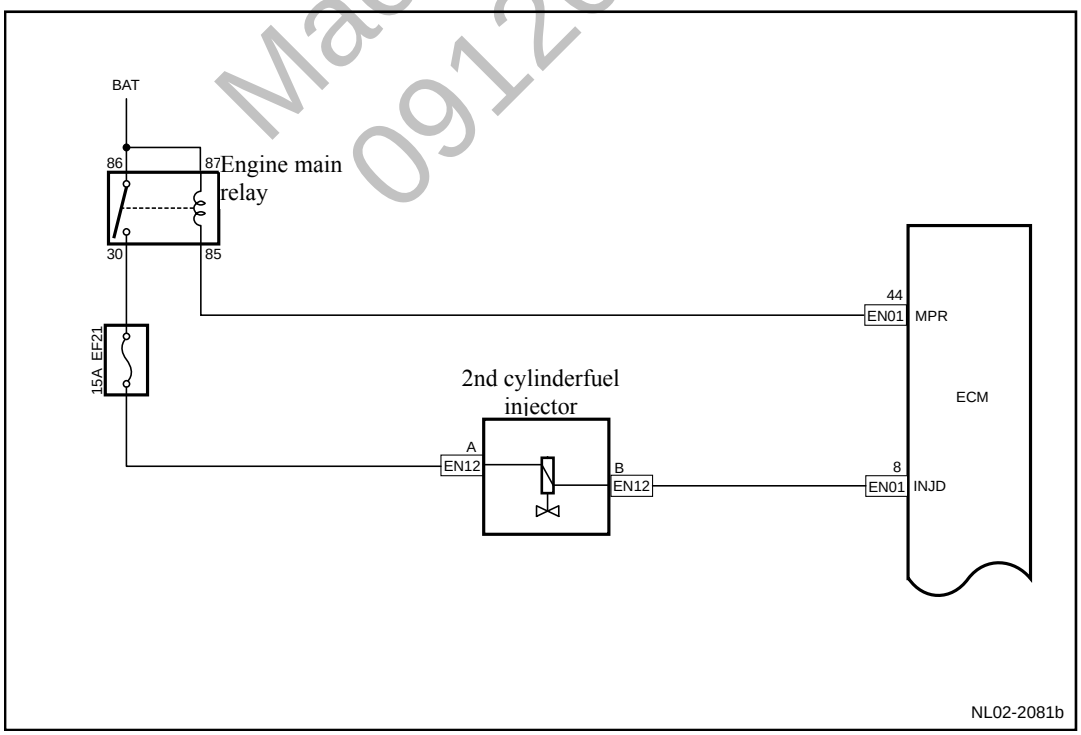
DTC	P0265	Cylinder No.2 Fuel Injector Circuit High Voltage Fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. Battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.A. ECM controls fuel injector ground circuit by ECM harness connector EN01 terminal No.8. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0264	Hardware Circuit Inspection	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM.
P0265	Hardware Circuit Inspection	Injector Signal Circuit Short To Power Supply	

3. Circuit sketch



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4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Inspect the fuel injector harness connector for damage, poor connection, aging or signs of loosening

Next

Step 2	Measure the fuel injector resistance.

(a) Disconnect the fuel injector harness connector EN12.

(b) Measure resistance between the two fuel injector terminals.

Standard Resistance

11.4-12.6Ωwith 20℃（68℉

(c) Connect the fuel injector harness connector EN12.

No → Refer to 2.2.8.2 “Replacement of Fuel Injectors” to replace the fuel injectors

Yes

3	Measure Fuel Injectors Working power supply

(a) Rotated ignition switch to OFF position .

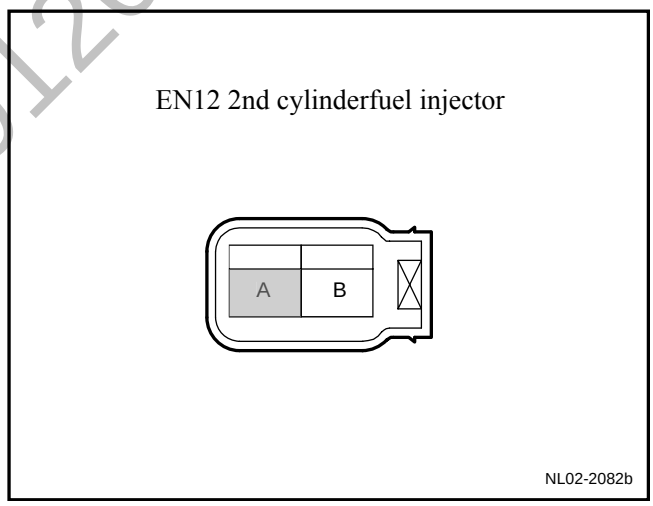
(b) Disconnect cylinder No.2 fuel injector harness connector EN12.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between cylinder No.2 fuel injector wiring harness connector EN12 No.A terminal and a reliable ground.

Standard Voltage: 11-14V

(e) Connect cylinder No.2 fuel injector harness connector EN12.



No → Go to step 5

Yes

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Step 4	Inspect the fuel injector control circuit.

(a) Rotated ignition switch to OFF position.

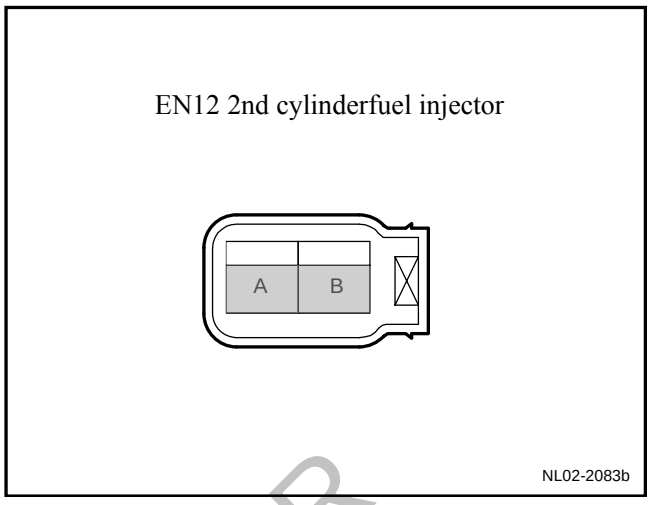
(b) Disconnect cylinder No.2 fuel injector harness connector EN12.

(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EN12 terminal No.A and B.

(d) Start the engine.

(e) Observe whether test lamp is flashing.

Is test lamp flashing as normal?



No	Go to step 6
Yes	Go to step 7

Step 5	Inspect and repair cylinder No.2 fuel injector power supply circuit.

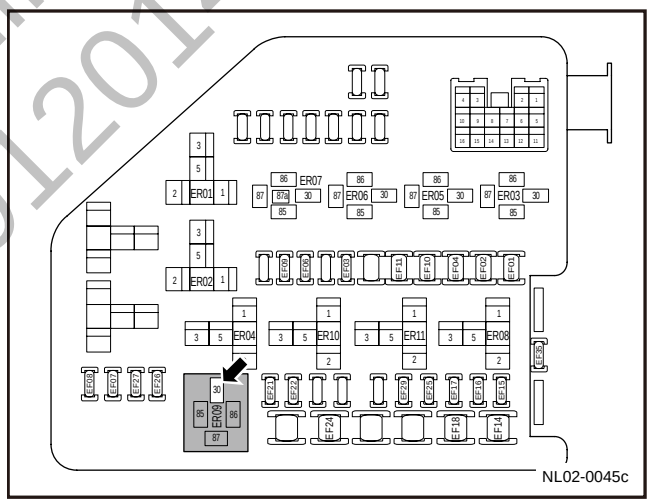
(a) Rotated ignition switch to OFF position .

(b) Disconnect the fuel injector harness connector EN12.

(c) Dismantle the engine main relay.

(d) Measure resistance between cylinder No.2 fuel injector wiring harness connector EN12 terminal No.B and engine main relay terminal No.30.

(e) Measure resistance between cylinder No.2 fuel injector wiring harness connector EN12 terminal No.B and a reliable ground.



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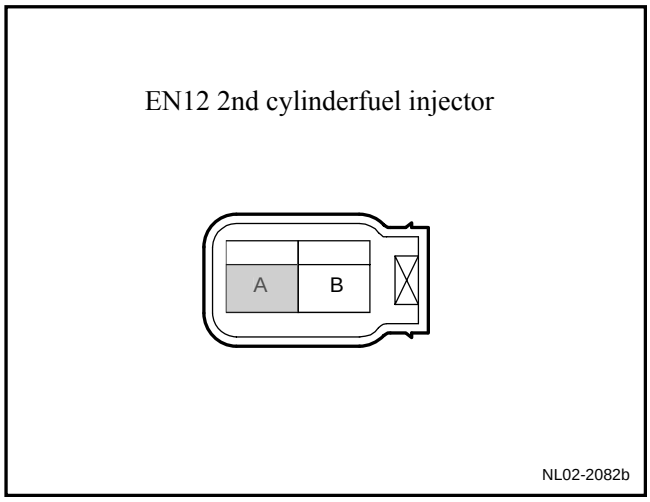


Standard Resistance

Test Items	**Standard Value**
EN12(b) and main relay No,30 terminal	Less than 1 Ω
EN12(b) and reliable grounding	10 kΩ or higher

(f) Install the engine main relay.

(g) Connect cylinder 2 fuel injector wire harness connector EN12.

Exclude the fuel injector power supply circuit fault.

Next → Go to step 9

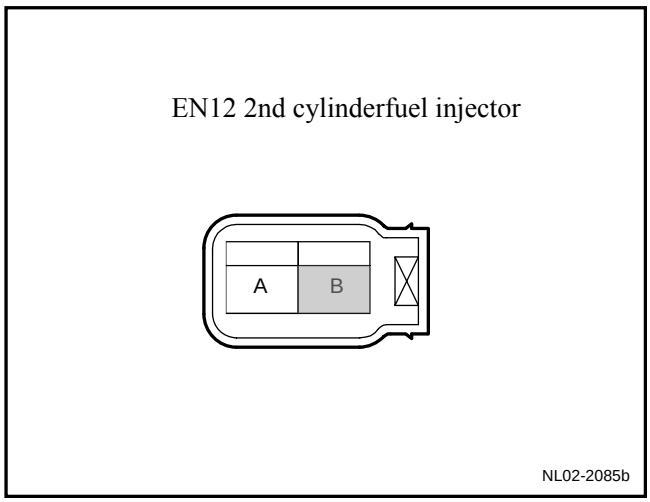
Step 6	Inspect the Cylinder #2 fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.2 fuel injector harness connector EN12.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between cylinder No.2 fuel injector wiring harness connector EN12 terminal No.A and ECM harness connector terminal No.66. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.



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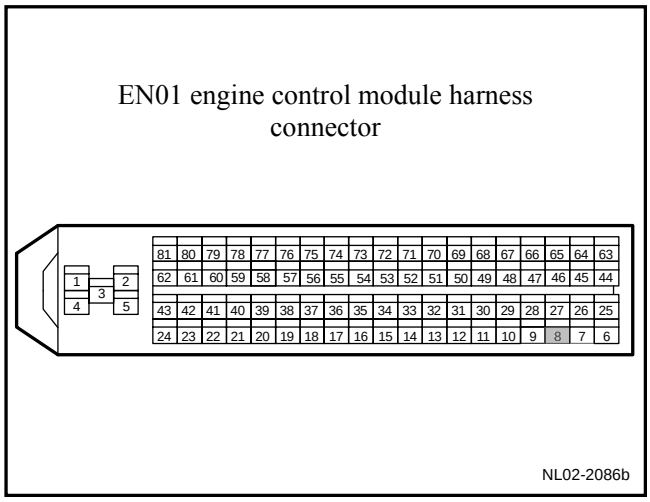
(e) Measure resistance between cylinder No.2 fuel injector wiring harness connector EN12 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the faulty part.

(f) Measure voltage between cylinder No.2 fuel injector harness connector EN12 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.



Test Items	Standard Value
EN12(A)-EN01(63)Resistance value	Less than 1 Ω
EN12(A)-reliable grounding resistance value	10 kΩ or higher
EN12(A)-Reliable grounding voltage value	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

Step 9	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

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(a) Connect fault diagnosis tester to the diagnostic interface.

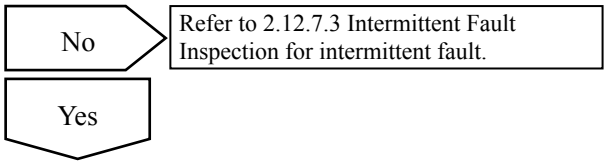
(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 10	Troubleshooting

5. Maintenance guide :

Refer to 2.12.8.5 “Replacement of Fuel Injectors” to replace the fuel injectors.

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2.12.7.31 DTC P0267 P0268

1. DTC description:

DTC	P0267	Cylinder No.3 Fuel Injector Circuit Low Voltage Fault

DTC	P0268	Cylinder No.3 Fuel Injector Circuit High Voltage Fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. Battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.A. ECM controls Cylinder No.3 fuel injector internal ground circuit through ECM harness connector EN01 terminal No.7. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0267	Hardware Circuit Inspection	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM.
P0268	Hardware Circuit Inspection	Injector Signal Circuit Short To Power Supply	

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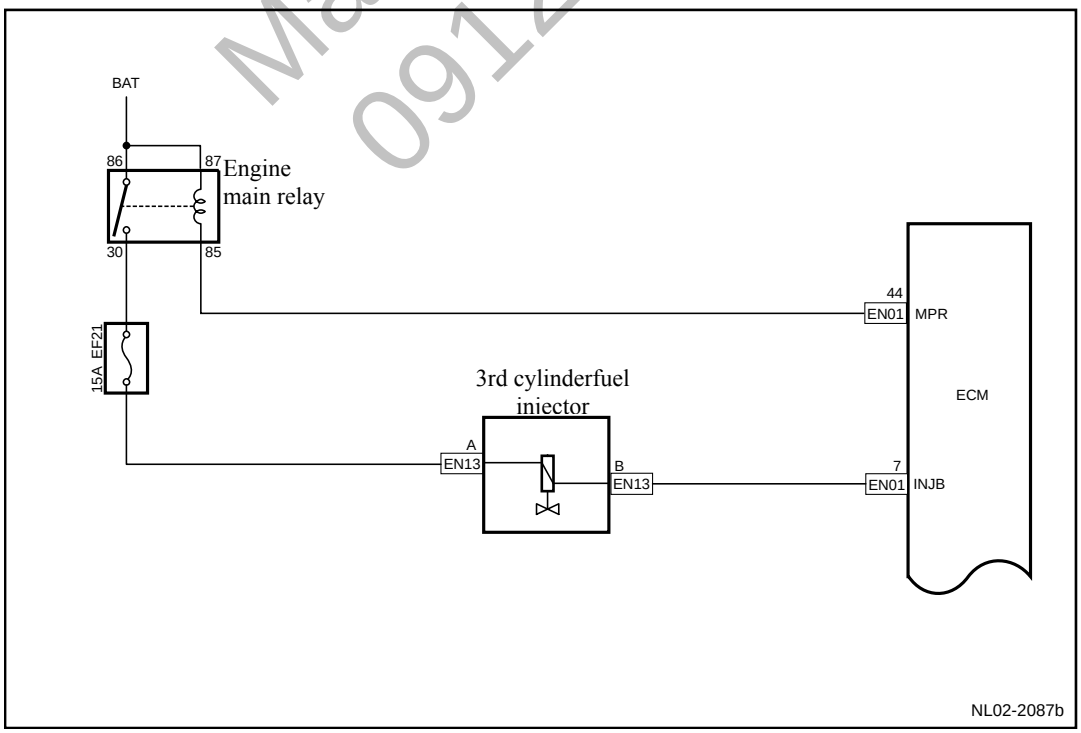
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Inspect the fuel injector harness connector for damage, poor connection, aging or signs of loosening

Next

Step 2	Measure the fuel injector resistance.

(a) Disconnect the fuel injector harness connector EN13.

(b) Measure resistance between the two fuel injector terminals.

Standard Resistance

11.4-12.6Ωwith 20℃（68℉

(c) Connect the fuel injector harness connector EN13.

No → Refer to 2.2.8.2 “Replacement of Fuel Injectors” to replace the fuel injectors

Yes

3	Measure Fuel Injectors Working power supply

(a) Rotated ignition switch to OFF position .

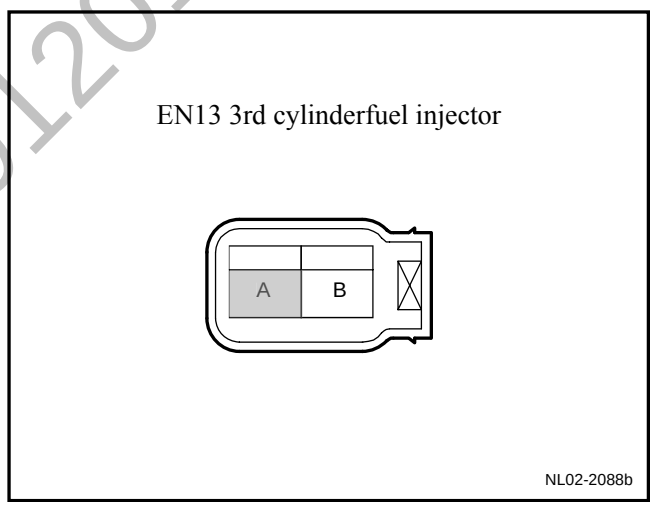
(b) Disconnect cylinder No.3 fuel injector harness connector EN13.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between cylinder No.3 fuel injector harness connector EN13 No.1 terminal and a reliable ground.

Standard Voltage: 11-14V

(e) Connect cylinder No.3 fuel injector harness connector EN13.



No → Go to step 5

Yes

Step 4	Inspect the fuel injector control circuit.

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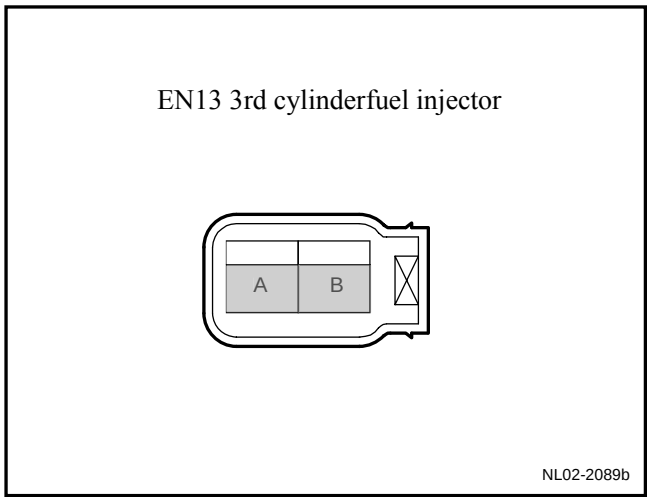
(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.3 fuel injector harness connector EN13.

(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EN13 terminal No.A and B.

(d) Start the engine.

(e) Observe whether test lamp is flashing.



Is test lamp flashing as normal?

No	Go to step 6
Yes	Go to step 7

Step 5	Inspect and repair cylinder No.3 fuel injector power circuit.

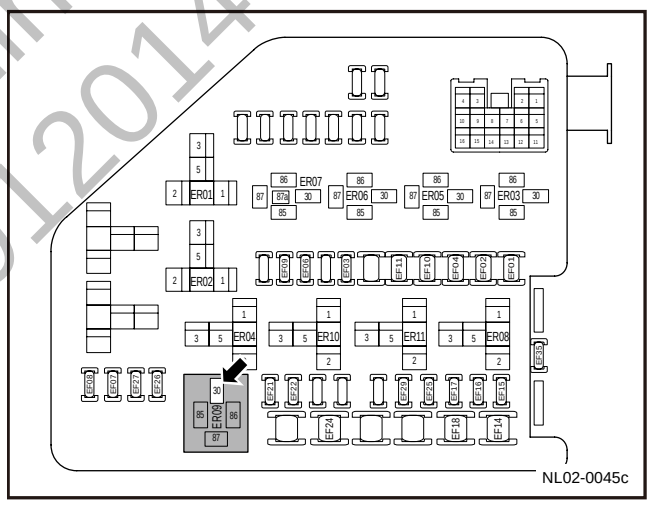
(a) Rotated ignition switch to OFF position .

(b) Disconnect the fuel injector harness connector EN13.

(c) Dismantle the engine main relay.

(d) Measure resistance between cylinder No.3 fuel injector wiring harness connector EN13 terminal No.B and engine main relay terminal No.30.

(e) Measure resistance between cylinder No.3 fuel injector wiring harness connector EN13 terminal No.B and a reliable ground.



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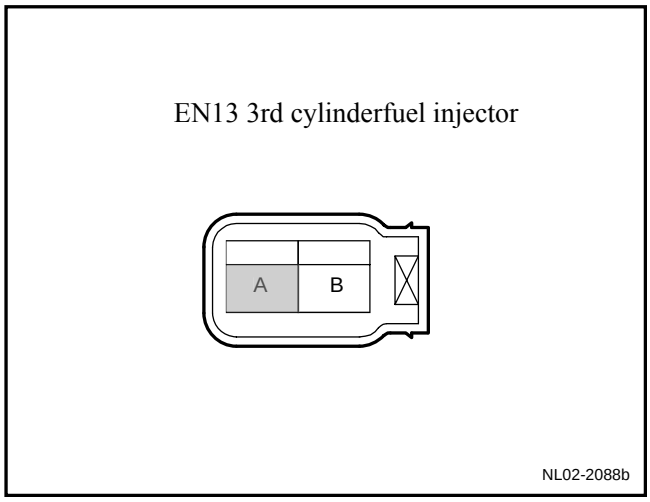


Standard Resistance

Test Items	Standard Value
EN13(b) and main relay No,30 terminal	Less than 1 Ω
EN13(b) and reliable grounding	10 kΩ or higher

(f) Install the engine main relay.

(g) Connect cylinder 3 fuel injector wire harness connector EN13.

Exclude the fuel injector power supply circuit fault.

Next	Go to step 9

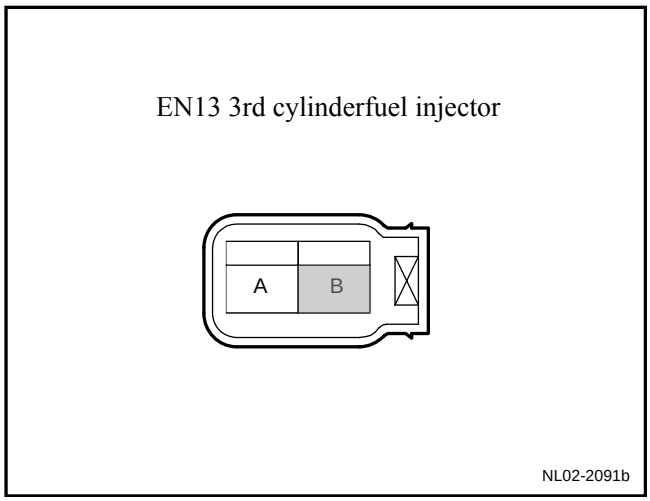
Step 6	Inspect the Cylinder #3 fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect cylinder No.3 fuel injector harness connector EN13.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between cylinder No.3 fuel injector wiring harness connector EN13 terminal No.A and ECM harness connector terminal No.7. Inspect whether the circuit is open. Otherwise, repair the faulty part.



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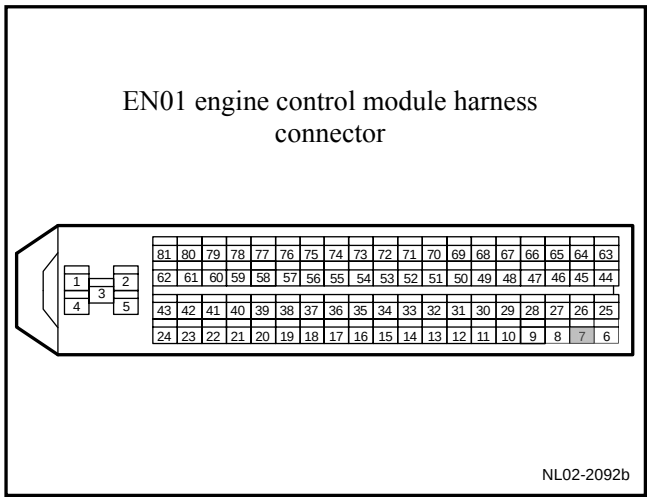
(e) Measure resistance between cylinder No.3 fuel injector wiring harness connector EM13 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the faulty part.

(f) Measure voltage between cylinder No.3 fuel injector harness connector EN13 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.



Test Items	**Standard Value**
EN13(A)-EN01(7)Resistance value	Less than 1 Ω
EN13(A)-reliable grounding resistance value	10 kΩ or higher
EN13(A)-Reliable grounding voltage value	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

Step 9	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

(a) Connect fault diagnosis tester to the diagnostic interface.

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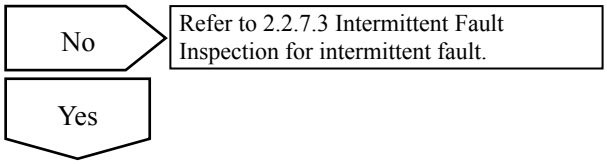
(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 10	Troubleshooting

5. Maintenance guide :

Refer to 2.12.8.5 “Replacement of Fuel Injectors” to replace the fuel injectors.

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2.12.7.32 DTC P0270 P0271

1. DTC description:

DTC	P0270	Cylinder No.4 fuel injector circuit low voltage fault

DTC	P0271	Cylinder No.4 fuel injector circuit high voltage fault

Fuel injectors operating voltage is provided by The Main Relay controlled by ECM. Battery voltage passes through the main relay terminal No.3 to all fuel injector wiring harness connectors terminal No.A. ECM controls Cylinder No.4 fuel injector internal ground circuit through ECM harness connector EN01 terminal No.26. ECM monitors all fuel injector driver circuits status, if ECM detects driving circuit status corresponding voltage is incorrect, ECM will set a fuel injector control circuit fault DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0270	Hardware Circuit Inspection	Injector Signal Circuit Open or Short To Ground	1. Sensor Circuit 2. Sensor 3. ECM.
P0271	Hardware Circuit Inspection	Injector Signal Circuit Short To Power Supply	

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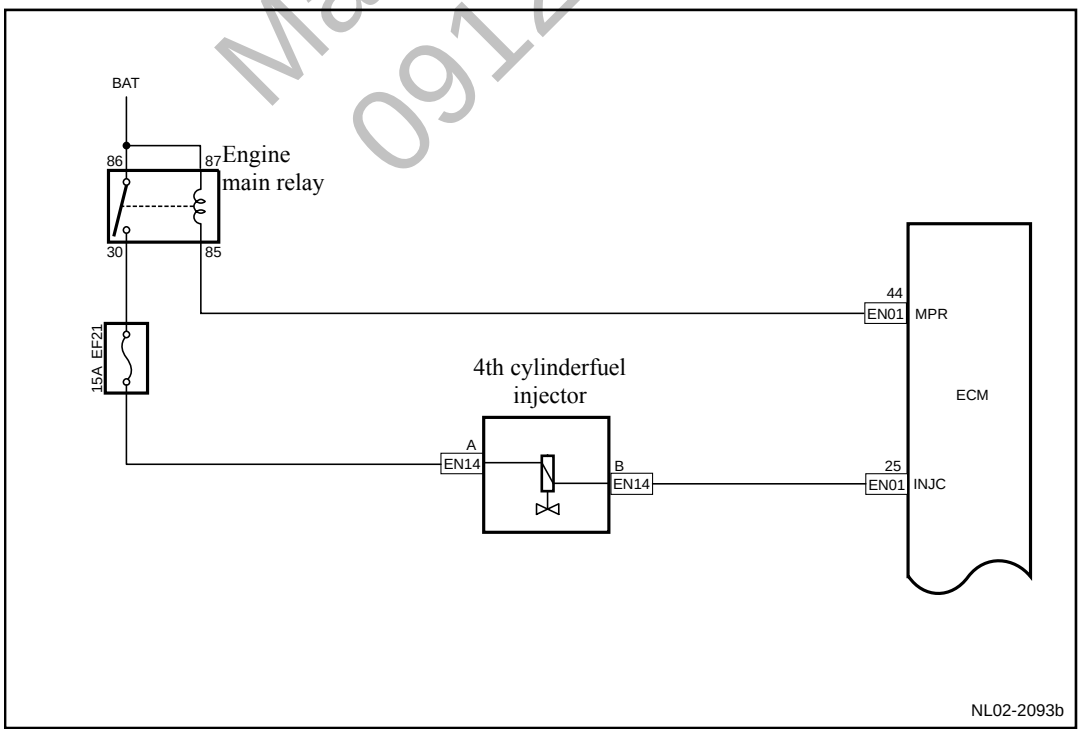
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a)Inspect the fuel injector harness connector for damage, poor connection, aging or signs of loosening

Next

Step 2	Measure the fuel injector resistance.

(a) Disconnect the fuel injector harness connector EN14.

(b) Measure resistance between the two fuel injector terminals.

Standard Resistance

11.5-12.6Ωwith 20℃（68℉

(c) Connect the fuel injector harness connector EN14.

No → Refer to 2.2.8.2 “Replacement of Fuel Injectors” to replace the fuel injectors

Yes

3	Measure Fuel Injectors Working power supply

(a) Rotated ignition switch to OFF position .

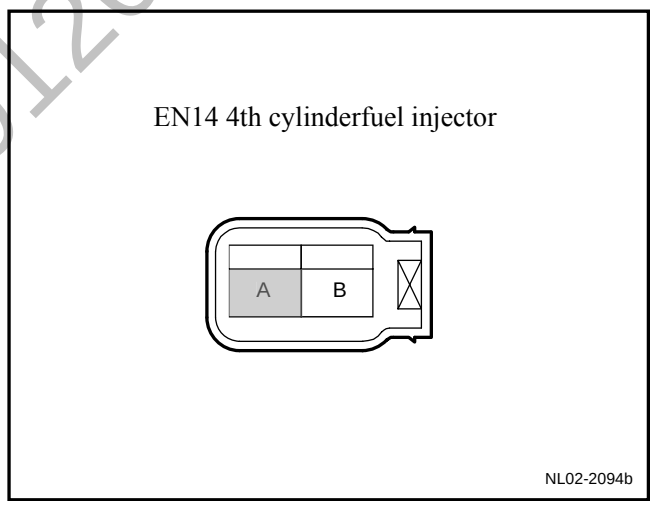
(b) Disconnect 4-cylinder fuel injector harness connector EN14.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between cylinder No.4 fuel injector wiring harness connector EN14 No.A terminal and a reliable ground.

Standard Voltage: 11-14V

(e) Connect to 4 cylinder fuel injector harness connector EN14.



No → Go to step 5

Yes

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Step 4	Inspect the fuel injector control circuit.

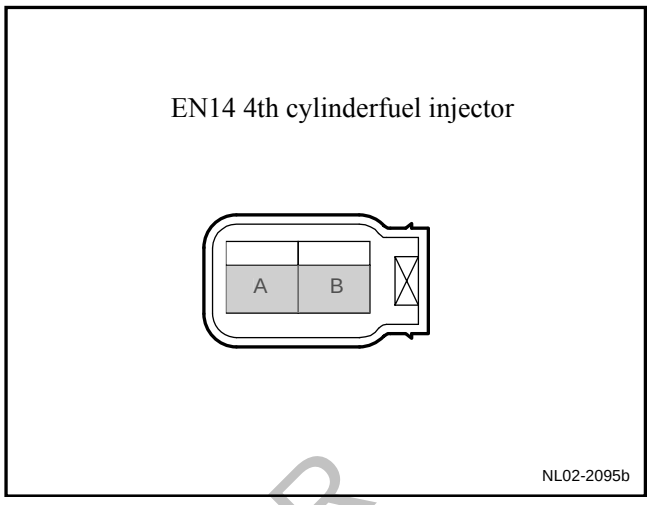
(a) Rotated ignition switch to OFF position .

(b) Disconnect 4-cylinder fuel injector harness connector EN14.

(c) Connect a light-emitting diodes test lamp to the fuel injector wiring harness connector EN14 terminal No.A and B.

(d) Start the engine.

(e) Observe whether test lamp is flashing.



Is test lamp flashing as normal?

No	Go to step 6
Yes	Go to step 7

Step 5	Inspect and repair cylinder No.4 fuel injector power circuit.

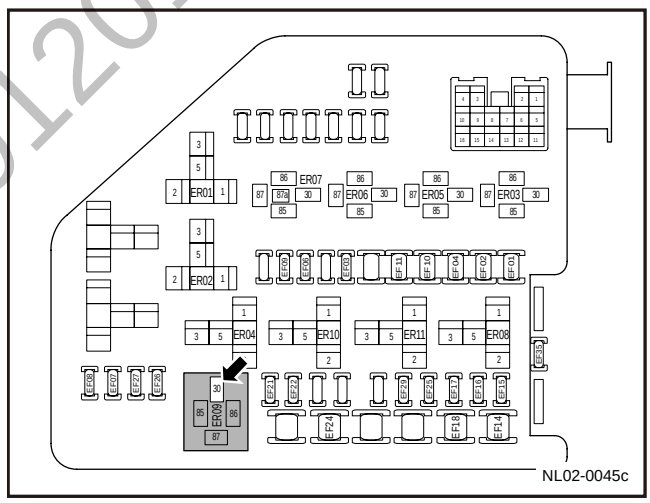
(a) Rotated ignition switch to OFF position .

(b) Disconnect the fuel injector harness connector EN14.

(c) Dismantle the engine main relay.

(d) Measure resistance between cylinder No.4 fuel injector wiring harness connector EN14 terminal No.B and engine main relay terminal No.30.

(e) Measure resistance between cylinder No.2 fuel injector wiring harness connector EN14 terminal No.B and a reliable ground.



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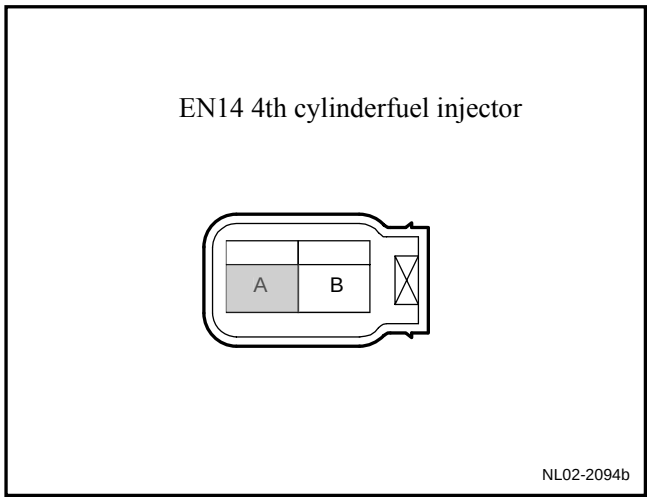


Standard Resistance

Test Items	Standard Value
Resistance Between EN14 (b) and Main Relay Terminal No.30	Less than 1 Ω
Resistance Between EN14 (b) and A Reliable Ground	10 kΩ or higher

(f) Install the engine main relay.

(g) Connect cylinder 4 fuel injector wire harness connector EN14.

Exclude the fuel injector power supply circuit fault.

Next	Go to step 9

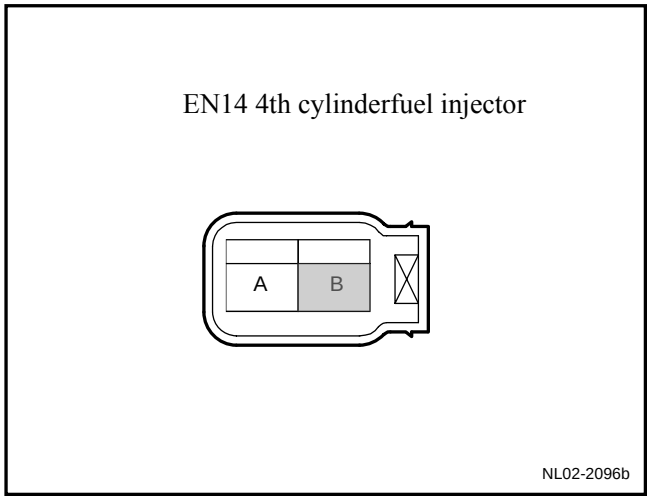
Step 6	Inspect the Cylinder #4 fuel injector control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect 4-cylinder fuel injector harness connector EN14.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between cylinder No.4 fuel injector wiring harness connector EN14 terminal No.A and ECM harness connector terminal No.66. Inspect whether the circuit is open. If there is no open circuit, repair the faulty part.



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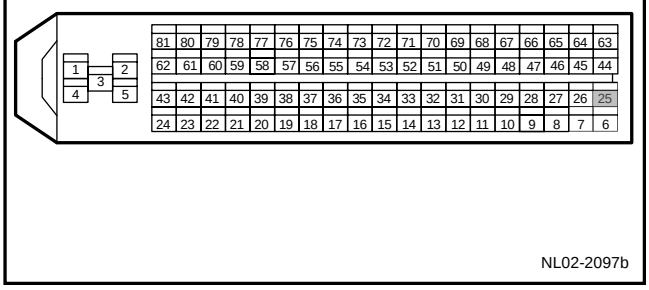
(e) Measure resistance between cylinder No.4 fuel injector wiring harness connector EN14 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground. Otherwise, repair the faulty part.

(f) Measure voltage between cylinder No.4 fuel injector harness connector EN14 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply. Otherwise, repair the faulty part.

EN01 engine control module harness connector



NL02-2097b

Test Items	**Standard Value**
EN14(A)-EN01(26)Resistance value	Less than 1 Ω
Resistance Between EN14 (a)and a Reliable Ground	10 kΩ or higher
Voltage Between EN14 (a) and a Reliable Ground	0V

Execute next step as per normal.

Next

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM

Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Step 9	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

(a) Connect fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

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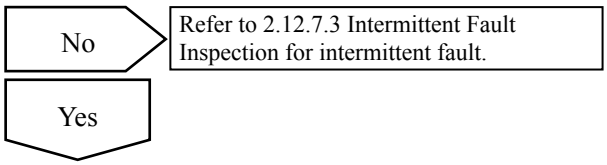
(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 10	Troubleshooting

5. Maintenance guide:

Refer to 2.12.8.5 “Replacement of Fuel Injectors” to replace the fuel injectors.

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2.12.7.33 DTC P0300

1. DTC description:

DTC	P0300	Multi-Cylinder Misfire

The engine control module (ECM) uses information from the crankshaft position (CKP) sensor and the camshaft position (CMP) sensors to determine when an engine mis?re is occurring. By monitoring variations in the crankshaft rotation speed for each cylinder ECM is able to detect individual mis?re events. When a misfire happens, unburnt mixture will be discharged into the exhaust system and burnt in the 3-way catalytic converter (TWC) which will overheat the converter. A misfire rate that is high enough can cause 3-way catalytic converter damage. The malfunction indicator lamp (MIL) will ash ON and OFF when the conditions for catalytic converter overheated are present. A DTC will be set.

2. Setting DTC code and Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0300	Under stable operating conditions, ECM detects the crankshaft rotation speed fluctuations.	Under stable operating conditions, When the ECM detects the crankshaft rotation speed fluctuations exceeding the threshold set by the system: When the fire degree is too low for affecting the exhaust emission, without emergency control scheme, only record the fault code and freeze the data stream as well as turn on the fault indication. Lamp; when the fire degree is too high, which may lead to overheating of the catalyst, compel to entering the fuel open-loop control working condition, and inhibit oxygen correction learning. The fault indicator lamp flickers with the frequency of 1HZ.	1. Connector Loose or Poor Connection 2. Vacuum Tube Hose Broken or Loose 3. Ignition System 4. Fuel Injectors 5. Fuel Pressure 6. Intake Air Pressure Sensor 7. Engine Coolant Temperature Sensor 8. Cylinder Compression Pressure 9. Valve Clearance and Timing 10. Evaporative Emission Control System 11. Purged Crankcase Ventilation System 12. Intake System 13. Poor Exhaust System Ventilation 14. ECM.

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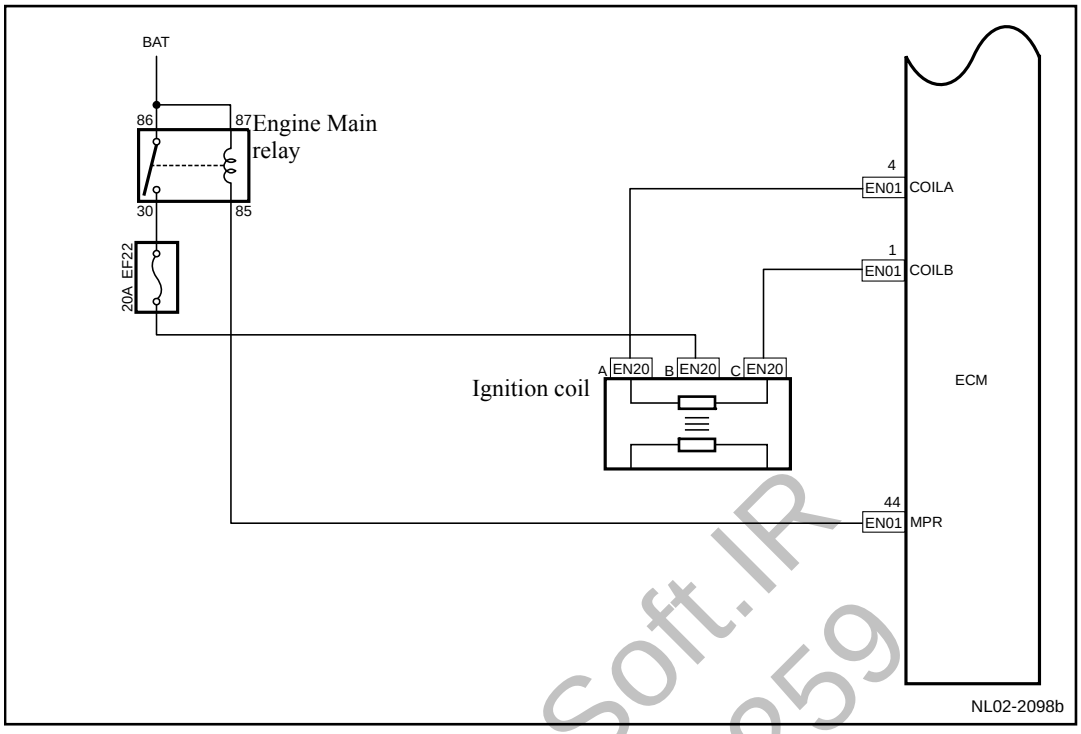
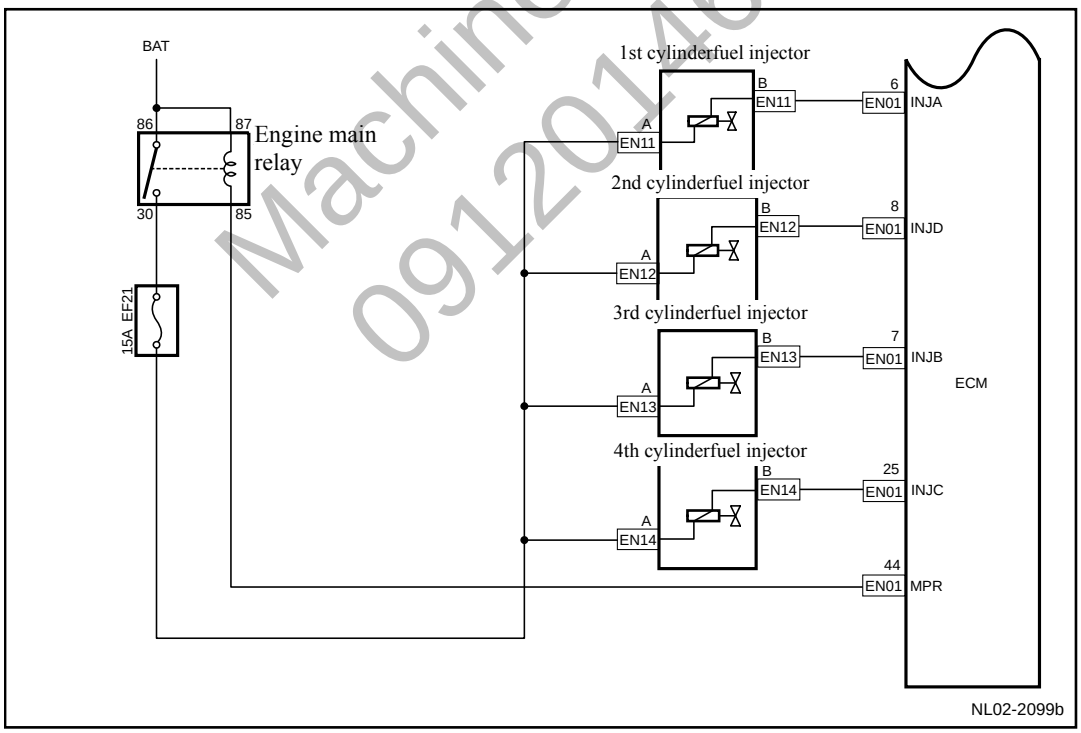
3. Circuit sketch

Ignition System



Fuel Injector Nozzle



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2. Diagnostic Steps:

Notes:

– ***If the control system stores DTC other than misfire, diagnose these DTC first and eliminate the faults.***

– ***If the vehicle does not have a misfire when sent to a service station, road test the vehicle, so that the misfire will occur again. Use fault diagnosis tester to record ECM data when misfire is occurring, in order to facilitate analyzing the cause of the fault.***

– ***If after a long period road test, ECM does not store any misfire associated DTC codes, then the fault may be due to the following reasons:***

- ***Overfill fuel tank and fuel enters the evaporative emission control system, so that the mixture is too thick and causes misfire.***
- ***Use improper fuel caused poor combustion and misfire.***
- ***Contaminated spark plug causes the ignition failure and misfire.***
- ***Carry out basic inspections at fault locations identified by DTC codes.***

– ***Road test the vehicle after repair to confirm no DTC is stored.***

Step 1	Initial Inspection

(a) Inspect the harness connector for damage, poor connection, aging or signs of loosening.

(b) Inspect the vacuum tube for damaged, loose, leakage and so on.

Next

Step 2	Inspect other DTC codes output.

(a) Connect fault diagnosis tester to the vehicle diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Press the fault diagnosis tester power button.

(d) Select the following menu items: Engine/Read DTC codes.

(e) Read DTC codes.

Results

DTC Codes Shown	**GO to Step**
DTC codes other than P0300	No
DTCP0300	Yes

No → Refer to 2.12.7.14 DTC Chapter Index.

Yes

Step 3	Inspect the vacuum tube and the air intake system.

(a) Inspect vacuum canister solenoid valve connection is correct or not and leakage.

(b) Inspect the vacuum brake booster vacuum tube connection is correct or not and leakage.

(c) Inspect the intake tube pressure sensor connection is correct or not and leakage.

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(d) Inspect the positive crankcase ventilation valve, ventilation pipe connection is correct or not and leakage.

(e) Inspect whether there is any leakage in the intake system.

Is there any above mentioned fault?

Yes → Repair the faulty part. Go to step 17

No

Step 4	Inspect the spark plug

(a) Dismantle the spark plug from the misfire cylinder.

(b) Inspect whether the spark plug clearance is too large or too small.

Standard Gap: 1.0-1.1 mm (0.039-0.043 in)

(c) Inspect the spark plug electrode for erosion and damage.

(d) Inspect whether the spark plug and the electrode part skirt is wet or not and Inspect the existence of a serious gasoline leakage.

(e) Reinstall the spark plug.

The existence of the above faults?

Note: Prior to the implementation of this test, the following conditions must be met:

(a) Disconnect all fuel injector connectors.

(b) Run the engine for no longer than 5s.

Yes → Refer to 2.10.8.4 Replacement of Spark Plug to replace the spark plug. Go to step 8

No

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Step 5	Inspect whether the spark plug arcing is normal.

(a) Test the spark.

(b) Dismantle misfire cylinder ignition wires.

(c) Disconnect all fuel injector cylinder connectors.

(d) Install the spark plug to the ignition wires.

(e) Run the engine (the engine running time no longer than 5s) and inspect the arcing.

(f) Reconnect all cylinder fuel injector connectors.

(g) Install the ignition wires.

Is spark plug arcing normal?

No → Go to step 9

Yes

Step 6	Inspect the misfire cylinder compression pressure.

The specific steps refer to 2.6.7.3 Cylinder Compression Test in 2.6Mechanical System.

Is cylinder compression pressure normal?

Yes → Go to step 10

No

Step 7	Refer to the 2.6.7 Diagnostic Information and Procedures in the Mechanical System to inspect the cause for the low cylinder compression force.

Step 8	Inspect fuel and misfire cylinder fuel injectors.

(a) Inspect whether there is fuel injectors leakage and stagnate.

(b) Inspect fuel quality.

The existence of the above faults?

Note: Prior to the implementation of this test, the following conditions must be met:

(a) Disconnect all fuel injector connectors.

(b) Run the engine for no longer than 5s.

Yes → Repair the faulty part. Go to step 17

No

Step 9	Use a properly working spark plug and inspect whether there is misfire cylinder jump-spark.

(a) Replace the installed spark plug with a spark plug that works properly.

(b) Test spark plug.

(c) Dismantle ignition guide wire of misfire cylinder .

(d) Disconnect all fuel injector cylinder connectors.

(e) Spark plug was installed on the ignition guide wire .

(f) Run the engine (the engine running time no longer than 5 s) and inspect the arcing.

(g) Reconnect all cylinder fuel injector connectors.

(h) Install ignition guide wire .

Is spark plug arcing normal?

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No → Inspect the ignition coil and ignition wire. Go to step 17.

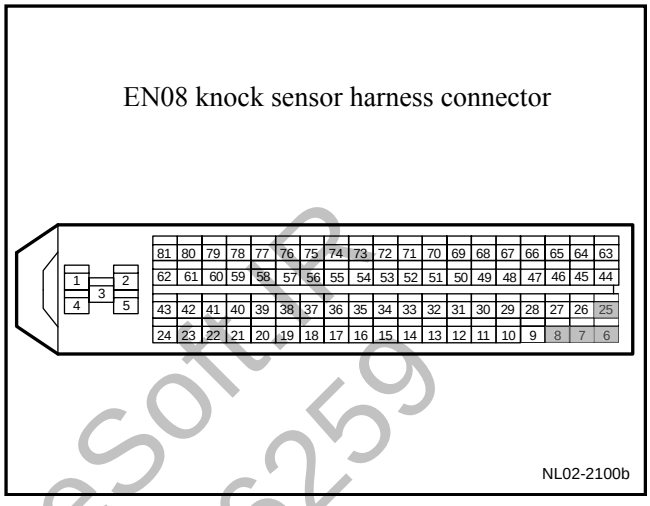
Yes → Replace the spark plug. Refer to 2.10.8.4 Replacement of Spark Plug. Go to step 17

Step 10	Inspect ECM control connector terminal voltage of the misfire cylinder fuel injector.

(a) Rotated ignition switch to ON position .

(b) Connect ECM harness EN01.

(c) Measure ECM harness connector EN01 terminal voltage according to the following table.



Connector terminal	Specified Value
EN01(6)	9-14V
EN01(7)	
EN01(8)	
EN01(25)	

Is voltage the specified value?

No → Inspect the fuel injector circuit. Refer to 2.2.7.29 DTC P0261, P0262.

Yes

Step 11	Inspect the misfire cylinder valve clearance.

Refer to the 2.6.8.21 Valve Clearance Adjustments in the Mechanical System, and is valve clearance normal?

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No → Adjust the valve clearance. Go to step 17.

Yes

Step 12	Inspect valve timing system.

Refer to the 2.6.8.9 Replacement of Timing Chain Cover in the Mechanical System, and Is valve timing normal?

No → Adjust the valve timing. Go to step 17.

Yes

Step 13	Inspect the fuel pressure

Refer to Fuel System in the2.3.7.3 Fuel Pressure Testing Procedure, and is fuel pressure normal?

No → Check fuel system: fuel pump, fuel filter, fuel pipe circuit and fuel pressure regulator. Go to step 17

Yes

Step 14	Inspect whether the data in the data flow table is normal.

(a) Inspect intake air pressure sensor data.

(b) Inspect engine coolant temperature sensor data.

(c) Inspect throttle position sensor.

Are these components normal?

No → Replace the damaged components. Go to step 17.

Yes

Step 15	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 16	Replace ECM

Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

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Next

Step 17	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

(a) Connect fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Road test the vehicle for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 18	Troubleshooting

5. Maintenance guide:

Refer to 2.10.7.4 Replacement of Spark Plug to replace the spark plug.

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2.12.7.34 DTC P0324、P0325

1. DTC description:

DTC	P0324	Knock Control System Fault

DTC	P0325	Knock Sensor Fault

KS sensor to ECM feedback signal helps ECM control the ignition timing to achieve the optimal operation and the ignition system to achieve the best performance, as well as to prevent damage to the engine by a potential knock. KS sensor is located below the intake manifold on the cylinder. KS sensor voltage changes with the AC signal generated by the vibration with running engine. Engine control module adjusts spark timing according to KS sensor signal amplitude and frequency.

ECM receives signals from KS sensor harness connector EN08 terminal No.1 and 2 through ECM harness connector EN01 terminal No.36 and 37.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0324	Knock Control System Fault	1. Engine speed is higher than 1,600 rpm. 2. Certain Load Conditions. 3. Any section of the sensor signal circuit is short to ground.	1. Sensor Circuit 2. Sensor 3. ECM.
P0325	Knock Sensor Fault	1. Engine speed is higher than 1,600 rpm. 2. Certain Load Conditions. 3. Sensor Signal Circuit Open.	

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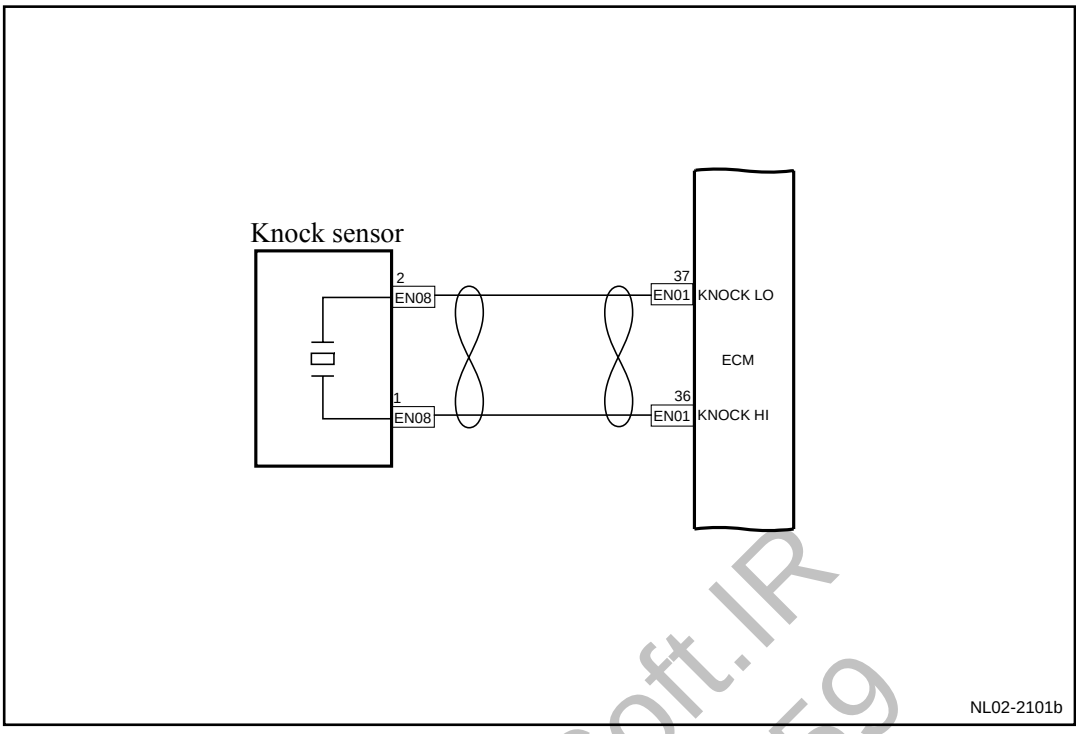
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Inspect whether there is KS sensor physical damage.

(b) Inspect whether KS sensor is installed correctly. Torque is set too tight or too loose will trigger DTC codes.

(c) Check KS sensor installation surface whether there are glitches, casting flash and foreign matter.

(d) Knock sensor must be kept away from hoses, brackets and engine wires.

Are these components normal?

No → Repair the faulty part. Go to step 9

Yes

Step 2	Read the engine data (engine speed) on the fault diagnosis tester.

(a) Connect fault diagnosis tester to diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Select Engine/Read Data/Knock Sensor Signal 1.

(d) Start and run the engine at normal working temperature.

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(e) Road test the vehicle and read the engine speed data on the fault diagnosis tester.

Is the data normal?

Standard Value: Normal data. Refer to 2.12.7.9 Data Flow Table

No → Go to step 4

Yes

Step 3	Refer to 2.12.7.4 Fault Symptom Table for intermittent fault.

Step 4	Inspect Knock Sensor

(a) Rotated ignition switch to OFF position .

(b) Disconnect Knock Sensor harness connector EN08.

(c) Measure knock sensor resistance.

Standard Resistance:

It is above 1MΩ with 1MΩ

(d)Connect Knock Sensor harness connector EN08.

Is the resistance normal?

No → Refer to 2.10.7.5 “Replacement of Knock Sensor” to replace the knock sensor. Go to Step 9.

Yes

Step 5	Inspect sensor terminal No.1 circuit.

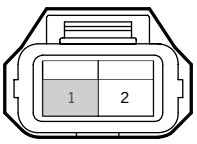
(a) Rotated ignition switch to OFF position .

(b) Disconnect Knock Sensor harness connector EN08.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between knock sensor harness connector EN08 terminal No.1 and ECM harness connector EN01 terminal No.36. Inspect whether the circuit is open.

EN08 knock sensor harness connector



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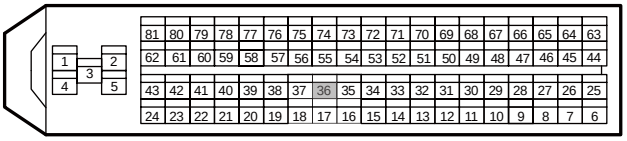
(e) Measure resistance between knock sensor harness connector EN08 terminal No.1 and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure resistance between knock sensor harness connector EN08 terminal No.1 and a reliable ground. Inspect whether the circuit is short to power supply.

EN01 engine control module harness connector



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Test Items	**Standard Value**
EN08(1)-EN01(36) resistance	Less than 1 Ω
EN08(1)-reliable grounding resistance	10 kΩ or higher
EN08(1)-reliable grounding voltage	0V

Are the values specified values?

No → Repair the faulty part. Go to step 9

Yes

Step 6	Inspect sensor terminal No.2 circuit.

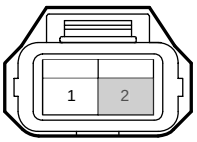
(a) Rotated ignition switch to OFF position .

(b) Disconnect Knock Sensor harness connector EN08.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between knock sensor harness connector EN08 terminal No.2 and ECM harness connector EN01 terminal No.37. Inspect whether the circuit is open.

EN08 knock sensor harness connector



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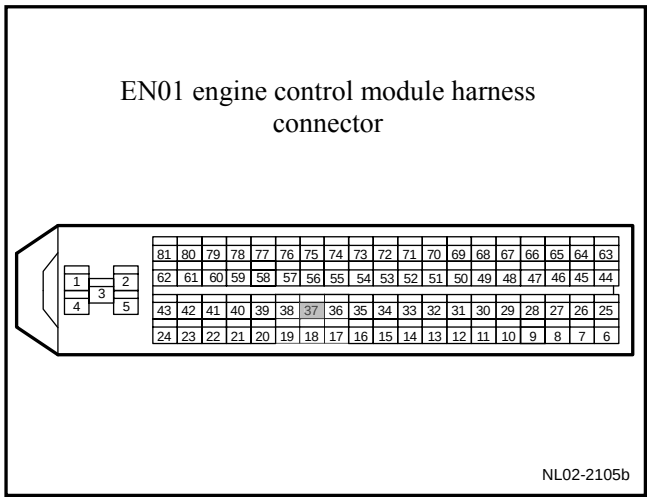
(e) Measure resistance between knock sensor harness connector EN08 terminal No.2 and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure resistance between knock sensor harness connector EN08 terminal No.2 and a reliable ground. Inspect whether the circuit is short to power supply.



Test Items	**Standard Value**
EN08(2)-EN01(37) resistance	Less than 1 Ω
EN08(2)-reliable grounding resistance	10 kΩ or higher
EN08(2)-reliable grounding voltage	0V

Are the values specified values?

No → Go to step 12

Yes

Step 7	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part. Go to step 12

Yes

Step 8	Replace ECM

Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Yes

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Step 9	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

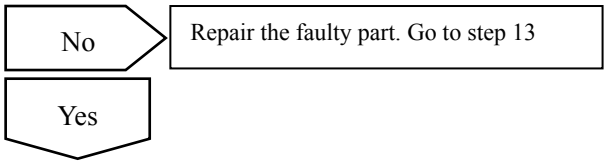
(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.



Step 10	Troubleshooting

5. Maintenance guide :

Refer to 2.10.7.5 Replacement of Knock Sensor to replace the knock sensor.

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2.12.7.35 DTC P0335,P0336

1. DTC description:

DTC	P0335	No signal from crankshaft position sensor circuit

DTC	P0336	Crankshaft Position Sensor Circuit Signal Interference

CKP sensor signal provides ECM with current crankshaft speed and position. CKP sensor produces an alternating voltage with different amplitude and frequency. Frequency depends on the crankshaft speed and the AC output voltage depends on the CKP. CKP sensor works with a fixed 58X variable reluctance rotor on the crankshaft. ECM calculates the ignition timing, injection timing, and knock ignition timing based on CKP sensor and camshaft position sensor input signals. CKP sensor is also used to detect misfire and tachometer display. ECM uses CAN network to send the engine speed signal to the instrument.

CKP sensor signal is sent through CKP sensor harness connector EN26 terminals A, B to ECM harness connector No.EN01 terminals No.30 and 11.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0335	Hardware Circuit Inspection	1. During startup, the crankshaft position sensor is disconnected, short to Ground and short to power supply. 2. Fault timer accumulated time is longer than 2 s.	1. Sensor Circuit 2. Sensor 3. ECM 4. Sensor signal disc
P0337	Hardware Circuit Inspection	1. Crankshaft position sensor and the signal tooth gap is too large. 2. The difference between actual identified number of teeth and 58 teeth is larger than a specified value.	

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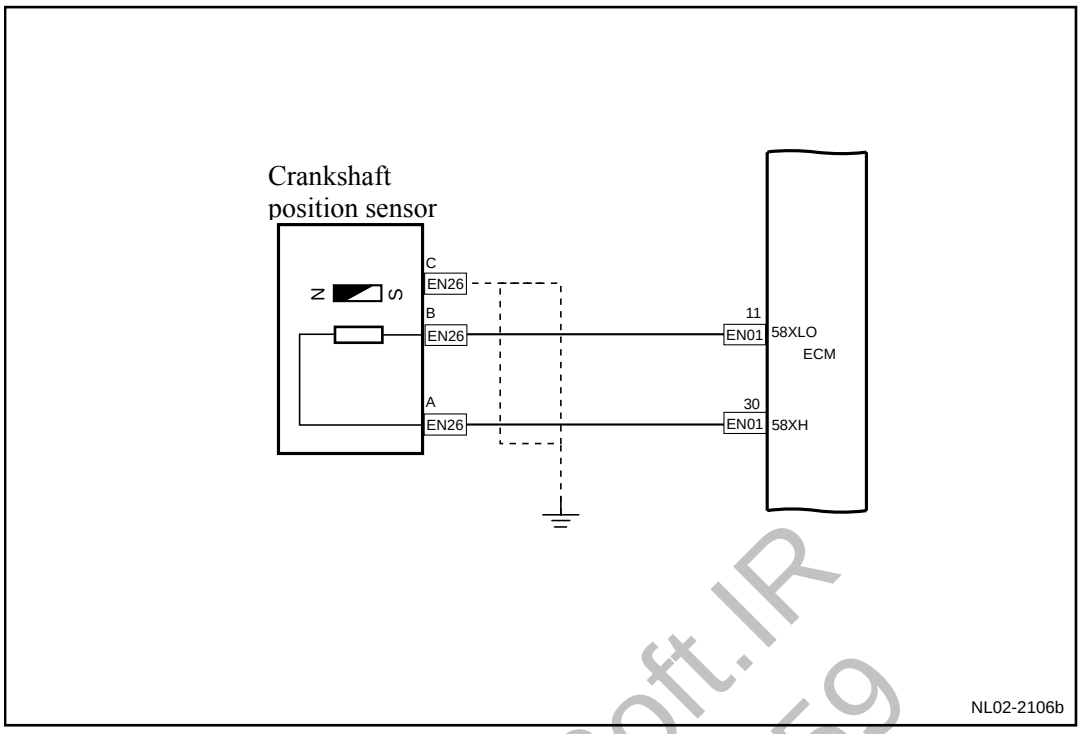
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Inspect the sensor wiring harness connector EN26 whether there is loose or poor connection and so on.

(b) Inspect whether the sensor is installed correctly.

(c) Inspect whether the sensor gap is normal.

No → Repair the faulty part. Go to step 10

Yes

Step 2	Read the engine data (engine speed) on the fault diagnosis tester.

(a) Connect fault diagnosis tester to diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Select Engine/Reading Data/Engine Speed.

(d) Start the engine.

(e) With the engine running, read the engine data on the fault diagnosis tester

Standard Value: Normal data. Refer to 2.12.7.9 Data Flow Table

(f) If the engine does not start, inspect the data with the engine running.

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(g) f the engine speed is shown as 0, it indicates the circuit between the crankshaft position sensor and ECM wiring harness open or short.

Yes → Go to step 4

No

Step 3	Refer to 2.12.7.4 Fault Symptom Table for intermittent fault.

Step 4	Inspect crankshaft position sensor.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the crankshaft position sensor harness connector EN26

(c) Measure crankshaft position sensor resistance.

Standard Resistance

25℃(77ºF) 900-1100Ω

(d) Connect the crankshaft position sensor harness connector EN26.

Is the resistance normal?

No → Refer to 2.10.7.2 "Replacement of Crankshaft Position Sensor" to replace the crankshaft position sensor. Go to Step 10.

Yes

Step 5	Inspect sensor terminal No.A circuit.

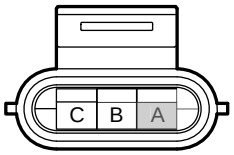
(a) Rotated ignition switch to OFF position .

(b) Disconnect the crankshaft position sensor harness connector EN26

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between crankshaft position sensor wiring harness connector EN26 terminal No.A and ECM harness connector EN01 terminal No.30. Inspect whether the circuit is open.

EN26 crankshaft position sensor harness connector



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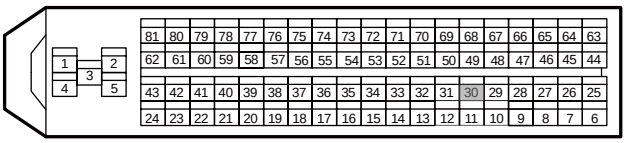
(e) Measure resistance between crankshaft position sensor harness connector EN26 terminal No.A and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure resistance between crankshaft position sensor harness connector EN06 terminal No.A and power supply. Inspect whether the circuit is short to power supply.

EN01 engine control module harness connector



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Test Items	**Standard Value**
EN26(A)-EN01(30) resistance	Less than 1 Ω
EN26(A)-reliable grounding resistance	10 kΩ or higher
EN26(A)-reliable grounding voltage	0V

Are the values specified values?

No → Repair the faulty part. Go to step 10

Yes

Step 6	Inspect sensor terminal B circuit.

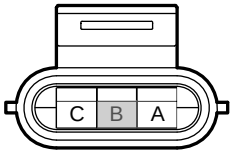
(a) Rotated ignition switch to OFF position .

(b) Disconnect the crankshaft position sensor harness connector EN26

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between crankshaft position sensor wiring harness connector EN26 terminal No.B and ECM harness connector EN01 terminal No.11. Inspect whether the circuit is open.

EN26 crankshaft position sensor harness connector



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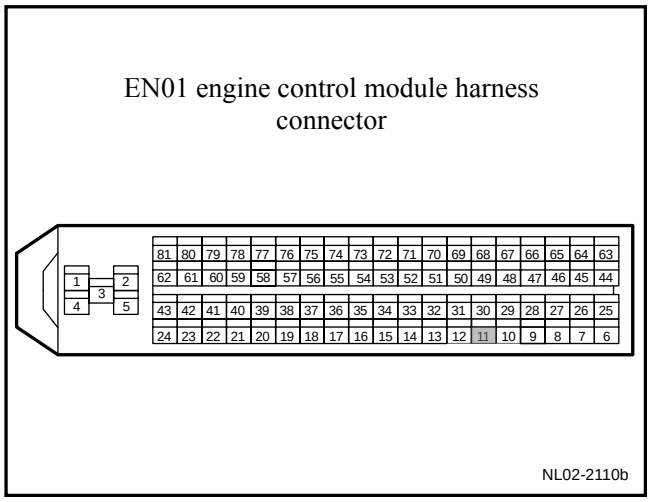
(e) Measure resistance between crankshaft position sensor harness connector EN26 terminal No.B and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure voltage between crankshaft position sensor wiring harness connector EN26 terminal B and power supply. Inspect whether the circuit is short to power supply.



Test Items	Standard Value
EN26(B)-EN01(11) resistance	Less than 1 Ω
EN26(B)-reliable grounding resistance	10 kΩ or higher
EN26(B)-reliable grounding voltage	0V

Are the values specified values?

No → Repair the faulty part. Go to step 10

Yes

Step 7	Inspect sensor signal plate.

(a) Inspect whether the sensor signal plate is damaged, missing and so on.

(b) Inspect whether the sensor signal plate is installed correctly.

No → Repair the faulty part. Go to step 10

Yes

Step 8	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

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No → Repair the faulty part.

Yes

Step 9	Replace ECM

Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

Step 10	Use fault diagnosis tester to confirm whether the DTC Code is stored again.

(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) test the vehicle on the road for at least 10 min.

(f) Read control system DTC code again to confirm that the system has no DTC code.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

Step 11	Troubleshooting

5. Troubleshooting

Refer to 2.10.7.2 “Replacement of Crankshaft Position Sensor” to replace the crankshaft position sensor.

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2.12.7.36 DTC P0340 P0341

1. DTC description:

DTC	P0340	VCP Camshaft Position Sensor Status Diagnosis

DTC	P0341	VCP Target Wheel Diagnosis

Camshaft position (CMP) sensor is used to detect camshaft position, and is associated with the crankshaft position. It sends signals to the engine control module (ECM) to determine the upcoming fuel injection. Engine Control Module (ECM) also uses the camshaft position sensor output to determine the camshaft to the crankshaft relative position to control the valve timing of camshaft adjustment and conduct emergency operations.

Intake Camshaft position sensor circuit includes the following:

– Reference Voltage: ECM provides a reference voltage to CMP sensor harness connector EN15terminal C via ECM harness connector EN01 terminal No.70.

– Signal Circuit: ECM receives signal voltage from CMP sensor harness connector EN15 terminal A via ECM harness connector EN01 terminal No.77.

– ECM Low Reference Voltage Circuit: ECM provides a low reference voltage to CMP sensor harness connector EN15 terminal B via ECM harness connector EN01 terminal No.74.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0340	ECM detects the engine running but does not receive the intake camshaft position sensor signal	1. ECM detects the engine running. 2. ECM detects the crankshaft position sensor signal. 3. The intake Camshaft position sensor signal is lost.	1. Sensor Circuit 2. Sensor 3. The intake Camshaft Signal Wheel 4. ECM
P0341	ECM detects the engine running, but receives a the intake camshaft position sensor signal and that does not match calibration.	1. ECM detects the engine running. 2. ECM detects the crankshaft position sensor signal. 3. ECM detected camshaft position sensor signal does not match the reference crankshaft position sensor signal.	

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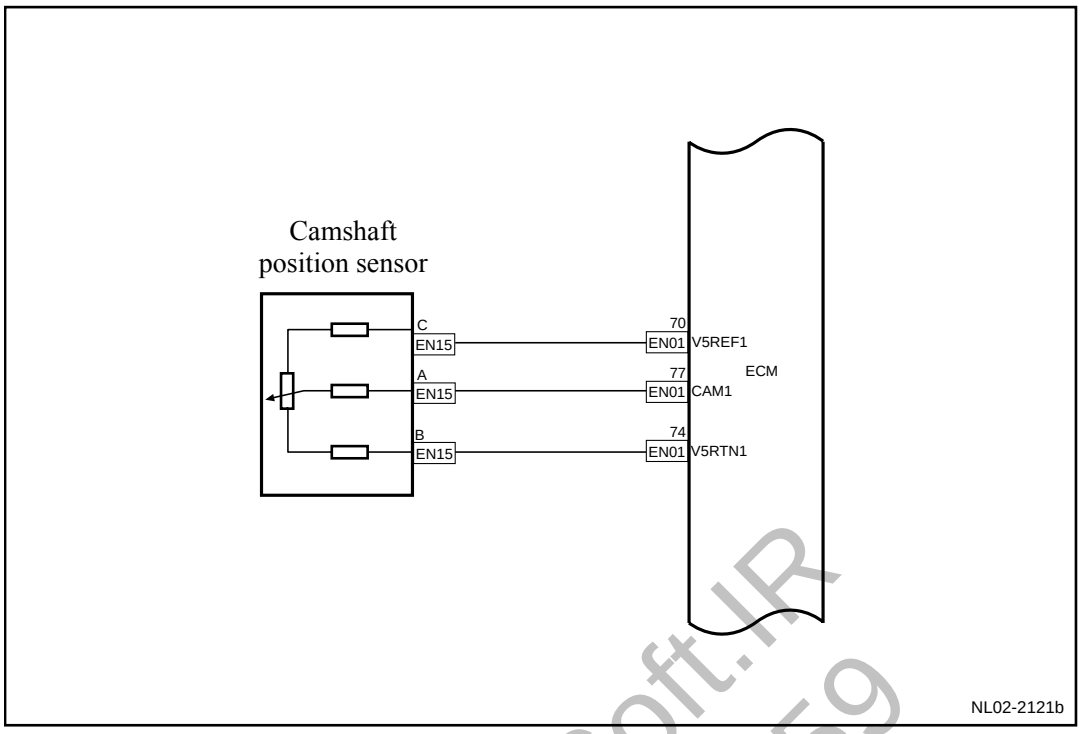
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Initial Inspection

(a) Inspect the sensor harness connector EN15 whether there is loose or poor connection and so on.

(b) Inspect whether the sensor is installed correctly.

(c) Inspect whether the sensor gap is normal.

Are these components normal?

No → Repair the faulty part. Go to step 9

Yes

Step 2	Measure sensor 5 V reference voltage.

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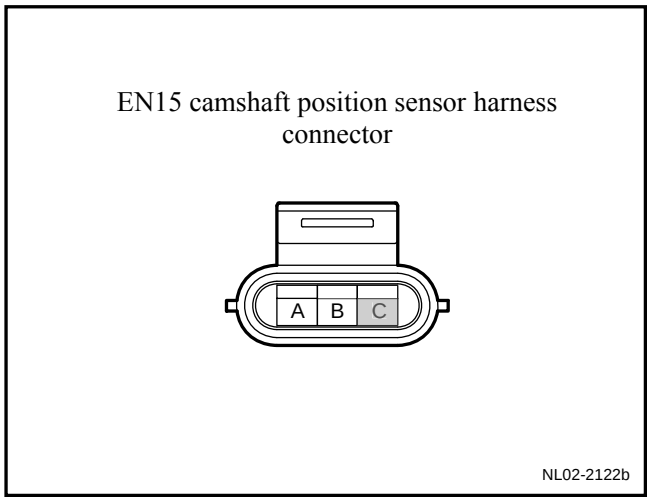
(a) Rotated ignition switch to OFF position .

(b) Disconnect the intake camshaft position sensor wiring harness connector EN15.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between the intake camshaft position sensor wiring harness connector EN15 terminal No.C and a reliable ground.

Standard Voltage: 4.5-5.5V



(e) Connect the intake camshaft position sensor wiring harness connector EN15.

Is the value specified value?

No	Go to step 6
Yes	

Step 3	Measure Sensor Signal Circuit

(a) Rotated ignition switch to OFF position.

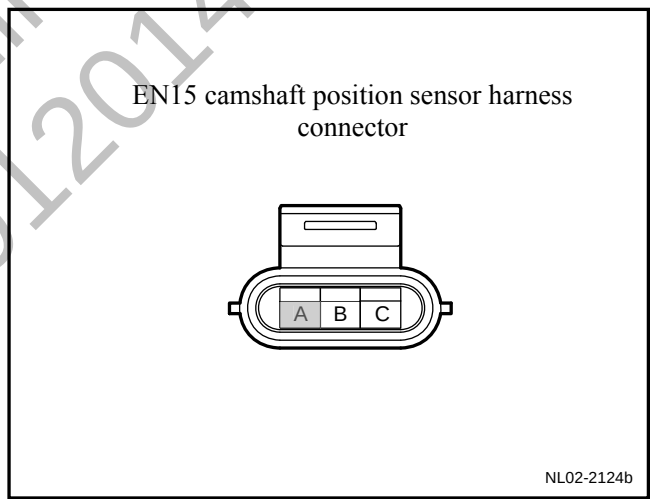
(b) Disconnect the intake camshaft position sensor wiring harness connector EN15.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between the intake camshaft position sensor wiring harness connector EN15 terminal A and a reliable ground.

Standard Voltage: 4.5-5.5V

e) Connect the intake camshaft position sensor wiring harness connector EN15.



Is the value specified value?

No	Go to step 7
Yes	

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Step 4	Test sensor ECM internal low reference circuit.

(a) Rotated ignition switch to OFF position .

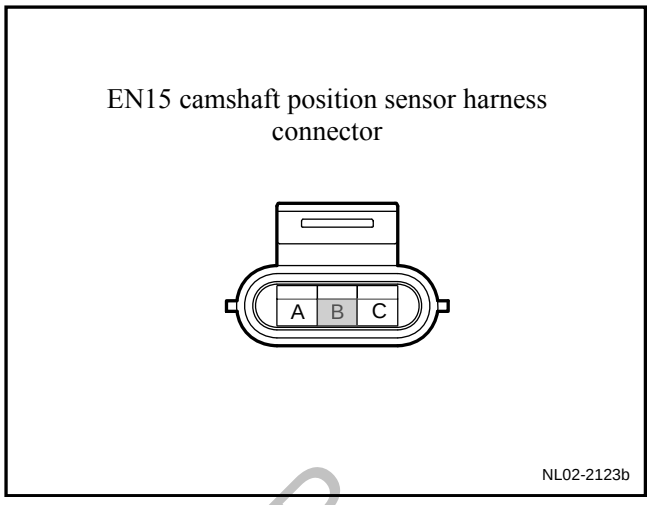
(b) Disconnect the intake camshaft position sensor wiring harness connector EN15.

(c) Rotated ignition switch to ON position .

(d) Measure resistance between the intake camshaft position sensor wiring harness connector EN15 terminal B and reliable ground.

Standard Resistance: Less than 3 Ω

(e) Connect the intake camshaft position sensor wiring harness connector EN15.



Is the value specified value?

No → Go to step 8

Yes

Step 5	Refer to 2.10.7.1 “Replacement of Camshaft Position Sensor” to replace the intake camshaft position sensor.

Next → Go to step 12

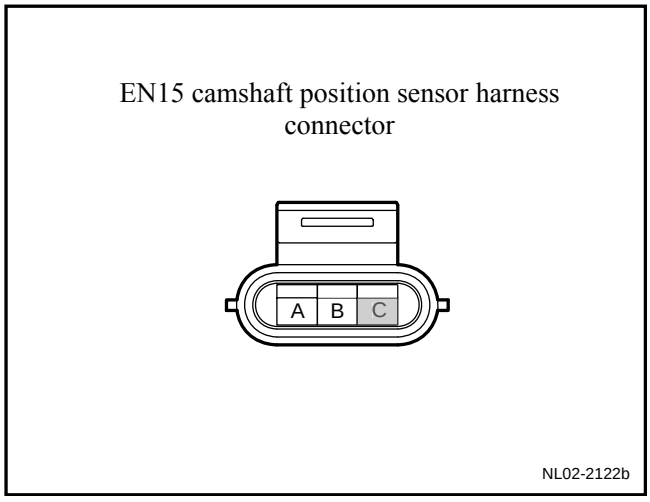
Step 6	Inspect the sensor 5 V reference voltage circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect the intake camshaft position sensor wiring harness connector EN15.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between intake camshaft position sensor wire harness connector EM15 terminal C and ECM wire harness connector EM01 terminal 70. Inspect whether there is short-circuit situation.



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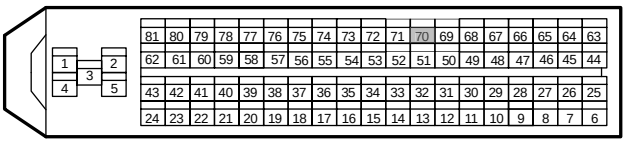
(e) Measure voltage between camshaft position sensor harness connector EN15 terminal No.C and a reliable ground. Inspect whether the circuit is short to power supply.

(f) Measure voltage between camshaft position sensor harness connector EN15 terminal No.C and a reliable ground. Inspect whether the circuit is open to power supply.

EN01 engine control module harness connector



NL02-2125b

Test Items	**Standard Value**
EN15(C)-EN01(70) resistance	Less than 1 Ω
EN15(C)-reliable grounding resistance	10 kΩ or higher
EN15(C)-reliable grounding voltage	0V

Execute next step as per normal.

Next	Repair the faulty part. Go to step

Step 7	Inspect Sensor Signal Circuit

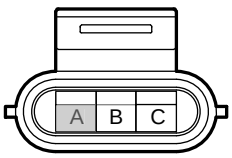
(a) Rotated ignition switch to OFF position .

(b) Disconnect the intake camshaft position sensor wiring harness connector EN15.

(c)Disconnect ECM harness connector EN01.

(d) Measure resistance between intake camshaft position sensor wire harness connector EM15 terminal A and ECM wire harness connector EM01 terminal 77. Inspect whether there is short-circuit situation.

EN15 camshaft position sensor harness connector



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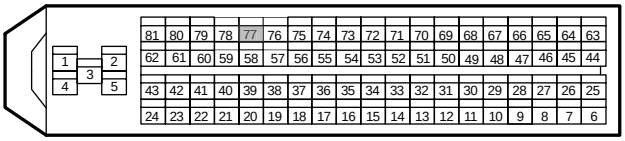
(e) Measure voltage between camshaft position sensor harness connector EN15 terminal No.A and a reliable ground. Inspect whether the circuit is short to power supply.

(f) Measure voltage between camshaft position sensor harness connector EN15 terminal No.A and a reliable ground. Inspect whether the circuit is open to power supply.

EN01 engine control module harness connector



NL02-2126b

Test Items	**Standard Value**
EN15(A)-EN01(77) resistance	Less than 1 Ω
EN15(A)-reliable grounding resistance	10 kΩ or higher
EN15(A)-reliable grounding voltage	0V

Are the values specified values?

No → Repair the faulty part. Go to step 12

Yes

Step 8	Inspect sensor ECM internal low reference circuit.

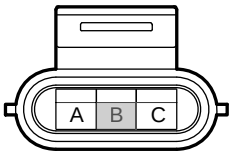
(a) Rotated ignition switch to OFF position .

(b) Disconnect the intake camshaft position sensor wiring harness connector EN15.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between intake camshaft position sensor wire harness connector EM15 terminal B and ECM wire harness connector EM01 terminal 74. Inspect whether there is short-circuit situation.

EN15 camshaft position sensor harness connector



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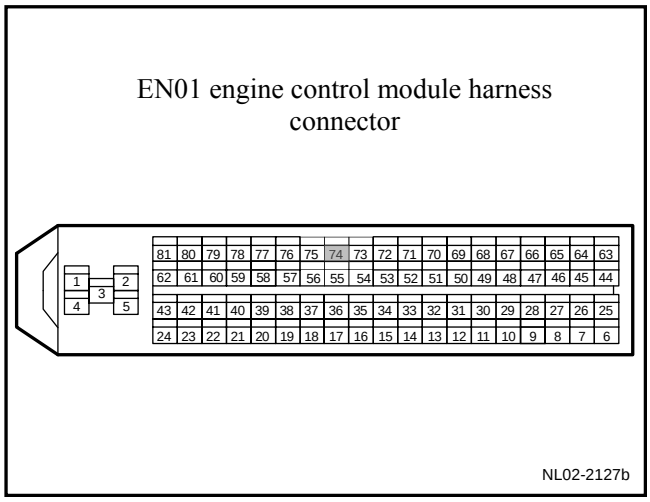
(e) Measure resistance between intake camshaft position sensor wire harness connector EN15 terminal B and reliable grounding. Inspect whether there is short-circuit situation.



Test Items	**Standard Value**
EN15(B)-EN01(18) resistance	Less than 1 Ω
EN15(B)-reliable grounding voltage	0V

Execute next step as per normal.

Next

Step 9	Inspect whether the intake camshaft signal plate is normal.

No → Repair the faulty part.

Yes

Step 10	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 11	Replace ECM

Next

Step 12	Use scan tool to confirm whether the DTC Code is stored again.

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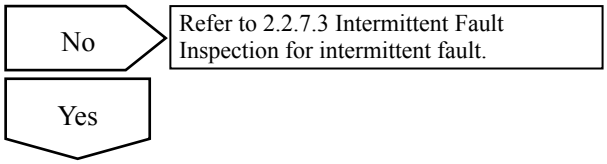
(a) Connect the fault diagnosis tester to the diagnostic interface.

(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.



Step 13	Troubleshooting

5. Maintenance guide :

Refer to2.10.7.1 Replacement of Camshaft Position Sensor to replace the intake CMP sensor.

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2.12.7.37 DTC P0351 P0352 P0353 P0354

1. DTC description:

DTC	P0351	Cylinder 1 Ignition Circuit malfunction

DTC	P0352	Cylinder 2 Ignition Circuit malfunction

DTC	P0353	Cylinder 3 Ignition Circuit malfunction

DTC	P0354	Cylinder 4 Ignition Circuit malfunction

Ignition coil #1 initiate the ignition for Cylinder #1; ignition coil #2 initiate the ignition for Cylinder #2; ignition coil #3 initiate the ignition for Cylinder #3; ignition coil #4 initiate the ignition for Cylinder #4. The ignition relay supplies power for the four ignition coils. ECM uses the ECM harness connector EN01 terminal #4 to control Cylinder #1 ignition coil primary circuit to be grounded; uses the terminal #1 to control Cylinder #2 ignition coil primary circuit to be grounded; uses the terminal #62 to control Cylinder #3 ignition coil primary circuit to be grounded; uses the terminal #81 to control Cylinder #4 ignition coil primary circuit to be grounded.

2. DTC Code Set Up and Removal Conditions:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P0351	Hardware Circuit Inspection	Operating at idle, with the ignition coil control end disconnected, short to ground or short to power supply, this DTC code will be set. The fuel injection of the cylinder with this DTC code will stop leading to engine speed fluctuates.	1. Ignition Coil Circuit 2. Ignition Coil 3. ECM
P0352			
P0353			
P0354			

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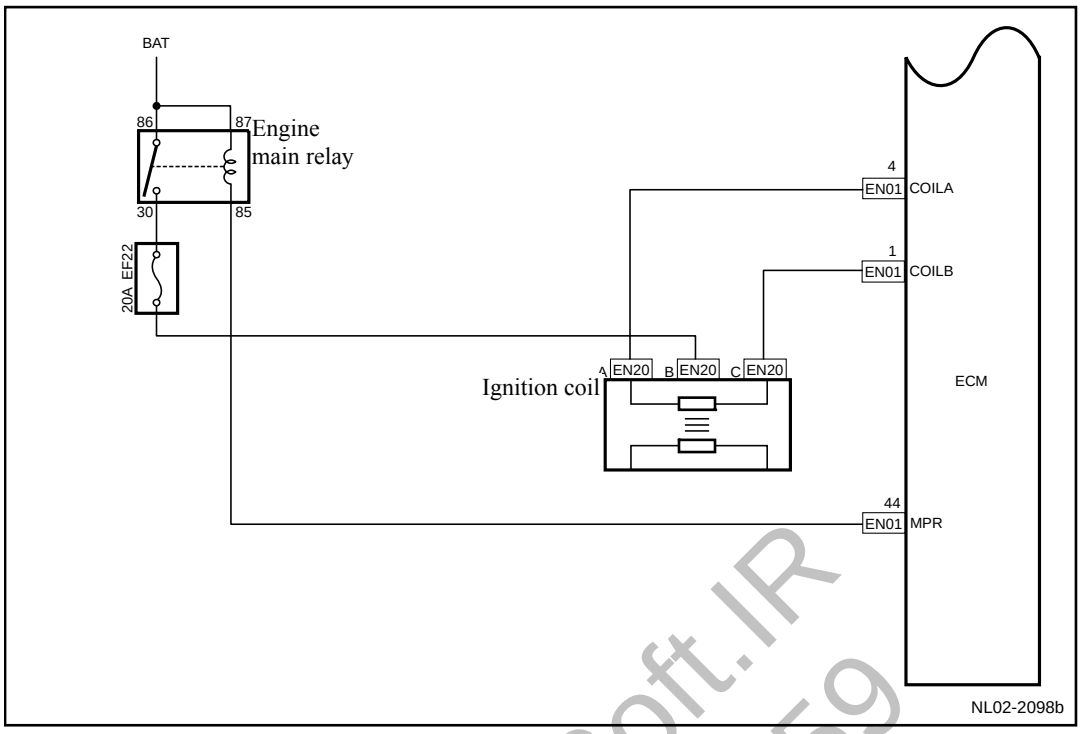
3. Circuit figure



4. Diagnostic Steps:

Refer to 2.10.6 “Diagnostic Information and Procedures” for ignition coil inspection.

5. Maintenance guide

Refer to 2.10.7.3 “Replacement of Ignition Coil” to replace the ignition coil.

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2.12.7.38 DTC P0420

1. DTC description:

DTC	P0420	Three-Way Catalytic Converter Conversion Efficiency Low

ECM uses two oxygen sensors (front oxygen sensor and rear oxygen sensor) installed before and after the three- way catalytic converters to monitor the conversion efficiency of the three-way catalytic converter (TWC). ECM uses front oxygen sensor for Air-fuel ratio close-loop control and monitors oxygen content in the exhaust gas not purified by TWC. The Post-catalytic oxygen sensor sends voltage signal to ECM indicating the oxygen content in the exhaust gas purified by the TWC. ECM compares signals from the two sensors to determine whether the TWC is currently under normal working condition. If the calculated TWC conversion efficiency is too low, the fault lamp will be lit and the DTC code will be set.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0420	Hardware Circuit Inspection	Coolant temperature is higher than 70°C (158 ?F), and the fuel system is in close-loop mode. After driving some distance and stop the vehicle, run the engine at idle, the system compares the front and rear oxygen sensor signals to calculate three-way catalyst converter oxygen storing time. When the oxygen storing time is less than the threshold, the system reports a fault.	1. Front Oxygen Sensor 2. Rear Oxygen Sensor 3. Three-way Catalytic Converter. 4. Exhaust Leak.

3. Circuit sketch

Refer to 2.12.6 Electrical Schematic Diagram.

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect whether there are control system DTC codes other than DTC P0420.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position.

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

Read DTC code

Results

DTC Codes Shown	To Step

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DTC P0420	Yes
DTC code other than P0420	No

No → Refer to 2.2.7.14 DTC Chapter Index.

Yes

2	Start engine and turn on the fault diagnosis tester.

Next

3	Keep the engine speed at 2,500 rpm for more than 2 min to warm up the engine, until the engine coolant temperature reaches 80℃ (176 ?F).

Next

4	(d) Select on the fault diagnosis tester: Engine/Read Data Flow/Group 1 Oxygen Sensor Voltage 1 (Front Oxygen Sensor). Group 1 Oxygen Sensor Voltage 2 (Rear oxygen sensor)

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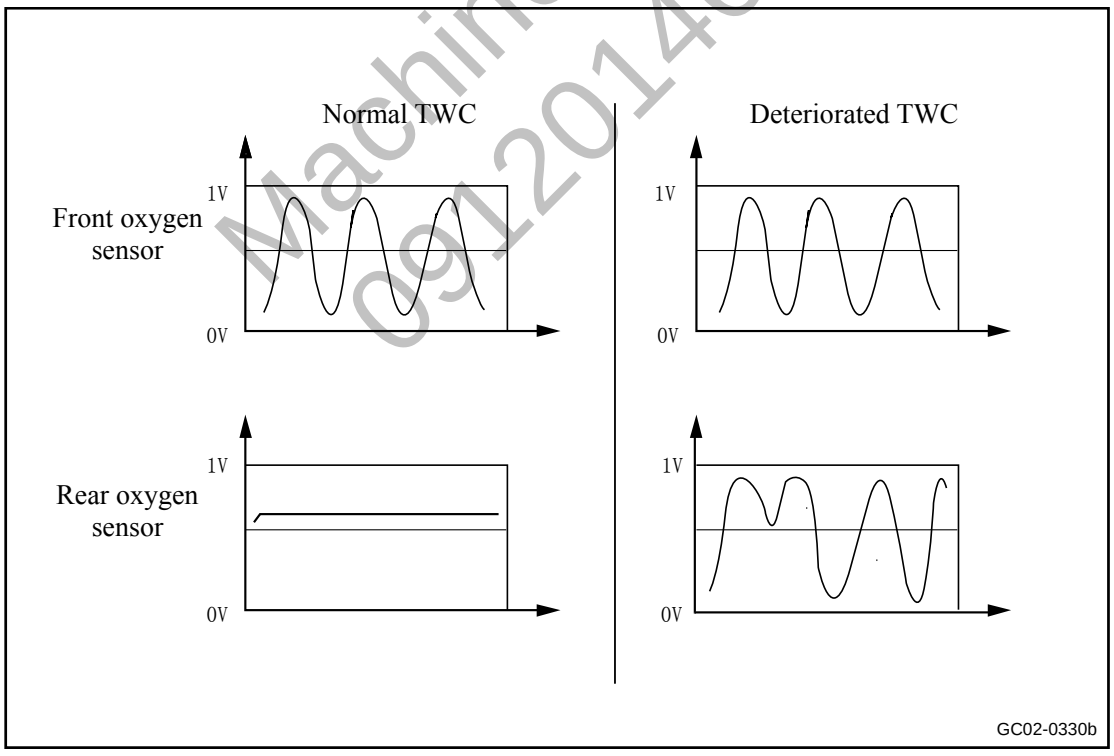

5	Observe front oxygen sensor and rear oxygen sensor output voltages.

Whether front oxygen sensor and rear oxygen sensor signal voltage is matching Normal TWC in

the figure?

Yes → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

No

Serious Warning: Propane gas is flammable gas. It is strictly prohibited to operate propane gas near a fire, otherwise it will cause a fire.

6	Carry out the oxygen sensor signal test.

A. If the voltage data is consistently lower than 0.45 V (mixture too thin), carry out the following inspection steps:

- Spray proper amount of propane gas into the intake.
- Inspect whether the sensor voltage data is changed significantly, as the signal voltage will increase rapidly.

Front Oxygen Sensor Signal Voltage	**Rear Oxygen Sensor Signal Voltage**	**To Step**
Obvious Change	No Change	A
No Change	Obvious Change	B
Obvious Change	No Change	C
No Change	No Change	D

B → Refer to 2.4.7.2 “Replacement of Front Oxygen Sensor” to replace the front oxygen sensor. Go to Step 11.

C → Go to step 9

D → Inspect the cause for engine air-fuel ratio too lean/too rich. Refer to 2.2.7.4 Fault Symptom Table.

A

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7	Inspect whether there is exhaust leakage.

Yes → Repair the faulty part. Go to step 11

No

Next	Go to step 11
8	Refer to 2.7.6.3 “Replacement of Three-way Catalytic Converter” to replace the three-way catalytic converter.

9	Inspect whether there is exhaust leakage	Yes	Repair the faulty part. Go to step 11
		No	

10	Replace the rear oxygen sensor. Refer to 2.7.6.1 Replacement of Rear Oxygen Sensor.	Next

11	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position .

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code.

No	Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.	
Yes		

12	Troubleshooting

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2.12.7.39 DTC P0458 P0459

1. DTC description:

DTC	P0458	Canister Control Valve Circuit Short To Low Voltage or Open

DTC	P0459	Canister Control Valve Circuit Short To High Voltage

EVAP solenoid valve absorbs fuel vapor from the evaporative emission canister to the intake manifold. EVAP solenoid valve is controlled by the pulse width modulation (PWM). The circuit consists of:

- Operating Voltage: Battery voltage passes through ECM controlled main relay terminal No.3 to reach EVAP solenoid harness connector EN24 terminal A.
- ECM control circuit: EVAP electromagnetic valve wire harness connector EN24 terminal B and ECM wire harness connector EN01 terminal 64 are connected. ECM has an internal driver circuit to control the solenoid valve ground. Drive circuit is equipped with a feedback circuit to ECM. ECM monitors the feedback voltage control circuit to determine whether the control circuit is open, short to ground or short to voltage.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0458	Hardware Circuit Inspection	At idle conditions, when canister solenoid valve is inoperative, make canister solenoid valve circuit short to ground or open, DTC code set.	1. Canister Solenoid Valve Circuit 2. Solenoid Valve 3. ECM
P0459	Hardware Circuit Inspection	At idle conditions, when the canister solenoid valve is inoperative, make anister solenoid valve circuit short to power supply, DTC code set.	

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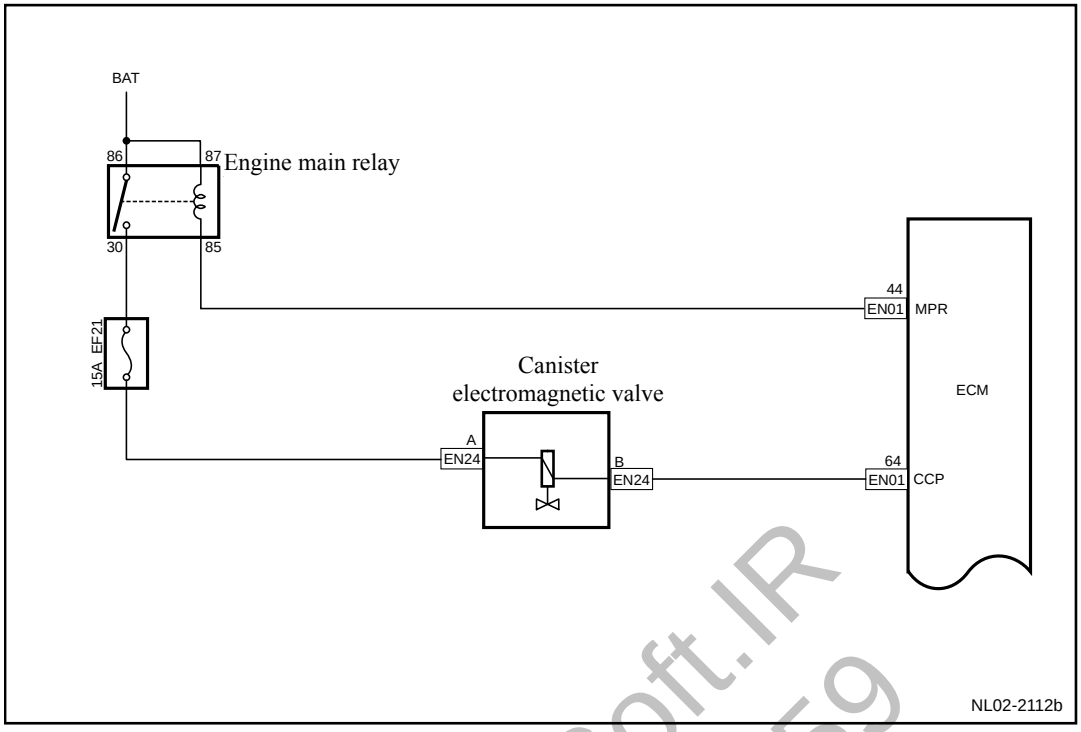
3. Circuit sketch



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

Step 1	Use fault diagnosis tester for canister solenoid valve active testing.

(a) Connect fault diagnosis tester to the Data Link Connector.

(b) Disconnect the canister solenoid valve to the Canister vacuum tubes.

(c) Start engine and turn on the fault diagnosis tester.

(d) Enter the following menu: Engine/Action Test/Canister Solenoid Valve

(e) Use fault diagnosis tester to enable the use of Canister Control Valve. Place a finger over the vacuum port solenoid valve and inspect whether there is suction.

Yes → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

No

Step 2	Measure canister solenoid valve resistance.

(a) Rotated ignition switch to OFF position .

(b) Disconnect canister solenoid valve harness connector EN24.

(c) Measure resistance between the canister solenoid valve two terminals.

Standard resistant value :20℃(68?F)11-22Ω

((d)Connect canister solenoid valve harness connector EN24.

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Is the value specified value?

Yes → Refer to "2.4.7.3 Replacement of Canister Solenoid Valve" to replace the canister solenoid valve. Go to Step 7.

No

Step 3	Measure solenoid valve working power supply.

(a) Rotated ignition switch to OFF position .

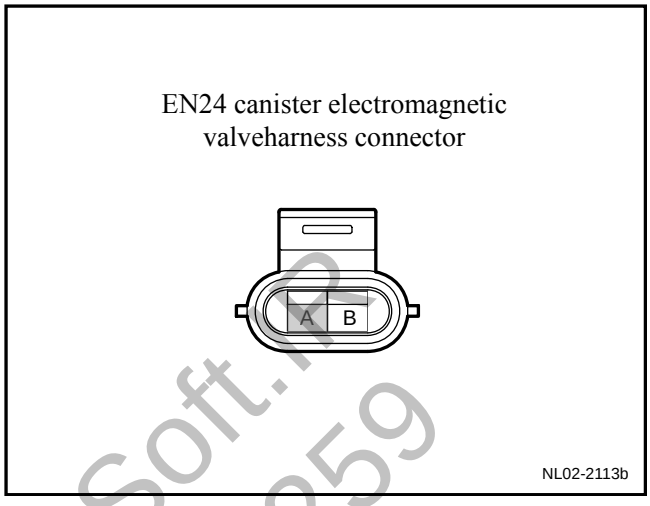
(b) Disconnect canister solenoid valve harness connector EN24.

(c) Rotated ignition switch to ON position .

(d) Measure voltage between canister solenoid valve harness connector EN24 terminal A and a reliable ground.

Standard Voltage: 11-14V

(e) Connect canister solenoid valve harness connector EN24. Is the value specified value?



No → Inspect whether there is an open circuit or a circuit short to ground between solenoid valve harness connector EM25 terminal No. A and main relay terminal No.3. Repair the faulty part. Go to step 7

Yes

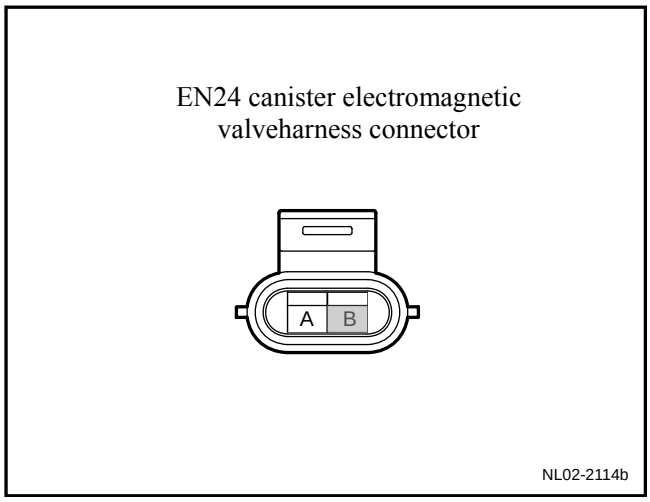
Step 4	Inspect canister solenoid valve control circuit.

(a) Rotated ignition switch to OFF position .

(b) Disconnect canister solenoid valve harness connector EN24.

(c) Disconnect ECM harness connector EN01.

(d) Measure resistance between canister solenoid valve harness connector EN24 terminal B and ECM harness connector EN01 terminal No.57. Inspect whether the circuit is open.



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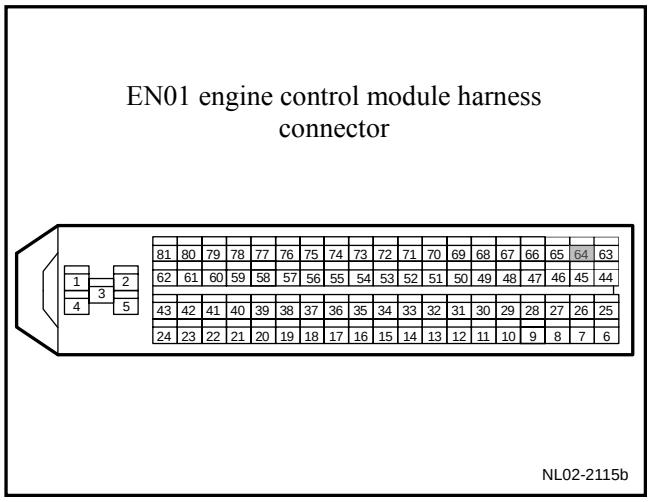
(e) Measure resistance between canister solenoid valve harness connector EN24 terminal B and a reliable ground. Inspect whether the circuit is short to ground.

(f) Measure voltage between canister solenoid valve harness connector EN24 terminal B and a reliable ground. Inspect whether the circuit is short to power supply.



Tester Connection	**Standard Value**
EN24(B)-EN01(64) resistance	Less than 1 Ω
EN24(B)-grounding resistance	10 kΩ or higher
EN24(B)-grounding voltage	0V

Are the values specified values?

Step 5	Inspect the ECM Power Supply Circuits.

(a) Inspect whether ECM power supply circuit is normal.

(b) Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 6	Replace ECM

Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

No → Repair or replace the wire harness connector to step 10.

Yes

Step 7	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Connect the fault diagnosis tester to the diagnostic interface.

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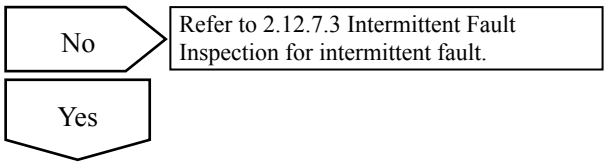
(b) Turn ignition switch to ON position.

(c) Clear DTC code.

(d) Start and run the engine at idle speed to warm up the engine for at least 5 min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.



8	Troubleshooting

5. Maintenance guide :

Refer to “2.4.8.1 Replacement of Canister Solenoid Valve” to replace the canister solenoid valve.

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2.12.7.40 DTC P0480 P0481

1. DTC description:

DTC	P0480	Low-Speed Fan Malfunction

DTC	P0481	High-Speed Fan Malfunction

High or low speed cooling fan relay coil power is provided by ECM controlled main relay. ECM controls the relay via ECM harness connector EN01 terminal No.65 and 17. Drive circuit is equipped with a feedback circuit to ECM. Drive circuit is equipped with a feedback circuit to ECM. ECM monitors the feedback voltage control circuit to determine whether the control circuit is open, short to ground or short to voltage.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0480	Hardware Circuit Inspection	Fan 1 control circuit open or shot, reported as DTC code.	1. Relay Circuit 2. Relay 3. ECM. 4. Cooling Fan
P0481			

3. Circuit figure

Refer to 2.12.6 Electrical Schematic Diagram

4. Diagnostic Steps:

Refer to 2.8.7.2 Cooling Fan Circuit Diagnosis

5. Maintenance guide :

Replace the cooling fan. Refer to 2.8.8.3 Replacement of Cooling Fan.

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2.12.7.41 DTC P0502

1. DTC description:

DTC	P0502	No signal from vehicle speed sensor

The vehicle speed signal is used to monitor the vehicle speed. The vehicle speed signal is one of the fuel control reference signals during an urgent deceleration. Input through the terminal 51 of ECM harness connector EN21 and further transmit to the instrument at the same time. The vehicle speed sensor signal is sent to the instrument panel used for the vehicle speed display.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0502	No signal from vehicle speed sensor	1. Under hot operating conditions, driving the vehicle at Low-Speed at 3rd gear, Disconnect the vehicle speed sensor. and then press the acceleration pedal hard to accelerate to higher than 4,000 and immediately release the pedal. Engine speed, vehicle speed and MAP values begin to decline. When entering the fault setting window, DTC code will be set. 2. Under hot operating conditions, driving the vehicle at medium speed at 4th gear, Disconnect the vehicle speed sensor. and then press the acceleration pedal to accelerate the vehicle. Engine speed, vehicle speed and MAP values entering the fault setting window, DTC code will be set.	1. Vehicle Speed Sensor 2. Vehicle Speed Sensor Circuit 3. ECM.

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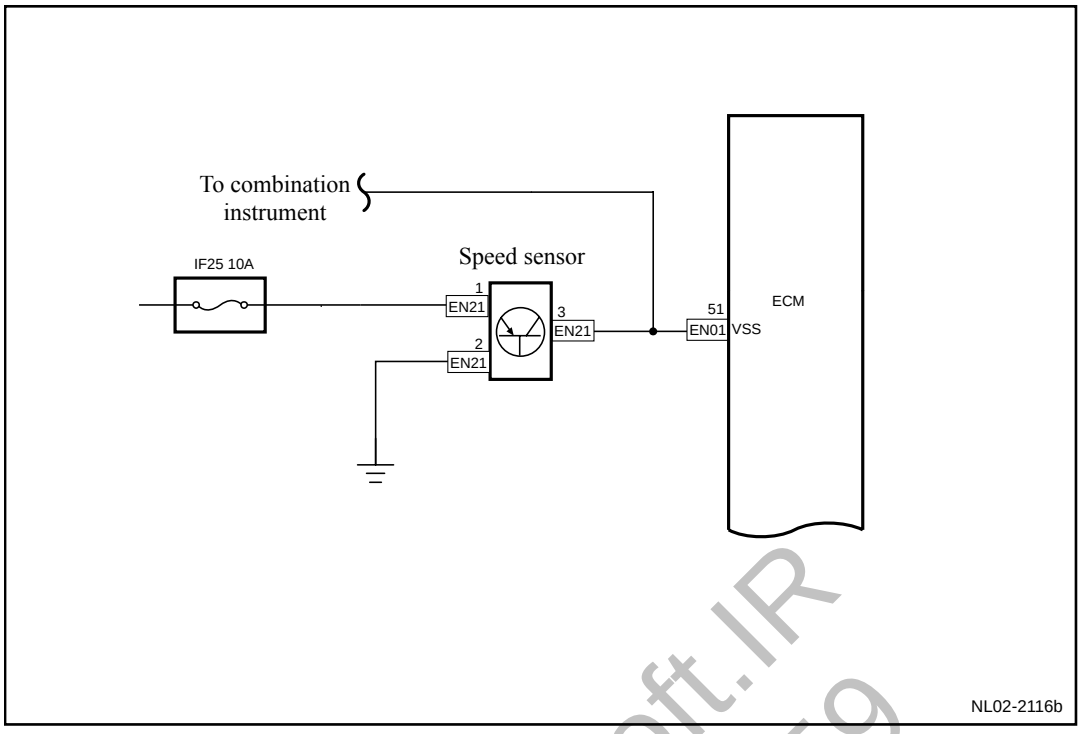
3. Circuit sketch



4. Diagnostic Steps:

1	Road test the vehicle. Is the vehicle speed displayed on the instrument working properly?

A. If the instrument displays the vehicle speed as per normal, the vehicle speed sensor is working correctly.

B. If the instrument displays the vehicle speed abnormally, the vehicle speed sensor or the circuit may be faulty.

No — Go to step 4

Yes

2	Inspect the vehicle speed sensor power supply circuit.

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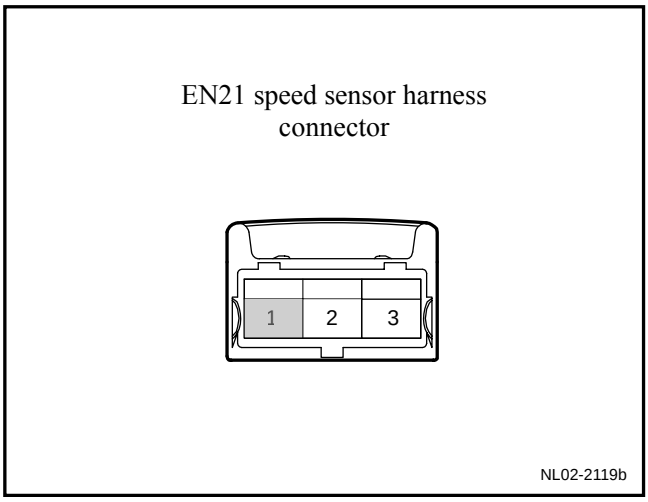
A. Turn the ignition switch to the OFF position.

B. Disconnect speed sensor harness connector EN21.

C. Turn the ignition switch to the ON position.

D. Measure voltage between vehicle speed sensor harness connector EN21 terminal No.1 and a reliable ground.

Standard value :7-9V



Is the value specified value?

No	Repair the circuit between the vehicle speed sensor terminal No.1 and the main relay terminal No.3. Go to step 1.
Yes	

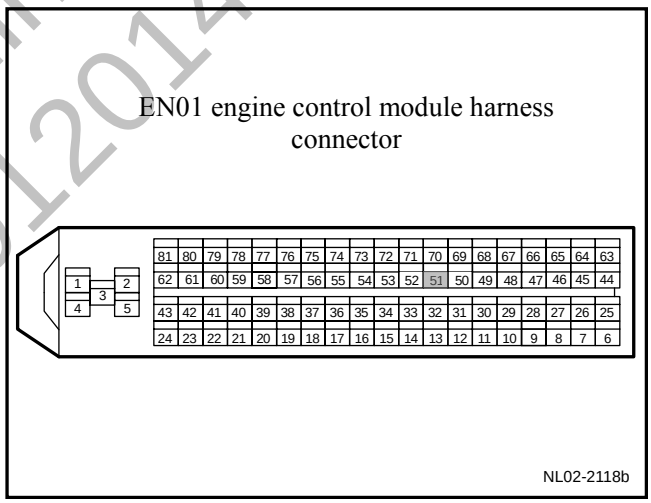
3	Inspect the vehicle speed signal circuit.

A. Turn the ignition switch to the OFF position.

B. Disconnect speed sensor harness connector EN21.

C. Disconnect ECM harness connector EN01.

D. Measure resistance between the vehicle speed sensor harness connector EN21 terminal No.3 and ECM harness connector EN01 terminal No.51. Inspect whether the circuit is open.



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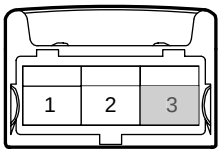
E. Measure resistance between the vehicle speed sensor harness connector EN21 terminal No.3 and a reliable ground. Inspect whether the circuit is short to ground.

F. Measure voltage between the vehicle speed sensor harness connector EN21 terminal No.3 and reliable ground with multimeter. Inspect whether the circuit is short to power supply.

EN21 speed sensor harness connector



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Tester Connection	Standard Value
EN21(3)-EN01(51) resistance	Less than 1 Ω
Resistance Between EN21 (3) and Ground	10 kΩ or higher
Voltage Between EN21 (3) and Ground	0V

Are the values specified values?

Yes	Go to step 7
No	Repair or replace the wire harness connector to step 8.

4	Inspect the vehicle speed sensor ground circuit.

A. rotated ignition switch to OFF position.

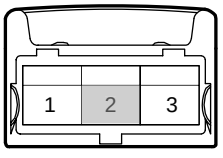
B. Disconnect speed sensor harness connector EN21.

C. Rotated ignition switch to ON position .

(d) Measure the resistance between vehicle speed sensor harness connector EN21 terminal No.2 and a reliable ground.

Standard Value: Less than 3 Ω

EN21 speed sensor harness connector



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Is the value specified value?

No → Repair or replace the wire harness connector to step 7.

Yes

5	Replace the vehicle speed sensor.

Next → Go to step 8

6	Inspect the ECM Power Supply Circuits.

A. Inspect whether ECM power supply circuit is normal.

B. Inspect whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

7	Replace ECM

A. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn after replacing the ECM.

Next

8	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Intermittent fault refers to 2.12.7.3 List of Intermittent Fault.

Yes

9	Troubleshooting

5. Maintenance guide :

Refer to 3.3.6.2 Replacement of Vehicle Speed Sensor to replace the vehicle speed sensor.

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2.12.7.42 DTC P0506 P0507

1. DTC description:

DTC	P0506	Idle Speed Too Low

DTC	P0507	Idle Speed Too High

Throttle actuator control motor is controlled by the engine control module (ECM). Internal DC motor drives throttle body. In order to reduce idle speed and adjust the spark and fuel supply, engine control module commands the throttle to close. By reducing the air flow into the engine, idle speed is lowered. In order to improve idle, the engine control module commands the throttle to open, so that more air flows through the throttle.

Engine control module (ECM) calculates and controls engine idle speed based on coolant temperature, speed compensation, reducing speed, Air-Conditioning compensation and voltage compensation.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0506	Idle speed is lower than the target speed by 100 rpm	1. The engine is at idle speed. 2. The vehicle speed is equal to 0. 3. Engine coolant temperature is more than 60℃(140°F) 4. Duration is longer than 10s.	1. ETC throttle body assembly 2. Intake System 3 Exhaust System 4. ECM
P0507	Idle speed is higher than the target speed by 200 rpm	1. The engine is at idle speed. 2. The vehicle speed is equal to 0. 3. Engine coolant temperature is more than 60℃(140°F) 4.Duration Longer Than 10s.	

3. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect whether there are control system DTC codes other than DTC P0506 P0507.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

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Results

DTC Codes Shown	To Step
DTC P0506 P0507	No
DTC code other than P0506 P0507	Yes

Yes → Refer to 2. 3.6.11 DTC Chapter Index.

No

2	Inspect whether generator is working properly.

A. Use a fault diagnosis tester to observe whether the system voltage parameters are normal. Is generator generating capacity normal?

No → Repair generator fault.

Yes

3	Inspect intake air pressure sensor parameters.

A. Use a fault diagnosis tester to observe whether system intake air pressure sensor parameters are correct. Refer to 2.12.7.9 Data Flow Table. Are intake air pressure sensor parameters normal?

No → Repair generator fault.

Yes

4	Inspect the working condition of the air-conditioner.

A. Use a fault diagnosis tester to observe whether the air-conditioning working status is consistent with the actual air-conditioning working condition. Refer to 2.12.7.9 Data Flow Table.

When the air-conditioning is switched on and the pressure switch voltage is greater than 0 V, does the idle speed increase by about 150 rpm?

Yes → Go to step 7

No

5	Inspect air intake system and exhaust system.

A. Inspect air intake system and exhaust system for blockage and air leakage.

B. Too much carbon residue in throttle.

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Any of these malfunctions?

Yes → Go to step 7

No

6	Inspect engine mechanical parts and accessory drive.

A. Shut down the engine and turn the ignition switch to OFF.

B. Check whether the drive belt of the engine is loosened.

C. Dismantle engine accessory belt, neutral gear. Rotate the engine crankshaft and inspect whether engine mechanical moving components catching.

D. Rotate engine accessory pulley and air-conditioning pump. Check whether engine and other components catching.

Any of these malfunctions?

Yes → Repair the faulty parts.

No

7	Inspect ECM power supply circuit.

A. Inspect whether ECM power supply circuit is normal.

B. Inspect whether ECM ground circuit is normal.

No → Repair the faulty parts.

Yes

8	Replace ECM

A. Replaces .

B. Carry out the crankshaft position sensor learning, refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learning.

Next

9	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

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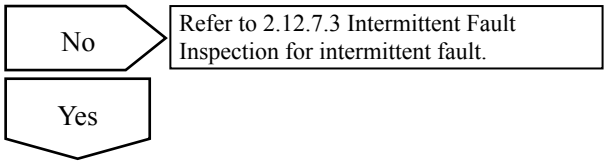

10	Troubleshooting

5. Maintenance guide :

Refer to 2.6.8.5 Replacement of Electrical Throttle Body Assembly to replace the electrical throttle body assembly.

Replace ECM. Refer to 2.12.8.1 Replacement of Engine Control Module.

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2.12.7.43 DTC P0562 P0563

1. DTC description:

DTC	P0562	System Voltage Too Low

DTC	P0563	System Voltage Too High

ECM power supply circuit consists of the following:

- Battery power passes through fuse EF16 10 A to ECM harness connector EN01 terminal No.67.
- When the ignition switch is turned to "ON" position, battery power passes through the fuses of EF 35 110A and EF14 30A to the ignition switch, and passes the ignition switch wiring harness connector IP45 terminal No.6 to fuse IF33 10 A and finally to ECM harness connector EN01 terminal No.68.
- When ECM detects that ECM harness connector EN01 terminal No.67 has battery voltage, ECM controls EN01 terminal #2 and #3 connected to internal ground. Because EN01 terminal No.62 is connected to the main relay terminal No.44, the main relay pulls in.

After the main relay pulls in, the battery power passes through the main relay terminal No.30 and the fuse EF22 10A to ECM harness connector EM01 terminals No.5.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0562	Lower Than the Lower Limit	1. Ignition switch is at ON. 2. Battery voltage is less than 11 V. 3. Duration Longer Than 40s.	1. ECM power supply Circuit 2. Generator 3. ECM
P0563	More Than the Upper Limit	1. Ignition switch is at ON. 2. Battery voltage is greater than 16 V. 3. Duration Longer Than 40s.	

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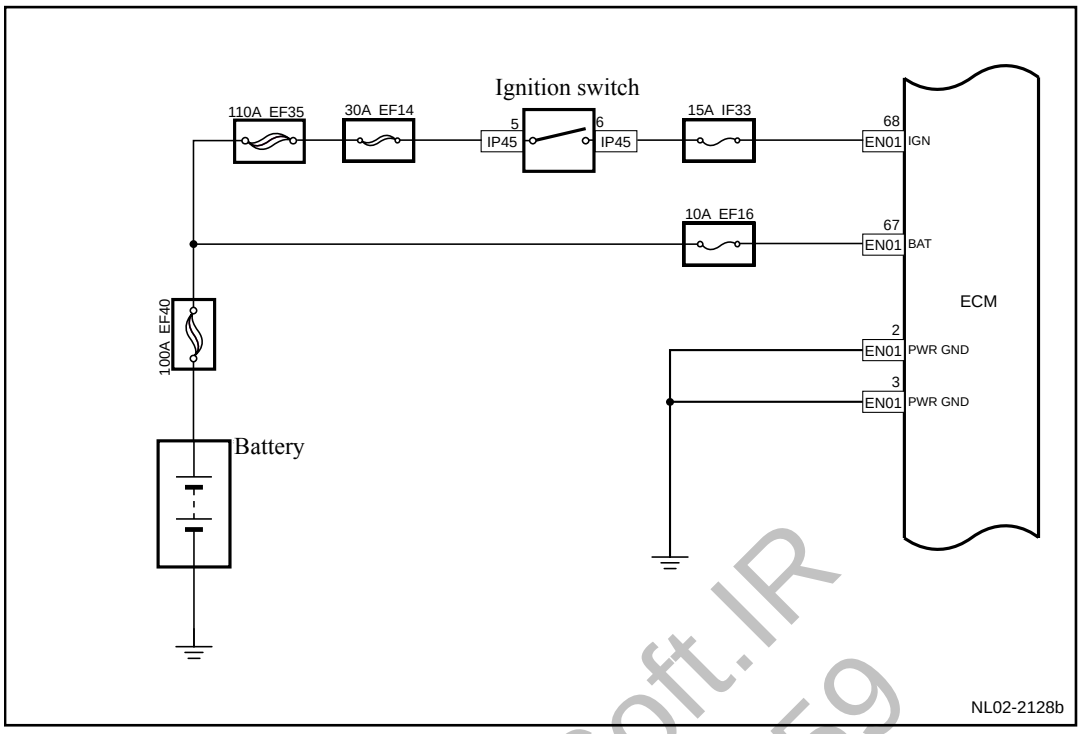
3. Circuit sketch



4. Diagnostic Steps:

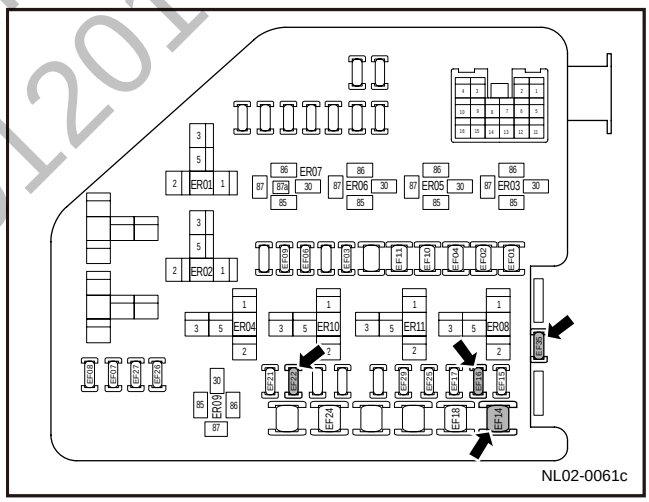
1	Check EF40、EF35、EF14、EF16、EF22 fuse。

A. rotated ignition switch to OFF position .

B. Dismantle EF40 、 EF35 、 EF14 、 EF16 、 EF22 fuse by compartment fuse box

C. Test continuity between the two fuses with a multimeter.

Conducted?



No → Inspect whether there are short circuits. Replace the fuses.

Yes

2	Inspect underhood fuse block fuses IF33.

A. rotated ignition switch to OFF position.

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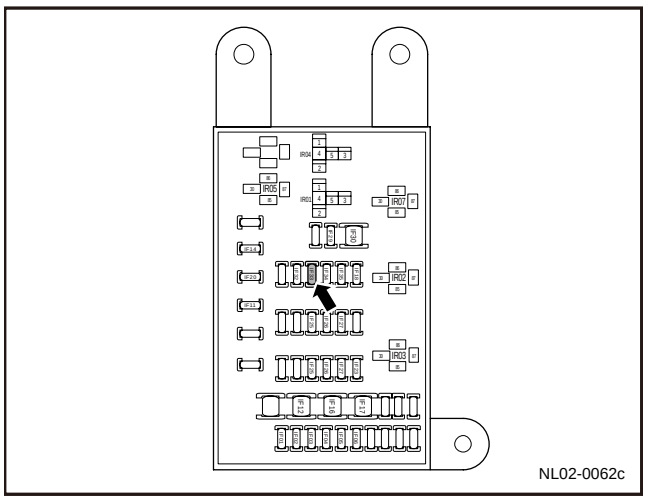
B. Dismantle the fuse IF33 from I/P fuse block of the instrument.

C. Test continuity between the two fuses with a multimeter.

Conducted?



No → Inspect whether there are short circuits. Replace the fuses.

Yes

3	Inspect the ECM Power Supply Voltage.

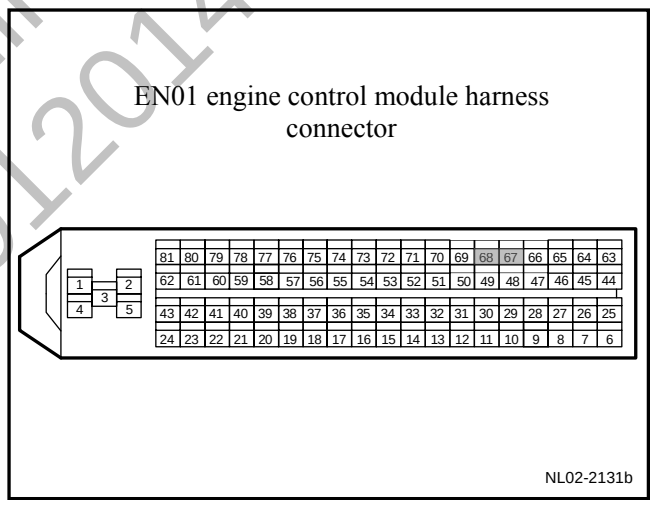
A. rotated ignition switch to OFF position .

B. Disconnect ECM harness connector EN01.

C. Rotated ignition switch to ON position .

D. Measure voltage between ECM harness connector EN01 terminal No.67 and a reliable ground.

E. Measure voltage between ECM harness connector EN01 terminal No.68 and a reliable ground.



Standard value :11-14V

Is the voltage normal?

No → Go to step 5

Yes

4	Inspect ECM ground circuit.

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A. rotated ignition switch to OFF position .

B. Disconnect ECM harness connector EN01.

C. Measure resistance between ECM harness connector EN01 terminal No.2 of and a reliable ground.

(d) Measure resistance between ECM harness connector EN01 terminal No.3 and a reliable ground.

Standard Value: Less than 1 Ω

Is the resistance normal?

No	ECM ground circuit malfunction. Repair the faulty part.
Yes	

5	Inspect the charging system.

A. Inspect the battery voltage: standard value 11V-14V.

B. Inspect charging voltage of generator: standard value 11.5V-14.5V.

Normal?

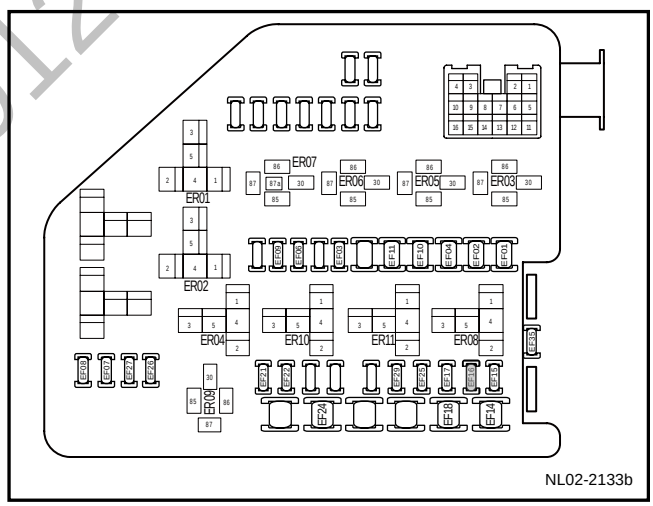
No	Repair the faulty part.
Yes	Go to step 8

6	Inspect the circuit from fuse EF16 to ECM.

A. rotated ignition switch to OFF position.

B. Disconnect ECM harness connector EN01.

C. Test continuity between ECM harness connector EM01 terminal No.67 and fuse EF10.



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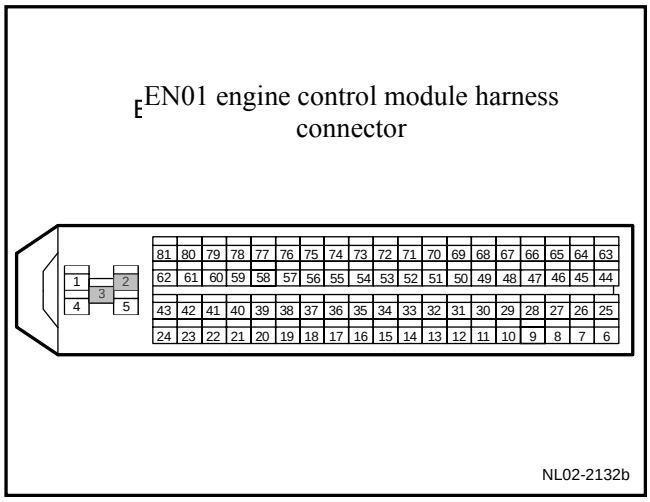
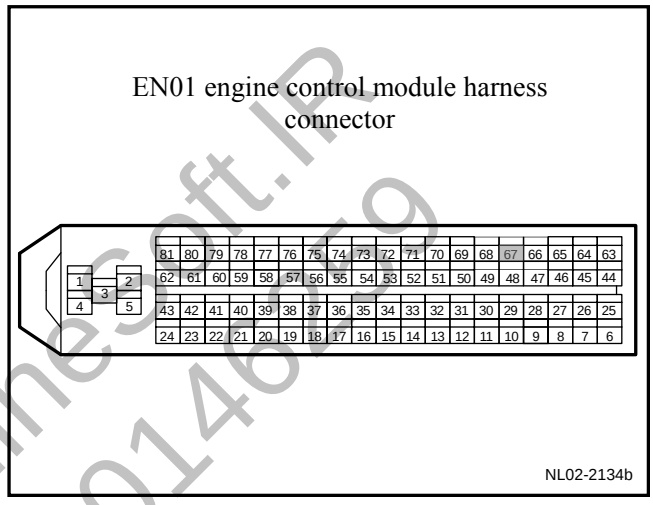
D. Measure resistance between ECM harness connector EN01 terminal No.67 and a reliable ground.





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Standard Value

Test Items	**Specified Value**
EN01(67)-EF10Continuity	Continuity
Resistance Between EM01 (67) and A Reliable Ground	10 kΩ or higher

Normal?

No → Circuit malfunction, repair or replace the wiring harness.

Yes

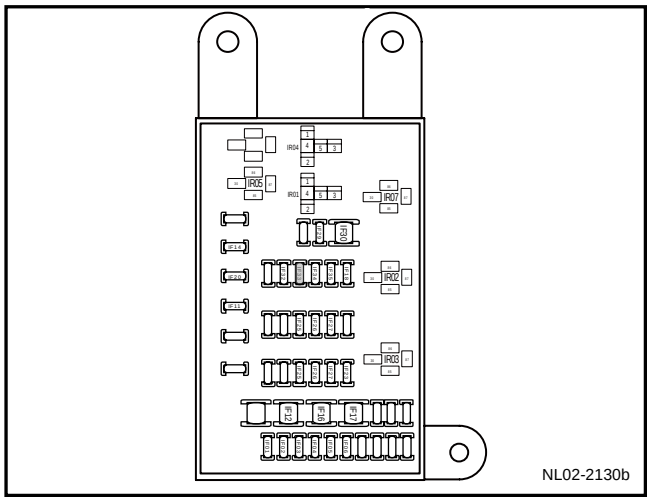
7	Inspect the circuit from fuse IF33 to ECM.

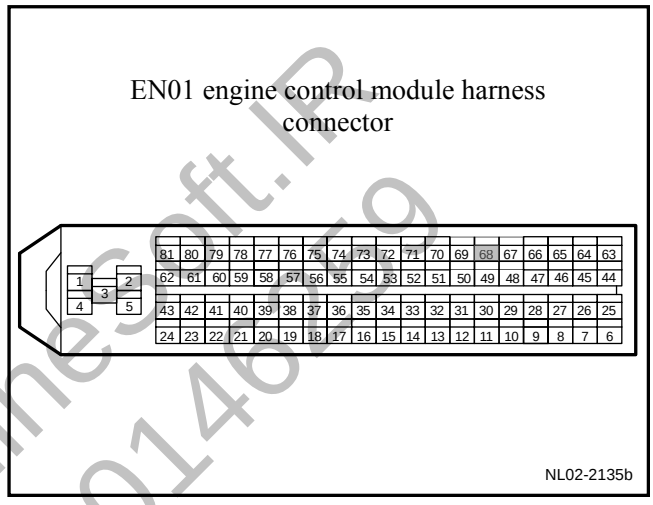
A. rotated ignition switch to OFF position .

B. Disconnect ECM harness connector EN01.

C. Test Continuity between ECM harness connector EN01 No.68 terminal and fuse IF33.

D. Measure resistance between ECM harness connector EN01 terminal No.68 and a reliable ground.





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Standard Value

Test Items	**Specified Value**
EN01(68)-IF33Continuity	Continuity
Resistance Between EM01 (68) and A Reliable Ground	10 kΩ or higher

Normal?

No → Circuit malfunction, repair or replace the wiring harness.

Yes

8	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position .

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.12.6.3 Intermittent Fault Inspection for intermittent fault.

Yes

9	Replace ECM

See 2.12.8.1 Replacement of Engine Control Module.

Next

10	Carry out crankshaft position sensor self learn.

Refer to 2.12.7.11 "Crankshaft Position Sensor Learn".

Next

11	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

12	Troubleshooting

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2.12.7.44 DTC P0571

1. DTC description:

DTC	P0571	The switch state of the brake lamp is not changed when braking.

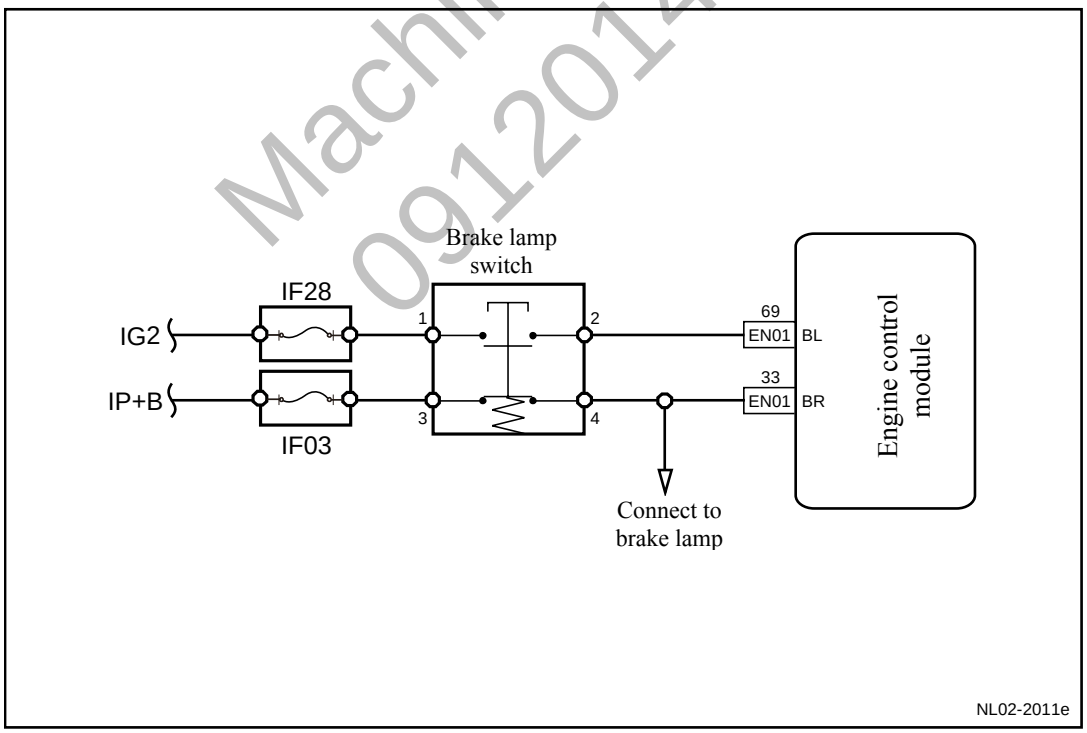
DTC	P0504	Brake Lamp Switch Relativity Malfunction

Disconnect the brake light switch signal. the vehicle braking, system enters the diagnostic window. After multiple braking, DTC code appears. Engine running smooth, the vehicle can be driven.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0571 P0504	ECM receives the brake light switch signal.	1. Brake Light Switch Signal Disconnected. 2. Vehicle braking, system enters the diagnostic window. 3. DTC codes appear after repeatedly braking.	1. Brake Light Switch Circuit 2. Brake Lights Switch 3. ECM

3. Circuit figure



4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

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1	Inspect brake lamps are working properly.

No → Refer to11.4.7.8 Brake Lamp Inoperation.

Yes

2	Inspect continuity between brake light switch wiring harness connector IP56 and ECM harness connector EN01.

A. rotated ignition switch to OFF position.

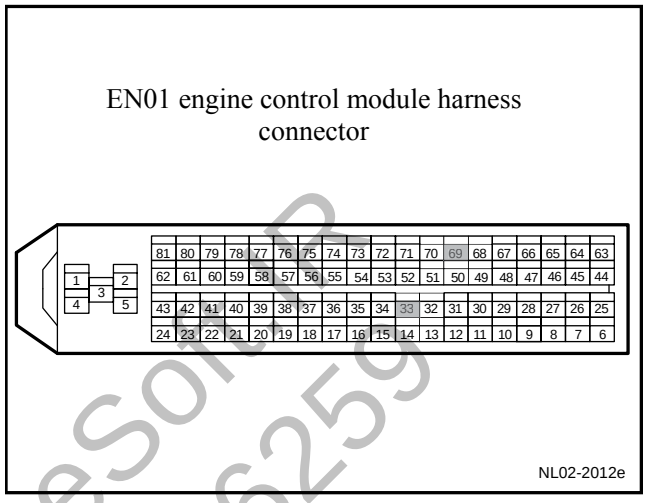
B. Disconnect ECM harness connector EN01.

C. Press the brake pedal.

D. Measure ECM harness connector EN01 terminal No.69 and 33 voltage.

Standard Voltage: 11-14 V

Confirm whether the voltage is normal.



Yes → Refer to 2.2.8.1 Replacement of Engine Control Module to replace ECM.

No

3	Repair circuit between brake light switch wiring harness connector IP56 and ECM harness connector EN01.

A. Repair circuit between brake light switch wiring harness connector IP56 and ECM harness connector EN01.

B. Confirm the repair is completed.

Next

4	Troubleshooting

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2.12.7.45 DTC P0601 P0602 P1516 P2101

1. DTC description:

DTC	P0601	ECM Processor Malfunction

DTC	P0602	ECM Processor Malfunction

DTC	P1516	Diagnostic error for second order of driving electronic throttle

DTC	P2101	Diagnostic error for static state of driving electronic throttle

ECM Internal Program Errors.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0601	ECM Internal Monitoring	——	ECM
P0602		——	
P1516		In a steady-state condition, the throttle expected by the system is located The position is more different from the actual throttle position.	
P2101		In a steady-state condition, the throttle expected by the system is located The position is more different from the actual throttle position.	

3. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect whether there is any control system DTC codes other than DTC P0601, P0602, P1516 and P2101.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic apparatus power supply

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D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

DTC Codes Shown	**To Step**
2.12.7.45 DTC P0601 P0602 P1516 P2101	Yes
DTC codes other than DTC P0601, P0602, P1516 and P2101	No

No → Refer to 2. 12.7.14 DTC Chapter Index.

Yes

2	Replace ECM

Refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learn” to carry out the crankshaft position sensor learn after replacing the ECM.

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2.12.7.46 DTC P0641 P0651

1. DTC description:

DTC	**P0641**	ETC Reference Voltage A # Amplitude Fault

DTC	**P0651**	ETC Reference Voltage B # Amplitude Fault

As ETC uses two throttle position sensors, its normal working required 5 V reference voltage and low reference voltage is shared with ETC harness connector terminals A and D. Where A and EN01 terminal No.74 is connected as the low reference voltage. Terminal D and EN01 terminal No.70 is connected as the 5 V reference voltage. Malfunction in any circuit will report DTC code P0641 or P0651.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0641	Hardware Circuit Malfunction	Internal chip self-diagnosis	1. Electronic Throttle Body 2. Electronic Throttle Circuit 3. ECM
P0651			

3. Circuit sketch

Refer to 2.12.7.21 DTC P0122 P0123

4. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect ETC harness connector EN27terminals A and D.

A. rotated ignition switch to OFF position .

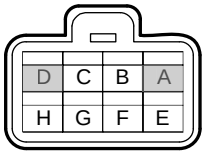
B. Disconnect the harness connector EN27 of the ETC.

C. Rotated ignition switch to ON position .

D. Measure resistance between EM27 terminal A and a reliable ground.

E. Measure voltage between EM27 terminal D and a reliable ground.

EN27 throttle position sensor harness connector



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Results

Test Items	Standard Value
EN27(A)-reliable grounding resistance value	Less than 3 Ω
EN27(D)-Reliable grounding voltage value	4.8 - 5.2 V

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

2	Replace the electronic throttle body

Refer to the Replacement of Electronic Throttle Body.

Next

3	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

4	Inspect ECM Power Supply Circuit and ground circuit.

A. Refer to 2.12.7.43 DTC P0562 P0563 to inspect ECM Power Supply Circuit and ground circuit.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

5	Replace ECM. Refer to 2.12.8.6 Replacement of Engine Control Module.

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Next

6	Carry out the crankshaft position sensor learning, refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learning.

Refer to 2.12.7.11 "Crankshaft Position Sensor Learn".

Next

7	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

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2.12.7.47 DTC P0641 P0651

1. DTC description:

DTC	P0646	Air-conditioning Clutch Relay Circuit Short to Low Voltage or Open

DTC	P0647	Air-conditioning Clutch Relay Circuit Short to High Voltage

The working voltage of the air-conditioning compressor relay is provided by the main relay which is controlled by ECM. ECM controls Air-Conditioning compressor relay internal ground through ECM harness connector EN01 terminal No.9, and relay pulls in. ECM has an internal driver circuit that controls relay coil ground. The driver circuit is equipped with a feedback circuit to ECM. ECM monitors the feedback voltage control circuit to determine whether the there is an open circuit, a circuit short to ground or power supply.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0646	Hardware Circuit Inspection	When air-conditioning is not working, with air-conditioning relay control circuit open or short to ground, the DTC code will be set.	1. Air Conditioner Relay 2. ECM 3. Air-Conditioning Relay Circuit
P0647		When air-conditioning is not working, with air-conditioning relay control circuit open or short to ground, the DTC code will be set.	

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3. Circuit figure :

Refer to 8.2.6.2 Air-conditioning System Circuit Diagram

4. Diagnostic Steps:

Refer to 8.2.7.8 Air-conditioning Clutch Inoperation.

2.12.7.48 DTC P0685

1. DTC description:

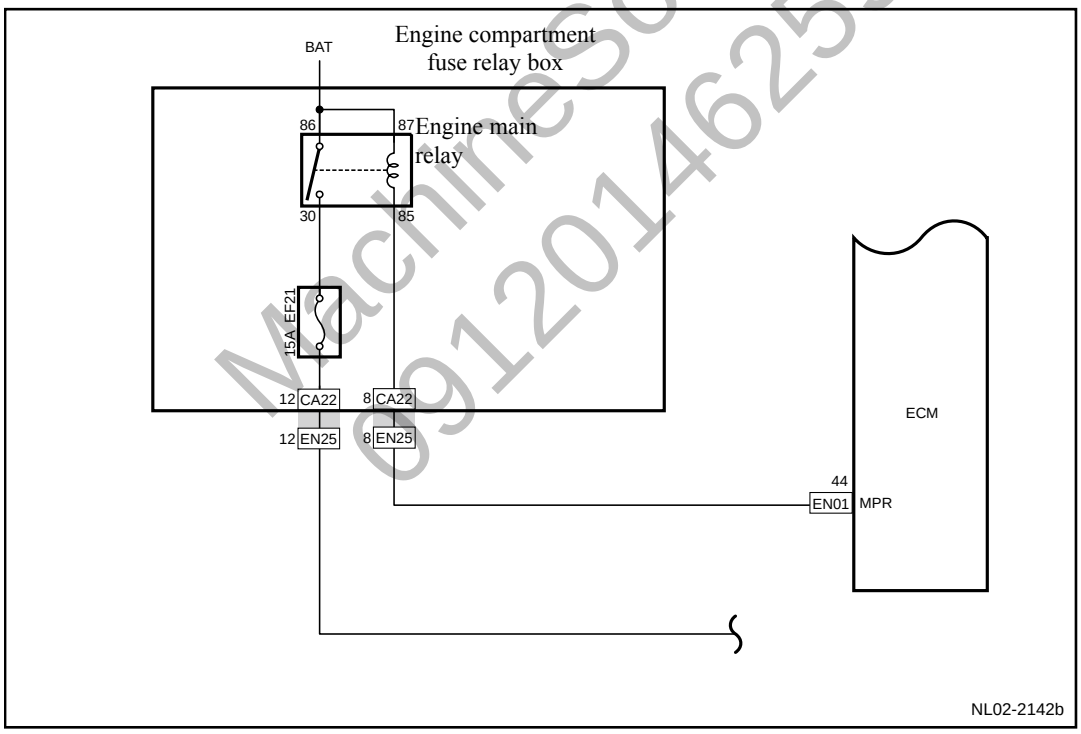
DTC	**P0685**	Main Relay Malfunction

Main relay is used to provide power to fuel injectors and oxygen sensors and other components. Battery provides power to main relay terminal No.86. ECM controls main relay ground through ECM harness connector EM01 terminal No.62. ECM has a detection circuit. By monitoring the feedback voltage, ECM determines whether the control circuit is open, short to ground or short to power supply.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Locations
P0685	Main Relay Malfunction	The main relay control circuit does not match ECM expected status.	1. Main Relay 2. Main Relay Circuit 3. ECM

3. Circuit sketch



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4. Diagnostic Steps:

1	Appearance Inspection

Inspect main relay for signs of damage.

Yes → Replace main relay ,go to steps10

No

2	Inspect the terminal 87 of the main engine relay.

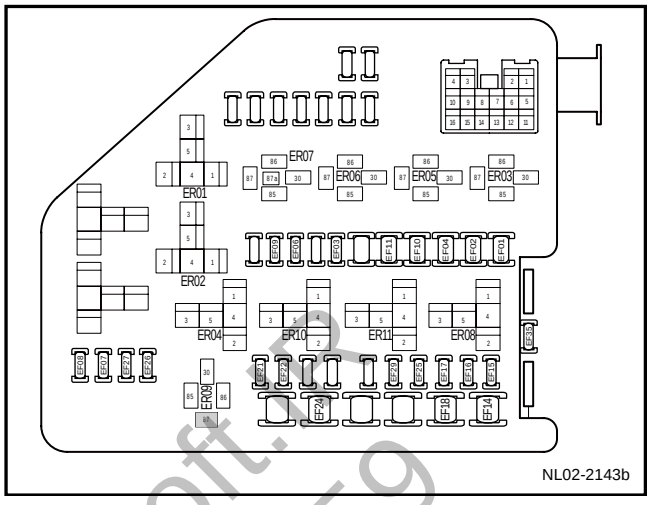
(a) Turn the ignition switch to "OFF" position.

(b) Dismantle engine main relay .

(c) Measure voltage between engine main relay No 87 and reliable grounding.

Standard Voltage: 11-14V

Confirm whether according with the standard value?



No → Repair the circuit between the battery and the terminal 87 of the main engine relay, and turn to the step 7.

Yes

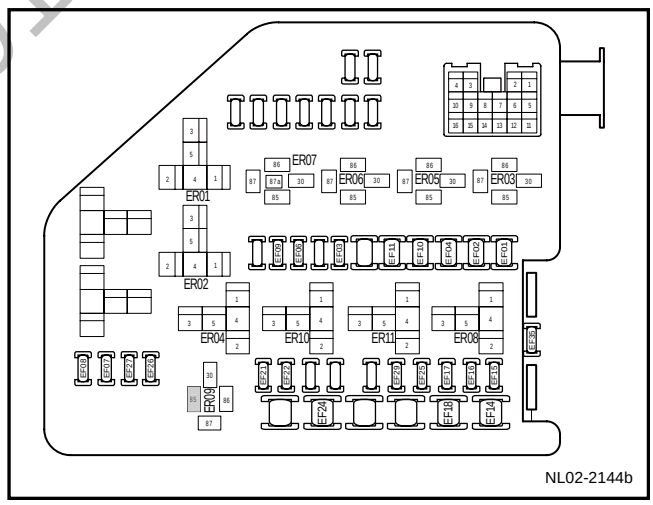
3	Inspect the circuit between the terminal 85 of the main engine relay and the terminal 44 of the EN01.

(a) Turn the ignition switch to "OFF" position.

(b) Measure resistance between EN01 terminal 44 and engine main relay terminal 85.

Standard Value: Less than 1 Ω

Confirm whether according with the standard value?



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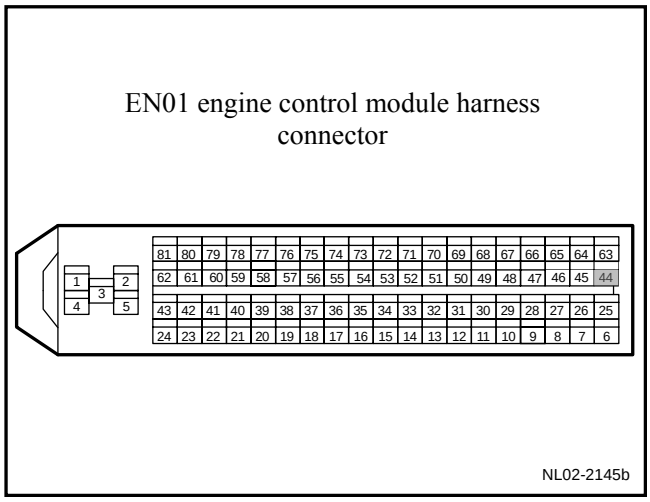


No

Repair the circuit between the terminal 44 of EN01 and the terminal 85 of the main engine relay, and turn to the step 7.

Yes

4	Inspect the voltage of the terminal 44 of the engine control module wire harness connector EN01.

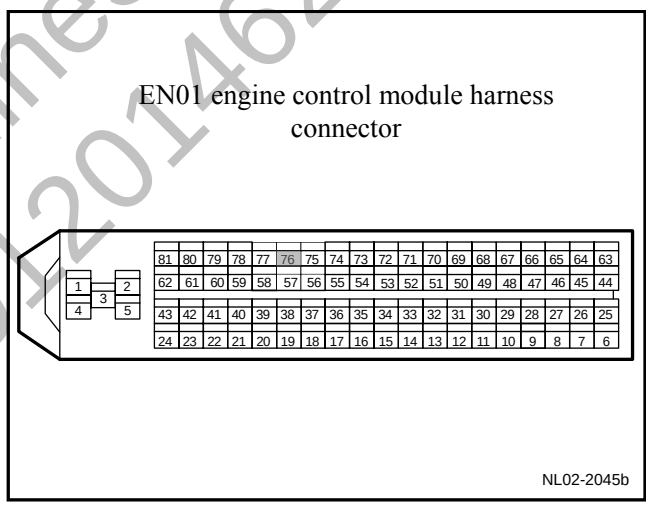
(a) Rotated ignition switch to "ON" position .

(b) Measure voltage between ECM harness connector EN01 terminal No.44 and a reliable ground.

Standard Voltage: 11-14V

(c) Rotated ignition switch to "OFF" position .

Whether voltage value is normal or not ?



No

Replace the main engine relay to step 7.

Yes

5	Inspect the ECM Power Supply Circuits.

Refer to 2.12.7.43 DTC P0562 P0563.

Inspect whether the ECM power supply circuit and ground circuit are normal.

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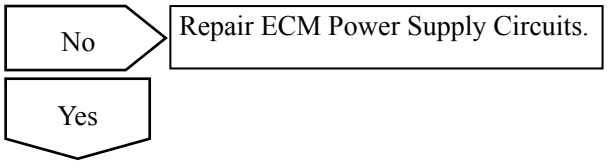


6	Replace ECM

See 2.12.8.1 Replacement of Engine Control Module.

7	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

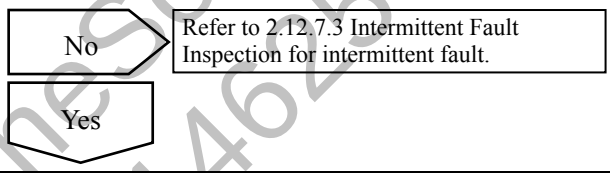
B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.



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2.12.7.49 DTC P2104 P2105 P2106 P2110

1. DTC description:

DTC	P2104	Mandatory Engine Idling

DTC	P2105	Forced engine stopping

DTC	P2106	Restrictions On Engine Performance

DTC	P2110	Engine Power Management

When the intake system or throttle body valve air floe control have faults, ETC system can not reliably use the throttle to control engine power.

2. DTC Code Set Up and Removal Conditions:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2104	Protected mandatory idle	When the sensor of the throttle, acceleration pedal or brake has certain fault, it will be forced into the idle mode, and determined as fault.	——
P2105	Fault Protection Mandatory Shutdown	When the sensor of the acceleration pedal, brake or ECM has certain fault, it will be forced into engine stalling and determined as fault.	
P2106	Fault Protection Limits	When the sensor of the throttle or acceleration pedal has certain fault, it will be forced into the performance limited mode, and determined as fault.	
P2110	Failsafe Power Limit	When the sensor of the throttle or acceleration pedal has certain fault, it will be forced into the power manage mode, and determined as fault.	

3. Diagnostic Steps:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and

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analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect whether there is any control system DTC code other than DTC P2104, P2105, P2106 and P2110.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic apparatus power supply

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC code

Results

DTC Codes Shown	**Go to step**
DTC P2104 P2105 P2106 P2110	No
DTC code other than DTC P2104, P2105, P2106, P2110	Yes

Yes → 2.12.7.14 DTC Chapter Index

No

2	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

Yes → Diagnostic

No

3	Inspect the ECM Power Supply Circuits.

A. Inspect whether ECM power supply circuit is normal.

B. Inspect whether ECM ground circuit is normal.

No → Repair the faulty part. Go to step 5

Yes

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4	Replace ECM

A. Replaces

B. Refer to 2.12.7.11 Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn.

Next

5	Use a fault diagnosis tester to confirm whether the DTC Code is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

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5. Maintenance guide

Replace ECM. Refer to 2.12.8.1 Replacement of Engine Control Module.

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2.12.7.50 DTC P2119

1. DTC description:

DTC	P2119	Electronic Throttle Return Malfunction

After the ignition switch is switched off, electronic throttle stays at the initial angle of 14.5 degrees. If the ignition switch is off, the throttle is always off, the DTC code may be recorded it may be accompanied by the engine difficult to start and so on.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2119	Electronic Throttle Return Malfunction	1. Ignition Switch OFF for several times. 2. If throttle can't reach requirement, conduct return test. Proper opening	1. Electronic Throttle Body Dirty 2. Electronic Throttle Body Mechanical Malfunction

3. Diagnostic Steps:

1	Inspect whether there is other ETC system related DTC codes?

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic apparatus power supply

D. Read DTC code

Results

DTC Codes Shown	To Step
Only P2119	Yes
DTC Code Other Than P2119	No

No → Refer to 2. 12.7.14 DTC Chapter Index.

Yes

2	Clean Electronic Throttle Body

A. Refer to 2.6.8.5 Replacement of Electrical Throttle Body Assembly to dismantle the throttle body.

B. Clean electronic throttle body.

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Next

3	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Troubleshooting

Yes

4	Replace the electronic throttle body (ETC).

Refer to 2.6.8.5 Replacement of Electrical Throttle Body Assembly to replace the electrical throttle body.

Next

5	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Troubleshooting

Yes

6	Inspect ECM Power Supply Circuit and ground circuit.

A. Refer to 2.12.7.43 DTC P0562 P0563 to inspect ECM Power Supply Circuit and ground circuit. ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

7	Replace ECM. Refer to 2.12.8.1 Replacement of Engine Control Module.

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Next

8	Refer to 2.12.7.11 “Crankshaft Position Sensor (CKP) Learn” to carry out the crankshaft position sensor learn.

Next

9	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

10	Troubleshooting

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2.12.7.51 DTC P2122 P2123

1. DTC description:

DTC	P2122	Electronic Acceleration Pedal Position Sensor #1 Circuit Low Voltage

DTC	P2123	Electronic Acceleration Pedal Position Sensor #1 Circuit High Voltage

In order to protect the security of the system, acceleration pedal position sensor (APP) uses a dual-sensor setting, sliding resistive. APP sensor 1 output is IP51 terminal No.4, through ECM wiring harness Connect EN01 terminal No.41 to ECM.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Set(Control Strategy) Conditions**	**Fault Locations**
P2122	Hardware Circuit Malfunction	1. APS1 signal terminal grounded or open. 2. Input signal larger than 97.5%.	1. Acceleration Pedal Position Sensor 2. Acceleration Pedal Position Sensor Circuit 3. ECM
P2123	Hardware Circuit Malfunction	1. APS1 signal terminal grounded or open. 2. Input signal less than 3.5%	

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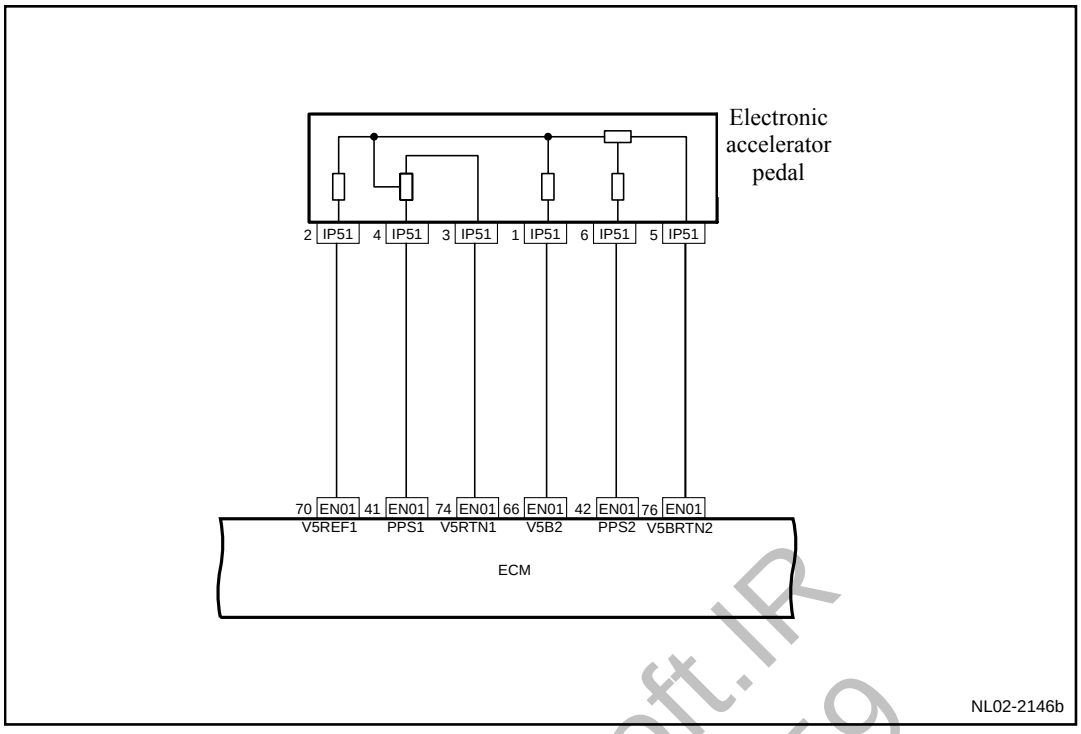
3. Circuit figure



4. Diagnostic Steps:

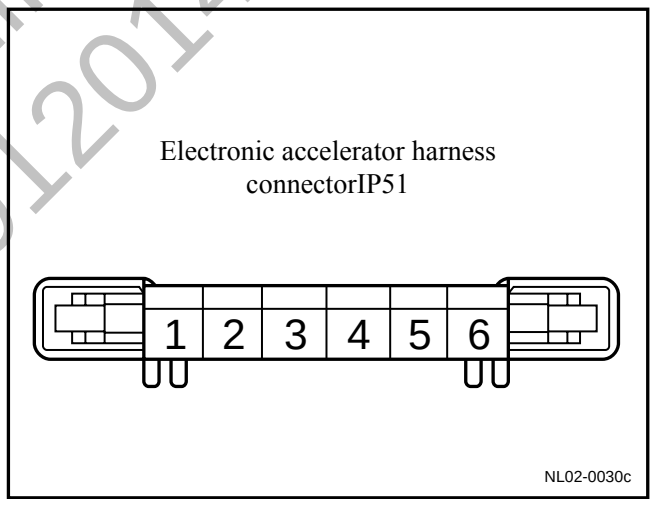
1	Inspect APP sensor harness connector IP51 terminal No.2 voltage.

A. Turn the ignition switch to the OFF position.

B. Disconnect APP sensor harness connector IP51.

C. Turn the ignition switch to the ON position.

D. Measure voltage between IP51 terminal No.2 and a reliable ground.



Standard Voltage: 4.8-5.2V

Does it conform to the standard value?

No — If the voltage is higher than the Standard Value, the circuit is short to power supply; if the voltage is lower than the standard value, go to step 5.

Yes

2	Inspect resistance between APP sensor harness connector IP51 terminal No.3 and ground.

A. Turn the ignition switch to the OFF position.

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B. Disconnect APP sensor harness connector IP51.

C. Turn the ignition switch to the ON position.

D. Measure resistance between IP51 terminal No.3 and a reliable ground.

Standard Resistance: Less than 3 Ω

Does it conform to the standard value?

No	Go to step 5
Yes	

3	Inspect APP sensor harness connector IP51 terminal No.4.

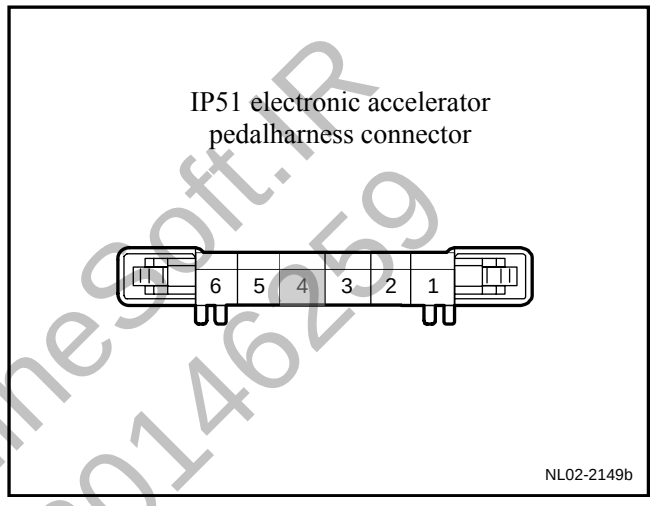
A. Turn the ignition switch to the OFF position.

B. Disconnect APP sensor harness connector IP51.

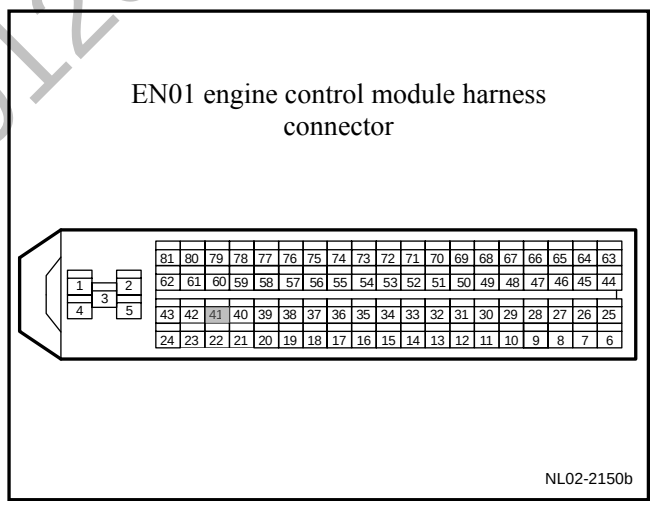
C. Disconnect ECM harness connector EN01.

D. Measure resistance between IP51 terminal No.4 and a reliable ground.

E. Measure voltage between IP51 terminal No.4 and a reliable ground.



F. Test continuity between IP51 terminal No.4 and EN01 terminal No.41.



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Results

Test Items	Standard Value
Resistance Between IP51(4)and A Reliable	10 kΩ or higher

Ground	
Voltage Between IP51 (4) and A Reliable Ground	0 V
Continuity Between IP51(4) and EM01(41)	Less than 1 Ω

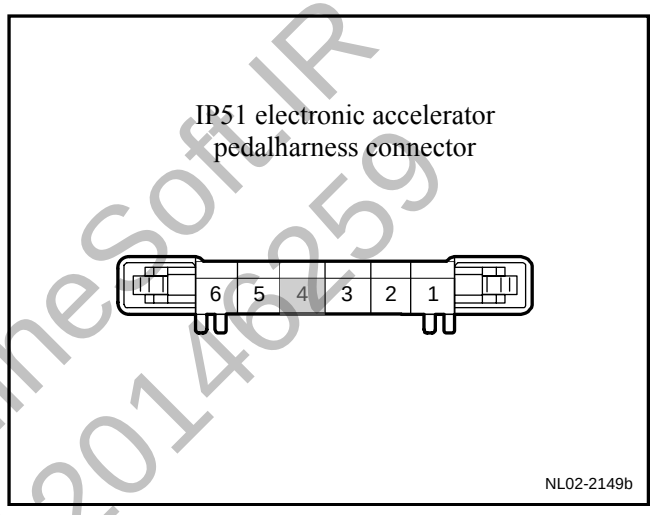
Inspect whether according with the standard value?

No → Circuit fault, repair the faulty part.

Yes

4	Inspect APP sensor harness connector IP51terminal No.4 output voltage.

Inspect APP sensor #4 terminal output voltage. Refer to 2.12.7.13 “Acceleration Pedal Position Sensor (APP) Inspection” for the standard values.



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No → Refer to 2.2.8.4 “Replacement of Acceleration Pedal” to replace the APP sensor.

Yes → Go to step 7

5	Inspect APP sensor harness connector IP51 terminal No.2 and 3.

A. Turn the ignition switch to the OFF position.

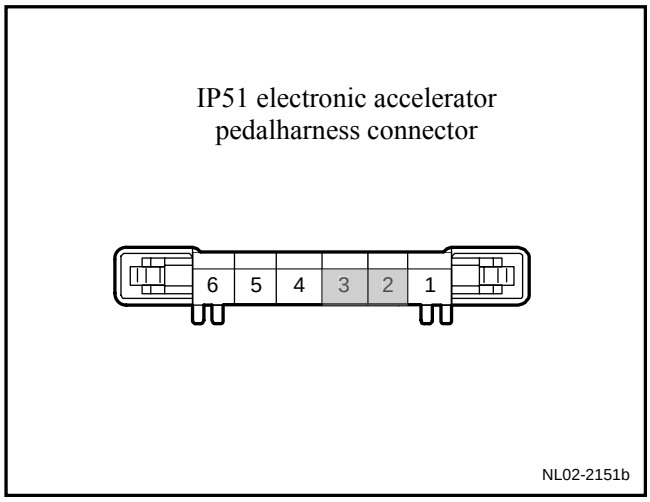
B. Disconnect APP sensor harness connector IP51.

C. Disconnect ECM harness connector EN01.

D. Turn the ignition switch to the ON position.

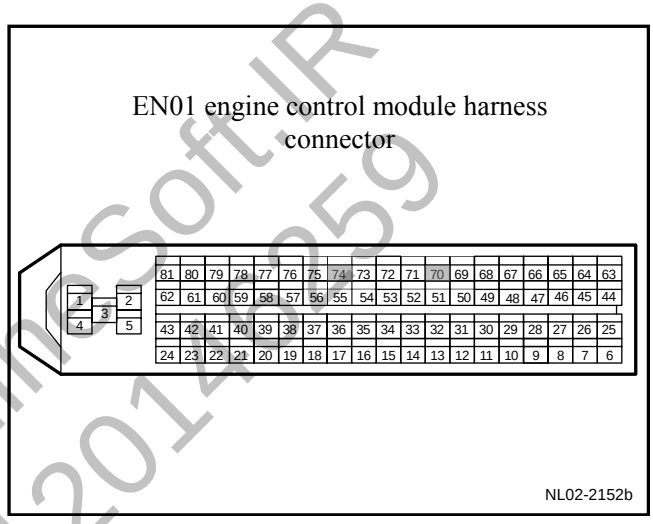
E. Measure resistance between IP51 terminal No.2 and a reliable ground.

F. Test continuity between IP51 terminal No.2 and EN01 terminal No.70.



G. Measure voltage between IP51 terminal No.3 and a reliable ground.

H. Test continuity between IP51 terminal No.3 and EM01 terminal No.74.



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Results

Test Items	**Standard Value**
Resistance Between IP51(2)and A Reliable Ground	Lager than 10 kΩ
IP51(2)- EN01(70) continuity	Less than 1 Ω
Voltage Between IP51(3)and A Reliable Ground	0 V
IP51(3)- EN01(74) continuity	Less than 1 Ω

Inspect whether according with the standard value?

No → Circuit fault, repair the faulty part.

Yes

6	Inspect ECM Power Supply Circuit and Ground Circuit.

Inspect ECM Power Supply Circuit and Ground Circuit, and refer to 2.12.7.43 DTC P0562 P0563.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

7	Refer to 2.12.8.1 Replacement of Engine Control Module to replace ECM.

Next

8	Refer to 2.12.7.11“Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn.

Next

9	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

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5. Maintenanceguide

Acceleration pedal position sensor can only be replaced as an assembly. Do not disassemble. Refer to 2.12.8.4“Replacement of Acceleration Pedal” to replace the acceleration pedal sensor.

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2.12.7.52 DTC P2127 P2128

1. DTC description:

DTC	P2127	Electronic Acceleration Pedal Position Sensor #2 Circuit Low Voltage or Open

DTC	P2128	Electronic Acceleration Pedal Position Sensor #2 Circuit High Voltage

In order to protect the security of the system, acceleration pedal position sensor (APP) uses a dual-sensor setting, sliding resistive. APP sensor 2 output is IP51 terminal No.6, through ECM wiring harness Connect EN01 terminal No.42 to ECM.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2127	Hardware Circuit Malfunction	1. APS2 signal terminal grounded or open. 2. Input signal less than 2.5%	1. Acceleration Pedal Position Sensor 2. Acceleration Pedal Position Sensor Circuit 3. ECM
P2128	Hardware Circuit Malfunction	Voltage is higher than the maximum limit, or short to power supply	

3. Circuit figure

Refer to 2.12.7.51 DTC P2122 P2123.

4. Diagnostic Steps:

1	Inspect APP sensor harness connector IP51 terminal voltage of the No.1.

A. Turn the ignition switch to the OFF position.

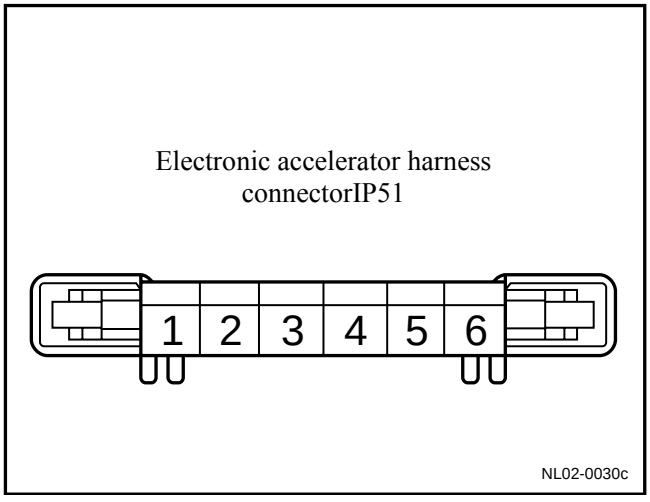
B. Disconnect APP sensor harness connector IP51.

C. Turn the ignition switch to the ON position.

D. Measure voltage between IP51 terminal No.1 and a reliable ground.

Standard Voltage: 4.8-5.2V

Does it conform to the standard value?



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No

If the voltage is higher than the Standard Value, the circuit is short to power supply; if the voltage is lower than the standard value, go to step 5.

Yes

2	Inspect resistance between APP sensor harness connector IP51 terminal No.5 and a reliable ground.

A. Turn the ignition switch to the OFF position.

B. Disconnect APP sensor harness connector IP51.

C. Turn the ignition switch to the ON position.

D. Measure resistance between IP51 terminal No.5 and a reliable ground.

Standard Resistance: Less than 3 Ω

Does it conform to the standard value?

No

Go to step 5

Yes

3	Inspect APP sensor harness connector IP51 terminal No.6.

A. Turn the ignition switch to the OFF position.

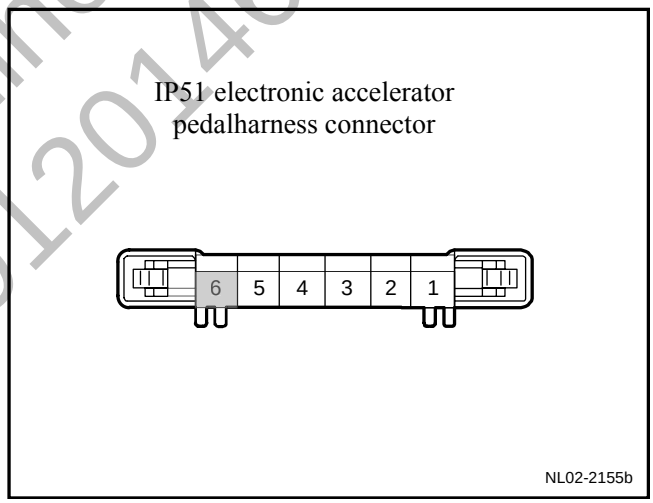
B. Disconnect APP sensor harness connector IP51.

C. Disconnect ECM harness connector EN01.

D. Measure resistance between IP51 terminal No.6 and a reliable ground.

E. Measure voltage between IP51 terminal No.4 and a reliable ground.

F. Test continuity between IP51 terminal No.6 and EN01 terminal No.42.



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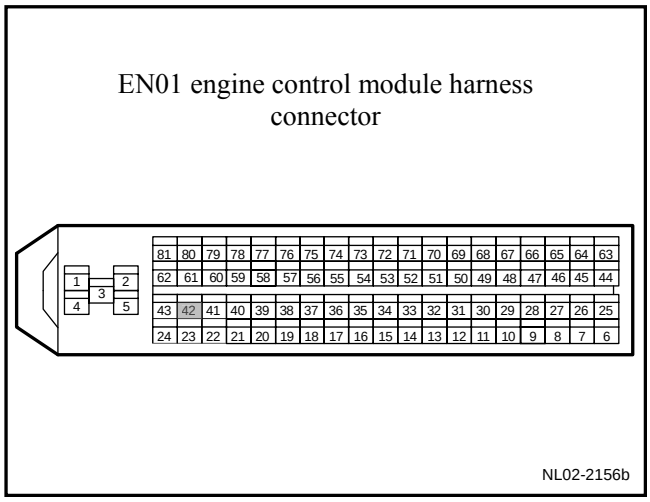


Results

Test Items	**Standard Value**
Resistance Between IP51(6) and A Reliable Ground	Lager than 10 kΩ
Voltage Between IP51(6)and A Reliable Ground	Less than 1 Ω
Continuity Between IP51(6)and EM01(42)	0 V

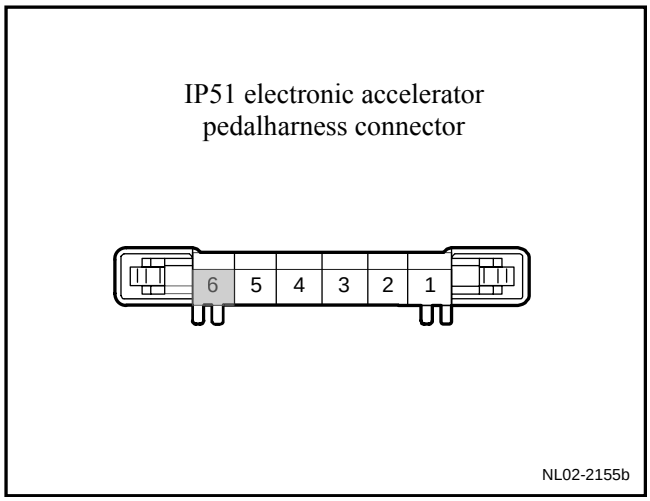
Inspect whether according with the standard value?

No → Circuit fault, repair the faulty part.

Yes

4	Inspect APP sensor harness connector IP51 terminal No.6 output voltage.

Inspect APP sensor harness connector IP51 terminal No.6 output voltage.



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No	Refer to 2.2.8.4 “Replacement of Acceleration Pedal” to replace the APP sensor.
Yes	Go to step 7

5	Inspect APP sensor harness connector IP51 terminal No.1 and 5.

A. rotated ignition switch to OFF position .

B. Disconnect APP sensor harness connector IP51.

C. Disconnect ECM harness connector EN01.

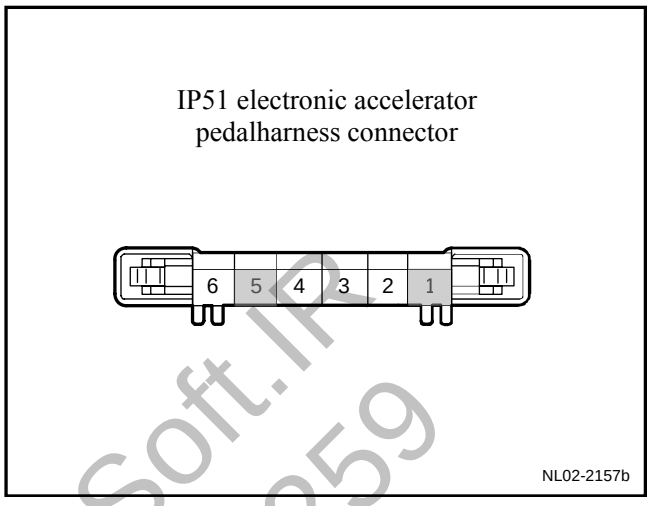
D. Turn the ignition switch to the ON position.

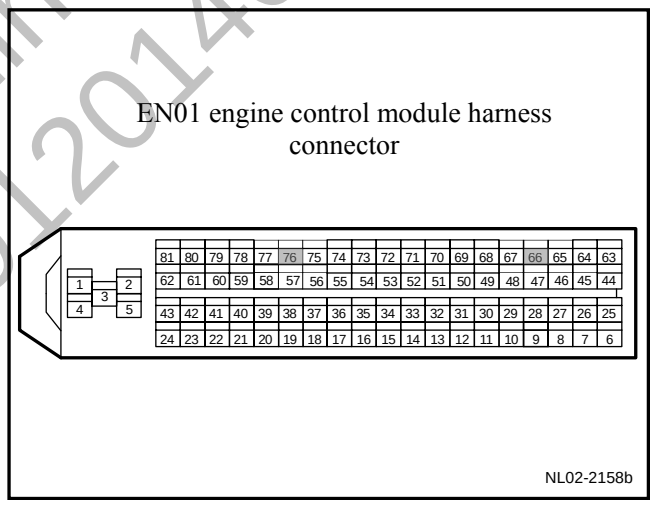
E. Measure resistance between IP51 terminal No.1 and a reliable ground.

F. Test continuity between IP51 terminal No.1 and EN01 terminal No.66.

G. Measure voltage between IP51 terminal No.5 and a reliable ground.

H. Test continuity between IP51 terminal No.5 and EM01 terminal No.76.





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Results

Test Items	**Standard Value**
Resistance Between IP51(1)and A Reliable Ground	Lager than 10 kΩ
IP51(1)- EN01(66)Continuity	Less than 1 Ω

Voltage Between IP51(5)and A Reliable Ground	0 V
IP51(5)-EN01(74)Continuity	Less than 1 Ω

Inspect whether according with the standard value?

No → Circuit fault, repair the faulty part.

Yes

6	Inspect ECM Power Supply Circuit and Ground Circuit.

A. Refer to 2.12.7.43 DTC P0562 P0563 to inspect ECM Power Supply Circuit and ground circuit.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

7	Refer to 2.12.8.1 Replacement of Engine Control Module to replace ECM.

Next

8	Refer to 2.12.7.11“Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn.

Next

9	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

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10	Troubleshooting

5. Maintenance guide

Acceleration pedal position sensor can only be replaced as an assembly. Do not disassemble. Refer to 2.12.8 “Replacement of Acceleration Pedal” to replace the acceleration pedal sensor.

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2.12.7.53 DTC P2135

1. DTC description:

DTC	P2135	Related fault of Electric throttle valve position sensor1# . 2#

ECM compares TPS1 and TPS2 input signals. Two input signals' sum at any time should be close to 5V. If ECM detects difference between the sum of TPS1 and TPS2 signals and the theoretical value is big, ECM will report the DTCs code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2122	Hardware Circuit Malfunction	– TPS1 or TPS2 single terminal short connection Power Supply or Ground – Inconsistence in both signals. – signal difference larger than 12%.	1. ETC 2. TPMS Sensor 3. ECM

3. Circuit figure

Refer to 2.12.7.21 DTC P0122 P0123

4. Diagnostic Steps:

1	Inspect whether there is other TPS system related DTC codes?

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes Shown	**To Step**
Only P2135	Yes
Has P0122,P0123,P0222,P0223	No

No → 2.12.7.14 DTC Chapter Index

Yes

2	Inspect TPS1 and TPS2 output voltage signals.

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A. Refer to 2.12.7.12 Electronic Throttle Body (ETC) Inspection for the technical parameters.

Do the TPS1 and TSP2 sensors output signal meet the specified values?

No → Refer to 2.6.8.5 Replacement of Electrical Throttle Body Assembly to replace the electrical throttle body assembly.

Yes

3	Inspect ECM Power Supply Circuit and ground circuit.

Refer to 2.12.7.43 DTC P0562 to inspect ECM power supply circuit and ground circuit.

P0563" ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

4	Refer to Replacement of Engine Control Module to replace ECM.

Next

5	Refer to 2.12.7.11"Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn.

Next

6	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

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2.12.7.54 DTC P2138

1. DTC description:

DTC	P2138	Electronic Acceleration Pedal Position Sensor #1 and #2 Related Malfunctions

ECM compares APP1 and APP2 signals. APP2 input signal at any given time should be close to twice the APP1 signal. If ECM detects the APP1 and APP2 signals do not satisfy this condition, ECM will report the DTC code.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	DTC Detection Strategy	Set(Control Strategy) Conditions	Fault Locations
P2122	Hardware Circuit Malfunction	– APS1 signal is not keep pace with APS2 Deliver – Input signal difference larger than 8%.	1. APP 2. APP Sensor Circuit 3. ECM

3. Circuit figure

Refer to 2.12.7.51 DTC P2122 P2123.

4. Diagnostic Steps:

1	Inspect whether there is other TPS system related DTC code?

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position .

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes Shown	To Step
Only P2138	Yes
has P2122,P2123,P2127,P2128	No

Yes → Refer to 2. 12.7.14 DTC Chapter Index.

No

2	Inspect TPS1 and TPS2 output voltage signals.

(a) For technical specifications, refer to 2.12.7.13 Acceleration Pedal Position Sensor (APP)

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Inspection.

Do the APP1 and APP2 sensors output signal meet the specified values?

No → Refer to 2.6.8.5 “Replacement of Electric Acceleration Pedal” to replace the electric acceleration pedal.

Yes

3	Inspect ECM Power Supply Circuit and ground circuit.

A. Refer to 2.12.7.43 DTC P0562 P0563 to inspect ECM Power Supply Circuit and ground circuit.

ECM power and ground circuits normal?

No → Power and ground circuits fault.

Yes

4	Refer to Replacement of Engine Control Module to replace ECM.

Next

5	Refer to 2.12.7.11“Crankshaft Position Sensor (CKP) Learn to carry out the crankshaft position sensor learn.

Next

6	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5 min.

E. Road test the vehicle for at least 10min.

F. Read control system DTC code again to confirm that the system has no DTC code output.

No → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

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2.12.7.55 DTC P0633 U0167 U0426

1. DTC description:

DTC	**P0633**	Anti-theft Does Not Learn Malfunction

DTC	**U0167**	No response of anti-theft device

DTC	**U0426**	Anti-theft Device Authentication Malfunction

ECM communicates with Anti-theft control module through ECM harness connector EN01 terminal No.46 R-LINE and wiring harness connector EN01 terminal No.75 R-LINE.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0633	Anti-theft Does Not Learn Malfunction	1. Ignition switch ON". 2. Anti-theft device doesn't study or fail to study.	1. Ignition key 2. Ignition Key Incentive Coil 3. ECM 4. Chip Security Module 5. Data Circuit (W-LIN Circuit, R-LIN Circuit)
U0167	No response of anti-theft device	1. Ignition switch ON". 2. Anti-theft Device No Response	
U0426	Anti-theft Device Authentication Malfunction	1. Ignition switch ON". 2. Anti-theft Device Request Authentication Failed	

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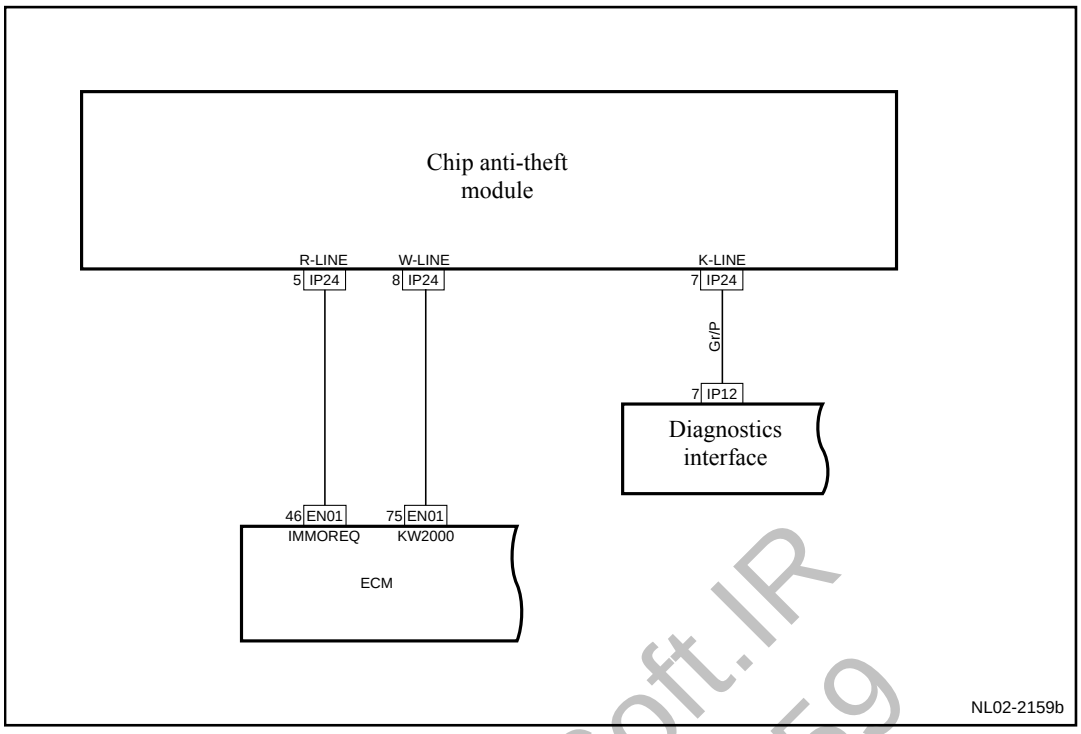
3. Circuit figure



4. Diagnostic Steps:

Refer to 2.5.7.17 Engine Anti-theft Warning Lamp Flashing, Vehicle Can Not Start

5. Maintenance guide :

Refer to 2.5.7 “Diagnostic Information and Procedures” of the engine anti-theft system to repair the anti-theft system.

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2.12.7.56 DTC P0831 P0832

1. DTC description:

DTC	P0831	Clutch switch circuit at low voltage

DTC	P0832	Clutch switch circuit at high voltage

When clutch switch is short to the ground or open (at high voltage), after several times of acceleration from starting-up to >52 Km/h, or deceleration from >52 Km/h to <3 Km/h, the DTC codes appear with the engine running stably, and the vehicle can be driven.

2. Conditions For Setting DTC and The Fault Location:

DTC Code	**DTC Detection Strategy**	**Conditions For Setting The DTC (Control Strategy)**	**Fault Locations**
P0831	ECM receives the clutch signal	1. Clutch switch signal disconnect or high voltage 2. Acceleration from starting-up to >52 Km/h, or deceleration from >52 Km/h to <3 Km/h. 3. DTC codes appear after repeatedly braking.	1. Clutch Switch Circuit 2. Clutch Switch 3. ECM
P0832		1. Clutch switch signal short. 2. Acceleration from starting-up to >52 Km/h, or deceleration from >52 Km/h to <3 Km/h. 3. DTC codes appear after repeatedly braking.	

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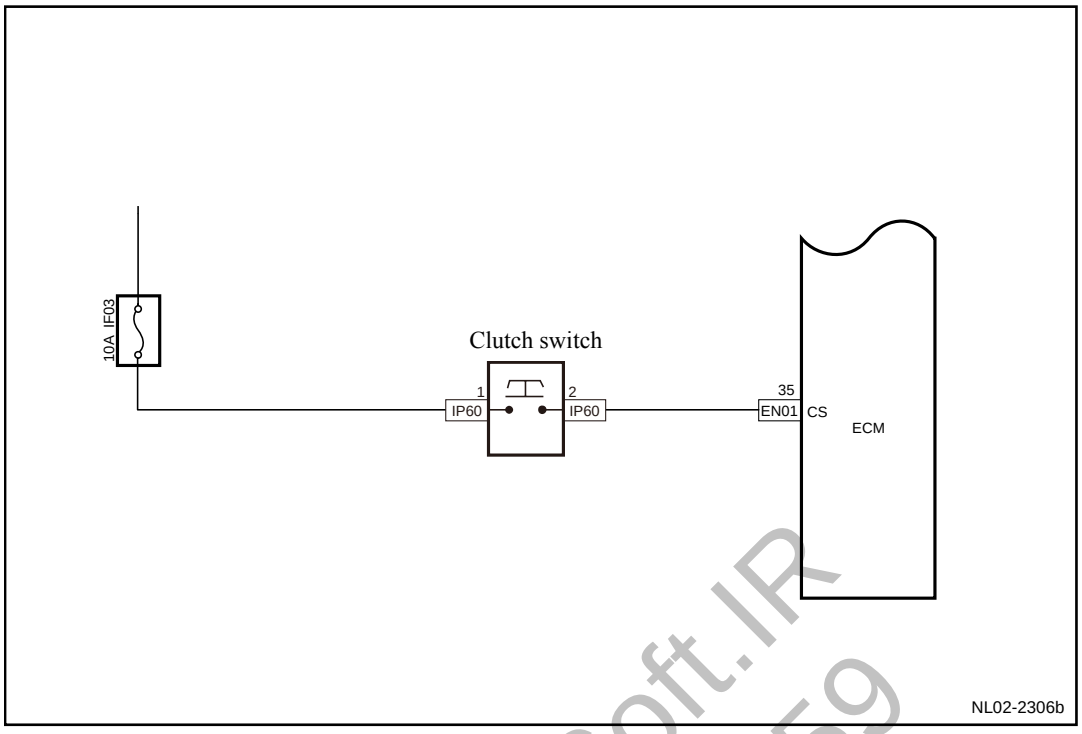
3. Circuit figure



4. Diagnostic Steps:

Notes:

Before carrying out this diagnosis steps, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Inspect for other DTC Codes other than P0831 and P0832.

A. Connect fault diagnosis tester to the vehicle diagnostic interface.

B. Rotated ignition switch to ON position.

C. Press the power button of fault diagnosis tester.

D. Select the following menu items: Engine/Read DTC codes.

E. Read DTC codes.

Results

DTC Codes shown	**To Step**
DTC P0831 P0832	Yes
DTC Code Other Than DTC P0831 P0832	No

Yes → Refer to 2. 12.6.11 DTC Chapter Index.

No

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2	Is the clutch switch working correctly?

Note: When the clutch switch fails, during emergent acceleration and deceleration, the vehicle will vibrate seriously and even push forward.

Yes → Refer to 2.12.7.3 Intermittent Fault Inspection for intermittent fault.

No

3	Inspect the continuity between clutch switch wiring harness connector IP60 and ECM harness connector EN01.

A. rotated ignition switch to OFF position.

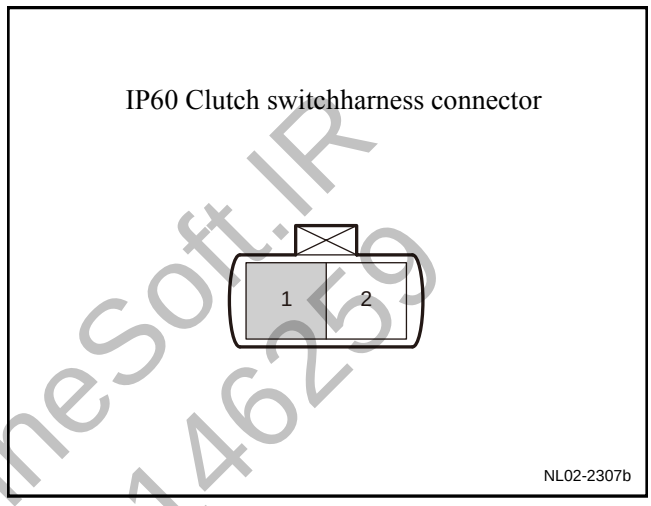
B. Disconnect ECM harness connector EN01.

C. Press the brake pedal.

D. Measure ECM harness connector EN01 terminal No.34 resistance.

Standard Resistance: Less than 3 Ω

Confirm whether the resistance is normal.



Yes → Refer to 2.12.8.1 Replacement of Engine Control Module to replace ECM.

No

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4	Repair the circuit between clutch switch wiring harness connector IP60 and ECM harness connector EN01.

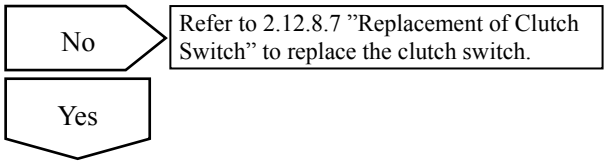
A. Repair the circuit between clutch switch wiring harness connector IP60 and ECM harness connector EN01.

B. Confirm the repair is completed.

Next

5	Is the clutch switch working correctly?

Note: When the clutch switch fails, during emergent acceleration and deceleration, the vehicle will vibrate seriously and even push forward.



4	Troubleshooting

5. Maintenance guide :

Refer to 2.12.8.7 Replacement of Clutch Switch to replace the Clutch switch.

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2.12.7.57 Crankshaft can rotate normally, but engine can't be started.

Notes:

Before carrying out this step, make sure the engine oil complies with the manufacturer requirements, the fuel tank has sufficient fuel and battery has enough power for starting engine. Observe the fault diagnosis tester data list, analyze the accuracy of the data, as these will facilitate diagnostic.

Diagnostic Steps:

1	Scan ECM for DTC codes.

A. Connect fault diagnosis tester.

B. Rotated ignition switch to ON position.

C. Scan ECM DTC codes.

D. Refer to 2.12.7.14 DTC Code Index to repair any DTC code faulty part related to fuel system.

E. Clear ECM DTC code.

Start the engine, fault solved?

Yes → The system is normal.

No

2	Inspect fuel pump relay.

A. Connect fault diagnosis tester.

B. Rotated ignition switch to ON position .

C. Choose fault diagnosis tester Action Test then fuel pump relay to drive the fuel pump relay.

Is fuel pump relay working properly?

Yes → Go to step 5

No

3	Replace the fuel pump relay.

A. Refer to 2.3.2 Description and Operation and 2.3.3 System Operating Principle in the Fuel System.

B. Replace the pump relay.

C. Inspect fuel pump relay circuits and repair the faulty part. Start the engine,fault solved?

Yes → The system is normal.

No

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4	Inspect the fuel pump circuit.

A. rotated ignition switch to OFF position .

B. Disconnect fuel pump harness connector SO26.

C. Connect fault diagnosis tester.

D. Turn the ignition switch to the ON position.

E. Select Fuel Pump Relay in Functional Testing of the diagnostic test er to drive the fuel pump relay.

F. Use a test lamp to connect SO26 terminals No. 3 and 4.

Is test lamp lit properly?

Yes — Go to step 7

No

6	Repair the fuel pump circuit.

A. Turn the ignition switch to the ON position.

B. Inspect fuel pump working circuit, repair the pump SO26 terminals No.3 and fuel pump relay terminal No.5 open circuit fault.

Start the engine, fault solved?

Yes — The system is normal.

No

7	Inspect the fuel pressure

A. rotated ignition switch to OFF position .

B. Install fuel pressure gage, connect fault diagnosis tester.

C. Rotated ignition switch to ON position .

D. Connect the diagnostic tester and select Fuel Pump Relay in Functional Testing.

Compel to drive the fuel pump relay.

Standard Fuel Pressure Value: 350 kPa

Is fuel pressure normal?

Yes — Go to step 8

No

8	Replace the fuel pump assembly.

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A. Turn off the ignition switch and remove the ignition key.

B. Refer to 2.3.6.3 Replacement of Fuel Pump Assembly to remove the fuel pump assembly.

Start the engine, fault solved?

Yes → The system is normal.

No

9	Inspect (repair) fuel injectors.

A. Refer to the DTC code 2.12.7.32 DTC P0270 P0271 for the inspect (repair) procedures. If necessary, replace the faulty fuel injectors.

Start the engine, fault solved?

Yes → The system is normal.

No

10	Inspect the ignition coil.

A. rotated ignition switch to OFF position .

B. Dismantle the ignition coil harness connector and connect an intact spark plug with well grounding.

C. Start the engine.

Is spark plug ignition normal?

Yes → Go to step 12

No

11	Replace the ignition coil,

A. Turn off the ignition switch and remove the ignition key.

B. Refer to 2.10.7.3 Replacement of Ignition Coil to replace the ignition coil.

Start the engine, fault solved?

Yes → The system is normal.

No

12	Inspect crankshaft position sensor and circuit.

A. Refer to 2.12.7.35 DTC P0335 P0336 to inspect crankshaft position sensor.

B. Measure crankshaft position sensor resistance with a multimeter.

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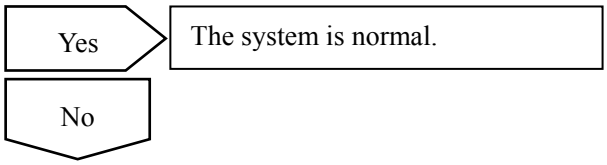
Rated resistance：20-30℃（68-86℉）900-1100Ω

C. Inspect sensor circuit, repair the faulty part. If necessary, refer to 2.10.7.2 Replacement of Crankshaft Position Sensor to replace the crankshaft position sensor.

Start the engine, fault solved?

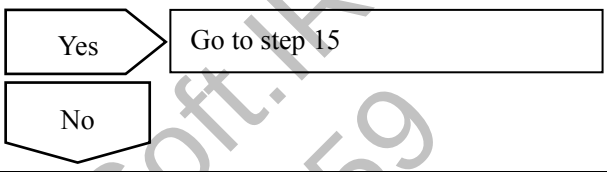


13	Test the cylinder pressure.

A. Refer to 2.6.7.3 "Comprehensive Engine Inspections" to carry out the cylinder compression pressure test.

Standard Cylinder Pressure: 800 kPa

Are all cylinders compression pressure equal to or higher than the specified value?

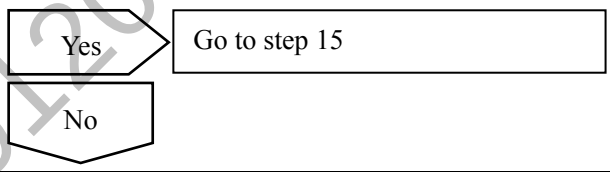


14	Inspect timing chain positioning.

A. Turn off the ignition switch and remove the ignition key.

B. Refer to 2.6.8.11 "Timing Chain Inspection" to inspect timing chain positioning.

Is the chain positioned properly?

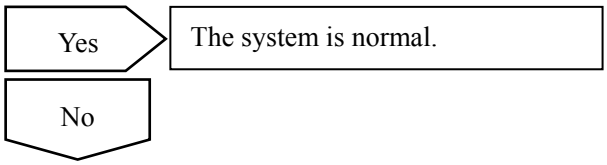


15	Install the timing chain.

A. Turn off the ignition switch and remove the ignition key.

B. Refer to the 2.6.8.10 "Replacement of Timing Chain Component" to reinstall the timing chain.

Start the engine, fault solved?



16	Inspect mechanical parts inside the engine.

A. Dismantle the engine.

B. Inspect engine mechanical parts. If necessary, repair the damaged engine components.

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C. identify the engine damaged components repair has been completed.

Next

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2.12.7.58 Electronic Throttle Body (ETC) Self-adaptive Learn Program

Notes:

After the throttle body for cleaning and serving, carry out ETC self-adaptive learn. Otherwise there will be idle instable, jitter and so on.

1	Use fault diagnosis tester "Action Test" function, clear the TPS learn value.

Next

2	Turn the ignition switch to "ON" position, after 3 s to "OFF" position.

Next

3	In 1s turn the ignition switch to "ON" position, after 3 s to "OFF" position.

Next

4	Repeat the above steps 5 times.

Next

5	Initialization completed.

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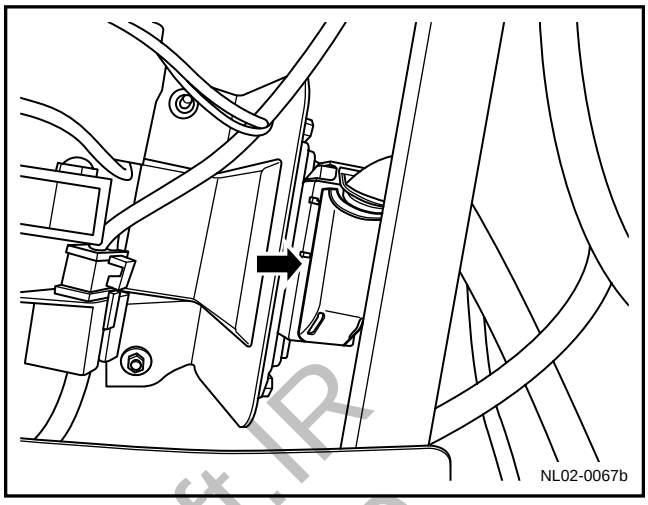
2.12.8 Removal and installation

2.12.8.1 Replacement of Engine Control Module

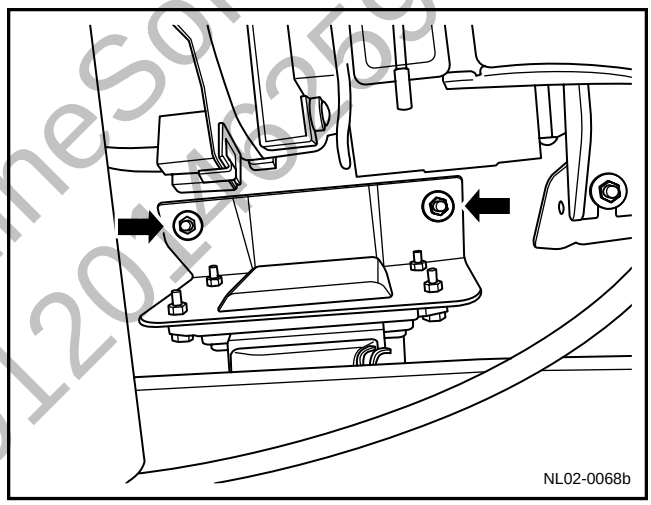
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of instrument table sundries box, refer to 12.8.3.3 Replacement of instrument table sundries box.
3. Disconnect engine control module harness connector.



4. Dismantle the fixing bolts of engine control module.



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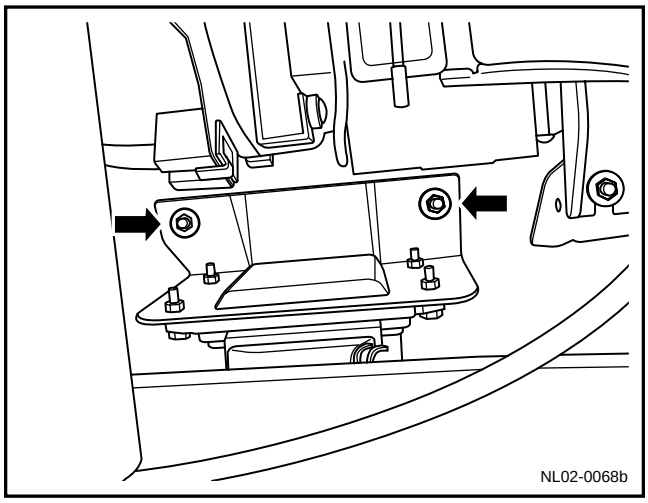
Installation Procedure:

1. Install the fixing bolts of engine control module.

Torque:10Nm(Metric) 7.4lb-ft(English system)

2. Connect the engine control module harness connector.
3. Install grove box of instrument desk .
4. Connect the battery negative cable .

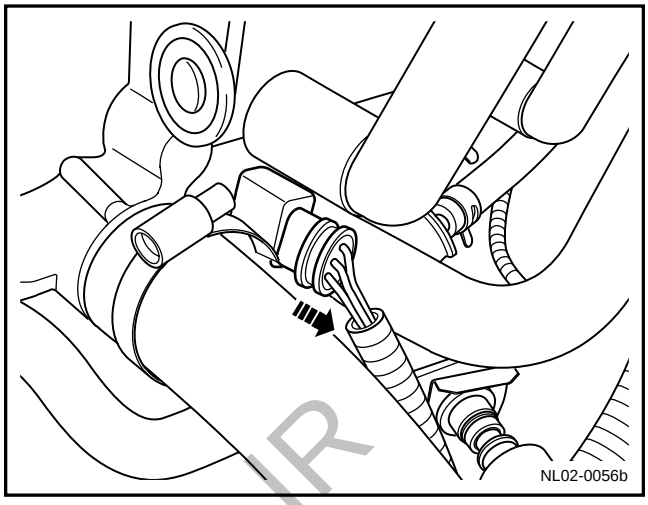


2.12.8.2 Engine coolant temperature sensor

Dismantlement Procedure

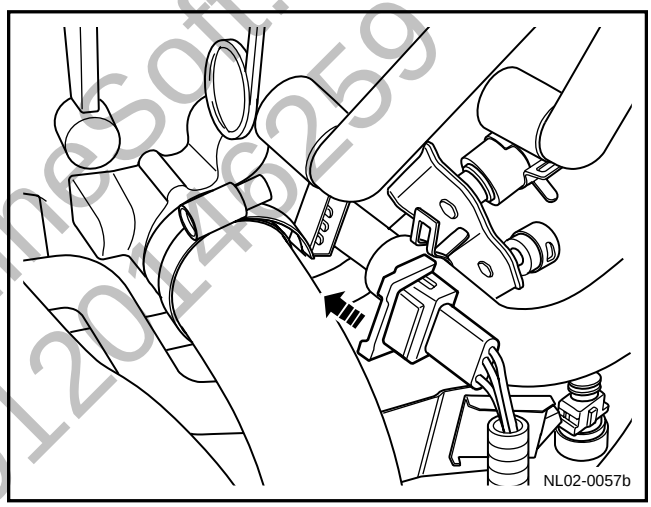
Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Release pressure in the cooling system.
2. Disconnect the battery negative electrode cable. Refer to 2.12.6.1 Battery Disconnection.
3. Disconnect the temperature sensor of engine coolant harness connector.
4. Dismantle the temperature sensor of engine coolant.



Installation Procedure:

1. Apply sealant on the temperature sensor of engine coolant thread.
2. Install the temperature sensor of engine coolant.
3. Connect temperature sensor of engine coolant harness connector.
4. Fill the engine coolant.
5. Connect battery negative cable.



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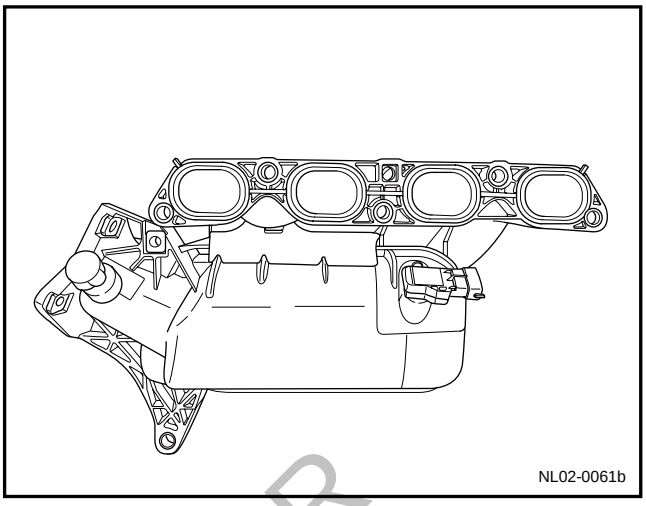
2.12.8.3 Replacement of Intake Pressure Temperature Sensor

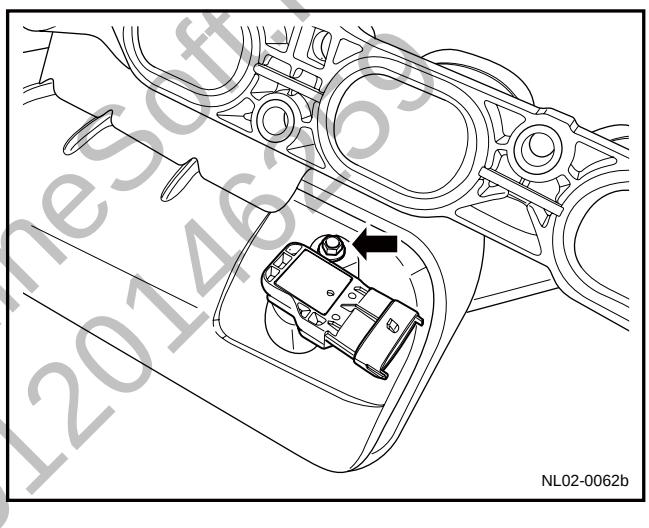
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

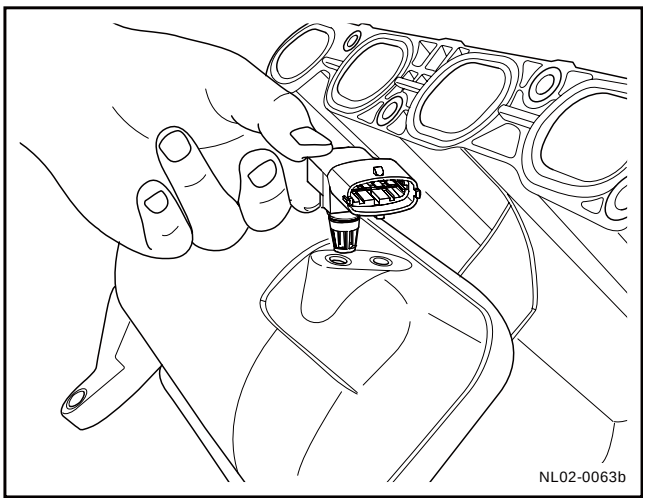
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Disconnect intake pressure temperature sensor harness connector.
3. For dismantling of air intake manifold assembly, refer to 2.6.8.6 Replacement of air intake manifold assembly.



4. Dismantle the fixing bolts of sensor.



5. Pull out the intake pressure temperature sensor.



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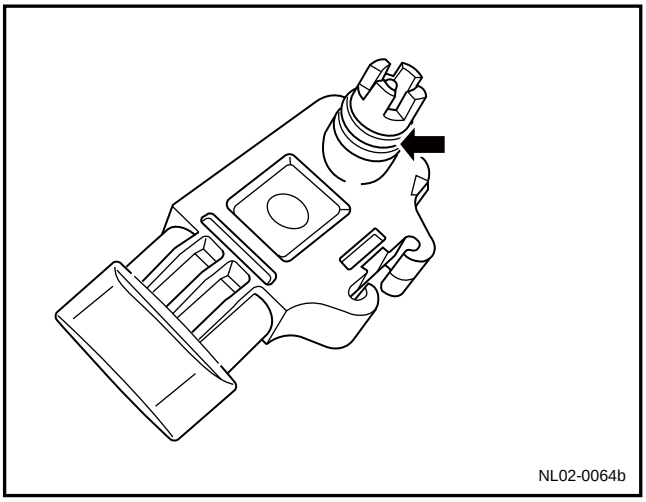
Installation Procedure:

1. Clean the intake pressure temperature sensor installation position and apply new seals.

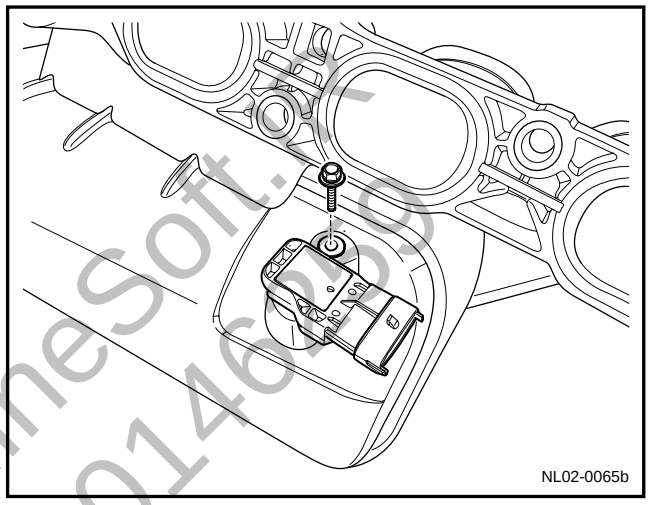
Note: the seal ring is a single use piece, which must be replaced by a new one after disassembling at every turn.



2. Install the fixing bolts of sensor.

Torque:10Nm(Metric) 7.4lb-ft(English system)

3. Install air intake manifold assembly.
4. Connect the intake pressure temperature sensors harness connector.
5. Connect the battery negative cable.



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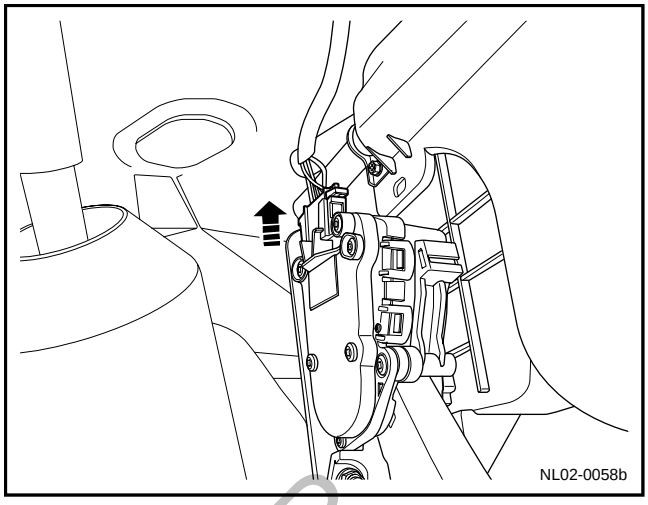
2.12.8.4 Replacement of Electronic Acceleration Pedal Assembly

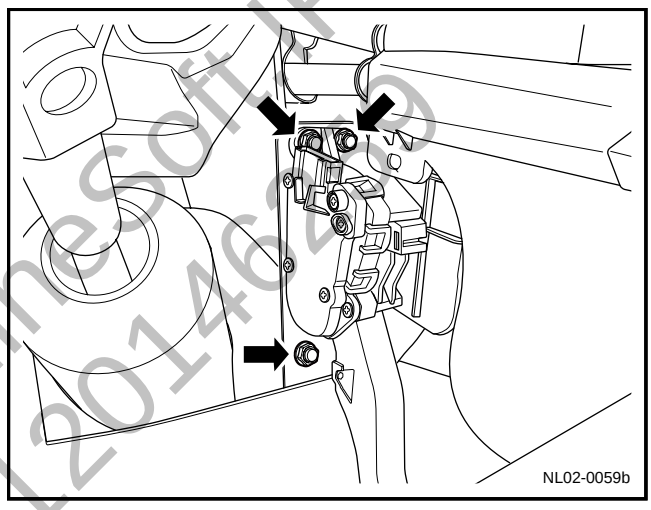
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery Cable Disconnection/Connection Procedures.
2. Disconnect the acceleration pedal assembly harness connector.



3. Dismantle the fixing bolts of acceleration pedal and dismantle the acceleration pedal.

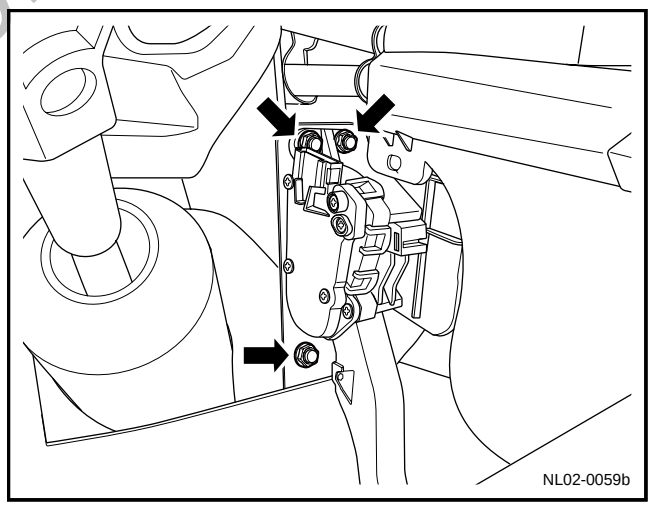


Installation Procedure:

1. Install the acceleration pedal and tighten the fixing nuts.

Torque:15 Nm(Metric) 11 lb-ft(English system)

2. Connect the acceleration pedal harness connector.
3. Connect the battery negative cable .



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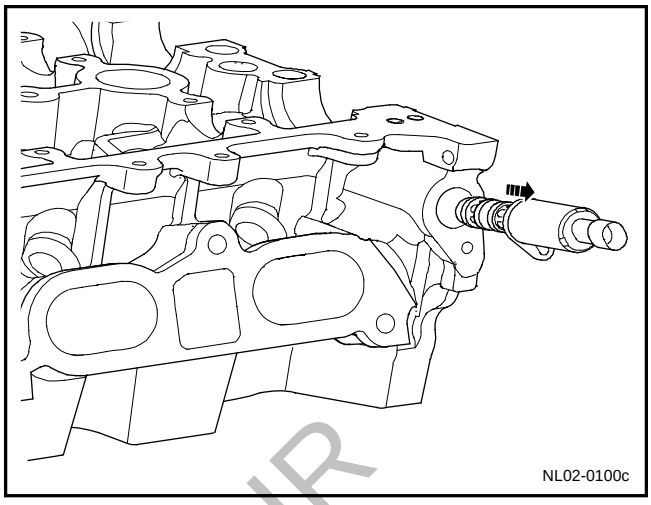
2.12.8.5 Replacement of VVT Solenoid Valve and Filter Cleaning

Dismantle the VVT solenoid valve.

Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions".

1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Refer to 2.6.8.1 "Replacement of Engine Shied" to dismantle the engine shied.
3. Disconnect VVT solenoid valve wiring harness connector.
4. Dismantle fixing bolts of VVT solenoid valve and dismantle the VVT solenoid valve.



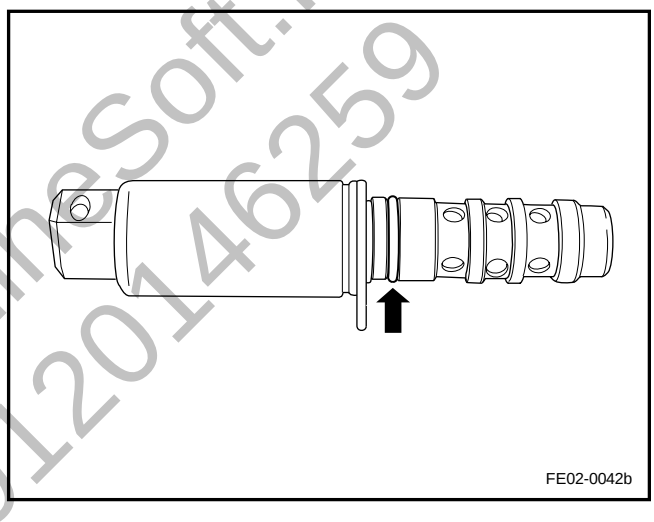
Install the VVT solenoid valve.

Important precaution: after replacing by new VVT electromagnetic value, the procedure of "clean and check the electromagnetic valve filter screen" must be implemented! Otherwise, cause damage to the electromagnetic valve.

1. Make sure the new VVT solenoid valve seals are intact. Apply a small amount of engine lubrication oil on the seal.
2. Install the VVT solenoid valve and fasten the fixing bolts.

Torque: 8Nm (Metric) 6 lb-ft (English system).

3. Connect the VVT solenoid valve wiring harness connector.



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2.12.8.6 VVT Solenoid Valve Cleaning

Precautions:

A. Inoperative near at high temperatures or near a fire to avoid cleaning agents being ignited or exploded.

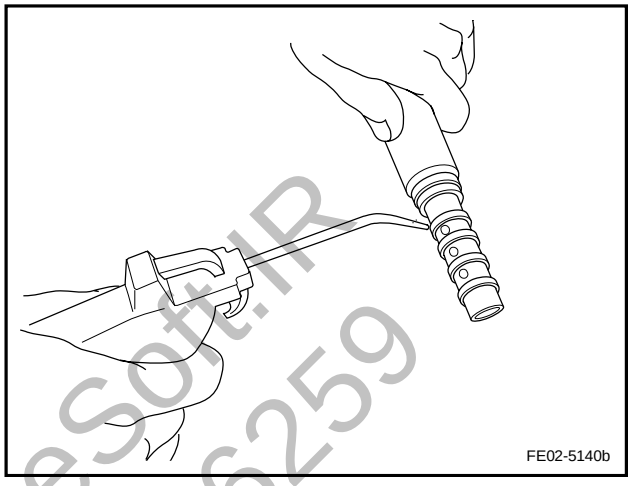
B. The length of wire should be more than 3m. It is recommended to install the wire relay.

C. During the cleaning process, do not scratch the O- ring, scratch or knock the surface of the valve or drop the valve..

D. After repair, reinstall the valve VVT and tightening the bolt to 10Nm.

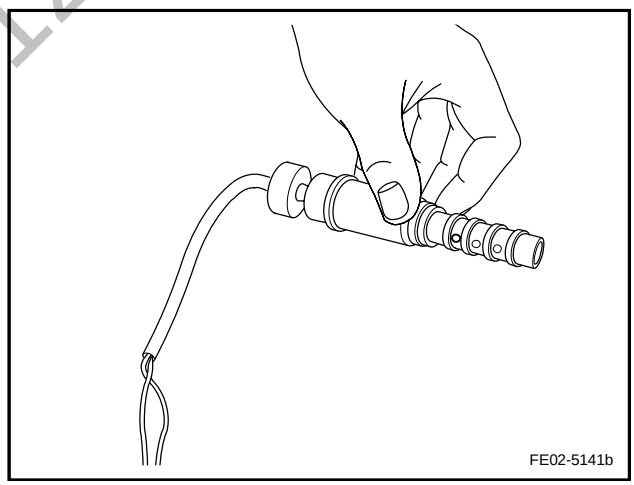
E. Replace repeatedly cleanedVVTvalve.

1. For disconnection of negative cable of battery, refer to "2.11.8.1 disconnection process of battery negative cable".
2. Refer to 2.12.8.4 "Replacement of VVT Solenoid Valve and Filter Cleaning" to dismantle the VVT Solenoid Valve.
3. Clean the VVT solenoid valve hole, return hole, the chamber.



Note: During the cleaning process, keep the VVT solenoid valve and wiring harness connector upright, otherwise the cleaning agent will easily enter the VVT solenoid valve and cause internal damage.

4. Use an air gun to clean the VVT valve hole and oil chamber. Clean up the cleaning agent residue.



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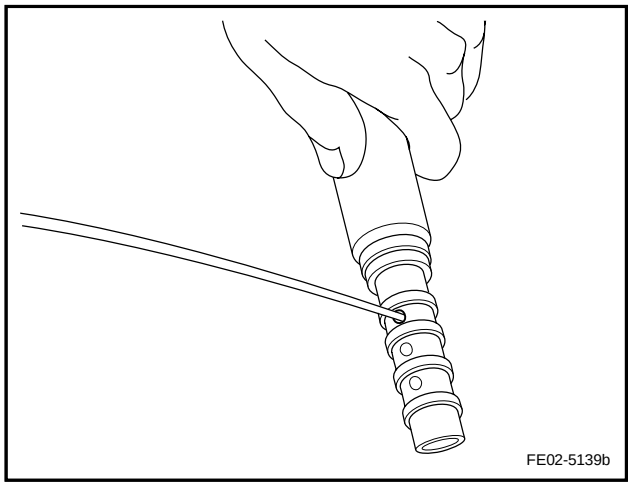
5. Switch on and off the VVT solenoid valve. Clean the valve with an air gun and repeat 23 times.

Note: Each time switch the valve on no longer than 2 seconds, otherwise the VVT solenoid valve may be damaged.



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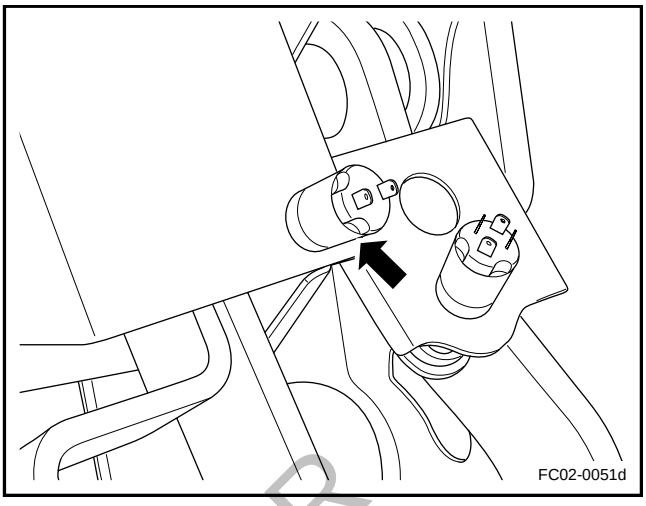
2.12.8.7 Replacement of Clutch Slave Cylinder

Dismantlement Procedure

1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Refer to "Replacement of Instrument Panel" to dismantle the instrument panel.

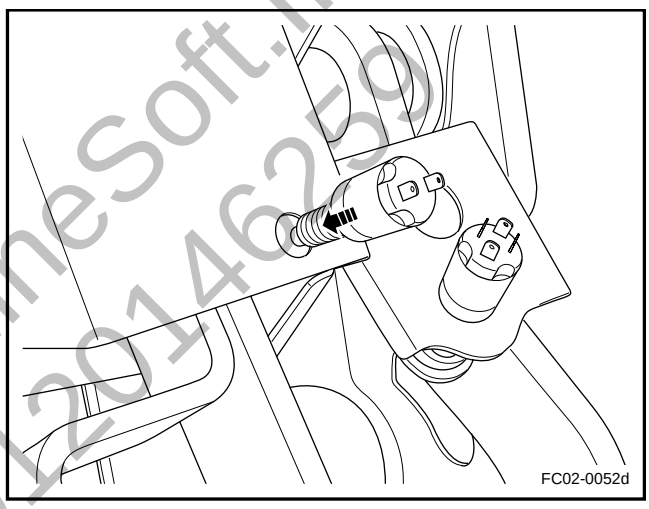
Note: Please use a special tool for body repair when disassembling the trim panel, otherwise, the edge of the interior trim will easily be scratched.

3. Disconnect clutch switch wiring harness connection.
4. Dismantle the clutch switch.



Installation Procedure:

1. Install the clutch switch.
2. Connect all clutch switch harness connection.
3. Install the instrument panel.
4. Connect battery negative cable.



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2.13 Mechanical system(4G18)

2.13.1 Specifications

2.13.1.1 Fastener specifications

Fastener Name	Specification	Tightening Torque	
		Metric (N.m)	English system (lb-ft)
Spark plug bolt	M14×1.25	20-30	14.8-22.2
Cylinder Hood Cover (Short Bolt)	M6	7-11	5.2-8.2
Cylinder Hood Cover (Long Bolts, Nuts, Special Bolts)	M6	9-13	6.7-9.6
Knock Sensor Bolt	M8×30	14.4-21.6	10.7-16
Cylinder Hood Bolts	M10×1.25	First Pass 46-52	First Pass 34-38.5
		Second Pass 76-84	Second Pass 56-62.2
VVT Actuator Mounting Bolts	M12×1.25	59-81	43.7-60
Intake Manifold Mounting Bolt	M8	24-36	17.8-26.7
Crankcase mounting bolt	M8	14.4-21.6	10.7-16
Exhaust Pipe Mounting Bolt	M8	20-30	14.8-22.2
Main Bearing Cap Installation Bolt	M10×1.25	First Pass 42-46	First Pass 31-34
		Second Pass 54-66	Second Pass 40-48.9
Flywheel Mounting Bolt	M10×1.25	83-93	61.4-68.8
Water Pump Mounting Bolt	M6×25	7.2-10.8	5.3-8
Water Pump Mounting Bolt	M6×35	9.8-13.2	7.3-9.8
Fuel Rail Bolt	M6×20	7.2-10.8	5.3-8
Connecting Rod Cap Bolt	M8×1	First Pass 19-21	First Pass 14-15.5

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		Second Pass 50-52	Second Pass 37-38.5
Camshaft Bearing Cap Bolt	M8;M6	21.6±-24.5/12.2±-13.8	16±-18.2/9±-10.2
Mounting bolt of oil pan	M6	7.2-10.8	5.3-8
Mounting Bolt of Oil Strainer	M6	7.2-10.8	5.3-8
Engine oil pressure alarm bolt	R1/8	10.5-19.5	7.8-14.4
Oil Filter Pipe Joint Bolt	M28×1.5	16-24	11.8-17.8
Oil Filter Pipe Joint Bolt	UNF3/4″16	33-37	24.4-27.4
Crankshaft Pulley Mounting Bolt	M12×1.25	129.7-146.3	96-108.3
The engine passes through the bolt.	M10×1.25×72	43.2-64.8	32-48
The engine is mounted with the bolt.	M8×30	20-30	14.8-22.2
Clutch assembly mounting bolt.	M8	21.6-32.4	16-24
Bolt of water drain valve component	M10	Above 25	Above 18.5
Oil Pump Mounting Bolt	M6	7.2-10.8	5.3-8
Timing Chain Cover Bolt	M8	14.4-21.6	10.7-16
Timing Chain Cover Bolt	M6	8.8-13.2	6.5-9.8
Right Engine Mounting Bracket Bolt	M10×55	37.6-56.4	27.8-41.7
Drive belt tensioner mounting bolt	M12	55.2-82.8	40.8-61.3
Drive belt tensioner mounting nut	M8	23.2-34.8	17.2-25.8
Exhaust cam shaft timing chain wheel mounting bolt	M10	43.2-64.8	32-48
Draining bolt of oil pan	M12	25-35	18.5-25.9

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2.13.1.2 Mechanical System Specification

Items	**Specification**
Bore (mm/in)	79/3.11
Stroke (mm/in)	91.5/3.6
Compression Ratio	1.792
Compression ratio	10:01
Power (km/rpm)	102/6000～6200
Torque (N.M/rpm)	172/4100～4300
Idle Speed (rpm)	800±50(A/C is ON . 1000±50)
ASM Emissions (g/km)	CO is less than 2.3；CH is less than 0.2；NOX is less than 0.15
Ignition Sequence	1-3-4-2(1、4 cylinders and 2,3 cylinders subgroup ignition)
Fuel consumption (90 km/h) during driving at constant speed （L/100KM）	Less than 6.5
Fuel grade	RON 93# and above lead-free gasoline
Engine coolant capacity (L/pt)	6.5/11.44
Engine Oil Capacity (L/pt)	4.0/7.04
Engine Coolant Specification / Grades	Meet SH0521 {freezing point≤-40 °C (-40 ?F).
Lubrication Oil Specification/Grades	Meet GB11121 standard, API quality level: SJ, description exporting to EU: SL, and viscosity: SAE5W-30, 10W-30, 10W-40 and 15W-40.
Spark Plug Model	K6RTC
Spark Plug Gap (mm/in)	1.0-1.1/0.03--0.04
Dry Mass (kg/lb)	Without starter, containing engine oil and no water, with harness and clutch, 117±2/257.94±4.41

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Overall dimension (LxWxH) mm/in	631×610×620/24 . 84×24 . 02×24 . 41
Camshaft	
Journal Diameter (mm/in)	23/0.91
Camshaft Axial Clearance (mm/in)	0.05±0.12/0.0020±0.0047
Intake Valve Clearance (mm/in)	0.23±0.03/0.0091±0.0011
Exhaust Valve Clearance (mm/in)	0.32±0.03/0.0126±0.0011
Intake VVT Adjustment Range	±25°
Valve Timing	
Intake Valve is Open.	18.5° before TDC
Intake Valve is Closed	55° after BDC
Exhaust Valve is Open	48° before BDC
Exhaust Valve is Closed	4° after TDC
Connecting rode Journal	
Connecting Rod Bearing Clearance (mm/in)	0.020±0.044/0.0007±0.0017
Connecting Rod Bearing Axial Clearance (mm/in)	0.16±0.342/0.006±0.0135
Crankshaft	
Axial Clearance (mm/in)	0.04±0.24/0.0015±0.0094
Main Bearing Clearance - All (mm/in)	0.015±0.033/0.0006±0.0013
Main Journal Diameter - All (mm/in)	47.982±48/1.8891±1.8898
Top Surface Flatness (mm/in)	0.05/0.0019
Crankshaft main journal circular degree (mm/in)	0.003/0.0001
Crankshaft main journal circle run-out (mm/in)	0.02/0.0008
Cylinder Hood	

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Machined Minimal Total Height (mm/in)	115±-0.05/4.53±-0.0019
Overall Height (mm/in)	115±+0.05/4.53±+0.0019
Valve Guide Height (mm/in)	34.5/1.36
Piston	
Gap Between Piston and Cylinder (mm/in)	0.060±0.083/0.0023±0.0033
Diameter (mm/in)	78.9/3.11
Piston Pin	
Gap Between Piston Pin and Piston (mm/in)	0.005-(-0.001)/0.0002-(-0.00003)
Gap Between Piston Pin and Rod (mm/in)	0.005±-0.011/0.0002±-0.0004
Diameter (mm/in)	20/0.787
Length (mm/in)	50/1.969
Piston Pin Offset - Thrust Side (mm/in)	0.6/0.0236
Oil Pump	
Safety Valve Opening Pressure (kPa/psi)	500 /72 . 52
Piston Ring	
Oil Ring End Gap (mm/in)	0.20±-0.70/0.0079±-0.0276
Second Compression Ring End Gap (mm/in)	0.40±-0.55/0.0157±-0.0217
First Compression Ring End Gap (mm/in)	0.25±-0.35/0.0098±-0.0138
Sealants and Adhesives	
Cylinder head cover pad sealant	TONSAN 1596 silicone plane sealant
Engine oil passage hole plug	TONSAN 1243 anaerobic thread locking sealant

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Oil Pan and Crank Box Joints	TONSAN 1596 silicone plane sealant
Crankcase With The Cylinder Block Joints	TONSAN 1596 silicone plane sealant
Flywheel Bolt	Loctite 204 anaerobic sealant
Valve System	
Intake Valve Diameter (mm/in)	31/1.2
Exhaust Valve Diameter (mm/in)	26/1
Valve Tube Diameter (mm/in)	5.5/0.22
Valve Stem Diameter - Intake Valve (mm/in)	5.5/0.22
Valve Rod Diameter - Exhaust Valve (mm/in)	5.5/0.22

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2.13.1.3 Specification Table for Tappet Rods of Intake and Exhaust Valves

Packet No.	Thickness size (mm/in)	**Packet No.**	Thickness size (mm/in)
06	5.06（0.1992）	42	5.42（0.2134）
08	5.08（0.200）	44	5.44（0.2142）
10	5.10（0.2008）	46	5.46（0.2150）
12	5.12（0.2016）	48	5.48（0.2157）
14	5.14（0.2024）	50	5.50（0.2165）
16	5.16（0.2031）	52	5.52（0.2173）
18	5.18（0.2039）	54	5.54（0.2181）
20	5.20（0.2047）	56	5.56（0.2189）
22	5.22（0.2055）	58	5.58（0.2197）
24	5.24（0.2063）	60	5.60（0.2205）
26	5.26（0.2071）	62	5.62（0.2213）
28	5.28（0.2079）	64	5.64（0.2220）
30	5.30（0.2087）	66	5.66（0.2236）
32	5.32（0.2094）	68	5.68（0.2236）
34	5.34（0.2102）	70	5.70（0.2552）
36	5.36（0.2110）	72	5.72（0.2260）
38	5.38（0.2118）	74	5.74（0.2260）
40	5.40（0.2126）		

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2.13.1.4 Selection Table for Tappet Rod of Intake Valve

Installed tappet rod thickness mm(in.) \ Clearance measuremen mm(in.)	0.000-0.030(0.0000-0.0012)	0.031-0.050(0.0012-0.0020)	0.051-0.070(0.0020-0.0028)	0.071-0.090(0.0028-0.0035)	0.091-0.110(0.0036-0.0043)	0.111-0.130(0.0044-0.0051)	0.131-0.150(0.0052-0.0059)	0.151-0.170(0.0059-0.0067)	0.171-0.189(0.0067-0.0074)	0.291-0.310(0.0115-0.0122)	0.311-0.330(0.0122-0.0130)	0.331-0.350(0.0130-0.0138)	0.351-0.370(0.0138-0.0146)	0.371-0.390(0.0146-0.0154)	0.391-0.410(0.0154-0.0161)	0.411-0.430(0.0162-0.0169)	0.431-0.450(0.0170-0.0177)	0.451-0.470(0.0178-0.0185)	0.471-0.490(0.0185-0.0193)	0.491-0.510(0.0193-0.0201)	0.511-0.530(0.0201-0.0209)	0.531-0.550(0.0209-0.0217)	0.551-0.570(0.0217-0.0224)	0.571-0.590(0.0225-0.0232)	0.591-0.610(0.0233-0.0240)	0.611-0.630(0.0241-0.0248)	0.631-0.650(0.0248-0.0256)	0.651-0.670(0.0256-0.0264)	0.671-0.690(0.0264-0.0272)	0.691-0.710(0.0272-0.0280)	0.711-0.730(0.0280-0.0287)	0.731-0.750(0.0288-0.0295)	0.751-0.770(0.0296-0.0303)	0.771-0.790(0.0304-0.0311)	0.791-0.810(0.0311-0.0319)	0.811-0.830(0.0319-0.0327)	0.831-0.850(0.0327-0.0335)	0.851-0.870(0.0335-0.0343)	0.871-0.890(0.0343-0.0350)	0.891-0.910(0.0351-0.0358)	0.891-0.910(0.0351-0.0358)
5.06(0.1992)										12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
5.08(0.2000)									06	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74
5.10(0.2008)								06	08	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	
5.12(0.2016)							06	08	10	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74		
5.14(0.2024)						06	08	10	12	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74			
5.16(0.2031)					06	08	10	12	14	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74				
5.18(0.2039)				06	08	10	12	14	16	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74					
5.20(0.2047)			06	08	10	12	14	16	18	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74						
5.22(0.2055)		06	08	10	12	14	16	18	20	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74						
5.24(0.2063)		08	10	12	14	16	18	20	22	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74							
5.26(0.2071)	06	10	12	14	16	18	20	22	24	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74								
5.28(0.2079)	08	12	14	16	18	20	22	24	26	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74									
5.30(0.2087)	10	14	16	18	20	22	24	26	28	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74										
5.32(0.2094)	12	16	18	20	22	24	26	28	30	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74											
5.34(0.2102)	14	18	20	22	24	26	28	30	32	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74												
5.36(0.2110)	16	20	22	24	26	28	30	32	34	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74													
5.38(0.2118)	18	22	24	26	28	30	32	34	36	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74														
5.40(0.2126)	20	24	26	28	30	32	34	36	38	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74															
5.42(0.2134)	22	26	28	30	32	34	36	38	40	48	50	52	54	56	58	60	62	64	66	68	70	72	74	74																
5.44(0.2142)	24	28	30	32	34	36	38	40	42	50	52	54	56	58	60	62	64	66	68	70	72	74	74																	
5.46(0.2150)	26	30	32	34	36	38	40	42	44	52	54	56	58	60	62	64	66	68	70	72	74	74																		
5.48(0.2157)	28	32	34	36	38	40	42	44	46	54	56	58	60	62	64	66	68	70	72	74	74																			
5.50(0.2165)	30	34	36	38	40	42	44	46	48	56	58	60	62	64	66	68	70	72	74	74																				
5.52(0.2173)	32	36	38	40	42	44	46	48	50	58	60	62	64	66	68	70	72	74	74																					
5.54(0.2181)	34	38	40	42	44	46	48	50	52	60	62	64	66	68	70	72	74	74																						
5.56(0.2189)	36	40	42	44	46	48	50	52	54	62	64	66	68	70	72	74	74																							
5.58(0.2197)	38	42	44	46	48	50	52	54	56	64	66	68	70	72	74	74																								
5.60(0.2205)	40	44	46	48	50	52	54	56	58	66	68	70	72	74	74																									
5.62(0.2213)	42	46	48	50	52	54	56	58	60	68	70	72	74	74																										
5.64(0.2220)	44	48	50	52	54	56	58	60	62	70	72	74	74	74																										
5.66(0.2236)	46	50	52	54	56	58	60	62	64	72	74	74	74																											
5.68(0.2244)	48	52	54	56	58	60	62	64	66	74	74	74																												
5.70(0.2252)	50	54	56	58	60	62	64	66	68	74	74																													
5.72(0.2260)	52	56	58	60	62	64	66	68	70	74																														
5.74(0.2260)	54	58	60	62	64	66	68	70	72																															

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2.13.1.5 Selection Table for Tappet Rod of Exhaust Valve

5.74(0.2260)	5.72(0.2260)	5.70(0.2252)	5.68(0.2236)	5.66(0.2236)	5.64(0.2220)	5.62(0.2213)	5.60(0.2205)	5.58(0.2197)	5.56(0.2189)	5.54(0.2181)	5.52(0.2173)	5.50(0.2165)	5.48(0.2157)	5.46(0.2150)	5.44(0.2142)	5.42(0.2134)	5.40(0.2126)	5.38(0.2118)	5.36(0.2110)	5.34(0.2102)	5.32(0.2094)	5.30(0.2087)	5.28(0.2079)	5.26(0.2071)	5.24(0.2063)	5.22(0.2055)	5.20(0.2047)	5.18(0.2039)	5.16(0.2031)	5.14(0.2024)	5.12(0.2016)	5.10(0.2008)	5.08(0.2000)	5.06(0.1992)	Installed tappet rod thickness (mm/in) / Clearance measurement mm(in.)
54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06											0.000-0.030(0.0000-0.0012)
56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06										0.031-0.050(0.0012-0.0020)
58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06									0.051-0.070(0.0020-0.0028)
60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06								0.071-0.090(0.0028-0.0035)
62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06							0.091-0.110(0.0036-0.0043)
64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06						0.111-0.130(0.0044-0.0051)
66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06					0.131-0.150(0.0052-0.0059)
68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06				0.151-0.170(0.0059-0.0067)
70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	06			0.171-0.190(0.0067-0.0075)
70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	08	08	06		0.191-0.199(0.0075-0.0078)
		74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	10	0.261-0.280(0.0103-0.0110)
			74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	12	0.281-0.300(0.0111-0.0118)
				74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	14	0.301-0.320(0.0119-0.0125)
					74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	16	0.321-0.340(0.0126-0.0134)
						74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	18	0.341-0.360(0.0134-0.0142)
							74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	20	0.361-0.380(0.0142-0.0150)
								74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	22	0.381-0.400(0.0150-0.0157)
									74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	24	0.401-0.420(0.0158-0.0165)
										74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	26	0.421-0.440(0.0166-0.0173)
											74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	28	0.441-0.460(0.0174-0.0181)
												74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	30	0.461-0.480(0.0181-0.0189)
													74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	32	0.481-0.500(0.0189-0.0197)
														74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	34	0.501-0.520(0.0197-0.0205)
															74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	36	0.521-0.540(0.0205-0.0213)
																74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	38	0.541-0.560(0.0213-0.0220)
																	74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	40	0.561-0.580(0.0221-0.0228)
																		74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	42	0.581-0.600(0.0229-0.0236)
																			74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	44	0.601-0.620(0.0237-0.0244)
																				74	72	70	68	66	64	62	60	58	56	54	52	50	48	46	0.621-0.640(0.0244-0.0252)
																					74	72	70	68	66	64	62	60	58	56	54	52	50	48	0.641-0.660(0.0252-0.0260)
																						74	72	70	68	66	64	62	60	58	56	54	52	50	0.661-0.680(0.0260-0.0268)
																							74	72	70	68	66	64	62	60	58	56	54	52	0.681-0.700(0.0268-0.0276)
																								74	72	70	68	66	64	62	60	58	56	54	0.701-0.720(0.0276-0.0283)
																									74	72	70	68	66	64	62	60	58	56	0.721-0.740(0.0284-0.0291)
																										74	72	70	68	66	64	62	60	58	0.741-0.760(0.0292-0.0299)
																											74	72	70	68	66	64	62	60	0.761-0.780(0.0300-0.0307)
																												74	72	70	68	66	64	62	0.781-0.800(0.0307-0.0315)
																													74	72	70	68	66	64	0.801-0.820(0.0315-0.0323)
																														74	72	70	68	66	0.821-0.840(0.0323-0.0331)
																															74	72	70	68	0.841-0.860(0.0331-0.0339)
																																74	72	70	0.861-0.880(0.0339-0.0346)
																																	74	72	0.881-0.900(0.0347-0.0354)
																																		74	0.901-0.920(0.0355-0.0362)

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2.13.2 Description and Operation

2.13.2.1 Description and operation

1. Cylinder Hood

Cylinder hood is made from aluminum alloy casting process. Cylinder valve stem is a mechanical system. Valve clearance can not be automatically adjusted, which is very important. The cylinder valve is an integrated part. OEMs can offer 38 different sizes for choosing. During the maintenance, required quite tube thickness can be calculated according to the formula. For details, refer to 2.13.8.20 Valve Clearance Adjustments. The camshaft is arranged in a double-top mode; a VVT actuator is further arranged on the inlet camshaft driving chain for regulating the air inlet timing. The specific operation principles refer to 2.13.3.1 Operation Principle of System.

2. Timing chain

Double overhead camshaft is driven through a timing chain. The timing chain must be replaced every one hundred and twenty thousand kilometers. The timing chain system consists of a timing chain, a timing chain guide rail, a timing chain tensioning rail and a timing chain tensioner acted on the timing chain tensioning rail. Where, the tension pressure of the timing chain tensioner is provided by the oil pump to ensure that the tension of the timing chain keeps balanced. The timing chain is lubricated by an engine oil nozzle installed on the engine oil pump. The specific information refers to 2.13.8.11 Check Timing Chain.

3. Intake Manifold

Intake manifold has four independent long ports, using inertia to improve the engine torque at low speed.

4. Camshaft

Dual overhead camshaft (DOHC) has two camshafts. A camshaft controls the intake valves, the other camshaft controls the exhaust valves. The camshaft is located in the journal in the cylinder hood on the top of the engine and fixed with camshaft cover. The cylinder hood camshaft journal drilling is used for engine oil channel. Engine oil flows to the camshaft under pressure, lubricating each camshaft journal. Engine oil flows through the cylinder hood to return to oil pan. Cam convex corner is formed by machining, at the right time, according to the appropriate amount, accurately open and close intake and exhaust valves. Cam convex is lubricated by high-pressure oil escaped from the engine camshaft.

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2.13.3 System Operating Principle

2.13.3.1 System operating Principle

1. Reciprocating Piston Engine Operating Principle:

- Intake Stroke: the crankshaft driven piston moves from TDC to BDC. At this point exhaust valve closes, intake valve opens. In the piston moving process, the cylinder volume gradually increased and the vacuum is formed within the cylinder. ECM controlled fuel injectors spray fuel into the intake pipe. At this time the intake valves open, air and fuel mixture sucked through the intake valve into cylinder and forms a combustible mixture.

- Compression Stroke: At the end of the intake stroke, crankshaft continues to drive the piston from the BDC to the TDC. Intake and exhaust valves are closed. With the piston moving up, the cylinder volume became smaller and smaller. Because gas is compressed, the temperature of the compressed gas rose rapidly.

- Power Stroke: At the end of compression stroke, the primary coil circuit of ignition coil controlled by ECM is disconnected and the secondary sensor produces a high voltage, which passes rapidly through the cylinder hood to the top of the spark plug, and finally the high-voltage breaks through the spark plug gap to generate electric spark, igniting the combustible mixture within the cylinder. Fire spreads rapidly inside the combustion chamber, while releasing a large amount of heat. Combustion gas expands rapidly .The pressure and temperature also increases. Swelling force acts on the piston top, prompting the piston to move from the TDC to the BDC and changing piston reciprocating motion into rotary movement through the connecting rod. At this point, intake and exhaust valves are still closed.

- Exhaust Stroke: At the beginning of the exhaust stroke, exhaust valve opens, intake valve is still closed. the crankshaft connecting rod drives the piston from the BDC to the TDC. After burning, the expanded gas residue will be discharged through the exhaust valve to outside the cylinder by its own pressure and the piston movement. When the piston reaches the TDC, the exhaust stroke ends and exhaust valve closes.

But in the actual process, the intake valve opens before the TDC and closes after BDC. This design is intended to draw more air into cylinder and reduce the power consumed in the intake process. In the exhaust process, the exhaust valve opens before BDC and closes after TDC. The aim is to reduce the mixture within the cylinder and reduce the power consumed in the intake process. Because intake and exhaust valves have a certain overlap angles, namely, at a certain crank angle intake and exhaust valves open at the same time. At this time the gas discharged through the exhaust valve forms a certain amount of inertia and draws the mixture into the cylinder. This will draw more air into the cylinder. But the valve overlap angle is not the bigger the better. In different operating conditions, the valve overlap angle requirements vary, therefore, in this engine there is intake valve variable valve timing, which aims to meet the engine intake valve opening angle requirements at different operating conditions. This function is achieved But the valve overlap angle is not the bigger the better. In different operating conditions, the valve overlap angle requirements vary, therefore, in this engine there is intake valve variable valve timing, which aims to meet the engine intake valve opening angle requirements at different operating conditions. this function is achieved through the VVT system.

2. VVT system working principle

VVT full write is Variable Valve Timing. Where there is mass, there is inertia. The air drawn into the engine cylinders also has inertia, after the intake process the air tends to help enter into the cylinder. At this time if the valve closing time is delayed, more air will be drawn into the cylinder, so that volumetric efficiency will be improved. As a result, the longer the delay in valve closing time, the better the High-Speed performance; On the contrary the more advanced valve closing, the better performance and the more torque at the Low-Speed.

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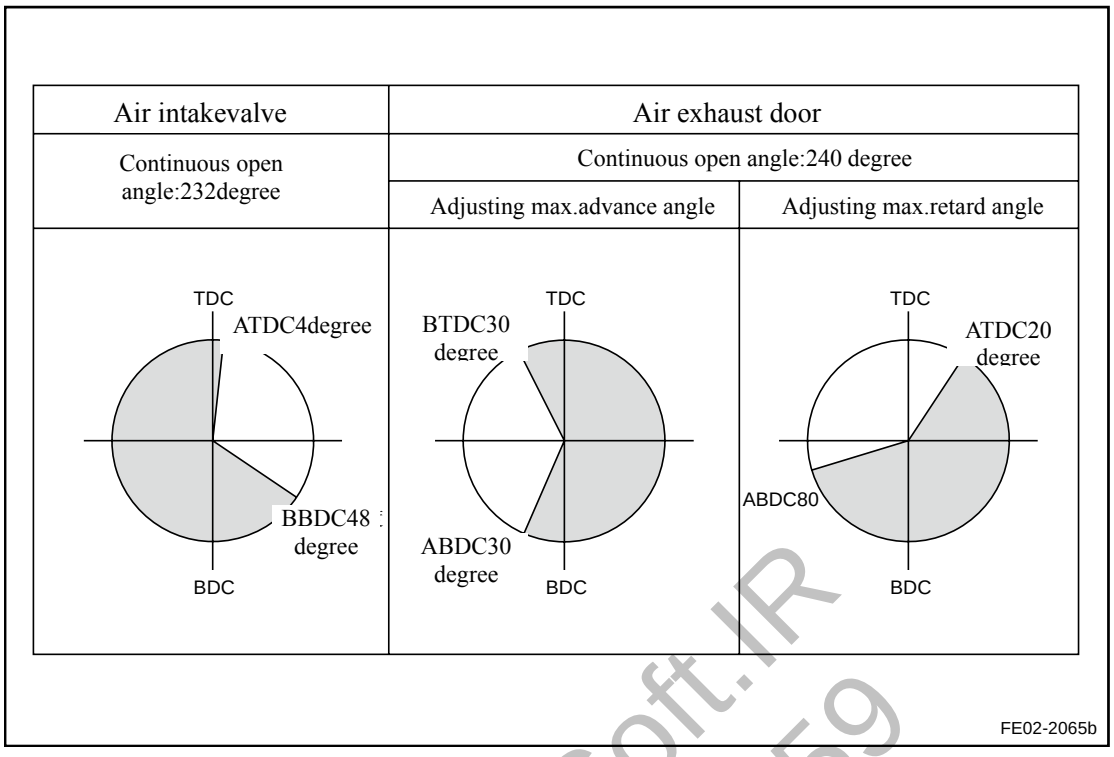
(1) With VVT Valve Timing Diagram



TDC: Top dead center BDC: Below dead center

ATDC: After Top dead center BTDC: Before Top dead center

ABDC: After Below dead center BBDC: Before Below dead center

(2) VVT Control Strategy

Driving Conditions	**Intake Valve Timing**	**Cause**
Low-Load	Lag	Steady Combustion
High Load, High Speed	Lag	Increased Output Characteristics
High Load, Low Speed	Advance	Increased Torque
Medium-Speed Condition	Advance	Improved Fuel Consumption Performance

(3) Advance Process

When the engine is in normal operation, the oil pressure generated by an oil pump plays the role on the VVT electromagnetic valve. ECM controls the VVT solenoid valve by means of pulse width modulation signals. When needing VVT to regulate the intake valve in the maximum position in advance, the ECM controls the VVT electromagnetic valve opening as 100%. At this time, the engine oil pressure is applied to the advancement cavity and the VVT rotor blades displace in the opposite direction to the crankshaft rotation angle to stop in the maximum position finally.

A VVT actuator commonly stays at about 8? when idling without load. Because the mechanical value of the opening angle of an intake valve is 5?, the actual opening

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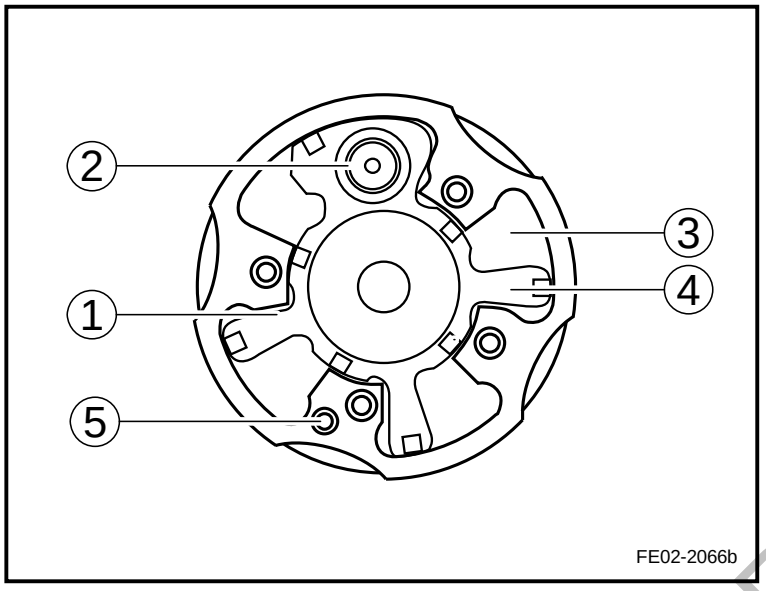
angle of the intake valve during idling is 13?.



1. Rear chamber
2. Locking pin
3. Advance cavity
4. rotor blade
5. support

(4) Lag Process

When the engine is in normal operation, the oil pressure generated by an oil pump plays the role on the VVT electromagnetic valve. ECM applies pulse width modulation signals to the VVT solenoid valve. If ECM wants the VVT to adjust the intake valve to the maximum lagging position, ECM controls the VVT solenoid valve to open by a degree of 0% and the oil pressure enters the lagging cavity of teh VVT actuator. Thus, the VVT rotor blade produces the displacement in the same direction with respect to the crank angle to ultimately remain in the maximum position.

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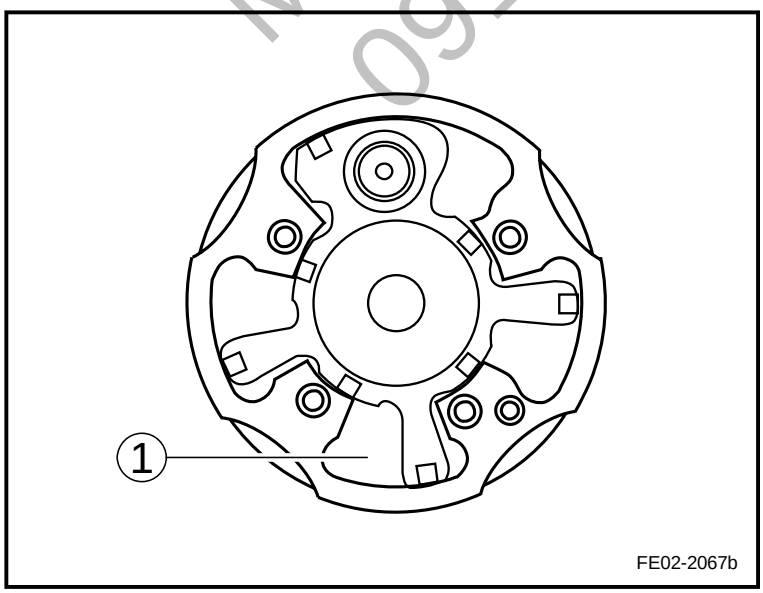
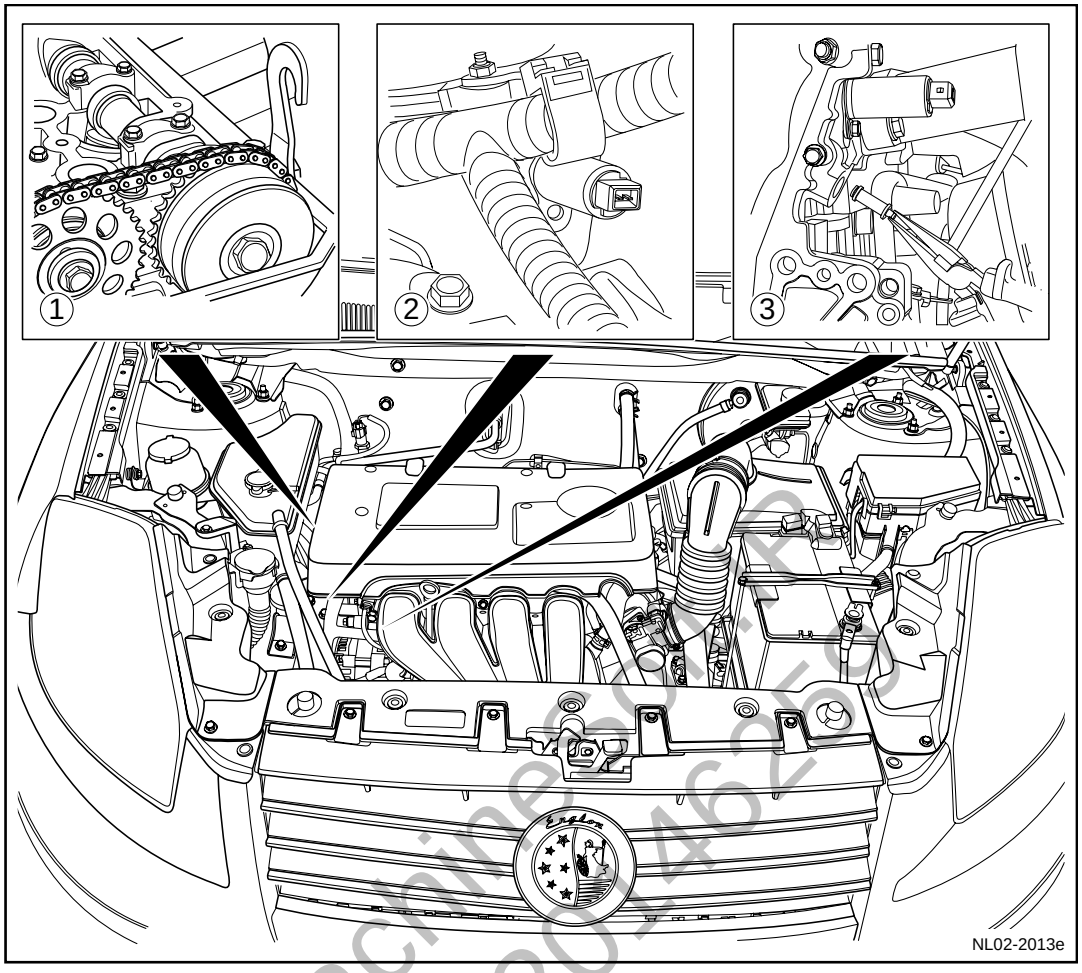


1. Rear chamber

2.13.4 Component position

2.13.4.1 Part position of VVT system

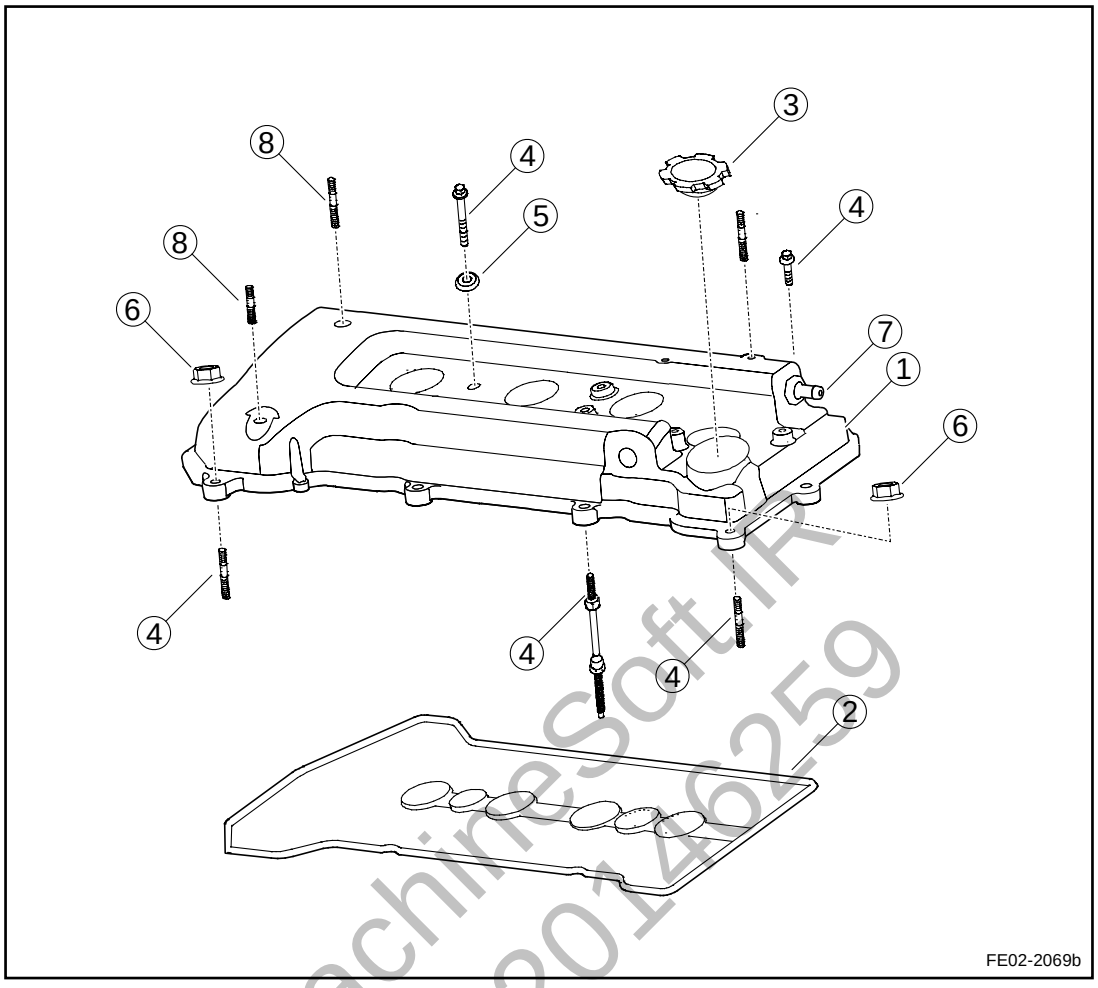


1. VVT actuator
2. VVT electromagnetic valve
3. VVT electromagnetic valve filter element

Machine Data
09120-46250

2.13.5 Part disassembly drawing

2.13.5.1 Cylinder Hood Cover



1. Cylinder cover hood
2. Sealing washer of cylinder cover hood
3. engine lubricating oil cover
4. Cylinder head fixing bolt
5. Cylinder head fixing bolt pad
6. Cylinder head fixing nut
7. Crankcase forced ventilation valve
8. Engine hood fixing bolts

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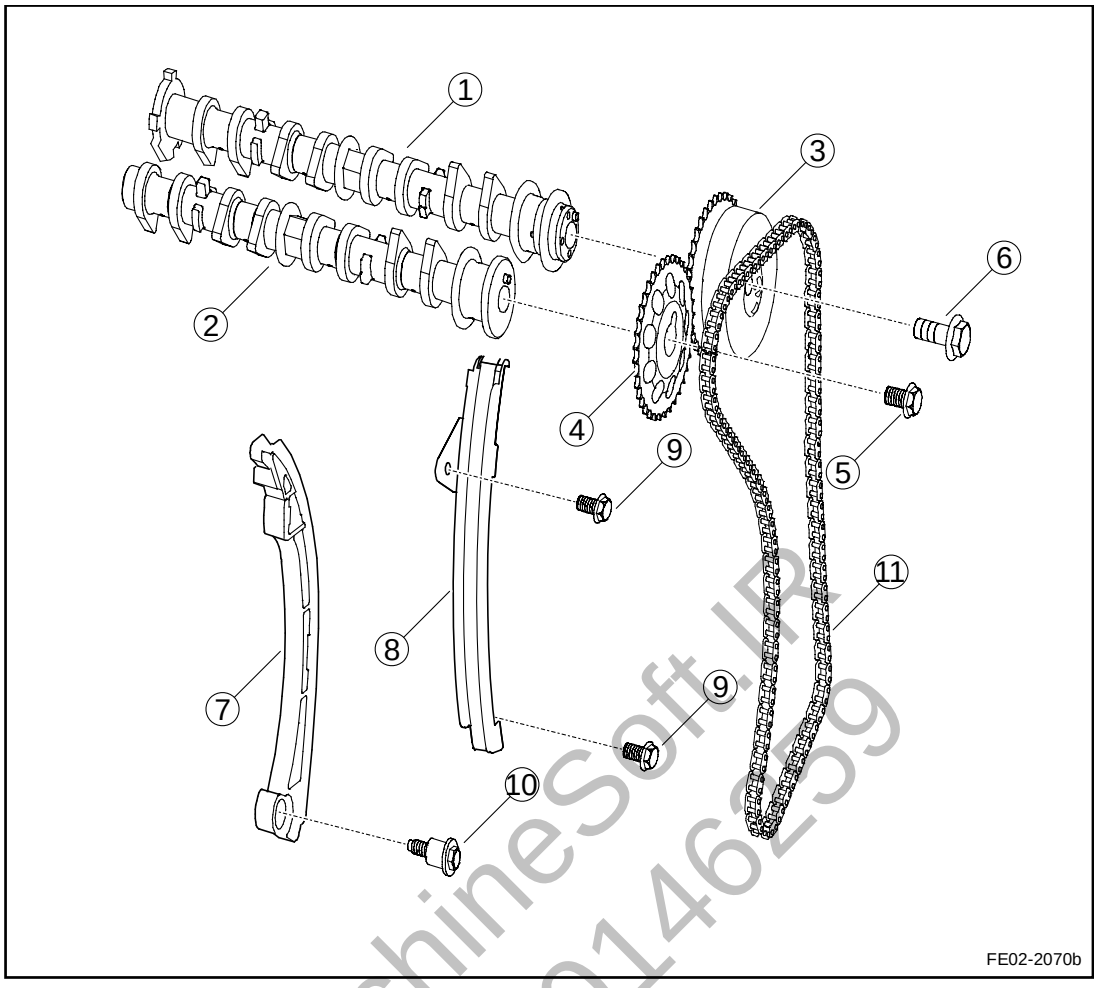
2.13.5.2 Camshaft



1. air intake camshaft
2. air exhaust camshaft
3. VVT actuator
4. Exhaust camshaft drive chain wheel
5. Exhaust chain camshaft drive chain wheel tightening bolt
6. VVT actuator tightening bolt
7. Timing chain tensioning rail
8. Timing chain guide rail
9. Timing chain guide rail fixing bolt
10. Timing chain tensioning guide rail fixing bolt
11. Timing chain

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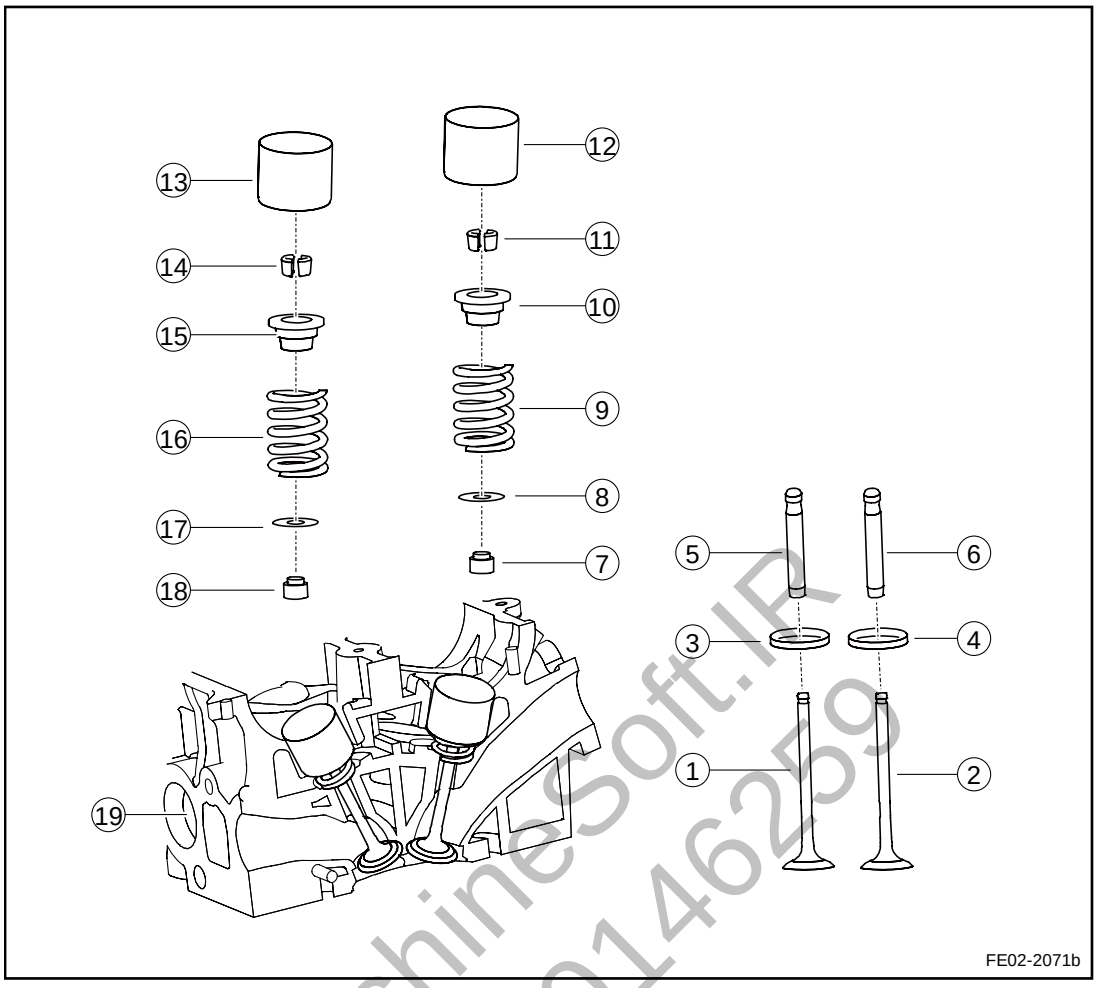
2.13.5.3 Cylinder Hood



1. Exhaust valve
2. Intake valve
3. Exhaust valve seat ring
4. Intake valve seat ring
5. Exhaust valve duct
6. Intake valve duct
7. Intake valve oil seal
8. Intake valve spring gasket
9. Intake valve spring
10. Intake valve spring seat
11. Intake valve locking plate
12. Intake valve tappet sleeve
13. Exhaust valve tappet sleeve
14. Exhaust valve locking plate
15. Exhaust valve spring seat
16. Exhaust valve spring
17. Exhaust valve spring gasket
18. Exhaust valve oil seal
19. Cylinder Hood

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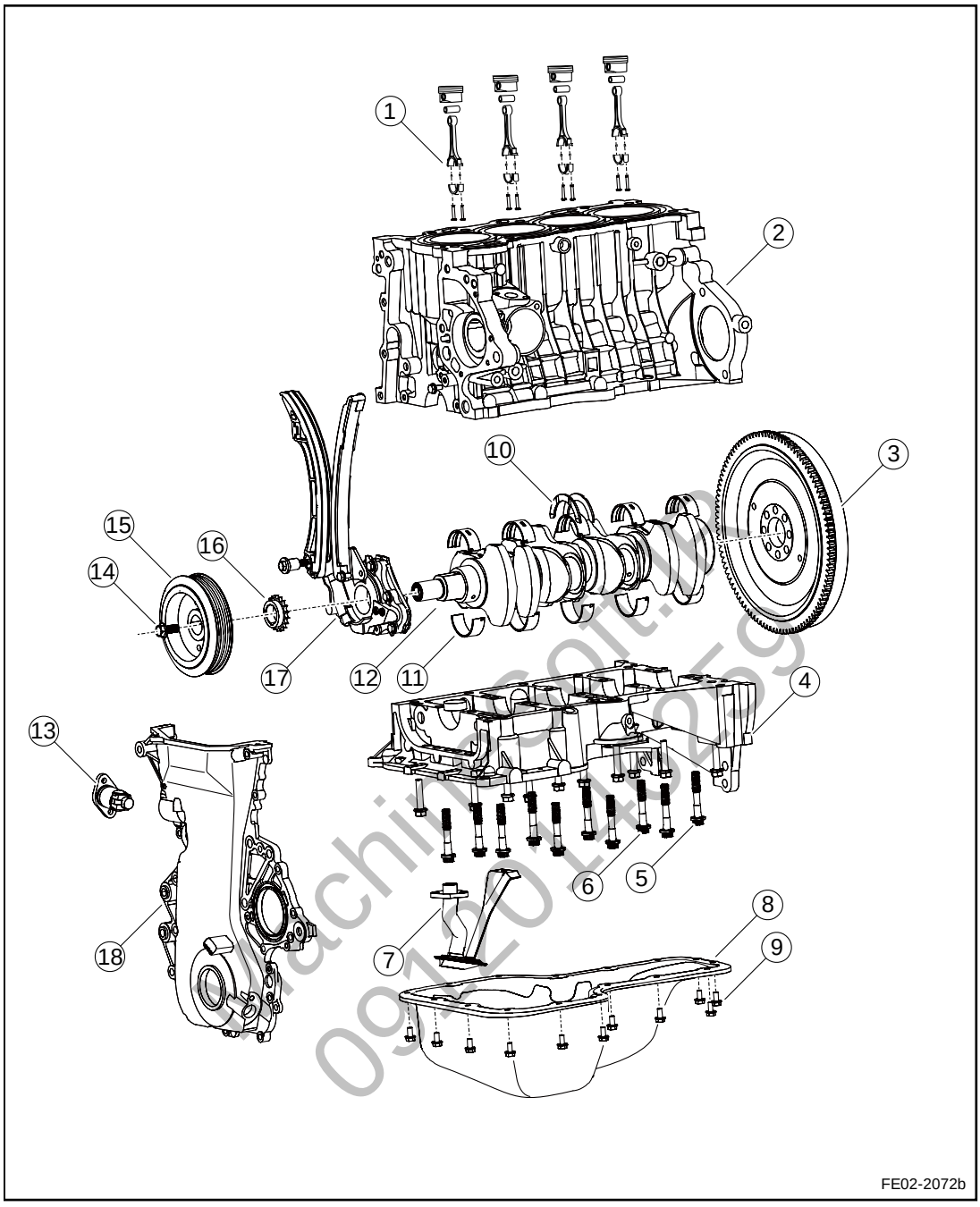
2.13.5.4 Cylinder Block



1. Piston
2. cylinder
3. flywheel
4. Crankcase body
5. Crankcase body fixing bolt
6. Crankshaft bearing tightening bolt.
7. Suction filter
8. Oil pan
9. Oil pan fixing bolt
10. Crankshaft thrust piece
11. Crankshaft bearing
12. Crankshaft
13. Timing chain tensioner
14. Crankshaft belt disc tightening bolt
15. crankshaft belt disc.
16. Crankshaft timing chain wheel

17. Engine lubricating oil pump

18. Timing chain cover

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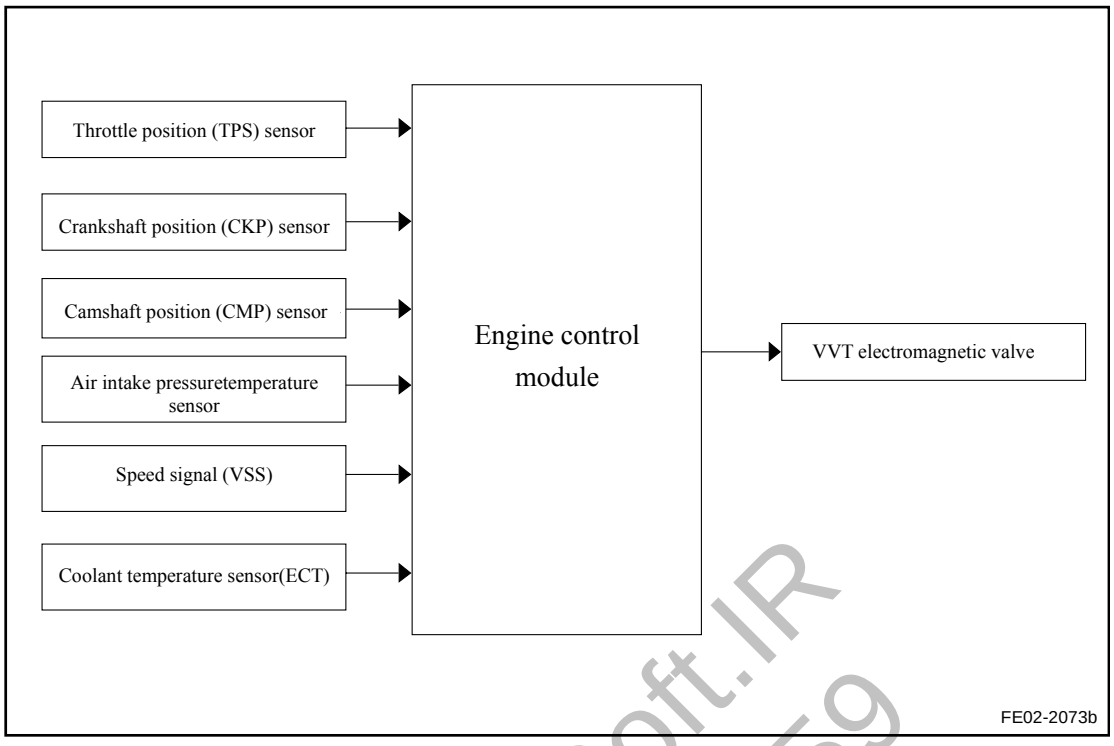
2.13.6 Electrical schematic diagram



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2.13.7 Diagnostic Information and Procedures

2.13.7.1 Diagnosis Descriptions

Refer to 2.13.3.1 System Working Principle to get familiar with the system functions and operations before starting the system diagnosis, so that it will facilitate the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer described is normal.

2.13.7.2 Visual Inspection

- Inspect installed after market equipment that may affect the mechanical systems performance.
- Check the system components that is easy to access to identify whether there is significant damage or potential faults.
- Confirm whether the engine lubrication oil level is normal and whether the engine oil viscosity is normal.
- Record engine speed, ambient temperature and other specific factors.
- Compare with a known good engine to check whether the current engine status is normal.

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2.13.7.3 Comprehensive Inspection of Engine

1. Inspect engine coolant.

Refer to 2.8.8.1 Engine Coolant Discharge and Filling.

2. Inspect engine lubrication oil.

Refer to 2.9.7.4 Engine Oil Pressure Diagnostic and Test.

3. Inspect the battery.

Refer to 2.11.2.3 Charging System Description and Operation.

4. Check the spark plug

See "2.10.7.6 Inspection and Diagnosis of Spark Plug".

5. Inspect the air filter.

A. Dismantle the air filter.

B. Inspect the air filter for the dust, blockage or breakage.

1) For dust, clean it with the compressed air.

2) After using the compressed air, if there is still dust or blockage, replace the air filter.

6. Inspect the ignition timing.

Inspect the ignition timing. The following conditions must be met:

- The engine must reach the normal working temperature.

(1) Use fault diagnosis tester to test methods:

1	Connect a fault diagnosis tester.

A. rotated ignition switch to OFF position .

B. Connect fault diagnosis tester to the diagnostic interface.

C. Start the engine to normal working temperature.

D. Turn off the A/C switch.

E. Select in sequence: Engine / Data List / Cylinder #1 ignition advance angle.

Standard Timing: Standard idling 8 ° -14 ° before TDC.

(2) Use the timing light to test:

1	Dismantle the engine hood cover.

Next

2	Pull out cylinder No.1 high-pressure resistor wire.

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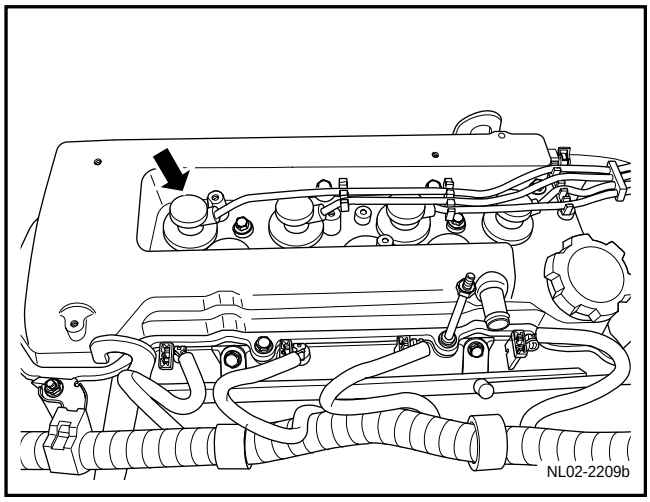
As shown, the lights are connected to cylinder No.1 high-pressure resistor wire.



Next

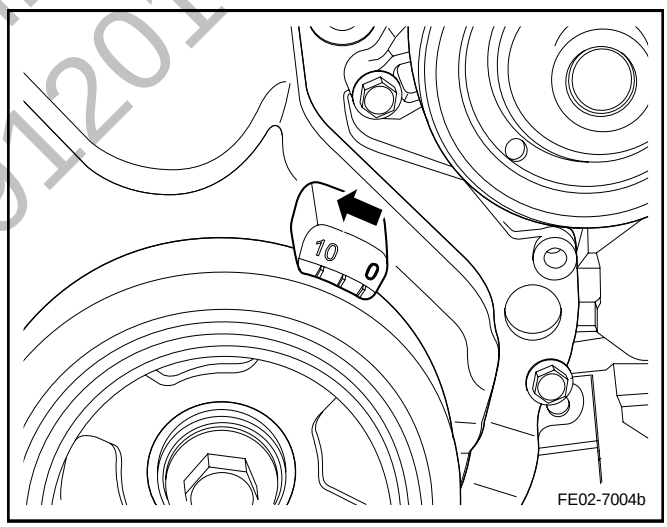
3	Inspect the ignition timing when idling.

Standard timing: TDC front 8°-14°with standard idling

Next

4	Inspect the ignition timing during acceleration.

Accelerate the engine; observe the engine ignition timing, which should be moving ahead as shown.



Next

5	Dismantle the timing light and restore high-voltage resistor wire to the installation position.

Next

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Test is completed.

7. Cylinder Compression Test

Precautions: Dismantle EF12 fuses. Fuel and ignition systems can not work. After the test clear the DTC code with a fault diagnosis tester.

Before the compression test is done, the following conditions must be met:

- The engine must reach the normal working temperature.
- Throttle in full open.
- Dismantle all four cylinder spark plugs.
- The battery has no phenomenon of the loss of electricity and must be fully charged.

Important precaution : During the start-up test, the ignition switch can not remain at the "ST" position for more than 15 s, otherwise it will damage the starter.

1	Test pressure of each cylinder, pressure dropping may be due to valve closure or piston ring wear.

Next

2	Spray proper amount of engine oil into each cylinder

Next

3	Install the cylinder pressure test gage to the spark plug installation port.

Next

4	Turn the ignition switch to the "ST" position, so that each cylinder runs 4 to 5 compression strokes.

Next

5	Individual cylinder pressure readings should not be less than 75% of the maximum and any cylinder pressure gage reading should not be less than 750 kPa.

Next

6	Inspect the pressure gage readings for each cylinder after the completion of four compression stroke. The readings are explained as follows:

A. Normal Conditions: The cylinder pressure rapidly increases and reaches the required uniform pressure value.

B. Piston Ring Fault: The first stroke pressure is low, increasing in the following strokes, but the

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pressure has not reached normal levels. Add engine oil in the cylinder, the pressure increased significantly.

C. Valve Fault: The first stroke pressure is low, and can not be increased in the following strokes. Add engine oil in the cylinder, the pressure is not increased.

Next

Test is completed.

2.13.7.4 Engine Noise Diagnosis

Engine vibration is actually referring to the engine resonance noise. When the engine's vibration frequency is the same as the vibration frequency of a fault, the noise will be perceived. Severe vibrating usually generates big noise, and it is generated by internal parts fracture or serious engine wear and tear. A slight vibration can be heard, but the sound is not big. Slight vibration is due to the engine internal components wear, loose or engine external components broken and it can lead to serious or slight vibration. In the engine noise diagnostic, the resonance noise cause must be found in order to eliminate the fault.

2.13.7.5 Noisy when there is engine load

1	Inspect whether the tension of the drive belt is too tight or strained?

Yes → Replace/adjust the drive belt to the specified value, and confirm whether the fault is fixed.

No

2	Inspect the exhaust system. Whether the system is interfered with the other body components or scraping to ground?

Yes → Relocate and install the exhaust system to confirm whether the fault is fixed.

No

3	Inspect the existence of the flywheel cracking, deformation and other components intervention. Is the flywheel normal?

Yes → Replace the flywheel assembly. Confirm whether the fault is fixed.

No

4	Inspect whether the main bearing clearance is too large, and if it exceeds the specified value.

Standard value (0.006 ~ 0.022mm/0.0002 ~ 0.0008in)

Yes → Replace the main bearings. Confirm whether the fault is fixed.

No

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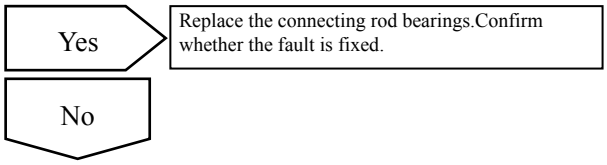
5	Inspect connecting rod bearing clearance, and does it exceed the specified value?

Standard value (0.020 ~ 0.044mm/0.0007 ~ 0.0017in)



6	Confirm that the fault is fixed.

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2.13.7.6 Slight Vibration When Engine Is Warming Up

1	Use fault diagnosis tester to read the "Knock" related to data. Is the engine knocking?

Yes → Inspect the engine timing systems and fuel quality, repair the faulty part.

No

2	Inspect whether there is exhaust manifold leakage?

Yes → Replace the exhaust pipe pad and tighten the exhaust pipe again.

No

3	Inspect connecting rod bearing clearance, and does it exceed the specified value?

Standard value (0.020 ~ 0.044mm/0.0007 ~ 0.0017in)

Yes → Replace the connecting rod bearings.Confirm whether the fault is fixed.

Next

4	Confirm that the fault is fixed.

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2.13.7.7 Vibration at Idle and When Engine Is Warming Up

1	Inspect drive belt tension. Is it too loose or worn? Any fault?

Yes → If necessary, replace the drive belt. Confirm whether the fault is fixed.

No

2	Inspect whether the viscosity of the engine lubrication oil is abnormal?

Yes → Refill engine lubrication oil suitable for the current season temperature, confirm whether the fault is fixed.

No

3	Inspect whether the generator and air-conditioning compressor is working properly. Any abnormal sound during working?

Yes → Replace failed components, confirm whether the fault is fixed.

No

4	Inspect the valve, valve spring and other valve components. Any fault?

Yes → Replace failed components, confirm whether the fault is fixed.

No

5	Inspect the piston pin gap. Does it exceed the specified value?

Standard value (0 . 005 ~ 0 . 011mm/0 . 0002 ~ 0 . 0004in)

Yes → Replace failed components, confirm whether the fault is fixed.

No

6	Inspect whether the connecting rod is bent?

Yes → Replace failed components, confirm whether the fault is fixed.

No

7	Inspect piston to cylinder gap value. Does it exceed the specified value?

Standard value (0 . 060 ~ 0 . 083mm/0 . 0023 ~ 0 . 0033in)

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Yes → Replace failed components, confirm whether the fault is fixed.

No

8	Inspect the piston pin offset. Does it exceed the specified value?

Standard value (0 . 6mm/0 . 0236in)

Yes → Repair the fault part to confirm whether the fault is removed.

No

9	Confirm that the fault is fixed.

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2.13.7.8 Engine Misfire with Abnormal Noise

1	Inspect whether engine control system has fault code through fault diagnostic unit?

Yes → According to the DTC code, repair the faulty part. Refer to the2.2.7.11 DTC Code Index

No

2	Use fault diagnosis tester to inspect the engine "Knock" data, compared with the normal vehicle data. Is it normal?

Yes → Inspect whether the fuel is normal. Inspect whether the timing system is normal. Repair the faulty part. Confirm whether the fault is fixed.

No

3	Inspect valve spring and check whether it is too soft and broken?

Yes → Repair the faulty part. Refer to 2.6.8.15 Cylinder Hood Assembly Disassembly and Assembly

No

4	Inspect valve whether there is catching and bending?

Yes → Repair the faulty part. Refer to 2.6.8.15 Cylinder Hood Assembly Disassembly and Assembly

No

5	Inspect valve whether it is stretched, stagnant or worn.

Yes → Repair the faulty part. Refer to 2.6.8.15 Cylinder Hood Assembly Disassembly and Assembly

No

6	Inspect whether there are excessive cam wear or obvious faults?

Yes → Replace camshaft, Refer to“2 . 6 . 8 . 12 replace camshaft” .

No

7	Inspect valve for the existence of cracks, excessive wear and tear and other faults?

Yes → Repair the faulty part. Refer to 2.6.8.15 Cylinder Hood Assembly Disassembly and Assembly

No

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8	Inspect valve spring seating and the valve spring washer. Is the installation incorrect?

Yes → Repair the faulty part. Refer to 2.6.8.15 Cylinder Hood Assembly Disassembly and Assembly

Next

9	Confirm that the fault has been fixed.

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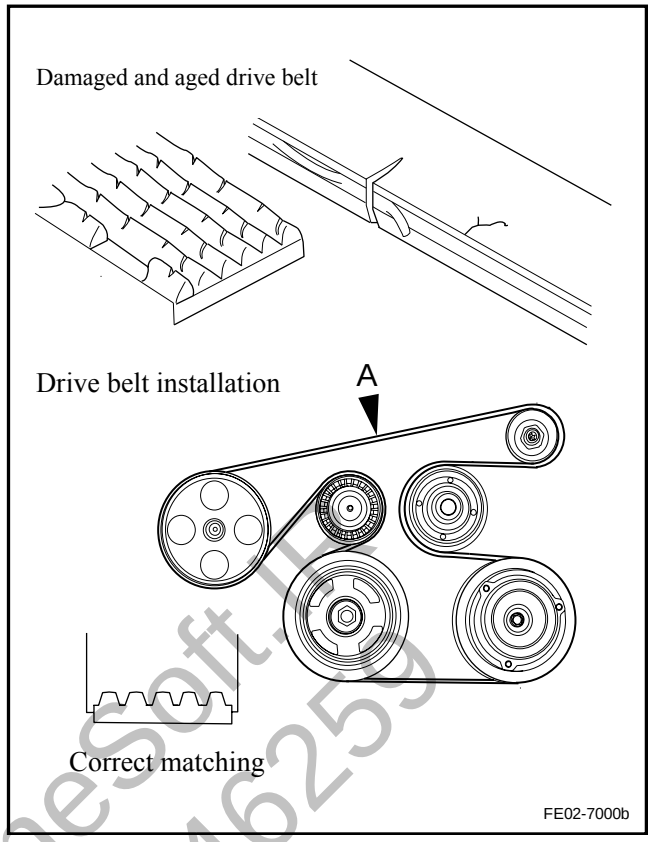
2.13.7.9 Drive belt inspection

1. Inspect when the engine is cool or has been turned off for 30 min.
2. Visually inspect whether there is V-drive belt excessive wear or cord wear. If faults are found, replace the V-drive belt.
3. Visually inspect the interior and edge of the belt for damage, wear or cracking. If any, replace it with new belt.
4. Visually inspect whether there are situation 2 and 3 on belt, and measure belt tensioning force :Clockwise turning two rounds of the crankshaft belt pulley to evenly distribute the belt tension between each belt pulley.
5. Use the sound pressure meter (via the repair tools) to measure the tension and frequency of the belt at the marking point A.



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	New belt	**Old belt**
Belt tension (N/lb)	400±-500/89.9±-112.4	300±-400/67.4±-89.9

A. Replace with new drive belt. Rotate the crankshaft two laps clockwise, so that the drive belt completely runs through the drive pulley. Measure the tension at marked position A. Refer to the table for the range and replace the drive belt if the measurement is beyond the scope of the table.

B. f the used drive belt (the old belt) has the tension beyond the scope of the table, replace it with a new drive belt.

C. During the drive belt installation, please make sure the correct installation to the drive pulley groove.

D. Do not drop engine oil or engine coolant onto the drive belt.

E. Do not over-wind or bend the drive belt.

2.21.7.10 Drive Belt Chirp Diagnosis

Diagnostic Hints: The symptom may be due to wet drive belt or pulley and may be an intermittent fault. Drive belt may need to spray a small amount of water to reproduce customer reported fault. If the symptom reoccurs after spraying water, then clean the pulley. Loose or unreasonable installation of body components, suspension components or other vehicle parts can also cause the chirp sound.

Fault Definition: The following conditions are the drive belt chirp sound symptoms

- A chirp jack noise can be heard once the drive belt rotates a lap.
- Noise often happens on a rainy day or in a cold morning.

1	Verify the fault. Does the engine have chirp sound?

Yes → To Diagnostic Hints

No

2	Dismantle the drive belt to confirm whether the giggle does not arise again?

A. Dismantle the drive belt. Refer to 2.13.8.3 Replacement of Drive Belt.

B. Run the engine, but no more than 30 s.

Does the scream disappear?

No → Refer to 2.6.7.4 Engine Noise Diagnosis

Yes

3	Inspect whether the drive belt surface is normal? (do not have ball, crack, etc)

Refer to 2.13.7.9 Drive Belt Inspection

No → Refer to 2.6.8.3 Replacement of Drive Belt to replace the drive belt.

Yes

4	Inspect whether the drive belt pulley is installed correctly? (do not happen misalignment)

No → Reinstall the drive pulley. If necessary, replace the drive belt.

Yes

5	Inspect whether the drive pulley is normal?

Inspect whether the pulley is bent, twisted and so on.

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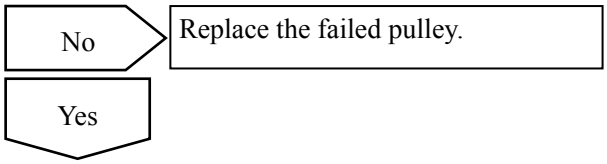
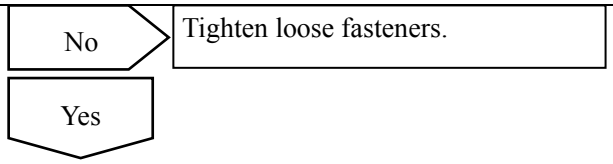


6	Inspect whether all fasteners associated with the drive belt are normal?



7	Replace the drive belt. Confirm the fault is fixed.

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2.13.7.11 Drive Belt Scream Diagnostic

Diagnostic Hints: Loose or unreasonable installation of body, suspension and other components may cause screams. If there is intermittent noise, inspect the attached components by changing the engine load. It is recommended to inspect whether the air-conditioning system is over filled, power steering hose is clamped, the power steering fluid is correct or whether the generator is faulty.

Fault Definition: The following conditions are the drive belt screams symptoms

- Scream is caused by drive belt slippage.
- Noise appears when a big load added to the drive belt, such as air-conditioning system compressor starting, the running engine with the throttle quickly opening or drive belt skidding in a drive component.

1	Verify the fault. Does the engine scream?	No	To Diagnostic Hints
		Yes	

2	Dismantle the drive belt. Confirm whether the scream disappears?

A. Dismantle the drive belt. Refer to 2.13.8.3 Replacement of Drive Belt.

B. Run the engine, but no more than 30 s.

Does the scream disappear?

No	Refer to 2.13.7.3 Engine Noise Diagnosis	
Yes		

3	Inspect whether the bearings of all accessory drive belt pulleys are normal?

Pulley bearings do not appear stuck, loose and so on.

No	Replace the damaged pulley or bearing.
Yes	

4	Inspect whether drive belt tensioner device is working properly?

Tensioner pulley bearing device does not appear stuck, loose. Tensioner device does not appear loose and other damages.

No	Replace the drive belt tensioner assembly. Refer to the 2.13.8.4 Replacement of Drive Belt Tensioner
Yes	

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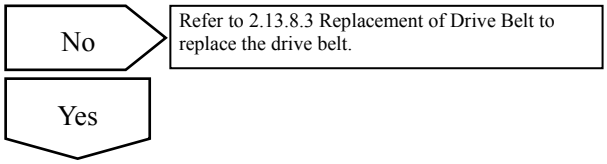
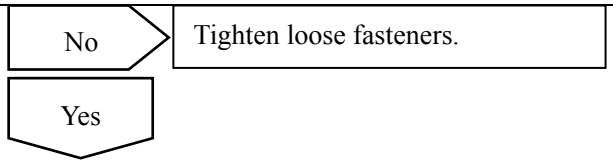
5	Inspect whether the correct drive belt is used?

Refer to 2.13.7.4 “Drive Belt Inspection” to inspect for the extension of the drive belt.

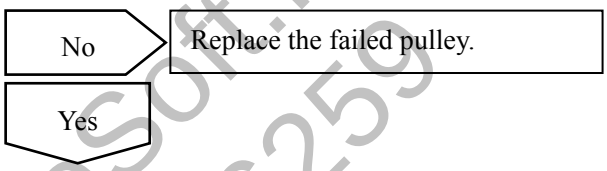


6	Inspect whether all fasteners associated with the drive belt are normal?



7	Inspect whether the drive pulley is normal?

Inspect whether the pulley is bent, twisted and so on.



8	To Diagnostic Hints

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2.13.7.12 Drive Belt Hum Sound Diagnostics

Diagnostic Hints: Drive belt should not produce hum sound. If there is an intermittent noise, inspect the attached parts by changing the load. Make sure that components run until the maximum load. These conditions may be due to (but are not limited to) over filling the air-conditioning system, blocked power steering system or incorrect steering fluid, as well as the generator failure.

Fault Definition: Sustained High-Frequency Noise

1	Verify the fault. Does the engine hum appear?	No → To Diagnostic Hints Yes

2	Dismantle the drive belt, confirm whether the hum sound disappears?

A. Dismantle the drive belt. Refer to 2.13.8.3 Replacement of Drive Belt.

B. Run the engine, but no more than 30 s.

Does the hum sound disappear?

No → Refer to 2.13.7.4 Engine Noise Diagnosis

Yes

3	Inspect whether the bearings of all accessory drive belt pulleys are normal?

Pulley bearings do not appear stuck, loose and so on.

No → Replace the damaged pulley or bearing.

Yes

4	To Diagnostic Hints

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2.13.7.13 Drive Belt Falling-off Diagnosis

Diagnostic tip: the drive belt dropped from the drive belt pulley repeatedly may ne caused by dislocation of the belt pulley. If the attachment drive belt driving components cause the load fluctuates, it may cause drive belt fall off from the pulley. Test whether accessories driving components are working correctly. If the drive belt's length is not proper, drive belt tensioner will not be able to maintain a suitable drive belt tension.

Fault Definition: Drive belt falls off from the pulley, or are incorrectly installed on the pulley.

1	Inspect the drive belt for damage. If ne[illegible]y, replace the drive belt.

Next

2	Inspect whether the pulley is misaligned. Repair the faulty part.

Next

3	Inspect whether the pulley is bent or depressed. Repair the faulty part.

Next

4	Inspect whether the drive belt tensioner device bracket is bent or cracked. Repair the faulty part.

Next

5	Inspect whether the drive belt tensioner device is working properly. Repair the faulty part.

Next

6	Inspect whether the drive belt tensioner device is working properly. Repair the faulty part.

Next

7	Inspect whether the attached fasteners loose. Repair the faulty components.

Next

8	Confirm that the fault has been fixed.

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2 . 13 . 7 . 14 Overwork of drive belt

Diagnostic tip: the excessive wear of the drive belt is usually caused by improper installation or the user of the wrong belt. Drive pulley slight misalignment will not cause excessive wear and tear, but it could lead to drive belt noise or loss. Drive pulley misalignment can cause excessive wear and can also lead to drive belt fall off.

Fault Definition: The drive belt is not properly installed which led to the drive belt outer edges worn.

1	Inspect whether there are frictions between drive belt and brackets, harness, hoses and other components?	Yes → Repair the faulty part. No
2	Inspect all attachments drive belt pulley for whether there are abnormal scratches on the surface, edges and corners and other abnormal conditions?	Yes → Repair the faulty part. If necessary, replace the belt pulley No
3	Inspect whether the installed drive belt model is correct?	Yes → Replace the drive belt with a correct type. No
4	To Diagnostic Hints	

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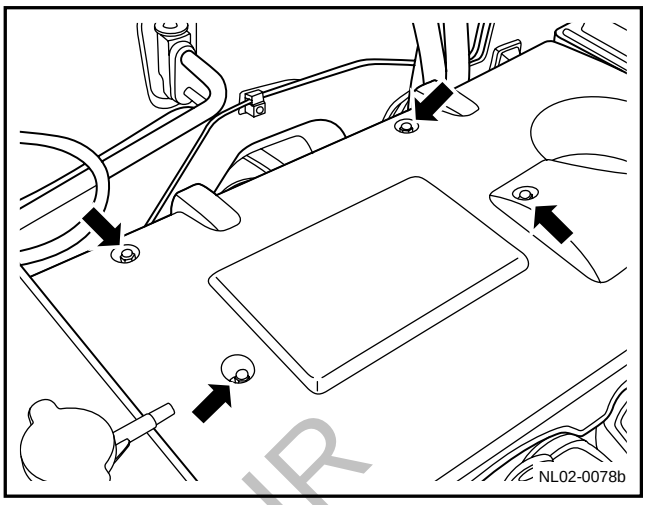
2.13.8 Removal and installation

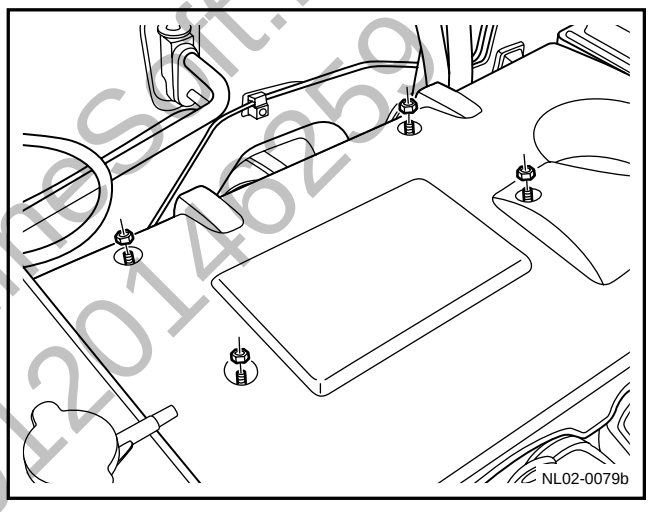
2.13.8.1 Engine hood cover replacement

Dismantlement Procedure

1. Dismantle engine plastic protective cover fixing nut.



2. Remove the plastic shield of engine.



Installation Procedure:

1. Install engine cover onto engine cover positioning bolt.
2. Tighten engine cover nut.

Torque :7N . m(Metric) 5 . 2lb-ft(English system)

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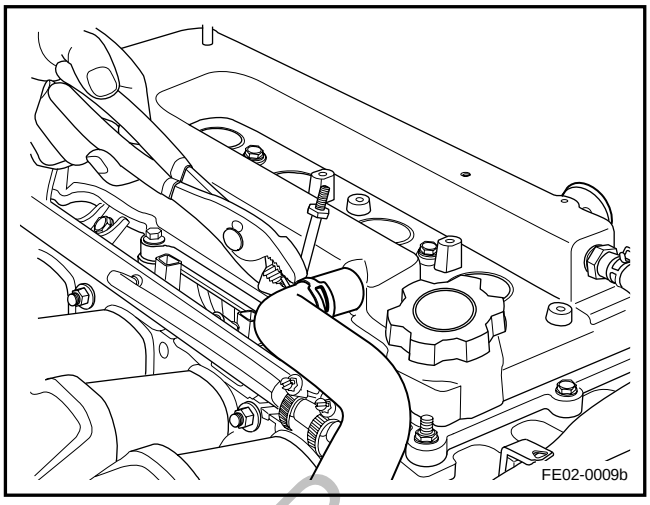
2.13.8.2 Replacement of Cylinder Hood Cover

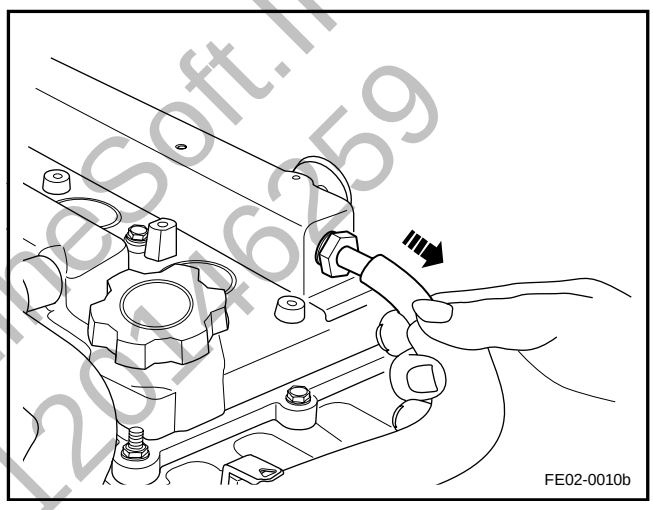
Warning: refer to "warning of battery disconnection" in "warnings and precautions".

Dismantlement Procedure

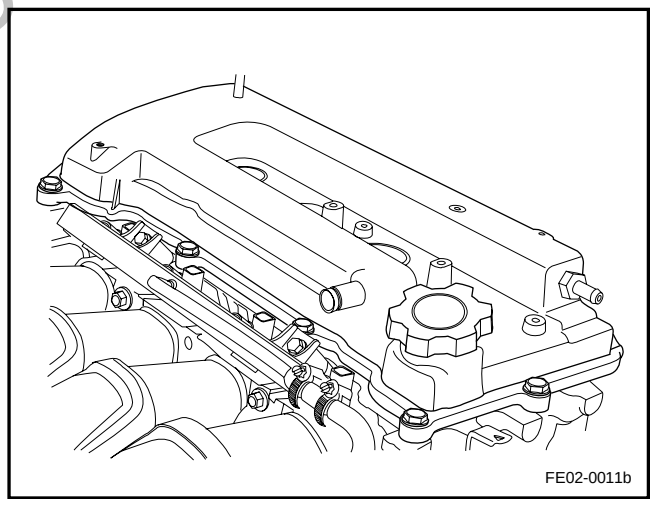
1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Refer to 2.13.8.1 "Replacement of Plastic Shield of Engine" to dismantle the engine shied.
3. Dismantle ignition coil and ignition guide wire . refer to“2 . 10 . 8 . 3 ignition coil replacement ” .
4. Dismantle the crankcase ventilation tube .



5. Dismantle the forced ventilation vacuum pipe of the crankcase.



6. Dismantle cylinder hood cover bolts and nuts.



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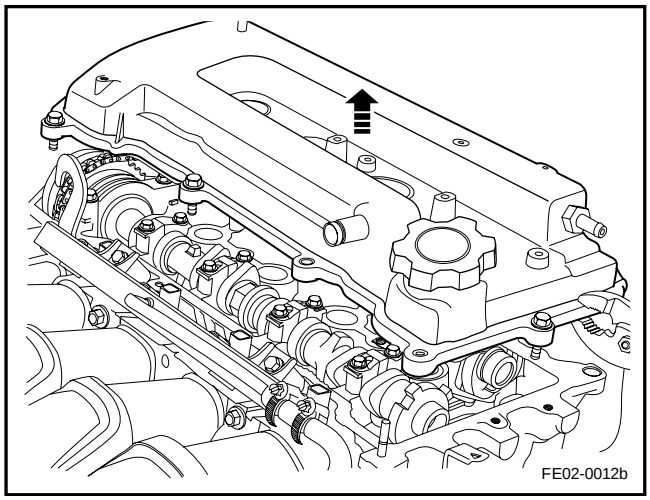
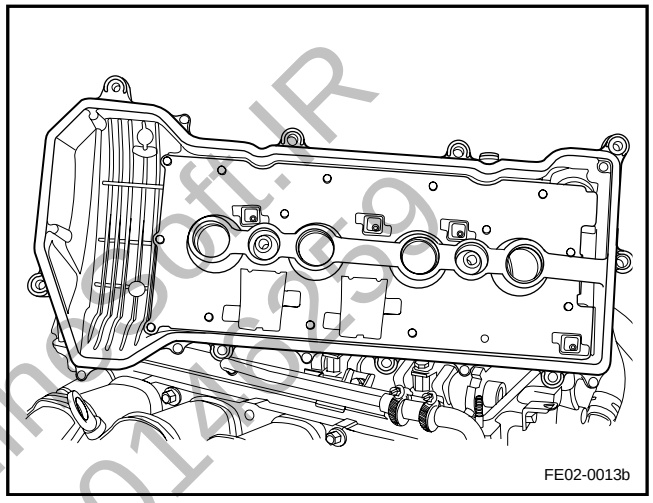
7. Remove the cylinder hood cover.



8. Dismantle the cylinder hood gasket from the cylinder hood cover.



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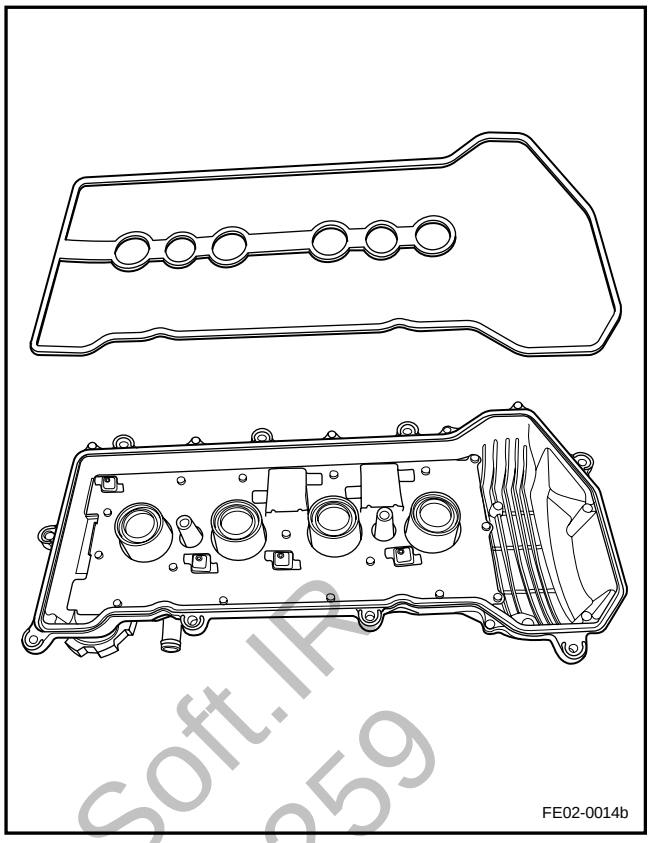
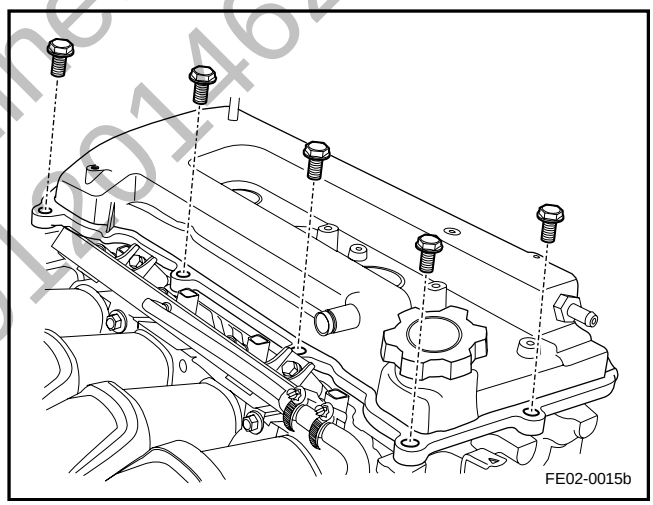
Installation Procedure:

1. Install the cylinder hood cover gasket.



2. Apply sealant evenly in the cylinder hood gasket.
3. Install the cylinder hood cover.



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4. Tighten the cylinder hood cover bolts.

Note: pay attention to single bolt fastening more than once.

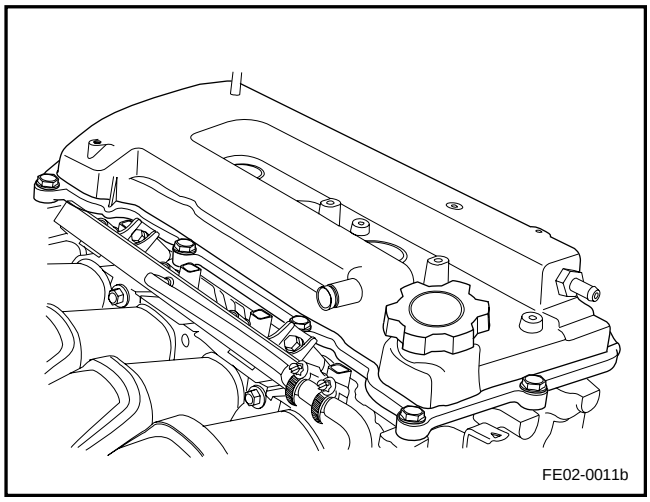
Fasten and tighten according to the specified torque.

Short Bolts:

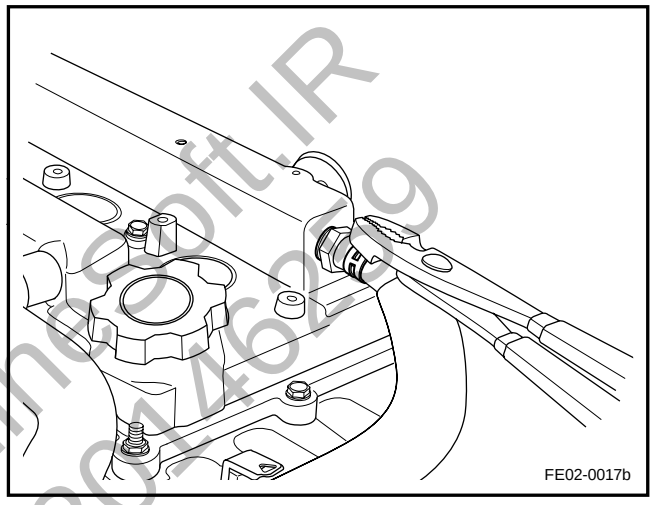
Torque: 9Nm (Metric) 6.66 lb-ft (English system)

Long Bolts, Nuts, Special Bolts:

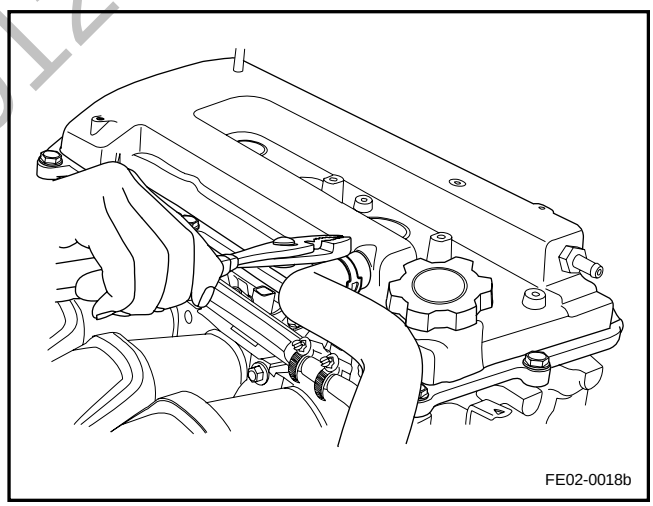
Torque :11N . m(Metric) 8 . 2lb-ft(English system)



5. Install the forced ventilation vacuum pipe of the crankcase.



6. Install the crankcase ventilation vacuum tube.
7. Install the ignition coil and ignition wire.
8. Install the plastic shield of engine.
9. Connect battery negative cable.



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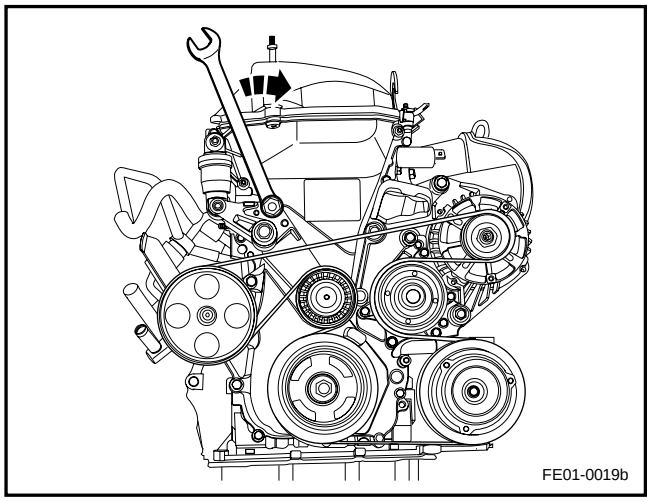
2.13.8.3 Replacement of Drive Belt

Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions".

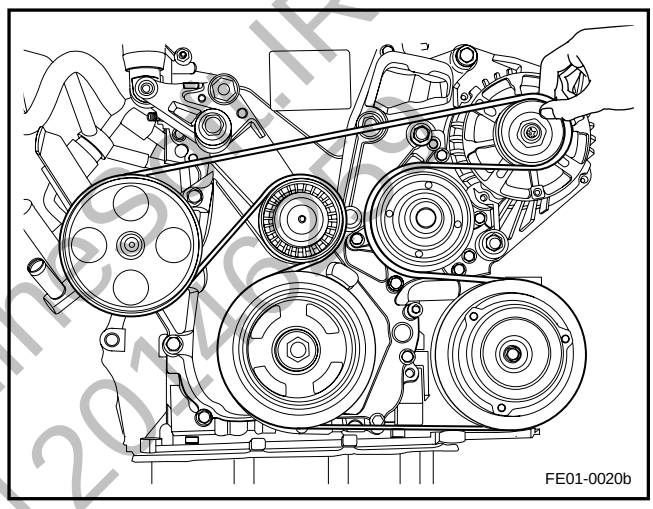
1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Rotate drive belt tensioner in clockwise by using wrench, and take out drive belt.

Note: prevent the spanner from slippage in the process of removing to damage to the operator!

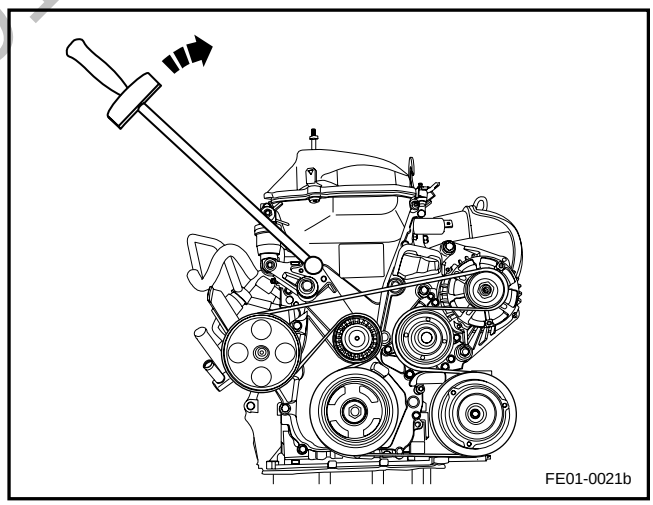


Installation Procedure:

1. Wrap the drive belt as shown.



2. Rotate the drive belt tensioner clockwise with a wrench to install the drive belt.



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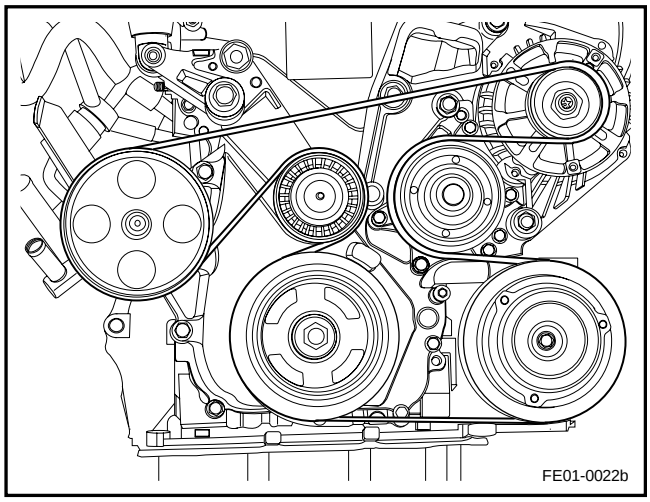
3. Release drive belt tensioner to normal position.

Important precaution : Before releasing the tensioner device, confirm the drive belt aligned with drive pulley groove, otherwise the drive belt may be damaged.

4. Connect battery negative cable.



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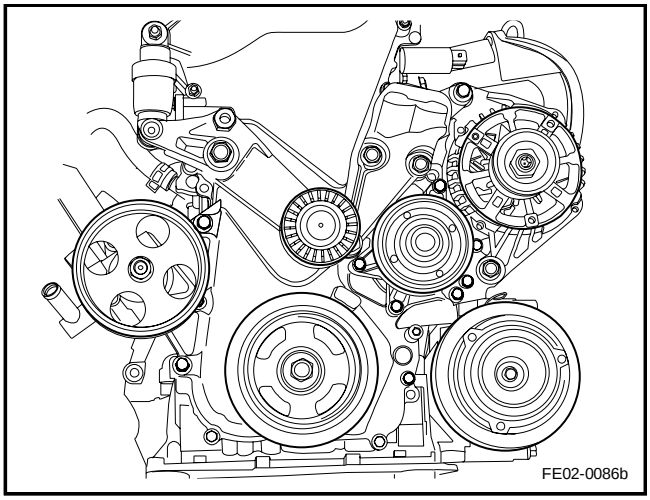
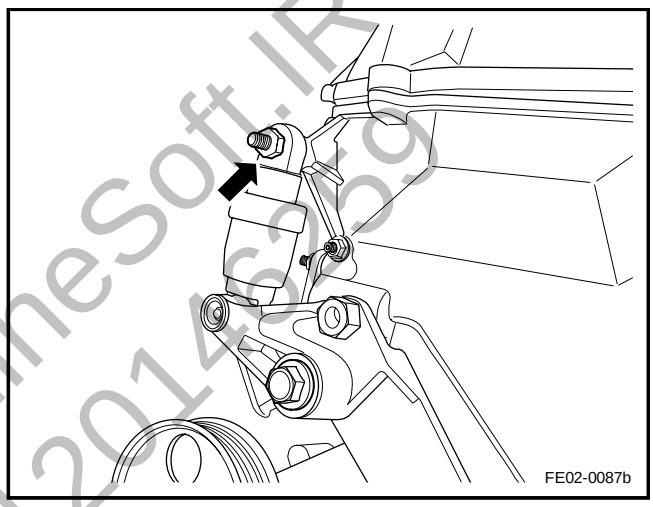
2.13.8.4 Replacement of Drive Belt Tensioner

Dismantlement Procedure

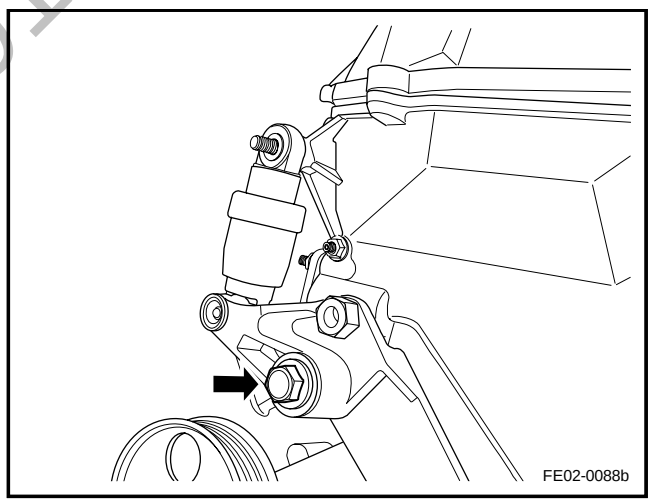
1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Refer to 2.13.8.1 "Replacement of Plastic Shield of Engine" to dismantle the engine shied.
3. Refer to 2.13.8.3 "Replacement of Drive Belt" to dismantle the drive belt.



4. Dismantle upper fixing nut of drive belt tensioner.



5. Dismantle the fixing bolts of drive belt tensioner pulley bracket.



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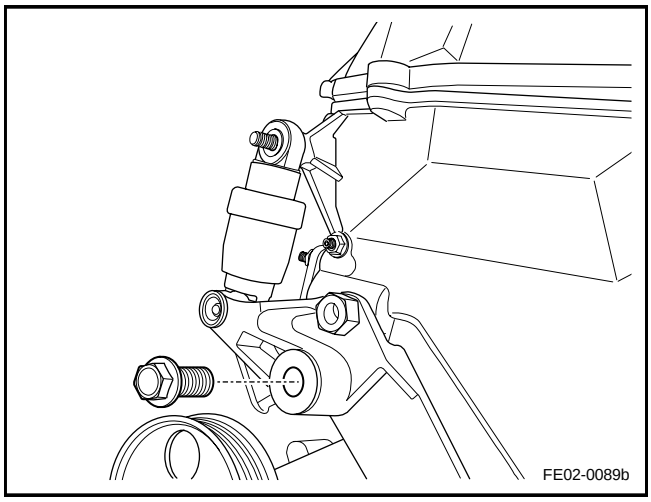
Installation Procedure:

1. Install drive belt tensioner support bolt.

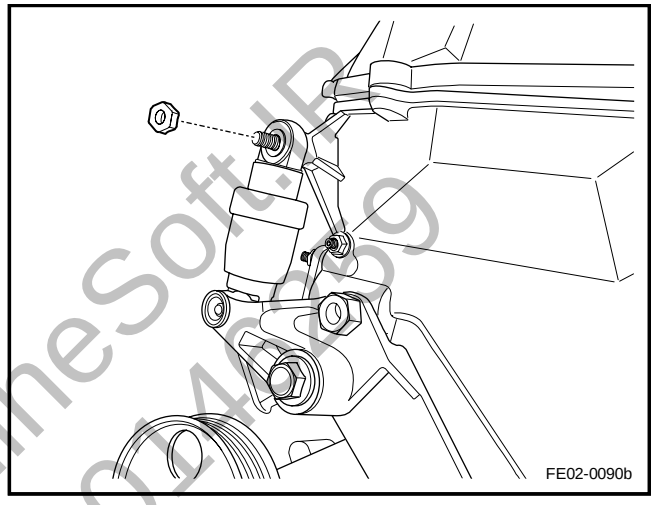
Torque :69N . m(Metric) 51 . 1lb-ft(English system)



2. Install fixing nut on the bracket of drive belt tensioner.

Torque :29N . M(Metric) 21 . 5lb-ft(English system)

3. Install the drive belt.
4. Install the engine hood.
5. Connect battery negative cable.



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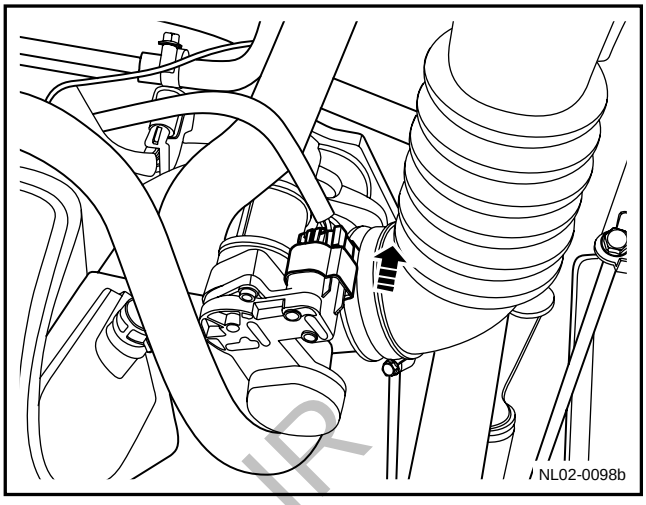
2.13.8.5 Replacement of Throttle Body Assembly

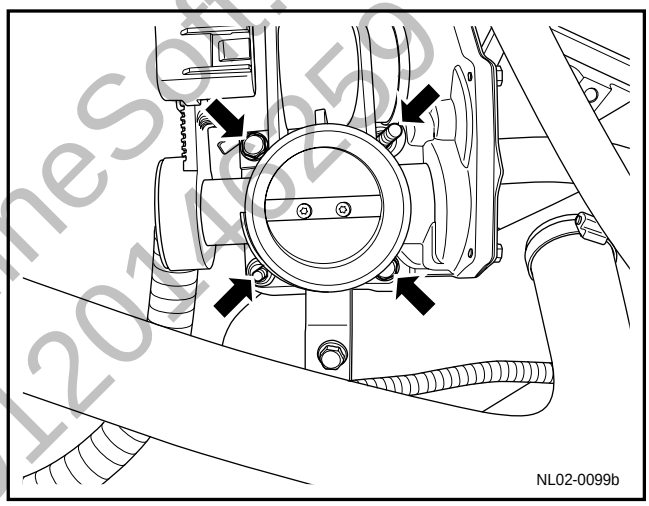
Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions".

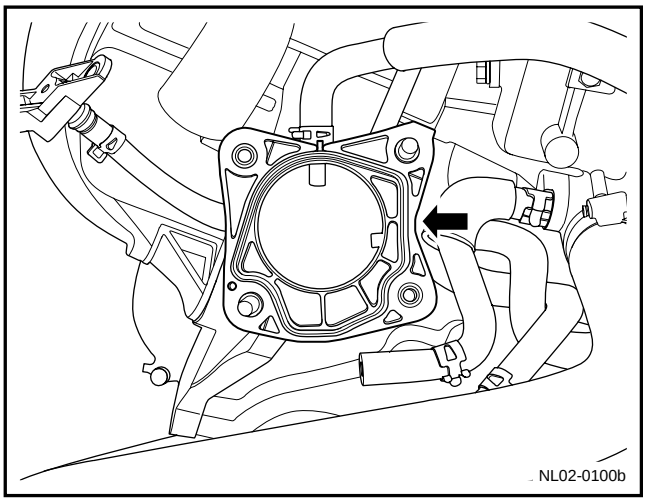
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Dismantle the throttle pull cable.
3. Disconnect throttle control valve harness connector.



4. Dismantle 2 fixing bolts and 2 nuts of throttle body and upper fixing nut of throttle body bracket.



5. Remove the electronic throttle body from the intake manifold.
6. Clean the contact surface between the engine throttle body and intake manifold and replace with new sealing ring.



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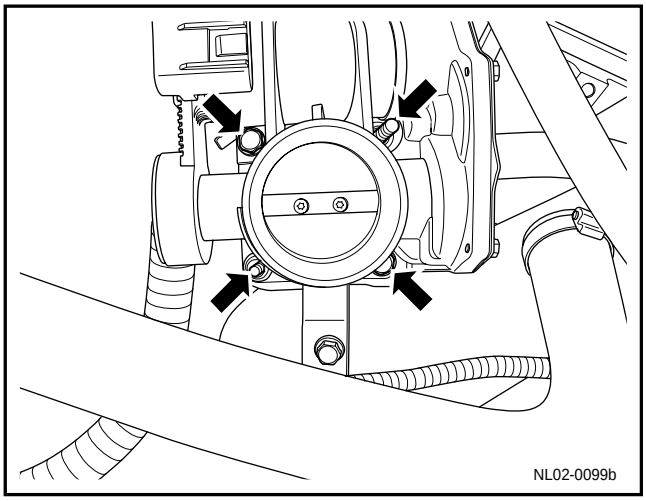
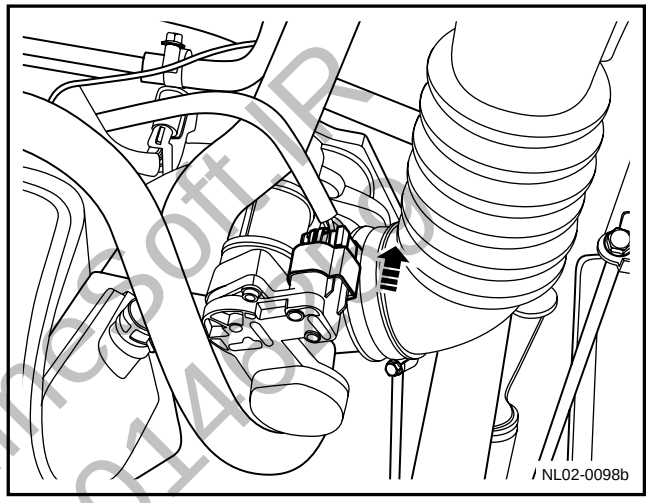
Installation Procedure:

1. Install 2 fixing bolts and 2 fixing nuts of throttle body and tighten them.

Torque : 23Nm(Metric) 17lb-ft(English system)



2. Connect throttle control valve wire harness connector.
3. Install air intake main pipe.
4. Connect the battery negative cable .



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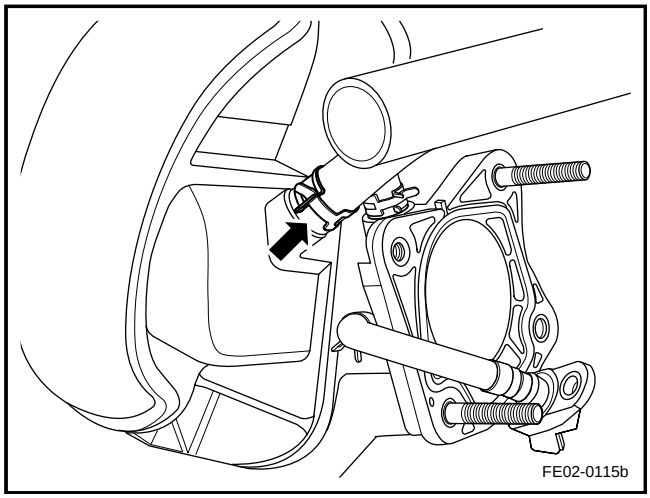
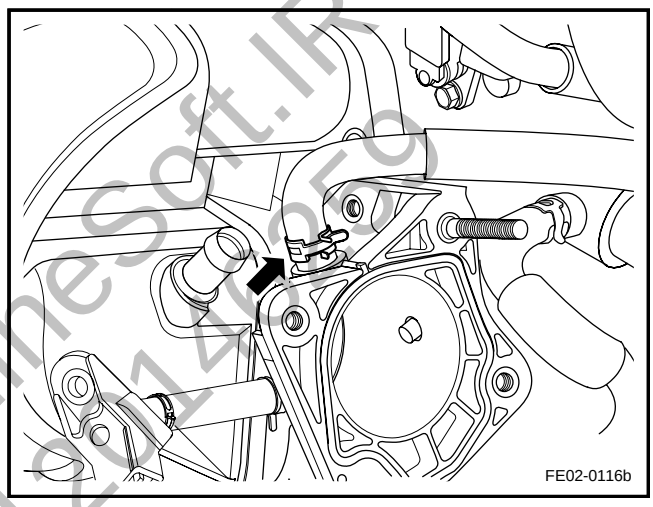
2.13.8.6 Replacement of Intake Manifold Assembly

Dismantlement Procedure

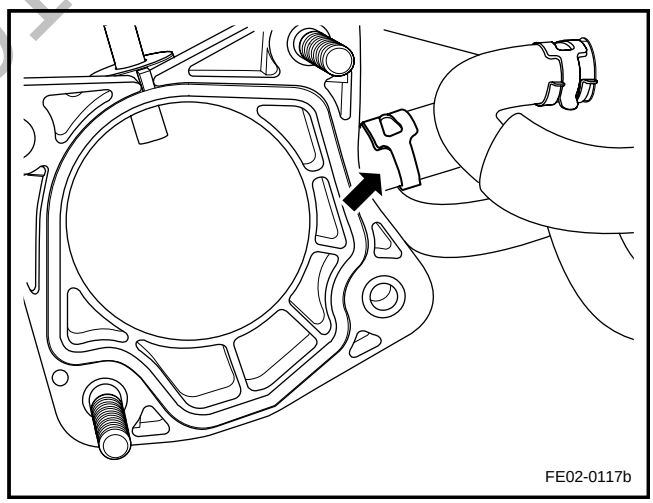
1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Refer to 2.13.8.1 "Replacement of Plastic Shield of Engine" to dismantle the engine shied.
3. Refer to "Replacement of Throttle Body Assembly" to dismantle the throttle body.
4. Dismantle the forced ventilation vacuum pipe of the crankcase.



5. Dismantle the canister solenoid valve vacuum tube.



6. Dismantle the vacuum booster vacuum tubes.



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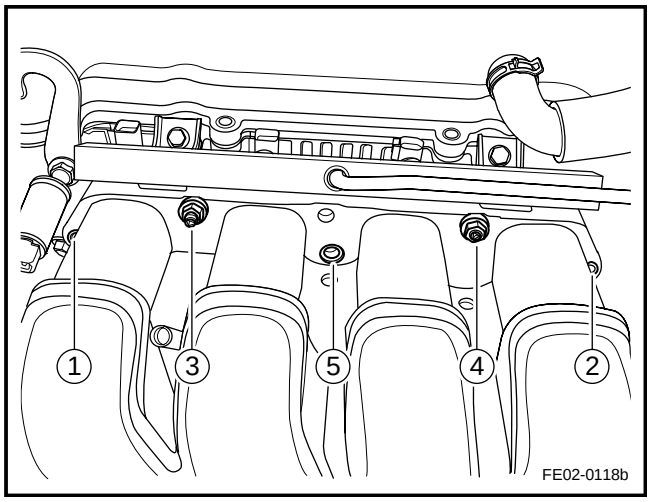
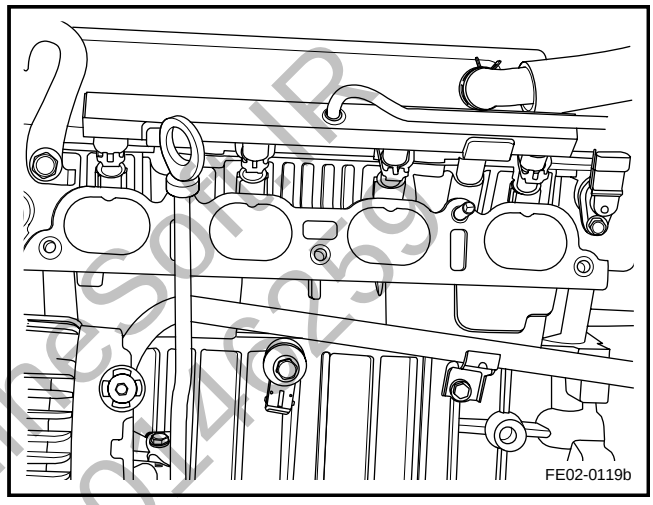
7. Dismantle the fixing bolts and nuts of intake manifold in the sequence as shown in the figure.

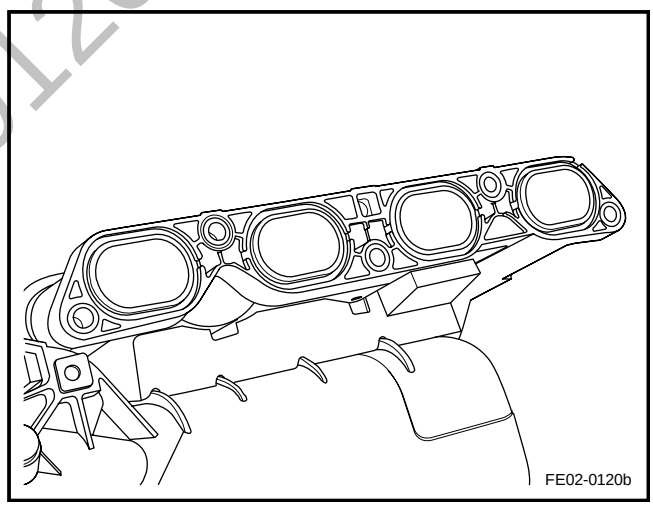


Installation Procedure:

1. Clean the cylinder head intake manifold installation surface.



2. Clean the intake manifold installation surface.



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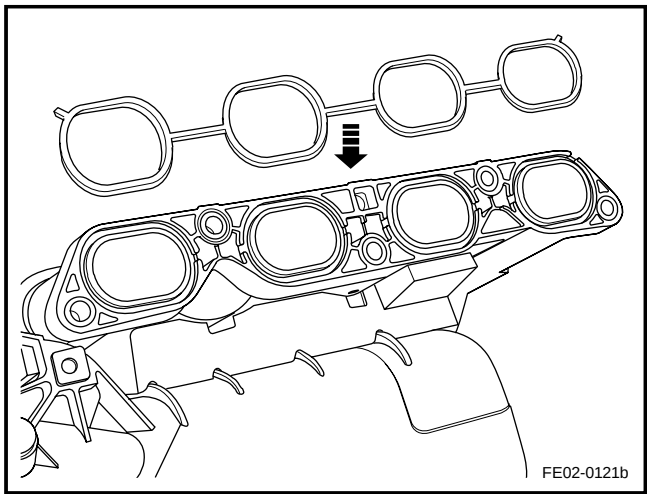
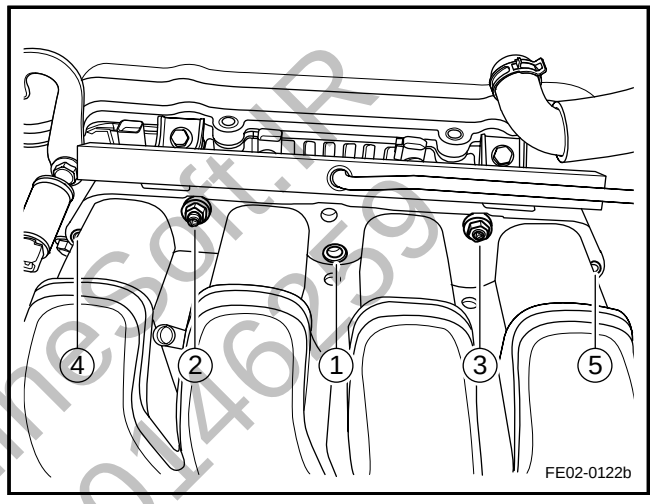
3. Install the intake manifold seals.



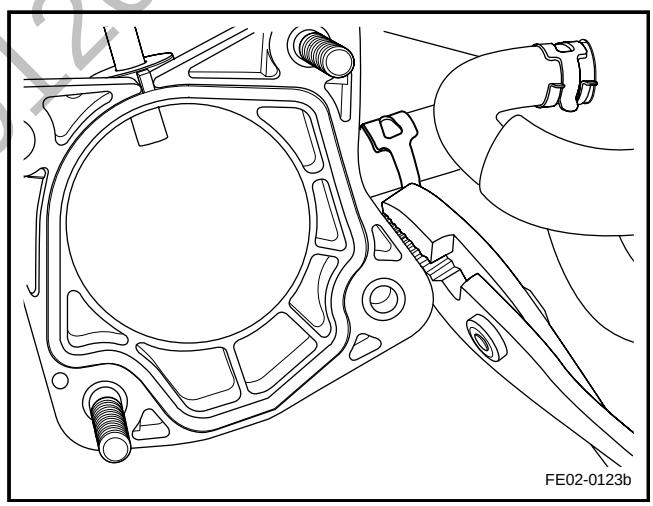
4. Tighten the intake manifold retaining bolts and nuts in the sequence shown in the graph.

Note: The bolts and nuts can not tighten to the specified torque at once, otherwise it will result in the intake manifold leakage. They should be tightened at several stages to the specified torques.

Torque force :30N.m(metric) 22.3lb-ft(English system)



5. Install the vacuum booster vacuum tubes.



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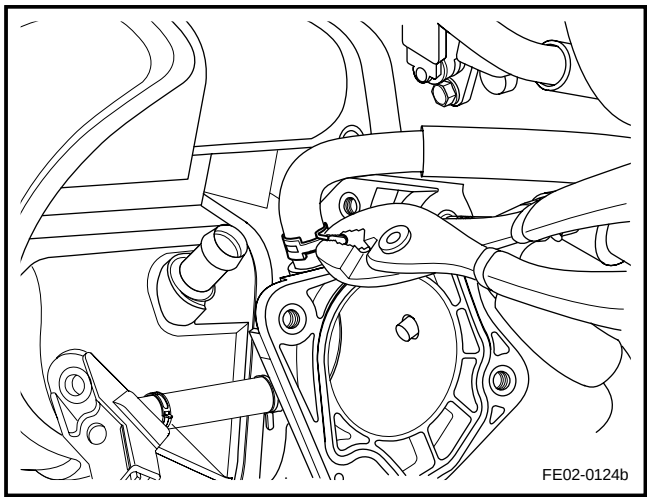
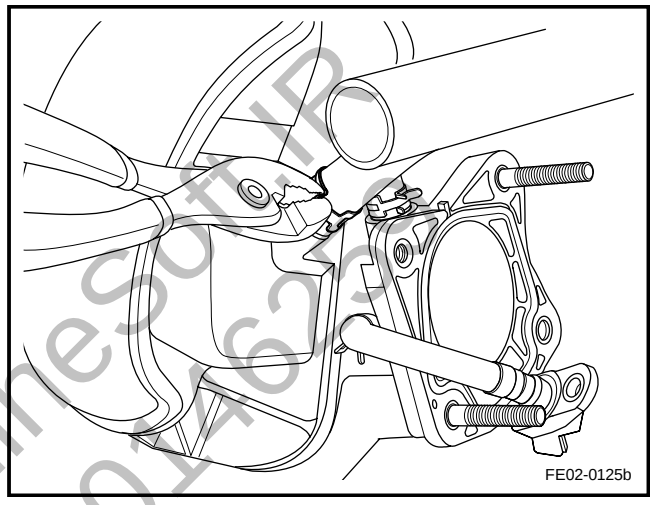
6. Install the canister solenoid valve vacuum tube.



7. Install the forced ventilation vacuum pipe of the crankcase.
8. Install the throttle body.
9. Install the engine hood.
10. Install negative cable of battery.



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2.13.8.7 Engine supporting seat Replacement

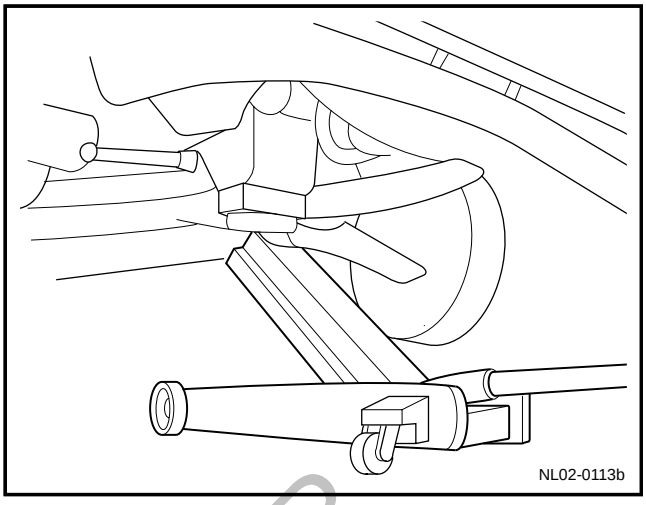
Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions".

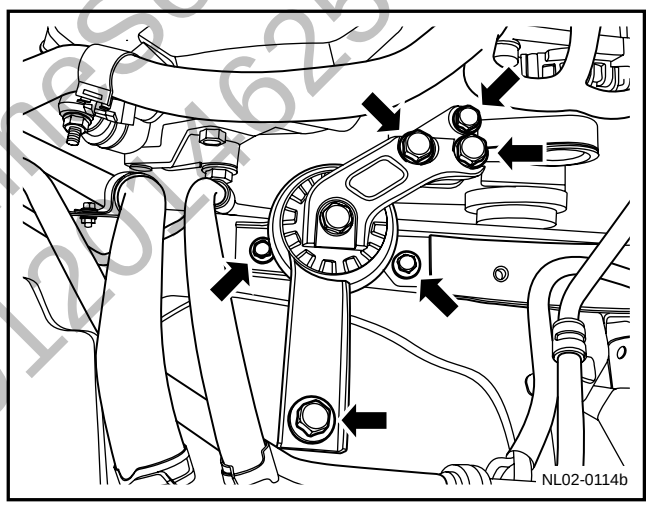
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Dismantle the plastic shield of engine. Refer to 2.13.8.1 Replacement of Plastic Shield of Engine.
3. Use horizontal jack to support engine assembly.

Note: prior to support, a wood block is placed between the jack and the engine sump; otherwise

Damage the engine sump.



4. Dismantle connecting bolts between right engine mount and body/engine.



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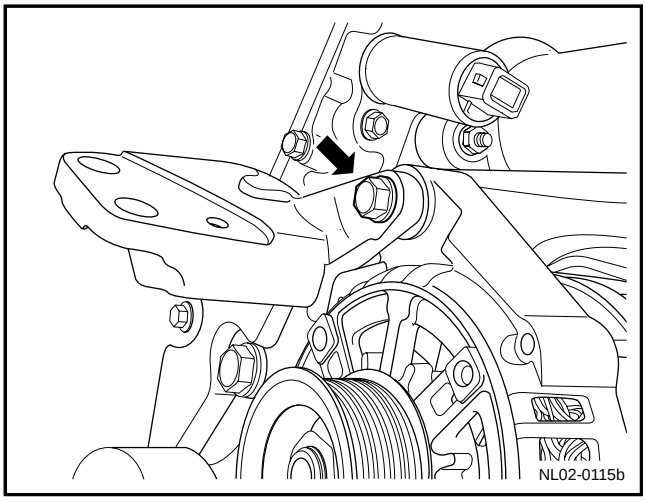
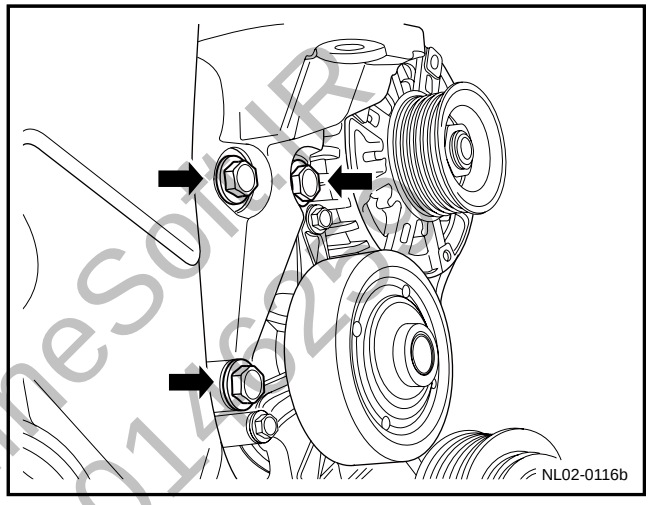
5. Dismantle the drive belt. Refer to 2.13.8.3 Replacement of Drive Belt.

6. For dismantlement of the drive belt tensioner, see 2.13.8.4 Replacement of Drive Belt Tensioner.

7. Remove the connecting bolt for the top generator bracket.



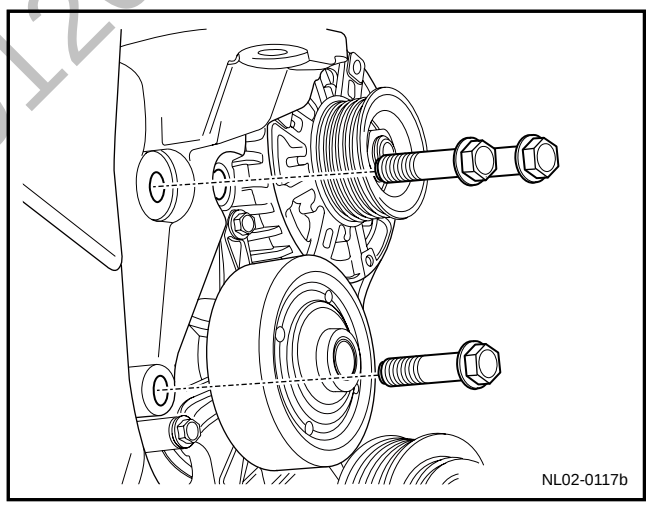
8. Dismantle the fixing bolts of engine mount and Dismantle the engine mount.



Installation Procedure:

1. Install and tighten the fixing bolts of engine mount to the specified torque.

Torque :45Nm(Metric) 33 . 3lb-ft(English system)



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2. Install connecting bolt of upper bracket of electric generator.

Torque :25Nm(Metric) 18 . 5lb-ft(English system)

3. Install drive belt tensioner.

4. Install the drive belt.

5. Install and tighten the bolt for connecting the right engine suspension with the engine.

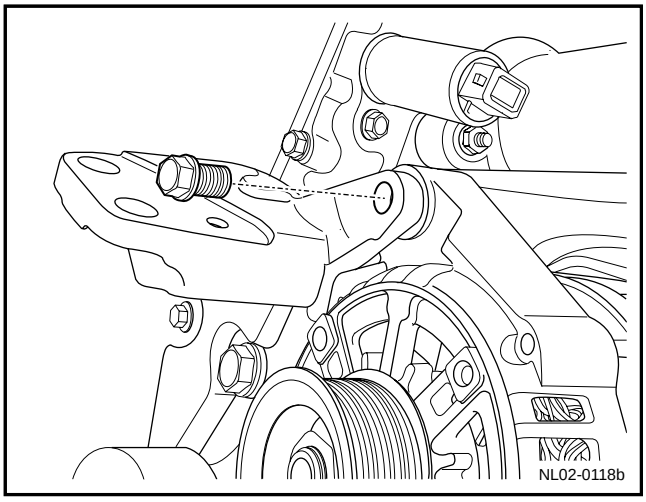
Torque :45Nm(Metric) 33 . 3lb-ft(English system)

6. Remove the supporting jack.

7. Install the generator assembly.

8. Install the plastic shield of engine.

9. Install battery negative cable .



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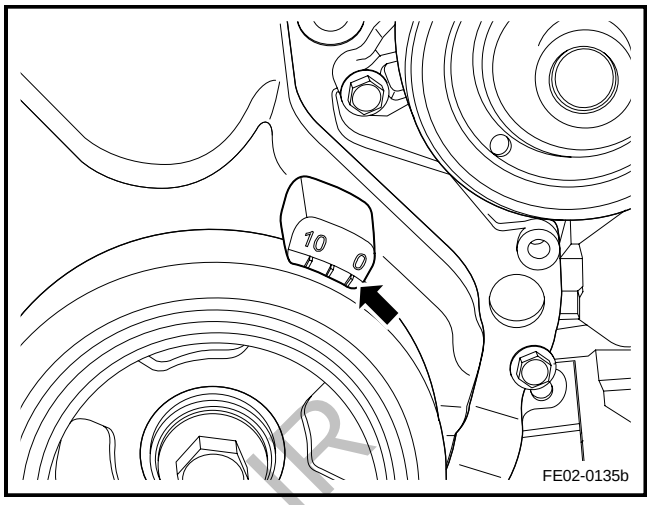
2.13.8.8 Timing chain tensioner replacement

Dismantlement Procedure

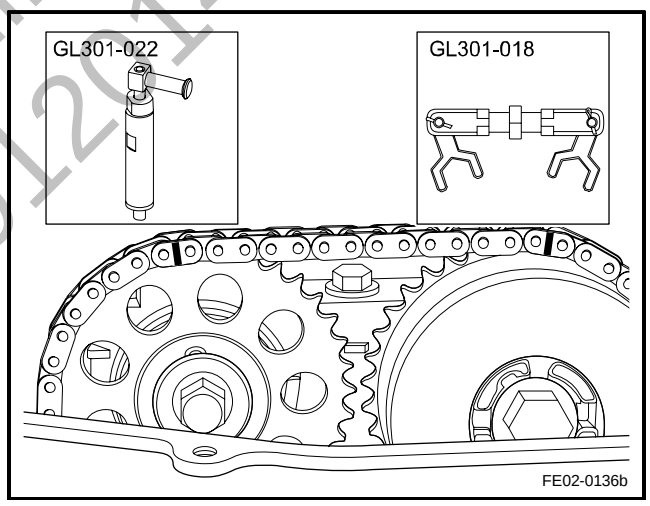
Warning: Refer to "Warning on Battery Disconnection" in "Warning and Precautions"!

1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Dismantle the plastic shield of engine. Refer to 2.13.8.1 Replacement of Plastic Shield of Engine.
3. Refer to 2.10.8.3 "Replacement of Ignition Coil" to dismantle the ignition coil.
4. Refer to 2.13.8.2 "Replacement of Cylinder Hood Cover" to dismantle the cylinder hood cover.
5. Rotate the crankshaft and make sure the cylinder No.1 is at TDC position.

Note: Crankshaft timing mark is aligned with the timing chain cast scale line "0".



6. As shown in the graphic, mark on the intake and exhaust sprocket timing with a marker and use a special tool GL301-022 to fix the timing chain and special tool GL301-018 to fix the camshaft.



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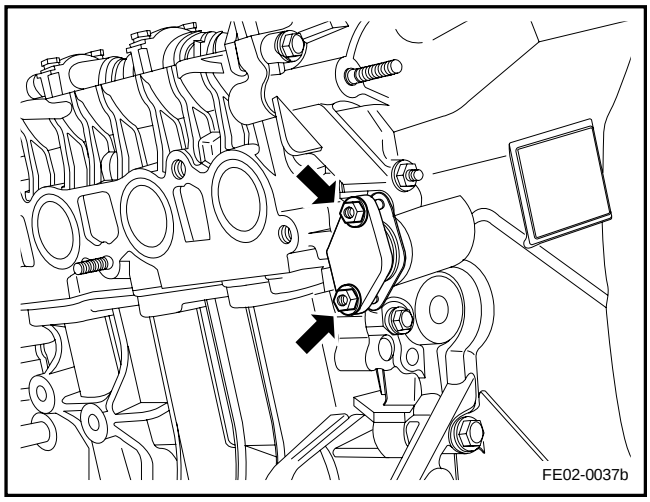
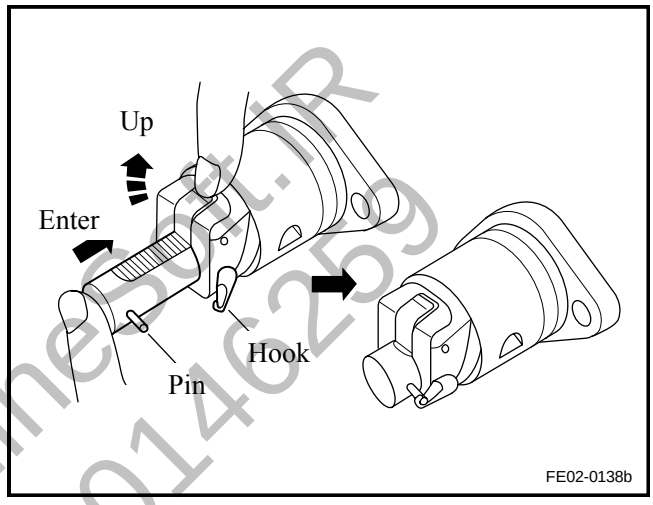
7. Dismantle the timing chain tensioner assembly.

Note: At this time do not rotate the crankshaft in order to prevent the timing chain teeth rolling.



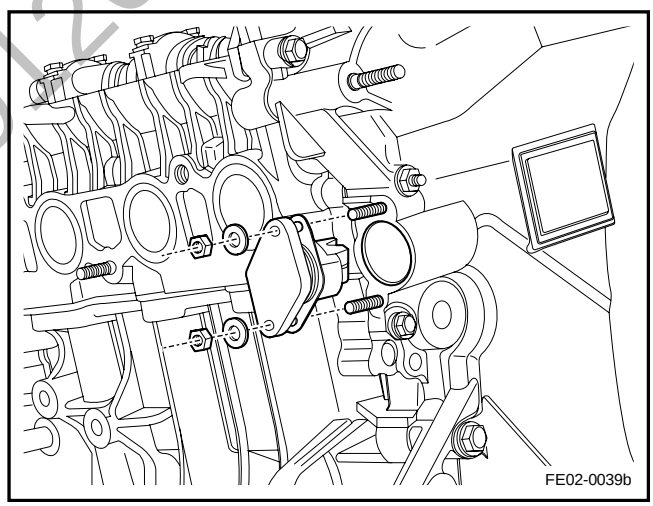
Installation Procedure:

1. Press timing chain tensioner pull rod to keep the tensioner into selft-lock condition as shown in figure.



2. Install the timing chain shroud tensioner and tighten the nuts.

Torque :29N . m(Metric)21 . 5lb-ft(English system)



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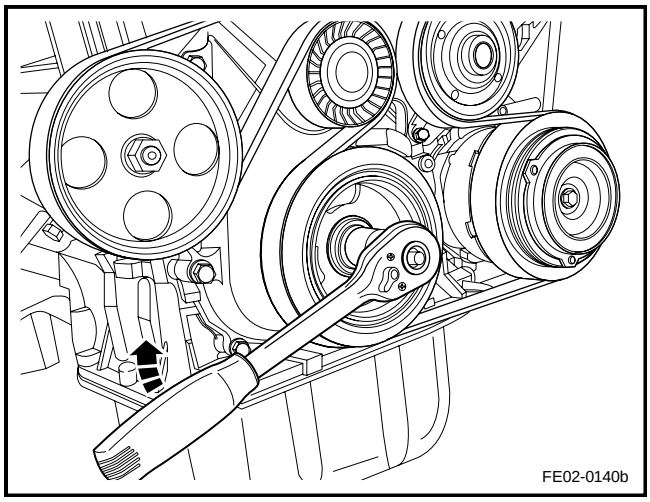
3. Counterclockwise rotate crankshaft pulley to unlock self-locking device of tensioner and pop push rod.

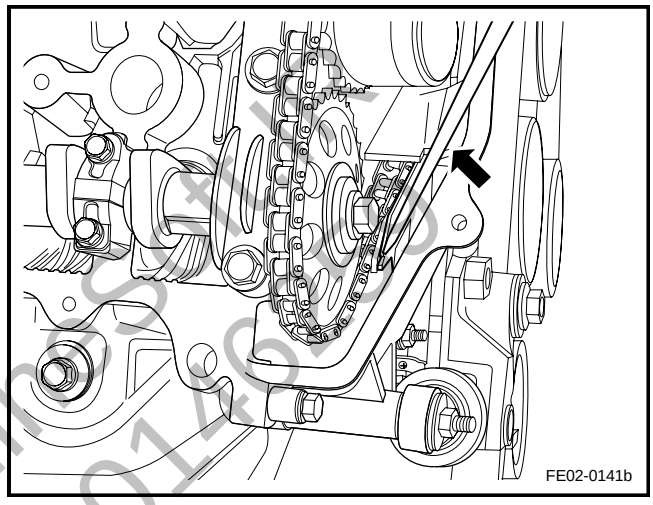
Note: the force should be uniform in the rotation process; otherwise, the timing chain may cause slip tooth!



4. Confirm the tensioner unlocked and the tensioner guide is firmly pressed by the handle.

Note: If not properly unlocked, use a screwdriver to push tensioner in the opposite direction to unlock the guide.

5. Install the cylinder hood cover.
6. Install the ignition coil.
7. Install the engine hood.
8. Connect battery negative cable.



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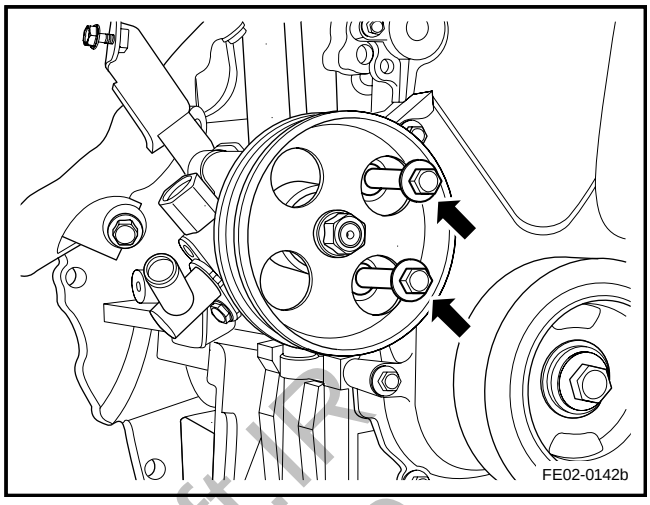
2.13.8.9 Timing chain cover hood replacement

Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" and "Warning on Cooling System maintenance" in "Warning and Precautions".

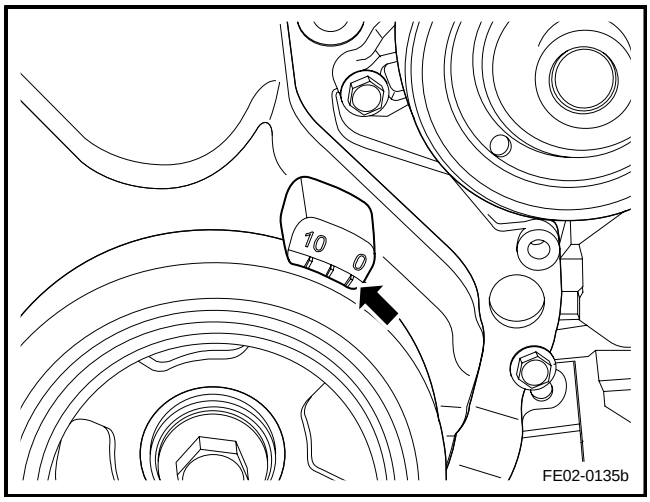
1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Exhaust engine coolant, Refer to“2.8.8.1 displacement and filling of coolant .”.
3. Dismantle the plastic shield of engine. Refer to 2.13.8.1 Replacement of Plastic Shield of Engine.
4. Refer to 2.10.8.3 "Replacement of Ignition Coil" to dismantle the ignition coil.



5. Refer to 2.13.8.2 "Replacement of Cylinder Hood Cover" to dismantle the cylinder hood cover.
6. Refer to 2.13.8.3 "Replacement of Drive Belt" to dismantle the drive belt.
7. For dismantlement of drive belt tensioner, see "Replacement of Drive Belt Tensioner".
8. For dismantlement of the generator assembly, see "2.11.8.3 Replacement of Generator".
9. For dismantlement of the water pump, see "2.8.8.6 Replacement of Water Pump".
10. Dismantle the engine mounting. Refer to 2.13.8.7 Replacement of Engine Mount.
11. Dismantle mounting bolt of power steering oil pump.

Note: In the confined operating space, lower the jack to facilitate the operation.

12. Rotate crankshaft, to make the timing mark of crankshaft belt align with scale 0, as shown in figure.



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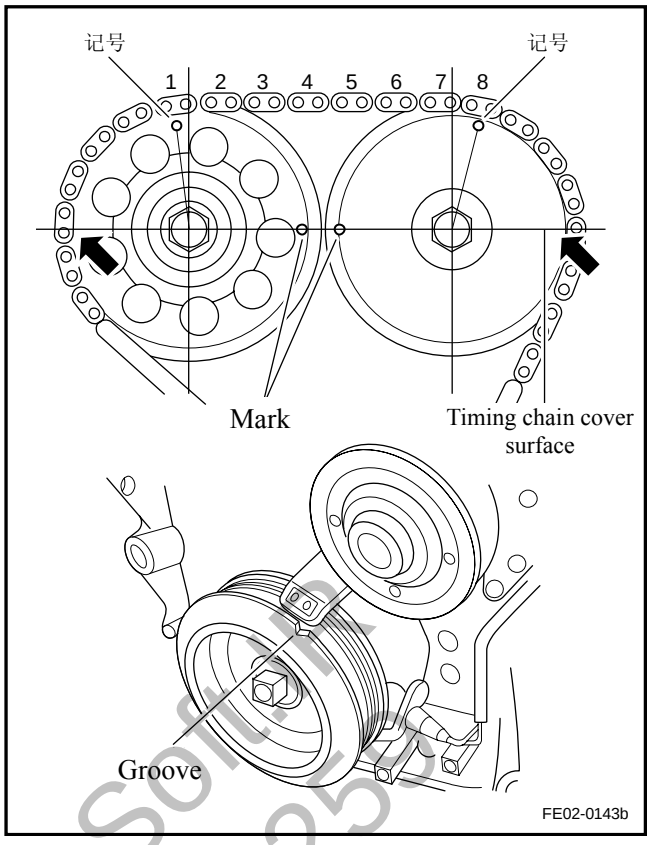
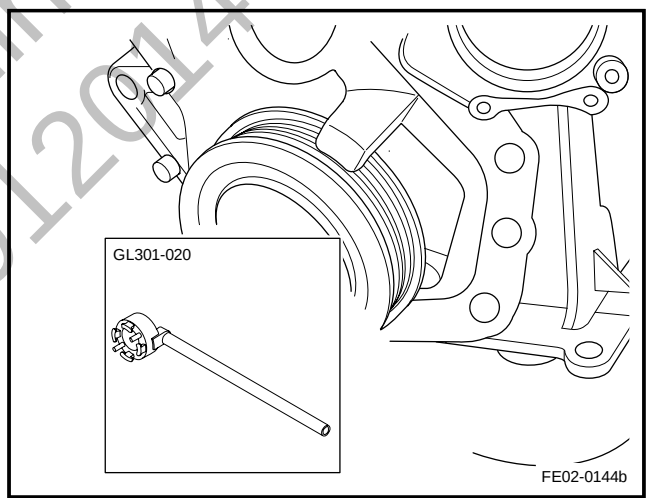
13. Make sure that timing marks of air intake VVT chain wheel and exhaust chain wheel are in positions shown in figure, to ensure that cylinder 1 is on upper stop point position of compression. If the position is wrong, repeat step 12 until timing marks of intake and exhaust chain wheel are on positions shown in figure, and make marks on chain wheels with marker pen.



Note: the exhaust chain wheel has three position marks, the one with two points of which faces upward. The VVT chain wheel has three position marks. The grooved side of the aluminum body should face up. During alignment with the marks, the yellow chain section may not coincide with the mark. During dismantlement, make sure the timing marks of two chain wheels are on the upmost position and the single-point mark on the chain wheel is on the horizontal straight line!

14. Use special tool GL301-020 to dismantle crankshaft pulley.



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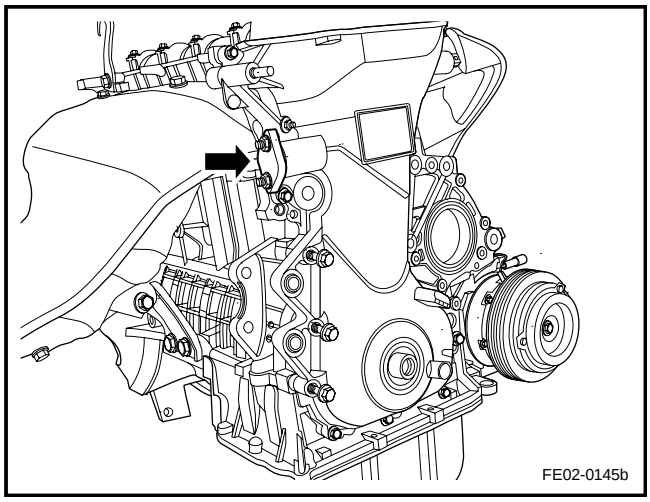
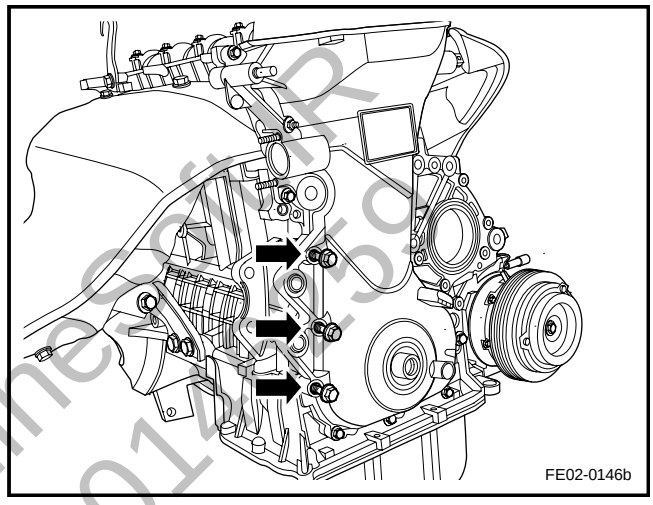
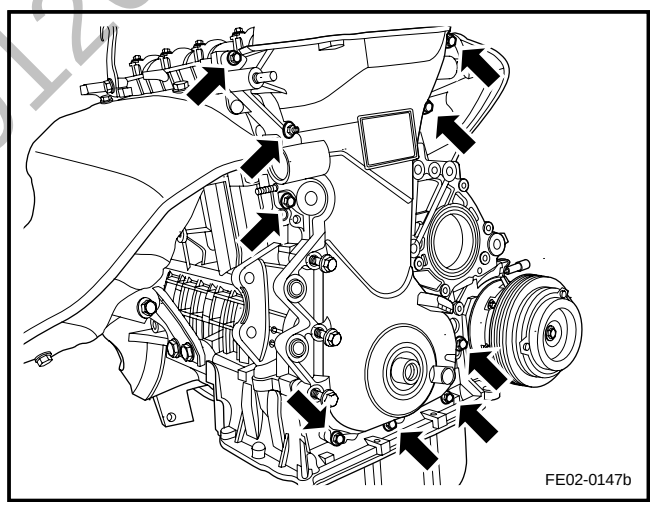
15. Dismantle timing chain bar tensioner .



16. Dismantle 3 M8 tightening bolts of timing chain cover.



17. Dismantle 9 M6 fixing bolt and bolt cap of timing chain.



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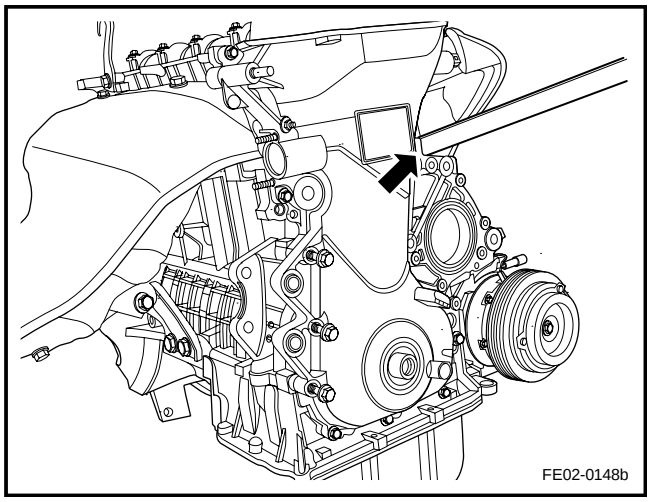
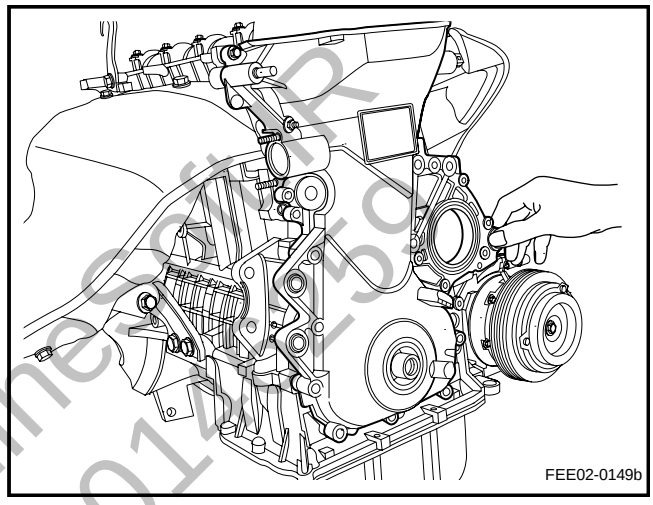
18. Insert pry bar into groove position, and loosen timing chain cover.

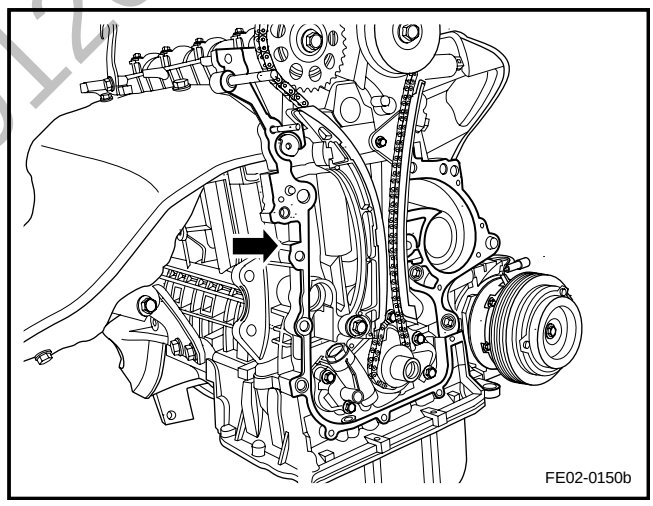


19. Remove the timing chain cover.



Installation Procedure:

1. Clean the residual sealant on the timing chain cover and cylinder.



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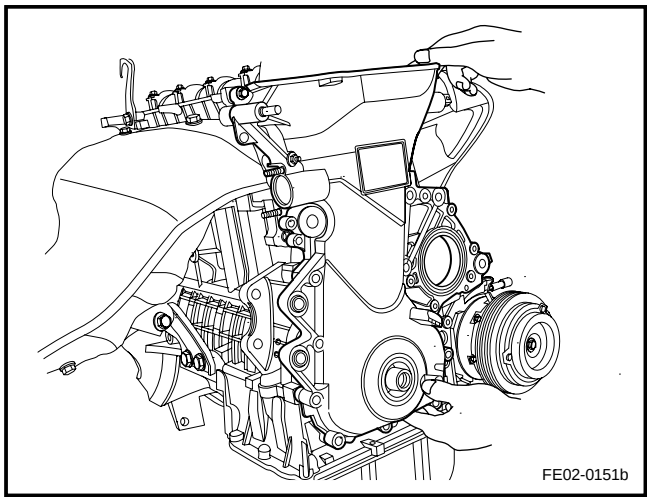
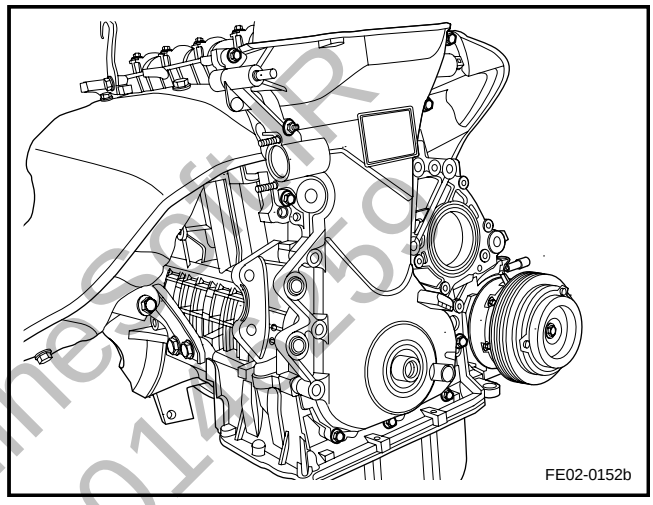
2. Apply special sealant on the timing chain cover and cylinder block mounting surface evenly and install the timing chain cover.

Note: prior to the installation of the timing chain cover cap, pay attention to check whether the marks on the timing chain are consistent; if not, please reinstall the timing chain, refer to 2.13.8.10 "Replacement of Timing Chain".



3. Install 9 M6 timing chain cover tightening bolt and screw cap, but do not tighten them too much.



4. Install 3 M8 tightening bolt of timing chain cover, and tighten tightening bolt and screw nut (total 12) of timing chain cover according to the sequence shown in figure.

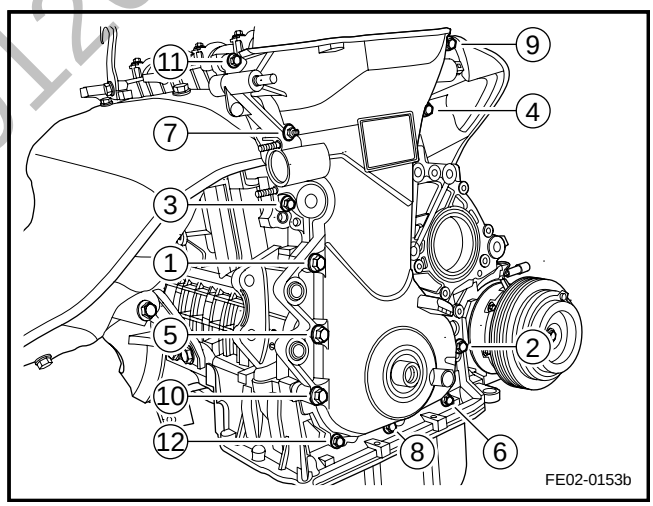
Torque value :

M6 bolt and screw cap :

Torque:12N.m(Metric)
8.2lb-ft(English System)

M8 Bolt

Torque ： 18N·m （ Metric)
13.4lb-ft(English System)



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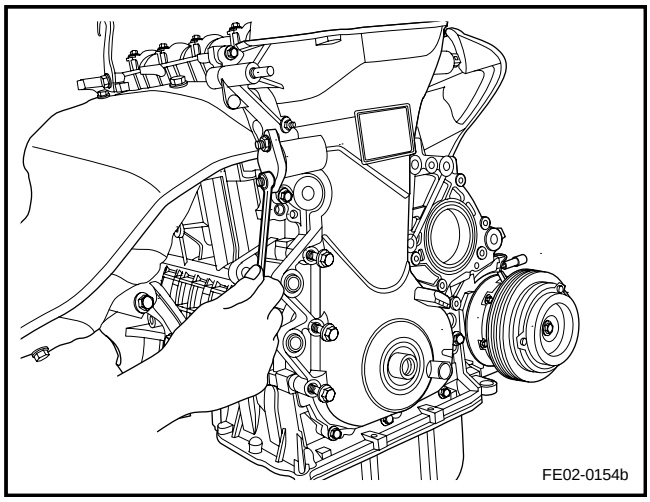
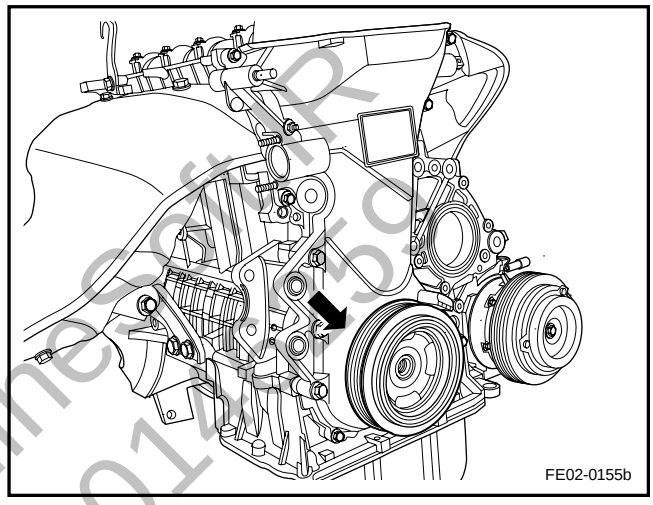
5. For installation of the timing chain tensioner, see "2.13.8.8 Replacement of Timing Chain Tensioner".

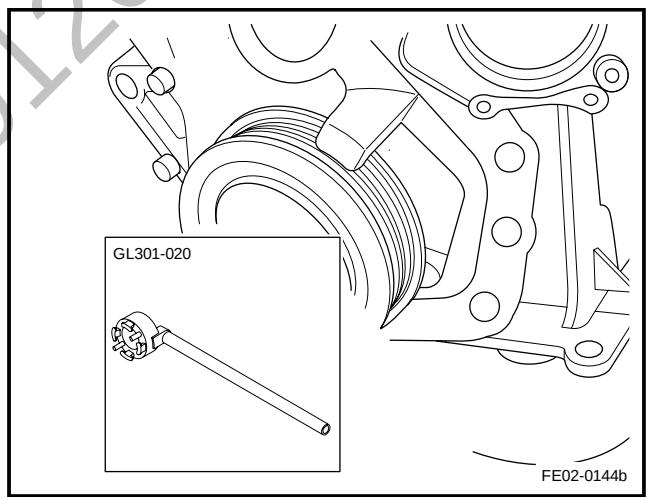


6. Install the crankshaft belt plate.



7. Use a special tool to install the crankshaft belt plate bolts.

Torque ： 138N.m(metric) 102.2 lb-ft(English system)



Machine Soft R
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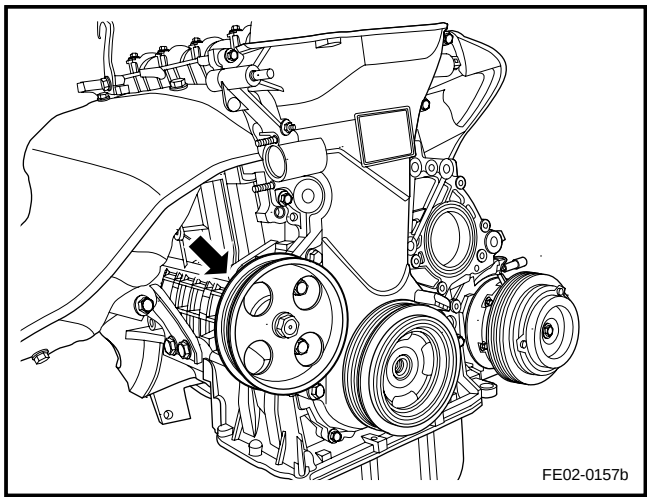
8. Install the power steering pump
9. Install the engine mounting.
10. Install water pump.
11. Engine assembly .
12. Install drive belt tensioner
13. Install the drive belt.
14. Install the cylinder hood cover.
15. Install the ignition coil.
16. Install the plastic shield of engine.
17. Fill the engine coolant.
18. Connect battery negative cable.



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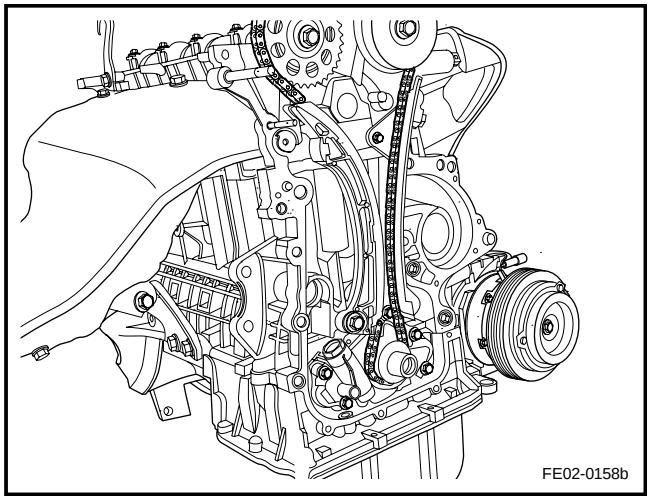
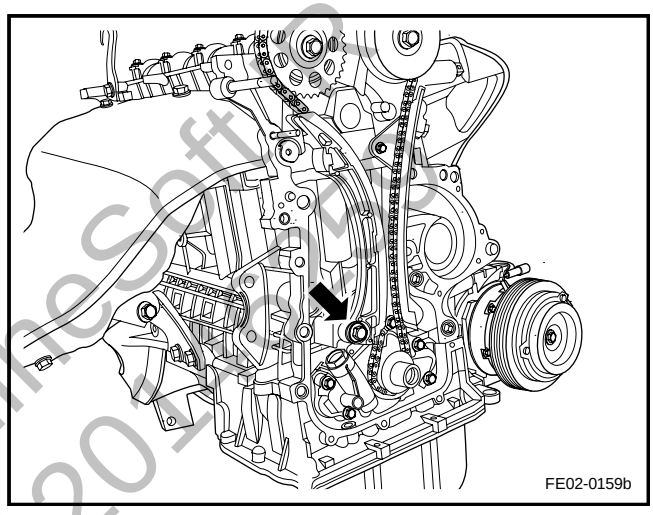
2.13.8.10 Replacement of Timing Chain

Dismantlement Procedure

1. Rotate the crankshaft so that the cylinder No.1 is at TDC position. Refer to 2.13.8.9 Replacement of Timing Chain Cover to dismantle the timing chain cover.

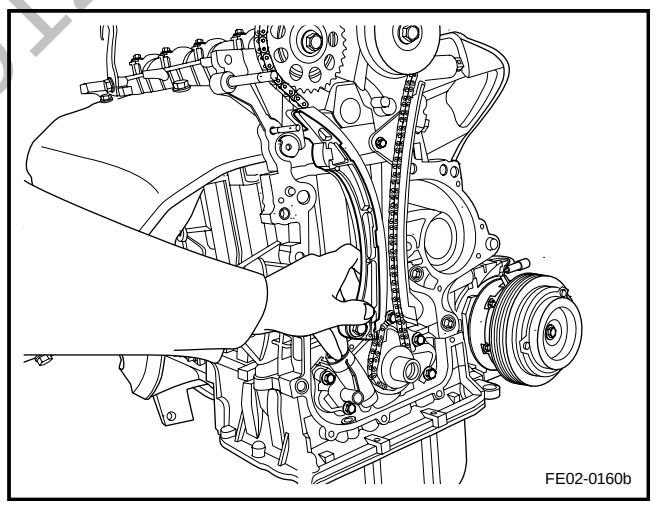


2. Dismantle fixing bolt of timing chain tensioner guideway assemblies.



3. Take out timing chain tensioning guide rail module.

Note: pay attention not to drop out the tensioner shoe in the removal process; otherwise, it is likely to result in damage to the tensioner shoe.



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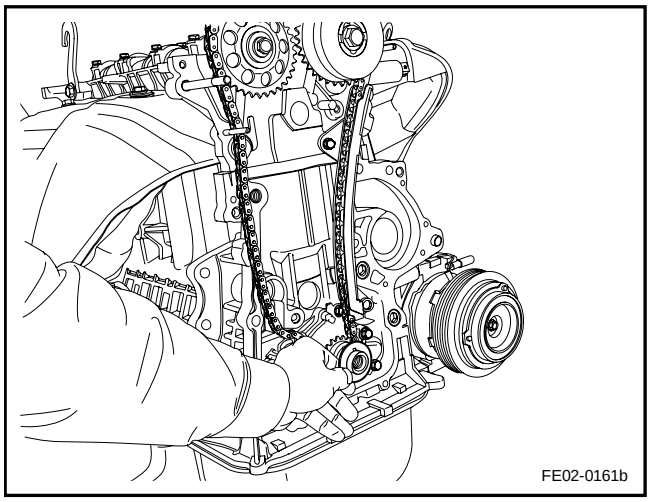
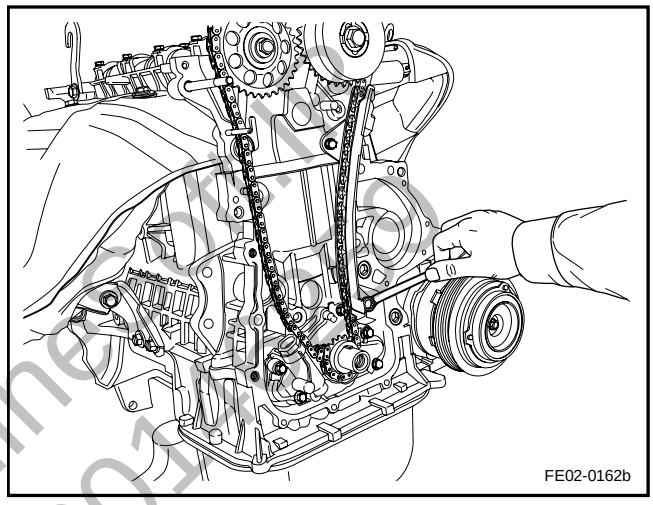
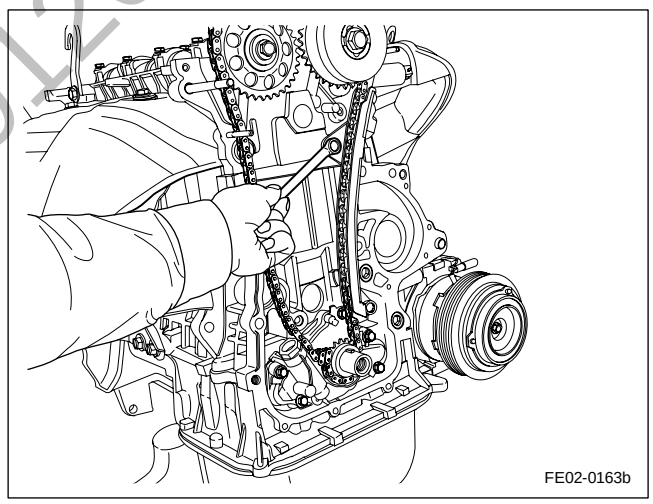
4. Take out crankshaft chain wheel retaining ring.



5. Remove the lower fixing bolt for the timing chain guide rail.



6. Remove the upper fixing bolt for the timing chain guide rail.



Machine Translated
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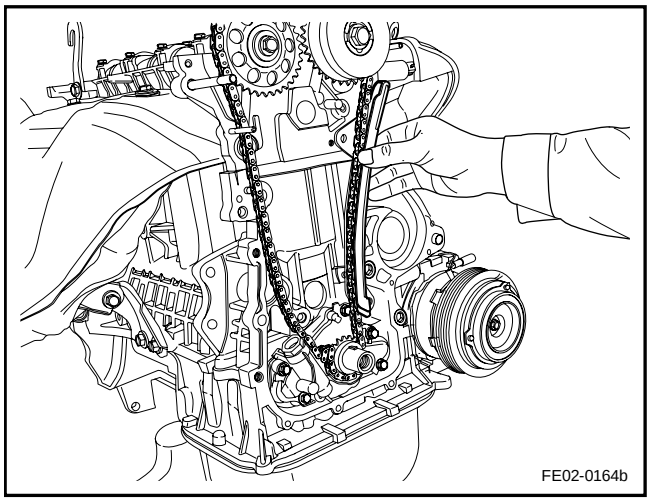
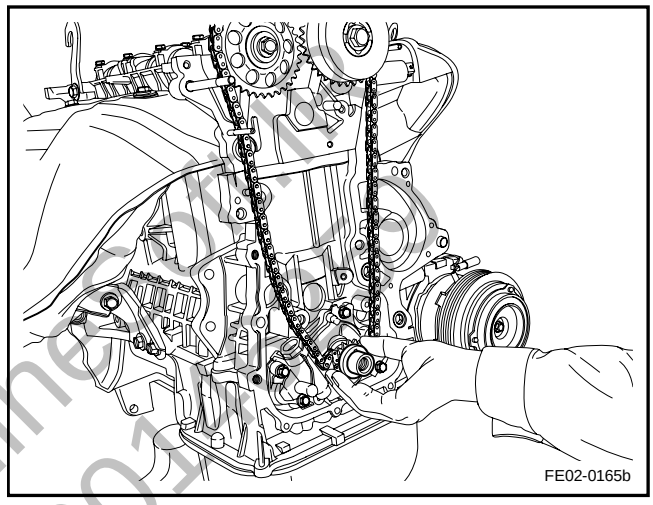
7. Dismantle the timing chain guide rail.

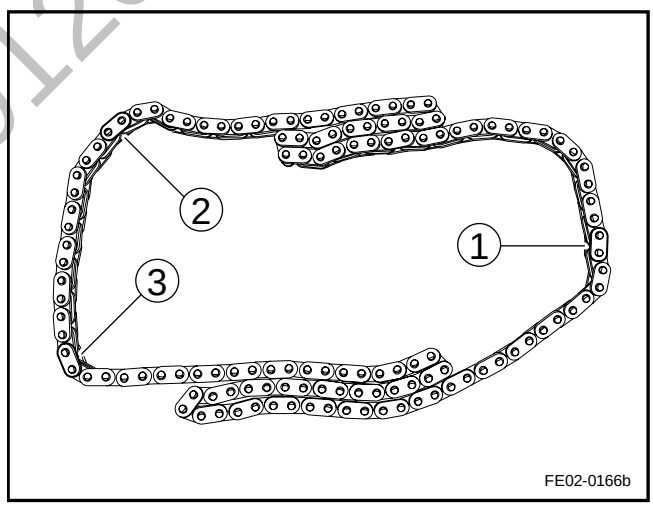


8. Dismantle the timing chain and crankshaft chain wheel.



Installation Procedure:

1. Make sure there is 3 yellow chain links on timing chain.



Machine Synthesis
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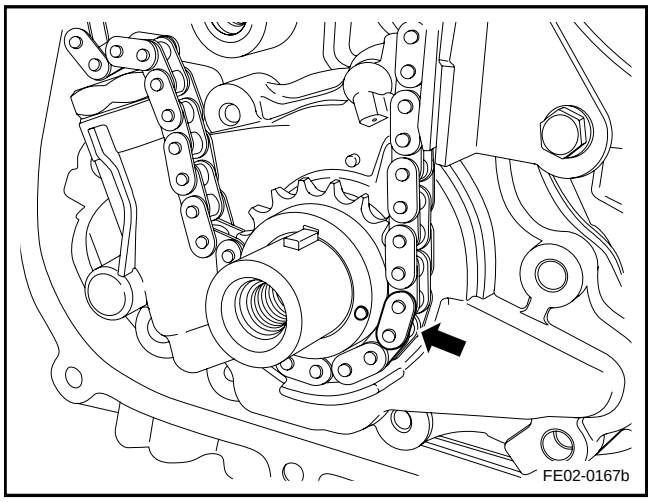
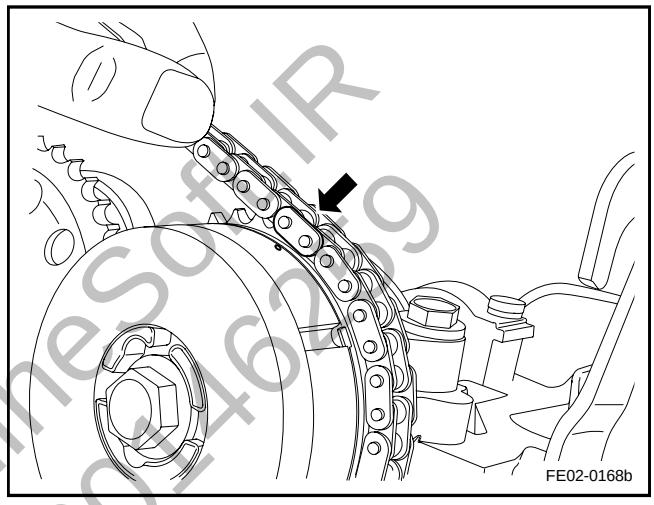
2. Install timing chain and crankshaft chain wheel. The first yellow chain link points to timing mark of positive crankshaft chain wheel.

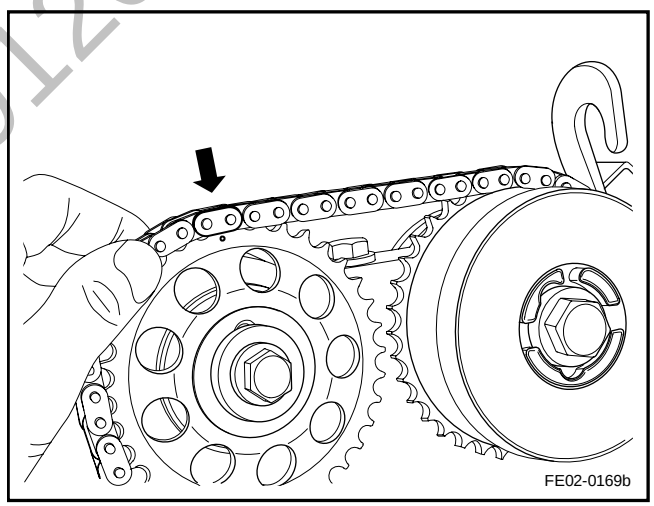
Note: there are three yellow chain links on the timing chain, wherein two yellow chain links (with 6 links therebetween) are aligned with the timing mark of the intake and exhaust camshaft chain!



3. Align the second yellow chain link on chain with timing mark of air intake cam VVT actuator chain wheel.



4. Align the 3rd yellow chain link of the the chain with timing mark of air exhaust chain wheel.



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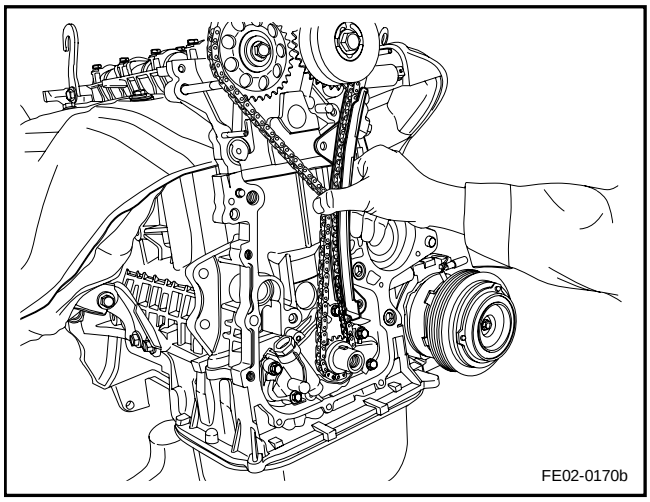
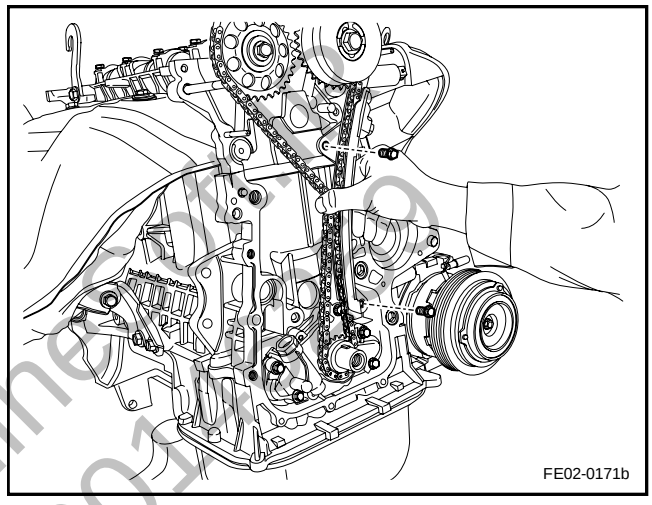
5. Install the timing chain guide rail components.

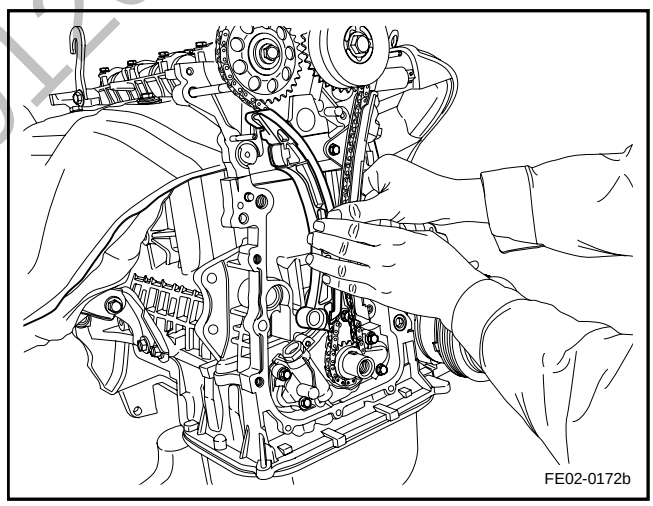


6. Install the fixing bolts for the timing chain guide rail components.

Tightening torque: 10N.m (Metric) 7.4lb-ft (Inch)



7. Install tensioning guide rail component



Machine Gun
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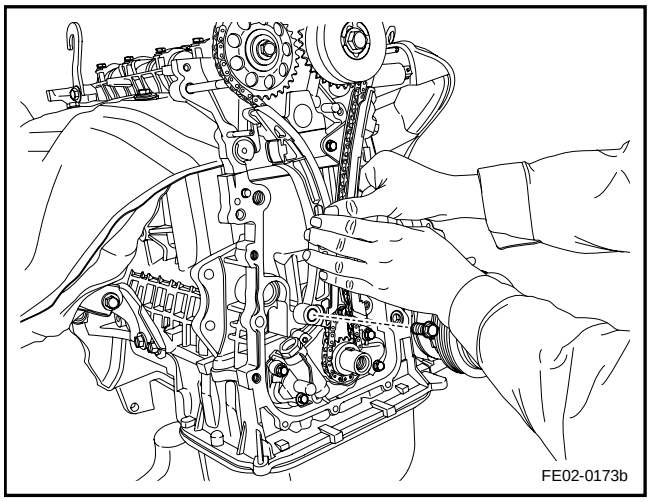
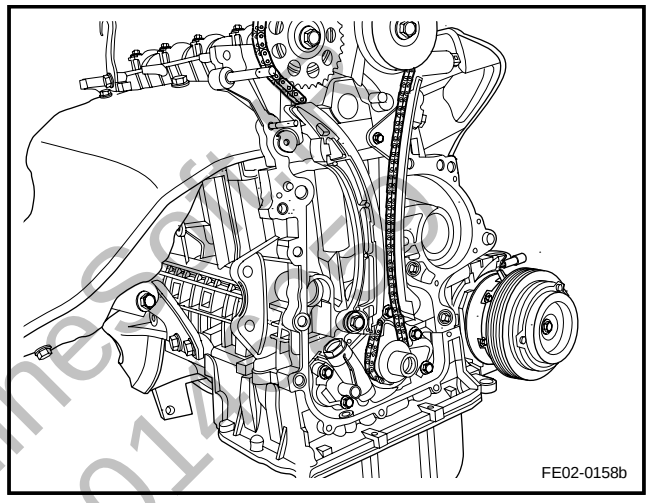
8. Install the fixing bolt for the tensioning guide rail assembly.

Tightening torque: 19N.m (Metric) 14lb-ft (Inch)



9. Install the crankshaft chain wheel retainer ring.
10. Install the timing chain cover and accessories.



Machine Soft
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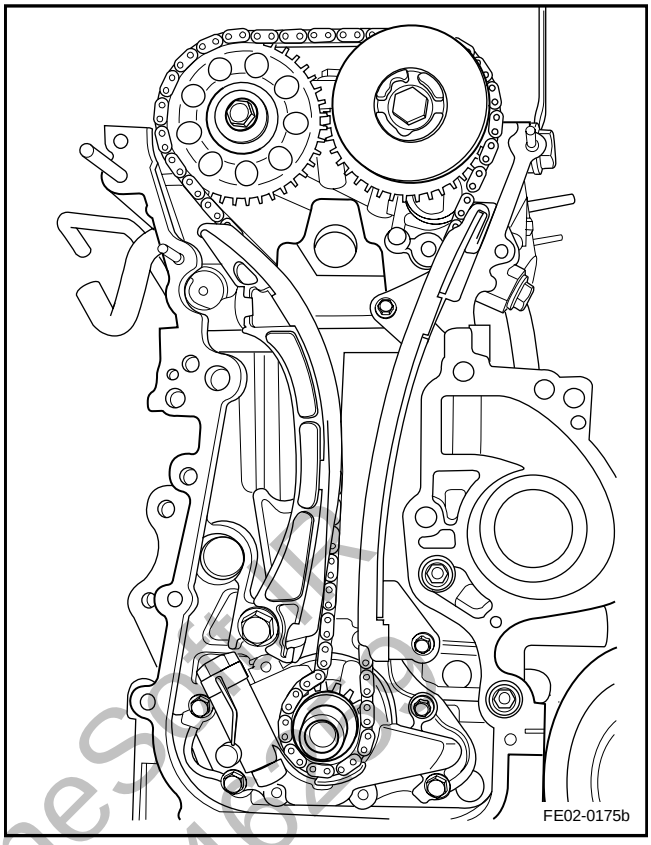
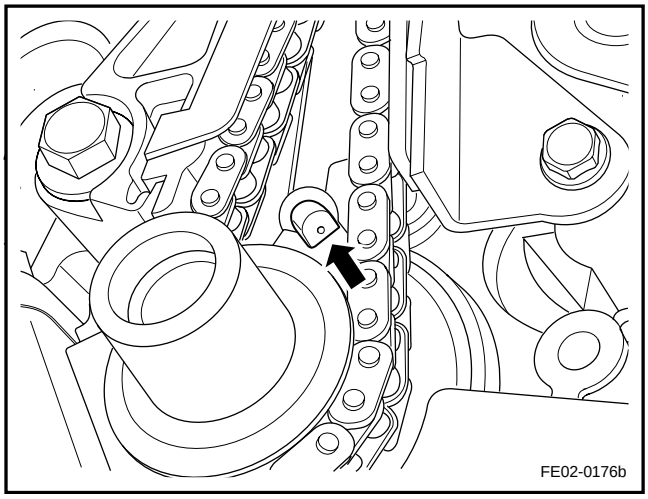
2.13.8.11 Timing Chain Inspection

1. Refer to 2.13.8.9 “Replacement of Timing Chain Shroud” to dismantle the timing chain shroud.
2. Refer to 2.13.8.10 "Replacement of Timing Chain" to dismantle the timing chain.
3. Inspect timing chain guide rail component for cracking, wear and tear.
4. If abrasion depth of chain guideway component surface exceeds 1mm (0.04in), replace timing chain guideway component.
5. Inspect timing chain tensioner rail component for wear and tear.
6. If the the surface of the chain tensioning guide rail component is worn to a depth more than 1mm (0.04in), then replace the timing chain tensioning guide rail component.



7. Check whether the timing chain and VVT actuator chain wheel are worn.
8. Check the exhaust cam shaft sprocket and VVT actuator sprocket and chain for excessive wear, breakage or any signs of dead jamming with the timing chain connecting rod.
9. Inspect the crankshaft timing sprocket teeth and chain for excessive wear, broken, or stuck.
10. Inspect whether timing chain tensioner is damaged, sealing pad is in good condition, if it is damaged, replace timing chain tensioner and sealing pad.
11. Inspect timing chain lubrication nozzles. If necessary, dismantle the oil pump assembly. Inspect the oil channel. Refer to 2.9.8.1 “Replacement of Oil Pump”.



MarineSpirit 09120140

2.13.8.12 Replacement of Camshaft

Dismantlement Procedure

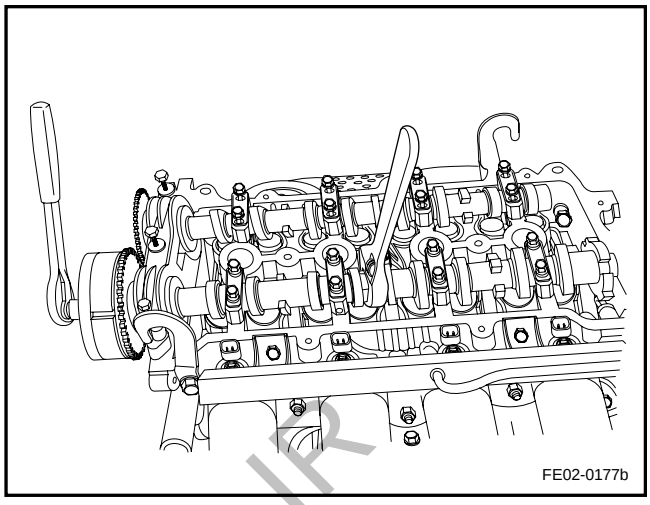
1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.

2. Dismantle the plastic shield of engine. Refer to 2.13.8.1 Replacement of Plastic Shield of Engine.

3. Refer to 2.13.8.2 "Replacement of Cylinder Hood Cover" to dismantle the cylinder hood cover.

4. Dismantle the drive belt. Refer to 2.13.8.3 Replacement of Drive Belt.

5. Refer to 2.13.8.9 "Replacement of Timing Chain Cover" to dismantle the timing chain cover.



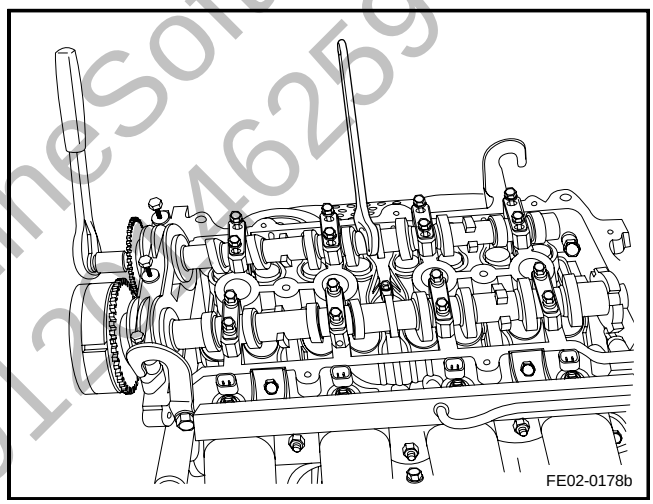
6. Refer to 2.13.8.10 "Replacement of Timing Chain" to dismantle the timing chain.

7. Dismantle the intake camshaft VVT actuator.

Note: Dismantle the camshaft VVT actuator tightening bolt with a wrench holding the camshaft.

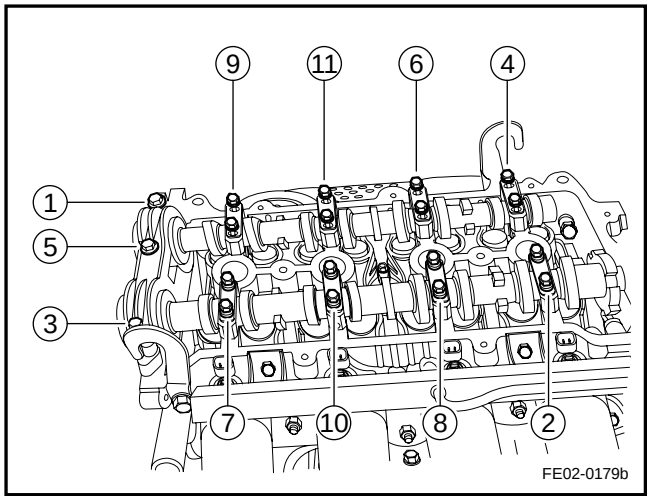
8. Dismantle the exhaust camshaft sprocket.

Note: Dismantle the camshaft sprocket tightening bolts with a wrench holding the camshaft.



9. Gradually loosen the camshaft bearing cap bolts in the order as shown in the figure and loosen by one half or one circle each time.

Special Precautions: Be careful when dismantling the camshaft. Avoid abrasions, scratches or damage to the camshaft surface or bearing surface.



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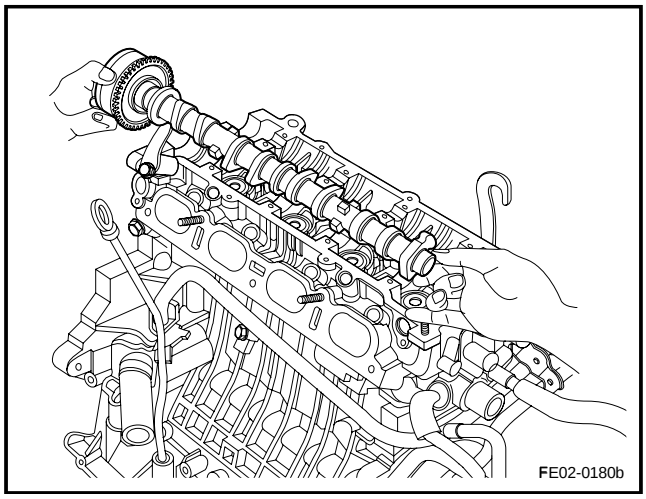
10. Dismantle the camshaft.

Important precaution : Camshaft must be withdraw from the bearing in order to avoid abrasions, scratches or damage to the camshaft surface or bearing surface.

11. Inspect for the camshaft and bearing wear. If necessary, replace.

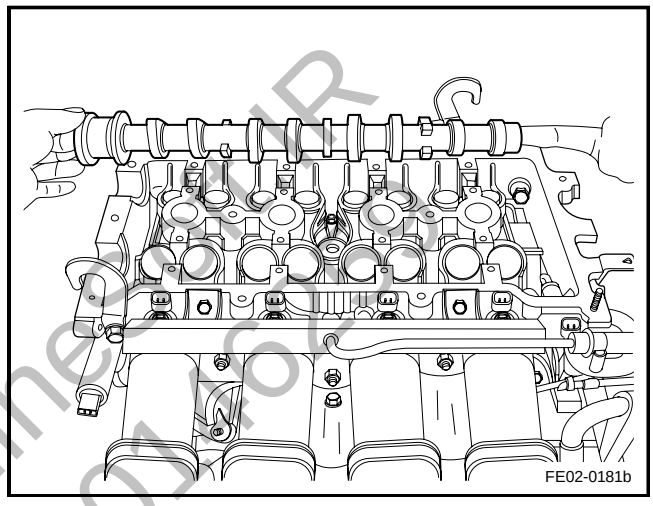


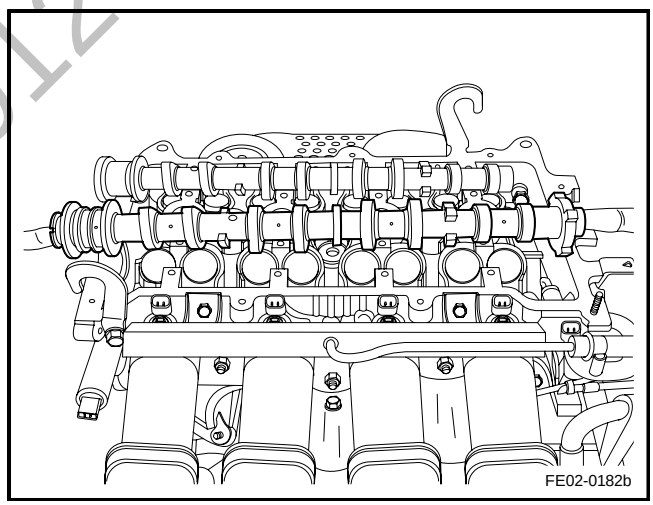
Installation Procedure:

Precaution: be careful to install the camshaft. Avoid abrasions, scratches or damage to the camshaft surface or bearing surface.

Special Precautions: Before installation,apply engine lubrication oil to the camshaft journal and the seal contacting surface.

1. Apply a small amount of engine oil to lubricate the journal and camshaft cap.
2. Install the exhaust camshaft.
3. Install the intake camshaft.





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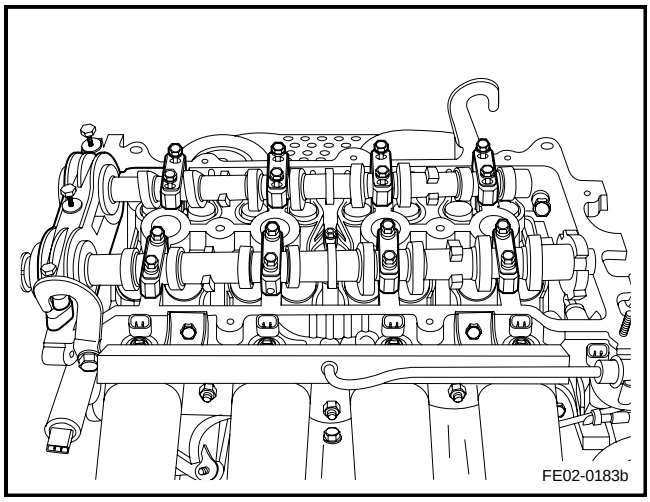
4. Install the intake and exhaust camshaft cover.

There are letters on the camshaft cover. Avoid installation errors. For example, "I ↑ 2" indicates that the camshaft cover is the No.2 intake camshaft cover. The arrow is toward the direction of timing chain. E ↑ 2 indicates the No.2 exhaust camshaft cover. The arrow is toward the direction of timing chain.



5. Tighten camshaft cover bolts in the order as showed in the figure.

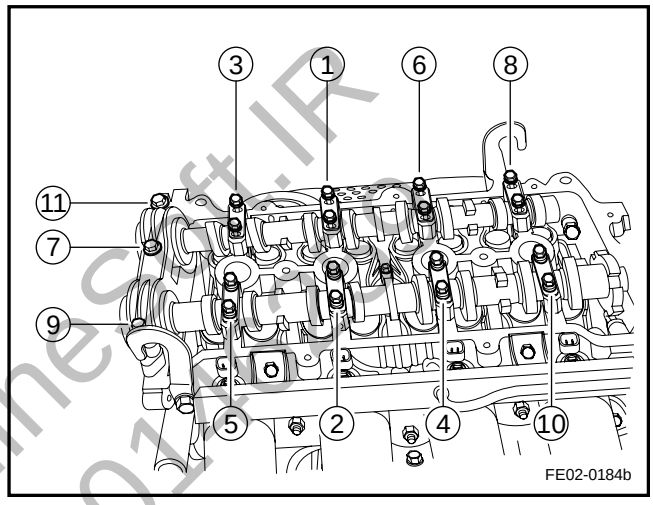
Note: Tighten the bolts during several stages. Do not tighten at once which may damage the camshaft and the camshaft cover.

Torque :M6 bolt

13N.m(Metric)10lb-ft(English system)

M8 Bolt

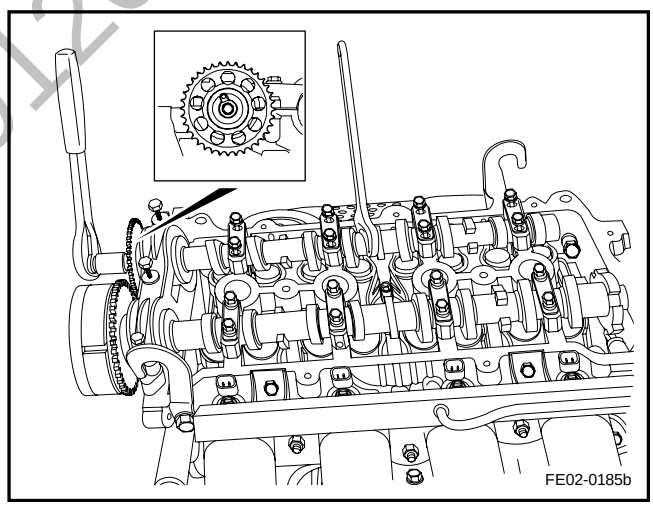
23 N.m(Metric)17lb-ft(English system)



6. Install the exhaust camshaft sprocket.

Note: Inspect the sprocket pin wear. If there is wear, replace the sprocket pin. Hold the camshaft with a wrench and then tighten the VVT actuator bolts.

Torque :55N . m(Metric)
41lb-ft(English system)



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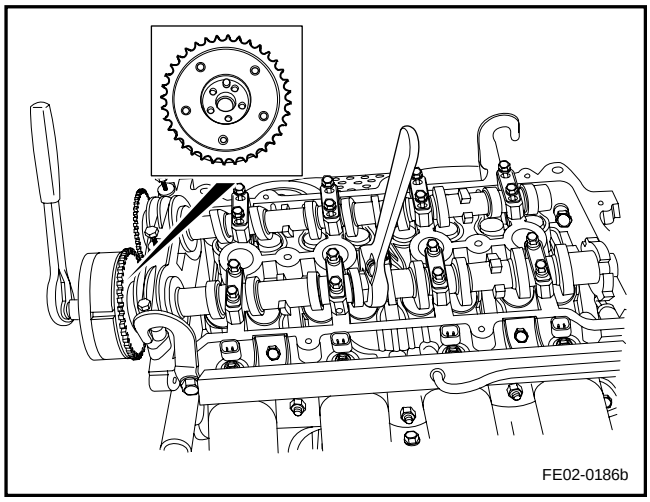
7. Install the intake camshaft VVT actuator.

Note: Inspect the VVT actuator pin wear. Hold the camshaft with a wrench and then tighten the sprocket bolts.

Torque :70N . m(Metric)
52lb-ft(English system)

8. Install timing chain
9. Install the timing chain cover.
10. Install the drive belt.
11. Install the cylinder hood cover.
12. Install the plastic shield of engine.
13. Connect battery negative cable.



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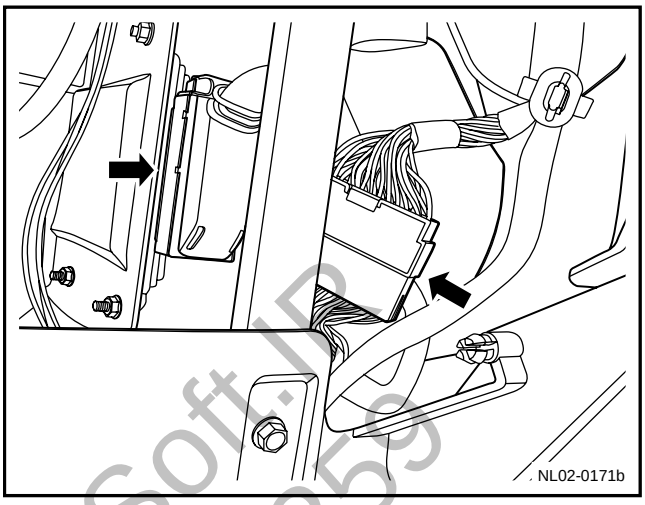
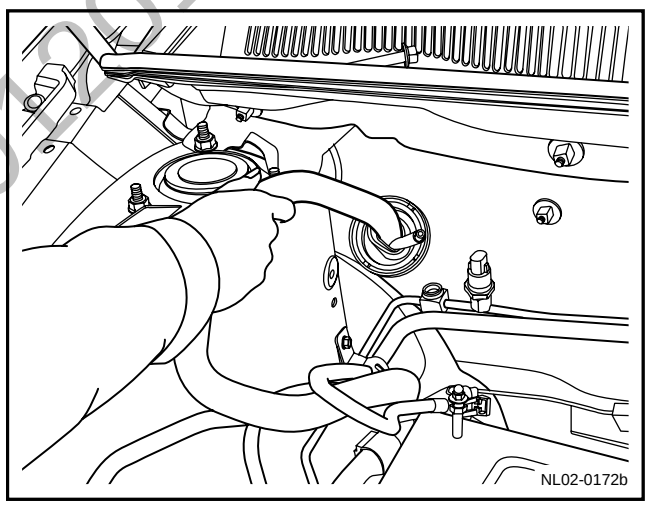
2.13.8.13 Replacement of Engine

Dismantlement Procedure

1. Dismantle battery negative cable,refer to 2.11.8.1 Disconnect connecting process of battery cable
2. Release the fuel pressure. Refer to 2.3.8.1 Fuel Pressure Release Procedure.
3. Discharge engine coolant. Refer to 2.8.8.1 Engine Coolant Discharge and Filling.
4. Refer to 2.8.8.2 "Replacement of Coolant Recovery Reservoir" to dismantle the coolant recovery reservoir.
5. Recover the air-conditioning refrigerant. Refer to 8.2.7.12 Air-conditioning Refrigerant Recovery and Filling.
6. Remove battery base plate, Refer to 2.11.8.2 Battery Replacement.
7. Refer to 12.8.3.3 "Replacement of Glove Box of the Instrument Panel" to dismantle the glove box of the instrument panel.
8. Disconnect the engine control unit and engine harness to the instrument panel harness connectors.
9. Pull the engine harness out of the firewall.





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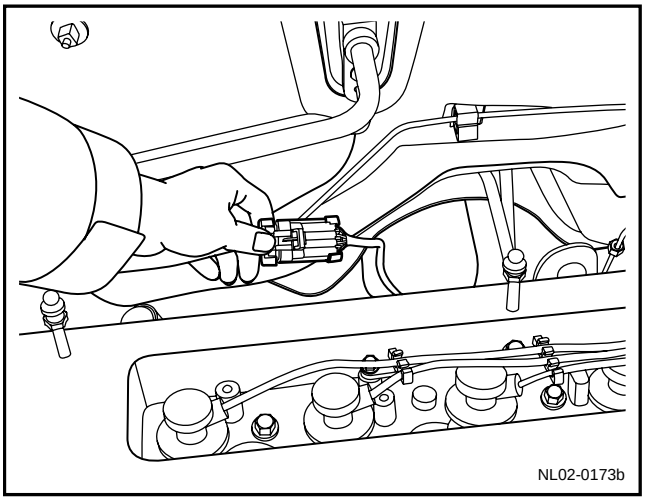
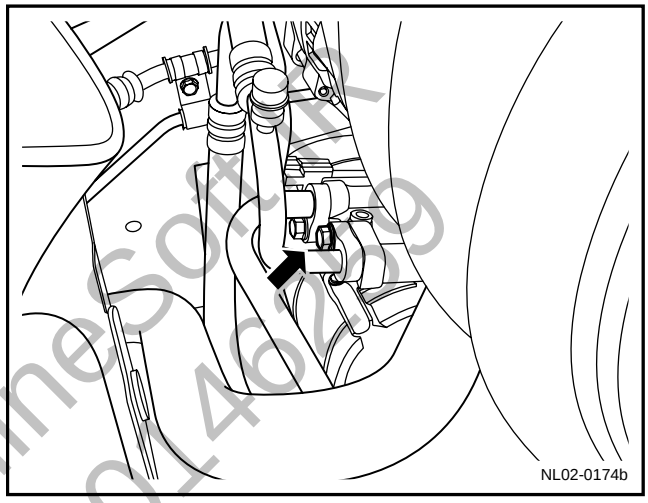
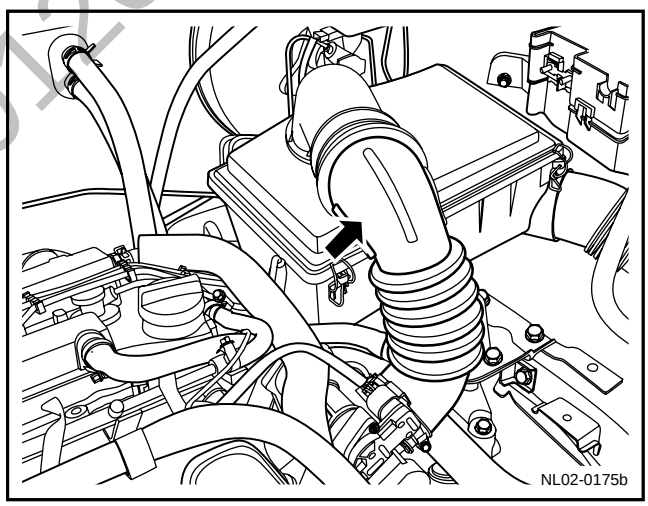
10. Disconnect front and rear oxygen sensor wiring harness connectors.



11. Dismantle the air-conditioning compressor high and low pressure connecting tubes.



12. Dismantle intake air pipe assembly.



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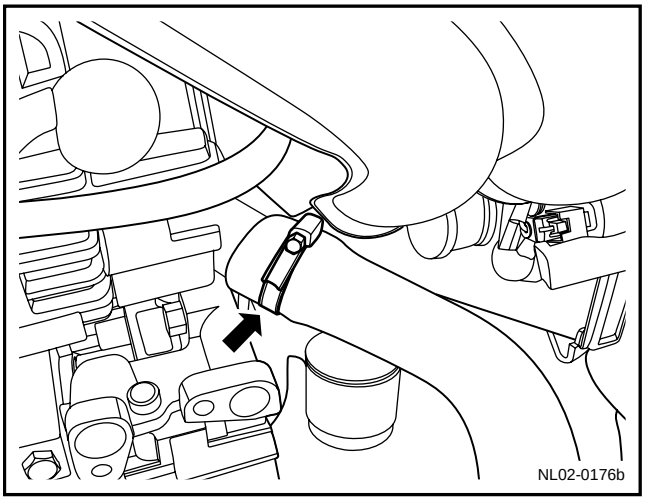
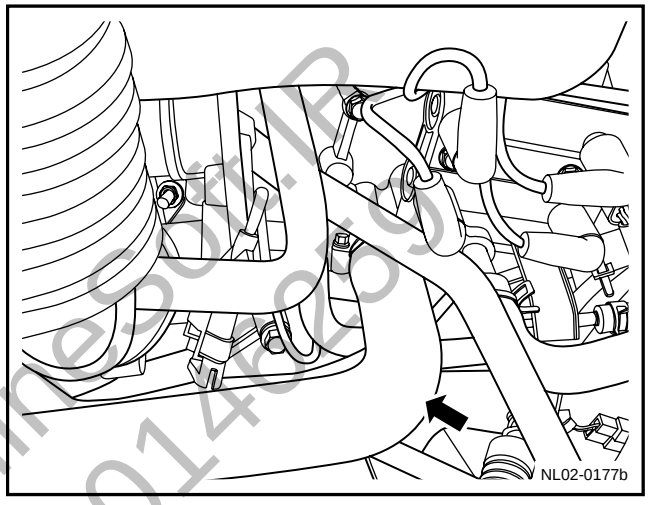
13. Dismantle the radiator output pipe.

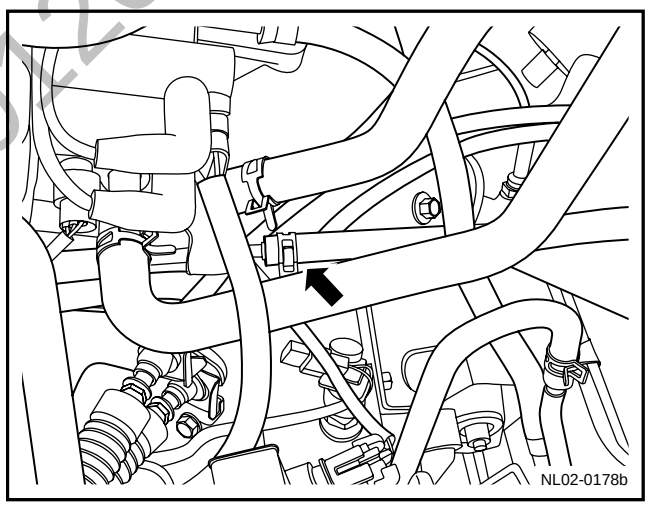
Warning: Refer to "Warning on Maintenance of Cooling System" in "Warnings and Precautions".



14. Dismantle the radiator inlet pipes.



15. Dismantle the vacuum booster vacuum tubes.



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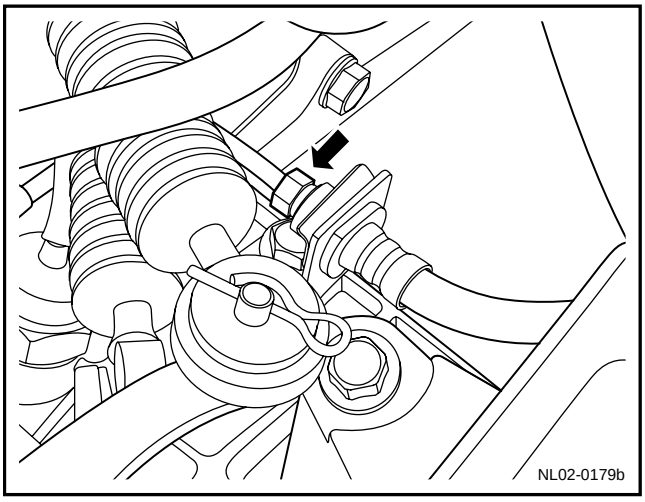
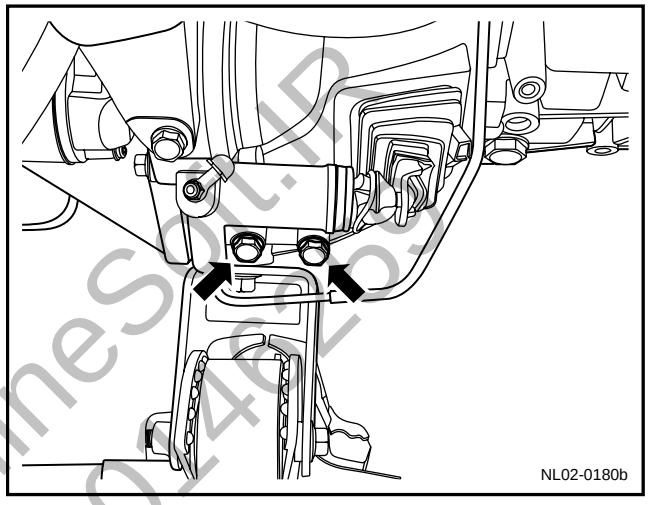
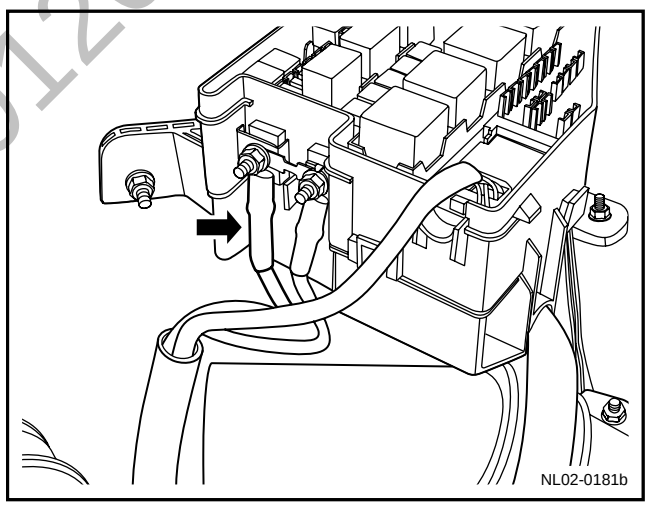
16. Dismantle the fixing bolts of clutch fuel tube bracket.



17. Dismantle fixing bolts of clutch slave cylinder.



18. Dismantle the engine wiring harness to the engine cabin junction box connecting cables and connectors.\



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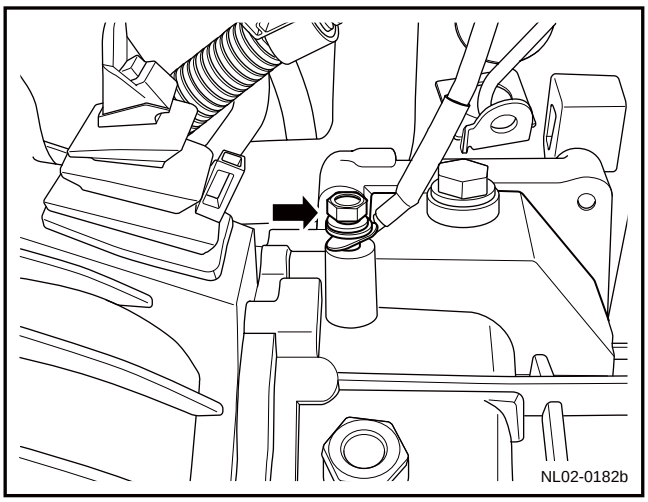
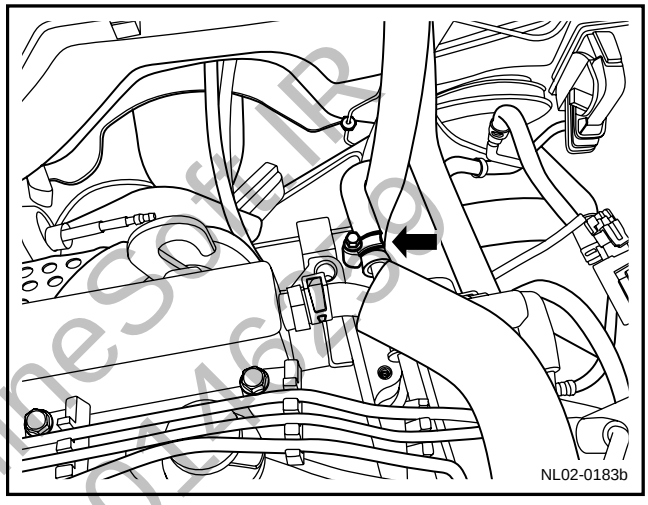
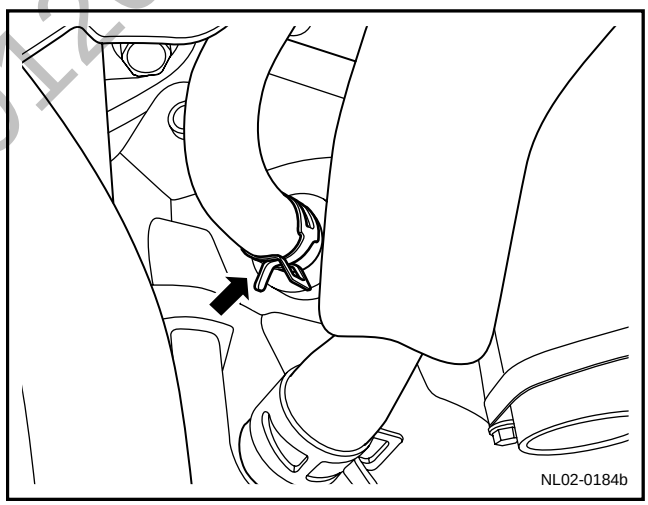
19. Dismantle battery negative cable gearbox shell grounding point.



20. Dismantle the fuel pipe.



21. Dismantle the canister vacuum tubes.



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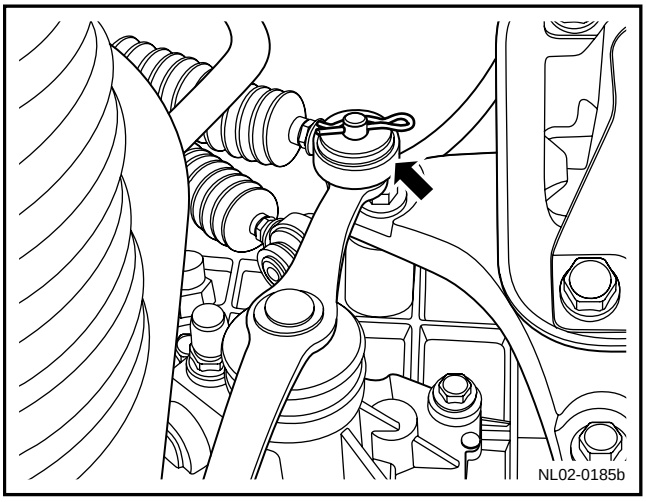
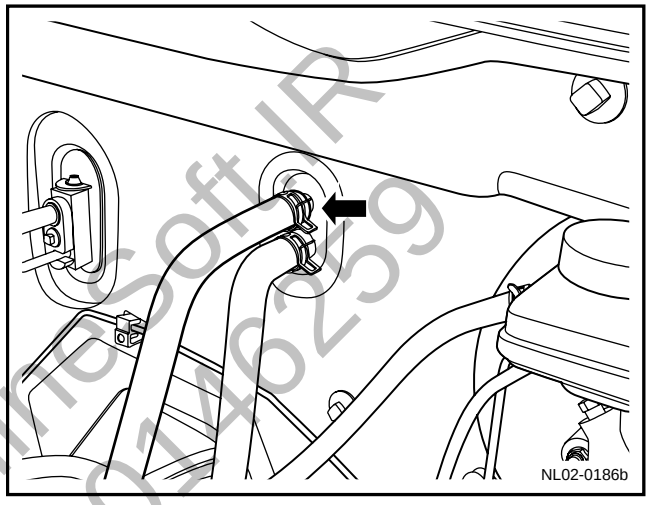
22. Dismantle gear shift lever cable.



23. Dismantle the heater intake and outlet pipes.



24. Dismantle the front wheels.

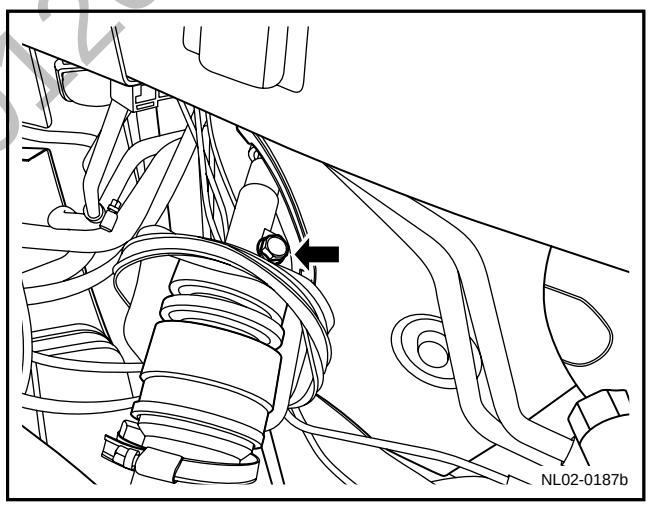
25. Lifting and Jacking the Vehicle

Warning: Refer to "Warning on Vehicle Lifting and Jacking" in "Warnings and Precautions".

26. Dismantle the gearbox oil discharge bolts until all the gearbox oil is discharged and reinstall. Refer to Gearbox Oil Level Inspection.

27. Dismantle the power steering gear tie rod lateral pin bolts.

Warning: Before remove the steering lateral pin bolt, remove the key from the ignition switch first and turn the steering wheel to lock position. Otherwise it will damage the airbag clock spring.



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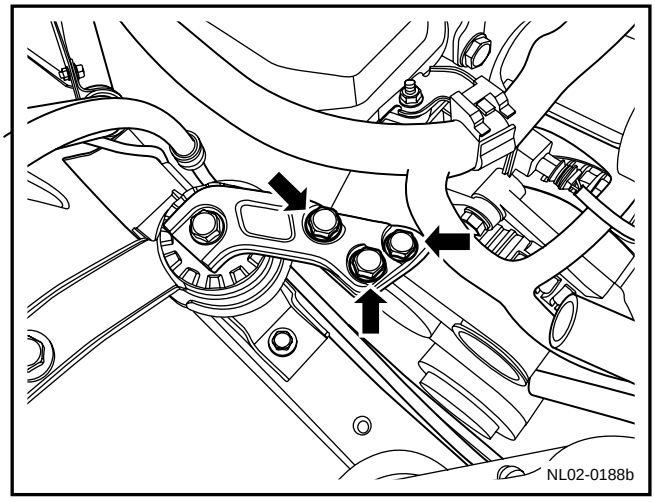
28. Refer to 12.6.4.3 "Replacement of Longitudinal Beam of Front Suspension" and 12.6.4.4 "Replacement of Front Subframe" to dismantle the longitudinal beam of front suspension, subframe and associated connectors.

29. Dismantle left and right drive shaft. Refer to 5.3.4.2 Replacement of drive shaft.

30. Place a mobile working table under the engine assembly to lower and support the powertrain assembly.



Warning: Make sure solid contact between the working table and the powertrain, otherwise it will result in human injury.

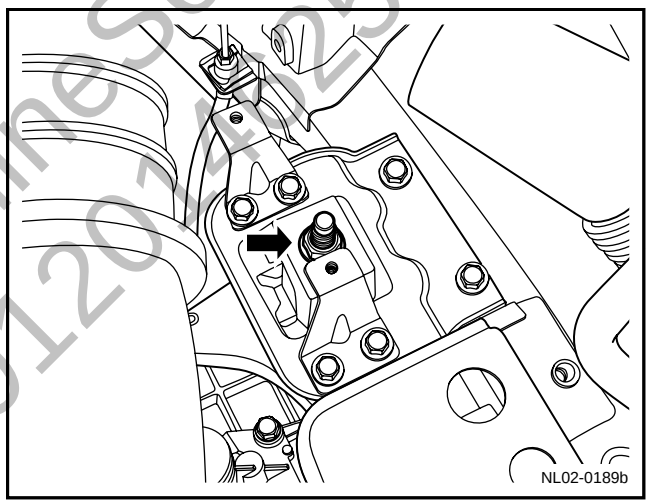
31. Dismantle the engine right suspension assembly .

32. Dismantle the gearbox left suspension assembly .

33. Lift the vehicle slowly to separate powertrain from the frame .

Note: In the lifting process, avoid the powertrain assembly tilt on the working table. Pay attention to the powertrain and vehicle body interference.

34. Use an engine lifting device to support the engine and then separate the engine and the gearbox. Refer to 3.3.8.3 Replacement of Gearbox.



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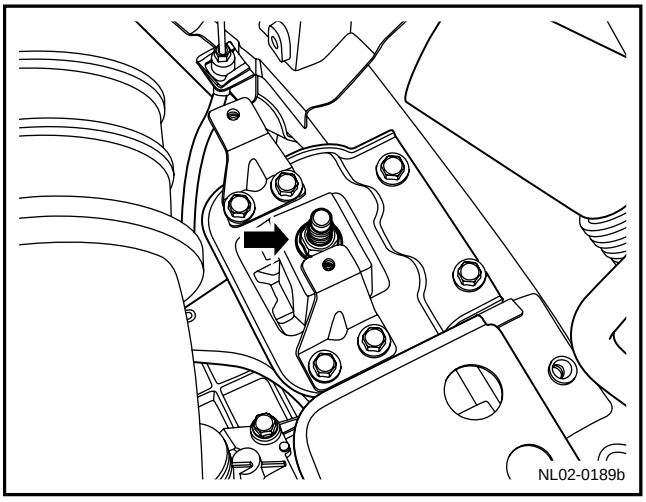
Installation Procedure:

1. Use the engine lifting device to support the engine and then connect the engine assembly and the gearbox assembly.
2. Place the powertrain assembly on the mobile working table, lift the vehicle and move the working table so the powertrain assembly moves back into the vehicle body frame.
3. Slowly lower the vehicle. Pay attention in the lowering process; do not interfere with the vehicle body frame.



Note: Make sure solid contact between the working table and the powertrain, otherwise it will result in personal injury.

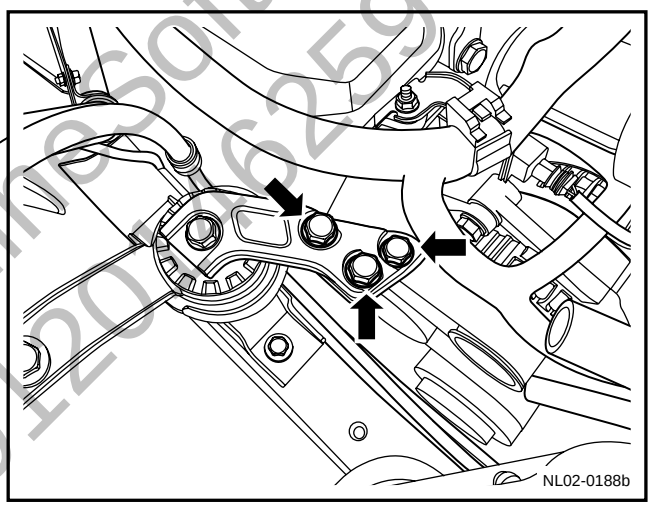
4. Install the engine right suspension assembly.

Torque :45Nm (Metric) 33 . 3lb-ft (English system)

5. Install the gearbox left suspension assembly.

Torque :50Nm (Metric) 37lb-ft (English system)

6. Lifting and Jacking the Vehicle
7. Install the left and right drive shafts.
8. Install the longitudinal beam of front suspension and front subframe.



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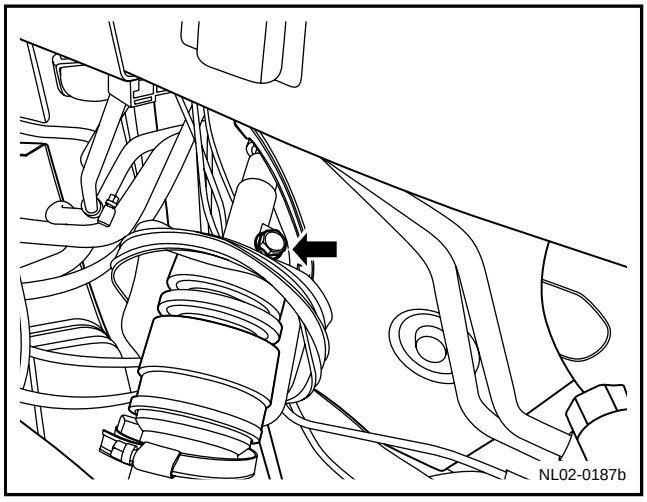
9. Install the power steering gear tie rod lateral pin bolts.

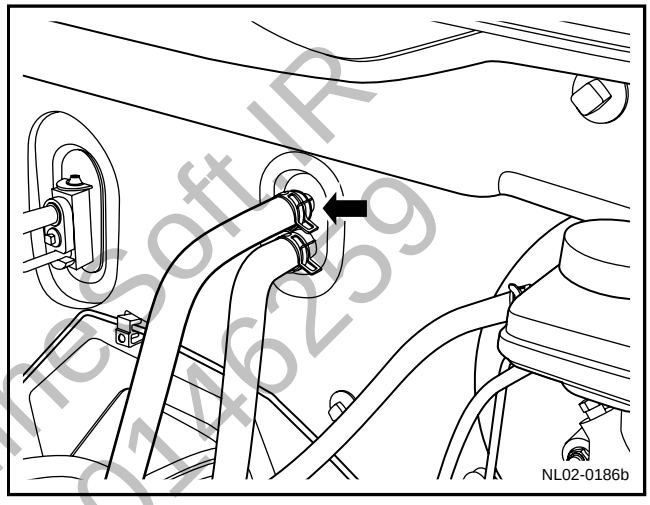
Refer to 3.3.8.1 “Inspect Gearbox Oil and Liquid Level” to inspect the tightness of the gearbox oil exhaust bolts and refill the gearbox oil.

11. Lower the vehicle.

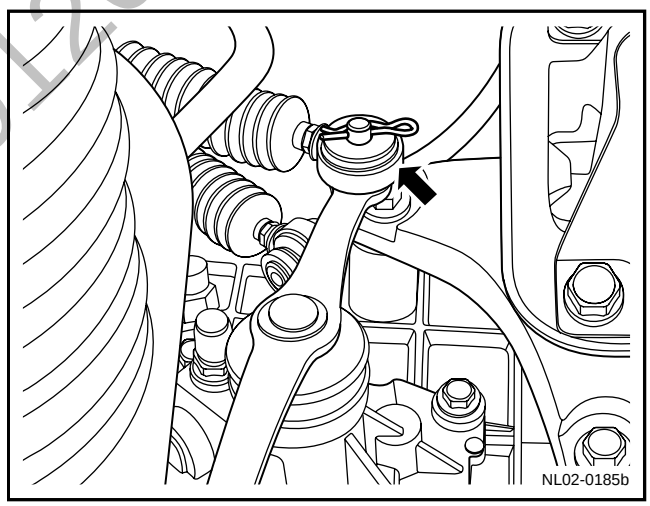
12. Install the front wheels.



13. Install the heater intake and outlet pipes.



14. Install gear shift lever cable.



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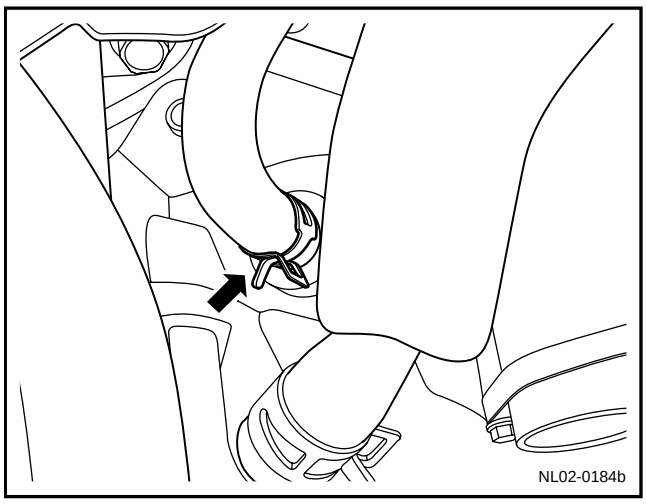
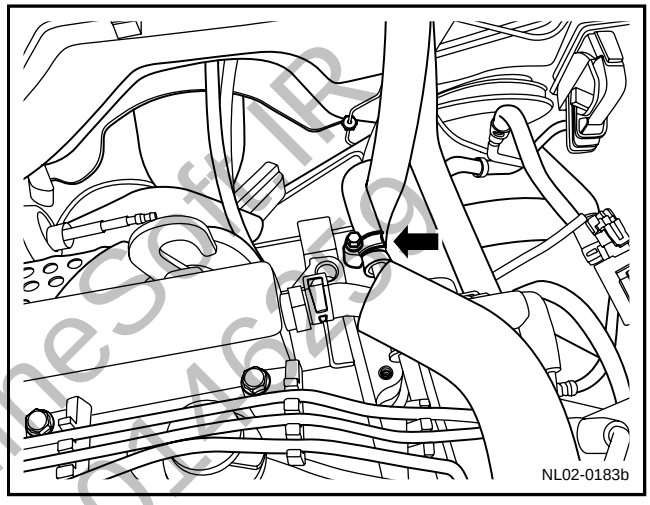
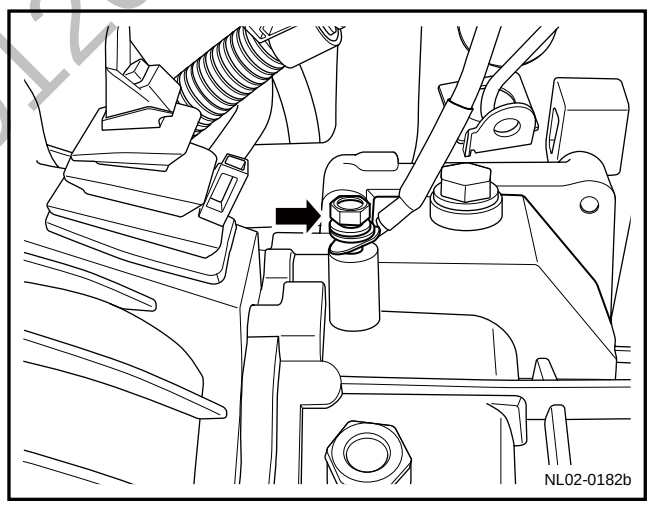
15. Install canister vacuum tubes.



16. Install the fuel pipe.



17. Install grounding point of battery negative cable in gearbox housing.



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18. Connect the engine wiring harness to the engine cabin junction box connecting cables and connectors.

19. Install fixing bolts of clutch slave cylinder.

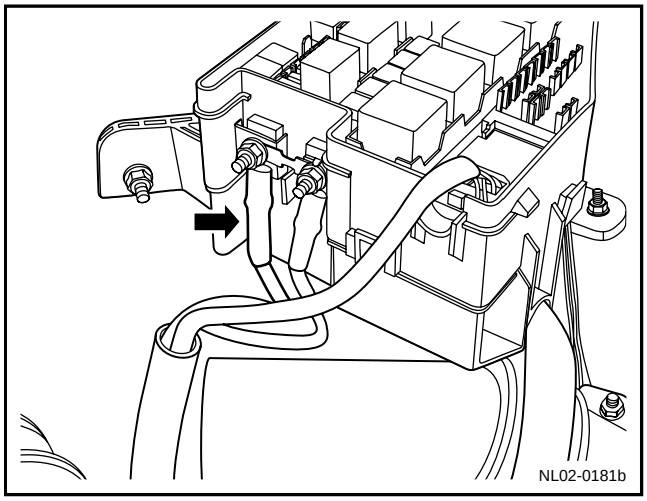
Torque :20Nm (Metric) 14 . 8lb-ft (English system)

20. Install and tighten the fixing bolts of clutch oil pipe bracket.

Torque:10Nm(Metric) 7.4lb-ft(English system)

21. Install the vacuum booster vacuum tubes.

22. Install the radiator inlet and outlet pipes.



23. Install radiator water outlet pipe.

24. Install the intake main pipe assembly.

25. Install the air-conditioning compressor high and low pressure connecting pipes.

Torque :18Nm (Metric) 13 . 3lb-ft (English system)

26. Connect the front and rear oxygen sensor harness connectors.

27. Connect the engine control unit and engine harness to the instrument panel harness connectors.

28. Install grove box of instrument desk .

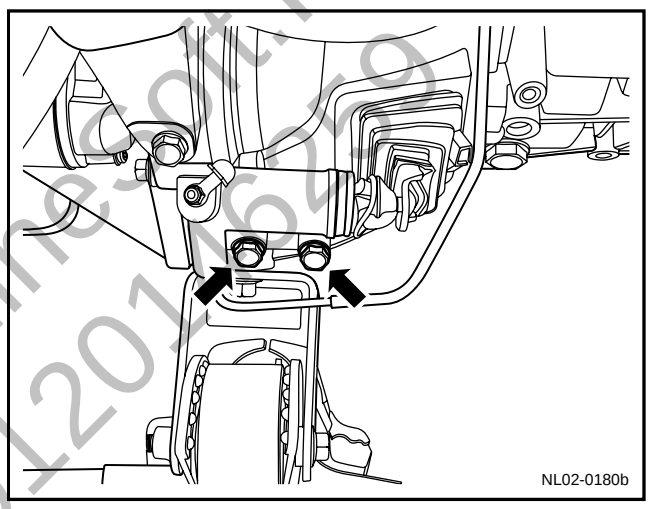
29. Install battery and bottom plate.

30. Install the Coolant Recovery Reservoir.

31. Fill engine coolant.

32. Fill the air-conditioning refrigerant .

33. Connect the battery negative cable .



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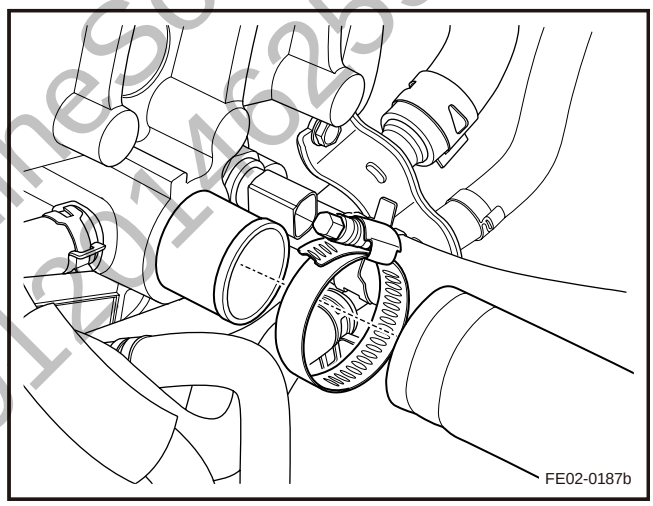
2.13.8.14 Replacement of Cylinder Hood Assembly

Dismantlement Procedure

1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Dismantle the plastic shield of engine. Refer to 2.13.8.1 Replacement of Plastic Shield of Engine.
3. Refer to 2.29.8.1 Engine Coolant Discharge and Filling to discharge the engine coolant.
4. Refer to "Replacement of Throttle Body Assembly" to dismantle the throttle body.
5. Refer to 2.13.8.6 "Replacement of Intake Manifold Assembly" to dismantle the intake manifold assembly.
6. For dismantlement of the exhaust manifold, see "2.7.6.1 Replacement of Exhaust Manifold".
7. Dismantle ignition coil and ignition guide wire. refer to“2 . 10 . 8 . 3 ignitioncoil replacement ” .
8. Refer to 2.13.8.2 "Replacement of Cylinder Hood Cover" to dismantle the cylinder hood cover.
9. Refer to 2.13.8.3 "Replacement of Drive Belt" to dismantle the drive belt.
10. Dismantle the engine mounting. Refer to 2.13.8.7 Replacement of Engine Mount.
11. Refer to 2.13.8.10 "Replacement of Timing Chain Cover" to dismantle the timing chain cover.
12. Refer to 2.13.8.10 "Replacement of Timing Chain" to dismantle the timing chain.
13. Refer to 2.2.8.2 “Replacement of Fuel Injector” to dismantle the fuel distributing pipe assembly.
14. Refer to 2.2.8.6 "Replacement of temperature sensor of engine coolant" to disconnect the temperature sensor of engine coolant harness connector.
15. Refer to 2.10.8.1 "Replacement of Camshaft Position Sensor" to dismantle camshaft position sensor.
16. For dismantling of VVT electromagnetic valve, refer to "2.2.8.4VVT Replacement of electromagnetic valve and cleaning of electromagnetic valve filter element".



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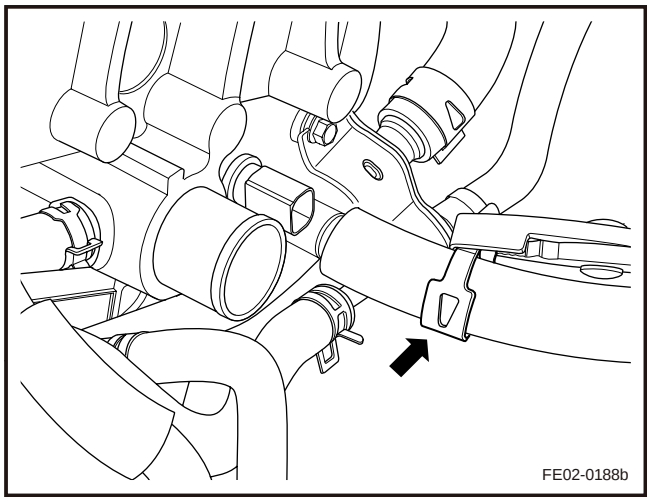
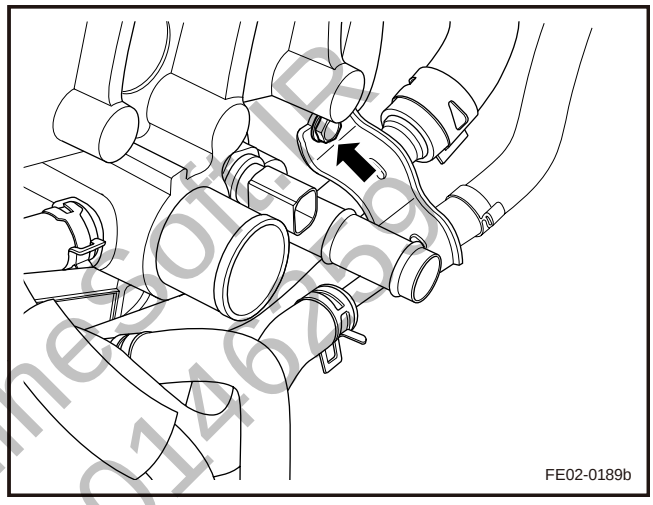
17. Refer to 2.13.8.12 “Replacement of Camshaft” to dismantle the camshaft.

18. Dismantle the radiator inlet pipes.

19. Dismantle the warm water pipe for the heater tank.

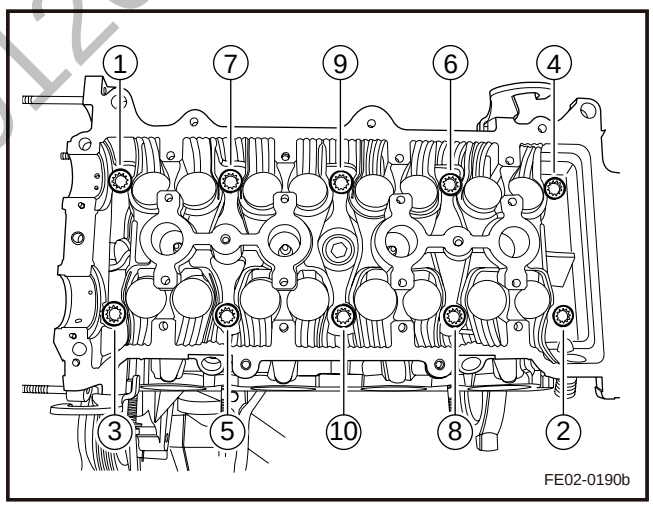


20. Dismantle the fixing bolts of small cycle pipes cylinder head.



21. Dismantle the cylinder hood bolts according to the sequence in the figure.

Note: When the engine is hot, it is prohibited to dismantle the cylinder hood, as this will cause the cylinder hood distortion.



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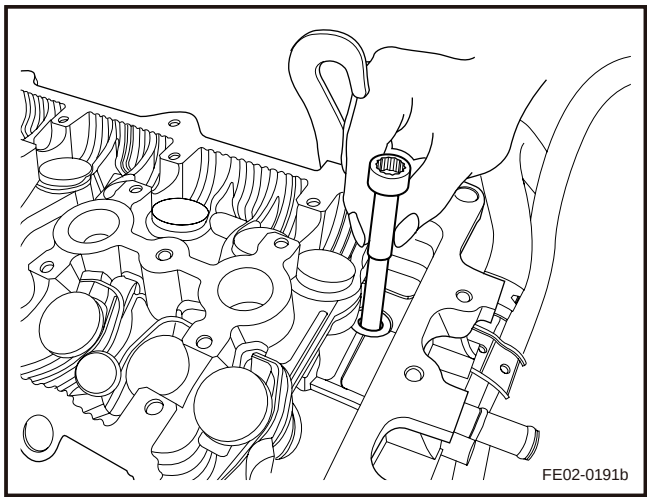
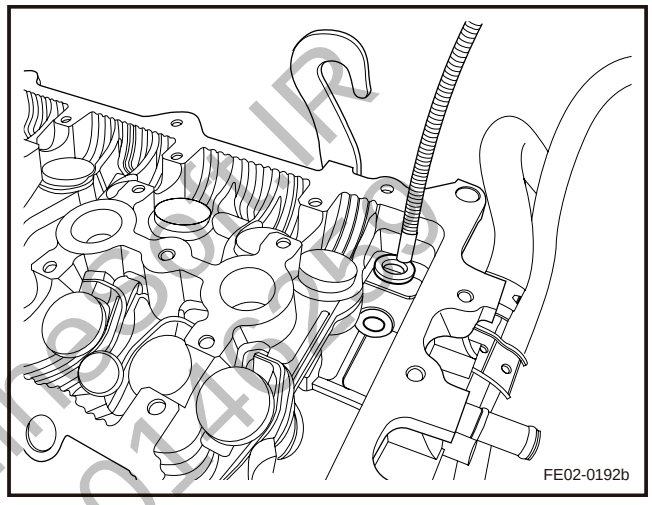
22. Remove the cylinder hood bolts.

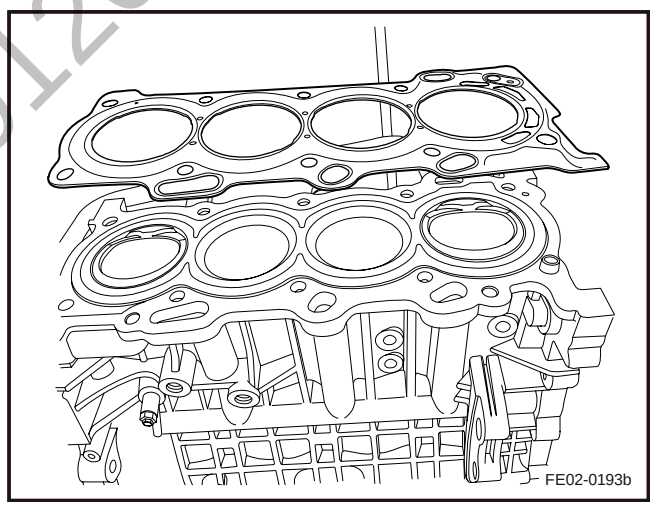
Note: Due to confined space, cylinder head bolts and bolt gaskets can not be removed together.



23. Remove the cylinder hood bolt gasket with a magnetic stick.



24. Dismantle the cylinder hood gasket.



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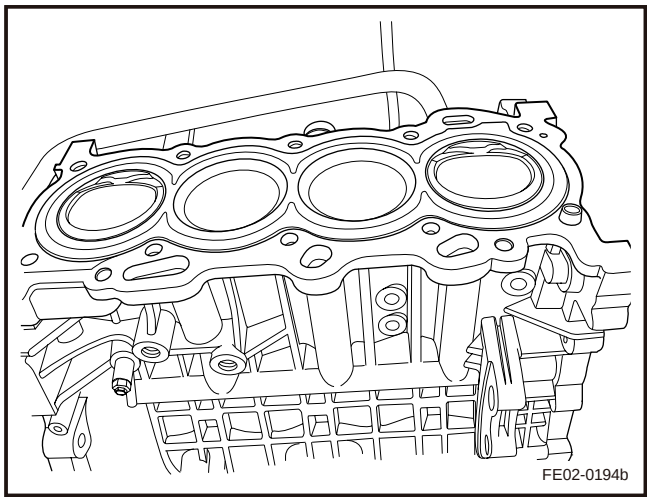
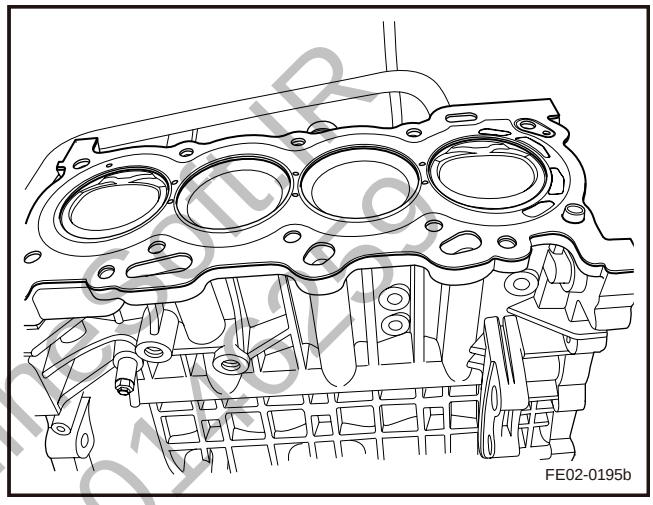
Installation Procedure:

1. Clean cylinder hood and engine body gasket surface.

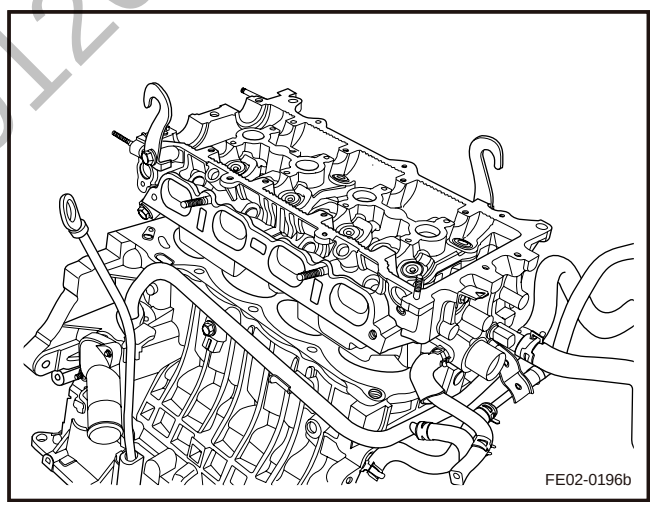


2. Install the cylinder hood gasket.

Note: the cylinder head gasket as a single use piece must be placed with a new one!



3. Install cylinder head assembly.



Machine Repair
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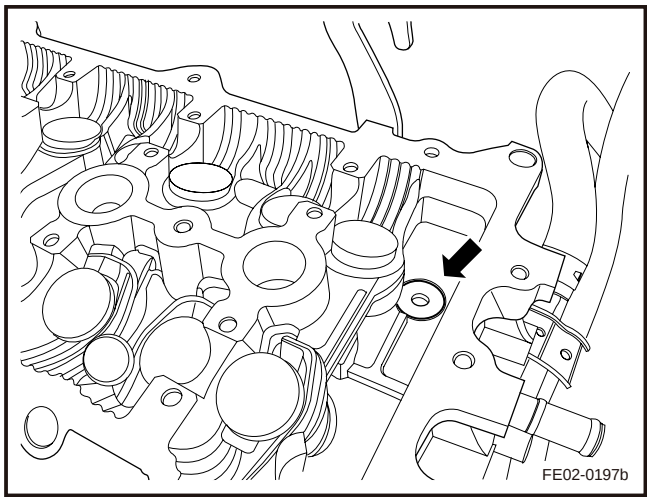
4. Install the cylinder hood gasket bolt gaskets.

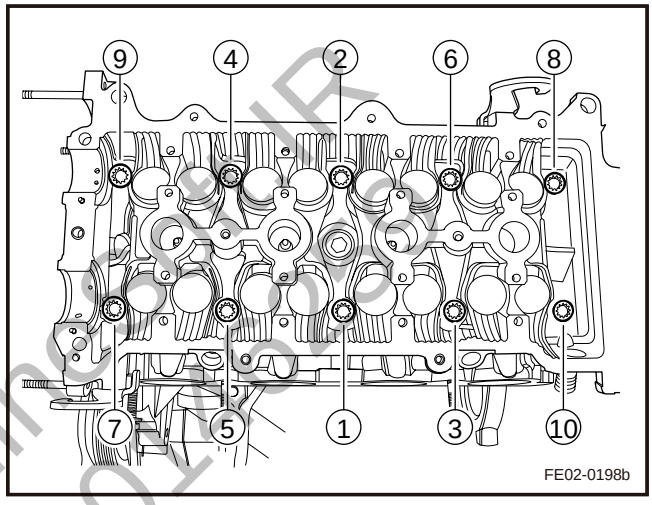


5. Install and tighten the cylinder hood bolts, according to the sequence in the graph.

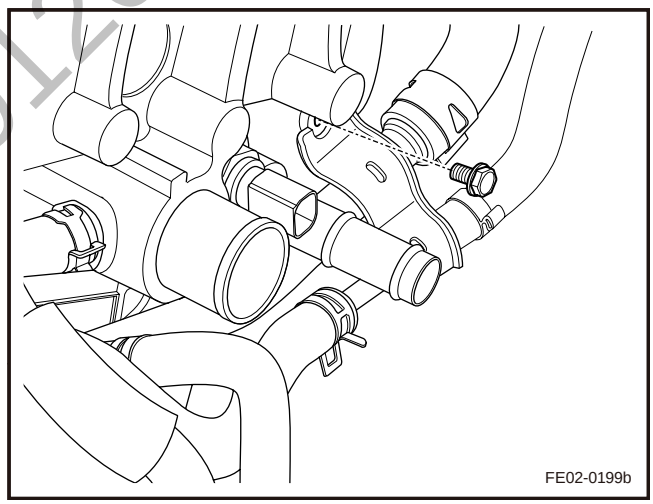
Torque

First49N . m(Metric) 36 . 3lb-ft(English system)

Second 80N . m(Metric) 59 . 1lb-ft(English system)



6. Install the fixing bolts of small cycle pipes cylinder head.



Machine 88HR
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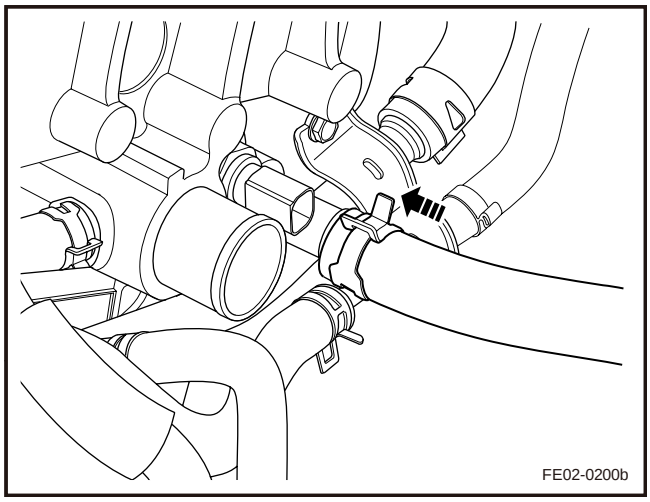
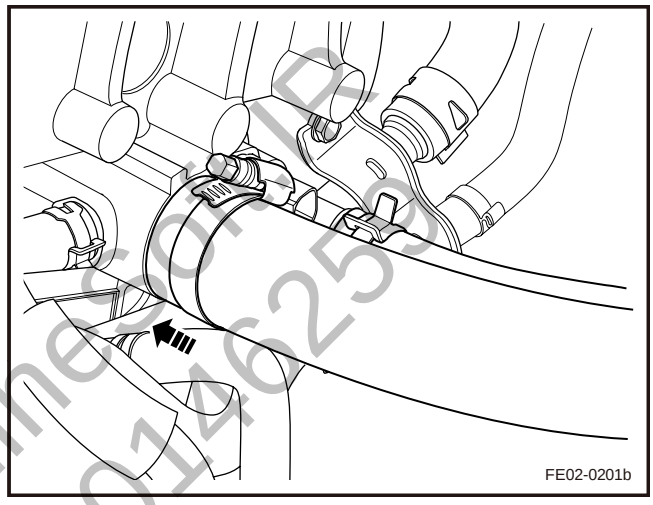
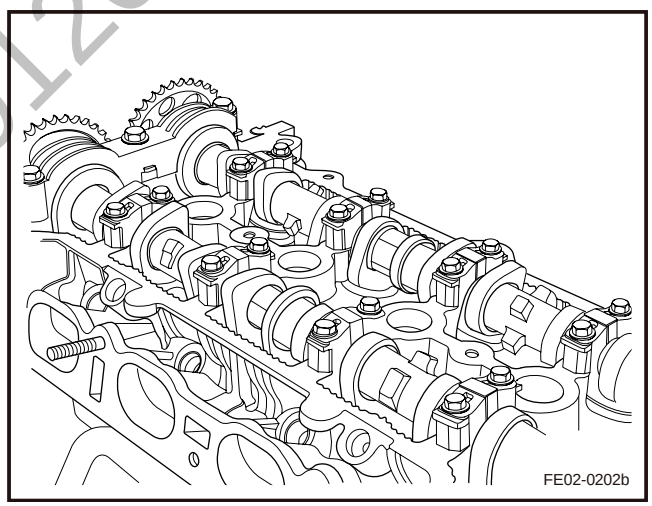
7. Install the warm water pipe for the heater tank.



8. Install the radiator inlet and outlet pipes.



9. Install camshaft.



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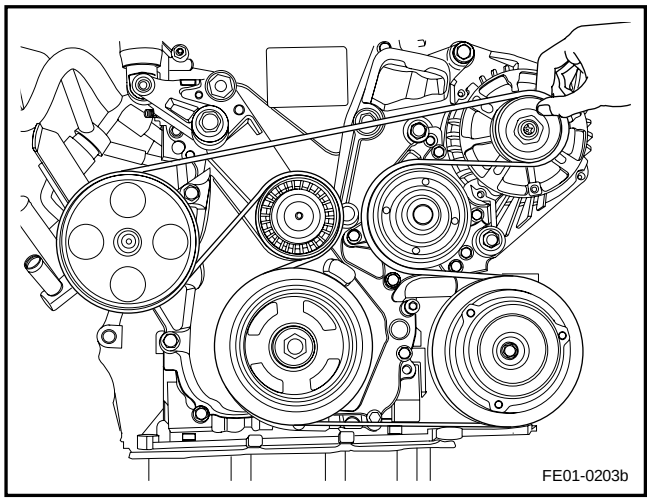
10. Install the VVT solenoid valve.
11. Install the camshaft position sensor.
12. Install the engine coolant temperature sensor wiring harness connector.
13. Install the fuel distributing pipe assembly.
14. Install timing chain
15. Install the timing chain cover.
16. Install the engine mounting.
17. Install the drive belt.
18. Install the cylinder hood cover.
19. Install the ignition coil and ignition wire.
20. Install air exhaust manifold.
21. Install air intake manifold assembly.
22. Install the throttle body.
23. Fill the engine coolant.
24. Install the plastic shield of engine.
25. Connect battery negative cable.



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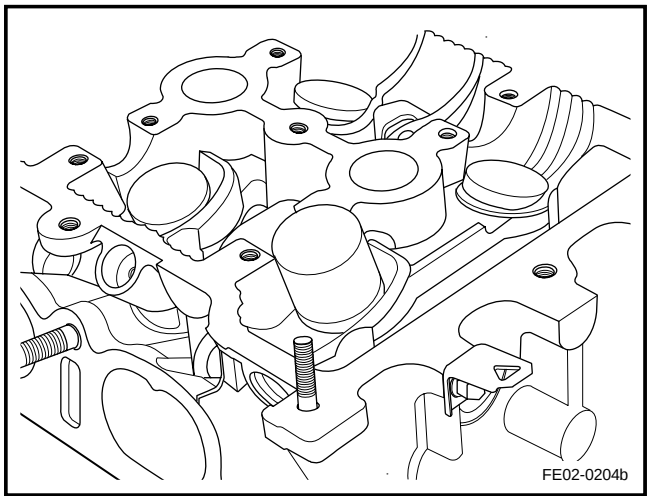
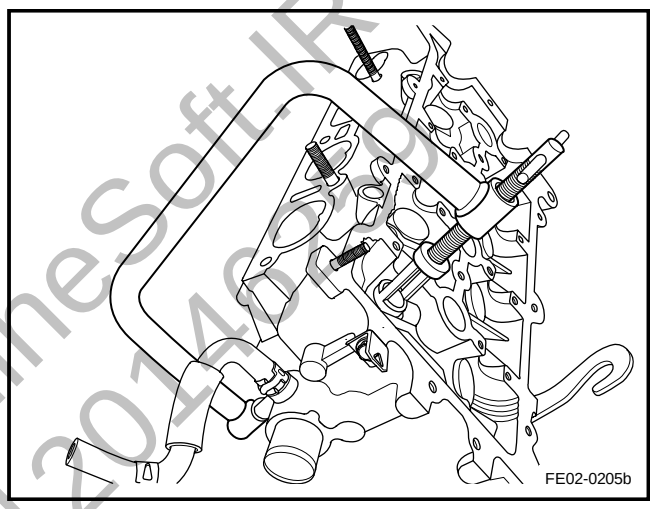
2.13.8.15 Cylinder Hood Assembly Disassembly and Assembly

Dismantlement Procedure

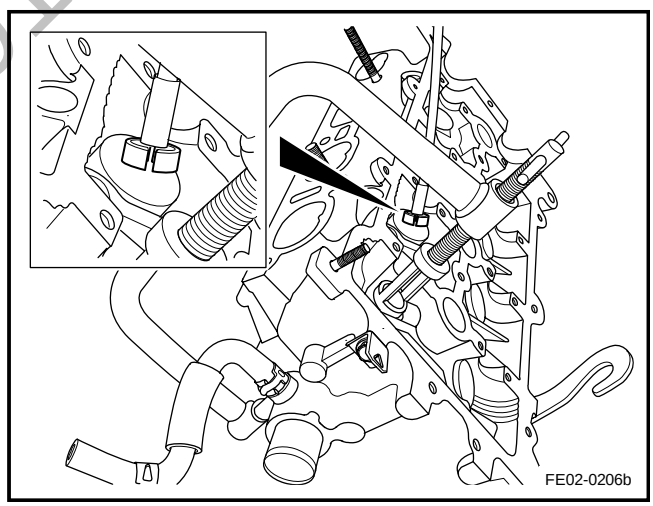
1. Refer to 2.13.8.14 “Replacement of Cylinder Hood Assembly” to dismantle the cylinder hood assembly.
2. Dismantle the valve Lifter.



3. Use a special tool to compress the valve springs.



4. Remove the valve locking plate with a magnetic stick.



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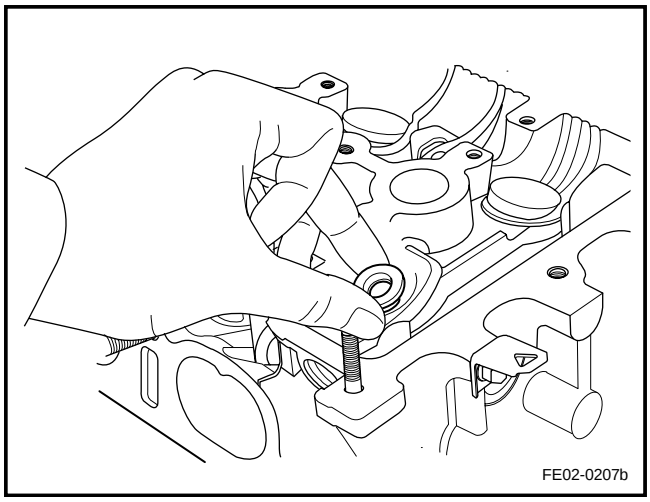
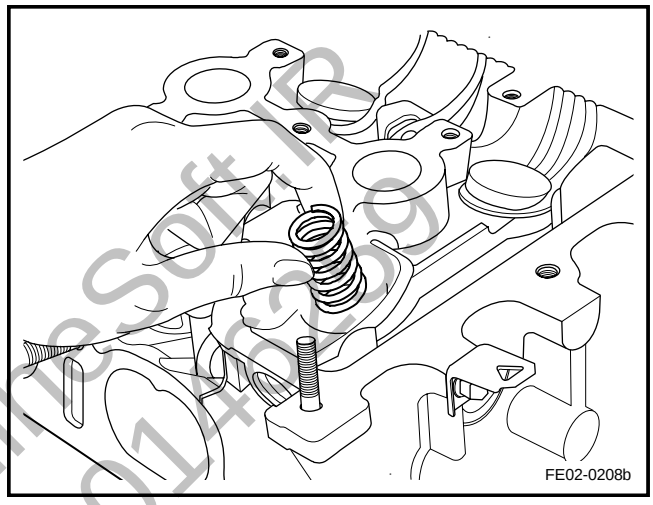
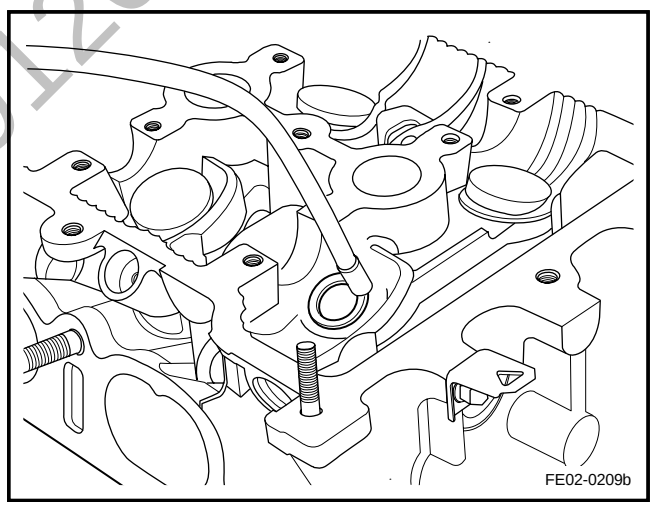
5. Remove the special tools and remove the valve spring seat.



6. Remove the valve spring.



7. Remove the valve spring pads with a magnetic stick.



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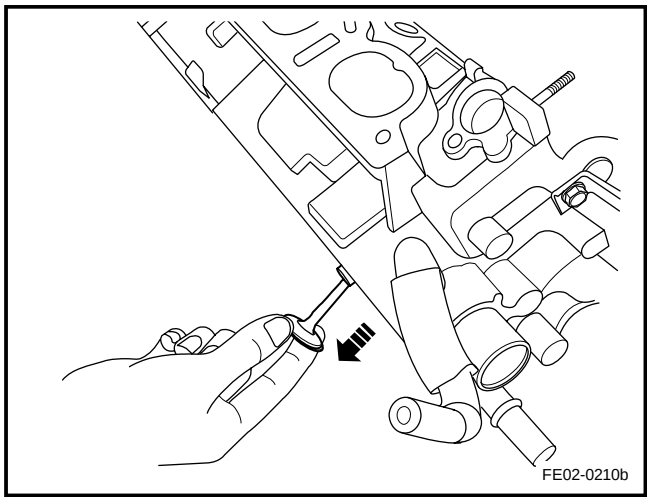
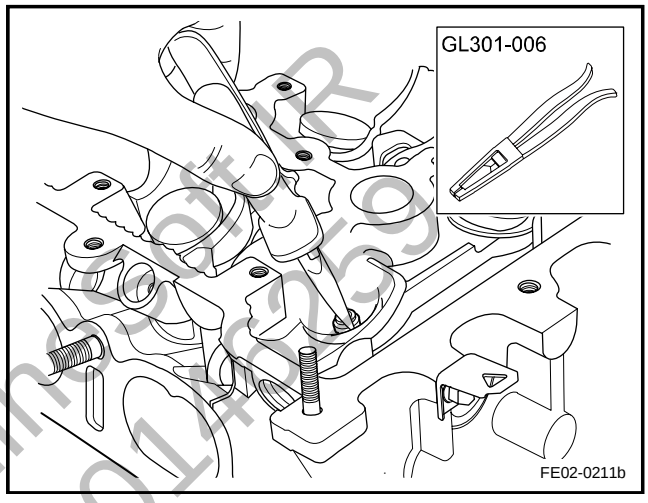
8. Dismantle the valve, mark the original position of the valve in order to re-install.

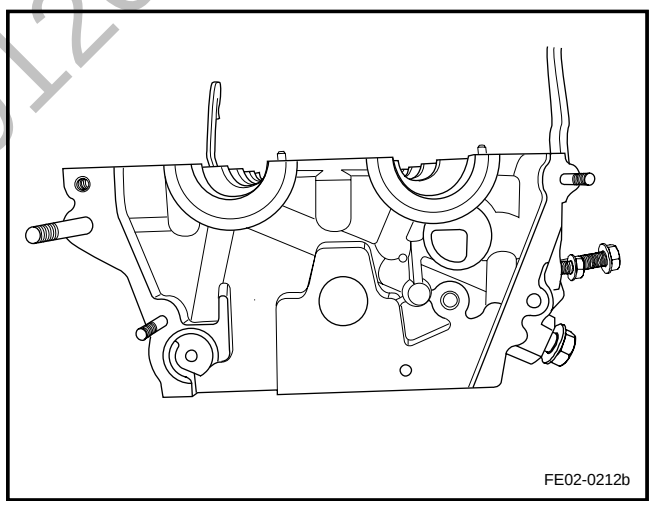


9. Dismantle the valve seals with the special tool GL301-006.



Cleaning for check:

1. Clean the contacting surface with the cylinder gasket.
2. Clean the mating surface with the cylinder hood cover.
3. Inspect and confirm that the cylinder hood and cylinder seal gasket contacting surface has no scratches.
4. Inspect and confirm that the cylinder seal gasket contacting surface has no leakage or channeling gas.
5. Inspect whether there are cracks on the cylinder hood.
6. Refer to 2.13.1.2 "Engine Mechanical System Specification" to measure the height of the cylinder hood within the measurement



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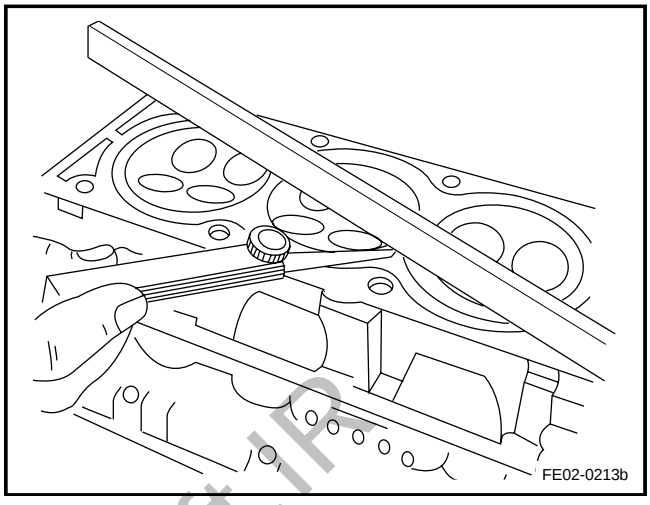
allowance. If the height is lower than the standard value, replace the cylinder hood.

Standard value :114 . 95mm/4 . 5281in

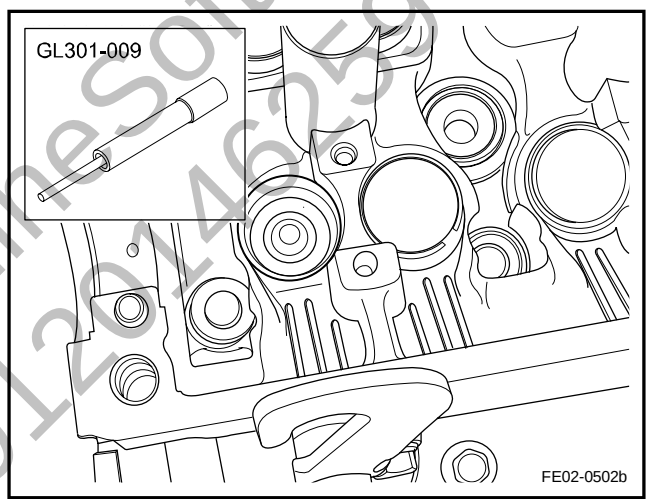
7. Inspect and confirm that the sealing surface has no distortion and warping and the cylinder hood sealing surface flatness must be within **0.05 mm (0.002 in).**



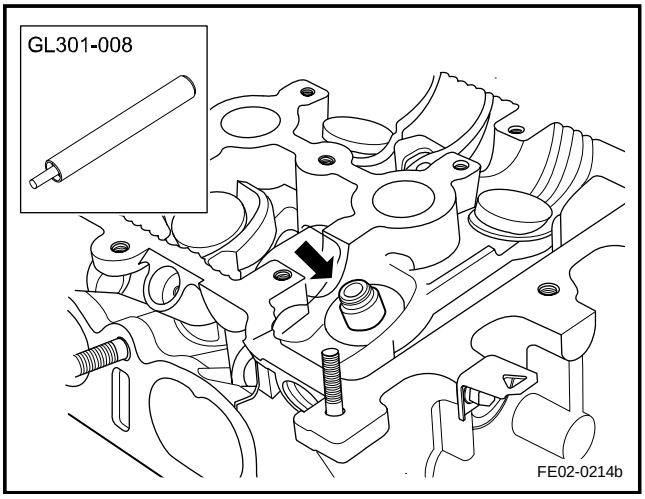
8. Inspect and confirm that valve seat ring has no excessive wear and burnt places.

Installation Procedure:

1. Use a special tool to install GL301-009 valve guide.



2. Use a special tool GL301-008 to install the special valve seals.



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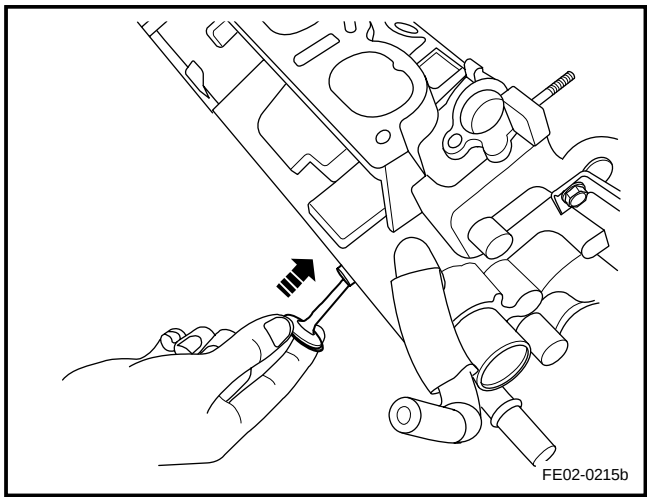
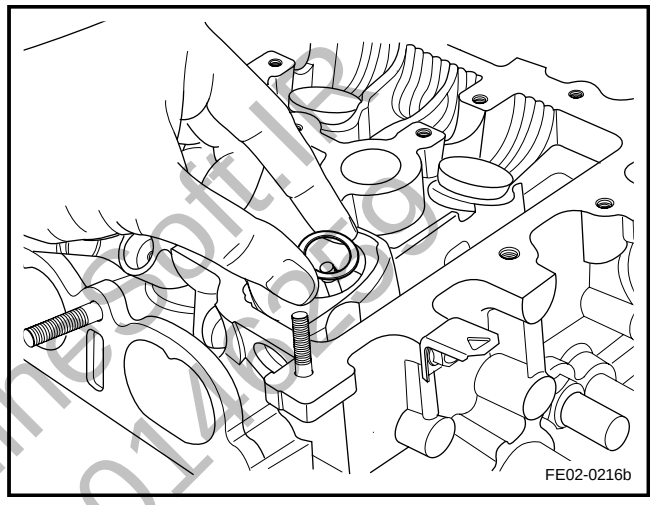
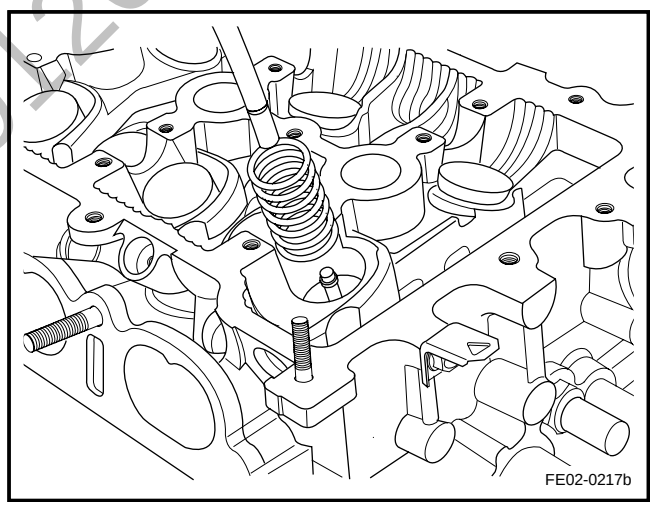
3. Install the valves.



4. Install the valve spring pads.



5. Install the valve springs.



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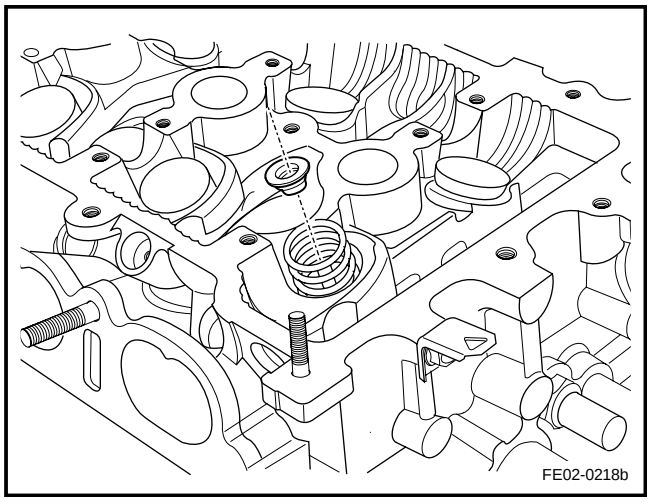
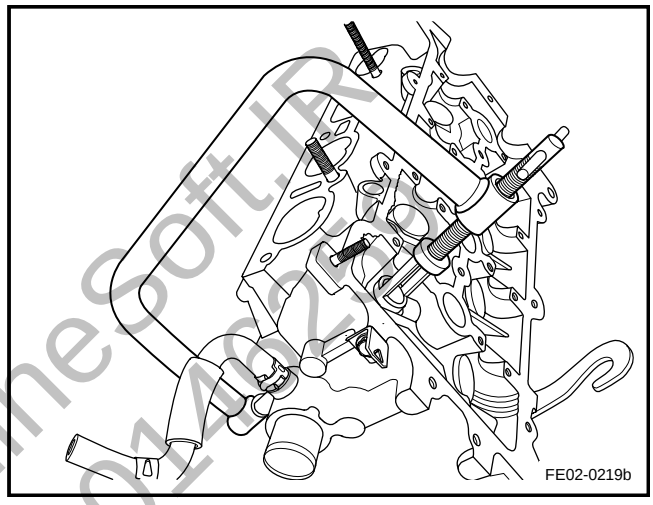
6. Install the valve spring seat.



7. Use a special tool to compress the valve springs and install the valve spring locking pieces.

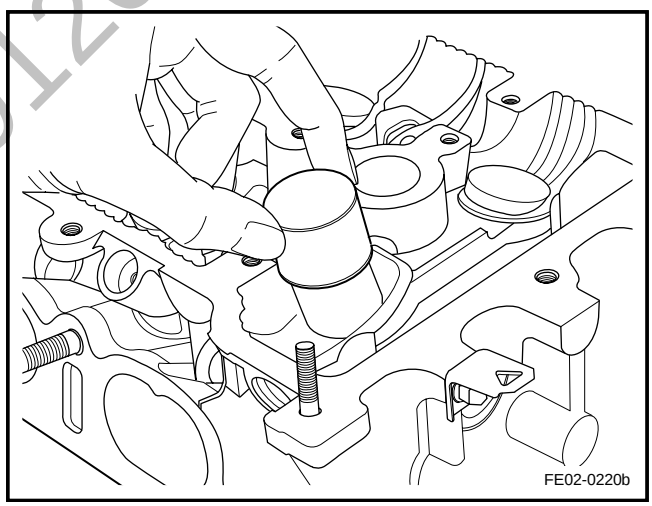


8. Confirm locking pieces is in place. slowly remove the special tool with a wood hammer gently knock the valve, so that the valve is in place.

Warning: Do not apply excessive force, otherwise the valve spring might pop up and cause personal injury.

9. Install the valve lifter.

10. Install the cylinder hood assembly.



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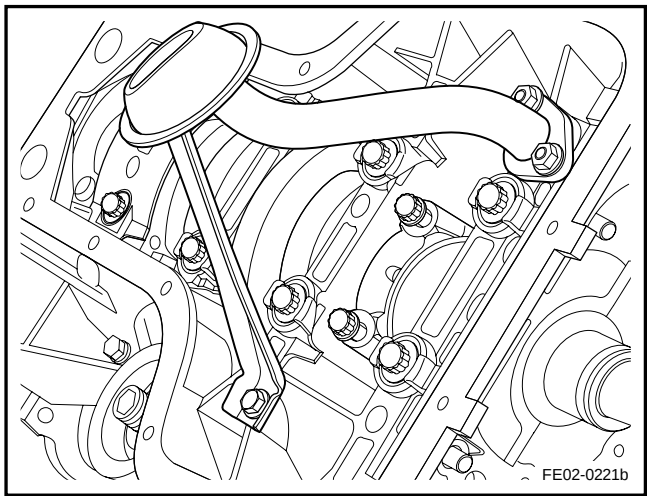
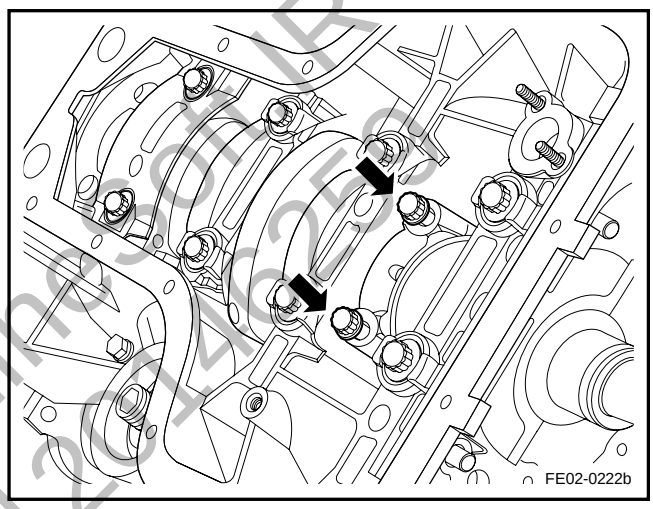
2.13.8.16 Replacement of Piston, Connecting Rod and Connecting Rod Bearing

Dismantlement Procedure

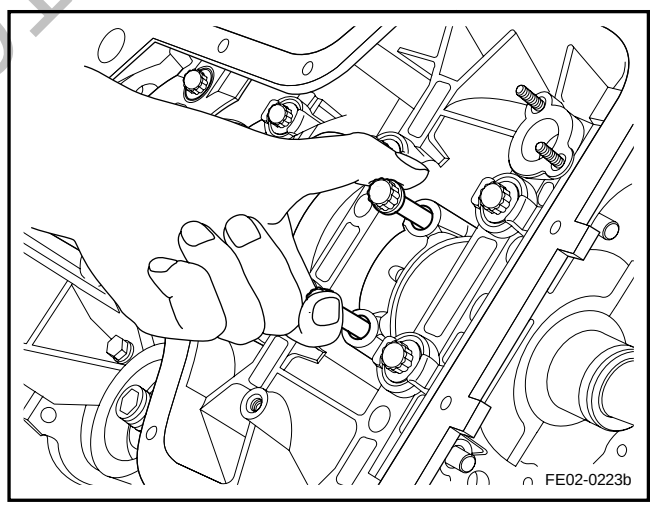
1. Dismantle the engine. Refer to 2.13.8.13 Replacement of Engine.
2. Refer to 2.13.8.14 "Replacement of Cylinder Hood Assembly" to dismantle the cylinder hood.
3. Dismantle oil pan, refer to 2.9.8.3 Replacement of Oil Pan.
4. Dismantle the filters.



5. Rotate the crankshaft, so that the cylinder NO.1 and 4 are at BDC positions. Dismantle the cylinder NO.1 rod bearing cap bolts.



6. Hold the connecting rod bolts and take out the Cylinder #1 connecting rode bearing cap and mark the Cylinder #1 position on the bearing cap.



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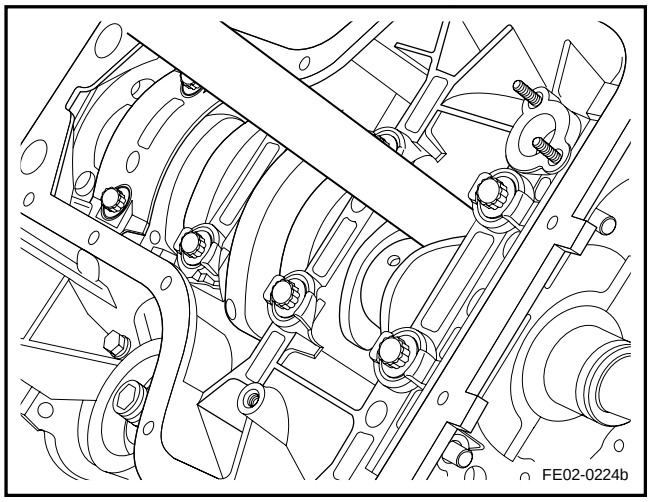
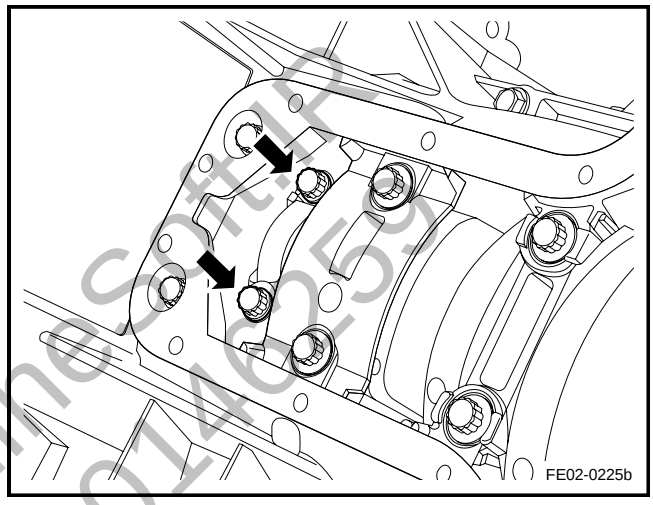
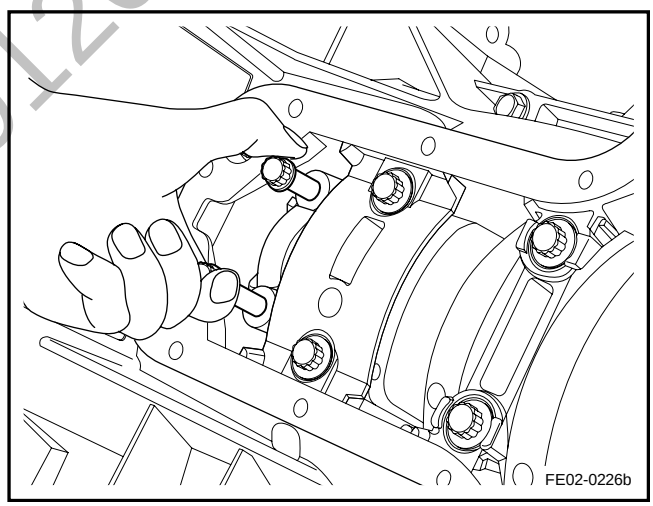
7. Drive #1 cylinder piston and connecting rod assembly with a wooden stick and mark the position of #1 cylinder on the piston and connecting rod assembly.



8. Remove the bolt for the #4 cylinder connecting rod bearing cover.



9. Hold the connecting rod bolts and take out the Cylinder #4 connecting rode bearing cap and mark the Cylinder #4 position on the bearing cap.



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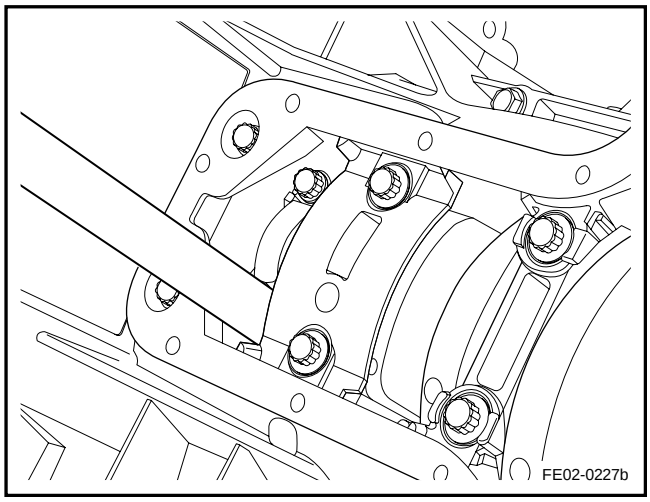
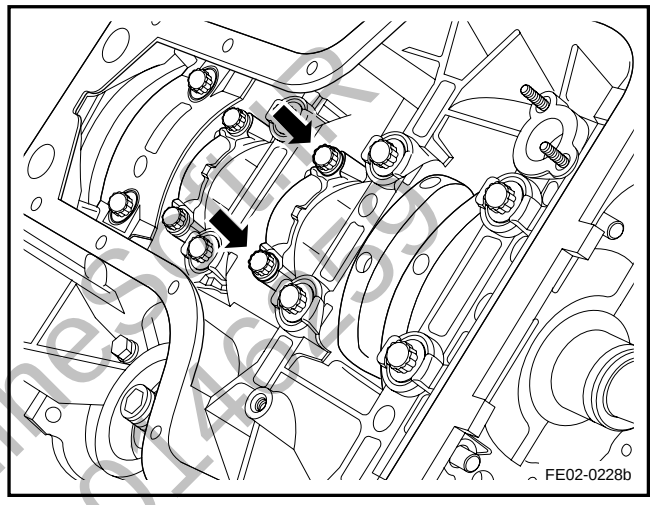
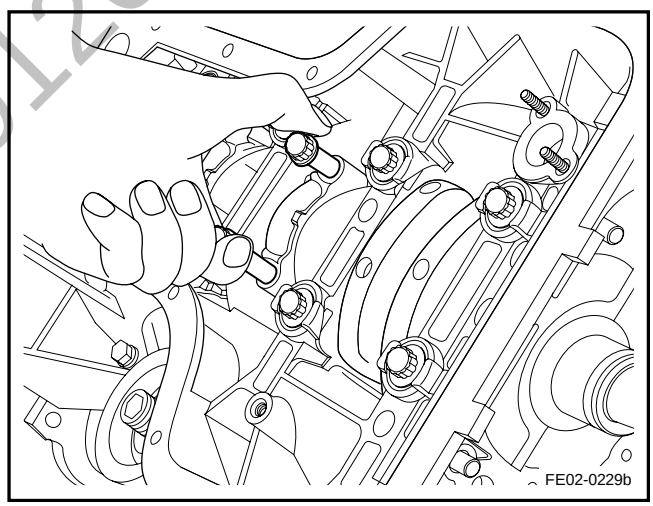
10. Use wooden handle to push out cylinder 4 piston connecting rod assemblies, and mark the position of cylinder 4 on piston and connecting rod assemblies.



11. Rotate crankshaft to180?, make 2-3 cylinders on lower stop point position, and then dismantle bolt of connecting rod bearing cover of cylinder 2.



12. Hold the connecting rod bolts and take out the Cylinder 2 connecting rode bearing cap and mark the Cylinder 2 position on the bearing cap.



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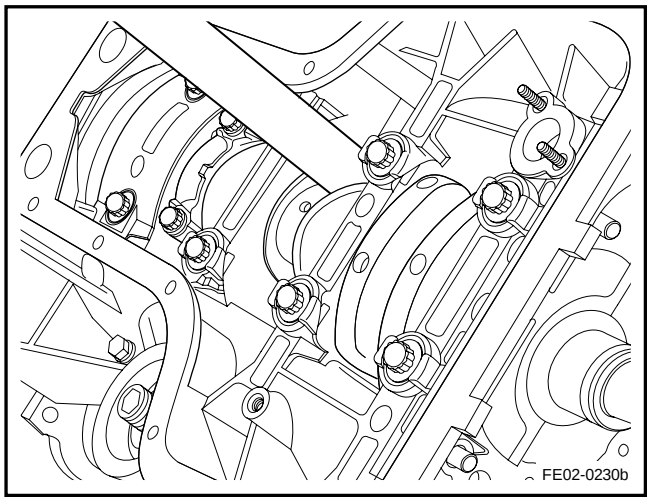
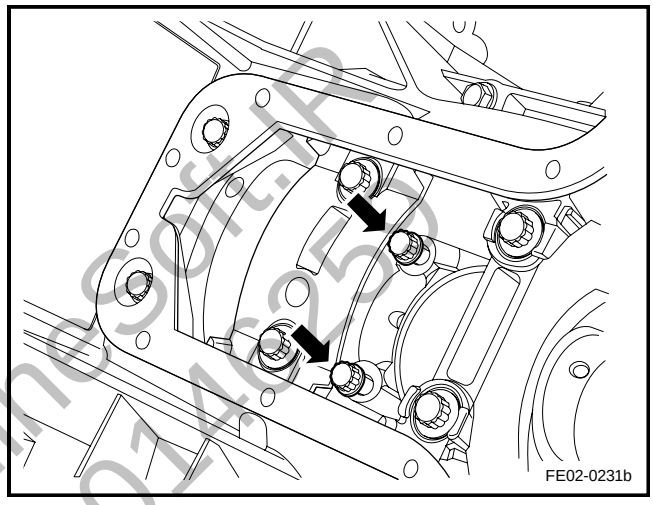
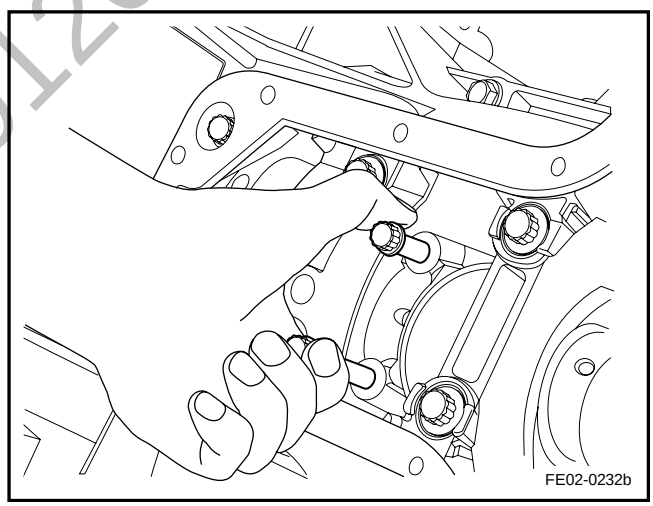
13. Use wooden handle to push out piston connecting rod components of cylinder 2, and mark the position of cylinder 2 on piston and connecting rod components.



14. Remove the bolt for the #3 cylinder connecting rod bearing cover.



15. Hold the connecting rod bolts and take out the Cylinder 3 connecting rode bearing cap and mark the Cylinder 3 position on the bearing cap.



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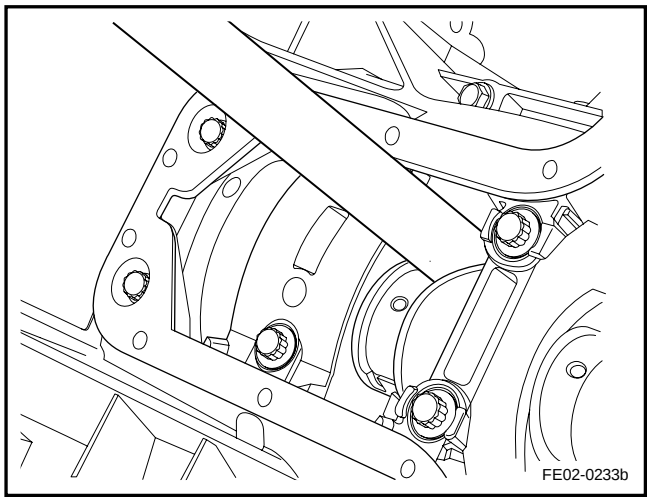
16. Use wooden handle to push out piston connecting rod components of cylinder 3, and mark the position of cylinder 3 on piston and connecting rod components.



Carry out the following inspection procedures prior to the installation of the piston.

1. Inspect whether the rod is bent or distorted. If the rod is bent or distorted, replace the connecting rod.

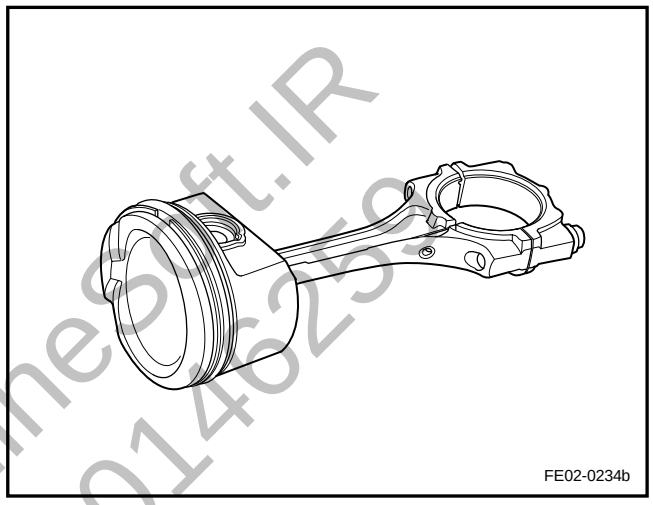
Cross degree: 0.03/100 (metric) 0.001/3.9 (Inch)

Twisted Degree: 0.05/100 (Metric) 0.002/3.9 (English system)

2. Inspect the connecting rod bearings.
3. Inspect whether the bottom rod is worn.
4. Inspect whether the connecting rod upper end is scratched.
5. Inspect whether there is the crankshaft connecting rod bearing journal wear and tear.
6. Inspect whether the piston is scratched, cracked and worn.
7. Inspect the piston and piston pin mating.

Standard value: 0 . 005-(-0 . 001mm)(Metric)

0.0002-(-0.00004in)(English system)



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8. Inspect piston pin and connecting rod clearance.

Standard value :0 . 005 ～ 0 . 011mm(Metric)

0.0002～0.0004in (English system)

9. Check the fitting clearance between the piston pin and piston pin hole.

Standard Value

(-0.001)-0.005 mm (Metric) (-0.00003)-0.0002 in (English system)

10. Inspect whether the engine block cylinder bore is worn, runout and taper.

11. Inspect whether the engine block cylinder bore is polished, if necessary, slightly polish the cylinder bore.

12. With a ruler and gap regulator, inspect the engine block top surface flatness.

Standard value :0 . 05mm(Metric) 0 . 002in(English system)

13. Select a new set of piston rings, use a gap regulator to measure piston ring end gap.

Oil ring end gap:0,20 ～ 0,70mm(Metric)/0,0079 ～ 0,0276in(English system)

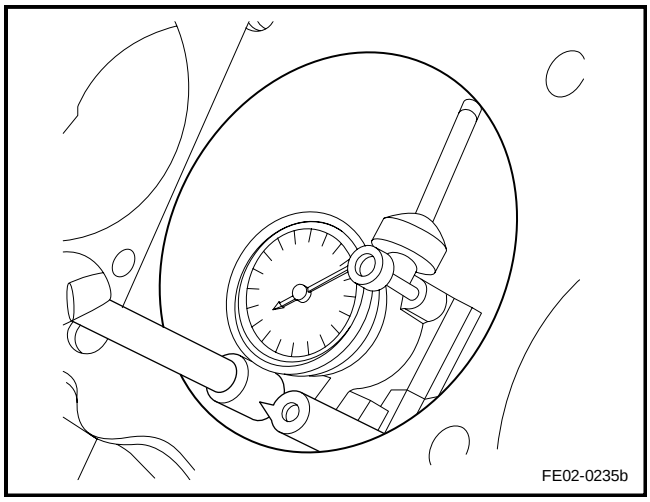
The second compression ring end gap: 0.40-0.55mm (Metric)/ 0.0157-0.0217in (English system)

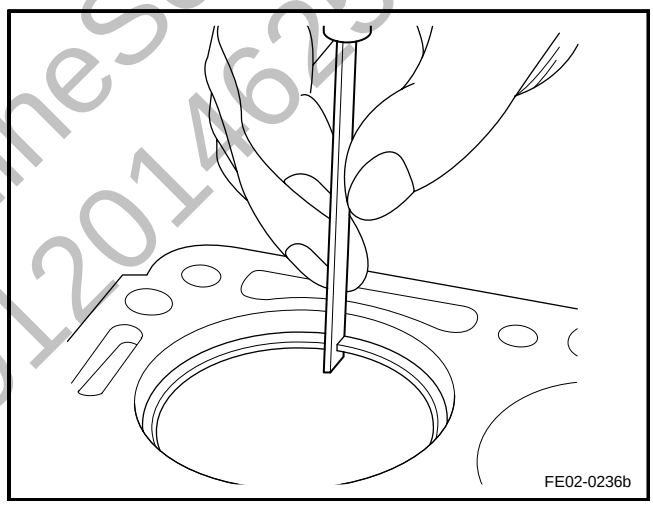
The first compression ring end gap: 0.25-0.35mm (Metric)/0.0098-0.0138in (English system)

14. Inspect the connecting rod bearings gap.

Standard velue： 0.020 ～ 0.044 mm(Metric)/0.0007 ～ 0.0017 in（English system）

15. Inspect the connecting rod bearing clearance.





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Standard value： 0.16 ～ 0.342 mm(Metric)/0.006 ～ 0.0135 in（English system）

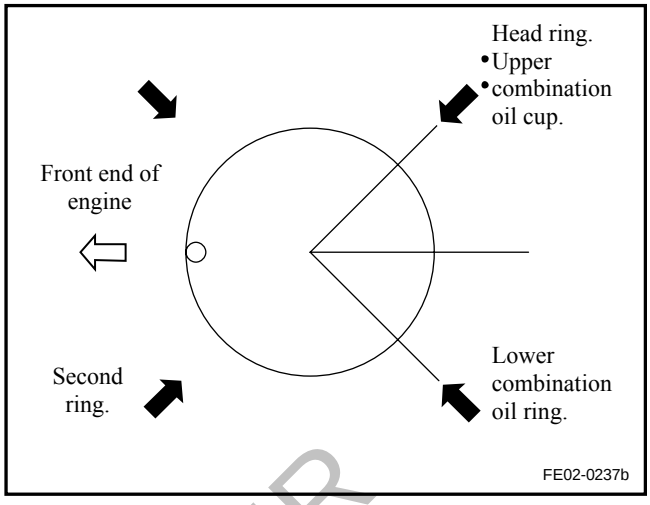
Installation Procedure:

1. install piston rings.

Important precaution : Note when installing the piston rings, do not expand too much, otherwise it will break the piston rings.

2. Install the piston rings to the location as shown in the graphic.

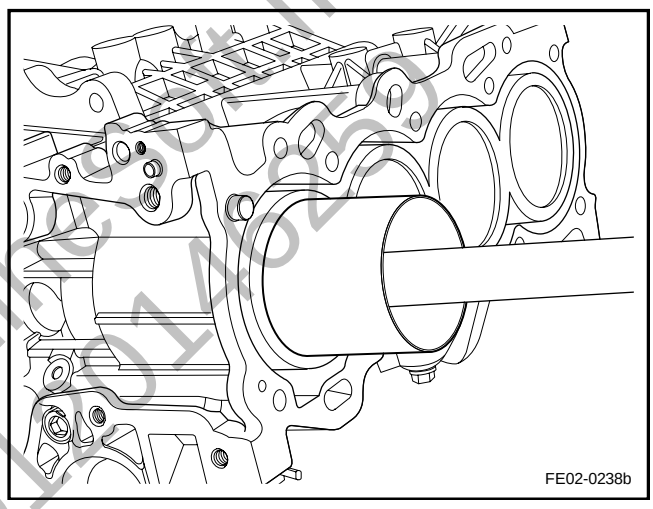
Important precaution : Oil ring opening can not be parallel to the piston pin axis.



3. Lubricate the cylinder wall with the new engine lubrication oil.

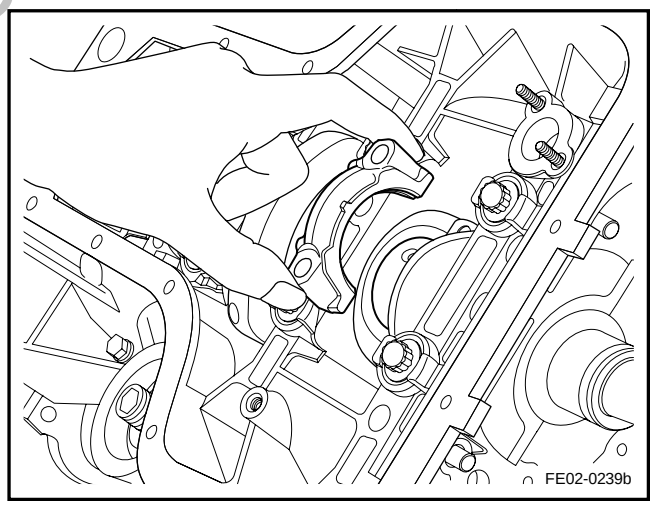
4. Lubricating piston of new engine lubricating oil should be used. Use special tool and wooden handle to install cylinder 1 piston connecting rod components marked with position of cylinder.

Note: The dot mark on the piston top surface should face to the engine front end. During installation, pay attention to the lower end of the connecting rod, avoiding damage due to hitting the crank journal.



5. Install the cylinder No.1 connecting rod bearing cap marked with cylinder No.1 location.

Note: The dot mark on the bearing cap should face the engine front end.



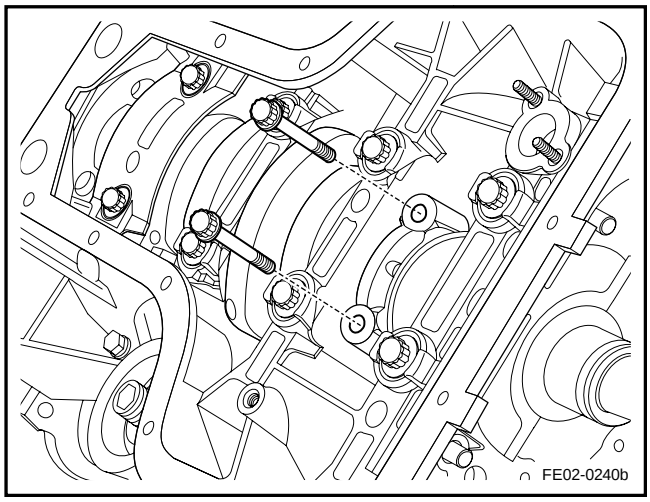
Machine Part NR 0913014625

6. Install and tighten cylinder No.1 connecting rod bearing cap bolts.

Torque

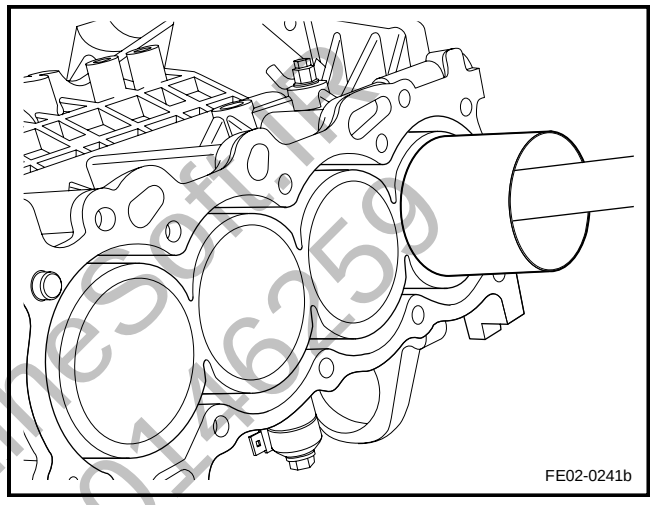
First 20N.m(metric) 14.8lb-ft(English system)

First51 N.M(metric) 37.8lb-ft(English system)



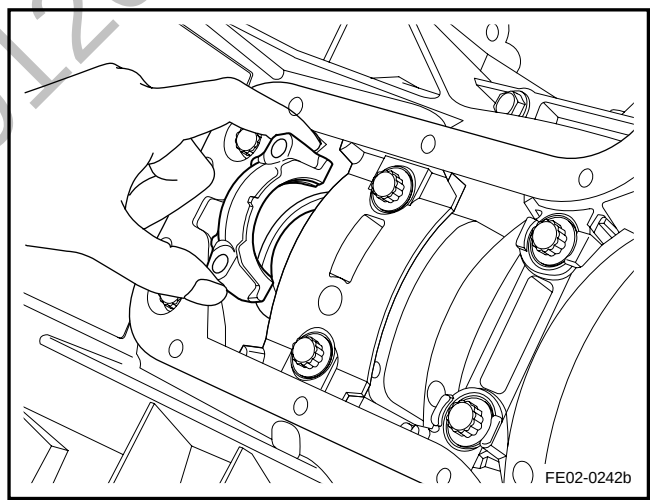
7. Lubricate the piston with a small amount of engine lubricating oil and install the #4 cylinder piston and connecting rod assembly to the position marked with a special-purpose tool and wooden stick.

Note: The dot mark on the piston top surface should face to the engine front end. During installation, pay attention to the lower end of the connecting rod, avoiding damage due to hitting the crank journal.



8. Install the cylinder No.1 connecting rod bearing cap marked with cylinder No.1 location.

Note: The dot mark on the bearing cap should face the engine front end.



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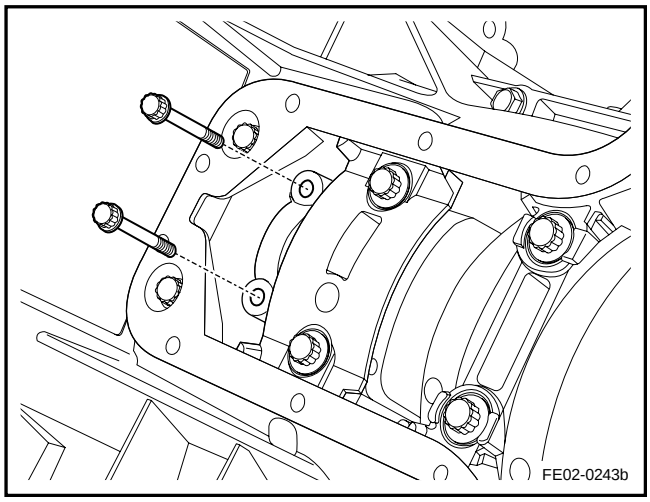
9. Install and tighten cylinder No.1 connecting rod bearing cap bolts.

Torque

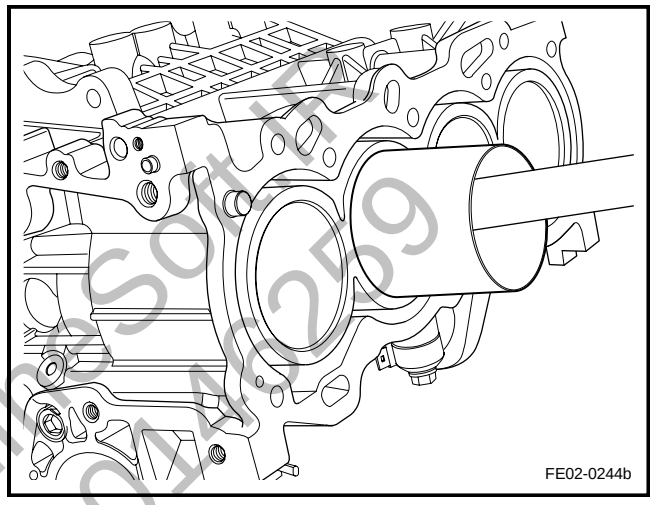
First 20 N.m(metric) 14.8lb-ft(English system)

Second 51 N.M(metric) 37.8lb-ft(English system)



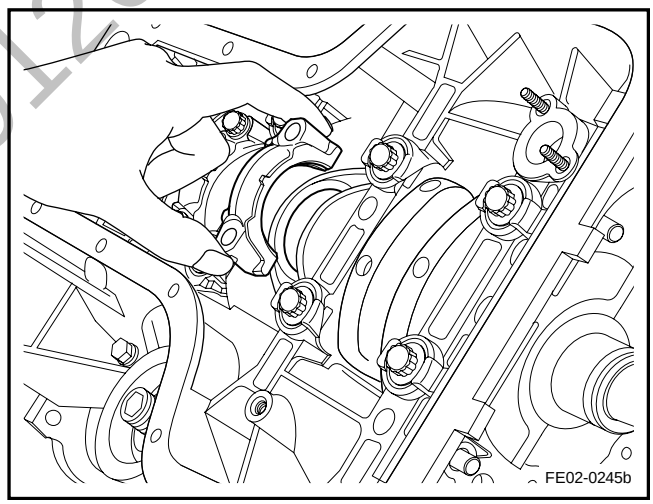
10. Rotate crankshaft to 180?, to make 2-3 cylinder on lower point position. Use new engine lubricating oil to lubricate piston. Use special tool and wooden handle to install cylinder piston connecting rod assemblies marked on cylinder 2.

Note: The dot mark on the piston top surface should face to the engine front end. During installation, pay attention to the lower end of the connecting rod, avoiding damage due to hitting the crank journal.



11. Install the cylinder No.2 connecting rod bearing cap marked with cylinder No.2 location.

Note: The dot mark on the bearing cap should face the engine front end.



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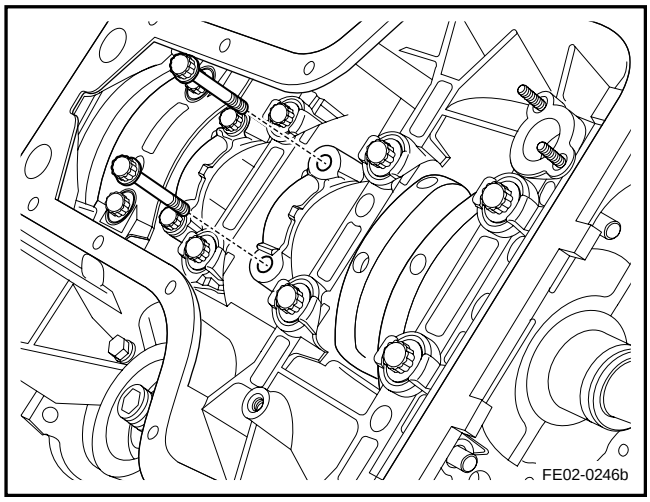
12. Install and tighten cylinder No.1 connecting rod bearing cap bolts.

Torque

First 20 N.m(metric) 14.8lb-ft(English system)

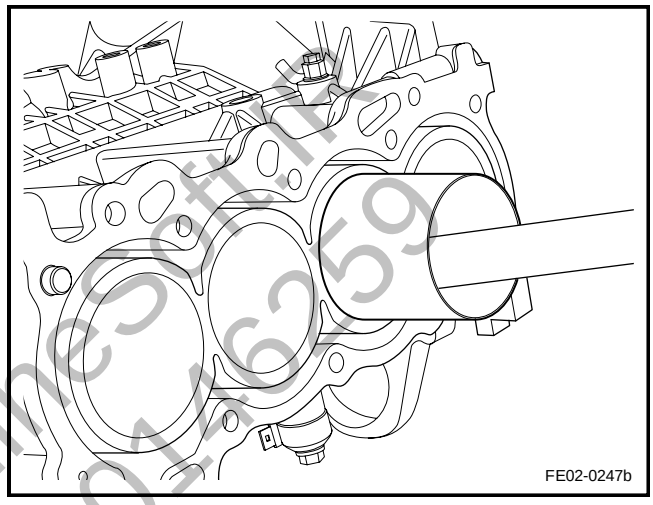
Second 51 N.m(metric) 37.8lb-ft(English system)



13. Lubricate the piston with the new engine lubrication oil, use universal tools and a wood handle to install cylinder No.3 piston connecting rod component and mark the cylinder No.3 location.

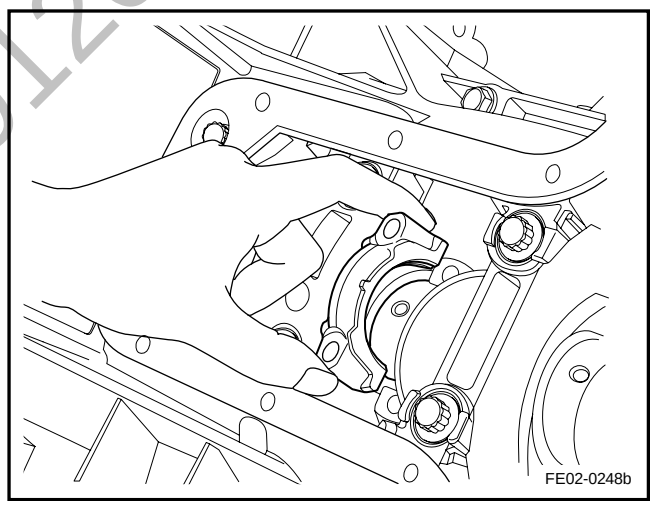
Note: The dot mark on the piston top surface should face to the engine front end.

During installation, pay attention to the lower end of the connecting rod, avoiding damage due to hitting the crank journal.



14. Install the cylinder No.3 connecting rod bearing cap marked with cylinder No.3 location.

Note: The dot mark on the bearing cap should face the engine front end.



Machine Soft No.
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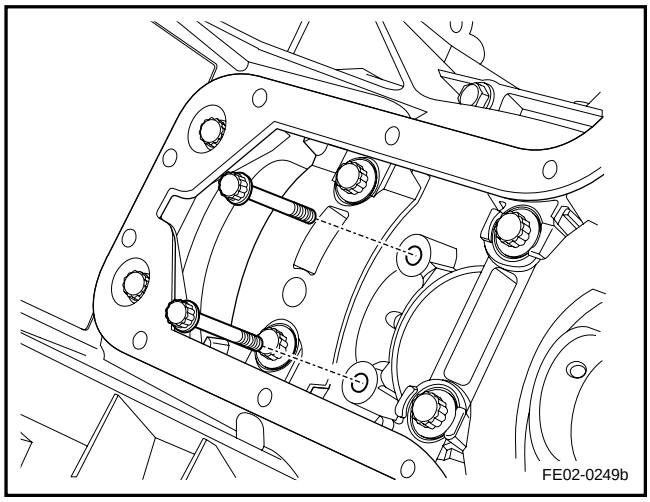
15. Install and tighten cylinder No.3 connecting rod bearing cap bolts.

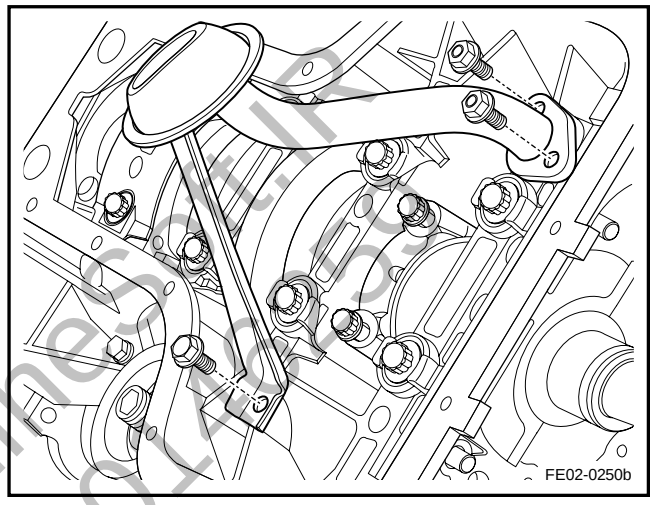
Torque

First 20 N.m(metric) 14.8lb-ft(English system)

Second51 N.m(metric) 37.8lb-ft(English system)



16. Install the oil filter.
17. Install oil reservoir.
18. Install the cylinder hood.



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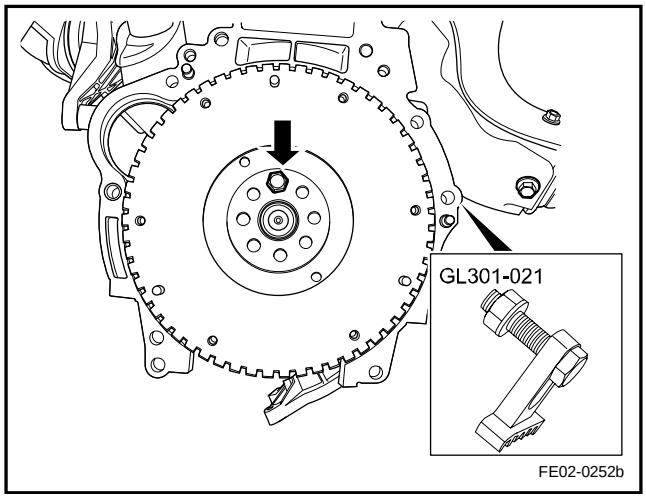
2.13.8.17 Replacement of Flywheel

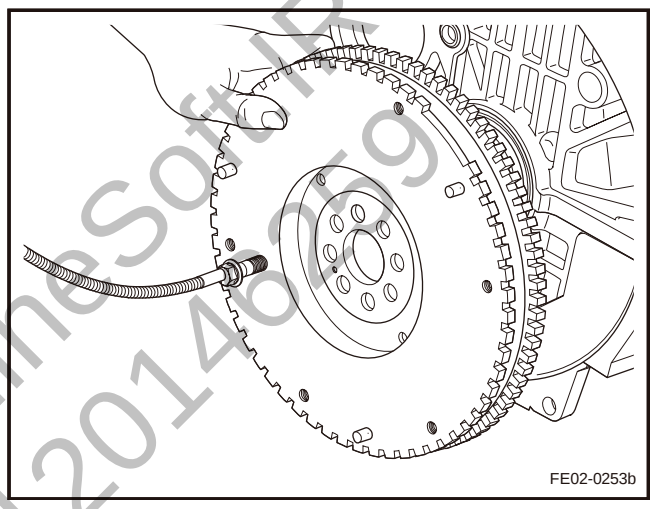
Dismantlement Procedure

1. Refer to 3.3.8.3 "Replacement of Gearbox Assembly" to dismantle the gearbox assembly.
2. Dismantle the clutch assembly. Refer to 3.2.8.6 Replacement of Clutch Assembly.
3. Use a special tool GL301-021 to prevent the crankshaft rotation.
4. Dismantle flywheel fixing bolt, and leave 1 bolt on the top of crankshaft to fix flywheel.



5. Hold the engine flywheel and remove the last bolt.

Warning: Be careful when remove the last bolt to avoid the flywheel drop.



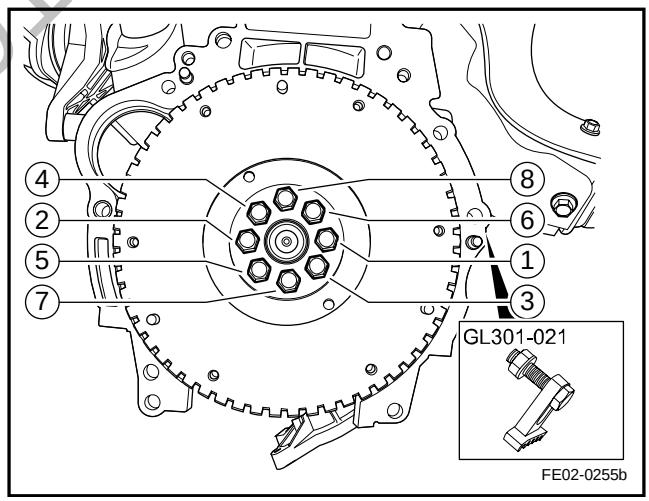
Installation Procedure:

1. Install new bolts to the engine flywheel, but do not tighten at this stage.

Note: apply adhesive on the bolt!

Adhesive: Thread Locking Sealant.

2. Install a special tool GL301-021 to prevent the crankshaft rotating.
3. Install and tighten the engine flywheel bolts to the specified torque, according to the sequence in the graphic.



Torque :88N . m(Metric) 65 . 1lbf . ft(English system)

4. Install the clutch assembly.
5. Install the gearbox.

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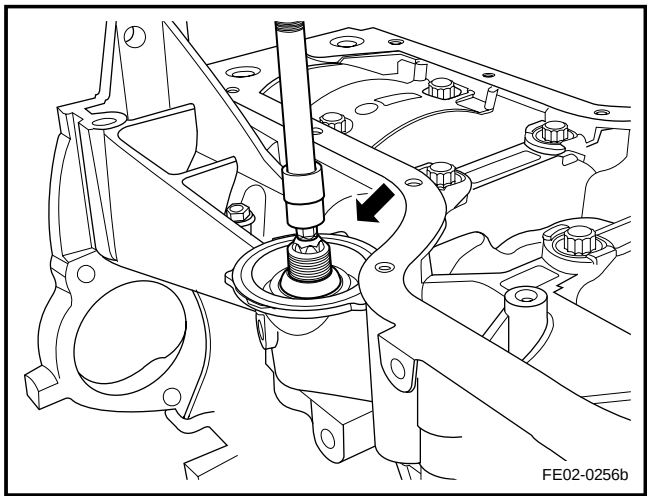
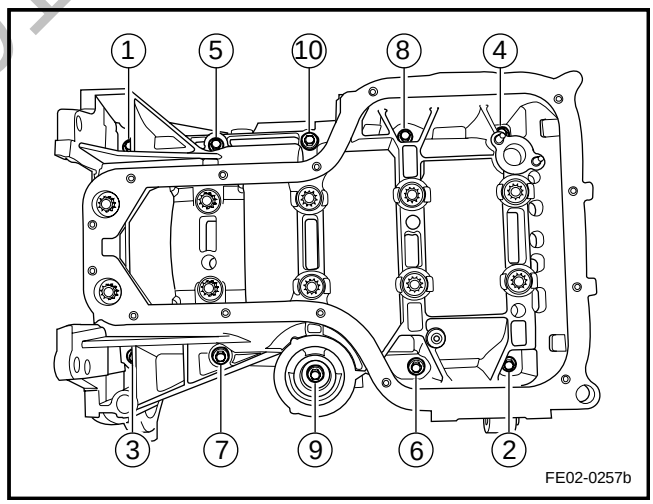
2.13.8.18 Replacement of Crankshaft

Dismantlement Procedure

1. Dismantle the engine. Refer to 2.13.8.13 Replacement of Engine.
2. Refer to 3.3.8.3 "Replacement of Gearbox Assembly" to dismantle the gearbox assembly.
3. Refer to 2.13.8.17 "Replacement of Flywheel" to dismantle the flywheel.
4. Dismantle the crankshaft rear oil seal.
5. Refer to 2.13.8.14 "Replacement of Cylinder Hood Assembly" to dismantle the cylinder hood.
6. Refer to 2.9.8.1 "Replacement of Oil Pump" to dismantle the oil pump.
7. Dismantle oil pan, refer to 2.9.8.3 Replacement of Oil Pan.
8. Refer to 2.13.8.16 "Replacement of Piston Connecting Rod and Bearing" to dismantle the piston connecting rod and bearing.
9. Dismantle oil cleaner install bolt .
10. Dismantle fixing bolt of crankshaft body according to sequence shown in figure.





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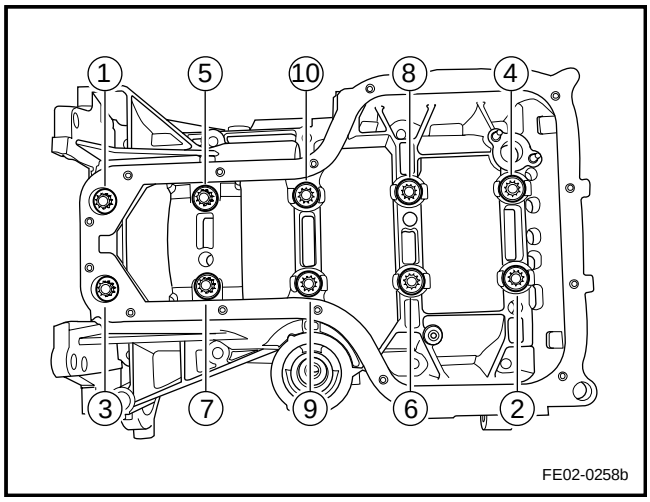
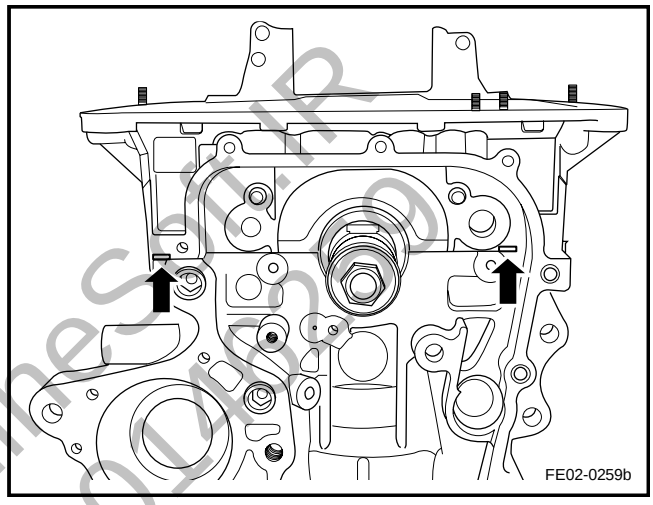
11. Dismantle crankshaft bearing cap bolt as shown in the diagram.

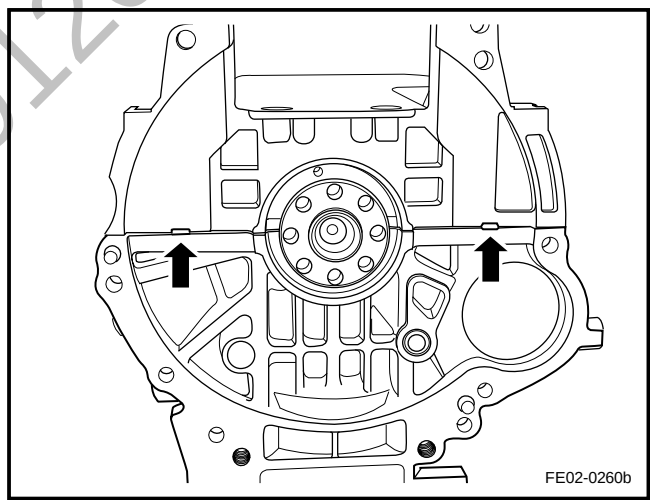
Note: Do not loose the bolts at one time during dismantling; the bolts should be loosened more than once; otherwise, the crankshaft may be damaged!



12. Insert slotted screwdriver into position shown in figure, and loosen the front end of crankshaft body.



13. Insert slotted screwdriver into position shown in figure, and loosen rear of crankshaft body.



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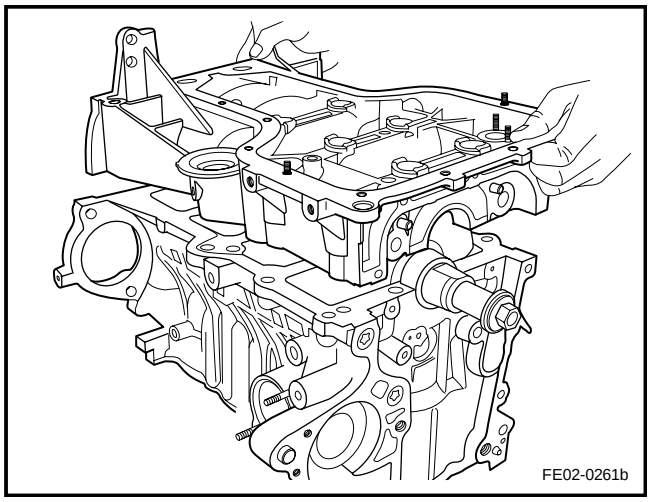
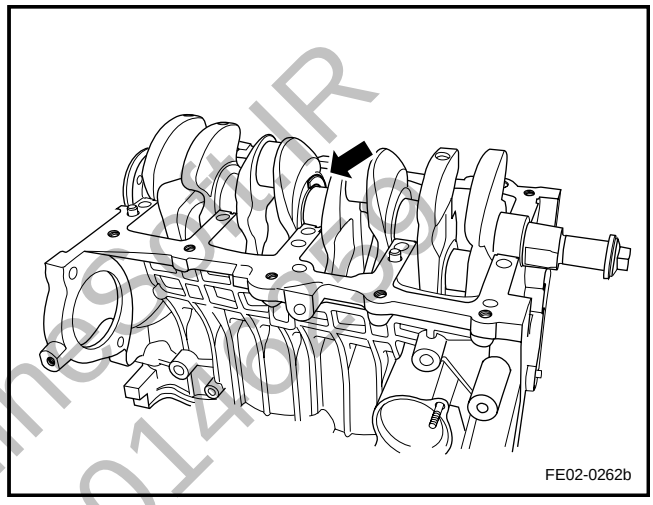
14. Dismantle the crankcase.

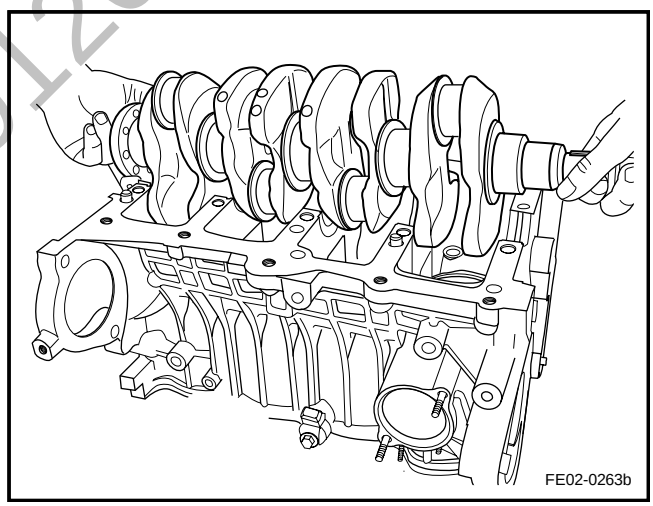


15. Dismantle the No.3 bearing crankshaft thrust film.

Note: Rotate the crankshaft during removing, so that the thrust film can exit together to facilitate the removal.



16. Dismantle the crankshaft.



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Crankshaft inspection, the crankshaft bearing clearance matching inspection procedure:

1. Measure the main bearing bore diameter with an inner diameter micrometer and record.
2. Measure diameter dimension of main shaft of crankshaft by using outside micrometer and record result.
3. Select the crankshaft main bearing dimensions according to the recorded dimensions in the

following table .

Inner diameter of main bearing seat (mm/in)	**External diameter of crankshaft main journal (mm/in)**	**Select the thickness of the main bearing (mm/in)**
52.005-52.011 2.0474-2.0477(code 1)	47 . 994-48/ 1.8895-1.8898(code 1)	1.993≤t≤1.996/ 0.0785≤t≤0.0786 (code 2)
52.011-52.017 2.0477-2.0479(code 2)	47 . 994-48/ 1.8895-1.8898(code 1)	1.996<t≤1.999/ 0.0786≤t≤0.0787 (code 3)
52.005-52.011 2.0474-2.0477(code 1)	47.988-47.994 1.8893-1.8895(code 2)	
52.017-52.021 2.0479-2.0481(code 3)	47 . 994-48/ 1.8895-1.8898(code 1)	1.999<t≤2.002/ 0.0787≤t≤0.0788 (code 4)
52.005-52.011 2.0474～2.0477(code 1)	47.982-47.988 1.8891～1.8893(code 3)	
52.011-52.017 2.0477-2.0479(code 2)	47.982-47.988 1.8891-1.8893(code 3)	2.002<t≤2.005/ 0.0788≤t≤0.0789 (code 5)
52.017-52.021 2.0479-2.0481(code 3)	47.988-47.994 1.8893-1.8895(code 2)	
52.017-52.021 2.0479-2.0481(code 3)	47.982～47.988 1.8891-1.8893(code 3)	2.005<t≤2.008/ 0.0789<t≤0.0791 (code 6)

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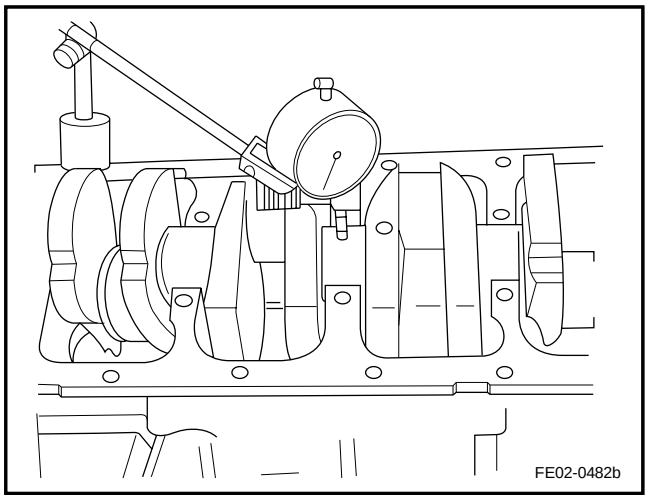
4. Install the crankshaft bearing crankshaft and inspect whether the middle of the crankshaft journal has acceptable loss of roundness and the beating degree.

Standard Value

Roundness 0.003 mm (Metric)/0.0001 in (English system)

Run Out 0.02 mm (Metric) /0.0008 in (English system)

5. Inspect the crankshaft axial clearance.

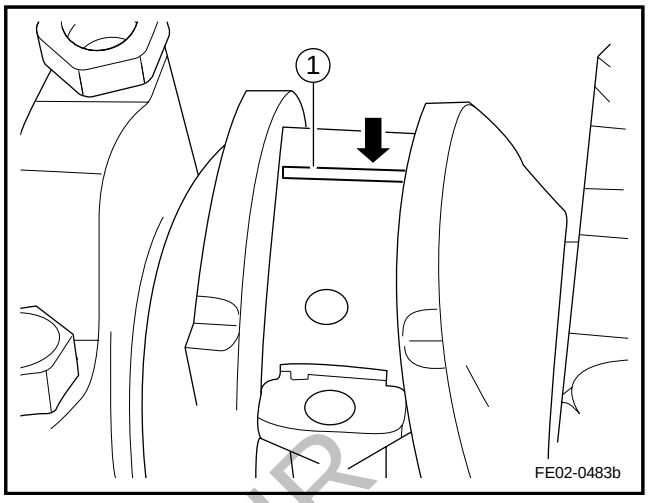


Standard Value

0.04 ～ 0.24 mm(Metric)/0.0015 ～ 0.0094 in（English system）

6. With a plastic gap measurement regulator, measure all the crankshaft bearings.

Important precaution: apply lubricating grease on the crankshaft journal and slightly lubricate the crankshaft bearing, so that the plastic clearance gauge is not torn when disassembling the crankshaft bearing cap.



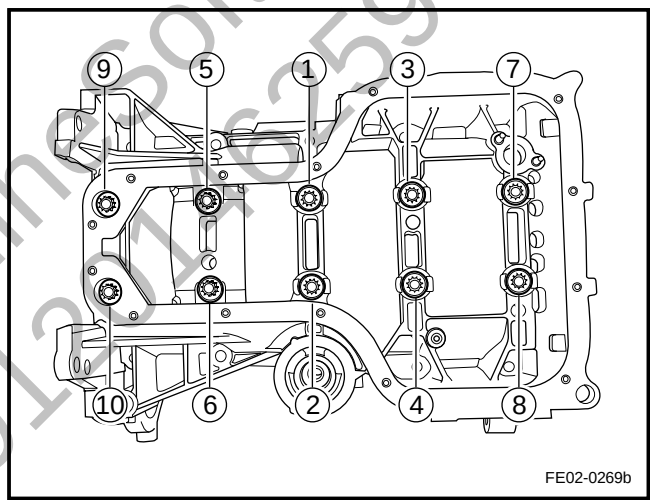
7. According to the width of bearing 1, cut the plastic gap measurement regulator, place the plastic along the axis between the journal and the crankshaft bearings.

8. Install the crankcase, install and tighten the crankshaft bearing cap bolts according to the sequence shown in the graphic.

Torque

First44N . m(Metric) 32 . 5 lb-ft(English system)

Second 60N.m(Metric) 44.5lb-ft(English system)

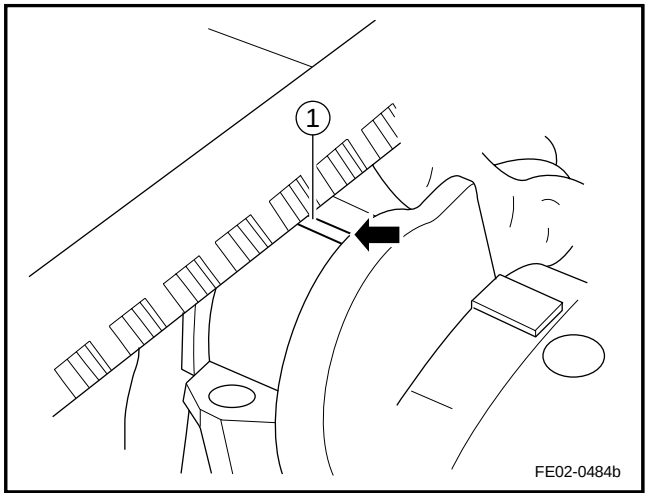


9. Dismantle the crankcase.

10. Use scales on feeler gauge to measure thickness 1 of extended plastic strip. Inspect whether crankshaft bearing clearance value is in the following range:

Standard value :0 . 015-0 . 033mm/0 . 0006-0 . 0013in

11. If the gap value is not within the specified range, re-adjust the crankshaft clearance. If necessary, replace the crankshaft.



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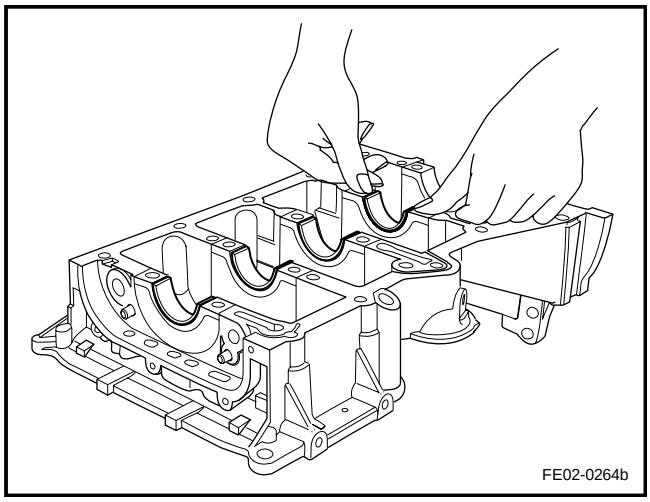
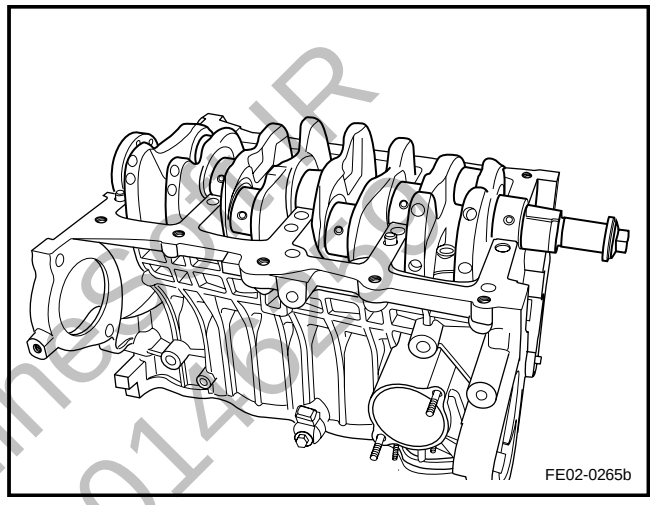
Installation Procedures:

1. Clean all the relevant components.
2. Apply a small amount of engine lubrication oil to the crankshaft bearing.
3. Install the selected crankshaft bearings.



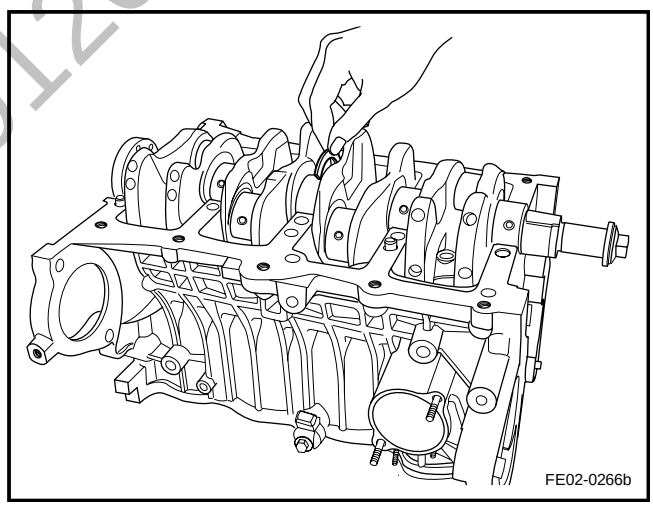
4. Install the crankshaft.



5. Install the crankshaft thrust half ring with the grooved side facing outside.
6. Inspect the crankshaft axial clearance, to confirm the crankshaft axial clearance is acceptable. Refer to 2.13.1.2 Mechanical System Specification.

Standard Value

0.04 ～ 0.24 mm(Metric)/0.0015 ～ 0.0094 in（English system）



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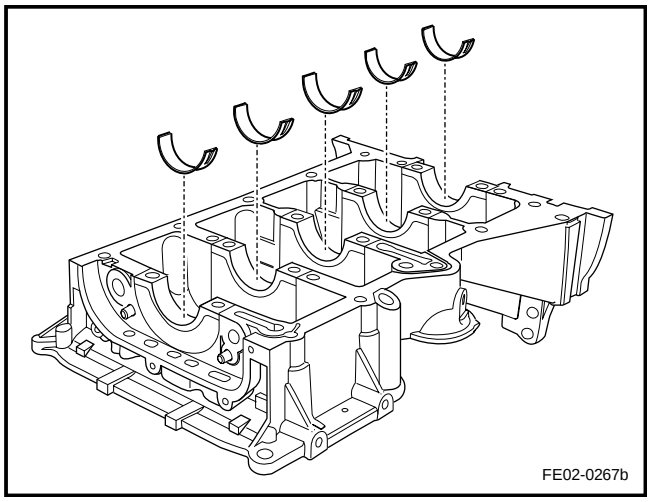
7. Install bearing of crankshaft case body.

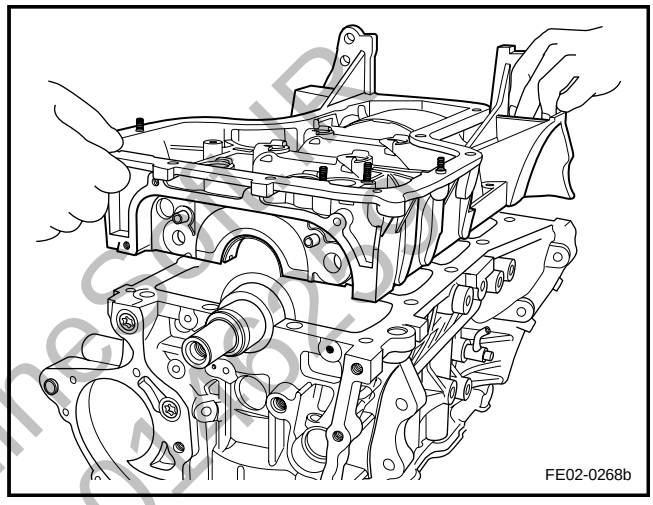


8. After installing the crankshaft in the front and rear crankshaft bearings, inspect whether the crankshaft journal has acceptable roundness and runout.

Note: apply the lubricating grease on the crankshaft journal and slightly lubricate the crankshaft bearing!

9. Coat evenly sealant on the interface between crankshaft case body and cylinder block .

10. Install the crankshaft body.

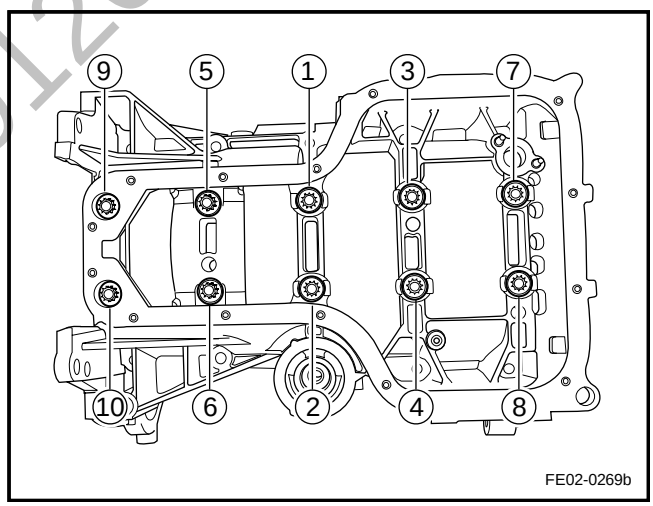


11. Install and tighten the crankshaft bearing cap bolts according to the sequence shown in the graphic.

Torque

First44N.m(Metric)
32.5lb-ft(English system)

First44N.m(Metric)
32.5lb-ft(English system)



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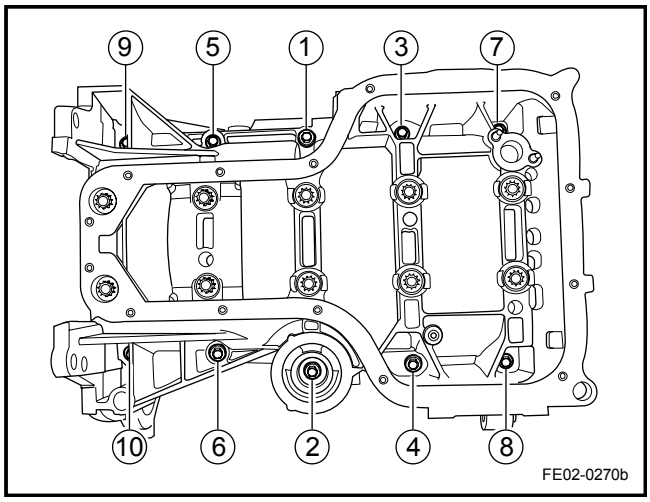
12. Install fixing bolt of crankshaft body.

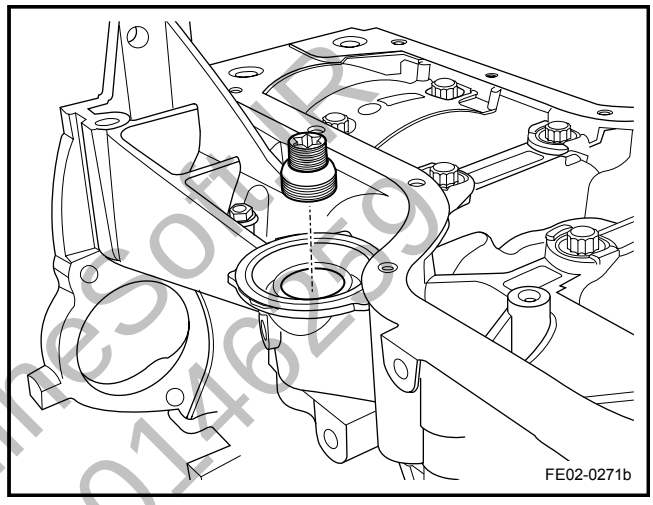
    Torque: 18N.m or 13.4lb-ft



13. Install the mounting bolts of oil filter.

First44N.m(Metric) 32.5lb-ft(English system)

14. Install pistons, connecting rods and bearings.
15. Install the oil pan.
16. Install the oil pan.
17. Install the cylinder hood.
18. Install the crankshaft rear oil seal.
19. Install the flywheel.
20. Install the gearbox.
21. Install the engine assembly.



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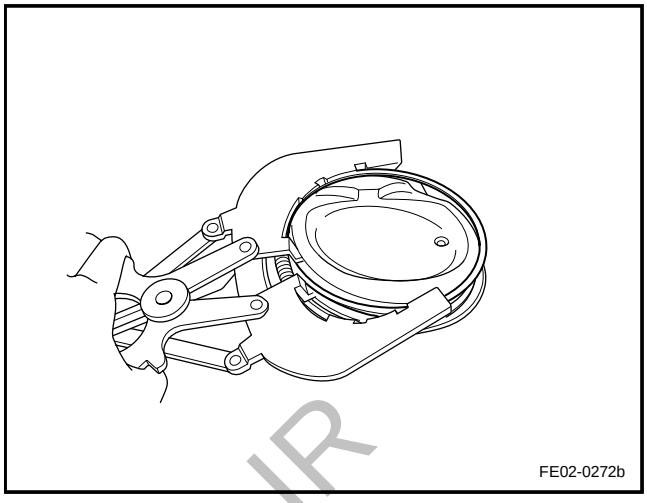
2.13.8.19 Piston Connecting Rod Components Disassembly, Assembly and Inspection

Note: Use the dedicated tools to carry out corresponding removal and installation.

Dismantlement Procedure

1. Dismantle the piston rod components. Refer to 2.13.8.16 Replacement of Piston Connecting Rod and Bearing.
2. Dismantle the first air ring.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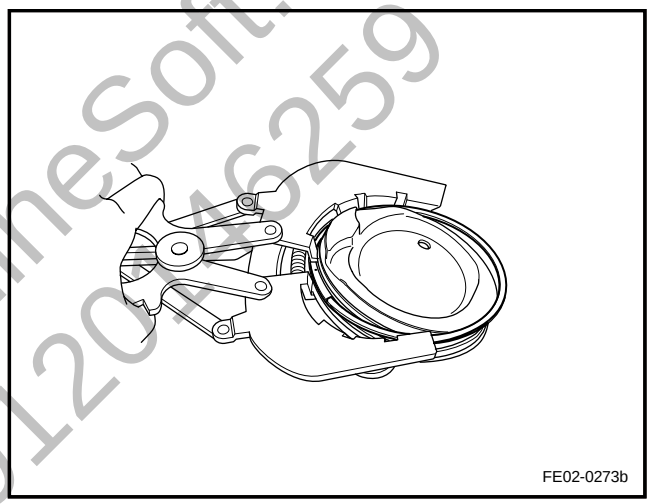
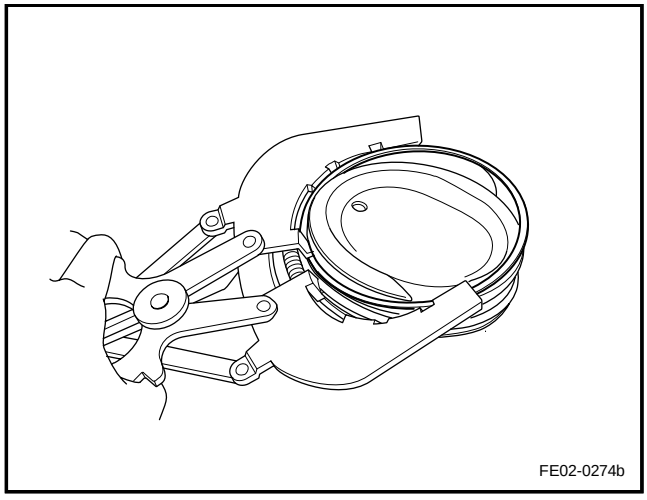
3. Dismantle the second air ring.


FE02-0273b

4. Dismantle the oil ring's upper ring combination.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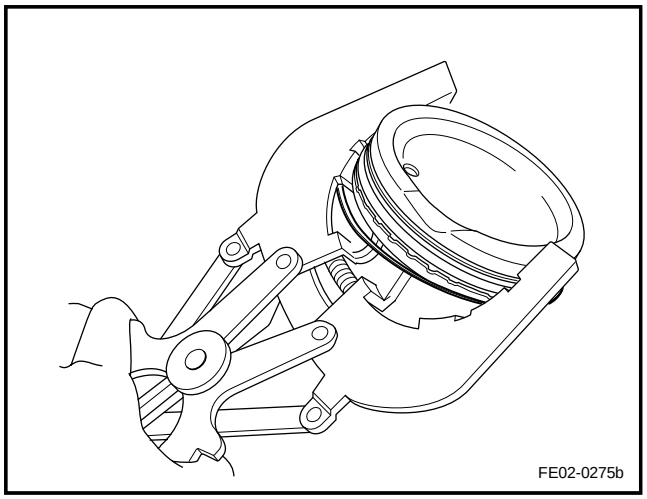
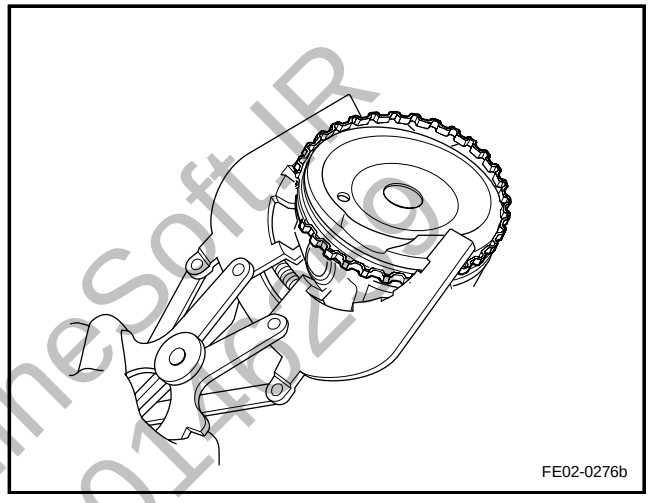
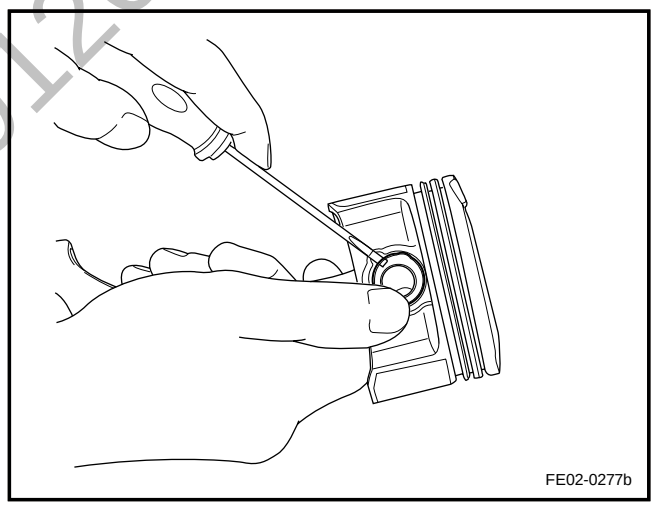
5. Dismantle the oil ring's lower ring combination.



6. Dismantle the oil ring.



7. Dismantle the piston pin circlip at both ends.



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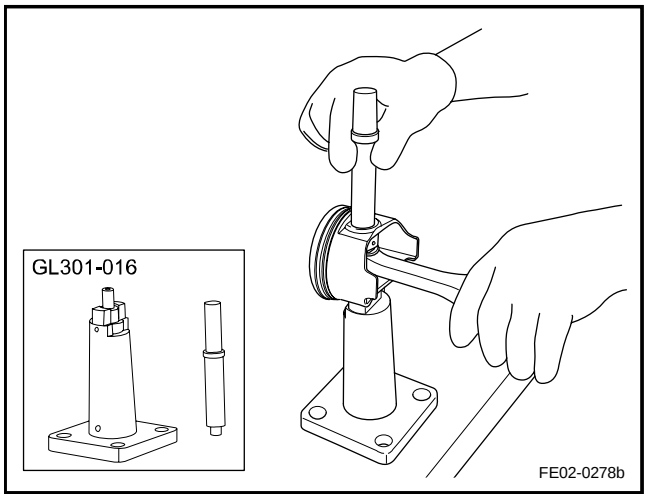
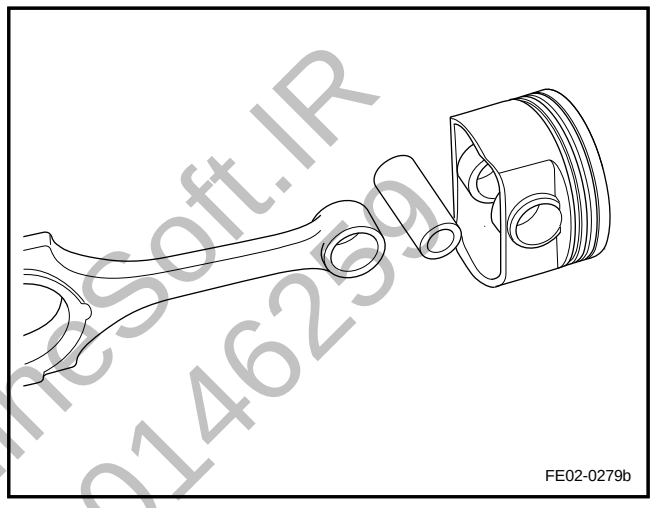
8. With a special tool GL301-016, remove the piston pin.



9. Disassemble connecting rod, piston pin and piston are shown in the graph.



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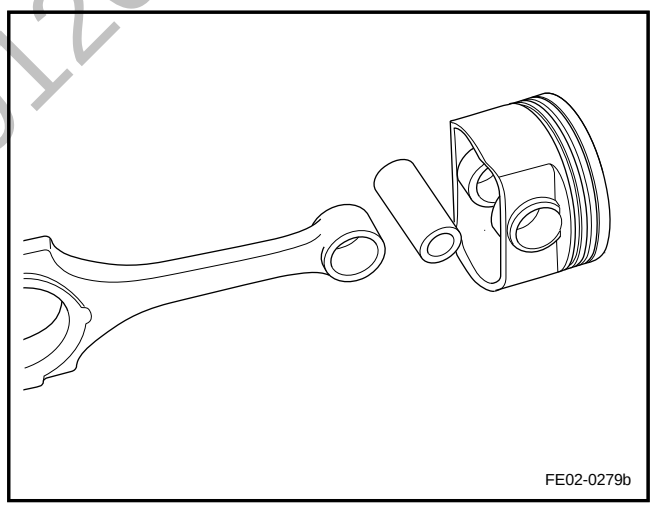
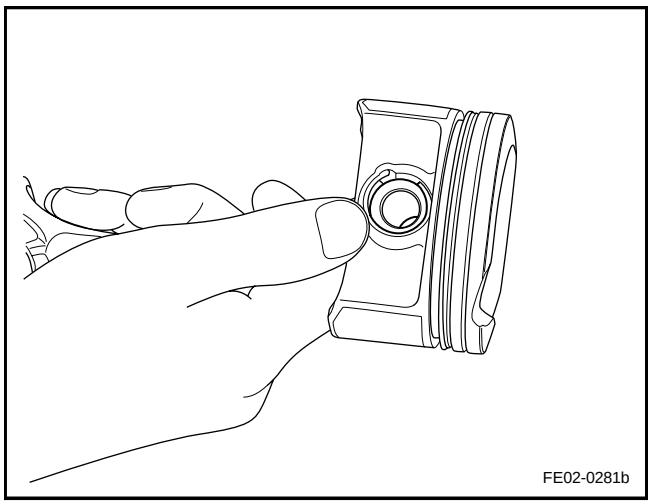
Installation Procedure:

1. Install piston pin, connecting rod and piston.

Note: During installation, make the dot on the connecting rod bearing cover facing towards the same direction as the dot mark on the piston.



2. Install the piston pin circlip.



3. Confirm normal movements between the piston and rod without any interference.
4. Inspect piston pin and connecting rod clearance.

Standard Value

0.005～0.011mm(Metric)

0.0002～0.0004in (English system)

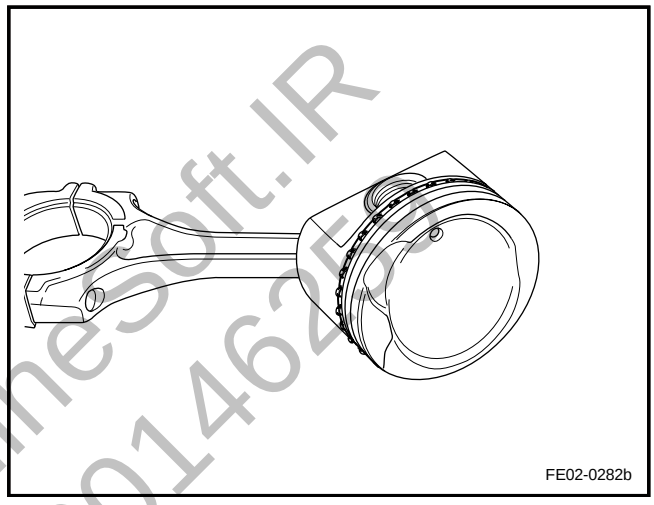
5. Inspect the piston and piston pin clearance.

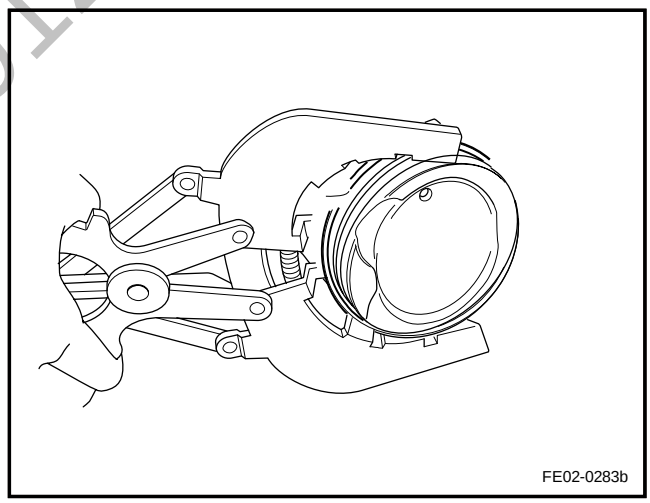
Standard Value

0.005-(-0.001)mm(Metric)

0.0002-(-0.00003)in(English system)

6. Install the oil ring.
7. Install the oil ring's lower ring combination.





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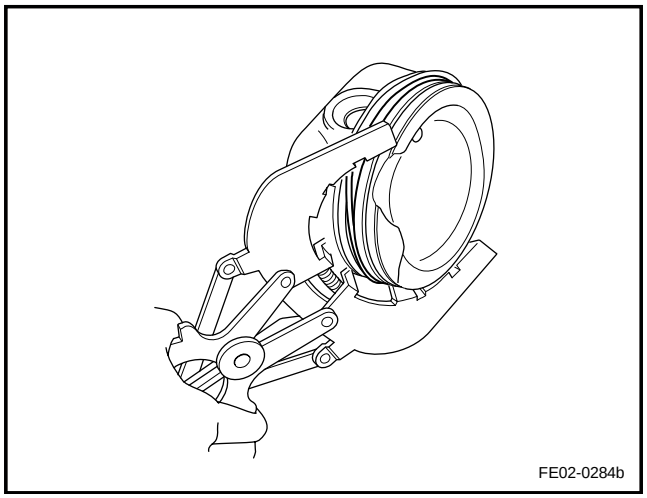
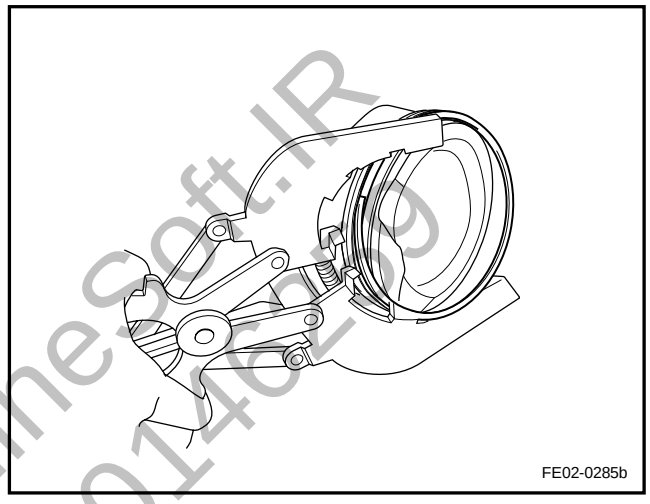
8. Install the oil ring's upper ring combination.



9. Install the second air ring.

Note: the face with letter faces toward the top end of the piston!

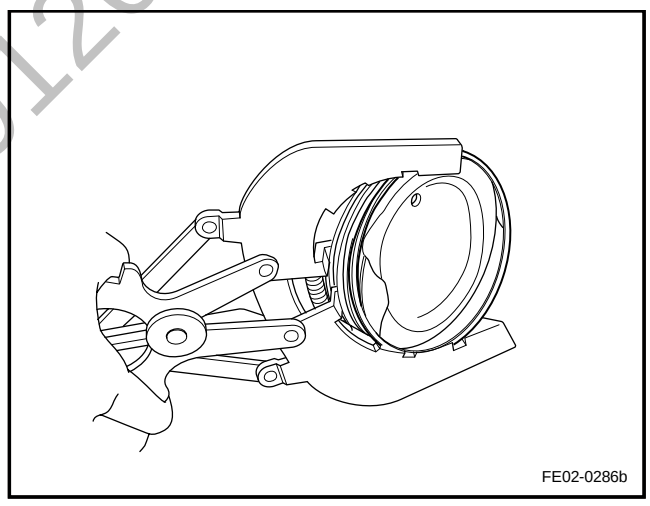


10. Install first air ring.

Note: the face of the piston ring with inner chamber faces toward the top end of the piston!

11. Apply the engine oil to the connecting rod bearings and install the connecting rod journal and the bearing cap.

12. Install connect rod to crankshaft , check if connecting bearing clearance meet capacity tolerance.Refer to"2.13.1.2 engine mechanical system specification"



Standard Value

(0.020)～(0.044)**mm（Metric）**

(0.0007)～(0.0017) **in (English system)**

13. Install and inspect the qualified piston connecting rod components.

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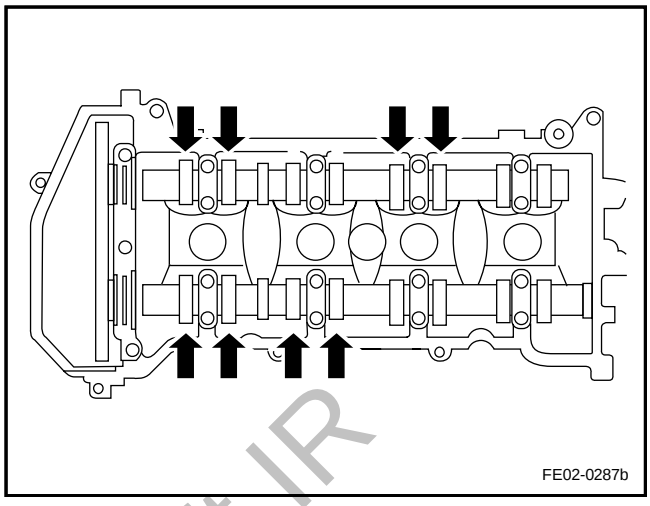
2.13.8.20 Valve Clearance Adjustment

1. Dismantle the plastic shield of engine. Refer to 2.13.8.1 Replacement of Plastic Shield of Engine.
2. Refer to 2.10.8.3 "Replacement of Ignition Coil" to dismantle the ignition coil.
3. Refer to 2.13.8.2 "Replacement of Cylinder Hood Cover" to dismantle the cylinder hood cover.
4. Dismantle timing chain cover, rotate crankshaft to make the 1st cylinder locate on upper compression stop position. Refer to "2.13.8.9 time chain cover". Replacement
5. Inspect valve clearance. Use the plug gage to measure valve clearance value, as arrows shown in the graphic and record the valve location and tolerance that exceeds the tolerance.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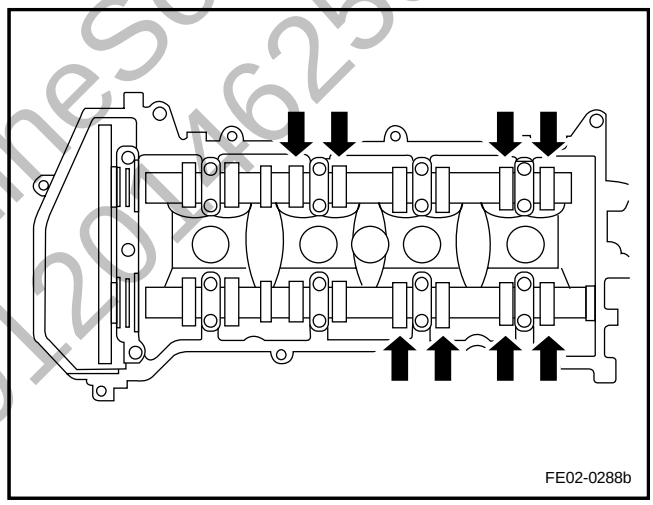
6. Rotate the crankshaft one circle (360 °), making the cylinder No. 4 stop at the compression TDC position. Measure the valve clearance as arrow pointed in the graph and record the clearance.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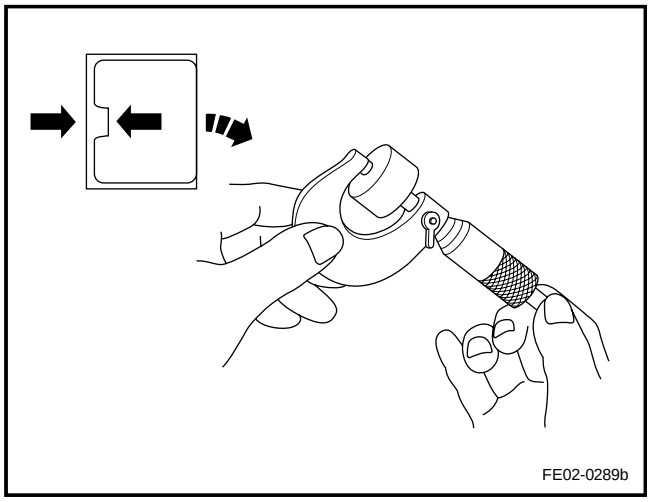
7. Use a jack to support the engine. Dismantle the timing chain. Refer to 2.13.8.10 "Replacement of Timing Chain"
8. Refer to 2.13.8.12 “Replacement of Camshaft” to dismantle the camshaft.
9. Remove the valve lifter that exceeds the tolerances. Use outside diameter micrometer to measure the thickness, according to the following formula calculate the thickness of the new valve lifters.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Intake: A=B+C-0.23 mm(0.01in)

Exhaust: A=B+C-0.32mm(0.13in)

A	Thickness of new valve lifter
B	Thickness of old valve lifter
C	Measured Valve Clearance

10. Selected new valve lifters must be as close as possible to the calculated values. For specifications. Refer to 2.13.1.3 Specification Table for Tappet Rods of Intake and Exhaust Valves for the thickness of the tappet rod of valve.
11. Based on the measurement, according to 2.13.1.4 Selection Table for Tappet Rod of Exhaust Valve, choose the tappet rod of valve to meet the specification.
12. Install intake and exhaust camshafts.
13. Install timing chain
14. Install the timing chain cover.
15. Install the ignition coil.
16. Install the plastic shield of engine.

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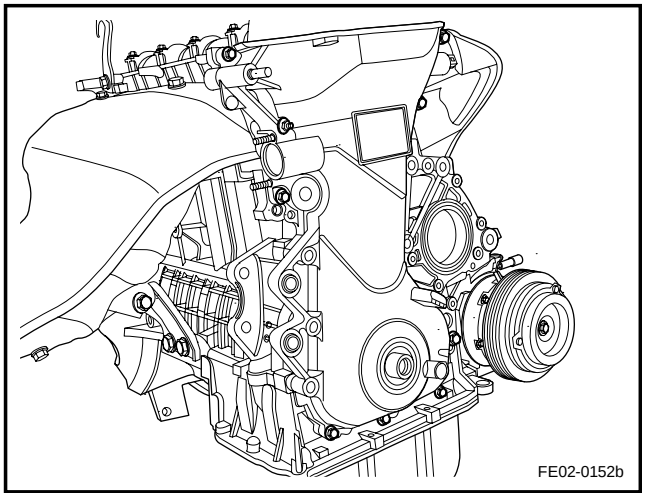
2.13.8.21 Replacement of Crankshaft Front Oil Seal

Dismantlement Procedure

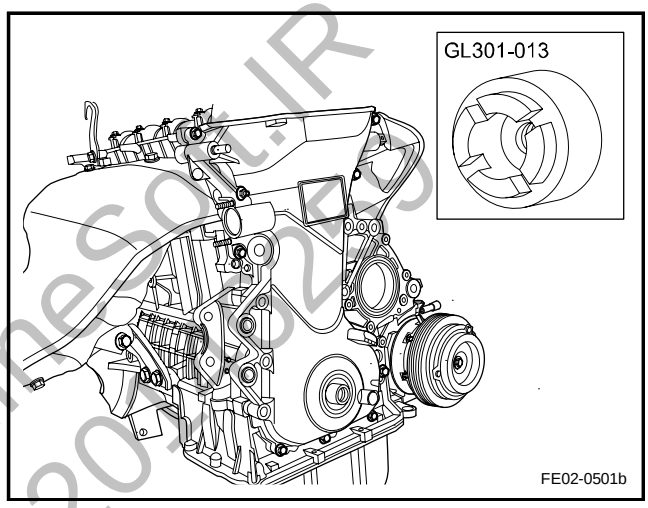
1. For dismantling of crankshaft belt disc, refer to 2.13.8.9 Replacement of timing chain cover
2. Dismantle crankshaft front oil seal.

Note: Be careful not to damage the crankshaft journal during dismantlement.



Installation Procedure:

1. install crankshaft front oil seal by special tool GL301-013
2. Install the crankshaft belt plate.



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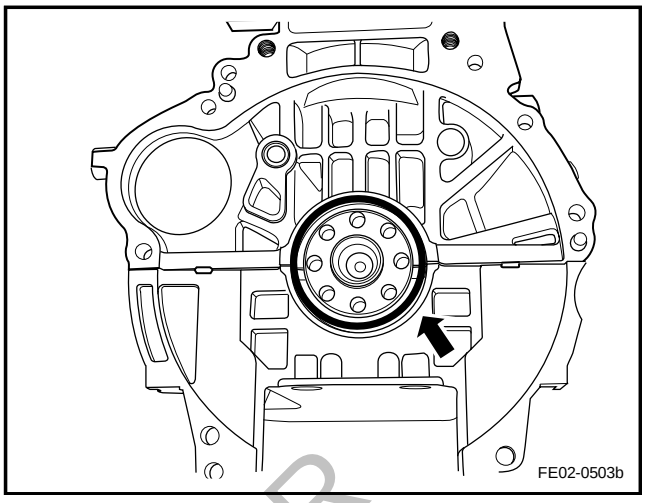
2.13.8.22 Replacement of Crankshaft Rear Oil Seal

Dismantlement Procedure

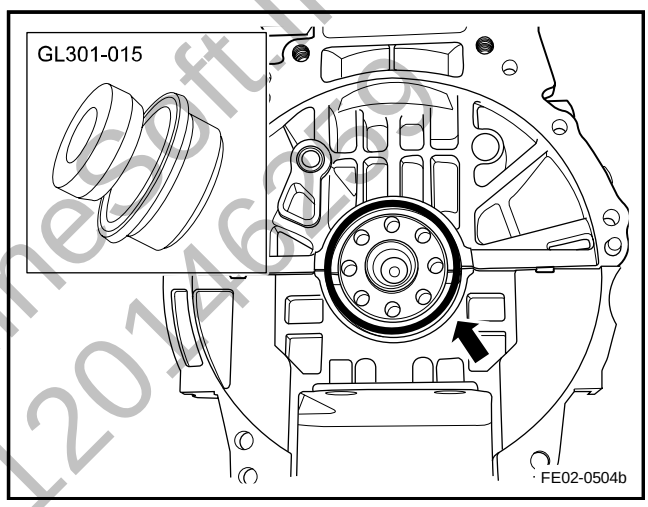
1. Refer to 2.13.8.17 “Replacement of Flywheel” to dismantle the flywheel.
2. Dismantle the crankshaft rear oil seal.

Note: Be careful not to damage the crankshaft journal during dismantlement.



Installation Procedure:

1. install crankshaft rear oil seal by special toolGL301-015.
2. Install the flywheel.



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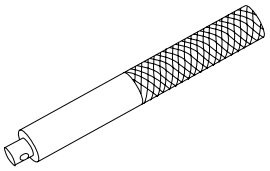
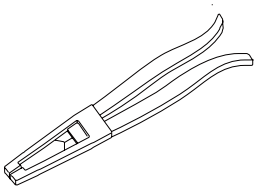
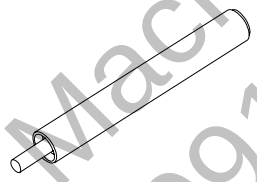
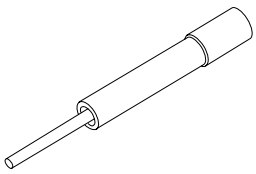
2.13.9 Special Tools and Equipment

2.13.9.1 Special Tools List

Serial Number	Illustration	Tool No.	Description
1	 FE01-2014b	GT301-002	Oil seal handle
2	 FE01-2015b	GT301-006	Tool for installing and dismantling valve oil seal
3	 FE01-2016b	GT301-008	Tool for installing valve oil seal
4	 FE01-2017b	GT301-009	Tool for installing and removing valve guide pipe

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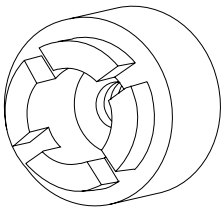
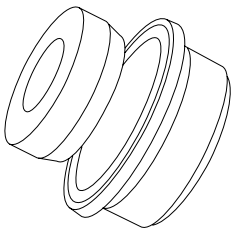
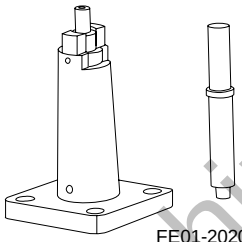
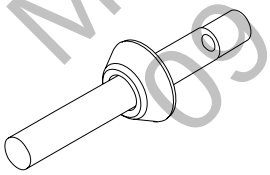
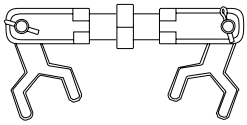
5	 FE01-2018b	GT301-013	Tool for installing front oil seal of crankshaft
6	 FE01-2019b	GT301-015	Crankshaft Rear Oil Seal Installation Tool
7	 FE01-2020b	GT301-016	Tool for installing and removing piston pin
8	 FE01-2021b	GT301-018	Tool for locating camshaft
9	 FE01-2022b	GT301-020	Tool for locating crankshaft belt disc

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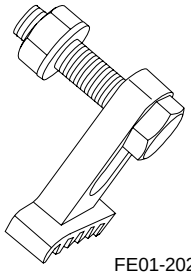
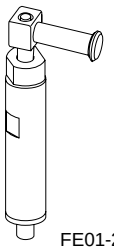
10	 FE01-2023b	GT301-021	Tool for tightening flywheel
11	 FE01-2024b	GT301-022	Tool for tightening timing chain

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2.14 Lubrication system (4G18)

2.14.1 Specifications

2.14.1.1 Fastener Tightening Specification

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lbf-ft)
Connecting bolt of oil pan and cylinder body	M6	8-10	6-7 . 4
Connecting Bolts Between Oil Strainer and Cylinder Block	M6	8-10	6-7 . 4
Oil Sensor Plug and Cylinder Block Connecting Bolts	R 1/8	11.5-19.5	8.6-14.4
Oil Filter and Cylinder Pipe Adapter	UNF3/4″－16	16-24	11.8-17.8
Oil Filter Adapter	M28×1.5	33-37	24.4-27.4
Oil Pump Mounting Bolt	M6	8-10	6-7 . 4
Oil drain plug of oil pan	M12	25-35	18.5-25.9

2.14.1.2 Oil Pump Specification

Side Clearance	0.0250-0.062mm (0.0010-0.0024in)
Tooth Clearance	0.0300-0.099mm (0.00120-0.0039in)
Engine oil pressure induction plug lightening pressure	≤40kPa(≤6psi)
Oil Pump Output Pressure	0.6MPa(87psi)
Oil Pump Relief Valve Opening Pressure	0.42-0.58MPa(61～85psi)

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2.14.2 Description and Operation

2.14.2.1 Operated and description

Oil Pan

The engine sump is installed at the bottom of the crankcase; engine oil is extracted by the oil pump from the oil sump; after passing through the oil filter, the engine oil lubricates the cylinder body and cover respectively through two oil passages; the engine oil flows to the connecting rod through the engine oil passage in the crankshaft, then to the piston and cylinder, and returns to the oil sump finally. In the second oil path, the engine oil passes through the engine oil passage to the camshaft, and also passes through the internal oil passage of the camshaft to lubricate the valve assembly and returns to the oil sump finally.

Oil Pump

Oil pump draws the engine oil from the oil pan and then pump the engine oil with pressure to the various parts of the engine. Oil pump inlet has an oil filter - set filter. Set filter blockage may damage the oil pump and cause the pump oil inoperative, and the lubricating system will be unable to establish a normal oil pressure, which will cause the engine mechanical damage. Oil pump is driven by the crankshaft concave. As long as the crankshaft rotates, the oil pump will be working. The oil pump displacement is fixed, so when the engine speed is high, the oil pump output pressure will exceed the needs of the engine lubrication system. There is a safety valve in the oil pump assembly. The safety pressure relief valve cavity is connected with the oil pump intake chamber. When the output pressure exceeds 0.5 MPa (73 psi), the security valve is open, the excess oil returns to the oil pump through the valve. With the normal oil supply, the safety valve bypass is closed.

Lubrication Descriptions

The oil filter stand is integrated on the crankcase body. The engine oil flows through the engine oil filter core through the lower oil passage of the engine oil filter seat upward. After being filtered, engine oil passes through the oil filter seat upper oil path to return to the cylinder block. Engine oil passes through the oil path to the cylinder block front. The engine oil is supplied to various cylinder heads, main shaft oil path, VVT electromagnetic valve and camshaft position actuator through these front oil paths.

Each cylinder head oil passage introduces the engine oil into the cylinder head and the camshaft bearing journal. Engine oil passes through the main oil path to the VVT solenoid valve, VVT solenoid valve oil cavity, to the VVT actuator. The VVT solenoid valve is used for controlling the intake camshaft position actuator and the engine control module (ECM) controls the VVT solenoid valve. When the engine control module provides power to the VVT solenoid valve, the solenoid valve guides the engine oil to flow through the cylinder hood cover camshaft front bearing caps. Engine oil passes through the intake camshaft bearing caps into the camshaft journal drilled hole and flows to the intake camshaft front installation surface. Then, the engine oil flows to the camshaft position actuator corresponding oil path. VVT solenoid valve guides engine oil into the system corresponding oil path, so that the engine oil pressure acting on the intake camshaft position actuator internal blades. The intake camshaft (installed on the camshaft position actuator inner rotor) rotates relative to the sprocket (mounted on the intake camshaft position actuator housing). At idle, the internal pin will lock the rotor to the intake camshaft actuator housing. When starting, the cam actuator position will maintain the original position or the default position. VVT solenoid valve guides engine oil hydraulic pressure to loosen the lock pin, so that the intake camshaft position actuator works. Oil pump contains a small engine oil nozzle, which sprays the engine oil to timing chain components. Engine oil passes through the camshaft timing chain drive belt area or cylinder hood cover and cylinder block casting oil return path and returns to the oil pan.

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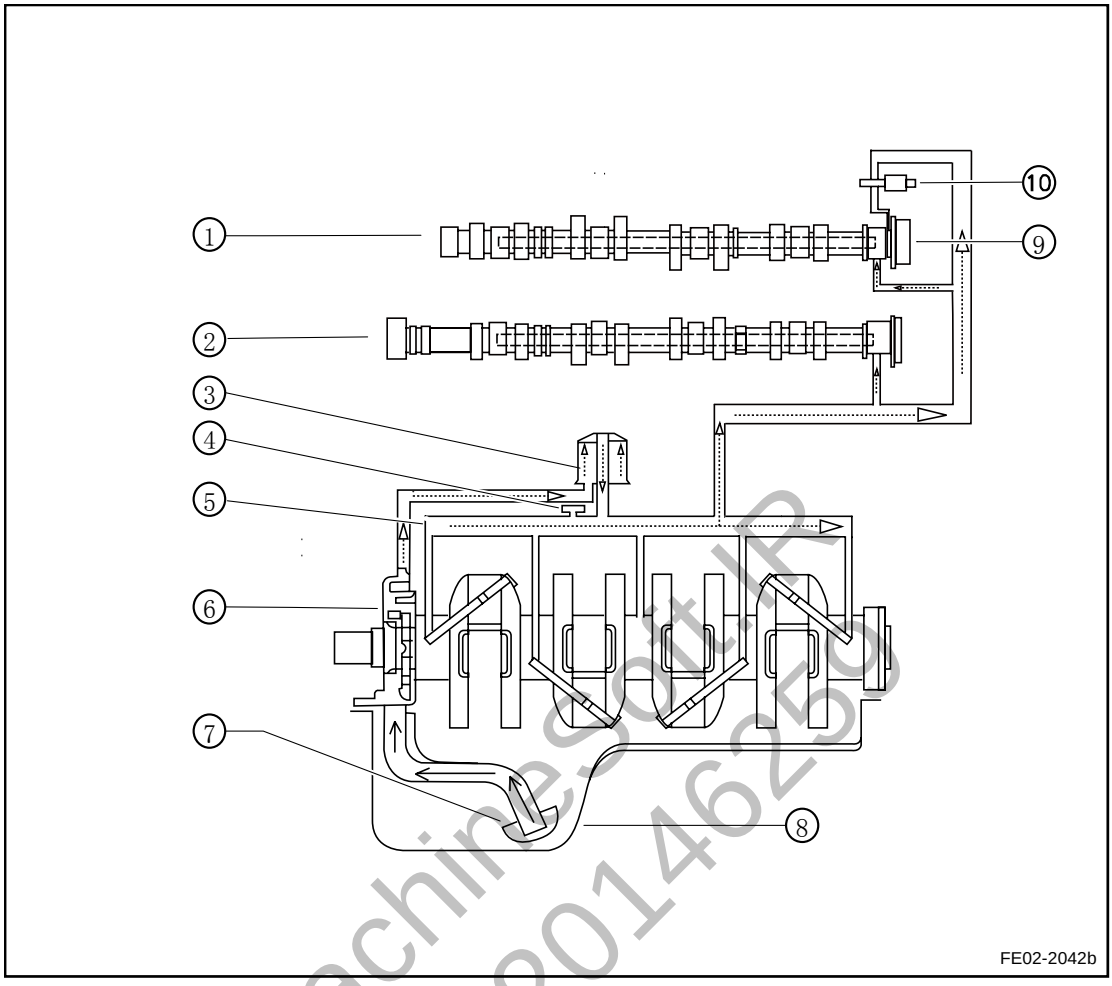
2.14.3 System operating principle

2.14.3.1 Lubrication Schematic



1. air intake camshaft
2. air exhaust camshaft
3. oil filter element
4. Sensing plug of oil pressure
5. Main oil gallery
6. oil pump
7. Oil strainer
8. Oil reservoir disc

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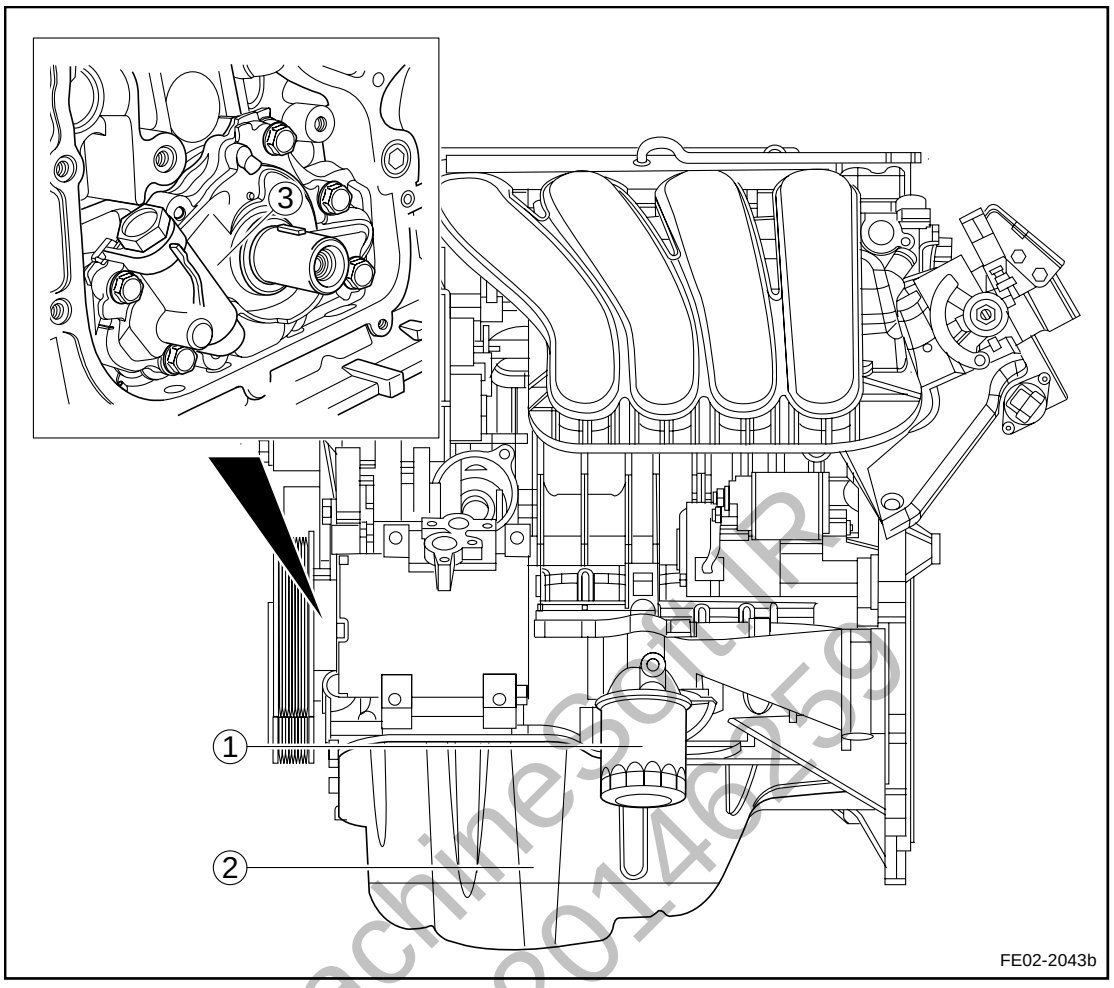
2.14.3.2 Sensing plug of oil pressure control principle

Engine oil pressure sensor plug is a pressure switch and is set on the oil filter. When the engine oil pressure is below the specified value, this switch is switched off and the engine oil pressure warning lamp in the instrument will be on. When the car starts normally, the oil pump transfers the oil pressure to the system, so this switch is switched off and the engine oil pressure warning lamp in the instrument will be off.

2.14.4 Component position

2.14.4.1 Component position



1. oil cleaner
2. storage disc
3. Engine Oil Pump

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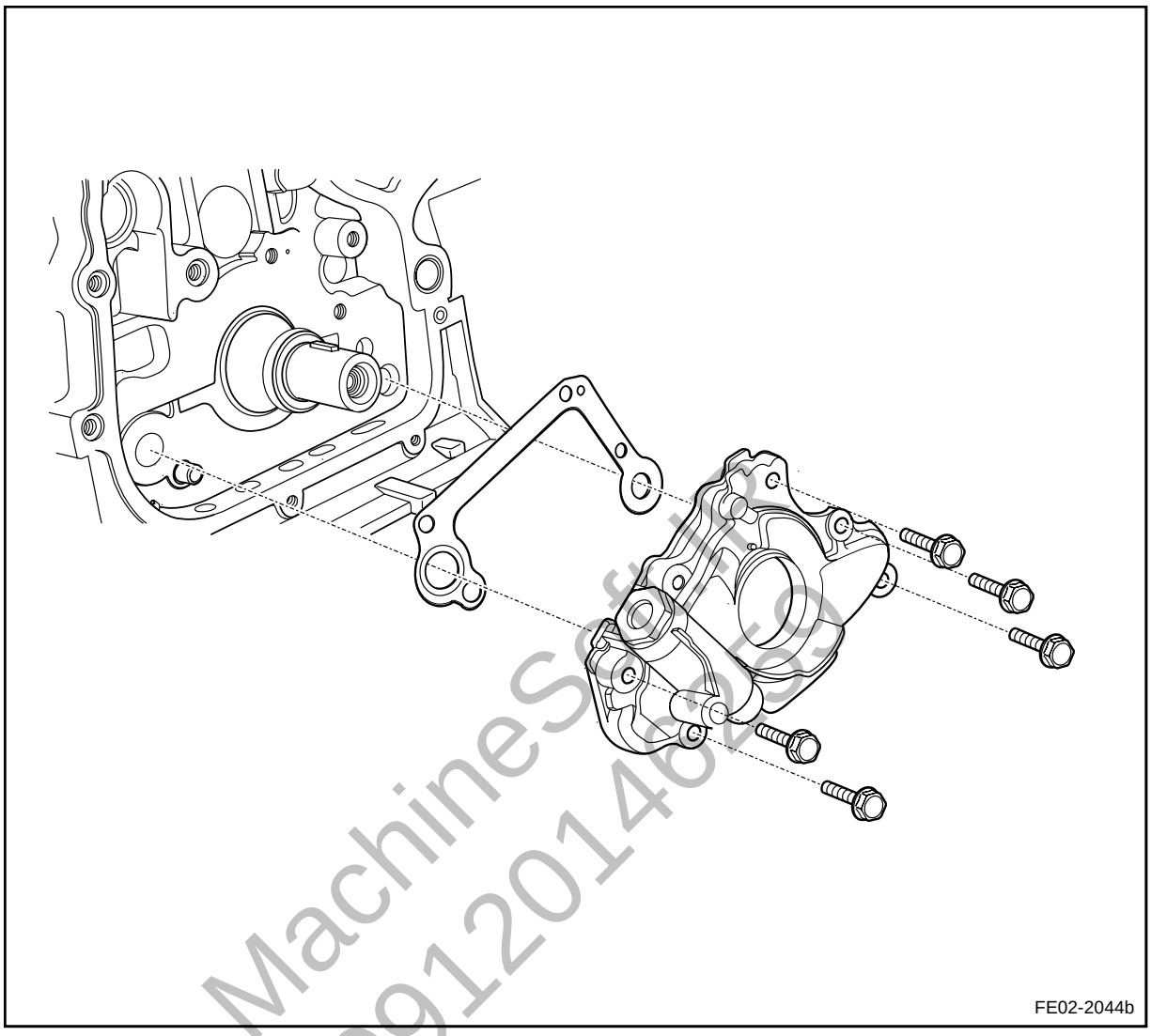
2.14.5 Disassemble drawings

2.14.5.1 Disassembly diagram



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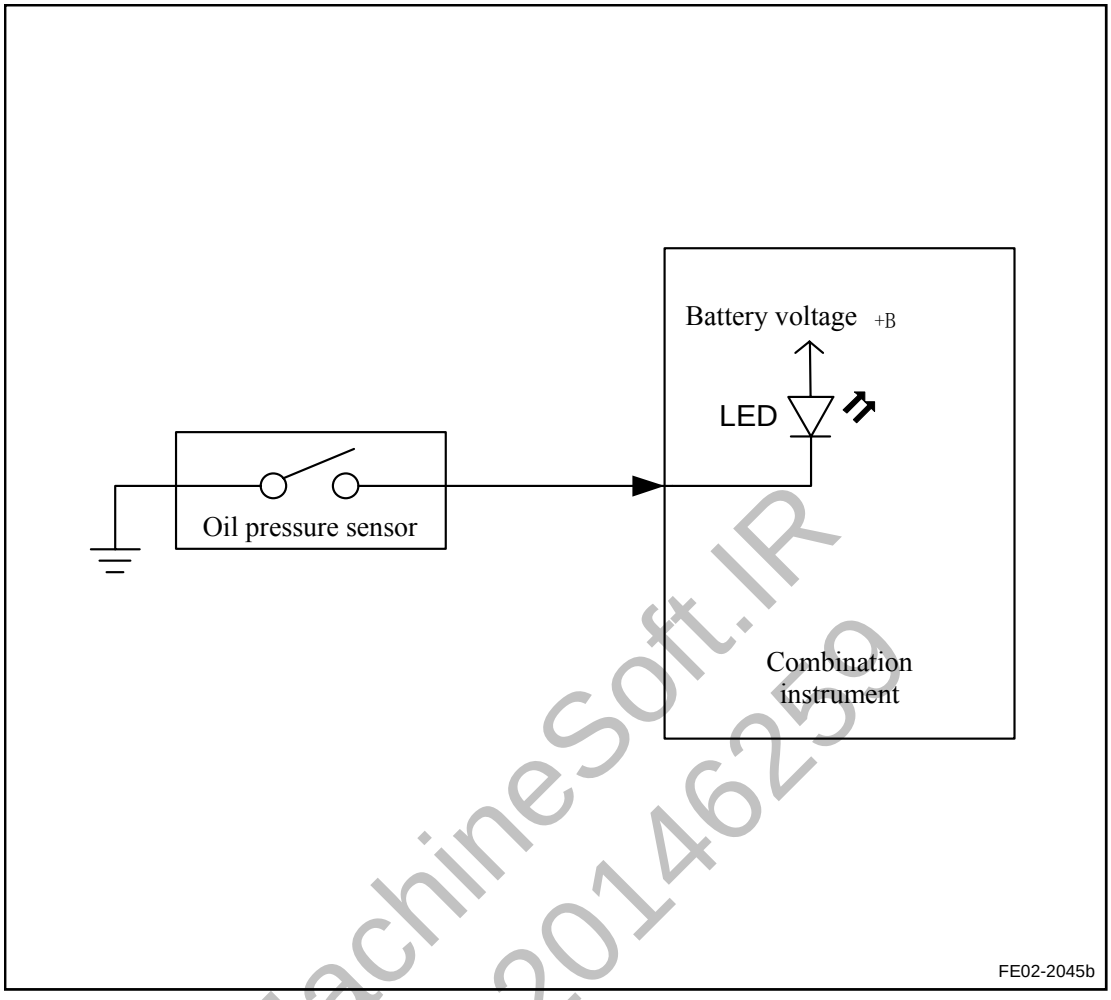
1. engine cylinder
2. Sealing washer of oil pump
3. Oil pump assembly
4. Engine oil pump bolt

2.14.6 Electrical schematic diagram

2.14 .6.1 Electrical Schematic Diagram



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2.14.7 Diagnostic message and steps

2.14.7.1 Diagnosis descriptions

Refer to 2.14.2.1 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

2.14.7.2 Visual inspection

- Inspect installed aftermarket equipment that may affect the operation of the lubrication system.
- Inspect easy to access system components to identify whether there are significant blockages or leakage. If there is leakage, confirm whether it is engine oil leak.
- Inspect whether the oil filter is dirty or blocked. If necessary, replace it.

2.14.7.3 Diagnosis of Engine Oil Abnormal Consumption

When the engine oil consumption (non-leaking) exceeds the acceptable range, abnormal engine oil consumption diagnostic must be carried out.

1	Inspect whether the fuel is normal.

Yes → Refer to 2.9.7.5 Engine Oil Leak Diagnostic

No

2	Inspect whether engine oil viscosity is abnormal. Inspect whether poor quality engine oil is used.

Yes → Replace the oil filter and engine oil

No

3	Inspect whether the vehicle sustained high speed / or excessive use.

Yes → Service the engine.

No

4	Inspect whether the positive crankcase ventilation system is blocked and whether the components are working correctly.

Yes → Repair the faulty components.

No

5	Inspect whether the valve conduit / or the valve rod is worn, whether the valve rod oil seal is worn, missing or improperly installed.

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Yes → Repair the faulty parts.

No

6	Inspect whether the piston and piston rings in the cylinder are improperly installed.

Yes → Repair the faulty parts.

No

7	Inspect whether there is correct piston ring seal, whether there are broken or worn piston rings. If necessary, repair the faulty part.

Next

8	Confirm that the fault has been fixed.

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2.14.7.4 Engine Oil Pressure Diagnostic and Test

1	Inspect whether engine oil viscosity is abnormal. Inspect whether poor quality engine oil is used.

Next

2	Park the vehicle on a level ground and let the engine run for a few minutes, waiting for a long enough period of time (2-3 min) to let the engine oil return.

Next

3	If necessary, add the recommended grade engine oil, until the engine oil level reaches the full scale.

Next

4	Let the engine run for 10-15 s. Confirm the vehicle indicator does not show that the pressure is too low or no engine oil pressure.

Next

5	Check whether there is noise or knock sound in the valve system.

Next

6	Inspect whether there are following conditions:

A. Engine oil has bubbles.

B. Idle speed is too low.

C. Oil filter is blocked.

D. Engine oil is diluted by water or the engine coolant and so on.

E. Oil filter bypass valve is faulty.

F. Oil pressure gauge is incorrect or faulty.

H. Engine oil viscosity is not suitable for the expected temperatures.

Yes

Refer to the user manual, according to local temperatures, use the Geely Automobile recommended grade and viscosity engine oil

No

7	Turn the ignition switch to "OFF" position, remove the oil pressure sensor plug.

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Next

8	Install the engine oil pressure test tool to the oil pressure sensor plug on the oil filter.

Next

9	Start the engine and measure engine oil pressure.

Next

10	Compare the readings with the pressure value in 2.14.1.2 Mechanical System Specification. If the engine oil pressure is less than the specified value. Inspect whether there are one or more of the following conditions:

A. The bolts of oil filter are loose.

B. Oil filter seat O-ring or seal is missing or damaged.

C. Oil pump is worn or dirty.

D. Oil pump to cylinder block bolts are loose.

E. Oil pump filter loose, blocked or damaged.

F, Oil pump filter O-ring missing or damaged.

G. Oil Pump Oil Filter pipes damaged or leaking.

H. Oil pump pressure regulating valve faulty.

I. The engine oil way hole plug is missing or improperly installed.

J. The intermediate drive shaft bolt for camshaft is loosened.

K. The following components bearing clearance exceed the acceptable tolerance range:

a) Link

b) Crankshaft

c) Camshaft

d) Sprocket of the intermediate drive shaft of camshaft

L. Engine oil channel cracking. There are pores or blockage.

M. Valve tappet rod broken.

When necessary, repair or replace the relevant components.

Next

11	Test is completed.

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2.14.7.5 Engine Oil Leak Diagnostic

Once a vehicle engine oil leak occurs, the following conditions must be inspected:

1	Inspect for the high level of the oil.

Yes → Discharge engine oil to the specified level.

No

2	Inspect whether the engine oil pressure is too high.

Yes → Inspect the engine oil filter or the pressure bypass valve is blocked or faults.

No

3	Inspect whether the engine ventilation system is blocked or malfunction.

Yes → Repair the faulty parts.

No

4	Inspect whether the fasteners are not fastened properly or damaged.

Yes → Replace the damaged components, tighten the torques again as required.

No

5	Inspect whether the related components have gaps or pores.

Yes → Repair the faulty parts.

No

6	Inspect whether the sealing surface is worn. Inspect whether the sealing gasket is installed properly.

Yes → Repair the faulty parts.

Next

7	Confirm that the fault has been fixed.

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2.14.8 Removal and installation

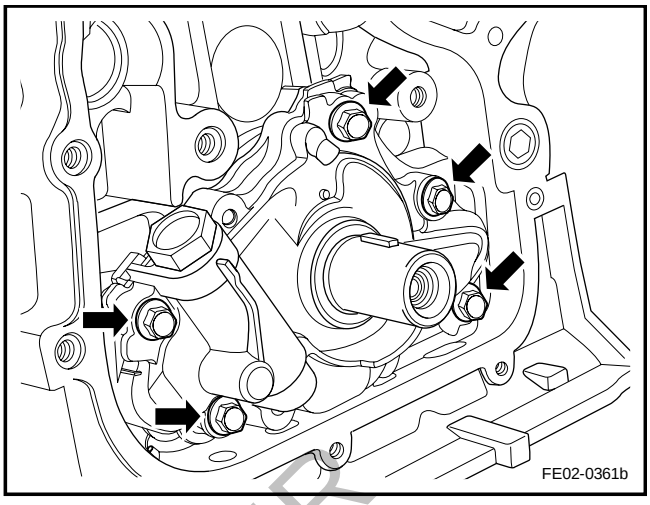
2.14.8.1 Replacement of Oil Pump

Dismantlement Procedure

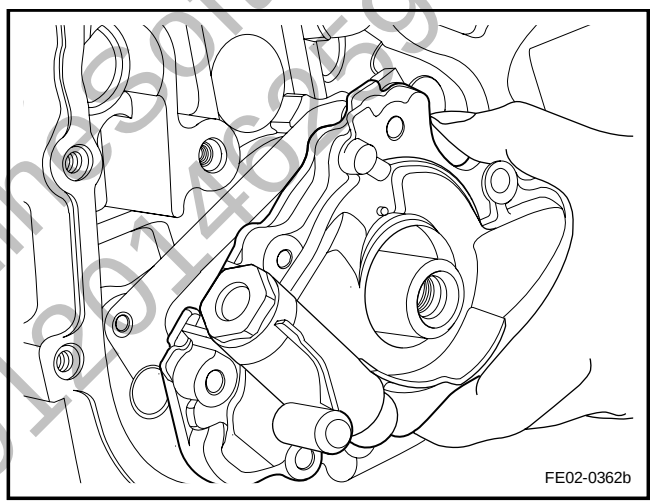
After a new oil pump is installed, the oil strainer, must be inspected.

Refer to replacement of engine oil pan and oil strainer.

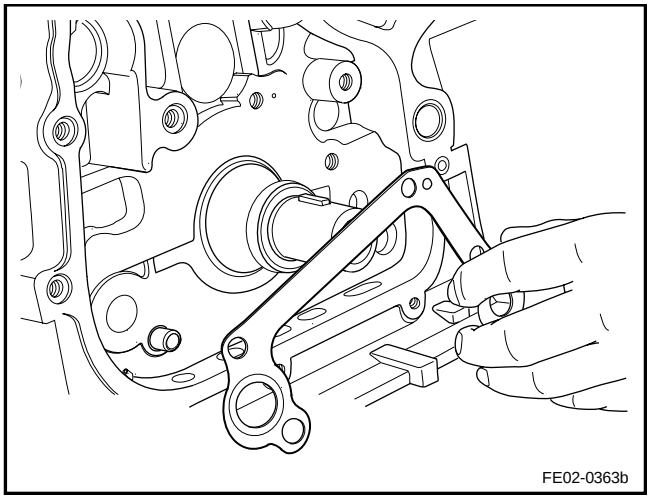
1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. For dismantling of timing chain cover, ""refer to 2.6.8.9 Replacement of timing chain cover".
3. Refer to 2.6.8.10 "Replacement of Timing Chain" to dismantle the timing chain.



4. Dismantle oil pump bolts.
5. Remove the oil pump from the engine cylinder body.



6. Remove the oil pump lining pad from the engine cylinder body.



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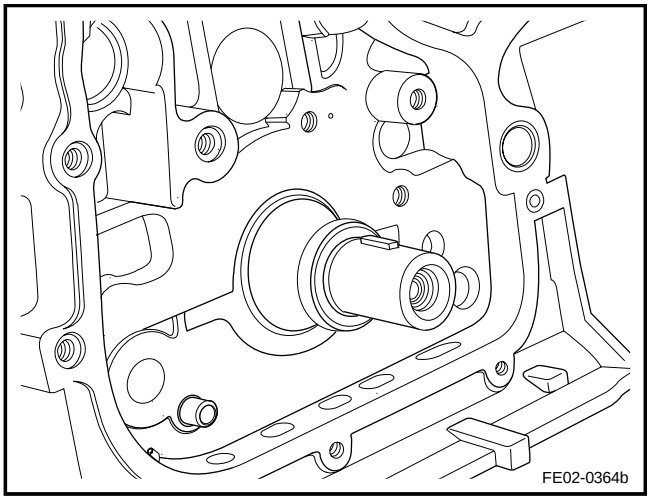
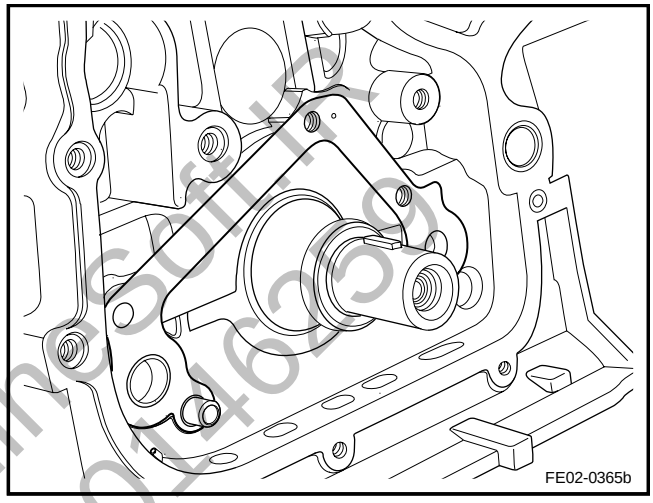
Installation Procedure:

1. Before installation, clean the strainer in the engine oil pan. Refer to 2.14.8.3 Replacement of oil pan.
2. Clean engine block oil pump installation surface.



3. Install Gasket of oil pump

Note: the engine oil pump linear is a single use piece, which must be replaced after repairing!

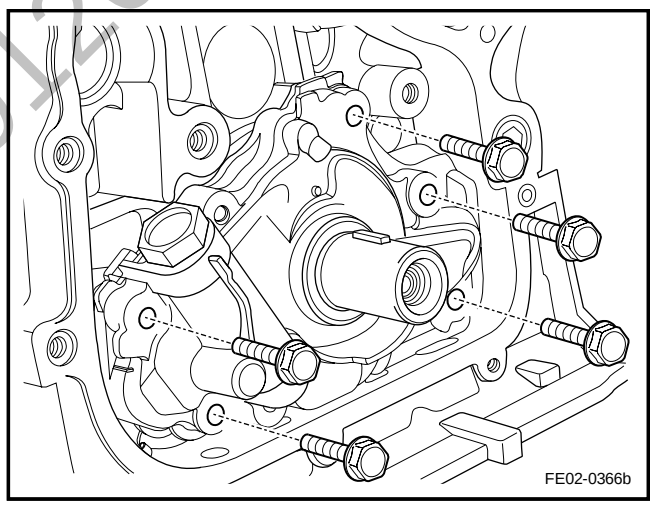


4. Install and tighten the fixing bolts of oil pump.

Torque :9N . m(Metric) .

6 . 7lb-ft(English system)

5. Install timing chain
6. Install the timing chain cover.
7. Install negative cable of battery.



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2.14.8.2 Oil Pump Cleaning and Inspection

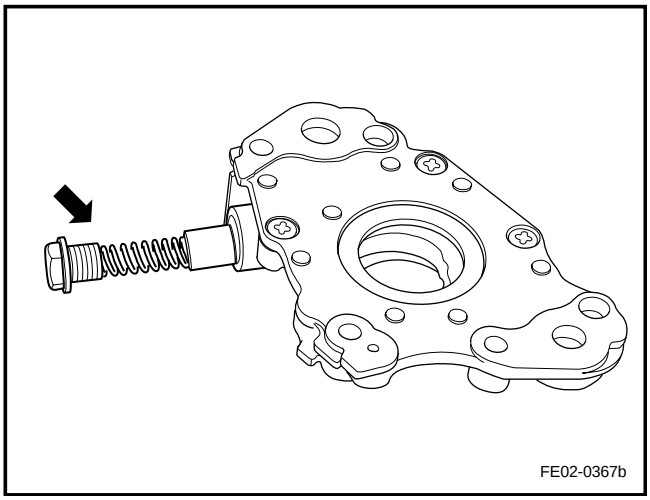
Decomposed cleaning steps:

1. Oil Pump Valve Inspection:

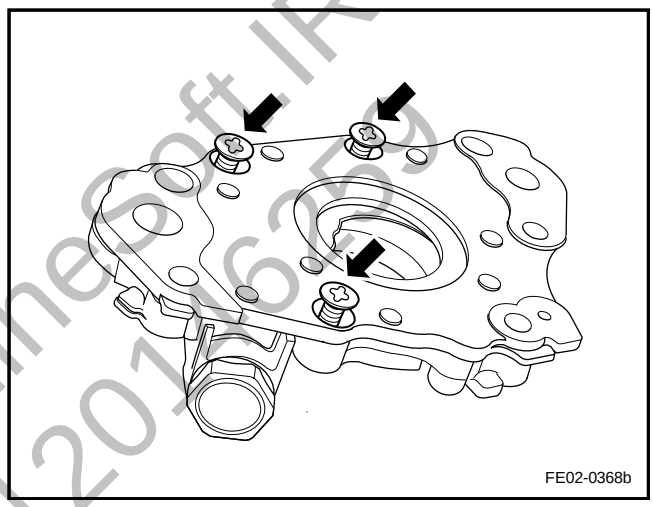
A. Dismantle the valve safety bolts, dismantle the springs and the slide valve.

B. Inspect whether the surface of slide valve is worn. whether the hole wall is worn. Whether the slide valve and the inner hole clearance is normal.

C. Apply lubrication oil on the slide valve, install slide valves and springs, tighten valve bolts.

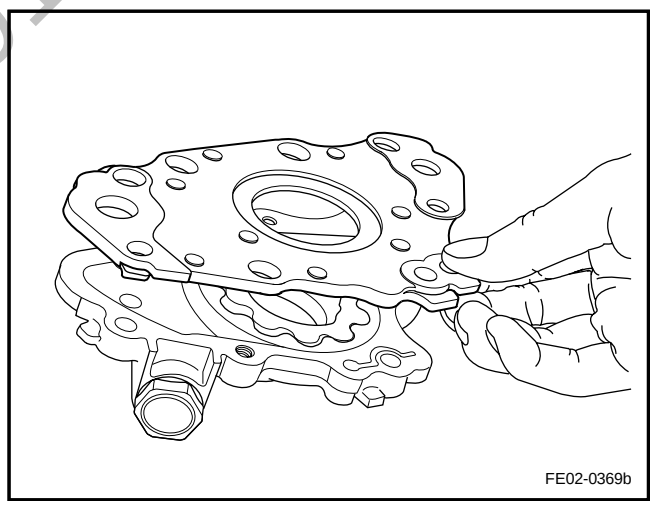


2. Dismantle fixing bolts on the rear cover of oil pump.



3. Take out end cover of oil pump

4. Clean the oil pump housing and internal part.



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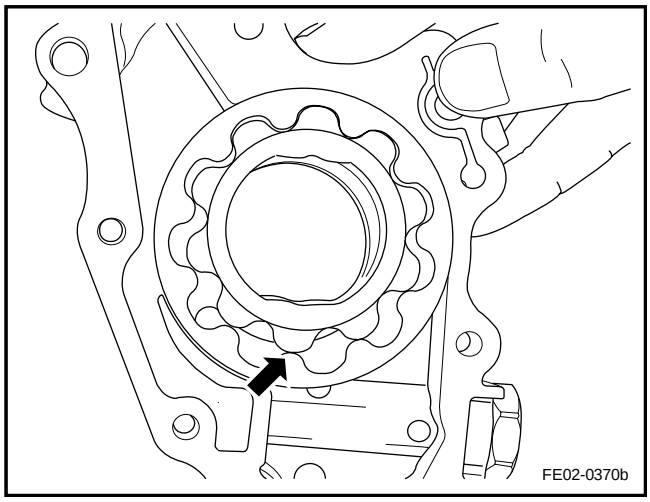
Inspection Procedure:

1. Inspect all oil pump parts for worn and torn.
2. Apply clean engine oil to all oil pump parts.

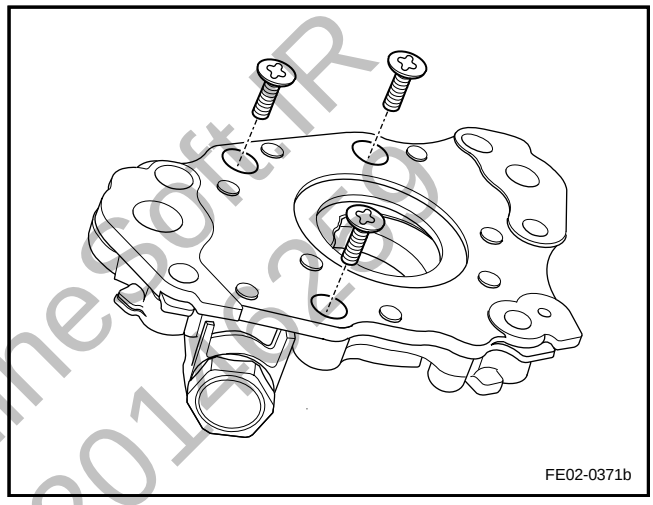
Precautions:

A: Apply lubrication grease to the oil pump gear chamber in order to ensure initial oil pump lubrication.

B. When :install engine oil pump gear . shall aim at reference position .



3. Install oil pump rear cover, and tighten connecting bolts.



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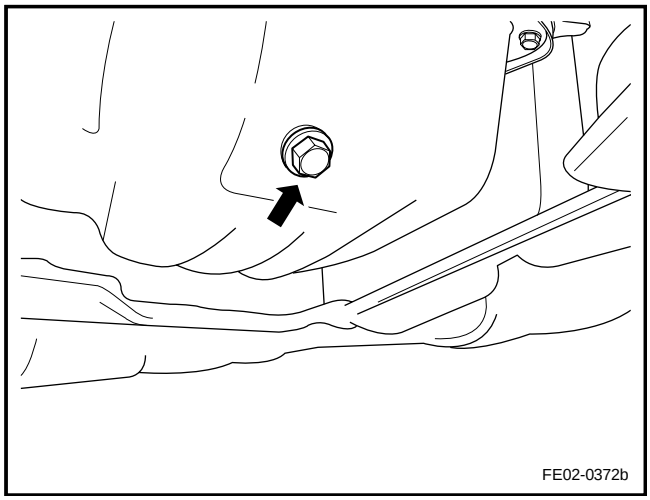
2.14.8.3 Replacement of Oil Pan

Dismantlement Procedure

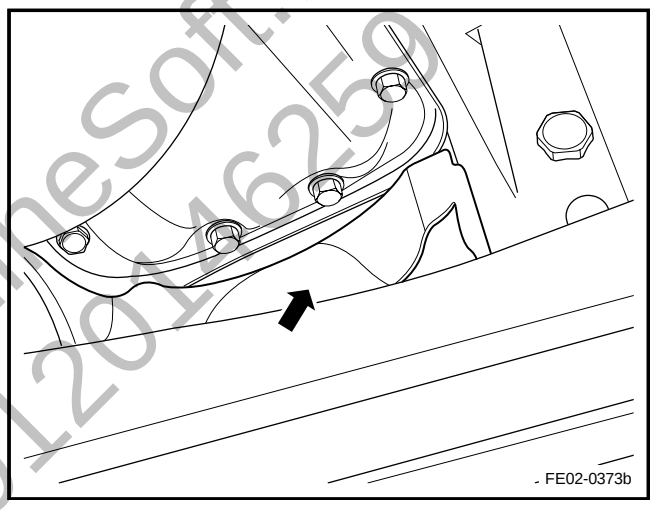
Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

Warning: Refer to Warning on Vehicle Lifting and Jacking in Warnings and Precautions.

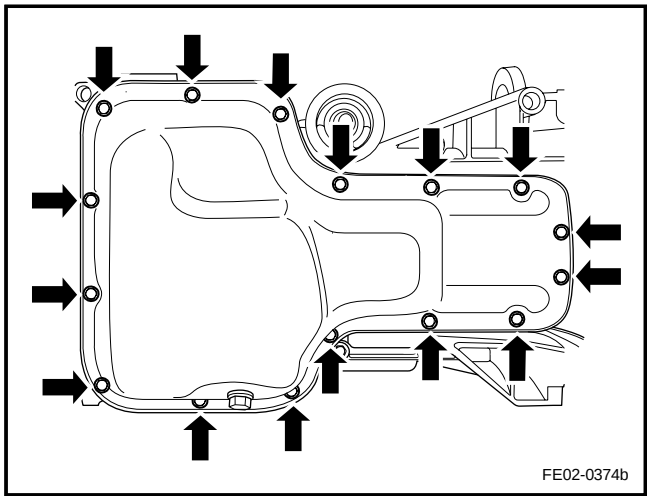
1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Lifting and Jacking Vehicle
3. Loosen oil drain bolt of engine oil reservoir, and drain lubricating oil from engine crankcase.



4. Dismantle anti-dust plate of crankshaft case.



5. Dismantle the fixing bolts and nuts of oil pan.



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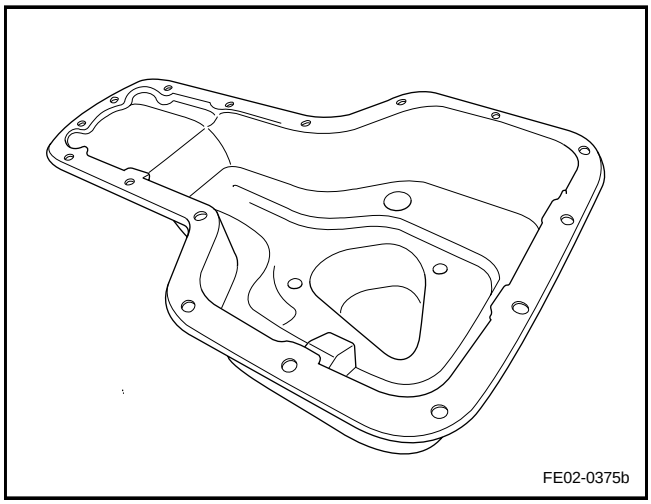
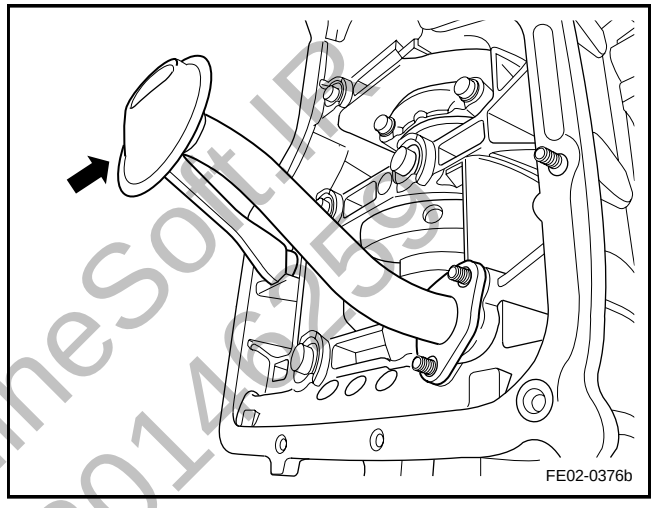
6. Dismantle the oil sump from the cylinder body.



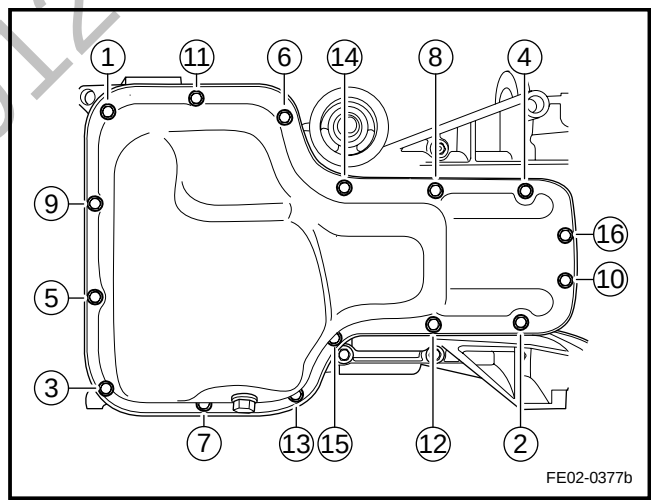
Installation Procedure:

1. Inspect and clean the strainer before installing the oil pan.



2. Clean combination surface of oil reservoir and cylinder.
3. Apply sealant uniformly on engine oil reservoir disc.
4. Install oil reservoir, and tighten 16 fixing bolts and nuts according to the sequence shown in figure.

Torque ： 9N.m(metric) 6.7lb-ft(English system)



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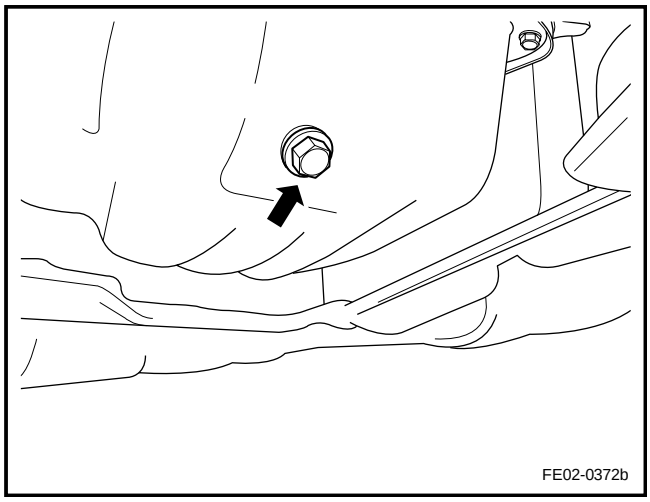
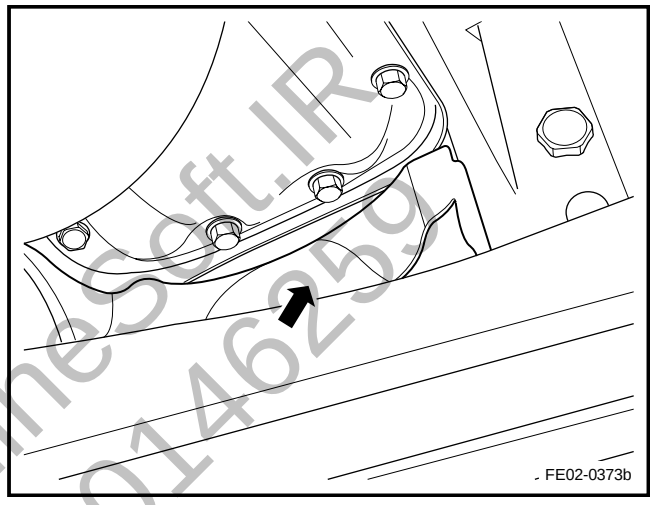
5. Install the crankcase dust guard.



6. Install and tighten the oil reservoir disc refueling bolt.

Torque ： 9N.m(metric) 6.7lb-ft(English system)



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3.1 Warnings and precaution

3.1.1 Warnings and precaution

Warning for battery disconnection

Warning!

Unless directed, otherwise, the ignition and start switch must be in OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable if a tool or any equipment easily comes in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

Warning for clutch dust

Warning!

When servicing clutch components, do not create dust by grinding or sanding the clutch disc or by cleaning parts with a dry brush or with compressed air. A water-dampened cloth - NOT SOAKED - should be used. Clutch disc may contain fiber, which can be mixed into air if dust is produced during maintenance. inbreathing dust containing fiber can damage your health severely.

Warning for moving components and hot surfaces

Warning!

Avoid contacting with moving components and hot surfaces while working around a running engine in order to prevent personal injury.

Warning for protective goggles and glove warning

Warning!

Approved protective goggles and gloves should be worn when dismantling the exhaust system components, or else the sharp edge or the iron rust dropped down from the exhaust system components may cause serious personal injury.

Warning for road test

Warning!

Test a vehicle on the roads under safe conditions and obey all traffic laws. Do not attempt any operation that could jeopardize vehicle control. Failure to obey these precautions will lead to serious personal injury and vehicle damage.

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Precaution for lifting engine

Notes:

When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Lifting the engine in an unapproved manner may cause damages to component.

Precaution for fastener

Notes:

Use the correct fastener in the correct position. Replacement of fasteners must have the correct part number for that application. Fasteners requiring replacement and fasteners requiring the use of thread locking compound or sealant are identified in the service procedure. Do not use paints, lubricants, or corrosion inhibitors on fasteners or fastener joint surfaces unless specified. These coatings affect fastener torque and joint clamping force and may damage the fastener. Use the correct tightening sequence and specifications when installing fasteners in order to avoid damage to parts and systems.

Precaution for sealant

Notes:

Do not allow the RTV sealant to enter any blind threaded hole. If RTV sealant enters a blind threaded hole, it can cause hydraulic lock of the fastener when the fastener is tightened. Hydraulic lock of a fastener can lead to damage to the fastener and/or the components. Hydraulic lock of a fastener can also prevent the proper clamping loads to be obtained when the fastener is tightened. Improper clamping loads can prevent proper sealing of the components allowing leakage to occur. Preventing proper fastener tightening can allow the components to loosen or separate leading to extensive engine damage.

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3.2 Clutch system

3.2.1 Fastener specification

3.2.1.1 Fastener Specifications

Fastener Name	Model	Specification	
		Metric (N.m)	English system (lb-ft)
Fixing bolt of clutch slave pump	M8×1.25×25	18～22	13.3～18.4
Fixing bolt of clutch slave pump oil pipe bracket	M8×1.25×16	18～22	13.3～18.4
Fixing bolt of clutch pressure plate and driven disc	M8×1.25×14	22～33	13.3～18.4

3.2.1.2 General Specifications

Applications	Specification	
	Metric（mm）	English System (in)
Outer diameter of clutch pressure plate	276.5	10.9
Outer diameter of clutch driven plate	230	9.1
Worn limiting value of Clutch driven disc (Rivet head depth)	1.95±0.3	0.077±0.011
Flywheel Plane Runout (Interface of clutch drive disc)	0.7	0.028

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3.2.2 Description and operation

3.2.2.1 Description and operation

The clutch assembly is located between the engine and the transmission, and is retained to the flywheel rear surface by fixing bolt . The clutch spline hub and transmission input shaft form rigid connections. During driving, the driver can press or release the clutch pedal according to requirement, to temporarily separate the engine and the transmission or gradually connect them in order to cut off or pass the input power from the engine to the transmission. Clutch system mainly includes the following components:

- Driving parts: Clutch pressure plate , Clutch pressure plate is fixed on the flywheel by bolts.
- Driven parts: clutch disc with a spline hub. Spline hub slides freely along the input shaft in axial direction, and drives the input axis. Driving parts and driven parts maintain contact through spring pressure. The pressure is applied by the diaphragm spring in the pressure plate assembly.
- Working parts: Clutch separation system consists of the clutch pedal, disengaging shaft, fork and Release bearings. When the clutch pedal is pressed, the Release bearings are pushed. Bearings then push the separation rod within the pressure plate and then the clutch is separated.

3.2.3 System operating principle

3.2.3.1 System Operating Principle

1. Ensure vehicle smooth start:

Before start, the vehicle is in stationary state. If the engine and transmission have a rigid connection, once a gear is engaged, vehicle will suddenly move forward because of the suddenly transmitted power. It will not only cause damage to mechanical parts, but also the driving force is not enough to overcome the enormous inertia caused by the forward force, so that the rapidly decrease in engine speed will shut down the engine. If a clutch is used when starting, the engine and transmission will be temporarily separated, and then the clutch will gradually engage. Due to the sliding between the clutch driving parts and the driven part, the torque transmitted from the clutch gradually increases from zero, while the vehicle driving force gradually increases, so that the vehicle starts smoothly.

2. Easy to shift:

During driving, there is a need to frequently switch to different gears in order to adapt to changing driving conditions. If there is no clutch to temporarily separate the engine and transmission, then the transmission meshing gears will be hard to separate due to the unreleased load. In addition, gears with different circumferential speeds are difficult to mesh. Even if forced into the mesh, there will be a huge impact on tooth side and cause damage to parts. Use the clutch to temporarily separate the engine and transmission, then pressure between meshing surfaces of the original pair of gears will be greatly reduced due to load released, and thus they are easy to separate. For the other pairs of meshing gears, because the gear is separated from the engine and the inertia is small, it can make the gears meshing circumferential speed to be equal to or close to equal just using appropriate shifting action, so as to avoid or mitigate the impact between gears.

3. Prevent the transmission system overload:

During emergency braking, the wheel speed suddenly decreases. Transmission system is connected to the engine and has the rotation inertia, so it remains the original speed, which generates a far greater inertia torque than the engine, causing damage to the powertrain parts. As the clutch relies on friction to transmit torque, so when the transmission system load exceeds the friction torque, the clutch drive parts and driven parts will skid, thus to prevent the overload.

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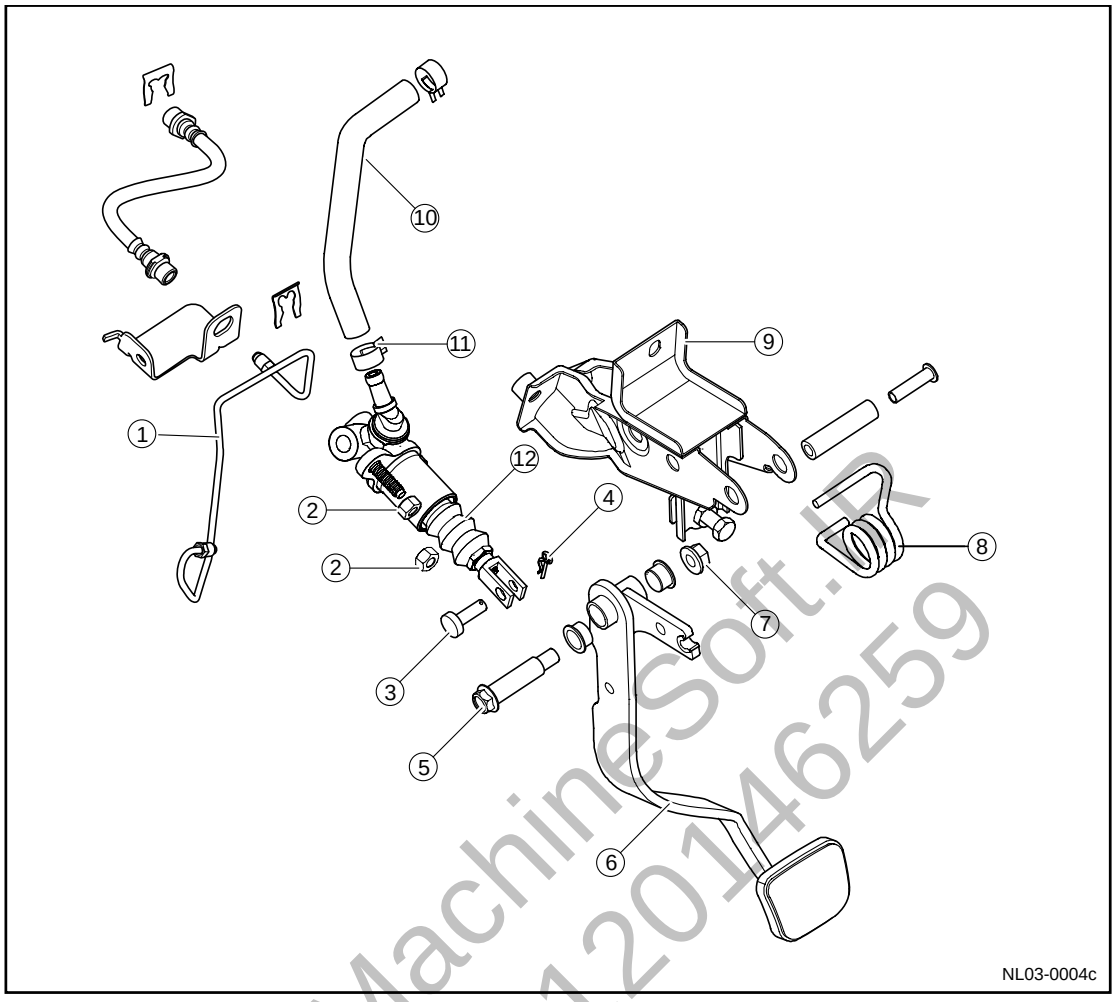
3.2.4 Disassemble drawings

3.2.4.1 Clutch control mechanism



1. Oil outlet pipe assembly of master pump
2. Fixing nut of clutch master pump
3. Pin axle
4. Pin axle lockpin
5. Clutch pedal mounting nolt
6. Clutch pedal
7. Clutch pedal mounting nut
8. Clutch pedal return spring
9. Clutch pedal support
10. Oil Inlet hose for master pump
11. Retaining clamp for oil inlet hose for master pump
12. Clutch master pump assebmly

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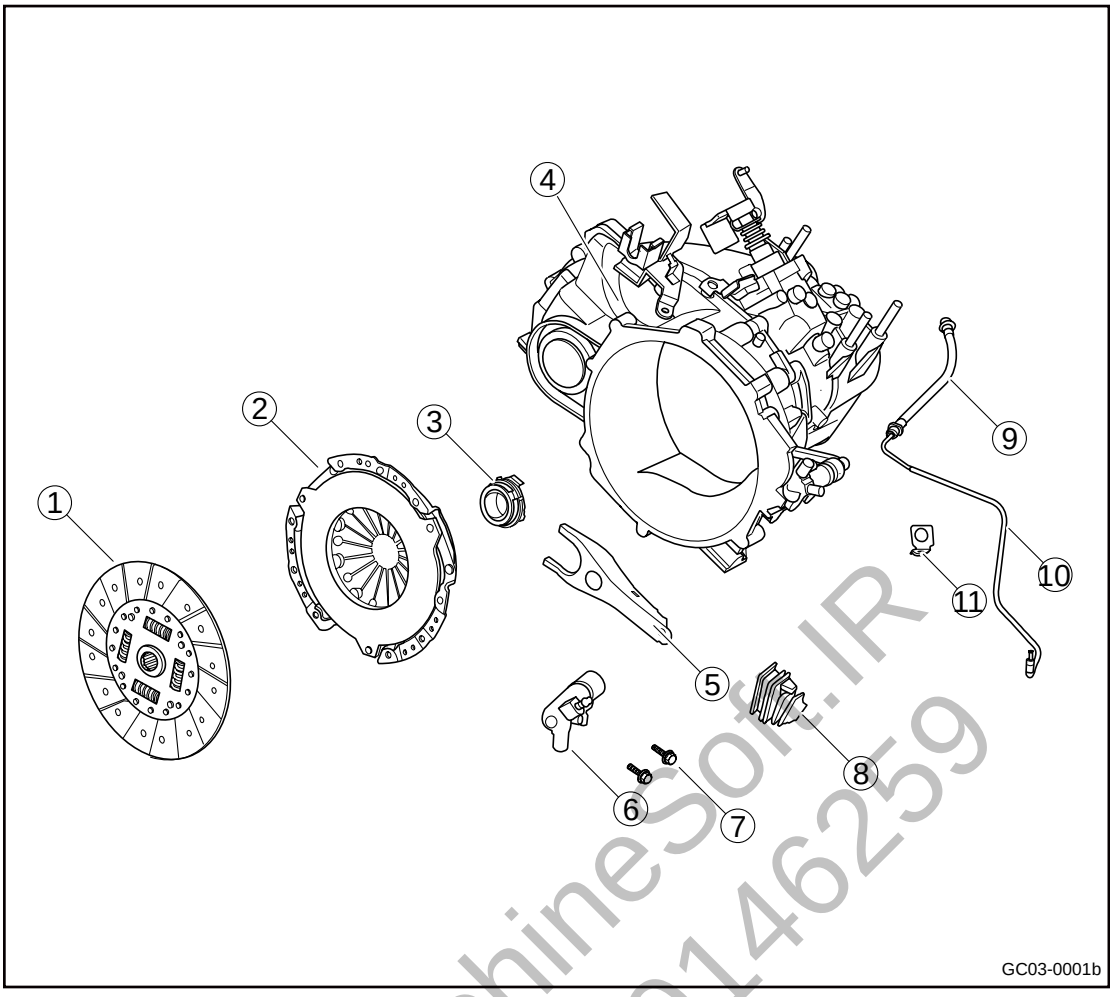
3.2.4.2 Clutch disengaging mechanism



1. Clutch driven disc
2. Clutch pressure plate
3. Release bearing
4. Transmission assembly
5. Release fork
6. Clutch slave pump
7. Fixing bolt of clutch slave pump
8. Release fork sleeve
9. Clutch hydraulic hose
10. Oil inlet pipe of clutch slave pump
11. Fixed support for clutch hydraulic hose

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3.2.5 Diagnostic information and procedures

3.2.5.1 Diagnosis descriptions

Refer to system 3.2.2 Description and operation and start system diagnosis. When malfunction occurs, refer to Description and operation, as it will help to determine the correct symptoms diagnostic procedures. It will also help to determine whether the condition the customer described is in normal. Refer to 3.2.2 Description and operation to confirm the correct procedures for system diagnosis.

3.2.5.2 Clutch disengaging fault (Gearshift lever cannot select gears)

Fault definition: In the normal running condition of engine, step on the clutch pedal to the full travel, the gearshift lever can not engage or disengage from a gear.

1	Check if there are obstacles under the clutch pedal.

A. Check if the floor cushion blocks the clutch pedal travel.

Check if there is an after-sale adding part, such as rubber flooring, etc., affecting the clutch pedal travel.

Yes → Repair the fault position

No

2	Step on the clutch pedal, and Check if the clutch release fork acts.

Yes → Go to Step 8

No

3	Check if the travel between the clutch pedal and clutch master pump is too large?

Check the pedal bushing for wear and tear.

Yes → Replace pedal bushing.

No

4	Check if the clutch master pump is seized or blocked.

Yes → Replace clutch master pump. Refer to 3.2.6.3 clutch master pumpr and pipe removal and assembling

No

5	Exhaust hydraulic clutch pipe system. Refer to 3.2.6.4 hydraulic clutch exhaust. Does clutch release fork work normally?

Yes → The system is normal.

No

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6	Check if clutch slave pump is struck or clamping stagnation? (Slave pump can be freely active under the normal condition)

Yes → Replace clutch master pump. Refer to 3.2.6.3 clutch master pump and pipe removal and assembling

7	Check if the clutch master pump leaks internally.

Inspect for correct clutch pedal reserve:

A. Release the clutch pedal to the half travel.

B. Apply the clutch pedal several times.

C. Inspect to ensure the clutch pedal reserve is correct.

Can not the clutch master pump keep correct pedal surplus?

Yes → Replace clutch master pump. Refer to 3.2.6.3 clutch master pump and pipe removal and assembling

No

8	Dismantle Transmission assembly, Check if clutch driven disc was damaged? (Check if it was warping or bending)

Yes → Replace the clutch driven disc.

No

9	Dismantle transmission assembly; check if clutch pressure plate was damaged? (check if it was warping or bending)

Yes → Replace the clutch pressure plate

No

10	Dismantle the transmission assembly, Check if the clutch driven disc is biding on the transmission input shaft axle?

Yes → Replace the clutch driven disc.

Next

The system is normal.

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3.2.5.3 Clutch skidding fault

Faultdefinition: When 1st speed is selected and the clutch is fully engaged, the vehicle is difficult to start or can not start.

1	Check if clutch pedal height is correct. Otherwise, clutch master pump can not be completely reset. Measure the free stroke of clutch pedal. Refer to “3.2.8.4 free stroke adjustment of clutch pedal

Next

2	Check whether the oil pipes are broken or damaged, thus causing the clutch slave pump oil pressure can not be released in time.

Yes → Replace the damaged pipe.

No

3	Check if the clutch slave pump is blocked.

Yes → Replace the clutch slave cylinder. Refer to 3.2.6.7 clutch slave cylinder replacement

No

4	Check if the clutch master pump is blocked.

Yes → Replace clutch master pump . Refer to 3.2.6.3 Clutch master pump and pipe removal and assembling

No

5	Check if the clutch driven disc is overheating.

Yes → Cool the clutch driven disc

No

6	Dismantle the transmission. Check if the clutch disc is contaminated by oil.

Next

7	Dismantle the transmission. Check if the clutch driven disc is excessively worn and torn, or broken.

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Yes → Replace clutch driven disc; refer to 3.2.6.5 replacement of clutch assembly

No

8	Check if the clutch pressure plate or flywheel is warped.

Yes → Replace clutch compressing disc or flywheel; refer to 3.2.6.5 replacement of clutch assembly and 2.7.8.20 replacement of flywheel

No

9	Check if the Clutch pressure plate diaphragm spring is too soft, replace the clutch assembly.

Next

Troubleshooting

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3.2.5.4 Clutch pedal is hard to push

Note：If the clutch oil is not correct, replace the clutch master pump and working cylinder, flush the system and fill the correct oil.

1	Check if clutch hydraulic oil is correct? (Check brake system work is normal)

Next

2	Check if the clutch oil is contaminated.

(a) Check if there is water in clutch oil.

(b) Check if there is dust or debris in the clutch oil.

(c) Check if the clutch oil is subject to the incorrect oil contamination. If the oil is contaminated, replace clutch master pump and clutch slave pump .

(d) Flush hydraulic system and fill the correct oil.

Next

3	Check if the clutch hydraulic hose is kinked or damaged.

Next

4	Check the clutch pressure plate, clutch driven disc.

Next

5	Troubleshooting

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3.2.5.5 Clutch pedal does not return

1	Check if the clutch slave pump is blocked.

Yes → Replace the clutch slave cylinder. Refer to 3.2.6.7 clutch slave cylinder replacement

No

2	Check if the clutch master pump is blocked.

Yes → Replace clutch master cylinder. Refer to 3.2.6.3 clutch master cylinder and pipe removal and assembling

No

3	Check if the clutch pedal height is correct, otherwise the clutch master pump can not completely reset. Measure the clutch pedal free travel. Refer to 3.2.6.4 clutch pedal free travel Adjustment.

Next

4	Check if the oil pipes are broken or damaged, thus causing the clutch slave pump oil pressure can not be released in time.

Yes → Replace the damaged pipe.

No

5	Check if clutch fork or release bearing are blocked.

Yes → Replace release bearing or release shift fork, refer to 3.2.6.6 replacement of release bearing

No

6	Check if the pressure plate spring is too soft. Replace the clutch pressure plate.

No

7	Troubleshooting

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3.2.5.6 Clutch bearing noisy when clutch engaging

1	Check if the release bearing is blocked.

Yes → Clean and relubricate the release bearng. Inspect if the release bearing has bur and notch.

No

2	Check if the fork is installed correctly, Dismantle and re-install the fork correctly.

Next

Troubleshooting

3.2.5.7 Clutch rattle

1	Check if the pressure plate diaphragm spring is too soft.

Yes → Replace the clutch pressure plate

No

2	Check if the fork is installed correctly, Dismantle and re-install the fork correctly.

Next

3	Check if clutch driven disc buffer has lubrication oil?

Yes → Rule out engine oil leakage and replace the clutch driven disc.

No

4	Check if the damping spring of the clutch driven disc is damaged, replace the clutch driven disc.

Next

Troubleshooting

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3.2.6 Dismantle and installation

3.2.6.1 Replacement of clutch pedal

Dismantle procedure

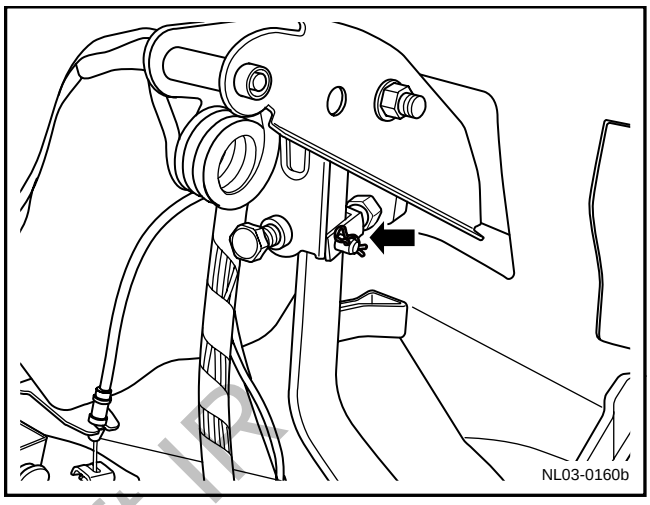
Warning: Refer to warning for battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery cable disconnection/connection procedures.
2. Dismantle instrument panel. Refer to 12.8.3.1 instrument panel replacement.

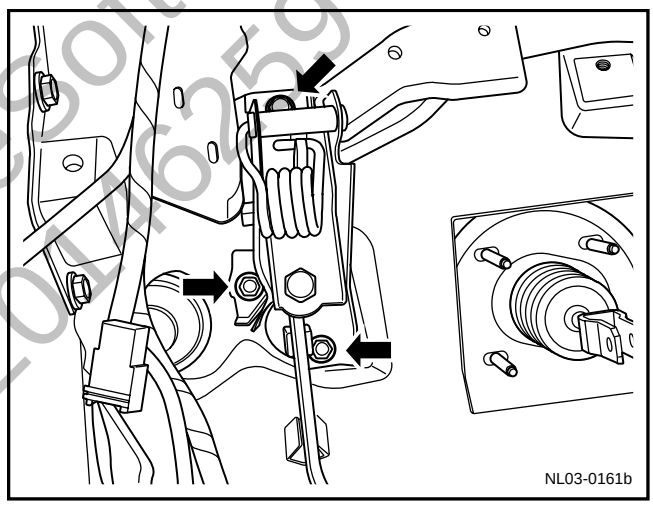
Note: Please use a special tool for body repair when disassembling the trim panel, otherwise, the interior trim will easily be

The panel edge is scratched.

3. Separate the clutch piston connecting rod U-shaped clip and the clutch pedal.



4. Dismantle the three fixing nuts of clutch pedal assembly.
5. Take out the clutch pedal.



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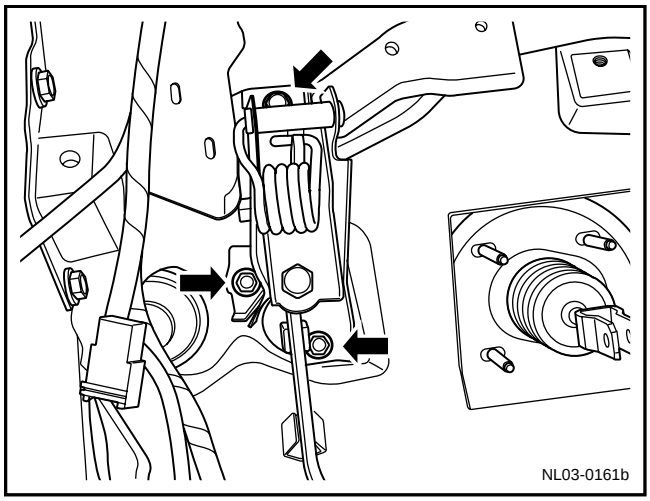
Installation procedure:

1. Install the clutch assembly.
2. Install and tighten fixing nut of clutch pedal.

Torque: 21N.m (Metric system) 15.5 lb-ft (English system)

3. Install the connecting pin between the clutch piston connecting rod U-shaped clip and the clutch pedal.
4. If necessary, adjust free stroke of clutch pedal. Refer to 3.2.6.4 free stroke adjustment of clutch Pedal.
5. Install the instrument panel.
6. Connect the battery negative cable.



3.2.6.2 Clutch master pump Replacement

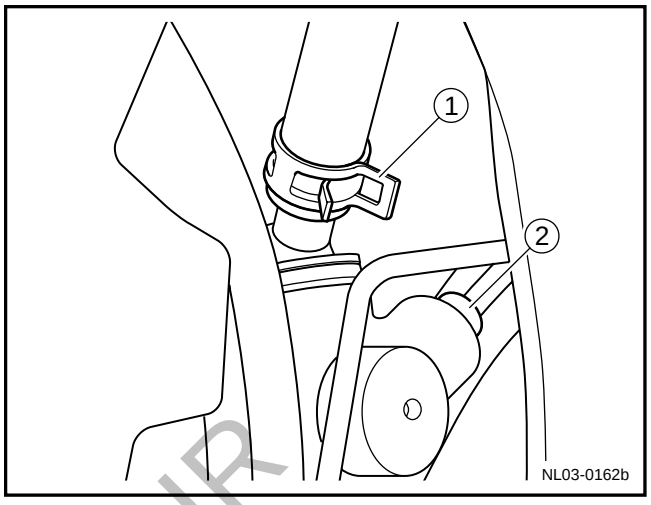
Dismantle procedure

Warning: Refer to warning for battery disconnection in warnings and precautions.

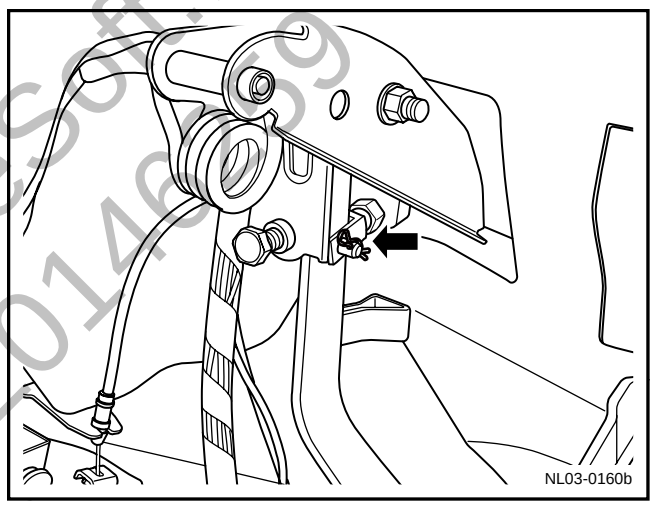
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery cable disconnection/connection procedures .
2. Dismantle left lower guard plate of instrument panel. Refer to 12.8.3.1 Replacement of instrument panel.

Note: Before disconnecting the cylinder, release the clutch/brake fluid.

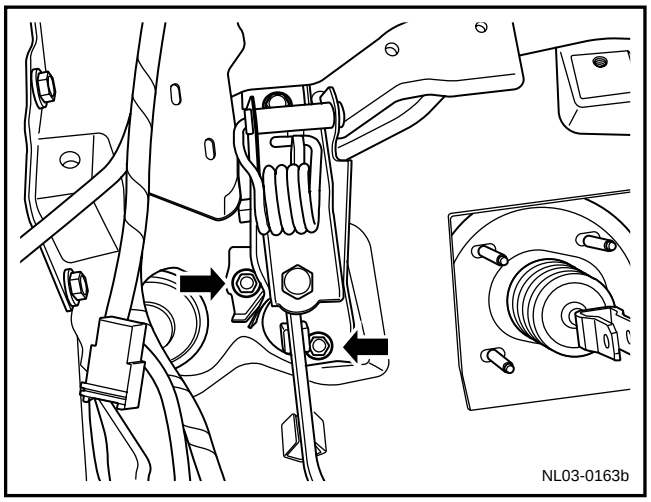
3. Loosen the hose clamp on master pump. Dismantle oil inlet hose 1 from liquid accumulator to master pump.
4. Disconnect the metal oil pipe joint 2 on clutch master pump.



5. Dismantle the cotter pin from the clutch pedal and the piston connecting rod U-shaped clip, and pull out the connecting pin.



6. Dismantle the two fixing nut s on the clutch cylinder.



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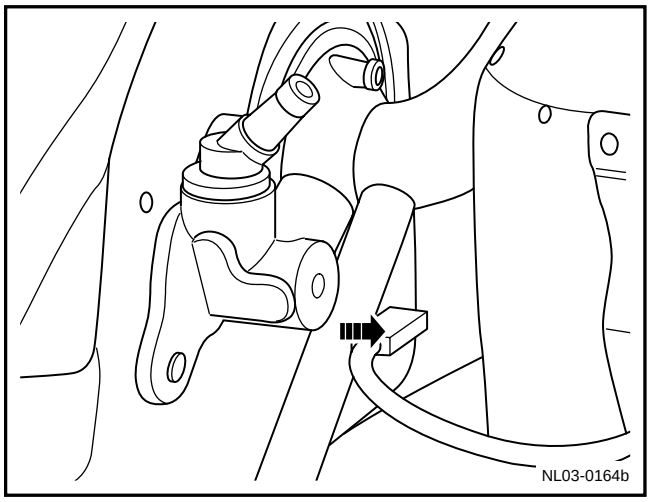
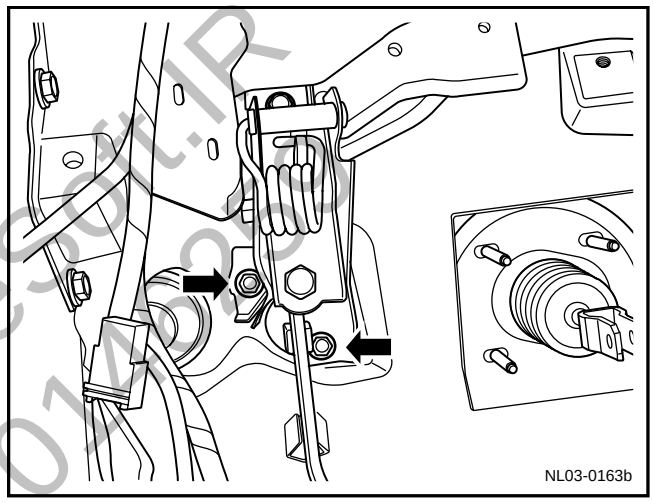
7. Pull out of master pump along the direction of the engine compartment.



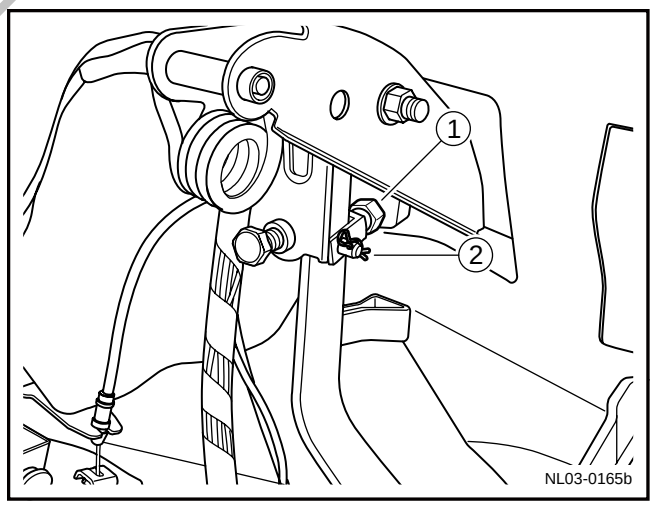
Installation procedure::

1. Install clutch master pump and tighten the two Fixing nut s of the clutch master pump.

Torque: 21Nm (Metric) 15.5 lb-ft (English system)



2. Install the connecting pin between the clutch pedal and the piston connecting rod U-shaped clip, lock the cotter pin 2.



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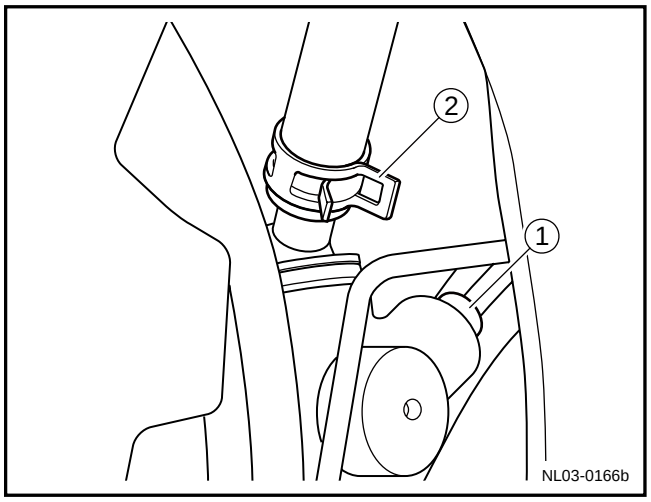
3. Connect the metal oil pipe joint 1 on the clutch master pump.
4. Install oil inlet hose from liquid accumulator to master pump and install fixing clamp 2 of hose.
5. Discharge the air.
6. Adjust the clutch pedal.
7. Install lower left guard plate of instrument panel.
8. Fill the clutch / brake fluid to the MAX (maximum) mark.
9. Connect the battery negative cable.



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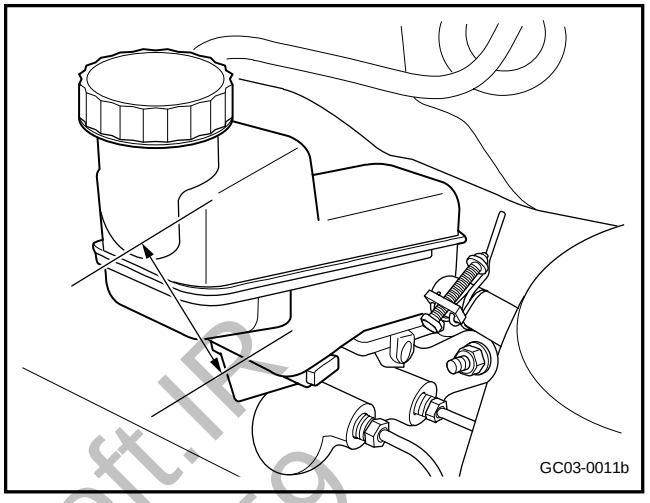
3.2.6.3 Hydraulic clutch exhaust

Note: Brake fluid has corrosivity, which will damage electrical joint and paint coating.

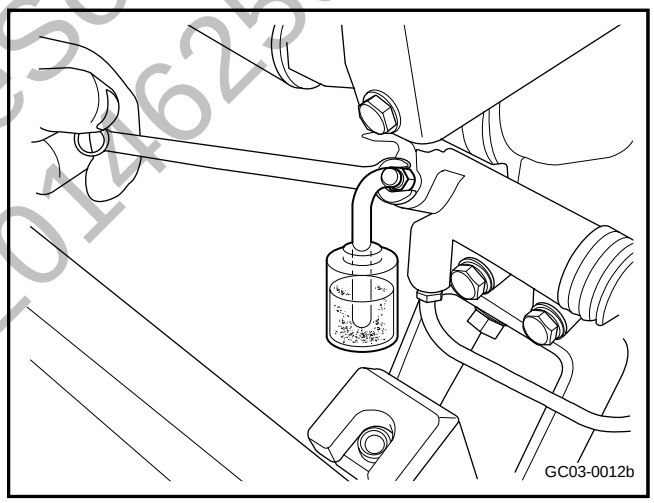
Use appropriate container and fender cover to prevent brake fluid from contacting with these parts. Use cotton cloth to wipe splashed brake fluid.

Note: It is prohibited to refill brake fluid to the clutch master pump brake fluid reservoir, because the used brake fluid may be mixed with the air, impurities and moisture.

1. After disconnecting the pipes, and during exhausting of the hydraulic system, make sure the clutch / brake fluid level is between fluid reservoir minimum (MIN) and maximum (MAX) marker.



2. Connect vinyl plastic hose to exhaust port plug. Insert the other end of vinyl plastic hose into the container with half capacity of brake fluid.
3. Slowly step on the clutch pedal several times.
4. Release the exhaust port screws when stepping on the pedal, until the fluid begins to flow, and then tighten the exhaust port screws.
5. Repeat step 3 until bubbles no longer appears in brake fluid.
6. Fill brake fluid to the maximum (MAX) marker level of fluid reservoir.



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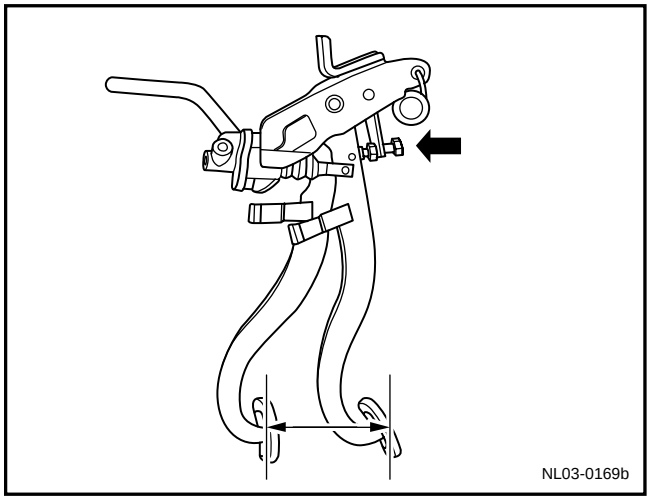
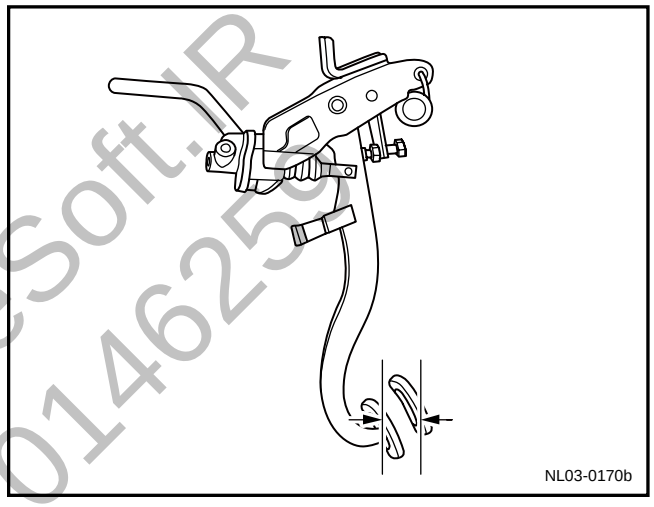
3.2.6.4 Clutch pedal free travel adjustment

1. Measure clutch pedal travel. Step on the clutch pedal to the end. Measure the distance between the start position and the end position.
2. Adjust the clutch pedal travel. Release the lock nut and rotate the bolt. Clutch pedal travel should be more than 125 mm (4.8 in). Tighten the lock nut after adjustment.



3. Determine the clutch pedal free travel, with a hand gently press the clutch pedal and determine the distance while there is a resistance feel.
4. Adjust the clutch pedal free travel. Release the lock nut and turn the push rod. Clutch pedal free travel should be 5-10 mm (0.2 - 0.3 in). Tighten the lock nut after adjustment.



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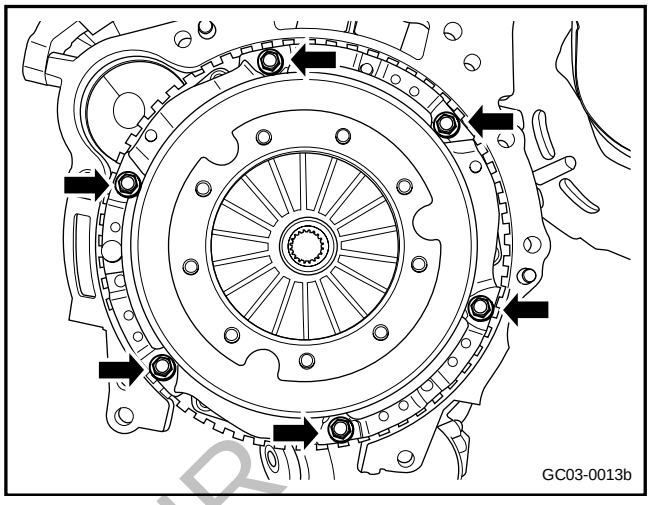
3.2.6.5 Clutch assembly replacement

Dismantle procedure

Warning: Refer to warning for battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.12.6.1 battery disconnection.
2. Lifting vehicle refer to 1.3.1.1 lifting vehicle.
3. Dismantle engine lower guard plate Refer to 12.10.1.6 engine bottom guard plate replacement
4. Dismantle the transmission assembly. Refer to 3.3.6.3 transmission assembly Replacement
5. Dismantle clutch pressure plate bolt
6. Dismantle clutch pressure plate and clutch-lamellae.



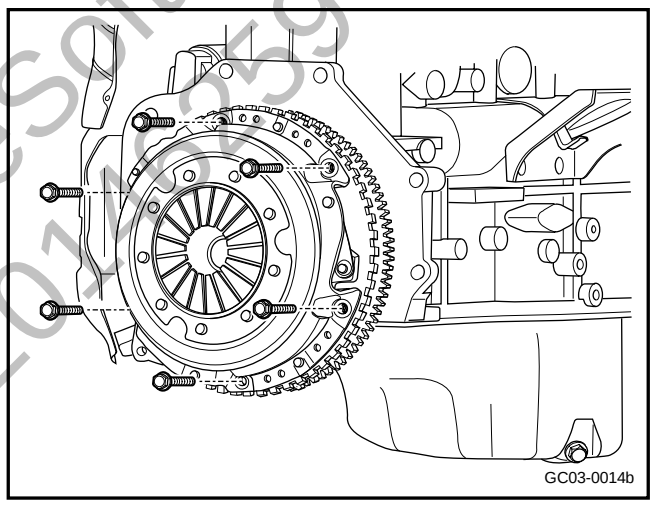
Installation procedure::

1. Apply grease on the clutch disc spline.
2. With a special tool (clutch heart shaft), align the clutch pressure plate and clutch-lamellae with the flywheel.
3. Install and tighten the pressure plate bolts.

Torque：25N.m（Metric），18.5 lb-ft（English system））

Note: Bolts are installed in diagonal order.

4. Install the transmission.
5. Install the engine lower guard plate
6. Lower the vehicle.



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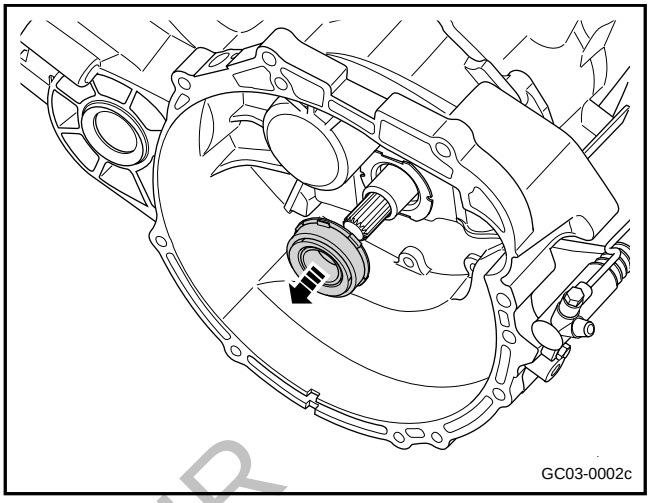
3.2.6.6 Release bearing replacement

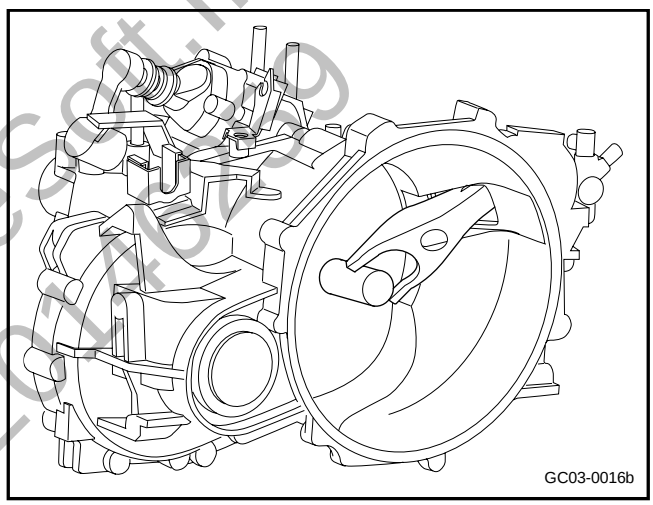
Dismantle procedure

Warning: Refer to warning for battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.12.6.1 battery disconnection.
2. Lifting vehicle refer to 1.3.1.1 lifting vehicle.
3. Dismantle engine lower guard plate refer to 12.10.1.6 engine bottom guard plate replacement
4. Dismantle transmission assembly, refer to 3.3.6.3 transmission assembly replacement



5. Dismantle the release bearing from the transmission input shaft.
6. Disconnect release fork from release fork fixing ball head, and pulled out release fork



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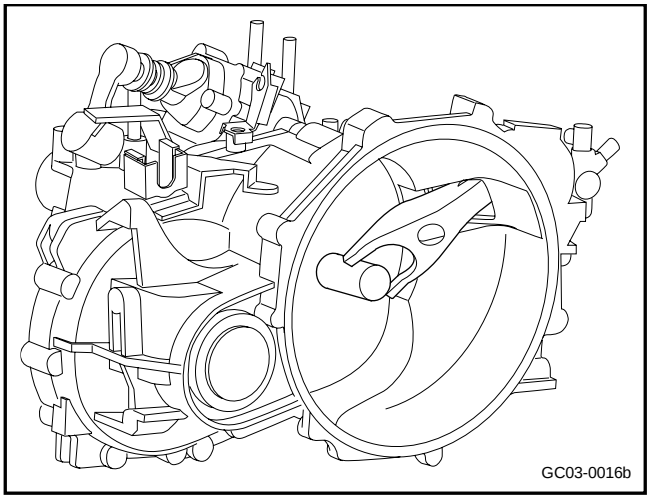
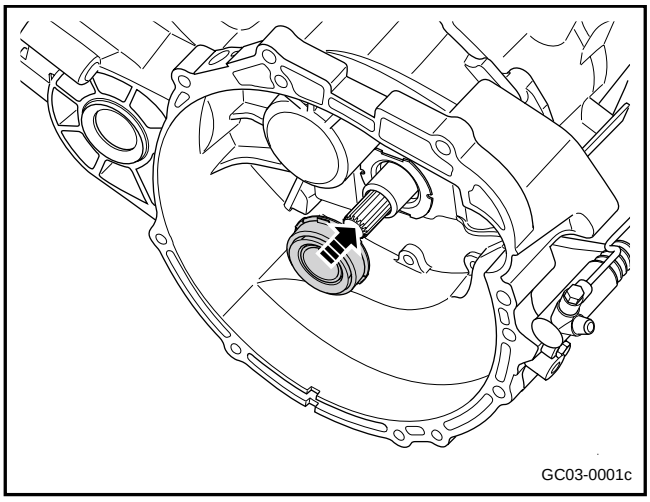
Installation procedure::

1. Install the fork to the dust cover, and insert it into the fork fixing ball head.



2. Install the release bearing on the transmission input shaft.
3. Install the transmission assembly
4. Install the engine lower guard plate



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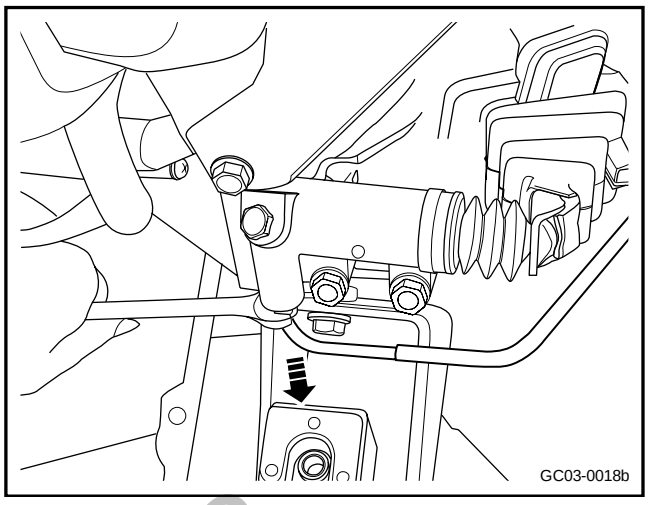
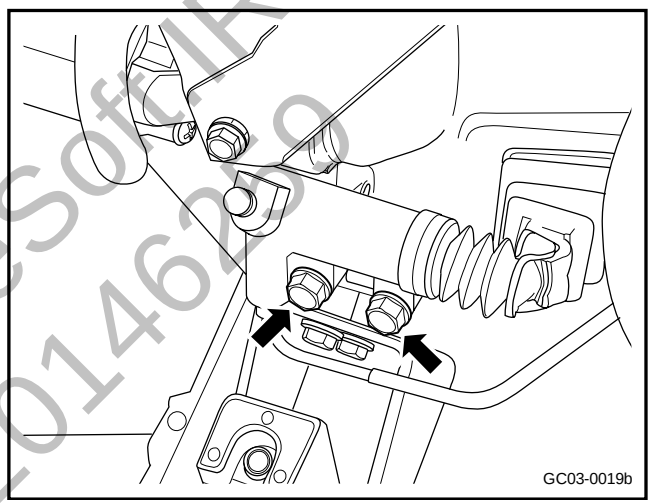
3.2.6.7 Clutch slave pump replacement

Dismantle procedure

1. Dismantle the bolts and disconnect the oil pipe from the clutch slave pump.



2. Dismantle fixing bolt of clutch slave pump and take off the clutch slave pump.



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Installation procedure::

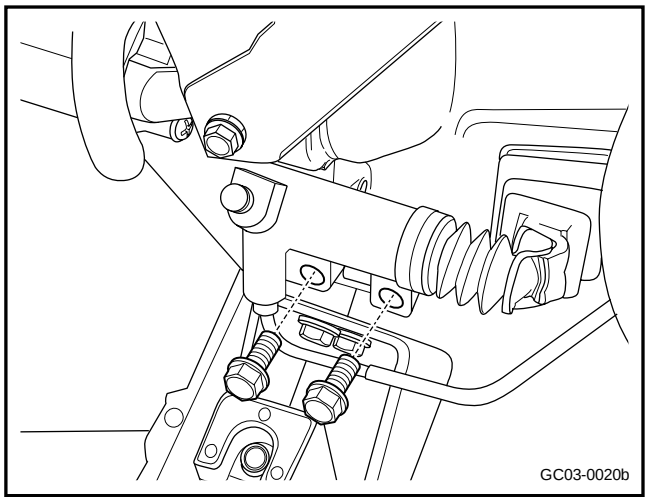
1. Connect the clutch slave pump to the transmission housing and tighten the bolts.

Torque: 20N.m(Metric). 14.8 lb-ft(English system)

2. Connect the clutch oil pipe to the clutch slave pump and tighten the bolts.

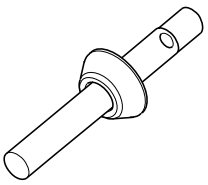
Torque: 10N.m(Metric) 7.4 lb-ft(English system)

3. Apply lubrication grease onto the rod joints, pay attention not to making the dust proof sleeve dirty.
4. Hydraulic clutch exhaust.
5. Adjust the clutch pedal.
6. Fill brake fluid to the fluid reservoir maximum mark.



3.2.7 Special tools and equipment

3.2.7.1 Special tools list

S/N	Illustration	Tool No.	Description
1	GL301-017  GC01-2002b	GL301-017	Clutch assembly tool

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3.3 V5A1C Manual transmission

3.3.1 Specifications

3.3.1.1 Fastener specifications

Fastener name	Torque range	
	N.m (Metric system)	English system (lb-ft)
Mounting bolt for lower cover	6.9	5.1
Interlock plate bolt	30	22.1
Mounting bolt forclutch housing － transmission housing	44	32.5
Mounting bolt for clutch release bearing retainer	9.8	7.2
Mounting bolt for controller housing	18	13.3
Mounting bolt for gear shift bracket	18	13.3
Mounting bolt for speedometer gear	3.9	2.9
Mounting bolt for retainer bracket	22	16.2
Mounting bolt for selector	18	13.3
Mounting nut for selector	11	8.1
Mounting bolt for differential drive gear	132	97.4
Reverse lamp switch	32	23.6
Main bearing cap retaining bolt	18	13.3
Lifting spring components	32	23.6
Reverse intermediate gear shaft mounting bolt	48	35.4
Mounting bolt for swing limiter bracket	69	50.9

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3.3.1.2 Manual transmission specifications

Transmission specifications

Applications	Specification
Gear ratio	
1st speed	3.583
2nd speed	1.947
3rd speed	1.379
4th speed	1.03
5th speed	0.82
Reverse gear	3.363
Main reduction ratio	4.058
Maximum speed	200
0~100km/h Maximum gradeability	15.2
Maximum gradeability	40
Gear oil capacity	2.2L
Lubrication oil type or model	75W/90 GL-4
Axial clearance for input shaft front bearing Mm	-0.01～0.21
Axial clearance for input shaft rear bearing mm	-0.01～0.12
Axial clearance for input shaft 5th speed gear mm	-0.01～0.09
Axial clearance of output shaft front bearing mm	-0.01～0.12
Axial clearance of output shaft rear bearing mm	-0.01～0.09
3st speed axial clearance of output shaft mm	-0.01～0.09
Differential housing pinion gap mm	0.025～0.150
Differential housing tightness mm	0.05～0.11
Clearance between synchronizer back and gear mm	Limit value 0.05

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Lubrication Grease

Items	Specified grease
Oil seal lip of drive shaft	Conforming to hypoid gear oil SAE 75W/85W above API GL－4
Oil seal lip of input shaft	OMEGA 85 lubricating grease
Selecting gear support block	

Sealants and adhesives

Items	Specified sealant and adhesive
Matching surface for clutch housing － transmission housing	Loctite 5699 or Equivalent
Matching surface for control housing - transmission housing	
Matching surface for bottom cover - transmission housing	
Vent	3M SUPER WEATHERSTRIP NO.8001 or equivalent class
Bolt of differential drive gear	3M STUD LOCKING NO.4170 or equivalent class

Adjusting gasket and snap ring specifications

Parts name	Thickness mm	Identification mark
Snap ring (used to adjust axial clearance for input shaft front bearing)	2.24	None
	2.31	Blue
	2.38	Brown
Snap ring (used to adjust axial clearance for input shaft rear bearing) (used to adjust axial clearance of output shaft rear bearing)	2.31	Black (2)
	2.35	None
	2.39	Blue
	2.43	Brown
	2.47	Green
	2.51	White
	2.55	Yellow
	2.59	Black
	2.63	Orange
	2.67	Blue
	2.71	Brown
Thrust plate (used to adjust 5th speed axial clearance of input shaft)	2.82	—
	2.86	—
	2.90	—
	2.94	—

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	2.98	—
	3.02	—
	3.06	—
	3.10	—
Snap ring (used to adjust axial clearance for output shaft front bearing)	1.43	Green (2)
	1.51	White (2)
	1.59	Yellow (2)
Snap ring (used to adjust output shaft 3rd speed axial clearance)	2.81	Green
	2.85	White
	2.89	Yellow
	2.93	Black
	2.97	Orange
	3.01	Red
	3.05	Peach
	3.09	Blue
(Used to adjust differential housing pre-tightening) gasket	0.80	80
	0.83	83
	0.86	86
	0.89	89
	0.92	92
	0.95	95
	0.98	98
	1.01	01
	1.04	04
	1.07	07
	1.10	J
	1.13	D
	1.16	K
	1.19	L
	1.22	G
	1.25	M
(used to adjust differential housing backlash) shim	0.75～0.82	-
	0.83～0.92	-
	0.93～1.00	-
	1.01～1.08	-
	1.09～1.16	-

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3.3.2 Description and operation

3.3.2.1 Transmission system operation

- Notes for maintenance

Formed in place gasket (FIPG)

Many parts on the transmission use FIPG. When using this sealant, in order to achieve sealing purpose fully, please pay special attention to sealing quantity, position and surface. Too little sealant may cause leakage. Excessive sealant may cause sealant to be overflowed, which blocks water or oil channel or makes the channel narrow. Therefore, in order to prevent leakage from joint surface, correct sealing quantity and continous coating are absolutely necessary.

After RTV (Room Temperature Vulcanizing) reacts with water in the atmosphere, it becomes vulcanized. Therefore, it is used on the flange of metal.

Disassemble

Without special methods, it is easy to disassemble compenents assembled by sealant. But on some occasions, it is necessary to use a wooden hammer or similar tools to knock on components to damage sealant on joint surface, or tap a smooth and thin sealant scraper into joint surface. But do not damage joint surface.

Clean sealing surface

Dismantle foreign matters with sealant scraper or wire brush. Confirm sealing surface is flat and smooth, without any oil dirt and foreign matters. Do not forget to Dismantle assembling hole and old sealant in threaded hole.

Application essentials

Notes when using FIPG to assemble components

Apply sealant on specified diameter uniformly. Enclose the assembling hole. Dismantle sealant that is not hardened. When sealant is wet (within 15 minutes), install parts on specified position. When installing, do not apply sealant to undesired positions. After installation, the sealant shall be hardened enough (about 1 hour). Do not apply oil onto applied part or make it wet or start engine.

Application procedures of FIPG sealant are different due to part shape. Please refer to application methods in this text.

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3.3.3 System operating principle

3.3.3.1 Gearshift operating principle

V5A1A type Transmission assembly is 5-gear Manual transmission. Gear shifter drives flexible shaft of selector to select gears of transmission.

3.3.3.2 Operating principle of odometer sensor

Vehicle speed sensor is a hall sensor, installed on the drive gear shaft. When the transmission main shaft rotates, the vehicle speed sensor operates, so that the vehicle speed sensor generates signals and sends the signal to the instrument panel.

3.3.3.3 Reverse lamp switch operating principle

Reverse lamp switch is a normally open switch. When the reverse gear is engaged, the reverse fork will squeeze reverse switch contact, making reverse lamp switch closed, then the reverse lamp circuit is completed and reverse lamp is lit.

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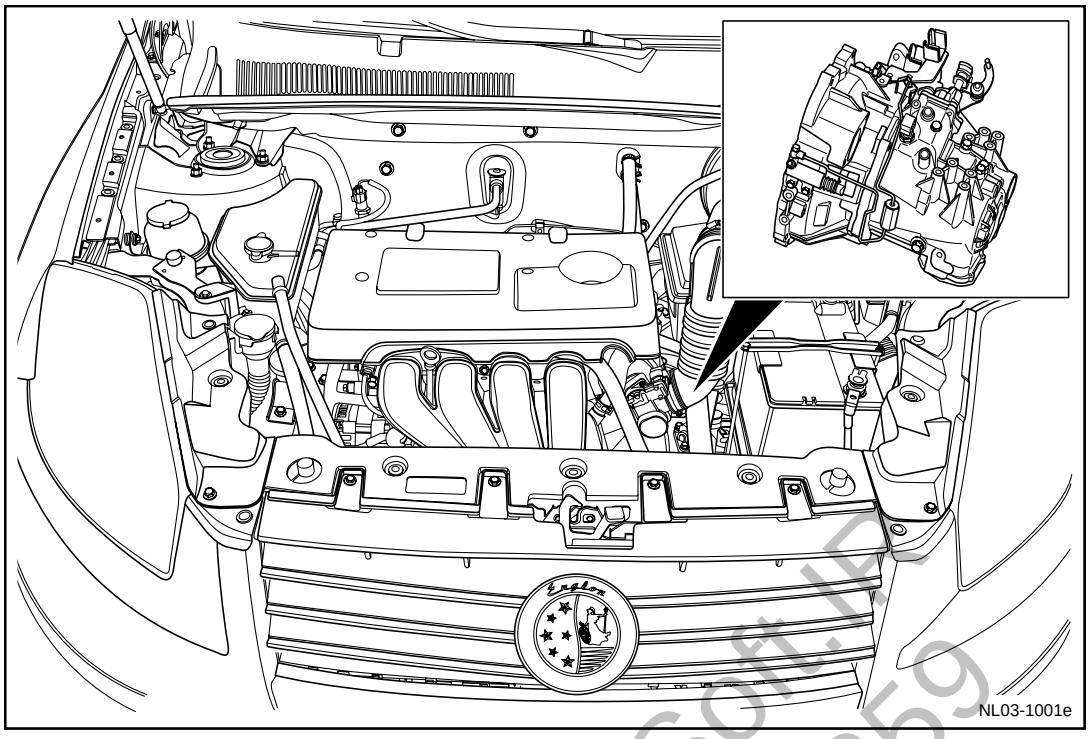
3.3.4 Component position

3.3.4.1 Transmission assembly position



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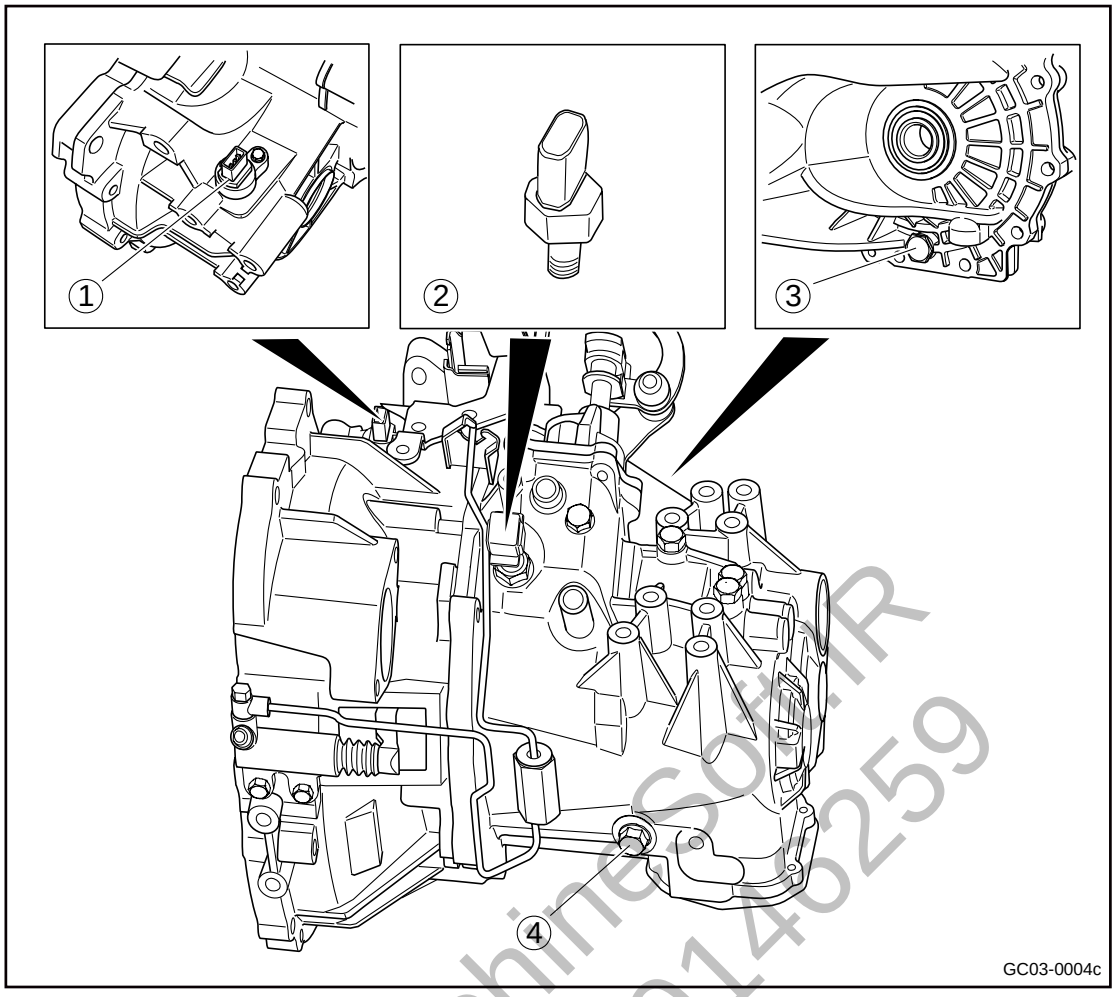
3.3.4.2 Vehicle speed sensor, reverse switch position



1. Vehicle speed sensor
2. Reverse switch
3. Drain hole
4. Filling hole of transmission oil

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3.3.5 Diagnostic information and procedures

3.3.5.1 Diagnosis descriptions

Refer to 3.3.2 Description and operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic procedures, more importantly, it will also help to determine whether the situation described by the customer is normal.

3.3.5.2 Visual inspection

Common malfunctions of transmission are: hard to shift, gear stuck, gear collision and grinding abnormal sound. The clutch, drive system malfunction can also cause the above faults. During maintenance, we need carefully analyze and distinguish.

Prior to repairing, carry out general inspection of the transmission and clutch:

- Check transmission, clutch pipe for oil seeping.
- Inspect the transmission oil level, transmission oil viscosity and color, and then inspect for dirt and metal debris to determine whether there have been internal components stuck, burning or broken.
- Check transmission and the surrounding components. Check for bolts and nuts loosening or falling off;
- Road test and engage gears to confirm the vehicle conditions for further diagnosis.

Before repairing the transmission abnormal sound, distinguish the clutch, drive shaft, and the engine abnormal sound, and exclude the external factors that may generate abnormal sound and noise.

Before repairing the transmission abnormal sound, identify the following items:

- Road Noise

  Such as noise generated from tires, road, wheel bearings, engine and exhaust system. The noise varies due to vehicle dimension, type and body insulation materials, etc.

- Drive shaft system noise

  As a mechanical device, drive axle system can not be without sound during the operation. There will be some sound during the operation. Confirm the abnormal noise:

  1. Choose a good road surface to reduce tires friction and body vibration generated noise.
  2. Drive a distance long enough to completely warm up the lubrication oil.
  3. Record speed and transmission gear when the noise occurs.
  4. Determine whether there is noise when driving the vehicle in the following conditions:
     - Slow acceleration or sudden acceleration;
     - On an even road, keep the throttle slightly open and maintain constant speed when driving;
     - Transmission is put in gear and the throttle closed when cruising.
  5. Stop vehicle and shut down the engine, whether there is abnormal sound.

- Bearing Noise

  1. Differential gear or bearing noise

     Noise of bearings on differential side and the wheel bearing noise is likely to be mixed up. As the differential bearings have a pre-load force, even if the wheels leave the road, as long as the differential and drive shaft are in operation, the differential bearings noise will not be significantly reduced.

  2. Wheel bearing noise

     When the transmission is in neutral gear and the vehicle is sliding, the wheel bearing issue a continuous roar or friction sound. Since there is no wheel bearing pre-load force, when the wheels leave the ground the wheel bearing noise will be significantly reduced.

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- Bearing internal wear, deformation, indentation in bearing ring; micro-abrasive entering into the bearing and its seat ring; foreign matter entering into the bearing and the seat ring is locked; bearing and its seat ring due to wear and tear become loose; and all of these will result in noise and thus make the system unable to work.

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3.3.5.3 Hard to shift

The table below describes possible fault positions. Check each part, and replace them if necessary.

Symptoms	Suspected parts	Referance
Hard to shift	1. Clutch	3.2 Clutch system
	2. Transmission gearshift lever	3.3 Manual transmission
	3. Transmission shift control guy wire	3.3 Manual transmission
	4. Transmission shift control mechanism	3.3 Manual transmission
	5. Faulty gear or synchronizer	3.3 Manual transmission

Diagnostic procedures:

1	Check the transmission shift lever operation.

A. Engine stopped.

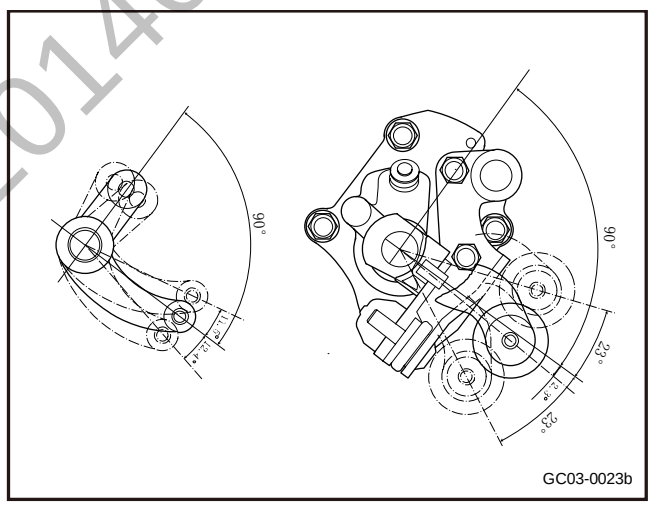
B. Shift rod hard to engage or disengage gears.

No → Go to step 6

Yes

2	Check shift control mechanism shift force and travel.

A. Operate the shift lever. Shifting force is 20~30N (4.5~6.7 LB). Transmission shift control travel should meet the range shown in the figure .



Yes → Repair or replace worn transmission shift control assembly or the fork

No

3	Check transmission shift lever shift force and travel

A. Disconnect transmission shift control guy cable and transmission control.

B. Operate the shift lever. Check if the shift control cable can stretch freely and easily.

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C. Transmission shift lever selectional force is <8 N (1.8 LB), shifting force is<4 N (0.9 LB). Transmission shift control travel should meet the range shown in the figure .

Yes → Adjust or replace the shift control cable . Repair or replace the transmission shift control assembly or fork.

No

4	Inspect transmission shift control cable movement.

A. Disconnect the transmission shift lever and the transmission control guy cable.

B. Check if the transmission control guy cable is difficult to stretch or broken.

Yes → Replace the transmission shift control cable.

No

5	Replace transmission shift lever

A. Whether tranmission shifting problem is resolved.

Yes → The system is normal.

No

6	Inspect the clutch

A. With the engine running, transmission is placed in neutral gear.

B. Step on the clutch pedal to the end, check if the lever can easily engage or disengage the reverse gear.

Yes → Check clutch, Check or replace reverse

No

7	Check fault position

A. Step on the clutch pedal to the end. Try each forward gear to identify the faulty gear.

B. Disassemble the transmission. check if the faulty gear synchronizer or gear are damaged.

C. Replace the synchronizer or the gear

D. Make sure that the repair work is finished.

Next

8	The system is normal.

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3.3.5.4 Out of gear

The table below describes possible fault positions. check each part, and replace them if necessary.

Symptoms	Suspected parts	Referance
Jumping out of gear	1. Engine mount	2.7.8.9 Engine supporting seat replacement
	2. Transmission gearshift Lever	3.3 Manual transmission
	3. Transmission shift control guy wire	3.3 Manual transmission
	4. Transmission shift control mechanism	3.3.6 Dismantle and installation
	5. Gearshift fork and lock mechanism	3.3.6 Dismantle and installation

Diagnostic Procedures:

1	Check the transmission and the engine support

A. When engine is running, whether there is serious jitter.

B. Serious jitter will cause the engine stall.

Yes → Tighten or replace the transmission and engine support.

No

2	Check transmission shift control system.

A. Whether the connection between transmission shift control guy cable and the transmission shift control mechanism is firm.

B. Whether the connection between the shift lever and the transmission control guy cable is firm.

No → Tighten or replace the transmission or engine support control lever

Yes

3	Check transmission gear self-locking nut

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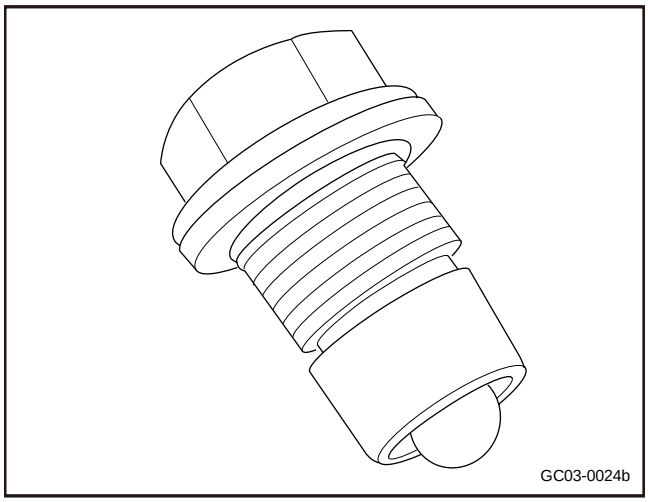
A. Whether the gear self-locking nut is installed correctly.



No → Tighten or replace the gear

Yes

4	Replace the shift control mechanism.

A. Dismantle the transmission shift control mechanism to inspect wear and tear or deformation.

Yes → Replace the shift control

No

5	Inspect the faulty gear fork locking pin.

A. Dismantle the transmission.

B. Disassemble the transmission. Check the shift fork for deformation.

C. Replace the damaged shift fork.

D. Make sure that the repair work is finished.

Next

6	The system is normal.

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3.3.5.5 Hard to disengage

The table below describes possible fault positions. check each part, and replace them if necessary.

Symptoms	Suspected parts	Referance
Jumping out of gear	1. Transmission gearshift Lever	3.3 Manual transmission
	2. Transmission shift control guy wire	3.3 Manual transmission
	3. Transmission shift control mechanism	3.3.6 Dismantle and installation
	4. Gearshift fork and lock mechanism	3.3.6 Dismantle and installation
	5. Synchronizer	3.3.6 Dismantle and installation

Diagnostic procedures:

1	Check transmission shift control system.

A. Disconnect transmission shift control guy cable and transmission control.

B. Check the shift lever for catching. The normal gear selection force is <8N (1.8LB), engaging a gear force is <4N (0.9LB).

C. Check the transmission shift control for damage and blocking.

Yes → Repair or replace the shift lever or shift control cable

No

2	Replace the shift control mechanism.

A. Engage transmission shift control mechanism lever and disengage gears.

B. Check the transmission shift control mechanism for blocking.

C. Repair or replace damaged shift fork, or synchronizer.

D. Make sure that the repair work is finished.

Next

3	The system is normal.

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3.3.5.6 Abnormal sound when running

Diagnostic procedures:

1	Check abnormal sound

A. Stop the vehicle, shut down the engine, and place transmission in neutral gear.

B. Check if the abnormal sound stops.

Yes → Go to step 4

No

2	Check abnormal sound on the side of clutch

A. Step on the clutch to the end.

B. Check if the abnormal sound stops.

No → Diagnose abnormal sound in clutch system; Diagnose abnormal sound of the engine

Yes

3	Check transmission interior

A. Dismantle and disassemble the transmission.

B. Check for gear group bearing, input shaft gears, each gears/bearings, main shaft bearings damage.

C. Replace the faulty transmission components.

D. Confirm whether the system is normal.

Yes → The system is normal.

No

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4	Check drive shaft system and front suspension.

A. Place transmission in neutral gear and release the hand brake.

B. Lifting vehicle . Refer to 1.3.1.1 Lifting vehicle .

C. Rotate the wheels. Check if there is abnormal sound in the drive half axle and drive half axle bearings.

Note: The vehicle is lifted at this time. The noise may disappear because the front suspension, drive axle and its bearings load decrease. Check if the abnormal sound appears only when the axle and the front suspension are under load.

D. Replace the damaged drive half axle or drive half axle bearings.

E. Confirm repairing was completed

Next

5	The system is normal.

3.3.5.7 engage in gear when driving, there is gear collision or grinding sound.

Dismantle the transmission. Inspect and replace the faulty gear, synchronizer or the bearing.

3.3.5.8 Engage in gear when driving, there is a dull metal sound.

(Check clutch and confirm there is no fault. Refer to 3.2 clutch systems. Dismantle transmission assembly. Check and replace the gear synchronizer that makes noise.

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3.3.6 Dismantle and installation

3.3.6.1 Transmission oil level inspection

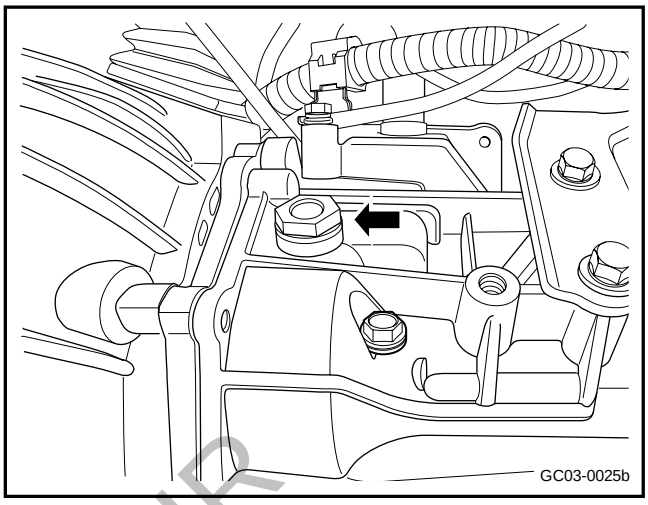
Inspection Procedure:

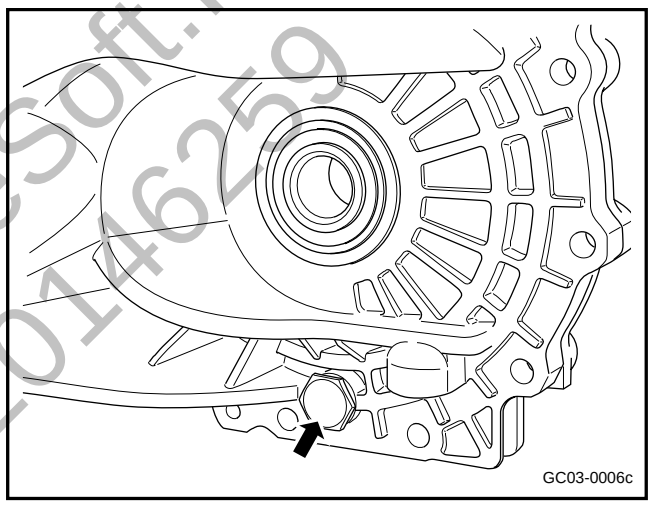
Note: Inspecting the transmission fluid when the transmission fluid temperature is too high, it may cause burns.

1. Park the vehicle on a level ground, wait for the transmission fluid cooling down, Dismantle the transmission fill plug and check the transmission fluid level.

Note: Transmission fluid level should be even with the lower edge of plug.

2. If the transmission fluid level is too low, add the dedicated manual transmission fluid through the plug to until the fluid begins to flow out.
3. Reinstall and tighten filling hole bolt
4. If needed, replace the transmission fluid. Dismantle the transmission drain bolt, and drain the transmission fluid.





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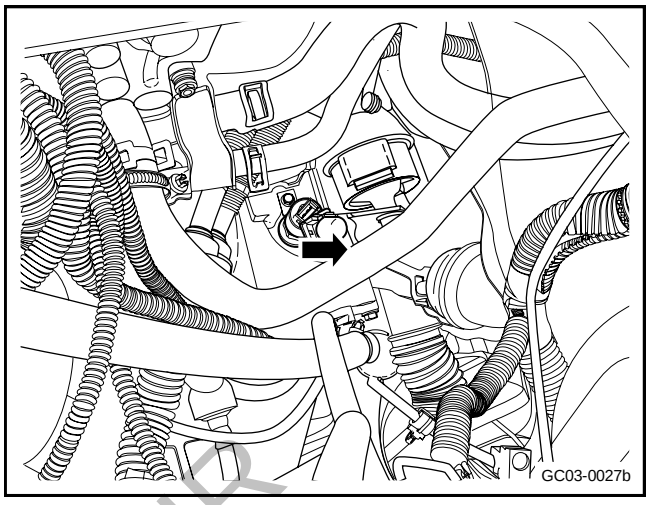
3.3.6.2 Vehicle speed sensor replacement

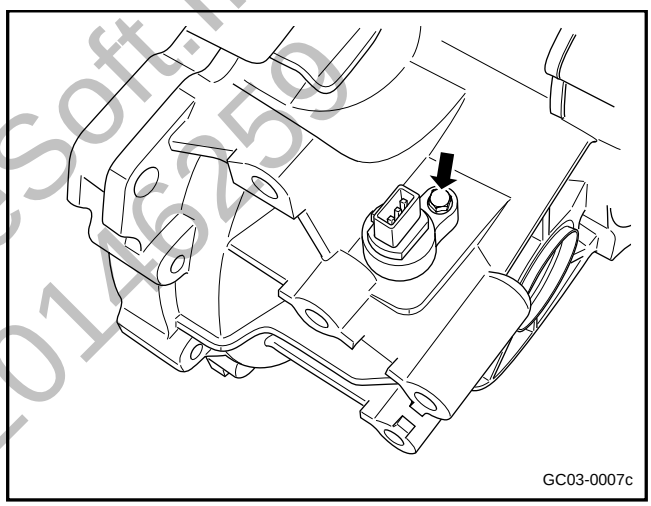
Warning: Refer to warning for battery disconnection in the warning and precaution.

Dismantle procedure

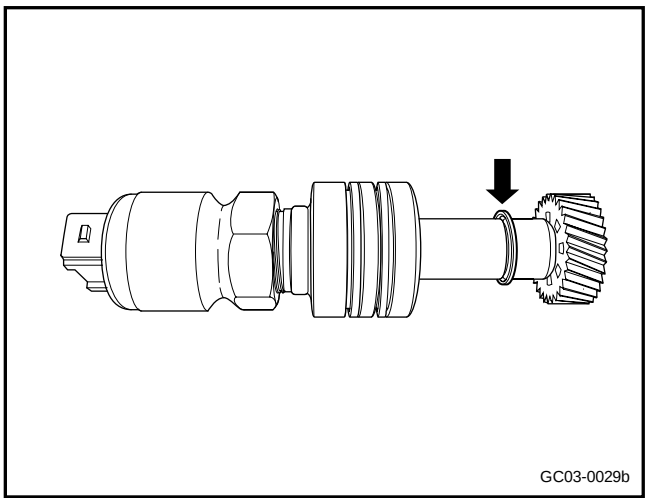
1. Disconnect the vehicle speed sensor harness connector.



2. Dismantle the fixing bolt of speed sensor.



3. Dismantle the circlip as shown in the figure , disassemble the vehicle speed sensor driven gear.



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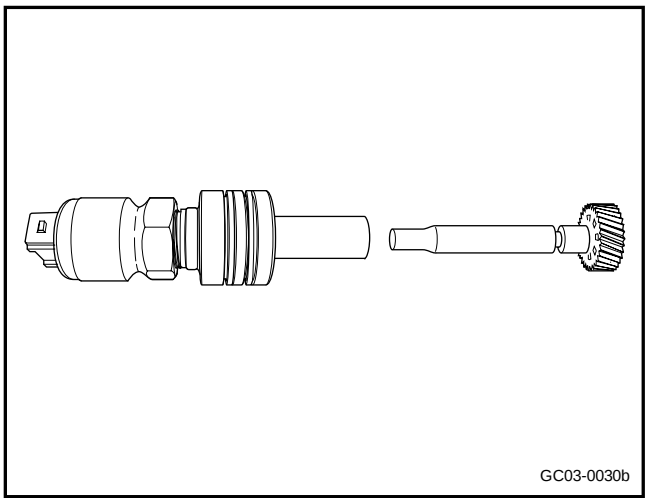
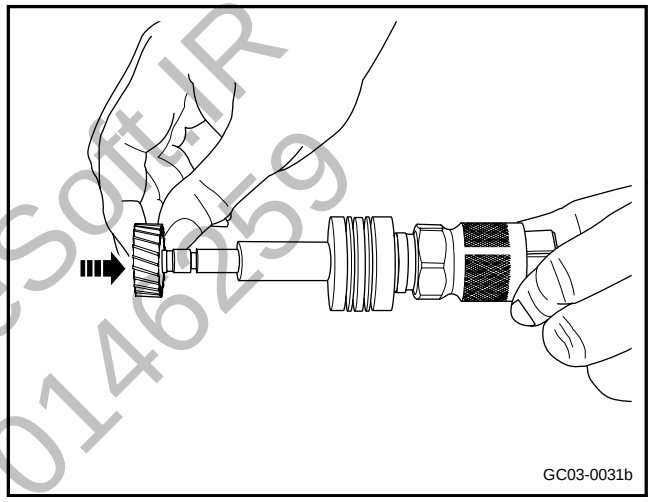
4. Disassembled speed sensor.

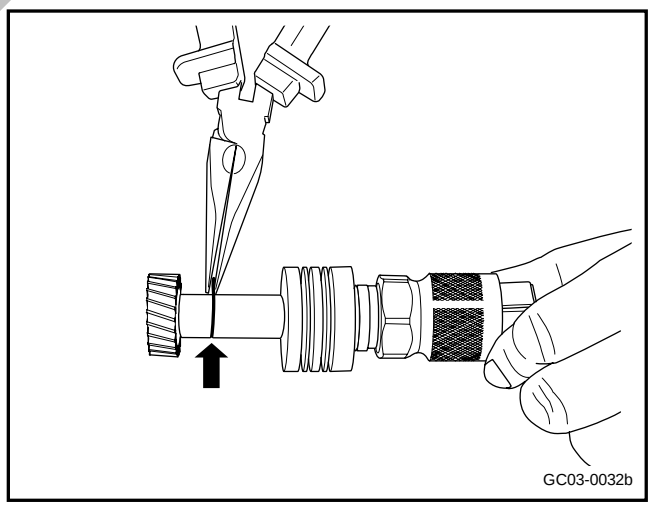


Installation procedure::

1. Install the vehicle speed sensor driven gear.



2. Install the driven gear clamp spring.



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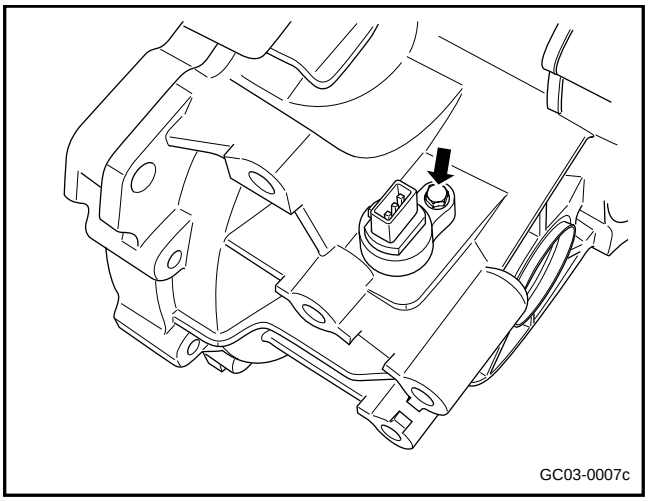
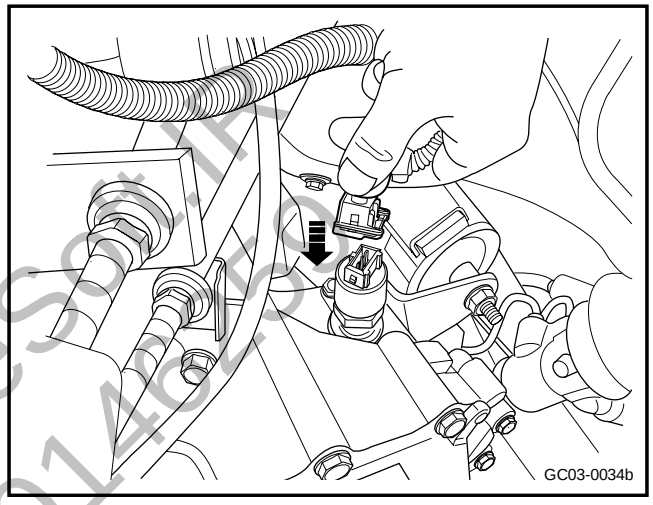
3. Install the vehicle speed sensor and tighten the fixing bolt, pay attention to the position of the washer.



4. Connect the vehicle speed sensor harness connector, as shown in the figure.



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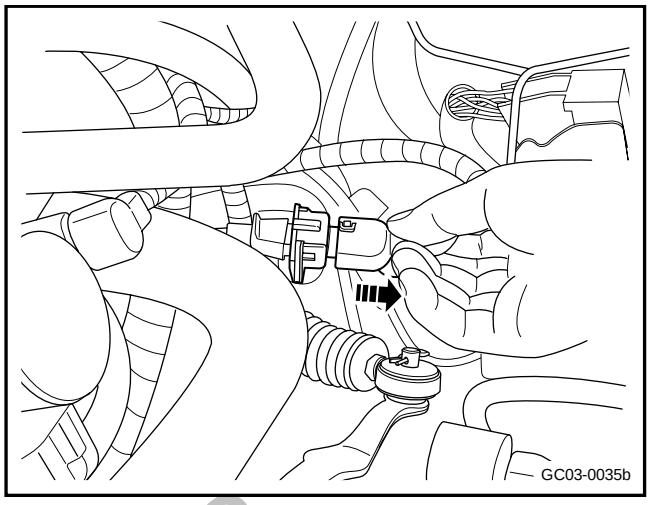
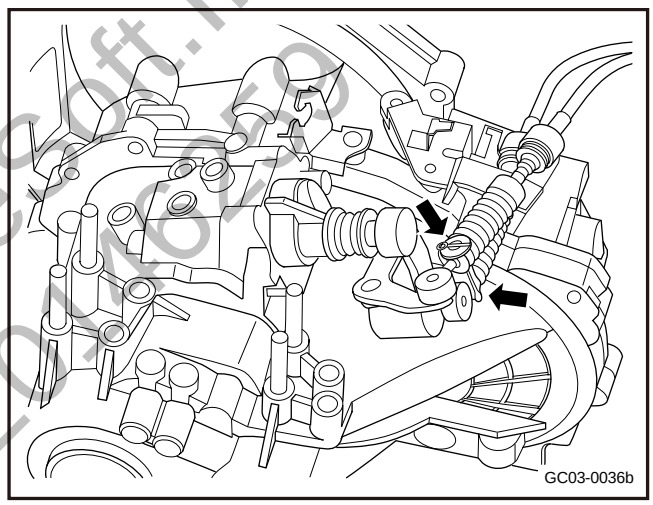
3.3.6.3 Transmission assembly replacement

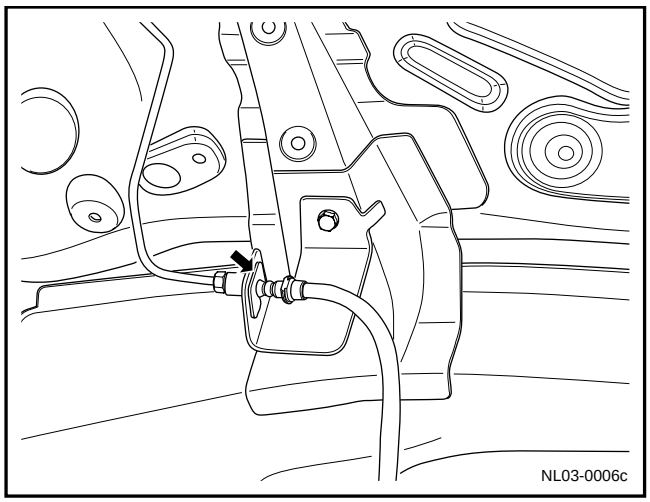
Dismantle procedure

1. Dismantle the battery negative cable. Refer to 2.12.6.1 Battery cable disconnection/connection procedures.
2. Dismantle battery base plate. Refer to 2.12.6.2 Battery replacement.
3. Dismantle the air filter base.
4. Disconnect the reverse lamp switch harness connector.
5. Disconnect the vehicle speed sensor harness connector.
6. Disconnect the crankshaft position sensor harness connector.
7. Dismantle the gearshift lever plug;
8. Dismantle the shift lever bracket;
9. Dismantle the shift lever fixing clamp





10. Dismantle the clutch slave pump oil pipe;



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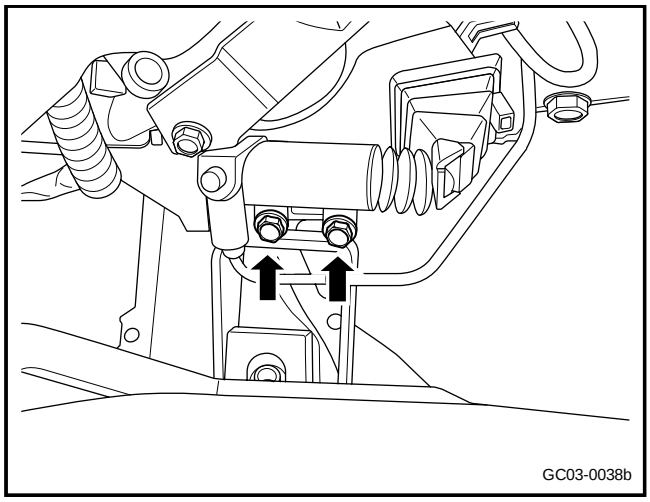
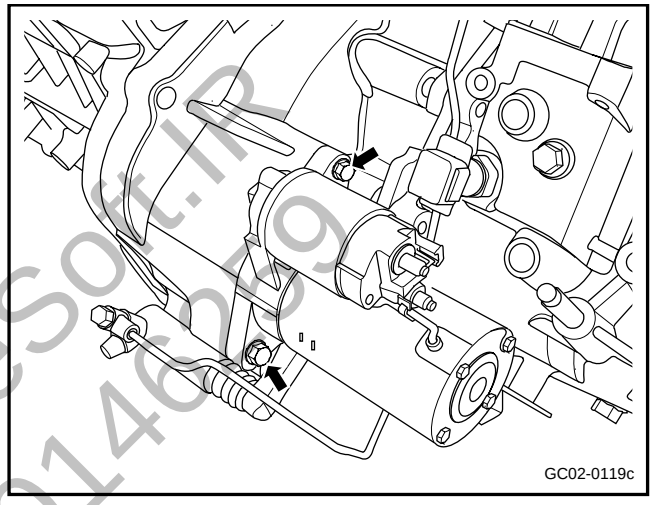
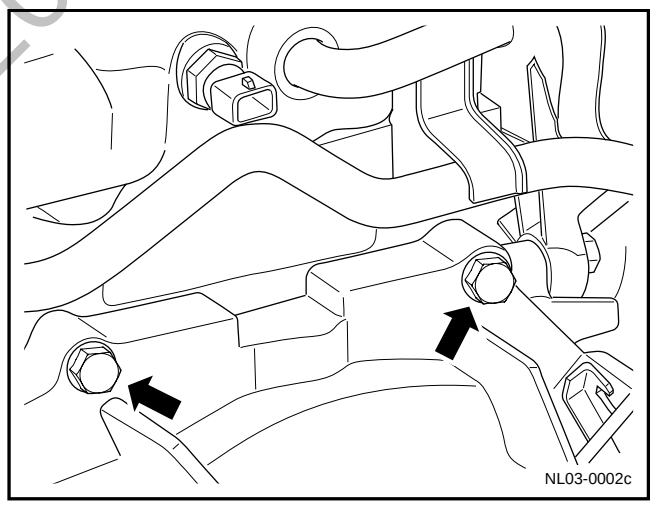
11. Dismantle the clutch slave pump fixing bolt ;



12. Dismantle the start motor cable and the fixing bolts.



13. Dismantle the transmission upper connecting bolts;



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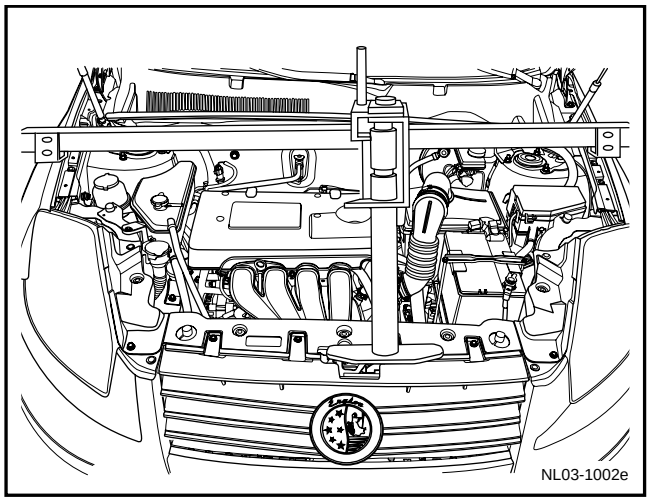
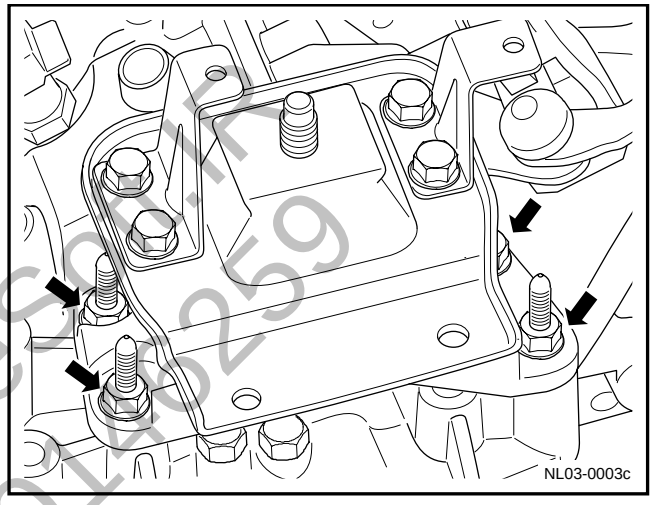
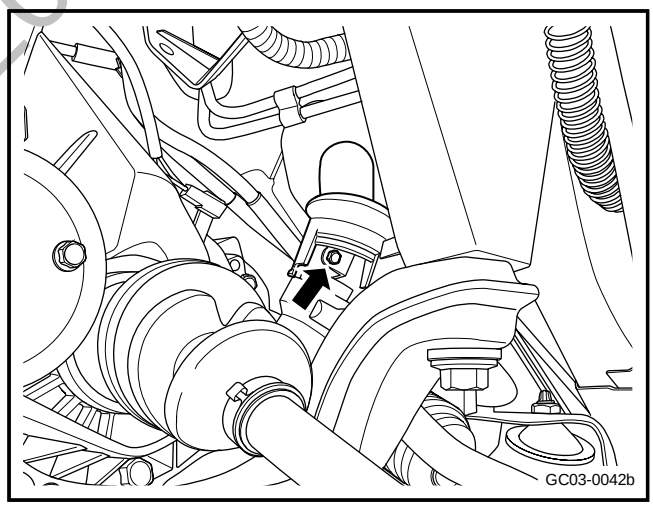
14. Use special tool to fix the engine.



15. Dismantle transmission left bracket assembly.



16. Dismantle the two front wheels;
17. Lifting vehicle, refer to 1.3.1.1 Lifting vehicle.
18. Dismantle the transmission drain bolt, after draining the transmission oil, install the transmission drain bolt.
19. Dismantle the steering cross pin bolt



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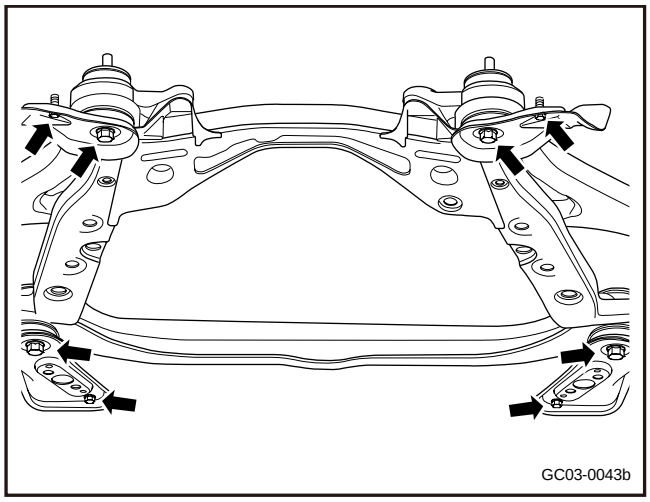
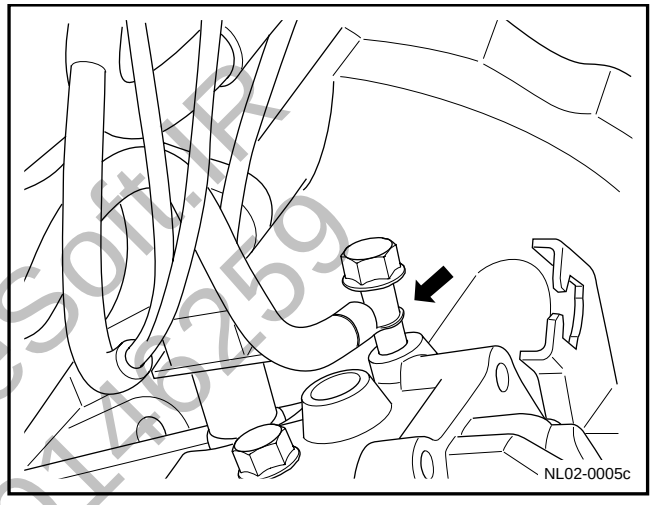
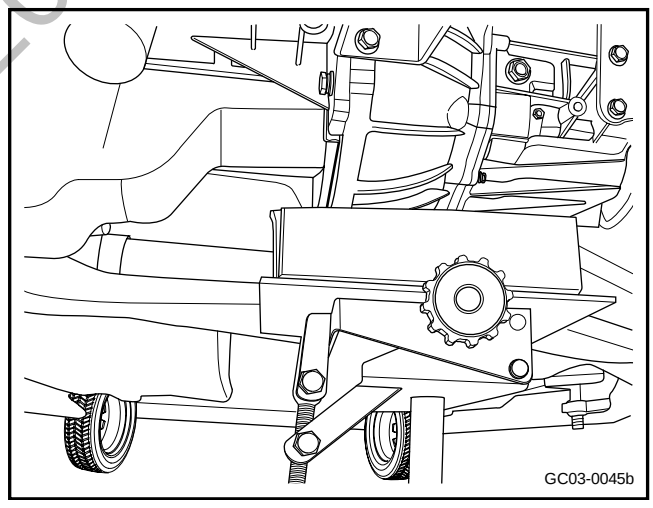
20. Dismantle the front longitudinal beam sub frame and related connecting components;



21. Dismantle the left and right drive shafts.
22. Dismantle negative cable of the transmission;



23. Use a jack to support the transmission;



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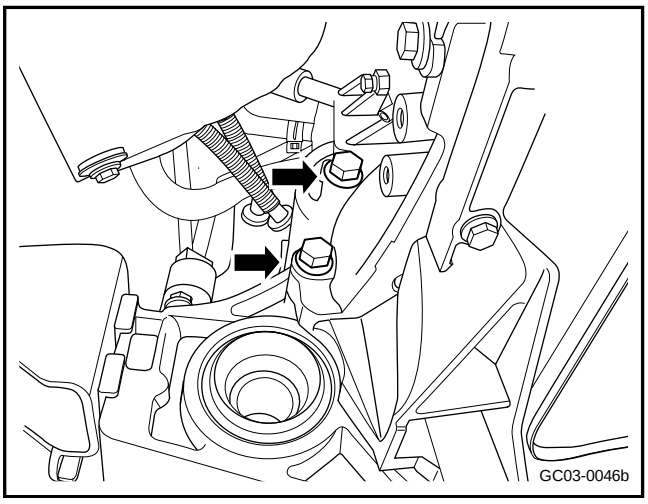
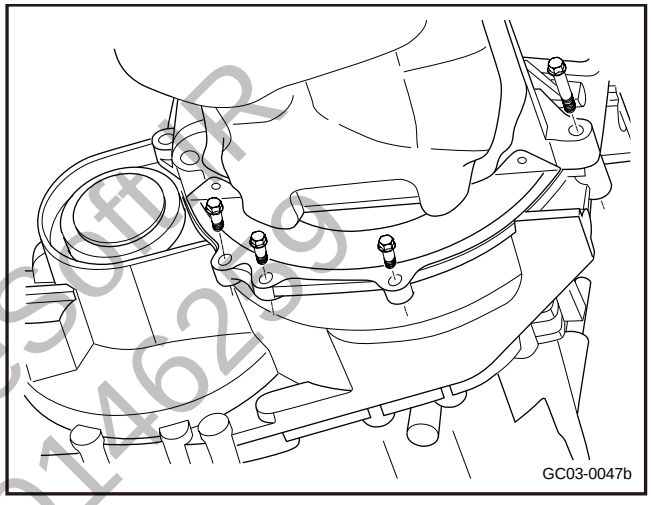
24. Dismantle the rear connecting bolt of transmission ;

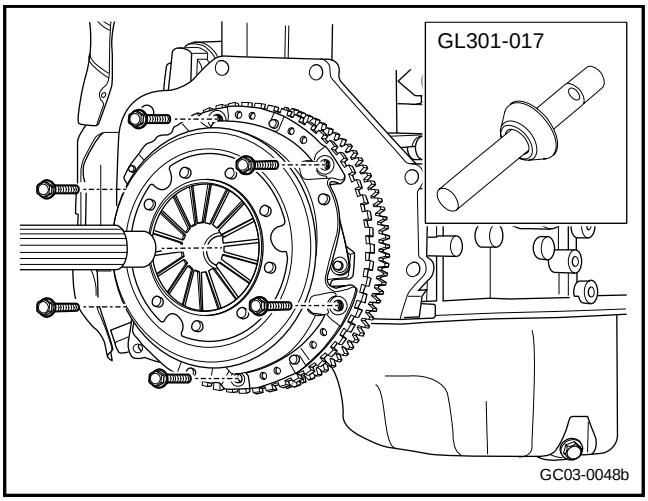


25. Dismantle the lower connecting bolt of transmission ;
26. Dismantle the transmission assembly.



Installation procedure::

1. Use a flat-panel jack to support the transmission assembly.
2. Insert the transmission input shaft into the clutch plates. Push the transmission to the engine end, pay attention to position of locating pin.



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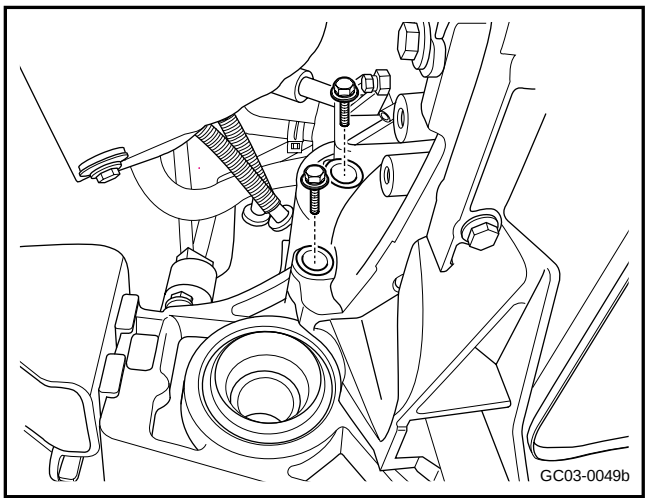
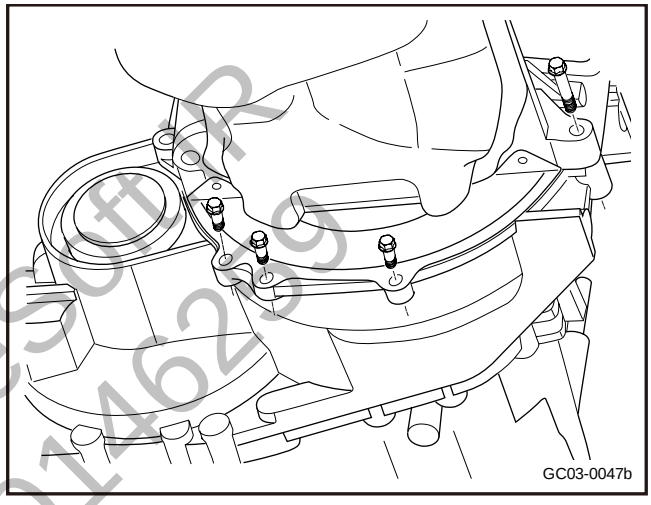
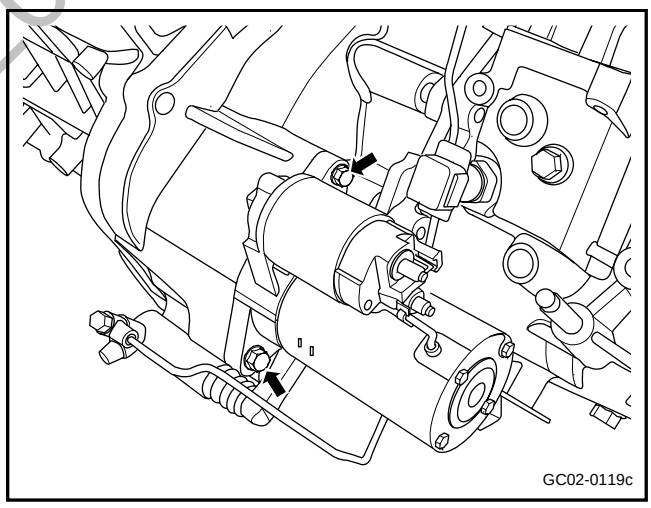
3. Install the rear connecting bolt of transmission ;



4. Install the lower connecting bolt of transmission ;



5. Install the starter motor fixing bolt and cables;



6. Dismantle the flat-panel jack;
7. Install negative cable of the transmission.
7. Install the left and right side of drive shafts.
8. Install the front sub frame and related connecting components.
9. Install the front wheel tire.

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10. Dismantle special tool for engine bracket;

11. Install the transmission upper connecting bolts;

13. Install the left bracket assembly of transmission.

14. Install the clutch slave pump oil pipe;

15. Install the clutch slave pump and release the air.

16. Install the shift control mechanism.

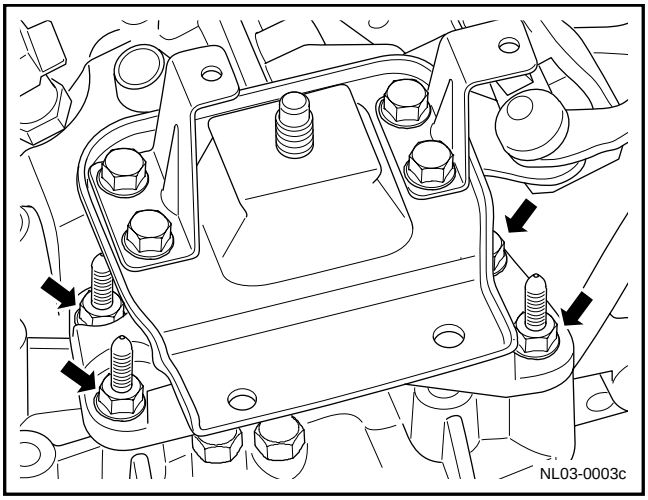
17. Install the crankshaft position sensor harness connector.

18. Install vehicle speed sensor connector;

19. Dismantle reverse lamp switch connector;

20. Install the battery base plate.

21. Connect the battery negative cable.



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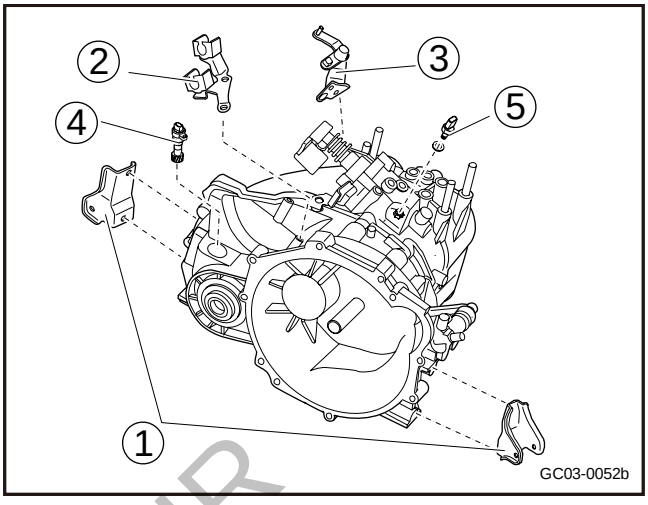
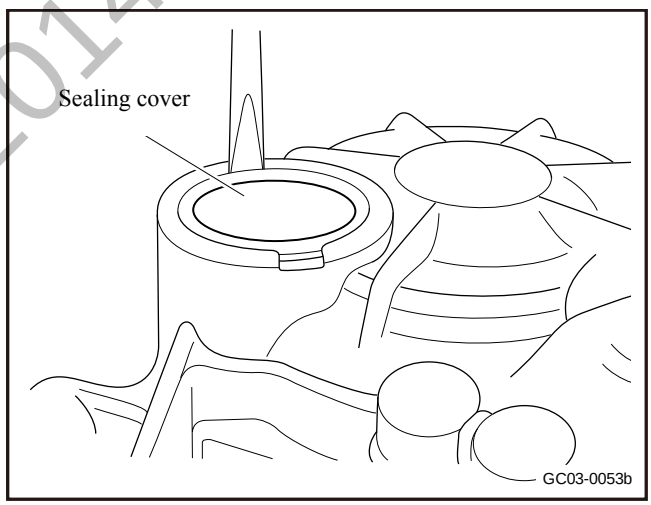
3.3.6.4 Transmission disassemble and assemble

Dismantle procedure

1. Dismantle rolling limiter bracket 1.
2. Dismantle gear shift bracket 2.
3. Dismantle selecting lever 3.
4. Dismantle speedometer 4st speed .
5. Dismantle reverse lamp switch 5.
6. Dismantle seal gasket.
7. Dismantle lifting spring component.
8. Dismantle seal gasket.
9. Dismantle interlocking bolt.
10. Dismantle seal gasket.
11. Dismantle controller housing.
12. Dismantle neutral gear return spring.
13. Dismantle the lower cover.
14. Dismantle reverse intermediate gear shaft bolt
15. Dismantle seal gasket.
16. Dismantle reverse intermediate gear.
17. Dismantle seal cover.





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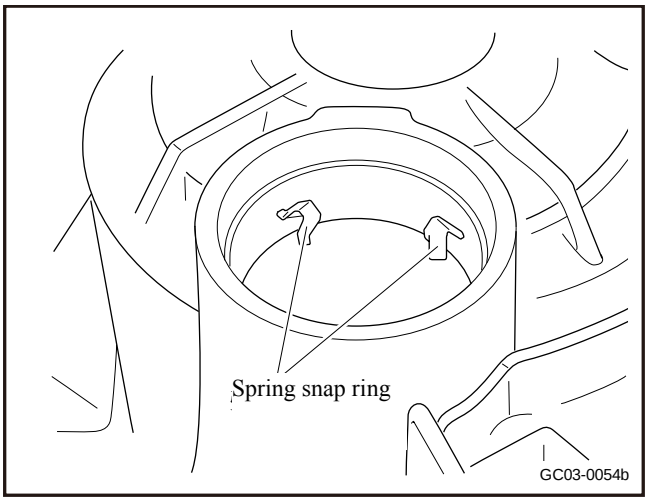
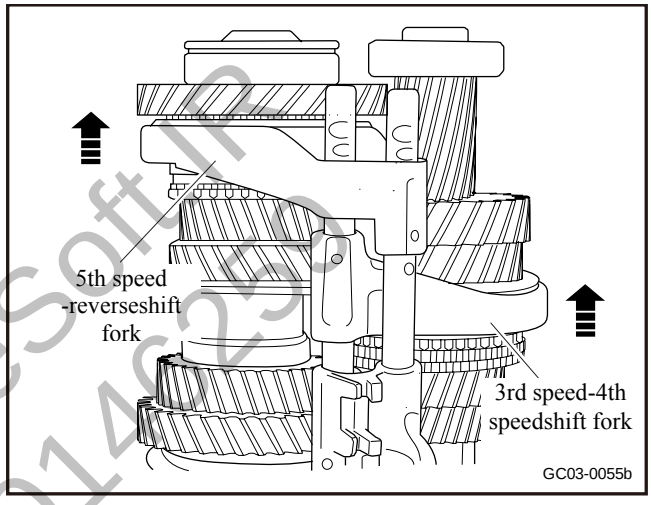
18. Dismantle transmission housing

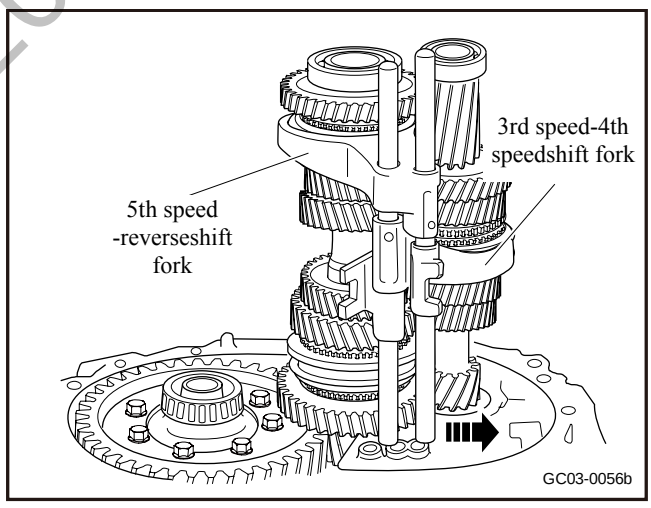
Note: when spring snap ring expands, spring snap ring may be pulled off due to self weight of output shaft.



19. Dismantle outer ring.
20. Dismantle the washer.
21. Dismantle magnetic plug seat.
22. Dismantle spring pin.
23. Dismantle 1st speed －2nd speed shifting slide rail component.
24. Dismantle 1st speed －2nd speed shifting fork.
25. Dismantle spring pin.
26. Dismantle 3rd -4th speed shift sliding rail module。



27. Dismantle 3rd -4th speed shift fork。
28. Dismantle 5th speed － Reverse gear shifting slide rail component.
29. Dismantle 5th speed － Reverse gear shifting fork.
30. Dismantle front bearing pedestal.



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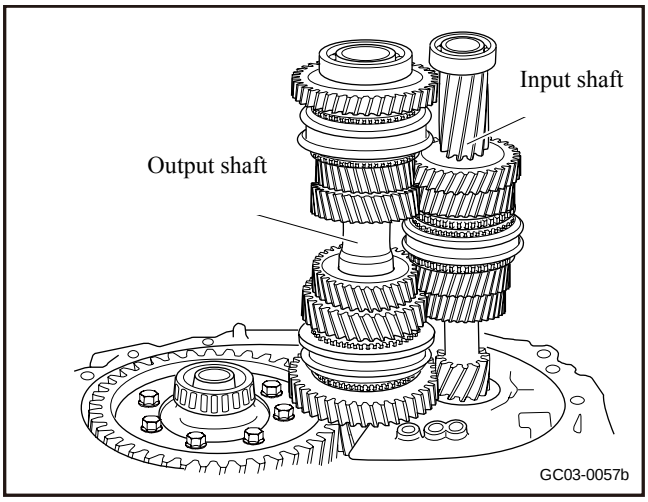
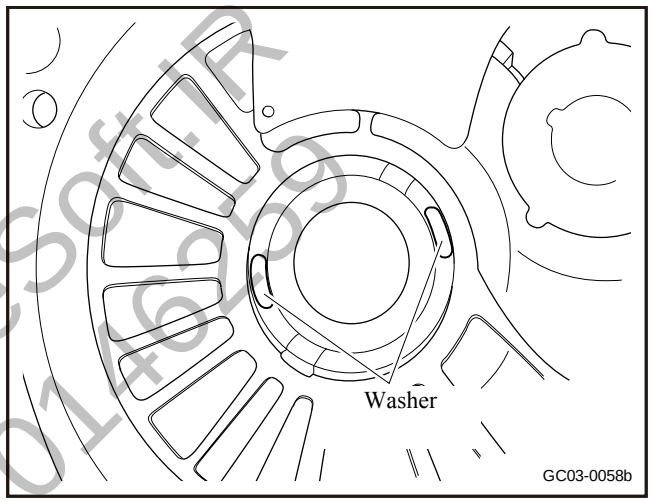
31. Dismantle input shaft.
32. Dismantle output shaft.
33. Dismantle differential components.
34. Dismantle the clutch housing.



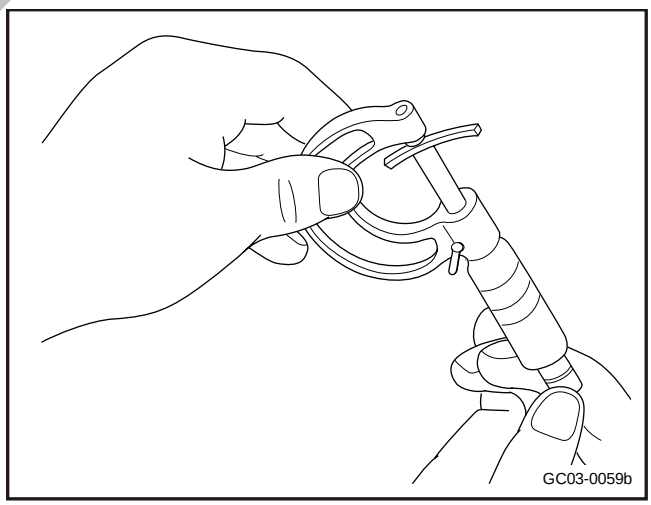
Transmission adjustment before installation:

1. Place soldering tin (with a length of 10 mm and a diameter of 1.6 mm more or less) on the position on the differential case as shown in the diagram. Then install bearing outer ring and differential.
2. Install clutch housing and tighten bolt to specified torque.
3. If soldering tin is not flat, it should be replaced with more thick soldering tin. Then repeat procedures (1) and (2).



4. Use micrometer caliper to measure flattened soldering tin thickness (T), selec washer thickness according to the following range.

Washer thickness: (T+0.05 mm)-(T+0.11 mm)



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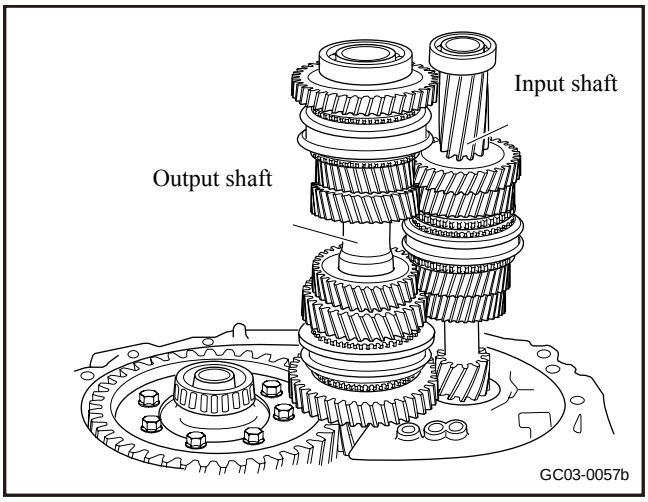
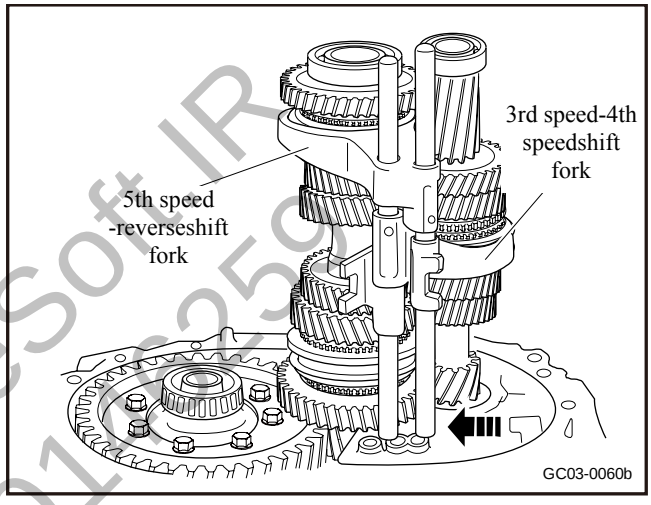
Installation procedure::

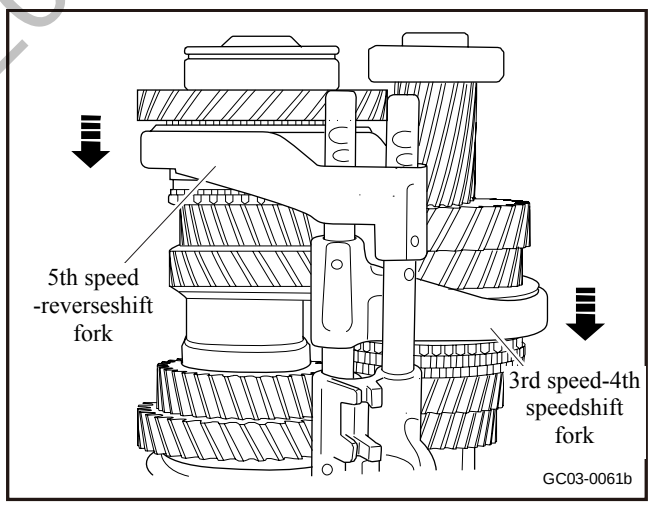
1. Install clutch housing.
2. Install differential components.
3. Install output shaft.
4. Install input shaft.



5. Install front bearing seat.
6. Install 5th speed － Reverse gear shifting fork.
7. Install 5th speed － Reverse gear shifting slide rail component.



8. Install 3rd speed －4th speed shifting fork.
9. Install 3rd speed－4th speed shifting slide rail component.



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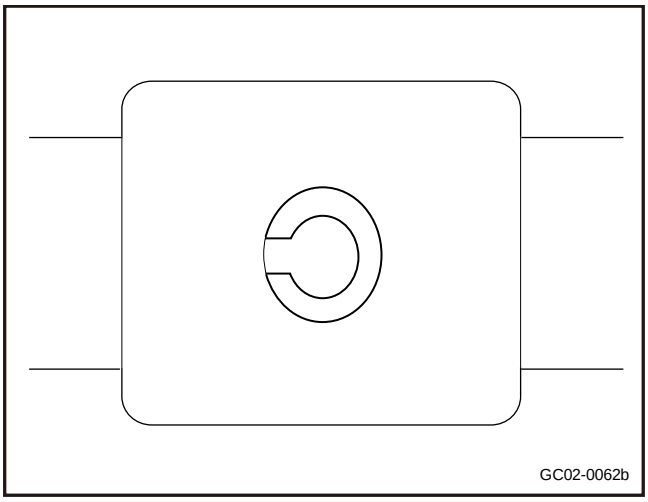
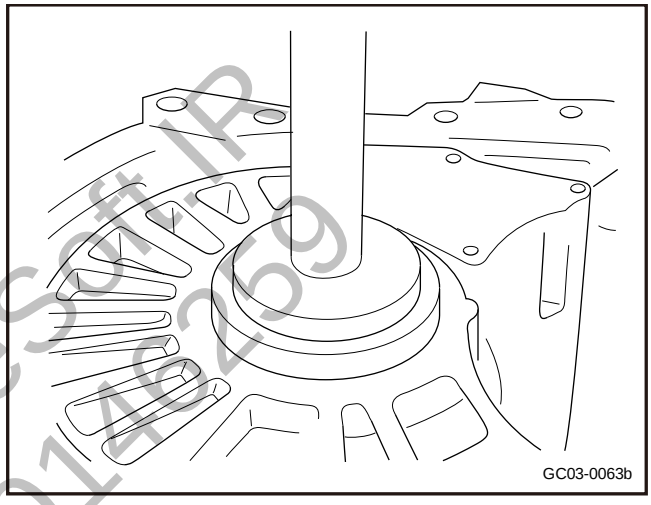
10. Install spring pin.



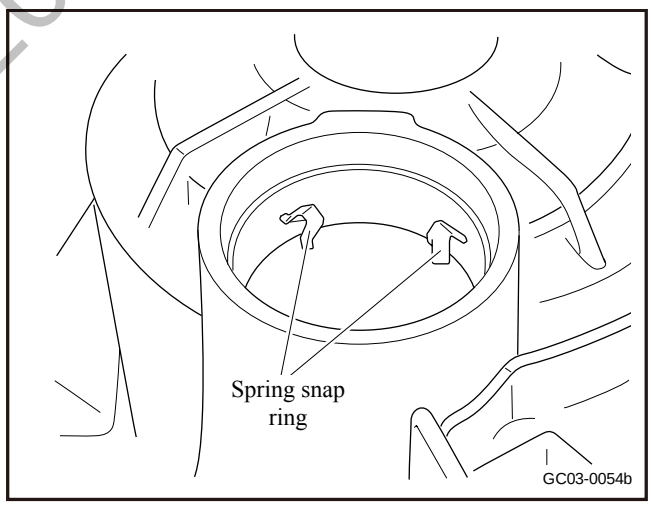
11. Install 1st-2nd speed shift fork.
12. Install 1st-2nd speed shift sliding rail component
13. Install spring pin.
14. Install magnetic plug seat.
15. Install washer.
16. Install outer race.



17. Install transmission housing.

Note: The extruded sealant line shall be uniform and continuous. No disconnection or excessive application is allowed.

18. Install seal cover.
19. Install reverse gear and shaft.
20. Install seal gasket.
21. Install Reverse intermediate gear shaft bolt.
22. Install lower cover.



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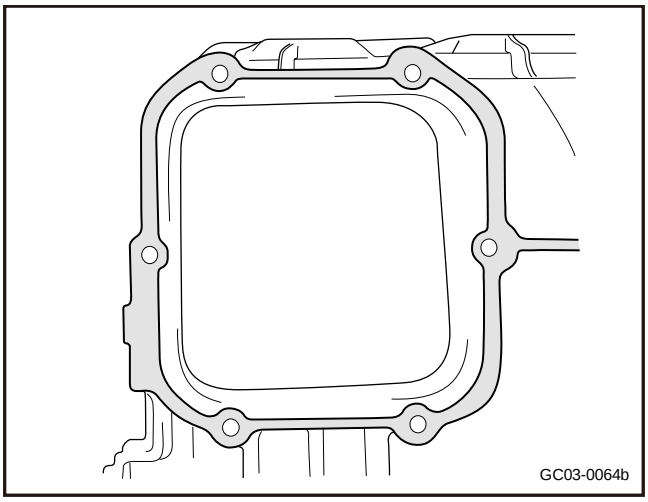
23. Install neutral gear return spring.
24. Install controller housing.

Note: The extruded sealant line shall be uniform and continuous. Not disconnection or excessive application is allowed.

25. Install seal gasket.
26. Install interlocking plate bolt.
27. Install seal gasket.
28. Install lifting spring components.
29. Install seal gasket.
30. Install reverse lamp switch.
31. Install speedometer gear.
32. Install selecting lever.
33. Install gear shifting cable bracket.
34. Install rolling limiter bracket.



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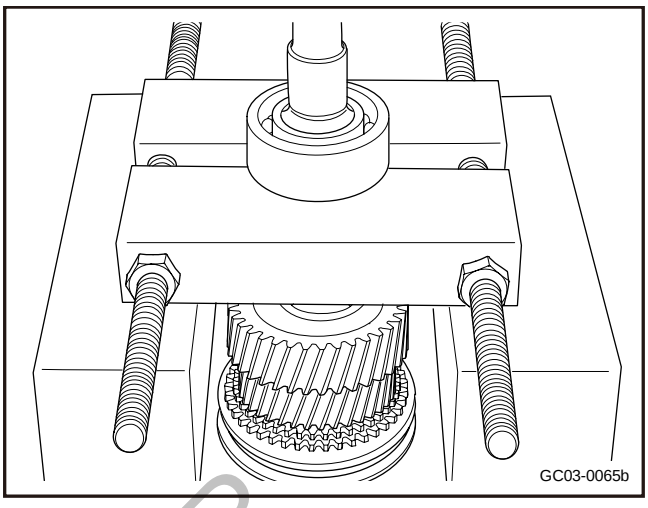
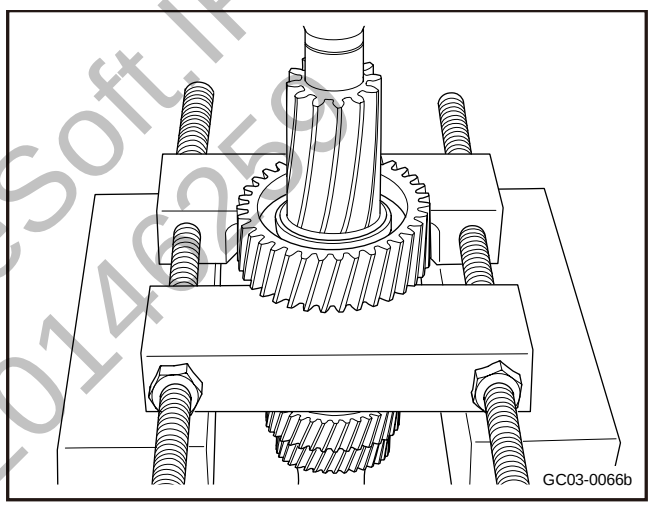
3.3.6.5 Input shaft disassemble and assemble

Dismantle procedure

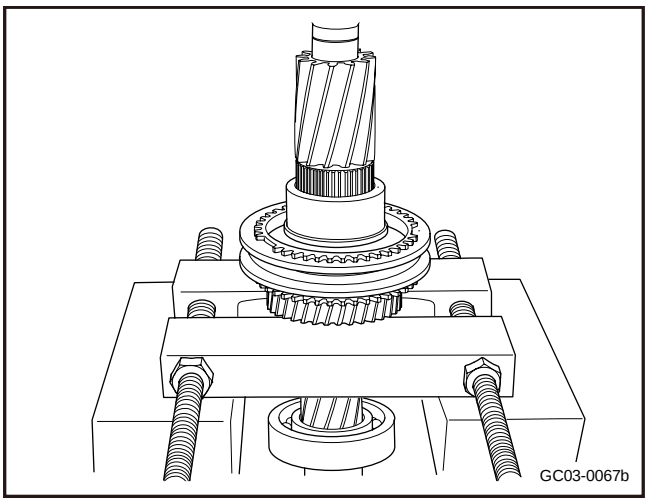
1. Dismantle the snap ring.
2. Dismantle ball-bearing.
3. Dismantle the position limiting mechanism of thrust plate.
4. Dismantle thrust plate.



5. Install the 5th speed gear .



6. Install the 4th speed gear.



7. Dismantle needle bearing.
8. Dismantle the 4th speed sleeve.
9. Dismantle synchronizer ring.

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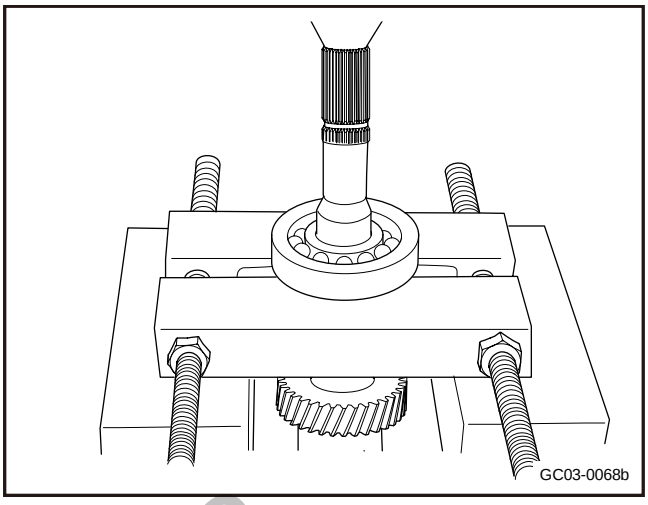
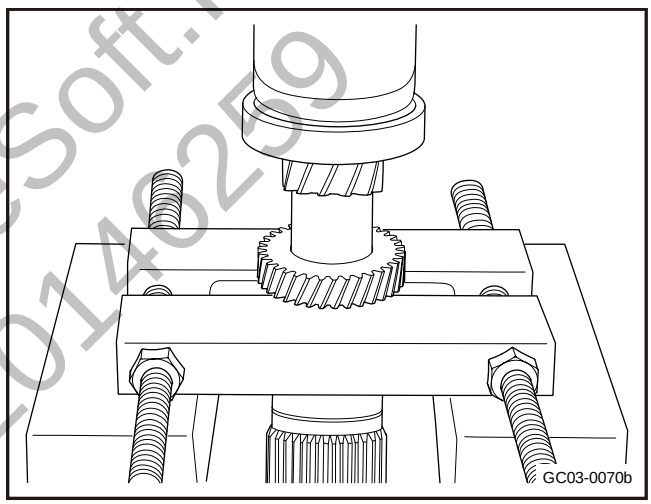
10. Dismantle synchronizer spring.
11. Dismantle synchronizer sleeve.
12. Dismantle the 3rd - 4th synchronizer hub.
13. Dismantle synchronizer ring.
14. Dismantle synchronizer spring.
15. Dismantle the 3rd speed gear.
16. Dismantle ball-bearing.
17. Dismantle the snap ring.
18. Dismantle front bearing.
19. Dismantle the oil seal.
20. Dismantle input shaft.

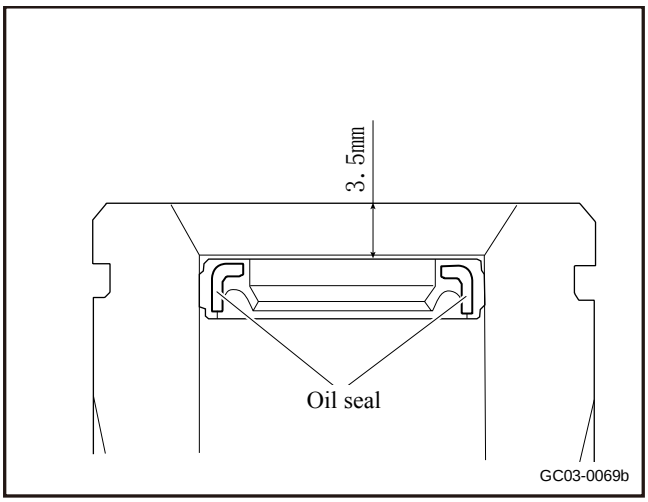


Installation procedure:

1. Install input shaft.
2. Install the oil seal.
3. Install front bearing.



4. Install needle bearing.



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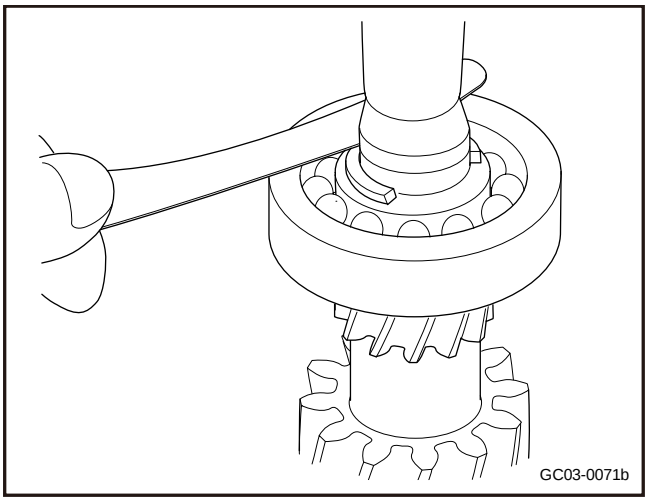
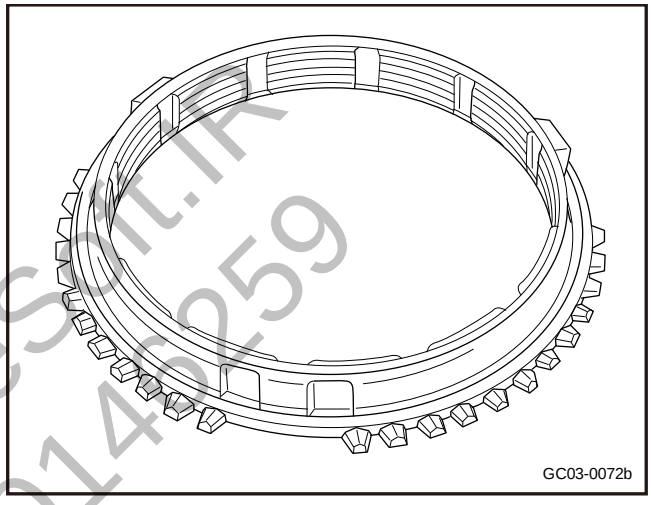
5. Install snap ring.

Note: select spring snap ring thickness to make axial clearance for input shaft front bearing conform to standards.

Standard value: -0.01～0.12 mm

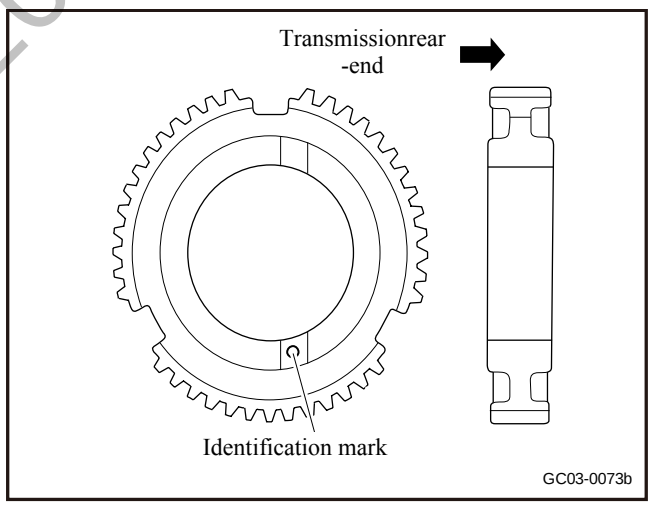


6. Install the 3rd speed gear .
7. Install synchronizer spring.
8. Install synchronizer ring.



9. Install the 3rd - 4th speed synchronizer hub.

Note: when installing the synchronizer, confirm if the synchronizer is blocked.



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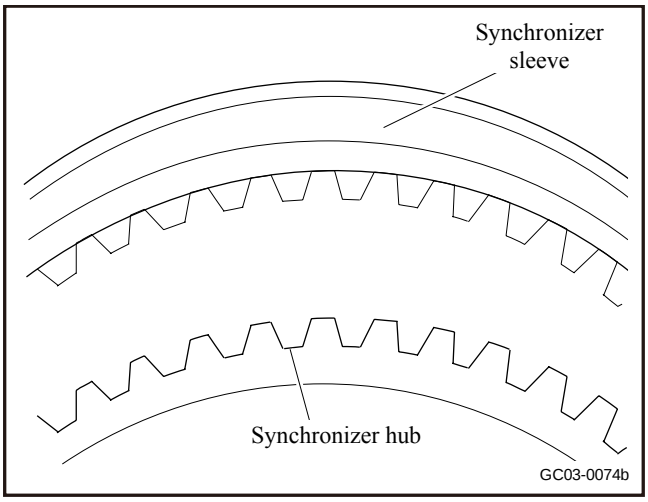
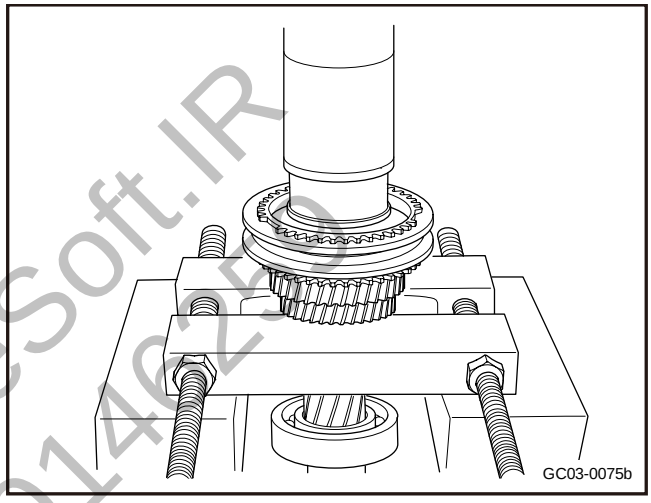
10. Install synchronizer sleeve.

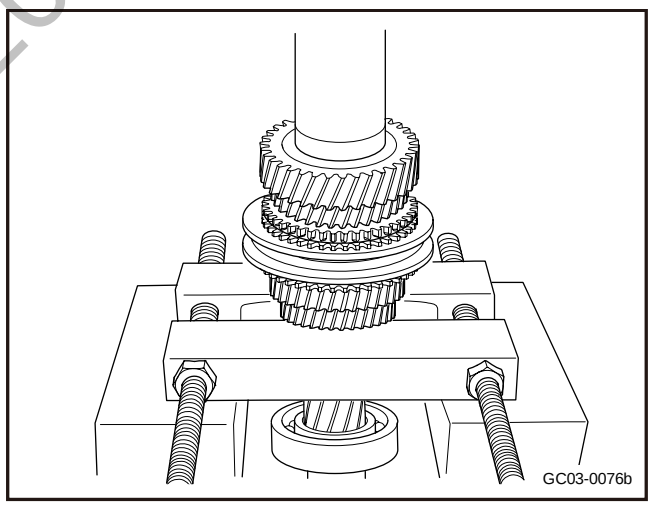
Note: please confirm the two deep gear slots of synchronizer hub align with two high racks correctly.



11. Install synchronizer spring.
12. Install synchronizer ring.
13. Install the 4th speed sleeve.
14. Install needle bearing.
15. Install the 4th speed gear.



16. Install the 5th speed gear.



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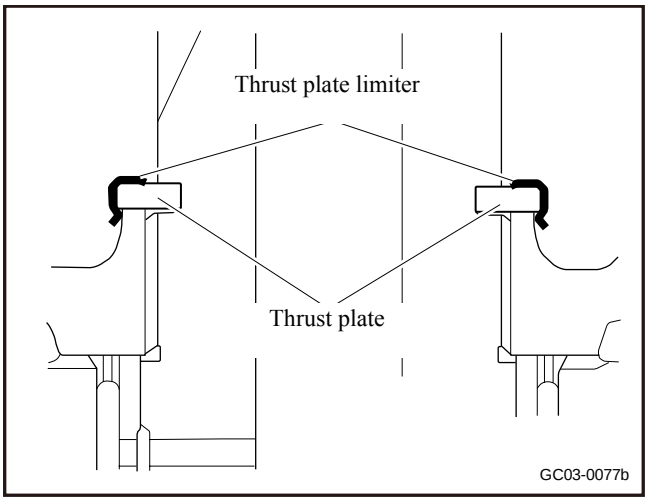
17. Install thrust plate.

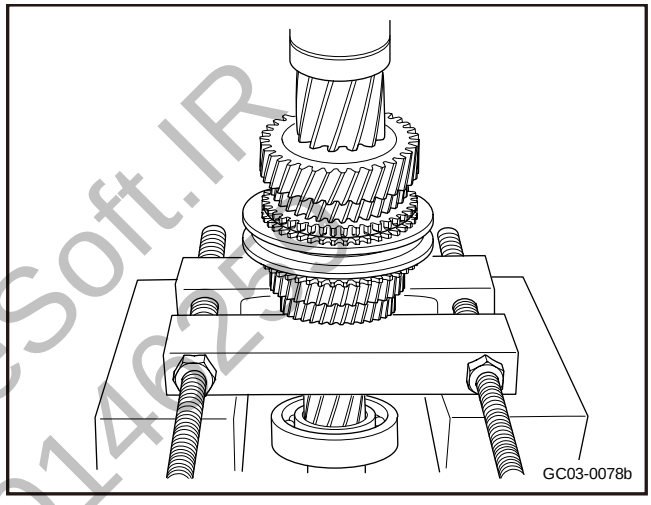
Note: when installing thrust plate, confirm thrust plate is not inclined.

18. Install thrust plate position limiter.



19. Install needle bearing.

20. Install snap ring.



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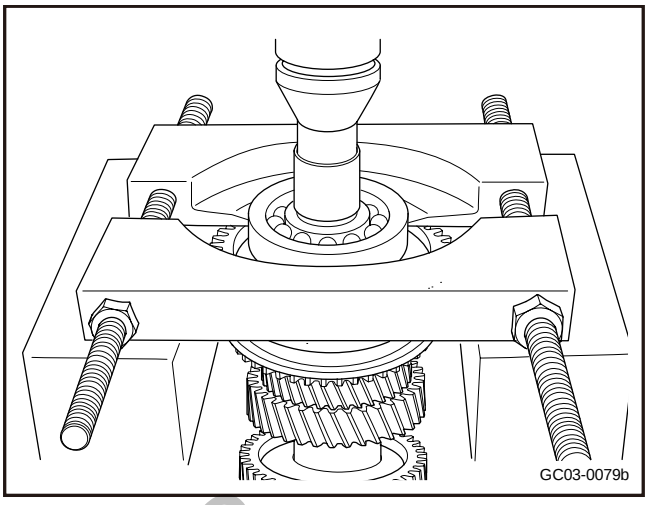
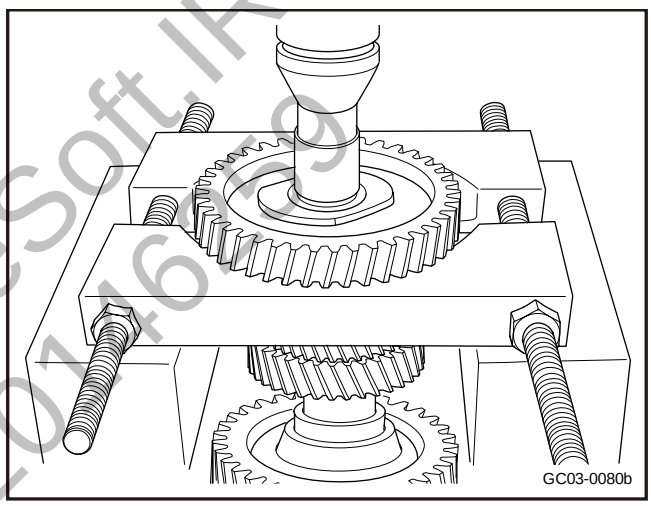
3.3.6.6 Input shaft disassemble and assemble

Dismantle procedure

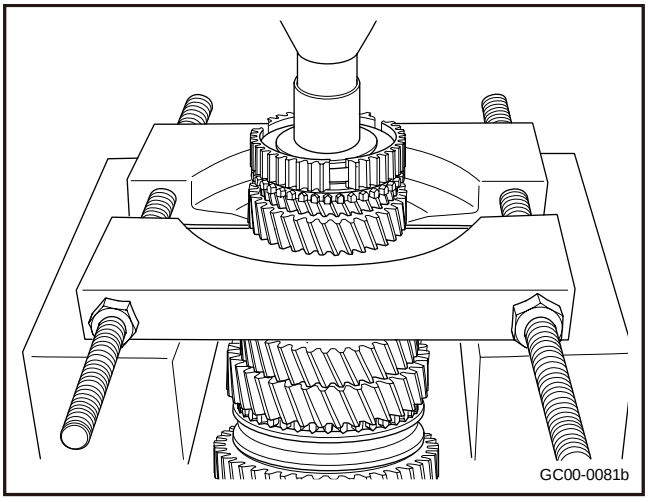
1. Dismantle spring snap ring .
2. Dismantle ball-bearing.



3. Dismantle reverse gear sleeve.
4. Dismantle needle bearing
5. Dismantle reverse gear.
6. Dismantle synchronizer ring.
7. Dismantle synchronizer spring.
8. Dismantle synchronizer sleeve.



9. Dismantle the 5th speed - reverse gear synchronizer hub.



10. Dismantle synchronizer ring.
11. Dismantle synchronizer spring.
12. Dismantle the 5th speed .

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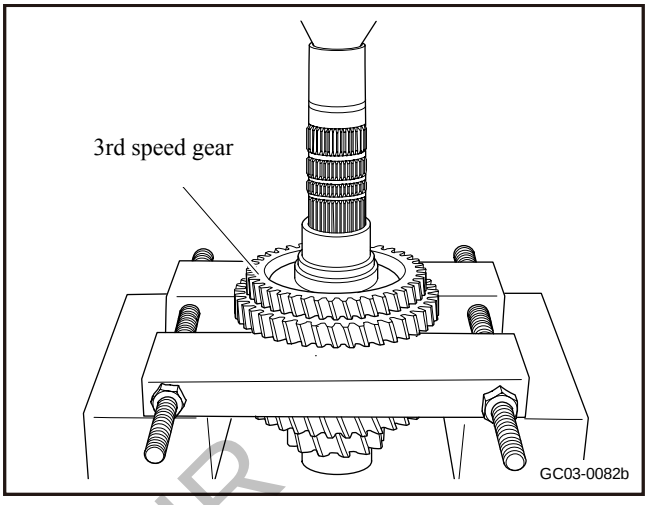
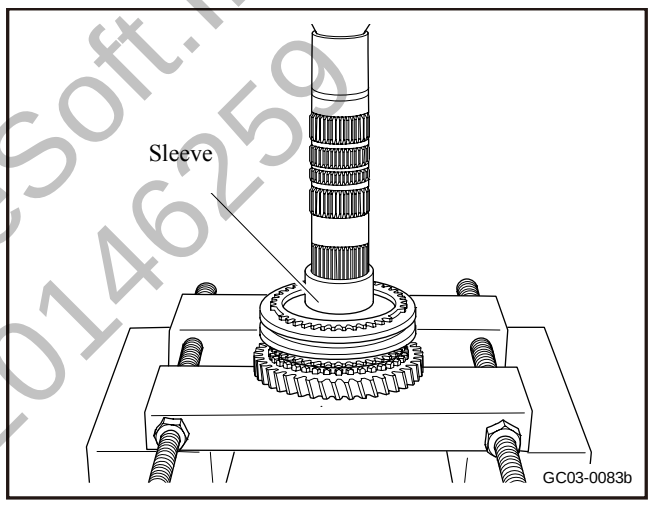
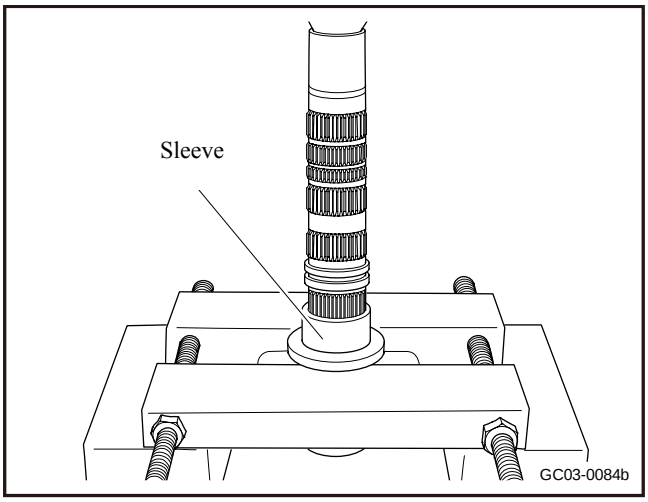
13. Dismantle needle bearing.
14. Dismantle the 5th speed sleeve.
15. Install the 4th speed gear.
16. Dismantle spring snap ring .
17. Dismantle the 3rd speed gear .



18. Dismantle the 2nd speed.
19. Dismantle needle bearing.
20. Dismantle the 2nd speed sleeve.
21. Dismantle inner synchronizer ring.
22. Dismantle synchronizer friction cone pulley.
23. Dismantle outer synchronizer ring.
24. Dismantle synchronizer spring.
25. Dismantle synchronizer sleeve.



26. Dismantle synchronizer hub of 1st speed and 2nd speed.
27. Dismantle synchronizer ring group.
28. Dismantle synchronizer spring.
29. Dismantle the 1st speed gear.
30. Dismantle needle bearing.
31. Dismantle the 1st speed sleeve.
32. Dismantle spring snap ring .



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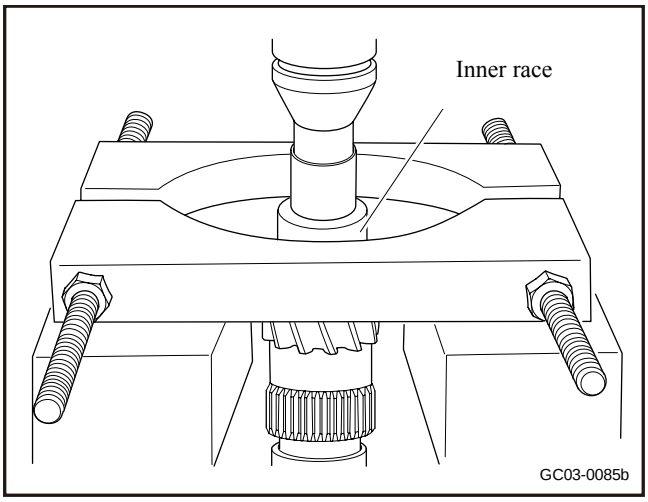
33. Dismantle inner race of needle bearing.

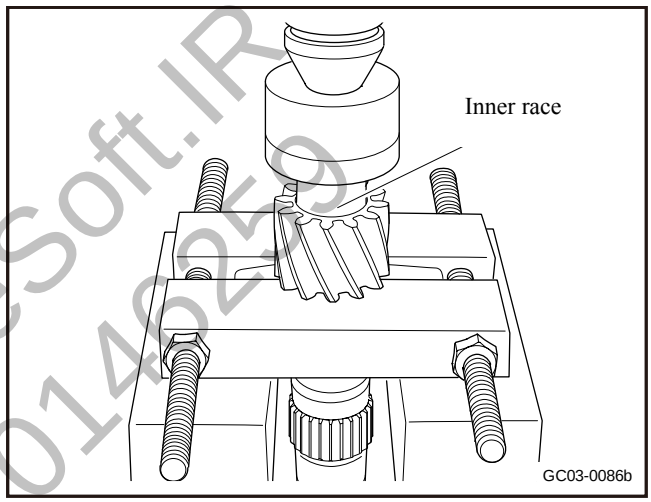
34. Dismantle output shaft.



Installation procedure:

1. Install output shaft.

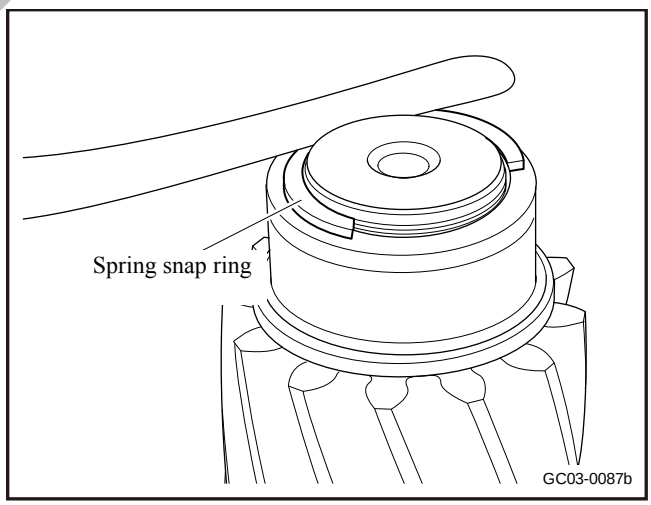
2. Install inner race of needle bearing.



3. Insatll spring snap ring.

Note: select and install spring snap ring to make axial clearance for output shaft front bearing confrom to standard value.

Standard value: -0.01～0.12 mm



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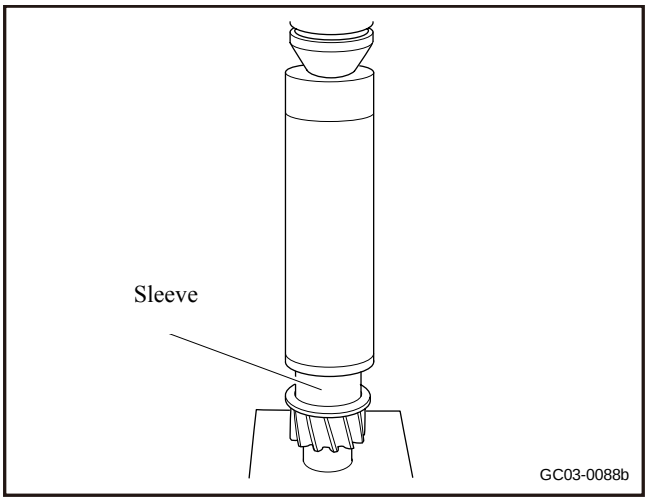
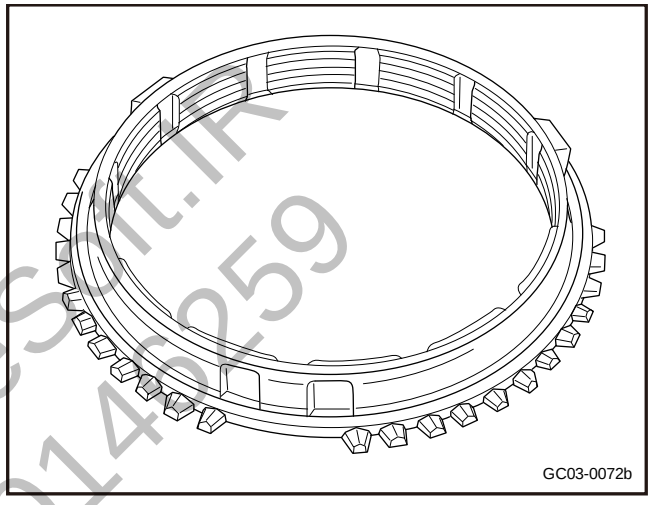
4. Install the 1st speed sleeve.
5. Install needle bearing.
6. Install the 1st speed gear.

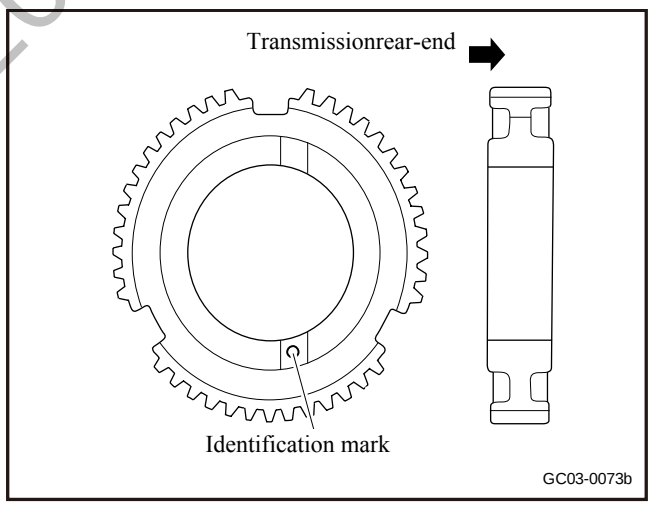


7. Install synchronizer spring.



8. Install synchronizer ring group.
9. Install the 1st and 2nd speed synchronizer hub.

Note: when installing synchronizer hub, confirm synchronizer ring is not blocked.



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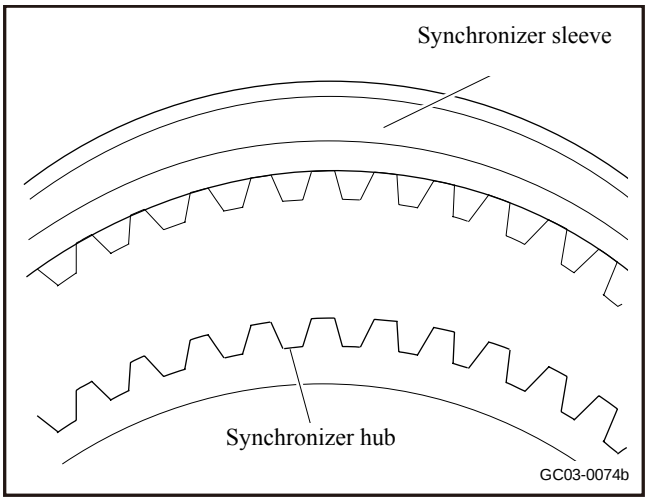
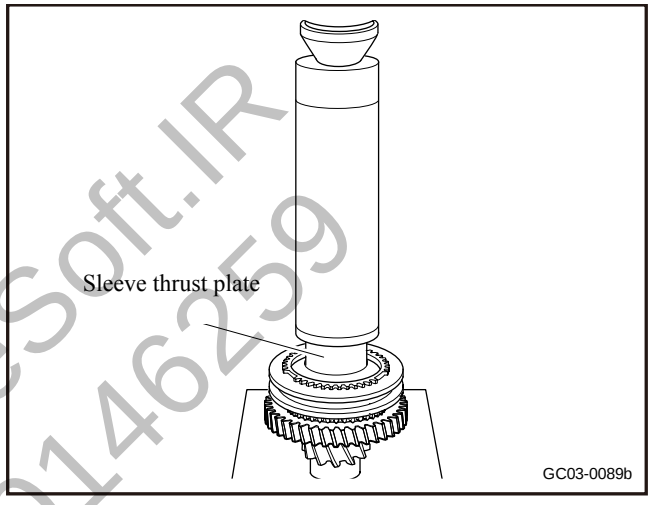
10. Install synchronizer sleeve.

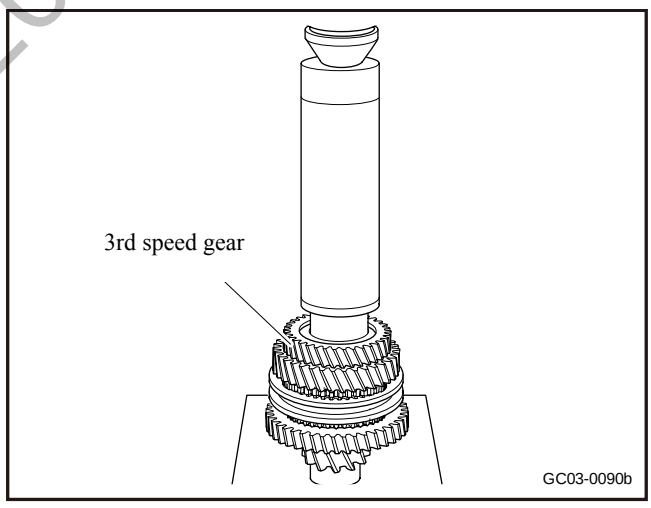
Note: When installing synchronizer, please confirm the two deep gear slots of synchronizer hub align with two high racks correctly.



11. Install synchronizer spring.
12. Install outer gear synchronizer ring.
13. Install synchronizer friction cone pulley.
14. Install inside synchronizer ring.
15. Install the 2nd speed sleeve.



16. Install needle bearing.
17. Install the 2nd speed gear.
18. Install the 3rd speed gear.



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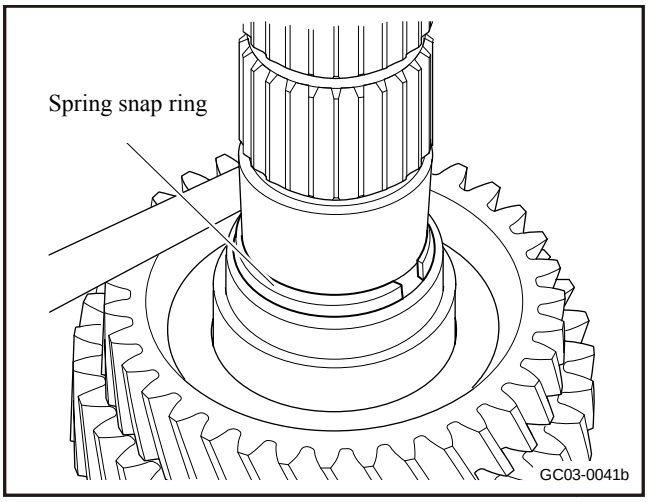
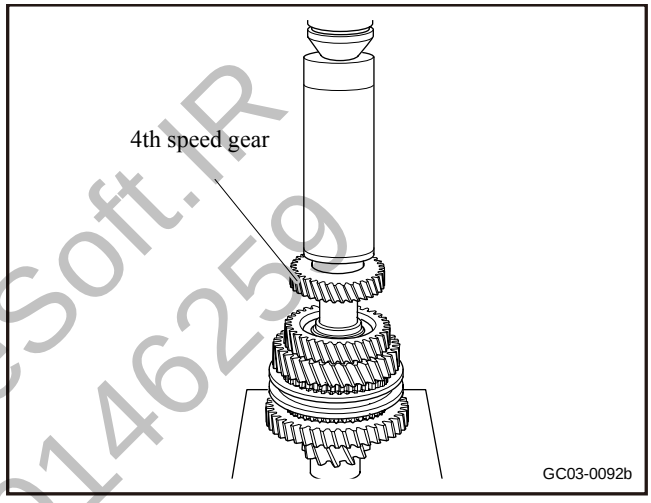
19. Insatll spring snap ring .

Note: select and install spring snap ring to make output shaft 3rd speed axial clearance conform to standard value.

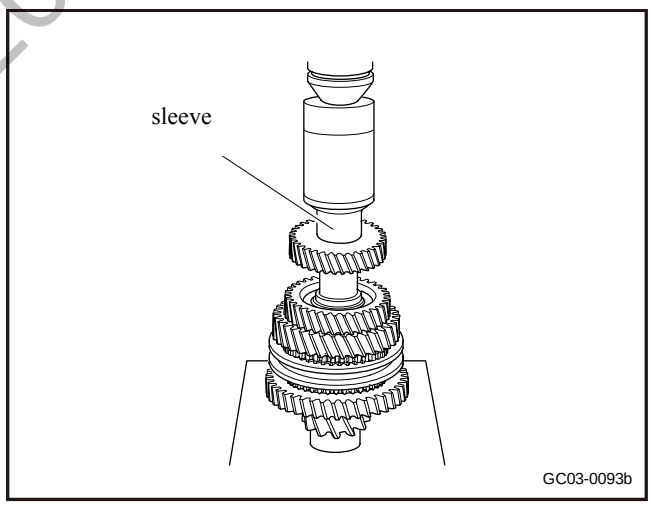
Standard value: -0.01～0.09mm



20. Install the 4th speed gear.



21. Install the 5th speed gear sleeve.



22. Install needle bearing.
23. Install the 5th speed gear
24. Install synchronizer spring.
25. Install synchronizer ring.
26. Install the 5th speed -reverse gear synchronizer hub.

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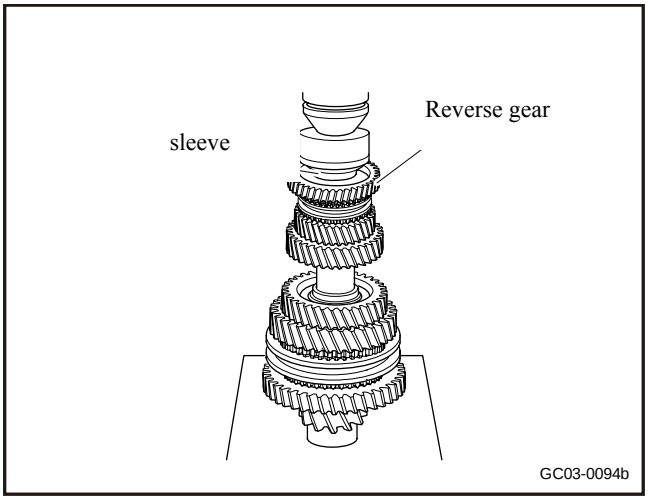
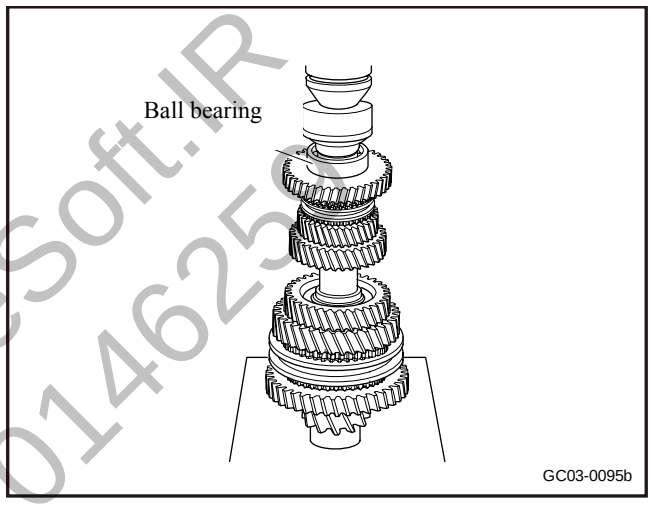
27. Install synchronizer sleeve.

28. Install synchronizer spring.
29. Install synchronizer ring.
30. Install reverse gear.
31. Install needle bearing.
32. Install reverse gear sleeve.



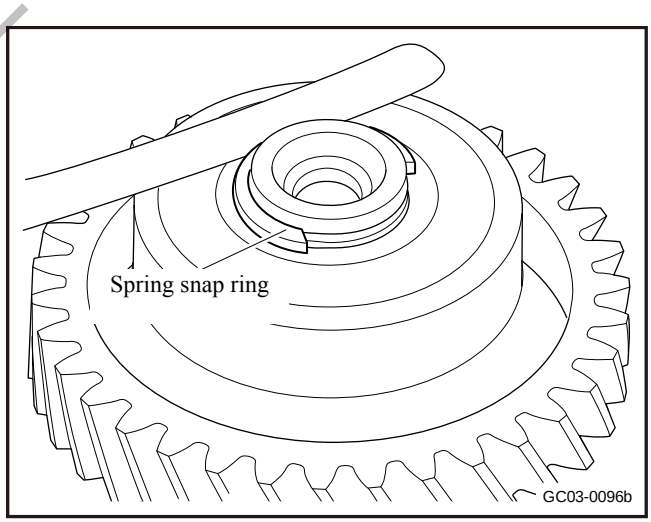
33. Install needle bearing.



34. Insatll spring snap ring.

Note: select and install spring snap ring to make axial clearance of output shaft rear bearing conform to standard value.

Standard value: -0.01～0.09mm



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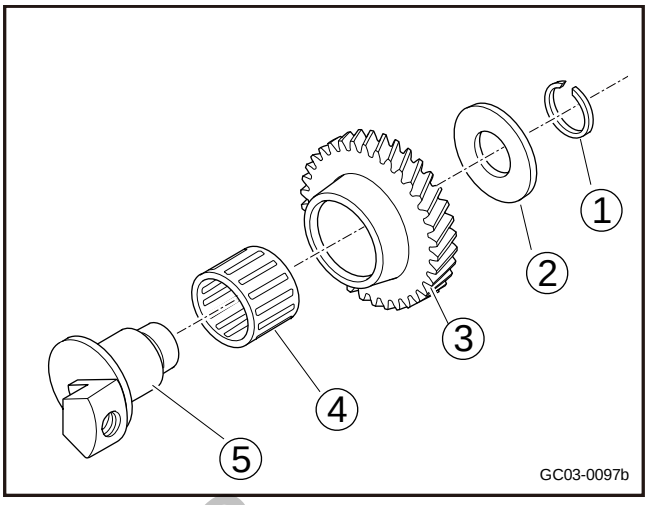
3.3.6.7 Reverse intermediate gear disassembly and assembly

Dismantle procedure

1. Dismantle spring snap ring 1.
2. Dismantle thrust washer 2.
3. Dismantle reverse intermediate gear 3 .
4. Dismantle needle bearing 4.
5. Dismantle Reverse intermediate gear shaft 5.



Installation procedure:

1. Install reverse intermediate gear shaft.
2. Install needle bearing.
3. Install reverse intermediate gear 3.
4. Install thrust washer.
5. Insatll spring snap ring.

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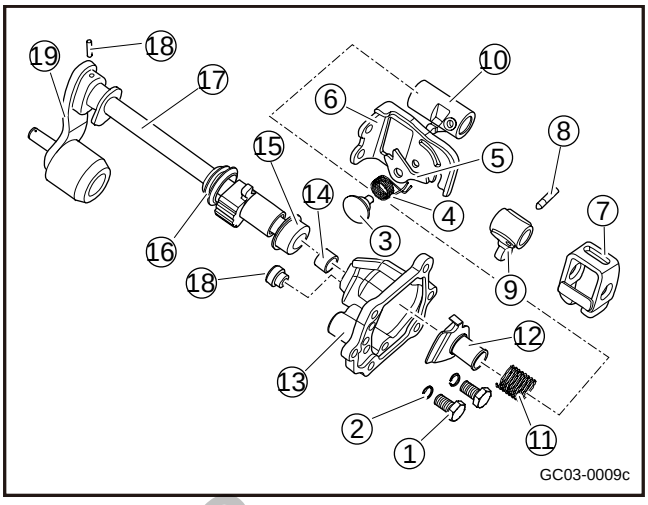
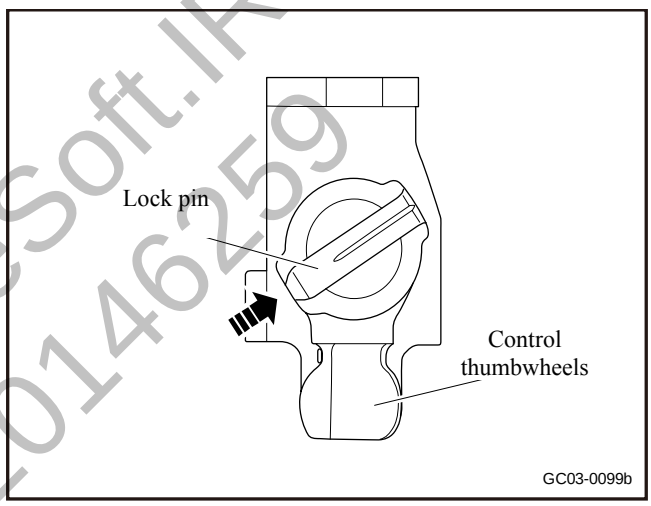
3.3.6.8 Disassemble and assemble of shift control mechanism

Dismantle procedure

1. Dismantle bolt1.
2. Dismantle spring washer 2.
3. Dismantle the pin 3.
4. Dismantle return spring 4.
5. Dismantle limiting plate 5.
6. Dismantle limiter bracket 6.
7. Dismantle interlocking plate 7.

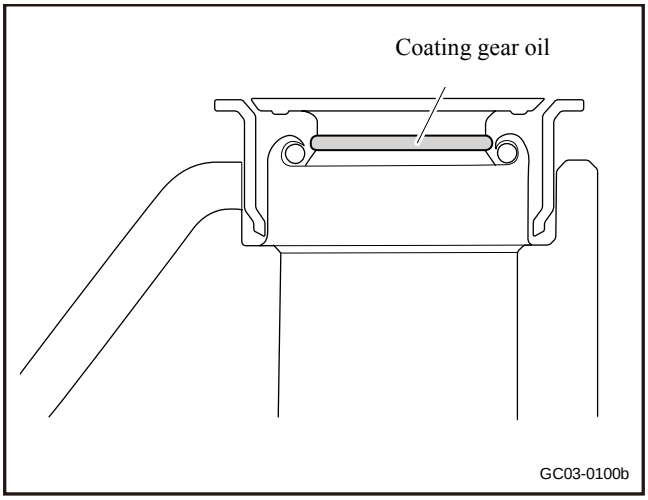


8. Dismantle lockpin 8.
9. Dismantle control claw 9.
10. Dismantle limiter body 10.
11. Dismantle neutral gear return spring 11.
12. Dismantle neutral gear return spring seat 12.
13. Dismantle controller housing 13.
14. Dismantle needle bearing14.
15. Dismantle oil seal 15.
16. Dismantle control shaft cover 16.
17. Dismantle control shaft component 17.
18. Dismantle vent pipe 18.



Installation procedure::

1. Install aeration pope.
2. Install control shaft component.
3. Install control shaft cover.
4. Install the oil seal.



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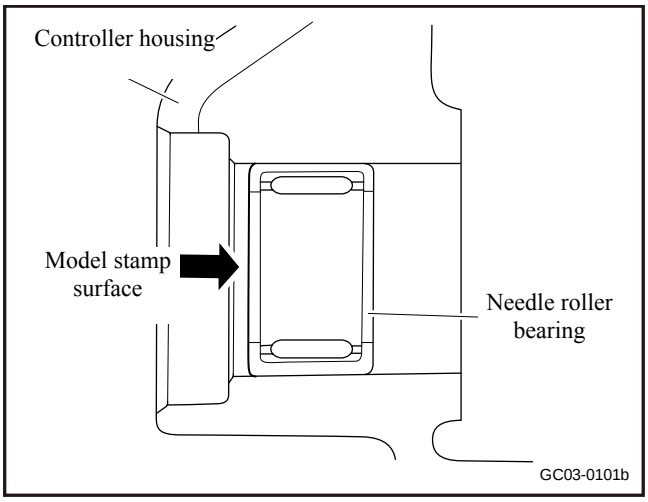
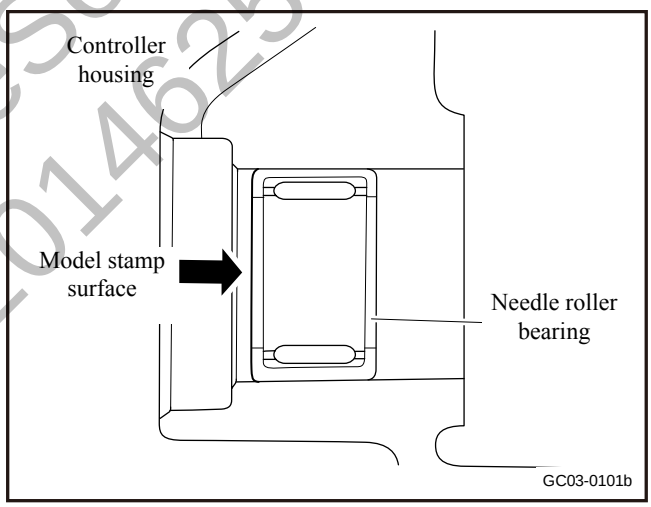
5. Install needle bearing.



6. Install the controller housing.
7. Install the neutral gear return spring seat.
8. Install the neutral gear return spring.
9. Install the limiter body.
10. Install the control claw.
11. Install lockpin.



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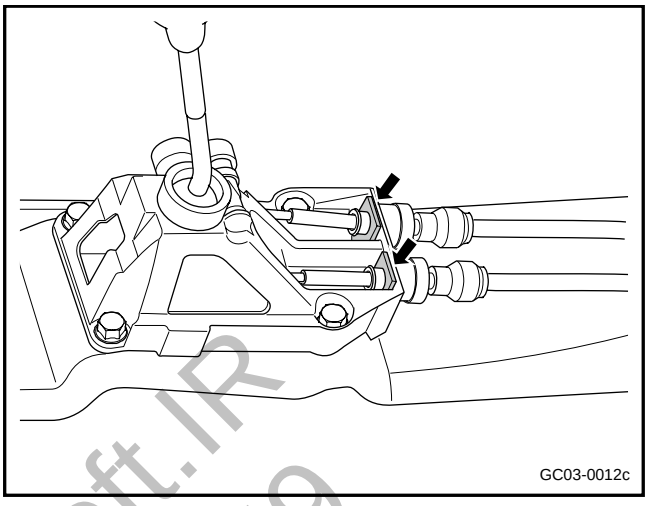
12. Install interlocking plate.
13. Install limiter bracket.
14. Install limiting plate.
15. Install return spring.
16. Install the pin.
17. Install spring washer.
18. Install the bolt.

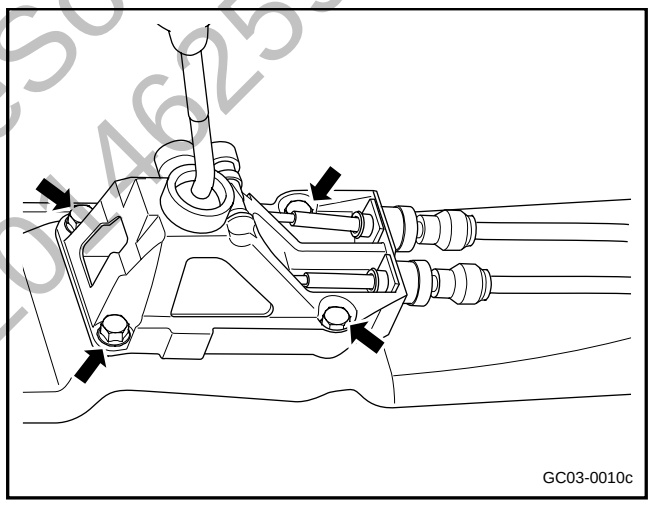
3.3.6.9 Shifter replacement

Dismantle procedure

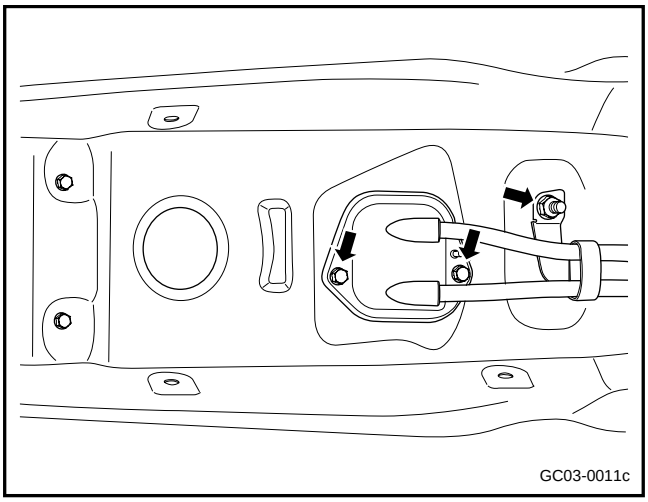
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle auxiliary instrument panel on the top of shifter; refer to 12.8.3.4 auxiliary instrument panel assembly replacement.
3. Dismantle U-shaped snap plate.
4. Disconnect flexible shaft of gearshift and shifter.



5. Dismantle fixing bolts between shifter assembly and body.
6. Dismantle shifter assembly.



7. Dismantle retaining bolt of fixed bracket for flexible shaft for gear shift.
8. Dismantle retaining bolt of seal clip plate for flexible shaft for gear shift.



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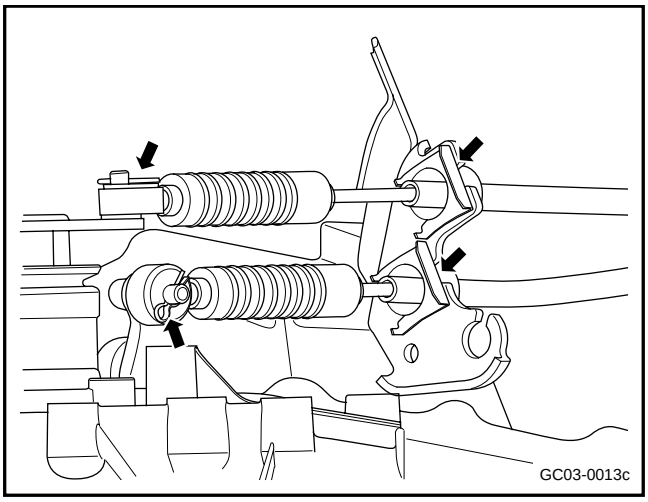
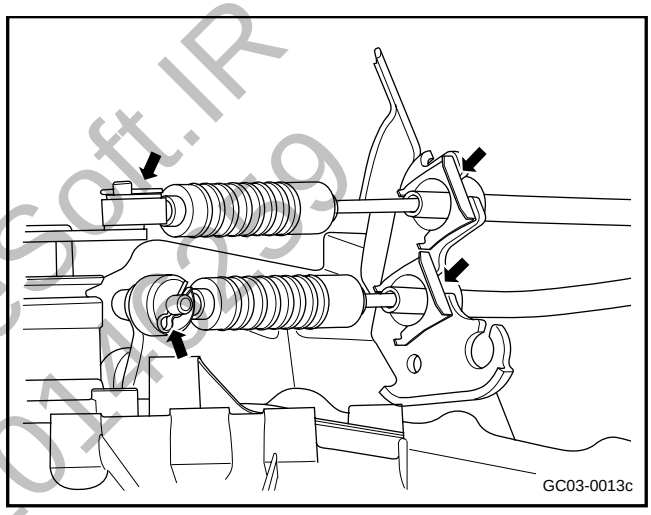
9. Dismantle U-shaped snap plate.
10. Disconnect flexible shaft of gearshift and the transmission.
11. Dismantle flexible shaft of gear shift.



Installation procedure:

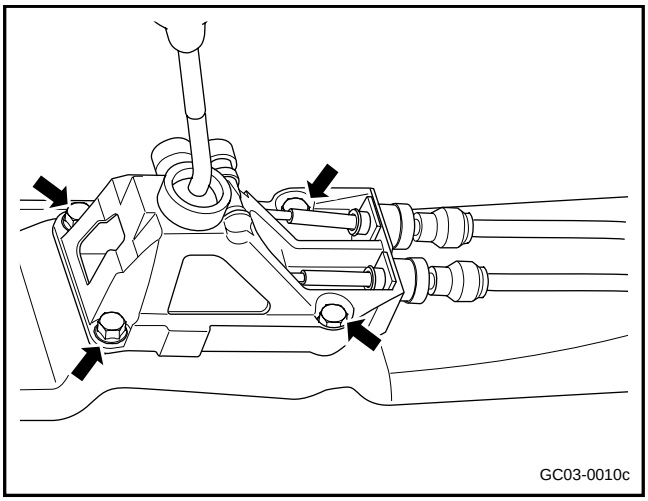
1. Install flexible shaft of gear shift.
2. Connect flexible shaft of gearshift with the transmission and install lockpin.
3. Install U-shaped snap plate.



4. Install seal clip plate of flexible shaft for gearshift and tighten the fixing bolts.
5. Install throttle body bracket and tighten retaining bolt.
6. Install the outside selector assembly and tighten the fixing bolts.

Torque: 16～26 N.m (Metric system)
9.9～16.2 lb-ft (English system)

7. Connect flexible shaft of gear shift with selector and install lock pin.
8. Install U-shaped snap plate.
9. Install subsidiary instrument desk.
10. Connect battery negative cable.



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3.4 S170BⅡ Manual transmission

3.4.1 Specifications

3.4.1.1 Fastener tightening specification

Fastener name	Model	Torque:	
		(Metric) (N·M)	English system(ft ,lbf)
Fixing support bolt of shift control rod	M8×18	20-26	15-19
Engine and transmission connecting bolt (Upper)	M12×50	96-110	71-81
Engine and transmission connecting bolt (middle)	M10×45	53-65	39-48
Engine and transmission connecting bolt (lower)	M10×40	53-65	39-48
Left support fixing bolt of transmission	M10×22	47-57	35-42
Left support through screw rod and nut	M10×100	47-57	35-42
Front support fixing bolt of transmission	M10×22	47-57	35-42
Through screw rod and nut of front support of transmission	M10×90	47-57	35-42
Drive gear lock bolt of speed sensor	M8×15	20-26	15-19
Rear support fixing nut of transmission	M10	47-57	35-42
Rear support through screw rod and nut of transmission	M12×100	70-90	52-67
Outer housing mounting bolt of transmission	M8×35	20-26	15-19
Mounting bolt of shift control mechanism	M8×35	20-26	15-19
End-cover connecting bolt	M6×15	7-11	5-8
Shift shaft self-lock bolt	M18×25	37-40	27-30
Lock bolt of reverse idling wheel shaft	M8×35	20-26	5-19
Fork fixing bolt	M8×15	20-26	5-19
Check hole bolt of oil level	M18×10	28-30	21-22
oil exhaust hole bolt	M18×10	28-30	21-22

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3.4.1.2 Manual transmission specifications

Applications	Specification
Gear ratio	
1st speed	3.182
2nd speed	1.895
3rd speed	1.25
speed	0.909
5th speed	0.8235
Reverse gear	3.133
Main reduction ratio	4.308
Gear oil capacity	2.0~2.2L
Lubrication oil	SAE 75W/90 GL-4
Type and model	JLS170BⅡ

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3.4.1.3 Size parameter specification

Dimensional parameter	Specification	
	Metric（mm）	English system(in×10-3)
Input shaft 3rd speed gear axial clearance	0.1～0.35	3.937 ~13.780
Input shaft 5th speed gear axial clearance	0.1～0.50	3.937~19.685
Input shaft 4th speed , 5th speed gear radial clearance	≦0.058	≦2.146
Input shaft 4th speed gear axial clearance	0.1～0.55	3.937～21.654
Input shaft run out	≦0.03	≦1.181
Distance synchronous ring back and gear end-face	≧0.8	≧31.496
Distance between gear bushing and shift fork	≦0.35	≦13.780
Min.diameter under the input shaft worn condition	33.985 and 30.985	1337.989 and 1219.879
Gear axial clearance of main shaft 1st speed and 2nd speed	0.1～0.35	3.937～13.780
Gear radial runout of main shaft 1st speed and 2nd speed	≦0.056	≦2.205
main bearing radial runout	≦0.03	≦1.181
Worn condition of main shaft:Min,diameter	33.985	1337.989
Distance from shift gear cove oil(sideward) seal end -face to oil seal hole end-face	2.0～2.5	78.740～98.425
Distance from shift gear cove oil(upper side) seal end -face to oil seal hole end-face	0～0.5	0～19.685

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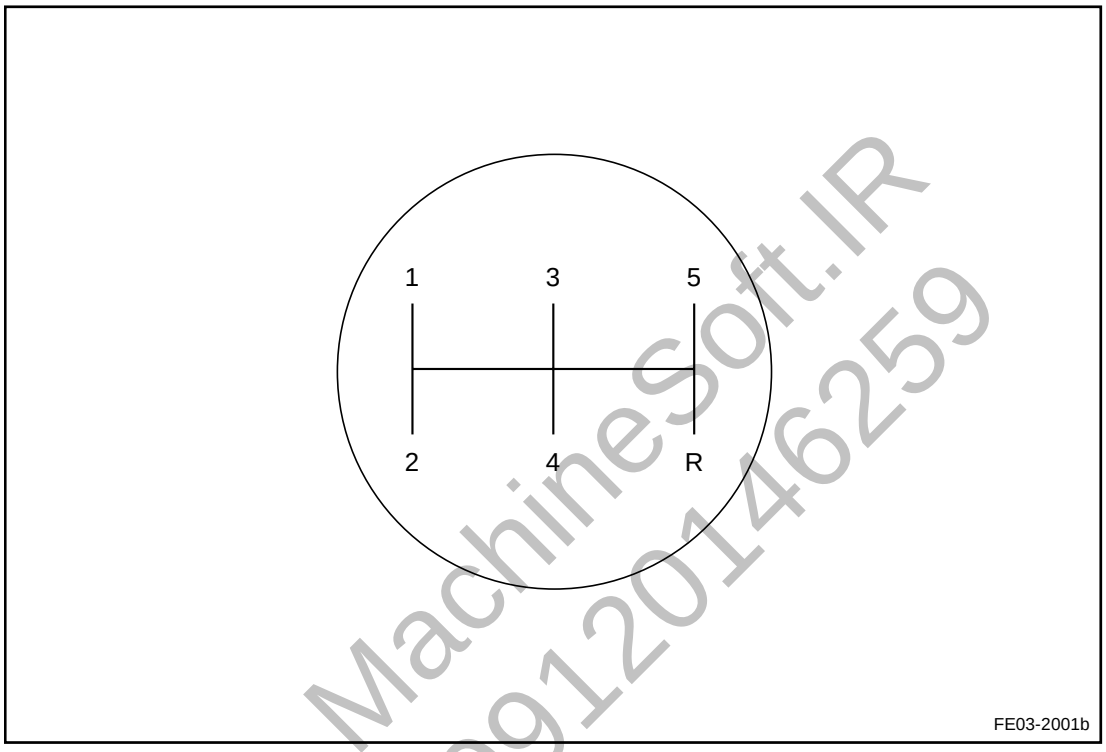
3.4.2 Description and operation

3.4.2.1 Transmission system and operated description

Warning: in the course of diagnosis and maintenance, it is necessary to strictly comply with the safety and normative operation standard in order to avoid from personal injury and vehicle damage. See Warning for lifting vehicle and warning for road test in warning and precaution . During maintenance of disassembling the transmission, a special tool for repairing the transmission must be used for prevented dust from mixing; therefore, not only the maintenance efficiency and quality can be improved, but also the vehicle is prevented from unnecessary damage.

The transmission is manual constant mesh 5the speed all synchronizer transmission

Control gears as shown in figure:



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Basic part included:

- Transmission housing
- Gear ring and differential assembly
- Shift control mechanism
- Input shaft
- Input shaft gear
- Main shaft
- Main shaft gear

Shift control mechanism

The shift control mechanism selects the shift fork shaft through moving the shift pin of the shift control mechanism up and down via the shift operation mechanism and selects the gear to be put into through moving left and right. Prevent out-of-gear through the self-locking bolt of the shift shaft. An interlocking pin is installed among the fifth reverse gear fork shaft and the first and 2nd speed fork shaft as well as among the 5th speed reverse gear fork shaft and the third and fourth gear fork shaft to prevent from putting into two gears at the same time; thereby ensuring the normal operation of the transmission.

Forward gear

The implementation of the forward gear is completed in combination with a group of shift sliding fork that controls the synchronizer with a lock ring.

Reverse gear

The Reverse gear is not synchronized, and a sliding idle gear is adopted; when putting into the Reverse gear, the sliding idle gear is engaged with the input shaft revering gear and the main shaft reversing output gear at the same time; the input torque is transmitted to the main shaft to output; and the steering of the main shaft is reverse to that of the main shaft put into the forward gear, thereby reversing the vehicle.

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3.4.3 System operating principle

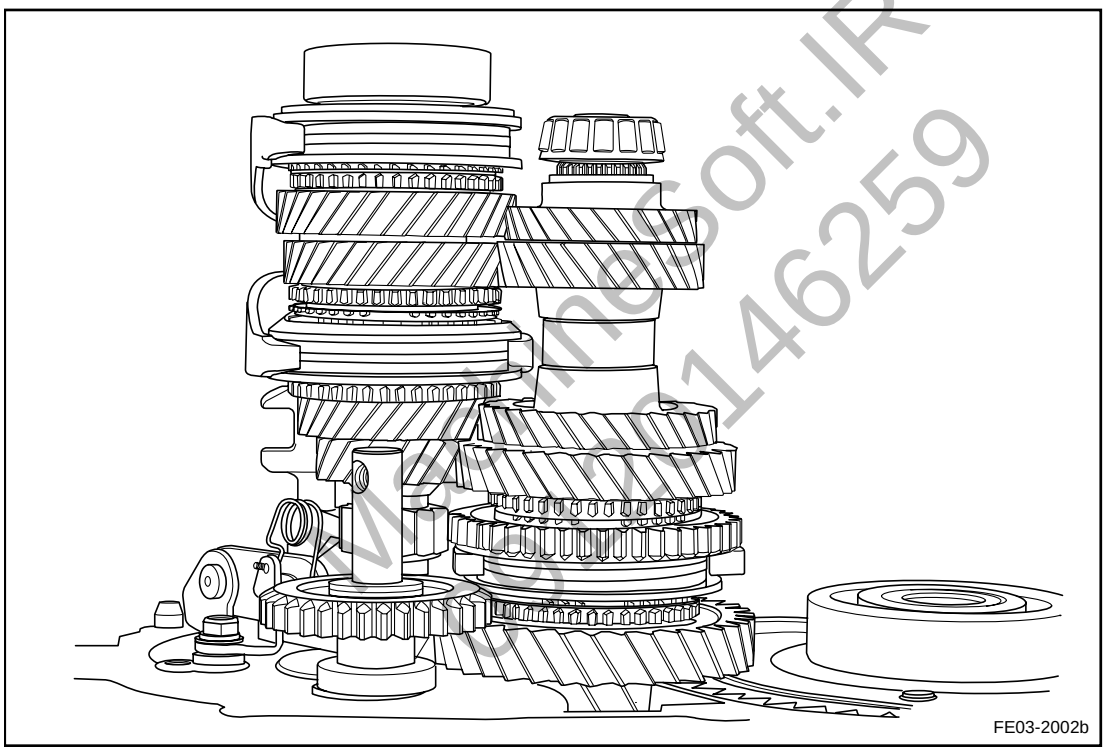
3.4.3.1 System operating principle

- **Operating principle of gearshift**

It is unable to meet of requiring the vehicle has fairly large traction and speed change in a complicated service condition because the variation range of the engine output torque and revolution speed is narrower. The function of the transmission is to change the transmission ratio of the output torque and RPM of the engine to widen the variation range of the torque and RPM of the driving wheel so as to adapt to frequently changing service conditions.

The transmission of the vehicle is a manual five-speed two-axis transmission, including five forward gears, reverse gear and neutral. The shift control mechanism is controlled by the shift lever and pushes the fork shaft and the fork to engage the gear synchronizer to be selected and the gear synchronously; the input shaft torque and the speed are transmitted to the spindle and are transfer to the differential through the spindle; and the half shaft and the wheels are driven.

1. Idle working status: gearshifting control mechanism doesn't push fork shaft and shifting yoke. Synchronizer and gear engagement are synchronous. Reversing idle wheel doesn't arrange with input shaft reversing gear and main shaft output gear. main shaft has not torque and speed output.



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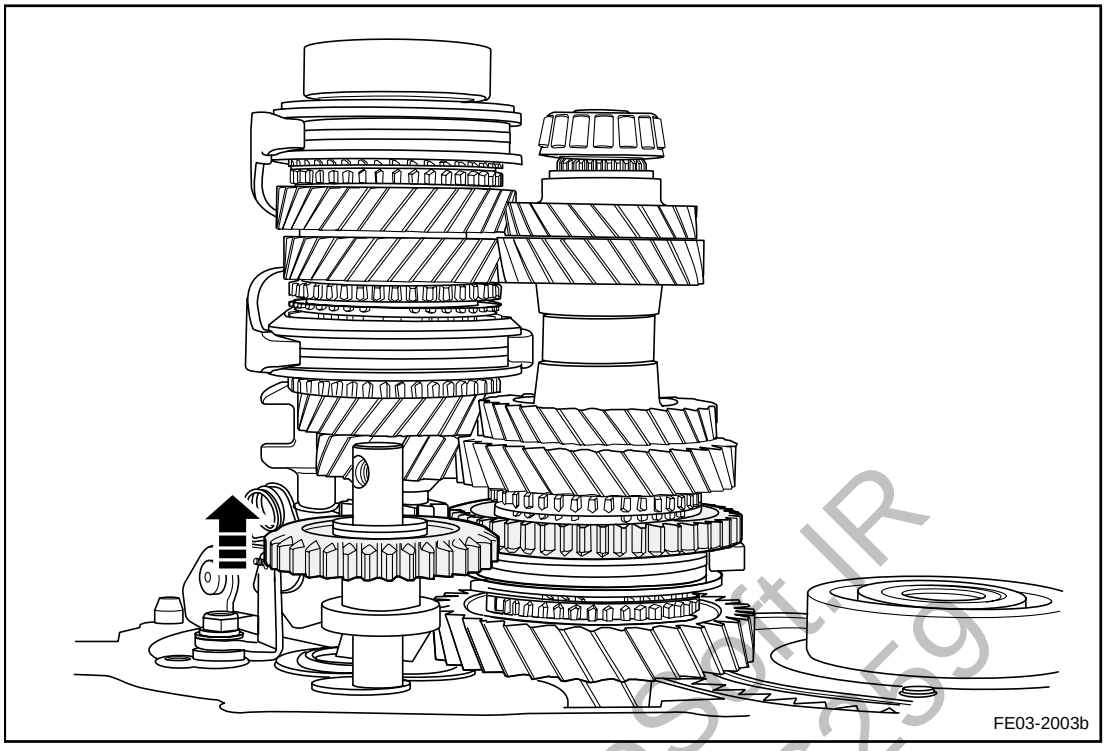
2. Working condition of reversing gear: gearshifting control mechanism drive 5th reversing gear fork shaft and fork to move to right side (rear end of transmission), to make the reversing gear idle wheel and input shaft reversing gear and main shaft reversing gear output gear engage. Torque and speed in the same direction of output of main shaft and input shaft.



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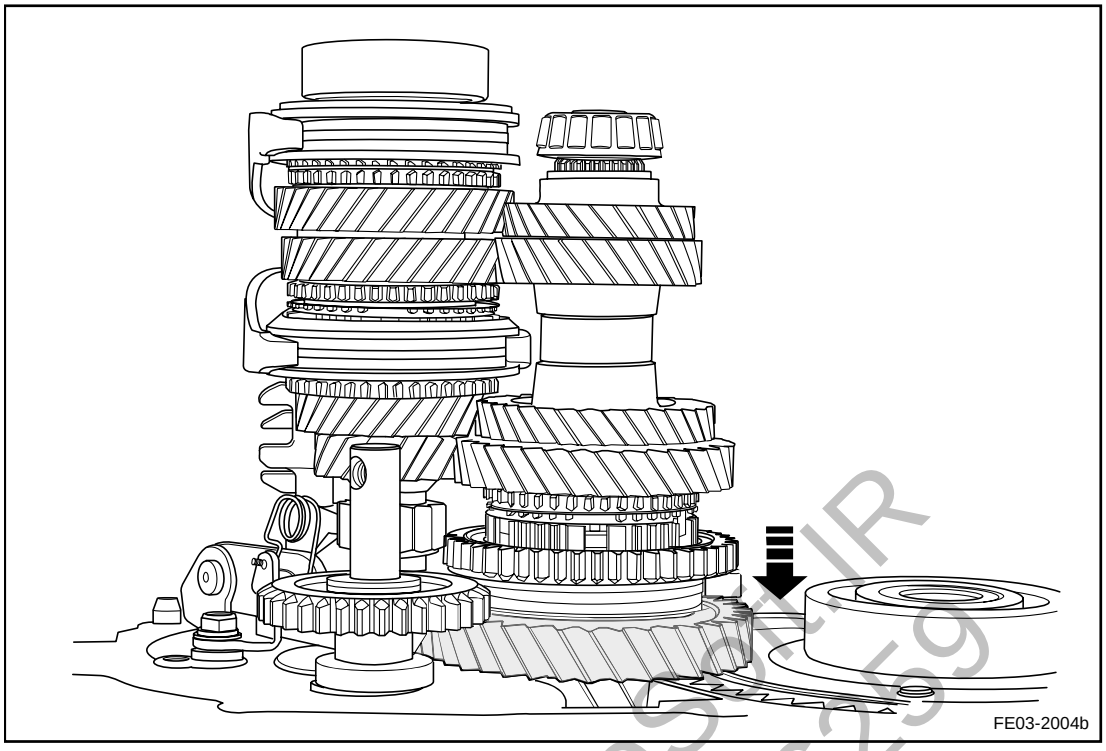
3. Working status of 1st speed: gearshifting control mechanism drives 1st and 2nd speed fork shaft and fork to move leftward (front end of transmission), which make the 1st and 2nd speed synchronizer and 1st speed engaged. Main shaft receives torque from input shaft and reversing torque and rotation speed of output nd input shaft through 1st speed.



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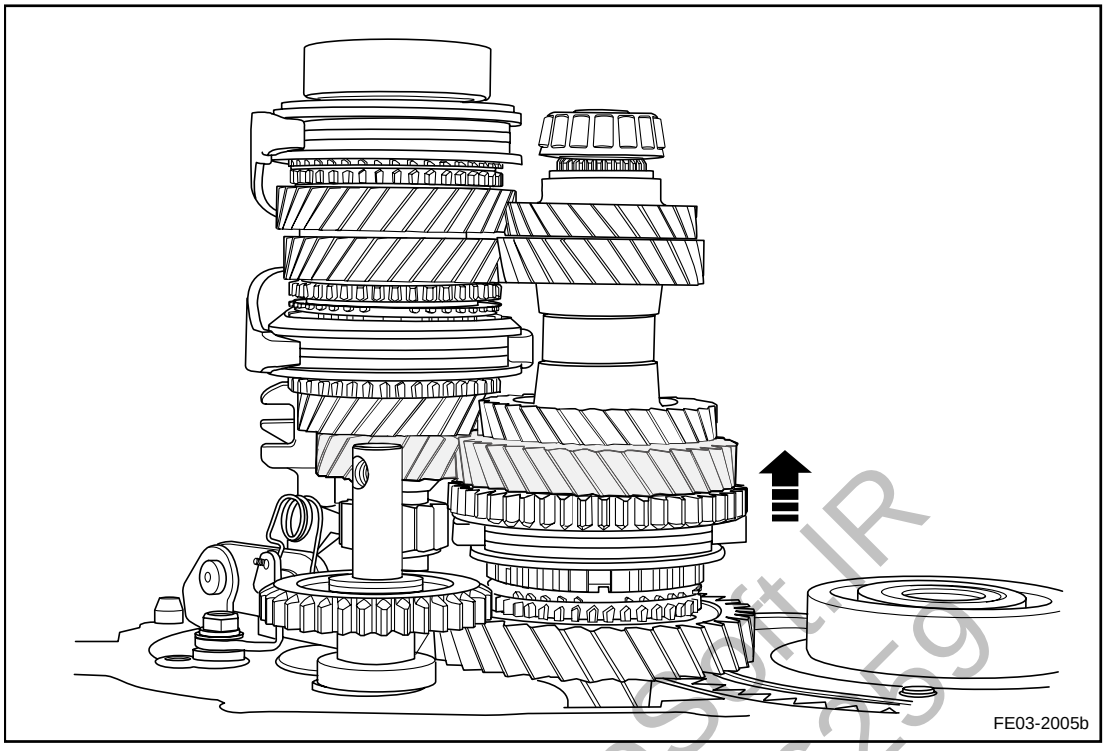
4. Working status of 2nd speed : gearshifting control mechanism drives 1st and 2nd speed fork shaft and fork to move leftward (rear end of transmission), which make the 1st and 2nd speed synchronizer and 1st speed engaged. Main shaft receives torque from input shaft and reversing torque and rotation speed of output nd input shaft through 2nd speed .



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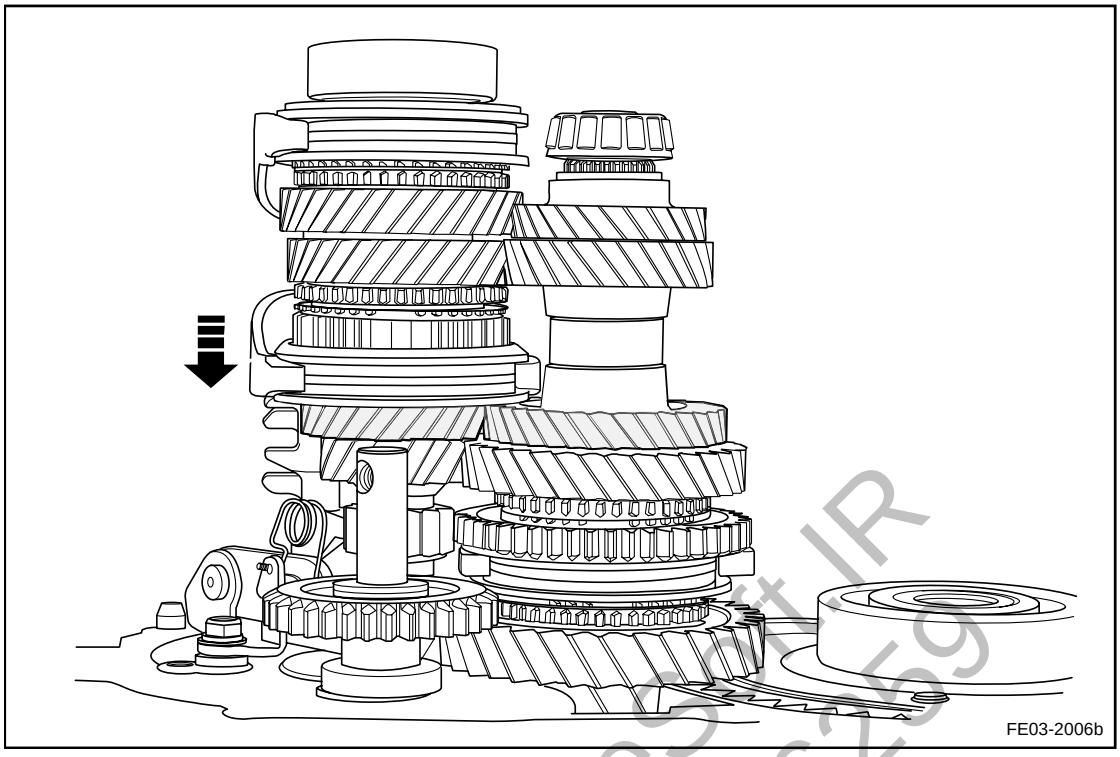
5. 3rd speed working status: the shift mechanism toggles the 3rd-4th speed fork shaft and the fork (at the front of the gear box) leftwards to engage the 3rd-4th speed syncrhonizer with the 3rd speed gear and the main shaft accepts the torque from the input shaft to output the the torque and RPM in the opposite direction of the those output by the input shaft.



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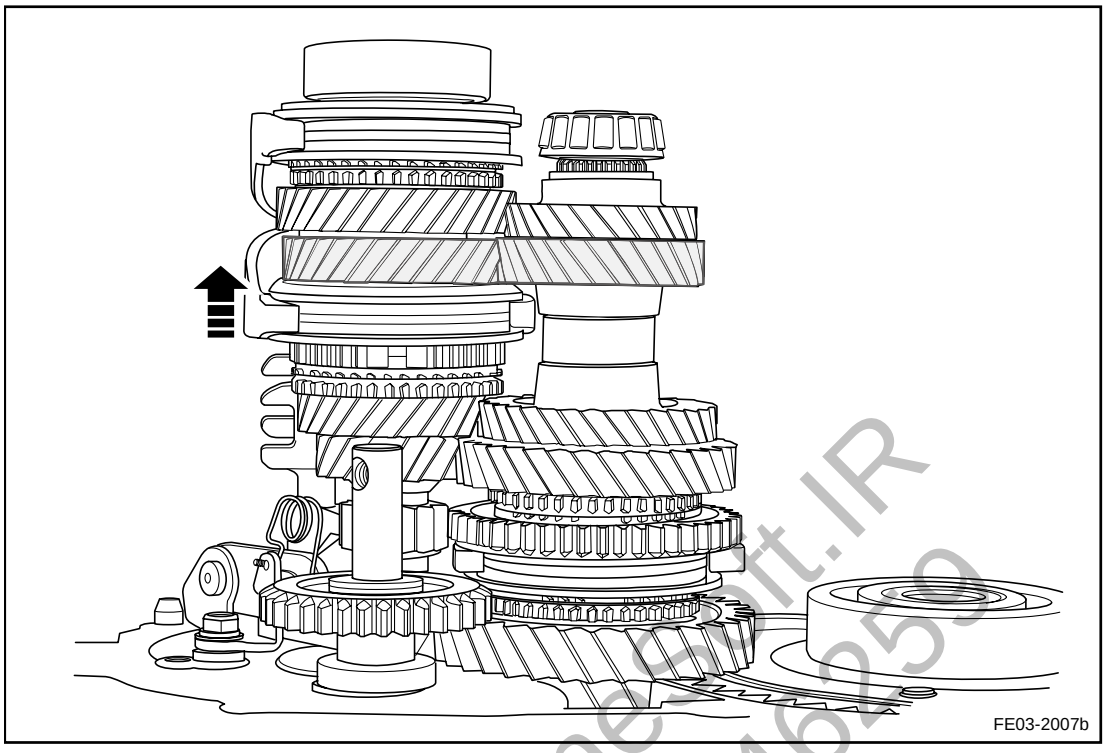
6. 4th speed working status: the shift mechanism toggles the 3rd-4th speed fork shaft and the shift fork (at the back side of the gear box) rightwards to engage the 3rd-4th speed syncrhonizer with the 4th speed gear and the main shaft accepts the torque from the input shaft to output the the torque and RPM in the opposite direction of the those output by the input shaft.



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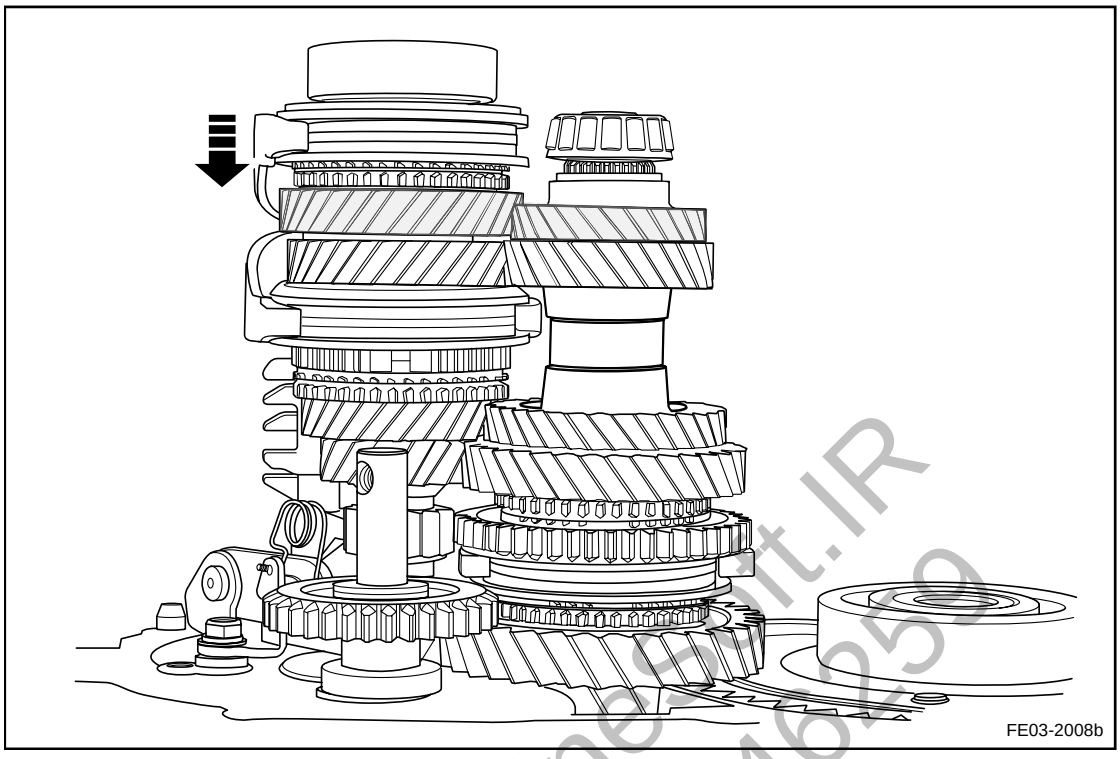
7. 5th-gear working status: the shift mechanism toggles the 5th-R gear selector rod and the shift fork (at the front of the gear box) leftwards to engage the 5th speed syncrhonizer with the 5th speed gear and the main shaft accepts the torque from the input shaft to output the the torque and RPM in the opposite direction of the those output by the input shaft.



- **Working principles of vehicle speed sensor**

The vehicle speed sensor is a hall-type sensor, which is installed on the drive gear shaft for the speed sensor. When the transmission main shaft rotates, the vehicle speed sensor operates, so that the vehicle speed sensor generates signals and sends the signal to the instrument panel.

- **Reverse switch operating principle**

Reverse lamp switch is a normally open switch. When the reverse gear is engaged, the reverse fork will squeeze reverse switch contact, making reverse lamp switch closed, then the reverse lamp circuit is completed and reverse lamp is lit.

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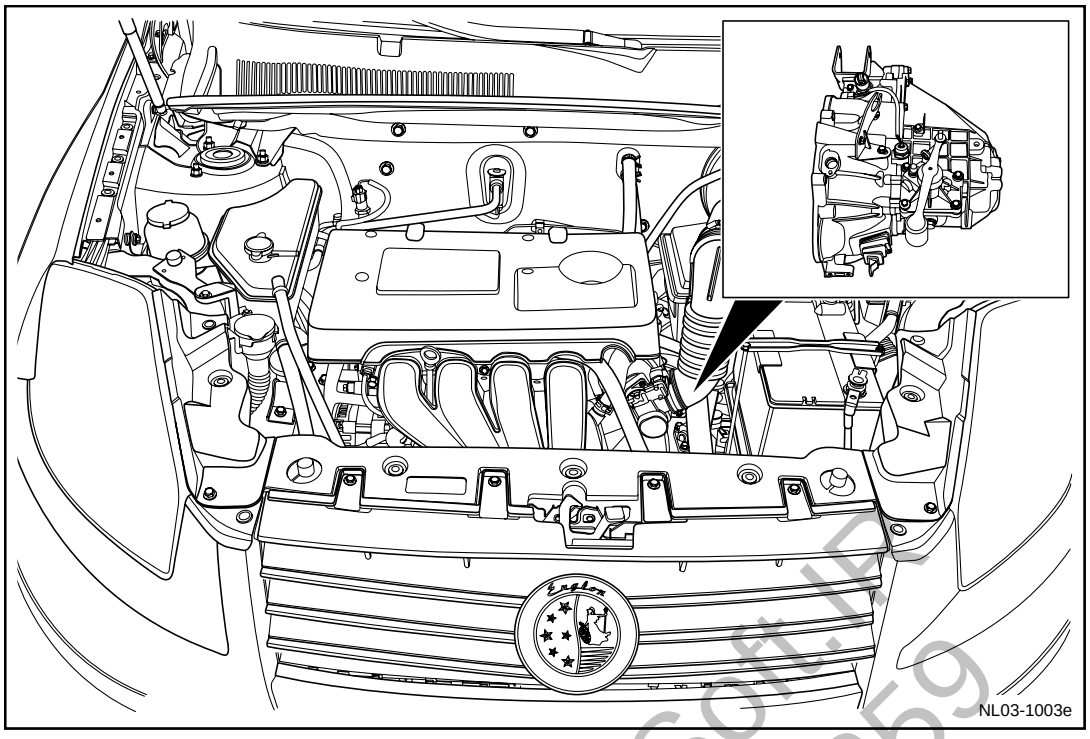
3.4.4 Component position

3.4.4.1 Transmission assembly position



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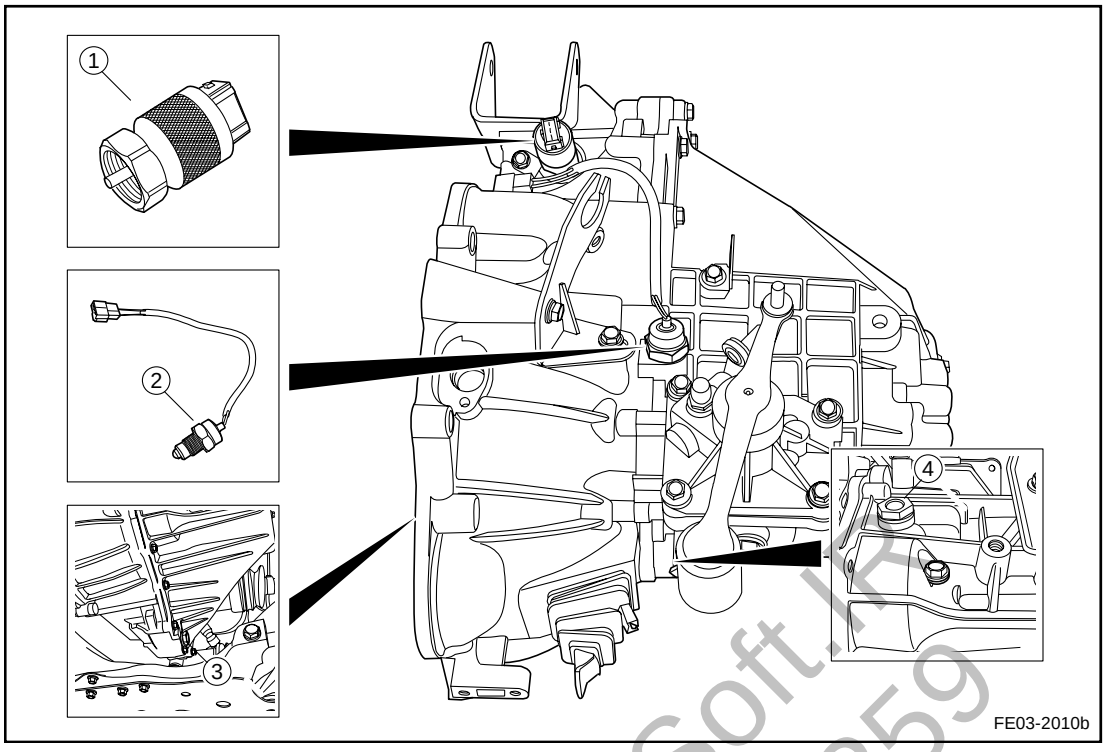
3.4.4.2 Vehicle speed sensor, reverse switch position



1. Vehicle speed sensor
2. Reversing switch
3. Oil drain hole
4. Filling hole of transmission oil

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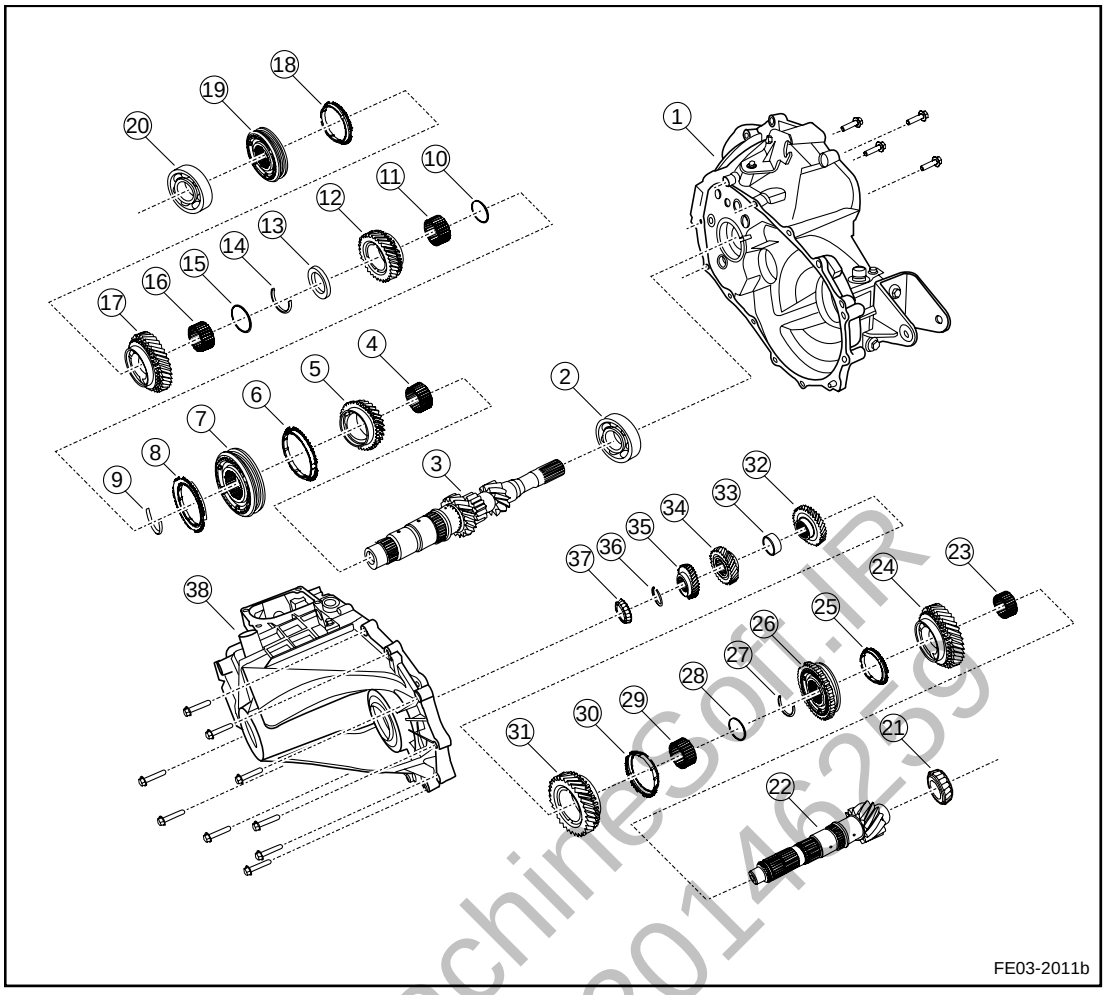
3.4.5 Disassemble drawings

3.4.5.1 Part disassemble drawing of gear module and gear box



1. Front-end housing of transmission
2. Input shaft front end bearing
3. Input shaft
4. 3rd speed gear bearing
5. 3rd speed gear
6. 3rd speed synchronizer
7. 3rd/4th speed synchronizer
8. 4th speed synchronizer
9. 3rd/4th speed synchronizer snaps spring
10. 4th speed gear bearing washer
11. 4th speed gear bearing
12. 4th speed gear
13. 4th speed gear retaining ring
14. 4th speed gear snap spring
15. 5th speed gear bearing washer
16. 5th speed gear bearing
17. 5th speed gear
18. 5th speed synchronizer
19. 5th speed synchronizer
20. Input shaft rear-end bearing
21. Front end bearing of main shaft
22. Main shaft
23. 1st speed gear bearing
24. 1st speed gear
25. 1st speed synchronizer
26. 2nd speed synchronizer
27. 1st/2nd speed synchronizer snap spring
28. 2nd speed gear bearing gasket
29. 2nd speed gear bearing
30. 2nd speed synchronizer

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31. 2nd speed gear
32. 3rd speed output gear
33. Bushing of 3rd/4th speed output gear
34. 4th speed output gear
35. 5th speed output gear
36. 5th speed output gear snap spring
37. Main shaft rear-end bearing
38. Rear end-housing transmission

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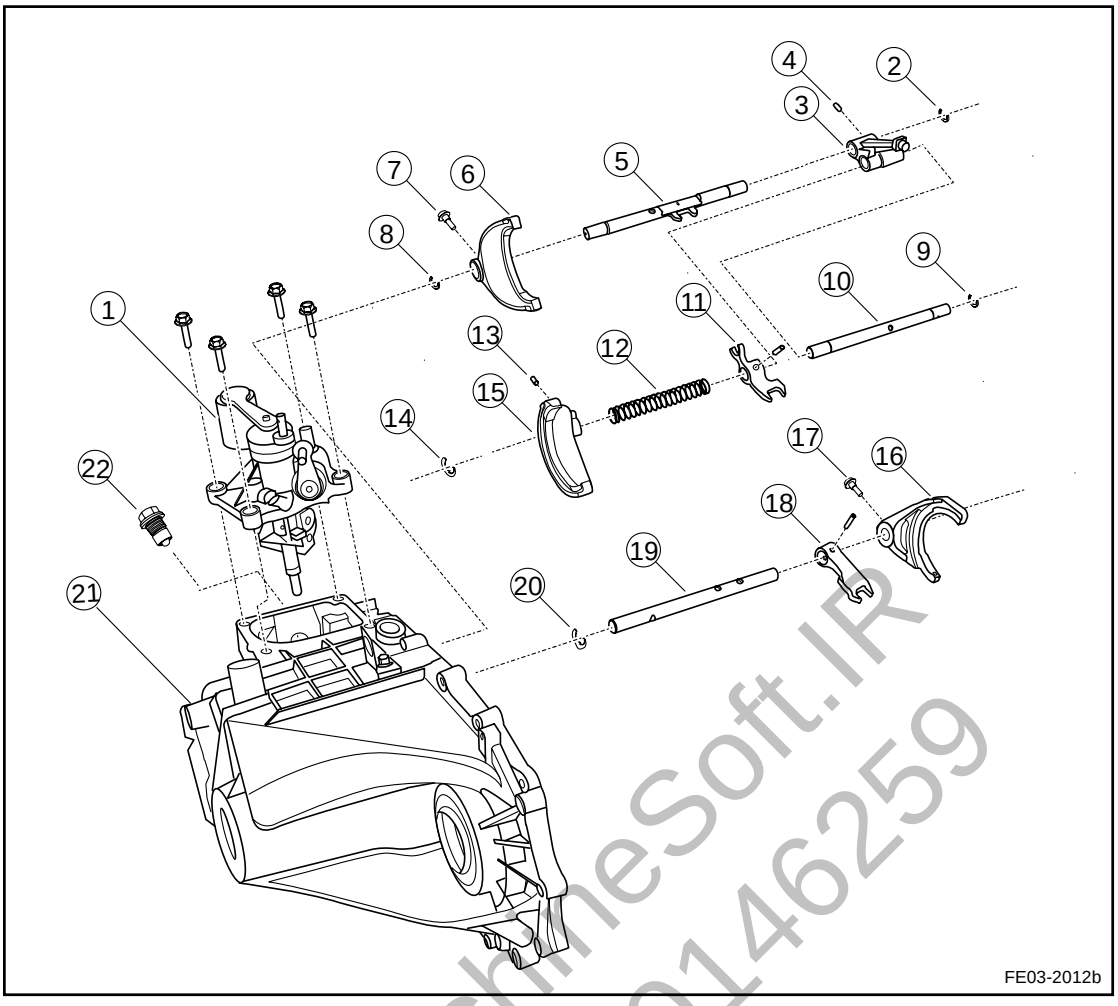
3.4.5.2 Disassembly drawing of control mechanism and fork module



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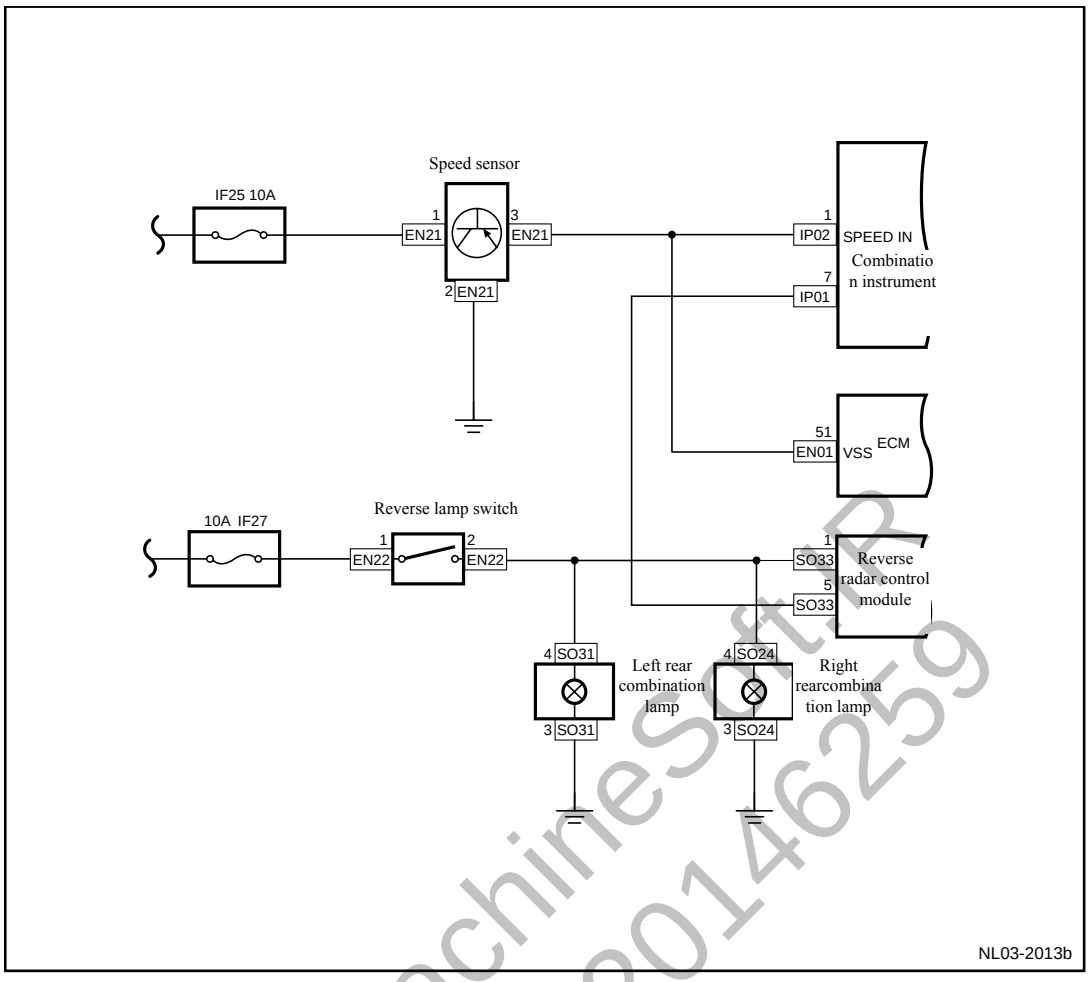
1. Gear shift mechanism
2. 3rd/4th speed fork shaft front end snap spring
3. 3rd/4th speed and mounting sleeve of 5th reverse
4. Interlock pin
5. 3rd/4th speed fork shaft
6. 3rd/4th speed fork
7. 3rd/4th speed fork fixing screw rod
8. 3rd/4th speed fork shaft rear-end\snap spring
9. 5th reverse gear fork shaft front end snap spring
10. 5th speed reverse fork shaft
11. 5th reverse gear mounting bushing
12. 5th speed fork spring
13. Interlock pin
14. Rear end snap spring of 5th reverse gear fork shaft
15. 5th speed fork
16. 1st/2 nd speed gear fork
17. 1st and 2nd fork fixing screw rod
18. 1st/2nd speed installing bushing
19. 1st/2nd speed fork shaft
20. 1st fork shaft rear-end\snap spring
21. Transmission rear housing
22. Self-lock bolt of shift shaft

3.4.6 Electrical schematic diagram

3.4.6.1 Reverse switch, vehicle speed sensor circuit schematic



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3.4.7 Diagnostic information and procedures

3.4.7.1 Diagnosis descriptions

Refer to 3.4.2 description and operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic procedures, more importantly, it will also help to determine whether the situation described by the customer is normal.

3.4.7.2 Visual inspection

Common malfunctions of transmission are: hard to shift, gear stuck, gear collision and grinding abnormal sound. The clutch, drive system malfunction can also cause the above faults. During maintenance, we need carefully analyze and distinguish.

Prior to repairing, carry out general inspection of the transmission and clutch:

- Check transmission, clutch pipe for oil seeping.
- Inspect the transmission oil level, transmission oil viscosity and color, and then inspect for dirt and metal debris to determine whether there have been internal components stuck, burning or broken.
- Check transmission and the surrounding components. Check for bolts and nuts loosening or falling off;
- Road test and engage gears to confirm the vehicle conditions for further diagnosis.

Before repairing the transmission abnormal sound, distinguish the clutch, drive shaft, and the engine abnormal sound, and exclude the external factors that may generate abnormal sound and noise.

Before repairing the transmission abnormal sound, identify the following items:

- Road Noise

Such as noise generated from tires, road, wheel bearings, engine and exhaust system. The noise varies due to vehicle dimension, type and body insulation materials, etc.

- Drive Shaft System Noise

As a mechanical device, drive axle system can not be without sound during the operation. There will be some sound during the operation. Confirm the abnormal noise:

1. Choose a good road surface to reduce tires friction and body vibration generated noise.
2. Drive a distance long enough to completely warm up the lubrication oil.
3. Record speed and transmission gear when the noise occurs.
4. Determine whether there is noise when driving the vehicle in the following conditions:

- Slow acceleration or sudden acceleration;
- On an even road, keep the throttle slightly open and maintain constant speed when driving;
- Transmission is put in gear and the throttle closed when cruising.

5. Stop vehicle and shut down the engine, whether there is abnormal sound.

- Bearing Noise

1. Differential Gear or Bearing Noise

Noise of bearings on differential side and the wheel bearing noise is likely to be mixed up. As the differential bearings have a pre-load force, even if the wheels leave the road, as long as the differential and drive shaft are in operation, the differential bearings noise will not be significantly reduced.

2. Wheel Bearing Noise

When the transmission is in neutral gear and the vehicle is sliding, the wheel bearing issue a continuous roar or friction sound. Since there is no wheel bearing pre-load force, when the wheels leave the ground the wheel bearing noise will be significantly reduced.

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- Bearing internal wear, deformation, indentation in bearing ring; micro-abrasive entering into the bearing and its seat ring; foreign matter entering into the bearing and the seat ring is locked; bearing and its seat ring due to wear and tear become loose; and all of these will result in noise and thus make the system unable to work.

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3.4.7.3 Hard to shift

The table below describes possible fault position s. Check each part, and replace them if necessary.

Symptoms	Suspected parts	Referance
Hard to shift	1. Clutch	3.2 Clutch system
	2. Transmission gearshift Lever	3.1 Control system
	3. Transmission shift control guy wire	3.1 Control system
	4. Transmission shift control mechanism	3.4.8 Dismantle and installation
	5. Faulty gear or synchronizer	3.4.8 Dismantle and installation

Diagnostic procedures:

1	Check the transmission shift lever operation.

A. Engine stopped.

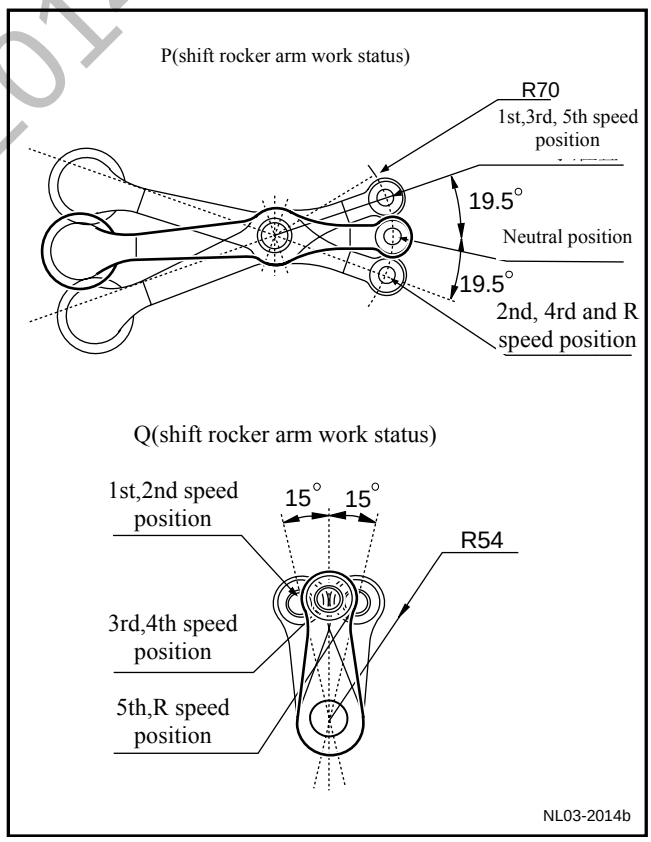
B. Shift rod hard to engage or disengage gears.

No → Go to step 6

Yes

2	Check shift control mechanism shift force and travel.

A. Operate the shift lever. Shifting force is 20~30N (4.5~6.7 LB). Transmission shift control travel should meet the range shown in the figure.



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Yes → Repair or replace worn transmission shift control mechanism or the fork

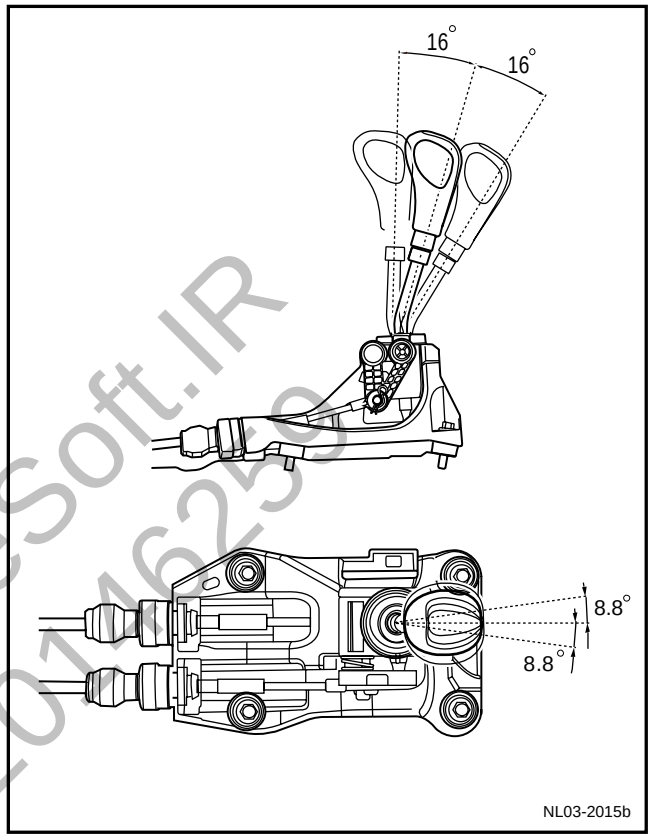
No

3	Check transmission shift lever shift force and travel

A. Disconnect transmission shift control guy cable and transmission control.

B. Operate the shift lever. check if the shift control cable can stretch freely and easily.

C. Transmission shift lever selectional force is <8 N (1.8 LB), shifting force is<4 N (0.9 LB). Transmission shift control travel should meet the range shown in the figure.



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Yes → Adjust or replace shift control cable; Overhaul or replace clamping stagnation transmission shift control mechanism or fork mechanism

No

4	Inspect transmission shift control cable movement.

A. Disconnect the transmission shift lever and the transmission control guy cable.

B. Check if the transmission control guy cable is difficult to stretch or broken.

Yes → Replace the transmission shift control cable.

No

5	Replace Transmission shift lever

A. Whether tranmission shifting problem is resolved.

Yes → The system is normal.

No

6	Inspect the clutch

A. With the engine running, transmission is placed in neutral gear.

B. Step on the clutch pedal to the end, check if the lever can easily engage or disengage the reverse gear.

No → Check clutch,
Check replace reverse

Yes

7	Check fault position

A. Step on the clutch pedal to the end. Try each forward gear to identify the faulty gear.

B. Disassemble the transmission. Check if the faulty gear synchronizers or gears are damaged.

C. Replace the fault of all the synchronizer or the gear.

D. Make sure that the repair work is finished.

Next

8	The system is normal.

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3.4.7.4 Out of gear

The table below describes possible fault position s. check each part, and replace them if necessary.

Symptoms	Suspected parts	Referance
Out of gear	1. Engine support	Engine support replacement
	2. Transmission gearshift Lever	3.1 control system
	3. Transmission shift control guy wire	3.1 control system
	4. Transmission shift control mechanism	3.4.8 Dismantle and installation
	5. Gearshift fork and lock mechanism	3.4.8 Dismantle and installation

Diagnostic procedures:

1	Check the transmission and the engine mount

A. When engine is running, whether there is serious jitter.

B. Serious jitter will cause the engine stall.

Yes → Tighten or replace the transmission and engine support.

No

2	Check Transmission shift control system.

A. Whether the connection between transmission shift control guy cable and the transmission shift control mechanism is firm.

B. Whether the connection between the shift lever and the transmission control guy cable is firm.

No → Tighten or replace transmission shift control cable or transmission shift control rod.

Yes

3	Check transmission gear self-locking nut

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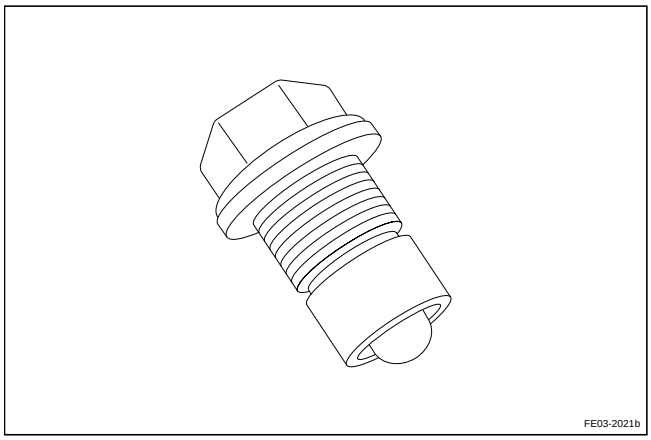
A. Whether the gear self-locking nut is installed correctly.



No → Tighten or replace the gear

No

4	Replace the shift control mechanism.

,A. Dismantle the transmission shift control mechanism to inspect for wear and tear or deformation.

Yes → Replace the shift control mechanism of transmission

No

5	Inspect the faulty gear fork locking pin.

A. Dismantle the transmission.

B. Disassemble the transmission. check the shift fork for deformation.

C. Replace the damaged shift fork.

D. Make sure that the repair work is finished.

Next

6	The system is normal.

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3.4.7.5 Hard to Disengage

The table below describes possible fault position s. Inspect each part, and replace them if necessary.

Symptoms	Suspected parts	Referance
Out of gear	1. Transmission gearshift Lever	3.1 control system
	2. Transmission shift control guy wire	3.1 control system
	3. Transmission shift control mechanism	3.4.8 Dismantle and installation
	4. Gearshift fork and lock mechanism	3.4.8 Dismantle and installation
	5. Synchronizer	3.4.8 Dismantle and installation

Diagnostic procedures:

1	Check transmission shift control system.

A. Disconnect transmission shift control guy cable and transmission control.

B. Check the shift lever for catching. The normal gear selection force is <8N (1.8LB), engaging a gear force is <4N (0.9LB).

C. Check the transmission shift control for damage and blocking.

Yes → Repair or replace the shift lever or shift control cable

No

2	Replace the shift control mechanism.

A. Engage transmission shift control mechanism lever and disengage gears.

B. Check the transmission shift control mechanism for blocking.

C. repaired or replace shift fork or damaged synchronizer

D. Make sure that the repair work is finished.

Next

3	The system is normal.

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3.4.7.6 Abnormal sound when running

Diagnostic procedures:

1	Inspect for abnormal sound

A. Stop the vehicle, shut down the engine, and place transmission in neutral gear.

B. Check if the abnormal sound stops.

Yes → Go to step 4

No

2	Check abnormal sound on the side of clutch

A. Step on the clutch to the end.

B. Check if the abnormal sound stops.

Yes → Diagnose abnormal sound in clutch system; Diagnose abnormal sound of the engine

Yes

3	Check transmission interior

A. Dismantle and disassemble the transmission.

B. Check for gear group bearing, input shaft gears, each gears/bearings, main shaft bearings damage.

C. Replace the faulty transmission components.

D. Confirm whether the system is normal.

Yes → The system is normal.

No

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4	Check drive shaft system and front suspension.

A. Place transmission in neutral gear and release the hand brake.

B. Lift vehicle.

C. Rotate the wheels. Check if there is abnormal sound in the drive half axle and drive half axle bearings.

Note: The vehicle is lifted at this time. The noise may disappear because the front suspension, drive axle and its bearings load decrease. Check if the abnormal sound appears only when the axle and the front suspension are under load.

D. Replace the damaged drive half axle or drive half axle bearings.

E. Confirm repairing was completed

Next

5	The system is normal.

3.4.7.7 Engage in gear when driving, there is gear collision or grinding sound.

Dismantle the transmission. Inspect and replace the faulty gear, synchronizer or the bearing.

3.4.7.8 engage in gear when driving, there is A dull metal sound.

(Check clutch and confirm there is no fault. Refer to 3-2 Clutch system. Dismantle Transmission assembly. Check and replace the gear synchronizer that makes noise.

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3.4.8 Dismantle and installation

3.4.8.1 Transmission oil level inspection

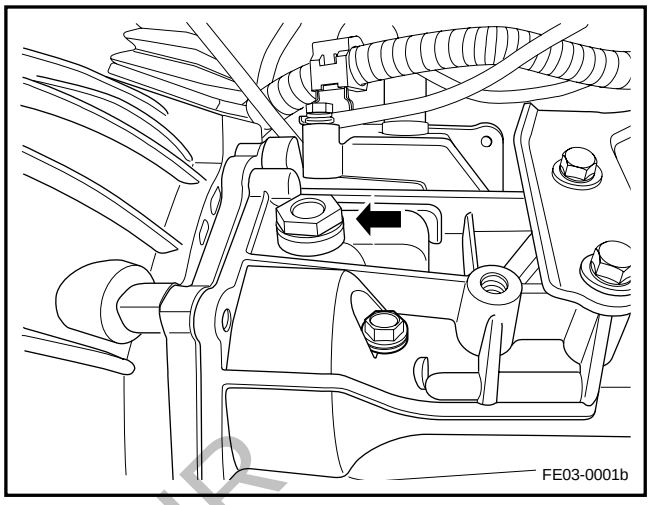
Inspection procedure:

Note: Inspecting the transmission fluid when the transmission fluid temperature is too high, it may cause burns.

1. Park the vehicle on a level ground,wait for the transmission fluid cooling down, Dismantle the transmission fill plug and check the transmission fluid level.

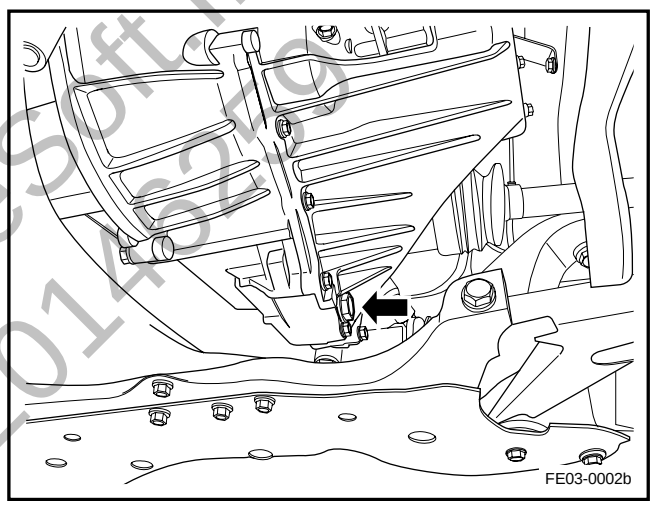
Note: Transmission fluid level should be even with the lower edge of plug.

2. If the transmission fluid level is too low, add the dedicated Manual transmission fluid through the plug to until the fluid begins to flow out.



3. Reinstall and tighten transmission drain bolt.

4. If needed, replace the transmission fluid. Dismantle the transmission drain bolt, and drain the transmission fluid.



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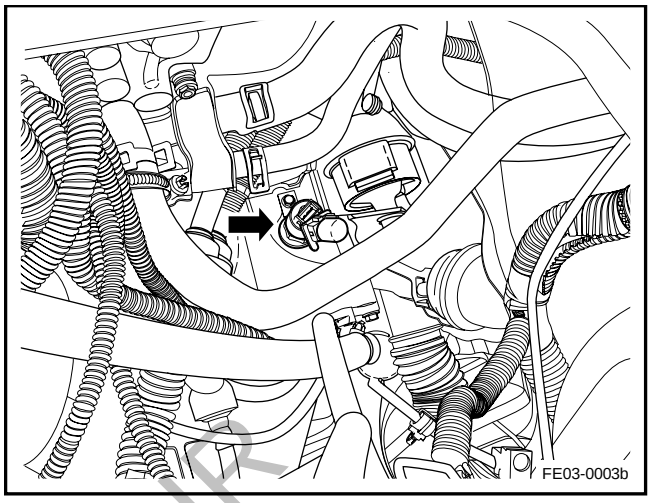
3.4.8.2 Vehicle speed sensor replacement

Warning: Refer to warning for battery disconnection in the warning and precaution .

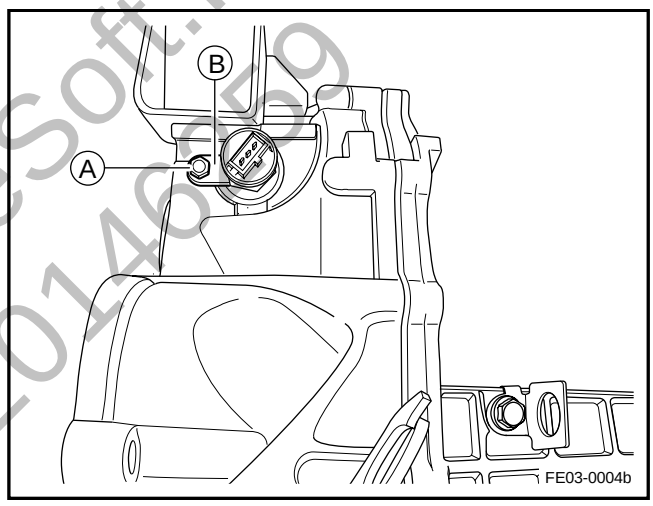
Dismantle procedure

1. Disconnect the vehicle speed sensor harness connector.

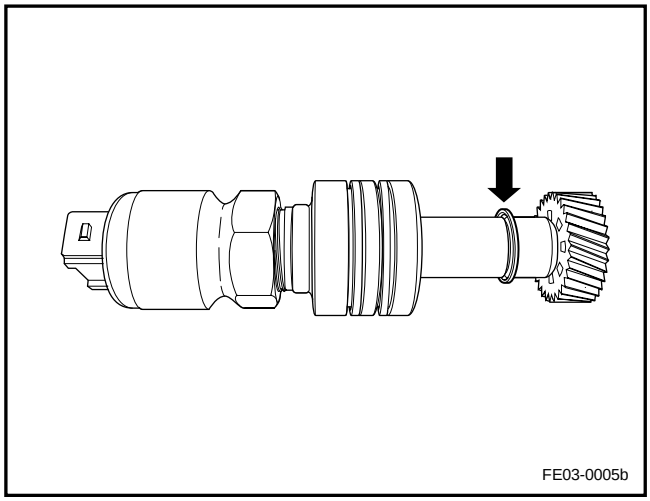


2. Dismantle speed sensor fixing bolt A.

Notes : Clip plate B is active as shown in the figure !



3. Dismantle the circlip as shown in the figure, disassemble the vehicle speed sensor driven gear.



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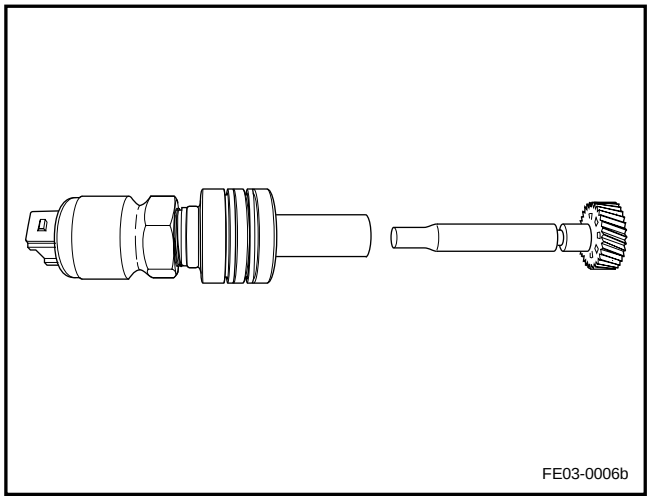
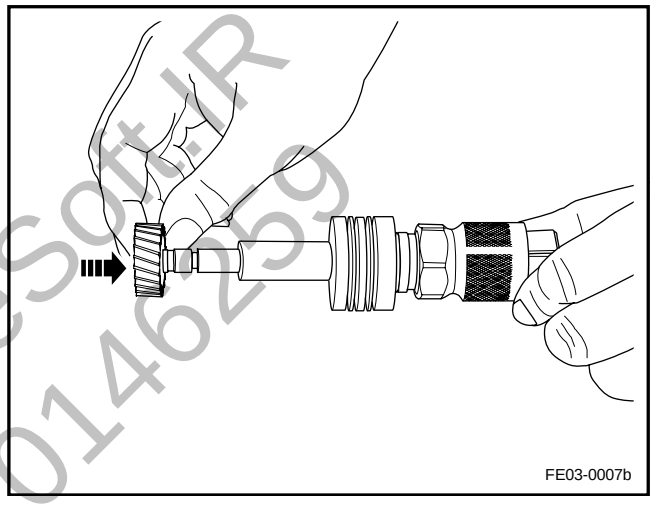
4. Disassembled speed sensor.

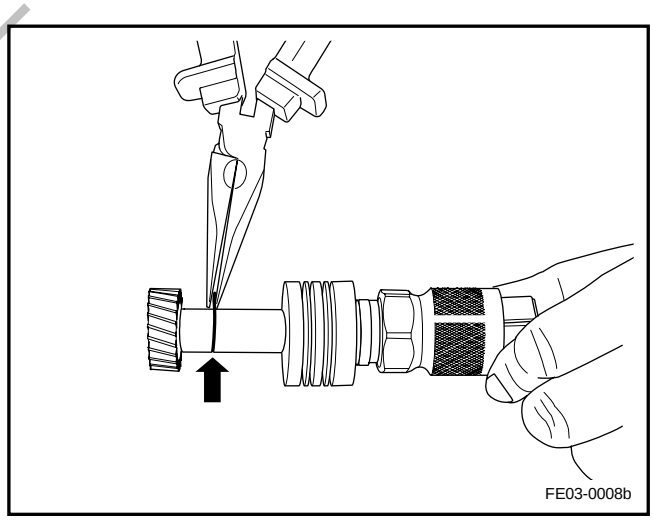


Installation procedure::

1. Install driven gear of speed sensor,



2. Install the driven gear clamp spring.



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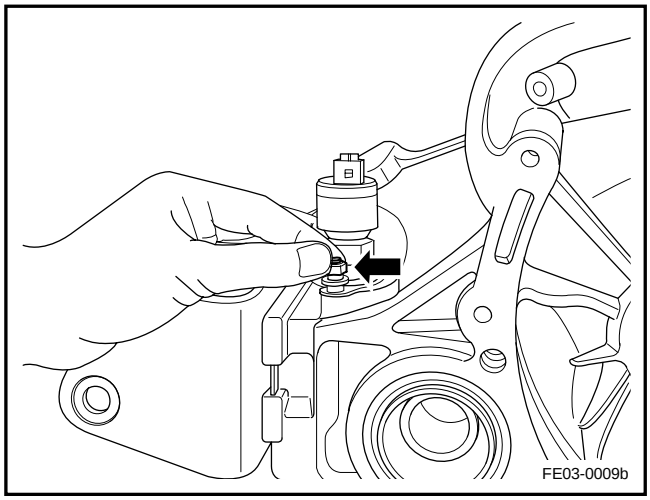
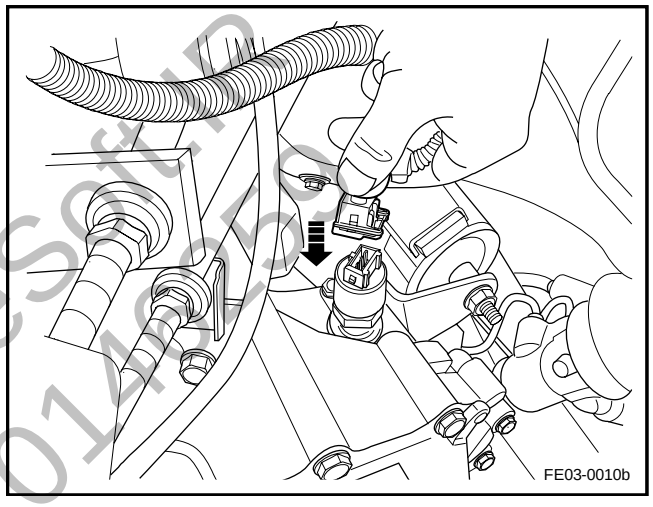
3. Install the vehicle speed sensor and tighten the bolt, pay attention to the position of the washer.



4. Connect the vehicle speed sensor harness connector, as shown in the figure.



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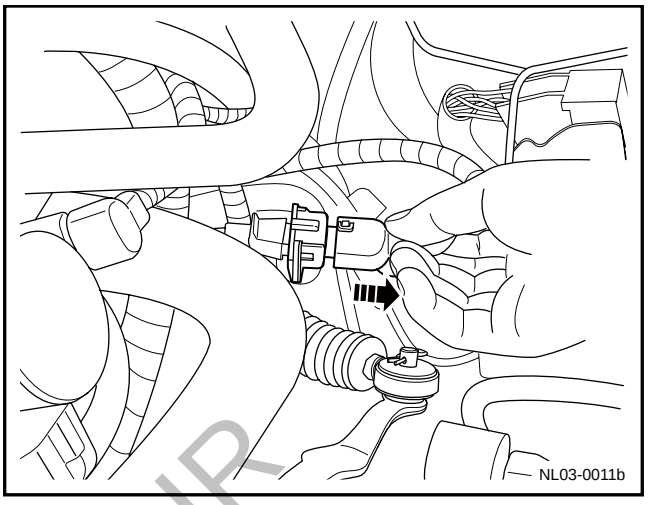
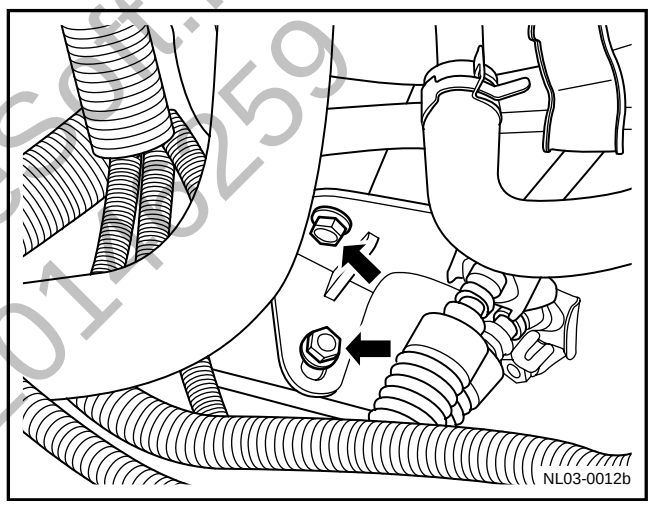
3.4.8.3 Transmission replacement

Dismantle procedure

Warning: refer to warning for lifting vehicle in warnings and precautions.

1. Dismantle battery negative cable , refer to 2.11.8.1 disconnect connecting process of battery cable
2. Dismantle battery,refer to2.11.8.2 battery replacement.
3. Dismantle base seat of air filter.
4. Disconnect reverse door lamp switch harness connector.
5. Disconnect the vehicle speed sensor harness connector.
6. Disconnect the crankshaft position sensor harness connector.
7. Dismantle shift control lever cable plug, refer to 3.3.8.4 shift control mechanism assembly replacement.
8. Dismantle the shift lever bracket;





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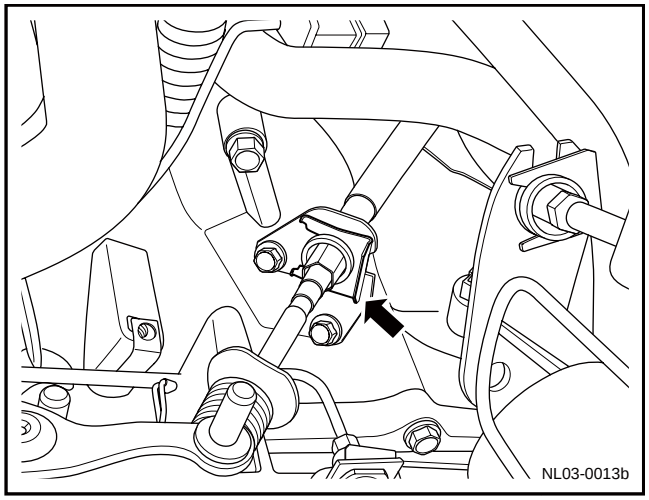
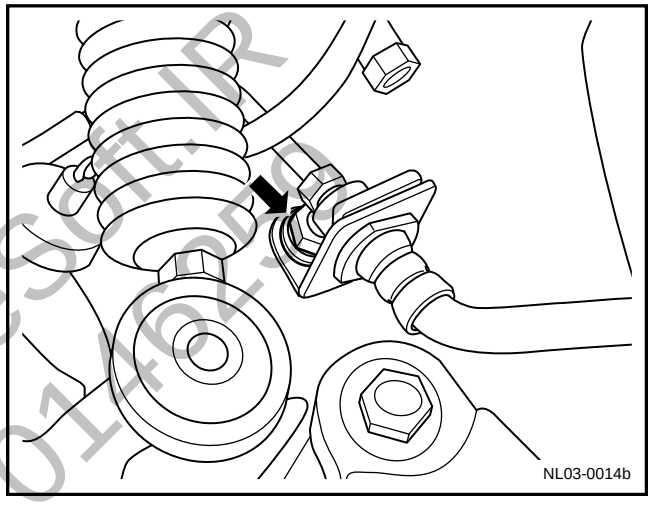
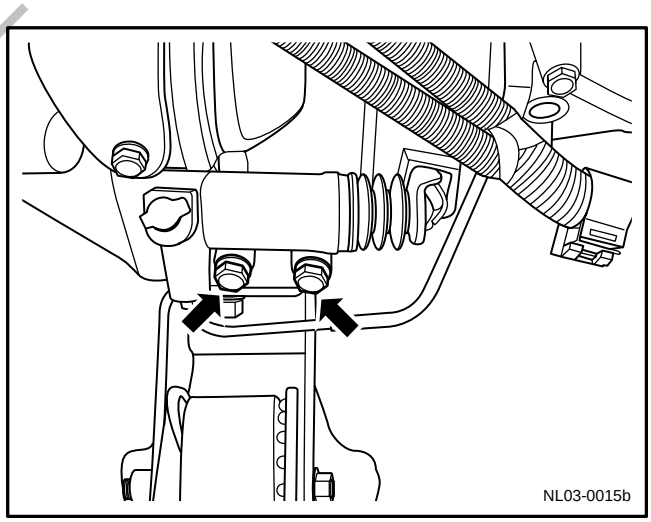
9. Dismantle the shift lever fixing pin.



10. Dismantle fixing support of clutch slave pump oil pipe



11. Dismantle fixing bolts of clutch slave pump .
12. Dismantle starter cable and upper fixing bolt. refer to2.11.8.4 motor replacement.



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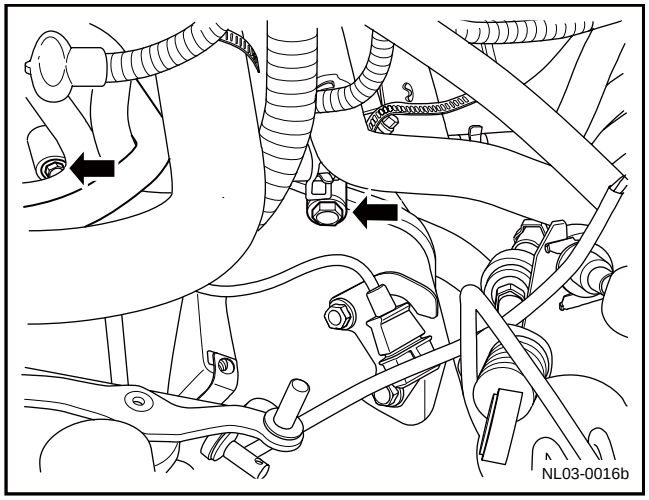
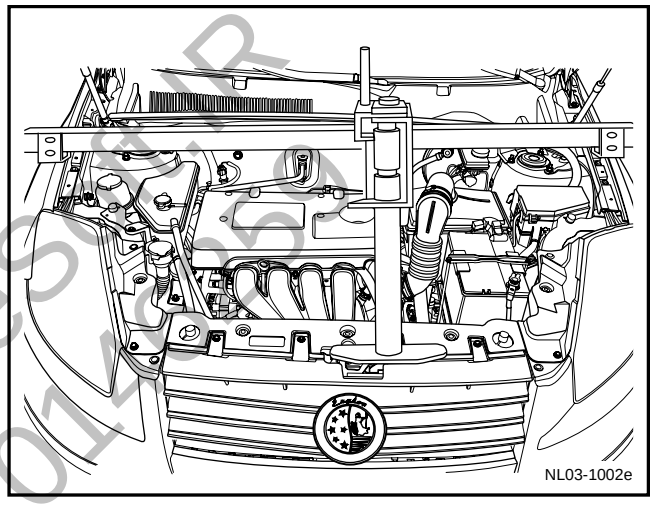
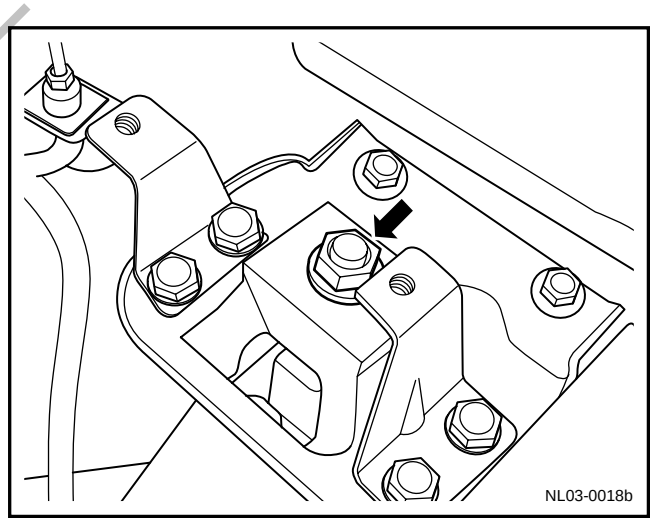
13. Dismantle the transmission upper connecting bolts;



14. Use an engine hoisting tool to fasten the engine.



15. Dismantle transmission left bracket assembly.
16. Dismantle two front wheels.
17 Lifting vehicle
18. Dismantle the transmission oil drain plug until all the transmission oil is drained and reinstall. Refer to 3.3.8.1 transmission oil level inspection.



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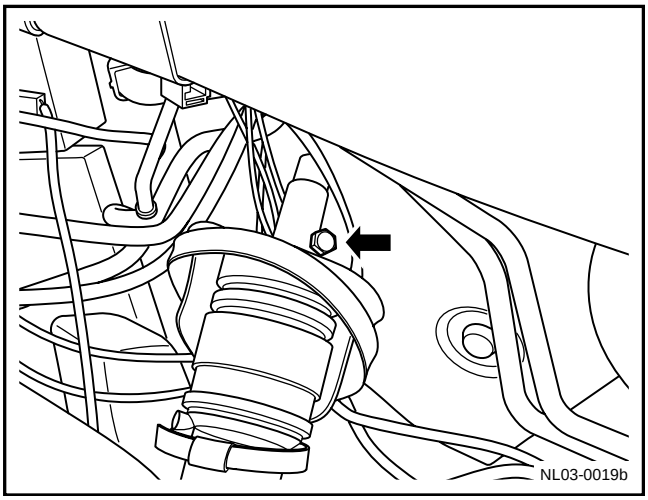
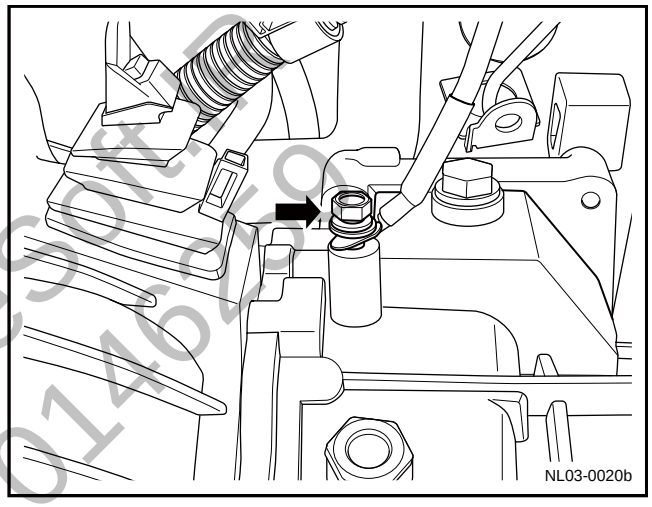
19. Dismantle the steering cross pin bolt

20. Dismantle front suspension Longitudinal beam.from subframe and related connecting part refer to 12.6.4.3 front suspension longitudinal beam replacement and 12.6.4.4 front sub-frame replacement.

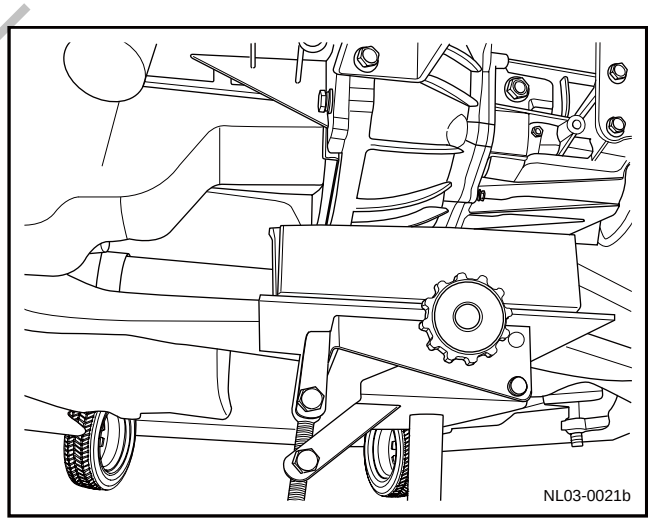
21. Dismantle left and right drive shaft, refer to 5.3.4.2 replacement of drive shaft.



22. Dismantle transmission housing grounding cable.



23. Use a jack to support the transmission;



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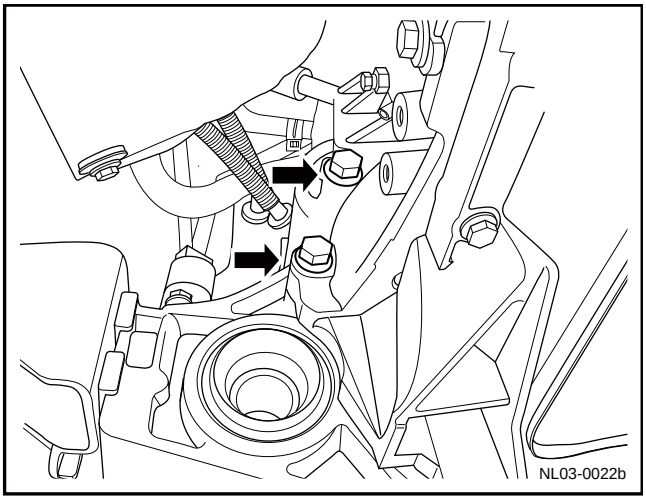
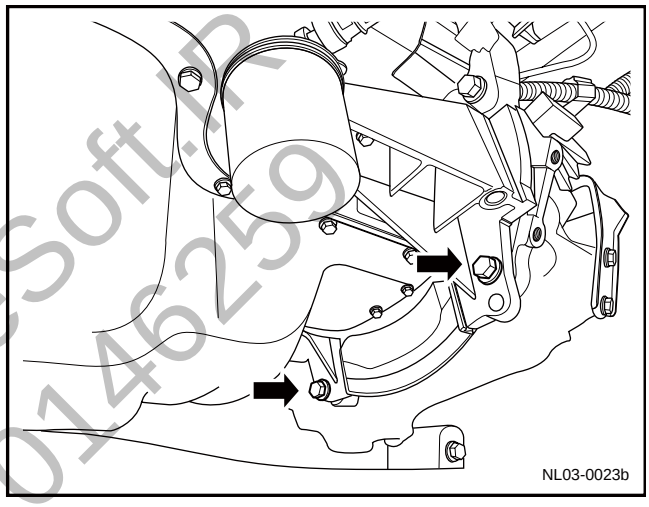
24. Dismantle the rear connecting bolt of transmission ;



25. Dismantle the lower connecting bolt of transmission ;
26. Dismantle the transmission assembly.



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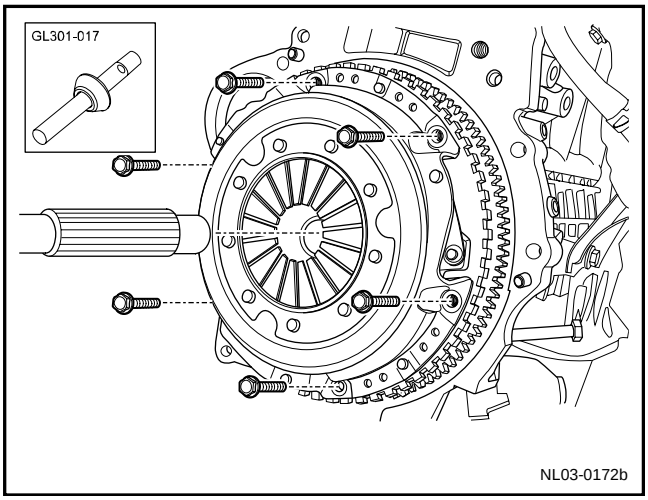
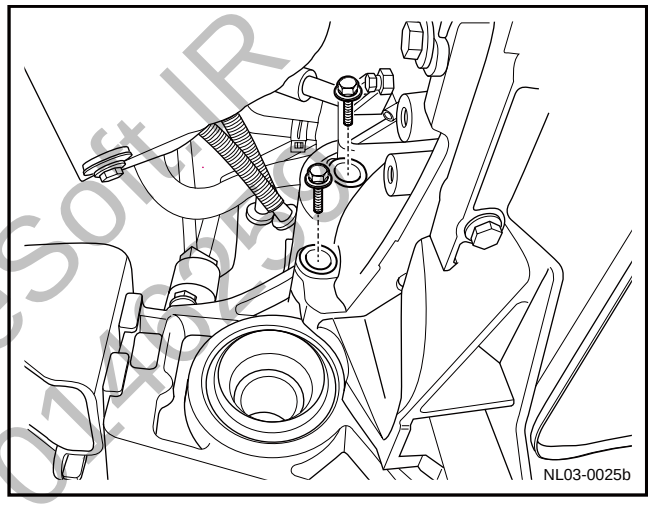
Installation procedure::

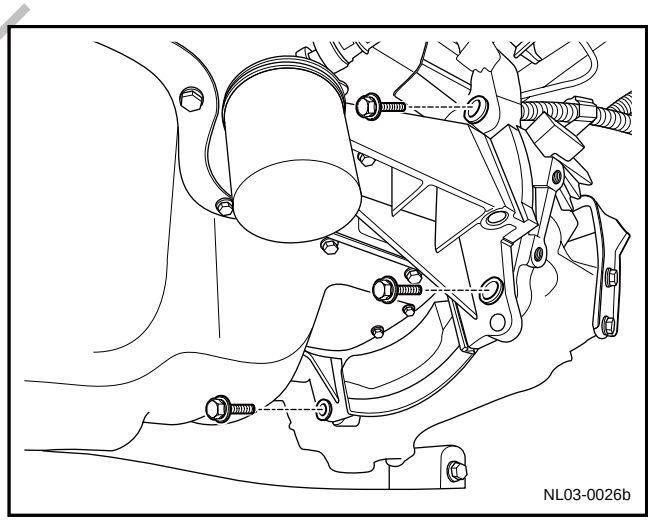
1. Use a flat-panel jack to support the transmission assembly.
2. Insert the transmission input shaft into the clutch plates. Push the transmission to the engine end, pay attention to position of locating pin.



3. Install the rear connecting bolt of transmission ;



4. Install transmission lower connecting bolt and start motor lower fixing bolt.



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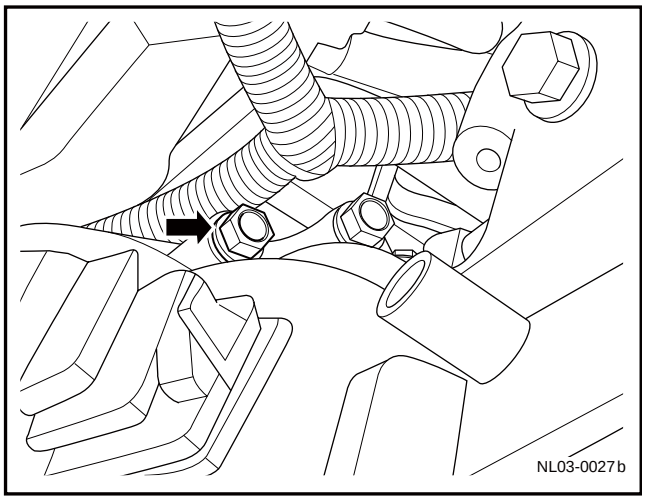
5. Install start fixing bolt and cable on the start motor

6. Dismantle the flat-panel jack;



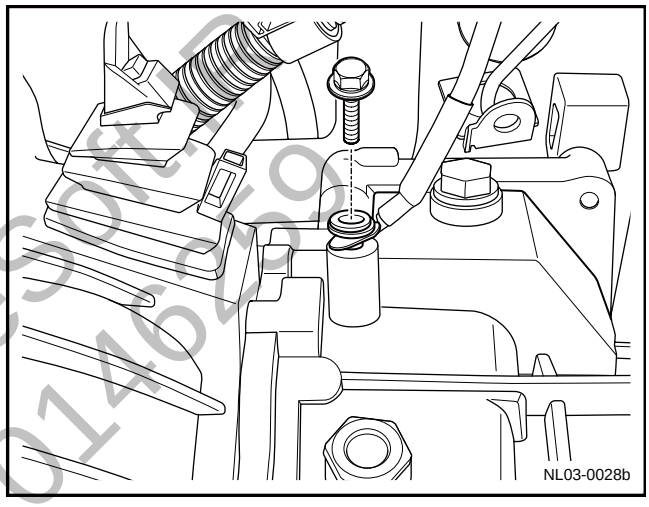
7. Install transmission housing grounding cable.

8. Install the left and right drive shafts.

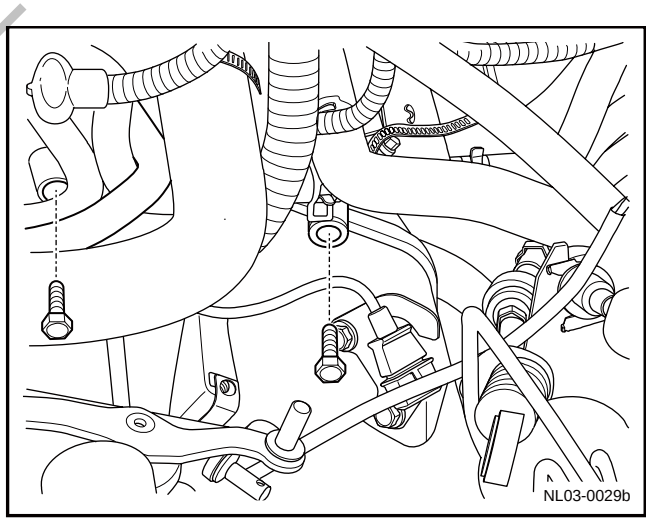
9. Install front suspension longitudinal beam.front subframe and related connecting part.

10. Install the front wheel tire.

11. Dismantle engine hoisting tool.



12. Install the transmission upper connecting bolts;



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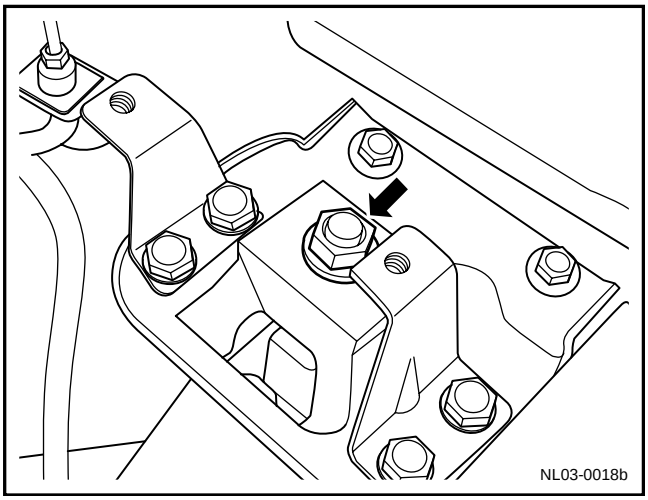
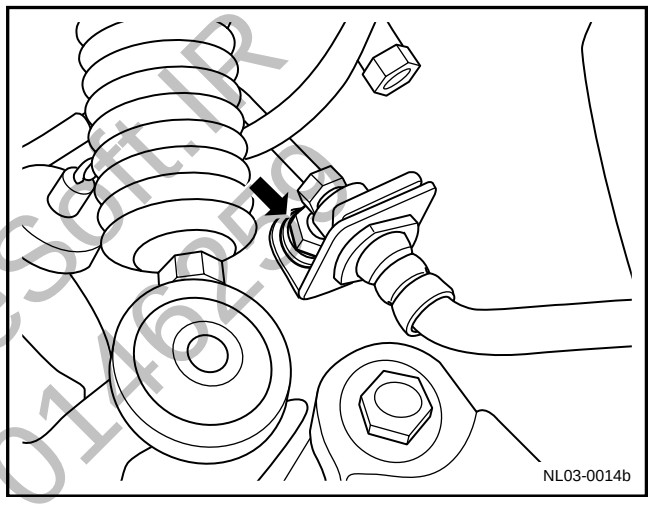
13. Install the transmission left bracket assembly.



14. install and tighten fixing support of clutch slave pump
15. Install the clutch slave pump and exhaust the air.
16. Install the shift control mechanism.
17. Install crankshaft position sensor harness connector.
18. Install speed sensor harness connector.
19. Install reverse door lamp switch harness connector.
20. Install the battery base plate.
21. Connect the battery negative cable.



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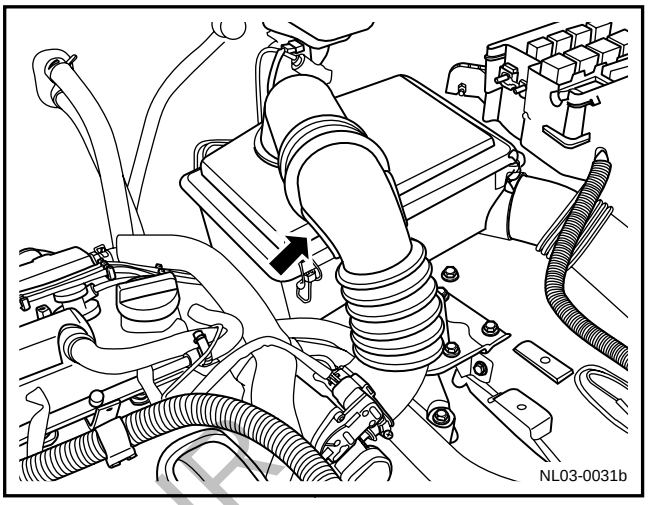
3.4.8.4 Shift control mechanism assembly replacement

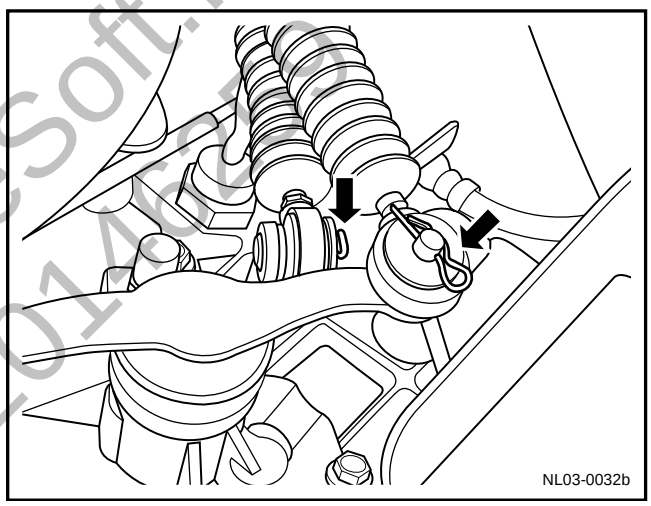
Dismantle procedure

Warning: refer to warning for battery disconnection in warnings and precautions.

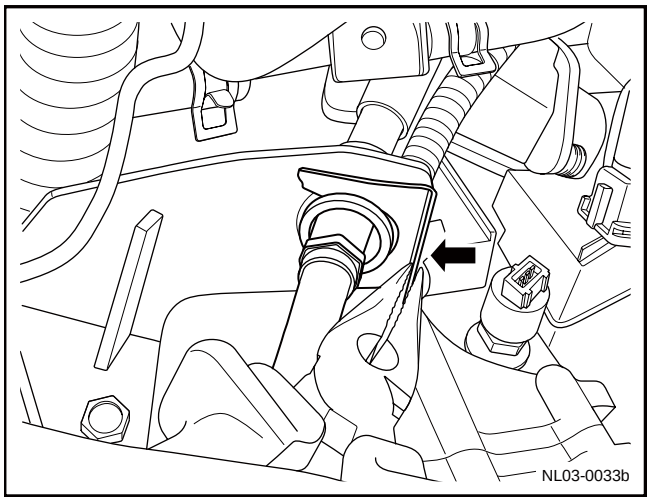
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle air filter.



3. Dismantle shift lever and selecting rod cable plug.



4. Dismantle fixing clip plate of shift lever cable position .take out shift control lever cable.



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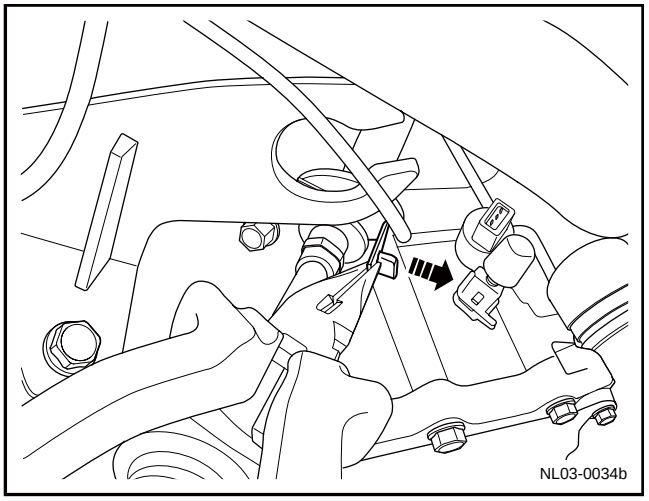
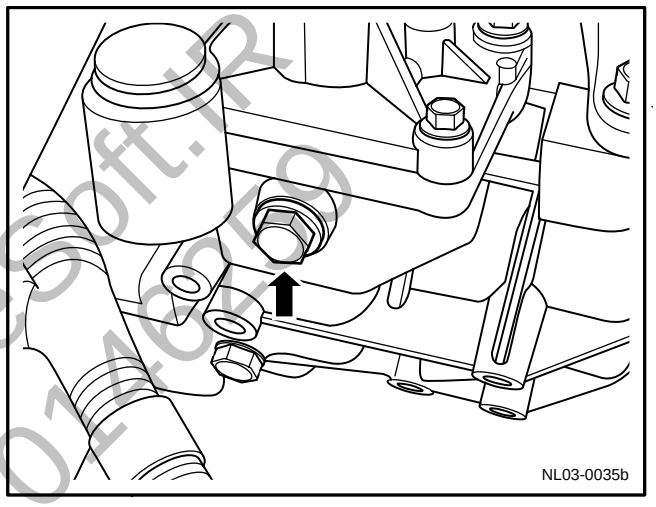
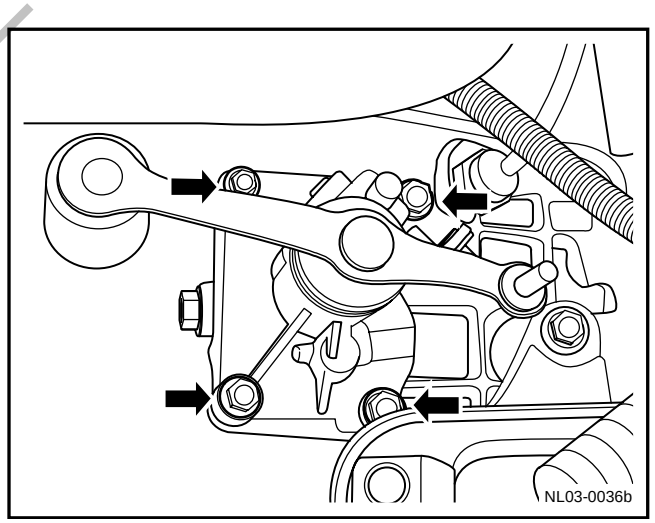
5. Dismantle fixing clip plate of selecting lever cable, take out selecting control lever cable.



6. Dismantle self-lock bolt of shift shaft as shown in figure



7. Dismantle 4 bolts as shown in the figure.



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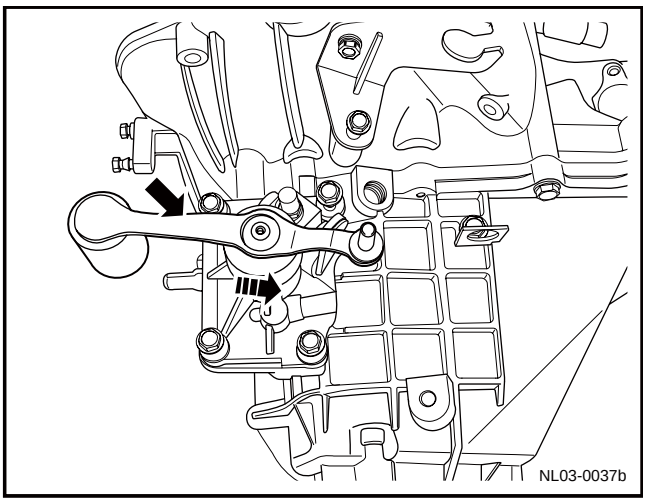
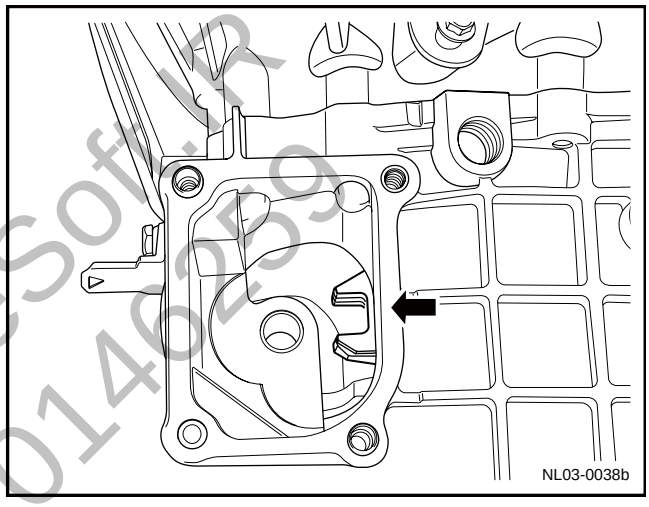
8. Take out shift control mechanism assembly.

Notes : Gears must be is in the netural position as shown in figure, otherwise .control mechanism can not be took out, pay attention to make sure return spring is in free status in the transmission at moment time, otherwise , it easily dropped in the transmission

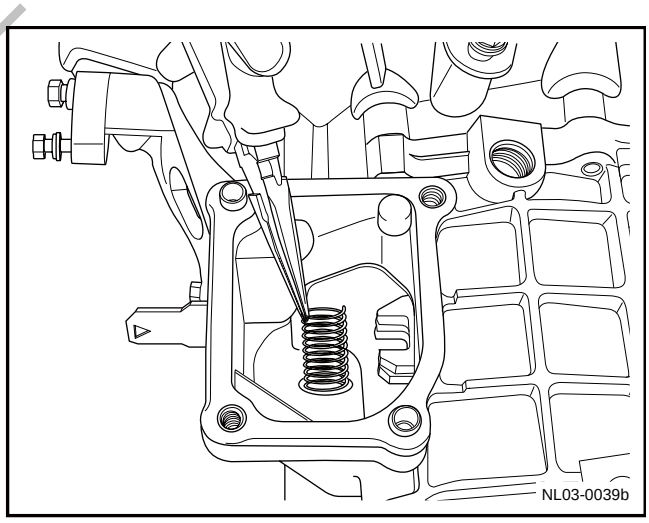


Installation procedure::

1. Confirm shift fork is in the neutral position in the transmission as shown in figure



2. Install return spring on the fixing hole.and confirm whether it is installed in the correct position.



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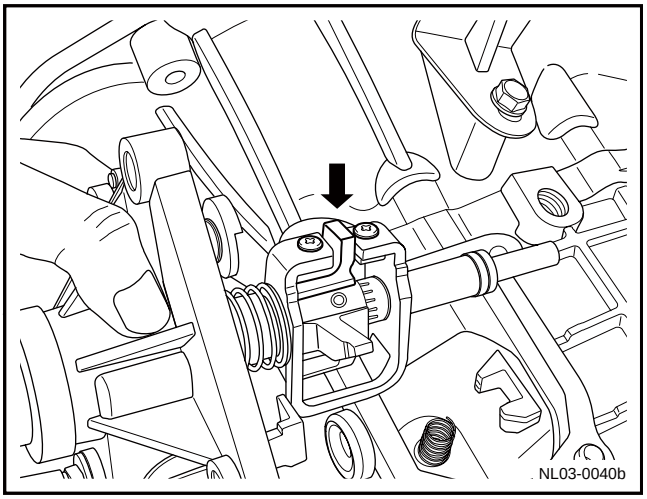
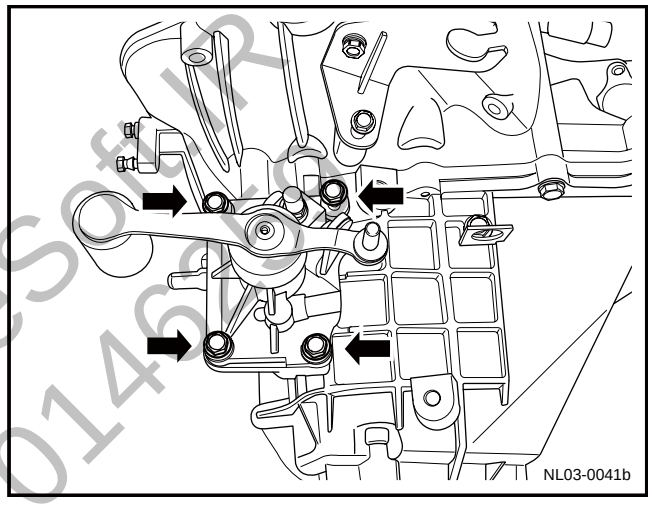
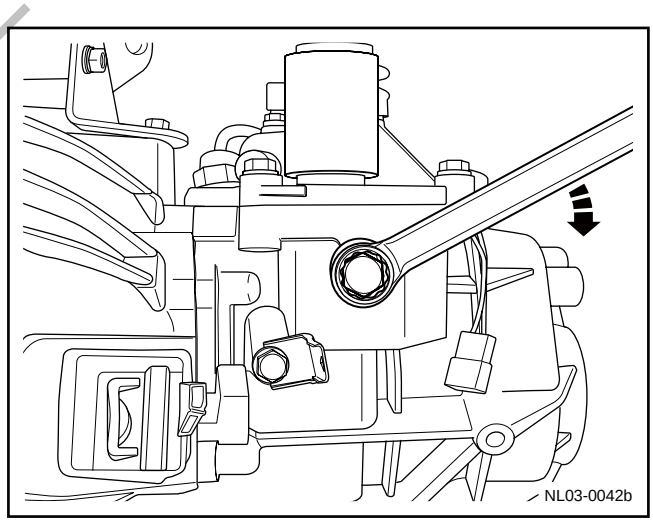
3. First confirm of control sliding block position shift control mechanism assembly is in the level position before installed



4. Before install shift control mechanism assembly.Coat sealant on the joint surface. And then install shift control mechanism assembly and tighten foot fixing bolts.



5. Install and tighten self-lock bolt of shift shaft.



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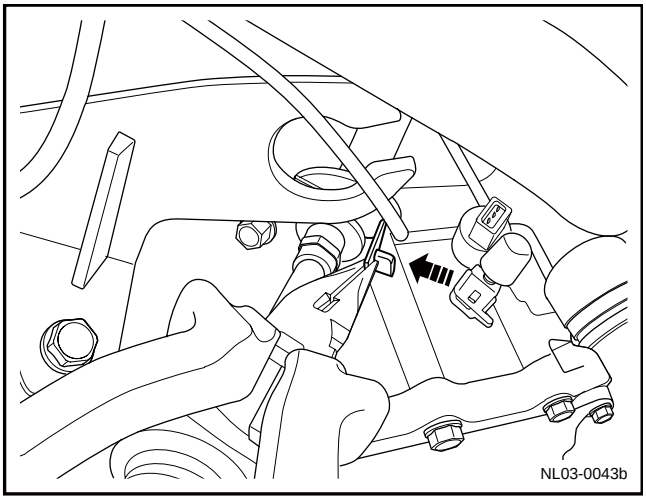
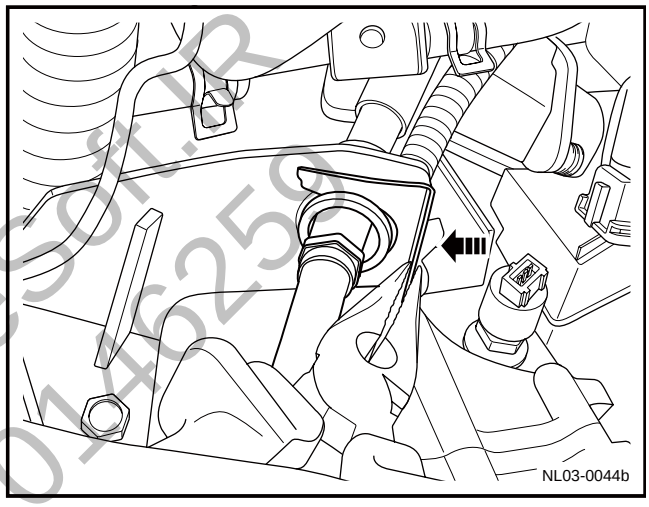
6. Install fixing clip plate of selecting lever cable position



7. Install fixing clip plate of shift lever cable position
8. Install shift lever selecting rod control rod cable plug
9. Install air filter.
10. Install the battery.



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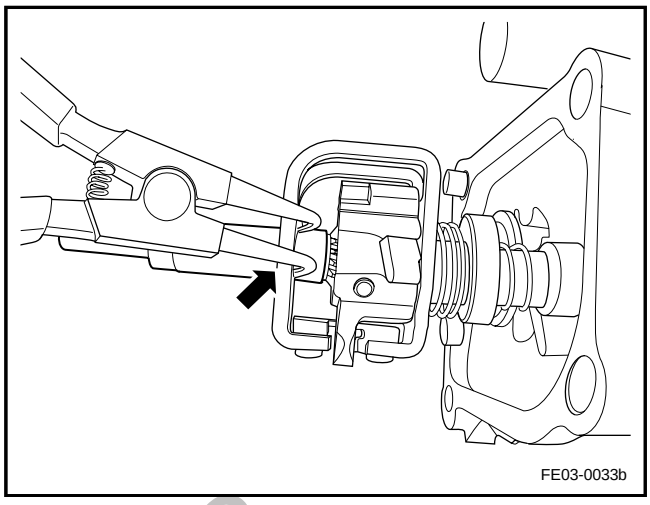
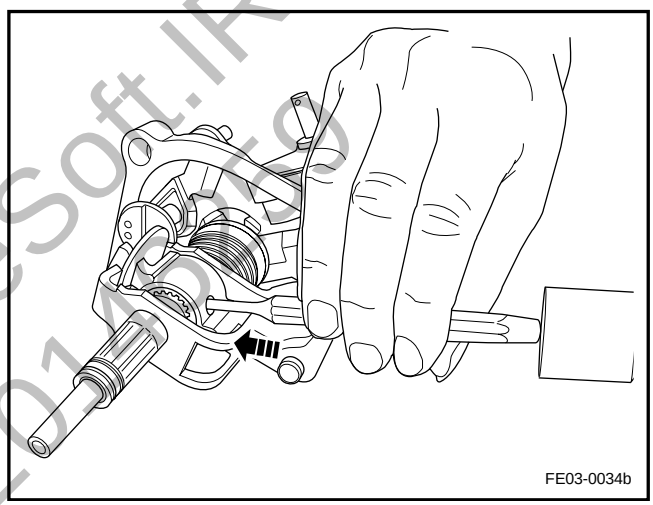
3.4.8.5 Disassembly and assembly of shift control mechanism

Dismantle procedure

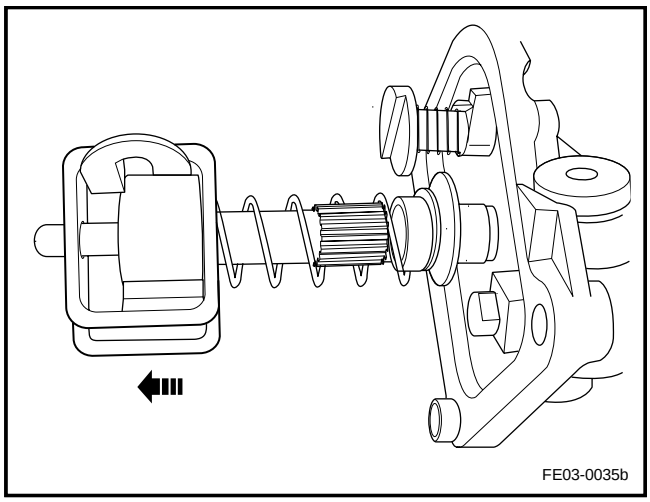
1. Dismantle shift control mechanism assembly, Refer to“3.4.8.4 shift control mechanism replacement”.
2. Dismantle outer snap spring on the shift control mechanism by snap soring pillar



3. Dismantle lock pin of shift control mechanism.



4. Take out shift lever sliding sleeve.



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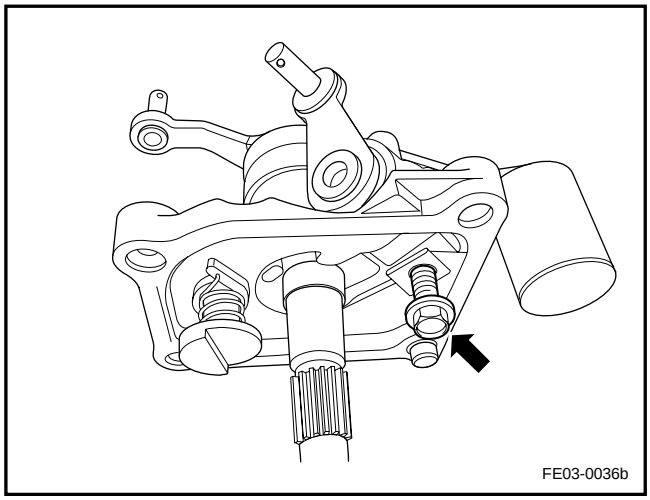
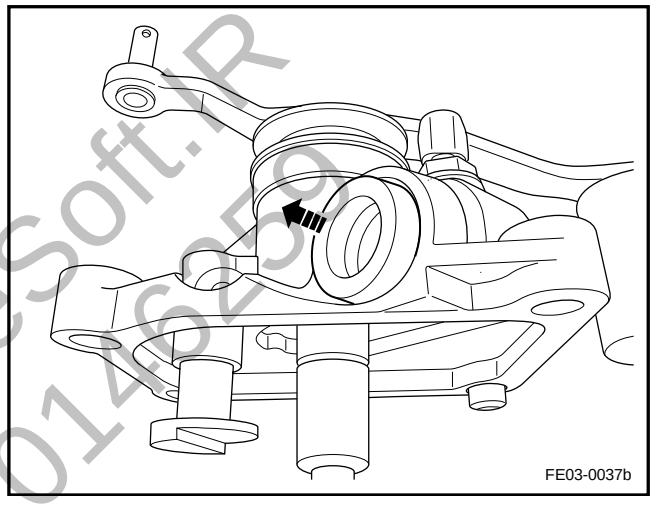
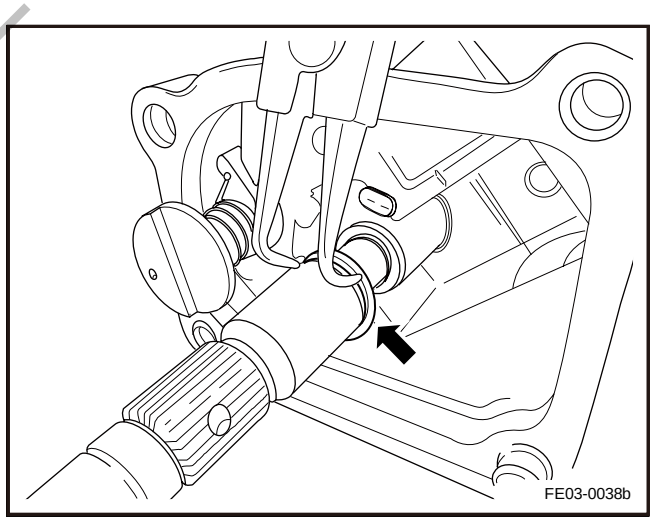
5. Dismantle selecting control arm fastening bolt



6. Dismantle control arm oil seal of selecting rod as shown in figure



7. Take out snap spring in the shift lever control arm by snap spring pillar.



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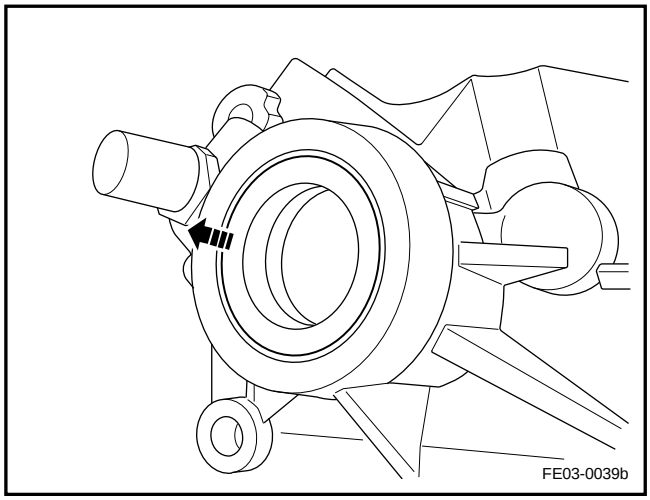
8. Dismantle shift lever control arm oil seal.completed shift control mechanism disassembly.

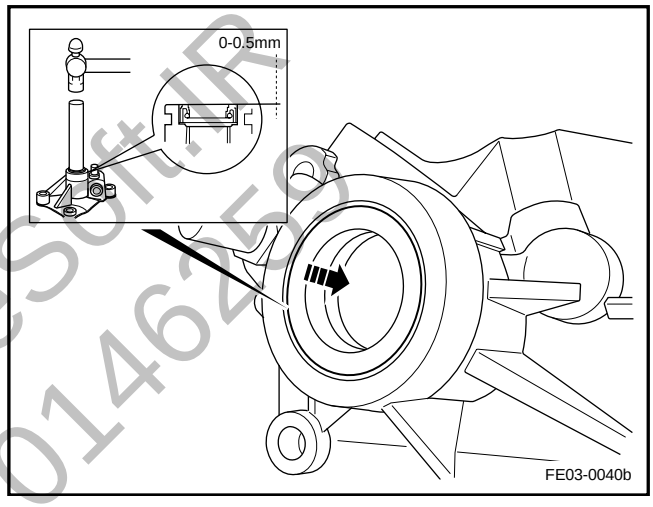


Installation procedure::

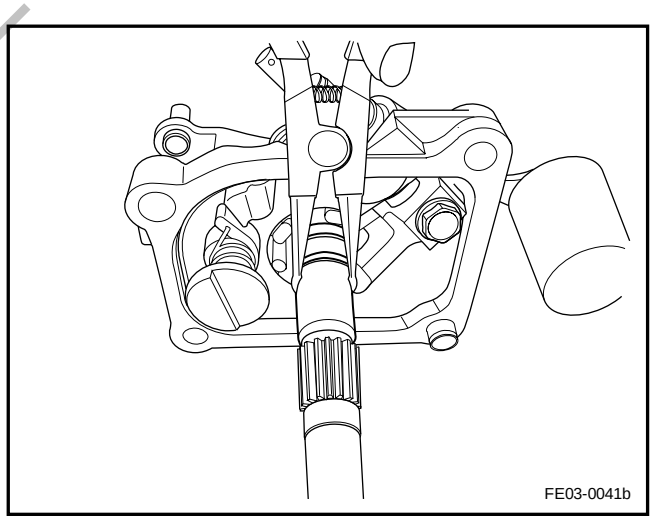
1. Install control trailing arm oil seal of shift lever

Notes : Distance from oil seal end to oil seal hole is 0～0,5mm(0～19,685 in×10^{-3}),

2. Install shift lever control lever .



3. Install inner snap spring .



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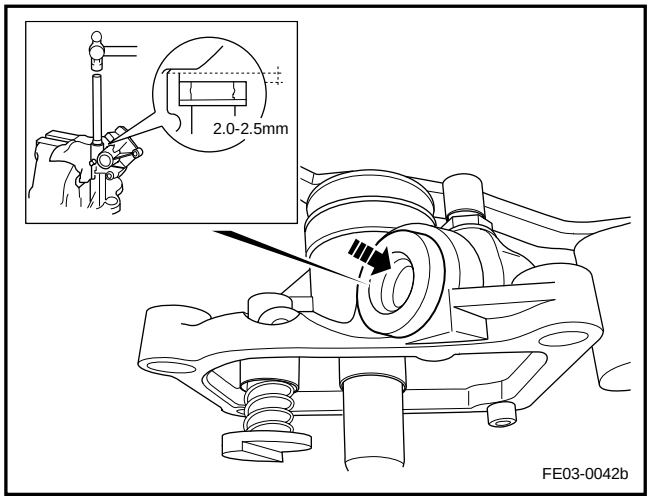
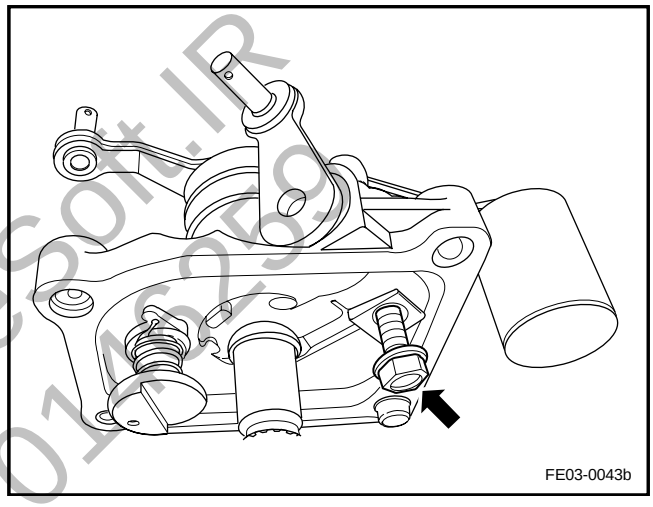
4. Install control level oil seal of selecting rod.

Distance from oil seal end to oil seal hole is 2.0～2.5mm(78.740～98.425 in×10^{-3})。

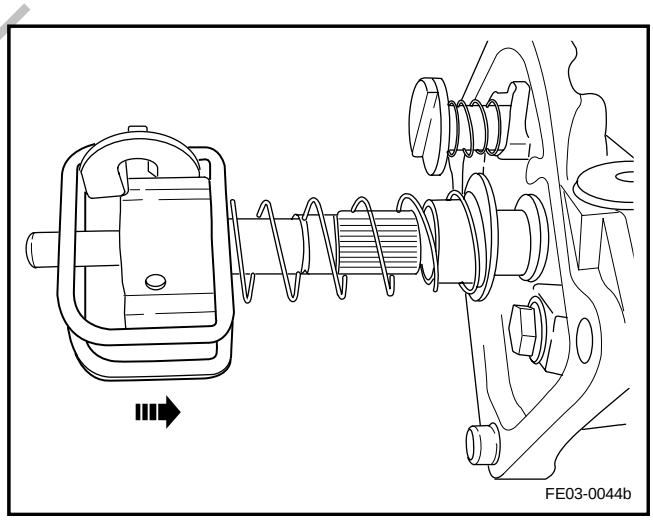


5. Mount control arm of selecting lever, and tighten bolt.

Notes:do not damaged seal lip



6. Install shift lever sliding sleeve .



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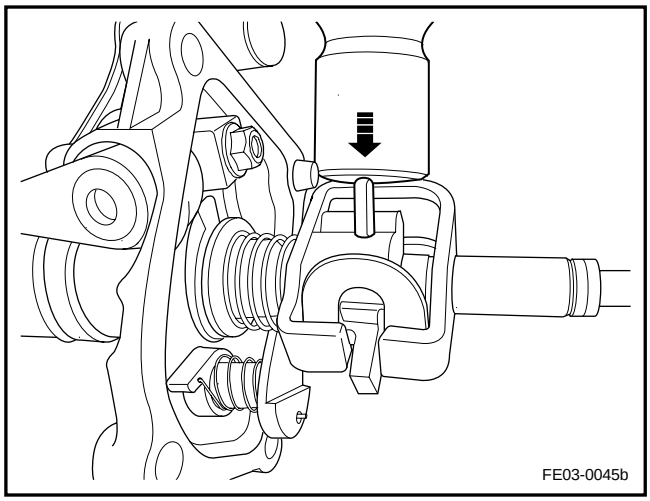
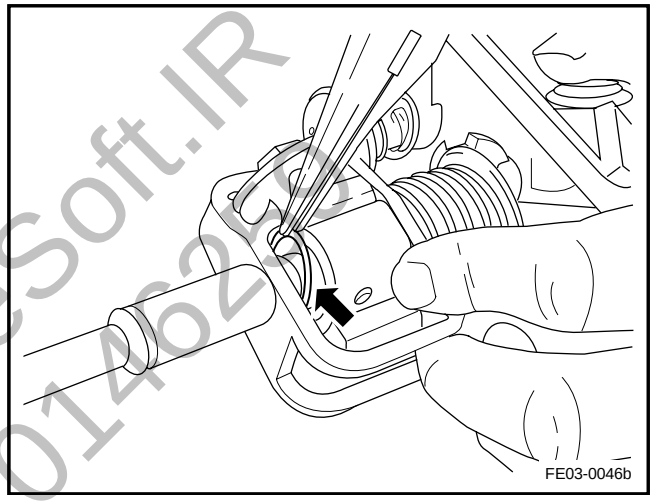
7. Install sliding sleeve locking pin.



8. Install outer snap spring.
9. Install shift control mechanism assembly.Refer to“3.4.8.4 shift control mechanism replacement”.



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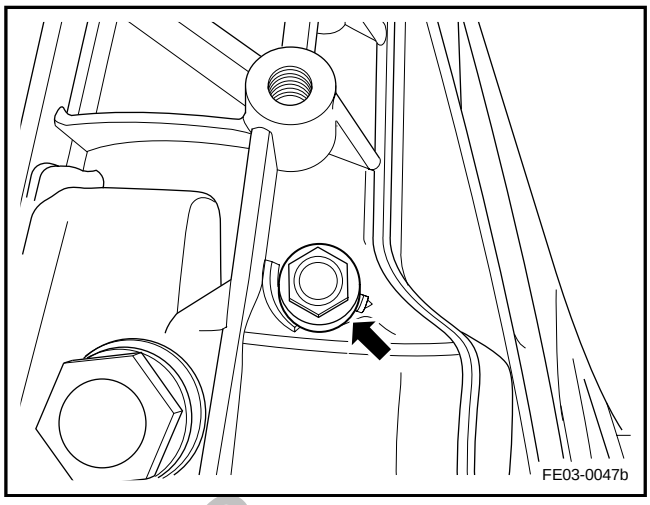
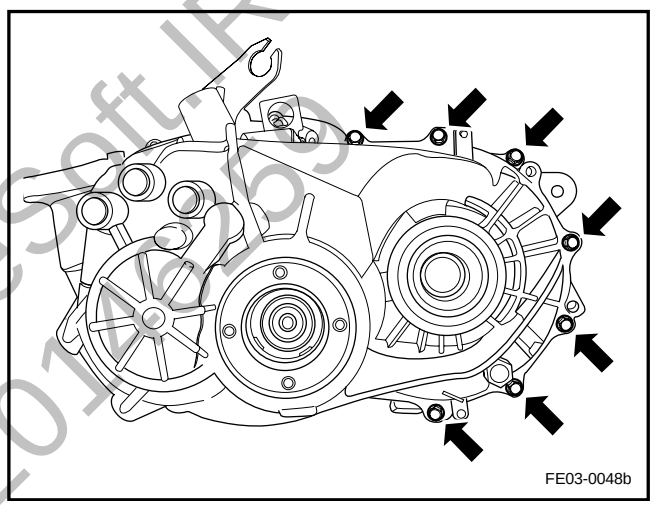
3.4.8.6 fork shaft replacement

Dismantle procedure

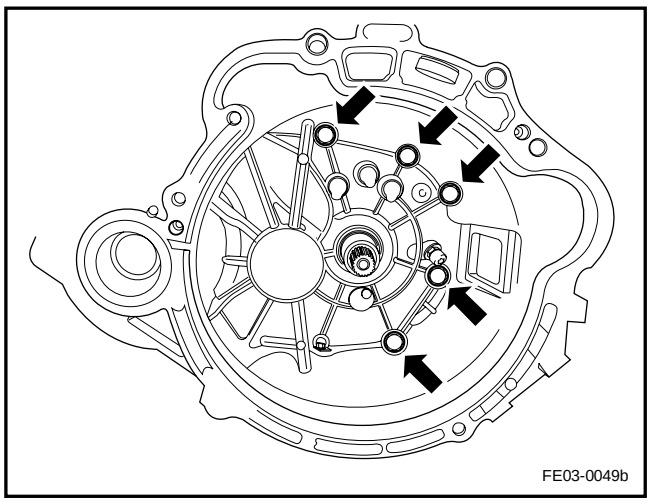
1. Refer to 3.4.8.3 "Replacement of transmission Assembly" to dismantle the transmission assembly.
2. Dismantle shift control mechanism assembly, Refer to“3.4.8.4shift control mechanism assembly replacement.
3. Dismantle location bolt of reverse gear.



4. Dismantle outer connecting bolt of transmission end-cover



5. Dismantle inner connecting bolt of transmission end cover.



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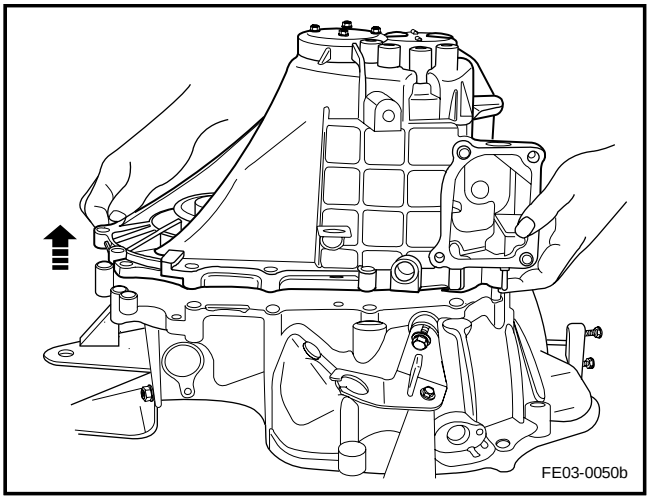
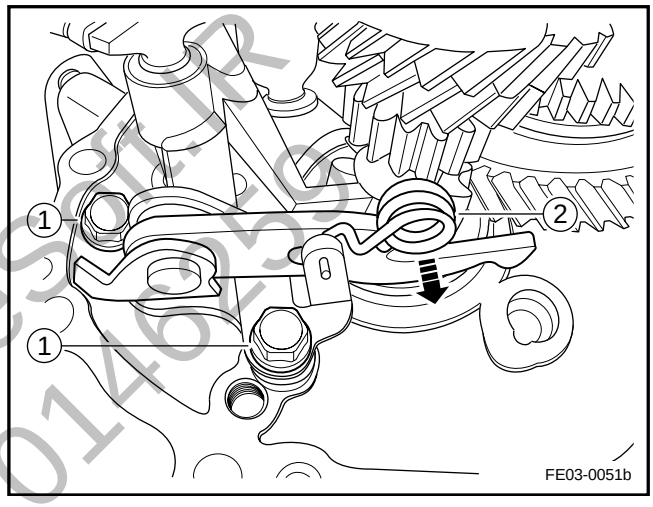
6. Take out rear end cover.

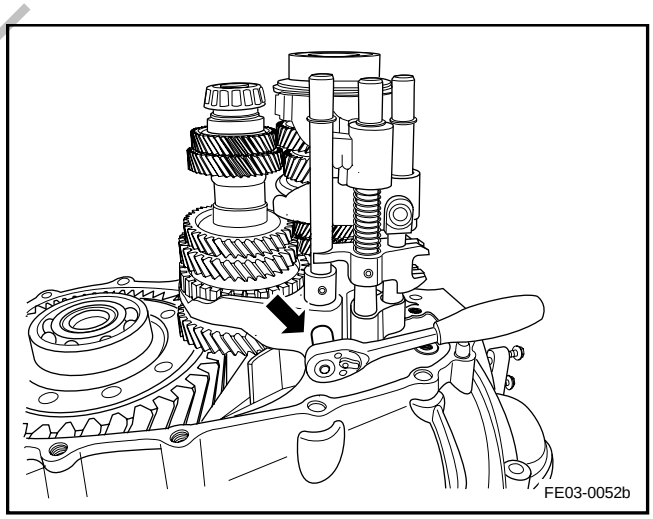


7 Dismantle coupling rod of reverse fork

Note ： Pull out one-end (2)of return spring beforce dismantle fixing bolt （1）.



8. Dismantle 1st and 2nd speed fork fixing bolt.



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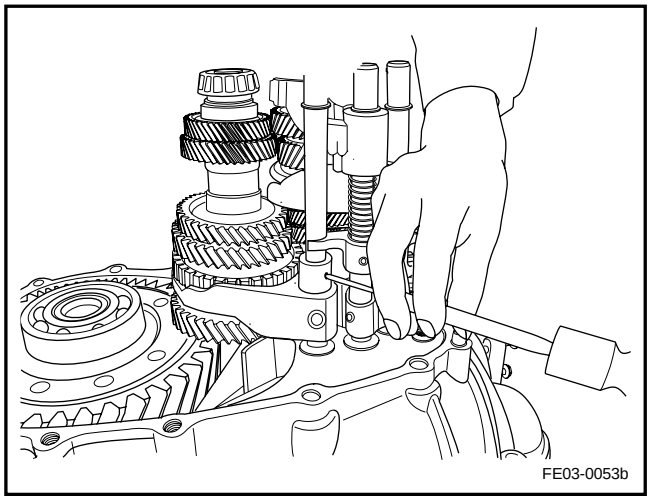
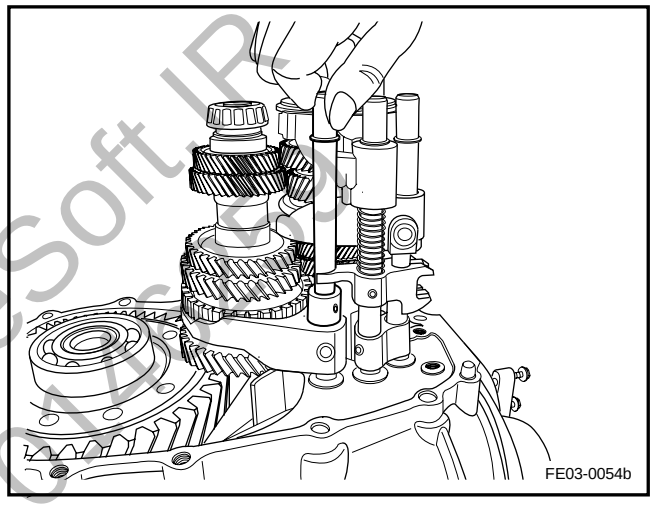
9. Dismantle lock ping on the 2nd speed fork shaft.

Notes :It must used special tool,otherwise,make lock pin swell so as not to pull out !

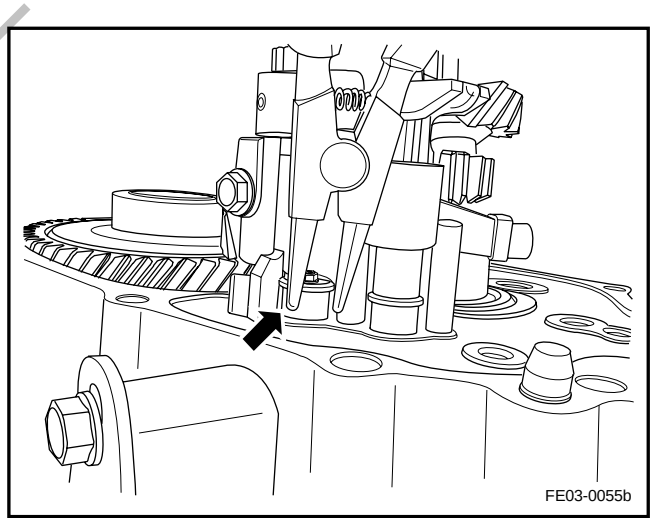


10 After clockwise rotated 180degress,Pull up 1st-speed fork shaft Notes 5th speed and self-lock pin of reverse fork

Notes :fork shaft is good match with fork, it is prohibit to used fork forward both side by free force to cause unusge fork changed bending and deformantion during dismantle process



11. Take out snap spring under the 5th speed and reverse fork shaft by snap ring pliers



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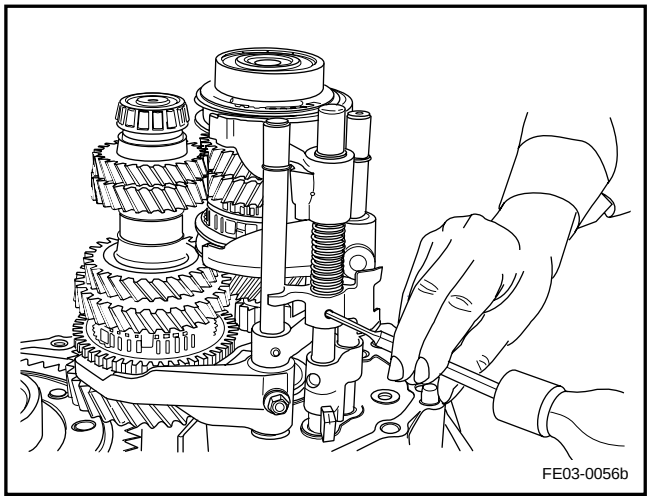
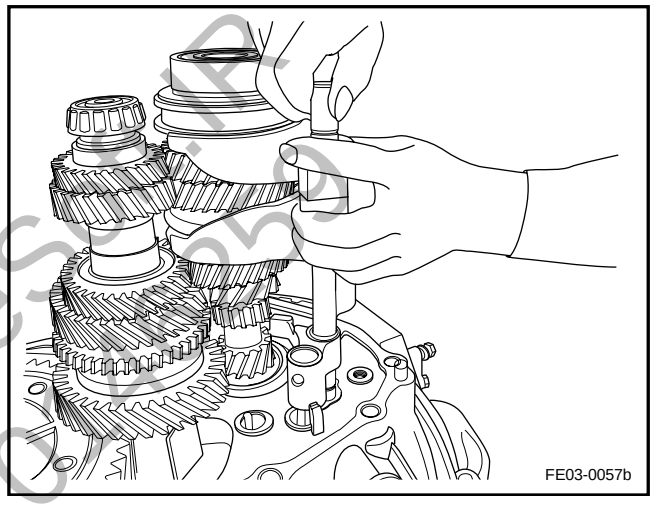
12. Dismantle locking pin on the 5th speed and reverse gear fork shaft.

Notes :It must used special tool,otherwise,make lock pin swell so as not to pull out ! *

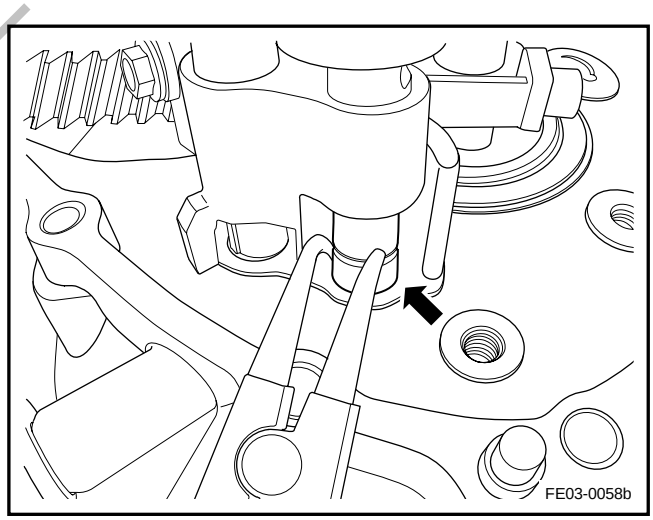


13. Upward pull out 5th speed and reverse gear fork shaft by rotated 180 degree. note: Self-lock pin prevent dropped

Notes :fork shaft is good match with fork, it is prohibit to used fork forward both side by free force to cause unusge fork changed bending and deformantion during dismantle process ; Guard intermediate spring by hand to pevent spring and low fork was spring out



14. Take out snap spring in the down most of 3rd/4the speed fork shaft by snap spring pillar.



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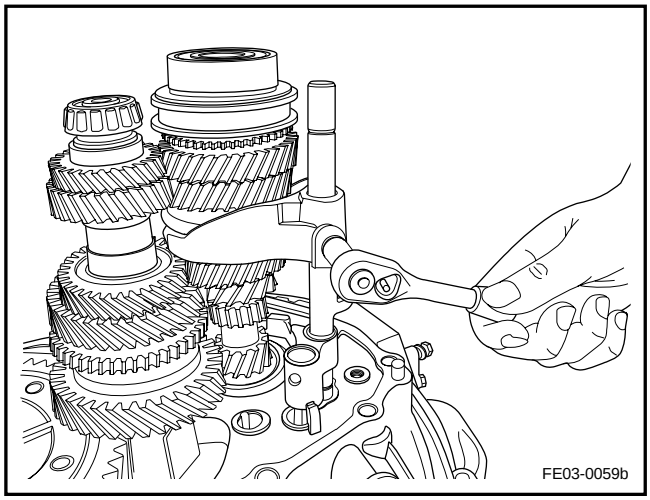
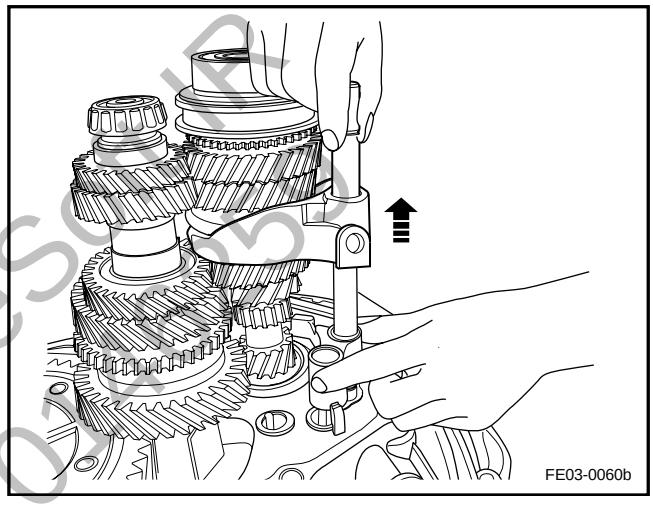
15. Dismantle 3rd /4th fork fixing bolt.



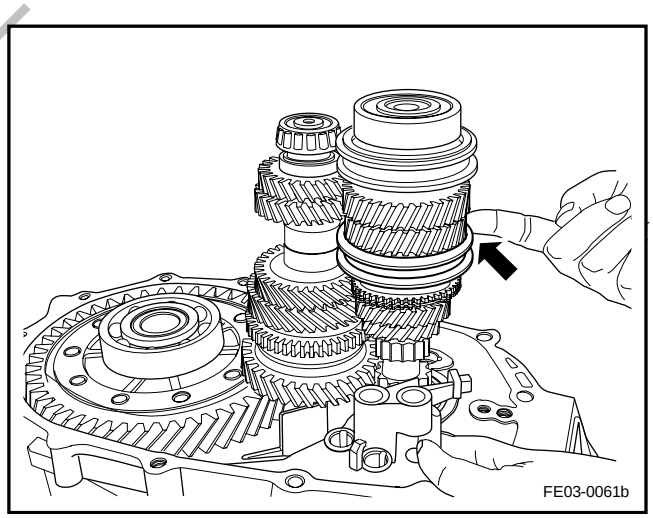
16. Pushed 3rd/4th speed synchronizer into the 4th speed gear , take out 3rd/4th speed synchronizer fork shaft and its other attachment

Notes :fork shaft is good match with fork, it is prohibit to used fork forward both side by free force to cause unusge fork changed bending and deformantion during dismantle process



Installation procedure::

1. Make 3rd/4th speed synchronizer engaged with 4th speed position



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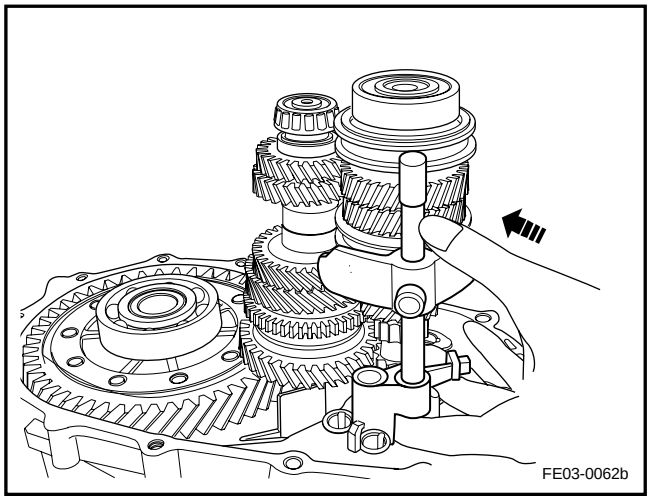
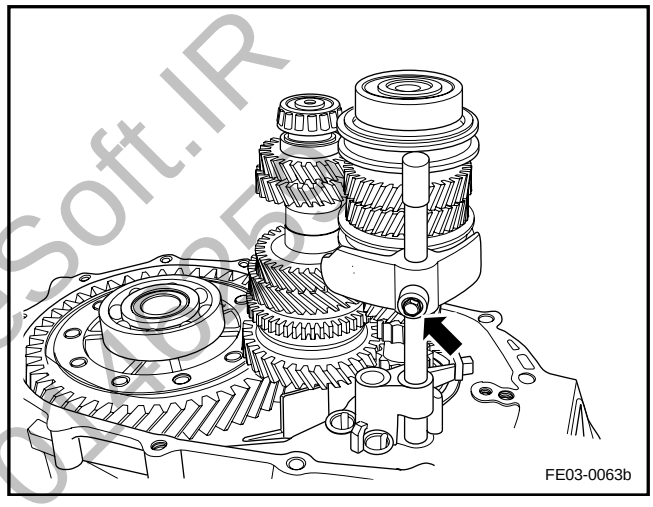
2. install 3rd /4th speed fork and fork shaft

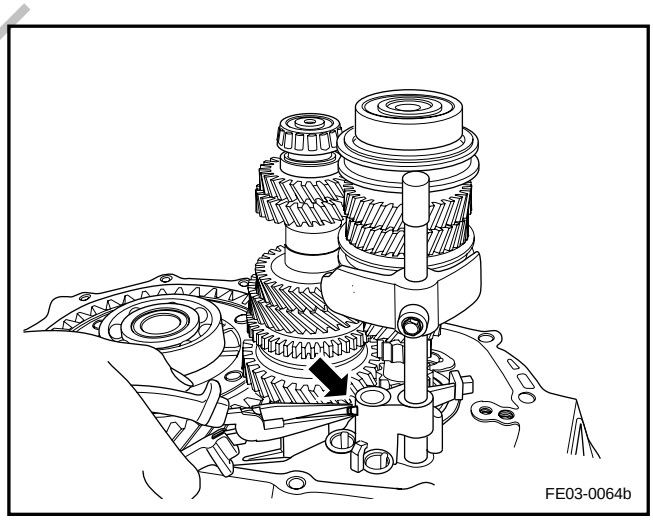


3. Install 3rd/4th speed fork shaft fastening bolt



4. Install 3rd/4th speed synchronizer fork shaft and 5th speed reverse fork shaft interlock pin.

Notes : Upper solt of 3rd/4th speed fork shaft align to pin hole,



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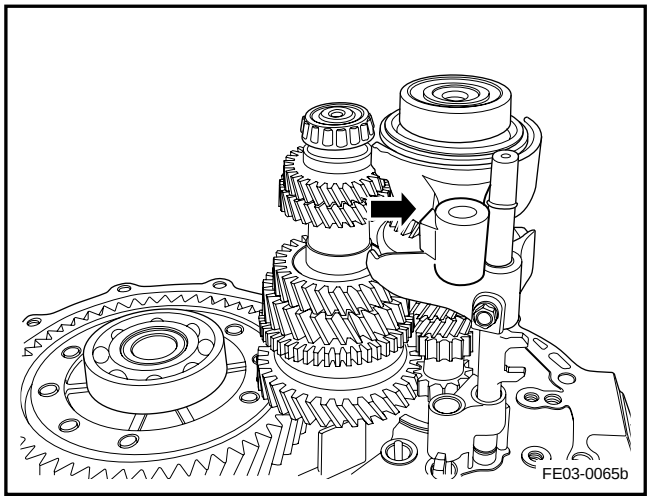
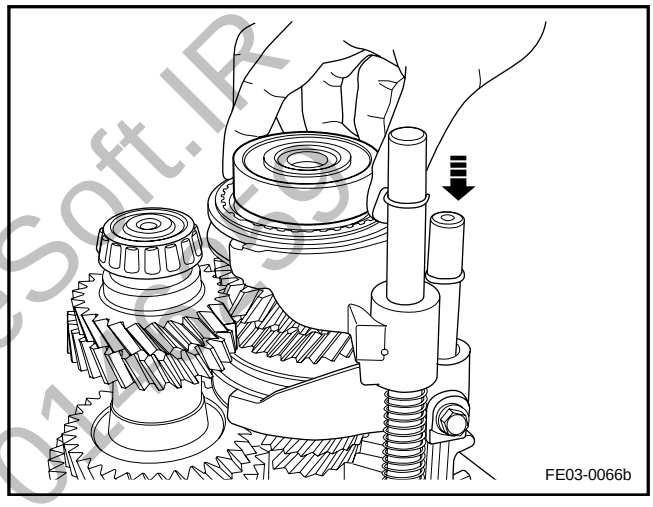
5. Install 5th speed synchronizer fork.



6. Install 5th speed reverse fork shaft

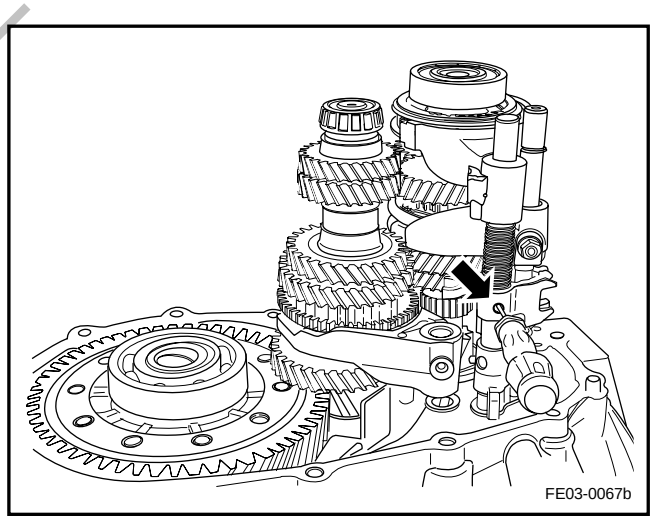
Notes : Hold 5the speed synchronizer by hand to prevent installation

Synchronizer spring out during fork shaft



7. Insert into locking pin hole by screwdriver and fixed it for 5th speed fork coupling lever

Notes :Upprt solt of fork shaft is consist with locking pin hole !



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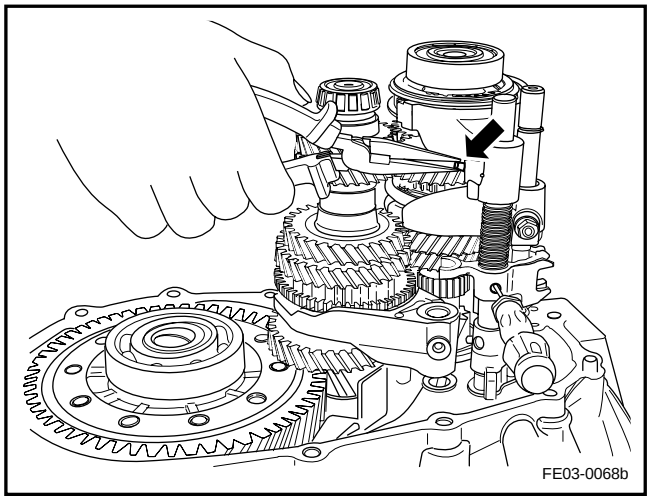
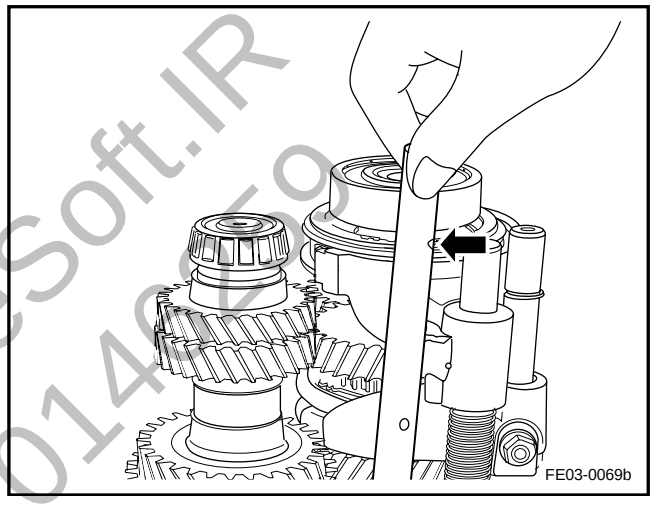
8. Install 5th speed reverse and 1st/2nd speed fork shaft interlock pin.

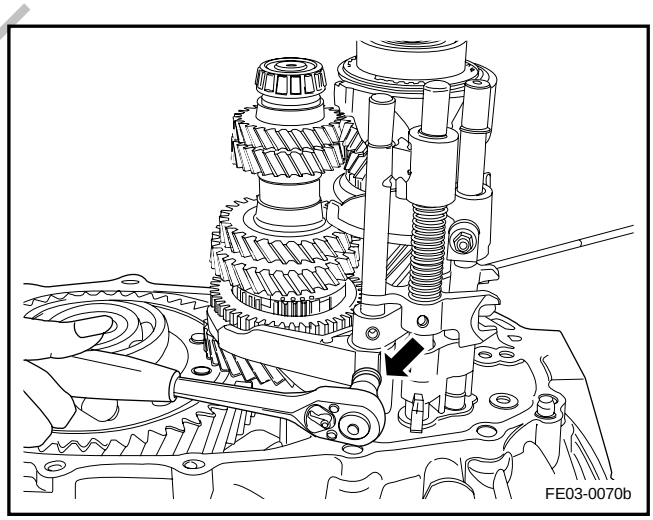


9. Install 1st/2nd speed fork shaft

Notes :Upprt solt of fork shaft is consist with locking pin hole !



10. Install fixing bolt on the 1st/2nd fork shaft.



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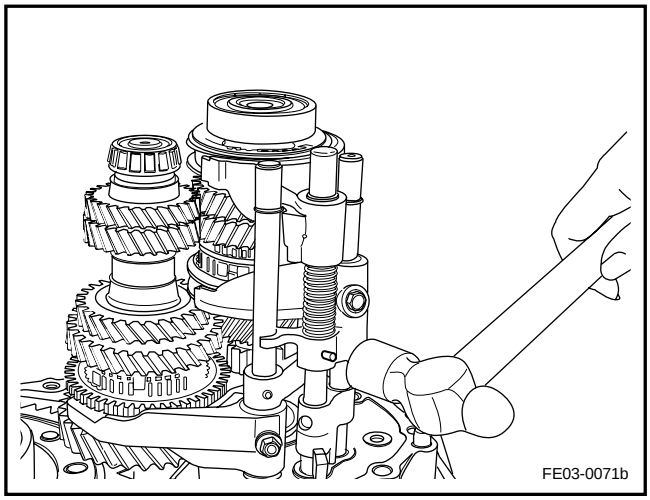
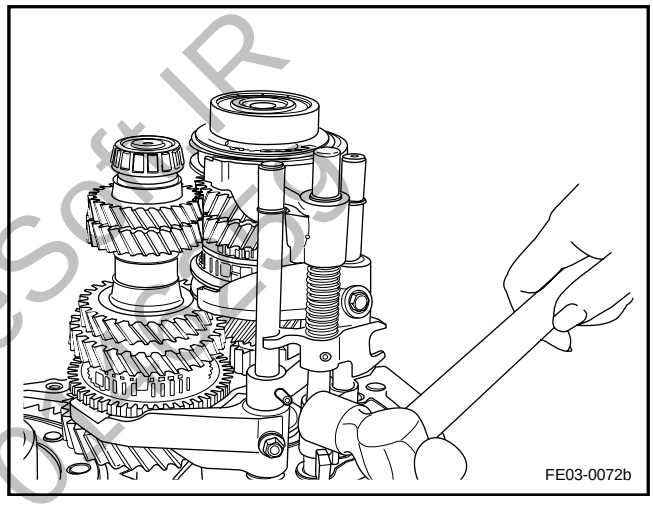
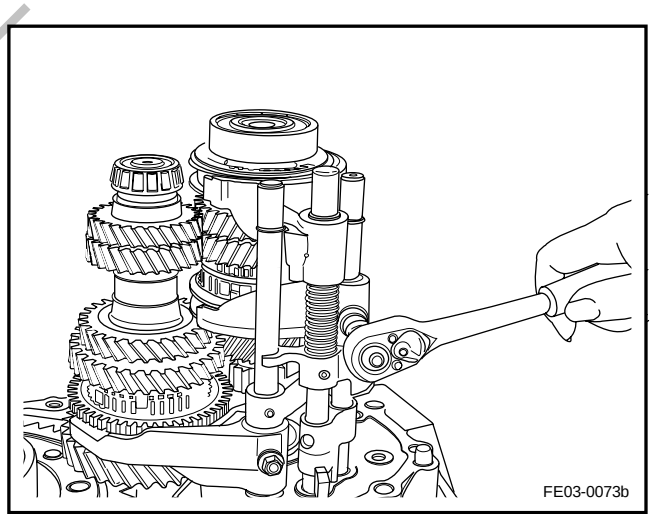
11. Install lock pin on the 5th speed reverse fork shaft



12. Install locking pin of 1st and 2nd speed fork shaft.



13. Tighten fixing bolt on the 3rd/4th fork shaft



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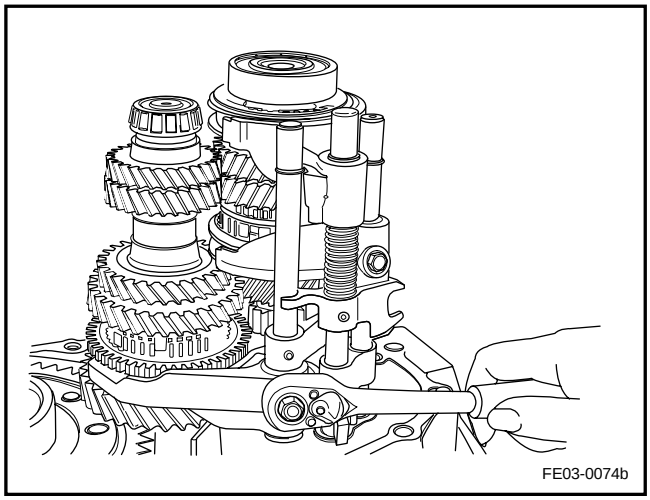
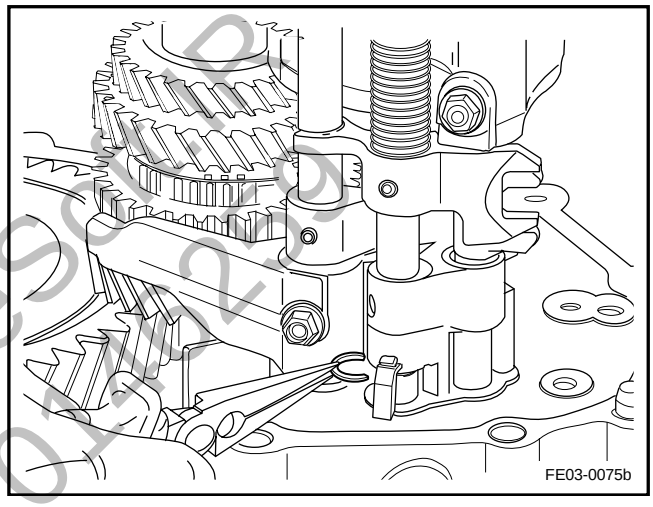
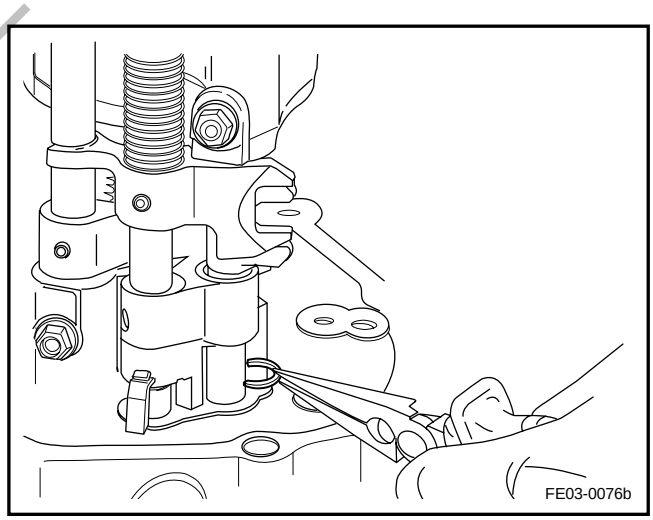
14. Tighten fixing bolt on the 1st/2nd speed fork shaft.



15. Install limiting snap spring under the 5th speed reverse fork shaft.



16. Install lower limiting snap spring of 3rd /4th speed fork shaft.



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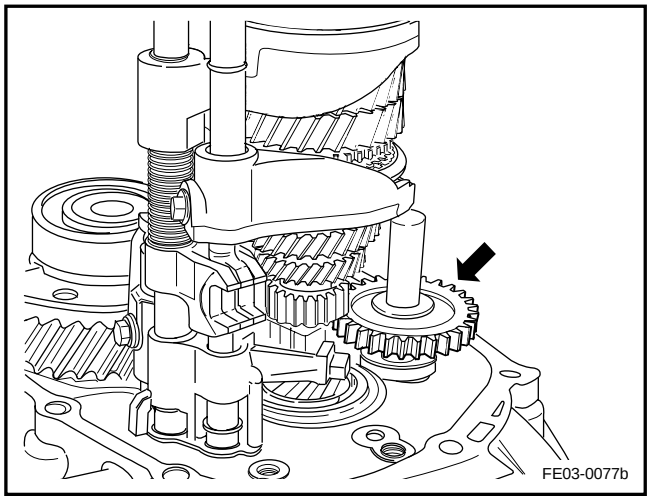
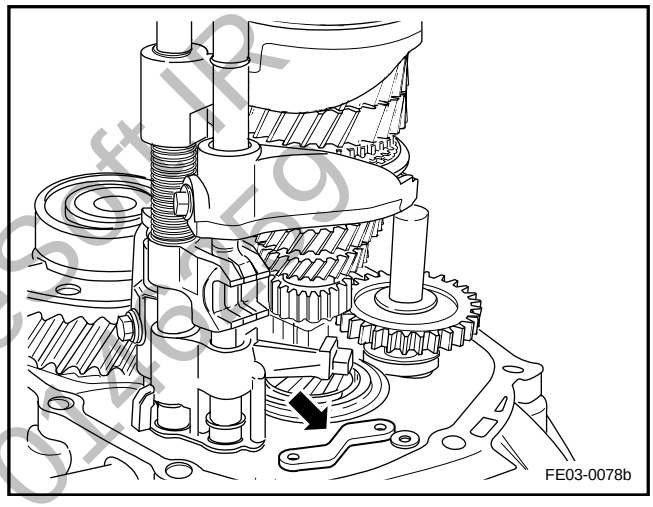
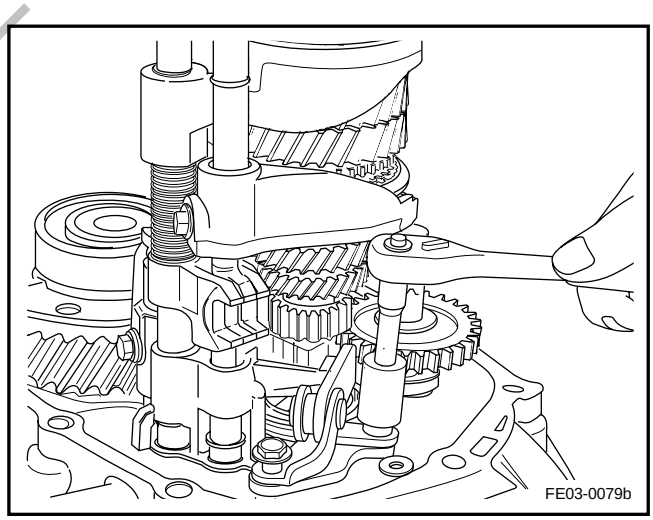
17. Install reverse gear and shaft.



18. Install fixing support seat gasket of reverse gear fork coupling lever.



19. Install and tighten fixing bolt of reverse coupling rod.



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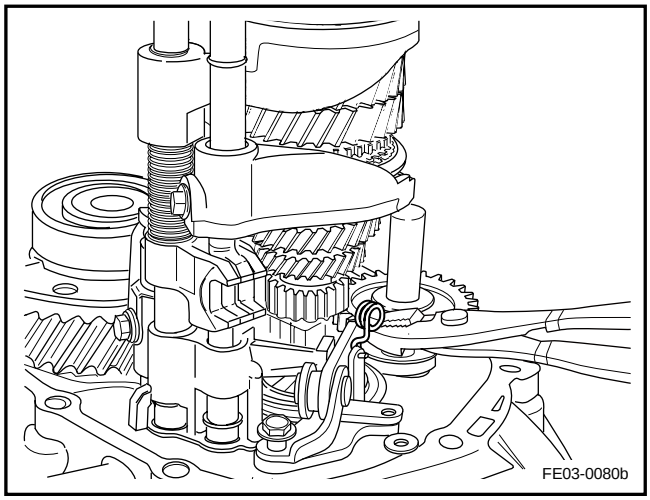
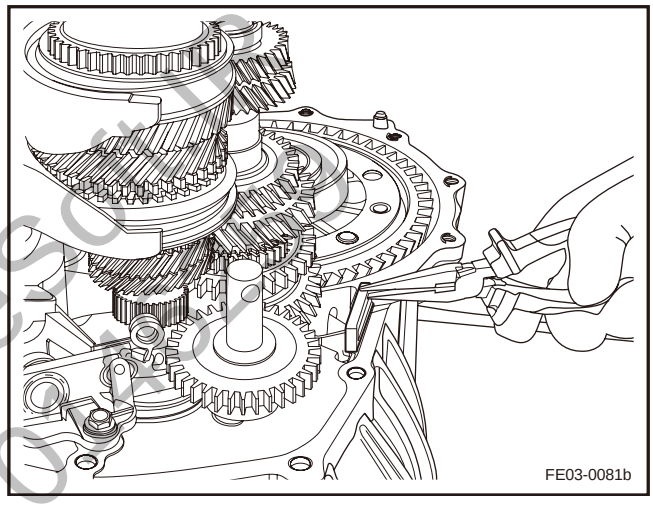
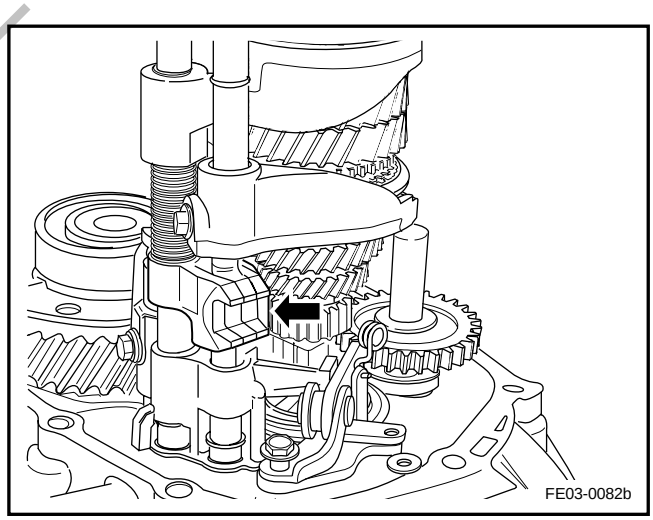
20. Install return spring of reverse coupling rod



21. Install inner filings adsorption magnet transmission.



22. Confirm all gears forks are in the netural position as shown in figure(all forks are in the level position)



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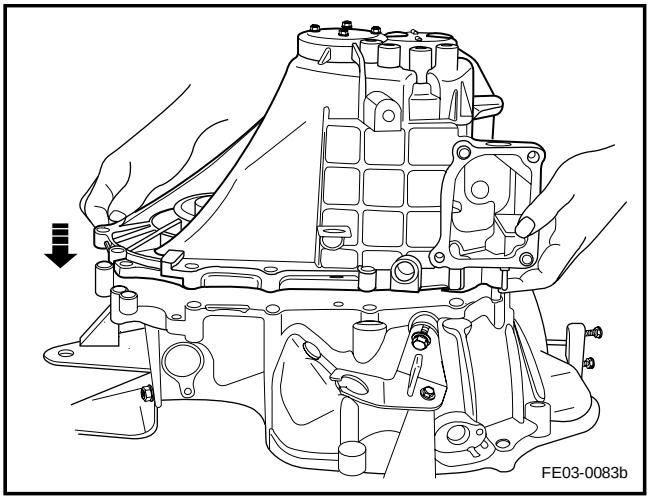
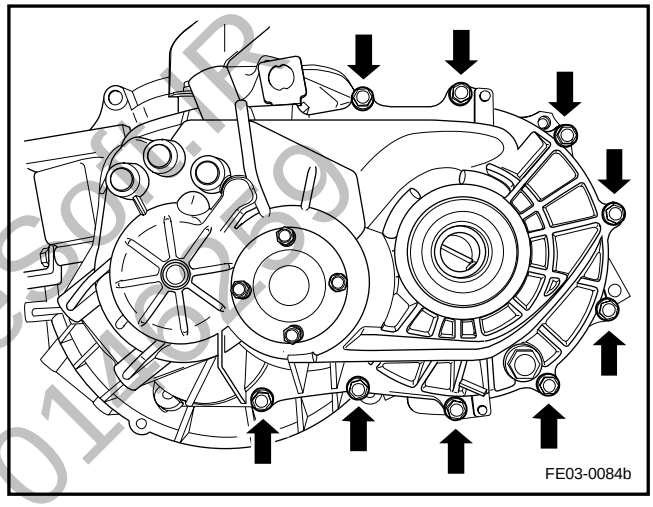
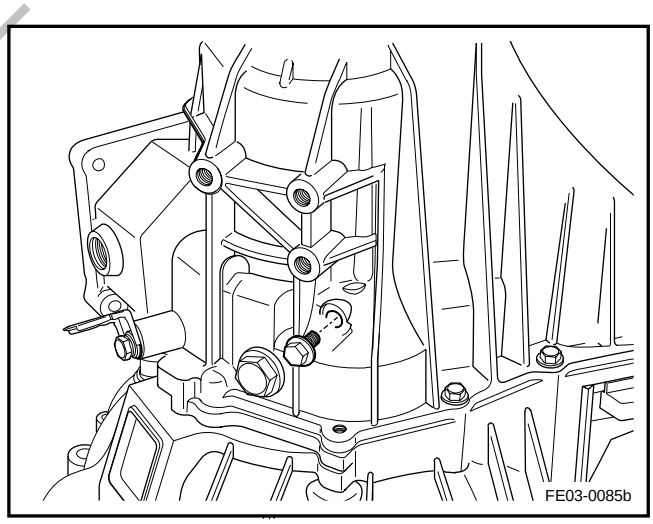
23. Install transmission rear end cover.



24. Install and tighten transmission rear end cover outer fixing bolt.



25. Install and tighten reverse gear shaft fixing bolt.



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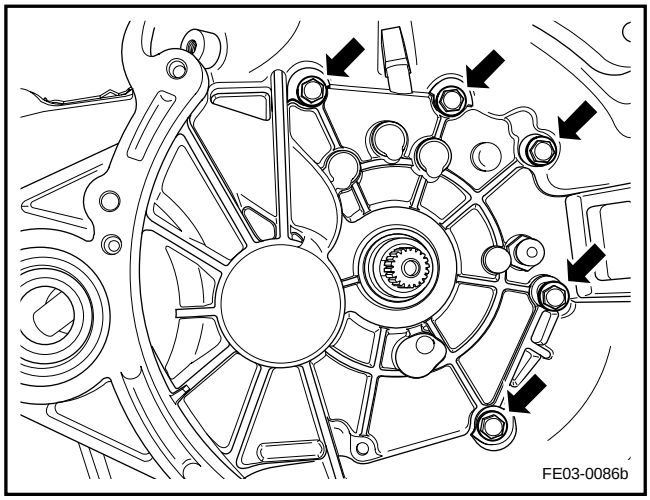
26. Install and tighten transmission rear end cover inner fixing bolt .

27. Install shift control mechanism assembly.Refer to“3.4.8.4shift control mechanism assembly replacement.

28. Install transmission assembly, refer to“3.4.8.3Transmission assembly replacement”.



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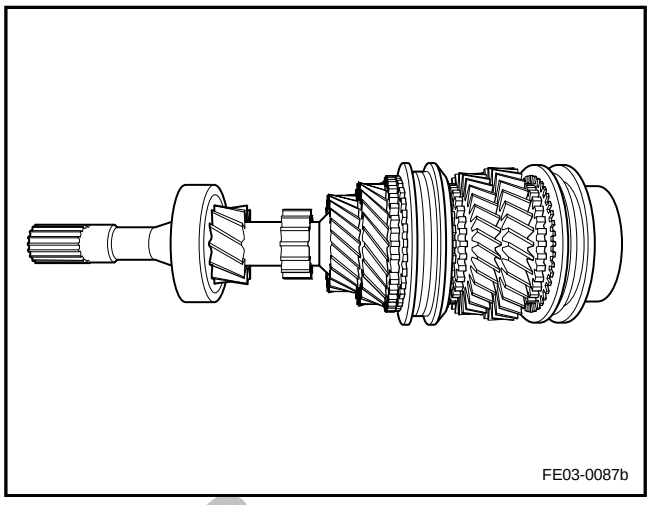
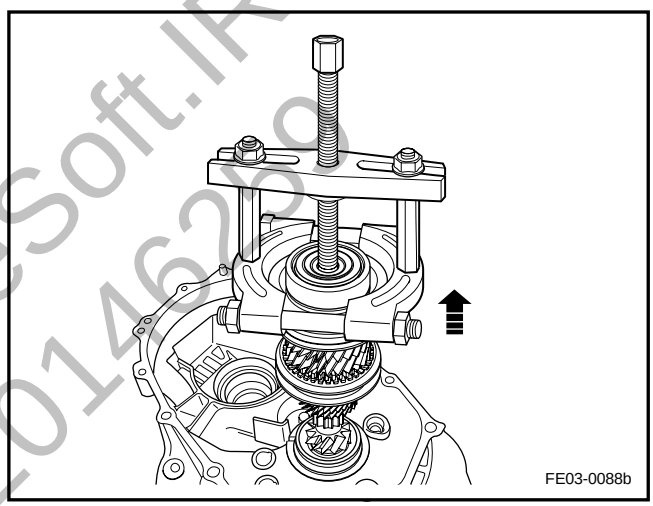
3.4.8.7 Input shaft disassembly and assembly

Dismantle procedure

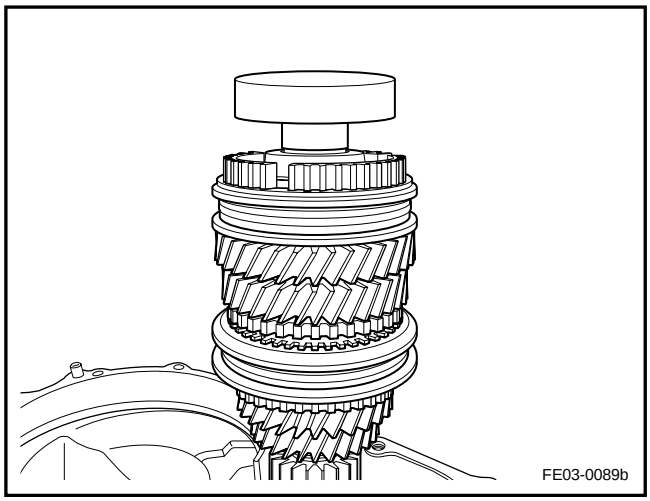
1. Refer to 3.4.8.3 "Replacement of transmission assembly" to dismantle the transmission assembly.
2. Dismantle shift control mechanism assembly, refer to“3.4.8.4 shift control mechanism assembly replacement”.
3. Dismantle fork shaft.Refer to“3.4.8.6 fork shaft replacement”.
4. Dismantle Input shaft assembly in the transmission



5. Pull out rear support bearing of input shaft by special tool



6. Status after pull out bearing.



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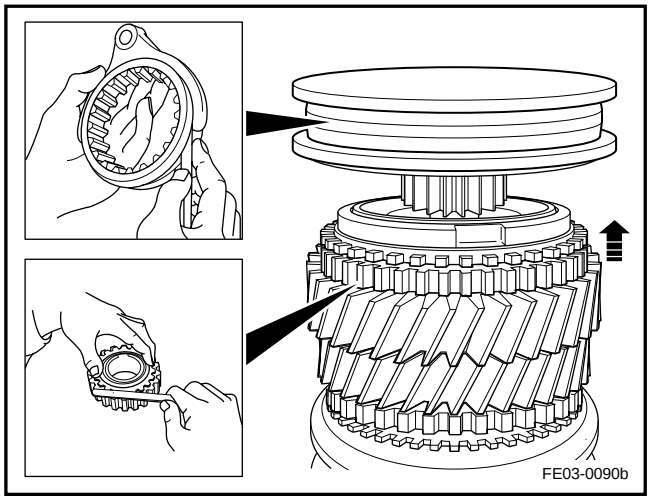
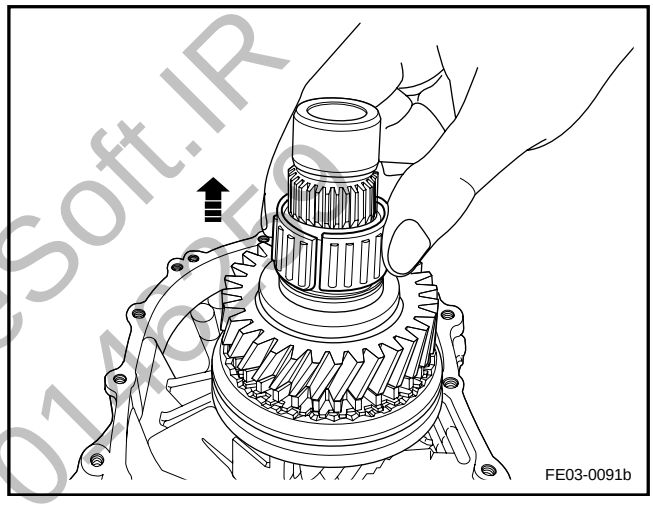
7. Take out 5nd speed synchonizer assembly。

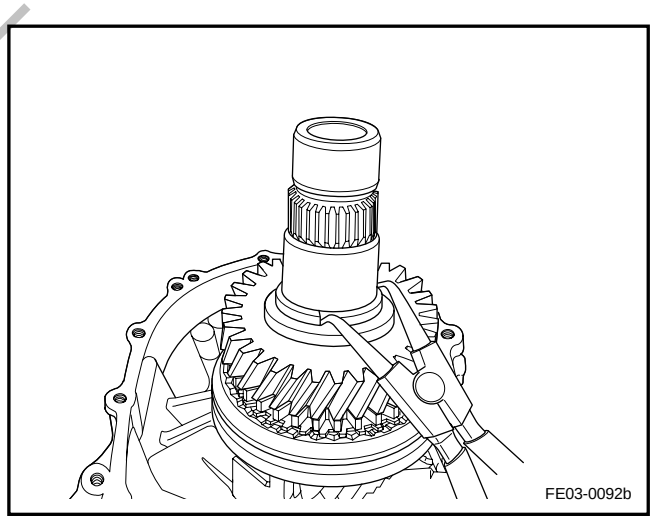
Notes :distance between gear bushing and shift fork≦0,35mm(≦13,780in×10-3)synchronizer
End-face distance back-face synchronizer and gear end ≧0,8mm(≧31,496 in×10^{-3}),



8. Take out 5th speed gear.needle bearing and needle bearing washer



9. Take out 4th speed gear snap spring and washer by snap spring pillar.



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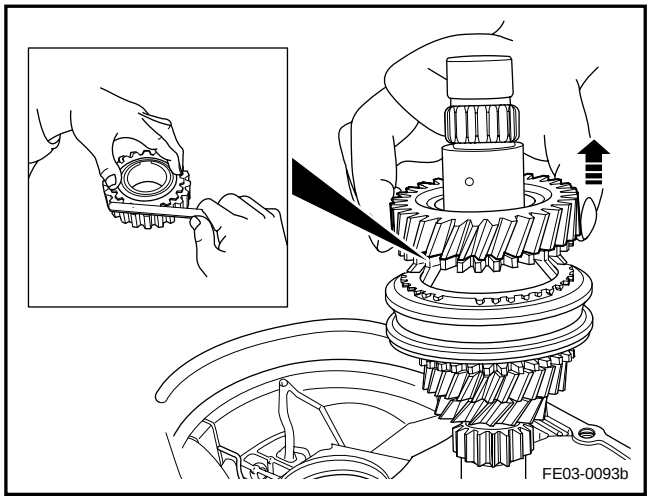
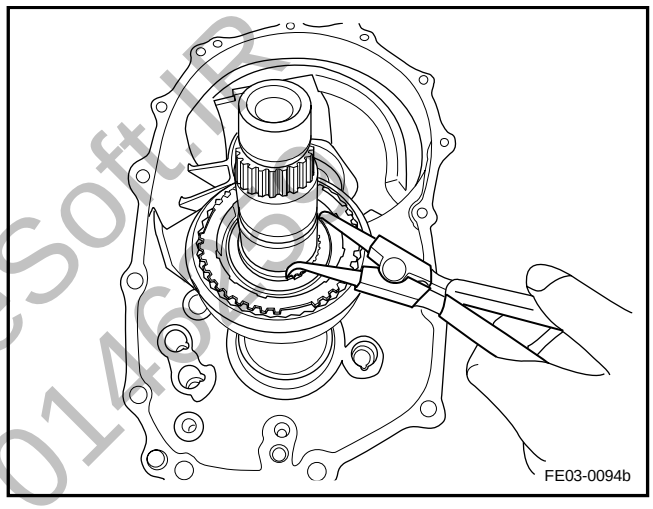
10 Take out 4th speed gear , needle bearing and washer,

Notes : synchronizer end-face distance back-face synchronizer and gear end ≧0,8mm(≧31,496in×10^{-3}),



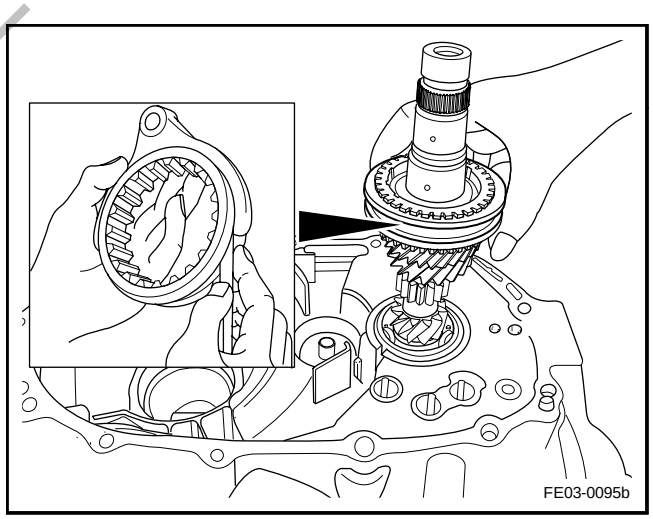
11. Dismantle 3rd/4th speed synchronizer snap spring by snap ring pliers

Notes : take out 4th speed synchronizer before dismantle snap ring , otherwire , snap spring hard take out !



12. Take out 3rd/4th speed synchronizer

Notes :distance between gear bushing and shift fork≦0,35mm(≦13,780 in×10$10^{-3}$)



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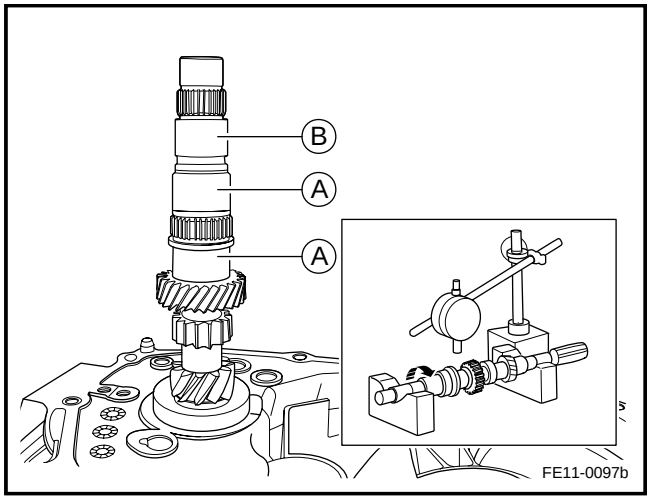
13. Take out 3rd speed gear and needle bearing.

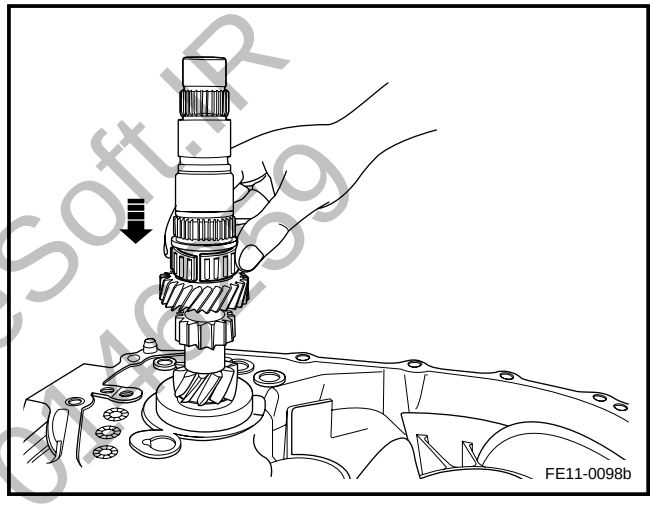
14. Final status after dismantle input shaft

Notes : Input shaft axial runout≦0,03mm(≦1,181 in×10^{-3})Input shaft worn face min,diameter is 33,985mm(1337,989 in×10^{-3}), surface B min,diameter is 30,985mm(1219,879 in×10^{-3})



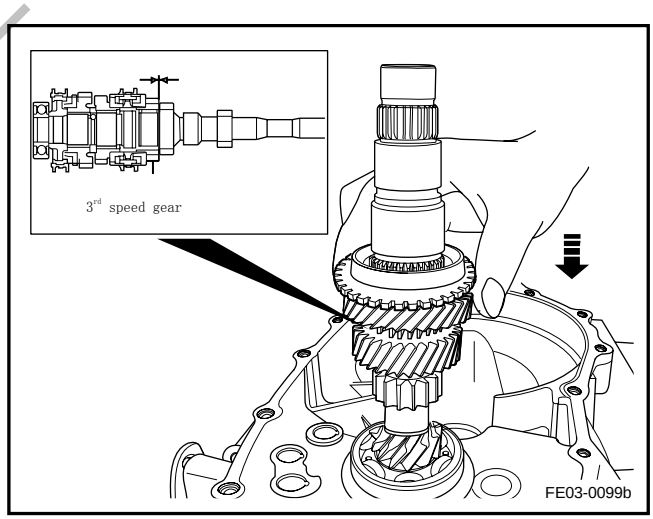
Installation procedure::

1. Install 3rd speed gear needle bearing.



2. Install the 3rd speed.

Notes : Input shaft 3rd speed gear axial clearance is 0,1～0,35mm(3,937～13,780 in×10^{-3})



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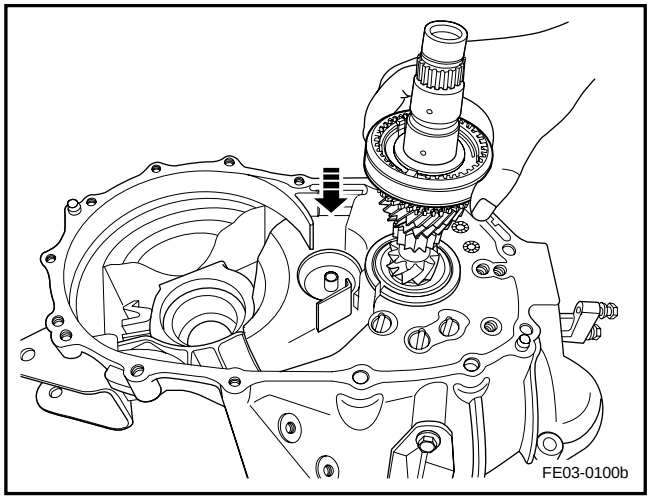
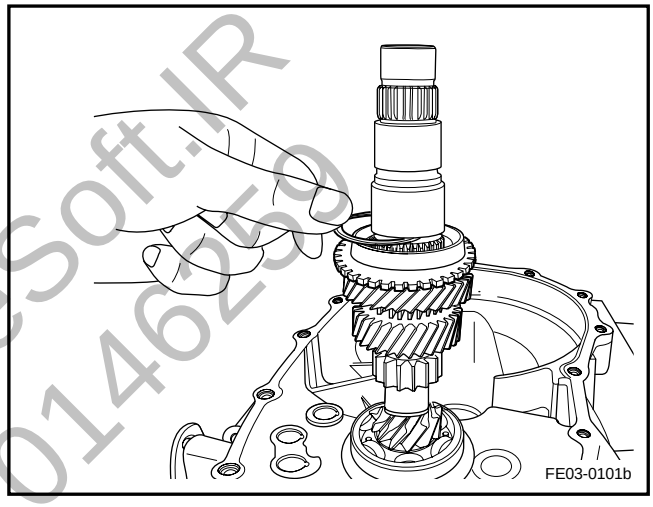
3. Install 3rd/4th speed synchronizer.

Notes : 4th speed synchronizer rings install together, otherwire.hard install 3rd/4th speed synchronizer snap spring.synchronizer has chamfer is face to rear end of transmission !

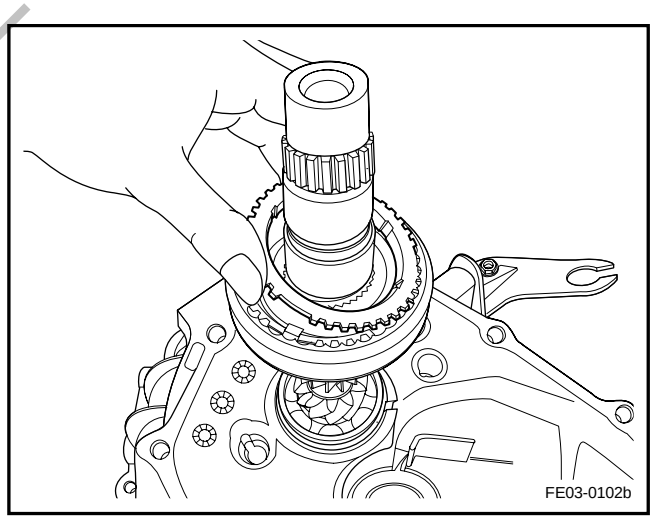


4. Install 3rd/4th speed synchronizer snap spring.



5. Install 4th speed synchronizer ring.

Notes : upper slot of synchronizer right insert into drive gear of synchronizer !



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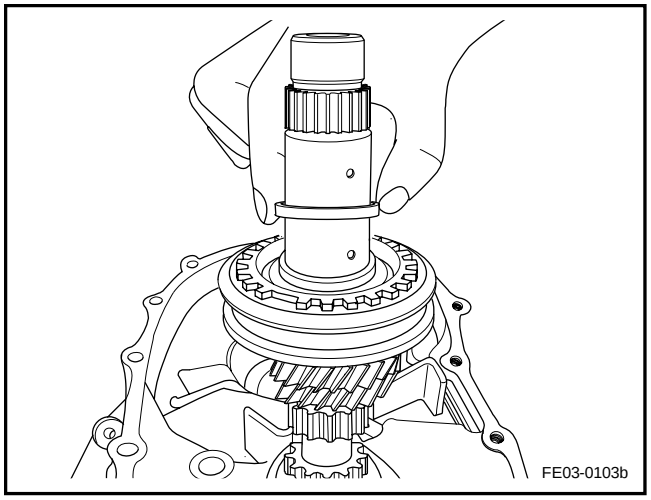
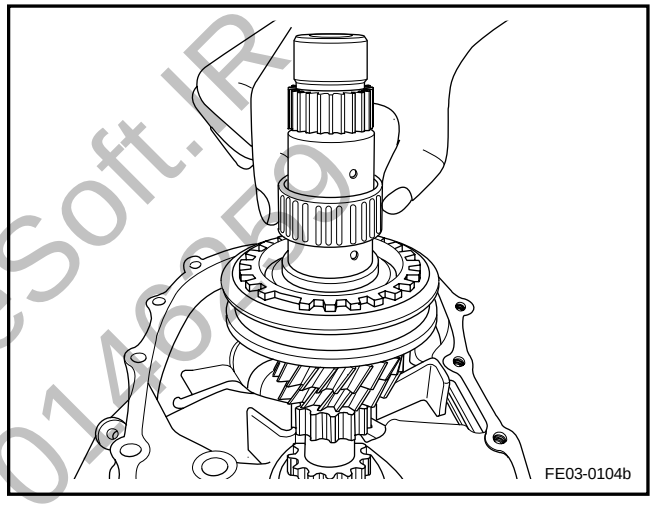
6. Install 4th speed gear needle bearing washer.

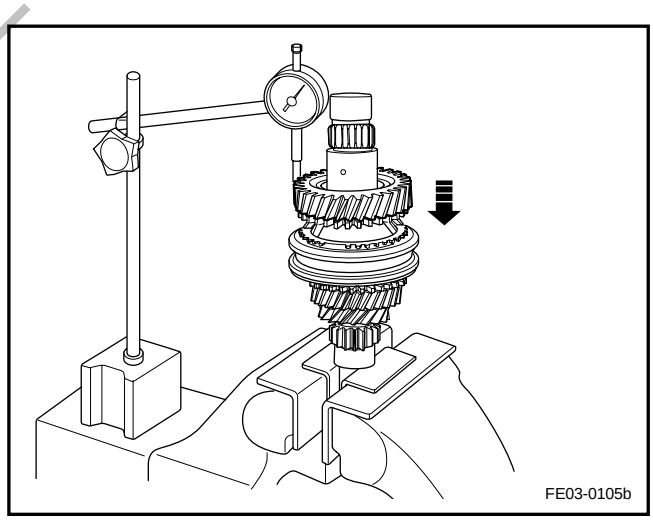


7. Install 4th speed gear needle bearing.



8. Install the 4th speed gear.

Notes : Input shaft 4th speed gear axial clearance is 0,1～0,55mm(3,937～21,654 in×10^{-3})



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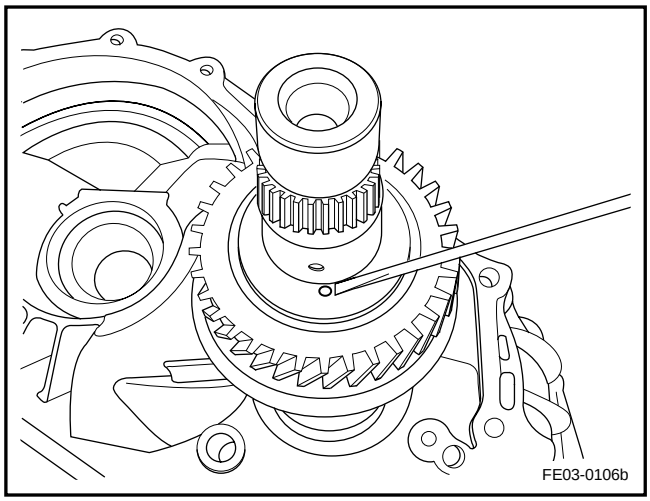
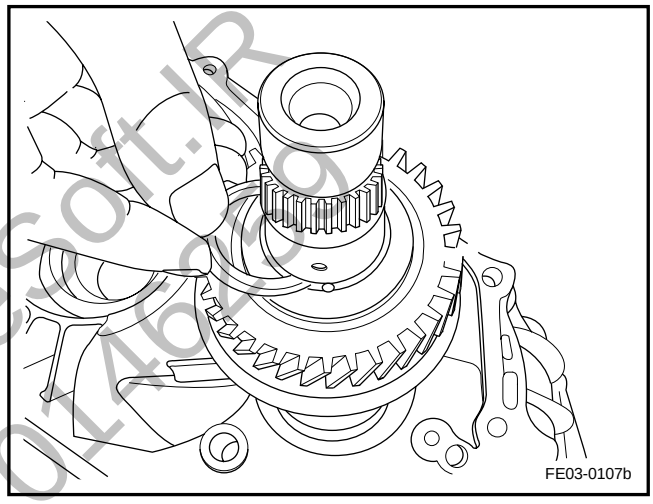
9. Install 4th speed gear retaining ring.

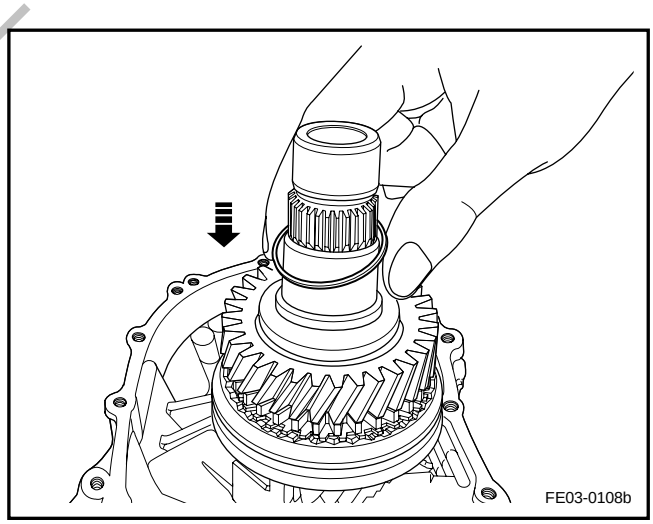
Notes : limiting ball direction of retaining ring is consist with retaining ring !



10. Install 4th speed gear snap ring.



11. Install 5th speed gear needle bearing gasket.



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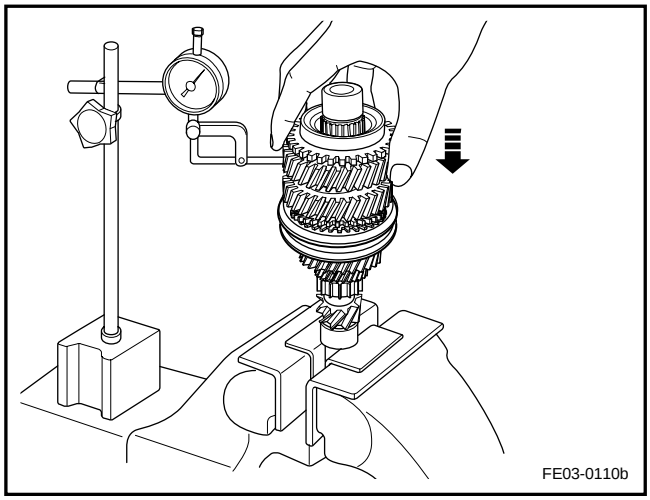
12. Install 5th speed gear needle bearing.

13. Install the 5th speed.

Notes : Axial clearance for input shaft 5th speed gear is 0,1～0,50mm(3,937～19,685 in×10^{-3})

14. Install 5th speed synchronizer

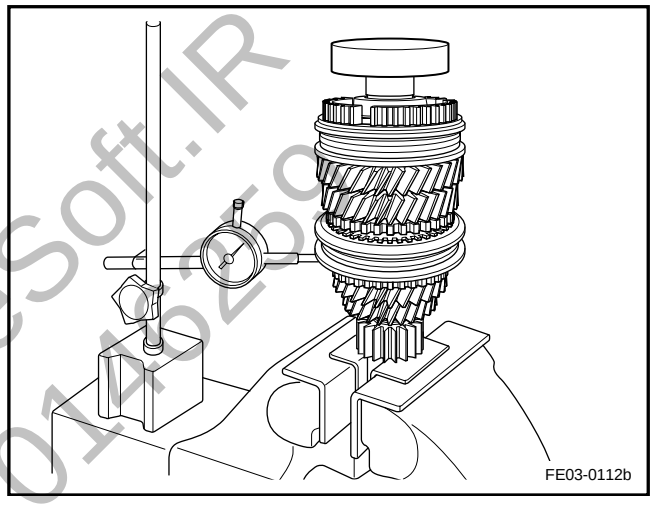
Notes: synchronizer has directional, One face of boss face to rear-end of transmission.



15. Install Input shaft rear support bearing .

Notes : The bearing has directional , one face of oil seal face to rear-edn of transmission input shaft 4th speed , 5th speed gear radial clearance ≦0,058mm(≦2,146 in×10^{-3})

16. Install Input shaft assembly.



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17. Install fork shaft.refer to“3.4.8.6 fork shaft replacement ”

18. Install shift control mechanism assembly; refer to“3.4.8.4shift control mechanism assembly replacement”.

19. Install transmission assembly, refer to“3.4.8.3transmission assembly replacement” .

3.4.8.8 Disassembly and assembly of main shaft

Dismantle procedure

1. Refer to 3.4.8.3 "Replacement of transmission assembly" to dismantle the transmission assembly.
2. Dismantle shift control mechanism assembly, refer to“3.4.8.4shift control mechanism assembly replacement” .
3. Dismantle fork shaft.Refer to“3.4.8.6fork shaft replacement ”
4. Dismantle main shaft assembly in the transmission.

Notes : Gear axial clearance of main shaft 1st speed and 2nd speed :

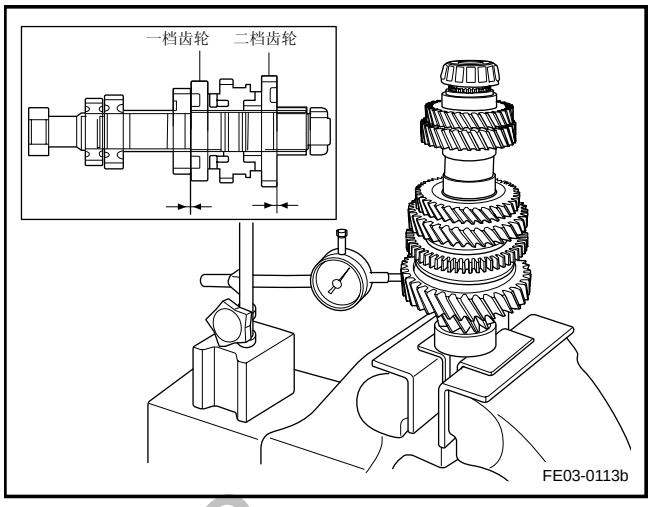
1 nd speed :0.1～0.35mm(3.937～13.780 in×10^{-3})

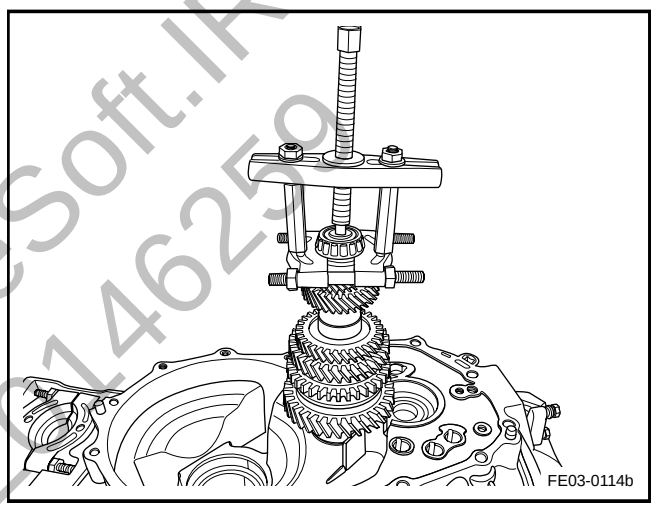
2 nd speed :0.1～0.35mm(3.937～13.780 in×10^{-3})

Gear radial runout of main shaft 1st speed and 2nd speed :

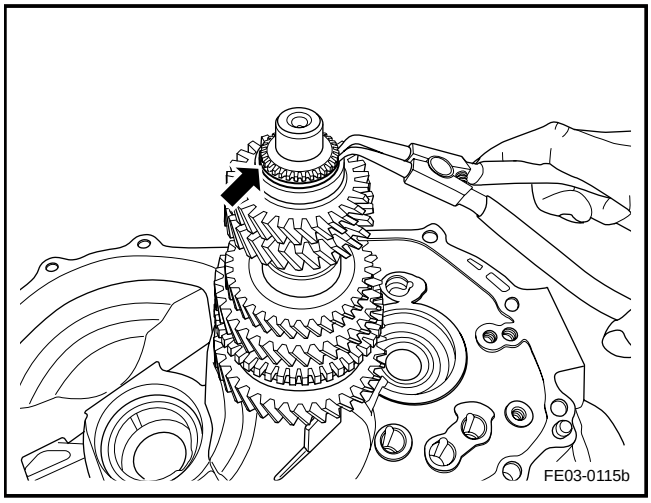
≦0.056mm≦(2.205 in×10^{-3})

5. Pull out main shaft rear bearing shaft by special tool bearing puller.





6. Take out 5th speed gear snap spring by snap spring pillar.



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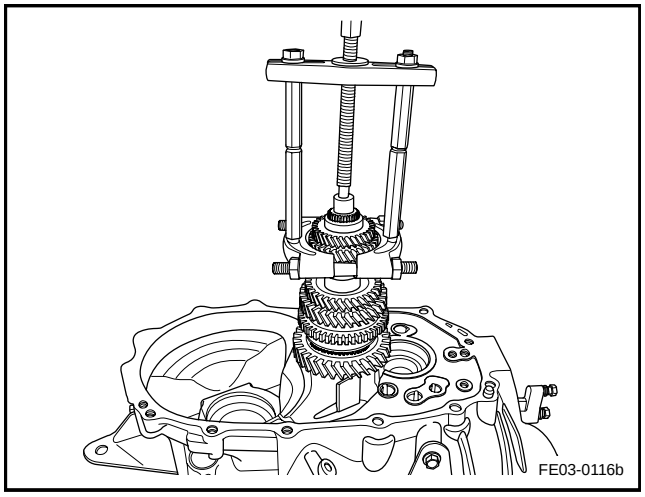
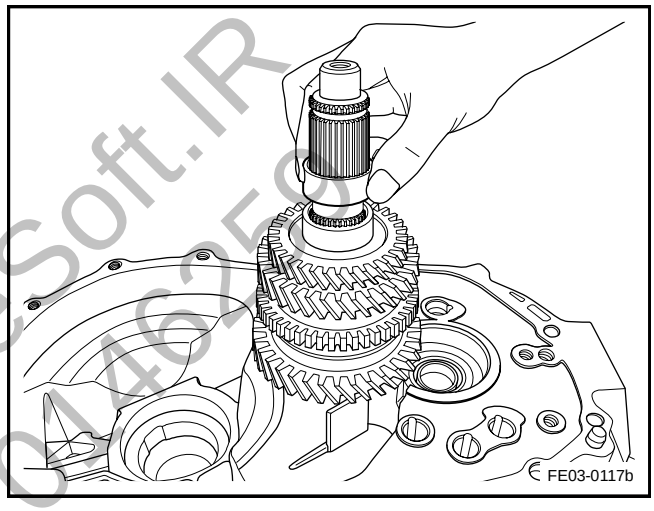
7. Pull out 5th speed gear and4th speed gear by special tool “bearing puller“.

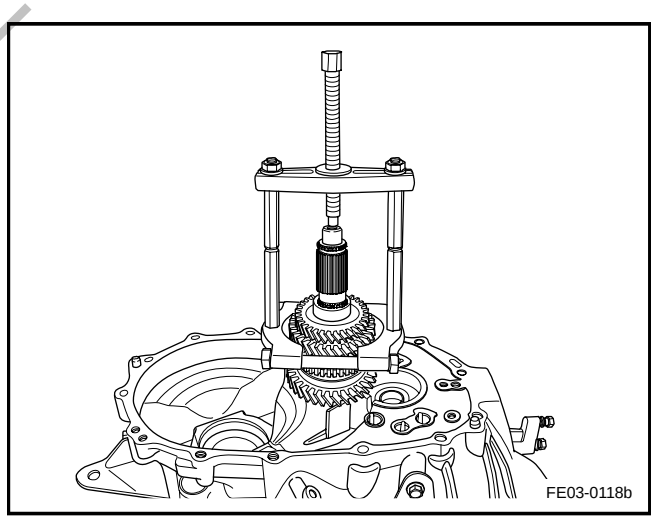


8. Take out 4th speed gear and 3rd speed gear bushing.



9. Pull out 3rd speed gear by special tool bearing puller.

Notes :Gap is too small between 3rd speed gear and 2nd speed gear, May separately pull out 3rd speed gear from a distance,



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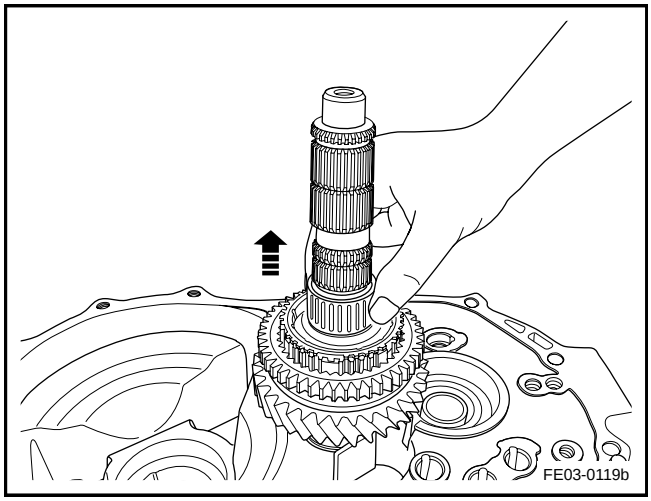
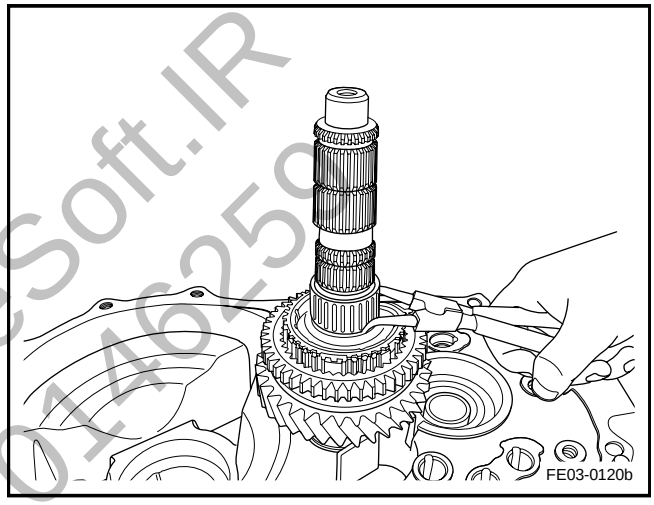
10. Take out 2nd speed gear, bearing and bearing retaining ring.

Notes : the needle bearing has opens to directly take out !

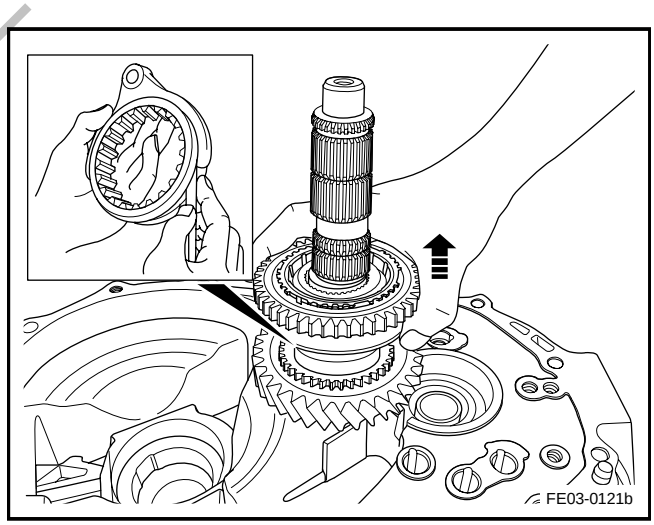


11. Take out 1st/2nd speed synchronizer snap spring by snap ring pliers



12. Take out 1st/2nd speed synchronizer

Notes :distance between gear bushing and shift fork≦0,35mm(≦13,780 in×10^{-3})



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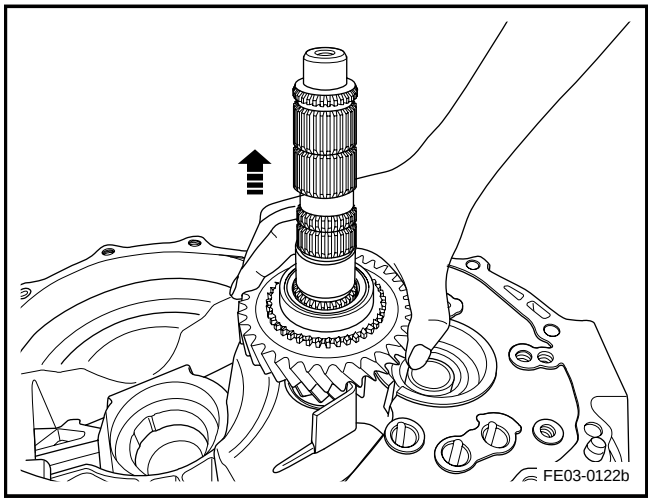
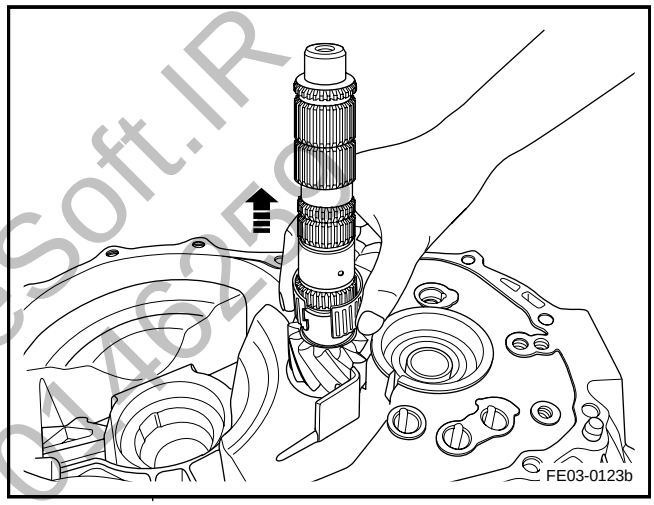
13. Take out 1 speed gear



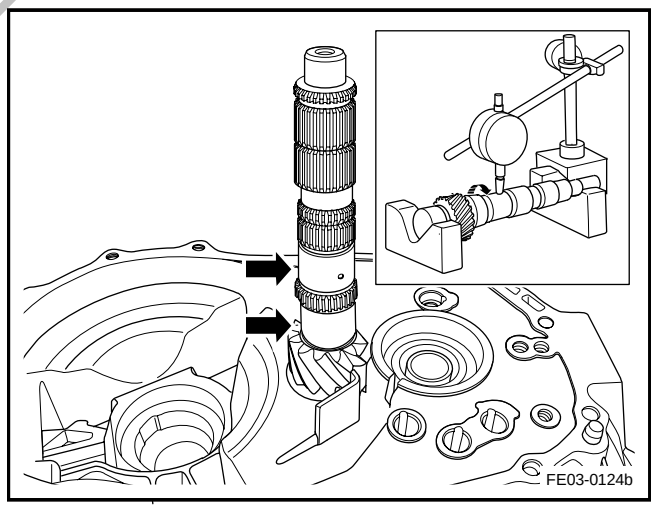
14. Take out 1st speed gear needle bearing.

Notes: the needle bearing has opens to, can not dismantle by big force, otherwire may cause this bearing!



15. Completed final status after dismantle main shaft.

Notes : Worn condition of main shaft:Min,diameter is 33,985mm(1337,989 in×10^{-3})main bearing radial runout≦0,03mm(≦1,181 in×10^{-3})



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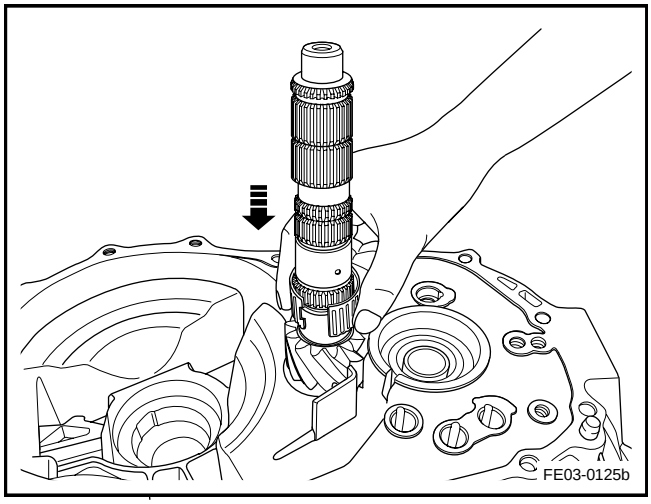
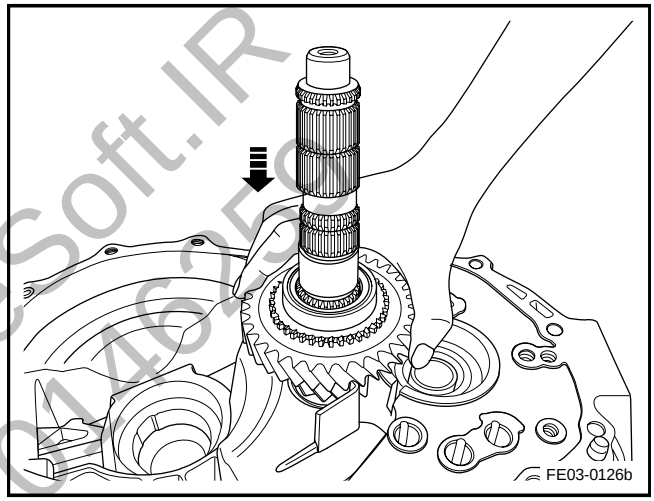
Installation procedure::

1. Install 1st speed gear needle bearing.



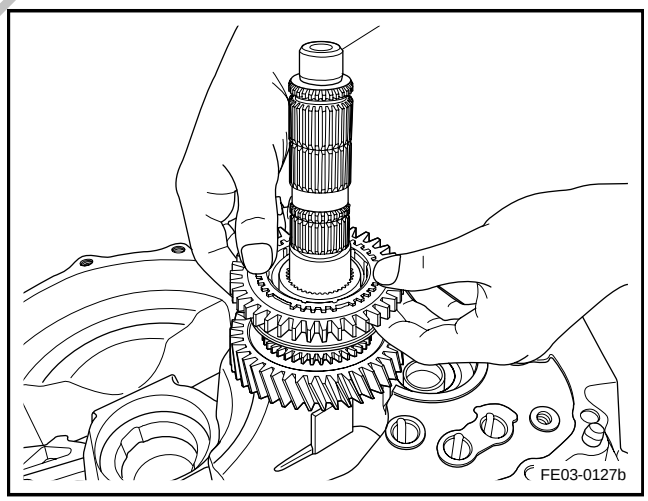
2. Install the 1st speed gear.



3. Install1st/2nd speed synchronizer.

Notes: gear surface face the rear-end of transmission

4. Install1st/2nd speed synchronizer snap spring .



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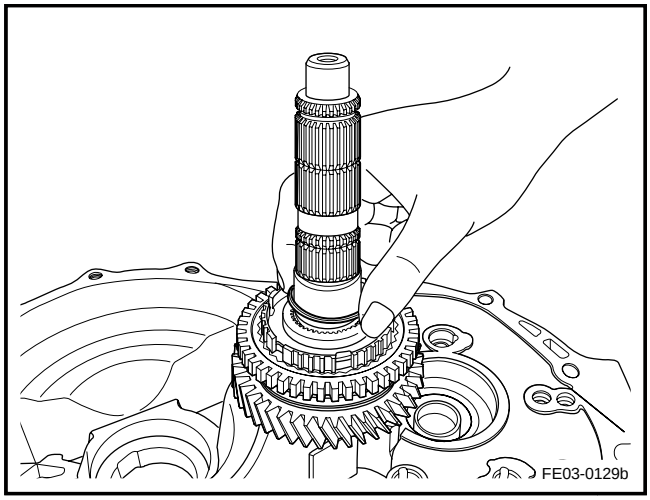
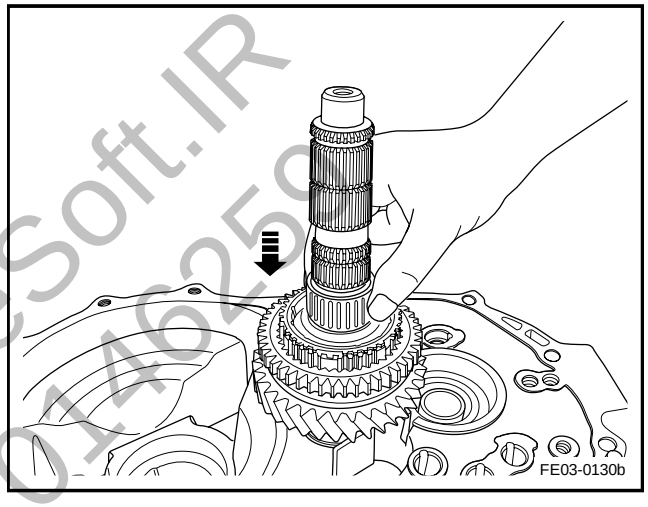
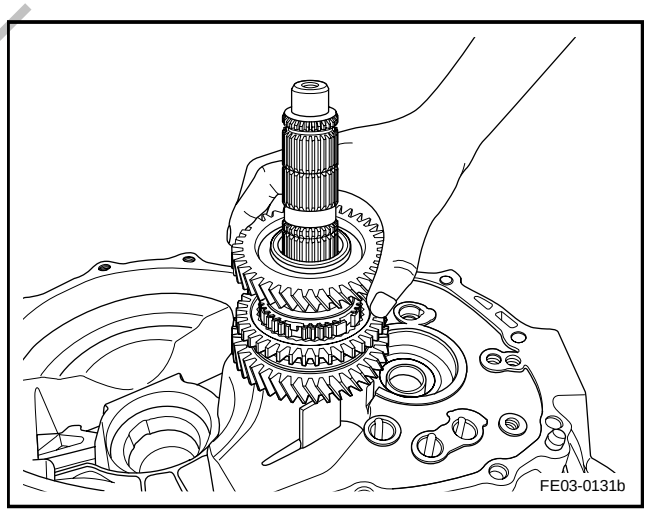
5. Install 2nd speed gear needle bearing retaining ring.



6. Install 2nd speed gear needle bearing.



7. Install the 2nd speed gear.



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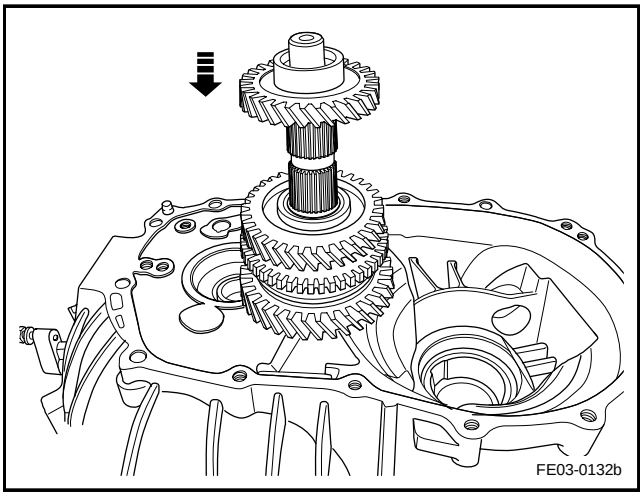
8. Install the 3rd speed gear.

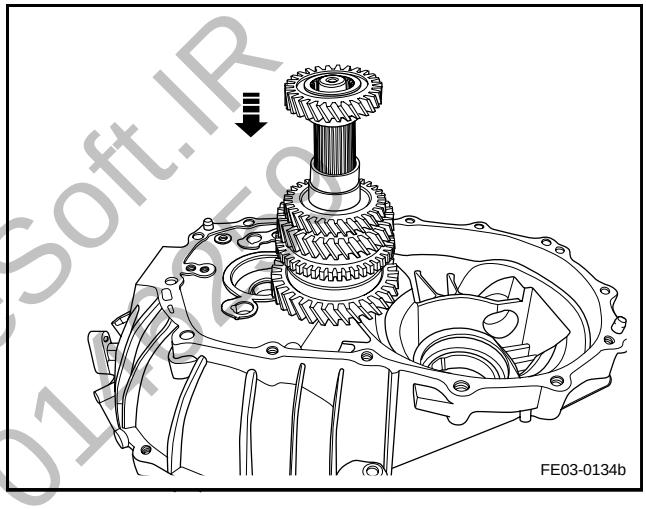
Notes :3rd speed gear required press by pressure bed, upward of boss face !



9. Install bushing of 3rd speed gear and 4th speed gear

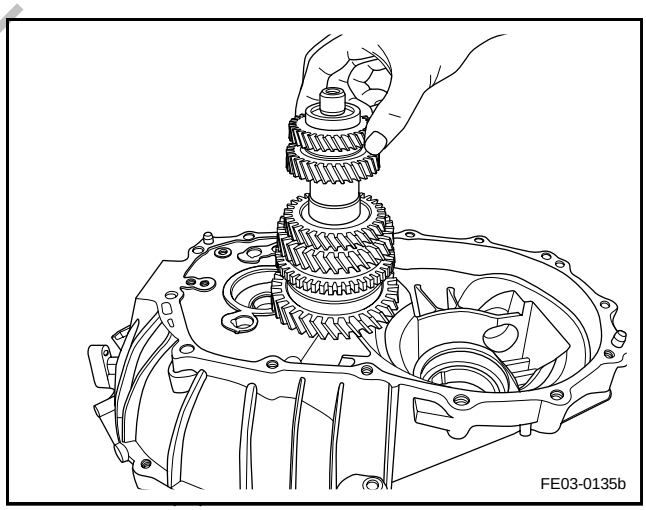
10. Install the 4th speed gear

Notes : 4th speed gear was pressed by pressure, One face is downward with boss !



11. Install the 5th speed gear.

Notes : 5th speed gear was pressure by pressure bed , one face is upward by boss



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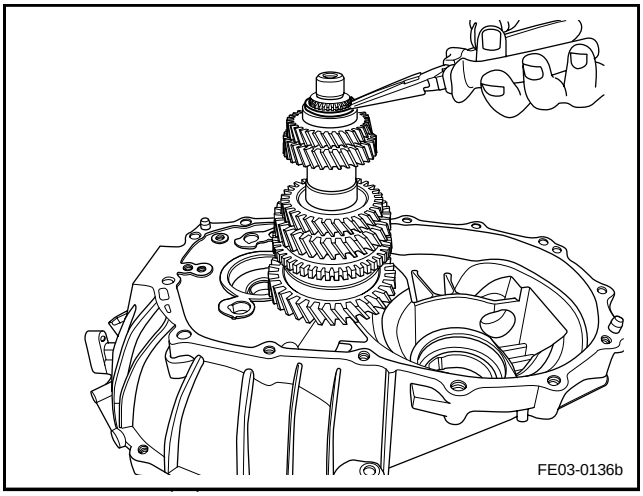
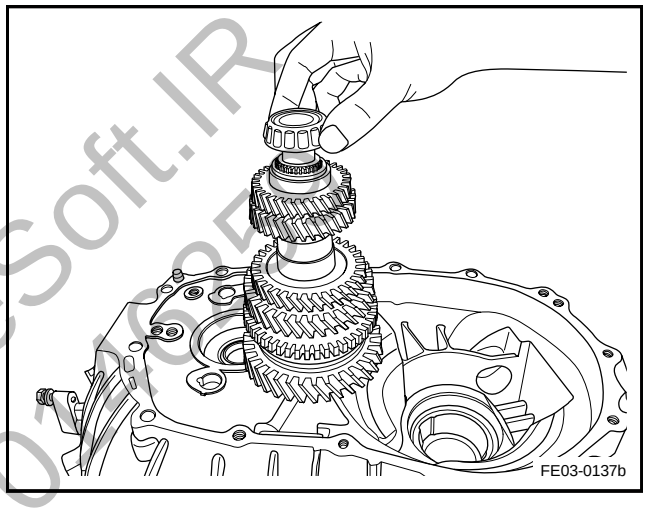
12. Install 5th speed gear snap spring.



13. Install rear support bearing of main shaft.



14. Install main shaft assembly.
15. Install fork shaft.Refer to“3.4.8.6 fork shaft replacement”.
16. Install shift control mechanism assembly, refer to“3.4.8.4 shift control mechanism assembly replacement”.
17. Install transmission assembly; refer to“3.4.8.3 transmission assembly replacement”.

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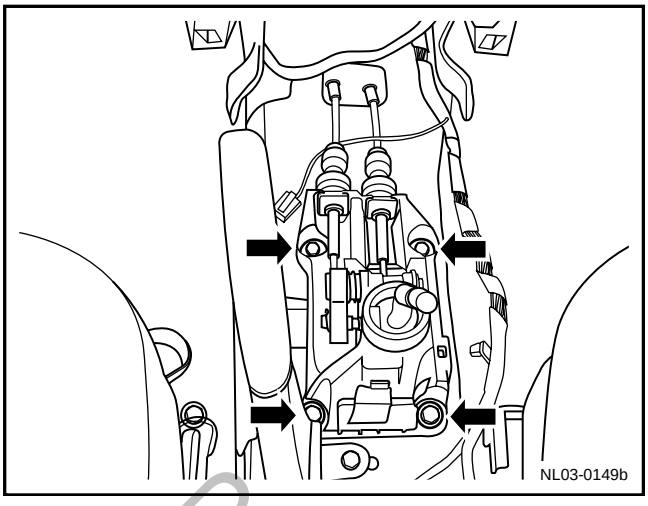
3.4.8.9 Shift control lever replacement

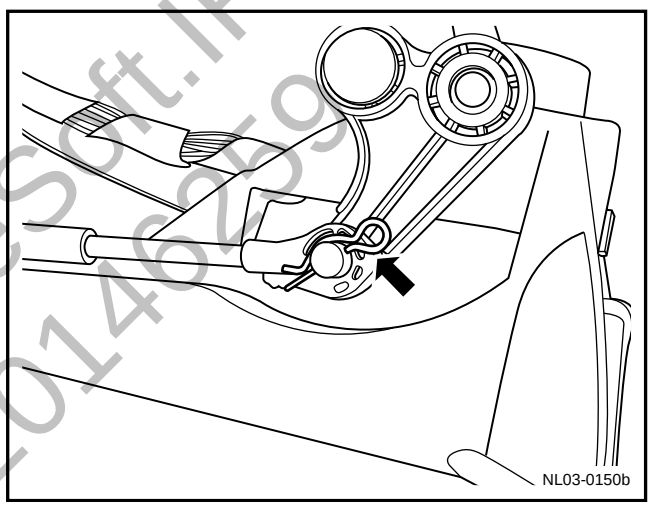
Dismantle procedure

Warning: refer to warning for battery disconnection in the warning and precaution ,

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of auxiliary instrument panel, refer to 12.8.3.2 Replacement of auxiliary instrument panel.
3. Dismantle 4 shift control lever fixing bolts as shown in the figure.

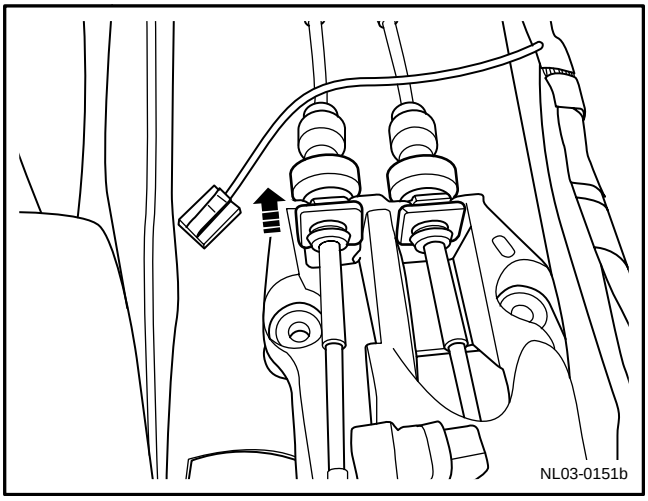


4. Take out selecting rod of snap spring.



5. Dismantle fixing sleeve of selecting gear cable

Notes: Selecting lever cable hardly poke up, and then Dismantle the selecting lever cable, black fixing bushing is as a whole was intalled on the cable.



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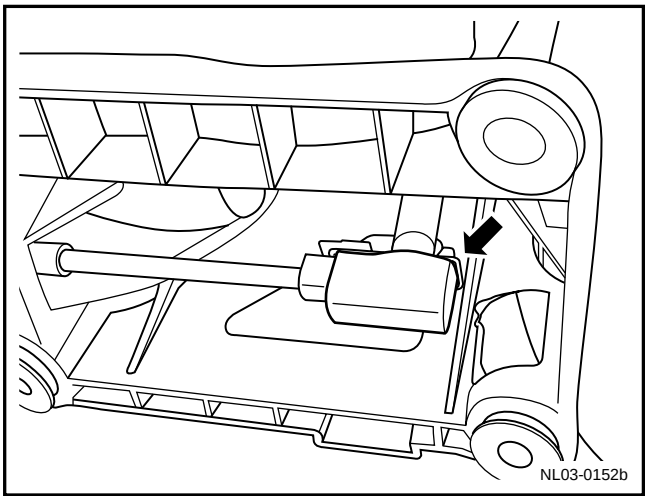
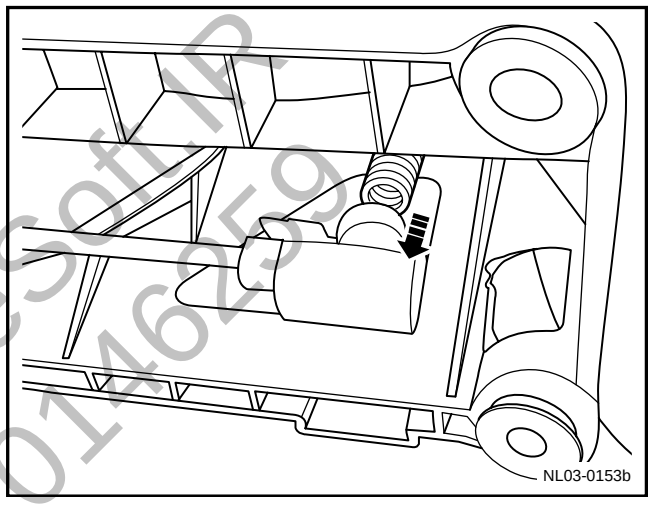
6. Snap spring move into both sides by straight screwdriver.

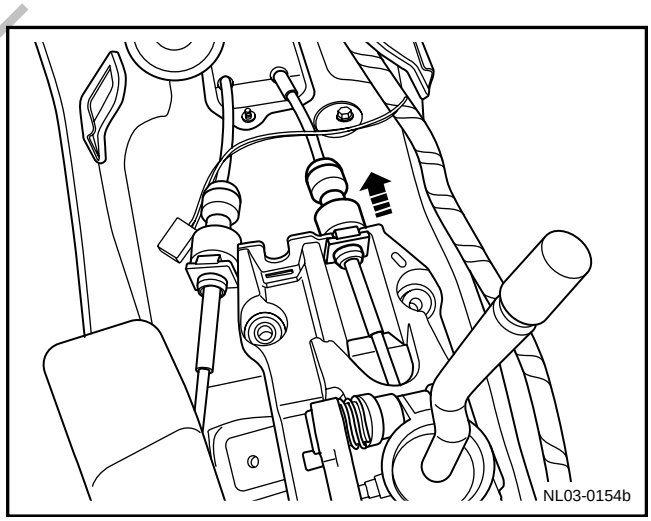


7. Take out shift lever cable



8. Take out fixing bushing of shift lever cable.

Notes: Selecting lever cable hardly poke up, and then dismantle the selecting lever cable, black fixing bushing is as a whole was intalled on the cable.



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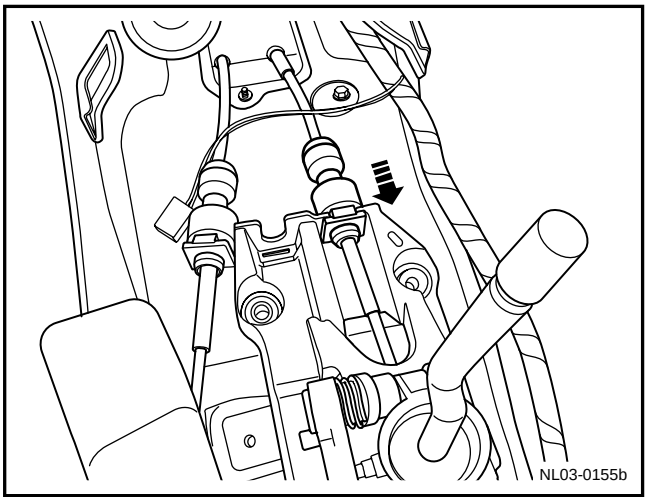
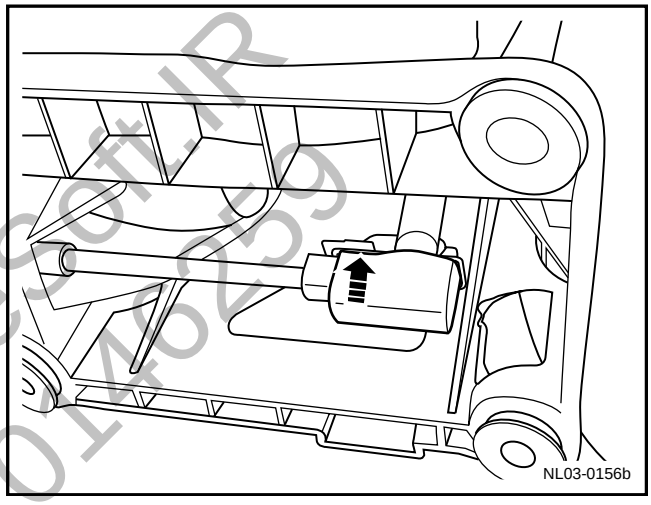
Installation procedure::

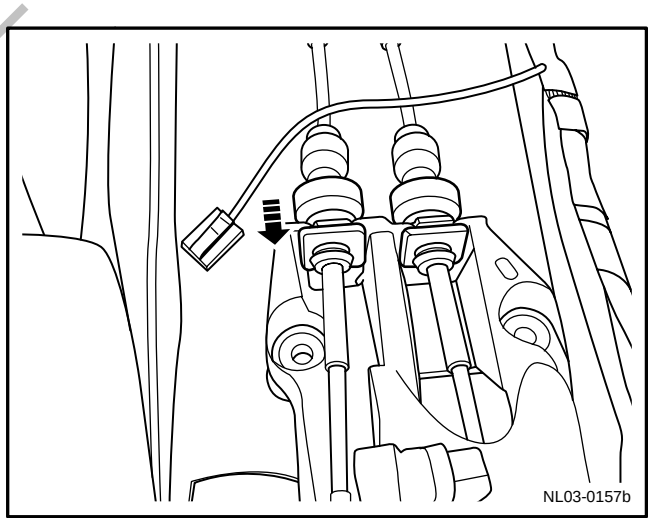
1. Install fixing sleeve of shift lever cable .pushed down hard enough.



2. Press shift lever cable into under the control lever, and confirm it was installed in the correct position.



3. Install the fixing bushing of shift lever cable, press down it.



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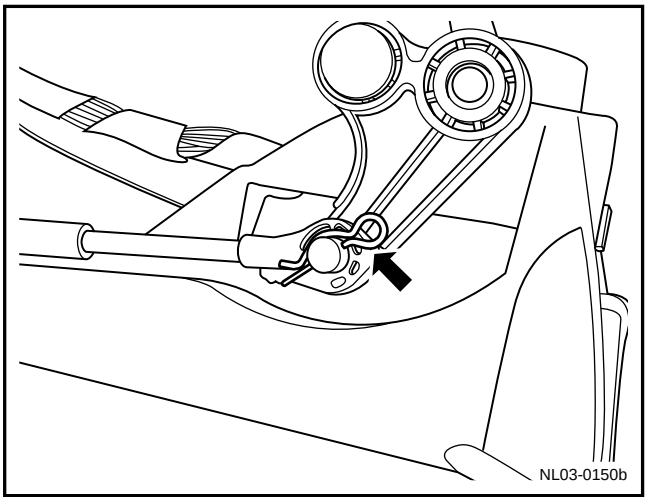
4. Install plug of selecting lever cable, press down downward it.

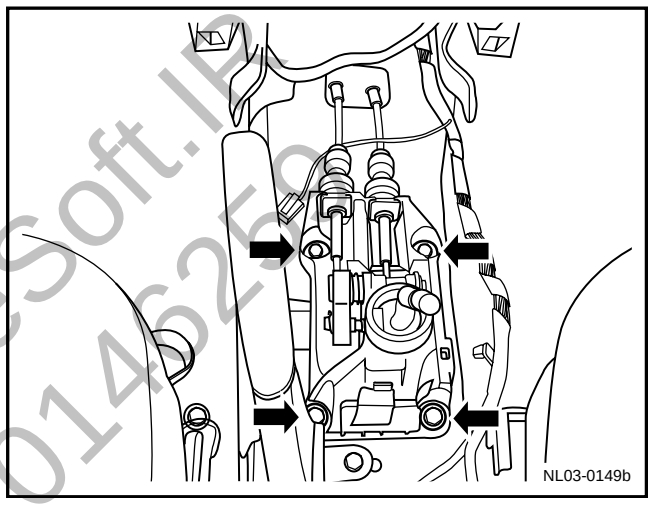


5. Install and tighten manual shifter assembly fixing bolt, at the same time, confirm ed shift operation is normal.

Torque :25Nm(Metric) 18.5lb-ft(English system)

6. Install the auxiliary instrument panel.

7. Connect the battery negative cable.



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3.5 DSI Automatic transmission

3.5.1 Specifications

3.5.1.1 Fastener specifications

Fastener name	Torque range	
	N.m (Metric system)	English system (lb-ft)
Check plug of transmission oil level	25—30	18.4—22.1
Connection of front cooling pipe and transmission	Max.13	Max.9.6
Connect rear cooling pipe with transmission	Max.13	Max.9.6
Connecting bolt of torque convertor and drive plate	40—42	29.5—31.0
Nut was connect the selecting rod of transmission and cross shaft	14—20	10.3—14.8
Nut of transmission oil tray of transmission	7—8	5.1—5.9

3.5.1.2 Automatic transmission fluid specification

Items	Specified sealant
Automatic transmission fluid (ATF)	Fuchs FES 209-3292

3.5.1.3 Relation of temperature sensor resistance and temperature for automatic transmission fluid

Temperature (℃) /(℉)	Min. resistance(kΩ)	Max. resistance(kΩ)
-40 / -40	1467	1896
-30 / -22	778.4	984.2
-20/-4	430.7	533.9
-10/14	247.3	301.1
0/32	146.8	175.7
10/50	89.95	106
20/68	56.74	65.86
30/86	36.76	42.10

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40/104	24.43	27.61
50/122	16.60	18.54
60/140	11.53	12.73
70/158	8.161	8.916
80/176	5.880	6.360
90/194	4.306	4.614
100/212	3.201	3.399
110/230	2.392	2.562
120/248	1.811	1.955
130/266	1.388	1.510
140/284	1.075	1.179
150/302	0.843	0.930

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3.5.2 Description and operation

3.5.2.1 DSIAutomatic transmission overview

The speed change gear has the following characteristics:

- Six forward gears are provided.
- A reverse gear is provided.
- A hydraulic torque converter is provided and includes a lock clutch capable of carrying out sliding abrasion control.
- Employ the electric gear shift and pressure control
- A single planetary gear row is provided.
- A double-planetary gear row is provided.
- A hydraulic control brake belt and a multi-friction sheet type brake are provided.
- Four multi-sheet wet clutches (clutches C1, C2 and C3 and brake B1) are provided.

All hydraulic functions are controlled and managed by an electromagnetic valve:

- Adjusting meshing
- Adjusting shift mass
- Selecting mode of shift curve
- Adjust hydraulic torque converter

This automatic transmission uses synthesized automatic transmission oil. To ensure the automatic transmission can normally operate within its service life, you must replace the automatic transmission oil per 60000km traveled.

The engine power is transmitted to the automatic transmission through the hydraulic torque converter with the lock clutch.

This automatic transmission provides gear shift among six forward gears and one reverse gear by means of the combination of one driving single-row planet wheel and one driven dual-row planet wheel and such type of gear structure is usually referred to as Lepelletire type gear assembly.

DSIAutomatic transmission control by electrical, its control system composition as follow:

- Input shaft and the output shaft speed sensor
- Four switch electromagnetic valves and fix variable flow electromagnetic valve units
- Hydraulic torque converter (TC)
- Automatic transmission control module (TCU)
- Internal embedded memory module (EMM)

Operate the internal clutch of the transmission and the brake strap by controlling the flow direction and pressure of the automatic transmission fluid (ATF). The transmission control unit (TCU) can control all electronic components as well as the gear selection, shift pressure and trackslip of the hydraulic torque converter.

If the transmission incurs the system fault, the transmission control unit (TCU) can also maintain maximized run of the function of the transmission through fault mode effect control (FMEC). If the transmission control unit (TCU) is completely out of control or powers off, the transmission still can retain its basic variable speed function (i.e., parking, reversing, and driving at neutral and fourth gear. The fourth forward gear, the reverse gear and the hydraulic torque converter clutch can be opened via the pure hydraulic system in the case without electronic control assistance completely.

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The transmission also comprises an externally built gear (P, R, N and D) selector sensor (gear switch) and a built-in gear box oil temperature sensor.

Under the application program of the manual mode, the transmission control unit (TCU) further needs to obtain the relevant signal from the transmission selector to determine the time that the driver stars the function of the manual mode.

If the transmission is broken down seriously or the other parts of the whole vehicle are broken down affecting the normal operation of the transmission, the transmission control unit (TCU) can automatic operate the limp home (malfunction) mode, thereby ensuring the vehicle can travel to the authorized dealer for maintenance. In limp mode, the engine malfunction (MIL) indicator lamp on the dashboard will be controlled to turn on, and the transmission will continue to operate in the case of functional limitation. The limit grade of the function depends on the severity of the fault detected by the TCU.

If the transmission overheats, the shift mode shall be automatically switched to the working condition that is conductive to the transmission cooling.

In extremely high temperature environments, in order to protect the transmission hardware, the transmission control unit (TCU) would disable all the shift functions of the transmission, so that the transmission is in the neutral state, until the transmission oil temperature is cooled to a safe level.

The transmission control unit (TCU) can also perform the transmission diagnosis and monitor all components that may affect the emissions from the vehicle. The diagnosis protocol complies with the requirements of the on-board diagnosis protocol II. In addition, the additional diagnostic function is supported to ensure all faults are quickly dismantled under the use environment.

If the vehicle is broken down to tow, firstly dismantle the main driving axle or support the driving wheel off the ground, and then drag the vehicle. If not moving the main transmission shaft or dragging the vehicle after supporting the driving shaft, the transmission may be broken down due to insufficient lubrication of the transmission bearing.

If the occurrence of the failure mode is sporadic, pull out the ignition key to withdraw limp home mode, and restart after 30 s; if the fault is still present, the transmission will still re-enter the limp home mode. where whether the failure mode will appear again, immediately slow down to the nearest service station for repairs.

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3.5.2.2 Six forward gear characteristic

Emergency brake skip-level shift down function

When the emergency brake is detected, the transmission can downshift with skid-level to increase the engine brake in order to avoid the gear from suffering from instantaneous excessive pressure.

Uphill / downhill gear control

If releasing the accelerator pedal during uphill, the normal upshift will be postponed, thereby reducing the frequent replacement of the gear to alleviate the sense of effort when climbing. If releasing the accelerator pedal during downhill, the normal upshift will be also postponed, thereby improving the engine brake.

Forward gear and reverse gear

When selecting forward gear or reversing gear, impact startup may be avoided from resulting in vehicle running forward through gentle clutch engagement performance. The process is realized by limiting the engine speed and torque. When the shift level is put into the position D or R immediately from Position P or Neutral, the time from starting gear shifting to completely combining the clutch is less than 2.2s.

Note: the vehicle can be switched from gear D to gear N in the process of moving; if the speed is higher, put into the gear D from the gear N; in order to ensure the safety of the transmission and the vehicle, the transmission control unit (TCU) does not engage the gear immediately; when the following conditions are met, restore the corresponding gear to drive, with slight impact at the moment. For safety consideration, put the vehicle back to Gear D after stopping the vehicle completely.

Combination condition-gear D:accelerator pedal opening is less than 20%;

The engine speed is less than 2,000 rpm.

Combination condition-gear R:

Accelerator pedal opening is less than 12%;

The engine speed is less than 1,700 rpm;

The vehicle speed is lower than 10km/h.

The torque converter clutch can be locked under all gear conditions.

This transmission can lock the torque converter clutch under all gear conditions. This function can save fuel and improve the vehicle performances. Further improve the transmission cooling efficiency when driving with large load at low speed, such as driving in city or mountain.

Embedded memory module

During the assembly of the transmission, the embedded memory module (EMM) is matched with the transmission valve body to ensure the precise shift quality. Embedded memory module (EMM) is installed on the transmission valve body. Embedded memory module (EMM) is used for storing data, such as valve body calibration data and valve body S/N data.

Upon completion of the installation, the transmission control unit (TCU) will download data from the embedded memory module (EMM) and use such data when the transmission is in operation.

3.5.2.3 Transmission cooling system

The transmission cooling system ensures rapid warm-up and the transmission can operate at a constant temperature to reduce the fuel consumption and ensure the high shift quality.

The transmission cooling system also comprises the cooler branch in the hydraulic system, so it can be ensured that a sufficient amount of coolant and lurbcant is conveyed to the transmission system of the transmission when the transmission cooler is blocked.

Max.stall pressure (Max.flow is 6.5 lt/min with 90℃)	Max. 1.65 bar

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3.5.2.4 Shift strategy

Shift transformation

Gear shifting of the transmission is controlled by the transmission control unit (TCU). The transmission control unit (TCU) receives different signals from all engine and vehicle sensors and select appropriate shift curves and controls the shifting quality and the action of the hydraulic toruqe converter clutch (TCC) in each shifting process.

Sliding downshift

Slide downshift occurs in the course of the vehicle sliding until stopping, the throttle pedal is completely released, so that the transmission automatically downshift in the free slide deceleration process of the vehicle.

Torque demand

When the torque needing for the driver is more than that provided by the engine under such transmission ratio, the transmission will open a hydraulic torque converter clutch (TCC) to provide extra torque output.

Manual mode

Differing from the Manual transmission, the manual mode of the automatic transmission includes certain automatic control factor in order to avoid high engine speed to damage the transmission.

When the shift level is in the position M, the driver can define the applicable gear positions through + or - on the selector When initially moving the shift level to a manual M position, the transmission will select the minimum applicable gear position.

Note: if the higher gear is selected under the condition that the vehicle speed is too low, or the lower gear is selected under the condition that the speed is too high, a shift operation shall not be executed with the consideration of the vehicle safety.

If the engine speed or the vehicle speed is too low, the transmission will automatically downshift to maintain the minimum engine speed. The downshift process is the same as the automatic control of the gear D.

In manual mode function, in order to prevent the low engine speed from affecting the normal engine operation and safety, the upshift with manual mode function needs to meet certain speed requirements; otherwise, upshift action will not be executed. The following table is the minimum upshift speed (actual speed may have smaller deviation) in the manual mode.

Up gear	1-2	2-3	3-4	4-5	5-6
Speed (km/h)	>0	>12	>38	>45	>69

In manual mode function, in order to prevent the excessive engine speed from affecting the normal engine operation and safety, the downshift needs to meet certain speed requirements; otherwise, downshift action will not be executed. The following table is the minimum upshift speed (actual speed may have smaller deviation) in the manual mode.

Downshift	6-5	5-4	4-3	3-2	2-1
Speed (km/h)	<170	<146	<110	<70	<40

When the shift level in the uplift position or downlift position exceeds 500ms, the system defaults that the driver hopes to operate at the maximum or minimum gear position. At this time, even if the manual operation is not done any more, the gear also automatically gradually switch the maximum or minimum gear shifts allowed by the current speed.

When the position of the accelerator pedal exceeds 80%, the system will withdraw from the manual mode, and at this tie, the control strategy of the gear D will be performed.

During manual shift, the automatic transmission may be slightly impacted; however, it is not sure that the automatic transmission is broken down.

When the shift level is in the position M, the driver can define the applicable gear positions through + or - on the level. When initially moving the control level to the manual M position, the transmission will maintain the current gear position.

When reaching the maximum of revolution speed of the engine, the transmission will automatically shift up no matter how the driver selects the gear position.

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State of 1st speed

The combination instrument displays the state of 1st speed. Engine brake can be used when the shift gear is in Manual 1st speed position different from Automatic 1st speed .

State of the 2nd speed

The combination instrument displays the state of the 2nd speed. Be capable of realizing 2-1 automatic kickdown through anxiously stepping on the accelerator pedal to the end. The engine brake can be used for the 2nd speed.

State of the 3rd speed

The combination instrument displays the state of the 3rd speed. Be capable of realizing 3-1 or 3-2 automatic kickdown through anxiously stepping on the accelerator pedal to the end. The engine brake can be used for the 3rd speed.

State of 4th speed

The combination instrument displays the state of 4th speed, be capable of realizing 4-3 or 4-2 automatic kickdown through anxiously stepping on the accelerator pedal to the end. The engine brake can be used for 4th speed.

State of 5th speed

The combination instrument displays the state of 5th speed. Be capable of realizing 5-4 or 5-3 automatic kickdown through anxiously stepping on the accelerator pedal to the end. The engine brake can be used for 5th speed.

State of 6th speed

The combination instrument displays the state of 6th speed. Be capable of realizing 6-5 or 6-4 automatic kickdown through anxiously stepping on the accelerator pedal to the end. The engine brake can be used for 6th speed.

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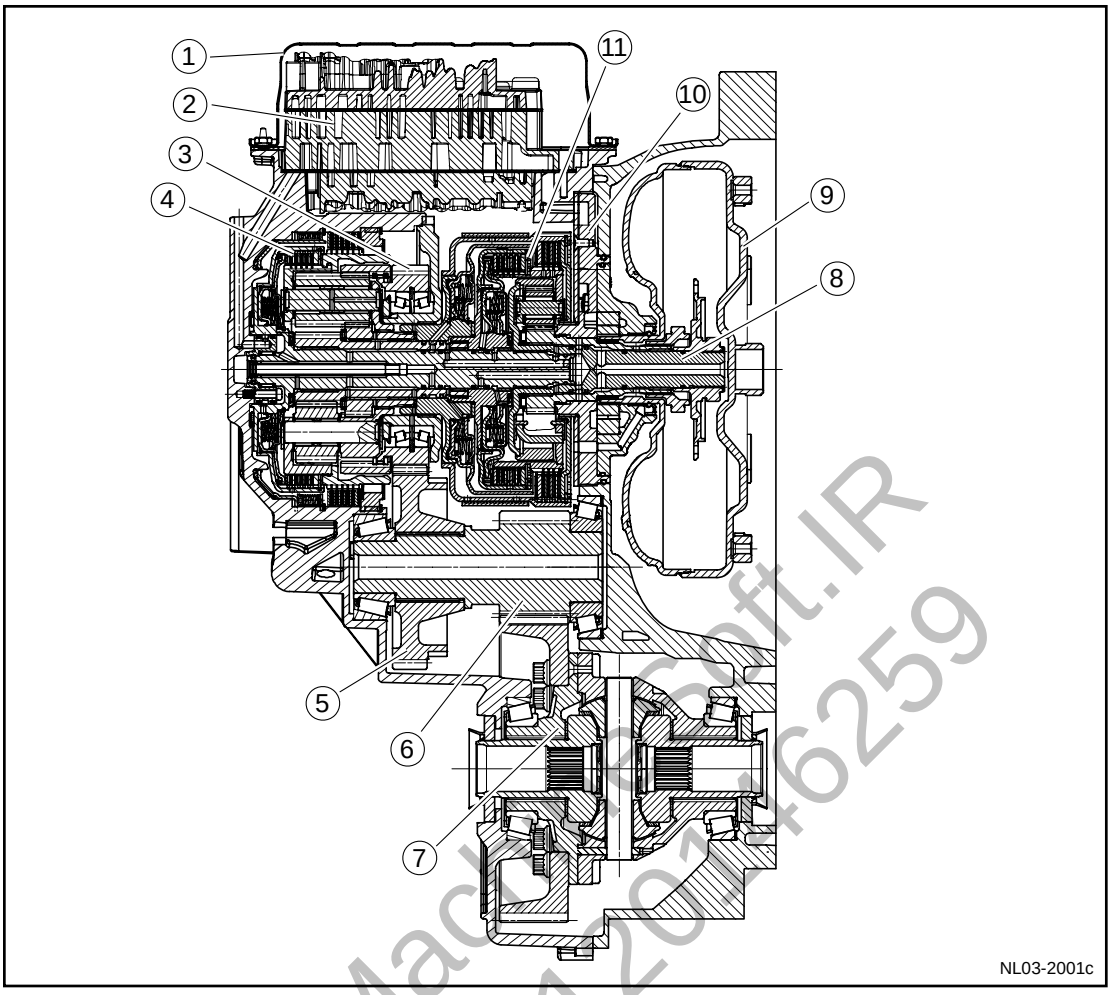
3.5.3 System operating principle

3.5.3.1 Automatic transmission structure principle

Section of automatic transmission



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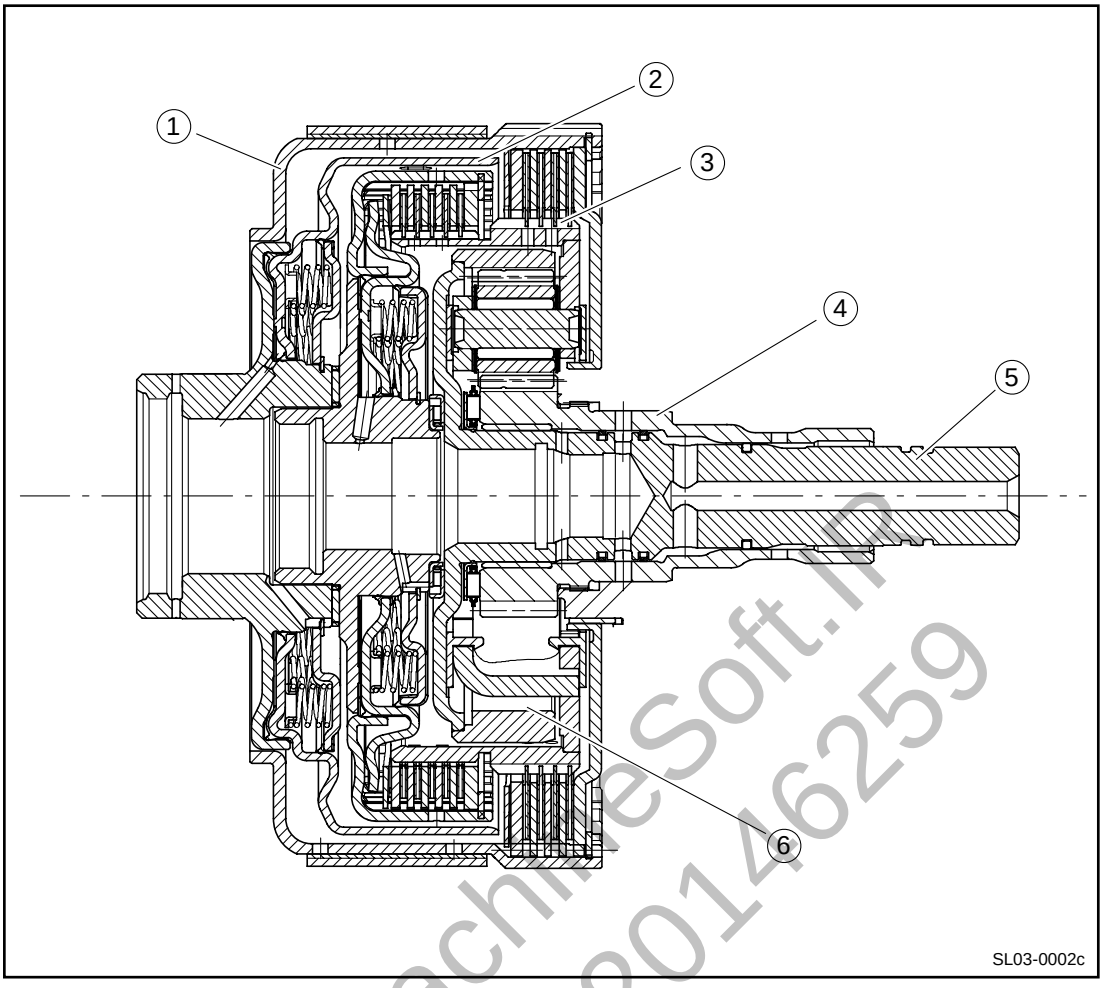
1. Oil Pan
2. Drive gear
3. Driven gear
4. Double-row planetary gear mechanism
5. Driven gear
6. Output shaft
7. Differential assembly
8. Input shaft
9. Torque converter assembly
10. Fuel pump
11. Single-row planet gear mechanism

Single-row planet gear mechanism and input shaft section diagram



1. C3 Outer gear hub of clutch
2. C2 Outer gear hub of clutch
3. Inner gear ring
4. Sun gear
5. Input shaft
6. Planet gear

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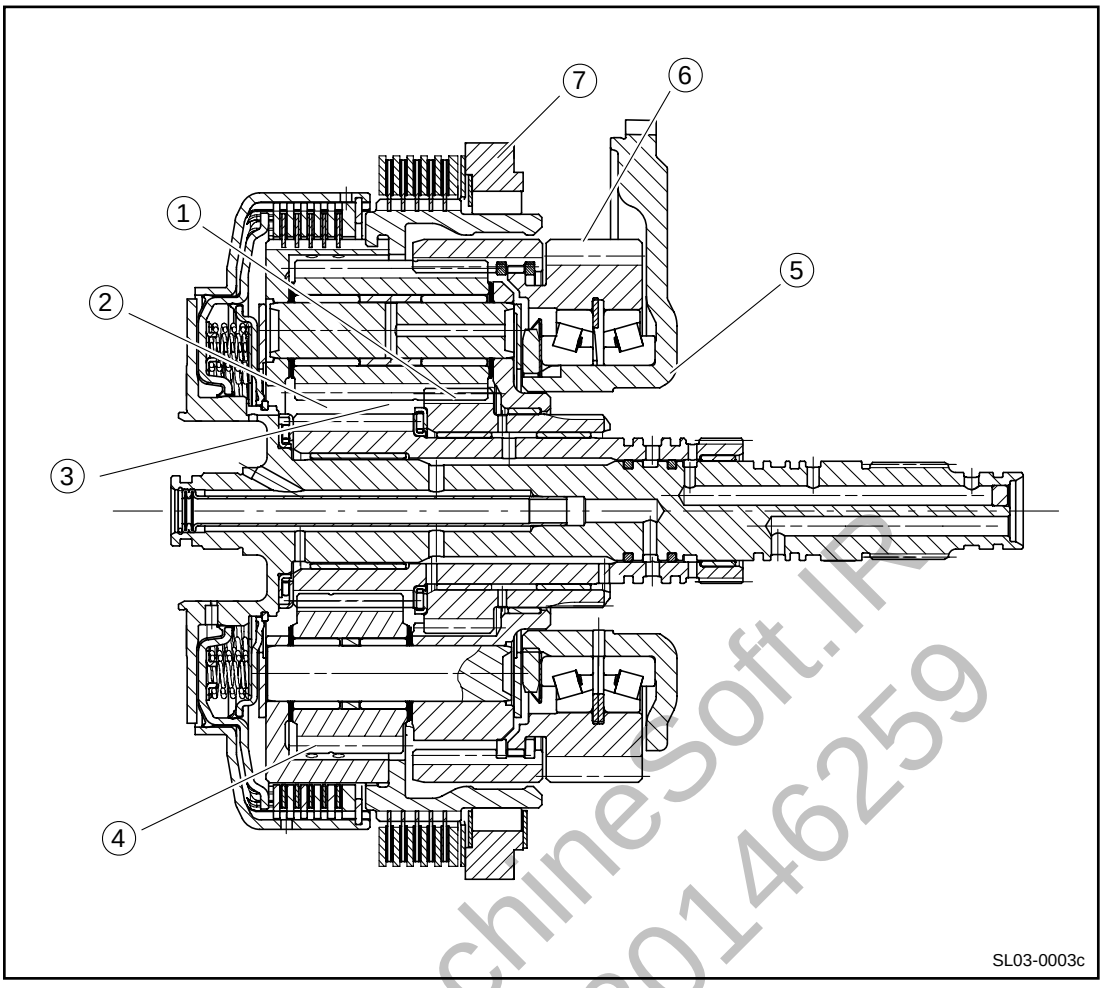
Section drawing of double row planetary gear mechanism



1. Rear sun gear
2. Front sun gear
3. Long planet gear
4. Short planetary gear
5. Intermediate support
6. Drive gear
7. One-way clutch

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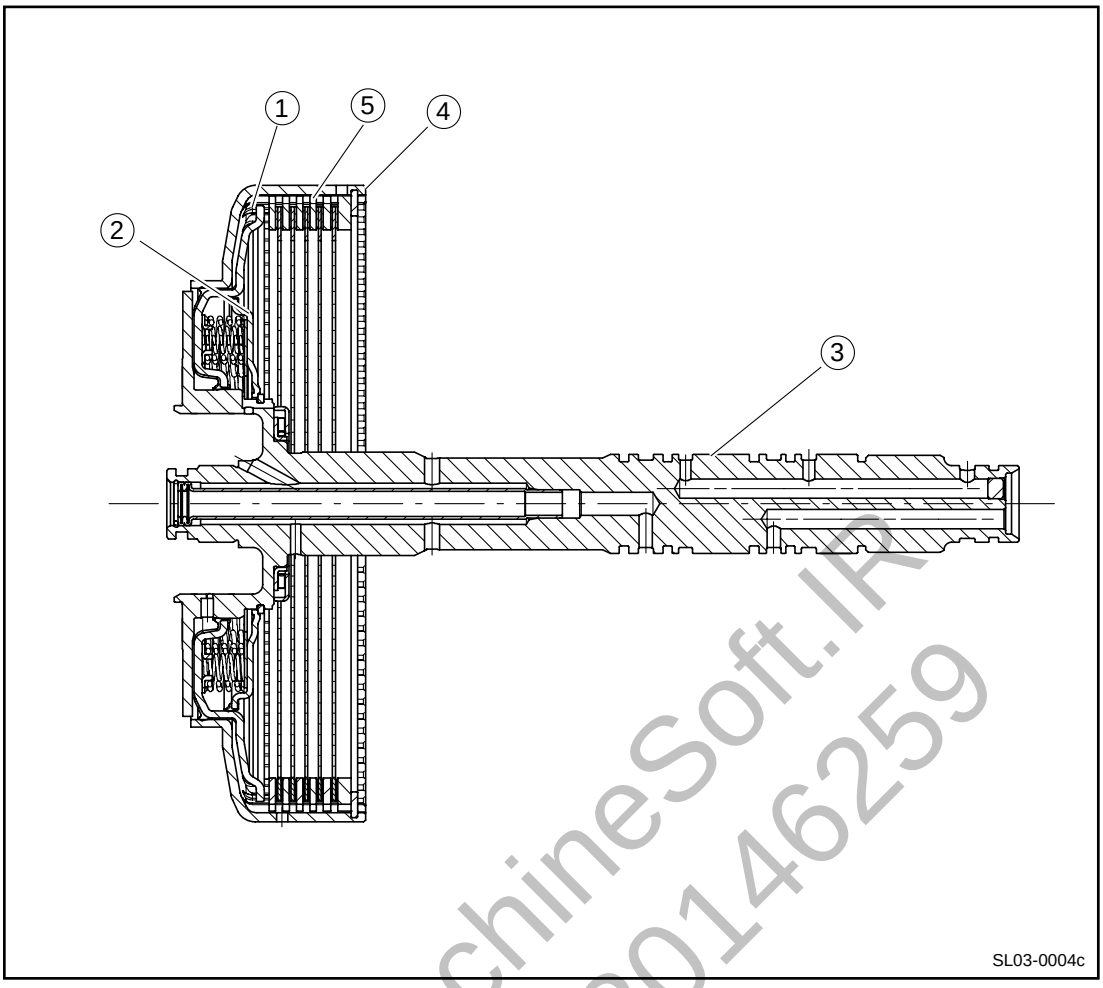
Section figure of C1 clutch and intermediate shaft



1. C1clutch piston
2. C1 clutch spring
3. Intermediate shaft
4. C1Outer gear hub of clutch
5. C1 clutch plate

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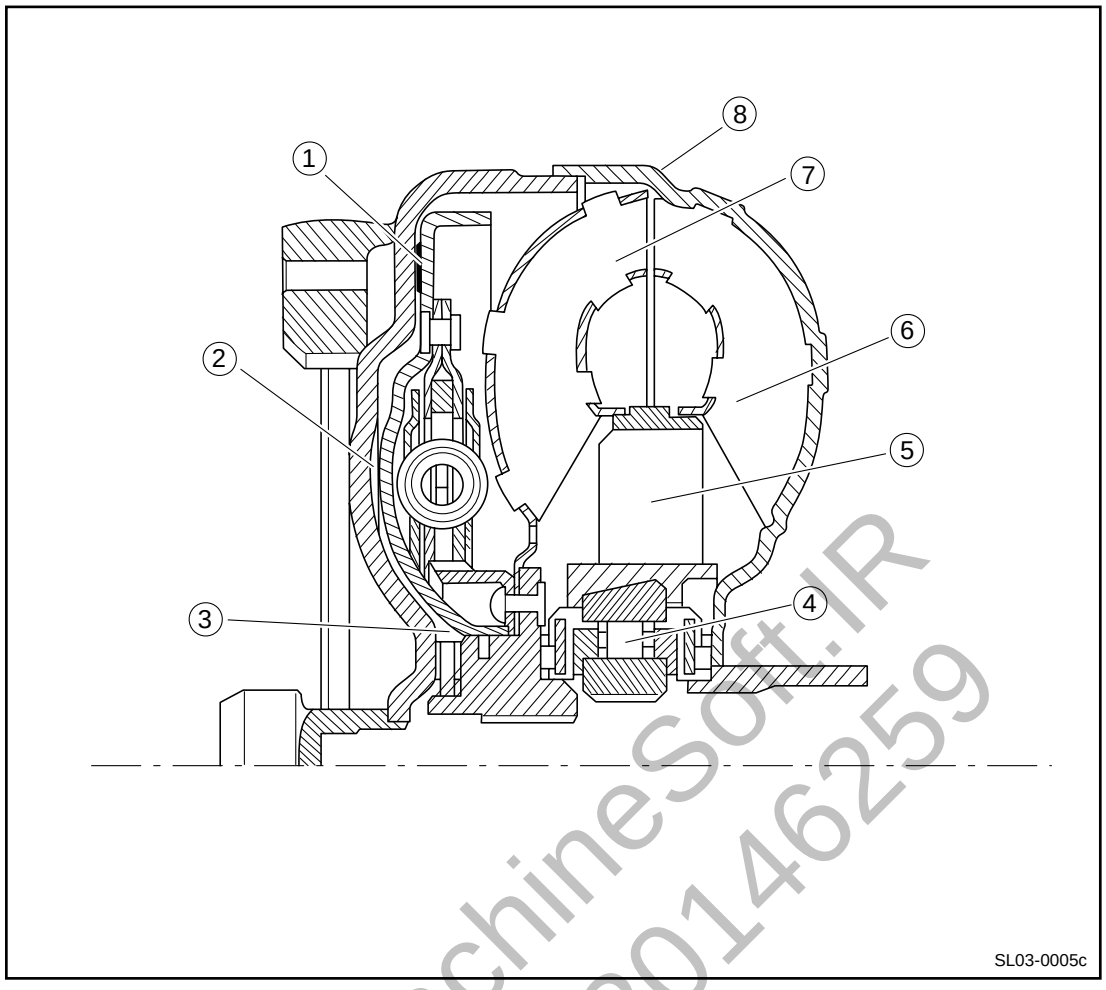
Section figure of torque converter



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1. Lock clutch lining plate
2. Lock clutch piston
3. Rear chamber of lock clutch
4. Single clutch rotor
5. Guide wheel
6. Pump wheel
7. Turbine
8. Torque converter cover

Hydraulic torque converter work principle

The torque converter contains a single-plate locking clutch. In any forward gear, control and realize the clutch lockout. Move the transmission oil pressure in the hydraulic torque converter from one side of the clutch to the other side thereof; apply the pressure to the other side to control the torque converter clutch. The torque converter can transmit and increase the torque. The torque converter consists of three parts, including:

- Pump impeller
- Guide wheel
- Turbine

The hydraulic torque converter is rotated by the following modes:

- The pump impeller is directly driven by the engine to enable the transmission oil in the torque converter to

flow.

- The transmission oil impacts the blades of the turbine, causing the change in the flowing direction of the transmission oil.
- The transmission oil flows out of the turbine and into the center to impact the pulley and changes in the flowing direction again here so as to enter the pump impeller.
- Torque reaction is caused by changing the direction of the guide wheel, so as to increase the torque that reaches the turbine.
- The torque ratio between the worm and the pump pulley is called as the torque magnification times or torque conversion coefficient, i.e., torque ratio.
- The greater the difference of the speed or revolution speed of impeller and the turbine is, the more the torque increased is. When the turbine is static, the torque is increased maximum. With the increase of the speed of the turbine wheel, the torque magnification value decreases gradually.
- When the turbine rotated at 85% speed, the torque conversion coefficient is 1, i.e., the torque on the turbine is not greater than that on the impeller.
- A one-way clutch is used for preventing a starter from reversing; and the shaft in torque converter housing can freely rotate in transmission oil to exceed the revolution speed of the one-way clutch. In the process of torque conversion, the starter drives the bearing to rotate with respect to the housing in term of the one-way clutch.

Hydraulic torque converter lock clutch:

The torque converter locking clutch is a device which can eliminate the mutual friction between the clutches within the torque converter, so it has a function of helping reducing the fuel consumption rate.

The hydraulic torque converter lock clutch is allowed to do slipping control at the speed of slightly lower than the normal speed of the engine, thereby improving the fuel economy.

The lock clutch of the hydraulic torque converter is engaged and released through the hydraulic control system.

The pressure on the hydraulic torque converter lock clutch piston depends on the electronic control pressure release valve (VBS).

In any forward gear, control the lock clutch of the hydraulic torque converter to lock.

The pressure of the rear space of the piston of the hydraulic torque converter lock clutch is discharged; meanwhile, the pressure of the liquid is extended from the turbine to the piston of the hydraulic torque converter lock clutch and extrudes the hydraulic torque converter housing, thereby locking the clutch between the piston and the housing and control at the normal temperature; moreover, the clutch grinds and transmits the torque to the planetary gear train.

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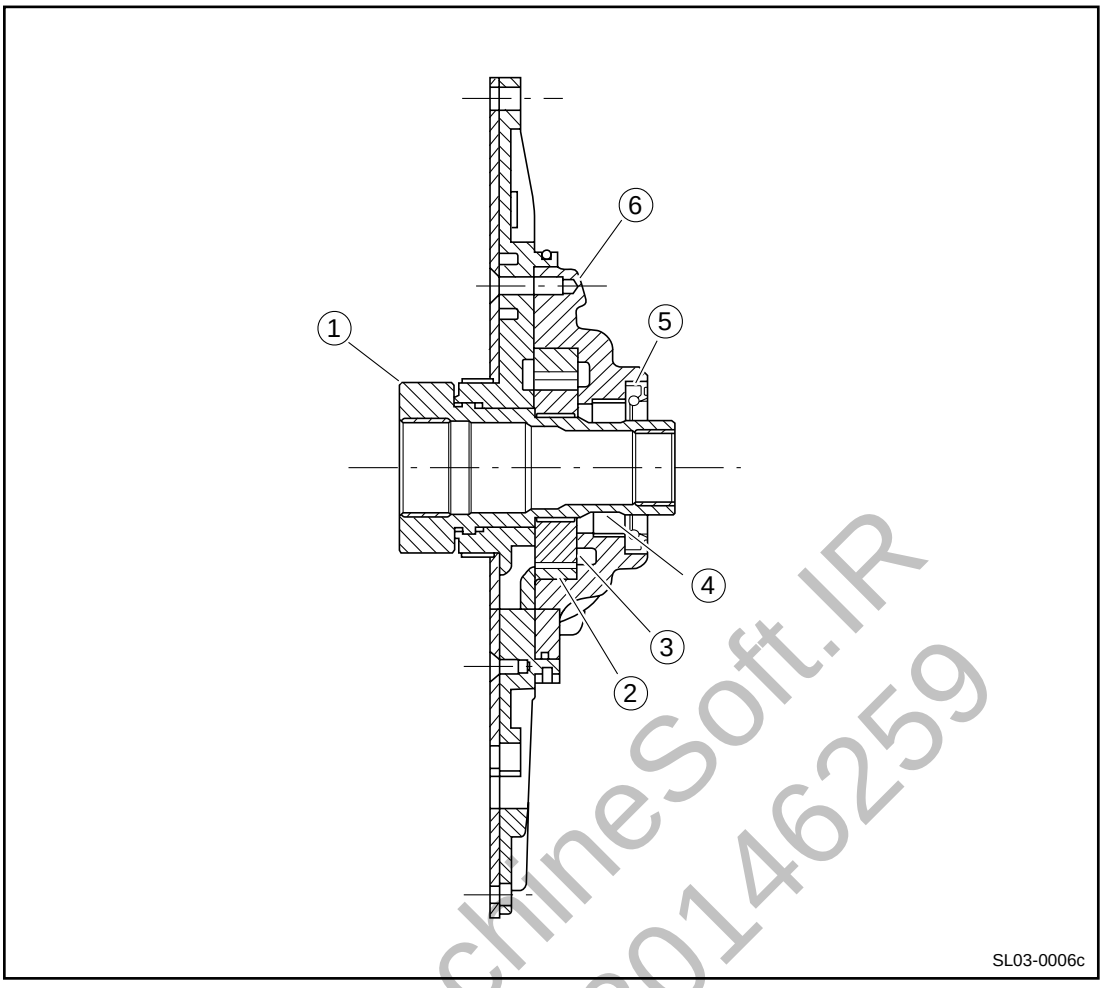
Section drawing of oil pump



1. Sun gear (single planetary gear)
2. Driven gear of fuel pump
3. Driver gear of oil pump
4. Support ring
5. Oil seal
6. Oil pump housing

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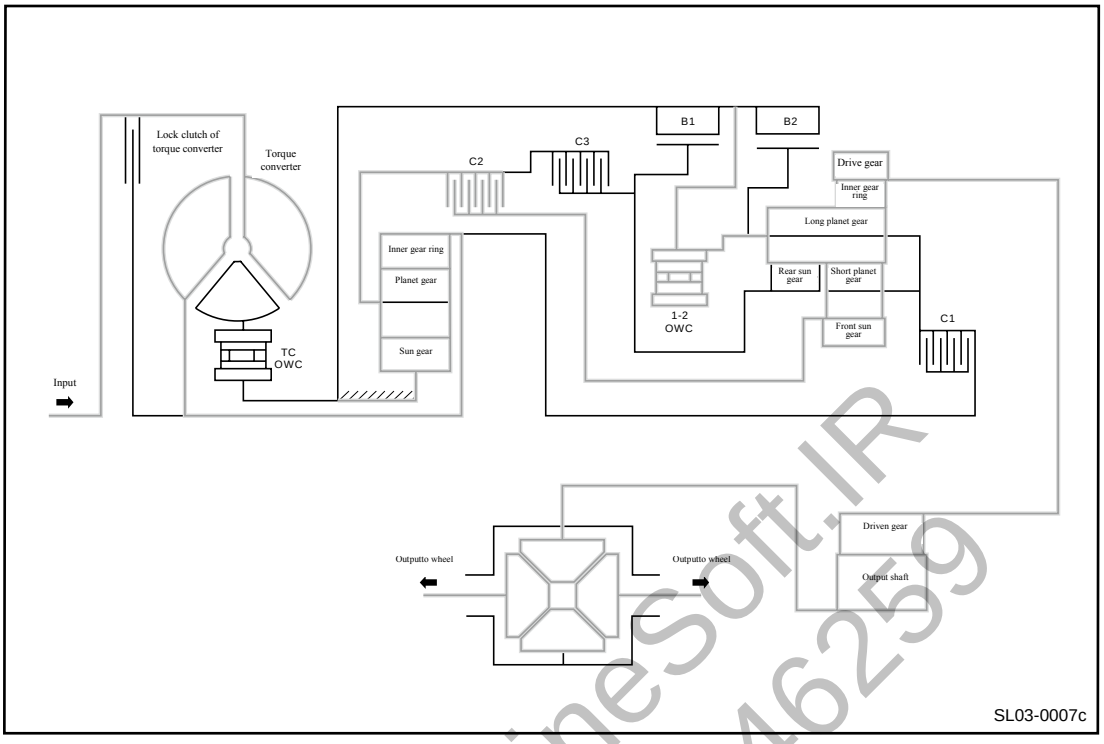
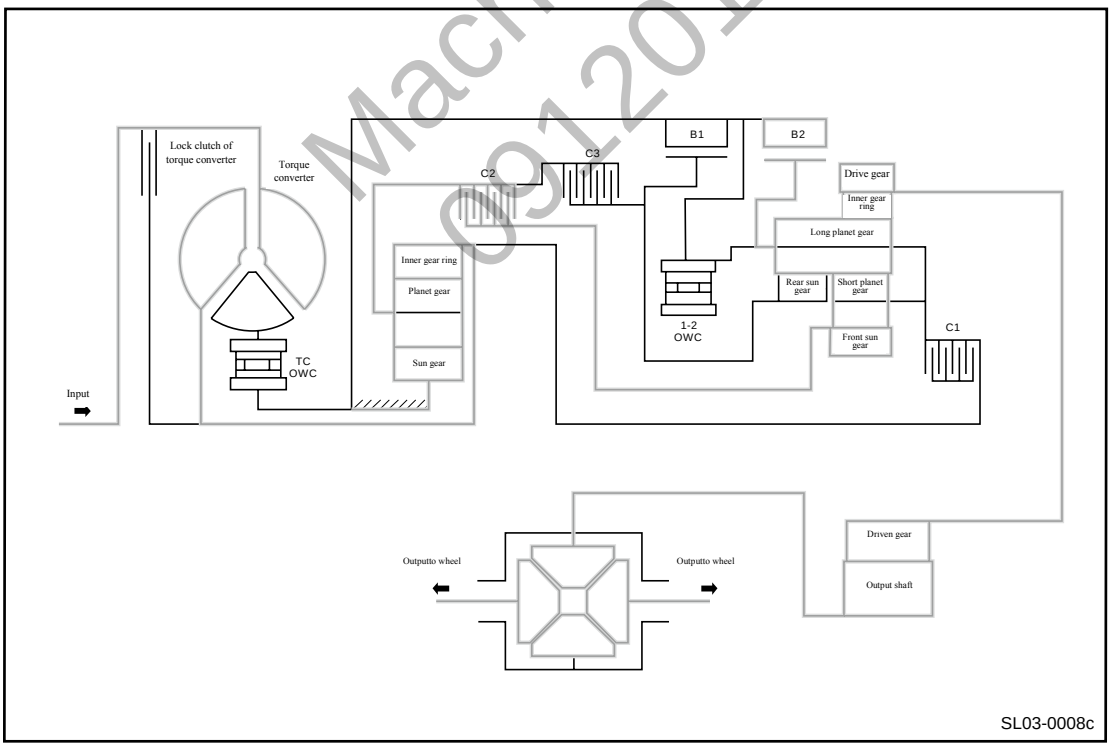
3.5.3.2 Shift work principle

Notes: Grey line mean power transmission path.

1st speed power transmission path (transmission ratio: 4,155:1)



Manual mode 1st speed power transmission path (transmission ratio: 4,155:1)



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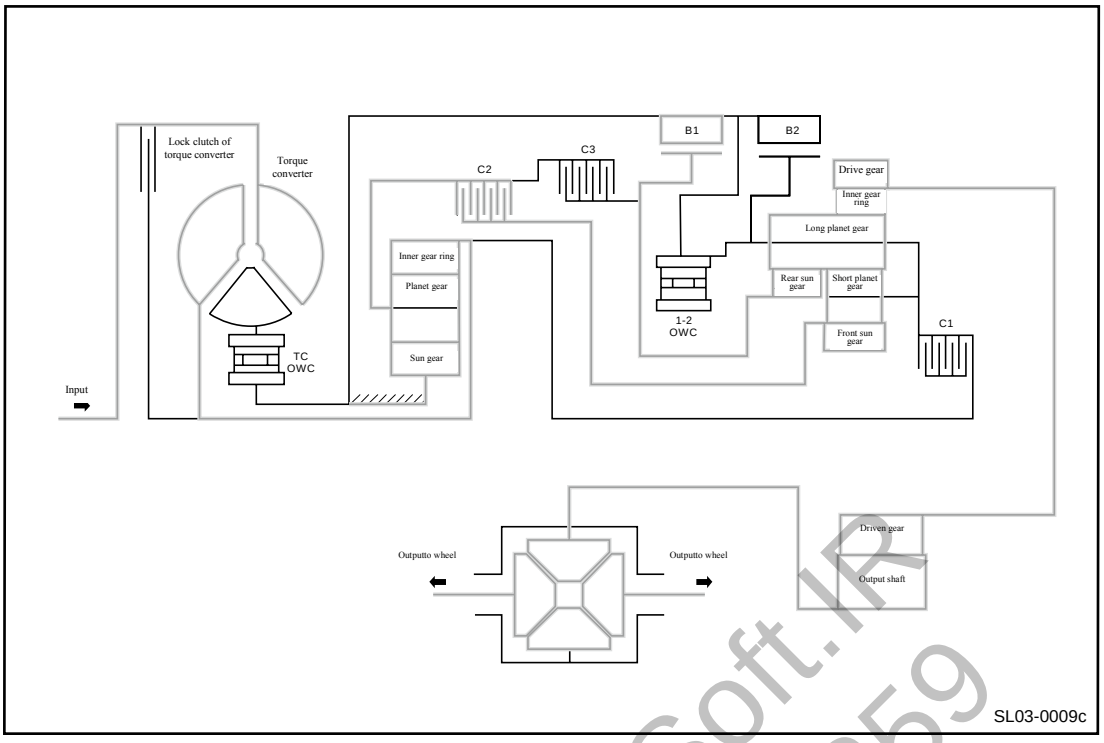
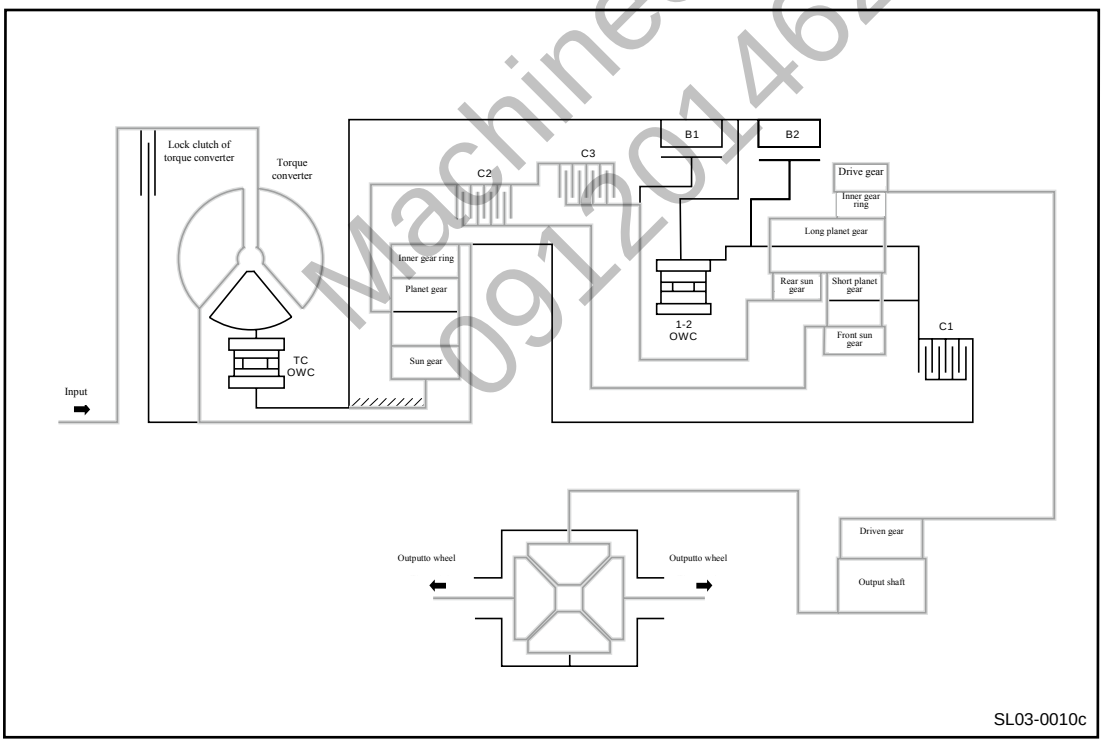
2nd speed power transmission path (transmission ratio: 2.375:1)



3rd speed power transmission path (transmission ratio: 1.522:1)



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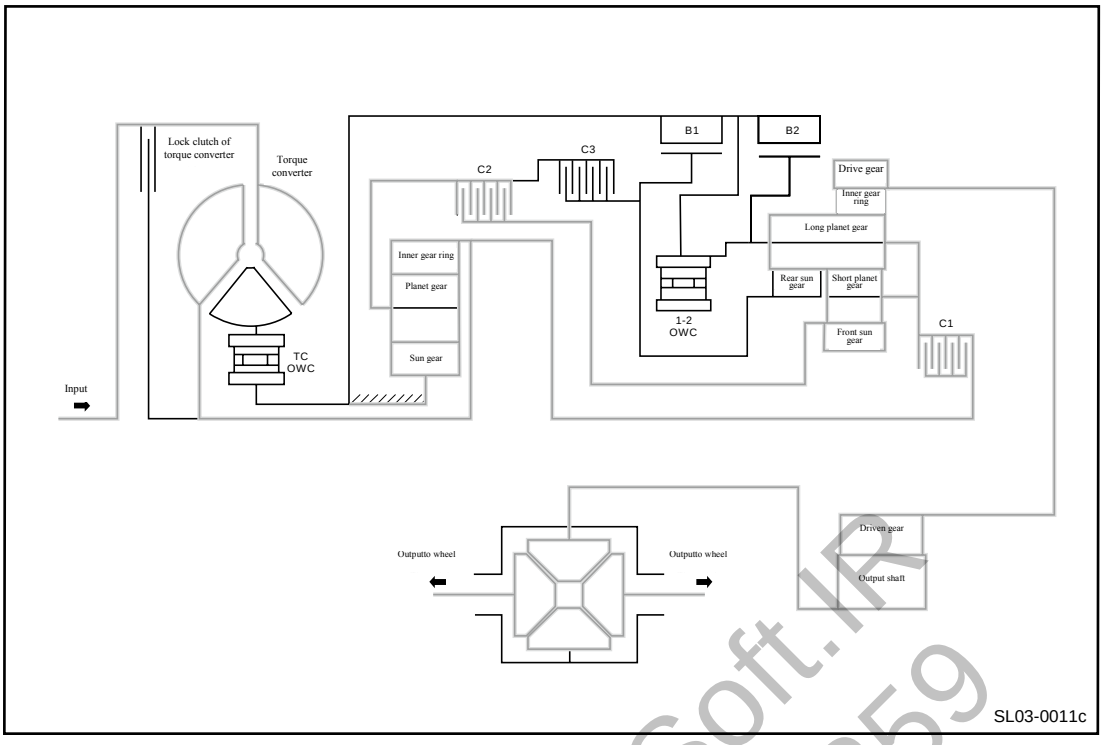
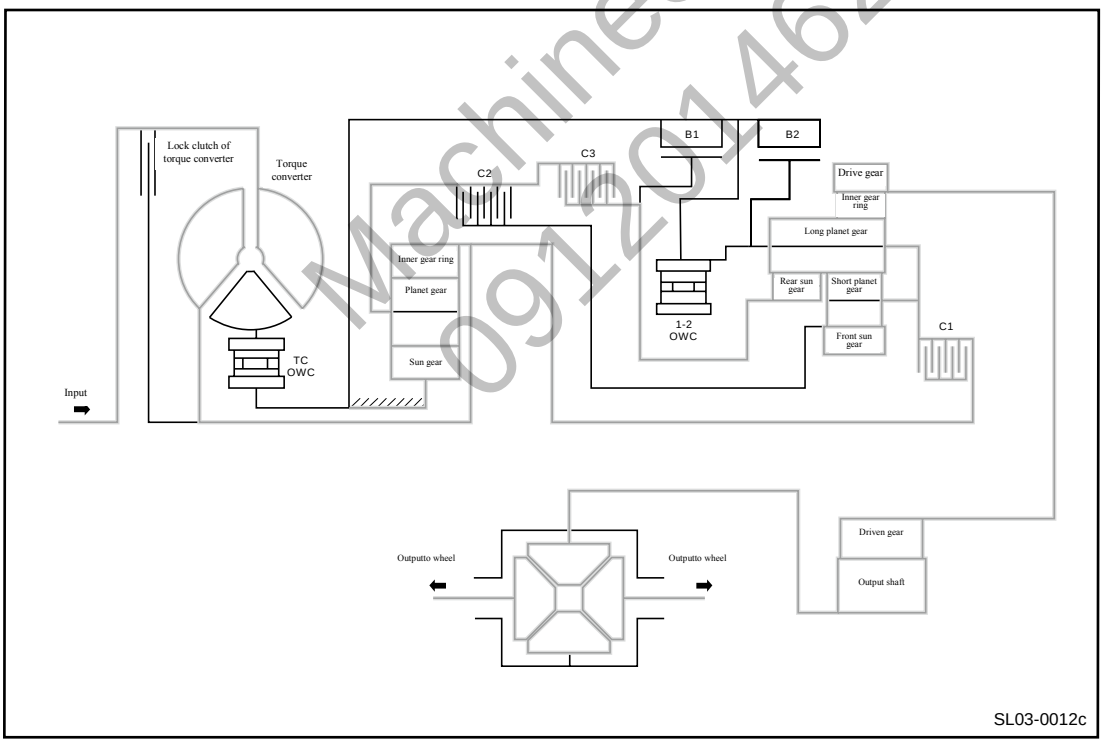
4th speed power transmission path (transmission ratio: 1,144:1)



5th speed power transmission path (transmission ratio: 0,859:1)



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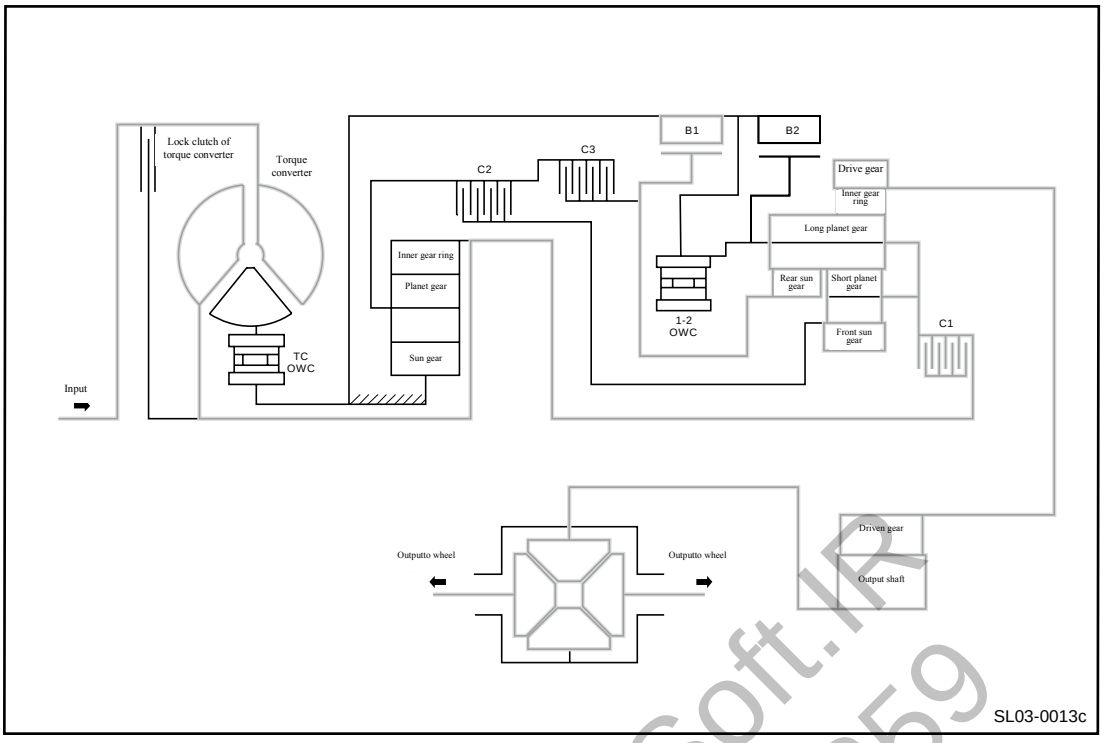
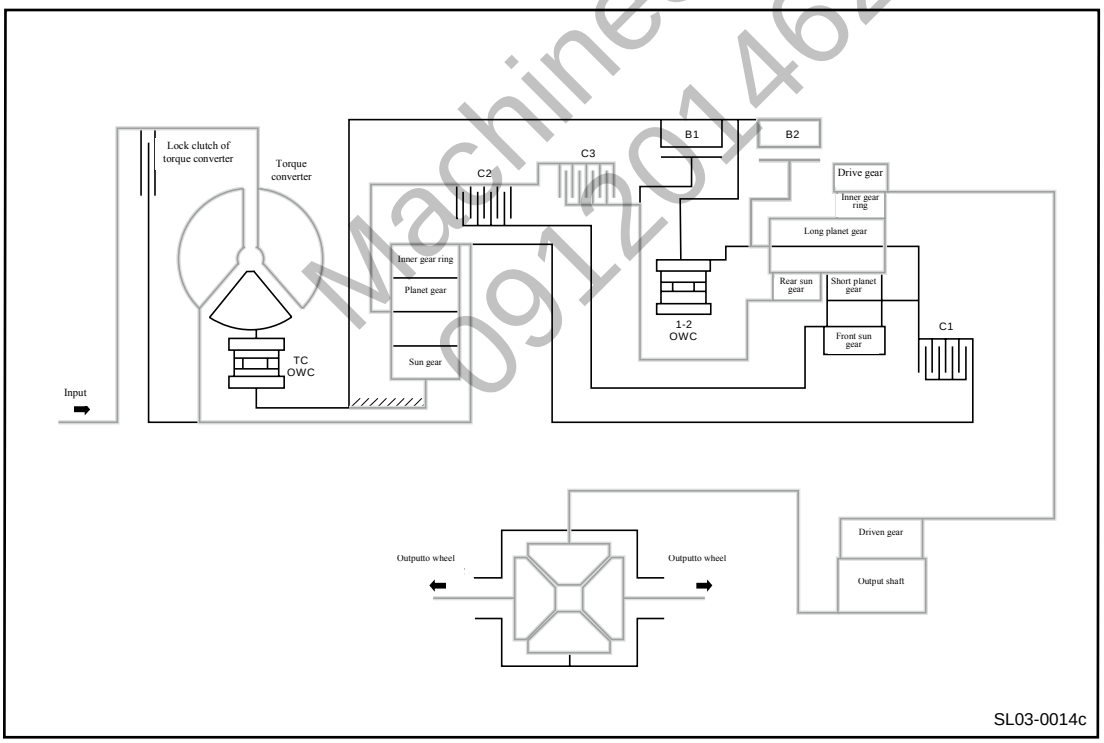
6th speed power transmission path (transmission ratio: 0.676:1)



Reverse gear power transmission path (transmission ratio: 3.178:1)



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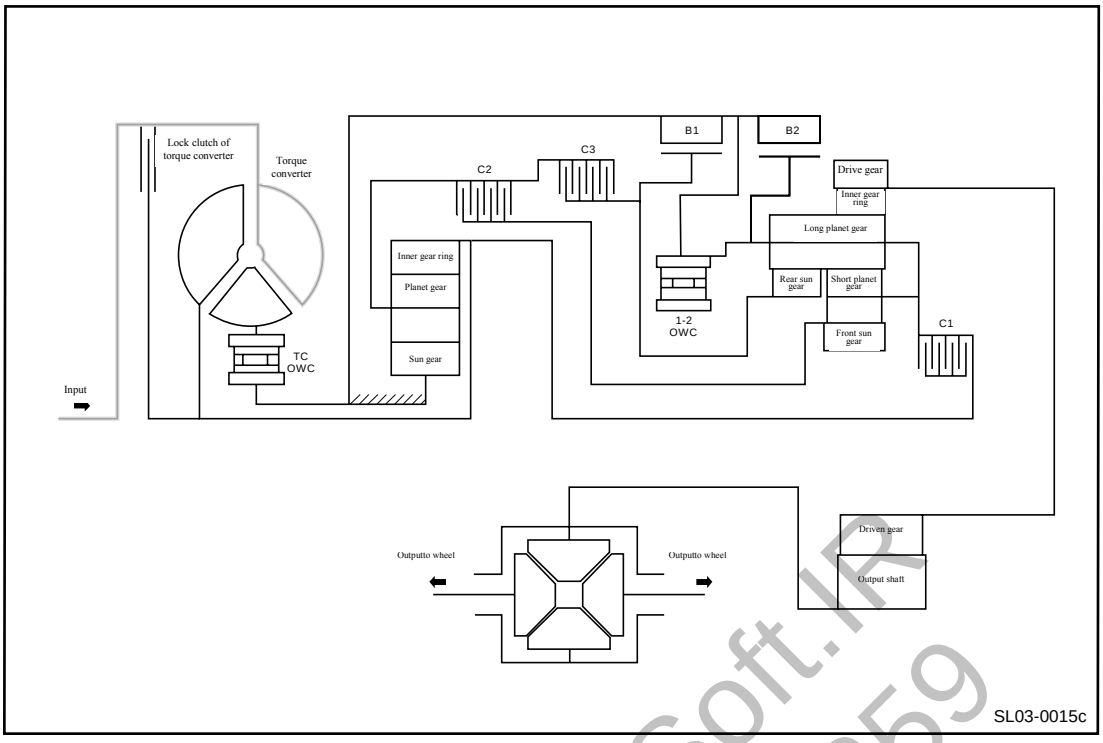
Parking/neutral power transmission route



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3.5.3.3 Shift mode

Command mode

The common mode is that the control level is located in gear D and the transmission is in the range of conventional temperature. In this mode, the shift curve more tends to better economy to meet the conventional way of driving.

Uphill and downhill mode

This mode is determined according to the load of the vehicle; in this mode, the transmission control unit (TCU) can automatically select different shift intervals to gradually adjust the shift points and the torque converter locking point.

High altitude mode

Due to effect of the atmospheric pressure and the temperature change at high altitude, the torque generated by the engine will be reduced; thus, the shifting point at the high altitude will be automatically be regulated to amend the change caused by torque reduction of the engine.

Trip stop mode:

The transmission supports direct shift between 2nd speed positions or 3 gear positions, for example from 5th speed to 3rd speed , 6th speed to 4st speed or 2nd speed to 4st speed to optimize the enginrer RPM.

Warming-up mode

It is usually used when the transmission oil temperature is lower than 20℃.

The hydraulic torque converter is not locked when the transmission oil temperature is below 20℃ to accelerate the transmission warm.

High temperature mode

The high temperature mode is applied in the transmission at the oil temperature between 110℃ and 145℃. The hydraulic torque converter locking range is increased in order to avoid from producing excessive heat by adding the hydraulic torque converter.

Other components that improve the high temperature of the transmission oil will be activated:

- If it is higher than 110℃ - radiator fan will be open.
- If exceeding 130℃ - engine torque will decrease.
- If it is higher than 145℃ - transmission will stop working until the transmission oil temperature is lower than 120℃, so as to create protection.

In case the high temperature mode is activated, the other performances of the transmission will be inhibited, including the amendment of the uphill and downhill modes and high altitude mode. The hydraulic torque converter is locked during shifting, which may drop the shifting feeling. The high temperature mode can be exited only when the transmission oil temperature is lower than 105℃.

Cruise mode

If the cruise mode is activated, the engine ECU requires transmission downshift; and at this time, the accelerator pedal is in automatic constant to improve the engine brake.

3.5.3.4 Control system element of transmission

Transmission control unit (TCU)

The transmission control unit (TCU) and its I/O bus control the following operations:

- Gear control
- Oil pressure control
- Clutch pressure control
- Control of hydraulic torque converter lock clutch

In addition, the transmission control unit (TCU) determines the transmission operation strategies by receiving the relevant sensor signals and input switching signals.

The transmission control unit (TCU) can decide whether the vehicle meets the shift criteria or the working conditions for the hydraulic torque converter clutch according to these input signals. Meanwhile, the transmission control unit (TCU) can calculate the working pressure required to regulate the shift quality. The transmission control unit (TCU) controls the gear shifting actions through 6 variable pressure electromagnetic valves and 4 switching electromagnetic valves.

Note: if the transmission control unit (TCU) needs to refresh, the hand brake must be pulled up to put the transmission gear into the gear P. The refreshing step of the automatic transmission refers to 3.5.7.4 Automatic Transmission Refreshing Procedure.

Embedded memory module

Embedded memory module (EMM) is matched with the transmission valve body in the manufacture process.

The EMM is integrated on input shaft speed sensor installed on the transmission valve body.

EMM data contains specific characteristic information of the transmission. Upon completion of installation, the transmission control unit will upload data from EMM and use such data when the transmission is in operation.

Electromagnetic valve and variable pressure electromagnetic valve

The valve body comprises four opening/closing electromagnetic valves and six variable pressure electromagnetic valves. On/off electromagnetic valve can be controlled to realize the change between two positions: on and off; these valves are used for changing the flow and on/off of the hydraulic system. The variable pressure electromagnetic valve converts the current into the hydraulic pressure in the same proportion.

Speed sensor

The input shaft speed sensor and the output shaft speed sensor are integrated, and both of them are Hall sensors. The sensor is installed in the transmission and located below the valve body.

Transmission oil temperature sensor.

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The transmission oil temperature sensor is located on the valve body harness. The transmission control unit (TCU) activates different shifting strategies according to the input from the transmission oil temperature sensor. The sensor consists of a temperature sensor.

The temperature sensor checks the reasonability of the reading. If the input signal from the temperature sensor is outside the normal operating range, it may be caused by sensor short circuit or open circuit.

Gear switch

The transmission control unit (TCU) determines the position of the shift lever through the position in which the gear switch is.

The gear switch is connected with the flexible gear shifting shaft, the selector controls the gear switch to switch the gear positions in the transmission among P, R, N and D.

For manual mode, the gear switch detects (+ or -) of the driver within manual selection scope and sends the signal detected to the transmission control unit (TCU).

Note: if the gear switch is no in gear P or gear N, or the gear switch is disconnected, the engine is unable to start.

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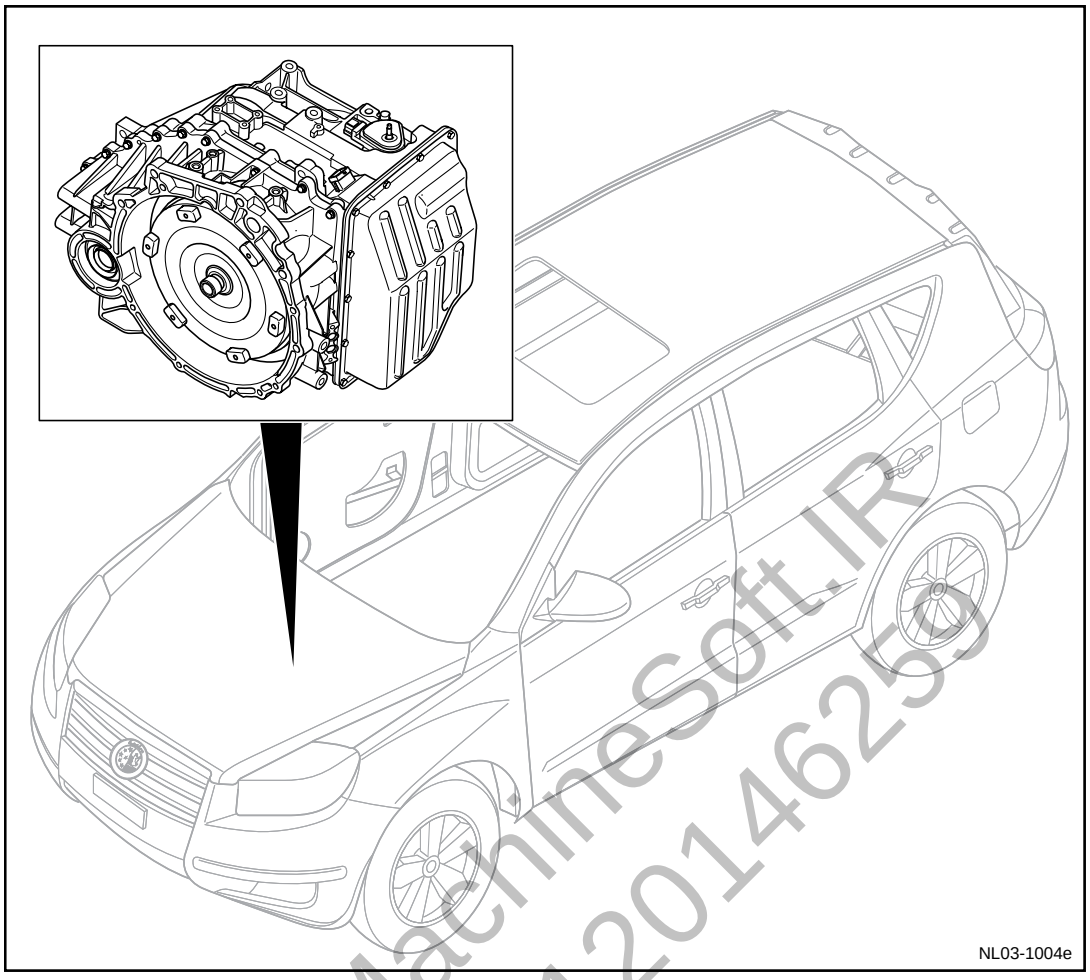
3.5.4 Component position

3.5.4.1 Automatic transmission assembly position



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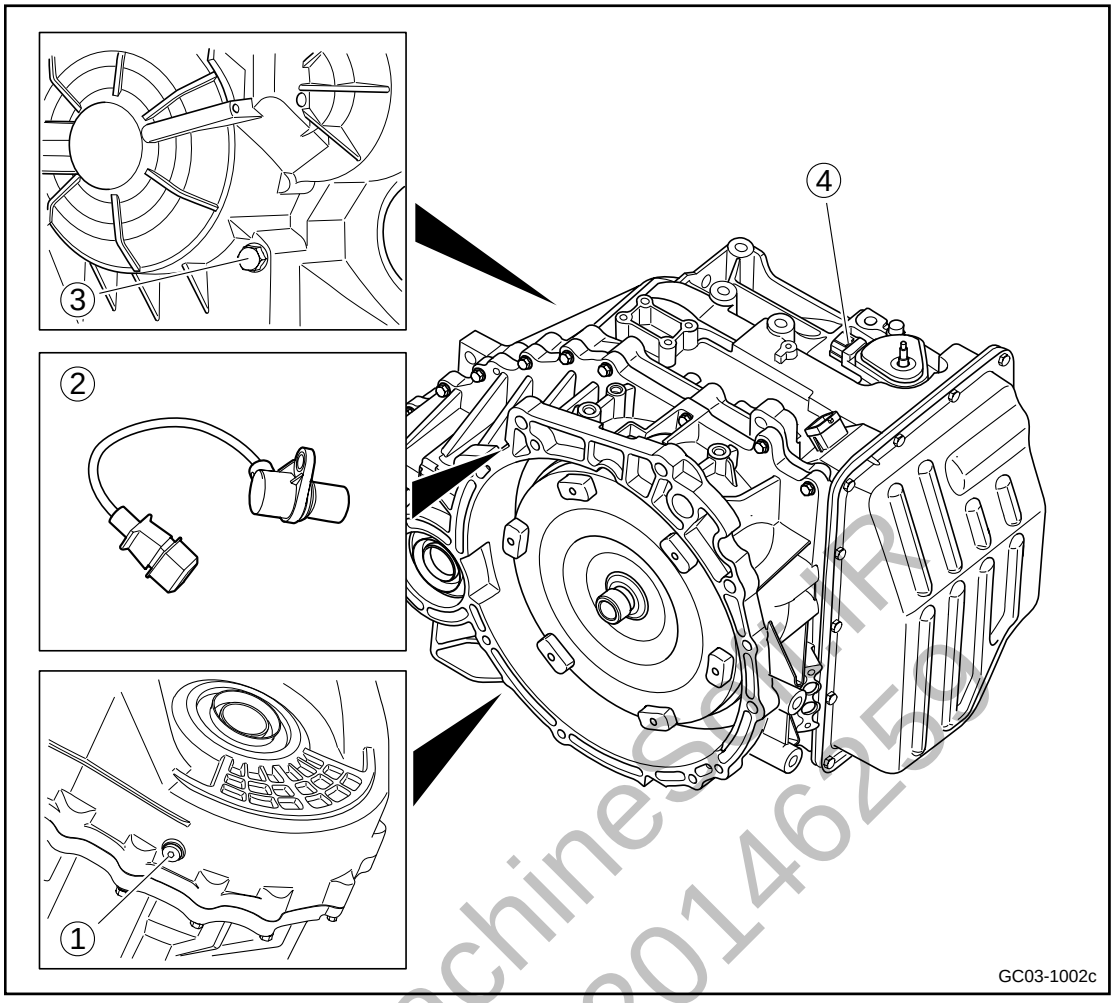
3.5.4.2 Automatic transmission sensor position



1. Oil drain plug
2. Speed sensor
3. Check bolt of oil level (filler)
4. Gears switch

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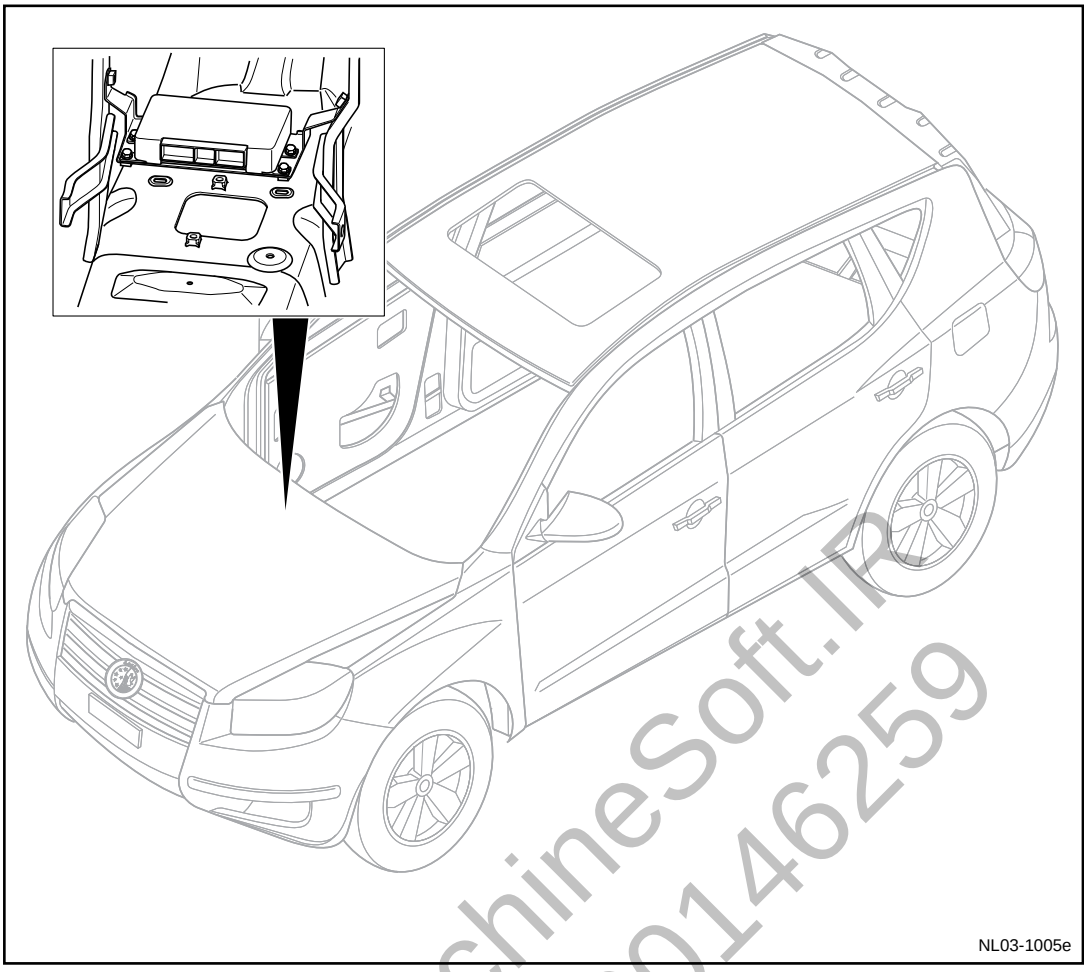
3.5.4.3 Automatic transmission control module position



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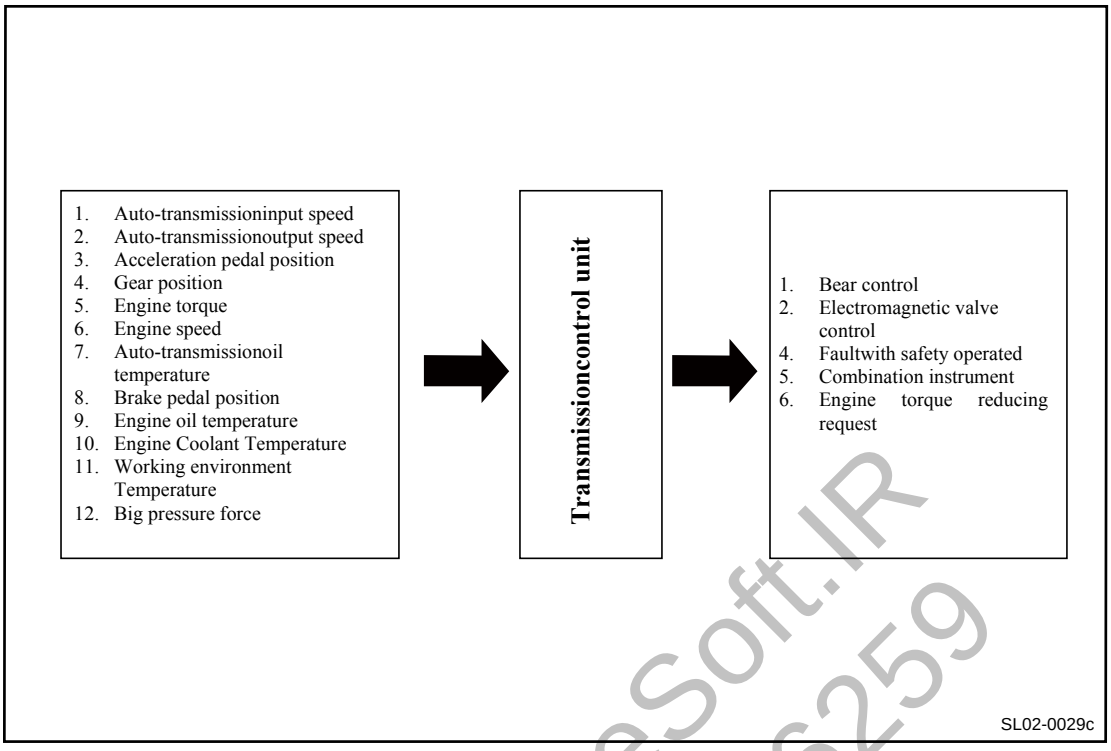
3.5.5 Electrical schematic diagram

3.5.5.1 Diagnostic schematic diagram



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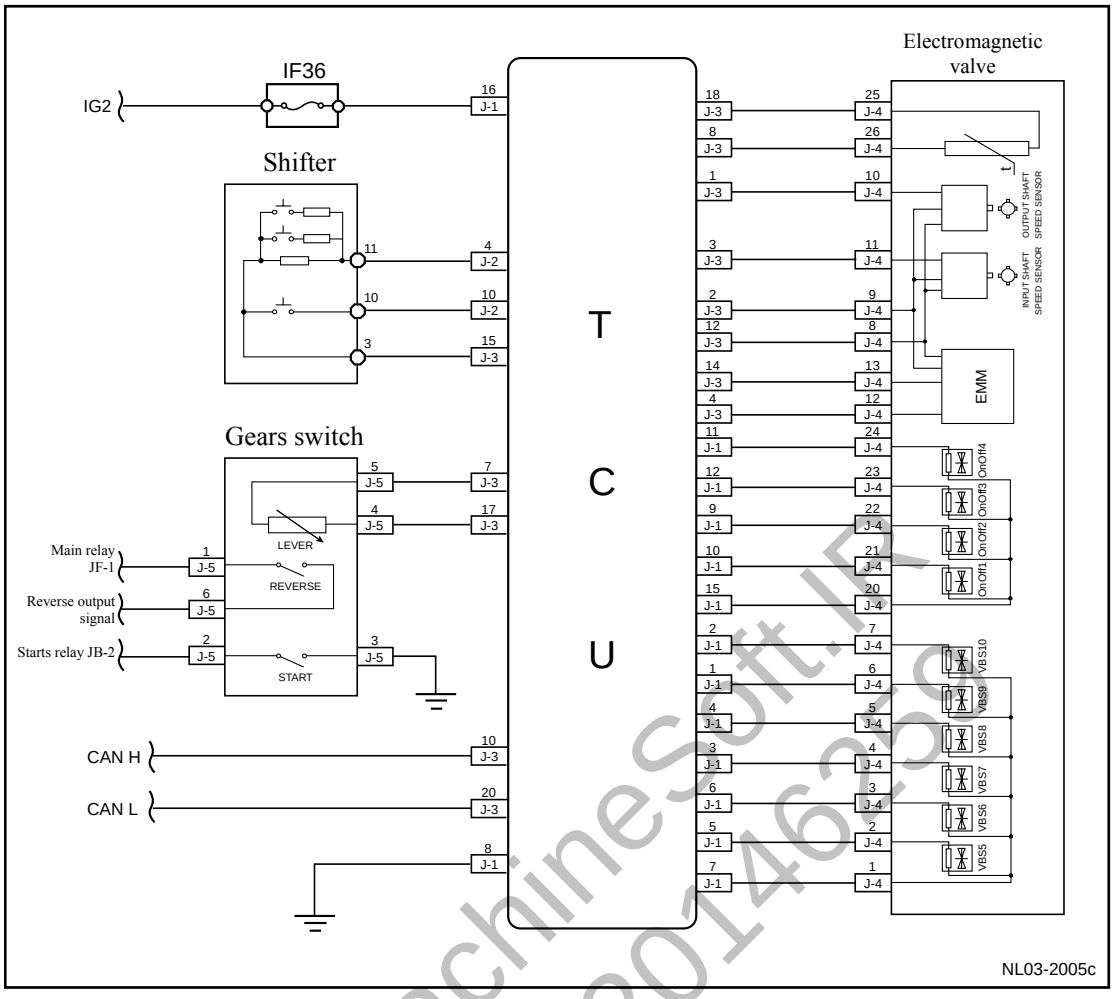
3.5.5.2 Circuit schematic diagram



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3.5.6 Diagnostic Information and Procedures

3.5.6.1 Diagnosis descriptions

Refer to 3.5.2 description and operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic procedures, more importantly, it will also help to determine whether the situation described by the customer is normal.

Diagnostic introduction:

The automatic transmission suddenly produces the following symptoms, such as noise or vibration, transmission oil leakage, and vehicle incapable of moving forward or backward, which may be caused by mechanical problems.

The following problems may result in the control system failure: original ECU failure, gear switch failure and wire harness connector failure.

3.5.7.2 Check control system

Diagnostic fault finding strategy:

Please use the following procedures to check your faults. If follow these procedures carefully, you will find most of the automatic transmission failure.

1. Collect fault information from vehicle owner as much as possible.
2. Verify fault situations described by vehicle owner.
3. Check if vehicle has anto-transmission trouble code (DTC).
4. If fault symptol only appears occasionally and no fault code (DTC) appears, it indicates that such fault is remittent. see 2.2.6.3 Inspection for intermittent malfunctions.
5. In case of the disnostic testing code unavailable although the malfunction can be confirmed or the failure of the system to communicate with the dianostic tester, see 2.2.6.26 DTC U1073.
6. Record the diagnostic testing code (DTC) if any.
7. Check with the malfunction conditions again after the road test is performed.
8. See the DTC List in the event of another appearance of DTC.
9. If the DTC does not appear again, then the malfunction is an intermittent malfunction. See 2.2.6.3 inpection of intermittent malfunctions.
10. After repair, conduct road test again, to confirm that fault is eliminated.

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3.5.7.3 Stall test

Be capable of carrying our underspeed test to the DSI automatic transmission to ensure whether the transmission-clutch can bear all torque of the engine, without sliding.

1. Time of stall test should not exceed 10s.
2. Pull up manual brake;
3. Start the engine
4. Press down brake pedal and keep its status;

Note: keep stepping on the brake pedal in the whole process of stepping on the accelerator pedal.

5. Shift to the forward position (D gear);
6. 100 % depress (fully) and hold the accelerator pedal for 6s;
7. Look at engine speed;

8. Release the accelerator pedal;
9. Shift to reverse (R) gear;
10. 100 % press down accelerator pedal, keep 6s;
11. Look at engine speed;

If the engine speed is higher than 2800rpm, the transmission has hardware fault.

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3.5.7.4 Automatic transmission refresh process

Note: after replacing the automatic transmission assembly or transmission control unit (TCU), need to execute the following procedure to reset the automatic transmission.

1	Rematch the automatic transmission

A. Connect fault diagnosis tester.

B. Put the transmission shift lever in the P position and turn the ignition switch to the ON position (with the engine not in operation);

C. Run the reset adaptive data program and wait for the response;

Next

2	Activate the original data

A. Connect fault diagnosis tester.

B. Put the transmission shift lever in the P position and turn the ignition switch to the ON position (with the engine not in operation);

C. Run the activate adaptive initial offsetting program and wait for the response;

Next

3	Reset actual service life

A. Connect fault diagnosis tester.

B. Put the transmission shift lever in the P position and turn the ignition switch to the ON position (with the engine not in operation);

C. Run the set mileage program.

Note: after replacing the new transmission or the warranty on the transmission is expired, the actual service life may be set as 0km.

Next

4	Re-commissioning

A. Turn the ignition switch to the OFF position.

B. Restart the vehicle to check if the automatic transmission can normally operate.

Check if the automatic transmission automatically operates?

Yes — The matching is done.

No

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5	Quick self-learning program

A. Keep the vehicle still and engine running and depress the brake pedal to respectively perform 15 N-D shifts and 5 N-R shifts when the transmission oil temperature is 25 °C, 50 °C and 80 °C. In the shifting process, move the level from the gear N to the gear D or R to wait for 2 s, and then confirm that the transmission shifting is completely finished, move the level from the D or R to the gear N, and wait for 2s to complete self-learning. You can select to perform this shift at any stage of the quick self-learning process;

B. Drive the vehicle and warm up the transmission oil to the normal temperature; (65 °C-90 °C)

C. During the following drive self-learning process, learning must be performed within an oil temperature range from 65°C to 95°C, otherwise the self-learning conditions will not be met;

D. Drive the vehicle by depressing the accelerator pedal in the steady state (to 20% acceleration opening) to complete the gradual gear shifting process form 1st speed to 5th speed .Repeat 15 times under this working condition. If there is still larger impact or the clutch slippage, replace the valve body.

E. Drive the vehicle by depressing the accelerator pedal in the steady state (to a 30% accelerator opening) to complete the shifting process from 1st speed to 5th speed and repeat 3 times. Repeat this procedure up to 15 times if a great impact or clutch clipping arises. If there is still symptom incurred, replace the valve body.

F. Drive the vehicle by depressing the accelerator pedal in the steady state (to 60% acceleration opening) to complete the gradual gear shifting process form 1st speed to 5th speed .Repeat 15 times under this working condition. Replace the valve body if a great impact or clutch slipping still arises;

G. Drive the vehicle by depressing the accelerator pedal in the steady state to100% acceleration opening to complete the gradual gear shifting process form 1st speed to 3rd speed.Repeat 15 times under this working condition. Replace the valve body if a great impact or clutch slipping still arises;

H. Perform the following acceleration and descending shifting operations:

- Repeat 5 full degree accelerations from 20 Km/h (you can stop the acceleration when you complete one gear shift and this is one acceleration).
- Repeat 5 full degree accelerations from 30 Km/h (you can stop the acceleration when you complete one gear shift and this is one acceleration).
- Repeat 5 full degree accelerations from 40 Km/h (you can stop the acceleration when you complete one gear shift and this is one acceleration).
- Repeat 5 full degree accelerations from 60 Km/h (you can stop the acceleration when you complete one gear shift and this is one acceleration).
- Repeat 5 full degree accelerations from 80 Km/h (you can stop the acceleration when you complete one gear shift and this is one acceleration).

I. Drive the vehicle to 80km/h and make sure the transmission is in 6th speed position. Release the accelerator pedal and slightly depress the brake pedal to decelerate the vehicle. Downshift the transmission from 6th speed to 1st speed and repeat this operation 5 times.

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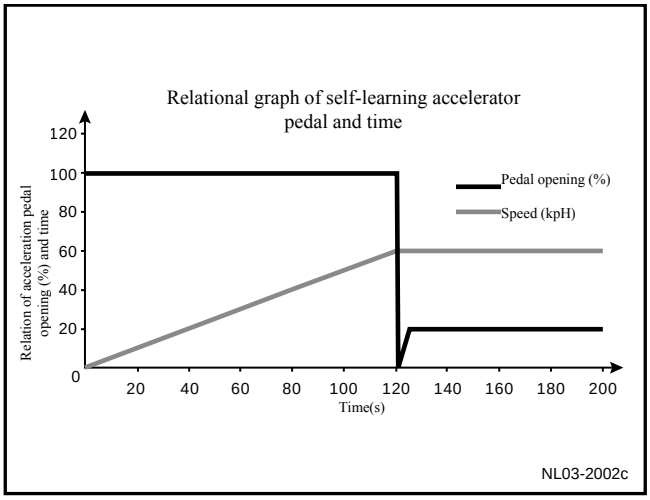
J. Perform the following operations for oil supply interruption and continued fueling to complete upshift the transmission.

- Accelerate at full to 40 km/h, release the accelerator pedal in 0.5 s, then rapidly step on 20 % of the accelerator pedal to maintain the speed at 40 km/h, and repeat 15 times (as shown in the right figure);
- Accelerate at full to 60 km/h, release the accelerator pedal in 0.5 s, then rapidly step on 20% of the accelerator pedal to maintain the speed at 60 km/h, and repeat 15 times (as shown in the right figure);
- Accelerate at full to 80 km/h, release the accelerator pedal in 0.5 s, then rapidly step on 20% of the accelerator pedal to maintain the speed at 80 km/h, and repeat 15 times (as shown in the right figure);



Next

6	Complete the matching

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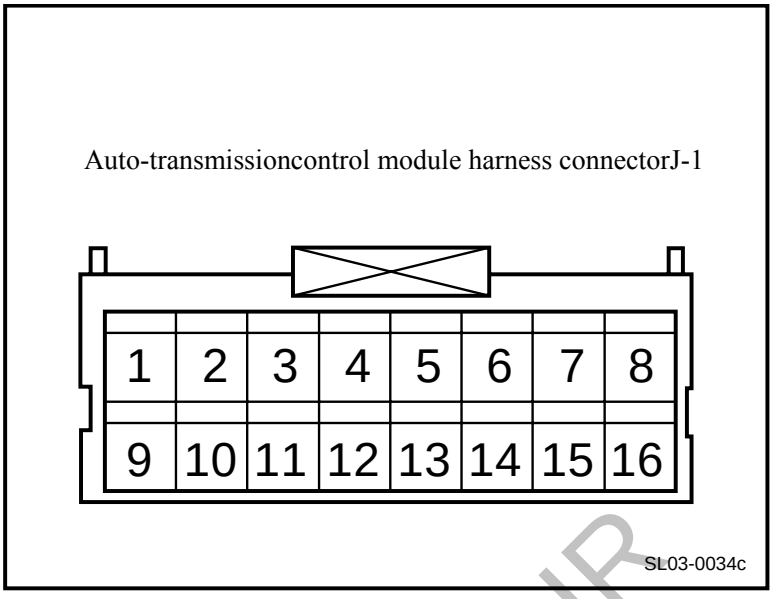
3.5.7.5 Automatic transmission terminal definition list



Terminal No.	Normal work current	Terminal descriptions
1	1.1A	Electromagnetic valves SOL 9
2	1.1A	Electromagnetic valves SOL 10
3	1.1A	Electromagnetic valves SOL 7
4	1.1A	Electromagnetic valves SOL 8
5	1.1A	Electromagnetic valves SOL 5
6	1.1A	Electromagnetic valves SOL 6
7	4.7A	Electromagnetic valves SOL RETURN
8	4A	Ground
9	760mA	Electromagnetic valveONOFF SOL 2
10	760mA	Electromagnetic valveONOFF SOL 1
11	760mA	Electromagnetic valveONOFF SOL 4
12	760mA	Electromagnetic valveONOFF SOL 3
13	Empty	Empty
14	Empty	Empty
15	2.28A	Electromagnetic valve ONOFF SOL RETURN

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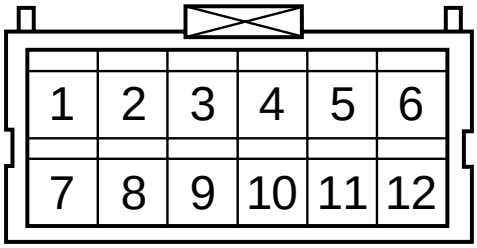
16	4A	Power supply

Auto-transmissioncontrol module harness connectorJ-2



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Terminal No.	Normal work current	Terminal descriptions
1	Empty	Empty
2	Empty	Empty
3	Empty	Empty
4	-	Shift gear control
5	Empty	Empty
6	Empty	Empty
7	Empty	Empty
8	Empty	Empty
9	Empty	Empty
10	-	Shift gear actives
11	Empty	Empty
12	Empty	Empty

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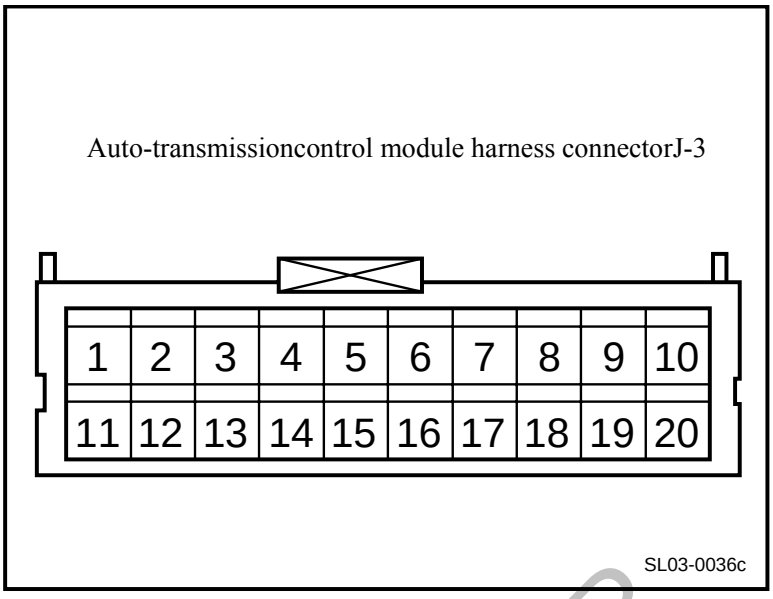

Terminal No .	Normal work current	Terminal descriptions
1	2mA	Output speed sensor of electromagnetic valve
2	40mA	Electromagnetic valveEMM/speed sensor signal
3	2mA	Electromagnetic valve input speed sensor
4	5mA	Electromagnetic valve EMM data
5	Empty	Empty
6	Empty	Empty
7	-	Gear switch
8	2mA	Electromagnetic valve oil temperature sensor
9	Empty	Empty
10	-	CAN HIGH
11	Empty	Empty
12	50mA	Electromagnetic valve EMM/speed sensor grounding
13	Empty	Empty
14	5mA	Electromagnetic valve EMM CLOCK
15	50mA	Shifter ground

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16	Empty	Empty
17	-	Gears switch grounding
18	2mA	Electromagnetic valve oil temperature sensor
19	Empty	Empty
20	-	CAN LOW

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3.5.7.6 Fault diagnosis code (DTC) chapter index

DTC	Descriptions	Diagnostic procedures
P0603	TCU Self-learning data memory error	Refer to3.5.7.8 DTC P0603 P0604 P1604 P1701 P1703
P0604	Reach to TCU self-learning data limit	
P1701	TCU power supply voltage is low	
P1703	TCU power supply voltage is high	
P1604	TCU EMM data error	
P0707	Voltage of shift lever position sensor is too low	Refer to3.5.7.9 DTC P0707 P0708
P0708	Voltage of shift lever position sensor is too high (open circuit)	
P0711	Oil temperature of transmission is too high	Refer to3.5.7.10 DTC P0711
P0712	Oil temperature of transmission sensor voltage is low	Refer to3.5.7.11 DTC P0711 P0712 P0713
P0713	Oil temperature of transmission sensor voltage is high(open circuit)	
P0716	Input shaft /turbine speed value	Refer to3.5.7.13 DTC P0716 P0717
P0717	Input shaft /turbine speed sensor signal is instability	
P071D	Manual shift control upper/ down (TGS)stuck	Refer to3.5.7.15 DTC P071D P071E P071F
P071E	Voltage of manual shift control upper/ down (TGS)signal is too low	
P071F	Voltage of manual shift control upper/ down (TGS)signal is too high (open circuit),	
P0721	Output shaft speed sensor value	Refer to3.5.7.14 DTC P0721 P0722
P0722	Output shaft speed sensor signal is instability	
P0729	6th speed transmission ratio error	Refer to3.5.7.16 DTC P0729 P0731 P0732 P0733 P0734 P0735 P0736
P0731	1st speed or M1 speed transmission ratio	

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	error	
P0732	2nd speed transmission ratio error	
P0733	3rd speed transmission ratio error	
P0734	4th speed transmission ratio error	
P0735	5th speed transmission ratio error	
P0736	Reverse gear transmission ratio error	
P0741	Hydraulic torque converter clutch in the lock status	Refer to3.5.7.17 DTC P0741 P0742 P0744
P0742	Hydraulic torque converter clutch lock in the lock status	
P0744	Sliding error of hydraulic torque converter clutch	
P0962	Electromagnetic valve S9 over current (short circuit)	Refer to3.5.7.18 DTC P0962 P0963
P0963	Electromagnetic valve S9 low current(open circuit)	
P0966	Electromagnetic valveS10 over current (short circuit)	Refer to3.5.7.19 DTC P0966 P0967
P0967	Electromagnetic valve S10 low current(open circuit)	
P0973	ON/OFF electromagnetic valve S1 over current (short circuit)	Refer to3.5.7.24 DTC P0973 P0974
P0974	ON/OFF electromagnetic valveS1 low current(open circuit)	
P0976	ON/OFF electromagnetic valve S2 over current (short circuit)	Refer to3.5.7.25 DTC P0976 P0977
P0977	ON/OFF electromagnetic valve S2 low current(open circuit)	
P0979	ON/OFF electromagnetic valve S3 over current (short circuit)	Refer to3.5.7.26 DTC P0979 P0980
P0980	ON/OFF electromagnetic valve S3 low current(open circuit)	
P0982	ON/OFF electromagnetic valve S4 over	Refer to3.5.7.27 DTC P0982 P0983

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	current (short circuit)	
P0983	ON/OFF electromagnetic valve S4 low current(open circuit)	
P0985	Electromagnetic valve S5 over current (short circuit)	Refer to3.5.7.20 DTC P0985 P0986
P0986	Electromagnetic valve S5 low current(open circuit)	
P0998	Electromagnetic valve S6 over current (short circuit)	Refer to3.5.7.21 DTC P0998 P0999
P0999	Electromagnetic valve S6 low current(open circuit)	
P099B	Electromagnetic valve S7 over current (short circuit)	Refer to3.5.7.22 DTC P099B P099C
P099C	Electromagnetic valve S7 low current(open circuit)	
P099E	Electromagnetic valve S8 over current (short circuit)	Refer to3.5.7.23 DTC P099E P099F
P099F	Electromagnetic valve S8 low current(open circuit)	
P1605	EMM Data mismatch	Refer to3.5.7.12 DTC P1605 P1610 P1611
P1610	EMM communication error	
P1611	EMM Data error	
U0100	EMS CAN signal is not used ,these CAN signal is necessary for TCU	Refer to3.5.7.28 DTC U0100U0121 U0146 U0401 U0415
U0121	CAN signal of brake system ECU (ABS/ESP/TCS) can not used , some CAN signal is necessary for TCU running	
U0146	Lost with Gateway communication	
U0401	EMS CAN signal is over range or invalid, these CAN signal is necessary for TCU	
U0415	CAN signal of brake system ECU (ABS/ESP/TCS) is over the range or invalid , some CAN signal is necessary for TCU running	

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U1601	TCU application software lost or damaged	Refer to3.5.7.29 DTC 1601U1606 U1607 U1608 U1609 U160E
U1606	TCU standard error –platform	
U1607	TCU standard error - Activation derived standard	
U1608	TCU VIN(Vehicle Identification code) code error	
U1609	TCU hardware (pcb) standard error	
U160E	Doctor hardware underlying software reason cause special DTC	Refer to 3.5.7.30 DTC U160E

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3.5.7.7 Data glow table

By reading the Data Flow Table on the fault diagnosis tester, you can inspect switches, sensors, actuators working state without dismantling any components. Before the control system diagnosis, observing and analyzing data is the first step, so that the diagnose time could be shortened.

Note: Data under normal conditions is listed in the following table for reference only. Do not determine whether a part is faulty solely based on these reference values. Under normal circumstances you can compare the vehicle that needs to be repaired with a normal working vehicle in the same state to determine whether the current vehicle diagnostic data is normal or not.

1. Run the engine to reach normal working temperature.
2. Rotated ignition switch is OFF position。
3. Connect the fault diagnosis tester.
4. Rotated ignition switch in the ON position.
5. Select “Engine”/”Read data stream”.
6. Refer to the following table and inspect the data of each item.

1. First step: At cold engine, turn the key switch to ON position, inhibit the engine (for about 30s)

Start - Normal/default Session
PowerOn Reset - ECU Reset
Clear (all/group/single error) - Fault memory
Read (environment data) - Fault memory
Read (all identified - SAE J2012) - Fault memory
Read (all supported - SAE J2012) - Fault memory
Read (all identified – 2Byte Hex) - Fault memory
Read (all supported – 2Byte Hex) - Fault memory
Read (most recent DTC) - Fault memory
Read - VIN-Current
Read - Software Version
Read - Calibration Version
Read - Bootloader Version
Read - CAL-ID
Read - CVN
Request Seed - DSI Seed

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Send Key - DSI Key
Start - Reset Adaptive Shift Data
Start - Activate Adaptive Green Offset
Start - Reset Adaptive Tcc Data
Start - Activate Adaptive Tcc Green Offset
Start - Set Km Travelled
Write - VIN-Current
Send (Response) - Tester Present
Send (No Response) - Tester Present

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3.5.7.8 P0603 P0604 P1604 P1701 P1703

1. DTC description:

DTC	**P0603**	TCU Self-learning data memory error

DTC	**P0604**	Reach to TCU self-learning data limit

DTC	**P1604**	TCU EMM data error

DTC	**P1701**	TCU power supply voltage is low

DTC	**P1703**	TCU power supply voltage is high

The transmission control unit (TCU) controls the transmission through the variable flow electromagnetic valve and switching electromagnetic valve. The transmission control unit operates under a voltage ranging from 8 to 16V and usually consumes less than 4A current and needs to change gear when the current consumption reaches 10A.

If the transmission element is worn to a certain extent, the transmission control unit TCU can compensate these differences within the range of the service life of the transmission through self-learning function, thereby ensuring the shift quality. However, in case the parts in the transmission are worn to a certain point, the gear shifting quality can not be ensured no matter how the transmission control unit (TCU) teaches oneself; and at this tie, the transmission control unit (TCU) shall report a fault code.

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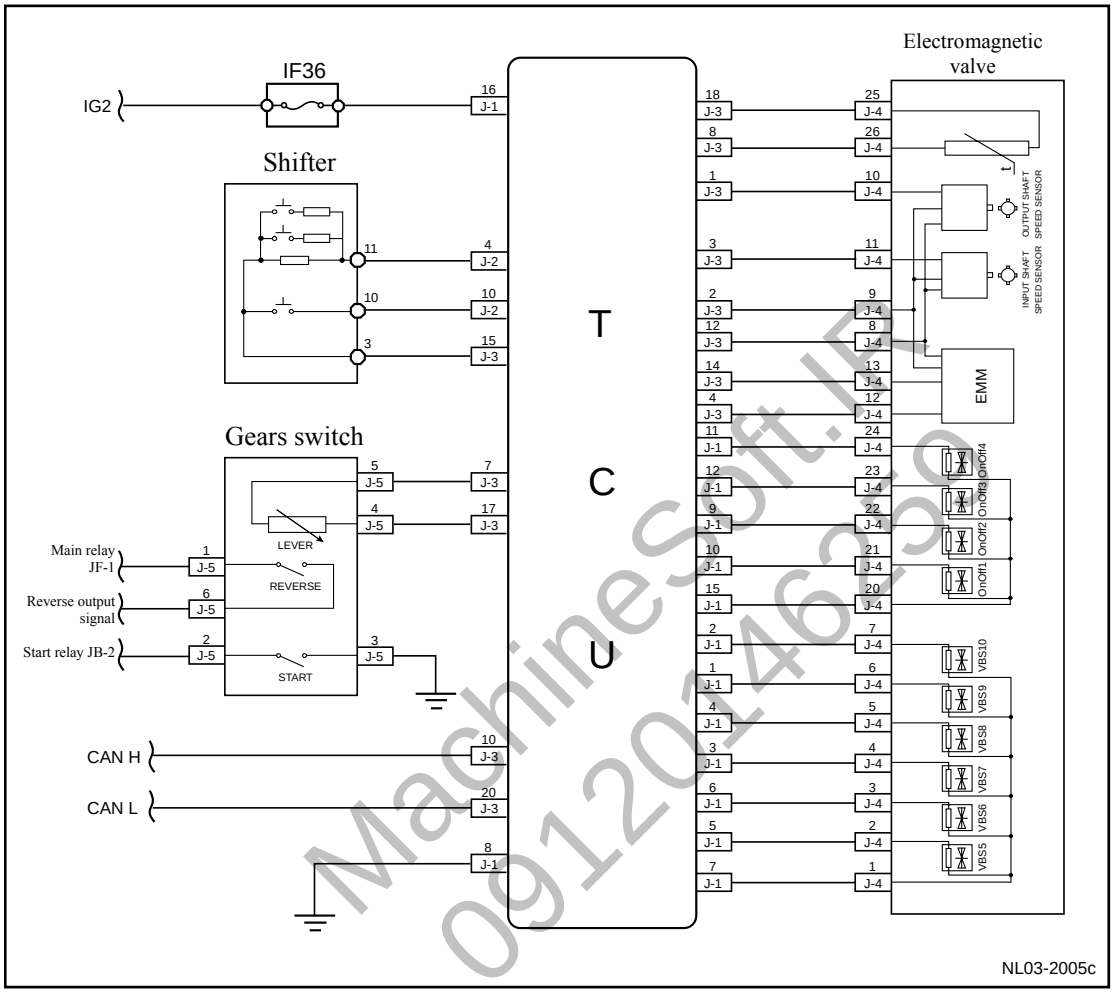
2. Conditions for setting DTC and the gault position:

DTC code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault positions
P0603	Detect hard part circuit	Ignition switch is in ON position	1. TCU 2. TCU power supply circuit 3. TCUgrounding circuit
P0604	Detect hard part circuit		
P1604	EMM digital image stored in the TCU was damaged and lost		
P1701	System pressure is less than work voltage of electromagnetic valve	1. ignition switch is in the opening position 2. Engine speed >300 r/min 3. Transmission control unit power supply voltage <8 V for 0.5 s	

P1703	System voltage is higher than work required voltage of electromagnetic valve	1. ignition switch is in the opening position 2. Voltage of transmission control unit power supply >17 V for 60s	

3. Circuit sketch



4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0603, P0604, P1604, P1701, and P1703 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

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DTC codes shown	To step
DTC P0603, P0604, P1604, P1701, P1703	Yes
DTC except for DTC P0603, P0604, P1604, P1701, P1703	No

No → Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Check power supply and charging system

A. Check negative and positive connection of battery is loosed

B. Check engine harness connector was damaged or loosed

Yes → Connect to harness connector or replace harness

No

3	Check TCUpower supply circuit

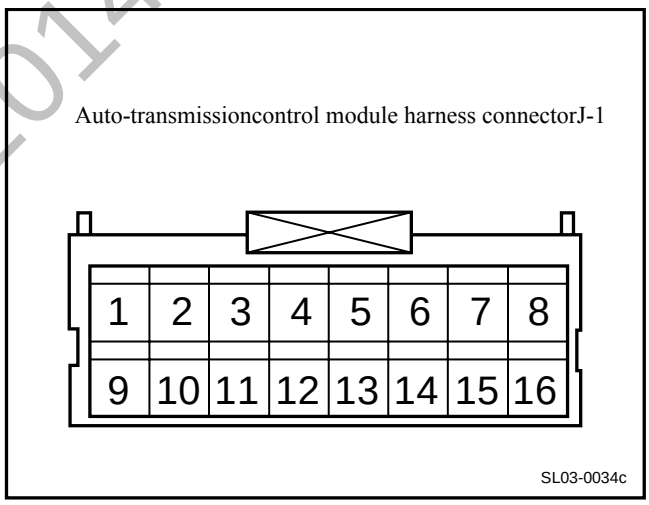
A. Rotated ignition switch to OFF position.

B. Disconnect TCU harness connector J-1

C. Rotated ignition switches to ON position.

D. Measure resistance value of automatic transmission harness connector J-1No.16 terminal and reliable grounding

E. Measure voltage value of automatic transmission harness connector J-1No.16 terminal and reliable grounding



Results

Test items	Standard value
J-1(16)-Reliable grounding resistance value	10 kΩ or higher
J-1(16)-Reliable grounding voltage value	11 - 14 V

Does it conform to the standard value?

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No

Circuit fault, repair circuit.

Yes

4	Check TCU grounding circuit

A. Rotated ignition switch to OFF position.

B. Disconnect TCU harness connector J-1

C. Rotated ignition switches to ON position.

D. Measure resistance value of automatic transmission harness connector J-1No.8 terminal and reliable grounding

E. Measure voltage value of automatic transmission harness connector J-1No.8 terminal and reliable grounding

Results

Test Items	**Standard value**
J-1(16)-Reliable grounding resistance value	Less than 3 Ω
J-1(16)-Reliable grounding voltage value	0 V

Does it conform to the standard value?

No

Circuit fault, repair circuit.

Yes

5	Replace TCU

Refer to3.5.7.8 replace automatic transmission control module

Next

6	Go to automatic transmission fresh process.

Refer to 3.5.7.4 replace automatic transmission refresh process

Next

7	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E Read control system DTC code again to confirm that the system has no DTC code exported.

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No

Refer to 2.2.7.3 intermittent fault inspection for intermittent fault.

Yes

8	Troubleshooting

5. Maintenance guide:

Replace automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

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3.5.7.9 P0707 P0708

1. DTC description:

DTC	**P0707**	Shift level position sensor (gear switch): low voltage

DTC	**P0708**	Shift level position sensor (gear switch): high voltage

The gear switch assembly provides gear shifting position data to the transmission control unit (TCU). When the gear switch is not in position P or N, the system will prohibit the operation of the starter. When putting into the gear R, the backup lamp circuit accesses. The shift switch has independent circuit with respect to the above function. The above function can only normally operate after the circuit is correctly connected with the TCU.

The transmission control unit provides a 5V reference signal to the gear position control circuit (gear switch) to measure the voltage of the circuit and thus determine the position in which the gear is in. The resistance value in different shift positions is different.

2. Conditions for setting DTC and the fault position:

DTC code	**DTC detection strategy**	**Conditions for setting the DTC (Control strategy)**	**Fault position s**
P0707	Shift level position sensor (gear switch) gives a grounding short circuit indicated value.	Ignition switch is in ON position	1.Gears switch 2. Gears switch circuit 3. TCU
P0708	The transmission oil temperature sensor provides an open circuit indicative value.		

3. Circuit sketch

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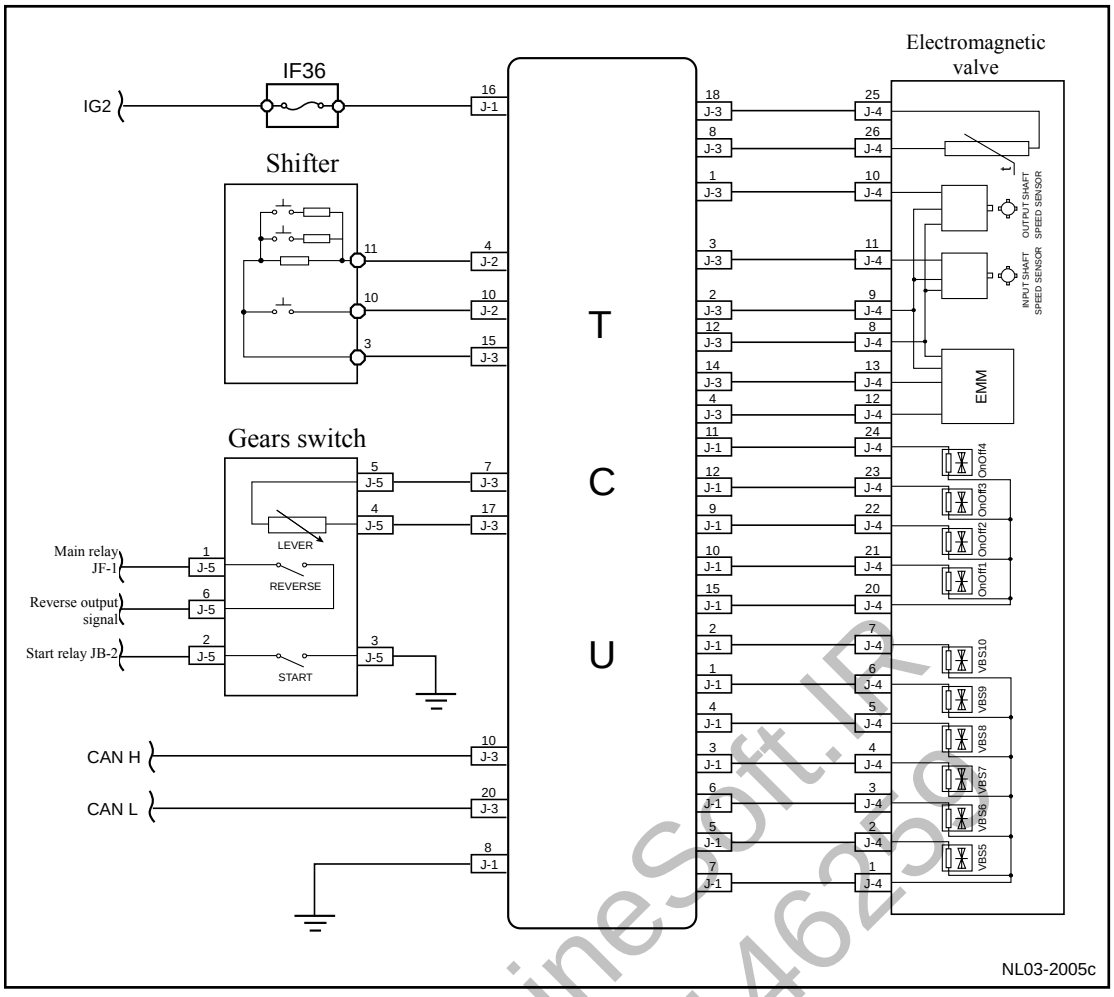

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0707 and P0708 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To step**
DTC P0707, P0708	Yes
DTC except for DTC P0707, P0708	No

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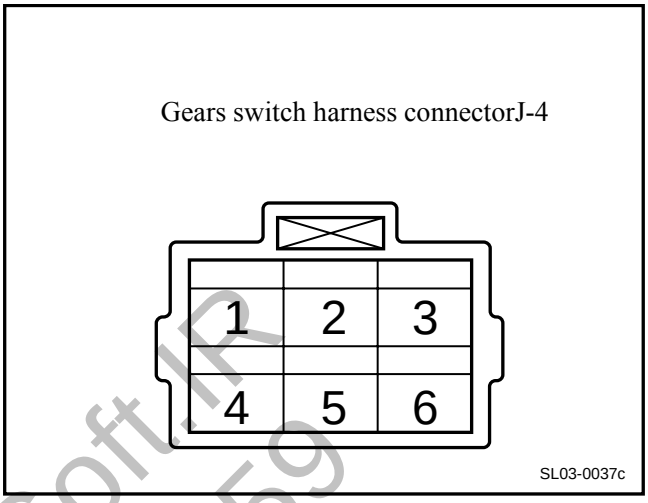
No → Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect the resistance of shift level position sensor (gear switch) under the state of each gear.

A. Turn the ignition switch to the OFF position.

B. Change the shift gear to the “P”, “R”, “N”, “D” and “M” positions in order to measure the resistance between Terminals 4 and 5 of the harness connector J-5 of the gear switch.



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Results

Gears	Test Items	Standard resistant value
P	J-5(4)—J-5(5)	16.789 kΩ±8%
R	J-5(4)—J-5(5)	8.953 kΩ±8%
N	J-5(4)—J-5(5)	5.036 kΩ±8%
D	J-5(4)—J-5(5)	2.686 kΩ±8%
M(manual mode)	J-5(4)—J-5(5)	1.119 kΩ±8%

Does it conform to the standard value?

Notes: if reset the step after replace gears switch, it meet standard valure, otherwise,replace Automatic transmission assembly,

No → Replace gears switch

Yes

3	Detect the signal circuit of shift level position sensor (gear switch)

A. rotated ignition switch to OFF position.

B. Disconnect the harness connector J-5 of the gear switch.

C. Rotated ignition switches to ON position.

D. Measure the voltage between TerminalsNo. 4 and 5 of the gear switch harness connector J-5.

Standard Voltage: 4.9-5.1V

Does it conform to the standard value?

No → Refer to 3.4.7.8 replacement of automatic transmission control module to replace TCU.

Yes

4	Detect the circuits of terminals.No.4 and 5 of shift level position sensor (gear switch).

A. Rotated ignition switch to OFF position.

B. Disconnect the harness connector J-5 of the gear switch.

C. Measure the resistance between terminal 4 of the gear switch harness connector J-5 and Terminal No.17 of the automatic transmission control module J-3.

D. Measure the resistance between terminal 5 of the gear switch harness connector J-5 and Terminal No.17 of the automatic control module J-3.

E. Turn the ignition switch to the ON position.

F. Measure the voltage between terminal No.4 of the gear switch harness connector J-5 and secure ground wire.

G. Measure voltage of gears switch harness connector J-5 terminal NO.5 and reliable grounding

Results

Test items	**Standard value**
J-5(4) — J-3(7)	Less than 3 Ω
J-5(5) — J-3(17)	Less than 3 Ω
J-5(4) — reliable grounding voltage value	O V
J-5(5) — reliable grounding voltage value	0 V

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Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

5	Replace TCU

Refer to3.5.7.8 replace automatic transmission control module

Next

6	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

7	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E Read control system DTC code again to confirm that the system has no DTC code exported.

No

Refer to 2.2.7.3 intermittent fault inspection for intermittent fault.

Yes

8	Troubleshooting

5. Maintenance guide:

Replace automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace gears switch, refer to 3.5.7.5 gears switch replacement

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3.5.7.10 P0711

DTC	P0711	Oil temperature of transmission is too high

The transmission control unit (TCU) monitors the temperature of the transmission oil. If the vehicle cools, the system is unable to maintain a normal automatic transmission oil temperature, and the sensor control unit will adopt preventive measure to prevent from damaging the parts of the vehicle, such as transmission and the like.

The transmitter control unit also monitors for the temperature variation rate according to the current operation status (performance). If the temperature sensor performance is out of the predetermined normal value, set DTC as P0711.

2. Conditions for setting DTC and the fault position:

DTC code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault position s
P0711	A very high transmission oil temperature results in transmission operability performance deterioration.	1. Ignition key is in the "ON" position 2. Transmission oil temperature >130°C	1. Coolant of automatic transmission 2. Automatic transmission cooling system 3. Engine cooling system

3. Circuit sketch

Refer to 3.5.5.1 diagnostic schematic diagram

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0711 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes shown	To step
DTC P0711	Yes
DTC except for DTC P0711	No

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No

Refer to 3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Check if the automatic transmission oil level and oil quality accord with the standard.

See 3.5.7.2 Automatic transmission oil level check procedures.

No

Refer to 3.4.7.3 replacement procedure of automatic transmission oil to fill or replace automatic transmission oil.

Yes

3	Check if the engine coolant accords with the standard.

No

Refer to 2.8.8.1 emission and filling of coolant to fill or replace the engine coolant.

Yes

4	Check if the automatic transmission cooling system leaks and is blocked or the pipeline is damaged.

No

Repair or replace the fault part

Yes

5	Check if the engine cooling system leaks and is blocked or the pipeline is damaged.

Refer to2.8.7 diagnostic information and procedures.

No

Repair or replace the fault part

Yes

6	Troubleshooting

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3.5.7.11 P0712 P0713

1. DTC description:

DTC	**P0712**	Oil temperature of transmission sensor voltage is low

DTC	**P0713**	Transmission oil temperature sensor high voltage (open circuit)

The Automatic transmission oil temperature sensor is installed in the electromagnetic valve body wire harness. The sensor of the TFT is a negative coefficient thermal thermostat. When the transmission fluid is at a low temperature, the sensor resistance is high and will decrease with the temperature rise.

The transmission control unit (TCU) provides a 5V reference signal to the automatic transmission oil temperature sensor to measure the voltage drop in the circuit. When the oil temperature of the automatic transmission is increased, the resistance of the sensor is decreased.

2. Conditions for setting DTC and the fault position:

DTC Code	DTC detection strategy	Conditions for setting the DTC (Control strategy)	Fault positions
P0712	The transmission oil temperature sensor provides a grounding short circuit indicative value.	Ignition switch is in ON position	1. Electromagnetic valve and harness assembly 2. TCU 3. Automatic transmission assembly
P0713	The transmission oil temperature sensor provides an open circuit indicative value.		

3. Circuit sketch

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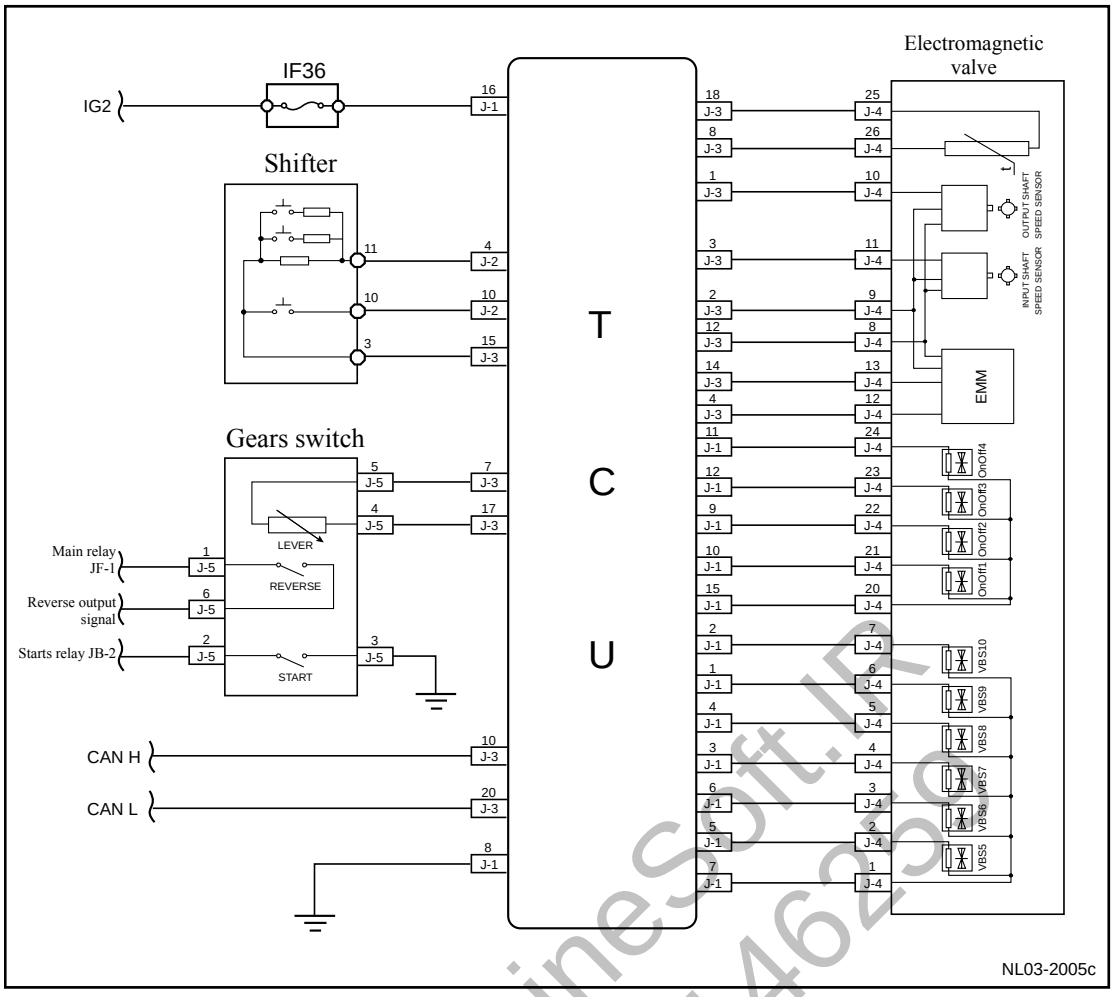

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4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0712 and P0713 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC codes shown	**Go to step**
DTC P0712, P0713	Yes
DTC except for DTC P0712, P0713	No

No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

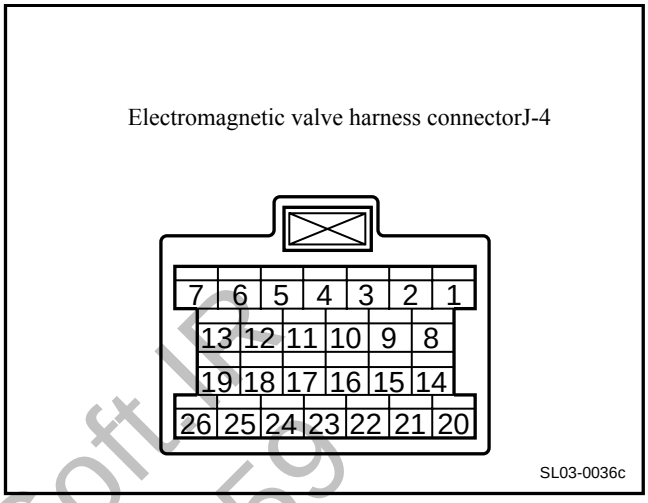
Yes

2	Detect the oil temperature sensor resistor.

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals No.25 and 26 of the electromagnetic valve harness connector J-4.



Standard resistance value (for detailed parameters, see 3.5.1.3 temperature-resistance relationship of automatic transmission oil temperature sensor): 20℃ (68°F)56.74 kΩ-65.86kΩ

Does it conform to the standard value?

No

Replace electromagnetic valve assembly

Yes

3	Detect the signal voltage of oil temperature sensor.

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Turn the ignition switch to the ON position.

D. Measure the voltage between Terminals 25 and 26 of the electromagnetic valve harness connector J-4.

Standard voltage: 4.9-5.1V

Does it conform to the standard value?

No

Refer to 3.4.7.8 replacement of automatic transmission control module to replace TCU.

Yes

4	Detect the oil temperature sensor circuit.

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A. rotated ignition switch to OFF position.

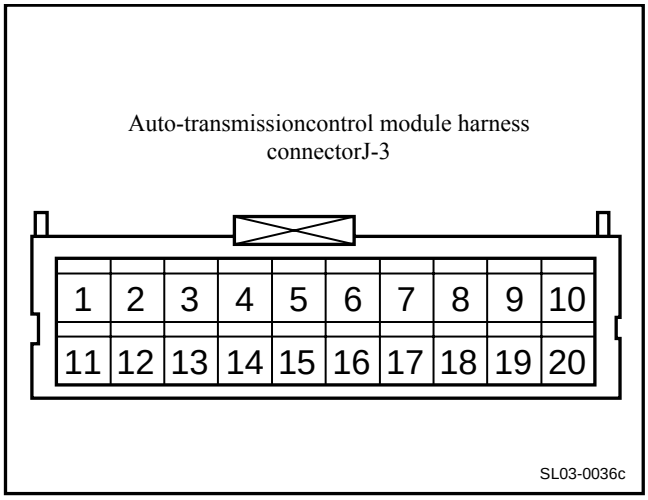
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal No.25 of the electromagnetic valve harness connector J-4 and terminal No.18 of the automatic control module J-3.

D. Measure the resistance between Terminal No.26 of the electromagnetic valve harness connector J-4 and terminal No.8 of the automatic control module J-3.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4terminalNo.25 and reliable grounding



G. Measure the voltage between terminal No.26 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test items	Standard value
J-4(25) — J-3(18)	Less than 3 Ω
J-4(26) — J-3(8)	Less than 3 Ω
J-4(25) — Reliable grounding voltage value	O V
J-4(26) — Reliable grounding voltage value	0 V

Does it conform to the standard value?

No → Circuit fault, repair circuit.

Yes

5	ReplaceTCU

Refer to 3.5.7.8 replace automatic transmission control module

Next

6	Go to automatic transmission fresh process.

Refer to 3.5.7.4 Automatic transmission refresh process

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Next

7	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 intermittent fault inspection for intermittent fault.

Yes

8	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

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3.5.7.12 P1605 P1610 P1611

1. DTC description:

DTC	**P1605**	EMM Data mismatch

DTC	**P1610**	EMM communication error

DTC	**P1611**	EMM Data error

In the process of manufacture and design, the EMM module is matched with the transmission electromagnetic valve body.

2. Conditions for setting DTC and the fault position :

DTC Code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault Position s
P1605	Data stored in an Embedded Memory Module (EMM) of a TCU (transmission control unit) can not be matched with the EMM in a transmission.	Ignition switch is in ON position	1. Electromagnetic valve and harness assembly 2. TCU 3. Automatictransmission assembly
P1610	TCU cannot communicate with EMM.		
P1611	Data stored in EMM is damaged or lost or invalid.		

3. Circuit sketch

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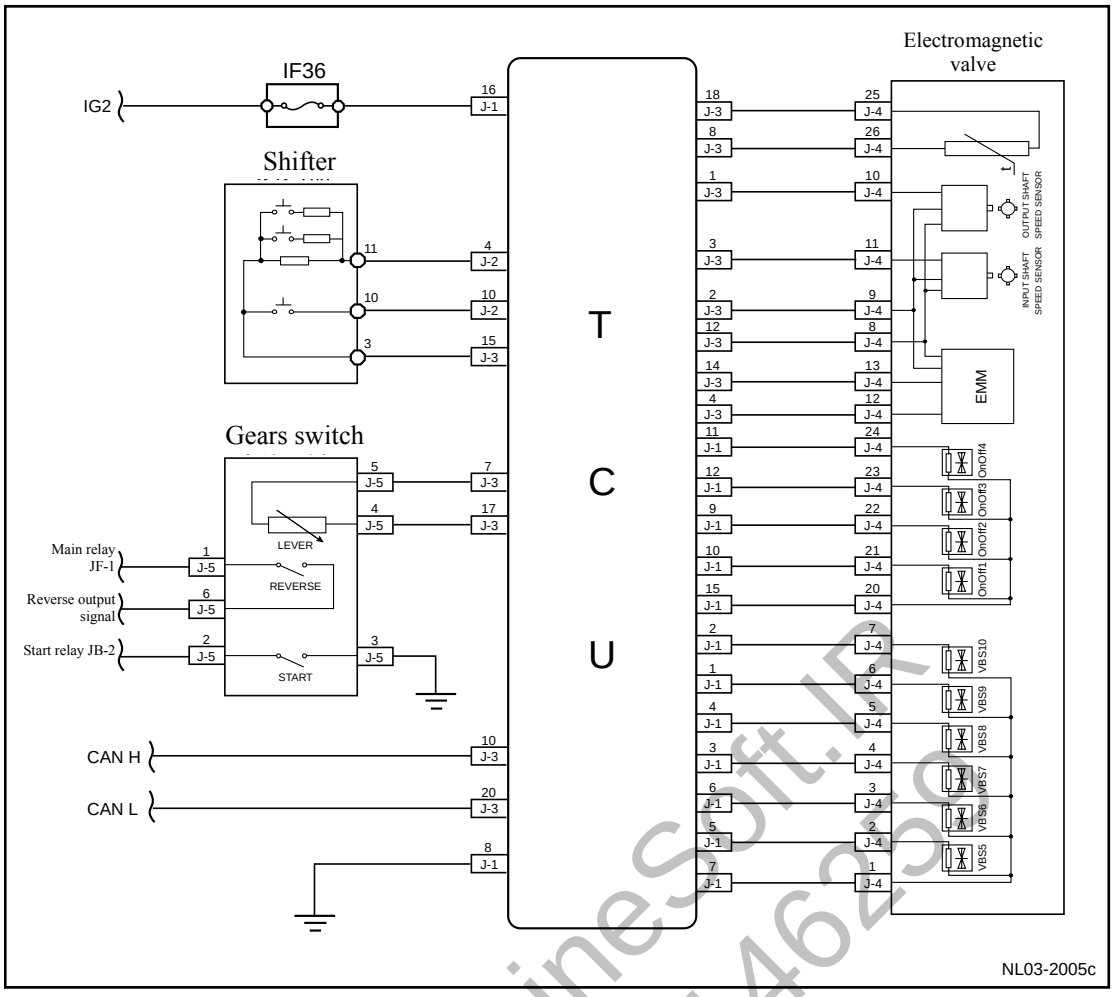

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4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P1605, P1610 and P1611 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC codes shown	**To Step**
DTC P1605, P1610, P1611	Yes
DTC except for DTC P1605, P1610, P1611	No

No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect EMM module circuit

A. rotated ignition switch to OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between terminal No.8of the electromagnetic valve harness connector J-4 and Terminal No.12 of the automatic control module J-3.

D. Measure the resistance between terminal 9 of the electromagnetic valve harness connector J-4 and terminal No.2 of the automatic control module J-3.

E. Measure resistance value of electromagnetic valve harness connector J-4Terminal No.12 and automatic transmission control moduleJ-3 No.4 terminal

F. Measure resistance of electromagnetic valve harness connector J-4 Terminal No.13 BS automatic transmission control moduleJ-3 No.14 terminal

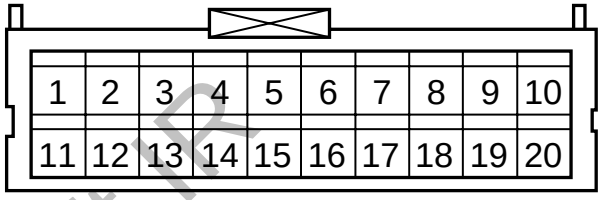
G. Turn the ignition switch to the OFF position.

H. Measure the voltage between terminal No.8of the electromagnetic valve harness connector J-4 and secure ground wire.

I. Measure voltage of electromagnetic valve harness connector J-4 Terminal No.9 and reliable grounding

J. Measure voltage of electromagnetic valve harness connector J-4terminal No.20 and reliable grounding

Auto-transmissioncontrol module harness connectorJ-3



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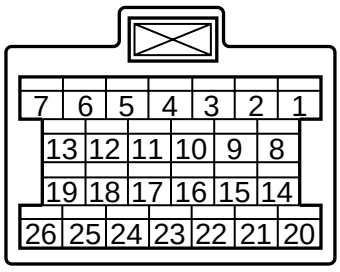
Electromagnetic valve harness connectorJ-4



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K. Measure voltage electromagnetic valve harness connector J-4 terminal No.13 and reliable grounding

Results

Test Items	Standard value
J-4(8) — J-3(12)	Less than 3 Ω
J-4(9) — J-3(2)	Less than 3 Ω
J-4(12) — J-3(4)	Less than 3 Ω

J-4(13) — J-3(14)	Less than 3 Ω
J-4(8) — Reliable grounding voltage value	O V
J-4(9) — Reliable grounding voltage value	0 V
J-4(12) — Reliable grounding voltage value	O V
J-4(13) — Reliable grounding voltage value	0 V

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

3	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

4	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

5	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

(d). Start and run the engine at idle speed to warm up the engine for at least 5min.

(e) Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

6	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

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Replace Automatictransmission assembly , refer to3.5.7.6 Automatictransmission assembly replacement

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3.5.7.13 P0716 P0717

1. DTC description:

DTC	**P0716**	Input shaft /turbine speed value

DTC	**P0717**	Input shaft /turbine speed sensor signal is instability

The ISS sensor is a Hall Effect sensor. The ISS sensor is integrated with the OSS sensor and installed on the main housing of the automatic transmission (below the valve body).

2. Conditions for setting DTC and the fault position:

DTC code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault position s
P0716	Compared the input shaft speed (ISS) with the engine speed, confirm the authenticity	1. Ignition key is in the "ON" position 2. Engine speed >3000 rpm	1. electromagnetic valve and harness assembly 2. TCU 3. Automatictrans mission assembly
P0717	The input speed sensor receives the intermittent pulse or interference pulse.		

3. Circuit sketch

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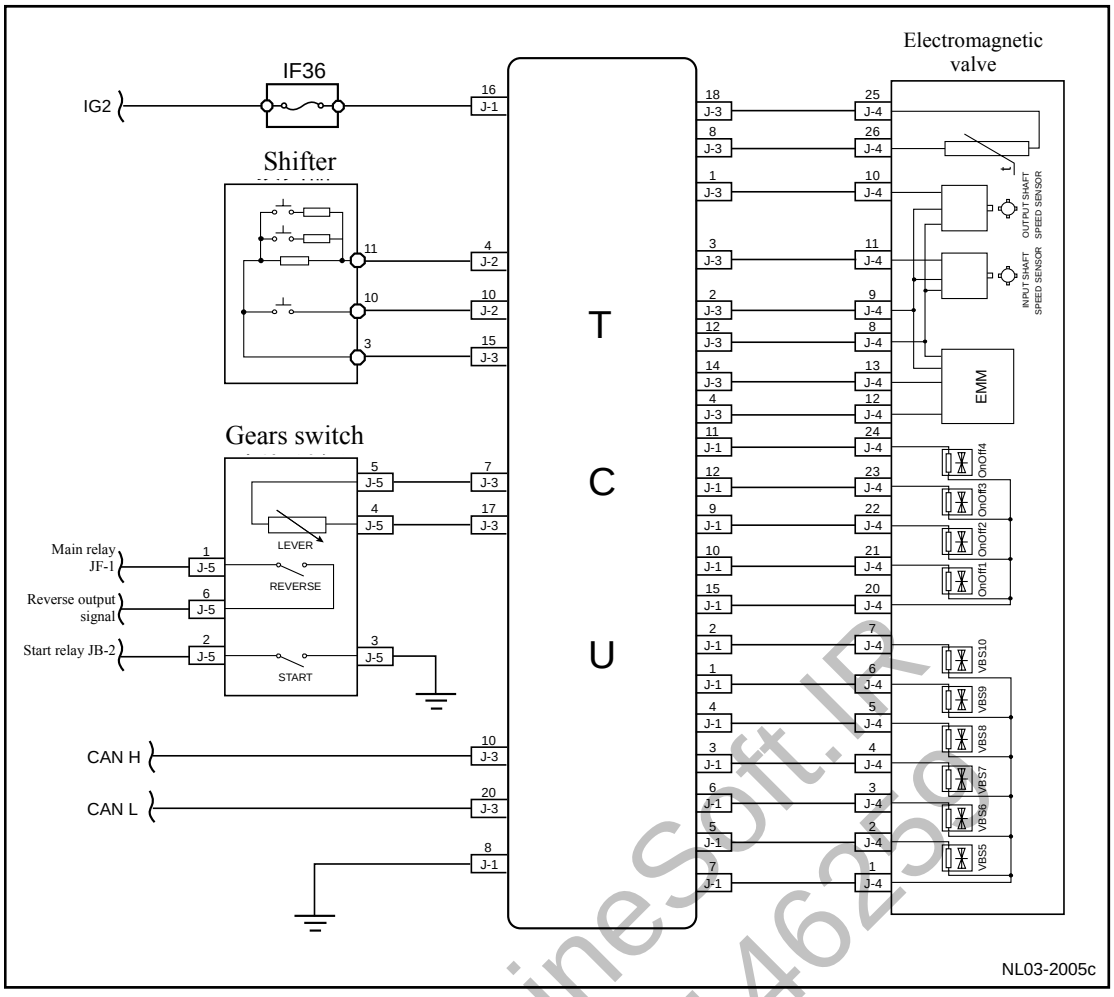

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0716 and P0717 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC codes shown	**To step**
DTC P0716, P0717	Yes
DTC except for DTC P0716, P0717	No

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No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect the reference voltage of the input shaft speed sensor.

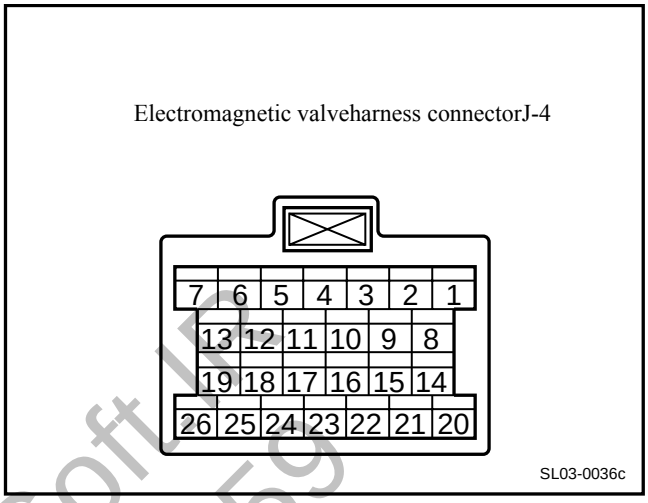
A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Turn the ignition switch to the ON position.

D. Measure the voltage between terminals 8 and 9 of the electromagnetic valve harness connector J-4.

Standard voltage values: is more than10V



Does it conform to the standard value?

No

Refer to 3.4.7.8 Replacement of automatic transmission control module to replace TCU.

Yes

3	Detect the signal voltage of the input shaft speed sensor.

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Turn the ignition switch to the ON position.

D. Measure the voltage between Terminals 8 and 11 of the electromagnetic valve harness connector J-4.

Standard voltage: 4.9-5.1 V

Does it conform to the standard value?

No

Refer to 3.4.7.8 replacement of automatic transmission control module to replace TCU.

Yes

4	Detect the circuit of the input shaft speed sensor.

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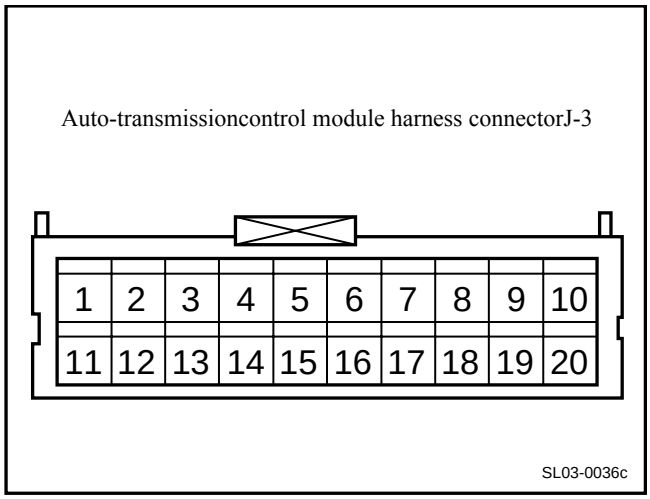
A. Rotated ignition switch to OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between terminal No.8of the electromagnetic valve harness connector J-4 and Terminal No.12 of the automatic control module J-3.

D. Measure the resistance between terminal 9 of the electromagnetic valve harness connector J-4 and Terminal No.2 of the automatic control module J-3.

E. Measure resistance of electromagnetic valve harness connector J-4 No ,11 terminal and Automatic transmission control moduleJ-3Terminal No.3



F. Turn the ignition switch to ON position.

G. Measure the voltage between Terminal No.8of the electromagnetic valve harness connector J-4 and secure ground wire.

H Measure voltage of electromagnetic valve harness connector J-4 terminal No.9 and reliable grounding

Measure voltage of electromagnetic valve harness connector J-4 No. 1 terminal No. 1 and reliable grounding

Results

Test Items	Standard value
J-4(8) — J-3(12)	Less than 3 Ω
J-4(9) — J-3(2)	Less than 3 Ω
J-4(11)— J-3(3)	Less than 3 Ω
J-4(8) — Reliable grounding voltage value	O V
J-4(9) — Reliable grounding voltage value	0 V
J-4(11) — Reliable grounding voltage value	O V

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

5	Detect the output waveform of the input shaft speed sensor.

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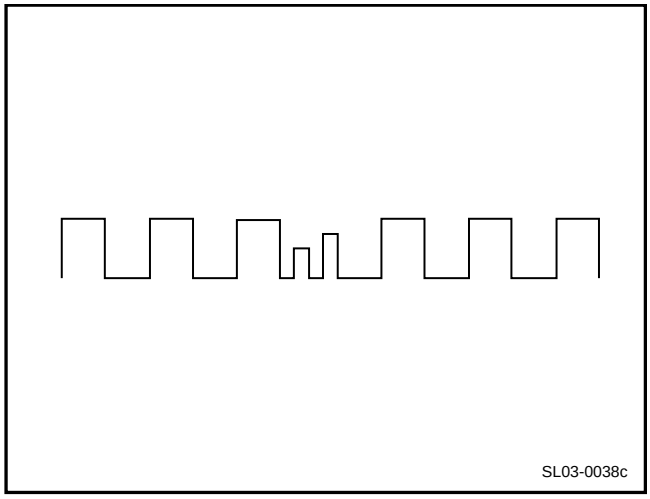
A. Turn the ignition switch to the OFF position.

B. Connect an oscilloscope to terminals No.3 and 12 of the harness connector J-3 of the automatic transmission control module.

C. Turn the ignition switch to the ON position.

D. Start up the engine and increase the engine RPM to observe whether the waveform on the oscilloscope is as shown in the right figure.



Is the waveform consistent with the right figure?

No → Replace auto-transmission assembly, refer to3.4.7.6 replace auto-transmission assembly

Yes

6	Replace TCU

Refer to3.5.7.8 replace automatic transmission control module

Next

7	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

8	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

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No

Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

9	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace Automatictransmission assembly; refer to3.5.7.6 Automatictransmission assembly replacement

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3.5.7.14 P0721 P0722

1. DTC description:

DTC	**P0721**	Output shaft speed sensor value

DTC	**P0722**	Output shaft speed sensor signal is instability

The ISS sensor is a Hall Effect sensor. The ISS sensor is integrated with the OSS sensor and installed on the main housing of the automatic transmission (below the valve body).

2. Conditions for setting DTC and the gault position :

DTC code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault position s
P0721	Compared the output shaft speed (OSS) sensor with the external equivalent revolution speed signal, verify the integrity thereof.	Ignition switch is in ON position	1. Electromagnetic valve and harness assembly 2. TCU 3. Automatictrans mission assembly
P0722	The output speed sensor receives the intermittent pulse or interference pulse.		

3. Circuit sketch

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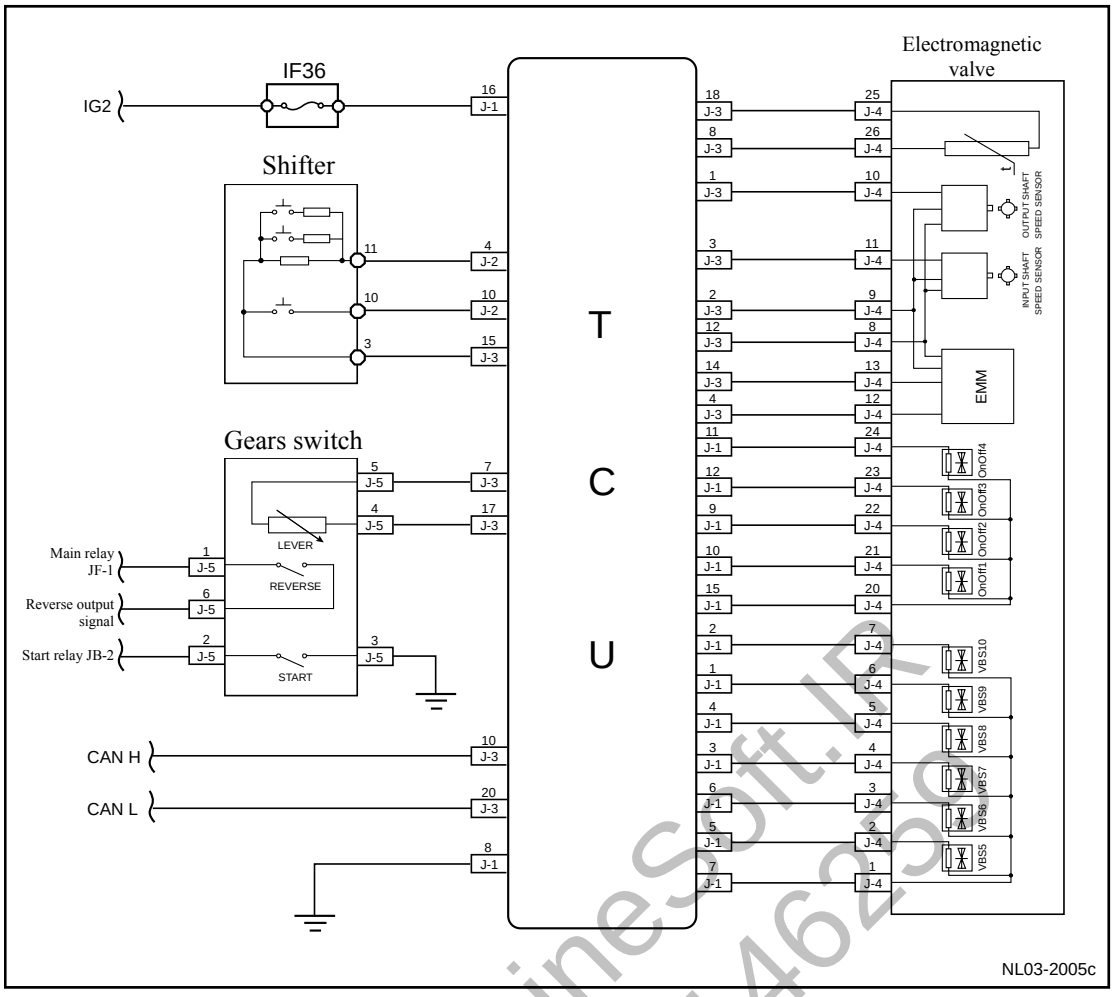

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P1605, P1610 and P1611 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC P0721 P0722	Yes
DTC except for DTC P0721 P0722	No

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No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect Output shaft speed sensor reference voltage

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

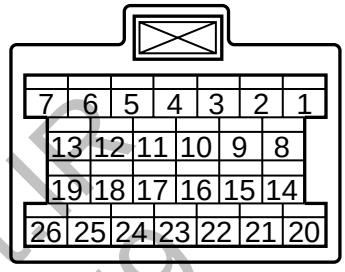
C. Turn the ignition switch to the ON position.

D. Measure the voltage between Terminals 8 and 9 of the electromagnetic valve harness connector J-4.

Standard voltage values: is more than10V

Does it conform to the standard value?

Electromagnetic valve harness connectorJ-4



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No

Refer to 3.4.7.8 Replacement of automatic transmission control module to replace TCU.

Yes

3	Detect output shaft speed sensor signal voltage

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Turn the ignition switch to the ON position.

D. Measure the voltage between terminals 8 and 10 of the electromagnetic valve harness connector J-4.

Standard voltage: 4.9-5.1 V

Does it conform to the standard value?

No

Refer to 3.4.7.8 replacement of automatic transmission control module to replace TCU.

Yes

4	Detect output shaft speed sensor circuit

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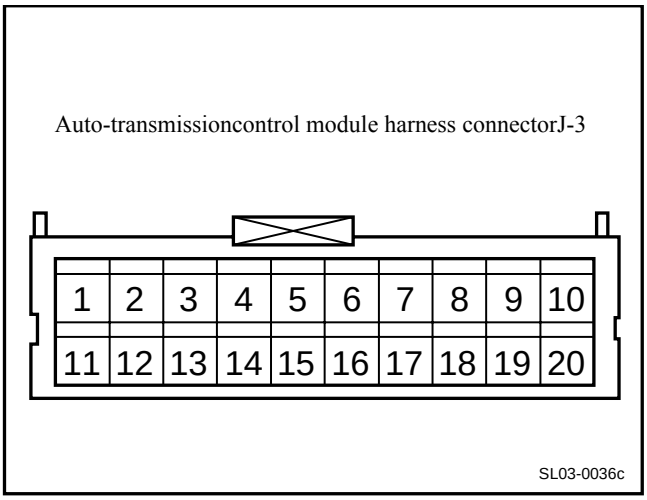
A. rotated ignition switch to OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal No.8of the electromagnetic valve harness connector J-4 and Terminal No.12 of the automatic control module J-3.

D. Measure the resistance between Terminal 9 of the electromagnetic valve harness connector J-4 and terminal No.2 of the automatic control module J-3.

E. Measure resistance of electromagnetic valve harness connector J-4 No ,10 terminal and automatic transmission control moduleJ-3No.1 terminal



F. Turn the ignition switch to ON position.

G. Measure the voltage between Terminal No.8of the electromagnetic valve harness connector J-4 and secure ground wire.

H Measure voltage of electromagnetic valve harness connector J-4 Terminal No.9 and reliable grounding

Measure Voltage of electromagnetic valve harness connector J-4 No.10 terminal and reliable grounding

Results

Test Items	Standard Value
J-4(8) — J-3(12)	Less than 3 Ω
J-4(9) — J-3(2)	Less than 3 Ω
J-4(10)— J-3(1)	Less than 3 Ω
J-4(8) — Reliable grounding voltage value	O V
J-4(9) — Reliable grounding voltage value	0 V
J-4(10) — Reliable grounding voltage value	O V

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

5	Detect the output waveform of the output shaft speed sensor.

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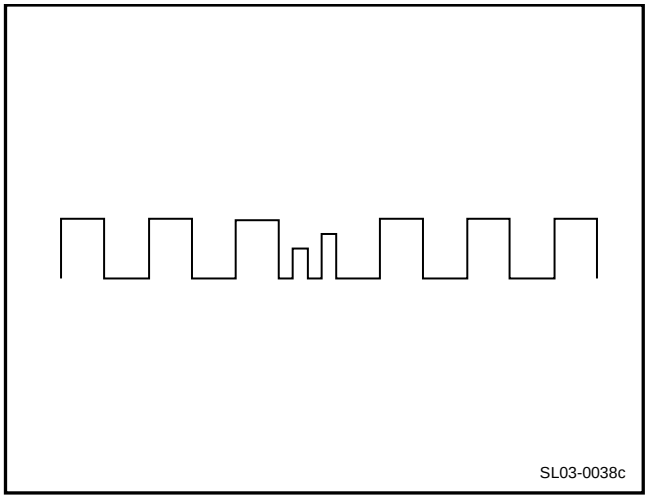
A. Turn the ignition switch to the OFF position.

B. Connect an oscilloscope to Terminals 1 and 10 of the harness connector J-3 of the automatic transmission control module.

C. Turn the ignition switch to the ON position.

D. Start up the engine and increase the engine RPM to observe whether the waveform on the oscilloscope is as shown in the right figure.



Is the waveform consistent with the right figure?

No

Replace auto-transmission assembly, refer to3.4.7.6 replace auto-transmission assembly

Yes

6	ReplaceTCU

Refer to 3.5.7.8 replace automatic transmission control module

Next

7	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

8	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E Read control system DTC code again to confirm that the system has no DTC code exported.

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No

Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

9	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace Automatictransmission assembly , refer to3.5.7.6 Automatictransmission assembly replacement

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3.5.7.15 P071D P071E P071F

1. DTC description:

DTC	**P071D**	Manual shift control upper/ down (TGS)stuck

DTC	**P071E**	Voltage of manual shift control upper/ down (TGS)signal is too low

DTC	**P071F**	High manual shift control up/down (TGS) signal voltage (open circuit)

When the control rod is in the position M, the driver can define the maximum applicable speed ratio through the selection of + or - on the selector. When initially moving the control level to the manual M position, the transmission will select the minimum applicable speed ratio.

When reaching the maximum of revolution per minute of the engine, the transmission will automatically shift up no matter how the driver selects the limit.

Manual mode gear control keys + and - are installed on the selector.

2. Conditions for setting DTC and the fault position :

DTC code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault position s
P071D	Manual shift control up/down switch (TGS) has been pressed down for at least 120s consecutively, which indicates that the switch is broken down.	Ignition switch is in ON position	1. shifter 2. Shifter line 3. TCU
P071E	Manual shift control upper/ down (TGS)switch signal give an short circuit indicating value		
P071F	Manual shift control upper/ down (TGS)switch signal give an open circuit indicating value		

3. Circuit sketch

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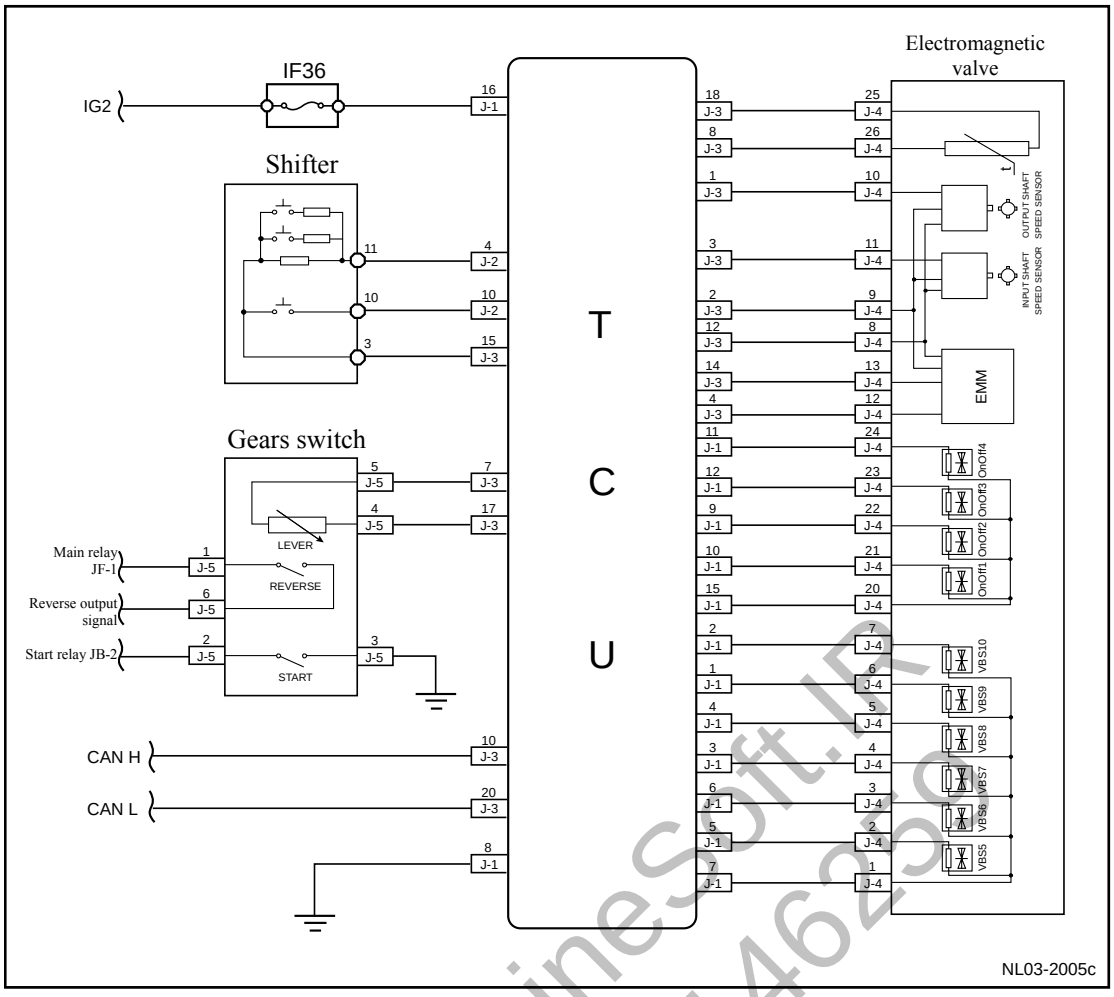

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4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P071D, P071E and P071F exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes shown	To step
DTC P071D, P071E, P071F	Yes
DTCs other than DTCs P071D, P071E and P071F	No

No → Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	The selector is used for switching various gears in sequence to check if there is a mechanical failure.

Yes → Refer to 3.4.7.7 Replacement of Selector to replace the selector assembly.

No

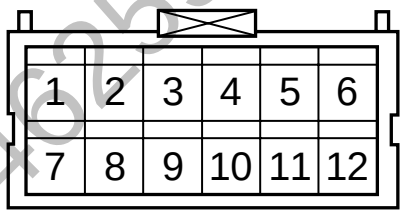
3	Detect the resistance of the selector in the manual mode.

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connectors J-2 and J-3 of the automatic transmission control module.

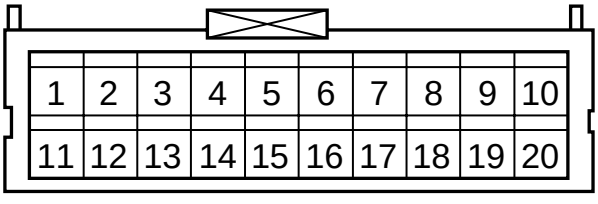
C. Control the shift gear to perform the following actions in the manual mode and measure resistance between terminal 4 of the automatic transmission control module harness connector J-2 and Terminal No.15 of the automatic transmission control module harness connector J-3.

Auto-transmissioncontrol module harness connectorJ-2



SL03-0035c

Auto-transmissioncontrol module harness connectorJ-3



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Results

Test items	Standard value
shifter press down “+”button under the manual mode	972Ω-1188Ω
shifter press down “-”button under the manual mode	499Ω-611Ω
shifter under the manual mode (not press down any button)	2916Ω-3564Ω

Does it conform to the standard value?

No → Refer to 3.4.7.7 replacement of selector to replace the selector assembly.

Yes

4	Detect the selector circuit.

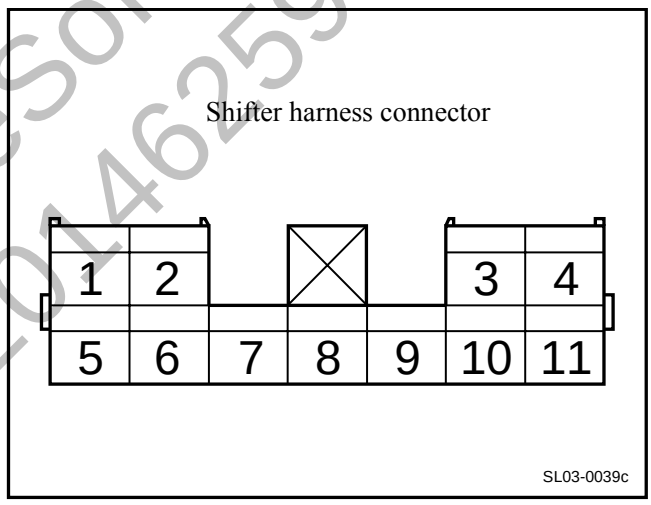
A. rotated ignition switch to OFF position.

B. Disconnect the harness connector of the shift gear.

C. Measure the resistance between Terminal No.11 of the shift gear harness connector J-4 and terminal 4 of the automatic control module J-2.

D. Measure the resistance between Terminal No.10 of the shift gear harness connector and Terminal No.10 of the automatic control module J-2.

E. Measure the resistance between terminal 3 of the shift gear harness connector and Terminal No.15 of the automatic transmission control module J-3.



F. Turn the ignition switch to ON position.

G. Measure the voltage between Terminal No.11 of the shift gear harness connector and secure ground wire.

H. Measure the voltage between Terminal No.10 of the shift gear harness connector and the secure ground wire.

I. Measure the resistance between Terminal 3 of the shift gear harness connector and secure ground wire.

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Results

Test Items	Standard Value
Shifter harness connector (11) — J-2(4)	Less than 3 Ω
Shifter harness connector (10) — J-2(10)	Less than 3 Ω
Shifter harness connector (3)— J-3(15)	Less than 3 Ω
Shifter harness connector (11) — Reliable grounding voltage value	O V
Shifter harness connector (10) — Reliable grounding voltage value	0 V
Shifter harness connector (3) — reliable grounding resistance value	Less than 3 Ω

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

5	Replace TCU

Refer to3.5.7.8 replace automatic transmission control module

Next

6	Go to automatic transmission fresh process.

Refer to3.5.7.4 automatic transmission refresh process

Next

7	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

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No

Refer to 2.2.7.3 intermittent fault inspection for intermittent fault.

Yes

8	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Refer to 3.5.7.7 replacement of selector to replace the selector assembly.

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3.5.7.16 P0729 P0731 P0732 P0733 P0734 P0735 P0736

1. DTC description:

DTC	**P0729**	6th speed transmission ratio error

DTC	**P0731**	1st speed or M1 speed transmission ratio error

DTC	**P0732**	2 nd speed transmission ratio error

DTC	**P0733**	3rd speed transmission ratio error

DTC	**P0734**	4th speed transmission ratio error

DTC	**P0735**	5th speed transmission ratio error

DTC	**P0736**	Reverse gear transmission ratio error

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The transmission gear shift is controlled by the transmission control unit (TCU). The transmission control unit receives the input information from the engine RPM sensor and other vehicle sensors. During each gear shift, it selects the time to change gear, controls the gear shift feel and the hydraulic torque converter clutch (TCC).

2. Conditions For Setting DTC and The Fault Position :

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Position s
P0729	When do not shift ,system observed transmission ratio of 6th speed is over the standard value	1. ignition switch is in ON position 2. Engine speed>300 rpm 3. Engine is in the LHM 4. Transmission oil temperature >0°C 5. Output shaft speed of transmission>300 rpm	1. Automatic transmission fluid 2. Automatic transmission fluid level 3. AutomaticTransmission assembly
P0731	It is observed that the transmission ratio when the shift gear is in the 1st speed position exceeds the calibration value when no gear shift is carried out.		

P0732	When do not shift , system observed transmission ratio of 2nd speed is over the standard value	6. Transmission shift lever is not in N speed and parking position.	
P0733	When do not shift , system observed transmission ratio of 3rd speed is over the standard value		
P0734	It is observed that the transmission ratio when the shift gear is in the 4st speed position exceeds the calibration value when no gear shift is carried out.		
P0735	It is observed that the transmission ratio when the shift gear is in the 5th speed position exceeds the calibration value when no gear shift is carried out.		
P0736	It is observed that the transmission ratio when the shift gear is in the Gear R position exceeds the calibration value when no gear shift is carried out.		

3. Circuit sketch

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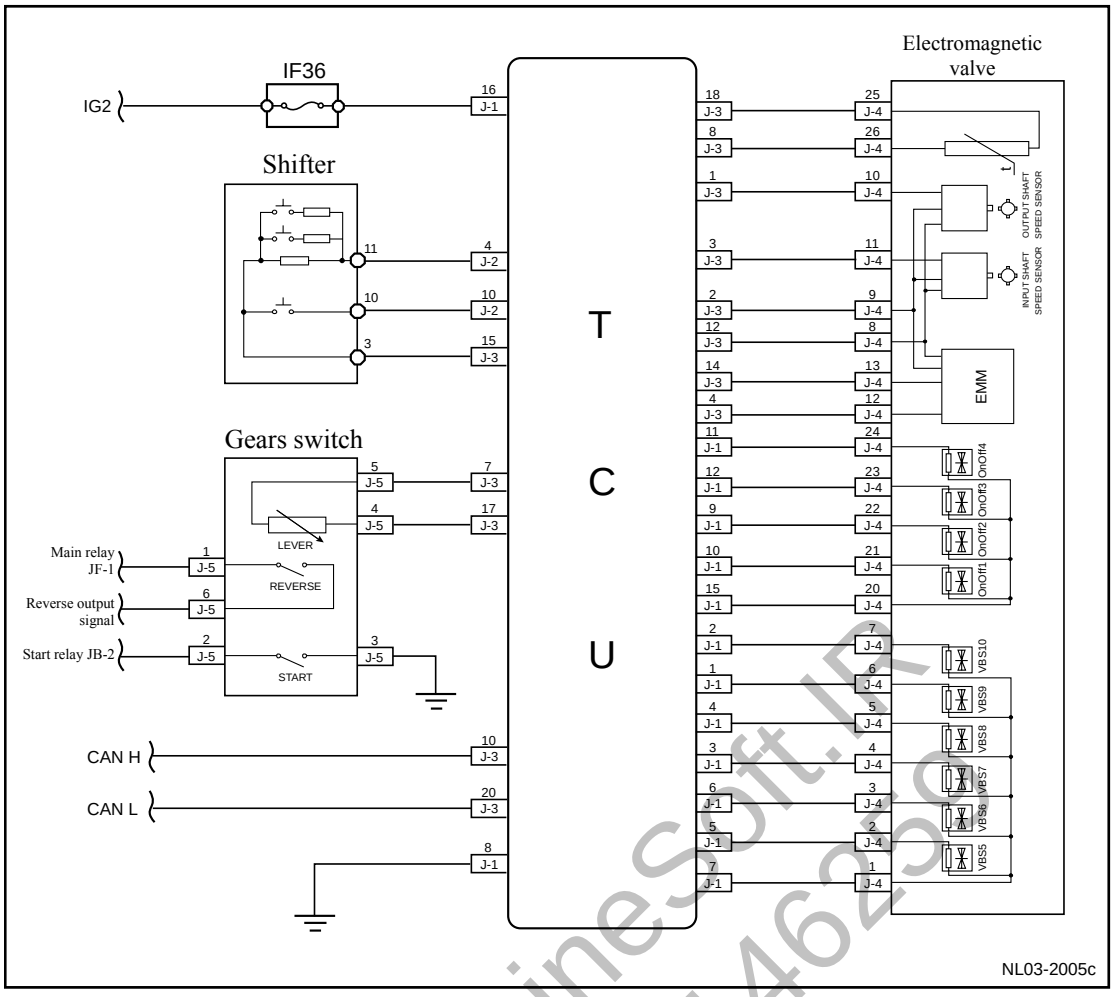

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to Check if fault codes, except DTC P0729, P0731, P0732, P0733, P0734, P0735 and P0736 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC P0729 P0731 P0732 P0733 P0734 P0735 P0736	Yes
DTCs other than DTCs P0729, P0731, P0732, P0733, P0734, P0735 and P0736	No

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No → Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Check if the automatic transmission leaks oil.

Yes → Repair or replace the fault part

No

3	Check if the Automatic transmission oil level and oil quality accord with the standard.

See 3.5.7.2 Automatic transmission oil level inspection procedures

No → Refer to 3.4.7.3 Replacement procedure of automatic transmission oil to fill or replace automatic transmission oil.

Yes

4	Check if the automatic transmission has obvious mechanical damage.

No → Repair or replace the damaged part

Yes

5	Replace Automatictransmission assembly

Replace Automatictransmission assembly , refer to3.5.7.6 Automatictransmission assembly replacement

Next

6	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

7	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

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No

Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

8	Troubleshooting

5. Maintenance guide:

Replace Automatictransmission assembly , refer to3.5.7.6 Automatictransmission assembly replacement

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3.5.7.17 P0741 P0742 P0744

1. DTC description:

DTC	**P0741**	Hydraulic torque converter clutch in the lock status

DTC	**P0742**	Hydraulic torque converter clutch lock in the lock status

DTC	**P0744**	Clutch slippage error of hydraulic torque converter

The automatic transmission controls the hydraulic torque converter clutch to lock or separate through the hydraulic control system.

The piston pressure of the hydraulic torque converter lock clutch is decided by pressure controllable electromagnetic valve (VBS). During operation, the transmission control unit (TCU) compares with the expected by calculating the torque converter slide speed, If the torque converter slip sheet is not within the predefined parameters, DTC will be set to indicate the torque converter lockout .

2. Conditions for setting DTC and the fault position :

DTC code	DTC detection strategy	Conditions for setting the DTC (control ftrategy)	Fault Position s
P0741	When requesting Lock, the hydraulic converter always keeps Open. When requiring Lock, the slippage revolution speed is higher than 50rpm and the time of duration is more than 0.5s.	1. ignition switch is in ON position 2. Engine speed >300 rpm 3. Engine is in the LHM 4. Transmission oil temperature >0°C 5. Transmission does not in the shift process. 6. Shift lever is in the D gear position	1. Automatic transmission fluid 2. Automatic transmission fluid level 3. AutomaticTransmission assembly
P0742	When requesting Open, the hydraulic converter always keeps Lock. When requiring Open, the slippage revolution speed is lower than 50rpm, the engine torque is more than 150Nm, and the time of duration is more than 0.5s.		
P0744	The sliding speed of the hydraulic torque converter is not controlled. The duration is more than 0.5s.		

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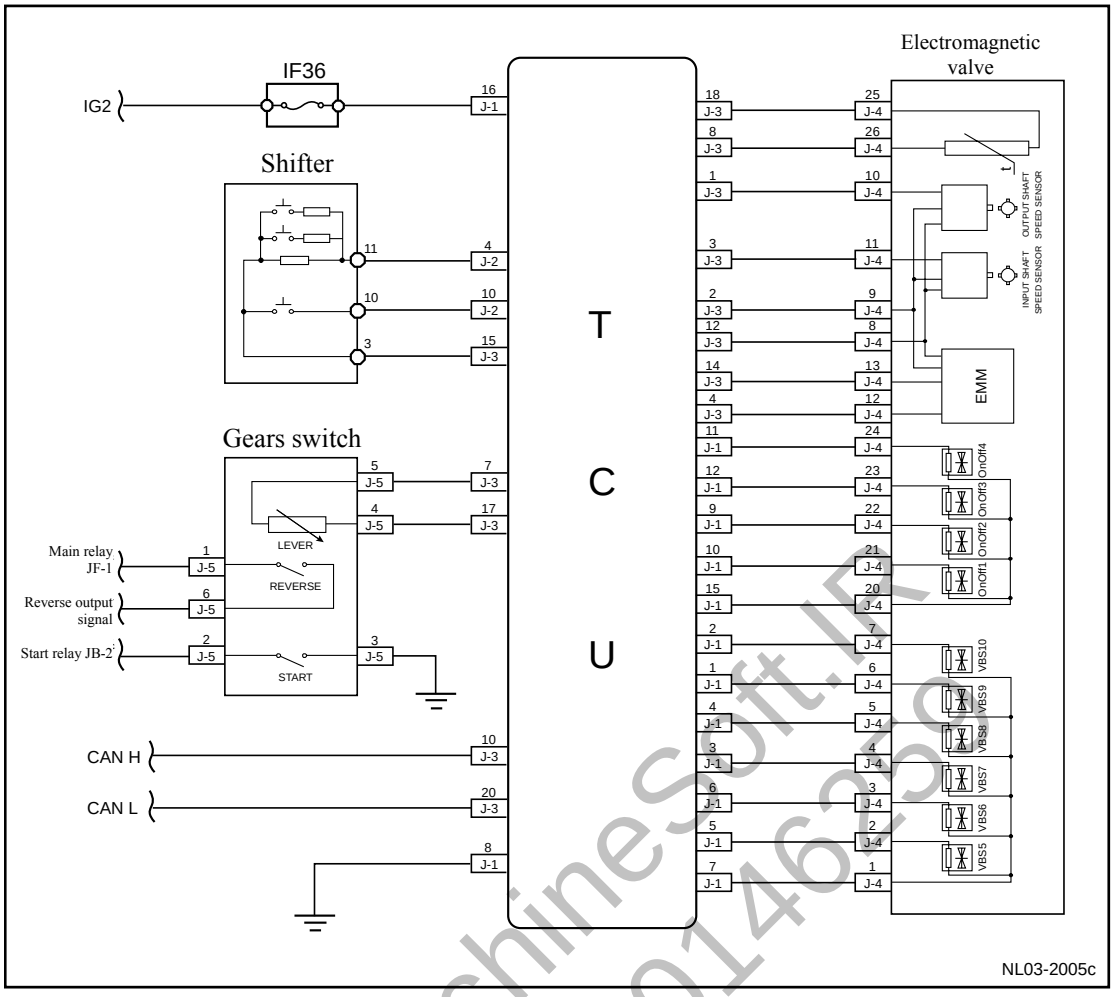
3. Circuit sketch



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4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0741, P0742 and P0744 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC P0741 P0742 P0744	Yes
DTCs other than DTCs P0741, P0742 and P0744	No

No → Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Check if the automatic transmission leaks oil.

Yes → Repair or replace the fault part

No

3	Check if the automatic transmission oil level and oil quality accord with the standard.

See 3.5.7.2 Automatic transmission oil level inspection procedures

No → Refer to 3.4.7.3 Replacement Procedure of Automatic Transmission Oil to fill or replace automatic transmission oil

Yes

4	Check if the automatic transmission has obvious mechanical damage.

No → Repair or replace the damaged part

Yes

5	Replace AutomaticTransmission assembly

Replace AutomaticTransmission assembly , refer to3.5.7.6 AutomaticTransmission assembly replacement

Next

6	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

7	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

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No

Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

8	Troubleshooting

5. Maintenance guide:

Replace AutomaticTransmission assembly , refer to3.5.7.6 AutomaticTransmission assembly replacement

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3.5.7.18 P0962 P0963

1. DTC description:

DTC	**P0962**	electromagnetic valveS9 high current (short circuit)

DTC	**P0963**	electromagnetic valveS9low current(open circuit)

The transmission control unit (TCU) uses a variable pressure electromagnetic valve to regulate the hydraulic pressure. The hydraulic system controls the clutch in the transmission to realize the torque transmission.

The transmission control unit (TCU) can control a certain amount of pressure by adjusting the current of the electromagnetic valve to enter the clutch and the transmission of the clutch torque is directly related to the current of the electromagnetic valve.

During operation, the transmission control unit evaluates the current actually delivered to the electromagnetic valve and compares with the expected. If there is no pre-defined parameter currently, the DTC is set to display abnormal load of the transmission control unit.

2. Conditions for setting DTC and the fault position:

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Position s
P0962	Feed back message of electromagnetic valveS9 exist short circuit	1. Ignition switch is in the "ON" position. 2. Electromagnetic valve power on 3. TCU power supply voltage is normal	1. Electromagnetic valve 2. Electromagnetic valve circuit 3. TCU
P0963	Feed back message of electromagnetic valveS9 exist open circuit		

3. Circuit sketch

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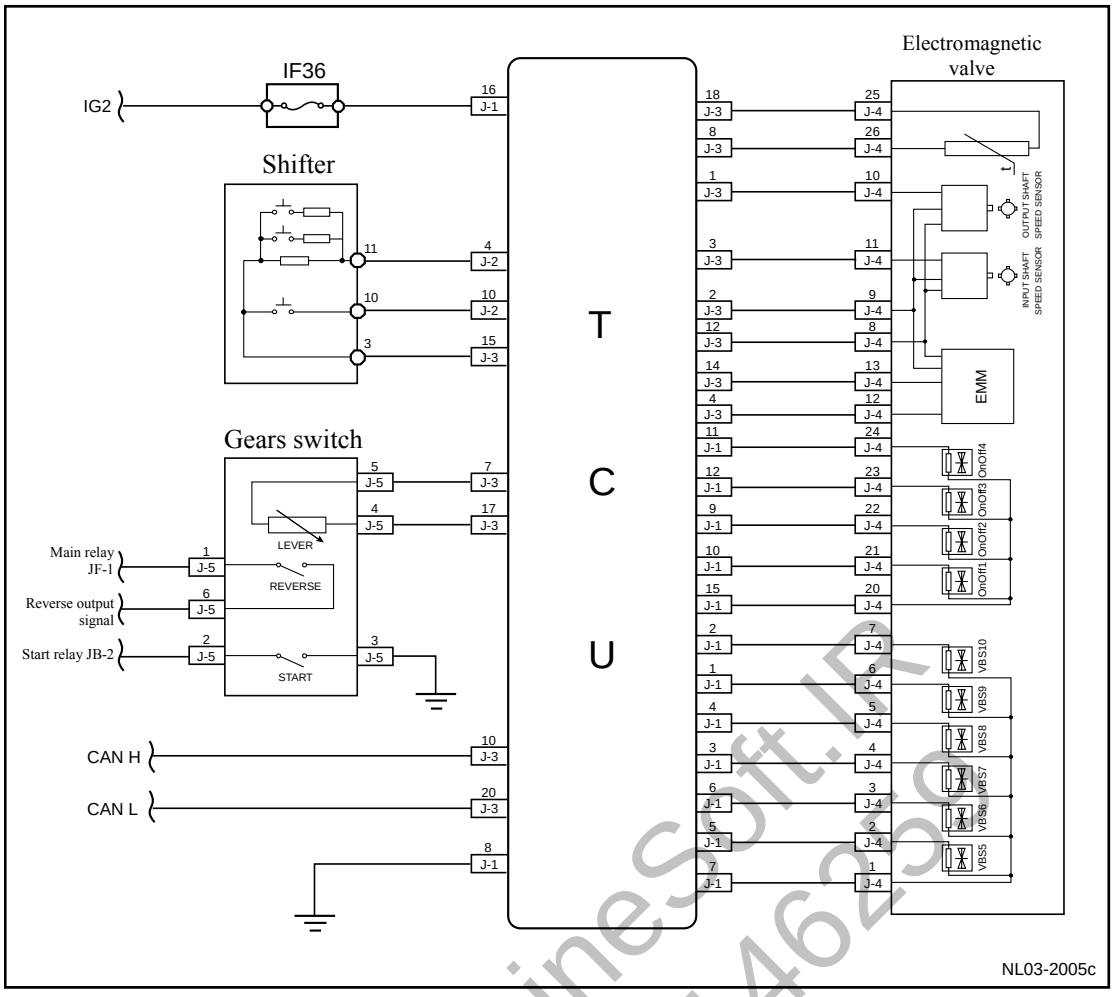

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4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0962 and P0963 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC P0962 P0963	Yes
DTCs other than DTCs P0962 and P0963	No

No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCU power supply circuit

See 3.5.7.8 P0603 P0604 P1604 P1701 P1703

Next

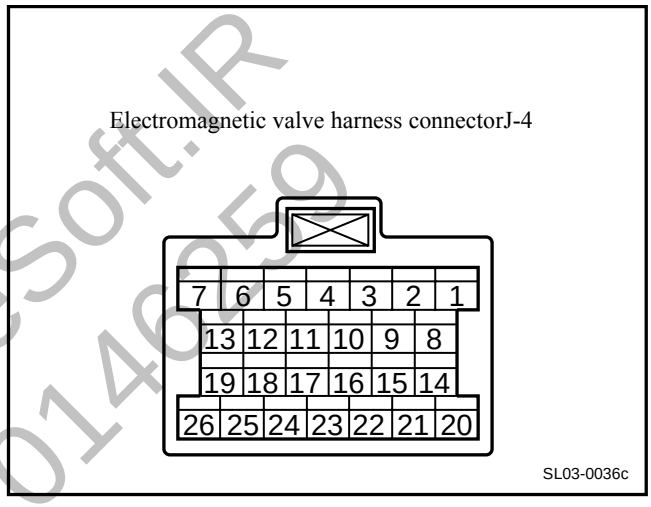
3	Detect S9electromagnetic valve resistance

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals 6 and 1 of the electromagnetic valve harness connector J-4.

Standard resistant value :4.11Ω-4.17Ω



Does it conform to the standard value?

No

Replace auto-transmission assembly, refer to3.4.7.6 auto-transmission assembly replacement

Yes

3	Detect S9electromagnetic valve circuit

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A. rotated ignition switch to OFF position.

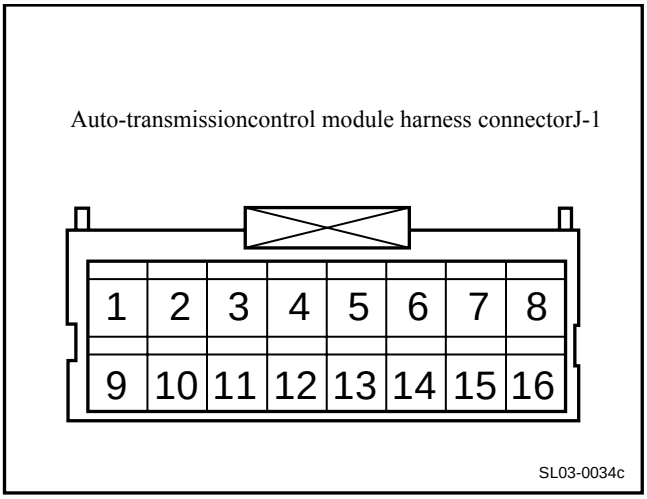
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal 6 of the electromagnetic valve harness connector J-4 and Terminal No.1 of the automatic control module J-1.

D. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and Terminal 7 of the automatic control module J-1.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4No.6 terminal and reliable grounding



G. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test Items	Standard Value
J-4 (6) — J-1(1)	Less than 3 Ω
J-4 (1) — J-1(7)	Less than 3 Ω
J-4 (6) — Reliable grounding voltage value	0 V
J-4 (1) — Reliable grounding resistance value	Less than 3 Ω

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Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

4	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

5	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

6	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace AutomaticTransmission assembly, refer to3.5.7.6 Automatictransmission assembly replacement

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3.5.7.19 P0966 P0967

1. DTC description:

DTC	**P0966**	Electromagnetic valve S10 high current (short circuit)

DTC	**P0967**	Electromagnetic valveS10low current(open circuit)

The transmission control unit (TCU) uses a variable pressure electromagnetic valve to regulate the hydraulic pressure. The hydraulic system controls the clutch in the transmission to realize the torque transmission.

The transmission control unit (TCU) can control a certain amount of pressure by adjusting the current of the electromagnetic valve to enter the clutch and the transmission of the clutch torque is directly related to the current of the electromagnetic valve.

During operation, the transmission control unit evaluates the current actually delivered to the electromagnetic valve and compares with the expected. If there is no pre-defined parameter currently, the DTC is set to display abnormal load of the transmission control unit.

2. Conditions For Setting DTC and The Fault Position :

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Position s
P0966	Feed back message of electromagnetic valveS10 exist short circuit	1. Ignition switch is in the "ON" position. 2. Electromagnetic valve power on 3. TCU power supply voltage is normal	1. Electromagnetic valve 2. Electromagnetic valve Circuit 3. TCU
P0967	Feed back message of electromagnetic valveS10 exist open circuit		

3. Circuit sketch

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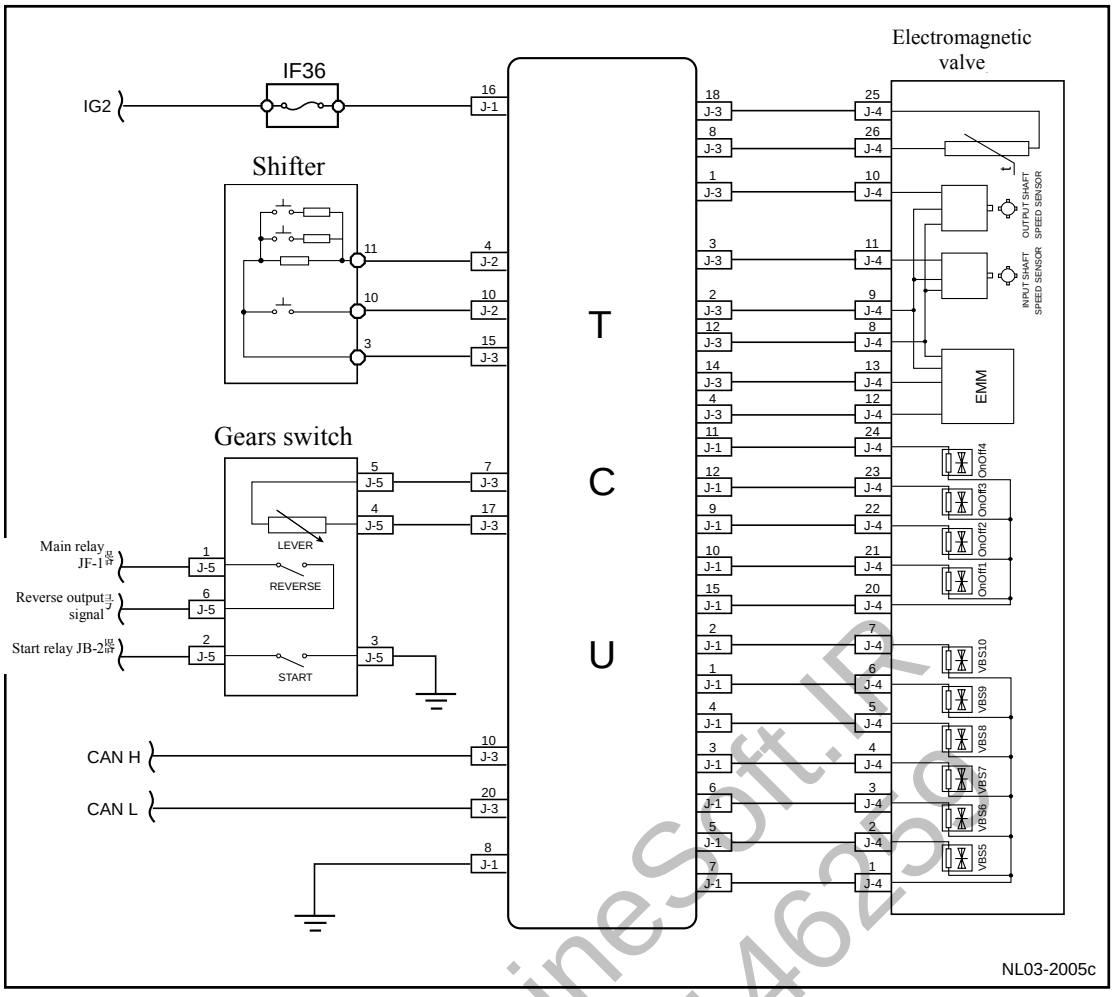

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to Check if fault codes, except DTC P0966 and P0967 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC codes shown	**Go to step**
DTC P0966 P0967	Yes
DTCs other than DTCs P0966 and P0967	No

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No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCU power supply circuit

See 3.5.7.8 P0603 P0604 P1604 P1701 P1703

Next

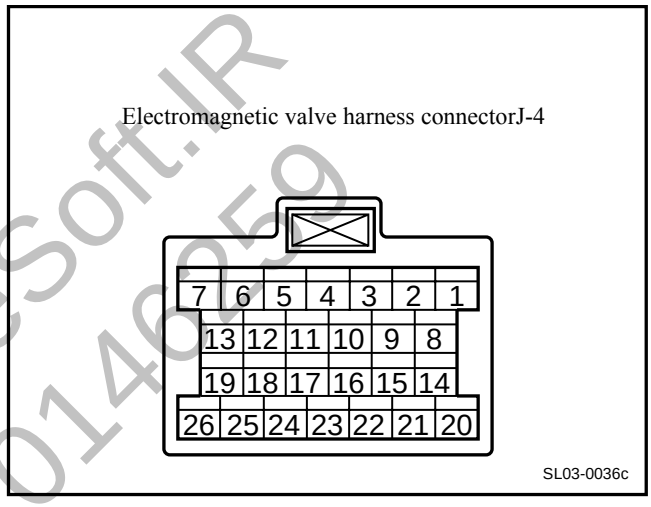
3	Detect S10electromagnetic valve resistance

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals 7 and 1 of the electromagnetic valve harness connector J-4.

Standard resistant value :4.11Ω-4.17Ω



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Does it conform to the standard value?

No

Replace auto-transmission assembly , refer to3.4.7.6 auto-transmission assembly replacement

Yes

3	Detect S10electromagnetic valve circuit

A. rotated ignition switch to OFF position .

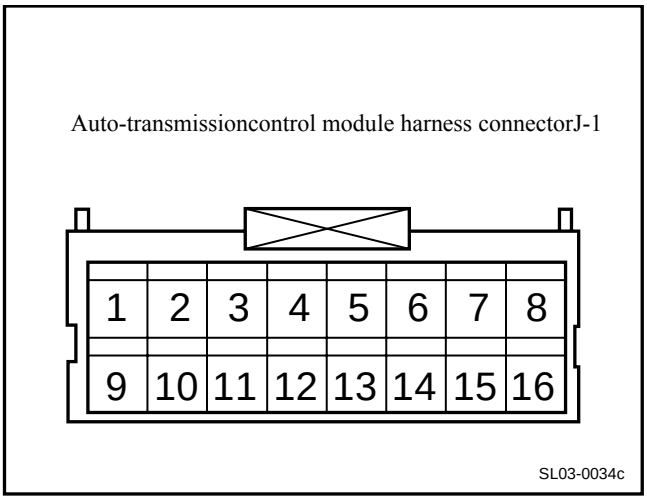
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal 7 of the electromagnetic valve harness connector J-4 and Terminal No.2 of the automatic control module J-1.

D. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and Terminal 7 of the automatic control module J-1.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4No.7 terminal and reliable grounding



G. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test Items	Standard Value
J-4 (7) — J-1(2)	Less than 3 Ω
J-4 (1) — J-1(7)	Less than 3 Ω
J-4 (7) — Reliable grounding voltage value	0 V
J-4 (1) — Reliable grounding resistance value	Less than 3 Ω

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

4	Replace TCU

Refer to3.5.7.8 replace automatic transmission control module

Next

5	Go to automatic transmission fresh process .

Refer to3.5.7.4 Automatic transmission refresh process

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Next

6	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E Read control system DTC code again to confirm that the system has no DTC code exported.

No

Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

5. Maintenance guide:

Replace automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace Automatictransmission assembly, refer to3.5.7.6 Automatictransmission assembly replacement

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3.5.7.20 P0985 P0986

1. DTC description:

DTC	**P0985**	Electromagnetic valveS5 high current (short circuit)

DTC	**P0986**	Electromagnetic valveS5low current(open circuit)

The transmission control unit (TCU) uses a variable pressure electromagnetic valve to regulate the hydraulic pressure. The hydraulic system controls the clutch in the transmission to realize the torque transmission.

The transmission control unit (TCU) can control a certain amount of pressure by adjusting the current of the electromagnetic valve to enter the clutch and the transmission of the clutch torque is directly related to the current of the electromagnetic valve.

During operation, the transmission control unit evaluates the current actually delivered to the electromagnetic valve and compares with the expected. If there is no pre-defined parameter currently, the DTC is set to display abnormal load of the transmission control unit.

2. Conditions For Setting DTC and The Fault Position :

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Position s
P0985	Feed back message of electromagnetic valveS5 exist short circuit	1. Ignition switch is in the "ON" position. 2. Electromagnetic valve power on 3. TCU power supply voltage is normal	1. Electromagnetic valve 2. Electromagnetic valve Circuit 3. TCU
P0986	Feed back message of electromagnetic valveS5 exist open circuit		

3. Circuit sketch

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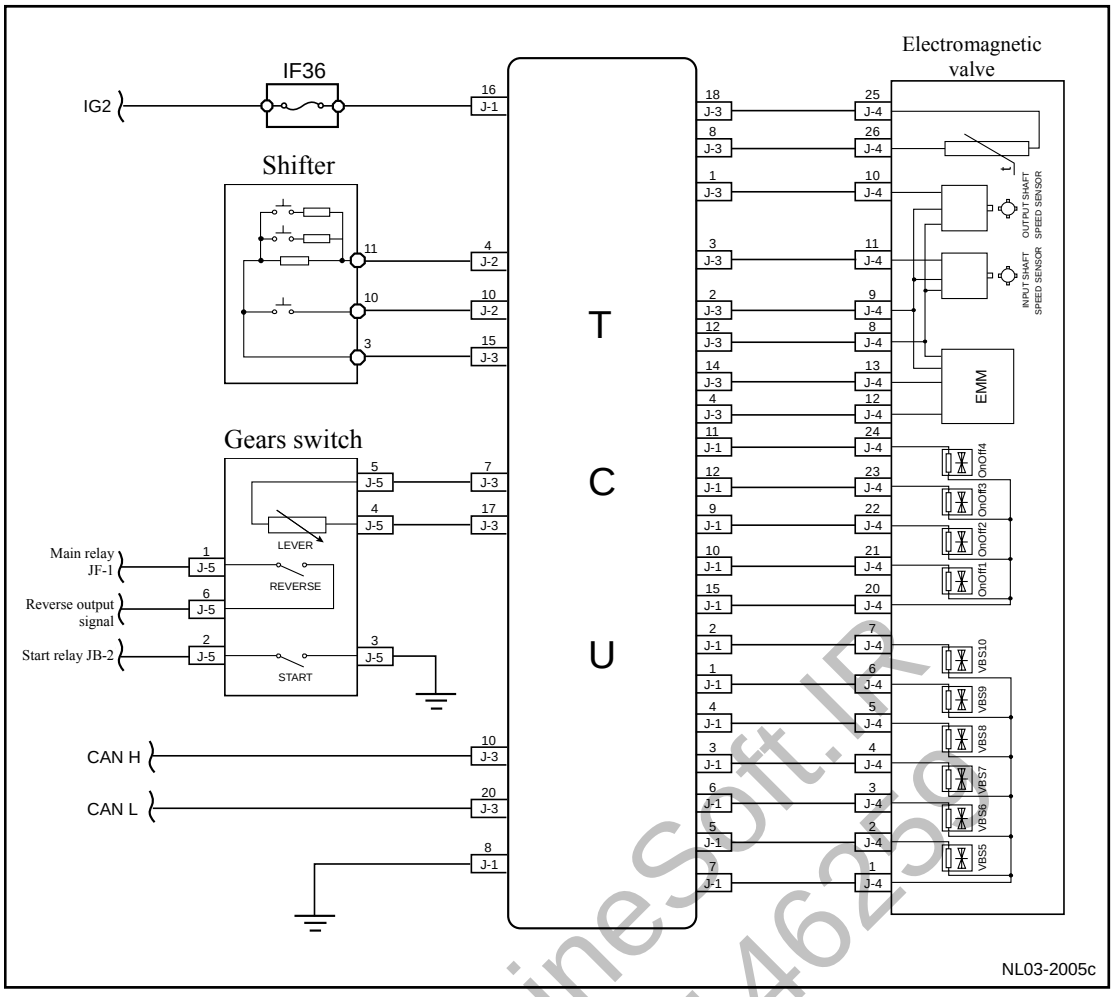

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0985 and P0986 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC P0985 P0986	Yes
DTCs other than DTCs P0985 and P0986	No

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No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCUpower supply circuit

See 3.5.7.8 P0603 P0604 P1604 P1701 P1703

Next

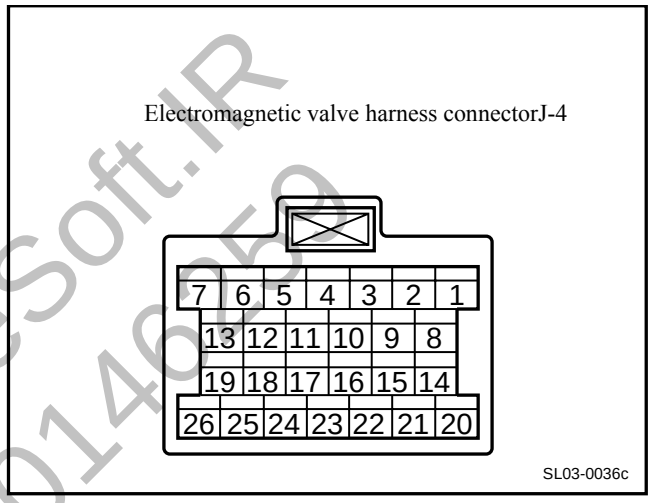
3	Detect S5electromagnetic valve resistance

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals 2 and 1 of the electromagnetic valve harness connector J-4.

Standard resistant value :4.11Ω-4.17Ω



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Does it conform to the standard value?

No

Replace auto-transmission assembly, refer to3.4.7.6 auto-transmission assembly replacement

Yes

3	Detect S5electromagnetic valve circuit

A. rotated ignition switch to OFF position.

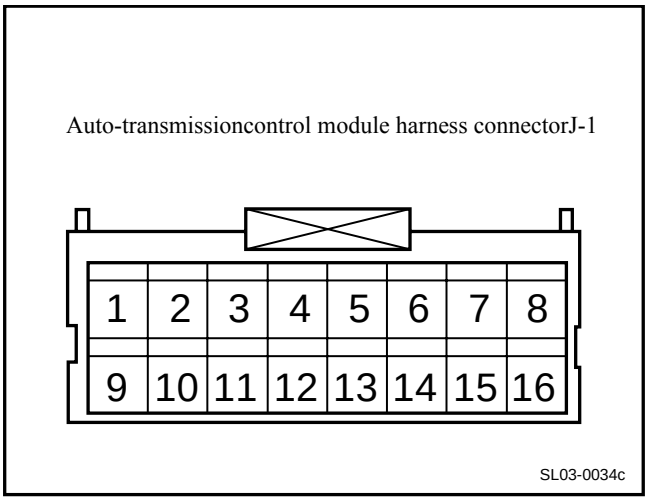
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal No.2 of the electromagnetic valve harness connector J-4 and Terminal 5 of the automatic control module J-1.

D. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and Terminal 7 of the automatic control module J-1.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4No.2 terminal and reliable grounding



G. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test Items	Standard Value
J-4 (2) — J-1(5)	Less than 3 Ω
J-4 (1) — J-1(7)	Less than 3 Ω
J-4 (2) — Reliable grounding voltage value	0 V
J-4 (1) — Reliable grounding resistance value	Less than 3 Ω

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

4	Replace TCU

Refer to3.5.7.8 replace automatic transmission control module

Next

5	Go to automatic transmission fresh process.

Refer to3.5.7.4 automatic transmission refresh process

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Next

6	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

5. Maintenance guide:

Replace automatic transmission control module, refer to 3.5.7.8 replace automatic transmission control module

Replace Automatictransmission assembly , refer to 3.5.7.6 AutomaticTransmission assembly replacement

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3.5.7.21 P0998 P0999

1. DTC description:

DTC	**P0998**	Electromagnetic valveS6 high current (short circuit)

DTC	**P0999**	Electromagnetic valveS6low current(open circuit)

The transmission control unit (TCU) uses a variable pressure electromagnetic valve to regulate the hydraulic pressure. The hydraulic system controls the clutch in the transmission to realize the torque transmission.

The transmission control unit (TCU) can control a certain amount of pressure by adjusting the current of the electromagnetic valve to enter the clutch and the transmission of the clutch torque is directly related to the current of the electromagnetic valve.

During operation, the transmission control unit evaluates the current actually delivered to the electromagnetic valve and compares with the expected. If there is no pre-defined parameter currently, the DTC is set to display abnormal load of the transmission control unit.

2. Conditions For Setting DTC and The Fault Position :

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Position s
P0998	Feed back message of electromagnetic valveS6 mean short circuit	1. Ignition switch is in the "ON" position. 2. Electromagnetic valve power on 3. TCU power supply voltage is normal	1. Electromagnetic valve 2. Electromagnetic valve Circuit 3. TCU
P0999	Feed back message of electromagnetic valveS6 mean open circuit		

3. Circuit sketch

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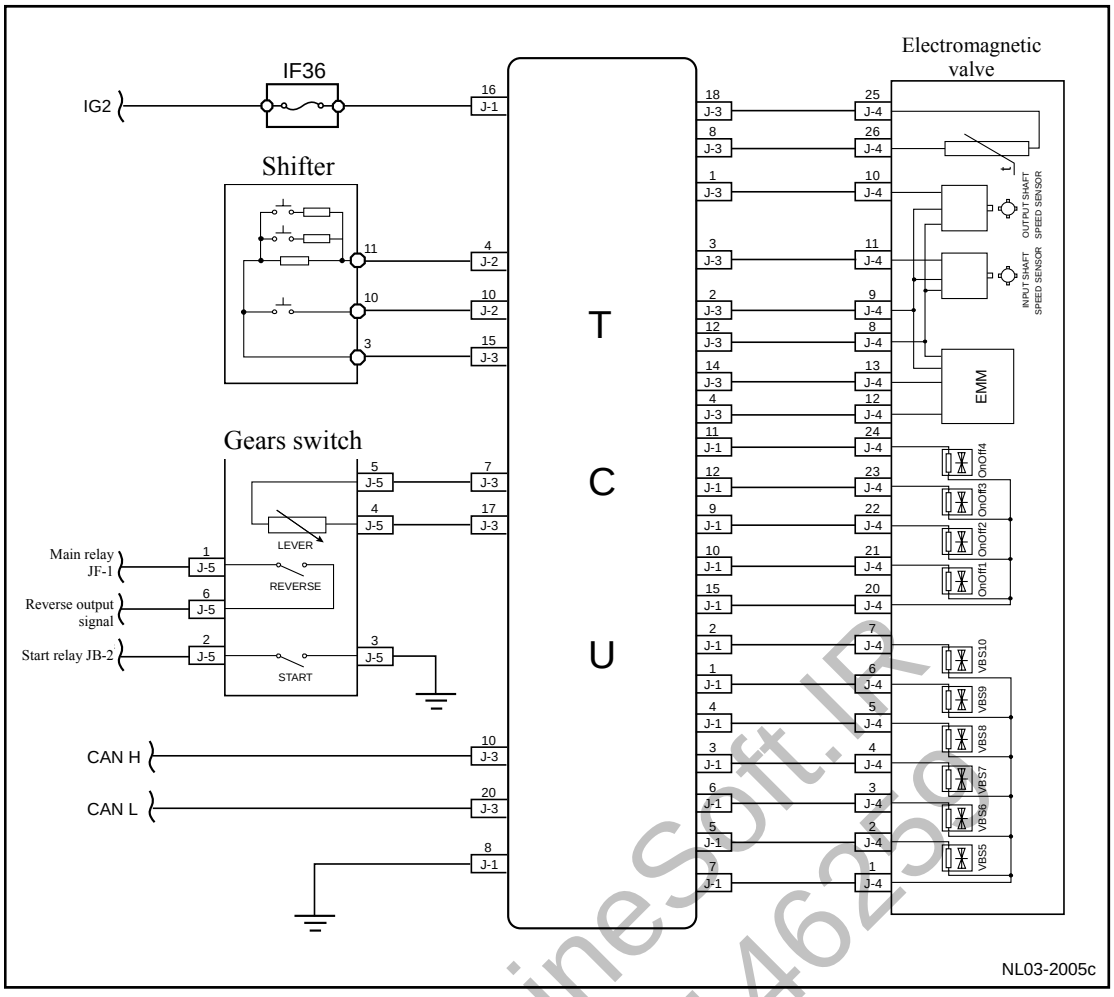

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4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to Check if fault codes, except DTC P0998 and P0999 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC P0998 P0999	Yes
DTCs other than DTCs P0998 and P0999	No

No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCUpower supply circuit

See 3.5.7.8 P0603 P0604 P1604 P1701 P1703

Next

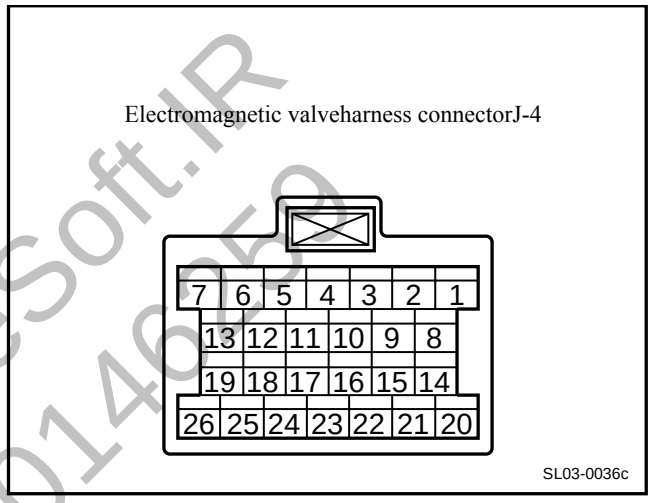
3	Detect S6electromagnetic valve resistance

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals 2 and 1 of the electromagnetic valve harness connector J-4.

Standard resistant value :4.11Ω-4.17Ω



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Does it conform to the standard value?

No

Replace auto-transmission assembly, refer to 3.4.7.6 auto-transmission assembly replacement

Yes

3	Detect S6electromagnetic valve circuit

A. rotated ignition switch to OFF position.

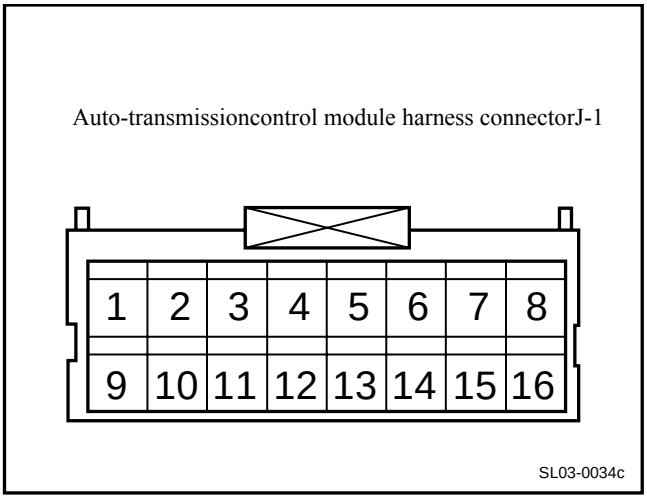
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal 3 of the electromagnetic valve harness connector J-4 and Terminal 6 of the automatic control module J-1.

D. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and Terminal 7 of the automatic control module J-1.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4Terminal No.3 and reliable grounding



G. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test Items	Standard Value
J-4 (3) — J-1(6)	Less than 3 Ω
J-4 (1) — J-1(7)	Less than 3 Ω
J-4 (3) — Reliable grounding voltage value	0 V
J-4 (1) — Reliable grounding resistance value	Less than 3 Ω

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Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

4	Replace TCU

Refer to3.5.7.8 replace automatic transmission control module

Next

5	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

6	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace Automatictransmission assembly, refer to3.5.7.6 Automatictransmission assembly replacement

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3.5.7.22 P099B P099C

1. DTC description:

DTC	**P099B**	High current of electromagnetic valveS7(short circuit)

DTC	**P099C**	electromagnetic valveS7low current(open circuit)

The transmission control unit (TCU) uses a variable pressure electromagnetic valve to regulate the hydraulic pressure. The hydraulic system controls the clutch in the transmission to realize the torque transmission.

The transmission control unit (TCU) can control a certain amount of pressure by adjusting the current of the electromagnetic valve to enter the clutch and the transmission of the clutch torque is directly related to the current of the electromagnetic valve.

During operation, the transmission control unit evaluates the current actually delivered to the electromagnetic valve and compares with the expected. If there is no pre-defined parameter currently, the DTC is set to display abnormal load of the transmission control unit.

2. Conditions for setting DTC and the fault position :

DTC code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault position s
P099B	Feed back message of electromagnetic valveS7 exist short circuit	1. Ignition switch is in the "ON" position. 2. Electromagnetic valve power on 3. TCU power supply voltage is normal	1. Electromagnetic valve 2. Electromagnetic valve Circuit 3. TCU
P099C	Feed back message of electromagnetic valveS7 exist open circuit		

3. Circuit sketch

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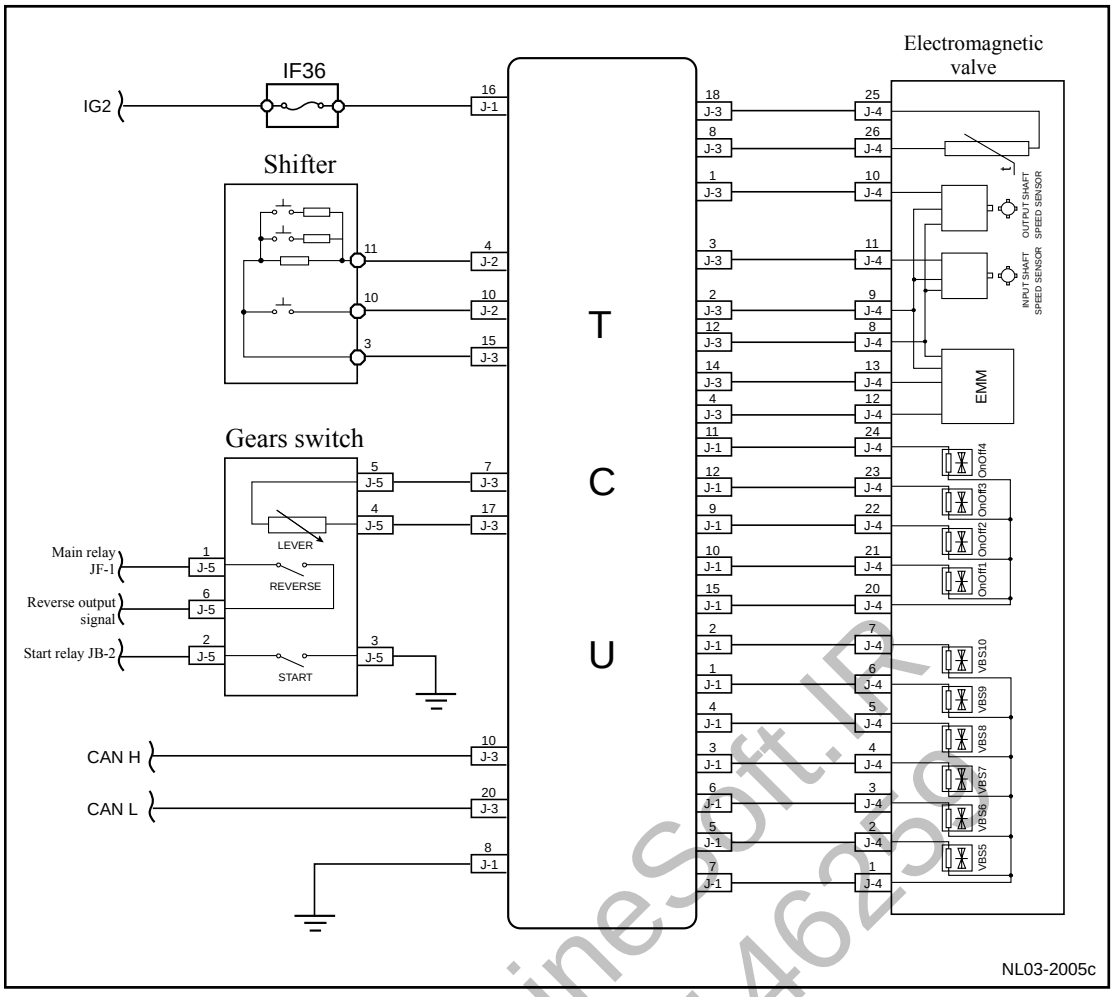

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0998 and P0999 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	To Step
DTC P099B P099C	Yes
DTCs other than DTCs P099B and P099C	No

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No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCU power supply circuit

See 3.5.7.8 P0603 P0604 P1604 P1701 P1703

Next

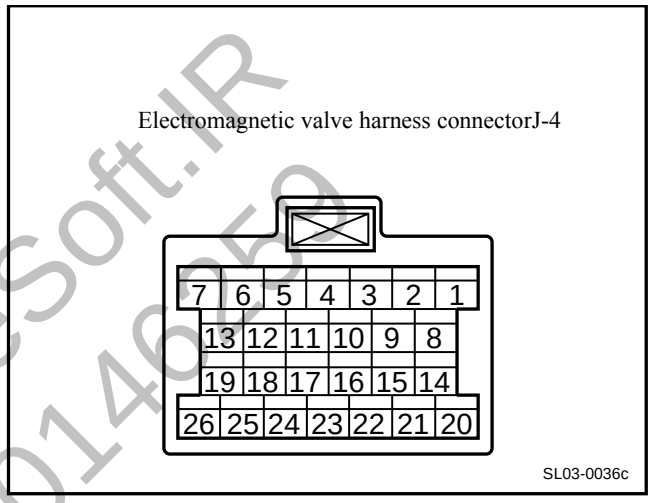
3	Detect S7electromagnetic valve resistance

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals 4 and 1 of the electromagnetic valve harness connector J-4.

Standard resistant value :4.11Ω-4.17Ω



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Does it conform to the standard value?

No

Replace auto-transmission assembly, refer to 3.4.7.6 auto-transmission assembly replacement

Yes

3	Detect S7 electromagnetic valve circuit

A. rotated ignition switch to OFF position.

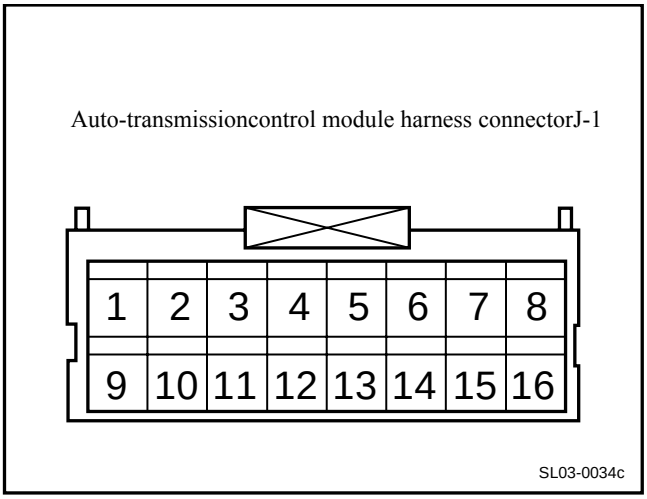
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal 4 of the electromagnetic valve harness connector J-4 and Terminal 3 of the automatic control module J-1.

D. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and Terminal 7 of the automatic control module J-1.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4No.4 terminal and reliable grounding



G. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test items	Standard value
J-4 (4) — J-1(3)	Less than 3 Ω
J-4 (1) — J-1(7)	Less than 3 Ω
J-4 (4) — Reliable grounding voltage value	0 V
J-4 (1) — Reliable grounding resistance value	Less than 3 Ω

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Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

4	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

5	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

6	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace AutomaticTransmission assembly , refer to3.5.7.6 AutomaticTransmission assembly replacement

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3.5.7.23 P099E P099F

1. DTC description:

DTC	**P099E**	High current of electromagnetic valveS8 (short circuit)

DTC	**P099F**	electromagnetic valveS8low current(open circuit)

The transmission control unit (TCU) uses a variable pressure electromagnetic valve to regulate the hydraulic pressure. The hydraulic system controls the clutch in the transmission to realize the torque transmission.

The transmission control unit (TCU) can control a certain amount of pressure by adjusting the current of the electromagnetic valve to enter the clutch and the transmission of the clutch torque is directly related to the current of the electromagnetic valve.

During operation, the transmission control unit evaluates the current actually delivered to the electromagnetic valve and compares with the expected. If there is no pre-defined parameter currently, the DTC is set to display abnormal load of the transmission control unit.

2. Conditions For Setting DTC and The Fault Position :

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Position s
P099E	Feed back message of electromagnetic valveS8 exist short circuit	1. Ignition switch is in the "ON" position. 2. Electromagnetic valve power on 3. TCU power supply voltage is normal	1. Electromagnetic valve 2. Electromagnetic valve Circuit 3. TCU
P099F	Feed back message of electromagnetic valveS8 exist open circuit		

3. Circuit sketch

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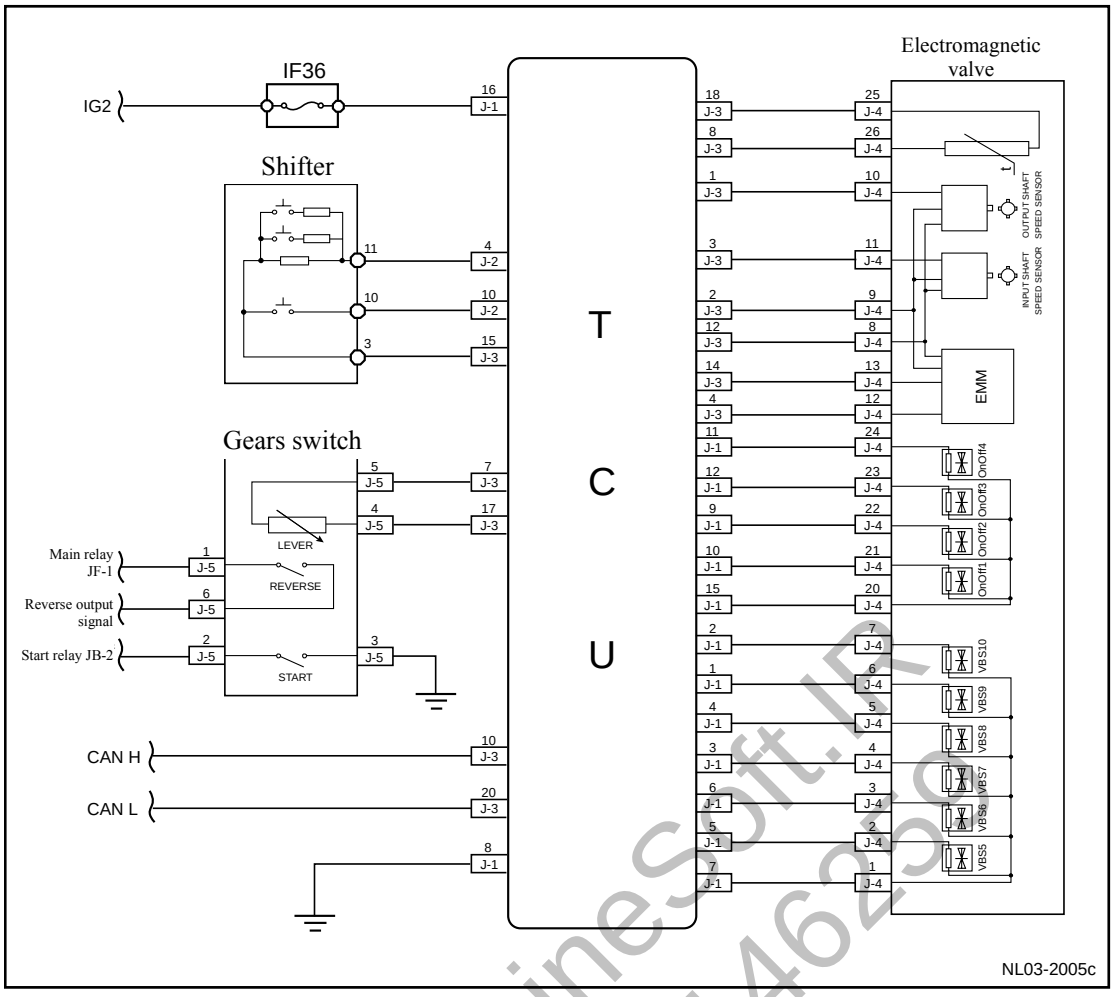

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4. Diagnostic Procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to Check if fault codes, except DTC P099E and P099F exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC P099E P099F	Yes
DTCs other than DTCs P099E and P099F	No

No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCUpower supply circuit

See 3.5.7.8 P0603 P0604 P1604 P1701 P1703

Next

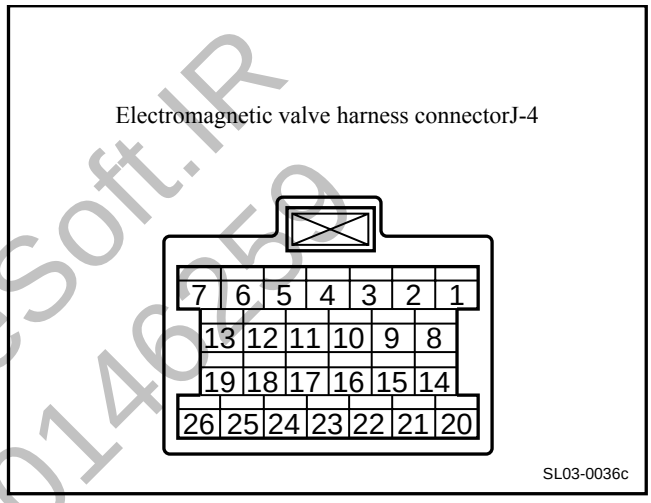
3	Detect S8electromagnetic valve resistance

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals 5 and 1 of the electromagnetic valve harness connector J-4.

Standard resistant value :4.11Ω-4.17Ω



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Does it conform to the standard value?

No

Replace auto-transmission assembly, refer to3.4.7.6 auto-transmission assembly replacement

Yes

3	Detect S8electromagnetic valve circuit

A. rotated ignition switch to OFF position.

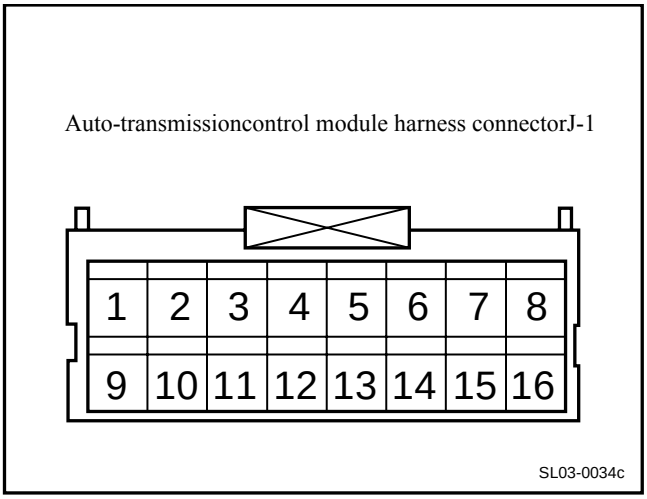
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal 5 of the electromagnetic valve harness connector J-4 and Terminal 4 of the automatic control module J-1.

D. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and Terminal 7 of the automatic control module J-1.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4No.5 terminal and reliable grounding



G. Measure the resistance between Terminal No.1 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test items	Standard value
J-4 (5) — J-1(4)	Less than 3 Ω
J-4 (1) — J-1(7)	Less than 3 Ω
J-4 (5) — Reliable grounding voltage value	0 V
J-4 (1) — Reliable grounding resistance value	Less than 3 Ω

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Does it conform to the standard value?

No → Circuit malfunction,repair circuit.

Yes

4	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

5	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

6	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace AutomaticTransmission assembly , refer to3.5.7.6 AutomaticTransmission assembly replacement

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3.5.7.24 P0973 P0974

1. DTC description:

DTC	**P0973**	On/off electromagnetic valve S1 high current (short circuit)

DTC	**P0974**	On/off electromagnetic valve S1 low current (open circuit)

The transmission control unit (TCU) uses a switching electromagnetic valve to select among different clutch elements within the transmission. During operation, the transmission control unit evaluates the current actually-delivered current to open/close the electromagnetic valve and compares with the expected. If the current is not in the pre-defined parameter currently, the DTC is set to display abnormal load of the transmission control unit.

2. Conditions For Setting DTC and The Fault Position :

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Position s
P0973	Feedback information of on/off electromagnetic valve S1 is that existence of short circuit.	1. Ignition switch is in the "ON" position. 2. Electromagnetic valve power on 3. TCU power supply voltage is normal	1. Electromagnetic valve 2. Electromagnetic valve circuit 3. TCU
P0974	Feedback information of on/off electromagnetic valve S1 is that existence of open circuit.		

3. Circuit sketch

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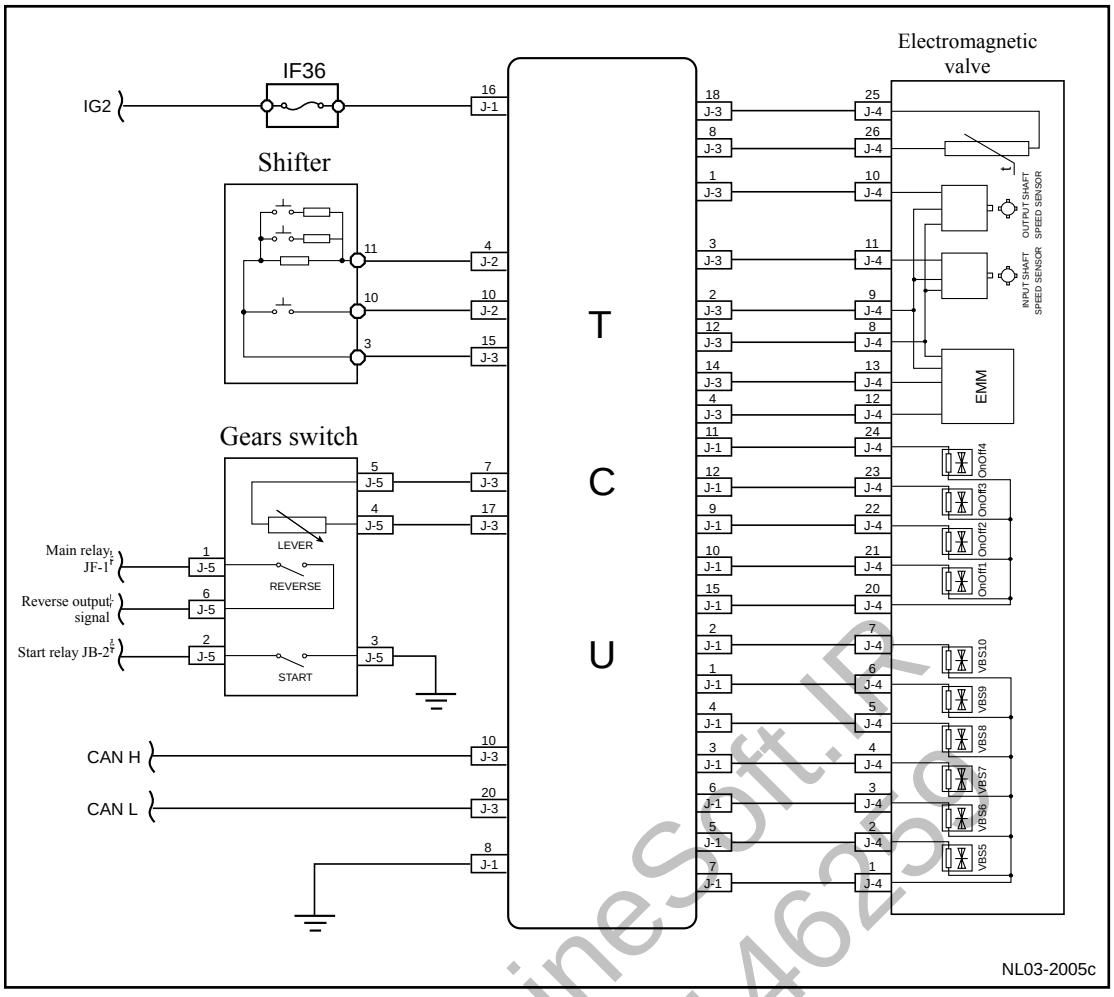

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4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0973 and P0974 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC codes shown	**To Step**
DTC P0973 P0974	Yes
DTCs other than DTCs P0973 and P0974	No

No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCU power supply circuit

See 3.5.7.8 P0603 P0604 P1604 P1701 P1703

Next

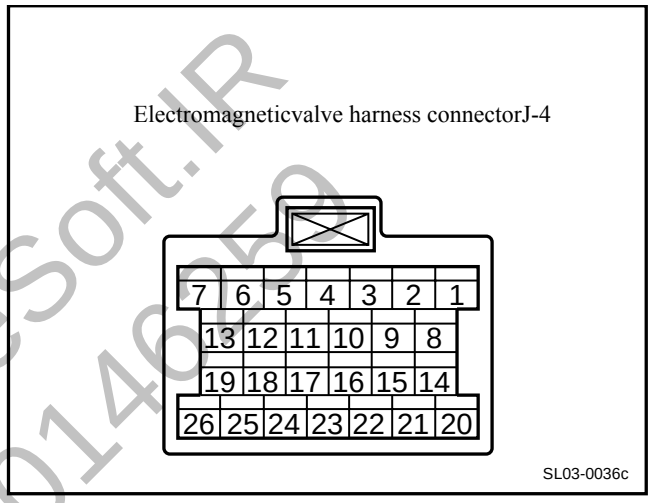
3	Detect resistance of on/off electromagnetic valve S1.

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals 21 and 20 of the electromagnetic valve harness connector J-4.

Standard resistant value :20.8Ω-23.2Ω



Does it conform to the standard value?

No

Replace auto-transmission assembly, refer to3.4.7.6 auto-transmission assembly replacement

Yes

3	Detect ON/OFF electromagnetic valve S1 circuit

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A. rotated ignition switch to OFF position.

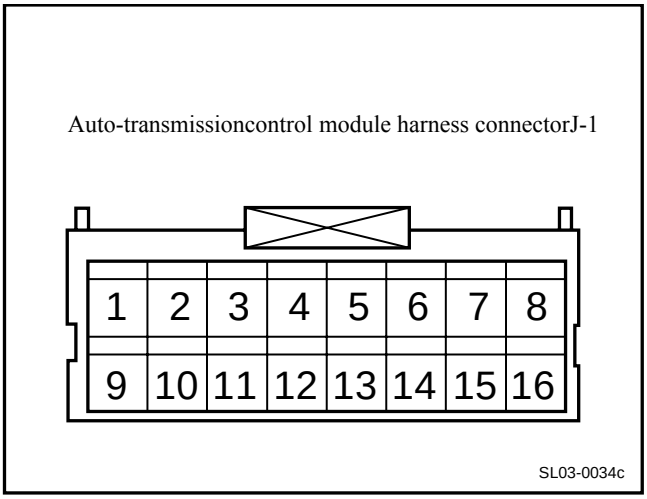
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between terminal No.21 of the electromagnetic valve harness connector J-4 and Terminal No.10 of the automatic control module J-1.

D. Measure the resistance between terminal No.20 of the electromagnetic valve harness connector J-4 and Terminal No.15 of the automatic control module J-1.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4No.21 terminal and reliable grounding



G. Measure the resistance between Terminal No.20 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test Items	Standard Value
J-4 (21) — J-1(10)	Less than 3 Ω
J-4 (20) — J-1(15)	Less than 3 Ω
J-4 (21) — reliable grounding voltage value	0 V
J-4 (20) — reliable grounding resistance value	Less than 3 Ω

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

4	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

5	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

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Next

6	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace Automatictransmission assembly , refer to3.5.7.6 Automatictransmission assembly replacement

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3.5.7.25 P0976 P0977

1. DTC description:

DTC	**P0976**	On/off electromagnetic valve S2 high current (short circuit)

DTC	**P0977**	On/off electromagnetic valve S2 low current (open circuit)

The transmission control unit (TCU) uses a switching electromagnetic valve to select among different clutch elements within the transmission. During operation, the transmission control unit evaluates the current actually-delivered current to open/close the electromagnetic valve and compares with the expected. If the current is not in the pre-defined parameter currently, the DTC is set to display abnormal load of the transmission control unit.

2. Conditions For Setting DTC and The Fault Position :

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Position s
P0976	Feedback information of on/off electromagnetic valve S2 is that existence of short circuit.	1. Ignition switch is in the "ON" position. 2. Electromagnetic valve power on 3. TCU power supply voltage is normal	1. Electromagnetic valve 2. Electromagnetic valve circuit 3. TCU
P0977	Feedback information of on/off electromagnetic valve S2 is that existence of open circuit.		

3. Circuit sketch

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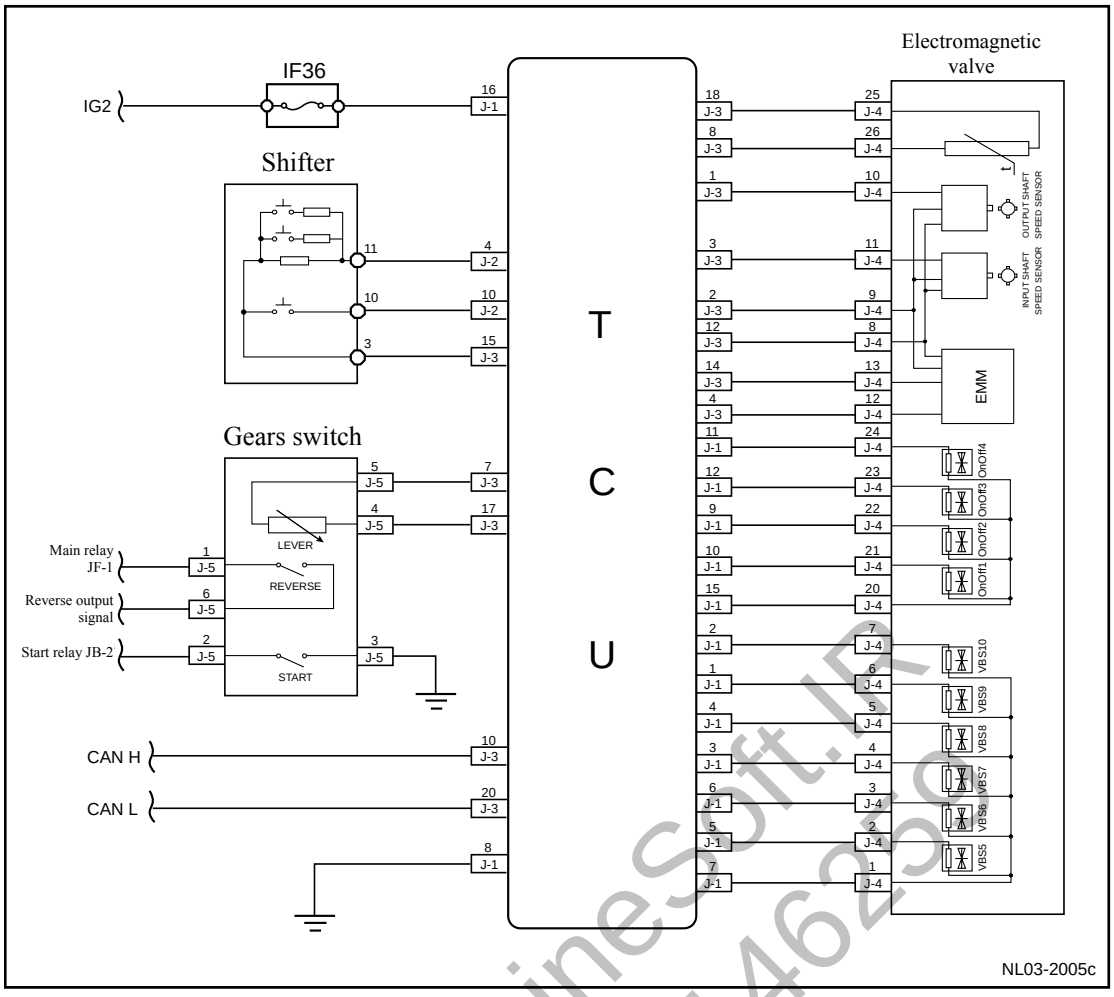

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to Check if fault codes, except DTC P0976 and P0977 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC P0976 P0977	Yes
DTCs other than DTCs P0976 and P0977	No

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No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCUpower supply circuit

See 3.5.7.8 P0603 P0604 P1604 P1701 P1703

Next

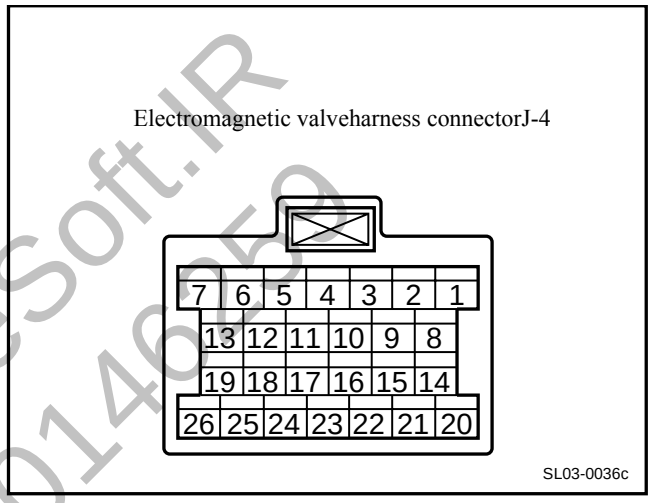
3	Detect ON/OFF electromagnetic valveS2resistance

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals 22 and 20 of the electromagnetic valve harness connector J-4.

Standard resistant value :20.8Ω-23.2Ω



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Does it conform to the standard value?

No

Replace auto-transmission assembly, refer to3.4.7.6 auto-transmission assembly replacement

Yes

3	Detect ON/OFF electromagnetic valve S2 circuit

A. rotated ignition switch to OFF position.

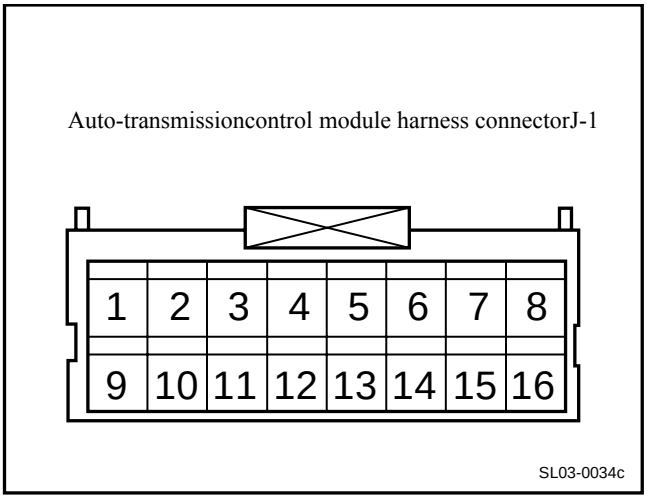
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal No.22 of the electromagnetic valve harness connector J-4 and Terminal 9 of the automatic control module J-1.

D. Measure the resistance between Terminal No.20 of the electromagnetic valve harness connector J-4 and Terminal No.15 of the automatic control module J-1.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4No.22 terminal and reliable grounding



G. Measure the resistance between Terminal No.20 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test Items	Standard Value
J-4 (22) — J-1(9)	Less than 3 Ω
J-4 (20) — J-1(15)	Less than 3 Ω
J-4 (22) — Reliable grounding voltage value	0 V
J-4 (20) — Reliable grounding resistance value	Less than 3 Ω

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

4	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

5	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

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Next

6	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace Automatictransmission assembly , refer to3.5.7.6 Automatictransmission assembly replacement

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3.5.7.26 P0979 P0980

1. DTC description:

DTC	**P0979**	On/off electromagnetic valve S3 high current (short circuit)

DTC	**P0980**	On/off electromagnetic valve S3 low current (open circuit)

The transmission control unit (TCU) uses a switching electromagnetic valve to select among different clutch elements within the transmission. During operation, the transmission control unit evaluates the current actually-delivered current to open/close the electromagnetic valve and compares with the expected. If the current is not in the pre-defined parameter currently, the DTC is set to display abnormal load of the transmission control unit.

2. Conditions For Setting DTC and The Fault Position :

DTC Code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault position s
P0979	Feedback information of on/off electromagnetic valve S3 is that existence of short circuit.	1. Ignition switch is in the "ON" position. 2. Electromagnetic valve power on 3. TCU power supply voltage is normal	1. Electromagnetic valve 2. Electromagnetic valve circuit 3. TCU
P0980	Feedback information of on/off electromagnetic valve S3 is that existence of open circuit.		

3. Circuit sketch

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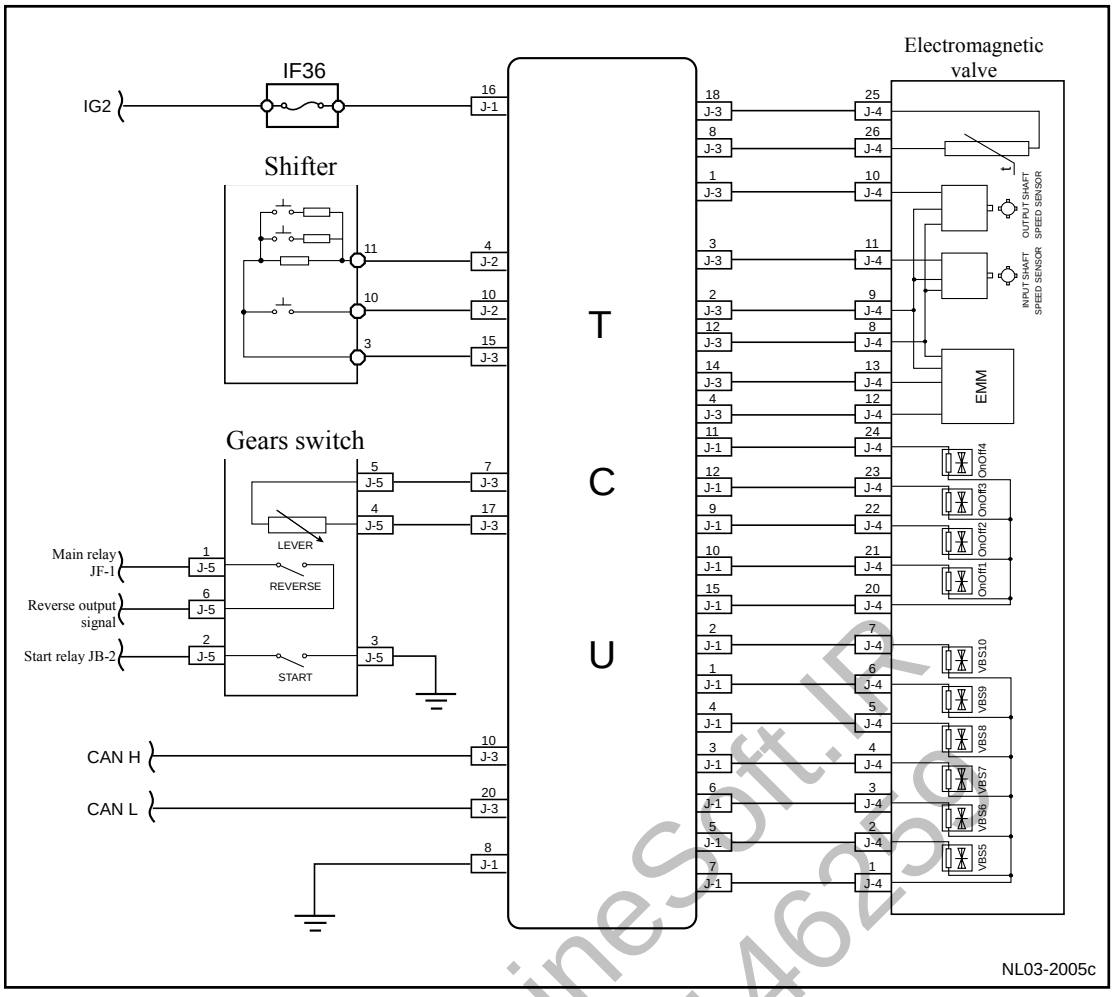

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0979 and P0980 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC codes shown	**To Step**
DTC P0979 P0980	Yes
DTCs other than DTCs P0979 and P0980	No

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No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCU power supply circuit

See 3.5.7.8 P0603 P0604 P1604 P1701 P1703

Next

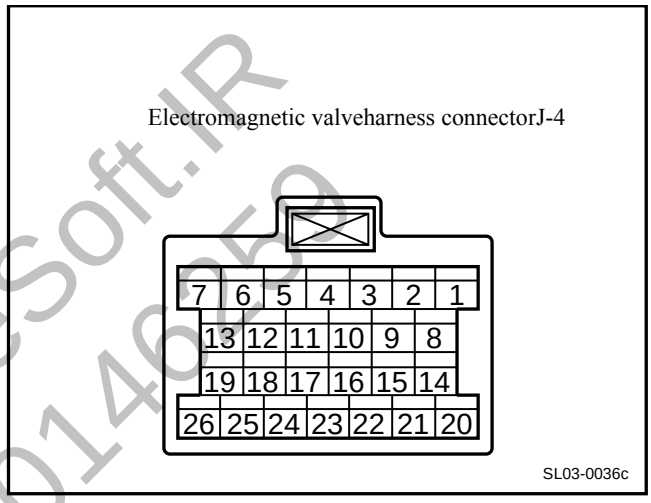
3	Detect ON/OFF electromagnetic valve S3 resistance

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals 23 and 20 of the electromagnetic valve harness connector J-4.

Standard resistant value :20.8Ω-23.2Ω



Does it conform to the standard value?

No

Replace auto-transmission assembly, refer to3.4.7.6 auto-transmission assembly replacement

Yes

3	Detect ON/OFF electromagnetic valveS3 circuit

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A. rotated ignition switch to OFF position.

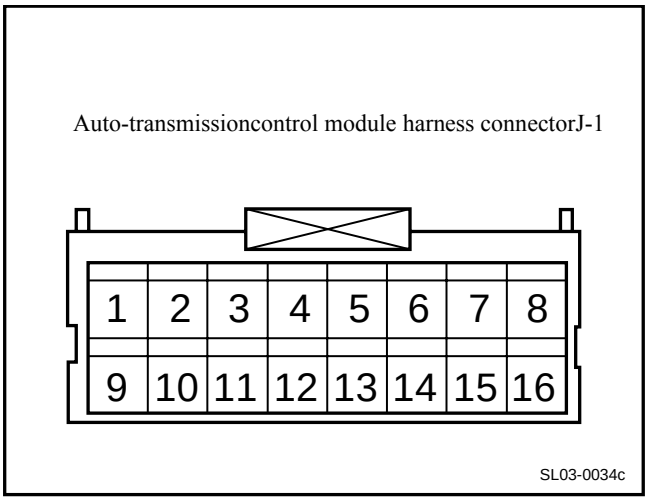
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal No.23 of the electromagnetic valve harness connector J-4 and Terminal No.12 of the automatic control module J-1.

D. Measure the resistance between Terminal No.20 of the electromagnetic valve harness connector J-4 and Terminal No.15 of the automatic control module J-1.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4No.23 terminal and reliable grounding



G. Measure the resistance between Terminal No.20 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test Items	Standard Value
J-4 (23) — J-1(12)	Less than 3 Ω
J-4 (20) — J-1(15)	Less than 3 Ω
J-4 (23) — reliable grounding voltage value	0 V
J-4 (20) — reliable grounding resistance value	Less than 3 Ω

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

4	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

5	Go to automatic transmission fresh process.

Refer to3.5.7.4 automatic transmission refresh process

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Next

6	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

Replace Automatictransmission assembly , refer to3.5.7.6 Automatictransmission assembly replacement

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3.5.7.27 P0982 P0983

1. DTC description:

DTC	**P0982**	On/off electromagnetic valve S4 high current (short circuit)

DTC	**P0983**	On/off electromagnetic valve S4 low current (open circuit)

The transmission control unit (TCU) uses a switching electromagnetic valve to select among different clutch elements within the transmission. During operation, the transmission control unit evaluates the current actually-delivered current to open/close the electromagnetic valve and compares with the expected. If the current is not in the pre-defined parameter currently, the DTC is set to display abnormal load of the transmission control unit.

2. Conditions For Setting DTC and The Fault Position :

DTC code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault position s
P0982	Feedback information of on/off electromagnetic valve S4 is that existence of short circuit.	1. Ignition switch is in the "ON" position. 2. Electromagnetic valve power on 3. TCU power supply voltage is normal	1. Electromagnetic valve 2. Electromagnetic valve Circuit 3. TCU
P0983	Feedback information of on/off electromagnetic valve S4 is that existence of open circuit.		

3. Circuit sketch

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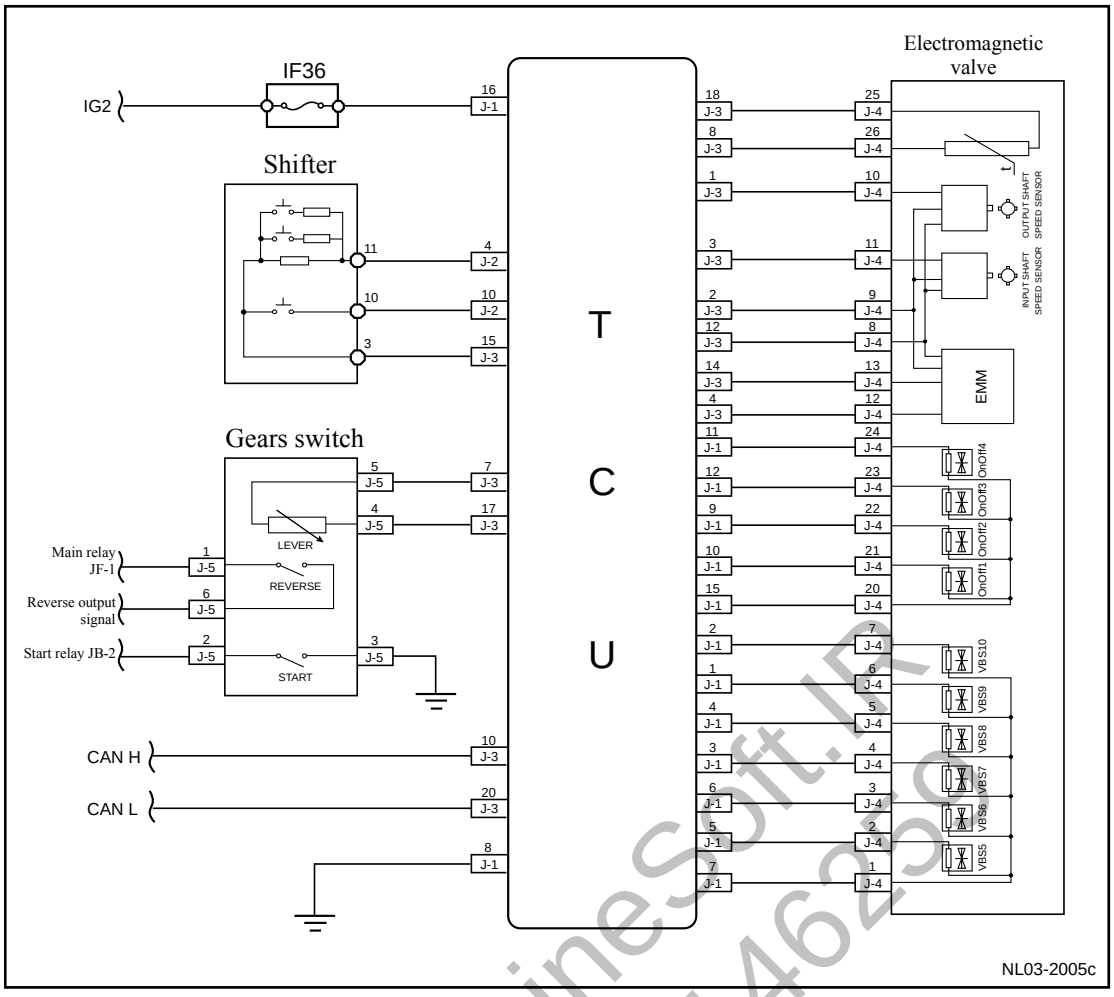

4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC P0982 and P0983 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC P0982 P0983	Yes
DTCs other than DTCs P0982 and P0983	No

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No

Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCUpower supply circuit

See 3.5.7.8 P0603 P0604 P1604 P1701 P1703

Next

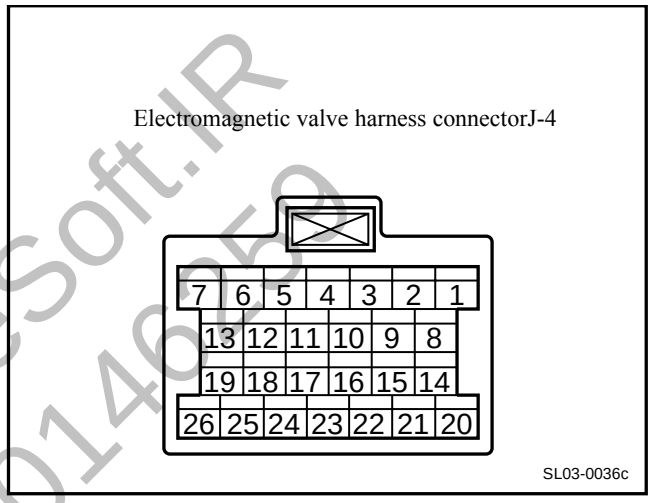
3	Detect ON/OFF electromagnetic valveS4resistance

A. Turn the ignition switch to the OFF position.

B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminals 24 and 20 of the electromagnetic valve harness connector J-4.

Standard resistant value :20.8Ω-23.2Ω



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Does it conform to the standard value?

No

Replace auto-transmission assembly, refer to3.4.7.6 auto-transmission assembly replacement

Yes

3	Detect ON/OFF electromagnetic valve S4 circuit

A. rotated ignition switch to OFF position.

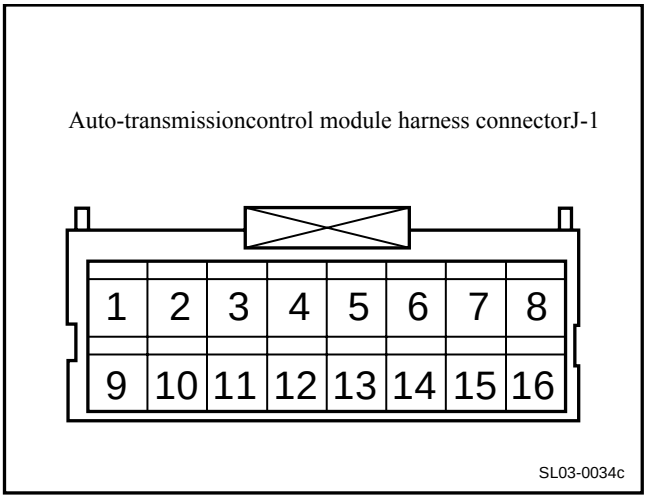
B. Disconnect the harness connector J-4 of the electromagnetic valve.

C. Measure the resistance between Terminal No.24 of the electromagnetic valve harness connector J-4 and Terminal No.11 of the automatic control module J-1.

D. Measure the resistance between Terminal No.20 of the electromagnetic valve harness connector J-4 and Terminal No.15 of the automatic control module J-1.

E. Turn the ignition switch to the ON position.

F. Measure voltage of electromagnetic valve harness connector J-4No.24 terminal and reliable grounding



G. Measure the resistance between Terminal No.20 of the electromagnetic valve harness connector J-4 and secure ground wire.

Results

Test Items	Standard Value
J-4 (24) — J-1(11)	Less than 3 Ω
J-4 (20) — J-1(15)	Less than 3 Ω
J-4 (24) — reliable grounding voltage value	0 V
J-4 (20) — reliable grounding resistance value	Less than 3 Ω

Does it conform to the standard value?

No → Circuit malfunction, repair circuit.

Yes

4	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

5	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

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Next

6	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

7	Troubleshooting

5. Maintenance guide :

Replace Automatic transmission control module , refer to3.5.7.8 replace automatic transmission control module

Replace AutomaticTransmission assembly , refer to3.5.7.6 AutomaticTransmission assembly replacement

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3.5.7.28U0100U0121 U0146 U0415

1. DTC description:

DTC	**U0100**	Circling CAN information from the ECU is unavailable.

DTC	**U0121**	Circling CAN information from the ABS is unavailable.

DTC	**U0146**	Lost with Gateway communication

DTC	**U0415**	The CAN signal of the TCU is out of the range or invalid.

Control area network (CAN) bus is used for sharing the vehicle system information in the control unit which is connected with the bus. If the transmission control unit does not regularly receive specific information sent to the CAN bus through the electronic control unit, the transmission control unit will trigger a DTC with respect to communication.

2. Conditions For Setting DTC and The Fault Position :

DTC Code	DTC Detection Strategy	Conditions For Setting The DTC (Control Strategy)	Fault Position s
U0100	Hardware Circuit Inspection	1.Ignition switch is in the "ON" position 2.Communication signals lost，logic signal is error	1. ECU,TCU, ABS 2. CAN bus
U0121			
U0146			
U0415			

3. Circuit sketch

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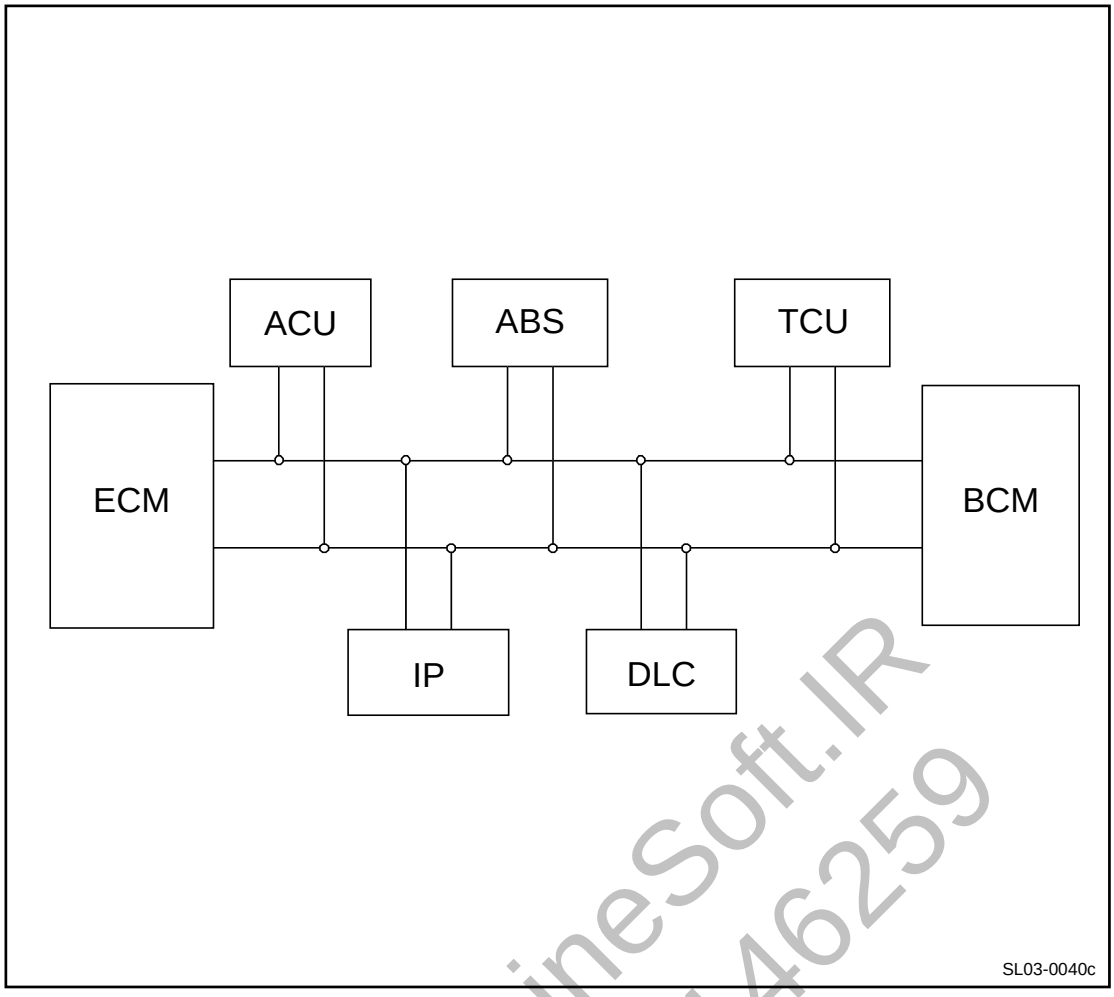

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4. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to check if fault codes, except DTC U0100, U0121, U0146 and U0415 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC U0100 U0121 U0146 U0415	Yes
DTCs other than DTCs U0100, U0121, U0146 and U0415	No

No → Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Detect TCU CAN bus circuit

See 11.17.7.6 diagnosis of CAN bus signal.

Whether the CAN bus is open circuited or short circuited?

Yes → Maintenance circuit fault

No

3	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

4	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

5	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

6	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

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3.5.7.29 U1601 U1606 U1607 U1608 U1609

1. DTC description:

DTC	**U1601**	TCU application software lost or damaged

DTC	**U1606**	TCU calibration error–platform

DTC	**U1607**	TCU calibration error-activate the derived calibration

DTC	**U1608**	TCU VIN (vehicle identification number)-coding error

DTC	**U1609**	TCU hardware (pcb) calibration error

The transmission control unit software or calibration software can be upgraded online. These DTC protection transmission control units prevent the documents damaged from loading to the transmission control unit. They further ensure only the correct calibration parameter and software version can be loaded into the current transmission control unit (TCU) for use.

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2. Conditions for setting DTC and the fault position :

DTC code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault position s
U1601 U1606 U1607	Hardware Circuit Inspection	1. ignition switch is in ON position 2. CRC is ineffective.	1. TCU
U1608		1. ignition switch is in ON position 2. VIN is not consist with rated concent	
U1609		1. ignition switch is in ON position 2. TCU made messages are not exist	

3. Diagnostic Procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to Check if fault codes, except DTC U1601, U1606, U1607, U1608 and U1609 exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	**To Step**
DTC U1601 U1606 U1607 U1608 U1609	Yes
DTCs other than DTCs U1601, U1606, U1607, U1608 and U1609	No

No → Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Update the TCU calibrated software.

Next

3	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switches to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

Yes → Troubleshooting

No

3	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

4	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

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Next

5	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

No → Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

6	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

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3.5.7.30 U160E

1. DTC description:

DTC	**U160E**	BOSCH underlying software error

The hardware and underlying software of the transmission control unit (TCU) are designed by BOSCH. When the underlying software of the transmission control unit (TCU) encounters an error, the system will report this diagnostic testing code (DTC).

2. Conditions For Setting DTC and The Fault Position :

DTC code	DTC detection strategy	Conditions for setting the DTC (control strategy)	Fault position s
U160E	Hardware circuit Inspection	1.ignition switch is in ON position	1. TCU

3. Diagnostic procedures:

Note: Before carrying out this diagnosis step, observe the data list on fault diagnosis tester and analyze the accuracy of the data, as these will help with quick diagnosis.

1	Read the fault code again after clearing away the fault code to Check if fault codes, except DTC U160E exist in the control system.

A. Connect fault diagnosis tester to the datalink connector.

B. Rotated ignition switch to ON position

C. Switch on fault diagnostic device power supply

D. Clear DTC code.

E. Reset reading fault code, and check if DTCs meet setting condition of fault code in current

DTC Codes Shown	To Step
DTC U160E	Yes
DTC other than DTC U160E	No

No → Refer to3.4.7.6 fault diagnosis code (DTC) chapter index

Yes

2	Switch off the ignition switch, and then switch on the ignition switch again,

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Next

3	Switch off the ignition switch again, and then switch on the ignition switch again,

Next

4	Switch off the ignition switch again, and then switch on the ignition switch again,

Next

5	Use fault diagnosis tester to confirm if DTC is stored again .

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

Yes — Troubleshooting

No

6	ReplaceTCU

Refer to3.5.7.8 replace automatic transmission control module

Next

7	Go to automatic transmission fresh process.

Refer to3.5.7.4 Automatic transmission refresh process

Next

8	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read control system DTC code again to confirm that the system has no DTC code exported.

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No

Refer to 2.2.7.3 Intermittent Fault Inspection for intermittent fault.

Yes

9	Troubleshooting

5. Maintenance guide:

Replace Automatic transmission control module, refer to3.5.7.8 replace automatic transmission control module

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3.5.7 Dismantle and install

3.5.7.1 Automatic transmission maintenance precaution

Notes:

- ***Automatic transmission contains many high-accuracy parts. During disassembly and reassembly, these parts must be carefully processed, without scratch or damage.***
- ***Lay a rubber pad on working table, keep constant clean.***
- ***During dismantling, do not wear cloth gloves and any other cloth. If necessary, only use nylon cloth or paper towel.***
- ***All dismantled parts must be cleaned, metal parts can also be cleaned by using common solution, but it should be blowed to dry by compressed air.***
- ***Use Automatic transmission oil (ATF) to clean clutch disc, thrust piece and rubber part, after cleaning, keep clean.***

If the transmission is damaged, need to repair, furthermore, dismantle and wash the ATF cooler system.

- ***It is forbidden to use any oil oil, used shim, O-ring and oil seal. New gaskets, O-rings and oil seals shall be used for replacing always.***
- ***When installing transmission, it is forbidden to use blue vaseline oil grease or other oil grease other than white vaseline to lubricate or maintain parts.***
- ***Before installation, it is necessary to apply automatic transmission fluid (ATF) on elements, rotating parts and sliding parts. Prior to the installation of the driven disc or brake disc of the clutch, firstly, soak the two parts in oil for automatic transmission for at least 2 h.***
- ***It is forbidden to apply sealant or adhesive on shim.***
- ***If it is necessary to replace bushing sleeve, the assembly of bushing components must be replaced.***
- ***When re-assembling, it is strictly forbidden to use any cloth gloves or cloth. You may use nylon cloth or paper towel if necessary.***
- ***It is also necessary to replace automatic transmission fluid (ATF) in transmission cooler and oil intake pipe.***

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3.5.7.2 Check process of automatic transmission oil level

Notes:

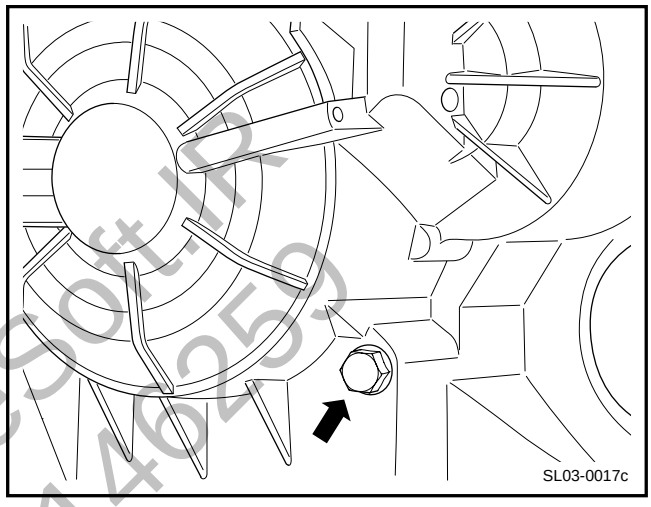
- ***Because the transmission oil temperature may create much effect on oil level, oil level can be checked only when transmission oil temperature is lower than 50°C. If the transmission oil temperature is 50 °C, but not executing the oil level correcting procedure later on, the oil level reading has a larger error.***
- ***When inspecting oil level, make sure that the vehicle keep horizontal and balance position.***
- ***It is necessary to use Fuchs FES 209-3292 Automatic transmission oil (part No. 0578-244023)***
- ***Complete and well equipped dry transmission needs 7.5lt automatic transmission oil***

Inspection Procedure:

1 Lifting vehicle

2. Install a container under oil level detection bolt of automatic transmission, and then loosen Automatic transmission oil level detection bolt.

3. If there is Automatic transmission oil flowing out of the hole, it indicates that oil level is normal. Re-tighten oil level inspection bolt. If there is no Automatic transmission oil outflows from the hole, which indicates that the oil level is too low, fill the Automatic transmission oil until the oil outflows from the hole.



Torque :25-30N.m(Metric)

18.4—22.1lb-ft(English system)

4. Place gearshifting rod to N position, start engine and run it at idle speed for 5 min, re-inspect automatic transmission oil level. If oil level is too low, refill automatic transmission oil.

5. After driving the vehicle for about 10min, connect the diagnostic tester to read the data about the temperature of the automatic transmission oil. If the temperature is below 50℃, have the engine run idle until the temperature reaches 50℃. Put the shift lever in the N position, turn off the engine and re-check the oil level in the automatic transmission. If the oil level is too low, re-fill with the automatic transmission oil. If oil flows out, keep the situation for 50s. If oil still flows out from the oil level checking bolt hole 50s later, then this indicates the oil level is reasonable; if no oil flows out 50s later, re-fill with the automatic transmission oil and perform this step until oil flows out.

6. Tighten the oil level detection bolt.

7. Perform the road test to check for oil leakage.

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3.5.7.3 Automatic transmission fluid replaces process

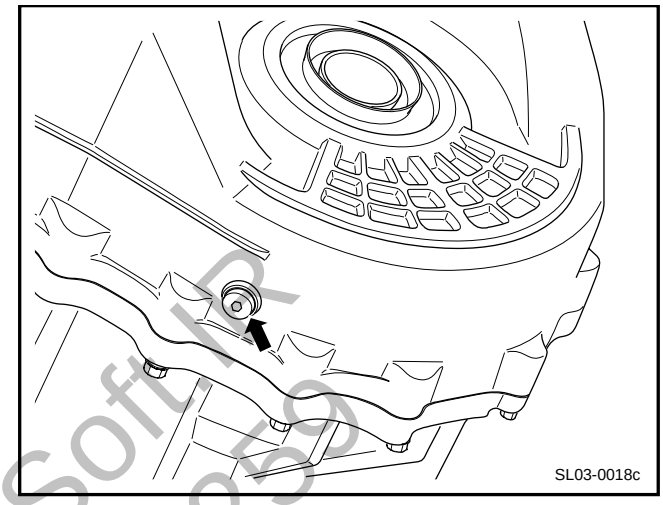
Notes:

- ***After vehicle runs every 60,000km, it is necessary to replace transmission oil once to prevent damage of transmission parts.***
- ***When inspecting oil level, make sure that the vehicle keep horizontal and balance position.***
- ***It is necessary to use Fuchs FES 209-3292 Automatic transmission oil (part No. 0578-244023)***

Oil change process

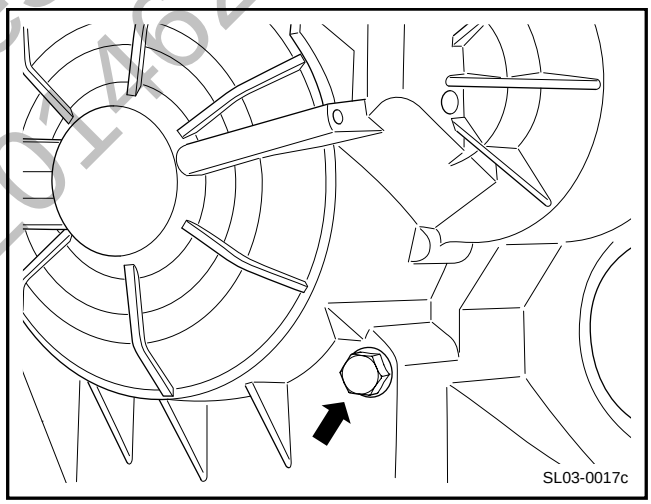
1 Lifting vehicle

2. Install a container under the oil drain plug of automatic transmission, and then loosen oil drain plug.



3. Open automatic transmission oil level inspection bolt, and fill automatic transmission oil here.

4. For inspection of automatic transmission oil level, refer to 3.5.7.2 Inspection procedures of autommatic transmission oil level.



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3.5.7.4 Automatic transmission fluid cooling system cleaning process

Notes:

- ***To prevent pollutants from cooling pipe and hydraulic pipe damaging transmission, it is necessary to clean cooling pipe and hydraulic pipe.***
- ***It is necessary to clean oil cooling system after replacing transmission assembly or overhaul of transmission.***

Washing procedure:

1 Lifting vehicle

2. Clean automatic transmission oil left in cooling pipeline by using compressed air.

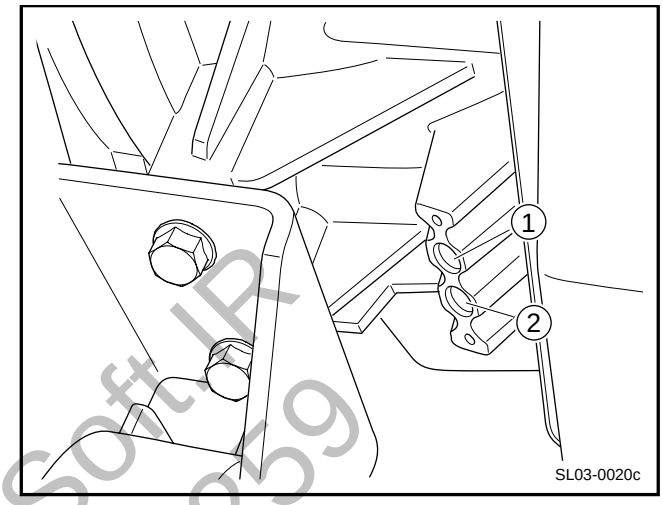
3. Connect oil outlet pipe of automatic transmission to oil outlet, and tighten it with fixing bolt.

Figure: 1 is the oil inlet.

2 is oil outlet

Torque : max.13 N.m(Metric)

Max.9.6 lb-ft (English system)



4. Use one end of a rubber hose to connect oil inlet, and the other end connects to container to collect automatic transmission oil flowed out.

5. Start and have the engine run in idle mode for 30s and collect the Automatic transmission oil flowing out. Fill with the automatic transmission oil while the engine runs in the idle mode.

Tips: the oil temperature of the automatic transmission is up to 50℃ after 30s, and there will be at least 2.5L Automatic transmission oil outflow.

6. Upon completion of collection, connect the Automatic transmission oil inlet pipe to the oil inlet.

7. For testing of the Automatic transmission oil level, see 3.5.7.2 Automatic transmission oil Level Inspection procedures

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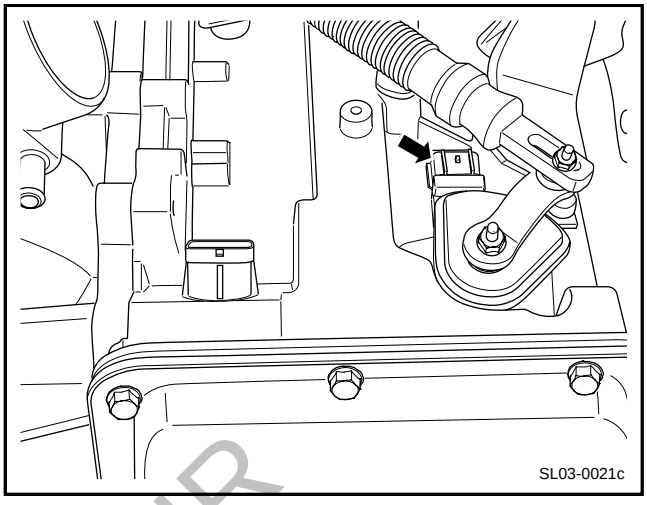
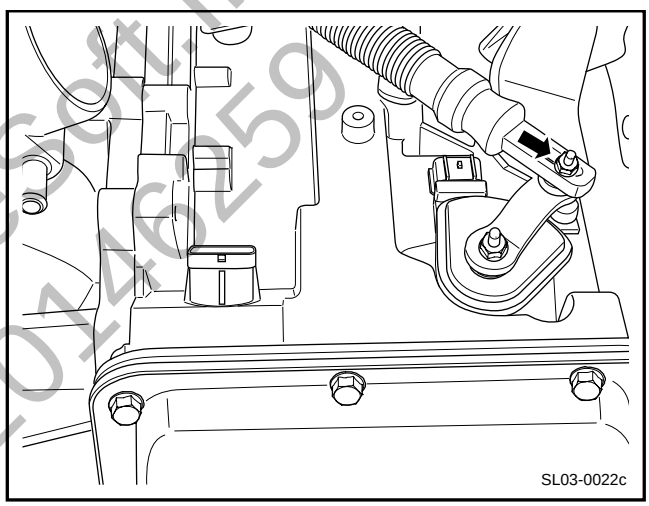
3.5.7.5 Gears switch replacement

Dismantle procedure

1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery disconnection.
2. Disconnect wire harness of gear switch.



3. Disconnect connection of shift flexible shaft and gears switch.
4. Dismantle gear switch fixing nut.
5. Dismantle the gear switch.



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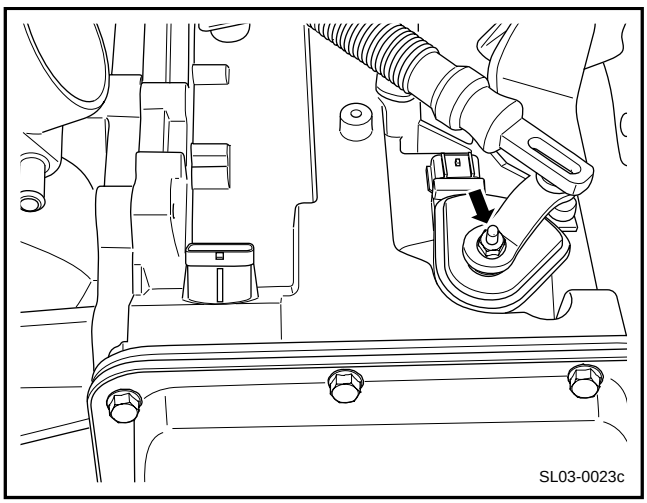
Installation procedure::

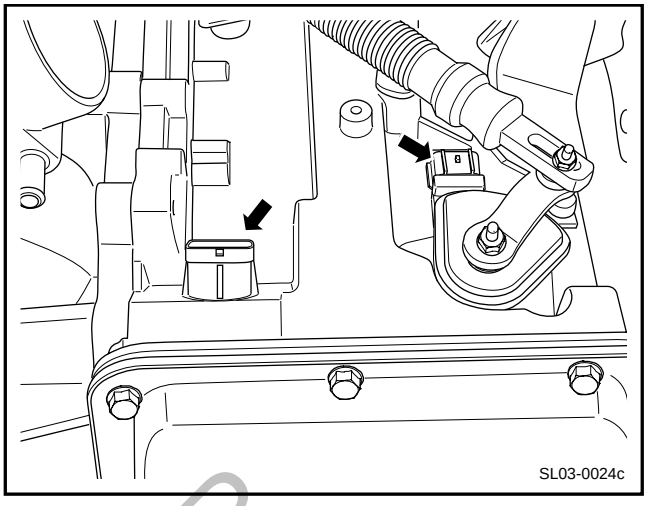
1. Install gear switch.
2. Install operating rod of gear switch, and tighten fixing nut.
3. Connect to shift flexible shaft, and tighten fixing nut .
4. Connect wire harness connector of gear switch.
5. Connect battery negative cable.



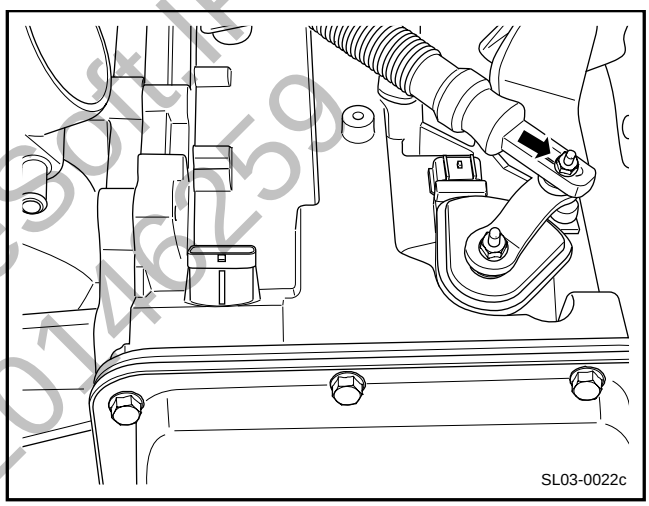
3.5.7.6 Automatictransmission assembly replacement

Dismantle procedure

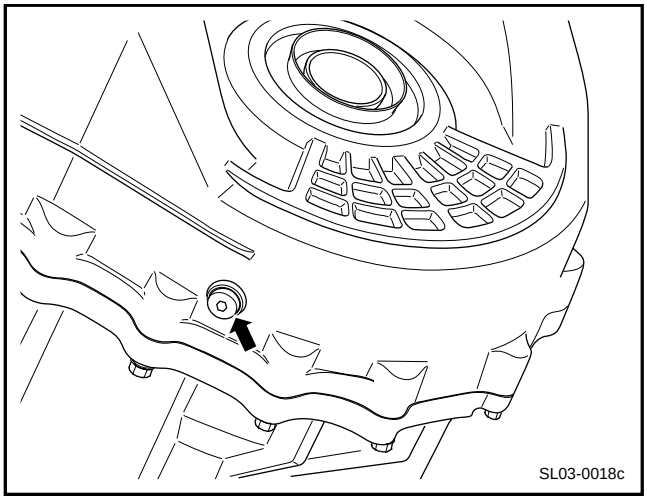
1. Disconnect the battery negative cable. Refer to 2.12.6.1 Battery disconnection.
2. Dismantle battery base plate. Refer to 2.12.6.2 Battery replacement.
3. Dismantle the air filter base.
4. Disconnect wire harness connector between electromagnetic valve and gear switch;
5. Disconnect the crankshaft position sensor harness connector.
6. Dismantle the fixing bolt for the negative earth on the transmission and disconnect the harness connector of the negative earth.



7. Disconnect connection of shift flexible shaft and gears switch.
8. Dismantle the shift lever bracket;
9. Dismantle the shift lever retaining pin.



10. Dismantle oil drain bolt of transmission. After transmission oil is totally drained out, install it. Refer to 3.5.7.3 Replacement procedure of automatic transmission oil.



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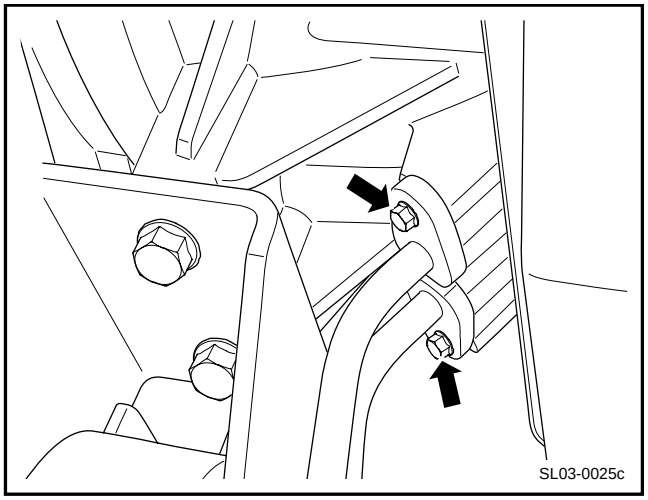
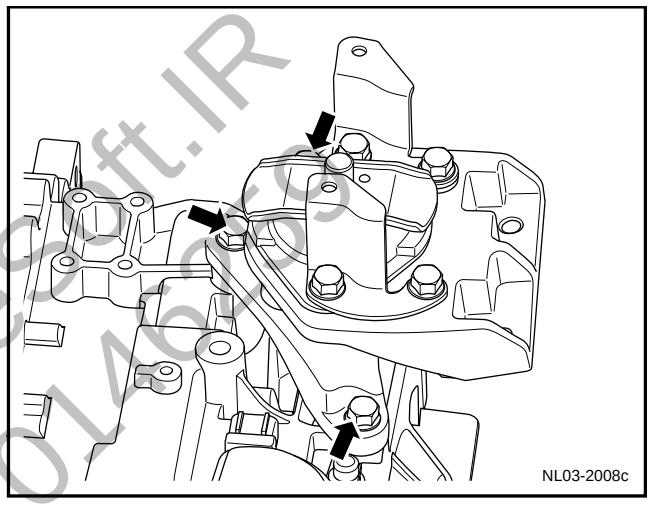
11. Dismantle oil inlet pipe of transmission ,

Notes:

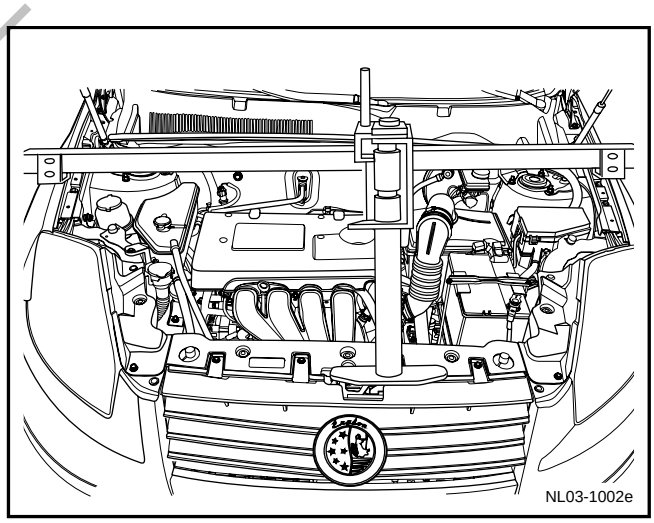
- ***For just stopping vehicle, oil temperature in transmission is high, it is necessary to prevent injury by hot oil flowed from transmission.***
- ***Before dismantling cooling oil pipe joint, clean neighboring dust, to ensure no dust enters into oil pipe and transmission.***
- ***After dismantling of oil inlet and outlet pipe of transmission, the port of pipe and joint must be covered with protective cap;***



12. Dismantle the starter cable and the fixing bolts.
13. Dismantle connecting bolt of left suspension and transmission
14. Dismantle the transmission upper connecting bolts;



15. Use special tool to fix the engine.



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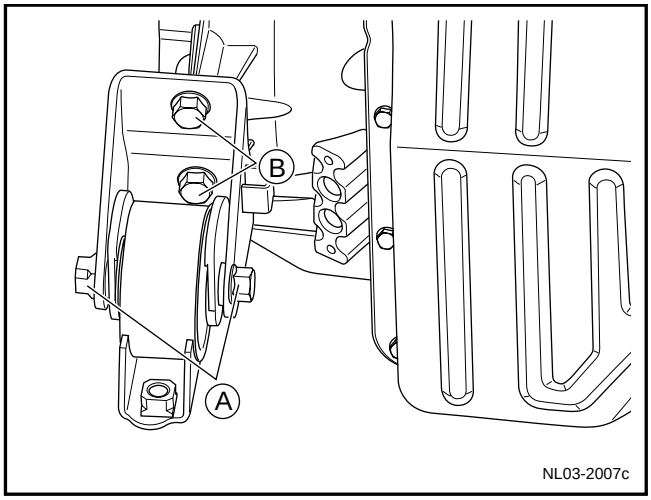
16. Dismantle fixing bolt B for rear suspension and auxiliary frame and through bolt A of rear suspension.



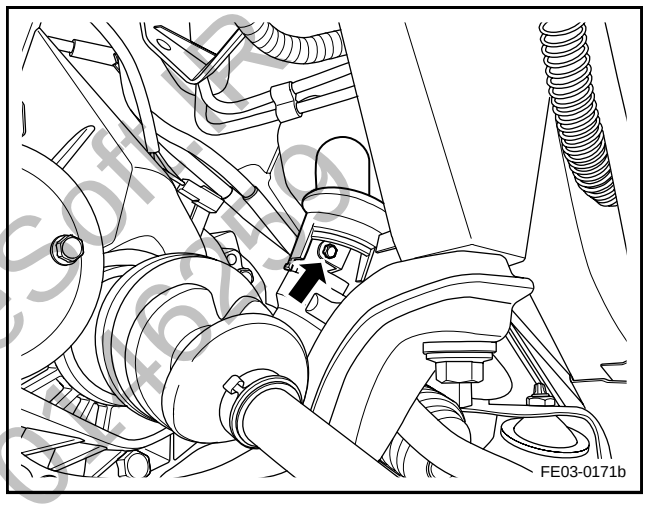
17. Dismantle the two front wheels;

18 Lifting vehicle

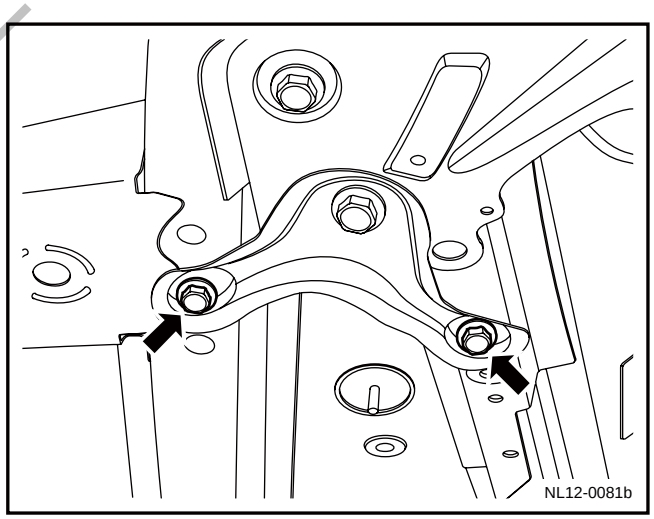
Warning: Refer to Warning for lifting vehicle in Warnings and Precautions.

19. Dismantle the steering cross pin bolt

20. Dismantle fixing bolt of lower protective plate and left and right bracket of horizontal beam, and take out bracket.



21. Respectively dismantle fixing bolt of reinforced plate of front auxiliary frame on both sides.



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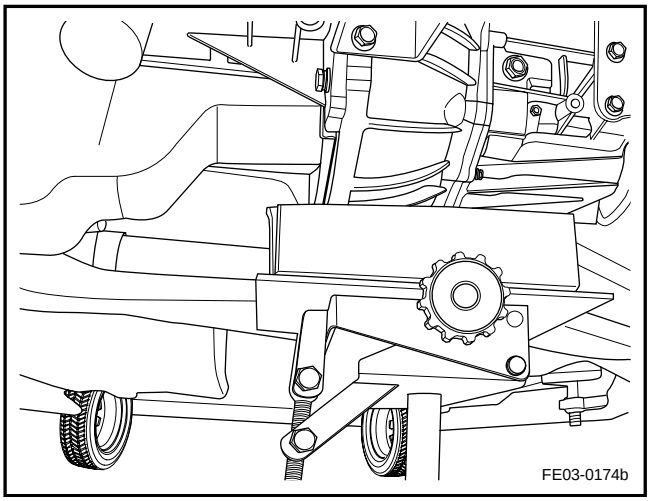
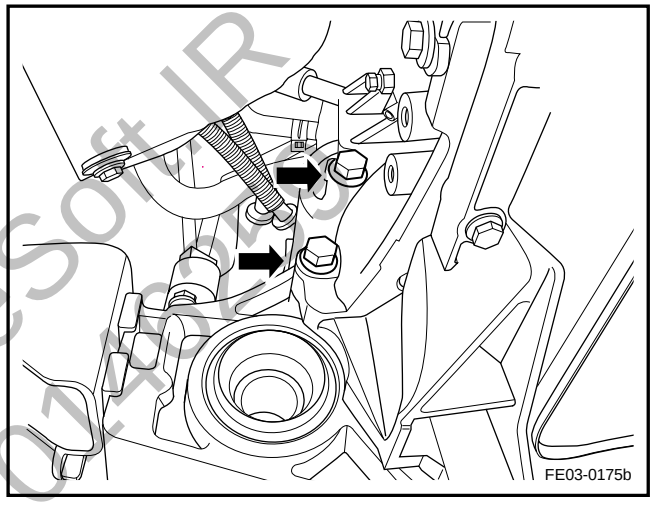
22. Dismantle left side and right side drive shaft, refer to“ drive shaft replacement

23. Use a jack to support the transmission;



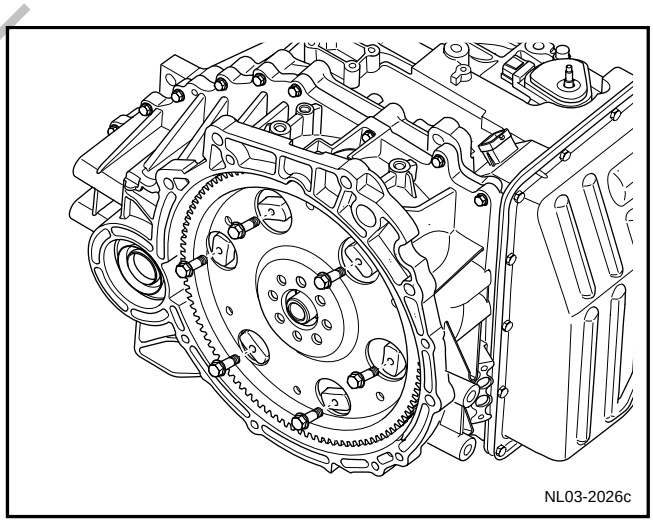
24. Dismantle the rear connecting bolt of transmission ;



25. Dismantle fixing bolt of drive disc and torque converter from the lower section of engine.

Note: disassemble another fixing bolt from the lower side of the engine again when disassembling one fixing bolt in the disassembling process to clockwise rotate the flywheel.

Warning: forbid rotating the crankshaft counterclockwise.



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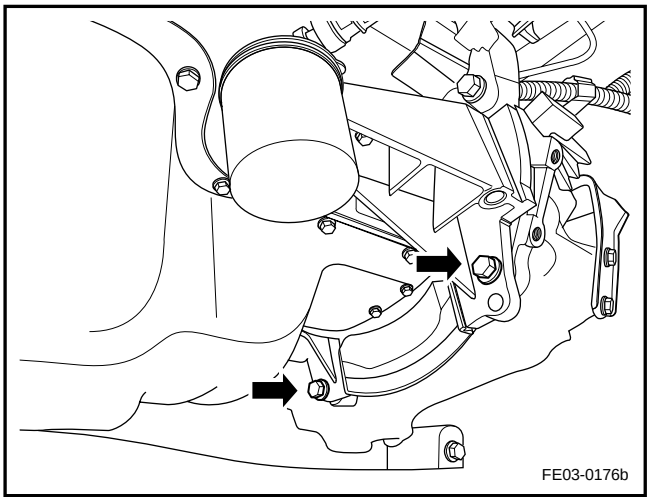
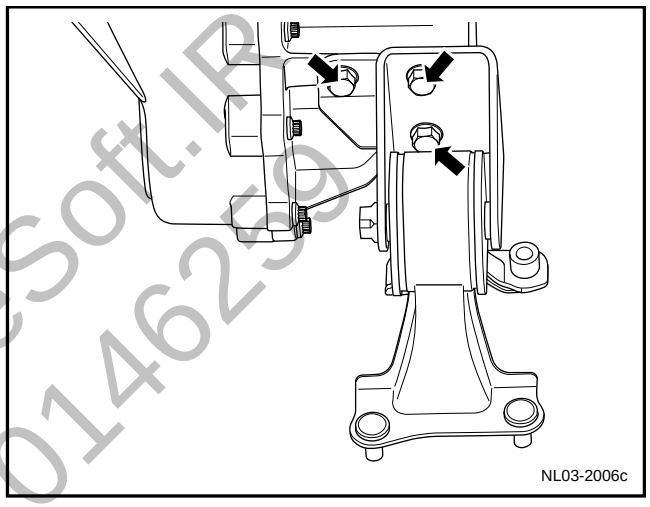
24. Dismantle the lower connecting bolt of transmission ;

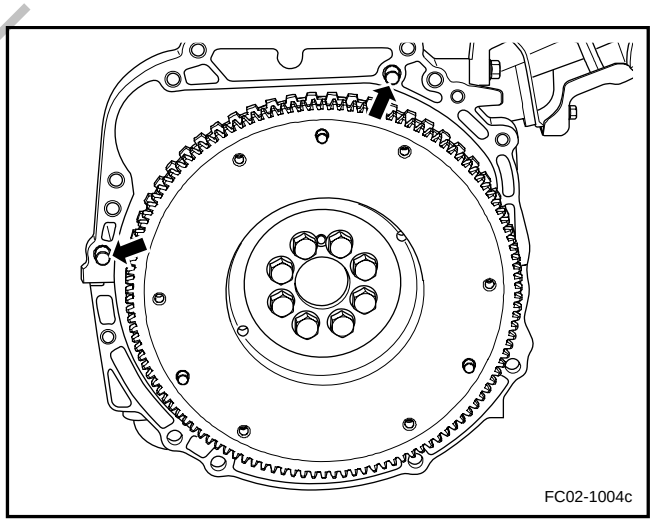


25. Dismantle fixing bolt of rear suspension bracket and transmission.

26. Separate engine and transmission, and slowly lower level hydraulic lifter, to ensure that transmission can be laid down stably.



27. Inspect 2 positioning pins on flywheel side of engine, to ensure no loosening condition.



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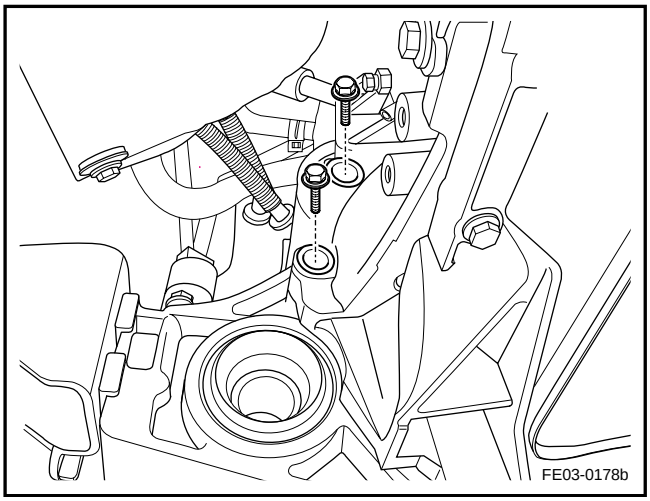
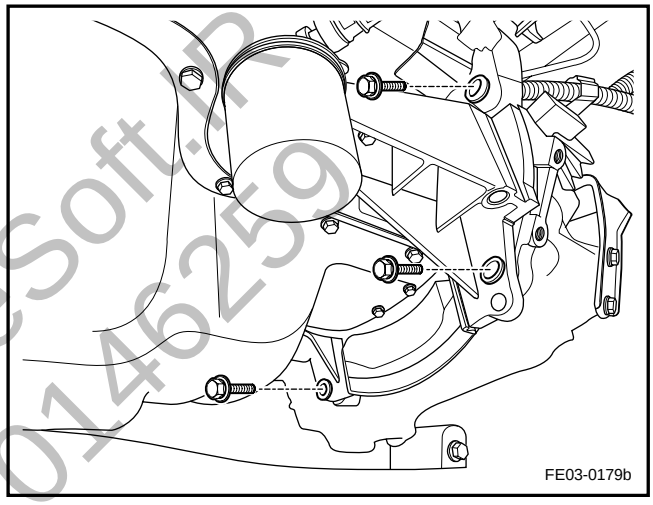
Installation procedure::

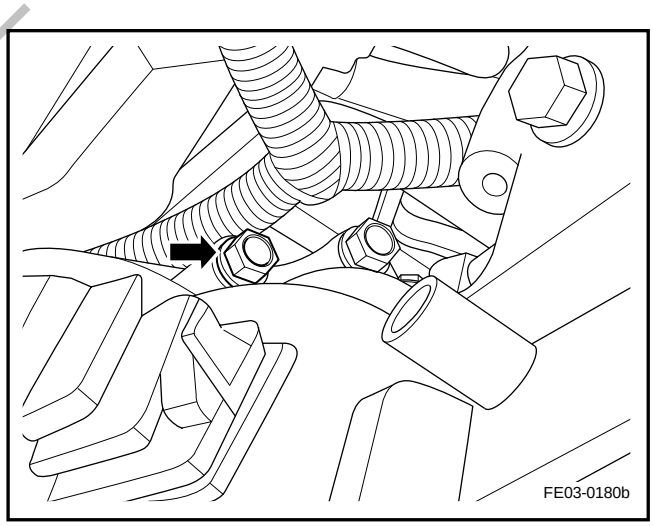
1. Use a flat-panel jack to support the Transmission assembly.
2. Insert transmission torque converter into crankshaft rear end, and push transmission to engine side, meanwhile fix flexible disc and torque converter.



3. Install the rear connecting bolt of transmission ;
4. Install connecting bolt under the transmission and fixing bolt under start motor;



5. For installation of the fixing bolts and cables on the starter motor, see Replacing the Starter Motor.



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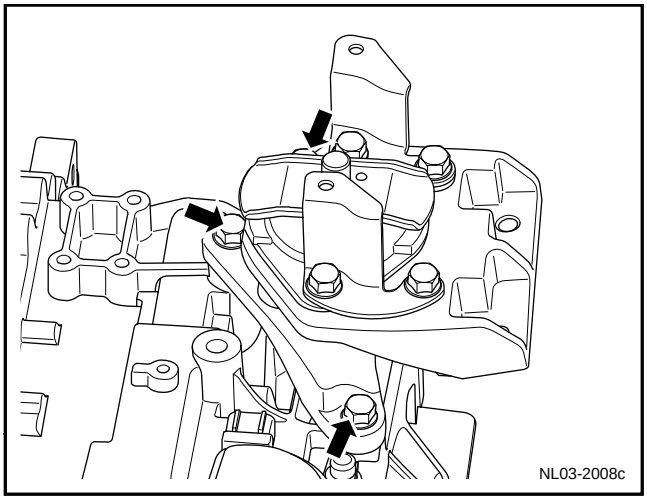
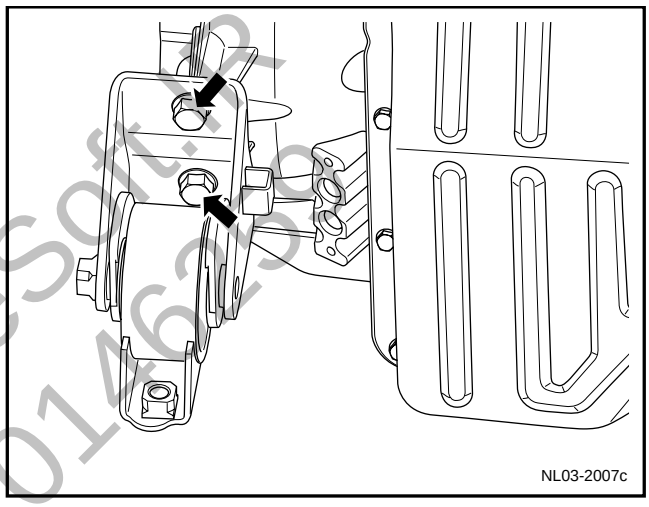
6. Dismantle the flat-panel jack;
7. Install left side and right side drive shaft , refer to“ Drive shaft replacement
8. For installation of front longeron subframe and relevant connections, see Replacement of Front Longeron and Subframe;
9. Install the front wheel tire.
10. Dismantle special tool for engine bracket;
11. Install the transmission upper connecting bolts;

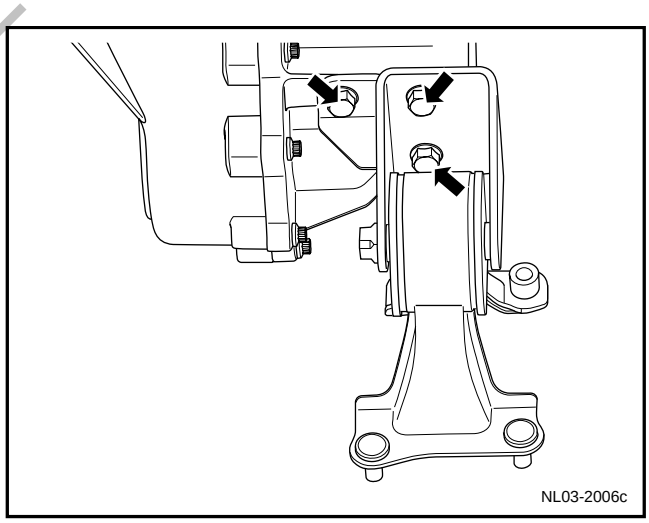


13. Install the transmission left bracket assembly.



14. Install right support assembly of transmission :
15. Connect gearshift switch and gearshift flexible shaft.
16. Install oil intake and outlet pipe of transmission.

Note: during assembling, firstly, the oil tube connector is pressed in place by hand and then tightened by a bolt; otherwise, it will scratch the internal seal ring to leak oil.



16. For filling of transmission oil, refer to 3.5.7.3 Replacement procedures of ATF;
18. Install the crankshaft position sensor harness connector.
19. Install transmission wire harness connector;
20. Install the battery bottom.
21. Connect battery negative cable.

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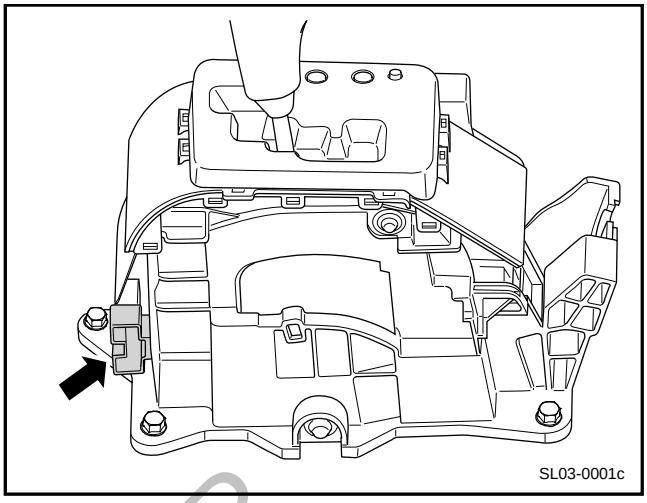
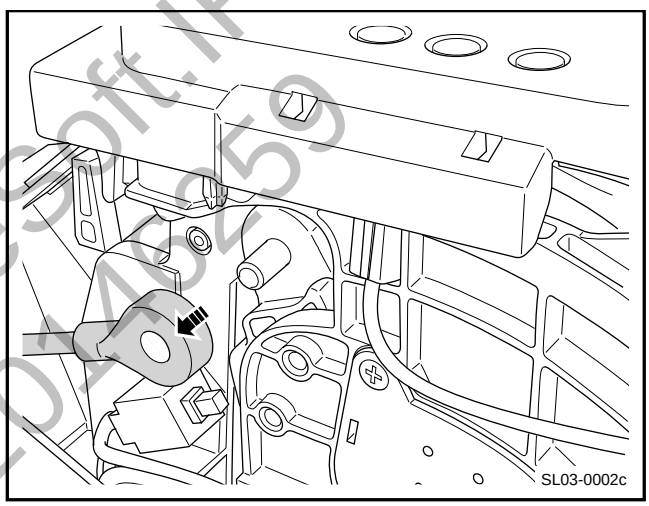
3.5.7.7 Shifter replacement

Dismantle procedure

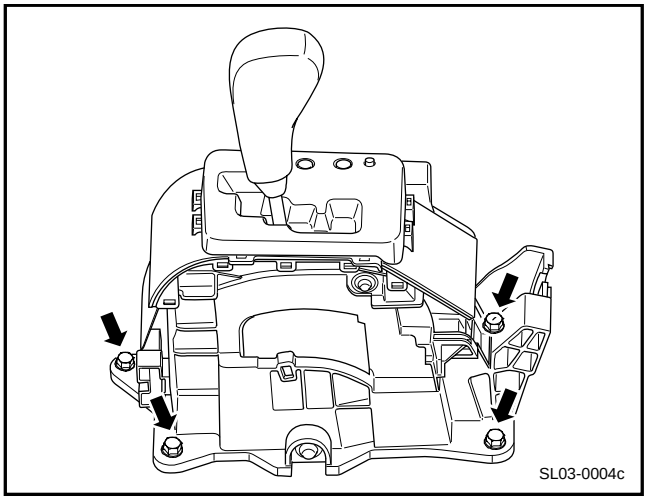
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery cable disconnection/connection procedures.
2. Dismantle auxiliary instrument panel on the top of selector, refer to 12.8.3.4 Auxiliary Instrument Panel Assembly Replacement.
3. Disconnect connection of shifter and instrument harness harness



4. Dismantle gearshifting flexible shaft.



5. Dismantle the shift gear fixing bolts.
6. Dismantle the shift gear assembly.



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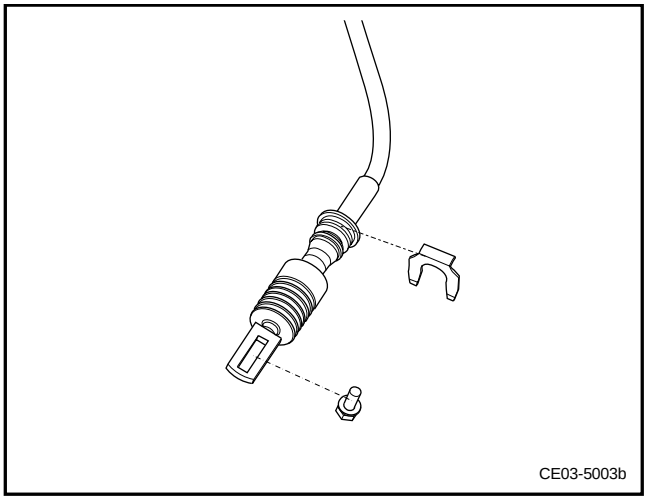
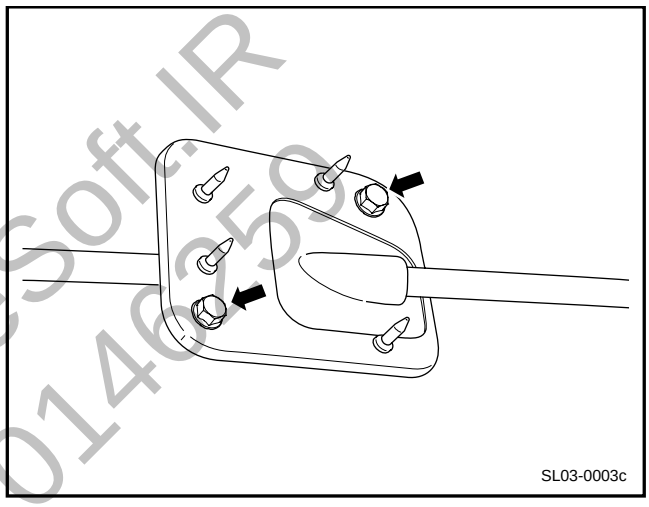
7. Extract the U-shaped clamping plate from the fixing bracket for the shift shaft on the transmission side and loosen the nut for fixing the transmission shift swing arm with the shift shaft.



8. Dismantle the bolt for fixing the flexible shaft sealing pressure plate and Dismantle the flexible shift shaft from the body floor.



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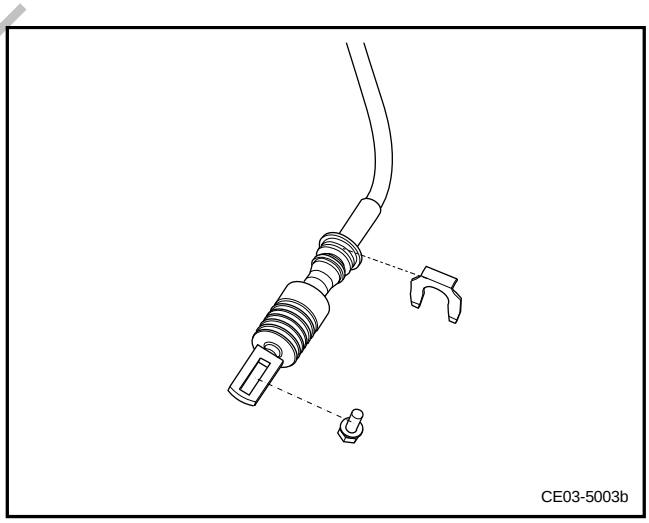
Installation procedure::

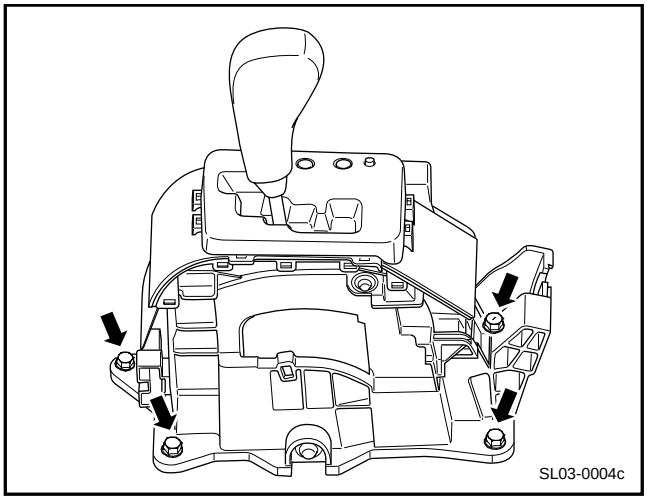
1. Install gearshifting flexible shaft.
2. Install U-clip plate on fixing bracket of gearshifting flexible shaft on transmission side and nut of fixing transmission gearshifting swing arm and gearshafting flexible shaft.



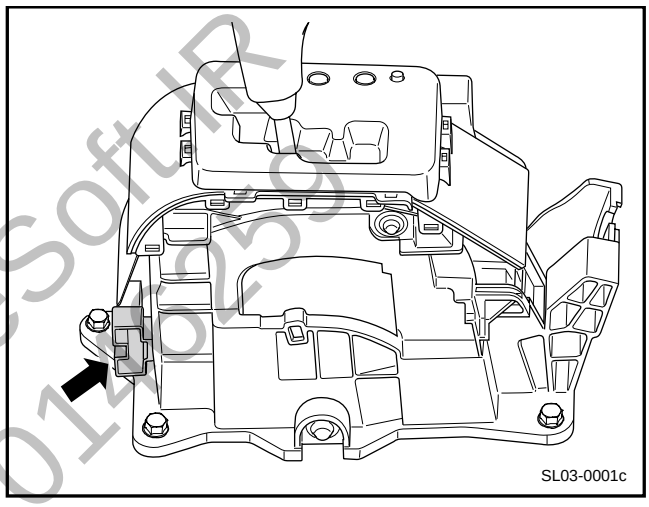
3. Install shifter assembly and tighten fixing bolt .

Torque: 16～26 N.m (Metric system)

9.9～16.2lb-ft(English system)



4. Connect gear selector and gearshift flexible shaft.
5. Install and secure the bolts on the soft shaft sealing pressure plate.
6. Connect the shift gear with the instrument harness connector.
7. Install t he floor console over the shift gear.
8. Connect battery negative cable.



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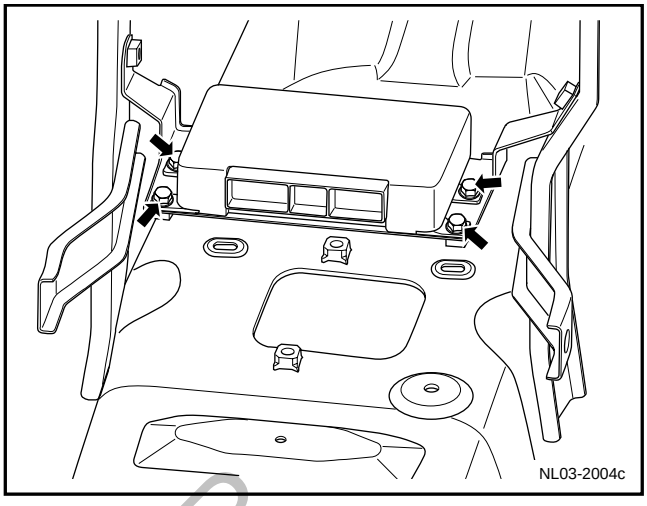
3.5.7.8 replace automatic transmission control module

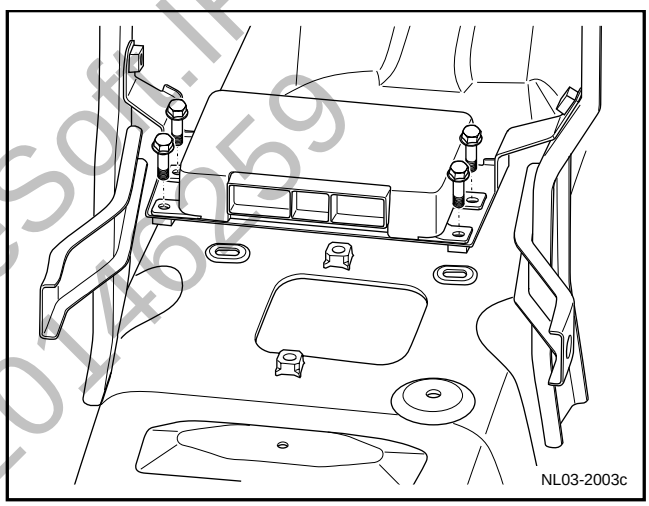
Dismantle procedure

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery cable disconnection/connection procedures.
2. For dismantling of sundries box of instrument, refer 12.8.3.2 Replacement of sundries box
3. Disconnect connection of Automatic transmission control module harness.
4. Dismantle fixing bolt of automatic transmission control module.
5. Dismantle the automatic transmission control module.



Installation procedure:

1. Install automatic transmission control module and tighten fixing bolt.
2. Connect wire harness of automatic transmission control module.
3. Install the glove box of instrument panel.
4. Connect battery negative cable.



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4 Suspension system

4.1 Warning and precaution

4.1.1 Warning and precaution

Assistant driving warning

Warning!

When the technician checks the fault part to be repaired, the assistant shall drive the vehicle; otherwise, it may cause personal injury.

Warning for battery disconnection

Warning!

Unless directed, otherwise, the ignition and start switch must be in OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable if a tool or any equipment easily comes in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

Warning for road test

Warning!

Test a vehicle on the roads under safe conditions and obey all traffic laws. Do not attempt any operation that could jeopardize vehicle control. Failure to obey these precautions will lead to serious personal injury and vehicle damage.

Precaution for engine lifting

Notes:

When raising or supporting the engine for any reason, do not use a jack under the oil pan, any sheet metal, or the crankshaft pulley. Lifting the engine in an unapproved manner may cause damages to component.

Important precaution for excessive adhesive on flywheel bolts

Notes:

Appropriate sealant shall be applied on the fastener when assembling the component. If the sealant is excessive, the part may be improperly assembled or the fastener is loose; if the part or fastener is improperly assembled, the component will be loose or dropped off, thereby resulting in serous damage to the engine.

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4.2 Front suspension

4.2.1 Specifications

4.2.1.1 Fastener specifications

Fastener name	Model	Torque range		Remarks:
		metric (NM)	English system (lb-ft)	
Front bolt of subframe	M14×1.5×133	133-157	98-116	
Rear bolt of subframe	M14×1.5×95	133-157	98-116	
Ball pin slot nut of steering tie rod	M12×1.25	31-35	23-26	Tighten the nut to an angle of 60°when the split pin cannot be sleeved.
Front shock absorber upper nut	M10×1.25	45-55	33-41	
Connecting bolt of lower swing arm and ball head	M10×1.25	70-90	51.8-66.6	
Connecting nut of lower swing arm and ball head	M10×1.25	70-90	51.8-66.6	
Lower mounting bolt of front shock absorber	M17×1.5×62	220-260	162-192	
Lower mounting nut of front shock absorber	M17×1.5	220-260	162-192	
Outer-end ball head and knuckle of steering gear tie rod	M12×1.25	31-35	23-26	
Front mounting bolt of front lower swing arm	M16×1.5×100	213-253	157-187	After falling down wheel, according to the specified torque
Rear mounting nut of front lower swing arm	M16×1.5	213-253	157-187	After tightening and falling down wheel, then according to the specified torque.
Low swing arm round head slotted nut	M14×1.5	123-143	91-106	When the split pin can not be worn by tightening, then screw the nut at 60°.
Front stabilizer bar connecting nut	M12×1.25	69-79	51-58	

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The upper support of the shock absorber and piston rod nut	M12×1.25	60-80	44-59	
Mounting support mounting bolt of front stabilizer rod	M12×1.25×30	79-95	58-70	
Connecting bolt between front suspension reinforcement plate and body	M12×1.5×30	85-101	63-75	
Front axle hub nut (drive shaft)	M22×1.5	216	160	The locking nut hits concavely to fix.

4.2.1.2 General specifications

Wheel runout		**No load**		**No load**	
		Front	**Rear**	**Front**	**Rear**
Upstroke	mm/in	93.4/3.6	116.8/4.6	80.8/3.1	94.5/16.1
Upstroke	mm/in	67.5/2.7	73.7/3	80/3.1	96/3.7

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4.2.2 Description and operation

4.2.2.1 Description and operation

The front suspension system of the vehicle plays the role in furthest increasing the tire and the road surface to provide good steering operation and stability as well as ensure the passenger comfort. It can absorb the energy of the vertical acceleration speed, so that the wheels are bumped up and down along with the road surface but the frame and body are not interfered. The front suspension for this vehicle is an independent strut suspension, which consists of the following components: spring, shock absorber and stabilizer bar.

4.2.3 System operation principle

4.2.3.1 Suspension system term

1. Spring weight:
    - Spring loading weight refers to vehicle weight borned by spring.
    - Spring loading weight should be more than unsprung loading weight to obtain normal opeartion performance.

      Examples of sprung weight:

      a. Body and frame

      b. Load or cargos

      c. Fuel tank

      Sprung part includes:

      a. Frame (including the subframe)

      b. Body (including the unit body)

      c. Power system (engine, transmission and transmission drive axle)

      d. Steering gear
2. Unsprung weight:
    - Unsprung loading weight refers to vehicle weight which is not borne by spring.
    - The smaller the unsprung loading weight is, the better it is, to ensure normal opeartion and traveling smoothness.

      Examples of nonsprung weight:

      a. Wheel and tire

      b. Wheel bearing and hub

      c. Axle and knuckle

      d. Braking components (installed on the wheel)

      Unsprung part includes:

      a. Wheel/tire, ball joint, bearing, control arm, I-beam, cross member axle and one-piece drive axle.

      b. Stabilizer bar and control rod components.

      c. Core shaft, knuckle, brake, etc.

      d. The suspension response will be good if the unsprung loaded weight is small.
3. Parts between spring-load weight and unsprung load weight:

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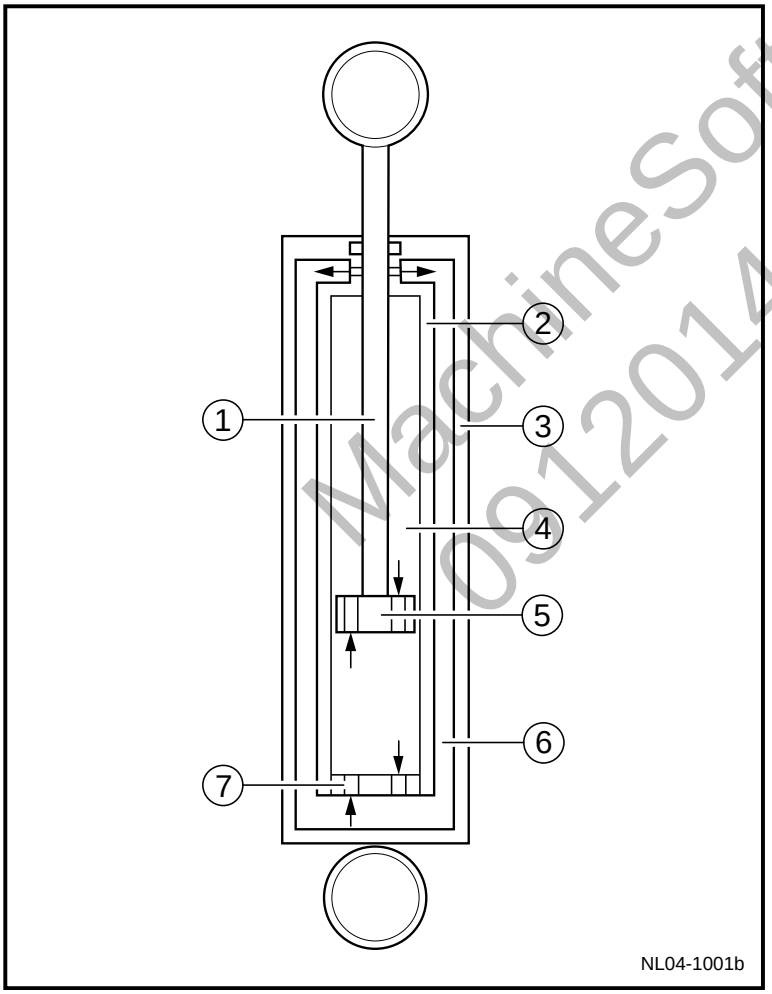
The steering rod, the drive shaft, the stabilizer and the other parts are located between the sprung part and the unsprung part.

4.2.3.2 Operation principle of suspension system component

1. Spring:

The rigidity of the spring will affect on the response of the sprung mass when the vehicle is running; the vehicle with rigidity too low of the spring can thoroughly eliminate bump and provide extremely stable running feeling; however, at the same time, it is easy to dive and crouch in the course of brake and acceleration; and it is easy to skew and turn over during turning a corner. The vehicle with rigidity too large of the spring has worse stability on the bump road surface; however, the body moves little, which means that the vehicle can also be driven in a quicker mode even though turning a corner. Therefore, although the spring itself seems simply, the spring can not individually provide an extremely smooth driving feel when designing and realizing these devices on the vehicle with a balance between the passenger comfort and handling characteristics of the vehicle. The performance of the spring on the aspect of absorbing energy is excellent; however, its capability of dissipating is worse. Therefore, the suspension system needs to use a part called as the shock absorber. If not using a damping structure, the spring will be bounced off at the uncontrollable speed, release the bump energy absorbed, continually upspring based on its frequency until exhaust all energy applied thereon initially. The suspension established on the spring drives the vehicle in the jumping mode according to terrain and is not controlled.

2. Shock absorber:



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1. Piston pushing rod
2. Inner cylinder
3. Outer cylinder
4. Hydraulic cylinder.
5. Piston and valves
6. Liquid-storing space
7. Internal cylinder bottom valve

It controls the unexpected spring motion through a process of damping called.The shock absorber slows down and reduces the motion of vibratility through converting the kinetic energy of suspension motion into heat energy dissipated by hydraulic oil. The upper support of the shock absorber is connected with the frame (i.e., sprung weight); and the lower support thereof is connected with the shaft close to the wheel (i.e., unsprung weight). In double-cylinder design, one of the most common types of shock absorber is that the upper support is connected with the piston rod, the piston rod is connected with the piston, and the piston is located in a cylinder filled with hydraulic oil. The inner cylinder is called as a pressure cylinder and the outer cylinder is called as the oil storage cylinder. The oil storage drum stores excessive hydraulic oil. When the wheels are on the bump road surface to compress and stretch the spring, the power of the spring is transmitted to a shock absorber through an upper support and to a piston through a piston rod downward. Holes are opened on the piston. When the piston moves up and down in the pressure cylinder, hydraulic oil leaks from those small holes. Because these holes are very small, there is still only a small amount of hydraulic oil passing through under the great pressure. Therefore, the piston slows down to decelerate the spring. The shock absorber work includes two circles-compression circle and stretching circle.The compression cycle refers to that the piston compresses the hydraulic oil therebelow when moving downwards; the drawing cycle refers to the hydraulic oil thereabove when the piston moves upward to the topside of the pressure cylinder. For a typical vehicle, the resistance to stretching circulation is larger than that to compression circulation. You need to also note that the compression circulation controls the motion of the unsprung loaded mass and the tension circulation controls the motion of the relatively heavier spring loaded mass. All modern shock absorbers have the speed sensing function--the faster the speed of movement of the suspension is, the greater the resistance provided by the shock absorber is. Thus, the shock absorber can be regulated according to the road condition; moreover, all unexpected motions possibly incurred in the driving vehicle are controlled, including bounce, rollover, brake subduction and acceleration crouch, etc.

3. Stabilizer rod:

It is matched with the shock absorber to provide additional stability for the moving vehicle. The stabilizer bar is a metal rod crossing the whole axle to effectively connect the two sides of the suspension together. When the suspension on one wheel moves up and down, the stabilizer bar can transit the motion to the other wheels. Therefore, run more stably to reduce the inclination of the vehicle, particularly, it can counteract the rollover of the vehicle on the suspension when turning a corner.

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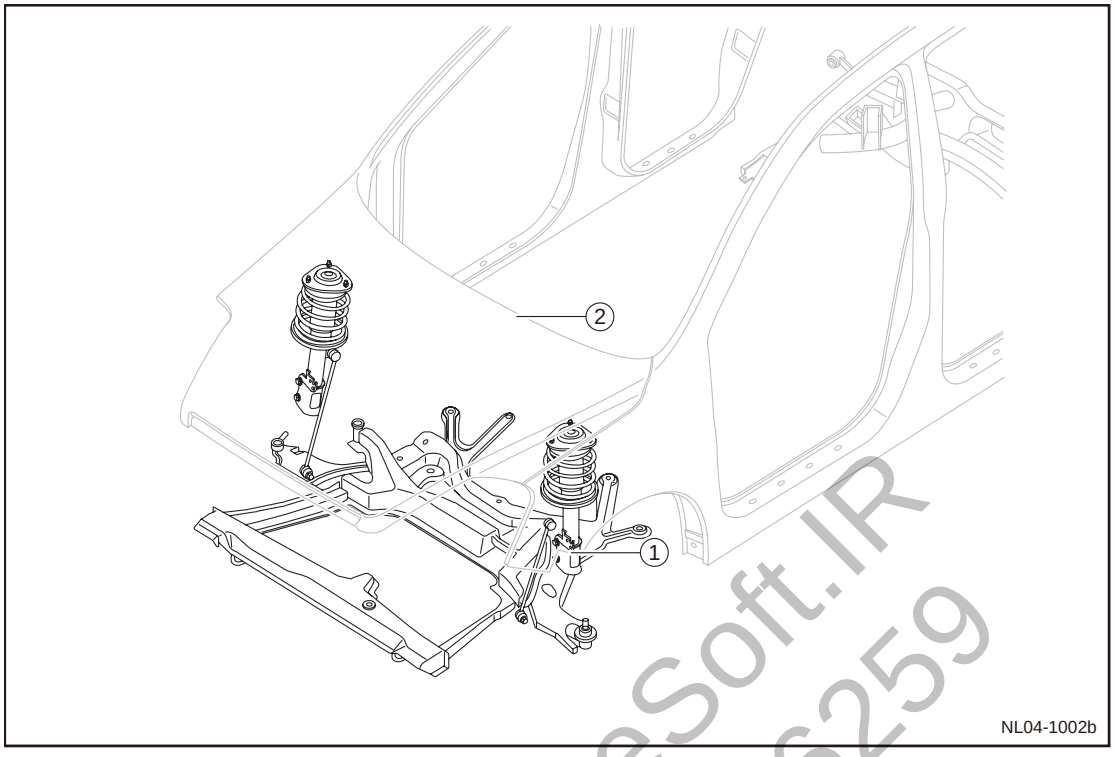
4.2.4 Component position

4.2.4.1 Component position



1 Front suspension

2. Vehicle body

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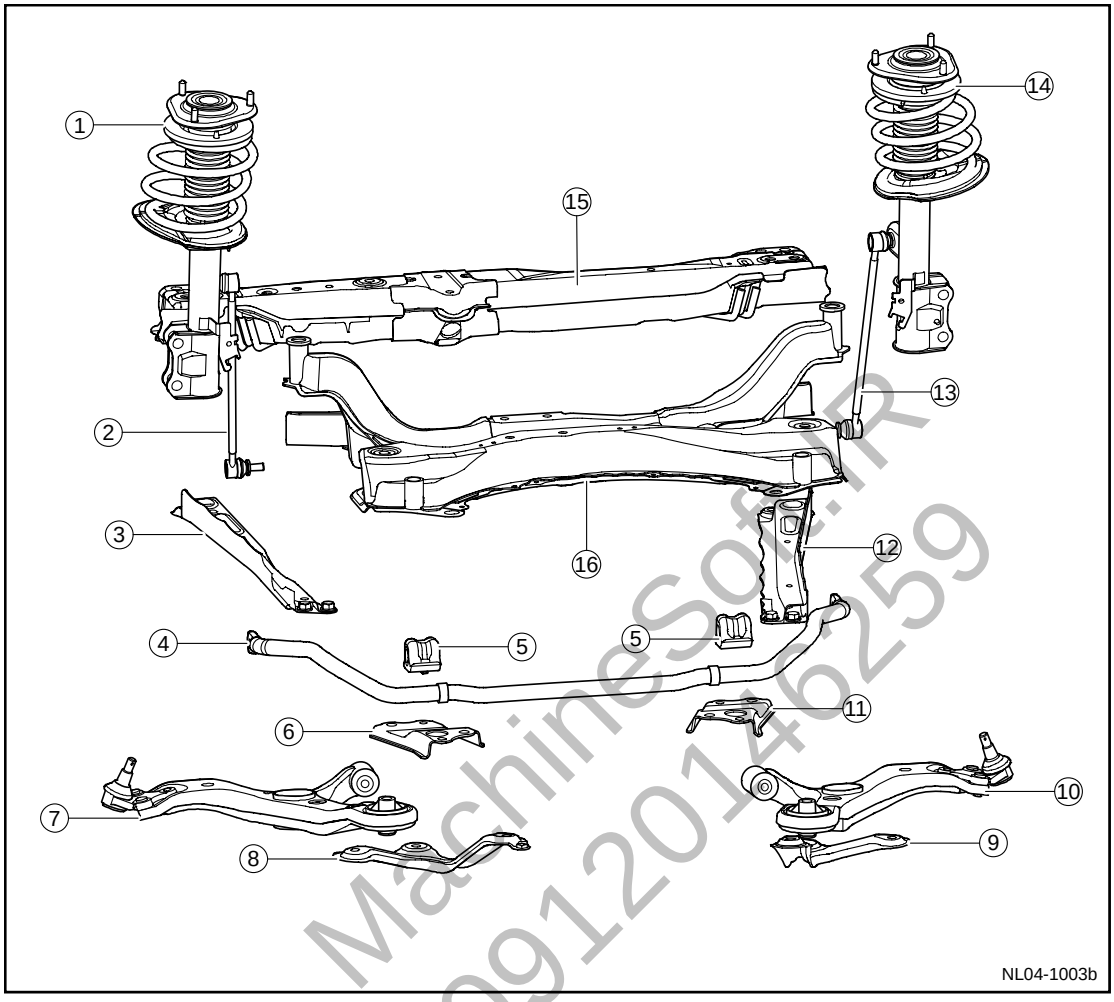
4.2.5 Disassemble drawings

4.2.5.1 Disassemble drawings

Front suspension



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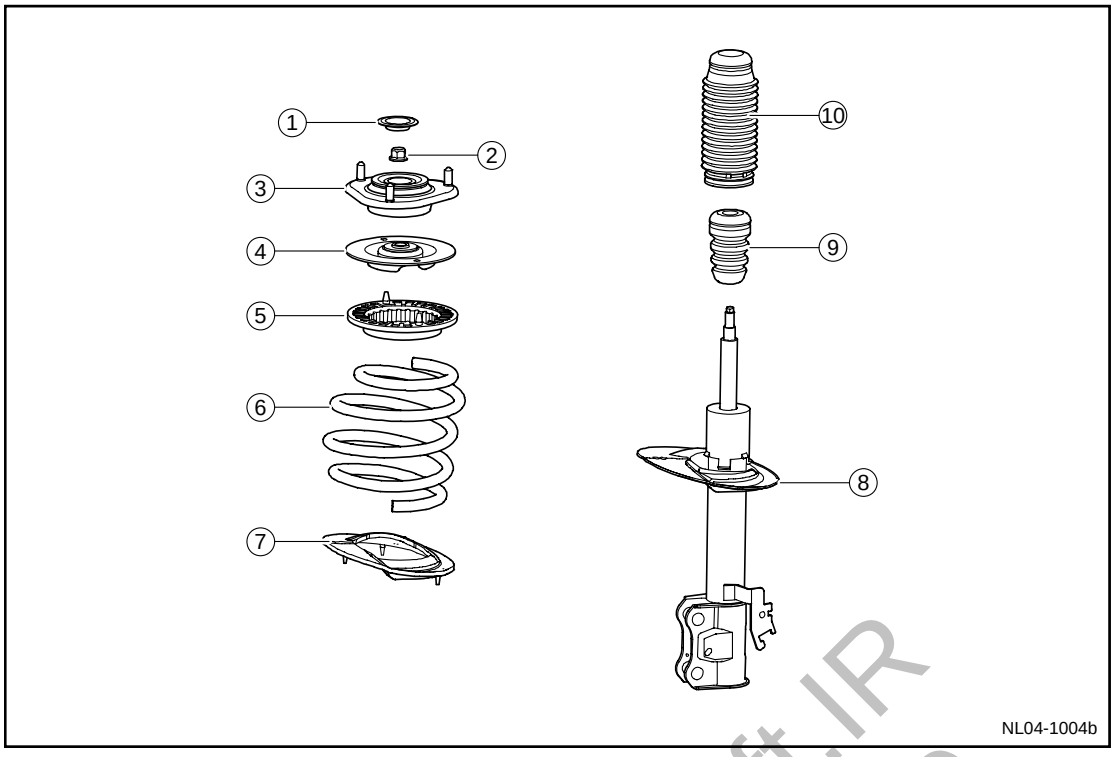
1. Right front support post
2. Right front stabilizer rod and stabilizer connecting rod assembly
3. Front suspension right side longitudinal beam
4. Front stabilizer bar
5. Front stabilizer bar bushing
6. Front right stabilizer bar fixing bracket
7. Right side lower swing arm
8. Right side front subframe reinforcement plate
9. Left side front subframe reinforcement plate
10. left side lower swing arm
11. Fixing support of left side front stabilizer rod
12. Front suspension left side longitudinal beam
13. Left front stabilizer rod and stabilizer connecting rod assembly.
14. Left front post assembly.
15. Front suspension horizontal beam assembly
16. Front auxiliary frame.



1. Upper support seat anti-dust cover of front shock absorber
2. Lock nut
3. Upper support seat of front shock absorber
4. Upper bracket for front coiling spring.
5. Upper damping cushion of front coiling spring
6. Front suspension coiling spring
7. Front coiling spring lower damping cushion
8. Front shock absorber assembly
9. Front shock absorber bumper block
10. Anti-dust cover of front shock absorber

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4.2.6 diagnosis information and procedures

4.2.6.1 Diagnosis descriptions

Starting system diagnosis referring to the system description and operations. When malfunction occurs, refer to description and operation, as it will help to determine the correct symptoms diagnosis procedures. It will also help to determine whether the condition the customer described is in normal. Refer to 4.2.2 Description and Operation to confirm the correct procedures for system diagnosis.

4.2.6.2 Shock absorber is too soft

1	Check whether the tire pressure is normal?

No → Adjust the tire pressure to the standard value according to the specification on the tire label.

Yes

2	Check whether the vehicle overloads?

No → Ask for the user to explain the user what is the normal load of the vehicle.

Yes

3	Check whether the compression resilience effects of the shock absorber are normal?

Quickly press down and release the closest detecting shock absorber bumper corner. Compare with the normal similar vehicle on the compression resilience effect.

No → Refer to 4.2.7.3 Replacement of front post Assembly and 4.3.7.1 Replacement of rear shock absorber to replace the shock absorber.

Yes

4	The system is normal.

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4.2.6.3 Shock absorber has noise

1	Check whether the shock absorber is installed normally and whether various parts of the shock absorber work normally (without abnormal conditions, such as loose and the like).

No → Replace the shock absorber if necessary.

Yes

2	Check whether the compression resilience effects of the shock absorber are normal?

Quickly press down and release the closest detecting shock absorber bumper corner. Compare with the normal similar vehicle on the compression resilience effect.

No → Refer to 4.2.7.3 replacement of front post assembly and 4.3.7.1 replacement of rear shock absorber to replace the shock absorber.

Yes

3	The system is normal.

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4.2.6.4 Shock absorber oil has leakage

1	Check whether there is a slight oil leakage phenomenon; if so, the shock absorber is normal.

Next

2	Inspect the seal situation when the shock absorber is completely stretched and whether the dust cover is damaged, etc.

Yes

No

Refer to 4.2.7.3 Replacement of front PostPostPostpost assembly and 4.3.7.1 Replacement of Rear shock absorber to replace the shock absorber.

3	Check whether the oil on the shock absorber is too much?

Yes

No

Refer to 4.2.7.3 replacement of front PostPostPostPostpost Assembly and 4.3.7.1 Replacement of Rear shock absorber to replace the shock absorber

4	The system is normal.

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4.2.6.5 Ball stud and steering knuckle inspection

1	The front end of the vehicle is raised, so that the front suspension is in the state of free suspension.

Warning: refer to warning for vehicle lifting and jacking in warnings and precautions.

Next

2	Grasp the topside and the bottom of the tire.

Next

3	Pull the topside of the wheel inward and outward.

Next

4	Note whether there is a clearance as well as whether the steering knuckle moves horizontally with respect to the control arm?

Next

5	If the following situations incur, the ball head must be replaced.

A. The ball joint is loosened.

B. Ball seal was broken

C. The ball end bolt is disconnected from the knuckle.

D. The ball end bolt is loosened on the knuckle.

E. The ball end bolt torsions in the seat when pressed with a finger.

Next

6	The system is normal.

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4.2.6.6 Ball head bolt inspection

When inspecting the ball joint each time, check whether the ball head bolt is tightly installed in the steering knuckle boss.

Inspect the method whether the ball head bolt is worn:

A. Rotate the wheel and sense the movement of the bolt head or slotted nut in the knuckle boss.

B. Check the tightening torque of the slotted nut. A loosened nut indicates the ball end bolt is under stress in the knuckle boss or contains a hole.

If there are the above situations, the worn or damaged ball joint or steering knuckle must be replaced. Refer to 4.2.7.7 Replacement of lower swing arm ball head assembly and 4.2.7.8 replacement of steering knuckle.

4.2.6.7 Frictional force overbig Check

Check for excessive front suspension frictional force following the procedures below:

1	Lift the front bumper to raise the vehicle as must as possible.

Next

2	Slowly put down the bumper, so that the vehicle restores the normal warping height.

Next

3	Measure the distance from the ground to the bumper center.

Next

4	Press the bumper and then slowly release to have the vehicle return to its normal nosing height.

Next

5	Measure the distance from the ground to the bumper center.

Next

6	The difference between the two measuring value shall be less than 12.7mm (0.5in); and if the distance exceeds this limit, check whether the control arm, the shock absorber and the ball head are damaged or worn .

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4.2.6.8 Driving smooth diagnosis (too hose or too rigid)

1. Too flexible.

1	Check whether the shock absorber is worn; and replace the shock absorber if necessary.

Next

2	Check whether the coiling spring is broken down or loose; and replace the spring if necessary.

2. Too hard

1	Check whether the shock absorber is installed correctly, whether the shock absorber does not accord with the vehicle type; and replace the shock absorber if necessary.

Next

2	Check whether the coiling spring is correct; and replace the coiling spring if necessary.

4.2.6.9 Bod inclined or swing with turning

1	Check whether the stabilizer bar connecting rod is loose; and refasten connecting nut between the connecting rod and the support assembly as per the specified torque.

Next

2	Check whether the shock absorber and the bolt spring seat are worn; replace the shock absorber if necessary, and retighten the fixing nut on the shock absorber.

Next

3	Check whether the vehicle is overloaded to reasonably account for the user.

Next

4	Check whether the coiling spring is broken down or loose; and replace if necessary.

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4.2.6.10 Noise diagnosis

1	Check whether the ball head or that of the steering tie rod is lack of lubrication?

Yes → Replace ball head. or steering tie rod ball head.

No

2	Check if suspension components were damaged?

Yes → Replace the suspension part damaged.

No

3	Check whether the lower swing arm lining is worn?

Yes → Replace lower swing arm

No

4	Check whether stabilizer bar connecting rod is loose?

Yes → Tighten stabilizer rod connecting rod

No

5	Check whether the shock absorber or the support coiling spring seat damping cushion is complete, or is installed in place or is damaged?

Yes → Replace the part damaged.

No

6	Check whether the support coiling spring is misplaced?

Yes → Reinstall the bolt spring.

No

7	Check whether the stabilizer barfixing clipper bushing is excessively worn?

Yes → Replace fixing clipper bushing stabilizer rod, Refer to 4.2.7.5 stabilizer rod replacement

No

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8	Find out a vehicle with the same type to comprehensively evaluate whether the noise belongs to the normal working noise.

Next

9	The system is normal.

4.2.6.11 Wrapping head height is abnormal

1	Check whether the coiling spring in the support assembly is broken down or loose; and replace if necessary.

Next

2	Check whether the vehicle overloads, and account for the user on the damage of vehicle overloading if necessary.

Next

3	Check whether the coiling spring of the support assembly is wrong or too soft, and replace by original coiling spring of Geely.

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4.2.7 Dismantle and installation

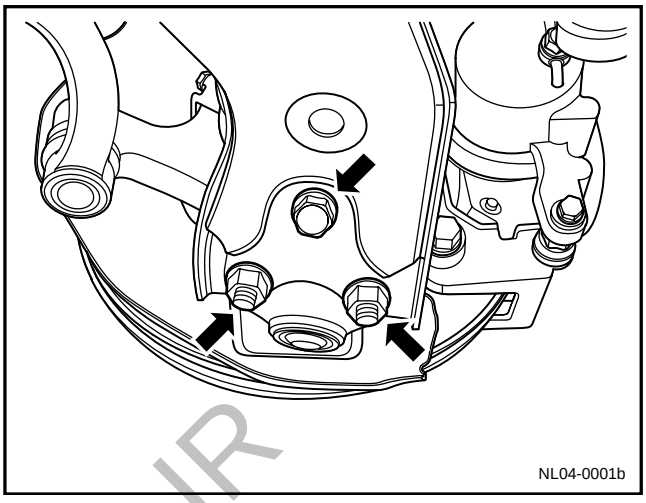
4.2.7.1 Lower swing arm assembly replacement

Dismantle procedure:

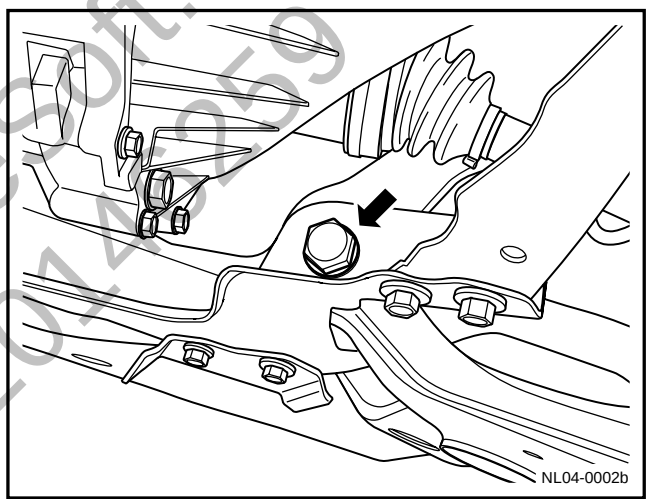
Notes:

Before starting the following dismantle procedure, firstly, the ignition key in the ignition switch must be removed, and the steering wheel is turned to lock it.

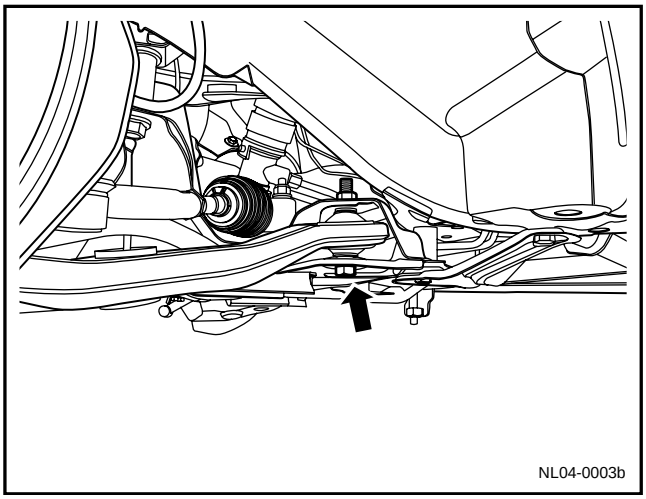
1. Lifting vehicle
2. For dismantling of front wheels, refer to 4.4.5.1 replacement of wheels.
3. Dismantle connecting bolt and nut between lower swing arm and lower swing arm ball head.



4. Dismantle connecting bolt between lower swing arm and front part of front auxiliary frame.



5. Remove the through bolt between the lower swing arm and the front subframe.
6. Remove the lower swing arm assembly.



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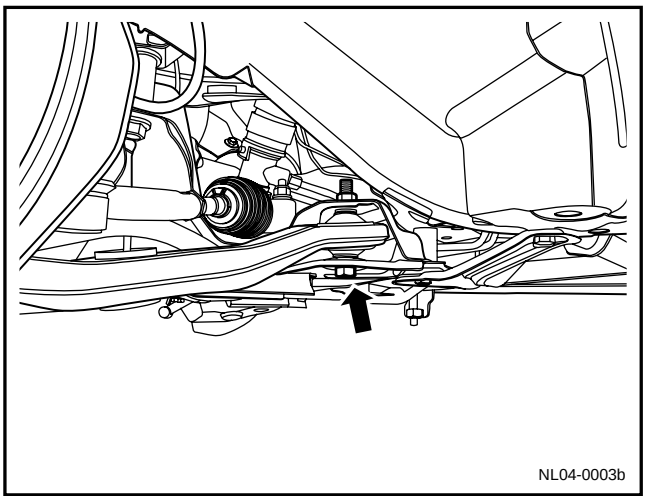
Installation Procedure:

Notes:

See Important precaution for fastener in warnings and precautions.

1. Install swing arm onto front auxiliary frame.
2. Install and tighten through bolt of lower swing arm and front auxiliary frame.

Torque:180 Nm (Metric) 133 lb-ft (English system)

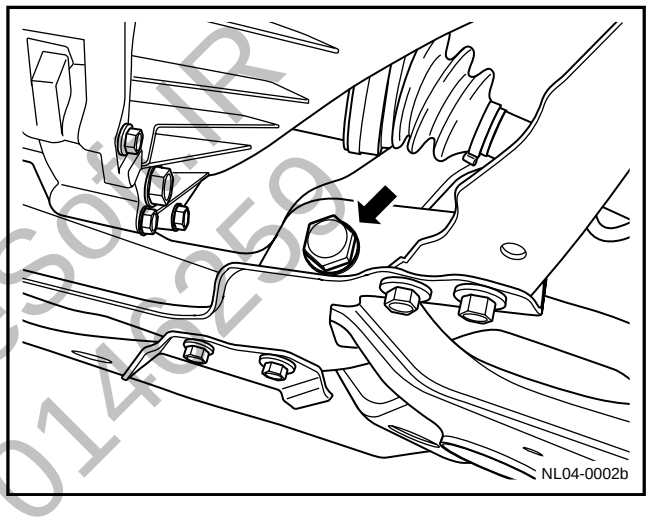


3. Install connecting bolt on the front of lower swing arm and front auxiliary frame.

Notes:

You must tighten the bolt to the specified torque after placing down the wheel.

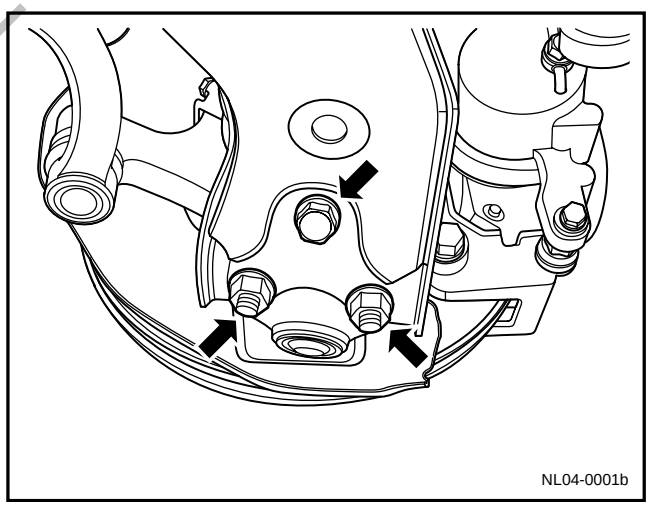
Torque:180 Nm(Metric) 133 lb-ft(English system)



4. Install fixing bolt and nut between lower swing arm and lower swing arm ball head.

Torque:145 Nm(Metric) 107.3 lb-ft(English system)

5. Install the wheel.
6. Lower the vehicle.



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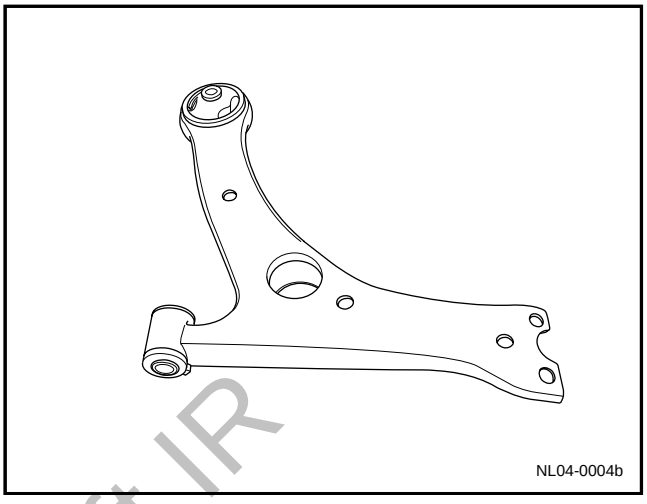
4.2.7.2 Lower swing arm bushing replacement

Dismantle procedure

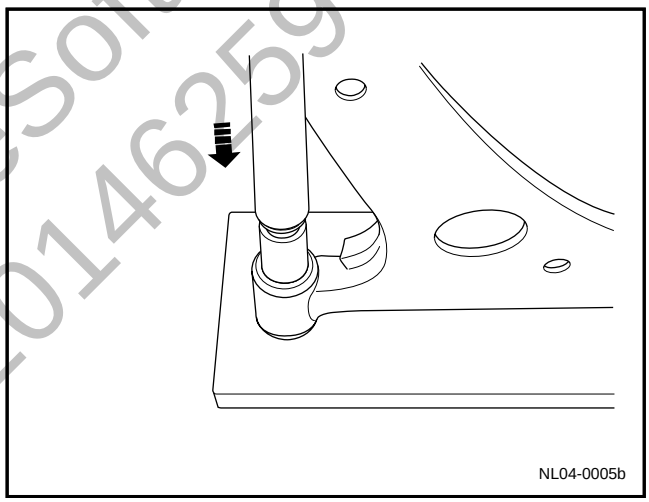
Notes:

Only one replacement of the bushing block is allowed.
In case of the second bushing block abnormality; you have to replace the lower swing arm assembly.

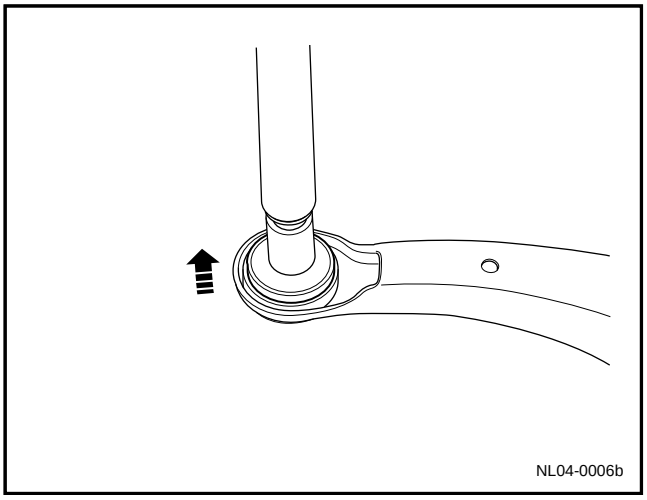
1. For dismantling of lower swing arm ball head, refer to 4.2.7.7 replacement of lower swing arm ball head assembly.
2. For dismantling of lower swing arm assembly, refer to 4.2.7.1 replacement of lower swing arm assembly.



3. Use dismantling tool of bushing to dismantle front bushing of lowe swing arm.



4. Remove the swing arm rear bushing with bushing dismantlement tool.



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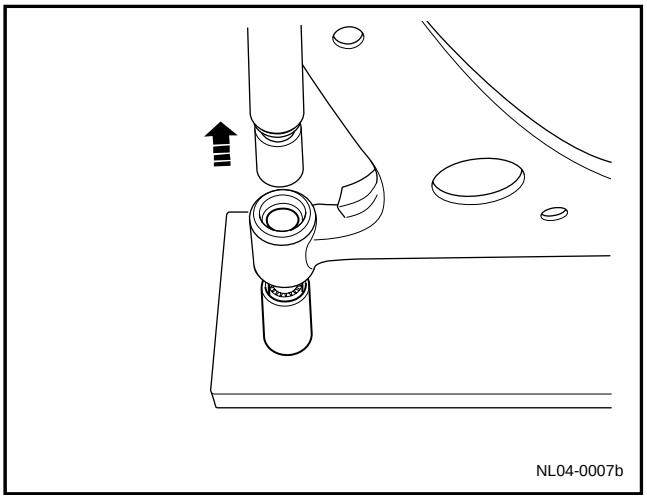
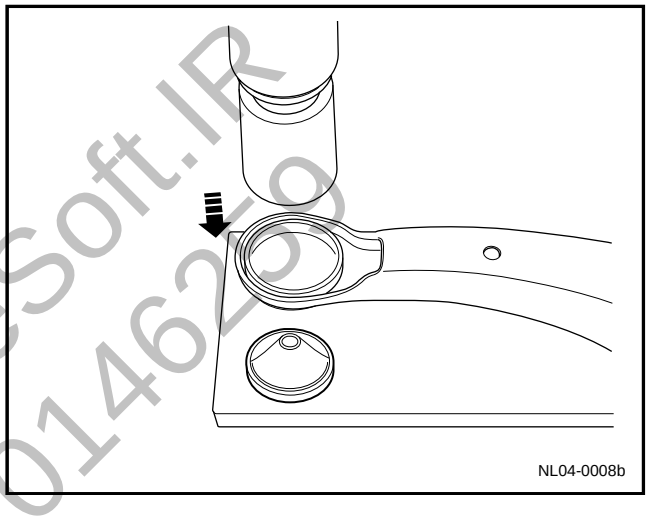
Installation procedure:

1. Apply multi-purpose grease to rear shaft of lower swing arm, and put rear sleeve into rear shaft of lower swing arm.



2. Apply multi-purpose lubricating grease on front shaft of lower swing arm, and press lower swing arm front bushing into front shaft of lower swing arm.
3. Install lower swing arm assembly.
4. Install lower swing arm ball head.



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4.2.7.3 Front post assembly replacement

Dismantle procedure:

1 Lifting vehicle

2. For dismantling of front wheels, refer to 4.4.5.1 replacement of wheels.

3. Dismantle connecting nut 1 between front stabilizer connecting rod and front shock absorber, and loose stabilizer rod from shock absorber.

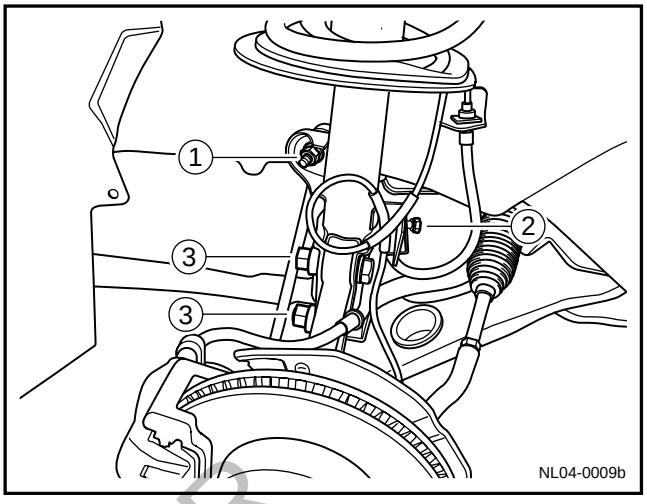
4. Dismantle bolt 2 of fixing support of front brake oil pipe.

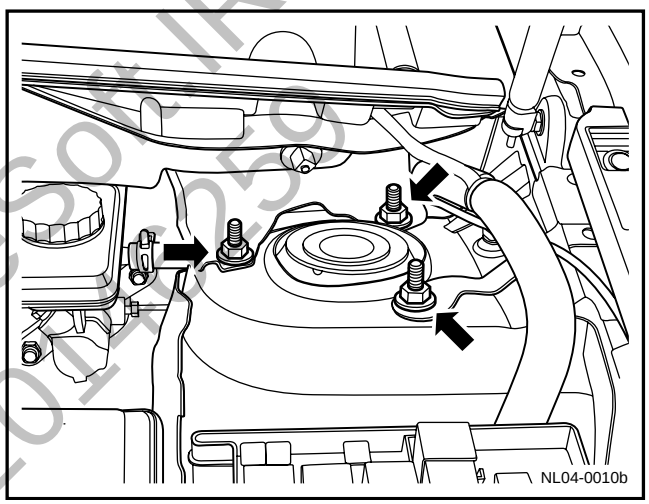
5. Detach the brake oil pipe and wheel speed sensor from the shock absorber.

6. Remove connecting bolt 3 between the knuckle and front shock absorber.

7. Remove 3 fixing nuts on the top of the front shock absorber.

8. Dismantle the front post assembly from the wheel casing side.





Installation procedure:

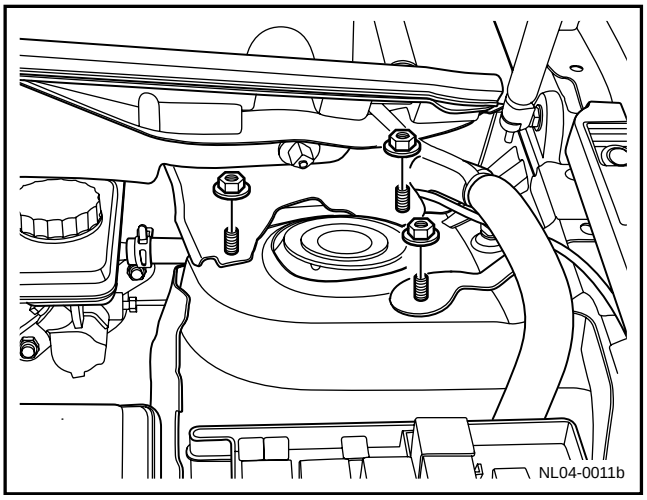
1. Install front shock absorber assembly, and tighten upper 3 fixing nuts.

Notes:

Be sure to operate carefully in order to avoid damaging or scratching the coating when moving the coiling spring of the suspension. Early failure may be caused by coating damage.

See Important precaution for fastener in warnings and precautions.

Torque:50 Nm(Metric) 37 lb-ft(English system)



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2. Install front shock absorber onto steering knuckle, and tighten bolt 3.

Torque:240Nm (Metric) 178 lb-ft (English system)

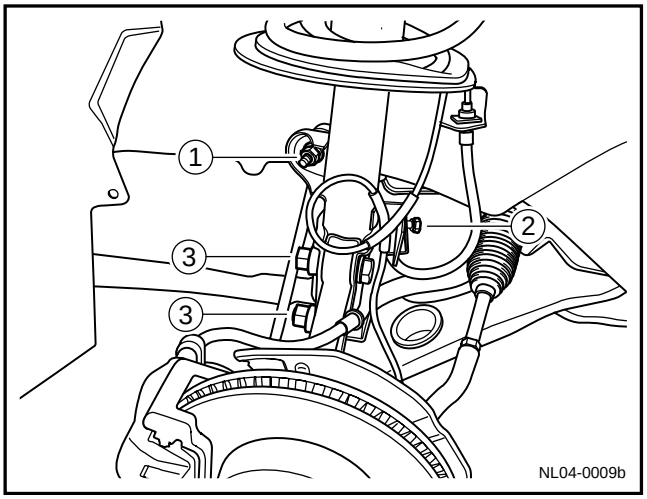
3. Install front brake hose bracket onto front post assembly, and tighten bolt 2.

4. Install the stablizing connection rod onto the front shock absorber and tighten Nut 1.

Torque:75 Nm(Metric) 55 lb-ft(English system)

5. Install the tires.

6. Lower the vehicle.



Notes:

The method for dismantling the front left and right shock absorbers is similar.

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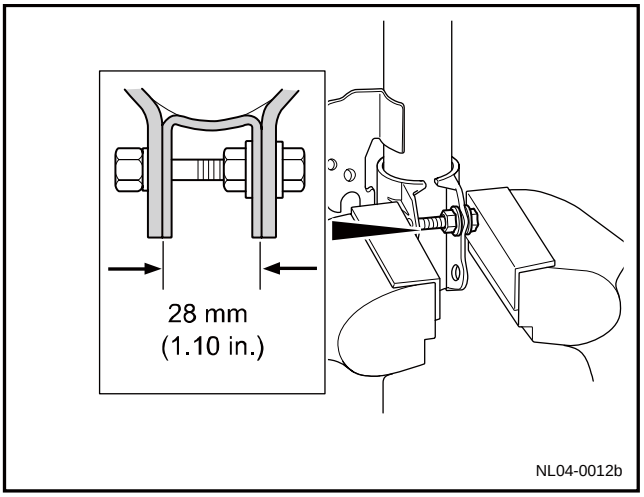
4.2.7.4 Front shock absorber component and spring replacement

Dismantle procedure:

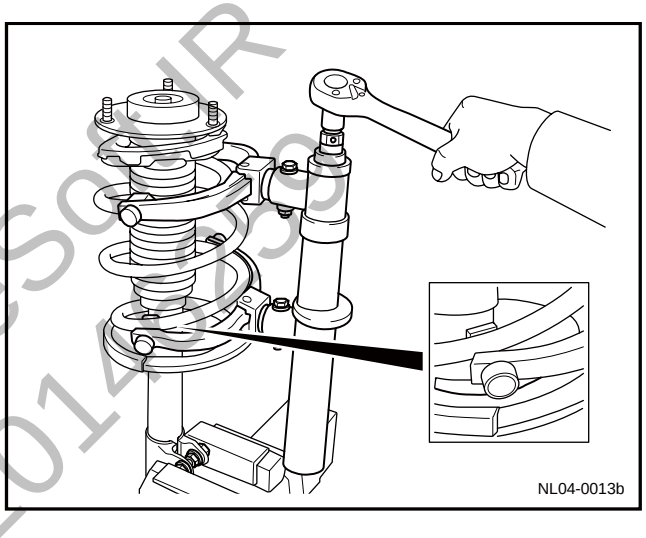
1. Install 2 screw cap and 1 bolt on shock absorber bracket, and then fix the front shock absorber assembly on table-vice.



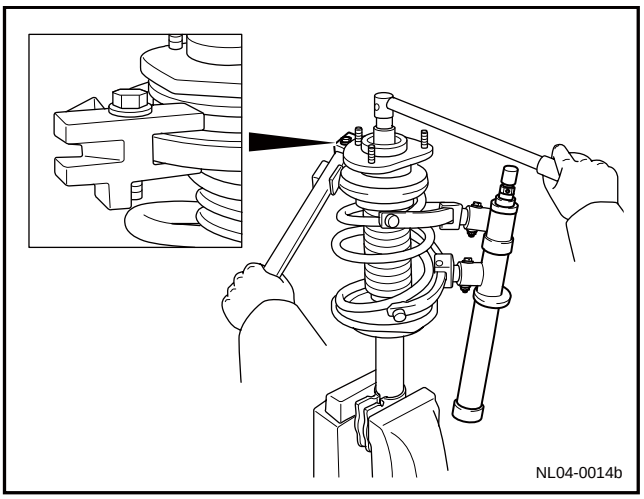
2. Use spring compression tool to compress coil spring.

Notes:

You cannot use a pneumatic wrench; otherwise this will damage the compression tool.



3. Dismantle dustroof cover of upper support of front shock absorber, and use tool to fix spring and dismantle locknut.



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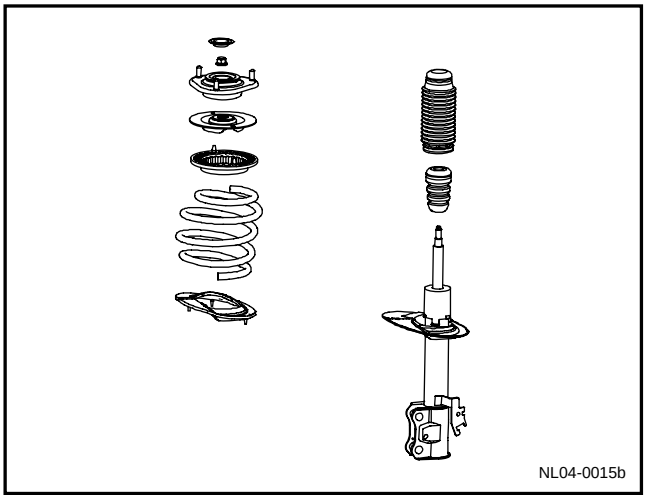
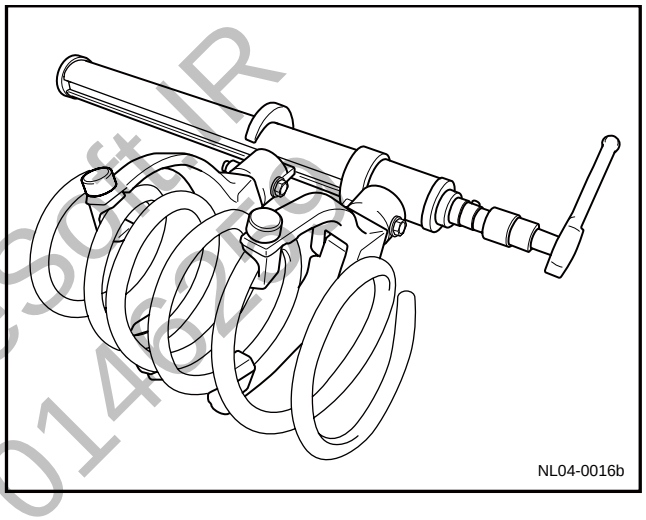
4. Dismantle upper support assembly of front shock absorber, upper support of coil spring , upper damping cushion of front suspension coil spring , coil spring of front suspension, dustproof cover of front shock absorber, cushion block of front shock absorber, lower damping cushion of coil spring .



Installation procedure:

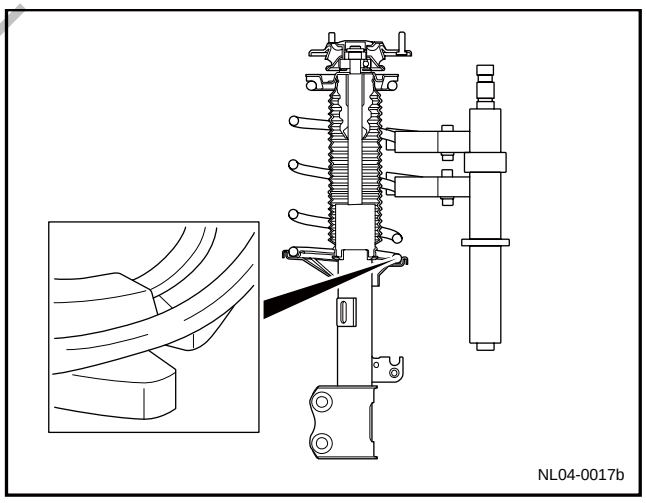
1. Use spring compression tool to compress sprial spring.



2. Install front coil spring lower damping cushion , frong shock absorber cushion block, front shock absorber dustproof cover, front suspension coil spring , front suspension coil spring upper damping cushion, front coil spring upper support, and front shock absorber upper support assembly on shock absorber bracket.

Notes:

The lower end of the coiling spring is mounted on the notch of the shock absorber spring seat.



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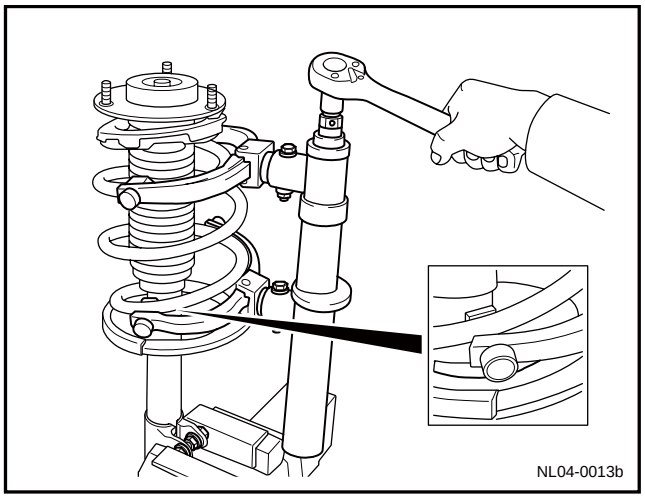
3. Install lock nut, and cover upper support dustproof cover of upper front shock absorber.

Torque:70 Nm (Metric) 51.8 lb-ft (English system)



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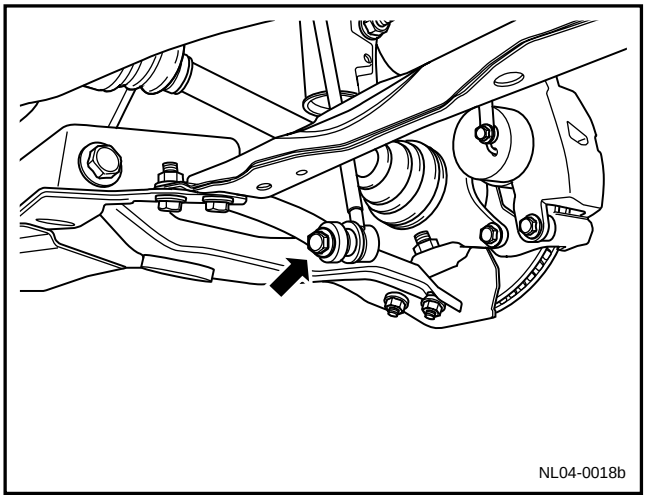
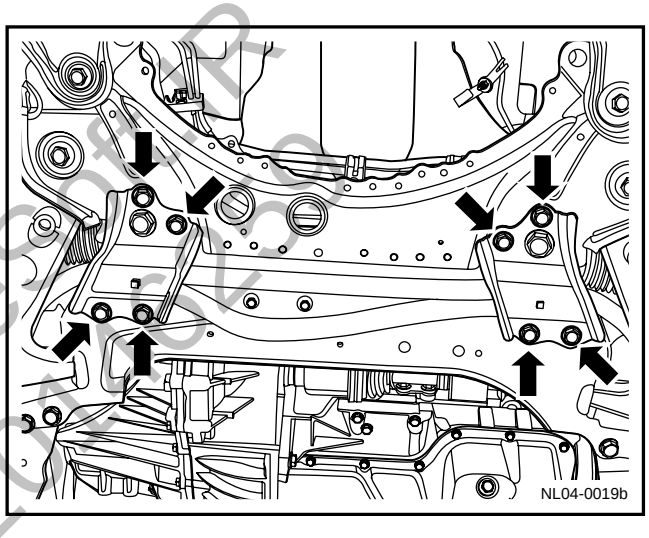
4.2.7.5 Stabilizer rod replacement

Dismantle procedure

1. For lifting of the vehicle, see 1.3 lifting vehicle.
2. For dismantling of wheels, refer to 4.4.5.1 replacement of wheels.
3. Dismantle connecting nut on the left and right sides of stabilizer rod and stabilizer connecting rod.



4. Dismantle connecting bolt between stabilizer rod and bushing and front auxiliary frame.
5. Dismantle the stabilizer bar.



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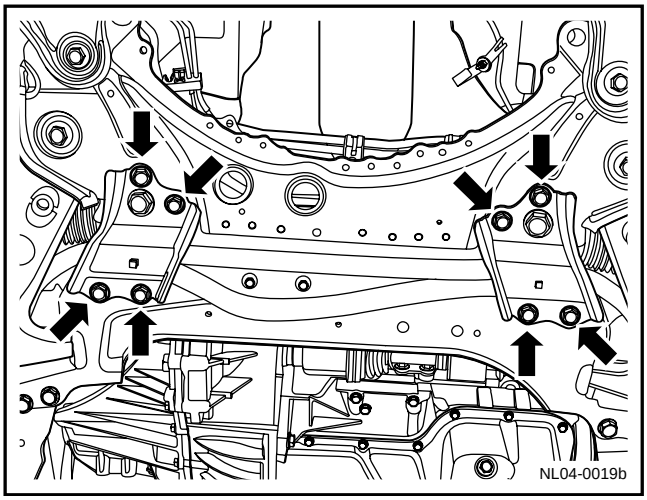
Installation procedure:

1. Install bushing on stabilizer rod, and then install U-clip and tighten bolt.

Torque:87 Nm (Metric) 64.5 lb-ft (English system)

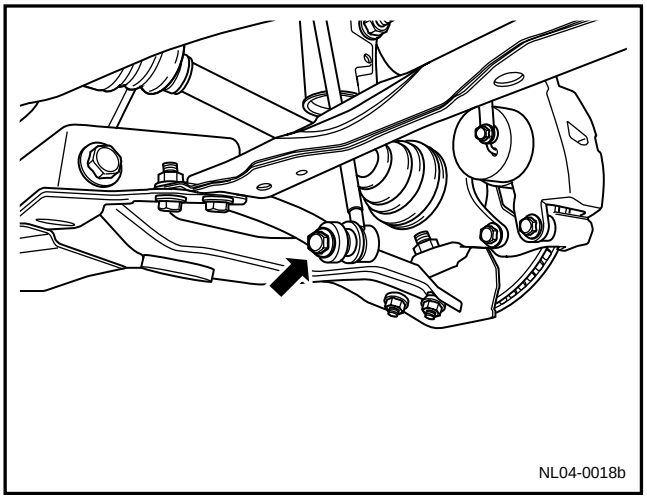


2. Install stabilizer rod and connecting nut on left and right side of stabilizer rod and stabilizer connecting rod.

Torque:75 Nm (Metric) 55 lb-ft (English system)

3. Install the wheel.

4. Lower the vehicle.



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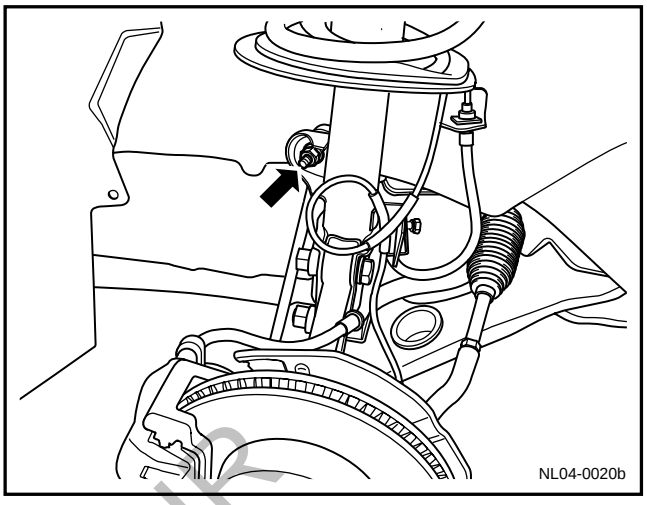
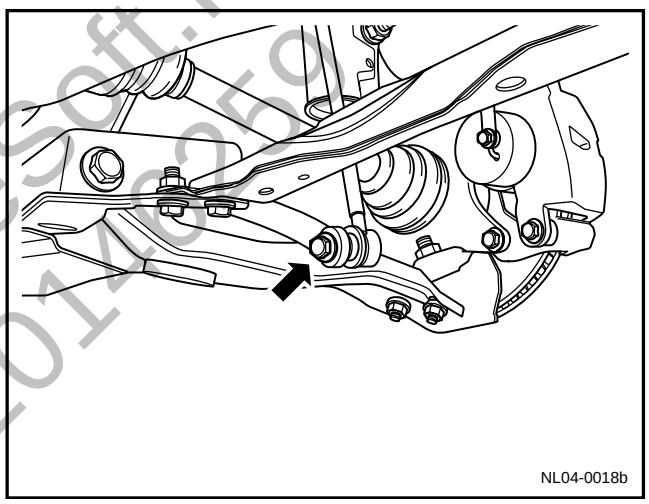
4.2.7.6 Stabilizer connecting rod replacement

Dismantle procedure

1. For lifting vehicle, refer to 1.3 lifting vehicle .
2. For dismantling of wheels, refer to 4.4.5.1 Replacement of wheels.
3. Dismantle connecting nut between stabilizer connecting rod and front shock absorber, and loosen stabilizer connecting rod from front shock absorber.



4. Dismantle connecting nut of stabilizer connnecting rod and stabilizer rod.
5. Dismantle the stabilizer connecting rod.



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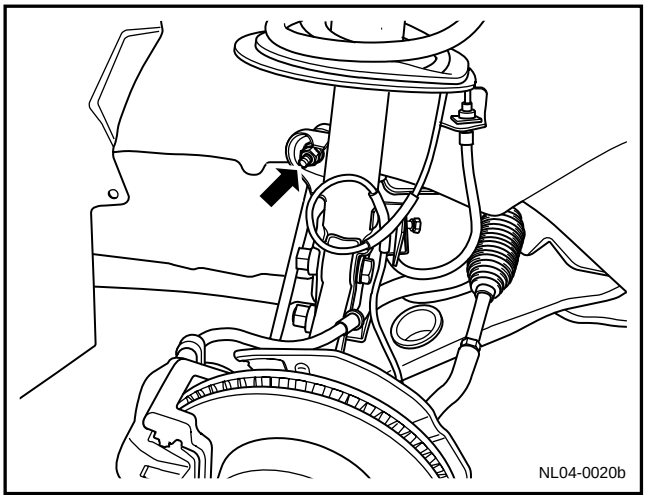
Installation Procedure:

1. Install stable connecting rod to front shock absorber, and fixed connecting nut.

Torque:75 Nm (Metric) 55 lb-ft (English system)

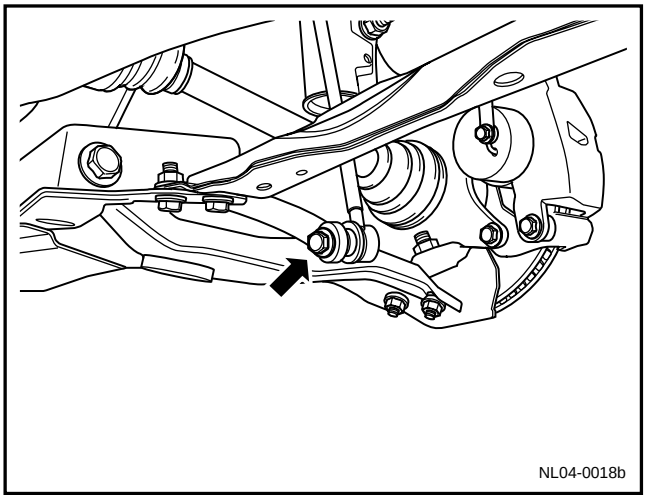


2. Install stabilizer connecting rod to stabilizer rod and tighten nut.

Torque: 75 Nm (Metric) 55 lb-ft (English system)

3. Install the wheel.

4. Lower the vehicle.



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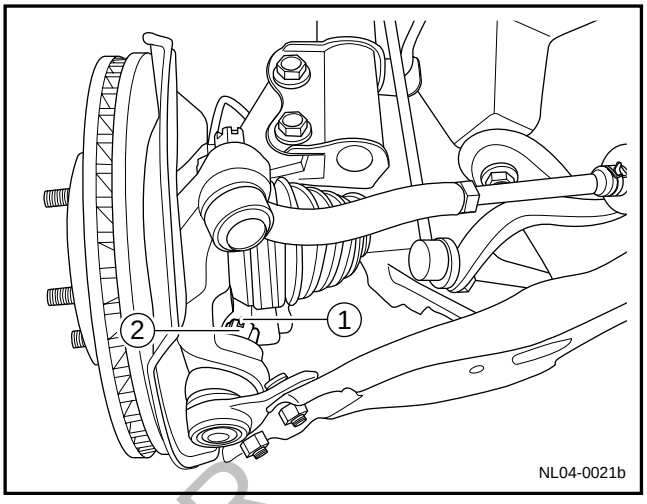
4.2.7.7 Lower swing alarm ball head assembly replacement

Dismantle procedure

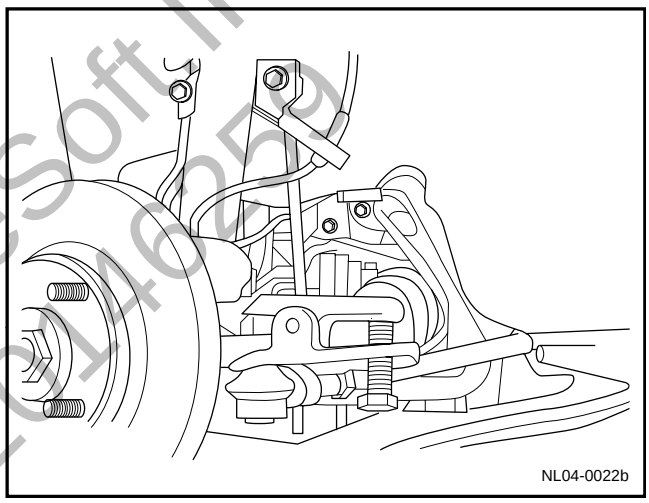
1. Lifting vehicle
2. Dismantle front wheels, refer to 4.4.5.1 replacement of wheels.
3. Dismantle split pin 1 and hexagonal slotted nut 2 of lower ball joint.



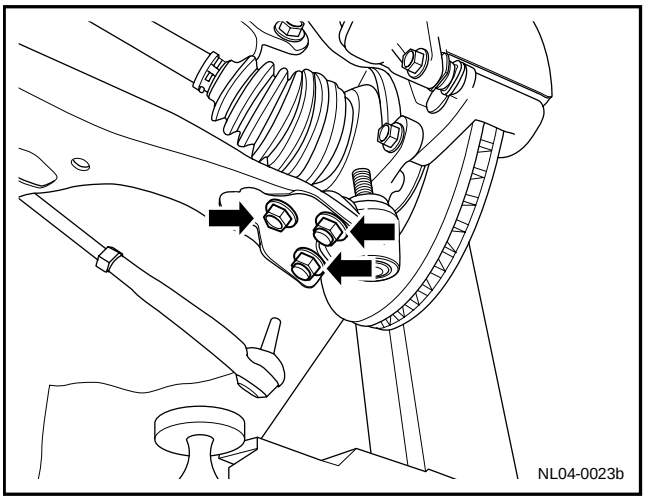
4. Disengage the connection between the lower ball joint and knuckle with the special tool GL401-006.

Notes:

Separate the lower ball joint from the steering knuckle by only using a common tool. Do not dismantle the lower ball joint fro the steering knuckle via hammer or pinch bar. If the tool recommended is not used, result in damaging the lower ball joint and seal.



5. Remove the fixing nut and bolt for the lower ball joint.
6. Dismantle the lower ball joint.



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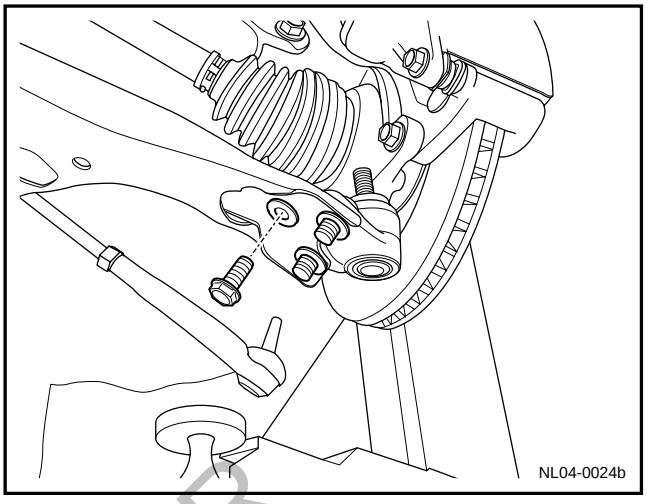
Installation Procedure:

Notes:

See Important precaution for fastener in Warnings and precautions.

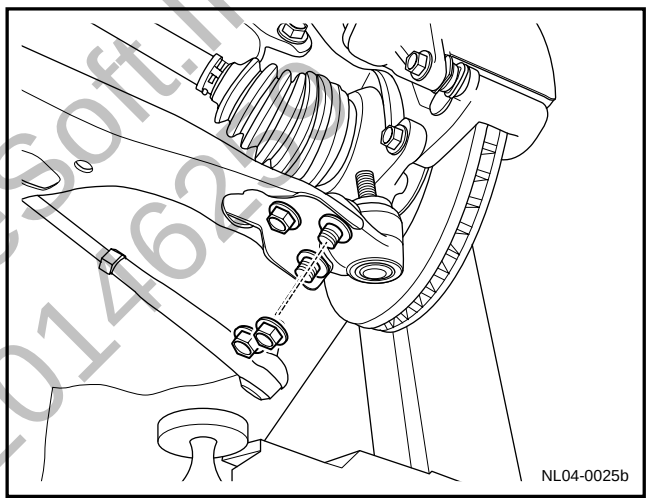
1. Install lower ball joint into lower swing arm.and tighten bolt.

Torque :80Nm (Metric) 59.2lb-ft (English system)



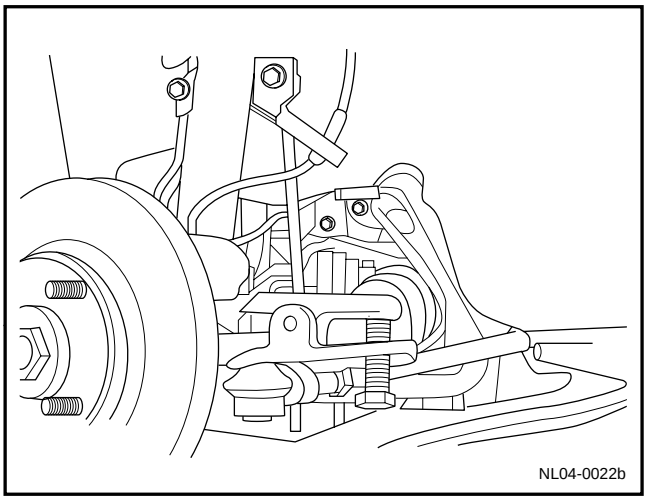
2. Tighten 2 fixing nuts of lower ball joint.

Torque :80Nm (Metric) 59.2lb-ft (English system)



3. Install and tighten fixing nut of tie rod ball head, and insert split pin.

Torque:33 Nm (Metric) 24.4 lb-ft (English system)



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4. Snap the lower ball joint into the knuckle, screw up the hexagon slotted nut 1 and engage split pin 2.

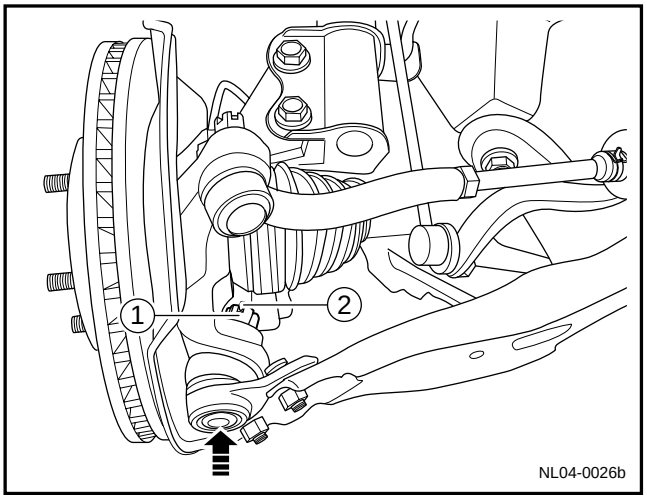
Torque: 213Nm (Metric system) 157lb-ft (English system)

5. Install the wheel.

6. Lower the vehicle.

Notes:

The method of dismantling the front wheel left and right lower ball joints is similar.



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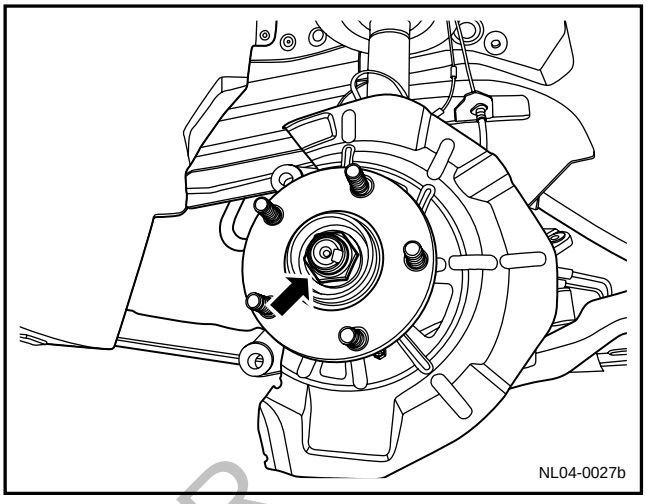
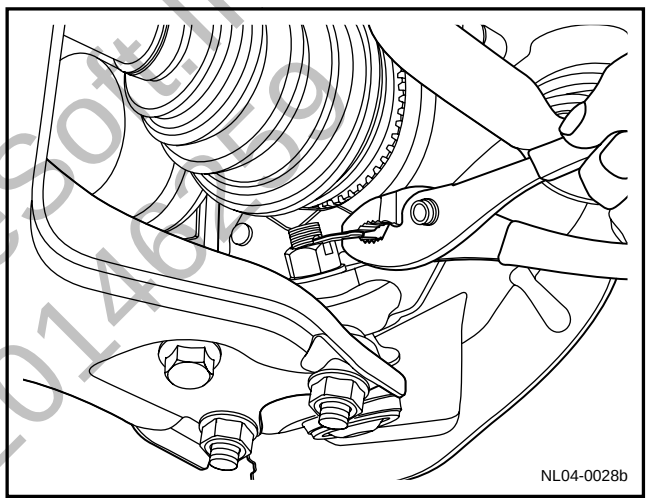
4.2.7.8 Knuckle replacement

Dismantle procedure

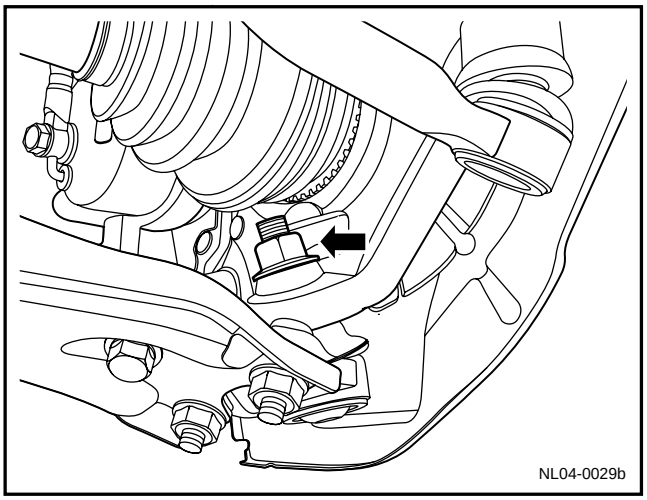
1. For lifting vehicle , refer to 1.2 Inspection of vehicle.
2. For dismantling of tire, refer to 4.4.5.1 Replacement of wheel.
3. Dismantle half shaft nut.



4. Dismantle split pin of connecting nut between lower swing arm ball head and steering knuckle.



5. Remove the connecting bolt between the lower swing arm ball and the knuckle.



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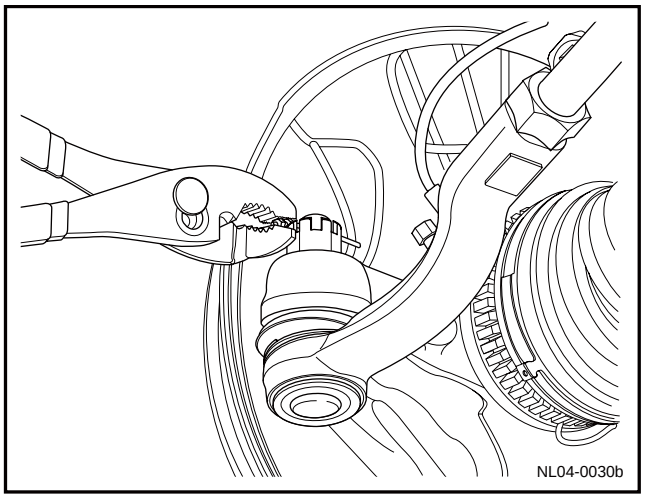
6. For dismantlement of front wheel speed sensor, see 6.6.7.2 replacement of Wheel Speed Sensors (Front)

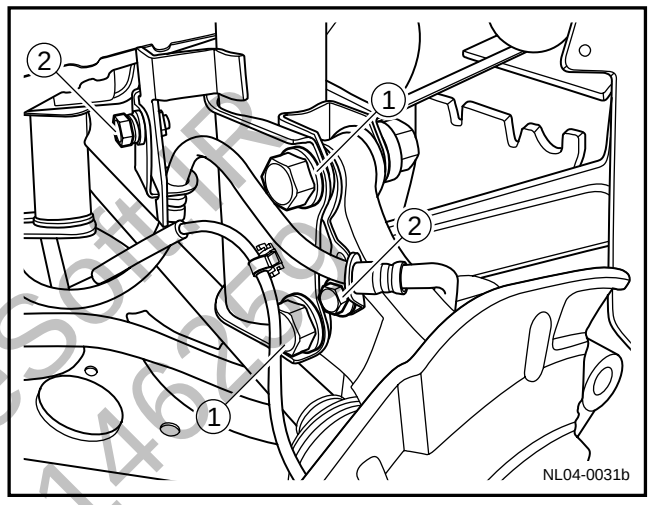
7. Remove the split pin of the connecting nut between the tie rod connecting rod and ball end assembly and the connecting nut.



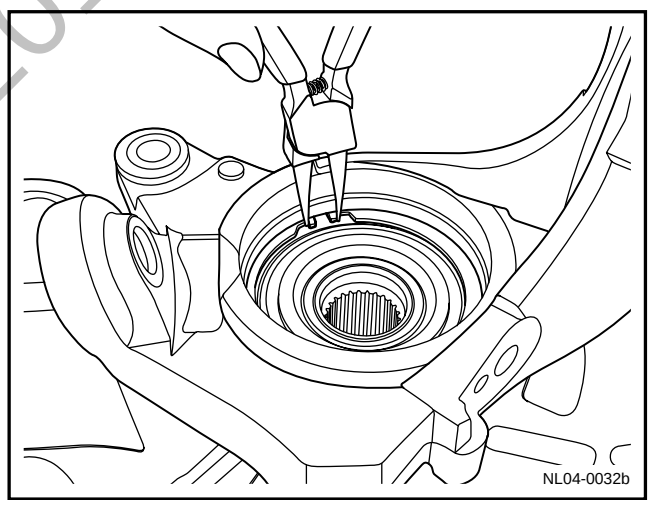
8. Remove the connecting bolt 1 between the knuckle and shock absorber.

9. Remove the brake hose bracket fixing bolt 2.

10. Loosen steering knuckle from shock absorber.



11. Dismantle fixing snap ring of front wheel hub



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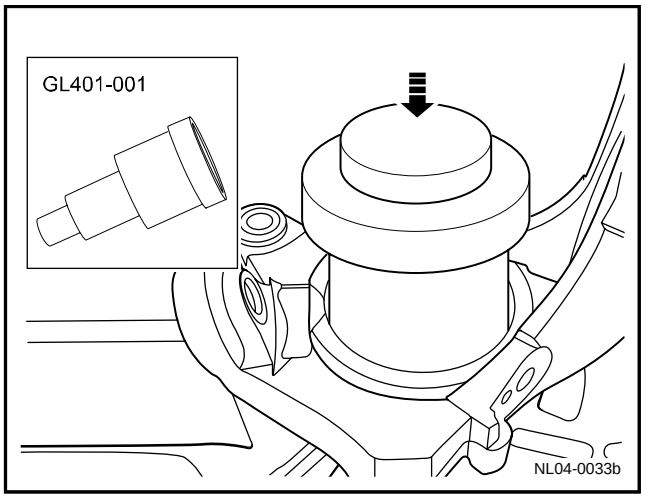
12. Dismantle front wheel hub from knuckle by special tool GL401-001.

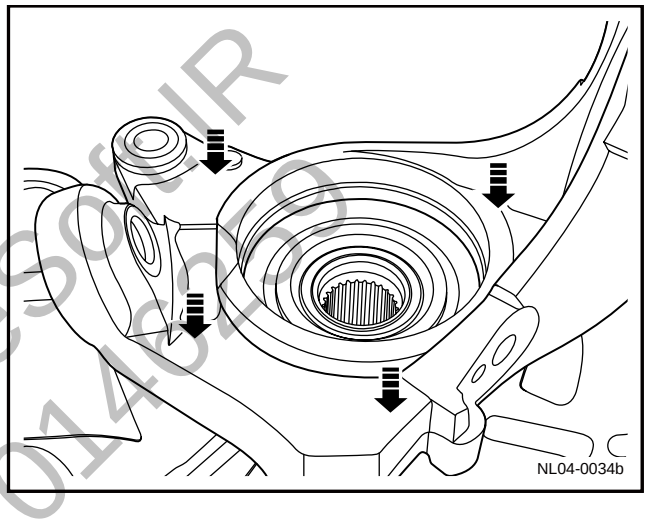


Installation Procedure:

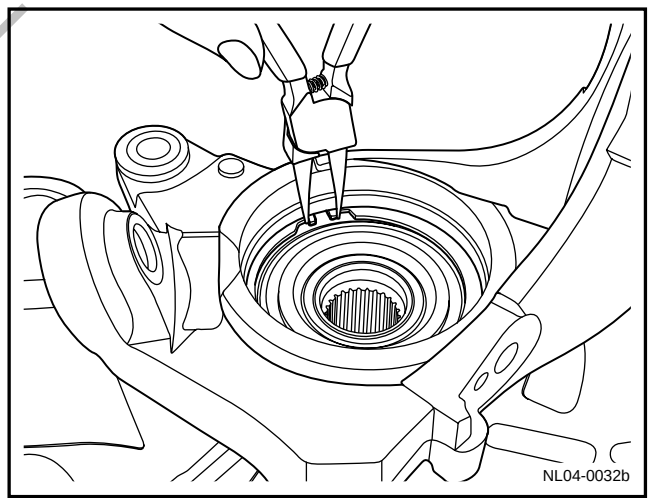
1. Pad wooden block with wheel hub, and install front wheel hub into front knuckle.

Notes:

See important precaution for fastener in warnings and precautions.



2. Install fixing snap ring of front wheel hub.



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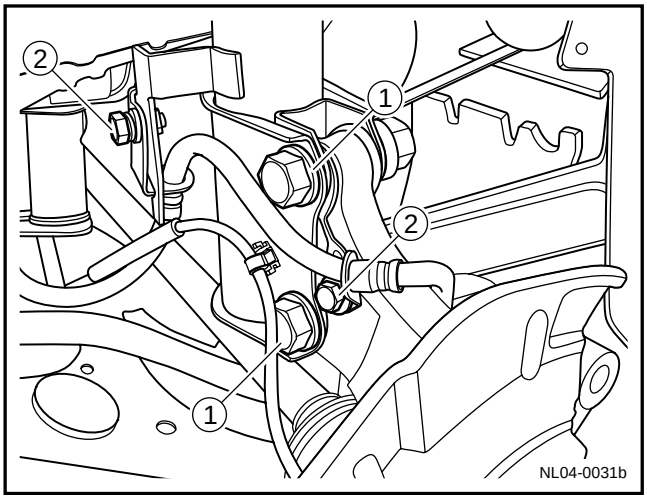
3. Install steering knuckle with front wheel hub, and tighten connecting bolt 1 between steering knuckle and shock absorber.

Torque:135 Nm (Metric) 99 lb-ft (English system)

4. Install fixing bolt 2 of brake hose support

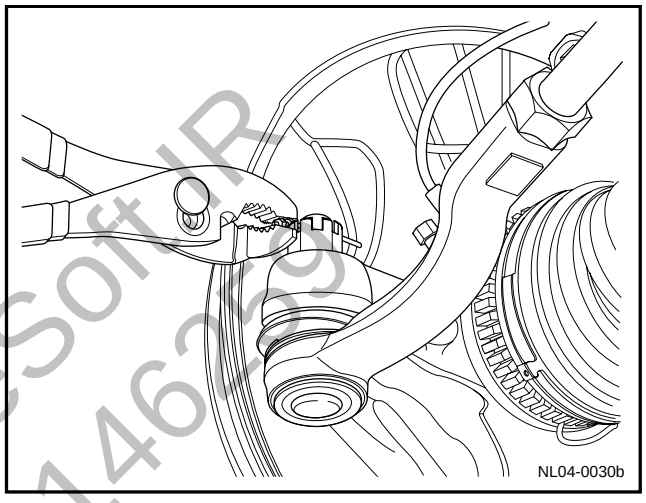
Torque:10Nm(Metric) 7.4lb-ft(English system)



5. Install and tighten fixing nut of tie rod ball head, and insert split pin.

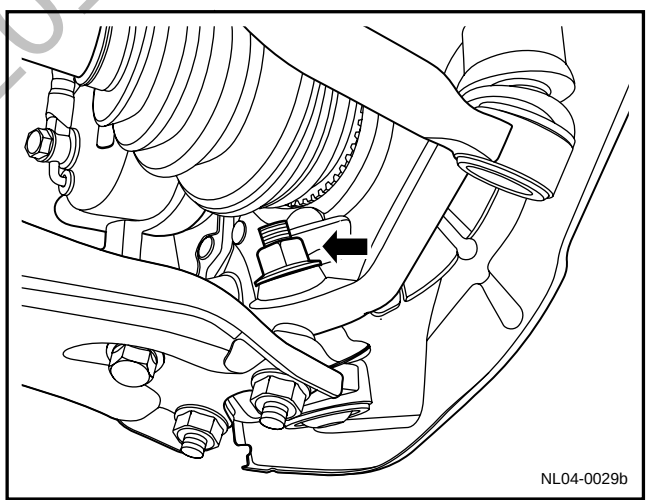
Torque:33 Nm (Metric) 24.4 lb-ft (English system)

6. Install the front wheel speed sensor.



7. Install the fixing bolt between the lower swing arm ball end and knuckle.

Torque:133 Nm (Metric) 98.4 lb-ft (English system)



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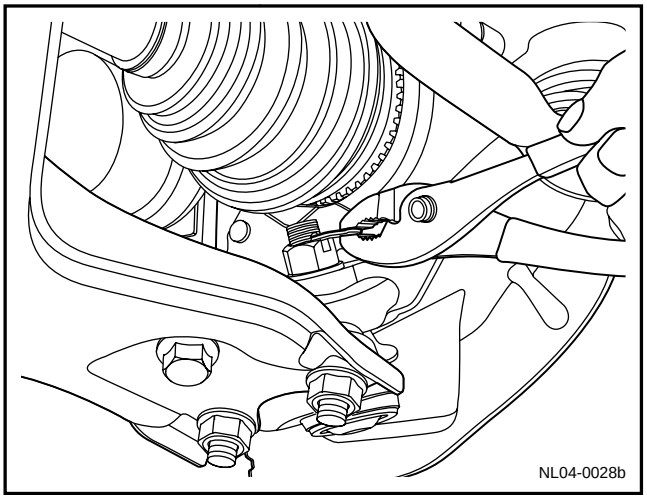
8. Insert the split pin of the fixing nut between the lower swing arm ball end and knuckle.



9. Install and tighten half-shaft nut

Torque : 216Nm (Metric) 160lb-ft (English system)

Notes:

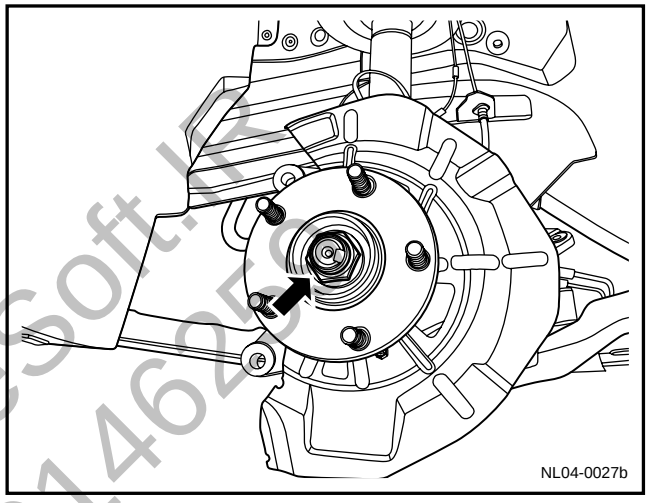
A new nut needs to be replaced when installing the fixed nut.

10. Install the tires.

11. Lower the vehicle.

Notes:

The method for dismantling the front left and right steering knuckles is similar.



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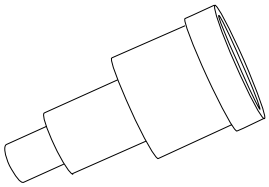
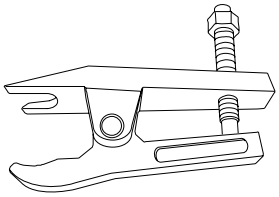
4.2.7.9 Front hub replacement

See 4.2.7.8 Replacement of knuckle.

4.2.8 Special tools and equipment

4.2.8.10 Special tools list

S/N	Illustration	Tool No.	Description
1	 NL01-2025b	GL401-001	Front axle wheel hub bearing dismantle
2	 NL01-2027b	GL401-006	Ball head dismantling tool

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4.3 Rear suspension

4.3.1 Specifications

4.3.1.1 Fastener specifications

Fastener name	Model	Torque Range		Remarks:
		Metric (N.m)	English system (lb-ft)	
Rear shock absorber and spindle nose mounting bolt	M12×1.25×25	72-88	53.1-64.9	After falling down wheel, tighten according to the specified torque.
Rear shock absorber and rear subframe mounting bolt	M12×1.25×65	72-88	53.1-64.9	
Mounting bolt of rear shock absorber and its support	M12×1.25×70	72-88	53.1-64.9	
No.1 swing arm of rear suspension and subframe mounting bolt	M12×1.25×65	80-100	59-73.8	
No.2 swing arm of rear suspension and subframe mounting bolt	M12×1.25×95	80-100	59-73.8	
No. 1 swing arm of rear suspension and spindle nose mounting nut	M12×1.25	90-110	66.4-81.1	After falling down wheel, tighten according to the specified torque.
No. 2 swing arm of rear suspension and spindle nose mounting nut	M12×1.25×85	80-100	59-73.8	After falling down wheel, tighten according to the specified torque.
After falling down wheel, tighten according to the specified torque.	M10×1.25×26	85-101	62.7-74.5	
Rear upper swing arm and spindle nose mounting bolt	M12×1.25×100	82-98	60.5-72.3	After falling down wheel, tighten according to the specified torque.
Mounting nut of rear upper swing arm and spindle head	M12×1.25	80-100	59-73.8	After falling down wheel, tighten according to the specified torque.
After falling down wheel,	M12×1.25	80-100	59-73.8	

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tighten according to the specified torque.				
Connecting rod of rear stabilizer rod and connecting nut of stabilizer rod	M12×1.25	69-79	51-58.5	
Mounting nut of rear stabilizer rod fixing frame	M12×1.25	55-65	40.7-48.1	
Rear stabilizer bar connecting rod and No.2 swing arm mounting nut	M10×1.25	27-33	20-24.4	

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4.3.2 Description and operation

4.3.2.1 Description and operation

Multi-rod type rear suspension uses multi-rod separate suspension. Including: rear longeron assembly, rear suspension upper swing arm assembly, rear shock absorber assembly, rear suspension #1 swing arm assembly and rear suspension No.2 swing arm assembly. One end of the several control arms is connected with the spindle nose and the other end thereof is connected with the frame or the body for guiding the motion of the wheels.

Rear suspension adopts dual link strut type suspension to realize the operation stability of the vehicle and the rid harshness. With the regulation of the multi-link, the better four-wheel positioning parameter change can be realized in the tire jumping process to reduce the tire wear.

4.3.3 System operation principle

4.3.3.1 System operation principle

See 4.2.3 System operation principle

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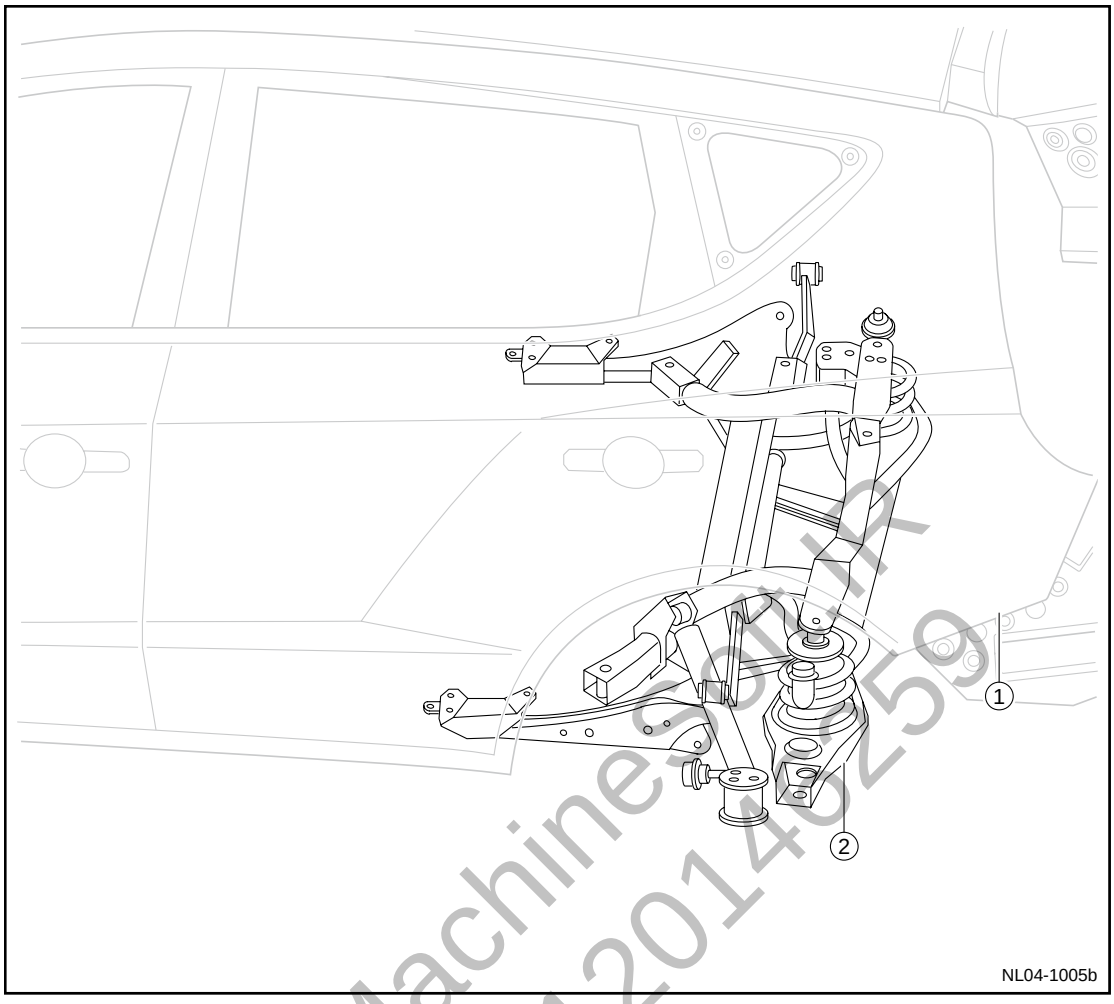
4.3.4 Component position

4.3.4.1 Component position



1. Vehicle body
2 Rear suspensions

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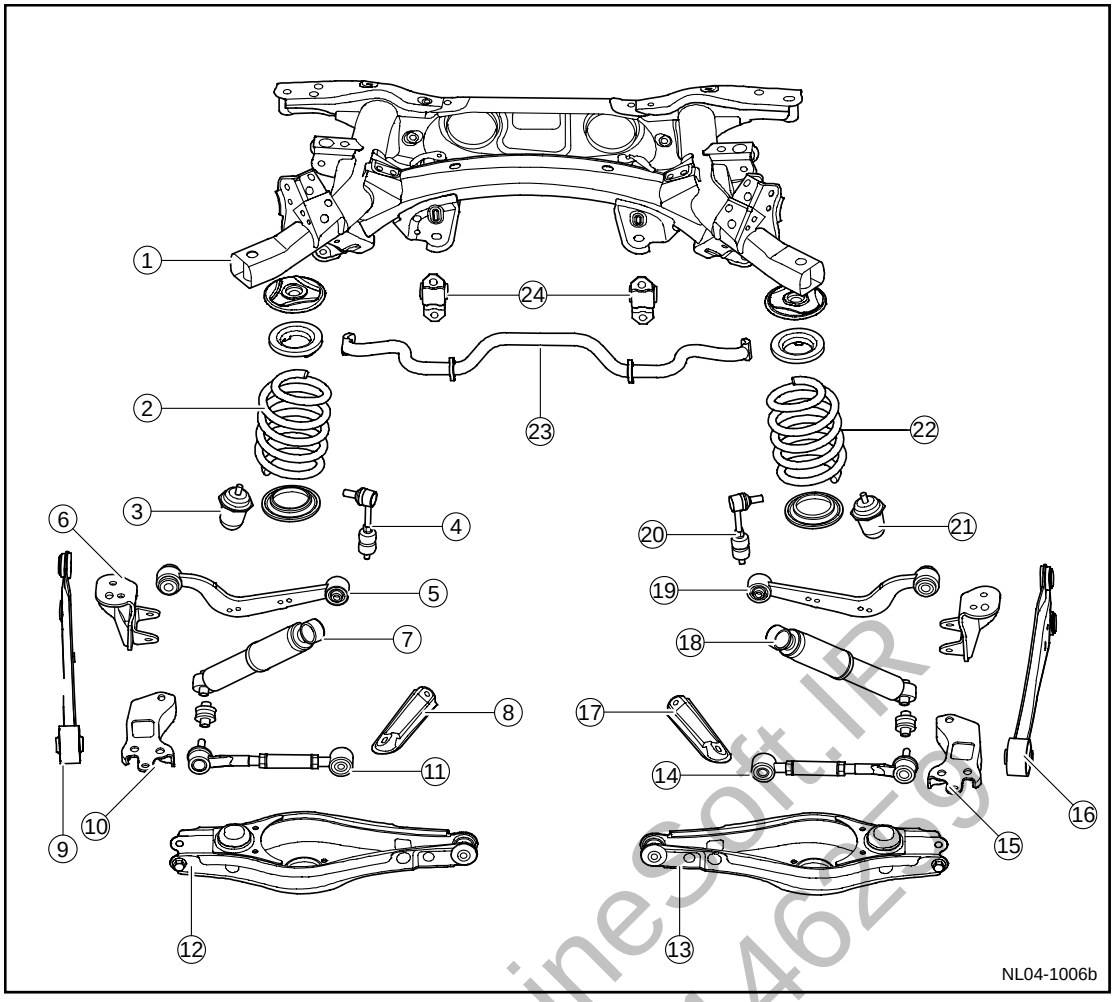

1. Hexagon flange face lock nut
2. Coil spring on right side of rear suspension.
3. Right side limiting block of rear suspension
4. Right rear stabilizer connecting rod
5. Right upper swing arm of rear suspension
6. Back right shock absorber mounting bracket
7. Right rear shock absorber
8. Rear subframe right reinforcement plate
9. Rear right tailing arm assembly
10. Right rear trailing arm mounting support
11. Rear frame right No.1 swing arm
12. Right No.2 swing arm of rear suspension
13. Left swing arm 2 of rear suspension
14. Left swing arm 1 of rear suspension
15. Left rear tailing arm mounting bracket.
16. Left rear tailing arm assembly
17. Left reinforce plate of rear auxiliary frame.
18. Left rear shock absorber
19. Left upper swing arm of rear suspension
20. Left side rear stabilizer rod and stabilizer connecting rod
21. Left side limiting block of rear suspension
22. Rear suspension left coil spring
23. Rear stabilizer rod
24. Fixing clamper and rubber sleeve of rear stabilizer rod

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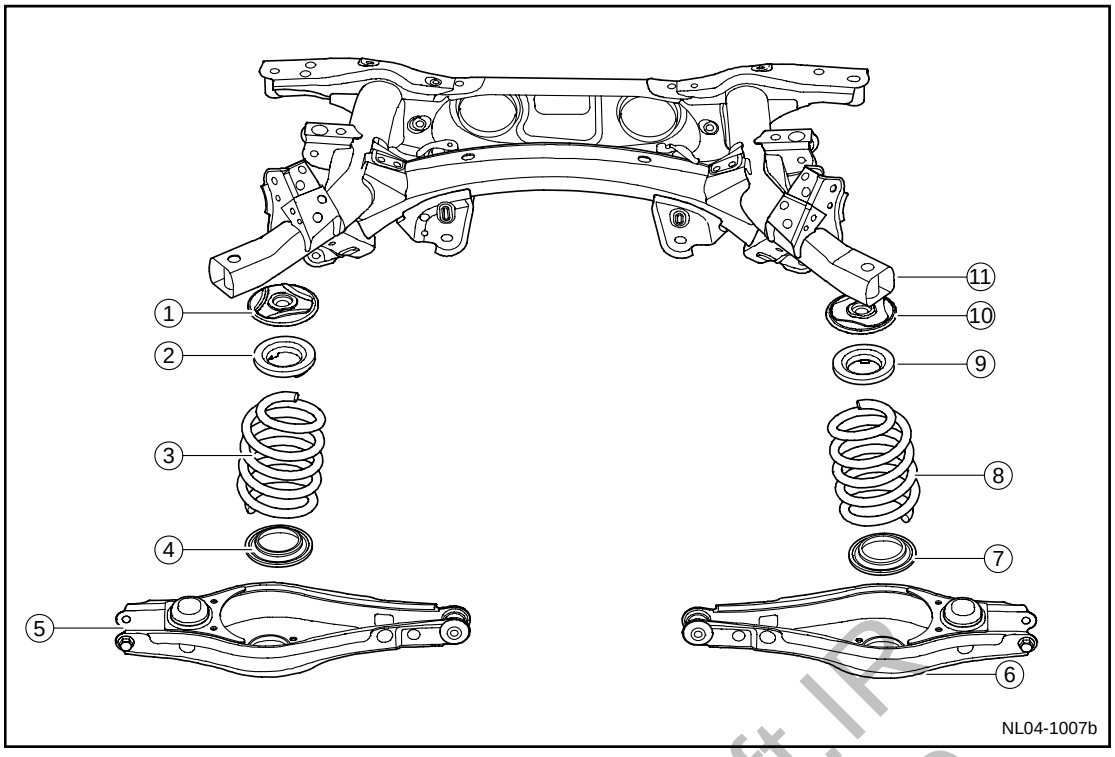

1. Upper seat of right rear coil spring
2. Upper damping cushion of right rear coil spring
3. Right rear coil spring
4. Lower damping cushion of right rear coiling spring.
5. Rear suspension right No.2 swing arm assembly
6. Rear suspension left No.2 swing arm assembly
7. Left rear coil spring lower damping cushion
8. Left rear coil spring
9. Left rear coil spring upper damping cushion
10. Upper support seat of left rear coil spring
11. Rear auxiliary frame assembly

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4.3.6 diagnosis information and procedures

4.3.6.1 diagnosis information and procedures

See 4.2.6 diagnosis information and procedures.

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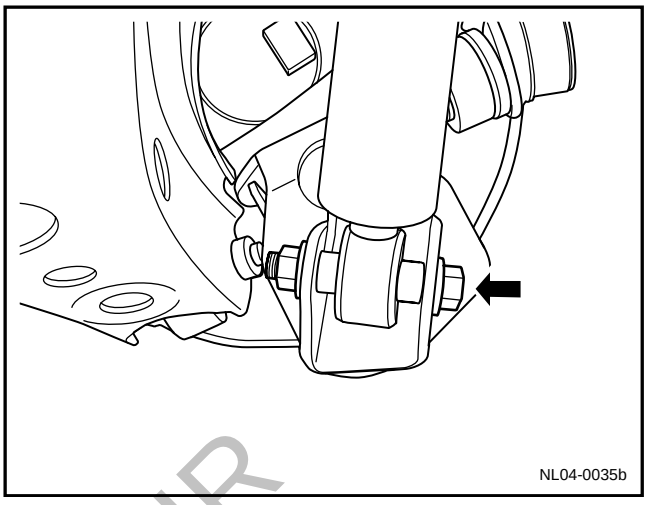
4.3.7 Dismantle and installation

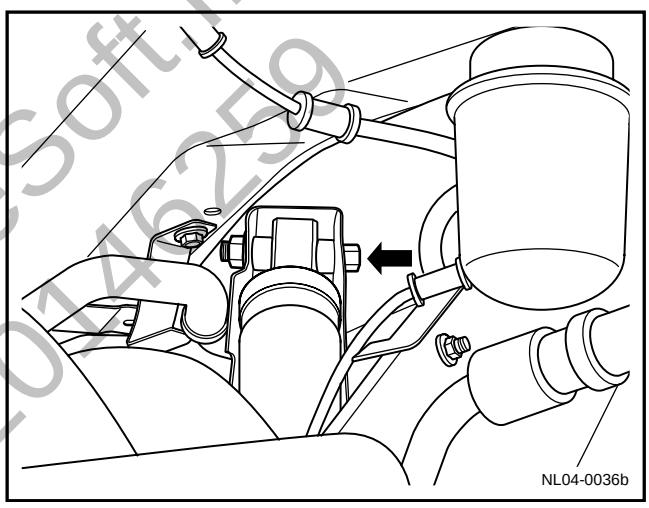
4.3.7.1 Rear shock absorber replacement

Dismantle procedure

1. For dismantling of rear wheel, refer to 4.4.5.1 replacement of wheels.
2. Lifting vehicle
3. Remove the lower through bolt for the rear shock absorber.



4. Dismantle through bolt on the upper of rear shock absorber, and remove rear shock absorber.



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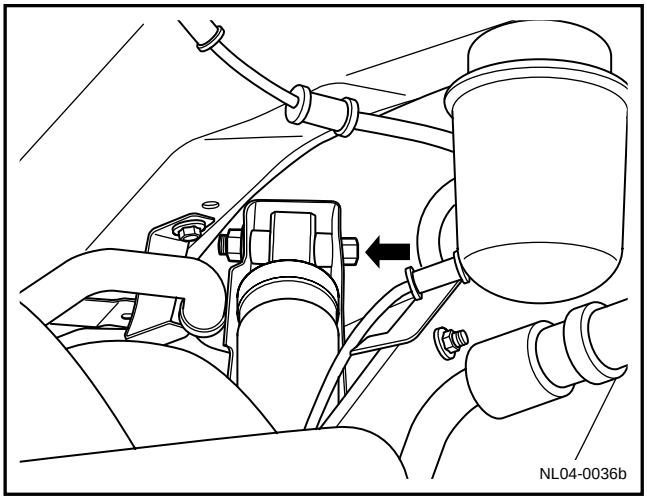
Installation procedure:

1. Install rear shock absorber, and fixing upper through bolt of rear shock absorber.

Torque:80 Nm (Metric) 59 lb-ft (English system)

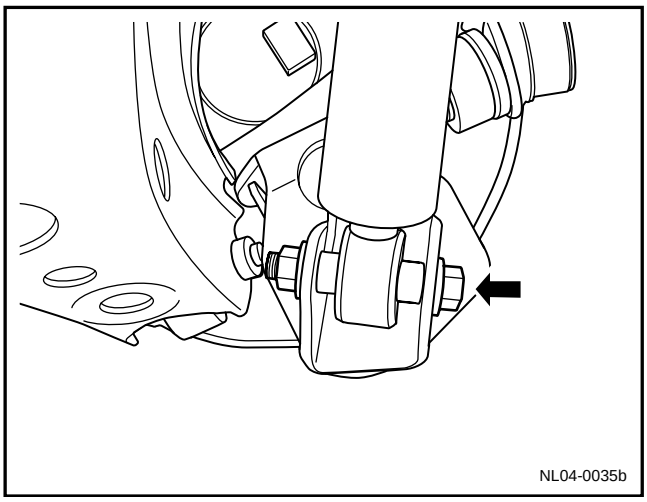


2. Install and tighten the lower through bolt for the rear shock absorber.

Torque:80 Nm (Metric) 59 lb-ft (English system)

3. Install the rear wheels.

4. Lower the vehicle.



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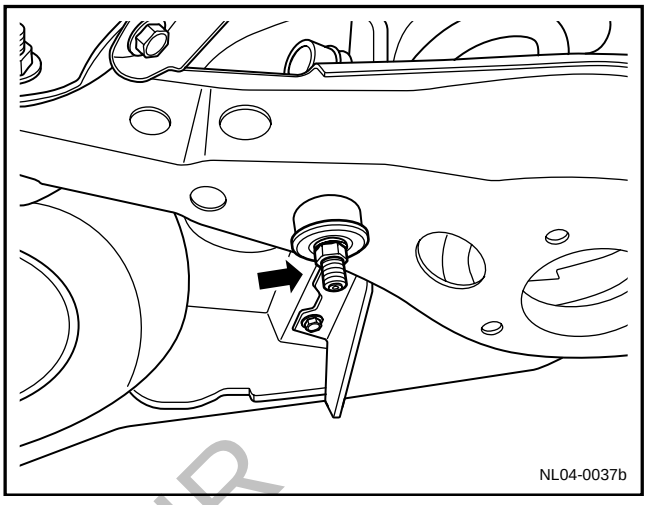
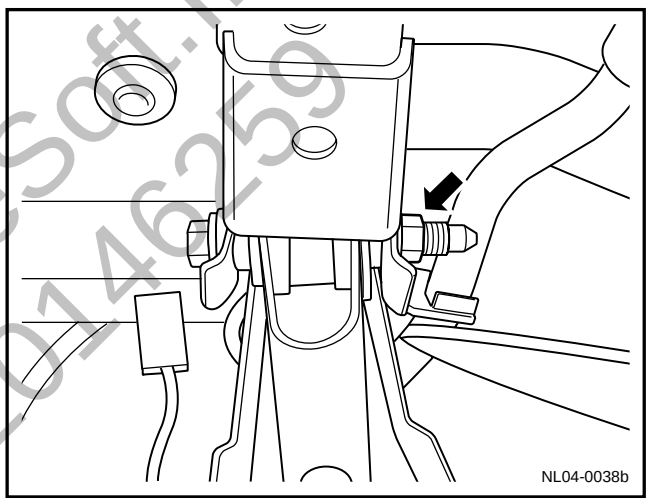
4.3.7.2 No.2 swing arm of rear suspension replacement

Dismantle procedure

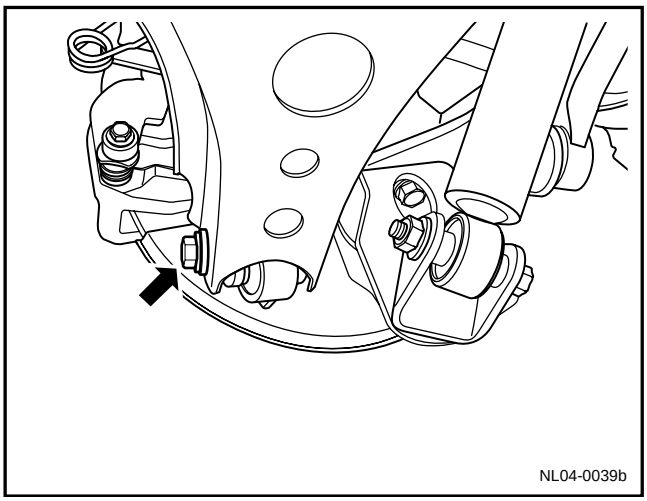
1. For dismantling of left, right rear wheel, refer to 4.4.5.1 replacement of wheel.
2. For lifting vehicle, refer to 1.3 lifting vehicle .
3. Use jack to support rear suspension swing arm.
4. Dismantle connecting nut between stabilizer rod and stabilizer connecting rod and No.2 swing arm.



5. Remove the through bolt for connecting the rear suspension No.2 swing arm and the rear subframe.



6. Remove the fixing bolt between the rear suspension No.2 swing arm and the rear axle spindle head bearing seat.
7. Slowly lower the flat jack and dismantle No.2 swing arm and rear suspension coiling spring.



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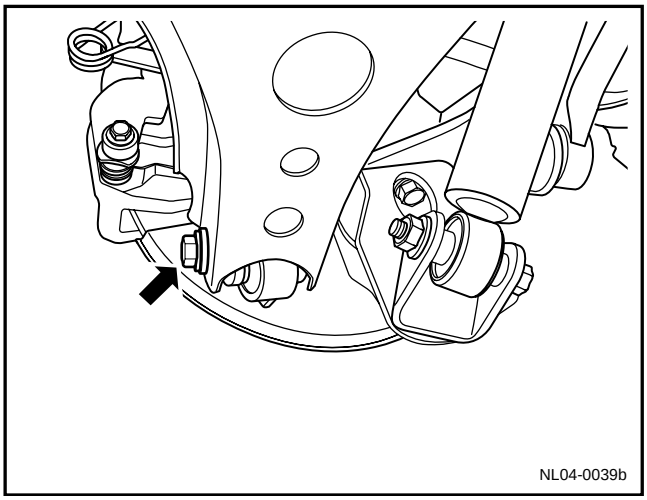
Installation procedure:

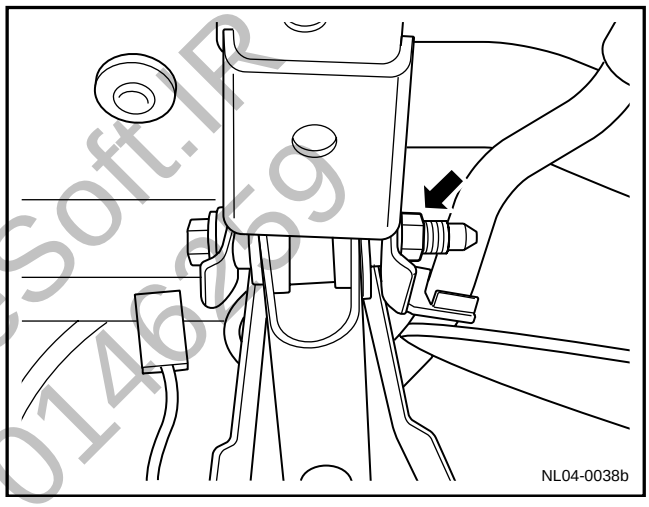
1. Lift the No.2 swing arm and coil spring of rear suspension.
2. Install the fixing bolt of rear suspension No.2 swing arm and rear axle head support.

Torque:90 Nm (Metric) 66.6 lb-ft (English system)



3. Install the through bolt between rear suspension No.2 swing arm and rear auxiliary frame.

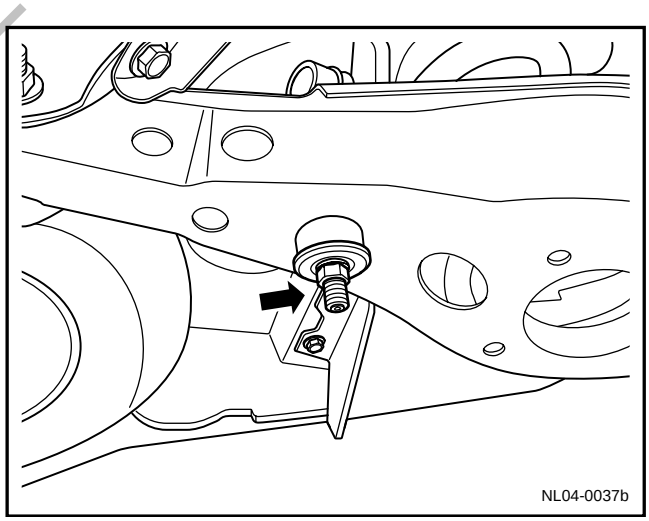
Torque:90 Nm (Metric) 66.6 lb-ft (English system)



4. Install the connecting nut between stabilizer rod and stabilizer connecting rod and No.2 swing arm.

Torque:30 Nm (Metric) 22.2 lb-ft (English system)

5. Move out the jack.
6. Install the left and right rear wheels.
7. Lower the vehicle.



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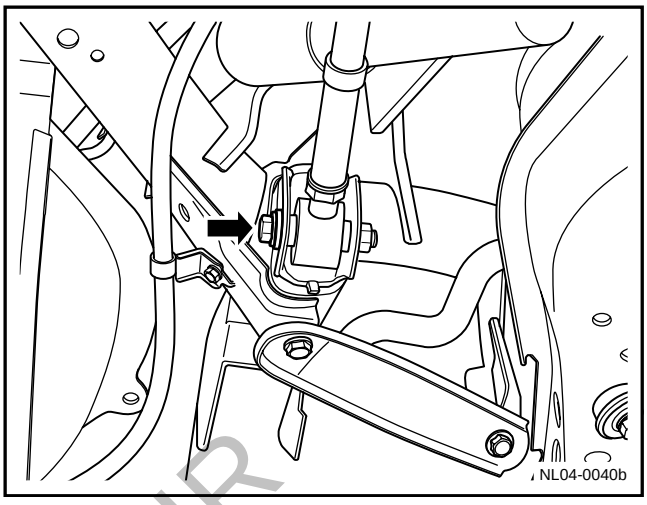
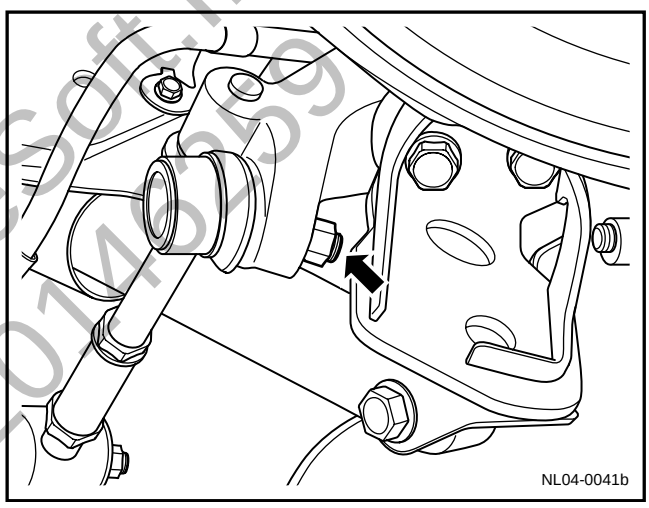
4.3.7.3 No.1 swing arm of rear suspension replacement

Dismantle procedure

1. For lifting of the vehicle, see 1.3 lifting vehicle .
2. Dismantle the through bolt of rear suspension No.1 swing arm and rear auxiliary frame.



3. Dismantle the fixing nut of rear suspension No.1 swing arm and rear axle head support.
4. Remove #1 swing arm of the rear suspension.



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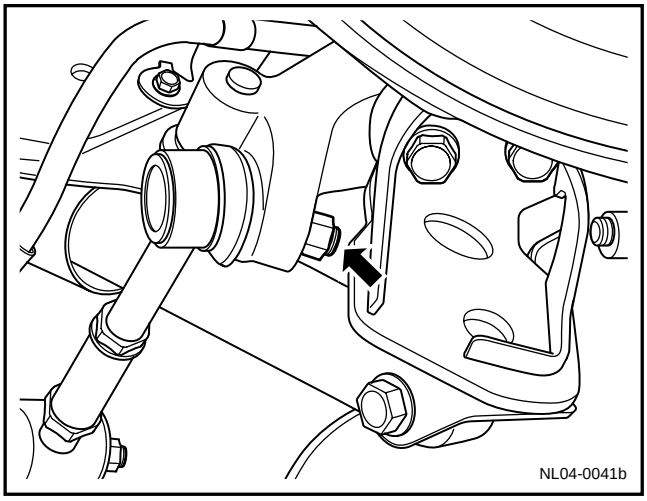
Installation procedure:

1. Install the rear suspension swing arm No.1.
2. Install and tighten the fixing nut of rear suspension No.1 swing arm and rear axle head support.

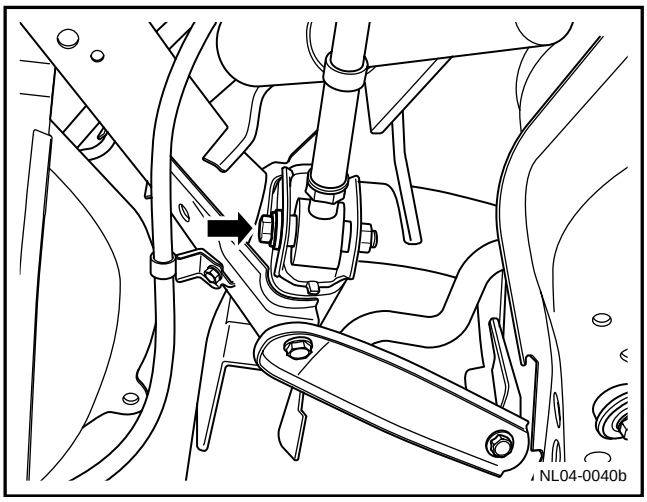
Torque: 100 Nm (metric) 74 lb-ft (metric)



3. Install and tighten through bolt between rear suspension No.1 swing arm and rear auxiliary frame.

Torque: 90 Nm (metric) 66.6 lb-ft (metric)

4. Lower the vehicle.



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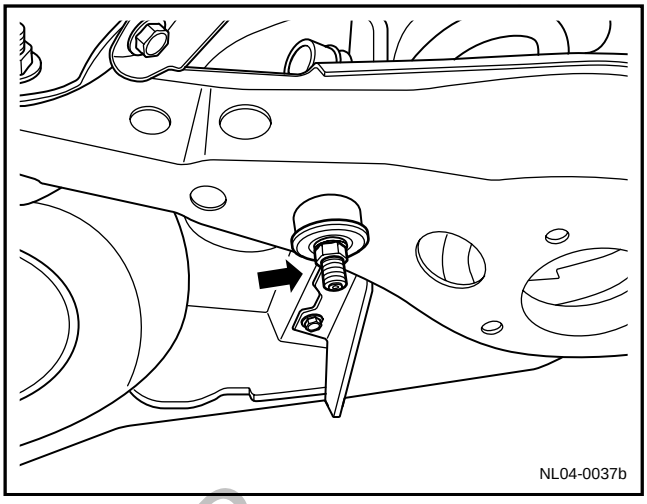
4.3.7.3 Rear suspension coil spring replacement

See 4.3.7.2 Replacement of rear suspension No.2 swing arm.

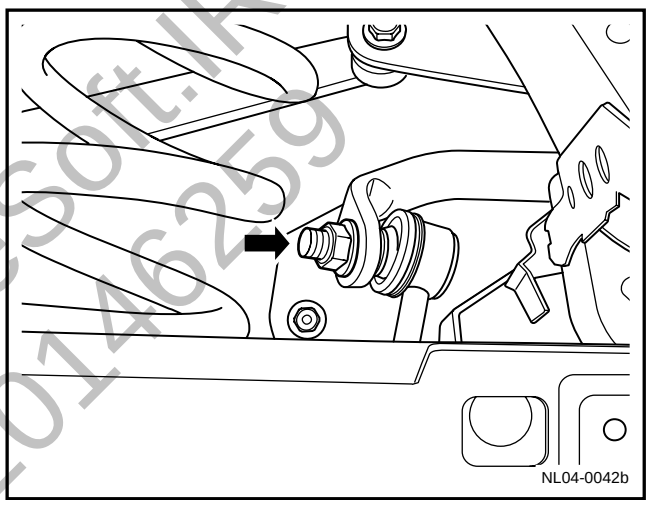
4.3.7.5 Rear stabilizer rod and stabilizer connecting rod replacement

Dismantle procedure

1. For lifting of the vehicle, see 1.3 Lifting vehicle .
2. Dismantle rear stabilizer rod and stabilizer connecting rod and rear suspension No.2 swing arm connecting nut.



3. Dismantle connecting nut between rear stabilizer rod and stabilizer connecting rod and rear stabilizer rod.
4. Remove the rear stabilizer bar connecting rod.



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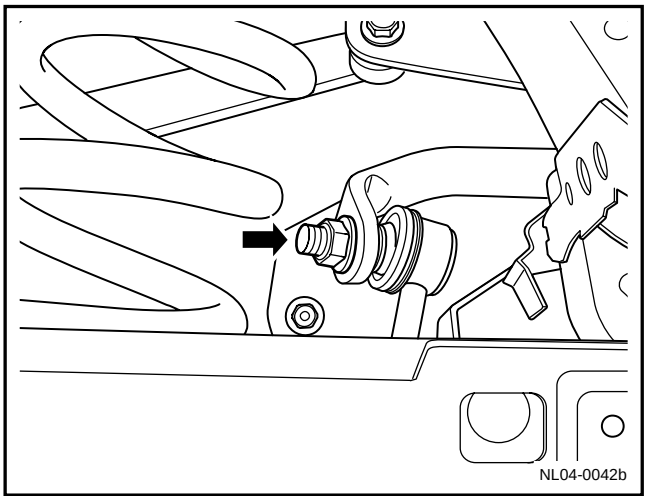
Installation procedure:

1. Install and tighten rear stabilizer rod and stabilizer connecting rod and rear stabilizer rod connecting nut.

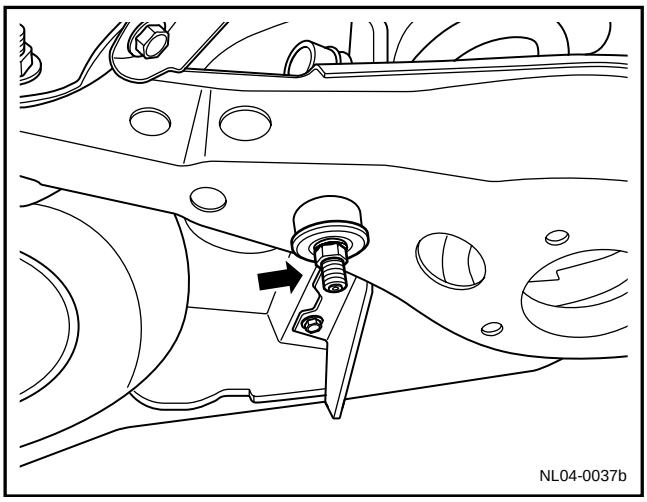
Torque:74 Nm (Metric) 54.8 lb-ft (English system)



2. Install and tighten connecting nut of rear stabilizer rod and stabilizer connecting rod and rear suspension No.2 swing arm.

Torque: 30 Nm (Metric) 22.2 lb-ft (English system)

3. Lower the vehicle.



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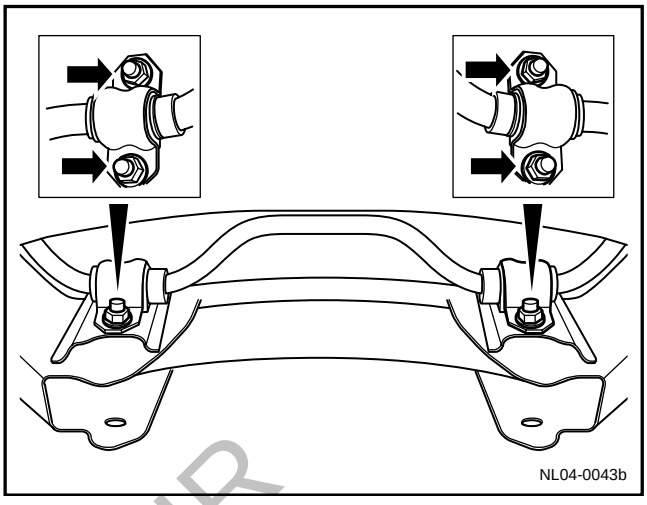
4.3.7.4 Rear stabilizer rod replacement

Dismantle procedure

1. For lifting vehicle, refer to 1.3 Lifting vehicle .
2. For dismantling of rear stabilizer rod and stabilizer connecting rod on both sides, refer to 4.3.7.5 Replacement of rear stabilizer rod and stabilizer connecting rod.
3. Dismantle fixing nut of rear stabilizer rod.

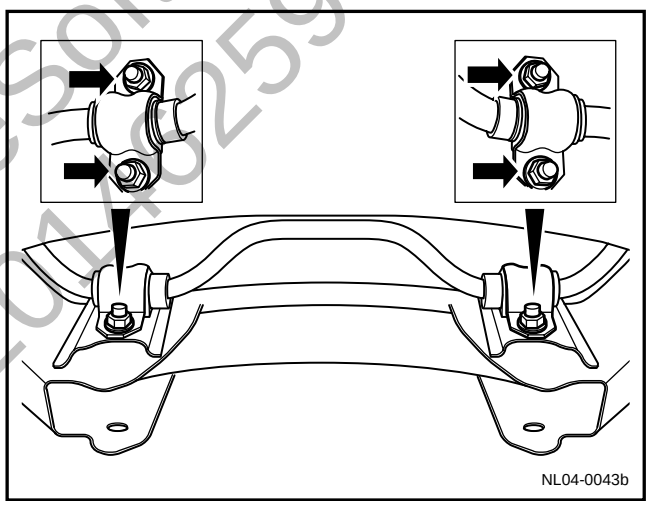


Installation procedure:

1. Install rear stabilizer rod fixing nut.

Torque:60 Nm (Metric) 44.4 lb-ft (English system)

2. Lower the vehicle.



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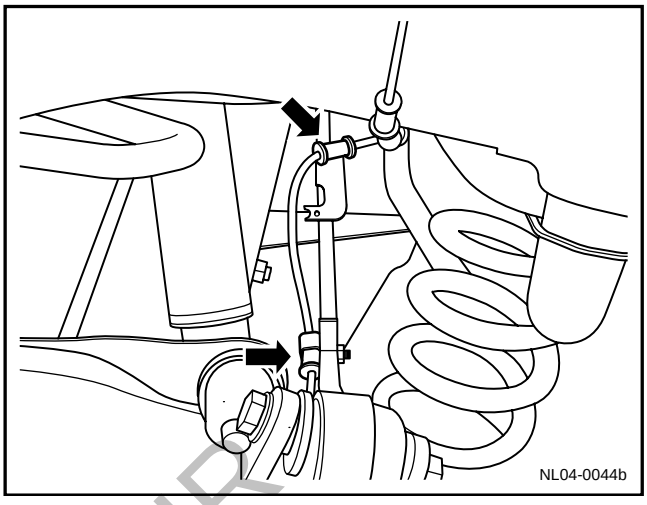
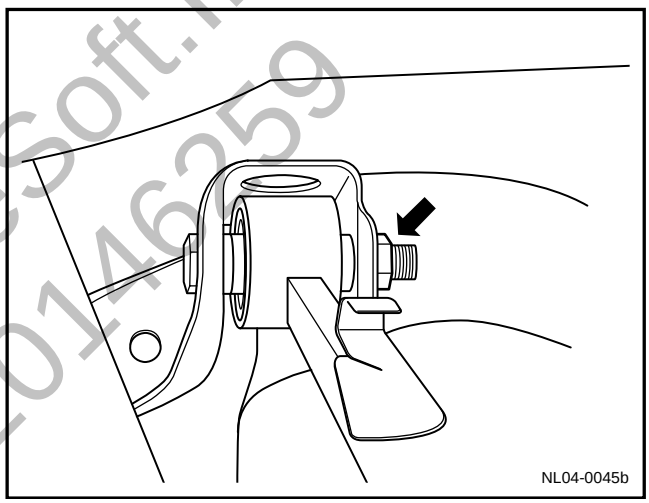
4.3.7.5 Upper switch arm of rear suspension replacement

Dismantle procedure

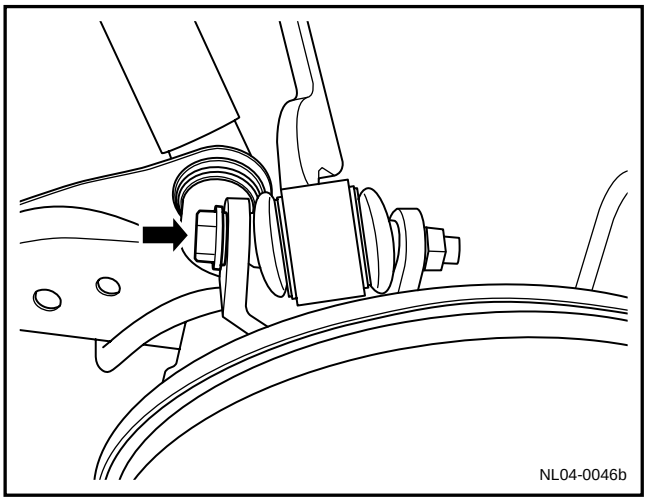
1. For lifting of the vehicle, see 1.3 lifting vehicle.
2. Separate rear wheel speed sensor connecting wire from upper swing arm of rear suspension.



3. Dismantle connecting bolt between rear suspension upper swing arm and rear auxiliary frame.



4. Dismantle through bolt between upper swing arm of rear suspension and rear axle head support.
5. Remove the rear suspension upper swing arm.



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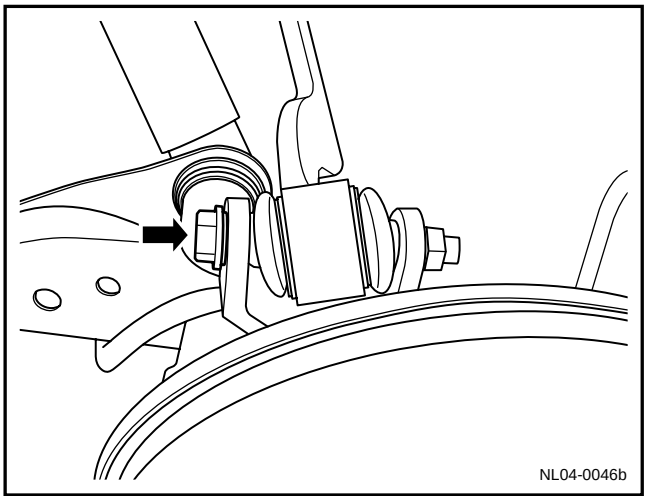
Installation procedure:

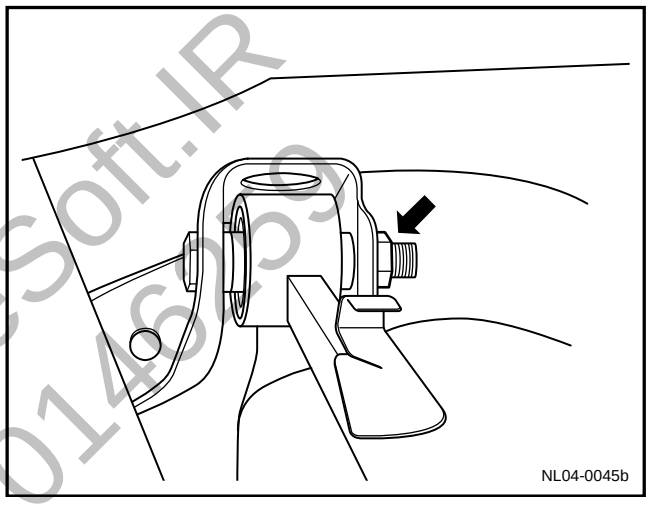
1. Install rear suspension upper swing arm.
2. Install and tighten the through bolt between the rear suspension swing arm and rear axle spindle head bearing seat.

Torque:90 Nm (Metric) 66.6 lb-ft (English system)

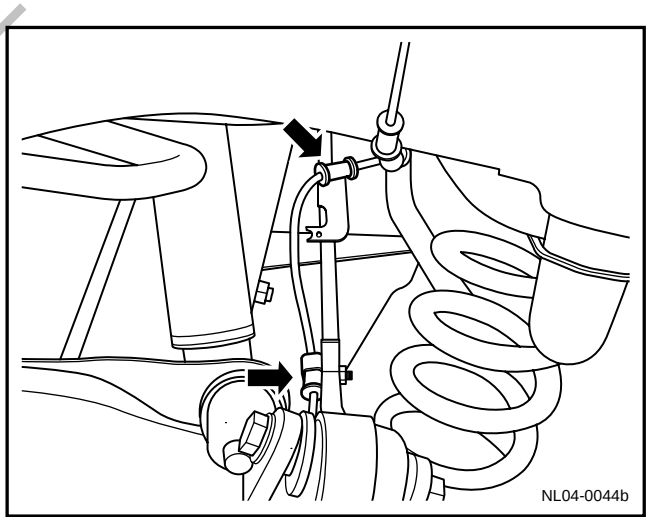


3. Install and tighten connecting bolt between rear suspension upper swing arm and rear auxiliary frame.

Torque:90 Nm (Metric) 66.6 lb-ft (English system)



4. Fix the rear wheel speed sensor harness on the beam bracket.
5. Lower the vehicle.



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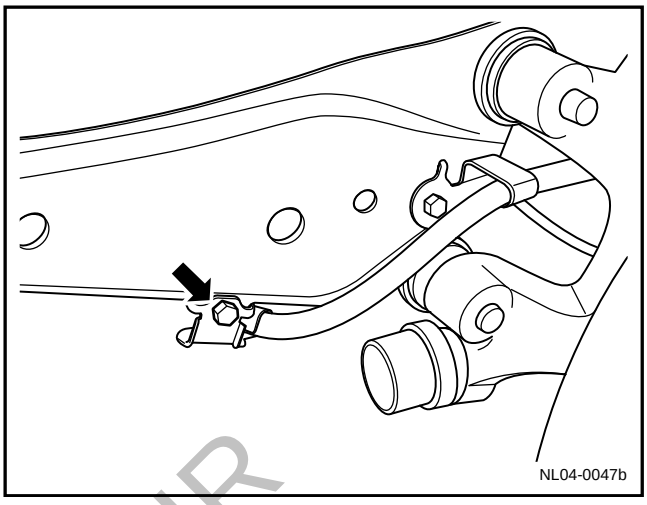
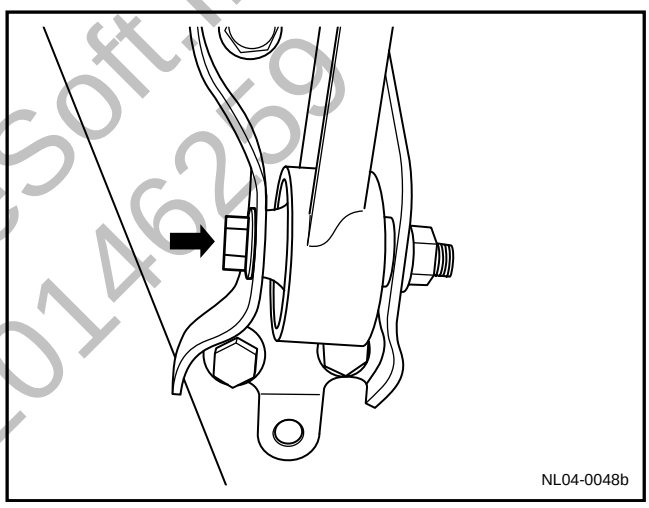
4.3.7.6 Rear tailing arm replacement

Dismantle procedure

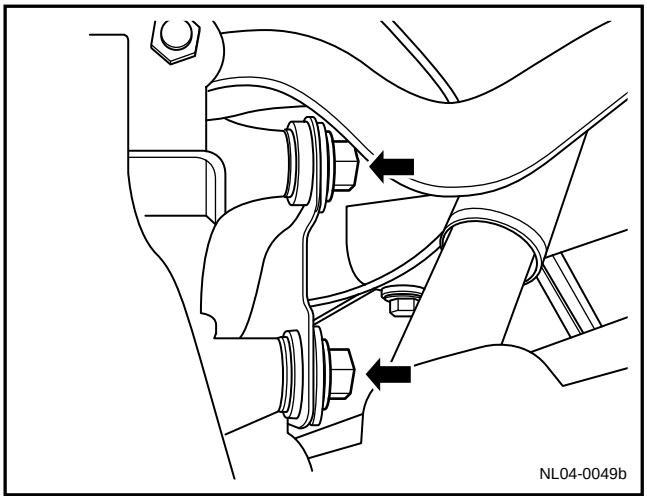
1. For dismantling of left, right rear wheel, refer to 4.4.5.1 Replacement of wheel.
2. For lifting of the vehicle, see 1.3 Lifting vehicle .
3. Dismantle 2 fixing bolts on parking brake cable.



4. Dismantle through bolt of mounting bracket of rear tailing arm and rear tailing arm assembly.



5. Remove two fixing bolts for the rear tailing arm and rear axle spindle head bearing seat.
6. Remove the rear trailing arm.



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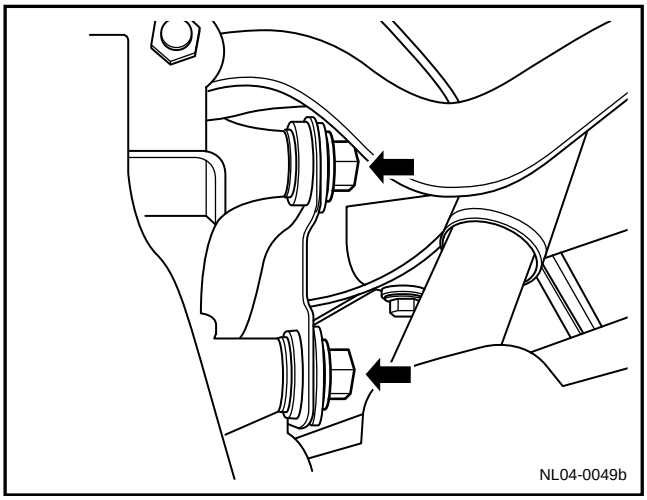
Installation procedure:

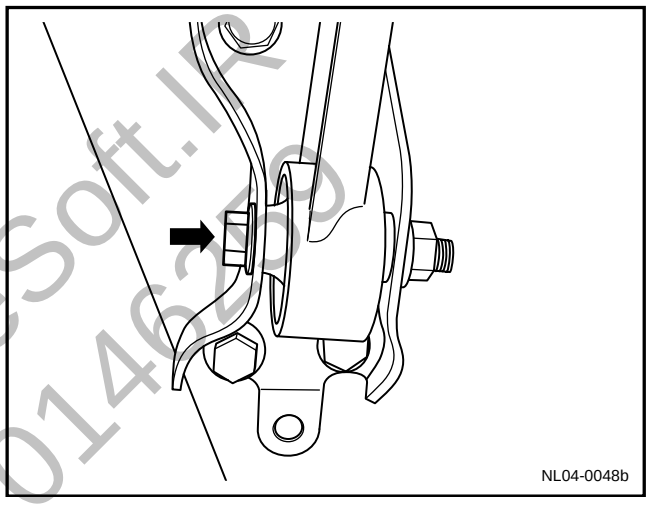
1. Install rear tailing arm
2. Install 2 fixing bolts on rear tailing arm and rear axle head support.

Torque:200 Nm (Metric) 148 lb-ft (English system)



3. Install through bolt between rear tailing arm mounting bracket and rear tailing arm assembly.

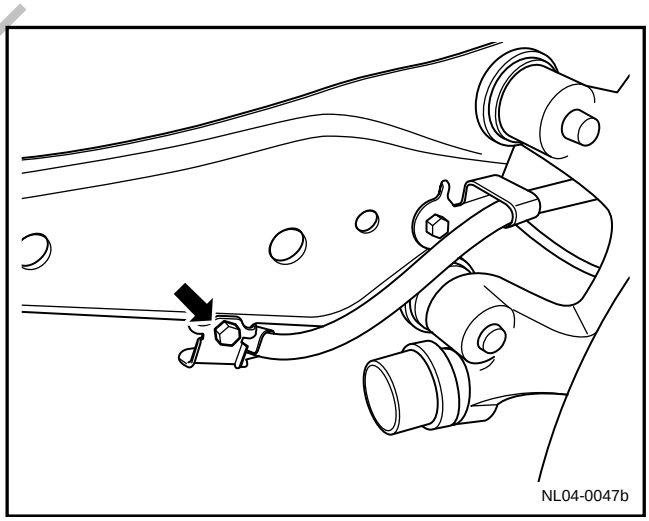
Torque:150 Nm (Metric) 111 lb-ft (English system)



4. Install 2 fixing bolts of parking brake cable.

Torque:10 Nm (Metric) 7.4 lb-ft (English system)

5. Install the front-right rear tire.
6. Lower the vehicle.



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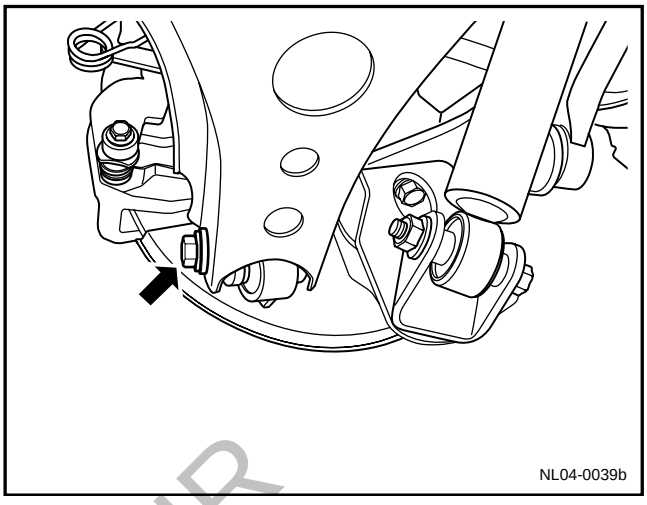
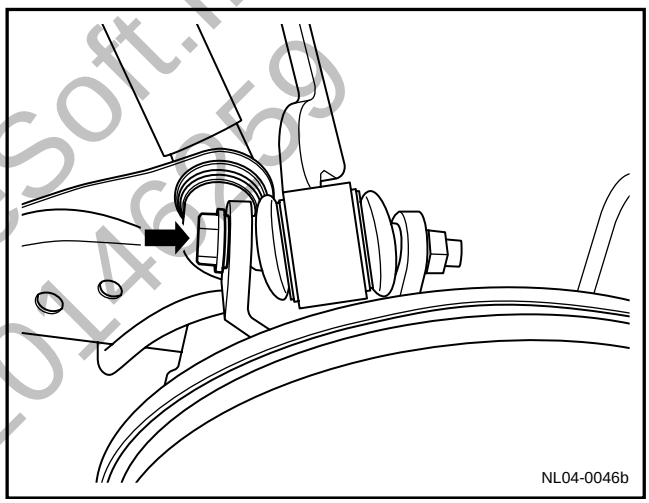
4.3.7.7 Rear axle ball head support replacement

Dismantle procedure

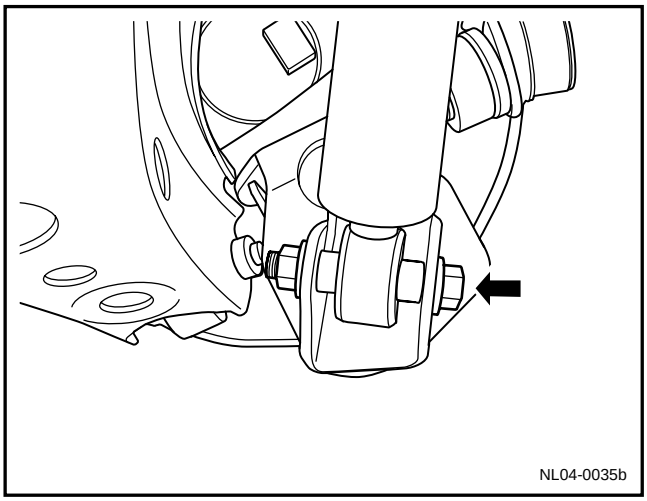
1. For dismantling of left, right rear wheel, refer to 4.4.5.1 Replacement of wheel.
2. For lifting vehicle, refer to 1.3 lifting vehicle.
3. Remove the fixing bolt between the rear suspension No.2 swing arm and the rear axle spindle head bearing seat.



4. Dismantle through bolt between upper swing arm of rear suspension and rear axle head support.



5. Remove the lower through bolt for the rear shock absorber.



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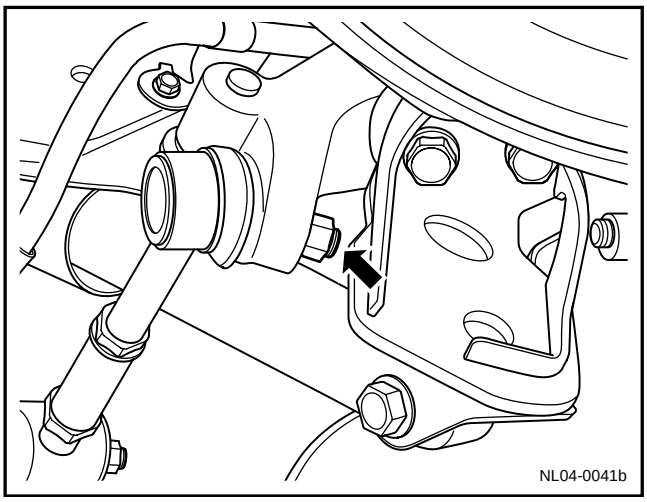
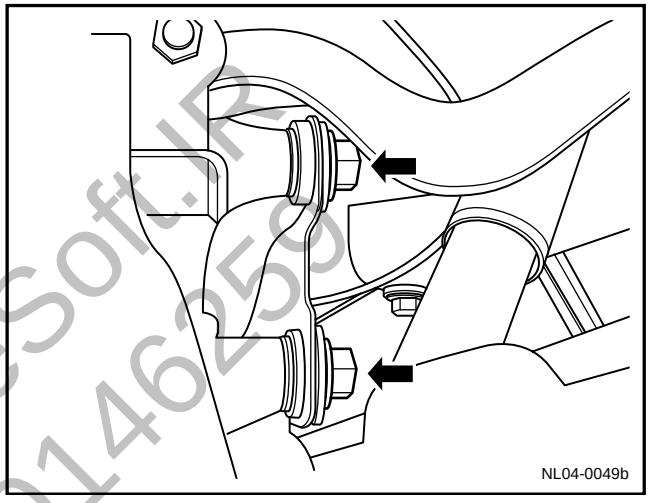
6. Remove the fixing bolt between the rear suspension No. 1 swing arm and the rear axle spindle head bearing seat.
7. For dismantlement of the rear brake disc, see 6.3.5.3 Replacement of Brake Discs - Rear.
8. For dismantlement of the rear wheel speed sensor, see 6.6.7.3 replacement of wheel speed sensors (rear).



9. Remove the fixing bolts for the rear trailing arm and rear axle spindle head bearing.
10. Take down rear axle spindle head



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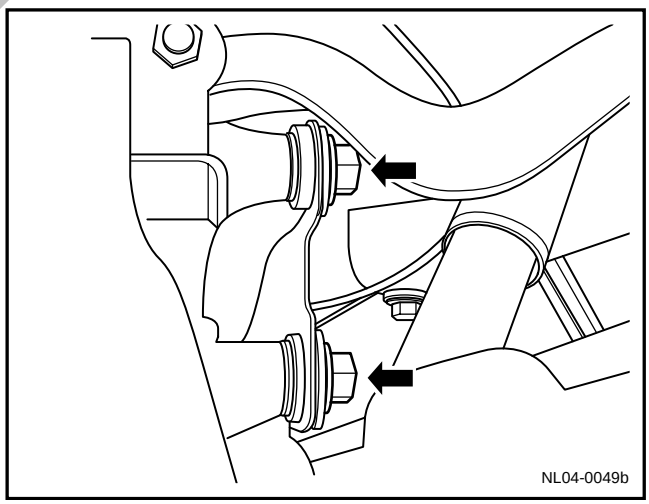
Installation procedure:

1. Install rear axle head support.
2. Install and tighten 2 fixing bolts on rear tailing arm and rear axle head support.

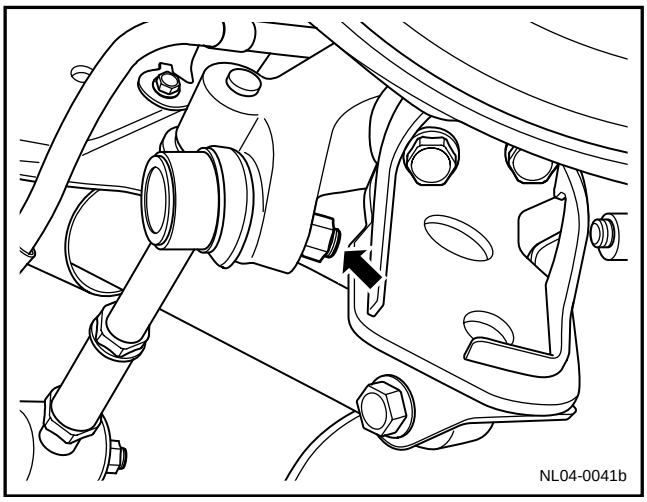
Torque:200 Nm (Metric) 148 lb-ft (English system)

3. Install rear wheel speed sensor.
4. Install rear brake disc.
5. Install the rear brake caliper.



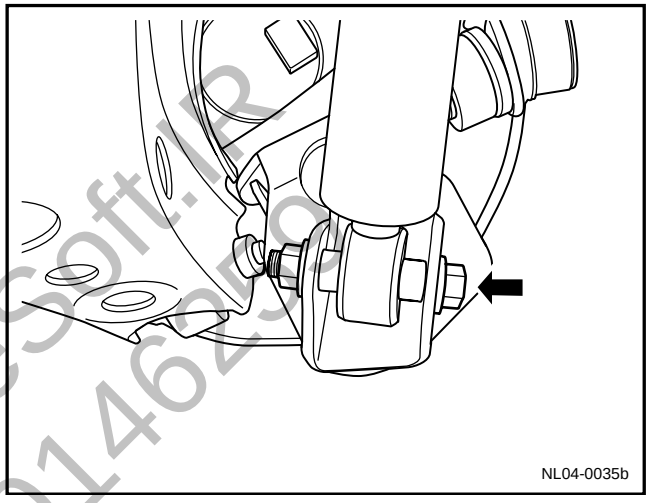
6. Install and tighten the fixing bolt between the rear suspension No.1 swing arm and the rear axle spindle head bearing seat.

Torque:100 Nm (Metric) 74 lb-ft (English system)



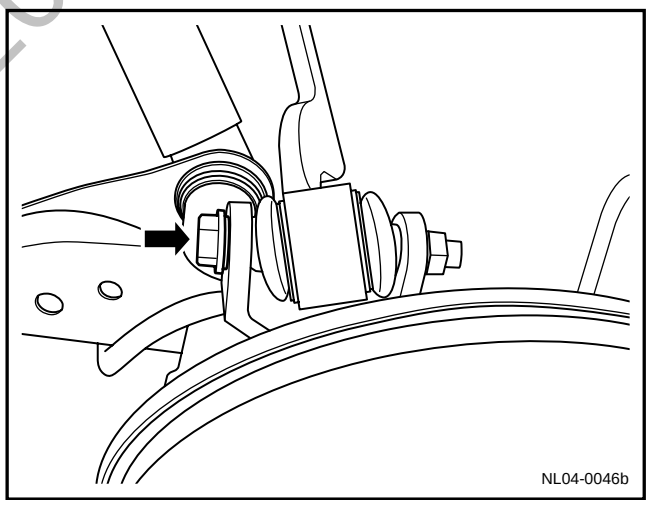
7. Install and tighten through bolt under rear shock absorber.

Torque:80 Nm (Metric) 59.2 lb-ft (English system)



8. Install and tighten the fixing bolt between the rear suspension No.1 swing arm and the rear axle spindle head bearing seat.

Torque:90 Nm (Metric) 66.6 lb-ft (English system)



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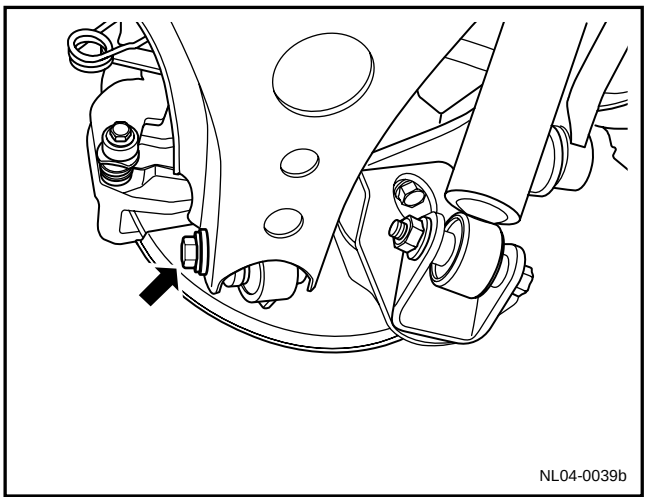
9. Fixing bolt between rear suspension No.2 swing arm and rear axle spindle head bearing seat

Torque: 80 Nm (Metric) 59.2 lb-ft (English system)

10. Install left right rear wheel.

11. Lower the vehicle.



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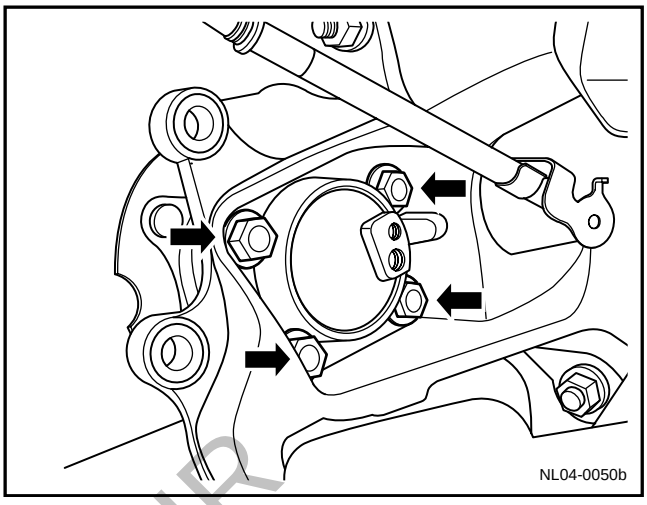
4.3.7.8 Rear hub unit replacement

Dismantle procedure

1. For dismantling of left, right rear wheel, refer to 4.4.5.1 replacement of wheel.
2. For lifting of the vehicle, see 1.3 lifting vehicle.
3. For dismantling of rear brake pad, refer to 6.3.5.1 replacement of brake pad - rear.
4. For dismantlement of the rear brake disc, see 6.3.5.3 Replacement of brake discs - rear.
5. For removal of the rear wheel speed sensor, see 6.6.7.3 Replacement of (rear) wheel speed sensors.
6. Remove the rear hub unit fixing bolt.
7. Extract the rear hub unit.

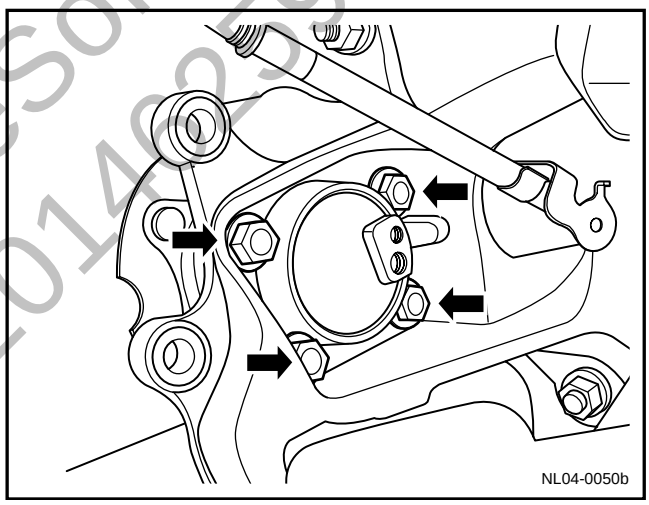


Installation procedure:

1. Install rea wheel hub unit and tighten fixing bolt.

Torque :80Nm (Metric) 59.2lb-ft (English system)

2. Install rear wheel speed sensor.
3. Install rear brake disc.
4. Install rear brake pad.
5. Install the front-right rear tire.
6. Lower the vehicle.



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4.4 Wheel and tire

4.4.1 Specifications

4.4.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lb-ft)
Vehicle wheel nut	M12×1.5	100～120	74～89

Tire specification

Specification	225/65 R17 102H
Cold pressure (front /rear)	220/220 kPa (Metric) /32/32 psi (English system)
Wheel rim	17×7J

Aeration pressure conversion table					
kPa	psi	kPa	psi	kPa	psi
140	20	185	27	235	34
145	21	190	28	240	35
155	22	200	29	250	36
160	23	205	30	275	40
165	24	215	31	310	45
170	25	220	32	345	50
180	26	230	33	380	55

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4.4.1.2 Front suspension position specification

Note: the following parameters refer to the technical parameters of the whole vehicle under the reorganizing state!

Front wheel angle	**Left internal / external**	38.83°/30.77°
	Right internal / external	38.83°/30.77°
Front wheel camber		-0.21°±0.75°
Kingpin inclination angle		11.58°±0.75°
Kingpin caster angle		6.0°±0.75°
Front wheel toe-in		2.8±0.2 mm/0.04±0.008 in
Front tread		1560 mm/61 in

4.4.1.3 Rear suspension position specification

Note: the following parameters refer to the technical parameters of the whole vehicle under the reorganizing state!

Rear wheel toe-in	-3.4±2 mm/-0.13±0.08 in
Rear wheel camber	-0.98°±0.75°
Rear tread	1560 mm/61 in
Wheelbase	2661 mm/105 in

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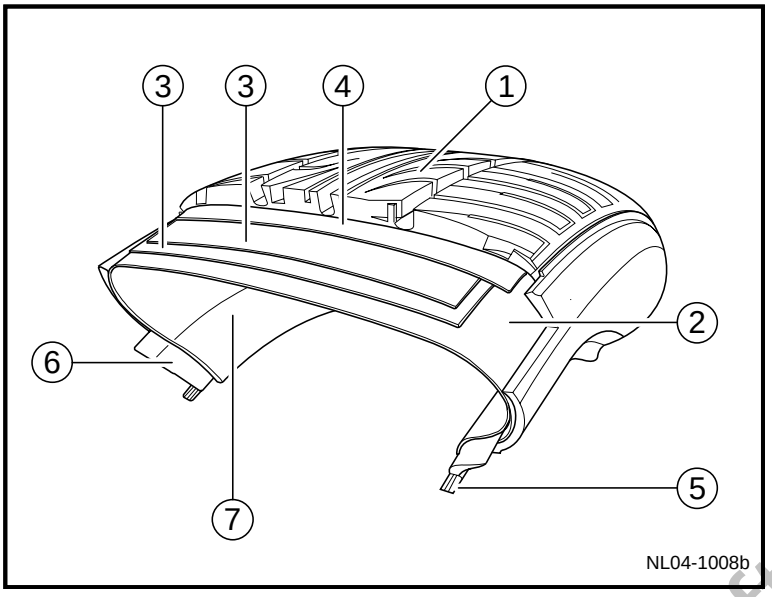
4.4.2 Description and operation

4.4.2.1 Tire structure



1. Tire tread

The part of the tire contacts with the road surface, enabling the vehicle with the performances of driving and braking through friction, shall have good abrasion resistance, puncture resistance, impact resistance, cooling and other performances.

2. Tire body

The cord ply in the tire is the main forced component of the tire, which has impact resistance and good flexibility resistance in traveling.

3. Belt

The steel cord between the tire tread and the tire body protects the tire body, inhibits the tire tread from deforming and maintains the grounding surface of the tire tread, thereby improving the wear resistance and driving stability.

4. Cap ply

Special cord plies above belt layer prevent the belt layer from moving when tires are running, so that the belt layer is prevented from tripping when running at high speed to keep the stability of the tire size under the state of high speed.

5. Tire thread

Hanging plastic steel wire is wound by a certain shape (quadrilateral or hexagonal shape) to play the role in fixing the tire by rim.

6. Apex strip

The filling material above the ring traveler in the tire prevents the tire bead from dispersing, retard the tire bead impact, protect the tire bead and prevent air from entering at the time of molding.

7. Inner liner

The part of the tubeless tire for maintaining the air impermeability is made of special rubber, which is equivalent to the role of the inner tube.

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4.4.2.2 Tire side mark means of tire and air pressure specification

Meaning of tire side wall identification

For example: 225/65 R17 102H

225—Nominal section width (unit: mm)

65—Flattening(depth-width ratio:%)

R—Meridian structure

17. Nominal wheel hub diameter (unit: in)

102—load Index

H—Speed class (210 km/h)

Common speed class mapping table:

Speed grade	S	T	H	V	W	Y	ZR
Max. speed (km/h)	180	190	210	240	270	300	Above 240

Description of tire pressure

The tire pressure has decisive effect on the tire wear, fuel consumption and fault damage; therefore, the standard pressure must be maintained and the air pressure must be checked regularly in order to drive safely.

- Loading capacity of tire is corsponding to its inflation pressure, so it is necessary to determine the rational air pressure according to the loading capacity of the vehicle. The climate and seasonal changes should not be the reason to adjust the tire pressure.
- In initial use of new tire, external rim dimension of tire will change due to the heating produced by yield movement, which will lower the air pressure of tire. Therefore, it is necessary to inspect and adjust air pressure tire during 24h use or after traveling 2,000-3,000km.
- If traveling at high speed for a long time, tire air pressure should be increased by 10%-15%.

1. Risk of insufficient air pressure.

   Insufficient air pressure will result in aggravating the deformation of the tire side wall, increase heat generation, greatly shorten the service life of the tire, and bring about the following problems and potential safety hazard;

   a. The tire shoulder is excessively worn.

   b. The opportunity for bulking of the tire under impact is increased

   c. Reduction in adhesive force between all components of the tire results in delamination.

   d. Severely insufficient pressure causes the side tire wall to be damaged due to being compressesd.

   e. Excessive tire run-out causes abnormal wear between the tire bead and hub which damages the hub.

   f. The oil consumption will increase with the increase in rolling resistance.

2. Harmness of excessive air pressure.

   Insufficient air pressure will result in ground contact area reduced of the tire tread, increase the tire rigidity, reduce the buffer, and bring about the following problems and potential safety hazard;

   a. The middle area of the tire tread is excessively worn.

   b. The risk of breakage and even burst when the tire is impacted by external force is increased.

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c. Maneuverability degradation resulting from the reduction in ground contacting area easily results in the risk of drift, sliding, etc.

d. Degraded passenger comfort

e. Low riding comfort and traveling with excessive tire pressure for a long time easily damage the chassis.

3. Nonuniform tire pressure on the same suspension may cause:

a. The braking force is unbalanced on the left and right sides.

b. Steering deviation

c. Maneuverability degradation

d. Deviation during acceleration

e. The vehicle deviates during travelling.

4.4.2.3 Tire rotation

Wear varies greatly between the front and rear wheels depending upon the loads thery withstand during operation, so to avoid tire from being subject to uni-directional wear you should perform tire rotation at the appropriate time periodically to make tire wear even and in turn extend the life of the tire.

Recommend to replace once every 5,000-8,000 km, with the main purpose of tire rotation as follows:

A. Ensure the tire is evenly worn and the fatigue of the tire is averaged to ensure the stability and economicality.

B. During tire exchange, check the tire condition to identify damages in time and thus prevent against the occurrence of accidents.

Tire rotation method is as shown in figure:

Rotation after use of spare tire

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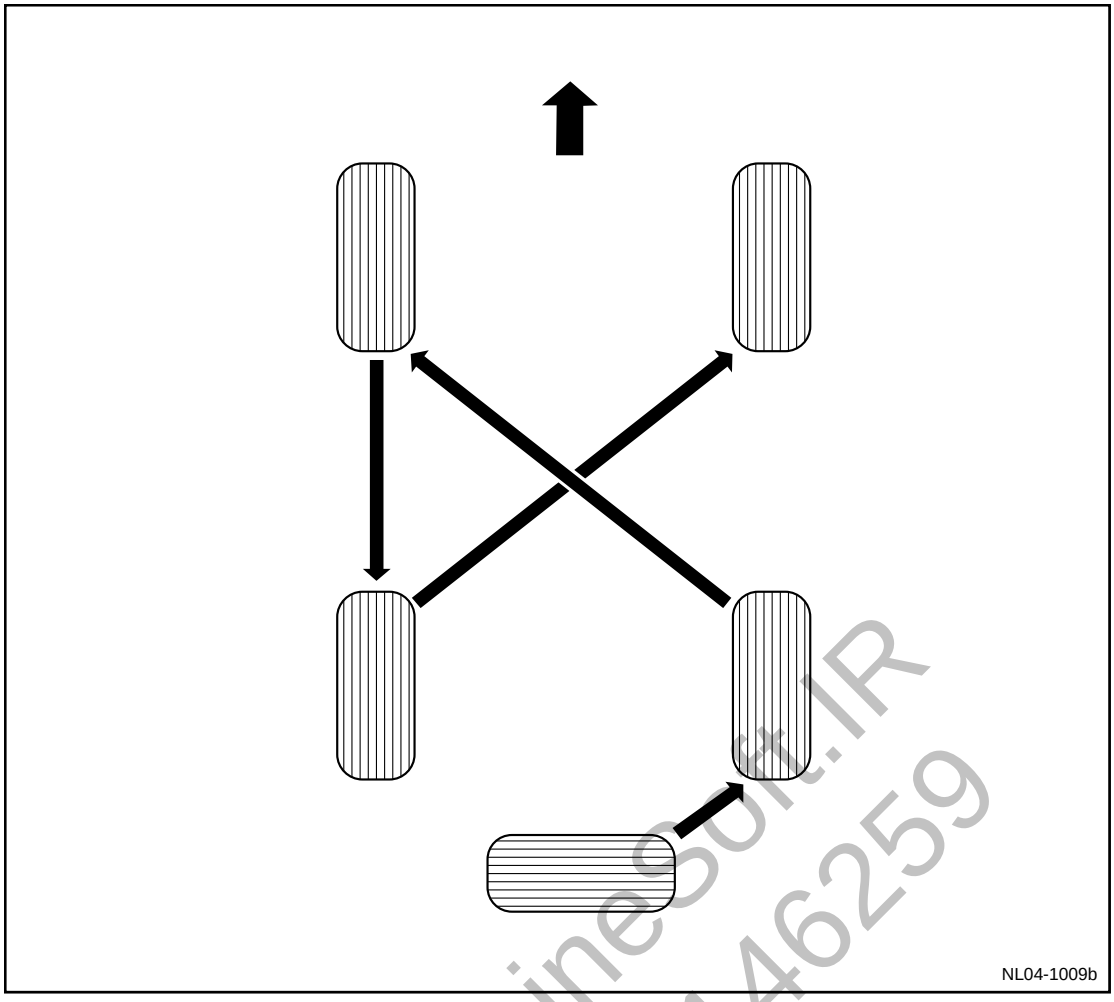

Parallel Rotationand coordinated rotationmethod refer to 1.4.2.5 description of tire transposition.

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4.4.3 System operation principle

4.4.3.1 Wheel alignment

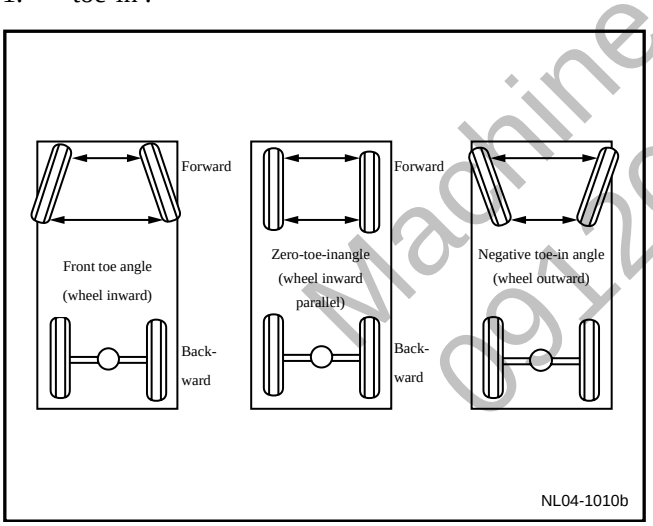
The driver turns the steering wheel to drive the vehicle in the desired direction. However, when running on the straight road, the driver shall keep the vehicle running straightly through continually operated the steering wheel of turn the vehicle through great force during turning a corner; thus, the driver shall consume great physical strength and suffers from great mental pressure. In order to solve this problem as well as prevent the tires from being worn untimely, the wheels are installed on the body (or chassis) at a certain angle according to the certain requirements. These angles are summed up to be called as wheel alignment. Positioning refers to a comprehensive noun of the angle relationship among the front and rear axles, wheel, steering part and suspension part.

If the wheel correctly positions, it is very easy to turn. During straight running, the driver only needs to regulate the steering wheel slightly to locate forward ahead and also turn with minimal intensity. In other words, it is very easy to turn if various angle relationships of forming wheel positioning are regulated correctly. However, even if one of the items is improperly adjusted, the following problems may be caused: difficult to steer, weak steering stability, bad steering returning and shortened service life of tire.

There are such alignment angles as: toe-in, tire camber, main pin caster angle, main pin camber angle, steering angle, included angle, and thrust-angle, scrub radius, etc. The above angle and size depends on the suspension system, tire driving system (front engine front-wheel driving or front engine rear-wheel driving, two-wheel driving or four-wheel driving), and steering system (manual steering or power steering) used in the vehicle.Adjust these factors, so that the driving performance and the steering stability reach the best state. And can extend the service life of the parts.

Commonly, the regulated angle is only recommended for the toe-in value during maintenance.

1. toe-in .



The toe-in is used for measuring the distance of the wheel rotating forward or deviating from the center line of the vehicle. Another comprehension to the toe-in is the contrast between the distance between the front of the two wheels and that between the rears of the same two wheels. If the vehicles are completely parallel, the two measured values should be equal and also the tie-on angle is zero. If the front of the wheel leans to the center line inward, the toe-in angle is positive.When the wheel is tilted outward, the toe-in angle is negative.The positive toe-in angle and the negative toe-in angle are also called as the toe-in of the front wheel and the toe-out of the front wheel commonly.

Toe-in plays the role in compensating the trend that the tires roll inward or outward due to camber angle and road surface resistance, thereby ensuring the straightness of the vehicle.

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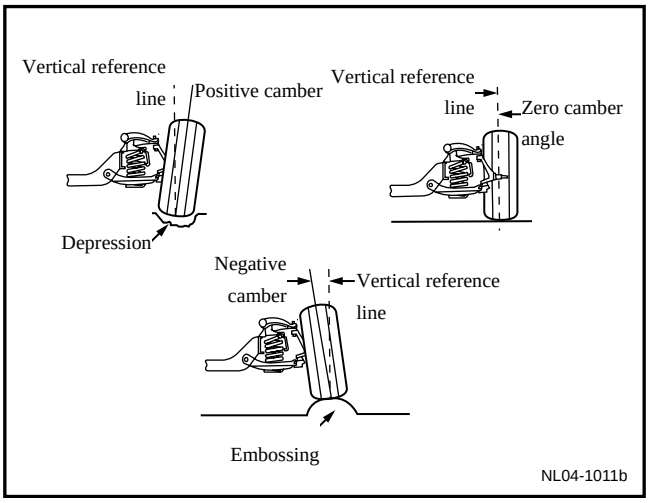
2. Camber angle



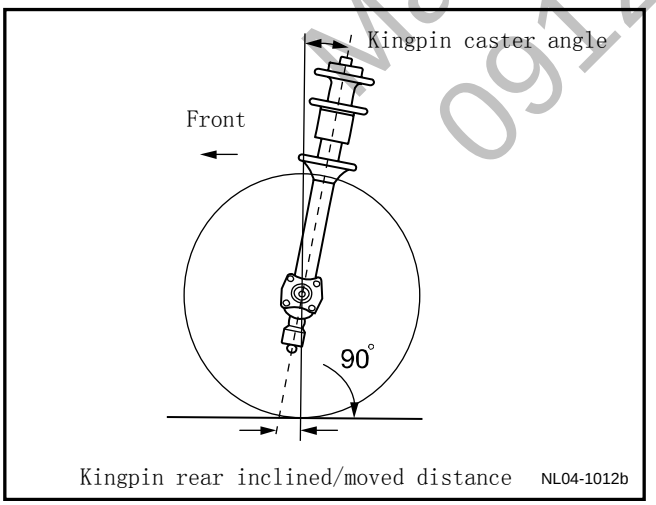
The camber angle is the inclination angle of the tire relative to the vehicle reference line. When the top of the wheel inclines outwards, the camber angle is positive at this time.When the topside of the wheel is tilted inward, the camber angle is negative at this time.The camber angle can be set to affect the control of the vehicle direction and the tire wear.

Various suspensions and steering devices are designed to minimize the abrasion of the tire tread and transfer traction through maintaining the wheel to run perpendicular to the ground and straightly when starting the vehicle.

An inappropriately set external camber angle will cause the tire to be excessively rapidly or unevenly worn; a too large positive camber angle will result in the wear of the side edge of the tire tread.When the load over the external side edge of the tire tread is higher than that over the internal side edge,such uneven wear will be resulted in.

Overlarge negative camber angle may wear the inside of the tire tread.The load of the inside of the tire tread higher than that of the outside may cause uneven wear.

3. Kingpin caster angle



The kingpin caster angle is the one of inclining the kingpin axis forward or backward. The kingpin caster angle is obtained by the measurement of the angle between the steering axis and the perpendicular line when observing from the side.

If tilted backward from the vertical line, it is called a positive kingpin caster angle; and if tilted forward, it is called a negative kingpin caster angle. There is a point of intersection between the center line of the steering axis and the ground; the tire contacts with the ground with a center point; and the distance between the two points is called as kingpin caster shift.

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The kingpin caster angle can produce the stability for straight running: if the vehicle has a positive kingpin caster angle, the left journal is to sink when the wheel turns left. (This is because bearing journal rotates around steering shaft, while this axle line is tilt) However, because fixed on the wheel assembly and can not move downward due to ground, the journal does not move downward as a matter of fact, but a left steering knuckle is forced to move upward. It leads to the body to rise slightly; the steering is completed; the steering knuckle is forced to move downward due to the lifted body weight; thus, the journal returns to the original position to drive right ahead.

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4.4.4 Diagnosis information and procedures

4.4.4.1 Diagnosis descriptions

Refer to 4.4.2 Description and operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnosis steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

4.4.4.2 Visual inspection

1. Check whether there is after-sales optional device which will affect wheels and tires.
2. Inspect the easy to access system components to identify whether there is obviously damage or potential fault.
3. Check if it exist conditions as follow:
   A. Obvious tire and wheel run-out.
   B. Check for obvious drive axle run-out.
   C. Incorrect tire pressure.
   D. Incorrect nosing height.
   E. The wheel is bent or damaged.
   F. Fragments exist on the tire or wheel.
   G. The tire is abnormal or excessively worn.
   H. Tire defects include tread deformation, separation or bulking caused by collision-slight side tire wall impression is normal and does not affect the travelling quality.

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4.4.4.3 Preliminary inspection before tire alignment

Notes:

The following inspection steps must be carried out before positioning the tires; otherwise, new faults may be caused by incorrect positioning.

1	Check whether the tire inflation pressure is abnormal as well as whether the tire wear is abnormal?

Yes → Adjust the tire pressure to the standard value, and replace the tire when necessary.

No

2	Check whether the wheel bearing is loose?

Yes → Inspect whether the wheel bearing bolt is loose and replace the wheel bearing if necessary. Refer to 4.2.7.9 replacement of front hub.

No

3	Check whether the lower swing arm ball head or the steering tie rod ball head are loose?

Yes → Fasten the nut and replace the lower swing arm ball head or the steering tie rod ball head if necessary.

No

4	Check whether the wheel and tire run-out is abnormal?

Yes → Measure and correct the tire run-out.

No

5	Check whether the warping height of the vehicle is abnormal?

Yes → Correct the vehicle nose before adjusting the toe-in.

No

6	Check whether the support assembly is installed wrongly?

Yes → Replace support post assembly, refer to 4.2.7.3 front support post assembly replacement.

No

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7	Check whether the lower control swing arm is loose?

Yes

Refer to 4.2.7.2 replacement of lower swing Arm Lining to fasten the control arm connecting bolt and replace the lower swing lining if necessary.

No

8	Check whether the equipment quality of the vehicle is normal or overloaded?

Yes

The vehicle is restored to the curb weight state when leaving factory.

No

9	Perform four-wheel positioning procedure

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4.4.4.4 Wheel bearing diagnosis

Warning: Please carry out road test of vehicle under the safety condition and comply with all traffic regulations. Do not attempt any operation that could jeopardize vehicle control. If contrary to the above safety instruction, result in serious injury accident and damage to the vehicle.

1	Carry out road test for the vehicle to confirm the fault phenomenon.

Tips: when the sealed wheel bearing is damaged, the outside impurities enter into the bearing to damage the damage; during rotating through external force, the bearing will make a sound similar to hum when the airplane takes off; thus, the noise appears only when the vehicle is in motion and it is stable without fluctuation and increased with increasing the vehicle speed.

Next

2	Confirm whether the wheel bearing makes noise. If not determining whether the wheel bearing makes the noise in the process of road test, hoist the vehicle.

To avoid any vehicle damage, serious personal injury or death when major components are dismantled from the vehicle and the vehicle is supported by a hoist, support with jack the components standing at the opposite end from which the components are being dismantled of the vehicle.

Next

3	Check whether the wheel is bent?

Yes → Replace the wheel

No

4	Check whether the wheel is unbalanced?

Yes → Carry out dynamic balance for the wheels again

No

5	Rotate the tire and wheel assembly to listen to whether the wheel bearing makes a noise.

Warning: when rotating the wheel by hand, the tire must be held by hand to rotate. If the position is incorrect, it is likely to result in personal injury!

Note: the front wheel bearing is pressed into the steering knuckle; and the rear wheel bearing is located in the brake drum and the wheel bearing assembly. The inner race is separated from the rear wheel bearing to result in the emergency of the noise.

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Yes

Refer to 4.2.7.9 replacement of front hub to replace the wheel bearing.

No

6	The wheel is shaken by hand to check whether the wheel bearings are loose?

Yes

Refer to 4.2.7.9 replacement of front hub to replace the front wheel bearing.

No

7	Perform a comprehensive comparison test with the normal vehicle in the same type to confirm whether the noise belongs to the normal working noise.

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4.4.4.5 Wheel vibration diagnosis

1. Dynamic balance of tire

The dynamic balance of the tire is the procedure which is most easily to be checked; and if the vehicle vibrates at high speed, the dynamic balance should be firstly carried out. Firstly, carry out double-faced dynamic balance under the vehicle to correct the imbalance of the tire and the wheel assembly. On-board final balancing can correct the imbalance of the brake drum, brake disc or hub cap. If the balancing operation fails to eliminate the vibration at high speed, or if the vibration occurs at low speed, the vibration is likely to be caused by jump.

2. Runout

The connection mode of the tire and the wheel or the wheel and the vehicle may result in jump. In order to probe the possibility of the wheel run-out, refer to the wheel run-out diagnosis table as follows:

Warning: Please carry out road test of vehicle under the safety condition and comply with all traffic regulations. Do not attempt any operation that could jeopardize vehicle control. If contrary to the above safety instruction, result in serious injury accident and damage to the vehicle.

1	Carry out road test for the vehicle to confirm the fault phenomenon as well as the vibration described by the customer belongs to fault?

No → Replace front wheel bearing

Yes

2	Determine the vibration speed.Is the speed more than 65 km/h when vibrating?

No → Go to step 5

Yes

3	Perform the tire dynamic balance under the vehicle and road test of vehicle to confirm the existence of the fault?

No → Troubleshooting

Yes

4	Perform the final balance in the vehicle and road test of vehicle to confirm the existence of the fault?

No → Troubleshooting

Yes

5	Check whether the wheel's free end face and the radial run-out (standard valve: 1.0mm/0.0394in) accord with the specified value?

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No → Go to step 8

Yes

6	Check whether the vehicle drive system is unbalanced?

Thoroughly check the drive axle and constant velocity universal joint.

No → Replace the part damaged.

Yes

7	Inspect the hub flange run-out (standard value: 0.26mm/0.0102in) as well as whether the run-out accords with the specified value?

No → Refer 4.2.7.9 replacement of Front Hub to replace the hub assembly.

Yes

8	Dismantle the wheel assembly and tires from the assembly to measure the run-out of the wheel.

Aluminum wheels	Radial run-out	0.5mm(0.02in)
	End-face runout	0.5mm(0.02in)
Aluminum wheel assembly	Free radius run-out	1.5mm(0.06in)

Is wheel run-out as specified?

No → Refer to 4.4.5.1 Replacement of wheels to replace the wheels.

Yes

9	Replace the tire

Next

10	Confirm whether the fault is removed.

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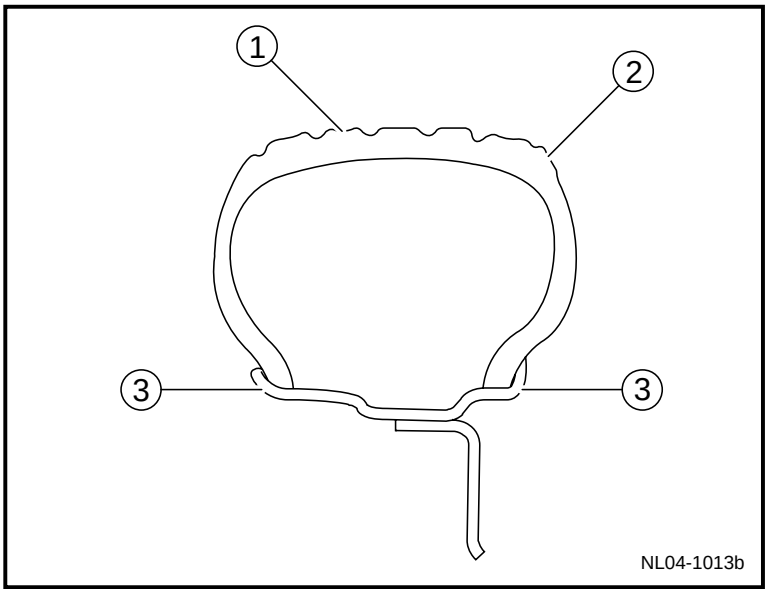
4.4.4.6 Wheel runout inspection



The wheel run-out can be measured by a dial gauge in and out of the vehicle; however, the mounting surface must be correct; it can be measured with tire during measuring; the radial and end face run-out are measured inside and outside the rim flange; a dial indicator is fixed next to the wheel and tire assembly; slowly rotate the wheel in a circle and record the reading of the dial gauge; if the measuring value exceeds the following specification, and the wheel balance can also not eliminate the vibration, replace the wheel.

Aluminum wheels

Radial run-out: 0.5mm (0.02in)

End-face runout: 0.5mm (0.02in)

Aluminum wheel assembly

Free radius run-out: 1.5 mm (0.06 in)

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4.4.4.7 Wheel abnormal worn diagnosis

There are many reasons for abnormal tire and premature wear, including wrong inflation pressure, irregular rotation, poor driving habits or incorrect wheel alignment. If needing to readjust the wheel positioning due to tire wear, the toe-in must be regulated close to zero as much as possible so long as the specification allows.

If the following situations incur, the tires must be converted.

A. Front tire wear is different the rear tire wear.

B. The wear of the front left tire is different from that of the front right tire.

C. The wear of the rear left tire is different from that of the rear right tire.

If the following situations incur, the wheel positioning must be checked.

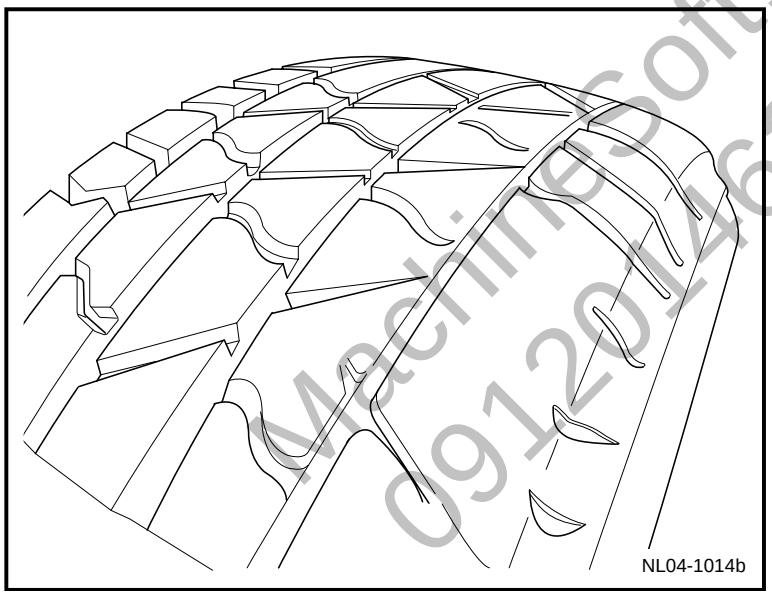
A. The wear of the front left tire is different from that of the front right tire.

B. The tread of either front wheel tire is unevenly worn.

C. A feather-shaped scratch exists on one side of the pattern rib or pattern block on the tread of the front tire.

The several typical tire wear conditions are as follows:

1. Eccentric abrasion



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Cause

A. Malfunctions of such movable parts as axles, bearings, etc.

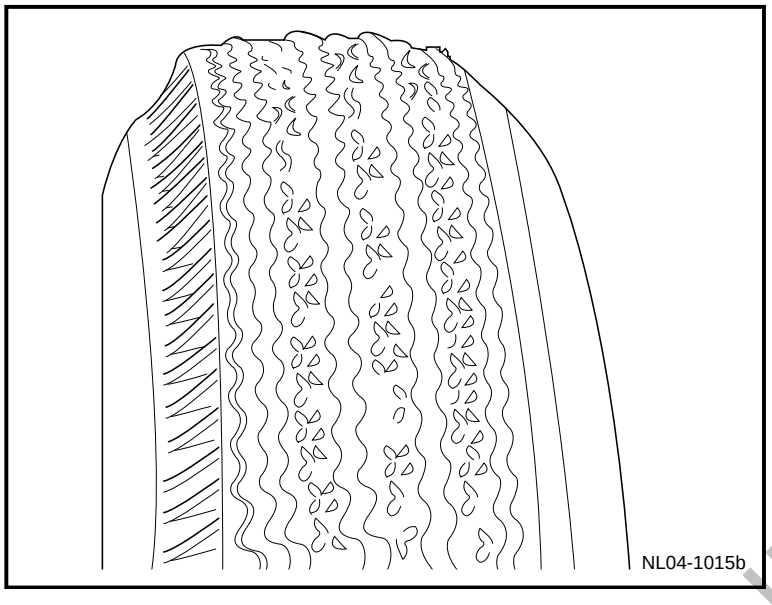
B. Brake system

C. Emergency startup and emergency brake

D. The gravity centers on the wheel are unevenly distributed.

E. The tire does not match with the size of the hub.

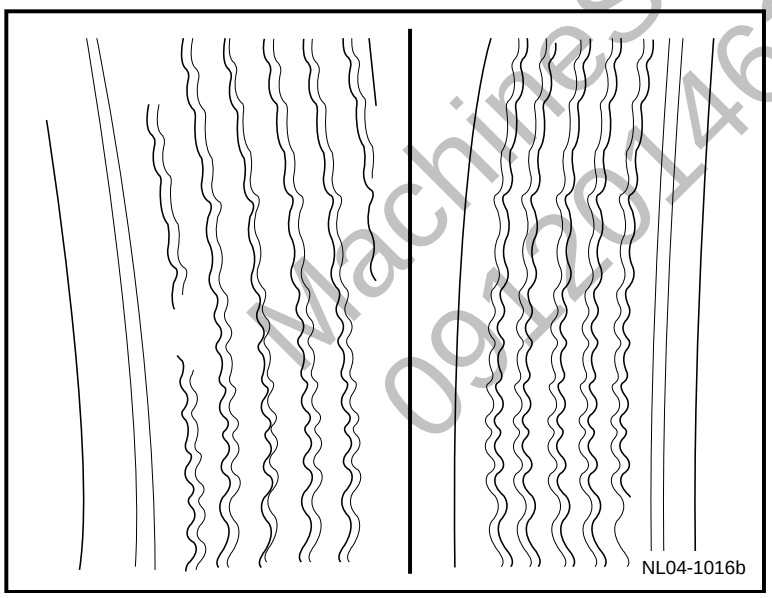
2. Abrasion of tire side position.



Cause

A. The toe-in is not correct.

3. Abnormal abrasion:



Cause

A. The camber is not correct.

B. Check for incorrect toe-in.

4. Abnormal abrasion:

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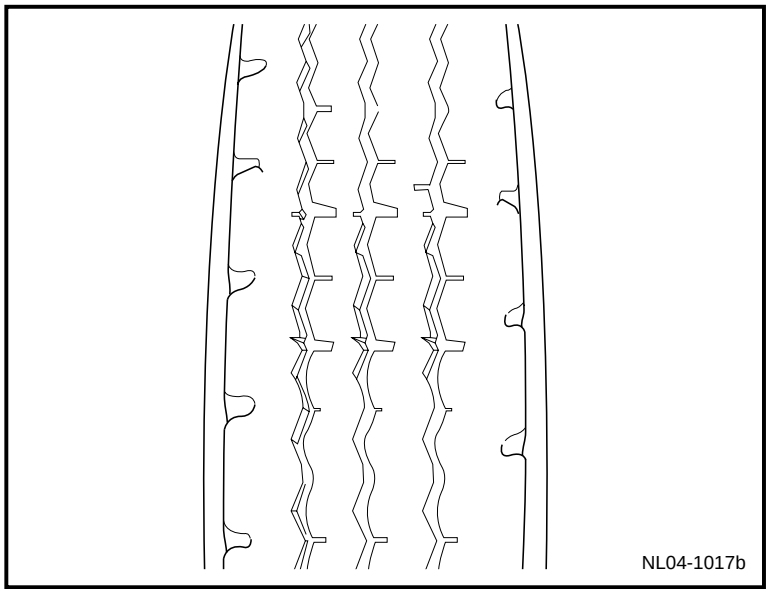

Cause

A. Dynamic balance is not correct.

B. Four wheels positioning are not correctly aligned.

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4.4.4.8 Tire overworn diagnosis

1	Check whether wheel positioning is normal?

No → Adjust the vehicle positioning

Yes

2	Check the maintenance record. You should perform tire exchange operations. Are the tires exchanged as specified?

No → Carry out the tire rotation

Yes

3	Check whether tire balance is normal and the tire pressure is normal?

No → Adjust the tire pressure to the standard value to perform dynamic balance for the tire.

Yes

4	Inspect the situation that the vehicle does not overload.

No → Explain the importance of keeping the reliable load capacity to the user.

Yes

5	Check whether the coiling spring works normally?

No → Refer to 4.2.7.4 Replacement of front damper part and spring to replace the helical spring.

Yes

6	Check whether the support assembly works normally?

No → Replace fault part

Yes

7	Check whether the lower swing arm works normally? (no bending or loosening faults occur)

No → Replace lower swing arm, refer to4.2.7.1 Lower swing arm assembly replacement

Yes

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8	Check whether the wheel bearing works normally? (no abrasion or loosening conditions occur)

No → Refer to 4.2.7.9 replacement of front hub to replace the wheel bearing.

Yes

9	Check whether the lower swing arm ball head or the steering tie rod ball head are normal? (no abrasion or loosening conditions occur)

No → Fasten the nut and replace the lower swing arm ball head or the steering tie rod ball head if necessary.

Yes

10	Check whether the wheel run-out is normal? see 4.4.4.6 check for wheel run-out.

No → Reassemble the tire, and replace the tire or wheel when necessary.

Next

11	Confirm that the fault has been fixed.

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4.4.4.9 Side-way diagnosis with vehicle running

1	Check whether tire balance is normal and the tire pressure is normal?

No → Adjust the tire pressure to the standard value to perform dynamic balance for the tire.

Yes

2	Check whether wheel positioning is normal?

No → Readjust the wheel positioning.

Yes

3	Check whether the tire wear is normal?

No → Replace the tire
Note: the wheels of the vehicle should be positioned immediately after replacing.

Yes

4	Check whether the hub run-out is normal?

No → Measure the run-out of the hub flange. Replace the hub if necessary.

Yes

5	Check whether the steering tie rod ball head works normally? (no abrasion or loosening conditions occur)

No → Fasten the nut and replace the steering tie rod ball head if necessary.

Yes

6	Check whether the lower swing arm ball head works normally? (no abrasion or loosening conditions occur)

No → Fasten the nut and replace the lower swing arm ball head if necessary. See 4.2.7.7 replacement of lower swing arm ball end assembly.

Yes

7	Check whether the wheel run-out is too large?

No → Measure the run-out of the wheel, re-assemble the wheel and tire and replace the damaged components if necessary.

Yes

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8	Confirm that the fault has been fixed.

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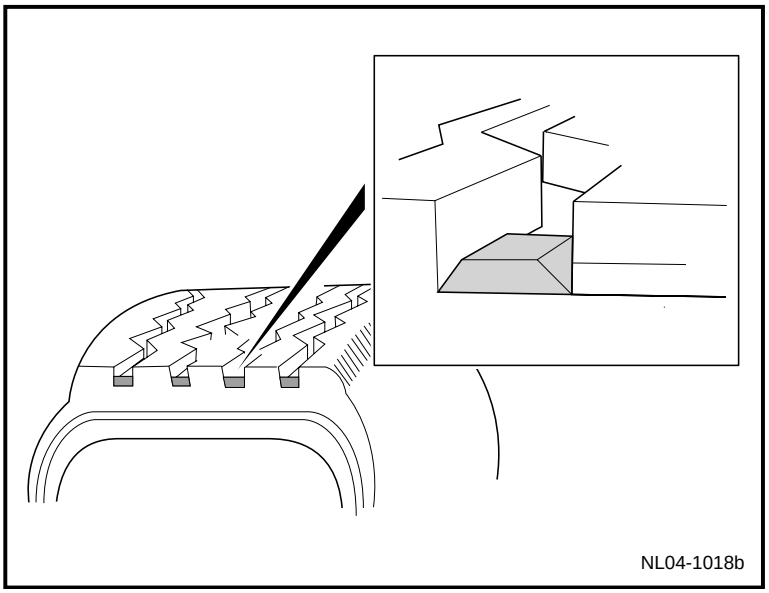
4.4.4.10 Indicating mark of tire worn



The original tire has embedded tread wear indication mark for displaying the tire needing to replace.When the tire tread is shallow, these marks display in the mode of strap; when there are 3 grooves in 6 positions appearing the indication marks, it is recommended to replace the tire.

4.4.4.11 Meridian tire line deflection correction

1. Definition of fault:

The vehicle deviates from the original traveling direction to the left or right when no external force is applied to the steering wheel during the straight-line running at a certain speed.

2. Determination baseline of vehicle off tracking:

A. To maintain the vehicle running along the original direction when it travels straightly at a certain speed, a force preventing the steering wheel from turning clockwise or counterclockwise needs to be applied to the steering wheel.

B. The vehicle deviates from the original route to the left or right when the hands leave the steering wheel under the circumstance that the vehicle travels along a straight line at a certain speed {this case usually refers to the case where the vehicle deviates from the original route by more than 1m (39.4 in) per 100m (3940 in) it travels}.

Notes:

During deviation correction, the inspection of the following basic items for the vehicle shall be done.

A. Check whether the front and rear wheel brakes are dragged.

B. Check for excessive difference in wear degree of the tires connected to the same suspension.

C. Check for excessive difference in wear degree of the tires connected to the same suspension.

If any one of the above is abnormal, please firstly regulate in the normal state, and then carry out road rest of the vehicle to confirm whether the fault is removed.

3. Correction procedure:

Warning!

Please carry out road test of vehicle under the safety condition and comply with all traffic regulations. Do not attempt any operation that could jeopardize vehicle control. If contrary to the above safety instruction, result in serious injury accident and damage to the vehicle.

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1	Carry out road test for the vehicle to judge whether the vehicle deviates?

No → Explain the deviation definition to the customer. The vehicle may be deviated in a short time according to different road conditions.

Yes

2	Check whether the toe-in of the front wheel is normal?

No → Readjust the toe-in value of the front wheel of the vehicle and perform positioning adjustment if necessary.

Yes

3	Check whether the wheel positioning accords with the specified value?

No → Adjust the wheel positioning of the vehicle

Yes

4	Check whether all positioning parameters of the vehicle compared with the numerical value in the specification table accord with the specification?

No → Go to step 10

Yes

5	Carried out tire rotation process

A. Exchange the front left wheel assembly with the rear left wheel assembly.

B. Road test the vehicle.

Does the vehicle still deviate?

No → The system is normal.

Yes

6	Carried out tire rotation process

A. Exchange the front left wheel assembly with the rear left wheel assembly and replace the front left tire.

B. Road test the vehicle.

Does the vehicle still deviate?

No → The system is normal.

Yes

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7	Carried out tire rotation process

A. Exchange the front right wheel assembly with the rear right wheel assembly.

B. Road test the vehicle.

Does the vehicle still deviate?

No → The system is normal.

Yes

8	Carried out tire rotation process

A. Exchange the front right wheel assembly with the rear right wheel assembly and replace the front right tire.

B. Road test the vehicle.

Does the vehicle still deviate?

No → The system is normal.

Yes

9	Return to the first step of the diagnosis starting point

10	Check whether frame and the suspension system part are bent or damaged?

No → Go to step 1

Yes

11	Correct the frame and replace the damaged part if necessary to confirm whether the fault is removed.

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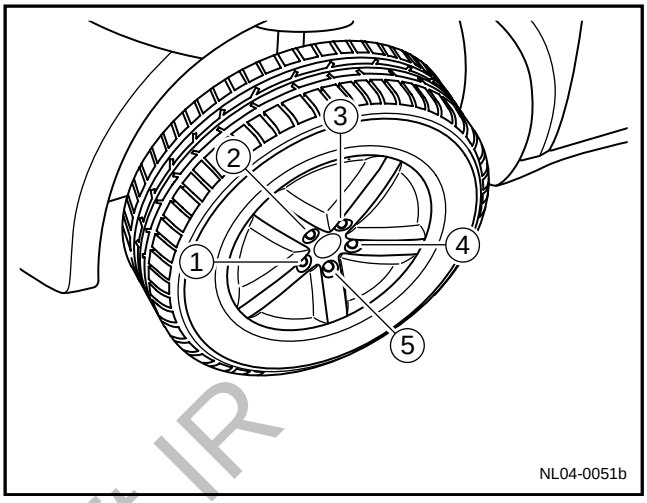
4.4.5 Dismantle and installation

4.4.5.1 Wheel replacement

Dismantle procedure

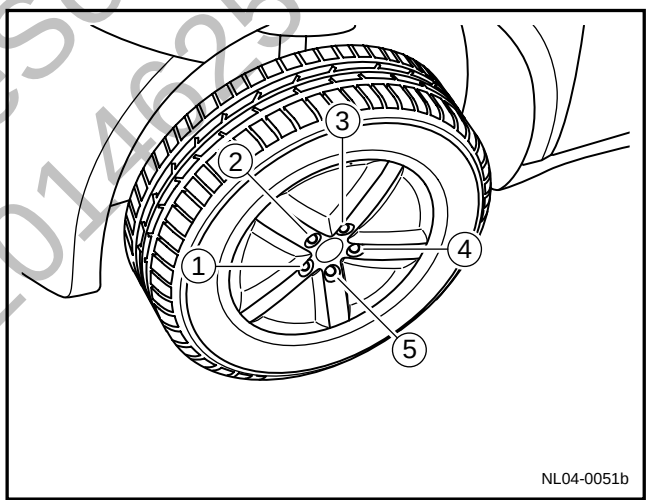
1. Unscrew wheel nuts.
2. Lifting vehicle
3. Dismantle wheel nuts.
4. Dismantle wheels.



Installation procedure:

1. Install the wheel.
2. Installing wheel nut was tightened lightly as per figure order1-4-2-5-3.
3. Lower the vehicle.
4. Tighten wheel nut according to sequence of 1-4-2-5-3 shown in figure.

Torque:110 Nm (Metric) 81.4 lb-ft (English system)



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4.4.5.2 Front wheel toe-in adjustment

Notes:

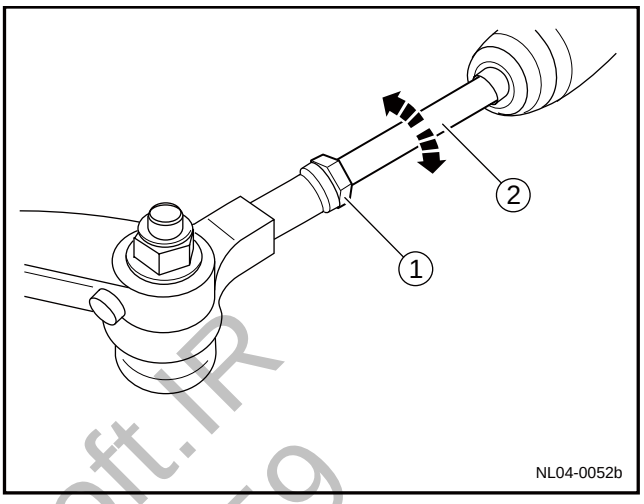
Ensure the vehicle is parked in a horizontal plane.

Ensure the wheels face right ahead.

1. Inspect the setting of toe-in on both sides.

Equipment used: wheel positioning system

2. Lifting vehicle
3. Loosen fixing screw cap 1 on left and right sides of tie rod.
4. Rotate Tie Rod 2 to the same quantity of motion clockwise or counterclockwise to adjust the toe-in of the both front wheels.
5. Tighten the left and right fixing nut caps for the tie rod.



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4.4.5.3 Rear wheel toe-in adjustment

Notes:

Ensure the vehicle is parked in a horizontal plane.

Ensure the wheels face right ahead.

1. Inspect the setting of toe-in on both sides.

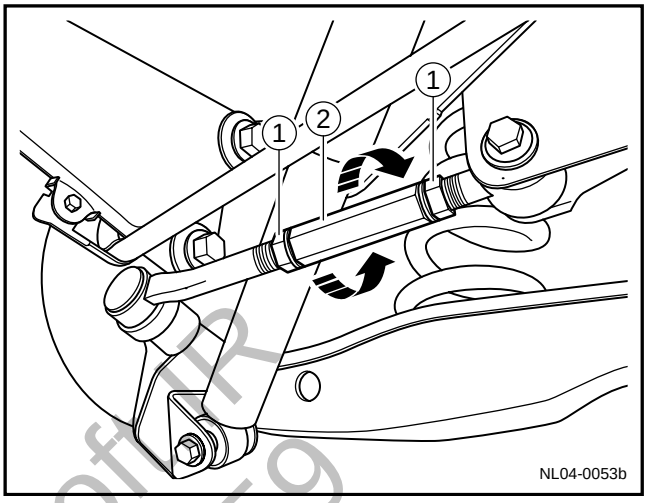
Equipment used: wheel positioning system

2 Lifting vehicle

3. Loosen fixing screw cap 1 on left and right sides of No.1 swing arm of rear suspension.

4. Rotate 2 swing arms of the rear suspension No.1 to the same quantity of motion clockwise or counterclockwise to adjust the toe-in of the both rear wheels.

5. Tighten the left and right fixing nut caps for the rear suspension No.1 swing arm.



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5 Drive shaft /powertrain

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5.1.1 Warning and precaution 1504

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5.1 Warning and precaution

5.1.1 Warning and precaution

Assistant driving warning

Warning!

When the technician checks the fault part to be repaired, the assistant shall drive the vehicle; otherwise, it may cause personal injury.

Warning for battery disconnection

Warning!

Before repairing any electrical component, the ignition key must be in the OFF or LOCK position and all electrical loads must be OFF (off), unless otherwise stated in the operating procedures; if tools or equipment are easy to contact with exposed electrical terminals, the negative battery cable must also be disconnected; and it may result in personal injury and/or damage to the vehicle or vehicle parts in the case of violating these safety instructions.

Warning for road test

Warning!

Warning:Test a vehicle on the roads under safe conditions and obey all traffic laws. Do not attempt any maneuvers that could jeopardize vehicle control. Failure to adhere to these precautions could lead to serious personal injury and vehicle damage.

Precaution for engine lifting

Notes:

Regardless of hoisting or supporting the engine due to any reason, do not support the jack below the oil sump, any stamping parts or crankshaft belt pulley. The part may be damaged by lifting the engine in an incorrect mode.

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5.2 Differential

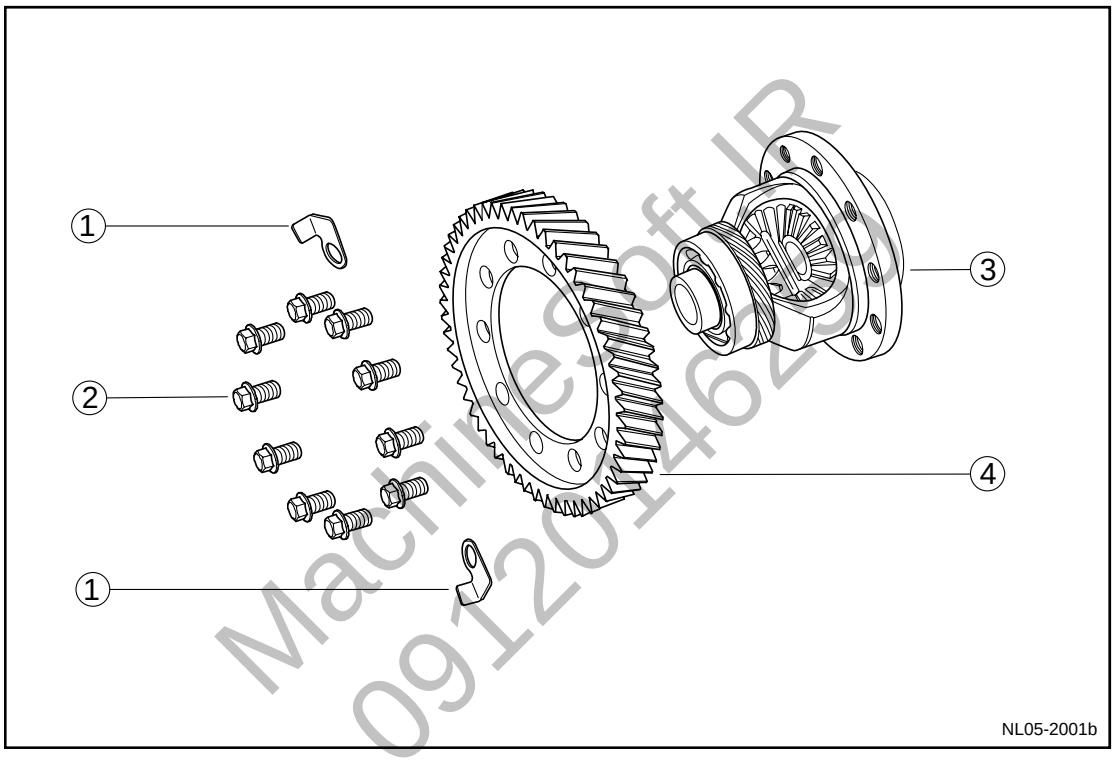
5.2.1 Specifications

5.2.1.1 Fastener specifications

Fastener Name	Model	Torque:	
		Metric (N·m)	English system (lb-ft)
Fixing bolts of main reducer driven gear	M10×20	47-57	35-42

5.2.2 Disassemble drawings

5.2.2.1 Disassemble drawings



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1. Planetary gear shaft lock piece
2. Fixing bolt of driven gear and planet carrier.
3. Planetary gear carrier
4. Driven gear

5.2.3 Diagnostic information and procedures

5.2.3.1 Fault symptom table

Symptoms	Suspected parts	Referance
Abnormal sound	Planet gear and Planet gear shaft	3.3.7.6 Abnormal sound during driving condition and 5.2.4.1 disassembly and assembly of differential

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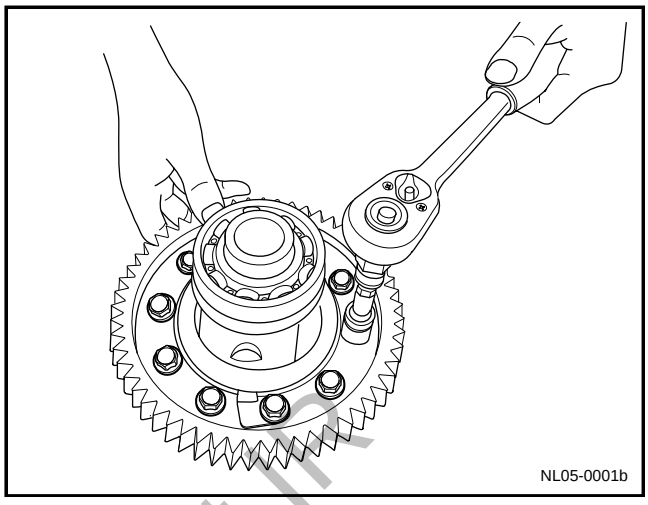
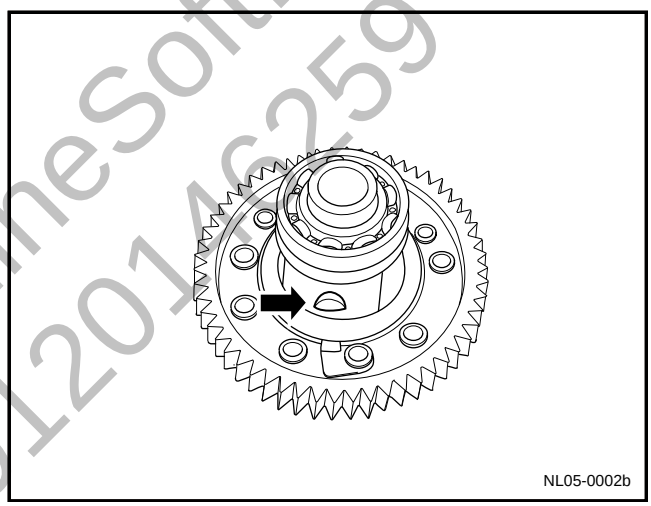
5.2.4 Dismantle and installation

5.2.4.1 Differential disassembly and assembly

Dismantlement procedure

1. Refer to 3.3.8.3 replacement of transmission assembly to dismantle the transmission assembly.
2. For dismantling of gearshifting control mechanical assembly, refer to 3.3.8.4 Replacement of gearshifting control mechanical assembly.
3. For dismantling of fork shaft, refer to 3.3.8.6 Replacement of fork shaft.
4. Dismantle differential assembly inside transmission.
5. Remove a total of 10 bolts for the driven gear of the main reducing gear.
6. Identify the position for the locking pin of the planet gear shaft.

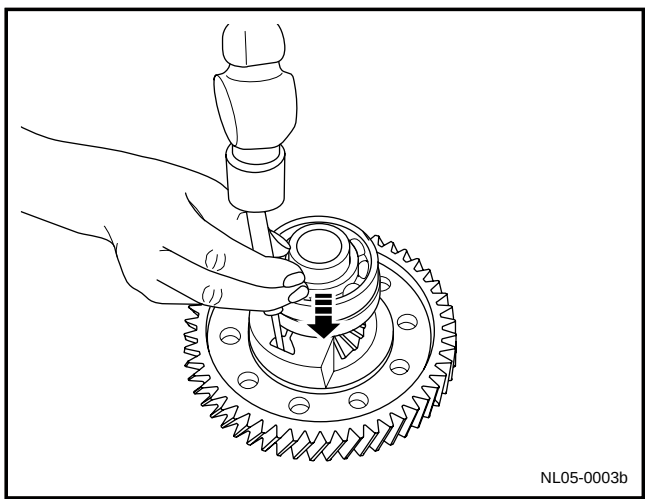




7. Extract the locking pin of the Planet gear shaft with a universal-purpose tool.

Notes:

The other face of the locking pin is provided with a locking steel ball to prevent the steel ball from dropping off in the course of dismantling.



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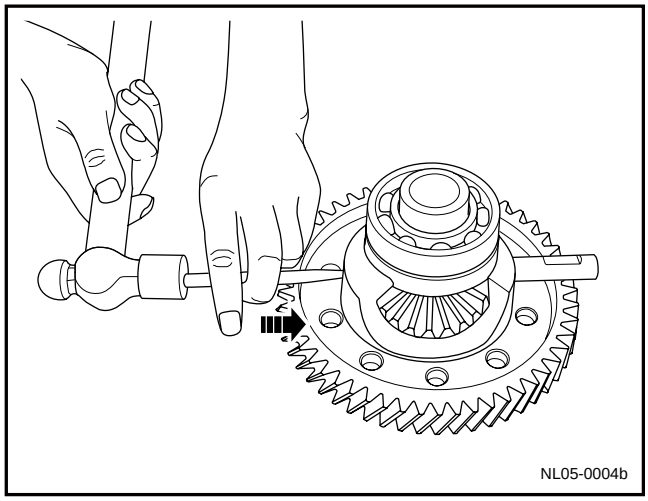
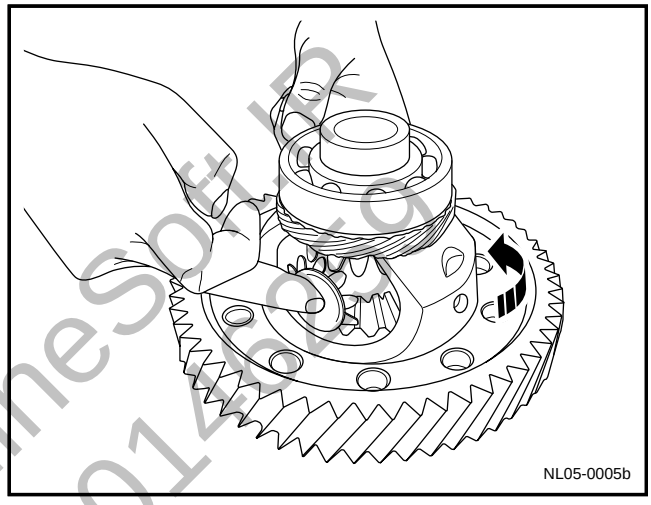
8. Take out planet gear shaft



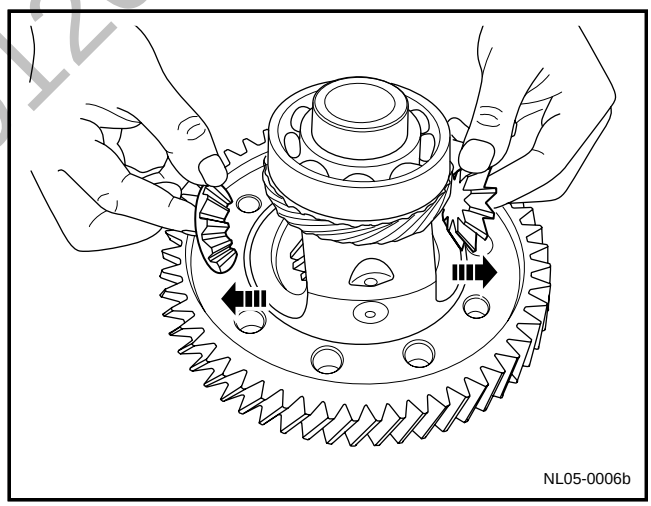
9. Rotary planet gear

Notes:

Revolve the Planet gear by 90°, as shown in the figure.



10. Take out planet gear



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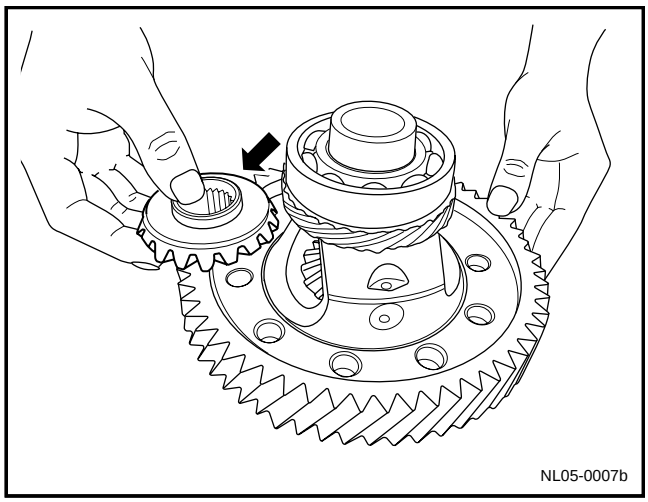
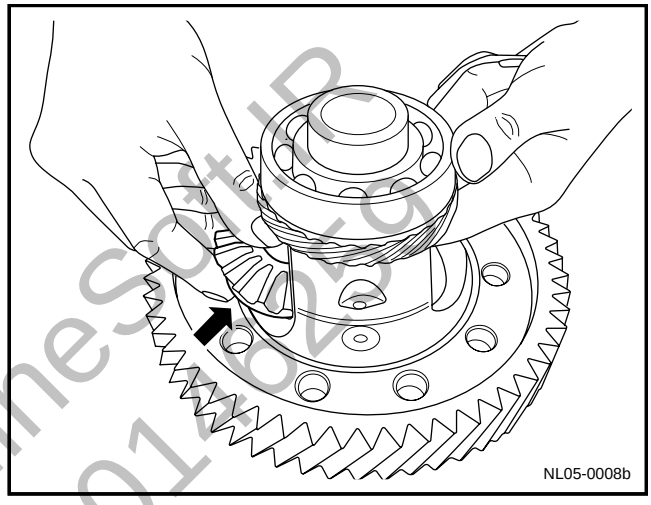
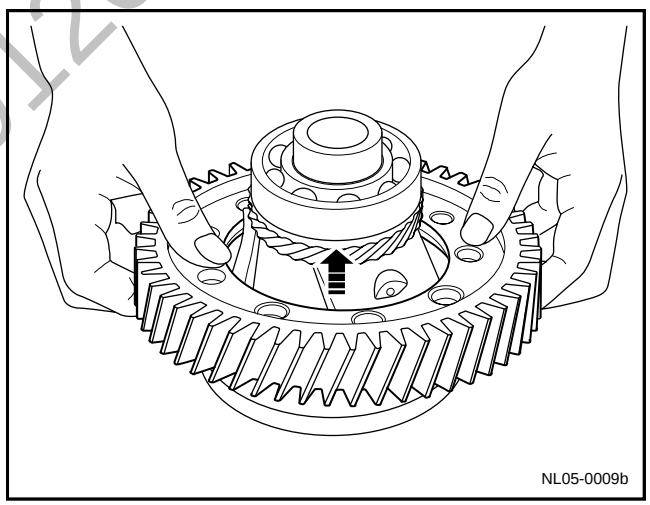
11. Take out right output pinion.



12. Take out left output pinion.



13. Take out driven gear of main reducer.



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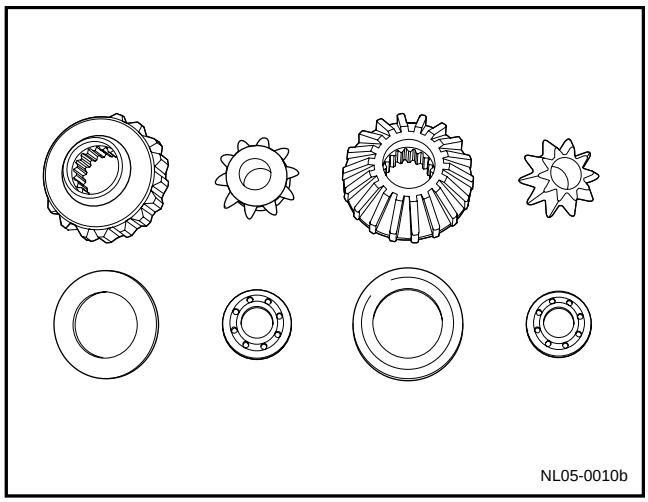
14. Dismantle rear planet gear and output gear

Notes:

If needing to adjust the engagement clearance between the planet gear and the output gear, adjust the thickness of the gasket.



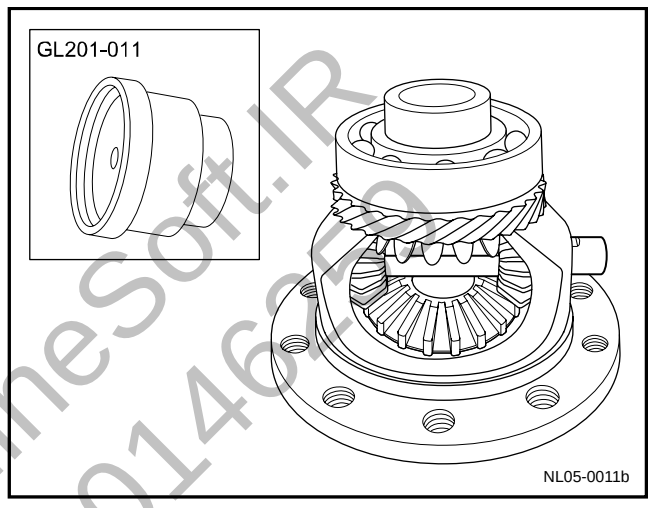
Installation procedure:

1. Install planet gear.

Notes:

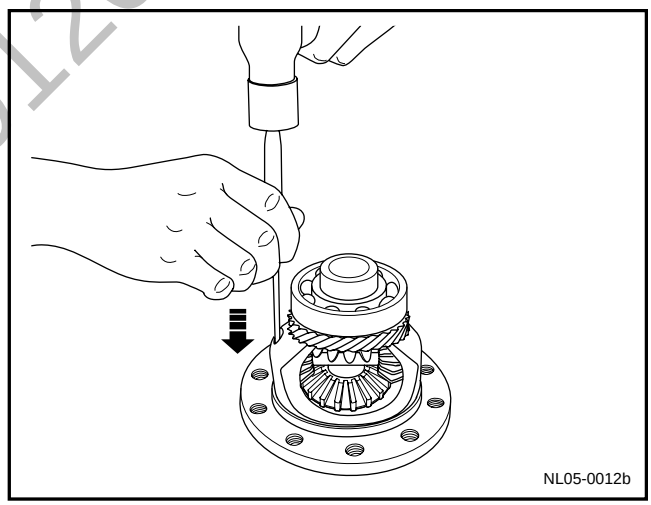
Please pay attention to the state of the gasket of the planet gear and the output gear in the process of installation.

If needing to replace the differential bearing, please use a dedicated tool GL201-011 to install the bearing.



2. Install planet gear shaft

3. Install lockpin of planet gear shaft.



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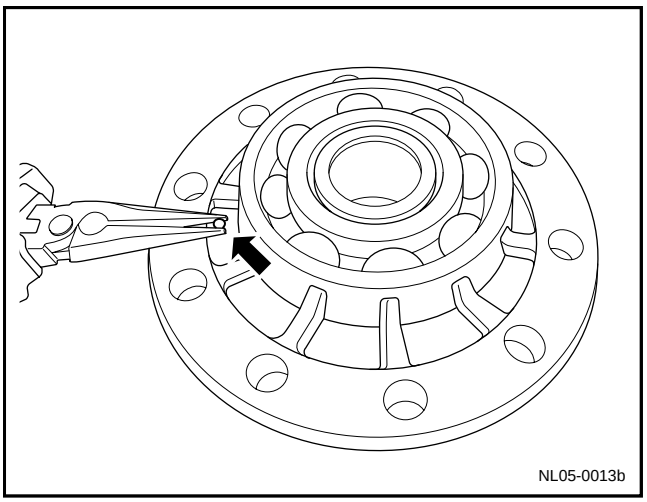
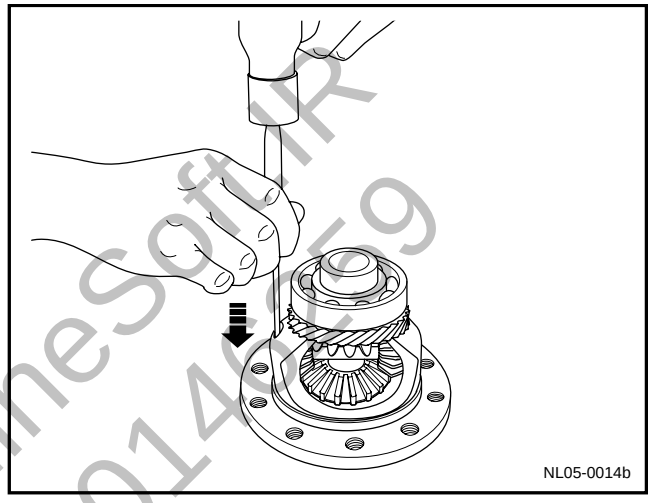
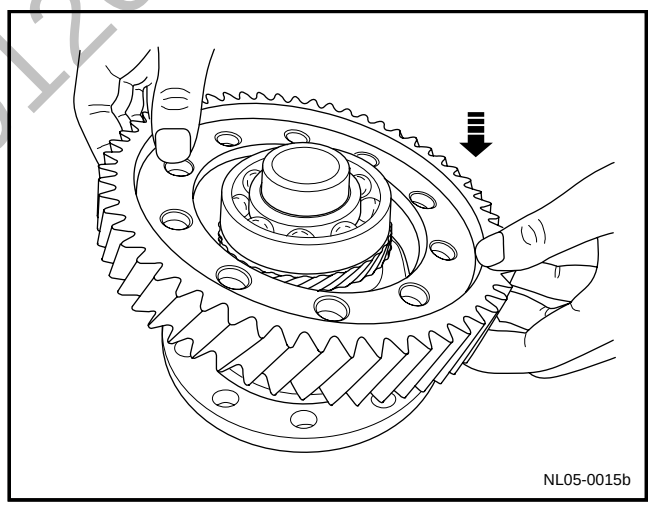
4. Install planet gear shaft lockpin steel ball.



5. Lock the locking pin (both sides) with a punch.



6. Install the driven gear of the main reducing gear.



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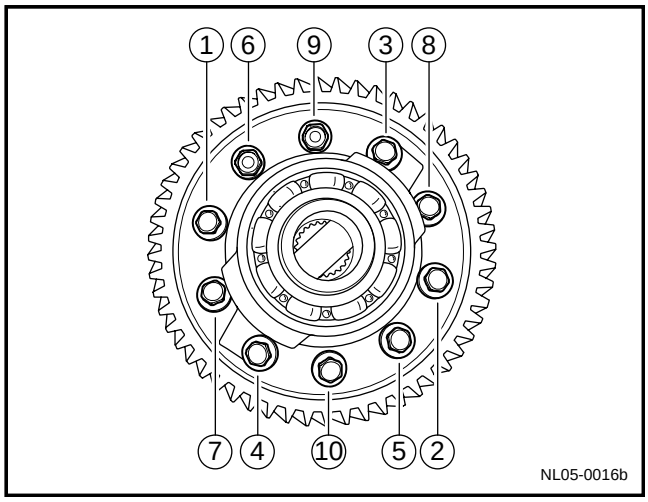
7. Tighten the fixing bolt for the driven gear of the main reducing gear.

Notes:

In the process of installation, confirm that the locking pieces at the both sides of the planet gear shaft are not missing and the bolt is fastened in sequence as shown in figure.



8. Install the differential assembly.
9. Install fork shaft
10. Install the transmission assembly.
11. Install shift control mechanism assembly.

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5.3 Drive shaft system

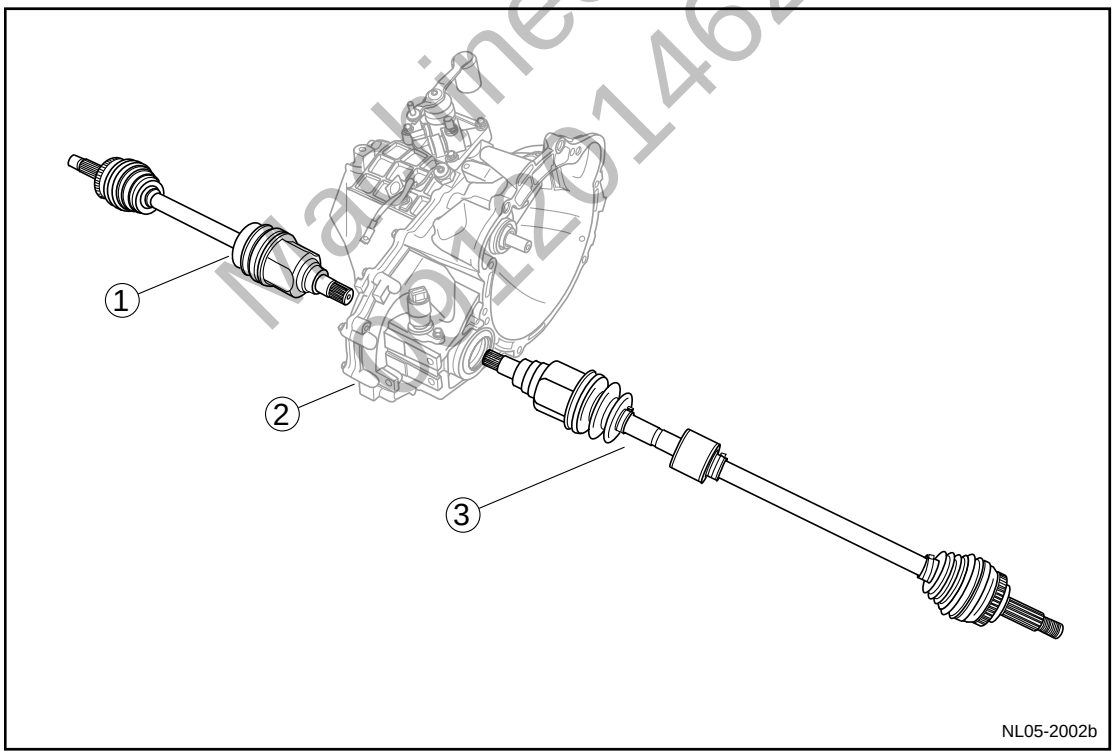
5.3.1 Specifications

5.3.1.1 Fastener specifications

Fastener Name	Model	Torque range		Remarks:
		Metric (NM)	English system (lb-ft)	
External lock nut of driving shaft	M22×1. 5	206-226	147-161	
Connecting bolt of lower swing arm and ball head	M10×1.25	70-90	51.8-66.6	
Connecting nut of lower swing arm and ball head	M10	70-90	51.8-66.6	
Ball pin slot nut of steering tie rod	M12×1.25	31-35	23-26	Tighten the nut to an angle of 60°when the cotter pin cannot be sleeved.

5.3.2 Disassemble drawings

5.3.2.1 Disassemble drawings



1. Left drive shaft
2. Transmission
3. Right drive shaft

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5.3.3 Diagnostic information and procedures

5.3.3.1 Fault symptom table

Symptoms	Suspected parts	Referance
Noise (front drive shaft)	Inner or outer ball joint （worn）	3.3.7.6 Abnormal sound during driving condition and 5.3.4.2 replacement of drive shaft

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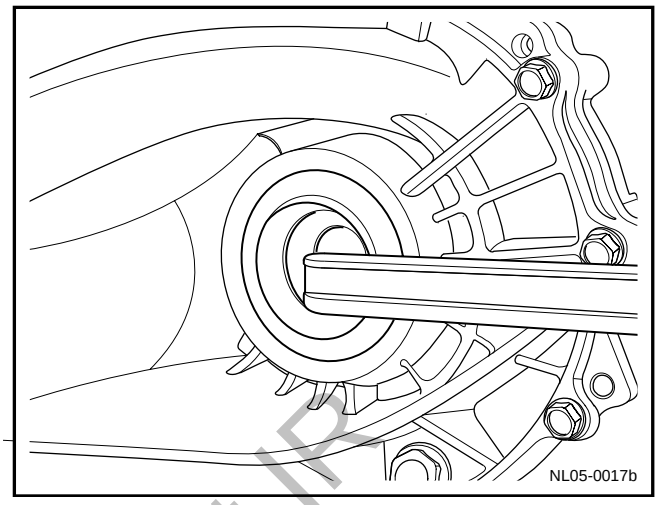
5.3.4 Dismantle and installation

5.3.4.1 Drive shaft oil seal replacement

Dismantlement procedure

1. For dismantling of drive shaft from transmission, refer to 5.3.4.2 replacement of drive shaft.
2. Use bar to pry outer lip of sealing piece, and dismantle drive axle sealing piece.

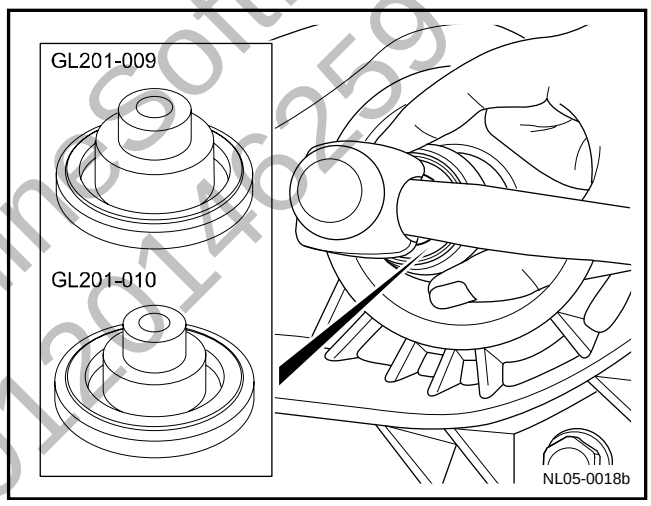


Notes:

When prying the sealing element by a pry bar, be careful particularly not to damage the transmission housing and the sealing element.

Installation procedure:

1. Use the special tool GL201-009, GL201-010 to install dirve shaft oil seal components.
2. Apply transmission oil on lip of sealing piece of drive axle.
3. Install drive shaft.



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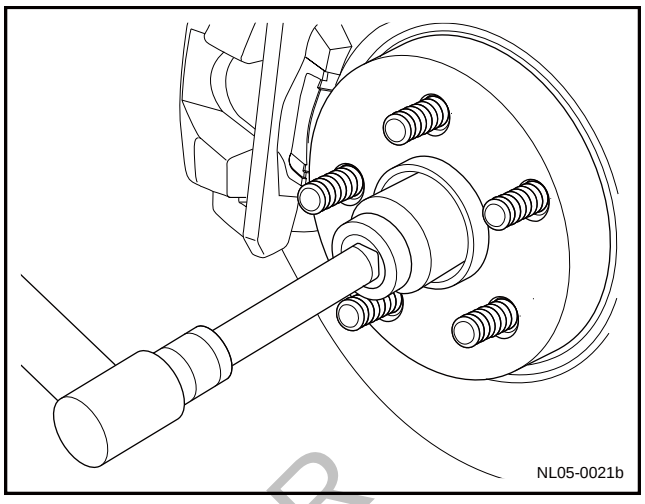
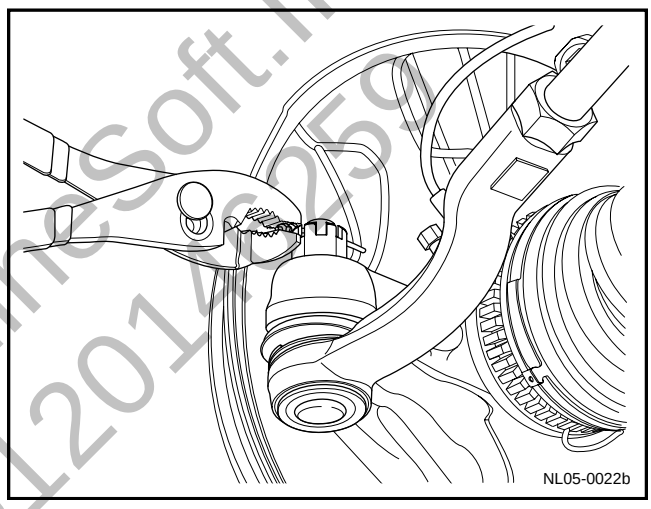
5.3.4.2 Drive shaft replacement

Dismantlement procedure

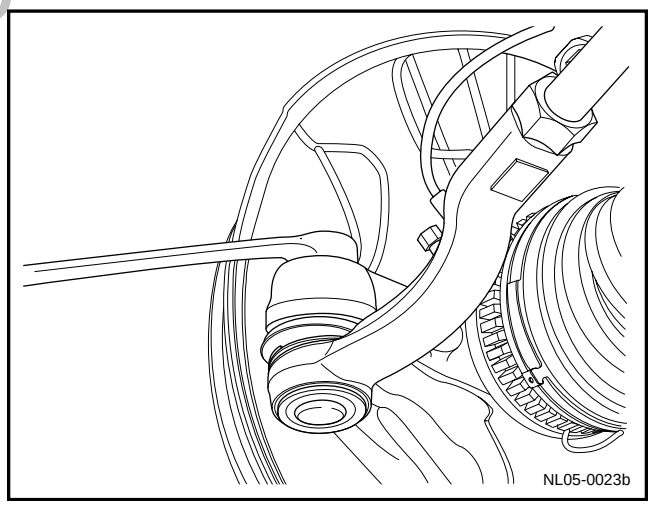
1. Disconnect the battery negative cable, refer to 2.11.8.1 Battery cable disconnection/connection Procedures.
2. For dismantling of tire, refer to 4.4.5.1 Replacement of wheel.
3. Use punching pin to loosen self-lock device of locknut outside drive shaft.



4. Dismantle locknut outside of drive shaft.



5. Remove the locking pin for the ball nut for the steering gear tie rod.



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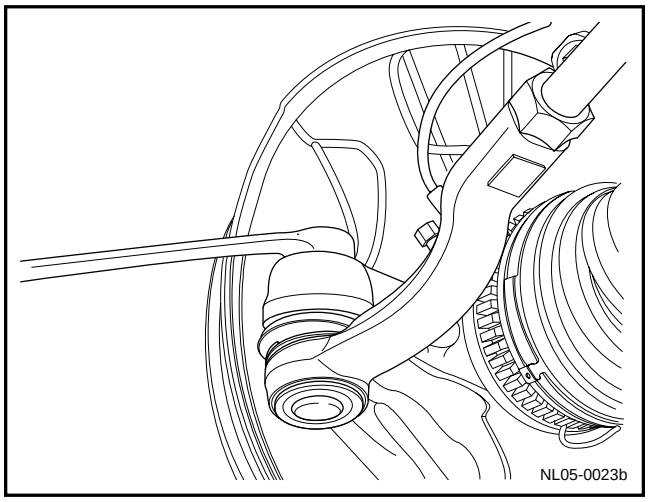
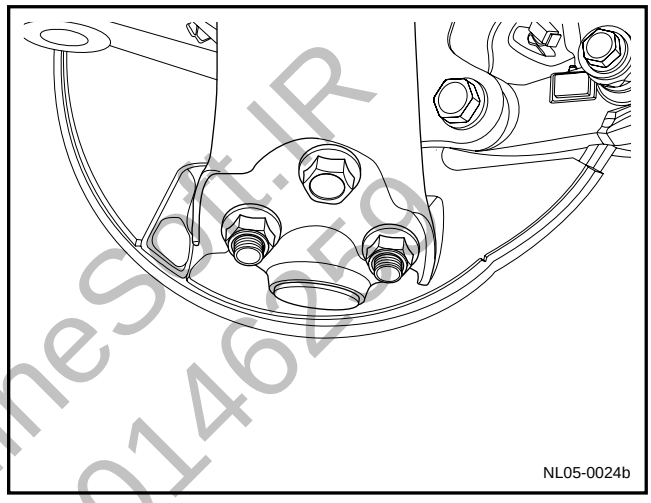
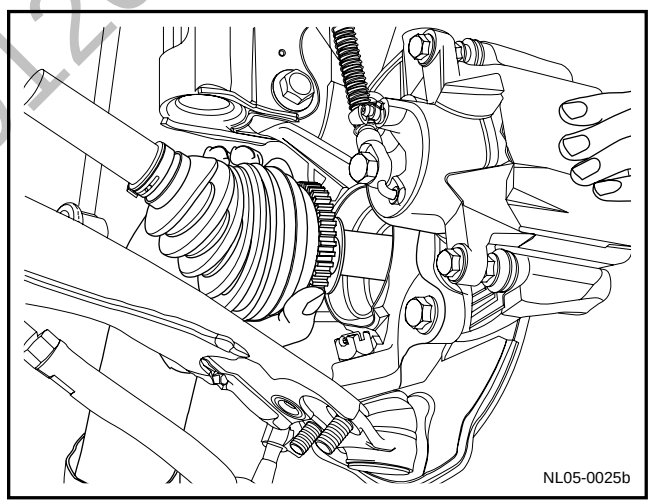
6. Remove the steering gear tie rod nut.



7. Remove the lower swing arm ball end fixing bolt and nut.



8. Take out drive shaft outer bushing



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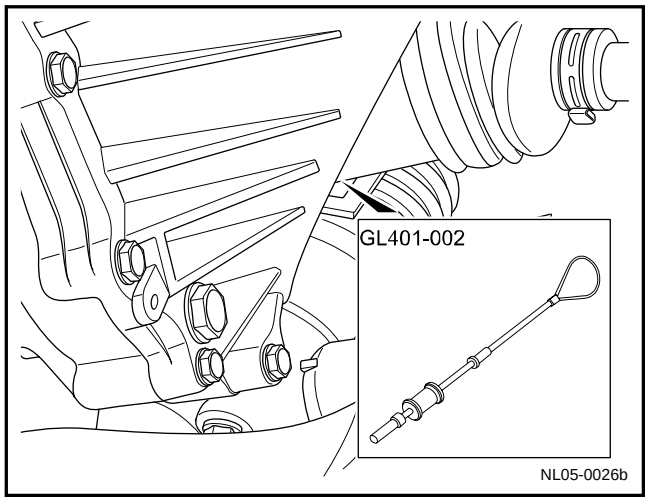
9. Extract the drive shaft with the special-purpose tool GL401-002.



Notes:

Brute force may not be used in the dismantling process to prevent from damaging the transmission housing.

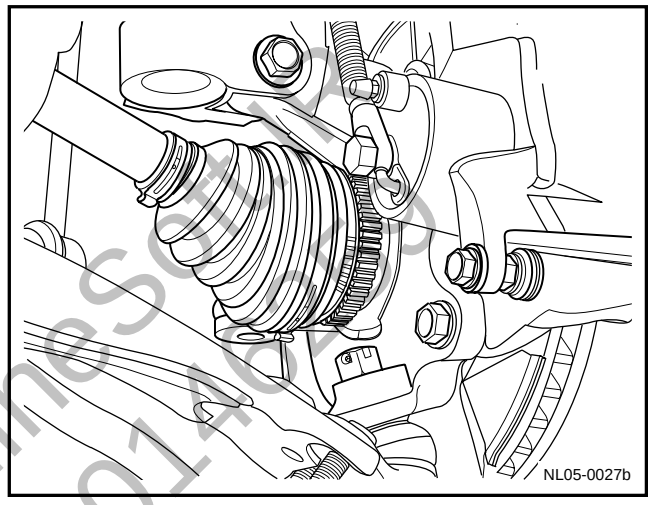
Installation procedure:

1. Install drive shaft inner end.

Notes:

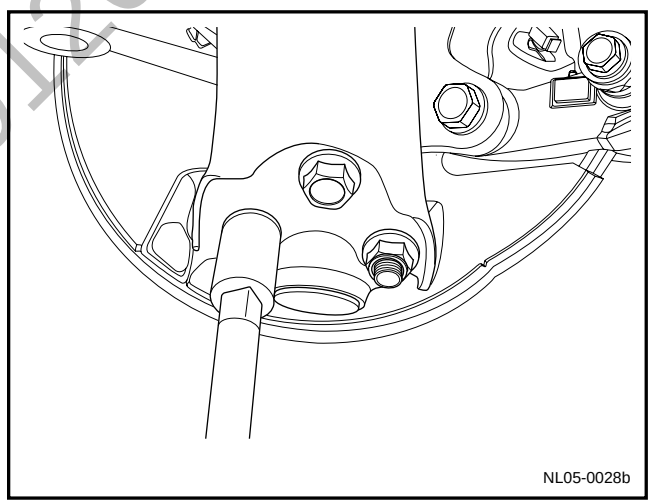
Push in the process of installation and confirm whether installing in place.

2. Install outer section of drive shaft.



3. Install and tighten fixing bolt and nut of lower swing arm ball head.

Torque: 80Nm (Metric) 59 . 2lb-ft(English system)



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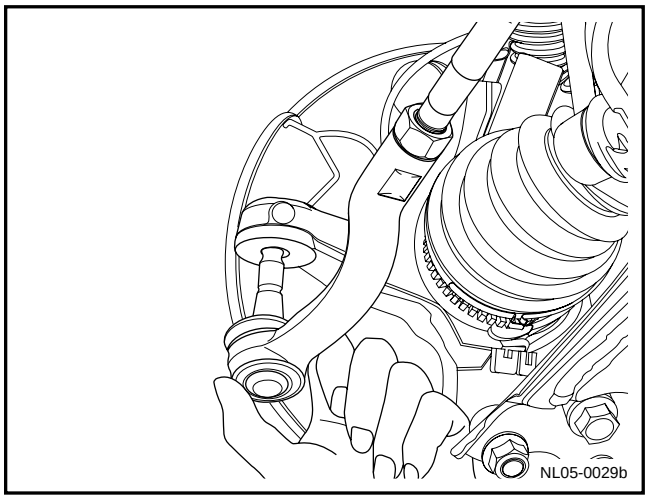
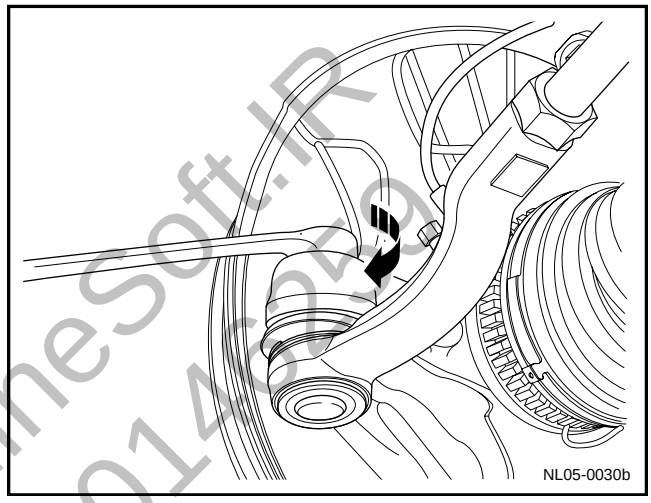
4. Install steering gear tie rod ball head.

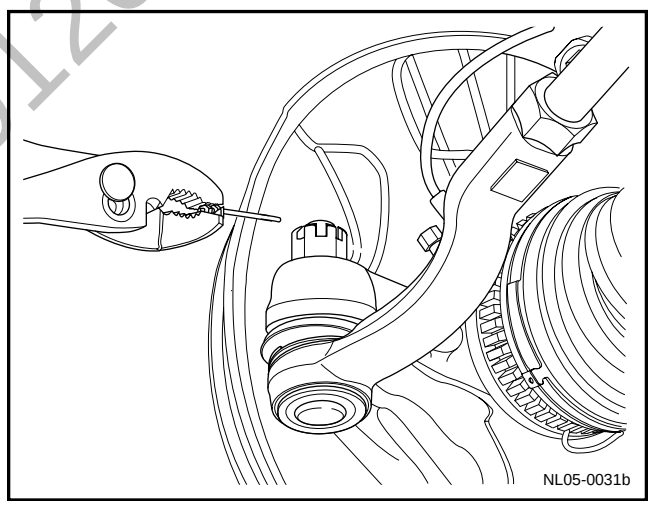


5. Install and tighten the steering engine tie rod ball nut.

Torque:33 Nm (Metric) 24.4 lb-ft (English system)



6. Install the locking pin for the steering gear tie rod ball nut.



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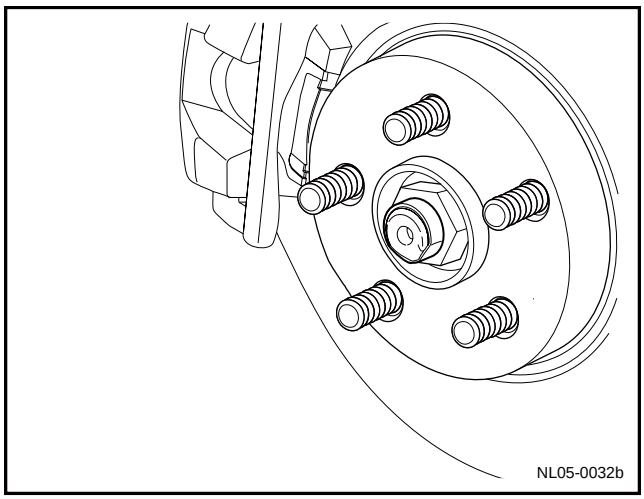
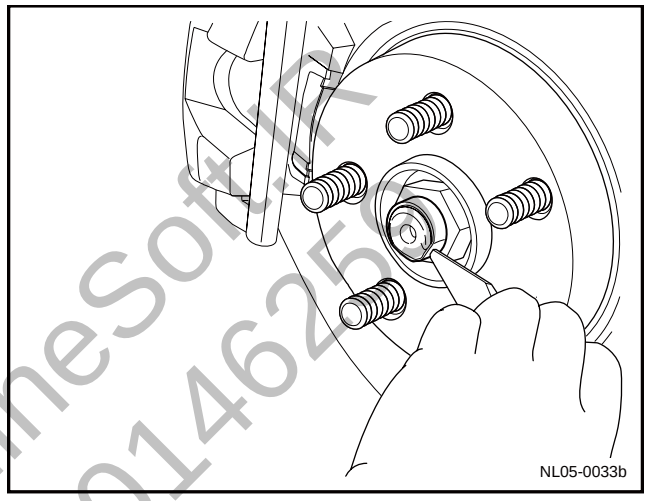
7. Install and tighten the external locking nut for the drive shaft.

Torque: 125Nm(Metric) 92.5lb-ft (English system)



8. Lock the self-lock device for the external locking nut of the drive shaft with a punch.
9. Install the tires.
10. Fasten tire bolt.
11. Connect the battery negative cable.



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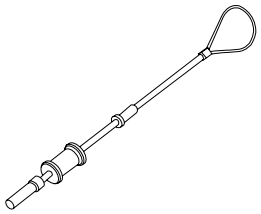
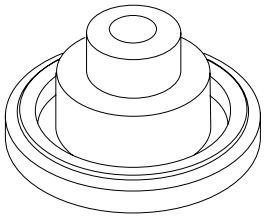
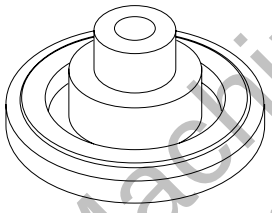
5.3.5 Special tools and equipment

5.3.5.1 Special tools list

S/N	Illustration	Tool No.	Description
1	 NL01-2026b	GL401-002	Tool for dismantling inner ball joint of drive shaft
2	 NL01-2009b	GL201-009	Tool for installing and removing differential clutch housing oil seal
3	 NL01-2010b	GL201-010	Tool for installing and removing differential transmission housing oil seal

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6 Brake System

6.1 Warning and precaution

6.1.1 Warning and precaution

Warning for ABS Component handling

Warning!

Certain parts in the antilock brake system (ABS) can not be independently repaired; if certain system parts are tried to dismantle or disconnect, personal injury and/or abnormal operation of system may be caused; therefore, only the parts capable of being dismantled and installed can be repaired.

Warning for brake dust

Warning!

When repairing the wheel brake part, please avoid the following operations:

–Do not repair or grind the brake lining.

–Do not polish the brake padwith sand paper.

–Do not clean the wheel brake parts with dry brushes or compressed air.

Warning!

Some modes or after-sales retrofitting part may contain fibers which are mixed in the dust. Inbreathing dust containing fiber can damage your health severely. Please use a water-dampened cloth in order to remove any dust on brake components.

Warning for brake fluid

Warning!

The brake fluid is made of polyethylene glycol, which is extremely easy to absorb humidity and moisture. Do not use the brake fluid that may be polluted by water in open container, because the use of improper or contaminated brake fluid may lead to system failure, losing control of the vehicle and personal injury.

Warning for brake fluid irritation

Warning!

The brake fluid has irritation to skin and eyes. Only adopted measure as follow:

Eye contact - completely rinse eye with clean water.

Skin contact – use soap water or clean water to rinse.

Warning for brake pipe replacement

Warning!

Warning: Carefully route and retain the brake pipes replacement. Always use the correct fasteners. Otherwise, it may cause damage to the brake pipes and brake system resulting in personal injury.

Important precaution on adding fluid to the brake system

Notes:

When adding the brake fluid into the brake master cylinder, only use the brake fluid in the clean and sealed brake fluid container in accordance with Super DOT4. The use of any type of fluid other than the recommended type of brake fluid may cause contamination which could result in damage to the internal rubber seals and/ or rubber linings of hydraulic brake system components.

Important precaution on brake caliper

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Notes:

You should support the brake caliper with a steel wire during dismantlement of the brake caliper to avoid damaging the brake hose.

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6.2 Front brake

6.2.1 Specifications

6.2.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lb-ft)
Brake hose bolt	M10×1	28-34	20-24
Brake caliper bolt	M12×1.25	99-121	71-86
Brake caliper support bolt	M8×1.28	39-45	28-32

6.2.1.2 Specifications of front wheel disc brake parts

Applications	Specification	
	Metric（mm）	English System (in)
Scrapped Front Brake Disc Thickness	16	0.624
Allowable end face run-out of front brake disc	Be less than or equal to 0.005 on the same circle as well as be less than or equal to 0.005 on the same radius.	-
Front brake disc thickness-new	18	0.702
Standard thickness of front brake blade gasket	12	0.468
Minimum thickness of front brake blade gasket	2	0.078

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6.2.2 Description and operation

6.2.2.1 Description and operation

Front disk-type brake system is composed of:

The front disk-type brake system consists of the following components:

Brake pad: the mechanical output force from the hydraulic brake caliper is acted on the friction surface of the brake disc.

Brake pad guiding piece: located between the disc-type brake pad and the brake pad mounting bracket to keep the brake pad moving smoothly, thereby eliminating noise.

Brake disc: the tire and wheel assembly is slowed down through the mechanical output force acted by the disc-type brake pad on the brake disc friction surface for the braking of the vehicle.

Brake caliper: receive the hydraulic pressure from the brake master cylinder, convert the hydraulic pressure into the mechanical output force to act on the internal brake pad, and enable the brake caliper piston to automatically

return when the master cylinder returns.

Brake caliper and brake pad bracket: used for fixing the disc-type brake pad and the brake caliper in place to keep in correct coordination with the hydraulic brake caliper; and slide the brake pad when the mechanical output force acts on the brake pad.

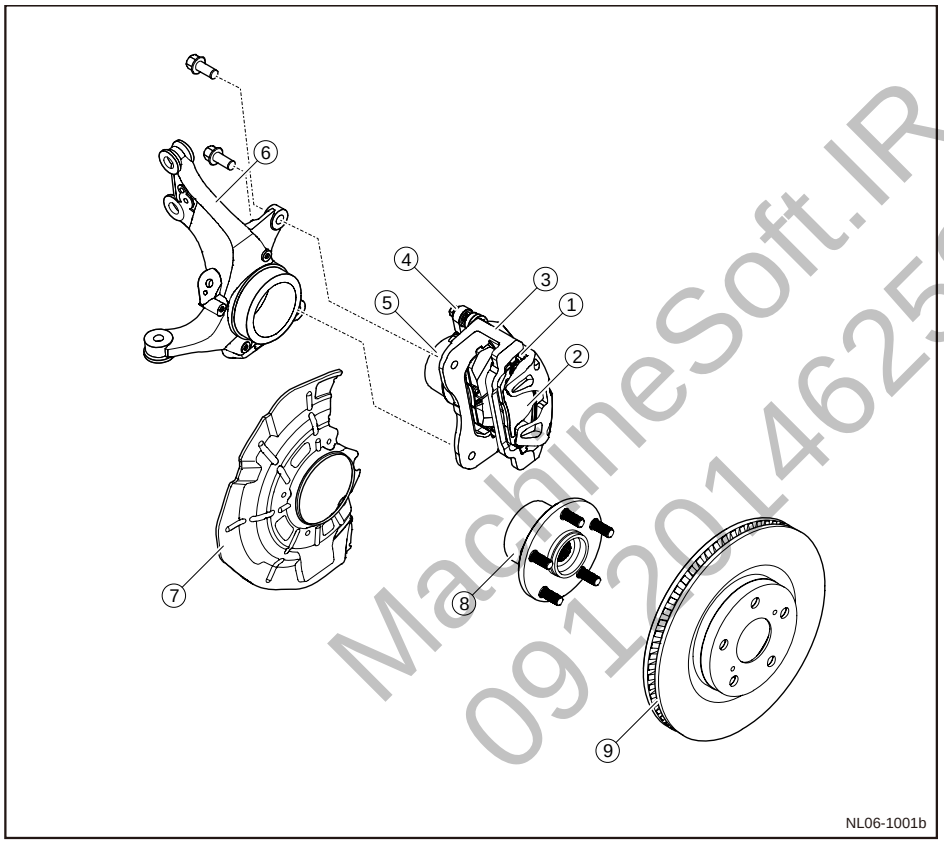
Floating pin of brake caliper: used for mounting the hydraulic brake caliper and fixing the brake caliper in place to keep in correct coordination with the brake caliper bracket; and leading the brake caliper to slide with respect to the brake pad when the mechanical output force acts on.

Front disk-type brake system operated :

The mechanical output force from the hydraulic brake caliper piston is acted on the internal brake pad ; when the piston pushes the internal brake pad outward, the brake caliper housing pulls the external brake pad inward at the same time so as to uniformly distribute the output force; the brake pad applies the output force to both friction surfaces of the brake plate so as to slow down the tire and the wheel assembly; and it is very important to uniformly distribute the brake force whether the functions of the brake pad guide plate and the brake caliper floating pin are normal.

6.2.3 Disassemble drawings

6.2.3.1 Disassembly Diagram



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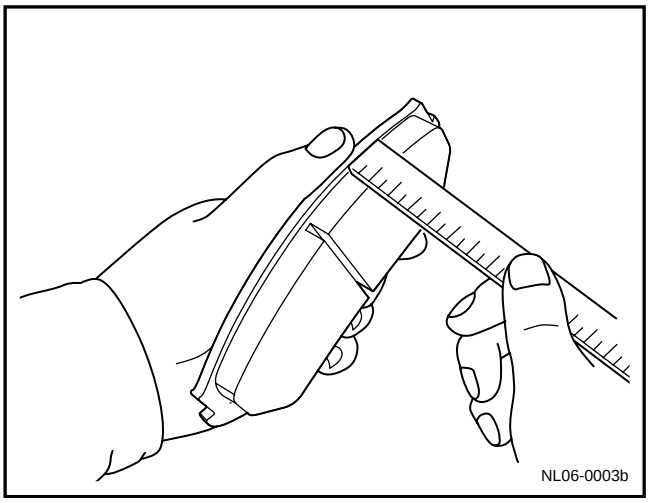
1. Brake pad guide plate
2. brake pad
3. Brake caliper mounting bracket
4. Float pin sealing ring
5. Brake caliper
6. Steering joint
7. Disc-type brake anti-dust cover
8. Hub assembly
9 . Brake disc

6.2.4 Diagnostic information and procedures

6.2.4.1 Brake pad inspection

1. Regularly inspect brake padand conduct measure according to the following figure. If it exceeds specification, replace brake lining.
2. If replacement is unavoidable, it is necessary to replace disc brake padin accordance with complete set of vehicle axle.
3 . Check if friction surface of disc- brake padis clack or damaged.



6.2.4.2 Brake caliper inspection

1. Inspect whether brake caliper has crack, serious abrasion and damage. If yes, replace brake caliper.
2. Inspect whether sealing ring of dust cover of brake caliper pistion has crack, breakage, gap, ageing and wrong installation out of brake caliper body. If yes, replace brake caliper.
3. Inspect whether there is brake fluid leakage around brake caliper piston dustproof cover sealing ring and from disc brake pad block, if yes, replace brake caliper.
4. Check whether the brake caliper piston can smoothly enter the brake caliper cylinder in full stroke. The brake caliper piston shall be able to move smoothly and uniformly in the brake caliper cylinder. The brake caliper needs to be replaced if the brake caliper piston is jammed or can hardly reach the bottom.

6.2.4.3 Brake pad guide plate inspection

Inspect whether brake pad guide piece is missing, has serious corrosion, or protruding tone bending due to inspection.

If any of situations above ocurrs, it is necessary to replace disc brake pad guide piece. Ensure the brake pad slides on the disc-type filler block guide blade smoothly, without retardation.

6.2.4.4 Brake caliper floating pin inspection

Check if brake caliper float pin exist condition as follow :

– Clamping stagnation
– Locked
– Sheath clack or damaged
– Sheath lack

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If any above situations are found, need to replace the brake caliper and dust cover seal ring.

6.2.4.5 Brake disc surface and wron n inspection

1. Clean brake disc friction surface by using industrial alcohol or allowed similar equivalent brake cleaning agent.
2. Inspect whether brake disc friction surface has the following situations:

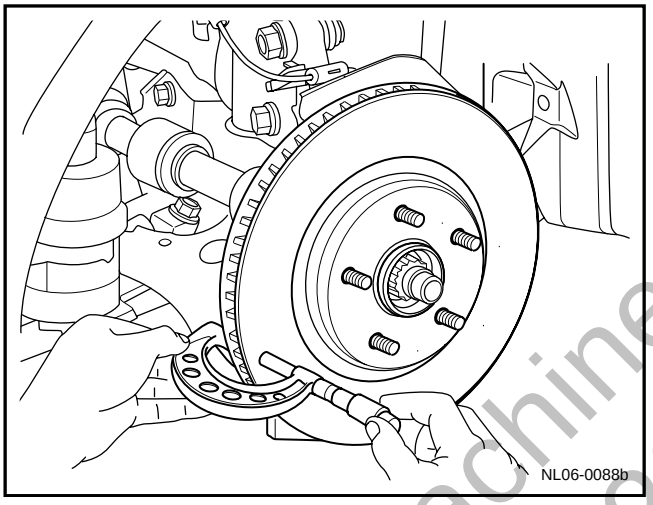
- Serious rust and/ or spot pitting
- Slight surface rusting
- Crack and / or burnings
- Serious decolor and turn into blue.
- Crack depth on brake disc friction surface

If the friction surface of the brake disc incurs the above on or more situations, the brake disc needs surface dressing or replacement.

Notes:

After surface dressing or replacement of the brake disc, further replace the brake pad .

6.2.4.6 Brake disc thickness measure



1. Clean brake disc friction surface by using industrial alcohol or smilar brake cleaning agent.
2. Use micrometer to measure and record minimum thickness of 4 or more than 4 position points uniformly distributed along the circumference of brake disc. Make sure that the measurement is only limited in brake padand contact surface area, and the distance between micrometer and exterior edge of brake disc during each measurement must be equal.
3. If thickness of brake disc exceeds specifications, brake disc needs to be repaired on its surface or replace.

Notes:

After surface dressing or replacement of the brake disc, further replace the brake pad .

6.2.4.7 End-face runout measure after brake disc installed

Notes:

When the brake disc is dismantled from the hub/axle flange, clean up rust or dirt on the matching surface of the hub/axle flange and the brake disc; otherwise, it may result in oversized end face runout after the brake disc is

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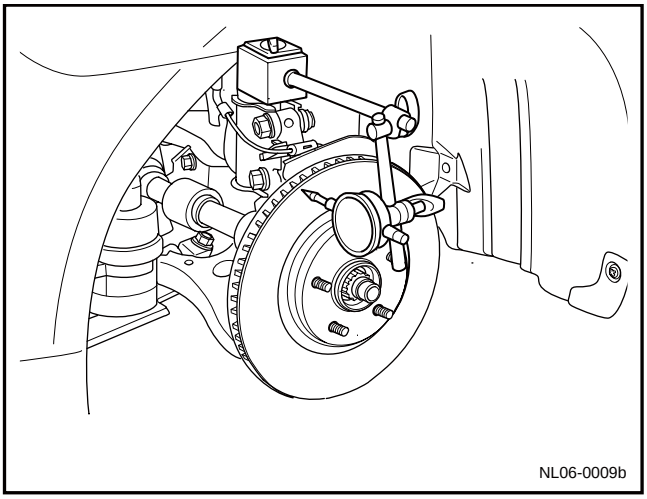
assembled to result in brake pulsation.



1. For dismantling of brake disc from vehicle, refer to 6.2.5.3 Replacement of brake disc and/ or 6.3.5.3 Replacement of brake disc - rear.
2. Clean brake disc friction surface by using industrial alcohol or smilar brake cleaning agent.
3. Install brake disc onto wheel hub/ axle flange.
4. Install the nut with hand and tighten with a wrench.
5. Install the dial indicator base to the steering joint and put the dial indicator measurement head in place in such a manner that the dial indicator measurement head is made to contact with the brake disc friction surface at an angle of 90° and is about 13mm (metric) or 0.5in (English) from the external edge of the brake disc.
6. Rotate the brake disc until the reading from the dial indicator reaches the minimum and then zero the dial indicator.
7. Rotate the brake disc until reading from the dial indicator reaches the maximum.
8. Mark and record the disc side face run-out.
9. Compare the disc side face run-out with the value as specified.

   Standard value : mm (Metric) in (English system)
10. If runout of rear end face exceeds stated specification after assembly of brake disc, it is necessary to inspect bearing axial clearance and runout of axle wheel hub. If axial clearance and runout of axle wheel hub are normal and brake disc thickness is within specified range, it is necesary to repair the surface of brake disc to ensure correct levelness.

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6.2.5 Dismantle and installation

6.2.5.1 Brake pad replacement －front

Dismantle procedure：

Warning!

See warnings for vehicle lifting in warnings and precaution.

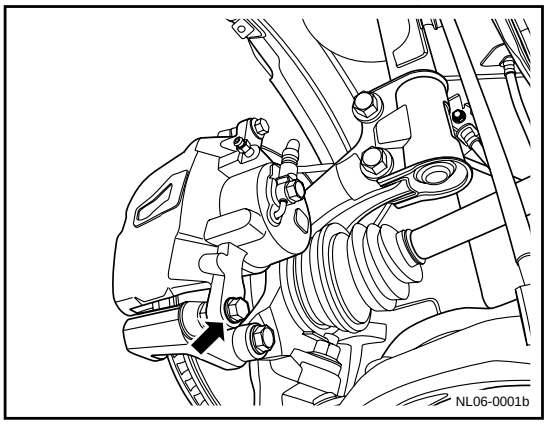
See warnings for brake dust in warning and precaution.

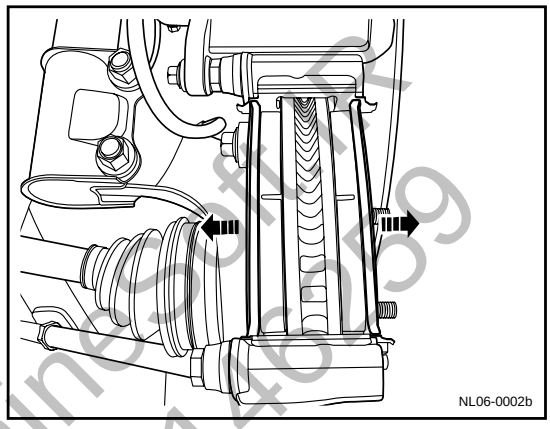
1. Lifting vehicle method see 1.3 lifting vehicle

Notes:

In order to keep the wheels balanced, mark the position of the hub with respect to the hub before dismantling the tires.

2. For dismantling of front wheels, refer to 4.4.5.1 Replacement of wheels.
3. Dismantle lower assembly bolt of brake caliper.
4. Turn the brake caliper upwards.
5. Dismantle the brake pad.





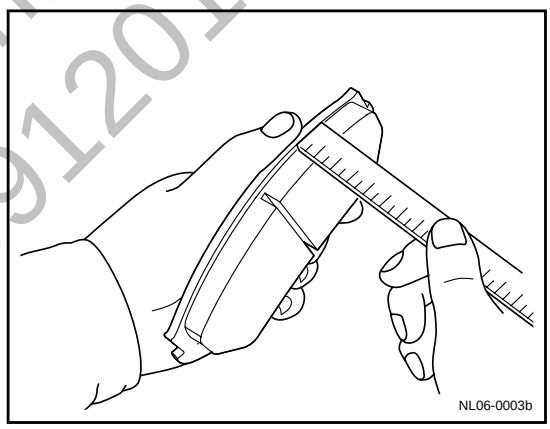
6. Check the brake pad.

Standard thickness:12mm(305in)

Min. thickness:2mm (51in)

Notes:

If the brake pad lining is less than minimum value, replace the front brake pad.



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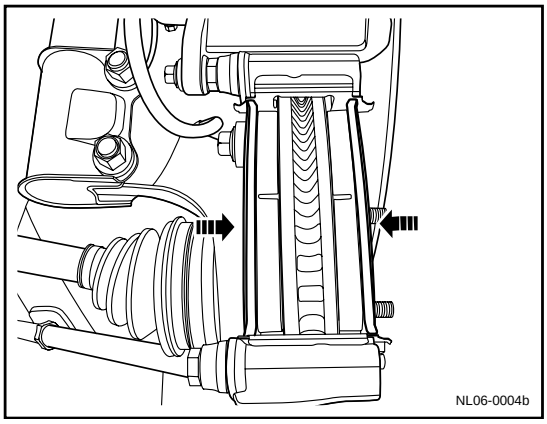
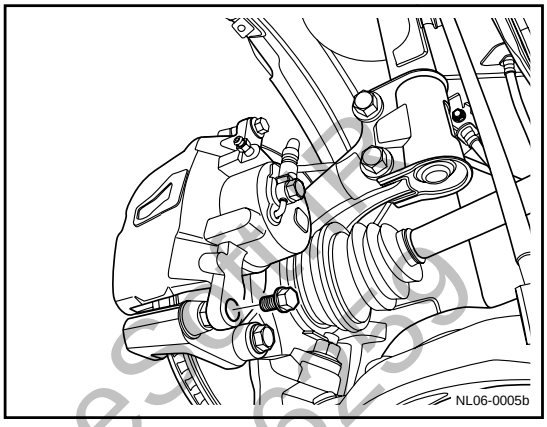
Installation Procedure:

1. Inspect thickness of brake pad
2. Install brake pad into brake caliper.



3. If necessary, use special tool to push piston.



Notes:

Be careful when pulling the brake caliper downward and assembling the bolt at the lower end. Do not damage the piston dustproof sealing element.

4. Pull down the brake caliper and install the lower assembly bolt.

   Torque: 110Nm (Metric) 81. 4lb-f t(English system)

5. Install the front wheels aligning to the mark made during the dismantlement.
6. Lower the vehicle.

Notes:

Similarly disassembly method of left/right front brake pad.

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6.2.5.2 Brake caliper replacement —front

Dismantle procedure：

Warning!

See warnings for vehicle lifting in Warnings and precaution .

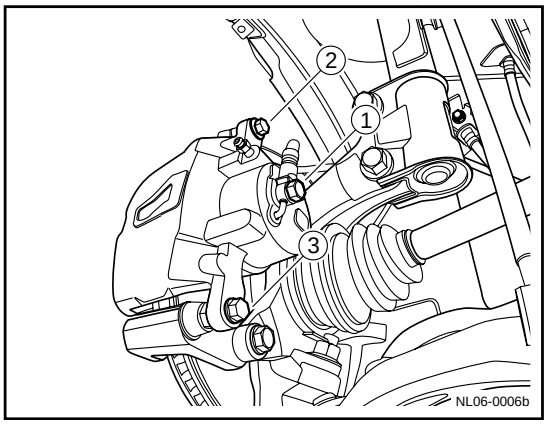
Special precaution for brake fluid affected paint and electrical component see warning and caution.

1. For lifting vehicle refer to 1.3 lifting vehicle.

Notes:

In order to keep the wheels balanced, mark the position of the hub with respect to the hub before dismantling the tires.

2. For dismantling of front wheel, refer to 4.4.5.1 replacement of wheels.
3. Dismantle inlet bolt 1 of brake hose of brake caliper, and plug brake caliper inlet and brake hose, to prevent brake fluid from lossing and pollution.
4. Dismantle upper and lower fixing bolts 2 of brake caliper.



Installation Procedure:

1. Install upper /lower fixing bolt 1 of brake caliper.

   Torque:30 Nm (Metric) 22.2 lb-ft (English system)
2. Install 2 brake caliper brake hose fixing bolts.

   Torque:30 Nm (Metric) 22.2 lb-ft (English system)
3. Install the front wheels
4. Lower the vehicle.
5. Add clean brake fluid into the master cylinder reservoir to the correct level.
6. For exhausting of the air in the brake system, see 6.4.5.5 hydraulic brake system air purging procedures.

Notes:

Similarly disassembly method of left/right front brake caliper.

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6.2.5.3 Brake disc replacement

Dismantle procedure：

Warning!

See Warnings for lifting vehicle in warning and precaution .

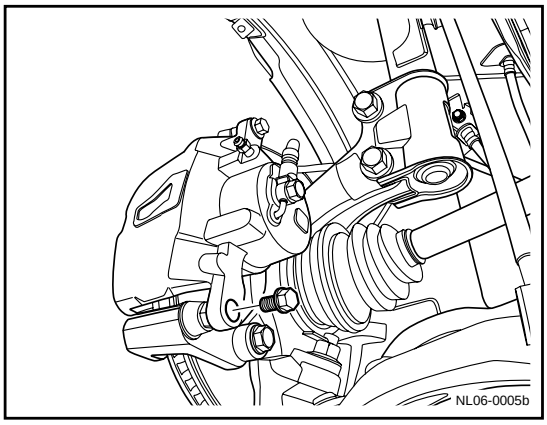
1. For lifting vehicle see 1.3 lifting vehicle.

Notes:

In order to keep the wheels balanced, mark the position of the hub with respect to the hub before dismantling the tires.

2. For dismantling of front wheels, refer to 4.4.5.1 Replacement of wheels.

3. For dismantling of brake pad, refer to 6.2.5.1 replacement of brake pad- front.



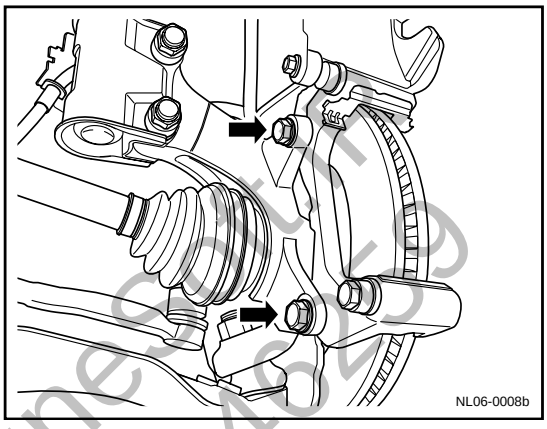
4. Dismantle upper and lower fixing bolts of brake caliper.

Notes:

To dismantle the brake caliper, you do not need to dismantle the brake caliper brake hose but should hang the brake caliper with a steel wire to avoid damaging the brake hose.

5. Remove the fixing bolts for the brake caliper anchor.

6. Dismantle the brake disc.



Notes:

The matching mark is marked on the brake disc and the axle hub.

7. Check the thickness of the brake disc. If the thickness of the front brake disc is smaller than the minimum, then replace the front brake disc.

Standard thickness:18mm(457in)

Min. thickness:16mm (406in)

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8. Check the brake disc for run-out.

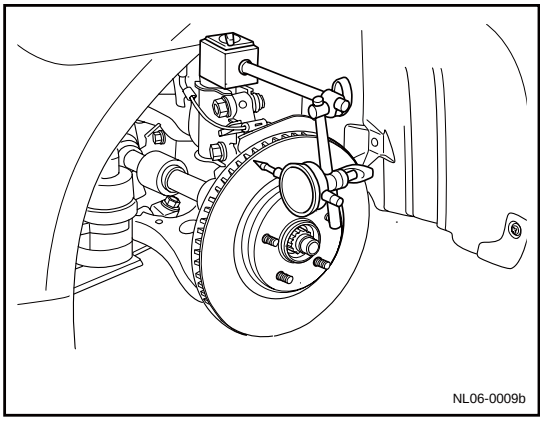
a. Install the front brake disc.

b. Tighten the brake disc with a special tool and hub nuts.

Torque:125 Nm(Metric) 92.5 lb-ft(English system)

c. Install the dial indicator on the shock absorber away from the axle hub and rotating speed sensor.

A dial indicator is used for measuring the brake disc rub-out in the position of 13mm (0.53 in) distancing from the edge of the brake disc.



Max. brake disc runout:0.005mm (0.002in)

Notes:

If the brake disc run-out exceeds the maximum, firstly change the mounting position of the brake disc and the axle to minimize the brake disc run-out; if the brake disc run-out further exceeds the maximum after changing the mounting position, inspect the upward clearance of the bearing and the run-out of the axle hub; if the bearing clearance and the axle hub run-out are normal, or the thickness of the brake disc is within the specified range, grind the brake disc; and if the brake disc is thinner than the minimum value, replace the brake disc.

Installation Procedure:

1. Align marks of brake disc and axle wheel hub, and install brake disc.

2. Install brake caliper support fixing bolt and tighten it.

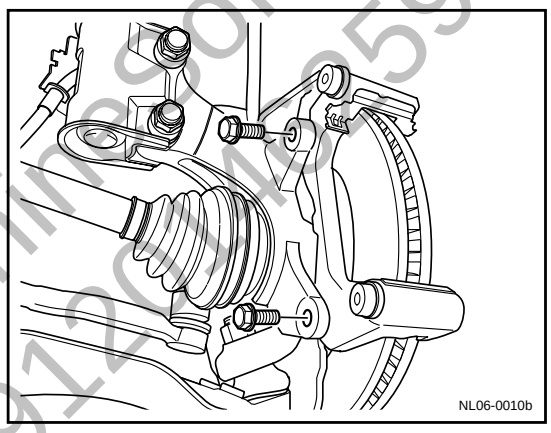
Torque:30 Nm(Metric) 22.2 lb-ft(English system)

3. Install brake caliper.

4. Install brake pad.

5. Install the front wheels

6. Lower the vehicle.



Notes:

Similarly disassembly method of left/right front brake disc.

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6.3 Rear brake

6.3.1 Specifications

6.3.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lb-ft)
Brake hose bolt	M10×1	28-34	20.7-25.2
Brake caliper bolt	M12×1.75	99-121	73.3-89.5
Brake caliper support bolt	M8×1	39-45	33.3

6.3.1.2 Specifications of rear wheel disc brake parts

Applications	Specification	
	Metric（mm）	English System (in)
Rear brake disc scrapping thickness	9	0.351
Allowable end face runout of rear brake disc	Be less than or equal to 0.005 on the same circle as well as be less than or equal to 0.005 on the same radius.	
Rear brake disc thickness-new	11	0.429
Standard thickness of rear brake blade gasket	10.9	0.425
Minimum thickness of rear brake blade gasket	2.0	0.078

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6.3.2 Description and operation

6.3.2.1 Description and operation

Composition of rear disc-type brake system:

The rear wheel disk-type brake system consists of the following components:

Brake pad: the mechanical output force from the hydraulic brake caliper is acted on the friction surface of the brake disc.

Brake pad guiding piece: located between the disc-type brake pad and the brake pad mounting bracket to keep the brake pad moving smoothly, thereby eliminating noise.

Brake disc: the tire and wheel assembly is slowed down through the mechanical output force acted by the disc-type brake pad on the brake disc friction surface for the braking of the vehicle.

Brake caliper: receive the hydraulic pressure from the brake master cylinder, convert the hydraulic pressure into the mechanical output force to act on the internal brake pad, and enable the brake piston to automatically return when the master cylinder returns.

Brake caliper and brake pad bracket: used for fixing the disc-type brake pad and the brake caliper in place to keep in correct coordination with the hydraulic brake caliper. When mechanical output force plays the role on the brake pad, slide the brake pad.

Disc-type brake caliper floating pin: used for mounting the hydraulic brake caliper and fixing the brake caliper in place to keep correct coordination position with the brake caliper bracket. When mechanical output force affects, the brake caliper is slid with respect to the braking filler block.

Operation of rear disc-type brake system:

The mechanical output force from the hydraulic brake caliper piston is acted on the internal brake pad; when the piston pushes the internal brake pad outward, the brake caliper housing pulls the external brake pad inward at the same time so as to uniformly distribute the output force; and the brake pad applies the output force to both friction surfaces of the brake plate so as to slow down the tire and the wheel assembly. Whether the function of the brake pad and the brake caliper component is normal is very important to uniformly distribute the brake force.

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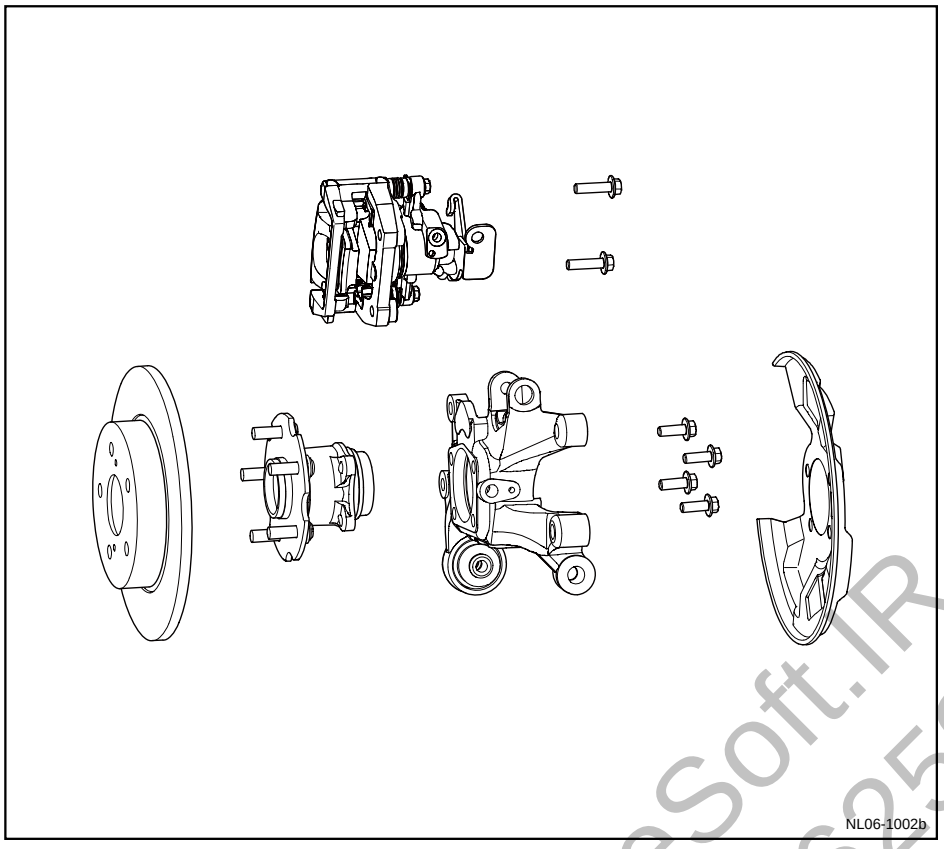
6.3.3 Disassemble drawings

6.3.3.1 Disassemble drawings



1. Brake pad guide plate
2. Brake pad
3. Brake caliper
4. Brake caliper mounting bracket
5. Floating pin dust cover
6. Disc brake dust cover
7. Knuckle
8. Hub assembly
9. Brake disc

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6.3.4 Diagnostic information and procedures

6.3.4.1 Diagnostic information and procedures

The rear brake-related diagnostic information and step refer to 6.2.4 diagnostic information and Step

6.3.5 Dismantle and installation

6.3.5.1 Brake pad replacement —rear

Dismantle procedure

Warning!

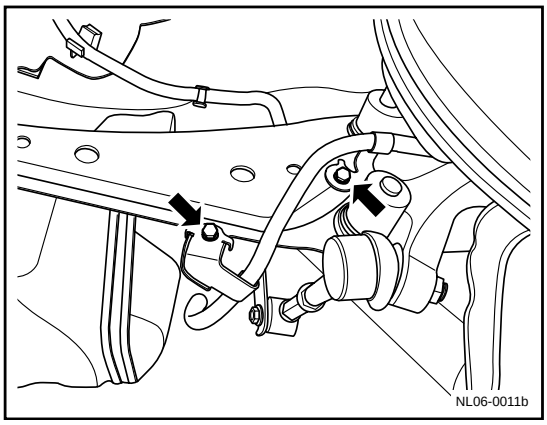
See Warnings for vehicle lifting in warnings and precaution.

See Warnings for brake dust in warnings and precaution.

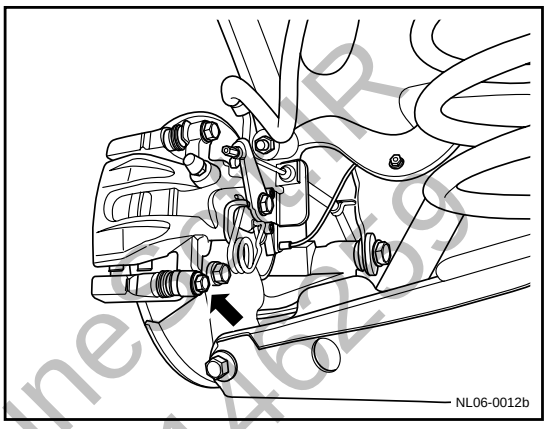
1. Release parking brake.
2. For lifting vehicle see 1.3 lifting vehicles.

Notes:

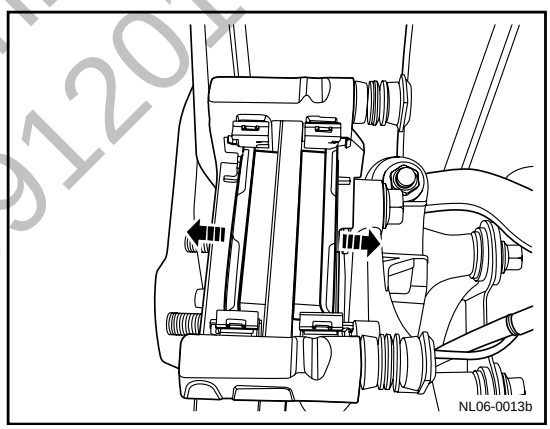
In order to keep the wheels balanced, mark the position of the hub with respect to the hub before dismantling the tires.



3. For dismantling of rear wheel, refer to 4.4.5.1 Replacement of wheels.
4. Dismantle fixing bolt of parking brake cable.
5. Remove the upper and lower assembled bolts for the brake caliper.



6. Turn the brake caliper upwards.
7. Dismantle the brake pad.



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8. Check the brake pad.

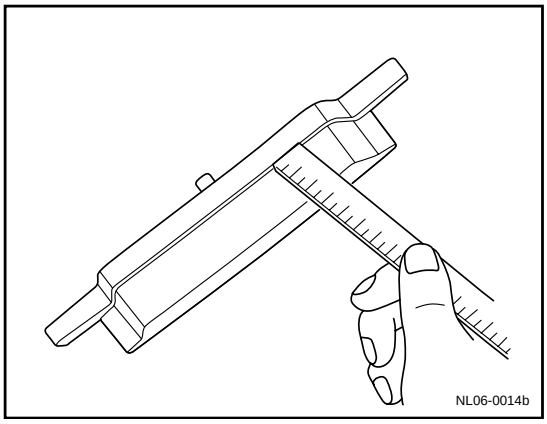
Standard thickness: 10. 9mm (0 . 425in)

Min. thickness:2mm (0.078in)

If the brake pad lining is thinner than minimum value, replace the rear brake pad.

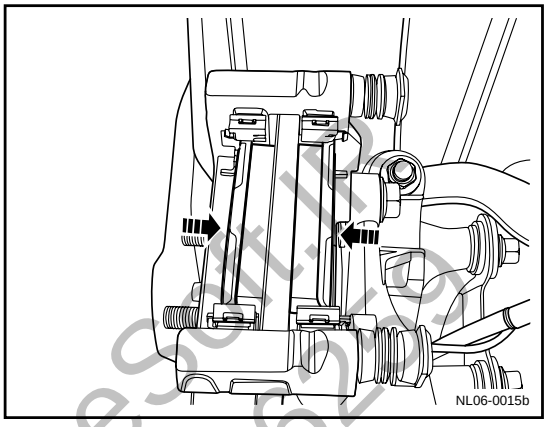
Notes:

After replace brake pad, check worn condition of rear brake disc.



Installation Procedure:

1. Inspect thickness of brake pad friction lining
2. Install brake pad into brake caliper.



3. If necessary, use application tool to push piston.

Notes:

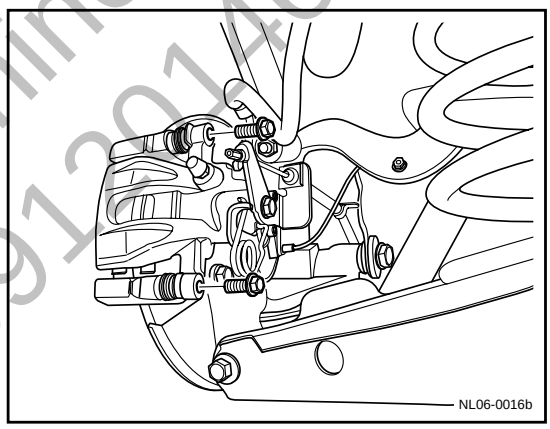
Be careful when pulling the brake caliper downward and assembling the bolt at the lower end. Do not damage the piston dustproof sealing element.

4. Install brake caliper and tighten assembly bolt.

Torque:100Nm (Metric) 74 lb-ft (English system)

Notes:

Refer to fastener important precaution in the warning and precaution



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5. Install the parking brake cable fixing bolt.

Torque:9 Nm (Metric) 6.7 lb-ft (English system)

Notes:

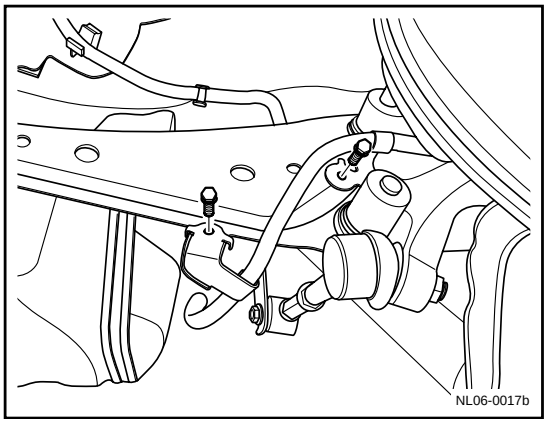
Refer to fastener important precaution in warnings and precaution.

6. Install the rear wheel aligning to the mark made during dismantlement.

7. Lower the vehicle.

Notes:

Similarly disassembly method of left/right rear brake pad



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6.3.5.2 Brake caliper replacement —rear

Dismantle procedure

Warning!

See Warnings for vehicle lifting in warnings and precaution.

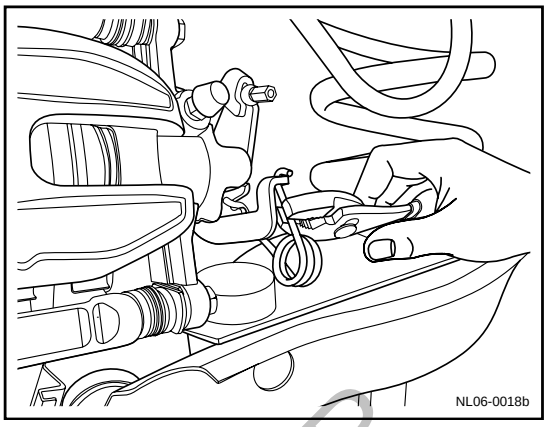
See important precaution for brake fluid affected paint and electrical parts in warnings and precaution.

1. Release parking brake.
2. For lifting vehicle, refer to 1.2 Inspection of vehicle.

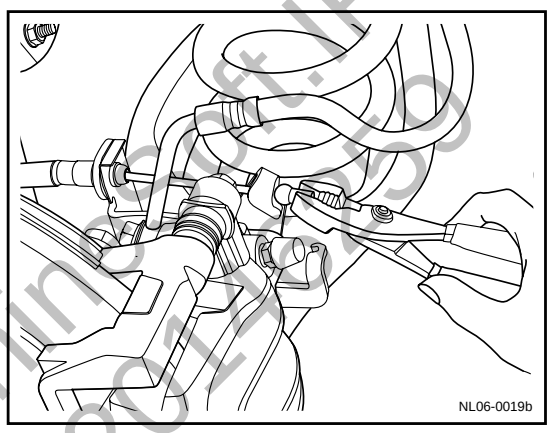
Notes:

In order to keep the wheels balanced, mark the position of the hub with respect to the hub before dismantling the tires.

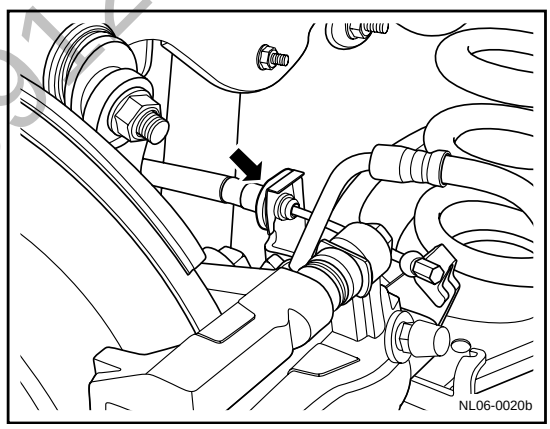
3. For dismantling of rear wheel, refer to 4.4.5.1 replacement of wheels.



4. Loosen parking brake cable return spring from rear brake caliper.
5. Detach the parking brake cable.



6. Remove the the parking brake cable fixing cliping plate



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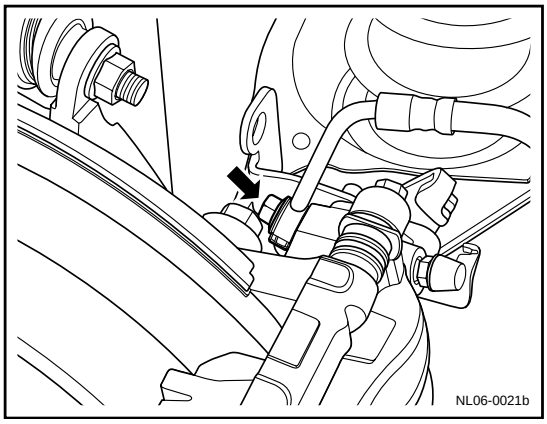
7. Remove the inlet bolt for the brake hose of the brake caliper.
8. Block the inlet of the brake caliper and brake hose to prevent the loss or contamination of the brake fluid.
9. For removal of the upper and lower brake caliper fixing bolts and brake caliper, see 6.3.5.1 replacement of brake pad-rear.



Installation Procedure:

Warning!

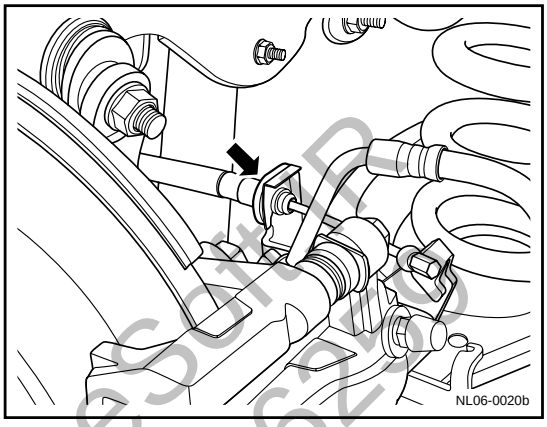
Refer to important precation of fastener in warnings and precaution.

1. Install brake pad and brake caliper onto brake caliper bracket and tighten assembly bolt.

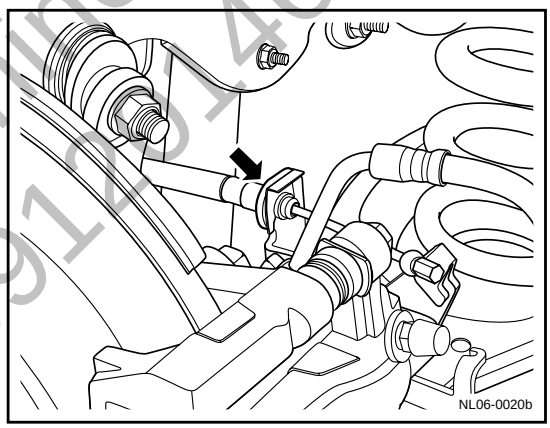
Torque:30 Nm (Metric) 22.2 lb-ft (English system)

2. Install brake caliper oil inlet hose and tighten oil inlet bolt.

Torque:30 Nm (Metric) 22.2 lb-ft (English system)



3. Install fixing clip of parking brake cable.



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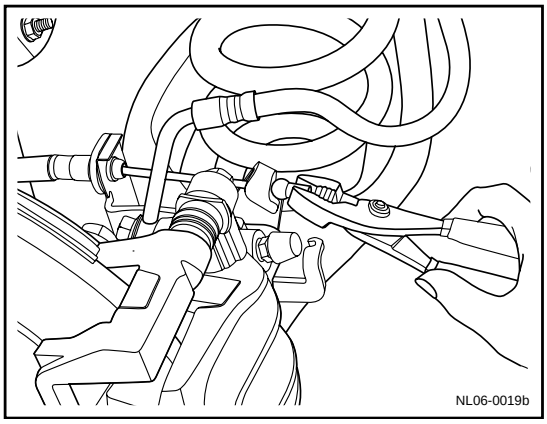
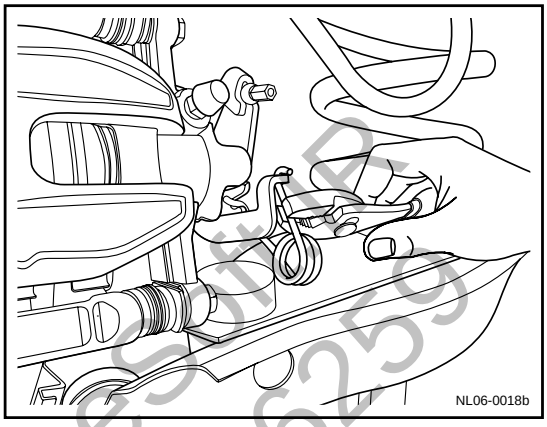
4. Install parking brake cable.



5. Install the parking brake return spring.
6. Install the rear wheels
7. Lower the vehicle.
8. Add clean brake fluid into the master cylinder reservoir to the correct level.
9. For exhausting of the air from the brake system, see 6.4.5.5 Hydraulic Brake System Air Exhausting Procedures.

Notes:

Similarly disassembly method of left/right rear brake caliper.



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6.3.5.3 Brake disc replacement —rear

Dismantle procedure

Warning!

See Warnings for vehicle lifting in warnings and precaution.

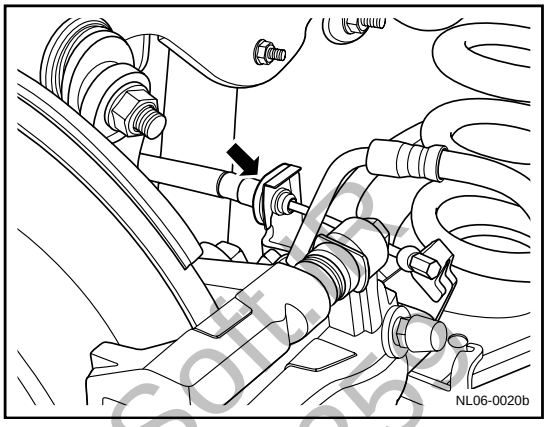
1. Release parking brake.
2. For lifting vehicle, refer to 1.3 lifting vehicle.

Notes:

In order to keep the wheels balanced, mark the position of the hub with respect to the hub before dismantling the tires.

3. For dismantling of rear wheel, refer to 4.4.5.1 Replacement of wheels.

4. For dismantling of brake pad, refer to 6.3.5.1 Replacement of brake pad- rear.



Notes:

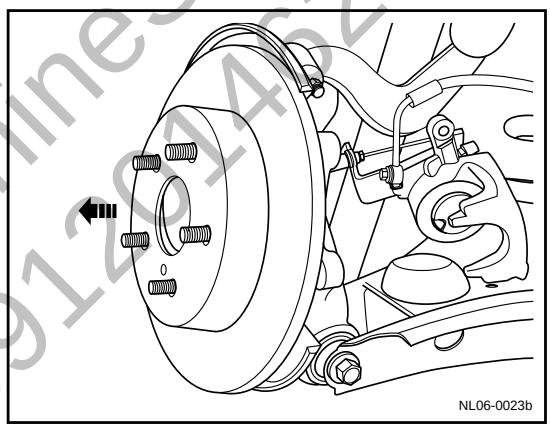
See Important precaution for brake caliper in warnings and precaution.

5. For dismantlement of the brake caliper, see 6.3.5.2 Replacement of brake caliper-Rear.

Notes:

To dismantle the brake caliper, you do not need to dismantle the brake caliper brake hose but should hang the brake caliper with a steel wire to avoid damaging the brake hose.

6. Remove the fixing bolts for the brake caliper support.
7. Dismantle the brake disc.



Notes:

The matching mark is marked on the brake disc and the axle hub.

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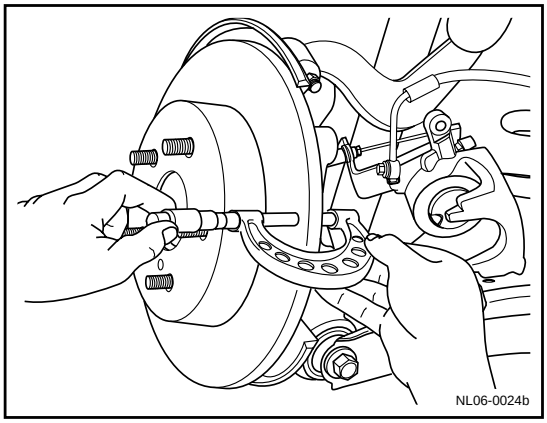
8. Check the thickness of brake disk

Standard thickness:11 mm (0 . 429in)

Min. thickness:9 mm (0.351in)

If the brake disc is thinner than the minimum value, replace the rear brake disc.



9. Check the brake disc for run-out.

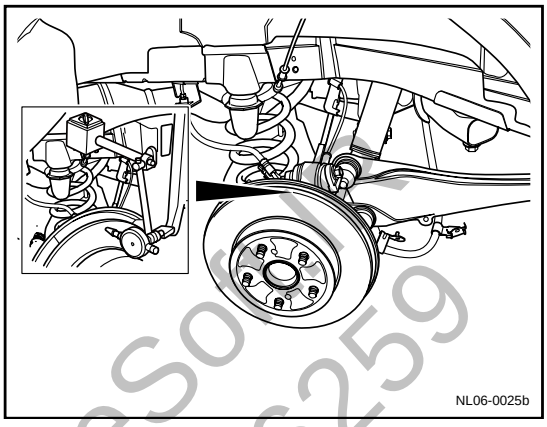
– install front brake disc.

Use special tool and hub not to tight brake disc.

Torque: 5Nm (Metric system) 3.7lb-ft (English system)

Install the dial indicator on the shock absorber where is far from axle wheel hub and speed sensor. A dial indicator is used for measuring the brake disc rub-out in the position of 10mm (0.39 in) distancing from the edge of the brake disc.

Max. brake disc hop: 0.005mm (0.002in)



Notes:

If the brake disc run-out exceeds the maximum, firstly change the mounting position of the brake disc and the axle to minimize the brake disc run-out; if the brake disc run-out further exceeds the maximum after changing the mounting position, inspect the upward clearance of the bearing and the run-out of the axle hub; if the bearing clearance and the axle hub run-out are normal, or the thickness of the brake disc is within the specified range, grind the brake disc; and if the brake disc is thinner than the minimum value, replace the brake disc.

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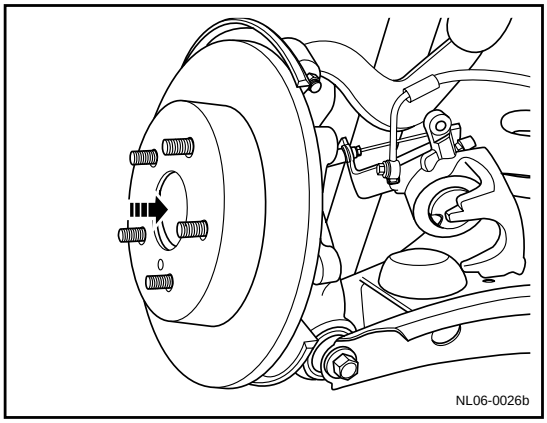
Installation procedure:

1. Align marks of brake disc and axle wheel hub, and install brake disc.



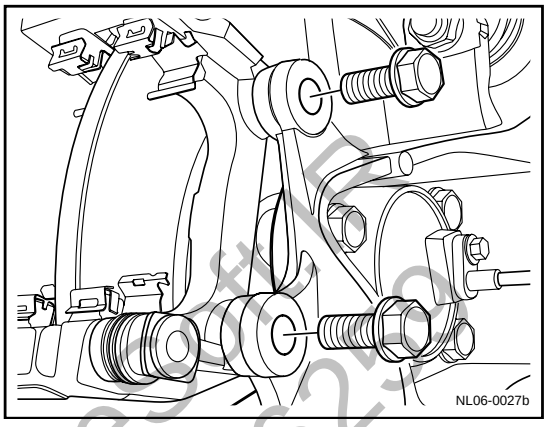
2. Install brake caliper support and tighten bolt.

Torque: 40Nm (Metric) 29. 6lb-ft(English system)

3. Install brake pad.
4. Install parking brake cable.
5. Install the rear wheels
6. Lower the vehicle.

Notes:

Similarly disassembly method of left/right rear brake disc.



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6.4 Hydraulic Brake

6.4.1 Specifications

6.4.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lb-ft)
Brake Master Cylinder Retaining Nut	M8	16 - 22	11.8 - 16.3
Brake hose connector nut	M8	16 - 22	11.8 - 16.3
Vacuum Booster Retaining Nut	M8	16 - 22	11.8 - 19.2
The fixing bolt of brake pedal assembly	M8×20	16 - 26	11.8 - 19.2

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6.4.2 Description and operation

6.4.2.1 Description and operation

The hydraulic brake system comprises the following parts:

Brake pedal: receiving, amplifying and transmitting the input force of the brake system from the driver.

Brake pedal push rod: transmitted to the vacuum booster through the amplified output force of the brake pedal.

Vacuum booster: the input force of the brake system is increased through the brake pedal, and then transmitted to the vacuum booster through the brake pedal push rod, and applied to the hydraulic brake master cylinder through the assistance of the vacuum booster. The vacuum booster utilizes the vacuum source for assistance to reduce the control force of the brake pedal applied by the driver.

Vacuum hose: used for transporting the vacuum source needed to the vacuum booster.

Brake master cylinder fluid reservoir: the inside is equipped with brake fluid used for hydraulic brake system.

Brake master cylinder: the mechanical input force is converted into the hydraulic output pressure which is distributed to two hydraulic oil paths from the master cylinder for providing oil to the diagonal wheel brake oil path.

Brake hard tube and brake hose: transmit the brake fluid to flow through various parts of the hydraulic brake system.

Brake wheel cylinder: converting the hydraulic input pressure into the mechanical output force.

System operation:

The mechanical force from the brake pedal is converted into the oil pressure via the master cylinder, which is conveyed to the brake cylinder through the brake hard tube and the hose after the adjustment of the hydraulic electronic control unit (i.e., HECU), then the oil pressure is converted into the mechanical force through the brake cylinder so that the brake pad compresses the brake disc to brake the vehicle.

Brake fluid level too low warning lamp

When detecting that the brake fluid level is too low (signal circuit is low potential), the combination instrument will turn on the warning lamp on low brake fluid level.

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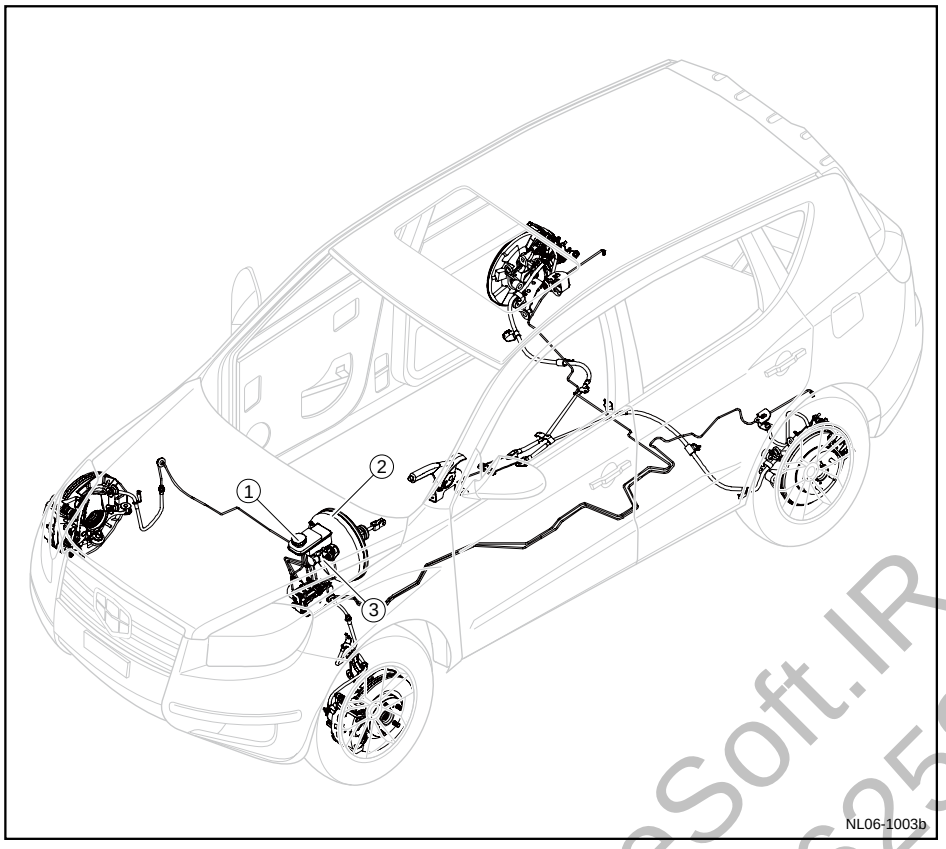
6.4.3 Component position

6.4.3.1 Component position



1. Brake master pump fluid reservoir
2. Vacuum booster
3. Brake main pump.

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6.4.4 Diagnostic information and procedures

6.4.4.1 Troubleshooting precaution

1. Attention should be paid when replacing each part, because it will affect performance of brake system and cause dangerous driving. Geely manufactured standard should be used.
2. When repairing brake system, it is very important to keep the parking and site clean.
3. If any leakage of brake fluid is found, it is necessary to disassemble it. If any abnormal situation is found, replace it with new components.
4. When dismantling the braking components, properly wrapping the brake pipeline to prevent such foreign matters as dust, soil, etc from entering the pipeline.
5. Do not damage or deform the brake line when dismantling or installing it.
6. Make the brake line or hose is not torsioned or bent when installing.
7. The flexible brake hose must be kept away from the shock absorber oil and grease.
8. Make sure the rigid brake pipe and flexible brake hose do not interfere with other components after they are installed.
9. Do not have the brake fluid adhere to such painted surface as the body surface. If the brake fluid is leaked to the painted surface, immediately remove the brake fluid.

6.4.4.2 Fault Symptom Table

Symptoms	Suspected Parts	Measures / Refer to
Brake warning lamp is always on	Brake fluid level	See 6.4.4.3 brake warning lamp keeps normally on.
	Brake fluid level sensor	See 6.4.4.3 brake warning lamp keeps normally on.
	Brake fluid level sensor harness	See 6.4.4.3 brake warning lamp keeps normally on.
The brake system has noise.	1. brake lining(broken, twist, dust, smooth)	See 6.2.4.1 inspection of brake pad in front and rear brake diagnostic information and procedures.
	2. brake caliper bracket fixing bolt (loose)	Check brake caliper support fixing bolt
	3. brake caliper fixing bolt (loosed)	Check brake caliper fixing bolt
	4. brake disc (flaw) (front)	See 6.2.4.5 brake disc surface and wear inspection.
	5. brake disc guide plate (loosening)	See 6.2.4.3 inspection of brake pad guide plate in front and rear brake diagnostic information and procedures.
	6. brake caliper floating pin (wear)	See 6.2.4.4 inspection of brake caliper floating pin in front and rear brake diagnostic information and procedures.

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Brake offset	1. piston(fixed, stuck)	See 6.2.4.2 inspection of brake caliper in front and rear brake diagnostic information and procedures.
	2. brake disc (with crack)	See 6.2.4.5 brake disc surface and wear inspection in front and rear brake diagnostic information and procedures.
	3 . Brake pad(crack . twist or oil mark)	See 6.2.4.1 inspection of brake pad in front and reare brake diagnostic information and procedures.
	4 brake rigid pipe, hose (distorted, deformation)	Check brake rigid pipe and hose
The brake pedal is too hard.	1. hydraulic brake booster system (vacuum leakage, fail)	Inspect the hydraulic vacuum booster.
	2. brake rigid pipe, hose (distorted, deformation)	Check brake rigid pipe and hose
The brake pedal is too soft and the brake is insufficient.	1. brake system brake fluid leakage	Check brake system brake fluid leakage
	2. there is air in brake system.	See 6.4.5.5 hydraulic brake system air exhausting procedures in this section dismantlement and installation.
	3. brake disc (with crack)	See inspection of brake discs in front and reare brake diagnostic information and procedures.
	4. bracke lining (breakage, torsion, excessive wear or oil stain)	See 6.2.4.1 inspection of brake pad in front and reare brake diagnostic information and procedures.
	5 brake master cylinder (internal leakage)	Check brake master pump
brake lag	1. brake pedal free stroke (shortage)	See 6.4.5.8 replacement of brake pedal in this section dismantlement and installation.
	2. parking brake rod stroke (can't be adjusted)	See 6.5.5.4 adjustment of parking brake control mechanism assembly in parking system dismantlement and installation.
	3 .front parking brake cable (struck)	See 6.5.5.3 replacement of parking brake control mechanism assembly control cable.
	4 . left / right parking brake cable (stuck)	See 6.5.5.3 replacement of parking brake control mechanism assembly control cable.
	5 . brake pad(clamping stagnation)	See 6.2.4.1 inspection of brake pad in front and reare brake diagnostic information

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		and procedures.
	Floating pin of brake caliper (rust)	See 6.2.4.4 inspection of brake caliper floating pin.
	6. piston (fixed, jammed)	See 6.2.4.2 inspection of brake caliper in front and rear brake diagnostic information and procedures.
	7. The vacuum booster is jammed.	Inspect the vacuum booster.
	8. brake master pump (fault)	Check brake master pump

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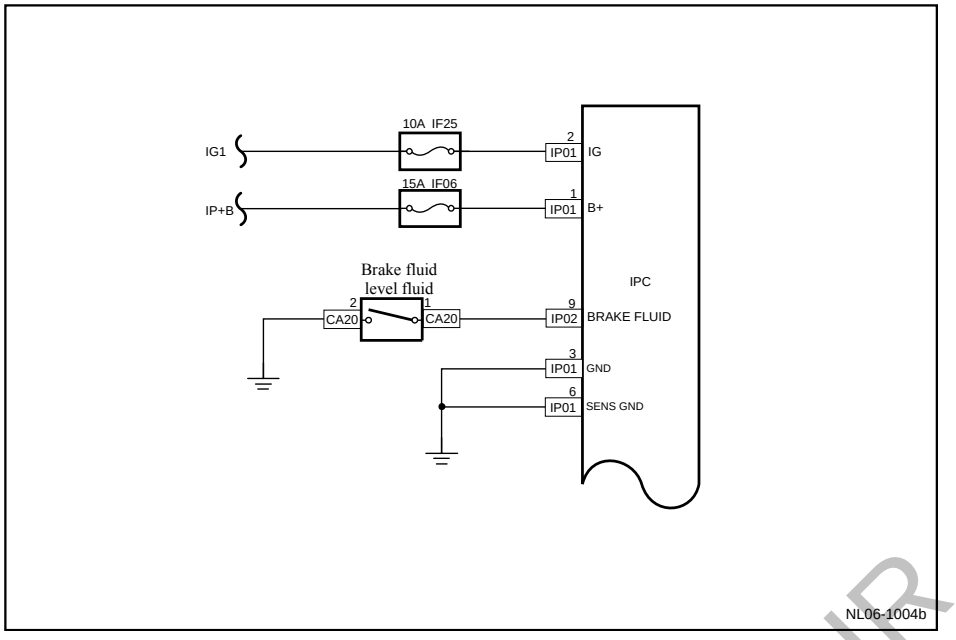
6.4.4.3 Brake warning lamp is always ON

Circuit diagram:



Diagnostic Steps:

1	Check brake fluid level .

A．Check if brake fluid level is normal

No → Fill brake fluid to MAX.

Yes

2	Check the harness (combination instrument asembly power supply, ground).

(a) Make ignition switch turn to OFF.

(b) Disconnect negative cable from battery.

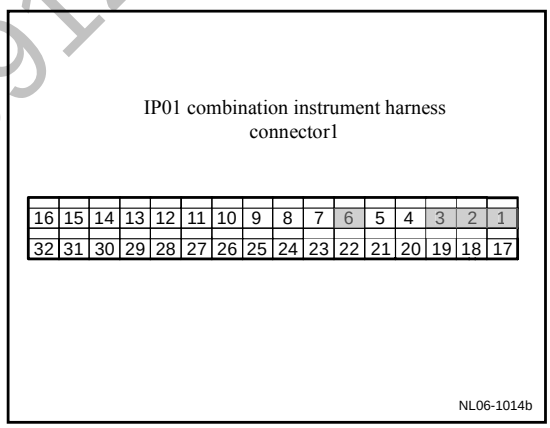
(c) Disconnect IP01 connector from combination instrument

(d) Battery negative cable connects to battery.

(e) Ignition switch was turned to ON (IG).

(f) Use multimeter to measure voltage between connector IP01 terminal 1 and 2 respectively with vehicle body groudning.

Standard voltage：11-14V



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(g) Ignition switch turn to OFF.

(h). Measure the resistance between terminals No.3 / No.6 of connector IP01 and the body ground respectively with a multimeter.

Standard Resistance: Less than 1 Ω

Confirm whether the measured value is accorded with the standard.

No → Check fuse, repair or replace harness

Yes

3	Check brake fluid fluid sensor .

A. Disconnect the harness connector of the brake fluid level sensor.

B. Measure the resistance between 2 terminals of the brake fluid level sensor with the universal meter.

Standard resistant value: infinity

C. Confirm if the resistance conforms to standard value.

No → Replace brake fluid level sensor, refer to 6. 4. 5 . 7 brake fluid

Yes

4	Check brake fluid level sensor harness.

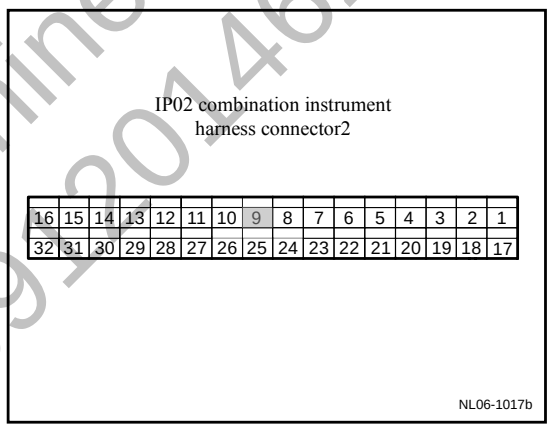
(a) Disconnect combination instrument harness connector IP02.

(b) Use multimeter to measure resistance between IP02 terminal 9 and CA20 terminal 1.

(c) Use multimeter to measure resistance between CA20 terminal 2 and vehicle grounding.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.



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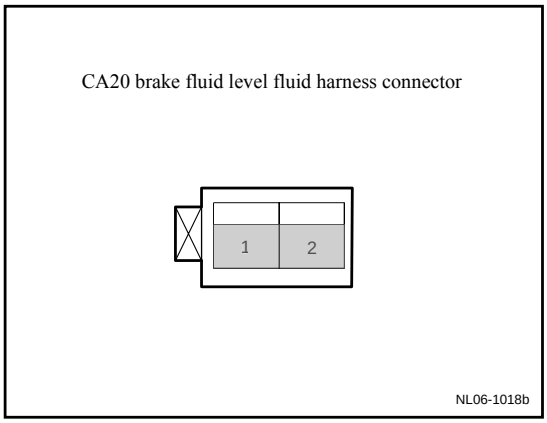

No → Repair or replace the harness.

Yes

5	Replace combination instrument ,

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

(b) Confirm the repair is completed.

Next

6	The system is normal.

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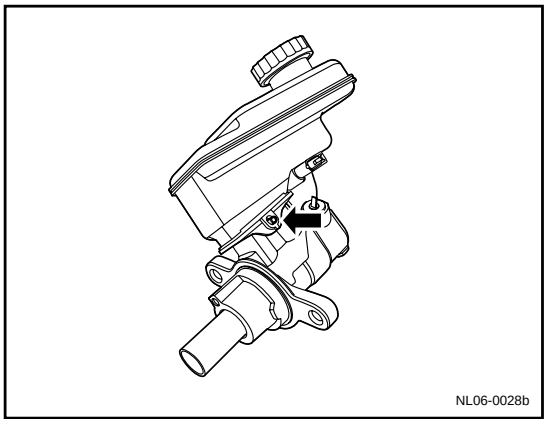
6.4.5 Dismantle and installation

6.4.5. 1 Brake master pump fluid reservoir replacement

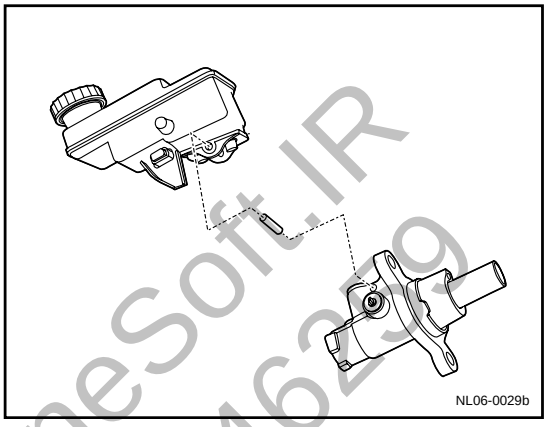
Dismantle procedure

1. For dismantling of brake main pump, refer to 6.4.5.2 Replacement of brake main pump.
2. Take out connecting pin of brake main pump and fluid reservoir, and dismantle fluid reservoir from brake main pump, and replace its sealing element.



Installation procedure:

1. Lubricate sealing element of fluid reservoir by using clean brake fluid.
2. Install lubricated sealing element into brake main pump.
3. Install fluid reservoir to brake main pump, and install connecting pin.
4. Install brake main pump with fluid reservoir.



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6.4.5.2 Brake master pump replacement

Dismantle procedure

Warning!

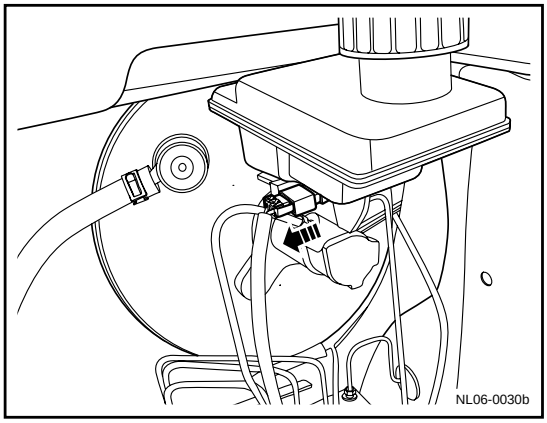
Warning:

Refer to Warning for battery disconnection in warning and precaution.

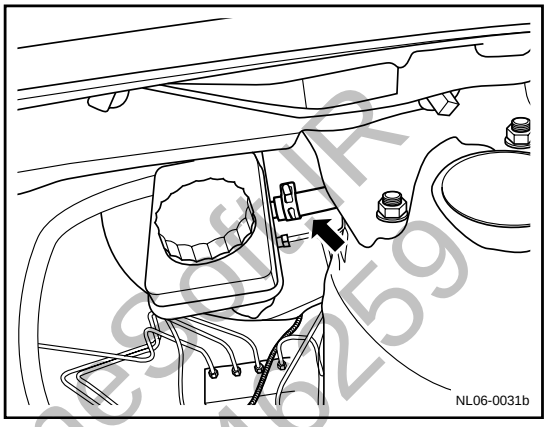
1. Disconnect the battery negative cable. refer to 2.11.8.1 battery cable disconnection/connection procedures .
2. Discharge brake fluid

Notes:

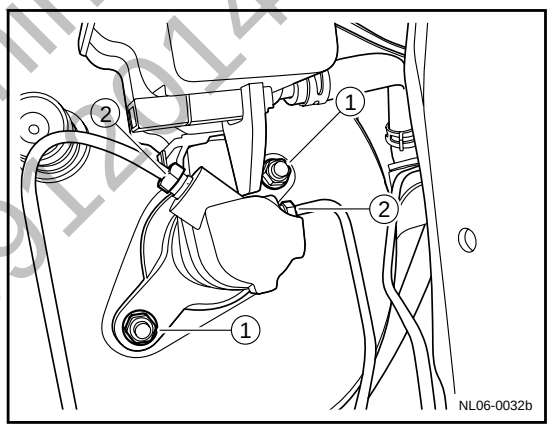
See Important precaution brake fluid affected for paint and electrical part in warnings and precaution .



3. Disconnect brake fluid level sensor harness connector.
4. Release the clamp for the hose from the clutch master cylinder to fluid reservoir and Take out the hose from the fluid reservoir.



5. Remove nut 1 of the brake oil pipe connector.
6. Block the brake line opening to prevent the loss of and contamination by the brake fluid.
7. Remove 2 Fixing Nuts 2 for the master brake cylinder.
8. Dismantle the brake master cylinder with fluid reservoir and place on a clean table.



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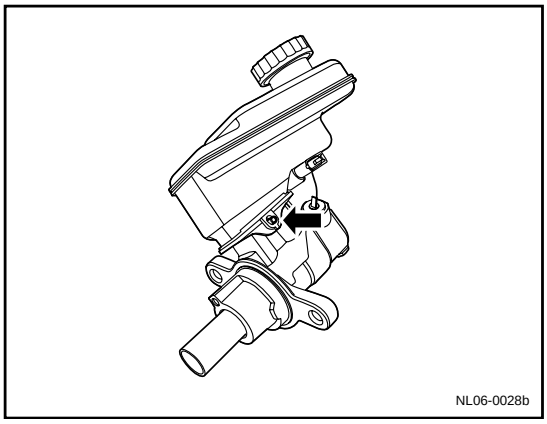
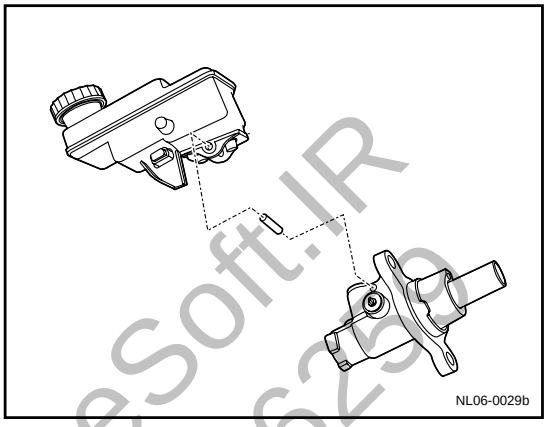
9. Take out the connecting pin between the reservoir and brake master cylinder to separate the reservoir from the brake master cylinder.

10. Dismantle brake main pump.



Installation Procedure:

1. Install connecting pin of fluid reservoir and brake main pump.



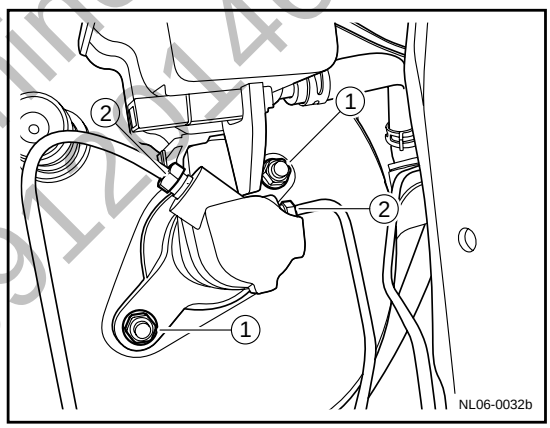
2. Install brake main pump with fluid reservoir into vacuum booster.

3. Tighten fixing nut 1 of brake main pump.

Torque: 16Nm (Metric) 11. 8lb-ft (English system)

4. Fix the hose of the clutch master cylinder to the reservoir with the clamp and tighten 2 brake oil pipe connector Nuts 2.

Torque: 16Nm (Metric) 11. 8lb-ft (English system)



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5. Connect the harness connector of the brake fluid level sensor.

6. Add the brake fluid.

Notes:

See Important precaution for filling brake system with brake fluid in warnings and precaution .

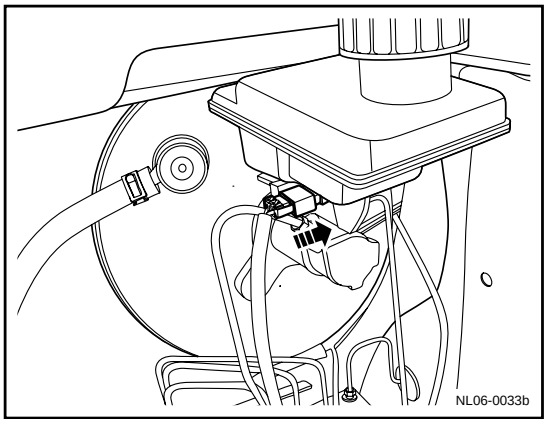
7. For exhausting the air from the brake system, see 6.4.5.5 hydraulic brake system air exhausting procedures.

8. For exhausting of air from the clutch system, see 3.2.6.3 hydraulic clutch air exhausting.

9. Check for leakage.

10. Check fluid level again

11. Connect the battery negative cable.



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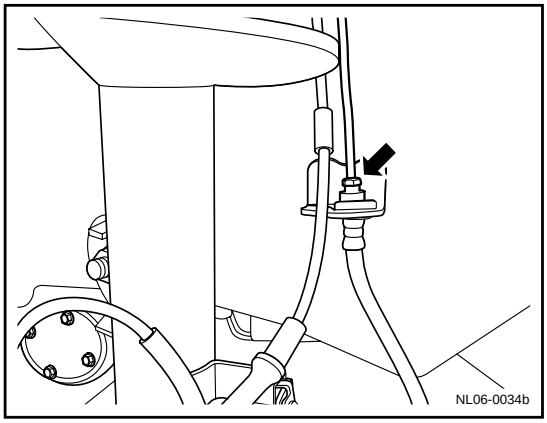
6.4.5.3 Brake hose replacement (front)

Dismantle procedure

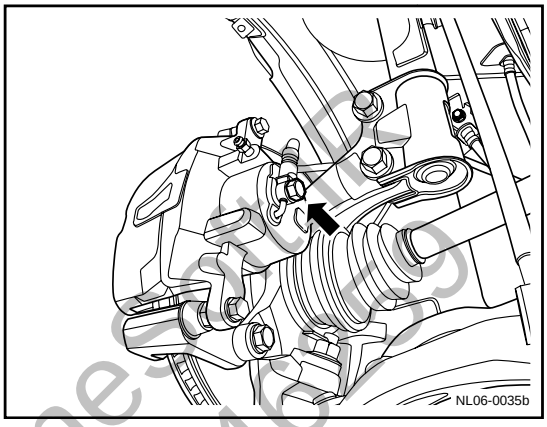
Notes:

See Important precaution for brake fluid affected paint and electrical parts in warnings and precaution.

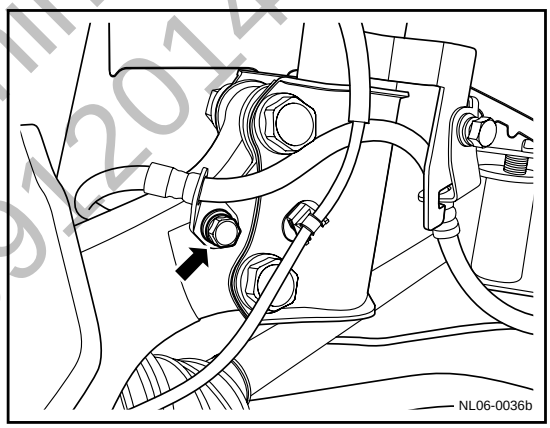
1. Discharge brake fluid
2. For lifting vehicle see 1.3 lifting vehicle.
3. For dismantling of front wheels, refer to 4.4.5.1 Replacement of wheels.
4. Dismantle connecting bolt between brake hose and brake hard pipe, and pull out spring stop piece, and then remove brake hose from fixing frame.



5. Remove the connecting bolt between the flexible brake hose and the brake cylinder.



6. Remove the flexible brake hose fixing bolt.



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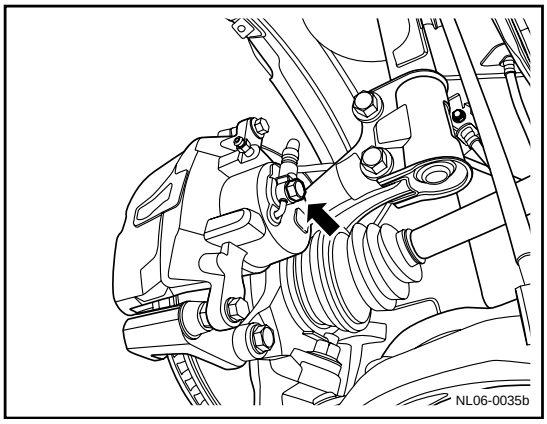
Installation Procedure:

Warning!

See Warning for replacement of Brake Pipe in Warnings and precaution.

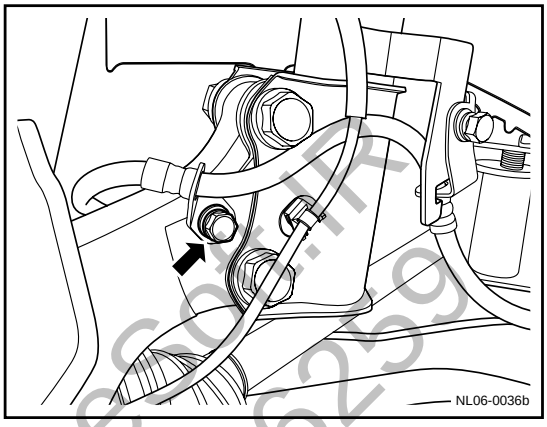
1. Install brake hose to brake slave pump. And tighten bolt.

Torque: 19Nm (Metric) 14 lb-ft (English system)



2. Fix brake hose and tighten fixing bolt.

Torque :19Nm(Metric) 14lb-ft(English system)



3. Connect brake hose and brake hard pipe, and tighten bolt, and then insert spring locking plate

Torque:10Nm(Metric) 7.4lb-ft(English system)

4. Install the wheel.

Notes:

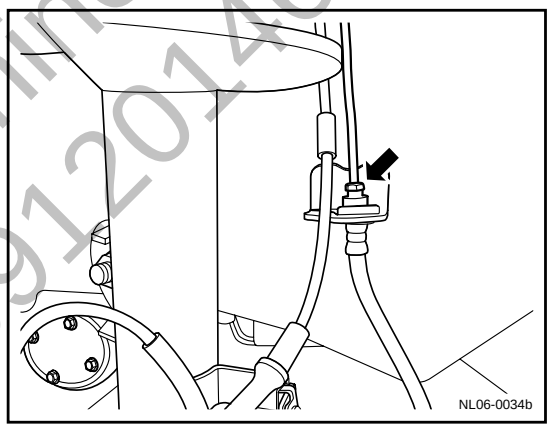
See Important precaution for filling brake system with brake fluid in warnings and precaution.

5. Fill with braking fluid.

6. Check for leakage.

Notes:

The method of dismantling the front wheel left and right brake hoses is similar.



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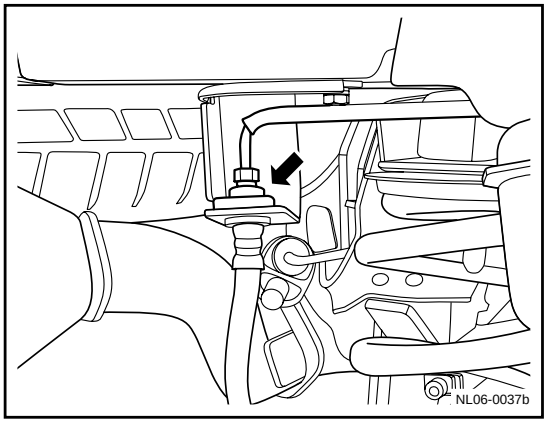
6.4.5.4 Brake hose replacement (rear)

Dismantle procedure

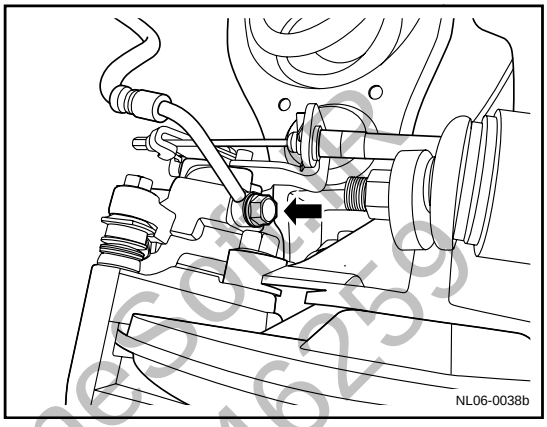
Notes:

See Important precaution for brake fluid affected paint and electrical parts in warnings and precaution.

1. Discharge brake fluid
2. For lifting vehicle see 1.3 Lifting vehicle.
3. For dismantling of rear wheel, refer to 4.4.5.1 Replacement of wheels.



4. Dismantle connecting bolt between brake hose and brake hard pipe, and pull out spring stop piece, and then remove brake hose from fixing frame.
5. Remove the bolt and detach the flexible brake hose from the rear brake cylinder.
6. Dismantle the rear flexible brake hose.



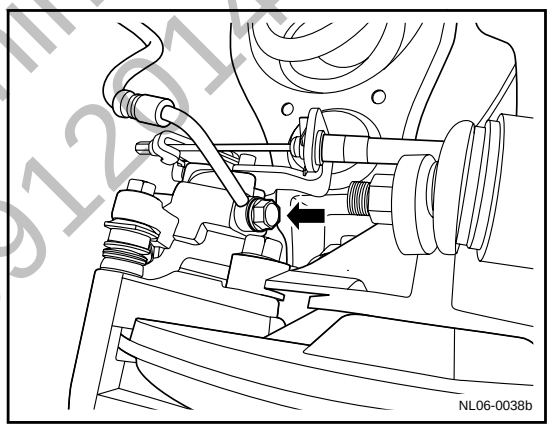
Installation procedure:

Warning!

See Warning for replacement of Brake Pipe in Warnings and precaution.

1. Install brake hose to rear brake slave pump, and fixed bolt.

Torque: 19Nm (Metric) 14 lb-ft (English system)



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2. Connect the brake host and brake hard tube and fasten the bolt to block into the spring stop plate.

3. Install the wheel.

Notes:

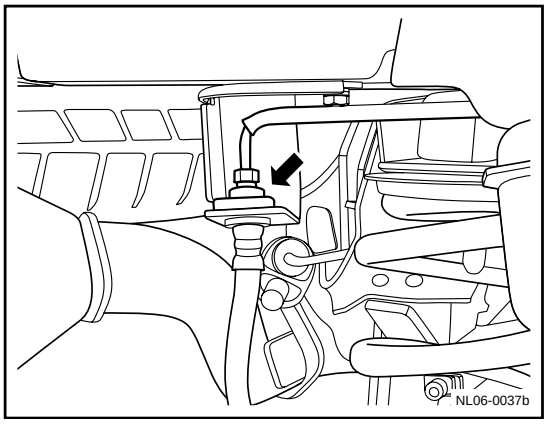
See Important precaution for filling brake system with brake fluid in warnings and precaution .

4. Fill with braking fluid.

5. Check leakage.

Notes:

The method of dismantling the rear brake left and right brake hoses is similar.



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6.4.5.5 Hydraulic brake system exhaust process

Notes:

See Important precaution for filling brake system with brake fluid in warnings and precaution .

Notes:

The air in the hydraulic brake adjustor cannot be discharged manually. If the air is mixed into the ABS hydraulic brake adjustor or the ABS hydraulic brake adjustor without being full of oil is installed, the fault diagnostic unit needs to be used for discharging the air in the brake system. Before the vehicle leaves the factory, the ABS Hydraulic brake regulator is fully filled with fluid and de-aerated, air will not enter the ABS hydraulic brake regulator during the normal maintenance procedures involving the regulator. In this case, use manual de-aeration procedures.

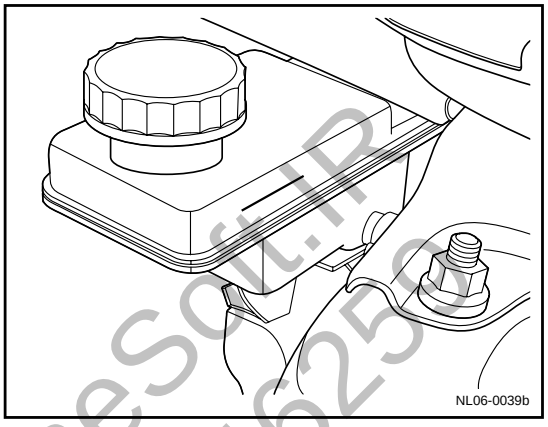
Notes:

If making no question of entering into the master cylinder, start the execution of the exhaust procedure from step 5. If suspecting that air enters the master pump, start the air emission in the master cylinder from the step 2.

Notes:

See Important precaution for brake fluid affected paint and electrical parts in Warnings and precaution.

1. Keep engine on flameout condition, step brake pedal for several times unti pressure in booster is released completely.
2. Fill brake fluid into main pump fluid reservoir, and fluid level in main pump fluid reservoir during exhaust operation should keep at least more than a half.
3. Slowly press down brake pedal and keeping .

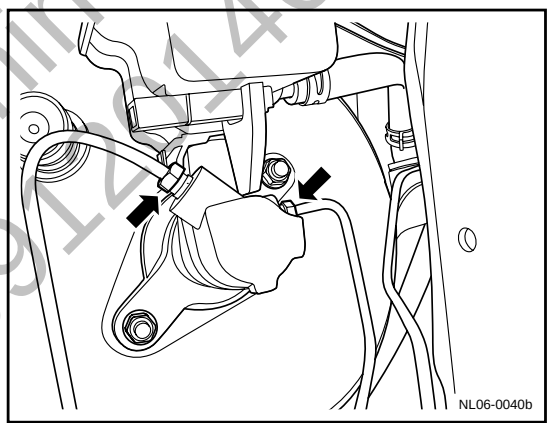


4. Release one brake line on the clutch master cylinder and tighten the brake oil pipe connector when the brake fluid flows out from the port.

Torque: 16Nm (Metric) 11. 8lb-ft (English system)

5. Loosen the other brake line on the master cylinder and tighten the brake line joint when the brake fluid flows out from the port.

Torque: 16Nm (Metric) 11.8 lb-ft (English system)



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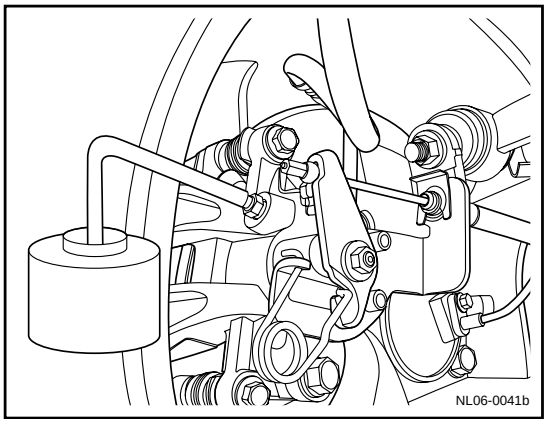
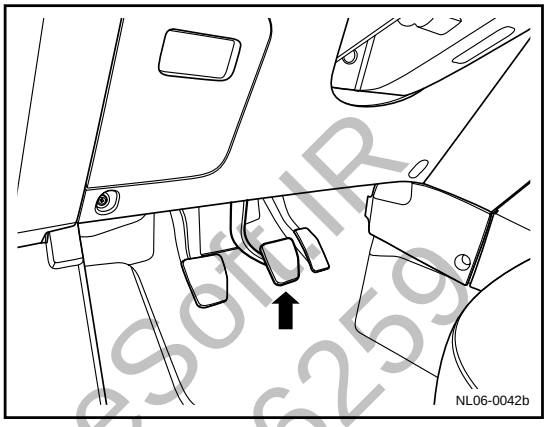
6. Repeated operation of steps 2-5 at third time to fourth time.

7. Dismantle the bleed screw dust cover and connect one transparent pipe to the rear bleed screw on the rear right brake caliper to immerse the pipe into the brake fluid in the transparent container. exhaust the air in the rear right brake caliper following the procedures below.



8. Depress and hold the brake pedal slowly rather than suddenly.



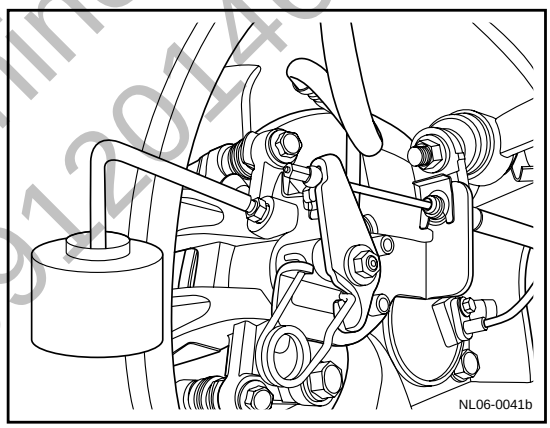
9. Loosen the bleed screw while depressing the brake pedal to exhaust the air in the brake caliper.

10. After air bule escape into brake fluid container, slightly tighten rear air draining screw.

11. Slowly loosen brake pedal.

12. Repeat step 6-9.until exhaust all air

13. When loosening bleed screw, if the container no longer appears air bubbles, it indicates that air is drained out completely.



Notes:

In the exhaust process, the master cylinder reservoir liquid level should be maintained more than half.

14. Tighten bleed screw.

Torque: 6 . 5Nm (Metric) 4. 8lb-ft (English system)

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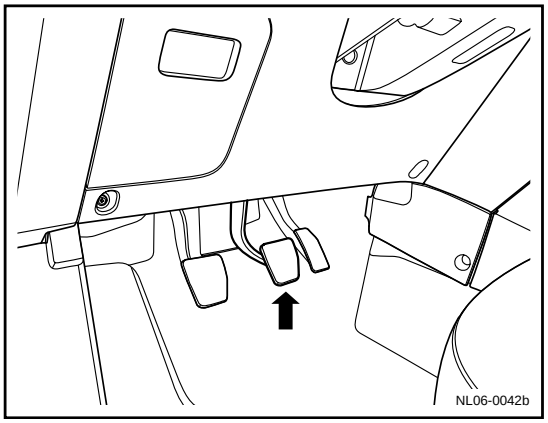
15. Exhaust air from brake caliper in order to left front, left rear and right front sequence. Perform operations following the procedures as described in steps 5-12.

16. Afte exhausting air from all brake calipers, inspect whether the brake pedal is soft, if yes, repeat the whole exhaust procedures until it is normal.



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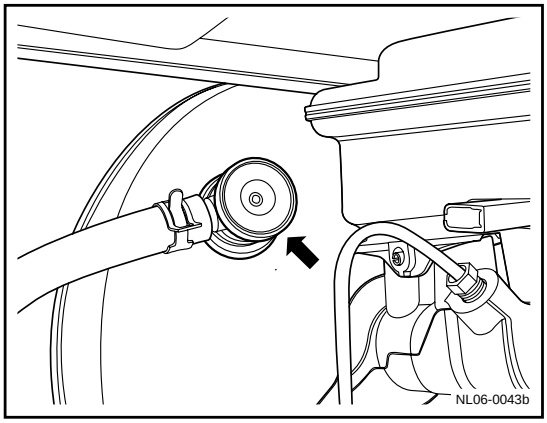
6.4.5.6 Vacuum booster replacement

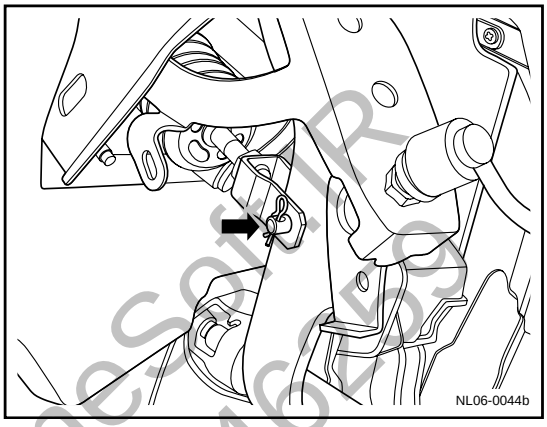
Dismantle procedure

Warning!

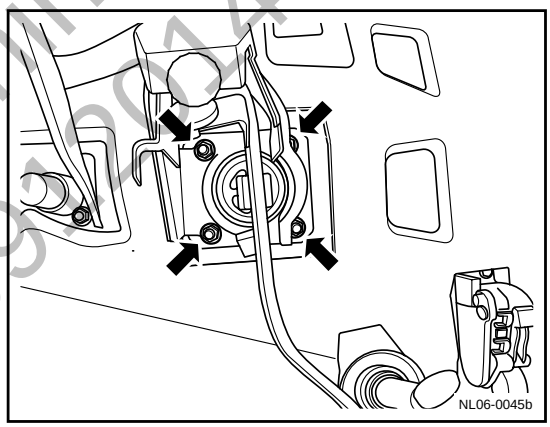
Warning: Refer to warning for battery disconnection in warning and precaution .

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery cable disconnection/connection procedures .
2. For dismantling of brake main pump fluid reservoir and brake main pump assembly, refer to 6.4.5.2 Replacement of brake main pump.
3. Dismantle vacuum hose.
4. Dismantle left lower guard plate of instrument panel. Refer to 12.8.3.1 Replacement of Instrument Panel.
5. Separate vacuum booster connecting rod U clip from brake pedal.





6. Remove 4 nuts on the brake pedal assembly.
7. Take out the vacuum booster.



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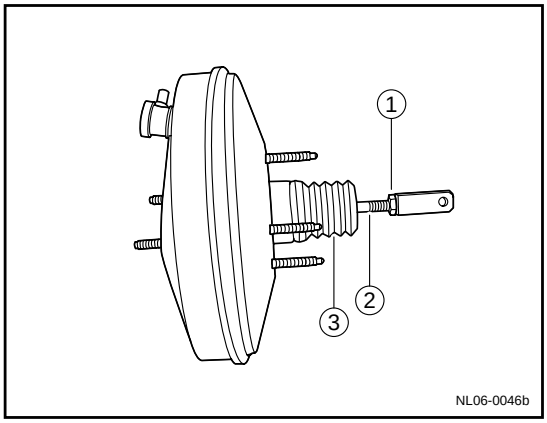
8. Loosen the locking nut of the U-shaped clip on the connecting rod and unscrew the U-shaped clip and locking nut 1.
9. Dismantle spring clip 2.
10. Dismantle rubber sleeve and sealing washer 3.

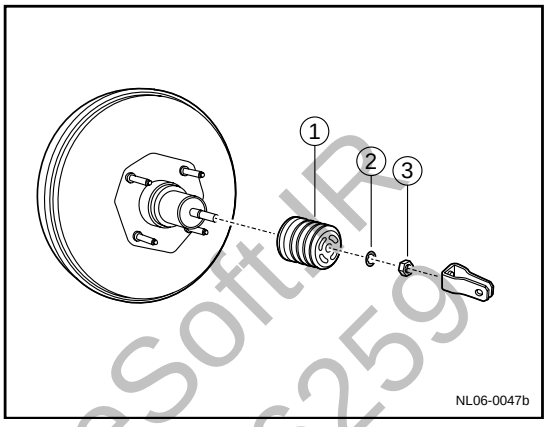
Notes:

If damaged or aging, the rubber sheath shall be scrapped and the sealing washer shall also be scrapped.



Installation Procedure:

1. Install new sealing washer. And then make rubber sheath nested in booster connecting rod 1.
2. Install spring clip 2.
3. Screw U-clip locknut and U-clip of connecting rod, and tighten nut 3.

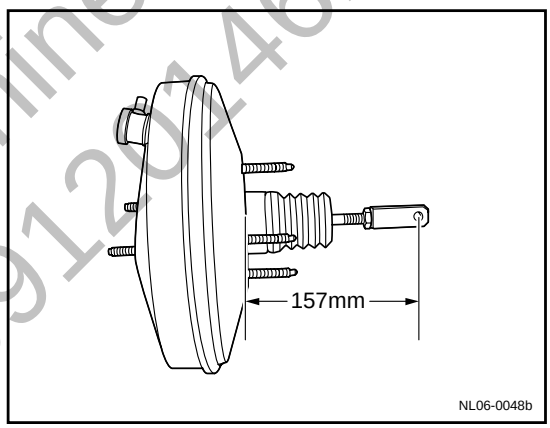


4. Adjust connecting U-clip stroke.

Distance of connecting rod U-shaped clip and rear end face of the booster: 157 mm (6.18 in).

5. Tighten the locking nut of the U-shaped clip.

Torque:20 Nm (Metric) 14.8 lb-ft (English system)



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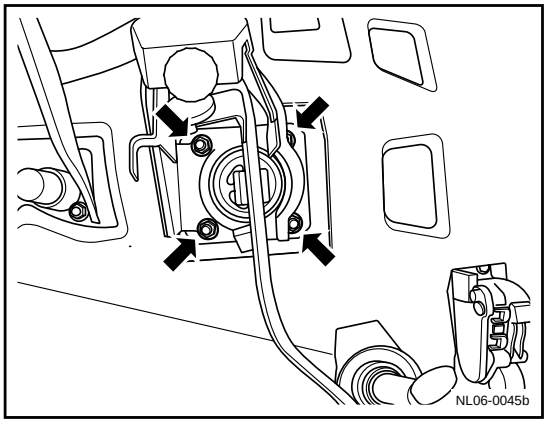
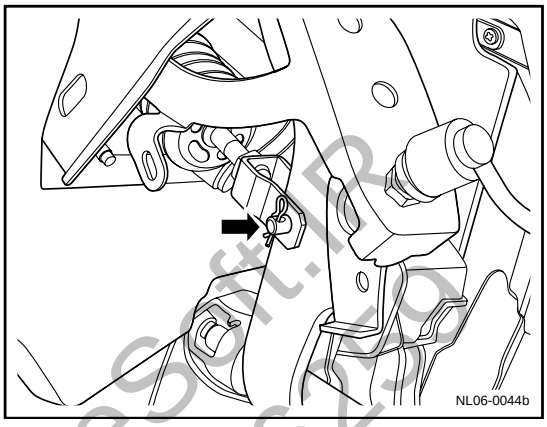
6. Install the vacuum booster.
7. Install and tighten 4 nuts on the brake pedal assembly.

Torque:23Nm (Metric) 17 lb-ft (English system)



8. Install the U-shaped clip of the vacuum booster connecting rod and brake pedal connecting pin and install the fixing pin.
9. Install lower left shield panel of instrument panel.
10. Install vacuum hose.
11. Install brake master pump fluid reservoir and brake master pump assembly



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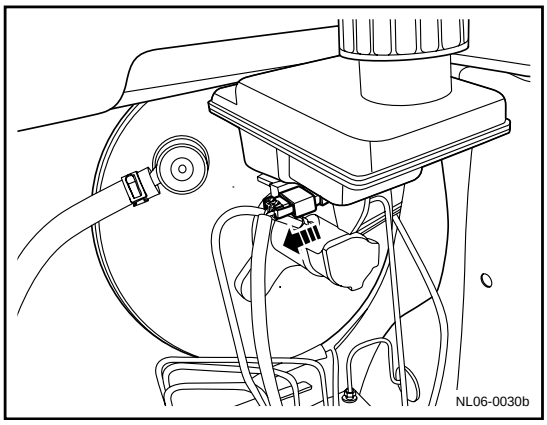
6.4.5.7 Brake fluid level sensor replacement

Dismantle procedure

Warning!

Warning: Refer to warning for battery disconnection in Warning and precaution .

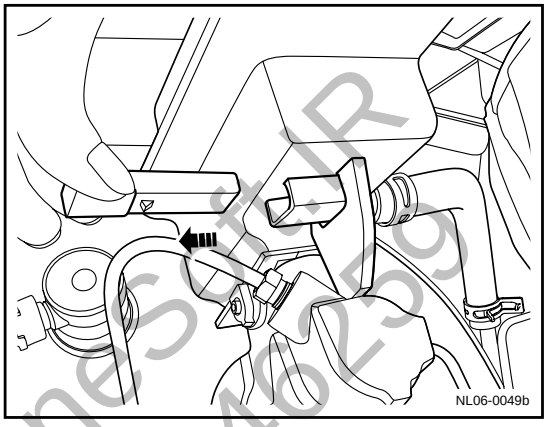
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery cable disconnection/connection procedures.
2. Disconnect brake fluid level sensor harness connector.



3. Take out brake fluid level sensor from the bottom of brake fluid reservoir.

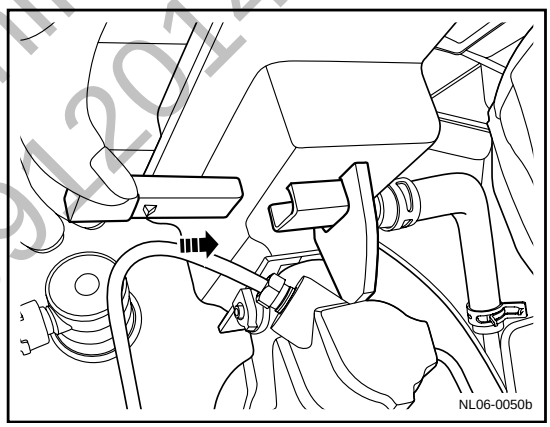
Notes:

It is unnecessary to discharge the brake fluid.



Installation Procedure:

1. Install brake fluid level sensor to fluid reservoir.



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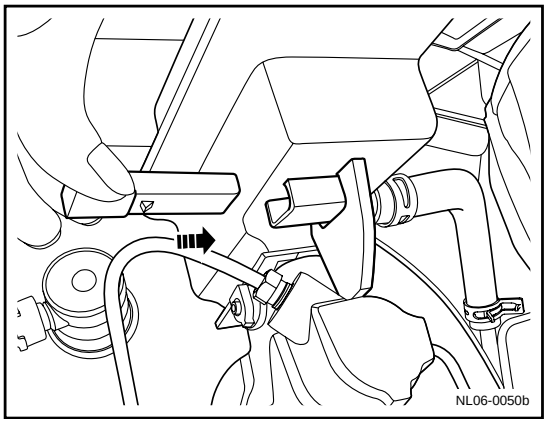
2. Connect the harness connector of the brake fluid level sensor.
3. Connect the battery negative cable.



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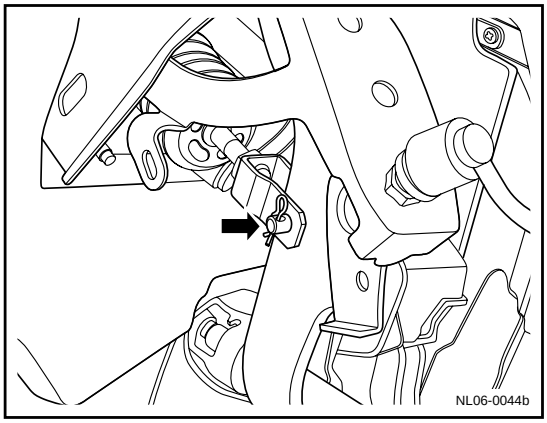
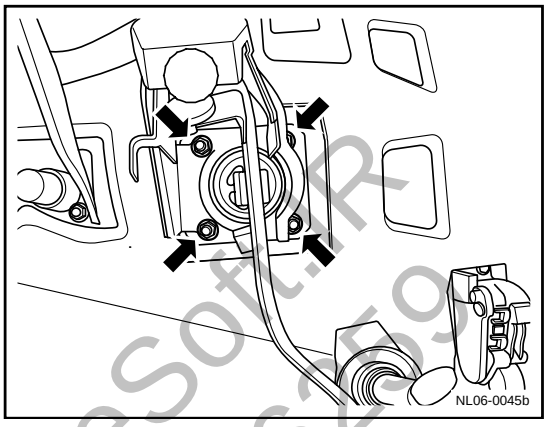
6.4.5.8 Replace brake pedal assembly

Dismantle procedure

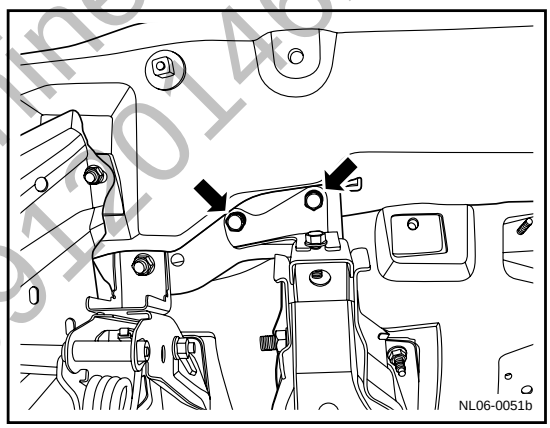
1. Remove instrument panel. Refer to 12.8.3.1 Instrument Panel Replacement.
2. Separate vacuum booster connecting rod U clip from brake pedal.
3. For dismantling of brake lamp switch, refer to 11.3.8.13 Replacement of brake lamp switch.



4. Dismantle fixing bolt on the upper of brake pedal.



5. Remove the 4 fixing nuts at the bottom of the braking padel.
6. Take out the brake pedal assembly.



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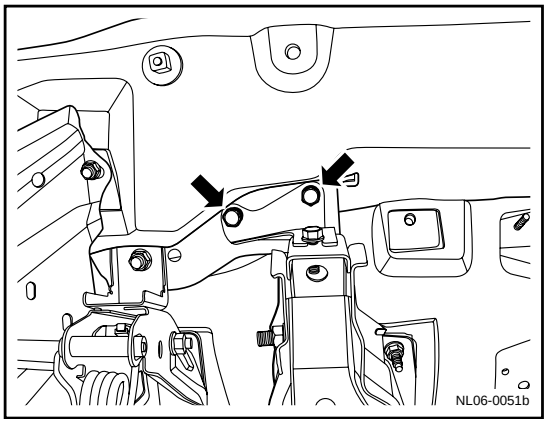
Installation Procedure:

1. install brake pedal
2. Install and tighten upper fixing bolt of brake pedal.

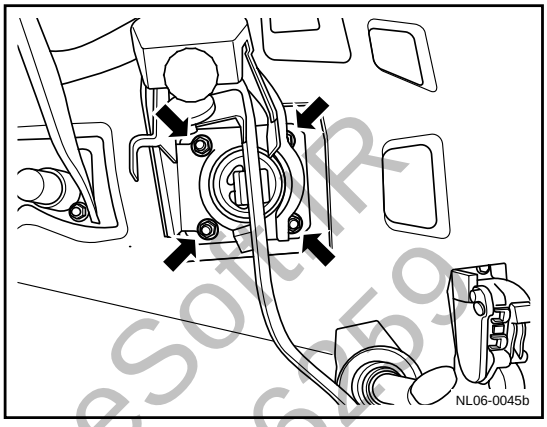
Torque:21 Nm(Metric) 15.5 lb-ft(English system)



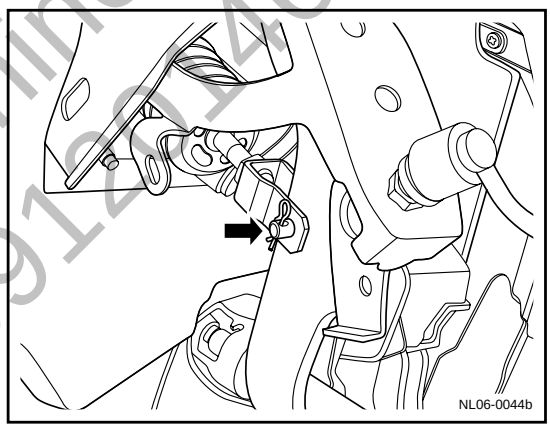
3. Install and tighten 4 fixing nuts on the lower section of brake pedal.

Torque:21 Nm(Metric) 15.5 lb-ft(English system)

4. Install brake lamp switch.



5. Install the U-shaped clip of the vacuum booster connecting rod and brake pedal connecting pin and install the fixing pin.
6. Install the instrument panel.



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6. 5 Parking system

6.5.1 Specifications

6.5.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (NM)	English system（lb-ft）
Fixing bolt of parking brake control mechanism assembly switch	M6	8-10	6-7
Fixing bolt of parking brake control mechanism assembly pulling rod to body	M8×25	16-26	13.3-16.2
Fixing bolt of parking braking cable	M6×14	6-12	4.4-8.9
Fixing bolt of parking brake control level	M8×20	16-26	12-19

6.5.2 Description and operation

6.5.2.1 Description and operation

The parking brake system is a mechanical system, which operates the rear disc brake caliper through a parking braking pull rod, pulling the parking brake pull rod to start the system; the parking braking pull rod controls the piston of the rear wheel disc brake caliper through the cable; and when the parking braking pull rod is pulled up and the ignition switch is on, the parking brake indicator lamp on the combination combination instrument will turn on.

Pull up the pull rod and press down the button on the pull rod; put down the parking braking pull rod to release the parking brake; thus, the parking braking indicator lamp in the combination instrument will turn off.

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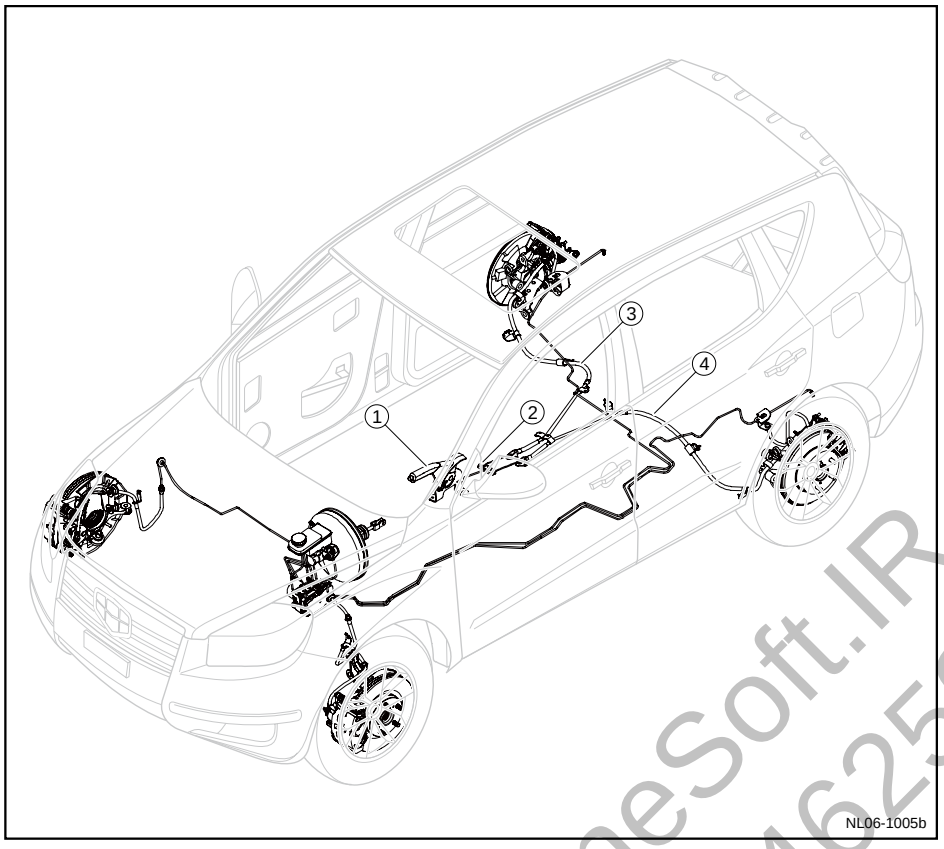
6.5.3 Component position

6.5.3.1 Component position



1. Parking brake control mechanism assembly
2. Front parking brake cable
3. Right rear parkin brake cable with bracket assembly
4. left rear parking brake cable with support assembly

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6.5.4 Diagnostic information and procedures

6.5.4.1 Fault Symptom Table

Symptoms	Suspected Parts	Measures / referance
Parking braking lag	1. Parking brake pull rod stroke is too small	See 6.5.5.4 adjustment of parking brake control mechanism assembly
	2 . Front parking brake cable (struck)	See 6.5.5.3 replacement of parking brake control mechanism assembly control cable.
	3 . Left/ right parking brake cable (stuck)	See 6.5.5.3 replacement of parking brake control mechanism assembly control cable.
	4. Rear disc brake piece (broken or distortion)	See 6.2.4.1 check of brake pad in rear brake system.
	5 . Rear disc type brake pillar fault (not return)	See 6.2.4.2 check of brake caliper in rear brake system.
Parking braking failure	1. Parking brake pull rod stroke is too big	See 6.5.5.4 adjustment of parking brake control mechanism assembly
	2 .front parking brake cable(stuck broken)	See 6.5.5.3 replacement of parking brake control mechanism assembly control cable.
	3. Left /right parking brake cable (stuck, broken)	See 6.5.5.3 replacement of parking brake control mechanism assembly control cable.
	4. Rear disc brake piece (excessive abrasion)	See 6.2.4.1 check of brake pad in rear brake system.
	5．Rear disc-type brake caliper fault	See 6.2.4.2 check of brake caliper in rear brake system.

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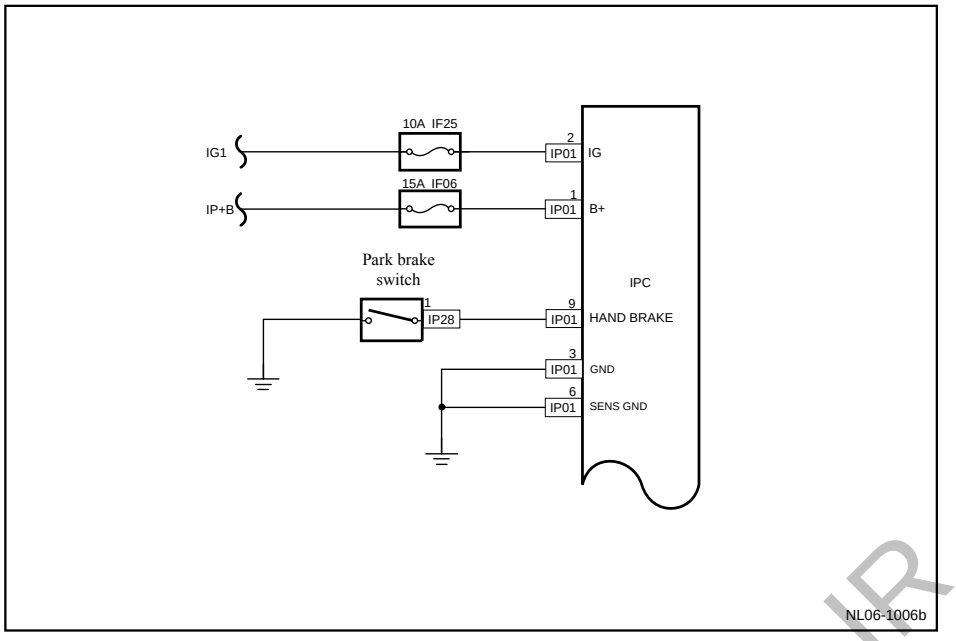
6.5.4.2 Parking brake warning lamp fault

Circuit diagram:



Diagnostic Steps:

1	Inspect the parking brake switch.

(a) Disconnect brake switch harness connector IP28.

(b) Inspect whether parking brake switch has reliable grounding connection.

(c) When pulling parking brake rod, inspect switch is closed or not.

No	Repair, regulate or replace the parking brake switch

Yes

2	Inspect the harness (harness connector IP01-IP28).

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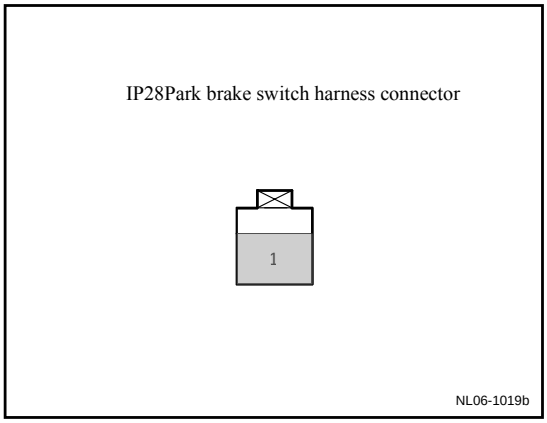
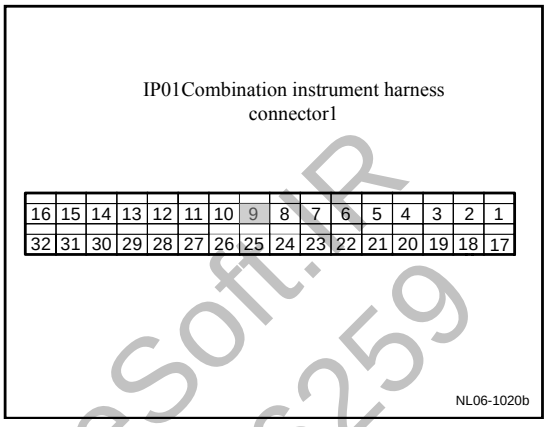
(a) Disconnect harness connector IP01 and IP28.

(b) Use multimeter to measure resistance between IP01 terminal 9 and IP28 terminal 1.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.





No → Repair or replace the harness.

Yes

3	Check the harness (combination instrument asembly power supply, ground).

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(a) Make ignition switch turn to OFF.

(b) Disconnect negative cable from battery.

(c) Disconnect IP01 connector from combination instrument

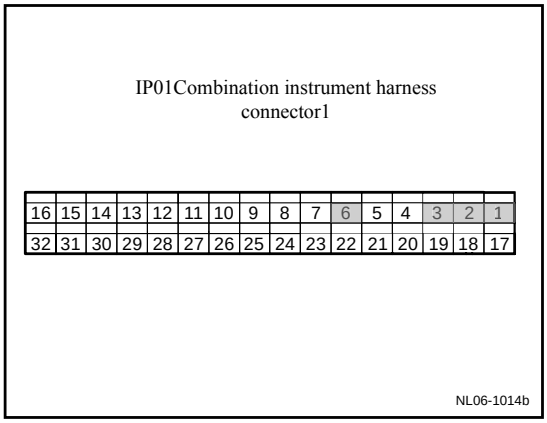
(d) Battery negative cable connects to battery.

(e) Ignition switch was turned to ON (IG).

(f) Use multimeter to measure voltage between connector IP01 terminal 1 and 2 respectively with vehicle body groudning.

Standard Voltage：11-14V

(g) Ignition switch turn to OFF.



(h). Measure the resistance between terminals No.3 and No.6 of connector IP01 and the body ground respectively with a multimeter.

Standard resistance value : less than 1 Ω

Does the measured value conform to standard value?

No → Clean the contact surface of the earth wire and the body grounding point as well as repair or replace the wire harness.

Yes

4	Replace combination instrument

A． Replace combination instrument , refer to combination instrument replacement ”

B． Confirm the completion of repair.

Next

5	The system is normal.

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6.5.5 Dismantle and installation

6.5.5.1 Parking brake control mechanism assembly switch replacement

删除的内容:

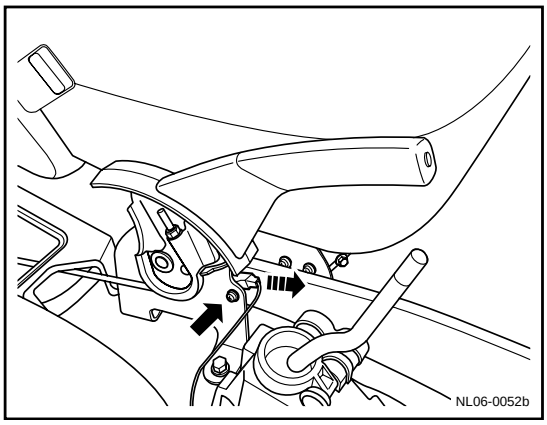
Dismantle procedure

Warning!

Warning:

Refer to warning for battery disconnection in Warning and precaution .

1. Disconnect the battery negative cable and wait for at least 90s. refer to 2.11.8.1 battery cable disconnection and connection procedures.
2. Release parking brake operation mechanism assembly.
3. For dismantling of auxiliary instrument panel, refer to 12.8.3.2 Replacement of auxiliary instrument panel.
4. Disconnect harness connector of parking brake operation mechanical assembly switch.
5. Remove the bolt for fixing the switch of the parking brake control mechanism assembly.

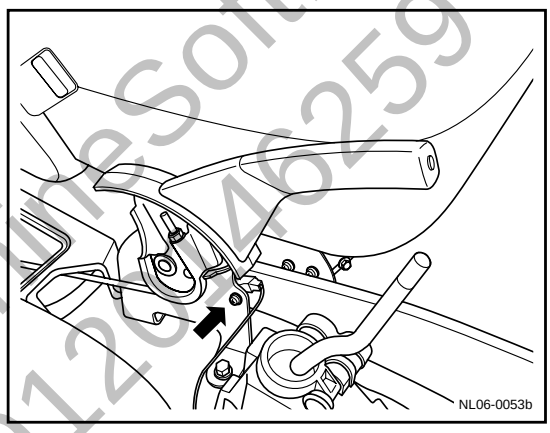


Installation Procedure:

1. Install fixing bolt of parking brake control mechanism assembly switch.

Torque:10Nm(Metric) 7.4lb-ft(English system)

2. Connect parking brake operation mechanical assembly switch harness connector.
3. Install the auxiliary instrument panel.
4. Pull up the parking brake control mechanism assembly.
5. Connect the battery negative cable.



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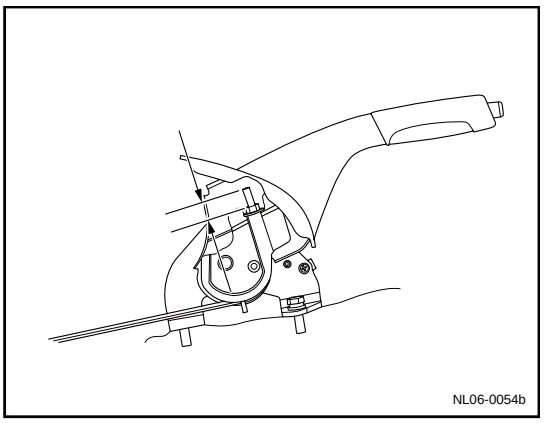
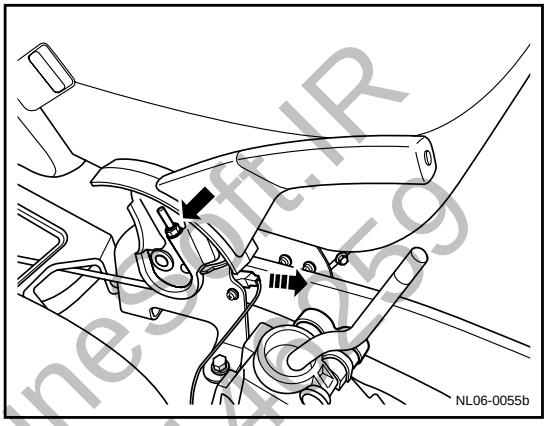
6.5.5.2 Parking brake control mechanism assembly replacement

Dismantle procedure

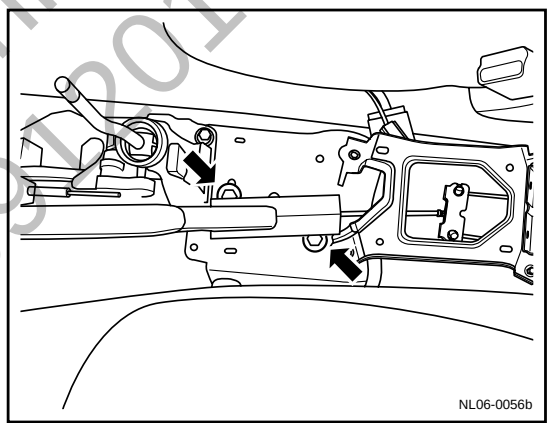
1. Release parking brake operation mechanism assembly.
2. For dismantle of the auxiliary instrument panel, see Replacement of auxiliary instrument panel.
3. Measure threads length between the top of cable to hexagonal nut, and record result.



4. Disconnect harness connector of parking brake operation mechanical assembly switch.
5. Remove the parking brake control mechanism assembly cable adjustment nut.



6. Remove 2 fixing bolts between the tie rod assembly of the parking brake control mechanism assembly and the body bottom.
7. Dismantle the parking brake control mechanism assembly tie rod assembly.



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Installation Procedure:

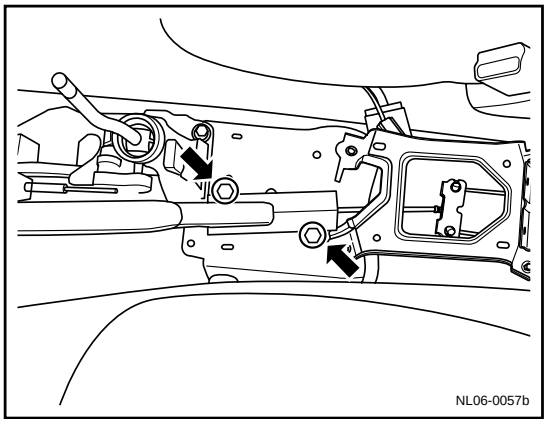
1. Install pulling rod assembly of parking brake control mechanism assembly.

Notes:

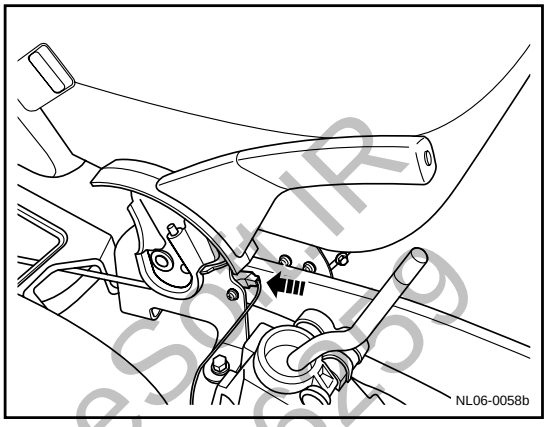
Refer to important precaution for fastener in warnings and precaution.

2. Install 2 fixing bolt sparking brake control mechanism assembly pulling rod assembly to underbody

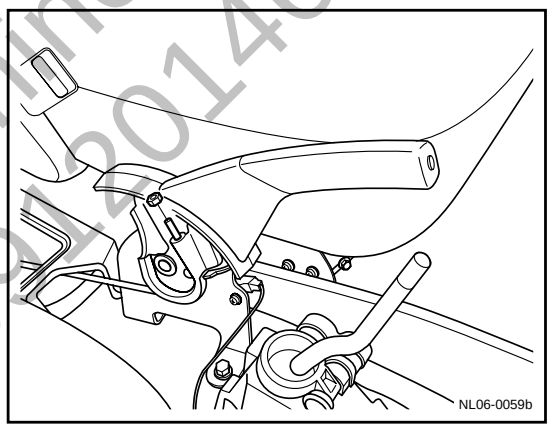
Torque:21 Nm (Metric) 15.5 lb-ft (English system)



3. Install parking brake operation mechanical assembly cable, and press mounting piece to make it clip parking brake operation mechanical assembly cable.
4. Connect parking brake operation mechanical assembly switch harness connector.



5. Install the nut for adjusting the cable of the parking brake control mechanism assembly.



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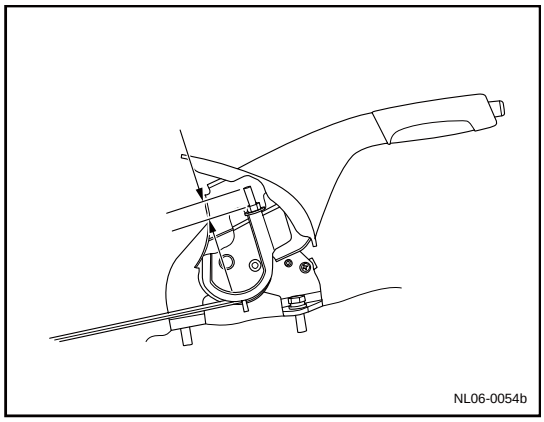
6. Adjust the cable of the parking brake control mechanism assembly according to the length of the thread from the top of the cable to the hexagon nut which is measured.
7. Pull up the parking brake control mechanism assembly.
8. if necessary, adjust the parking brake control mechanism assembly. See 6.5.5.4 Adjustment of Parking Brake Control Mechanism Assembly.
9. Install the auxiliary instrument panel.



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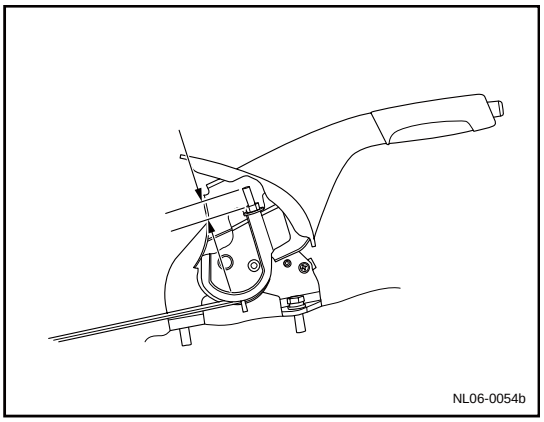
6.5.5.3 Parking brake control mechanism assembly cable replacement

Dismantle procedure

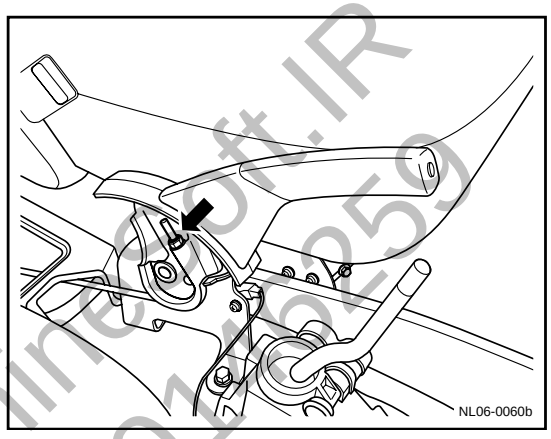
Warning!

See Warnings for vehicle lifting in warnings and precaution .

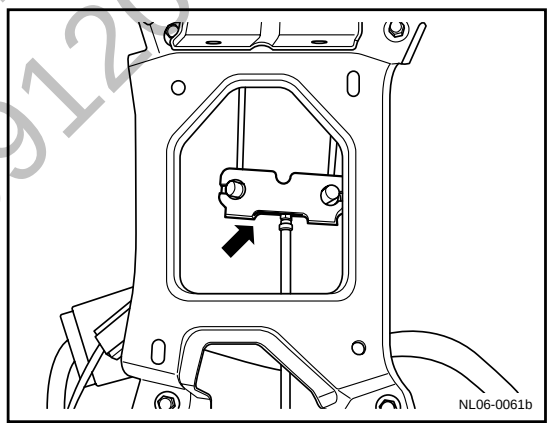
1. Disconnect the battery negative cable. Refer to battery cable disconnection/connection procedures.
2. Release parking brake operation mechanism assembly.
3. For dismantling of auxiliary instrument panel, refer to replacement of auxiliary instrument panel.
4. Disconnect harness connector of parking brake operation mechanical assembly switch.
5. Measure and record the length of the thread from the top of the control cable to the hexagon nut.



6. Remove the parking brake control mechanism assembly control cable adjustment nut.



7. Detach the left and right rear parking brake cables from the cable balancing tab.
8. Pull out the front parking brake cable from the internal side of the vehicle.



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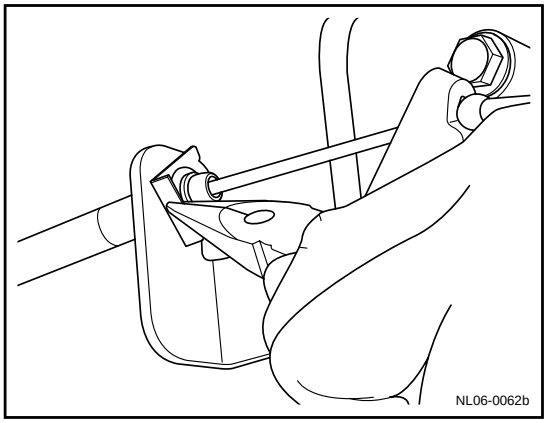
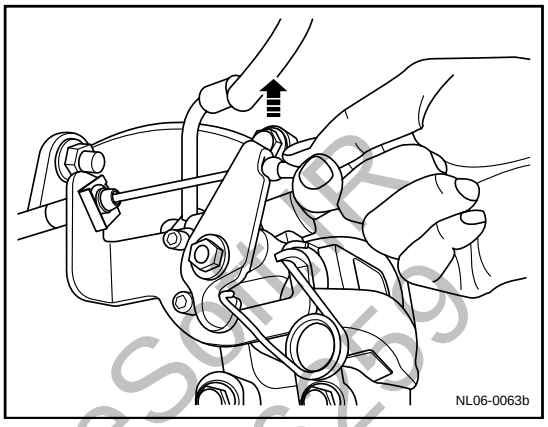
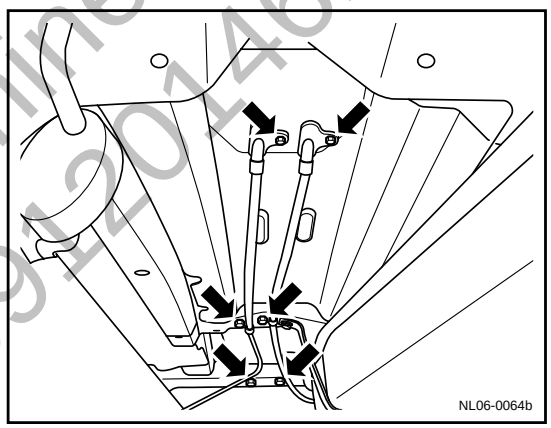
9. For lifting vehicle, refer to 1.3 lifting vehicle .
10. Dismantle left, right rear parking brake cable clip.



11. Dismantle left, right rear parking brake cable from rear brake caliper.



12. Loosed fixing bolt and spring clip plate under the brake cable.
13. Take out left, right rear parking brake cable.



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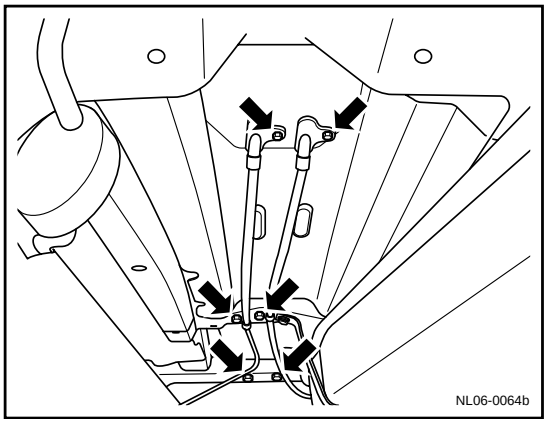
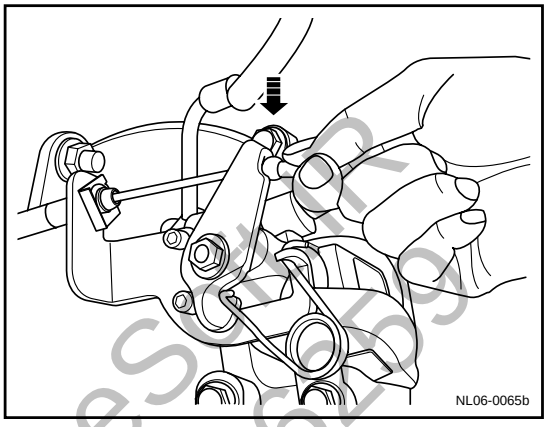
Installation procedure:

1. Install left/ right rear parking brake cable .
2. Install rear parking brake cable fixing bolt and spring clip.

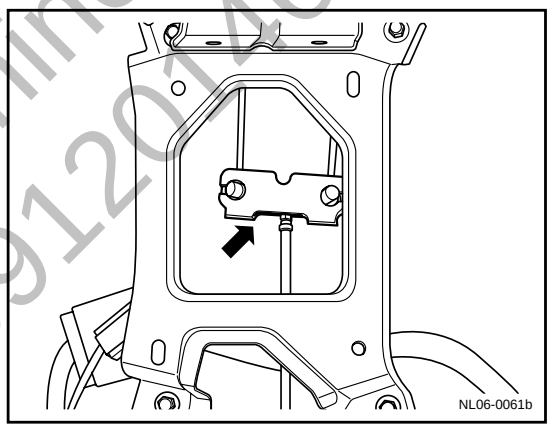
Torque:9Nm (Metric) 6.6 lb-ft (English system)



3. Respectively install left and right rear parking brake cables onto rear brake caliper.



4. Lower the vehicle.
5. Engage the left and right parking brake cable into the cable balance collar.



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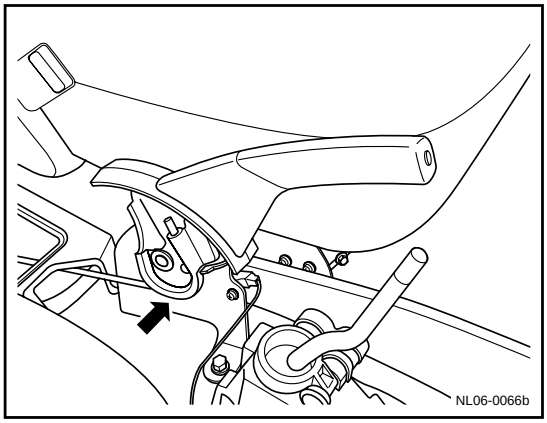
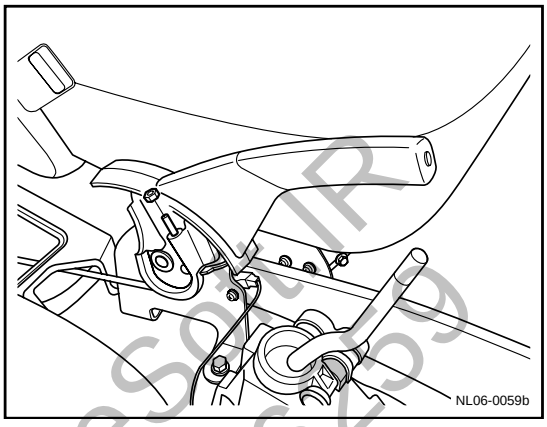
6. Install parking brake operation mechanical assembly cable, and press mounting piece to make it clip parking brake operation mechanical assembly cable.

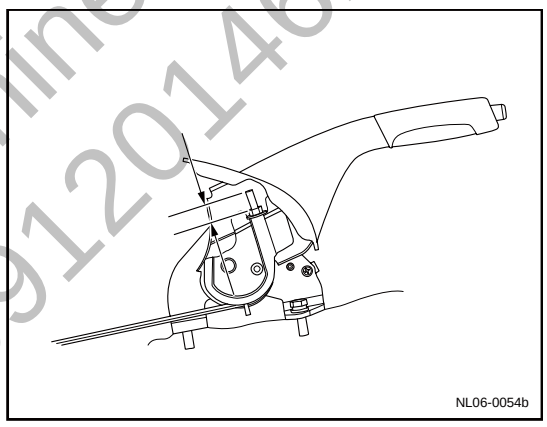


7. Install the parking brake control mechanism assembly control cable adjustment nut.

Torque:9 Nm (Metric) 6.7 lb-ft (English system)



8. Adjust the parking brake control mechanism assembly control cable according to the length of the thread from the top of the control cable to the hexagon nut which is measured and recorded.
9. If necessary, adjust the parking brake control mechanism assembly. See 6.5.5.4 Adjustment of Parking Brake Control Mechanism Assembly.
10. Pull up the parking brake control mechanism assembly.
11. Install the auxiliary instrument panel.
12 . Connect the battery negative cable.



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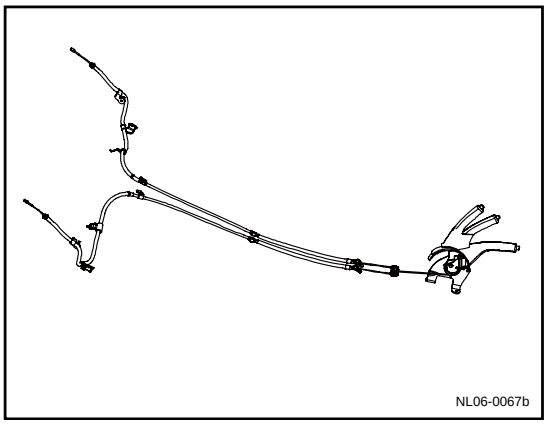
6.5.5.4 parking brake control mechanism assembly adjustment

Adjust process

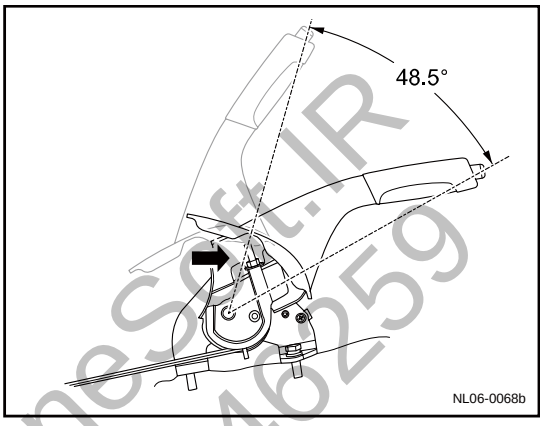
Warning!

See Warnings For vehicle lifting in Warnings and precaution.

1. Release parking brake operation mechanism assembly.
2. For lifting vehicle, refer to 1.3 lifting vehicle.
3. Inspect whether parking brake operation mechanical assembly cable can move freely.



4. Lower the vehicle.
5. For dismantling of auxiliary instrument panel, refer to Replacement of auxiliary instrument panel.
6. Slightly lift the vehicle to enable the wheels to rotate freely.
7. Tighten the parking brake control mechanism assembly cable adjustment nut until the wheel can hardly rotate.
8. Loosen the nut until the rear wheel can freely rotate.
9. Lower the vehicle.
10. Pull up parking brake. install auxiliary instrument panel



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6.6 ABS/TCS/EBD/ESP

6.6.1 Specifications

6.6.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lb-ft)
Fixed wheel speed sensor bracket nut	M6	8-10	5.9-7.4
Fixed wheel speed sensor support bolt	M6×18	16-20	11.8-14.8
A fixed HECU controller assembly Six fixed braking hoses	M8×20	15-21	11.1-15.5

6. 6. 1. 2 Speed sensor technique specifications

Wheel speed sensor	Descriptions
Sensor type	Hall-type Speed Sensor
Operating voltage	12±0.1V
Signal Current	Low level: 5.6 - 8.4 mA; high level: 11.2 - 16.8 mA
Clearance value with signal panel	Front axle 1.626 mm (0.06 in) rear axle 0.597 mm (0.02 in)

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6.6.2 Description and operation

6.6.2.1 Description and operation

This vehicle is equipped with an anti-lock braking system(ABS) and electronic brake force distribution (EBD) system and the following components are added on the basis of the original brake system:

Hydraulic electronic control unit (HECU)

Notes:

A rubber damping pad is equipped between the mounting bolt of the hydraulic electronic control unit and the bracket and plays the role in preventing the hydraulic electronic control unit from being affected by the vibration of the vehicle; the hydraulic electronic control unit is unable to decompose as assembly replacement.

The hydraulic electronic control unit (HECU) controls the system function and detects the fault. When the ignition switch is on and the fault diagnosis code of the antilock brake system is absent, the system electrifies the relay, so as to provide battery positive voltage to the electromagnetic valve and pump. The hydraulic electronic control unit (HECU) continues to detect the state of the wheel to control the wheel slip rate within a certain range, thereby maintaining the stability of the vehicle. The hydraulic control pipeline is configured in a diagonal branching rod, so that one branch of the oil of the brake master cylinder is flowed to the left front wheel and the right rear wheel and the other branch thereof is flowed to the right front wheel and the left rear wheel. Diagonal branch on the hydraulic control is isolated, so that the other branch can ensure the continuous braking capacity when one main braking pipeline leaks or is broken down. Hydraulic electronic control unit (HECU) comprises the following main components:

– ABS control module
– ABS pump and its relay
– Fuel inlet valve. Each fuel inlet valve control an wheel
– Oil drain valve: each oil drain valve controls one wheel.
– Electromagnetic coil relay

Wheel speed sensor:

The wheel speed sensor is a Hall type rotating speed sensor. As the wheel revolves, the ABS control module calculates the wheel speed from the wheel speed signal. The wheel speed sensor can be separately replaced, but the signal panel (gear ring) must be replaced together with the axle shaft as it is embedded on the axle shaft.

Brake lamp switch

Illuminate the brake lamp when depressing the brake pedal and at the same time send to the ABS control module the braking signal.

ABS warning lamp:

Locate on the combination instrument and remind the driver of malfunction of the ABS by turning on. When happen the following events, the dashboard combination instrument will turn on the ABS warning lamp:

– ABS control module inspect fault of ABS system, combination instrument is connect to an request light-up message by ABS control module

Combination instrument carries out self-inspection test at the beginning of each ignition cycle, and the indicator lamp will light up for 3s.

The combination instrument detects the missing of communication between ABS control modules.

EBD warning lamp:

Locate on the combination instrument and remind the driver of malfunction of the EBD by turning on. When an ABS warning lamp turns on but an EBD warning lamp does not turn on, there is still EBD function; and when both the ABS warning lamp and the EBD warning lamp turn on, both the ABS and EBD functions become invalid.

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Self-diagnostic test:

The antilock brake system performs self-diagnosis under the following two conditions:

– When each ignition switch is ON. ABS control module carried out one self-diagnostic test.

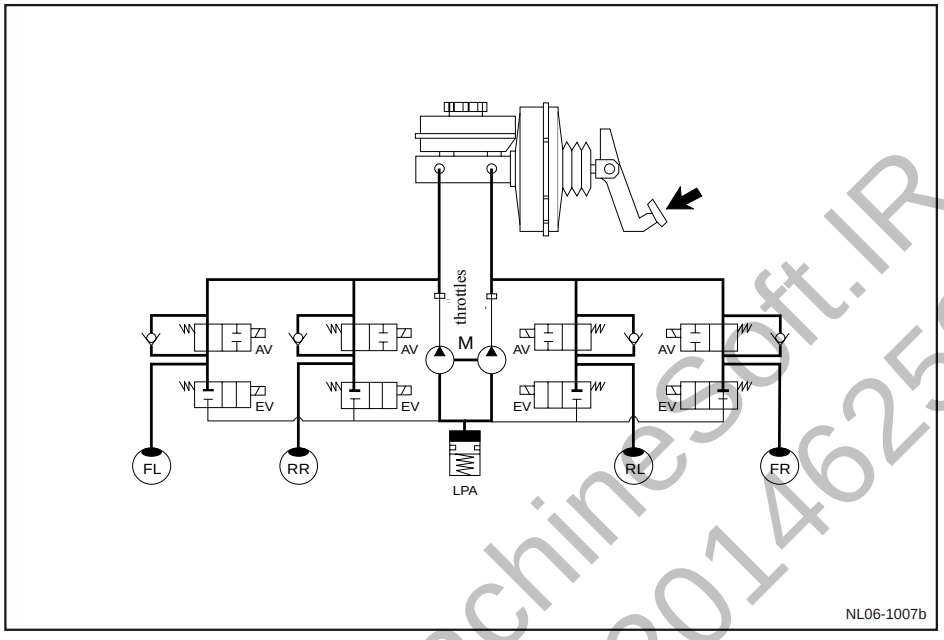
– After starting the engine, when vehicle travels about 15km/h, conduct a self-diagnosis test, and a buzz sound will be produced. This is the normal sound during ABS self-inspection.

The performance will be monitored as long as the ABS is in the working condition. In the case of discovering the error, give an alarm immediately until the error is eliminated. Error code keep in the ABS memory until manual clear thems 。

6.6.3 System operating principle

6.6.3.1 System operating principle

Schematic diagram of hydraulic pipeline of antilock brake system (ABS)



1. AV-oil inlet electromagnetic valve
2. EV- oil exhaust electromagnetic valve
3. LPA- lower pressure battery
4. M-motor
5. FL-Front left wheel
6. RR-right rear wheel
7. RL-Rear left wheel
8. FR-Front right wheel

Antilock brake system (ABS)

In the course of antilock brake, the antilock brake system controls the oil pressure in the wheel oil passage to prevent the wheel from sliding. Each wheel is equipped with independent hydraulic oil path and special electromagnetic valve. The antilock brake system can reduce, maintain or increase the oil pressure of the wheel brake. However, the oil hydraulic pressure does not exceed the pressure provided in the course of brake through the antilock brake system. During anti-lock braking, a series of pulsation may be sensed on the brake pedal. When an ABS control module perceives a vehicle speed sensor input and try to prevent the wheel-slip, various electromagnetic valves are quickly continuously changed in a circular manner, and an ABS pump works to generate pulse. Pedal pulsation only appears during the anti-lock braking and disappears after restoring the conventional brake or parking. For the vehicle with the antilock brake system, normal force is applied to the brake

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pedal to stop. The vehicle with an antilock brake system can effectively shorten a brake distance and maintains its stability. During anti-lock braking, the pressure adjustment of the brake system can be divided into 3 stages.

Pressure kept

In case of wheel-slip, the ABS control module closes an oil filling valve and keeps an oil draining valve closed, so as to isolate the system. In this way, the oil pressure in the brake can be maintained, so that the oil pressure is neither increased nor reduced.

Pressure reduced

In case of wheel-slip, the ABS control module reduces the pressure supplied to each wheel in the course of deceleration. Close the oil filling valve and open the oil draining valve. The excessive oil is stored in the accumulator until the ABS oil return pump return the oil to the master cylinder.

Pressure increased

If the wheels do not slip, the ABS control module gradually increases the brake pressure of each wheel to reduce the wheel speed. Open the oil filling valve and close the oil draining valve. The pressure increased is provided by the brake master cylinder.

Electric brake force distribution (EBD)

As the ground condition attached to each wheel may be different, the attachment coefficient provided by the ground may be different; in addition, when the vehicle brakes, its center of gravity will be changed; thus, it is easy to produce slippage, incline and rollover when braking.

The function of the EBD is to rapidly calculate the friction difference resulted in by difference in adhesion coefficients between four wheel tires and then adjust the solenoid valve within the hydraulic unit at a high speed to match the braking force with the frictional force (adhesional force) for ensuring the stability and safety of the vehicle. Under the condition of emergency brake, the effective ground traction of each wheel has been balanced by the EBD prior to ABS action, thereby preventing drifting and lateral displacement. Actually the EBD is an additional function of the ABS. It can automatically adjust the allocation of the braking force according to the road surface condition and load and thus can improve the function of the ABS.

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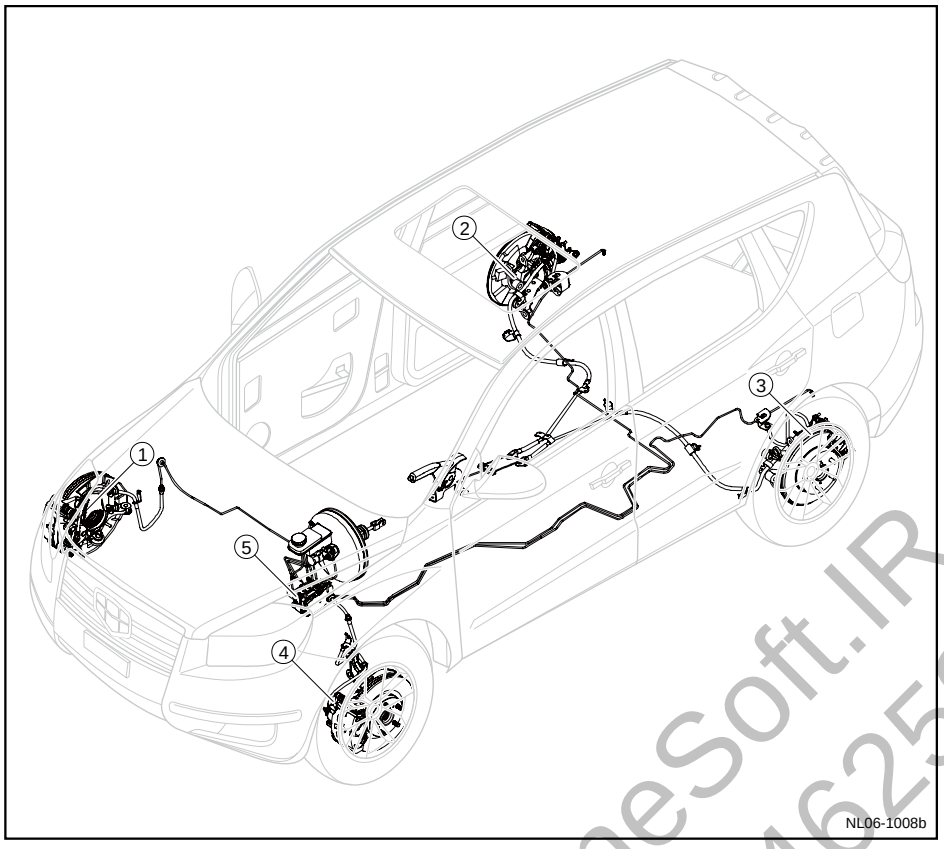
6.6.4 Component position

6.6.4.1 Component position



1. right front speed sensor
2. Right rear speed sensor
3. Left rear speed sensor
4. Left front speed sensor
5. Hydraulic electronic control unit (HECU)

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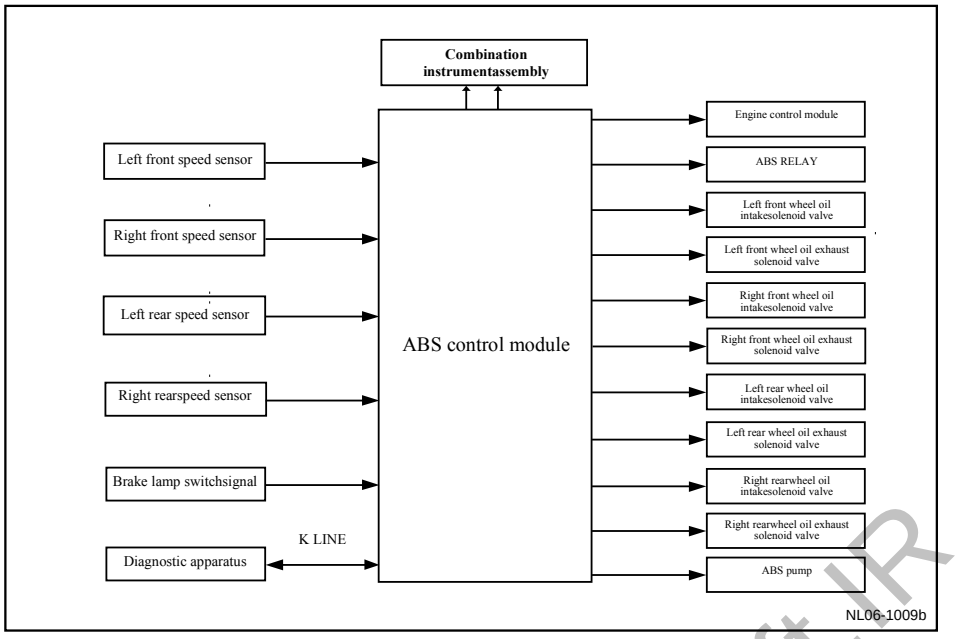
6.6.5 Electrical schematic diagram

6.6.5.1 Electrical schematic diagram



6.6.6 Diagnostic information and procedures

6.6.6.1 Diagnosis descriptions

Read the fault code through vehicle data connector (DLC diagnostic interface), execute the function of reading the switch and sensor value in the case without dismantling any part through reading the data sheet displayed on the intelligent tester by the data sheet of the ABS control module. Reading data sheet is the first step of trouble removal and also is one of the methods of shortening the diagnosis time.

6.6.6.2 Visual inspection

- Confirm fault symptom

The most difficult situation in troubleshooting is that there is no any symptom incurred; under such situation, the fault described by the user must be analyzed thorough. Then simulate the same or similar condition and environment when faults with the customer vehicle; no matter how rich the experience of the maintenance personnel is as well as how skilled the technology is, some important things will be ignored and error guesses will be made in some place during repair if troubleshooting without confirming the symptom. It may cause that the troubleshooting is unable to be done.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– Connector pins and vibrating point are main positions to be inspected. If the fault is caused by vibration, it is suggested using vibration method.

1. Slight vibrate possible fault sensor parts by using fingers, and inspect whether there is fault.
2. Gently shake the connector vertically and horizontally.
3. Slightly shake harness in vertical and horizontal direction.

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6.6.6.3 Fault diagnostic code (DTC) table

Diagnostic Trouble Code (DTC)	Failure Type
C1101	High power supply voltage
C1102	Low power supply voltage
C1200	Left front speed sensor wire fault(open circuit and short circuit)
C1201	Left front speed sensor signal fault (over range of signal. Interrupt of signal .signal invalid and so on.)
C1203	Right front speed sensor wire fault(open circuit and short circuit)
C1204	Right front speed sensor signal fault (Overrange of signal, interrupt of signal ,signal invalid and so on,)
C1206	Left rear speed sensor wire fault(open circuit and short circuit)
C1207	Left rear wheel speed sensor signal faults (signal exceeding range, signal interrupting and signal invalidation etc.)
C1209	Right rear speed sensor wire fault(open circuit and short circuit)
C1210	Right rear speed sensor signal fault (Overrange of signal, interrupt of signal ,signal invalid and so on,)
C1213	Wheel speed sensor frequency fault (the wheel speed difference is too large).
C2308	Left front wheel oil inlet valve fault
C2312	Left front wheel oil outlet valve fault
C2316	Right front wheel oil inlet valve fault
C2320	Right front wheel oil outlet valve fault
C2324	Left rear wheel oil inlet valve fault
C2328	Left rear wheel oil outlet valve fault
C2332	Right rear wheel oil inlet valve fault
C2336	Right rear wheel oil outlet valve fault
C2112	Electromagnetic valve relay faults
C2402	Pump motor faults

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C1604	ECU fault

6.6.6.4 Diagnostic unit can not communicate with vehicle

The diagnostic unit is connected with the data connector (DLC diagnose interface); the ignition switch is turned to ON; when operating the diagnostic unit, the vehicle or the tester is broken down if the display screen displays communication error information.

If the communication is normal after connecting tester to another vehicle, it is necessary to first inspect DLC of the vehicle.

When the communication still can't be established after the tester is connected with other vehicle, the problem may be caused by the tester. For details, refer to data communication system.

6.6.6.5 Fault Symptom Table

If the normal code is displayed in the DTC inspection, but the fault is still present, check whether the circuit has various symptoms in sequence given in the following table, and then enter into the relevant maintenance schedule to troubleshoot.

Symptoms	**Suspected Parts**	**Maintenance scheme**
Abs do not work	1. Inspect dtc, to confirm no history or current fault code.	Utilize diagnostic unit access module
	2 .ig2power supply circuit (abs module harness connector ca13 terminal32)	See 6.6.6.8 inspection of abs control module harness connector in keeping abs warning lamp normally on (voltage of terminal 32 of ca13).
	3 . Front speed sensor circuit	See 6.6.6.11 malfunction diagnosis of wheel speed sensor.
	4. Rear speed sensor circuit	See 6.6.6.11 malfunction diagnosis of wheel speed sensor.
	5.Check the brake system hydraulic electronic control unit with the proactive testing function of the diagnostic tester. If abnormal, inspect whether the hydraulic pipeline leaks.	See 6.6.6.6 active testing and data streams.
	6. Replace the hydraulic electronic control unit if the symptoms remain after it is confirmed the above mentioned circuits of the parts in question are normal after check.	See 6.6.7.1 replacement of hydraulic electronic control unit.
Abs can not	1. Inspect dtc, to confirm no history or current fault code.	Utilize diagnostic unit access module
	2 . Front speed sensor circuit	See 6.6.6.11 malfunction diagnosis of wheel speed sensor.
	3. Rear speed sensor circuit	See 6.6.6.11 malfunction diagnosis of wheel speed sensor.
	4. Brake light switch circuit	1.confirm the brake lamp works normally;

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effectively run		otherwise, refer to fault diagnosis that lighting system brake lamp does not work. 2.depress the brake pedal. The voltage of terminal 30 of the abs module harness connector ca13 is the voltage of the power supply.
Abs can not effectively run	5. Check the brake system hydraulic electronic control unit with the proactive testing function of the diagnostic tester. If abnormal, inspect whether the hydraulic pipeline leaks.	See 6.6.6.6 active testing and data streams.
	6. Replace the hydraulic electronic control unit assembly if the symptoms remain after it is confirmed the above mentioned circuits of the parts in question are normal after check.	See 6.6.7.1 replacement of hydraulic electronic control unit.
ABS warning lamp fault (keep on)	1 Combination instrument	See 6.6.6.8 ABS warning lamp keeps normally on.
	2 . Hydraulic electric control unit	See 6.6.6.8 ABS warning lamp keeps normally on.
ABS warning lamp fault(not light up)	1 combination instrument	See 6.6.6.9 ABS warning lamp is not on under any circumstances
Brake warning lamp failure (keep lighting constantly)	1.circuit of brake warning lamp	See 6.4.4.3 brake warning lamp keeps normally on.

6.6.6.6 Active testing and data streams

Active test

Suggestions:

The active test of the diagnostic unit can be performed in the case without dismantling any parts to operate the relay, actuator and other components. During troubleshooting, active test is firstly performed, thereby greatly reducing the working hours of the operation.

The data sheet can be displayed in the active testing process.

1. Connect intelligent tester to vehicle.
2. Turn ignition switch to ON (IG) position.
3. According to diagnostic tester screen to carry out active test.

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Tester display	Testing part	Control Range	Test remark
ABS warning lamp	ABS warning lamp light on or is not light up (ON / OFF)	Warning lamp on and off (ON/OFF)	Observe the combination meter
Pump motor	The pump motor actuates or does not actuate.	The pump motor actuates or does not actuate.	The sound of the motor during operation can be heard.
Left front oil inlet valve	ABS Magnetic coil work or do not work	Electromagnetic coils works or does not work.	Be capable of hearing the electromagnetic coil work sound.
Right front oil inlet valve	ABS Magnetic coil work or do not work	Electromagnetic coils works or does not work.	Be capable of hearing the electromagnetic coil work sound.
Left rear oil inlet valve	ABS Magnetic coil work or do not work	Electromagnetic coils works or does not work.	Be capable of hearing the electromagnetic coil work sound.
Right rear oil inlet valve	ABS Magnetic coil work or do not work	Electromagnetic coils works or does not work.	Be capable of hearing the electromagnetic coil work sound.
Left front oil drain valve	ABS Magnetic coil work or do not work	Electromagnetic coils works or does not work.	Be capable of hearing the electromagnetic coil work sound.
Left rear oil exhaust valve	ABS Magnetic coil work or do not work	Electromagnetic coils works or does not work.	Be capable of hearing the electromagnetic coil work sound.
Right front oil exhaust valve	ABS Magnetic coil work or do not work	Electromagnetic coils works or does not work.	Be capable of hearing the electromagnetic coil work sound.
Right rear oil draining valve	ABS Magnetic coil work or do not work	Electromagnetic coils works or does not work.	Be capable of hearing the electromagnetic coil work sound.

Data stream

Description	Status
Left front wheel speed	1km
Right front wheel speed	1km
Left rear wheel speed	1km

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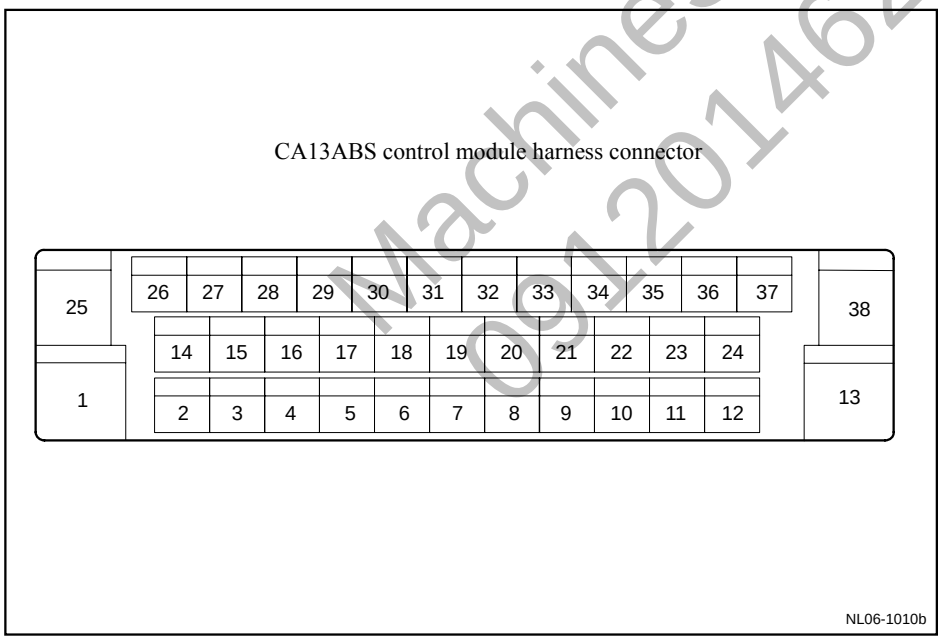
Right rear wheel speed	1km
Vehicle speed	1km
Left front oil inlet electromagnetic valve	Stop
Left front oil drain electromagnetic valve	Stop
Right front oil inlet electromagnetic valve	Stop
Right front oil exhaust electromagnetic valve	Stop
left rear oil inlet electromagnetic valve	Stop
Left rear oil exhaust valve electromagnetic valve	Stop
Right rear oil inlet electromagnetic valve	Stop
Right rear row of electromagnetic oil draining valve	Stop
ABS pump status	OFF
BCS status	OFF
Battery voltage	12.08V

6.6.6.7 list of ABS control module terminals



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Terminal No .	Description	Wiring	Terminal descriptions	Status	Specified Conditions
1	ALT	4. 0R	Power supply	Voltage positive	40A fuse
2	Empty	Empty	Empty		
3	WP RR	0.5Gr/Y	Right rear speed sensor signal	Wheel speed output	
4	ABS lamp	0.5O	ABS warning lamp	ABS output signal	Active type
5	Empty	Empty	Empty		
6	WS FR	0.5O/L	Right front speed sensor	Input	
7	Empty	Empty	Empty		
8	Empty	Empty	Empty		
9	Empty	Empty	Empty		
10	Empty	Empty	Empty		
11	Empty	Empty	Empty		
12	Empty	Empty	Empty		
13	GND	4.0B	Ground		
14	Empty	Empty	Empty		
15	Empty	Empty	Empty		
16	EBDlamp	0.5Br	EBD warning lamp	EBD warning lamp output	Active type
17	DIAGNOSTIC K	0.5Gr/P	K Line	Diagnostic interface	
18	WP FR	0.5Y	Right front speed sensor	Output	
19	WP RR	0.5L/B	Right rear speed sensor	Output	
20	WP RL	0.5W	Left rear speed sensor	Input	
21	Empty	Empty	Empty		

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22	WS FL	0.5R/L	Left front speed sensor	Input	
23	Empty	Empty	Empty		
24	Empty	Empty	Empty		
25	ALT	0.5R/L	Left front speed sensor	Input	
26	Empty	Empty	Empty		
27	Empty	Empty	Empty		
28	Empty	Empty	Empty		
29	Empty	Empty	Empty		
30	+BRAKE LIGHT SW	0.5Gr	Brake switch	Pedal switch input	
31	WS RR	0.5G/W	Right rear speed sensor	Input	
32	IG2	0.85G/Y	ON power supply	Ignition wire	10A fuse
33	WP RL	0.5W/R	Left rear speed sensor	Output	Voltage
34	WP FL	0.5O/B	Left front speed sensor	Output	Voltage
35	Empty	Empty	Empty		
36	Empty	Empty	Empty		
37	Empty	Empty	Empty		
38	GND	2.5B	Ground		

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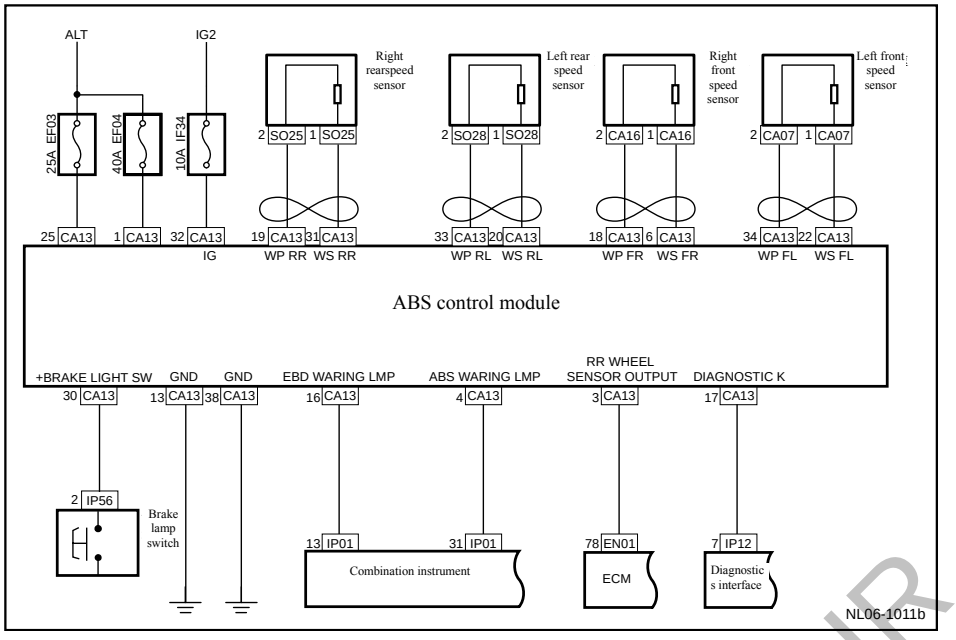
6.6.6.8 Keeping ABS Warning Light Normally On

Circuit diagram:



Diagnostic Steps:

1	The ABS control module is accessed via a diagnostic unit.

A. Check whether DTC is faulty

Yes → Repair the circuit according to DTC output

No

2	Inspect the battery.

A. Measure the voltage of the accumulator with the multimeter.

Standard Voltage: 11-14 V

B. Confrim whether the voltage is at a specified Value.

No → Charge the battery or inspect the charging

Yes

3	Check ABS control module harness connector

A. Inspect whether the harness connector is connected correctly.

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No → Connect the harness connector properly.

Yes

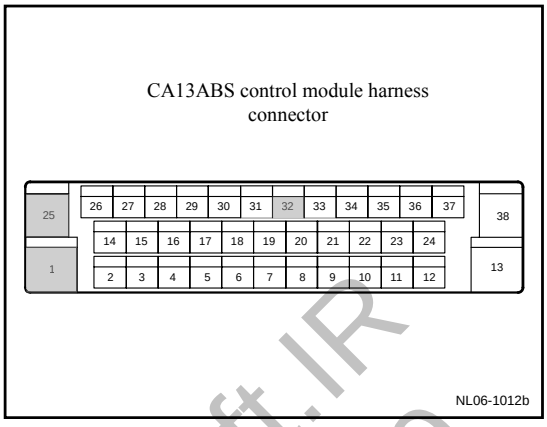
4	Check ABS control module harness connector (terminal voltage)

(a) Turn off the ignition switch.

B. Disconnect the harness connector of the control module.

C. Turn on the ignition.

D. Measure the voltages between Terminals 1, 25 and 32 of the harness connector CA13 and the body ground wire.



Standard Voltage: 11-14 V

E. Confirm if the voltage conforms to standard value.

No → Check fuse, repair or replace harness

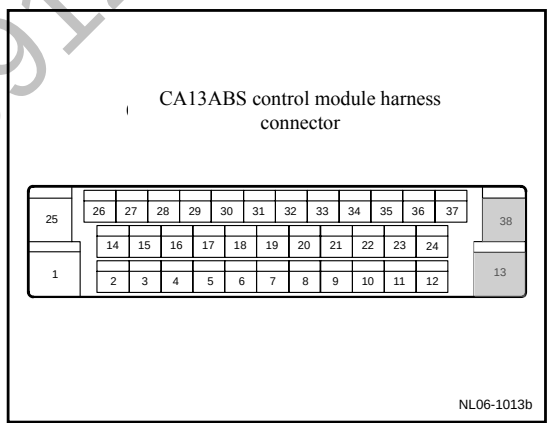
Yes

5	Check ABS control module harness connector (grounding terminal Continuity)

A. A universal meter is used for measuring the resistance among the terminals 13 and 38 of the connector CA13 and the body grounding.

Standard Resistance: Less than 1 Ω

B. Confirm whether the resistance is the standard value.



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No → Repair or replace the wire harness or the wire

Yes

6	Replace hydraulic electric control unit assembly

(a) Replace hydraulic electric control unit, refer to 6.6.7.1 hydraulic electric control unit replacement.

(b) Connect to positive of battery.

(c) Turn on ignition switch, confirm if ABS warning lamp is ON after go out.

Yes → The system is normal.

No

7	Inspect the combination instrument.

A. Connect the diagnostic tester.

B. Selected “Active test” on the function test

Active test: A B S

Tester display	Testing part
ABS warning lamp	ABS warning lamp light on or is not light up (ON / OFF)

C . Check whether the ABS warning lamp works normally.

Yes → The system is normal.

No

8	Replace control unit of combination instrument

(a) Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.

(b) For replacement of combination instrument control unit, refer to the replacement of combination instrument assembly.

(c) Confirm the repair is completed.

Next

9	The system is normal.

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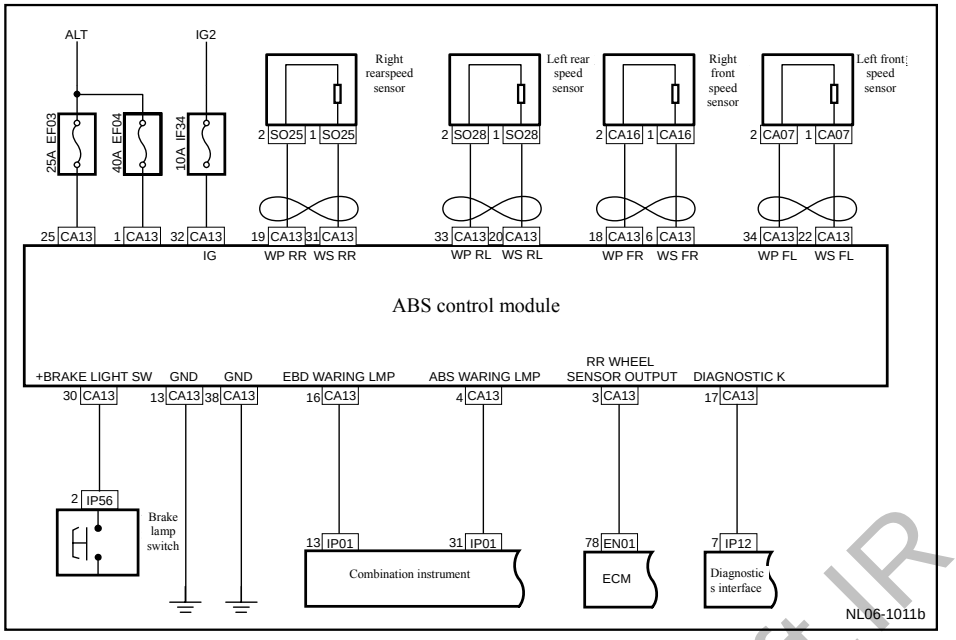
6.6.6.9 ABS warning Light is not on under all circumstances

Circuit diagram:



Diagnostic Steps:

1	Inspect the battery.

A. Measure battery voltage.

Standard voltage: 11-14 V

B. Confrim whether the voltage is at a specified value.

No → Inspect and replace the battery or charge system.

Yes

2	Inspect the combination instrument connector.

A. Turn the ignition switch to OFF position.

B. Disconnect the negative (-) cable from the accumulator.

C. Check whether the connector is correctly connected to the combination instrument assembly.

No → Correctly connect the connector.

Yes

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3	Check the harness (combination instrument asembly power supply, ground).

(a) Make ignition switch turn to OFF.

(b) Disconnect negative cable from battery.

(c) Disconnect harness connector IP01 from combination instrument assembly.

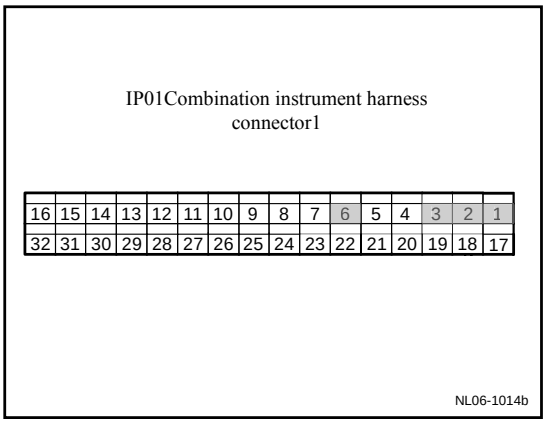
(d) Battery negative cable connects to battery.

(e) Ignition switch was turned to ON (IG).

(f) Use multimeter to measure voltage between connector IP01 terminal 1 and 2 respectively with vehicle body groudning.

Standard Voltage：11-14V

(g) Ignition switches turn to OFF.



(h). Measure the resistance between terminals No.3 and No.6 of connector IP01 and the body ground respectively with a multimeter.

Standard Resistance: Less than 1 Ω

Confirm whether the measured value conforms to the standard value.

No → Check fuse, repair or replace harness

Yes

4	Inspect the combination instrument.

(a) Connect diagnostic tester, and turn ignition switch to ON (IG) position.

(b) Select active test on functional test.

Active test: ABS warning lamp

Tester display	**Testing part**
ABS warning lamp	ABS warning lamp light on or is not light up (ON / OFF)

C. Check whether the ABS warning lamp works normally.

Yes → The svstem is normal.

No

5	Replace combination instrument

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A. For replacement of the combination instrument assembly, see replacement of combination instruments.

B. Check whether the ABS warning lamp works normally.

Yes → The system is normal.

No

6	Replace ABS control module

(a) Replace ABS control module refer to 6.6.7.1 hydraulic electric control unit replacement .

(b) Check if ABS warning lamp work is normal .

(c) Confirm the repair is completed.

Next

7	The system is normal.

6.6.6.10 Diagnosis of Power Malfunctions and Hydraulic Electronic Control Unit Assembly Internal Malfunctions

Diagnostic Trouble Code (DTC)	**Failure Type**
C1101	High power supply voltage
C1102	Low power supply voltage
C2308	Left front wheel oil inlet valve fault
C2312	Left front wheel oil outlet valve fault
C2316	Right front wheel oil inlet valve fault
C2320	Right front wheel oil outlet valve fault
C2324	Left rear wheel oil inlet valve fault
C2328	Left rear wheel oil outlet valve fault
C2332	Right rear wheel oil inlet valve fault
C2336	Right rear wheel oil outlet valve fault
C2402	Pump motor fault
C1604	ECU fault

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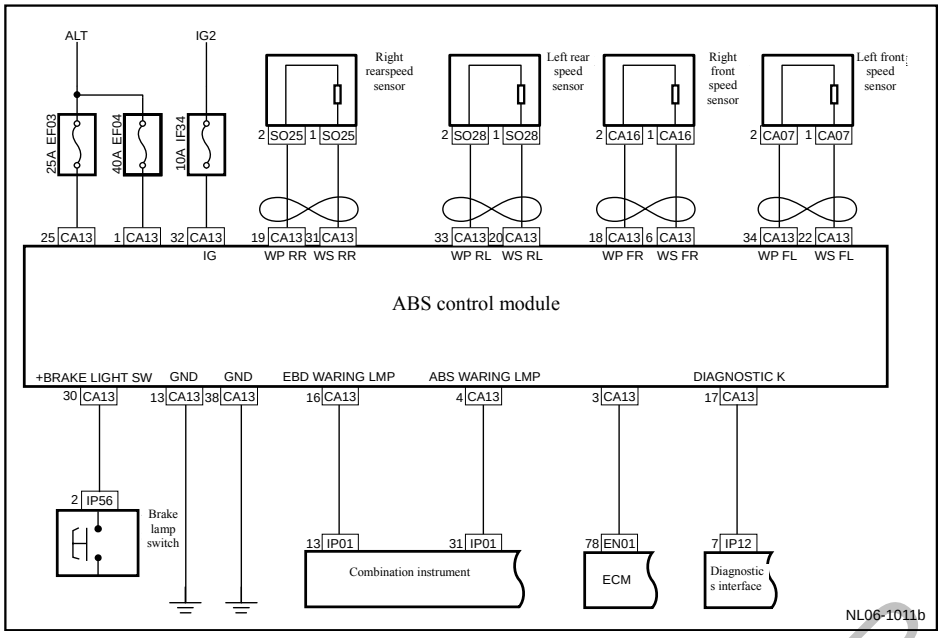
Circuit diagram:



Diagnostic Steps:

1	Inspect the battery.

A. Measure battery voltage.

Standard Voltage: 11-14 V

B. Confrim whether the voltage is at a specified Value.

No → Inspect and replace the battery or charge system.

Yes

2	Check ABS control module harness connector

A. Inspect whether the harness connector is connected correctly.

No → Connect the harness connector properly.

Yes

3	Check ABS control module harness connector (terminal voltage)

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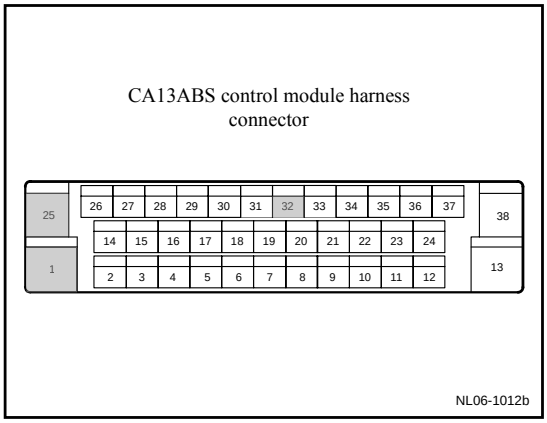
(a) Turn off the ignition switch.

B. Disconnect the harness connector of the control module.

C. Turn on the ignition.

D. Measure the voltages between Terminals 1, 25 and 32 of the harness connector CA13 and the body ground wire.



Standard Voltage: 11-14 V

E. Confirm whether the voltage is as specified in the standard.

Yes → Check fuse, repair or replace harness

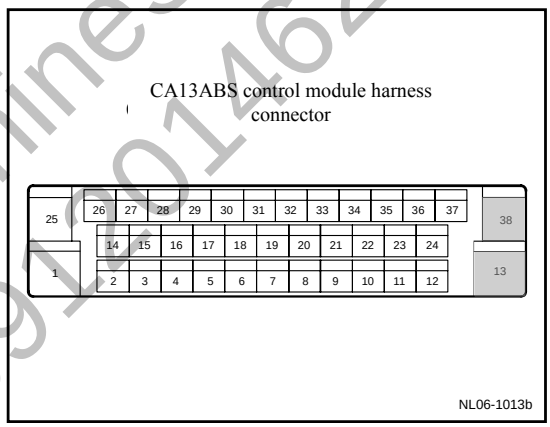
No

4	Check ABS control module harness connector (grounding terminal Continuity)

A. A universal meter is used for measuring the resistance among the terminals 13 and 38 of the connector CA13 and the body grounding.

Standard Resistance: Less than 1 Ω

B. Confirm whether the resistance is the standard value.



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Yes → Repair or replace the wire harness or the wire

No

5	Replace ABS control module assembly

(a) Replace ABS control module assembly, Refer to 6,6,7,1 hydraulic electric control unit replacements.

(b) Connect to battery negative cable.

(c) Turn on ignition switch, confirm ABS warning lamp is ON.

(d) Make sure that the repair work is finished.

Next

6	The system is normal.

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6.6.6.11 Wheel Speed Sensor Malfunction Diagnosis

Diagnostic Trouble Code (DTC)	Failure Type
C1200	Left front speed sensor wire fault(open circuit and short circuit)
C1201	Left front speed sensor signal fault (over range of signal. Interrupt of signal .signal invalid and so on.)
C1203	Right front speed sensor wire fault(open circuit and short circuit)
C1204	Right front speed sensor signal fault (Overrange of signal, interrupt of signal ,signal invalid and so on,)
C1206	Left rear speed sensor wire fault(open circuit and short circuit)
C1207	Left rear wheel speed sensor signal faults (signal exceeding range, signal interrupting and signal invalidation etc.)
C1209	Right rear speed sensor wire fault(open circuit and short circuit)
C1210	Right rear speed sensor signal fault (Overrange of signal, interrupt of signal ,signal invalid and so on,)
C1213	Wheel speed sensor frequency fault (the wheel speed difference is too large).

Notes:

This maintenance manual is only targeted at the troubleshooting of the front left wheel speed sensor. Troubleshooting of other wheel speed senors is similar. See Diagnosis of Front Left Wheel Speed Sensor Malfunctions.

Circuit diagram:

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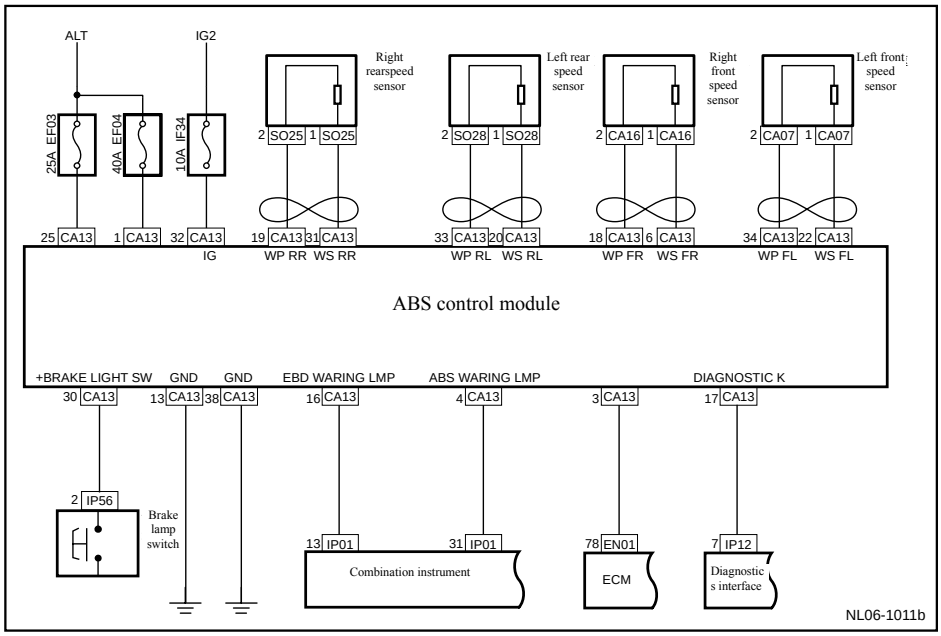

Diagnostic Steps:

1	Inspect the left front wheel speed sensor harness connector.

A. Inspect whether the left front wheel sensor harness connector is correctly connected.

No → Connect the harness connector properly.

Yes

2	Inspect the installation of the left front wheel speed sensor.

A. Check whether the front left wheel speed sensor is correctly installed.

B . Tighten torque: 10Nm(Metric)7 . 4lb-ft (English system)

No → Correctly install the left front wheel speed

Yes

3	Inspect the left front wheel speed sensor.

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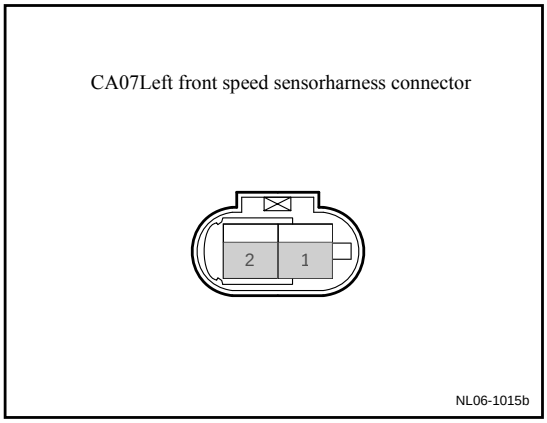
A. Test the front left wheel speed sensor with a multimeter according to the following tables.

Note: rotate the wheel by hand when measuring.

B. Confirm whether the voltage and current are the standard values.



Wheel speed sensor	**Descriptions**
Sensor type	Hall-type speed sensor
Signal current	Low level: 5.6 - 8.4 mA; high level: 11.2 - 16.8 mA
Clearance value with signal panel	Front axle 1.626 mm (0.064in) Rear axle 0.597 mm (0.023 in)

Yes → Go to step 5

No

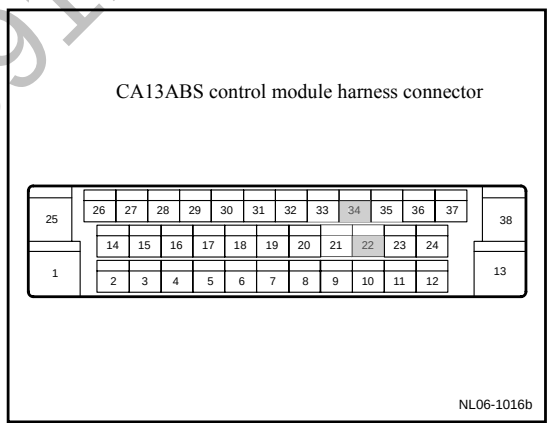
4	Inspect the harness (that between the left front wheel speed sensor and the ABS control module).

(a) Disconnect left front speed sensor harness connector.

(b) Disconnect ABS control module harness connector.

(c) Use multimeter to measure resistance between connector CA13 terminal 34 and CA07 terminal 2.

(d) Use multimeter to measure resistance between connector CA13 terminal 22 and CA07 terminal 1.



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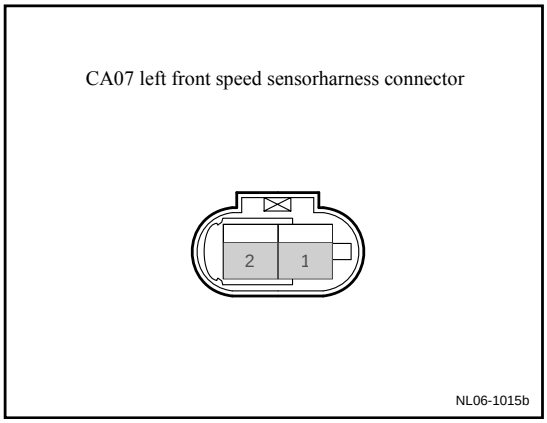
Standard Resistance: Less than 1 Ω

(e) Measure resistance between connector CA13 terminal 34, 22 and vehicle grounding.

Standard resistant value :10kΩ or higher

Confirm whether the resistance conforms to standard value.



No → Repair or replace the harness.

Yes

5	Inspect the left front wheel speed sensor.

A.Test both terminals of the sensor with the multimeter and confirm that no short circuit occurs between the both terminals.

B. The resistances between both terminals of the sensor and the body ground wire are infinite.

C. Confirm whether the resistance is as specified in the standard.

No → Replace left front wheel speed sensor

Yes

6	Inspect the left front wheel speed sensor head.

A For dismantlement of the front left wheel speed sensor, see 6.6.7.2 Replacement of Wheel Speed Sensors (front).

B. Check the sensor head for scratches, foreign matters and dirt.

Yes → Clean or replace the sensor

No

7	Inspect the left front wheel speed sensor gear ring.

A. Inspect the left front wheel speed sensor gear ring deforms or lacks of teeth.

B.

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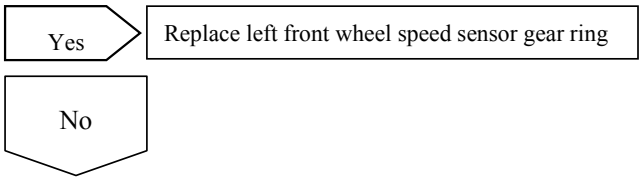
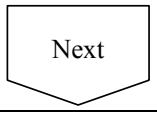
C.



8	Replace hydraulic electric control unit

A . For replacement of the hydraulic electronic control unit, see 6.6.7.1 Replacement of Hydraulic Electronic Control Unit.

B. Confirm the completion of repair.



9	The system is normal.

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6.6.7 Dismantle and installation

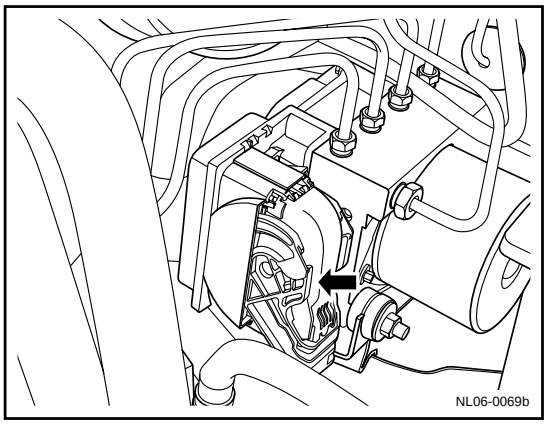
6.6.7. 1 Hydraulic electric control unit replacement

Dismantle procedure

Warning!

Warning: Refer to Warning for battery disconnection in Warning and precaution .

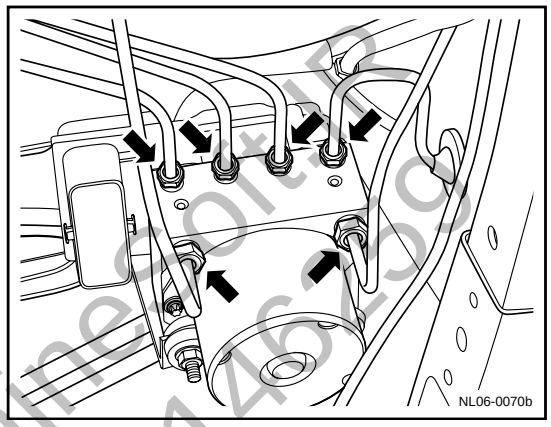
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable disconnection/connection procedures .
2. Dismantle air filter and air pipe between air filter and throttle.
3. Press plug clip pin, and pull lock catch upwards, and disconnect harness of brake adjuster.
4. Discharge brake fluid
5. Cover the socket and plug of the harness connector with cleaning cloth to avoid contact with the brake fluid.



Notes:

See Important precaution brake fluid affected for paint and electrical part in Warnings and precaution .

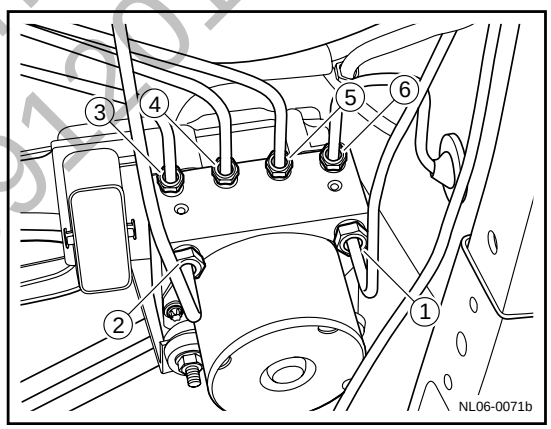
6. Remove 6 joint nuts for the brake line from the brake regulator and wipe off the overflowing brake fluid immediately.



7. Mark the position where the reconnection is made with a label or by recording.

Tips:

1. To No.1 brake master pump
2. To No.2 brake main pump
3. To right side brake slave pump of front wheel
4. To the left brake cylinder for the rear wheel.
5. Right brake cylinder for rear wheel
6. Left brake cylinder for front wheel.



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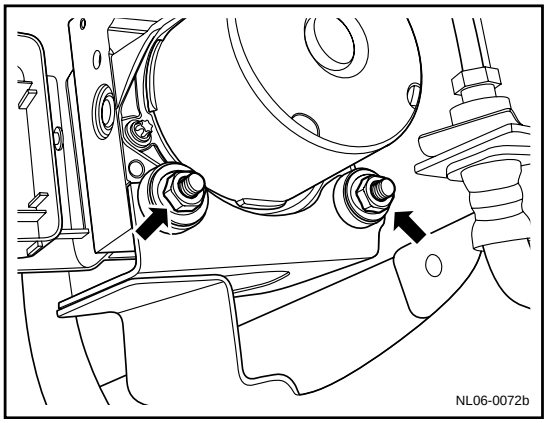
8. Remove 2 fixing nuts for the brake regulator bracket.
9. Take out the hydraulic control unit.



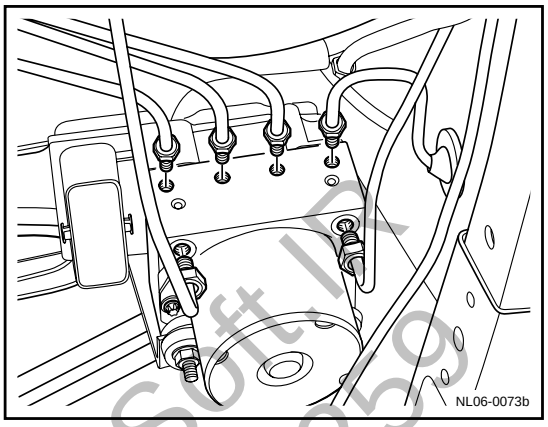
Installation Procedure:

1. Install Hydraulic control unit and tighten fixing nut.

Torque:20 Nm (Metric) 14.8 lb-ft (English system)

2. Install 6 brake hard pipe joint nut and tighten it.

Torque:16 Nm (Metric) 11.9 lb-ft (English system)



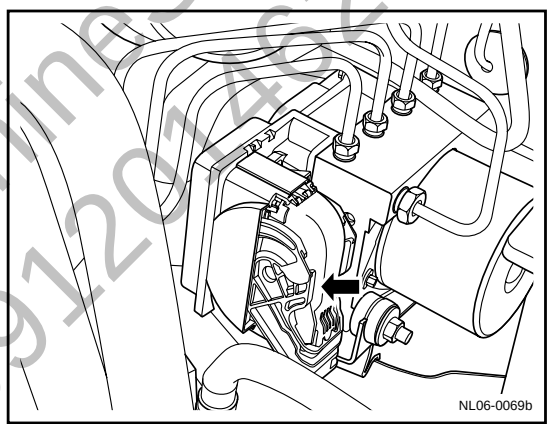
3. Press buckle, and connect hydraulic electric control unit harness connector.
4. Fill with braking fluid.

Notes:

See Important precaution for filling Brake System with brake fluid in warnings and precaution .

Important precaution

5. Exhaust the air from the hydraulic braking system.
6. Check the brake system for leakage.
7. Install the engine bottom guard plate.
8. Connect the battery negative cable.



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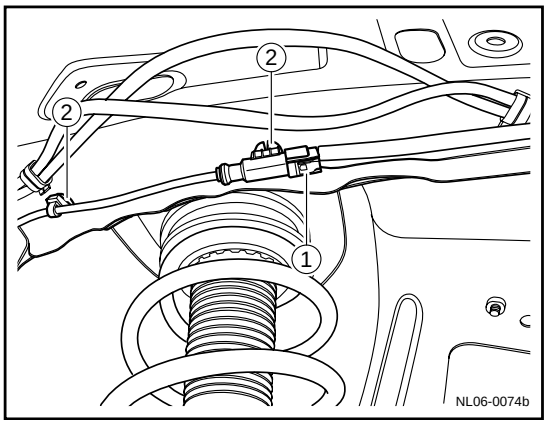
6.6.7.2 Speed sensor replacement (front)

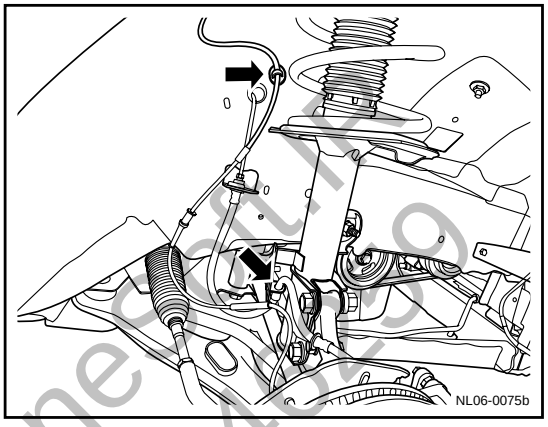
Dismantle procedure

Warning!

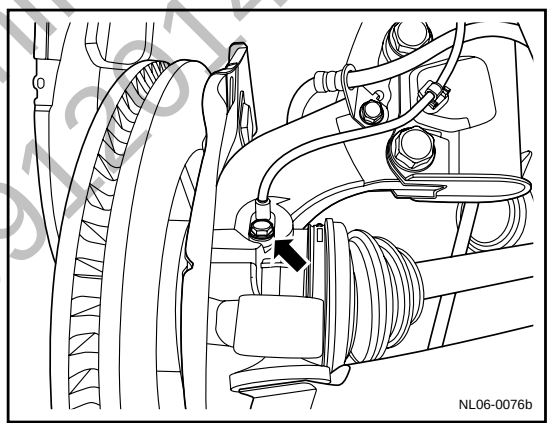
Warning: refer to warning for battery disconnection in Warning and precaution .

1. Dismantle battery negative cable , refer to 2.11.8.1 Disconnect connecting process of battery cable
2. For lifting vehicle see 1.3 Lifting vehicle .
3. For dismantling of front wheels, refer to 4.4.5.1 Replacement of wheels.
4. For dismantling of front fender lining plate, refer to 12.10.1.9 Replacement of front fender lining plate.
5. Disconnect harness connector 1 of the front wheel speed sensor and detach the sensor harness buckle 2.
6. Detach the front wheel speed sensor harness buckle.





7. Remove the fixing bolt for the front wheel speed sensor.
8. Dismantle the front wheel speed sensor.



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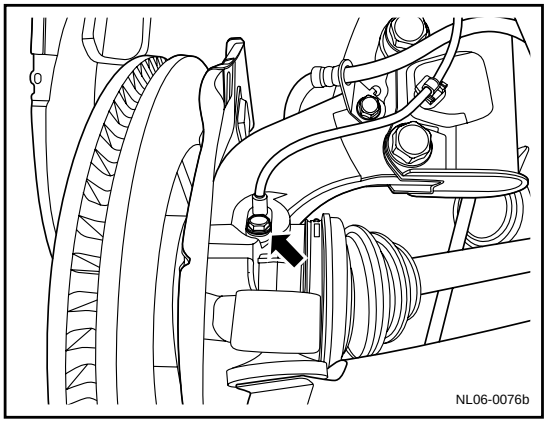
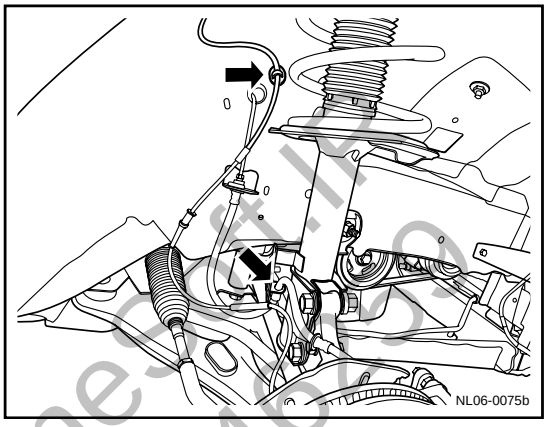
Installation Procedure:

1. Install front wheel speed sensor and tighten it by using bolt with plain washer.

Torque:20 Nm (Metric) 14.8 lb-ft (English system)



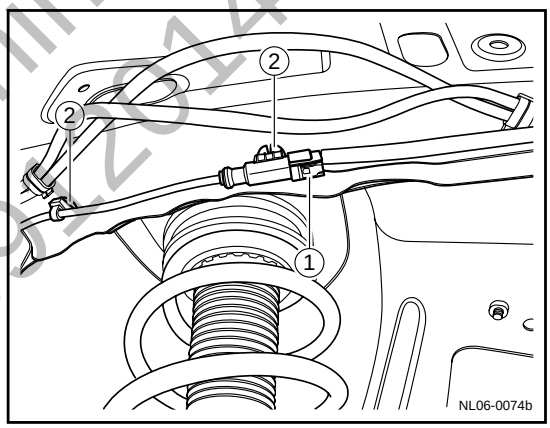
2. Fix fixing buckle of front wheel speed sensor.



3. Connect front wheel speed sensor harness connector 1 and fix buckle 2 of sensor wire harness.
4. Install the front fender liner.
5. Lower the vehicle.
6 . Connect the battery negative cable.
7. Install the front wheel.

Notes:

Similarly disassembly method of left front and right front speed sensor



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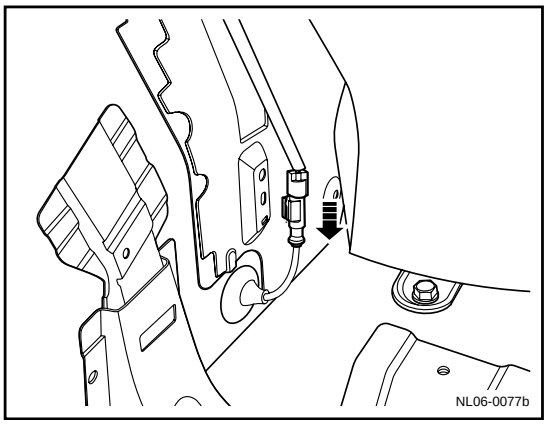
6.6.7.3 Speed sensor replacement (rear)

Dismantle procedure

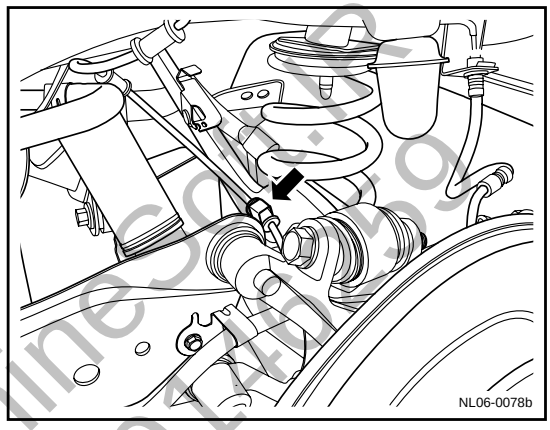
Warning!

Warning: Refer to warning for battery disconnection in Warning and precaution .

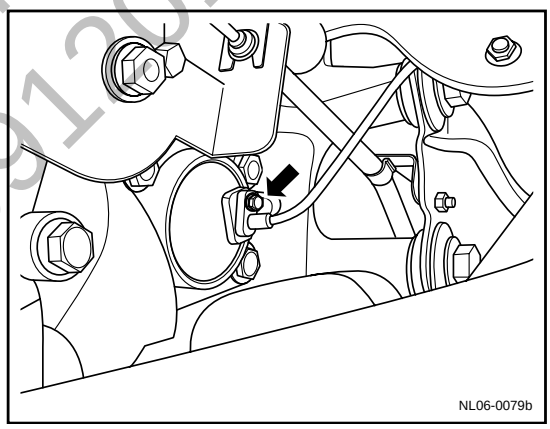
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery cable disconnection/connection procedures .
2. For dismantling of boot trimming plate, refer to 12.9.1.5 Replacement of lower trimming plate of rear column.
3 . Disconnect rear wheel speed sensor harness connector.
4. For lifting vehicle see 1.3 Lifting vehicle .
5. For removal of rear wheels, see 4.4.5.1 replacement of Wheels.



6. Detach the rear wheel speed sensor harness from the rear suspension.



7. Remove the rear wheel speed sensor fixing bolt.
8. Dismantle the rear wheel speed sensor.



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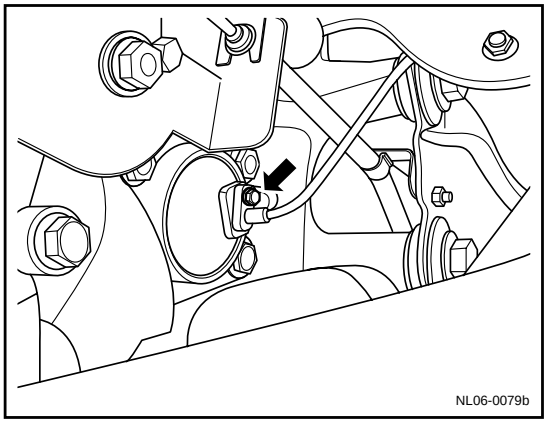
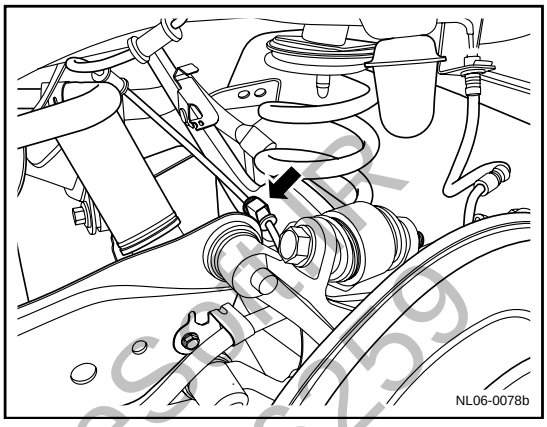
Installation Procedure:

1. Install rear wheel speed sensor and tighten it by using bolt with plain washer.

Torque:20 Nm (Metric) 14.8 lb-ft (English system)



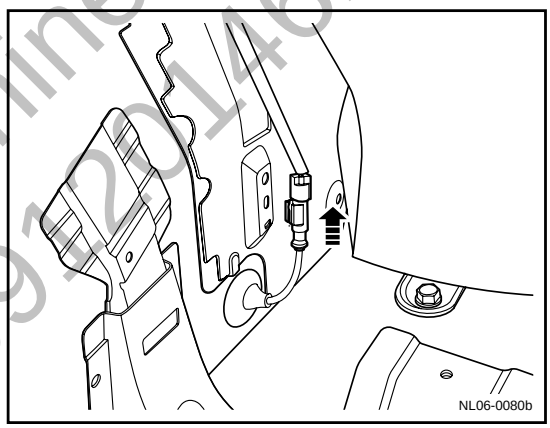
2. Fix rear wheel speed sensor harness onto rear suspension.
3. Install rear wheels.
4. Lower the vehicle.



5. Connect the harness connector of the rear wheel speed sensor.
6. Install the rear column lower trim panel.
7. Connect the battery negative cable.

Notes:

The method for disassembling the left rear and right rear speed sensors is similar.



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7 Steering system

7.1 Warning and precaution

7.1.1 Warning and precaution

Important precaution on anti-corrosion Materials

Warning!

If the power steering system has been repaired, the correct steering fluid level can not be obtained unless the air in the steering system is not discharged. The air in the fluid may cause pump cavitation noise and may cause power steering pump damage over a period of time.

Important precaution on power steering hose disconnection

Warning!

Do not start up the vehicle whenever the power steering gear inlet or outlet hose is disconnected. All hose interfaces must be blocked or covered when disconnecting the hose. Otherwise, pollute or loss the power steering fluid and damage the system.

Important precaution on steering wheel in the steering limiting position

Warning!

The duration of the steering wheel in the steering limiting position does not exceed 5s; otherwise, the steering pump may be damaged.

Precautions of correctly using power steering fluid

Warning!

When adding or completely replacing the oil, be sure to use the correct power steering fluid. the hose and sealing member may be damaged or oil leaks due to the use of incorrect oil.

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7.2 Hydraulic boosting steering system

7.2.1 Specifications

7.2.1.1 Fastener specifications

Fastener Name	Model	Torque:	
		Metric (N·m)	English system (lb-ft)
Power steering gear fixing device	M14×1.5	125	92.5
Fixing bolt of universal fork	M8	24	17.8
Fixing device of oil can support and body	M6	9	6.7
The power steering pump and the engine are connected with the bolt.	M10×1.25	50	37
The power steering pump and the engine are connected with the nut.	M10	50	37
A-shaped hose hoop is fixed by the steering gear dust cover and the steering gear.	D=70mm	-	-
Lengthened shaft and gear shaft fixing device	M8	24	17.8
Pipe column bracket and fixing bolt of beam	M8	25	18.5
The steering column spline dust cover and the front frame panel are fixed Fixed nut	M6	9	6.7
Oil return pipe clamp and steering gear fixing nut	M6	9	6.7
Mechanical steering column assembly coupling nut	M8	25	18.5
Cotter Pin	d=2.5;l=30	33	24.4
Oil pump and oil can are connected with the elastic hoop of the oil tube steel belt.	D=24	-	-
Fixture of power steering inlet-outlet oil pipe assembly	M6	9	6.7
Fixing flat washer of steering gear	M14	-	-
Fixing bolt of steering gear	M14	125	92.5

7.2.1.2 General specifications

Applications	Specification	
	(Metric)	English system
System pressure difference (direction adjustment)	490kPa or less	71 psi or less
Idling system pressure (steering maximum)	More than or equal to 8,000kPa	More than or equal to 900psi
Approximate fuel capacity (complete set power steering system)	0.91 L	4.58 pt

Applications	Type	Specification
Fluid	Power steering fluid	DEXRONⅢ

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7.2.2 Description and operation

7.2.2.1 Description and operation

Warning!

See Important precaution on the steering wheel in steering limiting position in warning precaution.

Warning!

Before disconnecting the mechanical steering column assembly and the power steering gear assembly with the tie rod, the wheel should be maintained in the forward direction, and the mechanical steering column assembly must be in the LOCK (lock) position.

After disconnecting the above part, do not move the front wheel tire and the wheel; otherwise, it will cause that certain parts are wrongly positioned in the process of installation and the airbag spiral coil in the mechanical steering column assembly deviates from the center to damage the airbag spiral coil.

Description of power steering pump assembly

The power steering pump assembly is a component served as a vane-type pump that provides the working hydraulic pressure to the whole power steering system.

The power steering pump assembly consists of the following components:

– Pump housing
– Vane pump rotor
– Blade of vane pump
– Front side plate of vane pump
– Vane pump shaft
– Vane pump shaft bearing
– Oil pressure switch assembly
– Flow control valve assembly
– Suction pipe

Oil seal and O-ring

The following parts are installed in the pump housing side hole:

– Suction pipe
– Oil pressure switch assembly
– Flow control valve assembly

The flow control valve assembly consists of the following parts:

– Oil outlet connector
– Flow control valve
– Flow control valve pressure spring

The flow control valve hole and the oil outlet interface are integrated. The flow control valve plays the main role in preventing the excessive pressure of the steering pump.

Description of power steering gear assembly with tie rod

The power steering gear assembly with tie rod adopts hydraulic power rack and pinion steering gear. When turning the steering wheel, the motion of the steering wheel is transferred to the steering control valve shaft, and the gear rack on the steering control valve shaft is engaged, so that the rack moves left and right.

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The power steering gear assembly with tie rod is provided with a steering control valve. The steering control valve introduces the high-pressure oil from the power steering pump assembly to the two sides of the rack piston to push the rack piston. The integrated power cylinder piston is connected with the rack, so that the hydraulic power subject to the rack piston is converted into the linear force to move the rack left and right; the linear force is transmitted to the internal and external steering tie rods, and then transmitted to the steering knuckle; and the steering knuckle turns the wheel. If hydraulic auxiliary is invalid, need more steering force applied to the steering wheel for manual control of the steering.

Description of power steering fluid

Warning!

When adding or completely replacing the oil, be sure to use the correct power steering fluid; if not, the hose and sealing element may be damaged and oil leaks. See power steering fluid recommended in this chapter.

The power steering pipeline assembly with oil can is made of plastic; and the internal oil level height can be seen. An oil level scale mark at the side of the oil pot is used for indicating the correct level position in the power steering fluid.

Be sure to correctly use oil.

– Oil temperature after preheating will be 75℃-80℃ (167-176ºF).

The liquid level shall be located between the marks HOT MAX and HOT MIN.

– Oil fluid and oil fluid temperature after cooling is about20℃-25℃ (68-77ºF) The liquid level shall be located between the marks COLD MAX and COLD MIN.

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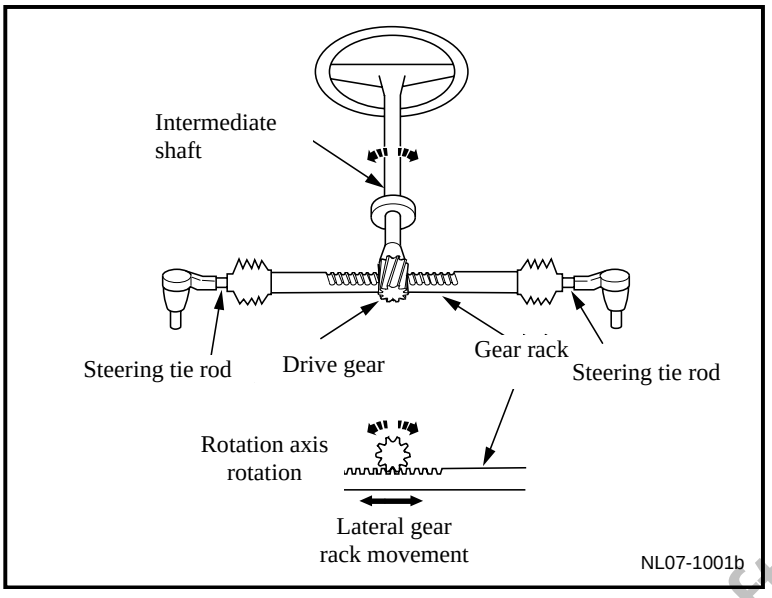
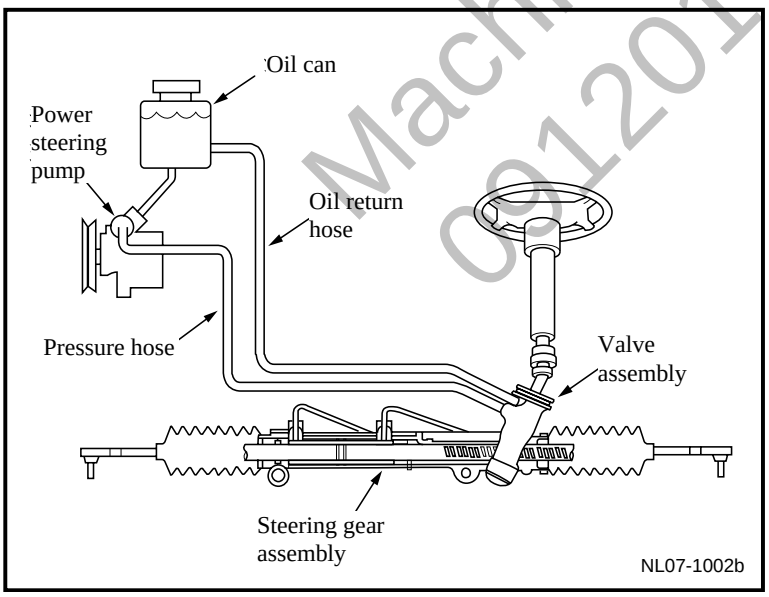
7.2.3 System operating principle

Hydraulic power gear rack and pinion steering operating principle



When there is no hydraulic pressure assisting to the hydraulic power rack and pinion steering gear, the operating principle of the steering gear is as shown in figure The torsional force applied on the steering wheel is transmitted to the steering gear pinion (steering control valve gear) through an intermediate shaft. Since the driving gear teeth (steering control valve gear teeth) are in engagement with the rack teeth, the torsional force transmitted from the steering wheel is converted into the linear force of the gear rack, so that the gear rack moves left and right. The linear force is further transmitted to the steering knuckle through the internal and external steering tie rods; and the steering knuckle reverses the direction of the wheel.



A hydraulic power rack and pinion steering system with is as shown in figure. the mechanical rack and pinion steering gear is designed with the steering power cylinder and the steering control valve integrally to form a whole power steering gear. The power cylinder piston and the rack are integrated to divide the power cylinder into left and right cavities.

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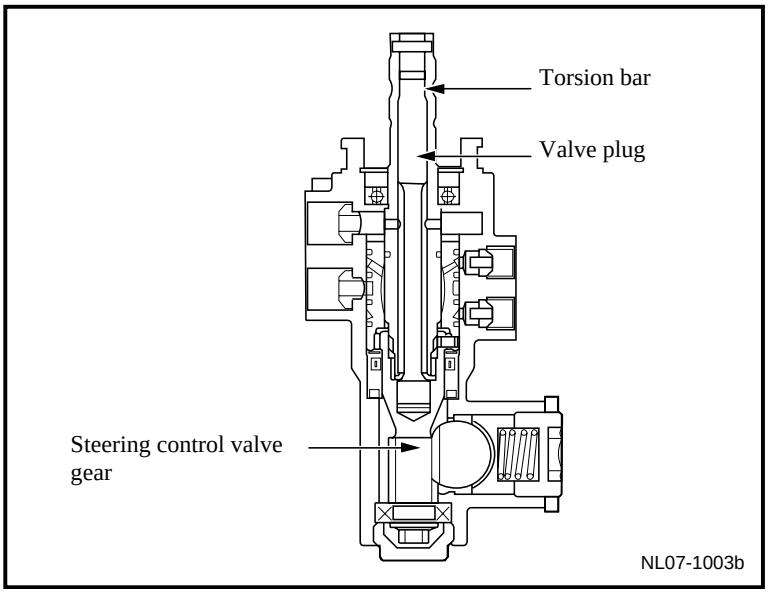

When the steering wheel is not turned, the steering control valve is in the middle, and the oil from the power steering pump assembly is flowed into the valve cavity from the oil inlet of the steering control valve. The steering control valve is located in the middle, so that the left and right cavities of the power cylinder are communicated; thus, oil is flowed to the oil can from the oil outlet of the steering control valve, so that the hydraulic power does not work.

When turning the steering wheel, the steering shaft rotates together with the steering control valve spool; due to road surface steering resistance transferred from the steering knuckle arm, the power cylinder piston and the rack can not move temporarily, so that the steering control valve gear also can not rotate together with the steering shaft temporarily. In this way, the torque transmitted by the steering shaft to the steering control valve gear can only make a torsion bar in the steering control valve to produce little torsional deformation, so that the steering shaft together with the steering control valve spool can rotate a little in respect to the steering control valve gear; therefore, the steering control valve leads the cavity at one side of the power cylinder to become a high-pressure oil inlet cavity and that at the other side to become a low-pressure oil return cavity. The high hydraulic acting force acted on the power cylinder piston helps the steering control valve gear to compel the steering rack to move to one side; and meanwhile, the steering control valve gear itself also begins to rotate with the steering shaft in the same direction. As long as the steering wheel continues to rotate, the torsional deformation of the torsion bar remains unchanged and the assistance action of the steering control valve is also unchanged. In case the steering wheel stops rotation, high hydraulic acting force in one side cavity of the power cylinder is still present temporarily, which causes that the steering control valve gear continues to rotating; thus, the deformation of the torsion bar is reduced until the torsion bar restores to its natural state. The steering control valve is restored to the middle position; the left and the right of the power cylinder are communicated, so that the hydraulic power does not work. At this time, the steering wheel keeps still in a certain position and the wheel rotation angle is kept constant. If re-rotating the steering wheel, hydraulic power also works.

Hydraulic pressure subject to power cylinder piston is converted into linear force the help the rack to move left and right and promote the rotation of the knuckle and wheel through a steering tie rod.

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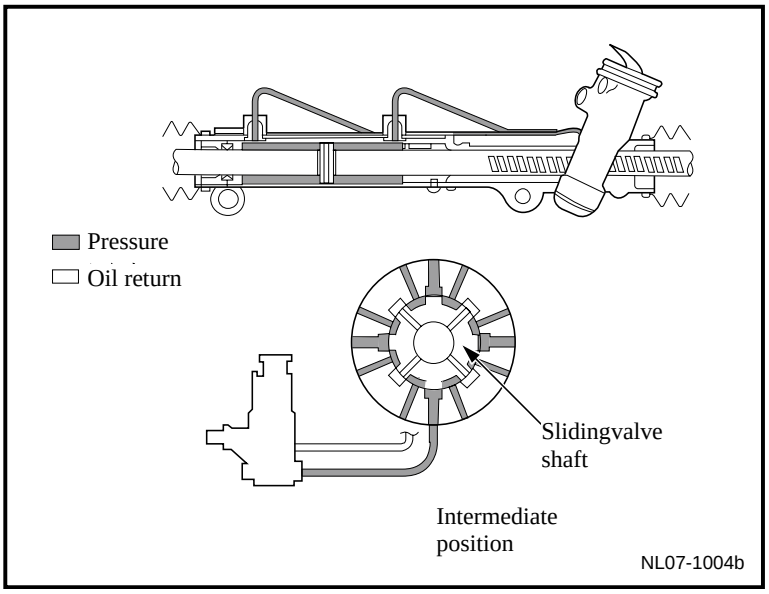
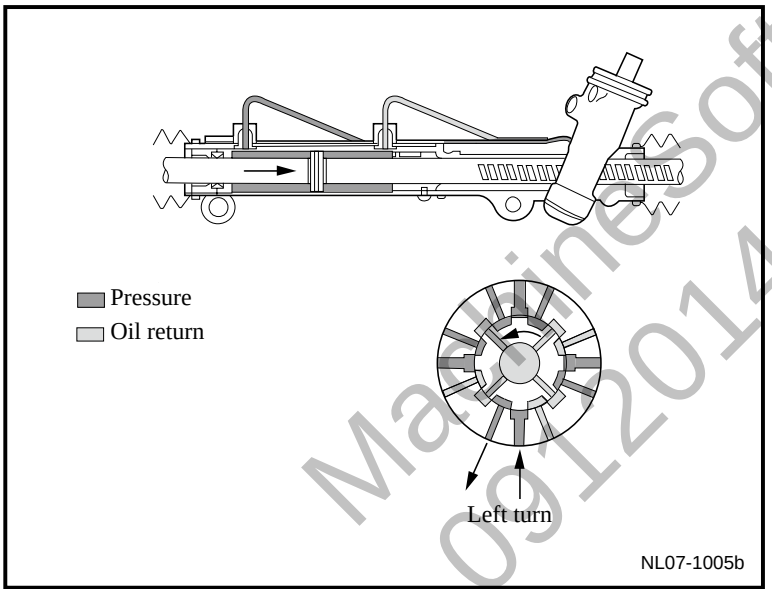
Control valve is in the middle position



Control valve turning left



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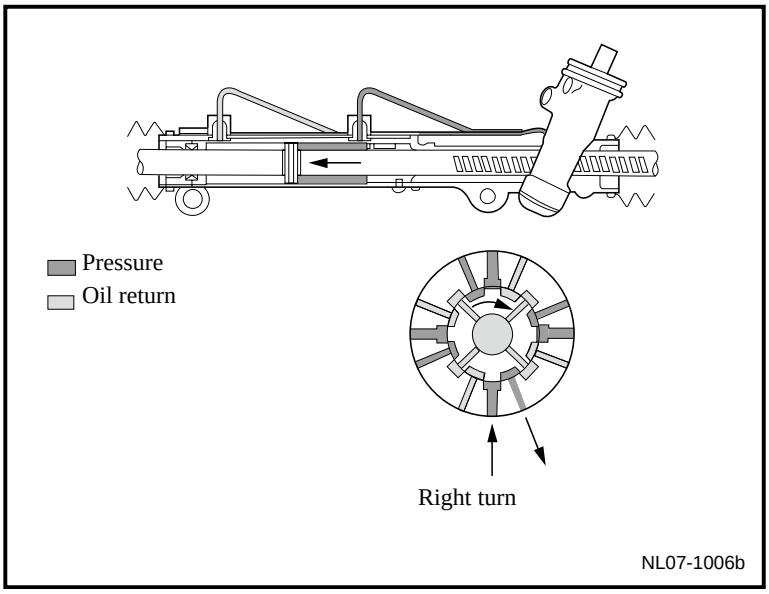
Control valve turning Right



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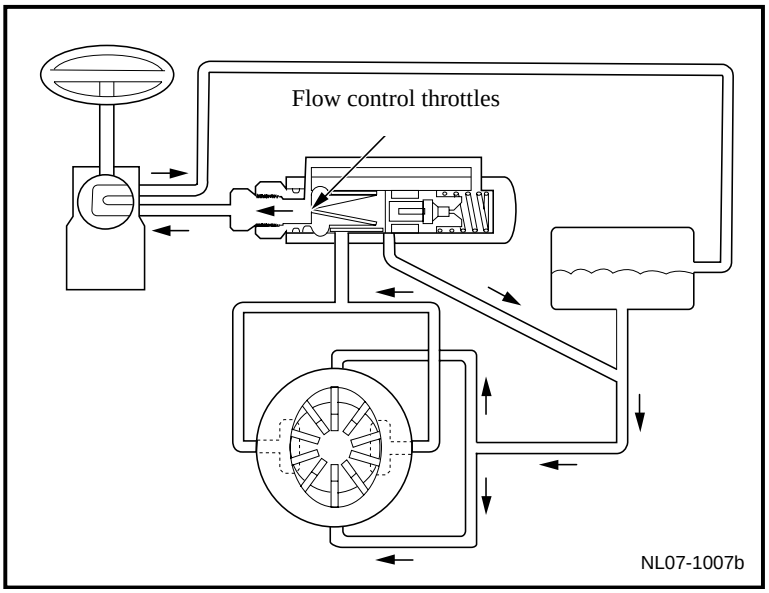
7.2.3.2 Power steering pump assembly work principle



The power steering pump assembly is a vane-type power steering pump, and its operating principle is as shown in figure

Rotating engine torque is transmitted to the power steering pump assembly belt pulley through the transmission belt and drives the power steering pump assembly shaft and the rotor to rotate， blades installed on the rotor are hurled out by the centrifugal force resulted in the revolution and revolves being attached closely and tightly to the internal wall of the pump ring (pump rear shell body) to absorb the steering fluid in the oil pan into the pump cavity and compress the steering fluid into the steering gear through the flow control valve for the purpose of providing hydraulic driving force to the steering gear.

The flow control valve regulates the flow of the oil flowed into the steering gear according to the oil pressure in the system to adjust the oil pressure in the system. Prevent the hydraulic pressure of the system too high.

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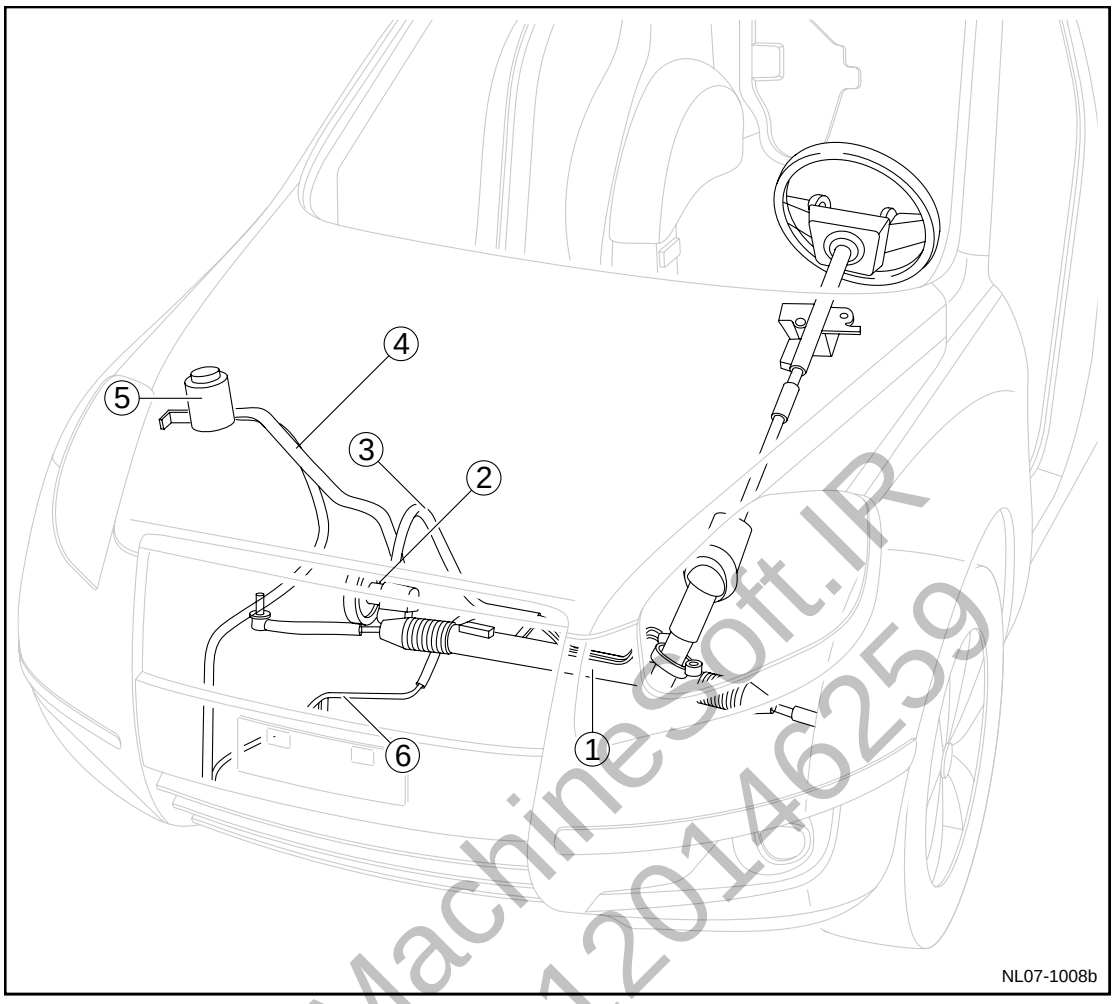
7.2.4 Component position

7.2.4.1 Component position



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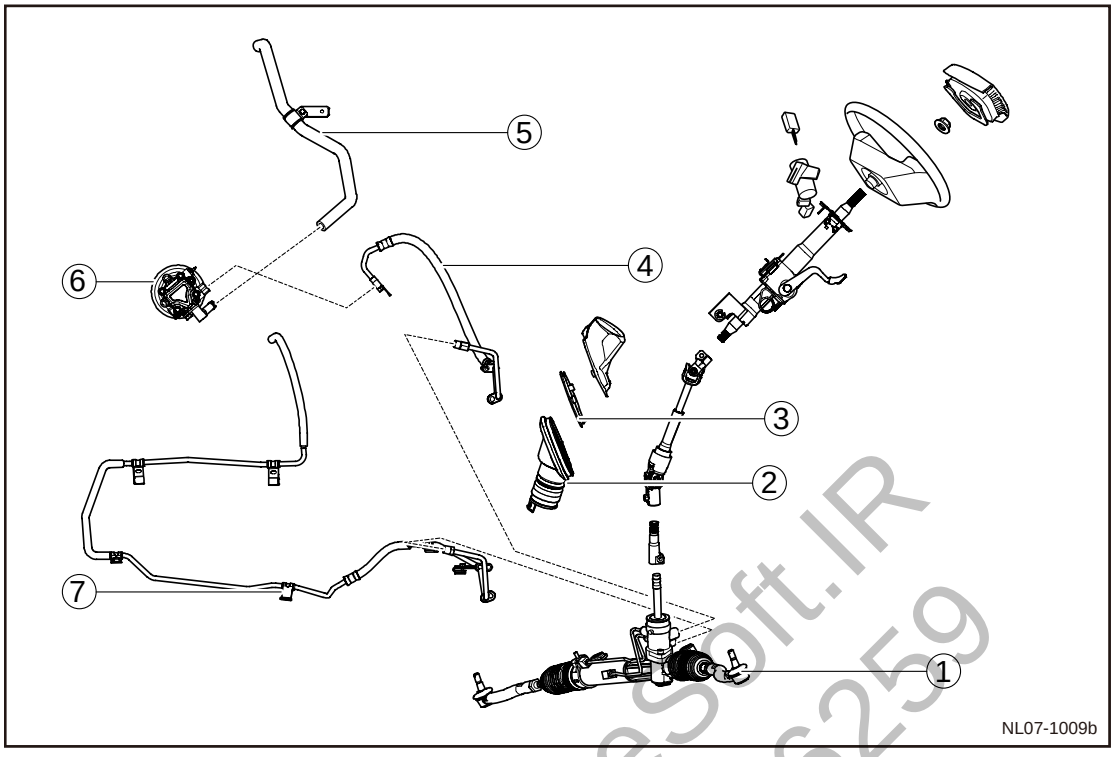
1. Power steering gear and tie rod assembly
2. Power steering pumps assembly.
3. Power steering inlet/outlet oil pipe assembly (Connect to steering gear,power steering pump)
4. Power steering oil inlet and outlet pipe assembly (to power steering pump and oil can)
5. Power steering pipeline oil cans assembly
6. Power steering inlet and outlet oil pipe assembly (connected with the steering gear and oil pan)

7.2.5 Disassemble drawings

7.2.5.1 Part disassembly drawing



1. Power steering gear and tie rod assembly
2. Steering dustproof cover
3. Inner lining plate of steering gear dustproof cover
4. Power steering oil inlet pipe assembly
5. Power steering inlet and outlet oil pipe assembly (oil inlet)
6. Power steering pumps assembly.
7. Power steering inlet and outlet oil pipe assembly (oil outlet).

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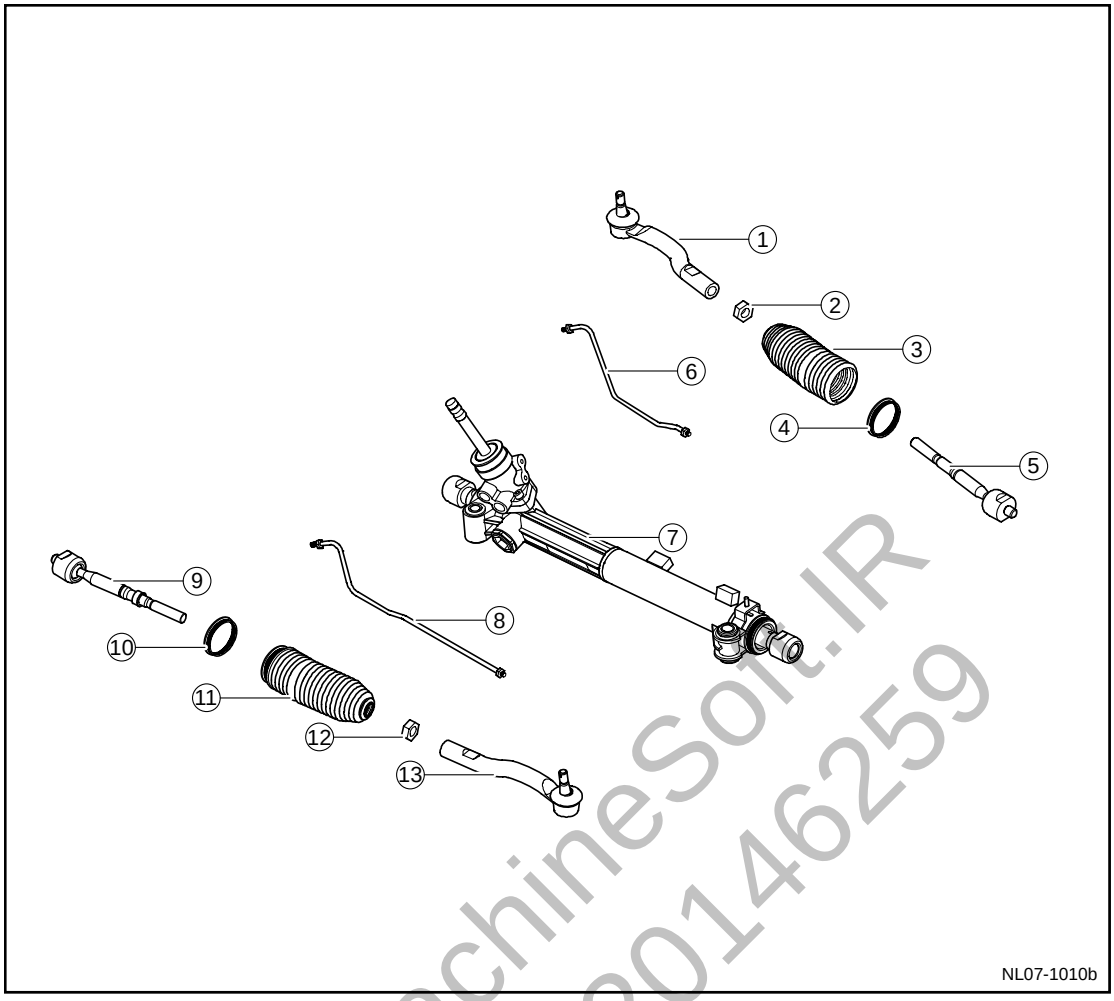
7.2.5.2 Steering gear disassembly drawing



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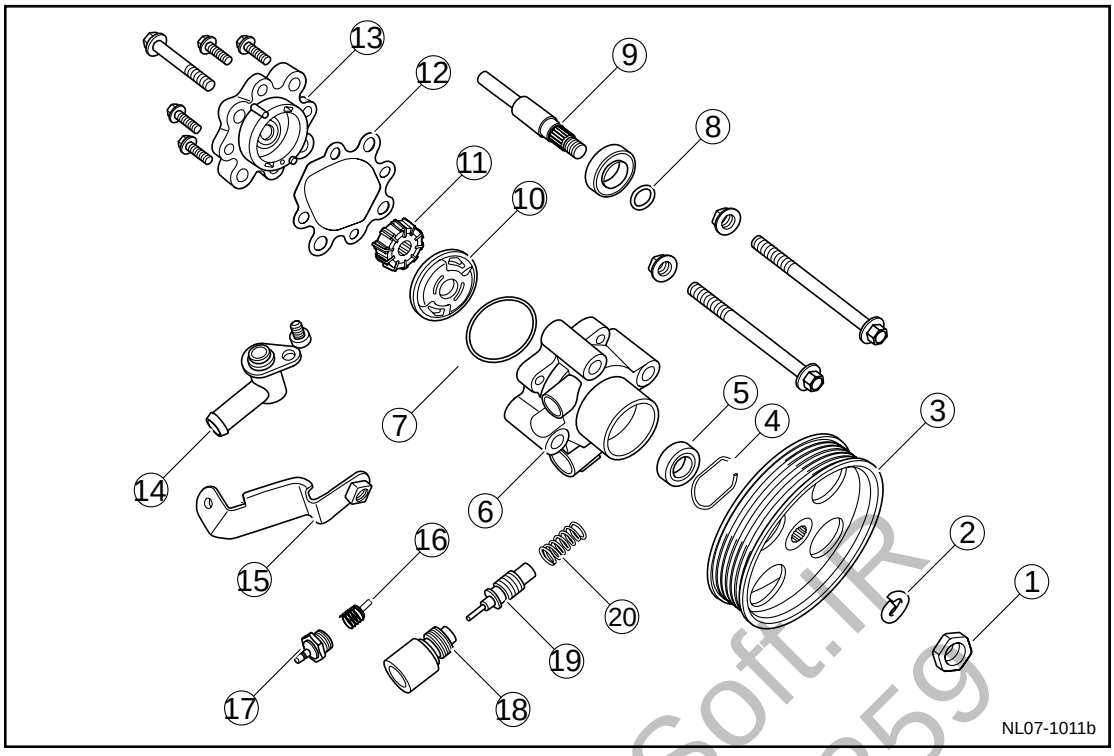
1. Left tie rod assembly
2. Locking nut
3. Left protective sleeve
4. Internal side clamp
5. Left inner tie rod
6. Left rigid steering pipe
7. Steering gear housing
8. Right steering rigid pipe
9. Right internal tie rod
10. Internal side clamp
11. Right protective sleeve
12. Locking nut
13. Right outer tie rod.

7.2.5.3 Power steering pump assembly disassembly drawing



1. Pulley wheel locking nut
2. Washer
3. Pulley
4. Bearing snap ring
5. Oil seal
6. Front pump shell
7. Large O-ring
8. Small O ring
9. Impeller pump shaft with a bearing
10. Front side plate of vane pump
11. Vane pump rotor and blade
12. Sealing washer
13. Rear housing of impeller pump
14. Oil suction pipe
15. Brake
16. Oil pressure switch and compression spring
17. Oil pressure switch connector
18. Oil outlet connector
19. Flow control valve
20. Flow control valve compression spring

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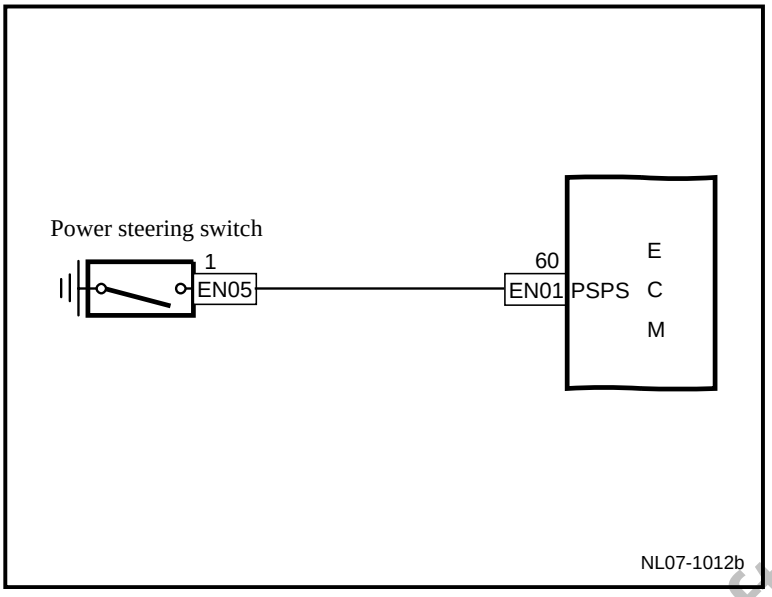
7.2.6 Electrical schematic diagram

7.2.6.1 Electrical schematic diagram



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7.2.7 Diagnostic information and procedures

7.2.7.1 Diagnosis descriptions

Refer to 7.2.2 Description and operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

7.2.7.2 Visual inspection

Before repairing, firstly confirm the fault of customer fault, and then carry out road test, Consider and visually inspect the following system:

– Tire and wheel

  a. Check whether the tire is under appropriate pressure and frictioned evenly.

  b. Check whether the tire is out-of-round.

  c. Check whether the tire is unbalanced.

  d. Whether the wheel shaft is loosened or emits noises.

– Suspension system

  a. Whether the front and rear suspensions and connecting rod components are loosened or damaged.

– Steering system

  a. Whether the joint between the mechanical steering column assembly and the steering gear is loosened or worn.

  b. Check if the power steering cylinder assembly, steering gear and pipeline for leakage.

  c. Check if the power steering fluid level is correct. see 7.2.8.2 power steering fluid level check.

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7.2.7.3 Fault symptom table

Help to determine the cause of the fault and part in the diagnostic process with reference to the following table. Display the possible malfunction causes in the descending numerical order and check each component in order. Repair or replace these components if necessary.

Symptoms	Suspected Parts	Measures / Refer to
It is difficult to steer.	1. Tire(Charging is inadequate or tire damaged)	For aeration or replacement of the tires, see 4.4 eheels and tires.
	2. Power steering liquid level (lower).	Refer to 7.2.8.2 inspection of power steering oil level to add steering fluid.
	3. Drive belt (loosed)	Refer to 7.2.8.1 inspection of transmission belt to pre-tighten or replace the transmission belt.
	4. Front wheel alignment (incorrect)	Adjust front wheel alignment. Refer to 4.4.3.1 wheel alignment.
	5. Power steering gear tie rod ball (wear)	Replace tie rod ball head, refer to7.2.8.11 replace steering tie rod and ball head.
	6. Lower swing arm ball end (wear)	Replace lower swing alarm ball head, refer to4.2.7.7 lower swing alarm ball head assembly replacement.
	7. Front shock absorber upper support seat assembly(worn)	Refer to 4.2.7.4 replacement of front damper part and spring to replace the front damper upper support assembly.
	8. Steering column inner shaft (stuck)	Refer to 11.3.8.12 replacement of mechanical steering column assembly to repair or replace the steering column.
	9. Universal joint between the upper and lower intermediate shaft assemblies (wear and rusting)	Lubricate or replace the intermediate shaft of the mechanical steering column assembly.
	10. Power steering pumps assembly (Inner decompression or plug. Pump blade damaged)	Refer to 7.2.8.10 replacement of power steering pump assembly to replace the power steering pump assembly.
	11. Power steering gear (Inner decompression. Control vale or rake clamping stagnation or damaged)	Refer to 7.2.8.13 replacement of power steering gear assembly with tie rod to replace the power steering gear.
	12. Air resistance occurred in the power steering hydraulic system	Refer to 7.2.8.7 air exhaust procedure of power steering system to exhaust air in the steering system.
Poor Steering Wheel Return	1. Tire(Charging is inadequate)	For aeration or replacement of the tires, see 4.4 wheels and tires.
	2. Front wheel alignment (incorrect)	Adjust front wheel alignment. Refer to 4.4.3.1 wheel alignment.
	3. Lower swing arm ball head (seize)	Refer to 4.2.7.7 replacement of lower swing arm ball head assembly to repair or replace the lower swing arm ball head.
	4. Universal joint between upper and lower counter shaft assemblies (rusted and jammed)	Lubricate or replace upper and lower intermediate shaft assemblies.

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	5. Steering column inner shaft (stuck)	Refer to 11.3.8.12 replacement of mechanical steering column assembly to repair and lubricate or replace the steering column.
	6. Power steering gear (control valve jammed or gear rack bearing over pre-tensioned and jammed)	Wash the steering hydraulic system or repair and replace the power steering gear. Refer to 7.2.8.13 replacement of power steering gear assembly with tie rod.
	7. Front shock absorber top bearing seat assembly (wear)	Refer to 4.2.7.4.replacement of front damper part and spring to replace the front damper upper support assembly.
Steering system stroke is too big	1. Steering gear tie rod (loosening)	Refer to 7.2.8.11 replacement of steering tie rod and bulb to fasten or replace the steering tie rod.
	2. Lower swing arm ball head (abrasion or loosening)	Replace lower swing alarm ball head , refer to4.2.7.7 lower swing alarm ball head assembly replacement .
	3. Front wheel bearing (worn or loosed)	Refer to 4.2.7.9 replacement of front hub to replace the front wheel bearing.
	4. Power steering gear steering tie rod assembly (loosening of fixing bolt)	Refer to 7.2.8.13 replacement of power steering gear assembly with tie rod to fasten the fixing bolt.
Noise	1. Power steering liquid level (low)	Refer to 7.2.8.2 inspection of power steering oil level to add steering fluid.
	2. Steering pipe column (inner shaft, bearing is loose)	Refer to 11.3.8.12 replacement of mechanical steering column assembly to repair or replace the steering column.
	3. Universal joint of upper and lower intermediate shaft assembly (loosed)	Fasten or replace upper and lower intermediate shaft assemblies.
	4. Power steering gear steering tie rod assembly (loosening of fixing bolt)	Refer to 7.2.8.13 replacement of power steering gear assembly with tie rod to fasten the fixing nut.
	5. Steering gear tie rod (loosening)	Refer to 7.2.8.11 replacement of steering tie rod and ball head to fasten the fixing nut or replace the tie rod ball head.
	6. power steering gear (preloading force of rack bearing is too loose)	Refer to 7.2.8.13 replacement of power steering gear assembly with tie rod to replace the power steering gear.
	7. Power steering pump assembly(flow control valve or pump blade damaged)	Refer to 7.2.8.10 replacement of power steering pump assembly to replace the power steering pump assembly.
	8. Front wheel bearing (loosening)	Refer to 4.2.7.9 replacement of front hub to replace the front wheel bearing.
The steering wheel rebounds too large or steering gear is too relax.	1. Power steering system(Included air)	Refer to 7.2.8.7 air exhaust procedure of power steering system to exhaust air in the steering system.
	2. Connection between upper, lower middle shaft assembly and power steering wheel tie rod assembly (loose)	Fasten the connecting nut.
	3. Steering tie rod ball head(loosed)	Refer to 7.2.8.11 replacement of steering tie rod

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		and bulb to fasten or replace the steering tie rod ball head.
	4. Front wheel bearing (abrasion)	Refer to 4.2.7.9 replacement of front hub to replace the front wheel bearing.
	5. Power steering gear (Inside loosed)	Refer to 7.2.8.13 replacement of power steering gear assembly with tie rod to repair or replace the power steering gear assembly with the steering tie rod.
Drifting or Steering Instability	1. Frongt wheel alignment (incorrect)	Adjust front wheel alignment. Refer to 4.4.5.2 front wheel toe-in adjustment.
	2. Front suspension (location incorrect)	Adjust and fasten front suspension part. Refer to 4.2 front suspensions.
	3. Wheel and tire (unbalance)	Dynamic balance of tire or replacement of tire and rim refer to 4.4 wheel and tire.
	4. Front wheel bearing (wear and loose)	Refer to 4.2.7.9 replacement of front hub to replace the front wheel bearing.
	5. Damping spring (breakage or fatigue and weakening)	Refer to 4.2.7.4 replacement of front damper part and spring to replace the damping spring.
	6. Front post (loosed and damaged)	Refer to 4.2.7.3 replacement of front support assembly to fasten or replace the front support.
	7. Brake system (loosed or work is abnormal)	Refer to 6 brake system to repair the brake system.
	8. Rear suspension (inaccurate alignment or loosening)	Adjust and fasten rear suspension part. Refer to 4.3 rear suspension.
Unstable steering during brake	1. Front suspension (Kingpin longitudinal inclination is even and incorrect)	Inspect and adjust the front suspension positioning. Refer to 4.2 front suspensions.
	2. Lower swing arm (loose)	Refer to 4.2.7.2 replacement of lower swing arm lining to fasten or replace the lower swing lining.
	3. Brake disc(deformation)	Replace brake disc, refer to6.2.5.3 replace brake disc.
	4. Damping spring (breakage or fatigue and weakening)	Refer to 4.2.7.4 replacement of front damper part and spring to replace the damping spring.
	5. Front or rear wheel bearing (Wear loosed)	Refer to 4.2.7.9 replacement of front hub and 4.3.7.10 replacement of rear hub unit to replace the front or rear wheel bearing.
	6. Brake system (Brake force is not even and correct)	Refer to 6 brake system to repair the brake system.

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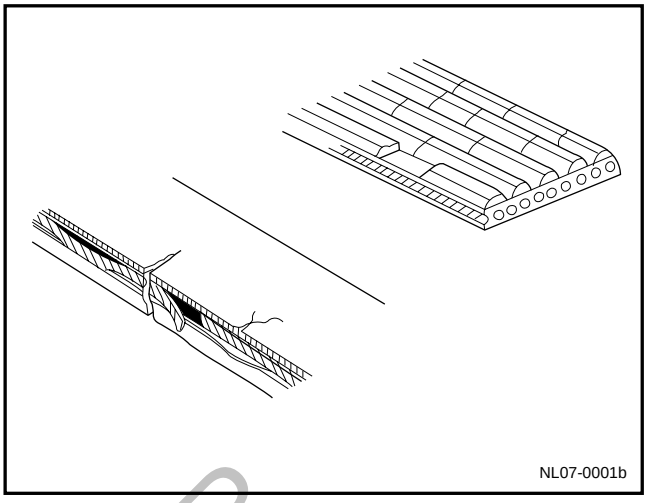
7.2.8 Dismantle and installation

7.2.8.1 Drive belt inspection

1. Check whether pretensioning of drive belt is normal. Refer to the inspection of drive belt.
2. Check whether drive belt has excessive abrasion, and curtain line breakage, etc.
3. If any defect of drive belt is found, replace drive belt.

Notes:

At the side of the transmission belt with rib, a slight crack is to be acceptable. If the transmission belt cracks from the rib or the shoulder are missing, if necessary, replace it.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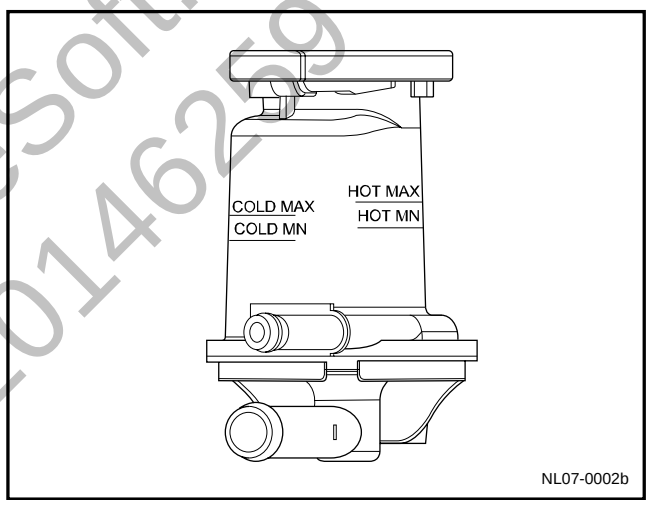
7.2.8.2 Power steering oil fluid lever inspection

1. Place vehicle on horizontal position.

2. When engine stops, inspect oil level in oil reservoir. Add fluid into the oil pan if necessary. The temperature of the pre-heated oil is 75-80℃ (167-176 ºF). The liquid level shall be located between the marks HOT MAX and HOT MIN. The temperature of the cooled oil is 20℃ - 25℃ (68 -77ºF). The liquid level shall be located between the marks COLD MAX and COLD MIN.

Notes:

Note: be sure to correctly use oil.



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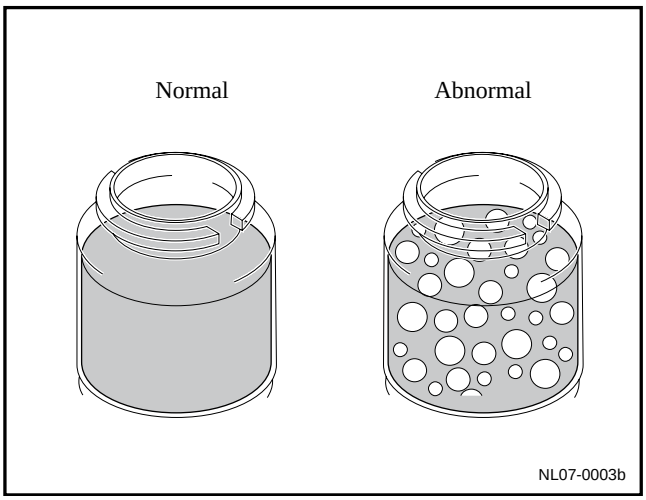
3. Preheat power steering oil, start engine to make it run at idle speed.
4. Turn steering wheel from left bottom to right bottom for several times to make oil temperature increase. Oil temperature preheat to: 75 - 80℃(167 - 176 ºF).
5. Check the braking fluid for bubbling or emulsification. In case of bubbling or emulsification, you need to purge air from the power steering system. See 7.2.8.7 Power Steering System Air Purging Procedures.
6. Check the oil level in the oil pan when the engine runs in the idle mode.
7. Stop the engine.



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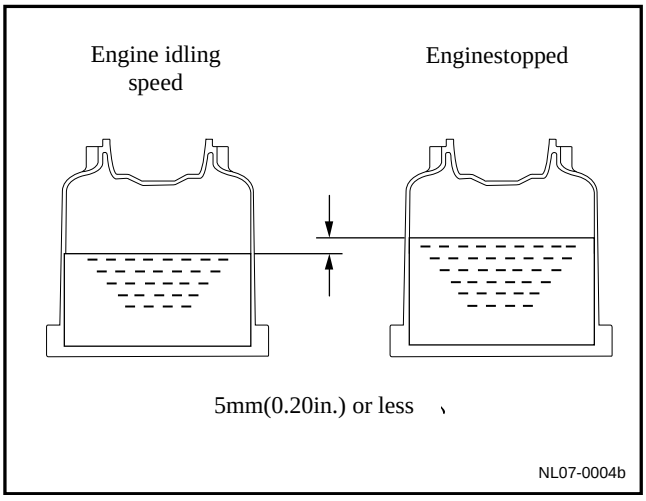
8. Wait several minutes and then re-check the oil level in the oil pan.

The maximum liquid level rising height: 5 mm (0.20 in)

9. In case of any problem discovered, exhaust air from the power steering system. See 7.2.8.7 Power Steering System Air Exhausting Procedures.

10. Re- checks oil fluid level height.



7.2.8.3 Steering hydraulic pressure inspection

1. Disconnect oil outlet tube of power steering pump asembly refer to 7.2.8.6 replacement of power steering oil intake and outlet tube.

2. As shown in figure, install hydraulic force testing tool.

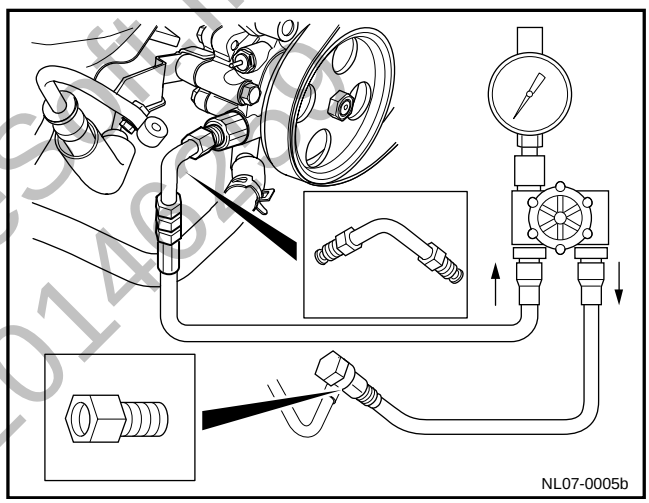
Notes:

The valve of the tool shall be in the open position when initial checking.

3. For exhaust of power steering system, refer to 7.2.8.7 Exhaust procedures of power steering system.

4. Preheat power steering oil, start engine to make it run at idle speed.

5. Turn steering wheel from left bottom to right bottom for several times to make oil temperature increase.



Oil temperature preheat to :75 - 80℃(167 - 176 ºF)

Notes:

See Important precaution Regarding Steering Wheel in Limit Steering Position in Warning and precaution .

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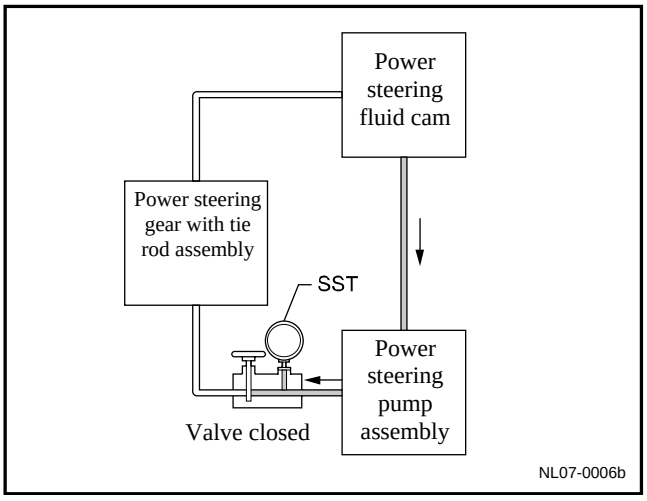
6. Keep the engine running in idle mode, close the tool valve and observe and record the reaadings from the pressure gauge.

Min. oil pressure: 6,400 kPa (928 psi)

If the power steering pump assembly is damaged due to low oil pressure, replace the power steering pump assembly damaged. Refer to 7.2.8.10 replacement of power steering pump assembly.

Warning!

The special tool valve shall not be closed more than 5s; otherwise, the oil temperature is too high, so that the power steering pump assembly will be damaged.



7. Keep the engine running in the idle mode and open the valve.

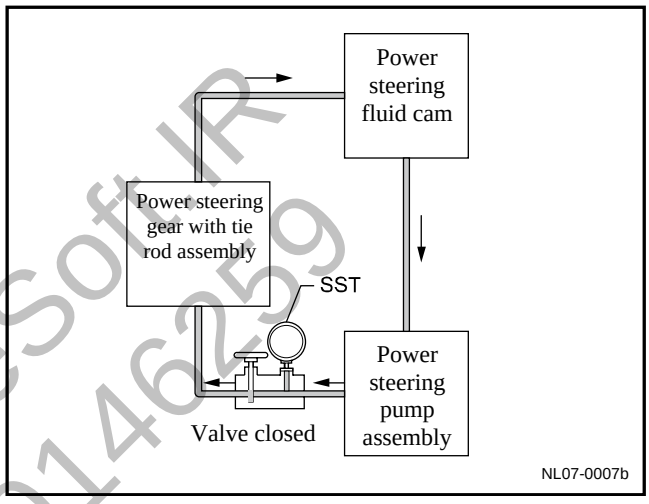
8. Have the engine run at a RPM ranging from 1,000 to 3,000 to measure the oil pressure when the engine revolving speed is 1,000 rpm and 3,000rpm.

oil pressure differential:490kPa (71 psi) or much less

Note: Do not turn the steering wheel.

If the power steering pump assembly flow control valve is damaged due to excessive oil pressure difference, repair or replace the power steering pump assembly. refer to 7.2.8.10 replacement of power Steering Pump Assembly.

If the hydraulic oil path of the power steering system blocks or leaks, wash and repair the hydraulic pipeline or replace the relevant parts.



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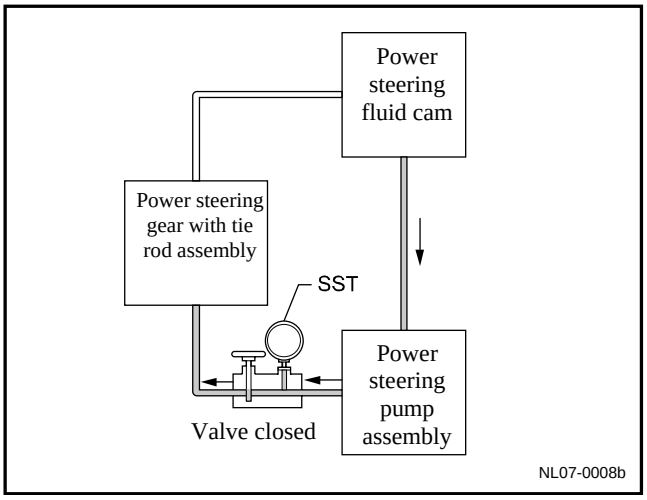
9. Have the engine run in idle mode, fully open the valve and thoroughly turn the steering wheel counterclockwise or clockwise to measure the oil pressure.

Min. oil pressure:6. 400 kPa (928 psi)

If the power steering pump assembly leaks are damaged due to low oil pressure, replace the power steering pump assembly damaged. Refer to 7.2.8.10 replacement of power steering pump assembly.

If the hydraulic oil path of the power steering system leaks, repair the hydraulic pipeline or replace the relevant parts. Refer to 7.2.8.6 Replacement of power steering Inlet and outlet oil pipe.



Notes:

The duration of the steering wheel in the steering limiting position does not exceed 5s; otherwise, the steering pump may be damaged.

10. Dismantle test tool.

11. For connection of oil outlet pipe of power steering pump assembly, refer to 7.2.8.6 replacement of power steering oil intake pipe.

12. Drain air from power steering system, refer to 7.2.8.7 Exhaust process of power steering system.

7.2.8.4 Steering force inspection

Warning!

Warning: Refer to Warning for battery disconnection in Warnings and precautions.

1. Stop the vehicle on flat rod, and make the vehicle wheel point to right front.

2. Disconnect the battery negative cable. Refer to Battery Cable Disconnection/Connection Procedures.

Notes:

Wait at least 60 s after disconnecting the battery cable to prevent the airbag and the safety belt pre-tensioner from being started.

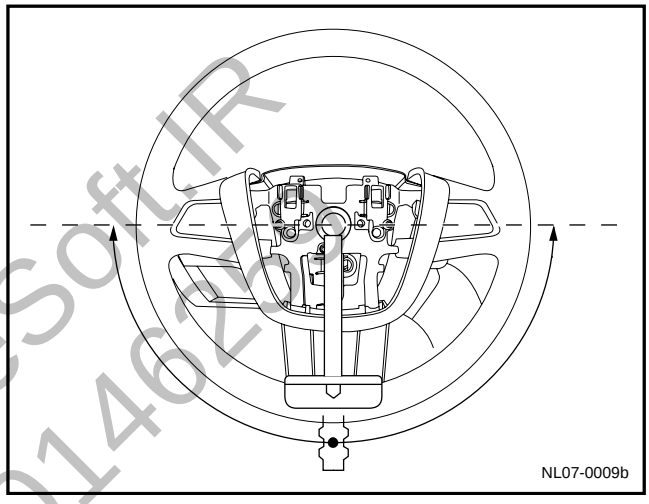
3. Dismantling of driver's side safety airbag, refer to Replacement of driver's side safety airbag.

4. Connect the battery negative cable.

5. Check whether a correct tightening torque is applied to the steering wheel fixing nut with a torque wrench.

6. Start the engine and have it run in idle mode.

7. Turn the steering wheel counterclockwise and clockwise by 90 degrees with a torque wrench to check the steering torque during the counterclockwise and clockwise rotation.



Steering force (reference): 5.5 Nm (metric) 4.1 lb-ft (English system)

Notes:

Prior to inspection, the tire type, the tire pressure and the contact surface must be firstly considered.

8. Disconnect the battery negative cable.

9. Re-check the torque of the steering wheel fixing nut.

Torque:40 Nm (Metric) 29.6 lb-ft (English system)

10. Install the driver's side airbag.

11. Connect the battery negative cable.

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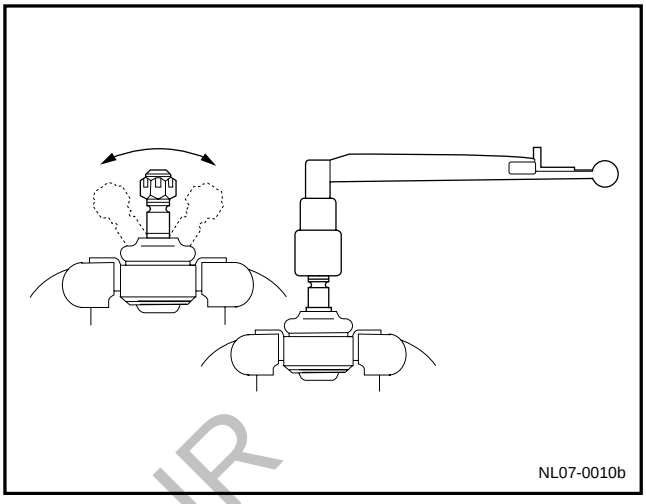
7.2.8.5 Steering gear tie rod ball head inspection

1. For dismantling of steering tie rod, refer to 7.2.8.11 replacement of steering tie rod and ball head.
2. Fixing tie rod ball head onto caliper firmly.
3. Install nut onto ball head bolt.
4. Shake the upper ball bolt back and forth more than 5 times.
5. Then continuously rotate the nut cap with a torque wrench at a speed ranging from 2 to 4rmp/s and read the torque for the 5th round.



Rotational torque :1.5-3 .0 Nm (1.1 - 2.2 lb-ft)

If the rotational torque is not within the specified range, replace the tie rod assembly.

Notes:

The method for inspecting the left and right steering gear tie rod ball heads is the same.

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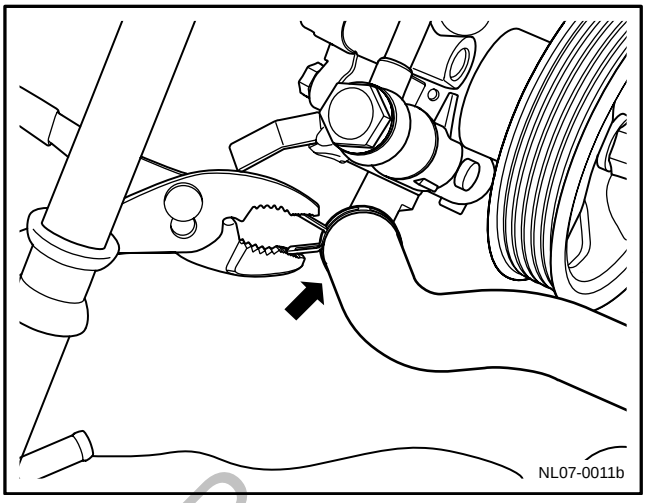
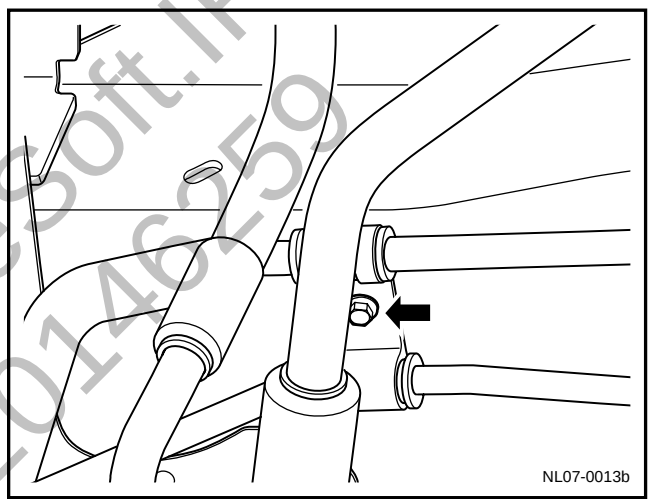
7.2.8.6 Power steering oil inlet/outlet pipe replacement

Dismantlement Procedure

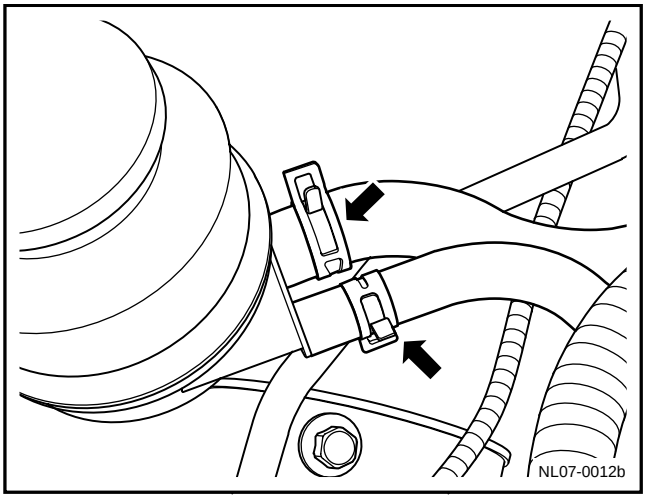
1. Drain power steering oil out of power steering pipeline with oil can assembly.
2. Disconnect power steering pump assembly oil supply hose and high-pressure oil pipe interface.



3. Disconnect power steering oil inlet and outlet pipe port from oil can.



4. Dismantle fixing bolt of oil pipe support of steering system on the front of right vertical beam.



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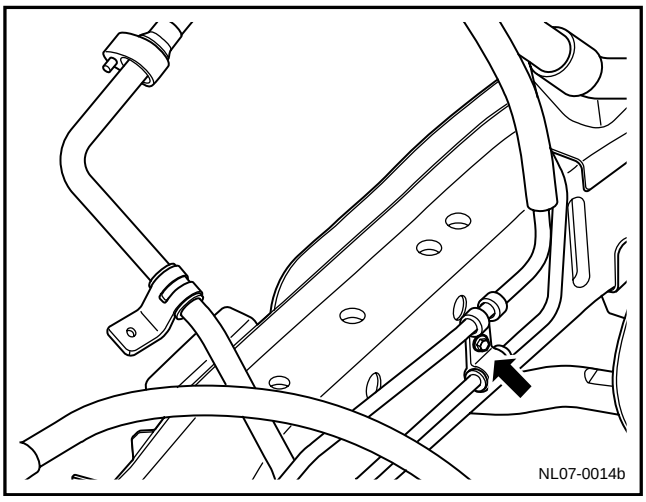
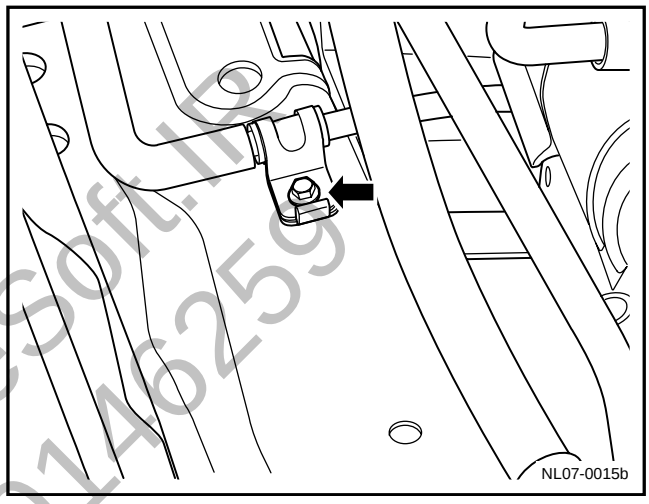
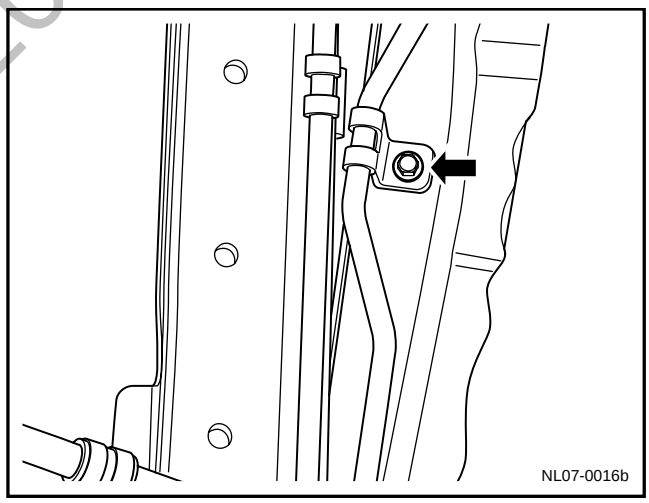
5. Remove the fixing bolt for the steering system oil pipe cradle on the back of the right longeron.



6. Remove the steering system oil pipe cradle fixing bolt on the front suspension cross member.



7. For lifting vehicle , see 1.3 lifting vehicle
8. Remove the steering system oil pipe cradle fixing bolt on the front right suspension longeron.



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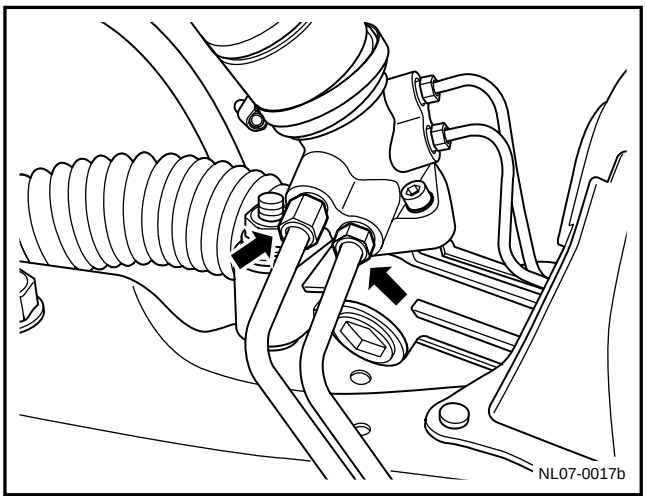
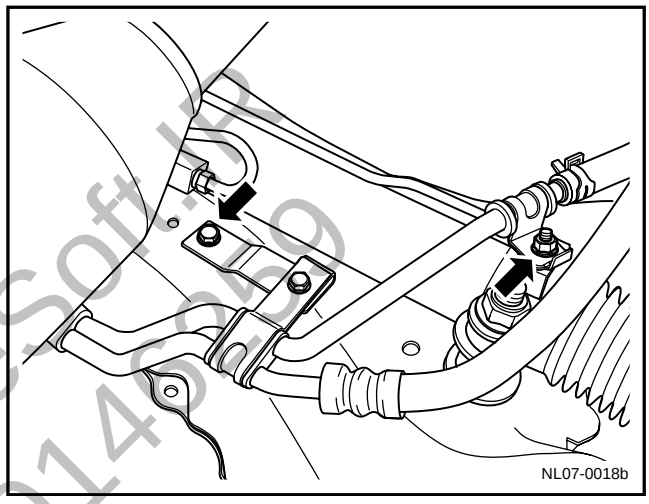
9. Disconnect the high pressure oil pipe and oil return pipe from the power steering gear steering tie rod assembly.



10. Dismantle fixing bolt of oil pipe support from auxiliary frame.

11. Dismantle oil return pipe and high-pressure oil pipe from vehicle.



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Installation procedure:

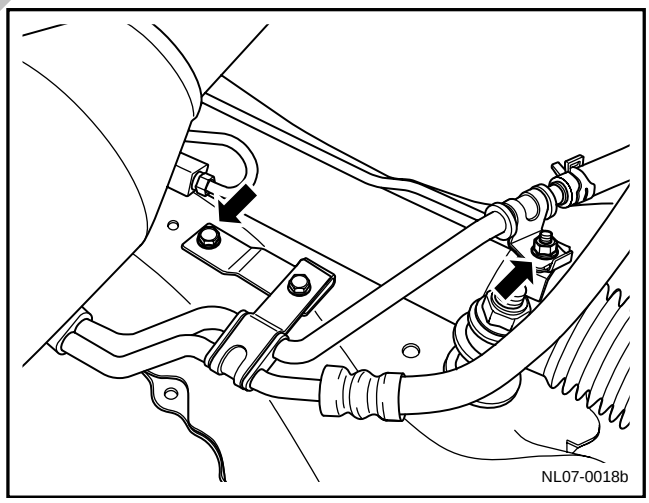
1. Connect high-pressure oil pipe to power steering gear from power steering pump assembly.

2. Connect oil return pipe from liquid reservoir to power steering gear.

3 Lifting and jacking the vehicle

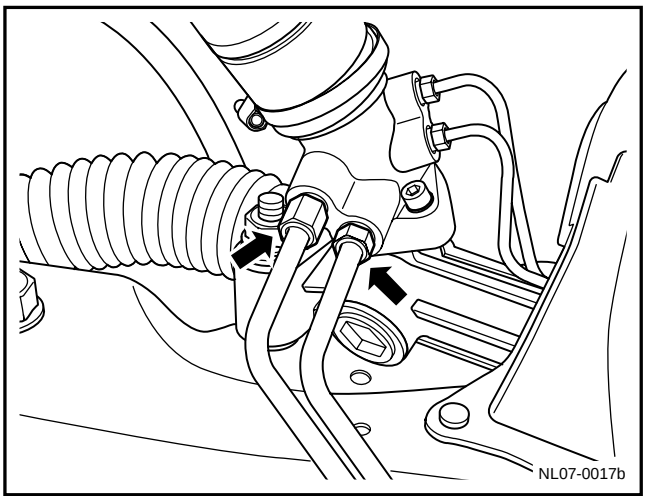
4. Install the steering system oil pipe onto the subframe and tighten the bolts.

Torque:9 Nm(Metric) 6.7 lb-ft(English system)



5. Connect the high pressure oil pipe and oil return pipe to the power steering gear and fasten.

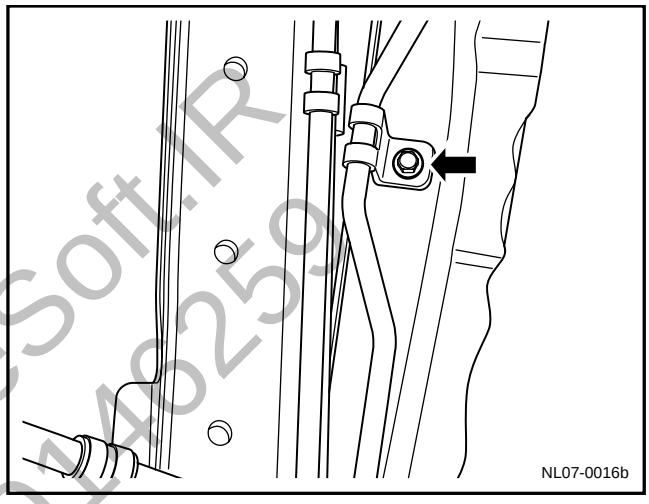
Torque:9 Nm (Metric) 6.7 lb-ft (English system)



6. Install and tighten the fixing bolt for the steering system oil line cradle on the right front suspension longeron.

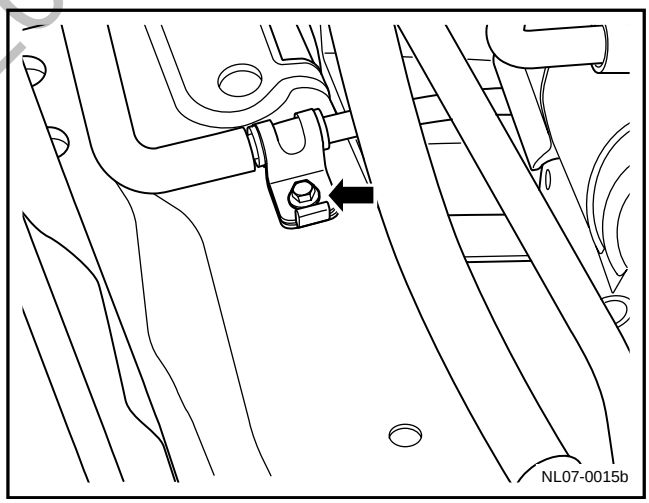
Torque:9 Nm (Metric) 6.7 lb-ft (English system)

7. Lower the vehicle.



8. Install and tighten the steering system oil pipe support bracket fixing bolt on the front suspension cross member.

Torque:9 Nm (Metric) 6.7 lb-ft (English system)



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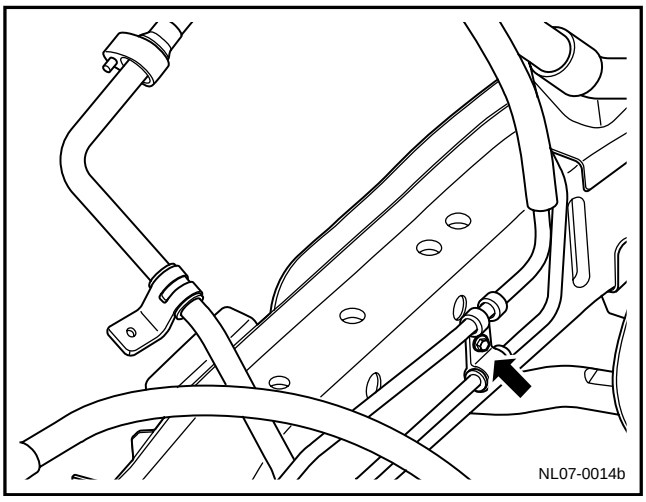
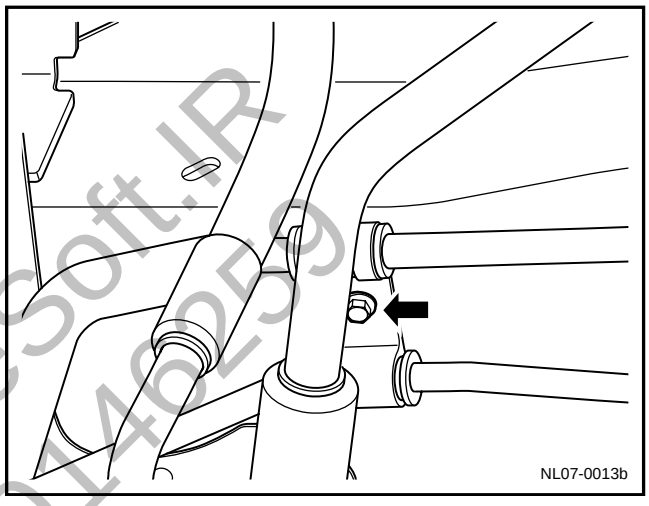
9. Install and tighten right side longitudinal beam rear steering system oil pipe bracket fixing bolt.

Torque:9 Nm (Metric) 6.7 lb-ft (English system)

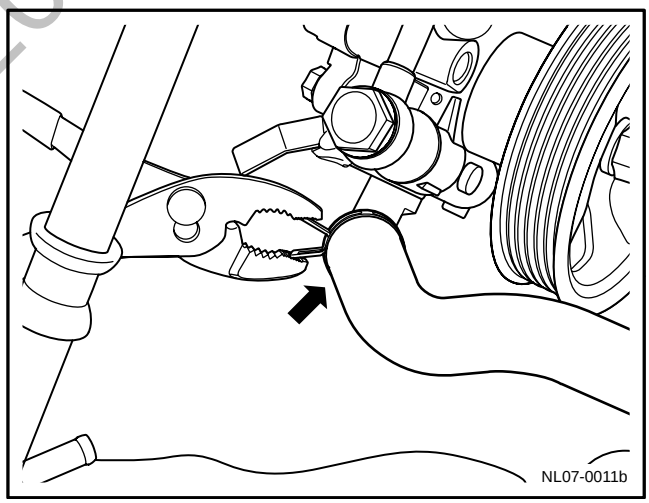


10. Install and tighten fixing bolt of right vertical beam front steering system oil pipe support.

Torque:9 Nm (Metric) 6.7 lb-ft (English system)



11. Connect oil supply hose and high-pressure oil pipe to power steering pump assembly.



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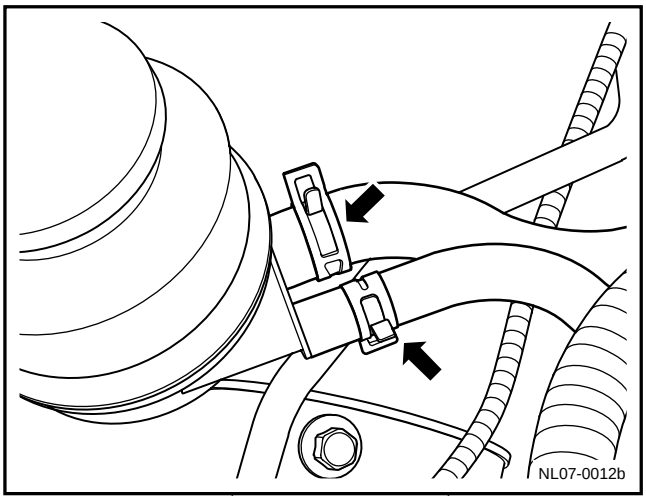
12. Steering system oil pipe connect with oil can
13. Fill power steering oil into power steering pipeline with oil can assembly.
14. Inspect whether pipline has leakage, if yes, repeat above steps to re-install new pipeline and exhaust air from pipeline.



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7.2.8.7 Power steering system exhaust process

1. When engine stops working, rotate steering wheel from one lock position to another lock position, and repeat this action for several times.
2. Start engine, to make engine run under idle condition, and inspect oil level of power steering pipeline with oil can assembly. If necessary, add new oil to make the oil level above scale of MIN.
3. Repeatly rotate steering wheel, but do not rotate completely to one direction, so as to exhaust air from system. To enable the liquid level to keep above MIN scale, the air in the system must be discharged to obtain the normal power steering performance.
4. Align the steering wheel and have the engine continue to run in idle for 2-3min.
5. Test the vehicle on a road to confirm whether the power steering can function normally and any abnormality exists.
6. Recheck the power steering fluid level following steps 1 and 2 to make sure the fluid level reaches the MAX position when the system reaches the temperature for normal operation and the temperature is kept stable. Add fluid if necessary.

7.2.8.8 Power steering oil inspection

- Power steering liquid level can be shown by the scale of power steering liquid tank.
- If the steering liquid temperature reaches to normal working temperature, the liquid level should located between MAX and MIN scales. If necessary, add steering liquid.
- If the steering liquid temperature is low, the liquid level should be located in MIN mark. Add steering fluid if necessary.

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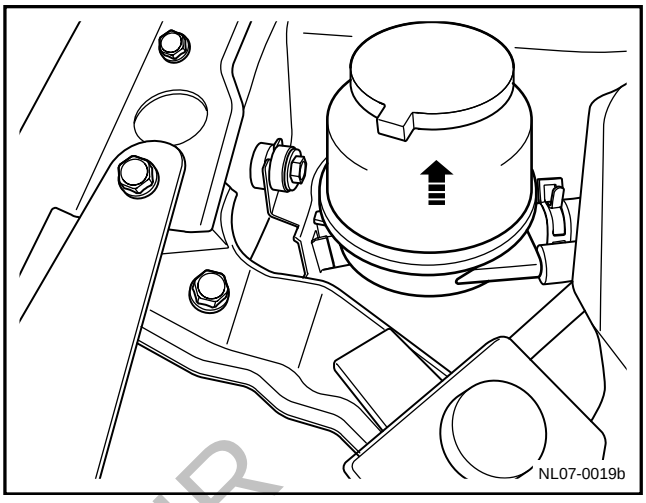
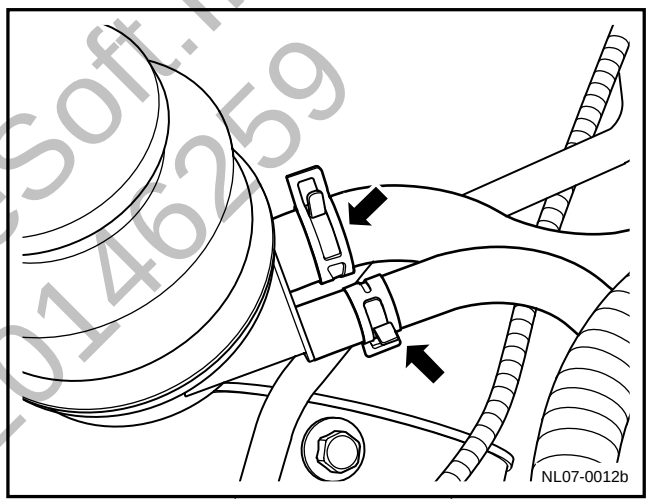
7.2.8.9 Power steering pipeline with oil can assembly replacement

Dismantlement Procedure

1. Absorb power steering oil out of power steering pipeline with oil can assembly.
2. Take power steering pipe with oil can assembly out of oil can bracket, and remove power steering pipe with oil can assembly.



3. Loosen hose snap ring of power steering pipeline with oil can and dismantle two hoses.



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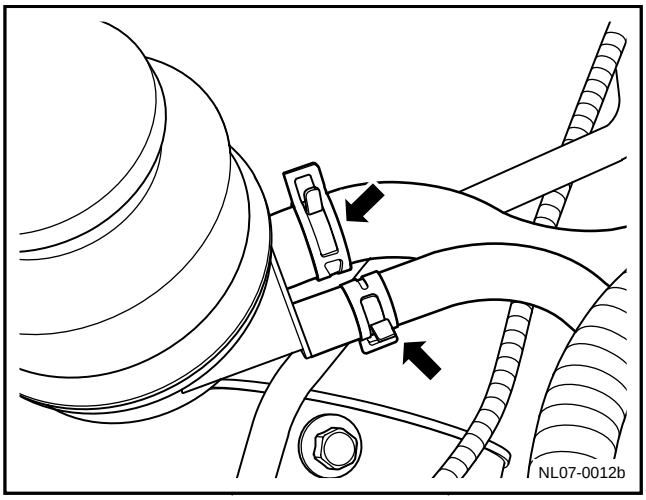
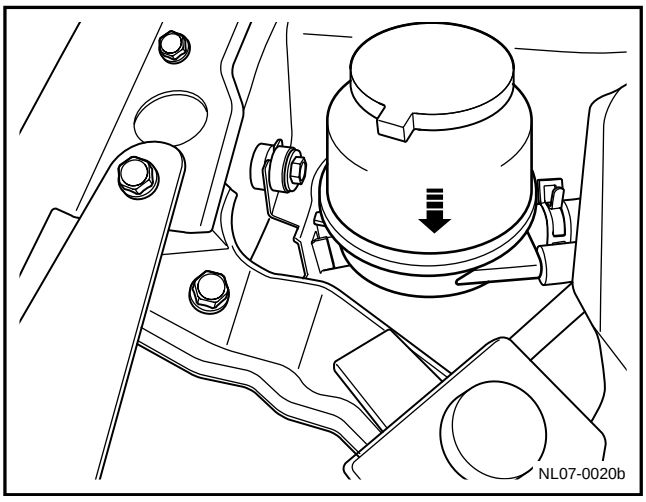
Installation Procedure:

1. Install power steering oil hose onto oil can and tighten clamp.



2. Install oil can onto oil can bracket.
3. Fill power steering oil into oil can.
4. Inspect whether there is leakage in power steering system pipeline, if yes, repeat above procedures until pipeline has no leakage.
5. Perform the air purging procedures of the power steering system.



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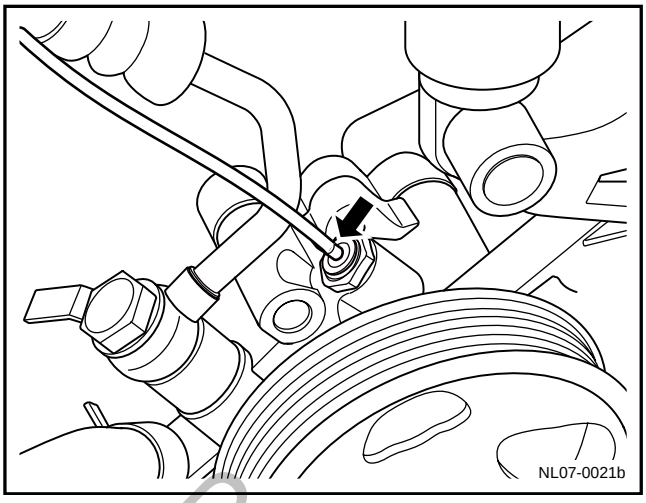
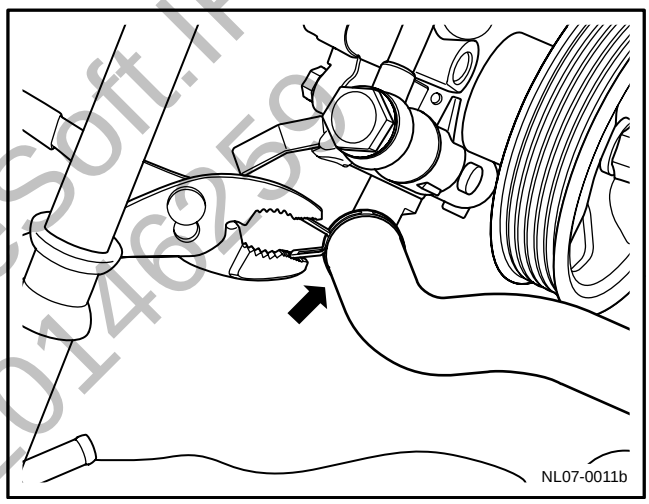
7.2.8.10 Power steering pump assembly replacement

Dismantlement Procedure

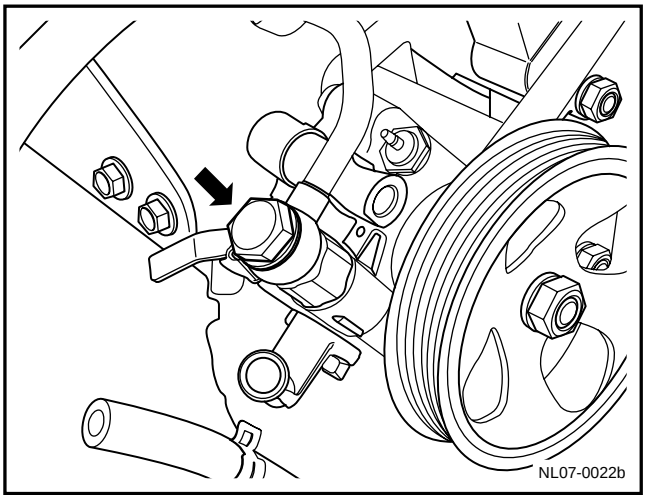
1. For dismantling of engine drive belt, refer to 2.6.8.3 Replacement of drive belt.
2. Use container to receive the power steering fluid flowed out.
3. Disconnect power steering pump assembly pressure switch harness connector.



4. Disconnect oil supply hose of power steering pump assembly.



5. Remove the high pressure pipe of the power steering pump assembly.



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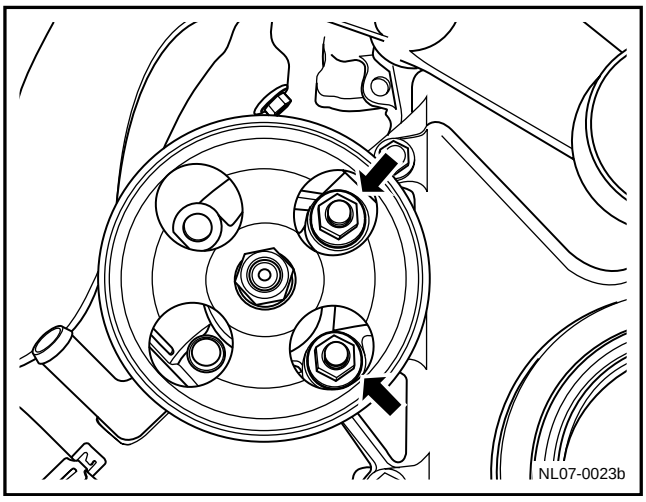
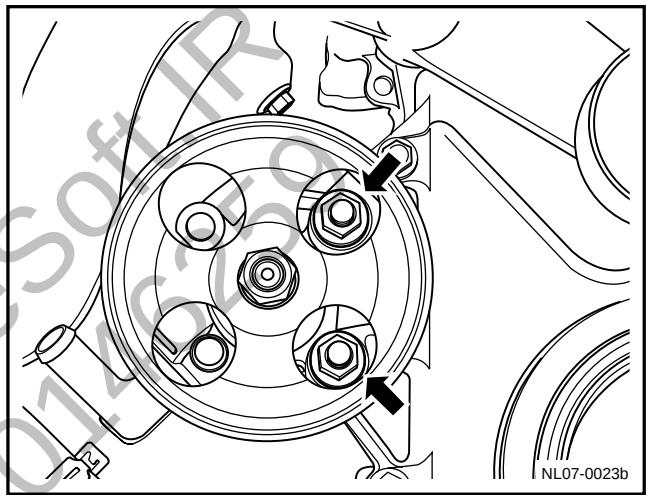
6. Remove the power steering pump assembly fixing bolt and nut fittings and dismantle the power steering pump assembly.



Installation Procedure:

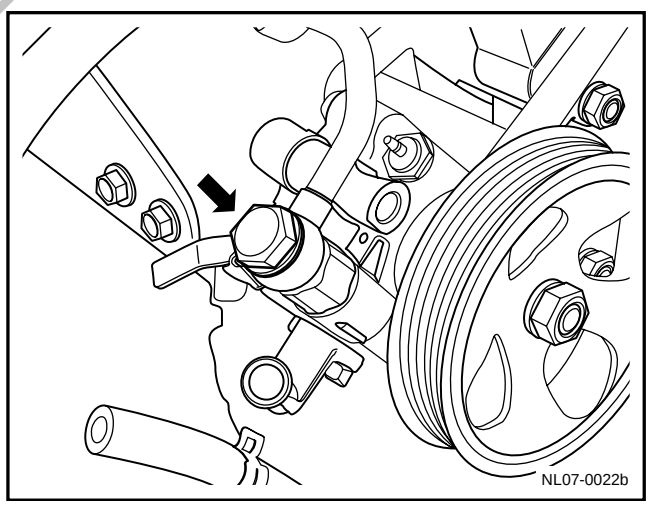
1. Install power steering pump assembly onto the vehicle and tighten fixing bolt and nut components.

Torque :50 Nm (Metric) 37 lb-f t(English system)



2. Connect power steering pump assembly high-pressure pipe and tighten it.

Torque :9Nm (Metric) 6.7lb-ft (English system)



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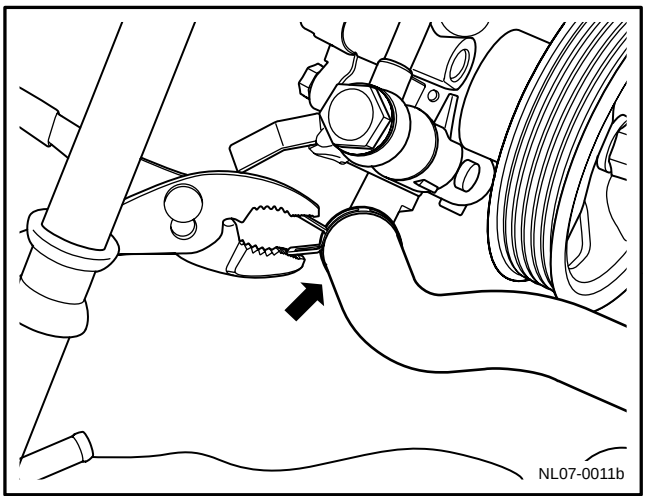
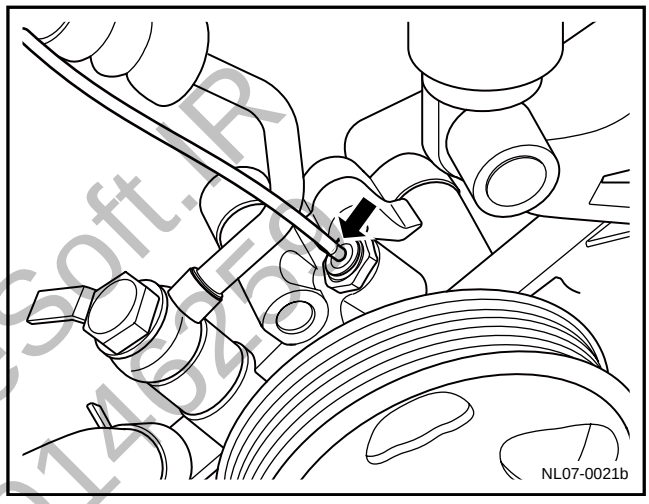
3. Connect oil supply hose of power steering pump assembly.



4. Connect the pressure switch harness connector for the power steering pump assembly.
5. Install the drive belt of the engine.
6. Fill with power steeering fluid.
7. For implementing of air exhaust procedures of power steering system refer to 7.2.8.7 Air exhaust procedures of power steering system.



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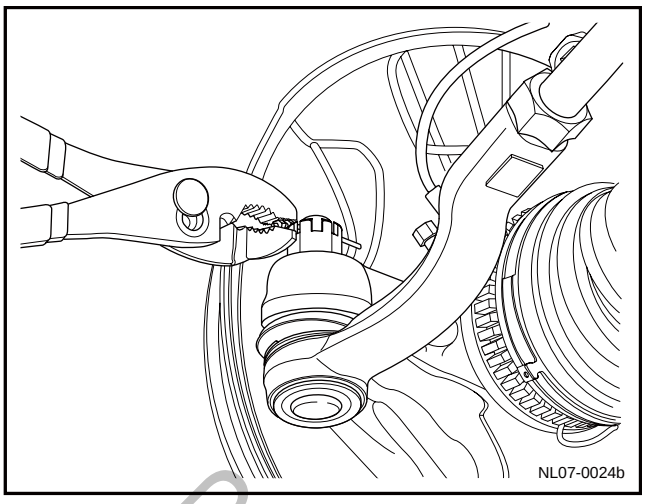
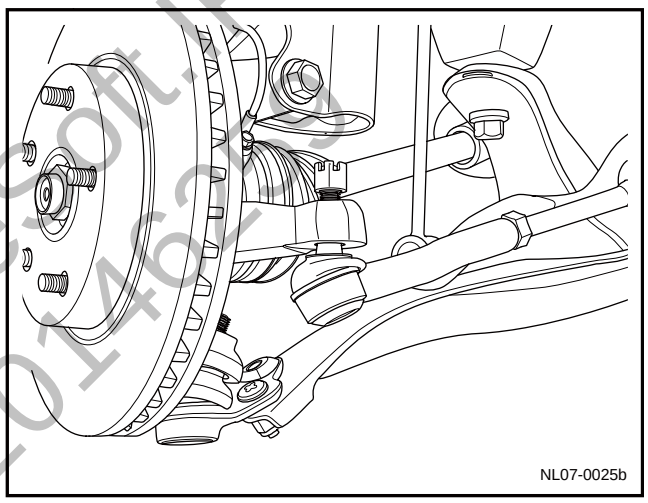
7.2.8.11 Replace steering tie rod and ball head

Dismantlement Procedure

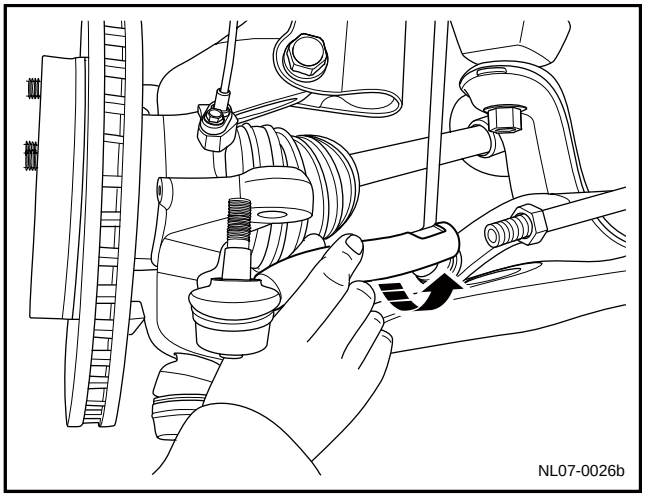
1. For dismantling of tire, refer to 4.4.5.1 Replacement of wheel.
2. Dismantle lock pin of steering tie rod ball head nut.



3. Mark threads position on inner steering tie rod to facilitate re-installation of adjusting nut.
4. Dismantle fixing nut between steering tie rod and ball head, and disconnect steering tie rod and ball head from steering knuckle.



5. Loosen the steering gear tie rod adjustment nut and unscrew the steering gear tie rod and ball end.



Installation procedure:

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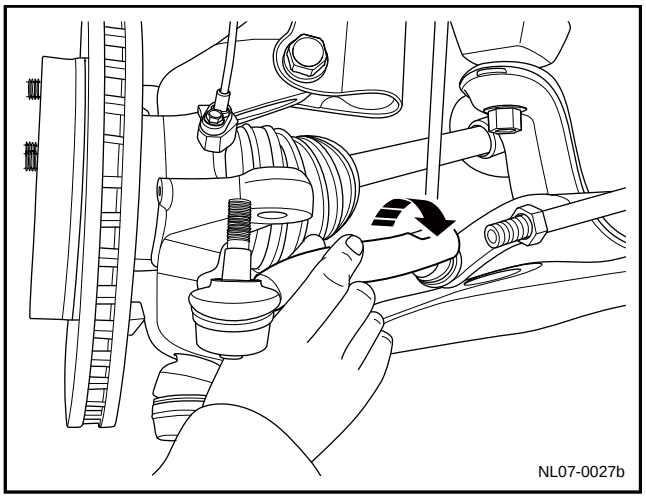
1. Align adjusting nut with mark of inner rotating tie rod.
2. Rotate and install steering tie rod and ball head onto inner rotating tie rod.

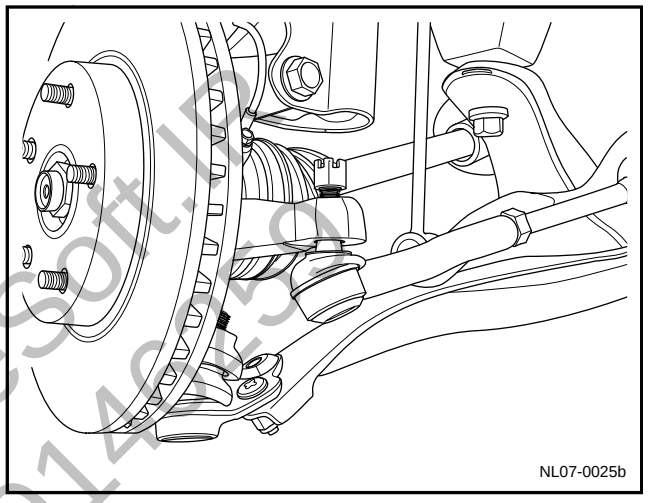


3. Install steering tie rod and ball head onto steering knuckle.
4. Install steering tie rod and hexagonal slotted nut and tighten them.

Torque:33 Nm (Metric) 24.4 lb-ft (English system)

5. Install the locking pin of the steering tie rod ball nut.
6. Install the wheel.
7. For adjustment of toe-in of front wheel, see 4.4.5.2 Adjustment of Toe-in of Front Wheel.
8. Tighten the adjustment nut between the steering tie rod and ball end.

Torque :24Nm (Metric) 17.8lb-ft (English system)



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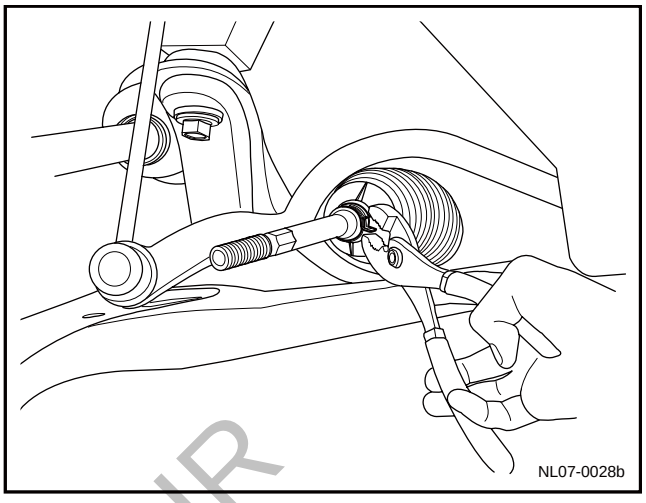
7.2.8.12 Power steering gear anti-duct sleeve replacement

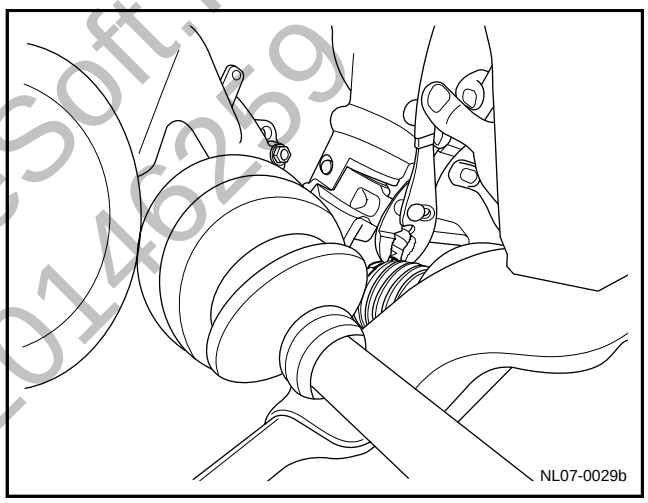
Dismantlement Procedure

1. For dismantling of wheel, refer to 4.4.5.1 Replacement of wheel.

2. For dismantling of steering tie rod and ball head of power steering gear, refer to 7.2.8.11 Replacement of steering tie rod and ball head.
3. Dismantle adjusting nut of tie rod.
4. Dismantle fixing snap ring of power steering gear dustproof sleeve.



5. Remove the internal retaining clamp of the power steering gear boot.
6. Dismantle the power steering gear dust boot.



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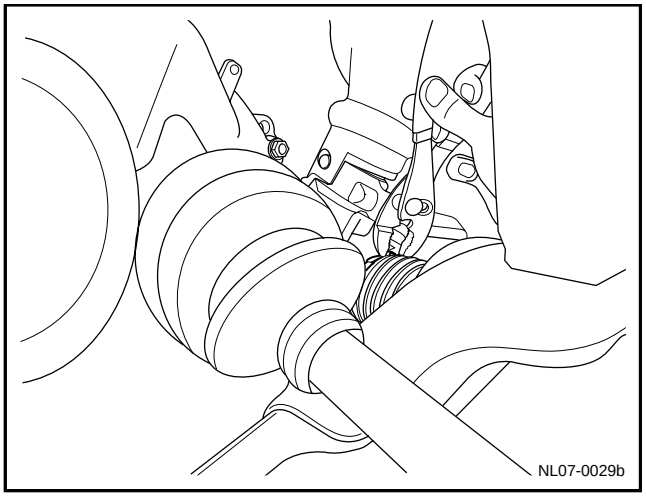
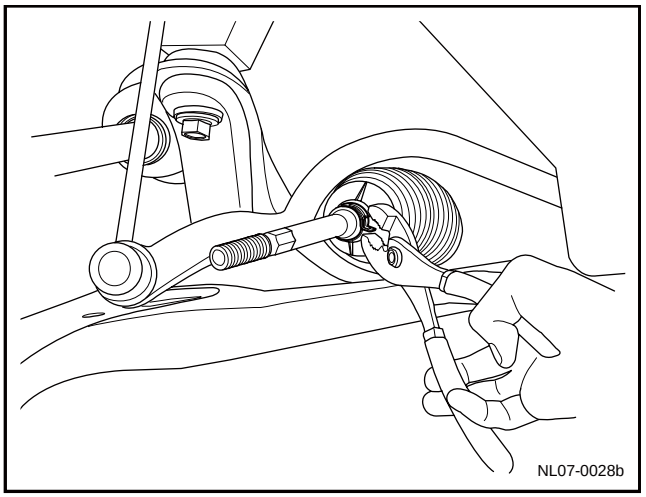
Installation Procedure:

1. Install anti-duct boot of steering gear
2. Install fixing hoop of steering gear anti-dust bushing.



3. Install fixing snap ring of steering gear dustproof sleeve.
4. Install adjusting nut of tie rod.
5. Install the tie rod assembly and ball of the power steering gear.
6. Install the wheel.
7. For adjustment of toe-in of front wheel, see 4.4.5.2 Adjustment of toe-in of front wheel.



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7.2.8.13 Power steering gear with tie rod assembly replacement

Dismantlement Procedure

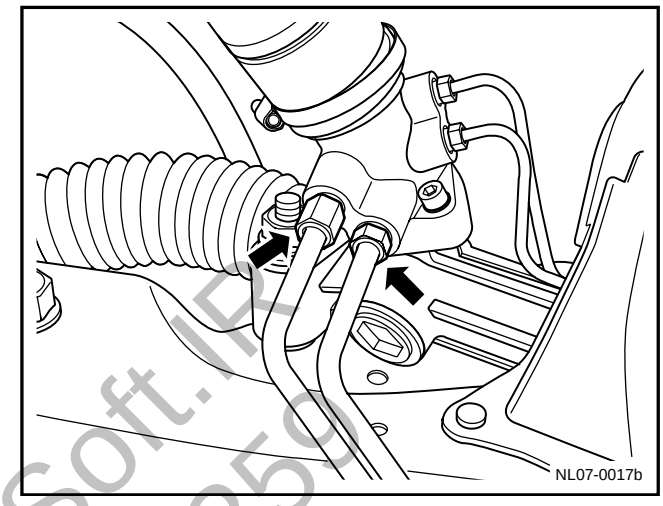
Notes:

Switch off the ignition switch before dismantling.

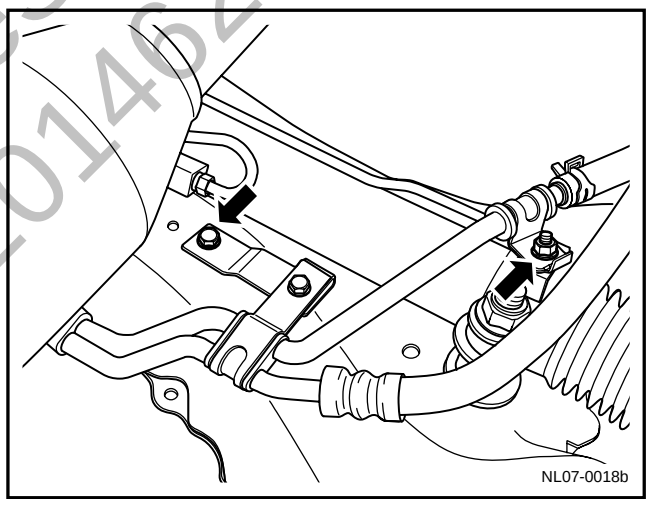
Warning!

Warning: Refer to warning for battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Lift the vehicle; refer to 1.3.1.1 Lifting and Raising the Vehicle.
3. For dismantling of wheels, refer to 4.4.5.1 Replacement of wheels.
4. Place the recycling container below the steering gear to receive the power steering fluid.



5. Disconnect the oil inlet pipe and oil return pipe from the power steering gear and tie rod assembly.
6. Remove the fixing bolt and nut for the power steering oil pipe bracket.



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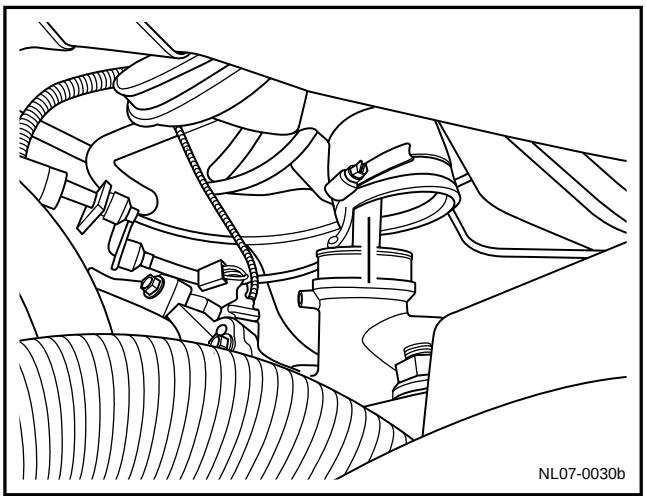
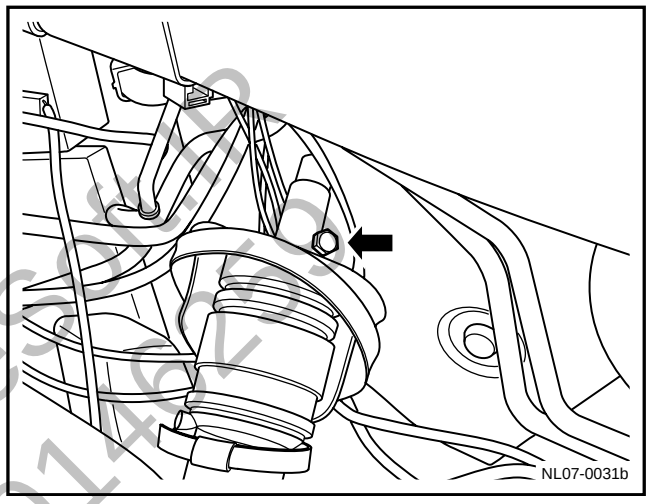
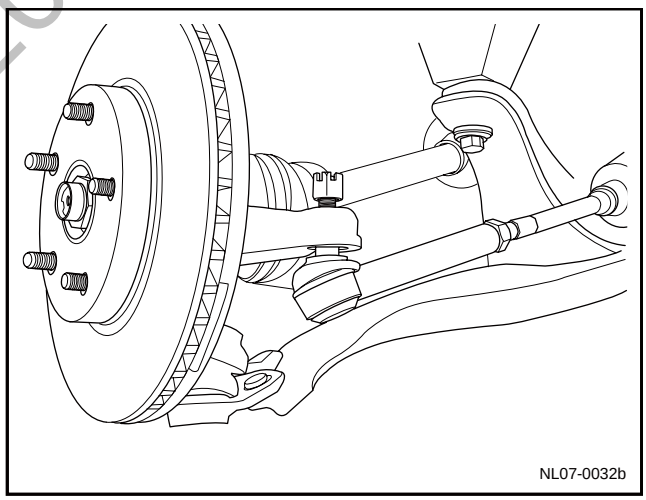
7. Rotate the steering wheel to align the marking on the coupler with the marking on the stub shaft housing.



8. Remove the universal joint bolt for the mechanical steering column assembly.



9. Remove the fixing nut between the steering tie rod and ball end.



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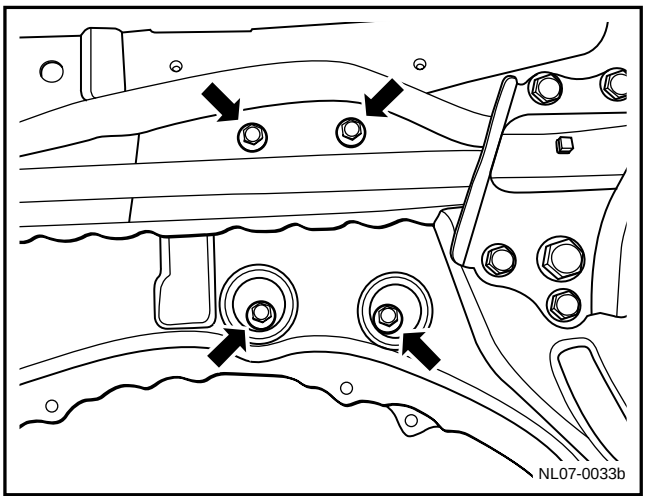
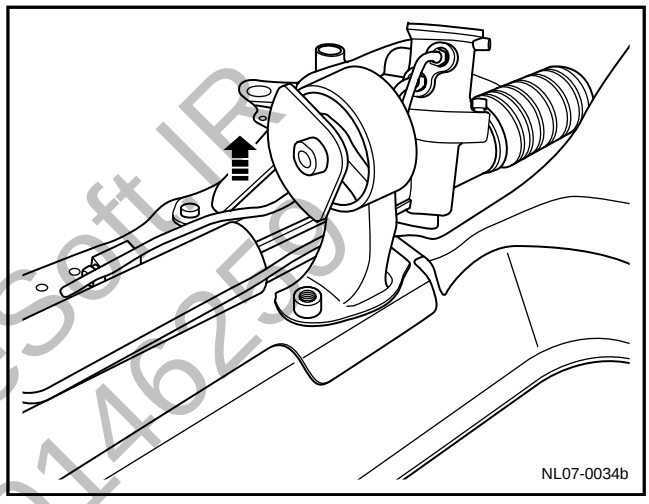
10. For dismantling of front auxiliary frame assembly, refer to 12.6.4.4 replacement of front auxiliary frame.

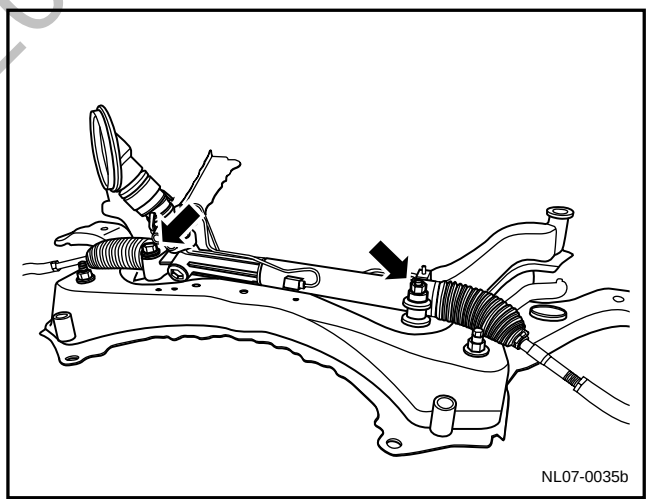
11. Dismantle fixing bolt and nut of engine rear vibration isolator cushion assembly



12. Take down rear vibration isolation cushion of engine from subframe.



13. Dismantle fixing bolt, nut assemblies of power steering gear with tie rod assembly, and remove power steering wheel with tie rod assembly from auxiliary frame.



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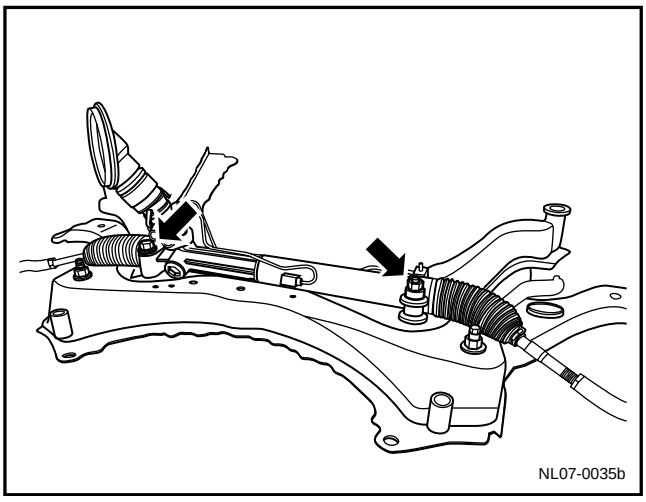
Installation Procedure:

1. Install steering gear onto the front auxiliary frame by using power steering gear fixing device.
2. Install fixing bolt, nut components of power steering gear with tie rod assembly and auxiliary frame, and tighten it.

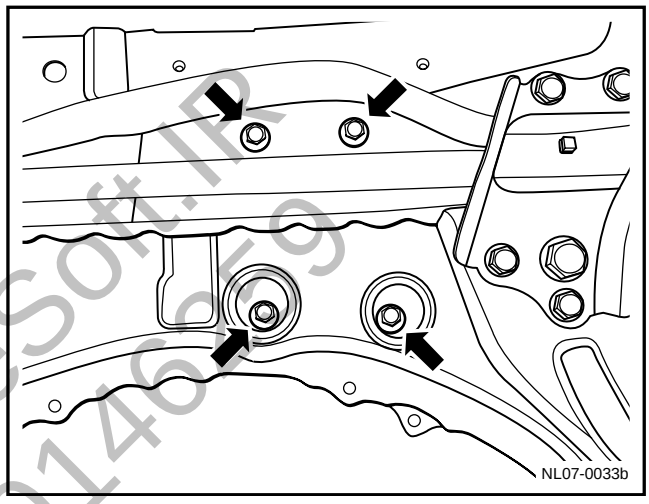
Torque:125 Nm (Metric) 92.5 lb-ft (English system)



3. Install engine rear vibration insulation pad assembly and tighten fixing bolt and nut.

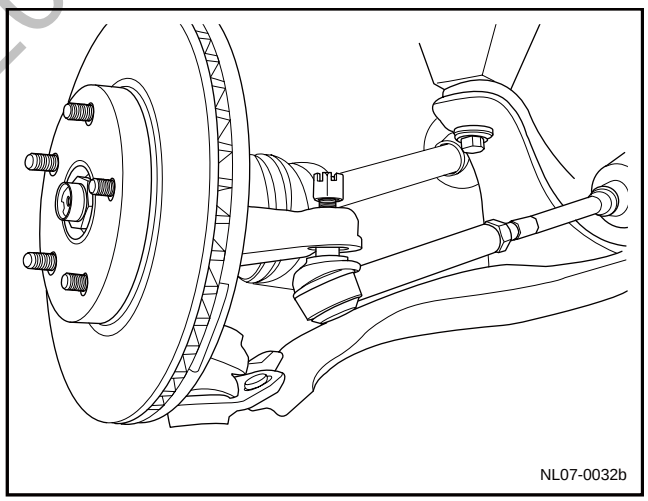
Torque:60 Nm (Metric) 44.4 lb-ft (English system)

4. Install auxiliary frame.



5. Install and tighten the bolt for fixing the tie rod assembly and ball of the power steering gear with the steering joint.

Torque:33 Nm(Metric) 24.4 lb-ft(English system)



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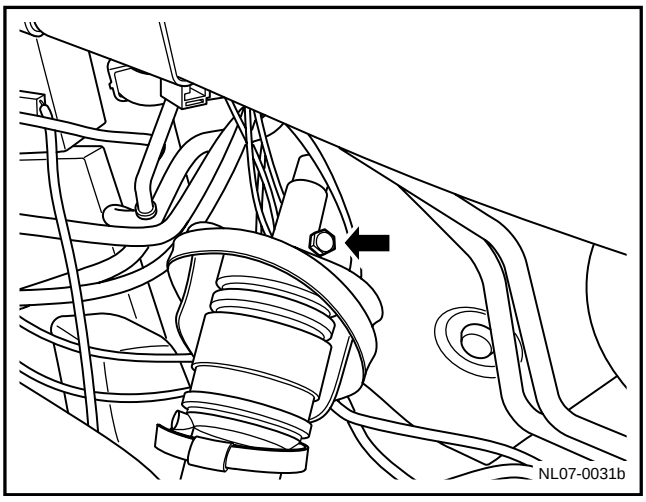
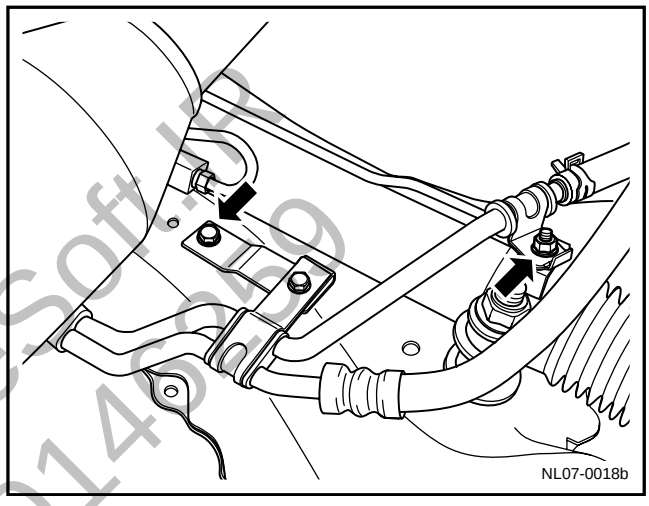
6. Install and tighten the bolt between the steering column and universal joint.

Torque :24Nm (Metric) 17.8lb-ft (English system)



7. Connect the power steering gear and tie rod assembly oil inlet and outlet pipes.

Torque:10Nm(Metric) 7.4lb-ft(English system)



8. Install and tighten the fixing bolt and nut for the power steering oil pipe bracket.

Torque :9Nm (Metric) 6.7lb-ft (English system)

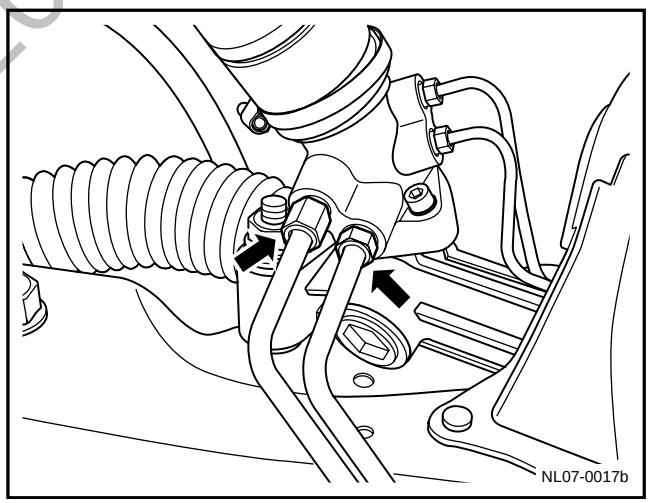
9. Install the wheel.

10. Lower the vehicle.

11. Refilled power steering fluid, check is it exist leakage , repeat the above steps until pipeline is normal

12. Connect the battery negative cable.

13. For implementing of air exhaust procedures of power steering system refer to 7.2.8.7 Air exhaust procedures of power steering system.



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7.3 Steering wheel and steering column

7.3.1 Specifications

7.3.1.1 Fastener specifications

Fastener name	Model	Torque:	
		Metric (N·m)	English system (lb-ft)
Steering Wheel Retaining Nut	M12×1.25	36-44	26.6 - 32.6
Lower guard plate on the steering column	-	-	-
Universal joint bolt of steering column (with knurling)	M8×32	23 - 27	17.0 - 20.0
Upper fixing bolt of steering column	M8	23 - 27	17.0 - 20.0
Lower fixing bolt of steering column	M8×32	23 - 27	17.0 - 20.0

7.3.2 Description and operation

7.3.2.1 Operations and Description

Warning!

See warnings regarding additional protection system in warning and precaution .

Notes:

See Important precaution regarding steering wheel in limit steering position in warning and precaution .

Notes:

Before disconnecting the mechanical steering column assembly, the upper intermediate shaft assembly and the lower intermediate shaft assembly, the wheel should be maintained in the forward direction, and the mechanical steering column assembly must be in the LOCK (lock) position.

After disconnecting the above part, do not move the front wheel tire and the wheel; otherwise, it will cause that certain parts are wrongly positioned in the process of installation and the airbag spiral coil in the mechanical steering column assembly deviates from the center to damage the airbag spiral coil.

Notes:

The steering column plays the role in either steering or safety protection. To ensure the energy absorption function of the steering column, be sure to use the specified screw, bolt and nut and tighten to the specified torque.

The energy absorption pipe column is collapsed in the face of a front-end collision, thereby reducing the change of injury to the driver.

The ignition switch comprising a steering wheel lock is installed on the mechanical steering column assembly to lock the steering plate, thereby preventing the vehicle from being stolen. After taking out an ignition key from an ignition switch, rotate the steering wheel left and right, popup the steering wheel lock pin in the ignition switch to lock the steering wheel. Release the lock handle to incline the steering wheel up and down. Therefore, the driver can regulate the steering wheel to a comfortable position. When the driver gets off, the ignition key reminding device enables the reminder in the instrument to beeps to remind the driver if the key is still in the ignition switch. Refer to remote control anti-theft system.

Notes:

Apply a layer of thin lithium-based lubricating grease on all friction points when reassembling. In this way, it is very easy to disassemble and assemble the mechanical steering column assembly.

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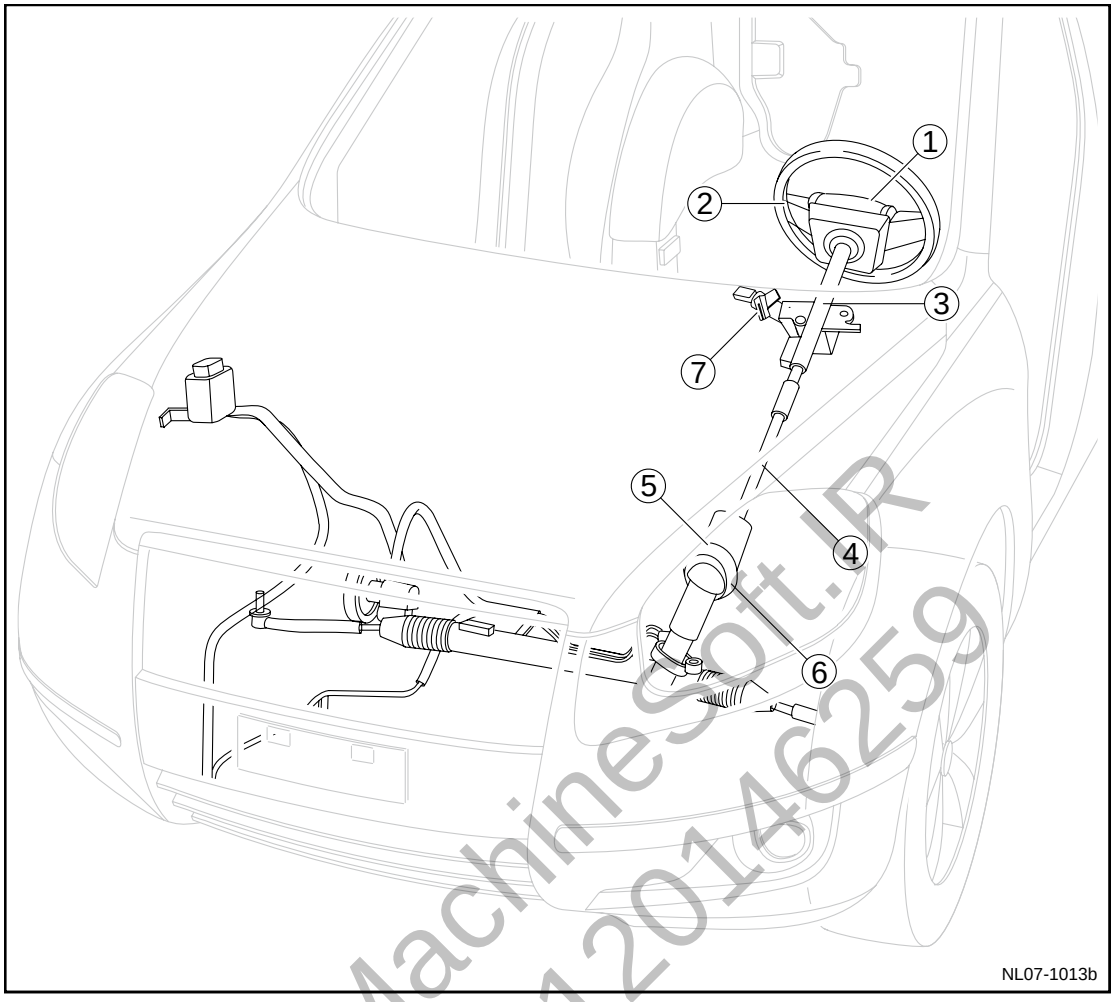
7.3.3 Component position

7.3.3.1 Component position



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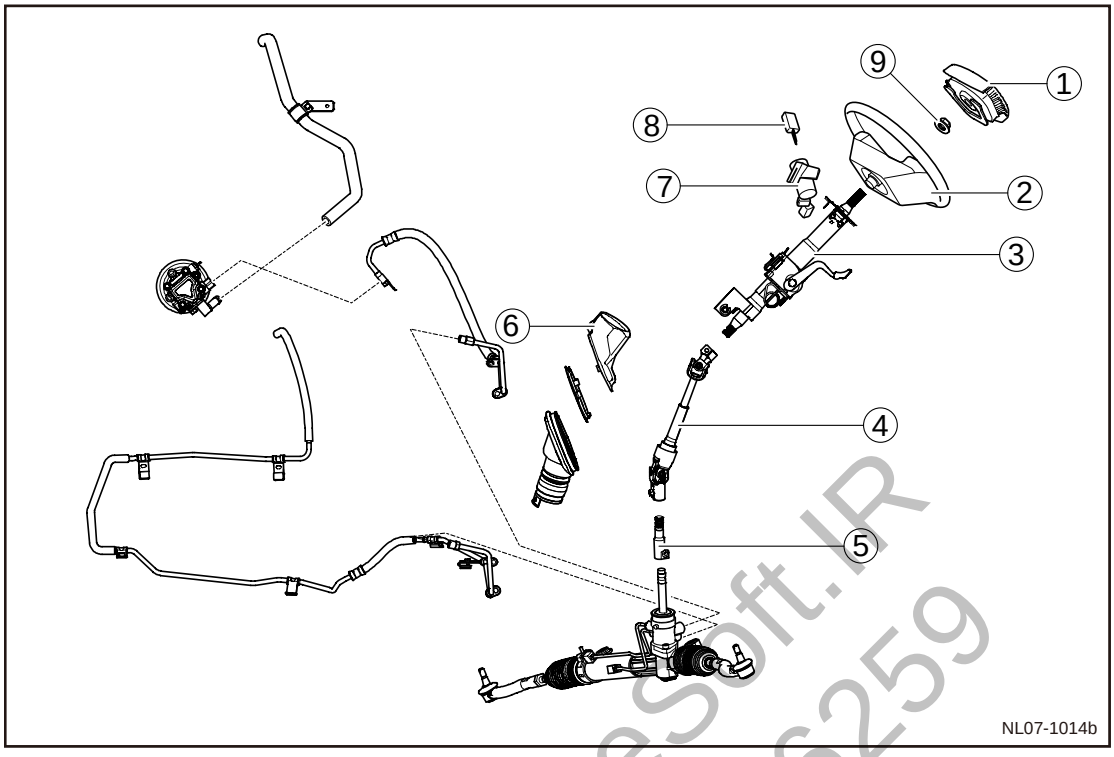
1. Driver side safety airbag.
2. Steering disc
3. Mechanical steering column assembly
4. Upper counter shaft assembly.
5. Lower intermediate shaft assembly
6. Steering column soundproof enclosure
7. Ignition Switch

7.3.4 Disassemble drawings

7.3.4.1 Disassemble drawings



1. Driver side safety airbag.
2. Steering disc
3. Mechanical steering column assembly
4. Upper counter shaft assembly.
5. Lower intermediate shaft assembly
6. Steering column soundproof enclosure
7. Ignition Switch
8. Ignition key
9. Steering wheel fixing nut\

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7.3.5 Diagnostic information and procedures

7.3.5.1 Diagnosis descriptions

Refer to 7.3.2 Description and operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

7.3.5.2 Visual inspection

Before repairing, firstly confirm the customer fault. Inspect whether the tire pressure is normal, whether there is obvious mechanical or electrical damage, whether the tightening bolt on the mechanical steering column assembly shaft movable coupling head is loose and whether the fixing bolt on the mechanical steering column assembly mounting bracket is loose.

7.3.5.3 Fault symptom table

Help to determine the cause of the fault and part in the diagnostic process with reference to the following table. Display the possible malfunction causes in the ascending numerical order and check each component in order. Repair or replace these components if necessary.

Symptoms	Suspected parts	Measures / referance
Steering wheel loosed	1. Fixing nut of steering wheel(loosed /damaged)	Refer to 7.3.6.3 Replacement of steering wheel to fasten or replace the nut.
	2. Mechanical steering column assembly system connecting bolt (loosed /damaged)	Refer to 11.3.8.12 Replacement of mechanical steering column Assembly to fasten or replace the bolt.
	3. Upper and lower middle shaft universal joint (abrasion)	Replace upper and lower intermediate shaft assemblies.
	4. Steering wheel spline housing (worn)	Replace steering wheel, refer to7.3.6.3 steering wheel replacement.
	5. Steering column spline shaft (wear)	Replace steering column, refer to11.3.8.12 machinery steering column assembly replacement.
	6. Upper and lower intermediate shaft spline housing/shaft (wear)	Replace upper and lower intermediate shafts.
	7. Power steering gear and tie rod assembly	Refer to 7.2.8.13 replacement of power steering gear assembly with Tie rod to repair or replace the power steering gear assembly with the tie rod.
Mechanical steering column Assembly loose	1. Mounting bolt of mechanical steering column (loosed /damaged)	Refer to 11.3.8.12 replacement of mechanical steering column Assembly to fasten or replace.
	2. Mounting support (damaged) of mechanical steering pipe column assembly.	Replace instrument desk bracket, refer to12.8.3.4 cross beam of instrument panel replacement.
	3. Mechanical steering column assembly (damaged)	Refer to 11.3.8.12 Replacement of mechanical steering column Assembly to replace mechanical steering column assembly.

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Mechanical steering column assembly noise	1. Mounting bolt of mechanical steering column assembly (loosed /damaged)	Refer to 11.3.8.12 replacement of mechanical steering column assembly to fasten or replace.
	2. Airbag clock spring (loosed /damaged)	Refer to 9.2.7.3 replacement of clock spring to reinstall or replace the clock spring.
	3. Connecting bolt of the mechanical steering column assembly system (loose/damaged)	Refer to 11.3.8.12 mechanical steering column assembly to fasten or replace the bolt. Assembly Replacement.
	4. Shaft/bearing of mechanical steering column assembly (damage)	Refer to 11.3.8.12 replacement of mechanical steering column assembly to replace mechanical steering column assembly.
	5. Upper and lower intermediate shaft universal joint (Lack lubrication/worn)	Apply lubricating grease or replace the upper and lower intermediate shafts.
The regulating function of the dip angle of the steering column is abnormal.	1. Inclined lock block of steering column (stuck)	Clean up impurities, derust the lubrication locking block or replace the steering column. Refer to 11.3.8.12 replacement of mechanical steering column Assembly.
	2. Steering pipe column inclination angle adjusting handle (loose/ damage)	Refer to 11.3.8.12 Replacement of mechanical steering column assembly to fasten the fixing nut or replace the handle.
	3. Steering pipe column tilting spring (soft/ damage)	Refer to 11.3.8.12 Replacement of mechanical steering column Assembly to reinstall or replace the spring.
	4. Tilting pivot of mechanical steering pipe assembly (rusting/ damage)	For derusting and lubrication or replacement of mechanical steering column assembly, see 11.3.8.12 replacement of mechanical steering column assembly.
The mechanical steering column assembly is difficultly locked/unlock.	1. Ignition switch install bolt(loosed /damaged)	Fasten or replace the mounting bolt.
	2. Ignition switch lock (stuck/damaged)	Derust and lubricate or replace the ignition switch.
	3. Ignition switch lock pin (broken /damaged)	Replace ignition switch.
	4. Inner shaft of mechanical steering column assembly (damage)	Refer to 11.3.8.12 replacement of mechanical steering column assembly to replace mechanical steering column assembly.
The mechanical steering column assembly is difficultly unlocked/ unable to unlock.	1. Ignition switch lock(clip-on/damaged)	Derust and lubricate or replace the ignition switch.
	2. Ignition key (worn /damaged)	Replace ignition switch.

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7.3.6 Dismantle and installation

7.3.6.1 Steering wheel free clearance inspection

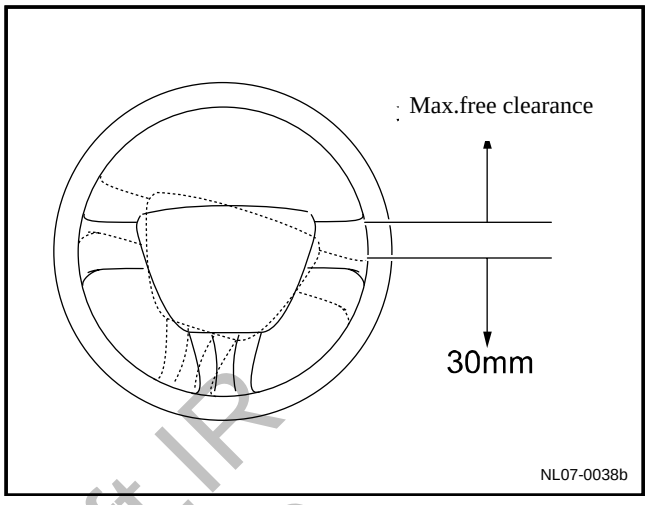
1. Park the automobile, and the front wheels are towards the front.

Notes:

The free clearance of the vehicle is unable to adjust. Replace the power steering gear assembly with tie rod in the case of normal upper and lower intermediate shaft universal joint.

2. During rotation, feel whether there is gap between upper and lower shafts, if yes, replace upper, and lower middle shafts.

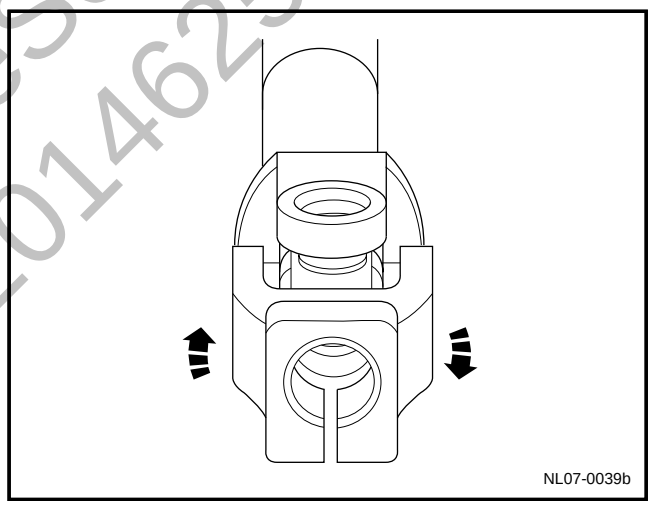
Max. free clearance:30 mm (1.18 in)



7.3.6.2 Upper/lower intermediate shaft universal joint inspection

1. Fix one end of upper, lower middle shaft universal joint, to rotate the other end of upper, lower middle shaft universal joint in clockwise and counterclockwise.

2. Whether there is any movement, if yes, it is necessary to replace upper, lower middle shaft.



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7.3.6.3 Steering wheel replacement

Dismantlement Procedure

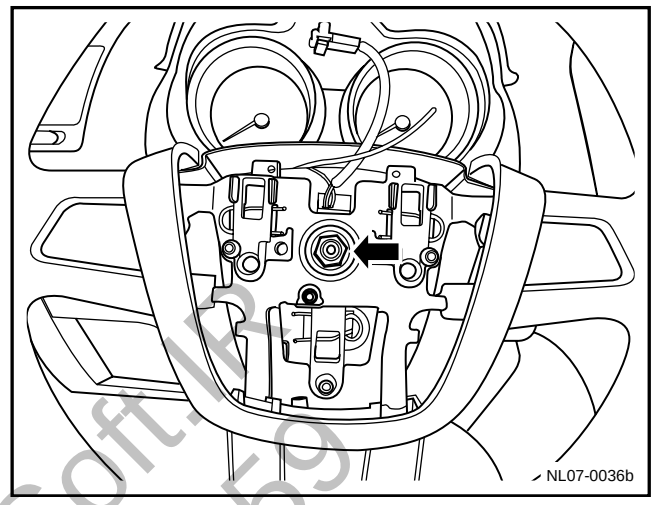
Warning!

Warning: Refer to Warning for battery disconnection in warnings and precautions.

Notes:

Prior to operation, the front wheel must be positioned right ahead and the steering wheel must be locked.

1. Dismantle battery negative cable , refer to 2.11.8.1 Disconnect connecting process of battery cable
2. Dismantling of driver's side safety airbag, refer to Replacement of driver's side safety airbag.



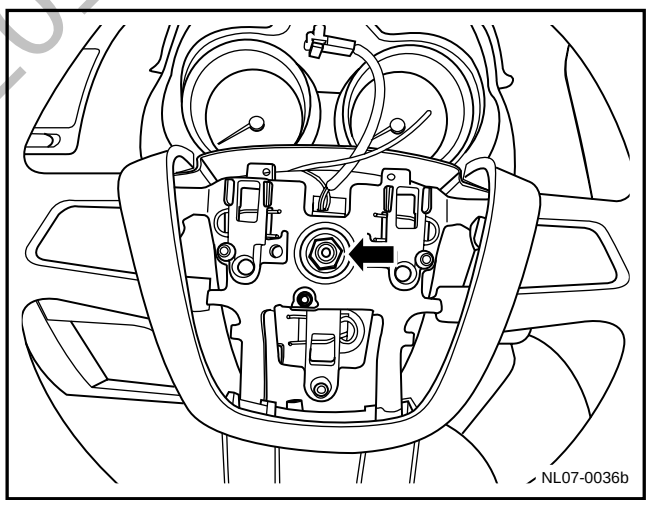
3. Dismantle fixing nut of steering wheel.
4. Pull out steering wheel.

Installation procedure:

1. Make the front wheel point to right front, and install steering wheel.
2. Tighten fixing nut of steering wheel.

Torque: 40 Nm (Metric) 29.6 lb-ft (English system)

3. Install the driver's side airbag.
4. Connect the battery negative cable.



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8 Heating, venting and A/C system

8.1 Warning and precaution

8.1.1 Warning and precaution

Warning!

Relevant operation of the refrigerant should be done in a well-ventilated environment, without breathing refrigerant vapor. The A/C refrigerant R-134a (tetrafluoroethane) and lubricating oil steam or fog should be prevented from being inhaled. Stimulate eyes, nose and throat after contacting with them. Operated in a well ventilated area.When cleaning R-134a from an A/C system, repairing equipment R-134a regenerating equipment that is authenticated and meets requirements shall be applied. If the system discharges accidentally, ventilate the work area prior to continuing to repair. Other health and safety information can be obtained from the refrigerant and lubricating oil manufacturer.

Warning!

The negative terminal of the battery must be disconnected prior to repairing the appliance system. Forbid welding or steam cleaning on the vehicle with A/C pipeline or part or close thereto.

Precaution relating to A/C refrigerant

Notes:

– If skin contacts it, it may cause frostnip.

– Must comply with specification was provided by manufacturer. During operation, wear proper safety goggles and protective gloves.

The A/C refrigerant should avoid the operations as follows.

Notes:

– Do not store refrigerant at a place with direct sunlight or heat sources.

– When filling, the refrigerant bottles must not be upright. Keep valves down.

– Refrigerant cylinder can not exposed in the snow area

– Can not be drop off refrigerant cylinder

– Do not.in any case. Directly discharge refrigerant to the atmosphere.

Can not be mix refrigerant, for example: R134a (fluoroethane) and R12 (Freon)

Precaution relating to refrigeration oil

Notes:

You must use the lubricating oil of the type and grade as specified by the compressor manufacturer. Lubricating oil of different types and grades must not be mixed; otherwise this will damage the compressor. The lubricating oil easily absorbs water, thereby shortening the contact time between the lubricating oil and the air as must as possible.

Notes:

Forbid washing of the A/C system through water, corrosive solvent or flammable and explosive solvent. It is recommended to use cleaning agent, such as R-141b and heptane etc.

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8.2 Auto conditioning

8.2.1 Specifications

8.2.1.1 Fastener specifications

Fastener Name	Model	Torque range	
		Metric (N·m)	English system (lb-ft)
Pipeline system assembly hexagonal flange face nut	M6	7-8	5-6
Pipeline system assembly hexagonal flange face bolt	M6×12	10-12	7-9
Pipeline system assembly hexagonal flange face bolt	M6×20	10-12	7-9
Pipeline system assembly hexagonal flange face bolt	M6×20	18-20	13-15
Pipeline system assembly hexagonal flange face bolt	M8×20	16-18	12-13
Compressor assembly hexagon-headed bolt	M8×105	28-30	21-22
Hexagon flange face bolt of condenser	M6×16	6-7	4-5
A/C head unit hexagon nut and spring gasket assembling unit	M6	6-7	4-5
A/C head unit hexagon flange bolt	M6×12	6-7	4-5
A/C head unit hexagon bolt and spring gasket assembling unit	M6×12	6-7	4-5
No.1,No.2 water pipe steel belt type elastic hoop	-	-	-
A/C control panel cross recessed pan head self-tapping screw and flat gasket assembling unit	ST4.2×16	3-4.5	2.2-3.3

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8.2.1.2 Refrigeration system parameters

Items		**Item parameter**
Compressor	Nominal refrigerating capacity/W	≥4500(rotational speed of compressor is 1800rpm)
	Displacement/(ml/r)	180
	Model	HS18
	Electromagnetic clutch consumption power/W	46
Blower	Max.air volume/(m3/h)	500
	Air Volume Control	Automatic
	Motor consumption power/W	250
Condenser	Size /mm	68×422×731
	heat exchange amount/W	≥15000
	Air-side resistance/Pa	≤110
Evaporator	Refrigerating capacity/W	≥5500
	H-type expansion valve (ton of refrigeration)	1.5
Temperature regulating method		Control cold-warm air mixture ratio
Lubricating oil/ml		FD46XG:150±10 ml
Driving belt (JL4G18-E)		Poly V-belt (6PK1875)
Driving belt (JLD-4G20//JLD-4G24)		Poly V-belt (7PK1956)

8.2.1.3 System Capacity

Applications	**Specification**	
	(Metric)	**English system**
Refrigerant lubricating oil (100PG)		
Refrigerant flow away suddenly	40 ml*	1.34 oz*
Replacement of compressor		
Note: if the lubricating oil discharged in the course of recyclinging the refrigerant is not replaced, the compressor may be damaged.		
The compressor on the vehicle is pre-filled with 150 ml** (5 oz**) of refrigerant lubricant (100PG).		
Replacement of Condenser	40 ml**	1.34 oz**
Replacement of evaporator	60 ml**	2.0 oz**
Replacement of Stored Fluid Dryer Core	20 ml#	0.67 oz#
# The oil volume of 100PG to be filled should be equal to the sum of emission and specified volume of old liquid reservoir dryer core.		

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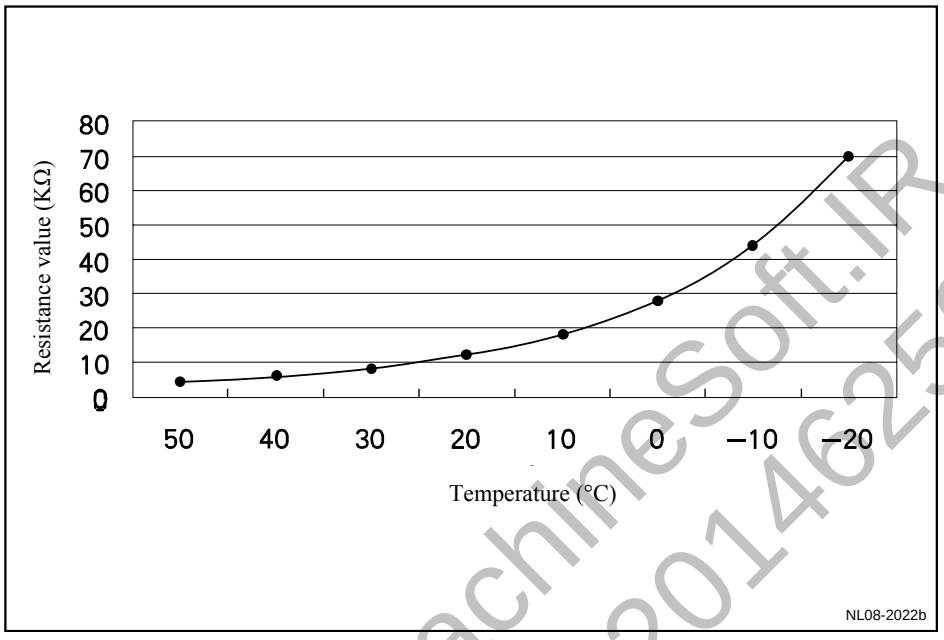
Replacement of any pipe assembly (hose/pipe or pipe assembly)	30 ml**	1.0 oz**
The refrigerant lubricating oil capacity of the whole system	150 ml	5.0 oz
R-134a		
Refrigerant charging capacity	550±50 g	1.21±0.11 b

*It may cause natural leakage of refrigerant, and will not cause refrigerant oil loss. Due to the large number of leaks, hose rupture and collision or pressure release valve opening,

The refrigerant is suddenly lost. When replacing the parts resulting in a hug loss of refrigerant, be sure to add sufficient lubricating oil for them.

8.2.1.4 Resistance Properties of Evaporator Temperature Sensor



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8.2.2 Description and operation

8.2.2.1 Description and operation

1 Overview

The automatic A/C system will provide comfortable riding environment to the passenger no matter how the outside weather is; and the system consists of the following main parts:

– Refrigeration system

– Heating system

– Air distribution system

– Mode /temperature control system

2 Compressor:

The A/C compressor is driven by the engine crankshaft driving the compressor clutch belt pulley through the transmission belt; when the electromagnetic clutch coil is not energized, the compressor belt pulley freely rotates without driving the compressor shaft; after the clutch coil is energized with voltage, the clutch plate and the hub are pushed to the belt pulley and are locked integrally through the magnetic force to drive the compressor shaft. The compressor is equipped with a unique lubrication system. The oil absorption port of the crankshaft discharges through the rotating swash plate, such a path allows the lubrication of the swash plate bearing. The rotation generates the effect of engine oil separation; certain engine oil is separated from the leakage liquid at the crankcase liquid suction port to reflow back into the crankcase. Refluent engine oil can lubricate the mechanical part of the compressor.

The compressor is closed with the following conditions:

– Full throttle valves are "ON"

– Low idling

– Ambient temperature is low

– Engine coolant temperature is too high

Pressure of refrigerant is higher than 3.2MPa (464.1pounds/ square inch) or lower than 0.2Mpa (21.9 pounds/ square inch).

Notes:

Do not impact, have fall or keep top down the compressor. If the compressor is impacted or kept top down, you should rotate the compressor clutch 5 to 6 times with hand to circulate the engine oil precipitated in the cylinder. When the engine oil is in the cylinder, sudden revolution of the compressor will cause the valve to be damaged and have adverse effect on the durability.

3. Condenser.receiver dryer

High-temperature high-pressure refrigerant steam from an air condition compressor is flowed into a condenser. The condenser consists of an aluminum pipe capable of performing rapid heat transmission and a cooling fin, wherein the cooling fin condensates the high-temperature high-pressure refrigerant steam into medium-temperature high-pressure liquid through radiation. Located on the left side of the condenser, the stored fluid dryer is welded with the condenser as a whole. The internal structure design of the stored fluid dryer can ensure the moderate temperature and high pressure refrigerant entering the dryer is in a mixed status of gas and liquid and the moderate temperature and high pressure refrigerant coming out of the dryer is in the liquefied status.

The stored fluid dryer contains drying agent which can absorb the moisture of the refrigeration system and the drying agent cannot be reused. Due to the following reasons, the receiver-dryer core can not be repaired but replaced when leaking.

– Perforation

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– Seal area damaged

– Time is too long for external air enter into the system

4. Indoor temperature sensor, outdoor temperature sensor

The following sensor affects the automatic control of the in-vehicle air temperature:

– Indoor temperature sensor

– Outdoor temperature sensor

These sensors are thermosensitive elements sensitive to temperature; the resistance and the temperature of the sensor are in inverse proportion corresponding relationship; the level of the signal transmitted to the A/C control module is determined by the resistance value; and the A/C control module sets the command signal needed to the following parts by using the information.

– Inside and outside circulation motor

– Cool-warm temperature wind direction motor

– Blower motor control module

The indoor temperature sensor housing is connected with the inhaler through the hose pipeline, the air flow from the A/C head unit forms a minute vacuum degree at the end part of the inhaler hose; and such vacuum formation realizes the following functions.

– To make the indoor air flow through indoor temperature sensor.

– Improved accuracy of sensor detecting temperature

The outdoor temperature sensor is located in the front grid area below the front bump of the vehicle; the A/C control module uses the sensor to obtain the ambient air temperature information; and the information A/C control module can be used for displaying the outside terminal on the instrument display screen.

5. Sunlight sensor

The sunlight sensor is located in the middle of the upper trim cushion of the instrument panel . The sunlight sensor belongs to the light energy sensor, which can measure the heat produced by sunlight hitting the vehicle to provide more compensation parameter to the A/C control module. A/C control module automatically adjusts the A/C volume and cold/hot wind mixing proportion in real time according to the state of the external illumination intensity, so that all passengers are able to get the most comfortable feeling.

6. Indoor temperature sensor

The indoor temperature sensor is integrated in the automatic A/C control panel to connect with the suction hose; and the in-vehicle temperature is collected through the suction of the wind direction passing through the inside of the warm air assembly housing.

7. Main host of indoor A/C

The indoor A/C head unit is located in the instrument panel , including a blower motor, a blower motor control module, an A/C filter, a heater core, an evaporator, an expansion valve, a warm and cold temperature wind control motor as well as a variety of air deflection throttles and ventilation ducts.

A. Blower motor

Notes:

When placing the blower motor, the fan wheel of the blower motor can not be used as the supporting surface.

To prevent the fan wheel blade from being damaged, inhibit collision of the fan wheel.

The blower consists of the following parts:

– Permanent magnet-type motor

– Squirrel-cage fan

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The change of the revolution speed of the blower at different speeds depends on the blower motor control module controlled by the blower motor revolution speed control device. If the user selects the maximum A/C mode, the vast majority of the air entering the blower is from the passenger compartment (inside circulation).

Outside air enters into the vehicle in the following mode under most of operational conditions:

– Blower motor word breathe the outside atmosphere

– Vehicle forward running was pressed into outside air

The blower motor blows air along the following line:

– Pass through evaporator core

– Pass through heating core

– Enter into the passenger compartment

B. Heater core

The heater core is the main part of the heater system. The heater core is located in the A/C head unit. When the engine is running, the engine coolant is pumped from the engine to the heater core, the heat fro the engine coolant is transmitted by the heater core to the air flowing through the heater core. The heater core is provided with special inlet and outlet warm air water pipe. The HVAC water pipeline of the heater core body must be thoroughly drained during dismantled. During maintenance, the heater core with the independent warm air water pipeline must have been installed. The heater core is equipped with the temperature sensor; the sensor transmits the surface temperature signal of the heater core to the A/C control module for providing more compensation parameters to the automatic A/C.

C. Evaporator and expansion valve

The evaporator is located at the left of the A/C head unit. When installed on the vehicle, the A/C head unit needs to be dismantled to dismantle and install the evaporator and the expansion valve. The refrigerant pipeline of the evaporator must be thoroughly drained during dismantlement. During maintenance, the evaporator with the independent refrigerant pipeline must have been installed. The expansion valve is connected with the evaporator, installed at one end of the evaporator and located at the inlet of the evaporator; one side of the expansion valve is connected with the air inlet pipe and the exhaust pipe of the A/C compressor and the other side thereof is connected with the air inlet pipe and the exhaust pipe of the evaporator; the high-pressure liquid refrigerant is limited in the liquid pipeline so that the refrigerant becomes the low-pressure liquid when flowing to the evaporator.

Expansion valve changes the position from large to small according to the lower limit of the A/C pressure and the upper limit of the A/C pressure.

The evaporator is cooled and dehumidified before the air enters the passenger compartment. The following processes are generated in the evaporator:

– Low pressure temperature fluid /vapor refrigerant enter into evaporator.

– Refrigerant flows through evaporation pipe.

– Refrigerant vaporizes.

– Absorb heat, when refrigerant vaporises, air flow absorb heat by evaporator

– Refrigerant enters into evaporator in the form of low pressure and low temperature, and leaves from evaporator in the form of steam.

When the heat in air is transmitted to the evaporator core, moisture in air will be condensed on the outer surface of the evaporator core to for water to flow outside.

The evaporator is equipped with a temperature sensor to prevent from freezing. The sensor measures the surface temperature of the radiating fin on the evaporator, the compressor clutch will not continue to work if the temperature is lower than about 2℃ (36 ºF). If the temperature is increased to above 4℃ (39 ºF), the compressor will start working again. In the system with automatic temperature control, the sensor signal is firstly transmitted to the A/C module, and then is transmitted to the A/C pressure switch through a special line; if the A/C pressure

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meets requirements, the corresponding A/C starting signal is transmitted to the ECM, and the ECM controls the on/off of the compressor clutch.

8. Refrigerant R-134a and lubricating oil

Refrigerant function in the A/C system as follow:

– Absorb heat

– Carrying heat.

– Release of heat

The vehicle uses the R-134a refrigerant, which is a non-toxci, flame-retardant, transparent and colorleess liquefied gas.

Please refer to the instruction to the disposal of the refrigerant pipeline and connector as well as the maintenance of the chemical stability before the maintenance operation needing to open the refrigerating system pipeline or the part. R-134a is filled with special lubricating oil FD46XG to synthesize refrigerant oil; the refrigerant oil needs to be stored in an airtight container due to its higher water-absorption. Only the FD46XG synthesized refrigerant lubricating oil can be used in the internal circulation of the R-134a A/C system. Only use the mineral-based 525 refrigerant oil at the thread and O ring and other lubricating oil used will result in compressor or accesesory malfunctions.

Be sure to repair as follow in accordance with the steps in the instruction:

Recycle and regeneration of refrigerant

– Added oil

– Drain out refrigeration System

– Added refrigeration system again

9. A/C high pressure pipe. A/C low pressure pipe. A/C pressure switch.

The vehicle uses A/C high pressure and low pressure pipes (A/C rigid pipe and/or hose) to connect the A/C refrigeration system as a sealed and enclosed system in which the refrigerant and lubricating oil flow to complete the circulation of the refrigerant. The A/C hard tube consists of an aluminum tube and corresponding adapter; and the A/C hose consists of rubber hose and corresponding adapter.

A/C pressure switch belongs to three-state pressure switch, which transmits the A/C pressure signal.

Pressures switch value:

Description	**Pressure added**		**Signal value**
	Metric (MPa)	**Inch (psi)**	
High-pressure side	3.2	464.1	OFF
	2.6	377.1	
midde pressure side	1.15	166.8	ON
	1.55	224.8	
Low-pressure side	0.2	29.0	OFF
	0.23	33.4	

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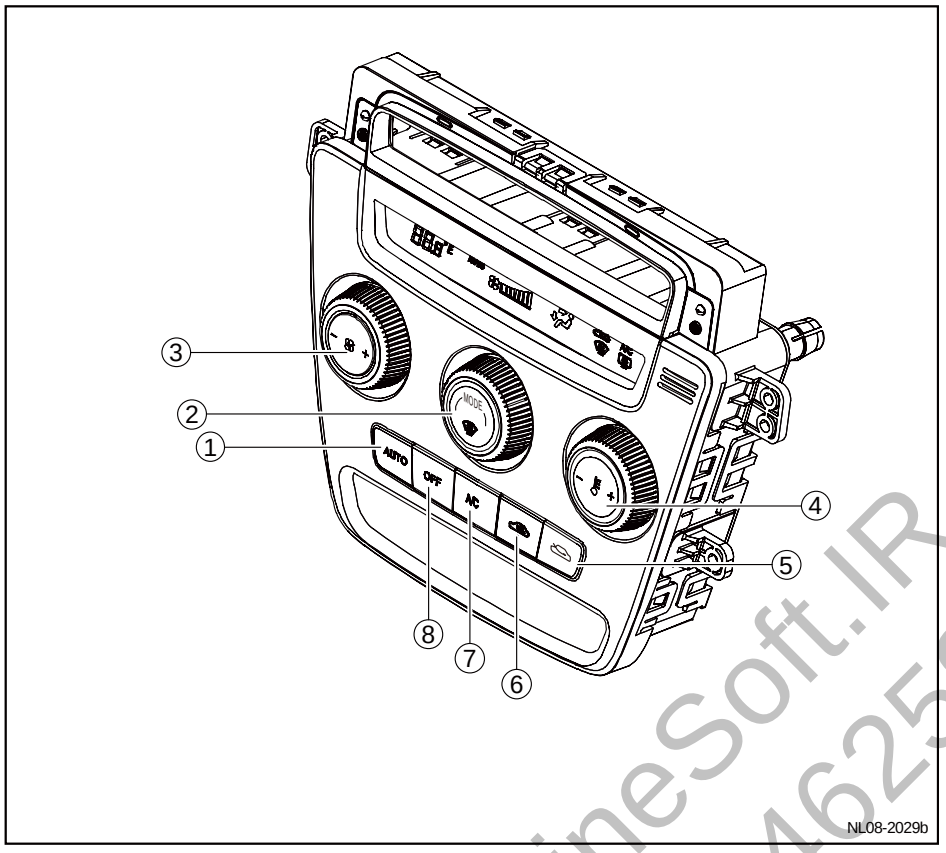
8.2.3 System operating principle

8.2.3.1 Functional description of A/C control panel

1. Drawing of control panel.



2. Setting of temperature

The temperature setting knob is used for setting the in-vehicle temperature; and the temperature value is used as the user information to display on the LCD. Temperature can be regulated within 7.5-31.5℃. Temperature adjustment in each step is 0.5℃; and the set range of the vehicle is 17.5-31.5℃. When the set temperature is lower than 17.5℃, LCD displays LO; and when higher than 31.5℃, LCD displays HI. Temperature setting does not change the operation mode of the A/C system.

In the automatic mode, the system will keep running the maximum amount of air supply when entering LO/HI. The position of the mixed throttle is controlled by certain input variable. The input variable includes driver set value, internal temperature, external temperature and sunlight intensity. Measure the position of the actuator (feedback voltage) when the A/C motor is in the Hi and Lo state:

Hot and Cold Air Adjust Motor	**Voltage (V)**
Low (Lo)	0.3
High (Hi)	4.7

3. Volume setting

In the automatic control mode, the wind speed is controlled by a number of input variables. According to the set value of the driver, interior temperature, exterior temperature and sunlight strength, the system automatically regulates the wind speed.

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Display screen displays the blower wind speed bar and fan identification.

In the automatic mode, the wind sped of the blower is not allowed to "jump" to a new set value.

The wind speed increased or decreased to a new set vale needs a period of time (refer to function "gradual increase of wind speed"). In the mode of automatically adjusting the wind speed, the voltage of the blower motor is limited by the out-vehicle temperature.

The air adjusting knob is used for manually setting the speed of the blower. The A/C system controls the gears 1-7 of the fan speed in the voltage linear regulating mode.

Under manual control mode, the blower speed is immediately changed to the new one according to the new wind speed set value. The blower is unable to be closed completely by rotating the wind speed regulating knob (at most reducing to gear 1). Completely shut down the blower only through the OFF key.

Under the manual control, AUTO is not displayed on the display screen.

Increase the wind speed gradually, start in the automatic mode in IG2, or wake up through the closing of the system. The wind speed of the blower increased to the set value needs a certain time (increased or decreased speed: gear 1 to gear 7/9s).

Notes:

When the system is started by manually adjusting the wind speed, the wind speed of the air blower is started by first manual gear.

Air quantity bar shows	Blower gear	Auto-mode blower end voltage (V)
1	1	4.5(Auto Min.)
2	2	4.6-5.5
3	3	5.6-6.7
4	4	6.8-7.7
5	5	7.8-8.9
6	6	9.0-10.1
7	7	10.2-11.2(Auto Max.)

4. Manually/automatically adjust the air delivery mode.

The automatic A/C controller provides a manual air-out mode and an automatic air-out mode for the user to choose. The throttle can control the air-out mode through the adjustment of the mode. Different allocation for air supply to head and feet is for the purpose of supply the feet with warm air and the head with cool air to ensure the driver can be constantly in a comfortable driving environment. The temperature distribution range is affected by the space of the vehicle.

The automatic A/C controller determines the temperature of the mixed gas through a heater and an evaporator temperature sensor.

The user can select 5 air-out modes under the manual state:

1. Blow to face.
2. bi-direction (blow to face or foot).
3. Blow to foot.
4. Mixture (blow to foot and defrosting)
5. Defrosting.

When the mode knob regulates, the mode will be changed as follows: surface blowing>surface blowing/foot blowing>foot blowing >foot blowing/defrosting>surface blowing

Under various air-out modes, the LCD displays the corresponding identifications.

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The air allocation model and actuator position (feedback voltage):

Mode (air distribution mode)	Actuator feedback voltage (V)
Air supply to face	0.3
Both-way (surface blowing and foot blowing)	1.4
Air supply to feet	2.5
Mix (blow foot and defrost)	3.6
Defrost	4.7

In the automatic control mode, the air distribution mode is controlled by a number of input signals. Input signal includes set value, in-vehicle temperature, out-vehicle temperature and sunlight intensity etc. When an air-out mode key is operated, the system will be automatically converted into the manual mode from the automatic mode.

Certain limit of the A/C system may cause that the comfort is unable to reach under exceptional circumstances. The A/C control module selects one proximal mode to display on the LCD at that time.

5. Internal-outside circulation control

The user can choose outside circulation mode or inside circulation mode:

1. Under outside circulation mode, open outside circulation vent port and close inside circulation vent.
2. Under interior circulation mode, interior circulation vent port must open, and exterior circulation vent port must close.

In the automatic control mode, the ventilation is controlled by a number of input variables. Input signal includes set point, in-vehicle temperature, out-vehicle temperature and sunlight intensity etc. In the automatic control mode, there are two throttle positions (outside circulation and internal circuit) for ventilation.

Under manual control mode

– Press down the fresh air button, venting valve keeps the outside circulation mode
– Press down the circulation button, venting valve keeps the inside circulation

The ventilation model and actuator position (feedback voltage)

Ventilation	Actuator feedback voltage (V)
Fresh air	0.3
Circulation	4.7

6. Defrost control

The defrosting button is used to activate the front windshield defrosting function. At this time, the fan speed reaches the maximum level and the internal circulation is canceled (as the internal circulation may affect the defrosting effect) and the compressor enabling request is made.

– Air volume allocation models is defrost
– Venting valve is in the new air position
– A/C is "ON", and A/C mark display (only if outside temperature is too low)

If the external temperature is too low when defrosting, the automatic controller does not send out a compressor start-up request signal to the engine control unit.

When the starting temperature is in the temperature setting zone, A/C ON is optimized.

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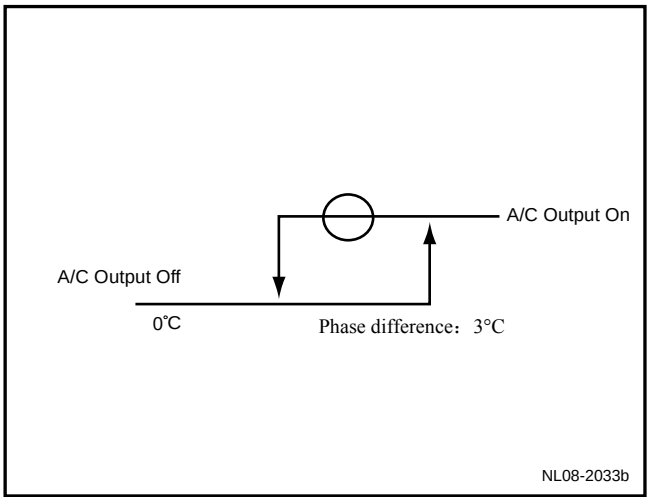

– AUTO mark is "OFF"

– DEF mark display.

Under nay working condition (automatic, manual and off), the system immediately operates under the defrosting state in the case of pressing the defrosting button. After the defrosting is deactivated, the system will immediately return to the status before defrosting (automatic, manual and shut down).

In a defrosting mode, the blower speed is adjusted to the maximum, so as to ensure that the blower voltage is above 6.5V. The throttle is regulated to blow glass, and the air-out temperature is increased by constant compensation. Start the compressor and open the circulation throttle to the outside circulation. Under the defrosting state, press the air speed regulating button to correspondingly increase or reduce the air speed. Keep defrosting in the working condition, continually operate the compressor, and keep glass blowing in the air-out mode.

Rear defrosting function

The rear defrosting is controlled upon the engine speed signal and the time check function. If the engine speed is lower than 750rpm, the controller shall cut off the rear defrosting output. In addition, the controller also has a time check function to inspect the running tie of rear defrosting; and if the running time reaches 12m, cut off the output of rear defrosting. LCD displays corresponding identification during rear windshield defrosting. The user can press the rear defrosting key again to cancel the rear defrosting function.

7. A/C control

The automatic control module provides an A/C request signal to the engine control unit to control the A/C compressor clutch through the engine control unit. Press down the A/C button when the system is closed; and the A/C can also not be opened if the blower is not opened.

Automatic control

When pressing down an AUTO key, select A/C automatic mode. In the automatic mode, A/C opening is controlled by a number of input conditions: driver set value, in-vehicle temperature, out-vehicle temperature and sunlight intensity, etc. When A/C opens, the display screen displays A/C identification.

Manual control

The A/C can be turned on or off with the A/C button.

Closing of the compressor clutch

When the heat in air is transmitted to the evaporator core, moisture in air will be condensed on the outer surface of the evaporator core to for water to flow outside. The evaporator is equipped with a temperature sensor to prevent from freezing. The sensor measures the surface temperature of the radiating fin on the evaporator, the compressor clutch will not continue to work if the temperature is lower than 2.5℃.

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If the temperature is increased to above 4℃, the compressor will start working again. In the system with automatic temperature control, the sensor signal is firstly transmitted to the controller, and then is transmitted to the A/C pressure switch through a special line; if the A/C pressure meets requirements, the corresponding air starting signal is transmitted to the engine control unit, and the engine control unit controls the on/off of the compressor clutch. In fact, the automatic A/C controller will always provide a, "A/C ON" signal to the engine control unit through a simulating resistance (5kΩ) and controls the closing of "A/C".

7. Auto and manual work status

The system has three states of automatic (AUTO), manual (MANU) and off (OFF).

The following functions are realized under the manual state:

– Manual wind speed adjustment

– Manual air-out mode control

– Manual inside and outside circulation control

Under the automatic state, the following functions are automatically regulated by the controller according to the driver set value, the in-vehicle temperature, the out-vehicle temperature and the sunlight intensity:

– Temperature automatic control

– Wind speed automatic control

– Air volume allocation models automatic control

– A/C automatic control

– Inside and outside circulation automatic control

Screen display with auto-mode

– AUTO mark display on the screen

– Driver temperature setting value display on the screen

– Wind speed and fan mark display in the screen

– Air volume allocation models display in the screen

– A/C mark displays in the screen

– Inside and outside circulation mark display in the screen

AUTO mark can only be shown in screen in automatic mode. When selecting OFF (all A/C systems are closed), the automatic mode is canceled.

Part of the following operation can cancel the automatic mode:

– Manual adjusting blower air speed (AUTO do not display)

– Manual adjustment air volume allocation models (AUTO do not display)

– Manual selecting A/C (AUTO do not display)

– Manual selecting inside and outside circulation (AUTO do not display)

– Defrost function option

Notes:

The function without manual regulation still automatically controls.

The AUTO mode will be re-enabled when the AUTO key is pressed.

System stop

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Close system (blower, compressor and indicator lamp etc.). All throttles keep the position prior to closing the system.

The LCD display screen is on and the mode and ventilation function can be operated manually.

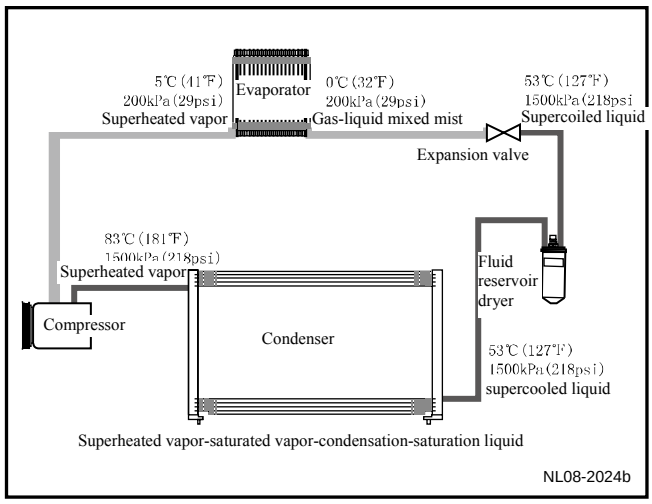
– Reset temperature: freeze and memory setting (not display in the screen).

– A7-A/C: closed and stored setting value (do not display in the screen

– Mode: Keep setting status and mode may be operated.

– Venting: keep setting status, venting mode may be operated

8.2.3.2 Working Principles of Automatic A/C



1. Refrigeration system work principle

The compressor is driven by the belt via the engine to extract the gaseous refrigerant from the evaporator and compress it. The refrigerant is heated to 83°C to 110℃ at pressures up to 15 bar (1.47 MPa), and high-pressure superheated refrigerant is conveyed to the condenser. At this time, heate in the refrigerant is carried away by the air conveyed to the radiator fins, so the refrigerant is cooled down and is retained in the condenser due to the dissipitation of such heat. Then, the refrigerant cooling to 53℃ and 70℃ is transmitted to the refrigerant storage dryer under the high pressure. As an intermediate storage, the store fluid Dry filters all moisture contained in the refrigerant. The dry undercooling refrigerant is delivered to the entrance of the expansion value as a function of the pressure and temperature in the evaporator; the expansion valve performs throttle and pressure reduction control on the flow of the refrigerant entering into the evaporator, the pressure of the fog-like refrigerant from the expansion valve is 2bar, the temperature is dropped to 0℃ to 2℃, and the fog-like refrigerant is heated to evaporate in the evaporator. At last, the heat in the air is completely absorbed by the refrigerant in the evaporator when entering the passenger compartment; therefore, when the air is cooled, the moisture mingled in the air is condensed on the surface of the evaporator core. The low-pressure refrigerant air flow from the evaporator is flowed to the upper opening of the expansion valve, the refrigerant pressure at this time is 2 bar and the temperature is raised to 5℃ to 8℃. However, the compressor extracts the superheated refrigerant steam herein.

2. Heating system work principle

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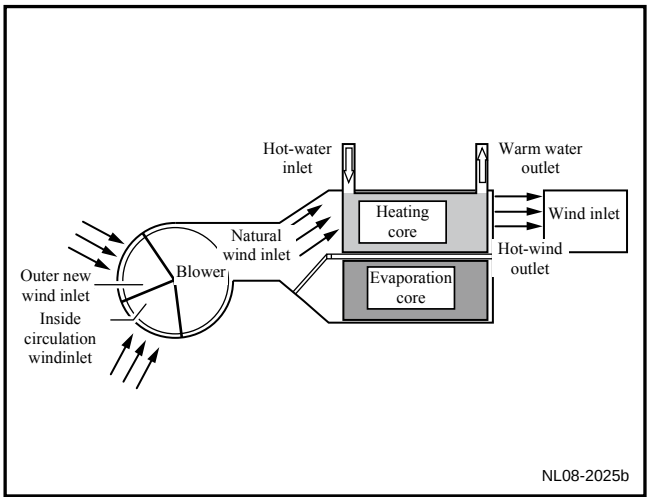


When the automatic A/C system is in the heating mode, the temperature control motor converts the temperature control device into the heating position, so that the air entering the heater core plays the following roles in

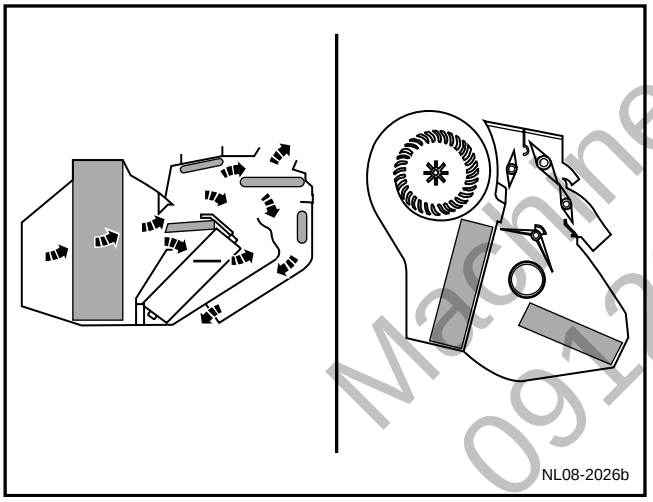
– Part or all air flow passes by to heating core

– Generate heat transmission

Any air needing not to heat will be mixed with the heated air before entering the passenger cabin to obtain the corresponding mixed air at proper temperature.

The state of the engine coolant is the key factor that whether the heating system is working normally.

3. Venting control System work principle



Various locations on the ventilation control system can enable the mode valve to mix or induct cold air and hot air through the air duct; and the outside air through the A/C system is transmitted to the passenger compartment via the air duct system and the air outlet.

Automatically select the appropriate mode status in the "AUTO (automatic)" mode, and change the air supply mode of the vehicle by using the "MODE (mode)" button. If displaying an air supply mode currently, press a "MODE (mode)" button to select the next air supply mode.

Air flow is changed in the following mode:

– Blowing face send wind by instrument panel

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- Bi-directional-send wind by outlet port, outlet port of floor
- Blowing foot send wind by outlet of floor
- Blend Air outlet of front windscreen send air by floor
- Defrost air outlet of front windscreen send air

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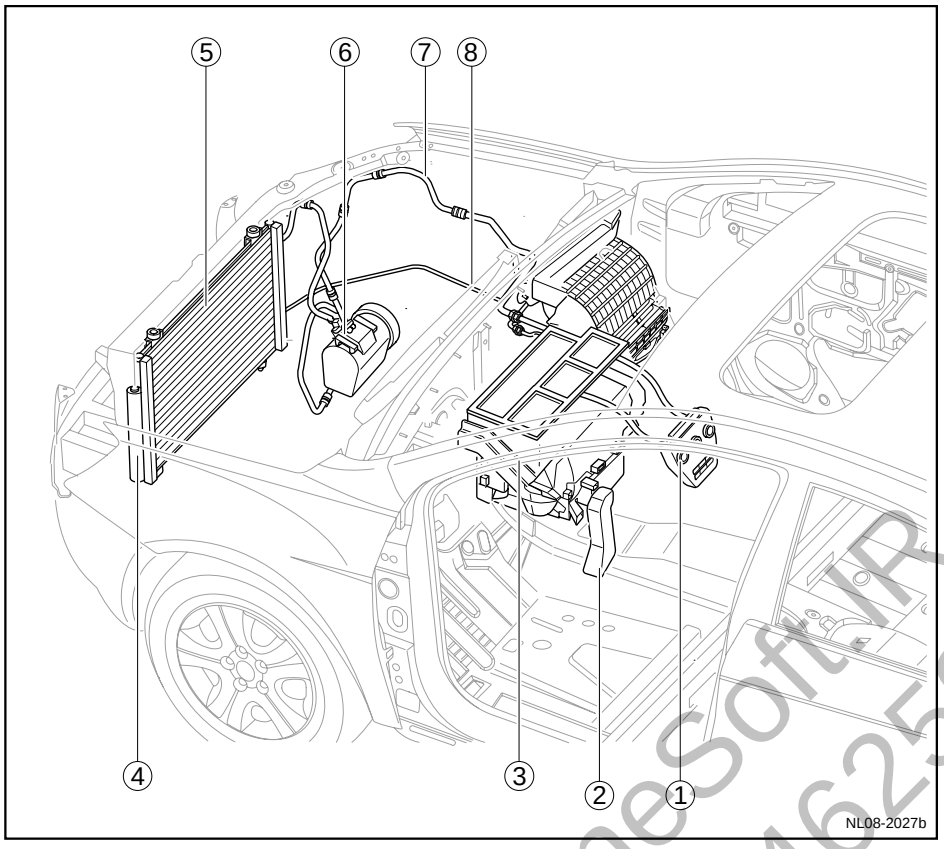
8.2.4 Component position

8.2.4.1 A/C system element layout location plan



Legend

1. A/C Control Panel
2. Floor vent duct.
3. A/C main host
4. Dryer
5. Condenser
6. Compressor:
7. Low pressure pipe of A/C
8. AC high pressure pipe.

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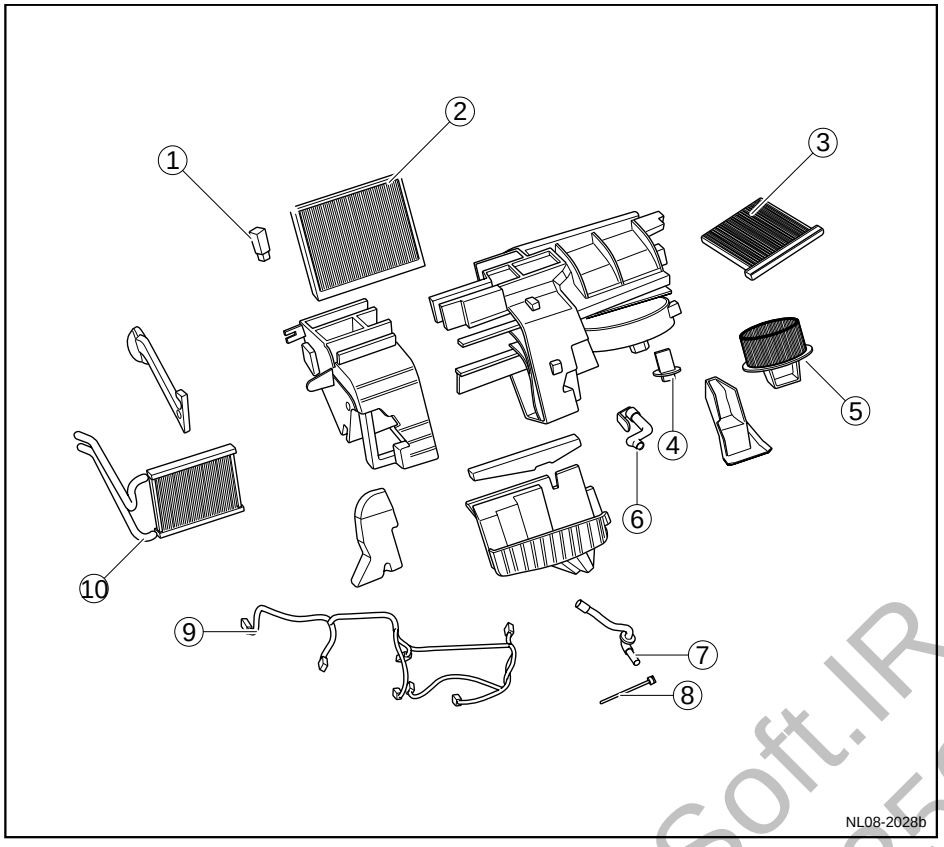
8.2.4.2 Structural layout of A/C main unit



Legend

1. H type expansion valve
2. Evaporator core assembly
3. Filter assembly
4. Speed adjusting module.
5. Blower assembly
6. Suction hose assembly
7. Draining pipe
8. Evaporator temperature sensor
9. Harness assembly
10. Heater core assembly

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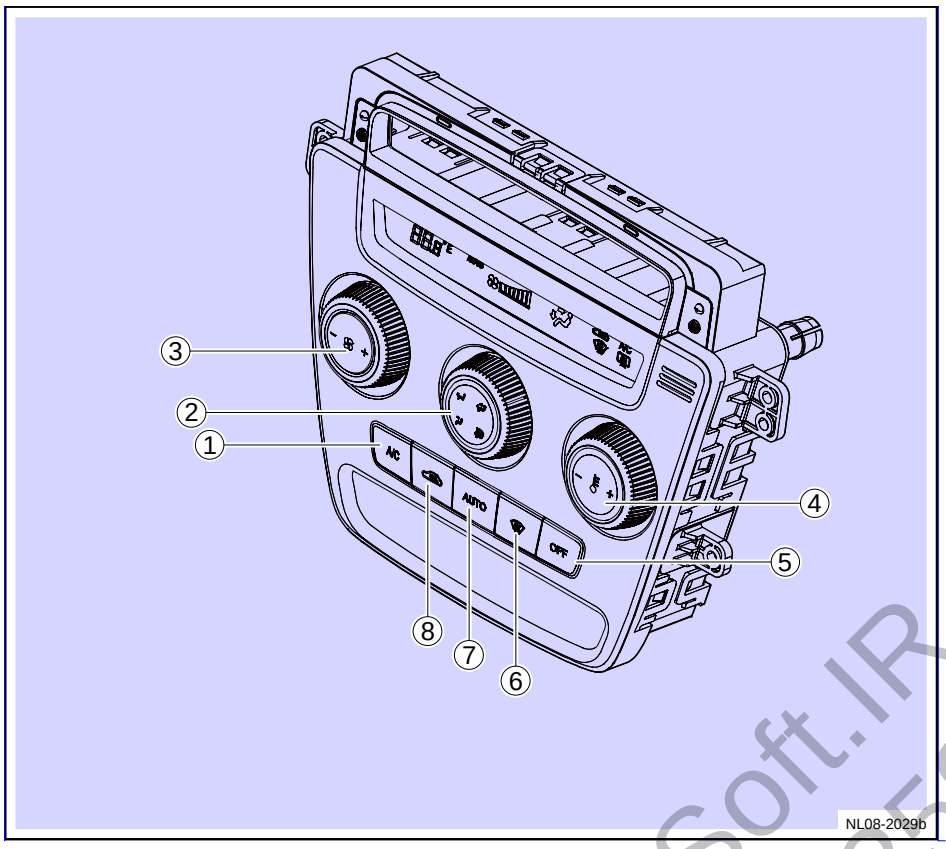
8.2.4.3 A/C panel schematic diagram

批注 [刘萍1]: Amend the intermediate knob and the lower key.



Legend

1. AC button
2. Air outlet mode key
3. Outside circulation button of volume adjusting knob
4. Chilling-Heating Mode Switching Knob
5. "OFF" button
6. Front windshield defrosting switch
7. AUTO key
8. Internal-outside circulation key

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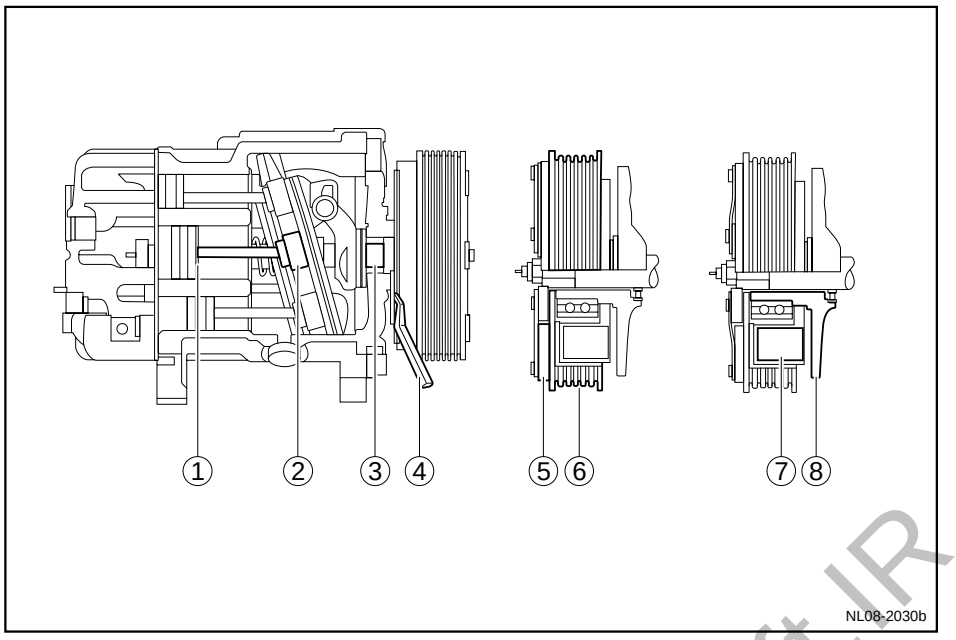
8.2.5 Disassemble drawings

8.2.5.1 Disassemble drawings

Compressor



Legend

1. Piston and cylinder
2. Slant disc.
3. Compressor shaft
4. Clutch coil connector.
5. Support
6. Pulley
7. Cultch coil
8. Pressure plate

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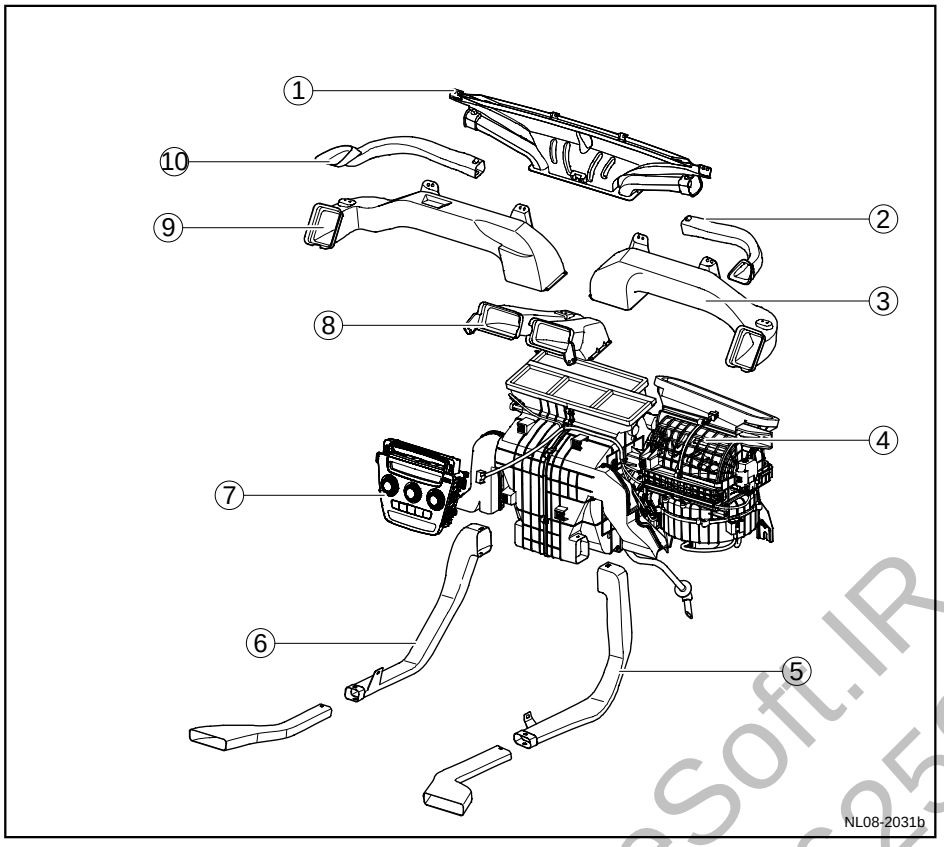
Breakdown drawing of indoor element of A/C system



Legend

1. Air outlet of front windscreen
2. Right side upper air outlet of instrument desk
3. Vent port on right side of instrument table.
4. A/C main host
5. Right floor air outlet
6. Left floor air outlet
7. A/C Control panel
8. Instrument desk center outlet port
9. Left instrument panel air outlet
10. Left side upper outlet of instrument desk

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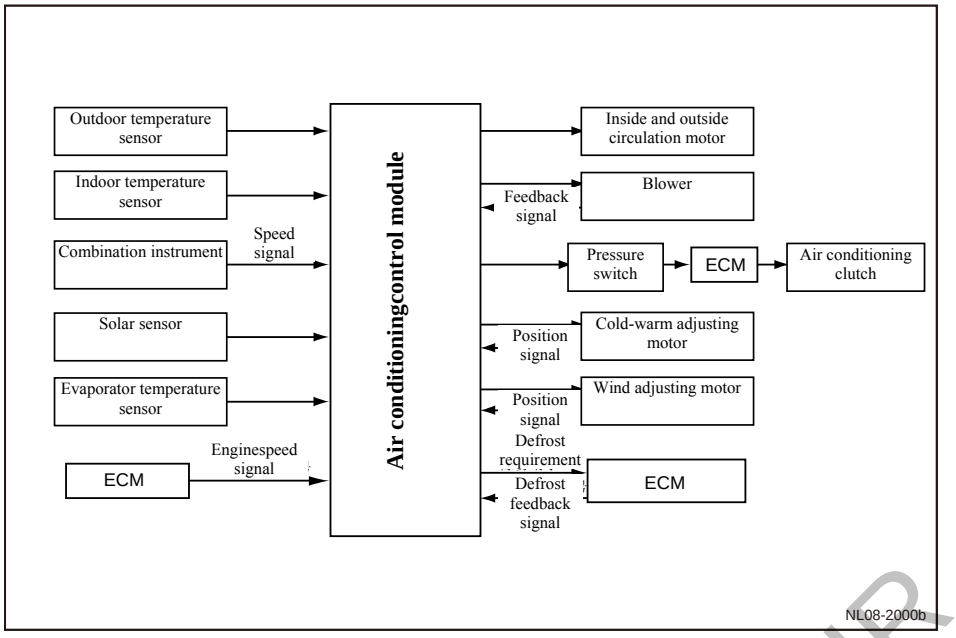
8.2.6 Electrical schematic diagram

8.2.6.1 A/C control system schematic diagram



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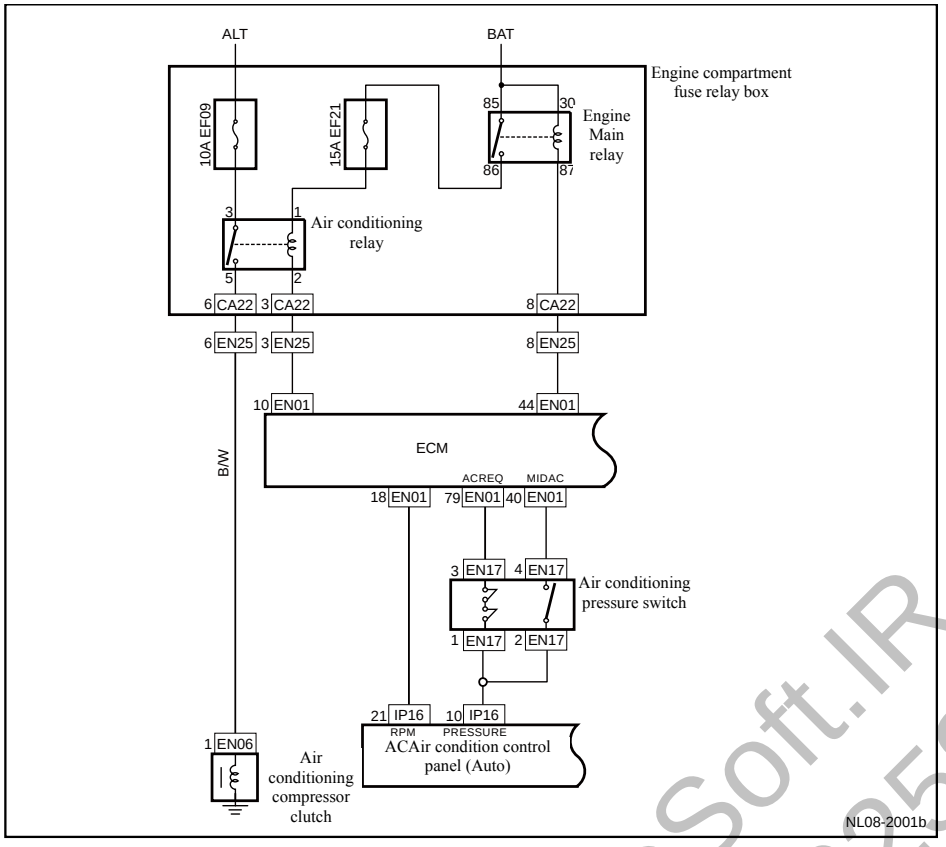
8.2.6.2 A/C system circuit sketch



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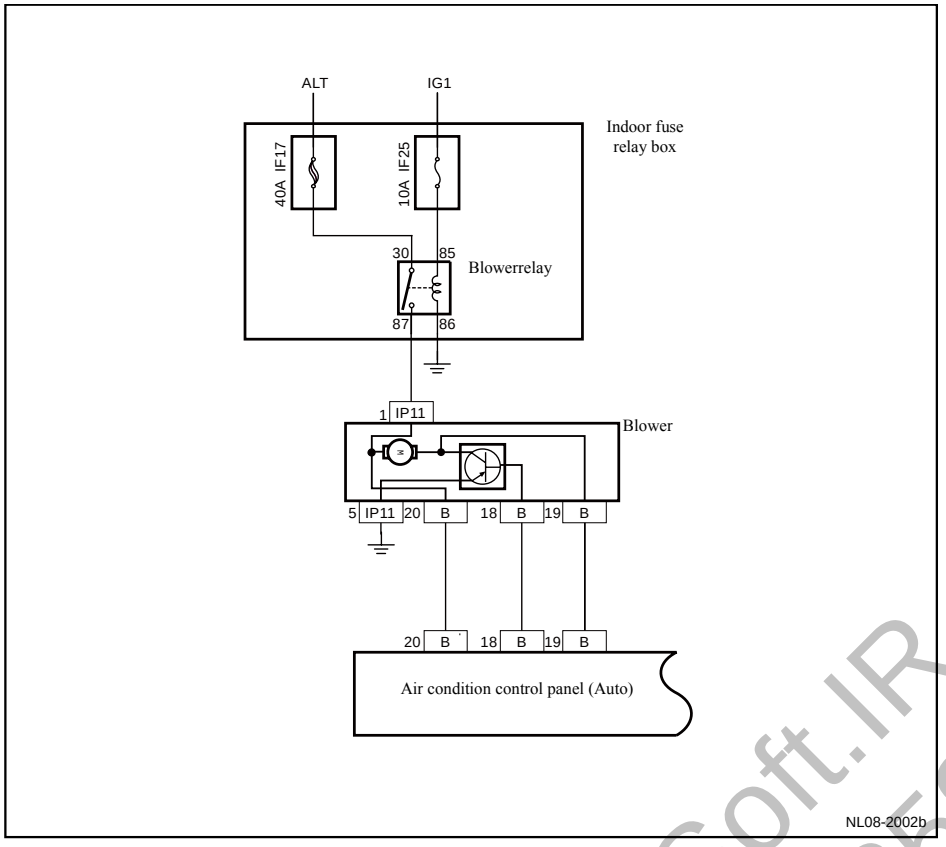

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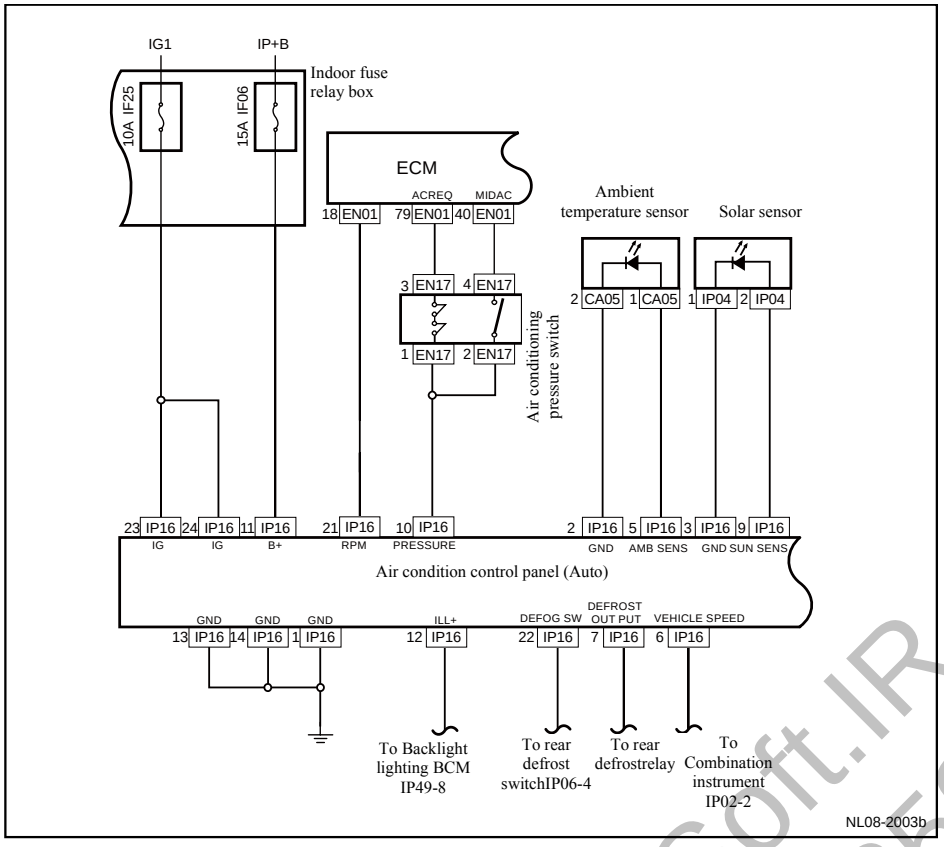

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8.2.7 Diagnostic information and procedures

8.2.7.1 Diagnosis descriptions

Refer to 8.2.2 Description and operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

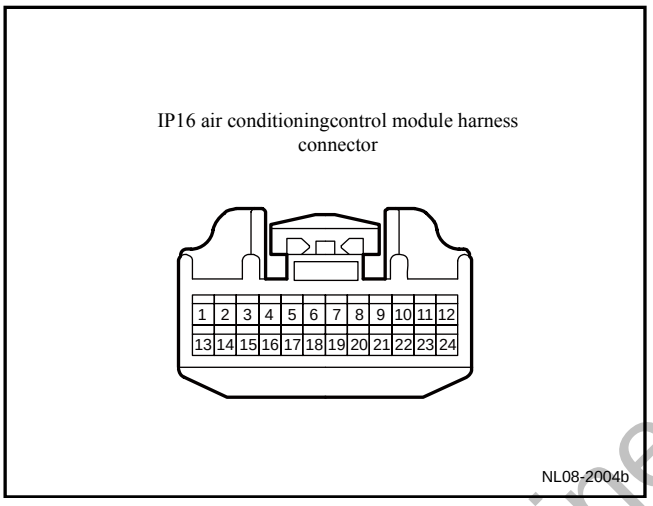
8.2.7.2 Visual inspection

Inspect the after-sales optional device which may affect the performance of A/C system.

Inspect the parts and circuits of A/C system which are accessible and easy to be seen, to find out whether there is any damage or possible cause to fault.

Inspect the pipelines which are accessible and easy to be seen, to find out whether there is any leakage of A/C system.

8.2.7.3 List of A/C control module terminals



Note: unless otherwise specified, GND is 0V or close to 0V.

Terminal No .	Terminal definition	Diameter/color	Terminal status	Specified conditions (voltage, current, waveform, etc.)
1	Lamplet (-)	0.3B	Output	GND DC signal
2	Sensor Grounding	0.3B	Output	GND DC signal
3	Sunlight sensor	0.3B	Input	0~+5v DC signal
4	-	-	-	
5	Outside Temperature Sensor	0.3V/W	Input	0~+5v DC signal
6	Speed Detection Signal	0.3B/R	Input	Pulse signal
7	Rear defrost signal output	0.3R/L	Output	A627 A628 DC signal
8	-	-	-	
9	Sensor Testing Signal (+5)	-	Output	+5v DC signal
10	A/C signal	0.3L	Output	A627 A628 DC signal
11	Battery	0.3R/Y	Input	A627 A628 DC signal

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12	Lamplet (+)	0.3L	Input	+12v DC signal
13	Ground	0.3B	Output	GND DC signal
14	Ground	0.3B	Output	GND DC signal
15	-	-	-	-
16	-	-	-	-
17	-	-	-	-
18	-	-	-	-
19	-	-	-	-
20	-	-	-	-
21	Speed signal	0.3Y/G	Input	Pulse signal
22	Rear defrost signal	0.3O	Input	A627 A628 DC signal
23	Ignition switch 2	0.3R/G	Input	A627 A628 DC signal

8.2.7.4 Data flow table

Serial Number	**Description**	**Range of data**
1	Inside Temperature Sensor	-40℃- 80℃
2	Outside Temperature Sensor	-40℃- 80℃
3	Evaporator temperature sensor	-40℃- 80℃
4	Heater temperature sensor	-40℃- 80℃
5	Sunlight sensor	0W-W
6	Temperature regulating motor	0%-100%
7	Air Direction Adjusting Motor	0%-100%
8	Inside and outside circulation motors	Inside/outside
9	Backlight adjustment	PWM signal 0%-100%
10	Compressor control	On/Off
11	Rear defrost control	On/Off
12	Vehicle speed signal	0-255Km/h
13	Blower voltage	0-16.5V
14	Battery voltage	0-18.5V

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8.2.7.5 Controller self-inspection testing

1	The ignition switch is turned from the gear OFF to the gear ON.

Next

2	Continuously press the "Circulated Air" switch 4 times within 2 seconds when the "OFF" switch is pressed.

Next

3	Start self-inspection testing after the LCD backlight flickers 3 times.

Next

4	Self-inspection item,

Press the "OFF" switch. → Go to step 6

Press the A/C switch.

5	Self-inspection item,

A. For replacement of the A/C control module, see "8.2.8.1 replacement of A/C control module".

Does the blower operate normally?

Press the "OFF" switch.

6	Control A/C ,

1. During self-inspection function running, data display area is the position to set teperature displaying, while other positions are "OFF" status.
2. During running of self-inspection function, A/C is controlled to be "OFF" status.
3. During self-inspection function running, the set temperature display position will be shown at every 0.5s and then fault code will be shown.
4. In the self-inspection test, keep the MODE characters in the previous state but do not run them.
5. When the vehicle is in the IGN2 OFF ON mode during the self-inspection testing, the vehicle will return to the OFF mode.
6. The display in the continuous operation mode is as follows:

– Normal condition or fault condition last for 1h:

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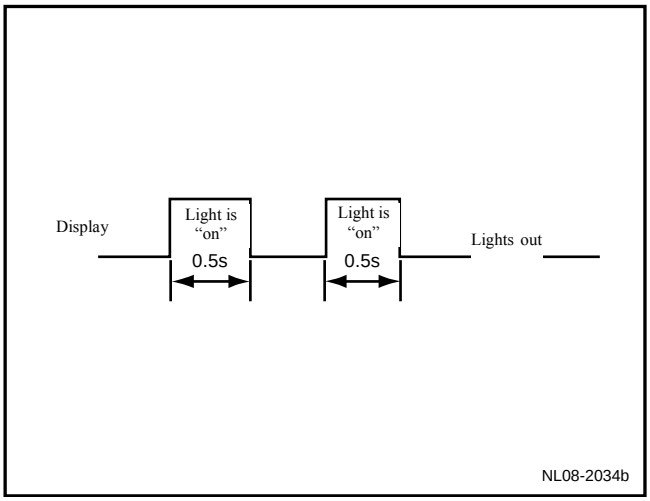
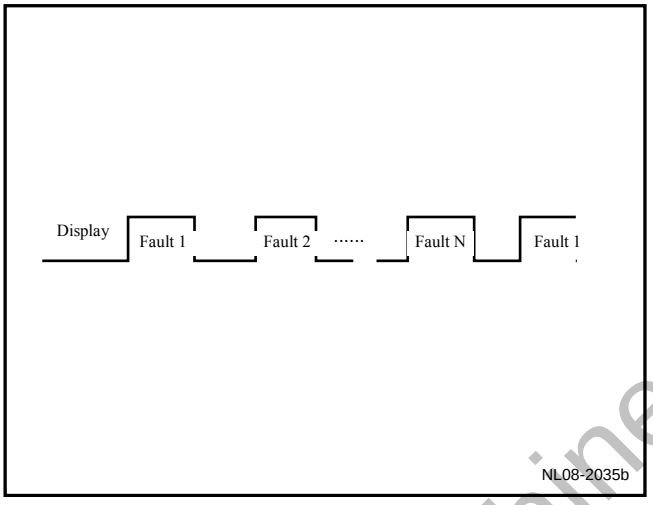


– When it have many faults



8.2.7.6 DTC List

Serial Number	Fault content	Remarks:
00	Normal	
11	Open circuit of indoor temperature sensor	
12	Short circuit of indoor temperature sensor	
13	Ambient air temperature is short circuit	
14	Ambient air temperature short circuit	
17	Evaporator sensor open	
18	Evaporator sensor shorted	
19	Short circuit or open circuit of driver-side temperature throttle motor	In case the motor is unable to reach the specific location within 40s, it is judged as blocked.
20	Driver-side temperature throttle motor is blocked.	
21	Model air motor shorted or open	

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22	Model air motor locked	
25	In case the motor is unable to reach the specific location within 40s, it is judged as blocked.	
26	Air inlet motor locked	
32	Passenger side temperature motor shorted or open	
33	Passenger side temperature motor locked	

8.2.7.7 Electrical Device Failure Relevance

Serial Number	Items	Status	Fault protection
1	Inside Temperature Sensor	Short circuit or open circuit	Default temperature 25℃
2	Ambient air temperature	Short circuit or open circuit	Default temperature 20℃
3	Evaporator temperature sensor	Short circuit or open circuit	Default temperature -2℃
4	Temperature throttle motor	Short circuit or open circuit	When the set temperature is 17℃-24.5℃, fix in the MAX COOL position.
			When the set temperature is 25℃-32℃, fix in the MAX HOT position.
5	Mode throttle motor	Short circuit or open circuit	Position surface-blowing mode: fixing in the surface-blowing mode
			Kept in the defrosting mode.
6	Air intake valve motor	Short circuit or open circuit	Fresh air mode: fixed in the fresh air mode.
			Air returning mode: fixed in the air returning mode
7	Sunlight sensor	Short circuit or open circuit	Default illumination 0 W/m2

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8.2.7.8 A/C does not work

Circuit diagram:

Refer to 8.2.6.2 A/C System Circuit Diagram

Diagnostic steps:

1	Carried out A/C self- inspection process

(a) Carried out A/C self- inspection process, refer to8.2.7.5 Self- inspection controller.

(b) Repair and check all indicator faults by self

Does the A/C clutch operate normally?

Yes → The system is normal.

No

2	Perform the maintenance procedures according to the symptom list.

A. Repair according to the following list of symptoms

Symptoms	**Suspected fault part**	**Maintenance scheme**
The engine coolant temperature is too low.	1. ECT sensor fault 2. ECT sensor harness fault 3. Engine cooling system work is in big circulation state 4. ECM malfunction	1. Repair ECT harnesses 2. Replacement 3. Replace the thermostat 4. Overhaul ECM ,if necessary ,replace
Abnormal A/C pressure switch signal	1. Pressure switch shows signal that A/C pressure doesn't meet standard value 2. Pressure switch harnesses fault. 3. ECM malfunction	1. Repair harnesses of pressure switch 2. Replace pressure switch. 3. Overhaul ECM ,if necessary ,replace
Outdoor temperature sensor signal is abnormal.	1. Outdoor temperature sensor shows temperature lower than 4℃. 2. Fault of outdoor temperature sensor harnesses. 3. A/C control module fault	1. Repair harnesses of outdoor temperature sensor 2. Replace outdoor temperature sensor 3. Overhaul A/C control module, if necessary,replacet
Evaporator temperature sensor signal is abnormal.	1. Evaporator temperature sensor display temperature below 2℃(35.6℉) 2. Evaporator temperature sensor harness fault 3. A/C control module fault	1. Evaporator outdoor temperature sensor harness 2. Replace evaporator termperature sensor. 3. Overhaul A/C control module, if necessary,replacet
Refrigerant pressure is abnormal	1. A/C high-presure exceeds 3.14MPa (455.4psi) 2. Low pressure of A/C is less than 0.196MPa(28.4psi)	1. Residual refrigerant added during emission. 2. Repair fault which caused vehicle's bad radiation. 3. Bad working condition of engine.

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		4. Inspect and repair fault which air conditoning system is blocked. 5. Detecting and Eliminating Leakage in A/C System

A. Confirm the completion of the malfunction elimination.

Does the A/C clutch operate normally?

Yes → The system is normal.

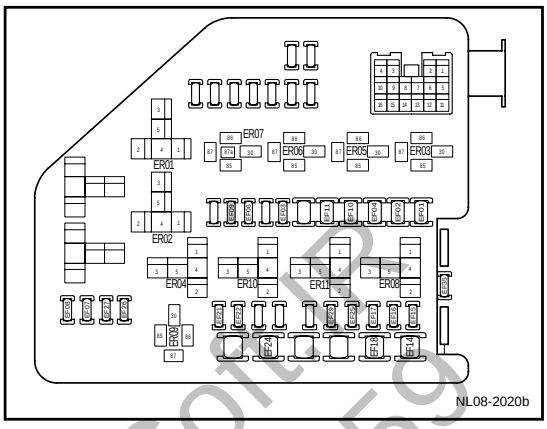
No

3	Check compressor fuse

(a) Inspect compressor fuse EF09.

Fuse rated value:10A

Whether fuse is broken or not?



No → Go to step 5

Yes

4	Repair the compressor clutch power supply circuit.

A. Service whether the power supply line of the compressor clutch is short circuited to the ground.

Does the A/C clutch operate normally?

Yes → The system is normal.

No

5	Detect the voltage of the power end of the compressor clutch.

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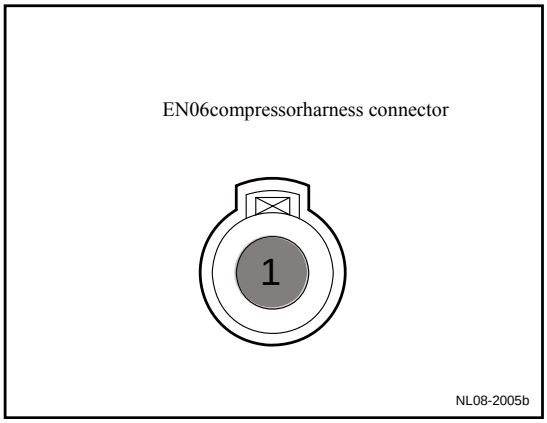
A. Start the engine and press the A/C control switch (A/C switch) to test the voltage of the supply terminal EN06-1 of the compressor clutch.

Standard Voltage: 11-14 V

Is voltage the Standard Value?



Yes → Replace compressor clutch

No

6	Repair the compressor clutch power supply circuit.

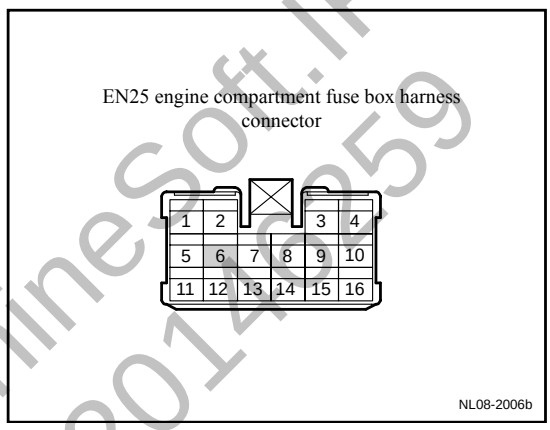
(a) Turn the ignition switch to OFF position.

(b) Disconnect engine hood fuse box harnesses connector EN25.

(c) Disconnect compressor clutch harnesses connector EN06.

(d) Inspect engine hood fuse box harnesses connector EN25 terminal 6 and compressor.

Open circuit between terminalS1 of the clutch harnesses connector EN06.

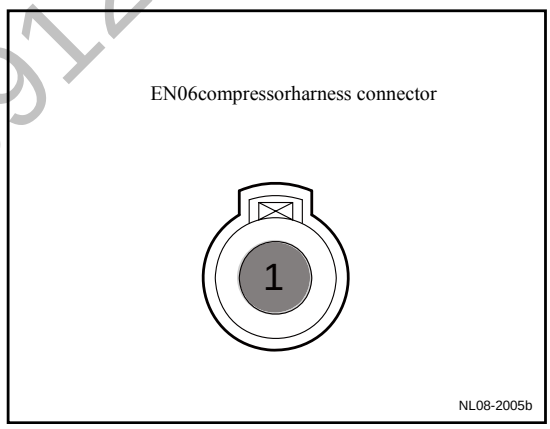


(e) Make sure that engine hood fuse box harnesses connector EN25 terminal 6 and compressor.

Circuit between terminalS1 of the clutch harnesses connector EN06 is normal.

Standard Resistance: less than 1 Ω

Does the A/C clutch operate normally?



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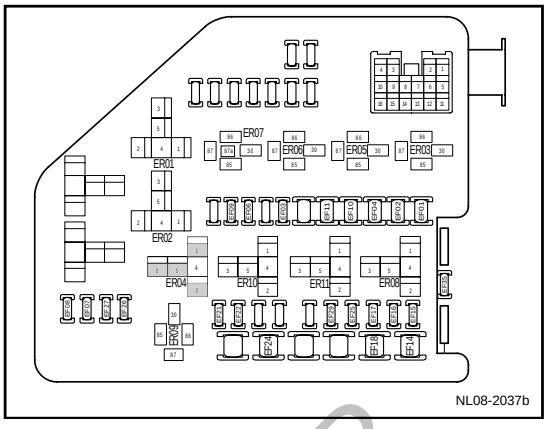
Yes → The system is normal.

No

7	Inspect and adjust the A/C relay, and replace if necessary.

(a) Check if. Adjusting A/C electrical.if ensure. place it.

Does the A/C clutch operate normally?



Yes → The system is normal.

No

8	Inspect the electromagnetic clutch.

(a) Connect positive pole of battery to junction terminal and negative pole to housing of compressor.

(b) Inspect electromagnetic clutch under switching on condition.

Does the A/C clutch operate normally?

Yes → The system is normal.

No

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9	Inspect the communication between engine cabin fuse box and ECM.

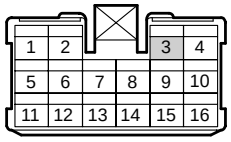
(a) Inspect whether the engine hood fuse box harnesses connector EN25 terminal 3 and ECM harnesses connector EN01 terminal 10 are connected.

(b) Make sure that engine hood fuse box harnesses connector EN25 terminal 3 and ECM harnesses connector EN01 terminal 10 are connected well.

Standard resistance: less than 1 Ω

Does the A/C clutch operate normally?

EN25 engine compartment fuse box harness connector



NL08-2007b

EN01 engine control module harness connector

NL08-2008b

Yes → The system is normal.

No

10	Inspect the ECM circuit.

(a) Check ECM power supply and grounding circuit.

(b) Make sure that ECM power supply and grounding are connected normally.

Does the A/C clutch operate normally?

Yes → The system is normal.

No

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11	Replace ECM

(a) Replace ECM and refer to 2.2.8.6 "replacement of engine control module".

Does the A/C clutch operate normally?

Yes → The system is normal.

No

12	Replace A/C pressure switch.

(a) Replace A/C pressure switch.

Does the A/C clutch operate normally?

Yes → The system is normal.

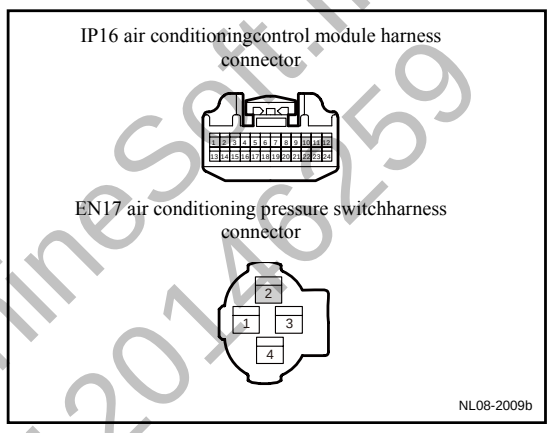
No

13	Detect the communication of the A/C control module and the A/C pressure switch.

(a) Inspect whether A/C control module harnesses connector IP16 terminal 10 and A/C pressure switch harnesses connector EN17 terminal 2 are connected.

(b) Make sure that A/C control module harnesses connector IP16 terminal 10 and A/C pressure switch harnesses connector EN17 terminal 2 are connected normally.

Does the A/C clutch operate normally?



Yes → The system is normal.

No

14	Inspect the communication of the ECM and the A/C pressure switch.

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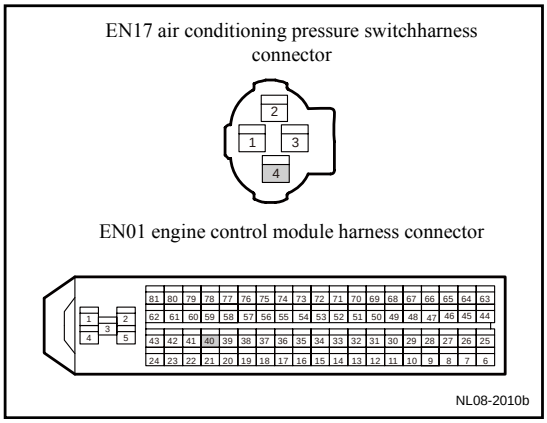
(a) Check if ECM harness connector EN01 terminal 40 connect with A/C pressure switch harness connector EN17 terminal 4

(b) Make sure that ECM harnesses connector EN01 terminal 40 is well connected with A/C pressure switch harnesses connector EN17 terminal 4.

Does the A/C clutch operate normally?



Yes → The system is normal.

No

15	Replace A/C control module.

(a) Replace A/C control module, refer to 8.2.8.1 A/C control panel

Confirm the completion of repair.

Next

16	The system is normal.

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8.2.7.9 AC Blower Does Not Work

Circuit diagram:

See Electrical appliance schematic diagram.

Diagnostic steps:

1	Carried out A/C self- inspection process ,

(a) Carried out A/C self- inspection process, refer to 8.2.7.5 Self- inspection controller.

(b) Repair and check all indicator fault by self

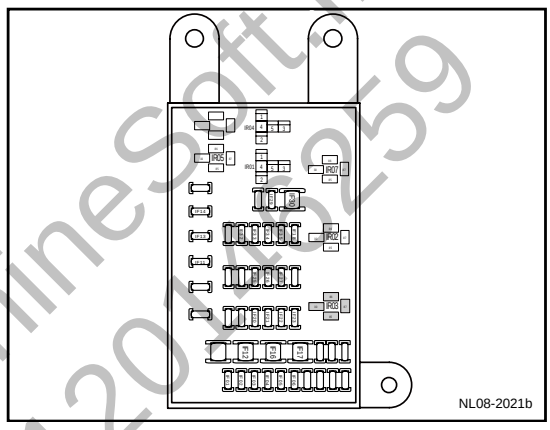
Does the A/C blower operate normally?

Yes → The system is normal.

No

2	Inspect the blower relay (indoor fuse relay box R03).

A. Perform the maintenance procedures according to the following list of symptoms.



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Symptoms	Suspected fault part	Maintenance scheme
Terminal 30 of the blower relay has no battery voltage.	The fuse IF17 (40A) is blown. harnesses fault	Repair the harnesses. Replace fuseIF17
Terminal 85 of the blower relay has no battery voltage.	The fuse IF25 (10A) is blown. harnesses fault	Repair the harnesses. Replace fuseIF25
Terminal of the blower assembly IP11-1 has no battery voltage.	The blower relay faults. harnesses fault	Replace blower relay Repair the harnesses.
Terminal 86 of the blower relay is in bad contact with ground.	harnesses fault Ground point G8 faults.	Repair the harnesses. Repair the fault of poor grounding of

		the ground point G8
The resistor between the terminals 86 and 85 of the blower relay does not accord with the standard.	The blower relay faults.	Replace blower relay

B. Confirm fault repair was completed

Does the blower operate normally?

Yes → The system is normal.

No

3	Inspect the voltage of the A/C control module terminal IP40-7.

(a) Turn the ignition switch to OFF position.

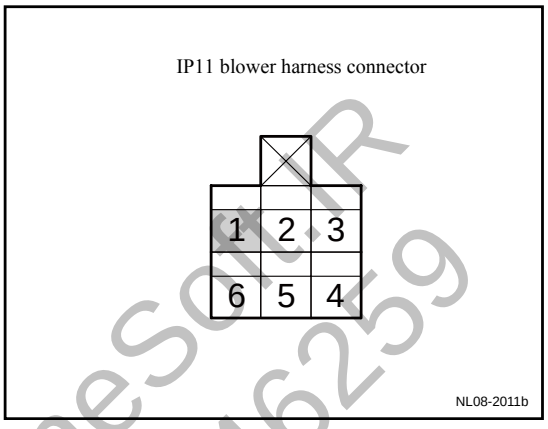
(b) Disconnect blower harness connector IP11.

(c) Inspect connection situation between blower relay terminal 87 and blower harnesses connector IP11 terminal 1.

Standard resistance: less than 1 Ω

(d) Confirm circuit of blower relay terminal87 and blow harness connector IP11 terminal is normal.

Does the blower operate normally?



Yes → The system is normal.

No

4	Inspect the voltage of the A/C control module terminal B-18.

(a) Start the engine.

(b) Pressed volume button on the A/C control panel

(c) Use multimeter to measure voltage of A/C control module terminal B-18.

(d) Standard voltage of each air volume gear is shown in table.

Air quantity bar shows	**Blower gear**	**Auto-mode blower end voltage (V)**
1	1	4.5 (Auto Min.)
2	2	4.6 - 5.5
3	3	5.6 - 6.7
4	4	6.8 - 7.7

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5	5	7.8 - 8.9
6	6	9.0 - 10.1
7	7	10.2-11.2 (Auto Max.)

Is voltage the standard value?

Yes → The system is normal.

No

5	Repair the circuit of the A/C control module and the blower.

(a) Turn the ignition switch to OFF position.

(b) Inspect connection situation between A/C control module harnesses connector terminal B-18, B-19, B-20 and blower harnesses connector terminal B-18, B-19, B-20.

Standard resistance: less than 1 Ω

(c) Make sure that circuit between A/C control module harnesses connector t erminal B-18，B-19,B-20 and blower harnesses connector terminal B-18,B-19,B-20 is normal.

Does the blower operate normally?

Yes → The system is normal.

No

6	Inspect the A/C control module circuit.

(a) Inspect power supply and grounding circuit of A/C control module.

(b) Make sure A/C control module power supply and grounding are connected normally.

Does the blower operate normally?

Yes → The system is normal.

No

7	Replace A/C control module.

(a) Replace A/C control module, refer to 8.2.8.1 A/C control panel replacement.

Does the blower operate normally?

Yes → The system is normal.

No

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8	Repair the blower.

A. Repair according to the following list of symptoms

Symptoms	**Suspected fault part**	**Maintenance scheme**
Blower jamming	The blower wheel has foreign matter. The blower wheel is damaged. The blower motor has foreign matter and is blocked.	Clean up the blower wheel foreign body. Clean up the blower motor foreign body. Replace blower motor assembly, included fan impeller
The blower motor does not work.	The blower motor is damaged.	Replace blower motor assembly, included fan impeller

B. Confirm that the blower works normally.

Confirm the completion of repair.

Next

9	The system is normal.

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8.2.7.10 Insufficient A/C system refrigeration capacity

Fault symptom table

Symptoms	Suspected fault part	Maintenance scheme
The engine coolant temperature is too high.	1. The engine at idle speed runs too long. 2. The engine runs with high load for a long time. 3. Lack of engine coolant 4. Coolant performance do not meet requirement 5. Thermostat Malfunction 6. Poor engine working conditions. 7. The cooling fan runs abnormally. 8. The cooling fan does not work. 9. Poor heat dissipation of water tank 10. The cooling fan air gathering hood is damaged.	1. Shorten the running time of the engine at the idle speed. 2. Shorten the running time of the engine with large load. 3. Repair the cooling fluid leakage condition; and add the cooling fluid to the standard value. 4. Replace the refrigerant according with the requirement of Geely manufacturer. 5. Replace the thermostat. 6. Overhaul engine cooling system 7. Overhaul engine work condition 8. Repair the cooling fan motor and circuit thereof; and replace if necessary. 9. Clean the cooling water tank. 10. Repair the cooling water tank and replace if necessary. 11. Repair the cooling fan wind gathering cover and replace if necessary.
Condenser temperature is too high	1. Poor condenser radiation 2. The water temperature of the engine is too high.	1. Clean the condenser. 2. Repair the condenser and replace if necessary. 3. Perform the maintenance procedures according to the "engine coolant temperature too high" symptom.
The compressor runs abnormally.	1. Compressor belt slipping 2. Compressor clutch slipping 3. Compressor abnormal sound 4. Frequent compressor start 5. Compressor Inoperation	1. Adjust compressor belt, and replace when necessary 2. Repair the compressor clutch and replace if necessary. 3. Inspect the amount of the refrigerant and the lubrication oil. Refer to the symptom of "abnormal A/C system pressure" in the table. 4. Repair the compressor clutch circuit. 5. Repair the compressor and replace if necessary. 6. Repair the A/C pressure switch, and replace if necessary. 7. Repair the A/C control module, and replace if necessary. 8. Overhaul engine control module.if necessary.replace it
Air volume of the instrument panel air outlet is too small.	1. Instrument air duct blocked 2. Instrument air duct leakage 3. Air direction control mechanism abnormal 4. Air direction control motor abnormal 5. Blower speed is too low.	1. Clean up the air outlet of the instrument panel and replace if necessary. 2. Repair the air outlet passage of the instrument panel and replace if necessary. 3. Overhaul wind control mechanism 4. Overhaul wind control motor 5. Repair circuit.

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	6. Blower Speed Control Module abnormal 7. A/C pipe frozen 8. A/C control module abnormal	6. Repair the blower motor and replace if necessary. 7. Replace blower speed regulation module 8. Replace the refrigerant according with the standard of Geely manufacturer. 9. Replace expansion valve 10. Repair the A/C control module circuit, and replace module if necessary.
Air-out temperature of the instrument panel air outlet is too high.	1. Switched to outside circulation 2. Ambient temperature is too high 3. The outside circulation throttle is blocked and not closed tightly. 4. Inside and outside circulation motors fault 5. Temperature control mechanical is abnormal. 6. Temperature control motor is abnormal. 7. Abnormal illumination sensor 8. A/C control module abnormal	1. Switch to inside circulation. 2. Move the vehicle to a cool and shaded place. 3. Adjust outside circulation throttle mechanism, and replace the internal and outside circulation throttle mechanism when necessary. 4. Replace Inside and outside circulation adjustment motor 5. Repair the temperature control motor, and replace if necessary. 6. Repair the light sensor and replace if necessary. 7. Repair the A/C control module circuit, and replace module if necessary.
A/C high pressure is too high and low pressure is too high.	1. Refrigeration system has air 2. Refrigerant charging is too much 3. Refrigerant lubricating oil charging is too much 4. The expansion valve opening is too large.	1. Repair the leakproofness of the pipeline of the refrigerating system and refill the refrigerant. 2. Discharge excessive refrigerant. 3. Discharge excessive refrigerant lubricating oil. 4. Replace expansion valve
A/C high pressure is too high and low pressure is too low.	1. High-pressure pipe prior to the expansion valve is blocked. 2. Expansion valve blockage 3. The expansion valve opening is too small.	1. Wash or replace blocked high-pressure pipe. 2. Replace expansion valve
A/C high pressure is too low and low pressure is too high.	1. The compressor lacks of oil. 2. The compressor is damaged.	1. Supplement with the compressor refrigerant lubricating oil. 2. Replace compressor
A/C high pressure and low pressure are too low.	1. Refrigerant charging capacity is not enough 2. Refrigerant is leakage	1. Fill with the A/C refrigerant according to the standard as specified by Geely. 2. Repair the leakage condition of the A/C system; and replace the A/C system element leaked.
A/C high pressure is too low and low pressure in vacuum.	1. The expansion valve is in serious filth blockage. 2. Expansion valve ice block 3. Evaporator temperature sensor faults. 4. Low-pressure pipeline leakage	1. Replace expansion valve 2. Prolong the pumpdown time of the system and fill the A/C refrigerant which is accorded with the standard specified by Geely manufacturer. 3. Replace stock solution dryer. 4. Replace evaporator temperature sensor 5. Wash or replace blocked low-pressure pipe.

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8.2.7.11 Insufficient A/C system heating capacity

Fault symptom table

Symptoms	Suspected fault part	Maintenance scheme
The engine coolant temperature does not reach 82℃ (180℉).	1. Thermostat malfunction 2. Insufficient running time of engine 3. Air entering the cooling system 4. Poor engine working conditions.	1. Prolong the running time of the engine. 2. Empty the air in the cooling system 3. Replace the thermostat. 4. Overhaul engine work condition
Air leakage of cold-warm valve	1. Mechanical fault of cold-warm valve mechanism 2. Cold-warm valve motor fault 3. The air outlet way leaks air. 4. A/C control module faults.	1. Adjust throttle mechanism 2. Replace cool-warn adjusting motor 3. Replace cool-warm valve mechanism 4. Repair the air leakage passage. 5. Replace air leakage passage. 6. Replace A/C control module
Inside and outside circulation throttle leaks air.	1. Switched to outside circulation 2. The outside circulation throttle is blocked and not closed tightly. 3. Inside and outside circulation motors fault 4. A/C control module faults.	1. Switch to inside circulation. 2. Adjust outside circulation throttle mechanism 3. Replace inside and outside circulation adjustment motor 4. Replace inside and outside circulation valve mechanism 5. Replace A/C control module

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8.2.7.12 Recycling and addition of A/C refrigerant

Operating efficiency and service life of the A/C system depend on the chemical stability of the refrigerating system. When the refrigeration system is polluted by foreign bodies (such as dust, air or moisture), the pollutant shall change the stability of the refrigerant and 100PG compressor oil, and can affect the relationship between pressure and temperature, reduce the working efficiency and may result in internal corrosion and abnormal element wear, The following methods are operated for ensuring the chemical stability of the system:

1. Before opening the joint, first remove oil stain from joint and position around joint to reduce posibility of small little of oil stain entering into system.
2. After disconnection of joint, immediately seal two sides of joint with cap, plug or adhesive tape, to prevent oil stains, foreign matters and wet air from entering into it.
3. Keep all tools clean and dry, including manifold pressure components and all replacing components.
4. Use clean and dry carrying device and container to fill 100PG refrigerant oil, make sure that refrigerant oil is free from wet effect.
5. During operation, reduce the time for which the inside of the A/C is exposed to the air as possible.
6. The A/C system must be air exhausted once again and filled with refrigerant after being exposed to the air. All service parts are dry and sealed prior to delivery, Open these sealed parts only being about to install. Prior to unpackaging, all parts should be at room temperature, moisture should be prevented from being condensed on the parts and then entering the system and all parts should be enclosed as soon as possible.

Emission of the A/C system as well as the adding, emptying and filling procedures of lubricating oil

Warning!

See "Warnings for intake of R-134a" in "Warning and precaution ". Other health and safety information can be obtained from the refrigerant and lubricating oil manufacturer.

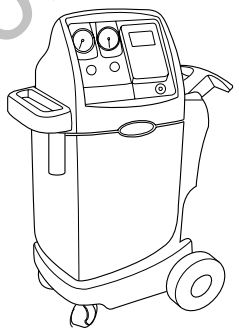
Warning!

See "Warnings for goggles and gloves" in "Warning and precaution ".

The filling machine is connected once to complete the emission, emptying and refilling procedure of the A/C system. The refrigerant is filtered in the course of recyclinging and emptying, thereby making sure that the refrigerant filled into the A/C system is clean and dry.

1. It is prohibit to fill R-134a system by oil filling machine. The refrigerant and the refrigerant oil of the two systems are not compatible and must not be mixed; even a small amount is also not allowed because the equipment may be damaged by mixing with the residual refrigerant.
2. It is strictly forbidden to use reducing joint, to ensure sealing performance inside system.

Air conditioning refrigerant recyclingy & recycling equipment



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Installation and maintenance of the filling machine

There are various types of filling machines; all filling machines perform various tasks, such as A/C system emission, refrigerant recycling, system emptying, quantitative addition of refrigerant oil and quantitative refilling

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of refrigerant, etc. see filling machine operation manual to master the initial installation and maintenance procedures.

Control panel function

Operator may control and monitor the operation process with the control button and indicator lamp on the filling machine. See the instruction for use of the filling machine for details. The instruction shall include the following content:

1. Main power supply switch: main power supply switch provided power supply with control panel.
2. Screen: screen shows time of vacuum pumping set by programming and weight of refrigerant to be refilled. See the manufacturer's Instructions for learning detailed programming information.
3. Manifold pressure gauge on low-pressure side: this gauge shows pressure on low pressure side of the system.
4. Manifold pressure gauge on high-pressure side: this gauge shows pressure on high-pressure side of the system.
5. Control panel: it accommodates various buttons and knobs for controlling various functions.
6. Low pressure side valve: this valve is used for connecting the low pressure side of the A/C system with the filling machine.
7. Humidity indicator: this indicator indicates whether the refrigerant is humidified.
8. High pressure side valve: this valve is used for connecting the high pressure side of the A/C system with the filling machine.

Refrigerant Recycling

Notes:

The refrigerant tank specially designed for the filling machine is only used. over-filling prevention mechanism of the filling machine is corrected specially for the refrigerant tank. However, the refrigerant tank valve is also manufactured specifically for the device.

1. Connect high-pressure side hose with quick coupler to high-pressure side coupler of vehicle A/C system.
2. Turn on high pressure side connector valve
3. Connect low-pressure hose with quick coupler to low-pressure coupler of vehicle A/C system.
4. Open low-pressure joint valve.

Notes:

If no refrigerant in the system, stop the Recycling operation immediately; otherwise, inhale into the Recycling tank.

5. Check the high-pressure side and low-pressure side pressure gauges on the filling machine control panel to ensure the A/C system is under pressure. If no pressure, the system has no recyclable refrigerant.
6. Open the high pressure side and low pressure side valves.
7. Open the gas and fluid valves on the refrigerant tank.
8. Thoroughly remove the refrigerant oil from the oil-liquid separator.
9. Closed oil drain valve
10. Connect filling machine to suitable power supply outlet.
11. Switch on main power supply switch.

Notes:

Forbid mixing of old refrigerant oil and new refrigerant oil together. Old oil may be precipitated with aluminum or mixed with other foreign materials. Be sure to use new refrigerant oil when refilling the A/C system, correctly scrap the used refrigerant oil.

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Notes:

Some 100PG lubricating oil for the A/C system may be recycled together with the refrigerant. The recyclinged lubrication oil quantity is indeterminate. The filling machine can separate lubrication oil from refrigerant, so as to determine the amount of lubrication oil recyclinged. The same amount of lubricating oil should be added when refilling the system. See the manufacturer's Instructions for learning in detail the use method of the filling machine.

12. Start Recycling process see the manufacturer's Instructions for learning in detail the use method of the filling machine.

13. Waiting for 5min, and then inspect pressure gauge on low-pressure side of control panel, if the A/C system keeps vacuum, and complete Recycling.

Notes:

If the control panel display the refrigerant tank is full in the course of Recycling, close the filling machine, another empty tank is installed for storing the refrigerant needing to the next step. Forbid using of the other types of refrigerant tank.

14. If pressure gauge on low-pressure side begins to rise from zero, it indicates that there still has refrigerant in system. Recycling the rest of the refrigerant. Repeat this step until the system can maintain vacuum for 2min. The emptying filling machine refrigerant tank must be filled with enough R-134a refrigerants to fill. Inspect the refrigerant quantity in the tank. If the amount of the refrigerant is less than 3.6kg (8lb), add the new refrigerant to the refrigerant tank. See the instruction for use of the filling machine for details to learn the method of adding the refrigerant.

1. Inspect whether high-pressure and low-pressure hose are connected to A/C system. Open high-pressure and low-pressure valves on control panel of filling machine.

2. Open air valve and liquid on refrigerant reservoir.

Notes:

See the manufacturer's Instructions for learning in detail the use method of the filling machine, you must exhaust the air from the system thoroughly before you refill with the refrigerant or recycled refrigerant.

3. Start vacuum pump and implement exhaust procedures. In the recycling process, the non-condensable gas (mostly air) is automatically discharged from the tank. You will hear the pressure relief sound.

Notes:

Regularly replace vacuum pump oi, see the manufacturer's instructions for learning in detail the use method of the filling machine.

4. Check the system for any leakages; see the manufacturer's instructions for learning in detail the use method of the filling machine.

Filling and supplement of A/C system lubricating oil

You must supplement with the lubricating oil drained from the A/C system during the recycling process.

1. Use 100PG lubricating oil contained with scale bottle specially used for R-134a system.

2. Refer to the user's manual provided by manufacturer, in which use method of filling machine is explained. Add 100PG lubricating oil to the system.

3. When filled oil volume reaches requirments, close valve.

Notes:

Remember tightening the lubricating oil bottle cover in order to avoid moisture or pollutant from entering the lubricating oil. This operation requires the A/C system has a certain degree of vacuum, inhibits opening the lubricating oil filling valve when the A/C system has positive pressure; otherwise, it will lead to the backflow of the lubricating oil through the air port of the oil bottle. The oil level shall not be lower than oil suction pipe when filling or compensating lubrication oil; otherwise, air will enter the A/C system.

Filling

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Notes:

Firstly empty the A/C system prior to filling.

1. Close high, low pressure valves on control panel.
2. Close high-pressure side valve on control panel.
3. Refer to User's manual provided by manufacturer to learn application method of filling machine.
4. Fill the A/C with a necessary amount of refrigerant and make sure the amount is measured in the correct unit (namely kilogram or pound).
5. Start filling

Refrigerant charging was completed successfully

1. Close high, low pressure valves on control panel of filling machine, both valves must be closed.
2. Start vehicle and A/C system.
3. Keep engine running until the readings of pressure gauge on high-pressure side and low-pressure side are stable.
4. Compare the readings with the system specifications.
5. Check the evaporator outlet temperature and make sure the operations performed on the A/C system comply with the system specifications.
6. Keep the A/C in operation.
7. Close the high pressure side quick coupling valve.
8. Disconnect the high pressure side hose from the vehicle.
9. Open the high pressure and low pressure side valves from the control panel. The system will be quickly absorbed with the refrigerant in the two hoses through low-pressure side hose.
10. Closed low pressure side lower pressure quick connector valve
11. Dismantle low-pressure hose from vehicle.

Unsuccessful for refrigerant charging

Sometimes, the refrigerant entering the A/C system does not reach the total filling quantity. There are two reasons for resulting in such situation:

1. Pressure of refrigerant can of filling machine is more or less the same as that of A/C system, which will lead to slow filling process. See the manufacturer's Instructions for learning in detail the use method of the filling machine.
2. There is no sufficient refrigerant in refrigerant reservoir for filling. Hereto, recycling part of refrigerant injected from the vehicle, empty the A/C system, add refrigerant to the refrigerant can, and at last, inject again. See the manufacturer's Instructions for learning in detail the use method of the filling machine.

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8.2.8 Dismantle and installation

8.2.8.1 A/C control panel replacement

See 8.3.8.1 Replacement of electric A/C control panel.

8.2.8.2 Ambient air temperature replacement

8.2.8.3 A/C pressure switch replacement

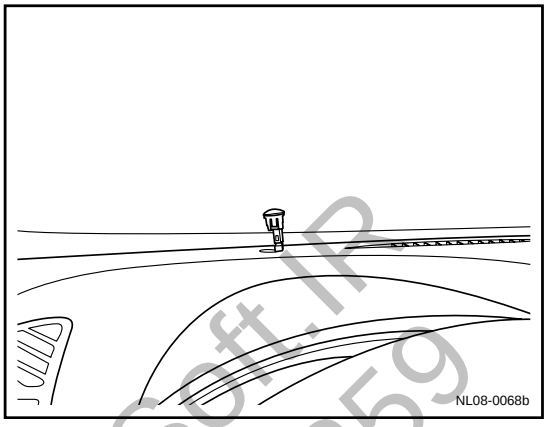
8.2.8.4 Solar sensor replacement

Dismantle procedure

Warning!

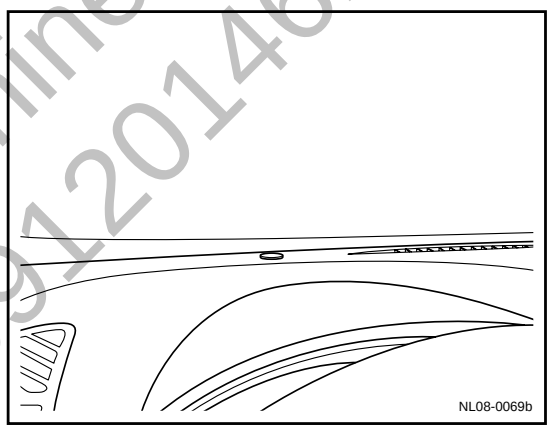
See 8.1.1 "warnings for intake of R-134a" in warning and precaution.

1. Disconnect the battery negative cable. Refer to.11.8.1battery cable disconnection/connection Procedures.
2. Disconnect harnesses connector of sun sensor from instrument table.



Installation Procedure:

1. Connect to solar sensor harness connector.
2. Install sun sensor onto instrument table.
3. Connect the battery negative cable.



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8.3 Power A/C

8.3.1 Specifications

8.3.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N·m)	English system (lb-ft)
Pipeline system assembly hexagonal flange face nut	M6	7-8	5-6
Pipeline system assembly hexagonal flange face bolt	M6×12	10-12	7-9
Pipeline system assembly hexagonal flange face bolt	M6×20	10-12	7-9
Pipeline system assembly hexagonal flange face bolt	M6×20	18-20	13-15
Pipeline system assembly hexagonal flange face bolt	M8×20	16-18	12-13
Compressor assembly hexagon-headed bolt	M8×105	28-30	21-22
Hexagon flange face bolt of condenser	M6×16	6-7	4-5
A/C head unit hexagon nut and spring gasket assembling unit	M6	6-7	4-5
A/C head unit hexagon flange bolt	M6×12	6-7	4-5
A/C head unit hexagon bolt and spring gasket assembling unit	M6×12	6-7	4-5
No.1. No.2 water pipe steel belt type elastic hoop	-	-	-
A/C control panel cross recessed pan head self-tapping screw and flat gasket assembling unit	ST4.2×16	3-4.5	2.2-3.3

8.3.1.2 Refrigeration system parameters

Items		Item parameter
Compressor	Nominal refrigerating capacity/W	≥4500 (rotational speed of compressor is 1800rpm)
	Displacement/(ml/r)	180
	Model	HS18
	Electromagnetic clutch consumption power/W	46
Blower	Max.air volume/(m3/h)	500
	Air Volume Control	Automatic
	Motor consumption power/W	250
Condenser	Size /mm	68×422×731

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	heat exchange amount/W	≥15000
	Air-side resistance/Pa	≤110
Evaporator	Refrigerating capacity/W	≥5500
	H-type expansion valve (ton of refrigeration)	1.5
Temperature regulating method		Control cold-warm air mixture ratio
Lubricating oil/ml		FD46XG:150±10 ml
Driving belt (JL4G18-E)		Poly V-belt (6PK1875)
Driving belt (JLD-4G20//JLD-4G24)		Poly V-belt (7PK1956)

8.3.1.3 System capacity

Applications	**Specification**	
	(Metric)	**English system**
Refrigerant lubricating oil (100PG)		
Refrigerant flow away suddenly	40 ml*	1.34 oz*
Replacement of compressor		
Note: if the lubricating oil discharged in the course of recyclinging the refrigerant is not replaced, the compressor may be damaged.		
The compressor on the vehicle is pre-filled with 150 ml** (5 oz**) of refrigerant lubricant (100PG).		
Replacement of Condenser	40 ml**	1.34 oz**
Replacement of evaporator	60 ml**	2.0 oz**
Replacement of Stored Fluid Dryer Core	20 ml#	0.67 oz#
# The oil volume of 100PG to be filled should be equal to the sum of emission and specified volume of old liquid reservoir dryer core.		
Replacement of any pipe assembly (hose/pipe or pipe assembly)	30 ml**	1.0 oz**
The refrigerant lubricating oil capacity of the whole system	150 ml	5.0 oz
R-134a		
Refrigerant charging capacity	550±50 g	1.21±0.11 b

*It may cause natural leakage of refrigerant, and will not cause refrigerant oil loss. The refrigerant is lost suddenly due to the large number of leaks, hose rupture and collision or pressure release valve opening. When replacing the parts as a result of a huge loss of the refrigerant, be sure to add sufficient lubricating oil to them.

** If loss of refrigerant oil (FD46XG) from part exceeds specified volume, the lost volume will be added.

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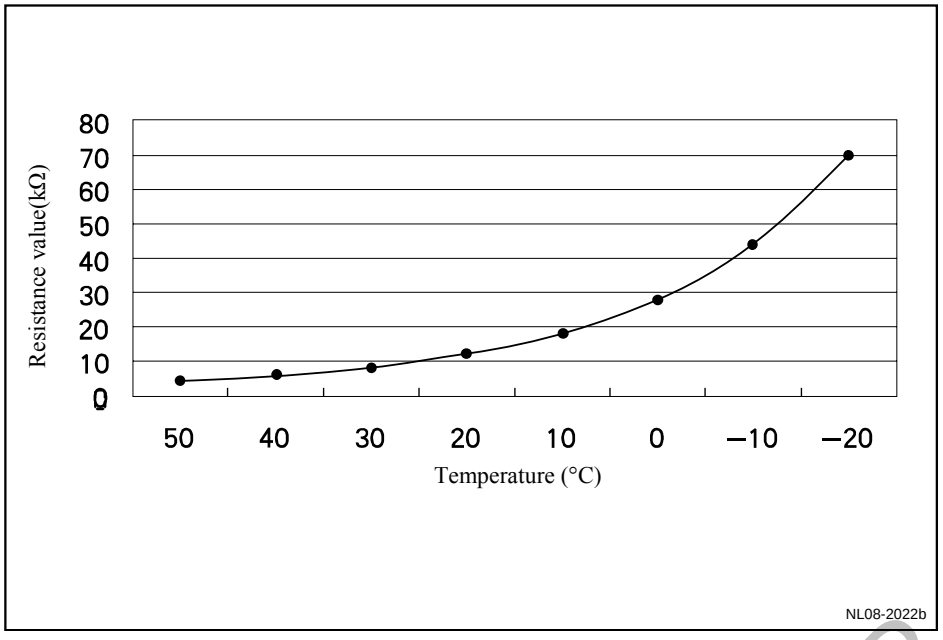
8.3.1.4 Resistance properties of evaporator temperature sensor



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8.3.2 Description and operation

8.3.2.1 Description and operation

1. Overview

The automatic A/C system will provide comfortable riding environment to the passenger no matter how the outside weather is; and the system consists of the following main parts:

– Refrigeration system

– Heating system

– Air distribution system

– Mode /temperature control system

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2. Compressor:

The A/C compressor is driven by the engine crankshaft driving the compressor clutch belt pulley through the transmission belt; when the electromagnetic clutch coil is not energized, the compressor belt pulley freely rotates without driving the compressor shaft; and after the clutch coil is energized with voltage, the clutch plate and the hub are pushed to the belt pulley and locked integrally by magnetic force to drive the compressor shaft. The compressor is equipped with a unique lubrication system. The oil absorption port of the crankshaft discharges through the rotating swash plate, such a path allows the lubrication of the swash plate bearing. The rotation generates the effect of engine oil separation; certain engine oil is separated from the leakage liquid at the crankcase liquid suction port to reflow back into the crankcase. Refluent engine oil can lubricate the mechanical mechanism of the compressor.

The compressor is closed with the following conditions:

– Full throttle valves are "ON"

– Low idling

– Ambient temperature is low

– Engine coolant temperature is too high

– Pressure of refrigerant is higher than 3.2MPa (464.1pounds/ square inch) or lower than 0.2Mpa (21.9 pounds/ square inch).

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Notes:

Do not impact, have fall or keep top down the compressor. If the compressor is impacted or kept top down, you should rotate the compressor clutch 5 to 6 times with hand to circulate the engine oil precipitated in the cylinder. When the engine oil is in the cylinder, sudden revolution of the compressor will cause the valve to be damaged and have adverse effect on the durability.

3. Condenser.receiver dryer

High-temperature high-pressure refrigerant steam from an air condition compressor is flowed into a condenser. The condenser consists of an aluminum pipe capable of performing rapid heat transmission and a cooling fin, wherein the cooling fin condensates the high-temperature high-pressure refrigerant steam into medium-temperature high-pressure liquid through radiation. Located on the right side of the condenser, the stored fluid dryer is welded with the condenser as a whole. The internal structure design of the stored fluid dryer can

ensure the moderate temperature and high pressure refrigerant entering the Dryer is in a mixed status of gas and liquid and the moderate temperature and high pressure refrigerant coming out of the Dryer is in the liquefied status.

The stored fluid dryer contains drying agent which can absorb the moisture of the refrigeration system and the drying agent cannot be reused. Due to the following reasons, the receiver-dryer core can not be repaired but replaced when leaking.

– Perforation

– Seal area damaged

– Time is too long for external air enter into the system

4. Main host of indoor A/C

The indoor A/C head unit is located in the instrument panel , including a blower motor, a blower motor control module, an A/C filter, a heater core, an evaporator, an expansion valve, a warm and cold temperature wind control motor as well as a variety of air deflection throttles and ventilation ducts.

A. Blower motor

Notes:

When placing the blower motor, the fan wheel of the blower motor can not be used as the supporting surface.

To prevent the fan wheel blade from being damaged, inhibit collision of the fan wheel.

The blower consists of the following parts:

– Permanent magnet-type motor

– Squirrel-cage fan

The change of the revolution speed of the blower at different speeds depends on the blower motor control module controlled by the blower motor revolution speed control device. If the user selects the maximum A/C mode, the vast majority of the air entering the blower is from the passenger compartment (inside circulation).

Outside air enters into the vehicle in the following mode under most of operational conditions:

– Blower motor word breathe the outside atmosphere

– When Vehicle moves forwards, external air is pressed into

The blower motor blows air along the following line:

– Pass through evaporator core

– Pass through heating core

– Enter into the passenger compartment

B. Heater core

The heater core is the main part of the heater system. The heater core is located in the A/C head unit. When the engine is running, the engine coolant is pumped from the engine to the heater core, the heat fro the engine coolant is transmitted by the heater core to the air flowing through the heater core. The heater core is provided with special inlet and outlet warm air water pipe. The HVAC water pipeline of the heater core body must be thoroughly drained during dismantled. During maintenance, the heater core with the independent warm air water pipeline must have been installed. The heater core is equipped with the temperature sensor; the sensor transmits the surface temperature signal of the heater core to the A/C control module for providing more compensation parameters to the automatic A/C.

C. Evaporator and expansion valve

The evaporator is located at the left of the A/C head unit. When installed on the vehicle, the A/C head unit needs to be dismantled to dismantle and install the evaporator and the expansion valve. The refrigerant pipeline of the evaporator must be thoroughly drained during dismantlement. During maintenance, the evaporator with the independent refrigerant pipeline must have been installed. The expansion valve is connected with the evaporator,

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installed at one end of the evaporator and located at the inlet of the evaporator; one side of the expansion valve is connected with the air inlet pipe and the exhaust pipe of the A/C compressor and the other side thereof is connected with the air inlet pipe and the exhaust pipe of the evaporator; the high-pressure liquid refrigerant is limited in the liquid pipeline so that the refrigerant becomes the low-pressure liquid when flowing to the evaporator.

Expansion valve changes the position from large to small according to the lower limit of the A/C pressure and the upper limit of the A/C pressure.

The evaporator is cooled and dehumidified before the air enters the passenger compartment. The following processes are generated in the evaporator:

– Low pressure temperature fluid /vapor refrigerant enter into evaporator.
– Refrigerant flows through evaporation pipe.
– Refrigerant vaporizes.
– Absorb heat, when refrigerant vaporises, air flow absorb heat by evaporator
– Refrigerant enters into evaporator in the form of low pressure and low temperature, and leaves from evaporator in the form of steam.

When the heat in air is transmitted to the evaporator core, moisture in air will be condensed on the outer surface of the evaporator core to for water to flow outside.

The evaporator is equipped with a temperature sensor to prevent from freezing. The sensor measures the surface temperature of the radiating fin on the evaporator, the compressor clutch will not continue to work if the temperature is lower than 2.5℃. If the temperature is increased to above 4℃, the compressor will start working again. In the system with automatic temperature control, the sensor signal is firstly transmitted to the A/C module, and then is transmitted to the A/C pressure switch through a special line; if the A/C pressure meets requirements, the corresponding A/C starting signal is transmitted to the ECM, and the ECM controls the on/off of the compressor clutch.

5. Refrigerant R-134a and lubricating oil

Refrigerant function in the A/C system as follow:

– Absorb heat
– Carrying heat.
– Release of heat

The vehicle uses the R-134a refrigerant, which is a non-toxci, flame-retardant, transparent and colorleess liquefied gas.

Please refer to the instruction to the disposal of the refrigerant pipeline and connector as well as the maintenance of the chemical stability before the maintenance operation needing to open the refrigerating system pipeline or the part.

The R-134a system is filled with the special-purpose lubricating oil FD46XG synthesized refrigerant oil which easily absorbs water and needs to be stored in a enclosed container. Only the FD46XG synthesized refrigerant lubricating oil can be used in the internal circulation of the R-134a A/C system. Only use the mineral-based 525 refrigerant oil at the thread and O ring and other lubricating oil used will result in compressor or accesesory malfunctions.

Be sure to repair as follow in accordance with the steps in the instruction:

– Recycle and regeneration of refrigerant
– Added oil
– Drain out refrigeration System
– Added refrigeration system again

6. A/C high pressure pipe belonged to the A/C low pressure pipe and the A/C pressure switch.

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The vehicle uses A/C high pressure and low pressure pipes (A/C rigid pipe and/or hose) to connect the A/C refrigeration system as a sealed and enclosed system in which the refrigerant and lubricating oil flow to complete the circulation of the refrigerant. The A/C hard tube consists of an aluminum tube and corresponding adapter; and the A/C hose consists of rubber hose and corresponding adapter.

A/C pressure switch belongs to three-state pressure switch, which transmits the A/C pressure signal.

Description	**Pressure added**		**Signal value**
	Metric (MPa)	**Inch (psi)**	
High-pressure side	3.2	464.1	OFF
	2.6	377.1	ON
midde pressure side	1.15	166.8	OFF
	1.55	224.8	ON
Low-pressure side	0.2	29.0	OFF
	0.23	33.4	ON

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8.3.3 System operating principle

8.3.3.1 Functional description of A/C control panel

1. Temperature control

The temperature setting knob is used for setting the in-vehicle temperature; and the temperature adjustment can get through the temperature knob

Change the mixed throttle by button to further change the air-out temperature.

Measure the position of the actuator (feedback voltage) when the A/C motor is in the Hi and Lo state:

Hot and Cold Air Adjust Motor	**Voltage (V)**
Low (Lo)	0.3
High (Hi)	4.7

2. Volume control

Air adjusting knob controls the wind speed through the control of the sped regulating resistor of the blower. There are totally 4 gears.

3. Air volume distribution (mode) control

The throttle can control the air-out mode through the adjustment of the mode, different allocation for air supply to head and feet is for the purpose of supply the feet with warm air and the head with cool air to ensure the driver can be constantly in a comfortable driving environment. The temperature distribution range is affected by the space of the vehicle.

The user can choose 5 air-out modes:

– Blowing face

– Blowing face/blowing foot

– Blowing foot

– Blowing foot/defrost

– Defrost

When the mode knob regulates, the mode will be changed as follows: surface blowing>surface blowing/foot blowing>foot blowing >foot blowing/defrosting

The air allocation model and actuator position (feedback voltage):

Mode (air distribution mode)	**Actuator feedback voltage**
Air supply to face	0.3 V
Air supply to face/Air supply to feet	1.4 V
Air supply to feet	2.5 V
Air supply to feet/defrosting	3.6 V
Defrost	4.7 V

Blower gear	**Voltage (V) at manual mode blower end**
1	3.65
2	4.85
3	7.2

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4	12

4. Internal-outside circulation control

The user can choose outside circulation mode or inside circulation mode:

1. Under outside circulation mode, open outside circulation vent port and close inside circulation vent.
2. Under interior circulation mode, interior circulation vent port must open, and exterior circulation vent port must close.

In the automatic control mode, the ventilation is controlled by a number of input variables. Input signal includes:

set point, in-vehicle temperature,out-vehicle temperature and sunlight intensity etc. In the automatic control mode, there are two throttle positions (outside circulation and internal circuit) for ventilation.

Under manual control mode

– Press down the fresh air button, venting valve keeps the outside circulation mode
– Press down the circulation button, venting valve keeps the inside circulation

The ventilation model and actuator position (feedback voltage)

Ventilation	**Actuator feedback voltage**
Fresh air	0.3V
Circulation	4.7V

5. Defrost control

The defrosting button is used to activate the front windshield defrosting function.

– Air volume allocation models is defrost
– Venting valve is in the new air position
– A/C is "ON", and A/C mark display (only if outside temperature is too low)

When the temperature induced by the evaporator temperature sensor is lower than 2.5℃ during defrosting, the compressor does not close (the A/C does not work).

When the starting temperature is in the temperature setting zone, A/C ON is optimized.

Rear defrosting function

The rear defrosting is controlled upon the engine speed signal and the time check function. If the engine speed is lower than 750rpm, the controller shall cut off the rear defrosting output. In addition, the controller also has a time check function to inspect the running tie of rear defrosting; and if the running time reaches 12m, cut off the output of rear defrosting.

6. A/C control

The control module provides an A/C request signal to the engine ECU to control the A/C compressor clutch through the engine ECU.

The blower does not open and A/C also can not open.

The A/C can be turned on or off with the A/C button.

Closing of the compressor clutch

When the heat in air is transmitted to the evaporator core, moisture in air will be condensed on the outer surface of the evaporator core to for water to flow outside. The evaporator is equipped with a temperature sensor to prevent from freezing. The sensor measures the surface temperature of the radiating fin on the evaporator, the compressor clutch will not continue to work if the temperature is lower than 2.5℃. If the temperature is increased to above 4℃, the compressor will start working again.

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7. Max.refrigerate (MAX A/C)

The controller is demanded for operating in the maximum refrigerating mode.

Rotate the mode knob to "MAX A/C", the control module will control by the following states:

– Mode valve: Mode valve is in blowing face position

– A/C: On

– Inside and outside circulation: Inside circulation

– Bleed door valve: full cooling mode

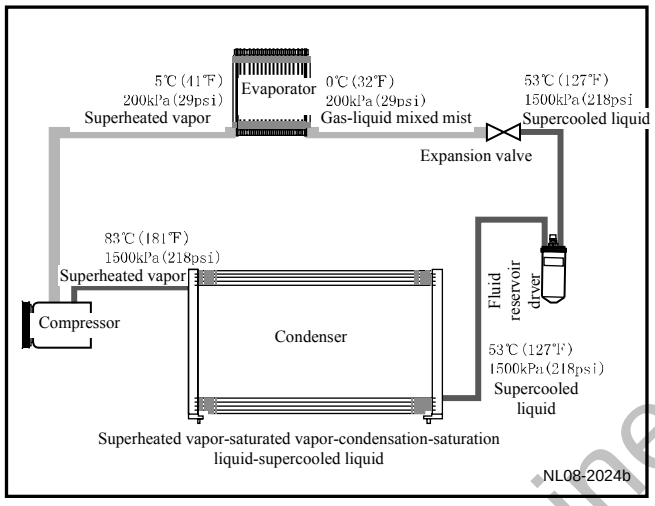
Notes:

When regulating the control mode knob to revolve from the position "Max A/C", electric

The A/C system performs the previous working condition.

8.3.3.2 Power A/C work principle

1. Refrigeration system work principle



The compressor is driven by the belt via the engine to extract the gaseous refrigerant from the evaporator and compress it. The refrigerant is heated to 83°C to 110℃ at pressures up to 15 bar (1.47 MPa), and high-pressure superheated refrigerant is conveyed to the condenser. At this time, heate in the refrigerant is carried away by the air conveyed to the radiator fins, so the refrigerant is cooled down and is retained in the condenser due to the dissipitation of such heat. Then, the refrigerant cooling to 53℃ and 70℃ is transmitted to the refrigerant storage dryer under the high pressure. As an intermediate storage, the store fluid dry filters all moisture contained in the refrigerant. The dry undercooling refrigerant is delivered to the entrance of the expansion value as a function of the pressure and temperature in the evaporator; the expansion valve performs throttle and pressure reduction control on the flow of the refrigerant entering into the evaporator, the pressure of the fog-like refrigerant from the expansion valve is 2bar, the temperature is dropped to 0℃ to 2℃, and the fog-like refrigerant is heated to evaporate in the evaporator. At last, the heat in the air is completely absorbed by the refrigerant in the evaporator when entering the passenger compartment; therefore, when the air is cooled, the moisture mingled in the air is condensed on the surface of the evaporator core. The low-pressure refrigerant air flow from the evaporator is flowed to the upper opening of the expansion valve, the refrigerant pressure at this time is 2 bar and the temperature is raised to 5℃ to 8℃. However, the compressor extracts the superheated refrigerant steam herein.

2. Heating system work principle

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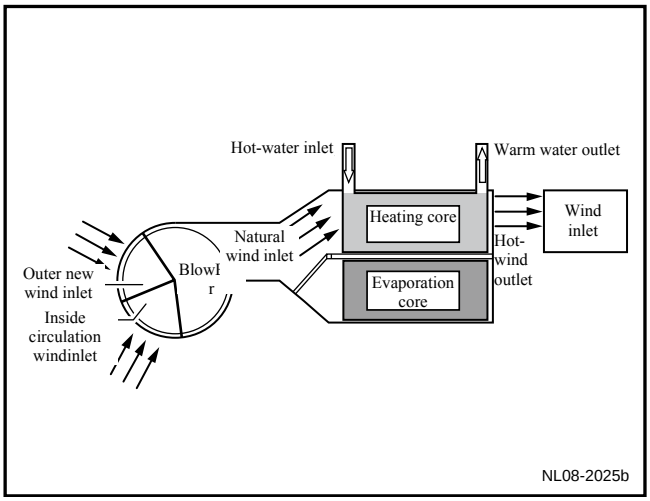


When the automatic A/C system is in the heating mode, the temperature control motor converts the temperature control device into the heating position, so that the air entering the heater core plays the following roles in

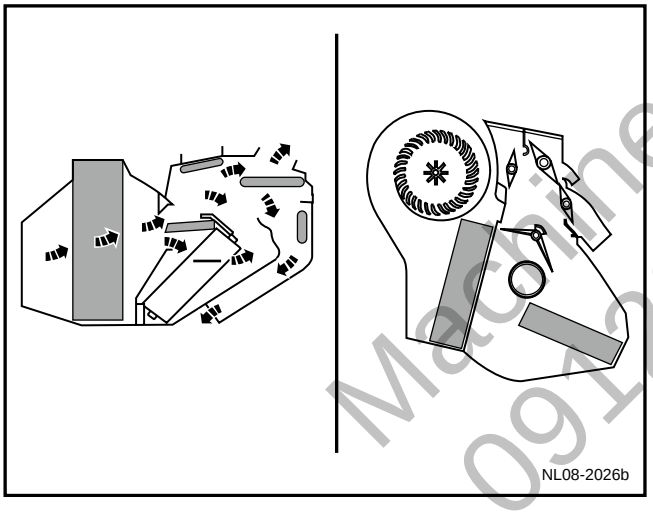
– Part or all air flow passes by to heating core

– Generate heat transmission

Any air needing not to heat will be mixed with the heated air before entering the passenger cabin to obtain the corresponding mixed air at proper temperature.

The state of the engine coolant is the key factor that whether the heating system is working normally.

3. Venting control System work principle



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Various locations on the ventilation control system can enable the mode valve to mix or induct cold air and hot air through the air duct; and the outside air through the A/C system is transmitted to the passenger compartment via the air duct system and the air outlet.

Air flow is changed in the following mode:

Air supply to face-supply air through instrument panel air outlet

Both-way-air supply through air outlet and that of floor

Air supply to feet-supply air through the floor air outlet

Mixture-air supply through floor and front air window outlet

Defrosting-front air window air outlet supplies air.

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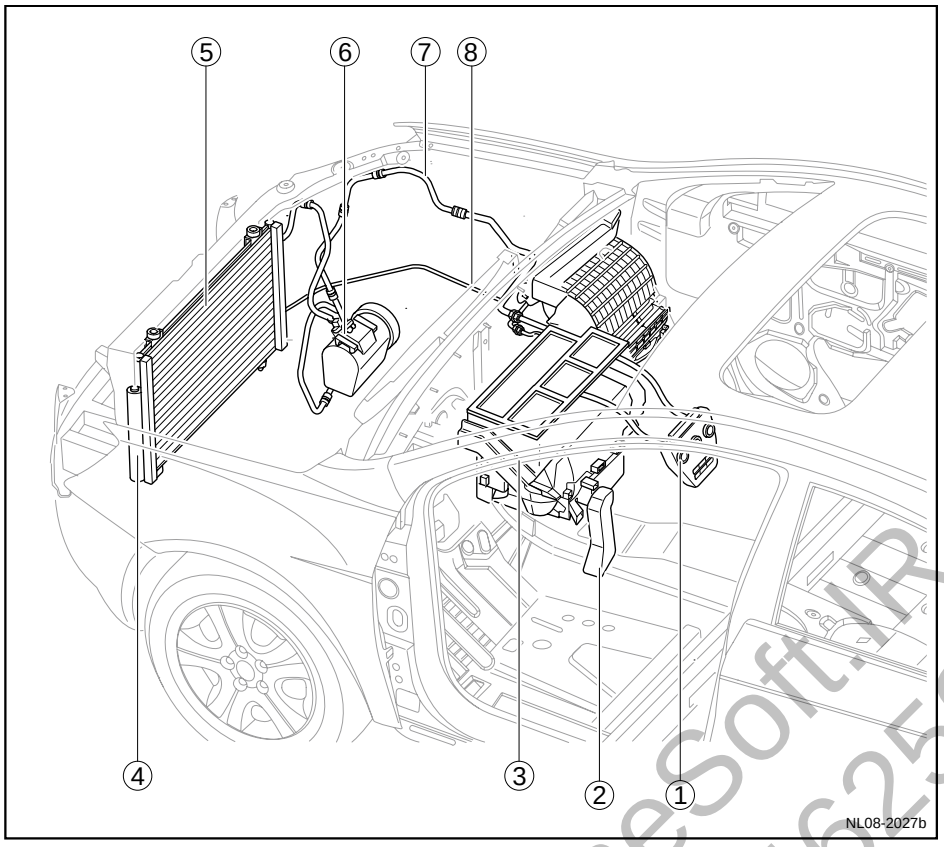
8.3.4 Component position

8.3.4.1 A/C system element layout location plan



Legend

1. A/C control Panel
2. Floor vent duct.
3. A/C main host
4. Dryer
5. Condenser
6. Compressor:
7. A/C low pressure pipe
8. AC high pressure pipe.

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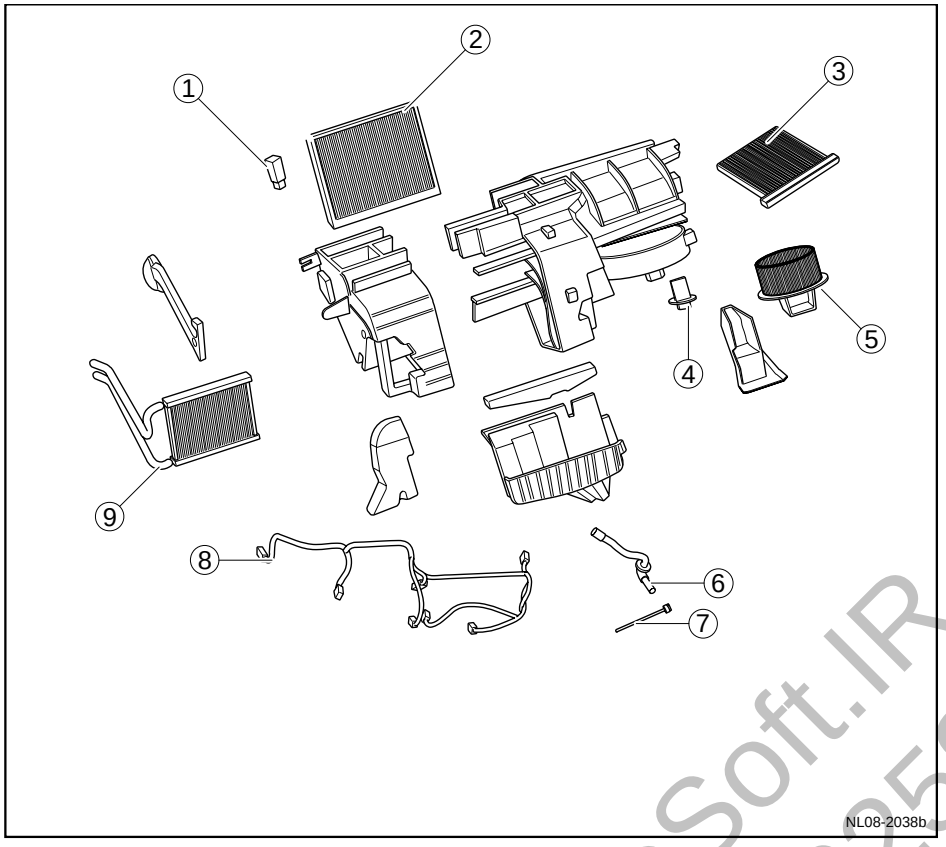
8.3.4.2 Structural layout of A/C main unit



Legend

1. H type expansion valve
2. Evaporator core assembly
3. Filter assembly
4. Speed adjusting resistance.
5. Blower assembly
6. Draining pipe
7. Evaporator temperature sensor
8. Harness assembly
9. Heater core assembly

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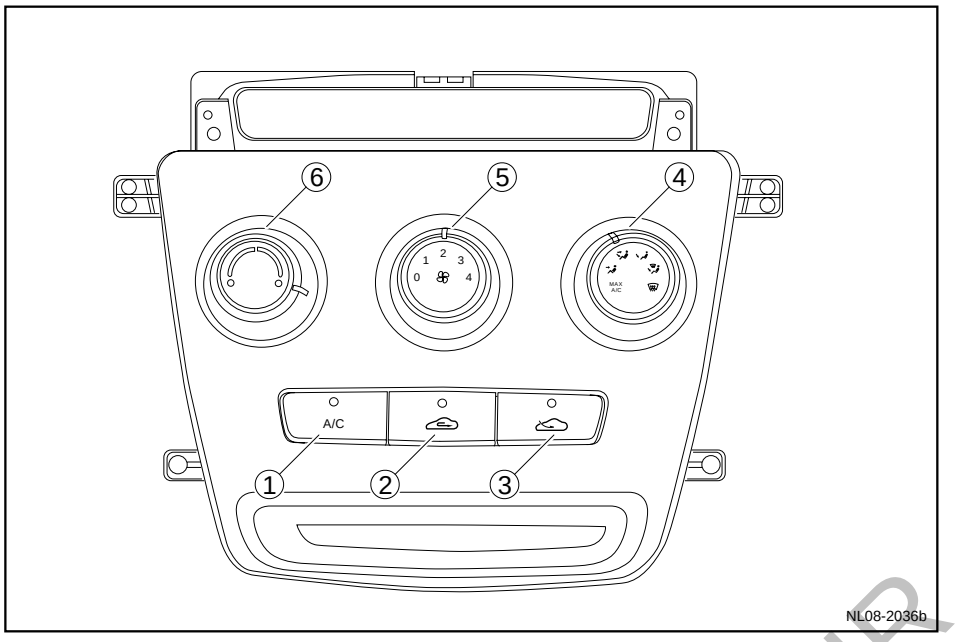
8.3.4.3 A/C panel schematic diagram



1. A/C button
2. Interior circulation key
3. Exterior circulation button
4. Air outlet mode key
5. Chilling-heating mode switching knob
6. Air regulation knob

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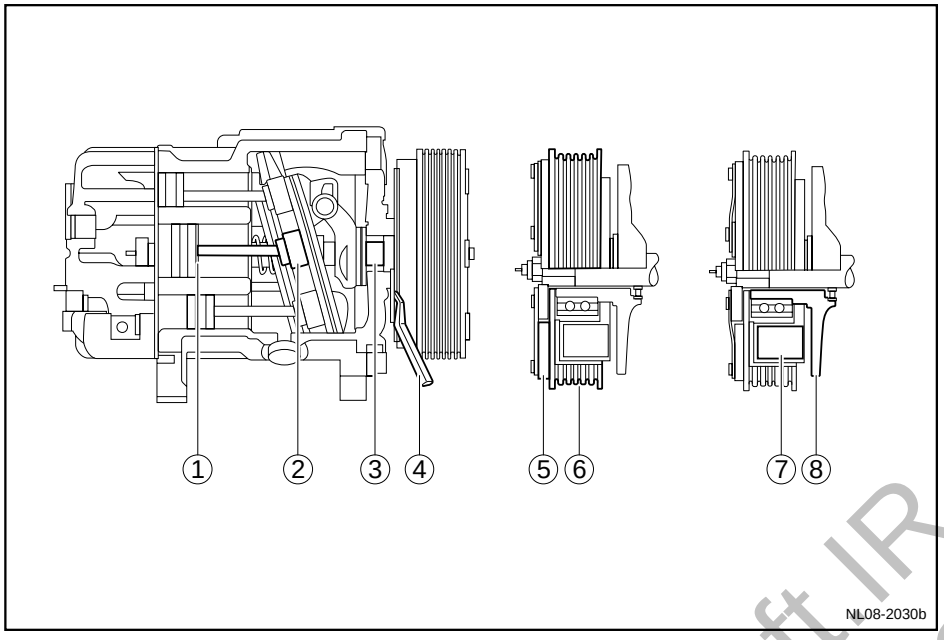
8.3.5 Disassemble drawings

8.3.5.1 Disassemble drawings

Compressor



1. Piston and cylinder
2. Slant disc.
3. Compressor shaft
4. Clutch coil connector.
5. Carrier
6. Pulley
7. Cultch coil
8. Pressure plate

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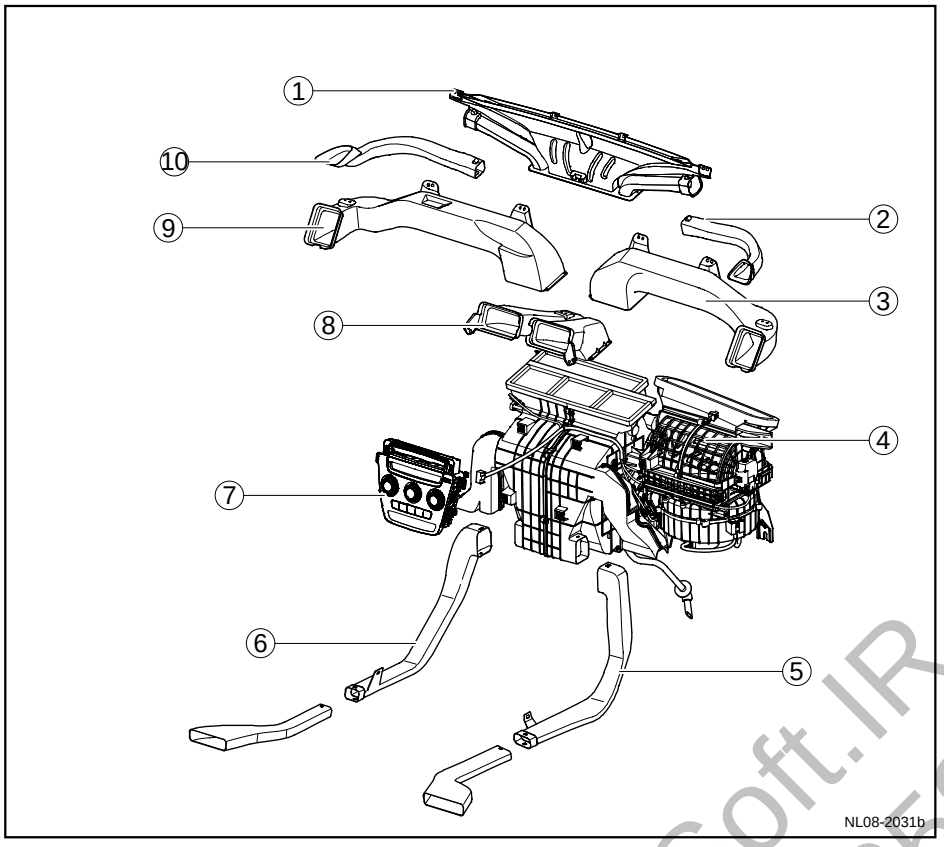
Breakdown drawing of indoor element of A/C system



1. Air outlet of front windscreen
2. Right side upper air outlet of instrument desk
3. Vent port on right side of instrument table.
4. A/C main host
5. Right floor air outlet
6. Left floor air outlet
7. A/C control Panel
8. Instrument desk center outlet port
9. Left instrument panel air outlet
10. Left side upper outlet of instrument desk

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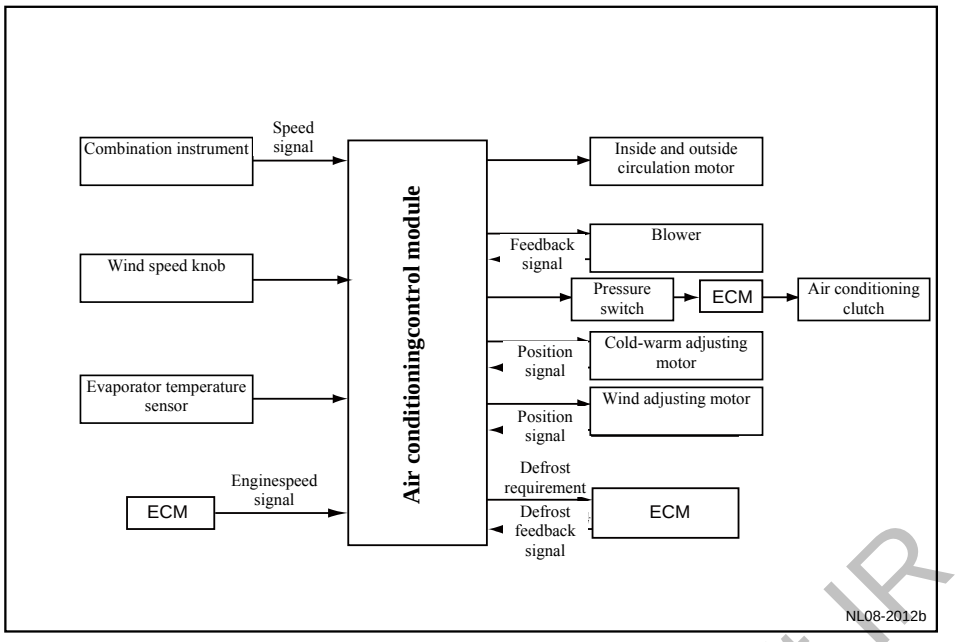
8.3.6 Electrical schematic diagram

8.3.6.1 A/C control system schematic diagram



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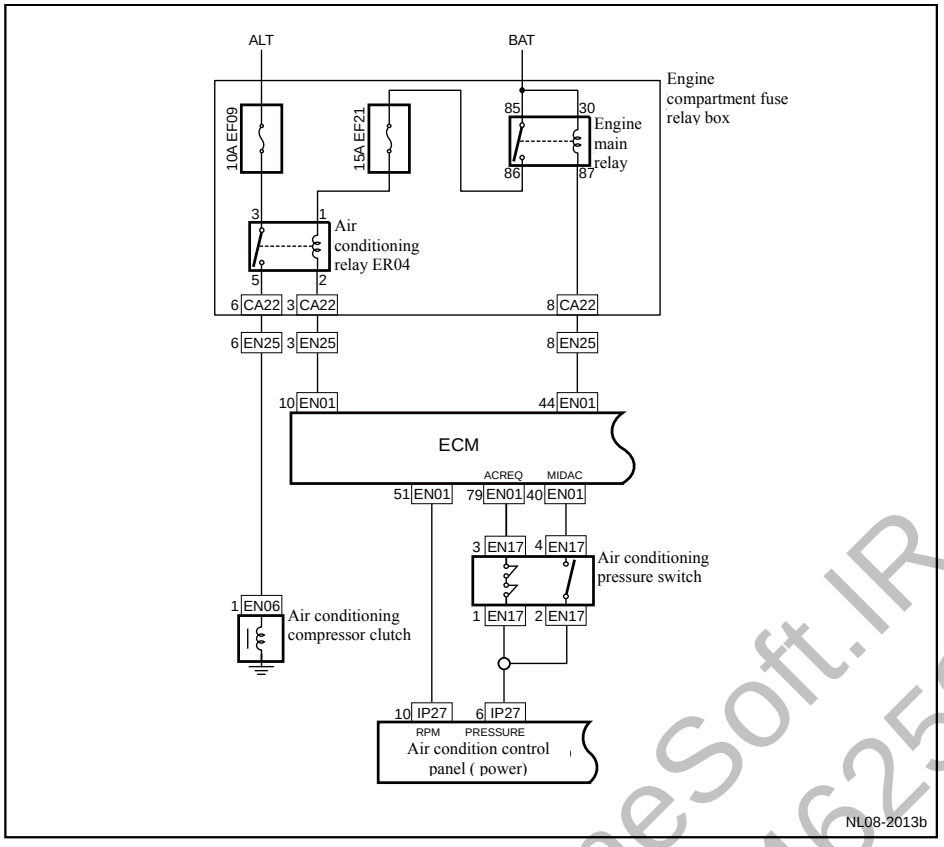
8.3.6.2 A/C system circuit sketch



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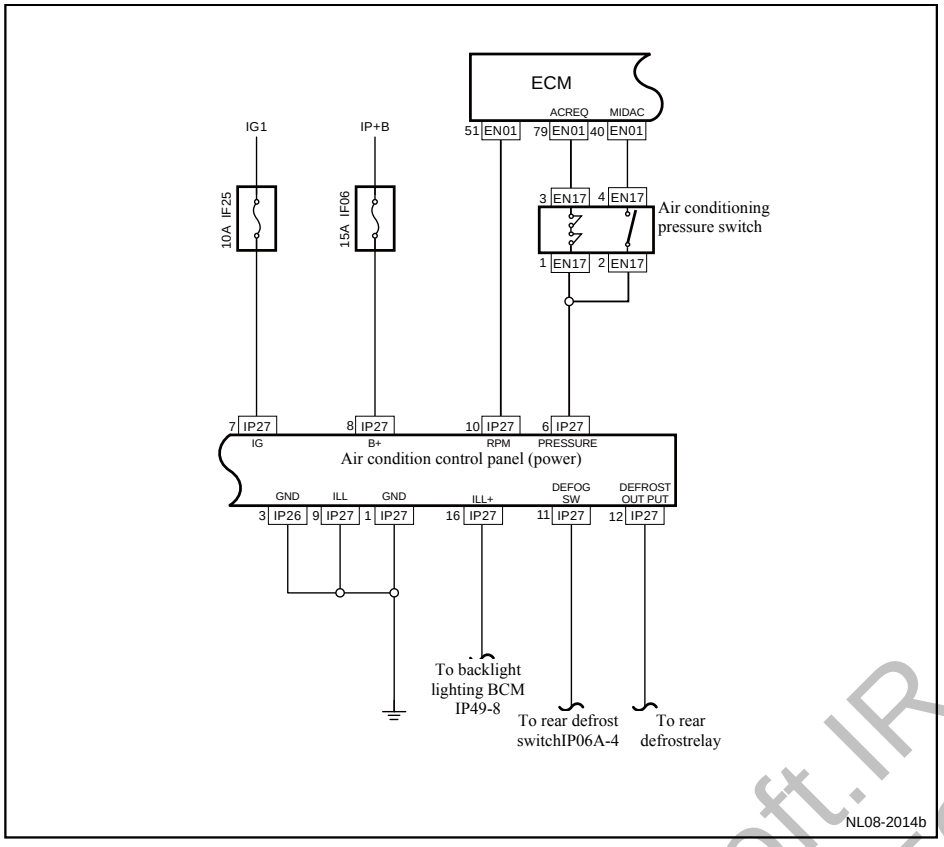

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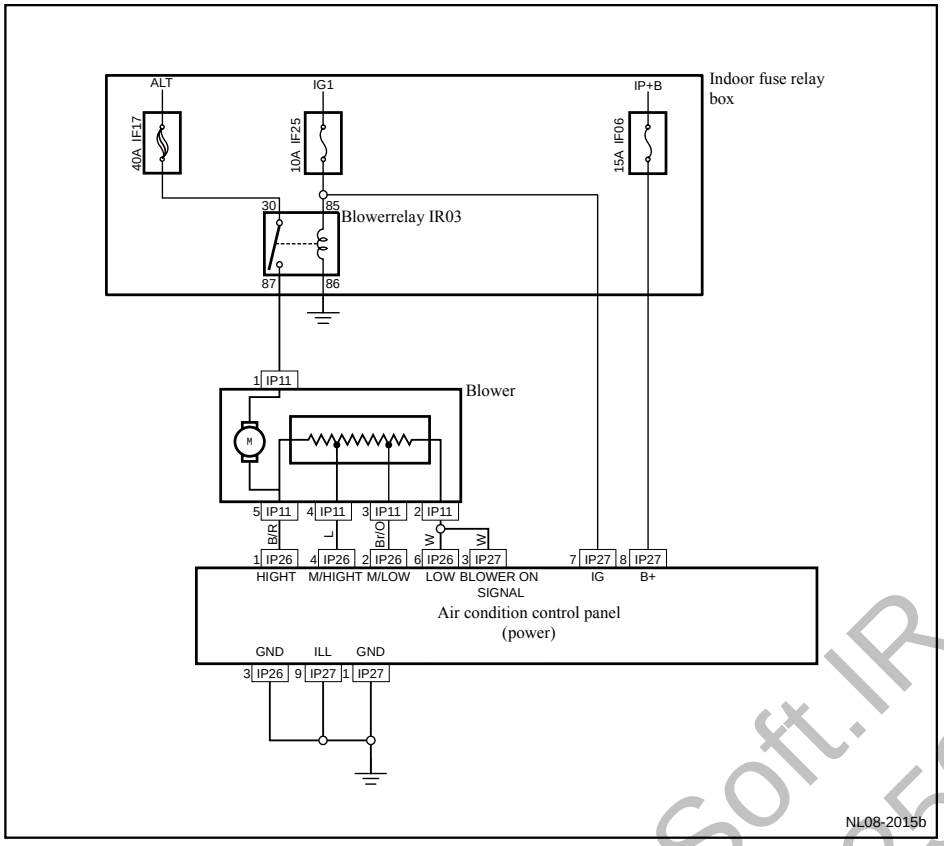

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8.3.7 Diagnostic Information and Procedures

8.3.7.1 Diagnosis descriptions

-Refer to 8.3.2 Description and Operation, get familiar with the system functions and operation before starting -system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help -to determine whether the situation described by the customer is normal.

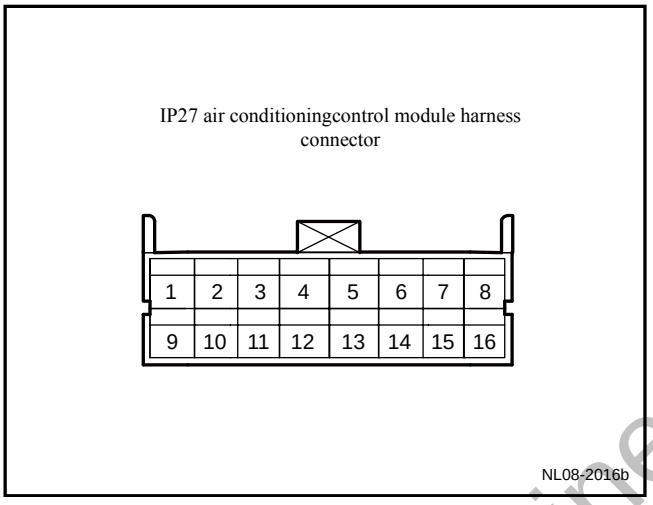
8.3.7.2 Visual inspection

-Inspect the after-sales optional device which may affect the performance of A/C system.

-Inspect the parts and circuits of A/C system which are accessible and easy to be seen, to find out -whether there is any damage or possible cause to fault.

-Inspect the pipelines which are accessible and easy to be seen, to find out whether there is any leakage of A/C system.

8.3.7.3 A/C control module terminal list



Note: unless otherwise specified, GND is 0V or close to 0V.

Terminal No .	Terminal Definition	Diameter/Color	Terminal Status	Specified Conditions (Voltage, Current, Waveform, etc.)
1	Ground	0.3B	Output	GND DC signal
2	-	-	-	-
3	Blower starting signal (-)	0.3W	Input	GND DC signal
4	-	-	-	-
5	-	-	-	-
6	A/C Output	0.3L	Input	GND DC signal
7	Ignition Switch	0.3R	Input	A627 A628 DC signal
8	Battery	0.3R/Y	Output	A627 A628 DC signal
9	Lamplet (-)	0.3B	Output	DC signal
10	Engine Speed Signal	0.3W	Input	Pulse signal
11	Rear defrost signal	0.3O	Input	A627 A628 DC signal

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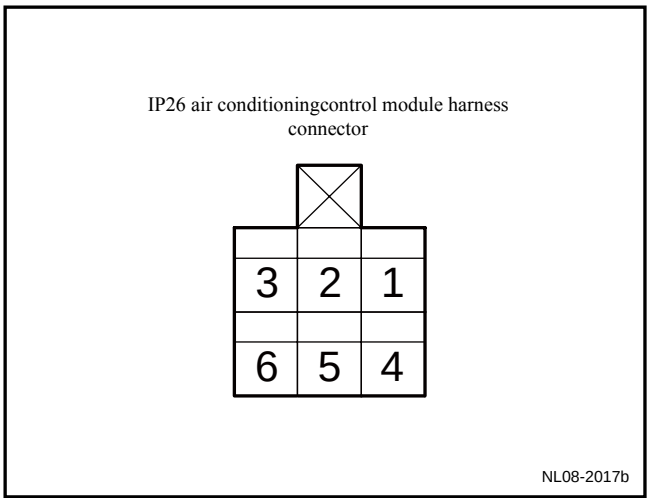
12	Rear defrost output	0.3R/L	Output	A627 A628 DC signal
13	-	-	-	-
14	-	-	-	-
15	-	-	-	-
16	Lamplet (+)	0.3L	Input	A627 A628 DC signal



Terminal No.	**Terminal definition**	**Diameter/color**	**Terminal status**	**Specified conditions (voltage, current, waveform, etc.)**
1	Gear 4	3.0B/R	Output	DC signal
2	Gear 2	3.0Br/O	Output	DC signal
3	Ground	3.0B	Output	DC signal
4	3rd gear	3.0L	Input	DC signal
5	-	-	-	-
6	1st gear	3.0W	Output	DC signal

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8.3.7.4 A/C clutch do not work

Circuit diagram:

Refer to 8.3.6.2 A/C system circuit diagram

Diagnostic Steps:

1	Perform the maintenance procedures according to the symptom list.

A. Repair according to the following list of symptoms

Symptoms	Suspected fault part	Maintenance scheme
The engine coolant temperature is too low.	1. ECT sensor fault 2. ECT sensor harness fault 3. Engine cooling system work is in big circulation state 4. ECM malfunction	1. Repair ECT harnesses 2. Replacement 3. Replace the thermostat 4. Overhaul ECM ,if necessary ,replace
Abnormal A/C pressure switch signal	1. Pressure switch shows signal that A/C pressure doesn't meet standard value 2. Pressure switch harnesses fault. 3. ECM malfunction	1. Repair harnesses of pressure switch 2. Replace pressure switch. 3. Overhaul ECM ,if necessary ,replace
Outdoor temperature sensor signal is abnormal.	1. Outdoor temperature sensor shows temperature lower than 4℃. 2. Fault of outdoor temperature sensor harnesses. 3. A/C control module fault	1. Repair harnesses of outdoor temperature sensor 2. Replace outdoor temperature sensor 3. Overhaul A/C control module, if necessary,replacet
Evaporator temperature sensor signal is abnormal.	1. Evaporator temperature sensor display temperature below 2℃(35.6℉) 2. Evaporator temperature sensor harness fault 3. A/C control module fault	1. Evaporator outdoor temperature sensor harness 2. Replace evaporator termperature sensor. 3. Overhaul A/C control module, if necessary,replacet
Refrigerant pressure is abnormal	1. A/C high-presure exceeds 3.14MPa (455.4psi) 2. Low pressure of A/C is less than 0.196MPa(28.4psi)	1. Residual refrigerant added during emission. 2. Repair fault which caused vehicle's bad radiation. 3. bad working condition of engine. 4. Inspect and repair fault which air conditoning system is blocked. 5. Detecting and Eliminating Leakage in A/C System

b. Confirm that the malfunctions are fixed.

Does the A/C clutch operate normally?

Yes	The system is normal.
No	

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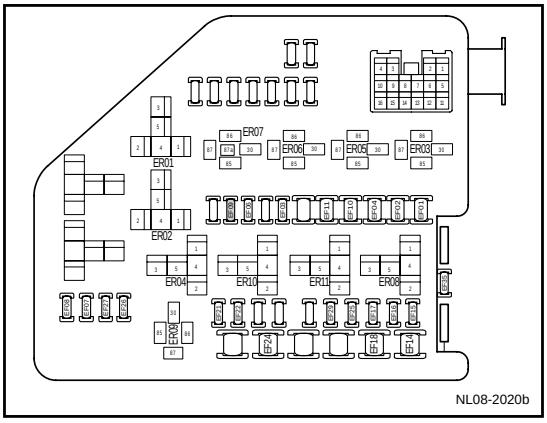
2	Check compressor fuse

(a) Inspect compressor fuse EF09.

Fuse rated value:10A

Whether fuse is broken or not?



No → Go to step 4

Yes

3	Repair the compressor clutch power supply circuit.

A. Service whether the power supply line of the compressor clutch is short circuited to the ground.

Does the A/C clutch operate normally?

Yes → The system is normal.

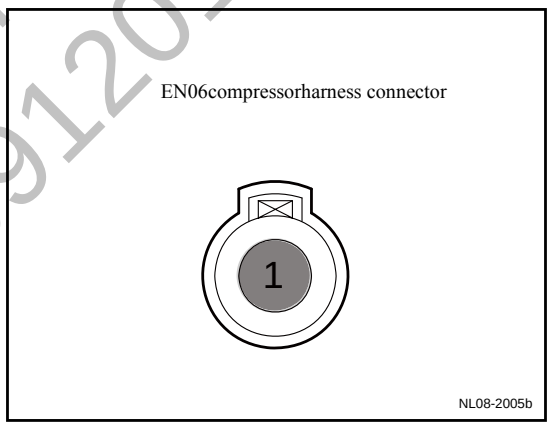
No

4	Detect the voltage of the power end of the compressor clutch.

A. Start the engine and press the A/C control switch (A/C switch) to test the voltage of the supply terminal EN06-1 of the compressor clutch.

Standard Voltage: 11-14 V

Is voltage the dtandard value?



Yes → Replace compressor clutch

No

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5	Repair the compressor clutch power supply circuit.

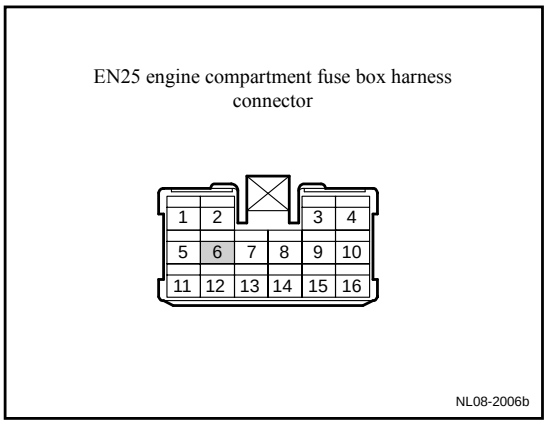
(a) Turn the ignition switch to OFF position.

(b) Disconnect engine hood fuse box harnesses connector EN25.

(c) Disconnect compressor clutch harnesses connector EN06.

(d) Inspect engine hood fuse box harnesses connector EN25 terminal 6 and compressor.

Open circuit between terminalS1 of the clutch harnesses connector EN06.

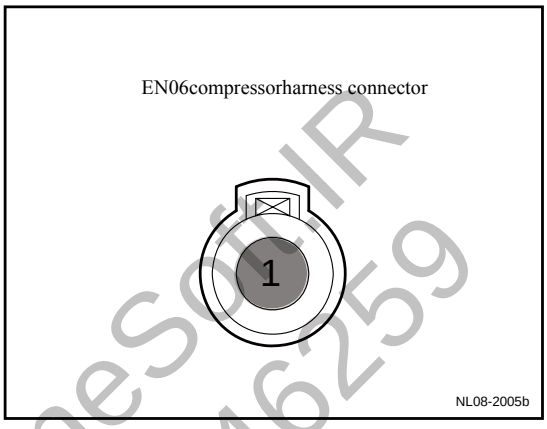


(e) Make sure that engine hood fuse box harnesses connector EN25 terminal 6 and compressor.

Circuit between terminalS1 of the clutch harnesses connector EN06 is normal.

Standard Resistance: Less than 1 Ω

Does the A/C clutch operate normally?



Yes	The system is normal.
No	

6	Inspect and adjust the A/C relay, and replace if necessary.

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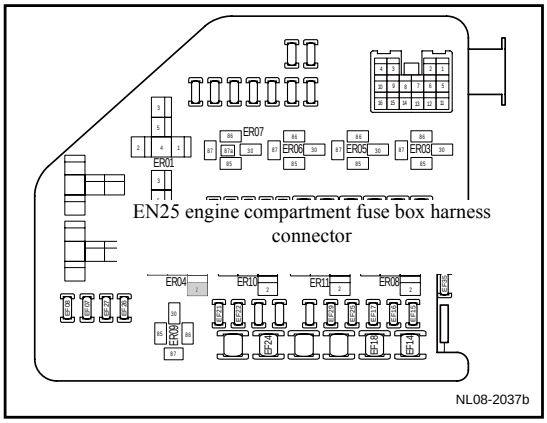
(a) Check if. Adjusting A/C electrical.if ensure. place it.

Does the A/C clutch operate normally?



Yes → The system is normal.

No

7	Inspect the electromagnetic clutch.

(a) Connect positive pole of battery to junction terminal and negative pole to housing of compressor.

(b) Inspect electromagnetic clutch under switching on condition.

Does the A/C clutch operate normally?

Yes → The system is normal.

No

8	Inspect the communication between engine cabin fuse box and ECM.

(a) Inspect engine hood fuse box harnesses connector EN25 terminal and ECM harnesses.

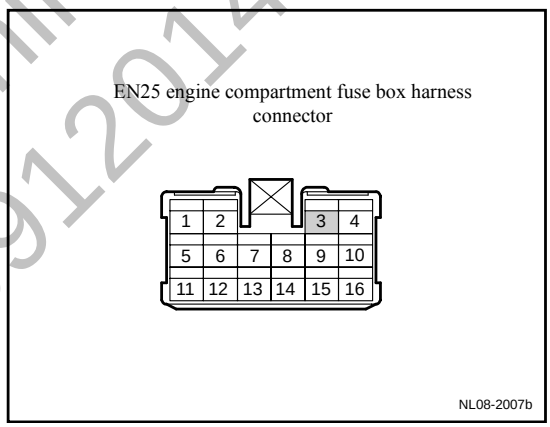
Communication between terminals 10 of connector EN01.

(b) Make sure that engine hood fuse box harnesses connector EN25 terminal 3 and ECM harnesses connector EN01 terminal 10 are connected well.

Circuit between terminals 10 of connector EN01 is normal.

Standard Resistance: Less than 1 Ω

Does the A/C clutch operate normally?



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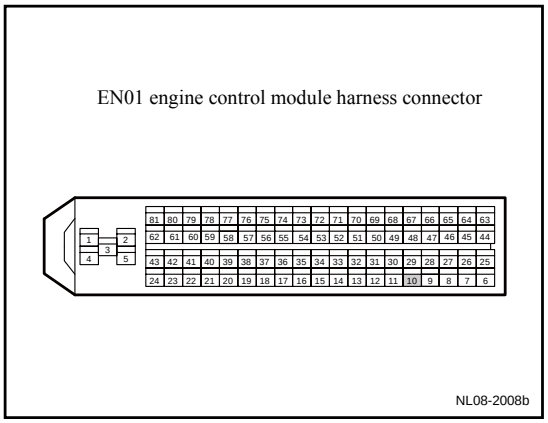

Yes → The system is normal.

No

9	Inspect the ECM circuit.

(a) Check ECM power supply, grounding wire.

(b) Confirm if ECM power supply is normal with body circuit.

Does the A/C clutch operate normally?

Yes → The system is normal.

No

10	Replace ECM

(a) Replace ECM and refer to 2.2.8.6 "Replacement of engine control module".

Does the A/C clutch operate normally?

Yes → The system is normal.

No

11	Replace A/C pressure switch.

(a) Replace A/C pressure switch.

Does the A/C clutch operate normally?

Yes → The system is normal.

No

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12	Detect the communication of the A/C control module and the A/C pressure switch.

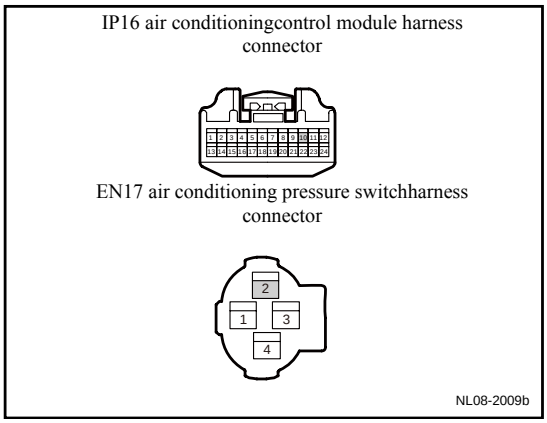
(a) Inspect A/C control module harnesses connector IP16 terminal 10 and A/C pressure switch.

Communication between terminals 2 of the harnesses connector EN17.

(b) Make sure that A/C control module harnesses connector IP16 terminal 10 and A/C pressure switch harnesses connector EN17 terminal 2 are connected normally.

The circuit between the terminals 2 of the harnesses connector EN17 is normal.

Does the A/C clutch operate normally?



Yes → The system is normal.

No

13	Inspect the communication of the ECM and the A/C pressure switch.

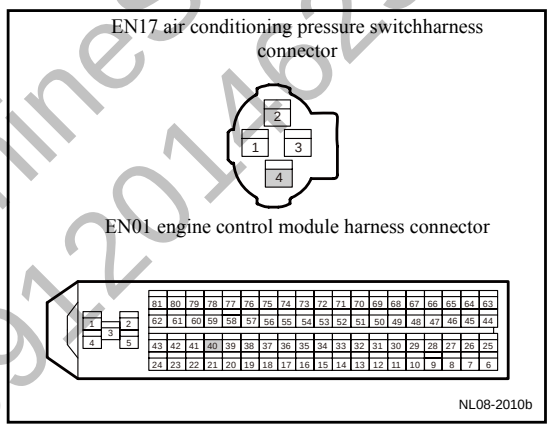
(a) Check if ECM harness connector EN01 terminal 40 connect with A/C pressure switch harness

Communication of the terminal 4 of the connector EN17.

(b) Make sure that ECM harnesses connector EN01 terminal 40 is well connected with A/C pressure switch harnesses connector EN17 terminal 4.

The circuit of the terminal 4 of the connector EN17 is normal.

Does the A/C clutch operate normally?



Yes → The system is normal.

No

14	Replace A/C control module.

(a) Replace A/C control module, refer to 8.2.8.1 A/C control panel

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Confirm the completion of repair.

Next

16	The system is normal.

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8.3.7.5 A/C blower do not work

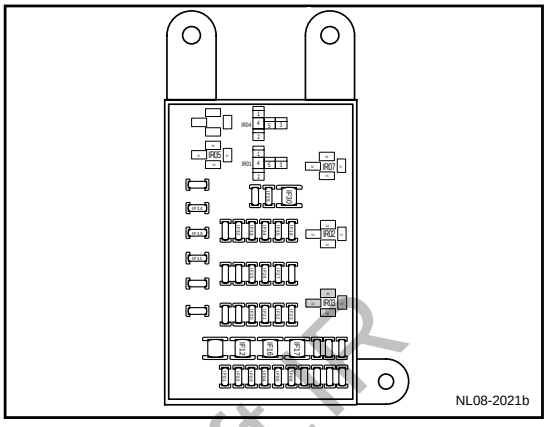
Circuit diagram:

See Electrical Appliance schematic diagram 2.

Diagnostic steps:

1	Inspect the blower relay (indoor fuse relay box R03).

A. Perform the maintenance procedures according to the following list of symptoms.



Symptoms	Suspected fault part	Maintenance scheme
Terminal 30 of the blower relay has no battery voltage.	The fuse IF17 (40A) is blown. harnesses fault	Repair the harnesses. Replace fuseIF17
Terminal 85 of the blower relay has no battery voltage.	The fuse IF25 (10A) is blown. harnesses fault	Repair the harnesses. Replace fuseIF25
Terminal of the blower assembly IP11-1 has no battery voltage.	The blower relay faults. harnesses fault	Replace blower relay Repair the harnesses.
Terminal 86 of the blower relay is in bad contact with ground.	harnesses fault Ground point G8 faults.	Repair the harnesses. Repair the fault of poor grounding of the ground point G8
The resistor between the terminals 86 and 85 of the blower relay does not accord with the standard.	The blower relay faults.	Replace blower relay

B. Confirm the completion of fault maintenance.

Does the blower operate normally?

Yes	The system is normal.
No	

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2	Repair the circuit between the blower relay and the blower.

(a) Turn the ignition switch to OFF position.

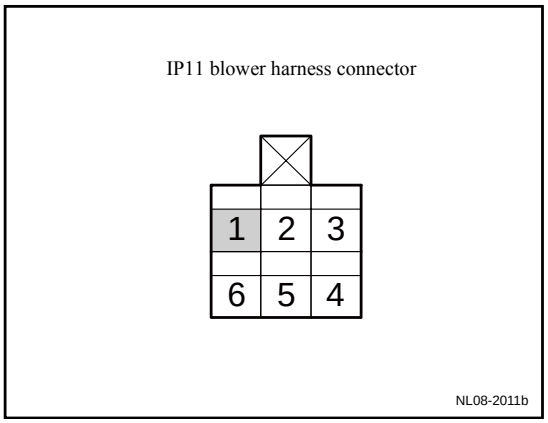
(b) Disconnect blower harness connector IP11.

(c) Inspect connection situation between blower relay terminal 87 and blower harnesses connector IP11 terminal 1.

Standard Resistance: Less than 1 Ω

(d) Make sure that the circuit between blower relay terminal 87 and blower harnesses connector IP11 terminal 1 is normal.

Does the blower operate normally?



Yes → The system is normal.

No

3	Inspect the voltage of the A/C control module terminal.

(a) Start the engine.

(b) Pressed volume button on the A/C control panel

(c) Use multimeter to measure voltage of A/C control module terminal.

(d) Standard voltage of each air volume gear is shown in table.

Air quantity bar shows	**Voltage (V) at manual mode blower end**
1	3.65
2	4.85
3	7.2
4	12

Is voltage the Standard Value?

Yes → The system is normal.

No

4	Repair the circuit of the A/C control module and the blower.

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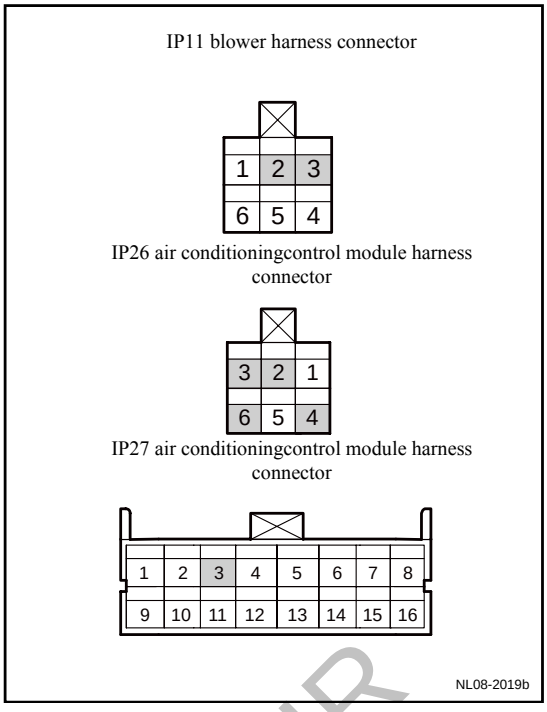
(a) Turn the ignition switch to OFF position.

(b) Inspect connection situation between A/C control module harnesses connector terminal IP26-1, IP26-4, IP26-2, IP26-6, IP27-3 and blower harnesses connector terminal IP11-5, IP11-4, IP11-3, IP11-2.

(c) Make sure that circuit between A/C control module harnesses connector t erminal IP26-1，IP26-4,IP26-2 and blower harnesses connector terminal IP11-5,IP11-4,IP11-3，IP11-2 is normal.

Standard Resistance: Less than 1 Ω

Does the blower operate normally?



Yes → The system is normal.

No

5	Inspect the A/C control module circuit.

(a) Inspect power supply and grounding circuit of A/C control module.

(b) Make sure A/C control module power supply and grounding are connected normally.

Does the blower operate normally?

Yes → The system is normal.

No

6	Replace A/C control module.

(a) Replace A/C control module refer to 8.2.8.1 A/C control panel replacement.

Does the blower operate normally?

Yes → The system is normal.

No

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7	Repair the blower.

A. Repair according to the following list of symptoms

Symptoms	**Suspected fault part**	**Maintenance scheme**
Blower jamming	The blower wheel has foreign matter. The blower wheel is damaged. The blower motor has foreign matter and is blocked.	Clean up the blower wheel foreign body. Clean up the blower motor foreign body. Replace blower motor assembly, included fan impeller
The blower motor does not work.	The blower motor is damaged.	Replace blower motor assembly, included fan impeller

B. Confirm that the blower works normally.

Confirm the completion of repair.

Next

8	The system is normal.

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8.3.7.6 A/C system cooling capacity is lack

Fault symptom table

Symptoms	Suspected fault part	Maintenance scheme
The engine coolant temperature is too high.	1. Engine idle running time is too long. 2. Engine is running with overload for long time 3. Coolant is lock 4. Coolant performance can't meet requirement. 5. Thermostat Malfunctions 6. The engine is in poor operation. 7. The cooling fan is in abnormal operation. 8. The cooling fan does not work. 9. The water tank is in poor heat dissipation. 10. Cooling fan air connection cover.	1.Reduce engine idling running time 2. Reduced engine running time with big load. 3. Overhaul leakage condition of coolant , added coolant to the standard value 4. Replace coolant which meets requirements of Geely. 5. Replace the thermostat 6. Check the cooling system of the engine 7. Service the engine to check its working condition. 8. Service the cooling fan motor and its circuits and replace if necessary. 9. Clean the cooling water tank. 10. Overhaul cooling water tank, if necessary, replace it. 11. Overhaul cooling fan wind concentrator cowl. if necessary,replace it
Condenser temperature is too high	1. Condenser radiation is bad. 2. Water temperature of engine is too high	1 Clean the condenser 2. Overhaul condenser. If necessary, replace it 3. Conduct repair according to symptom specified in this table "engine coolant temperature is too high".
The compressor runs abnormally.	1. Compresor belt is skidding. 2. Compressor clutch is skidding. 3. Compressor has abnormal sound 4. Frequent start of compressor 5. Operation Failure of Compressor	1. Adjust compressor belt, and replace when necessary 2. Repair the compressor clutch and replace if necessary. 3. Inspect the amount of the refrigerant and the lubrication oil. Refer to the symptom of "abnormal A/C system pressure" in the table. 4. Repair the compressor clutch circuit. 5. Repair the compressor and replace if necessary. 6. Repair the A/C pressure switch, and replace if necessary. 7. Repair the A/C control module, and replace if necessary. 8. Overhaul engine control module.if necessary.replace it
Air volume of the instrument panel air outlet is too small.	1. Instrument air duct blocked 2. Instrument air duct leakage 3. Air direction control mechanism abnormal 4. Air direction control motor abnormal 5. Blower speed is too low. 6. Blower Speed Control Module abnormal 7. A/C pipe frozen 8. A/C control module abnormal	1. Clean up the air outlet of the instrument panel and replace if necessary. 2. Repair the air outlet passage of the instrument panel and replace if necessary. 3. Overhaul wind control mechanism 4. Overhaul wind control motor 5. Repair circuit. 6. Repair the blower motor and replace if necessary. 7. Replace blower speed regulation module 8. Replace the refrigerant according with the standard of Geely manufacturer. 9. Replace expansion valve

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		10. Repair the A/C control module circuit, and replace module if necessary.
Air-out temperature of the instrument panel air outlet is too high.	1. Switched to outside circulation 2. Ambient temperature is too high 3. The outside circulation throttle is blocked and not closed tightly. 4. Inside and outside circulation motors fault 5. Temperature control mechanical is abnormal. 6. Temperature control motor is abnormal. 7. Abnormal illumination sensor 8. A/C control module abnormal	1. Switch to inside circulation. 2. Move the vehicle to a cool and shaded place. 3. Adjust outside circulation throttle mechanism, and replace the internal and outside circulation throttle mechanism when necessary. 4. Replace Inside and outside circulation adjustment motor 5. Repair the temperature control motor, and replace if necessary. 6. Repair the light sensor and replace if necessary. 7. Repair the A/C control module circuit, and replace module if necessary.
A/C high pressure is too high and low pressure is too high.	1. Refrigeration System has air 2. Refrigerant charging is too much 3. Refrigerant lubricating oil charging is too much 4. The expansion valve opening is too large.	1. Repair the leakproofness of the pipeline of the refrigerating system and refill the refrigerant. 2. Discharge excessive refrigerant. 3. Discharge excessive refrigerant lubricating oil. 4. Replace expansion valve
A/C high pressure is too high and low pressure is too low.	1. High-pressure pipe prior to the expansion valve is blocked. 2. Expansion valve blockage 3. The expansion valve opening is too small.	1. Wash or replace blocked high-pressure pipe. 2. Replace expansion valve
A/C high pressure is too low and low pressure is too high.	1. The compressor lacks of oil. 1. The compressor is damaged.	1. Supplement with the compressor refrigerant lubricating oil. 1. Replace compressor
A/C high pressure and low pressure are too low.	1. Refrigerant charging capacity is not enough 2. Refrigerant is leakage	1. Fill with the A/C refrigerant according to the standard as specified by Geely. 2. Repair the leakage condition of the A/C system; and replace the A/C system element leaked.
A/C high pressure is too low and low pressure in vacuum.	1. The expansion valve is in serious filth blockage. 2. Expansion valve ice block 3. Evaporator temperature sensor faults. 4. Low-pressure pipeline leakage	1. Replace expansion valve 2. Prolong the pumpdown time of the system and fill the A/C refrigerant which is accorded with the standard specified by Geely manufacturer. 3. Replace stock solution dryer. 4. Replace evaporator temperature sensor 5. Wash or replace blocked low-pressure pipe.

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8.3.7.7 A/C system air warming is lack

Fault symptom table

Symptoms	Suspected fault part	Maintenance scheme
The engine coolant temperature does not reach 82℃ (180℉).	1. Thermostat Malfunction 2. Insufficient running time of engine 3. Air entering the cooling system 4. Poor engine working conditions.	1. Prolong the running time of the engine. 2. Empty the air in the cooling system 3. Replace the thermostat. 4. Overhaul engine work condition
Air leakage of cold-warm valve	1. Mechanical fault of cold-warm valve mechanism 2. Cold-warm valve motor fault 3. The air outlet way leaks air. 4. A/C control module faults.	1. Adjust throttle mechanism 2. Replace cool-warn adjusting motor 3. Replace Coo-warm valve mechanism 4. Repair the air leakage passage. 5. Replace air leakage passage. 6. Replace A/C control module
Inside and outside circulation throttle leaks air.	1. Switched to outside circulation 2. The outside circulation throttle is blocked and not closed tightly. 3. Inside and outside circulation motors fault 4. A/C control module faults.	1. Switch to inside circulation. 2. Adjust outside circulation throttle mechanism 3. Replace inside and outside circulation adjustment motor 4. Replace inside and outside circulation valve mechanism 5. Replace A/C control module

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8.3.7.8 A/C refrigerant Recycling & recycling

Operating efficiency and service life of the A/C (A/C) system depend on the chemical stability of the refrigerating system. When the refrigeration system is polluted by foreign bodies (such as dust, air or moisture), the pollutant shall change the stability of the refrigerant and 100PG compressor oil. And can affect the relationship between pressure and temperature, reduce the working efficiency and may result in internal corrosion and abnormal element wear. The following methods are operated for ensuring the chemical stability of the system:

1. Before opening the joint, first remove oil stain from joint and position around joint to reduce posibility of small little of oil stain entering into system.
2. After disconnection of joint, immediately seal two sides of joint with cap, plug or adhesive tape, to prevent oil stains, foreign matters and wet air from entering into it.
3. Keep all tools clean and dry, including manifold pressure components and all replacing components.
4. Use clean and dry carrying device and container to fill 100PG refrigerant oil, make sure that refrigerant oil is free from wet effect.
5. During operation, reduce the time for which the inside of the A/C is exposed to the air as possible.
6. The A/C system must be air exhausted once again and filled with refrigerant after being exposed to the air. All service parts are dry and sealed prior to delivery. Open these sealed parts only being about to install. Prior to unpackaging, all parts should be at room temperature, moisture should be prevented from being condensed on the parts and then entering the system and all parts should be enclosed as soon as possible.

Emission of the A/C system as well as the adding, emptying and filling procedures of lubricating oil

Warning!

See "warnings for Intake of R-134a" in "warning and precaution ". Other health and safety information can be obtained from the refrigerant and lubricating oil manufacturer.

Warning!

See "warnings for goggles and gloves" in "warning and precaution ".

The filling machine is connected once to complete the emission, emptying and refilling procedure of the A/C system. The refrigerant is filtered in the course of recyclinging and emptying, thereby making sure that the refrigerant filled into the A/C system is clean and dry.

1. It is prohibit to fill R-134a system by oil filling machine. The refrigerant and the refrigerant oil of the two systems are not compatible and must not be mixed; even a small amount is also not allowed because the equipment may be damaged by mixing with the residual refrigerant.
2. It is strictly forbidden to use reducing joint, to ensure sealing performance inside system.

Installation and maintenance of the filling machine

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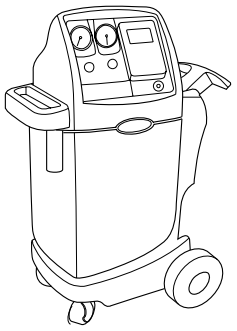
There are various types of filling machines. All filling machines perform various tasks, such as A/C system emission, refrigerant recycling, system emptying, quantitative addition of refrigerant oil and quantitative refilling of refrigerant, etc. See filling machine operation manual to master the initial installation and maintenance procedures.

Air conditioning refrigerant recyclingy & recycling equipment



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Control panel function

Operator may control and monitor the operation process with the control button and indicator lamp on the filling machine. See the instruction for use of the filling machine for details. The instruction shall include the following content:

1. Main power supply switch: main power supply switch provided power supply with control panel.
2. Screen: screen shows time of vacuum pumping set by programming and weight of refrigerant to be refilled. See the manufacturer's Instructions for learning detailed programming information.
3. Manifold pressure gauge on low-pressure side: this gauge shows pressure on low pressure side of the system.
4. Manifold pressure gauge on high-pressure side: this gauge shows pressure on high-pressure side of the system.
5. Control panel: it accommodates various buttons and knobs for controlling various functions.
6. Low pressure side valve: this valve is used for connecting the low pressure side of the A/C system with the filling machine.
7. Humidity indicator: this indicator indicates whether the refrigerant is humidified.
8. High pressure side valve: this valve is used for connecting the high pressure side of the A/C system with the filling machine.

Refrigerant Recycling

Notes:

The refrigerant tank specially designed for the filling machine is only used. Over-filling prevention mechanism of the filling machine is corrected specially for the refrigerant tank. However, the refrigerant tank valve is also manufactured specifically for the device.

1. Connect high-pressure side hose with quick coupler to high-pressure side coupler of vehicle A/C system.
2. Turn on high pressure side connector valve
3. Connect low-pressure hose with quick coupler to low-pressure coupler of vehicle A/C system.
4. Open low-pressure joint valve.

Notes:

If no refrigerant in the system, stop the Recycling operation immediately; otherwise, inhale into the Recycling tank.

5. Check the high-pressure side and low-pressure side pressure gauges on the filling machine control panel to ensure the A/C system is under pressure. If no pressure, the system has no recyclable refrigerant.
6. Open the high pressure side and low pressure side valves.

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7. Open the gas and fluid valves on the refrigerant tank.

8. Thoroughly remove the refrigerant oil from the oil-liquid separator.

9. Closed oil drain valve

10. Connect filling machine to suitable power supply outlet.

11. Switch on main power supply switch.

Notes:

Forbid mixing of old refrigerant oil and new refrigerant oil together. Old oil may be precipitated with aluminum or mixed with other foreign materials. Be sure to use new refrigerant oil when refilling the A/C system. Correctly scrap the used refrigerant oil.

Notes:

Some 100PG lubricating oil for the A/C system may be recycled together with the refrigerant. The recyclinged lubrication oil quantity is indeterminate. The filling machine can separate lubrication oil from refrigerant, so as to determine the amount of lubrication oil recyclinged. The same amount of lubricating oil should be added when refilling the system, see the manufacturer's Instructions for learning in detail the use method of the filling machine.

12. Start Recycling process See the manufacturer's Instructions for learning in detail the use method of the filling machine.

13. Waiting for 5min, and then inspect pressure gauge on low-pressure side of control panel, if the A/C system keeps vacuum, complete Recycling.

Notes:

If the control panel display the refrigerant tank is full in the course of Recycling, close the filling machine, another empty tank is installed for storing the refrigerant needing to the next step. Forbid using of the other types of refrigerant tank.

14. If pressure gauge on low-pressure side begins to rise from Zero, it indicates that there still has refrigerant in system. Recycling the rest of the refrigerant. Repeat this step until the system can maintain vacuum for 2min. The emptying filling machine refrigerant tank must be filled with enough R-134a refrigerants to fill. Inspect the refrigerant quantity in the tank. If the amount of the refrigerant is less than 3.6kg (8lb), add the new refrigerant to the refrigerant tank. See the instruction for use of the filling machine for details to learn the method of adding the refrigerant.

1. Inspect whether high-pressure and low-pressure hose are connected to A/C system. Open high-pressure and low-pressure valves on control panel of filling machine.

2. Open air valve and liquid on refrigerant reservoir.

Notes:

See the manufacturer's Instructions for learning in detail the use method of the filling machine. You must exhaust the air from the system thoroughly before you refill with the refrigerant or recycled refrigerant.

3. Start vacuum pump and implement exhaust procedures. In the recycling process, the non-condensable gas (mostly air) is automatically discharged from the tank. You will hear the pressure relief sound.

Notes:

Regularly replace vacuum pump oil. See the manufacturer's Instructions for learning in detail the use method of the filling machine.

4. Check the system for any leaks. See the manufacturer's Instructions for learning in detail the use method of the filling machine.

Filling and supplement of A/C system lubricating oil

You must supplement with the lubricating oil drained from the A/C system during the recycling process.

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1. Use 100PG lubricating oil contained with scale bottle specially used for R-134a system.
2. Refer to the user's manual provided by manufacturer, in which use method of filling machine is explained. Add 100PG lubricating oil to the system.
3. When filled oil volume reaches requirments, close valve.

Notes:

Remember tightening the lubricating oil bottle cover in order to avoid moisture or pollutant from entering the lubricating oil. This operation requires the A/C system has a certain degree of vacuum, inhibits opening the lubricating oil filling valve when the A/C system has positive pressure; otherwise, it will lead to the backflow of the lubricating oil through the air port of the oil bottle. The oil level shall not be lower than oil suction pipe when filling or compensating lubrication oil; otherwise, air will enter the A/C system.

Filling

Notes:

Firstly empty the A/C system prior to filling.

1. Close high, low pressure valves on control panel.
2. Close high-pressure side valve on control panel.
3. Refer to User's manual provided by manufacturer to learn application method of filling machine.
4. Fill the A/C with a necessary amount of refrigerant and make sure the amount is measured in the correct unit (namely kilogram or pound).
5. Start filling

Refrigerant charging was completed successfully

1. Close high, low pressure valves on control panel of filling machine. Both valves must be closed.
2. Start vehicle and A/C system.
3. Keep engine running until the readings of pressure gauge on high-pressure side and low-pressure side are stable.
4. Compare the readings with the system specifications.
5. Check the evaporator outlet temperature and make sure the operations performed on the A/C system comply with the system specifications.
6. Keep the A/C in operation.
7. Close the high pressure side quick coupling valve.
8. Disconnect the high pressure side hose from the vehicle.
9. Open the high pressure and low pressure side valves from the control panel. The system will be quickly absorbed with the refrigerant in the two hoses through low-pressure side hose.
10. Closed low pressure side lower pressure quick connector valve
11. Dismantle low-pressure hose from vehicle.

Unsuccessful for refrigerant charging

Sometimes, the refrigerant entering the A/C system does not reach the total filling quantity. There are two reasons for resulting in such situation:

1. Pressure of refrigerant can of filling machine is more or less the same as that of A/C system, which will lead to slow filling process. See the manufacturer's Instructions for learning in detail the use method of the filling machine.
2. There is no sufficient refrigerant in refrigerant reservoir for filling. Hereto, recycling part of refrigerant injected from the vehicle, empty the A/C system, add refrigerant to the refrigerant can, and at last, inject again. See the manufacturer's Instructions for learning in detail the use method of the filling machine.

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8.3.8 Dismantle and installation

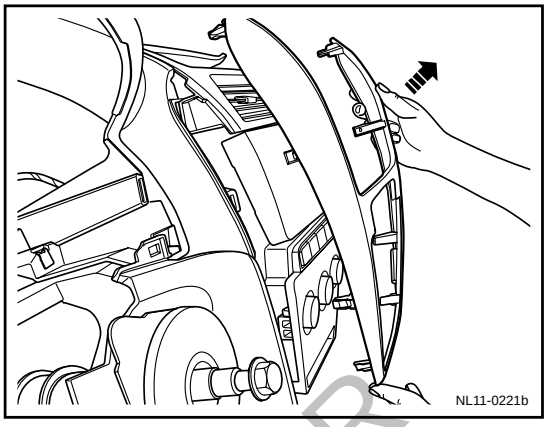
8.3.8.1 Power A/C control panel replacement

Dismantle procedure

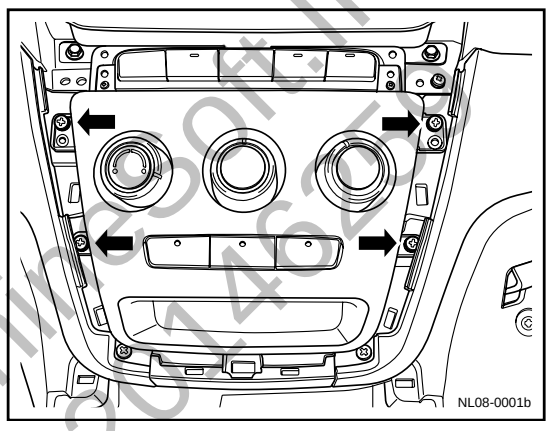
Warning!

Warning: refer to "warning for battery disconnection" in "warnings and precautions".

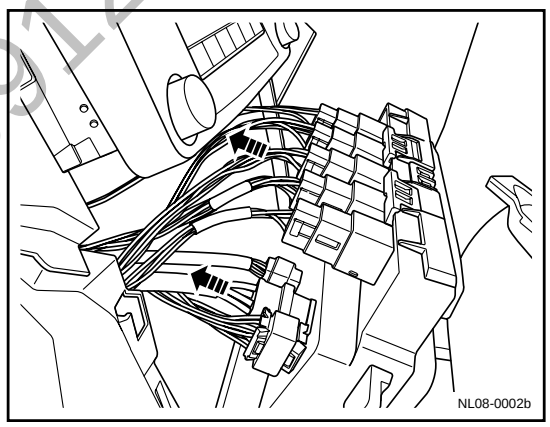
1. Disconnect the battery negative cable, refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle central control panel trimming cover.



3. Dismantle 4 fixing screws of control panel of electric A/C.



4. Disconnect 5 harnesses connectors of instrument panel middle switch.
5. Disconnect 3 harness connectors of the electric A/C control panel.



Notes:

Mark the position of each connector to facilitate correct installation.

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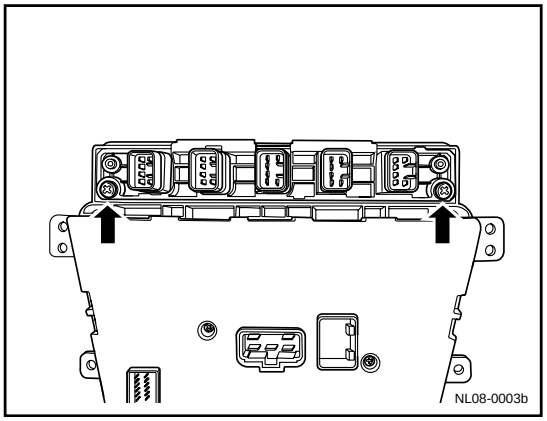
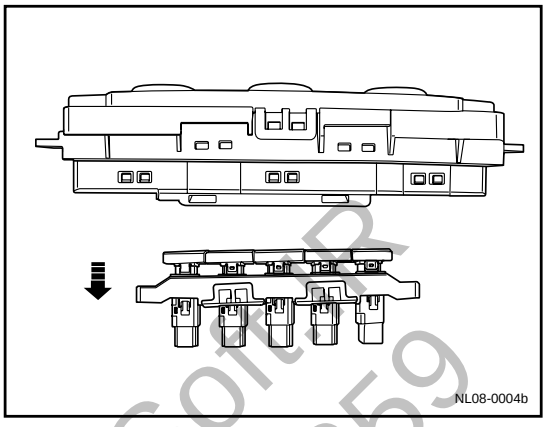
6. Remove the fixing screw for the center switch assembly on the instrument panel .

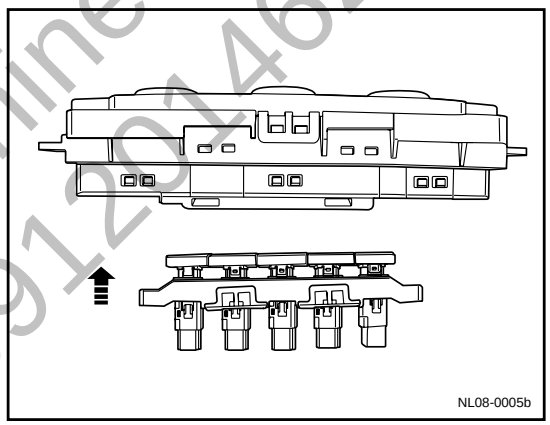


7. Dismantle the central instrument panel switch assembly from the power A/C control panel.



Installation procedure:

1. Install intermediate switch assembly of instrument panel



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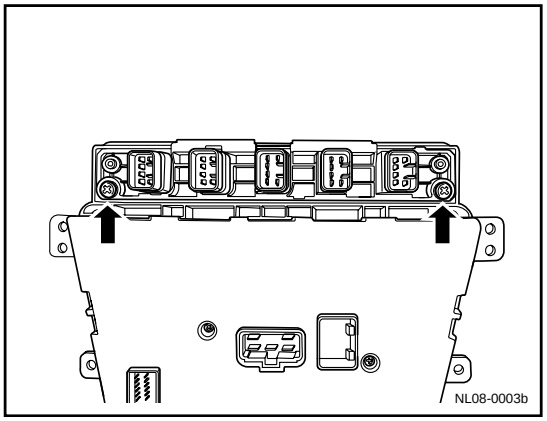
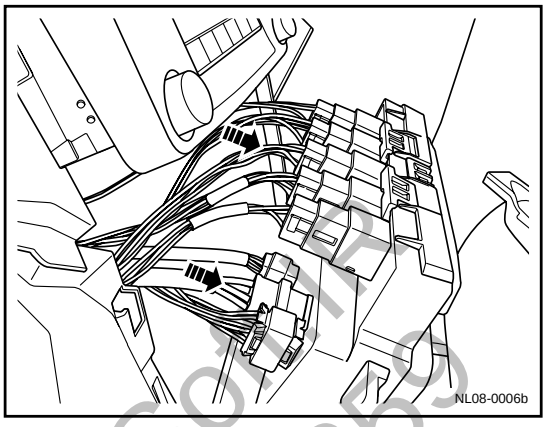
2. Install fixing screw of instrument panel intermediate switch assembly and tighten it.

Torque: 3.5Nm (Metric system) 2.6lb-ft (English system)

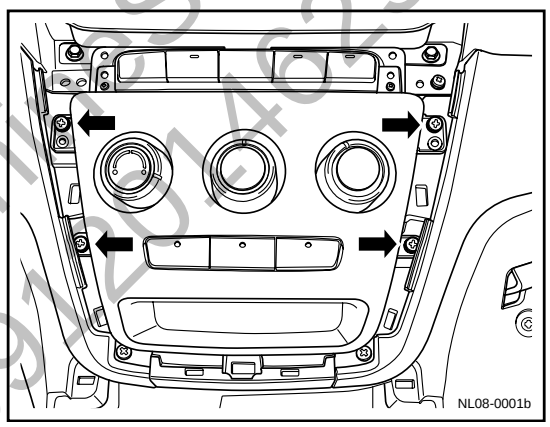


3. Connect 5 harnesses connectors of instrument panel middle switch.
4. Connect 3 harness connectors for the electric A/C control panel.



5. Install and tighten 4 fixing screws of the A/C control panel.

Torque:3 Nm (Metric) 2.2 lb-ft (English system)



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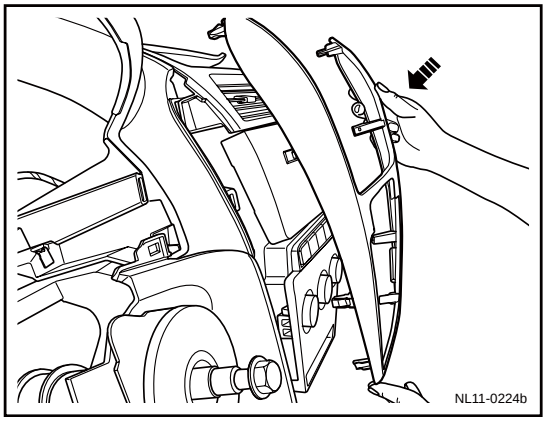
6. Install the center console trim cover.
7. Connect the battery negative cable.



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8.3.8.2 A/C pressure switch replacement

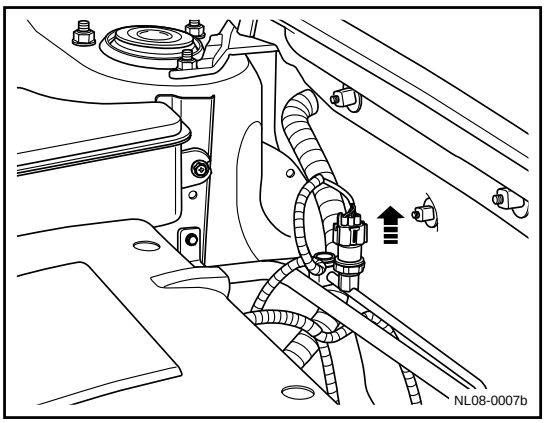
Warning!

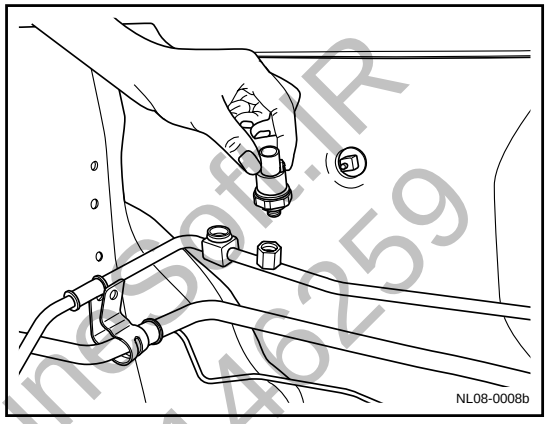
See "Warnings for intake of r-134a" in 1.1.1.1 warning and precaution .

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For operation of recycling programs of A/C refrigerant, refer to 8.2.7.12 Recycling and filling of A/C refrigerant.

Recycling and filling

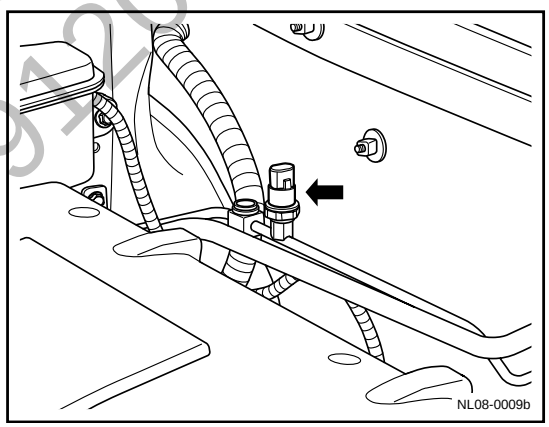
3. Disconnect A/C refrigerant pressure switch harness connector.
4. Dismantle A/C pressure switch.





Installation Procedure:

1. Install the A/C pressure switch.



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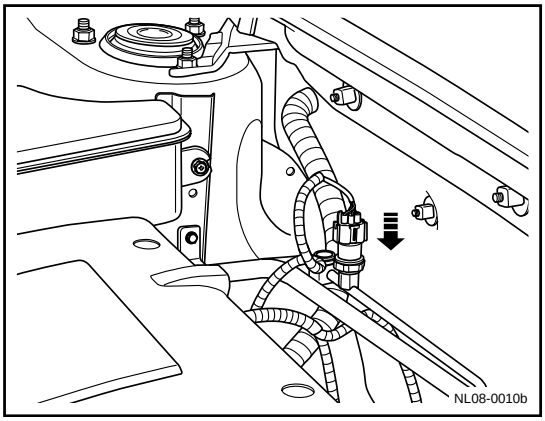
2. Connect A/C refrigerant pressure switch harnesses connector.



Notes:

The O-ring related in the process of installation must be replaced by a new one.

3. A/C refrigerant filling procedures

4. Connect the battery negative cable.

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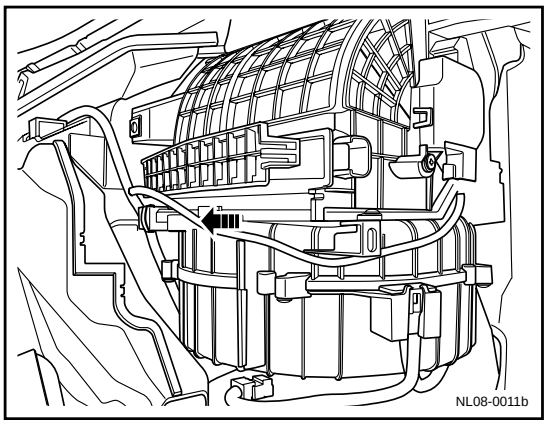
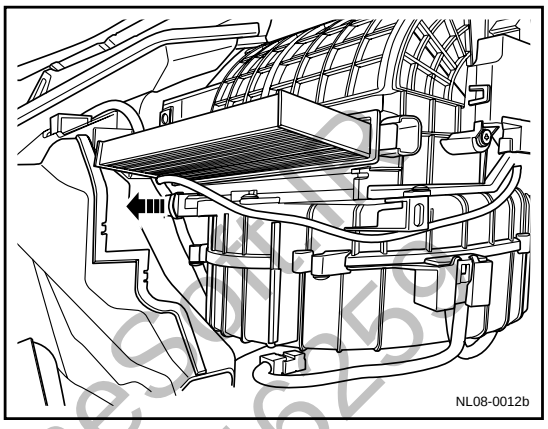
8.3.8.3 A/C filter element replacement

Dismantle procedure

Refer to 12.8.3.3 “replacement of glove box of the instrument panel” to dismantle the glove box of the instrument panel.

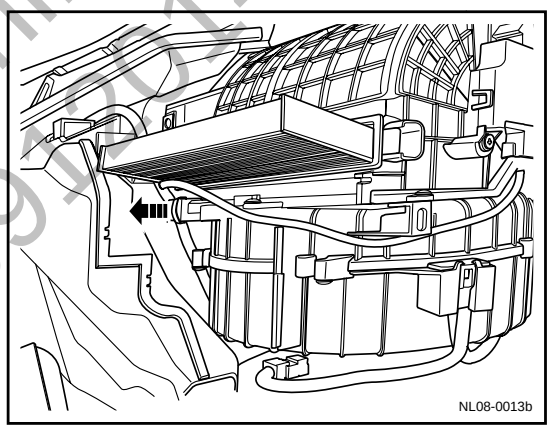


2. Dismantle protective cover of A/C filtering element.
3. Pull out A/C filter element.



Installation Procedure:

1. Insert air condition filter element.



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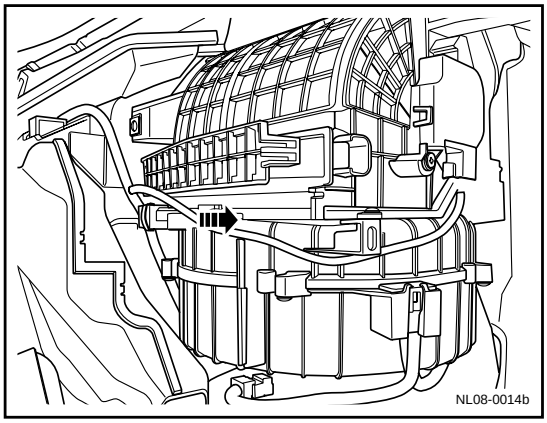
2. Install A/C filter element trimming cover.
3. Install grove box of instrument desk.



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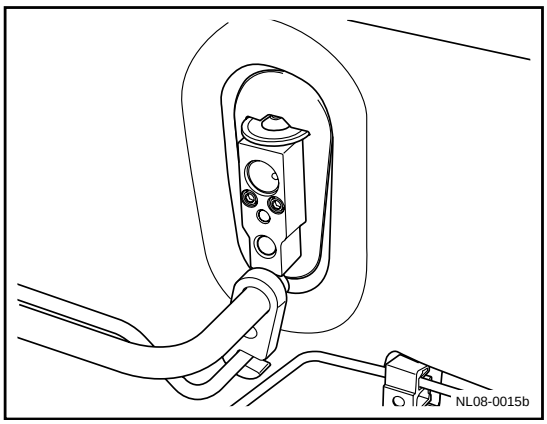
8.3.8.4 A/C main host assembly replacement

Dismantle procedure

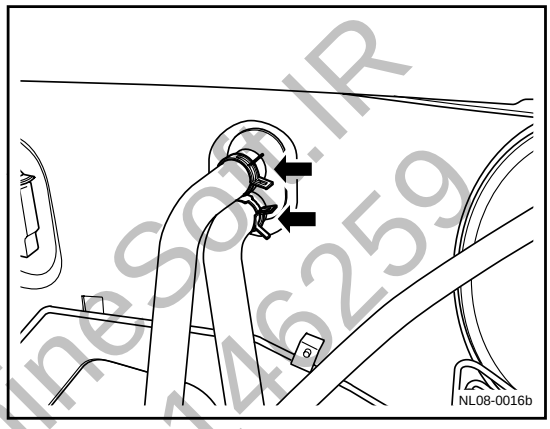
Warning!

1.1.1.1 "Warning related to absorption of R-134a" stated in warning and caution.

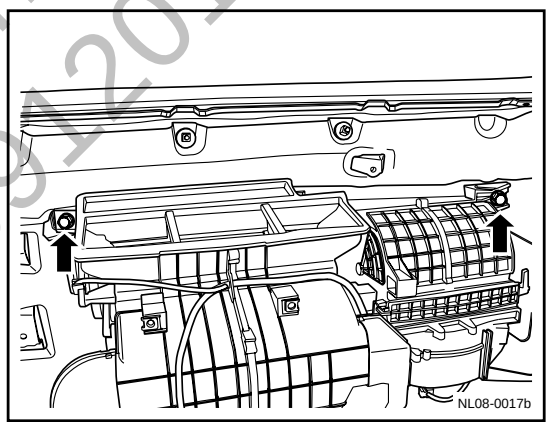
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For operation of recycling procedures of A/C refrigerant, refer to 8.3.7.8 Recycling and filling of A/C refrigerant.
3. Discharge engine coolant. Refer to 2.8.8.1 Engine Coolant Discharge and Filling.
4. Dismantle fixing bolt of A/C pipe on expansion valve side, and disconnect A/C pipe.



5. Remove the clamps for the side inlet and outlet heat air and water pipes of the heater core and remove the inlet and outlet heat air and water pipes.



6. Remove instrument panel. Refer to 12.8.3.1 Instrument Panel Replacement.
7. For dismantlement of the instrument desk cross beam, see 12.8.3.4 Replacement of Instrument Panel Cross Beam.
8. Remove 2 fixing nuts on the top of the A/C main unit.



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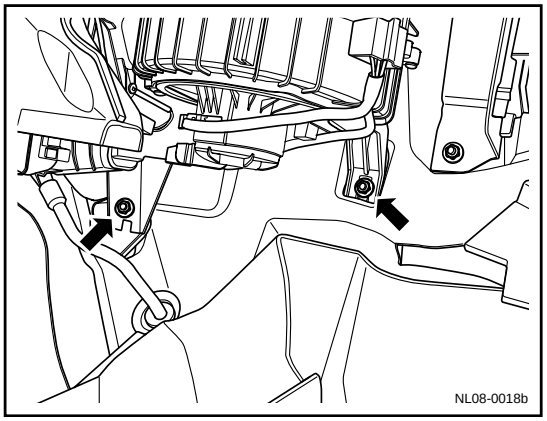
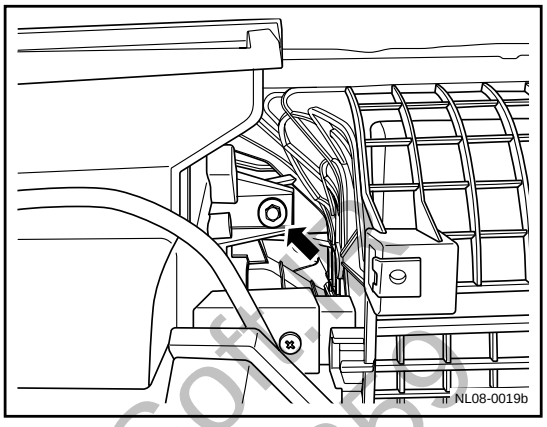
9. Remove the lower 2 fixing bolts of the A/C main unit.



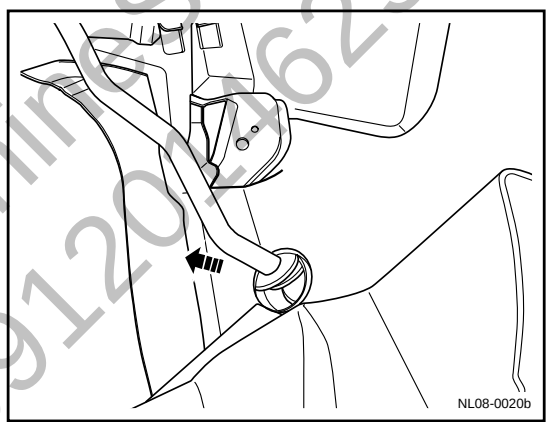
10. Dismantle 1 fixing bolt in the middle of main host of A/C.



11. Pull out air exhaust hose of evaporator
12. Dismantle A/C main host

Installation procedure:

1. Install main host of A/C.
2. Insert water drain hose of evaporation box.



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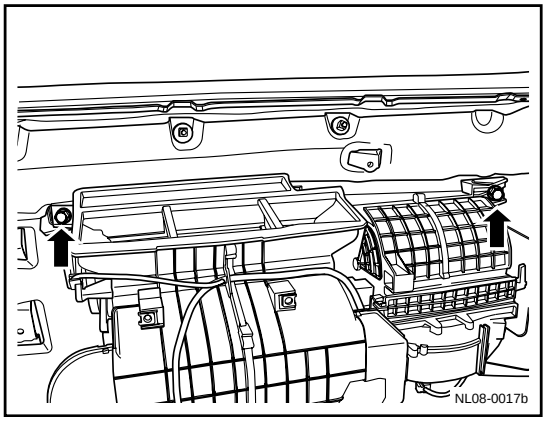
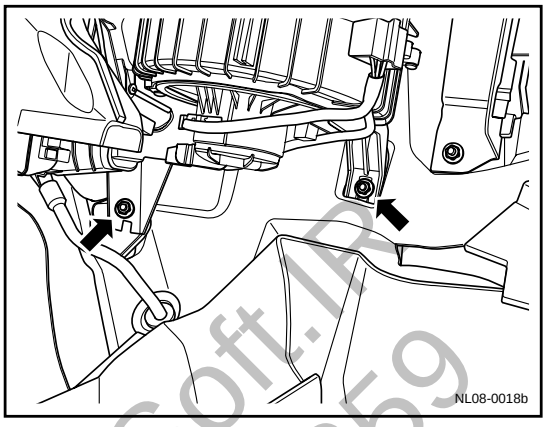
3. Install 2 fixing nuts on the upper section of main host of A/C and tighten them.

Torque: 7 Nm (Metric) 5.2 lb-ft (English system)



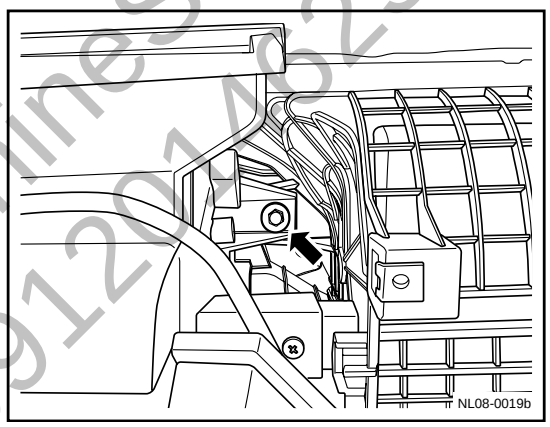
4. Install 2 fixing bolts under the main host of A/C and tighten them.

Torque:7 Nm (Metric) 5.2 lb-ft (English system)



5. Install and tighten 1 fixing bolt in the middle of the A/C main unit.

Torque:7 Nm (Metric) 5.2 lb-ft (English system)



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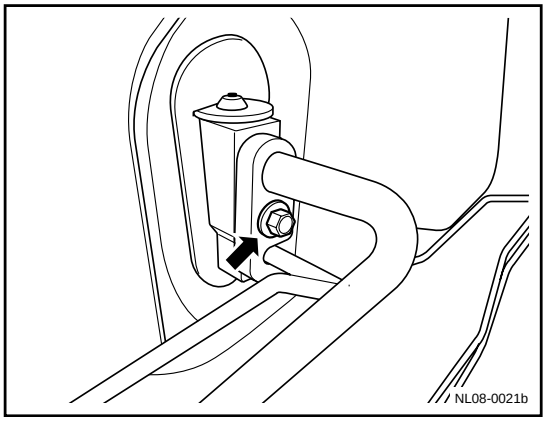
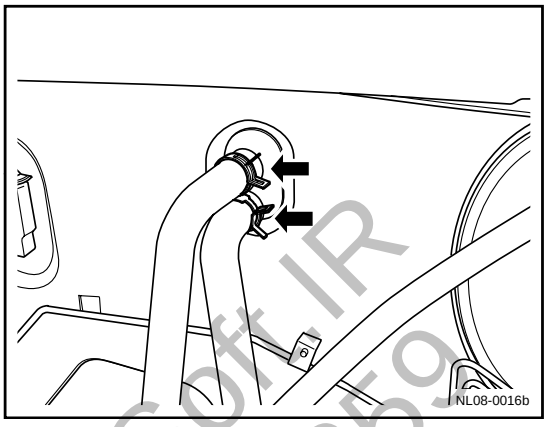
6. Install the instrument desk cross member
7. Install the instrument panel.
8. Connect the A/C pipe on the expansion valve's side and secure with a fixing bolt.

Notes:

The O-ring related in the process of installation must be replaced by a new one.



9. Install air wind water pipe.and fixed it by hoop.
10. Fill engine coolant.
11. A/C refrigerant filling procedures
12. Connect the battery negative cable.



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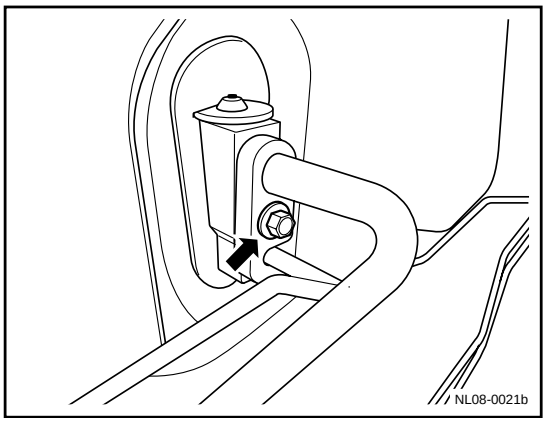
8.3.8.5 Expansion valve replacement

Dismantle procedure

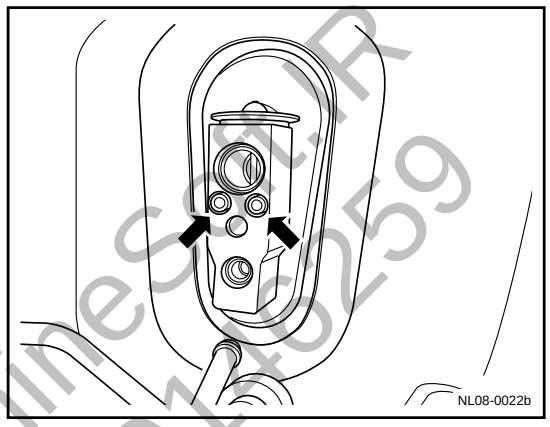
Warning!

1.1.1.1 "Warning related to absorption of R-134a" stated in warning and caution.

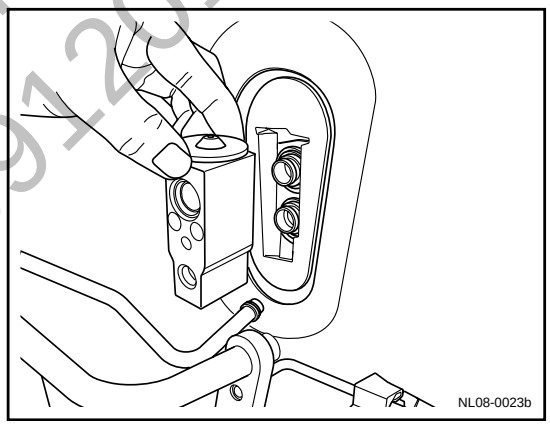
1. For operation of recycling procedures of A/C refrigerant, refer to 8.2.7.12 Recycling and filling of A/C refrigerant.
2. Dismantle fixing bolt of A/C pipe on expansion valve side, and disconnect A/C pipe.



3. Dismantle 2 hexagonal bolts used for fixing expansion valve.



4. Dismantle expansion valve.



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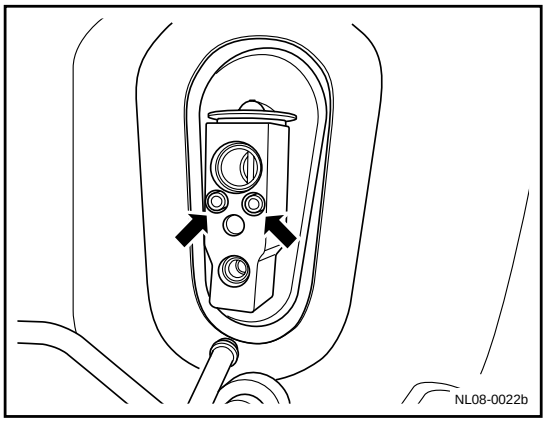
Installation Procedure:

1. Install expansion valve and tighten it with hexagonal bolt.

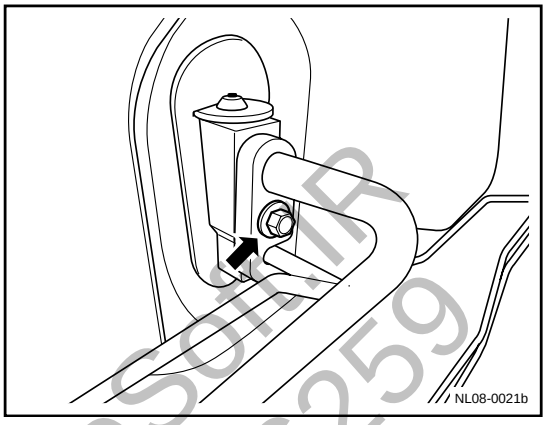


2. Connect expansion valve side A/C pipe and tighten it with bolt.

Notes:

The O-ring related in the process of installation must be replaced by a new one.

3. Operate recycling programs of A/C refrigerant.



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8.3.8.6 Compressor replacement

Dismantle procedure

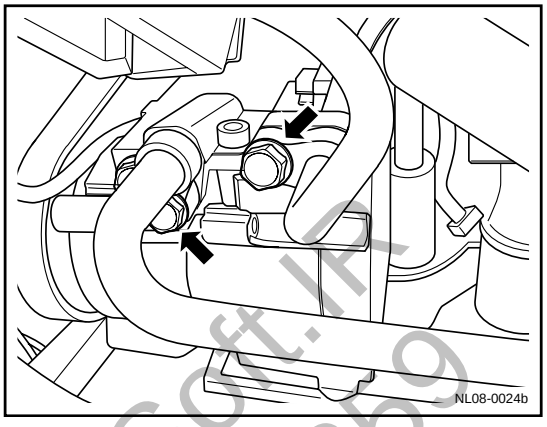
Warning!

See "warnings for Intake of R-134a" in 1.1.1.1 warning and precaution.

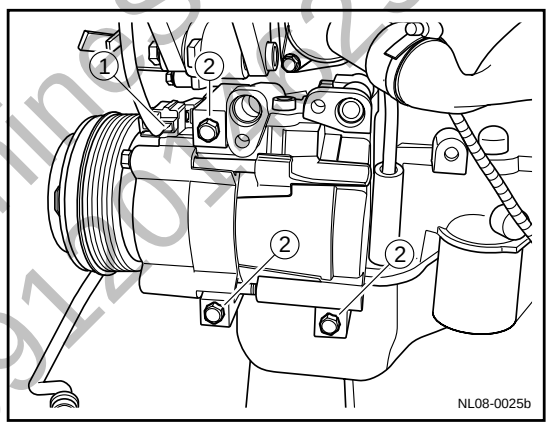
Warning!

Warning: Refer to "warning for battery disconnection" in "warnings and precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For operation of recycling procedures of A/C refrigerant, refer to 8.2.7.12 recycling and filling of A/C refrigerant.
3. Dismantle the drive belt; refer to 2.6.8.3 replacement of drive belt.
4. Dismantle high and low pressure A/C pipe joint on compressor.



5. Disconnect harness connector 1 of the compressor.
6. Dismantle 3 fixing bolts 2 for the compressor and remove the compressor.



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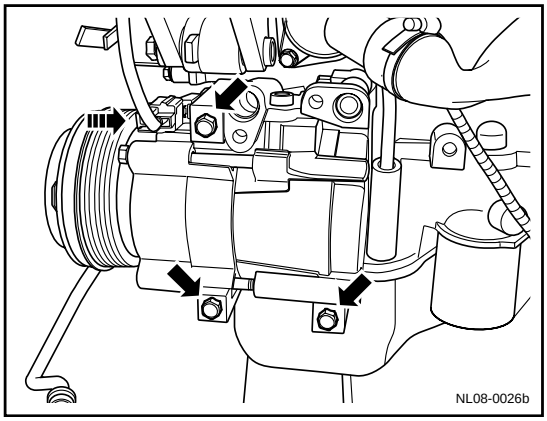
09120-12259

Installation procedure:

1. Install compresserand fasten it by bolt.

Torque: 20 Nm (Metric) 14.8 lb-ft (English system)

2. Connect compressor harnesses connector.



3. Install high /lower pressure A/C pipe joint on the compressor.

Torque : 18Nm(Metric) 13.3lb-ft(English system)

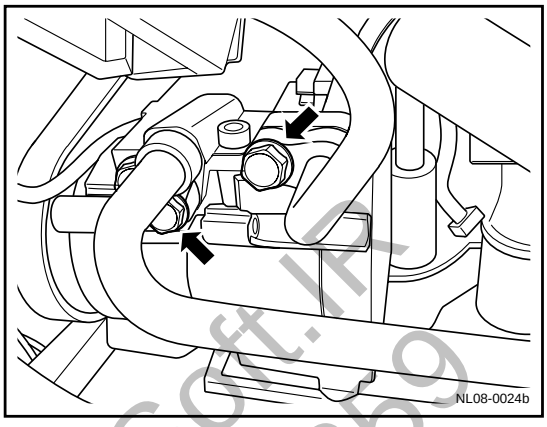
Notes:

The O-ring related in the process of installation must be replaced by a new one.

4. For installation of drive belt, refer to 2.6.8.3 Replacement of drive belt.

5. A/C Refrigerant Filling Procedures

6. Connect the negative cable of the battery.



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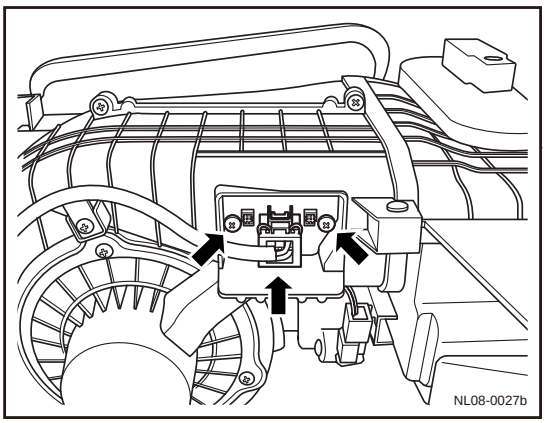
8.3.8.7 Blower speed regulation module replacement

Dismantle procedure

Warning!

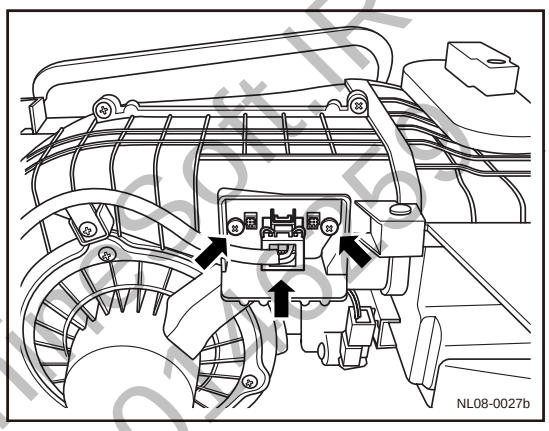
Warning: refer to "warning for battery disconnection" in "warnings and precautions".

1. Disconnect the battery negative cable. refer to 2.11.8.1 Battery cable disconnection/connection procedures.
2. For dismantling of main host of A/C, refer to 8.3.8.4 replacement of A/C main host assembly.
3. Disconnect blower speed regulation module harness connector.
4. Dismantle fixing screw of blower motor speed adjusting module.



Installation Procedure:

1. Install blower adjusting module fixing screw.
2. Connect blower speed adjusting module harnesses connector.
3. Install main host of A/C.
4. Connect the negative cable of the battery.



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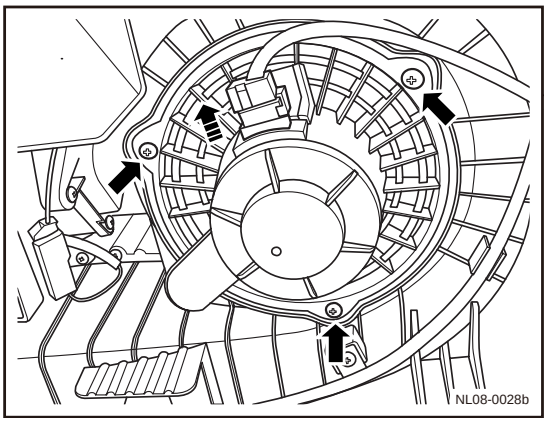
8.3.8.8 Blower motor replacement

Dismantle procedure

Warning!

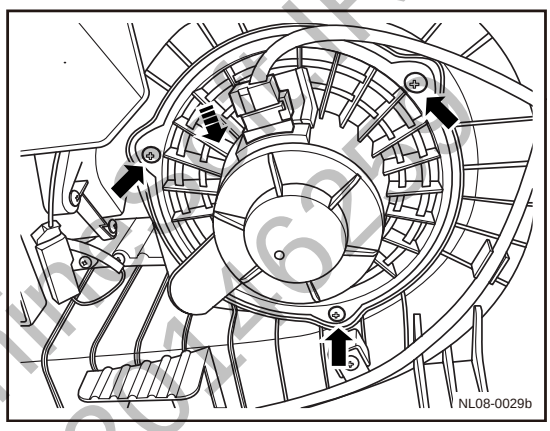
Warning: Refer to "Warning for battery disconnection" in "warnings and precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of main host of A/C, refer to 8.3.8.4 Replacement of A/C main host assembly.
3. Disconnect blower motor harnesses connector.
4. Dismantle 3 fixing screws of blower motor, and remove blower motor.



Installation procedure:

1. Install blower motor and tighten fixing screw.
2. Connect the harness connector of the blower motor.
3. Install main host of A/C.
4. Connect the battery negative cable.



Machine TR
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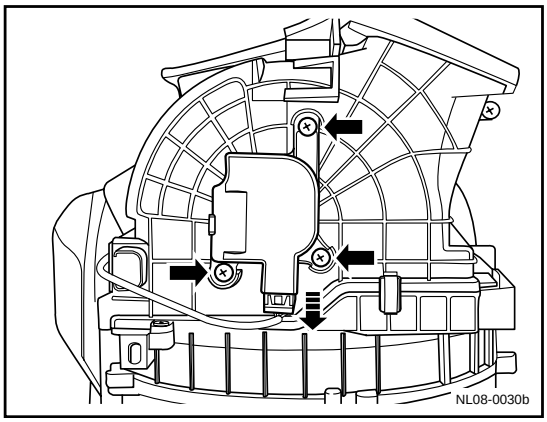
8.3.8.9 Inside and outside circulation adjusting motor replacement

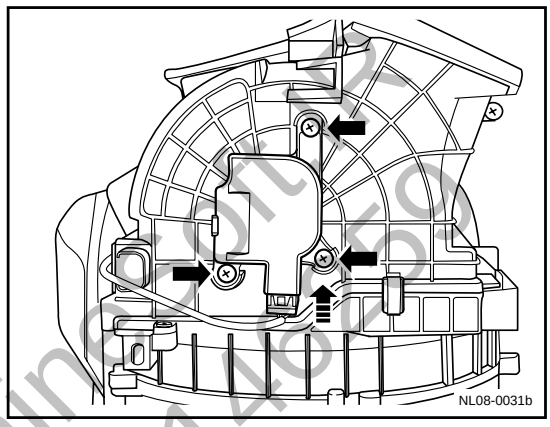
Dismantle procedure

1. For dismantling of main host of A/C, refer to 8.3.8.4 Replacement of A/C main host assembly.
2. Disconnect internal and outside circulation adjusting motor harnesses connector.
3. Dismantle 3 fixing screws of interior and exterior circulation adjusting motor.
4. Remove the internal and external air circulation regulation motors.



Installation Procedure:

1. Install inner and outside circulation adjusting motor and tighten it with screw.
2. Connect inner and outside circulation adjusting motor harnesses connector.
3. Install main host assembly of A/C.



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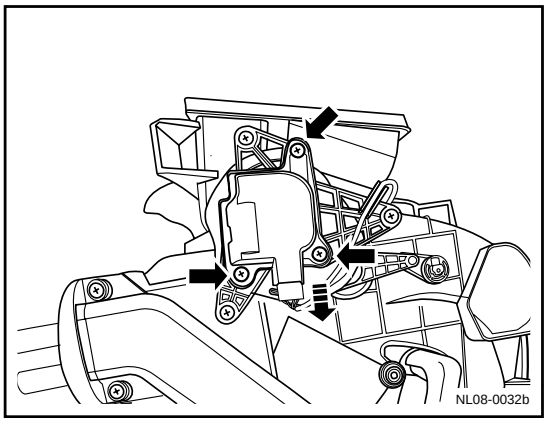
8.3.8.10 Cold-warm wind direction adjusting motor replacement

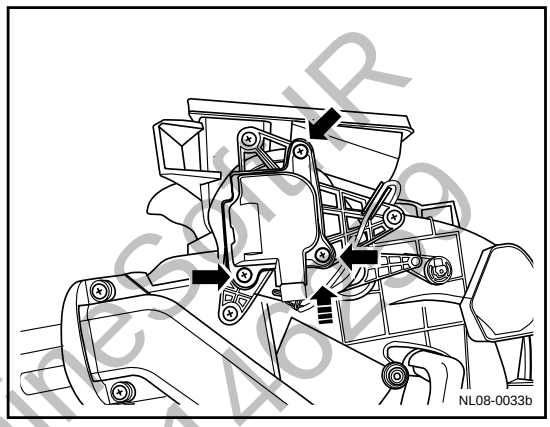
Dismantle procedure

1. For dismantling of main host of A/C, refer to 8.3.8.4 Replacement of A/C main host assembly.
2. Disconnect cold-warm air adjusting motor harnesses connector.
3. Dismantle 3 fixing screws of cold and warm air direction adjusting motor.
4. Dismantle 3 fixing screws of cold and warm air direction adjusting motor.



Installation Procedure:

1. Install cooling and warm air adjusting motor and tighten it with screw.
2. Connect cold and warm air direction adjusting motor harnesses connector.
3. Install A/C main host assembly.



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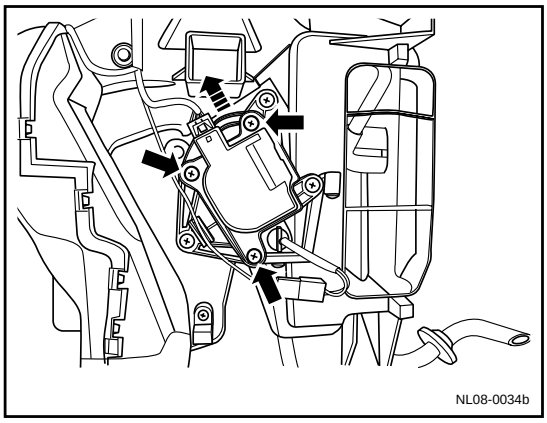
8.3.8.11 Temperature throttle motor replacement

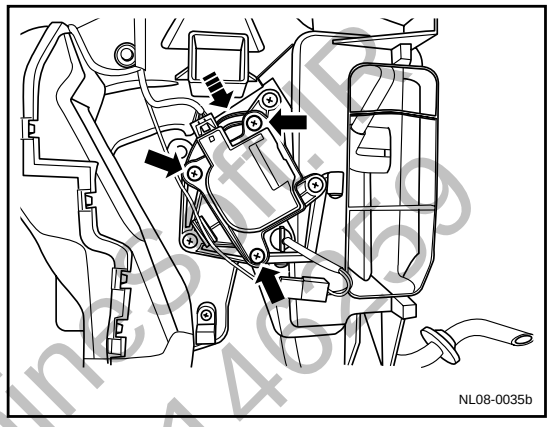
Dismantle procedure

1. For dismantling of main host of A/C, refer to 8.3.8.4 Replacement of A/C main host assembly.
2. Separate evaporator assembly and blower assembly.
3. Disconnect temperature throttle motor harness connector.
4. Dismantle 3 fixing screws of temperature vent motor.
5. Dismantle the temperature damper motor.



Installation Procedure:

1. Install temperature valve motor and fixed by screw
2. Connect temperature vent motor harnesses connector.
3. Assemble evaporation tank assembly and blower assembly.
4. Install main host assembly of A/C.



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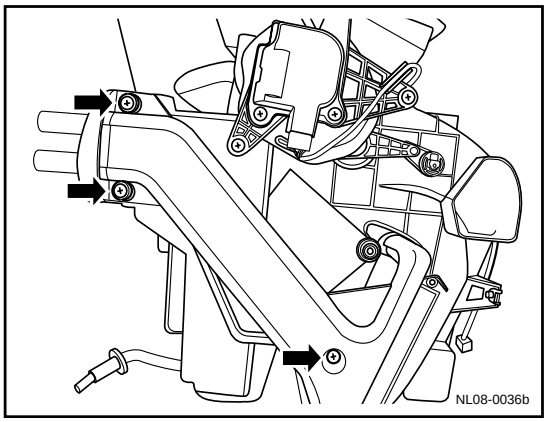
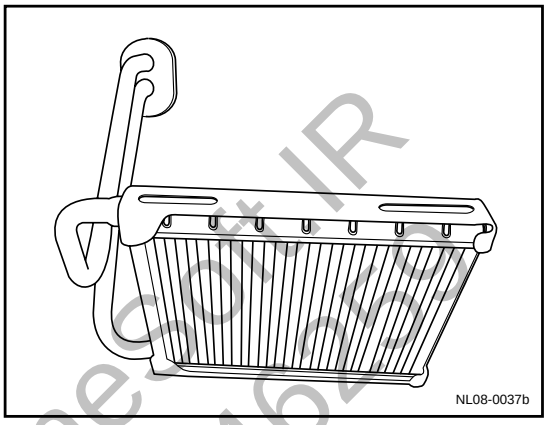
8.3.8.12 Heater core assembly replacement

Dismantle procedure

1. For dismantling of main host of A/C, refer to 8.3.8.4 Replacement of A/C main host assembly.
2. Dismantle protective trimming cover of heater core hard pipe.

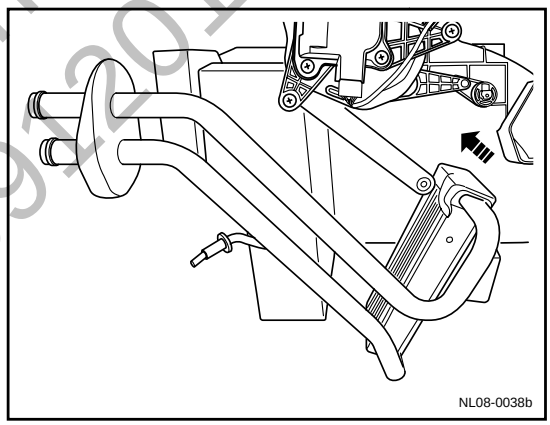


3. Dismantle heater core body assembly.



Installation Procedure:

1. Insert heater core body assembly.



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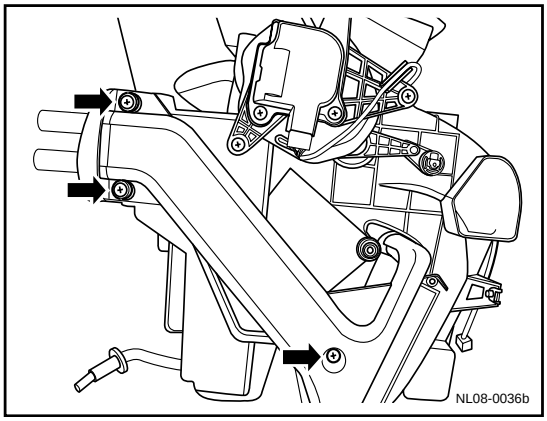
2. Install protective trimming cover of heater core hard pipe and tighten it with screw.
3. Install main host assembly of A/C.



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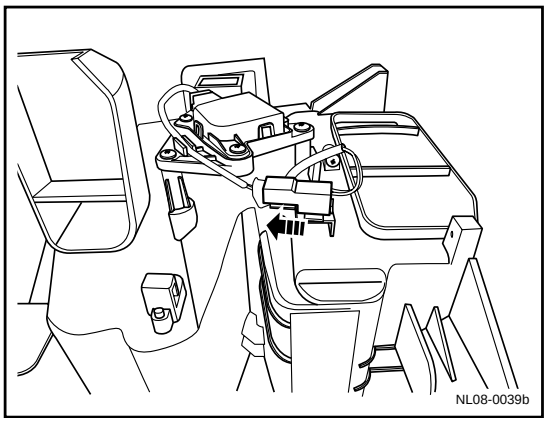
8.3.8.13 Evaporator temperature sensor replacement

Dismantle procedure

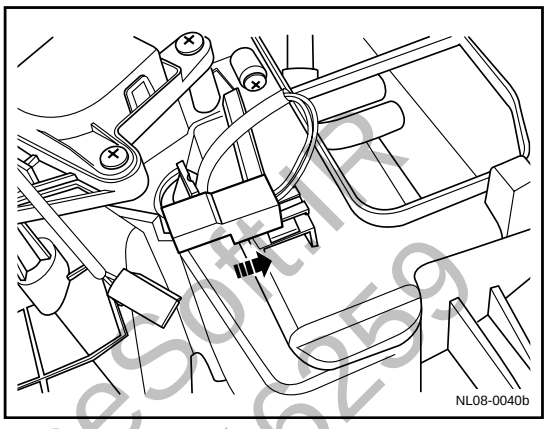
1. For dismantling of main host of A/C, refer to 8.3.8.4 Replacement of A/C main host assembly.
2. Separate evaporator assembly and blower assembly.
3. Disconnect evaporator temperature sensor harness connector.



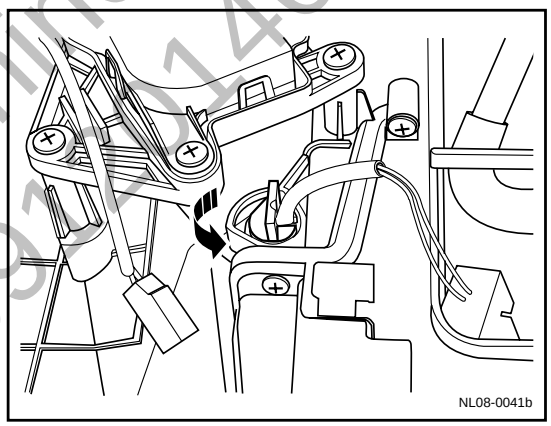
4. Dismantle evaporator temperature sensor connector.

Notes:

Be capable of sliding the sensor together with the fixing clip backward.



5. Rotate the evaporator temperature sensor by a certain angle counterclockwise and then pull out.



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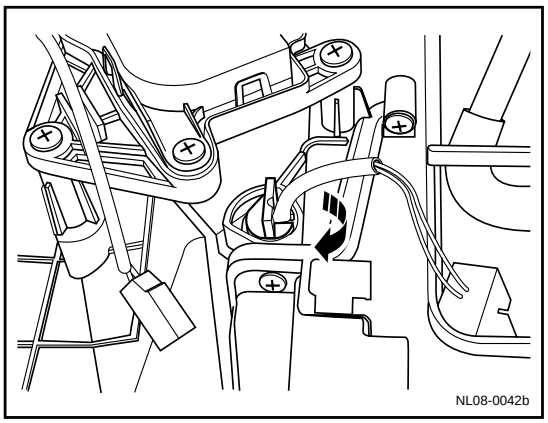
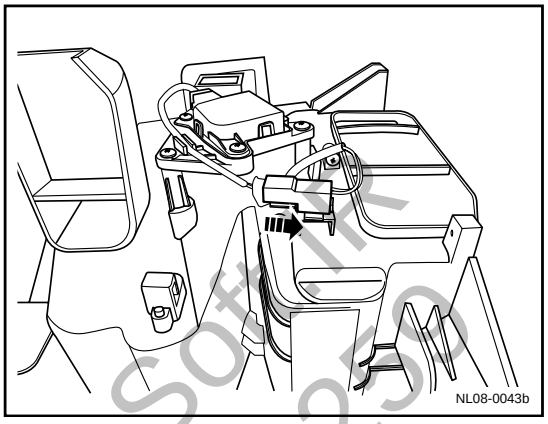
Installation procedure:

1. Install evaporator temperature sensor.
2. Clockwise rotate and install evaporator temperature sensor to specified fixing position.



3. Install and connect evaporator temperature sensor harnesses connector.
4. Assemble the evaporator assembly and blower assembly.
5. Install main host assembly of A/C.



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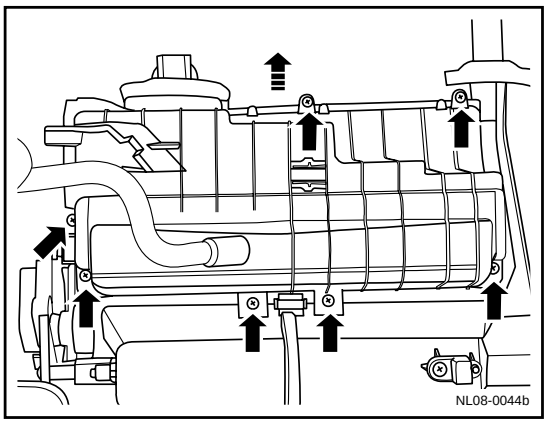
8.3.8.14 Evaporator core assembly replacement

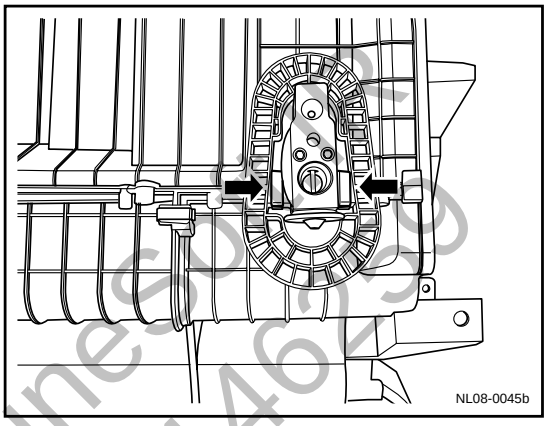
Dismantle procedure

1. For dismantling of main host of A/C, refer to 8.3.8.4 replacement of A/C main host assembly.

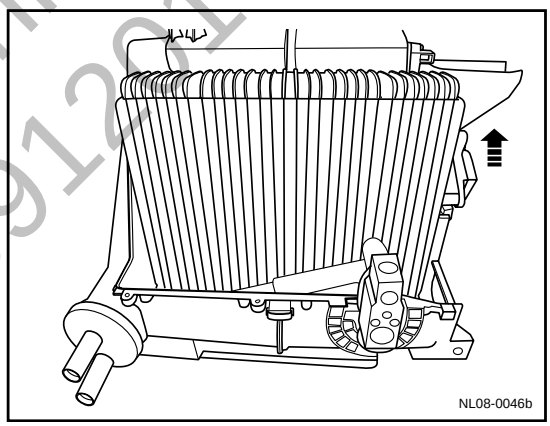
2. Separate evaporator assembly and blower assembly.
3. For dismantling of temperature vent motor, refer to 8.3.8.11 Replacement of temperature vent motor.
4. For dismantling of evaporator temperature sensor, refer to 8.3.8.13 Replacement of evaporator temperature sensor.
5. Remove 7 fixing screws and 1 buckle on the evaporator tank body.
6. Dismantle the expansion valve sealing gasket.



7. Dismantle 2 fixing buckles.



8. Dismantle the trim cover of the evaporator.
9. Dismantle the evaporator core body.



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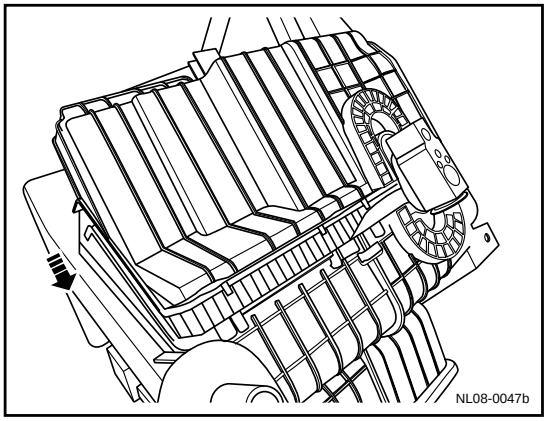
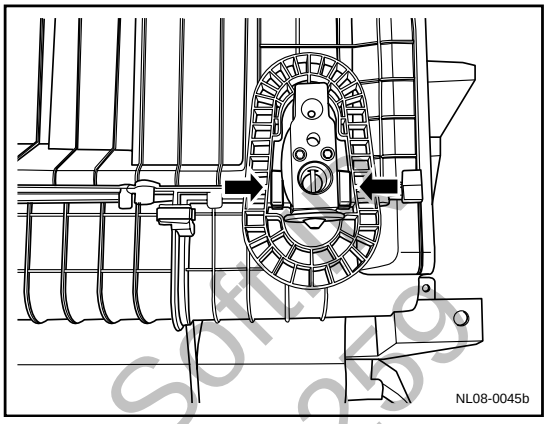
Installation procedure:

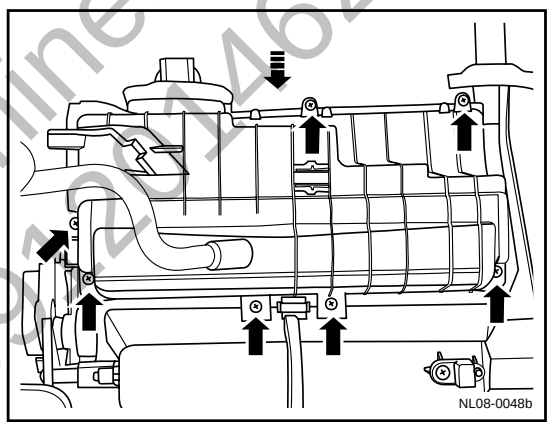
1. Install Evaporator core assembly.
2. Install evaporator housing.



3. Install fixing buckle.



4. Install sealing pad of expansion valve.
5. Install 7 fixing screws and 1 buckle for the evaporator tank body and tighten the fixing screws.
6. Install the temperature damper motor.
7. Install the evaporator temperature sensor.
8. Assemble the evaporator assembly and blower assembly.
9. Install main host assembly of A/C.



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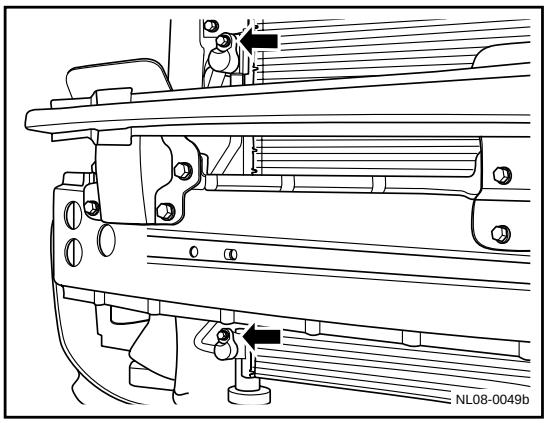
8.3.8.15 Condenser replacement

Dismantle procedure

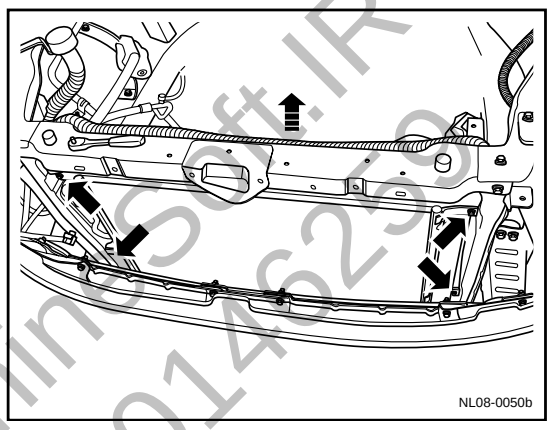
Warning!

See "warnings for intake of R-134a" in 1.1.1.1 warning and precaution.

1. For operation of recycling procedures of A/C refrigerant, refer to 8.3.7.8 recycling and filling of A/C refrigerant.
2. Dismantle front bumper. refer to 12.4.3.1 Replacement of Front Bumper.
3. For dismantling of horn, refer to 11.13.8.1 Replacement of horn.
4. For dismantling of engine cover lock, refer to 12.2.3.2 Replacement of engine cover lock.
5. Remove the upper and lower two rigid pipe connectors on the condenser.



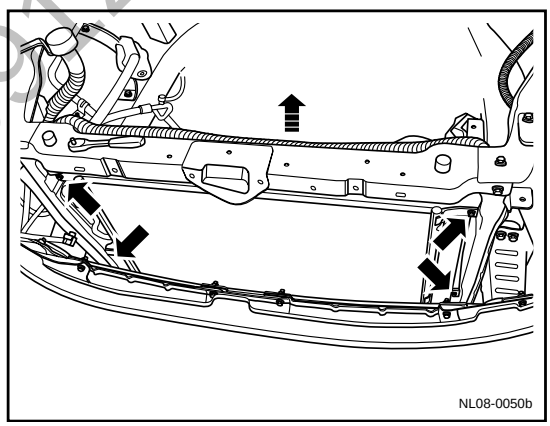
6. Remove 4 condenser fixing bolts.
7. Pull out the condenser upwards.



Installation procedure:

1. Install condenser and tighten it with fixing bolt.

Torque:7 Nm (Metric) 5.2 lb-ft (English system)



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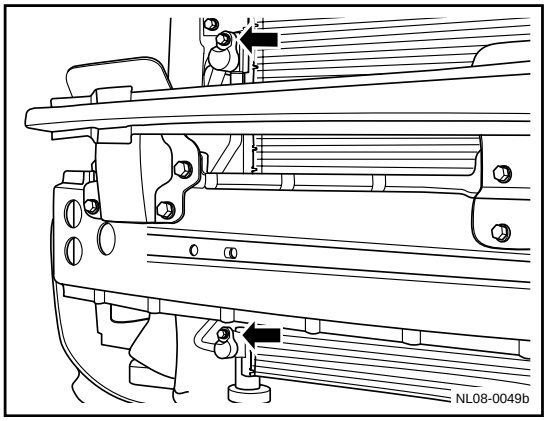
2. Install upper and lower 2 hard pipe connector of condenser and tighten it with bolt.



Notes:

The O-ring related in the process of installation must be replaced by a new one.

3. Install the engine hood latch.
4. Install horn.
5. Install front bumper.
6. A/C refrigerant filling procedures

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8.3.8.16 A/C pipe replacement

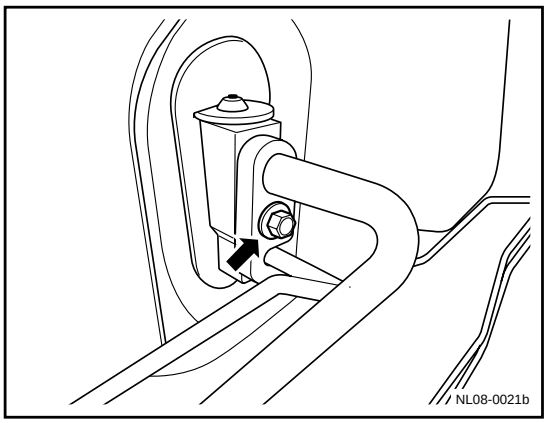
Refrigerant A/C pipe replacement

Dismantle procedure

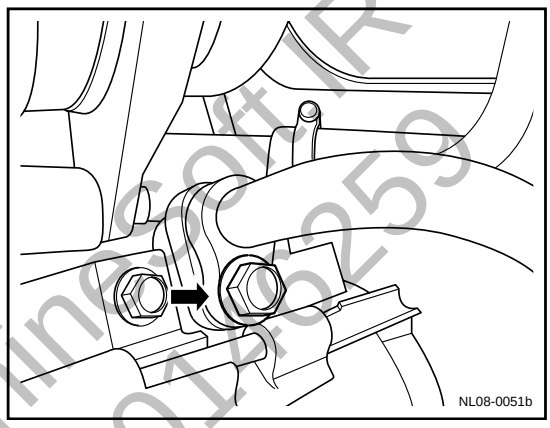
Warning!

See "Warnings for intake of R-134a" in 1.1.1.1 warning and precaution .

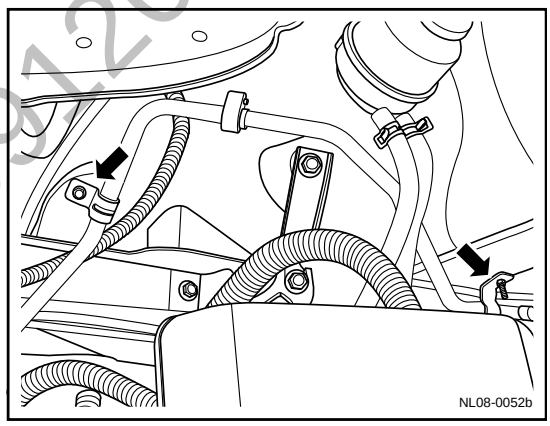
1. For operation of recycling procedures of A/C refrigerant, refer to 8.2.7.12 recycling and filling of A/C refrigerant.
2. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection Procedures.
3. For dismantling of fixing bolt of expansion valve and removing of expansion valve, refer to 8.3.8.5 Replacement of expansion valve.
4. Dismantle front bumper, refer to 12.4.3.1 Replacement of Front Bumper.



5. Remove the A/C pipe rigid connector fixing bolt on the expansion valve side.
6. Remove the fixing bolt for the A/C low pressure pipe rigid connector on the compressor side.



7. Dismantle 2 brackets for the A/C low pressure pipe from the evaporator to the compressor.
8. Dismantle the A/C low pressure pipe from the evaporator to the compressor.



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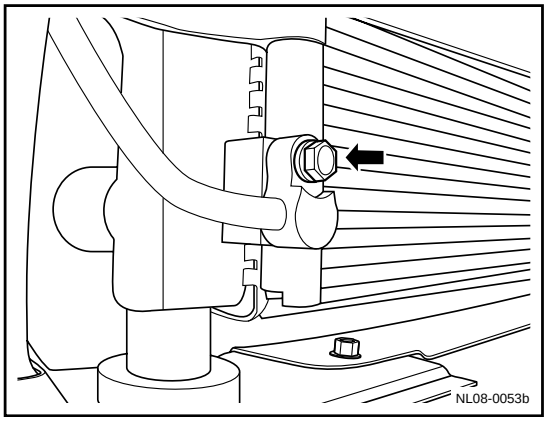
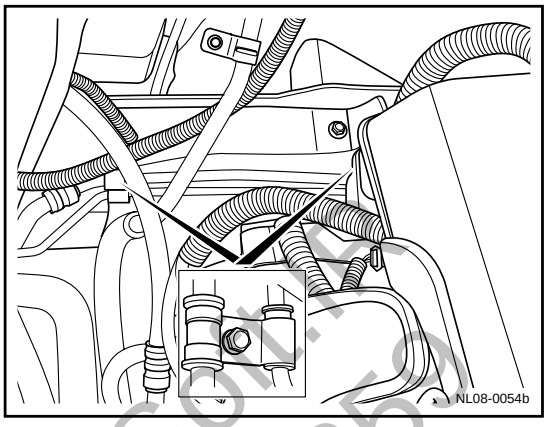
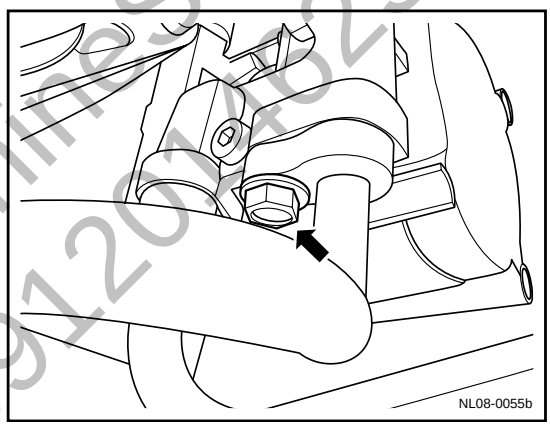
9. Dismantle the lower A/C high pressure pipe rigid connector on the condenser side.



10. For dismantling of A/C pressure switch, refer to 8.3.8.2 Replacement of A/C pressure switch.
11. Dismantle 2 supports from condenser to A/C high pressure pipe of evaporator
12. Dismantle high pressure from condenser to evaporator



13. Dismantle high-pressure pipe hard joint from compressor side to condenser A/C.



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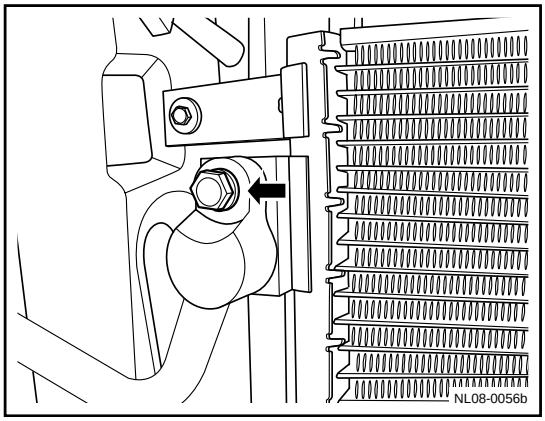
14. Dismantle A/C high-pressure pipe joint on the top of condenser.
15. Dismantle A/C high-pressure pipe between compressor and condenser.



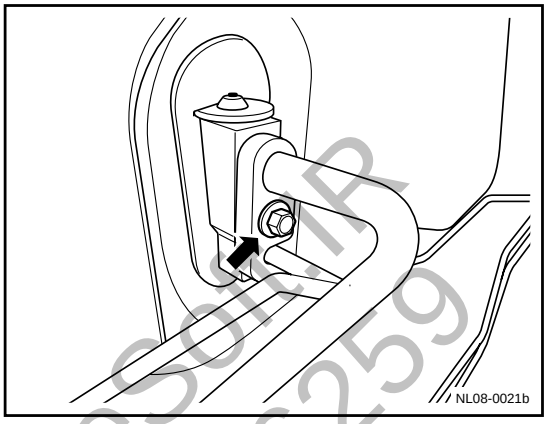
Installation Procedure:

Notes:

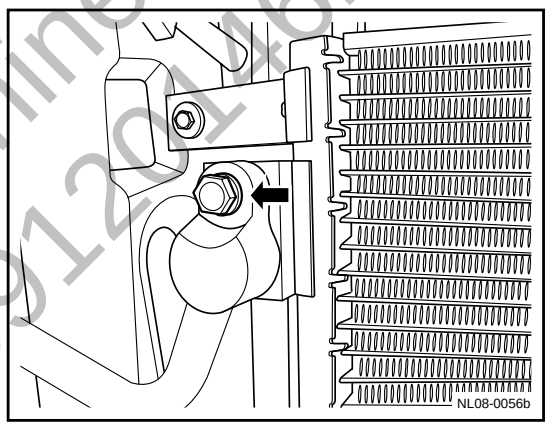
The O-ring related in the process of installation must be replaced by a new one. During installation of A/C pipe, first insert thoroughly the pipe joint and then tighten the bolt.

O-ring and pipeline joint are damaged.

1. Install A/C pipe and tighten A/C fixing bracket.
2. Tighten fixing bolt on expansion valve side.



3. Install high-pressure pipe hard joint bolt on the upper section of condenser and tighten it.



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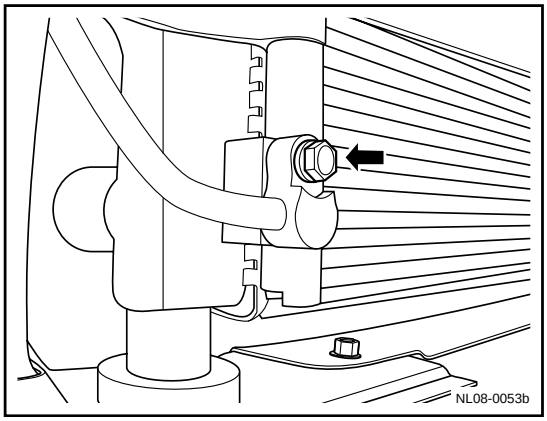
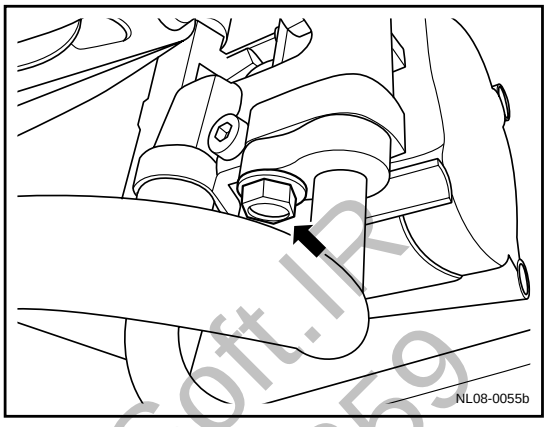
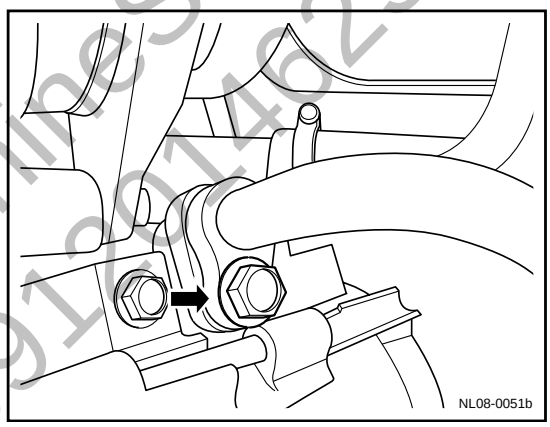
4. Install high-pressure pipe hard joint bolt under condenser and tighten it.



5. Install and tighten the bolt between the hard connector of the high pressure pipe from the compressor to the condenser.



6. Install and tighten the A/C low pressure pipe rigid connector bolt on the compressor's side.
7. Install the A/C pressure switch.
8. Assemble expansion valve
9. Install front bumper.
10. Operate filling procedures of A/C refrigerant.
11. Connect the battery negative cable.



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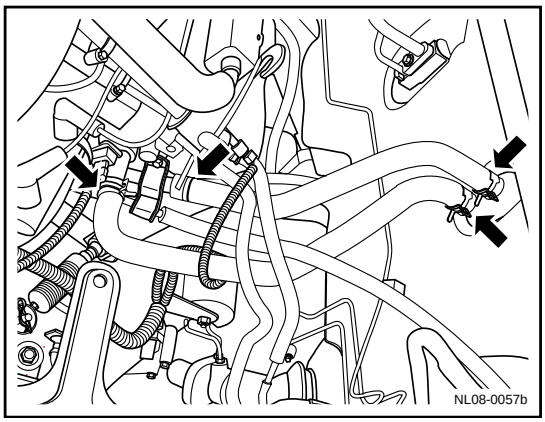
Replacement of Heater Pipe

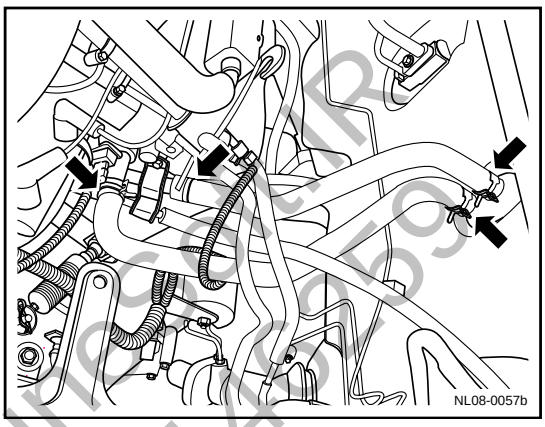
Dismantle procedure

1. Drain engine coolant.
2. Loosen fixing snap ring of warm air water pipe.
3. Dismantle warm air water pipe.



Installation procedure:

1. Install heat air water pipe.
2. Tighten fixing snap ring of warm air water pipe.
3. Fill engine coolant.



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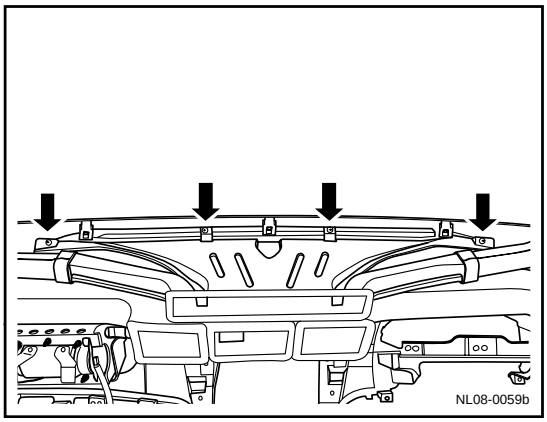
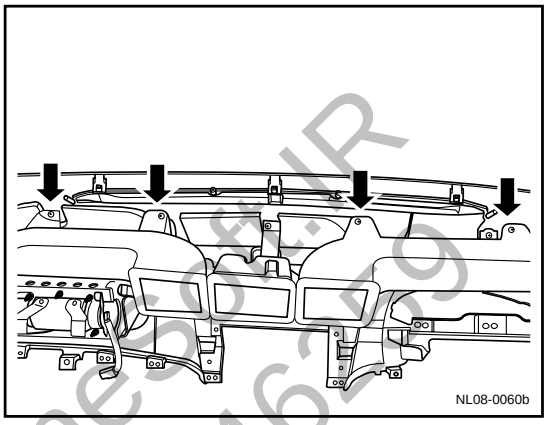
8.3.8.17 A/C venting pipe replacement

Dismantle procedure

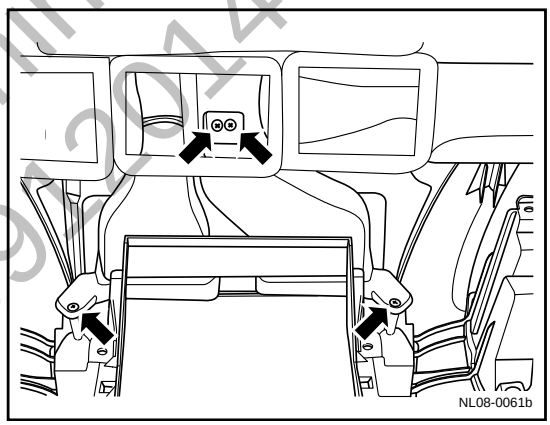
1. For dismantling of upper cover of instrument table, refer to 12.8.3.1 Replacement of instrument panel.
2. Dismantle left and right inner bracket of vent pipe and defrosting pipe.
3. Dismantle 4 fixing screws of defrosting pipe.
4. Dismantle defrosting pipe.



5. Remove 4 fixing screws for the ventilation pipe.



6. Remove the 4 fixing screws inside and at the bottom of the ventilation pipe.



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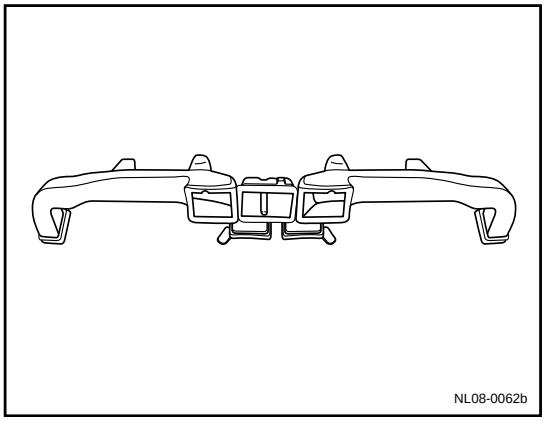
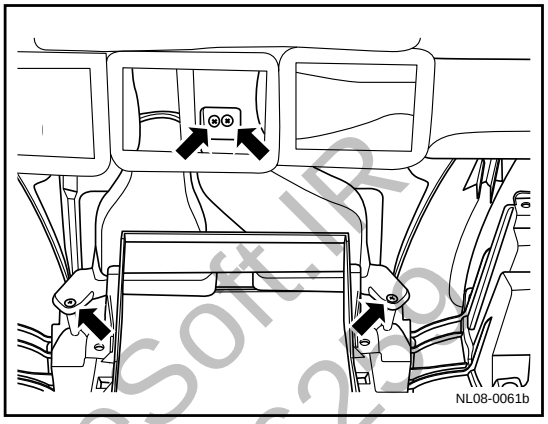
7. Dismantle the A/C ventilation pipe.

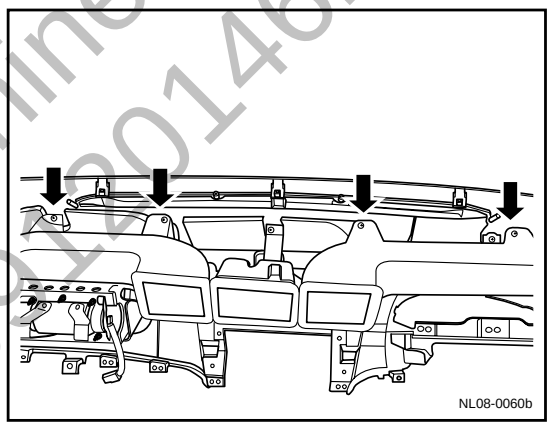


Installation procedure:

1. Install A/C vent pipe.
2. Install 4 fixing screws respectively in vent pipe and lower section.



3. Install 4 fixing screws of vent pipe and tighten them.



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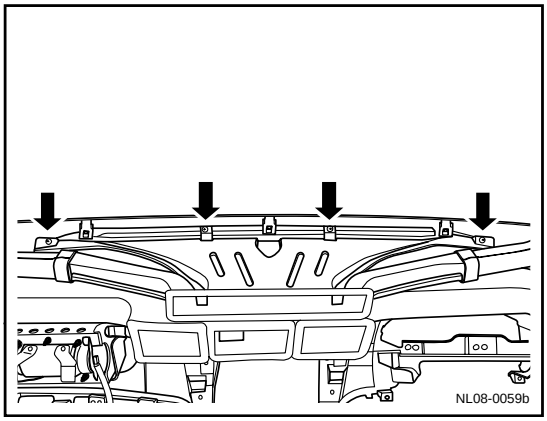
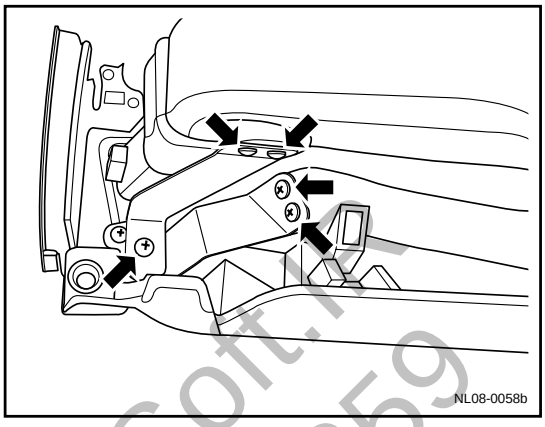
4. Install defrosting pipe.
5. Install and tighten 4 fixing bolts for the defrosting pipe.



6. Install the left and right internal brackets for the ventilation pipe and defrosting pipe and secure with screws.
7. Install upper cover of instrument desk.



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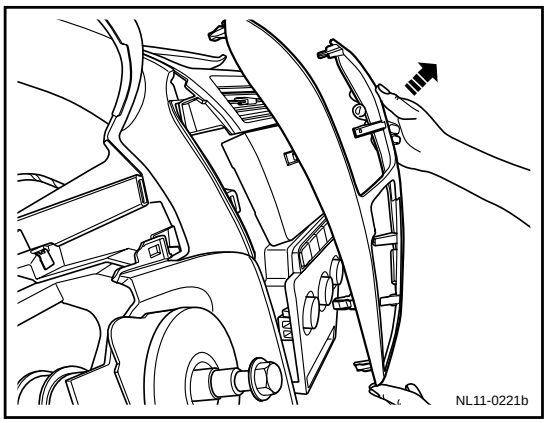
8.3.8.18 Instrument panel outlet replacement

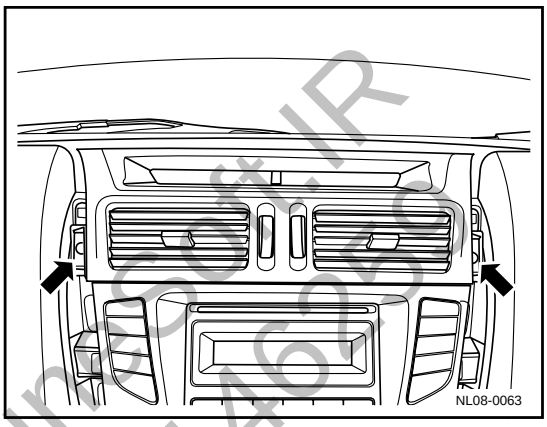
Replacement of middle air outlet

Dismantle procedure

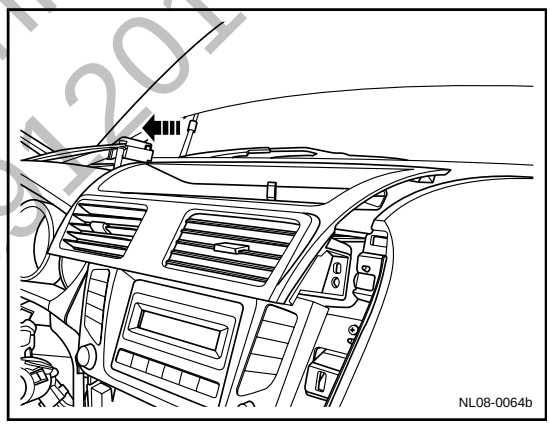
1. Dismantle central control panel trimming cover.



2. Dismantle fixing screw of middle vent port.



3. Dismantle middle air outlet.



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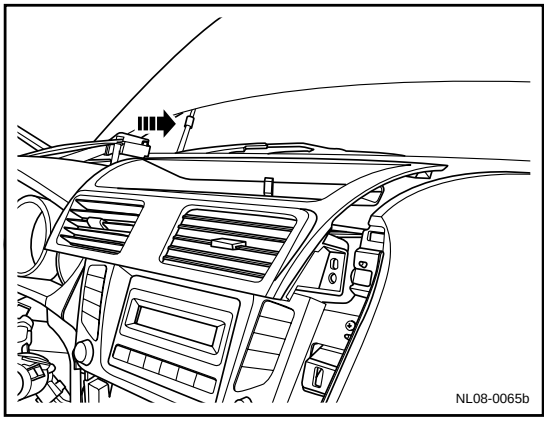
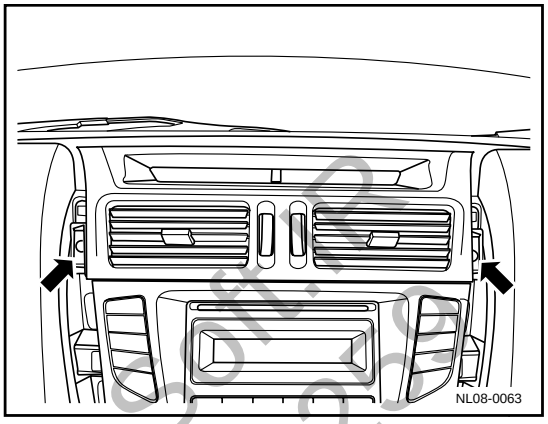
Installation procedure:

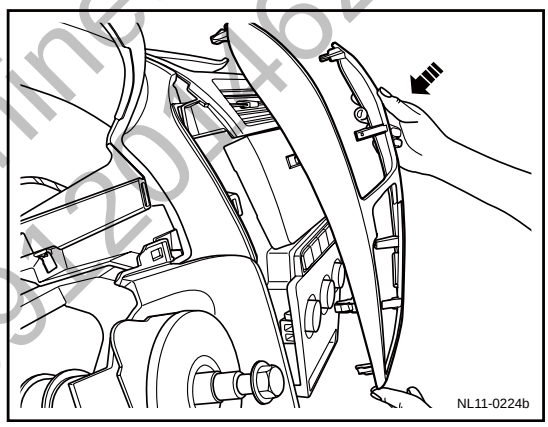
1. Install air intermediate inlet



2. Install intermediate outlet screw and tighten.



3. Install trim cover of center control panel.



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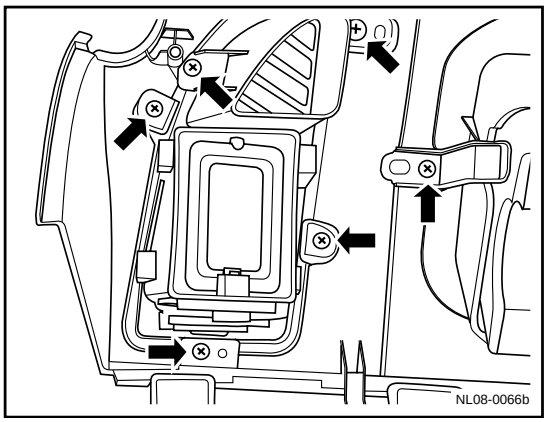
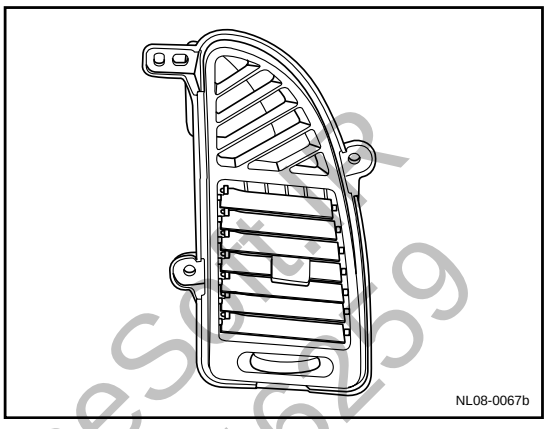
Replacement of side air outlet.

Dismantle procedure

1. For dismantling of A/C vent pipe and defrosting pipe, refer to 8.3.8.17 Replacement of A/C vent pipe.



2. Dismantle fixing bolt of left and right vent port of instrument table.
3. Dismantle side vent port.

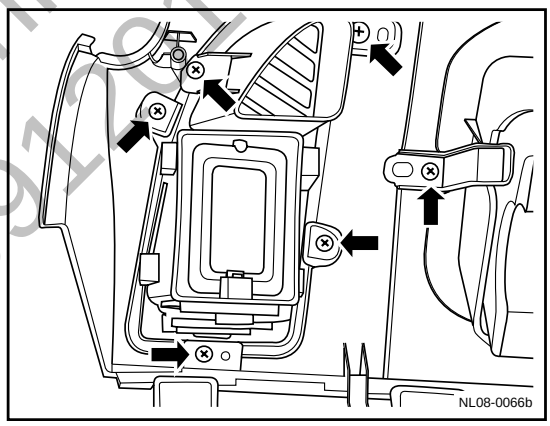


Installation procedure:

1. Install side air outlet.

Notes:

1. The dismantling method of the air outlets at the left and right of the instrument panel is the same.
2. Install fixing screw on side vent port and tighten it.
3. Install vent pipe and defrosting pipe of A/C.



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9 Safety Protection Device

9.1 Warning and precaution

9.1.1 Warning and precaution

Airbag System Warning

Warning: This vehicle is equipped with airbag system. Failure to follow the correct procedures will lead to the following conditions:

- Airbag is opened accidentally
- The system does not work when needing the airbag to protect

Warning: Strictly abide by the following criteria in order to avoid the above situation:

- Refer to view of the airbag system components to determine whether you are doing the maintenance on the airbag system components, surrounding components or the circuits.
- If you are doing the repair on the airbag system components, surrounding components or the circuits, remove the airbag system. Refer to "Warning on Battery Negative Cable Disconnection" in "Warnings and Precautions".

Warning on High Temperature of Deployed Airbag Module

Warning: After being deployed, the metal surfaces of the airbag system component may be very hot. To help avoid a fire or personal injury:

- Allow sufficient time for cooling before touching any metal surface of the airbag system component.
- Do not place the deployed airbag system component near any flammable objects.

Warning for airbag system clock spring

Warning: Improper installation of the clock spring assembly may damage the spiral coil inside the clock spring. This may result in a malfunction of the coil which may make the airbag module do not work normally and cause personal injury.

Safety System Module Disposal Warning

Warning: In order to prevent accidental deployment of the safety system and avoid the risk of personal injury, do not dispose of an unexpanded airbag module as normal shop waste. Unexpanded airbag modules contain substances that could cause severe illness or personal injury if their sealed containers are damaged during disposal. Use the following deployment procedures to safely dispose of an unexpanded airbag module.

Warning for the Handling and Storage of Airbag System Inflating Module

Warning: When carrying an unexpanded airbag module:

- not carry the airbag module by the wires or connector.
- Make sure the air bag opening do not point towards you and others.

Warning: when storing unexpanded airbag module, ensure the opening does not face the surface on which it will be placed. Do not point the airbag opening to the ground. Do not place any items onto the airbag module. Provide free space for the airbag to expand in case of an accidental deployment. Do not have the unexpanded airbag module soaked in water or come into contact with other liquids. Do not place the unexpanded airbag module near the fire source or a high-temperature area. Prevent personal injury caused by accidental airbag deployment.

Warning on Handling Airbag System Collision Sensor

Warning: Do not hit or shake airbag system collision sensors. Before supplying power to the collision sensors, ensure the collision sensors are firmly tightened. Failure to follow the correct procedures may cause airbag accidental deployment or inoperative, resulting in personal injury.

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9.2 Airbag System

9.2.1 Specifications

9.2.1.1 Fastener specifications

Fastener Name	Model	Specification	
		Metric (N.m)	English system (lb-ft)
Fasten the Beams of Passenger Airbag and Instruments	M8×16	22-26	16-19
Fasten Passenger Airbag and Instrument Panel	ST4 . 8×16	4-6	3-4
Fasten Driver Knee Airbag	M6×16	7-9	5-7
Fasten Driver Knee Airbag	ST4 . 8×16	4-6	3-4
Fasten Side Guard Curtain Airbag	M6×16	7-9	5-7
Fix side collision sensor	M6×25	8-10	6-8
Fix Front Collision Sensor	M6×25	8-10	6-8
Fasten Airbag Control Module	M6×20	4-6	3-4

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9.2.2 Description and operation

9.2.2.1 Description and operation

Important precaution: Airbag system cannot be a substitute for safety belt function. Serious injury may occur during airbag explosion. Geely Automobile reminds you to fasten the safety belt when driving or sitting in the car. Only if you fasten the safety belt, the airbag system can offer better auxiliary protection to passengers.

Airbag System Description

Airbag system consists of the following components:

- Airbag Warning Lamp
- Combination Instrument Assembly
- Airbag Control Module (SRS)
- Front Collision Sensor (Left / Right)
- Side Collision Sensor
- Rear collision sensor (left/right)
- Passenger Inspection Sensor
- Driver side airbag
- Passenger Side Airbag
- Driver Side Seatbelt Preloader
- Passenger Side Seatbelt Preloader
- Driver Curtain Airbag
- Passenger Curtain Airbag
- Front row left/right airbag
- Driver Knee Airbag
- Clock Spring
- Airbag System Harness
- Steering Wheel and Steering Column

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Beside Seatbelts, airbag system provides additional protection to passengers and it is a passive safety system. Airbag system includes multiple inflatable protection modules, distributed in different locations of vehicles, including steering wheel, instrument units, front seat back, and roof rails. In addition to inflatable protection module, the vehicle can be equipped with seat belt preloader. When a collision occurs, it will fasten seat belt, inflate the module, and increase the distance between passenger and airbag at the same time. Each inflatable module has a detonating circuit controlled by the airbag control module. When the airbag control module detects that the collision impact is large enough, it deploys the airbag. Airbag control module continuously monitors the airbag system electrical components. When a circuit failure is detected, the airbag control module will set a DTC code and turn on airbag warning lamps to inform the driver. The steering column has adopted energy-absorbing design. In the event of frontal impact, it will contract, reducing the risk of driver injury.

Airbag control module receives the sensor signals to determine the severity of the collision. When the signal value is greater than the memory settings, airbag ignition control module will send ignition command to unfold corresponding inflatable airbag system module. When confronted with a large enough collision, front airbags will expand and the preloader will be activated. When confronted with a large enough side collision, side airbags curtain and seat belt preloader will be activated.

When airbag control module confirms the collision signal, it will send "collision unlock doors and stop fuel supply" signal to the bus within 20 ms, a total of 30 cycles (100 ms a cycle, a total of 3 s). When BCM and EMS receive more than three consecutive signals, respectively, unlocking doors and stopping fuel supply will be implemented.

9.2.3 System operating principle

9.2.3.1 System operating Principle

Airbag warning light

Airbag warning lamp is located inside the combination instrument assembly, used to notify the driver about the airbag system failures and examine whether the airbag control module is communicating with the instrument panel. When the ignition key is turned to ON position, airbag control module will carry out the system self-checking. During this process, airbag warning lamp lightens for 6 seconds and goes out for 2 seconds. If any fault occurs to the airbag system, the airbag warning lamp will lighten all the time. If no fault occurs to the airbag system, the airbag warning lamp will lighten for 6 seconds and continue going out after going out for 2 seconds. If any fault occurs to the airbag system, please go to the service station authorized by Geely for maintenance. Before the repair is completed, the airbag warning lamp will not be off.

Airbag Control Module (SRS)

Note: Airbag control module (SRS) has a back up power supply, which can deploy the airbag, even if the battery voltage is lost during a collision. Disconnect the battery negative cable for at least 90s to empty the stored power supply, before carrying out the airbag system maintenance.

Airbag control module is a microprocessor which is the airbag system control center. If any collision occurs to the vehicle, the airbag control module will decide whether the airbag shall be ignited to explode by the signals coming from the sensors. When the airbags are deployed, the airbag control module will record the status of airbag systems, and light the airbag indicator on the combination instrument. After the vehicle starts, airbag control module will continue to monitor the airbag system electrical components and circuits. If any malfunction is detected by the airbag control module, it will store a diagnostic trouble code, and light the airbag warning lamp to inform the driver that a malfunction exists.

Front Collision Sensor

Front collision sensor is used to collect the magnitude of the positive acceleration during the collision, and transmit the acceleration signal to airbag control module to decide whether the airbag should be ignited to explode.

Side Collision Sensor

Side collision sensor is used to collect the magnitude of the side acceleration during the collision, and transmit the acceleration signal to airbag control module to decide whether the airbag should be ignited to explode.

Passenger Recognition Sensor

Passenger recognition sensor is located inside the passenger seat cushion assembly and used to sense whether the passenger seat is occupied by a passenger. It is a variable resistance-type pressure sensor and senses the pressure through the resistance changes. When the passenger seat is occupied by a passenger, the seatbelt warning lamp will be lit to inform the driver to remind the passenger to fasten the seatbelt.

Driver Side Airbag, Passenger Side Airbag

Driver side airbag and passenger side airbag module includes a shell, inflatable airbag, a detonating device and gas generating agent. When the front collision impact force is large enough, the airbag control module will send a command in the form of a strong current not less than 1.2 A to the front circuit to deploy the airbag. When the current flows through the igniter and activates the gas generating agent to rapidly produce large amounts of gas. The gas inflates the airbag. The airbag, once filled with the gas, will deflate through holes in the airbag. Airbag control module harness connector terminal (driver airbag, passenger and airbag deployment circuits) has a short circuit film. When the connector is disconnected, the airbag deployment short circuit will prevent the airbag accidental deployment during the repair.

Driver Seatbelt Preloader, Passenger Seatbelt Preloader

Driver Seat Belt preloader, passenger seat belt preloader r module includes a shell, a detonating device and gas generating agent. The igniter is part of the seat belt preloader deployment return circuit. When the front or side collision impact force of the vehicle is large enough, the airbag control module will send an ignition command (electric current signal), the electric current flow through the igniter to detonate the gas generating agent and rapidly produce a large amount of gas. The gas will make the preloader take in the safety belt rapidly. Airbag control module harness connector terminal (each seat belt preloader r return circuit) has a short film. This short film will short out the preloader return circuit to prevent the seat belt preloader accidental detonation during the

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repair.

Driver Side Airbag, Passenger Side Airbag

Driver side airbag and passenger side airbag are located in the driver seat back and passenger seat backrest respectively. Side airbag modules include airbags, detonating devices and gas generating agent. The igniter is part of the airbag modules deployment circuit. When a side impact force is large enough, side collision sensors will detect the collision and send a signal to the airbag control module. Airbag control module will compare the signal from the side collision sensor with the value in the memory. When the signal exceeds the stored value, the airbag control module commands the side airbag to deploy. When the passenger side collision happens, it requires the driver side airbag, driver curtain airbag are not deployed, while the passenger side airbag, passenger curtain airbag deploy. Airbag control module continuously monitors whether the airbag deployment circuit is faulty. In the event of a fault, it will light the airbag indicator. Airbag control module harness connector (airbag deployment circuit) has a short film. When the connector is disconnected, the airbag deployment short circuit will prevent the airbag accidental deployment during the repair.

Knee Airbag

The knee airbag is an important part of the front collision passenger safety system. Its protection includes the potential collision area on the lower part of the instrument panel. The advantage of active knee protection is to improve the system constraint protection of the passenger thighbone and basin and help to balance the loads of the chest and legs. The knee airbag can help to improve the integral safety of passengers. During the accident, it will deploy together with the front airbag. The two airbags will restrain the passenger in a proper position and let the seat safety belt system work more effectively.

Driver Side Curtain Airbag, Passenger Side Curtain Airbag

Driver side curtain airbag, passenger side curtain airbag are located on the left and right roof rails from the A-pillar extension to the C- pillar. Curtain airbag module includes airbags, a detonating device and gas generating agent. Igniter is part of the curtain airbag deployment circuit. When a side impact force is large enough, side collision sensors will detect the collision and send a signal to the airbag control module. Airbag control module will compare the signal from the side collision sensor with the value in the memory. When the signal exceeds the stored value, the airbag control module commands the curtain airbag to deploy. When the passenger side collision happens, it requires the driver side airbag, driver curtain airbag are not deployed, while the passenger side airbag, passenger curtain airbag deploy. Airbag control module continuously monitors whether the airbag deployment circuit is faulty. In the event of a fault, it will light the airbag indicator. Airbag control module harness connector (curtain airbag deployment circuit) has a short film. When the connector is disconnected, the airbag deployment short circuit will prevent the airbag accidental deployment during the repair.

Clock Spring

Airbag clock spring is located in the steering column below the steering wheel. When the steering wheel rotates, the clock spring maintains continuous electrical contact between the airbag deployment circuit and the driver front airbag. The steering wheel clock spring connector is equipped with a short film which can short the driver front airbag deployment circuit, in order to prevent the airbag accidental deployment during the repair.

Airbag System Harness

The airbag system harness connects the sensor, airbag control module, airbag module and safety belt preloader together by a water-proof connector. When repairing the airbag system harness, please abide by relevant testing and circuit repair procedures in this manual.

Steering Wheel and Steering Column

The steering wheel and steering column have adopted energy- absorbing designs to absorb energy when the driver and the steering wheel come into contact. When a vehicle front collision happens, the driver may be contacted directly with the steering wheel, or the impact will be loaded into the steering wheel and steering column. The steering column will shrink down to absorb some of the collision energy, thereby help to reduce the driver personal injury. After a collision, you must inspect the steering wheel and steering column damage.

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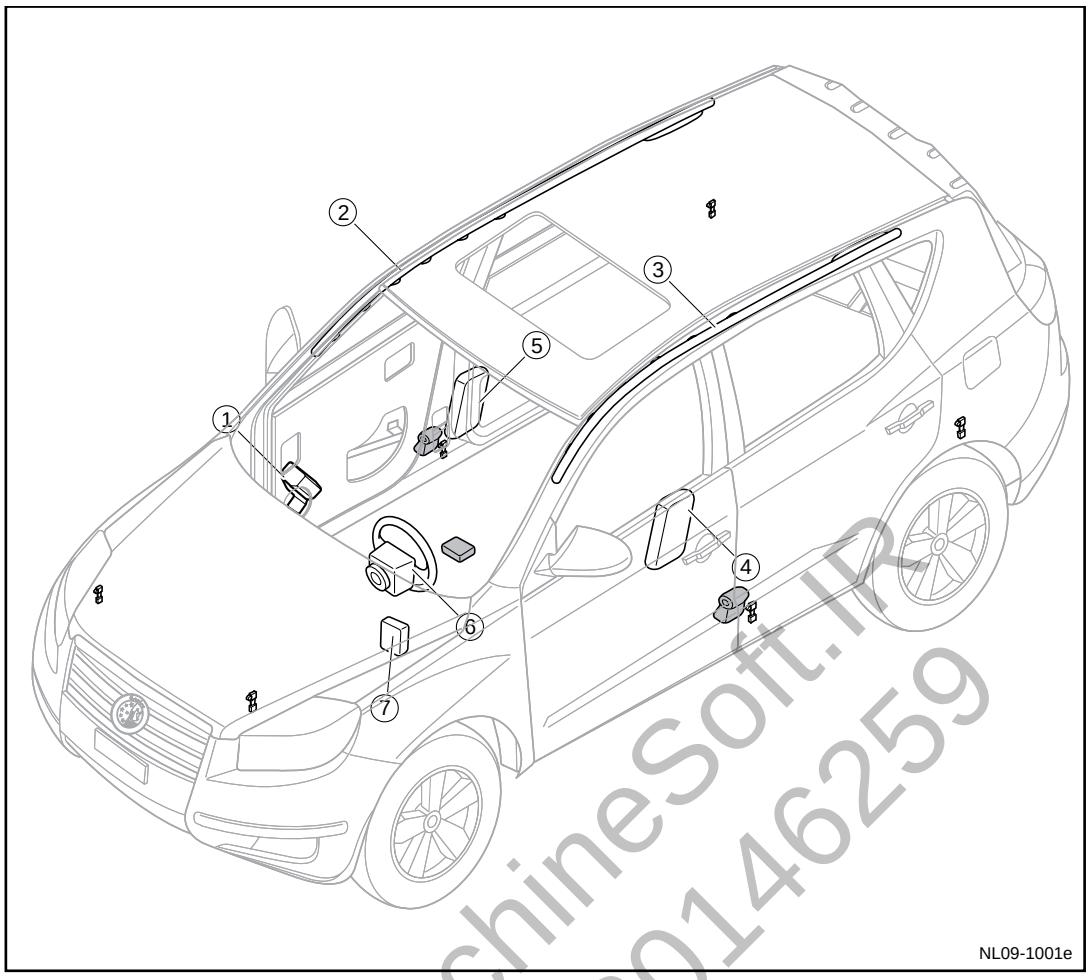
9.2.4 Component Position

9.2.4.1 Component Position



1. Passenger Airbag
2. Passenger Side Curtain Airbag
3. Driver Side Curtain Airbag
4. Driver Side Airbag (Located inside the seat back)
5. Passenger Side Airbag (Located inside the seat back)
6. Driver Airbag and Clock Spring
7. Driver Knee Airbag

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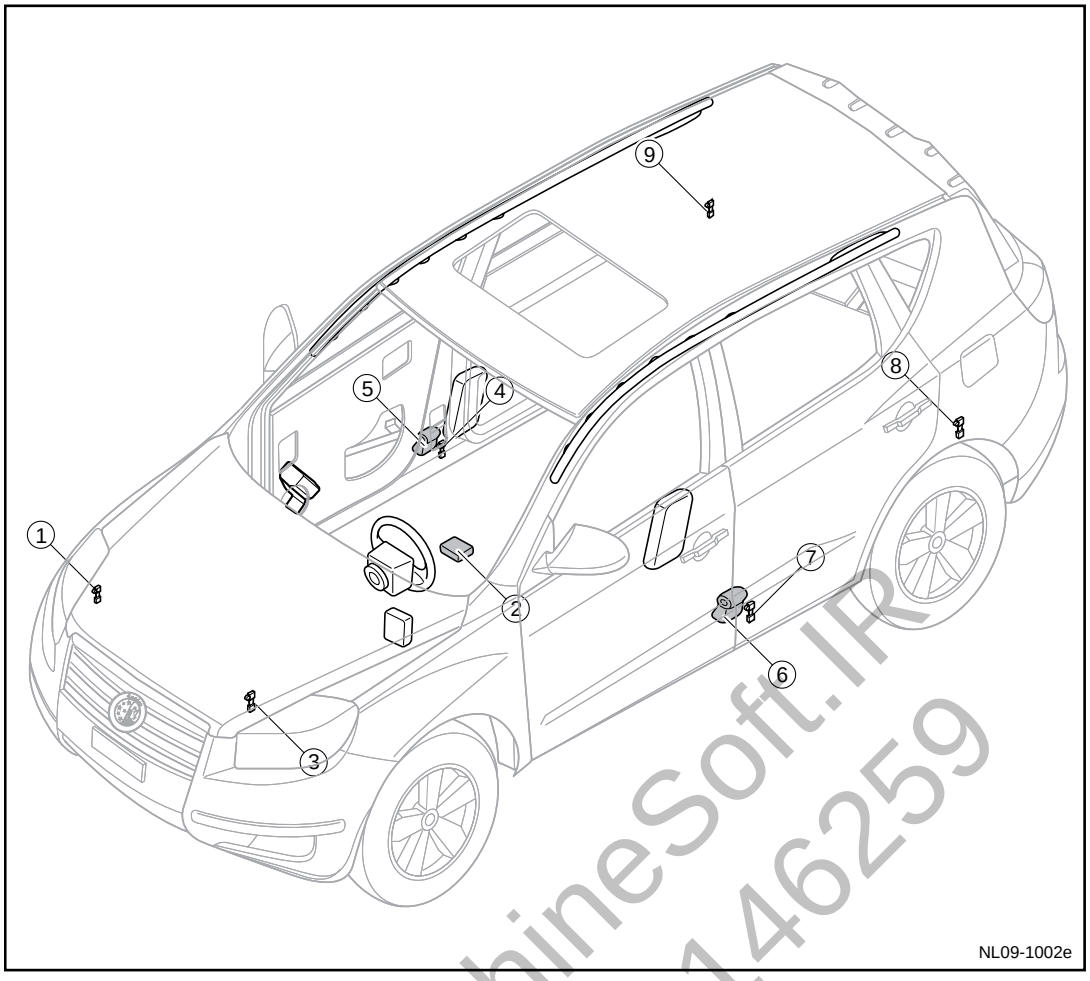

1. Front Collision Sensor (Right)
2. Airbag Control Module (SRS)
3. Front Collision Sensor (Left)
4. Passenger Collision Sensor
5. Passenger Seat Belt Preloader
6. Driver Seat Belt Preloader
7. Driver Side Collision Sensor
8. R.L. Collision Sensor
9. Right rear Collision Sensor

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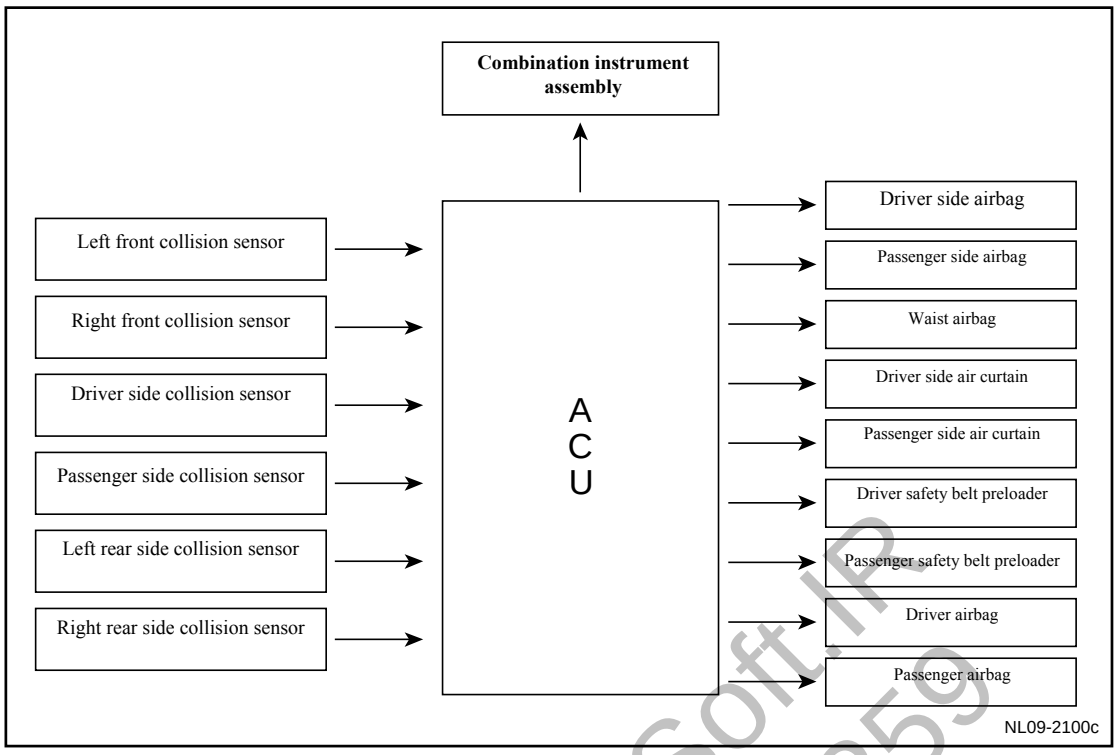
9.2.5 Electrical schematic diagram

9.2.5.1 Electrical schematic diagram



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9.2.6 Diagnostic information and procedures

9.2.6.1 Visual inspection

- Confirm Fault Symptom
- Inspect the easy to access system components to identify whether there is a significant damage or a potential malfunction.
- Connector’s connection and vibration should be thoroughly examined. If possible, for vibrations caused malfunction, it is recommended to use the vibration method.

1. With a finger, gently shook the part that may be faulty and inspect for malfunction.
2. Gently shake the connector vertically and horizontally.
3. Slightly shake wire harness in vertical and horizontal direction.

9.2.6.2 Fault diagnostic code (DTC) table

Diagnostic Trouble Code (DTC)	Failure Type
B101200	ECU Internal Fault
B101300	ECU Overuse
B101400	ECU Collision Records Exist In the Storage
B101800	No Vehicle Identification Code
B109700	System Voltage Too High
B109800	System Voltage Too Low
B101700	Short circuit between ignition circuits
B102100	High Resistance of Driver Airbag Module
B102200	Low Resistance of Driver Airbag Module
B102300	High Resistance of Driver Airbag Module
B102400	Driver Airbag Module Short Circuit over the Voltage
B102900	High Resistance of Driver Seatbelt Preloader
B102A00	Low Resistance of Driver Seatbelt Preloader
B102B00	Driver Seat Belt Preloader Short Circuit to the Ground
B102C00	Driver Seat Belt Preloader Short Circuit to the Voltage
B103100	High Resistance Of Passenger Airbag Module
B103200	Low Resistance Of Passenger Airbag Module
B103300	Passenger Airbag Module Short Circuit Over the Ground
B103400	Passenger Airbag Module Short Circuit Over the Voltage
B103900	High Resistance of Passenger Seat Belt Preloader

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B103A00	Low Resistance Of Passenger Seat Belt Preloader
B103B00	Passenger Seat Belt Preloader Over the Ground
B103C00	Passenger Seatbelt Preloader Short Circuit Over the Voltage
B104100	High Resistance of Driver Airbag Module
B104200	Low Resistance of Driver Airbag Module
B104300	Driver Airbag Module Short Circuit Over the Ground
B104400	Driver Airbag Module Short Circuit Over the Voltage
B104500	High Resistance of Passenger Airbag Module
B104600	Low Resistance of Passenger Airbag Module
B104700	Passenger Airbag Module Short Circuit Over the Ground
B104800	Passenger Airbag Module Short Circuit Over the Voltage
B10A100	High Resistance of Driver Curtain Airbag Module
B10A200	Low Resistance of Driver Curtain Airbag Module
B10A300	Driver Curtain Airbag Module Short Circuit Over the Ground
B10A400	Driver Curtain Airbag Module Short Circuit Over the Voltage
B10A500	High Resistance of Passenger Curtain Airbag Module
B10A600	Low Resistance of Passenger Curtain Airbag Module
B10A700	Passenger Curtain Airbag Module Short Circuit Over the Ground
B10A800	Passenger Curtain Airbag Module Short Circuit Over the Voltage
B10B100	High Resistance of Driver Knee Airbag Module
B10B200	Low Resistance of Driver Knee Airbag Module
B10B300	Driver Knee Airbag Module Short Circuit Over the Ground
B10B400	Driver Knee Airbag Module Short Circuit Over the Voltage
B105100	Driver Front Collision Sensor Short Circuit Over the Ground
B105300	Driver Front Collision Sensor Internal Fault
B105400	Driver Front Collision Sensor Communication Error
B105500	Driver Front Collision Sensor Sampling Error
B106100	Passenger Front Collision Sensor Short Circuit Over the Ground
B106300	Passenger Front Collision Sensor Internal Fault

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B106400	Passenger Front Collision Sensor Communication Error
B106500	Passenger Front Collision Sensor Sampling Error
B107100	Left Column B Side Collision Sensor Short Circuit Over the Ground
B107300	Left Column B Side Collision Sensor Internal Fault
B107400	Left Column B Side Collision Sensor Communication Error
B107500	Left Column B Side Collision Sensor Sampling Error
B108100	Right Column B Side Collision Sensor Short Circuit Over the Ground
B108300	Right Column B Side Collision Sensor Internal Fault
B108400	Right Column B Side Collision Sensor Communication Error
B108500	Right Column B Side Collision Sensor Sampling Error
B10E100	Left Column C Side Collision Sensor Short Circuit Over The Ground
B10E300	Left Column C Side Collision Sensor Internal Fault
B10E400	Left Column C Side Collision Sensor Communication Error
B10E500	Left Column C Side Collision Sensor Sampling Error
B10F100	Right Column C Side Collision Sensor Short Circuit Over the Ground
B10F300	Right Column C Side Collision Sensor Internal Fault
B10F400	Right Column C Side Collision Sensor Communication Error
B10F500	Right Column C Side Collision Sensor Sampling Error
U012187	Communication With ABS-ESP Lose
U012287	Communication With VDC_1 - P-CAN Lose
U014687	Communication With GW Lose
U010087	Communication With EMS Lose
U12201C	ACU Stops Sending Message on P-Can
U12211C	ACU Stops Sending Message on P-Can
U007388	P-CAN Communication Error

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9.2.6.3 Diagnosis Tester Can Not Communicate with Vehicle

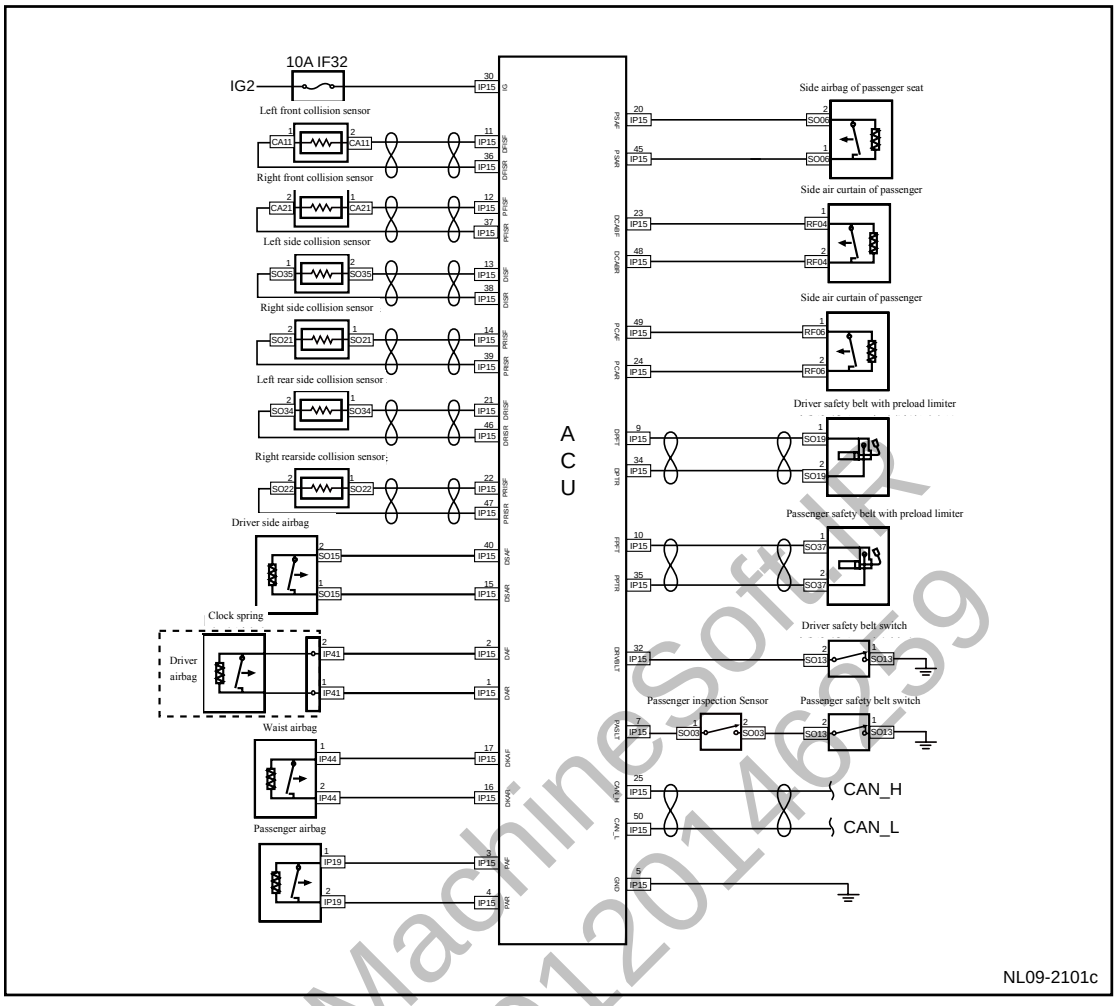
Connect the tester to the data link connector (DTC Data Link Connector) and turn the ignition switch to ON position. Operate diagnostic unit, if the display shows the communication error message, then the vehicle or the tester is faulty.

- If the communication is normal when the tester is connecting with another vehicle, then DLC diagnostic interface. See Relevant Contents In Control System Inspection for the detailed steps.

- If the tester cannot communicate with other vehicles, then the tester may be faulty. Please refer to the tester manual or consult the manufacturer.

9.2.6.4 Airbag Warning Lamp Always On

Circuit diagram:



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Diagnostic Steps:

1	Use tester to access airbag electronic control unit.

A. Check whether DTC is faulty

Yes → Refer to 9.2.6.6 Relevant DTC Code Diagnostic

No

2	Inspect the battery.

A. Turn the ignition switch to "ON" and measure the battery voltage by universal meter

Standard Voltage: 11-14 V

B. Confirm whether the voltage is at a specified Value.

No → Inspect and replace the battery or the charging system. Go to step 9

Yes

3	Inspect airbag electronic control unit and its harness connector.

A. Turn the ignition switch to OFF position.

B. Disconnect the battery negative cable and wait for at least 90s.

C. Inspect whether the connector is properly connected to the airbag electronic control unit.

No → Properly connect the connector. Go to step 9

Yes

4	Check the harness (Airbag Electronic Control Unit - power supply, Ground).

A. Disconnect the battery negative cable, turn the ignition switch to OFF position and wait for 90 seconds. Pull down the connector from the airbag control module.

B. Connect the battery negative cable and wait for at least 2s.

C. Turn the ignition switch to ON (IG).

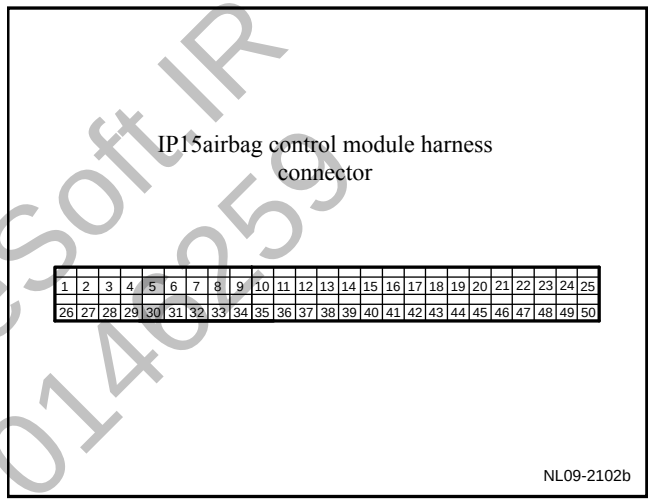
D. Measure the voltage between terminal No.30 of harness connector IP15 and vehicle body ground with a multimeter.

Standard Voltage: 11-14 V

A. Turn the ignition switch to OFF position .

F. Measure the resistance between terminal No.5 of harness connector IP15 and vehicle body ground with a multimeter.

Standard Resistance: Less than 1 Ω



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No → Repair or replace the harness. Go to step 9

Yes

5	Check the harness (instrument cluster assembly power supply, ground).

A. Disconnect the battery negative cable and wait for at least 90s.

B. Disconnect the connector from the combination instrument assembly.

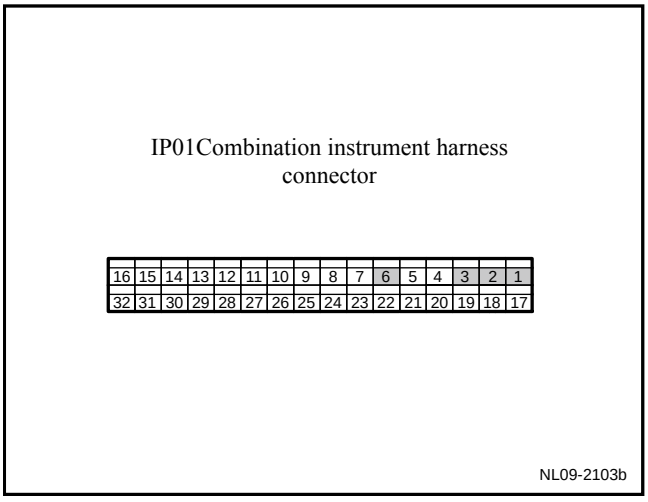
C. Connect the battery negative cable and wait for at least 2s.

D. Turn the ignition switch to ON (IG).

E. Measure the voltage between terminals No.1 and No.2 of IP01 and the body ground respectively with a multimeter.

Standard Voltage: 11-14 V

F. Turn the ignition switch to the OFF position.



G. Measure the resistance between terminals No.3 and No.6 of connector IP01 and the body ground respectively with a multimeter.

Standard Resistance: Less than 1 Ω

No → Repair or replace the harness. Go to step 9

Yes

6	Inspect whether CAN bus communication is faulty.

Check CAN bus integrity

No → Repair or replace the harness. Go to step 9

Yes

7	Replace the instrument cluster assembly.

A. Replace the combination instrument. Refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

B. Connect the battery negative cable and wait for at least 2s.

C. Turn the ignition switch to ON (IG).

D. Check the airbag warning lamp condition and whether ACU warning lamp is continuously lightening after going out

No → The system is normal.

Yes

8	Replace the airbag control module.

A. Replace the airbag control module. Refer to 9.2.7.1 Replacement of Airbag Control Module.

B. Confirm that the repair is completed.

Next

9	The system is normal.

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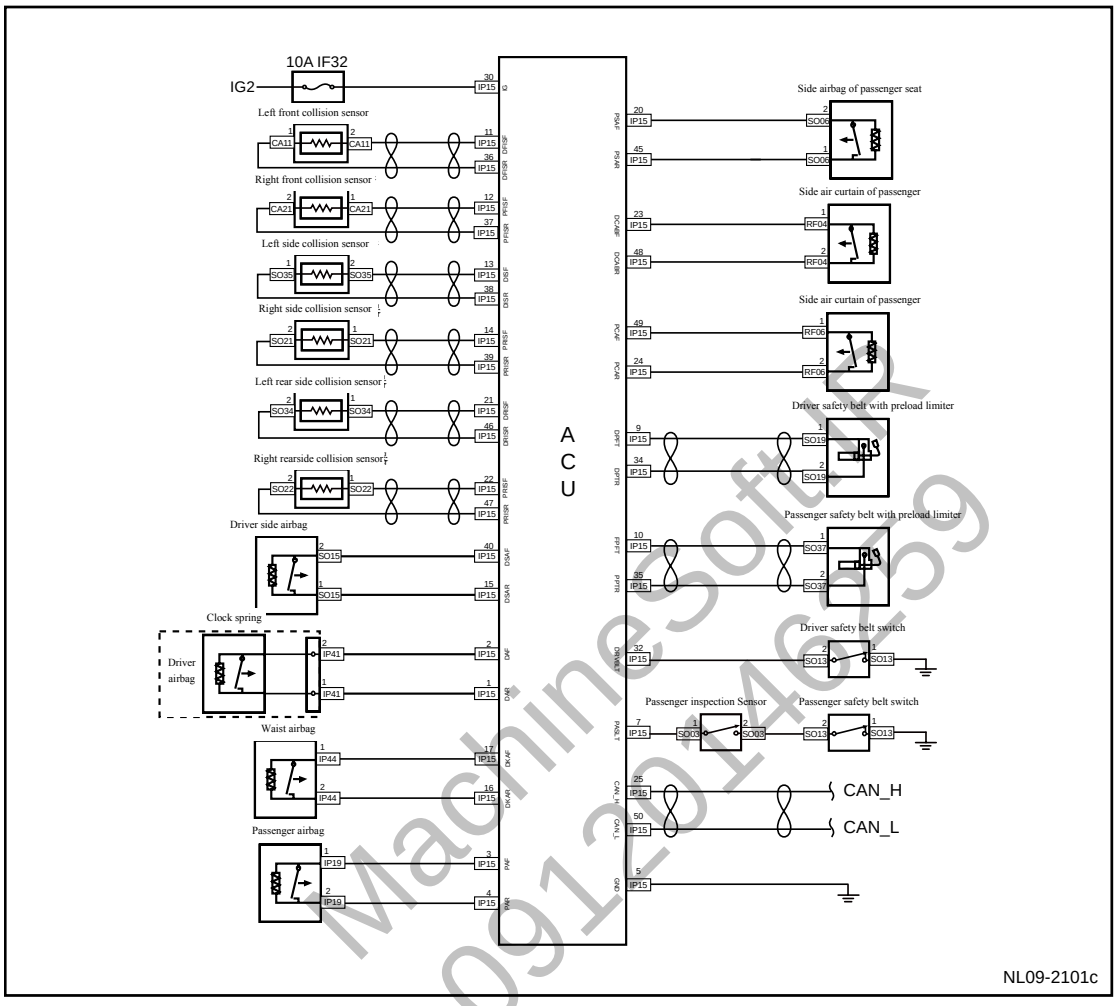
A. Turn the ignition switch to ON position, observe the warning lamp status to confirm that the system is normal.

B. Use a tester to check whether there is a historical failure and clear the historical faults.

9.2.6.5 Airbag Warning Lamp Does Not Lighten

Circuit diagram:



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Diagnostic Steps:

1	Inspect the battery.

A. Turn the ignition switch to "ON" and measure the battery voltage by universal meter

Standard Voltage: 11-14 V

B. Confirm whether the voltage is at a specified Value.

No → Inspect and replace the battery or the charging system. Go to step 6

Yes

2	Inspect the combination instrument wire harness connector.

A. Turn the ignition switch to OFF position.

B. Disconnect the battery negative cable and wait for at least 90s.

C. Inspect whether the connectors are properly connected to the combination instrument.

No → Properly connect the connector. Go to step 6

Yes

3	Check the harness (instrument cluster assembly power supply, ground).

A. Disconnect the battery negative cable and wait for at least 90s.

B. Disconnect the connector from the combination instrument assembly.

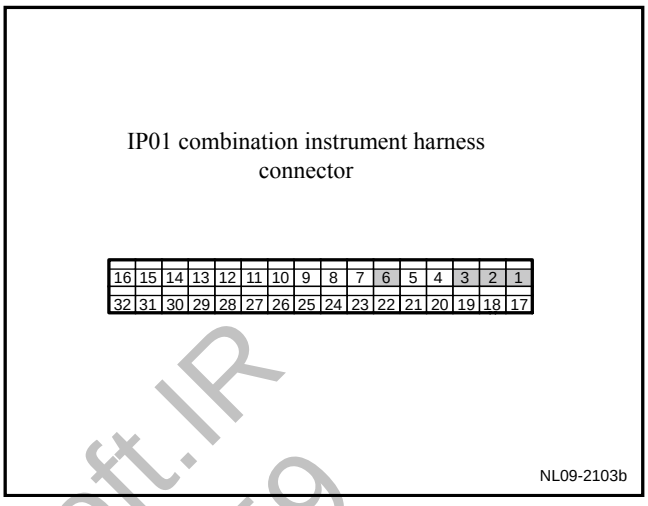
C. Connect the battery negative cable and wait for at least 2s.

D. Turn the ignition switch to ON (IG).

E. Measure the voltage between terminals No.1 and No.2 of IP01 and the body ground respectively with a multimeter.

Standard Voltage: 11-14 V

F. Turn the ignition switch to the OFF position.



G. Measure the resistance between terminals No.3 and No.6 of connector IP01 and the body ground respectively with a multimeter.

Standard Resistance: Less than 1 Ω

No → Repair or replace the harness. Go to step 6

Yes

4	Inspect whether CAN bus communication is faulty.

Check CAN bus integrity

No → Repair or replace the harness. Go to step 6

Yes

5	Replace the instrument cluster assembly.

A. Replace the combination instrument. Refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

B. Connect the battery negative cable and wait for at least 2s.

C. Turn the ignition switch to ON (IG).

D. Check the airbag warning lamp condition and whether ACU warning lamp is continuously lightening after going out

No → The system is normal.

Yes

6	The system is normal.

A. Turn the ignition switch to ON position, observe the warning lamp status to confirm that the system is normal.

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B. Use a tester to check whether there is a historical failure and clear the historical faults.

9.2.6.6 Relevant DTC Code Diagnosis

Collision Sensor Malfunction

Note: This manual is only for the left front wheel speed sensor fault diagnosis, other sensor diagnostic methods are similar. Please refer to the F.L. Wheel Speed Sensor Fault Diagnosis.

F.L. Collision Sensor Malfunction

Diagnostic Trouble Code (DTC)	Descriptions	Trouble-shooting Method
B105100	F.L. Collision Sensor Circuit Open	1. Turn the ignition switch to OFF, and disconnect the battery negative cable and wait for 90s. The above, reconnect the battery negative cable. 2. Measure the resistance between the collision sensor harness connector and the ground.
B105300	F.L. collison sensor internal fault.	Replace the sensor; refer to 9.2.7.7 Replacement of Front Collision Sensor.
B105400	F.L. Collision Sensor Communication Error	Check whether the sensor pin signaling terminal and the airbag control module pin are connected properly. If the connection is not correct, replace the harness.
B105500	F.L. Collision Sensor Sampling Error	Replace the sensor; refer to 9.2.7.7 Replacement of Front Collision Sensor.

Circuit diagram:

Refer to 9.2.6.4 Circuit Diagram in Warning Lamp Always On.

Diagnostic Steps:

1	Check the harness (Airbag Electronic Control Unit - power supply, Ground).

A. Disconnect the battery negative cable, turn the ignition switch to OFF position and wait for 90 seconds. Pull down the connector from the airbag control module.

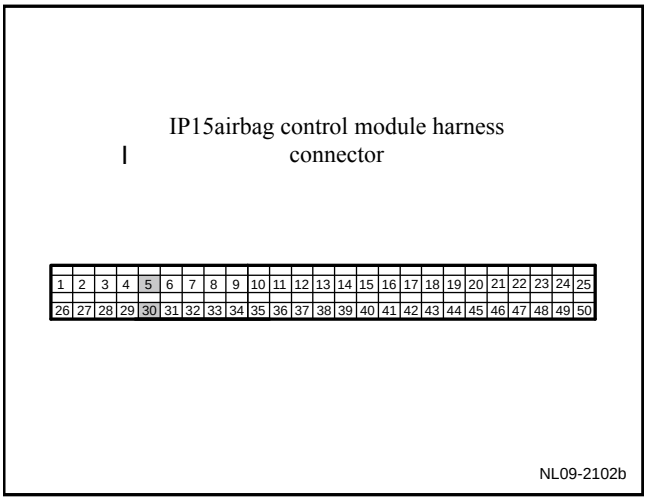
B. Connect the battery negative cable and wait for at least 2s .

C. Turn the ignition switch to ON (IG).

D. Measure the voltage between terminal No.30 of harness connector IP15 and vehicle body ground with a multimeter.

Standard Voltage: 11-14 V

E. Turn the ignition switch to OFF position .



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F. Measure the resistance between terminal No.5 of harness connector IP15 and vehicle body ground with a multimeter.

No → Inspect the fuses, repair or replace the harness.

Yes

Standard Resistance: Less than 1 Ω

2	Inspect the harness connector.

A. Disconnect the airbag control module harness connector IP15.

B. Disconnect the left front collision sensor harness connector CA11.

Are the two harness connectors normal?

Yes → Replace the harness connectors.

No

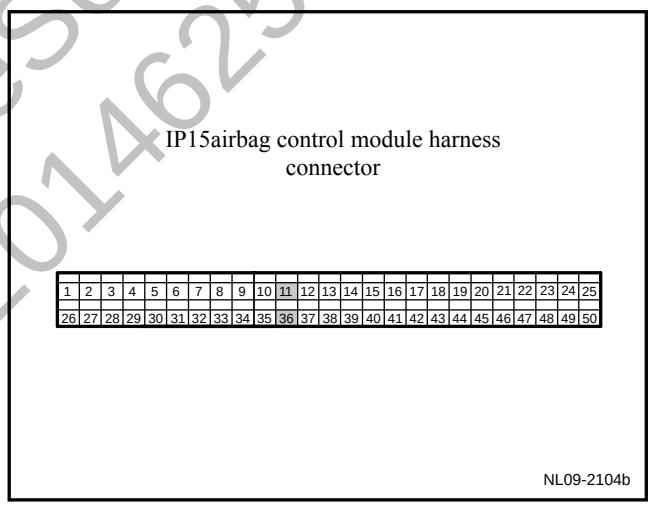
3	Inspect the left front collision sensor harness (open circuit).

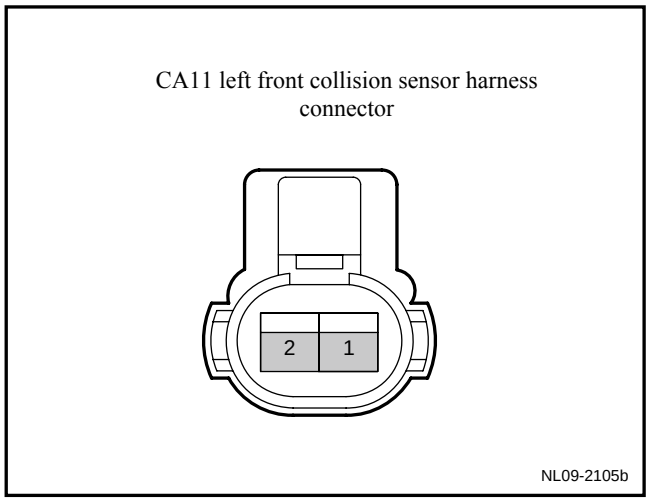
A. Measure the resistance between terminal No.36 of IP15 and terminal No.1 of CA11 with a multimeter.

B. Measure the resistance between terminal No.11 of IP15 and terminal No.2 of CA11 with a multimeter.

Standard Resistance: Less than 1 Ω

Is the resistance at a specified value?





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No → Replace the harness

Yes

4	Inspect the left front collision sensor harness (whether there ia short circuit between lines).

A. Measure the resistance between terminals No. 1 and No. 2 of connector CA11 with a multimeter.

Standard Resistance: 10 kΩ or higher

Is it a Standard resistance?

No → Replace the harness

Yes

5	Check the left front collision sensor harness (whether the circuit is short to ground).

A. Measure resistance between terminal No.1 of CA11 and the vehicle body ground with a multimeter.

B. Measure resistance between terminal No.2 of CA11 and the vehicle body ground with a multimeter.

Standard Resistance: 10 kΩ or higher

Is it a Standard resistance?

No → Replace the harness

Yes

6	Check the left front collision sensor harness (short to power supply).

A. Connect the battery negative cable and wait for at least 2s.

B. Turn the ignition switch to ON (IG).

C. Measure voltage between terminals No.1 and No.2 of CA11 and the body ground respectively with a multimeter.

Standard Voltage: Less than 1 V

Is it a Standard resistance?

No → Replace the harness

Yes

7	Replace the left front collision sensor.

A. Disconnect the battery negative cable and wait for at least 90s. Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

B. Replace left collision sensor, refer to 9.2.7.7 Replacement of Front Collision Sensor.

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Is the system working normally?

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Yes → The system is normal.

No

8	Replace the airbag control module.

A. Replace the airbag control module. Refer to 9.2.7.1 Replacement of Airbag Control Module.

B. Confirm that the repair is completed.

Next

9	The system is normal.

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Actuator Malfunction

Note: The workshop manual only diagnoses the driver airbag and driver seatbelt preloader, the rest actuators diagnostics are similar. Please refer to Driver Airbag and Driver Seatbelt Preloader Diagnostic.

Driver Airbag Malfunction

Diagnostic Trouble Code (DTC)	Descriptions
B102100	High Resistance of Driver Airbag Module
B102200	Low Resistance of Driver Airbag Module
B102300	High Resistance of Driver Airbag Module
B102400	Driver Airbag Module Short Circuit over the Voltage

Circuit diagram:

Refer to 9.2.6.4 Circuit Diagram in Warning Lamp Always On.

Diagnostic Steps:

1	Check the harness (Airbag Electronic Control Unit - power supply, Ground).

A. Disconnect the battery negative cable, turn the ignition switch to OFF position and wait for 90 seconds. Pull down the connector from the airbag control module.

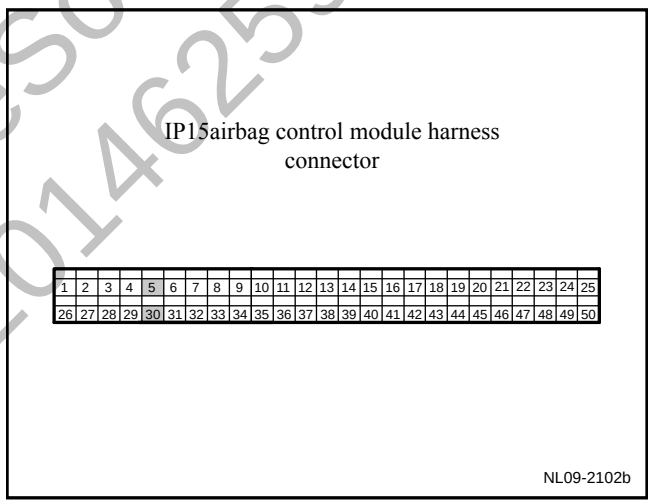
B. Connect the battery negative cable and wait for at least 2s .

C. Turn the ignition switch to ON (IG).

D. Measure the voltage between terminal No.30 of harness connector IP15 and vehicle body ground with a multimeter.

Standard Voltage: 11-14 V

E. Turn the ignition switch to OFF position .



F. Measure the resistance between terminal No.5 of harness connector IP15 and vehicle body ground with a multimeter.

Standard Resistance: Less than 1 Ω

No → Inspect the fuses, repair or replace the harness.

Yes

2	Check the harness connector.

A. Disconnect the battery negative cable and wait for at least 90s. Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

B. Check whether the clock spring connector is damaged, whether the retaining buckle is damaged.

Yes → Replace the clock spring.

No

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3	Inspect the circuit between the airbag control module and driver airbag.

A. Disconnect the battery negative cable and wait for at least 90s. Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

B. Disconnect the clock spring harness connector form the driver airbag.

C. Disconnect harness connector from the airbag control module.

Note: Before measuring, please dismantle terminal No.1 of the airbag control module harness connector IP15 and the short films of terminal No.2.Please install the short films before installing harness connector.

Note: Do not use a multimeter to measure the driver airbag, otherwise it might set off airbag explosion and cause serious injuries.

D. Measure the resistance between terminals No.1 and No.2 of the airbag control module harness connector IP15 and the body ground with a multimeter.

Standard Resistance: 10 kΩ or higher

E. Measure the resistance between terminal No.1 and No.2 of airbag control module harness connector IP15 and relevant terminals of the airbag harness connector with a multimeter.

Standard Resistance: Less than 1 Ω

F. Measure the resistance between terminal No.1 and terminal No.2 of the airbag control module harness connector IP15 with a multimeter.

Standard Resistance: 10 kΩ or higher

G. Connect the battery negative cable and wait for at least 2s.

H Turn the ignition switch to ON position.

I Measure the voltage between terminals No.1 and No.2 of the airbag control module harness connector IP15 and the body ground with a universal meter.

Standard Voltage: Less than 1 V

Confirm whether the measured value is accorded with the standard?

Yes	Go to step 6
No	

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4	Inspect the harness between the clock spring and the airbag control module.

A. Disconnect the clock spring harness connector IP41.

B. Measure the resistance between terminal No.1 of harness connector IP41 and terminal No.1 of IP15 with a universal meter. Measure the resistance between terminal No.2 of harness connector IP41 and terminal No.2 of IP15 with a multimeter (Check for open circuit).

Standard Resistance: Less than 1 Ω

C. Measure the resistance between terminal No.1 and No.2 of IP41 with a multimeter (inspection for short circuit).

Standard Resistance: 10 kΩ or higher

D. Measure the resistance between terminals No.1&No.2 of harness connector IP41 and the body ground with a multimeter (Inspect for short circuit to earth).

Standard Resistance: 10 kΩ or higher

E. Connect the battery negative cable and wait for 2s at least. Refer to 2.12.6.1 Battery Cable Disconnection and

Connection Procedures.

F. Turn the ignition switch to ON (IG).

G. Measure the voltage between terminals No.1 and No.2 of IP41 and the body ground with multimeter (Check for short circuit to power supply).

Standard Voltage: Less than 1 V

Confirm whether the measured value conforms to the standard value.

No → Replace the clock spring wire harness connector harness.

Yes

5	Replace the clock spring.

A. Replace the clock spring; refer to 9.2.7.3 Replacement of Clock Spring.

B. Connect the connectors.

C. Connect the battery negative cable and wait for 2s at least. Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

D. Turn the ignition switch to ON (IG).

E. Connect the diagnostic unit to clear stored DTC.

F. Reread the DTC .

Does DTC exist?

Yes → The system is normal.

No

6	Replace driver airbag.

A. Replace driver airbag.

B. Connect the clock spring and airbag control unit harness connector.

C. Connect the battery negative cable and wait for 2s at least. Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

D. Turn the ignition switch to ON (IG).

E. Connect the diagnostic unit to clear stored DTC.

Does DTC exist?

Yes → The system is normal.

No

7	Replace the airbag control module.

A. Turn the ignition switch to OFF position.

A. Disconnect the battery negative cable and wait for at least 90s.Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

C. Replace the airbag control module. Refer to 9.2.7.1 Replacement of Airbag Control Module.

D. Connect the battery negative cable and wait for 2s at least. Refer to 2.12.6.1 Battery Cable Disconnection and

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Connection Procedures.

E. ignition switch turn to ON gear.

F. Connect the diagnostic unit to clear the stored DTC.

G. Confirm the repair is completed.

Next

8	The system is normal.

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Driver Seatbelt Preloader Fault

Diagnostic Trouble Code (DTC)	Descriptions
B102900	Resistance of Driver Seatbelt Preloader is tooHigh
B102A00	Resistance of Driver Seatbelt Preloader is too Low
B102B00	Driver Seat Belt Preloader Short Circuit to the Ground
B102C00	Driver Seat Belt Preloader Short Circuit to the Voltage

Circuit diagram:

Refer to 9.2.6.4 Circuit Diagram in Warning Lamp Always On.

Diagnostic Steps:

1	Check the harness (Airbag Electronic Control Unit - power supply, Ground).

A. Disconnect the battery negative cable, turn the ignition switch to OFF position and wait for 90 seconds. Pull down the connector from the airbag control module.

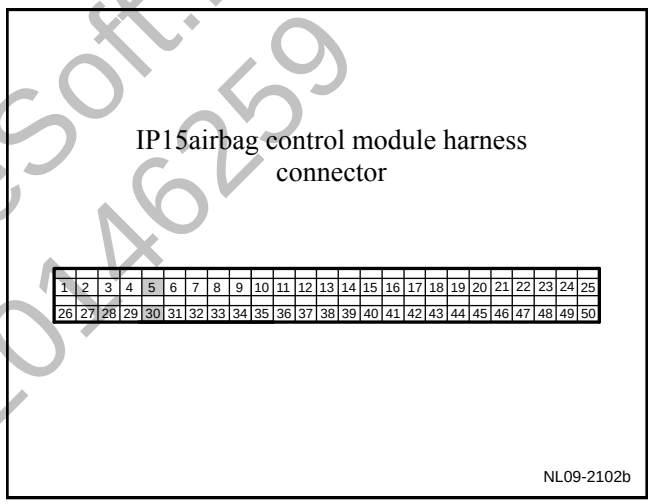
B. Connect the battery negative cable and wait for at least 2s .

C. Turn the ignition switch to ON (IG).

D. Measure the voltage between terminal No.30 of harness connector IP15 and vehicle body ground with a multimeter.

Standard Voltage: 11-14 V

E. Turn the ignition switch to OFF position .



F. Measure the resistance between terminal No.5 of harness connector IP15 and vehicle body ground with a multimeter.

Standard Resistance: Less than 1 Ω

No → Inspect the fuses, repair or replace the harness.

Yes

2	Check driver seatbelt preloader harness connector.

A. Check whether driver seatbelt preloader harness connector is connected properly.

No → Connect the harness connector properly.

Yes

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3	Check the circuits of driver seatbelt preloader.

A. Disconnect the battery negative cable and wait for at least 90s. Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

B. Disconnect the airbag control module harness connector IP15.

Note: Before measuring, please dismantle terminal No.1 of the airbag control module harness connector IP15 and the short films of terminal No.2.Please install the short films before installing harness connector.

C. Disconnect the harness connector SO19 from the driver seatbelt preloader.

D. Measure the resistance between terminal No.9 of harness connector IP15 and terminal No.1 of harness connector SO19 and the resistance between terminal No.34 of harness connector IP15 and terminals No. 2 of harness connector SO19 with a multimeter (Inspect for open circuit).

Standard Resistance: Less than 1 Ω

E. Measure the resistance between terminal No.9 and terminal No.34 of harness connector IP15 with a multimeter (Inspect for short circuit).

Standard Resistance: 10 kΩ or higher

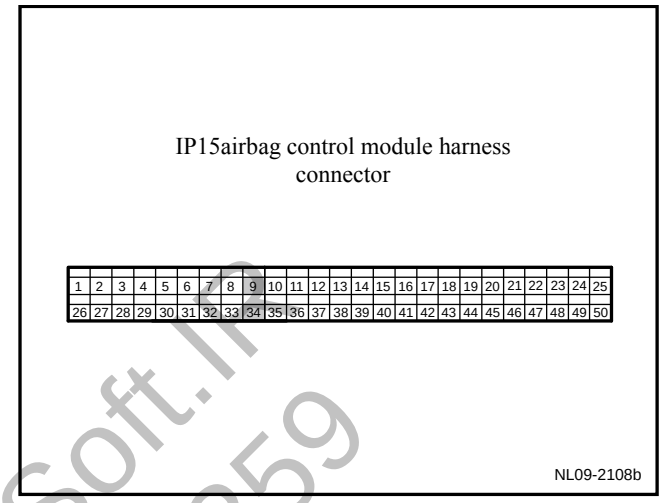
F. Measure the resistance between terminal No.9 of harness connector IP15 and terminal No.34 of IP15 and body grounding by a multimeter. (Check for open circuit).

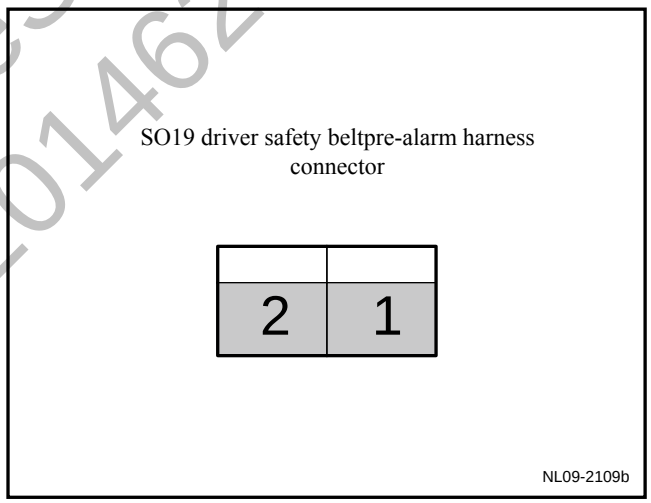
Standard Resistance: 10 kΩ or higher

G. Connect the battery negative cable and wait for 2s at least. Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

H Turn the ignition switch to ON position.

I. Measure the voltage between terminal No.9 of harness connector IP15 and the body ground as well as the resistance between terminals No.34 of harness connector IP15 with a multimeter (Inspect for short circuit to power supply).





Standard Voltage: Less than 1 V

Confirm whether the measured value conforms to the standard value.

No → Replace the harness

Yes

4	Replace the driver Seatbelt Coiler.

A. Disconnect the battery negative cable and wait for at least 90s. Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

B. Replace the driver seatbelt coiler; refer to 9.3.7.7 Replacement of Front Seat Seatbelt Coiler.

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C. Install short films and connect the harness connector.

D. Connect the battery negative cable and wait for 2s at least. Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

E. ignition switch turn to ON gear.

F. Connect the diagnostic unit to clear stored DTC.

G. Reread the DTC.

Does DTC exist?

Yes → The system is normal.

No

5	Replace the airbag control module.

A. Turn the ignition switch to OFF position.

B. Disconnect the battery negative cable and wait for at least 90s.Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

C. Replace the airbag control module. Refer to 9.2.7.1 Replacement of Airbag Control Module.

D. Connect the battery negative cable and wait for 2s at least. Refer to 2.12.6.1 Battery Cable Disconnection and Connection Procedures.

E. ignition switch turn to ON gear.

F. Connect the diagnostic unit to clear the stored DTC.

G. Confirm the repair is completed.

Next

6	The system is normal.

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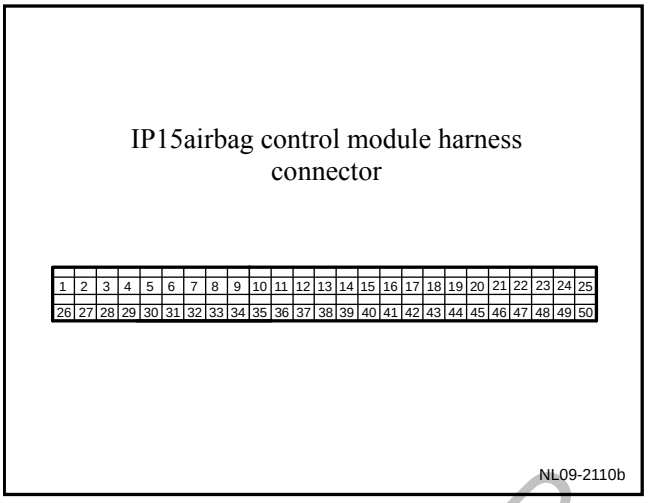
9.2.6.7 Airbag Control Module (SRS) Terminal Table

Airbag Control Module Harness Connector IP15



Terminal No .	Terminal Definition	Diameter/Color	Terminal Status	Specified Conditions (Voltage, Current, Waveform, etc.)
1	Driver Airbag Minus	0.5 B/0	I	250mV×1.47A
2	Driver Airbag Plus	0.5 B/R	O	6V×1.47A
3	Passenger Airbag Plus	0.5 B/L	O	6V×1.47A
4	Passenger Airbag Minus	0.5 B/W	I	250mV×1.47A
5	Ground	0.5 B	Ground	0V×1A Inrush: 15A×1ms
6	-	-	-	-
7	Passenger Seatbelt Switch	0.5 W/R	I	35V(LOAD DUMP) ×19 . 4mA
8	-	-	-	-
9	L.F. Seatbelt Preloader Machine positive	0.5 L/B	O	6V×1.47A
10	R.F. Seatbelt Preloader Plus	0.5 L/O	O	6V×1.47A
11	Driver Front Collision Sensor Plus Machine positive	0.5 Br	I/O	8V×50mA
12	Passenger Front Collision Sensor Plus	0.5 Br/Y	I/O	8V×50mA
13	Left Middle Column Side Collision Sensor Plus	0.5 Br/L	I/O	8V×50mA
14	Right Middle Column Side	0.5 R/B	I/O	8V×50mA

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	Collision Sensor plus			
15	L.F. Side Airbag Minus	0.5 G/Y	I	250mV×1.47A
16	Driver Knee Airbag Minus	0.5 B/G	I	250mV×1.47A
17	Driver Knee Airbag Plus	0.5 Br/R	O	6V×1.47A
18	—	—	—	—
19	—	—	—	—
20	R.F. Side Airbag Plus	0.5 G/L	O	6V×1.47A
21	R.L. Column Side Collision Sensor Plus	0.5 R/Y	I/O	8V×50mA
22	R.R Column Side Collision Sensor Plus	0.5 R/L	I/O	8V×50mA
23	Left Curtain Airbag Plus	0.5 O/B	O	6V×1.47A
24	Right Curtain Airbag Minus	0.5 G/R	I	250mV×1.47A
25	CAN_H	0.5 Y/B	I/O	
26	Short Circuit Protection	—	—	—
27	Short Circuit Protection	—	—	—
28	Short Circuit Protection	—	—	—
29	Short Circuit Protection	—	—	—
30	Ignition	0.5 R	I	16V×1A Inrush: 15A x 1ms
31	—	—	—	—
32	Driver Seatbelt Switch	0.5 W/B	I	35V(LOAD DUMP)×19 . 4mA
33	—	—	—	—
34	L.F. Seatbelt Preloader Minus	0.5 L/R	I	250mV×1.47A
35	R.F. Seatbelt Preloader Minus	0.5 L	I	250mV×1.47A
36	Driver Front Collision Sensor Minus	0.5 Br/R	Ground	0V×50mA
37	Passenger Front Collision Sensor Minus	0.5 Br/G	Ground	0V×50mA
38	Left Middle Column Side Collision Sensor Minus	0.5 Br/W	Ground	0V×50mA
39	Right Middle Column Side	0.5 R/O	Ground	0V×50mA

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	Collision Sensor Minus			
40	L.F. Side Airbag Plus	0.5 G/O	O	6V×1.47A
41	Short Circuit Protection	—	—	—
42	Short Circuit Protection	—	—	—
43	Short Circuit Protection	—	—	—
44	Short Circuit Protection	—	—	—
45	R.F. Side Airbag Minus	0.5 G/W	I	250mV×1.47A
46	R.L. Column Side Collision Sensor Minus	0.5 R/G	Ground	0V×50mA
47	R.R. Column Side Collision Sensor Minus	0.5 Br/R	Ground	0V×50mA
48	Left Curtain Airbag Minus	0.5 O	I	250mV×1.47A
49	Right Curtain Airbag Plus	0.5 G/B	O	6V×1.47A
50	CAN_L	0.5 G/Br	I/O	—

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9.2.7 Removal and installation

9.2.7.1 Airbag control module replacement

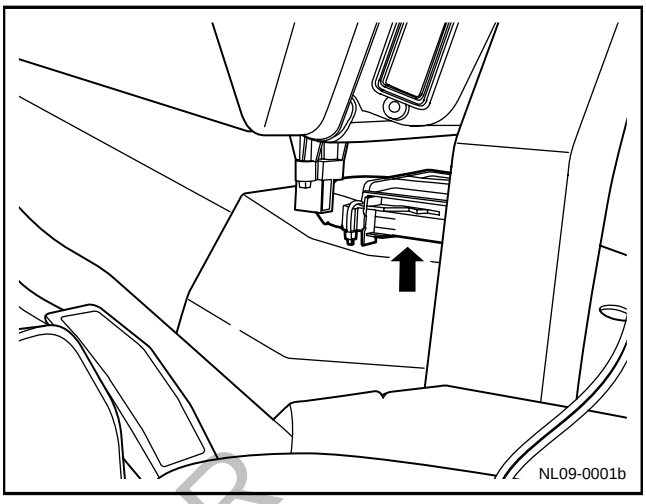
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.

Note: disassemble after the negative of the battery is disconnected for 90s.

2. Dismantle the auxiliary instrument panel assembly. Refer to 12.8.3.2 Replacement of Auxiliary Instrument Panel.
3. Disconnect airbag control module harness connector.
4. Dismantle fixing bolt of safety airbag control module.

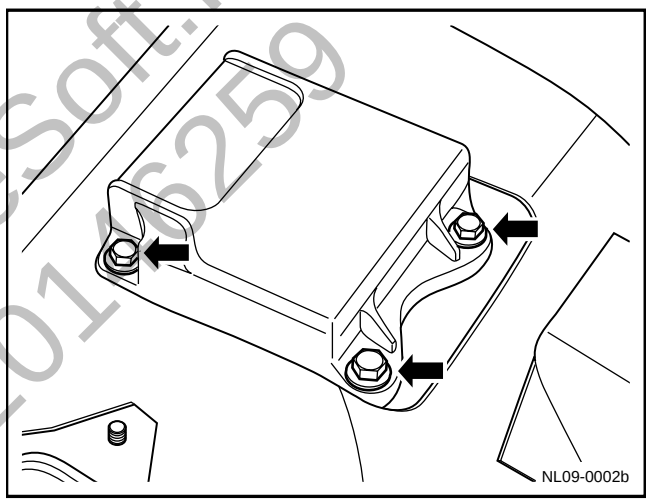


Installation Procedure:

1. Install safety airbag control module fixing bolt.

Torque: 5Nm (Metric system) 3.7lb-ft (English system)

2. Connect safety airbag control module wire harness connector.
3. Install the auxiliary instrument panel assembly.
4. Connect the battery negative cable.



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9.2.7.2 Driver side airbag replacement

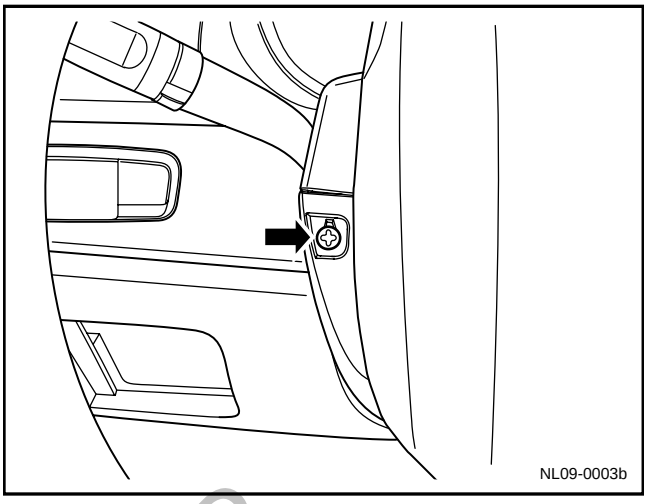
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

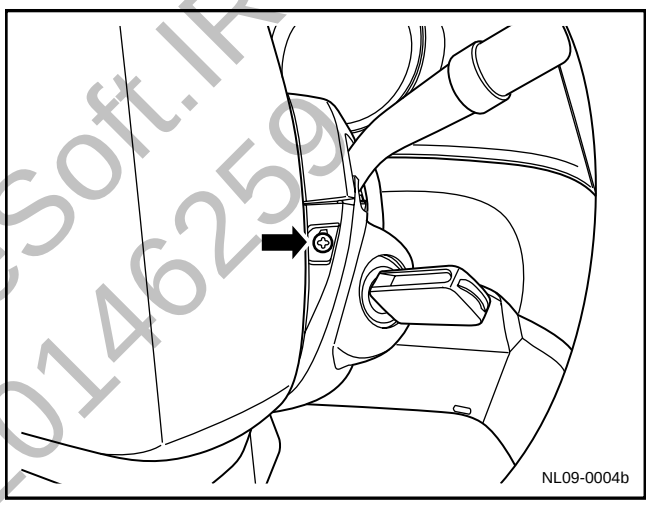
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.

Note: disassemble after the negative of the battery is disconnected for 90s.

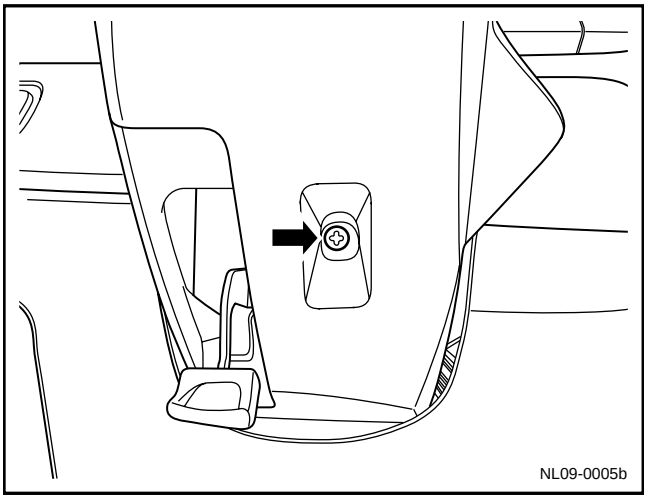
2. Rotate left turning steel wheel to left direction for 90 degree, and dismantle upper left screws on the upper side of upper, lower steering column protective plate of steering column.



3. Rotate steering wheel to 90 degree to right direction, and dismantle right screw on the upper of protective plate of upper and lower steering columns.



4. Dismantle the lower steering column shield screw.
5. Remove the steering column upper and lower shield panels.



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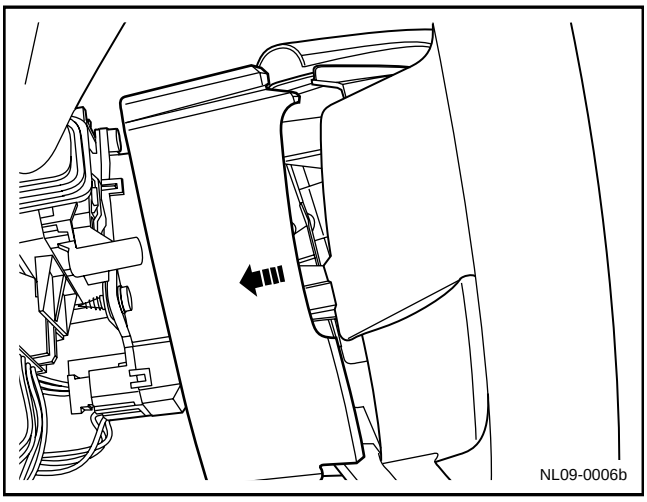
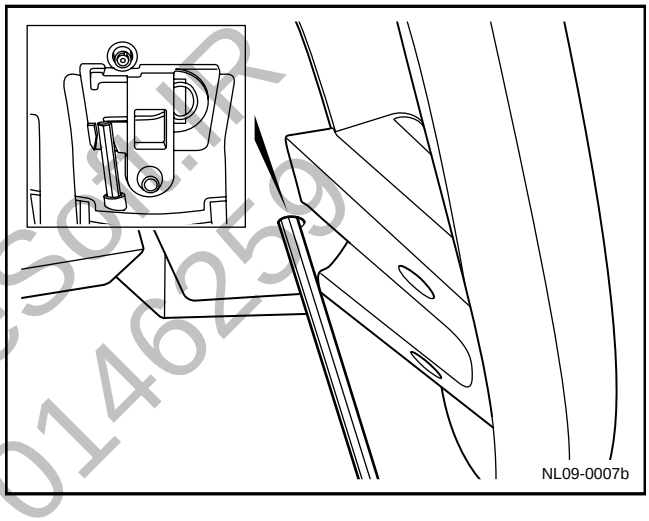
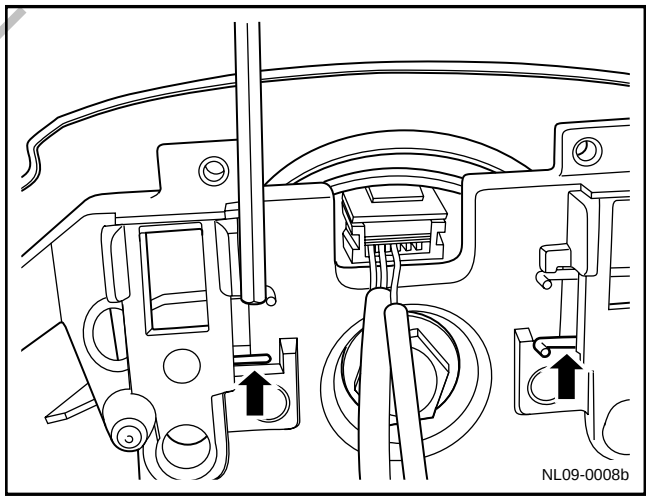
6. Detach the steering wheel back cover from the steering wheel.



7. Push up the fixing buckle below the driver side airbag with an appropriate tool.



8. Push off the two fixing buckles on the top of the driver side airbag with an appropriate tool and remove the driver side airbag.



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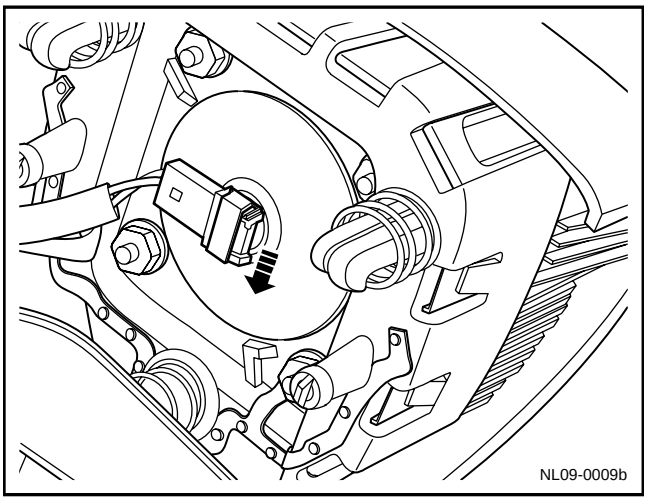
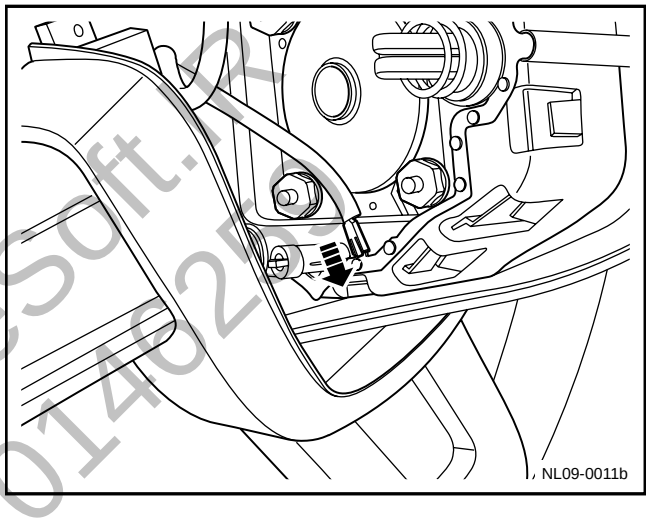
9. Disconnect the harness connector between the clock spring and the driver side airbag.

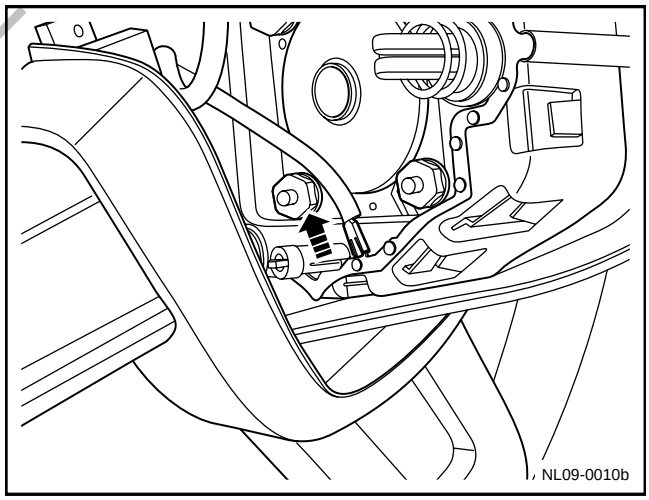


10 . Disconnect horn harness connector.



Installation Procedure:

1. Connect to horn harness connector .



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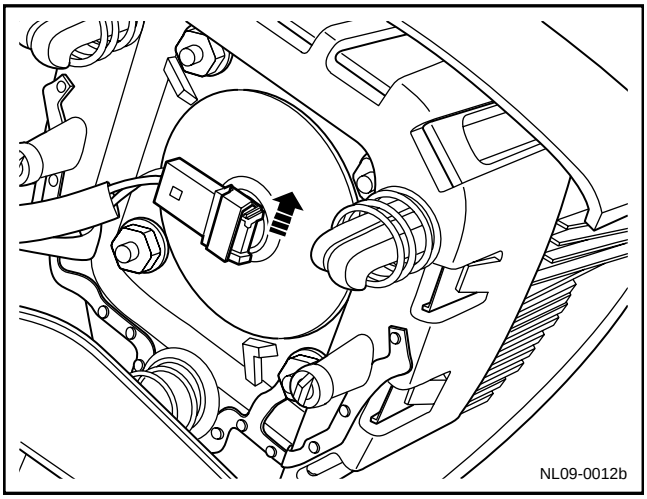
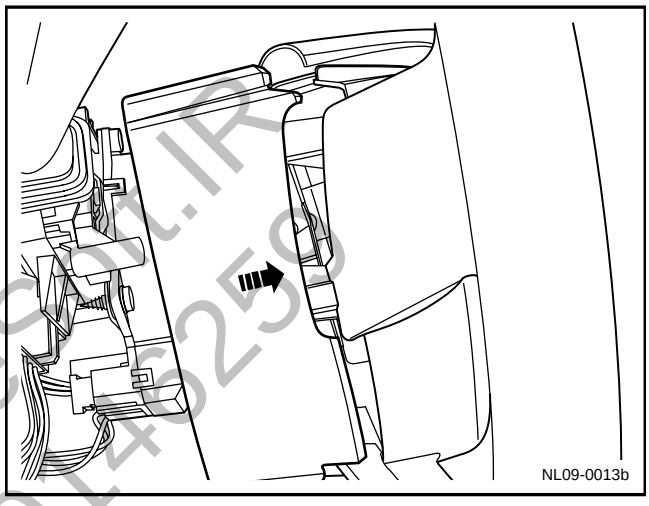
2. Connect timer spring and driver's side safety airbag wire harness connector.
3. Install driver's safety airbag onto steering wheel.



4. Close rear cover of steering wheel.
5. Install the upper and lower steering column fenders aprons and tighten the screws.

Torque: 3 Nm (Metric) 2 . 2 lb-ft(English system)

6. Connect the battery negative cable.



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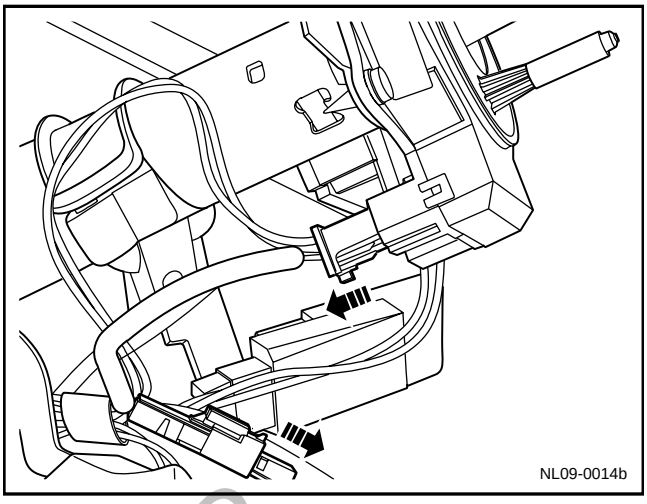
9.2.7.3 Clock spring replacement

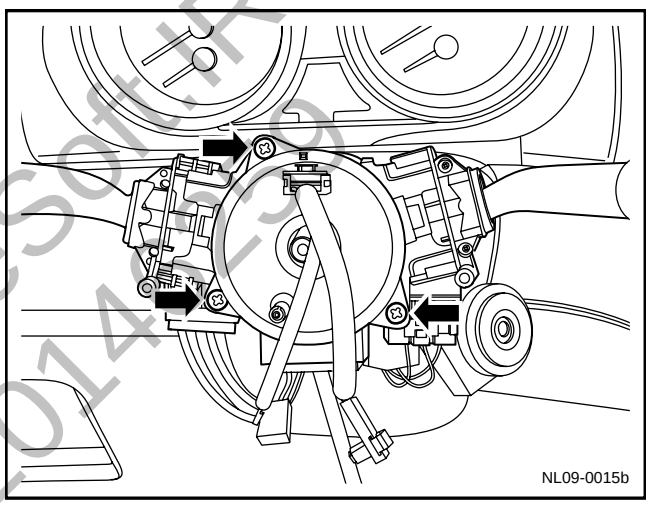
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect negative cable of battery and wait for 90s. Refer to 2.11.8.1 Disconnection procedures of battery cable.
2. Adjust steering wheel to straight traveling condition and lock it up.
3. Dismantle driver's side safety airbag and disconnection procedures of battery cable.
4. Dismantle the steering wheel. Refer to 7.3.6.3 Replacement of Steering Wheel.



5. Disconnect the harness connector of the clock spring.
6. Remove the clock spring fixing screw and clock spring.

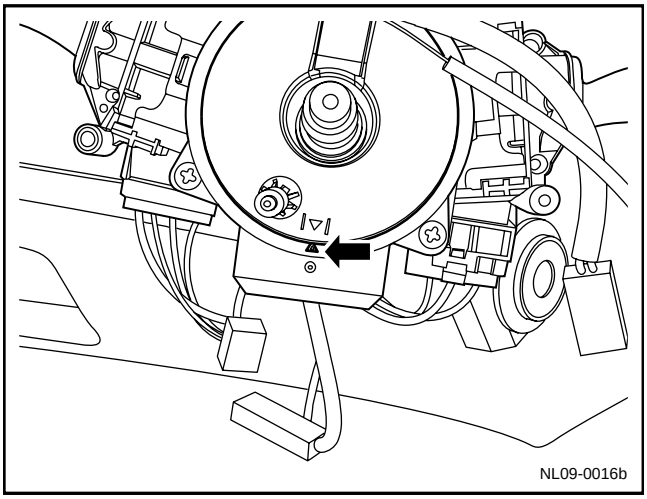


Installation Procedure:

1. Install timer spring onto steering column and tighten fixing screw.

Torque:5 Nm (Metric) 3.5 lb-ft (English system)

2. Completely rotate timer spring in clockwise, and then rotate 3.2 circles in reverse order to align mark.
3. Connect timer spring wire harness connector.
4. Install the steering column upper and lower shield panels.
5. Assemble steering wheel
6. Install the driver's side airbag.
7. Connect the battery negative cable.



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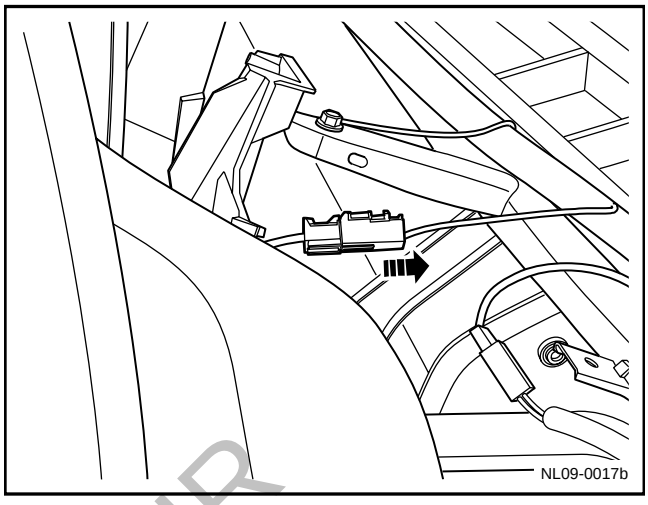
9.2.7.4 Passenger side airbag replacement

Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

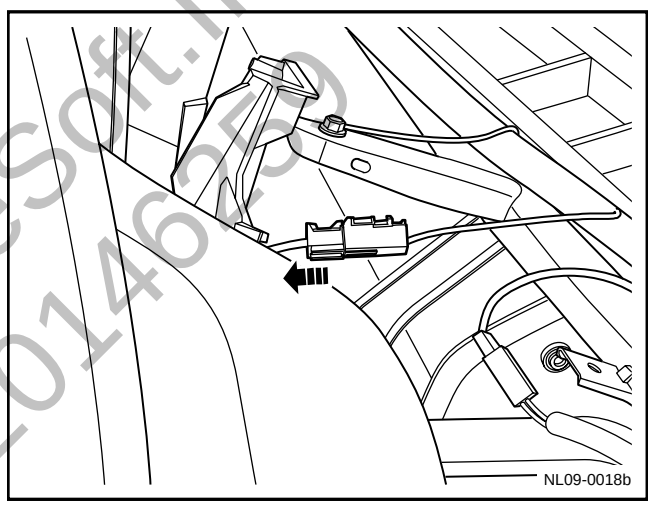
Warning: Refer to "Warning on Additional Protective System" in "Warning and Precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of upper cover of instrument panel, refer to 12.8.3.1 Replacement of instrument panel.
3. Disconnect passenger side airbag harness connector.
4. Dismantle passenger's side safety airbag.



Installation Procedure:

1. Install the passenger side airbag.
2. Connect passenger's side safety airbag wire harness connector.
3. Install Upper cover of instrument desk.
4. Connect the battery negative cable.



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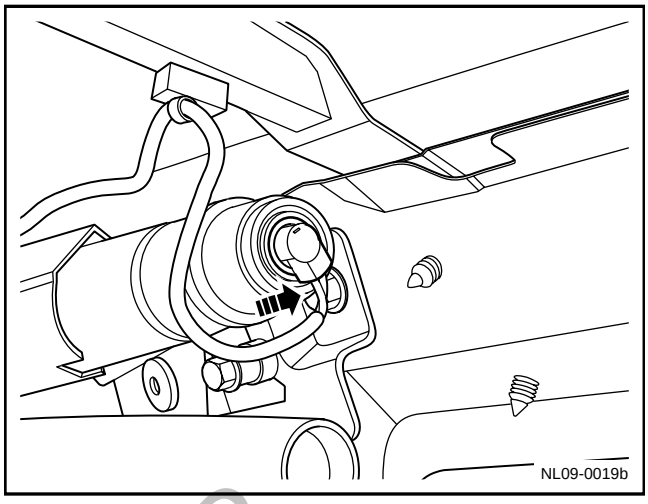
9.2.7.5 Side air curtain replacement (such as equipment)

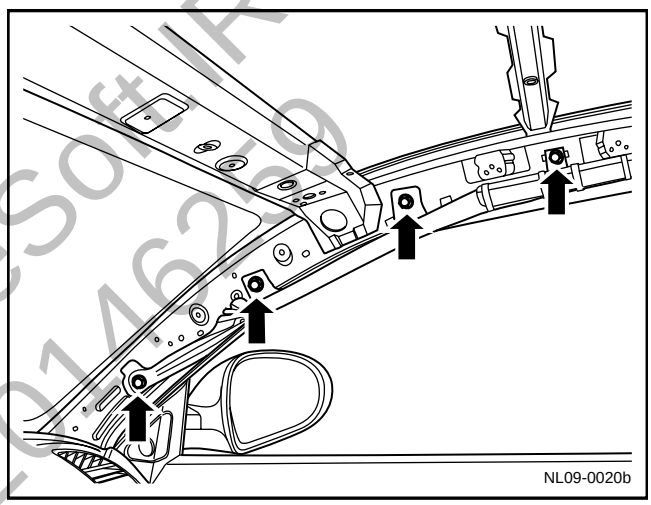
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

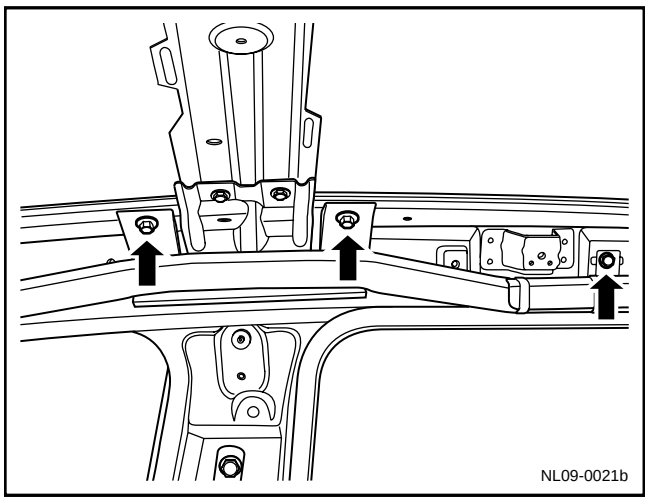
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of vehicle top inner trimming plate, refer to 12.9.1.11 Replacement of top cover inner trimming plate.
3. Disconnect side air curtain harness connector.



4. Disconnect fixing bolt on the front of side air curtain.



5. Remove the fixing bolt in the middle of the curtain airbag.



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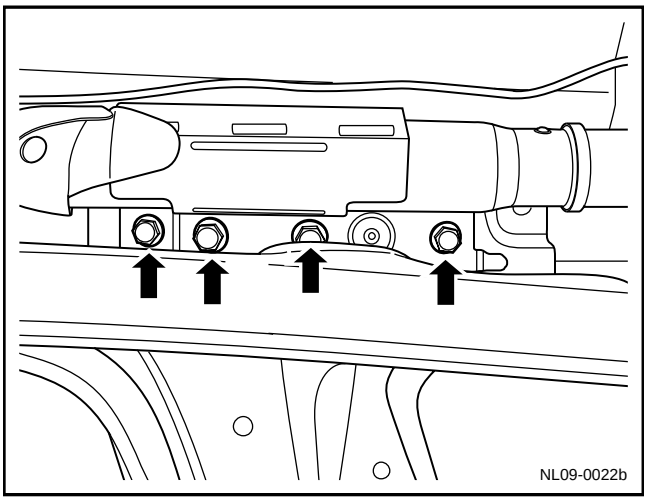
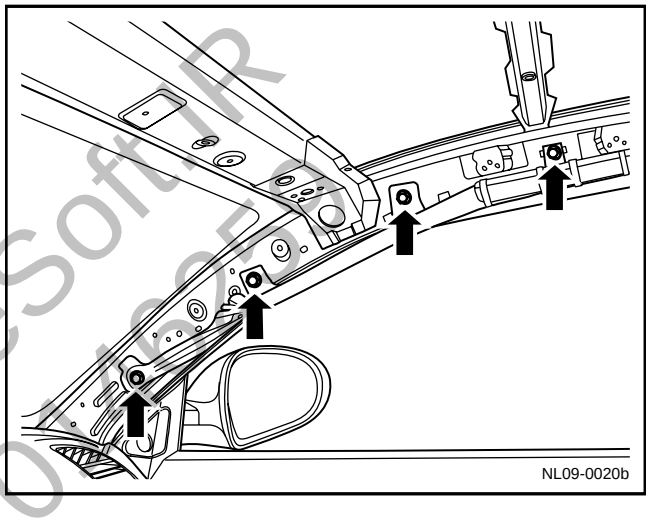
6. Remove the rear fixing bolt for the curtain airbag and the curtain airbag.



Installation Procedure:

1. Install side air curtain.
2. Install and tighten fixing bolt on front of side air curtain.

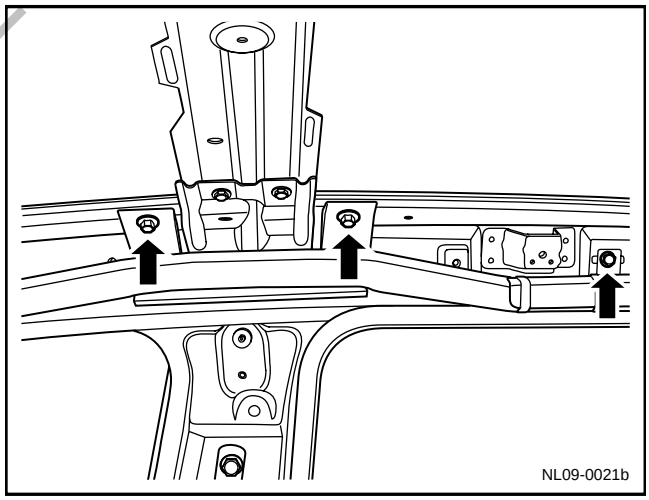
Torque : 9Nm (Metric) 6 . 7ft-bf(English system)



3. Install and tighten fixing bolt in the middle of air curtain.

Torque: 9Nm (Metric) 6 . 7ft-bf(English system)

4. Install and tighten fixing bolt on the rear of side air curtain.
5. Connect the harness connector of the curtain airbag.
6. Install the in-vehicle roof trim panel.
7. Connect the battery negative cable.



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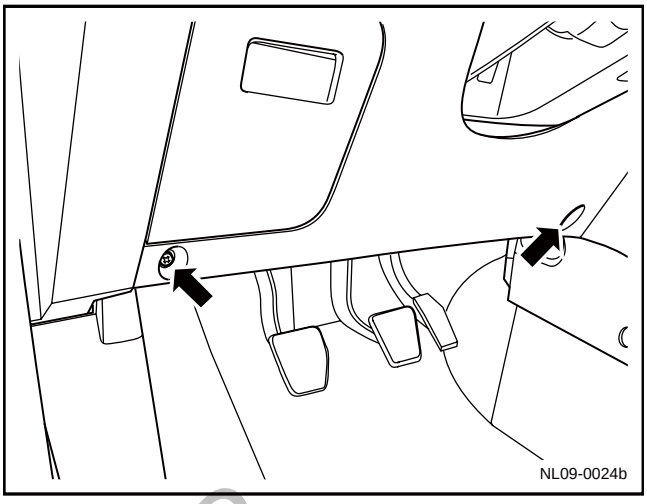
9.2.7.6 Driver waist airbag replacement (such as equipment)

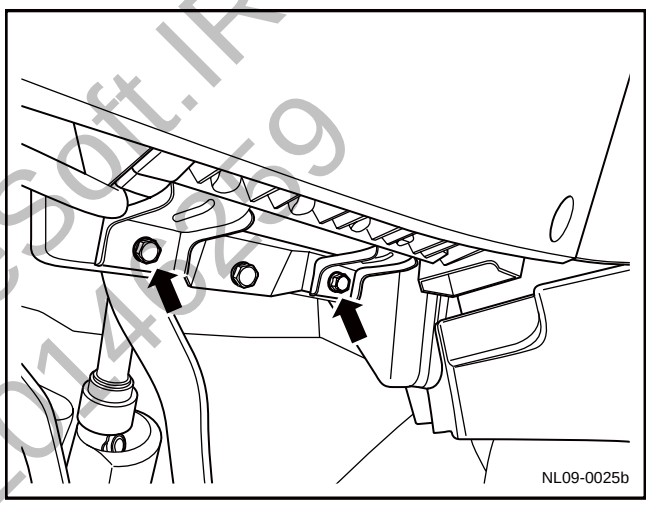
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

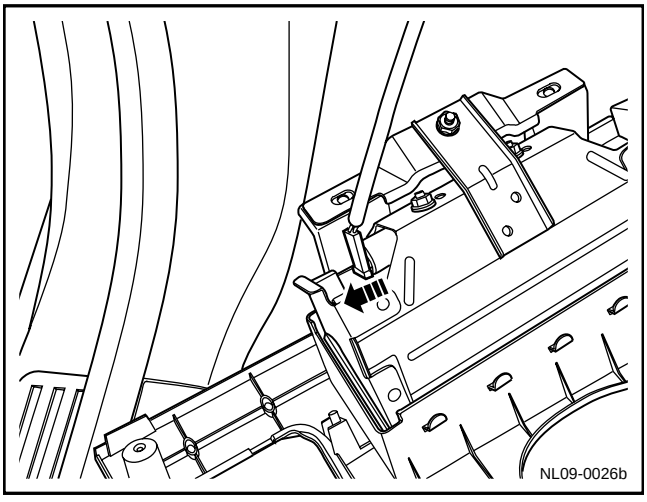
1. Disconnect negative cable of battery and wait for 90s.
2. Dismantle fixing screw of left lower trimming plate of instrument panel.



3. Dismantle driver's side knee airbag fixing bolt.



4. Disconnect driver's knee airbag wire harness connector.



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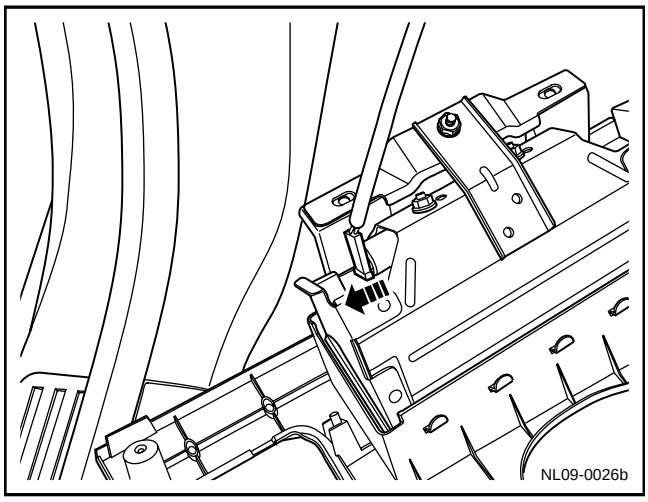
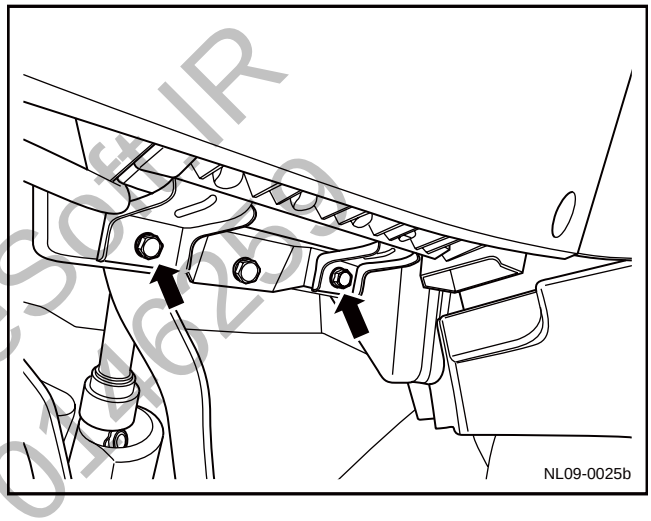
Installation Procedure:

1. Connect to driver's knee airbag harness connector .



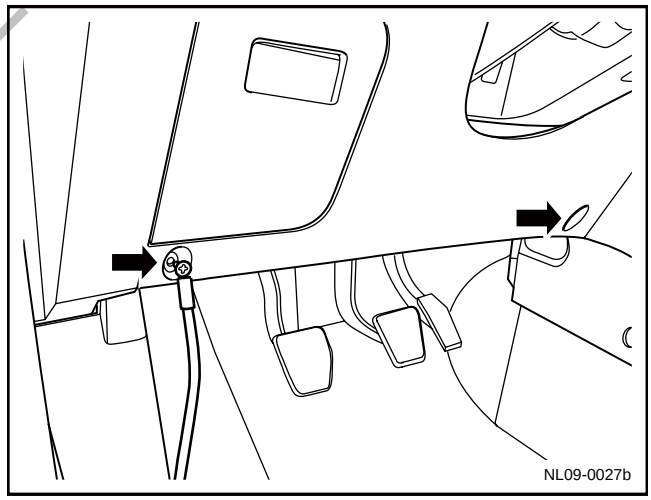
2. Install and tighten fixing bolt of driver knee airbag.

Torque: 9 Nm (Metric) 6.7 lb-ft (English system)



3. Install and tighten fixing screw of left lower trimming plate of instrument table.

Torque: 5 Nm (Metric) 3.7 lb-ft (English system)



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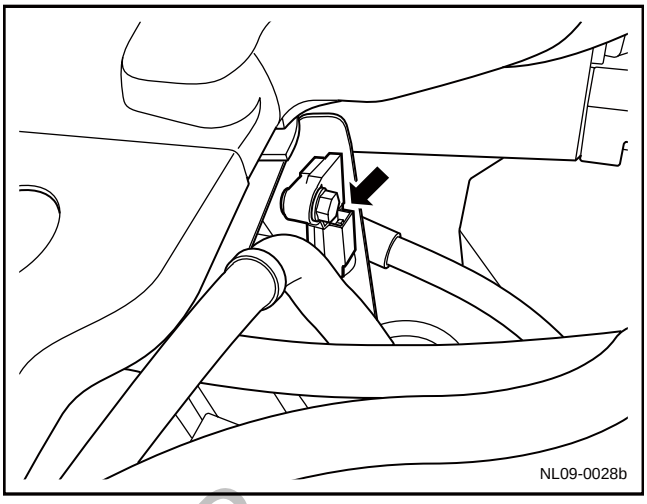
9.2.7.7 Front crash sensor replacement

Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection and Connection Procedures.
2. Disconnect front impact sensor wire harness connector.
3. Dismantle fixing bolt of front impact sensor and take of left front impact sensor.

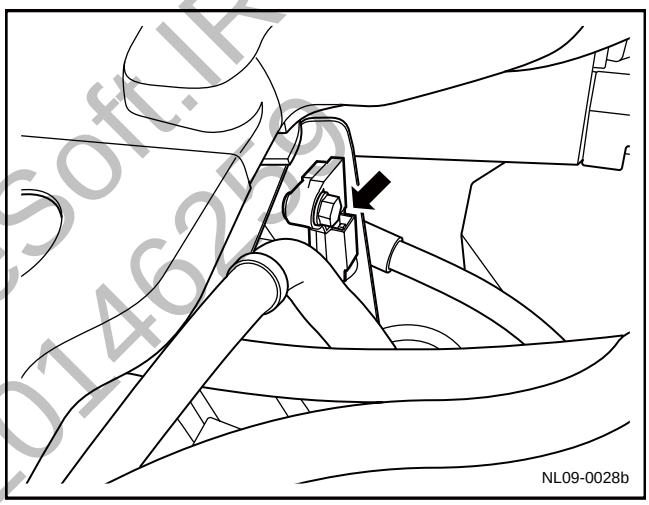


Installation Procedure:

1. Install and tighten front impact sensor fixing sensor fixing bolt.

Torque: 8Nm (Metric system) 5.9lb-ft (English system)

2. Connect front impact sensor wire harness connector.
3. Connect the battery negative cable.



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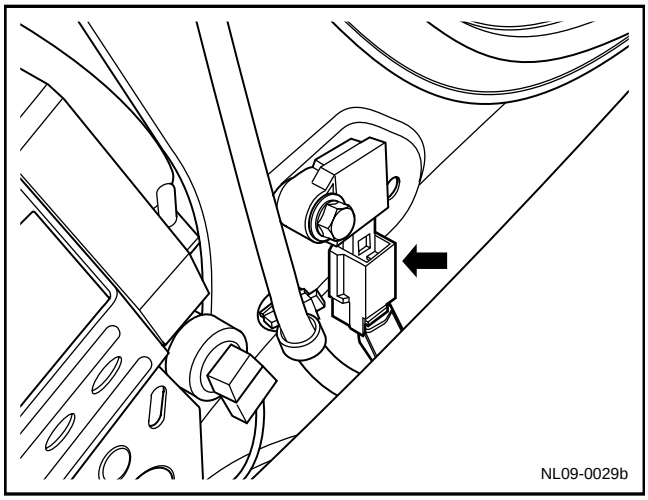
9.2.7.8 Side crash-sensor replacement (such as equipment)

Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect negative cable of battery and wait for 90s. Refer to 2.11.8.1 Disconnection procedures of battery cable.
2. For dismantling of lower inner trimming plate of middle column, refer to 12.9.1.3 Replacement of trimming plate of middle column.
3. Disconnect side crash-sensor harness connector.
4. Dismantle fixing bolt of side impact sensor and remove sensor.

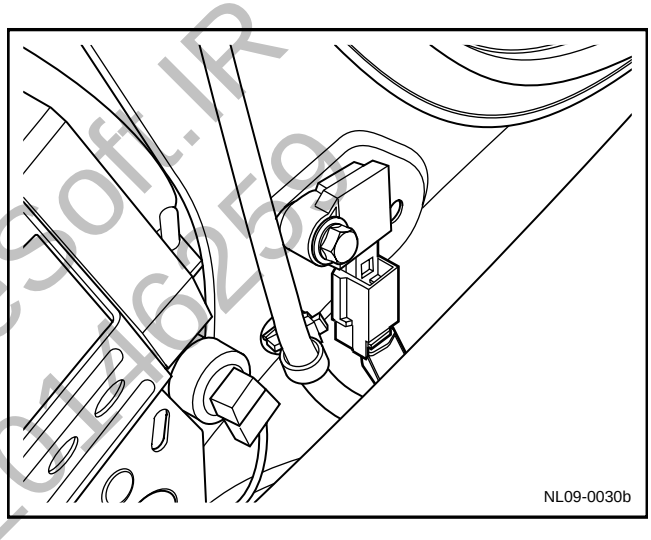


Installation Procedure:

1. Install side impact sensor and tighten fixing bolt.

Torque：8Nm (Metric) 5.9-lbf (English system).

2. Connect side impact sensor wire harness connector.
3. Install the lower trim panel for the center pillar.
4. Connect the battery negative cable.



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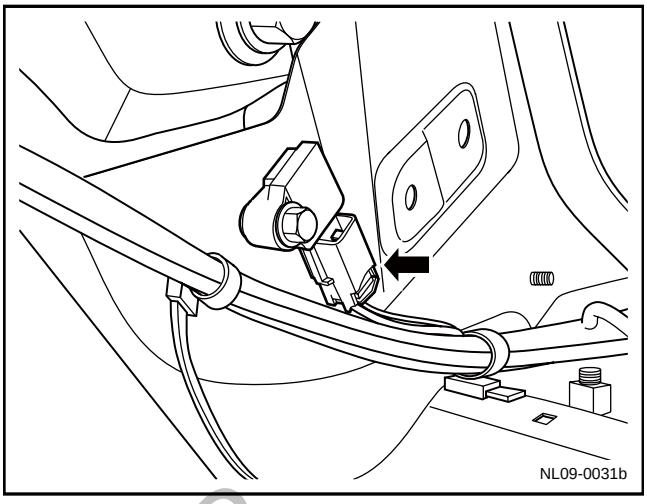
9.2.7.9 Rear side crash-sensor replacement (such as equipment)

Dismantlement Procedure:

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect negative cable of battery and wait for 90s. Refer to 2.11.8.1 Disconnection procedures of battery cable.
2. For dismantling of rear column lower trimming plate, refer to 12.9.1.5 Replacement of rear column lower trimming plate.
3. Disconnect rear side crash-sensor harness connector.
4. Dismantle fixing bolt of rear side impact sensor and remove sensor.

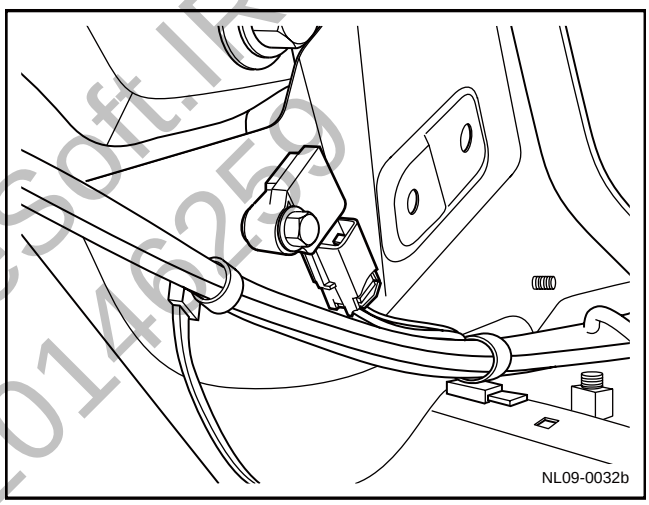


Installation Procedure:

1. Install rear side impact sensor and tighten fixing bolt.

Torque:8 Nm (Metric) 5.9 lb-ft (English system)

2. Connect rear side impact sensor wire harness connector.
3. Install the rear column lower trim panel.



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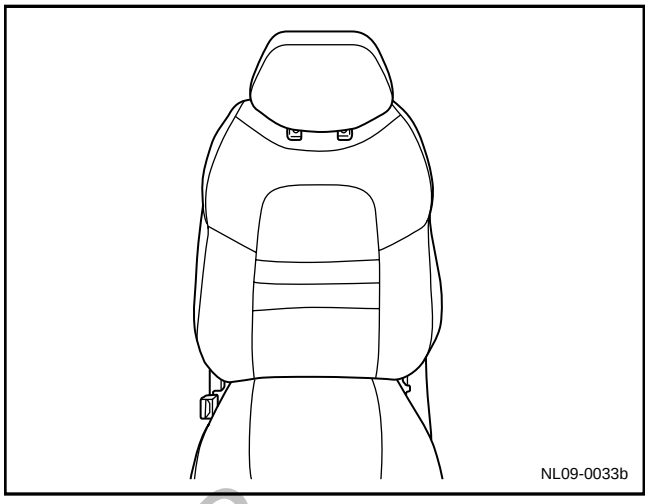
9.2.7.10 Passenger D detect sensor replacement

Dismantlement Procedure

For dismantlement and installation procedures, see 11.11.8.3 Replacement of Power Seat Regulator Assembly.

Note: the cushion can be directly removed after disassembling the power seat adjuster; and the manned sensor is installed in the cushion.



9.2.7. Replacement of 11 Seat Side Airbag

Note: please replace the front row of seat back if the seat-side airbag is detonated.

1. For dismantling procedures, refer to 11.11.8.3 Replacement of electric seat adjuster assembly.

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9.3 Preload type safety belt system

9.3.1 Specifications

9.3.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lb-ft)
Lower fixing bracket of front row of left safety belt retractor (pre-tightening force-limit mode)	Inch 7/16	40-50	30-37
Lower fixing bracket of front row of right safety belt retractor (pre-tightening force-limit mode)	Inch 7/16	40-50	30-37
Lower fixing bracket of front row of left safety belt retractor (common mode)	Inch 7/16	40-50	30-37
Lower fixing bracket of front row of left safety belt retractor (common mode)	Inch 7/16	40-50	30-37
Front row safety belt latch fixing point	Inch 7/16	40-50	30-37
Height adjuster fixing point of front row safety belt height adjuster	M10×22	30-40	22-30
Fixed support of the second row of left safety belt retractor	Inch 7/16	40-50	30-37
Fixed support of the second row of right safety belt retractor	Inch 7/16	40-50	30-37
Fixed point of the second row of left safety belt buckle	Inch 7/16	40-50	30-37
Fixed point of the second row of right safety belt buckle	Inch 7/16	40-50	30-37
Fixed point of the second row of medium safety belt retractor	Inch 7/16	40-50	30-37
Fixed point of the second row of left medium safety belt buckle	Inch 7/16	40-50	30-37
Fixed point of the second row of right medium safety belt buckle	Inch 7/16	40-50	30-37
Fixed point of the rear row of two-side safety belt (two-point type)	Inch 7/16	40-50	30-37
Rear row left side safety belt latch fixing point	Inch 7/16	40-50	30-37
Fixed point of the rear row of right safety belt buckle	Inch 7/16	40-50	30-37

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Shoulder guide ring fixing nut of front row safety belt	Inch 7/16	40-50	30-37
Upper fixing support of safety belt retractor	M6×15	8-10	6-8

9.3.2 Description and Operation

9.3.2.1 Description and operation

Seat belt

The front-row seats and the rear-row seats are both equipped with safety belts and these are the main means to protect the passengers. The passenger can be kept in the passenger compartment via the safety belt with the following conditions, and the impact force can be gradually reduced.

Face impact type

- Rear impact type collision
- Side impact type collision
- Turnover type collision

All vehicles are equipped with an emergency locking retractor. Safety belt with self-lock function The locking function is activated when quickly pulling the safety belt from the retractor completely. The locking function can prevent the pull-out amplitude of the safety belt from exceeding the allowable rolling position.

Recommend to fix the child seat with the self-locking function. When the safety belt is completely rolled into the emergency locking retractor, the function can be canceled. After the locking function is canceled, the safety belt is unlocked. After the locking function is canceled, the safety belt can be pulled out from the retractor. This vehicle is also equipped with an airbag system. See 9.2.2.1 Description and Operations in "Airbag System".

Seat safety belt warning lamp

The driver seat safety belt warning lamp and the passenger seat safety belt warning lamp are located on the combination instrument and the multifunctional instrument displayer respectively to remind the client of wearing the safety belt.

Child Seat Protection System

Warning: Do not use backward protective device for children on the passenger sear. When inflating the passenger-side SRS, the child sitting in the backward protective device for children on the passenger seat will be suffered fro severe injuries. If the forward protective device for children is applicable to your child, make sure the front row of passenger chair moves backward as far as possible, and then install the protective device for children. Ensure the position of the protective device for children does not conflict with any additional requirements of the manufacturer. See the user manual of the automobile as well as the user guide attached in the protective device for children for details.

Child seat can only be used for the forward seating position. The child seat should be installed and fixed according to the guidance of the manufacturer. If the child seat is equipped with an upper strap, need to fix the seat. If the safety belt on the seat is used for fixing the child seat, the seat shall not be allowed to sit.

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9.3.3 System operating principle

9.3.3.1 System operating Principle

Front row seat safety belt system

The front row of seat safety belt system comprises driver and passenger seat safety belt pre-tightener retractors, a passenger identification sensor and two front rows of seat safety switches. The passenger recognition sensor is used for detecting whether the passenger seat is occupied by a passenger. If unmanned via detection, turn off the passenger safety belt warning lamp. Two front rows of seat safety belt switches are located in the seat lock catches respectively for controlling the safety belt warning lamp and the buzzer.

1. Driver seat safety belt warning lamp

After the ignition switch is ON, the airbag electronic control unit (ACU) detects the status of the driver's seat belt and sends out a signal to the combination instrument through the CAN bus if the driver's seat belt is not fastened, the driver seat safety belt warning lamp on the combination instrument flashes, and the buzzer sounds for 4s to remind the driver of wearing the safety belt.

2. Passenger seat safety belt warning lamp.

When the ignition switch is in the position ON, a passenger identification sensor detects whether the passenger seat is occupied and sends out a signal to the electronic control unit of the airbag. The airbag electronic control unit detects the condition of the passenger seat belt and sends to the instrument assembly a signal. Then the combination instrument assembly sends to the multi-functional instrument a signal and requests the passenger seat belt warning lamp to flicker or go out.

Rear row of seat safety belt system

The rear row of seat safety belt system comprises the following parts:

— Rear row seat safety belt retractor and safety belt assembly; safety belt retractor is located under the rear stand trimming plate and its lower section is fixed on the floor.

— Rear row seat safety belt buckle and middle row seat safety belt buckle; buckle is fixed on the floor by the buckle.

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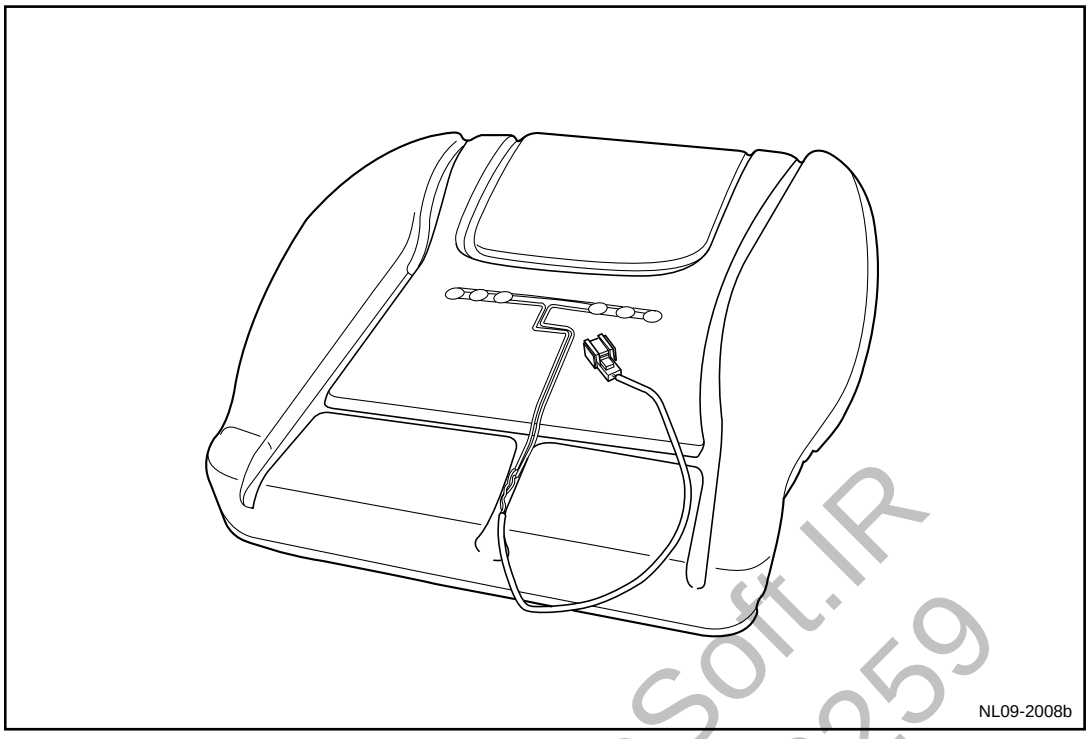
9.3.4 Component position

9.3.4.1 Component position

Passenger identification sensor



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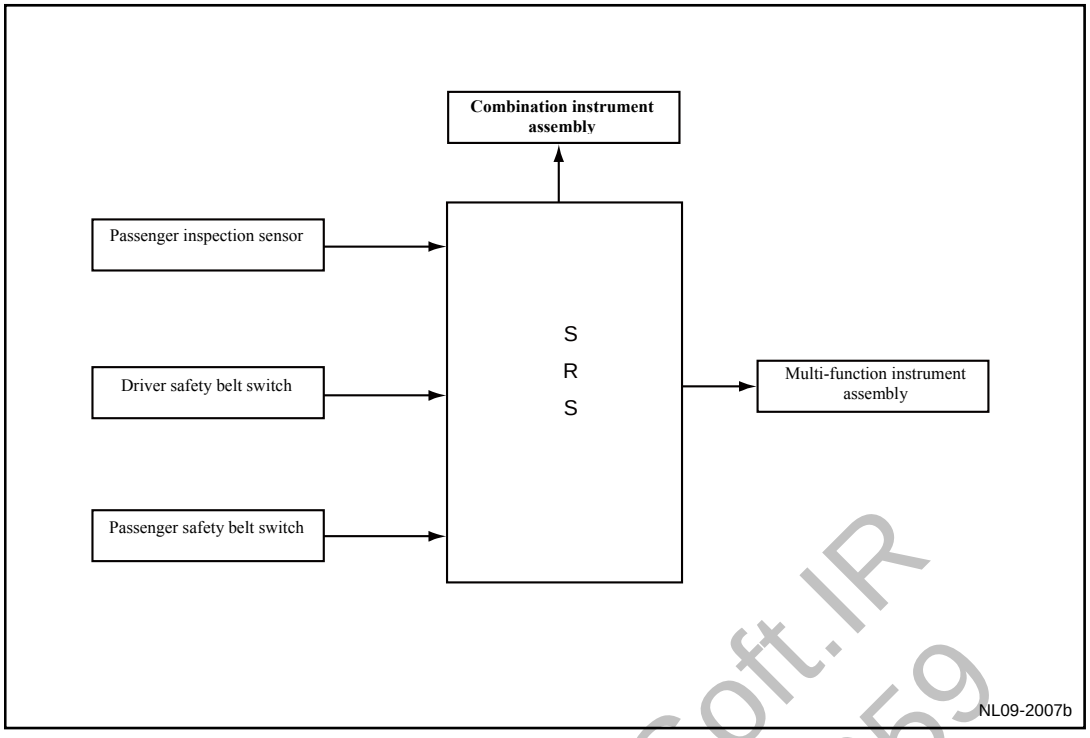
9.3.5 Electrical schematic diagram

9.3.5.1 Electrical schematic diagram



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9.3.6 Diagnostic information and procedures

9.3.6.1 Visual inspection

- Confirm Fault Symptom

The most difficult situation in troubleshooting is that there is no any symptom incurred. In this case, it is necessary to analyze the fault described by the user thoroughly. Then simulate the failure with the customer vehicle.

The same or similar condition and environment. No matter how rich the experience of the maintenance personnel is and no matter how skilled the technology is, troubleshoot if not confirming the symptom, it will during repair

Ignore something important, and make wrong guess in some places. It may cause that the troubleshooting is unable to be done.

- Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.
- Support of connector joint and completely check main part for vibration, if vibration may caused fault condition, suggest vibration method

1. With a finger, gently shook the part that may be faulty and inspect for malfunction.
2. Gently shake the connector vertically and horizontally.
3. Slightly shake wire harness in vertical and horizontal direction.

- On-board inspection

A. Check the driver seat belt warning lamp;

a. Turn the ignition switch to the ON position.

b. When the driver seat belt is unfastened, check whether the driver seat belt warning lamp on the combination instrument flickers.

c. When the driver seat belt is fastened, check whether the driver seat belt warning lamp on the combination instrument goes out.

B. Check the passenger seat belt warning lamp:

a. Turn the ignition switch to the ON position.

b. If the passenger's seat is occupied and the seat belt is not fastened, check whether the passenger seat belt warning lamp on the multi-functional instrument indicator flickers.

c. If the passenger seat is occupied and the seat belt is fastened, check whether the passenger seat belt warning lamp on the multi-functional instrument indicator goes out.

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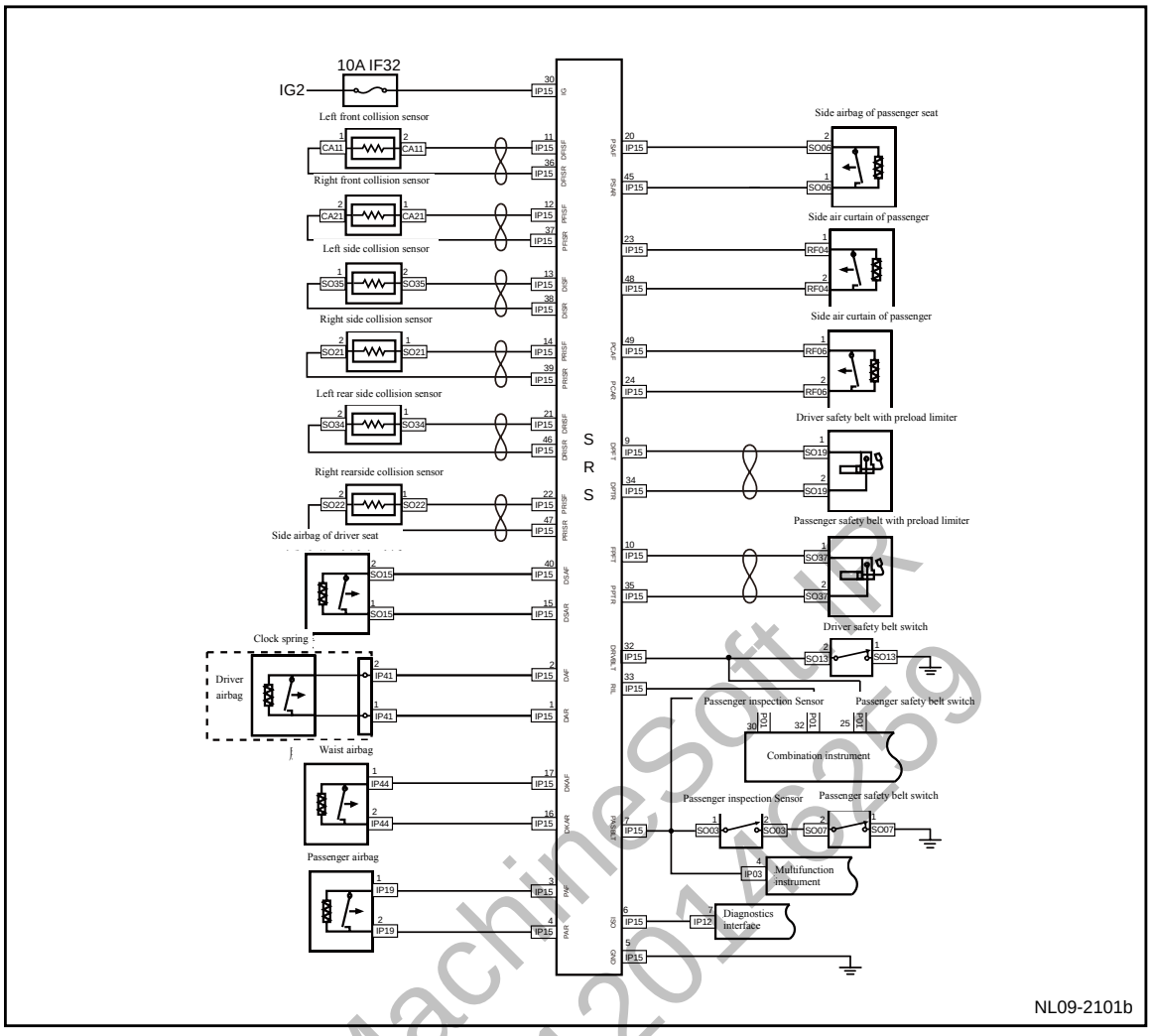
9.3.6.2 Driver Seat Belt Warning Lamp Does Not Work

Circuit diagram:



Diagnostic Steps:

1	Inspect the passenger seat safety belt buckle assembly.

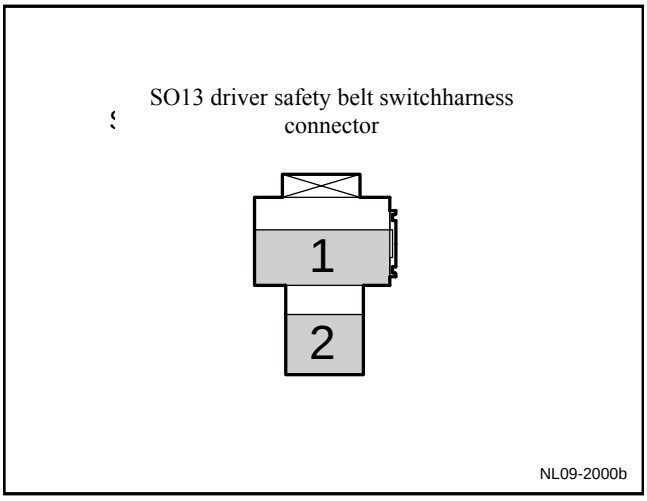
(a) Disconnect driver seal safety belt lock catch harness connector SO13.

(b) Use multimeter to measure whether driver's side seat safety belt switch status meets the following requirements.

(c) Tie safety belt, resistance between terminal 1 and 2 is 10kΩ or higher.

(d) When disconnect safety belt, resistance between terminal 1 and 2 is lower than 1Ω.

Confirm if the resistance conforms to standard value.



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No → Replace passenger seat safety belt buckle assembly.

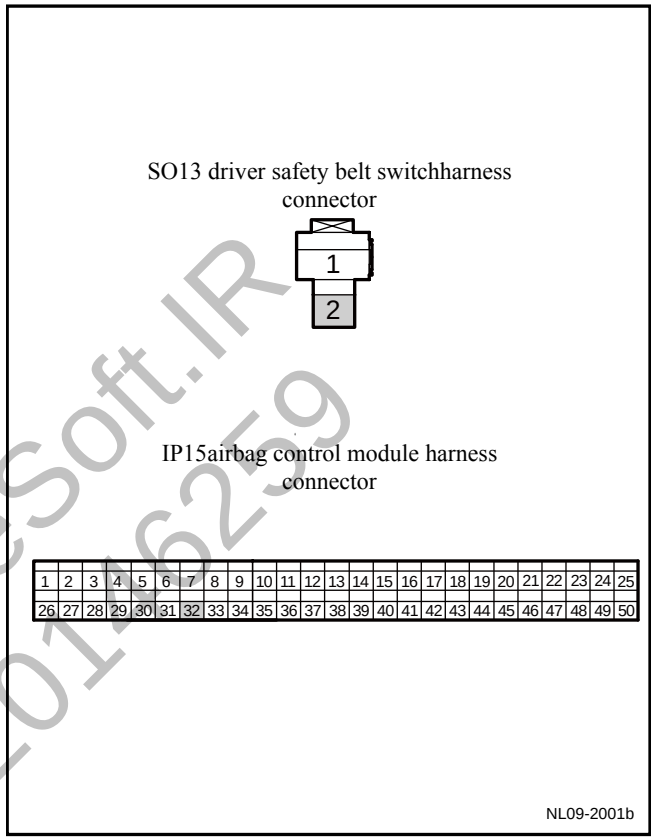
Yes

2	Inspect the communication between the wire harness driver seat safety belt buckle and the SRS control module.

a) Disconnect the harness connector SO13 of the driver seat belt lock catch and harness connector IP15 of the airbag control module.

(b) Use multimeter to measure resistance between driver's side seat safety belt buckle wire harness connector SO13 terminal 2 and safety airbag control module wire harness connector IP15 terminal 32.

Standard Resistance: Less than 1 Ω



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Yes → Go to step 4

No

3	Replace circuit between the driver seat safety belt buckle and the SRS control module.

(a) Replace circuit between harness driver seal safety belt lock catch and airbag control module.

Confirm whether the driver seat safety belt warning lamp work normally.

Yes → The system is normal.

No

4	Inspect the communication between the passenger seat safety belt buckle and the body grounding.

(a) Measure resistance between driver's seat safety belt buckle wire harness connector SO13 terminal 1 and grounding.

Standard resistant value: is less than 1Ω

Is the resistance at a specified value?

Yes → Go to step 6

No

5	Replace circuit between passenger seat safety belt buckle and body grounding.

(a) Replace circuit of driver seal safety belt lock catch and body grounding,

Does the driver seat safety belt warning lamp work normally?

Yes → The system is normal.

No

6	Inspect the communication between the SRS control module and the combination instrument.

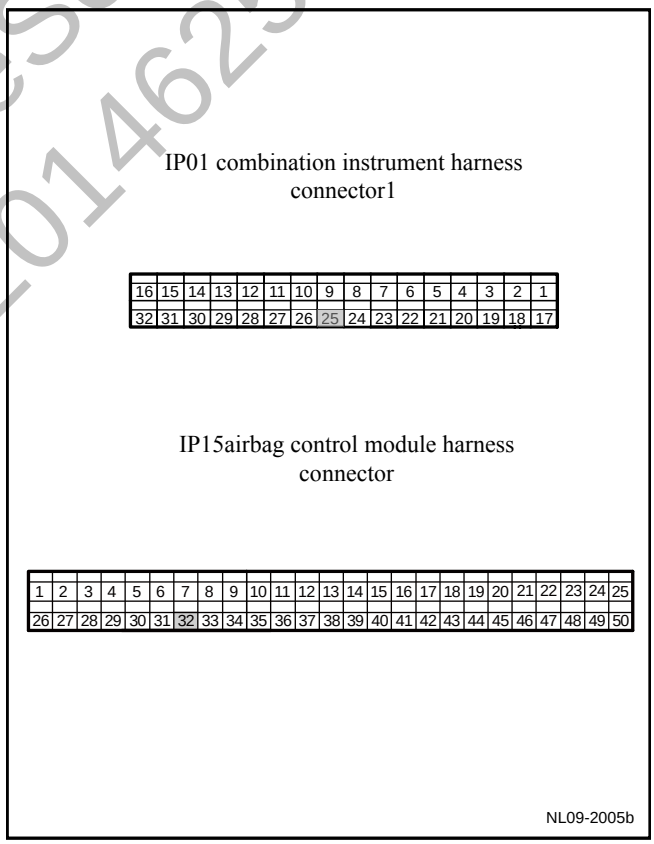
(a) Disconnect wire harness connector IP15 of safety air bag control module.

(b) Disconnect instrument cluster harness connector IP01.

(c) Measure resistance between wire harness connector IP15 terminal 32 of safety airbag control module and combined instrument wire harness connector IP01 terminal 25.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 8

No

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7	Replace the circuit between the SRS control module and the combination instrument.

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(a) Replace wire circuit of SRS and instrument cluster

Does the driver seat safety belt warning lamp work normally?

Yes → The system is normal.

No

8	Replace the airbag control module.

(a) Replace the airbag control module and refer to 9.2.7.1 Replacement of Airbag Control Module.

Does the driver seat safety belt warning lamp work normally?

Yes → The system is normal.

No

9	Replace the instrument cluster assembly.

(a) Replace instrument cluster assembly; refer to11.7.7.1 instrument cluster assembly replacement.

Confirm the completion of repair.

Next

10	The system is normal.

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9.3.6.3 Front Passenger Seat Belt Warning Lamp Malfunction

Circuit diagram:

Refer to 9.3.6.2 Circuit Diagram of Driver Seat Belt Warning Lamp Not Working.

Diagnostic Steps:

1	Inspect passenger seat safety belt buckle assembly.

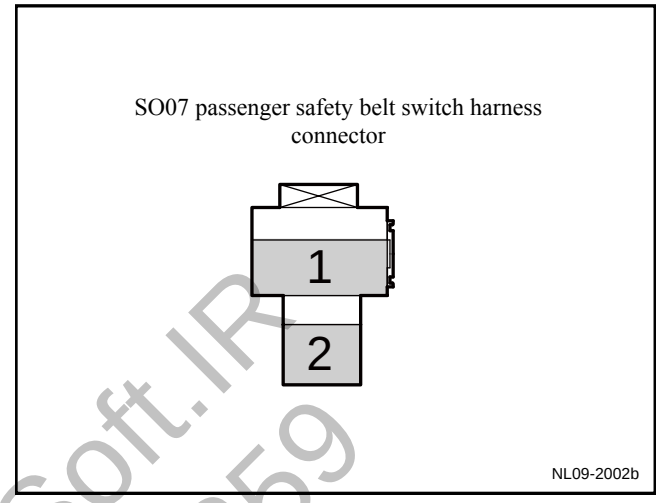
(a) Disconnect passenger seat safety belt buckle wire harness connector SO07.

(b) Use multimeter to measure whether passenger's side seat safety belt switch status meets the following requirements.

(c) Disconnect safety belt, and resistance between terminal 1 and 2 is lower than 1Ω.

(d) When tie safety belt, resistance between terminal 1 and 2 is 10kΩ or higher.

Confirm if the resistance conforms to standard value.



No → Replace passenger-side seat safety belt buckle assembly.

Yes

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2	Inspect the communication between the passenger seat safety belt buckle assembly and the grounding.

(a) Disconnect passenger seat safety belt buckle wire harness connector SO07.

(b) Measure passenger seat safety belt buckle wire harness connector SO07 terminal 1 and vehicle body grounding.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.

No → Replace circuit between passenger seat safety belt buckle and ground

Yes

3	Inspect passenger detection sensor.

(a) Disconnect passenger seat sensor connector SO03.

(b) Use multimeter to measure resistance of sensor according to the following condition.

(c) Passenger seat was took up , resistance is low than 100 Ω

(d) When passenger seat isn't occupied, resistance will be 10kΩ or higher.

Confirm if the resistance conforms to standard value.

No → Replace passenger detection sensor.

Yes

4	Inspect whether the passenger seat has communication between the manned sensor and passenger seat safety belt buckle.

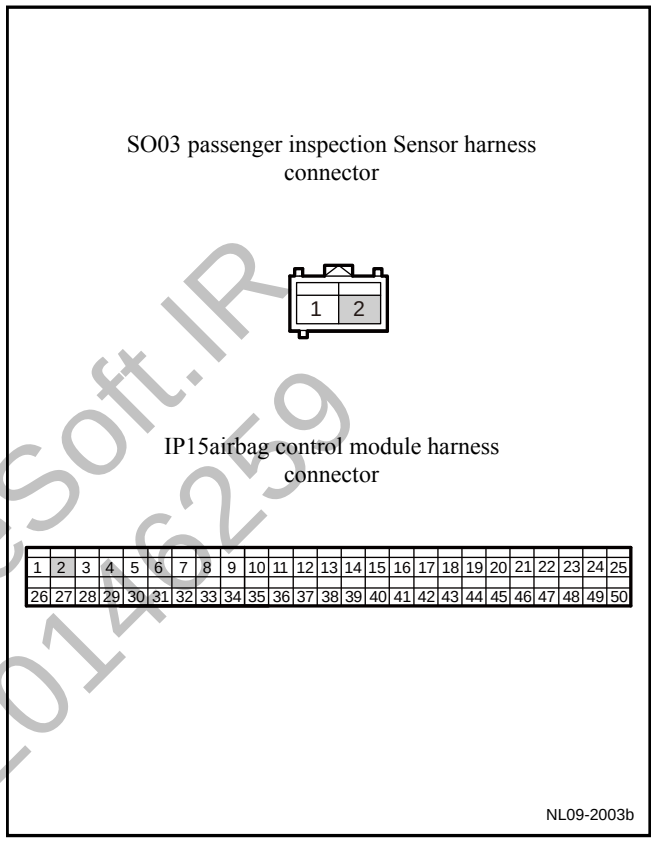
(a) Disconnect passenger detection sensor wire harness connector SO03.

(b) Disconnect passenger seat safety belt latch harness connector SO07.

(c) Use multimeter to measure resistance between passenger seat detection sensor wire harness connector SO03 terminal 2 and passenger seat safety belt buckle wire harness connector SO07 terminal 2.

Standard resistant value :is less than 1Ω

Confirm if the resistance conforms to standard value.



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No → Repair or replace the wire harness or connector

Yes

5	Inspect whether the passenger seat has communication between the manned sensor and SRS control module.

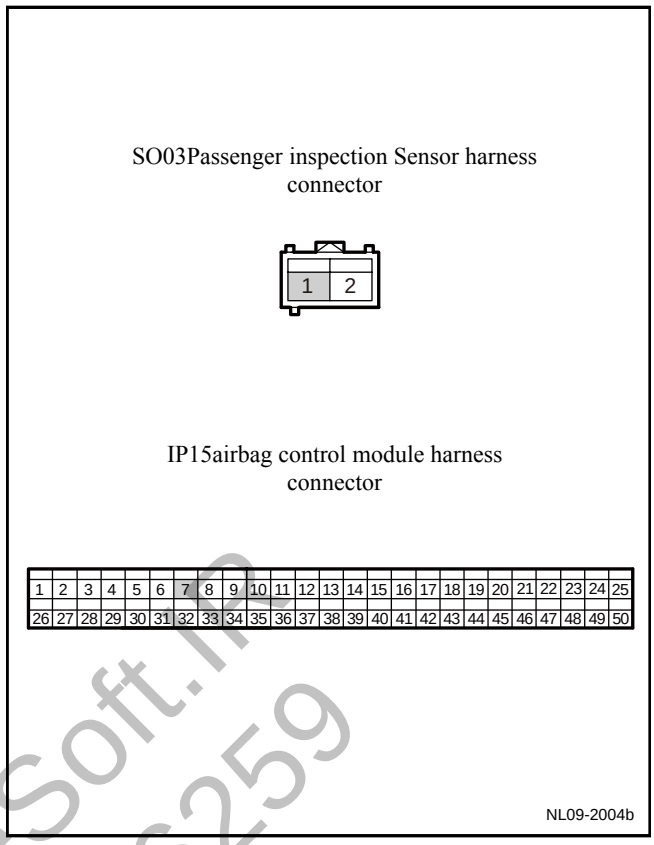
(a) Disconnect passenger seat sensor wire harness connector SO03.

B. Disconnect the airbag control module harness connector IP15.

(c) Use multimeter to measure resistance between passenger seat man sensor wire harness connector SO03 terminal 1 and safety airbag control module wire harness connector IP15 terminal 7.

Standard resistant value :is less than 1Ω

Confirm if the resistance conforms to standard value.



No → Repair or replace the wire harness or connector

Yes

6	Inspect the communication between the SRS control module and the combination instrument.

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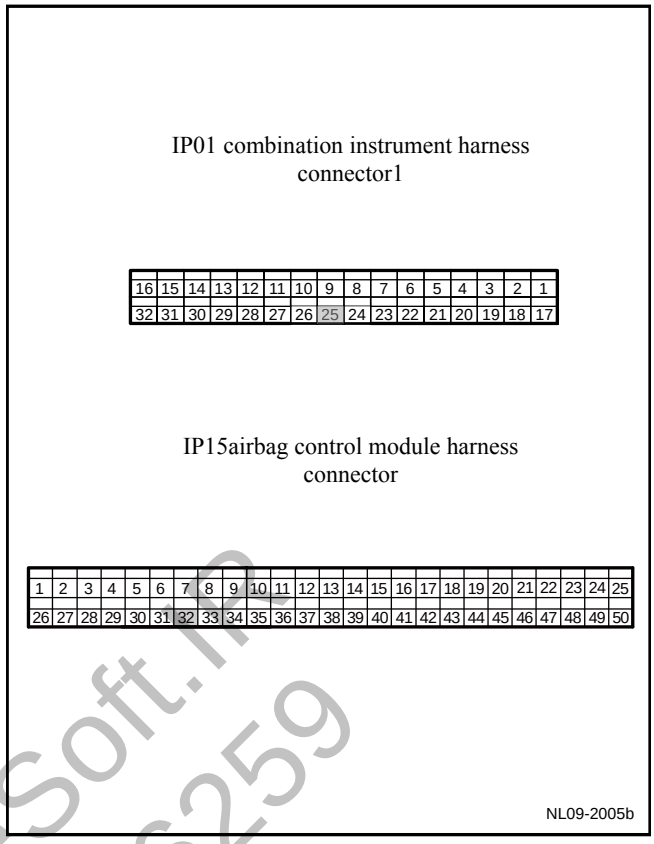
(a) Disconnect the airbag control module harness connector IP15.

(b) Disconnect instrument cluster harness connector IP01.

(c) Measure resistance between wire harness connector IP15 terminal 32 of safety airbag control module and combined instrument wire harness connector IP01 terminal 25.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.



No → Repair or replace the wire harness or connector

Yes

7	Inspect the communication between the SRS control module and the multifunctional instrument.

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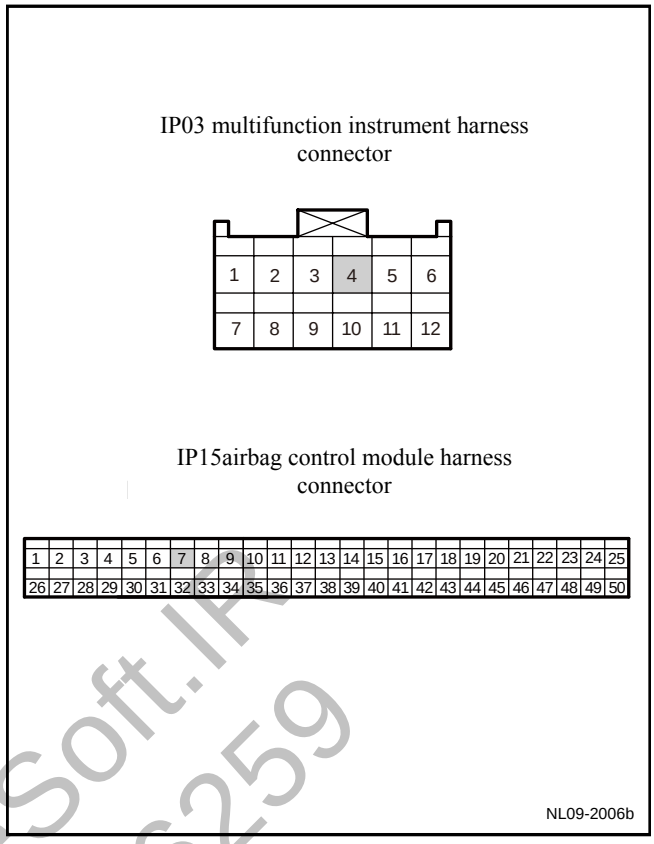
(a) Disconnect the airbag control module harness connector IP15.

(b) Disconnect multi-functional instrument wire harness connector IP03.

(c) Measure resistance between wire harness connector IP15 terminal 7 of safety airbag control module and multifunctional instrument wire harness connector IP03 terminal 4.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.



No → Repair or replace the wire harness or connector

Yes

8	Replace the airbag control module.

(a) Replace the airbag control module and refer to 9.2.7.1 Replacement of Airbag Control Module.

Does the driver seat safety belt warning lamp work normally?

Yes → The system is normal.

No

9	Replace the instrument cluster assembly.

(a) Replace instrument cluster assembly. refer to11.7.7.1 instrument cluster assembly replacement .

Confirm the completion of repair.

Yes → The system is normal.

No

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10	Replace multifunctional instrument.

(a) Replace multi-function instrument. refer to11.15.8.1 multi-function instrument replacement .

Confirm the completion of repair.

Next

11	The system is normal.

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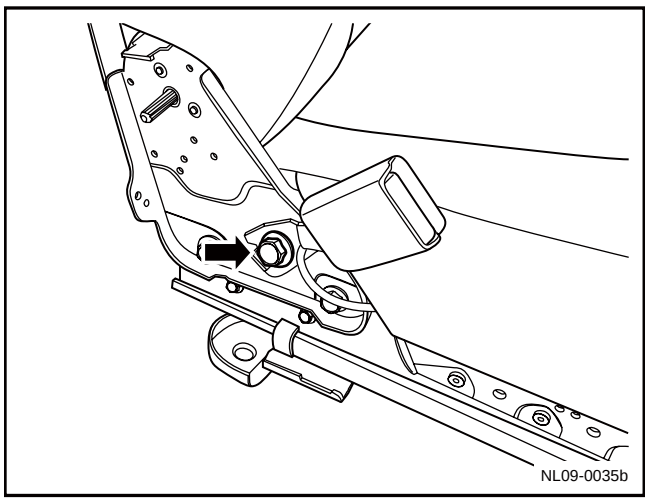
9.3.7 Removal and installation

9.3.7.1 Replacement of Front Seat Belt Lock Catch

Dismantlement Procedure

1. For dismantling of front row seat, refer to 12.7.3.2 Replacement of front row seat.
2. For dismantling of front row seat side trimming plate, refer to 11.11.8.2 Replacement of seat side trimming plate.
3. Dismantle fixing bolt of safety belt buckle of front row seat.

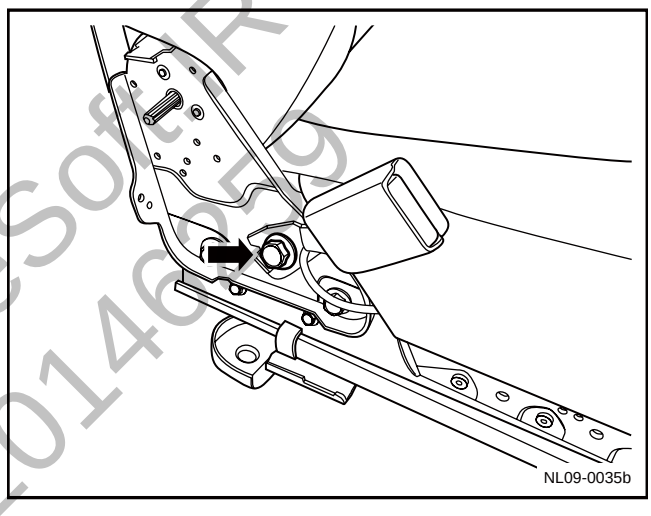


Installation Procedure:

1. Install front row seat safety belt buckle and tighten fixing bolt.

Torque: 45Nm (Metric) 33. 3lb-ft(English system)

2. Install front row seat trimming plate.
3. Install the front seats.



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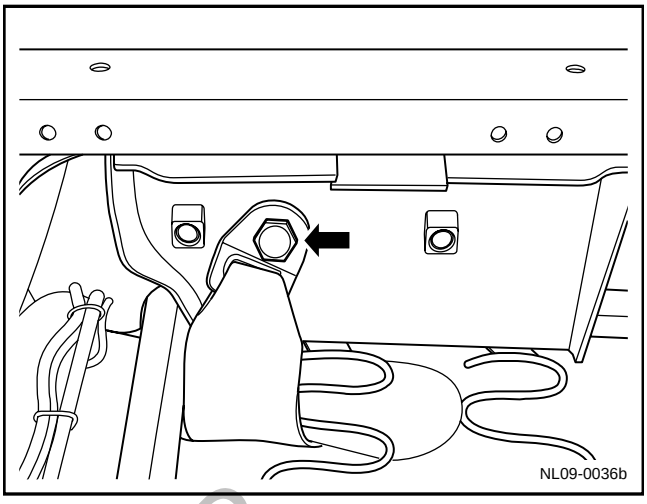
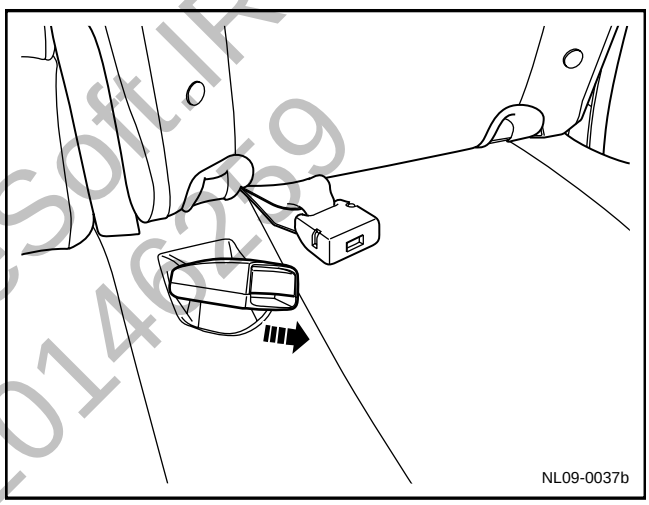
9.3.7.2 Replacement of Second-row Left Seat Belt Lock Catch

Dismantlement Procedure

1. For dismantling of middle row left seat, refer to 12.7.3.5 Replacement of middle row seat.
2. Dismantle fixing bolt of the second left middle safety belt buckle.



3. Remove the second left safety belt buckle.

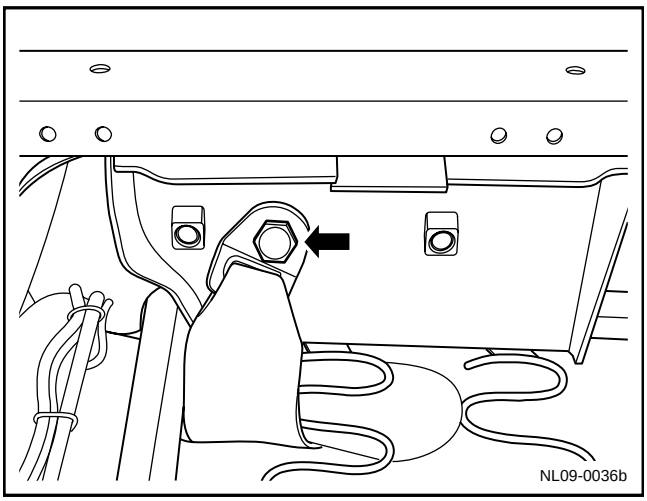


Installation Procedure:

1. Install second row left safety belt buckle and tighten fixing bolt.

Torque:45 Nm (Metric) 33.3 lb-ft (English system)

2. Install middle row left side seat.



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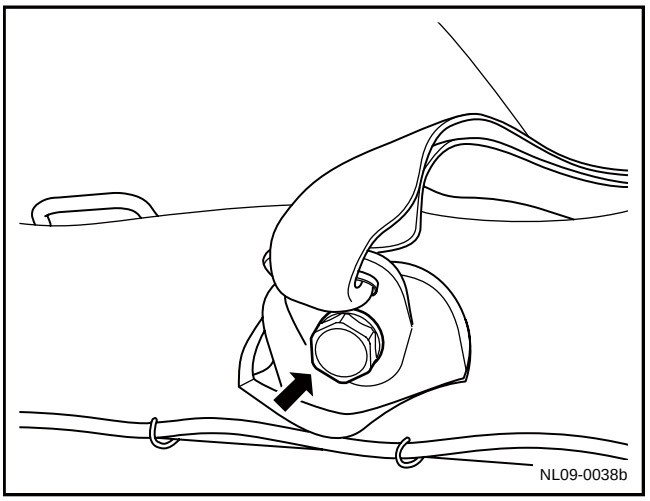
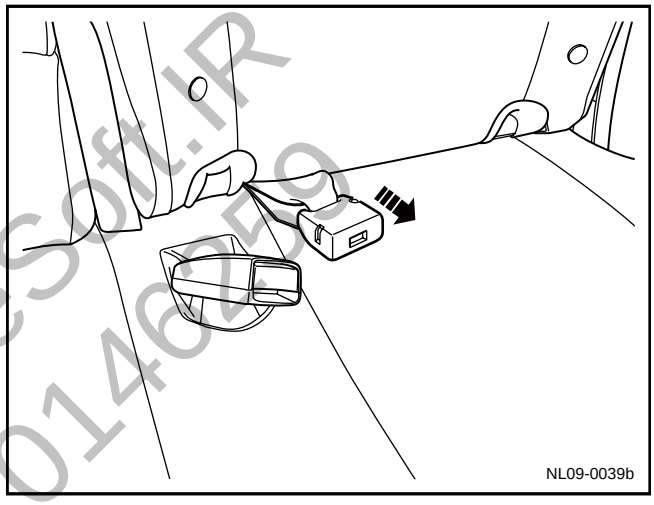
9.3.7.3 Replacement of Second-row Middle Seat Belt Lock Catch

Dismantlement Procedure

1. Dismantle second row left middle safety belt buckle fixing bolt fixed on the back of middle row left side seat.



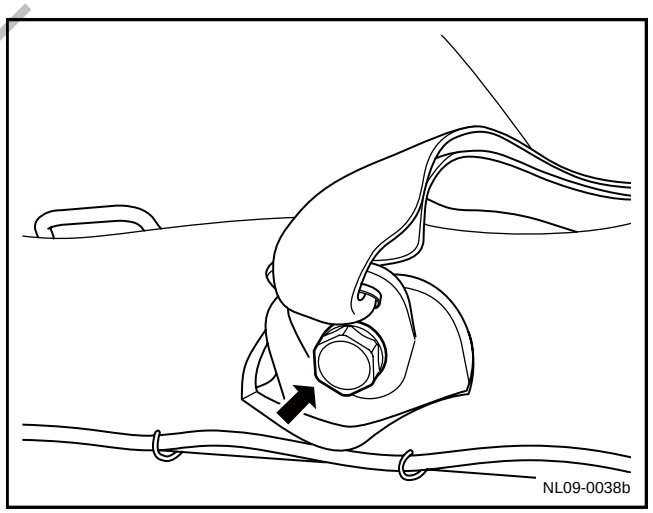
2. Draw out the second row left middle safety belt buckle.



Installation Procedure:

1. Install second row left middle safety belt buckle and tighten fixing bolt.

Torque: 45Nm (Metric) 33. 3lb-ft (English system)



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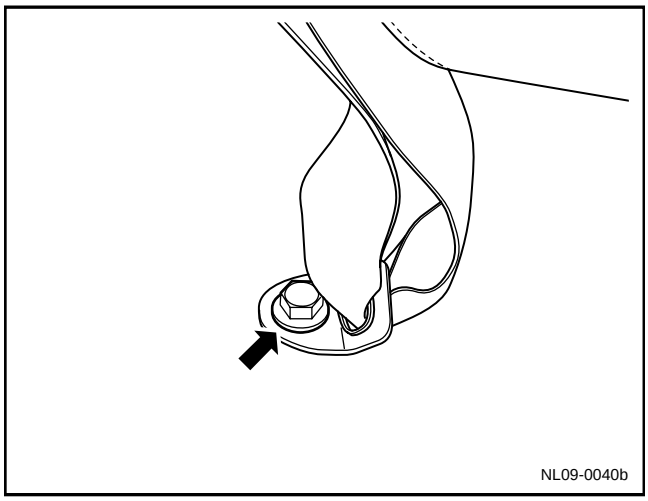
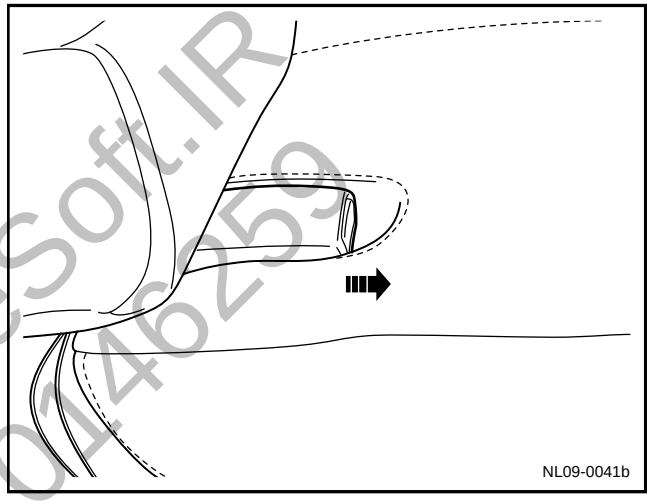
9.3.7.4 Replacement of Second-row Right Middle Seat Belt Lock Catch

Dismantlement Procedure

1. Turn over middle row right side seat.
2. Dismantle fixing bolt of the second right middle safety belt buckle.



3. Remove the second row right middle safety belt buckle.

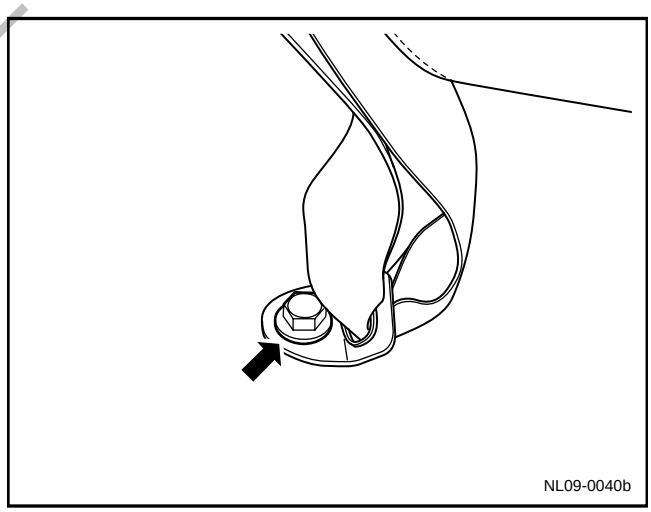


Installation Procedure:

1. Install and tighten the second row right middle safety belt buckle fixing bolt.

Torque: 45Nm (Metric) 33. 3lb-ft(English system)

2. Turn down middle row right seat.



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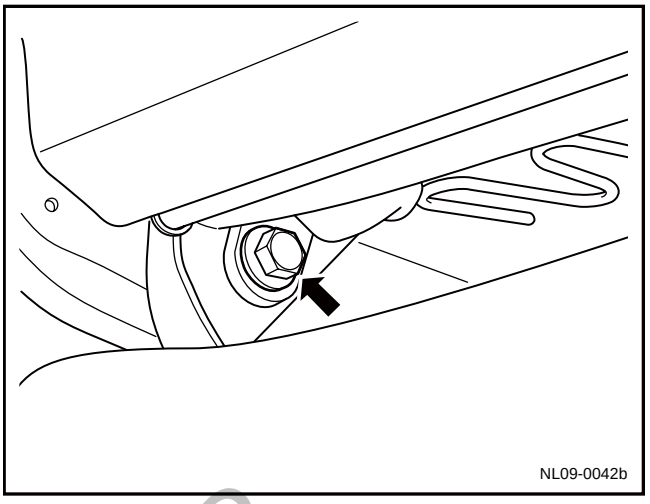
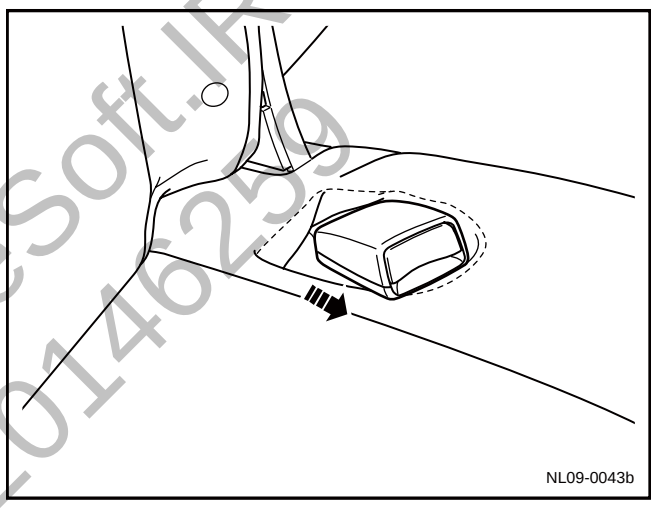
9.3.7.5 Replacement of Second-row Right Seat Belt Lock Catch

Dismantlement Procedure:

1. For dismantling of middle row right seat, refer to 12.7.3.4 Replacement of middle row seat.
2. Curl up middle row left seat cushion sleeve, and dismantle fixing bolt of the second row right safety belt buckle.



3. Remove the second row right safety belt buckle.



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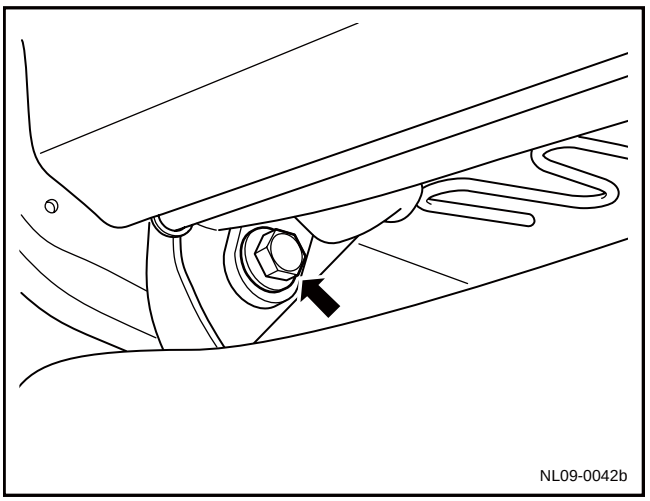
Installation Procedure:

1. Install second row right safety belt buckle and tighten fixing bolt.

Torque: 45Nm (Metric) 33. 3lb-ft (English system)

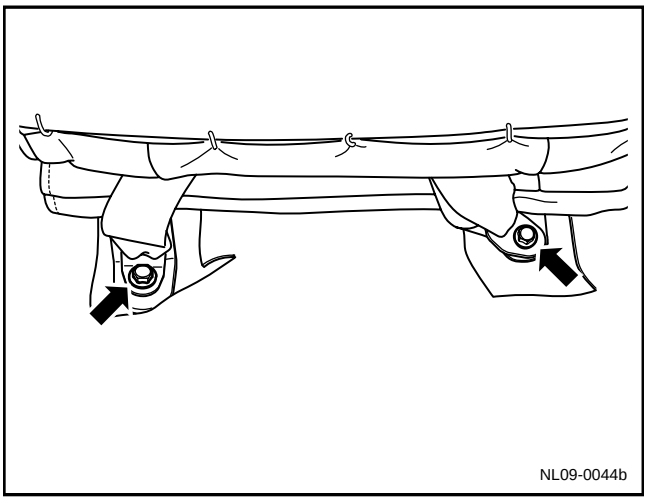
2. Install middle row right side seat.



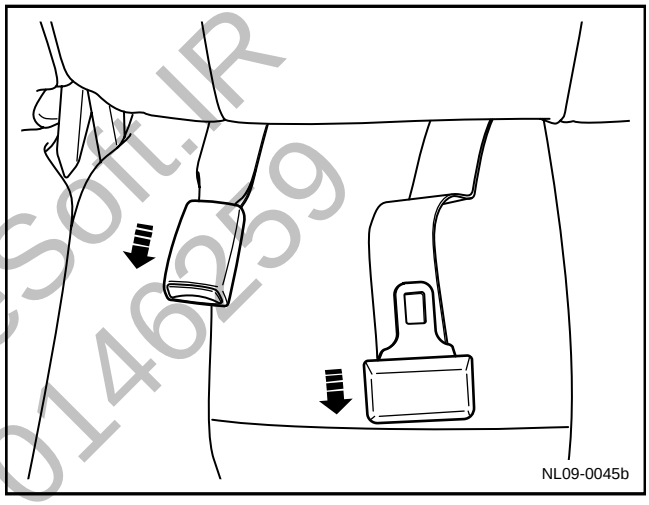
9.3.7.6 Replacement of Rear Row Two-point Seat Belt Assembly (such as equipment)

Dismantlement Procedure

1. Dismantle rear row seat rear fixing bolt.



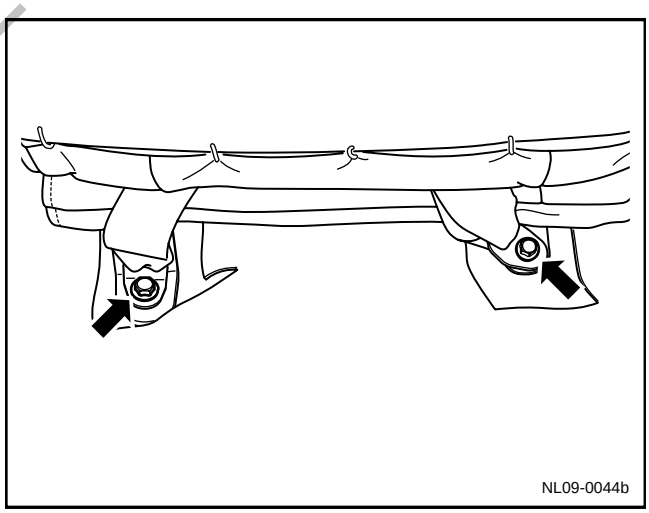
2. Draw out rear row two-point type safety belt assembly.



Installation Procedure:

1. Install rear-row two point type safety belt assembly and tighten fixing bolt.

Torque: 45Nm (Metric) 33. 3lb-ft(English system)



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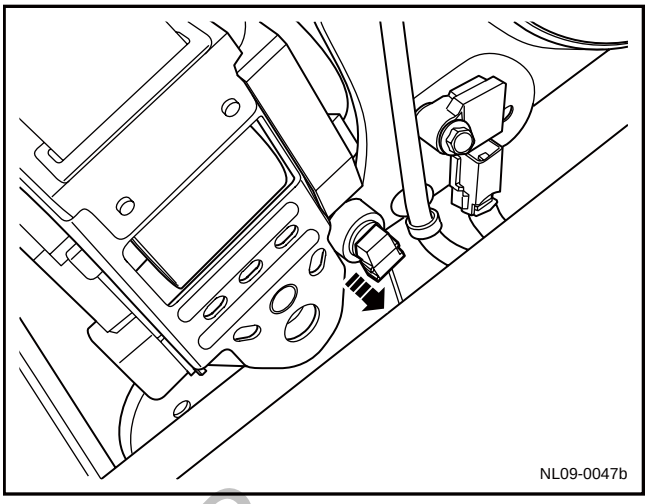
9.3.7.7 Replacement of Front-row Seat Belt Retractor

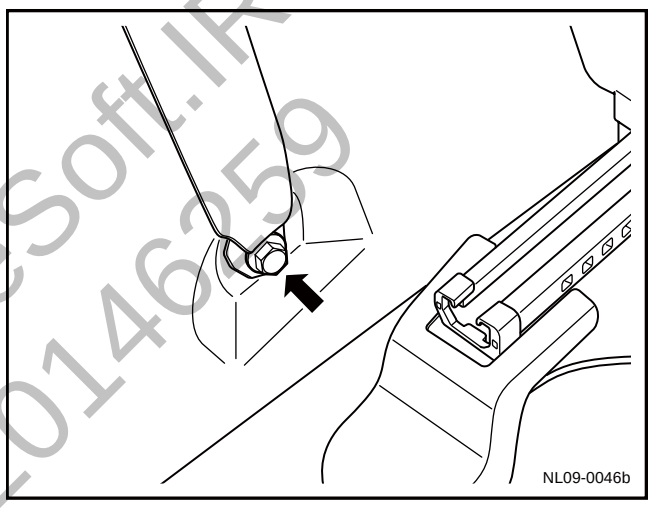
Dismantlement Procedure

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

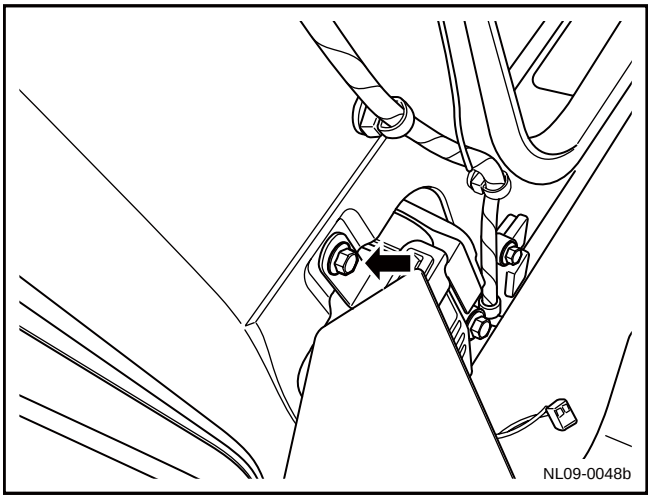
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Dismantle fixing bolt of lower fixing plate of middle column of front row seat safety belt.
3. For dismantling of upper and lower trimming plates of middle column, refer to 12.9.1.3 Replacement of trimming plates of middle column.



4. Disconnect wire harness connector of front row seat safety belt retractor.



5. Remove the fixing bolt for the front seat belt retractor.



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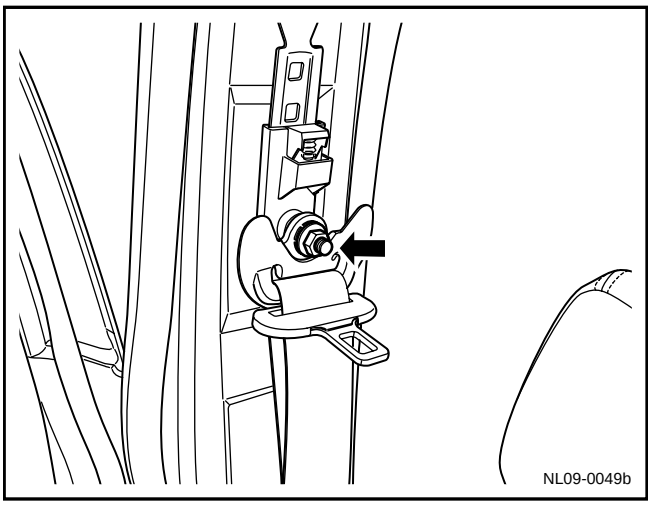
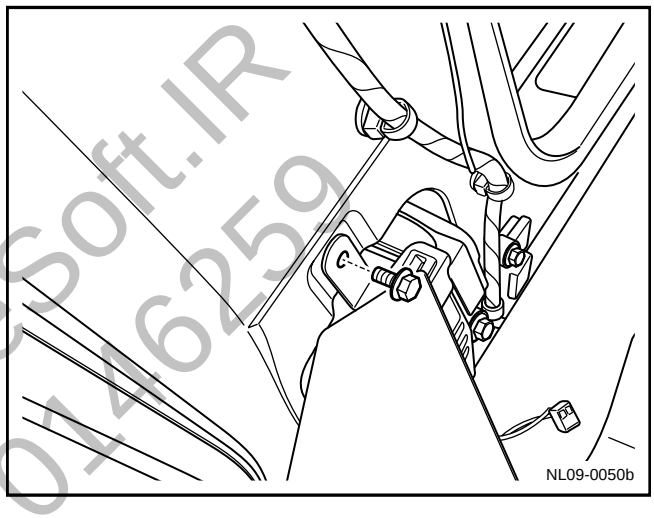
6. Remove the top fixing nut on the center pillar for the front seat belt.



Installation Procedure:

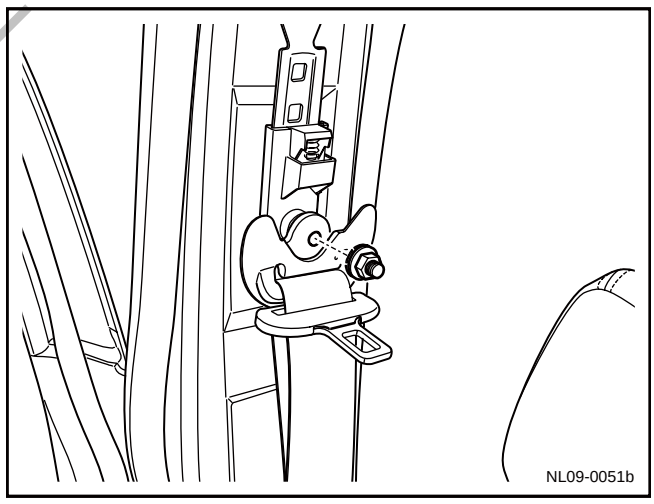
1. Install and tighten front row seat safety belt retractor fixing bolt.

Torque: 9Nm (Metric system) 6.7lb-ft (English system)



2. Install and tighten upper fixing nut of middle column of front seat safety belt.

Torque: 45Nm (Metric) 33. 3lb-ft(English system)



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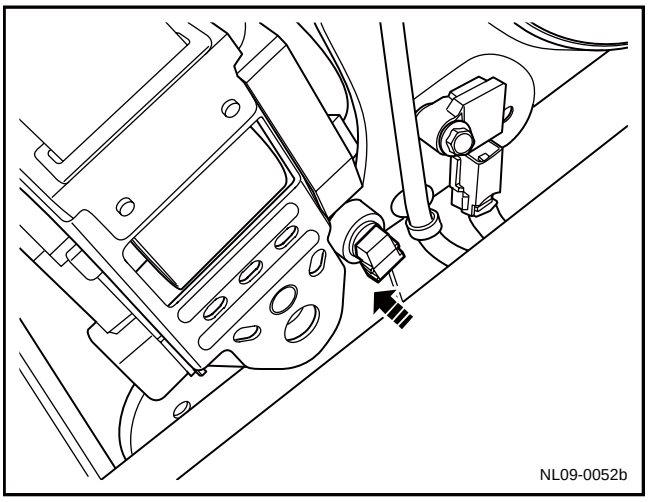
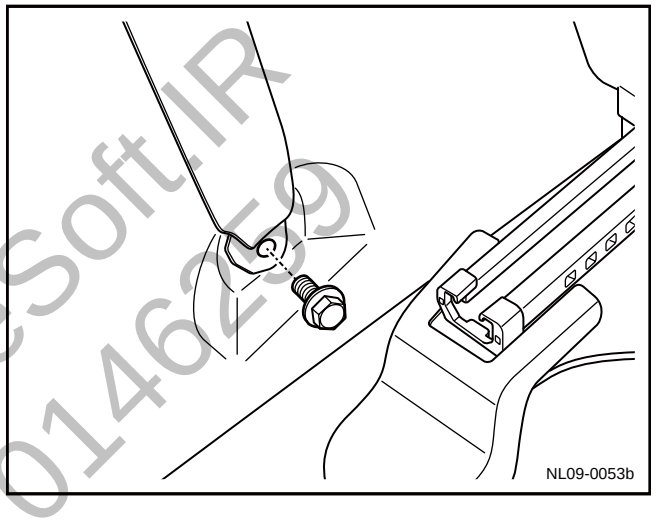
3. Connect front row seat safety belt retractor wire harness connector.
4. Upper and lower install panels of B pillar



5. Install and tighten the fixing bolt for the bottom clamping plate on the center pillar.
6. Connect the battery negative cable.



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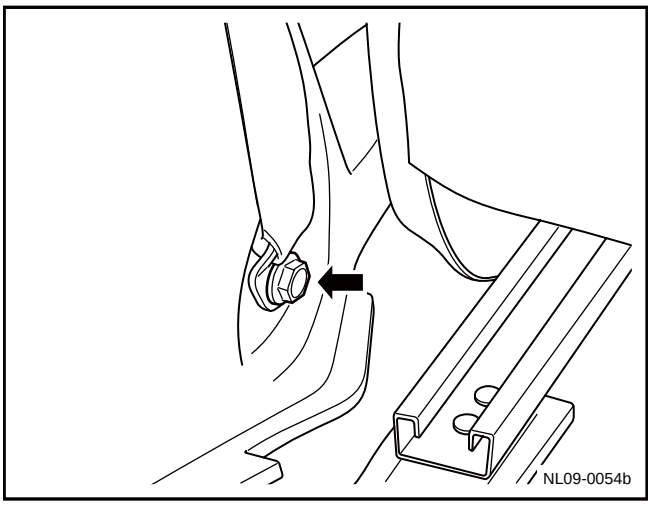
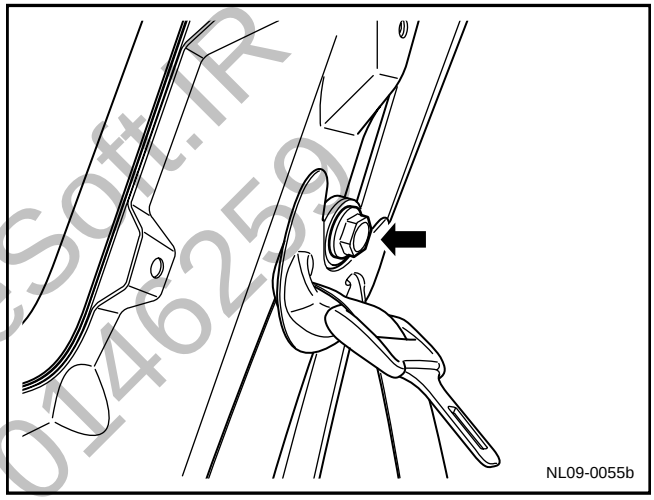
9.3.7.8 Replacement of Second-row Side Seat Belt Retractor

Dismantlement Procedure

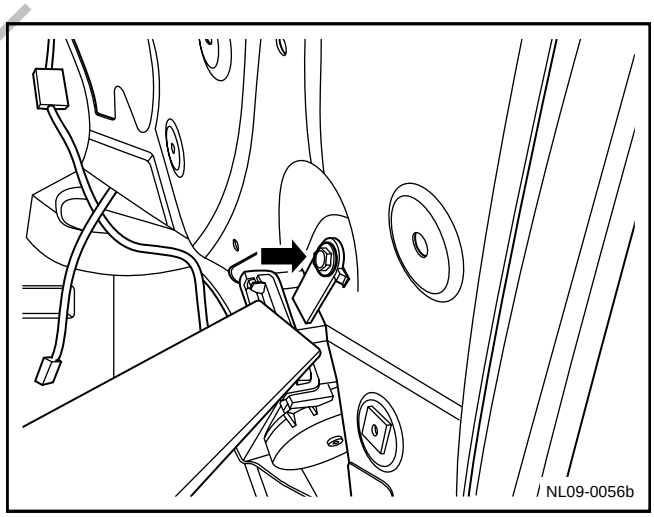
1. Dismantle fixing bolt of middle row seat safety belt lower fixing plate.
2. For dismantling of rear column lower trimming plate, refer to 12.9.1.5 Replacement of rear column lower trimming plate.
3. For dismantlement of the rear pillar top trim panel, see 12.9.1.6 Replacement of Rear Pillar Top Trim Panel.



4. Dismantle fixing bolt of upper fixing plate of middle row seat safety belt.



5. Remove the fixing bolt for the side belt retractor on the middle seat.



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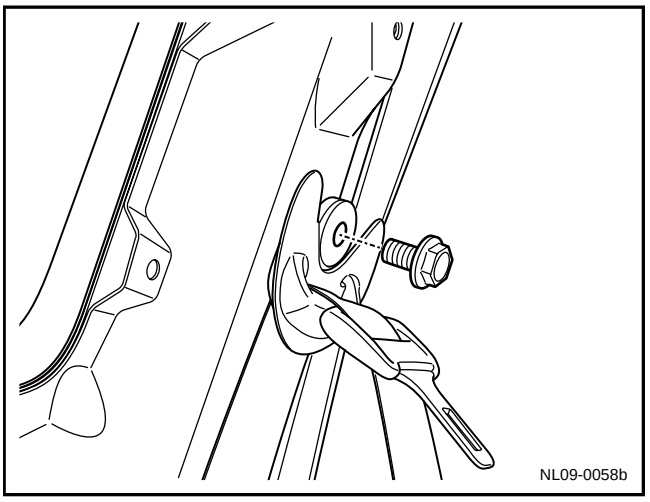
Installation Procedure:

1. Install and tighten middle row right side safety belt retractor fixing bolt.

Torque: 9Nm (Metric) 6. 7lb-ft (English system)

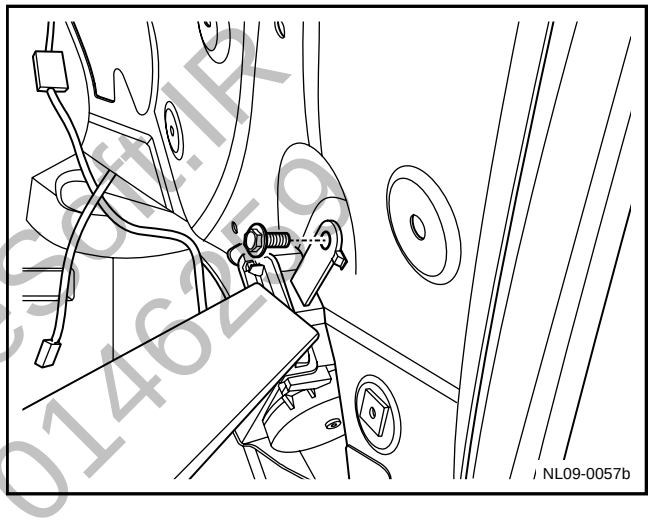


2. Install and tighten fixing bolt of upper fixing plate of safety belt on middle row seat side.

Torque: 45Nm (Metric) 33. 3lb-ft (English system)

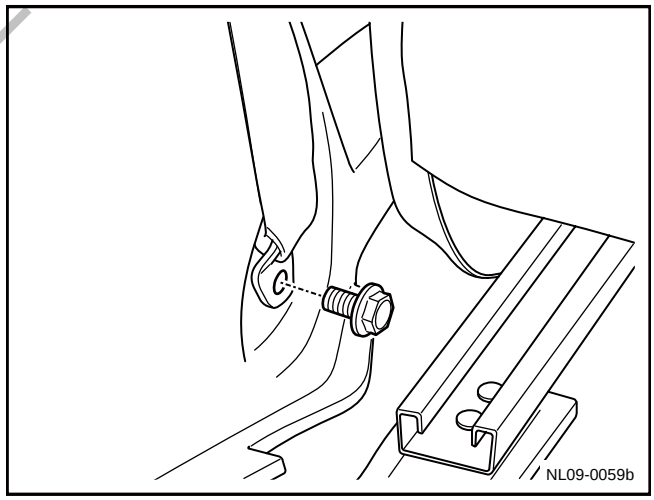
3. Install the rear column upper trim panel.

4. Install the rear column lower trim panel.



5. Install and tighten the fixing bolt for the bottom clamping plate for the intermediate seat belt.

Torque: 45Nm (Metric) 33. 3lb-ft (English system)



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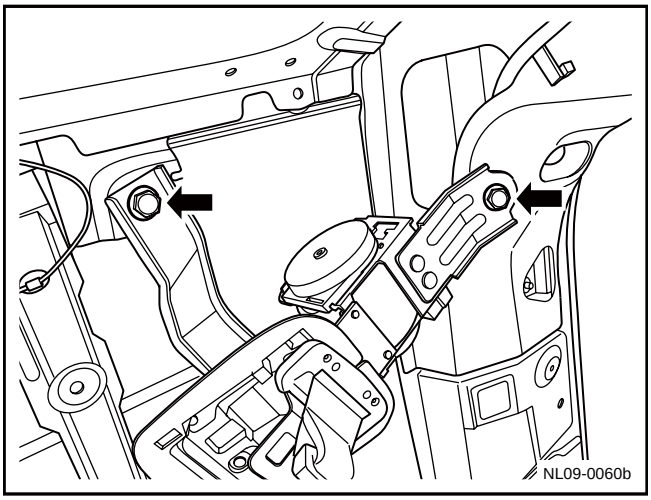
9.3.7.9 Replacement of Second-row Middle Seat Belt Retractor

Dismantlement Procedure

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of vehicle top inner trimming plate, refer to 12.9.1.11 Replacement of top cover inner trimming plate.
3. Dismantle fixing bolt of middle safety belt retractor of middle row seat.

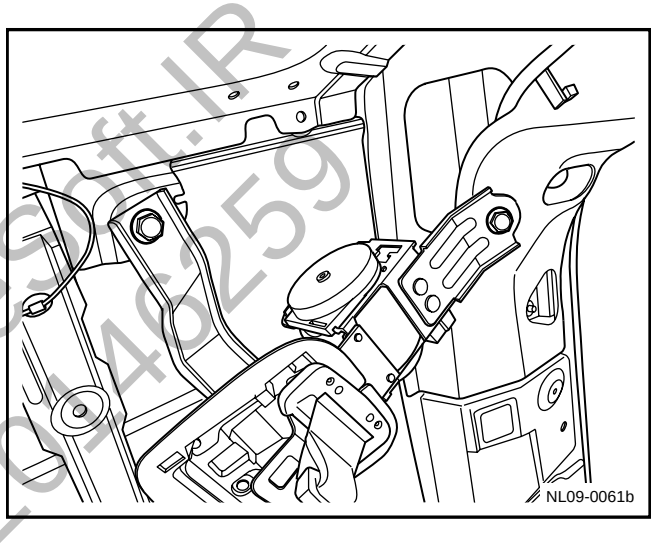


Installation Procedure:

1. Install and tighten middle row seat middle safety belt retractor fixing bolt.

Torque: 45Nm (Metric) 33. 3lb-ft (English system)

2. Install the roof panel.
3. Connect the battery negative cable.



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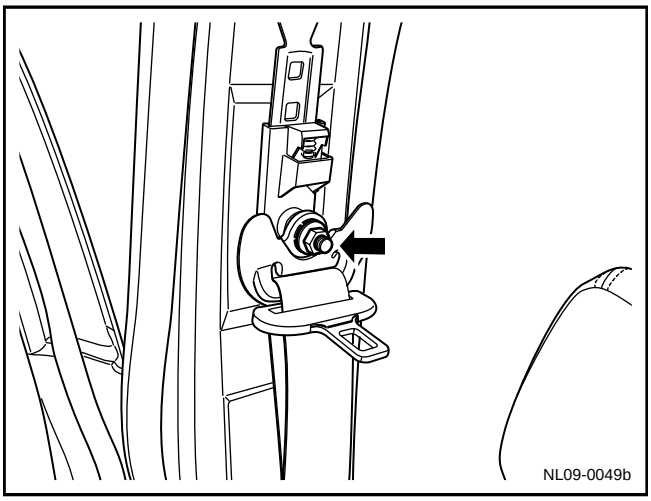
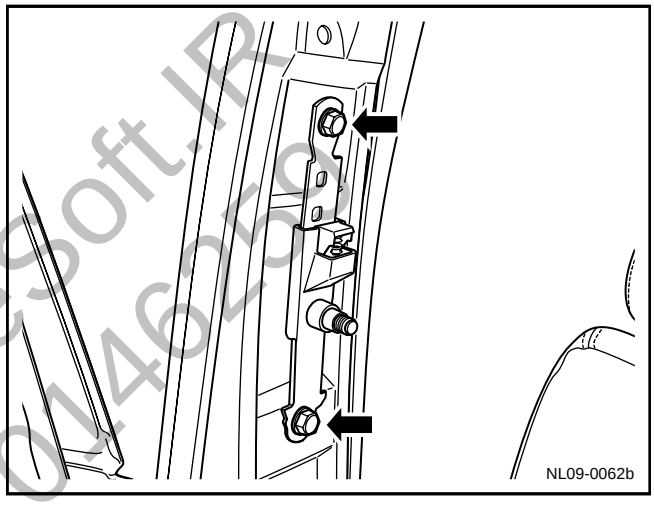
9.3.7.10 Replacement of Front Seat Belt Height Regulator

Dismantlement Procedure

1. For dismantling of middle column upper trimming plate, refer to 12.9.1.3 Replacement of middle column trimming plate.
2. Remove the top fixing nut on the center pillar for the front seat belt.



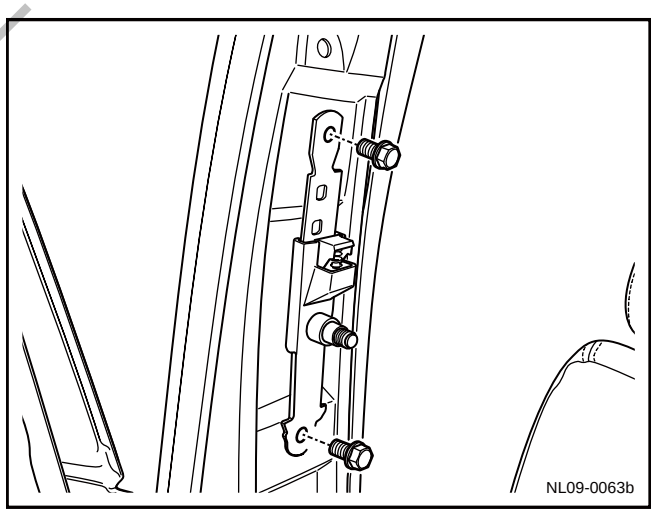
3. Dismantle fixing bolt of safety belt height adjuster of front row seat.



Installation Procedure:

1. Install front row seat safety belt height adjuster and tighten fixing bolt.

Torque: 35Nm (Metric) 25. 9lb-ft(English system)



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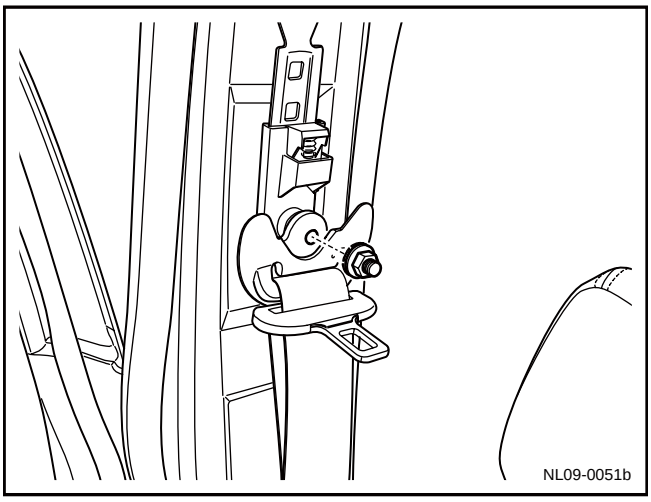
2. Install and tighten upper fixing nut of middle column of front seat safety belt.

Torque: 45Nm (Metric) 33. 3lb-ft(English system)

3. Install the middle column upper trimming plate.



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10.1 Warning and precaution 1886

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10.2.1 Specifications.....1887

10.2.1.1 Fastener specifications.....1887

10.2.2 Description and Operation.....1887

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10.2.3.1 BCM location plan.....1889

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10.2.4.1 BCM Terminal List.....1890

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10.2.4.3 DTC B1201 B1202.....1896

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10.2.4.13 DTC B1214.....1928

10.2.4.14 DTC B1215.....1930

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10.2.4.16 DTC B1218.....1935

10.2.4.17 DTC B1220.....1938

10.2.4.18 DTC B1222 1941

10.2.4.19 DTC B1224 1944

10.2.4.20 DTC B1236 1945

10.2.4.21 DTC U1000 1947

10.2.4.22 DTC U1004 1949

10.2.4.23 DTC U1005 1951

10.2.5 Dismantle and install 1953

10.2.5.1 BCM replacement.....1953

10.3 Computer integrated manufacturing system(JLD-4G20/JLD-4G24).....1954

10.3.1 Specification.....1954

10.3.1.1 Fastener specifications 1954

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10.3.3.1 BCM Terminal List. 1963

10.3.3.2 Fault Diagnosis Code (DTC) List.....1970

10.3.3.3 DTC B1201 B1202.....1972

10.3.3.4 DTC B11B312. B11B312. 1978

10.3.3.5 DTC B11B312. B11B312 1983

10.3.3.6 DTC B11B512. B11B512 1986

10.3.3.7 DTC B11D214. B11D213. B11D212. B11D312. B11D313. B11D314. 1989

10.3.3.8 U012187. U010087. U015187. U12501C. U12511C. U015587 1992

10.3.5 Dismantle and install 1993

10.3.5.1 BCM replacement.....1993

10.4 Programming and Setting.....1994

10.4.1 Programming and Setting.....1994

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10.1 Warning and precaution

10.1.1 Warning and precaution

Warning on Battery Disconnection

Warning!

Unless directed, otherwise, the ignition and start switch must be in OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable if a tool or any equipment easily comes in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

Road Test Warning

Warning!

Test a vehicle on the roads under safe conditions and obey all traffic laws. Do not attempt any operation that could jeopardize vehicle control. Failure to obey these precautions will lead to serious personal injury and vehicle damage.

Window Quick Down Warning

Warning!

Operate the power window switch when working inside the driver door. When operated, the Quick Up/Down function allows the window to move very quickly without stopping, which could cause personal injury.

Ignition OFF When Disconnecting Battery Notice

Notes:

Always turn the ignition OFF when connecting or disconnecting battery cables, battery chargers or jumper cables. Failing to do so may damage the control module or other electronic components.

Precautions on Power System Control Module and Electrostatic Discharge

Notes:

Do not touch the connector pins or soldered components on the circuit board in order to prevent possible electrostatic discharge (ESD) damage to the ECM.

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10.2 Computer and integration system(JL4G18-E)

10.2.1 Specifications

10.2.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (NM)	English system (lb-ft)
Fixing Bolts of Body Control Module (BCM)	M6×16	8	6

10.2.2 Description and Operation

10.2.2.1 Description and operation

Overview

In order to reduce the failure rate of vehicles, more effective humanistic control is realized. Therefore, BCM is integrated in electric accessories. BCM includes a RF receiver, with a frequency of 433 MHz.

External Anti-theft Function

The remote control anti-theft system is operated independent from the engine anti-theft system. The design of the remote control anti-theft system is to give the alarm when somebody forces to open the door. Under the alarm system, the anti-theft horn will emit an intermittent alarm sound and the steering signal lamp also flickers at the same time. When the ignition key is in the non-insertion state, press the unlock key on the remote control unit only once within 2s (the duration is not less than 0.1s), unlock the driver-side door lock, and flicker the steering lamp for confirmation. When the ignition key is in the non-insertion state, press the unlock key on the remote control unit twice within 2s (the duration is not less than 0.1s), unlock the other three door locks at the same time, and flicker the steering lamp for confirmation. When the ignition key is in the non-insertion state, press the unlock key on the remote control unit for 1s; thus, the remote signal independently unlocks the driver-side door lock signal (100s), and the other three door lock signals (1s). When the ignition key is in the non-insertion state, press the lock key on the remote control unit; then lock the five doors, and flicker the steering lamp for confirmation. When the ignition key is pulled out, close the door, lock the door through a remote control lock key (press the lock key once), and flash the steering lamp once. After 30s, it enters into anti-theft status. When automatically locking, the system will automatically enter the anti-theft state. When the door is locked by a remote control unit lock key, the steering lamp flickers three times and the anti-theft horn sounds three times if the door/backdoor is are not closed well. When the vehicle enters into an anti-theft alarm state from a non-anti-theft alarm state, the alarm circulation is as follows: left and right flash lamps flicker and an anti-theft alarm horn beeps for 30s; then judge again after 5s, if the alarm condition is still met after 5s, start alarm for 30s again, and there is a maximum of 8 circulations of the anti-theft alarm triggered at every turn. During anti-theft alarm, the flicker frequency of all turn signal lamps: 83min-1; sound frequency of horn: 3s; and ringing for 30ms.

Door lock control function

When the ignition key is in the non-insertion state, press the unlock key on the remote control unit, then lock the four door locks and the back door lock, and flicker the steering lamp for confirmation; and press the lock key on the remote control unit, then lock the four door locks and the back door lock, and flicker the steering lamp for confirmation. The driver-side door key is turned to the unlocking position to unlock the four door locks and the back door lock and turned to the lock position to lock the four locks and the back door lock. When the in-vehicle unlocking/locking switch performs the unlocking action, the four doors and back door are unlocked. When the switch performs the locking action, the four doors and back door are locked. After the remote control unit unlocks for 15s, the door will be automatically relocked if any one of the four doors and the backdoor is not opened. If repress the unlock key once within 15s, re-clock for 15s. When the ignition switch is in gear ON and the speed is higher than 30km/h, the four door locks automatically lock. If the speed exceeds 30km/h again, do not self-lock again. Only when the ignition switch is turned from the position OFF to the position ON or any one of door is opened and closed again, restart the automatic locking. When the key is inserted in the position OFF of the ignition switch (the position ACC is not detected), the door can not be locked (the function that the key is forgot to pull out); in the state that the door lock is locked, after the ignition key is pulled out or turn to the position ACC,

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the four door locks and the backdoor are automatically unlocked. When the door lock is not in the locking state, the four door locks and the back door locker are not operated after pulling out the ignition key. The back door can be unlocked by the remote control unit or the unlocking switch. When the BCM receives an airbag opening signal, automatically open four door locks and back door lock. However, it can not ensure to be applicable to under the condition that the power supply of door lock control motor cannot be supplied due to battery undervoltage or because the wire harness is damaged with collision.

Comfortable Lighting Control

– **Follower home lighting :**

Under the fortification state (the body anti-theft non-alarm state), consecutively press the remote-control lock twice within 2s, output the headlamp control signal for 60s, i.e., turn off the headlamp after delaying for 60s; within the 60s of delaying, press the remote-control unlock key once, stop the signal output through the BCM, and turn off the headlamp.

– **Auto-lighting function :**

When the ignition switch is in position "on" and the combination switch is in position of AUTO, the position lamp relay and headlamp relay are automatically switched on or off according to the brightness of the ambient environment. (environment sun and sun sensor signal input)

– **Steering lamp and hazard warning lamp:**

When the ignition switch is at "ON" position, turn on the left steering lamp switch. The left steering lamp will flash at a frequency of about 85 times per minute. When the ignition switch is at "ON" position, turn on the right steering lamp switch. The right steering lamp will flash at a frequency of about 85 times per minute.

No matter what position the ignition switch is at, press the warning switch and left and right steering lamps will flash at the same time at a frequency of about 85 times per minute. Press the warning switch again and the warning flash function will be canceled. During turning, if one of the steering signal lamps is (21W) damaged, the other steering signal lamps of the same side will flash at a frequency about double of normal frequency. When the speed is higher than 30 km/h, the key is in the position ON of the ignition switch, and the alarm switch signal is valid, the BCM drives left front, left side and left rear steering signal lamps to flicker if the lamp switch handle is pulled to the left lane or the left turning position. Steering lamp flashed with sound。

– **Indoor lamp Control:**

The BCM controls the in-vehicle roof lam to fade in within 0.7s and fade out within 1.7s. During unlocking, the indoor ceiling lamp will fade in turning on and will fade in turning off after 30s if there is no door opened. After the vehicle doors are properly locked (the locking device actuates), the in-vehicle roof lamp will fade out within 1.7s. After all doors are closed and the ignition switch is closed, an indoor ceiling lamp fades out and turns off after 30s; and after all doors are closed and the ignition switch is opened, the indoor ceiling lamp fades out and turns off immediately. If the four doors are not closed completely from the state of being closed completely, the BCM turns on the indoor dome lamp and shields all started functions of turning on through delaying for 30s. If the four doors are not closed completely, the indoor dome lamp turns on for 10min through delay to turn off.

If the dome lamp turns on within 10min consecutively, the timer re-clocks when there is a signal that another door is opened.

– **Front wiper Control:**

The front wiper provides a low level signal to the BCM body control unit through a wiper switch, and the BCM drives the front wiper motor to rotate after receiving the wiper switch driving signal; the deluxe / ultimate vehicle is further equipped with a rain sensor; when the wiper switch is in gear Auto, the BCM provides the rainfall signal according to the rain sensor and automatically adjusts the rotational speed of the wiper motor, thereby greatly improving driving safety and comfort.

Other functions

1. LIN bus communication function
2. K bus communication function

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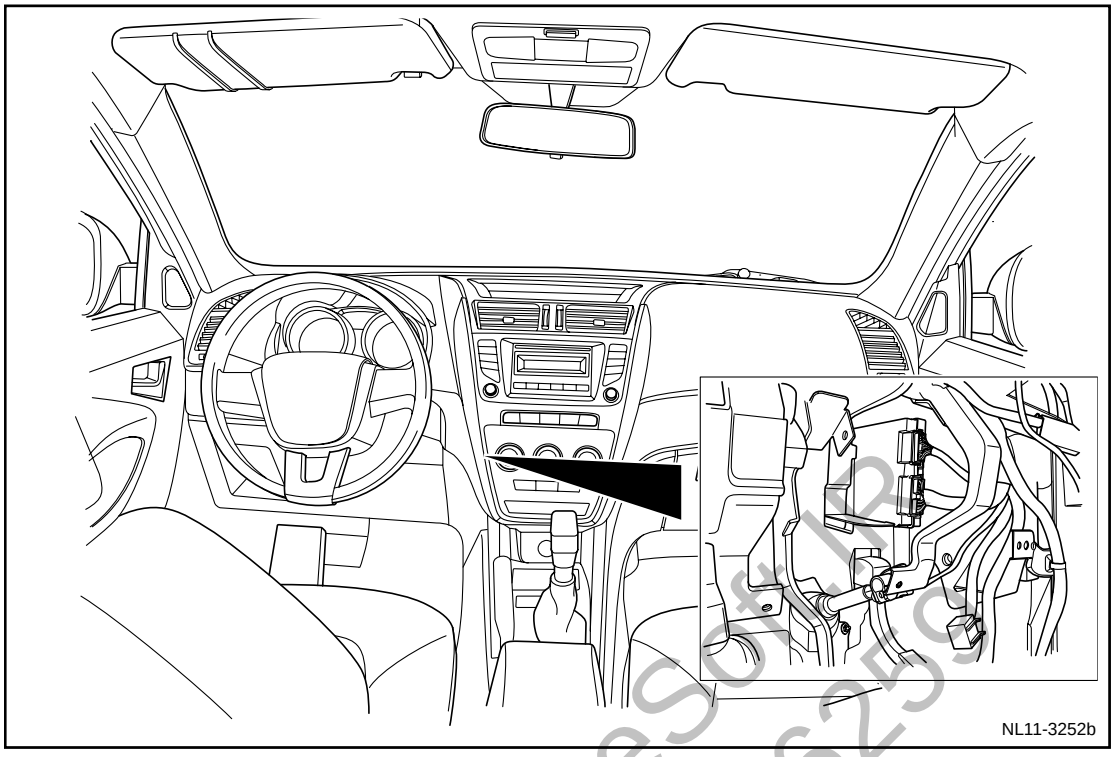
10.2.3 Part position

10.2.3.1 BCM location plan



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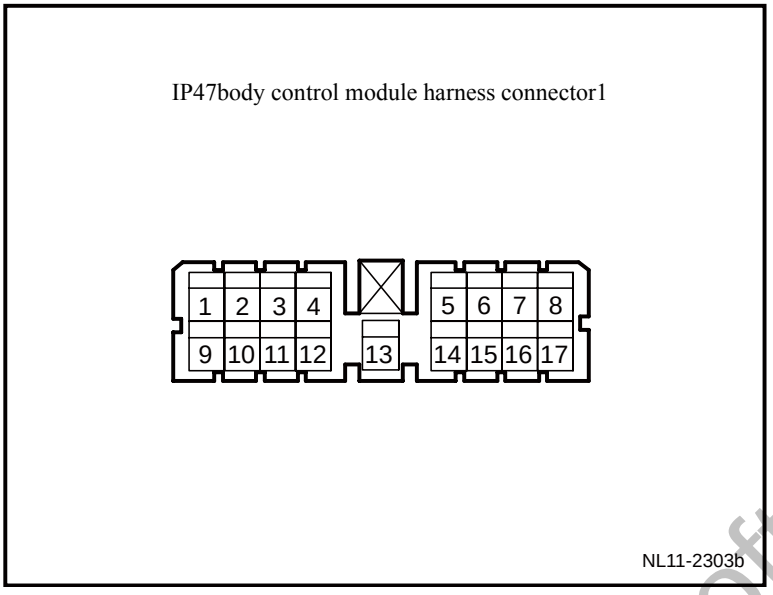
10.2.4 Diagnostic information and steps

10.2.4.1 BCM Terminal List

BCM harness connector (A)IP47



Terminal	Wiring	Terminal descriptions	Specified Conditions
1	2.0R	Right rear power window power supply	power supply. High battery input. Max.current15A
2	2.0 L	Right rear power window Down output	High battery output. Max.current15A
3	2.0 B	Right rear power window ground	Low battery output. Max.current15A
4	2.0 W/O	Left rear power window Up output	High battery output. Max.current15A
5	2.0 R	Right front power window power supply	power supply. High battery input. Max.current15A
6	2.0 B	Right front power window grounding	Low battery output. Max.current15A
7	2.0 Br	Left front power window Up output	High battery output. Max.current15A
8	2.0 Gr	Left front power window Down output	High battery output. Max.current15A
9	1.25 W/O	Front Wiper Power Supply	power supply. High battery input. Max.current15A
10	2.0 O	Right rear power window Up output	High battery output. Max.current15A
11	2.0 R	Left rear power window power supply	power supply. High battery input. Max.current15A
12	2.0 W	Left rear power window Down output	High battery output. Max.current15A
13	2.0 B	Left rear power window	Low battery output. Max.current15A

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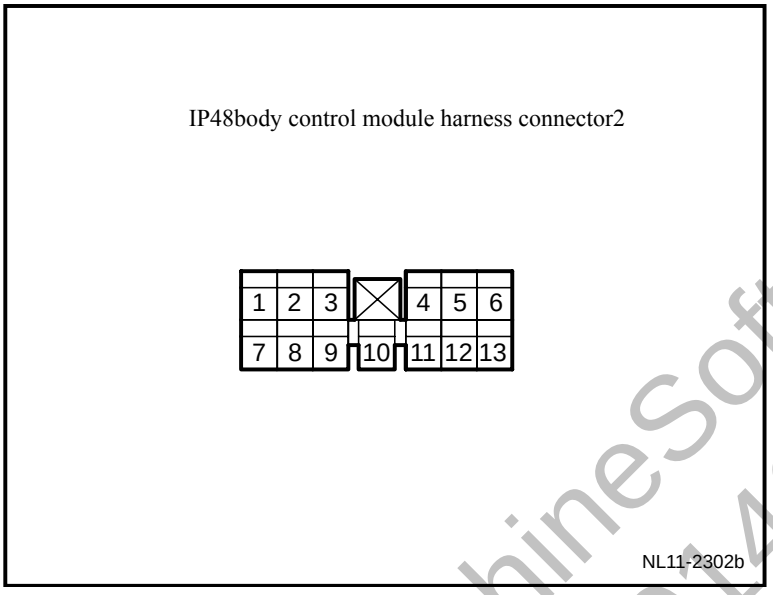
		grounding	
14	2.0 P	Right front power window Up output	power supply. High battery input. Max.current15A
15	2.0 Gr/R	Right front power window Down output	High battery output. Max.current15A
16	2.0 B	Left front power window grounding	Low battery output. Max.current15A
17	2.0 R	Left front power window power supply	High battery output. Max.current15A

BCM harness connector (B) IP48 terminal list



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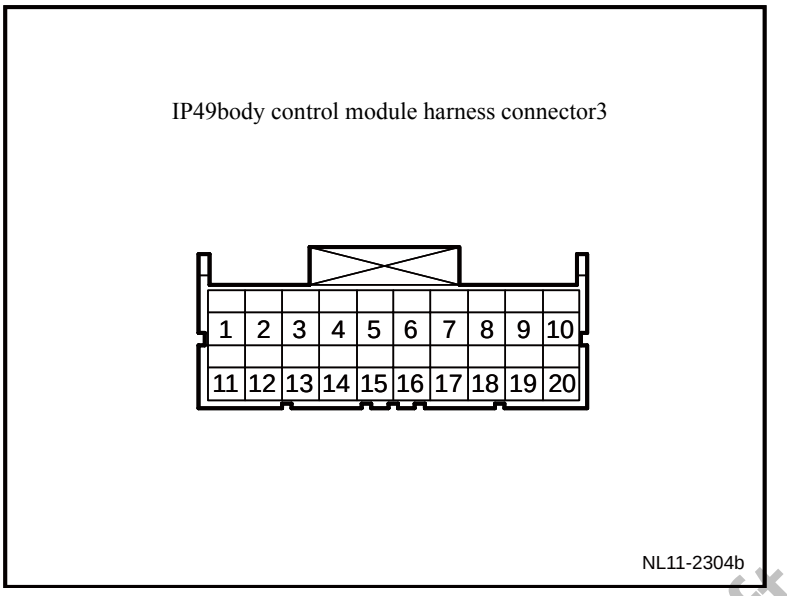
Terminal	Wiring	Terminal descriptions	Specified Conditions
1	0.5 R/G	Position lamp/license plate lamp/daytime lamp power supply	power supply. High battery output. Max.current10A
2	0.85 B	Central lock grounding	Low battery output. Max.current 15A
3	0.85 W/P	Central lock output	High battery output. Max.current10A
4	1.25 L	Central Lock Power Supply	power supply. High battery input. Max.current15A
5	0.85 V/B	Trunk unlock output	High battery output. Max.current3A
6	0.85 P/W	Driver-side door unlocks individually.	High battery output. Max.current3A
7	0.5 W/B	Steering Lamp Power Supply	power supply. High battery input. Max.current10A
8	0.5 G/B	Left turn output	High battery output. Max.current4A
9	0.5 B/G	Right turn output	High battery output. Max.current4A
10	0.85 V/W	Central unlock output	High battery output. Max.current10A
11	1.25 B	Front rain wiper grounding	Ground, low level output, the maximum current 10A
12	1.25 W/B	Front Wiper High-Speed Output	High battery output. Max.current10A
13	1.25 Br	Front Wiper Low-Speed Output	High battery output. Max.current10A

BCM harness connector (C)IP49 terminal list



Terminal	Wiring	Terminal descriptions	Specified Conditions
1	0.5 R/Y	BCM power supply	power supply. High battery input. Max.current5A
2	0.3 W/R	Footstep lamp/keyhole light output	Bulb model
3	0.5 O/G	Interior dome lamp output	Bulb model
4	0.3 O	Horn Output	Low battery output.Max.current500mA
5	0.5 B/G	high beam lamp output	Low battery output.Max.current500mA
6	---	---	---
7	---	---	---
8	0.5 L	License plate lamp/backlight/fog lamp control output	High battery output.Max.current3A
9	---	---	---
10	0.5 R/B	Position lamp (left) control output	High battery output,Max,current1A
11	0.5 B	BCM grounding	Ground, high level output, the maximum current 5A
12	0.5 W/R	Anti -Theft Indicator Output	Low battery input.Max.current15mA
13	0.5 V/Y	Right front Door contact switch	Low battery input.Max.current10mA
14	0.5 B/G	BCMpower supply	power supply. Low battery input.Max.current10mA
15	0.5 Gr/p	Footstep lamp/keyhole light output	Low battery input.Max.current10mA
16	0.5 G	Interior dome lamp output	Low battery input.Max.current10mA
17	0.5 V/G	Horn Output	Low battery input.Max.current10mA
18	0.5 B	high beam lamp output	Low battery input. Max.current40mA
19	---	---	---

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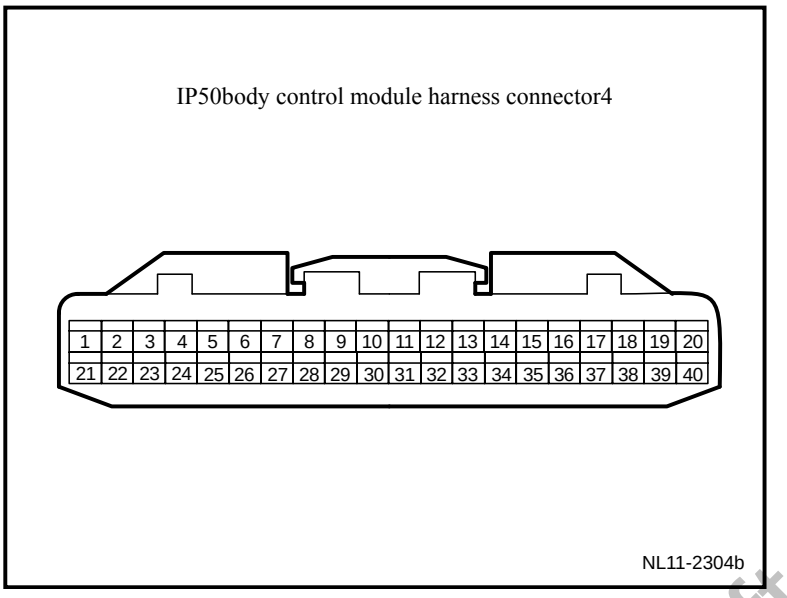
20	0.5	Rearview mirror/rear defrosting/seat heater enabling	High battery output. Max.current1A

BCM harness connector (D) IP50 terminal list



Terminal	Wiring	Terminal descriptions	Specified Conditions
1		Driver-side door united switch	Low battery input.Max.current10mA
2	0.3 R/W	Front wiper low speed/point scraping switch	Low battery input.Max.current10mA
3	0.5 W/L	Left front power window Up switch	Low battery input.Max.current10mA
4	---	---	---
5	---	---	---
6	0.5 Gr	Hazard warning lamp switch	High battery input.Max.current10mA
7	0.5 O	Automatic lighting switch	Low battery input.Max.current10mA
8	0.5 W/V	Front washing switch	High battery input.Max.current10mA
9	---	---	---
10	0.5 P/B	Collision signal	Pulse signal, maximum current 10mA
11	0.5 B/R	Vehicle speed signal	Low battery input.Max.current10mA
12	0.3 W/R	Right front power window Down switch	Low battery input.Max.current10mA
13	0.3 W/Y	Right front power window auto-switch	Low battery input.Max.current10mA
14	0.5 V	LIN BUS	Square signal
15	0.5 Gr/P	KLINE	---
16	0.3 R	Ignition key inserting signal	Low battery input.Max.current10mA
17	---	---	---
18	---	---	---
19	0.5 W/R	Left front power window auto-switch	Low battery input.Max.current10mA

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20	0.5 V/B	Right back door contact switch	Low battery input.Max.current10mA
21	0.3 W/Br	Left rear power window Down switch	Low battery input.Max.current10mA
22	0.3 G	Front wiper intermittence gear	Low battery input.Max.current10mA
23	0.3 W/B	Front wiper high-speed switch	Low battery input.Max.current10mA
24	0.3 W/R	Indoor central locking switch/unlocking	Low battery input.Max.current10mA
25	0.5 R/L	Right steering switch	Low battery input.Max.current10mA
26	0.5 B/W	Position lamp switch	Low battery input.Max.current10mA
27	0.5 G/R	Left steering switch	Low battery input.Max.current10mA
28	---	---	---
29	---	---	---
30	0.3 V	Speed signal	Pulse, maximum current 10mA
31	0.3 W/B	Right rear power window Up switch	Low battery input.Max.current10mA
32	0.3 W/V	Right front power window Up switch	Low battery input.Max.current10mA
33	0.3 W/O	Right rear power window Down switch	Low battery input.Max.current10mA
34	0.3 B/L	Right rear power window auto-switch	Low battery input.Max.current10mA
35	0.5 V/W	Left rear power window auto-switch	Low battery input.Max.current10mA
36	0.3 W/R	Left rear power window Up switch	Low battery input.Max.current10mA
37	0.5 L	Unlock input of front door key	Low battery input.Max.current10mA
38	0.5 G/R	Ignition signal	Low battery input.Max.current10mA
39	0.5 W/G	Left front power window Down switch---	Low battery input. Max.current10mA
40	---	---	---

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10.2.4.2 Fault diagnostic code (DTC) table

Code	Descriptions
B1201	Open circuit of left stop lamp
B1202	Left stop lamp short circuit to ground fault
B1203	Right stop lamp open circuit fault
B1204	Right stop lamp short circuit to grounding fault
B1205	License plate lamp is in open-circuit fault.
B1206	License plate lamp is shorted to ground failure.
B1206	Right back door contact circuit faults.
B1207	Left front/left rear steering lamp with an open circuit
B1208	Left front/ left rear steering lamp short circuit to grounding fault

B1209	Right front/right rear steering lamp，One of both has open circuit fault
B1210	The right front and right rear steering lamps are shorted to ground.
B1211	The indoor dome lamp is in short circuit until the battery is broken down.
B1212	The key hole illumination lamp is shorted to battery fault.
B1213	If not detecting the stop bit signal within 8S consecutively the front wiper faults.
B1214	If detecting the stop bit signal within 8S consecutively the front wiper faults.
B1215	A horn relay controls short circuit until a battery faults.
B1216	A headlamp relay controls short circuit until a battery faults.
B1217	Open circuit incurs on driver-side electric window driving.
B1218	Open circuit incurs on co-pilot-side electric window driving.
B1220	Open circuit incurs on left rear electric window driving.
B1222	Open circuit incurs on right rear electric window driving.
B1224	Driver-side electric window anti-trapping module HALL sensor faults.
B1225	Driver-side electric window motor relay faults.
B1227	Co-pilot-side electric window motor relay faults.
B1231	Left rear electric window motor relay faults.
B1234	Left rear electric window motor relay faults.
B1236	Rain sensor fault
B1237	Sunlight sensor fault
U1000	Communication error of driver-side electric window LIN
U1004	Light rain sensor LIN communication error
U1005	BCM LIN communication error

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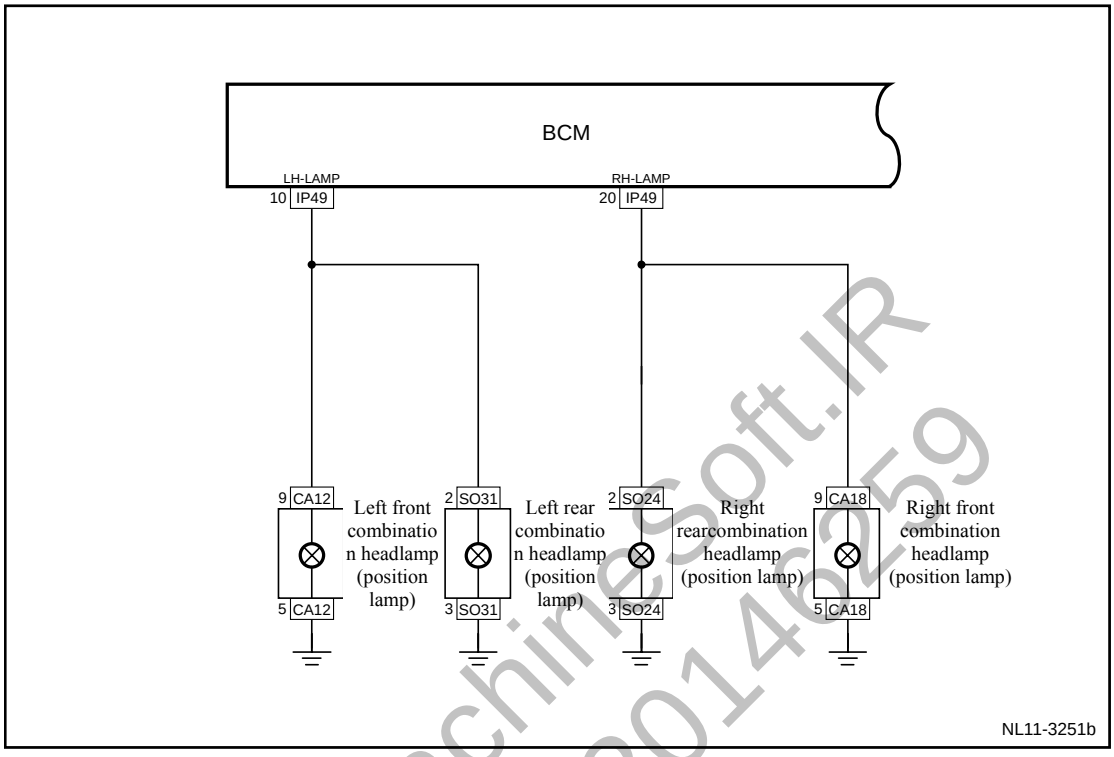
10.2.4.3 DTC B1201 B1202

Display	Descriptions
B1201	Open circuit of left stop lamp
B1202	Left stop lamp short circuit to ground fault

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any fault code except B1201 and B1202.

(a) Check if any fault code exist except for B1201 B1202

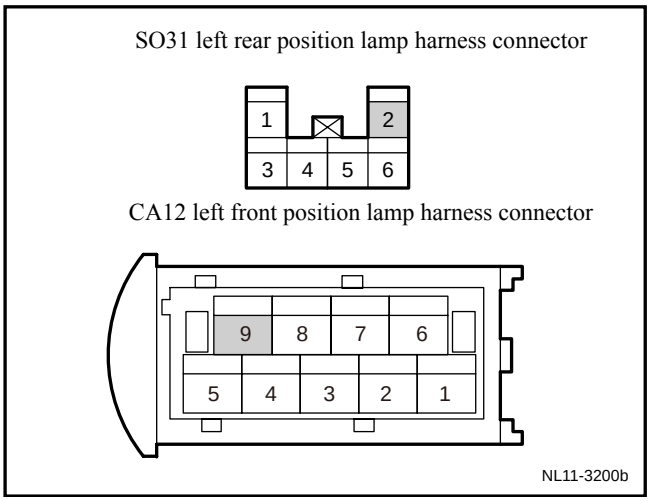
Yes → Go to (DTC) list in 10.2.4.2 and repair according to trouble codes.

No

2	Measure left stop lamp voltage.

(a) Measure voltage between left front parking lamp wire harness connector CA12 terminal 9, left rear parking lamp wire harness connector SO31 terminal 2.

Standard Voltage: 11-14 V



No → Go to step 4

Yes

3	Inspect the bulb.

(a) Inspect whether parking lamp bulb is burned out.

Confirm whether the parking lamp bulb is blown out.

Yes → Replace the bulb.

No

4	Repair the communication between the BCM and the left parking lamp.

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(a) Turn the ignition switch to OFF position.

(b) Disconnect BCM wire harness connector IP49.

(c) Disconnect the left front stop lamp harness connector CA12。

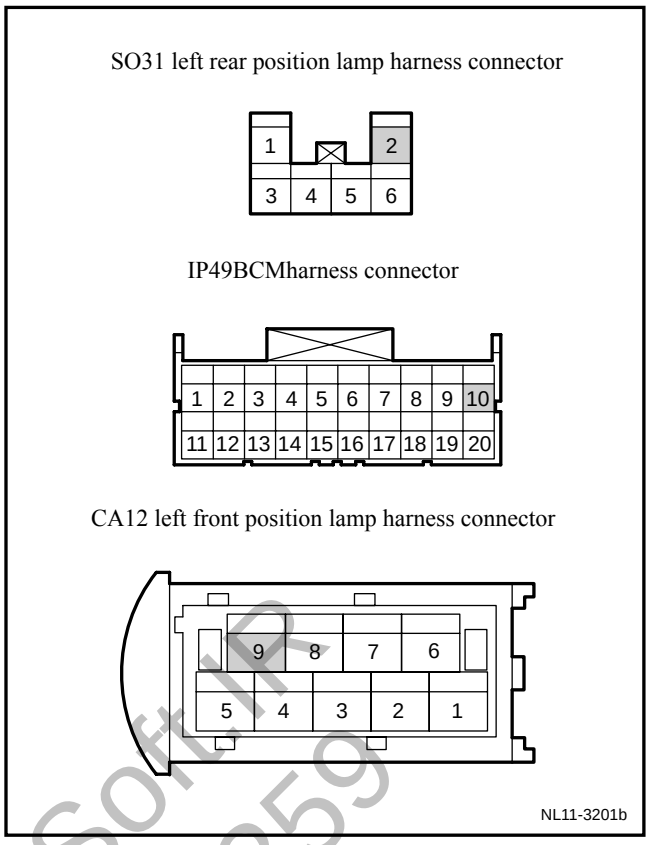
(d) Disconnect left rear stop lamp harness connector SO31.

(e) Measure resistance between BCM wire harness connector IP49 terminal 10 and left front parking lamp wire harness connector CA12 terminal 9.

(f) Measure resistance between BCM wire harness connector IP49 and left rear parking lamp wire harness connector SO31 terminal 2.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.



No → Repair or replace the harness.

Yes

5	Inspect the communication between the left parking lamp and grounding.

(a) Disconnect left front stop lamp harness connector CA12.

(b) Measure resistance value between Left front stop lamp harness connector CA12 terminal5 and grounding

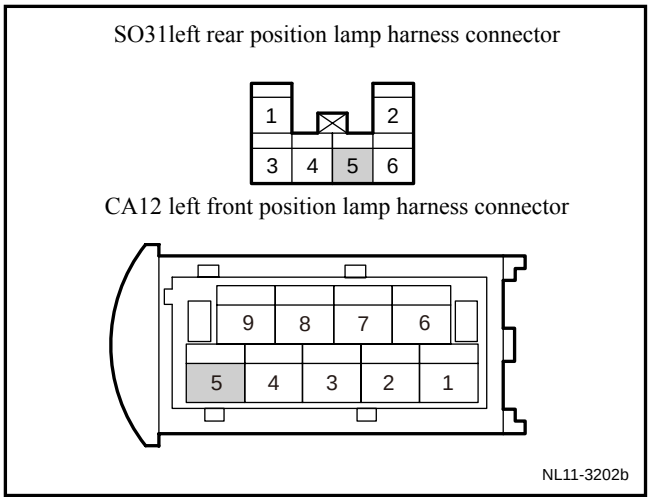
(c) Disconnect the rear stop lamp harness connector SO31。

(d) Measure left rear parking lamp wire harness connector SO31 terminal 3 and grounding.

Standard Resistance: Less than 1 Ω

(e) Measure resistance between left front parking lamp wire harness connector CA12 terminal 9.

(f) Measure resistance between left rear parking lamp wire harness connector SO31 terminal 2 and grounding.



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Standard Resistance: More than 10 Ω or higher

Confirm if the resistance conforms to standard value.

Yes → The system is normal.

No

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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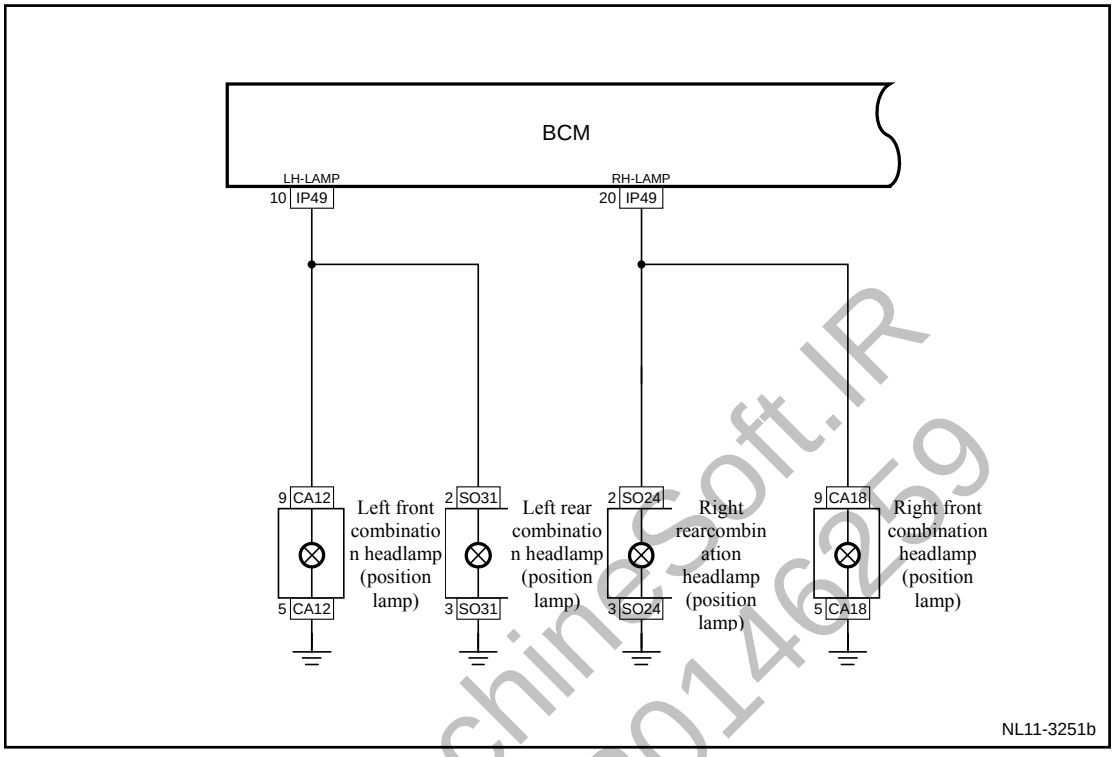
10.2.4.4 DTC B1203 B1204

Fault diagnosis code	Descriptions
B1203	Right stop lamp open circuit fault
B1204	Right stop lamp short circuit to grounding fault

Circuit diagram:



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Diagnostic Steps:

1	Check any fault code except for B1203 B1204.

(a) Check if any fault code exists except for B1203 B1204.

Yes	Go to (DTC) list in 10.2.4.2 and repair according to trouble codes.
No	

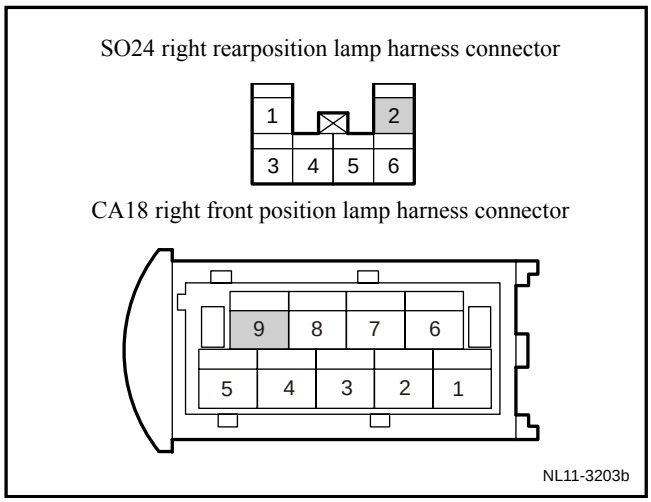
2	Measure right stop lamp voltage.

(a) Turn on position lamp.

(b) Measure voltage of right front stop lamp harness connector CA18 terminal9.

(c) Measure Right rear stop lamp harness connector SO24 terminal2 voltage.

Standard Voltage: 11-14 V



No → Go to step 4

Yes

3	Inspect the bulb.

(a) Inspect whether parking lamp bulb is burned out.

Confirm whether the parking lamp bulb is blown out.

Yes → Replace the bulb.

No

4	Inspect the communication between BCM and right parking lamp.

(a) Turn the ignition switch to OFF position.

(b) Disconnect BCM wire harness connector IP49.

(c) Disconnect right front parking lamp wire harness connector CA18.

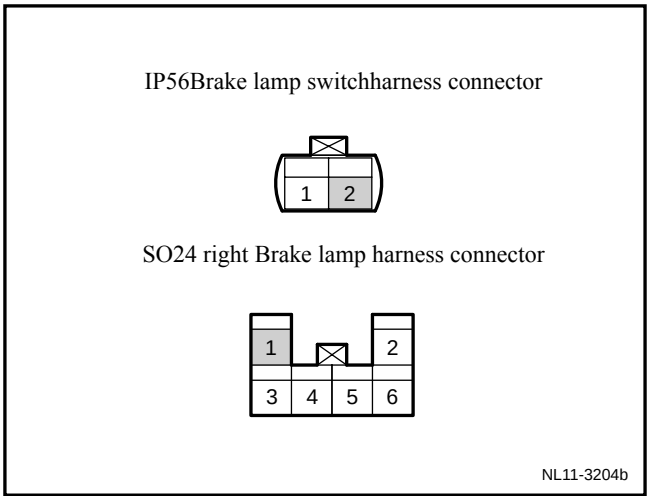
(d) Disconnect right rear stop lamp harness connector SO24.

(e) Measure resistance between BCM wire harness connector IP49 terminal 20 and right front brake lamp wire harness connector CA18 terminal 9.

(f) Measure resistance between BCM wire harness connector IP49 terminal 20 and right rear wire harness connector SO24 terminal 2.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.



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No → Repair or replace the harness.

Yes

5	Inspect the communication between the right parking lamp and grounding.

(a) Disconnect right front stop lamp harness connector CA18.

(b) Disconnect right rear parking lamp harness connector SO24.

(c) Measure resistance value between of right front stop lamp harness connector CA18 terminal5 and grounding.

(d) Measure resistance between right rear parking lamp wire harness connector SO24 terminal 3 and grounding.

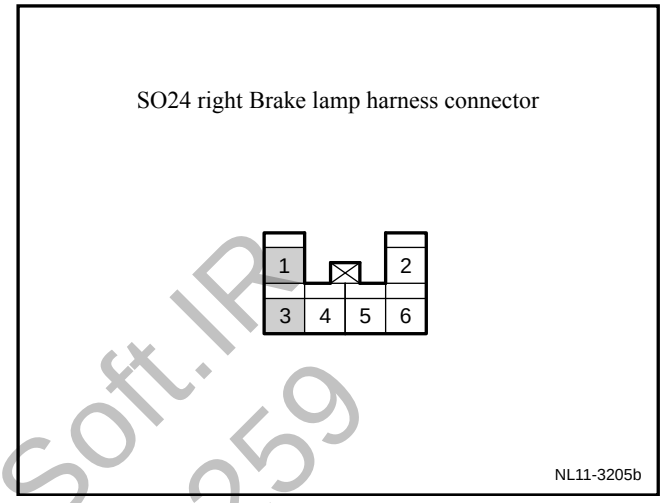
Standard Resistance: Less than 1 Ω

(e) Measure resistance between right front parking lamp wire harness connector CA18 terminal 5 and grounding.

(f) Measure right rear parking lamp wire harness connector SO24 terminal 3 and grounding.

Standard Resistance: More than 10 Ω or higher

Confirm if the resistance conforms to standard value.



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No → Repair or replace the harness.

Yes

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

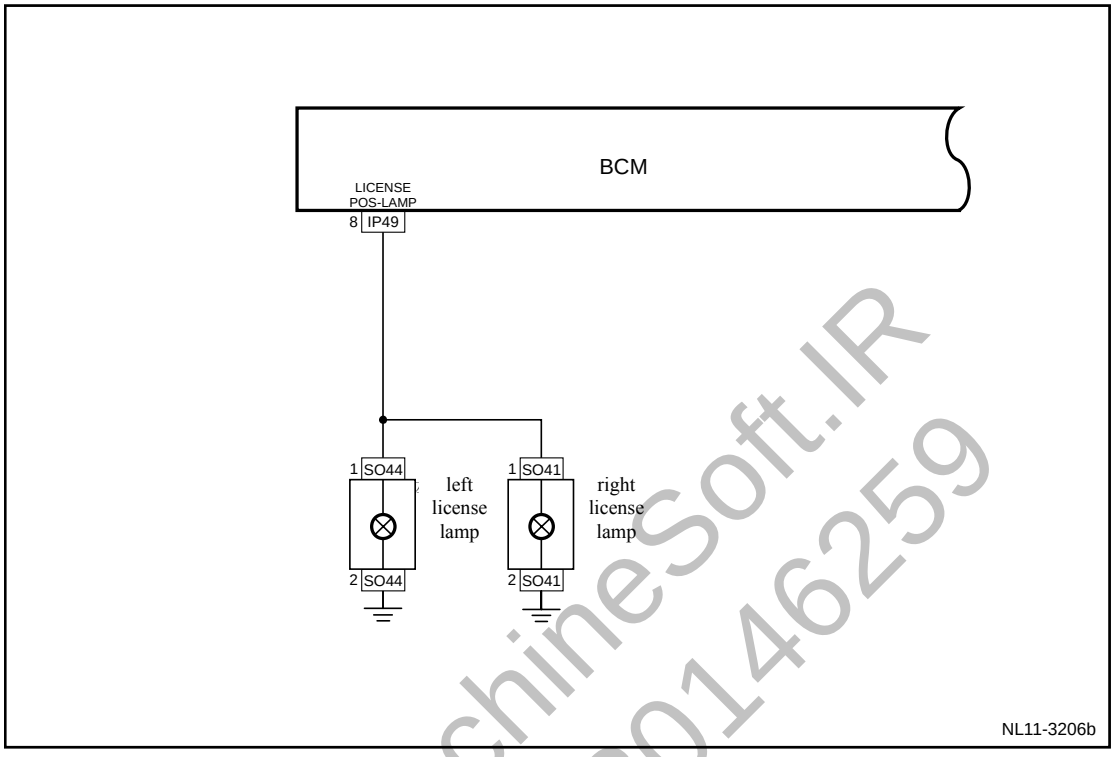
Next

7	The system is normal.

10.2.4.5 DTC B1205 B1206

Fault diagnosis code	Descriptions
B1205	License plate lamp is in open-circuit fault.
B1206	License plate lamp is shorted to ground failure.

Circuit diagram:



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Diagnostic Steps:

1	Check any fault code except forB1205 B1206

(a) Check if any fault code exist except for B1205 B1206

Yes	Go to (DTC) list in 10.2.4.2 and repair according to trouble codes.
No	

2	Measure the voltage of the license plate lamp.

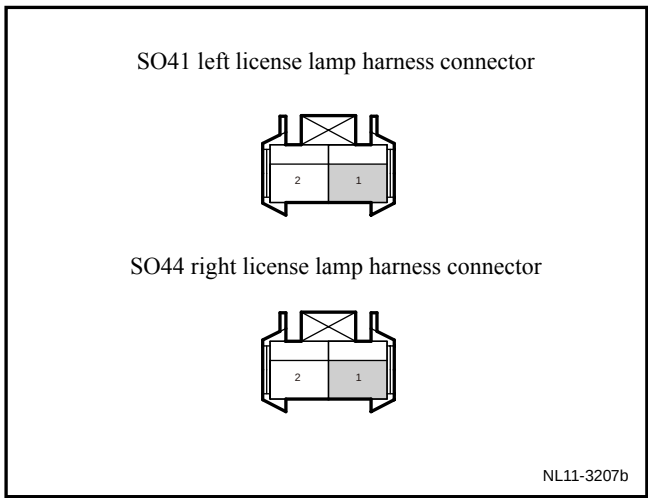
(a) Turn the ignition switch to ON position.

(b) Turn on lighting combination switch.

(c) Measure voltage of left license lamp harness connector SO41 terminal1, right license brake lamp harness connector SO44 terminal.

Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.



No → Go to step 4

Yes

3	Inspect the bulb.

(a) Inspect whether licence lamp bulb is burned out.

Confirm whether the license plate lamp bulb is blown out.

Yes → Replace the bulb

No

4	Inspect the communication between BCM and license plate lamp.

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(a) Turn the ignition switch to OFF position.

(b) Disconnect BCM harness connector IP49.

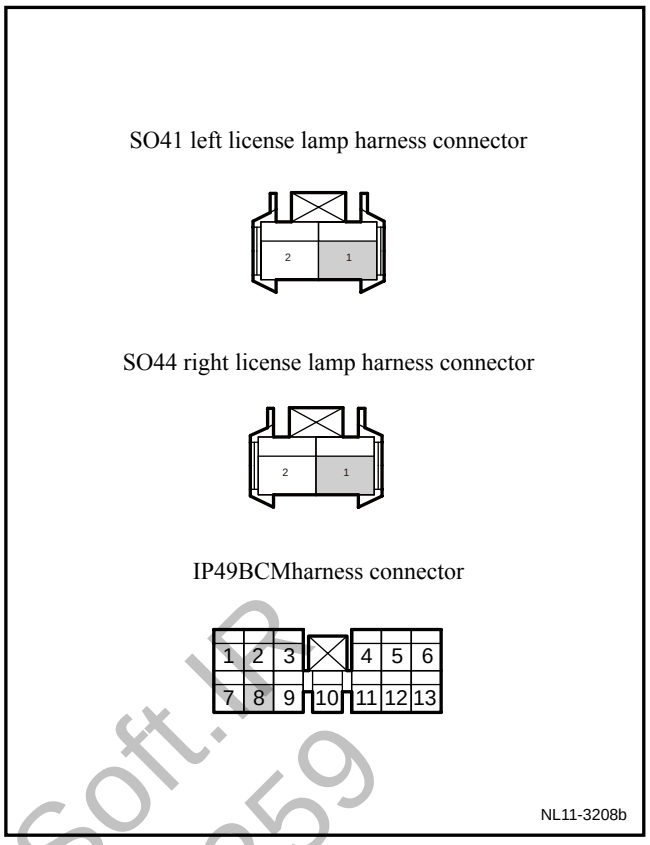
(c) Disconnect licence lamp wire harness connector SO41, SO44.

(d) Measure resistance between BCM wire harness connector IP49 terminal 8 and license lamp wire harness connector SO41 terminal 1.

(e) Measure resistance between BCM wire harness connector IP49 terminal 8 and license lamp wire harness connector SO44 terminal 1.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.



No → Repair or replace the harness.

Yes

5	Inspect the communication between the license plate lamp and grounding.

(a) Disconnect license lamp harness connector SO41, SO44.

(b) Measure resistance between license lamp wire harness connector RF12 terminal 2 and BCM wire harness connector IP49 terminal 3.

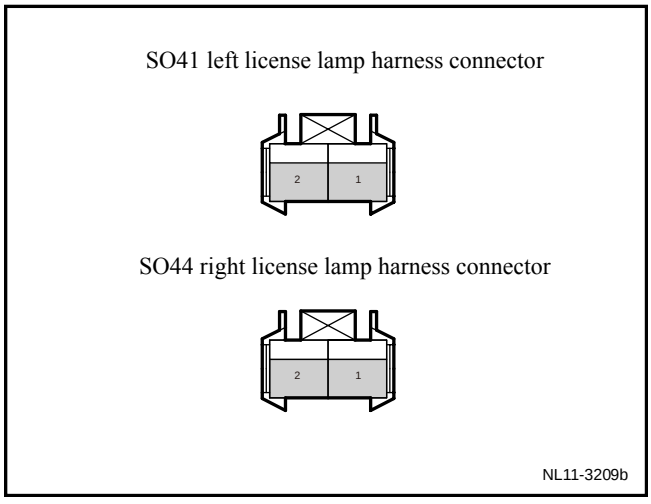
(c) Measure resistance value between license lamp harness connector SO44 terminal2 and grounding.

Standard Resistance: Less than 1 Ω

(d) Measure the resistance between terminal 1 of license lamp harness connector SO41 and grounding.

(e) Measure resistance value between license lamp harness connector SO44 terminal1 and grounding.

Standard Resistance: More than 10 Ω or higher



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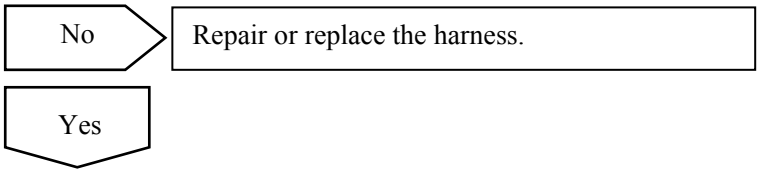
Confirm if the resistance conforms to standard value.



6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

7	The system is normal.

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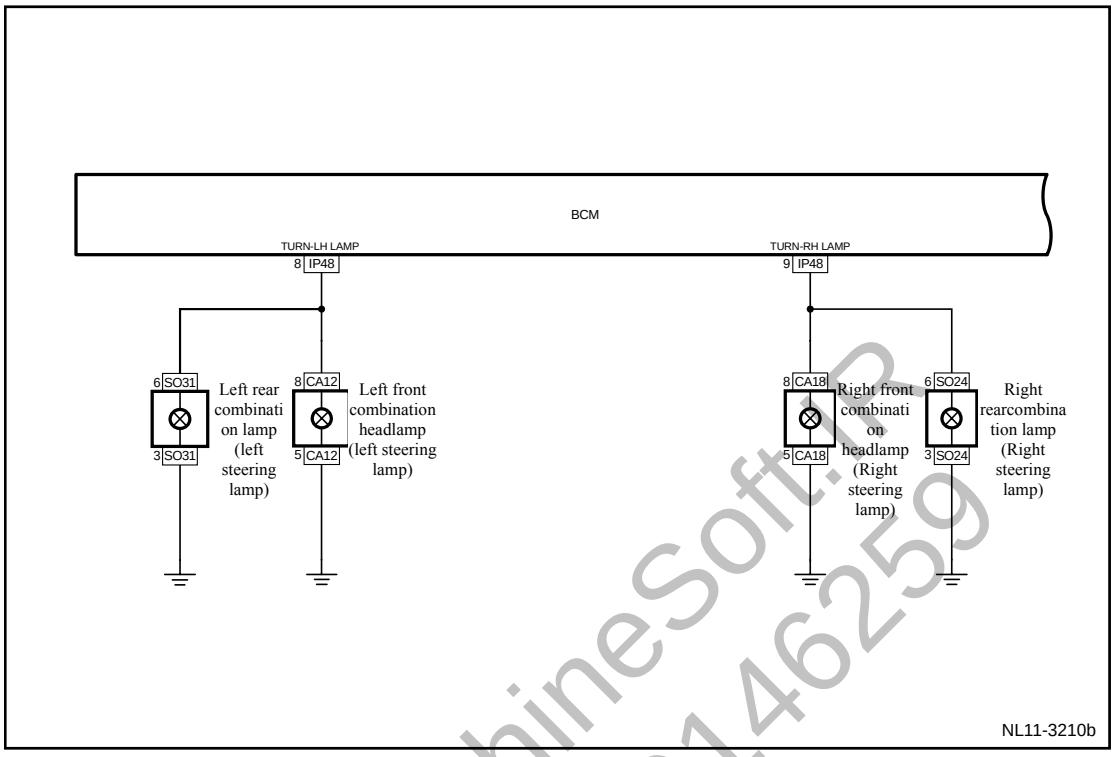
10.2.4.6 DTC B1207 B1208

Fault diagnosis code	Descriptions
B1207	Left front/left rear steering lamp with an open circuit
B1208	Left front/ left rear steering lamp short circuit to grounding fault

Circuit diagram:



Diagnostic Steps:

1	Check any fault code except forB1207 B1208

(a) Check if any fault code exist except for B1207 B1208

Yes	Go to (DTC) list in 10.2.4.2 and repair according to trouble codes.
No	

2	Measure left steering lamp voltage.

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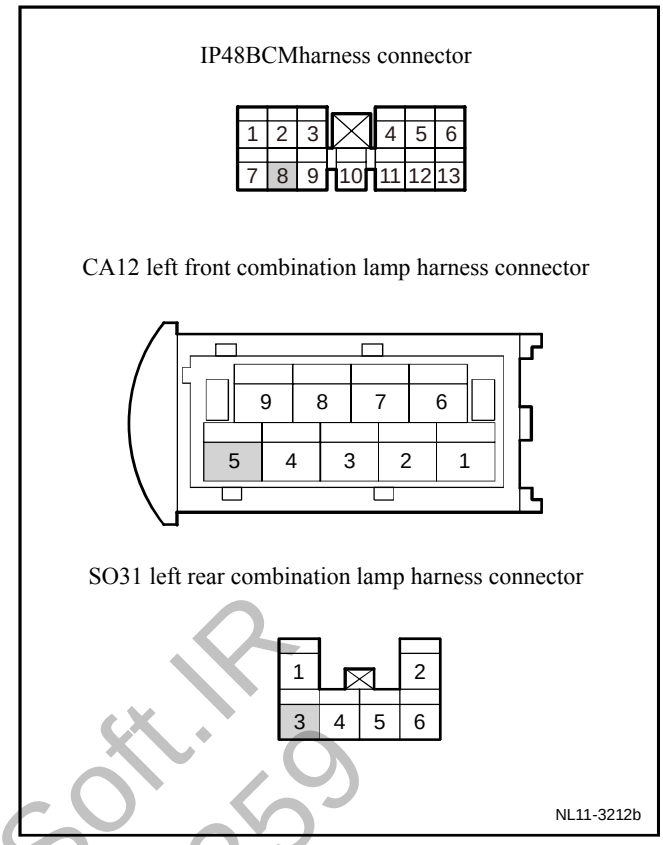
(a) Turn the ignition switch to ON position.

(b) Turn on the left steering lamp.

(c) Measure voltage value of left front steering lamp harness connector CA12 terminal8, left rear steering lamp harness connector SO31 terminal6.

Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.



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No	Go to step 4
Yes	

3	Inspect the bulb.

(a) Check if the bulb of turning light is blown.

Confirm whether the license plate lamp bulb is blown out.

Yes	Replace the bulb .
No	

4	Inspect the communication among the BCM, the left front steering lamp and the left rear steering lamp.

(a) Turn the ignition switch to OFF position.

(b) Disconnect BCM harness connector IP48.

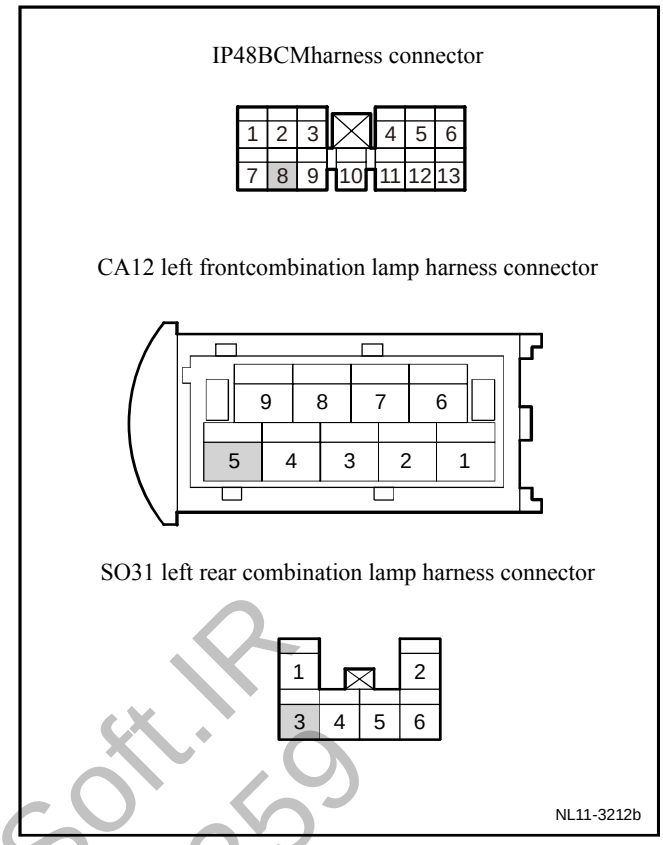
(c) Disconnect the steering lamp harness connector CA12、SO31.

(d) Measure resistance between BCM wire harness connector IP48 terminal 8 and license lamp wire harness connector CA12 terminal 5.

(e) Measure resistance between BCM wire harness connector IP48 terminal 8 and license lamp wire harness connector SO31 terminal 3.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.



No → Repair or replace the harness.

Yes

5	Inspect the communication among the left front steering lamp, the left rear steering lamp and grounding.

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(a) Disconnect steering lamp harness connector CA12, SO31.

(d) Measure the resistance between terminal 8 of license lamp harness connector CA12 and grounding.

(c) Measure resistance value between license lamp harness connector SO31 terminal6 and grounding.

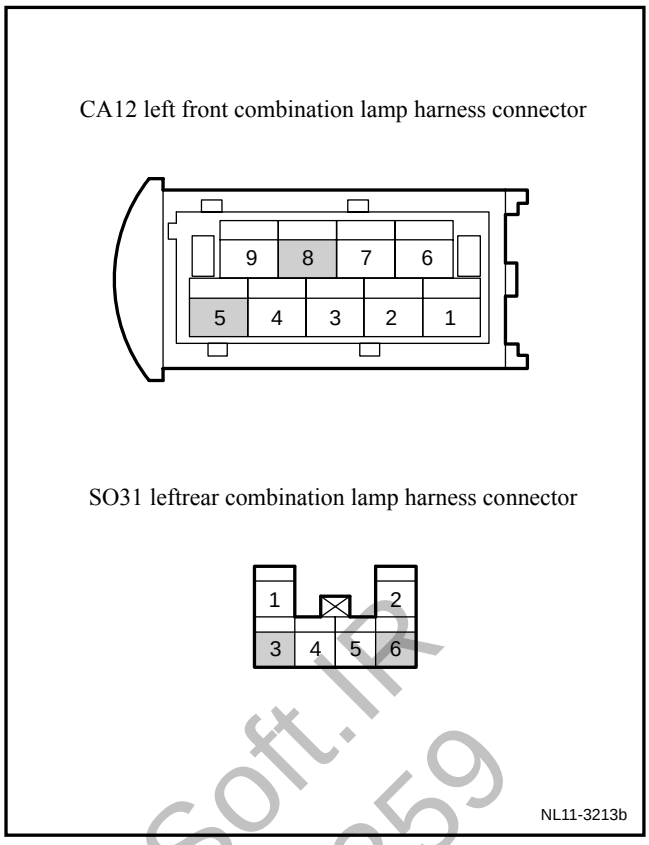
Standard Resistance: Less than 1 Ω

(d) Measure the resistance between terminal 5 of license lamp harness connector CA12 and grounding.

(e) Measure resistance value between license lamp harness connector SO31 terminal3 and grounding.

Standard Resistance: More than 10 Ω or higher

Confirm if the resistance conforms to standard value.



No → Repair or replace the harness.

Yes

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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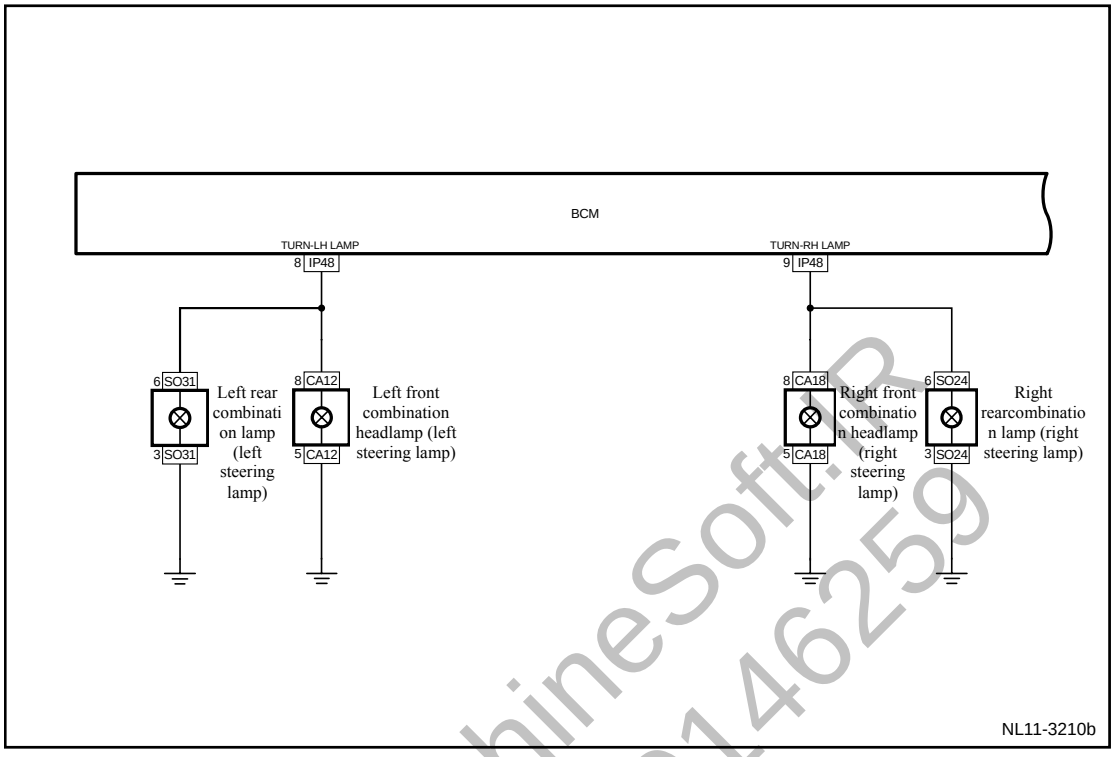
10.2.4.7 DTC B1209 B1210

Fault diagnosis code	Descriptions
B1209	Right front/right rear steering lamp，One of both has open circuit fault
B1210	The right front and right rear steering lamps are shorted to ground.

Circuit diagram:



Diagnostic Steps:

1	Check any fault code except forB1209 B1210

(a) Check if any fault code exists except for B1209 B1210

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

2	Measure right steering lamp voltage.

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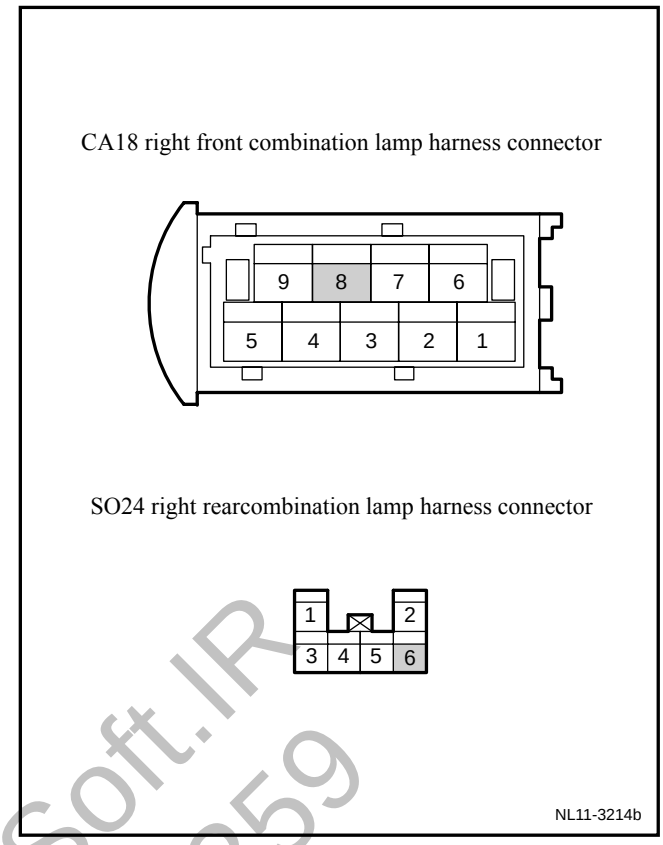
(a) Turn the ignition switch to ON position.

(b) Turn on right turning lamp.

(c) Measure right front steering lamp harness connector CA18 terminal8, right rear steering lamp harness connector SO24 terminal6.

Standard Voltage: 11-14 V



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No → Go to step 4

Yes

3	Inspect the bulb.

(a) Check if the bulb of turning light is blown.

Is the bulb filament blown?

Yes → Replace the bulb.

No

4	Inspect the communication among the BCM, the right front steering lamp and the right rear steering lamp.

(a) Turn the ignition switch to OFF position.

(b) Disconnect BCM harness connector IP48.

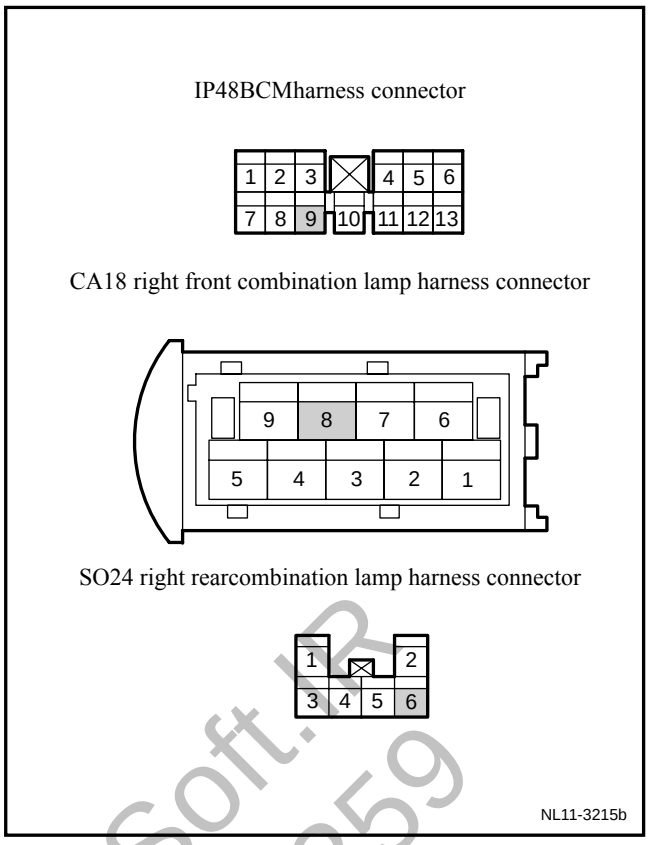
(c) Disconnect the steering lamp harness connectorCA18、SO24.

(d) Measure resistance between BCM wire harness connector IP48 terminal 9 and license lamp wire harness connector CA12 terminal 8.

(e) Measure resistance between BCM wire harness connector IP48 terminal 9 and license lamp wire harness connector SO24 terminal 6.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.



No → Repair or replace the harness.

Yes

5	Inspect the communication among the right front steering lamp, the right rear steering lamp and grounding.

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(a) Disconnect steering lamp harness connector CA18, SO24.

(d) Measure the resistance between terminal 5 of license lamp harness connector CA18 and grounding.

(c) Measure resistance between license lamp wire harness connector SO24 terminal 3 and grounding.

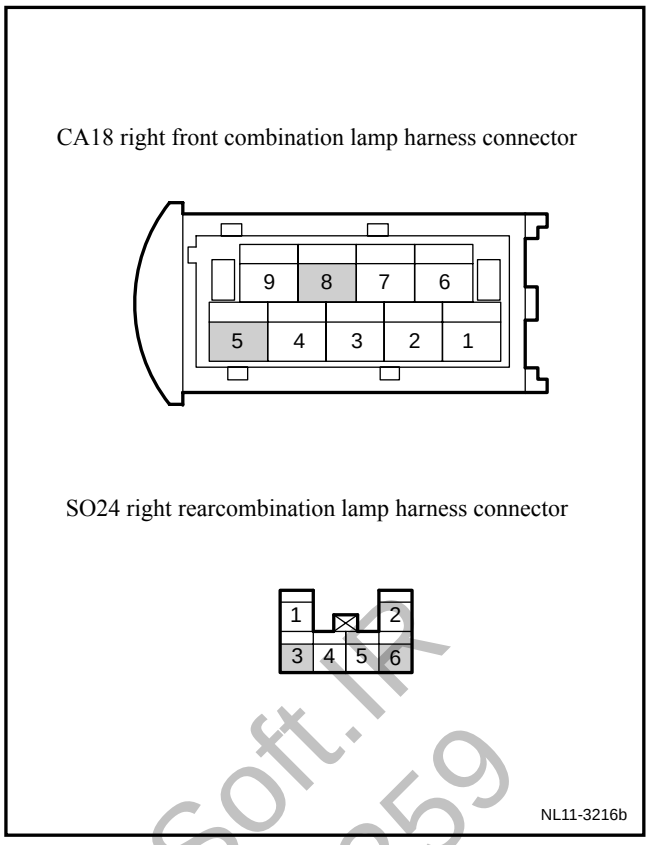
Standard Resistance: Less than 1 Ω

(d) Measure the resistance between terminal 8 of license lamp harness connector CA18 and grounding.

(e) Measure resistance between license lamp wire harness connector SO24 terminal 6 and grounding.

Standard Resistance: More than 10 Ω or higher

Confirm if the resistance conforms to standard value.



No → Repair or replace the harness.

Yes

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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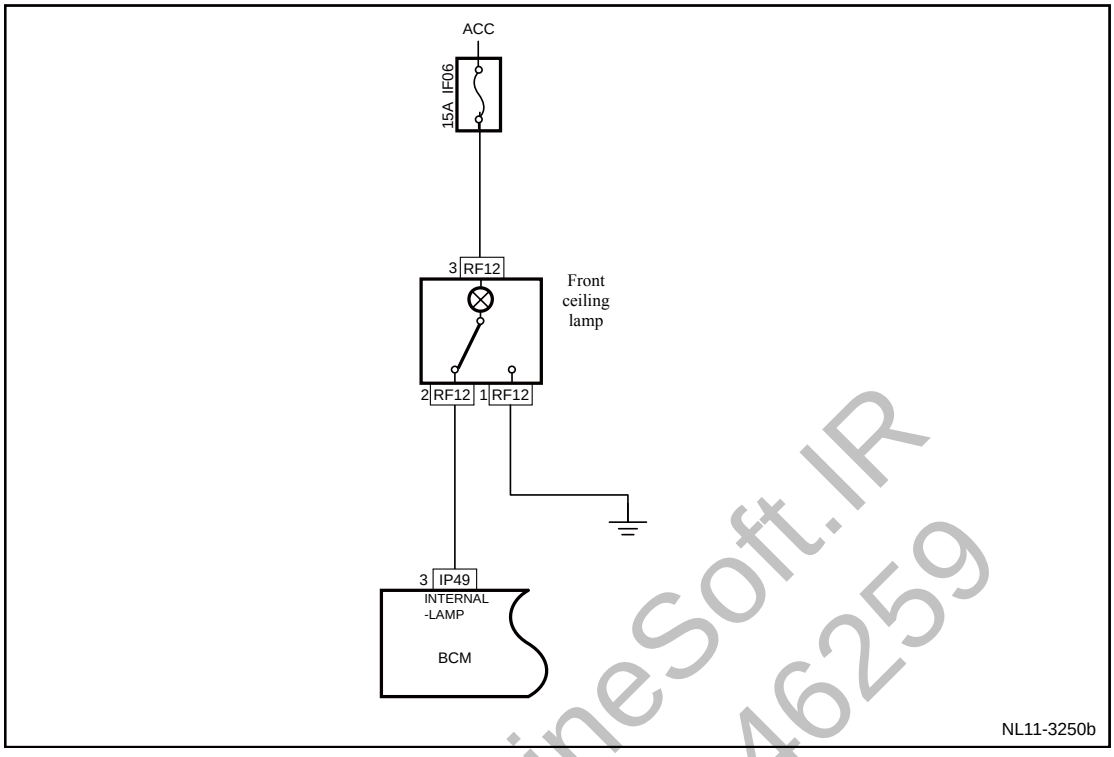
10.2.4.8 DTC B1211

Fault diagnosis code	Descriptions
B1211	The indoor dome lamp is in short circuit until the battery is broken down.

Circuit diagram:



Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1211.

(a) Inspect whether there is any DTC Code other than B1211.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

2	Measure the voltage of the in-vehicle roof lamp.

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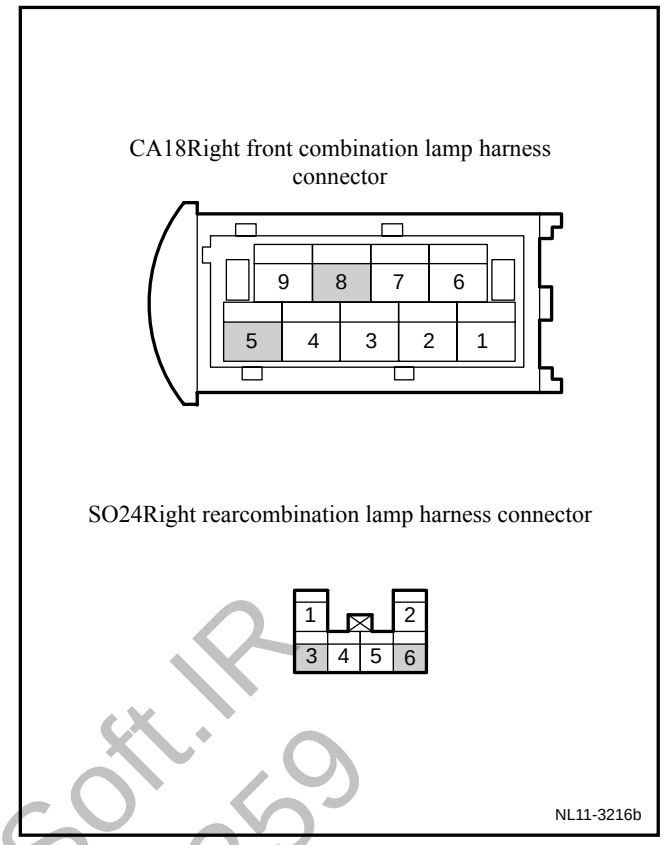
(a) Turn the ignition switch to ON position.

(b) Open indoor lamp

(c) Measure voltage of dome lamp wire harness connector RF12 terminal 3.

Standard Voltage: 11-14 V



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No → Go to step 4

Yes

3	Inspect the bulb.

(a) Inspect whether dome lamp bulb is burned out.

Confirm whether the indoor dome lamp bulb is blown out.

Yes → Replace the bulb .

No

4	Inspect the communication between the fuse and the front ceiling lamp.

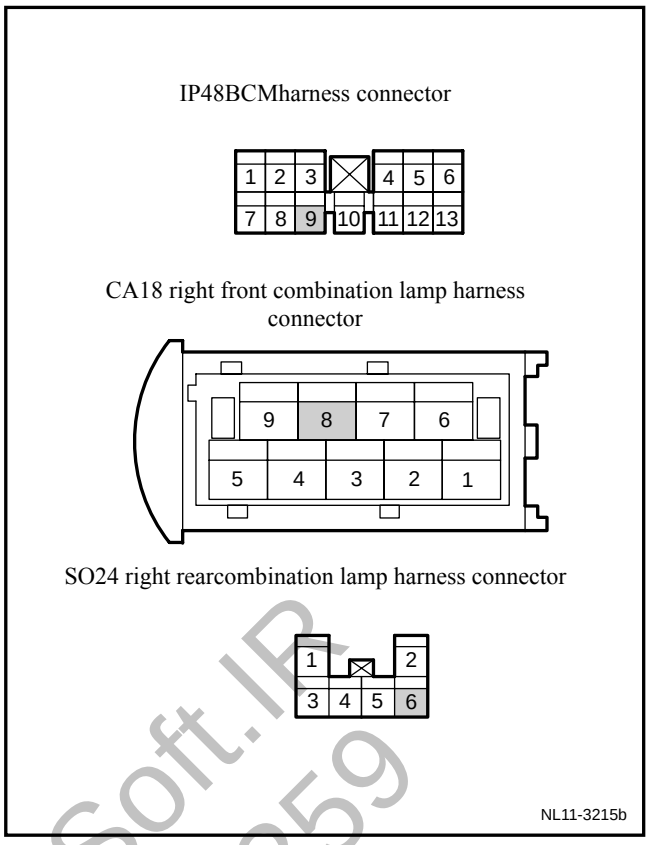
(a) Turn the ignition switch to OFF position.

(b) Disconnect front ceiling harness connector RF12.

(c) Measure resistance between fuse IF06 and front top lamp wire harness connector RF12 terminal 3.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.



No → Repair or replace the harness.

Yes

5	Inspect the communication between the front ceiling lamp and the BCM.

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(a) Disconnect BCM wire harness connector IP49.

(b) Measure resistance between front dome lamp wire harness connector RF12 terminal 2 and BCM wire harness connector IP49 terminal 3.

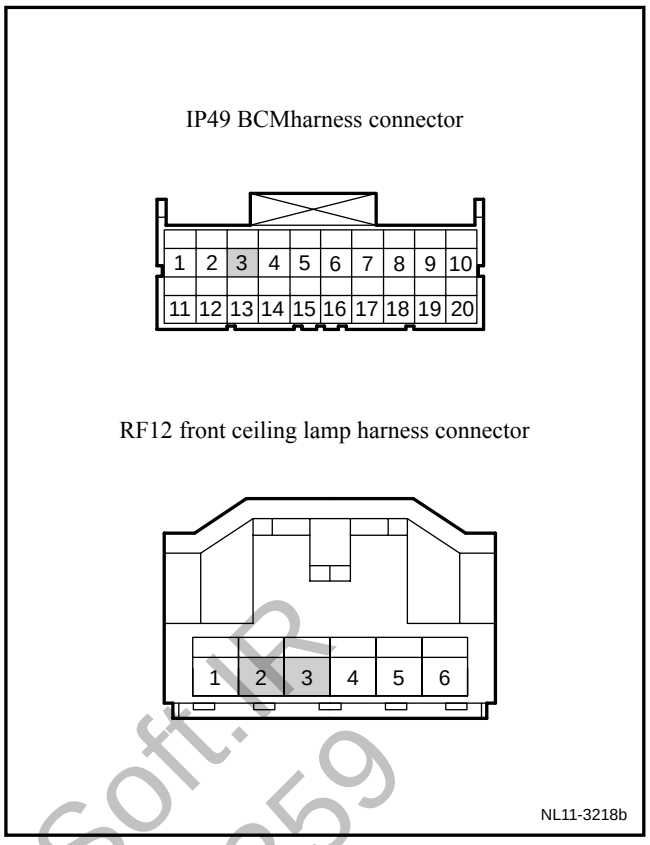
Standard Resistance: Less than 1 Ω

(c) Measure resistance value between front celling lamp harness connector RF12 terminal2 and grounding

(d) Measure resistance between front dome lamp wire harness connector RF12 terminal 3 and grounding.

Standard Resistance: More than 10 Ω or higher

Confirm if the resistance conforms to standard value.



No	Repair or replace the harness.
Yes	

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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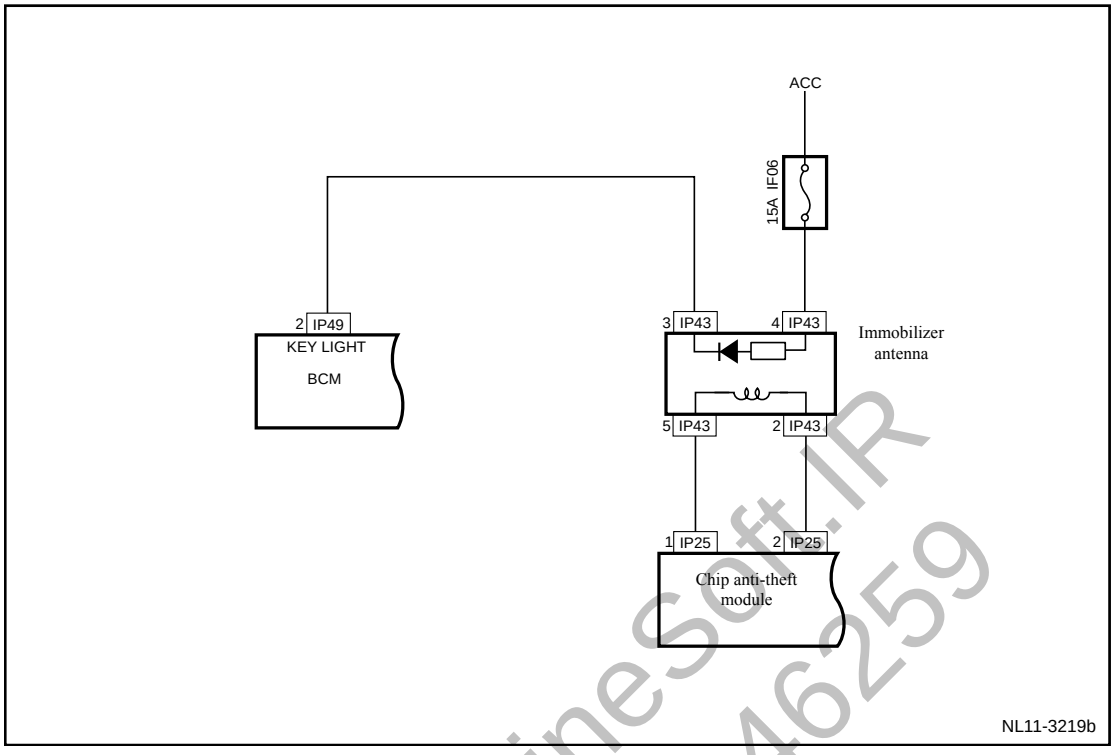
10.2.4.9 DTC B1212

Fault diagnosis code	Descriptions
B1212	The key hole illumination lamp is shorted to battery fault.

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1212.

(a) Inspect whether there is any DTC Code other than B1212.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

2	Inspect the voltage of the key buckle illuminating lamp.

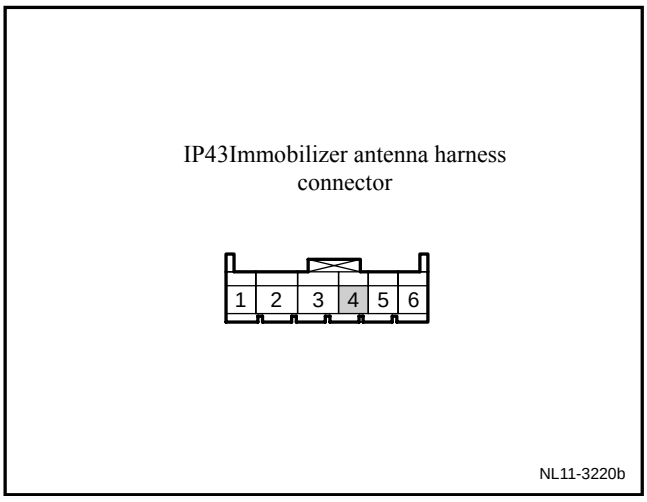
(a) Turn the ignition switch to ON position.

(b) Unplug fuse IF06.

(b) Measure anti-theft antenna harness connector IP43 terminal 4 voltage.

Voltage standard value :0V

Confirm if the voltage conforms to standard value.



No → Repair or replace the harness.

Yes

3	Replace electronic Anti-theft coil.

(a) Inspect whether dome lamp bulb is burned out.

Confirm the completion of repair.

Next

4	The system is normal.

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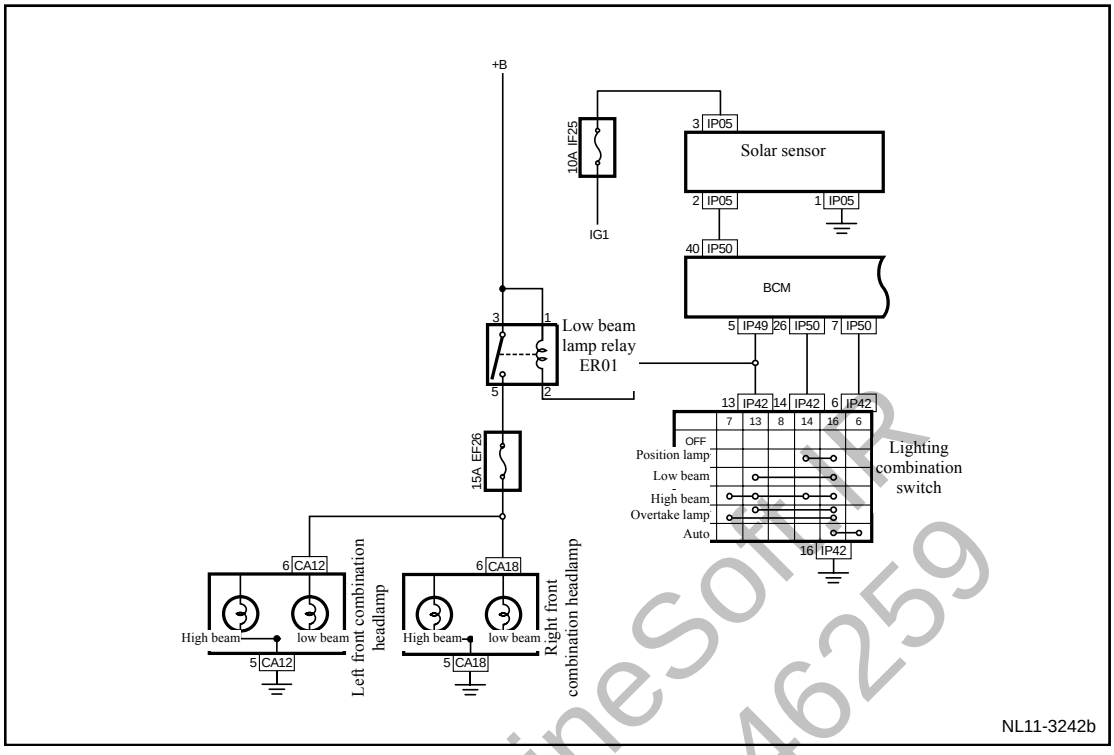
10.2.4.10 DTC B1216

Fault diagnosis code	Descriptions
B1216	A headlamp relay controls short circuit until a battery faults.

Circuit diagram:



Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1216.

(a) Inspect whether there is any DTC Code other than B1216.

Yes	Go to DTC list in 10.2.4.2 and repair according to trouble codes.
No	

2	Inspect the voltage of the terminal 5 of BCM wire harness connector IP49.

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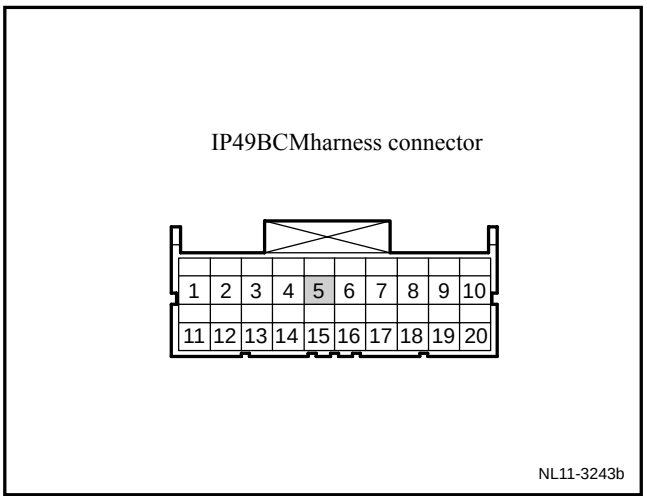
(a) Turn on lower-beam lamp.

(b) Measure voltage of BCM wire harness connector IP49 terminal 5.

Voltage standard value :0V

Confirm if the voltage conforms to standard value.



No → Repair or replace the harness.

Yes

3	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

4	The system is normal.

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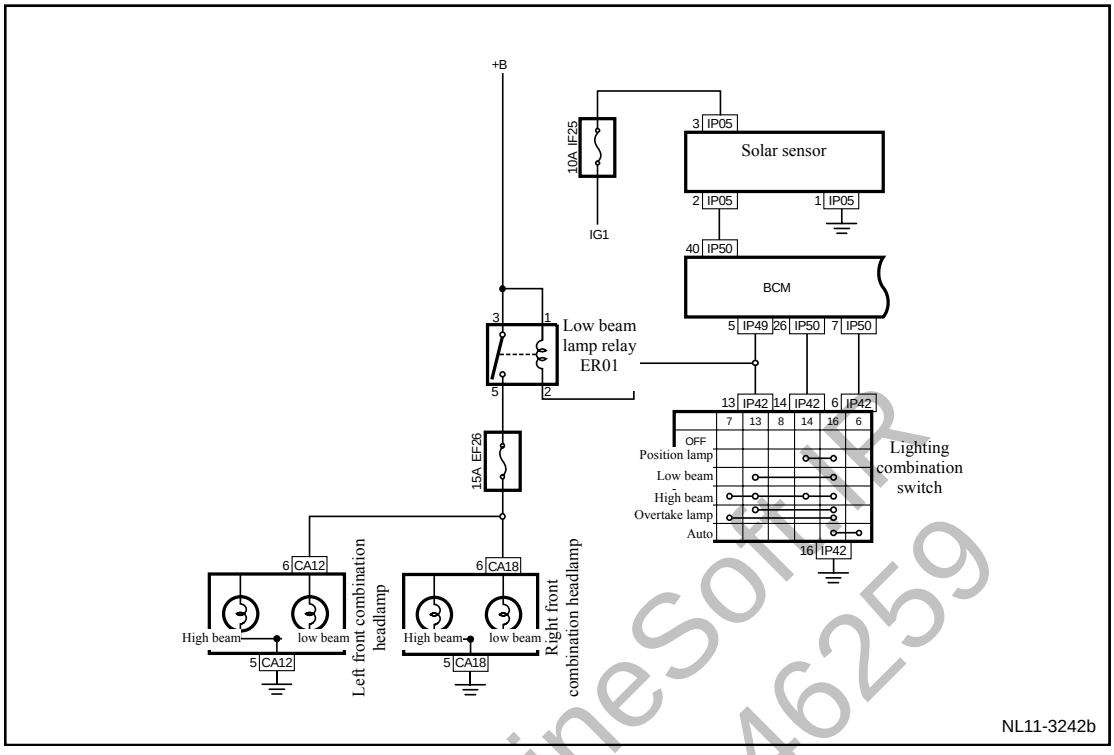
10.2.4.11 DTC B1237

Fault diagnosis code	Descriptions
B1237	Sunlight sensor fault

Circuit diagram:



Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1237

(a) Inspect whether there is any DTC Code other than B1237.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

2	Inspect the communication between the sunlight sensor and the fuse.

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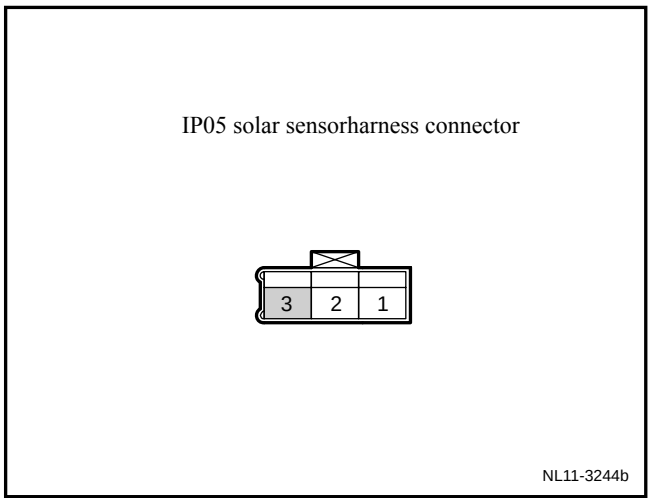
(a) Rotated ignition switch to "OFF" position .

(b) Disconnect solar sensor harness connector IP05.

(c) Measure resistance value between solar sensor harness connector IP05 terminal3 and indoor fuseIF25.

Standard Resistance: Less than 1 Ω

Confirm whether the resistance is normal.



No → Repair or replace the harness.

Yes

3	Inspect the communication between the sunlight sensor and the grounding.

(a) Measure resistance between sun sensor wire harness connector IP05 terminal 1 and grounding.

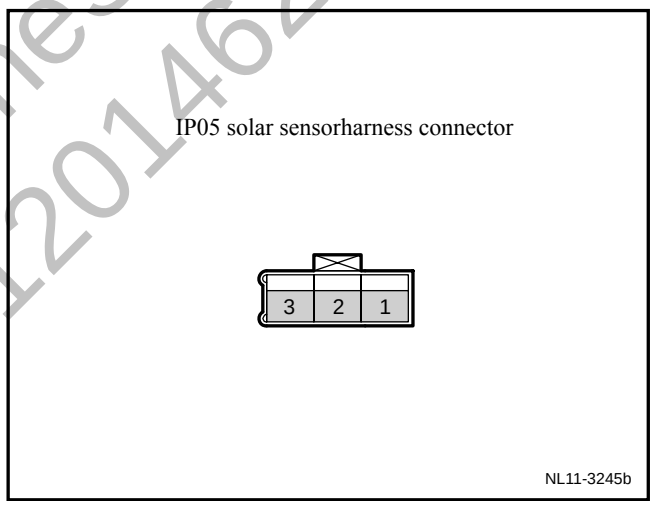
Standard Resistance: Less than 1 Ω

(b) Measure resistance value between solar sensor harness connector IP05 terminal3 and grounding

(c) Measure resistance value between of resistance value between solar sensor harness connector IP05 terminal2 and grounding.

Standard Resistance: 10 kΩ or higher

Confirm if the resistance conforms to standard value.



No → Repair or replace the harness.

Yes

4	Communication between the sunlight sensor and the BCM.

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(a) Turn the ignition switch to OFF position.

(b) Disconnect BCM harness sensor IP50.

(c) Measure solar sensor harness connector IP05 terminal2 and BCM harness connector

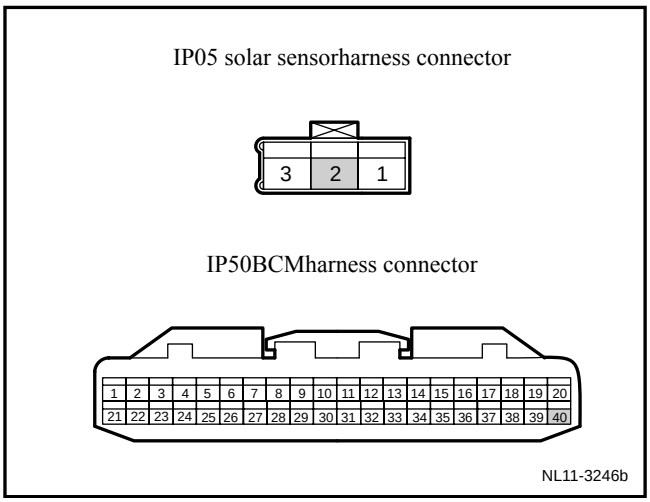
Resistance of IP50 terminal and No.40

Standard Resistance: Less than 1 Ω

(d) Measure resistance between BCM wire harness connector IP50 terminal 40 and grounding.

Standard Resistance: 10 kΩ or higher

Confirm if the resistance conforms to standard value.



No → Repair or replace the harness.

Yes

5	Replace solar sensor,

(a) Replace solar sensor, refer to11.3.8.16 ambient light and solar sensor replacement.

(b) Clear DTC, and read again.

Standard Resistance: Less than 1 Ω

(c) Measure resistance value between front celling lamp harness connector RF12 terminal2 and grounding

(d) Measure resistance between front dome lamp wire harness connector RF12 terminal 3 and grounding.

Confirm whether the fault code still exists.

No → The system is normal.

Yes

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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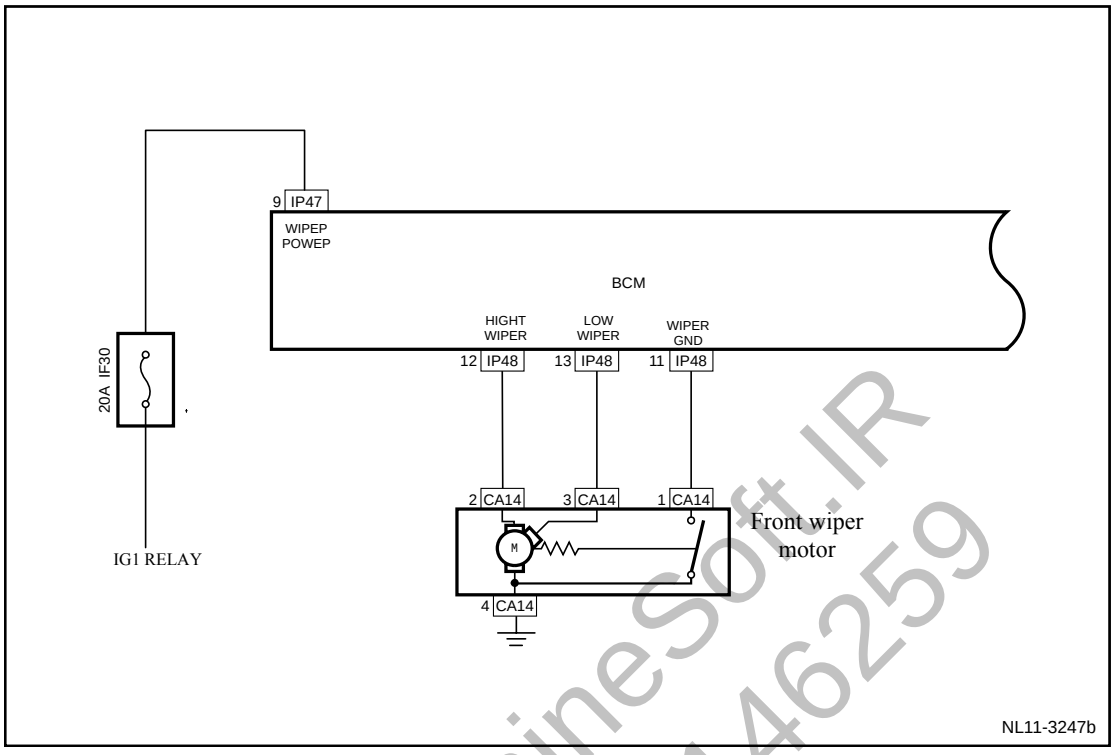
10.2.4.12 DTC B1213

Fault diagnosis code	Descriptions
B1213	If not detecting the stop bit signal within 8S consecutively the front wiper faults.

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1213.

(a) Inspect whether there is any DTC Code other than B1213.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

2	Inspect the communication between the wiper motor and the BCM.

(a) Turn the ignition switch to OFF position.

(b) Disconnect wiper motor harness connector.

(c) Disconnect BCM harness connector.

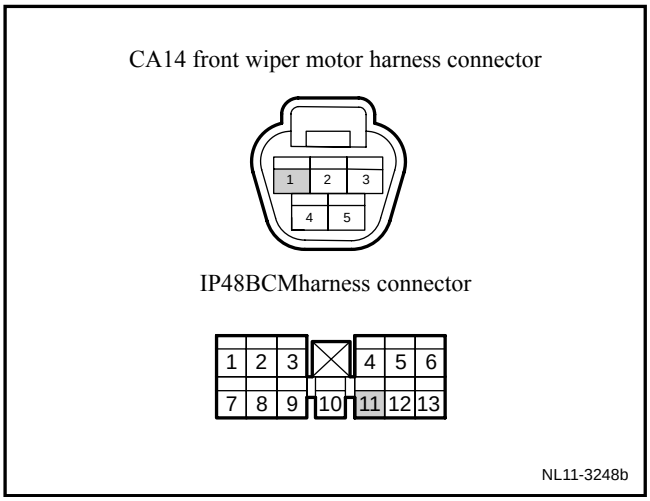
(d) Measure wiper motor wire harness connector CA14 terminal 1 and BCM wire harness connector.

IP48 terminal11 resistance

Standard Resistance: Less than 1 Ω

(e) Measure resistance between wiper motor wire harness connector CA14 terminal 1 and grounding.

Standard Resistance: 10 kΩ or higher



Is the resistance at a specified value?

No → Repair or replace the harness.

Yes

3	Replace wiper motor .

(a) Replace wiper motor, refer to11.5.8.10 replace wiper motor.

(b) Clear DTC,and read again .

Does DTC exist?

No → The system is normal.

Yes

4	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

5	The system is normal.

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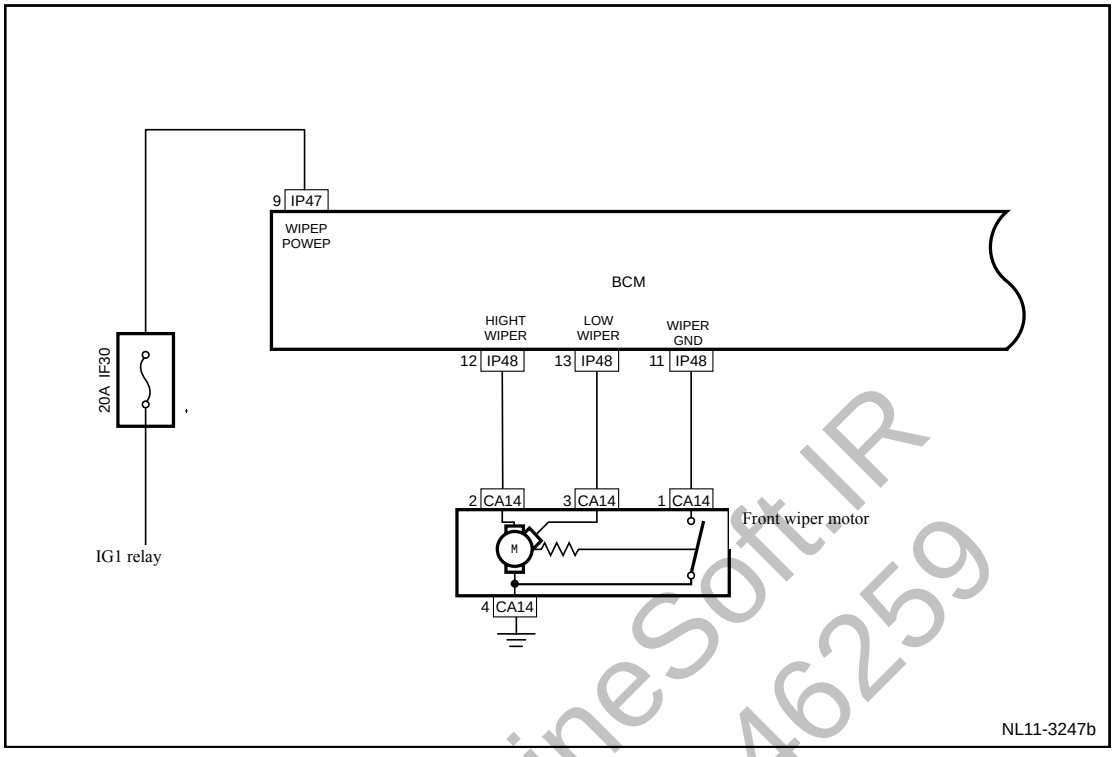
10.2.4.13 DTC B1214

Fault diagnosis code	Descriptions
B1214	If detecting the stop bit signal within 8S consecutively the front wiper faults.

Circuit diagram:



Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1214.

(a) Inspect whether there is any DTC Code other than B1214.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

2	Inspect the communication between the wiper motor and the BCM.

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(a) Turn the ignition switch to OFF position.

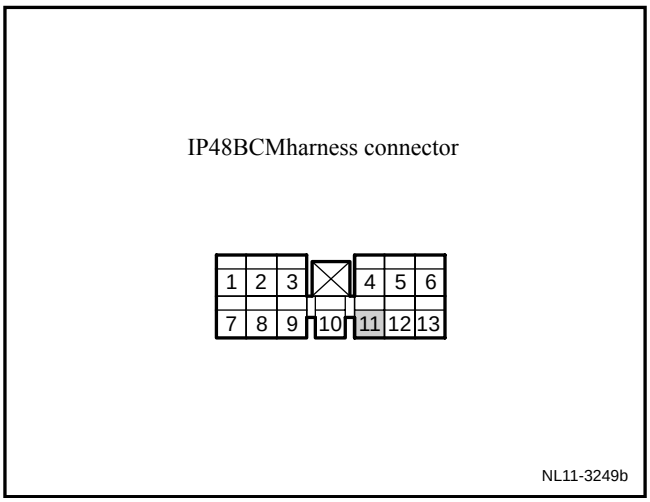
(b) Disconnect wiper motor harness connector .

(c) Disconnect BCM harness connector .

(d) Measure resistance between BCM wire harness connector IP48 terminal 11 and grounding.

Standard Resistance: 10 kΩ or higher

Is the resistance at a specified value.



No → Repair or replace the harness.

Yes

3	Replace wiper motor .

(a) Replace wiper motor, refer to11.5.8.10 replace wiper motor.

(b) Clear DTC,and read again .

Does DTC exist?

No → The system is normal.

Yes

4	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

5	The system is normal.

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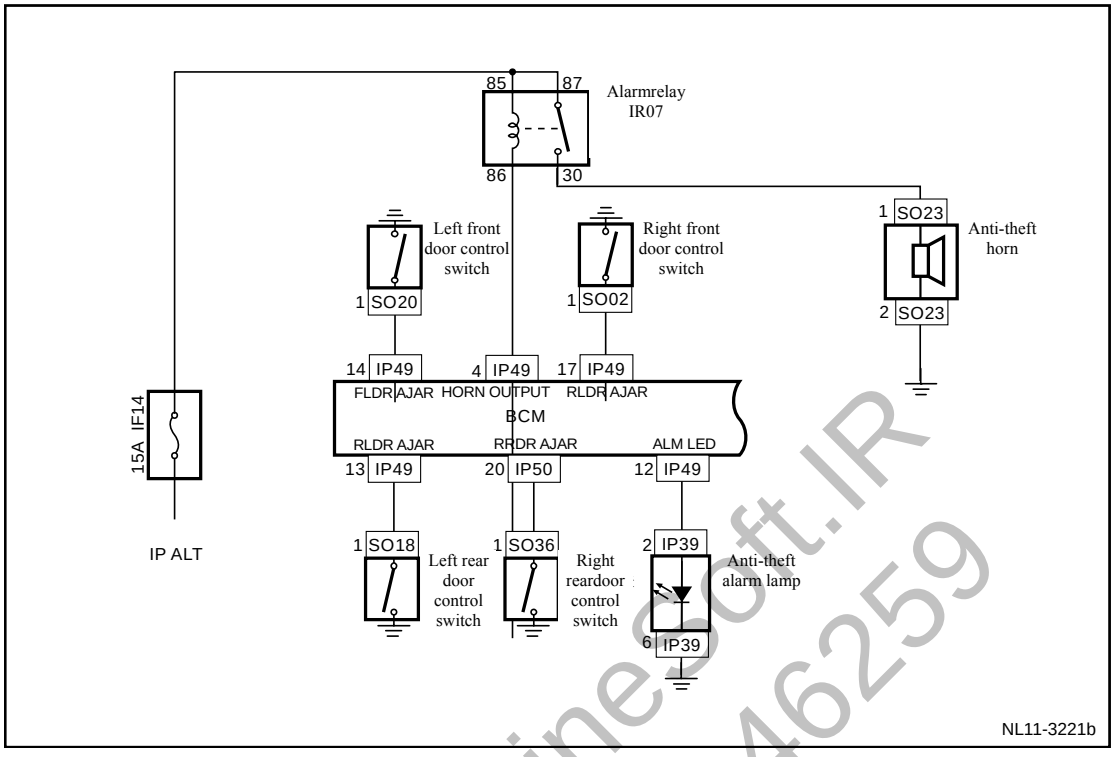
10.2.4.14 DTC B1215

Fault diagnosis code	Descriptions
B1215	A horn relay controls short circuit until a battery faults.

Circuit diagram:



Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1215.

(a) Inspect whether there is any DTC Code other than B1215.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

2	Inspect the voltage of the alarm relay IR07.

(a) Turn the ignition switch to OFF position.

(b) Dismantle alarm relay IR07.

(c) Measure voltage of alarm relay IR07 terminal 86.

Voltage standard value: 0V

Is voltage the Standard Value?

No → Repair or replace the harness.

Yes

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3	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

4	The system is normal.

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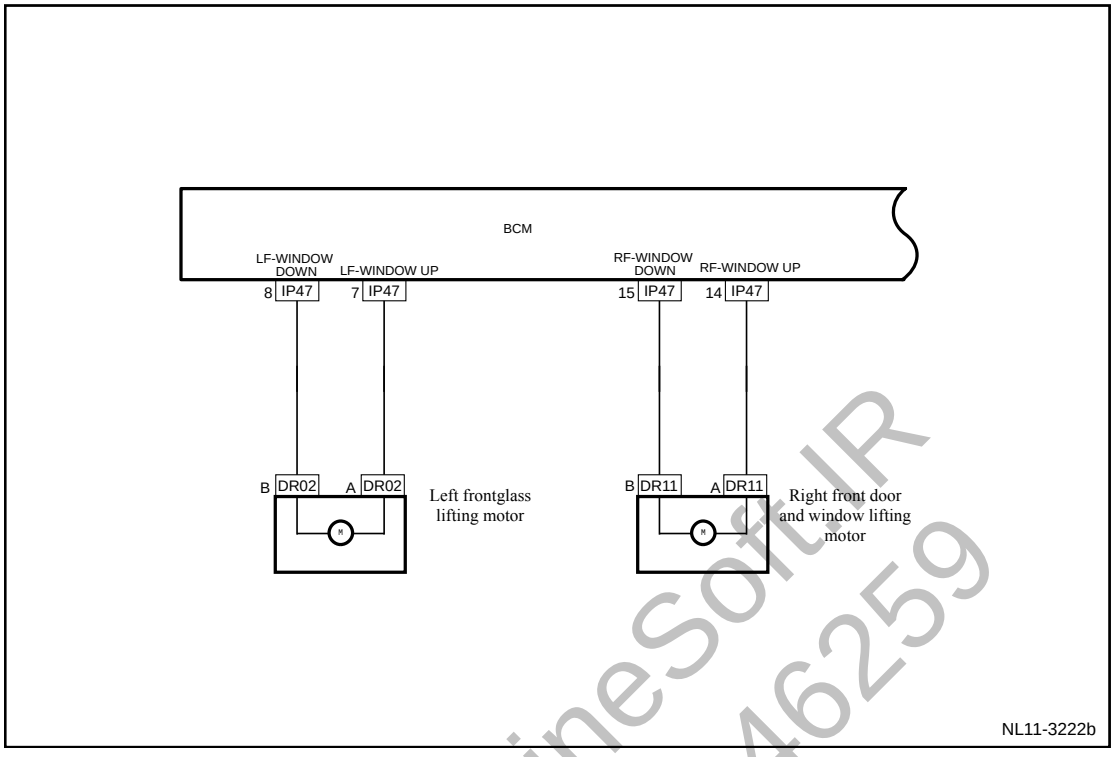
10.2.4.15 DTC B1217

Fault diagnosis code	Descriptions
B1217	Open circuit incurs on driver-side electric window driving.

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1214.

(a) Inspect whether there is any DTC Code other than B1217.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

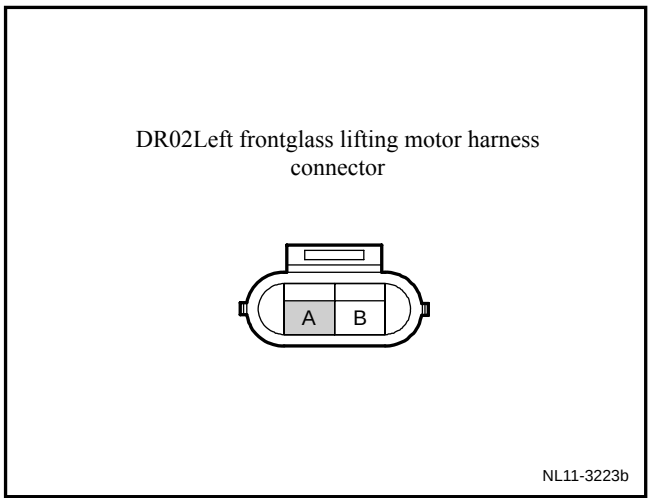
2	Inspect the upshift voltage of the left front glass lifting motor.

(a) Turn on left front glass lifter switch to lift left front glass.

(b) Measure voltage of Left front glass lift motor harness connector DR02 terminal

Standard Voltage: 11-14 V

Is voltage the Standard Value?



No	Go to step 4
Yes	

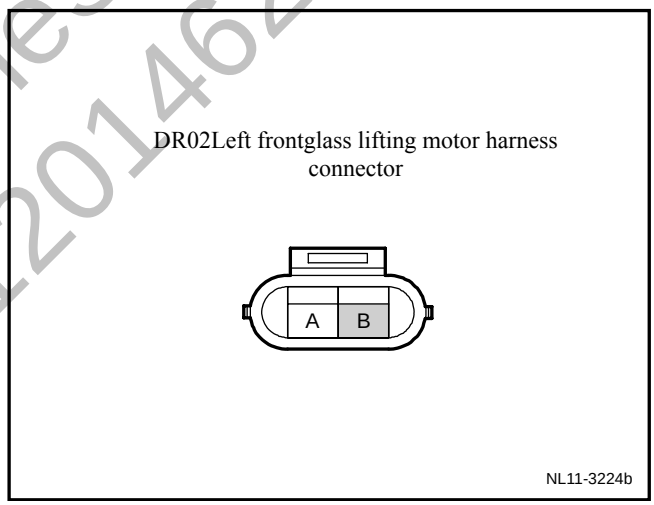
3	Inspect the downshift voltage of the left front glass lifting motor.

(a) Turn on left front glass lifter switch to lower left front glass.

(b) Measure voltage of Left front glass lift motor harness connector DR02 terminal

Standard Voltage: 11-14 V

Is voltage the Standard Value?



No	Go to step 5
Yes	

4	Inspect the communication of the left front glass lifting motor and the BCM.

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(a) Turn the ignition switch to OFF position.

(b) Disconnect Left front glass lift motor harness connector DR02.

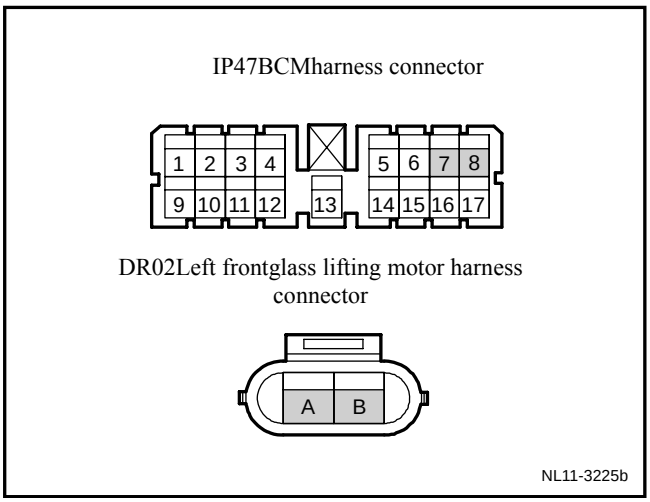
(c) Disconnect BCM harness connector IP47.

(d) Measure left front glass lifter motor wire harness connector DR02 terminal A and BCM wire harness connector IP47 terminal 7.

(e) Measure left front glass lifter motor wire harness connector DR02 terminal B and BCM wire harness connector IP47 terminal 8.

Standard Resistance: Less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 6

No

5	Replace left front glass lift motor,

(a) Replace left front glass lift motor; refer to11.4.8.5 Replacement of left front glass lifter motor.

(b) Clear DTC, and read DTC again

Whether fault code exists or not.

No → The system is normal.

Yes

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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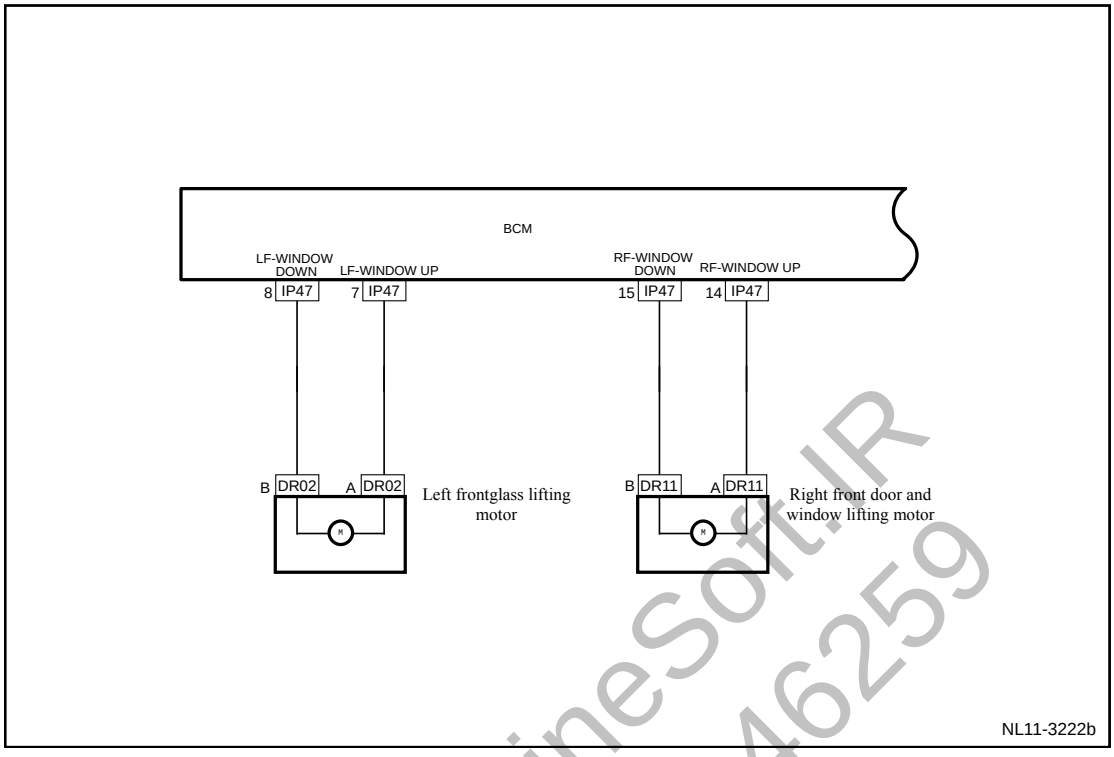
10.2.4.16 DTC B1218

Fault diagnosis code	Descriptions
B1218	Open circuit incurs on co-pilot-side electric window driving.

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1218.

(a) Inspect whether there is any DTC Code other than B1218.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

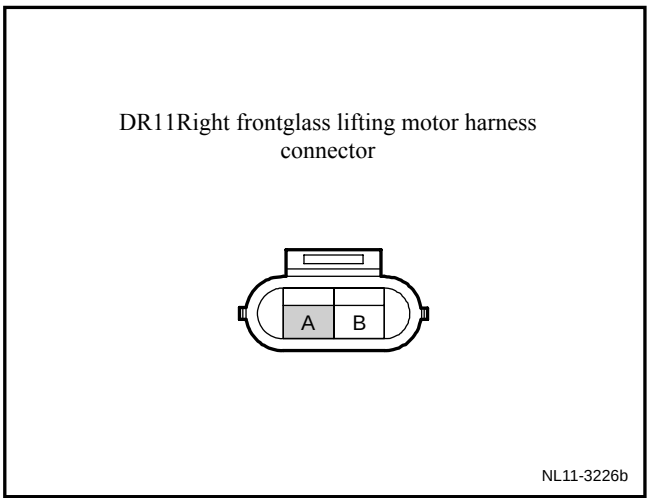
2	Inspect the upshift voltage of the right front glass lifting motor.

(a) Turn on right front glass lifter switch to lift right front glass.

(b) Measure voltage of right front side glass lift motor harness connector DR11 terminal.

Standard Voltage: 11-14 V

Is voltage the Standard Value?



No → Go to step 4

Yes

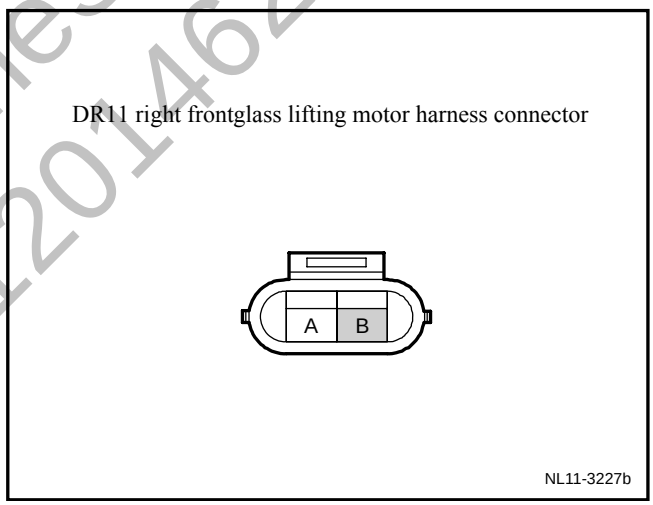
3	Inspect the downshift voltage of the right front glass lifting motor.

(a) Turn on right front glass lifter switch to lower right front glass.

(b) Measure voltage of right front side glass lift motor harness connector DR11 terminal

Standard Voltage: 11-14 V

Is voltage the Standard Value?



No → Go to step 5

Yes

4	Inspect the communication of the right front glass lifting motor and the BCM.

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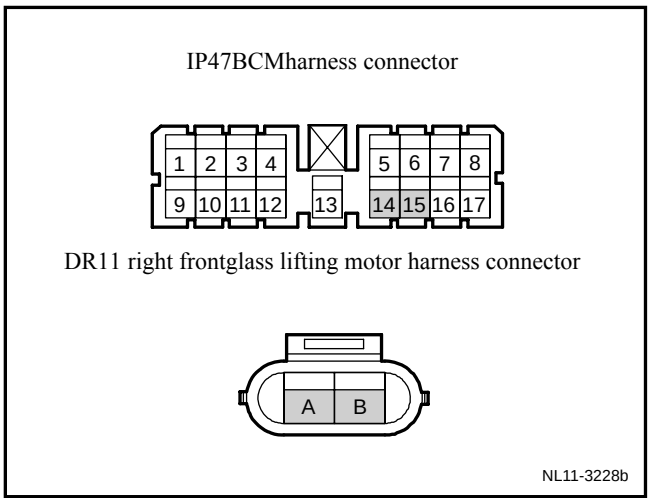
(a) Turn the ignition switch to OFF position.

(b) Disconnect Left front glass lift motor harness connector DR11.

(c) Disconnect BCM harness connector IP47.

(d) Measure left front glass lifter motor wire harness connector DR11 terminal A and BCM wire harness connector IP47 terminal 14.

(e) Measure resistance between left front glass lifter motor wire harness connector DR11 terminal B and BCM wire harness connector IP47 terminal 15.



Standard Resistance: Less than 1 Ω

Is the resistance at a specified value?

Yes → Go to step 6

No

5	Replace right front side glass lift motor .

(a) Replace right front side glass lift motor, refer to11.4.8.5 left front glass lifter motor replacement.

(b) Clear DTC, and read DTC again

Whether fault code exists or not

No → The system is normal.

Yes

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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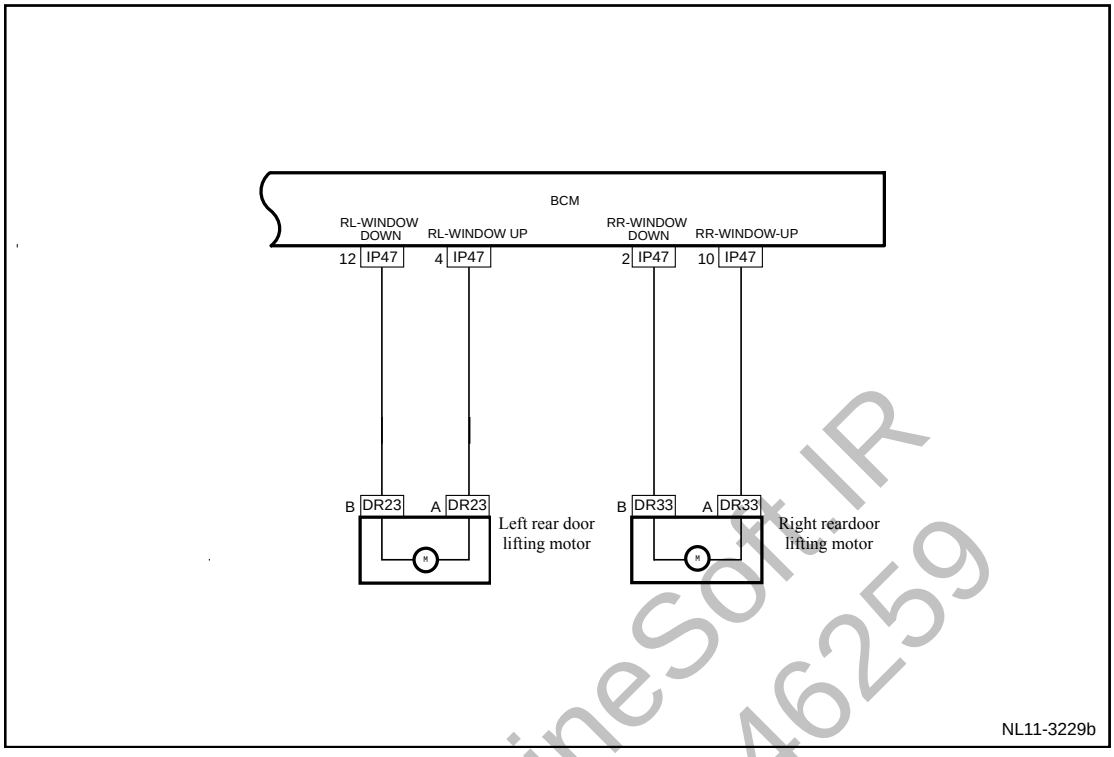
10.2.4.17 DTC B1220

Fault diagnosis code	Descriptions
B1220	Open circuit incurs on left rear electric window driving.

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1220.

(a) Inspect whether there is any DTC Code other than B1220.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

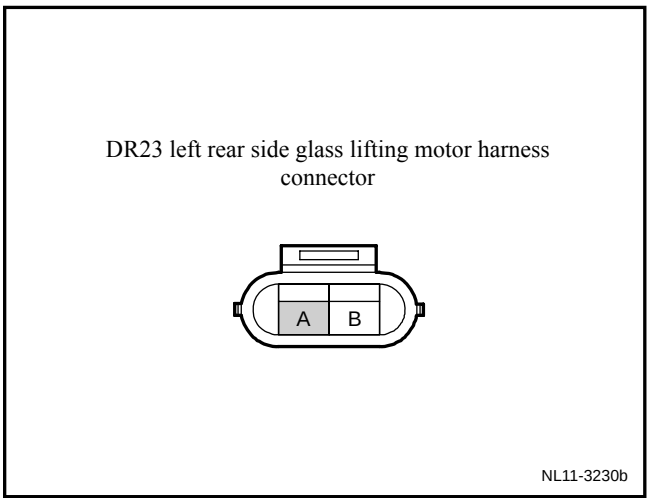
2	Inspect the upshift voltage of the left rear side glass lifting motor.

(a) Turn on left rear glass lifter switch to lift left rear glass.

(b) Measure voltage of left rear side glass lift motor harness connector DR23 terminal.

Standard Voltage: 11-14 V

Is voltage the Standard Value?



No → Go to step 4

Yes

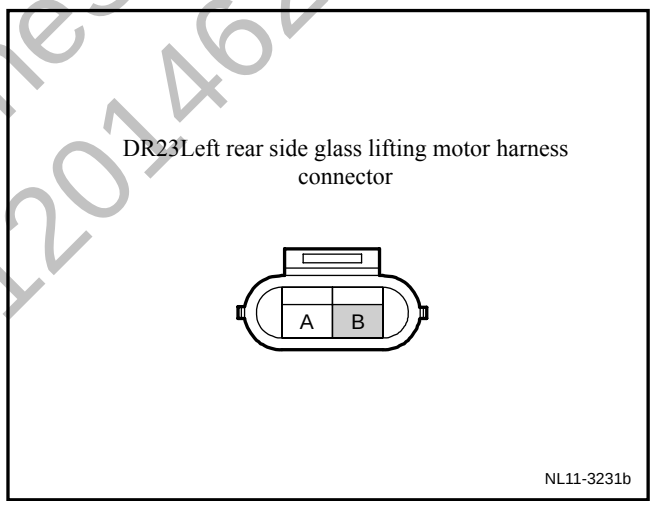
3	Inspect the downshift voltage of the left rear side glass lifting motor.

(a) Turn on left rear glass lifter switch to lower left rear glass.

(b) Measure voltage of left rear side glass lift motor harness connector DR23 terminal

Standard Voltage: 11-14 V

Is voltage the Standard Value?



Yes → Go to step 5

No

4	Inspect the communication of the left rear glass lifting motor and the BCM.

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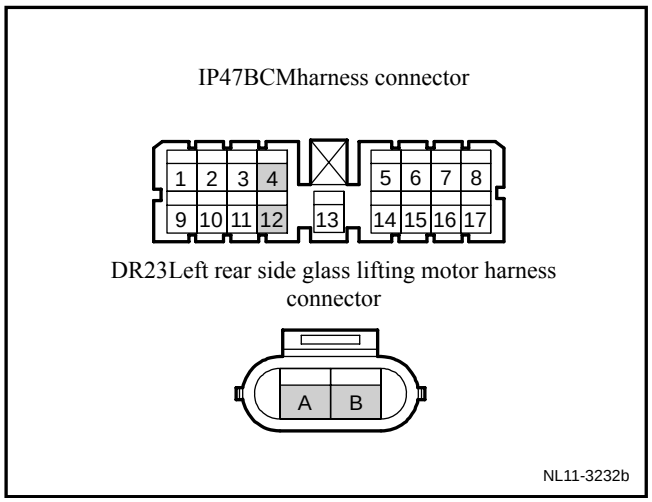
(a) Turn the ignition switch to OFF position.

(b) Disconnect left front glass lift motor harness connector DR23.

(c) Disconnect BCM harness connector IP47.

(d) Measure left rear glass lifter motor wire harness connector DR23 terminal A and BCM wire harness connector IP47 terminal 4.

(e) Measure resistance between left rear glass lifter motor wire harness connector DR23 terminal B and BCM wire harness connector IP47 terminal 12.



Standard Resistance: Less than 1 Ω

Is the resistance at a specified value?

Yes	Go to step 6
No	

5	Replace left rear side glass lift motor,

(a) Replace left rear side glass lift motor; refer to11.4.8.11 rear door glass lift motor replacement.

(b) Clear DTC, and read DTC again

Whether fault code exists or not ,

No	The system is normal.
Yes	

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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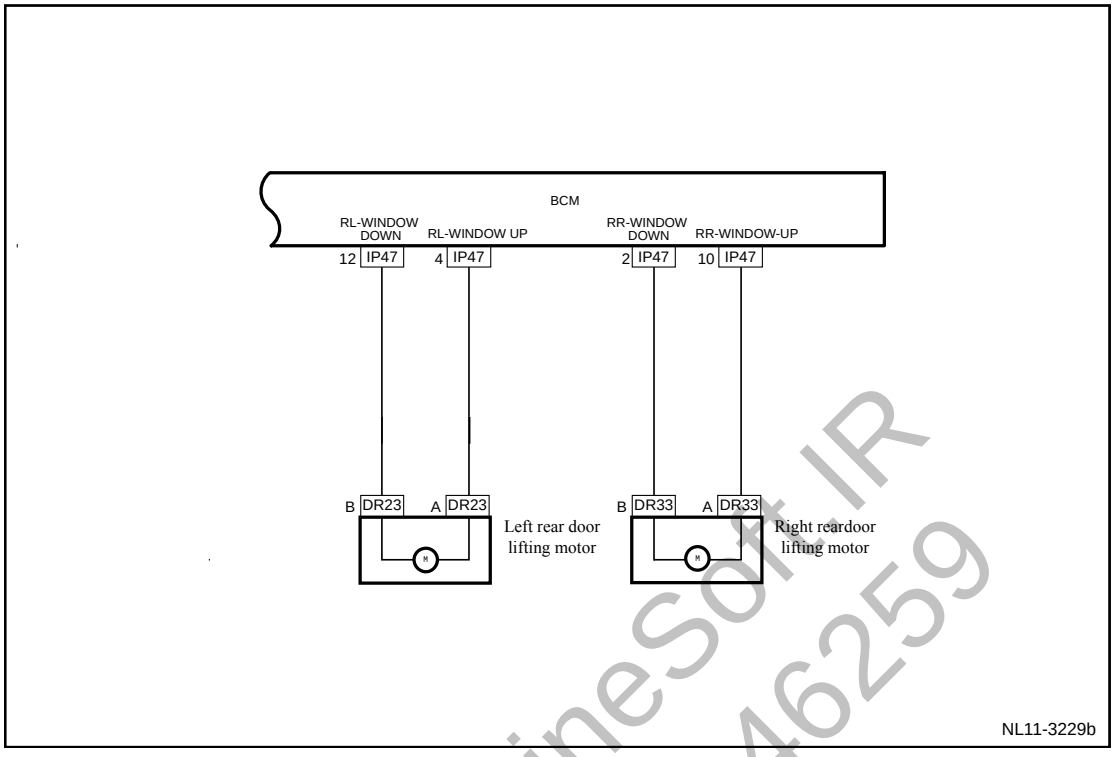
10.2.4.18 DTC B1222

Fault diagnosis code	Descriptions
B1222	Open circuit incurs on right rear electric window driving.

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1222.

(a) Inspect whether there is any DTC Code other than B1222.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

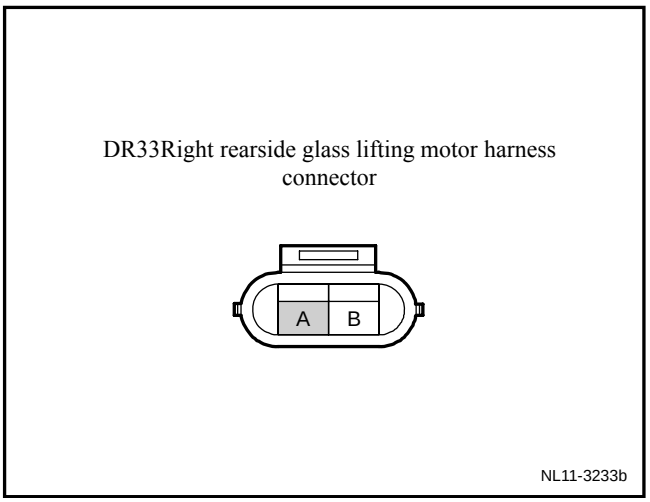
2	Inspect the upshift voltage of the right rear side glass lifting motor.

(a) Turn on right rear glass lifter switch to lift right rear glass.

(b) Measure voltage of right rear side glass lift motor harness connector DR33 terminal.

Standard Voltage: 11-14 V

Is voltage the Standard Value?



No	Go to step 4
Yes	

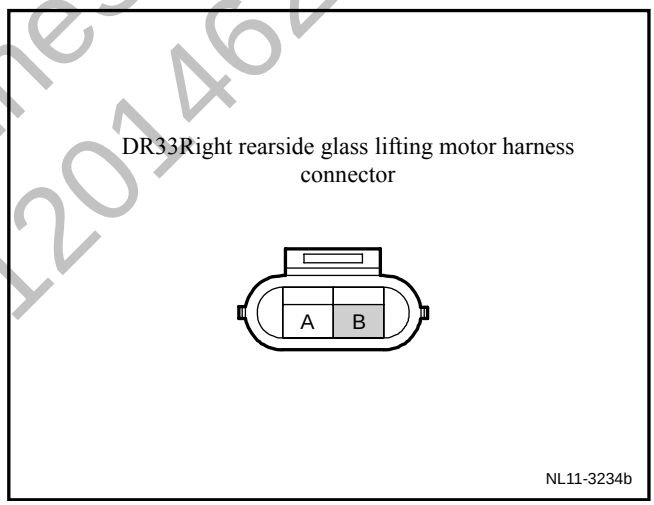
3	Inspect the down shift voltage of the right rear side glass lifting motor.

(a) Turn on right rear glass lifter switch to lower right rear glass.

(b) Measure voltage of right rear side glass lift motor harness connector DR33 terminal.

Standard Voltage: 11-14 V

Is voltage the Standard Value?



Yes	Go to step 5
No	

4	Inspect the communication of the left rear glass lifting motor and the BCM.

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(a) Turn the ignition switch to OFF position.

(b) Disconnect right rear glass lift motor harness connector DR33.

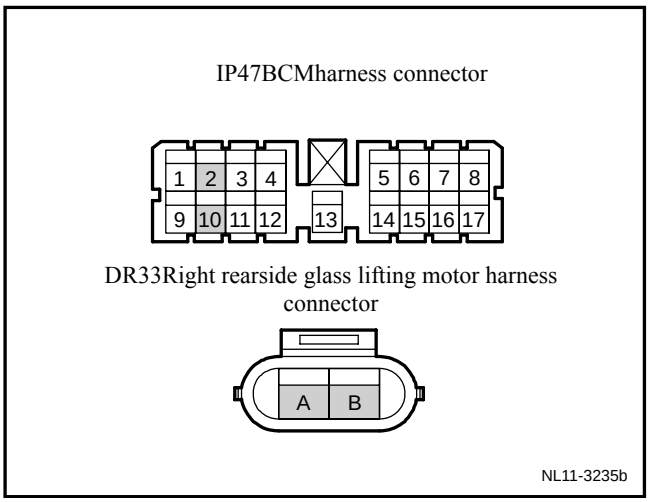
(c) Disconnect BCM harness connector IP47.

(d) Measure resistance between left rear glass lifter motor wire harness connector DR33 terminal A and BCM wire harness connector IP47 terminal 10.

(e) Measure resistance between left right glass lifter motor wire harness connector DR33 terminal B and BCM wire harness connector IP47 terminal 2.

Standard Resistance: Less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 6

No

5	Replace right rear side glass lift motor.

(a) Replace right rear side glass lift motor, refer to11.4.8.11 rear door glass lift motor replacemen .

(b) Clear DTC, and read DTC again

Whether fault codes exists or not.

No → The system is normal.

Yes

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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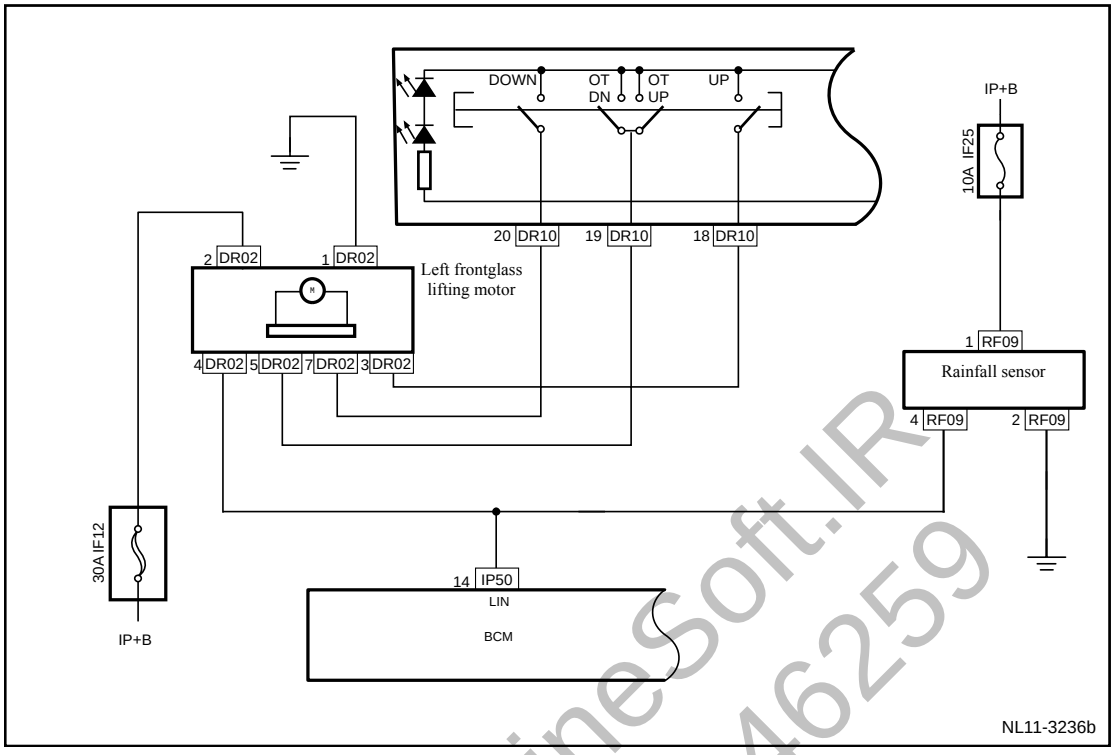
10.2.4.19 DTC B1224

Fault diagnosis code	Descriptions
B1224	Driver-side electric window anti-trapping module HALL sensor faults.

Circuit diagram:



Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1224.

(a) Inspect whether there is any DTC Code other than B1224.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

2	Replace left front glass lift motor,

(a) Replace left front glass lift motor; refer to11.4.8.5 left front glass lifter motor replacement.

Confirm the completion of repair.

Next

3	The system is normal.

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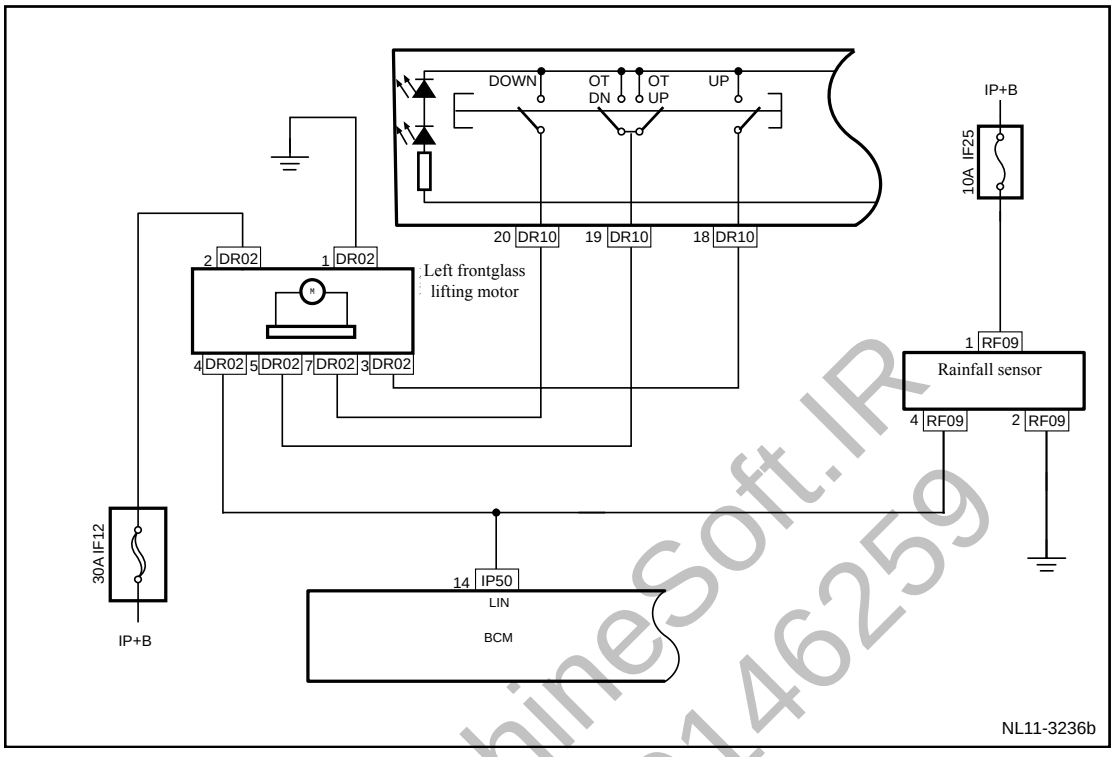
10.2.4.20 DTC B1236

Fault diagnosis code	Descriptions
B1236	Rain sensor fault

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1236.

(a) Inspect whether there is any DTC Code other than B1236.

Yes	Go to DTC list in 10.2.4.2 and repair according to trouble codes.
No	

2	Inspect the communication between the rain motor and the fuse.

(a) Turn the ignition switch to OFF position.

(b) Disconnect rain sensor harness connector RF09.

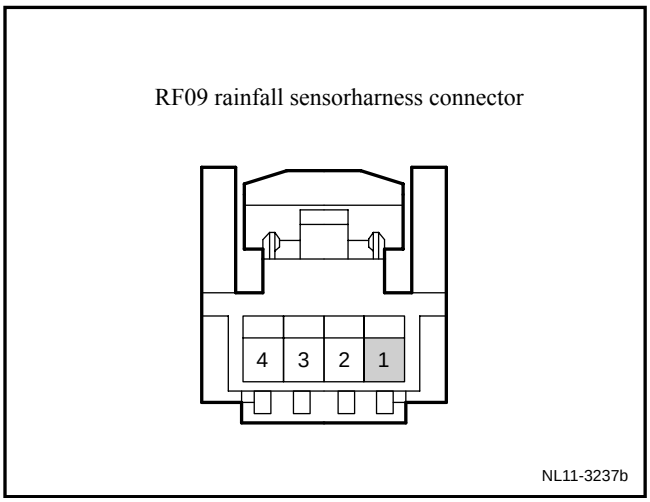
(c) Measure resistance value between rain sensor harness connector RF09 terminal1 and fuse

Standard Resistance: Less than 1 Ω

(d) Measure resistance between rain volume sensor wire harness connector RF09 terminal 1 and grounding.

Standard Resistance: 10 kΩ or higher

Is the resistance at a specified value?



No → Repair or replace the harness.

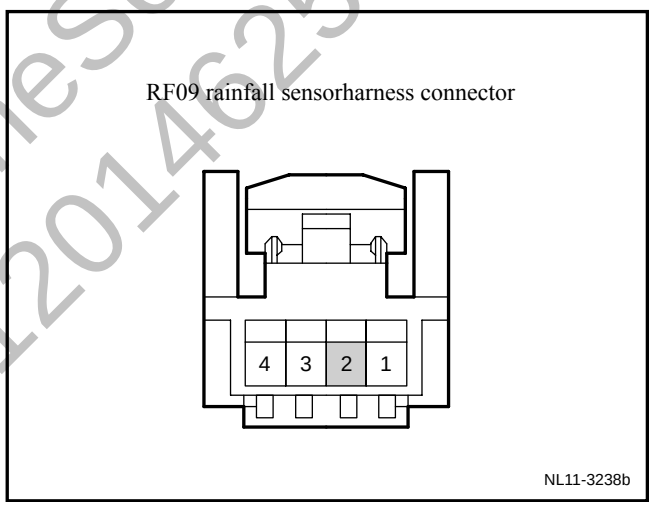
Yes

3	Inspect the communication between the rain motor and the grounding.

(a) Measure resistance between rain volume sensor wire harness connector RF09 terminal 2 and grounding.

Standard Resistance: Less than 1 Ω

Is the resistance at a specified value?



No → Repair or replace the harness.

Yes

4	Replace rain sensor.

(a) Replace rain sensor, refer to

Confirm the completion of repair.

Next

5	The system is normal.

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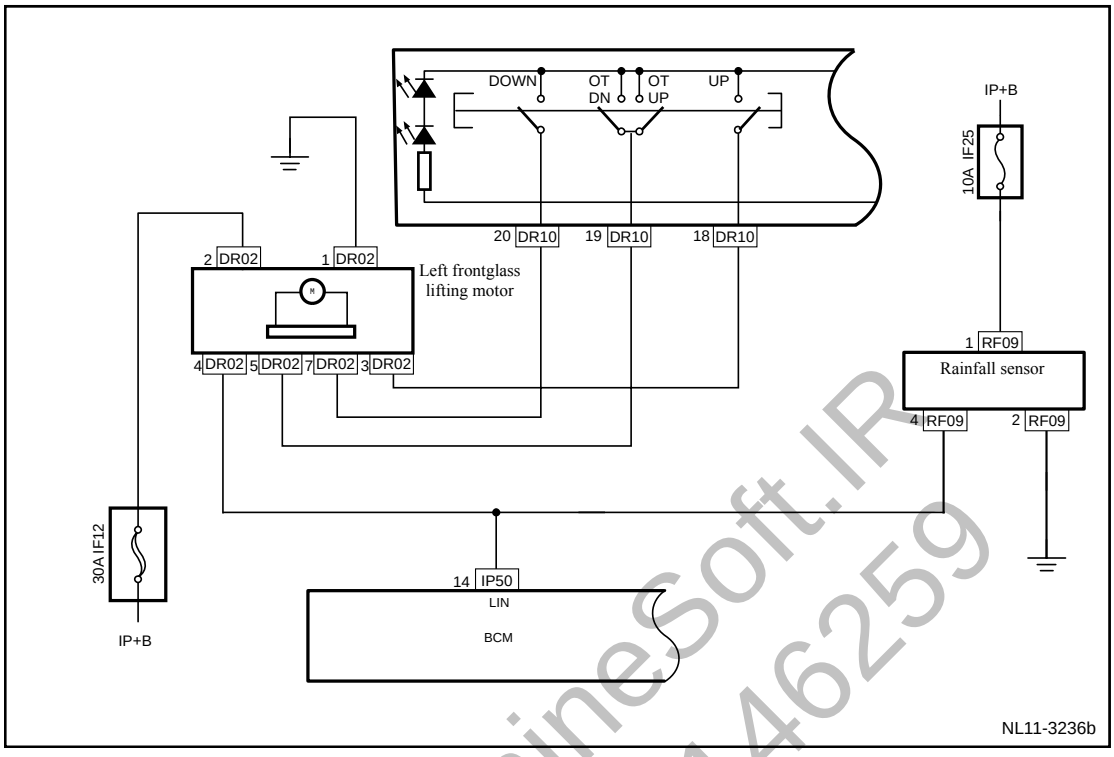
10.2.4.21 DTC U1000

Fault diagnosis code	Descriptions
U1000	Communication error of driver-side electric window LIN

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than U1000

(a) Inspect whether there is any DTC Code other than U1000.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

2	Inspect the communication of the left front lifting motor and the BCM.

(a) Turn the ignition switch to OFF position.

(b) Disconnect Left front side lifting motor harness connector DR02.

(c) Disconnect BCM harness connector IP50.

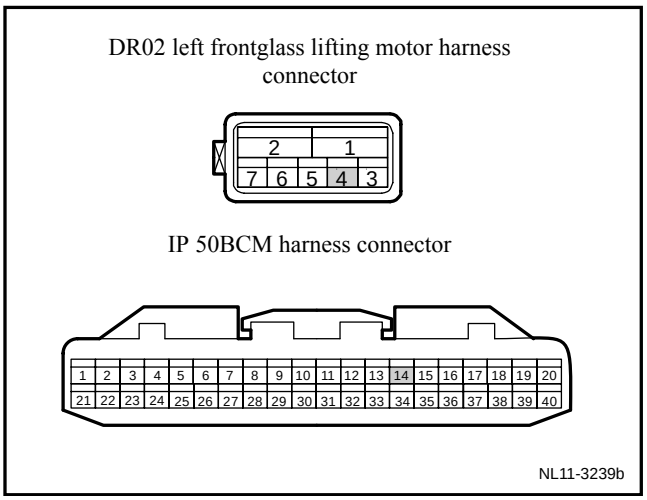
(d) Measure left front lifter motor wire harness connector DR02 terminal 4 and BCM wire harness connector IP50 terminal 14.

Standard Resistance: Less than 1 Ω

(e) Measure resistance between left front lifte motor wire harness connector DR02 terminal 14 and grounding.

Standard Resistance: 10 kΩ or higher

Is the resistance at a specified value?



No — Repair or replace the harness.

Yes

3	Replace left front side glass lift motor,

(a) Replace left front side glass lift motor, refer to11.4.8.5 left front glass lifter motor replacement.

Confirm the completion of repair.

Next

4	The system is normal.

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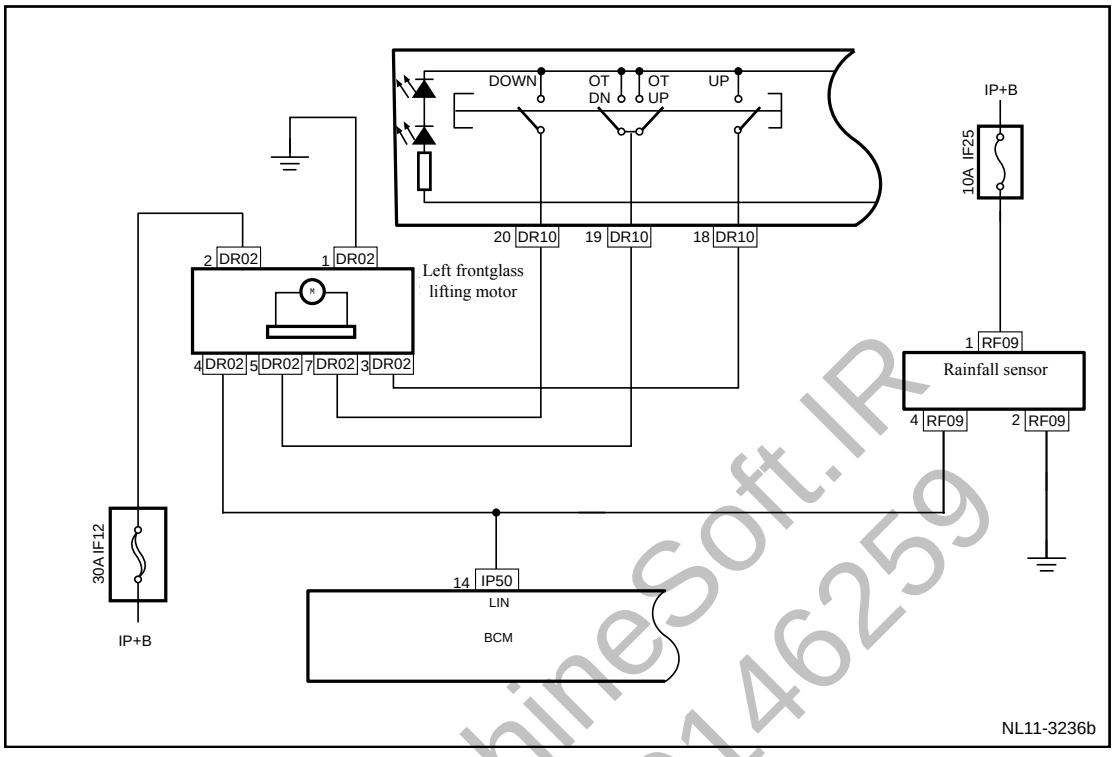
10.2.4.22 DTC U1004

Fault diagnosis code	Descriptions
U1004	Light rain sensor LIN communication error

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B1220.

(a) Inspect whether there is any DTC Code other than B1220.

Yes	Go to DTC list in 10.2.4.2 and repair according to trouble codes.
No	

2	Inspect the communication between the rain motor and the BCM.

(a) Turn the ignition switch to OFF position.

(b) Disconnect rain sensor harness connector RF09.

(c) Disconnect BCM harness connector IP50.

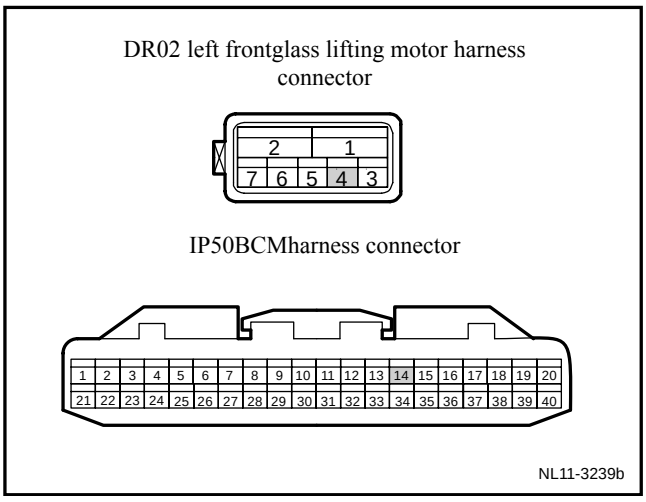
(d) Measure resistance between rain volume sensor wire harness connector RF09 terminal 4 and BCM wire harness connector IP50 terminal 14.

Standard Resistance: Less than 1 Ω

(e) Measure resistance between rain volume sensor wire harness connector RF09 terminal 4 and grounding.

Standard Resistance: 10 kΩ or higher

Is the resistance at a specified value?



No → Amend or replace the wire harness

Yes

3	Replace rain sensor .

(a) Replace rain sensor, refer to

Confirm the completion of repair.

Next

4	The system is normal.

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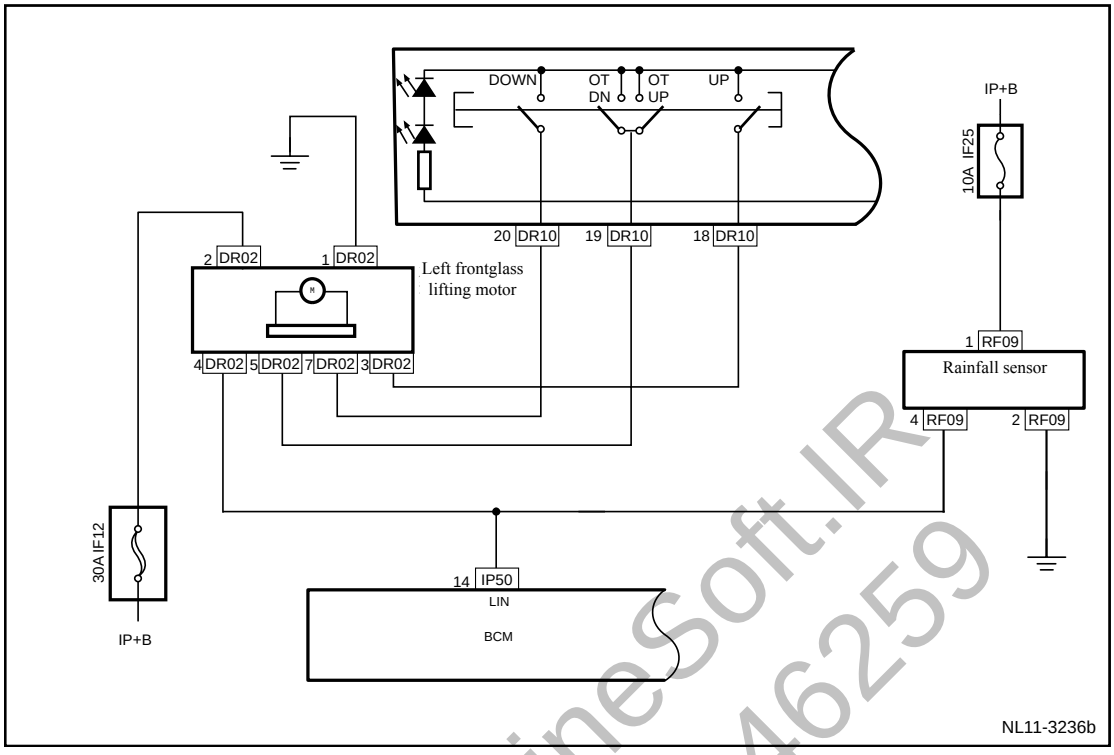
10.2.4.23 DTC U1005

Fault diagnosis code	Descriptions
U1005	BCM LIN communication error

Circuit diagram:



Diagnostic Steps:

1	Inspect whether there is any DTC Code other than U1005

(a) Inspect whether there is any DTC Code other than U1005.

Yes → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

No

2	Inspect the communication among the BCM, the left front glass lifting motor and the rain sensor.

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(a) Turn the ignition switch to OFF position.

(b) Disconnect BCM harness connector IP50.

(c) Disconnect the left front glass lifting motor harness connector DR02.

(d) Disconnect rain sensor harness connector RF09.

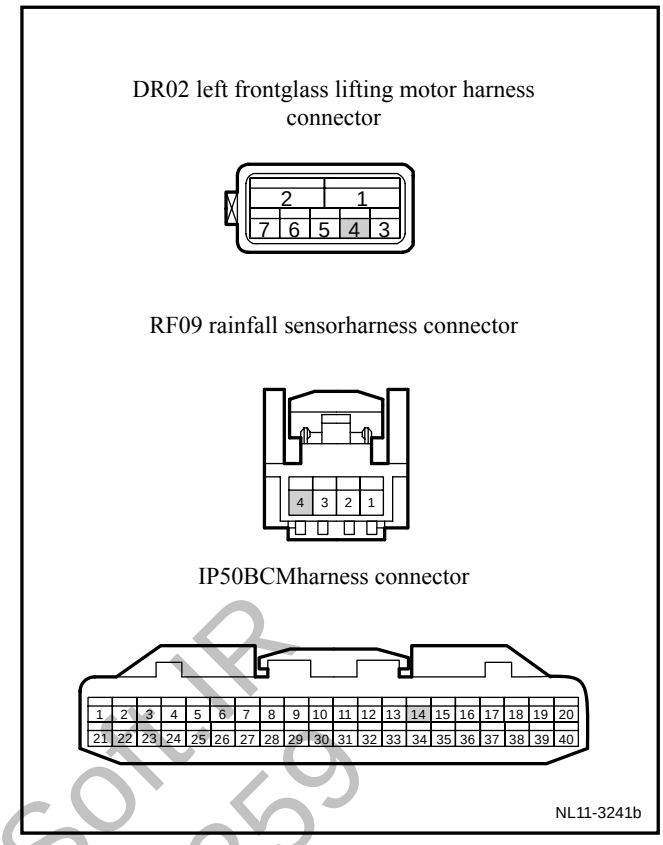
(e) Measure resistance between BCM wire harness connector IP50 terminal 14 and left front glass lifter motor wire harness connector DR02 terminal 4, rain volume sensor RF09 terminal 4.

Standard Resistance: Less than 1 Ω

(f) Measure resistance between BCM wire harness connector IP50 terminal 14 and grounding.

Standard Resistance: 10 kΩ or higher

Is the resistance at a specified value?



No → Amend or replace the wire harness

Yes

3	Replace the BCM

(a) Replace BCM, refer to"BCM replace".

Confirm the completion of repair.

Next

4	The system is normal.

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10.2.5 Dismantle and install

10.2.5.1 BCM replacement

Refer to 11.8.8.1 Replacement of BCM.

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10.3 Computer integrated manufacturing system(JLD-4G20/JLD-4G24)

10.3.1 Specification

10.3.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lb-ft)
Fixing Bolts of Body Control Module (BCM)	M8×16	8	6

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10.3.2 Description and operation

10.3.2.1 Description and operation

Overview

In order to reduce the failure rate of vehicles, more effective humanistic control is realized. Therefore, BCM is integrated in electric accessories. BCM includes a RF receiver, with a frequency of 433 MHz.

External Anti-theft Function

When the vehicle is on alarm arrangement state, once there are external illegal actions, body anti-theft alarm system will enter the alarm status. Alarm cycle is as follows. Left and right flashlights flash and anti-theft alarm horn sounds interactively. If the system is at mute mode, the horn doesn't sound.

Switch between system silence mode and normal mode can be realized by long pressing remote unlock and lock buttons for 2 seconds at anti-theft deactivation state.

The state of anti-theft alarm system is kept in EEPROM to ensure to keep original anti-theft alarm system status after the system removes power and restarts.

Anti-theft alarm system consists of following states:

Anti-theft deactivation state: There is no alarm and alarm arrangement in anti-theft system. Press remote unlock button to enter anti-theft deactivation state.

Previous alarm state: There is no alarm in anti-theft system. After previous alarm period which is 3 seconds, the vehicle will enter alarm arrangement state.

Alarm arrangement state: There is no alarm in anti-theft system. Any action to trigger alarm generates, the system will enter alarm state. Regardless of the state of anti-theft alarm system, if EMS sends engine locking signal on IGN ON condition, anti-theft alarm system will immediately enter alarm state.

Alarm state: When alarm generates, enter alarm cycle.

Reminding state: Close all doors in the reminding period which is 10 seconds and reminding state will stop. Anti-theft alarm system will enter alarm arrangement state or alarm deactivation state accordingly. If the reminding period which is 10 seconds ends, there are doors not locking and alarm system will enter alarm state.

Anti-theft alarm

When anti-theft system is at alarm mode and alarm cycle is as follows:

Left and right flashlights flash and anti-theft alarm horn sounds interactively. Work cycle is as follows. It is on for 500 milliseconds and off for 500 milliseconds. After 30 seconds , the horn stops and only left and right flashlights flash for 5 minutes .

At alarm arrangement state, conditions to trigger alarm are as follows:

- Open the left front door
- Open the right front door
- Open the left rear door
- Open the right rear door
- Open rear compartment lid.
- Open engine compartment cover
- Illegal key ignition

Otherwise, once BCM receives engine locking signal sent by EMS on IGN ON condition, the system will immediately enter anti-theft alarm state.

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When remote lock button is received on alarm, turning light will flash once and alarm cycle will stop so that the system will enter anti-theft alarm arrangement system. In addition, trigger condition which is the same as before occurs again and alarm cannot be triggered. This trigger condition is reset only at alarm deactivation state.

Deactivate alarm by remote unlock button or engine release signal sent by EMS and anti-theft system will enter alarm deactivation state. When remote unlock command is received, left and right turning lights will flash for 3 times. Position light will be on for 25 seconds and LED stops flashing.

State transition of anti-theft system

When the ignition key is removed, close all doors/rear compartment lid/engine compartment cover and lock all doors with the remote lock button (press lock button once), turning lights flash once. First enter previous alarm state for 3 seconds after anti-theft deactivation state. At this time, anti-theft indicator flashes quickly and the cycle is as follows. It is on for 160 milliseconds and off for 160 milliseconds. In the meantime, if door or rear compartment lid or engine compartment cover is open, it will be always at previous alarm state. Otherwise, after 3 seconds, the system will automatically transfer to anti-theft alarm arrangement state. At this time, anti-theft indicator flashes slowly. The cycle is as follows. It is on for 160 milliseconds and off for 1920 milliseconds. At anti-theft alarm arrangement state, anti-theft indicator keeps flashing at this cycle.

When locking door with remote lock button, if door/rear compartment lid/engine compartment cover is not secured, steering lamp flashes for three times and the system will enter reminding state. Anti-theft horn sounds for 2 sounds every 2 seconds. If pressing lock button in 10 seconds, the system will also stay at reminding state and after 10 seconds enter alarm cycle. If pressing remote unlock button in 10 seconds, the system will enter alarm deactivation state after reminding state. In the anti-theft alarm mode, if the remote unlock button is pressed again, it will stop the alarm cycle, and the anti-theft alarm arrangement status will be deactivated. If pressing lock button again, the system will enter reminding state again.

Anti-theft alarm arrangement is automatically enabled.

After automatic re-lock, the system will re-enter the anti- theft mode.

Anti-theft horn disables/enables.

In the anti-theft mode, pressing the remote "lock" and "unlock" buttons at the same time for more than 2 seconds, steering lamps will flash twice and the system will enter the mute mode. In the status of mute function, if it is alarming, the theft deterrent horn will not sound.

And then simultaneously press the "lock" and "unlock" keys on the remote control unit for more than 2s; right now, the steering lamp flickers twice to indicate exit.

Mute state

Remote key learning

Remote controller key learning function: In anti-theft deactivation case, open the driver door. Turn the key from OFF to ON 6 times in 10 seconds. the last stop is at the OFF position. At this time, the anti-theft indicator is on and steering lamp flashes once, and it indicates to enter the learn mode. Hold any button on the remote controller. If the anti-theft light flashes once, it indicates a successful learning. Four keys can be learned in turn.

The remote controller learn mode will end after 10 seconds or after four keys learn, or the ignition lock is turned to "ON" after at least one key learning.

Central door lock function

Body control system provides following functions of central control door lock:

- Lock/unlock of remote key
- Unlock/lock of interior central door lock switch for super lock
- Automatic re-lock
- Automatic lock of driving vehicle
- Collision automatic unlock
- Automatic unlock at flameout

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- Rear compartment lid unlock
- Automatic lock of rear compartment lid
- Forbid unlocking of rear compartment lid.
- Forbid remote command
- Overheat protection of door lock motor

Unlock/lock of remote key

Ignition key is not at inserted state. Execute once in 1 second to press remote unlock button and four doors are unlocked. Steering lamp flashes 3 times to confirm. Interior lamp lights gradually while position lamp lights.

When the ignition key is in the non-insertion state, press the lock key on the remote control unit once within 1s; then lock the five doors, flicker the steering lamp for confirmation, turn off the interior lamp gradually, and turn off the position lamp.

Ignition key is not at inserted state. Press remote lock button twice or more in 500 milliseconds, then super lock starts.

Ignition key is not at inserted state. Press remote lock button for more than 2 seconds then power window automatically closes. This signal transmits by LIN.

Super lock

Premise of super lock function is stopping at OFF position.

Dual locking function: Dual locking function is realized by two methods:

1) Press remote lock button twice in 500 milliseconds. (Remote control double-click lock)

2) Turn the key to unlock position in 3 seconds, and then switch to lock position.

Only for (1), flashlight will flash once to confirm.

Unlock/lock of interior central door lock switch

Press lock button and five doors lock.

If central door lock switch is pressed to unlock position, BCM drives four doors to unlock when ignition switch is not at ON or ignition switch is at ON and vehicle speed is less than 15kph.

When vehicle speed is higher than 15kph, central unlocked command will be disabled.

Unlock of interior central door lock switch is only at anti-theft deactivation state. At other anti-theft states, there is no response.

Automatic re-lock

After pressing the remote unlock button 15 seconds, if none of all four doors, rear compartment lid is opened, all doors will automatically re-lock. Interior light turns off and the system will enter alarm arrangement state.

Automatic lock of driving vehicle

Five doors will automatically lock when the ignition switch is at ON position and vehicle speed is more than 20 km/h.

Collision unlock

When SRS opening signal is received from CAN bus, four doors will automatically open.

Note: But this function may not apply due to low battery voltage or collision damage to the door lock motor harness power supply.

Collision signal occurs. Trigger central unlock twice in 3 seconds and left and right turning lights will keep flashing so that central lock will fail. Unless the door is open and ignition switch turns to OFF simultaneously, and collision signal has expired for 4 seconds.

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Automatic central unlock at flameout

With door locks locked, when the ignition key is removed, the four doors automatically unlock.

Rear compartment lid unlock

When inserting or removing the key, press remote rear compartment lid unlock button for 1 second and rear compartment lid can be unlocked by remote controller.

Press rear compartment lid unlock switch for more than 1 second and rear compartment lid is unlocked.

When ignition switch is at ON position and vehicle speed is higher than 15km/h, rear compartment lid unlock will not be executed.

Automatic lock of rear compartment lid

Rear compartment lid will automatically lock after closing for 1.5 seconds.

During automatic re-lock process, rear compartment lid will also lock.

Forbid remote command

When ignition switch is at ON position, any remote command except alarm deactivation operation will not be executed.

Overheat protection of door lock motor

When it is executed continuously for six times and every interval time of lock or unlock action is not more than 1280 millimeters, overheat protection function of door lock will be activated. At this time, only collision can automatically unlock and other unlock requests can only be executed once. Other lock/unlock requests except this will not be executed in 20 seconds.

Driver alarm information

When the driver has some abnormal operations, body control system will send CAN information to the instrument to make it generate sound warning to the driver. It includes following functions.

Warning for light not off

Ignition switch is at OFF position and the key is removed. Combination switch will light headlight or position light. If the driver's side door is open, body control system will generate warning signal to the instrument to make it generate sound warning.

Comfortable Lighting Control

Follow me home lights

In 10 minutes after ignition switch is from ON to OFF position, turn light switch from OFF position to small light position or headlight position or auto light position and then turn back to OFF position in 2 seconds. => Function of follow me home light is activated. => Low beam will light for 30 seconds.

When follow-up home light function is activated, the low beam turns on by delaying for 180s if one door is opened (delay Reset)

Function of remote control unlock vehicle-tracking lamp

Ignition switch is at OFF position and press remote unlock button. Position light will light for 25 seconds. If in 25 seconds there is close action, position light will automatically go out after 5 seconds when all doors close.

Auto light

When the ignition switch is at ON position, and the combination switch in at AUTO position, position light relay and the headlight relay automatically connect or disconnect in accordance with the LIN request.

When the ignition switch is at ON position and combination switch is at AUTO position, fault signal in LIN message is effective. BCM will light the small light and low beam keeps previous state.

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When the combination switch is at AUTO position and ignition switch is out of ON position, if the state of the headlight or position light is on, continuously light for 60 seconds. If in 60 seconds, lock signal is received and this function is off.

Position Lamp

Small light switch is off. Small light and license lamp are lighted.

Small light switch is off. Ignition switch is at OFF position:

1) Left turning light switch is on so that left position light lights and license plate light will not light.

2) Right steering lamp switch is off so that right position lamp lights and license lamp will not light.

Steering Lamp

Turning light system will use flashing signal of turning light to react to various body control requests.

Requests from interior module of steering lamp system include left steering lamp switch, right steering lamp switch and alarm lamp switch.

Requests from other external modules mainly include central door lock, diagnostic operation, anti-theft alarm system, emergency braking and collision flash.

Collision flash has the highest priority and alarm light has the second highest priority.

Collision flash

When ignition swith is at ON position, if BCM receives collision signal from the hardware, front, rear, left and right steering lamp will flash at 83 times per minute sumultaneously. Press warning switch once again and warning flash function will be canceled.

Alarm light

No matter what position the ignition switch is at, press the warning switch and left and right steering lamps will flash at the same time at a frequency of about 83 times per minute. Press the warning switch again and the warning flash function will be canceled.

Turning hints

When the ignition switch is at "ON" position, turn on the left steering lamp switch. The left steering lamp will flash at a frequency of about 83 times per minute.

When the ignition switch is at "ON" position, turn on the right steering lamp switch. The right steering lamp will flash at a frequency of about 83 times per minute.

Turning light self-diagnosis: During turning for fail mode double-flashing, if one of the turning lights (21W) is damaged, the other turning light at the same side will flash at about double normal frequency.

In the case of alarm activation, if one of the steering lamps is damaged, the steering lamps at both sides will flash at the frequency of about 166 times per minute.

Lane changing light function

When steering lamp switch is turned on and it is turned off between 100 ms and 700 ms, corresponding steering lamp will flash for three times as lane changing light hint.

Emergency brake alarm

If the vehicle speed (BCM receives signal through CAN bus) rapidly decreases due to emergency braking, all turning lights will be activated and flashing; if the vehicle speed stops decreasing, the alarm flash will be deactivated. (The deceleration higher than 0.55g is regarded as emergency brake and deceleration threshold vaule can be configured in EEPROM)

BCM has a function of short circuit protection. If any steering lamp has fault, BCM should record and store this fault.

Interior light and power saving function

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Interior light system is mainly made up of two parts. First is interior light control and second is power saving control.

Interior light control is mainly activation and off of indoor light.

Power saving control is mainly to turn on or off power saving control relay.

Interior light

When one of following circumstances occurs, indoor dome light will fade to light in about 0.7 second.

- Any door opens.
- Turn off the ignition switch.
- When ignition is turned off, unlock request is sent including remote and internal unlocking.

When one of following circumstances occurs, indoor dome light will fade to light in about 1.7 seconds.

- Ignition switch is at ON position and all doors close.
- When ignition switch is at OFF position and all doors close, lock request is sent including remote and internal unlocking.
- Central door lock is at unlocked state and ignition switch is at OFF position. Delay 30 seconds after the last door is closed.
- Interior light is lighted for 30 seconds and there is no condition to activate it.
- Close all doors and lock central door lock.

The situation when interior dome light goes out immediately is as follows:

- It occurs when power saving delays to start for 10 minutes.

Power Saving Function

When following actions occur, power saving function will be re-timing.

- State change of ignition switch
- State change of any door
- Send unlock command including remote and internal unlocking.
- When power saving delays to start for 10 minutes, power saving relay will cut off power output of BCM.

Keyhole illumination light/footlight

Any door opens. Key illumination light and footlight turn on. Turn off after the door is closed for 3 minutes.

Ignition switch is on. Footlight and key lighting lamp turns out.

Lock command, footlight and key illumination light go out.

If any one of doors is opened, turn on the key illuminating lamp and the foot lamp; and if the door is still not closed after 10min, the key illuminating lamp and the foot

After 10 minutes if the door is also open, key illumination light and footlight go out in 10 minutes if any door is open, the timer resets.

Remove the key form ignition switch and all the doors close. Footlight and key lighting lamp goes out.

Rear Wiper/Washer Control

BCM controls following states of front wiper:

- Front wiper wipes continuously and quickly.
- Front wiper runs continuously and at low speed.

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- Front wiper gets inching operation.
- Front washing/wiping
- Front wiper wipes automatically

When ignition switch is at OFF/ACC position or front wiper switch is not on, front wiper is at OFF state which is default state.

State

If ignition switch is at ON position and wiper switch is at OFF position, the wiper should stop at stop position.

If the wiper cannot detect stop position after the wiper has continuously run for 8 seconds, the wiper stops running and the fault is recorded and stored.

Front wiper runs continuously and quickly.

Turn the front wiper/washer switch to the continuous and quick operation position, the front wiper relay will be activated continuously and the front wiper will work continuously and quickly.

Front wiper runs continuously and at low speed.

Turn the front wiper/washer switch to the continuous operation position, the front wiper relay will be activated continuously and the front wiper will work continuously and at low speed.

Front wiper gets inching operation.

Turn the front wiper/washer switch to the inching operation position, the front wiper relay will be activated continuously and the front wiper will work at low speed.

Front washing/wiping

Front washing/wiping: If front washer switch is pressed, front wiper relay is activated for 1 second. If the switch is continuously pressed and not released, BCM thinks that the switch is pressed only once.

Heating function

Heating function is mainly made up of two parts, which are heating functions of rear defroster and rearview mirror and seats.

Rear defrosting and rearview mirror heating function

The voltage signal is achieved from CAN bus. When the battery voltage is higher than 10.7 V, and the ignition lock switch is at "ON", it allows the heating functions rear defroster/rear view mirrors to work. When the battery voltage is less than 10.3 V, BCM does not allow the heating functions of rear defroster/rearview mirrors to work.

The rear defroster/rear view mirror heating switch is a push button switch. After pressing the defroster/rearview mirror heating switch, the heaters of rear defroster/rearview mirrors work for 12 minutes; if the heating switch is pressed again during heating, the heating stops. Press the rear defroster/rearview mirror heating switch again, the heaters of rear defroster/rearview mirror working for 12 minutes (accumulative running for 12 minutes) stops.

There should be a time parameter (about 36 minutes) to reset the first time. Before the 36 minutes, the heating time is not accumulative.

In the low voltage status, the heating functions of rear defroster/rear view mirror do not work. But previous timer (12 minutes) will not be interrupted and will still be included in the next cycle.

Rear defroster/rear view mirror heater working signal will be sent to EMS through CAN.

Window Control

Ignition switch is at ON position to operate on the window.

When ignition switch is at OFF position, window control will be shielded if any of following conditions is satisfied:

- 1 minute after ignition switch is turned to OFF position.

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- Any front door opens in 1 minute.

Manual up

Press manual up button and the window will rise manually until the button is released or the window rises to the top.

Manual down

Press manual down button and the window will drop manually until the button is released or the window drops to the bottom.

Automatic down

Press automatic down button and the window will drop to the bottom or press other buttons which control this window.

CAN Network Management

Wake-up conditions of BCM CAN networks are as follows:

Local network wake-up conditions are as follows:

- Ignition key is at ON position.
- Hazard alarm switch is at ON position.
- Key inserted state is changing.
- The light is not turned off and the alarm is activated.
- Command frame of remote key is received.
- The state of any door is changing.

Dormancy conditions of BCM CAN networks are as follows:

- Ignition key is at OFF position.
- There is no change of key inserted state.
- Steering lamp is not activated.
- Remote key command is not received.
- There is no light which is not turned off and alarm function is activated.
- There is no change of state of any door.
- There is no signal transmission on CAN bus.

Other functions

1. CAN bus communication function
2. LIN bus communication function

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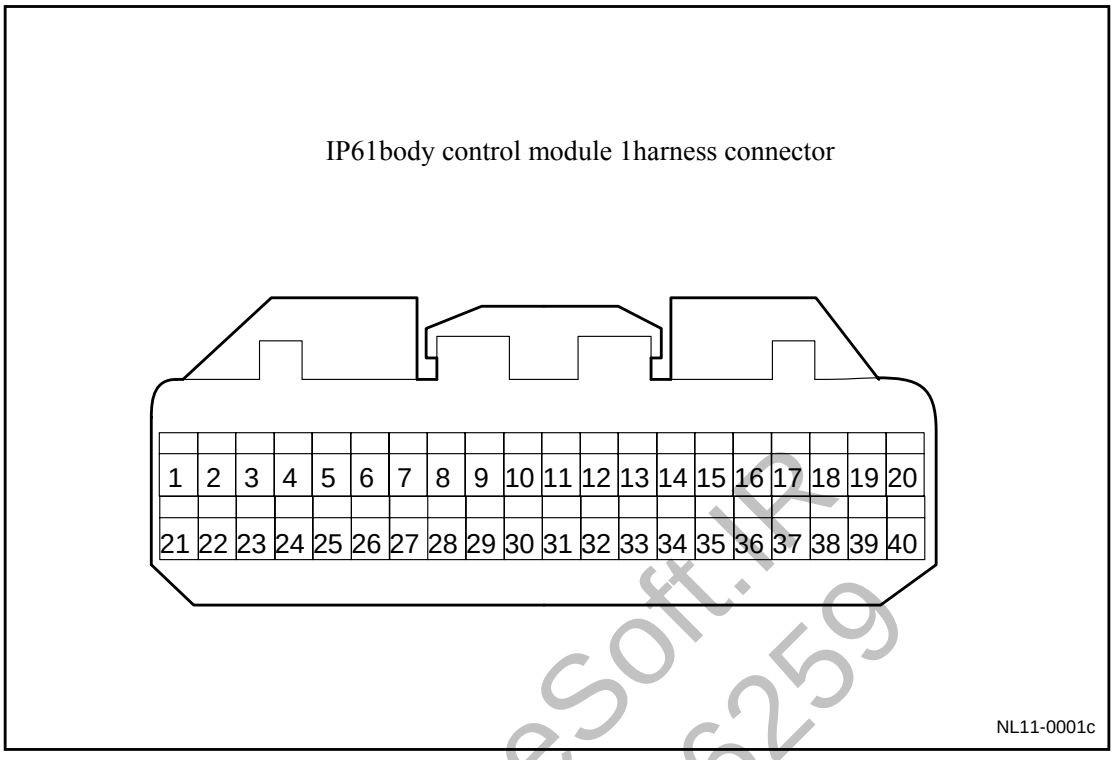
10.3.3 Diagnostic information and steps

10.3.3.1 BCM Terminal List



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Terminal	Wiring	Terminal descriptions	Specified Conditions
1	0.5 Y/G	CAN2 HIGH	
2	0.5G/Br	CAN2 LOW	
3		/	
4		/	
5		/	
6	0.3W/Y	Automatic Down Input Of Right Front Window Regulator	L
7	0.3B/L	Automatic Down Input Of Right Rear Window Regulator	L
8	0.5B/G	Low Beam Relay Output	L
9	0.5R/B	Left Position Light Relay Output	L
10		/	
11		/	
12		/	
13		/	
14	0.5L/W	Right Position Light Relay Output	L
15	0.35W/O	Manual Down Input Of Right Rear Window Regulator	L
16		/	
17	0.5G/Br	CAN1 LOW	
18	0.5Y/B	CAN1 HIGH	

19	0.35B/R	Horn Output	L
20	P	Starting Relay Enables.	L
21		/	
22		/	
23	0.5W/R	Anti -Theft Indicator Output	H
24		/	
25	0.5V	Ambient light signal input	
26-31		/	
32	0.5O	Auto Light Switch Input	L
33	0.5Gr/B	ST Signal Detection	H
34	0.5B/W	Position Light Switch Circuit Input	L
35	0.5G/B	Low Beam Switch Input	L
36	0.5B/O	Stop Position Input Of Front Wiper	L
37		/	
38	0.5W	Washing state input of front windshield	H
39	0.35W/V	Manual Up Input Of Right Front Window Regulator	L
40	0.35W/R	Manual Down Input Of Right Front Window Regulator	L

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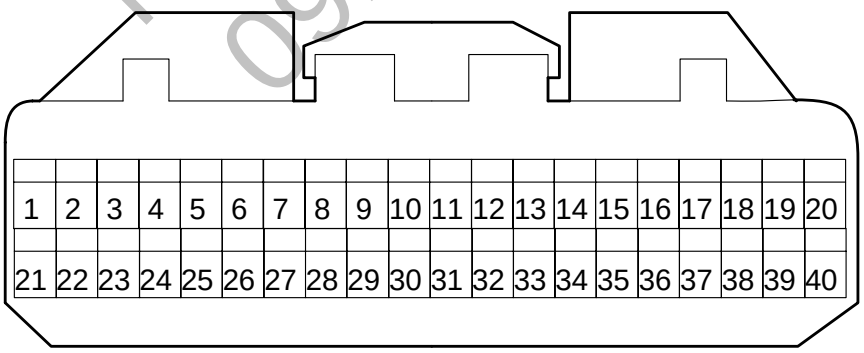
IP62body control module 2harness connector



NL11-0002c

Terminal	Wiring	Terminal descriptions	Specified Conditions
1-8		/	
9	0.35W/R	Manual Up Input Of Left Rear Window Regulator	L

10	0.35W/Br	Manual Down Input Of Left Rear Window Regulator	L
11	0.5V/W	Automatic Down Input Of Left Rear Window Regulator	L
12	0.35W/B	Manual Up Input Of Right Rear Window Regulator	L
13	0.5V/W	LIN Bus 1	
14	0.5B/G	Left Front Door Contact Switch Input	L
15	0.5V/Y	Right Front Door Contact Switch Input	L
16	0.5R/L	Right Turning Light Switch Input	L
17	0.5G/R	Left Turning Light Switch Input	L
18	0.5L	Door unlock signal input	L
19	0.35G	Wiper Automatic Regulating Switch Input	L
20	0.5G/R	Ignition Switch Input	H
21		/	
22		/	
23		/	
24	0.35B/W	Front Wiper High-Speed Switch Input	L
25	0.35W/B	Front Wiper Low-Speed Switch Input	L
26	0.5Y/R	ACC Switch Input	H
27-30		/	
31		Rear Compartment Lid Unlock Input	L
32	0.35R	Key Insert Switch Input	L
33	0.35G	Central Lock Unlock Switch Input	L
34	0.35W/B	Central Lock Lock Switch Input	L
35	0.35V/B	Right Rear Door Contact Switch Input	L
36	0.35V/G	Left Rear Door Contact Switch Input	L
37	0.5Gr/P	Rear Compartment Lid Contact Switch Input	L
38		Engine Hood Contact Switch Input	L
39	0.5Gr	Warning lamp switch input	H
40		/	

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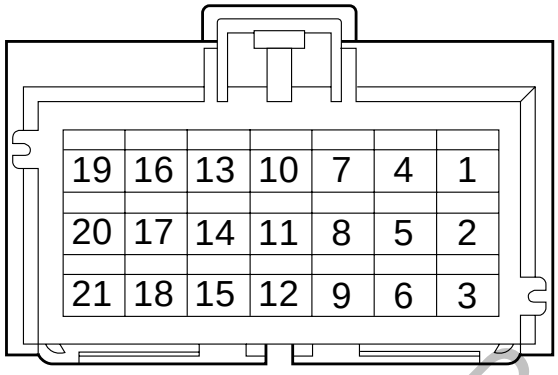
IP63body control module 3harness connector



NL11-0003c

Terminal	Wiring	Terminal descriptions	Specified Conditions
1	0.5W/B	Steering Lamp Power Supply	H
2-6		/	
7		Dual-Lock Relay Output (Reserved)	
8	0.5B/G	Right Steering Lamp Output	H
9		/	
10	0.5W/R	Key hole illumination output	H
11	0.5G/B	Left Steering Lamp Output	H
12-15		/	
16	0.5L	License Lamp Output	H
17	2.0R	/	
18		/	
19	2.0Br	/	
20	2.0Gr	/	
21	0.85V/Y	Rear Compartment Lid Unlock Output	H

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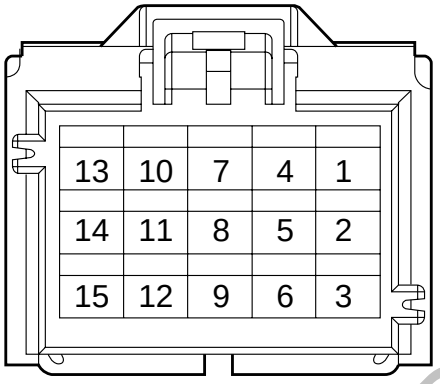
IP64body control module 4harness connector



NL11-0004c

Terminal	Wiring	Terminal descriptions	Specified Conditions
1	2.0R	Power Supply Of Right Front Window Regulator	H
2	2.0Gr/R	Down Output Of Right Front Window Regulator	H
3	2.0 O	Up Output Of Right Rear Window Regulator	H
4	2.0P	Up Output Of Right Front Window Regulator	H
5	2.0R	Power Supply Of Right Rear Window Regulator	H
6	2.0L	Down Output Of Right Rear Window Regulator	H
7-8		/	
9	0.5O/G	Indoor Light Output	L
10-11		/	
12	0.5R/G	Daytime Running Light Power Supply	H
13	0.5R/Y	Power Saving Function Output	H
14	0.5B/R	Daytime Running Light Output	H
15	0.5R/G	Power Saving Function power supply	H

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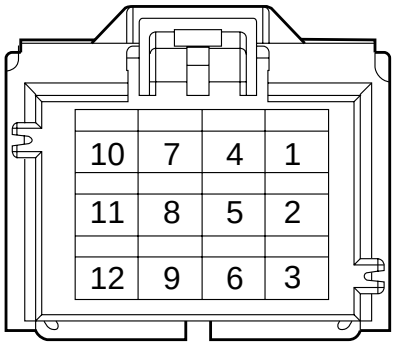
IP65body control module 5harness connector



NL11-0005c

Terminal	Wiring	Terminal descriptions	Specified Conditions
1	1.25W/B	Front Wiper Low-Speed Output	H
2	1.25B	Ground of Front Wiper	L
3	0.5R/G	Power Supply	H
4	1.25Br	Front Wiper High-Speed Output	H
5	1.25W/G	Front Wiper Power Supply	H
6	2.0R	Power Supply Of Right Rear Window Regulator	H
7	0.85V/W	Central Lock Unlock Output	H
8	1.25B	Power Ground 3	L
9	2.0W	Down Output Of Left Rear Window Regulator	H
10	0.85W/P	Central Lock Lock Output	H
11	1.25L	Central Lock Power Supply	H
12	2.0W/O	Left Rear Window Regulator Up Output	H

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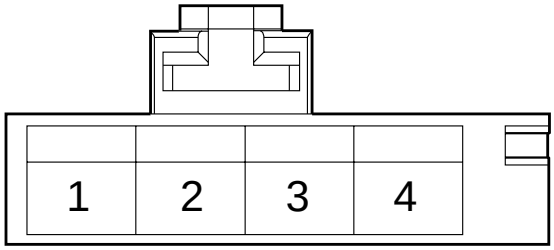
IP66body control module 6harness connector



NL11-0006c

Terminal	Wiring	Terminal descriptions	Specified Conditions
1		Power Ground 2	L
2		Power Ground 1	L
3	2.0B	/	
4	2.0B	/	

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10.3.3.2 Fault Diagnosis Code (DTC) List

1. DTC Code Setting Method:

C	**Continuous Working**	No matter whether the system is working or not, BCM will monitor whether the system condition is normal. If the system is faulty, BCM will record the related fault diagnosis code.
O	**On-Demand Self-Test**	Only when the system is working, BCM will monitor whether its status is normal. If the system is faulty, BCM will record the corresponding fault diagnosis code. Inspect the module input state. When the input status is not correct, set the DTC Code.
W	**On-demand Wiper Test**	Rear wiper intermittent relay will send an output signal at each working cycle of the wiper. If there is fault, it will be detected and recognized. In addition, it will detect the washer input signal.

2. Code List

Display	Descriptions
U012187	Lose Communication With ABS
U012287	Lose Communication With ESP
U012687	Lose Communication With SAS
U010087	Lose Communication With EMS
U015187	Lose Communication With SRS
U010187	Lose Communication With TCU
U011487	Lose Communication With 4WD
U12501C	BCM Stops Sending CAN Information
U12511C	BCM Stops CAN Communication
U015587	Lose Communication With ICU
U016487	Lose Communication With HVAC
U007388	BUS-Off Error
U120088	BUS-Off Error
U030195	EMS Integration Error
U030295	TCU Integration error
U031495	4WD Integration Error
U031595	ABS Integration Error
U031695	ESP Integration Error
U032895	SWA Integration Error
U130095	ACU Integration Error
U032295	BCM Integration Error
U032395	ICU Integration Error
U032495	HVAC Integration Error
U121F08	Completeness Error of Gateway LIN Bus

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U019987	Lose Communication With Left Front Door Module
U020087	Lose Communication With Right Front Door Module
U020187	Lose Communication With Right Rear Door Module
U020287	Lose Communication With Right Rear Door Module
U023187	Lose Communication With Rainfall And Sunshine Module
U201088	BCM Cannot Send Main Sequence Frame
B110017	Battery Voltage is Too High
B110016	Battery Voltage is Too Low
B11B012	Left Circuit Fault Of Parking Light
B11B011	Left Circuit Fault Of Parking Light
B11B112	Right Circuit Fault Of Parking Light
B11B111	Right Circuit Fault Of Parking Light
B11B212	Circuit Fault Of Low-Frequency Buzzer
B11B211	Circuit Fault Of Low-Frequency Buzzer
B11B312	Permission Light Circuit Malfunction
B11B311	Permission Light Circuit Malfunction
B11B412	Anti-Theft LED Circuit Fault
B11B411	Anti-Theft LED Circuit Fault
B11B512	Key Illumination Light Circuit Fault
B11B511	Key Illumination Light Circuit Fault
B11B612	Headlight Washing Circuit Fault
B11B611	Headlight Washing Circuit Fault
B11D112	Lock circuit fault
B11D111	Lock circuit fault
B11D214	Right Steering Lamp Fault
B11D213	Right Steering Lamp Fault
B11D212	Right Steering Lamp Fault
B11D312	Left Steering Lamp Fault
B11D313	Left Steering Lamp Fault
B11D314	Left Steering Lamp Fault

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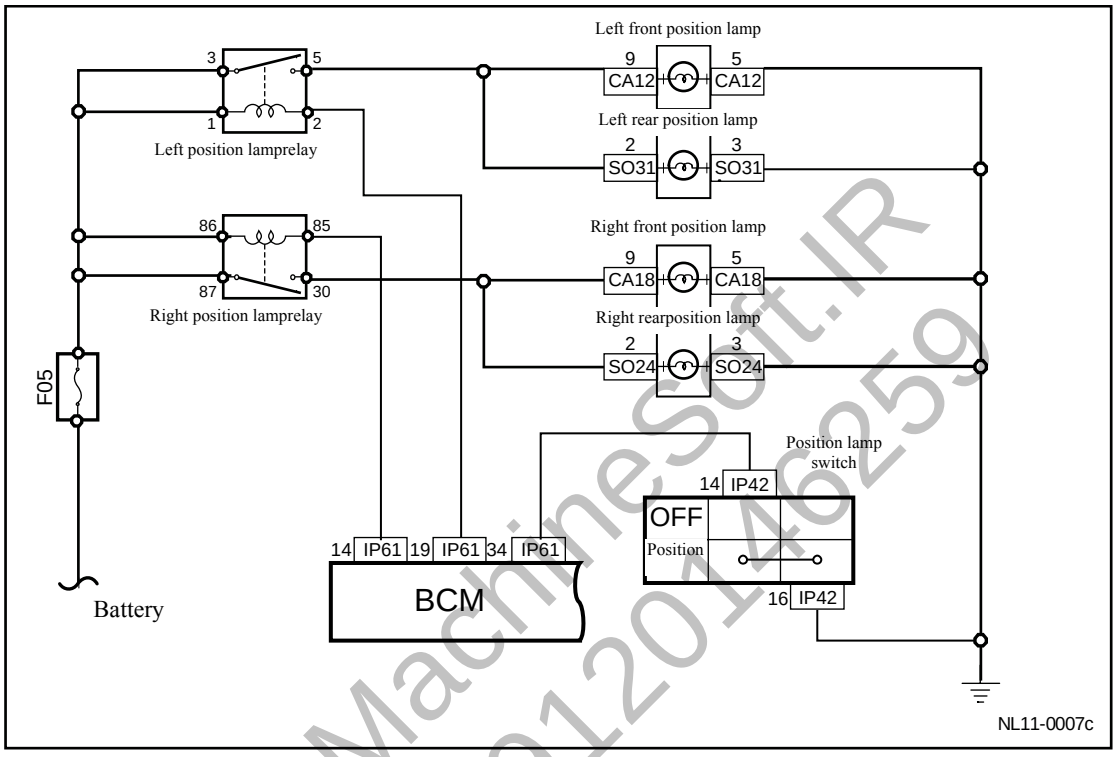
10.3.3.3 DTC B1201 B1202

Display	Descriptions
B11B012	Left Circuit Fault Of Parking Light
B11B011	Left Circuit Fault Of Parking Light
B11B112	Right Circuit Fault Of Parking Light
B11B111	Right Circuit Fault Of Parking Light

Circuit diagram:



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Diagnostic Steps:

1	Use active test function of fault diagnosis tester to check the position light working status.

A. Select as the following sequence: Body Control Module/active test/external light control output/light the position light.

Is the position light (small light) lit?

Yes	Go to step 10
No	

2	Check position light bulb

A. Remove position light bulb

Is the bulb filament blown?

No	Go to step 4

Yes

3	Replace the faulty position light bulb.

A. Remove position light bulb

Confirm if the position lights are working properly.

Yes → The system is normal.

No

4	Check the fuse IF05.

A. Check whether the fuse IF05 is blown.

Fuse Rating: 10A

No → Go to step 7

Yes

5	Check the fuse IF05 circuit.

(a) Inspect the fuse IF05 short circuit malfunction.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm if the position light is working correctly.

Yes → The system is normal.

No

6	Check the right front position light harness connector CA12 terminal 9 voltage.

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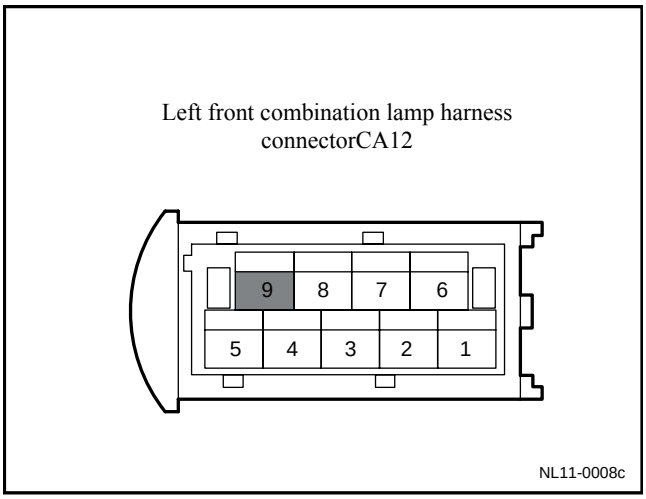
(a) Turn on position lights, measure the left front position light harness connector CA12 terminal 9 voltage.

Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 9

No

7	Check position light relay IR08

(a) Position light relay IR08 is replaced with a new one.

(b) Turn on position lamp, and measure voltage of left front position lamp wire harness connector CA12 terminal 9.

Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.

Yes → The system is normal.

No

8	Check if terminal 5 of position light relay IR08 and terminal 9 of harness connector CA12 of right front position light are conducted.

(a) Inspect and repair the open circuit between IR08 terminal 5 and the left front position light harness connector CA12 terminal 9.

Confirm if the position light is working correctly.

Yes → The system is normal.

No

9	Check continuity between the left front position light harness connector CA12 terminal 5 and the body ground.

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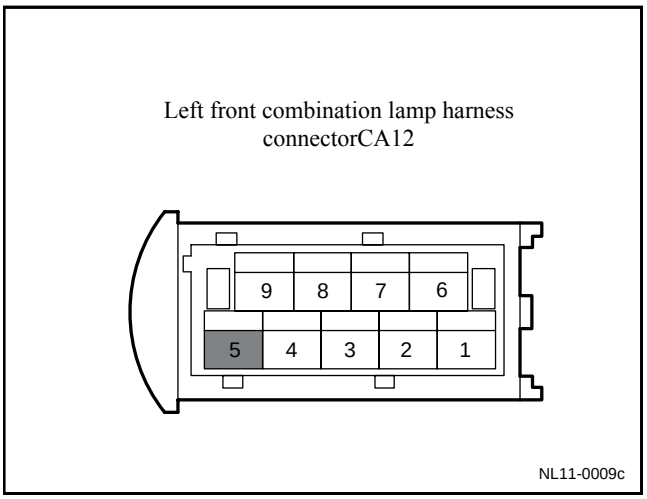
(a) Inspect and repair the open circuit between the right front position light harness connector CA12 terminal 5 and the body ground.

Confirm if the position light is working correctly.



Yes → The system is normal.

No

10	Inspect position lamp relay IR08 circuit.

(a) Turn off the ignition switch.

(b) Unplug position light relay IR08.

(c) Disconnect the light combination switch harness connector.

(d) Measure the resistance between terminal 1 of position light relay IR08 and fuse F05.

(e) Measure the resistance between terminal 3 of position light relay IR08 and fuse F05.

(f) Measure the resistance between terminal 2 of position light relay IR08 and terminal 19 of BCM harness connector IP61.

Standard Resistance: Less than 1 Ω

Is the resistance specified value?

No → Repair or replace faulty circuit

Yes

11	Check the light combination switch ground circuit.

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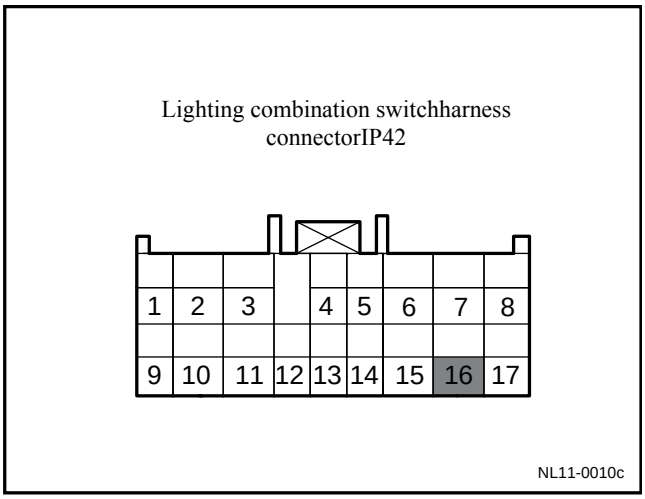
(a) Turn off the ignition switch.

(b) Disconnect the light combination switch harness connector.

(c) Measure the resistance between terminal 16 of light combination switch corresponding with harness connector IP42 and body reliable ground.

Standard Resistance: Less than 1 Ω

Is the resistance specified value?



No → Repair or replace faulty circuit

Yes

12	Check the light combination switch.

(a) Turn off the ignition switch.

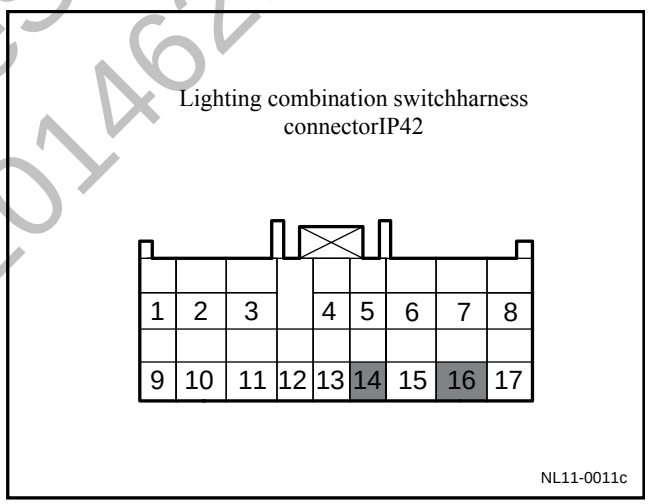
(b) Disconnect the light combination switch harness connector.

(c) Disconnect the light combination switch harness connector.

(d) Measure the resistance between terminal 14 and 16 of light combination switch corresponding with harness connector IP42.

Standard Resistance: Less than 1 Ω

Is the resistance specified value?



No → Replace combination switch

Yes

13	Check continuity of light combination switch and BCM.

(a) Turn the ignition switch to OFF position.

(b) Disconnect the BCM harness connector IP61.

(c). Disconnect the light combination switch harness connector IP42.

(e) Measure the resistance between terminal 19 of BCM harness connector IP61 and terminal 14 of harness

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connector IP42 of light combination switch.

Standard Resistance: Less than 1 Ω

Is the resistance specified value?

No → Repair or replace faulty circuit

Yes

14	Replace the BCM

Next

15	The system is normal.

Note: Taking diagnostic steps of left front position light for example, fault diagnosis of other three position lights can refer to left front position light.

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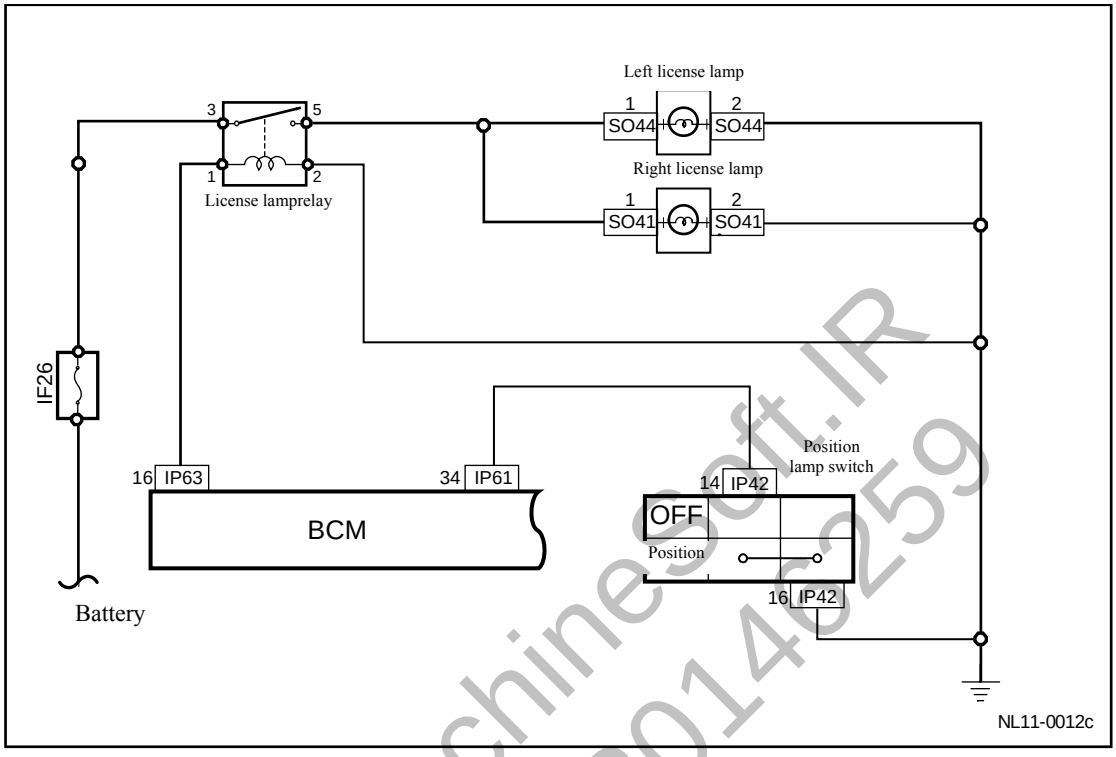
10.3.3.4 DTC B11B312.B11B312

Fault diagnosis code	Descriptions
B11B312	License Plate Light Circuit Malfunction
B11B311	License Plate Light Circuit Malfunction

Circuit diagram:



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Diagnostic Steps:

1	Use fault diagnosis tester active test function to check the license plate light working status.

A. Select as the following sequence: Body Control Module/active test/external light control output/license plate light.

Is license plate light lit?

Yes — Go to step 10

No

2	Check position light bulb

A. Remove position light bulb

Is the bulb filament blown?

No — Go to step 4

Yes

3	Replace the faulty license plate light bulb.

A. Replace the faulty license plate light bulb.

Confirm if the position lights are working properly.

Yes → The system is normal.

No

4	Inspect the fuse IF26

A. Inspect whether the fuse IF26 is blown.

Fuse Rating: 10A

No → Go to step 7

Yes

5	Inspect the fuse IF26 circuit.

(a) Inspect the fuse IF26 short circuit malfunction.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm if the position light is working correctly.

Yes → The system is normal.

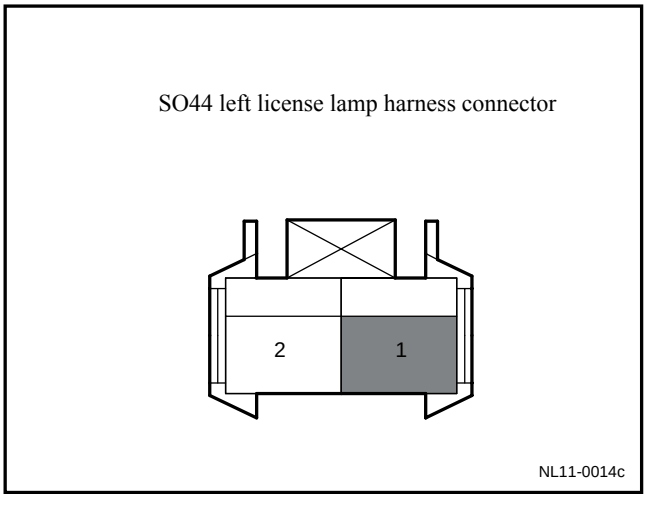
No

6	Check the voltage of terminal 1 of harness connector SO44 of license plate light.

(a) Turn on position lamps, measure the license lamp harness connector SO44 terminal 1 voltage.

Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 9

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No

7	Check license plate light relay IR09.

(a) License plate light relay IR09 is replaced with a new one.

(b) Turn on license plate light and measure the voltage of terminal 1 of harness connector SO44 of license plate light.

Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.

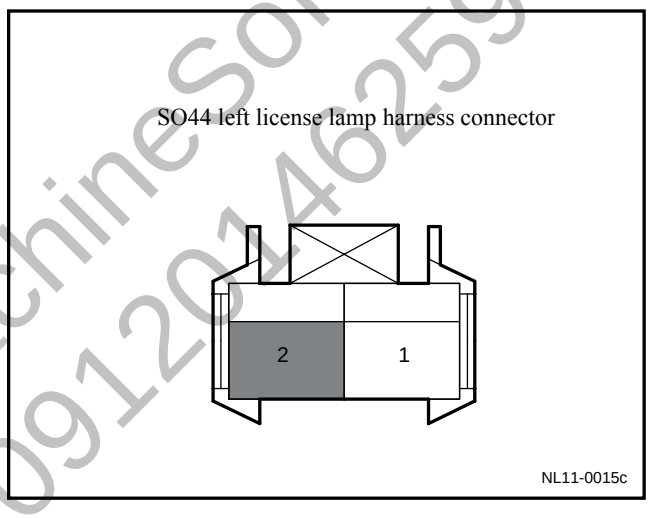
Yes → The system is normal.

No

8	Check if terminal 5 of license plate light relay IR09 and terminal 1 of harness connector SO44 of license plate light are conducted.

(a) Inspect and repair open circuit fault between terminal 5 of license lamp relay IR09 and terminal 1 of license lamp harness connector SO44.

Confirm if the position light is working correctly.



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Yes → The system is normal.

No

9	Inspect continuity between the license lamp harness connector SO44 terminal 2 and the body ground.

(a) Inspect and repair the open circuit between the right front position light harness connector SO44 terminal 2 and the body ground.

Confirm if the position light is working correctly.

Yes → The system is normal.

No

10	Check license plate light relay IR09 circuit.

(a) Turn off the ignition switch.

(b) Unplug license plate light relay IR09.

(c) Disconnect the light combination switch harness connector.

(d) Measure the resistance between terminal 1 of license lamp relay IR09 and BCM IP63-16.

(e) Measure the resistance between terminal 3 of license plate light relay IR09 and fuse IF26.

(f) Measure the resistance between terminal 2 of license plate light relay IR09 and reliable ground.

Standard Resistance: Less than 1 Ω

Is the resistance specified value?

No → Repair or replace faulty circuit

Yes

11	Check the light combination switch ground circuit.

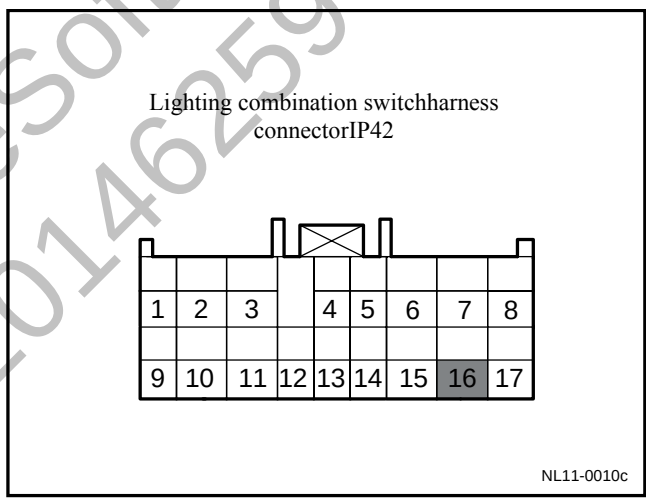
(a) Turn off the ignition switch.

(b) Disconnect the light combination switch harness connector.

(c) Measure the resistance between terminal 16 of light combination switch corresponding with harness connector IP42 and body reliable ground.

Standard Resistance: Less than 1 Ω

Is the resistance specified value?



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No → Repair or replace faulty circuit

Yes

12	Check the light combination switch.

(a) Turn off the ignition switch.

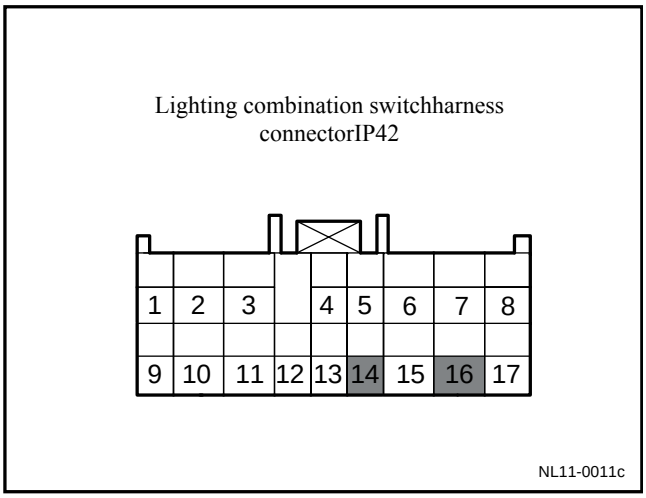
(b) Disconnect the light combination switch harness connector.

(c) Disconnect the light combination switch harness connector.

(d) Measure the resistance between terminal 14 and 16 of light combination switch corresponding with harness connector IP42.

Standard Resistance: Less than 1 Ω

Is the resistance specified value?



No → Replace combination switch

Yes

13	Check continuity of light combination switch and BCM.

(a) Turn the ignition switch to OFF position.

(b) Disconnect the BCM harness connector IP61.

(c). Disconnect the light combination switch harness connector IP42.

(e) Measure the resistance between terminal 19 of BCM harness connector IP61 and terminal 14 of harness connector IP42 of light combination switch.

Standard Resistance: Less than 1 Ω

Is the resistance specified value?

No → Repair or replace faulty circuit

Yes

14	Replace the BCM

Next

15	The system is normal.

Note: Taking diagnostic steps of left license plate light for example, fault diagnosis of other right license plate lights can refer to left license plate light.

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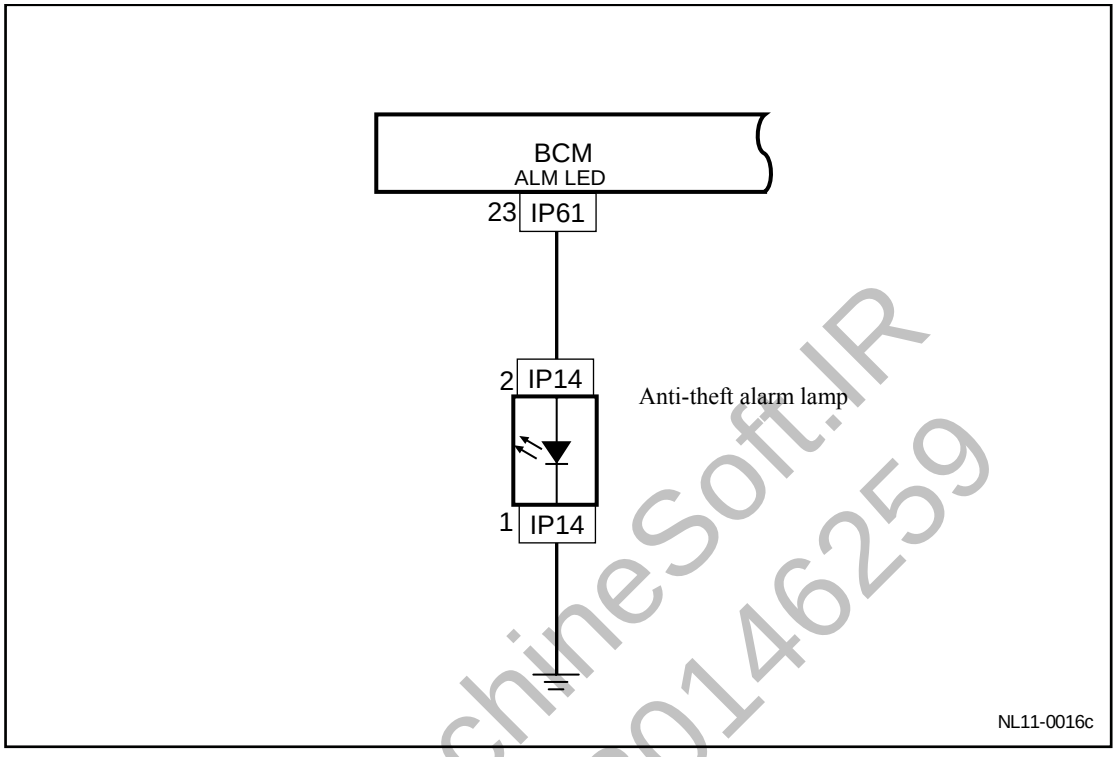
10.3.3.5 DTC B11B312.B11B312

Fault diagnosis code	Descriptions
B11B412	Anti-Theft LED Circuit Fault
B11B411	Anti-Theft LED Circuit Fault

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B11B412/B11B411.

(a) Inspect whether there is any DTC Code other than B11B412/B11B411.

No → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

Yes

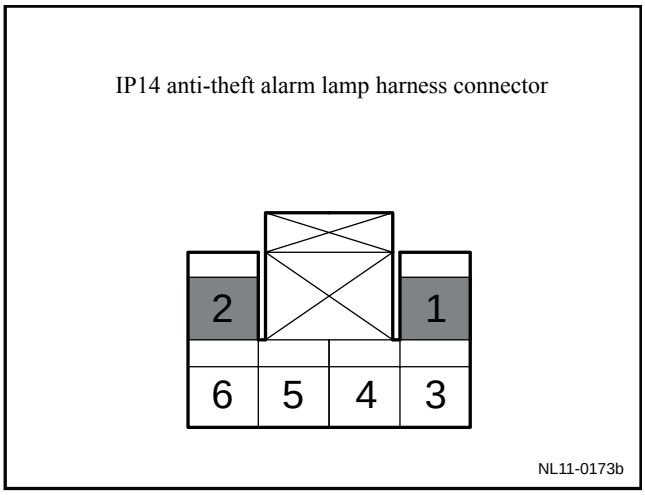
2	Measure voltage between the alarm indicator harness connector IP14 terminal 2.and 1.

(a) Disconnect the anti-theft indicator harness connector IP14.

(b) Measure voltage between terminal 2 and 1 with a universal meter.

Standard Voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes	Go to step 7
No	

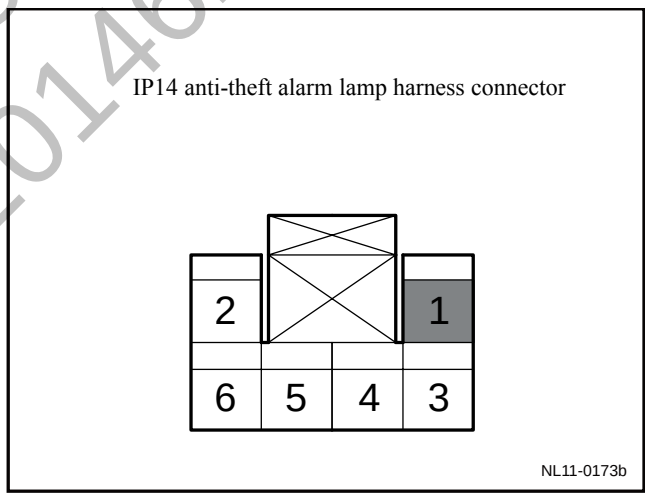
3	Check ground circuit of anti-theft indicator.

(a) Disconnect the anti-theft indicator harness connector IP14.

(b) Measure voltage between harness connector terminal 1 and vehicle body ground point with a universal meter.

Standard Resistance: Less than 1 Ω

Confirm whether the resistance is at a specified value.



Yes	Go to step 4
No	

4	Repair ground circuit of anti-theft indicator.

a) Repair fault point from anti-theft indicator to body ground circuit.

Is the anti-theft indicator working correctly?

Yes	The system is normal.

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No

5	Check supply circuit of anti-theft indicator.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect the battery negative cable.

(c) Disconnect BCM harness connector IP61.

(d) Disconnect the anti-theft indicator harness connector.

(e) Measure the resistance between terminal 2 of anti-theft indicator harness connector IP14 and BCM harness connector IP61 with a universal meter.

Specified Value of Test Project	Specified Value of Test Project
IP61(23)—IP14(2)	Less than 1 Ω

Is the resistance at a specified value?

No → Repair open circuit fault between terminal 2 of anti-theft indicator harness connector IP14 and BCM harness connector IP61

Yes

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Is the anti-theft indicator working correctly?

Yes → The system is normal.

No

7	Replace the anti-theft indicator.

(a) Replace anti-theft indicator and refer to 11.8.8.2 "Replacement of Anti-theft Indicator".

Confirm the completion of repair.

Next

8	The system is normal.

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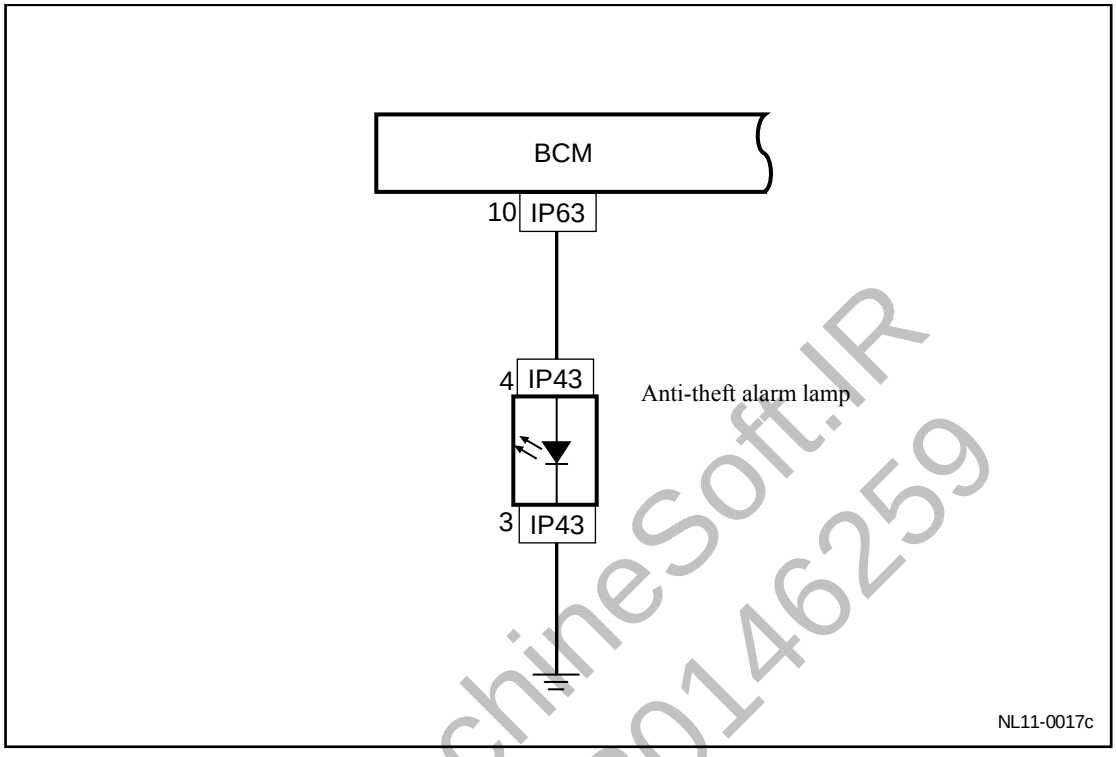
10.3.3.6 DTC B11B512.B11B512

Fault diagnosis code	Descriptions
B11B512	Key Illumination Light Circuit Fault
B11B511	Key Illumination Light Circuit Fault

Circuit diagram:



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1	Inspect whether there is any DTC Code other than B11B512/B11B511.

(a) Inspect whether there is any DTC Code other than B11B512/B11B511.

No → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

Yes

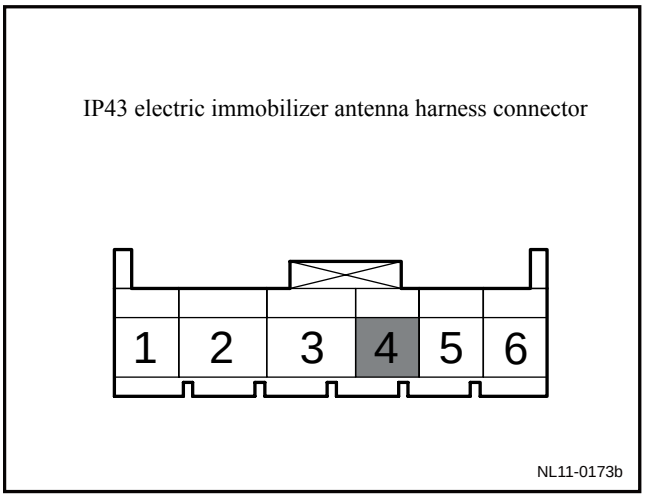
2	Measure the voltage of anti-theft alarm light.

(a) Turn the ignition switch to ON position.

(b) Measure anti-theft antenna harness connector IP43 terminal 4 voltage.

Standard Voltage: 12-14 V

Confirm if the voltage conforms to standard value.



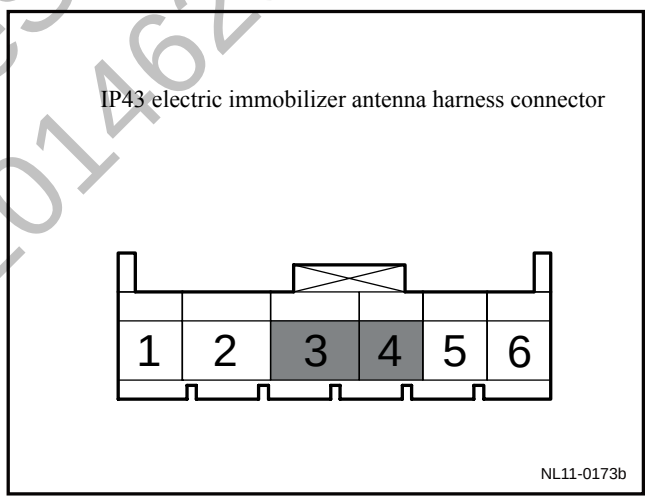
No → Go to step 4

Yes

3	Inspect the anti-theft alarm lamp.

(a) Disconnect the anti-theft indicator harness connector.

(b) Measure if the continuity between the anti-theft indicator IP43 terminal 3 and 4 is consistent with diode one-way continuity with a universal meter.



No → Replace anti-theft alarm light.

Yes

4	Inspect conduction situation between BCM and anti-theft alarm lamp.

(a) Disconnect the anti-theft indicator harness connector IP43 and the BCM harness connector IP63.

(b) Measure resistance between the BCM harness connector IP63 terminal 10 and the anti-theft indicator harness connector IP43 terminal 4 with a universal meter.

Standard resistant value: is less than 1Ω

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Confirm if the resistance conforms to standard value.

No → Repair or replace the harness.

Yes

5	Inspect conduction situation between anti-theft indicator and ground point.

(a) Disconnect the anti-theft indicator harness connector IP43.

(b) Measure resistance between harness connector IP43-3 and the body ground point with a universal meter.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.

No → Repair or replace the harness.

Yes

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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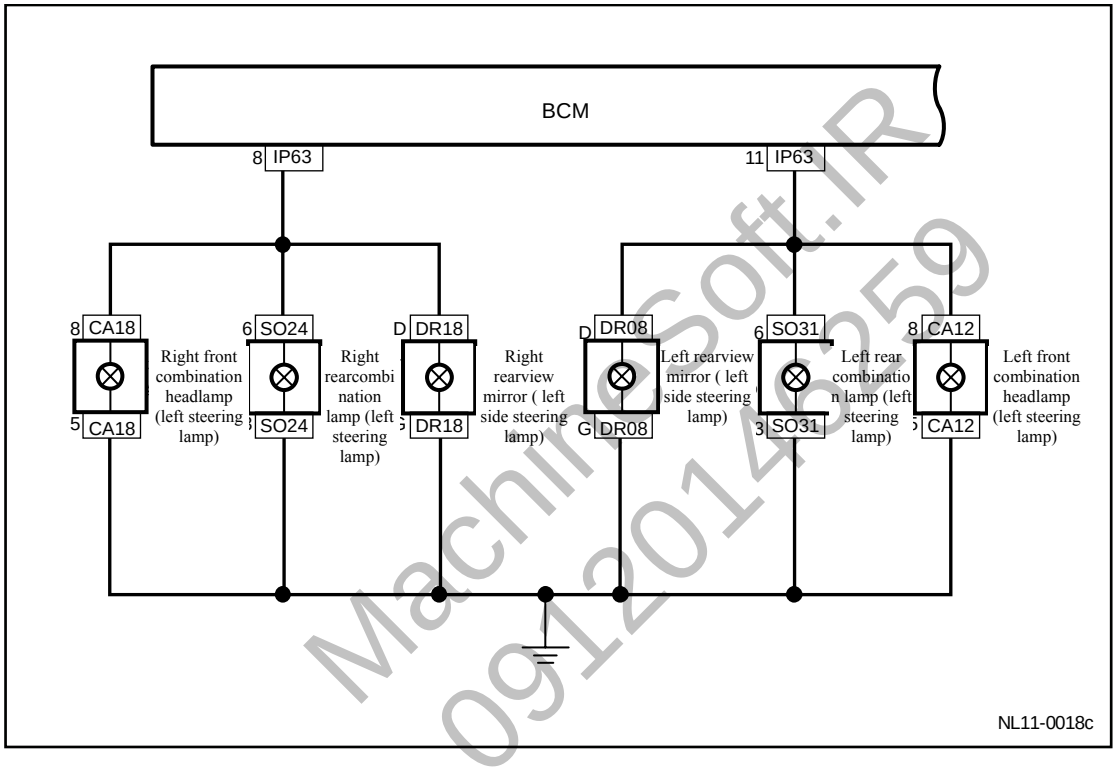
10.3.3.7 DTC B11D214. B11D213. B11D212. B11D312. B11D313. B11D314

Fault diagnosis code	Descriptions
B11D214	Right Steering Lamp Fault
B11D213	Right Steering Lamp Fault
B11D212	Right Steering Lamp Fault
B11D312	Left Steering Lamp Fault
B11D313	Left Steering Lamp Fault
B11D314	Left Steering Lamp Fault

Circuit diagram:



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Diagnostic Steps:

1	Inspect whether there is any DTC Code other than B11D214.

(a) Inspect whether there is any DTC Code other than B11D214.

No → Go to DTC list in 10.2.4.2 and repair according to trouble codes.

Yes

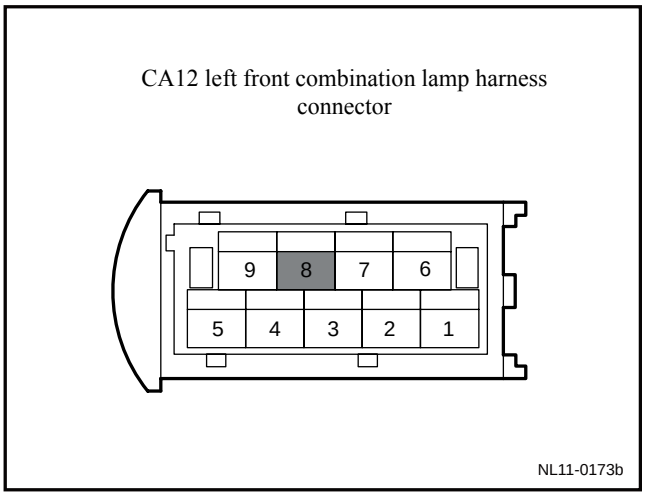
2	Measure the voltage of left front turning light.

(a) Turn the ignition switch to ON position.

(b) Turn on the left steering lamp.

(c) Measure the voltage of terminal 8 of left front steering lamp harness connector CA12.

Standard Voltage: 11-14 V



No → Go to step 4

Yes

3	Inspect the bulb.

(a) Check if the bulb of turning light is blown.

Is the bulb filament blown?

Yes → Replace the bulb .

No

4	Check conduction situation between BCM and left front turning light.

(a) Turn the ignition switch to OFF position.

(b) Disconnect the BCM harness connector IP63.

(c) Disconnect the steering lamp harness connector CA12.

(d) Measure the resistance between terminal 11 of BCM harness connector IP63 and terminal 8 of steering lamp harness connector CA12.

Standard Resistance: Less than 1 Ω

Confirm if the resistance conforms to standard value.

No → Repair or replace the harness.

Yes

5	Inspect the continuity between left front steering lamp and grounding.

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(a) Disconnect the steering lamp harness connector CA12.

(b) Measure the resistance between terminal 5 of harness connector CA12 of turning light and grounding.

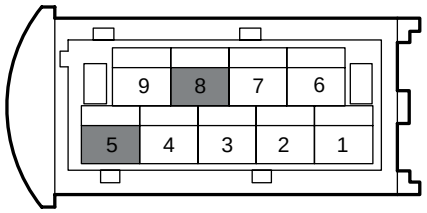
Standard Resistance: Less than 1 Ω

(d) Measure the resistance between terminal 8 of license lamp harness connector CA12 and grounding.

Standard Resistance: More than 10 Ω or higher

Confirm whether the resistance is at a specified value.

CA12 left front combination lamp harness connector



NL11-0173b

No → Repair or replace the harness.

Yes

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

Note: Taking circuit faults of left front steering lamp as an example, circuit troubleshooting of the other five steering lamps can refer to left front steering lamp.

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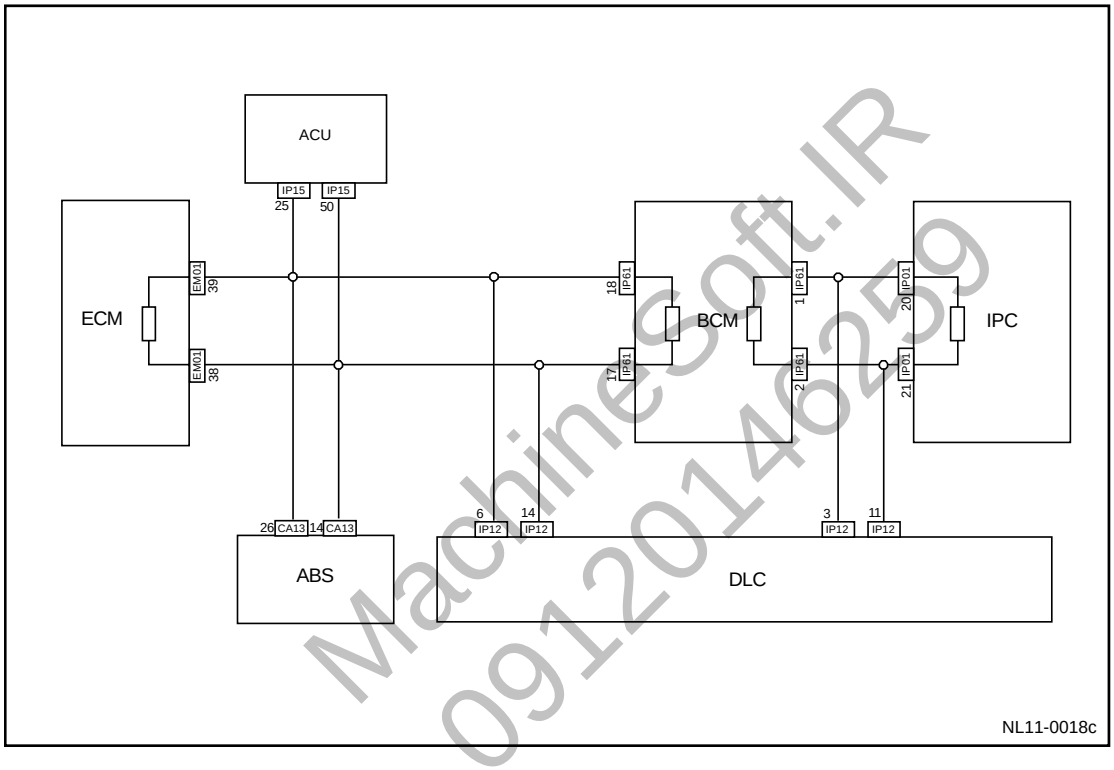
10.3.3.8 U012187. U010087.U015187.U12501C. U12511C. U015587

Fault diagnosis code	Descriptions
U012187	Lose Communication With ABS
U010087	Lose Communication With EMS
U015187	Lose Communication With SRS
U12501C	BCM Stops Sending CAN Information
U12511C	BCM Stops CAN Communication
U015587	Lose Communication With ICU

Circuit diagram:



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Diagnostic Steps:

Refer to CAN Bus Signal Diagnosis

10.3.5 Dismantle and install

10.3.5.1 BCM replacement

Refer to 11.8.8.1 Replacement of BCM.

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10.4 Programming and Setting

10.4.1 Programming and Setting

1. Cautions in compilation.

Prior to control module programming; ensure that the following conditions have been met:

A. Vehicle system voltage

a. The charging system should be free from malfunctions. The charge system failure must be removed before programming the control module.

b. The accumulator voltage should be higher than 12V but lower than 16V. If the battery voltage is too low, the battery must be charged prior to the control module programming.

c. The accumulator recharger must not be connected to the vehicle accumulator. An incorrect system voltage or voltage fluctuation caused by the accumulator recharger will result in programming failure or cause the control module to be damaged.

d. Turn off or disable all electrical loads of the vehicle accumulator, such as the following components:

– Inside lamp

– Heating, venting and air condition (HVAC) system

– Engine cooling fan and audios.

B. The ignition switch must be put in the correct position. Do not change the position of the ignition switch in the programming process, unless the diagnostic unit is indicated.

C. Make sure all tools including the following components and circuits are connected securely:

a. Control module serial data link tester

b. Connection at DLC

c. Power circuit

D. Do not disturb the tool harness during programming. An unexpected interruption of programming will result in programming failure or control module damage.

2. Programming and setting after replacement of ECM.

After replacing the ECM, an anti-theft read-in program must be executed for the ECU; refer to 2.5.7.10 Programming after Replacing ECM

3. Programming and setting after replacement of ABS module.

The device needs not to program or set.

4. Programming and setting after replacement of combination instrument assembly.

The device needs not to program or set.

6. Programming and Setting after Replacement of BCM.

Remove anti-theft; and open the driver-side door. After carrying out IGN OFF / ON for three times within 8s, IGN is placed in ON; after carrying out the driver-side door OPEN / CLOSE / OPEN once within 8s, the driver-side door is placed in the OPEN; after carrying out IGN ON / OFF / ON once within 8s, IGN is placed in ON; and if successfully enter the learning code mode, the horn sounds once. Simultaneously press the emitter unlock key and lock key within 10s to enter into the system; if learning code successfully, the anti-theft horn sounds twice; and if it is the first key with successful code learning in this learning process, wipe all previous learned codes. If learning code fails, the anti-theft horn sounds four times. Repeat step 5 and step8, and then learn the next remote control unit. Clean the previous ID after learninga the first key at every turn.

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7. Programming and Setting After Replacement of Chip Security Module.

After replacing the engine anti-theft control module, the anti-theft read-in program must be executed for the module, rfer to 2.5.7.11 Programming after Replacing Anti-theft Module and ECM.

8. ReplaceIgntion key rear programming and setting

The engine anti-theft system can learn up to 5 keys, and the detailed steps refer to 2.5.7.7 Replacement of New Key Programming.

9. Programming and Setting after Replacement of Remote Control Key

Refer to 10.4 Programming and Setting.

10. Replace programming and setting of parking motor module

The device needs not to program or set.

11. Replace programming and settting of electric door window motor (anti-clamp) .

An electric window-door motor with the anti-trapping function must be initialized after replacing. Refer to 11.4.7.4 Glass Lifter Initialization (such as equipment anti-trapping function).

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11 Body Electric

11.1 Warning and precaution 2004

11.1.1 Warnings and precautions 2004

11.2 Audio entertainment system 2005

11.2.1 Specification 2005

11.2.1.1 Fastener specifications 2005

11.2.2 Description and operation 2005

11.2.2.1 Description and operation 2005

11.2.3 System work principle 2006

11.2.3.1 System operating Principle 2006

11.2.4 Part position 2007

11.2.4.1 Component position 2007

11.2.5 Electrical schematic diagram 2010

11.2.5.1 Electrical schematic diagram 2010

11.2.6 Diagnostic information and steps 2011

11.2.6.1 Diagnosis descriptions 2011

11.2.6.2 Visual inspection 2011

11.2.6.3 Audio main machine can notstart 2011

11.2.6.4 Audio head unit can be turned on but the speakers are inoperative 2015

11.2.7 Dismantle and install 2020

11.2.7.1 Front door speaker replacement 2020

11.2.7.2 Radio antenna module replacement. 2025

11.2.7.3 Rear speaker replacement 2027

11.2.7.4 Replacement of audio headunit 2029

11.3 Navigation 2031

11.3.1 Specification. 2031

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11.3.2 Description and operation 2032

11.3.2.1 Overview. 2032

11.3.2.2 GPS system Introduction. 2033

11.3.2.3 Extended function Introduction. 2034

11.3.3 System work principle 2035

11.3.3.1 Schematic diagram of navigation system 2035

11.3.3.2 GPS system-A-GPS 2035

11.3.3.3 Self-discipline 2036

11.3.3.4 Map matching technology 2036

11.3.4 Part position 2037

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11.1 Warning and precaution

11.1.1 Warnings and precautions

Warning on vehicle lifting and jacking warning!

Warning!

To avoid any vehicle damage, serious personal injury or death when major components are dismantled from the vehicle and the vehicle is supported by a hoist, support with jack the components standing at the opposite end from which the components are being dismantled of the vehicle.

Warning on battery disconnection

Warning!

Unless directed, otherwise, the ignition and start switch must be in OFF or LOCK position, and all electrical loads must be OFF before servicing any electrical component. Disconnect the negative battery cable if a tool or any equipment easily comes in contact with an exposed electrical terminal. Failure to follow these precautions may result in personal injury and/or damage to the vehicle or its components.

Warning for window crack

Warning!

If part of glass for vehicle window is cracked but still intact, crisscross the glass for vehicle window with masking tape in order to reduce the risk of damage or personal injury.

Window quick down warning

Warning!

Operate the power window switch when working inside the driver door. When operated, the Quick Up/Down function allows the window to move very quickly without stopping, which could cause personal injury.

Warning on halogen bulb

Warning!

The halogen bulb contains high-pressure gas. Improper disposal will cause the bulb burst into pieces. To avoid personal injury: close the light switch and cool the bulb prior to the replacement of the bulb. Keep the lamp switch off until the bulb is replaced. Wear safety goggles when replacing the halogen bulb. When taking the bulb, only hole the lamp holder. Avoid contacting glass. The bulb is refrained from dust and moisture. Correctly scrap the old bulb. The halogen bulb must be far away from the children.

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11.2 Audio entertainment system

11.2.1 Specification

11.2.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N.m)	English system (lb-ft)
Audio head unit bolt	Q2205516	4—6	3—4
Front door high-pitch speaker self tapping screw	ST4.2×9.5	3—4	2—3

11.2.2 Description and operation

11.2.2.1 Description and operation

Setting for audio system

Whenever the audio system circuit is disconnected from the battery, all the customerspersonalized settings in the audio system will be initialized.

Antenna on roof

The roof antenna is located on the front area of the roof. The antenna pole is detachable but cannot be folded.

Front and rear loudspeakers

All audio systems are equipped with six loudspeakers: the front door is equipped with two front door loudspeakers and two front door high pitch loudspeakers. Two backdoor loudspeakers are arranged at the backdoor.

CD maintenance

Carefully carry the CDs. CD should be stored in boxes to avoid sunlight, heat and dust. If there is surface contamination, use a clean and soft cloth soaked in neutral cleaning agent to wipe and clean the disc.

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11.2.3 System work principle

11.2.3.1 System operating principle

Radio

Turn the audio head unit switch to "AM" and "FM", the antenna module receives the radio signal and transmits to the audio head unit through dedicated circuit. The audio head unit receives the radio signal and then tunes out the channel you want to receive through the processing of the internal filter circuit.

Amplify audio signal through internal amplifier to output to various loudspeaker through terminals 1-2, 3-4, 5-6 and 7-8 of IP22 finally.

CD player:

Turn the audio head unit switch to CD mode, the audio head unit controls the CD movement. CD system mainly consists of the laser and turntable system, servo system, signal processing system, information storage system and control system, etc.. The laser is a key component of CD player, which consists of semiconductor lasers, optical system and electrical detector. It is a low-power laser diodes.Laser beam is sent through the optical lens system onto the LP information surface. The disc has a number of pits, when the beam hits the pit, as the reflected light is weak, photoelectric detector picks up weak signals; when the beam hits the smooth aluminum surface, there will be a strong reflected light. The detector's high or low electrical pulse output signal corresponds to the presence or absence of the pits. Through the RF amplifier and the internal comparator, "1" and "0" serial digital signals are obtained, and added to the digital signal and processing circuit to carry out demodulation, frame sync detection, error correction. The processed data will be added to the digital analog conversion (D / A) and converted into analog sound output to the amplifier. The amplified audio signals will be sent to each speaker through the audio head unit harness connector IP22 terminal 1-2, 3-4, 5-6 and 7-8.

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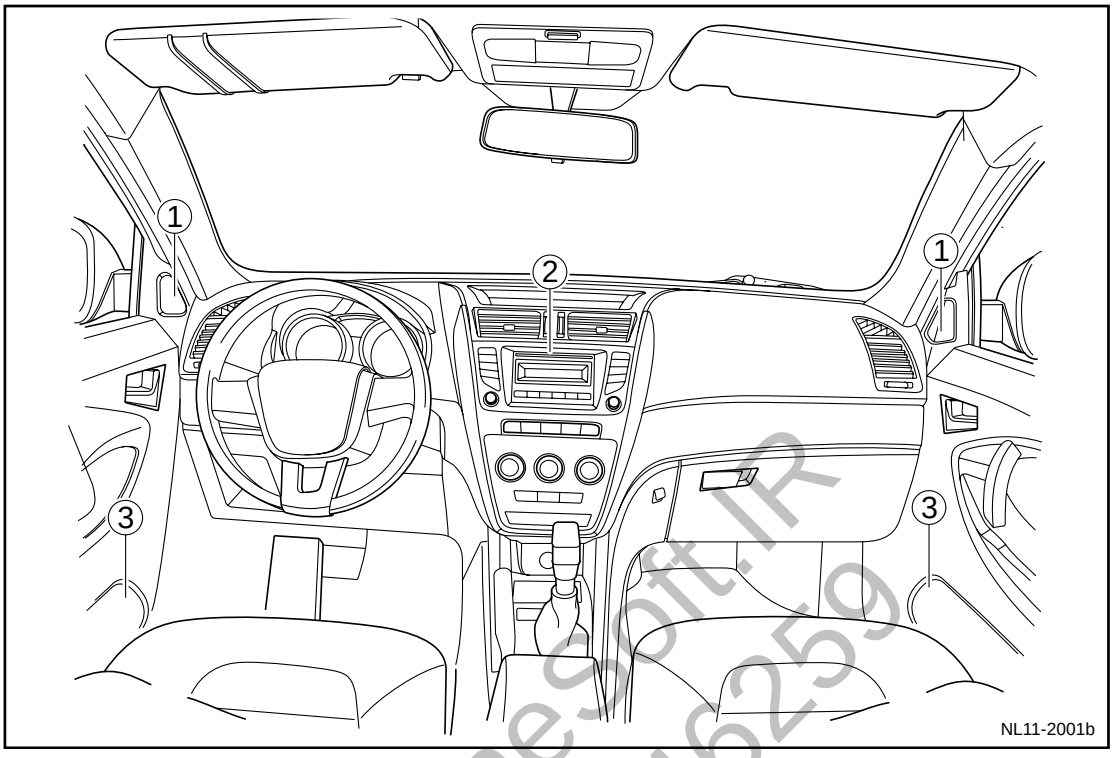
11.2.4 Part position

11.2.4.1 Component position

Acoustic head unit and front door loudspeaker



1. Front door high -pitch speaker
2. Audio main machine
3. Front door loudspeaker.

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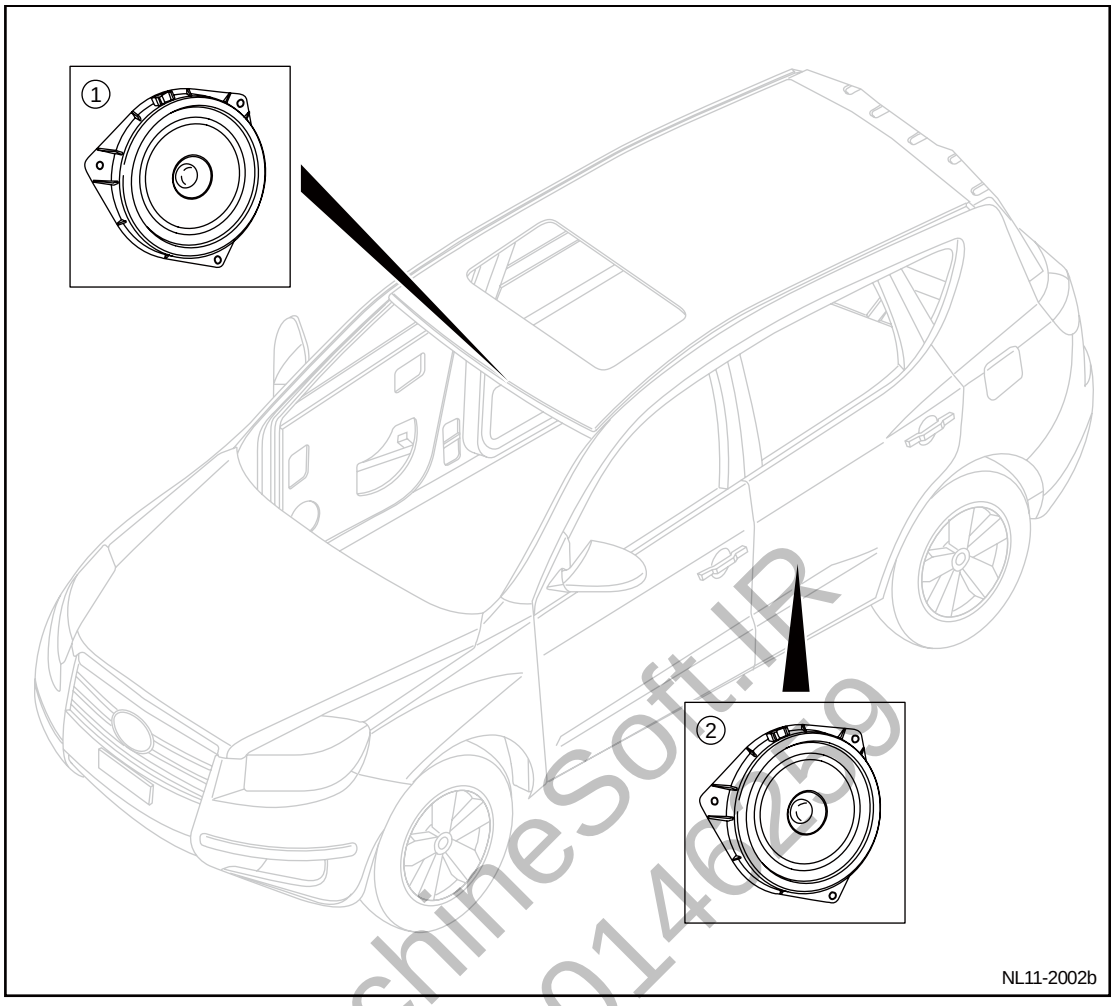
Rear loudspeaker (sedan)



1. Right rear speaker
2. Left rear speaker

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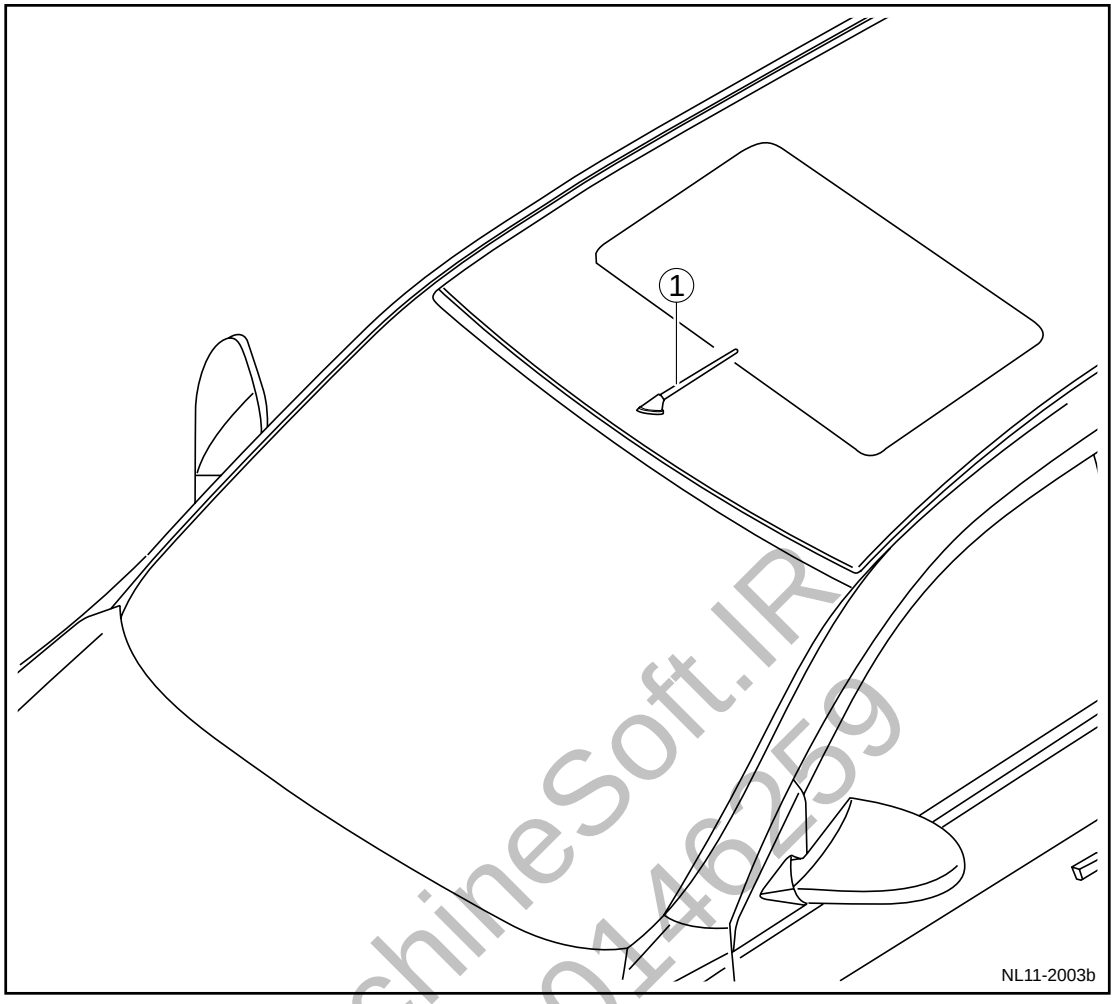
Radio antenna



1. Radio antenna.

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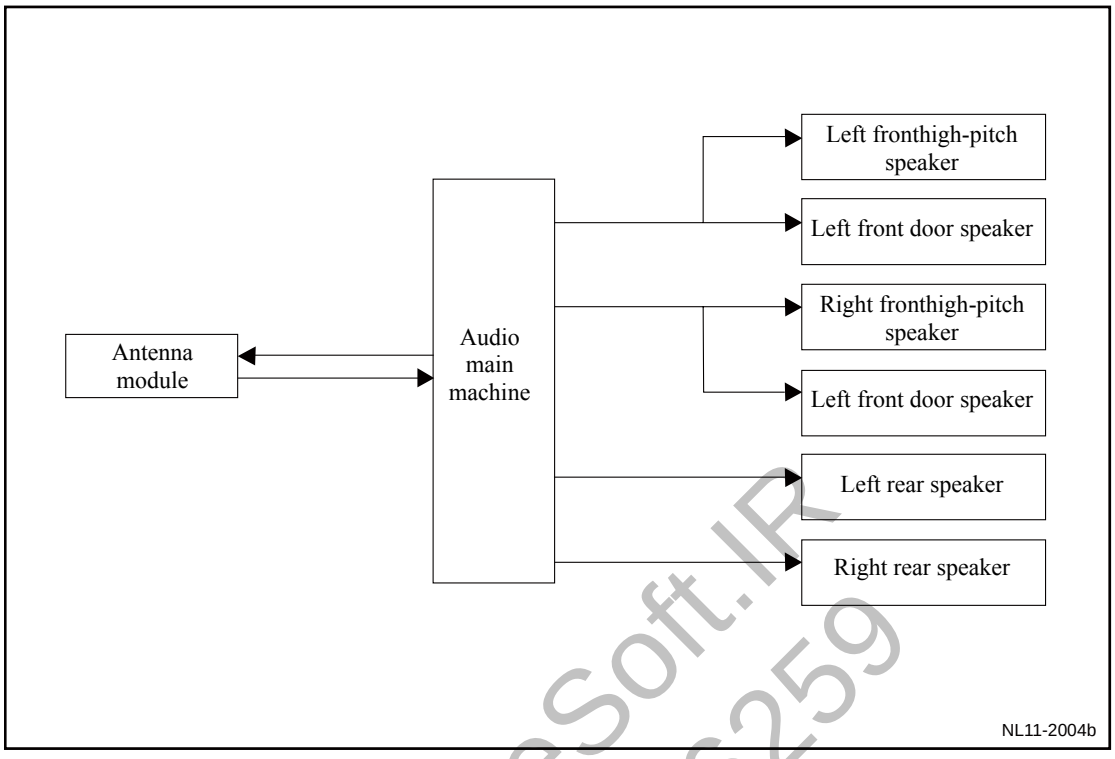
11.2.5 Electrical schematic diagram

11.2.5.1 Electrical schematic diagram



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11.2.6 Diagnostic information and steps

11.2.6.1 Diagnosis descriptions

Refer to 11.2.2.1 description and operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.2.6.2 Visual inspection

– Inspect installed aftermarket equipment that may affect the operation of the audio system.

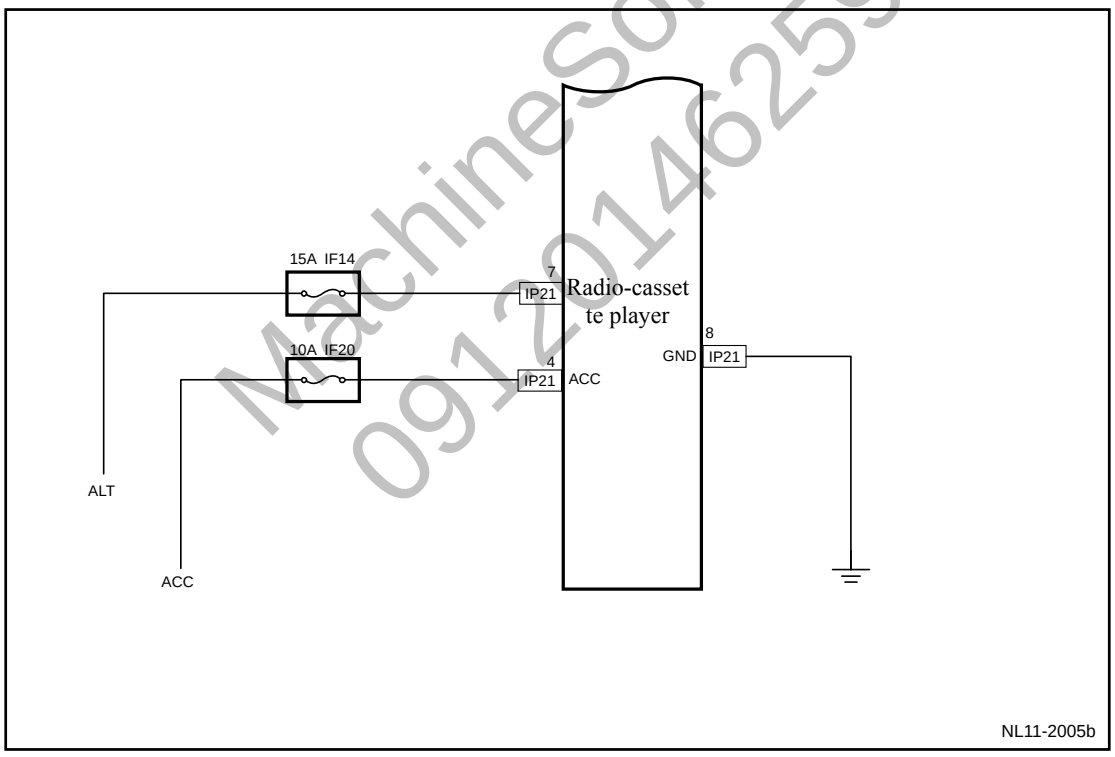
– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– In the event of all speakers inoperation, focus on speaker circuits that are easy to short to ground, as it will help troubleshoot quickly.

– If a single speaker is inoperative, it may because the audio channel is shielded, causing a single channel inoperative. It is not an audio system malfunction. Refer to the audio system instructions in the user manual.

11.2.6.3 Audio main machine can not start

Circuit diagram:



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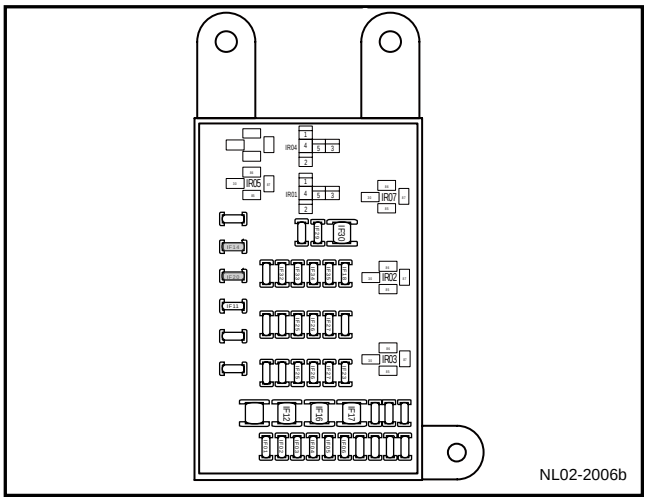
Diagnostic steps:

1	Check fuseIF20 and IF14.

(a) Whether fuse IF20 and IF14 are burned out.

The rated current of the fuses is: 10A for IF20 and 15A for IF14.

Confirm whether the fuses are blown.



No → Go to step 3

Yes

2	Check fuseIF20 and IF14 circuit

A. Check whether Fuse IF20 and Fuse IF14 lines are short circuited.

B. Repair the circuits,confirm that there are no short circuits.

C. Replace the fuses with rated current.

Confirm whether the radio is working correctly.

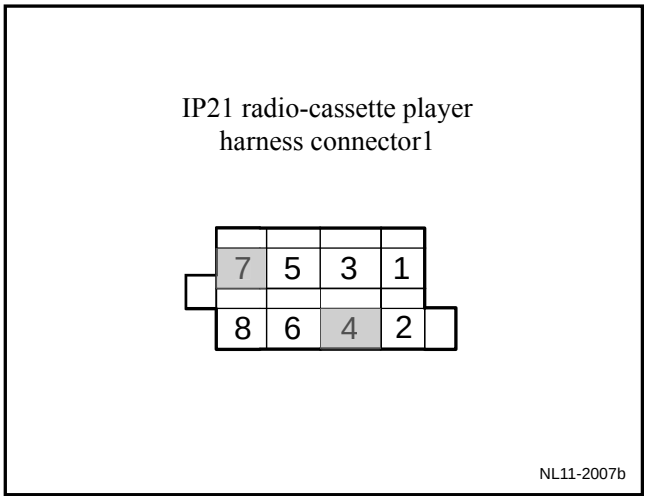
Yes → The system is normal.

No

3	Inspect the audio head unit power supply.

A. Dismantle the audio head unit.

B. Measure the voltage of audio head unit harness connector IP21 terminal No. 7, 4.



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Standard voltage

Test terminal	Test conditions	Standard voltage
IP21(7) —— body grounding	Always	**11-14 V**
IP21(4)——body grounding	Ignition switchACC	**11-14 V**

Yes → Go to step 5

No

4	Repair the open circuit fault between the audio head unit wire harness connector IP21 and the fuses IF20 and IF14.

(a) Confirm the open circuit malfunction between audio head unit harness connector IP21 terminal No. 7 and fuse IF14 maintenance is completed.

(b) Confirm the open circuit malfunction between audio head unit harness connector IP21 terminal No. 4 and fuse IF20 maintenance is completed.

Confirm whether the radio is working correctly.

Yes → The system is normal.

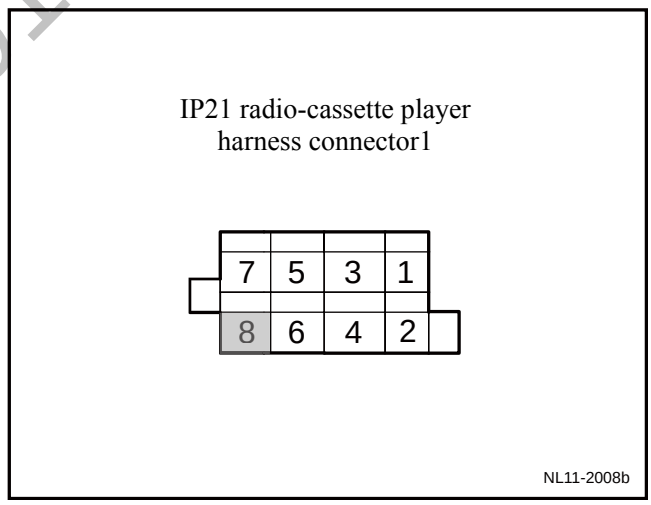
No

5	Inspect the audio head unit grounding.

(a) Use multimeter to measure resistance between wire harness connector IP21 terminal No. 8 of main host of sound equipment and grounding circuit.

Standard resistant value :is less than 1 Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 7

No

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6	Repair the open circuit fault between the audio head unit wire harness connector IP21 and the body grounding.

(a) Confirm the open circuit malfunction between the audio head unit harness connector IP21 terminal No. 8 and the body ground maintenance is completed.

Confirm whether the radio is working correctly.

Yes → The system is normal.

No

7	Replace audio main machine

A. See "11.2.7.5 replacement of audio unit".

Confirm whether the radio is working correctly.

Next

8	The system is normal.

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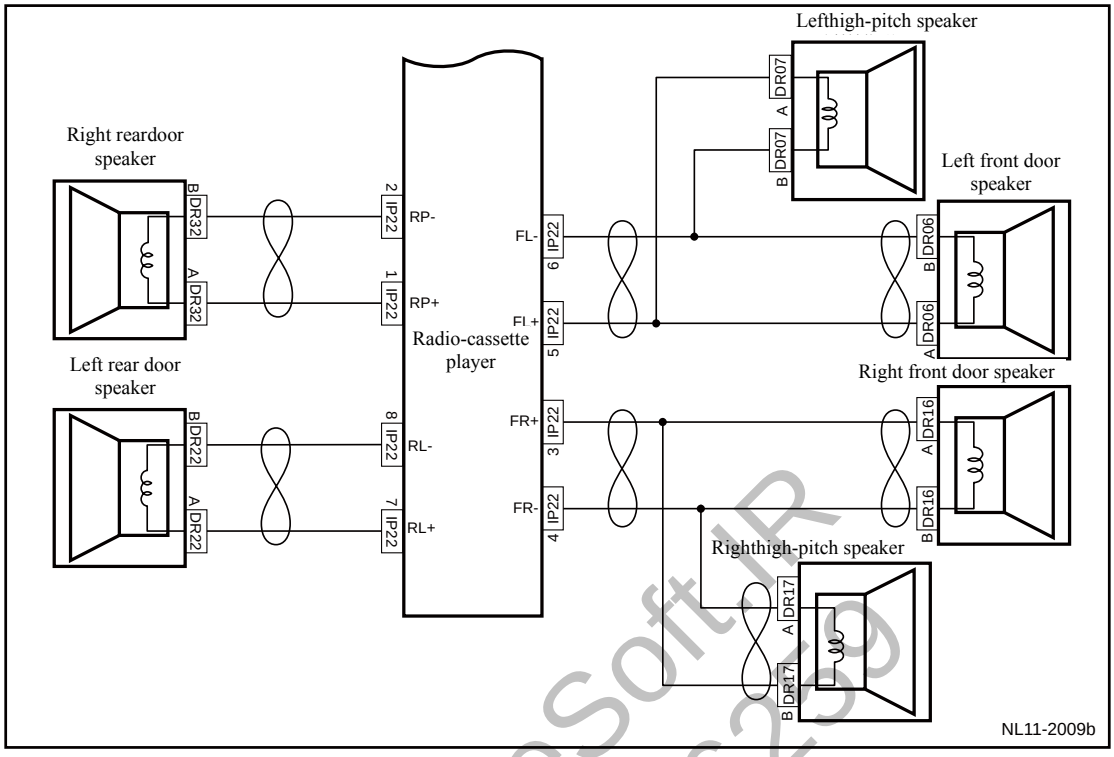
11.2.6.4 Audio head unit can be turned on but the speakers are inoperative

Circuit diagram:



Diagnostic steps:

1	Operate the audio unit.

A. Operate the audio head unit master control panel,adjust the channel, so that front and rear and left and right channels are in the middle.

Confirm whether all the speakers are inoperative?

No — Go to step 4

Yes

2	Inspect audio output of the audio wire harness connector IP22 and the grounding resistor.

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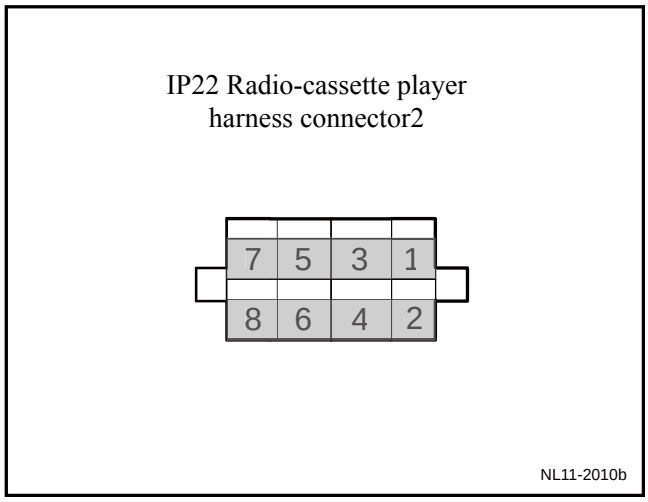
(a) Dismantle main host of sound equipment.

(b) Disconnect audio main machine harness connector IP22.

(c) Use multimeter to measure resistance between all audio output terminal of wire harness connector IP22 of main host of sound equipment and grounding.

Standard resistant value :10 KΩ or higher

Confirm if the resistance conforms to standard value.



Yes → Go to step 8

No

3	Repair the short circuit fault between the audio head unit wire harness connector IP22 and the body grounding.

A. Confirm that the open circuit between Terminal 5 of the harness connector IP22 of the audio unit and ground wire of the body is fixed.

Confirm whether the radio is working correctly.

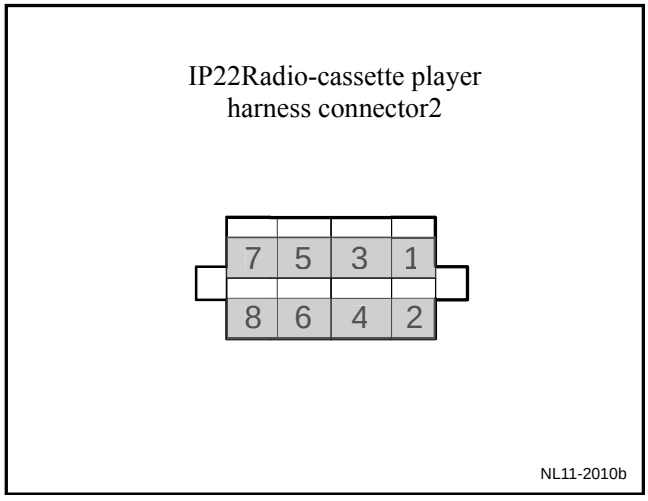
Yes → The system is normal.

No → Go to step 8

4	Inspect the loudspeaker circuit that does not work.

A. Dismantle audio main machine harness connector IP22

B. Measure the resistance of the loudspeaker from the harness connector IP22 with a universal meter.



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Standard Resistance

Test speakers	Test terminal	Standard resistance
Left rear speaker	Instrument harness connector IP22-No 8, 7 terminal	4Ω
Right rear loudspeakers	Instrument harness connector IP22-No 2, 1 terminal	4Ω
Left front door window high pitch speaker	Instrument harness connector IP22-No 5, 6 terminal	2-3Ω
Driver door speaker	Instrument harness connector IP22-No 5, 6 terminal	2-3Ω
Right front door and window high-pitch speaker	Instrument harness connector IP22-No 4, 3 terminal	2-3Ω
Driver door speaker	Instrument harness connector IP22-No 4, 3 terminal	2-3Ω

Confirm whether the resistance is normal.

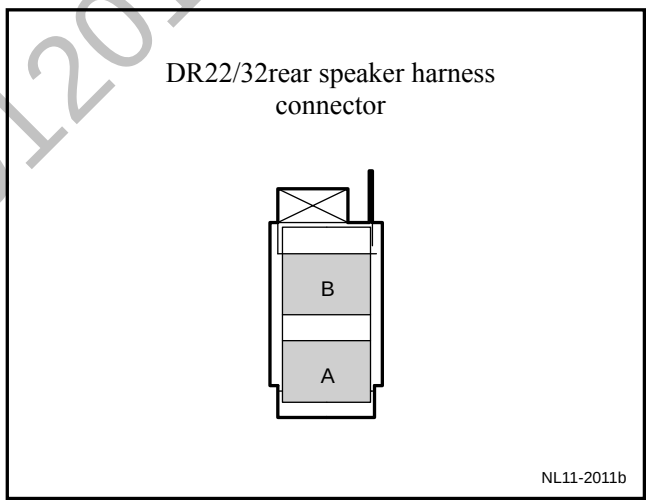
Yes	Go to step 7
No	

5	Inspect the open circuit fault between the loudspeaker circuits.

(a) Disconnect audio main machine harness connector IP22.

(b) Disconnect the inoperative speaker connector.

(c) According to the following items, use multimeter to measure connetor terminal of speaker which doesn't work.



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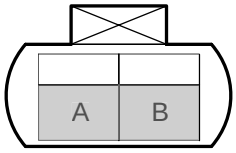
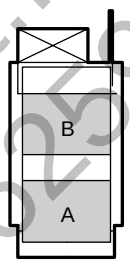
DR07/17front doorhigh-pitch speaker harness connector



NL11-2012b

DR06/16 front door speaker harness connector



NL11-2013b

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Position	Multimeter connection	Specified conditions
Left rear speaker	Terminals A and B of door wire harness connector DR22 and the instrument wire harness connector respectively IP22 No. 7. 8 terminal	**Less than 1 Ω**
Right rear loudspeakers	Terminals A and B of door wire harness connector DR32 and the instrument wire harness connector respectively IP22 No 1. 2 terminal	**Less than 1 Ω**
Left front door window high pitch speaker	Terminals A and B of door wire harness connector DR07 and terminal No. 5 and 6 of instrument wire harness connector IP22	**Less than 1 Ω**
Right front door and window high-pitch speaker	Terminals A and B of door wire harness connector DR17 and terminal No. 4 and 3 of instrument wire harness connector IP22	**Less than 1 Ω**
Driver door speaker	Terminals A and B of door wire harness connector DR06 and terminal No. 5 and 6 of instrument wire harness connector	**Less than 1 Ω**

	IP22	
Passenger side door loudspeaker	Terminals A and B of bottom plate wire harness connector DR16 and terminal No. 3 and 4 of instrument wire harness connector IP22	**Less than 1 Ω**

D. Confirm the open circuit malfunction between the circuits maintenance is completed.

Confirm whether the radio works normally.

Yes → The system is normal.

No

6	Check speaker

A. Measure speaker terminal

Standard resistance: 3.5-4.5Ω

Confirm whether the resistance is at a specified value.

Yes → Go to step 8

No

7	Replace speaker

Confirm whether the loudspeaker works normally.

Yes → The system is normal.

No

8	Replace audio main machine

A. See "11.2.7.5 replacement of audio unit"

Confirm the completion of repair.

Next

9	The system is normal.

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11.2.7 Dismantle and install

11.2.7.1 Front door speaker replacement

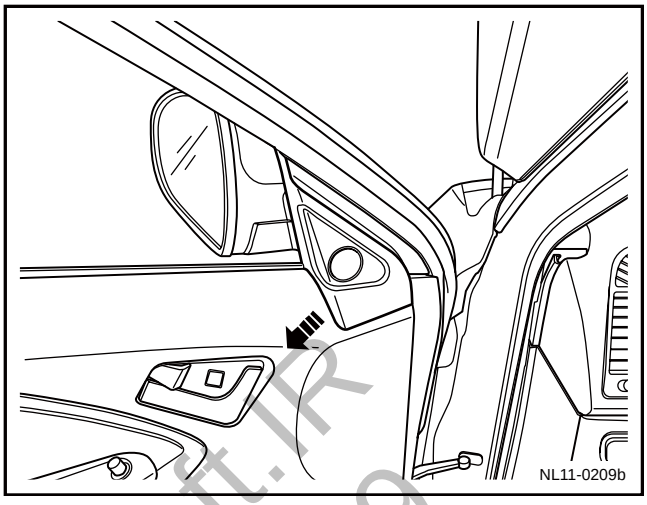
Replacement of tweeter

Dismantlement procedure

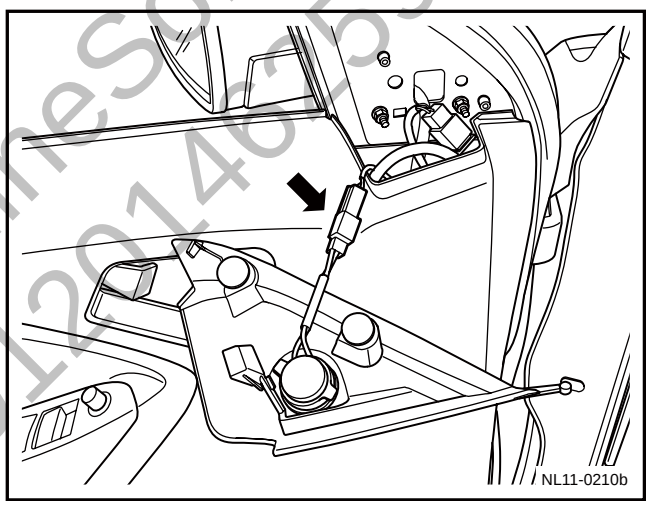
Warning!

Warning: refer to "warning on battery disconnection" in "warnings and precautions".

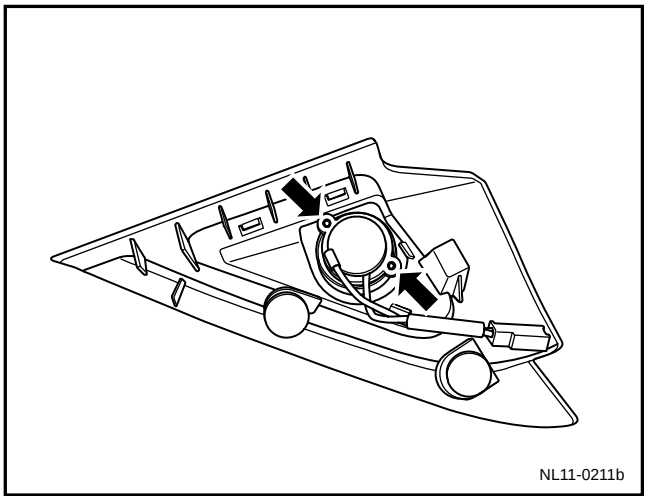
1. Disconnect the battery negative cable.Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle front door treble speaker housing.



3. Disconnect front door high pitch speaker harness connector.



4. Dismantle fixing screw of front door treble speaker, and remove front door treble speaker.



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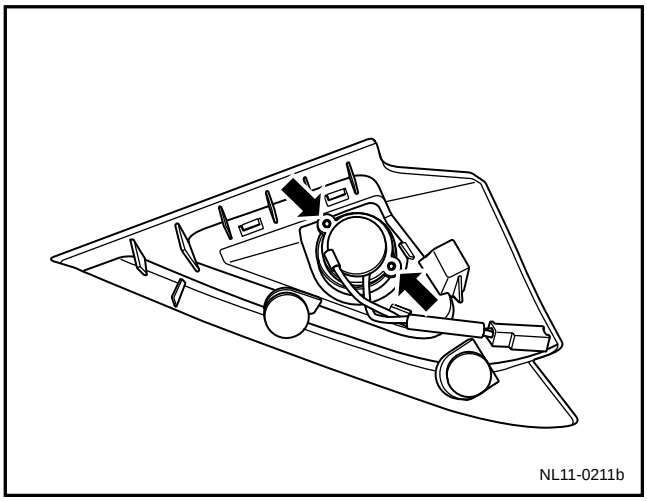
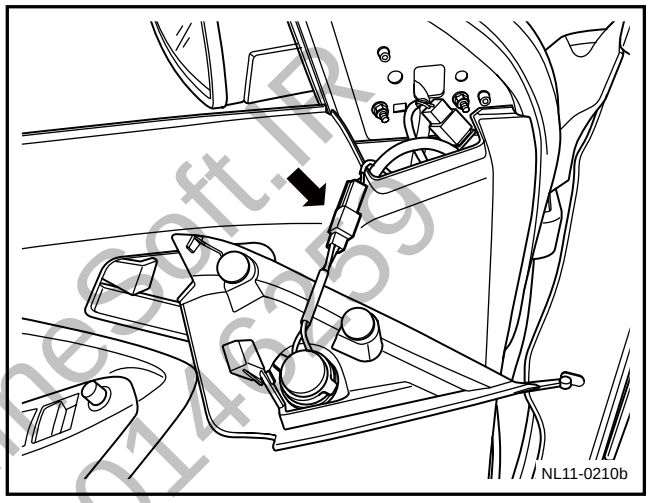
Installation procedure:

1. Install front door treble speaker fixing screw.

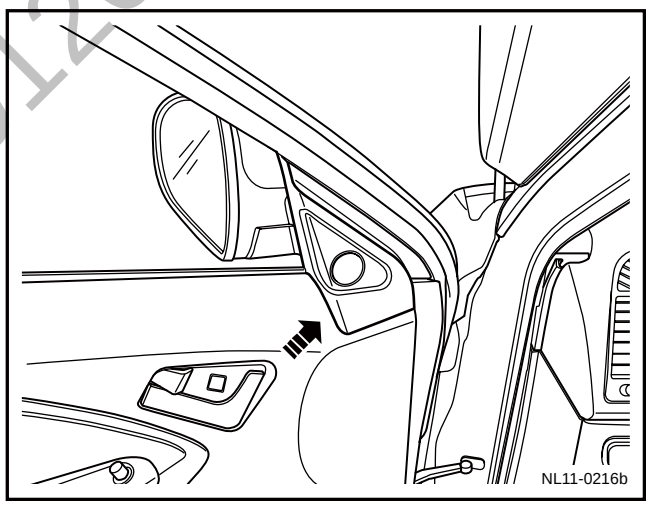
Torque :4nm(metric) 3lb-ft(english system)



2. Connect front door speaker wire harness connector.



3. Install the front door speaker enclosures.
4. Connect the battery negative cable.



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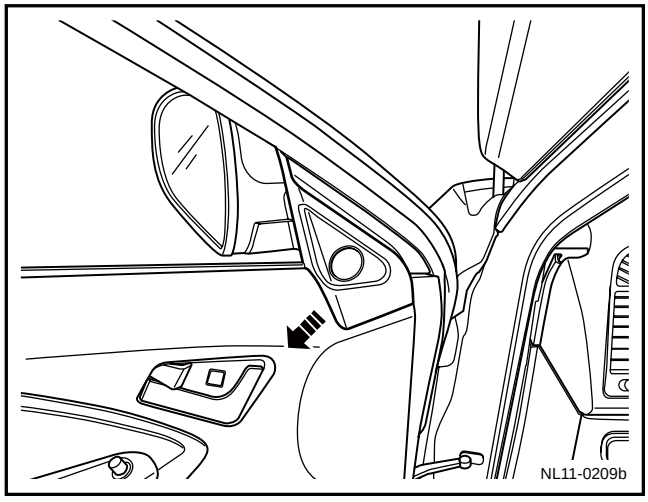
Replacement of bass loudspeaker

Dismantlement procedure

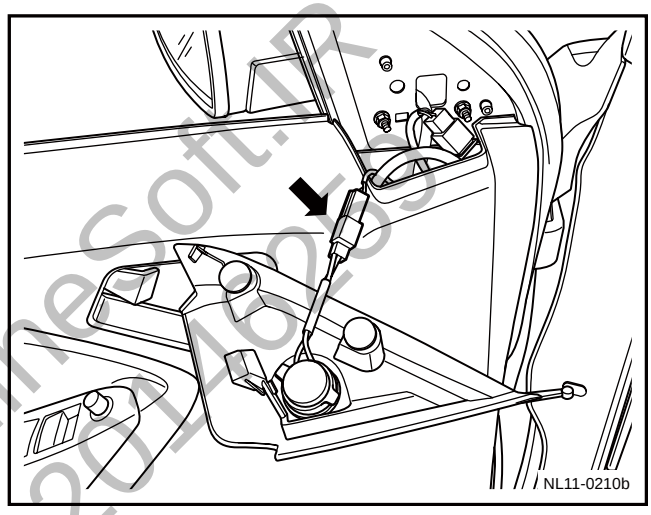
Warning!

Warning: refer to "warning on battery disconnection" in "warnings and precautions".

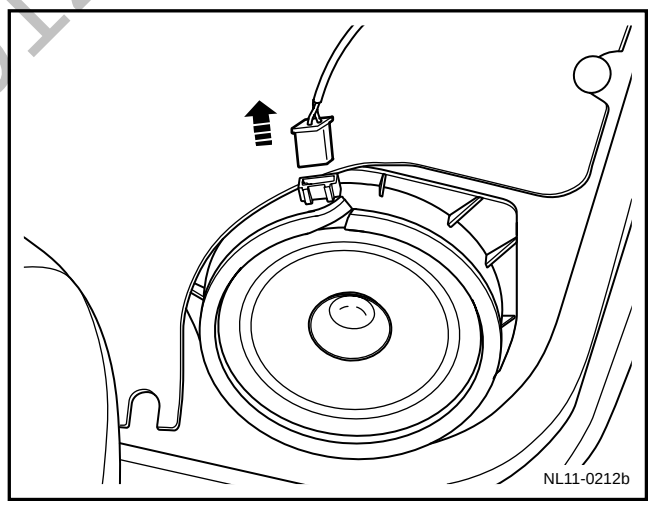
1. Disconnect the battery negative cable.refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle front door treble speaker housing.



3. Disconnect front door high pitch speaker harness connector.



4. Dismantle the front door interior trim panel. refer to12.9.1.7 replacement of front door interior trim panel.
5. Disconnect the harness connector of the front door loudspeaker.



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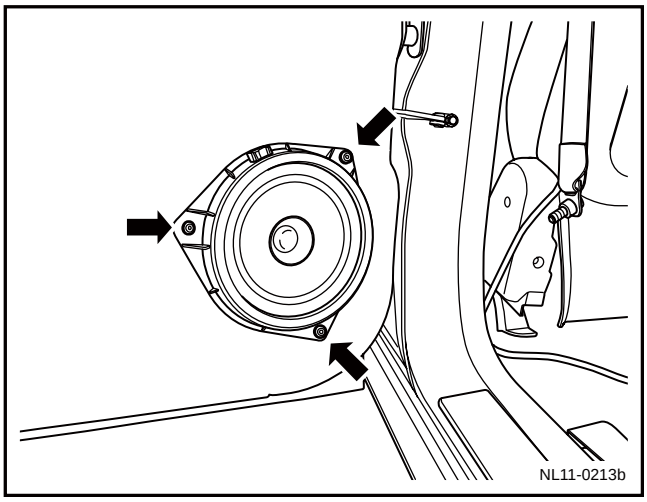
6. Dismantle fixing rivet of speaker.

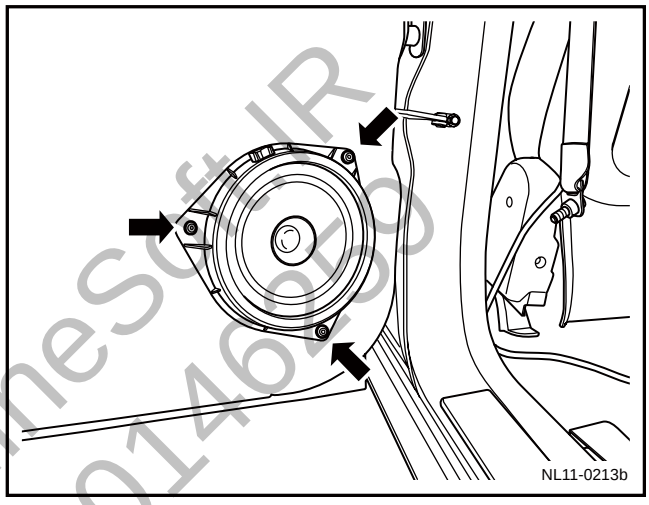


Installation procedure:

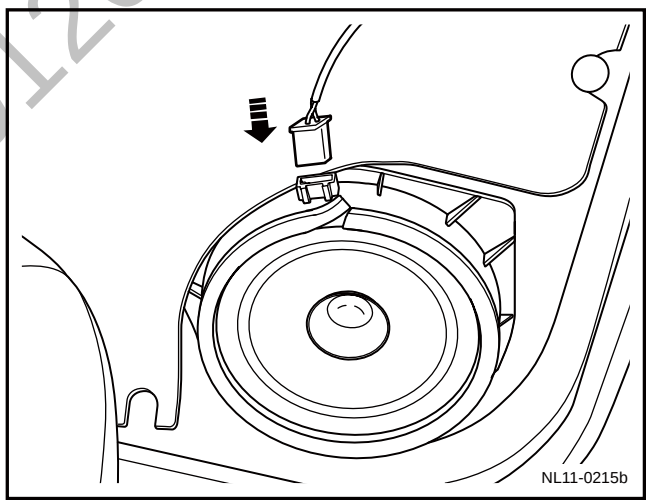
1. Install speaker. and fasten fixing rivet.

Notes:

See "important cautions regarding fastening parts" in "warnings and cautions".



2. Connect speaker wire harness connector.
3. Install the front door interior trim panel.



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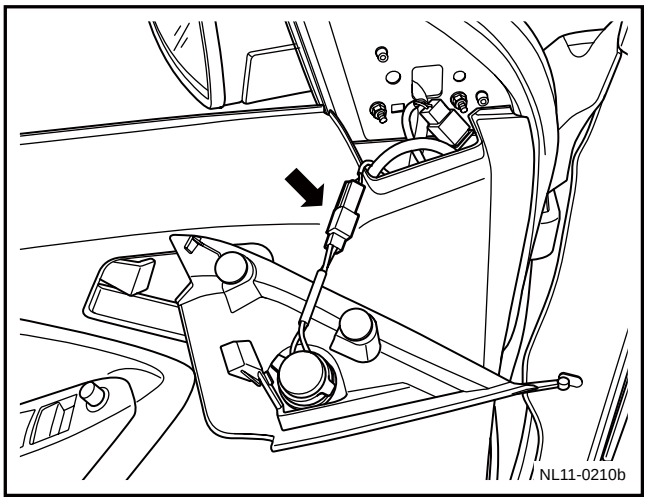
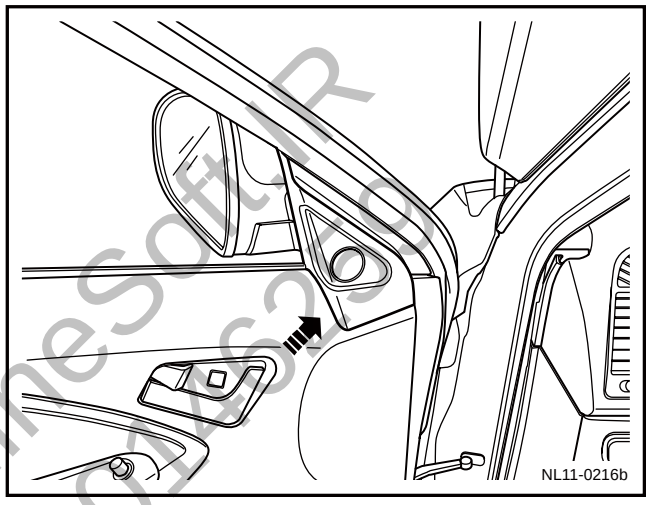
4. Connect front door speaker wire harness connector.



5. Install the front door speaker enclosures.
6. Connect the battery negative cable .



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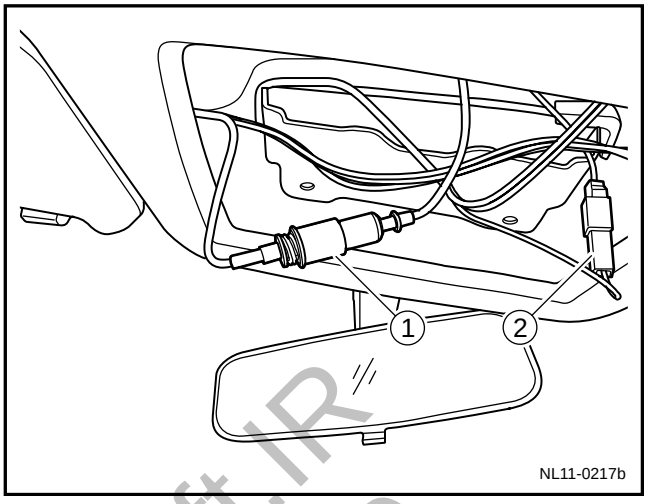
11.2.7.2 Radio antenna module replacement

Dismantlement procedure

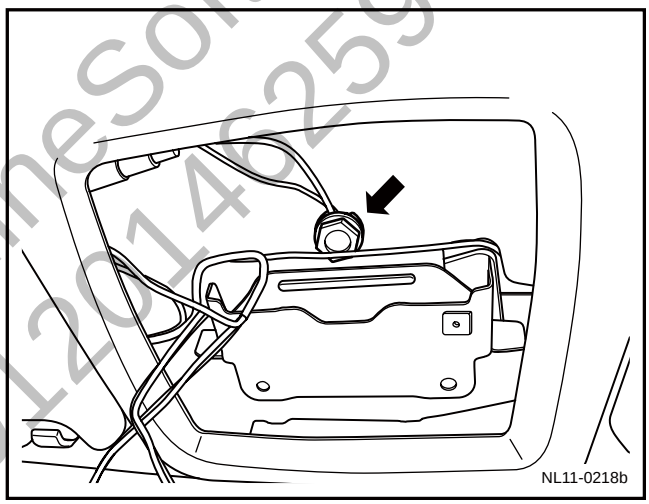
Warning!

Warning: refer to "warning on battery disconnection" in "warnings and precautions".

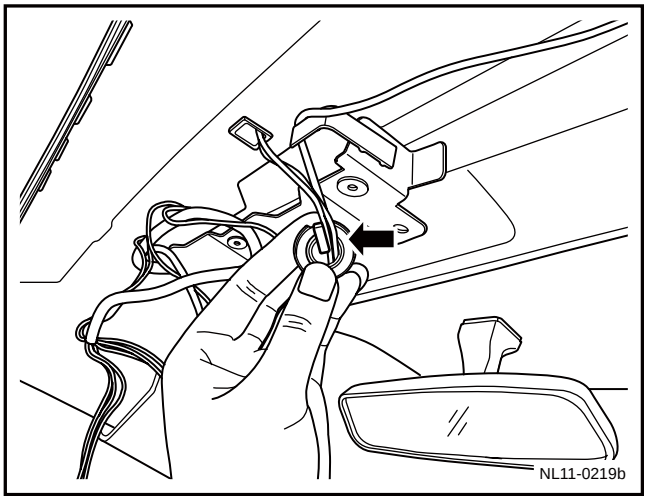
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of front read lamp, refer to 11.3.8.2 Replacement of dome lamp and read lamp.
3. Disconnect antenna feeder harness connector 1 .
4. Disconnect antenna wire harness connector 2.



5. Remove the antenna fixing bolt.



6. Loosen the antenna fixing nut locating tab and extract the antenna harness connector.



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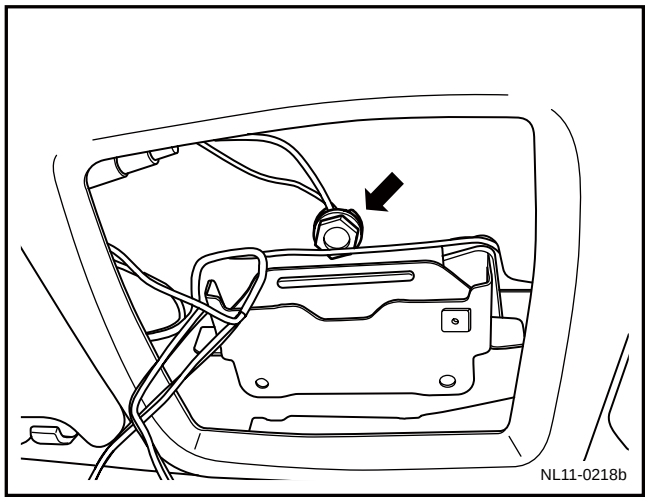
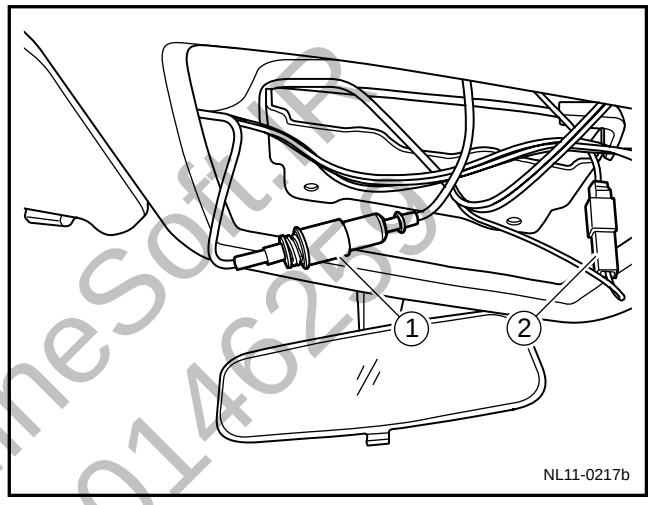
Installation procedure:

1. Install new antenna fixing nut and fasten.



2. Connect antenna feed line wire harness connector 1.
3. Connect antenna wire harness connector 2.
4. Install the front reading lamp.
5. Connect the battery negative cable.



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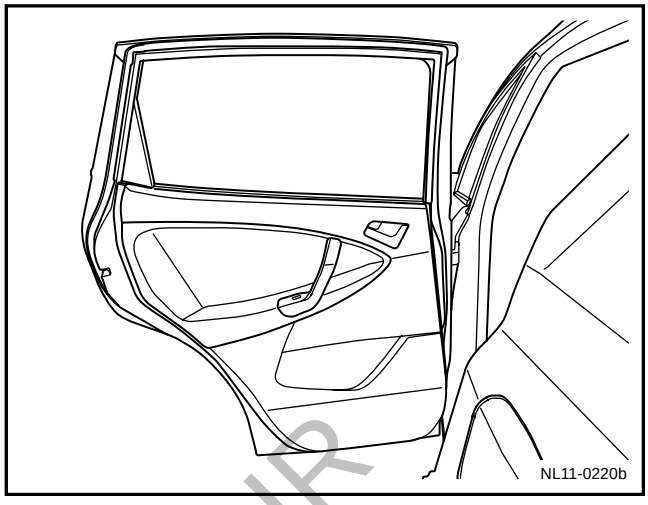
11.2.7.3 Rear speaker replacement

Dismantlement procedure

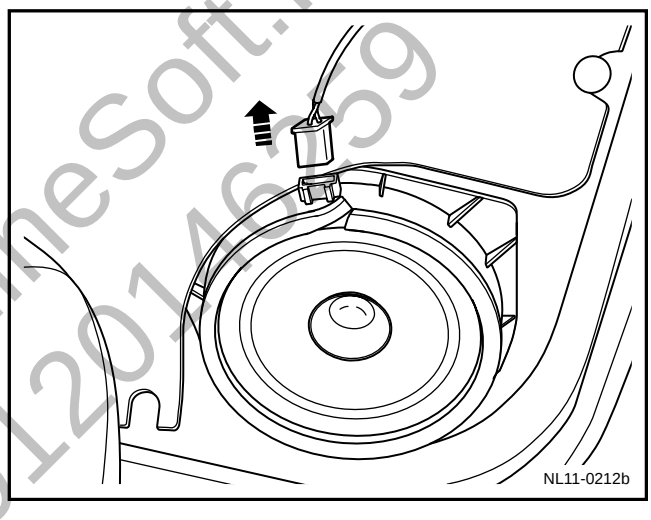
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

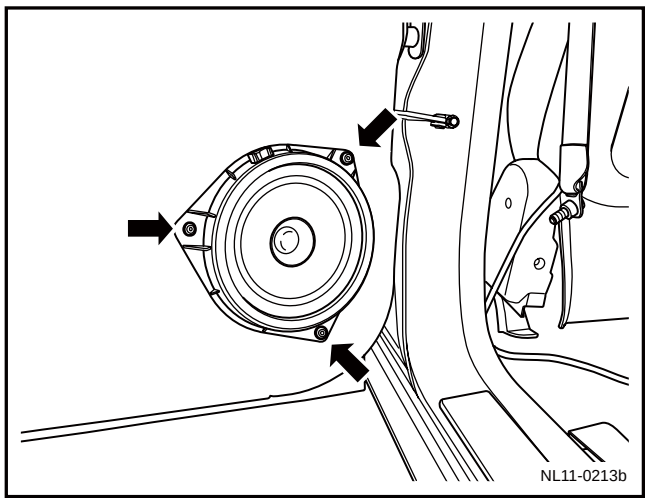
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of rear door inner trimming plate, refer to 12.9.1.9 Replacement of rear door inner trimming plate.



3. Disconnect speaker harness connector.



4. Dismantle fixing rivet of speaker.



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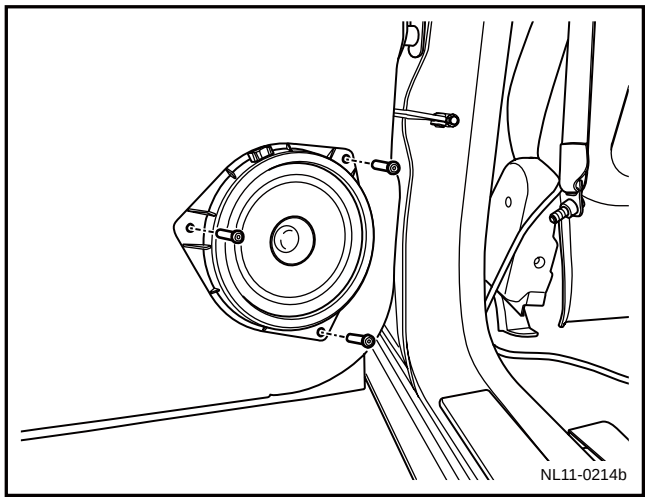
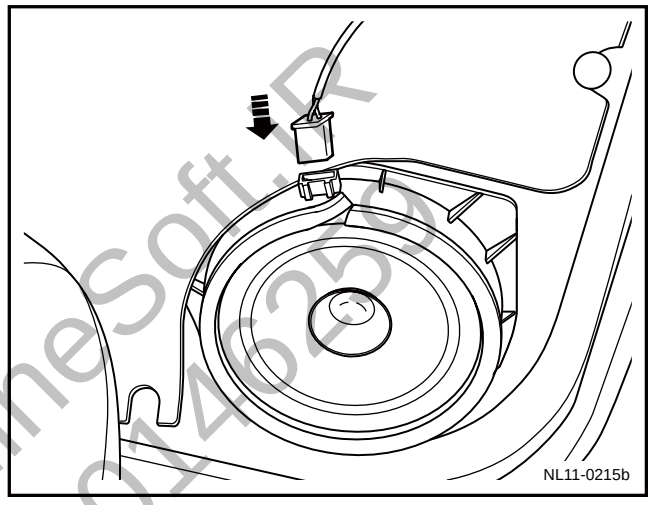
Installation procedure:

1. Install speaker.and fasten fixing screw.



2. Connect speaker wire harness connector.
3. Install the rear door internal trim panel.
4. Connect the battery negative cable.



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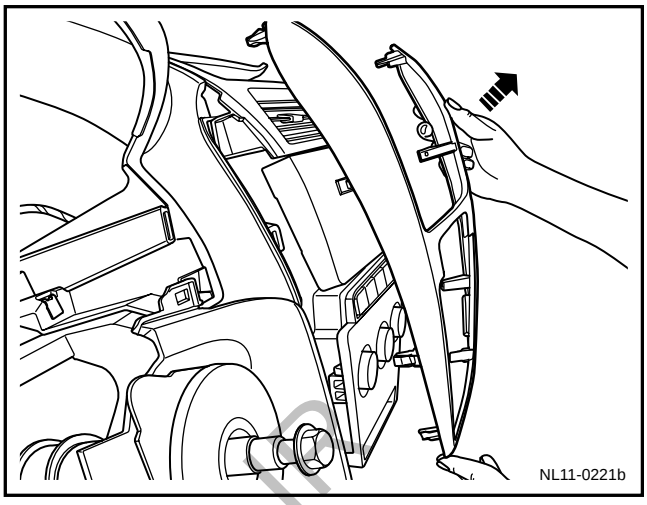
11.2.7.4 Replacement of audio head unit

Dismantlement procedure

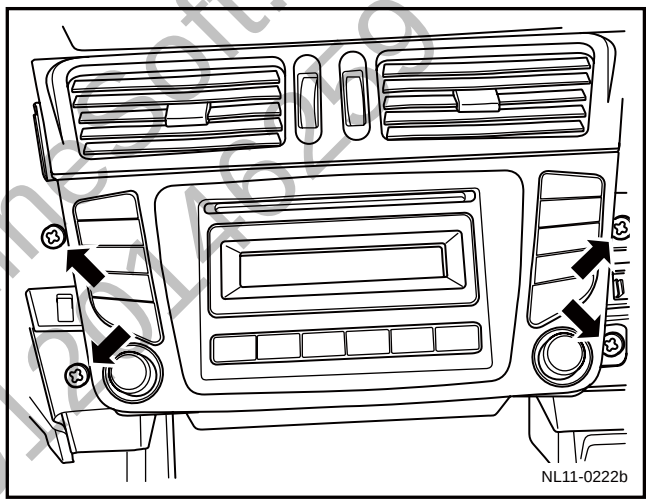
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

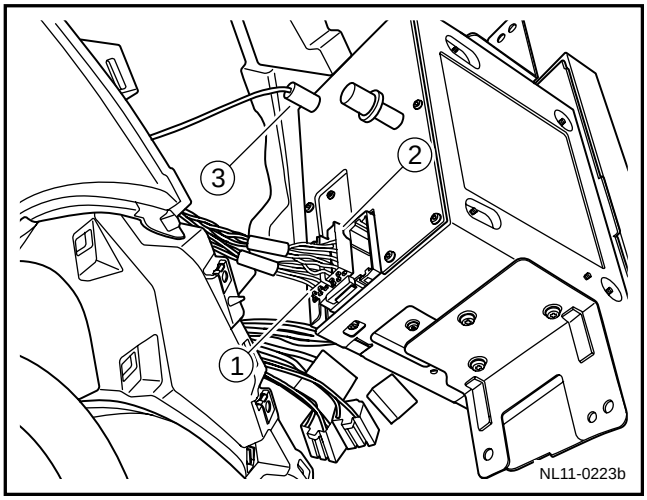
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle the instrument panel trim panel.



3. Dismantle fixing bolt and fixing screw of main host of equipment sound.



4. Disconnect harness connector 1 of the audio unit.
5. Disconnect harness connector 2 of the audio unit.
6. Disconnect harness connector 3 of the audio unit.



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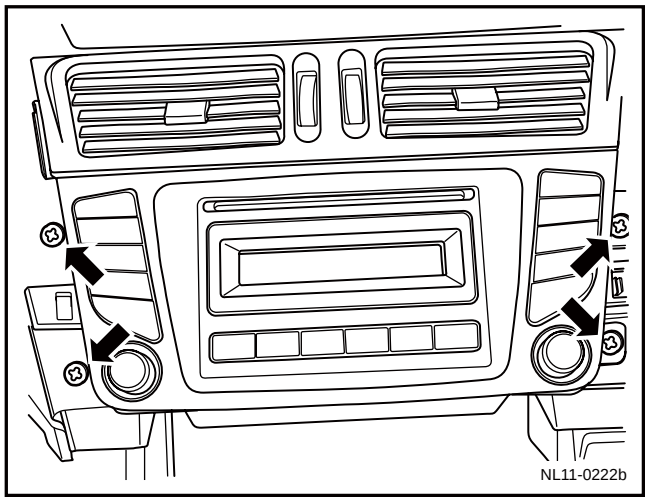
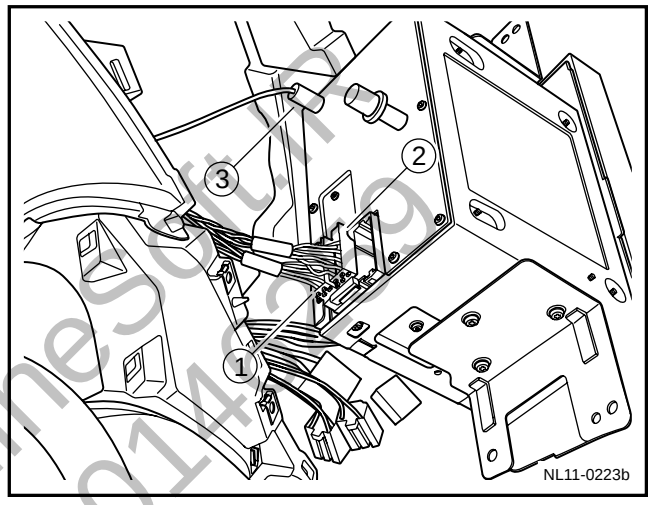
Installation procedure:

1. Connect wire harness connector 1 of main host of sound equipment.
2. Connect wire harness connector 2 of main host of sound equipment.
3. Connect wire harness connector 3 of main host of sound equipment.

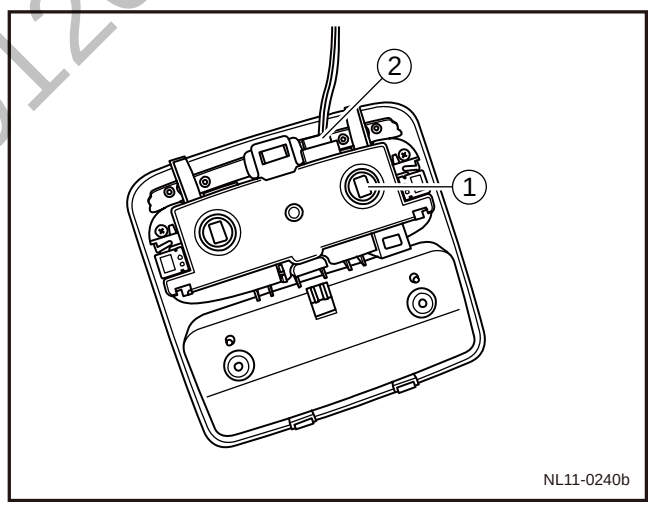


4. Install main host of sound equipment, and tighten fixing bolt and fixing screw.

Torque :4Nm(Metric) 3lb-ft(English system)



5. Install the dashboard trim panel.
6. Connect the battery negative cable.
7. Connect the battery negative cable.



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11.3 Navigation

11.3.1 Specification

11.3.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N.m)	English system (lb-ft)
Bolt of navigation head unit	Q2205516	4 - 6	3 - 4.4
	Q1460620	5 - 8	3.7 - 6
GPS antenna self tapping screw	ST4 . 2×16	3 - 4	2 - 3
Front door high-pitch speaker self tapping screw	ST4.2×9.5	3 - 4	2 - 3

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11.3.2 Description and operation

11.3.2.1 Overview

The on-board navigation system consists of a GPS receiver, a self-disciplined navigation device, a vehicle speed sensor, a gyro sensor, an LCD display, etc. GPS is the abbreviation of the term "Global Positioning System", which is developed by the United States for military purpose.

Sending.Its meaning is that the navigation satellite is used for measuring time and distance to form the global navigation system.

The navigation system of this vehicle has an advanced design: the navigation screen, navigation ECU and radio are integrated as a whole. Map database adopts a SD card storage technology; the previous map database is reserved in the mode of compact disc (CD); compared with the map CD, the data is read quickly in the storage mode of SD card; moreover, the map CD player is reduced, so that the structure is simple; therefore, the fault probability is also greatly reduced. When new navigate map database needs to be updated, the computer only needs to update the data in the SD card. If you need to upgradae the map database when you only have a traditional map disc, you must replace with a new disc.

SX718Navigation SD card capacity is 4G.

The on-board navigation system mainly provides the following functions:

– Best route search of destination;

– Have instant and search function

– Provided rich menus and record function with searcher

– Provide real-time voice prompt during proper time;

– Extended function.

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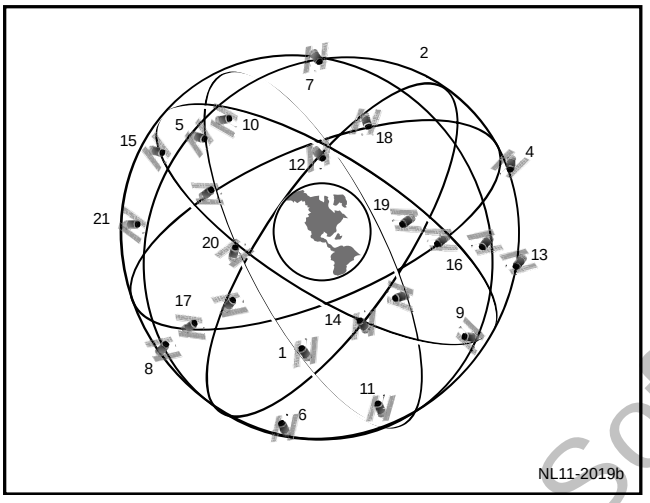
11.3.2.2 GPS system introduction

A GPS mainly consists of three parts: space equipment, ground control and user terminals.

Space segment:

Including 21 satellites and 3 backup satellites, which as a whole seem like a constellation hanging 20,000km high above the ground.Uniformly distribute in 6 orbital planes at the orbital angle of 55°, wherein the angle between the orbital planes is 60°, 4 satellites are distributed in each orbit; thus, such distribution structure ensure that more than 4 satellites can be seen at any place of the global.



Ground control section:

For navigation positioning, firstly, the position of the satellite must be known. However, the position of the satellite is obtained based on the calculation of the movement of the satellite and its orbital parameters. Ground monitoring station constantly observes each satellite all the year round. According to the satellite state parameter observed, regulate the satellite to the preset orbit timely and amend the pose of the satellite. When certain satellite faults, a standby satellite can further be dispatched instead of the invalid one.

User receiving system:

The user receiving system includes hardware, such as a power supply, an antenna, a receiver, a microprocessor, control display device and the like, as well as other built-in software and data processing software package etc.

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11.3.2.3 Extended function introduction

1. Radio function

The same as the common radio, the system has a radio function. The radio station can be stored by storing the list. After disconnecting the battery negative cable, radio station information in a memory list shall be reset completely.

2. SD function

Notes:

This system supports the function of using a SD card for its intended purpose: an MP3/WMA file can be played only when it is copied onto another SD card not storing map files if it is copied onto a SD card containing map files and the system cannot recognize the corresponding audio file.

This system supports playing audio files of such formats as MP3, WMA. After the SD card equipped with the MP3/WMA format file is inserted, the [SD] key system is pressed to start playing audio files in the SD card, and the display shows the SD state, including the information, such as "track name", "singer information" and "playback progress bar", etc.

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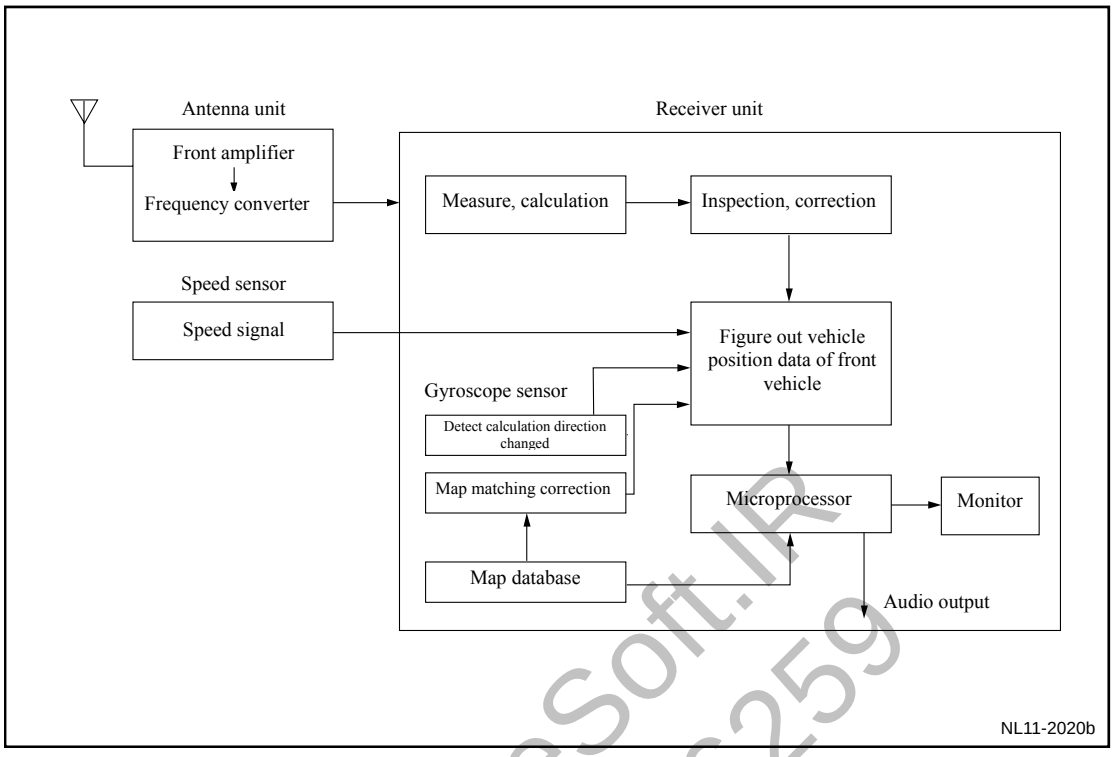
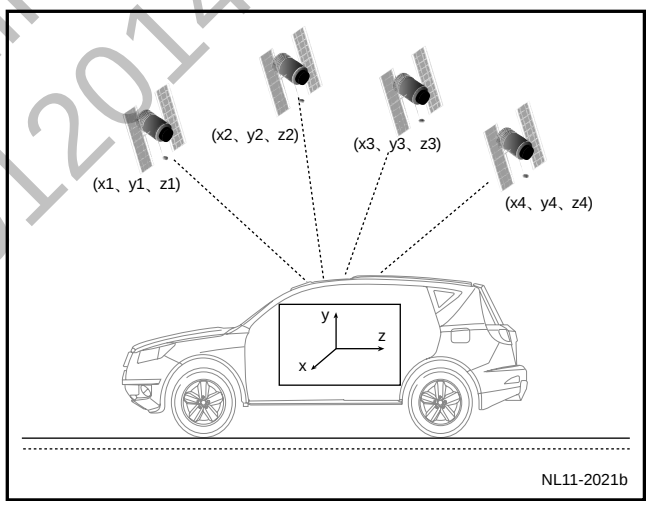
11.3.3 System work principle

11.3.3.1 Schematic diagram of navigation system



11.3.3.2 GPS system-A-GPS

A GPS is used to locate a user on the earth. Each GPS satellite revolves around the earth for two circles each day, so signals from more than 4 GPS satellites can be received from anywhere on the earth. By using these signals, the computer can calculate the exact coordinates (longitude and latitude) of the user on the earth. After the receiver receives these signals, the current three-dimensional position, three-dimensional direction and the motion speed and time and the like are obtained through calculation. The GPS receiver usually employs pseudo-range measurement, carrier phase measurement, satellite radio interferometry, doppler measurement, etc.



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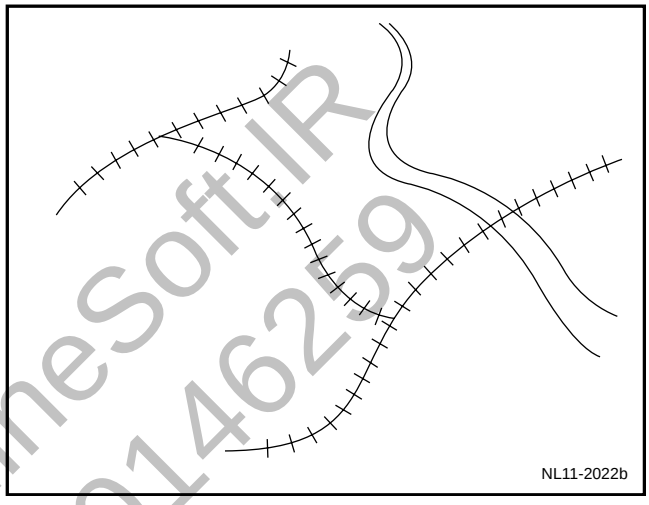
11.3.3.3 Self-discipline

When the vehicle is driven in underground tunnels, high-rise buildings, highways and other cover materials and can not receive the GPS satellite signal, the system can automatically enter into autonomous navigation. At this time, the vehicle speed sensor measures the vehicle speed from the forward speed and calculates the vehicle speed through the microprocessor.

Calculate the forward distance of the vehicle. Gyro sensor is used for directly detecting the change and traveling state forward. For example, when the vehicle traveling in groove-like mountain path, annular disc-shaped bridge and in-situ sliding district of trail, all these curve distance and the longitude and latitude of satellite navigation produce error; thus, the position of the vehicle only can be detected by the detection of a gyro sensor and the calculation of a microprocessor. However, its positioning precision is far below that of GPS (Global Positioning System).

11.3.3.4 Map matching technology

The electronic map distinguished by the microprocessor is the nodded data.



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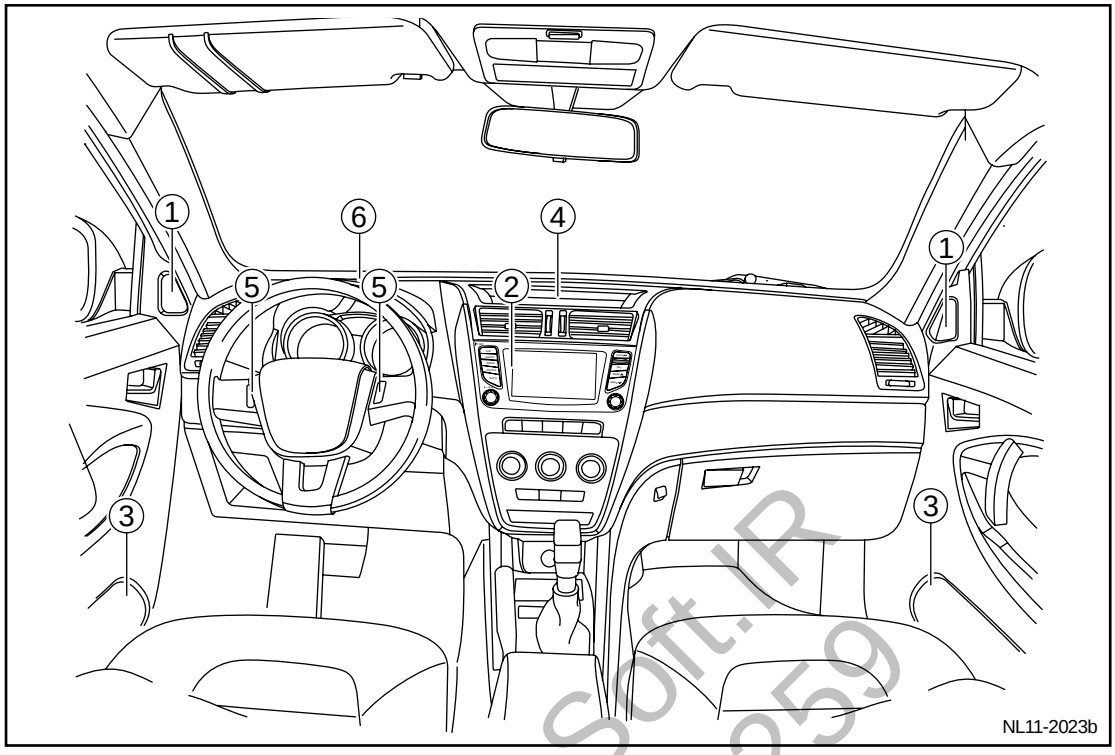
Both the vehicle position coordination data and the forward direction detected by GPS satellite navigation and autonomous navigation device are different from the actual travel route traces certainly. In order to correct the errors of the both with the unification of the route on the map, a map matching technique needs to be used; at this time, the microprocessor performs relevant real-time matching and automatic correction on the vehicle driving route and the road error on the electronic map. Vehicle arterial traffic, road map and urban traffic map are reserved into the map database. Before driving, the driver inputs the city, street and place name to go into the processor through an input interface; the processor determines the orientation of the place to go according to the actual measurement data, such as speed sensor, gyroscope sensor and the like and by virtue of the signal of the satellite as well as marks the best route of the place to go according to the attribute of the current route planning. The driver can observe the map of area where the vehicle is and the position of the vehicle on the map on the screen at any time through the display screen in the vehicle in the driving process. The display screen can further display the rest distance to the destination. Meanwhile, the relevant information is output via audio and prompts the driver via voice.

11.3.4 Part position

11.3.4.1 Component position



1. Front door high -pitch speaker
2. Main host of navigation.
3. Front door loudspeaker.
4. Functional instrument
5. Steering wheel wire control switch
6. GPS antenna

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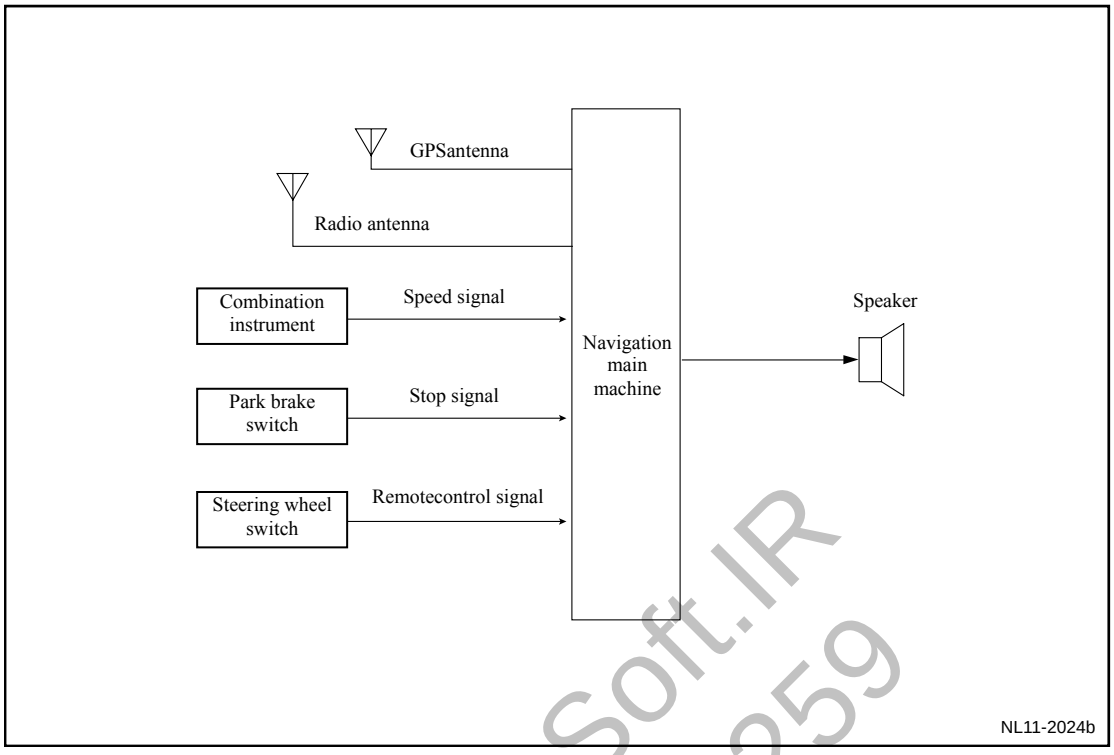
11.3.5 Electrical schematic diagram

11.3.5.1 Diagnostic schematic diagram



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11.3.6 Diagnostic information and steps

11.3.6.1 Visual inspection

– Inspect installed aftermarket equipment that may affect the operation of the audio system.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– For the fault that all speakers don't work, the inspection can emphasize on some positions of speaker circuit which are easy to create short-circuit to the ground

– If a single speaker is inoperative, it may because the audio channel is shielded, causing a single channel inoperative. It is not an audio system malfunction. Refer to the audio system instructions in the user manual.

– For the fault which can't be guided into the navigation interface, it may be caused by the situation that the customer doesn't install SD card with navigation map data, or the card is not special for the purpose use. Firstly, check whether the performance of the SD card and the internal data are normal.

11.3.6.2 System diagnostic description

1. When vehicle is running, it is strictly forvbidden to operate this navigation system to avoid traveling safety caused by distracting attention.

2. When vehicle is running on unflat road, huge jolt may cause sound jumping.

3. GPS positioning of vehicle entertainment navigation system may be affected by weather condition and application places (high building/ tunnel/ basement/ forest), and most of GPS can't be used indoor and basement, and GPS signal also can't penetrate high-story buildings and vehicle heat insulation film or similar products containing metal element.

4. The GPS results provided by the vehicle entertainment and navigation system is only for the driver's reference. If it is abnormal, please travel on the actual road conditions.

5. The electronic navigation geo data provided by the vehicle entertainment and navigation system is only for common reference and cannot provide high accuracy positioning and route planning. The voice prompts and intersection information are the recommendation result calculated in the best path based on the electronic map database for pilot reference only; and the driver must abide by the local traffic rules.

6. When driving, keep the voice instruction volume at the appropriate level to ensure you can perceive the road and vehicle conditions for guarantee safe travelling.

7. Avoid excessive moisture and dust. Do not have the navigation unit get in contact with water. This will cause electric shock, firing or other damages.

8. A too high or too low temperature will interfere with the normal functioning. If the vehicle is closed and the engine parks for a long time in direct sunlight or cold place, the vehicle becomes particularly hot or cold; moreover, the entertainment navigation system may work abnormally in this environment. Once the in-vehicle temperature returns to the normal range, the normal function can be restored. If beyond recovery, please contact with the after-sale service center authorized by Geely Automobile for maintenance.

9. If the vehicle entertainment and navigation system malfunctions (power failure, no image and no sound) or is in an abnormal status (containing foreign matters, water permeation, smoke leak or abnormal smell), do not open the casing, disassemble the unit or lubricate the movable parts. Immediately cut off the power and contact with the service center authorized by Geely Automobile for inspection.

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11.3.6.3 Navigation usage precaution

1. Due to there is difference between each vehicle, when initially using navigation system, there should have a period for correction, so that the vehicle can be positioned more accurately. In the traveling process, the system will automatically and dynamically corrects.

2. If start vehicle after the vehicle stops for a long time, the time navigation system receives GPS signal and re-positioning is longer. Generally, positioning can be successfully finished within 3 min in signal strong area.

3. If GPS in located in places where GPS signal receiving may be affected: such as high buildings on both sides of road, big tree besides road, place under overpass, underground parking garage, place inside tunnel. At this moment, GPS signal can't be received, and positioning effect may also has error.

4. Sometimes the chip security module may fail to identify whether the vehicle is on an elevated road or the ground. After a period of time, the vehicle will be repositioned correctly after the road is branched.

5. If the vehicle runs on one of two parallel roads close to each other which run in the same direction (e.g. main road and auxiliary road), the vehicle may be positioned as runnign on the other road. After a period of time, the vehicle will be repositioned correctly after the road is branched.

6. A high turning speed or travelling on areas other than the middle may result in slight lagged or intermittent positioning. If the turned road has side road, it may be positioned on the side road. After a period of time, the vehicle will be repositioned correctly after the road is branched. Keep running at a lower constant speed when turning, thereby reducing the occurrence of such problems.

7. To avoid excessive no-effect voices and the failure to give out voice prompt at some curves: no fork junction exists at this turning point or the class of the turning point is excessively different from that of the fork junction.

8. During the turning process, the navigator will ask you to "turn to y at the xth crossing" to help the vehicle select the correct route if the road to be accessed is neighbored with other parallel roads in the same direction. One condition easily incurred is side road; at this time, prompt to regard the side road as the road junction.

9. To avoid plugging and removing the SD card when the navigation system is not turned off which will result in the damage and loss of the map file system on the SD card and in turn the failure of the navigation system to normally read the map file for navigation, it is prohibited to plug and remove the SD card when the navigation system is still on.

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11.3.6.4 Localization revision of special road condition under the navigation non-fault status

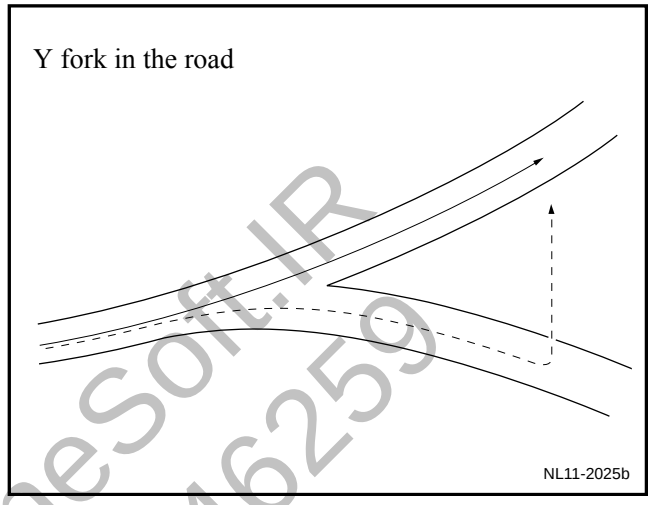
Notes:

The following situations listed are not the fault phenomenon of navigation; if meeting the similar problem during maintenance, do a reasonable explanation to customer after commissioning validation.

Diagnostic steps:

1	Y fork in the road

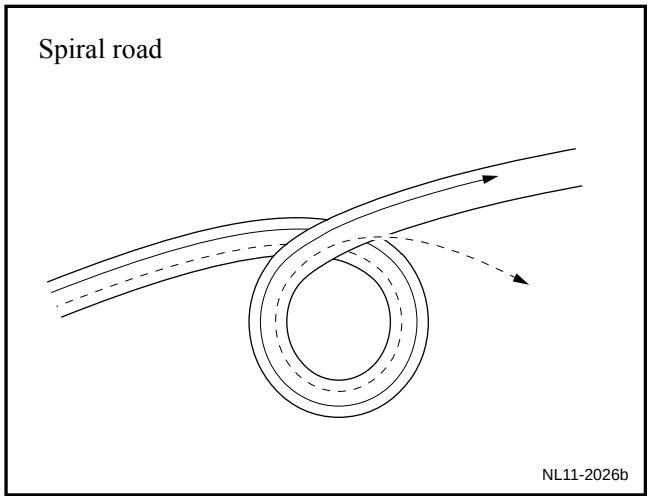
On Y-shaped fork road or similar transition fork road, the error accumulated by the sensor in the running direction may result in the current position mark present to the error road.



Repair method	When continually running for a period of time, the vehicle will be correctly positioned again after the road is branched.

2	Replace the spiral road.

When driving on the larger and continual spiral road (such as annular overpass and the like), the error of angle of turn will be accumulated, and the position mark may be deviated from the current position.



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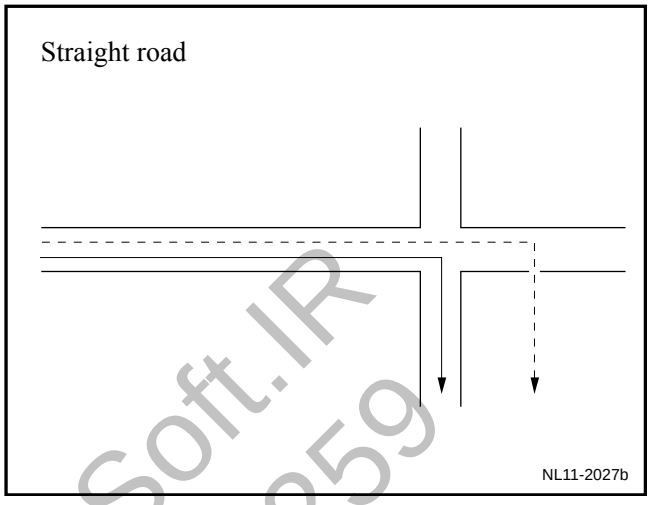
Repair method	When continually running for a period of time, the vehicle will be correctly positioned again after the road is branched.

3	When turning a corner after running straightly

When driving on a longer straight road with smaller stop bending, the map can not sufficiently and effectively match, thereby accumulating the distance error. Thus, the position mark may be deviated from the current position when the vehicle turns a corner.



Repair method	When continually running for a period of time, the vehicle will be correctly positioned again after the road is branched. Keep running at a lower constant speed when turning, thereby reducing the occurrence of such problems.

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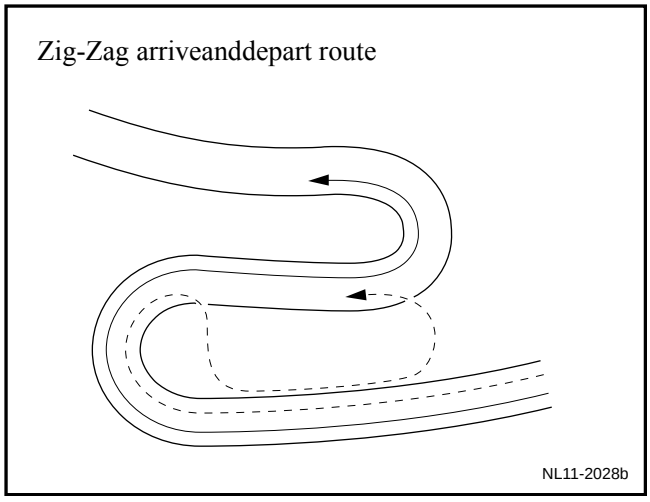
4	Zigzag-shaped round-trip route

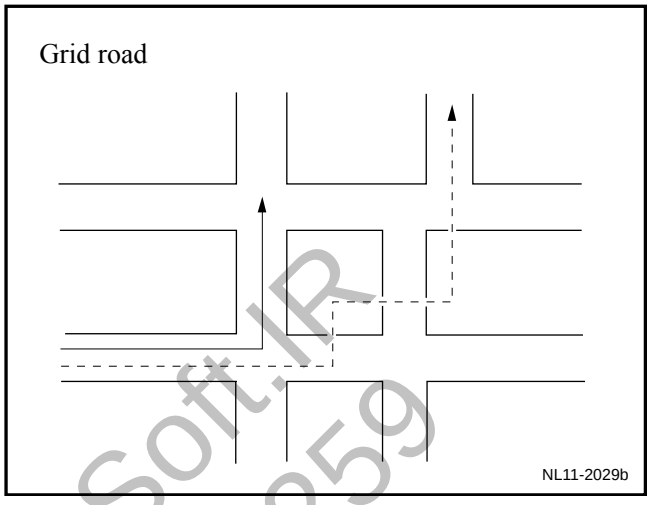
When driving one a zigzagged road, the map may be matched with the other adjacent road in the same direction during turning a corner at every turn, so that the position mark may be deviated from the current position.



Repair method	When continually running for a period of time, the vehicle will be correctly positioned again after the road is branched.

5	Grid road

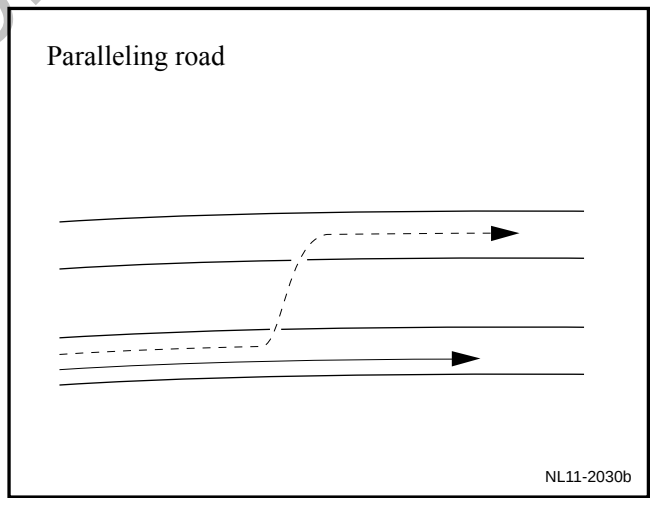
When driving in the place where the road is distributed in a gird manner and there are multiple roads nearby extending along the same direction, the map can match with the other roads, so that the position mark can be deviated from the current position.



Repair method	When continually running for a period of time, the vehicle will be correctly positioned again after the road is branched.

6	Paralleling road

When two roads are parallel (for example, there is another side road adjacent to the highway), the other road may be wrongly matched in the map; thus, the position mark may be deviated from the current position.



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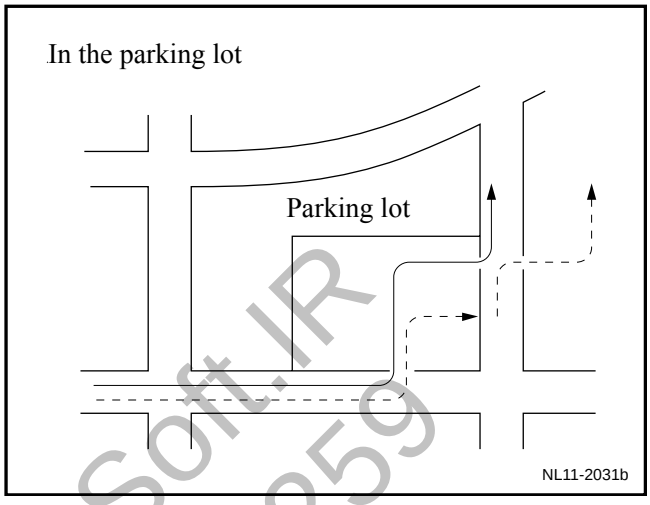
Repair method	When continually running for a period of time, the vehicle will be correctly positioned again after the road is branched.

7	In the parking lot.

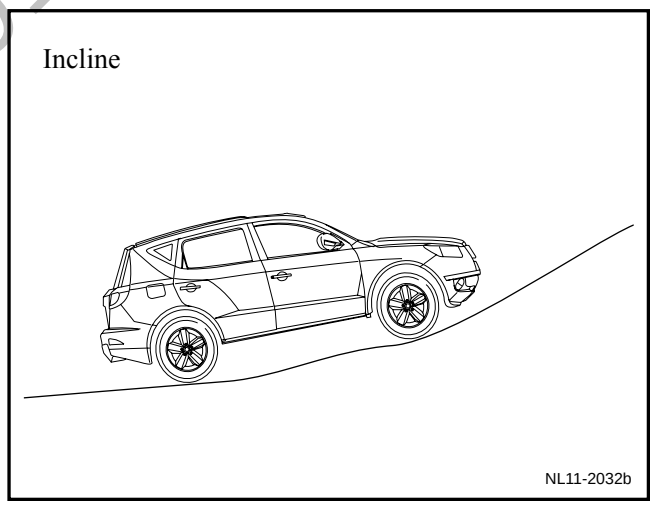
When running in the parking lot or on the road that does not exist in the map, the current position of the vehicle may be marked on the closed road. When the vehicle returns to the road, the position mark point may be deviated from the correct position.



Repair method	When continually running for a period of time, the vehicle will be correctly positioned again after the road is branched.

8	Steep mountain slope and incline.

When parking on a slope road or in the case of the vehicle inclined, the error of angle of turn may be caused, so that the position mark point may be deviated from the correct position.



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Repair method	When continually running for a period of time, the vehicle will be correctly positioned again after the road is branched.

9	Irregular traveling route

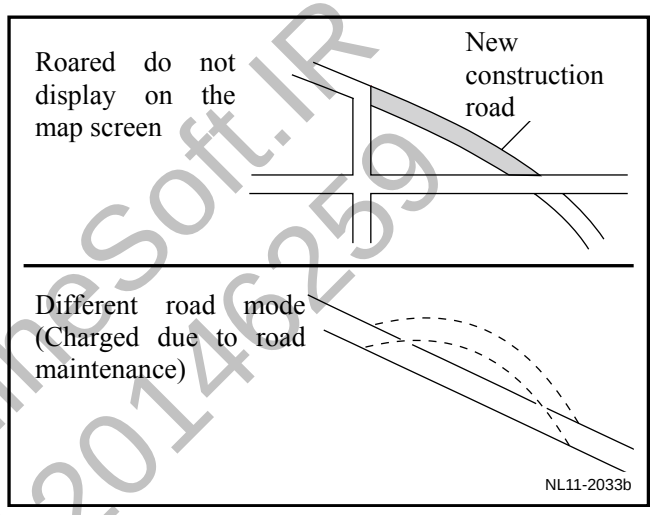
When the lane is frequently changed during driving, the position marking position may be deviated from the correct position.

Repair method	When continually running for a period of time, the vehicle will be correctly positioned again after the road is branched.

10	Map data correlation

(a) When vehicle runs on new road or road which can't be shown on map screen, the map matching function can't make effect. Therefore, when other neighboring roads are matched, the position point will have a little deviation from correct position.

(b) If road shape and actual road stored on map data are different from actual road, the map matching function can't make effect. Therefore, when other neighboring roads are matched, the position point will have a little deviation from correct position.



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Repair method	When continually running for a period of time, the vehicle will be correctly positioned again after the road is branched.

11.3.6.5 Common fault symptom table of navigation

Fault symptom	Cause	Disposal method
The map cannot be successfully activated.	1. Error series number of main host is input when generating active code. It is necessary to update navigation map data.	Correctly update the navigation map data
	2. When map disc has more than two versions, misuse of map disc may cause mismatching of map version whose active code is generated and map version copied into SD card. This will cause map version mismatching and activation operation can't be conducted.	
	3. When continuously operating multiple vehicles, if oil activation code in U disc isn't deleted and new activation code is loaded into SD card directly, it may cause error of file name and map can't be activated.	
Navigation can receive the GPS signal, but the GPS does not synchronously move when the vehicle moves.	The on-board navigation system is equipped with a built-in such devices as a gyroscope, etc which require the vehicle to travel a certain distance for paring the map data.	Drive the vehicle at 60km/h for a period of time, then perform Testing.
The destination is not found out in the map.	1. Input wrong address, such as some big hotel is input into small hotel.	Refer to the Navigation System Operation Manual for correct operation.
	2. Old name is input and name in map is also old, but this unit is renamed, or address is changed, etc.	
	3. Some information related to state security can't be shown in map, such as embassy, waterworks and military unit, etc.	

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11.3.6.6 Navigation main machine can not start

The diagnostic step refers to 11.2.6.3 audio head unit is unable to start.

11.3.6.7 Navigation main machine can start but can not enter into the navigation

1	Check SD card.

(a) `Check if SD card correctly insert.

No → Reinstall SD card

Yes

2	Inspect whether the SD card is the map card dedicated for navigation.

(a) Closed navigation main engine.

(b) Take down SD card from navigation host

(c) Use PC machine to inspect whether there is any other data except for map data in SD card.

Is data on the SD card normal?

No → Re-write the map data in the SD card

Yes

3	Replace SD card,

(a) Closed navigation main engine. Is navigation normal?

(b) Take out SD card

(c) Re-install normal SD card.

Yes → The system is normal.

No

4	Inspect the power circuit of the navigation head unit.

(a) Diagnostic procedure refer to11.2.6.3 audio main machine can not start machine.

Whether power supply circuit is good or not?

No → Handle power circuit malfunctions

Yes

5	Inspect the power circuit of the navigation head unit.

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(a) Refer to 11.2.7.4 Replacement of main host of sound equipment.

6	The system is normal.

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11.3.6.8 May enter into Navigation screen but navigation main engine search GPS

Fault definition: the vehicle is in any position (including open ground), GPS is unable to search any satellite signal.

1	Inspect whether there is cover on the front windshield glass.

Is there a cover material?

Yes → Clear away the covering material.

No

2	Inspect the GPS antenna connector.

(a) For dismantling of main host of navigation, refer to 11.2.7.4 Replacement of main host of sound equipment.

(b) Check if GPS antenna connection is normal

No → Reconnect GPS antenna.

Yes

3	Replace GPS antenna.

(a) For dismantling of GPS antenna, refer to 11.3.7.1 Replacement of GPS antenna.

Is the system normal?

Yes → The system is normal.

No

4	Replace navigation main machine

(a) Refer to 11.2.7.4 Replacement of main host of sound equipment.

Next

5	The system is normal.

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11.3.6.9 Navigation main machine can not closed

Circuit diagram:

See 11.2.6.3 circuit schematic for startup failure of audio unit.

Diagnostic steps:

1	Inspect the work triggering power supply of the navigation head unit.

(a) For dismantling of main host of navigation, refer to 11.3.7.4 Replacement of main host of sound equipment.

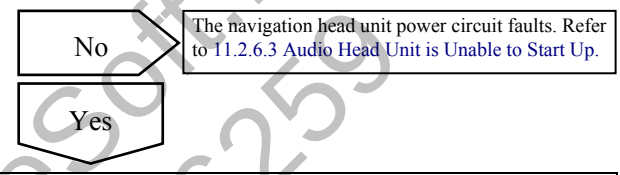
(b) Rotated ignition switch to "OFF" position.

(c) Disconnect navigation main host wire harness connector IP21.

(d) Measure voltage between navigation main host wire harness connector IP21 terminal No. 4 and reliable grounding.

Standard voltage：12V

Whether voltage meet standard value or not?



2	Replace navigation main machine, refer to11.3.7.4 navigation main machine replacement.

11.3.6.10 Navigation main machine can be normal but speaker can not be work

See 11.2.6.4 audio unit can be normally turned on but loudspeaker does not work.

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11.3.7 Dismantle and install

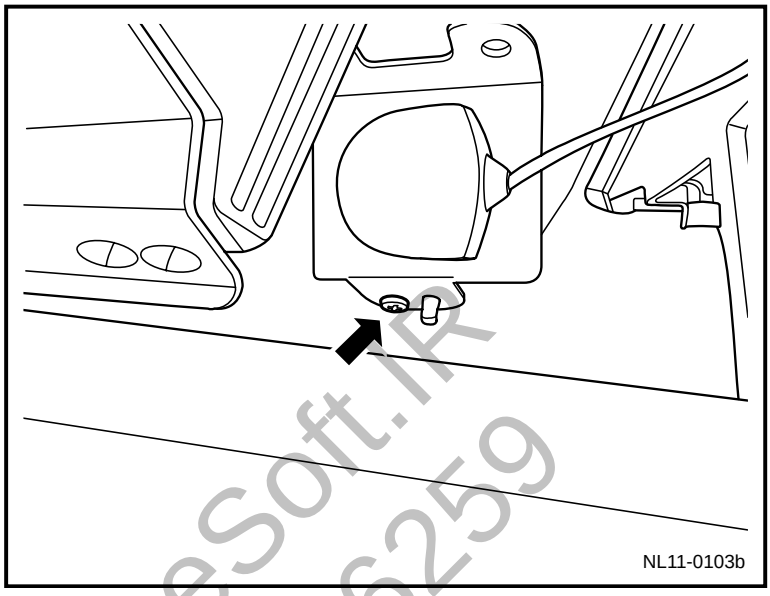
11.3.7.1 GPS antenna replacement

Dismantlement procedure

Warning!

Warning about disconnection of battery shown in "warning and cautions"

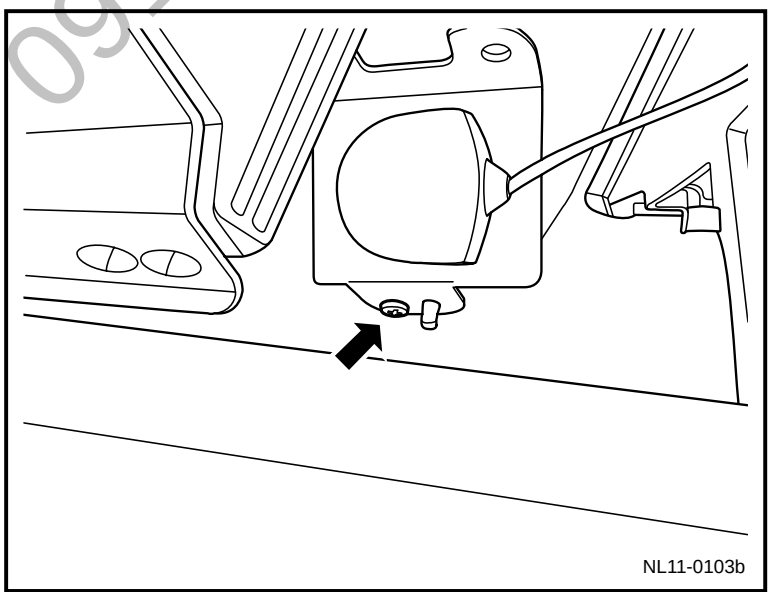
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of navigation main host, refer to 11.2.7.4 Replacement of main host of sound equipment.
3. Disconnect GPS antenna harness connector.
4. For dismantling of upper cover of instrument panel, refer to 12.8.3.1 Replacement of instrument panel.
5. Remove the GPS antenna fixing screws.



Installation procedure:

1. Install GPS antenna, and tighten fixing screw.

   Torque :4Nm(Metric) 3lb-ft(English system)
2. Install Upper cover of instrument desk.
3. Connect GPS antenna wire harness connector.
4. Install main host of navigation.
5. Connect the battery negative cable.



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11.3.7.2 Speaker replacement

See "replacement of front door loudspeaker".

See "replacement of rear door loudspeaker".

11.3.7.3 Radio antenna replacement

See "Replacement of receiver antenna".

11.3.7.4 Navigation main machine replacement

See "Replacement of audio unit".

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11.4 Lighting system

11.4.1 Specification

11.4.1.1 Bulb specification

Component name	Bulb name	Bulb model	Power
Front combination lamp assembly	High beam	H7	12v 55w
	Low beam	Halogen bulb	12v 55w
	Steering lamp	License lamp	12v 21w
	Front position lamp	Turn on the following lights: turn head lamp/turn signal light lever.	12v 5w
Rear combination lamp assembly	Brake lamp	Ceiling lamp	---
	Rear position lamp	Ceiling lamp	---
	Rear steering lamp	License lamp	12v 21w
	Reverse lamp	W16w	12v 16w
Front fog lamp assembly	Front fog lamp	H11	12v 55w
	Daytime running light	-	-
Rear fog lamp assembly	Rear fog lamps	The indicator will be on when all the lights on.	12v 21w
High brake light assembly	High mounted brake lamp	Ceiling lamp	---
License plate lamp assembly	License lamp	Turn on the following lights: turn head lamp/turn signal light lever.	12v 5w
Front indoor dome light assembly	Left side reading lamp	Turn on the following lights: turn head lamp/turn signal light lever.	12v 5w
	Right side reading lamp	Turn on the following lights: turn head lamp/turn signal light lever.	12v 5w
Intermediate indoor dome	Left side reading	C5w(regardless of and left and right ,only has one	12v 5w

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light assembly	lamp	bulb)	
	Right side reading lamp	-	-
	Door control lamp	-	-
Glove compartment lamp assembly	Glove box lamp	-	-
Trunk lamp assembly	Trunk lamp	Turn on the following lights: turn head lamp/turn signal light lever.	12v 5w
Door lamp seat	Door lamp	W3w	12v 3w

11.4.1.2 Fastener specifications

Fastener name	**Model**	**Torque range**	
		Metric (N.m)	**English system (lb-ft)**
Fixing bolt of left/right front combination lamp assembly	M6×16	7-9	5.2-6.7
Fixing nut of left/right rear combination lamp assembly	ST4.8×16	4-6	3-4.4
Self tapping screw of left/right front fog lamp assembly	ST4.8×16	4-6	3-4.4
Left/right rear fog lamp assembly self tapping screw	ST4.8×13	4-6	3-4.4
Self-tapping screw of front reading lamp assembly	ST4.2×16	2-4	1.5-3
Self-tapping screw of rear reading lamp assembly	ST4.2×16	3-5	2-4
Self-tapping screw of high braking lamp assembly	ST4.8×13	4-6	3-4.4

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11.4.2 Description and operation

11.4.2.1 Description and operation of outside lighting system

Headlamp

The headlamp is controlled by the multi-function control lever at the left side of the steering column. When turning the headlamp switch to the first position, turn on the position lamp, the license plate lamp and the dashboard illuminating lamp. When turning the front headlamp switch to the second position, turn on all the above lamps, and further turn on the front ceiling lamp.

Turn the switch to the close position, turn off all the lamps.

The high beam and low beam of the headlamp are controlled by the control lever. When switching on the headlamp, push the control lever until the click appears, that is, the high beam changes to low beam. When the high beam of headlamp is switched on, the indicator lamp on the instrument assembly will be on. Pull the lever towards the driver, the headlamp changes from high beam to low beam. Continuously pull the lever towards the driver, the headlamp changes from low beam to high beam again. When releasing, the control lever will automatically return to the low beam position.

The headlamp must focus to realize the correct illumination of road surface. When installing a new headlamp assembly or carrying out maintenance for front area, it may affect the headlamp assembly or the installation seat, so it is necessary to inspect the light of headlamp.

If the headlamp does not turn off, remind the buzzer

When the headlamp switch is in the position ON of the headlamp or the position lamp, as well as when the ignition switch is not in the position of "ON (On)","ACC (Accessory)" or "START (Start)", the driver door state is monitored by the body control module at this time; and if the left front door is opened, the buzzer beeps through the body control module. If the body control module does not detect that the headlamp switch is opened after turning off the headlamp, the buzzer will not beep.

Position Lamp and Steering Signal Lamp

Turn the lighting switch to the first position to turn on the position lamp. Turn the ignition switch to "OFF (off)" position to turn off the position lamps. When the steering signal lamps are enabled, the front and rear steering signal lamps and side steering signal lamp flash to send out steering signal. Steering signal lamps only work when the ignition switch is turned on. Steering signal lamps are controlled by switch of the lamp at the left side of the steering column. Move the control lever up or down (beyond the retaining-point) will turn on front, rear and side steering signal lamps. After turning, return the control lever to the horizontal position, **steering signal lamps will stop flashing**.

When changing lane or turning at a small corner, the steering wheel angle may not be great enough to cancel steering signal, so the signal lever will stop and maintain at a position. When the lever is released, the control lever will return to the horizontal position and steering signal will be canceled. When the remote control anti-theft system works, the BCM can control the flicker of the steering indicator lamp to show the working condition of the remote control anti-theft system.

Fog lamp

Fog lamp switch is located on the multi-function lever at the left side of the steering column. When the lighting switch is turned on, rotate the front fog lamp switch on the multi-function lever to switch on the front fog lamps. At the same time, the fog lamps indicator will be lit. To use the rear fog lamps, turn on headlamps (or position lamps) first, with the front fog lamps turned on, rotate the multi-function lever to the position of rear fog lamps. The rear fog lamp indicator will be on, indicating the rear fog lamps are turned on. Press the switch again to turn off rear fog lamps. The indicator will be off.

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Fog lamps must be adjusted to achieve the correct lighting. After installing a new bulb or the repair of front area may have affected the installation of front fog lamps, inspect the light of the fog lamps.

Rear Combination Lamp

Rear position lamps, brake lamps, rear fog lamps, steering signal lamps and reverse lamps are forming an assembly.

Rear fog lamps form a separate assembly. When the headlamps or position lampsj are turned on, rear position lamps will be turned on. When stepping on a brake pedal, the rear position lamp is brighter as a brake lamp at this time.

The center high mounted brake lamp which is located at the top of back door will bje turned on when depressing the brake pedal.

Reverse lamp

Two reversing lamps are located in the rear combination lamp. When the transmission is in reverse position, the reverse lamps will be turned on. The reverselamps are controlled by a reverse switch connected with the transmission.

License lamp

License lamp will be turned on when headlamps or position lamps are on. The ljicense lamps are installed on top of the license plate.

11.4.2.2 Description and operation of inside lighting system

In-vehicle door control lamp

The door controlled lamp is arranged in the center ceiling lamp; the switch is located at the left of the mask; when the switch is pressed, the door is opened, the door controlled lamp turns on; the door is closed, the door controlled lamp delays for several seconds to turn off. When the switch is switched off, the door is opened; the courtesy lamp does not turn on.

Reading lamp

In the middle part of the intermediate dome lamp, the switch is located in the middle part of the mask, the bulb turns on when pressing the switch and the bulb turns off when uplifting the switch.

Trunk lamp

The trunk lamp is located on the left wheel cover decoration plate. The lamp will turn on as long as the trunk is opened.

11.4.2.3 Comfortable lighting control function

Function of taking you home

Under the fortification state (the body anti-theft non-alarm state), consecutively press the remote-control lock twice within 2s, output the headlamp control signal for 60s, i.e., turn off the headlamp after delaying for 60s; within the 60s of delaying, press the remote-control unlock key once, stop the signal output through the BCM, and turn off the headlamp. (Do not unlock and exit protection process)

Automatic lighting function

1. When placing key to ON position of ignition switch and after keeping for 500, headlamp button on lamp switch handle is placed to AUTO position, if information about environment light sensor received by BCM control unit is in switching on condition (light is dim), BCM will switch on headlamp relay and light up small lamp.

2. When key is located on ON position of ignition switch and keep for 500ms, headlamp in vehicle lamp switch handle is turned to AUTO position, if BCM control unit receives

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environment light sensor information on disconnection status (sun light is strong), BCM will disconnect headlamp relay and go out small lamp (if front automatic lighting function is effective, BCM will disconnect headlamp relay after 3s, and small lamp will flame out.

3. When headlamp button in lamp switch handle is placed in AUTO position, when key is plugged from ON position of ignition switch, if information of environment light sensor received by BCM on previous time is in switching on status (light is dim), BCM will switch on headlamp relay and light up small lamp for 60s.if it receives remote control lock or key lock signals, this function stops.

4. In the event of a shortcircuit of headlight relay, BCM must be shortcircuit safe and record and store relevant malfunctions.

5. When the ignition switch is in the ACC or OFF position and the lamp switch is turned from AUTO to other position, BCM will provide no output and the lamp will not go on when the switch returns to AUTO.

6. When the ignition switch is in the ON position and the light switch is turned from AUTO to the other position, BCM provides no output and the automatic lighting function will be resumed when the light switch is turned back to AUTO position.

Bulb Detection Function

During turning, if one of the steering signal lamps is (21W) damaged the other steering signal lamps of the same side will flash at a frequency about double of normal frequency.

Fading and lightening function

The external prerequisite for the BCM to control the room lamp is that the room lamp switch is put in the "DOOR" position.

1. The following 2 conditions should be met:

– Key is placed in pull-out position of ignition switch;

– Four doors are closed,

If pressing the wireless remote control unit unlocking button, BCM drives to tujrn on the indoor dome lamp. When the above mentioned 2 conditions are met continuously, the BCM turns on the in-vehicle roof lamp in a delayed manner and the in-vehicle roof lamp goes out 30s later if the wireless remote control unlocking button is pressed multiple times and timing is from the last press.

2. If key is unplugged from LOCK position of ignition switch, BCM will delay to light up indoor lamp for 30s and then extinguish it.

3. If conditions of 4 doors are changed from not-all-closed conditions into all-closed conditions:

– If the key is placed to the ON position of ignition switch, BCM will immediately extinguish dome lamp.

– If the key is placed to the unconnection or position other than ON position of ignition switch, BCM will light the dome lamp and last for 30s before extinguishment.

If the four doors are not closed completely from the state of being closed completely, the BCM turns on the indoor dome lamp and shields all started functions of turning on through delaying for 30s. If the four doors are not closed completely, the indoor dome lamp turns on for 10min through delay to turn off. If the dome lamp turns on within 10min consecutively, the timer re-clocks when there is a signal that another door is opened.

4. The following 2 conditions should be met:

– Key is placed in pull-out position of ignition switch;

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– Four doors are closed,

If pressing the wireless remote control unit lock key or the front door key locking button, BCM immediately turns off the indoor dome lamp.

5. The BCMj drives the indoor roof lamp and ignition switch light to work in the FADE UP AND FADE DOWN mode with 0.7s to turn from full out conditjion to full on condition and 1.7s to turn from full on condition to full out condition.

6. In the event of a shortcircuit of the in-vehicle roof lamp, the BCM must be shortcircuit safe and record and store the data about relevant malfunctions.

Keyhole lighting lamp

1. Door turn on.key hole lighting lamp light on ; Door closed.it automatically go out after 3min.

2. Turn on ignition switch (ON), and key hole illuminating lamp lights up.

3. The following 2 conditions should be met:

– Key is placed in pull-out position of ignition switch;

– Four doors are closed,

If pressing the wireless remote control unit lock key or the front door key locking button, BCM immediately turns off the illuminating lamp for key hole.

4. When four doors are not all closed, the keyhole light will go out after being kept on for additional 10min. If the key hole illuminating lamp turns on within 10min consecutively, the timer re-clocks when there is a signal that another door is opened.

5. In case of a shorcircuit of the keyhole lamp, the BCM must be shortcircuit safe and record and store the data about relevant malfunctions.

– Paint film should have sufficient flexibility and allow the plastic deformation without rupture.

– Plastic pieces can reflect some of the original particles and rough surface texture.

Patching procedure for painted surface of plastic parts surface

The plastic primer surface repair can refer to the local spraying process, and pay attention to the low-temperature baking.

The baking condition is at 70-80℃ (158-176 ºF) for 20-30 min.

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11.4.3 System work principle

11.4.3.1 System operating principle

Headlamp operating principle

When the light combination switch is turned to the “headlamp” gear, the operating voltage is input through a terminal No. 13 of the combination switch wire harness connector IP42, and the headlamp relay is driven to close through control grounding of a terminal No. 16 of the wire harness connector IP42 to turn on the headlamp. The headlamp supply voltage is transmitted to the headlamp optical axis regulating switch as well as left and right headlamp optical axis regulating motors; at this time, the signal voltage of the regulating motor can be changed by turning the regulating switch up and down, thereby realizing the height regulating function of the headlamp.

Notes:

The regulating motor may not work or be damaged due to the frequently turning of the button. When BCM (centralized controller) monitors that the voltage of a terminal No. 6 of a light combination switch wire harness connector IP42 is less than 1V, which shows that the switch is in "AUTO" (automatic transmission); at this time, the BCM shall monitor a signal from an ambient light sensor; if the ambient illumination is not strong, the BCM will input power supply from a terminal No. 5 of the IP49, a headlamp relay is driven to close by controlling grounding through a terminal No. 7 of a wire harness connector IP50, so that the headlamp automatically turns on; when the ambient illumination is strengthened, the MCB cuts off the power supply output, so as to realize that the headlamp automatically turns off.

When the light combination switch is turned to the high beam position, the operating voltage is input through the terminal No. 7 of the combination switch wire harness connector IP42, and the high beam relay is driven to close through control grounding of the terminal No. 16 of the wire harness connector IP42 to turn on the high beam; and at the same time, the high beam provides.

Voltage is sent to the instrument to turn on the high beam indicator lamp therein.

Notes:

The working voltage of high beam lamp relay is from the headlamp power supply circuit.

Position lamp operating principle

When the light combination switch is turned to the "headlamp" gear, the switch signal is output to a terminal No. 26 of the BCM wire harness connector IP50 through a terminal No. 14 of the wire harness connector IP42 of the combination switch, and the operating voltage turns on all position lamps through BCM wire harness connector position lamps passing through IP49-20 and IP49-10; the operating voltage turns on left and right license plate lamps through the BCM wire harness connector position lamps passing through IP49-8; and at the same time, the voltage is transmitted to a back light regulating switch, and the brightness of the back light can be regulated through the switch.

Front fog lamp operating principle

Coil driving power supply of the front fog lamp relay is from the terminal No. 8 of the IP49 of the BCM. When the front fog lamp switch is switched off, the switch provides the grounding circuit to drive the front fog lamp relay to close, and the operating voltage turns on the front fog lamp through the relay. Meanwhile, this voltage is transmitted to the instrument.

Illuminate the front fog lamp indicator.

Rear fog lamp operating principle

Coil driving power supply of the rear fog lamp relay is from terminal No. 8 of the IP49 of the BCM. After the rear fog lamp switch is closed, the rear fog lamp turns on. At the same time, this voltage is sent to the instrument panel to light the front fog lamp indicator.

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Steering lamp operating principle

Multifunctional steering column controls the grounding circuit of the terminal No. 1 and 3 of the light combination switch wire harness connector, and the grounding signal is transmitted to the BCM. The BCM respectively turns on the left and right steering lamps through the output voltages of Terminals 8 and 9 of the harness connector IP48.

Notes:

When pressing down a hazard warning lamp button, the BCM outputs voltage to the two circuits and turns on all steering lamps.

Brake lamp operating principle

The brake lamps are controlled by the brake lamp switch on the brake pedal. When the brake pedal is depressed.The working voltage is directly sent to the brake lamp bulb through the switch.

Notes:

The high braking lamp is arranged at the topside of the back door.

Reverse lamp operating principle

The reverse lamp is controlled by the reverse lamp switch arranged on the transmission. When the vehicle is at reversing, the working voltage is directly sent to the brake lamp bulb through the switch.

Operating principle of courtesy lamp and luggage compartment (back door) lamp

The power supply of the courtesy lamp and the trunk lamp is from the indoor fuse IF06.

When opening the door, a grounding circuit of a courtesy lamp is connected by a door latch switch, so that the courtesy lamp of the door turns on.

After opening the back door, the back lock latch switch will access the grounding circuit of the trunk lamp to turn on the trunk lamp.

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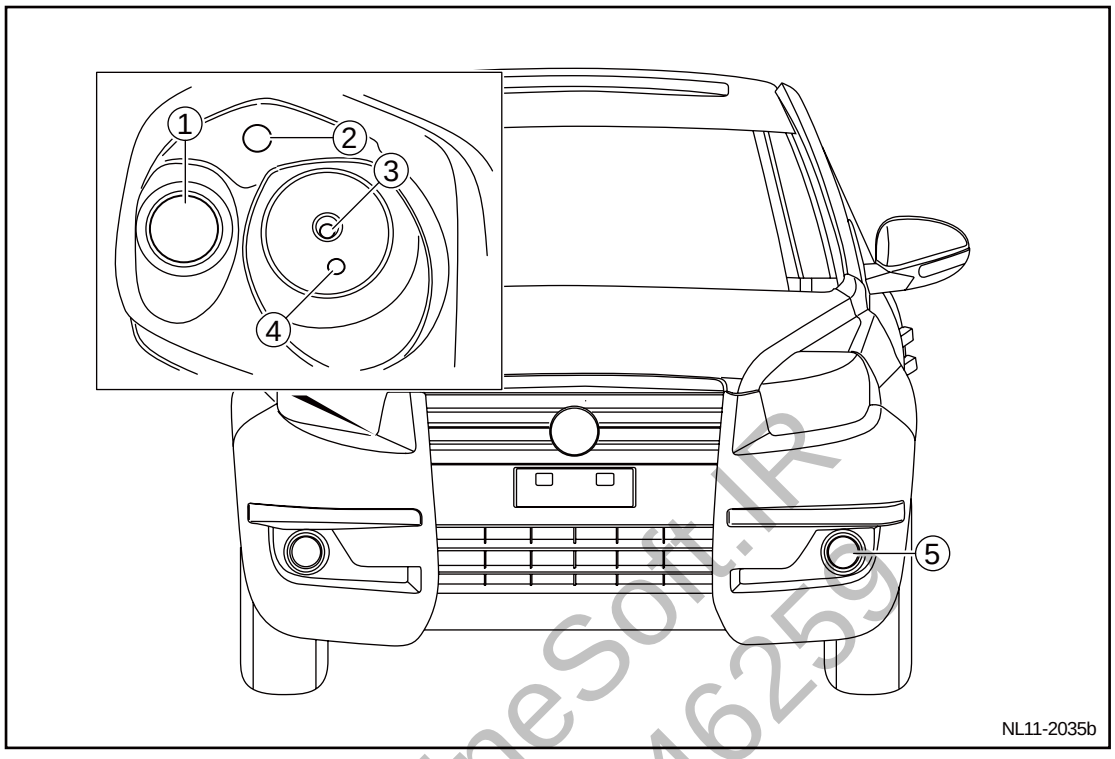
11.4.4 Part position

11.4.4.1 Component position

Front-end of vehicle body



1. Low beam
2. Steering lamp
3. High-beam lamp
4. Position lamp
5. Front fog lamp

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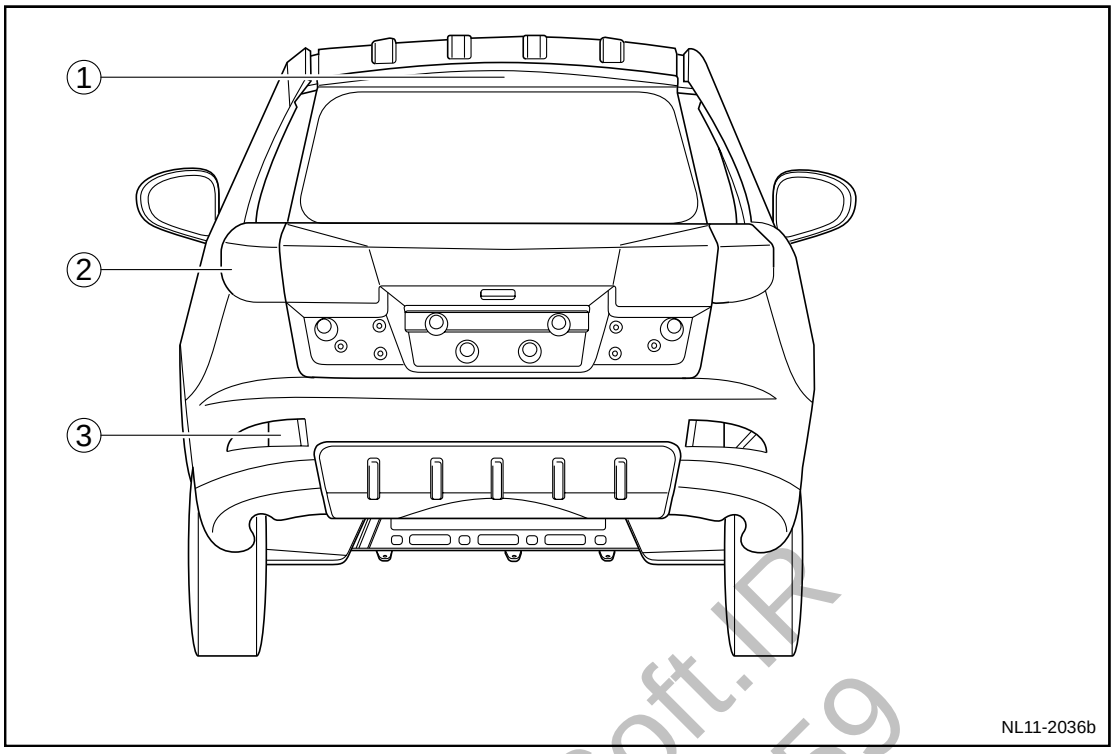
Rear-end of vehicle body



1. High brake lamp
2. Rear combination lamp assembly
3. Rear fog lamp (added rear reflex reflector)

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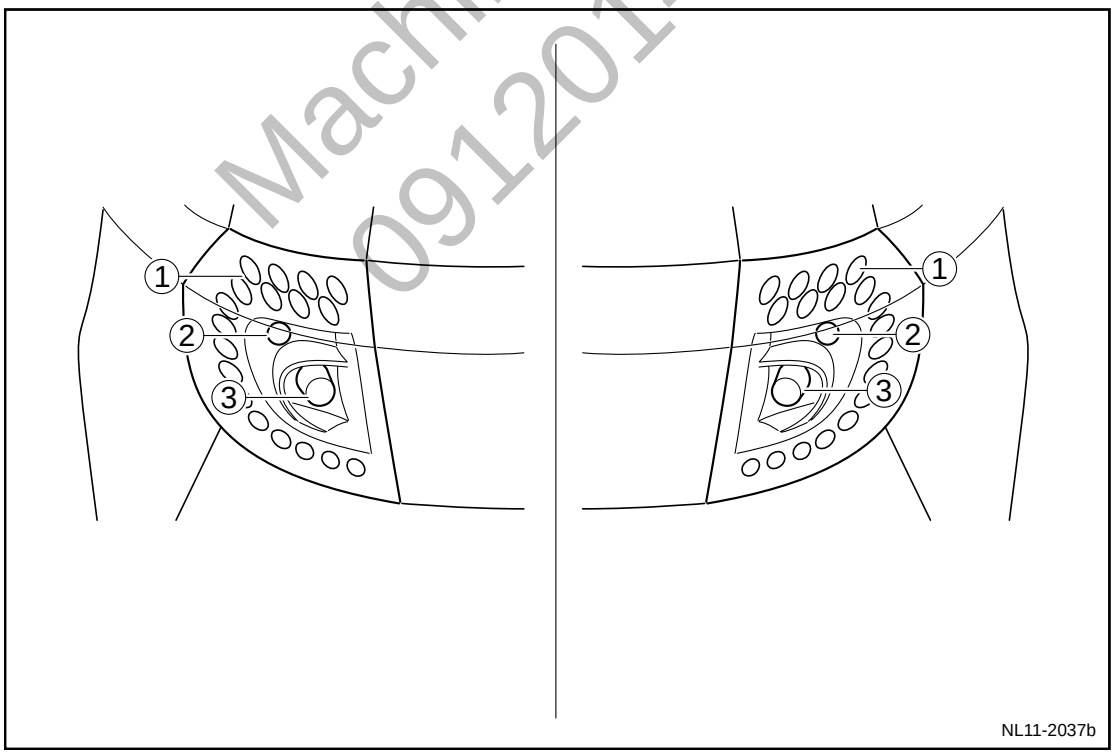
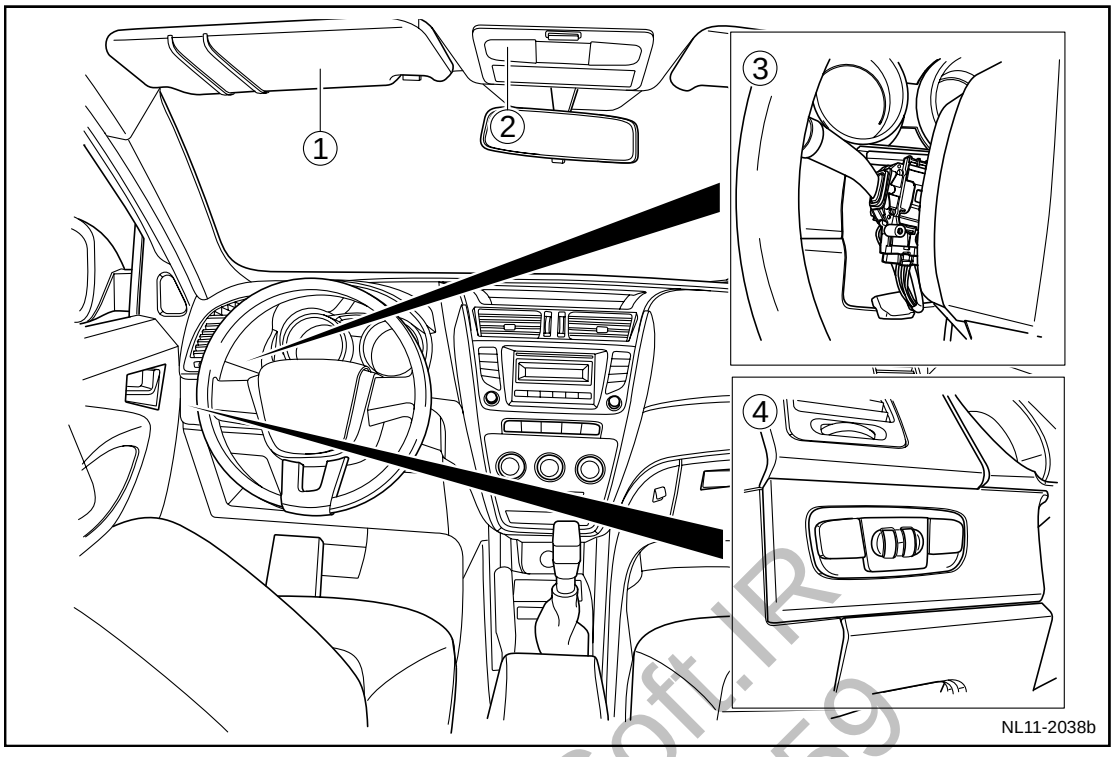
Rear Combination Lamp Assembly



1. Brake light and position light
2. Steering lamp
3. Reversing lamp

Indoor lamp and switch



1. Sunvisor
2. Reading lamp
3. Multi-function lever rod
4. Front headlight height adjustment switch

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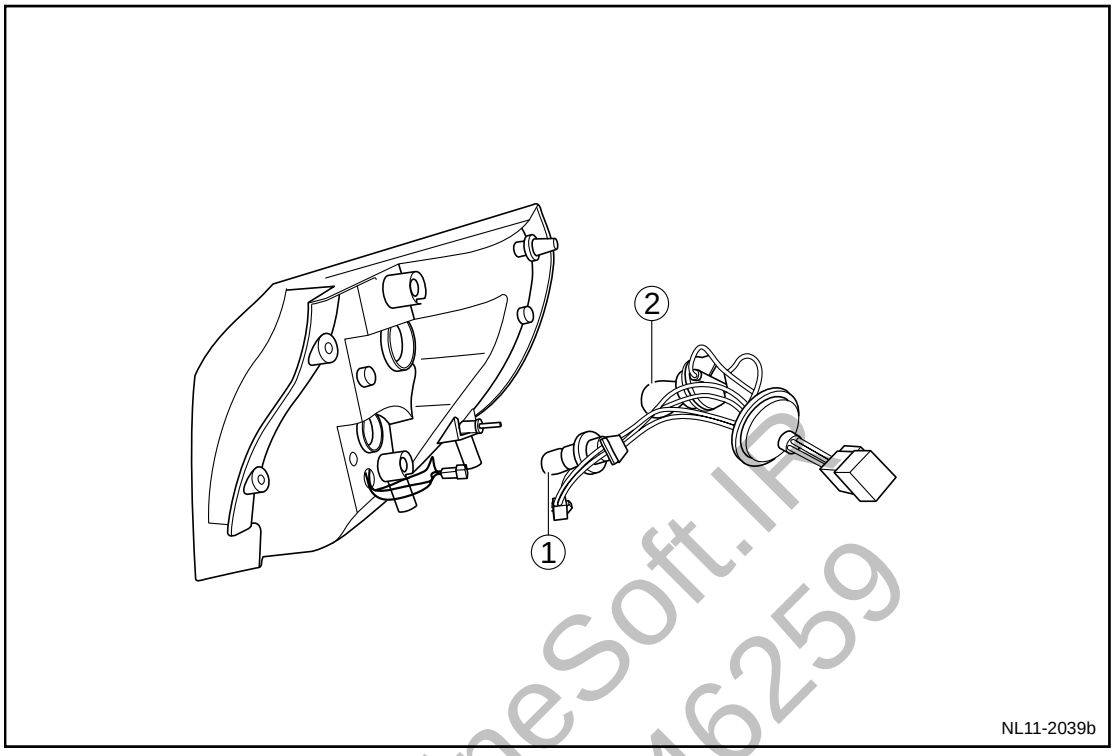
11.4.5 Disassemble drawings

11.4.5.1 Disassemble drawings

Rear combination lamp assembly



1. Bulb of reverse lamp
2. Bulb of steering lamp

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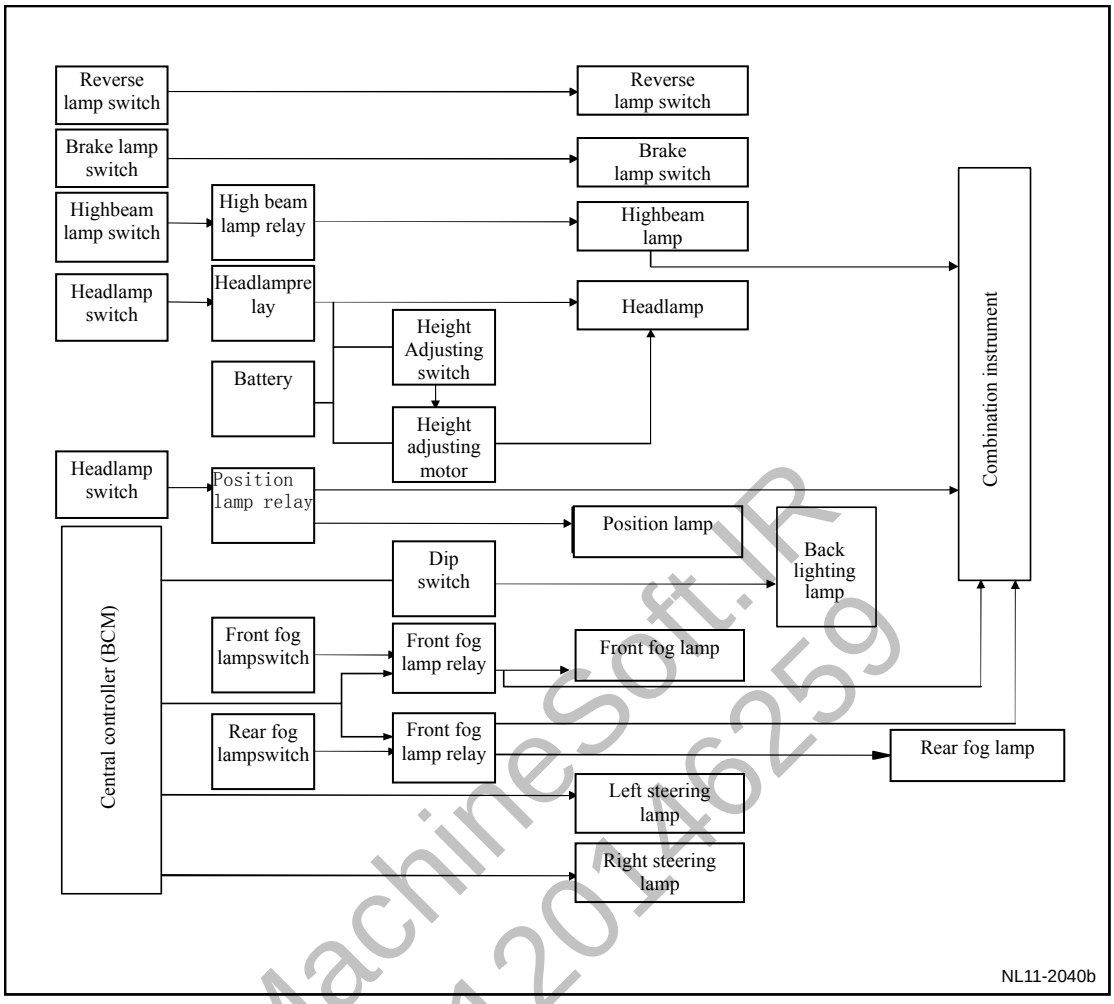
11.4.6 Electrical schematic diagram

11.4.6.1 Diagnostic schematic diagram



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11.4.7 Diagnostic information and steps

11.4.7.1 Diagnosis descriptions

Refer to 11.4.2 description and operation to get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.4.7.2 Visual inspection

– Installed aftermarket equipment that may affect the operation of front windshield wiper/washer system.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– If there is only one inoperative lamp, before replacing the bulb, inspect and repair poor connections or open circuit malfunction to power supply or ground.

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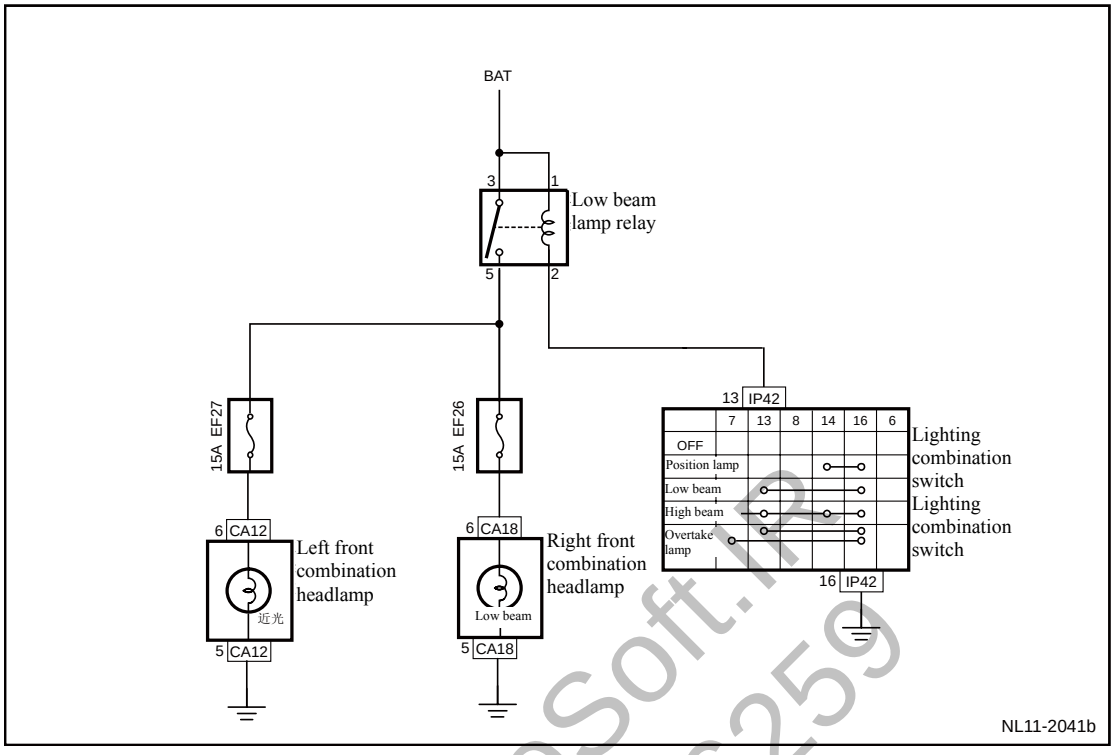
11.4.7.3 Headlamp inoperation

Circuit diagram:



Diagnostic steps:

1	Inspect the left front or right front headlamp bulb.

A. Dismantle Left front rear right front headlamp bulb

Is the bulb filament blown?

No — Go to step 3

Yes

2	Replace headlamp bulb with fault

A. Replace the malfunctioning headlight bulb.

Confirm whether the headlamp is working correctly.

Yes — The system is normal.

No

3	Repair the fuse EF26 or EF27.

A. Check whether Fuse EF26 or EF27 is blown.

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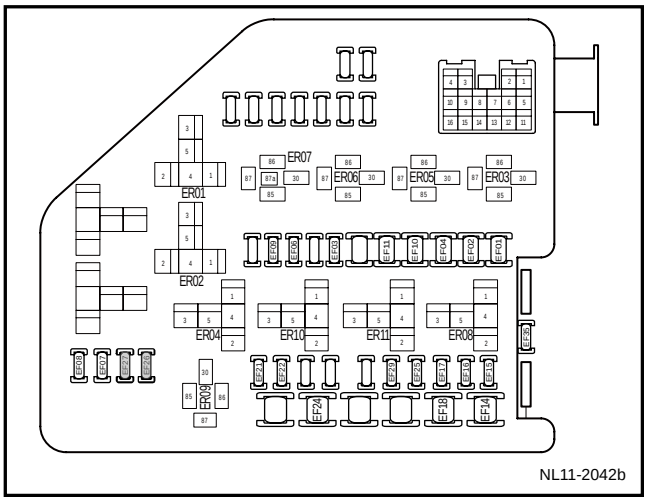
Fuse Rating: 15A



No → Go to step 5

Yes

4	Check fuseEF26or EF27 line

A. Check whether Fuse EF26 or EF27 line is short circuited.

B. Repair the line to confirm that there is no line short circuit.

C. Replace the fuses with rated current.

Confirm whether the headlamp is working correctly.

Yes → The system is normal.

No

5	Check fuseEF26 or EF27 voltage

A. Turn on the headlight and measure the voltage of Fuse EF26 or EF27 with a multimeter.

Standard voltage: **11-14 V**

Confirm if the voltage conforms to standard value.

No → Go to step 9

Yes

6	Inspect the circuit between the terminal No. 6 of the headlamp wire harness connector CA12/CA18.

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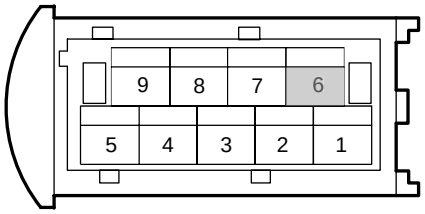
(a) Turn on headlamp and use multimeter to measure voltage of wire harness connector connector CA12/CA18 terminal No. 6.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.

CA12/CA18 front combination headlamp harness connector



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Yes → Go to step 11

No

7	Inspect the circuit between the headlamp fuse EF26/EF27 and the terminal No. 6 of the headlamp wire harness connector CA12/CA18.

(a) Use multimeter to measure resistance between headlamp fuse EF26/EF27 and headlamp wire harness connector terminal CA12/CA18 terminal No. 6.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → Go to step 9

No

8	Repair the open circuit fault between the headlamp fuse EF26/EF27 and the terminal No. 6 of the headlamp wire harness connector CA12/CA18.

(a) Make sure that the open-circuit fault between headlamp fuse EF26/EF27 and headlamp wire harness connector terminal CAN12/CA18 terminal No. 6 is repaired.

Whether the headlamp normally works.

Yes → The system is normal.

No

9	Replace the low beam relay to the headlamp relay.

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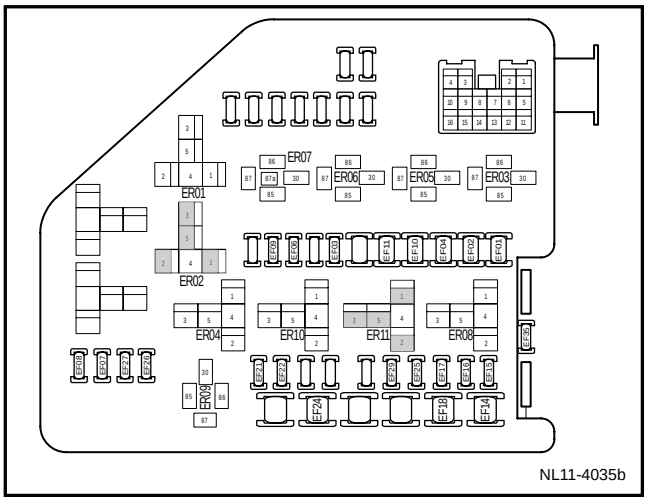
(a) After replacing the relay, the headlamp turns on .



No → Go to step 11

Yes

10	Install the new headlight relay

A. Install the distance light relay back to the original position and then install a new headlight relay.

Confirm whether the headlamp is working correctly.

Yes → The system is normal.

No

11	Inspect the resistance between the terminal No. 5 of the headlamp wire harness connector CA12/CA18 and body grounding.

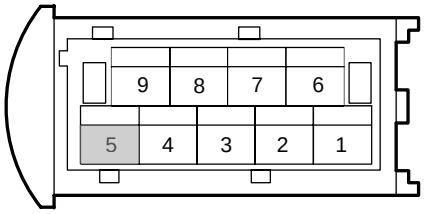
A. Disconnect the headlight harness connectors CA12/CA18.

B. Measure the resistance between Terminal 5 of the headlight harness connector CA12/CA18 and the body ground wire with the universal meter.

Standard resistance: less than 1 Ω

Confirm whether the resistance is at a specified value.

CA12/CA18 front combination headlamp harness connector



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Yes → Go to step 14

No

12	Repair the open circuit fault between the headlamp wire harness connector CA12/CA18 and the body grounding.

A. Confirm that the open circuit between Terminal 5 of the harness connector CA12/CA18 of the headlight and ground wire of the body is fixed.

Confirm whether the headlamp is working correctly.

Yes → The system is normal.

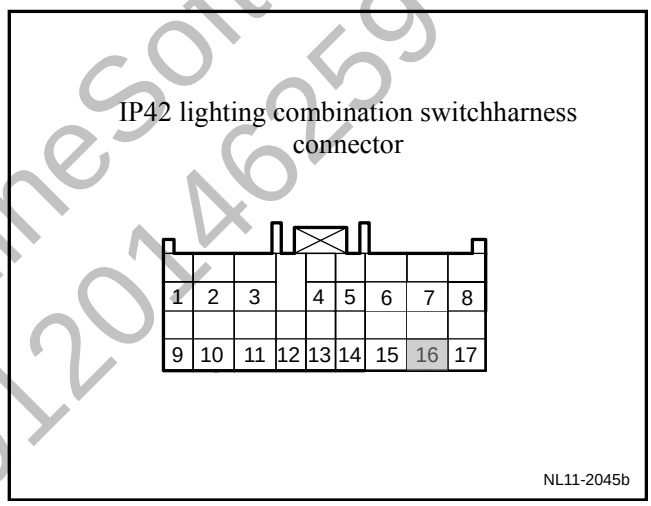
No

13	Measure the voltage of Terminal 16 of the harness connector IP42 of the combination light switch.

(a) Measure voltage of light combined switch wire harness connector IP42 terminal No. 16 (wire harness connector needn't to be disconnected).

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



No → Go to step 15

Yes

14	Repair the terminal No. 16 of the light combination switch wire harness connector IP42 and grounding circuit.

(a) Repair open-circuit fault between light combined switch wire harness connector IP42 terminal No. 16 and vehicle body grounding.

Confirm whether the headlamp is working correctly.

Yes → The system is normal.

No

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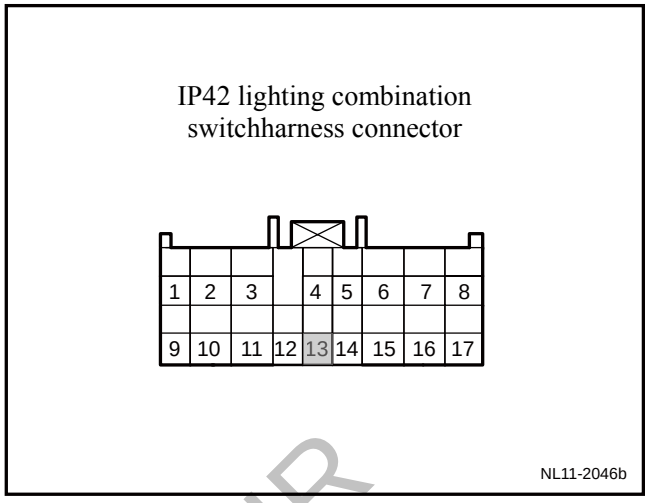
15	Inspect the voltage of the terminal No. 13 of the light combination switch wire harness connector IP42.

A. Measure lighting combination switch harness connector IP42 terminal No.13 voltage

Standard voltage: 11-14 V



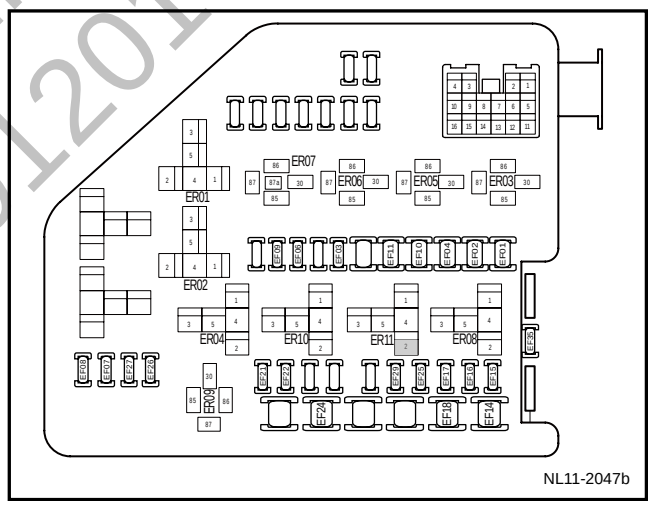
Yes → Go to step 17

No

16	Inspect the circuit between the terminal No. 2 of the low beam relay and the terminal No. 13 of the light combination switch connector IP42.

(a) Inspect and repair short-circuit fault between lower-beam lamp relay terminal No. 2 and light combined switch connector IP42 terminal No. 13..

Confirm whether the headlamp is working correctly.



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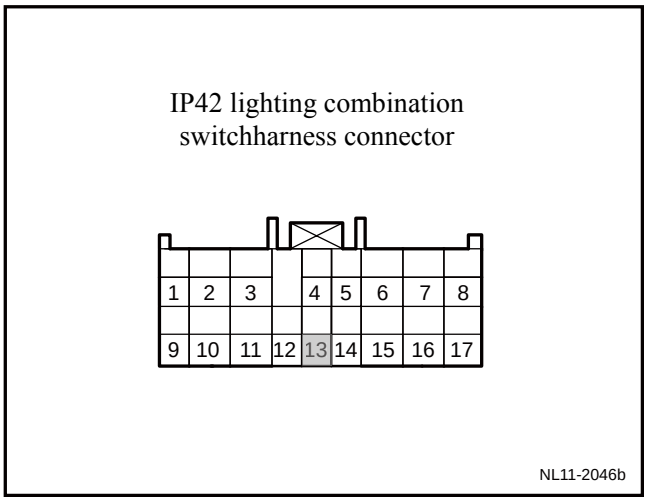

Yes → The system is normal.

No

17	Replace combination switch ,

(a) Refer to 11.3.8.1 Replacement of light combined switch.

Confirm the completion of repair.

Yes → The system is normal.

No

18	The system is normal.

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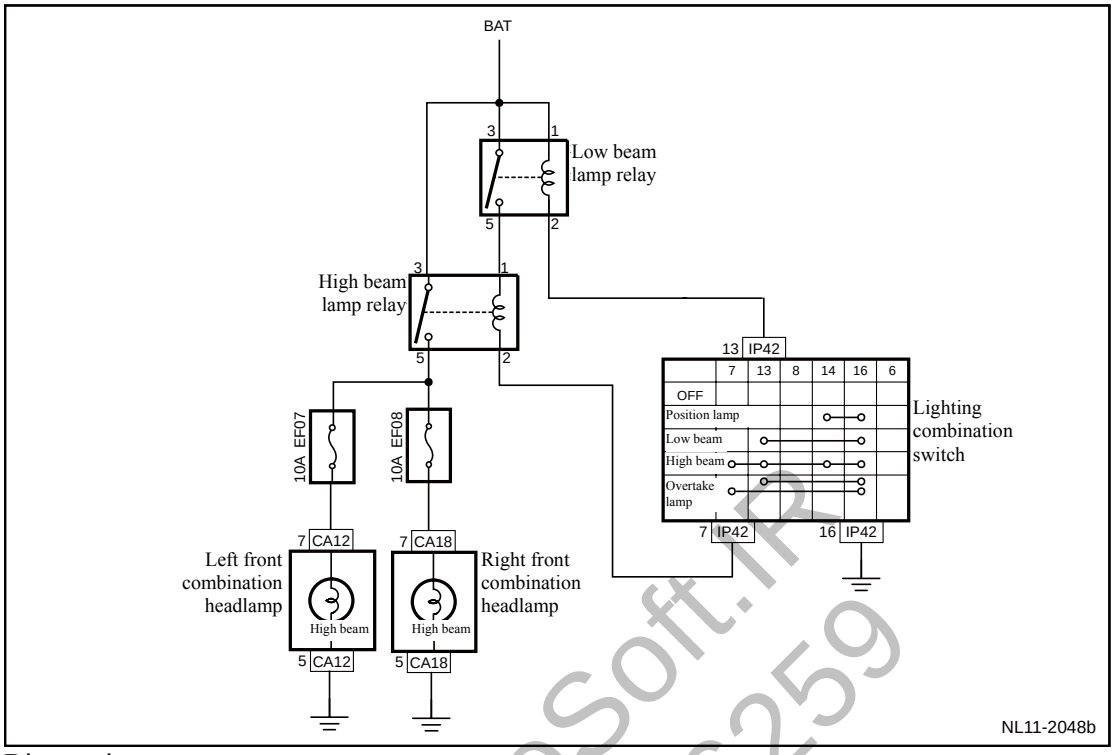
11.4.7.4 High beam lamp do not work

Circuit diagram:



Diagnostic steps:

1	Inspect the left front or right front high beam bulb.

A. Dismantle Left front or right front high beam lamp bulb

Is the bulb filament blown?

No → Go to step 3

Yes

2	Replace headlamp bulb with fault

A. Replace the malfunctioning headlight bulb.

Confirm whether the high beam works normally.

Yes → The system is normal.

No

3	Check fuseEF07 and EF08

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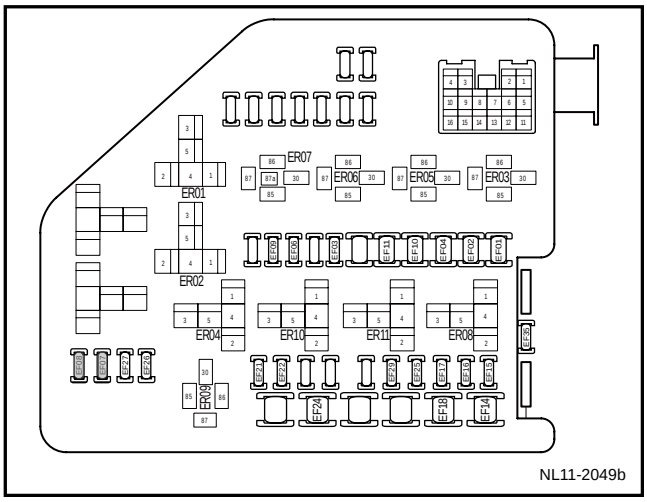
A. Check Fuses EF07 and EF08.

Confirm whether the fuses are blown.

Fuse Rating: 10A



No → Go to step 5

Yes

4	Check fuseEF07 and EF08 line

A. Check Fuses EF07 and EF08 for shortcircuit malfunctions.

B. Repair the circuits, Confirm that there are no short circuits.

C. Replace the fuses with rated current.

Confirm whether the high beam works normally.

Yes → The system is normal.

No

5	Confirm the terminal No. 5 of the headlamp wire harness connector CA12/CA18 and the body are grounded well.

(a) Make sure that headlamp wire harness connector CA12/CA18 terminal No. 5 is well connected with vehicle body grounding. Refer to "11.3.7.3 Headlamp doesn't work".

Next

6	Check voltage of fuseEF07and EF08

(a) Turn on high-beam lamp and use multimeter to measure voltage of fuse EF07 or EF08.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.

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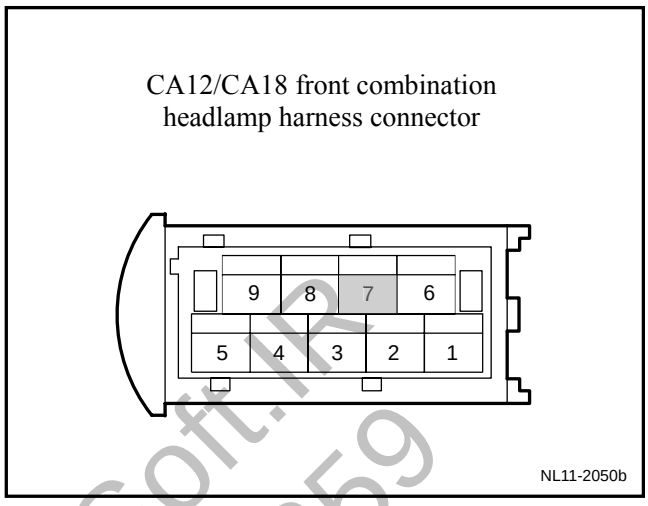
No → Go to step 8

Yes

7	Repair the open circuit fault between the headlamp fuse EF07 or EF08 and CA12/CA18 terminal No. 7.

(a) Make sure that the open-circuit fault between headlamp fuse EF07/EF08 and headlamp wire harness connector terminal CAN12/CA18 terminal No. 7 is repaired.

Confirm whether the high beam works normally.



Yes → The system is normal.

No

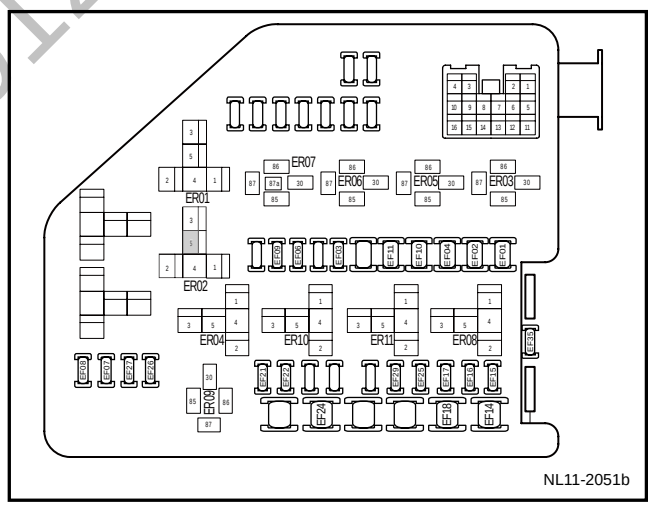
8	Inspect the voltage on the high beam relay terminal No. 5.

(a) Make lighting combination switch turn to high beam lamp position.

(b) Use multimeter to measure voltage of high-beam lamp relay terminal No. 5.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Repair the engine cabin fuse relay box, and replace the engine cabin line if necessary.

No

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9	Inspect the circuit between the terminal No. 1 of the high beam relay and the terminal No. 5 of the front headlamp relay wire harness connector.

(a) Make sure that headlamp works normally.

(b) Inspect and repair open-circuit fault between high-beam lamp relay terminal No. 1 and headlamp relay terminal No. 5.

Confirm whether the high beam works normally.

Yes → The system is normal.

No

10	Inspect the voltage of the terminal No. 7 of the combination switch wire harness connector IP42.

(a) Make lighting switch turn to high beam light position.

(b) Use multimeter to measure voltage of light combined switch IP42 terminal No. 7.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.

Yes → Replace lighting combination switch, Refer to11. 3. 8.1 lighting combination switch replacement

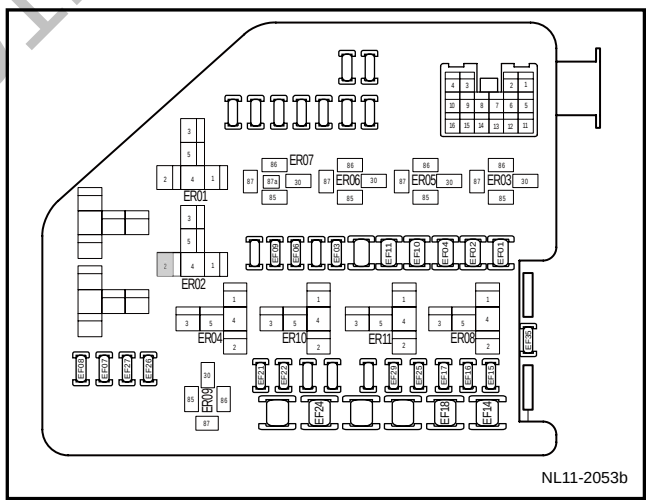
No

11	Repair the circuit between the terminal No. 2 of the low beam relay and the terminal No. 7 of the light combination switch wire harness connector IP42.

(a) Turn on high-beam lamp and measure voltage between light combined switch wire harness connector IP42 terminal No. 7 and 16.

Standard voltage: 11-14 V

(b) Whether voltage is in accordance with standard value.



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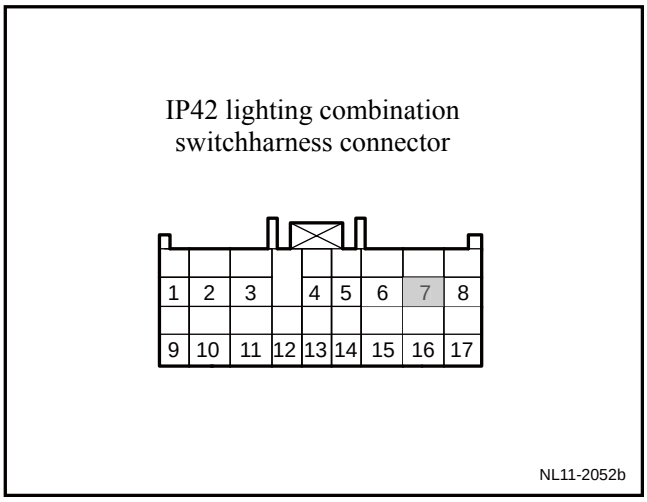

No → Replace combination switch, refer to11.3.8.1lighting combination switch replacement

Yes

12	Inspect the circuit between the terminal No. 7 of the light combination switch wire harness connector IP42 and the terminal No. 1 of the high beam relay C (M).

(a) Inspect and repair open-circuit between high-beam lamp relay terminal No. 2 and light combined switch wire harness connector IP42 terminal No. 7.

Confirm the high beam works normally.

Yes → The system is normal.

No

13	Replace high beam lamp relay.

(a) Replace high beam lamp relay.

Confirm the completion of repair.

14	The system is normal.

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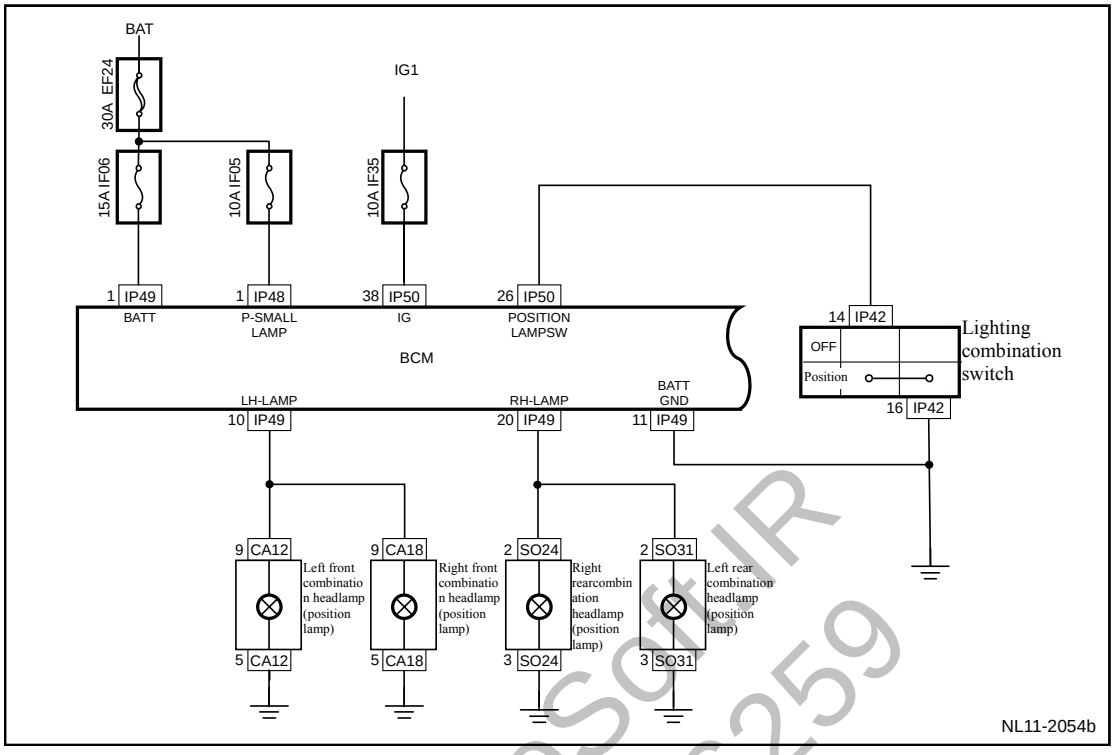
11.4.7.5 Position lamp inoperation

System diagram:



1	Inspect the left front or right front position lamp bulb.

A. Dismantle the left front or right front position lamp bulb.

Is the bulb filament blown?

No — Go to step 3

Yes

2	Replace Left front or right front position lamp bulb with fault

A. Replace the faulty left front or right front position lamp bulb.

Confirm if the position lights are working properly.

Yes — The system is normal.

No

3	Check the fuse IF05.

A. Check whether the fuse IF05 is blown.

Fuse Rating: 10A

Confirm whether the fuses are blown.

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No → Go to step 5

Yes

4	Check the fuse IF05 circuit.

A. Inspect the fuse IF05 short circuit malfunction.

B. Repair the circuits, Confirm that there are no short circuits.

C. Replace the fuses with rated current.

Confirm if the position light is working correctly.

Yes → The system is normal.

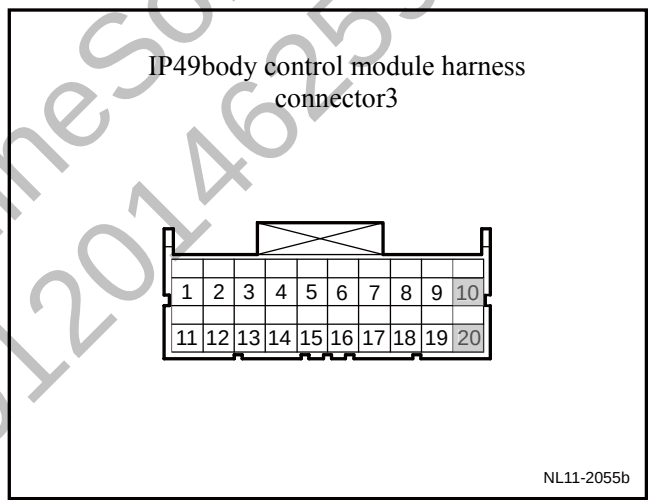
No

5	Inspect the grounding voltage of the terminal No. 10 and 20 of BCM wire harness connector IP49.

(a) Turn on position lamp, and measure voltage between BCM wire harness connector IP49 terminal No. 10 and terminal No. 20.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 9

No

6	Repair the circuit between the BCM wire harness connector IP49 and the position lamp.

(a) Inspect, repair or replace circuit between BCM wire harness connector IP49 and position lamp.

Confirm if the position light is working correctly.

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Yes → The system is normal.

No

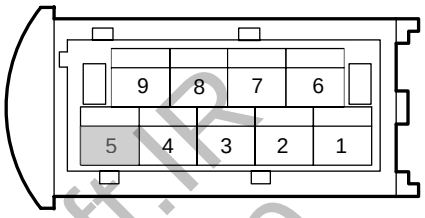
7	Inspect whether it is communicated among the terminal No. 5 of the position lamp CA12/18, the terminal No. 3 of SO24/31 and the body grounding.

(a) Inspect and repair open-circuit between headlamp wire harness connector CA12/18 terminal No. 5 and vehicle body grounding.

(b) Inspect and repair open-circuit fault between rear combined lamp wire harness connector SO23/31 terminal No. 3 and vehicle body grounding.

Confirm if the position light is working correctly.

CA12/CA18 front combination headlamp harness connector



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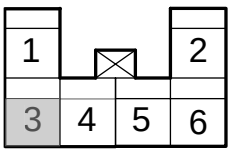
SO24/SO31 rear combination lamp harness connector



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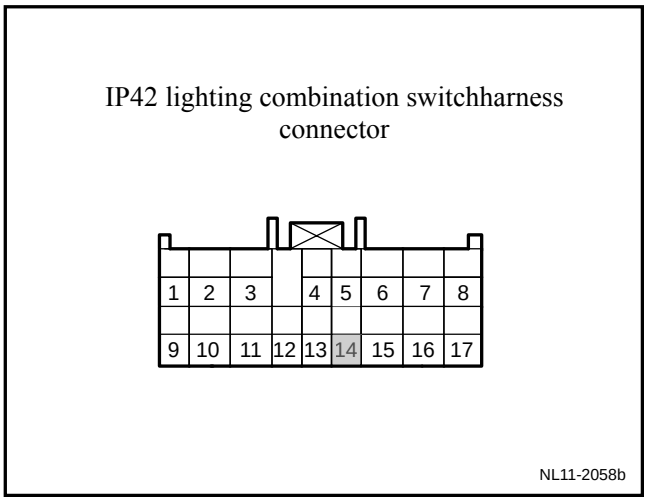
Yes → The system is normal.

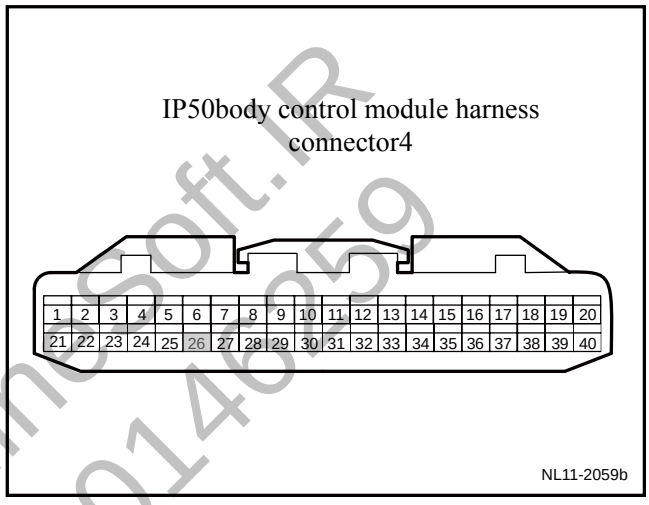
No

8	Inspect the communication between the terminal No. 14 of the combination switch IP42 and the terminal No. 26 of the BCM wire harness connector IP50.

(a) Inspect and repair open-circuit between combined switch IP42 terminal No. 14 and BCM wire harness connector IP50 terminal No. 26.

Confirm if the position light is working correctly.





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Yes → The system is normal.

No

9	Inspect the resistance between the terminal No. 16 of the light combination switch wire harness connector IP42 and the body grounding.

(a) Measure resistance between light combined switch wire harness connector IP42 terminal No. 16 and vehicle body grounding.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.

No → Repair ground harness.

Yes

10	Replace lighting combination switch, Refer to 11.3.8.1 lighting combination switch replacement .

Confirm the completion of repair.

Next

11	The system is normal.

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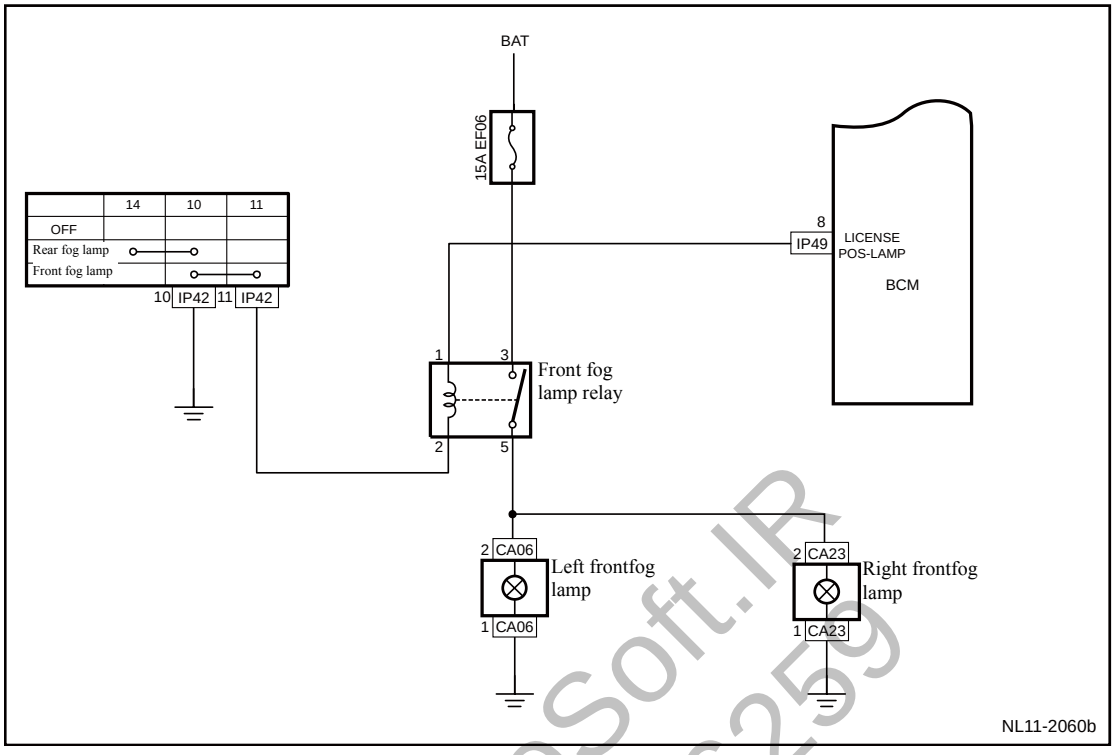
11.4.7.6 Front fog lamp inoperation

System diagram:



Diagnostic steps:

1	Inspect the left front or right front fog lamp bulb.

A. Dismantle the left front or right front fog lamp bulb.

Is the bulb filament blown?

No — Go to step 3

Yes

2	Replace left front or right front fog lamp bulb with fault

A. Replace the faulty front fog lamp bulb.

Confirm whether the front fog lamps are working properly.

Yes — The system is normal.

No

3	Inspect the circuit communication between the terminal No. 1 of the front fog lamp connector CA06/23 and body grounding.

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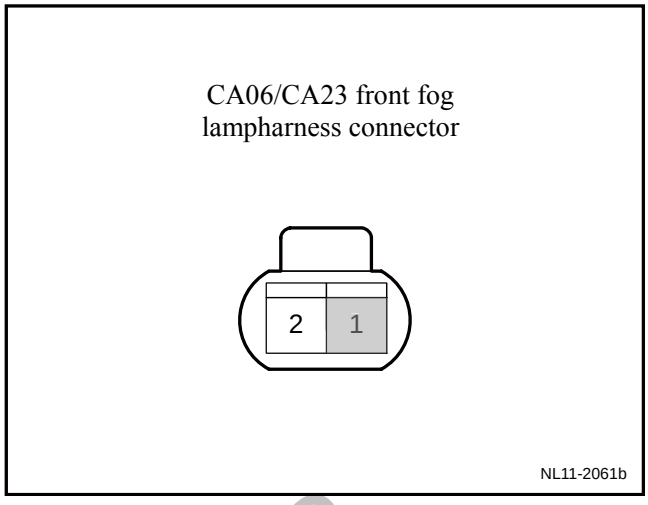
(a) Inspect and repair the open-circuit fault between left front fog lamp wire harness connector CA06 terminal No. 1 and vehicle body grounding.

(b) Inspect and repair open-circuit fault between right front fog lamp wire harness connector CA23 terminal No. 1 and vehicle body grounding.

Confirm whether the front fog lamps are working properly.



Yes → The system is normal.

No

4	Replace front fog lamp relay

(a) Replace front fog lamp relay.

Confirm whether the front fog lamp works normally.

Yes → The system is normal.

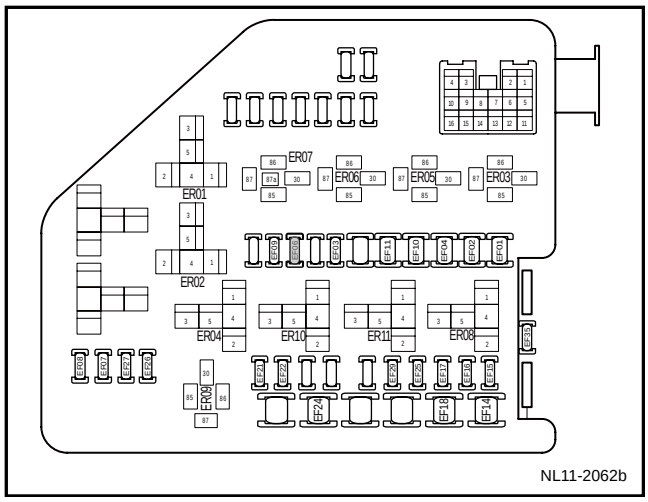
No

5	Inspect the front fog lamp fuse EF06.

(a) Check if fuse EF06 was blown.

Rating Value of Fuse: 15A

Confirm whether the fuses are blown.



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No → Go to step 7

Yes

6	Check fuseEF06 line.

(a) Check fuse 06 circuit was short-circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the headlamp is working correctly.

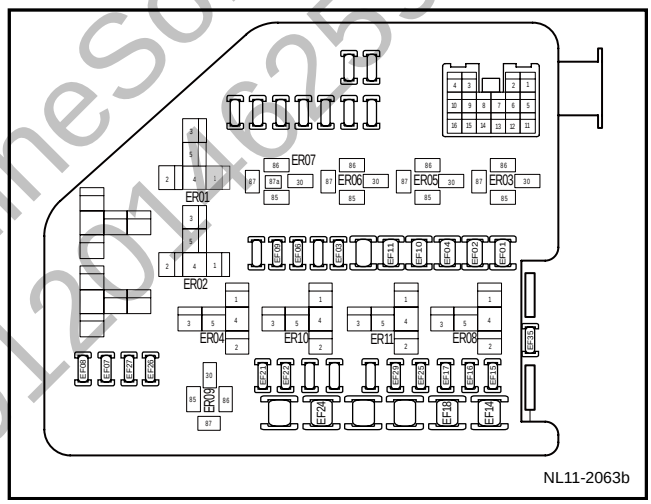
Yes → Normal operation

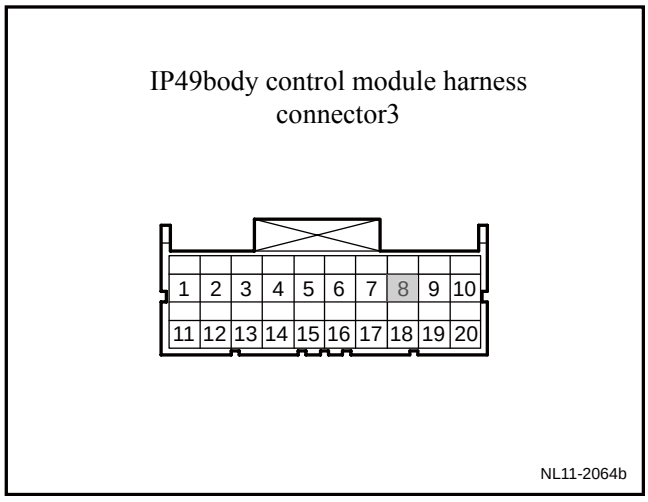
No

7	Inspect the circuit between the front fog lamp relay terminal No. 1 and the terminal No. 8 of the BCM wire harness connector IP49.

(a) Inspect and repair circuit between front fog lamp relay terminal No. 1 and BCM wire harness connector IP49 terminal No. 8.

Confirm whether the front fog lamps are working properly.





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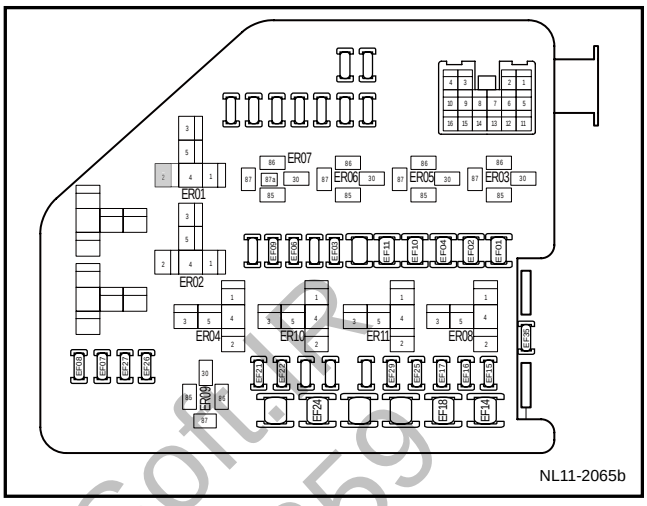
No → Normal operation

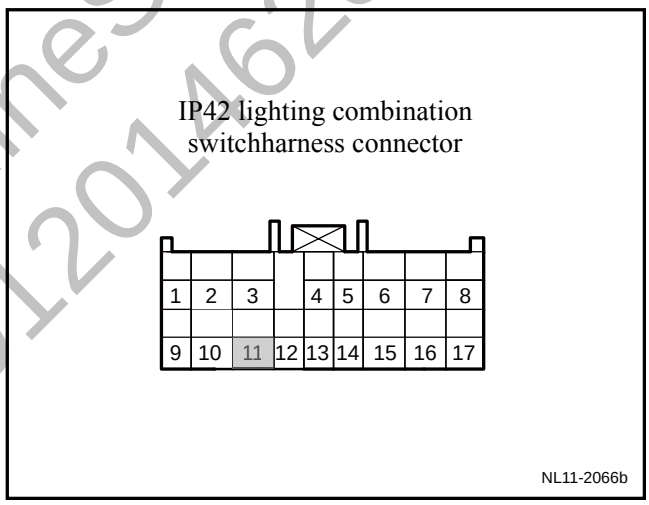
Yes

8	Inspect the circuit between the front fog lamp relay terminal No. 2 and the terminal No. 11 of the combination switch wire harness connector IP42.

(a) Inspect and repair circuit between front fog lamp relay terminal No. 2 and combined switch wire harness connector IP42 terminal No. 11.

Confirm whether the front fog lamp works normally.





Yes → The system is normal.

No

9	Inspect the circuit between the front fog lamp relay terminal No. 5 and the terminal No. 2 of the front fog lamp wire harness connector CA06/23.

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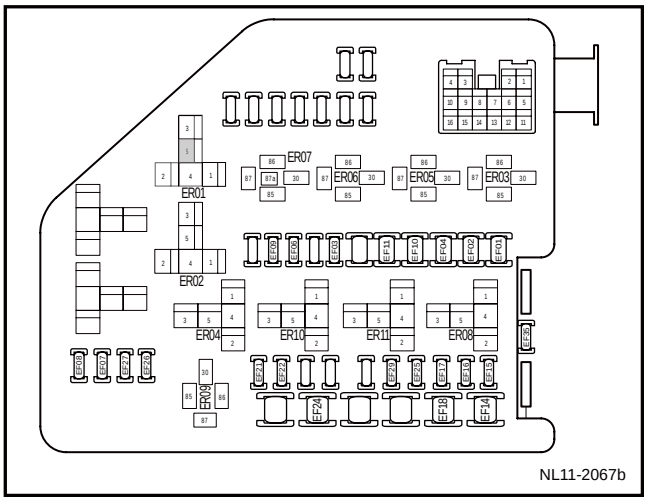
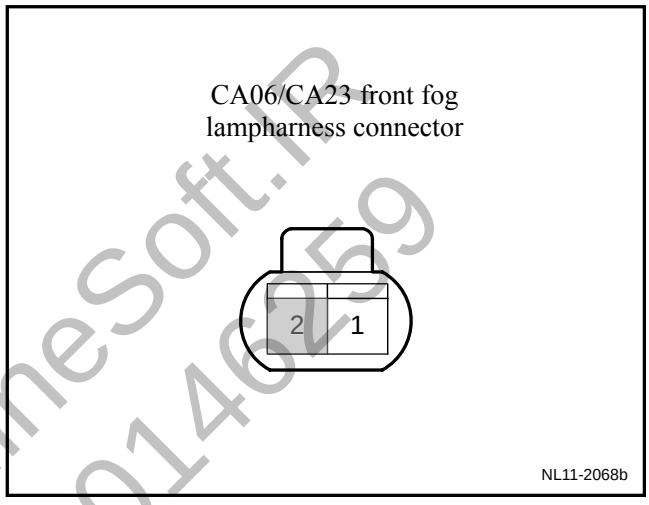
(a) Inspect and repair circuit between front fog lamp relay terminal No. 5 and front fog lamp wire harness connector CA06/23 terminal No. 2.

Confirm whether the front fog lamps are working properly.





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Yes → The system is normal.

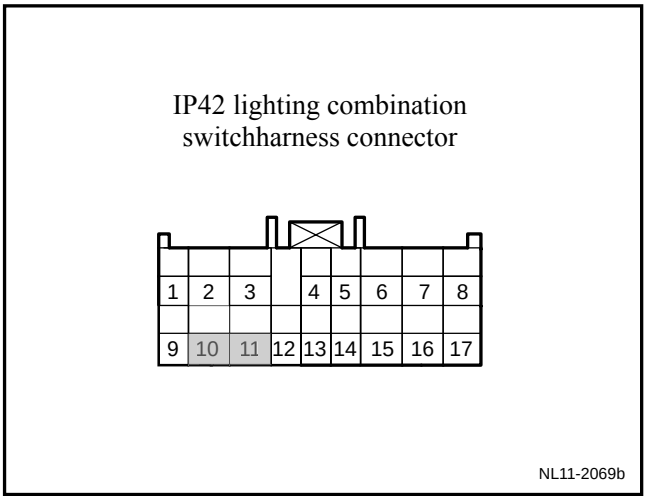
No

10	Check the light combination switch.

(a) Disconnect light combined switch wire harness connector IP42, and press front fog lamp switch and use multimeter to measure whether terminal No. 10 and 11 are connected.

Standard resistant value :is less than 1Ω

Confirm whether the resistance is normal.



Yes → Go to step 12

No

11	Replace lighting combination switch

A. Replace the light combination switch.

Confirm whether the front fog lamps are working properly.

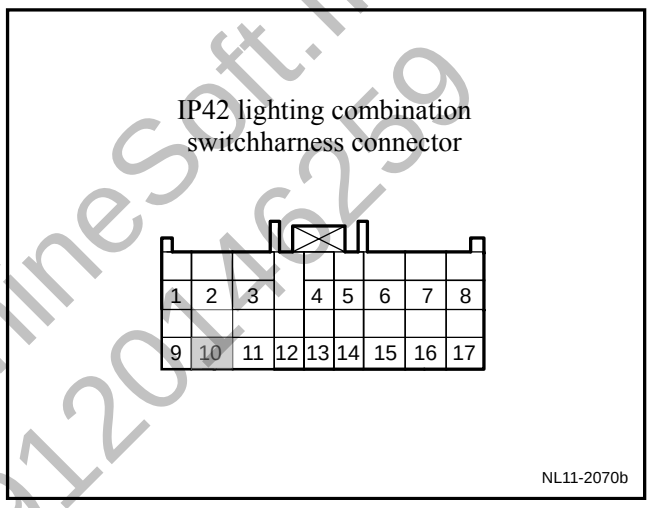
Yes → The system is normal.

No

12	Inspect the communication of the circuit between the terminal No. 10 of the light combination switch wire harness connector IP42 and the body grounding.

(a) Inspect and repair the circuit between light combined switch wire harness connector IP42 terminal No. 10 and vehicle body grounding.

Confirm the completion of repair.



Next

13	The system is normal.

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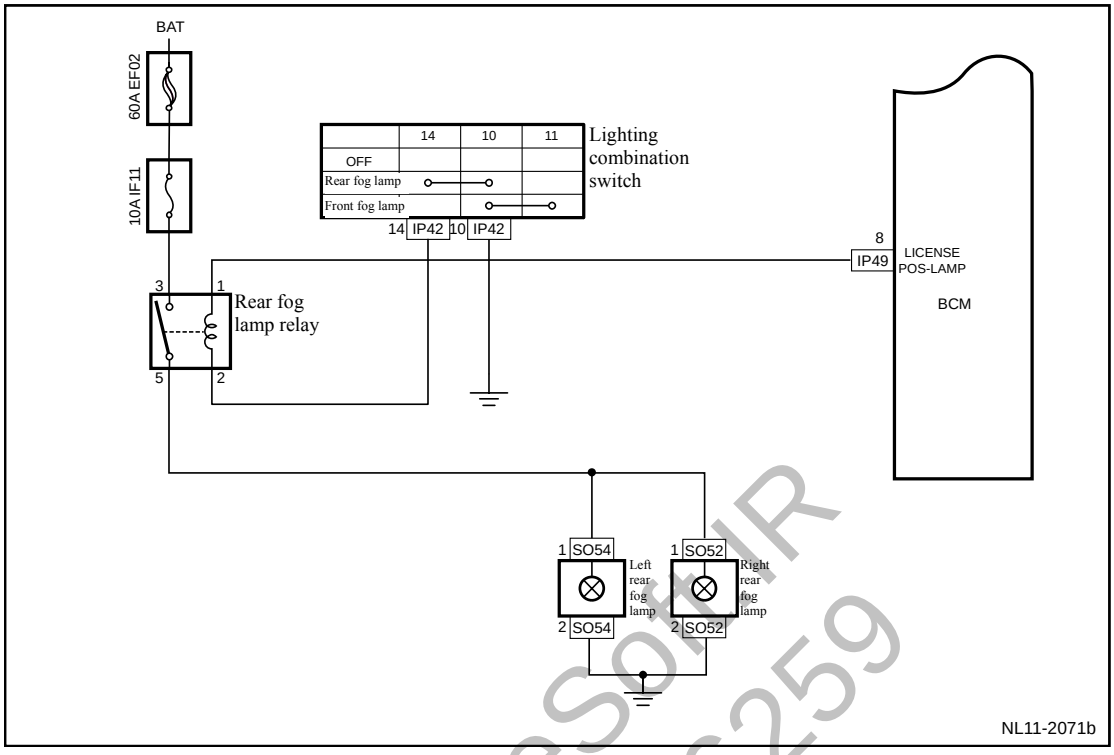
11.4.7.7 Rear fog lamp inoperation

Circuit diagram:

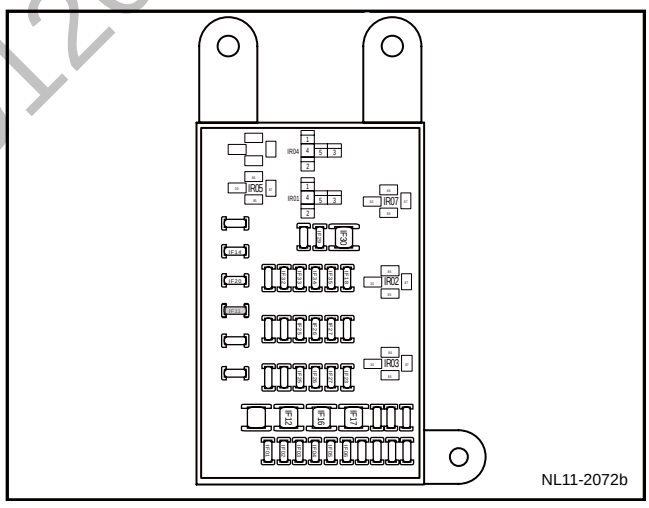


Diagnostic steps:

1	Inspect the rear fog lamp fuse IF11.

(a) Inspect whether rear fog lamp fuse IF11 is burned out.

Rating value of Fuse: 10A



Yes	Go to step 3
No	

2	Inspect the circuit of the rear fog lamp fuse IF11.

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(a) Inspect the fuse IF01 for short circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the front fog lamps are working properly.

Yes	The system is normal.
No	

3	Replace rear fog lamp relay.

(a) Replace rear fog lamp relay.

Confirm whether the rear fog lamps are working normally.

Yes	The system is normal.
No	

4	Inspect the rear fog lamp bulb.

(a) Dismantle left rear or right rear fog lamp bulb.

Is the bulb filament blown?

No	Go to step 6
Yes	

5	Replace rear fog lamp bulb with fault

(a) Replace rear fog lamp bulb with fault.

Confirm whether the rear fog lamps are working normally.

Yes	The system is normal.
No	

6	Inspect the circuit between the terminal No. 2 of the rear fog lamp bulb wire harness connector SO54/52 and the body grounding.

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(a) Measure resistance between rear fog lamp wire harness connector SO54/52 terminal No. 2 and vehicle body grounding.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → The system is normal.

No

7	Repair the circuit between the terminal No. 2 of the rear fog lamp bulb wire harness connector SO54/52 and the grounding.

(a) Repair open-circuit fault between rear fog lamp wire harness connector SO54/52 terminal No. 2 and grounding.

Confirm whether the rear fog lamps are working normally.

Yes → The system is normal.

No

8	Measure the voltage of terminal No. 1 of the harness connector SO54/52 of the rear fog lamp.

(a) Disconnect rear fog lamp connector SO54/52.

(b) Turn on rear fog lamp to measure voltage of SO54/52 terminal No. 1.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.

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Yes → Confirm the fault phenomenon and then turn to the step 1.

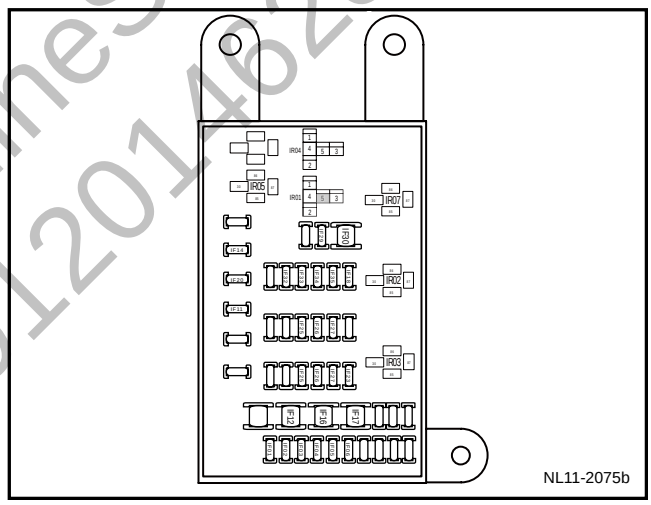
No

9	Inspect the circuit between the SO54/52 terminal No. 1 and the rear fog lamp relay terminal No. 5.

(a) Use multimeter to measure resistance between SO54/52 terminal No. 1 and rear fog lamp relay terminal No. 5.

Standard resistance: less than 1 ω

confirm whether the resistance is normal.



No → Repair the terminal 1 of SO54/52 and the rear fog lamp relay terminal 5.

Yes

10	Measure the voltage of terminal No. 14 of the combination switch IP42.

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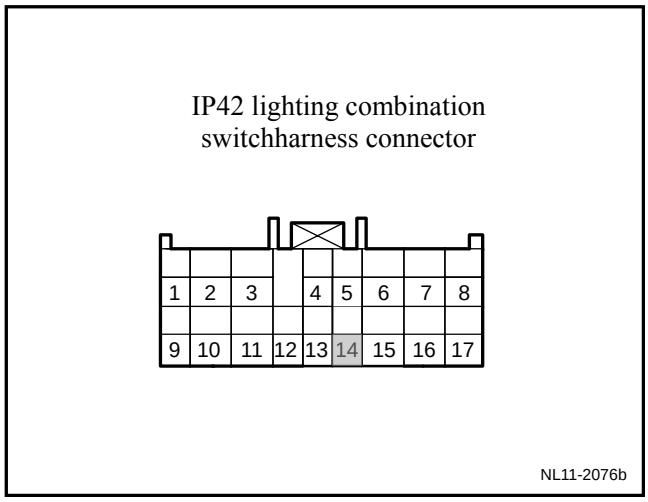
(a) Closed rear fog lamp switch .

(b) Inspect voltage of combined switch wire harness connector IP42 terminal No. 14.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



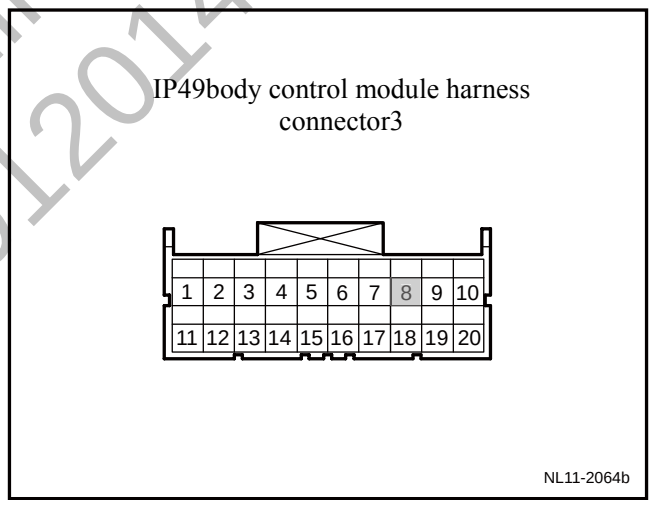
Yes → Go to step 13

No

11	Inspect and repair the circuit between the rear fog lamp relay terminal No. 1 and the terminal No. 8 of the BCM wire harness connector IP49.

(a) Make sure that open-circuit fault between rear fog lamp relay terminal No. 1 and BCM wire harness connector IP49 terminal No. 8 is repaired.

Confirm whether the rear fog lamps are working normally.



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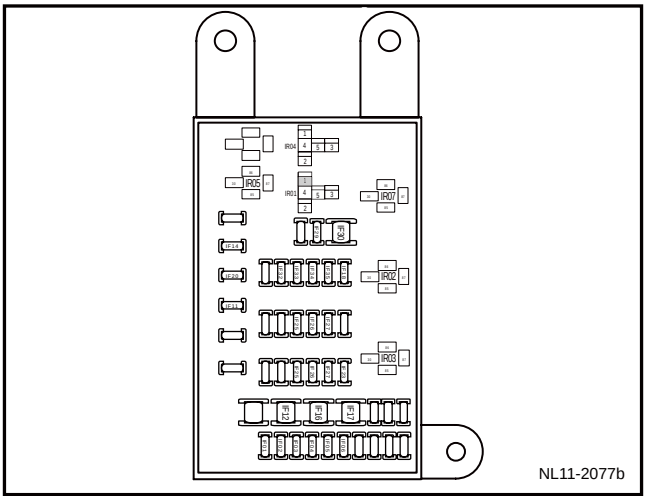


Yes → The system is normal.

No

12	Inspect and repair the circuit between the rear fog lamp relay terminal No. 2 and the terminal No. 14 of the BCM wire harness connector IP42.

(a) Make sure that open-circuit fault between rear fog lamp relay terminal No. 2 and combined switch wire harness connector IP42 terminal No. 14 is repaired.

Confirm whether the rear fog lamps are working normally.

Yes → The system is normal.

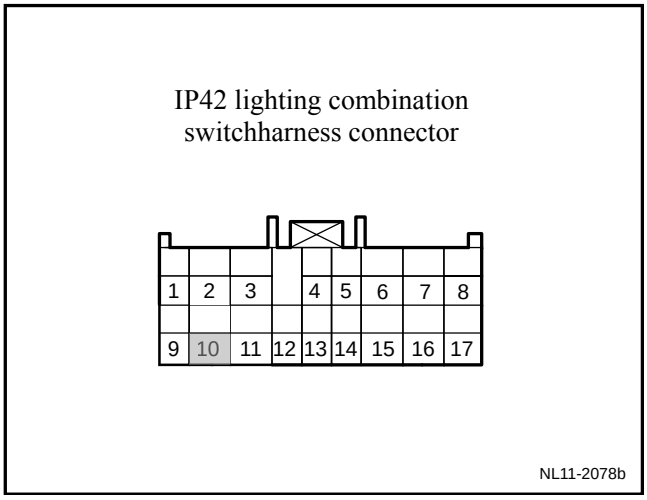
No

13	Inspect the circuit between the terminal No. 10 of the light combination switch wire harness connector IP42 and the body grounding.

(a) Disconnect light combined switch wire harness connector IP42.

(b) Measure resistance value between harness connector IP42 10 terminal and body grounding.

Standard resistance: less than 1 Ω



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14	Repair the circuit between the terminal No. 10 of the light combination switch wire harness connector IP42 and the body grounding.

(a) Repair open-circuit fault between light combined switch wire harness connector IP42 terminal No. 10 and vehicle body grounding.

Confirm whether the rear fog lamps are working normally.

Yes → The system is normal.

No

15	Replace lighting combination switch.

(a) Replace the lighting combination switch.refer to11.3.8.1 replacement of lighting combination switch.

(b) Confirm the repair is completed.

Next

16	The system is normal.

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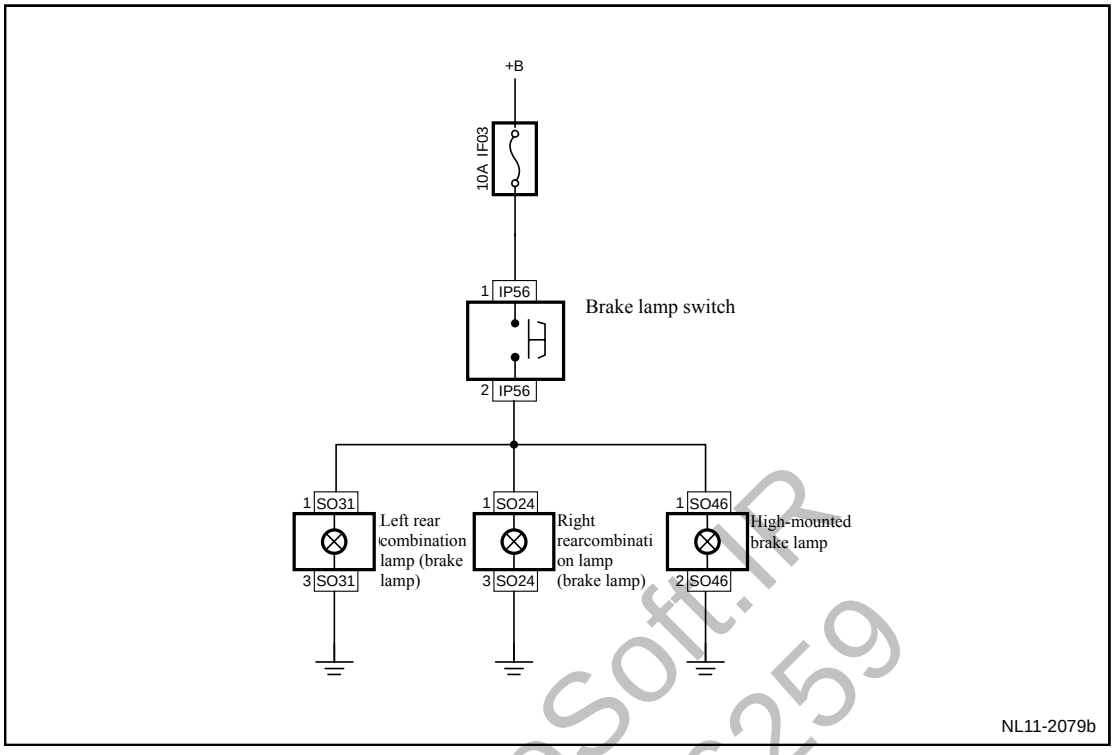
11.4.7.8 Brake lamp inoperation

System diagram



Diagnostic steps:

1	Inspect the brake lamp bulb.

A. Dismantle the bulb of brake lamp.

Is the bulb filament blown?

No — Go to step 3

Yes

2	Replace brake lamp bulb

A. Replace the faulty bulb of brake lamp.

Confirm whether the brake lamps are working properly.

Yes — The system is normal.

No

3	Check fuseIF03

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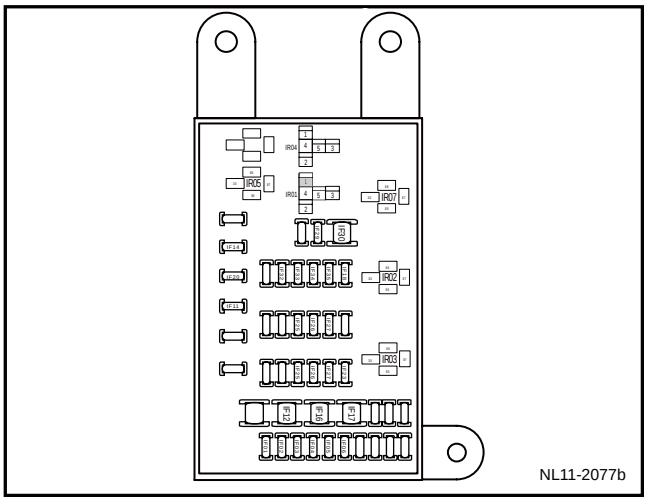
A. Check whether the fuse IF03 is blown.

Fuse Rating: 10A

Confirm whether the fuses are blown.



No → Go to step 5

Yes

4	Check the fuse IF05 circuit.

A. Inspect the fuse IF03 short circuit malfunction.

B. Repair the circuits, Confirm that there are no short circuits .

C. Replace the fuses with rated current.

Confirm whether the brake lamp works normally.

Yes → The system is normal.

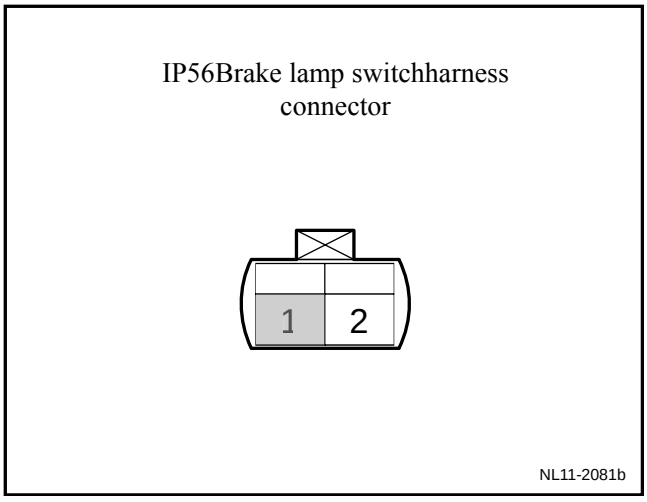
No

5	Inspect the voltage of the terminal No. 1 of the brake lamp switch wire harness connector IP56.

A. Measure the voltage of terminal No. 1 of the harness connector IP56 of the brake lamp switch.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



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Yes → Go to step 7

No

6	Repair the open circuit fault between the terminal No. 1 the brake lamp switch wire harness connector IP56 and the fuse IF03.

(a) Make sure that open-circuit fault between brake lamp switch wire harness connector IP56 terminal No. 1 and fuse IF03 is repaired.

Confirm whether the brake lamp works normally.

Yes → The system is normal.

No

7	Check brake switch

(a) Disconnect brake lamp switch harness connector, stepped down brake pedal, measure resistance between brake switch terminal No. 1 and 2

Standard Resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → Go to step 10

No

8	Inspect the circuit between the brake lamp switch wire harness connector IP56 and the terminal No. 1 of the brake lamp wire harness connector SO31/24/46.

(a) Disconnect harness connector SO31, SO24, SO46.

(b) Measure resistance value between Brake lamp switch harness connector IP56 terminal No. 2 and rear combination harness connector SO31/24 terminal No.1.

(c) Measure resistance between brake lamp switch harness connector IP56 terminal No. 2 and high mounted brake lamp harness SO46 terminal

Standard Resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.

No → Repair the open circuit fault.

Yes

9	Inspect the circuit among the combination lamp wire harness connectors SO31/24 and SO46 and the body grounding.

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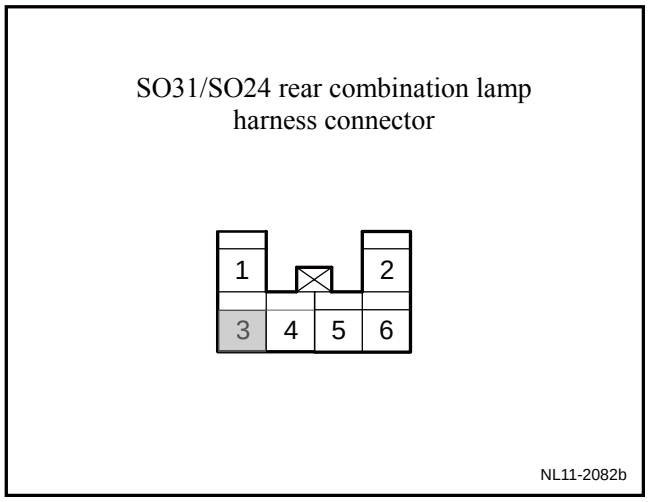
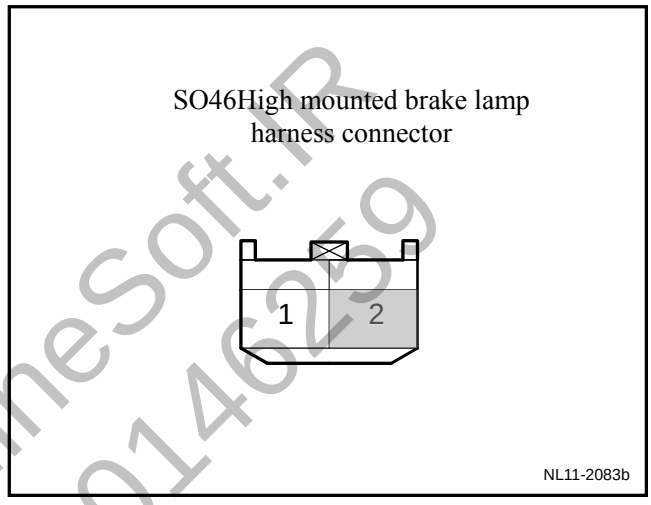
(a) Disconnect harness connector SO31, SO24.

(b) Measure resistance between rear combined lamp wire harness connector SO31/24 terminal No. 3 and SO46 terminal No. 2 and vehicle body grounding.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.





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No → Repair the open circuit fault.

Yes

10	Replace brake lamp switch.

(a) Replace the brake lamp switch.

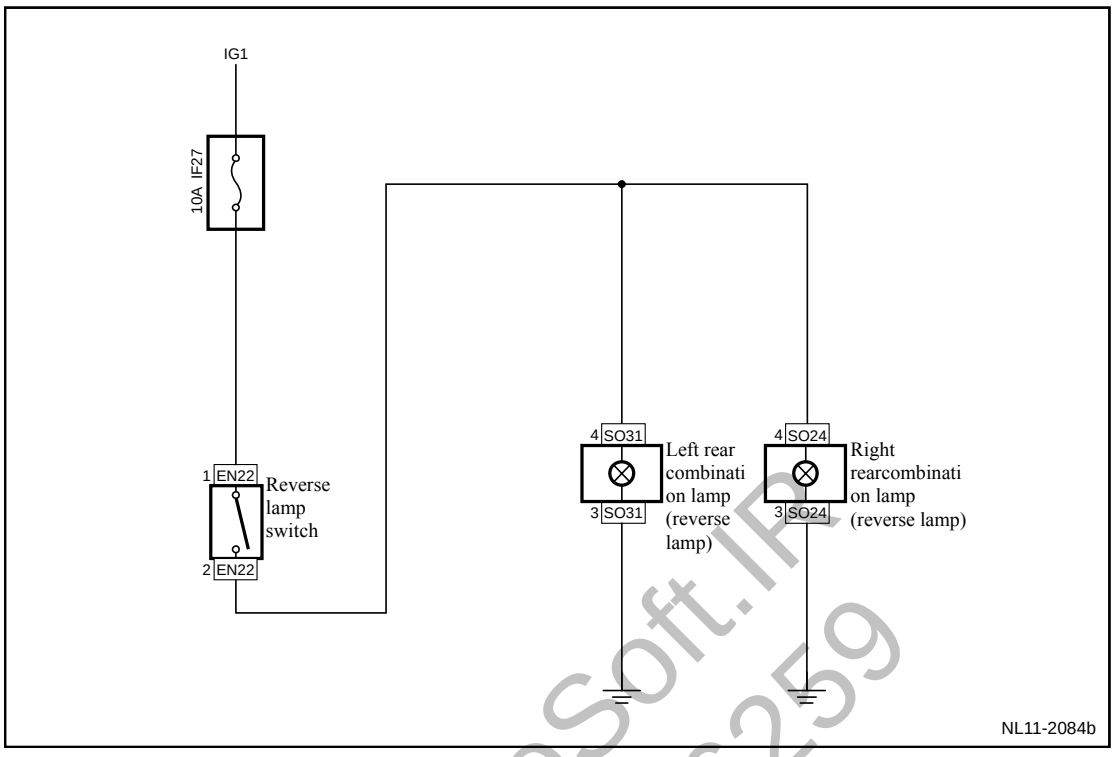
Confirm the completion of repair.

Next

11	The system is normal.

11.4.7.9 Reverse lamp inoperation

Circuit diagram:



Diagnostic steps:

1	Inspect reversing lamp bulb.

A. Dismantle reverse lamp bulb

Is the bulb filament blown?

No — Go to step 3

Yes

2	Replace reverse lamp bulb

A. Replace the faulty bulb of reverse lamp.

Confirm whether the brake lamps are working properly.

Yes — The system is normal.

No

3	Check fuse circuit IF27

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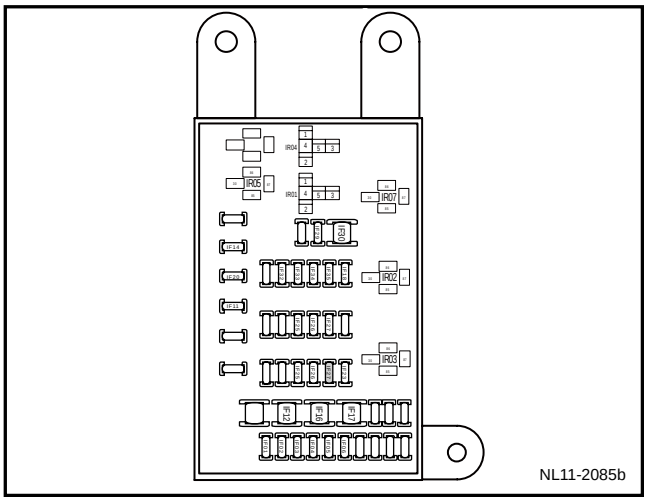
A. Inspect whether the fuse IF27 is blown.

Fuse Rating: 10A

Confirm whether the fuses are blown.



Yes → Go to step 5

No

4	Overhaul fuseIF27 circuit

(a) Check short circuit of fuse IF27 circuit

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the reverse lamps are working properly.

Yes → The system is normal.

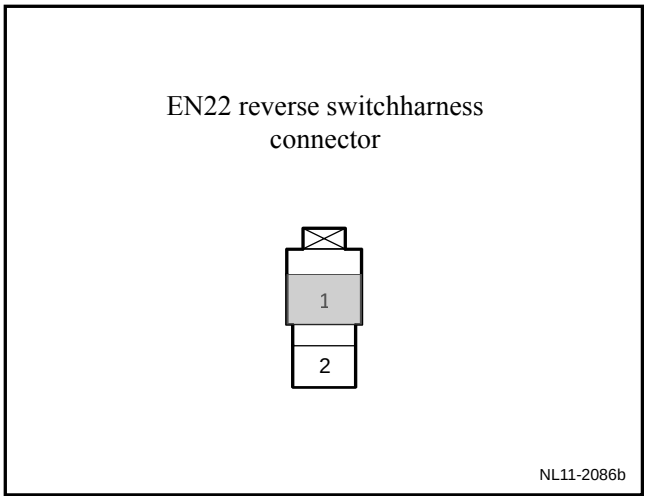
No

5	Measure the voltage of terminal No. 1 of the harness connector EN22 of the reverse gear switch.

(a) Use multimeter to measure terminal voltage of reversing lamp switch wire harness connector EN22 terminal.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



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Yes → Go to step 7

No

6	Repair the open circuit fault between the reverse lamp switch wire harness connector terminal and fuse IF27.

(a) Make sure that open-circuit fault between reversing lamp switch wire harness connector terminal and fuse IF27 is repaired.

Confirm whether the reverse lamps are working properly.

Yes → The system is normal.

No

7	Inspect reversing switch.

(a) Turn on ignition switch, do not run the engine, gear on reverse gear, and disconnect reverse switch wire harness connector.

(b) Use multimeter to measure resistance between brake switch terminal No. 1 and 2.

Standard resistant value: is less than 1Ω

Confirm if the resistance conforms to standard value.

Yes → Go to step 9

No

8	Replace reverse switch

A. For replacement of the reverse gear switch, see "11.3.8.11 Replacement of Reverse Gear Switch".

Confirm whether the reverse lamps are working properly.

Yes → The system is normal.

No

9	Inspect whether rear combined lamp wire harness connector SO31/24 and reversing lamp switch wire harness connector EN22 terminal No. 2 are connected.

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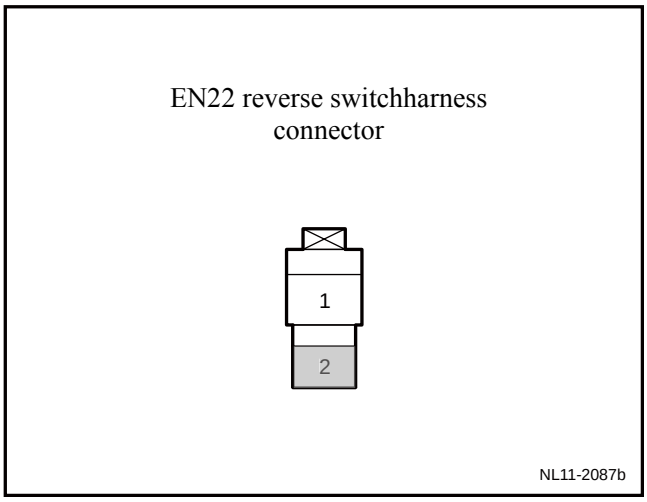
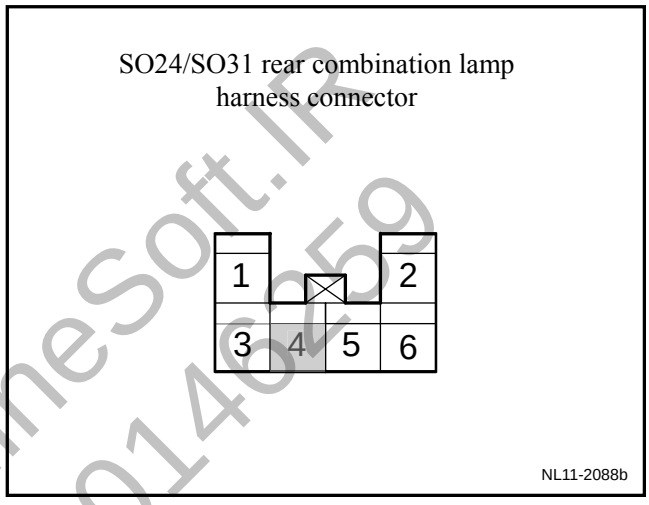
(a) Make sure that rear combined lamp wire harness connector SO31/24 terminal No. 4 and reversing lamp switch wire harness connector EN22 terminal No. 2 are connected.

Confirm whether the reverse lamps are working properly.





Next

10	The system is normal.

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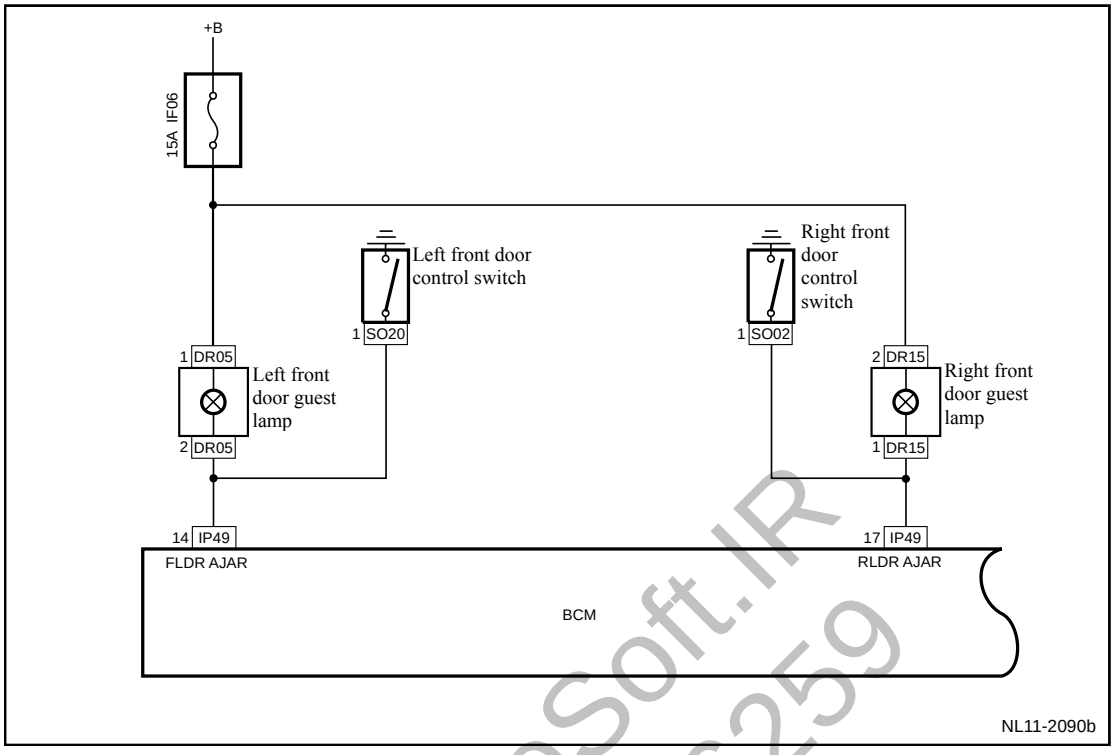
11.4.7.10 Courtesy light do not work

Circuit diagram:



Diagnostic steps:

1	Inspect the courtesy lamp bulb.

A. Dismantle courtesy lamp bulb

Is the bulb filament blown?

No — Go to step 3

Yes

2	Replace the courtesy bulb.

A. Replace the malfunctioning courtesy light bulb.

Confirm whether the courtesy lamp works normally.

Yes — The system is normal.

No

3	Check the fuse IF06 circuit.

A. Check whether the fuse IF06 is blown.

Fuse Rating: 15A

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Confirm whether the fuse IF06 is blown out.

No	Go to step 5
Yes	

4	Overhaul fuseIF06 circuit

A. Check whether Fuse IF06 line is short circuited.

B. Repair the circuits, Confirm that there are no short circuits.

C. Replace the fuses with rated current.

Confirm whether the courtesy lamp is working properly.

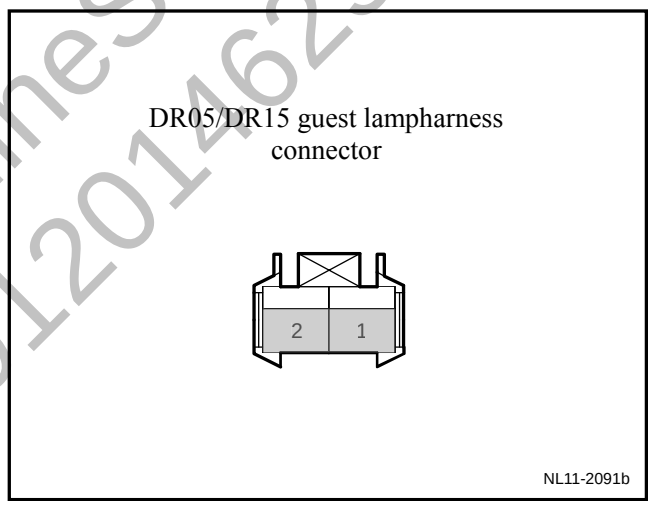
Yes	The system is normal.
No	

5	Measure the voltages of Terminal 1 of the harness connector DR05 of the guest lamp switch and Terminal 2 of the harness connector DR15.

(a) Measure voltage of customer lamp switch wire harness connector DR05 terminal No. 1, DR15 terminal No. 2.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



No	Go to step 7
Yes	

6	Repair the open circuit fault among terminal No. 1 of the guest lamp switch wire harness connector DR05, the terminal No. 2 of DR15 and fuse IF06..

(a) Make sure that the open-circuit fault between courtesy lamp switch wire harness connector DR05/DR15 and fuse IF06 is repaired.

Confirm whether the guest lamp works normally.

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Yes → The system is normal.

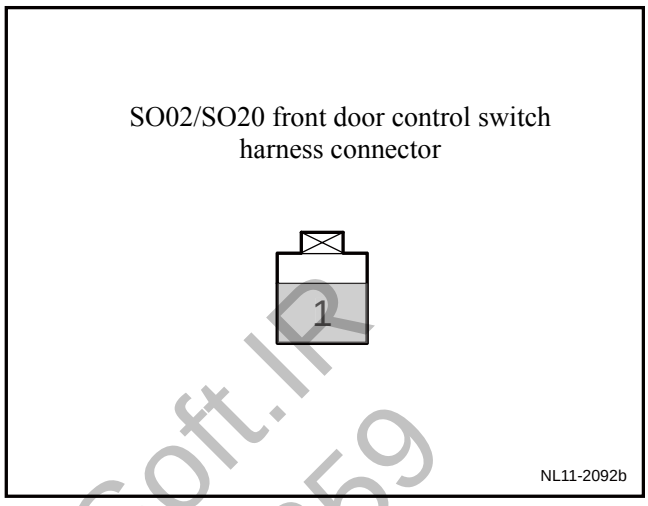
No

7	Inspect the voltage of the terminal No. 1 of the door controlled switch wire harness connector SO20/02.

(a) Use multimeter to measure voltage of door lock assembly wire harness connector SO20/02 terminal No. 1.

Standard voltage: 11-14 V

Confirm whether the voltage accords with the standard value.



Yes → Go to step 9

No

8	Confirm the communication among the terminal No. 1 of the door controlled switch wire harness connector SO20/02 and the terminal No. 2 of the guest lamp wire harness connector DR05 and the terminal No. 1 of the DR15.

(a) Make sure that door control switch wire harness connector SO20/02 terminal No. 1 and courtesy lamp wire harness connector DR05 terminal No. 2, DR15 terminal No. 1 are connected.

Confirm whether the guest lamp works normally.

Yes → The system is normal.

No

9	Replace door control switch assembly ,

(a) Replace door control switch assembly.

(b) Confirm the repair is completed.

Next

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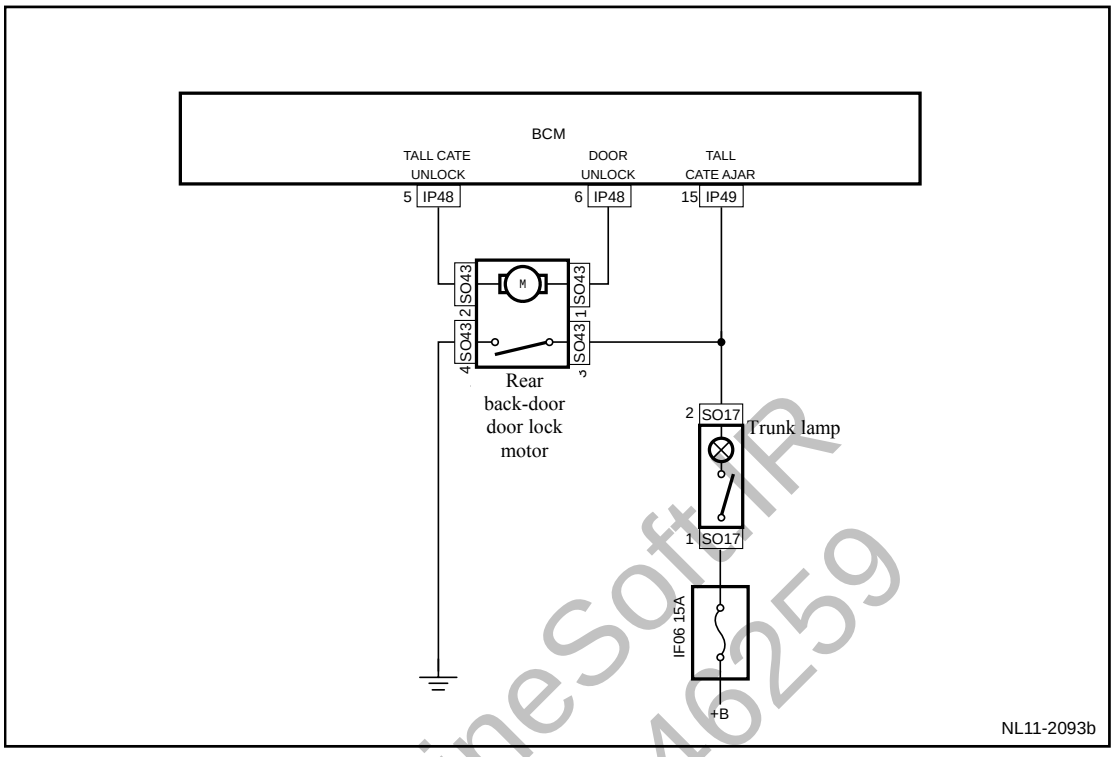
10	The system is normal.

11.4.7.11 Trunk lamp do not work

Circuit diagram:



Diagnostic steps:

1	Inspect whether the trunk is able to open.

A. Check whether the luggage compartment can be opened.

No — See that the trunk is unable to open.

Yes

2	Inspect the trunk lamp bulb.

A. Dismantle trunk lamp bulb

Is the bulb filament blown?

No — Go to step 4

Yes

3	Replace trunk lamp bulb

A. Replace the malfunctioning luggage compartment lamp bulb.

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Confirm whether the luggage compartment lamp works normally.

Yes → The system is normal.

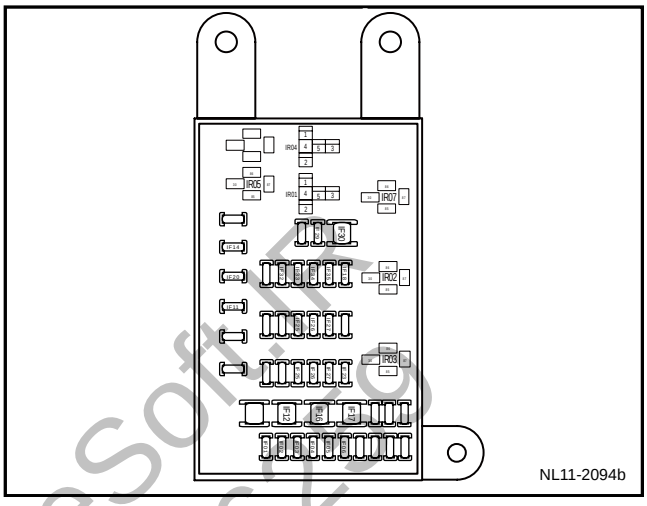
No

4	Check the fuse IF06 circuit.

A. Check whether the fuse IF06 is blown.

Fuse rating: 15A

Confirm whether the fuses are blown.



No → Go to step 6

Yes

5	Overhaul fuseIF06 circuit

A. Check whether fuse IF06 line is short circuited.

B. Repair the circuits, Confirm that there are no short circuits.

C. Replace the fuses with rated current.

Confirm whether the luggage compartment lamp works normally.

Yes → The system is normal.

No

6	Inspect the voltage of the terminal No. 2 of the trunk lamp switch wire harness connector SO17.

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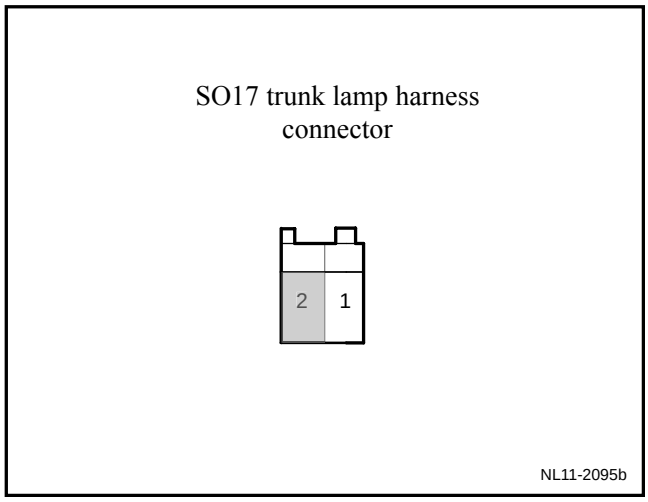
(a) Measure voltage of boot lamp switch wire harness connector SO17 terminal No. 2.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 8

No

7	Replace trunk lamp assembly.

(a) Replace trunk lamp assembly.

Confirm whether the courtesy lamp is working properly.

Yes → The system is normal.

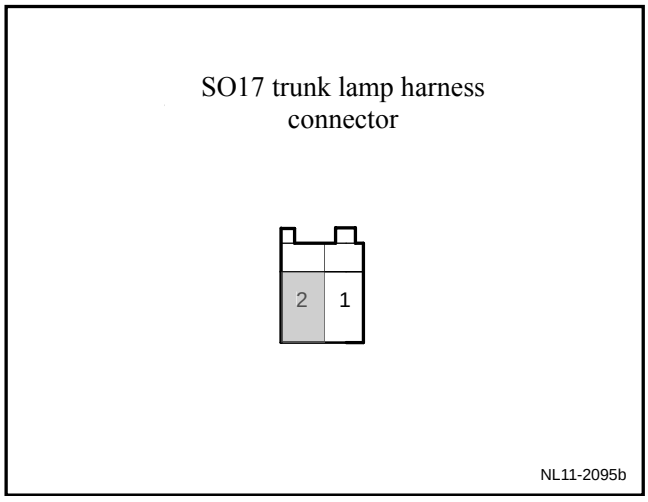
No

8	Inspect the communication between the terminal No. 2 of the trunk lamp switch wire harness connector SO17 and the terminal No. 3 of the trunk lock wire harness connector SO43.

(a) Use multimeter to measure resistance between boot lamp switch connector SO17 terminal No. 2 and boot lock wire harness connector SO43 terminal No. 3.

Standard resistant value :is less than 1Ω

Confirm if the resistance conforms to standard value.



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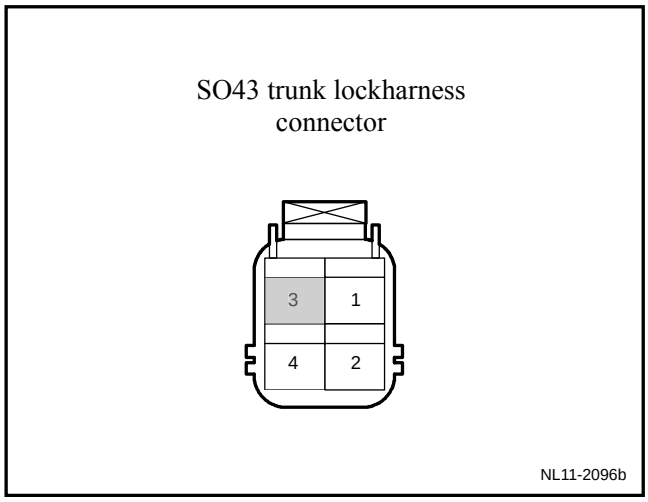

Yes → Go to step 10

No

9	Repair the open circuit fault between the trunk lamp switch wire harness connector SO17 and the trunk wire harness connector SO43.

(a) Make sure that open-circuit fault between boot lamp switch wire harness connector SO17 terminal No. 2 and boot lock wire harness connector SO43 terminal No. 3 is repaired.

Confirm whether the trunk lamp works normally.

Yes → The system is normal.

No

10	Replace motor switch of trunk

(a) Replace trunk motor assembly; refer to rear back-door lock assembly replacement.

Confirm the completion of repair.

Next

11	The system is normal.

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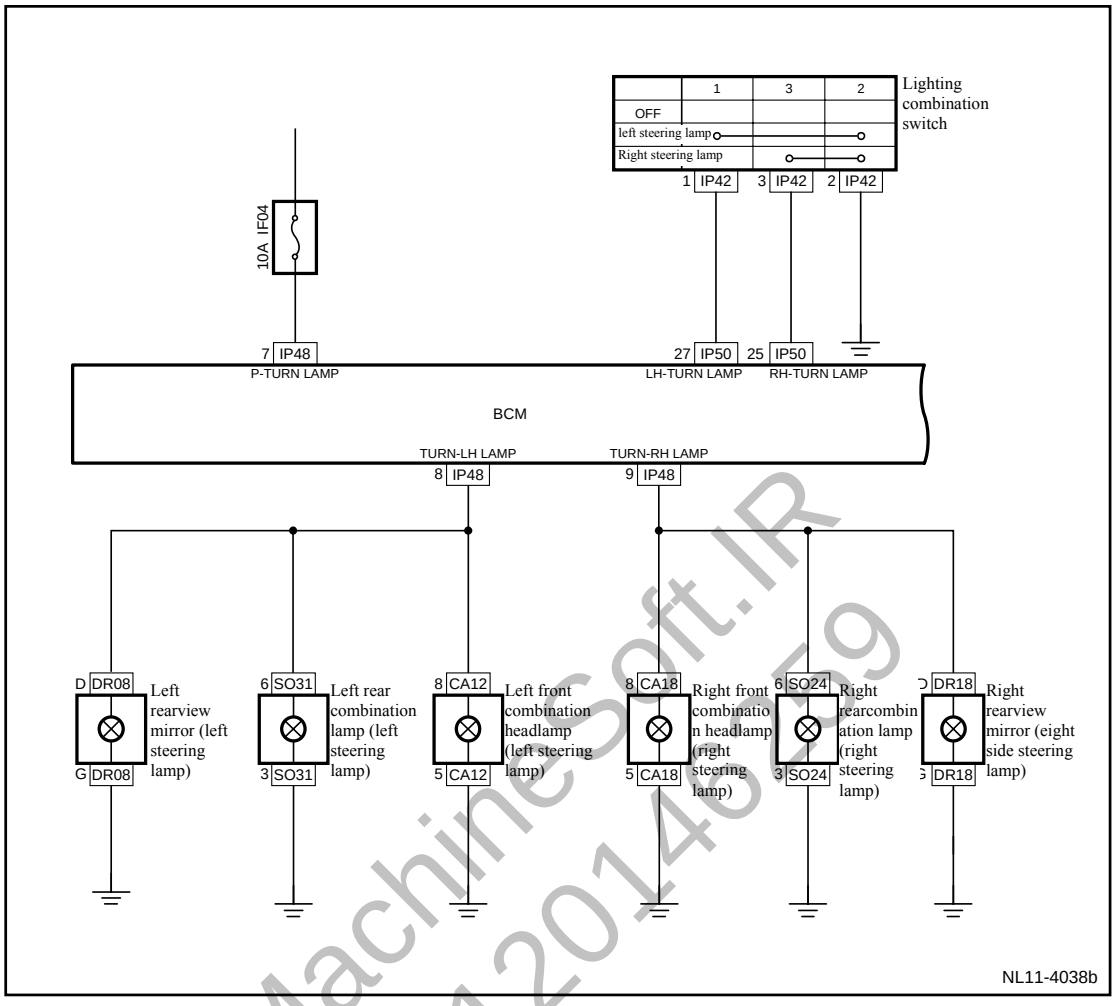
11.4.7.12 Steering lamp inoperation

Circuit diagram:



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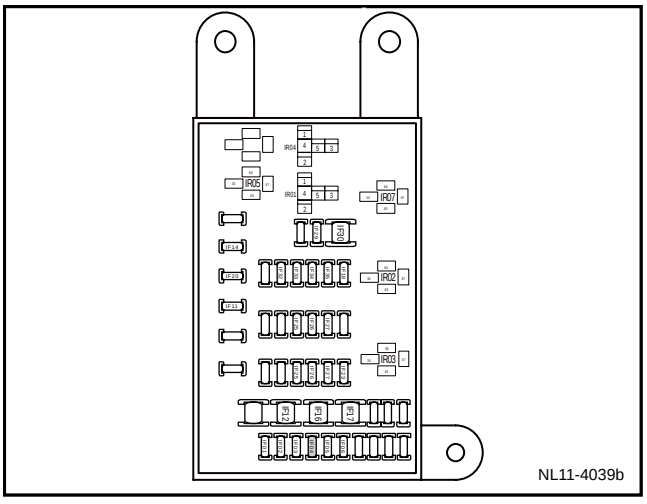
Diagnostic steps:

1	Check fuseIF04was blown

(a) Check fuse IF04was blown

Rating Value of Fuse: 10A

Confirm whether the fuses are blown.



No → Go to step 3

Yes

2	Overhaul fuseIF04 circuit.

(a) Inspect the fuse IF01 for short circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the steering lamps are working correctly.

No → The system is normal.

Yes

3	Inspect the steering lamp bulb.

(a) Dismantle turning lamp bulb and inspect bulb filament.

Is the bulb filament blown?

No → Go to step 5

Yes

4	Replace turning lamp bulb,

(a) Replace turning lamp bulb.

Confirm whether the system is normal or not.

Yes → The system is normal.

No

5	Inspect the voltage of the terminal No. 8 of the steering lamp wire harness connector CA12/18, the terminal of SO31/24 and the terminal D of DR08/18.

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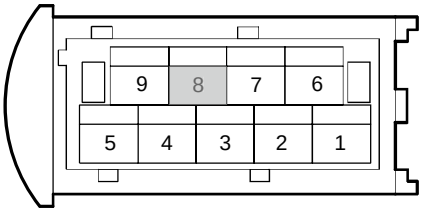
(a) Turn on turning lamp switch and measure voltage between turning lamp wire harness connector CA12/18 terminal No. 8, SO31/24 terminal No. 6 and DR08/18 terminal D.

Standard voltage: 11-14 V

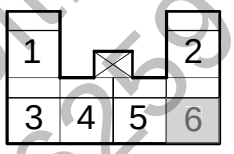
Confirm if the voltage conforms to standard value.

CA12/CA18 front combination headlamp harness connector



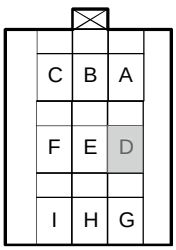
NL11-4040b

SO31/SO24 rear combination headlamp harness connector



NL11-4041b

DR08/DR18rearview mirrorharness connector



NL11-4042b

Yes → Go to step 7

No

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6	Repair the open circuit among the terminal No. 8 of the steering lamp wire harness connector CA12/18, the terminal No. 6 of the SO31/24, the terminal D of the DR08/18 and the terminal No. 7 of the BCM wire harness connector IP48.

(a) Repair open-circuit fault beteen turning lamp wire harness connector CA12/18 terminal No. 8, SO31/24 terminal No. 6, DR08/18 terminal D and BCM wire harness connector IP48 terminal No. 7.

Confirm whether the system is normal or not.

Yes	The system is normal.
No	

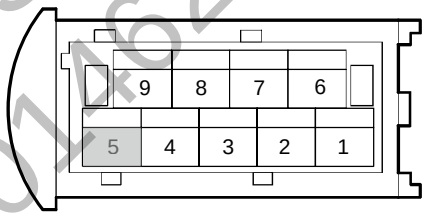
7	Inspect the communication of the terminal No. 5 of the steering lamp wire harness connector CA12/18, the terminal No. 3 of the SO31/24, the terminal G of the DR08/18 and the body grounding.

(a) Measure resistance between turning lamp wire harness connector CAN12/18 terminal No. 5, SO31/24 terminal No. 3, DR08/18 terminal G and vehicle body grounding.

Resistance stated value:is less than 1Ω

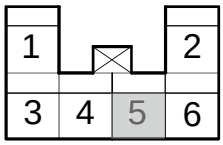
Confirm if the resistance conforms to standard value.

CA12/CA18 front combination headlamp harness connector



NL11-4044b

SO31/SO24 rear combination headlamp harness connector



NL11-4045b

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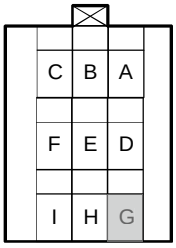
DR08/DR18rearview mirrorharness connector



NL11-4046b

Yes → Go to step 9

No

8	Repair the circuit of the terminal No. 5 of the steering lamp wire harness connector CA12/18, the terminal No. 3 of the SO31/24, the terminal G of the DR08/18 and the body grounding.

(a) Make sure that open-circuit fault between turning lamp wire harness connector CA12/18 terminal No. 5, SO31/24 terminal No. 3, DR08/18 terminal G and vehicle body grounding is repaired.

Confirm whether the system is normal or not.

Yes → The system is normal.

No

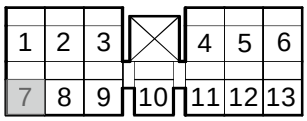
9	Inspect the voltage of the terminal No. 7 of BCM wire harness connector IP4.

(a) Use multimeter to measure resistance of BCM wire harness connector IP48 terminal No. 7.

Standard voltage: 11-14 V

Confirm whether the voltage accords with the standard value.

IP48body control module harness connector2



NL11-4043b

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Yes → The system is normal.

No

10	Repair the circuit between the BCM wire harness connector and the fuse IF04.

(a) Inspect and repair open-circuit fault between BCM wire harness connector and fuse IF04.

Confirm whether system work is normal or not

Yes → The system is normal.

No

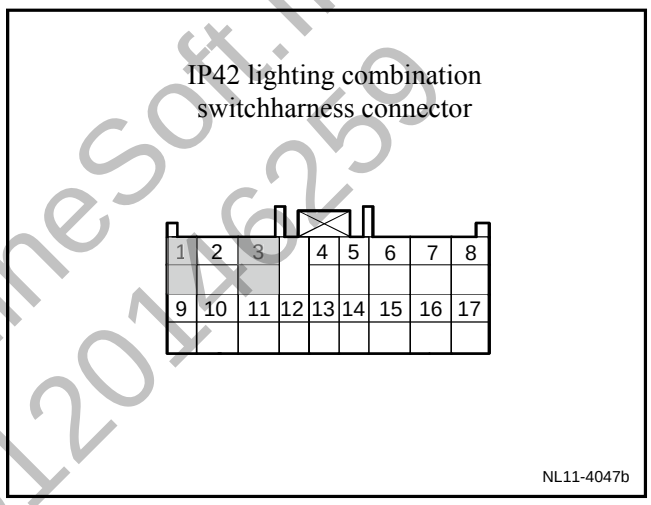
10	Inspect the voltage of the terminal No. 1 and 3 of the light combination switch wire harness connector IP42.

(a) Turn on left turning lamp switch and measure voltage of light combined switch wire harness connector IP42 terminal No. 1.

(b) Turn on right turning lamp switch, and measure voltage of light combined switch wire harness connector IP42 terminal No. 3.

Standard voltage: 11-14 V

Confirm whether the voltage accords with the standard value.



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Yes → The system is normal.

No

12	Repair the circuit of the terminal No. 1 and 3 of the light combination switch wire harness connector IP42, and the terminal No. 27 and 25 of the BCM wire harness connector IP50.

(a) Inspect and repair open-circuit fault between light combined switch IP42 terminal No. 1, terminal No. 3 and BCM wire harness connector IP50 terminal No. 27 and 25.

Confirm whether the system is normal or not.

Yes → The system is normal.

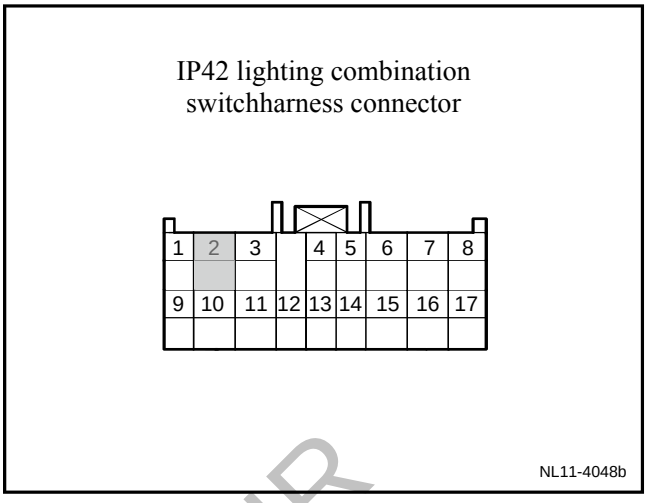
No

13	Inspect the voltage of the terminal No. 2 of the light combination switch wire harness connector IP42.

(a) Turn on left, right turning lamp switch and measure voltage of light combined switch wire harness connector IP42 terminal No. 2.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 15

No

14	Replace lighting combination switch.

(a) Replace lighting combination switch.

Confirm whether the system is normal or not.

Yes → The system is normal.

No

15	Inspect the circuit between the terminal No. 2 of the light combination switch IP42 and the body grounding.

(a) Inspect and repair open-circuit fault between light combined switch IP42 terminal No. 2 and vehicle body grounding.

Confirm the completion of repair.

Next

16	The system is normal.

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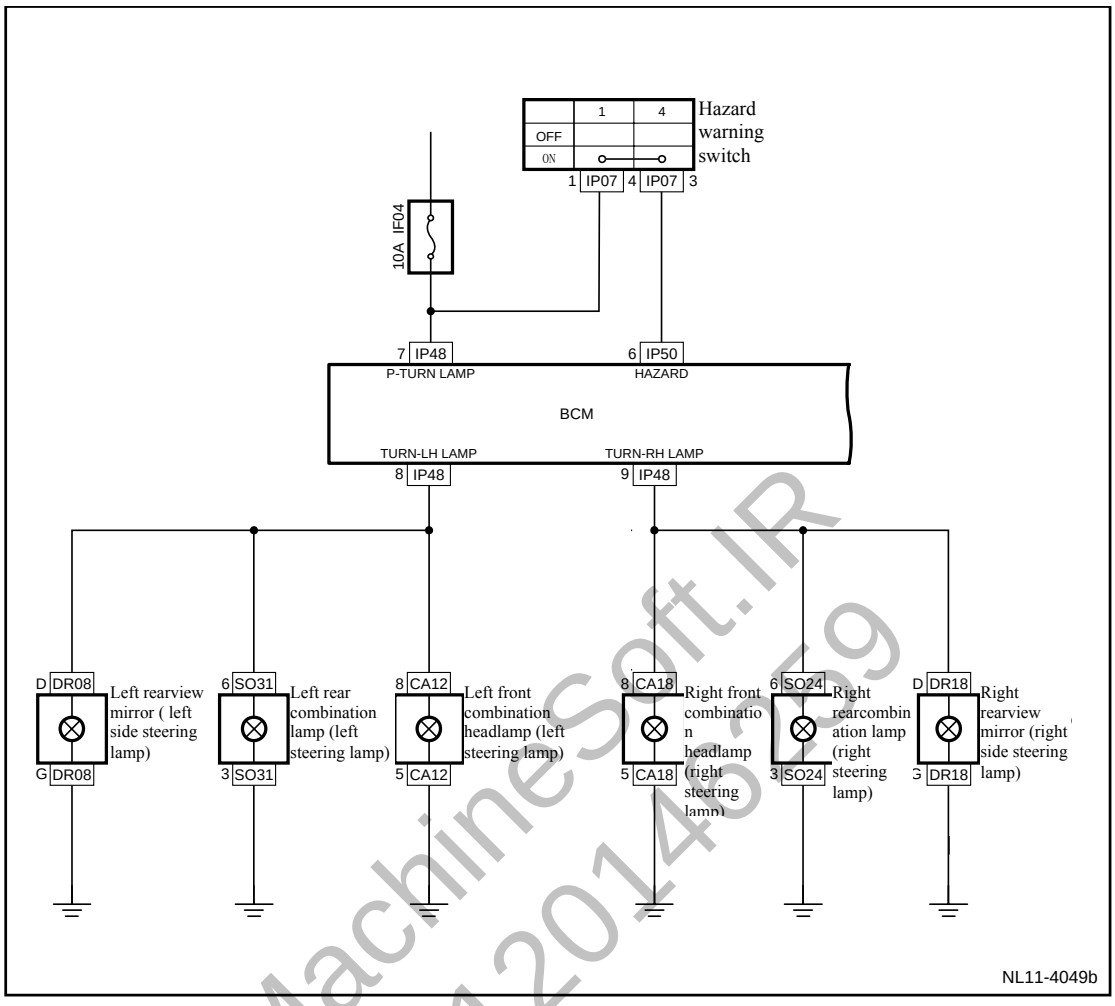
11.4.7.13 Hazard warning lamp do not work

Circuit diagram:



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Diagnostic steps:

1	Confirm whether the steering work light is normal.

(a) Ensure whether turning lamp works normally.

No → See 11.3.7.12 steering lamp does not work.

Yes

2	Repair the circuit from the fuse IF04 to the terminal No. 1 of the hazard warning switch IP07.

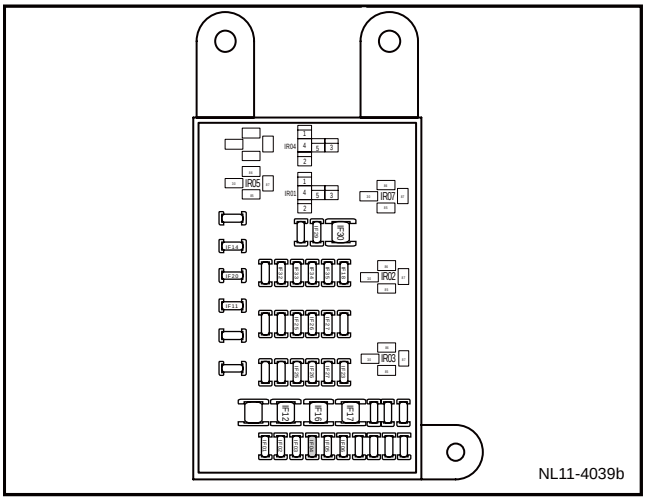
(a) Rotated ignition switch to "OFF" position.

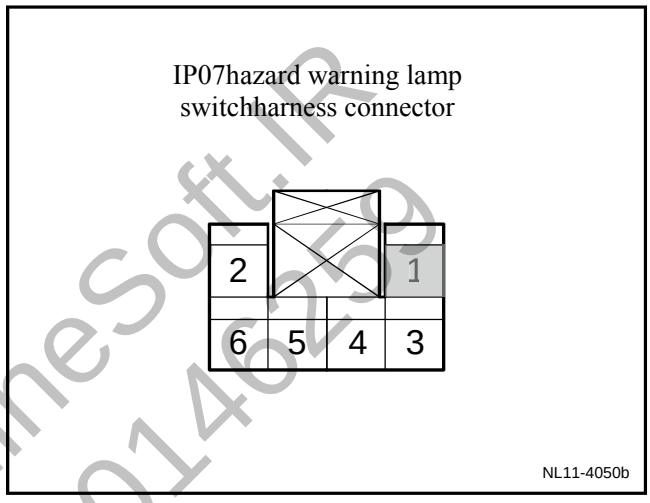
(b) Disconnect hazard warning lamp switch harness connector.

(c) Measure resistance between fuse IF04 to danger warning lamp switch wire harness connector IP07 terminal No. 1.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.





No → Repair or replace the harness.

Yes

3	Inspect the grounding voltage of the terminal No. 4 of the hazard warning lamp switch wire harness connector IP07.

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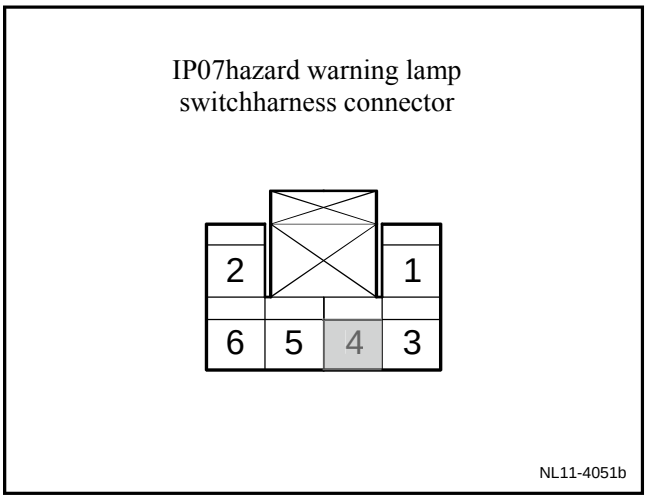
(a) Connect danger warning lamp switch wire harness connector.

(b) Open hazard warning lamp switch.

(c) Measure grounding voltage of danger warning switch wire harness connector IP07 terminal No. 4.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



No → Replace hazard warning lamp switch, Refer to11.3.8.17 replace hazard warning lamp switch.

Yes

4	Repair the wire harness between the terminal No. 4 of the hazard warning lamp switch wire harness connector IP07 and the terminal No. 6 of the BCM wire harness connector IP50.

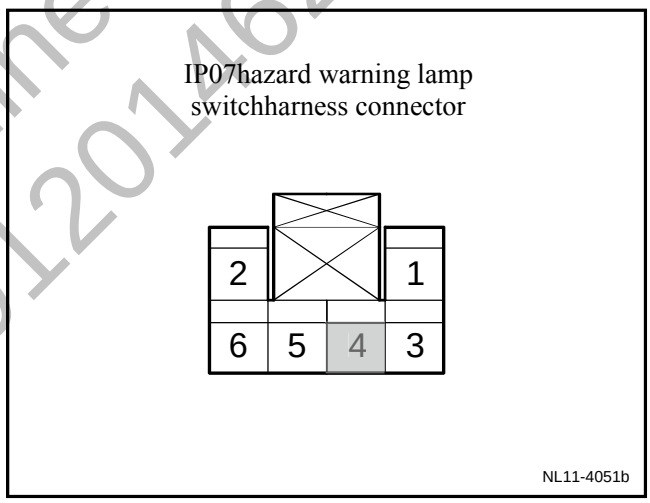
(a) Rotated ignition switch to "OFF" position.

(b) Separately disconnect danger warning lamp wire harness connector and vehicle body control module wire harness connector 4.

(c) Measure resistance between warning lamp switch IP07 terminal No. 4 and vehicle body control module wire harness connector 4 IP50 terminal No. 6.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.



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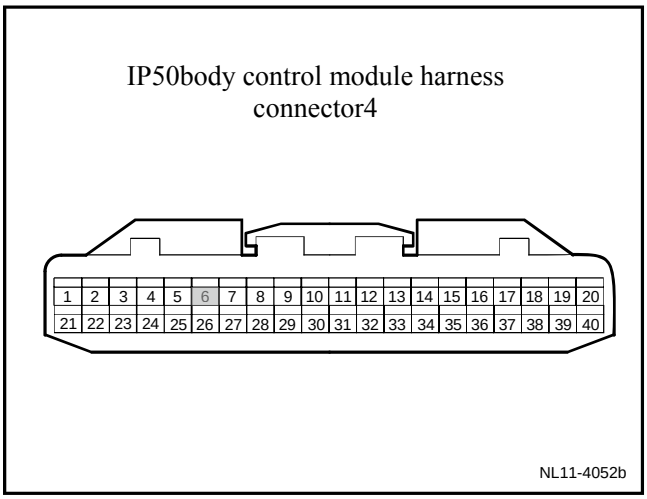

No → Repair or replace the harness.

Yes

5	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

16	The system is normal.

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11.4.8 Dismantle and install

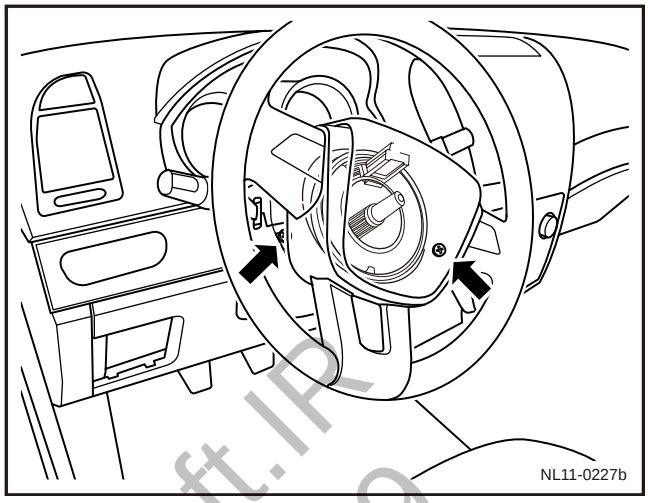
11.4.8.1 Replacement of lighting combination switch

Dismantlement procedure

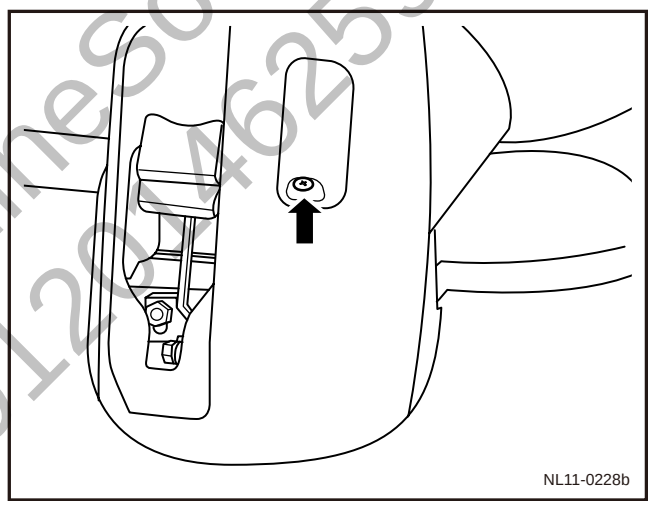
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

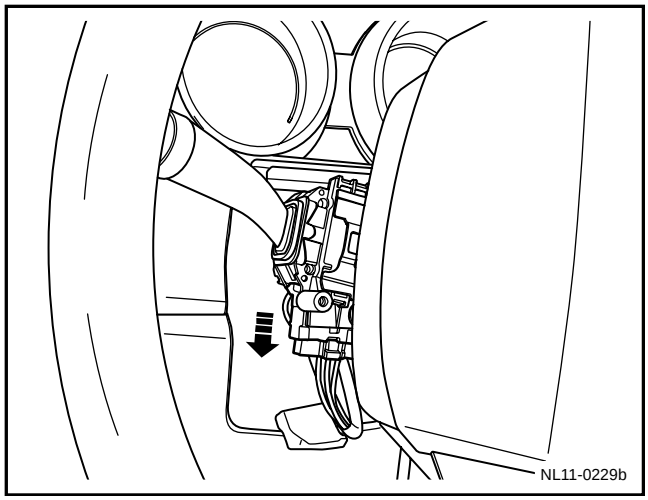
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Turn the steering wheel and dismantle the upper and lower steering column shield panel retaining screws.



3. Dismantle the lower steering column shield screw.
4. Remove the steering column upper and lower shield panels.



5. Disconnect the lighting combination switch arness connector.



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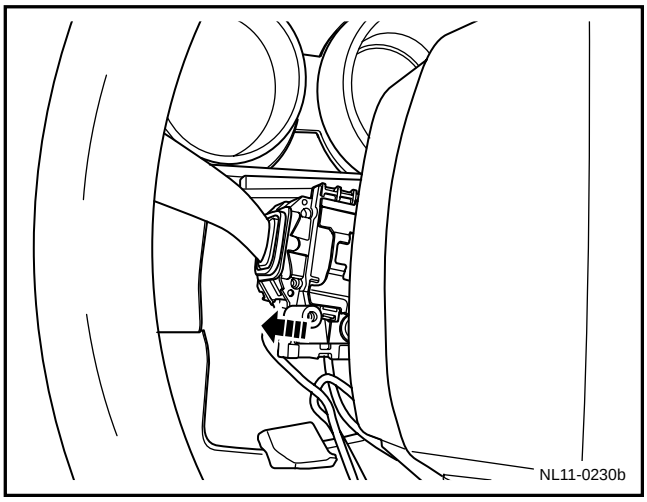
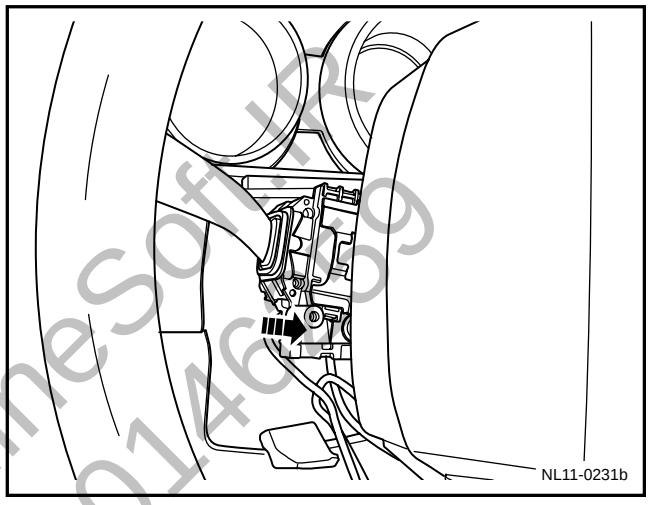
6. Press the outside tongue of switch to dismantle the lighting combination switch.

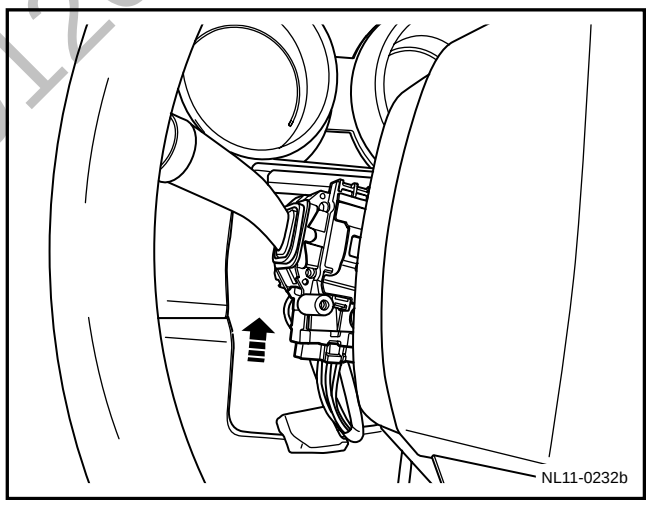


Installation procedure:

1. Insert the lighting combination switch into the switch seating.



2. Connect the lighting combination switch harness connector.



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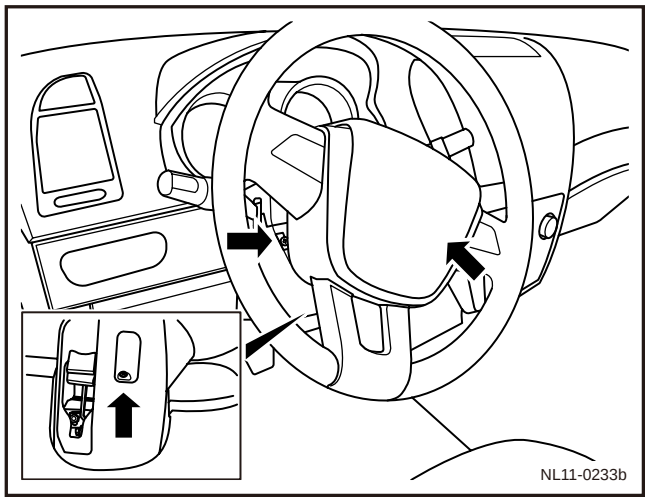
3. Install upper and lower protective plates of steering column, and tighten cover plate screw.



Notes:

See "Important Cautions Regarding Fastening Parts" in "Warnings and Cautions".

Torque:8.8 Nm(Metric) 6.5 lb-ft(English system)

4. Connect the battery negative cable.

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11.4.8.2 Ceiling lamp and reading lamp replacement

Replacement of front ceiling lamp

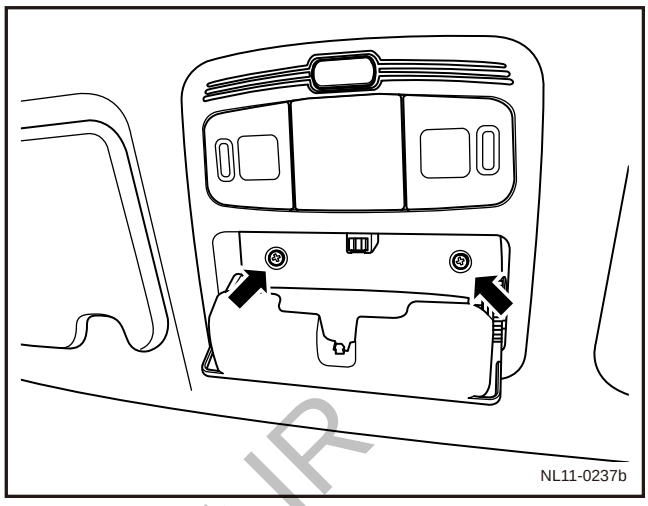
Dismantlement procedure

Warning!

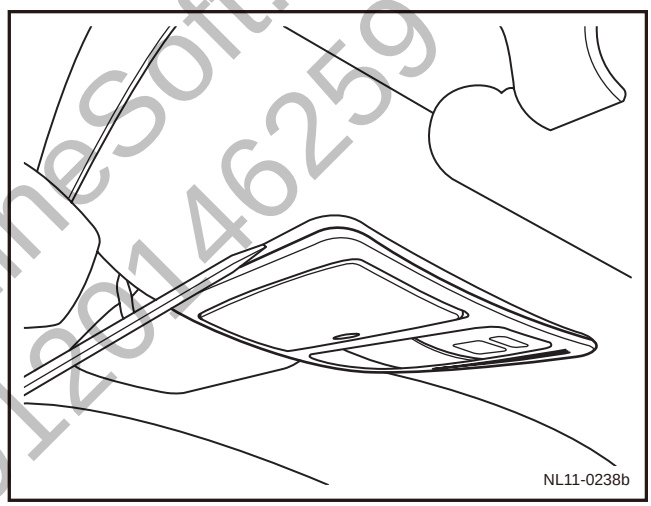
Warning: refer to warning on battery disconnection in warnings and precautions.

1. For disconnection of negative cable of battery, refer to 2.11.8.1 Disconnection procedures of battery cable.

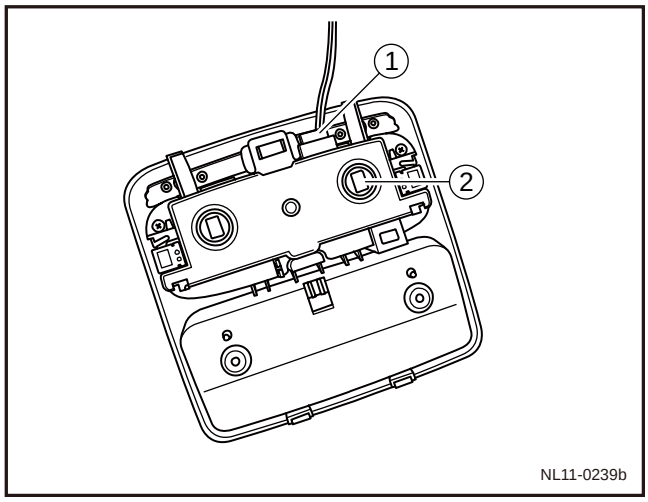
Connection procedures.



2. Open glass box, and dismantle screw.
3. Use suitable tool to dismantle front read lamp.



4. Disconnect front read lamp wire harness connector 1.
5. Screw out Bulb 2.



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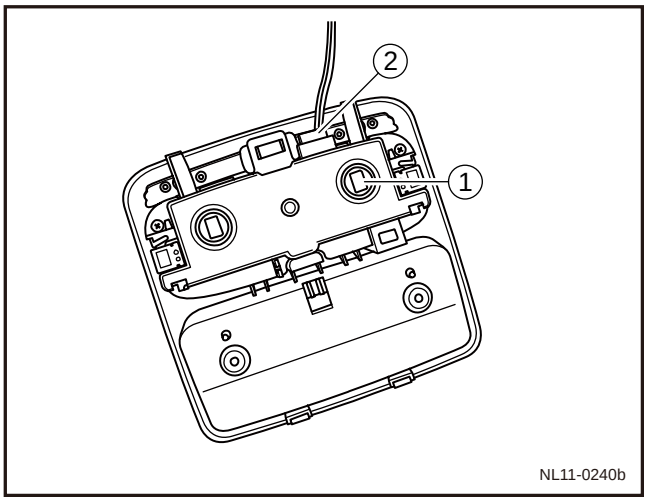
Installation procedure:

1. Install bulb 1.
2. Connect front read lamp wire harness connector 2.



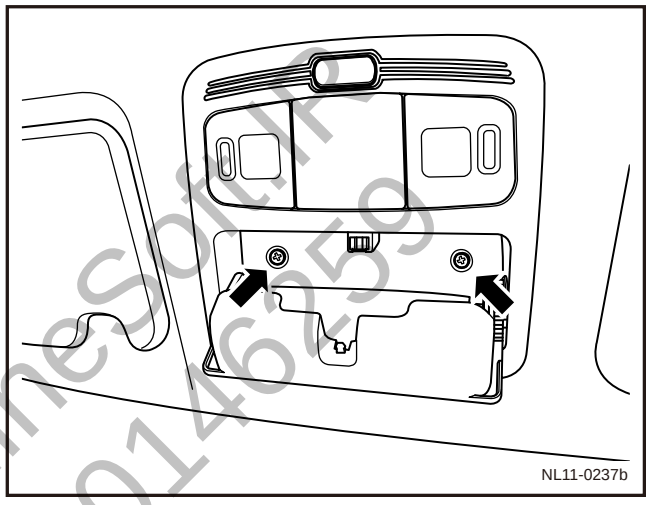
3. Install the dome lamp and tighten the fixing screws.

Notes:

"Cautions of fasteners" shown in "warning and cautions".

Torque: 3Nm (Metric system) 2.2lb-ft (English system)

4. Connect the battery negative cable.



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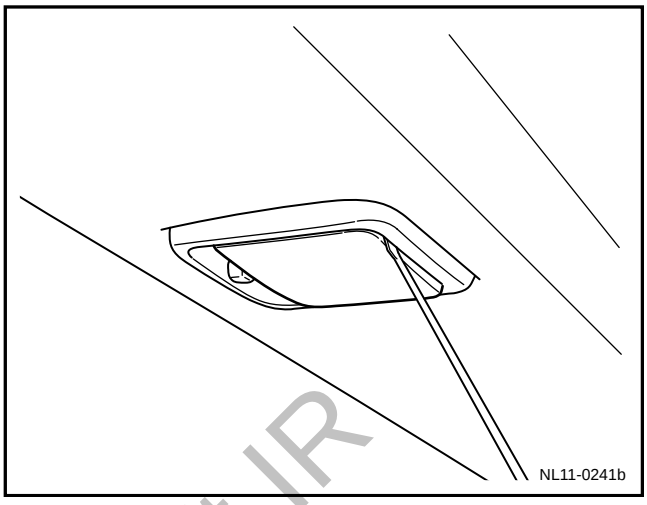
Replacement of rear ceiling lamp and reading lamp

Dismantlement procedure

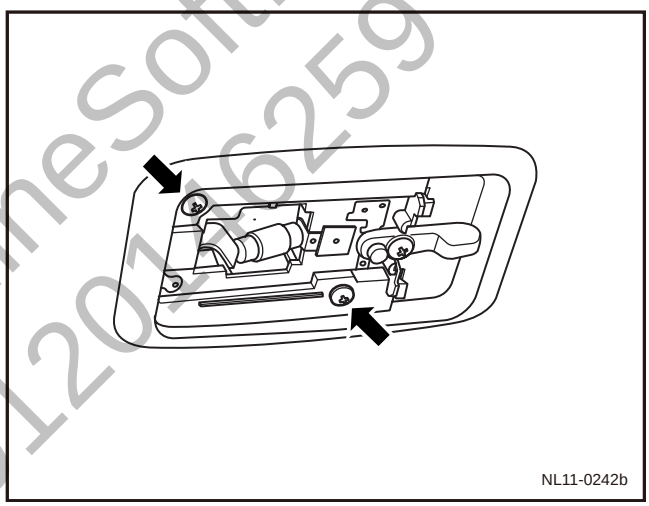
Warning!

Warning: refer to “warning on battery disconnection” in “warnings and precautions”.

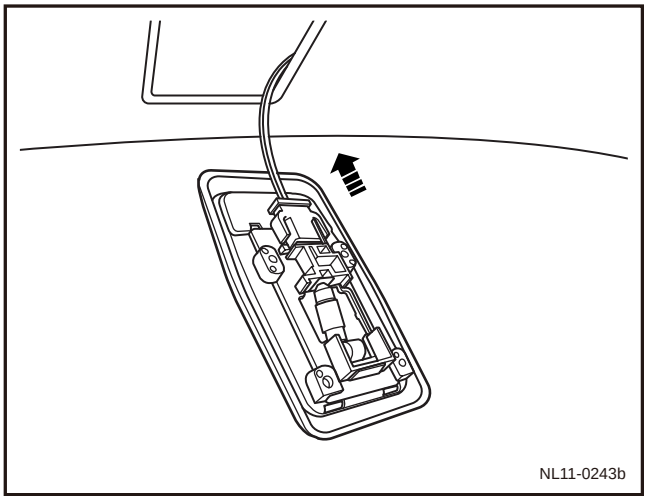
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Insert special tool into rear dome lamp shield rim groove, and dismantle lamp shield



3. Dismantle fixing screw of rear read lamp.



4. Disconnect rear dome lamp wire harness connector.
5. Remove the rear reading lamp.



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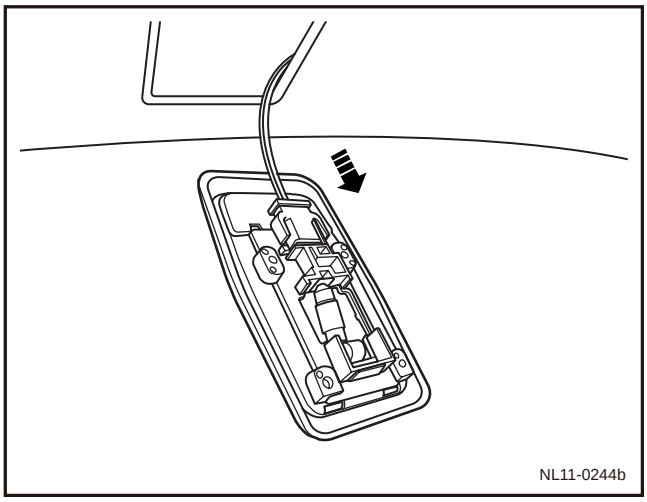
Installation procedure:

1. Connect to rear ceiling lamp harness connector.



2. Install rear read lam and tighten fixing screw.

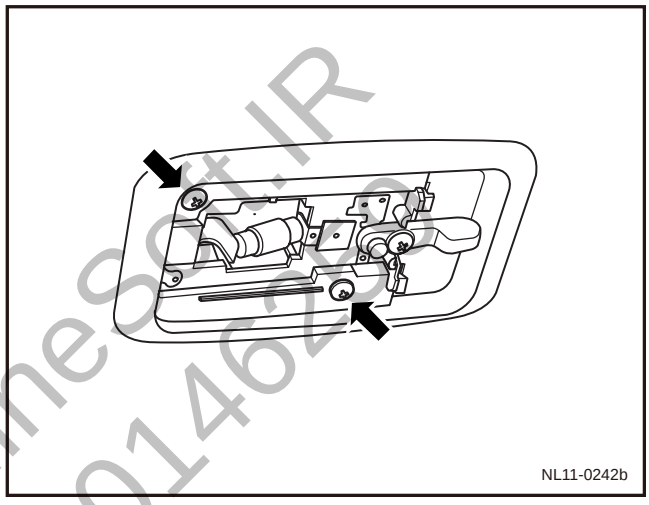
Notes:

"Cautions of fasteners" shown in "warning and cautions".

Torque: 2Nm (Metric system) 1.5lb-ft (English system)

3. Press indoor door control lamp shield into the housing.

4. Connect the battery negative cable.



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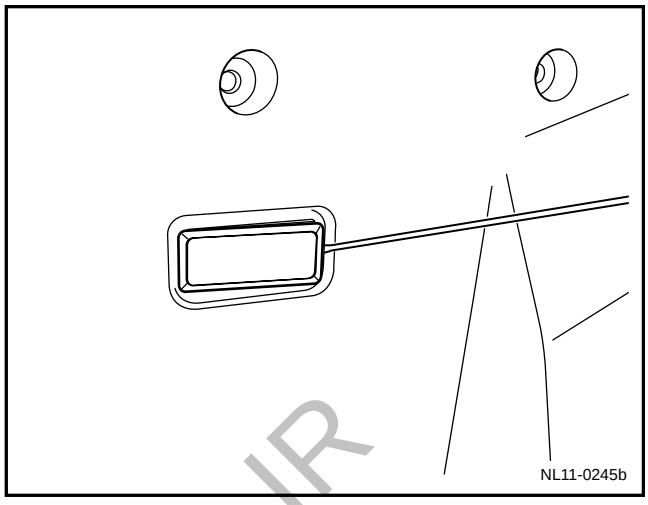
11.4.8.3 Trunk lamp replacement

Dismantlement procedure

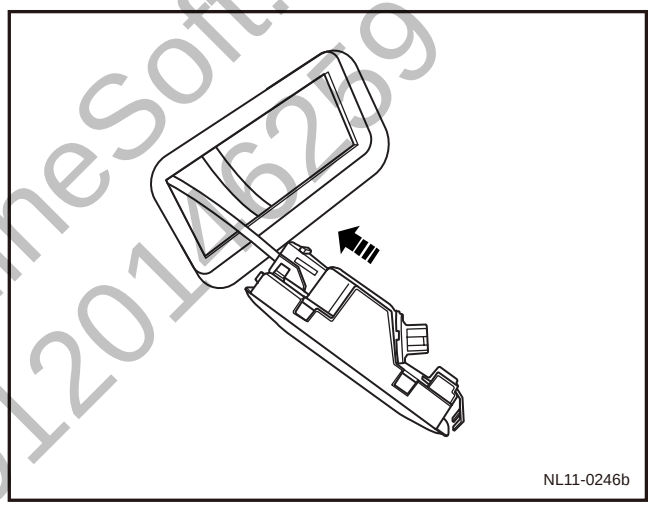
Warning!

Warning: refer to “warning on battery disconnection” in “warnings and precautions”.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Use suitable tool to dismantle boot lamp from inner trimming plate.



3. Disconnect trunk lamp harness connector.



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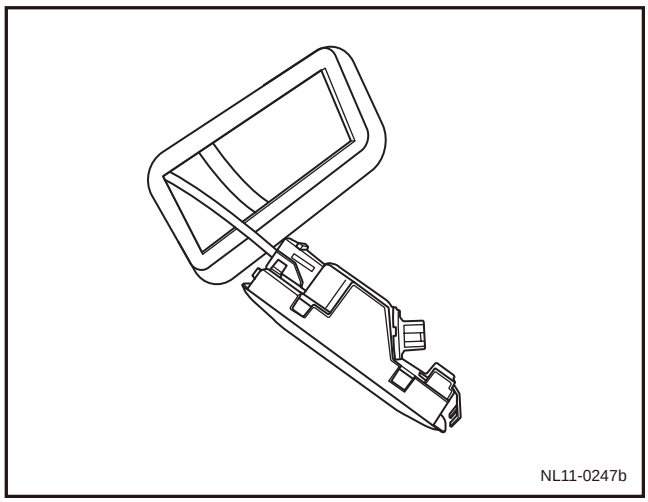
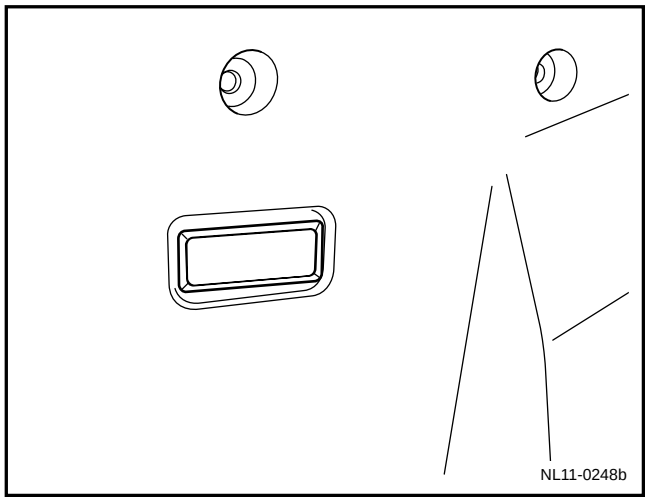
Installation procedure:

1. Connect to trunk lamp harness connector.



2. Install boot lamp.



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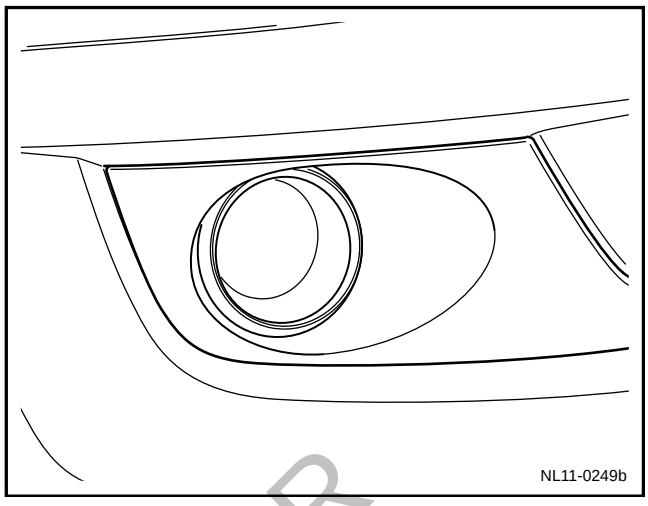
11.3.8.4 Replacement of front fog lamp

Dismantlement procedure

Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

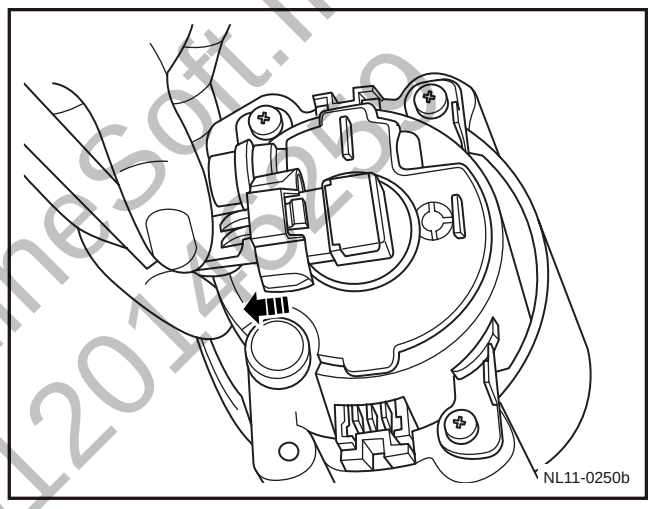
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.



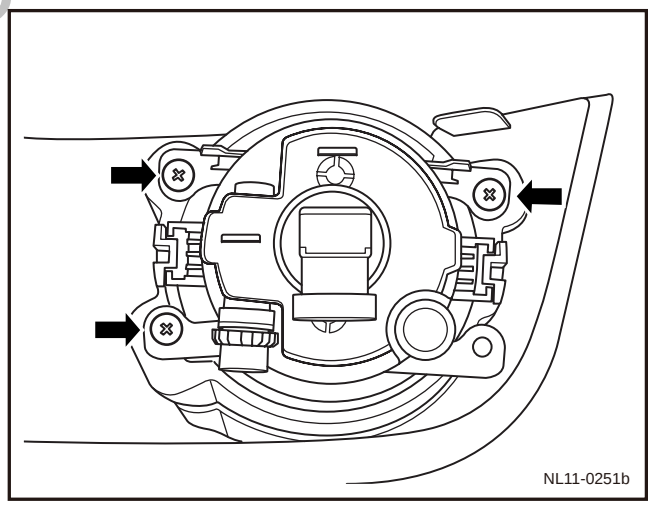
2. For dismantling of lower protective plate of engine, refer to 12.10.1.8 left and right protective plate at the bottom of engine.

Replacement

3. Disconnect the fog lamp assembly harness connector.



4. Remove the fixing bolts of fog lamp.
5. Remove the fog lamp assembly.
6. Loosen and remove the bulb from the fog lamp assembly.



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Installation procedure:

1. Insert the replaced bulb and tighten the fog lamp assembly.

Notes:

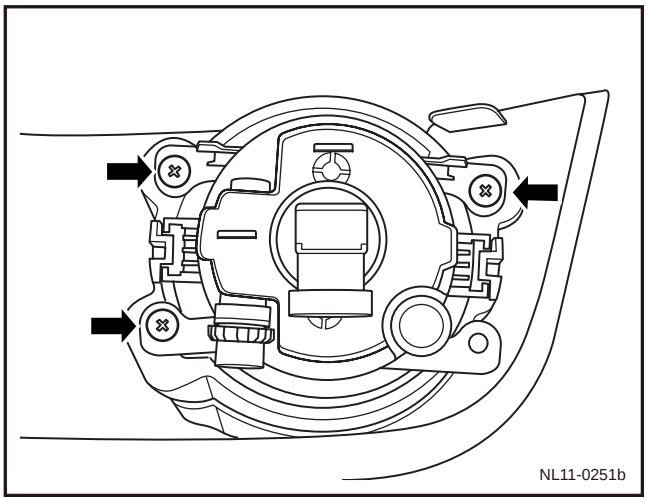
Avoid contacting the bulb or having it get in contact with any wet item.

When the lamp is turned on, the grease or moisture on the bulb may cause the bulb explode. If the bulb contacts with grease or moisture, clean the bulb with alcohol or an appropriate cleaning agent and dry the bulb.

2. Tighten fog lamp bolt.

Torque:5.5Nm(Metric) 4lb-ft(English system)

3. Connect the fog lamp assembly harness connector.
4. Install the engine bottom guard plate.
5. Connect the battery negative cable.



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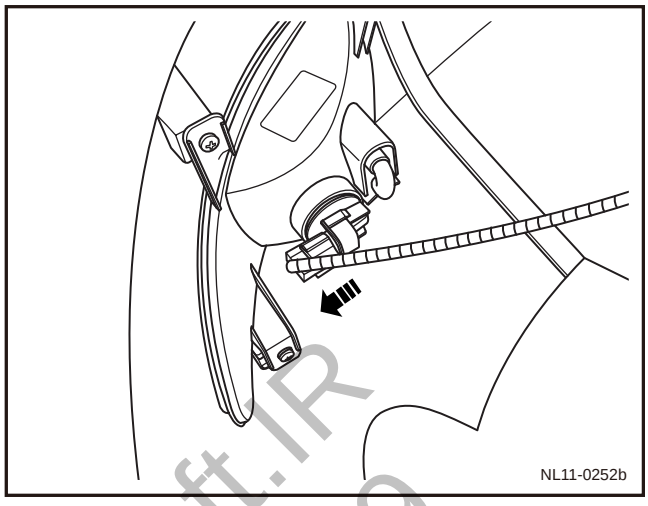
11.4.8.5 Replacement of rear fog lamp

Dismantlement procedure

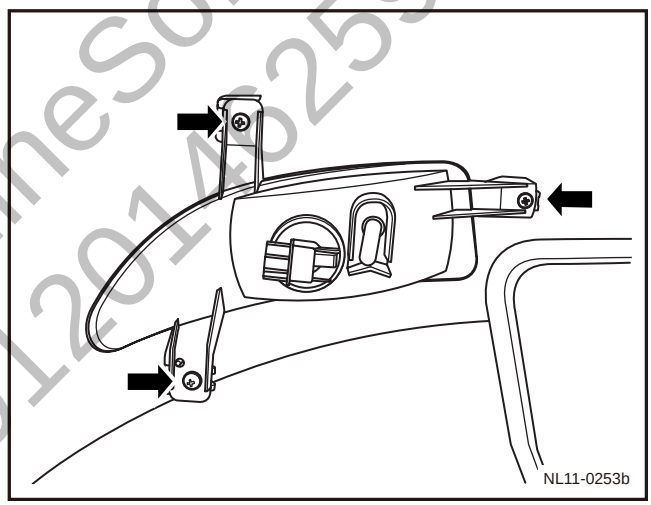
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative electrode cable. Refer to 2.11.8.1 Battery Disconnection.
2. Dismantle the rear bumper. Refer to 12.4.3.3 Replacement of Rear Bumper.
3. Disconnect the rear fog lamp harness connector



4. Dismantle screw used for fixing of rear fog lamp.
5. Screw out the bulb.



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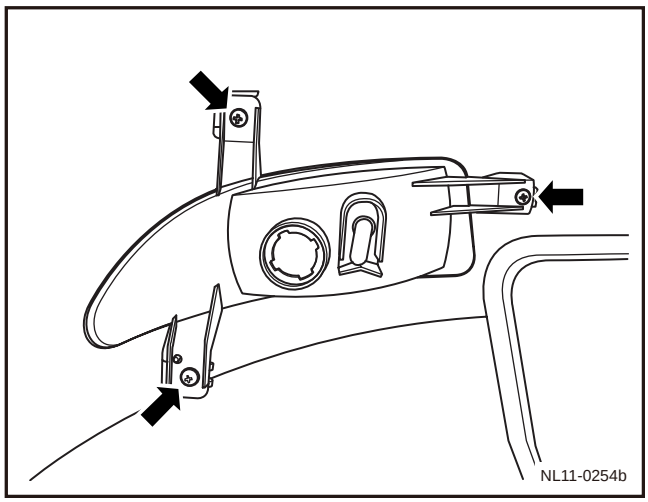
Installation procedure:

1. Install and tighten rear fog lamp fixing screw.



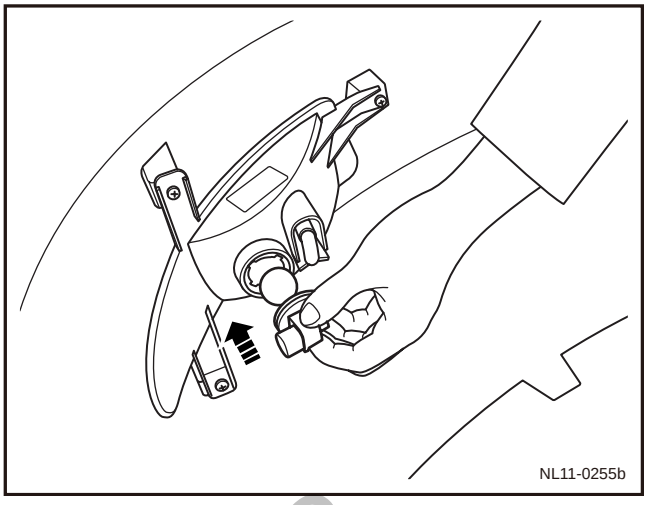
Notes:

Avoid contacting the bulb or having it get in contact with any wet item. When the lamp is turned on, the skin grease or moisture on the bulb may cause the lamp

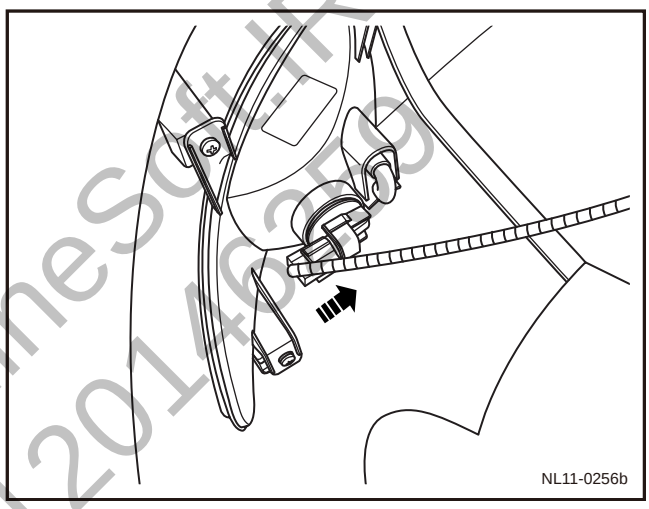
Bulb explodes. If the bulb contacts with grease or moisture, clean the bulb with alcohol or an appropriate cleaning agent and dry the bulb.

Torque: 5Nm (Metric system) 3.7lb-ft
(English system)

2. Install the rear fog lamp assembly.



3. Conect wire harness connector of electric device of combined lamp assembly.
4. Install the rear bumper.
5. Connect the battery negative cable.



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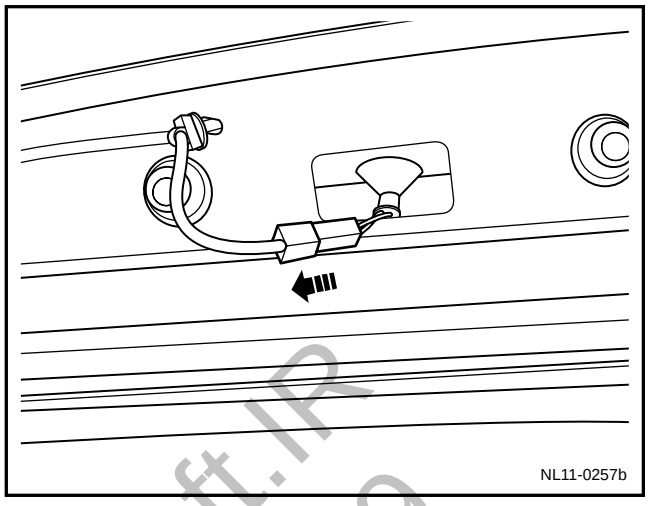
11.4.8.6 Replacement of high mounted brake lamp

Dismantlement procedure

Warning!

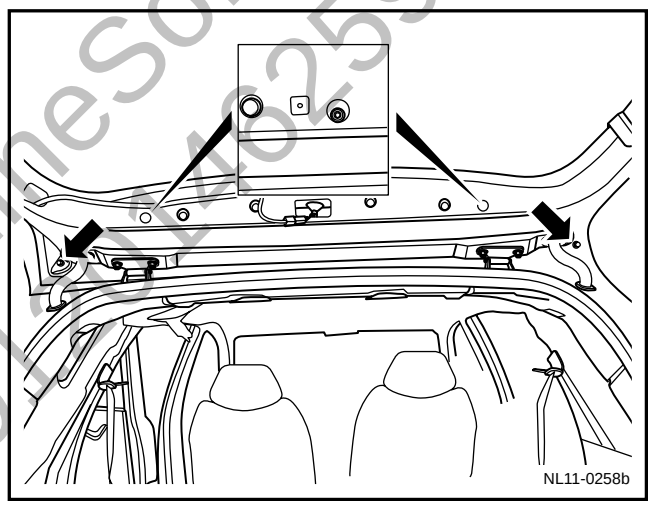
Warning: refer to warning on battery disconnection in warnings and precautions.

1. For disconnection of negative cable of battery, refer to 2.11.8.1 Disconnection procedures of battery cable.

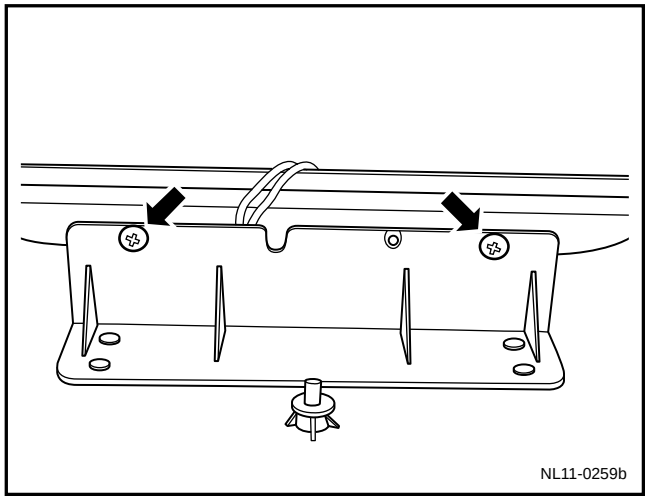


Connection procedures.

2. For dismantling of upper trimming plate of back door frame, refer to 12.9.1.10 Replacement of back door trimming plate.
3. Disconnect the high mounted brake lamp harness connector.
4. Dismantle fixing nut of spoiler.



5. Remove the fixing bolt of the high braking light.



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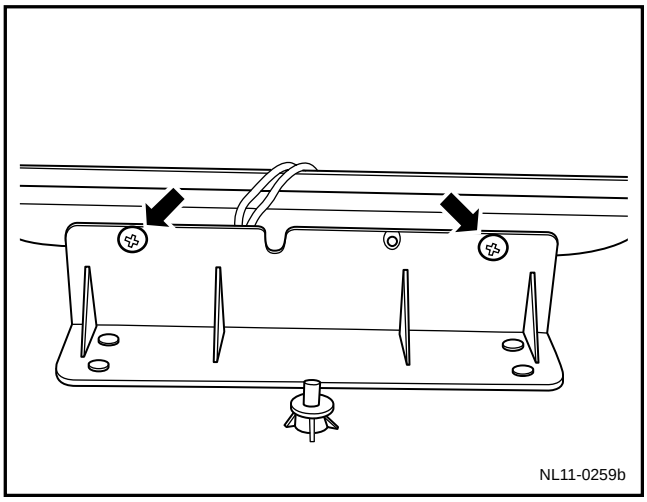
Installation procedure:

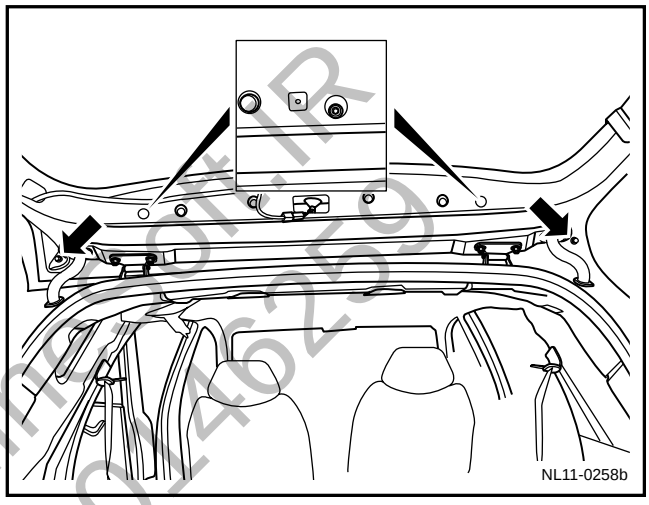
1. Install the high mounted brake lamp and tighten the fixing screws.

Torque:5Nm(Metric) 4lb-ft(English system)

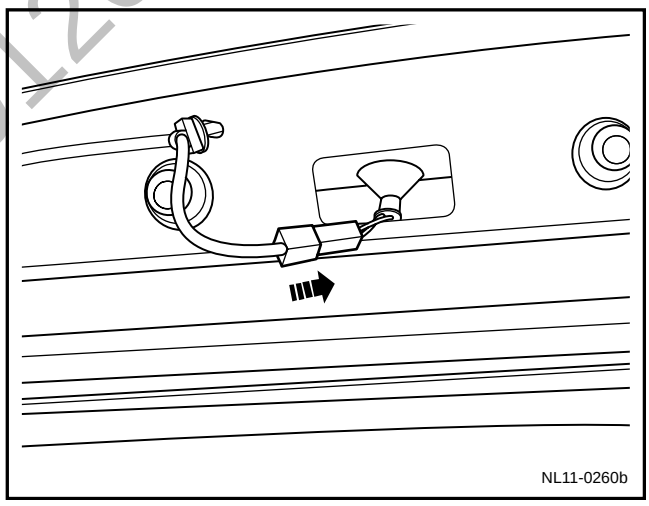


2. Install spoiler and tighten it with fixing nut.

Torque:10Nm(Metric) 7.4lb-ft(English system)



3. Connect the high mounted brake lamp harness connector.
4. Install upper trimming plate of rear back door frame.
5. Connect the battery negative cable.



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11.4.8.7 Replacement of headlamp

Dismantlement procedure

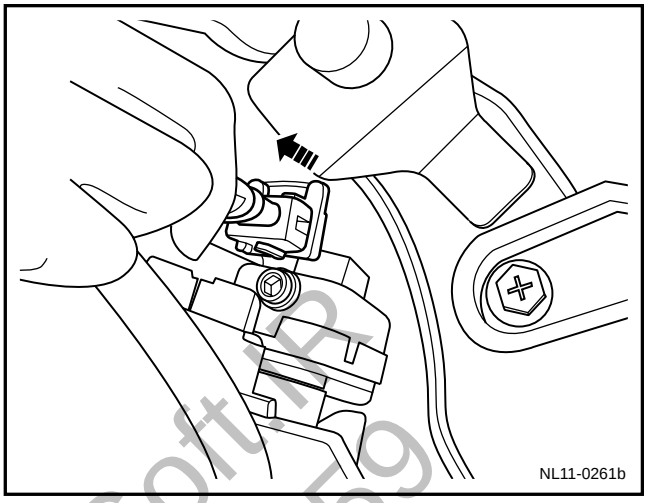
Notes:

A light height adjusting motor is internally arranged in a headlamp assembly.

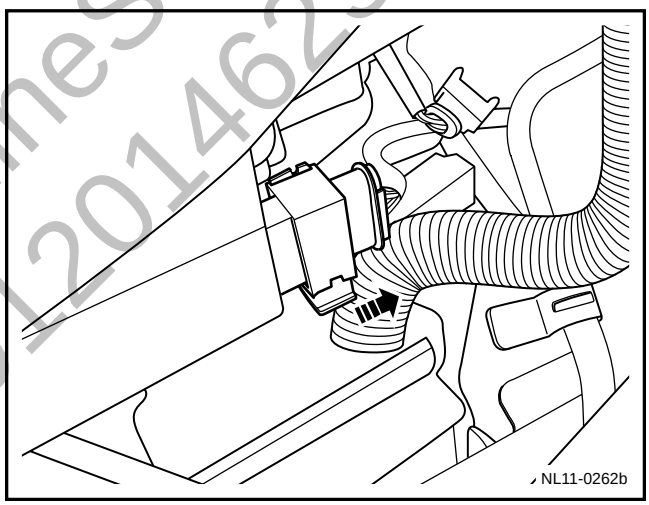
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of front bumper, refer to 12.4.3.1 Replacement of front bumper.
3. Front bumper replacement.



4. Disconnect wire harness connector under headlamp assembly.



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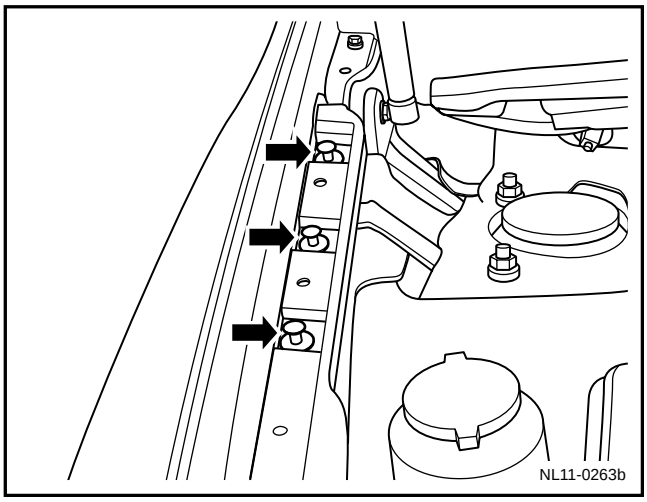
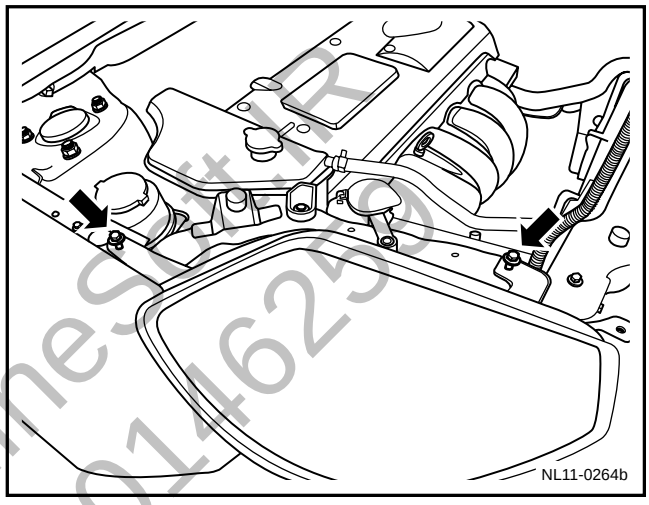
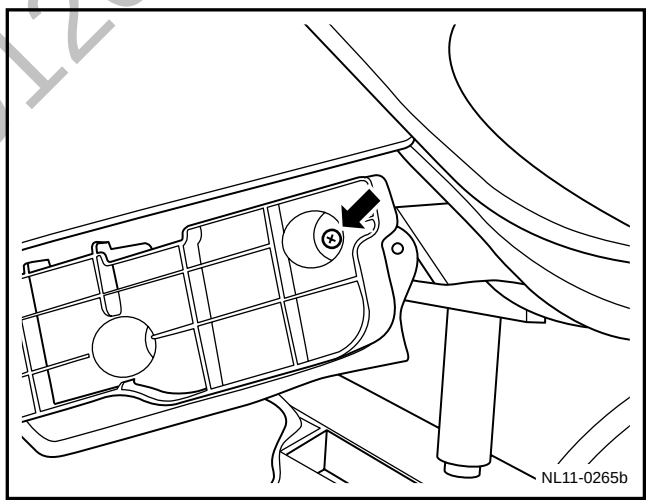
5. Remove the fixing buckle for the front fender lining plate trim panel and the upper trim panel.



6. Dismantle the upper fixing bolts of headlamp assembly.



7. Remove the side fixing screw for the headlight assembly.



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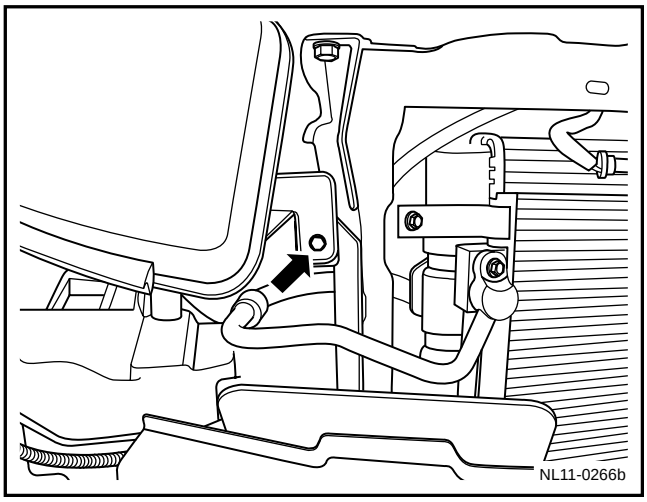
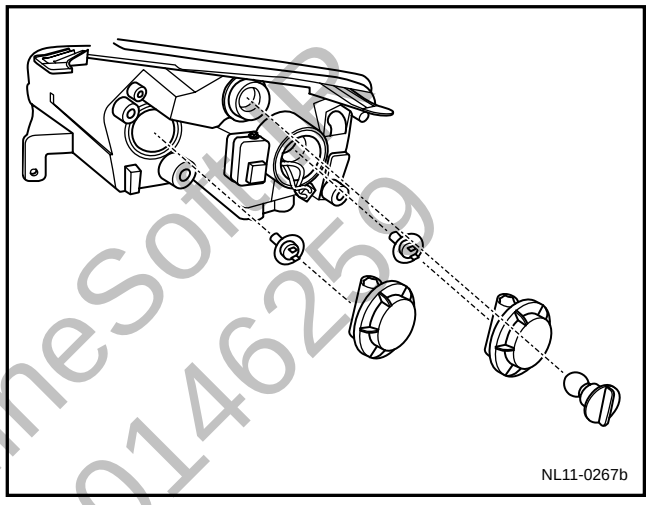
8. Remove the fixing bolt on the front of the headlight.
9. Dismantle the headlight assembly.



10. Loose the bulb cover of headlamp.
11. Disconnect the bulb connector of headlamp.
12. Dismantle the headlamp bulb.



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Installation procedure:

Warning!

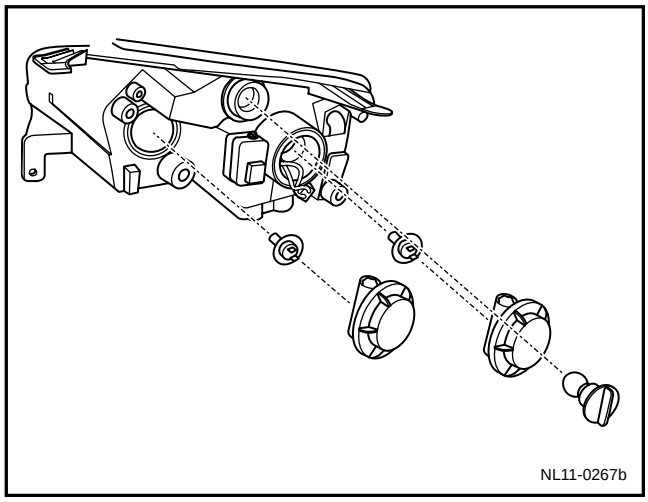
Refer to "warning on halogen bulb" in "warnings and precautions".

1. Install the headlamp bulb.

Notes:

Avoid contacting the bulb or having it get in contact with any wet item. When the lamp is turned on, the skin grease or moisture on the bulb may cause the bulb explode. If the bulb contact with any one of the above, use alcohol or appropriate

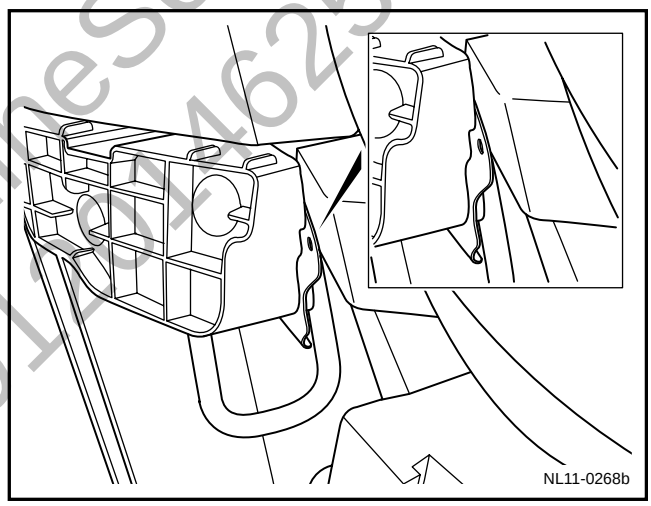
Clean through degreaser and dry the bulb.



2. Connect the headlamp bulb connector.

3. Tighten the headlamp bulb cover.

4. When installing headlamp, pay attention to align with limit hole of headlamp.



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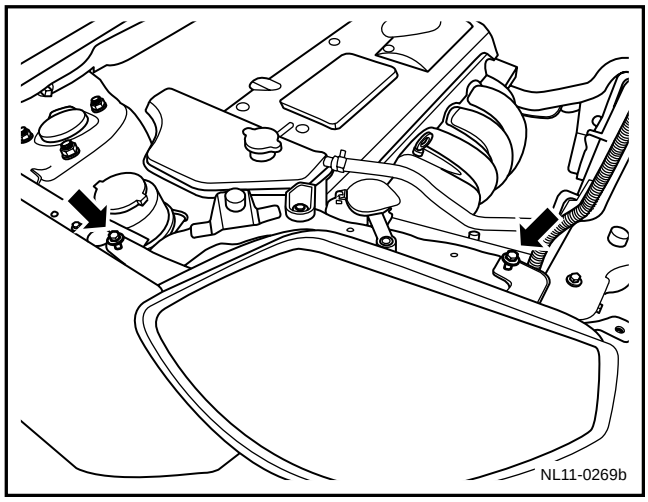
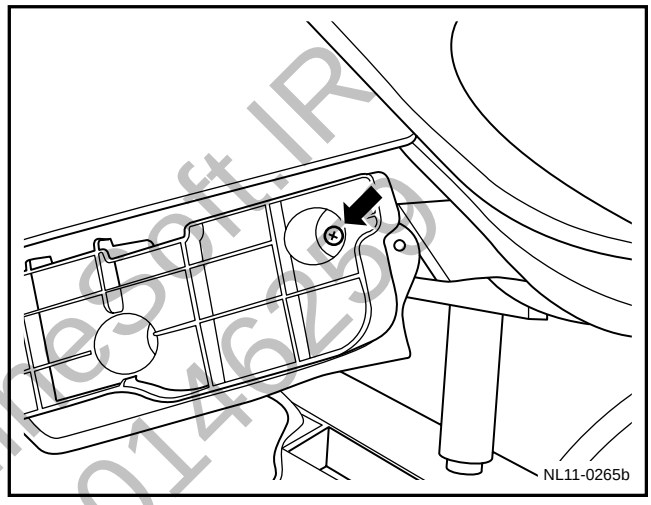
5. Install the upper fixing bolts of headlamp.

Torque:8.8Nm(Metric)
6.5lb-ft(English system)



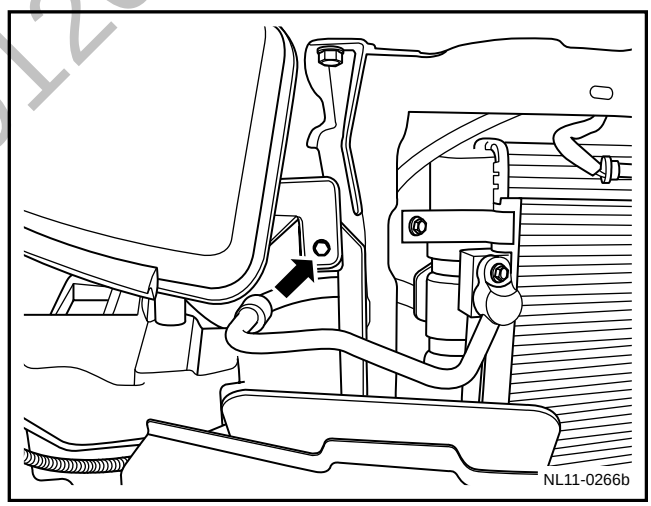
6. Install and tighten the side fixing screw for the headlight.

Torque:8.8Nm(Metric)
6.5lb-ft(English system)



7. Install and tighten the front fixing bolt for the headlight.

Torque: 8.8Nm (Metric) 6.5 lb-ft (English system)



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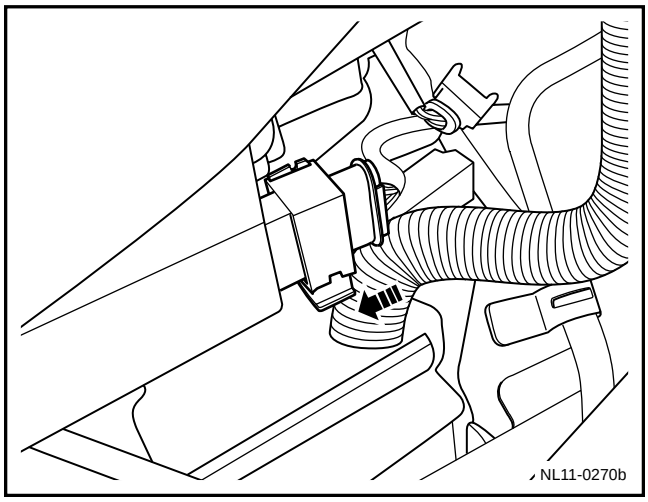
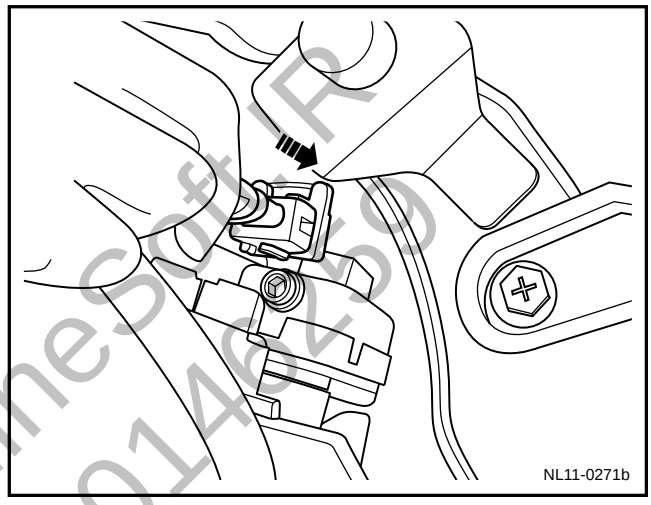
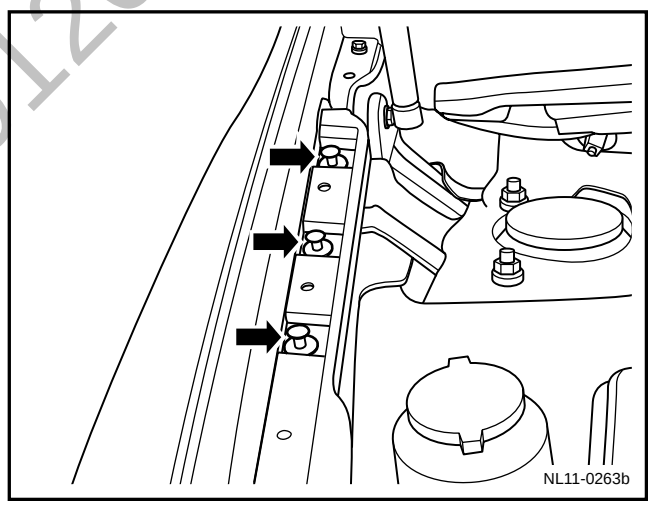
8. Connect the headlight assembly lower electrical wire harness connector and press into connector bayonet lock.



9. Connect the upper harness connector of the headlight.



10. Install front fender bushing trimming plate and press fixing buckle.
11. Install front bumper.
12. Connect the battery negative cable.



Notes:

Adjust the headlamps harness after installation.

Notes:

The method for replacing the front position lamp and the front steering signal lamp is the same as that for replacing the headlamp; and the replacement procedure refers to "replacement of headlamp".

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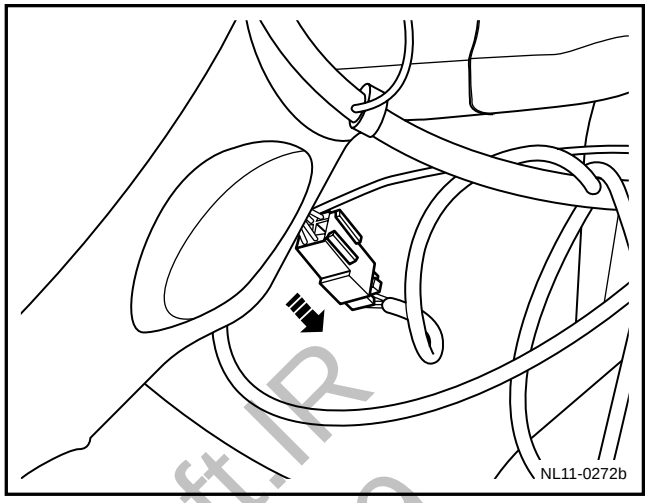
11.4.8.8 Replacement of rear combination lamp

Dismantlement procedure

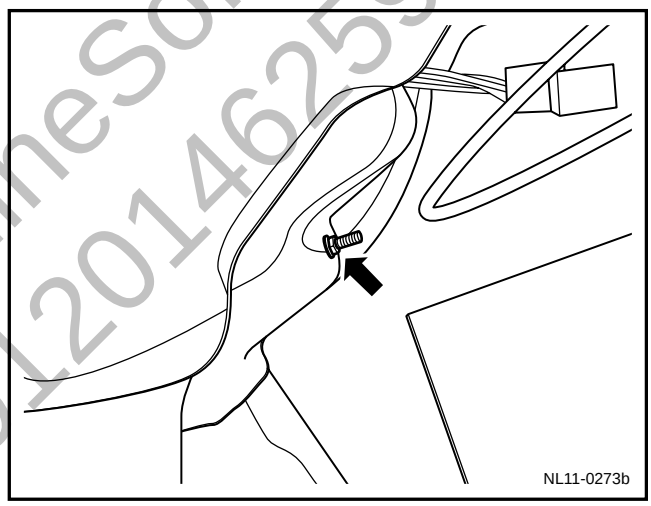
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

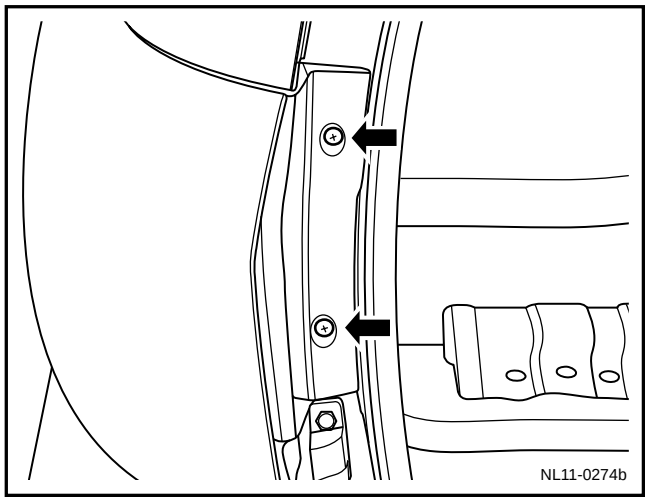
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of lower trimming plate of rear column, refer to 12.9.1.5 replacement of lower trimming plate of rear column.
3. Disconnect the rear combination lamp harness connector.



4. Dismantle fixing nut inside rear combined lamp.



5. Remove the external fixing bolt for the rear assembled lamp.
6. Remove the assembled lamp.



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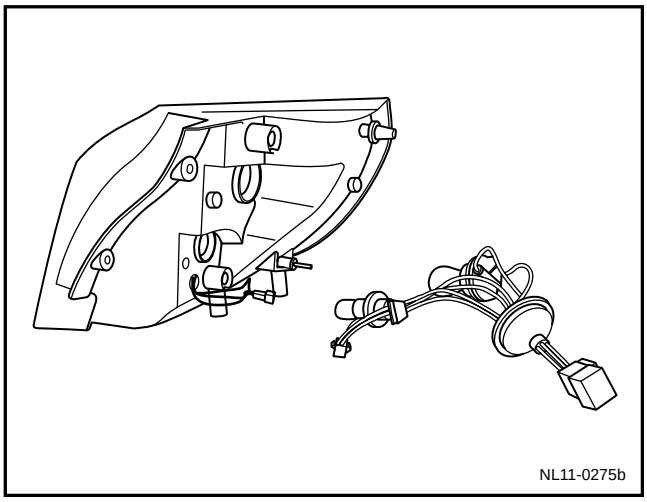
7. Unscrew the back cover of the rear assembled lamp and dismantle the bulb.

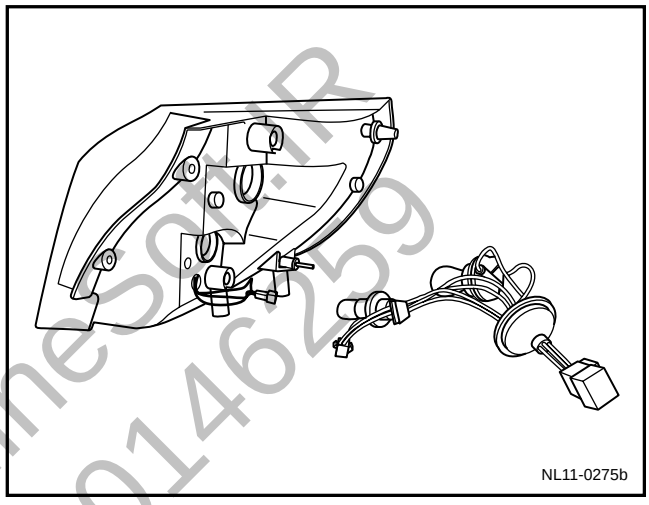


Installation procedure:

1. Assemble bulb into rear combined lamp assembly.

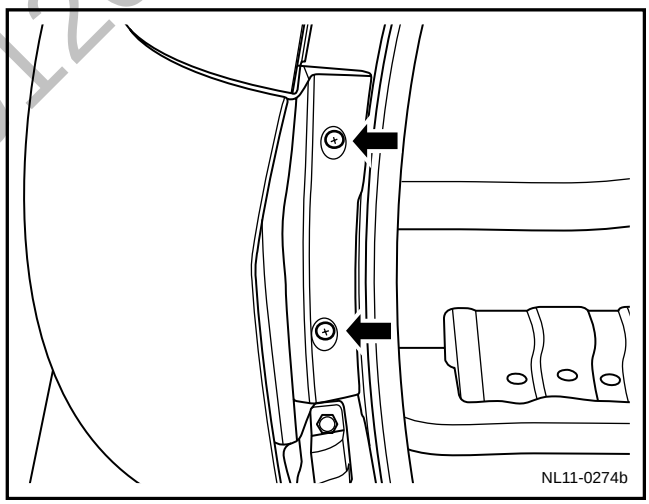
Notes:

Avoid contacting the bulb or having it get in contact with any wet item. When the lamp is turned on, the skin grease or moisture on the bulb may cause the bulb explode. If the bulb contacts with grease or moisture, clean the bulb with alcohol or an appropriate cleaning agent and dry the bulb.



2. Install rear combined lamp assembly and tighten external fixing screw.

Torque: 3Nm (Metric system) 2.2lb-ft (English system)



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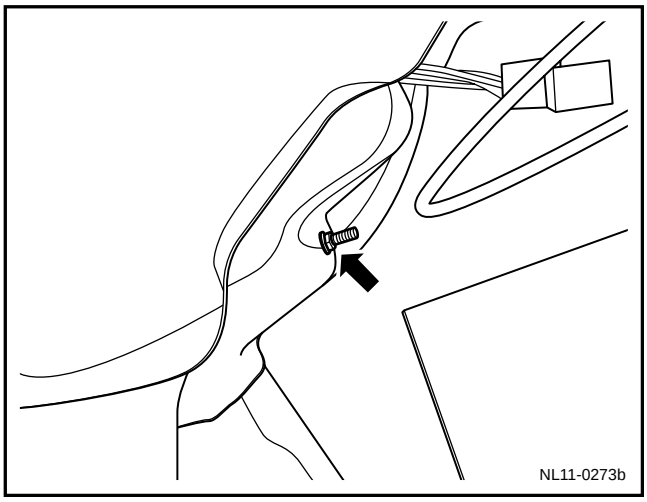
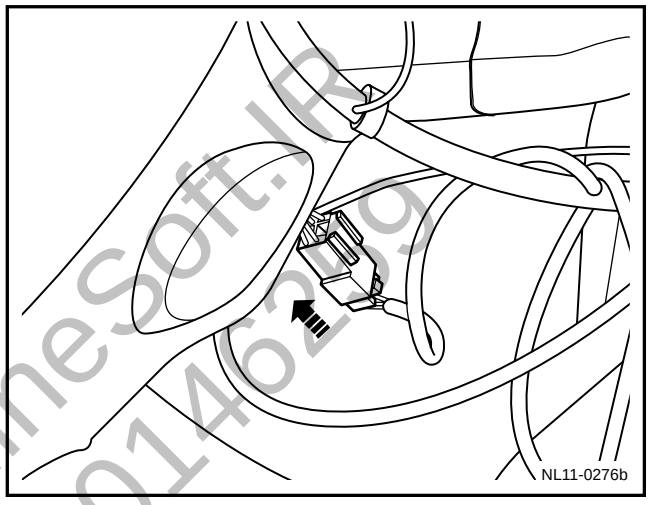
3. Install fixing nut inside rear combined lamp.

Torque: 3Nm (Metric system) 2.2lb-ft (English system)



4. Connect the harness connector for the rear combination lamp assembly.
5. Install the rear column lower trim panel.
6. Connect the battery negative cable.
7. If you want to only replace the rear assembled bulb, you may directly open the rear assembled lamp decorative cover.



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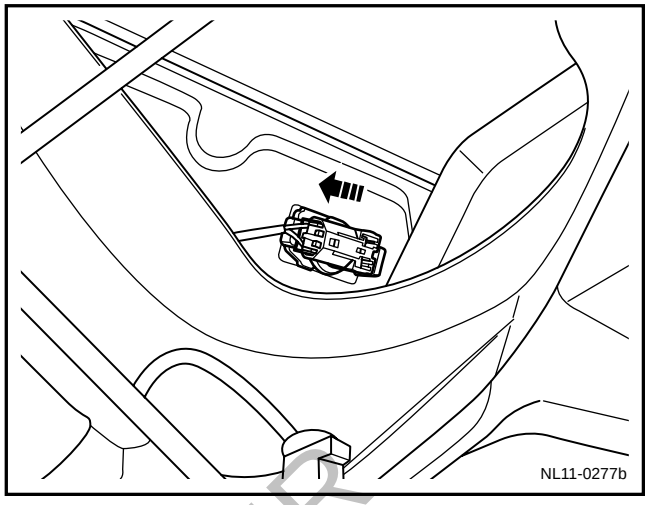
11.4.8.9 Replacement of rear license lamp

Dismantlement procedure

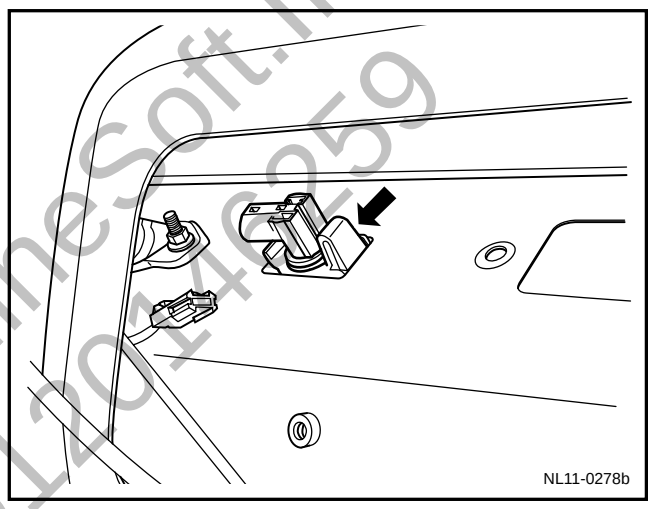
Warning!

Warning: refer to "warning on battery disconnection" in "warnings and precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of back door inner trimming plate, refer to 12.9.1.10 Replacement of back door trimming plate.



3. Disconnect license lamp harness connector.
4. For dismantling of back door trimming strip, refer to 12.10.1.5 Replacement of back door trimming strip.
5. Remove the license plate lamp by pressing and holding the clamping tongue of the license plate lamp.
6. Unscrew the bulb from the license plate lamp assembly.



Installation procedure:

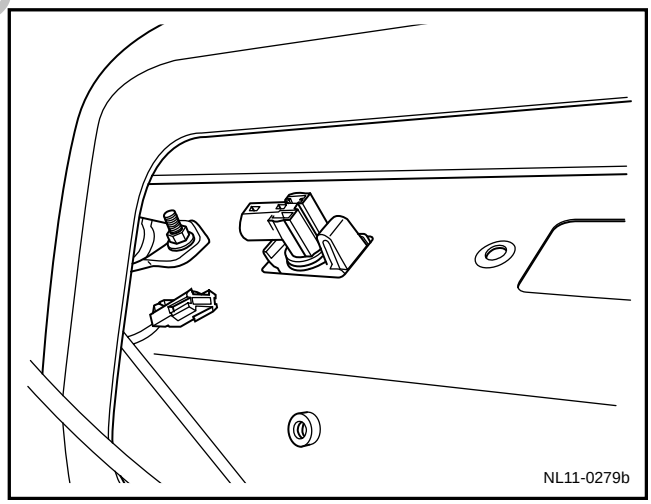
1. Install the license lamp bulb.

Notes:

Avoid contacting the bulb or having it get in contact with any wet item. When the lamp is turned on, the skin grease or moisture on the bulb may cause

Bulb explodes. If the bulb contacts with grease or moisture, clean the bulb with alcohol or an appropriate cleaning agent and dry the bulb.

2. Press licence lamp into mounting hole of luggage compartment.



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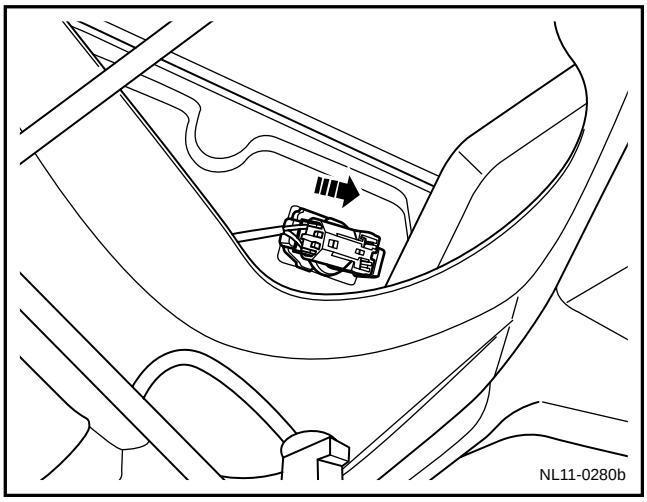
3. Install back door trimming strip.
4. Connect the license lamp harness connector.
5. Assembled back door internal trim panel
6. Connect the battery negative cable.



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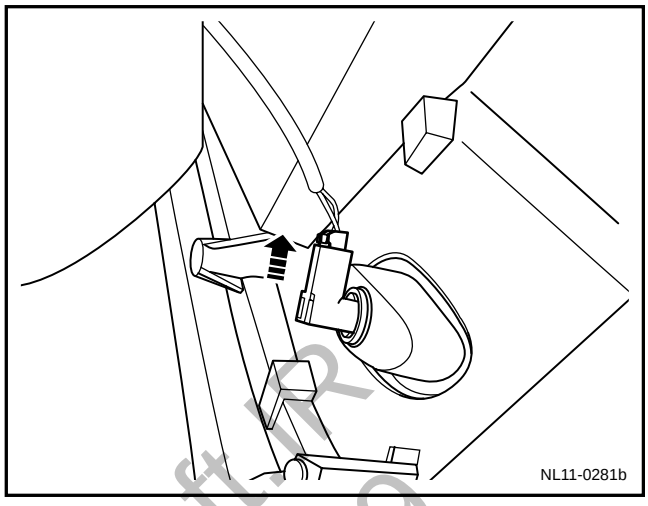
11.4.8.10 Door lamp replacement

Dismantlement procedure

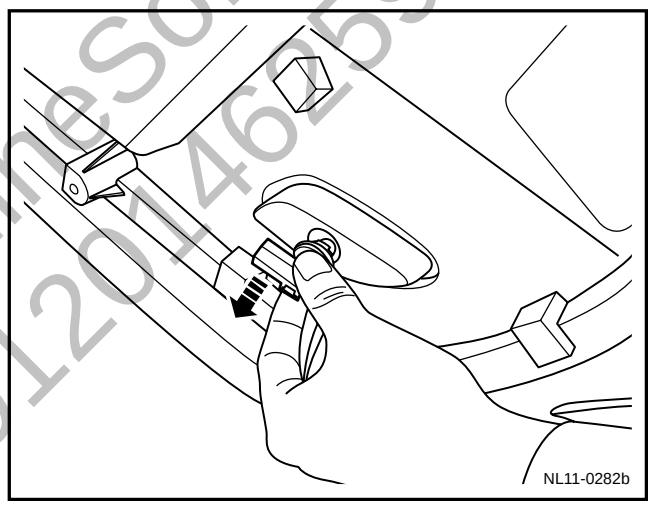
Warning!

Warning: refer to "warning on battery disconnection" in "warnings and precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle the front door interior trim panel. Refer to12.9.1.7 replacement of front door interior trim panel.
3. Dismantle door lamp wire harness connector.



4. Screw out the door lamp bulb.

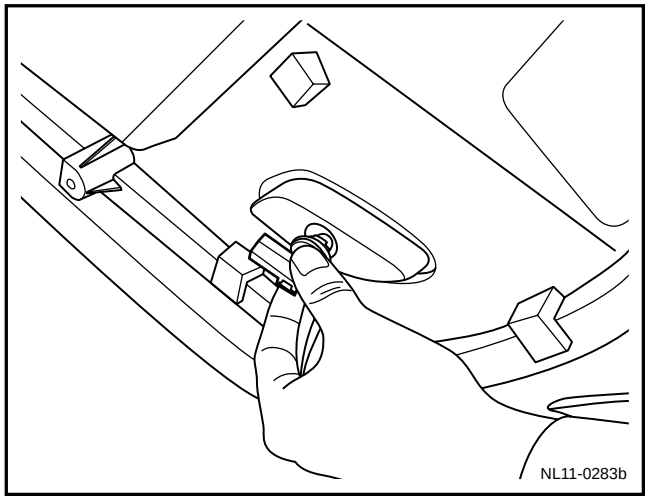


Installation procedure:

1. Install door bulb.

Notes:

Avoid contacting the bulb or having it get in contact with any wet item. When the lamp is turned on, the skin grease or moisture on the bulb may cause the bulb explode. If the bulb contacts with grease or moisture, clean the bulb with alcohol or an appropriate cleaning agent and dry the bulb.



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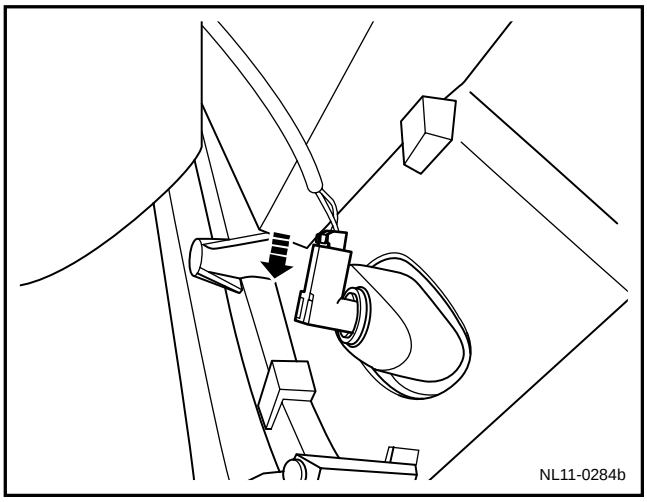
2. Connect door lamp wire harness connector.
3. Install the front door interior trim panel.
4. Connect the battery negative cable.



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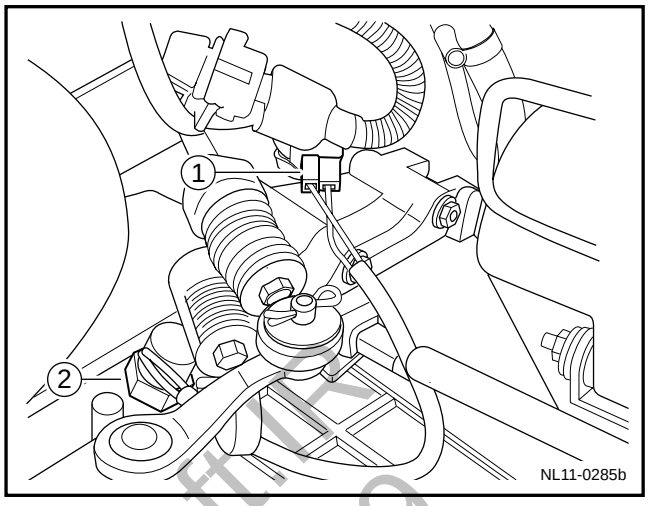
11.4.8.11 Replacement of reverse switch

Dismantlement procedure

Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Disconnect reversing switch wire harness connector 1.
3. Unscrew reversing switch from gearbox.

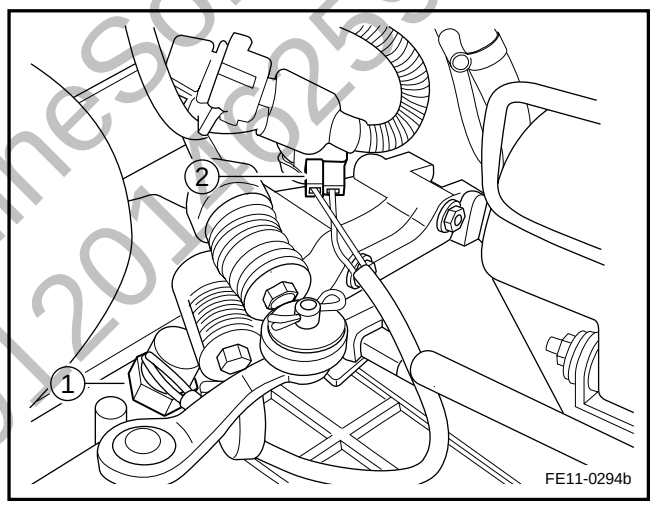


Installation procedure:

1. Install and tighten reversing switch 1.

Torque: 40Nm (Metric) 30lb-ft (English system)

2. Connect switch wire harness connector 2.
3. Connect the battery negative cable.



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11.4.8.12 Mechanical steering column assembly replacement

Dismantlement procedure

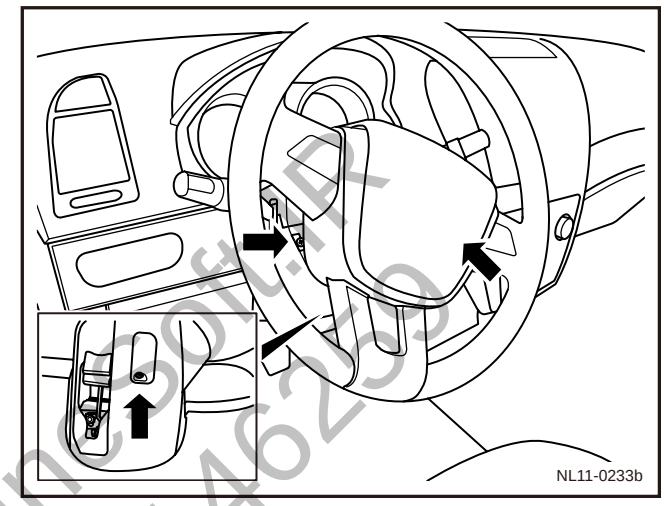
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Rotated steering disc to make front wheel in the front of it.
2. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.

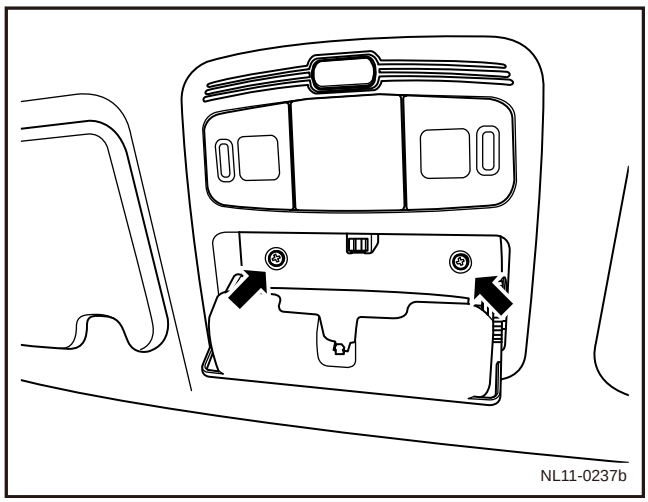
Notes:

Wait at least 90 s after disconnecting the battery cable to prevent the airbag and the seat safety belt pre-tensioner from being started.



3. Dismantle the steering wheel. Refer to 7.3.6.3 Replacement of Steering Wheel.
4. Dismantle upper and lower protective plates of mechanical steering pipe column assembly.
5. For removal of the clock spring, see 9.2.7.3 Replacement of Clock Spring.
6. For dismantlement of light combination switch, see 11.3.8.1 Replacement of Light Combination Switch.
7. For dismantlement of the wiper and washer switches, see 11.5.8.9 Replacement of Wiper and Washer Switches.

8. Remove instrument panel. Refer to 12.8.3.1 Instrument Panel Replacement.



9. Remove 2 Fixing Nuts 1 of the pipe separation bracket for the mechanical steering column.
10. Dsimantle 1 connecting bolt 2 of mechanical steering column assembly pipe bracket and horizontal beam.
11. Dismantle lock cylinder 3 of ignition switch
12. Dismantle 4 fixing bolt 4 of mechanical steering column and intermediate shaft
13. Take out mechanical steering pipe column.

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Installation procedure:

1. Install mechanical steering pipe column.
2. Install and tighten fixing bolt 4 between mechanical steering column pipe and middle shaft.

Torque:25 Nm (Metric) 18.5 lb-ft (English system)

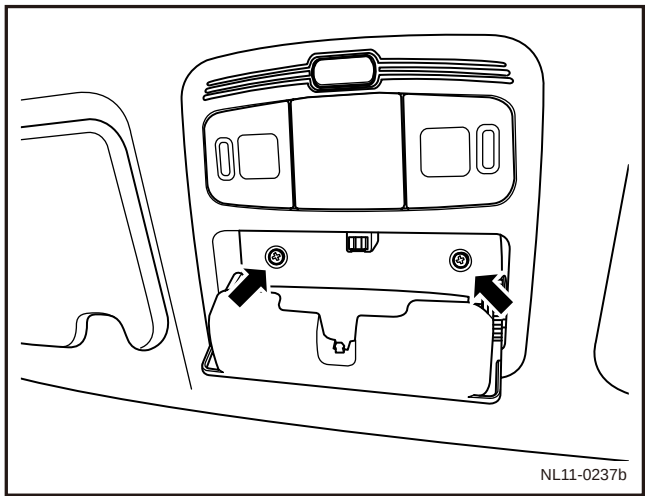
3. Install connecting bolt 2 between mechanical steering pipe column assembly pipe bracket and horizontal beam, and tighten it.

Torque: 25 Nm (Metric) 18.5 lb-ft (English system)

4. Install 2 fixing nut 1 of pipe separation bracket of mechanical steering pipe column assembly.

Torque: 25Nm (Metric) 18.5lb-ft (English system)

5. Install Ignition Lock Cylinder 3.
6. Install the instrument panel.
7. Install the wiper and washer switch.
8. Install the combination light switch.
9. Install the clock spring
10. Install mechanical steering pipe column asembly upper and lower protective plate.
11. Assemble steering wheel
12. Connect the battery negative cable.



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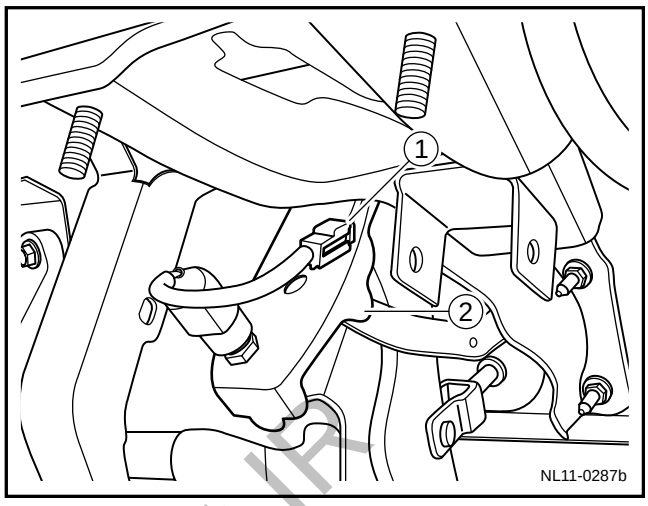
11.4.8.13 Replacement of brake lamp switch

Dismantlement procedure

Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Disconnect brake lamp switch wire harness connector.
3. Loosen locknut, rotate switch and dismantle it from brake pedal support 2.



Installation procedure:

1. Rotate the locking nuts of brake lamp switch to the top position.
2. Press the brake pedal to the end.
3. Screw brake lamp switch into mounting screw hole2.

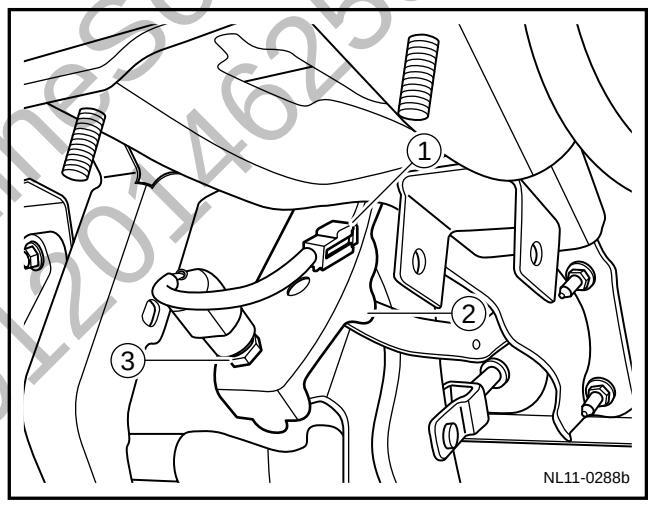
Notes:

Do not thoroughly screw.

4. Slowly release the brake pedal until the brake lamp switch contact points are fully pressed in because of the reaction from brake pedal.
5. Tighten Locking Nut 3.

Torque:10Nm(Metric) 7.4lb-ft(English system)

6. Connect harness connector 1 of the brake lamp switch.
7. Connect the battery negative cable.



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11.4.8.14 Replacement of side steering lamp

See 11.4.8.1 replacement of electric rearview mirror.

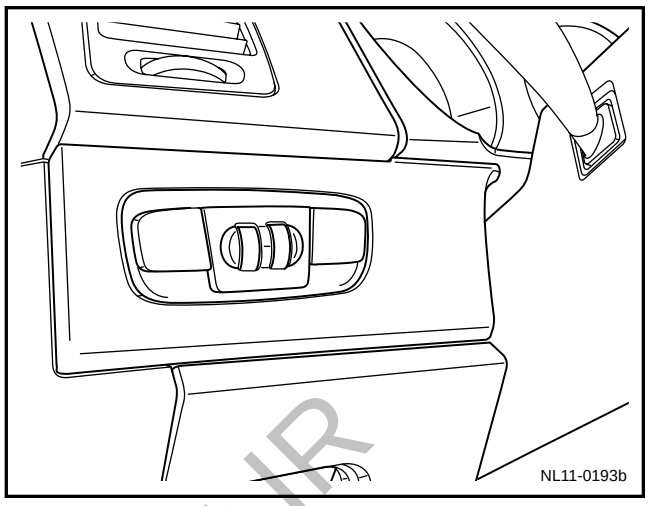
11.4.8.15 Headlamp optical axis adjusting switch replacement

Dismantlement procedure

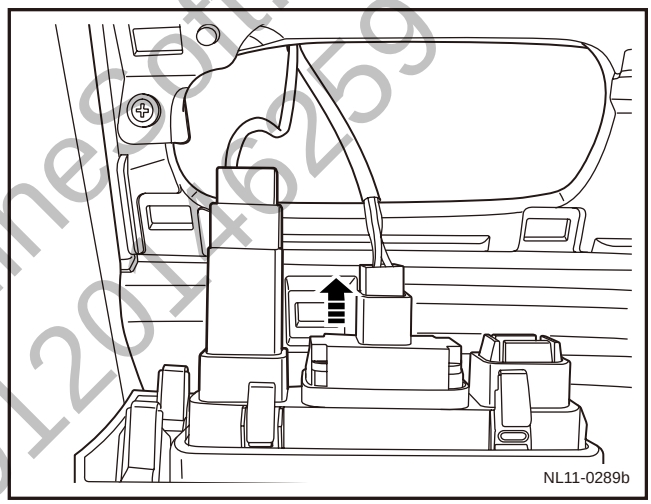
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle instrument panel switch group assembly.



3. Disconnect headlamp optical axis adjusting switch harness connector.
4. Remove the headlight optic axis regulator switch.



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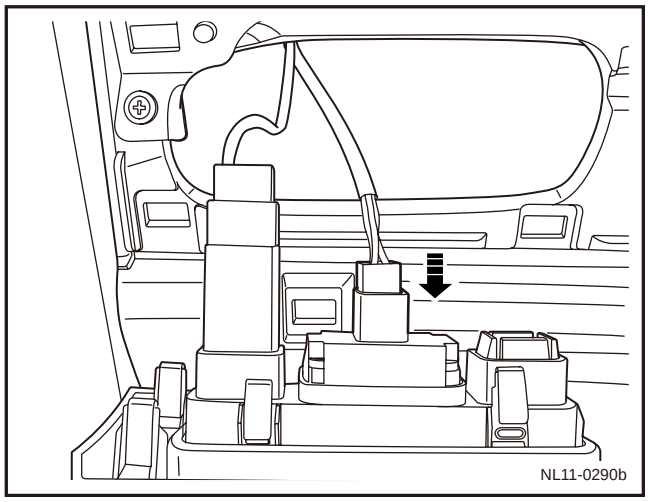
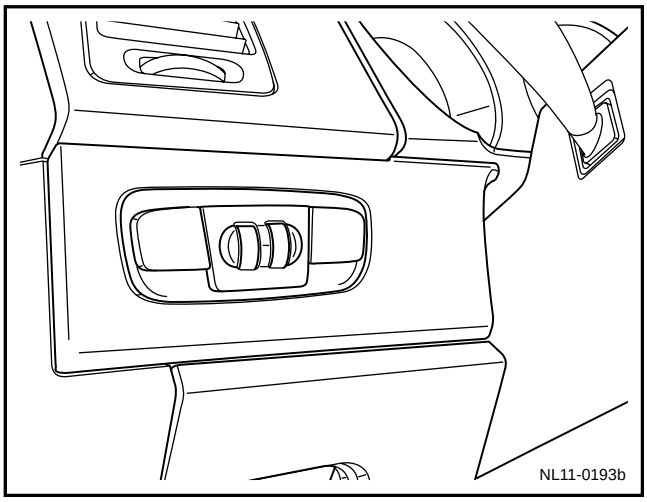
Installation procedure:

1. Install headlamp light axle adjusting switch.
2. Connect headlamp light shaft adjusting switch wire harness connector.



3. Install instrument panel switch group assembly into instrument table.
4. Connect the battery negative cable.



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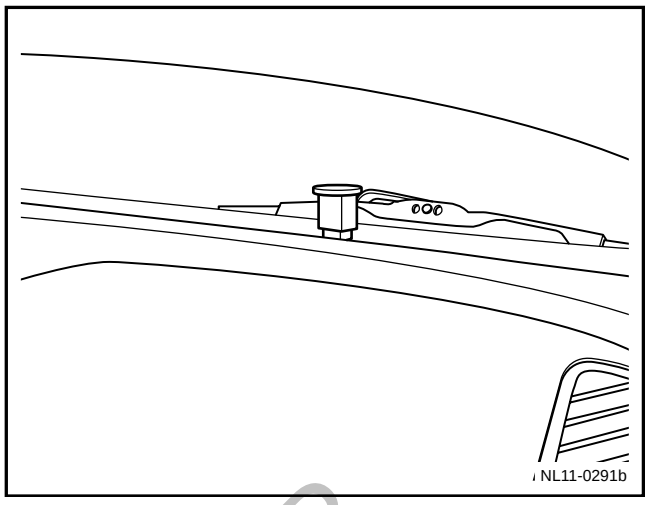
11.4.8.16 Ambient light and solar sensor replacement

Dismantlement procedure

Warning!

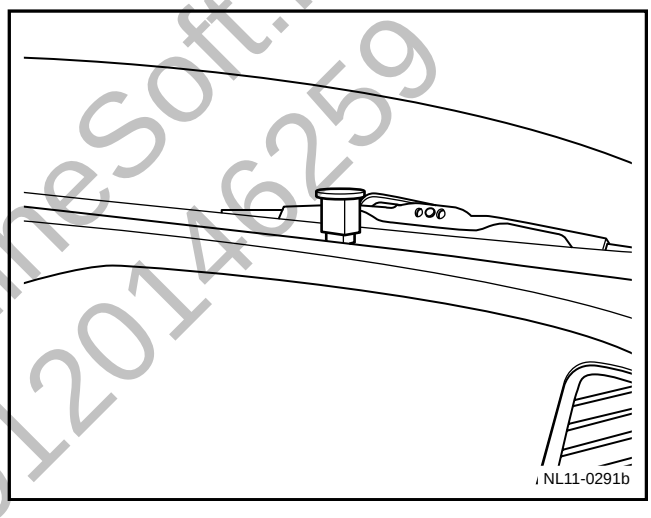
Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle headlamp environment light sensor from instrument panel.
3. Disconnect ambient light and solar sensor harness connector.



Installation procedure:

1. Connect to ambient light and solar sensor harness connector.
2. Press sun sensor into instrument table.
3. Connect the battery negative cable.



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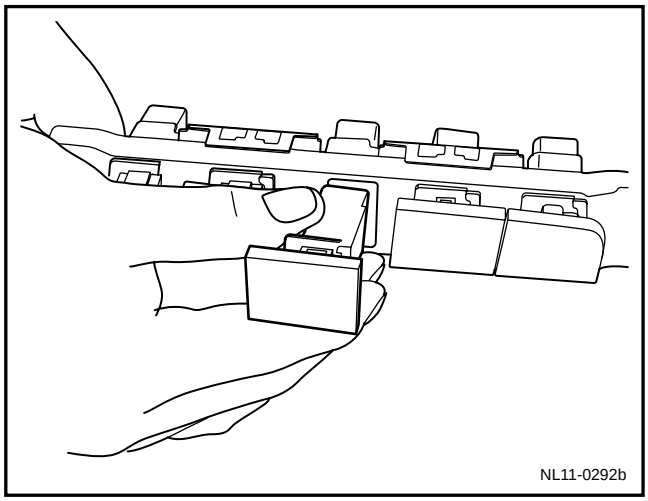
11.3.8.17 Replacement of hazard warning lamp switch

Dismantlement procedure

Warning!

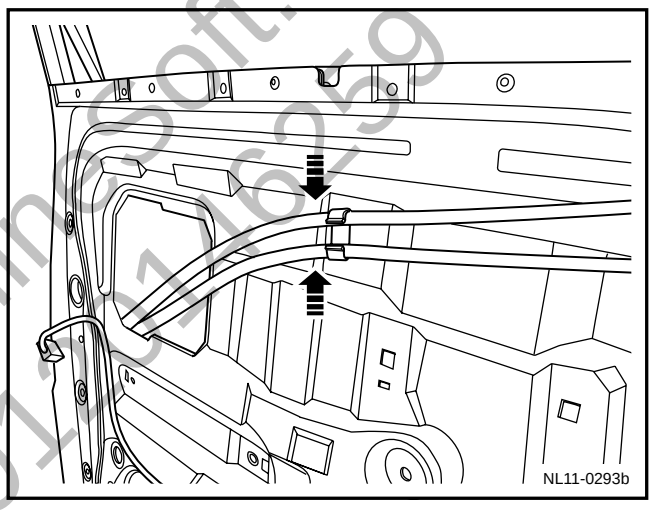
Warning: refer to "warning on battery disconnection" in "warnings and precautions".

1. For disconnection of negative cable of battery, refer to "disconnection procedures of battery".
2. For dismantling of instrument panel central switch assembly, refer to "replacement of air conditioner control panel".
3. Dismantle danger warning lamp switch.



Installation procedure:

1. Install the hazard warning lamp switch to the instrument panel center switch assembly.
2. Install the instrument panel center switch.
3. Connect the battery negative cable.



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11.5 Glasses / windows / rear view mirrors

11.5.1 Specification

11.5.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N·m)	English system (lb-ft)
Self-tapping screw of driver glass lifter control switch assembly with panel	ST4.8×13	4-6	3-5
self tapping screw of co-driver glass lifter control switch with panel assembly	ST4.8×13	4-6	3-5
Bolt for door window lifter assembly	M6×16	7-9	5-7
External window sealing strip self-tapping screw	ST4.8×13	4-6	3-5

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11.5.2 Description and operation

11.5.2.1 Description and operation

Description and operation of window regulator

A. Window lifter startup control (GX718)

If the igintion switch is locked in ON position, glass lifter can be operated; this function can only achieve turning ON or OFF of glass lifter by controlling indoor glass lifter switch.

When glass lifter is effective, start the children's safety: children's safety switch is disconnected, which can make the glass lifters corresponding to copilot side and left rear, right rear glass lifter switch effective (not achieved by BCM). When a safety switch for children

When closing under the locking state. The driver-side glass lifter switch can still control the copilot-side as well as left rear and right rear glass lifter.

It is shielded when one of the following conditions is satisfied.

1) When ignition lock close to OFF gear, time begins to be calculated. After 1min, time uses up.

2) Any of two doors in front row open.

3) Unlock/ lock vehicle by using remote control key or key switch (including operation of remote control boot).

B. Operation mode: manual lifting and lowering; automatic lifting and lowering.

– Manual-up

Press the manual lifting button of the window lifter switch and the window lifter motor actuates to lift the window. When the button is released, the window stops moving.

– Manual-down

Press the manual lowering button of the window lifter switch and the window lifter motor actuates to lower the window. When the button is released, the window stops moving.

– Auto-Up

1) Press automatic lifting gear of glass lifter switch: relevant glass lifter motor will move to drive vehicle window glass move upwards to the top; or repress relevant glass lifter switch during moving (up, down). Auto Up of broken glass

2) All 4 glass lifters in standard/ comfortable model of vehicle have no auto-lifting function.

Deluxe/ultimate driver-side glass lifter driving is controlled by driver door anti-trapping module with function of automatically lifting up; and the copilot-side, left rear and right rear side glass lifters have no function of automatically lifting up.

– Auto-Down

Press and release the automatic lowering button of the window lifter switch: the corresponding window lifter motor actuates to lower the window to the bottom or, press the corresponding window lifter switch (lifting and lowering) during the motion again.

Broken glass drops automatically.

Notes:

If the glass lifter switch is pressed to an ascending position and a descending position at the same time, the corresponding glass lifter motor does not work.

C. Window lifter switch signal control

Switching detection of the window lifter of the standard/comfort version and driving of the corresponding window lifters are directly completed by the BCM. Switching detection of the driver side window lifter of the luxury/ultimate version and driving of teh front left window lifter are directly completed by the front left window lifter anti-jamming module. The switching detection of the co-driver side and rear left and rear right window lifters and driving of the corresponding window lifters of the luxury/ultimate version are directly completed by the BCM.

D. Malfunction memory

When the window the lifter drive of the standard/comfort version and rear left and rear right window lifter drives of the luxury/ultimate version are open circuited (current less than 2A), the BCM records and stores this malfunction and the malfunction sent by the driver side window lifter anti-jamming module through the Lin.

E. Window lifter automativc disabling function

BCM automatically controls the disabling of the window lifter: the window lifter of the standard/comfortable version can be directly disabled by the BCM, while the driver side window lifter of the luxury/ultimate version is driven by the window lifter signal sent by the BCM through the Lin line.

The left rear door and right rear door glass lifters are directly closed by the BCM; the remote control unit closes the glass lifter.

When the lifter signal is released, the automatically closing function of the glass lifter is cancelled (the glass lifter anti-trapping module automatically controls the stop action of automatically closing anti-trapping glass lifter).

Description and Operations of External Rearview Mirror

Exterior rear view mirror is controlled by the driver door switch. Rear view mirror has 3 switches. The left and right selector switches select the required rear view mirror, while the direction

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buttons are used to adjust the rear view mirror position. The mirror face of the external rearview mirror is also equipped with a heating element. When pressing down a rear window defroster switch, an exterior rearview mirror heating element also works.

For defrosting operations, see Rear Window Defrosting. 11.11.2. Operated and description”

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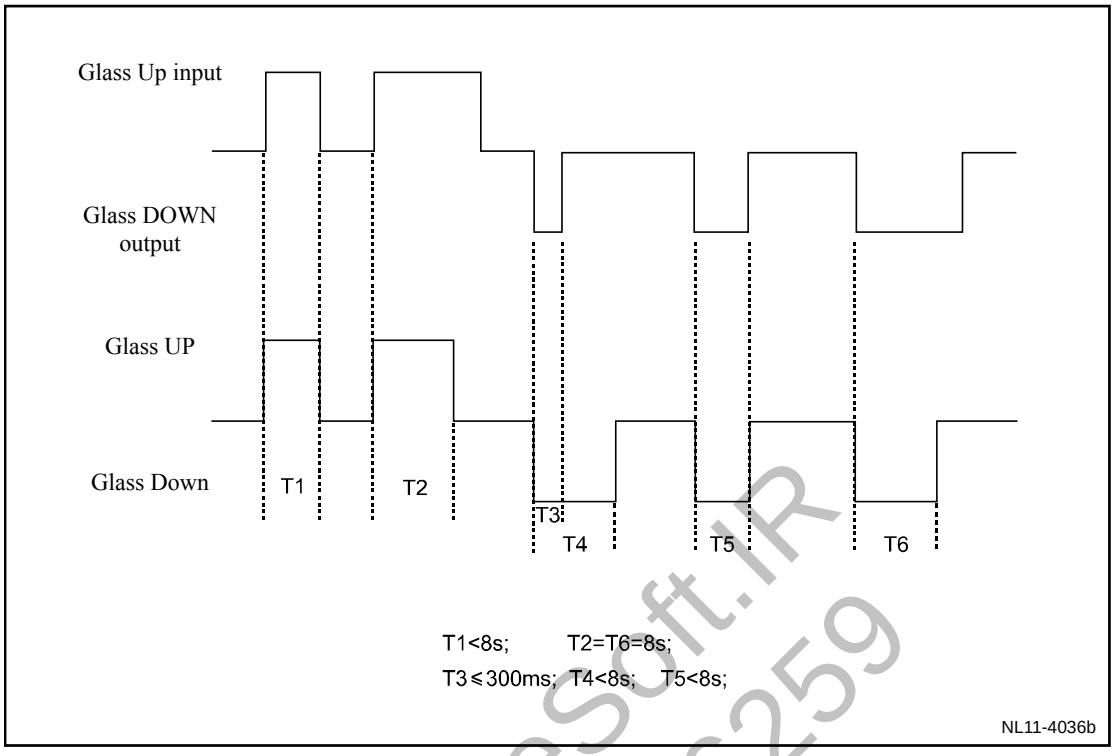
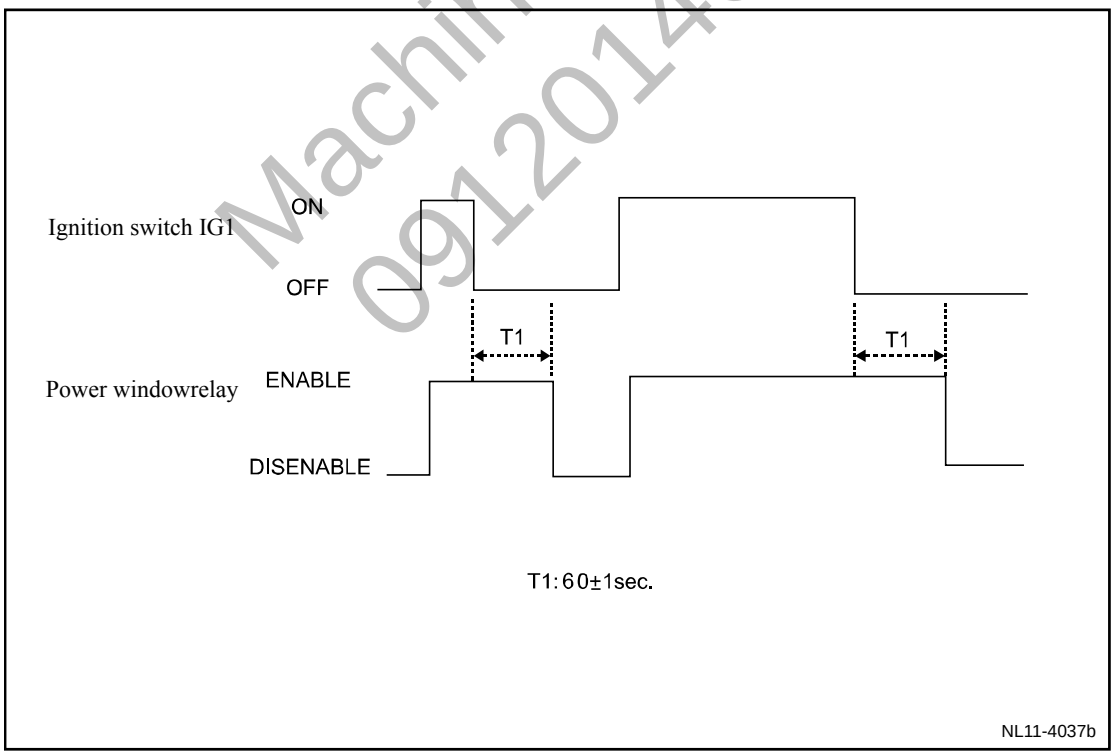
11.5.3 System work principle

11.5.3.1 Time series figure of function



11.5.3.2 Power window relay time control



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11.5.3.3 Mode

– Work mode: control big current by small current; continuously used protection function for 8S.

– Sleep mode:

- No remote control signal
- Key is placed to unplug position.
- When driver's side door lock core switch isn't in unlock/lock action,
- Four door, front cover and rear part are totally closed.
- Door lamp switch is in OFF position
- When danger warning lamp is ineffective,
- BCM under anti-theft alarm status
- Glass lifter can not act when glass lifter can not act
- When sending you "go home" function and action are ineffective,
- When rear back door unlock switch is on unlock position,
- When rear back door lock motor is on lock status,

When meeting all conditions: the BCM enters into the sleep mode after 5 s.

To reduce the power consumption of the system, BCM quits the sleep mode if the above conditions are not met.

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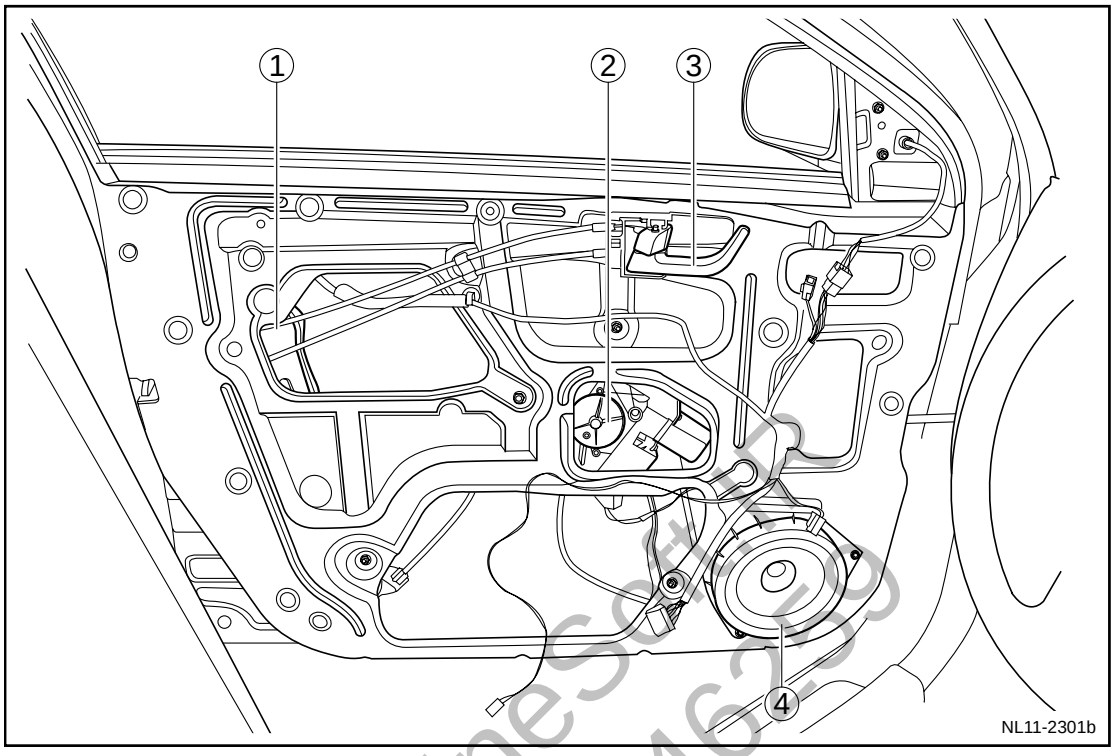
11.5.4 Part position

11.5.4.1 Component position

Window lifter



1. Door lock motor
2. Glass lifter motor.
3. Door inner handle
4. Front door loudspeaker.

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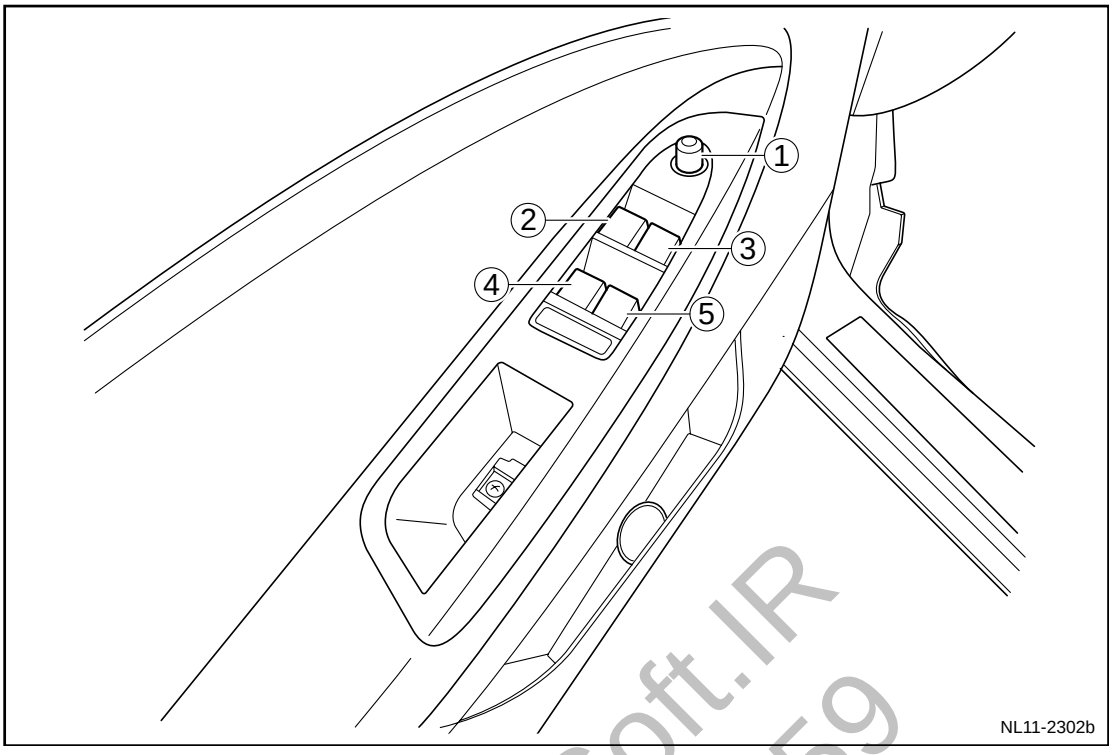
Left front door combination switch



1. Selecting button of right rearview mirror
2. Left front window lift switch
3. Right front window lifter switch
4. Left rear window lift switch
5. Right rear door window lifter switch.

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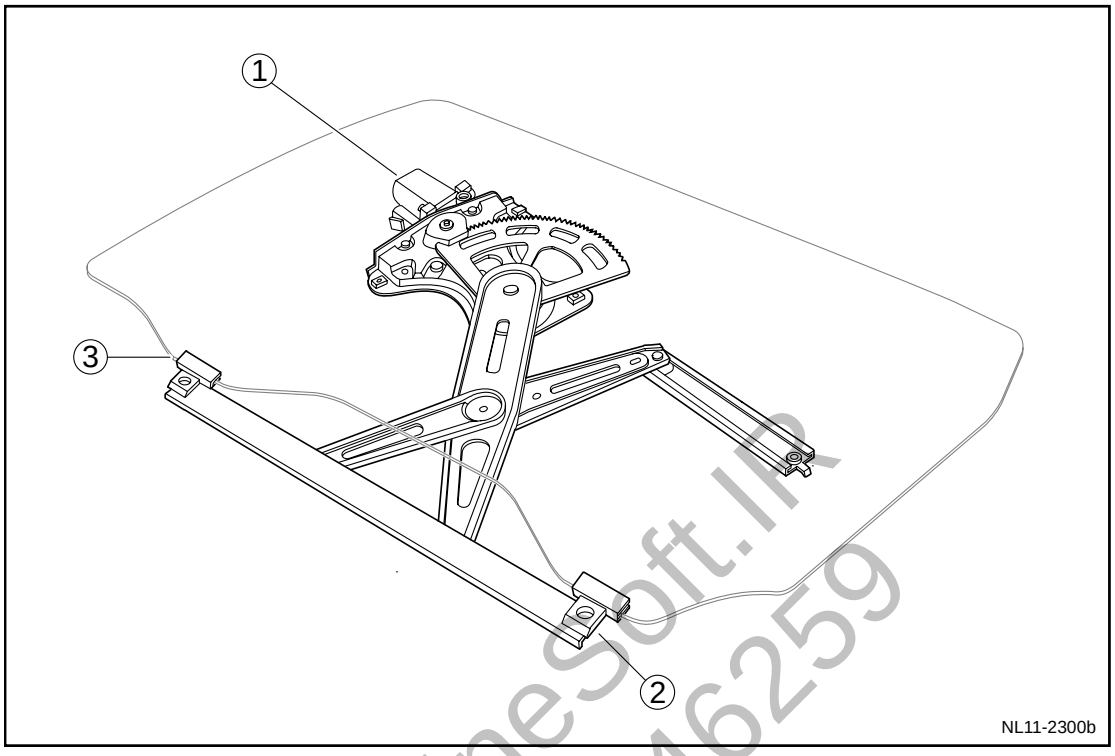
11.5.5 Disassemble drawings

11.5.5.1 Disassemble drawings

Window regulator assembly



1. Glass lifter motor.
2. Glass lifter guideway.
3. Electric window glass

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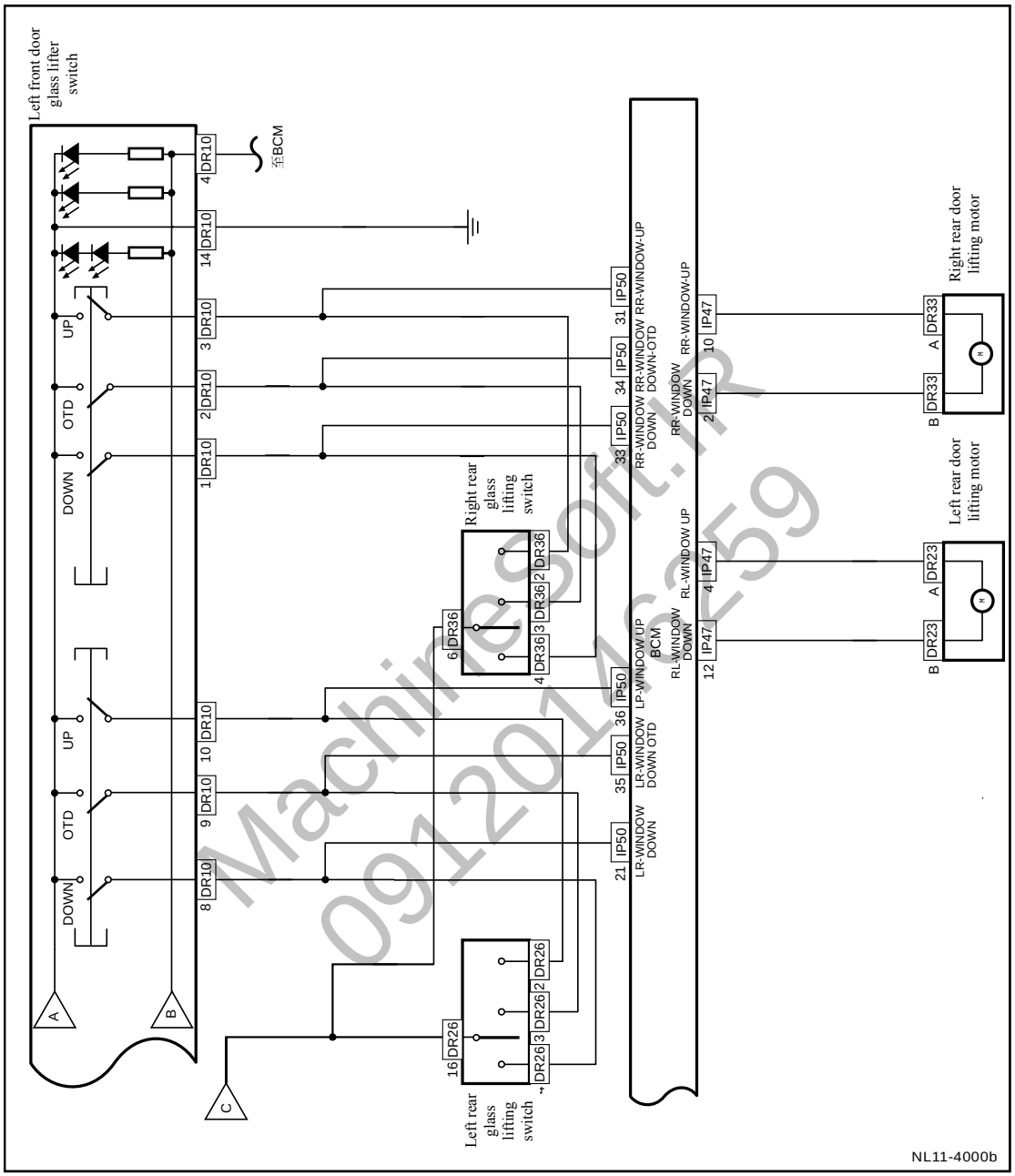
11.5.6 Electrical schematic diagram

11.5.6.1 Electrical schematic diagram

Schematic diagram of glass lifting motor assembly with anti-trapping function (such as equipment)



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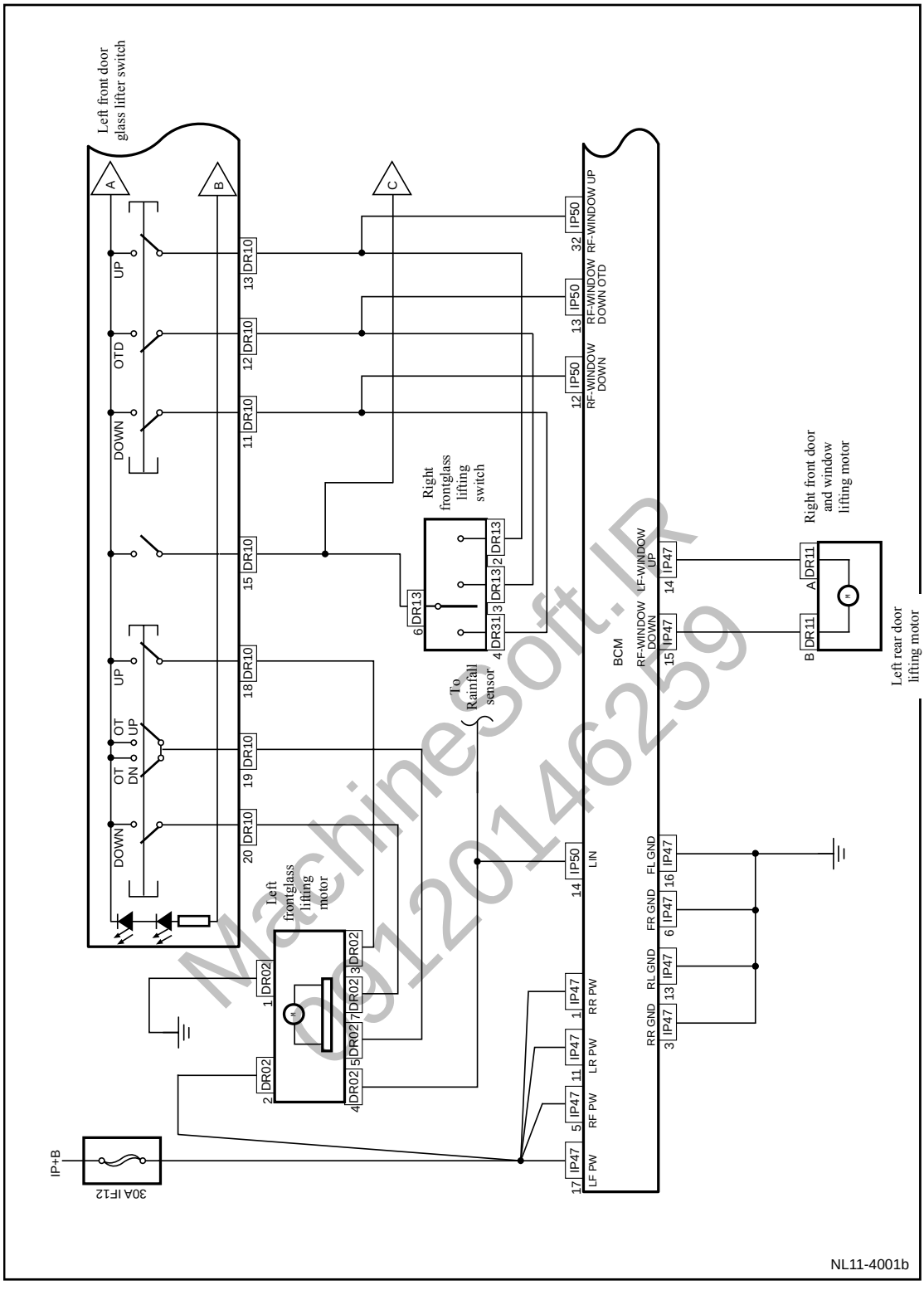

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11.5.7 Diagnostic information and steps

11.5.7.1 Diagnosis descriptions

Refer to 11.5.2 description and operation to get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.5.7.2 Visual inspection

- Inspect the after-sales optional device which may affect the normal operation of glass lifter and electric rearview mirror system.
- Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.
- Inspect whether the initialization of window is invalid.
- Inspect battery voltage.
- Put diagnostic tester into BCM fault memorizer to read fault code.

11.5.7.3 DTC code list of BCM body control unit

DTC code	Fault description	Fault locations	Treatment
B1217	Open circuit incurs on driver-side electric window driving.	– Lifting motor – BCM – Circuit fault.	– Replace the lifting motor – Replace BCM – Inspect circuit.
B1218	Open circuit incurs on co-pilot-side electric window driving.	– Lifting motor – BCM – Circuit fault.	– Replace the lifting motor – Replace BCM – Inspect circuit.
B1220	Open circuit incurs on left rear electric window driving.	– Lifting motor – BCM – Circuit fault.	– Replace the lifting motor – Replace BCM – Inspect circuit.
B1222	Open circuit incurs on right rear electric window driving.	– Lifting motor – BCM – Circuit fault.	– Replace the lifting motor – Replace BCM – Inspect circuit.
B1224	Driver-side electric window anti-trapping module HALL sensor faults.	– Lifting motor	– Replace the lifting motor

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B1225	Driver-side electric window motor relay faults.	– BCM – Circuit fault.	– Replace BCM – Inspect circuit.
B1227	Co-pilot-side electric window motor relay faults.	– BCM – Circuit fault.	– Replace BCM – Inspect circuit.
B1231	Left rear electric window motor relay faults.	– BCM – Circuit fault.	– Replace BCM – Inspect circuit.
B1234	Left rear electric window motor relay faults.	– BCM – Circuit fault.	– Replace BCM – Inspect circuit.
U1000	Communication error of driver-side electric window LIN	– Lifting motor – BCM – Circuit fault.	– Replace the lifting motor – Replace BCM – Inspect circuit.
U1005	BCM LIN communication error	– Lifting motor – BCM – Circuit fault.	– Replace the lifting motor – Replace BCM – Inspect circuit.

11.5.7.4 Glass lifter initialization (such as anti-clamp function)

If the system needs to be initialized, the glass must be completely risen to the ceiling and the switch is held down until the control module stops the glass lifting motor (the window is located at the top for blockage rotation within 1s). When the system loses initialization at every turn, the above operation must be repeated to restore the anti-trapping function. After initializing, all specified system functions must be operated; the voltage on the control mode can not be reduced to below 9V during initializing; and when the supply voltage on the control module drops instantly but more than 6V, the initialized state keeps valid.

Notes:

If the initialization procedure has not been executed or has been lost, the anti-trap and comfort closing functions are not provided. Manual lifting up and down functions and automatic lifting down function can also be operated.

The following situations will cause the initialization loss (such as anti-trapping function of the equipment).

– When the lifter moves, voltage of power supply should be lowered to below 6V.

– Power supply was cut off

– Control module detects illogical hall sensor signal.

– Vehicle window is moved to the position outside the standard operation range.

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11.5.7.5 BCM terminal definition lists

List of terminals of harness connector IP47 of body control module

Terminal No.	Wiring color	Terminal descriptions	Status	Rated load (a)
1	R	Right rear power window power supply	Power	15
2	L	Right rear power window Down output	Output	9
3	L	Right rear power window ground	GND	15
4	W/O	Left rear power window Up output	Output	9
5	R	Right front power window]power supply	Power	15
6	B	Right front power window grounding	GND	15
7	Gr	Left front power window Up output	Output	9
8	Br	Left front power window Down output	Output	9
9	--	--	--	--
10	O	Right rear power window Up output	Output	9
11	R	Left rear power window power supply	Power	15
12	W	Left rear power window Down output	Output	9
13	B	Left rear power window grounding	GND	15
14	Gr/R	Right front power window Up output	Power	9
15	R	Right front power window Down output	Output	9

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16	B	Left front power window grounding	GND	15
17	R	Left front power window power supply	Input	15

List of terminals of harness connector ip50 of body control module

Terminal No.	Wiring color	Terminal descriptions	Status	Rated load (A)
1	--	--	--	--
2	--	--	--	--
3	W/L	Left front power window Up switch	Output	10
4	--	--	--	--
5	--	--	--	--
6	--	--	--	--
7	--	--	--	--
8	--	--	--	--
9	--	--	--	--
10	--	--	--	--
11	--	--	--	--
12	W/R	Right front power window Down switch	Output	10
13	W/Y	Right front power window auto-switch	Output	10
14	V	LIN BUS	Output Input	--
15	Gr/P	Output Input	Output Input	--
16	--	--	--	--
17	--	--	--	--
18	--	--	--	--

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19	W/R	Left front power window auto-switch	Input	10
20	--	--	--	--
21	W/Br	Left rear power window Down switch	Input	10
22	--	--	--	--
23	--	--	--	--
24	--	--	--	--
25	--	--	--	--
26	--	--	--	--
27	--	--	--	--
28	--	--	--	--
29	--	--	--	--
30	--	--	--	--
31	W/B	Right rear power window Up switch	Input	10
32	W/V	Right front power window Up switch	Input	10
33	W/O	Right rear power window Down switch	Input	10
34	B/L	Right rear power window auto-switch	Input	10
35	V/W	Left rear power window auto-switch	Input	10
36	W/R	Left rear power window Up switch	Input	10
37	--	--	--	10
38	G/R	Ignition signal	Input	10
39	W/G	Left front power window	Input	10

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		Down switch		
40	V	Reserved	Input	10

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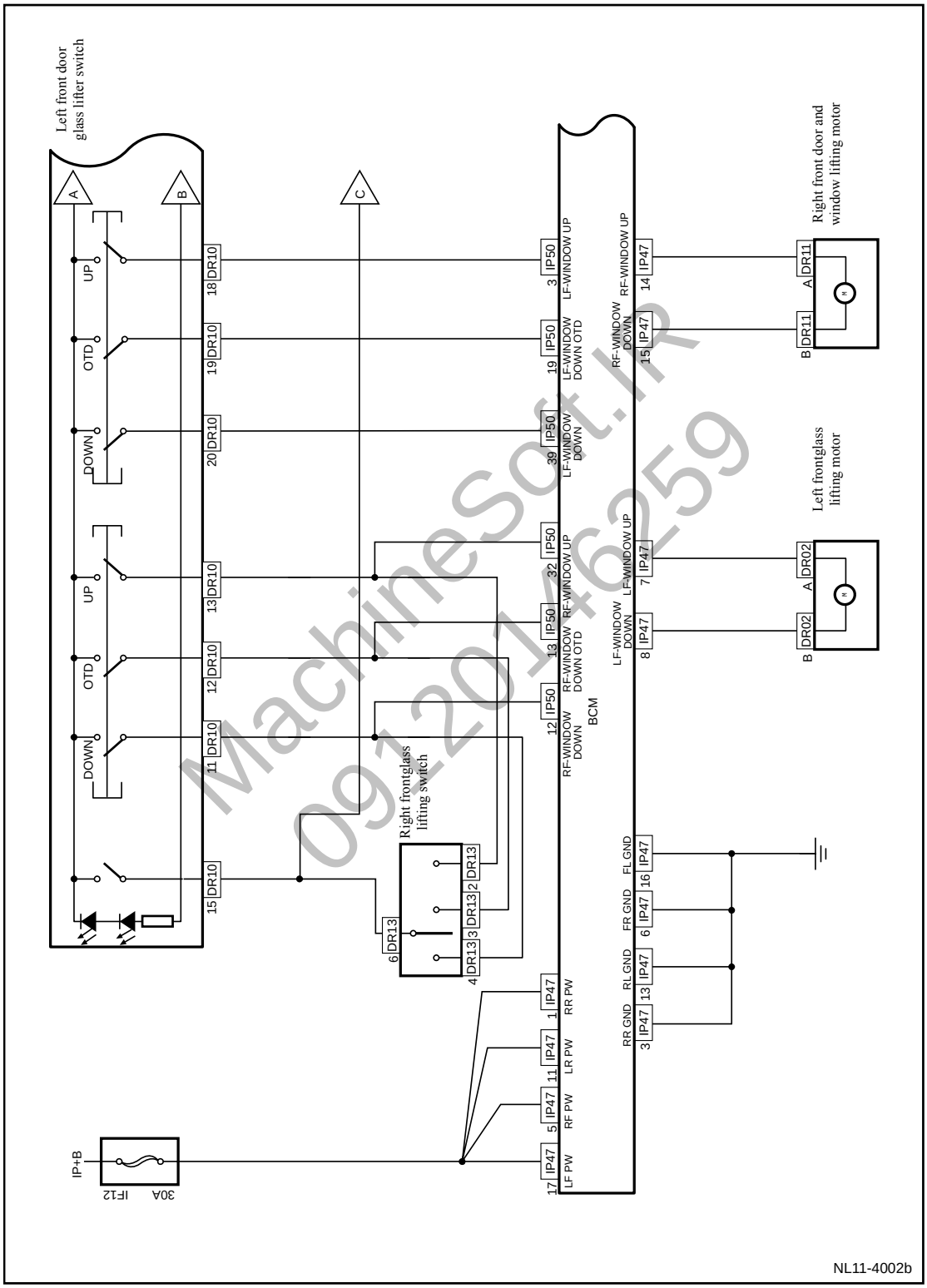
11.5.7.6 All Window regulators in operation (without anti-clamp)

Notes:

Please accord with 11.4.7.2 Visual Inspection before performing the following inspection process.

Circuit diagram:



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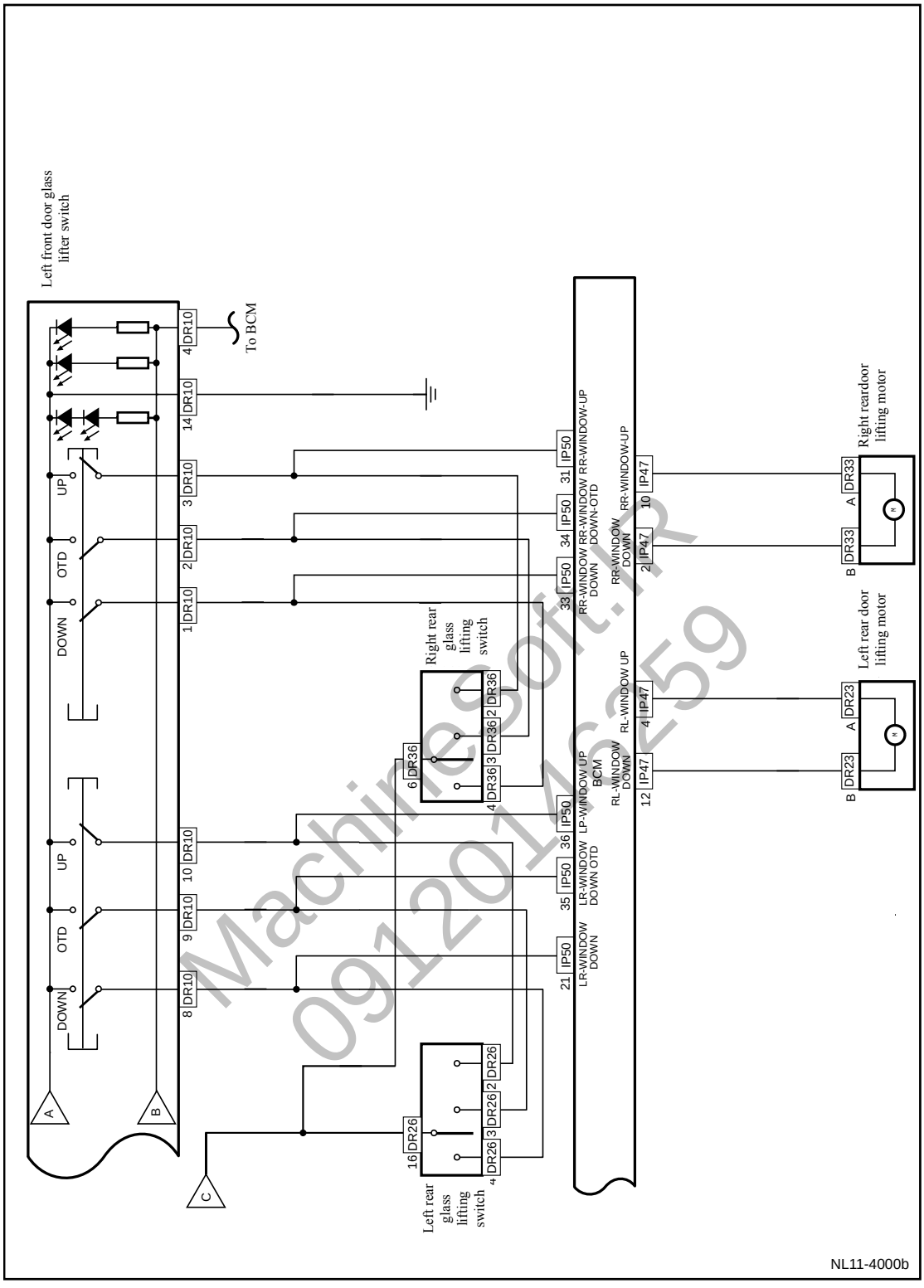

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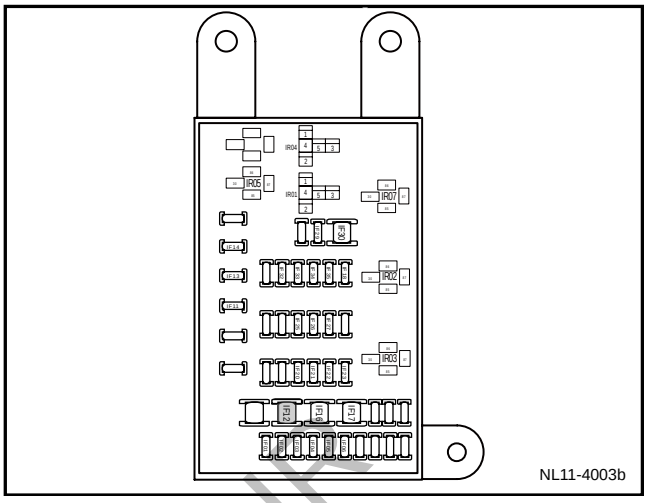
Diagnostic steps:

1	Inspect fuse IF12.

A. Whether the fuse IF12 is blown.

B. Check that the rated current of the fuse is 30A.

Confirm whether the fuses are blown.



No → Go to step 3

Yes

2	Check fuse circuit

(a) Inspect for short circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the glass lifter works normally.

Yes → The system is normal.

No

3	Inspect the circuit between the fuse and the BCM as well as the BCM and body grounding circuit.

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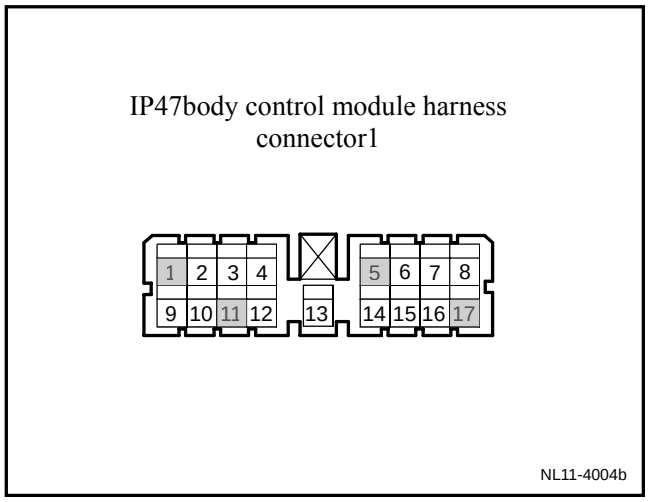
(a) Closed ignition switch to position OFF.

(b) Disconnect battery negative cable.

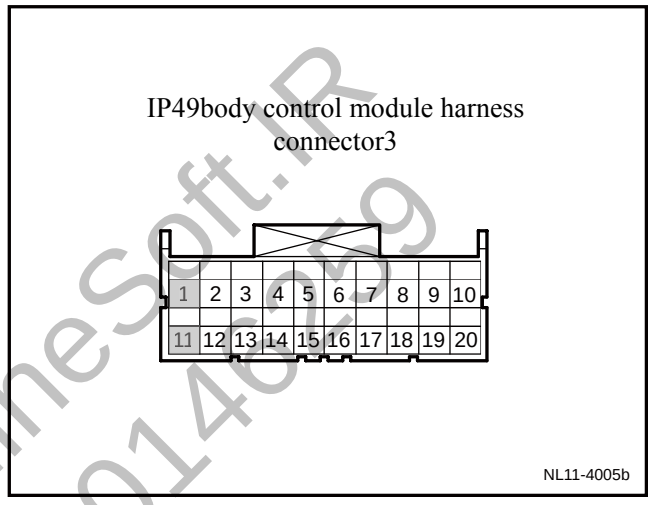
(c) Disconnect BCM harness connector IP49, IP50, IP47.

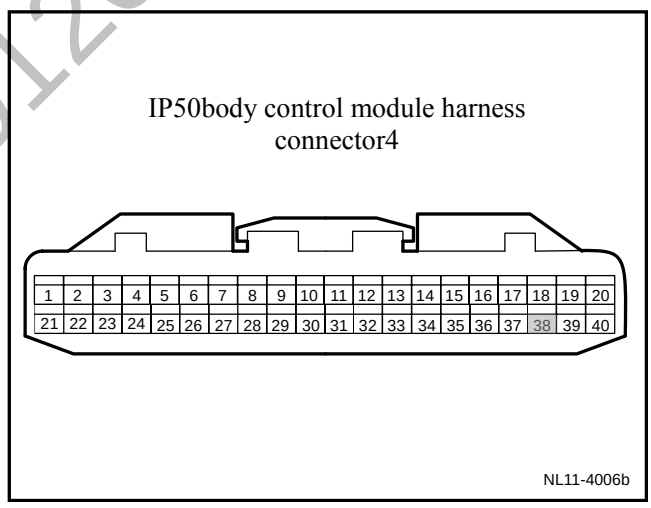
(d) Connect battery negative cable.

(e) Turn on ignition switch to position "ON".



(f) Use multimeter to measure effective grounding voltage between wire harness connector terminal and vehicle body.





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Measurement terminal.	Specified Value
IP49(01)——grounding	11——14V

IP50(38)——grounding	11——14V
IP47(17)——grounding	11——14V
IP47(05)——grounding	11——14V
IP47(11)——grounding	11——14V
IP47(01)——grounding	11——14V
IP47(17)——IP47(16)	11——14V
IP47(05)——IP47(6)	11——14V
IP47(11)——IP47(13)	11——14V
IP47(01)——IP47(3)	11——14V
IP49(01)——IP49(11)	11——14V

Yes → Go to step 5

No

4	Repair the BCM and the fuse; the fault point of the open circuit between the BCM and the ground point.

(a) Closed ignition switch to position OFF.

(b) Disconnect the battery negative cable.

(c) Repair fault points or replace wire harness.

(d) Connect to BCM harness connector.

(e) Connect the battery negative cable.

(f) Turn on ignition switch to "ON" position.

(g) Operated glass lifter switch.

Confirm whether the glass lifter works normally.

Yes → The system is normal.

No

5	Inspect the left front door combination switch grounding circuit.

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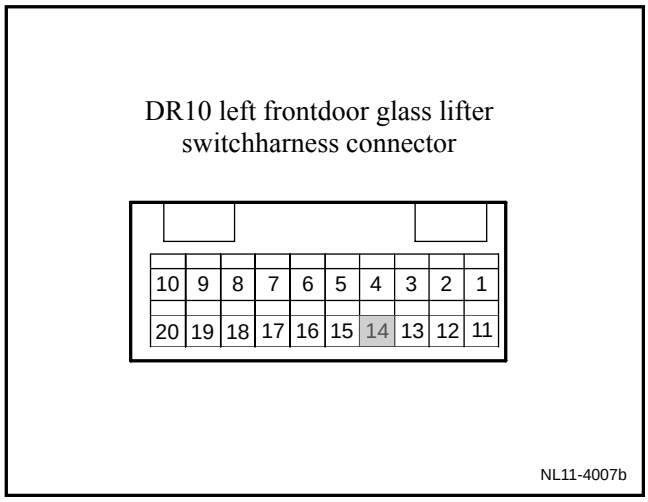
(a) Disconnect left front door combination switch harness connector DR10.

(b) Use multimeter to measure resistance between wire harness connector DR10 terminal No. 14 and vehicle body grounding point.

Resistance stated value:is less than 1Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 7

No

6	Repair or replace glass lifter switch grounding wire harness.

(a) Repair or replace glass lifter switch wire harness.

(b) Connect glass lifter switch wire harness connector.

(c) Operate glass lifter switch.

Confirm whether the glass lifter works normally.

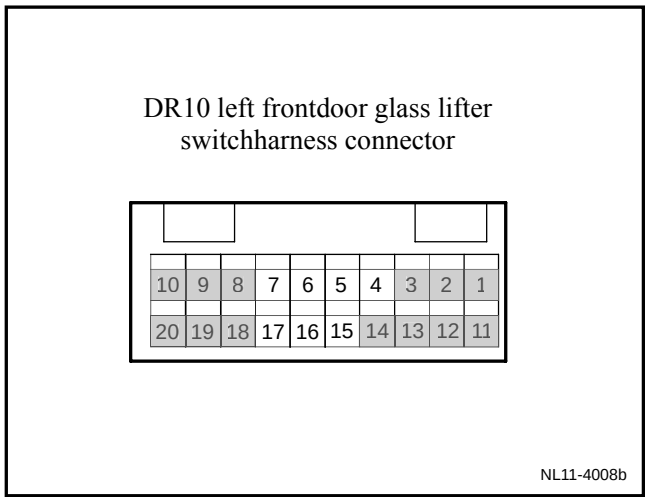
Yes → The system is normal.

No

7	Inspect the left front glass lifter switch.

(a) Disconnect lifter switch harness connector.

(b) Break over condition of test Left front lifter switch



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Test terminal	Test conditions	Conduction condition
DR10-20—DR10－14	LF-WINDOW DOWN	Less than 1 Ω
DR10-19—DR10－14	LF-WINDOW DOWN OTD	Less than 1 Ω
DR10-18—DR10－14	LF-WINDOW UP	Less than 1 Ω
DR10-11—DR10－14	RF-WINDOW DOWN	Less than 1 Ω
DR10-12—DR10－14	RF-WINOW DOWN OTD	Less than 1 Ω
DR10-13—DR10－14	RF-WINDO UP	Less than 1 Ω
DR10-8—DR10－14	LR-WINDOW DOWN	Less than 1 Ω
DR10-9—DR10－14	LR-WINDOW DOWN OTD	Less than 1 Ω
DR10-10—DR10－14	LR-WINDOW UP	Less than 1 Ω
DR10-1—DR10－14	RR- WINDOW DOWN	Less than 1 Ω
DR10-2—DR10－14	RR-WINDOW DOWN OTD	Less than 1 Ω
DR10-3—DR10－14	RR- WINDOW UP	Less than 1 Ω

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Confirm whether the resistance conforms to standard value.

Yes	Go to step 9
No	

8	Replace left front door combination switch ,

(a) Replace left front door combination switch. Refer to11.4.8.6 Left front glass lifting switch replacement.

(b) Connect glass lifter switch wire harness connector.

(c) Operate glass lifter switch.

Confirm whether the glass lifter works normally.

Yes	The system is normal.
No	

9	Inspect the circuit between BCM and left front door combination switch.

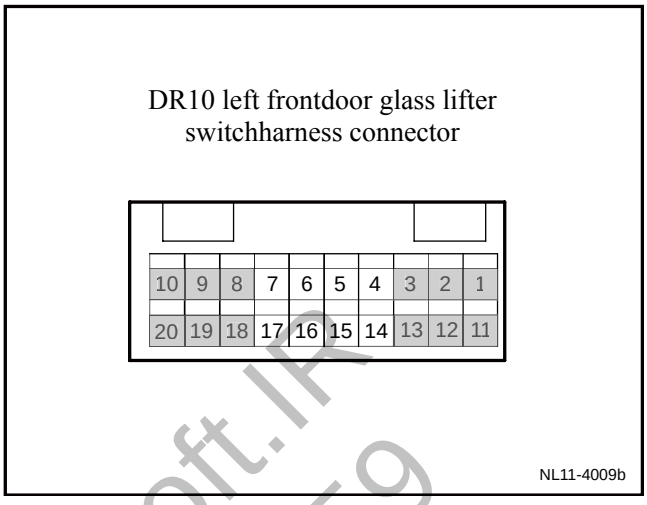
(a) Closed ignition switch to position OFF.

(b) Disconnect the battery negative cable.

(c) Disconnect the left front door combination switch harness connector.

(d) Disconnect BCM harness connector IP50.

(e) Use multimeter to measure connection situation of circuit.



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Test terminal	Conduction condition
IP50-12——DR10-11	Less than 1 Ω
IP50-13——DR10-12	Less than 1 Ω
IP50-32——DR10-13	Less than 1 Ω
IP50-39——DR10-20	Less than 1 Ω
IP50-19——DR10-19	Less than 1 Ω
IP50-03——DR10-18	Less than 1 Ω
IP50-21——DR10-08	Less than 1 Ω
IP50-35——DR10-09	Less than 1 Ω
IP50-36——DR10-10	Less than 1 Ω
IP50-33——DR10-01	Less than 1 Ω
IP50-34——DR10-02	Less than 1 Ω
IP50-31——DR10-03	Less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes	Go to step 12
No	

10	Repair or replace the circuit between BCM and lifter switch.

(a) Repair or replace wire harness between BCM and lifter.

(b) Connect glass lifter switch wire harness connector.

(c) Connect to BCM harness connector.

(d) Connect battery negative cable.

(e) Turn on ignition switch to position "ON".

(f) Operate glass lifter switch.

Confirm whether the glass lifter works normally.

Yes	The system is normal.
No	

11	Replace BCM body control unit.

Refer to 11.8.8.1 Replacement of BCM to replace BCM body control unit.

Confirm the completion of repair.

Yes	The system is normal.
Next	

12	Repair is completed.

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11.5.7.7 Only left front window regulator in operation (without anti-clamp)

Notes:

Refer to 11.4.7.2 visual Inspection before carrying out the following testing procedures.

Circuit diagram:

See 11.4.7.6 all window lifter does not work (without anti-jamming device).

1	Inspect the left front door window switch.

(a) Disconnect left front door combination switch harness connector DR10.

(b) Operate left front door window switch and use multimeter to test the connection of switch.

Test terminal	Test conditions	Measured value
DR10(20)—DR10(14)	LF WINDOW DOWN	Less than 1 Ω
DR10(19)—DR10(14)	LF WINDOW DOWN OTD	Less than 1 Ω
DR10(18)—DR10(14)	LF WINDOW UP	Less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → Go to step 3

No

2	Replace left front door combination switch assembly,

(a) Replace left front door combination switch assembly. Refer to11.4.8.6 Left front glass lifting switch replacement.

Confirm whether the left glass lifter works normally.

Yes → The system is normal.

No

3	Inspect the left front glass lifter power supply and grounding.

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(a) Closed ignition switch to position OFF.

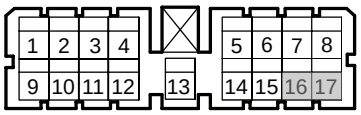
(b) Disconnect the battery negative cable.

(c) Disconnect BCM body control unit harness connector IP47.

(d) Connect battery negative cable.

(e) Use multimeter to measure voltage between BCM wire harness connector IP47 terminal No. 17 and vehicle body, voltage between connector IP47 terminal No. 17 and 16.

IP47body control module harness connector1



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Terminal measure	Specified value
IP47(17)—grounding	11-14V
IP47(17)—IP47(16)	11-14V

Confirm whether the terminal voltage accords with the standard value?

Yes → Go to step 5

No

4	Repair the circuit fault point between the terminal No. 17 of the BCM wire harness connector IP47 and the wire harness connection point S59 as well as between the terminal No. 16 of IP47 and the body.

(a) Repair fault points between BCM wire harness connector IP47 terminal No. 17 and power supply wire harness connecting point S59, connector IP47 terminal No. 16 and vehicle body.

(b) Disconnect the battery negative cable.

(c) Connect to BCM harness connector.

(d) Connect battery negative cable.

(e) Turn on ignition switch to position "ON".

(f) Operate left front window switch.

Confirm whether the left front window works normally.

Yes → The system is normal.

No

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5	Inspect the circuit communication between the left front window switch and the BCM wire harness connector IP50.

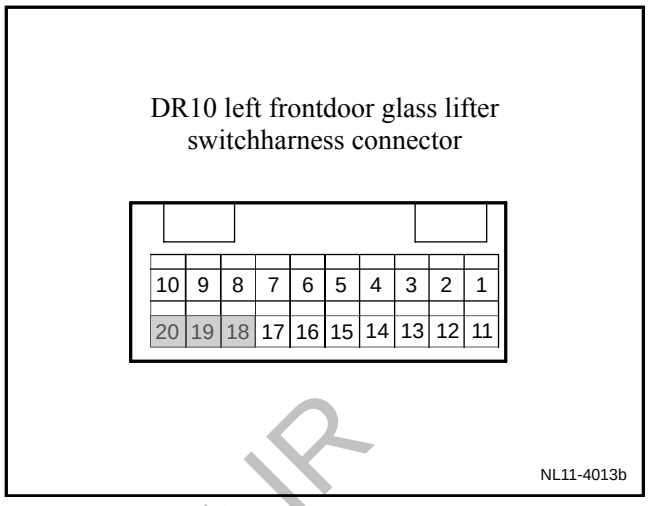
(a) Closed ignition switch to position OFF.

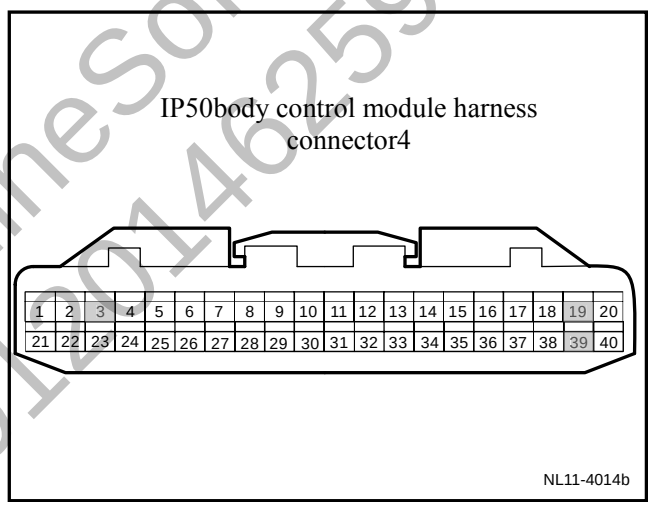
(b) Disconnect the battery negative cable.

(c) Disconnect the left front door combination switch harness connector.

(d) Disconnect BCM harness connector IP50.

(e) Use multimeter to measure resistance between left front door window switch wire harness DR10 and BCM wire harness connector IP50.





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Test terminal	Conduction condition
DR10(20)—IP50(39)	Less than 1Ω
DR10(19)—IP50(19)	Less than 1Ω
DR10(18)—IP50(3)	Less than 1Ω

Confirm whether the resistance conforms to standard value.

Yes → Go to step 7

No

6	Repair the fault point between the left front window switch wire harness connector and the BCM circuit.

(a) Repair fault points between left front window switch wire harness connector DR10 terminal No. 20, 19 and 18 corresponding to BCM wire harness connector IP50 terminal No. 39, 19 and 3.

(b) Connect glass lifter switch wire harness connector.

(c) Connect to BCM harness connector IP50,

(d) Connect battery negative cable.

(e) Turn on ignition switch to position "ON".

(f) Operate left front window glass lifter switch.

Confirm whether the left glass lifter works normally.

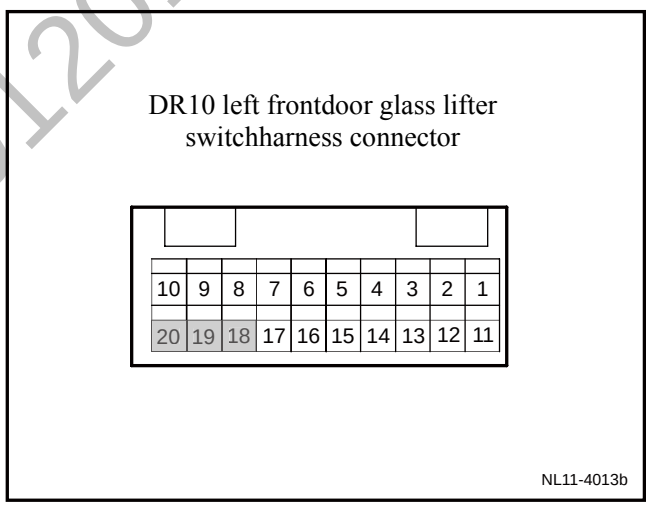
Yes → The system is normal.

No

7	Inspect the voltage among the terminal No. 20, 19 and 18 of the left front window wire harness connector DR10 and the body.

(a) Disconnect left front window harness connector DR10.

(b) Measure terminal voltage by millimeter.



Test terminal	Terminal voltage
DR20(20)—grounding	Signal voltage 5V
DR20(19)—grounding	Signal voltage 5V

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DR20(18)—grounding	Signal voltage 5V

Confirm if the voltage conforms to standard value.

No → Go to step 11

Yes

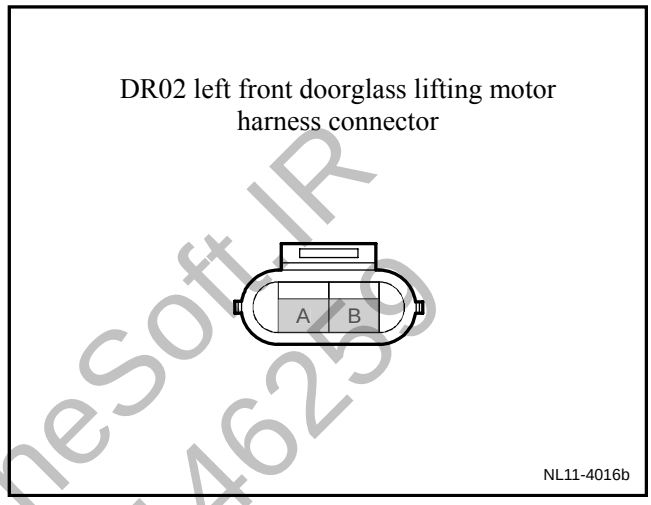
8	Inspect the resistance of the BCM wire harness connector IP47 terminal and the left front glass lifting motor wire harness connector DR02.

(a) Closed ignition switch to position OFF.

(b) Disconnect the battery negative cable.

(c) Disconnect BCM harness connector IP47.

(d) Use multimeter to measure connection situation of circuit.



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Test terminal	Terminal voltage
DR20(20)——grounding	Signal voltage 5V
DR20(19)——grounding	Signal voltage 5V
DR20(18)——grounding	Signal voltage 5V

Confirm if the resistance conforms to standard value.

Yes → Go to step 10

No

9	Repair or replace the harness.

(a) Repair or replace wire harness between BCM wire harness connector IP47 terminal No. 8 and 7 corresponding to left front door glass lifting point wire harness connector DR02 terminal No. B, A.

(b) Connect BCM wire harness connector IP47.

(c) Connect to Left front door glass lifter harness connector.

(d) Connect battery negative cable.

(e) Turn on ignition switch.

(f) Operate left front window switch.

Confirm whether the glass lifter works normally.

Yes → The system is normal.

No

10	Inspect the left front glass motor wire harness connector DR02 terminal voltage.

(a) Disconnect left front door glass lift motor harness connector DR02.

(b) Operated Left front door and window switch button.

(c) Use multimeter to measure voltage between left front glass lifter wire harness connector DR02 terminal No. A and B.

Test terminal	Test conditions	Conduction condition
DRO2(A)—DR02(B)	LF WINDOW UP	12-14V
DRO2(A)—DR02(B)	LF WINDOW DOWN	12-14V
DRO2(A)—DR02(B)	LF WINDOW DOWN OTD	12-14V

Confirm if the voltage conforms to standard value.

Yes → Go to step 12

No

11	Replace the BCM

Refer to 11.8.8.1 Replacement of BCM to replace BCM.

Confirm whether the glass lifter works normally.

Yes → The system is normal.

No

12	Replace left front glass lift motor assembly ,

Refer to 11.4.8.5 Replacement of Left Front Glass Lifter Motor to replace the left front glass lifting motor assembly.

Confirm the completion of repair.

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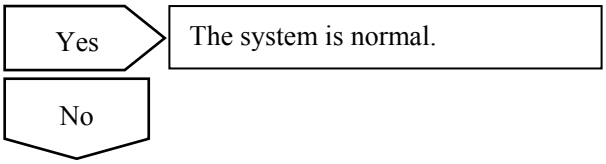

13	The system is normal.

If other single lifters without anti-trap window do not work, refer to the fault diagnosis process of the left front door glass lifter.

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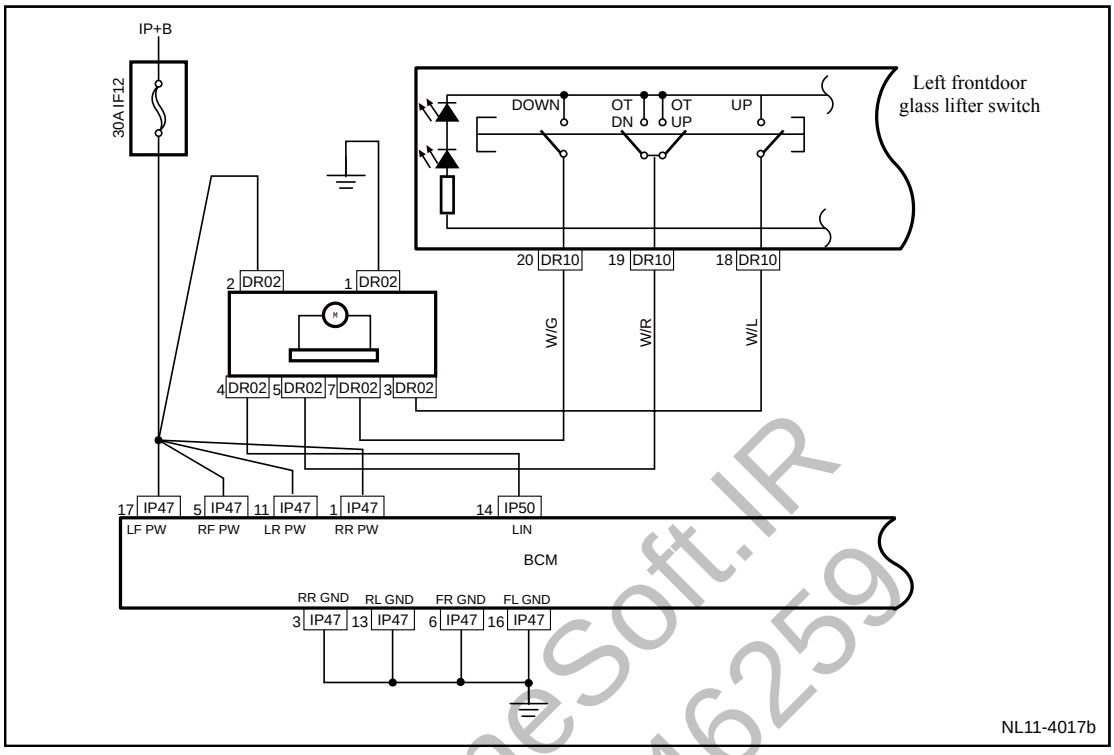
11.5.7.8 Left front door glass lifter do not work (Only for left front door with anti-clamp)

Notes:

Refer to 11.4.7.2 visual Inspection before carrying out the following testing procedures.



Diagnostic steps:

1	Inspect the left front window switch.

(a) Operate left front window switch.

(b) Use multimeter to measure switch connection situation.

Test terminal	Test conditions	Conduction condition
DR10(18)—DR10(14)	LF WINDOW UP	Less than 1 Ω
DR10(20)—DR10(14)	LF WINDOW DOWN	Less than 1 Ω
DR10(19)—DR10(14)	LF WINDOW OT DN	Less than 1 Ω
DR10(19)—DR10(14)	LF WINDOW OT UP	Less than 1 Ω

Confirm if the voltage conforms to standard value.

Yes	Go to step 3
No	

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2	Replace combination switch ,

(a) Replace combination switch, refer to11.4.8.6 left front glass lifting switch replacement .

(b) Operated Left front window switch.

Confirm whether the left front window works normally.

Yes → The system is normal.

No

3	Inspect the left front window anti-trapping control module power supply and the grounding.

(a) Disconnect left front window anti-clamp module harness connector DR02.

(b) Measure terminal voltage by millimeter.

Test Terminal	Terminal voltage
DR02(2)－grounding	11-14V
DR02(2)－DR02(1)	11-14V

Confirm whether the measures value is normal.

Yes → Go to step 5

No

4	Repair and replace the wire harness.

(a) Repair fault points between wire harness connector DR02 terminal No. 2 and fuse, DR02 terminal No. 2 and grounding circuit.

(b) Connect to harness connector DR02.

(c) Operate left front window switch.

Confirm whether the left front window works normally.

Yes → The system is normal.

No

5	Inspect the circuit between the left front window anti-trapping control module and the left front window switch.

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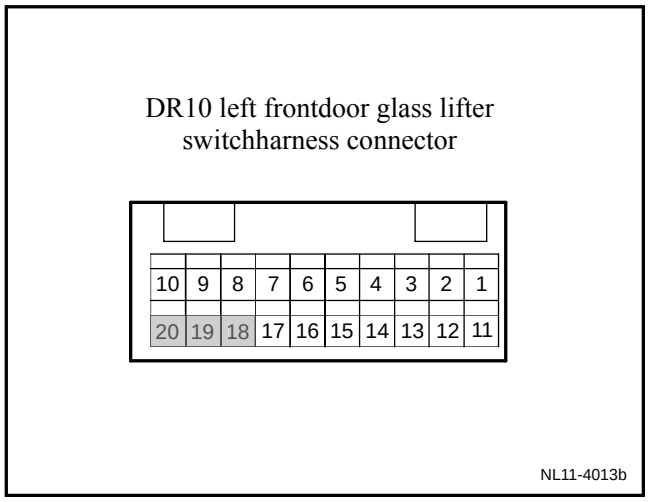
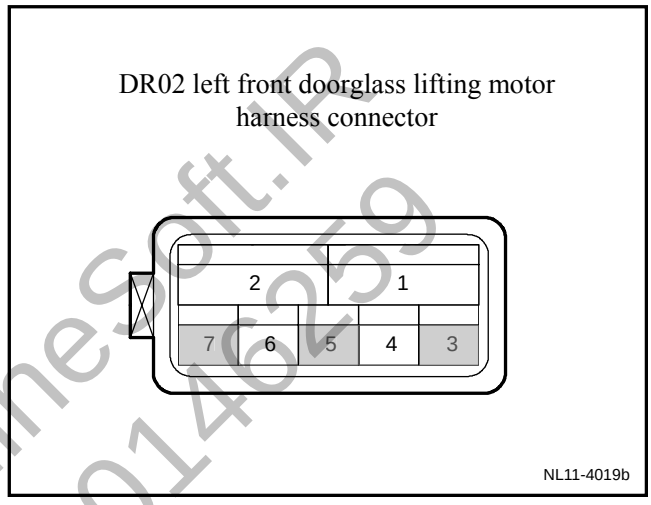
(a) Disconnect left front window switch harness connector.

(b) Disconnect Left front window anti-clamp control module harness connector.

(c) Use multimeter to measure connection sitaution of wire harness.





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Test terminal	Conduction condition
DR10(20)—DR02(7)	Less than 1 Ω
DR10(19)—DR02(5)	Less than 1 Ω
DR10(18)—DR02(3)	Less than 1 Ω

Confirm whether the terminal voltage accords with the standard value?

Yes	Go to step 7
No	

6	Confirm whether the measures value is normal.

(a) Repair circuit fault points between left front window switch wire harness connector DR10 and left front window anti-clamp control module wire harness connector DR02.

(b) Connect to left front window switch harness connector.

(c) Connect to Left front window anti-clamp control module harness connector.

(d) Operated left front window switch,

Confirm whether the left front window works normally.

Yes → The system is normal.

No

7	Inspect the control signal circuit of the fault-side glass lifter motor.

(a) Replace left front window anti-clamp module, refer to11.4.8.5 Left front glass lifter motor replacement.

Confirm the completion of repair.

Next

8	The system is normal.

11.5.7.9 Left front window anti-clamp function invalidation

Circuit diagram:

See Front Left Door's Anti-jamming Window Does Not Work.

Diagnostic steps:

1	For initialization of the front left window, see 11.4.7.4 Initialization of Window Lifter (such equipment anti-jamming function).

Next

2	The BCM fault memory DTC code is read by a detector.

Next

3	Repair the window. See11.4.7.7 Only Front Left Window Lifter Does Not Work (without Anti-jamming Device).

Next

4	The system is normal.

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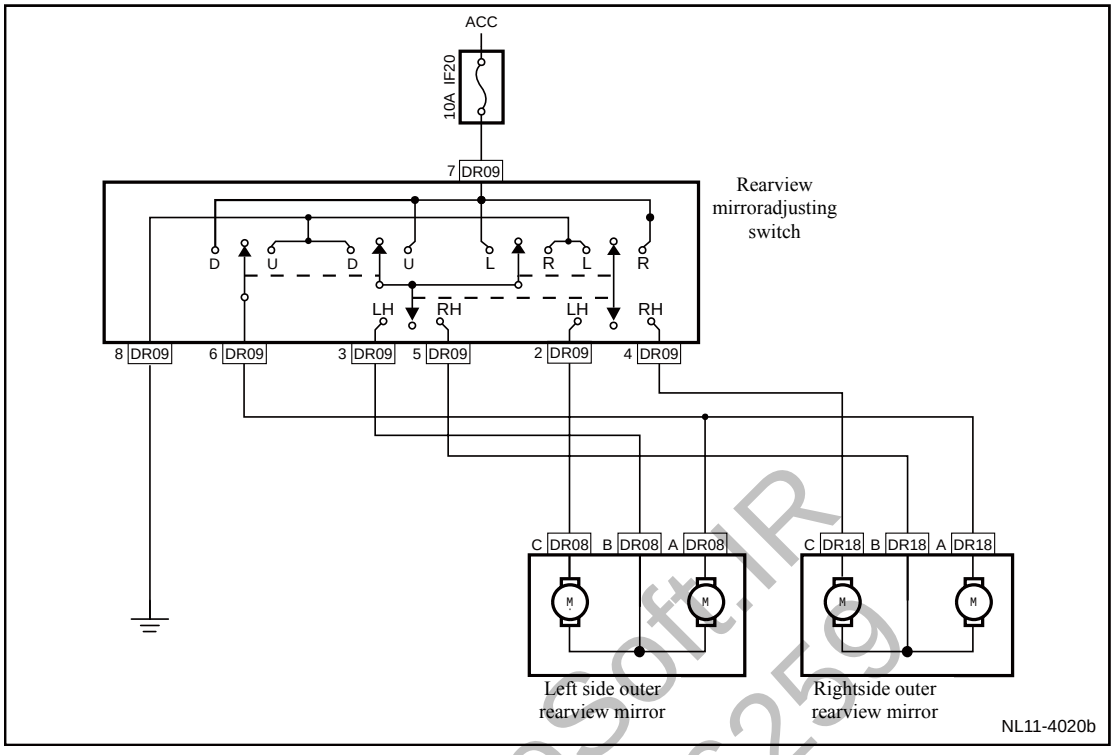
11.5.7.10 Electric rear view mirror can not be adjusted

Circuit diagram:



Diagnostic steps:

1	Inspect the working condition of the left and right electric rearview mirrors.

(a) Adjust the electric rear view mirrors on both sides.

Are the electric rear view mirrors on both sides inoperative?

No — Go to step 7

Yes

2	Check fuseIF20.

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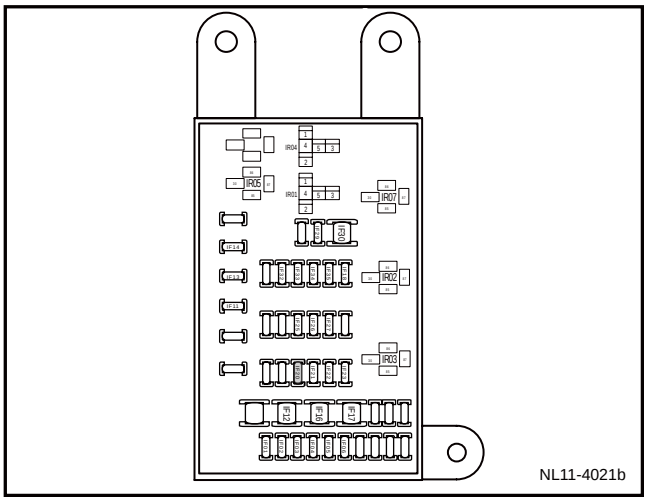
(a) Whether fuse IF20 is burned out.

Rated Current of Fuse: 10A.

Confirm whether the fuses are blown.



No → Go to step 4

Yes

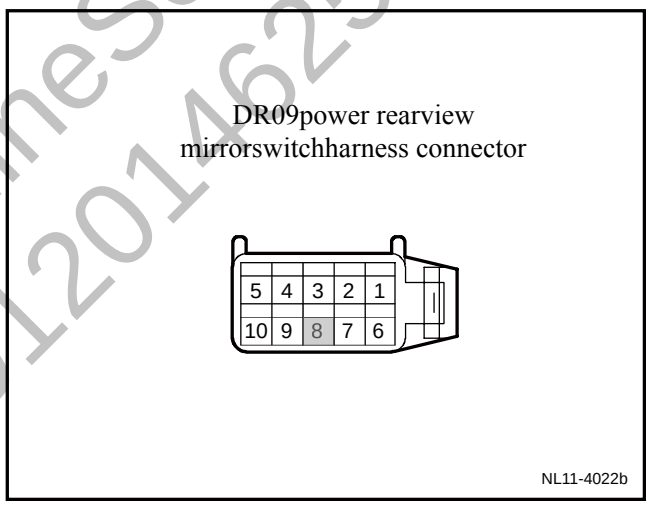
3	Inspect the left front door rearview mirror regulating switch grounding circuit.

(a) Disconnect left front door rearview mirror adjusting switch harness connector DR09.

(b) Inspect resistance between left front door rearview mirror adjusting switch wire harness connector DR09 terminal No. 8 and grounding circuit.

Resistance standard value :is less than 1Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 8

No

4	Repair the open circuit fault of the left front door rearview mirror regulating switch grounded circuit.

(a) Repair open-circuit fault points between left front door rearview mirror adjusting switch grounding circuit.

Confirm whether the electric rear view mirror is working normally?

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Yes → The system is normal.

No

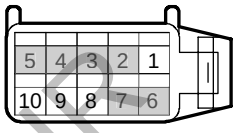
5	Inspect the energy conduction property of the left front door rearview mirror regulating switch.

(a) Turn on ignition switch to ACC position.

(b) Operate electric rearview mirror adjusting button of left front door rearview mirror adjusting switch.

(c) Use multimeter to measure voltage between left front door rearview mirror adjusting switch wire harness connector DR09 corresponding terminals (note: do not disconnect wire harness connector DR09).

DR09power rearview mirrorswitchharness connector



NL11-4023b

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Test terminal	Test conditions	Specified value
DR09 (7)— DR09(3)	Left side upward	11-14V
DR09 (7)— DR09(6)	Left side downward	11-14V
DR09 (7)— DR09(2)	Left side towards the right	11-14V
DR09 (7)— DR09(3)	Left side towards the left	11-14V
DR09 (7)— DR09(5)	Right side UPward	11-14V
DR09 (7)— DR09(6)	Right side downward	11-14V
DR09 (7)— DR09(4)	Right side towards the right	11-14V

DR09 (7)— DR09(5)	Right side towards the left	11-14V

Confirm whether the terminal voltage accords with the standard value?

Yes → Go to step 8

No

6	Replace power rearview mirror adjusting switch,

(a) Replace power rearview mirror adjusting switch. Refer to11.4.8.4 power rearview mirror adjusting switch replacement.

Confirm whether the electric rear view mirror is working normally?

Yes → The system is normal.

No

7	Inspect working condition of the electric rearview mirror of the fault side.

(a) Put left and right selection switch to the electric rearview mirror on fault side to allow up and down, left and right adjustment.

Confirm whether the electric rearview mirror can be regulated up and down.

Yes → Go to step 10

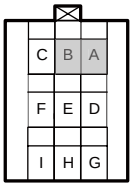
No

8	Inspect the upper and lower control signal circuit of the fault-side electric rearview mirror.

(a) Operate electric rearview mirror up and down adjusting button of left front glass lifter switch

(b) Meanwhile, use multimeter to measure voltage between terminal A and B of electric rearview mirror wire harness connector DR08 (left) or DR18 (right side) on fault side.

DR08/DR18 outer rearview mirrorharness connector



NL11-4024b

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Test terminal	Test conditions	Specified value
DR08 (A)—DR08(B)	Upward	11-14V
DR08 (A)—DR08(B)	Downward	11-14V
DR18 (A)—DR18(B)	Upward	11-14V
DR18 (A)—DR18(B)	Downward	11-14V

Confirm whether the terminal voltage accords with the standard value.

Yes → Go to step 10

No

9	Repair the open circuit fault of the upper and lower control signal circuits of the fault-side electric rearview mirror.

(a) Repair open-circuit fault between up and down control signal circuit of fault side electric rearview mirror.

Confirm whether the electric rear view mirror is working normally?

Yes → The system is normal.

No

10	Replace side power rearview mirror motor assembly with fault.

(a) Replace power rearview mirror assembly with fault; refer to11.4.8.1 power rearview mirror replacement.

Confirm whether the electric rearview mirror can be regulated left and right.

Yes → Go to step 12

No

11	Inspect the left and right control signal circuit of the fault-side electric rearview mirror.

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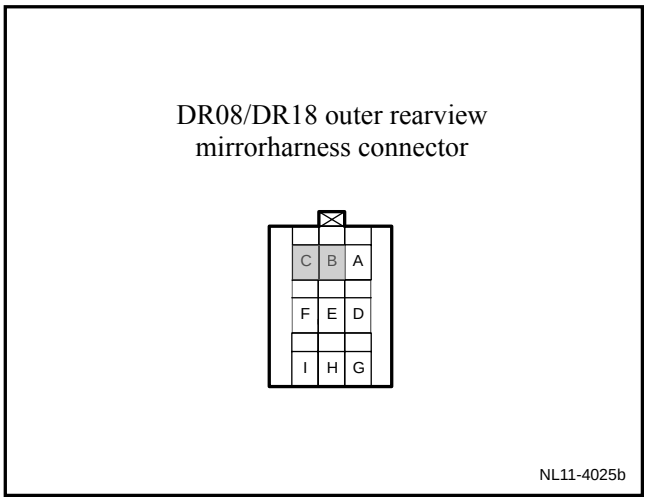
(a) Operate electric rearview mirror left and right adjusting button of left front glass lifter switch

(b) Meanwhile, use multimeter to measure voltage between terminal C and B of electric rearview mirror wire harness connector DR08 (left) or DR18 (right side) on fault side.



Test terminal	Test conditions	Specified value
DR08 (A)—DR08(B)	Upward	11-14V
DR08 (A)—DR08(B)	Downward	11-14V
DR18 (A)—DR18(B)	Upward	11-14V
DR18 (A)—DR18(B)	Downward	11-14V

Confirm whether the terminal voltage accords with the standard value.

Yes → Go to step 13

No

12	Repair the open circuit fault of the left and right control signal circuits of the fault-side electric rearview mirror.

(a) Repair open-circuit fault between left and right control signal circuit of fault side electric rearview mirror.

Confirm whether the electric rear view mirror is working normally?

Yes → Go to step 13

No

13	Replace side power rearview mirror motor assembly with fault.

(a) Replace power rearview mirror motor assembly with fault, Refer to

Confirm the completion of repair.

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Next

14	The system is normal.

11.4.7.11 power rearview mirror can not heat

See 11.10.6.3 rear air window defroster does not work.

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11.5.8 Dismantle and install

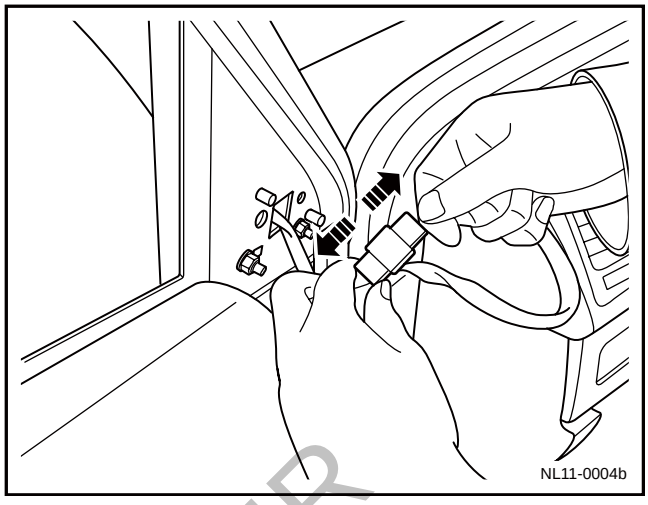
11.5.8.1 Replacement of electric rear view mirror

Dismantlement procedure

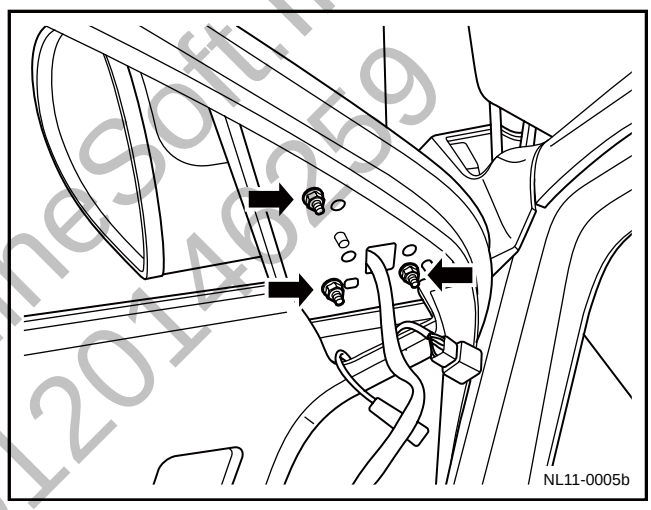
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.



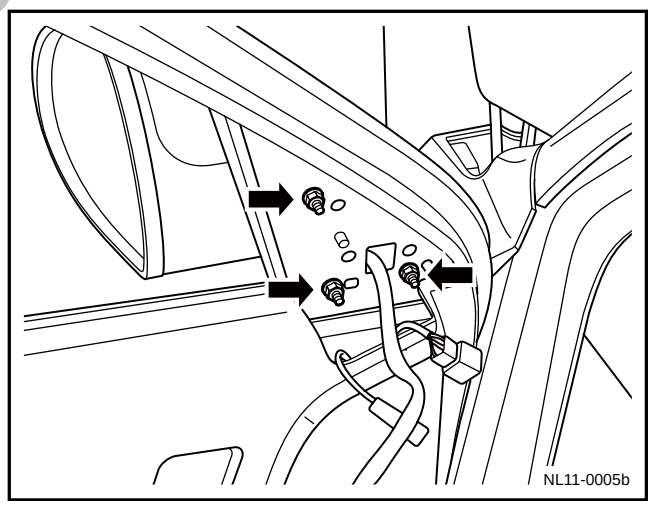
2. For dismantling of front door treble speaker, refer to 11.2.7.1 Replacement of front door speaker.
3. Disconnect power rearview mirror harness connector.
4. Dismantle fixing nut of electric rearview mirror.



Installation procedure:

1. Install electric rearview mirror fixing nut.

Torque:8 Nm(Metric) 5.8 lb-ft(English system)



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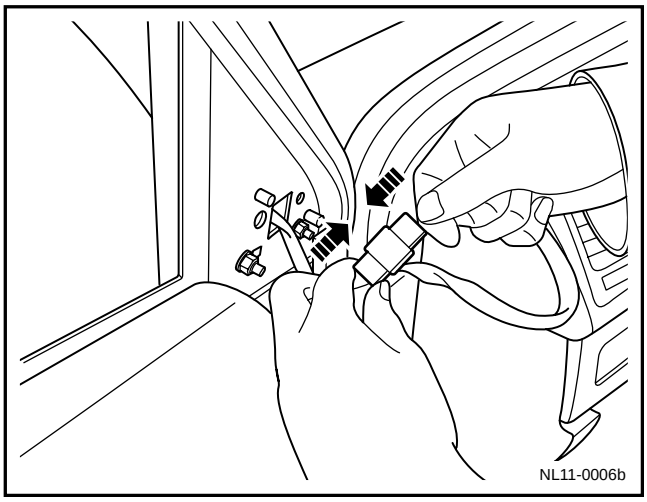
2. Connect electric rearview mirror wire harness connector.
3. Install front door speaker.
4. Connect the battery negative cable.



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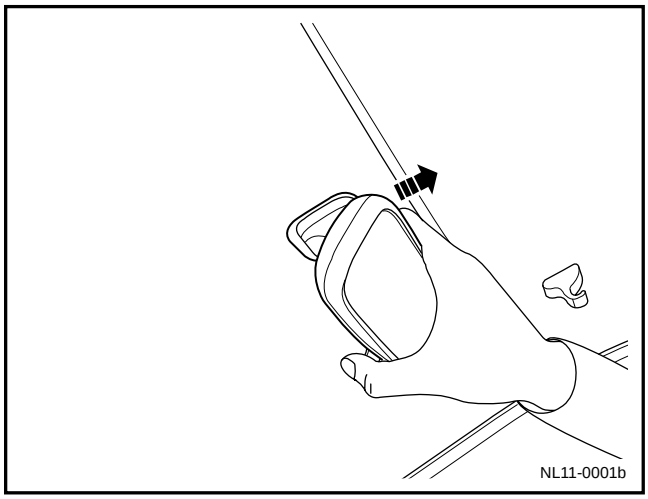
11.5.8.2 Replacement of Interior rear view mirro

Dismantlement procedure

1. Remove the interior rear view mirror from the mounting bracket.
2. Dismantle the interior rear view mirror mounting bracket.

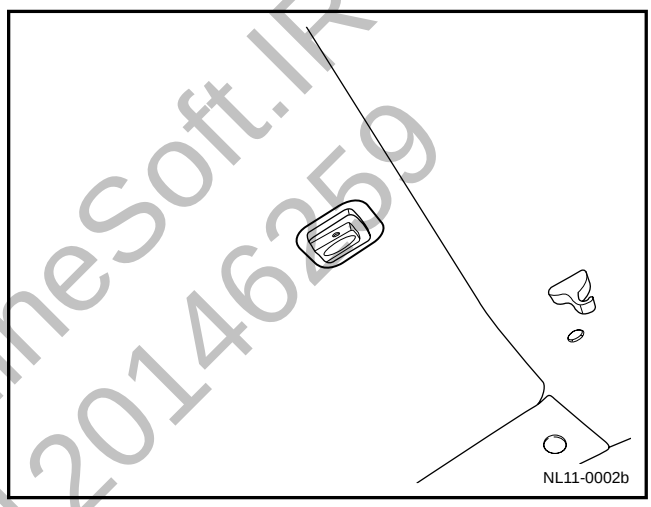
Notes:

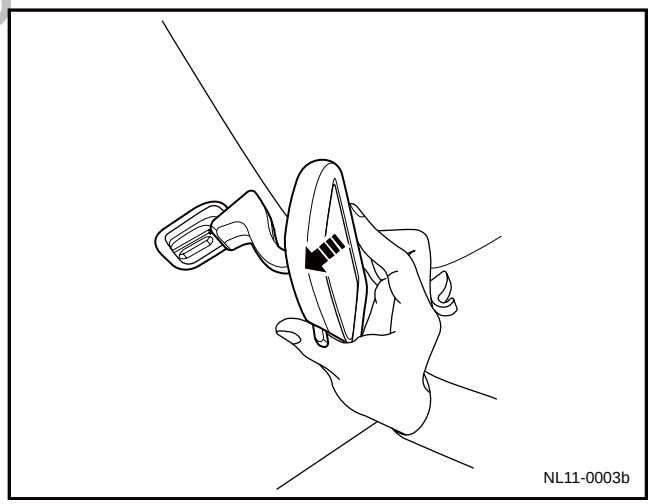
Inside rearview mirror bracket is bonded on the windshield through special adhesive.



Installation procedure:

1. Use dedicated cleaning agent to clean the interior rear view mirror bracket installation surface.
2. Apply the adhesive according to the adhesive requirements.
3. Position the rear view mirror bracket to the marked position, and press the bracket onthe glass for 1-2min with the constant pressure.
4. Use dedicated cleaning agent to remove excess adhesive after 5 min.
5. Install the interior rear view mirror.





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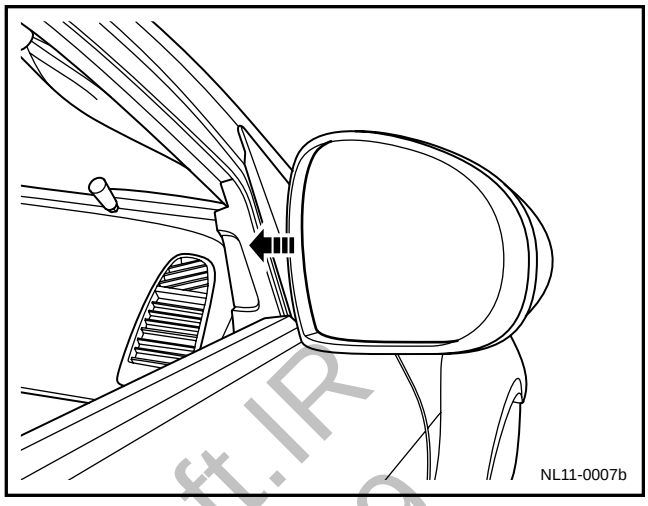
11.5.8.3 Replacement of electric rear view mirror glass

Dismantlement procedure

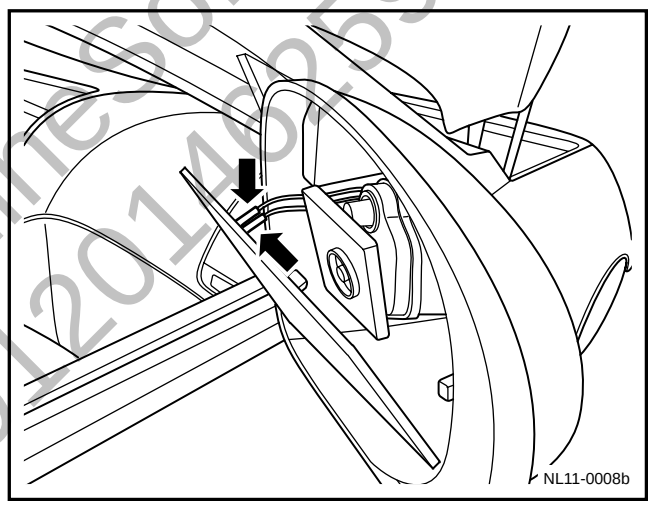
Warning!

Warning: refer to "warning on battery disconnection" in "warnings and precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle electric rearview mirror glass.



3. Disconnect power rearview mirror glass harness connecting, take out rearview mirror glass.



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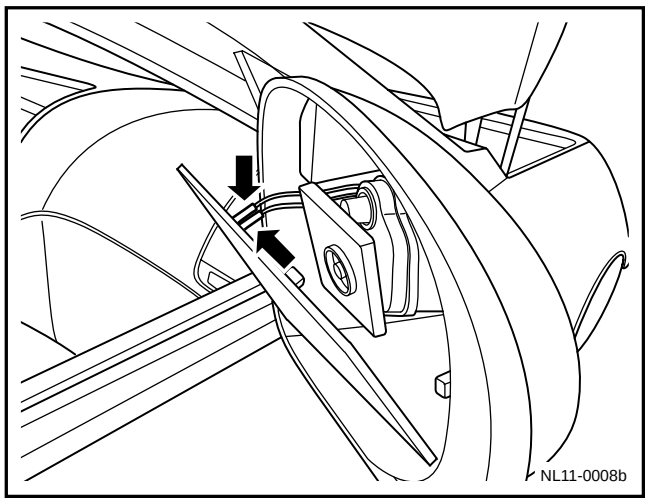
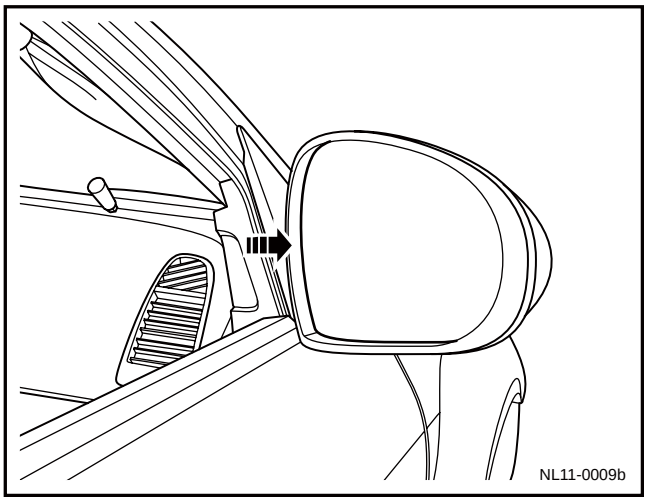
Dismantlement procedure

1. Install rearview mirror glass, and connect wire harness connector of electric rearview mirror glass.



2. Install electric rearview mirror glass.
3. Connect the battery negative cable.



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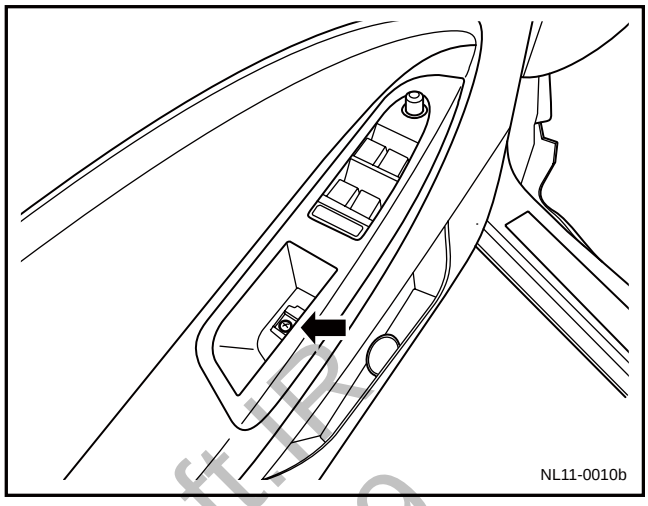
11.5.8.4 Power rearview mirror adjusting switch replacement

Dismantlement procedure

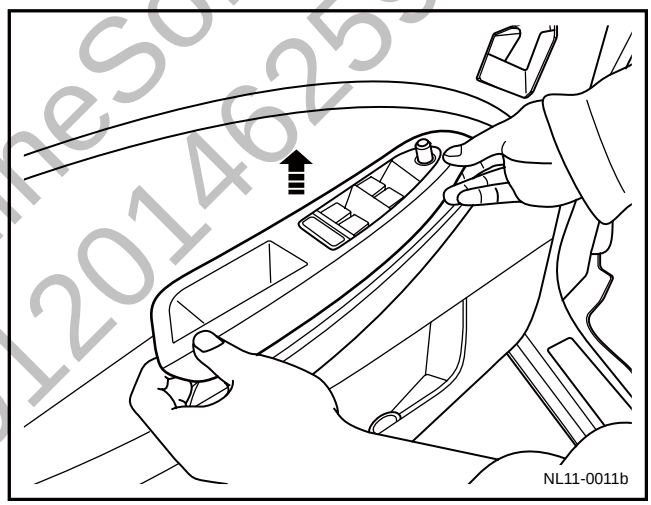
Warning!

Warning: refer to "warning on battery disconnection" in "warnings and precautions".

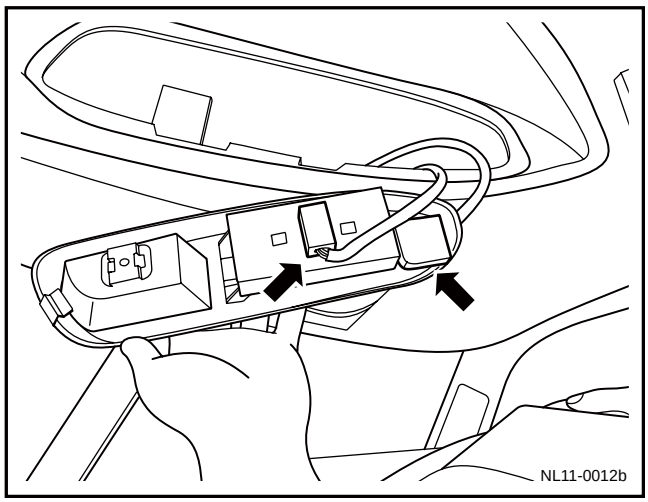
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Loosen fixing bolt of electric rearview mirror switch.



3. Dismantle electric rearview mirror switch assembly.



4. Disconnect wire harness connector between rearview mirror adjusting switch and left front glass lifter switch.
5. Extract the rearview mirror adjustment switch assembly.



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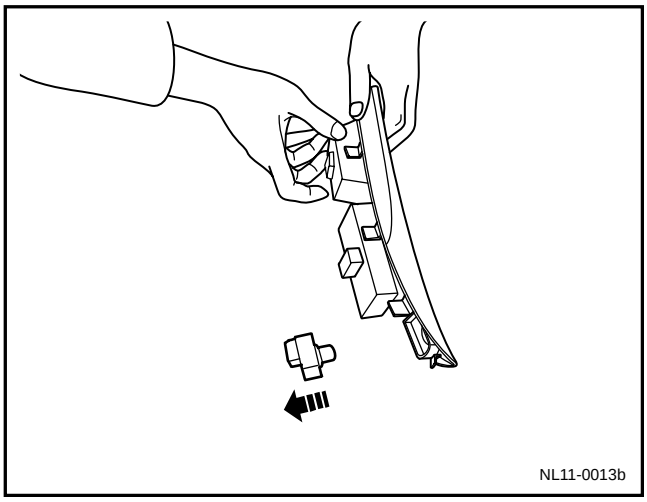
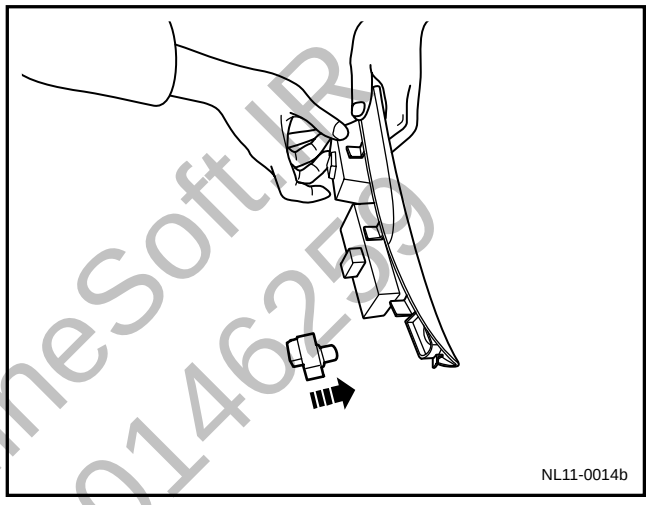
6. Dismantle the rearview mirror adjustment switch.

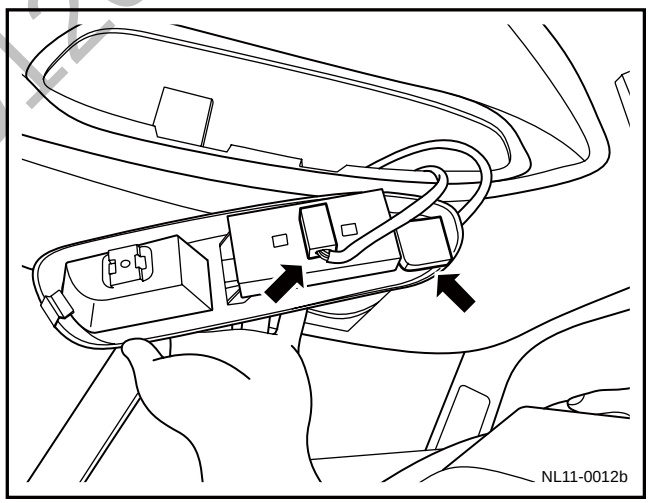


Installation procedure:

1. Install rearview mirror adjusting switch.



2. Connect wire harness connector between rearview mirror adjusting switch and left front glass lifter switch.



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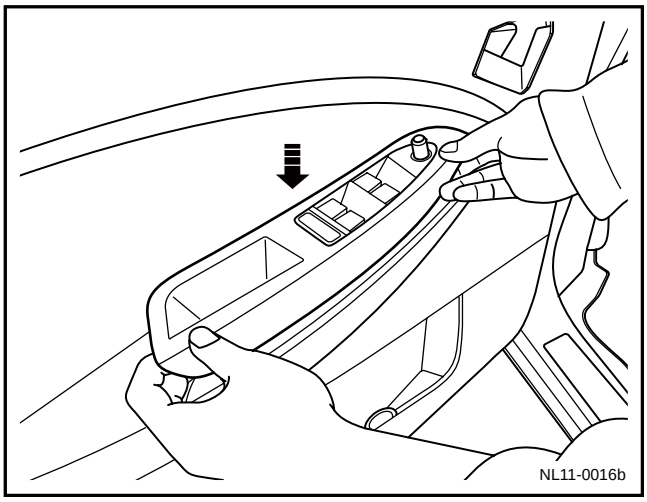
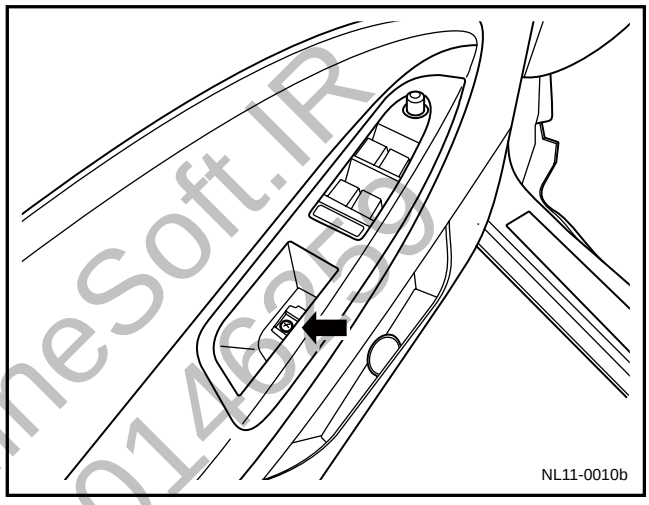
3. Install rearview mirror adjusting switch assembly.



4. Install fixing bolt of rearview mirror adjusting switch assembly.

Torque: 4 Nm (metric) 3 lb-ft (english system)

5. Connect the battery negative cable.



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11.5.8.5 Left front glass lifter motor replacement

Dismantlement procedure

Warning!

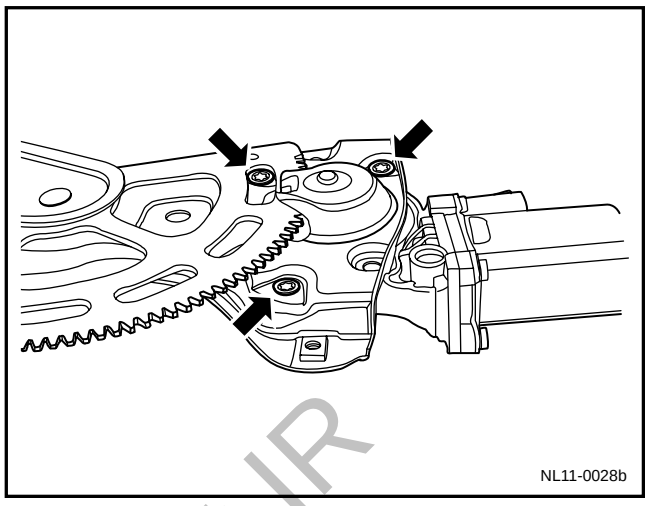
Warning: refer to warning on battery disconnection in warnings and precautions.

1. For disconnection of negative cable of battery, refer to 2.11.8.1 Disconnection procedures of battery cable.

Connection procedures.

2. For dismantling of left front glass lifter assembly, refer to 11.4.8.7 Replacement of front door glass lifter.

3. Dismantle fixing screw of left front glass lifter motor.



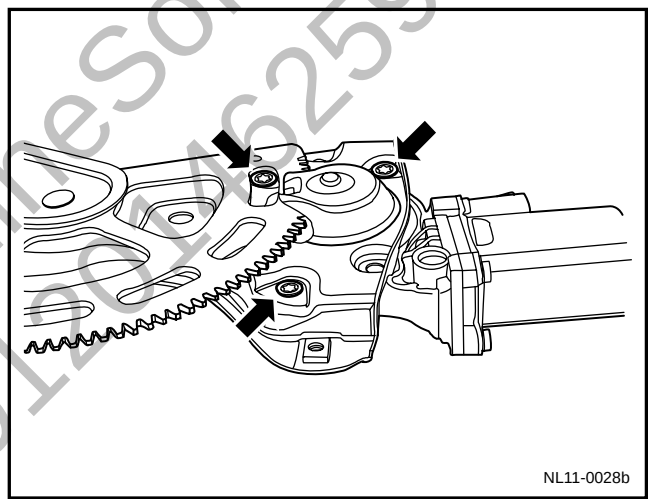
Installation procedure:

1. Install fixing screw of left front glass lifter motor.

Torque: 10 Nm (metric) 7.4 lb-ft (english system)

2. Install left front glass lifter assembly.

3. Connect the battery negative cable.



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11.5.8.6 Replacement of left front window regulator switch

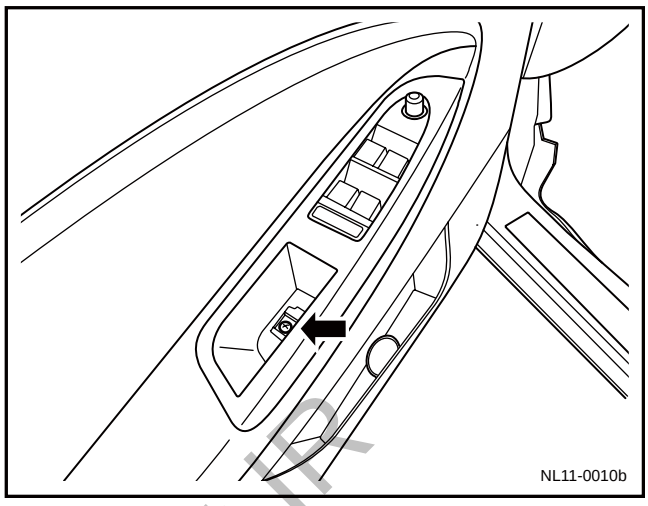
Dismantlement procedure

Warning!

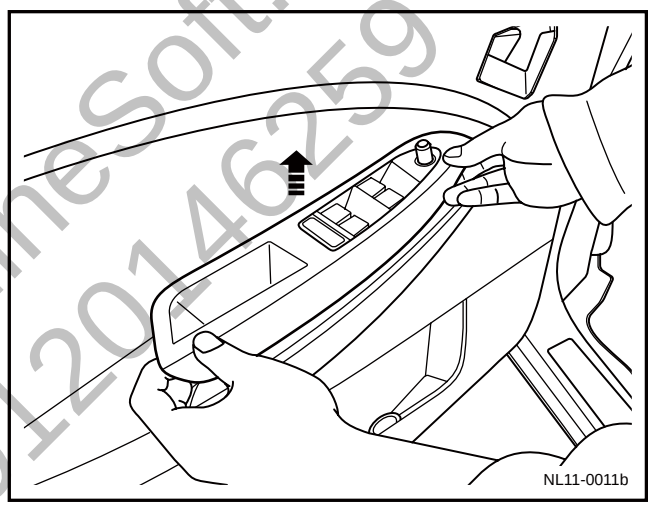
Warning: refer to warning on battery disconnection in warnings and precautions.

1. For disconnection of negative cable of battery, refer to 2.11.8.1 disconnection procedures of battery cable.

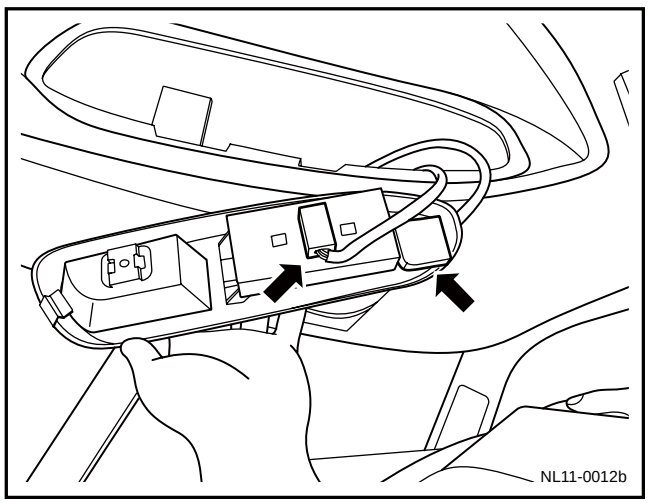
Connection procedures.



2. Loosen fixing bolt of left front glass lifter switch assembly.
3. Dismantle left front glass lifter switch assembly.



4. Disconnect wire harness connector between left front glass lifter switch and rearview mirror adjusting switch.
5. Extract the front left door window lifter switch assembly.



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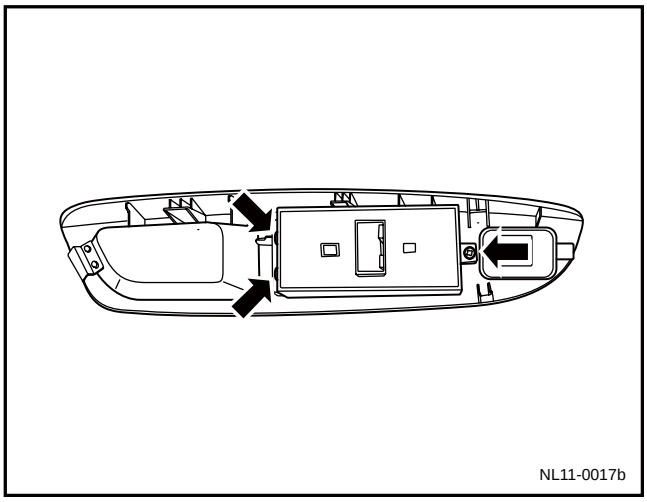
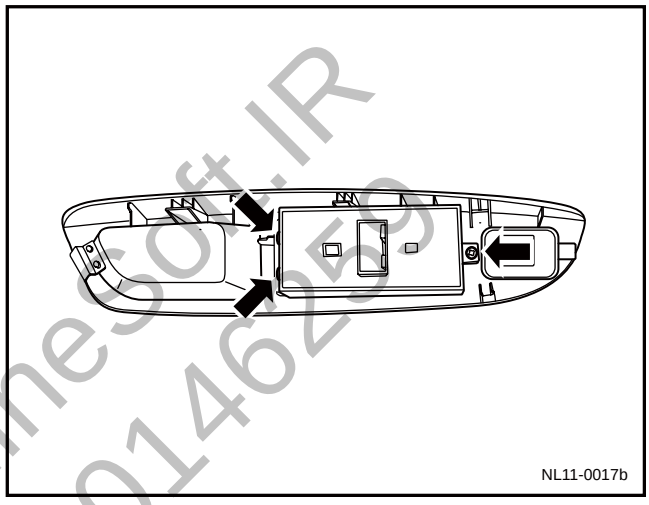
6. Dismantle the fixing screws of left front window regulator switch.
7. Extract the front left door window lifter switch.



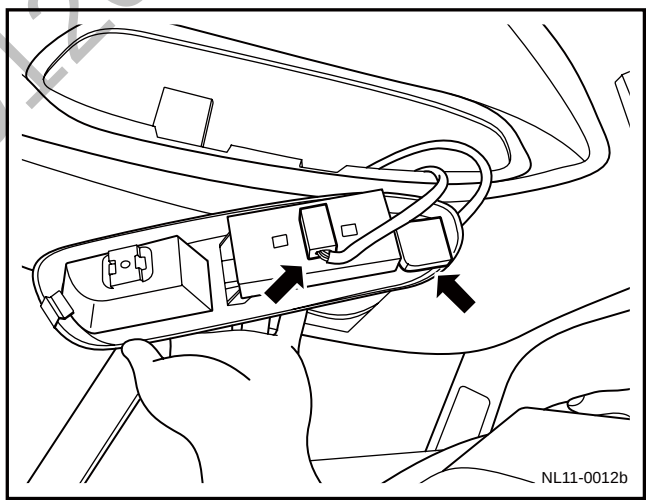
Installation procedure:

1. Install left front glass lifting switch.
2. Install left front glass lifting switch fixing screw.

Torque:5Nm(metric) 4lb-ft(english system)



3. Connect wire harness connector between left front glass lifter switch and rearview mirror adjusting switch.



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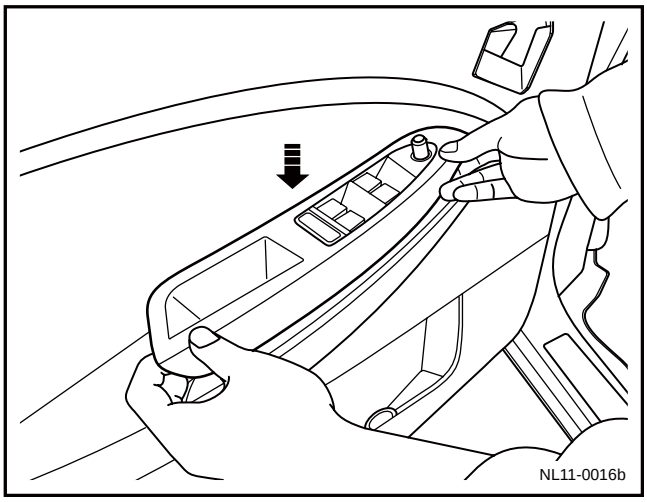
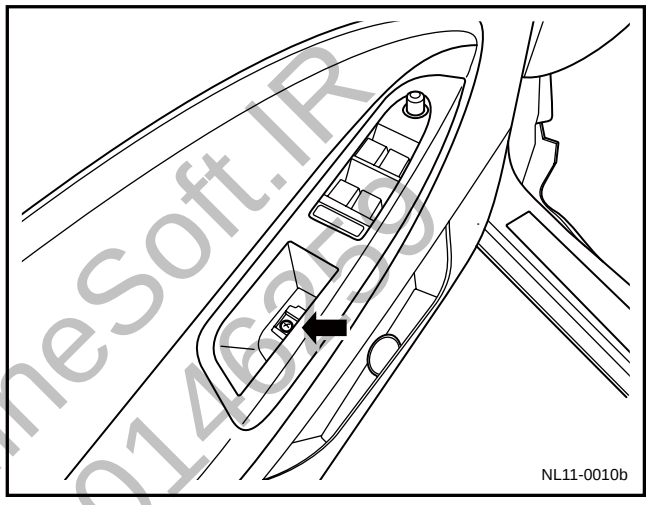
4. Install left front glass lifter switch assembly.



5. Install the fixing bolt of the front-left power window switch assembly.

Torque: 5Nm (metric) 4 lb-ft (english system)

6. Connect the battery negative cable.



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11.5.8.7 Replacement of front door window regulator

Dismantlement procedure

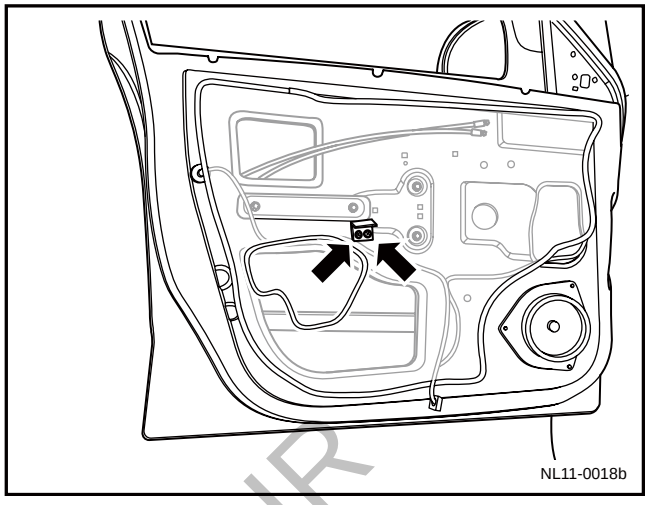
Warning!

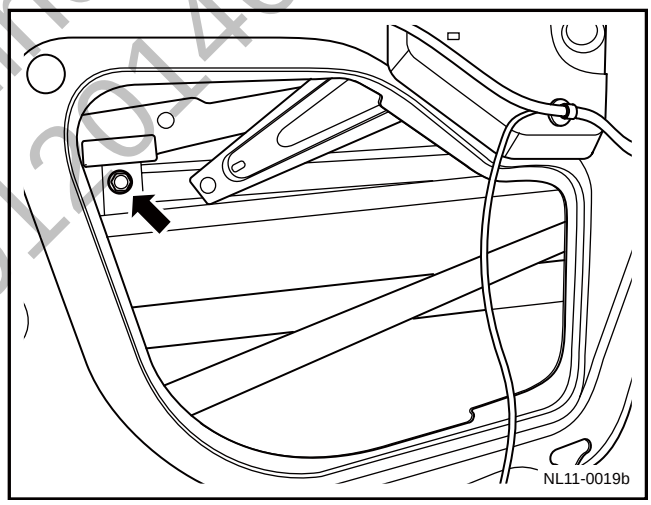
Warning: refer to warning on battery disconnection in warnings and precautions.

1. For disconnection of negative cable of battery, refer to 2.11.8.1 Disconnection procedures of battery cable.

Connection procedures.

2. For dismantling of front door treble speaker, refer to 11.2.7.1 Replacement of front door speaker.
3. For dismantling of front door inner trimming plate, refer to 12.9.1.7 Replacement of left front door inner trimming plate.
4. Dismantle front door glass lifter switch bracket, and remove water retaining membrane.
5. Remove the fixing bolt on one side of the front door window.





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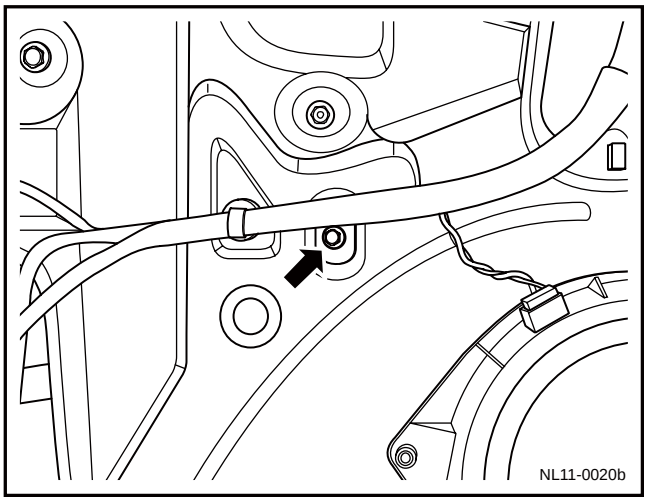
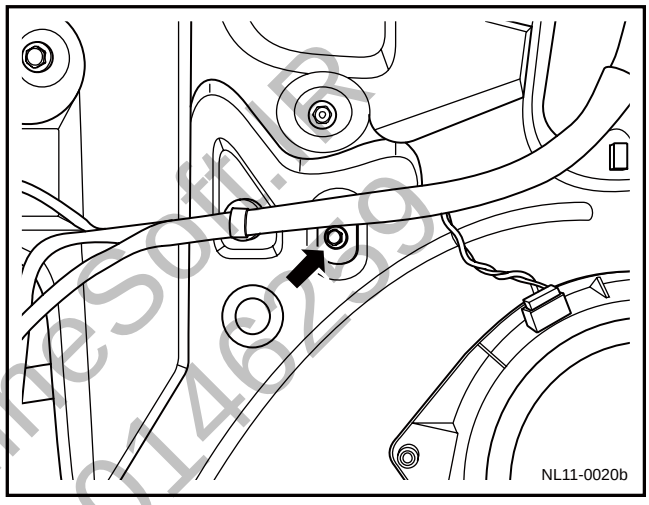
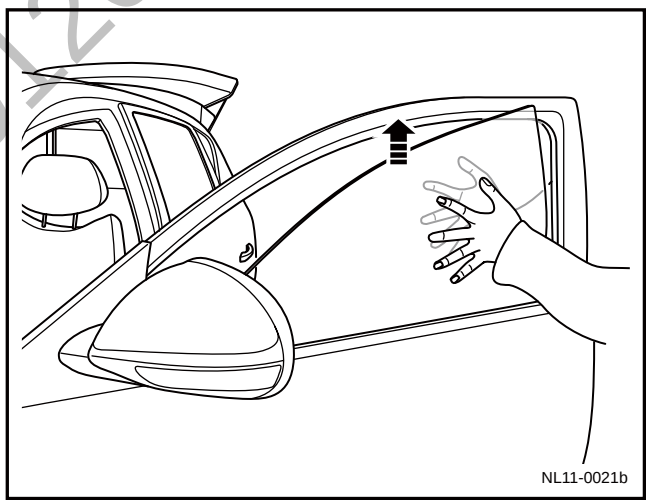
6. Remove the fixing bolt on the other side of the front door window.



7. Pull out the front door window upwards.



8. Remove the front door window lifter fixing bolt.



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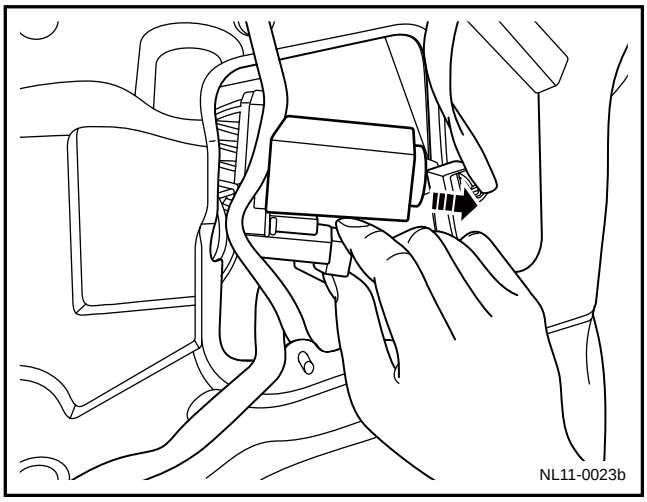
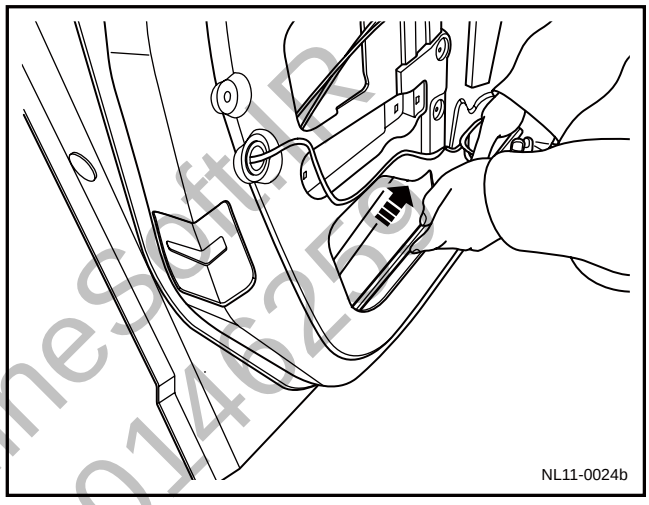
9. Disconnect the harness connector of the front door window lifter motor.

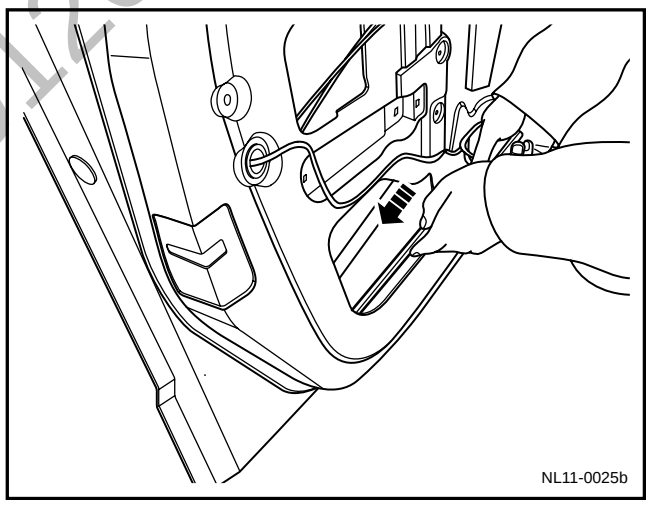


10. Take out front door glass lifter .



Installation procedure:

1. Install front door glas lifter.



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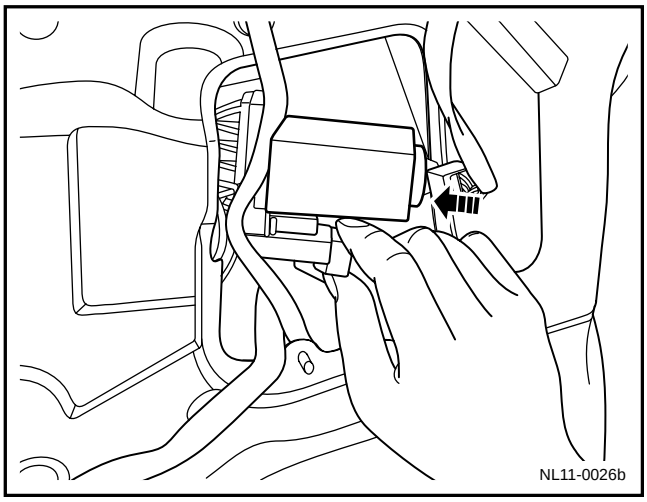
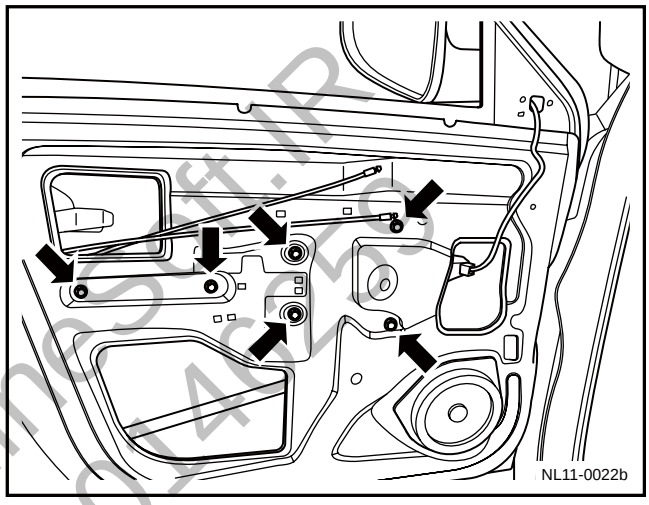
2. Install wire harness connector

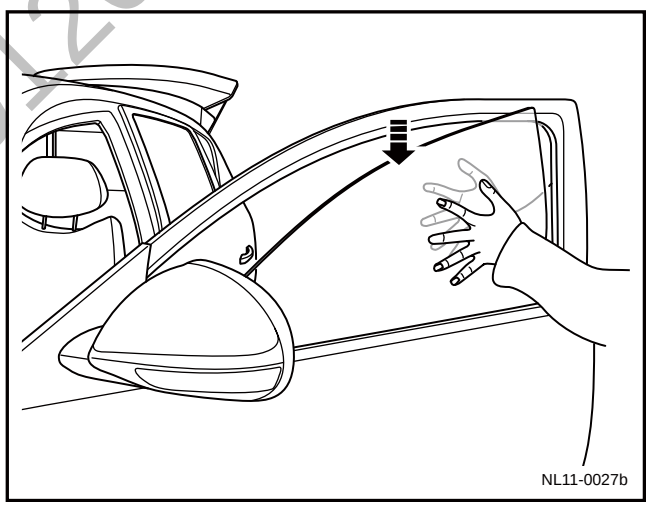


3 of front door glass lifter motor. Install fixing bolt of front door glass lifter.

Torque: 8Nm(Metric) 6lb-ft(English system)



4. Insert the front door window glass plate downwards.



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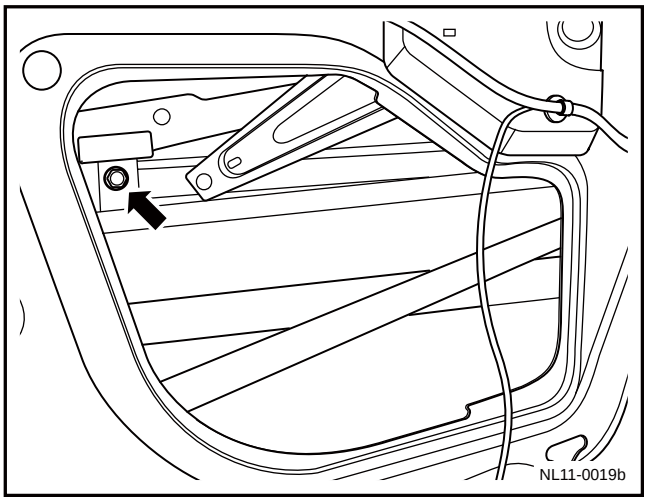
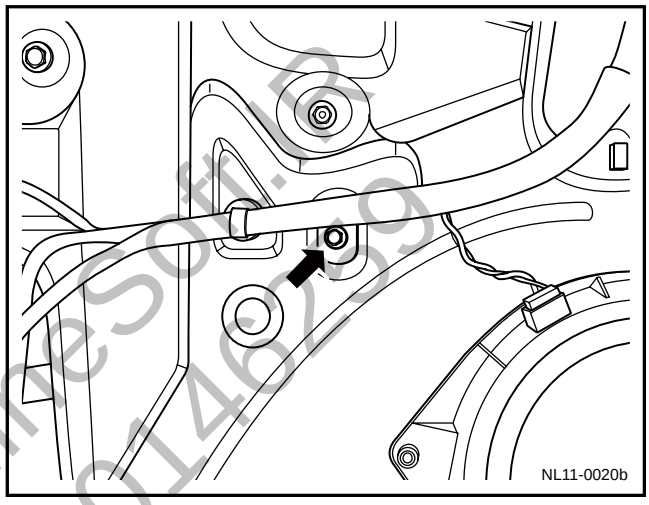
5. Install and tighten the fixing bolt on one side of the front door window.

Torque: 8Nm(Metric) 6lb-ft(English system)



6. Install and tighten the fixing bolt on the other side of the front door window.

Torque: 8Nm(Metric) 6lb-ft(English system)



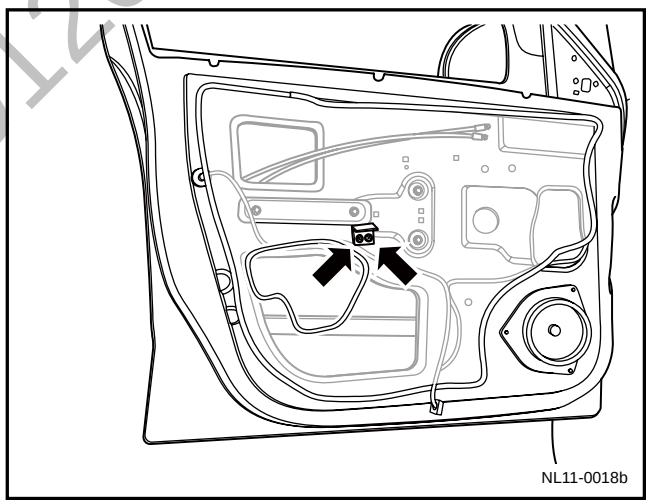
7. Paste the retaining membrane and install the window lifter switch bracket.

Torque: 5Nm (metric system) 3.7lb-ft (english system)

8. Install the front door interior trim panel.

9. Install front door speaker.

10. Connect the battery negative cable.



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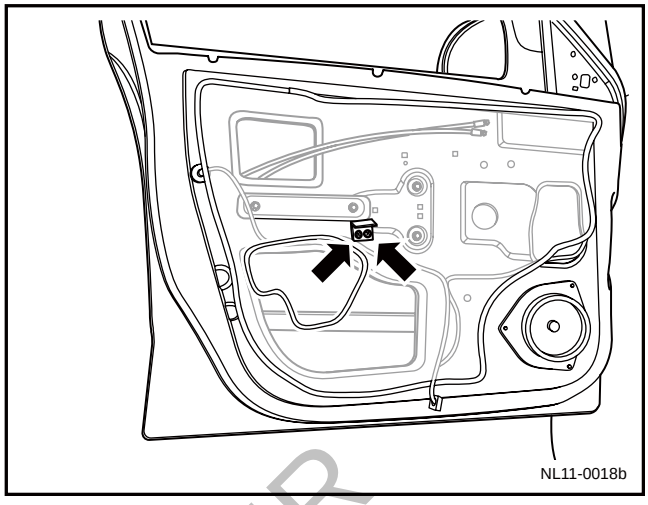
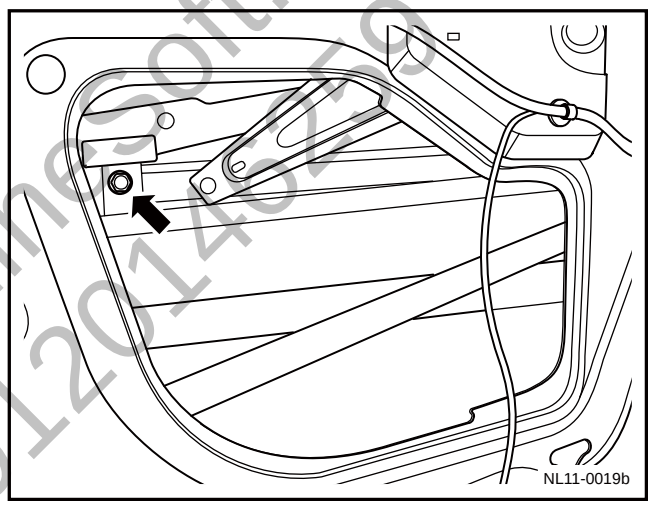
11.5.8.8 Replacement of front door window slot

Dismantlement procedure

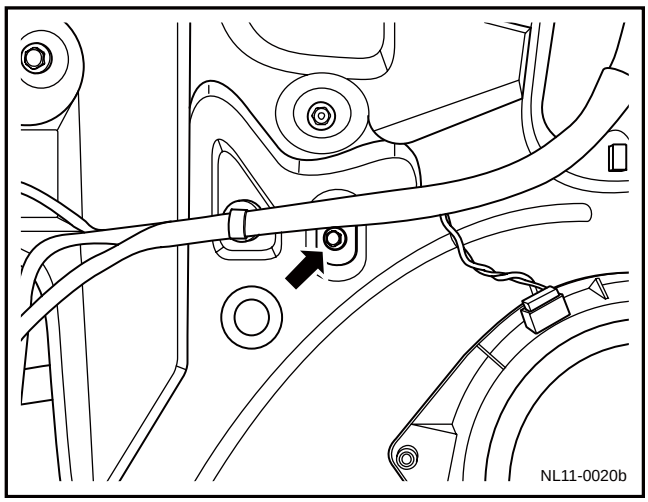
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of front door speaker, refer to 11.2.7.1 Replacement of front door speaker.
3. Dismantle the front door interior trim panel. Refer to12.9.1.7 Replacement of Front Door Interior Trim Panel.
4. Dismantle front door glass lifter switch bracket, and remove water retaining membrane.



5. Remove the fixing bolt on one side of the front door window.



6. Remove the fixing bolt on the other side of the front door window.



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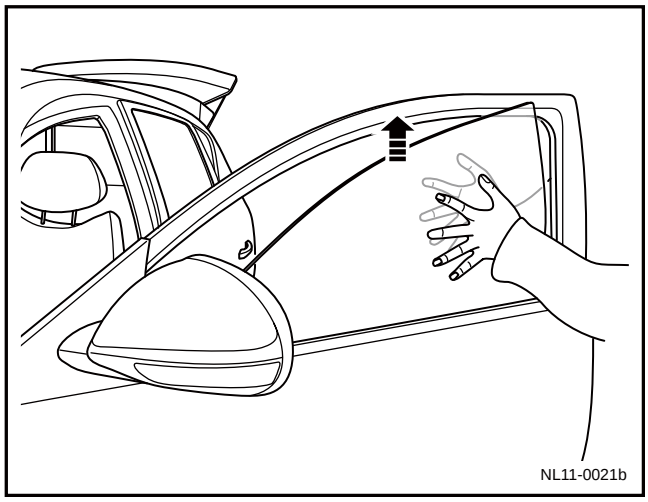
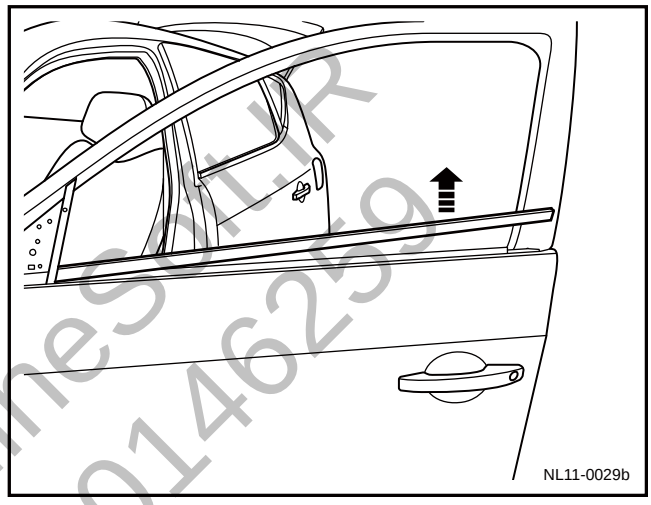
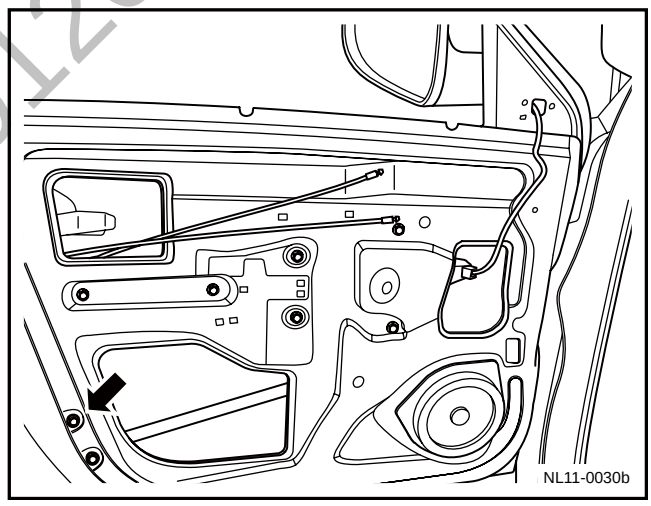
7. Pull out the front door window upwards.



8. Remove the external sealing strip of the front door window.



9. Remove the window guide rail fixing bolt.



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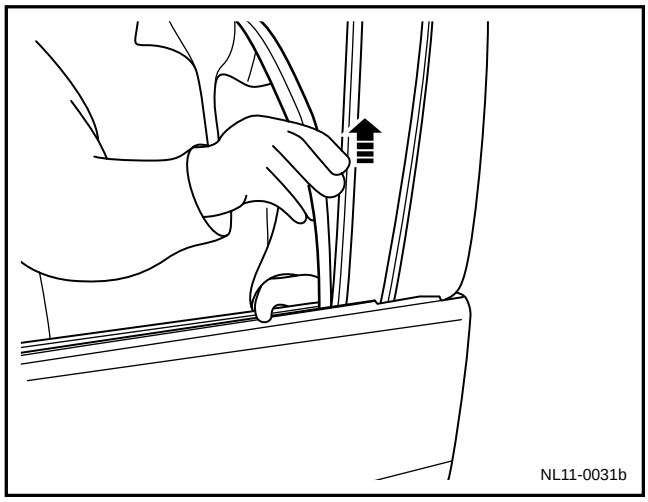
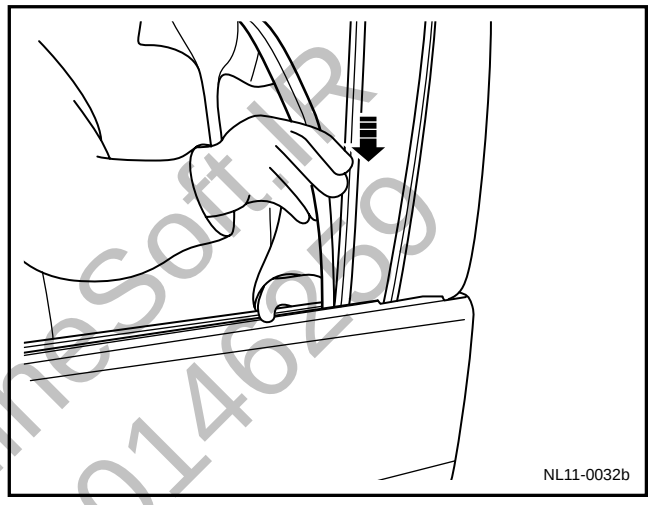
10. Dismantle front door glass guide groove.



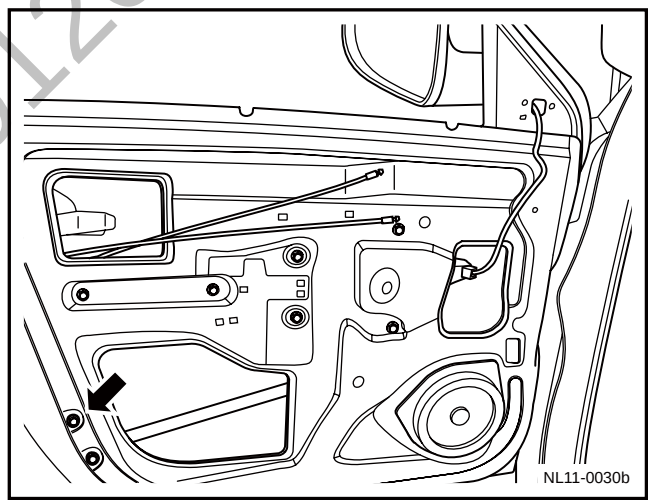
Installation procedure:

1. Install the front door window guide groove.



2. Install fixing bolt of glass guideway.

Torque: 8Nm(Metric) 6lb-ft(English system)



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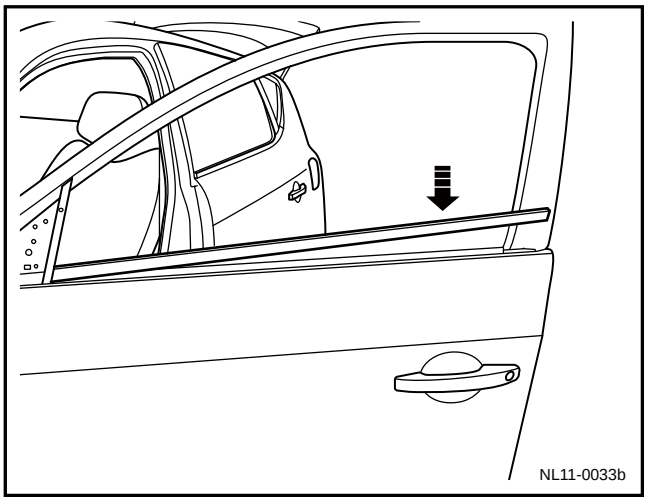
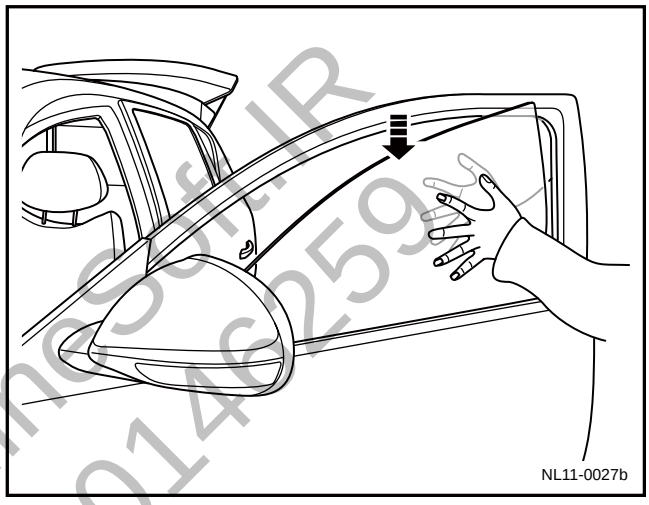
3. Install front door glass sealing strip.

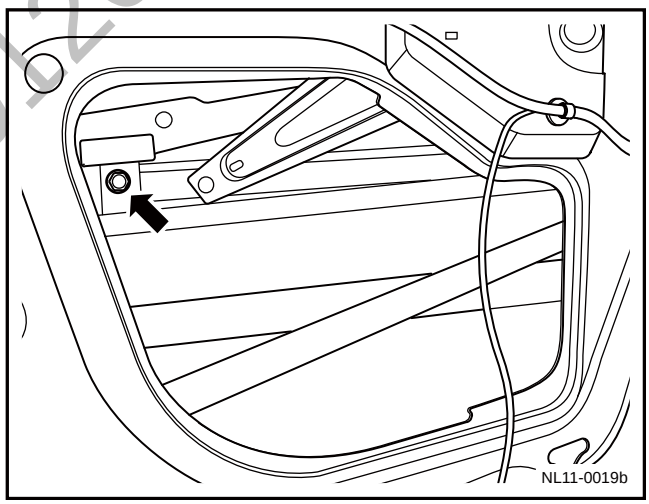


4. Insert the front door window glass plate downwards.



5. Install the fixing bolt on one side of the front door window.

Torque: 8Nm(Metric) 6lb-ft(English system)



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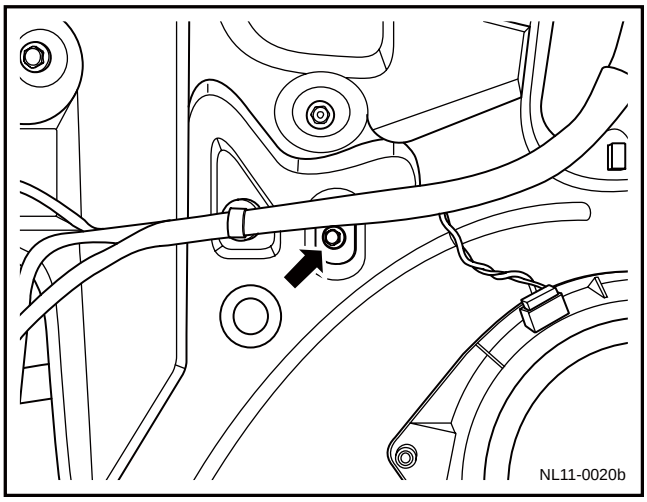
6. Install the fixing bolt on the other side of the front door window.

Torque: 8Nm(Metric) 6lb-ft(English system)



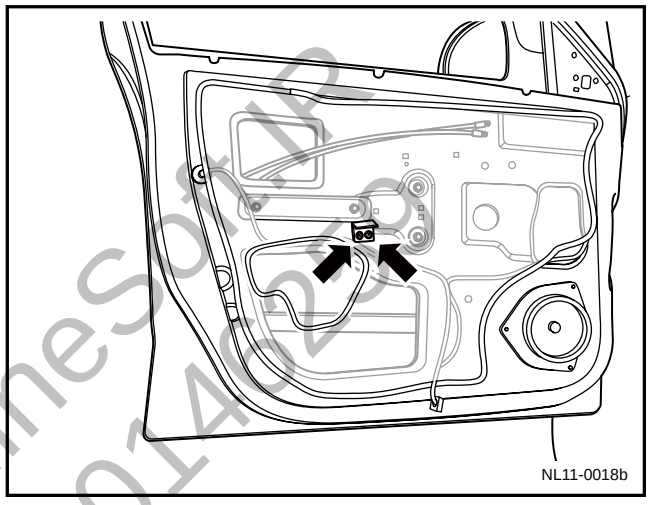
7. Paste the retaining membrane and install the window lifter switch bracket.

Torque: 5Nm (metric system) 3.7lb-ft (english system)

8. Install the front door interior trim panel.

9. Install front door treble speaker.

10. Connect the battery negative cable.



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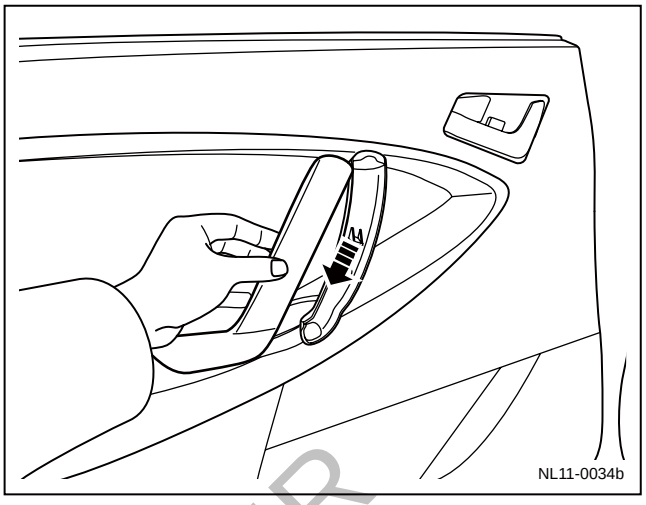
11.5.8.9 Replacement of rear door window regulator switch

Dismantlement procedure

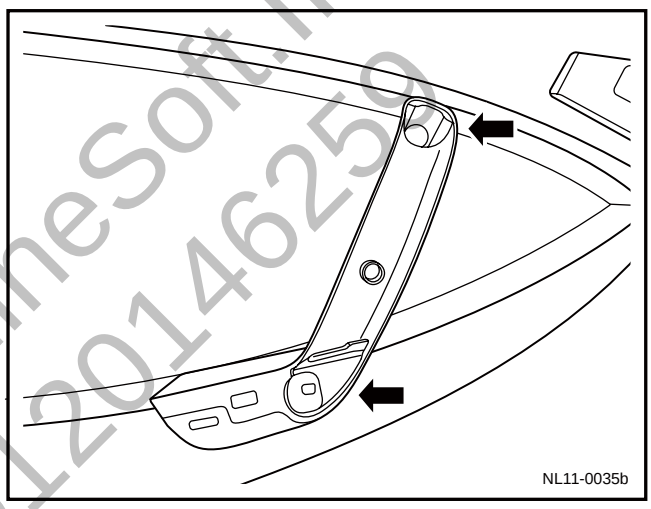
Warning!

Warning: refer to "warning on battery disconnection" in "warnings and precautions".

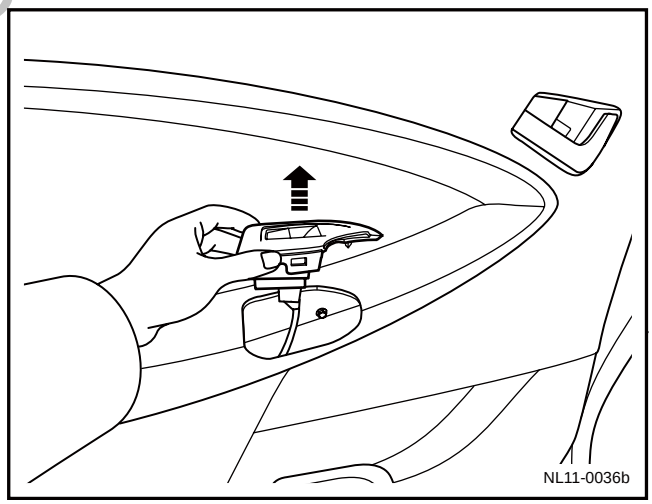
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.



2. Dismantle inner trimming plate handle cover plate.
3. Dismantle mounting seat of inner trimming plate handle.



4. Dismantle rear door glass lifter switch.
5. Disconnect the rear door window regulator switch harness connector.



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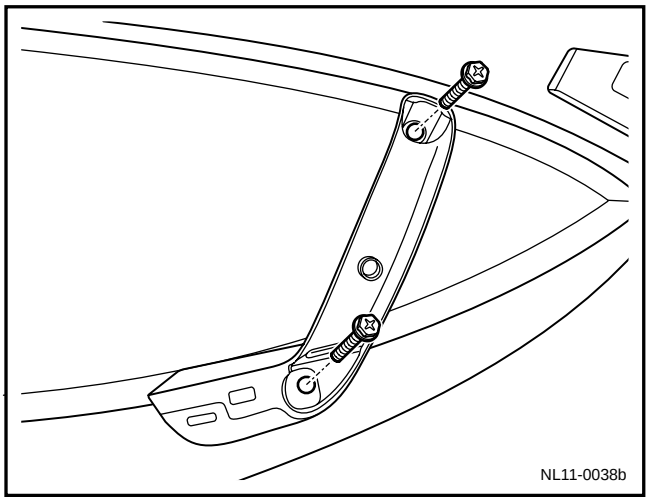
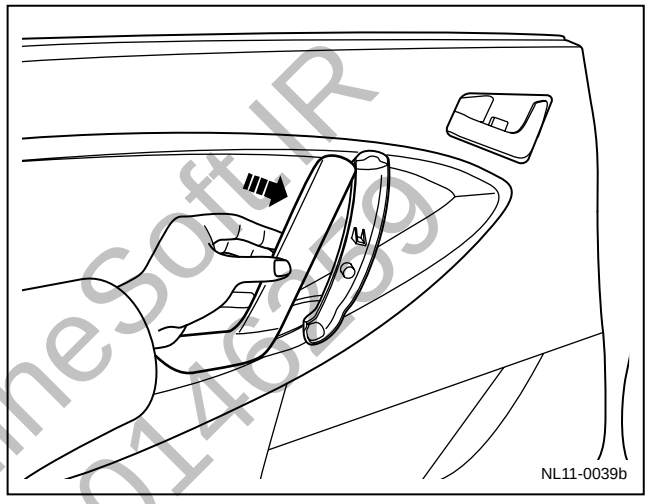
Installation procedure:

1. Connect to rear door glass lifting switch harness connector.
2. Install the rear door window regulator switch.
3. Install mounting seat of inner trimming plate handle.

Torque: 8Nm(Metric) 6lb-ft(English system)



4. Install cover plate of inner trimming plate handle.
5. Connect the battery negative cable.



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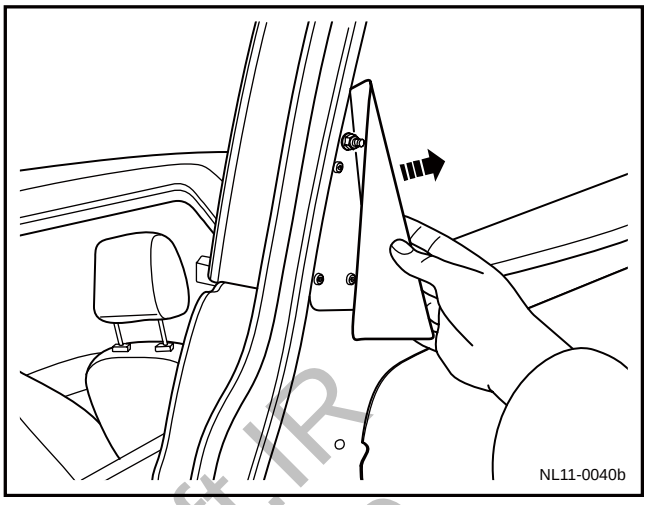
11.5.8.10 Replacement of rear door window regulator

Dismantlement procedure

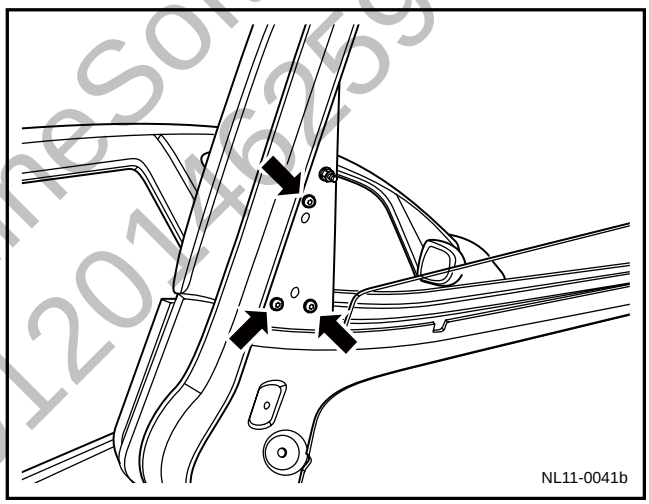
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

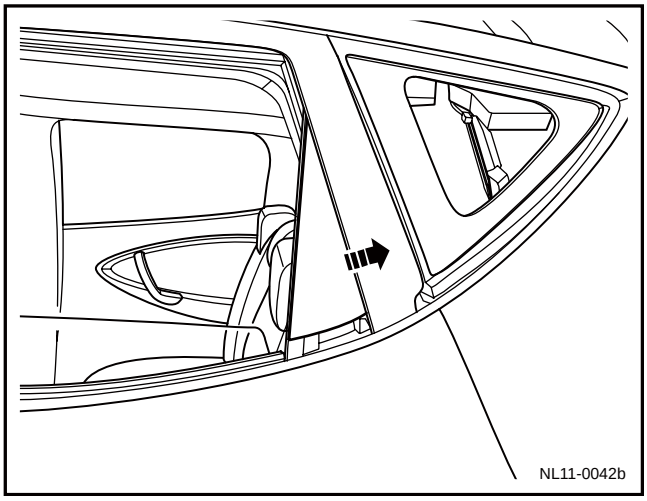
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of door inner trimming plate, refer to 12.9.1.9 Replacement of rear door inner trimming plate.
3. Dismantle door inner trimming plate angle decoration.



4. Dismantle fixing bolt of outer angle decoration of door.



5. Remove the door external trim mirror.



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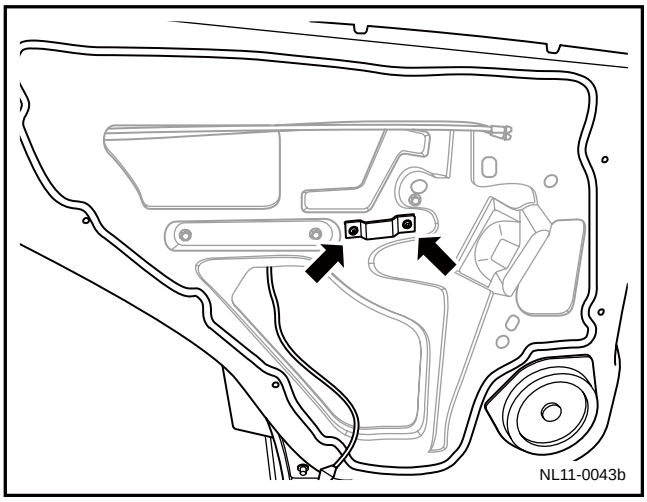
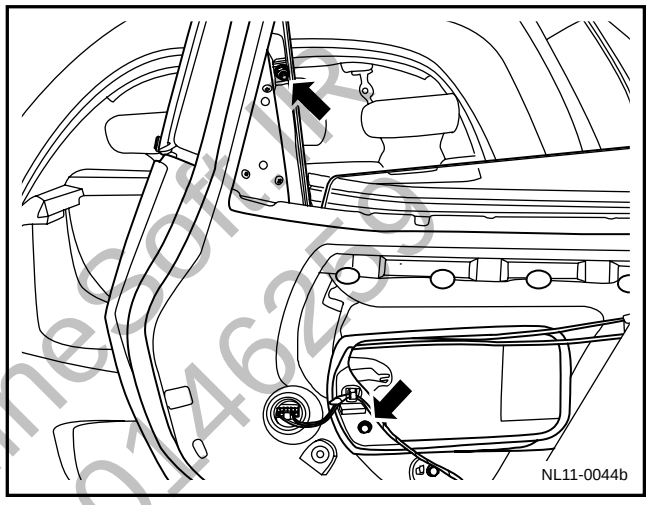
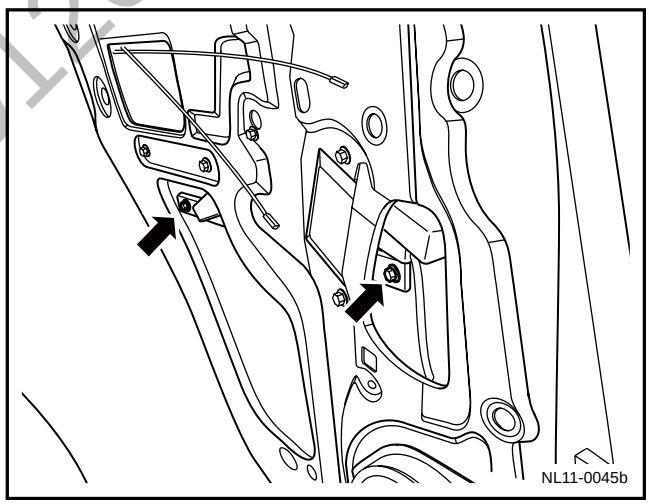
6. Dismantle the retaining membrane fixing frame and tear down the retaining membrane.



7. Connect the battery negative cable.
8. Operate the rear door window lifter switch to adjust the window to an appropriate level.
9. Disconnect the battery negative cable.
10. Dsimantle rear door glass guideway bolt, and loosen guideway to facilitate rear window glass.



11. Dismantle fixing bolt of rear door glass



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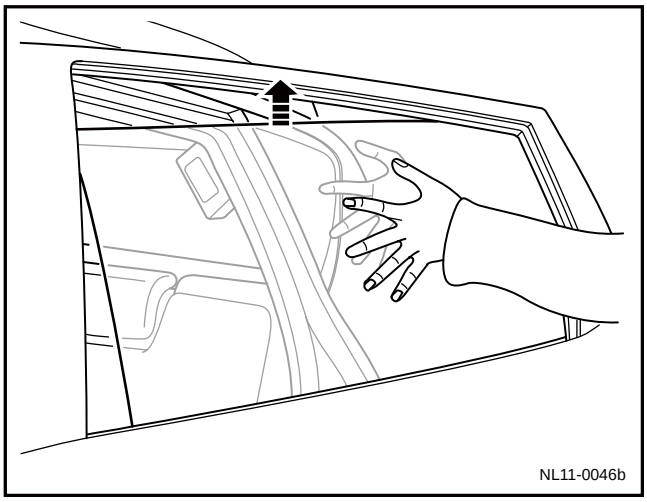
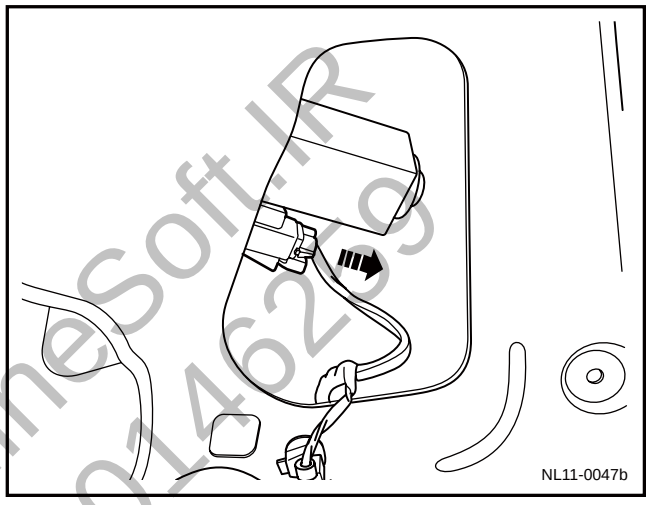
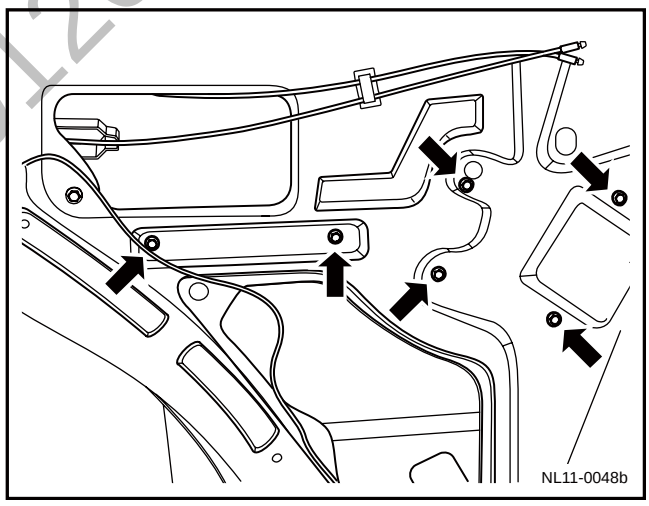
12. Take out rear door glass.



13. Disconnect glass lifter motor wire harness connector.



14. Dismantle fixing bolt of rear door glass lifter.



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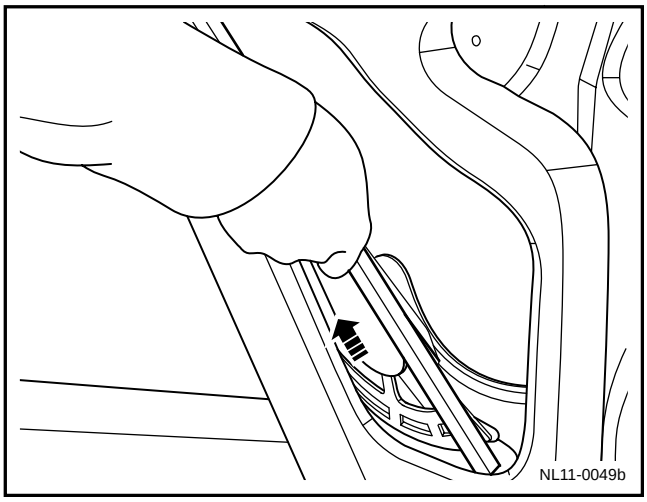
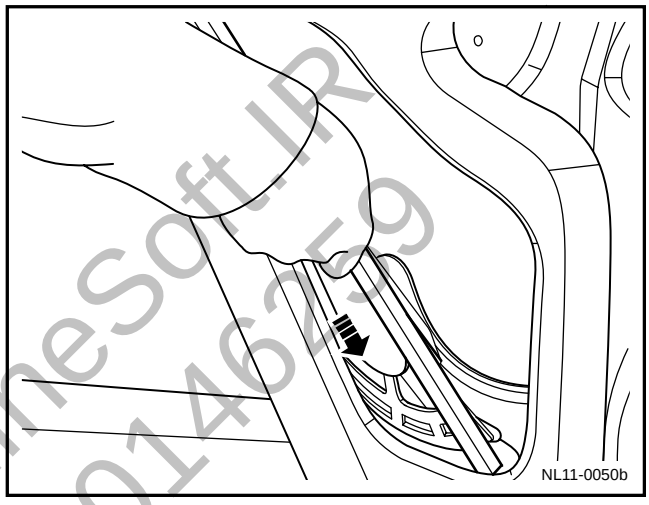
15. Take out rear door glass lifter.



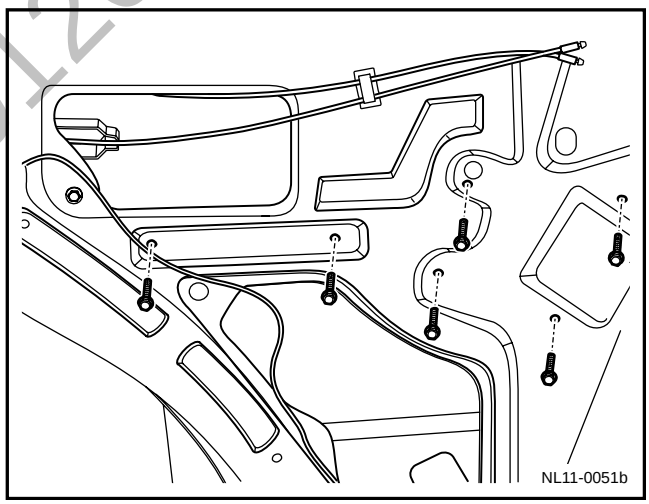
Installation procedure:

1. Install the rear door window regulator.



2. Tighten fixing bolt of rear door glass lifter.

Torque: 8Nm (Metric) 6 lb-ft (English system)



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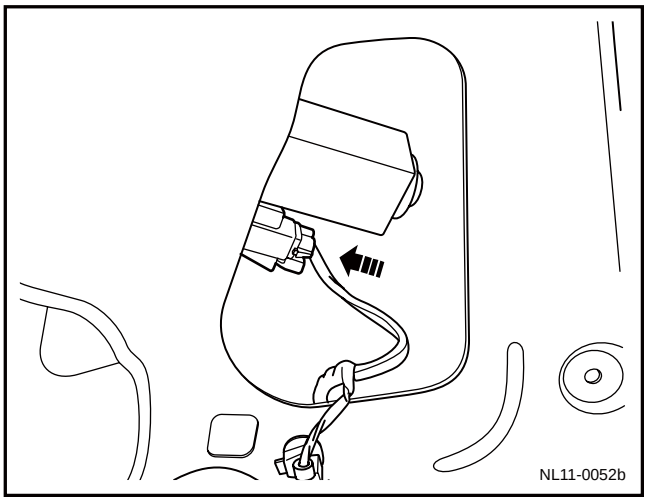
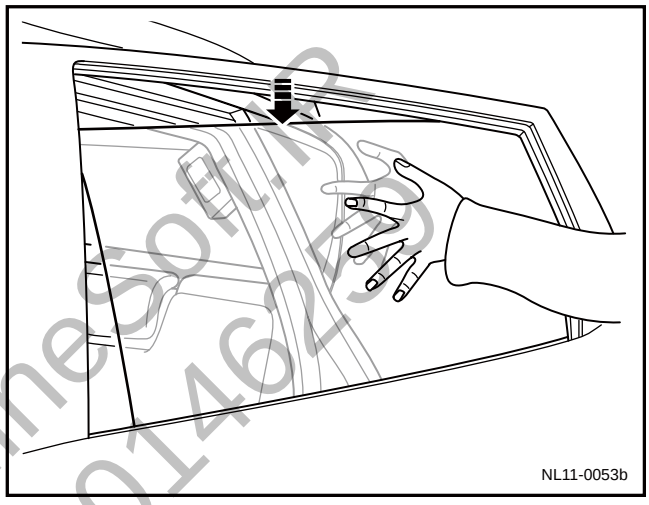
3. Connect the wire harness connector of rear door glass lifter motor.

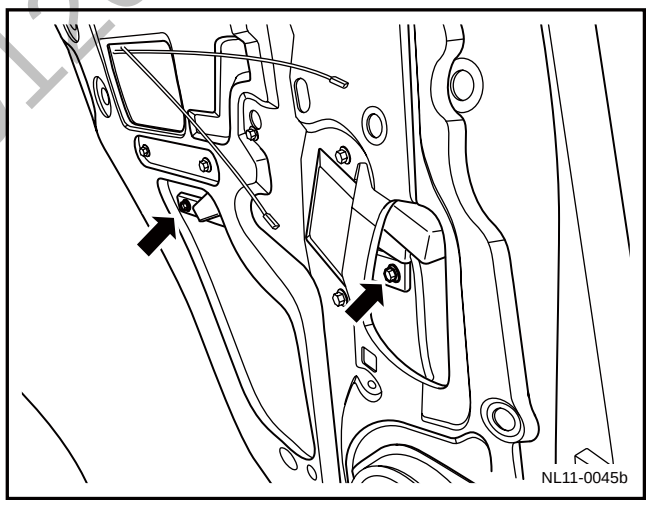


4. Install the rear door window glass plate.



5. Screw up the rear door window fixing bolt.

Torque: 8Nm(Metric) 6lb-ft(English system)



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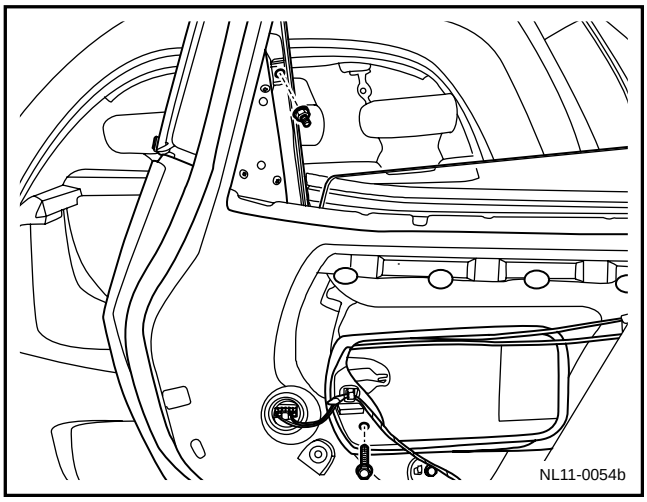
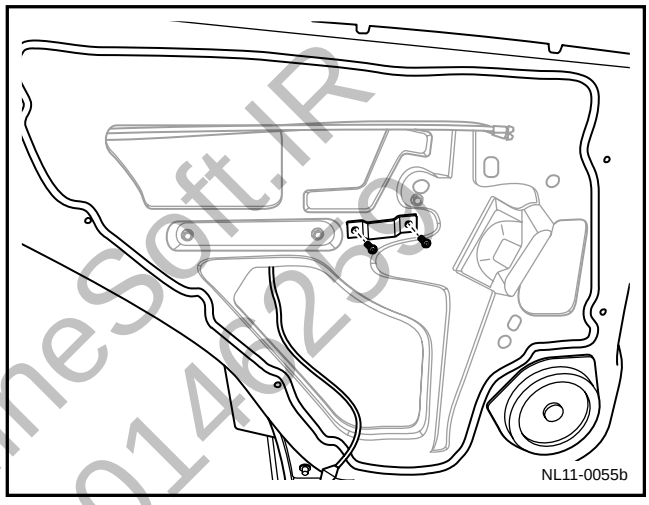
6. Install and tighten the fixing bolt for the rear door window guide groove.

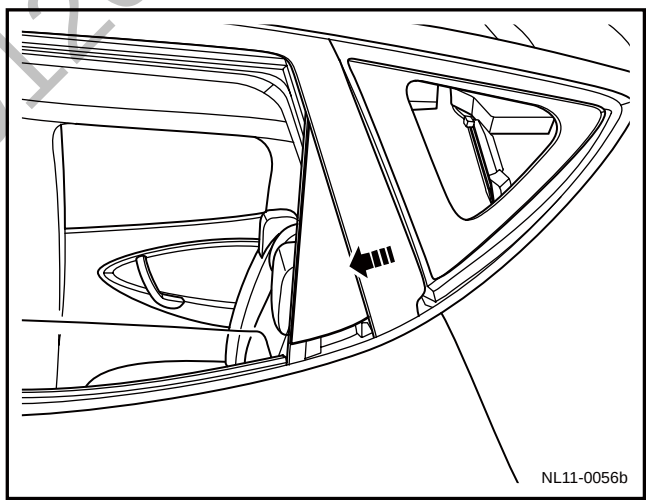
Torque: 8Nm(Metric) 6lb-ft(English system)



7. Paste the retaining membrane and install the window lifter switch bracket.



8. Install the door external trim corner.



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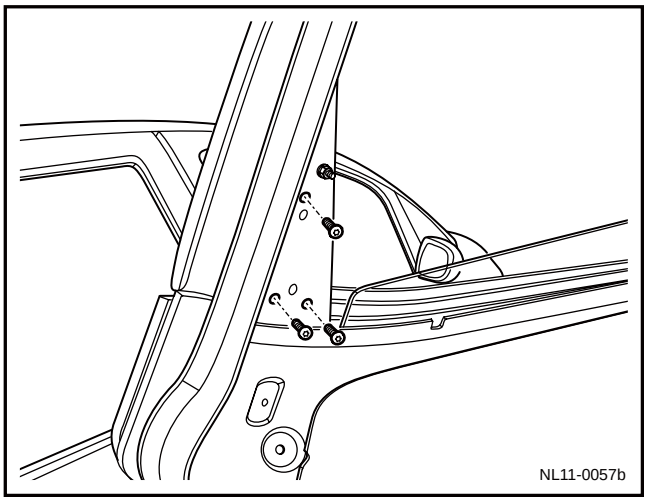
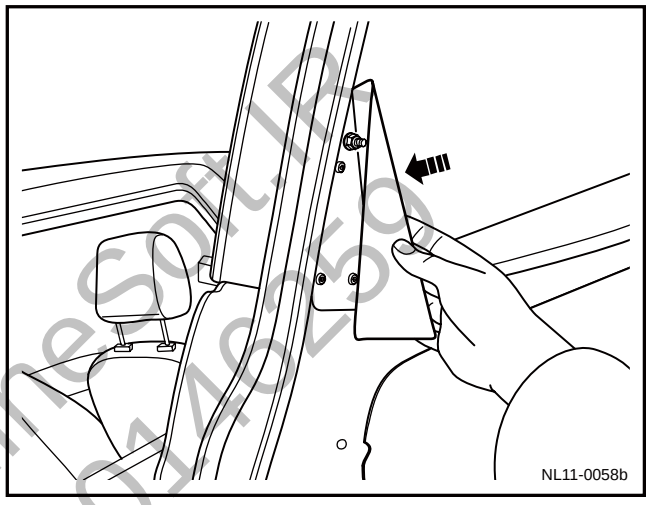
9. Tighten the fixing bolt for the door external trim corner.

Torque: 8Nm(Metric) 6lb-ft(English system)



10. Install angle decoration of door inner trimming plate.
11. Install the door interior trim panel.
12. Connect the battery negative cable.



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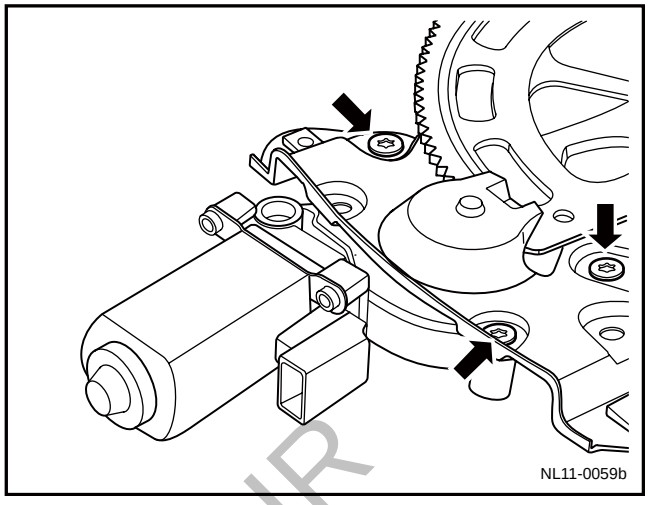
11.5.8.11 Replacement of rear door window regulator motor

Dismantlement procedure

Warning!

Warning: refer to "warning on battery disconnection" in "warnings and precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of rear door glass lifter, refer to "replacement of rear door glass lifter".
3. Dismantle the fixing bolts of rear door glass lifter motor.

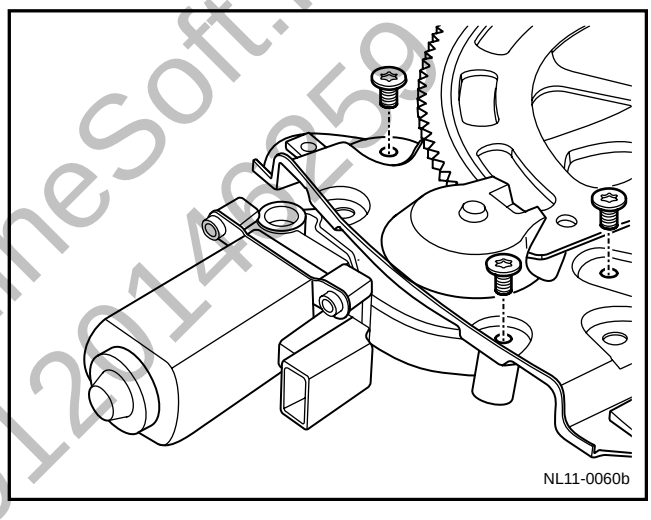


Installation procedure:

1. Install the fixing bolts of rear door window regulator motor.

Torque:10Nm(Metric) 7.4lb-ft(English system)

2. Install the rear door window regulator.
3. Connect the battery negative cable.



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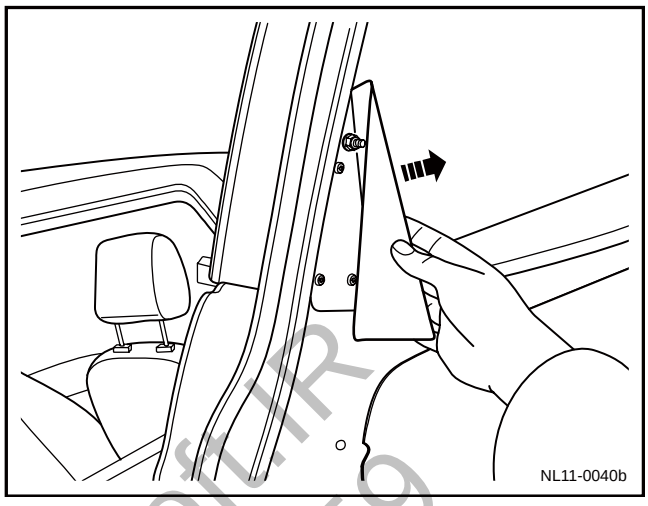
11.5.8.12 Replacement of rear door window slot

Dismantlement procedure

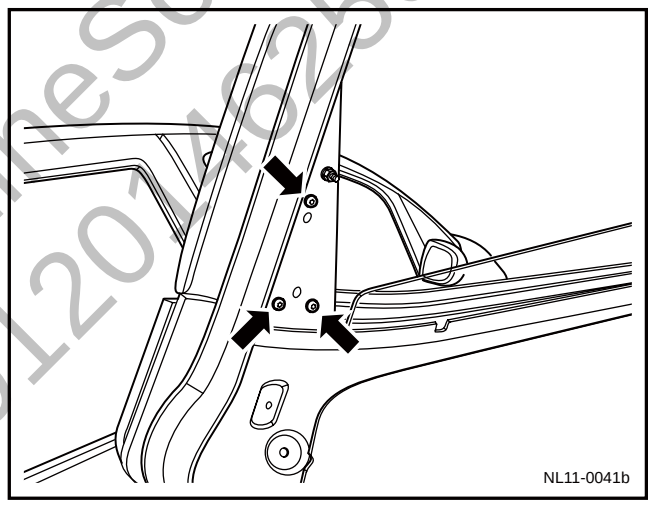
Warning!

Warning: refer to "warning on battery disconnection" in "warnings and precautions".

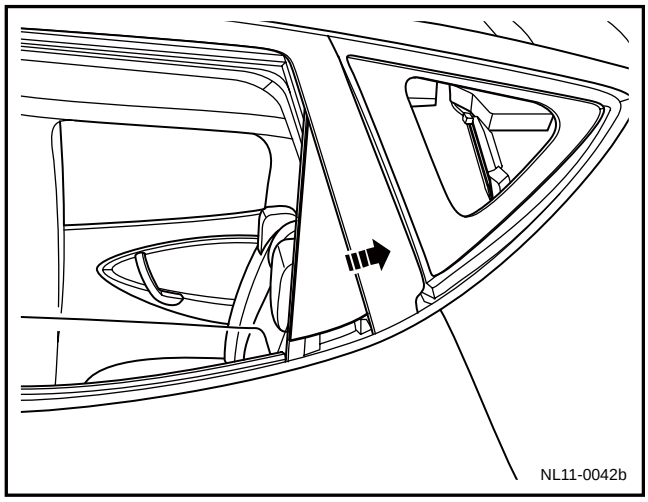
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of door inner trimming plate, refer to 12.9.1.9 Replacement of rear door inner trimming plate.
3. Dismantle door inner trimming plate angle decoration.



4. Dismantle fixing bolt of outer angle decoration of rear door.



5. Remove the rear door external trim mirror.



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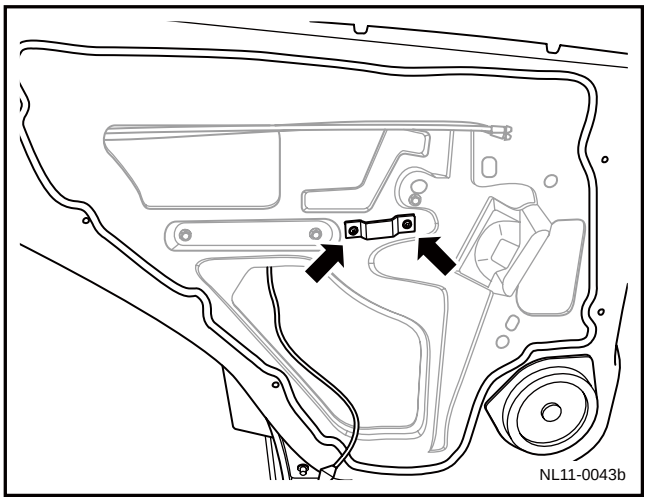
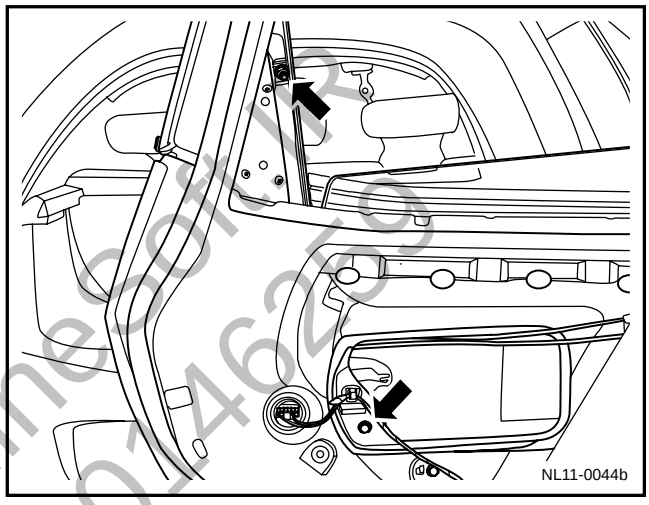
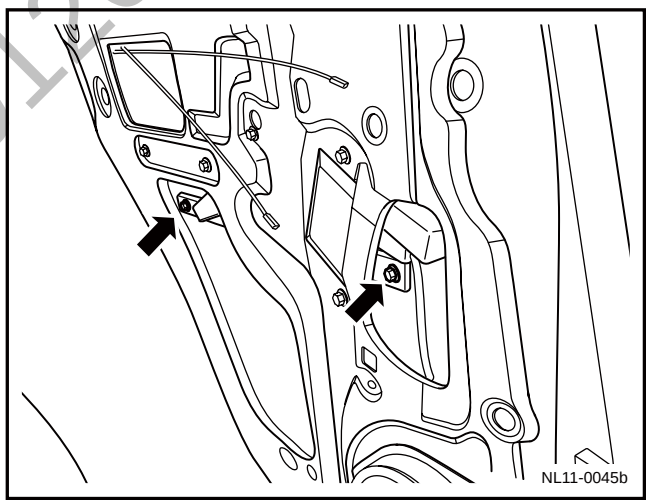
6. Dismantle the retaining membrane fixing frame and tear down the retaining membrane.



7. Connect the battery negative cable.
8. Operate the rear door window lifter switch to adjust the window to an appropriate level.
9. Disconnect the battery negative cable.
10. Dismantle rear door glass guide way bolt, and loosen guideway to facilitate dismantling of rear door glass.



11. Dismantle rear door glass bolt



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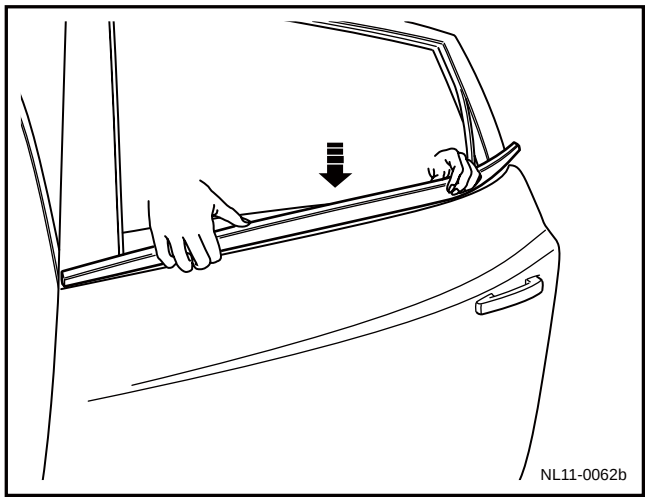
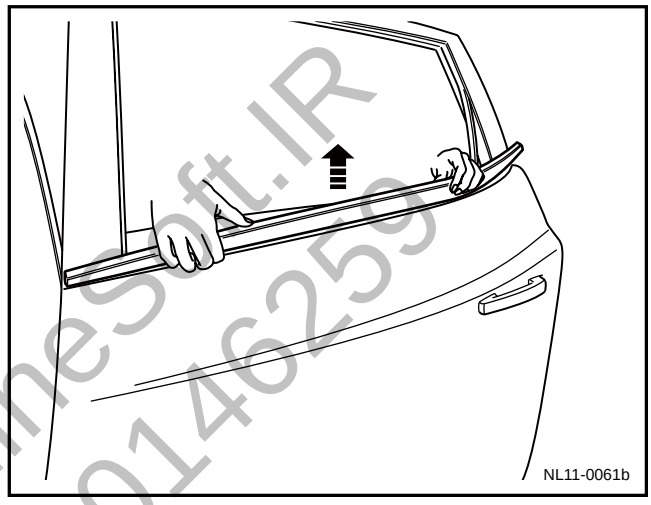
12. Take out rear door glass
13. Dismantle rear door glass guide groove.

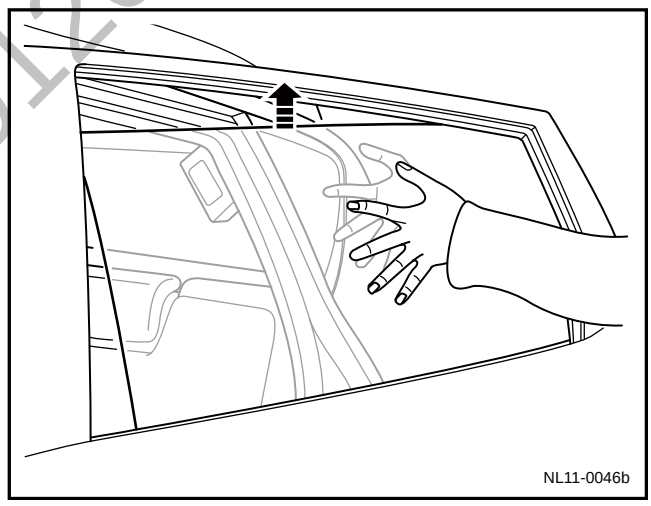


14. Dismantle the exterior seal tape of rear door glass.



Installation procedure:

1. Install the exterior seal tape of rear door glass.



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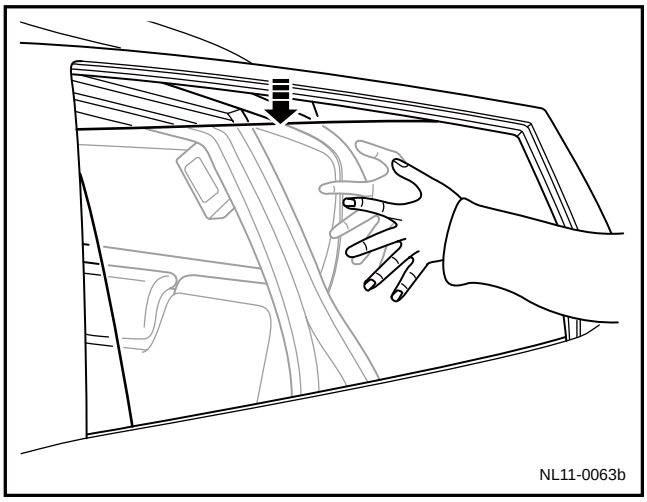
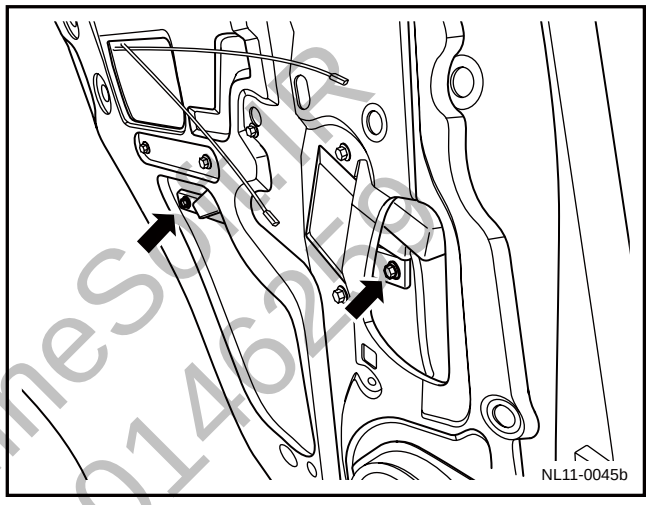
2. Install into rear door glass.



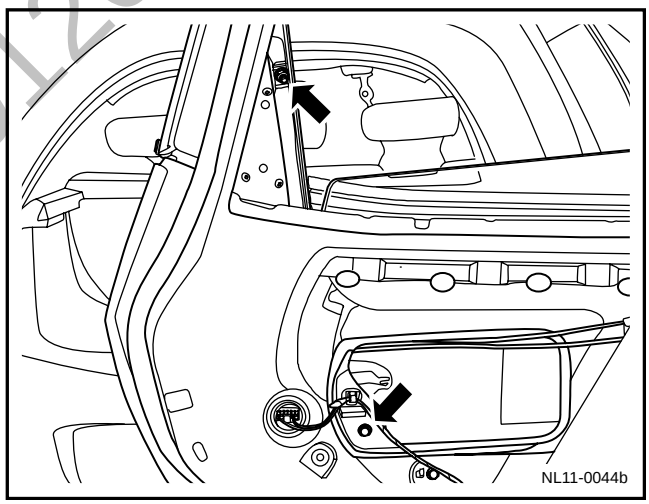
3. Tighten rear door glass fixing bolt。

Torque: 8Nm(Metric) 6lb-ft(English system)



4. Install rear door glass guideway.

Torque: 8Nm(Metric) 6lb-ft(English system)



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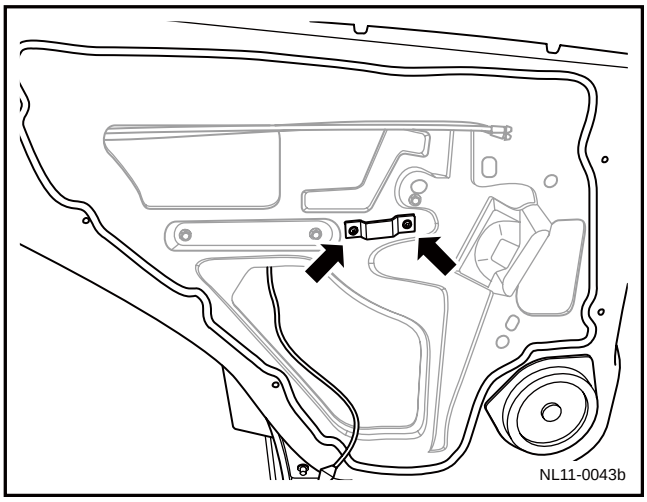
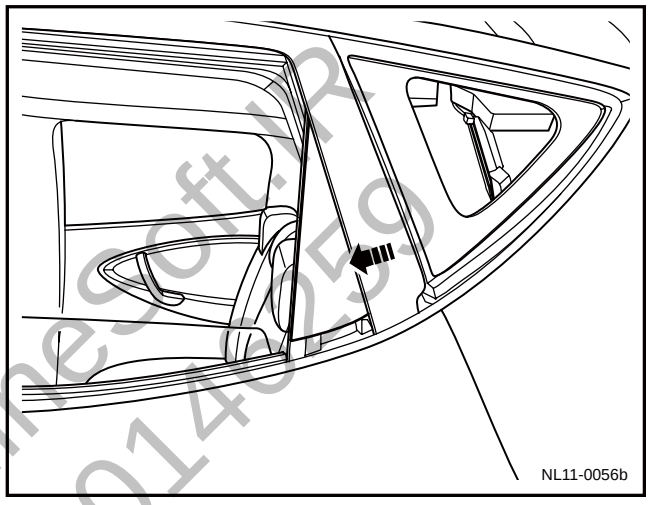
5. Paste the retaining membrane and install the window lifter switch bracket.

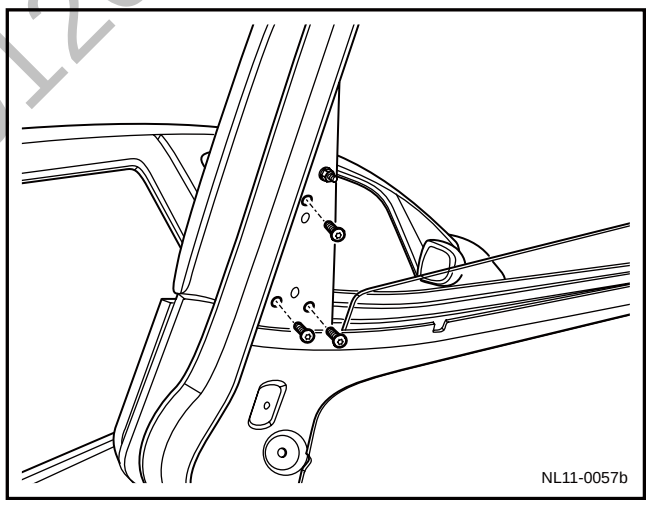


6. Install the rear door trim mirror.



7. Tighten the fixing bolt for the rear door external trim corner.

Torque: 8Nm(Metric) 6lb-ft(English system)



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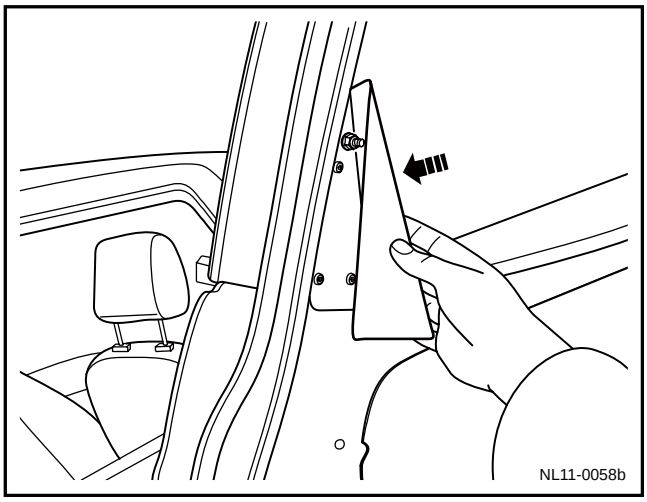
8. Install the rear door internal trim panel corner trim.
9. Install the rear door internal trim panel.
10. Connect the battery negative cable.



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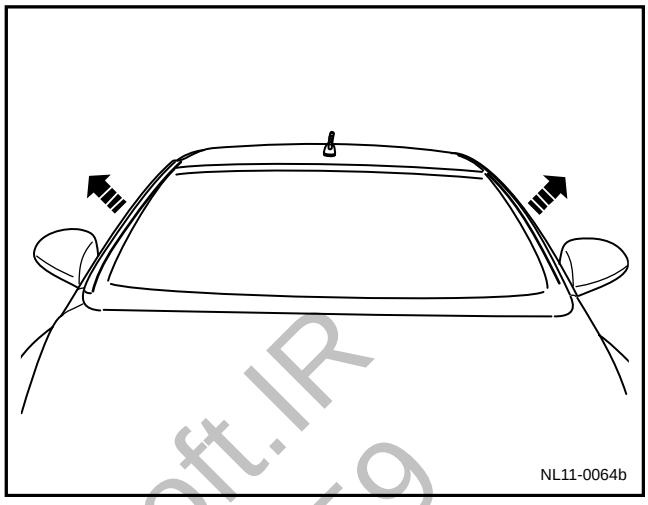
11.5.8.13 Replacement of front windshield

Dismantlement procedure

1. For dismantling of front wiper arm, refer to 11.5.8.2 replacement of front wiper arm.
2. Dismantle the ventilation cover plate. refer to 12.10.1.3 replacement of ventilation cover plate.

3 For dismantling of upper trimming plate assembly of left/right front vertical column, refer to 12.9.1.2 replacement of upper trimming plate of left/right front vertical column.

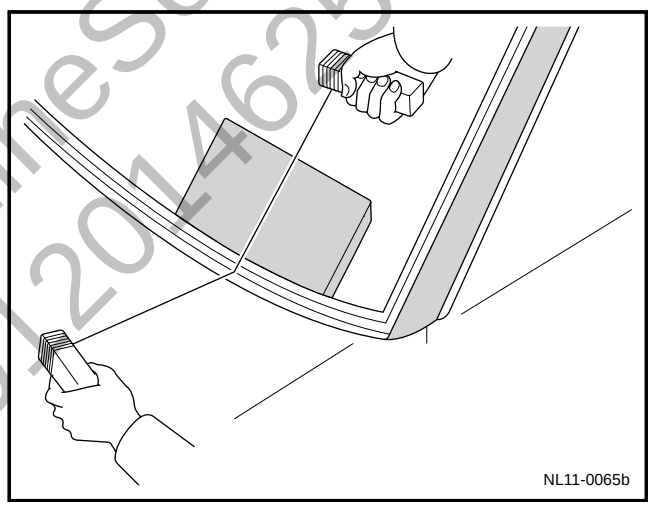
4. For dismantling of indoor rearview mirror, refer to 11.4.8.2 Replacement of inner rearview mirror.
5. Dismantle the seal strip around the front windshield.



6. Cut the adhesive around front windshield with a thin steel wire.

Notes:

Both ends of thin steel wire are wound with wood blocks, which is operated by two persons to facilitate disassembling. Place a piece of plastic gasket on the instrument panel to protect the instrument panel from being scratched.



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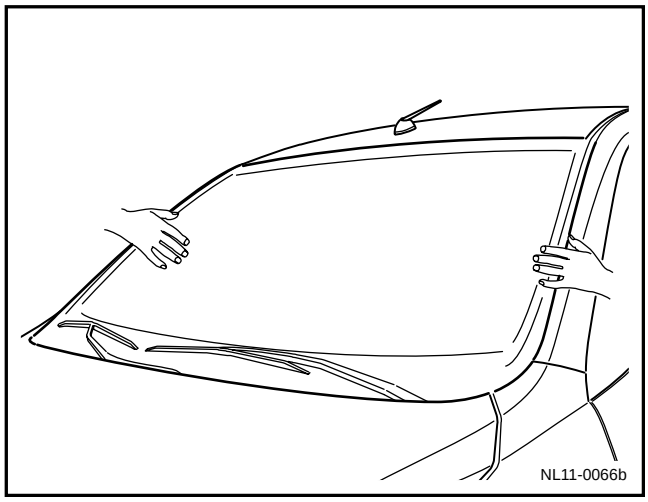
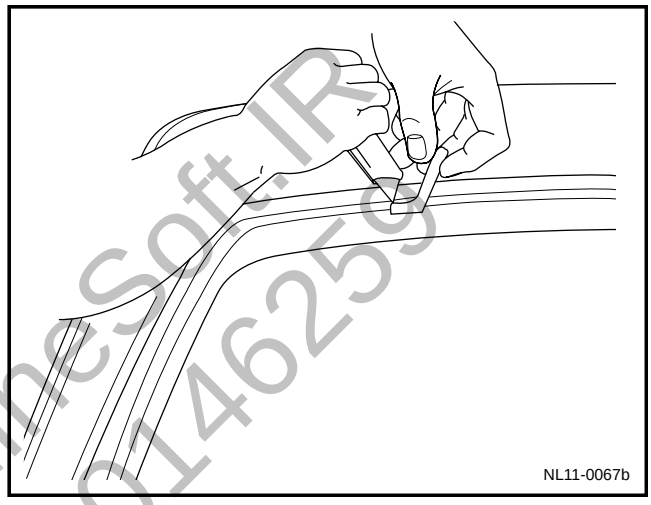
7. Dismantle the front windshield from the front windshield frame of body.

Notes:

Two persons need to complete the step jointly.

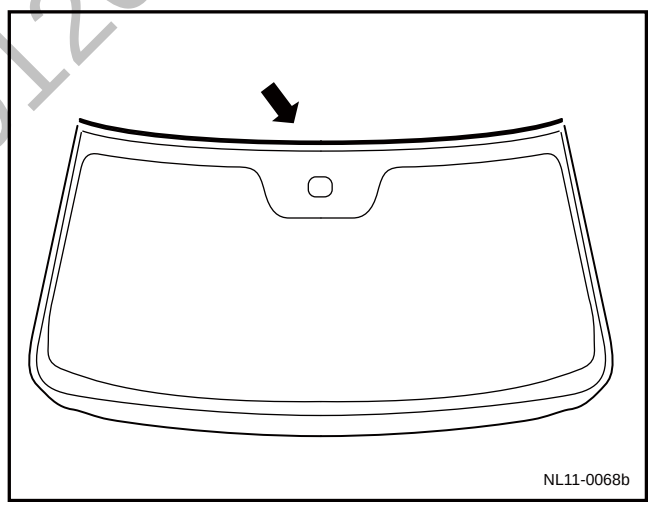


8. Dismantle the glue residue on the front windshield with a blade.
9. Dismantle the adhesive on the front windshield frame of body with a blade.
10. Clean the inner surface edge of windshield with a cloth stained soaked with industrial ethanol and water mixture50/50.



Installation procedure:

1. Install the new glass seal strip to the front windshield.



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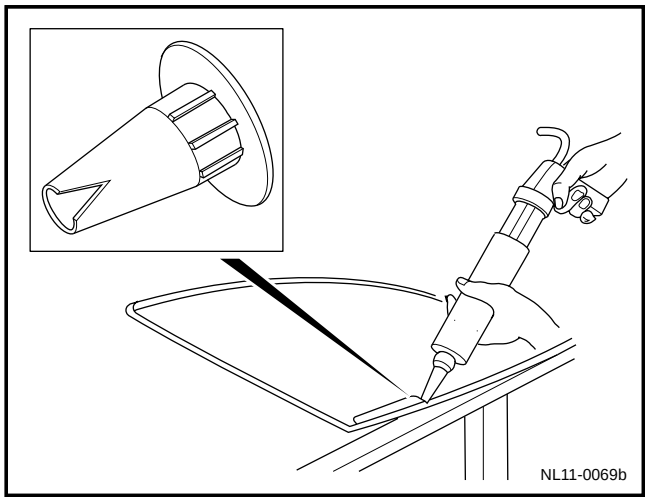
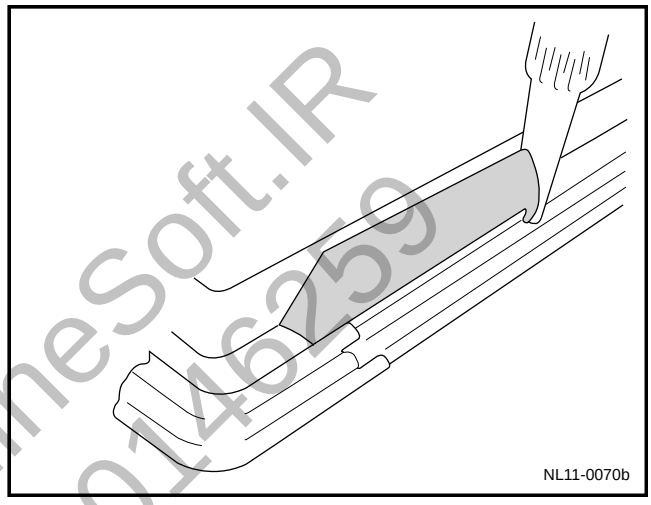
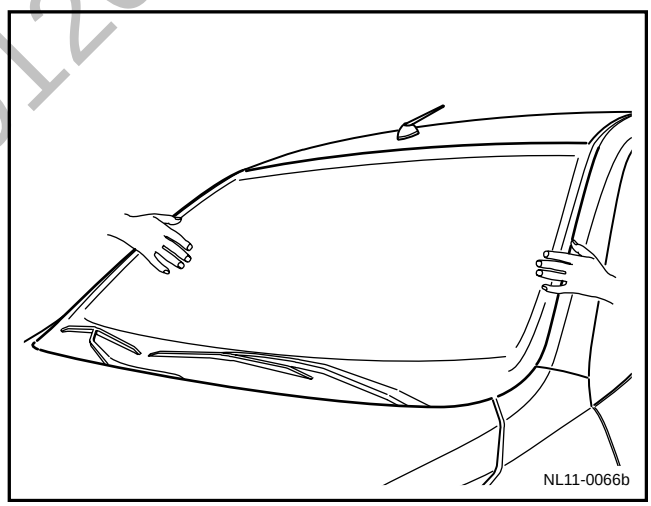
2. Open the dedicated Geely glass sealant nozzle to make the edge of glass sealant is with a width of 8 mm (0.3in) and a height of 8 mm (0.3in).



3. With a double-pipe gun evenly apply glass sealant to the edge of window glass to make sure that the width of sealant is even.



4. With the help of an assistant, install the front windshield into the front windshield frame with a sucker.
5. Press the windshield to bond the adhesive to the seal strip, the front windshield and the front windshield frame to retain the front windshield.
6. Make the adhesive stay dry for 24h.
7. Spray water onto the front windshield to inspect for water leakage. If it leaks, dry the front windshield and apply adhesives to the leaking location. If it still leaks, dismantle the front windshield and repeat the entire repair procedure.
8. Install the left / right front column upper trim panel



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assembly.

9. Install indoor rearview mirror.
10. Install the ventilation cover plate.
11. Install the wiper arm.

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11.5.8.14Back glass replacement

Dismantlement procedure

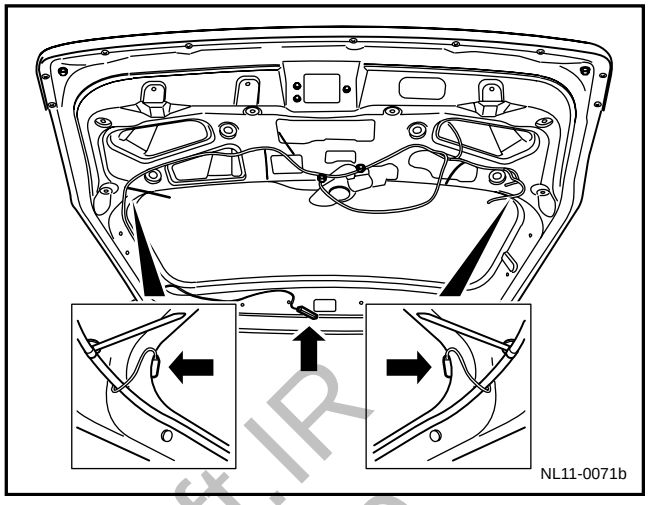
1. Dismantle battery negative cable, Refer to 2.11.8.1 Disconnect connecting process of battery cable

2. For dismantling of rear wiper arm, refer to 11.5.8.3 Replacement of rear wiper arm.

3. For dismantling of back door trimming plate, refer to 12.9.1.10 Replacement of back door trimming plate.

4. Disconnect high-mounted brake lamp wire harness connector.

5. Disconnect the rear defrosting harness connector.

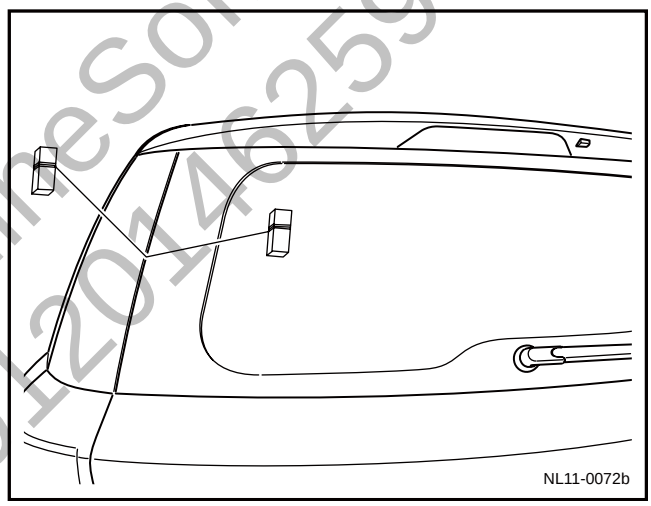


6. Cut out the glazing compound around the back door window with a fine steel wire.

Notes:

Both ends of thin steel wire are wound with wood blocks, which is operated by two persons to facilitate disassembling.

7. Remove the back door window from the back door window frame.



Notes:

Two persons need to complete the step jointly.

8. Remove the adhesive on the back door window with a knife blade.

9. Remove the adhesive on the back door window frame with a knife blade.

10. Clean the inner surface edge of windshield with a cloth stained soaked with industrial ethanol and water mixture50/50.

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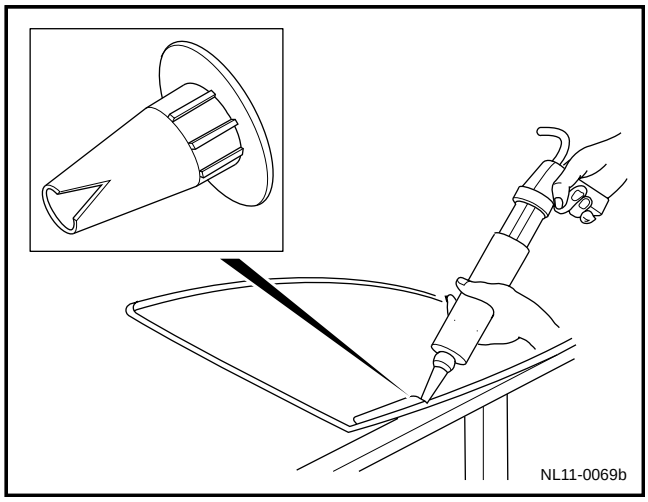
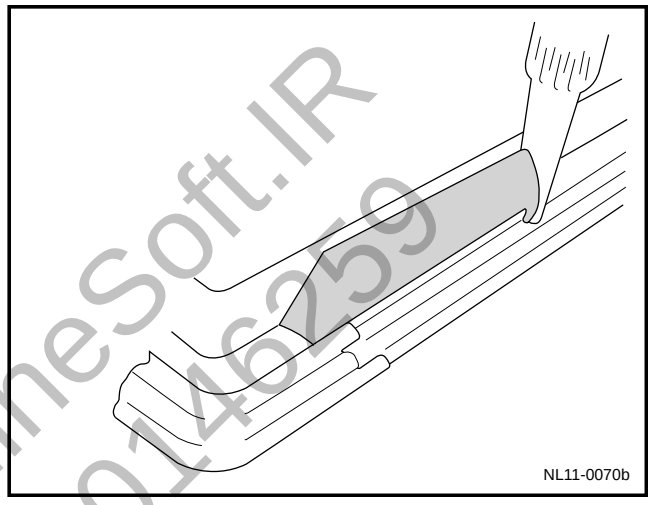
Installation procedure:

1. Open the dedicated Geely glass sealant nozzle to make the edge of glass sealant is with a width of 8 mm (0.3in) and a height of 8 mm (0.3in).



2. With a double-pipe gun evenly apply glass sealant to the edge of window glass to make sure that the width of sealant is even.
3. With the help of assistant, use sucker to install back door glass into vehicle body rear windshield frame.
4. Press back door glass, and then apply adhesive tape on back door glass and rear windshield glass frame to fix back door glass.
5. Make the adhesive stay dry for 24h.
6. Spray water to the back door window to check for leakage. If leaking water, dry the back door and plug the leakage part through glazing compound. If still leaking water, dismantle the back door glass and repeatedly execute the whole maintenance procedure.



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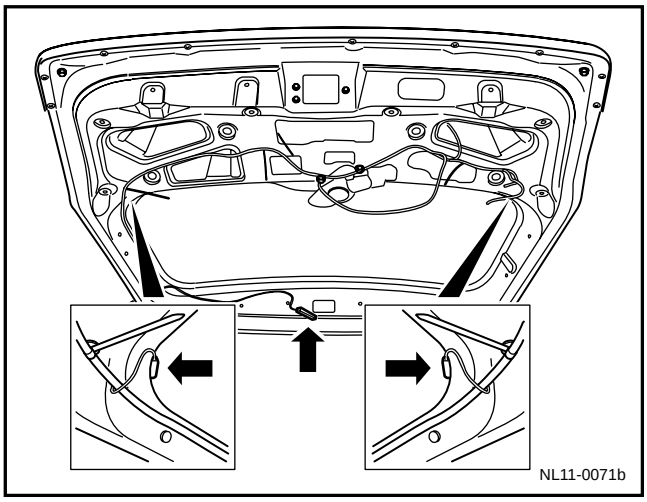
7. Connect the rear defrosting harness connector.
8. Connect the high mounted brake lamp harness connector.
9. Install rear wiper arm
10. Install the back door trim panel.
11. Connect the battery negative cable.



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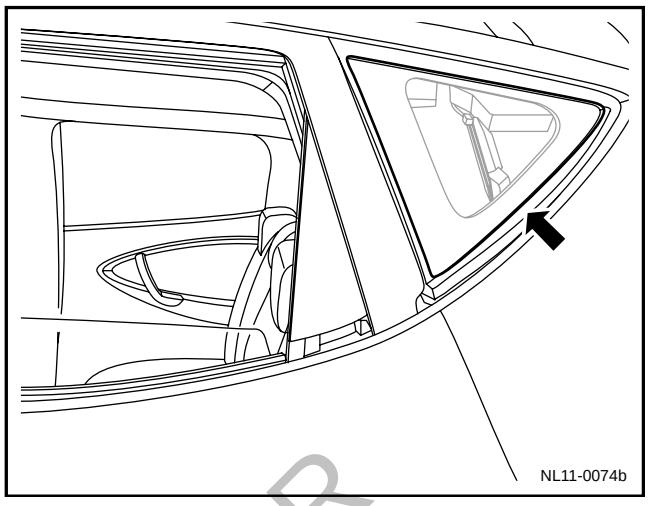
11.5.8.15 Replacement of triangle glass

Dismantlement procedure

1. For dismantling of rear column upper trimming plate, refer to 12.9.1.6 replacement of rear column upper trimming plate assembly.



Replace

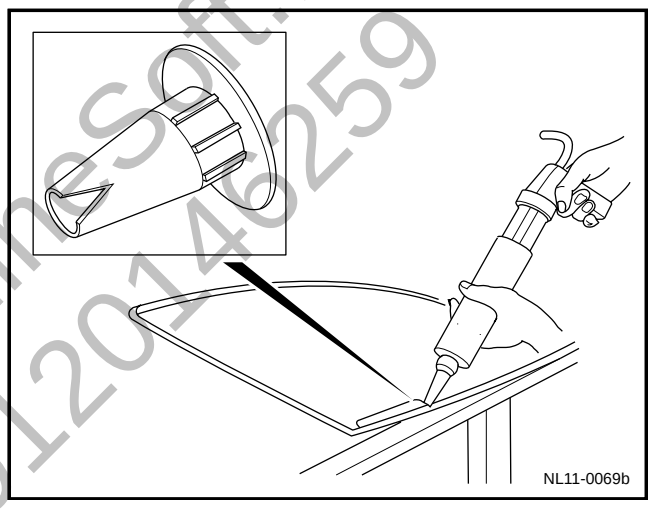
2. Use fine steel wire to cut glass sealing glue around the triangle glass.

Notes:

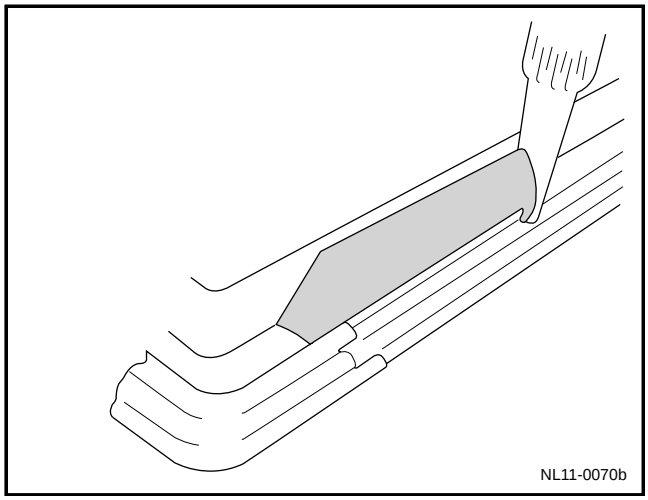
Both ends of thin steel wire are wound with wood blocks, which is operated by two persons to facilitate disassembling.

Installation procedure:

1. Open the dedicated Geely glass sealant nozzle to make the edge of glass sealant is with a width of 8 mm (0.3in) and a height of 8 mm (0.3in).



2. With a double-pipe gun evenly apply glass sealant to the edge of window glass to make sure that the width of sealant is even.
3. Use sucker to install triangle glass into triangle glass window frame of vehicle body.
4. Press triangle glass, and then apply adhesive tape on triangle glass and triangle glass window frame to fix triangle glass.
5. Let the glue dry for 24h.
6. Spray water to the triangle window to check for leakage. If leaking water, dry triangular glass and plug the leakage part



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through glazing compound. If still leaking water, dismantle the triangular glass and repeatedly execute the whole maintenance procedure.

7. Install the rear column upper trim panel.

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11.6 Wiper /washing system

11.6.1 Specification

11.6.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N.m)	Inch (lb-t)
Front fender liner screw	ST4.8×19	4-6	3-4.4
Fixing bolt of washer fluid reservoir	M6×20	7-9	5-6
Fixing support of wiper	M6×16	9-12	6-8.9
wiper motor bolt	M6×25	8-11	6-8
Connecting rod nut of wiper arm	M8	14-16	10-12
Wiper arm nut	M8	14-16	10-12
Rear wiper motor bolt	M6×25a	8—11	6—8
Rear wiper nut	M6	8—11	6—8

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11.6.2 Description and operation

11.6.2.1 Description and operation

Wipers / washers system consists of the following components:

– Central controller

– Wiper/washer switch

– IF30 20A front washer fuse

– Washer fluid reservoir

– Front wiper motor

– Washer fluid pump

– Front wiper arm and connecting rod device

– Washer nozzle

– Rear wiper motor

– Rear wiper fluid pump

– Rear wiper relay

– IF23 15A rear wiper fuse

– Rear wiper arm

The wiper/washer for the standard/comfort version can operate in the High Speed, Low Speed and Clearance modes and can be automatically return the original position when the wiper switch is turned off. The wiper switch is arranged on the control level at the right side of the steering column.

Front wiper/washer system

The front wiper system consists of a wiper/washer switch, a wiper motor, a connecting rod, a wiper arm and a wiper blade. The front wiper circuit is provided with a self-stop device which consists of a worm gear and a cam plate, with the purpose of further transiently keeping the circuit complete after disconnecting the wiper/washing switch; and the circuit is disconnected until the wiper arm completely returns to the initial position. Wiper system is driven by a permanent magnet motor. The front wiper motor is installed on the front fender and directly connected with the front wiper connecting rod. Wiper switch is a component of wiper / washer system.

Front windshield washer system

The front windshield washer system consists of a glass cleaning agent, a fluid reservoir, a washing fluid pump, a hose, a nozzle and a wiper/washing switch. The front windshield washing fluid reservoir is installed below the right front headlamp assembly and at the front of the right front fender liner. The washing fluid pump is fixed on the washer fluid reservoir and transmits the washing fluid to the two nozzles through the hose. Washer switch is also a component of wiper/washer switch.

Rear wiper/washer system

The rear wiper/washer system consists of wiper motor, wiper arm and wiper blade. Rear window wiper motor is located in the back door, is directly connected with the rear window wiper arm and equipped with independent washing fluid pump, hose and nozzle. The rear window washer and the front window washer share one washing fluid storage tank. The washing fluid pump transmits the washing fluid to the rear wiper nozzle through the hose and then uniformly sprayed on the rear windscreen through the nozzle.

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11.6.3 System operating principle

11.6.3.1 System operating principle

The front wiper provides a low level signal to the BCM body control unit through a wiper switch, and the BCM drives the front wiper motor to rotate after receiving the wiper switch driving signal; and when the wiper switch is in the low gear, the current flows into the armature coil from the low-speed electric brush of the motor to produce

Motor rotates at a low speed due to large counter electromotive force. When a wiper switch is at high gear position, current is flowed from a high-speed electric brush of the moor to an armature coil to generate small counter electromotive force; thus, the motor rotates at a high speed; when starting a wiper washer switch, a wiper water jet pump is under a working condition; and a wiper motor also start the low gear to rotate after continually operating the washer switch for 1s.

Deluxe/ultimate vehicle is further equipped with the rain sensor. When the wiper switch is in the automatic transmission, a rain signal is provided to the BCM according to the rain sensor, and the revolution speed of the wiper motor is automatically regulated by the BCM, thereby greatly improving the driving safety and comfort. After closing the wiper switch, the wiper motor does not stop immediately and continually rotates for a moment under the inertia effect of the armature; at the same, the armature generates the counter electromotive force to generate electric brake for the wiper motor, and the motor stop in the fixed position immediately.

The rear wiper switch starts or the rear washer switch starts for 1s continuously, the rear wiper relay closes, and the terminal No. 3 outputs the power supply to the rear wiper motor, so as to realize the operation of the rear wiper.

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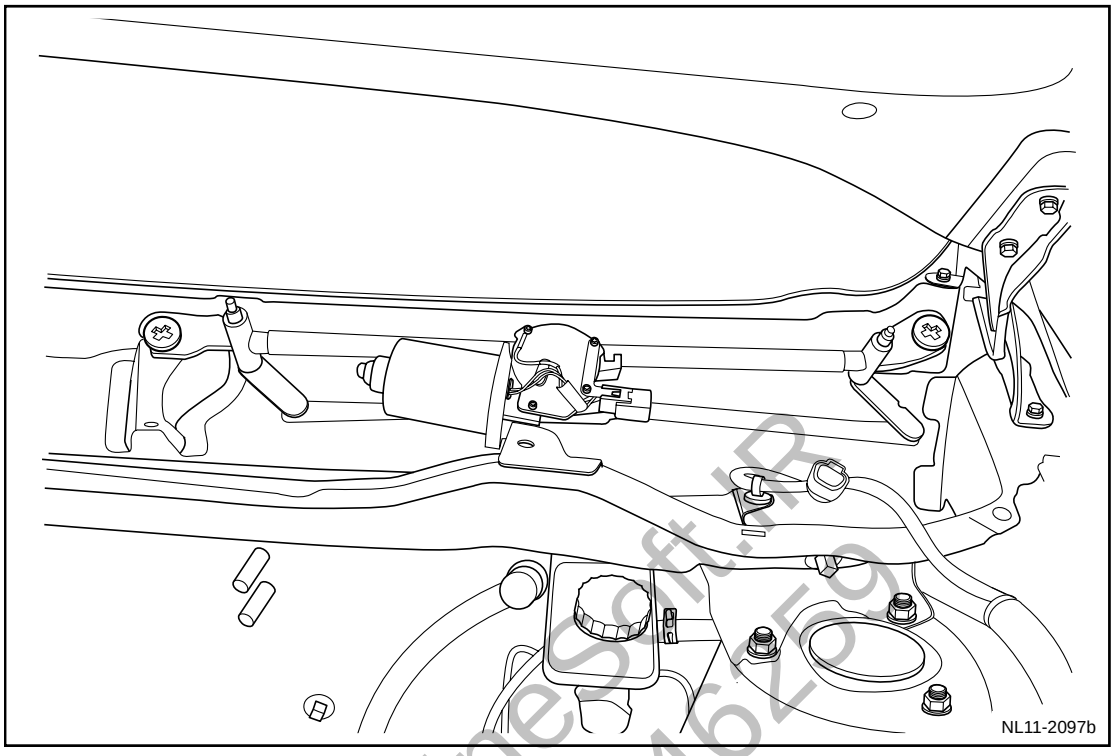
11.6.4 Part position

11.6.4.1 Component position

Front wiper motor



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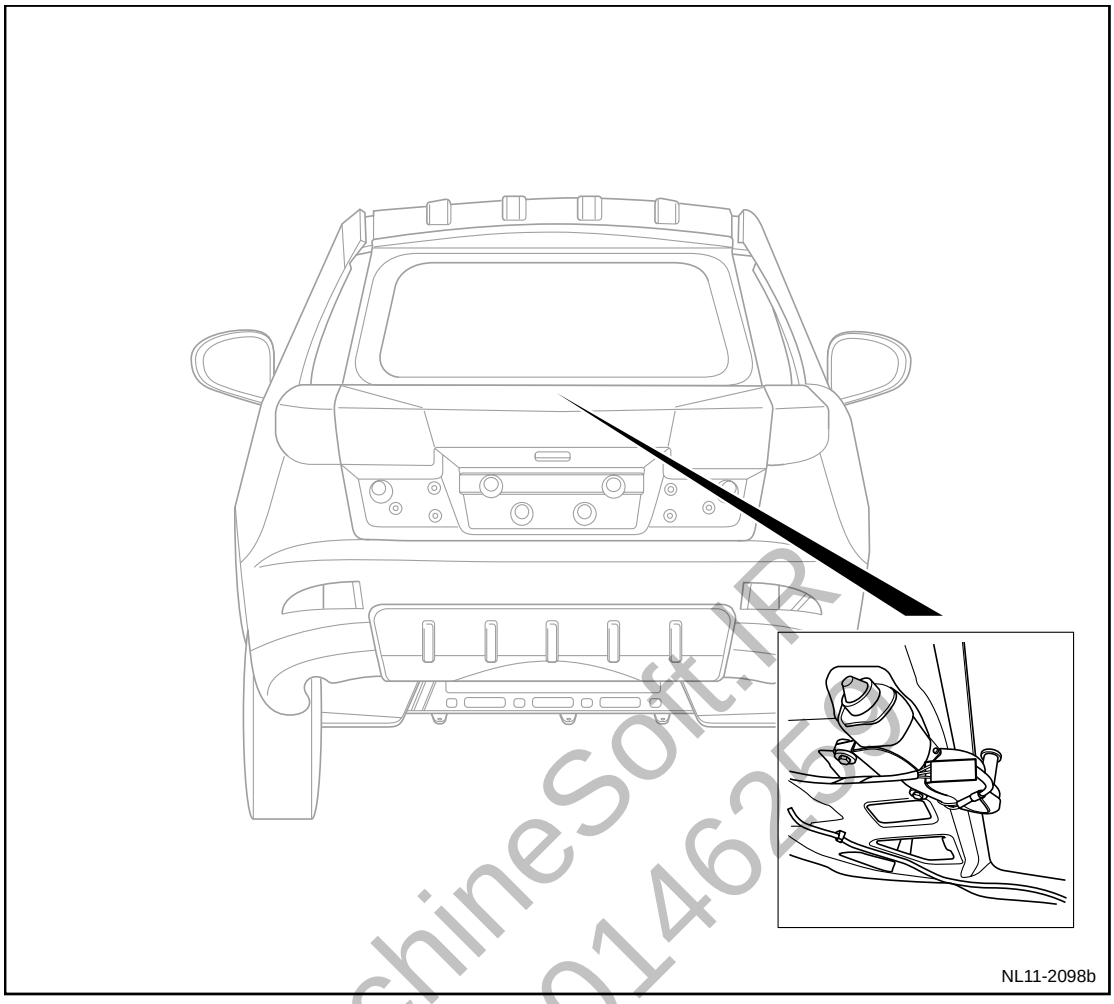
Rear wiper motor



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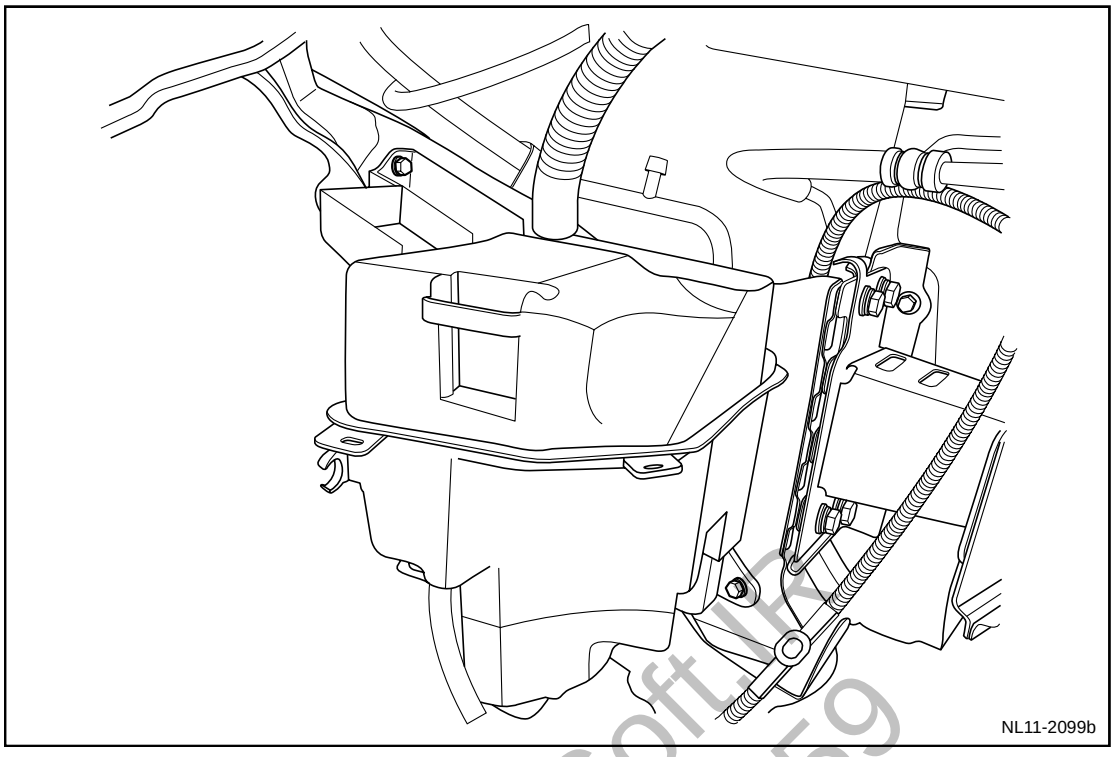
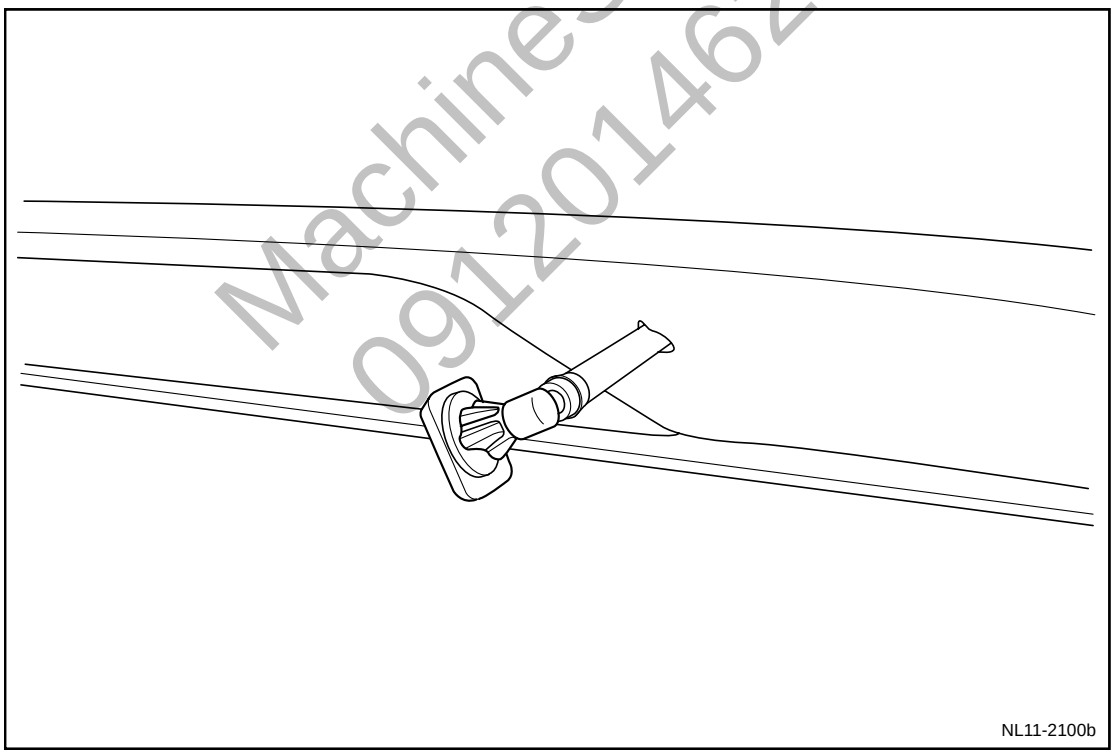
Washer fluid reservoir



Rear washer nozzle



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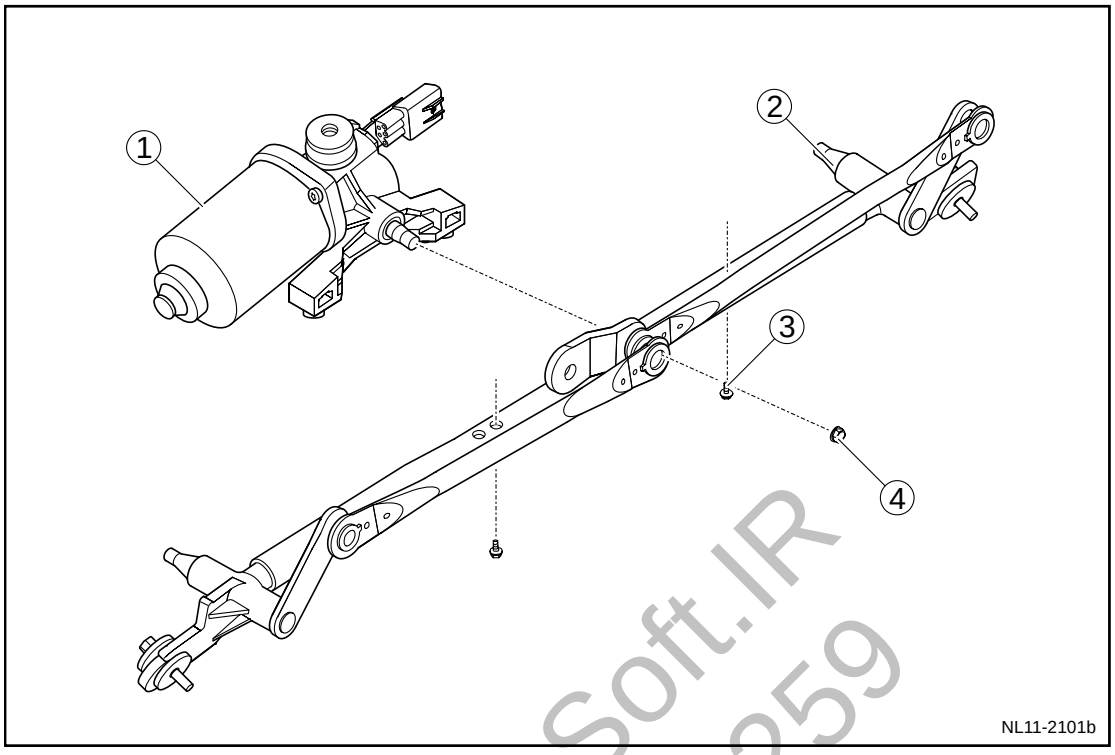
11.6.5 Disassemble drawings

11.6.5.1 Disassemble drawings



1. Wiper motor.
2. Wiper connecting link rod.
3. Wiper motor fixing bolt
4. Wiper connecting rod fixing nut

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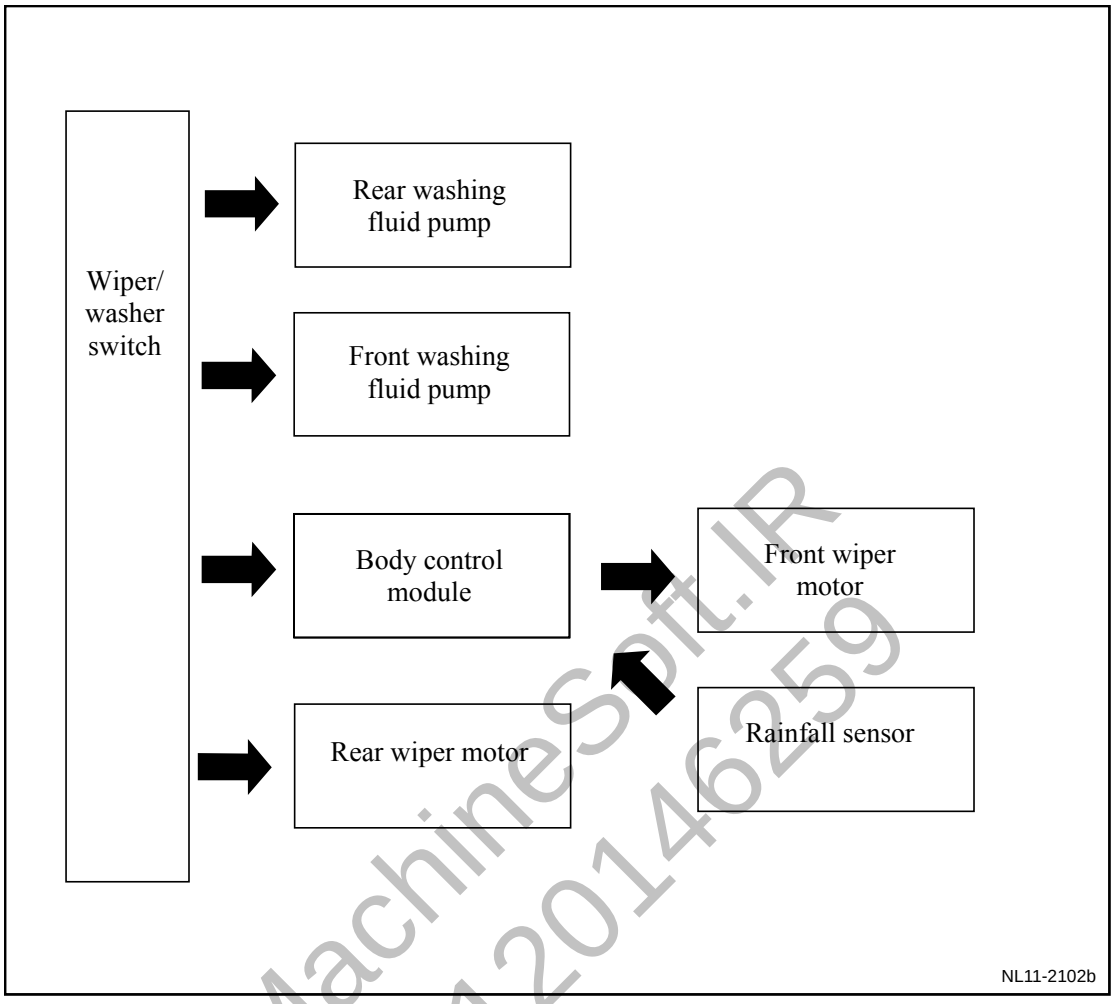
11.6.6 Electrical schematic diagram

11.6.6.1 Electrical schematic diagram



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11.6.7 Diagnostic information and steps

11.6.7.1 Diagnosis descriptions

Refer to 11.6.2 description and operation to get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.6.7.2 Visual inspection

– Installed aftermarket equipment that may affect the operation of front windshield wiper / washer system.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– Inspect whether the washer fluid level in washer fluid reservoir is correct.

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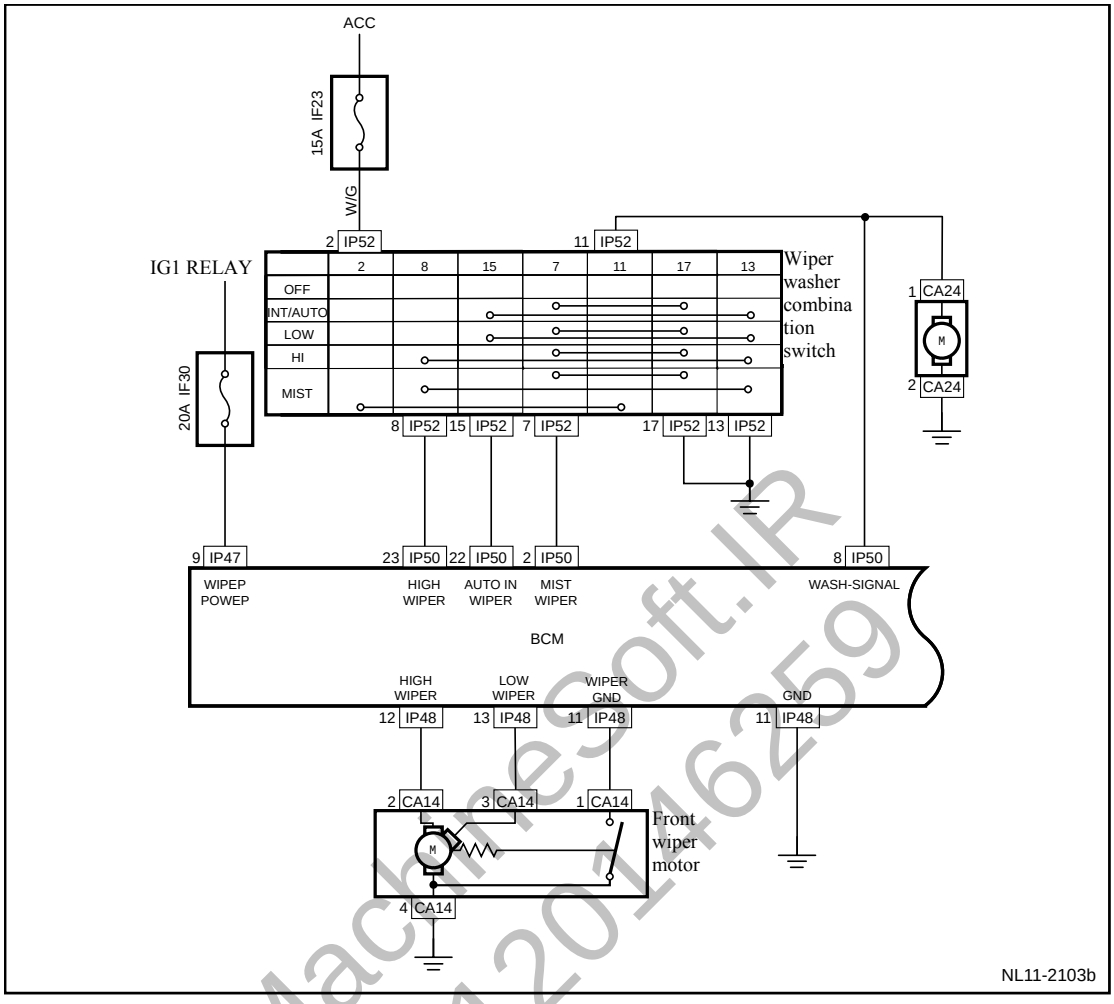
11.6.7.3 Wiper inoperation at all speed

Circuit diagram:



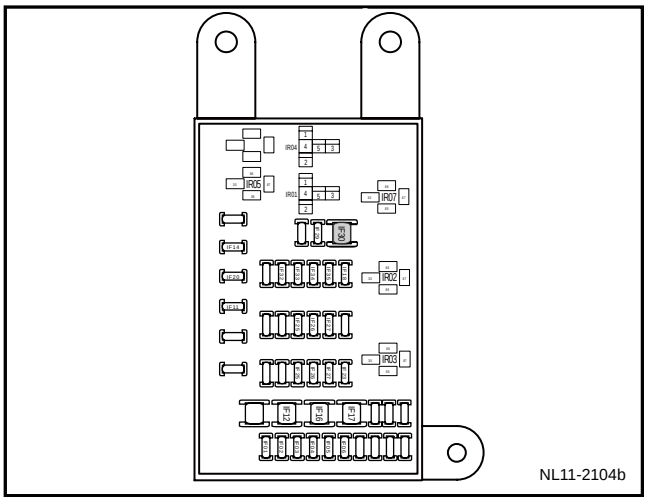
Diagnostic steps:

1	Check fuseIF30

A. Whether fuseIF30 is broken

Rating value of fuse: 20A

Confirm whether the fuses are blown.



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No → Go to step 3

Yes

2	Overhaul fuseIF30 circuit

A. Check whether fuse IF30 line is short circuited.

B. Repair the circuits. Confirm that there are no short circuits.

C. Replace the fuses with rated current.

Confirm whether the wiper works normally.

Yes → The system is normal.

No

3	Inspect the voltage of the wiper motor wire harness connector terminal No. 1.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect the wiper motor harness connector CA14.

(c) Use multimeter to measure effective grounding voltage between wire harness connector CA24 terminal No. 4 and vehicle body.

Standard resistance: less than 1 Ω

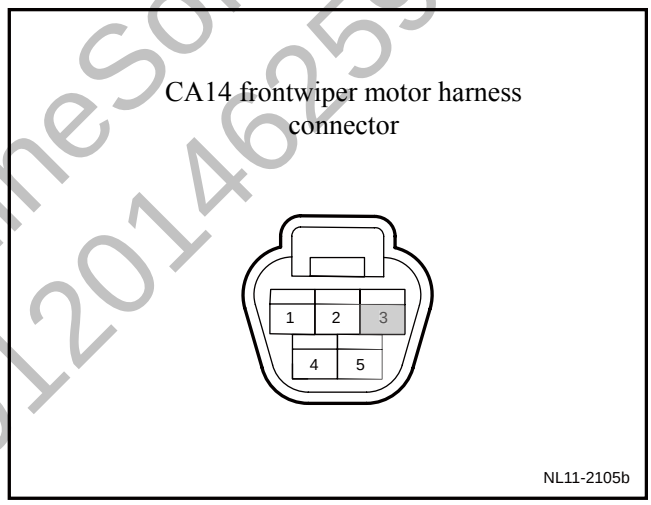
(d) Turn ignition switch "ON" position.

(e) Wiper switch was turned to "low" gears position.

(f) Use multimeter to measure effective grounding voltage between wire harness connector CA14 terminal No. 3 and vehicle body.

Standard voltage: 11-14 V

Confirm whether the voltage and resistance accord with the standard value.



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All are normal.	Go to step 12
Voltage is normal	Go to step 5
Resistance is abnormal	

4	Repair the fault point of the terminal No. 4 of the wiper motor wire harness connector CA14 and the body grounding wire.

A. For replacement of the wiper motor, see "11.5.8.9 replacement of wiper motor".

Confirm whether the wiper works normally.

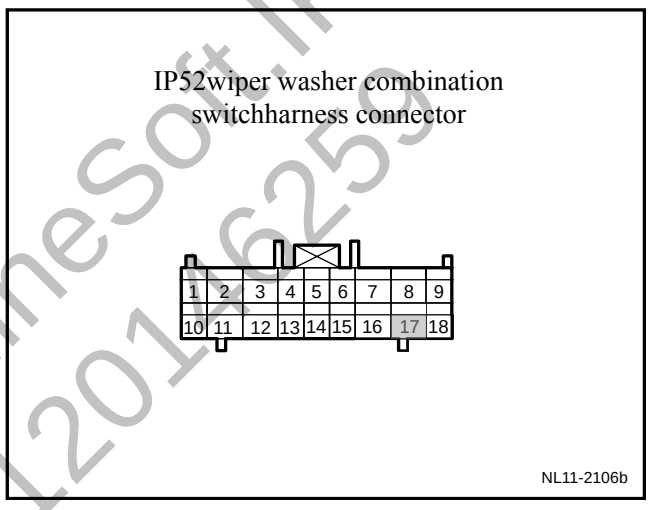
5	Inspect the wiper switch grounding circuit.

(a) Disconnect harness connector IP52.

(b) Test energy guide of wiper switch grounding wire , IP52 terminal No.17 and body

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.



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Yes	Go to step 7
No	

6	Repair or replace the wiper switch grounding circuit.

(a) Repair or replace fault wire harness.

(b) Operate wiper switch.

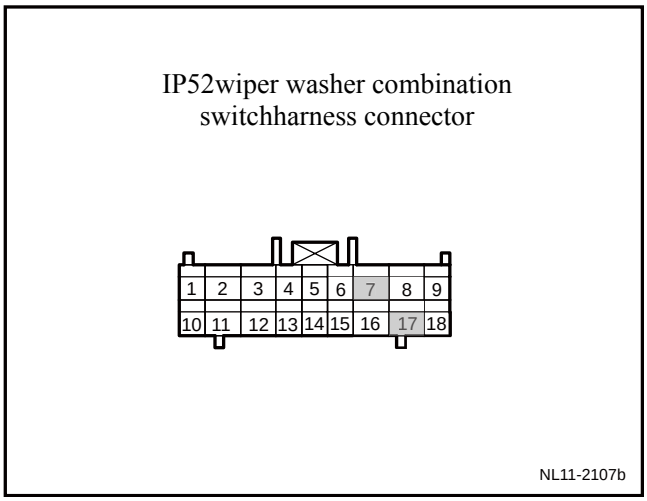
Confirm whether the wiper works normally.

Yes	The system is normal.
No	

7	Inspect the communication of the wiper switch.

(a) Disconnect wiper switch harness connector IP52.

(b) Operate wiper switch low gear and use multimeter to test the connection of switch low gear.



Test terminal	Test conditions	Conduction condition
IP52(07)-IP52(17)	Low revolution speed gear	Less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → Go to step 9

No

8	Replace wiper switch

(a) Replace wiper switch, refer to11.5.8.9 wiper and washer switch replacement.

Confirm whether the wiper switch works normally.

Yes → The system is normal.

No

9	Inspect BCM power supply and grounding as well as the energy conduction property of the wire harness among the BCM, wiper switch and the motor.

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(a) Rotated ignition switch to "OFF" position.

(b) Disconnect the battery negative cable.

(c) Disconnect BCM harness connector IP47, IP48, IP49, IP50.

(d) Disconnect wiper switch wire harness connector IP52.

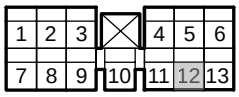
(e) Disconnect wiper motor harness connector CA14.

(f) Connect to battery negative cable.

(g) Rotated ignition switch to "ON" position.

(h) Use multimeter to measure voltage of BCM wire harness connector terminal and circuit conductivity

IP47body control module harness connector2



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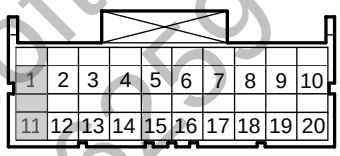
IP49body control module harness connector3



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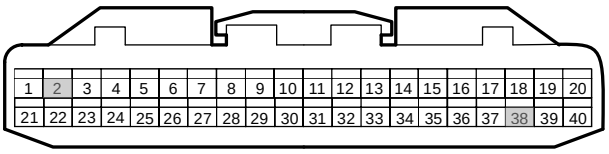
IP50body control module harness connector4



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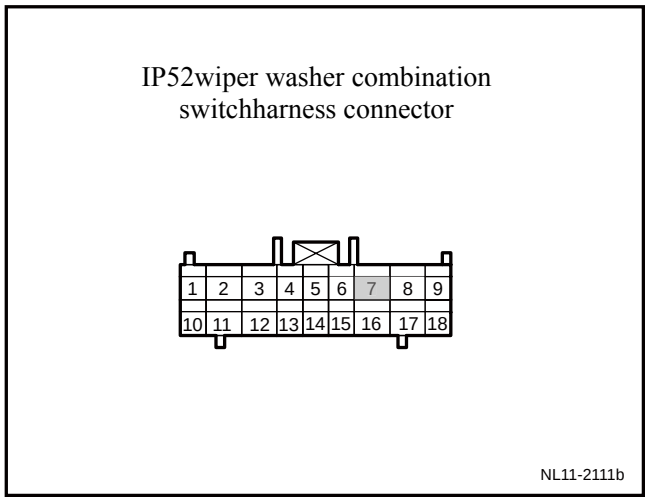

Test items	Specified value
IP49(1)-effective grounding	11 - 14V
IP50(38)-effective grounding	11 - 14V
IP49(11)-effective grounding	Less than 1 Ω
IP50(2)- IP52(7)	Less than 1 Ω
IP48(12)-CA14(2)	Less than 1 Ω

Confirm whether the measured value conforms to the standard value.

Yes	Go to step 11
No	

10	Repair the BCM wire harness fault point.

(a) Repair BCM wire harness fault points.

(b) Rotated ignition switch to "OFF" position.

(c) Disconnect battery negative cable.

(d) Connect to wiper motor harness connector CA14.

(e) Connect to BCM harness connector IP47, IP48, IP49, IP50.

(f) Connect to wiper switch harness connector IP52.

(g) Connect to battery negative cable.

(h) Rotated ignition switch to "ON" position.

(i) Operated wiper low speed (low switch)

Confirm whether the voltage of the terminal No. 2 of the wiper motor wire harness connector

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CA14 and the effective body grounding point is normal.

Yes → Go to step 12

No

11	Replace the BCM

Confirm whether the wiper works normally.

Yes → The system is normal.

No

12	Replace wiper motor.

Replace wiper motor, Refer to11.5.8.10Replace wiper motor.

Confirm the completion of repair.

Next

13	The system is normal.

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11.6.7.4 Wiper inoperation at high speed

Circuit diagram:

See 11.6.7.3 wiper does not work under any gear position.

Diagnostic steps:

1	Inspect the voltage of the terminal No. 2 of the wiper motor wire harness connector CA14 and the effective body grounding point.

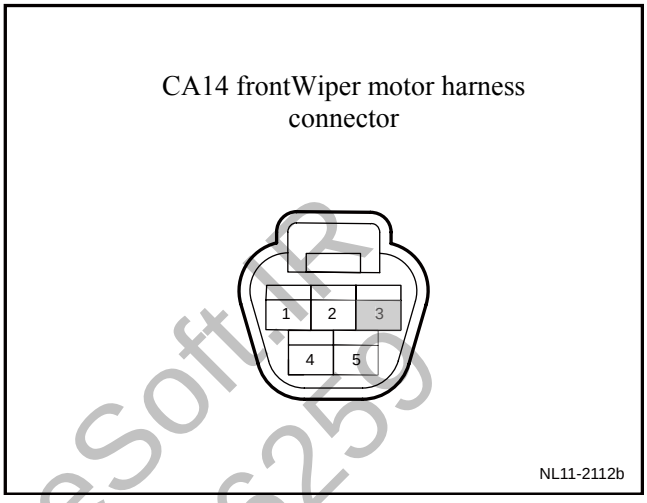
(a) Rotated ignition switch to "OFF" position.

(b) Disconnect the wiper motor harness connector CA14.

(c) Place wiper switch to high speed gear (HIGH) position.

(d) Turn ignition switch "ON" position.

(e) Use multimeter to measure voltage between wire harness connector CA14 terminal No. 2 and vehicle body grounding.



Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.

No → Go to step 7

Yes

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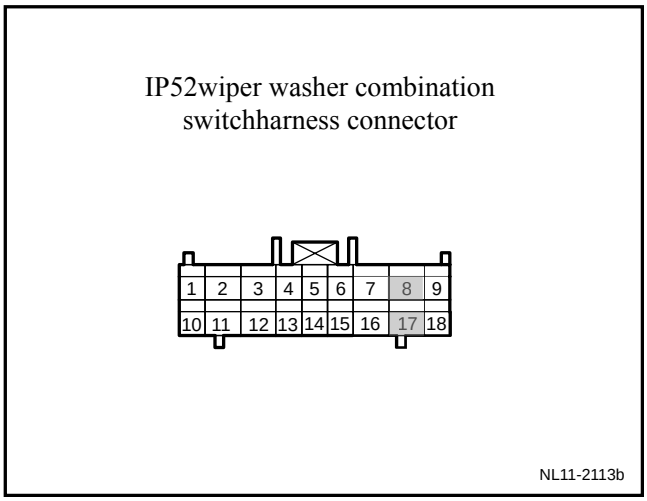
2	Inspect the wiper switch.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect wiper switch harness connector IP52.

(c) Operate wiper switch and use multimeter to measure the connection situation of switch.



Test terminal	Test conditions	Specified value
IP52(8)-IP52(17)	High revolution speed gear	Less than 1 Ω

Confirm whether the resistance is at a specified value.

Yes → Go to step 4

No

3	Replace wiper switch.

(a) Replace wiper switch, refer to11.5.8.9 wiper and washer switch replacement.

Confirm whether system work is normal or not

Yes → The system is normal.

No

4	Inspect the energy conduction property of the circuit among the BCM wire harness connector terminal, the wiper switch and the wiper motor.

(a) Rotated ignition switch to "OFF" position.

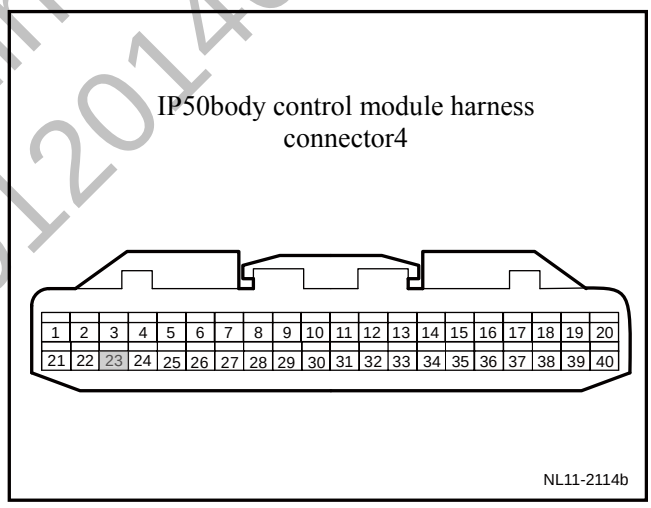
(b) Disconnect the battery negative cable.

(c) Disconnect BCM harness connector IP50, IP48.

(d) Disconnect wiper switch wire harness connector IP52.

(e) Disconnect wiper motor harness connector CA14.

(f) Use multimeter to measure circuit conductivity between BCM wire harness connector terminal and wiper switch, and wiper motor.



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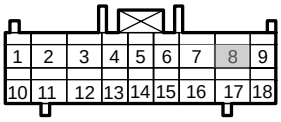
IP52wiper washer combination switchharness connector



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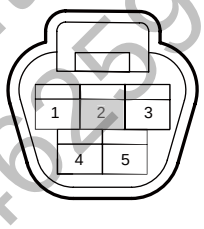
CA14frontwiper motor harness connector



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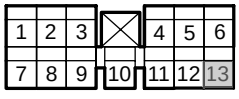
IP48body control module harness connector2



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Test terminal	Specified value
IP50(23)-IP52(8)	Less than 1 Ω
IP48(13)-CA14(3)	Less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → Go to step 6

No

5	Repair the circuit fault point among the BCM wire harness connector terminal, the wiper switch and the wiper motor.

(a) Repair fault points between BCM wire harness connector terminal and wiper switch, wiper motor.

(b) Connect wiper switch wire harness connector IP52.

(c) Connect to wiper motor harness connector CA14,

(d) Connect to BCM harness connector IP50. IP48.

(e) Connect the battery negative cable.

(f) Turn the ignition switch to "ON" position.

(g) Operated wiper switch high speed (HIGH).

Confirm whether the voltage of the terminal No. 3 of the wiper motor wire harness connector CA14 and the effective body grounding point is normal.

Yes → Go to step 7

No

6	Replace the BCM

Confirm whether the wiper works normally.

Yes → The system is normal.

No

7	Replace wiper motor

Replace wiper motor, refer to11.5.8.10 replace wiper motor

Confirm the completion of repair.

Next

8	The system is normal.

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11.6.7.5 Wiper inoperation at low speed

Circuit diagram:

See 11.6.7.3 wiper does not work under any gear position.

Diagnostic steps:

1	Inspect the voltage of the terminal No. 3 of the wiper motor wire harness connector CA14 and the effective body grounding point.

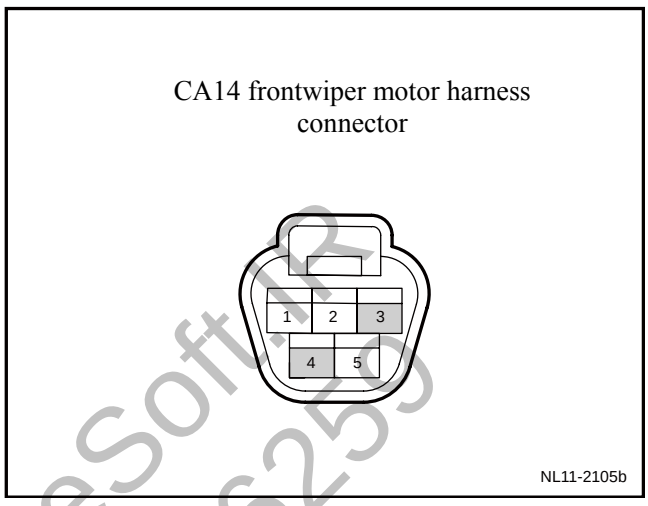
(a) Rotated ignition switch to "OFF" position.

(b) Disconnect the wiper motor harness connector CA14.

(c) Place wiper switch to high speed gear (LOW) position.

(d) Turn ignition switch "ON" position.

(e) Use multimeter to measure voltage between wire harness connector CA14 terminal No. 3 and vehicle body grounding.



Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.

No → Go to step 7

Yes

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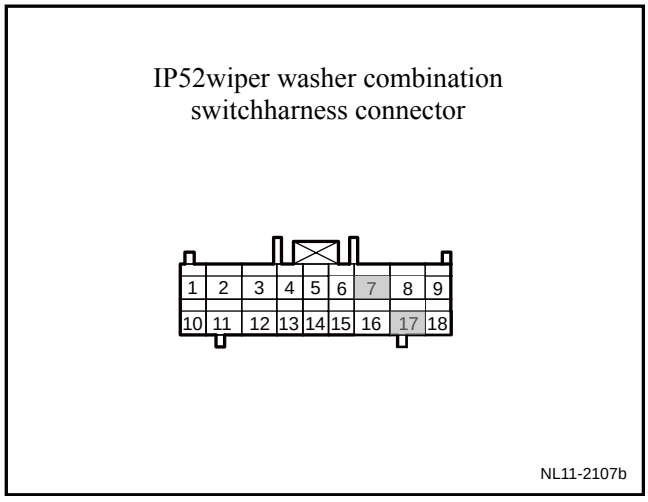
2	Inspect the wiper switch.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect wiper switch harness connector IP52.

(c) Operate wiper switch and use multimeter to measure the connection situation of switch.



Test terminal	Test conditions	Specified value
IP52(07)-IP52(17)	Low revolution speed gear	Less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → Go to step 4

No

3	Replace wiper switch.

(a) Replace wiper switch, refer to11.5.8.9 wiper and washer switch replacement .

Confirm whether system work is normal or not

Yes → The system is normal.

No

4	Replace wiper switch

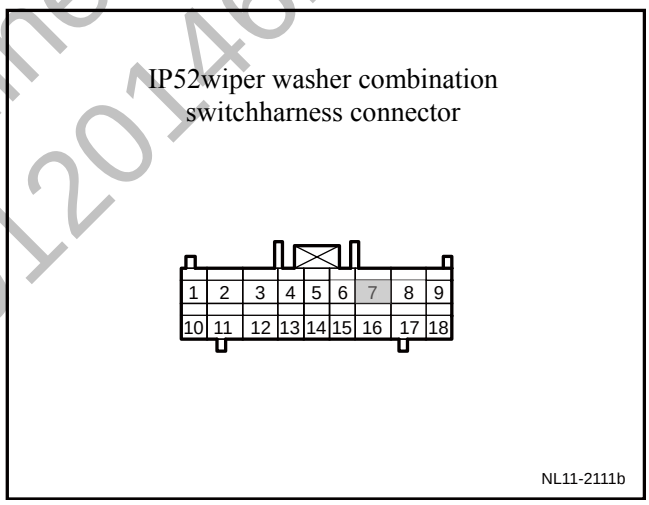
(a) Rotated ignition switch to "OFF" position.

(b) Disconnect the battery negative cable.

(c) Disconnect BCM harness connector IP50, IP48.

(d) Disconnect wiper switch wire harness connector IP52.

(e) Disconnect wiper motor harness connector CA14.



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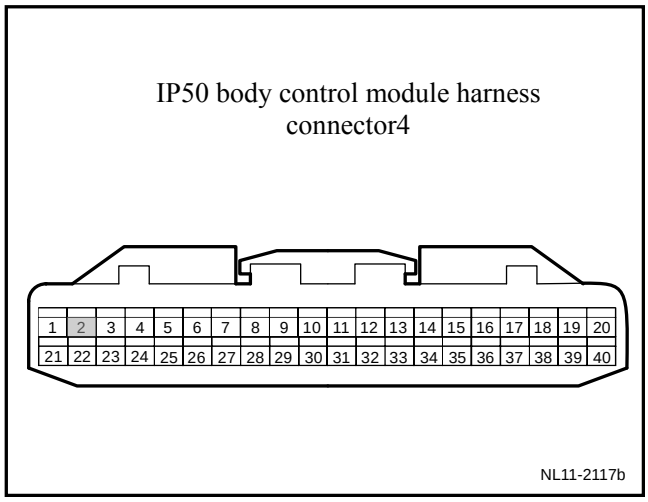
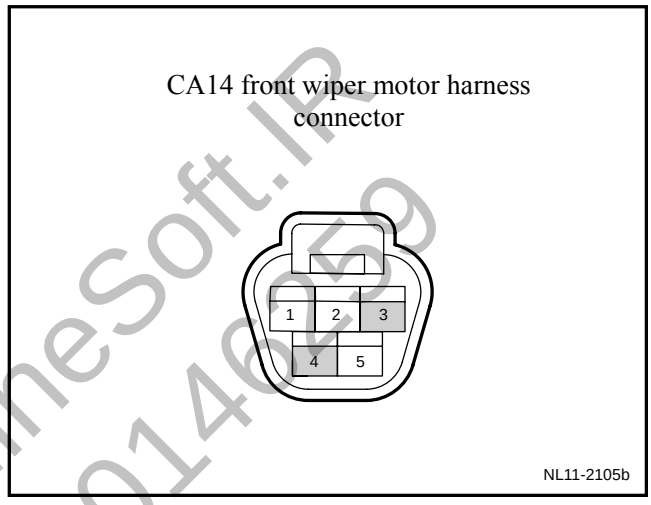
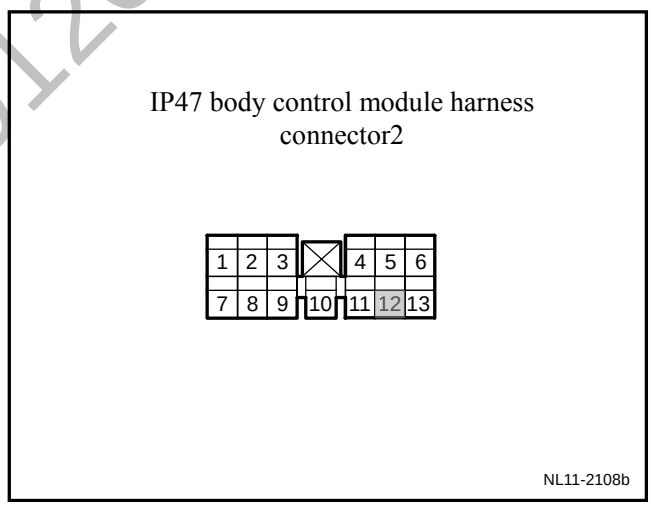
(f) Measure harness energy guide between BCM harness connector terminal and wiper switch. Wiper motor by millimeter.







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Test terminal	Specified value
IP50(2)-IP52(7)	Less than 1 Ω

IP48(12)-CA14(2)	Less than 1 Ω

Confirm whether the resistance conforms to standard value.

Yes → Go to step 6

No

5	Repair the wire harness fault point among the BCM wire harness connector terminal, the wiper switch and the wiper motor.

(a) Repair wire harness fault points between BCM wire harness connector terminal and wiper switch, wiper motor.

(b) Connect wiper switch wire harness connector IP52.

(c) Connect to BCM harness connector IP50, IP48.

(d) Connect to wiper harness connector CA14.

(e) Connect the battery negative cable.

(f) Turn on ignition switch to "ON" position.

(g) Operated wiper switch low speed (LOW).

(h) Voltage between wiper motor wire harness connector CA14 terminal No. 2 and vehicle body.

Standard voltage: 11-14 V

Confirm whether the voltage is normal.

Yes → Go to step 7

No

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6	Replace the BCM

(a) Replace BCM.

Confirm whether the wiper works normally.

Yes → The system is normal.

No

7	Replace wiper motor

Replace wiper motor, refer to11.5.8.10 Replace wiper motor

Confirm the completion of repair.

Next

8	The system is normal.

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11.6.7.6 Wiper inoperation at intermittent

Circuit diagram:

See 11.6.7.3 wiper does not work under any gear position.

Diagnostic steps:

1	Inspect the voltage of the terminal No. 2 of the wiper motor wire harness connector CA14 and the effective body grounding point.

(a) Disconnect wiper motor harness connector CA14.

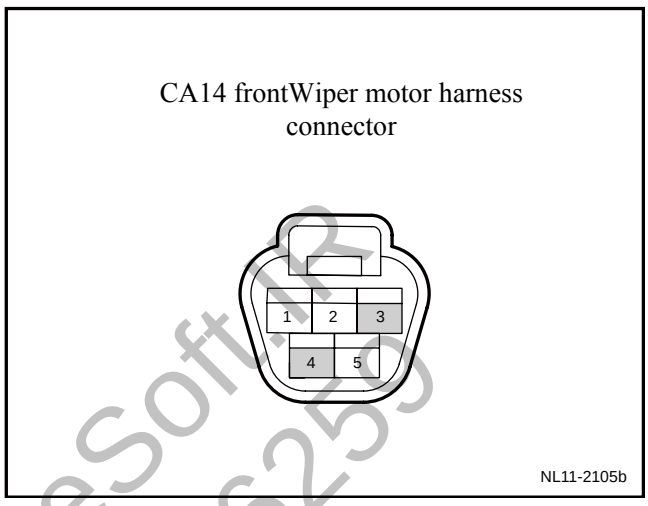
(b) Place wiper switch to interval (INT) position.

(c) Rotated ignition switch to "ON" position.

(d) Use multimeter to measure effective grounding voltage between wire harness connector CA14 terminal No. 2 and vehicle body.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



No → Go to step 7

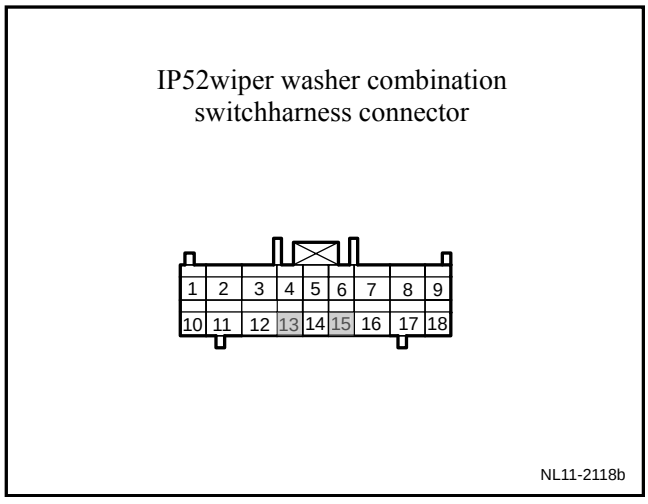
Yes

2	Inspect the wiper switch.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect wiper switch harness connector IP52.

(c) Place wiper switch to interval gear and use multimeter to measure the connection situation of switch.



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Test terminal	Test conditions	Specified value
IP52(15)-IP52(13)	Clearance gear	Less than 1 Ω

Confirm whether the wiper motor works normally.

Yes → The system is normal.

No

3	Replace wiper switch.

(a) Replace wiper switch, refer to11.5.8.9 wiper and washer switch replacement.

Confirm whether the system works normally.

Yes → The system is normal.

No

4	Inspect the energy conduction property of the circuit among the BCM wire harness connector terminal, the wiper switch and the wiper motor.

(a) Rotated ignition switch to "OFF" position.

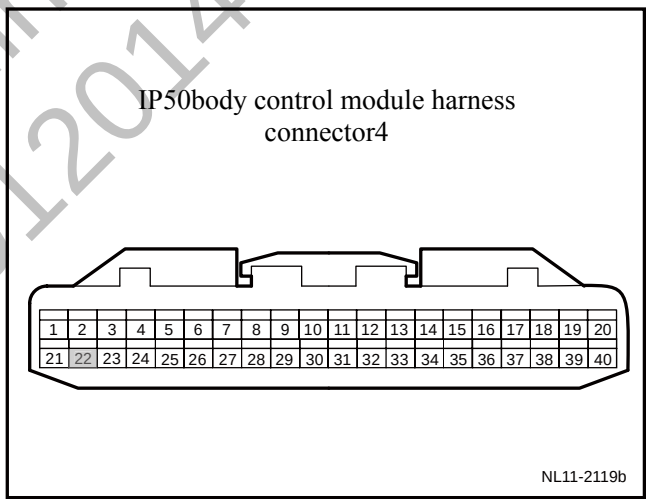
(b) Disconnect the battery negative cable.

(c) Disconnect BCM harness connector IP50, IP48.

(d) Disconnect wiper switch wire harness connector IP52.

(e) Disconnect wiper motor harness connector CA14.

(f) Use multimeter to measure circuit conductivity between BCM wire harness connector terminal and wiper switch, and wiper motor.



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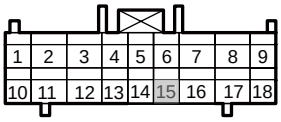
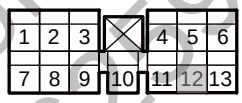
IP52wiper washer combination switchharness connector



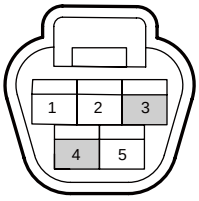
NL11-2120b

IP48body control module harness connector2



NL11-2108b

CA14 frontwiper motor harness connector



NL11-2105b

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Test terminal	Specified value
IP50(22)-IP52(15)	Less than 1 Ω

IP48(12)-CA14(2)	Less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → Go to step 6

No

5	Repair the circuit fault point among the BCM wire harness connector terminal, the wiper switch and the wiper motor.

(a) Repair circuit fault points between BCM wire harness connector terminal and wiper switch, wiper motor.

(b) Connect wiper switch wire harness connector IP52.

(c) Connect to BCM harness connector IP50, IP48.

(d) Connect to wiper motor harness connector CA14.

(e) Connect the battery negative cable.

(f) Turn ignition switch to "ON" position.

(g) Operated wiper switch to clearance gear (INT).

Confirm whether the voltage of the terminal No. 2 of the wiper motor wire harness connector CA14 and the effective body grounding point is normal.

6	Replace the BCM

(a) Replace BCM.

Confirm whether the wiper works normally.

Yes → The system is normal.

No

7	Replace wiper motor

Replace wiper motor, refer to11.5.8.10 Replace wiper motor

Confirm the completion of repair.

Next

8	The system is normal.

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11.6.7.7 Front washer inoperation

Circuit diagram:

See 11.5.7.3 wiper does not work under any gear position.

Diagnostic steps:

1	Inspect whether the washing fluid reservoir level is sufficient.

Confirm whether the washing fluid reservoir level is sufficient.

Yes → Go to step 3

No

2	Add windscreen cleaning agent.

(a) Fill glass cleaner to washing fluid reservoir.

Confirm whether the washing system works normally.

Yes → The system is normal.

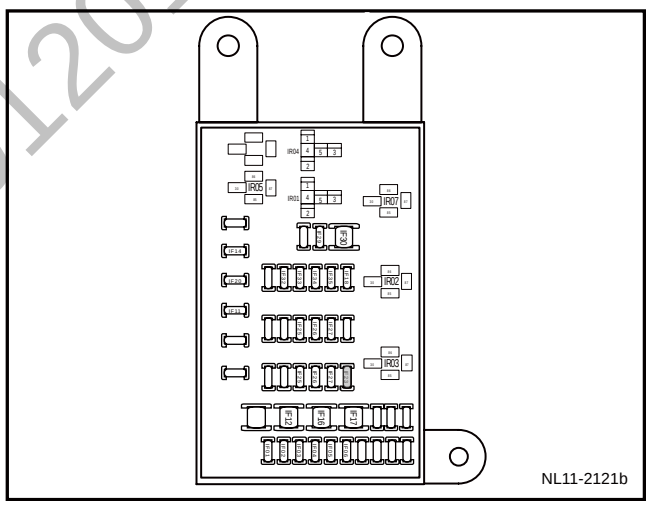
No

3	Check fuseIF23.

(a) Check fuse IF23was blown

Rated Current of Fuse: 15A

Confirm whether the fuses are blown.



Yes → Go to step 5

No

4	Check fuse circuit.

(a) Check fuse IF23 circuit has short circuit phenomenon.

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(b) Repair the circuit and confirm that there are no short circuits.

(c) Replace with fuses with rated current.

Confirm whether the front washer pump works normally.

Yes → Go to step 12

No

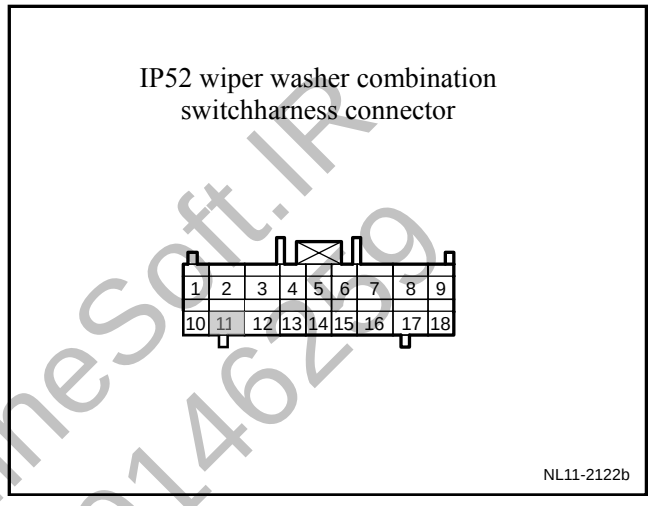
5	Inspect the voltage of the terminal No. 11 of the wire harness connector IP52 and the effective body grounding point.

(a) Turn on washer switch.

(b) Use multimeter to measure voltage between wire harness connector IP52 terminal No. 11 and vehicle body effective grounding point (note: do not disconnect wire harness connector IP52).

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 7

No

6	Replace washer switch.

(a) Replace wiper switch assembly, refer to11.5.8.9 wiper and washer switch replacement.

Confirm whether the front washer pump works normally.

Yes → Go to step 12

No

7	Inspect the voltage of the terminal No. 1 of the wire harness connector CA24 on the washer bump and the effective body grounding point.

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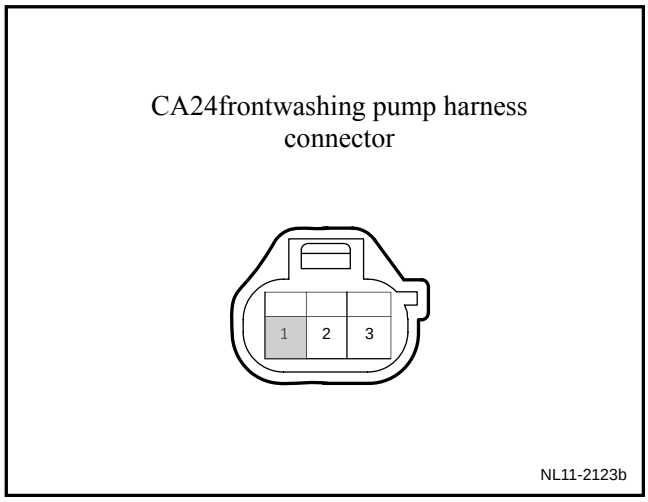
(a) Disconnect front washer pump upper harness connector CA24.

(b) Start washer switch.

(c) Use multimeter to measure effective grounding voltage between wire harness connector CA24 terminal No. 1 on washing pump and vehicle body.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 9

No

8	Repair the fault point between the terminal No. 1 of the wire harness connector CA24 and the terminal No. 11 of the wiper switch wire harness connector IP52.

(a) Repair open-circuit fault between wire harness connector CA24 terminal No. 1 and wiper switch wire harness connector IP52 terminal No. 11.

Confirm whether the front washer pump works normally.

Yes → The system is normal.

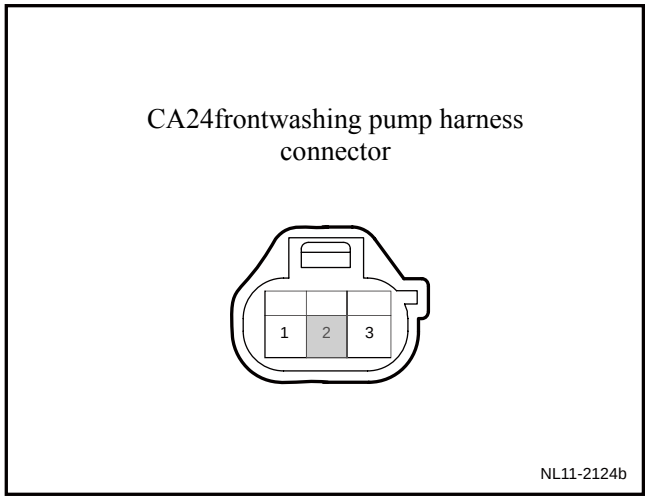
No

9	Inspect the resistance of the terminal No. 2 of the wire harness connector CA24 and the effective body grounding.

(a) Measure resistance between wire harness connector CA24 terminal No. 2 and vehicle body effective grounding.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.



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Yes → Go to step 11

No

10	Repair the fault point between the terminal No. 2 of the wire harness connector CA24 and the body grounding.

(a) Repair fault points between wire harness connector CA24 terminal No. 2 and vehicle body grounding.

Confirm whether the front washer pump works normally.

Yes → Go to step 12

No

11	Replace washing motor.

(a) Replace washing motor, refer to 11.5.8.7 front/rear washing motor and house replacement .

Is the washer system working correctly?

Yes → The system is normal.

No

12	Inspect the front windshield washer hose and water spray nozzle.

(a) Inspect whether front windshield washer hose and nozzle are damaged or blocked.

Next

13	The system is normal.

(a) Repair or replace blocked/damaged front windshield washer hose and nozzle. Refer to 11.5.8.7 Replacement of front, rear wiper motor and hose.

Confirm whether the washer works normally.

Next

14	Normal operation

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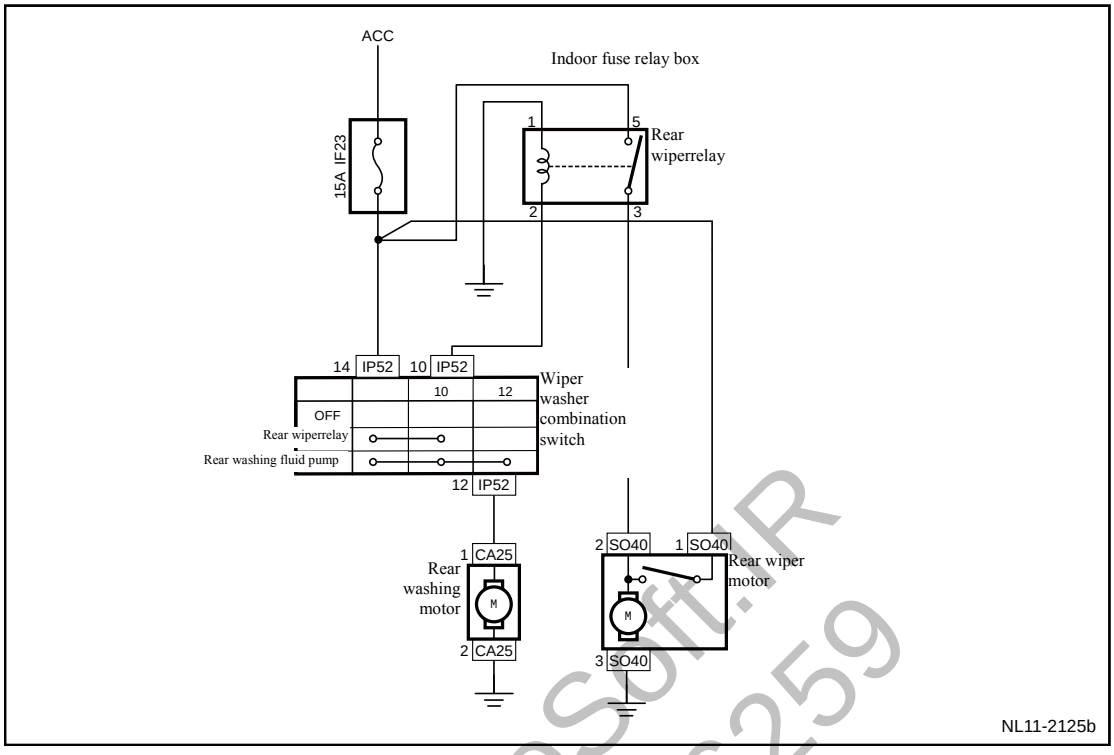
11.6.7.8 Rear Wiper Inoperation

Circuit diagram:



Diagnostic steps:

Notes:

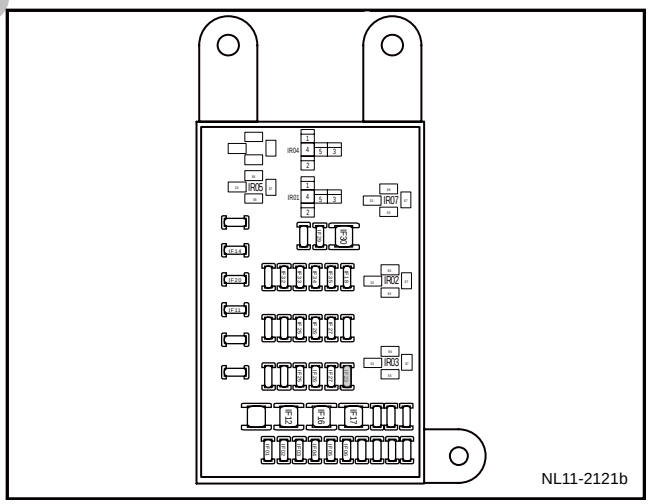
Prior to the implementation of the diagnostic procedures, firstly ensure no fault of rear wiper motor grounded circuit.

1	Check fuse IF23.

(a) Check fuse IF23was blown

Fuse rated current:15A

Confirm whether the fuses are blown.



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Yes → Go to step 3

No

2	Check the fuse IF23 circuit .

(a) Check fuse IF23 circuit has short circuit phenomenon.

(b) Repair circuit to ensure that there is no short-circuit (note: when fuse is inserted, fuse will be burned out. Inspect short-circuit between fuse to switch; when starting rear wiper switch or rear washer switch, fuse will be burned out. Inspect short-circuit of grounding to wiper relay or to rear washer pump.

(c) Replace with fuses with rated current.

Confirm whether the rear wiper works normally.

Yes → The system is normal.

No

3	Inspect the effective grounding voltage of the terminal No. 10 of the wiper motor wire harness connector IP52 and the body.

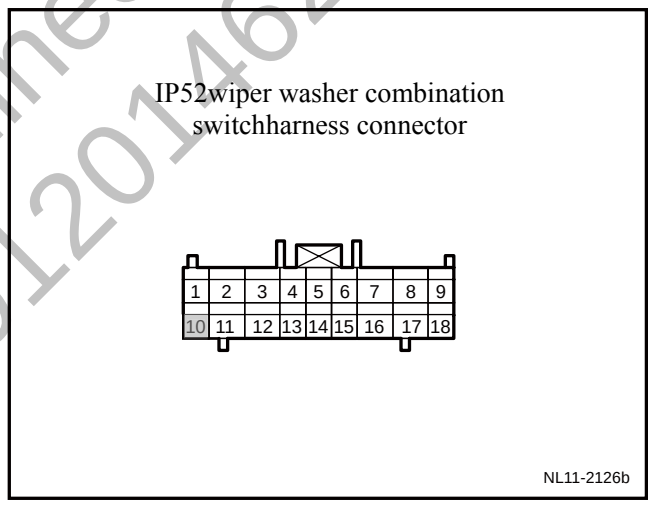
(a) Rotated ignition switch to "ON" position

(b) Place rear wiper switch to ON position.

(c) Use multimeter to measure voltage between wiper switch wire harness connector IP52 terminal No. 10 and vehicle body effective grounding (note: do not disconnect wire harness connector IP52).

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



No → Inspect the circuit and replace the fuse to confirm the fault has been removed.

Yes

4	Replace wiper switch.

(a) Replace wiper switch assembly, refer to11.5.8.9 wiper and washer switch replacement .

Confirm whether the rear window wiper works normally.

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Yes → The system is normal.

No

5	Does the rear wiper relay work when starting the rear wiper?

Yes → Go to step 7

No

6	Inspect the rear wiper relay coil circuit.

(a) Rotated ignition switch to "OFF" position.

(b) Dismantle rear wiper relay.

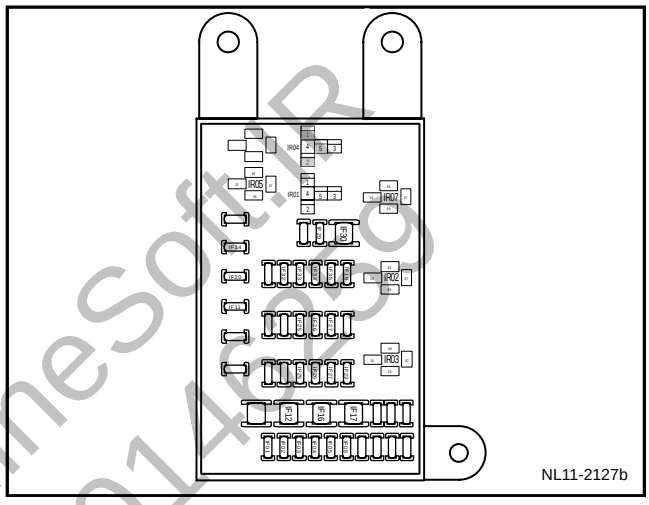
(c) Rotated ignition switch to "ON" position.

(d) Turn on rear wiper switch.

(e) Use multimeter to measure voltage between wiper relay plug hole 1 and 2.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Replace relay

No

7	Repair the open circuit fault circuit of the rear wiper relay power supply and grounding circuit.

Next

8	Inspect the voltage of the terminal No. 2 of the wiper motor wire harness connector SO40 and the effective body grounding.

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(a) Disconnect rear wiper motor harness connector SO40.

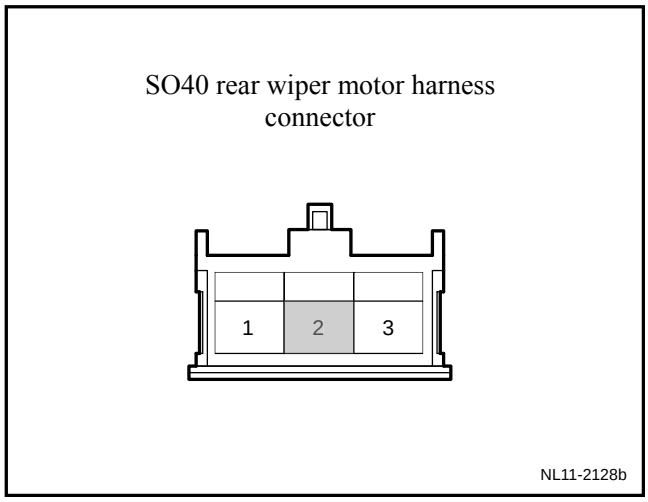
(b) Rotated ignition switch to ON position.

(c) Turn on rear wiper switch.

(d) Use multimeter to measure effective grounding voltage between wire harness connector SO40 terminal No. 2 and vehicle body.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 10

No

9	Inspect the voltage of the No.5 jack of the rear wiper relay and the effective body grounding.

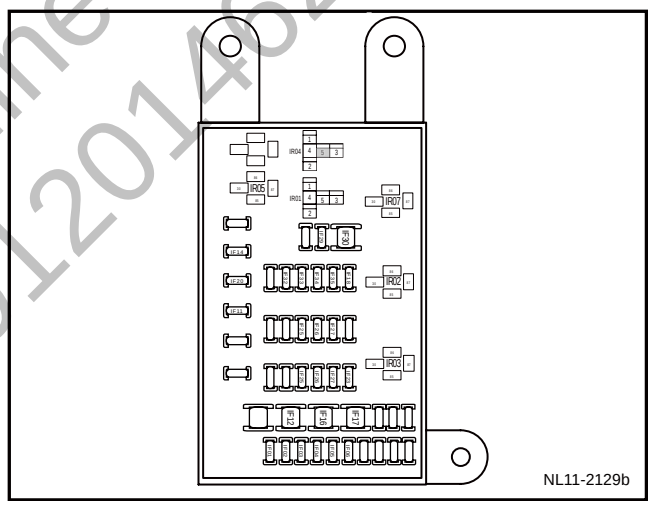
(a) Rotated ignition switch to "OFF" position.

(b) Dismantle rear wiper relay.

(c) Use multimeter to measure effective grounding voltage of rear wiper relay No.5 plug hole and vehicle body.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → The system is normal.

No

10	Repair the open circuit fault between the No. 3 jack of the rear wiper relay and the terminal No. 2 of the rear wiper motor wire harness connector SO40.

11	Inspect the resistance between the terminal No. 3 of the rear air window wiper wire

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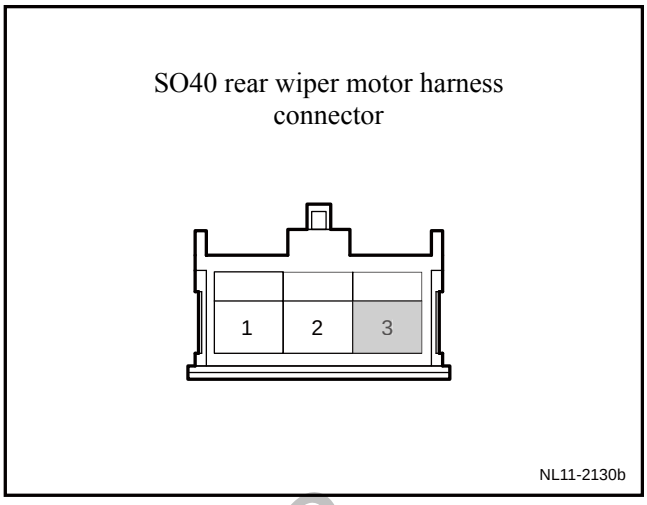
	harness connector SO40 and the effective body grounding point.

(a) Disconnect wiper motor of rear windscreen harness connector SO40.

(b) Use multimeter to measure resistance between rear windshield wiper wire harness connector SO40 terminal No. 3 and vehicle body effective grounding point.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 13

No

12	Repair the fault point of the terminal No. 3 of the rear windshield wiper wire harness connector SO40 and the body ground point.

(a) Repair fault points between windshield wiper wire harness connector SO40 terminal No. 3 and vehicle body grounding.

(b) Connect to harness connector SO40.

(c) Start Rear windscreen wiper switch.

Confirm whether rear windscreen wiper work is normal or not

Yes → The system is normal.

No

13	Replace wiper motor of rear windscreen.

(a) Replace wiper motor of rear windscreen, Refer to11.5.8.11 rear replace wiper motor.

Confirm the completion of repair.

Next

14	The system is normal.

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11.6.7.9 Rear washer inoperation

Circuit diagram:

Circuit diagram refers to 11.5.7.8 rear wiper does not work.

Diagnostic steps:

Notes:

Prior to the implementation of the diagnostic procedures, determine the rear wiper normally operates.

1	Inspect whether the washing fluid reservoir level is sufficient.

(a) Inspect whether glass washing solution in liquid can is sufficient.

Yes → Go to step 3

No

2	Add glass detergent.

A. Add windscreen detergent into the fluid reservoir.

Confirm whether the rear washer works normally.

Yes → The system is normal.

No

3	Inspect the voltage of the terminal No. 12 of the wire harness connector IP52 and the effective body grounding.

(a) Rotated ignition switch to "ON" position

(b) Washer switch after started

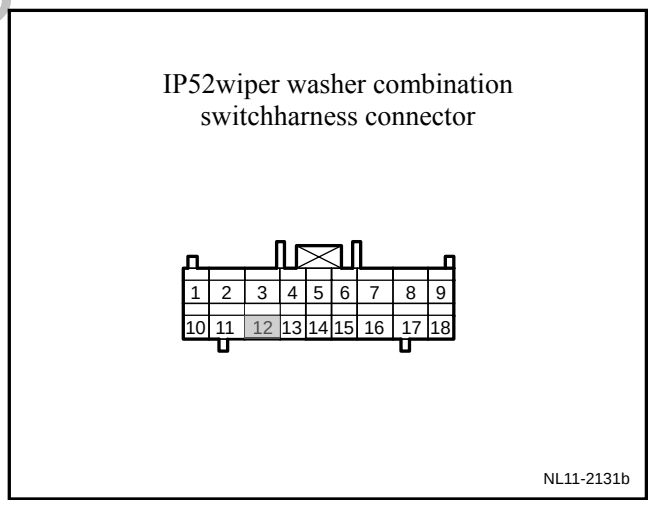
(c) Use multimeter to measure effective grounding voltage between wire harness connector IP52 terminal No. 12 and vehicle body.

(note: do not disconnect wire harness connector IP52)

(d) Use multimeter to measure the voltage of rear washer motor terminal No. 2.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



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No → Go to step 5

Yes

4	Replace washer switch.

(a) Replace wiper switch assembly, Refer to11.5.8.9 wiper and washer switch replacement.

Confirm whether the washer works normally.

Yes → The system is normal.

No

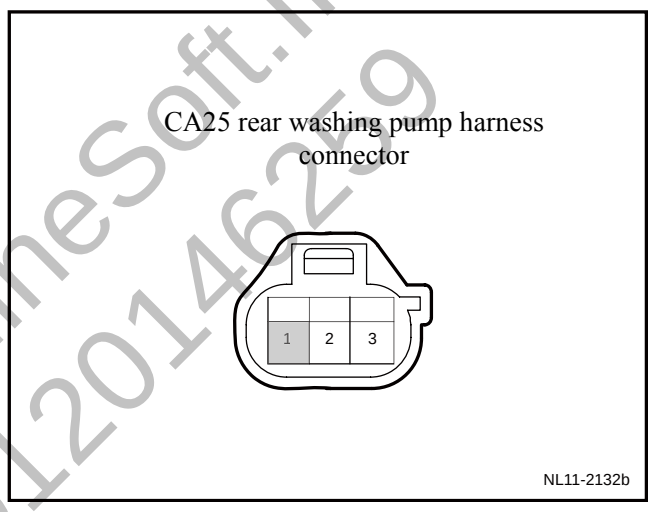
5	Inspect the voltage of the terminal No. 1 of the wire harness connector CA25 on washing fluid bump and the effective body grounding.

(a) Disconnect rear washing pump harness connector CA25.

(b) Rotated ignition switch to "ON"position.

(c) Start washer switch.

(d) Use multimeter to measure effective grounding voltage between washing pump wire harness connector CA25 terminal No. 1 and vehicle body.



Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.

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Yes → Go to step 10

No

6	Repair the open circuit fault between the terminal No. 1 of the wire harness connector CA25 on the washing fluid pump and the terminal No. 12 of the wire harness connector IP52.

(a) Inspect and repair open-circuit between CA25 terminal No. 1 and wire harness connector IP25 terminal No. 12 on washing pump.

Confirm whether the rear wiper works normally.

Yes → The system is normal.

No

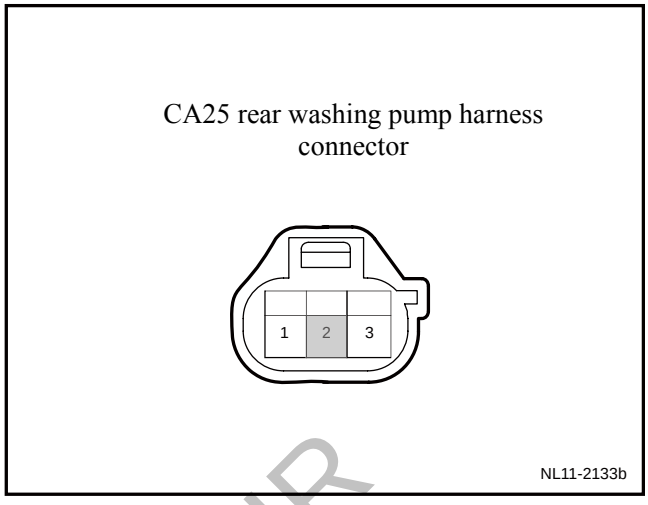
7	Inspect the resistance of the terminal No. 2 of the rear washer wire harness connector CA25 and the effective body grounding.

(a) Disconnect rear washer harness connector CA25.

(b) Inspect resistance between wire harness connector CA25 terminal No. 22 and vehicle body effective grounding.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 9

No

8	Repair the fault point between the terminal No. 2 of the wire harness connector CA25 and the body.

(a) Repair fault points between wire harness connector CA25 terminal No. 2 and vehicle body grounding.

Confirm whether the washer works normally.

No → The system is normal.

Yes

9	Replace rear washing motor.

(a) Replace rear washing motor, Refer to

Confirm whether the rear wiper works normally.

Yes → The system is normal.

No

10	Inspect the front windshield washer hose and water spray nozzle.

(a) Inspect whether front windshield washer hose and nozzle are damaged or blocked.

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Next

11	Repair the rear windshield washer hose and water spray nozzle.

(a) Repair or replace blocked/damaged front windshield washer hose and nozzle. Refer to 11.5.8.6 Replacement of rear wiper nozzle.

Confirm the completion of repair.

Next

12	The system is normal.

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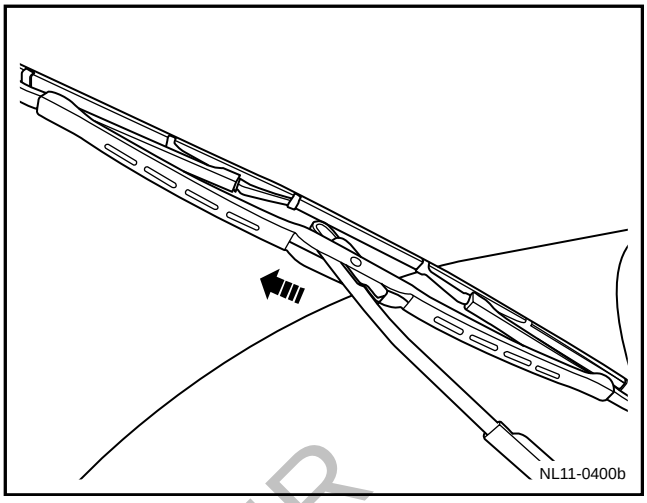
11.6.8 Dismantle and install

11.6.8.1 Boneless wiper blade replacement

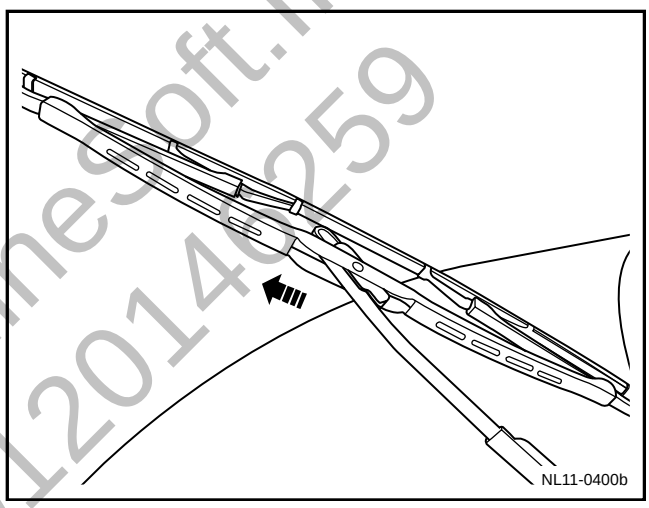
Dismantlement procedure

1. Lift front wiper arm.
2. Open fixing clip, and dismantle non-bone wiper piece.



Installation procedure:

1. Install boneless wiper until it be coupled with fixing clamper.



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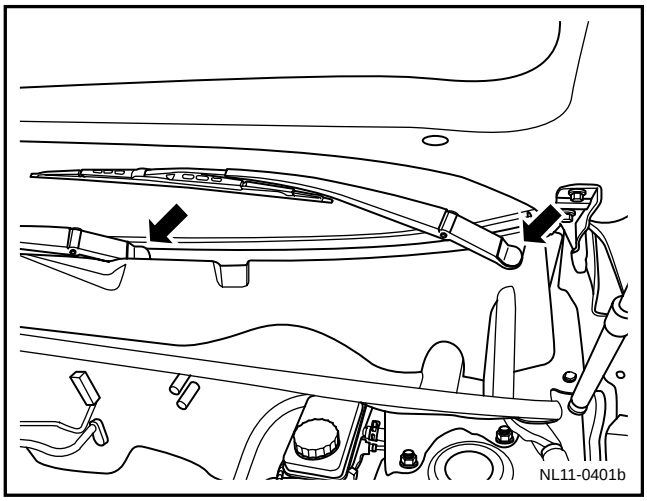
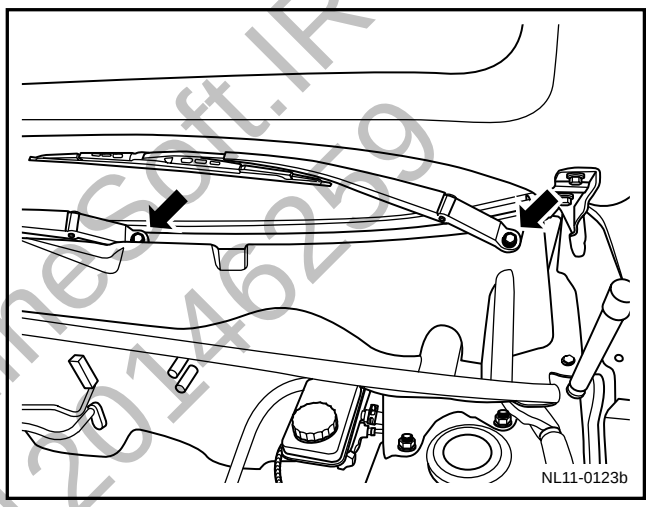
11.6.8.2 Front wiper arm replacement

Dismantlement procedure

1. Before dismantlement, place the wiper arm at its initial position.
2. Dismantle the nut cover of wiper arm.



3. Dismantle the nuts of wiper arm.



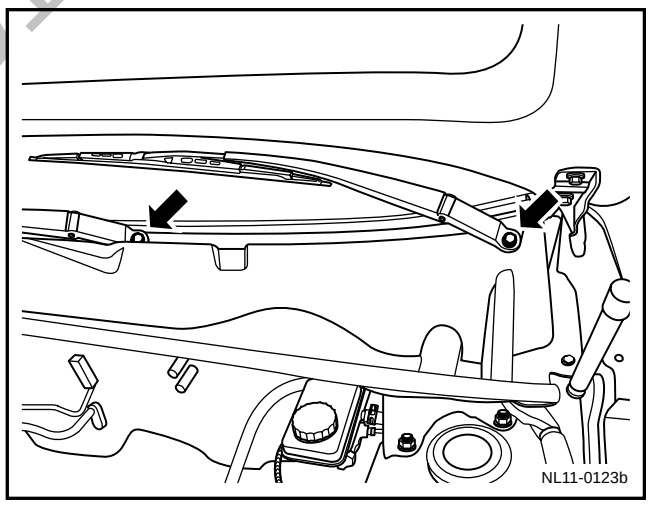
Installation procedure:

1. Install the wiper arm.
2. Install and tighten the installation nuts of wiper arm.

Notes:

See "Important cautions regarding fastening parts" in "warnings and cautions".

Torque: 15Nm(Metric) 11lb-ft(English system)



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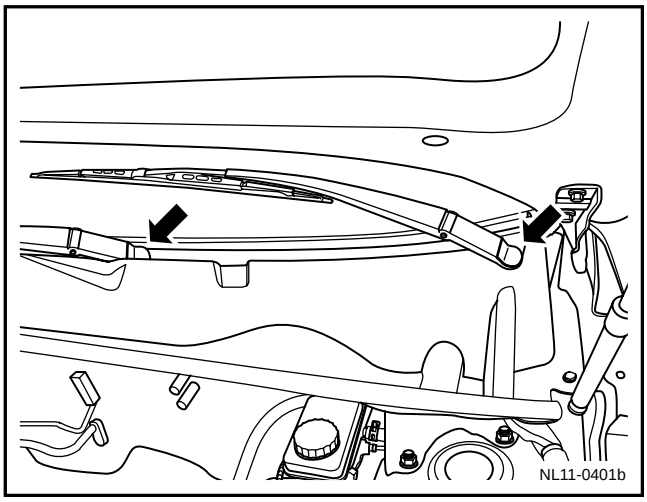
3. Install wiper arm nut cap.



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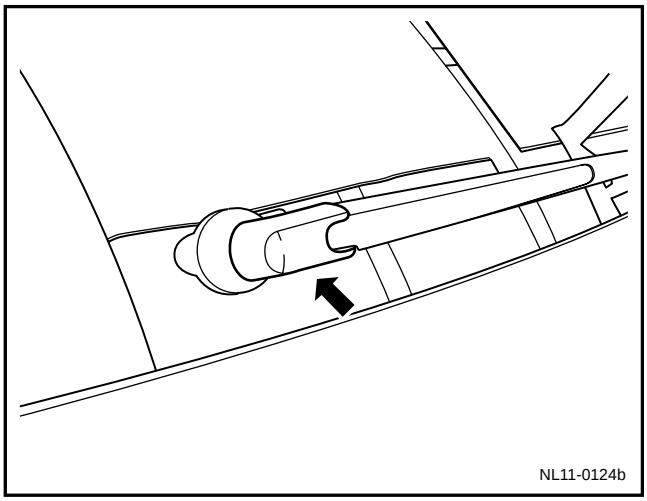
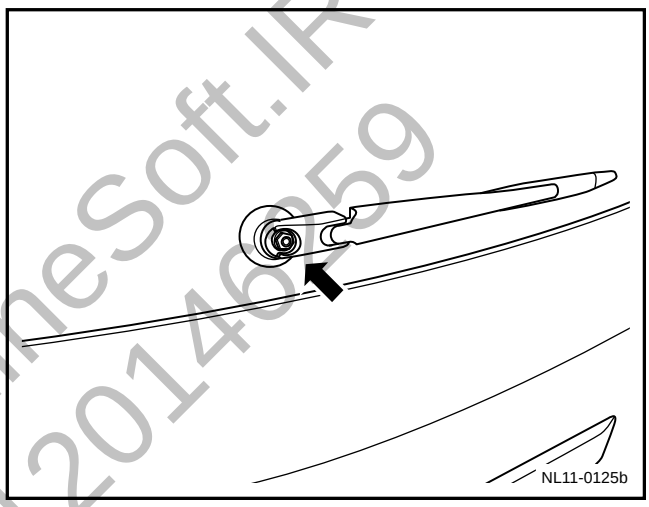
11.6.8.3 Rear wiper arm replacement

Dismantlement procedure

1. Before dismantling, put the wiper piece on initial position.
2. Dismantle wiper arm screw cap housing.



3. Dismantle the nuts of wiper arm.
4. Remove the wiper arm upwards.



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Installation procedure:

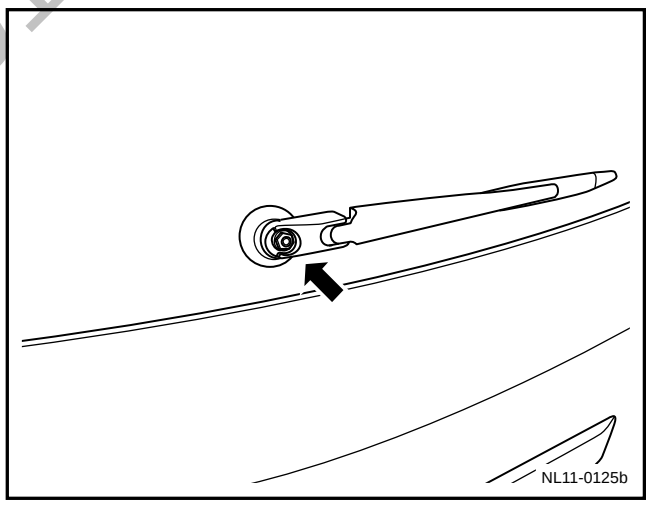
1. Install the wiper arm.
2. Tighten mounting nut of wiper arm.

Notes:

See "important cautions regarding fastening parts" in "warnings and cautions".

Torque: 8Nm(Metric) 6lb-ft(English system)

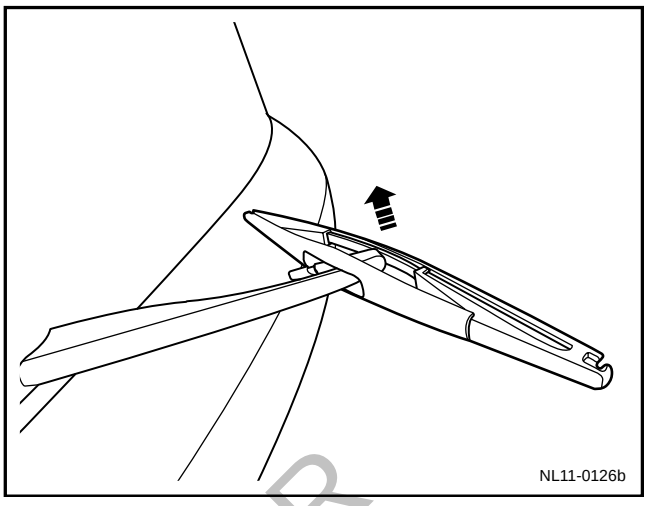
3. Install wiper arm screw cap cover.



11.6.8.4 Rear wiper blade replacement

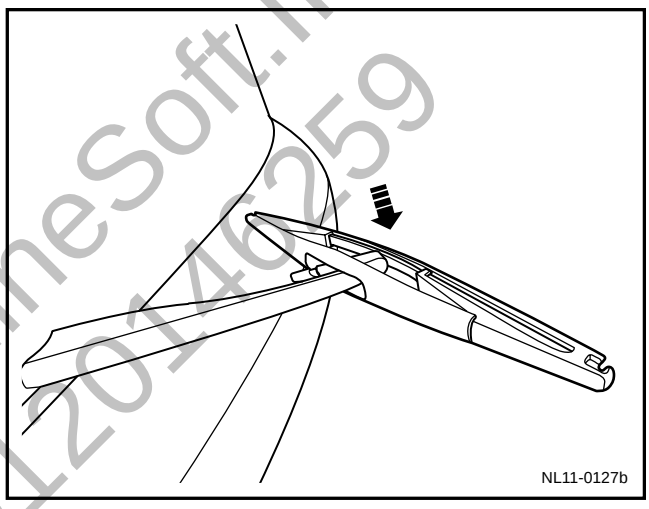
Dismantlement procedure

1. Before dismantlement, place the wiper arm at its initial position.
2. Rotate the rear wiper blade to remove it.



Installation procedure:

1. Install the rear wiper blade to the wiper arm.
2. Rotate the rear wiper blade to install it correctly.



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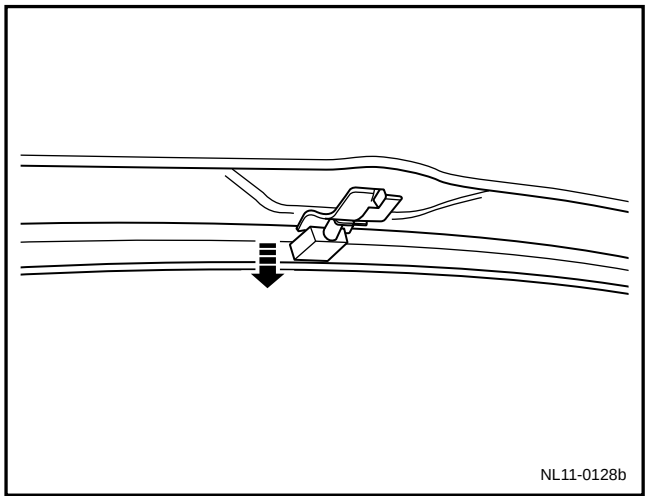
11.6.8.5 Replacement of wiper nozzle

Dismantlement procedure

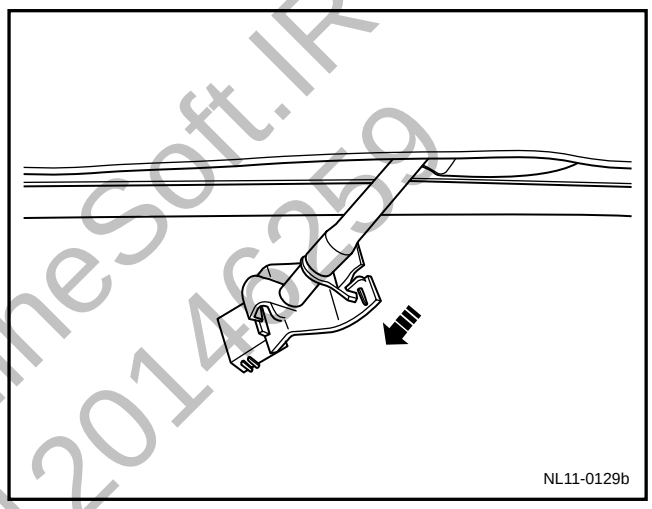
1. For dismantling of engine cover vibration insulation pad, refer to 12.10.1.2 replacement of engine cover vibration insulation pad.
2. Remove wiper nozzle from engine cover.



3. Disconnect nozzle and washing hose.

Installation procedure:

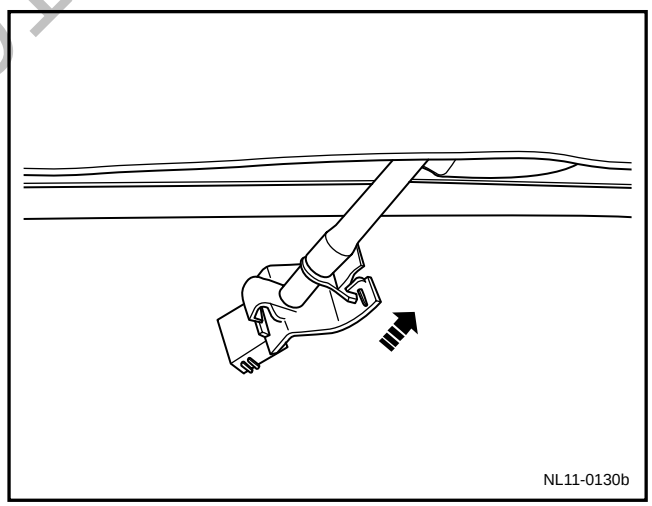
1. Connect nozzle to water spraying hole.



2. Install wiper nozzle onto the engine hood cover.

Notes:

Regulate the water spraying angle to the proper position after assembling!



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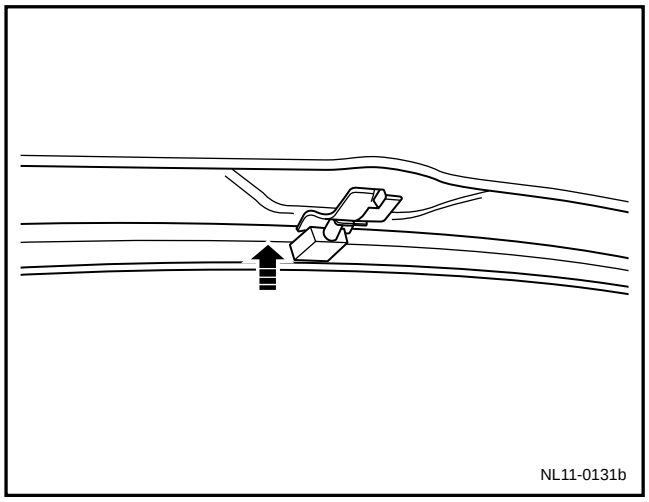
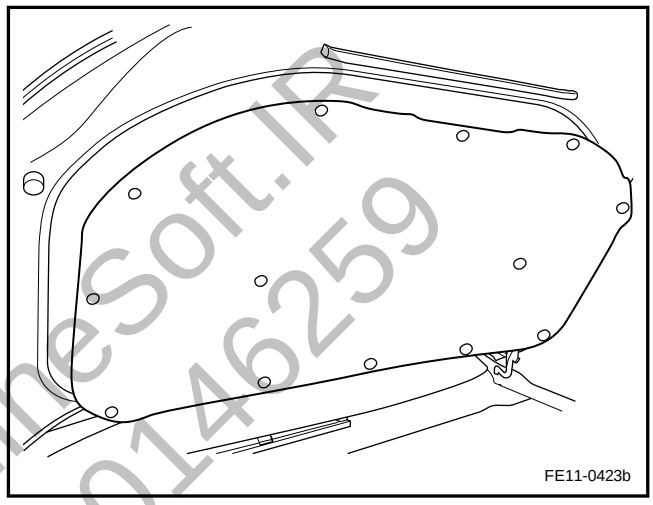
3. Install the soundproof pad of the engine hood.



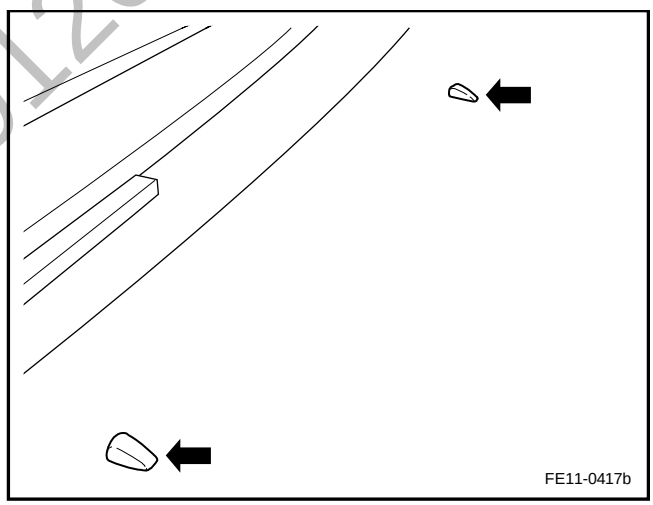
3. Install the soundproof pad of the engine hood.



4. Close engine cover.

Notes:

Regulate the water spraying angle to the proper position after assembling.



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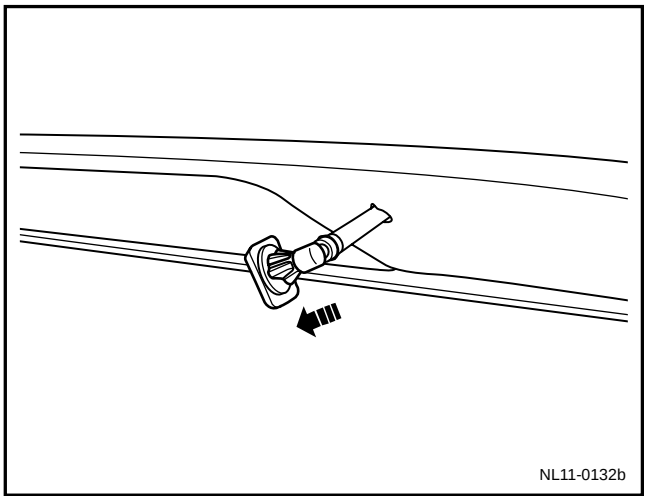
11.6.8.6 Rear wiper nozzle replacement

Dismantlement procedure

1. Use proper tool to remove rear wiper nozzle from spoiler.
2. Push out wiper nozzle from water spraying hose.

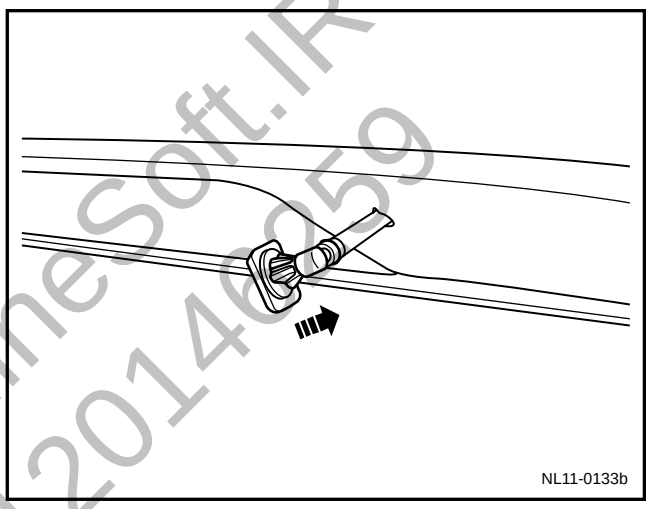


Installation procedure:

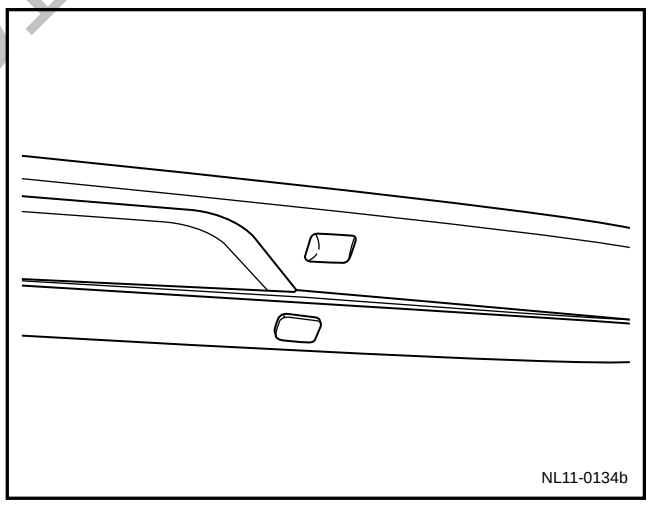
1. Connect to nozzle and water injecting hose.

Notes:

Hose can not be extruded and folded.



2. Install rear wiper nozzle onto the spoiler.



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11.6.8.7 Front/rear washing motor and hose replacement

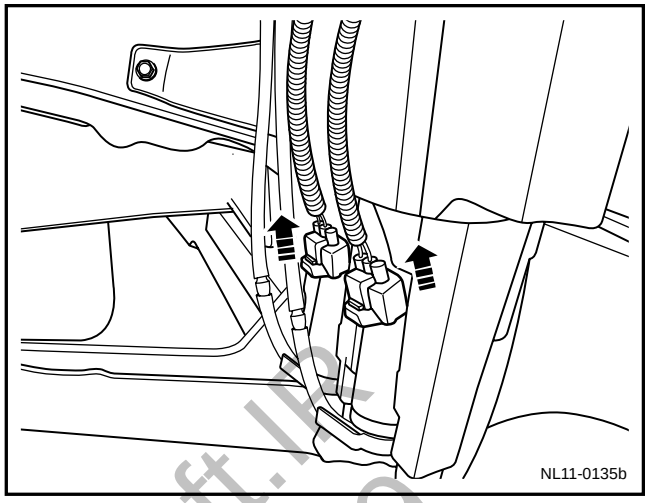
Replacement of washer motor

Dismantlement procedure

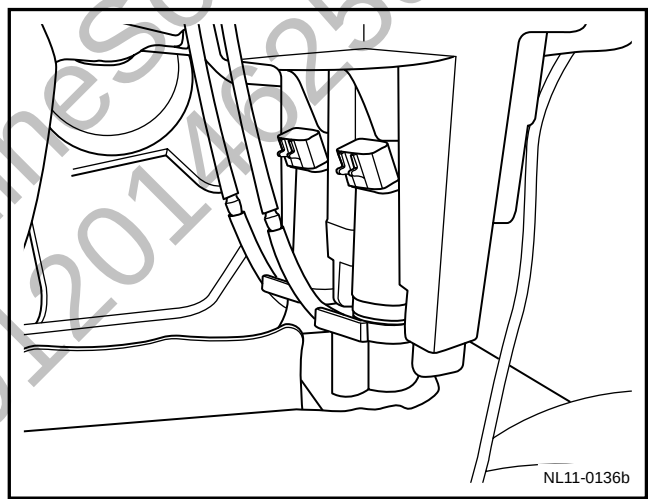
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Completely rotate front wheel to right direction to allow for enough operation space.
2. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
3. Dismantle the left front fender liner. Refer to 12.10.1.9 Replacement of Front Fender Liner.

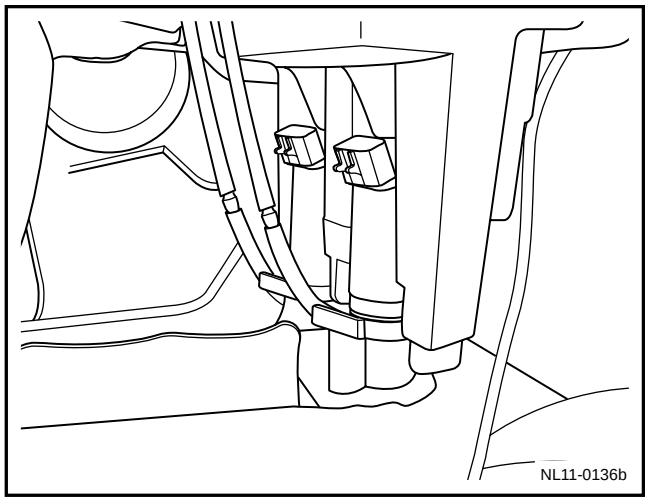


4. Disconnect the front / rear washer motor harness connector.
5. Disconnect the washing fluid hose from the front and rear washer motors.
6. Extract the front and rear washing fluid pumps.



Installation procedure:

1. Install front, rear washer motor.
2. Connect the washer liquid hose.



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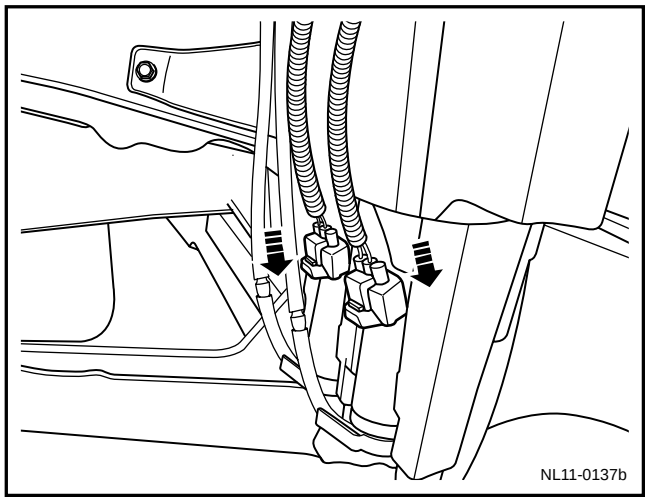
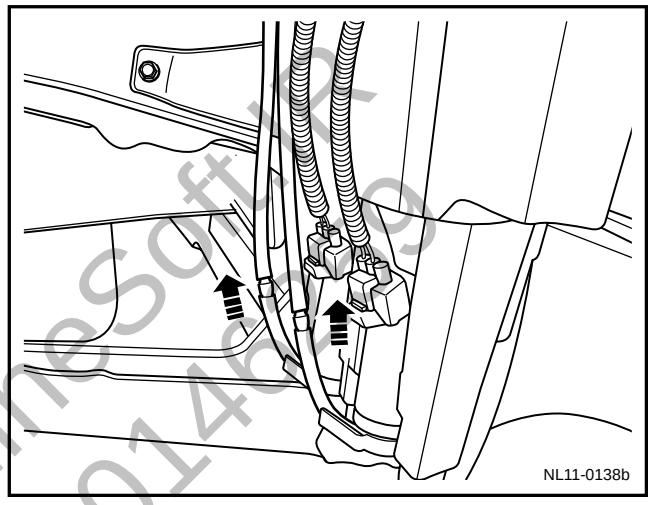
3. Connect washing agent pump wire harness connector.
4. Install right front wheel splashboard.
5. Connect the battery negative cable.
6. Turn the front wheels back to straight.



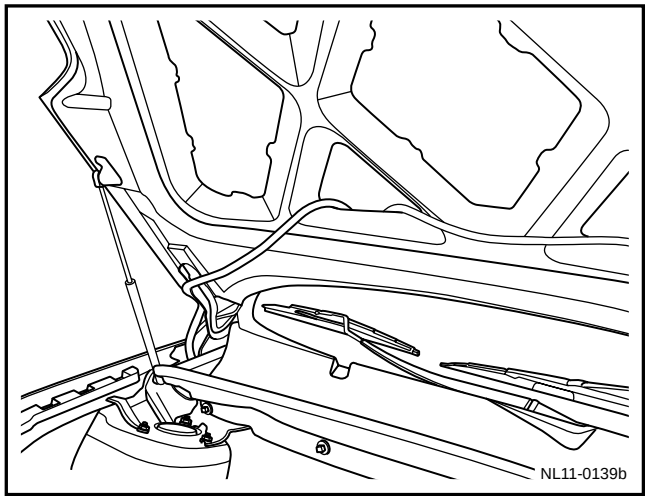
Replacement of hose

Dismantlement procedure

1. Completely rotate front wheel to right direction to allow for enough operation space.
2. For dismantling of engine cover vibration insulation pad, refer to 12.10.1.2 Replacement of engine cover vibration insulation pad.
3. Disconnect connection of washing fluid and nozzle, Refer to 11.5.8.5 wiper nozzle replacement.
4. Dismantle the left front fender liner. Refer to 12.10.1.9 Replacement of Front Fender Liner.



5. Disconnect the washing fluid hose from the front and rear washer motors.
6. Dismantle the front washing fluid hose.



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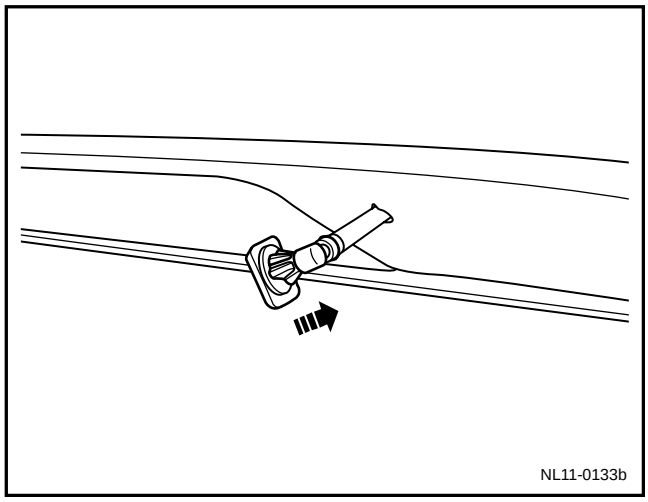
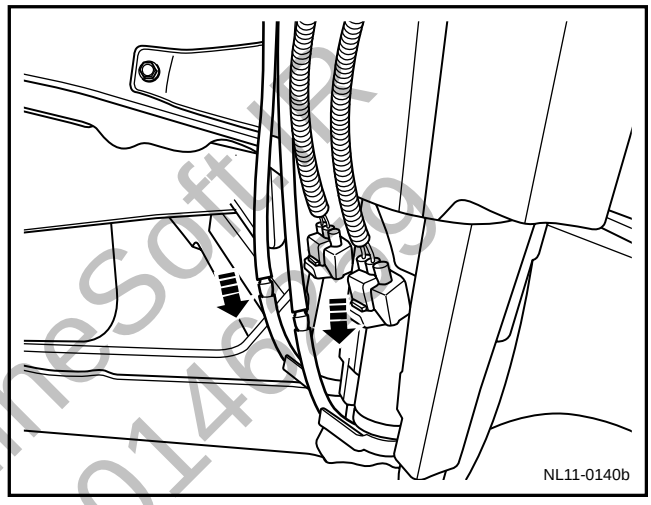
7. Detach the rear washing fluid hose from the rear wiper nozzle.

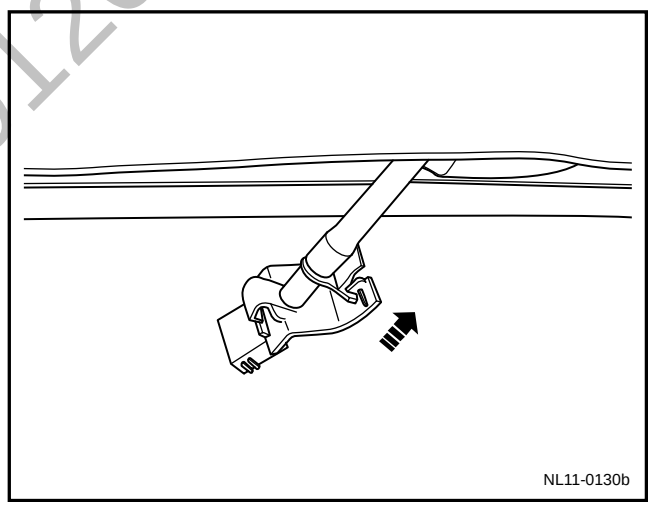


Installation procedure:

1. Install washing solution hose onto front, rear washer motors.



2. Pass through and install front wiper washing reservoir hose.
3. Connect washing agent hose to wiper nozzle.
4. For installation of sound insulation pad of engine cover, refer to "Replacement of sound insulation pad of engine cover".



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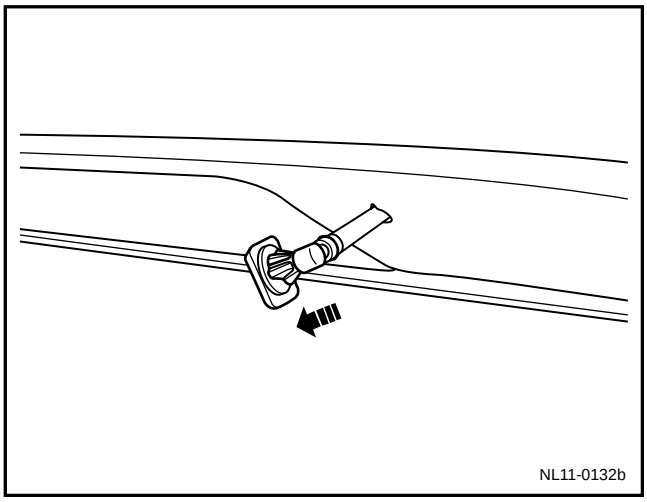
5. Install the rear washing fluid hose onto the rear wiper nozzle.
6. Install the front fender liner.



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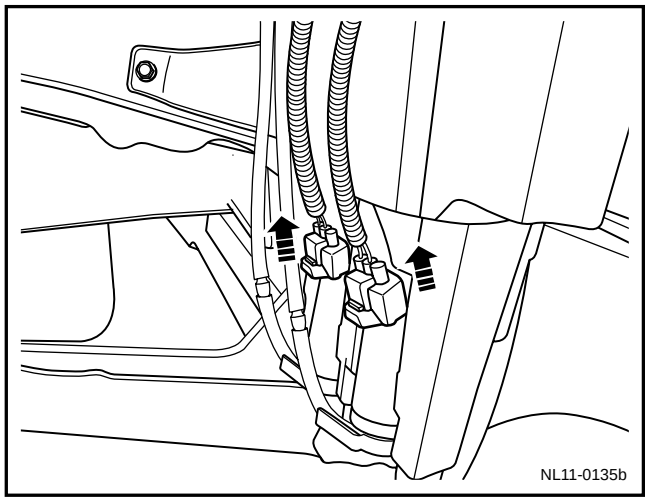
11.6.8.8 Replacement of washer fluid reservoir

Dismantlement procedure

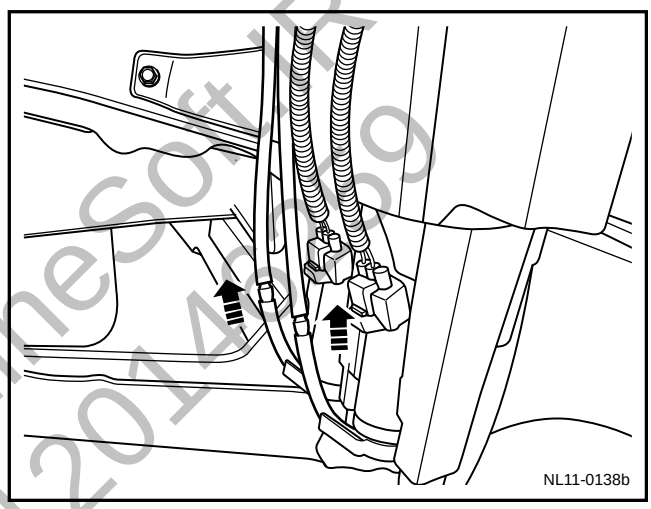
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

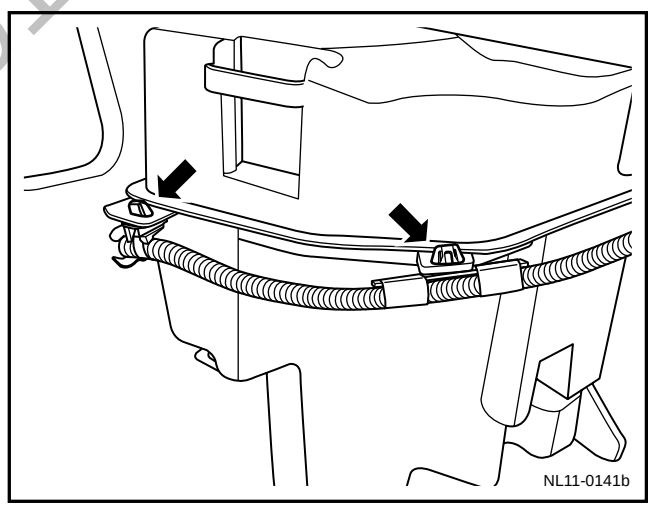
1. Completely rotate front wheel to right direction to allow for enough operation space.
2. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.



3. Dismantle the left front fender liner. Refer to 12.10.1.9 replacement of front fender liner.
4. Accumulator cable disconnection procedures
5. Disconnect the washing fluid motor hose.



6. Detach the harness fixing buckle fixed on the washing fluid reservoir.



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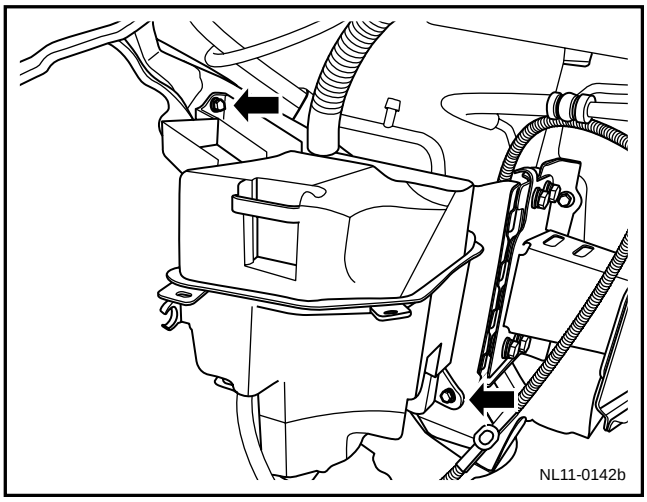
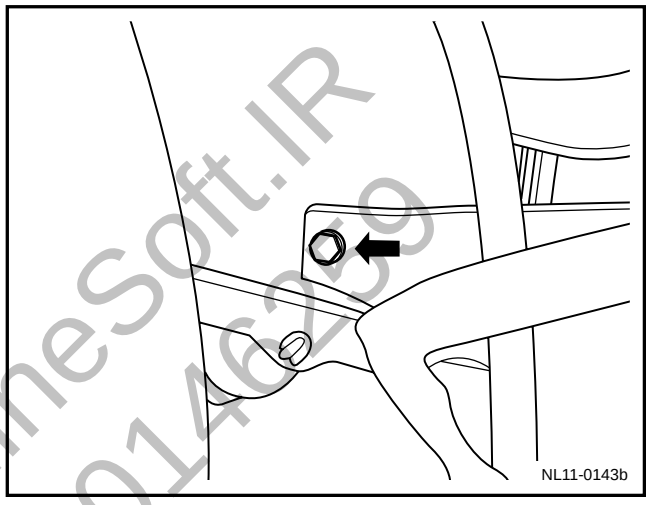
7. Remove the front fixing bolt for the washing fluid reservoir.

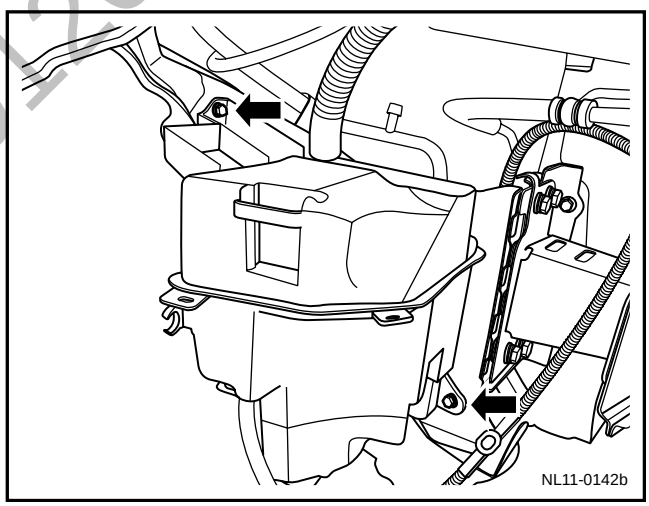


8. Remove the fixing bolt on the back side of the washing fluid reservoir.
9. Dismantle the washer fluid reservoir.



Installation procedure:

1. Install the washer fluid reservoir.
2. Install the lower fixing bolts of the washer fluid reservoir but do not tighten strictly.



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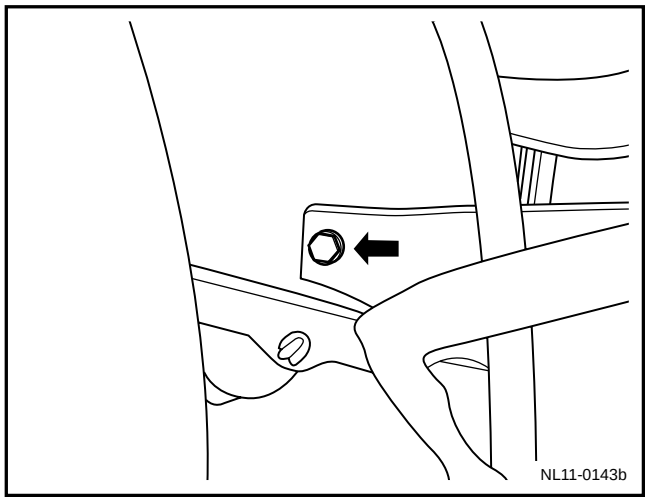
3. Install fixing bolt on rear section of washing liquid reservoir.

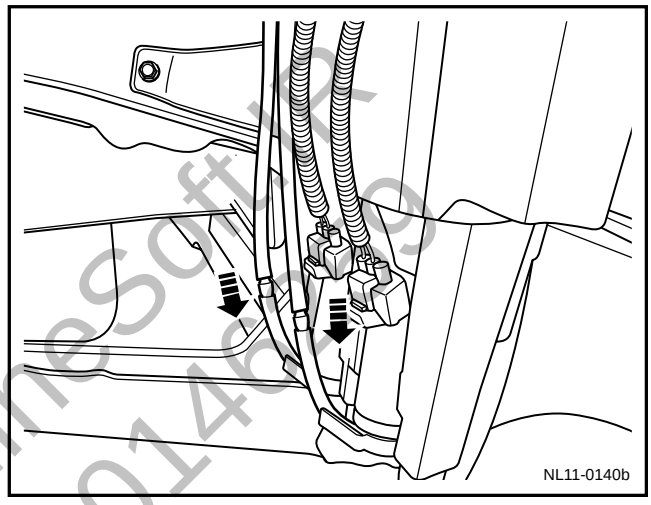
Torque: 9Nm (Metric) 6. 7lb-ft (English system)

Notes:

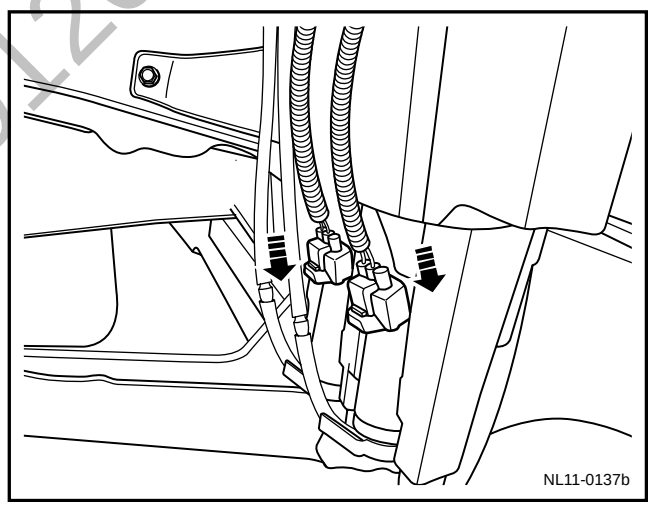
See "important cautions for fastening parts".



4. Connect the washing fluid hose to the washing fluid motor.



5. Connect the harness connectors of the front and rear washing fluid motors.



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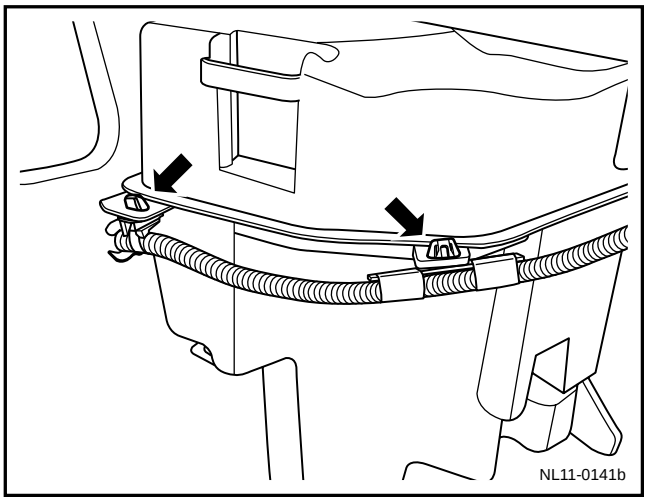
6. Fix the harness on the washing fluid reservoir.
7. Install the front right fender lining plate.
8. Connect the battery negative cable.



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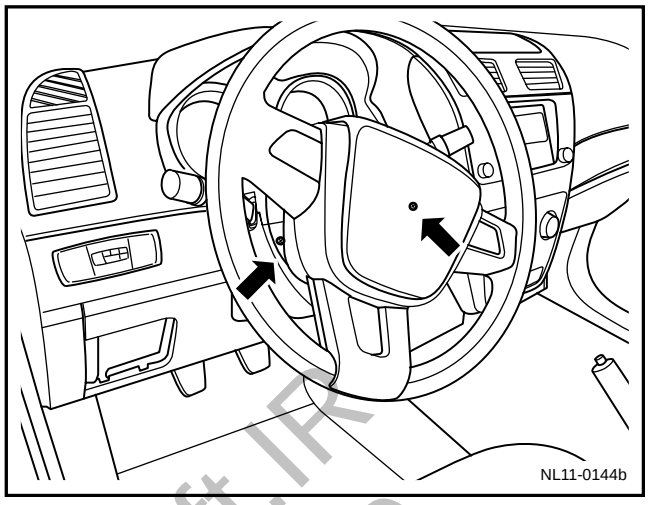
11.6.8.9 Replacement of wiper and washer switch

Dismantlement procedure

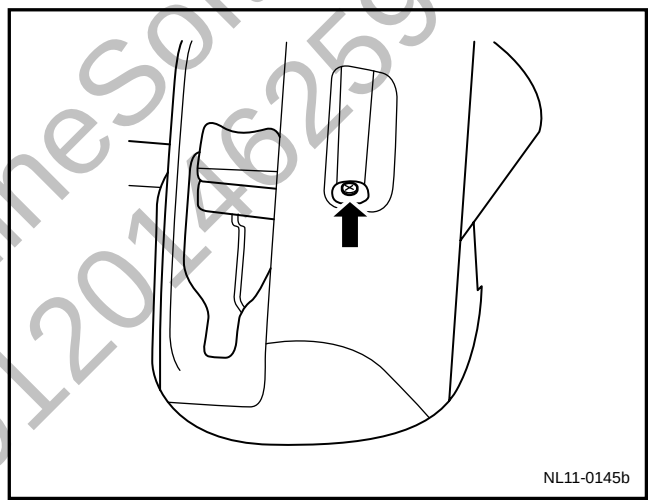
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

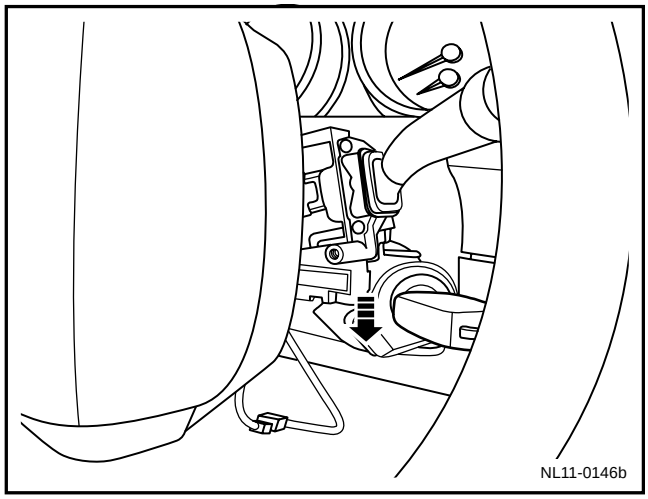
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Turn the steering wheel and dismantle the upper and lower steering column shield panel retaining screws.



3. Dismantle the lower steering column shield screw.
4. Remove the steering column upper and lower shield panels.



5. Disconnect the wiper switch harness connector.



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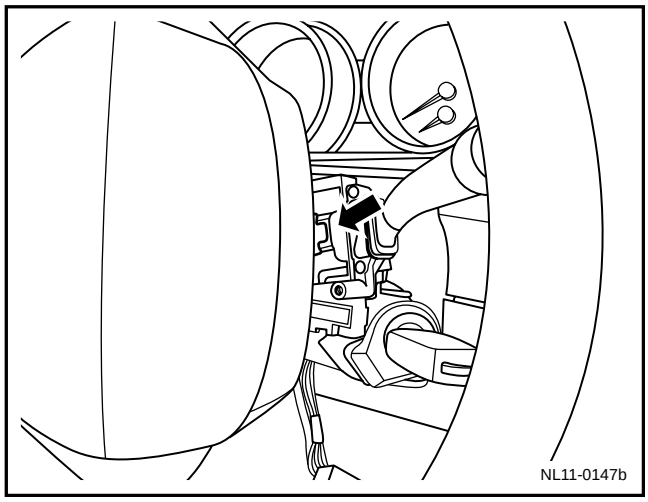
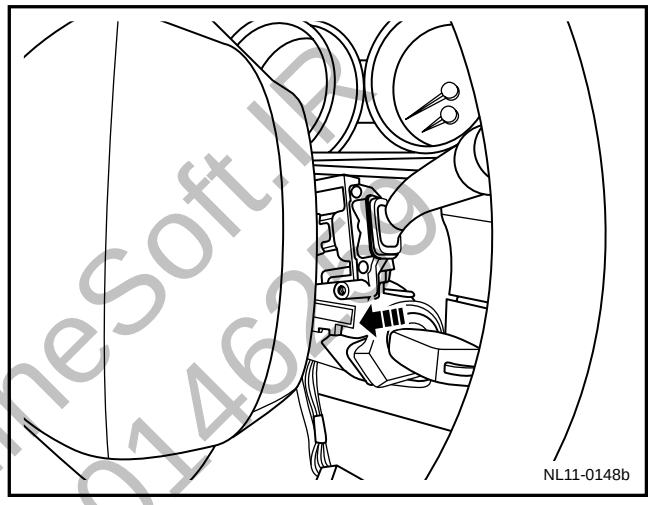
6. Press the switch tongue at the top to dismantle the wiper switch.
7. Dismantle the wiper switch.

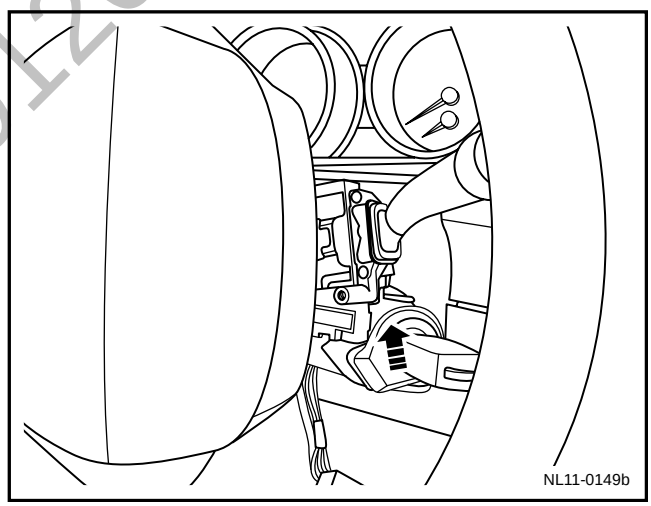


Installation procedure:

1. Install the wiper switch into the switch housing.



2. Connect the wiper switch harness connector.



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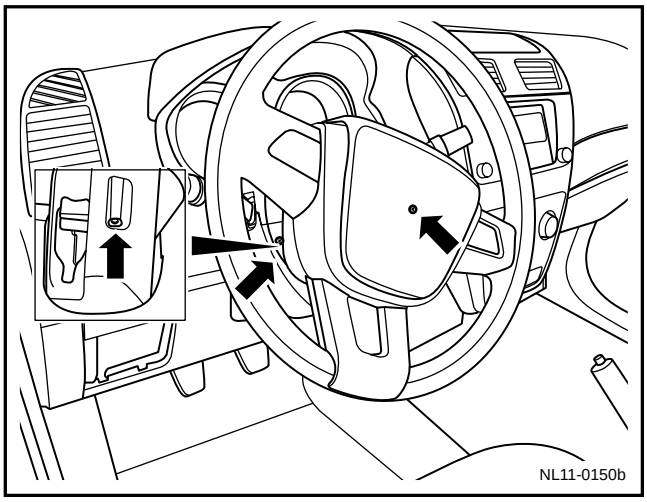
3. Install screws of upper, lower steering column cover plate.

Torque: 8.8Nm (Metric) 6.5 lb-ft(English system)

Notes:

Refer to "important cautions for fastening parts".

4. Connect the battery negative cable.



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11.6.8.10 Replace wiper motor

Dismantlement procedure

Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

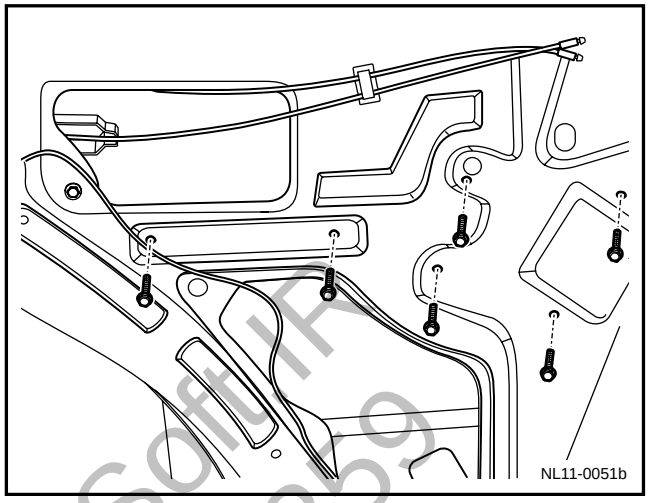
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.

2. For dismantling of wiper piece, refer to 11.5.8.1 replacement of non-bone wiper piece.

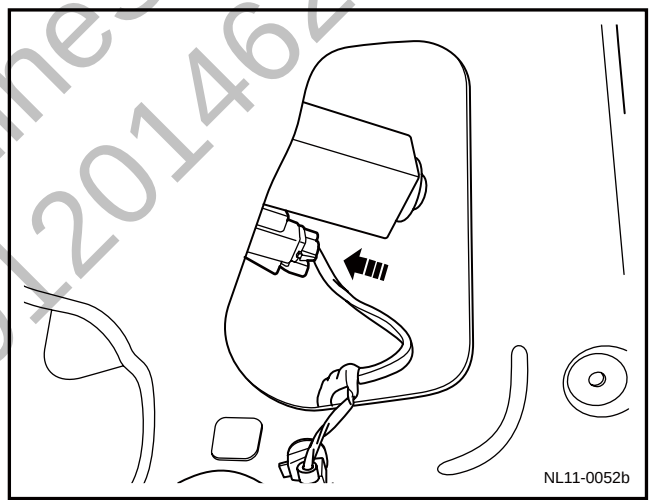
3. For dismantling of wiper arm, refer to 11.5.8.2 replacement of front wiper arm.

4. Dismantle the ventilation cover plate. Refer to 12.10.1.3 Replacement of ventilation cover plate.

5. Disconnect the wiper motor harness connector.



6. Dismantle the fixing bolts of wiper connecting rod.



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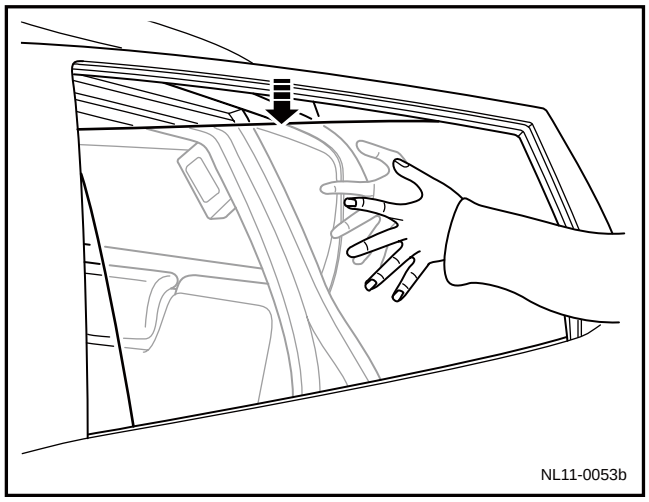
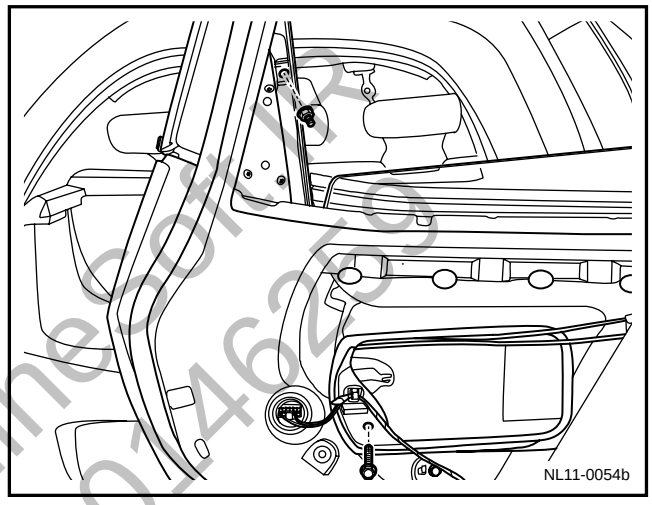
7. Extract the wiper connecting rod and motor assembly.



8. Remove the wiper motor bolt and nut.



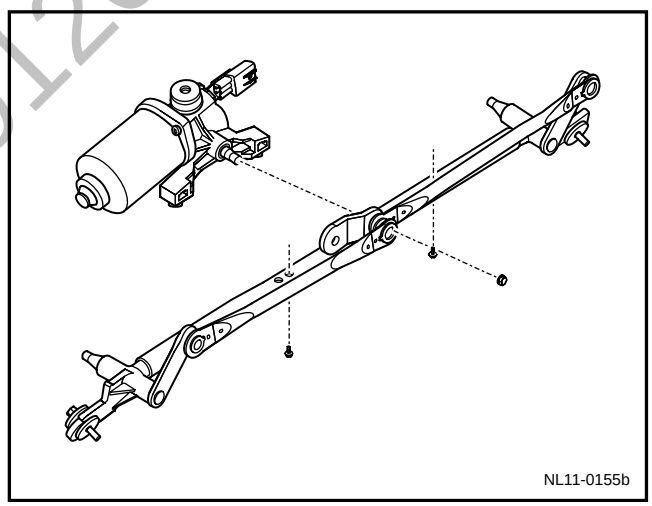
Installation procedure:

1. Install wiper motor and tighten bolt and nut.

Notes:

See "important cautions regarding fastening parts" in "warnings and cautions".

Torque: 8Nm(Metric) 6lb-ft(English system)



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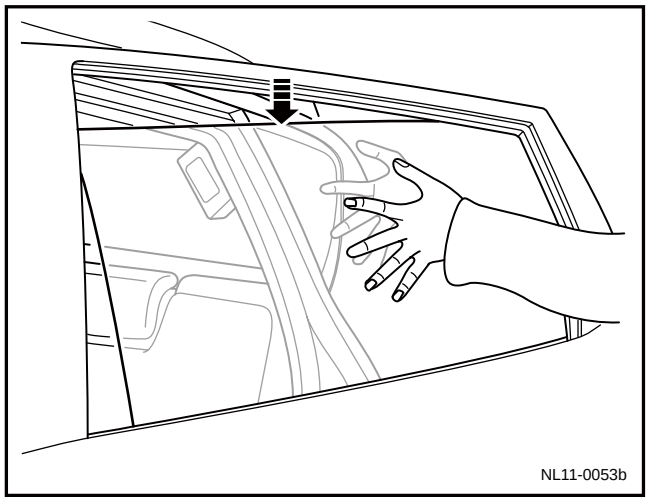
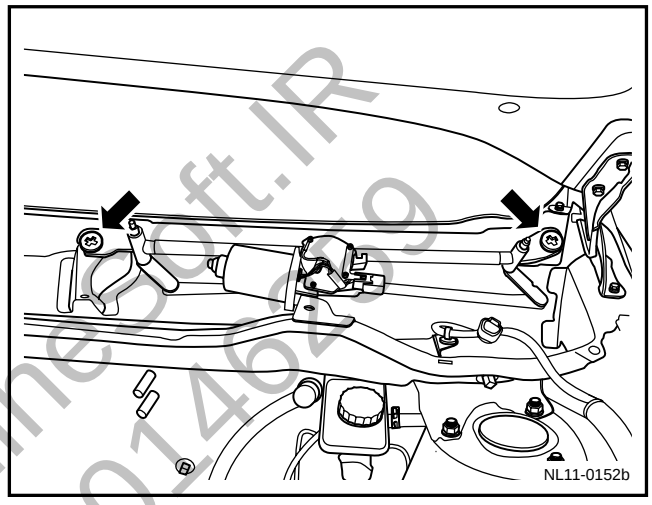
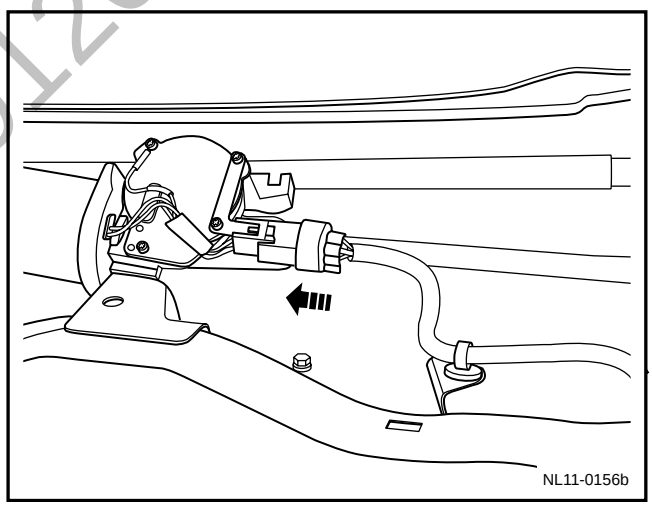
2. Install wiper connecting rod with motor assembly into U groove.



3. Install and tighten fixing bolt of wiper connecting rod.



4. Connect the wiper motor harness connector.
5. Install the ventilation cover plate.
6. Install the wiper arm.
7. Install the wiper blade.
8. Connect the battery negative cable.



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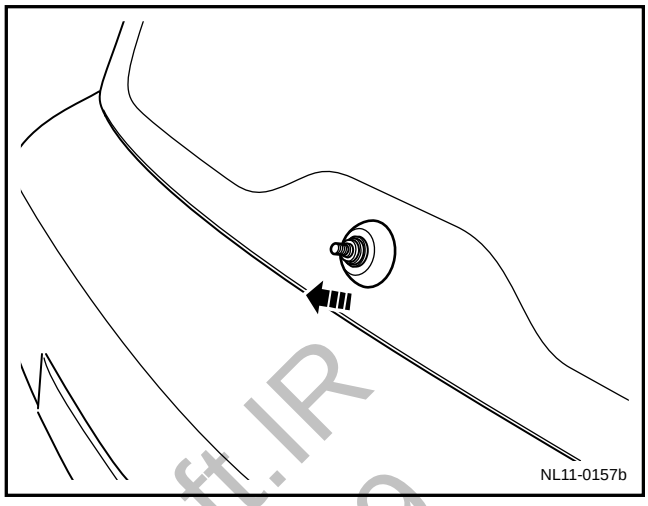
11.6.8.11 Replacement of rear wiper motor

Dismantlement procedure

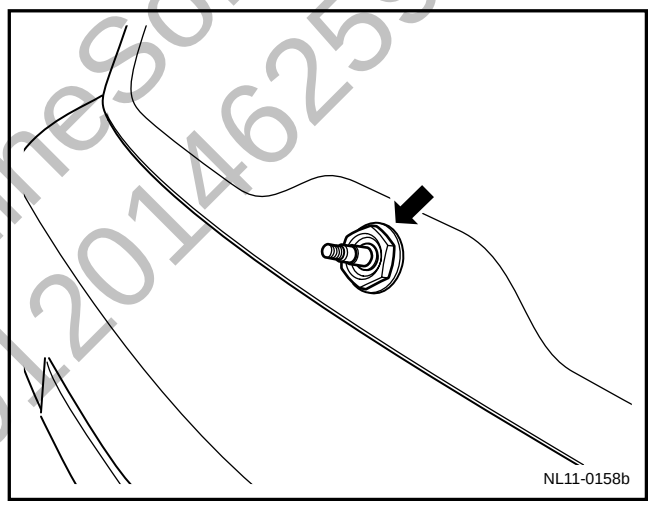
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

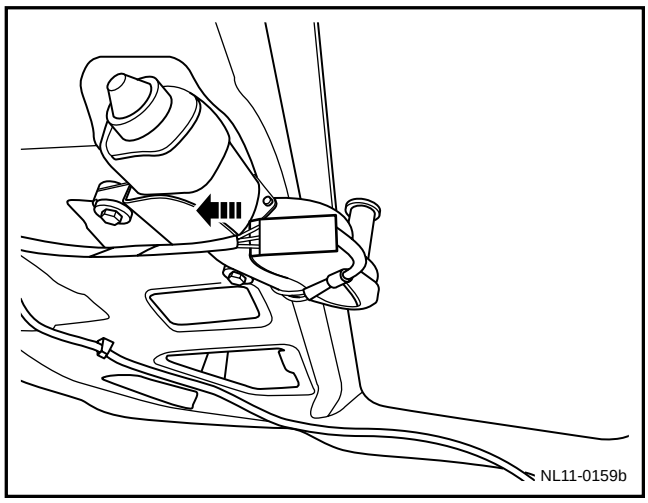
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle rear wiper piece.
3. For dismantling of rear wiper arm, refer to 11.5.8.3 Replacement of rear wiper arm.
4. Remove the external fixing nut cap of the rear wiper motor.



5. Remove the external fixing bolt of the rear wiper motor.



6. For dismantlement of rear back door internal trim panel, see 12.9.1.10 Replacement of Back Door Trim Panels.
7. Disconnect the rear wiper motor harness connector.



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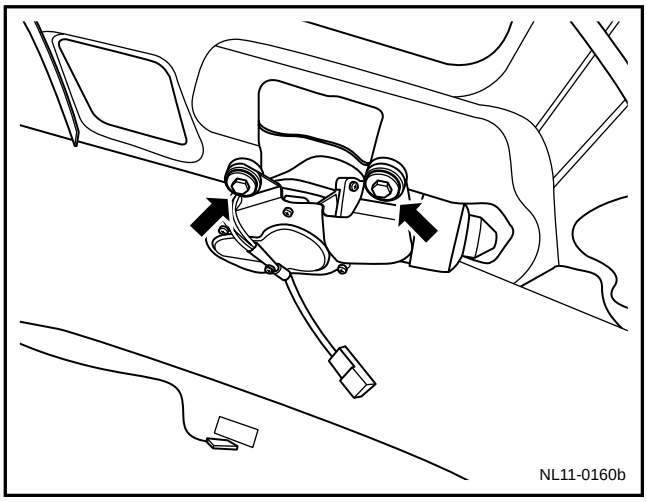
8. Dismantle the fixing bolts of rear wiper motor.
9. Dismantle the rear wiper motor.



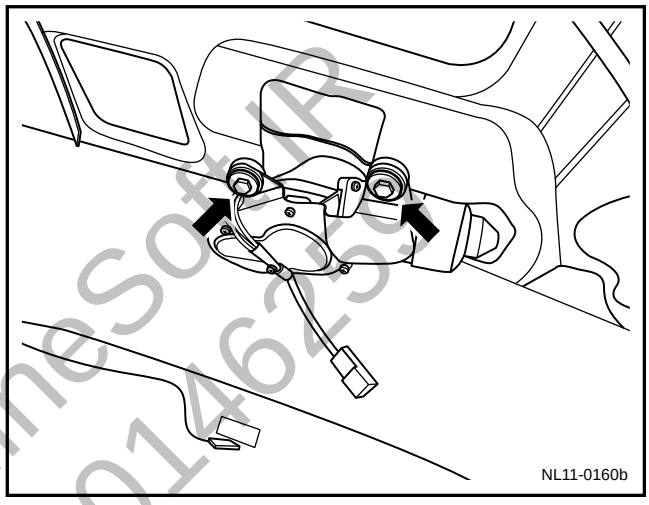
Installation procedure:

1. Install rear wiper motor and tighten bolt.

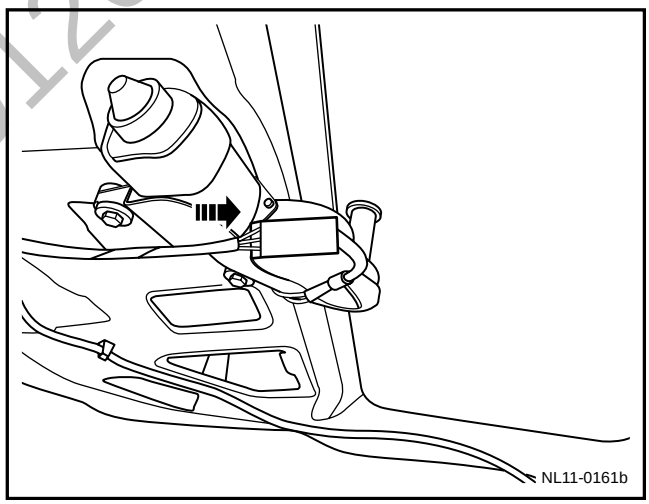
Notes:

See "important cautions regarding fastening parts" in "warnings and cautions".

Torque:10Nm(Metric) 7.4lb-ft(English system)



2. Connect rear wiper motor wire harness connector.
3. Install inner trimming plate of back door.



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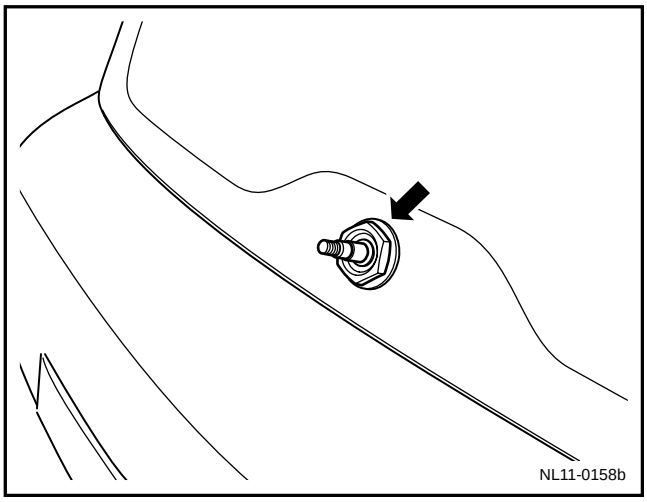
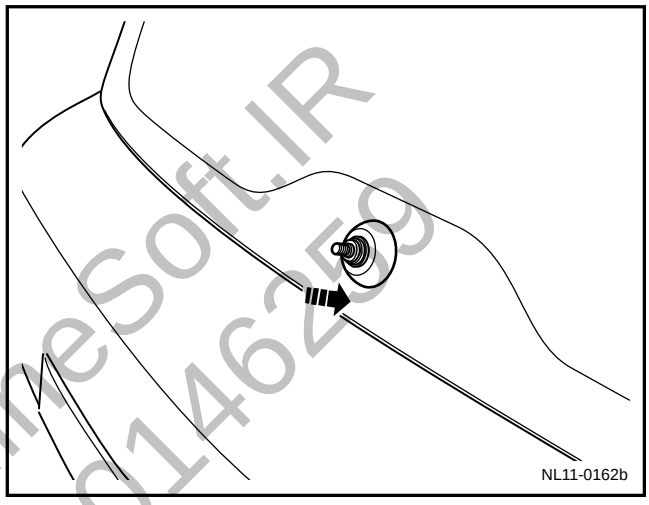
4. Install and tighten fixing nut outside rear wiper motor.

Torque:10Nm(Metric) 7.4lb-ft(English system)



5. Install the external fixing nut cap of the rear wiper motor.
6. Install the rear wiper arm.
7. Install the rear wiper blade.
8. Connect the battery negative cable.



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11.7. Instrument

11.7.1 Specification

11.7.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N.m)	English system (lb-ft)
Instrument assembly self-tapping screws	ST4.8×16	4-6	3-4
Multi-function Instrument Assembly Self- Tapping Screws	ST4.2×9.5	2-4	1-3

11.7.1.2 Indicator descriptions

There are 26 warning lamps altogether in the combination instrument to supply warning or hint message for the user.

Lamp symbols	Indicator	Color	Remarks:
	Engine oil pressure warning light	Red	
	Charging warning light	Red	
	Engine malfunction indicator	Yellow	
	Driver seat belt not tied warning lamp	Red	
	Airbag fault warning lamp	Red	
	Headlamp high beam indicator	Blue	
	Front fog lamp indicator	Green	

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	Rear fog lamp indicator	Yellow	
	Position lamp indicator lamp	Green	
SVS	Engine locking system warning lamp	Yellow	
	Fuel level too low warning lamp	Yellow	
	Engine overheating warning lamp	Red	
	Abs failure warning lamp	Yellow	
EBD	EBD malfunction warning lamp	Yellow	
	Hand brake warning lamp	Red	
	Brake failure / brake fluid low warning lamp	Red	
	Left steering indicator	Green	
	Right turn signal light	Green	
	Body electronic stability system	Yellow	JLD-4G24 /JLD-4G20
	Four-wheel drive lock	Green	JLD-4G24 /JLD-4G20

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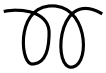
	Low beam(+)	Green	JLD-4G24 /JLD-4G20
	Engine anti-theft system	Red	JLD-4G24 /JLD-4G20
4WD	4wd system failure	Red	JLD-4G24 /JLD-4G20
	Preheating wire indicator	Yellow	JLD-4G24 /JLD-4G20
	Oil-water seperation	Red	JLD-4G24 /JLD-4G20
	Main warning light （CAN system）	Yellow	JLD-4G24 /JLD-4G20

The multifunctional instrument is provided with a total of 3 warning lamps to provide warning or prompt message to the user.

Lamp symbols	Indicator	Color
	Tire pressure warning lamp	Yellow
	Unsecured warning lamp of auxiliary safety belt	Red
TPMS	Tire pressure management system fault indication lamp	Yellow

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11.7.2 Description and operation

11.7.2.1 Display

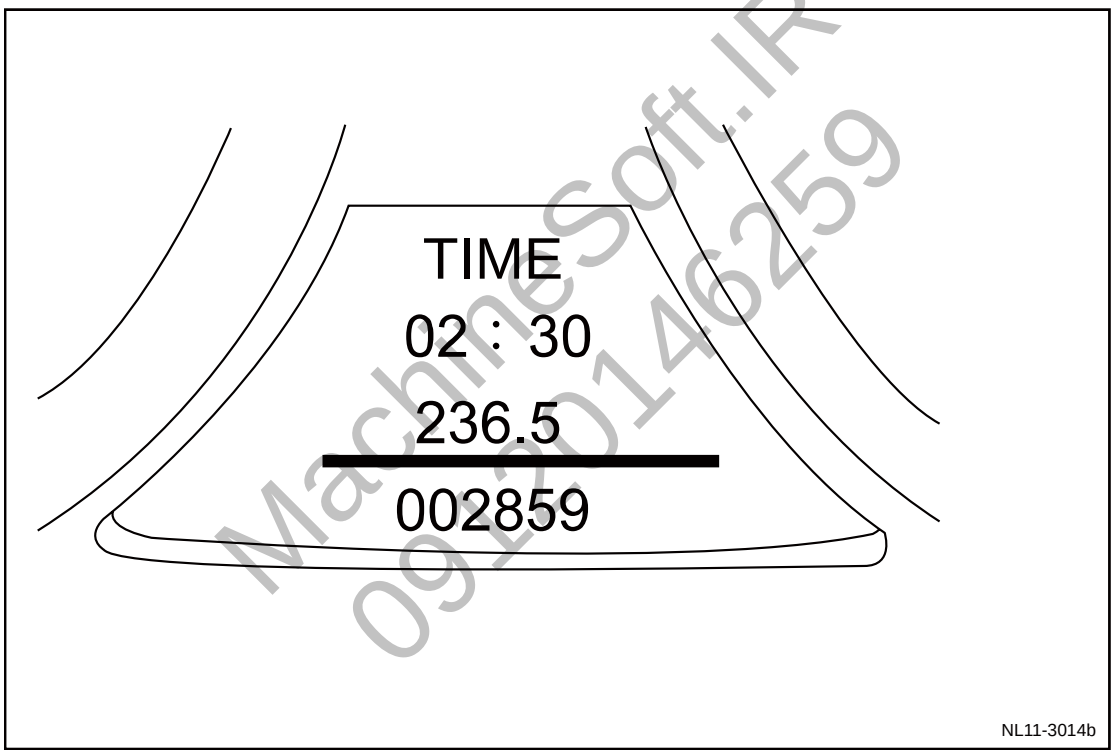
There is an LCD display screen on dashboard and installed on the main dashboard.

LCD Default display: traveling hours, mileage subtotal and mileage total One line of the middle display the subtotal mileage, driving time, average speed and actual service life in turn through pressing the mode switching key; and the lower line display the total mileage. See the figure below:

Subtotal mileage display

The subtotal odometer displays total mileage after reset subtotal mileage last time or the battery power failure. The range is from 0km to 999.9km. The value of the subtotal mileage is only stored in RAM. If the supplying power is failure (not the ignition supply power but battery supply power), the value of the subtotal mileage will be reset to zero.

When the subtotal mileage reaches the maximum value, the numerical value will automatically return to zero, and it can return to zero through a Disp key at any time.



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– Subtotal mileage will be shown in LED display in default form.

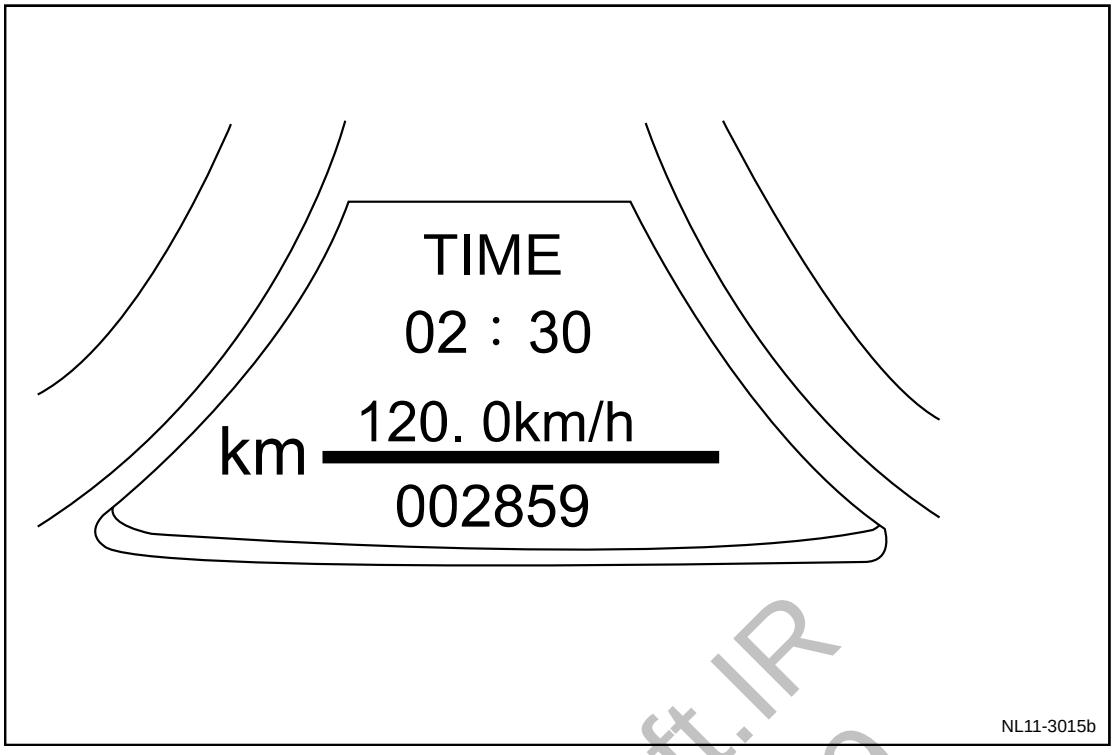
– Displaying range of subtotal mileage should be 0.0-999.9km.

– Not display Max.height “0” except for 0.0-0.9 km

– Update interval of subtotal mileage LED display is 0.1km, and the update frequency will not exceed 1/s.

Average speed display

The average speed is calculated base on the travel mileage and total travel time during running the engine. The display value is refreshed once every 10s.



The average speed algorithm shall meet:

– The status of ignition switch will not affect the calculation of average vehicle speed. After the ignition switch is turned off, average vehicle speed will not be cleared automatically.

– Average speed can be calculated only when the oil consumption pulse signal is effective.

– After pressing reset button (not less than 1.5s), average vehicle speed should be cleared (meanwhile, it will be automatically cleared during traveling condition).

– When average speed is cleared, the traveling mileage must also be cleared.

Actual service life

After the vehicle drives for 500 meters, display. According to the fuel oil quantity retaining in the oil tank and the fuel consumption in the past, estimate the running mileage.

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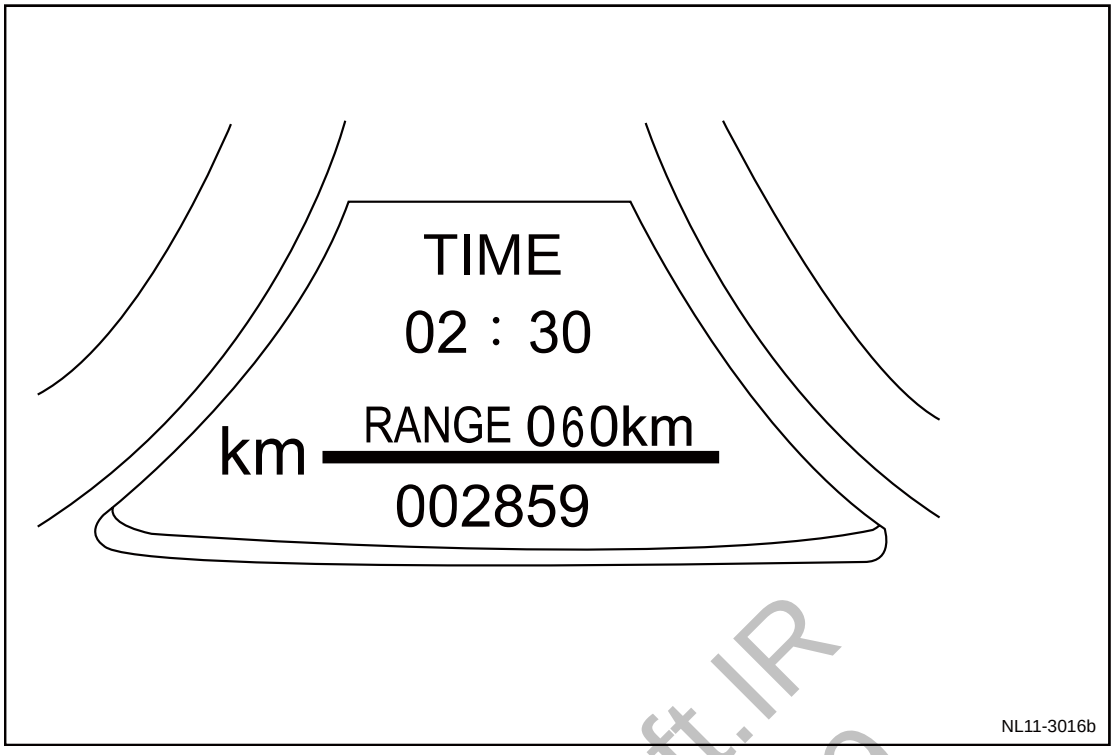

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– Symbol to display possible mileage by residual oil in oil tank is range.

– Displaying range of possible mileage produced by residual oil in oil tank should be 0-999km.

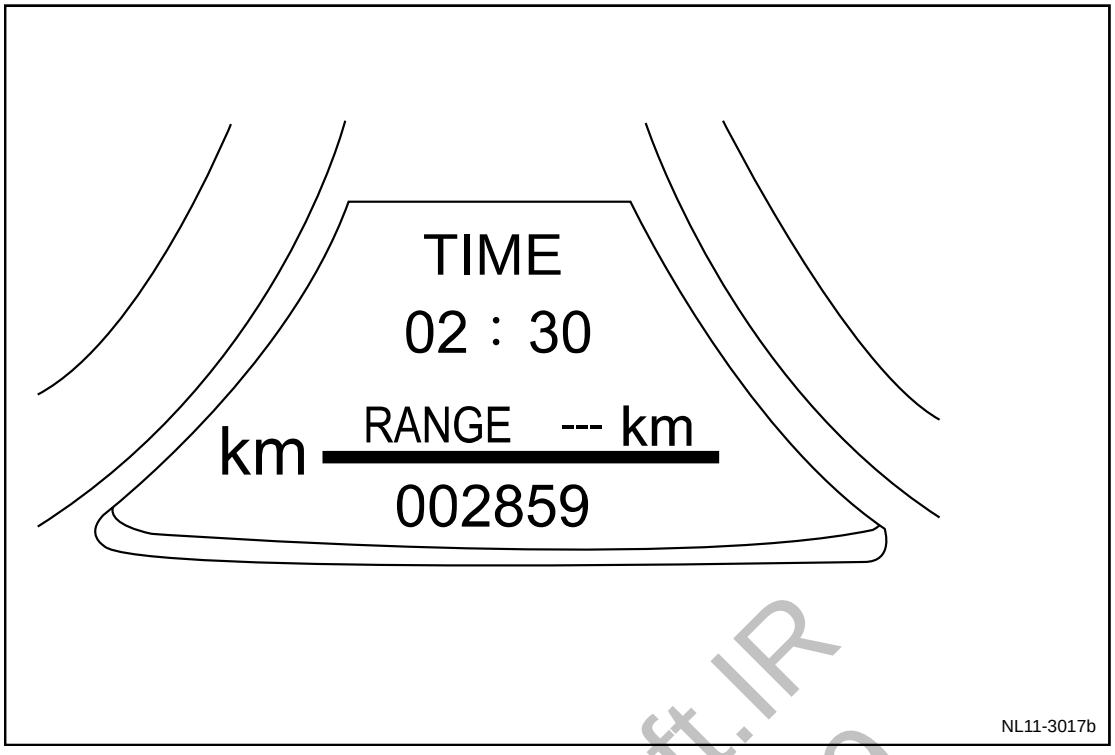
– Not display Max.height“0”.

– Update frequency of display of possible mileage produced by residual oil in oil tank will be once 5s (Range_Refresh)

– When connecting to the battery for the first time or after reset, it should display “---km” until the instrument begins to calculate average oil consumption.

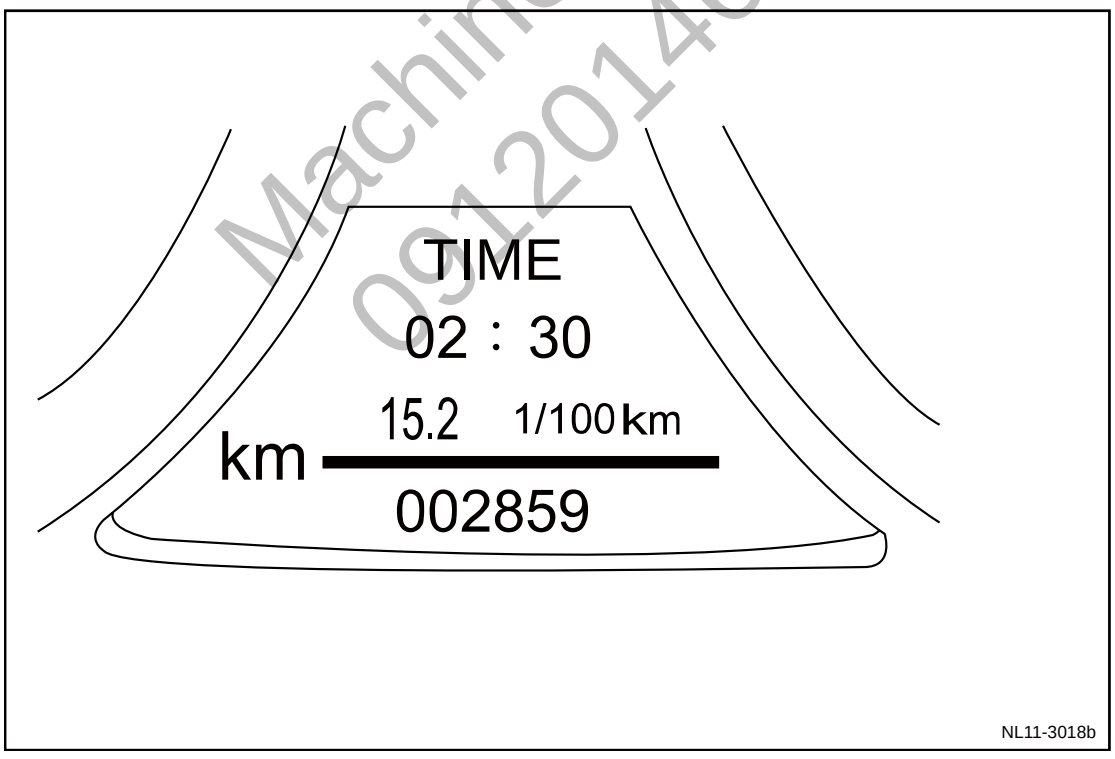
– After the vehicle travels 500m, available mileage will be shown on the screen. When residual oil in oil tank can make the vehicle travel less than 50km (Fuel_Range_Warning), it should display “—km”.

It is as shown in fig when the vehicle runs within 500 meters or the driving mileage is smaller than 50 kilometers.



Average fuel consumption

The average fuel consumption is calculated based on the driven distance and the total amount fuel consumed at the time of rotating the engine. After fueling up at every turn, automatically reset the display value.



The instrument shall calculate the average fuel consumption according to the fuel injection pulse signal output by the engine management module and the speed pulse signal output by the speed sensor.

– Average oil consumption will be displayed within the range of 0.1-99.9 L/100km.

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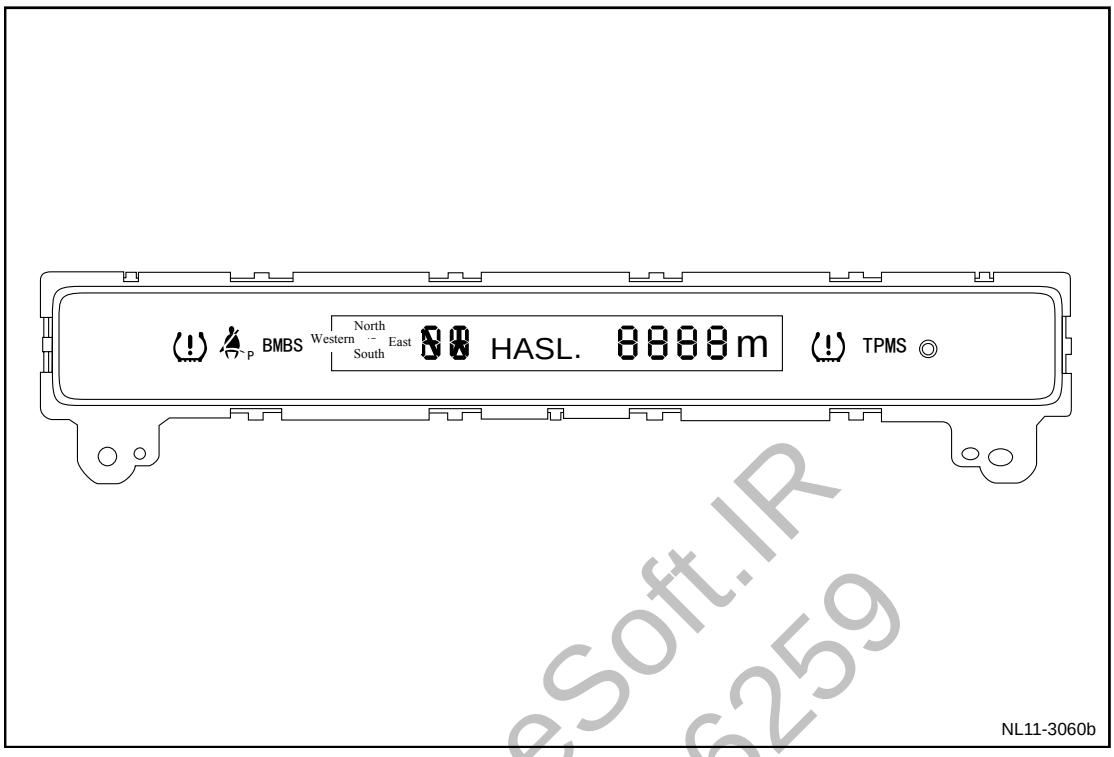
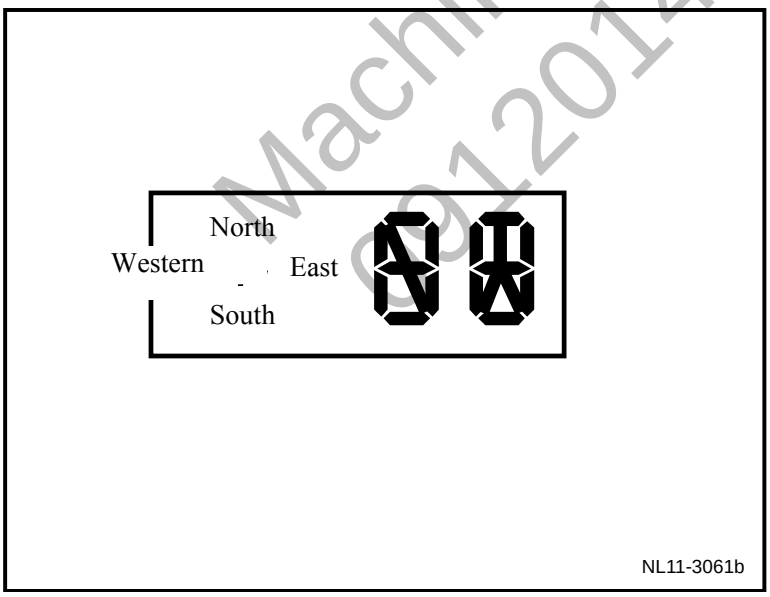
– Not display Max.height “0” except for 0.0-0.9 L/100km

– Update frequency of display of oil consumption will be once 10s.

The multifunctional instrument can display a compass and altitude.



Compass



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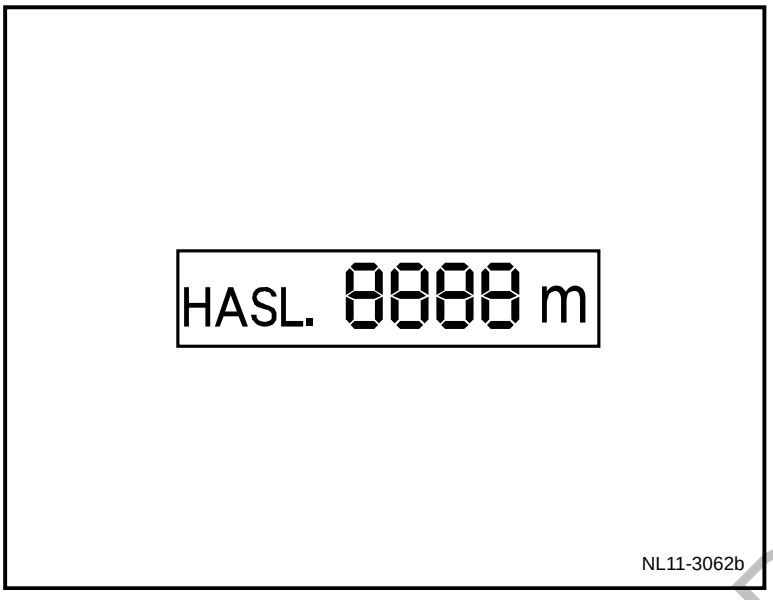
Altitude



- The compass totally points at 8 directions (east, south, west, north, southeast, southwest, northeast, northwest).
- Angle range in each range is 40 degree, and there is 5 degree of transition area between adjacent direction. Display the corresponding font in the corresponding direction.
- Its function display: it mainly depend on magnetic sensors to come true
- Altitude height display range is -100-5000m.
- Near-surface resolution is 10-20m.
- Not display Max.height“0”.

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11.7.2.2 Odometer display mode switch

The LCD can display 4 different types of values in the middle rows of the right area, including mileage subtotal, traveling hours, average speed and available mileage. The above mentioned values can be switched by pressing the mode switching button (see "11.7.4 Component Positions"). Only after engine ignition, the mode key changing-over and zero clearing key operation can be used.

Short press the DISP key, the area corresponding to LCD displays the switching as follows:

Sub-mileage - average speed - driving mileage - average fuel consumption after refueling.

Long press the DISP key:

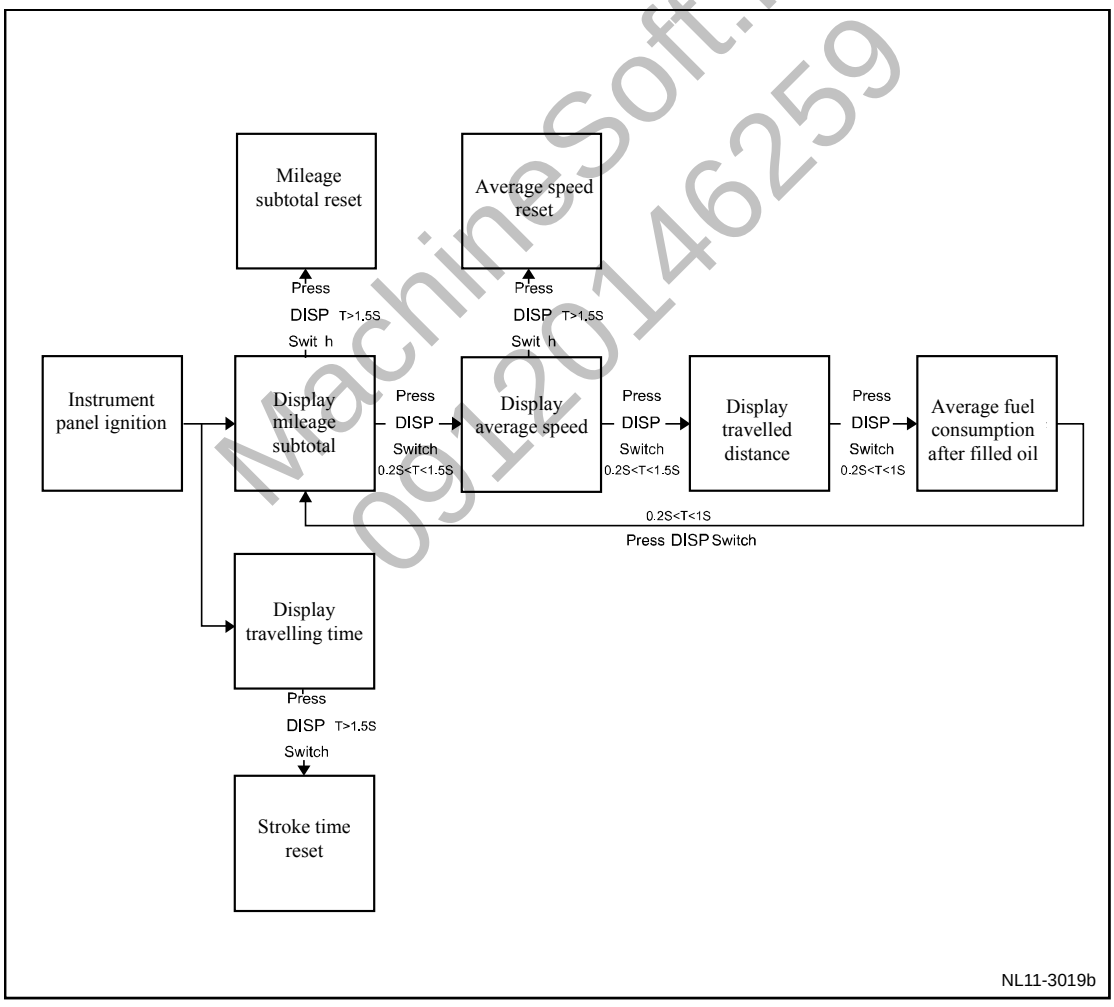
– When displaying subtotal mileage, the subtotal mileage will be cleared.

– When displaying average vehicle speed, average vehicle speed will be cleared with speed at the same time during traveling.

– Fuel consumption displays L/100km as per hundred kilometers

– Press ignition button for 60s, when traveling, it display 00:00.

Mode switching logic is as shown in figure as follows:



The main LCD defaults the mode of displaying subtotal mileage in the case of flameout; and the mode can not be switched. When igniting the engine again, the main LCD will display the ignition mode last time.

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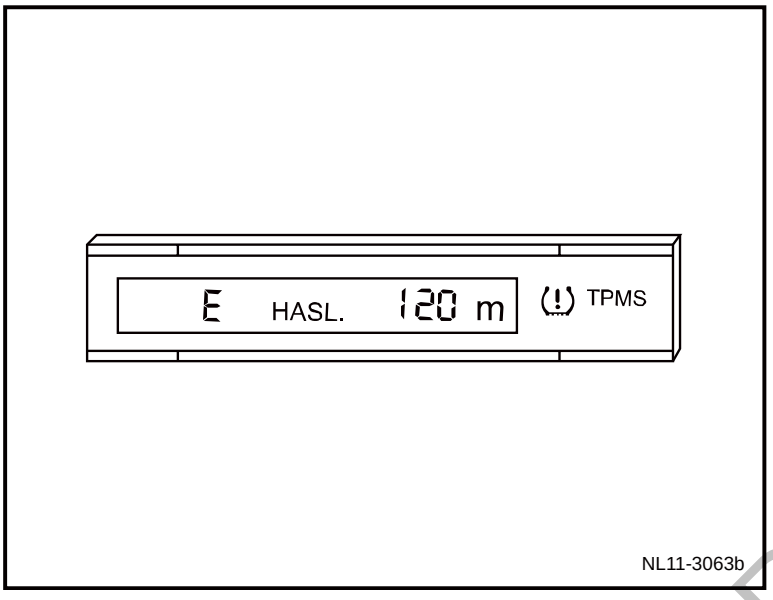
Altitude adjustment



Regulate the single digit by short press, regulate by long press and confirm by short press again. Then, regulate the tens digit by short press, regulate by long press and confirm by short press again, and so forth. The OK status is by default when the button is not long pressed.

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11.7.3 System work principle

11.7.3.1 System operating principle

Lightening:

Lighting color:

Function	Day	Night
Pointer	Red(632nm, Lighted)	Red(632nm, Lighted)
Plate dial/number white	Color/white	White/white
Back through lighting	White	White
Alarm light	Green, red, blue, yellow	
LCD-negative polarity, white on black.	White	

Lighting logic:

Ignition signal	Position lamp signal	LCD, pointer and dial plate illumination.
Close:	Close	Close
Open:	Close	Open
Close:	Open	Close
Open:	Open	Open (backlight darken 1 level)

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Warning lamp control

The following warning lamp is directly controlled by the hardware:

High-beam and lower-beam lamp indicator

– Charging warning lamp

– Tire-pressure warning lamp

– Parking brake indicator

– Indicator lamp of tire pressure management system fault

– Oil pressure warning lamp

Buzzer

Buzzer function

In the following five cases, the buzzer will beep to remind the driver of corresponding warning information. The tone frequency parameter of the buzzer is stored in EEPROM.

Function	Triggering conditions
Alarm against Unremoved Ignition Key	When the ignition switch is under the state of ACC or OFF, the key is not pulled out of, and the left front door is opened,
Unsecured warning of safety belt	Driver's safety belt pill reminder signal must include visual signal and audible signal. If the driver does not wear the safety belt, the ignition switch is in position "ON", the above two signals are activated at the same time, wherein the audible signal lasts for 4 s and the visible signal persists in activating state until the safety belt is worn. If the driver does not wear a safety belt, the audible signal is activated for 30s consecutively when the forward running speed of the vehicle exceeds 25 Km/h; if the safety belt is worn within 30s, the visible signal is closed; and if the safety belt is not worn after 30s, the audible signal is automatically closed. After activated, the audible signal is still activated if the speed is lower than 25 Km/h until the safety belt is worn or within consecutive 30 s. When the next speed exceeds 25Km/h, the audible signal is not be activated secondarily regardless of whether the driver wears the safety belt. When the ignition switch is in the position "ON", a visual signal will be under activation state continually until the safety belt of the driver is worn.
Co-driver safety belt unsecured	The signal of the front row of passenger safety belt reminding device is in the form of visual signal and audible signal; meanwhile, the front row of passenger shall have the detection function of the active condition of the seat; if the front row of passenger seat is not ridden by the passenger, the front row of passenger seat monitor sensor does not send out the use signal at this time, and the safety belt reminding device is in close state automatically. If the passenger sits on the front row of passenger seat, the ignition switch is in the position "ON"; if the passenger does not wear the safety belt, the audible signal lasts for 10s; if the safety belt is worn within 10s, the audible signal is closed; and the audible signal is automatically closed after 10s.
Alarm against travelling with door unlocked.	Any one of four doors and two cover is not closed and the speed is higher than 10Km/h, the buzzer beeps three times to remind the driver.
Overspeed Alarm	When the combination instrument speedometer is higher than 120Km/h (allowable error of -1 Km/h), the buzzer beeps; and when the vehicle speed is lower than 115Km/h (allowable error of +1 Km/h), the buzzer stops beeping.
Parking motor warning	The combination instrument prompts according to the distance from the obstacle to the bumper and position information provided by the parking

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	radar head unit.	
	The distance between the obstacle and the vehicle	Sound frequency
	800mm-1400mm	2Hz
	300mm-800 mm	4Hz
	0mm-300mm	Longly sounding
Light does not close the warning.	When the ignition switch is under the state of ACC or OFF, the position lamp turns on, and the left front door is opened,	

Buzzer priority

When the alarm functions of the multiple buzzers exists at the same time, the high-priority alarm will be activated preferentially; and if a higher-priority alarm function is generated when the lower-priority alarm function is performed, the lower-priority alarm function will be activated again after the higher-priority alarm function is completed. The buzzer warning function priority is as follows:

Alarm against travelling with door unlocked＞alarm against unfastened seat belts (main and auxiliary)>prompt of unremoved ignition key>prompt of forgeteting to turn off the clearance lamp.

Seat belt alarm

At any time after ignition, the corresponding alarm lamp turns off unless the safety belt of the driver or the co-pilot is worn. Self-check

After the ignition switch is switched on, 2 LED warning lamps turns on under the software control to ensure the normal operation of the LED. These warning lamps are as follows:

– Coolant high temperature alarm lamp:

LED turns on for 3 minutes for self-check after the ignition switch is switched on.

– Low fuel warning lamp:

LED turns on for 3 seconds for self-check after the ignition switch is switched on.

When the engine speed is higher than 300rpm, self-inspection will be broken.

Scale

After flameout, the pointers of all scales return to the zero position of the dial plate.

Speedometer

Speedometer	Special stepping motor
Deflection angle:	240/degree
Input signal to speedometer.	The vehicle speed signal comes from the vehicle speed sensor.
Corresponding output pulses per revolution of	4

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sensor	
The highest level output	Min.high battery Vcc-0.5V
The lowest level output	Max. low level 0.5V
Duty ratio	50±12%
Max.drive current	25mA

The speedometer acquires the speed signal via the signal sent by the vehicle speed sensor.

Engine speed indicator

Revolution meter input signal: the revolution speed signal is from a square-wave pulse signal given by the ECM.

The corresponding value of the revolution speed and the frequency:

Revolution speed r/min	Frequency Hz
1000	33.3
2000	66.7
3000	100
4000	133.3
5000	166.7
6000	200
7000	233.3

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Fuel gauge

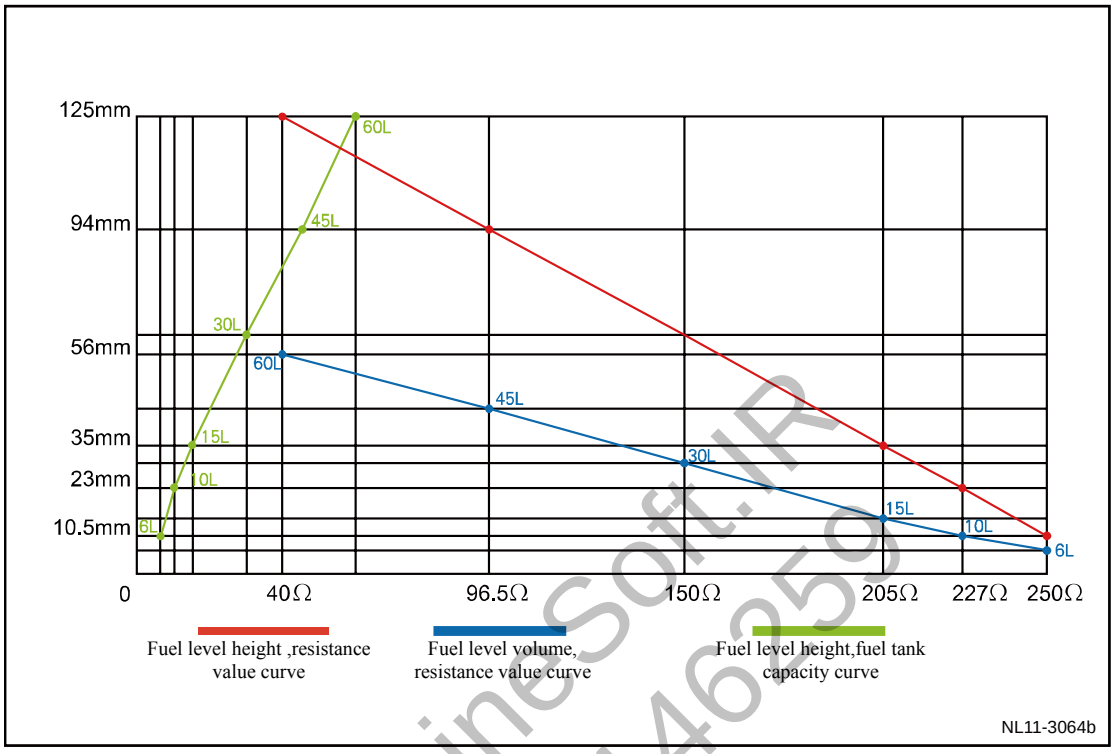
Fuel gauge input signal: it is from thick-film resistor sensor. One end is connected with the sensor ground.

The fuel level sensor resistance parameters are recommended as follows:

Capacity:	Capacity	Resistance
Full	60L	40±4Ω
3/4	45L	96.5±5Ω
1/2	30L	150±5Ω
1/4	15L	205±6Ω

Alarm	10L	227±6Ω
Empty	6L	250±7Ω

Sensor resistance-capacity curve parameteric chart



When the oil quantity value reduced exceeds between the alarm set zone, the alarm lamp turns on if the fuel oil level is too low.

Engine coolant temperature gauge

The engine coolant temperature signal is from the water temperature sensor.

Temperature ℃	Instrument	Resistance (Ω)
60	C	164.5
70	-	-
80	-	-
90	1/2	59.4
100	-	-
105	-	-
110	-	-
115	H	29

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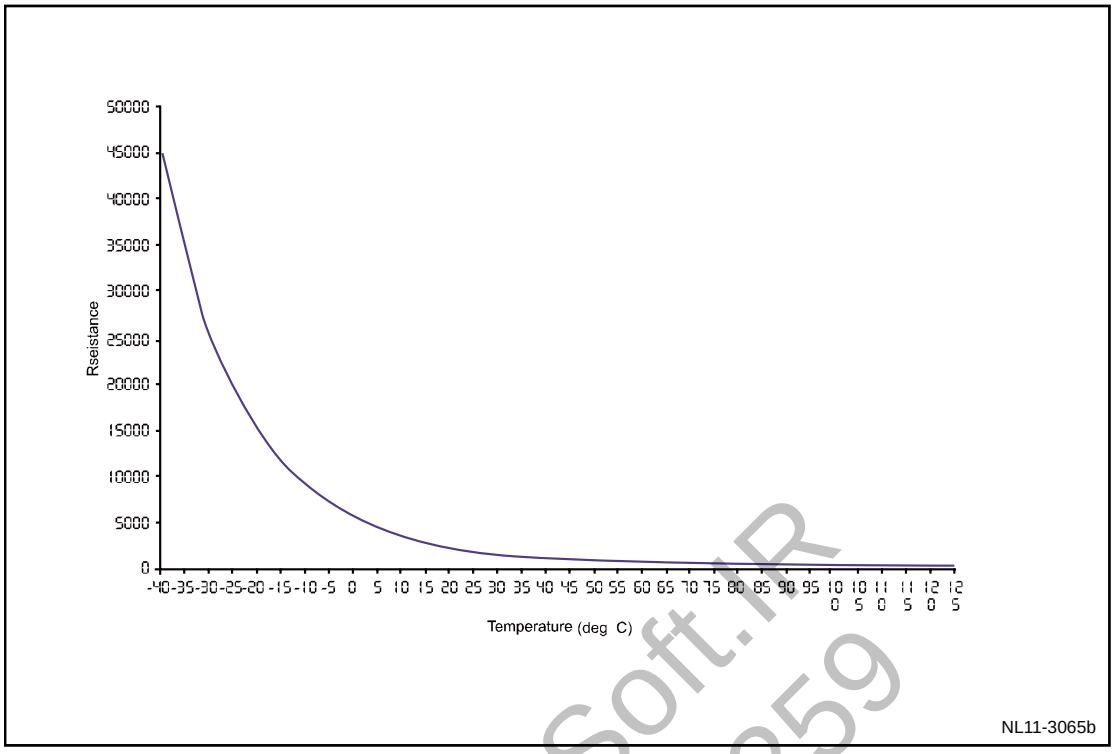
120	-	25



The detailed alarm strategy refers to the following table:

Previous alarm status	Temperature T (℃)	Next state
No high temperature alarm	T≥115	There is high temperature alarm.
There is high temperature alarm.	T<105	High-temperature alarm is released.

Door switch state display

When the door is not closed, the engine hood is opened and the trunk is opened, the body displays together with the corresponding signal so long as one of the above signals exists; otherwise, the body does not display when there is no signal.

When any one of doors, trunk or engine hood is opened, the LCD corresponds to the door opening state; and when the opening state is released, automatically restore the fault state.

When any information in the function is present, automatically regulate to this screen.

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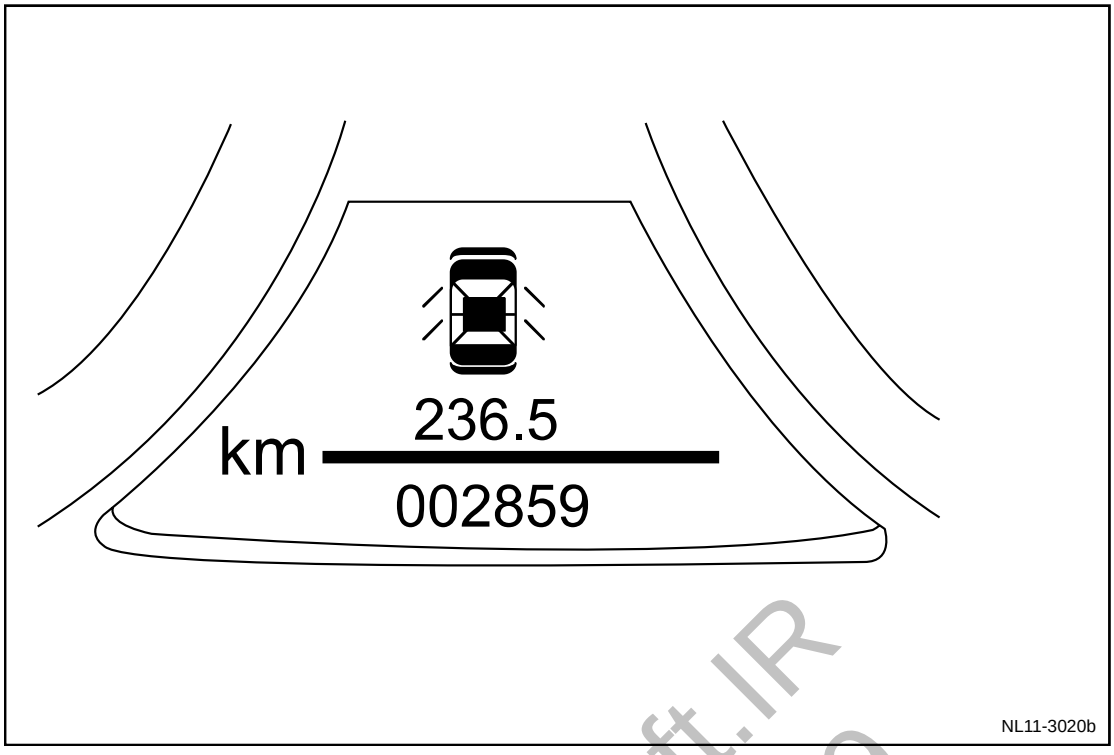

Compass

The multifunctional instrument detects the direction of travel of the vehicle.

Altitude

The multifunctional instrument detects atmospheric pressure through the pressure sensor to calculate the altitude through the atmospheric pressure detected.

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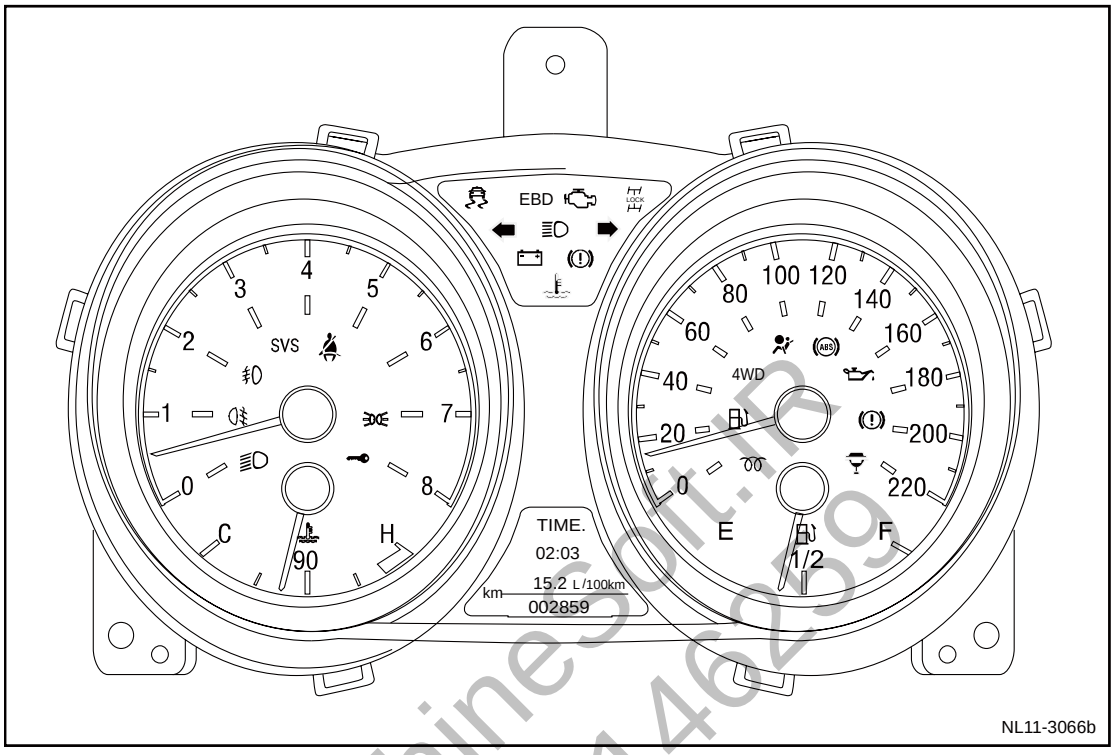
11.7.4 Part position

11.7.4.1 Component position

JL4G18-E

Instrument front end (warning lamp and scale)



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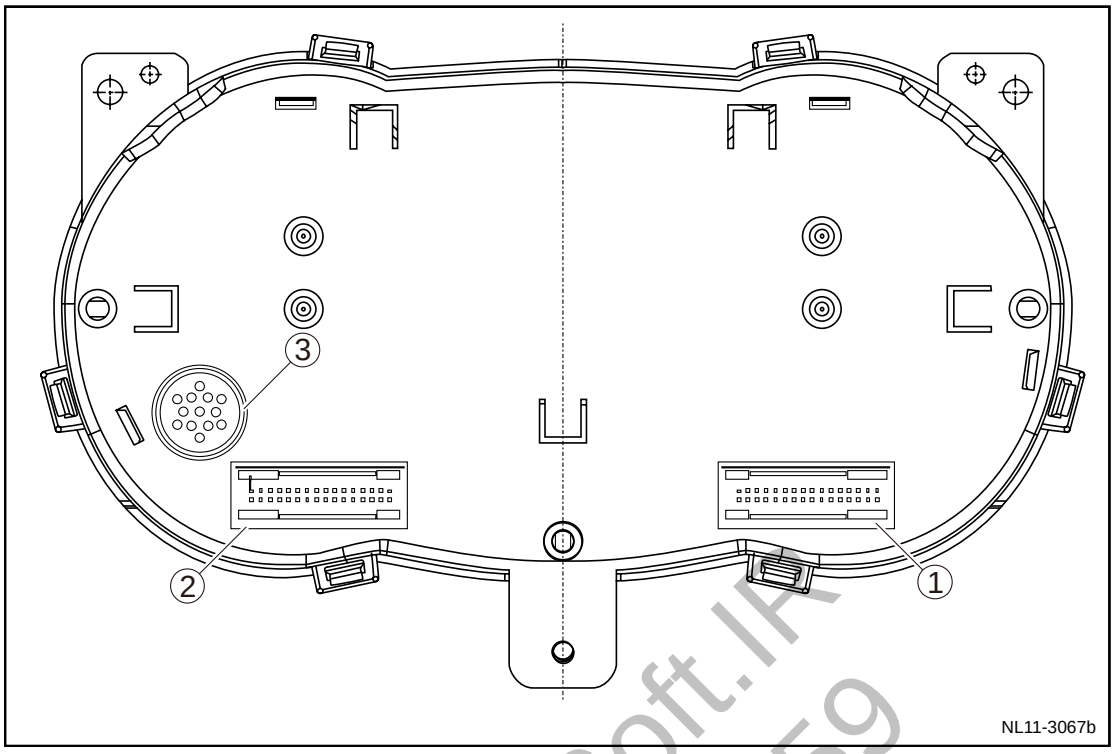
Rear end of instrument



1. Instrument cluster harness connector (32 pin, green)
2. Combined instrument wire harness connector (32pin, blue)
3. Buzzer

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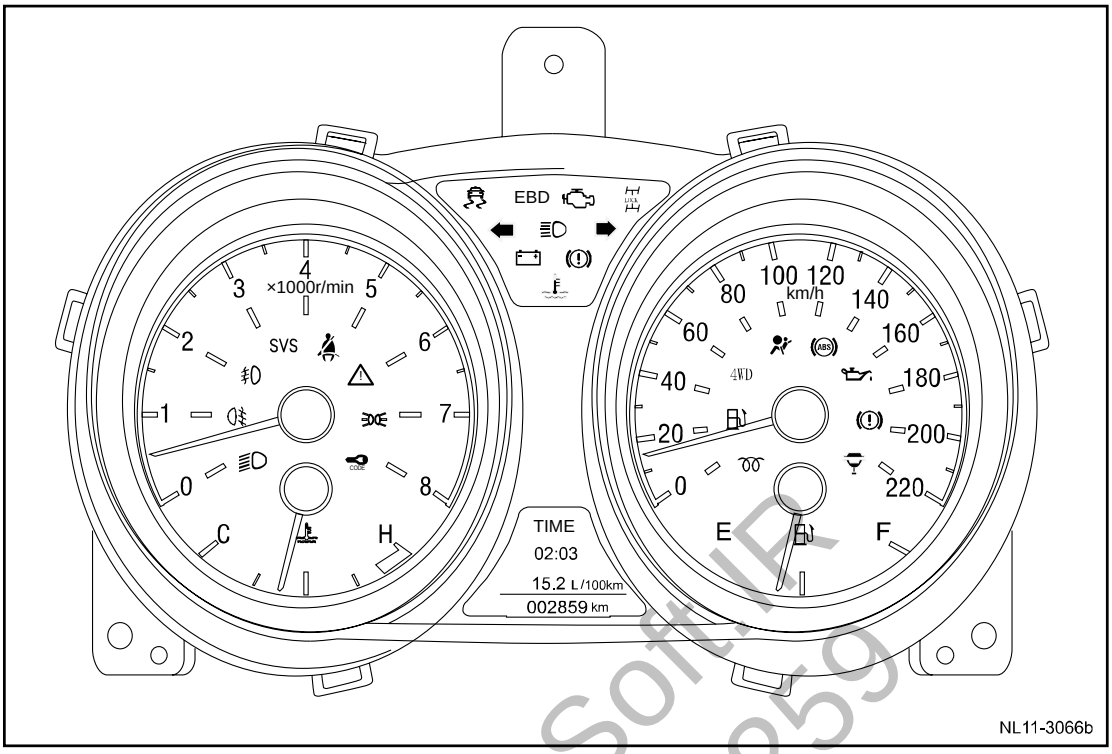
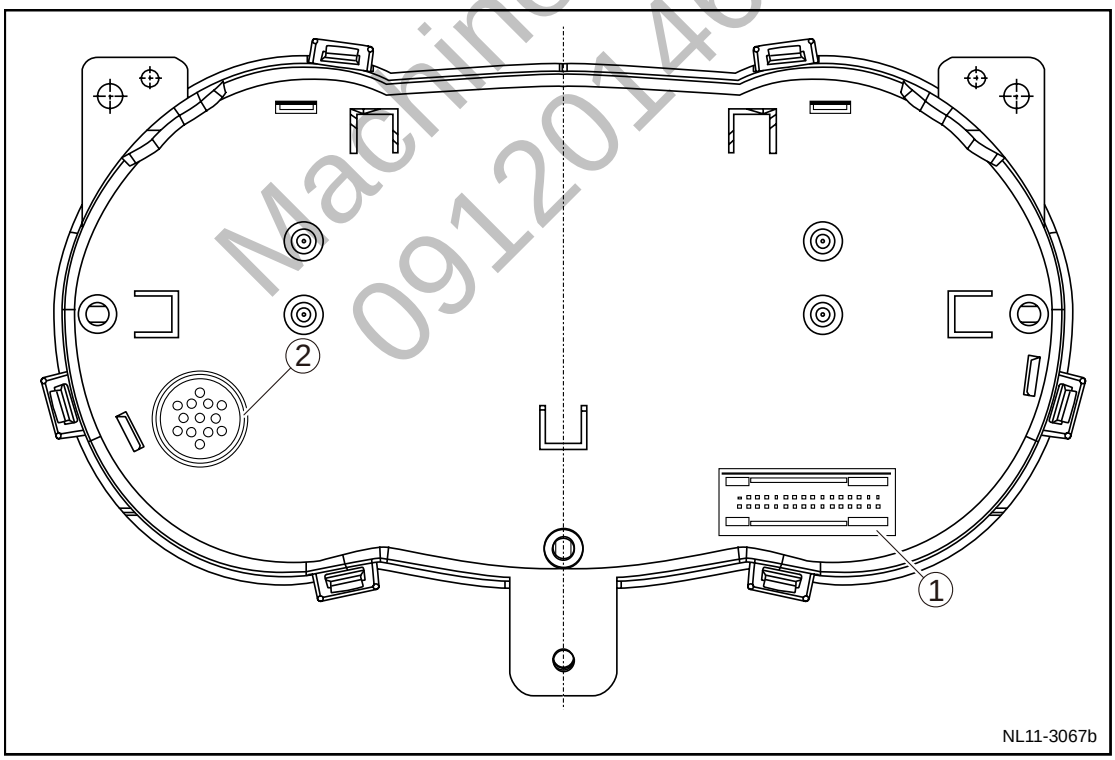
JLD-4G24/JLD-4G20

Instrument front end (warning lamp and scale)



Rear end of instrument



(1) Harness connector of combination instrument (32 Needle,Green)

(2) Buzzer

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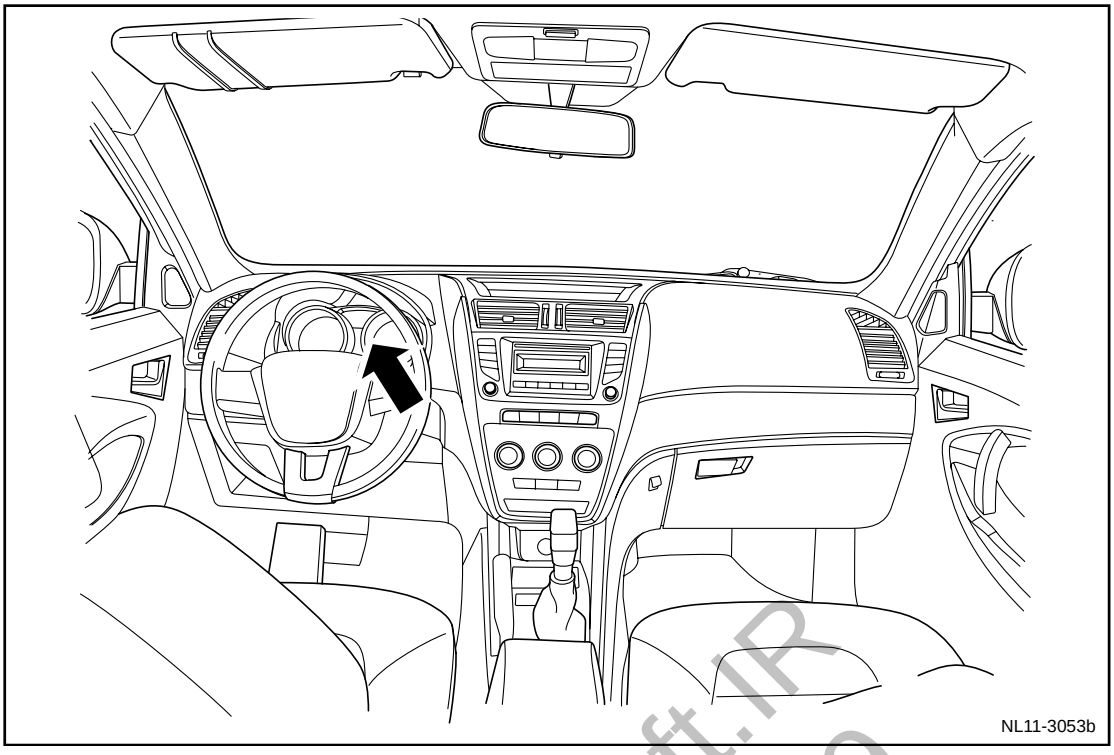

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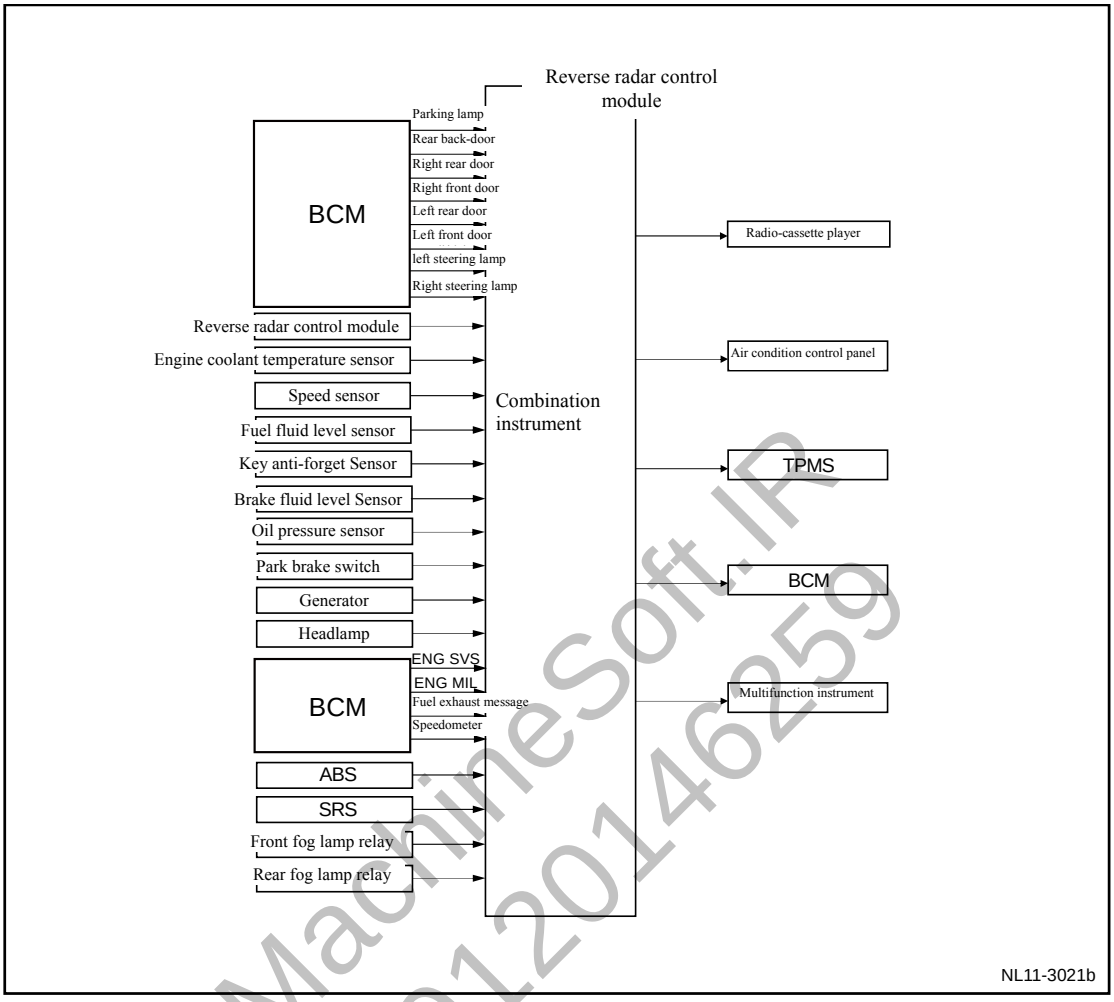
11.7.5 Electrical schematic diagram

11.7.5.1 Electrical schematic diagram

JL4G18-E



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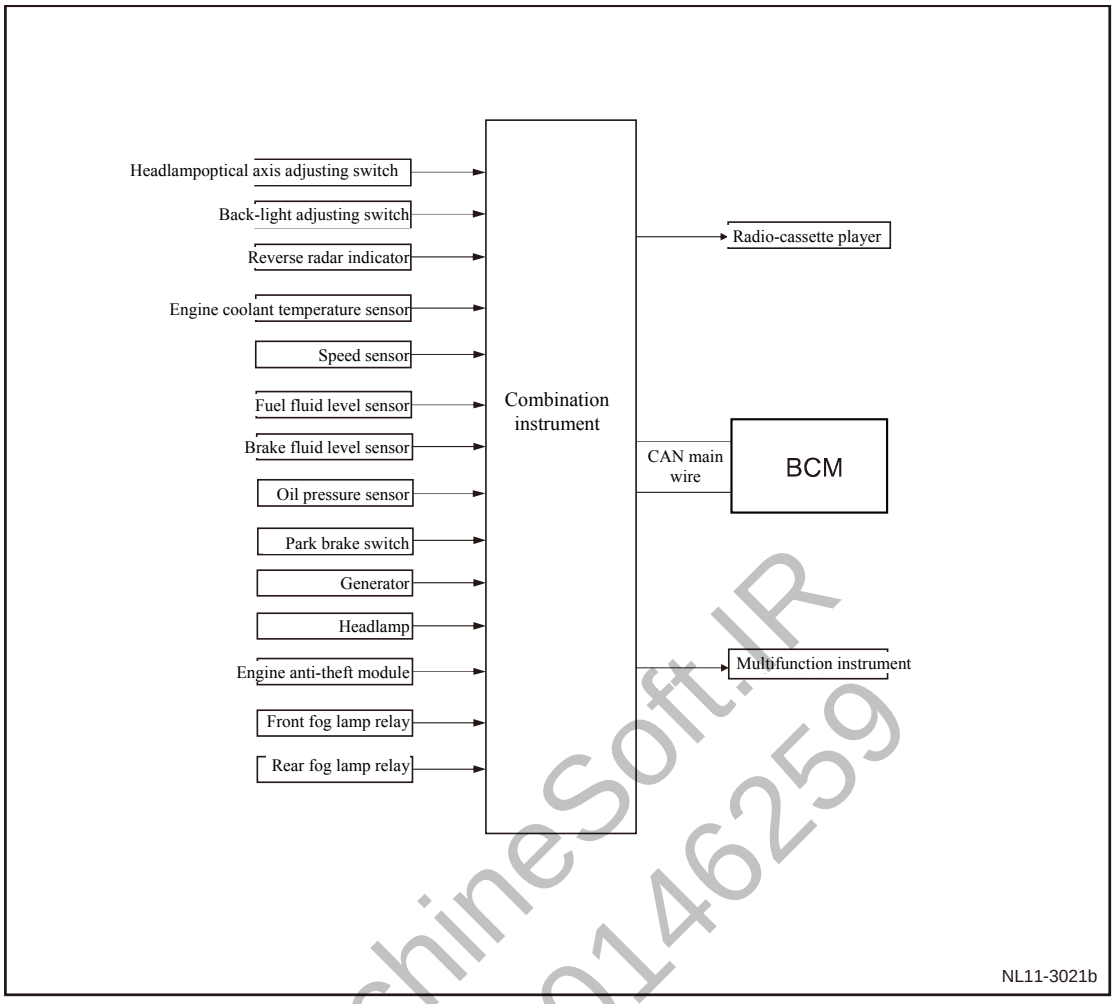
JLD-4G24/JLD-4G20



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11.7.6 Diagnostic information and steps (JL4G18-E)

11.7.6.1 Diagnosis descriptions

Refer to 11.7.2 description and operation to get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.7.6.2 Visual inspection

- Inspect installed aftermarket equipment that may affect the operation of the instrument system.
- Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.
- Inspect whether the sensors for each instrument to display information are normal.

11.7.6.3 Instrument active test list

Testing part	Test Items
Beep when the lampet does not turn off.	Beep when the lampet does not turn off.
	Beep when the key is not pulled out.
	Safety belt buzzer
Buzzer testing	Co-driver safety belt buzzing
	Door open with buzzing
	Overspeed Buzzing
	Parking motor buzzing
LC testing	Vertical section, horizontal section, special section and sign section.
	Clear away all of them.
	Warning of driver safety belt
	Co-driver safety belt warning, ABS warning ,and EBD warning
	Low oil mass warning
Digital output	Left water temperature alarm steering lamp
	Right steering lamp
	Opening alarm of trunk
	Low brake oil warning
	Airbag warning mi warning

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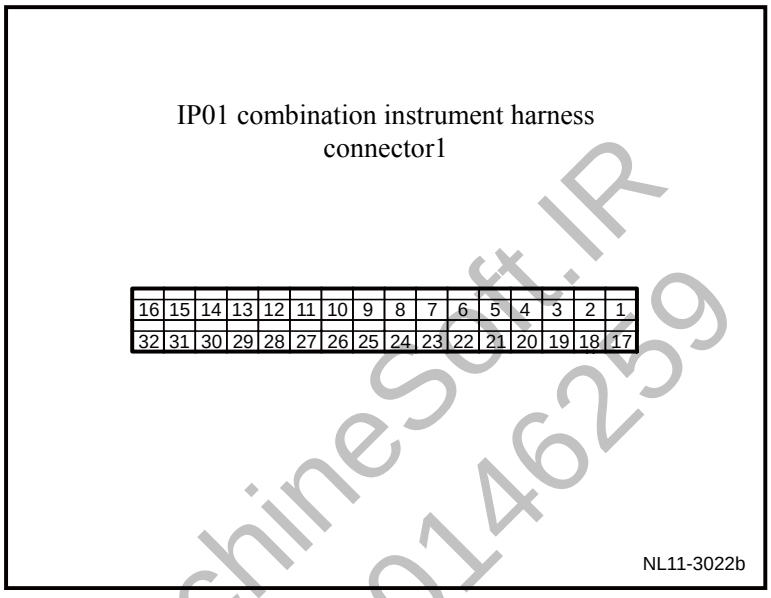
	SVS alarm
Beep when the lampet does not turn off.	Beep when the lampet does not turn off.
	Beep when the key is not pulled out.
	Safety belt buzzer
Buzzer testing	Co-driver safety belt buzzing
	Door open with buzzing

11.7.6.4 Instrument terminal list



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Terminal No.	Terminal Definition	Terminal Status	Specified conditions (voltage, current and waveform, etc.)
1	Battery	Input	12V/1A
2	Ignition (+)	Input	12V/1A
3	Instrument ground (-)	Input	GND/1A
4	Fuel signal	Input	Resistance value
5	Water temperature signal	Input	Resistance value
6	Sensor ground wire (-)	Input	GND/1A
7	Parking motor	Input	Pulse
8	Empty		/
9	Park brake(low effective)	Input	GND/20mA
10	Communication port (instrument for testing)		/

11	Empty		/
12	ESP fault (Low and suspended)	Input	GND/20mA
13	EBD malfunctions (active suspension)	Input	12V/20mA
14	Engine emission fault (low effective)	Input	GND/20mA
15	Four-wheel drive lock (low effective)	Input	GND/20mA
16	4WD(low effective)	Input	GND/20mA
17	Fuel consumption pulse signal	Input	Pulse
18	Disp button (low effective)	Input	GND/20mA
19	Overspeed alarm dead (reserved)		
20	Empty		/
21	Empty		/
22	Engine oil pressure alarm (low effective)	Input	GND/20mA
23	Empty		/
24	Empty		/
25	Safety belt unsecured(low effective)	Input	GND/20mA
26	Oil-water seperation（High effective ）	Input	12V/20mA
27	Pre-heating filament (low effective)	Input	GND/20mA
28	Right steering indication (high effective)	Input	12V/20mA
29	Position lamp (high effective)	Input	12V/20mA
30	Auxiliary safety belt unsecured(low effective)	Input	GND/20mA
31	ABS fault (high and suspension has effective)	Input	12V/20mA

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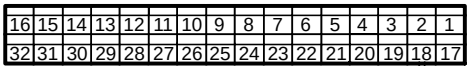
32	Airbag malfunction (active in low position)	Input	GND/20mA

IP02 combination instrument harness connector2



NL11-3023b

Terminal No.	Terminal definition	Terminal status	Specified conditions (voltage, current and waveform, etc.)
1	Vehicle speed signal	Input	Pulse
2	Vehicle speed output	Output	Pulse
3	Empty		/
4	Empty		/
5	Empty		/
6	Empty		/
7	Empty		/
8	Signal of not pull key out in empty vehicle (low effective)	Input	GND/20mA
9	Brake fluid level low (low effective)	Input	GND/20mA
10	Battery charging and discharging (low effective)	Input	GND/20mA
11	Left steering indication (high effective)	Input	12V/20mA
12	High beam（-）	Input	GND/20mA
13	High beam（+）	Input	12V/20mA

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14	Rear fog lamp （High effective）	Input	12V/20mA
15	Front fog lamp (active-high signal)	Input	12V/20mA
16	Low beam (high effective)	Input	12V/20mA
17	Speed signal	Input	Pulse
18	Empty		/
19	Empty		/
20	Empty		/
21	Empty		/
22	Empty		/
23	Back door opening (low effective)	Input	GND/20mA
24	Engine hood opening (low effective)	Input	GND/20mA
25	Right back door opening (low effective)	Input	GND/20mA
26	Left rear door opening (low effective)	Input	GND/20mA
27	Right front door opening (low effective)	Input	GND/20mA
28	Left front door "ON"(low effective)	Input	GND/20mA
29	Empty		/
30	Empty		/
31	Anti-theft indication (low effective)	Input	GND/20mA
32	Engine system fault (low effective)	Input	GND/20mA

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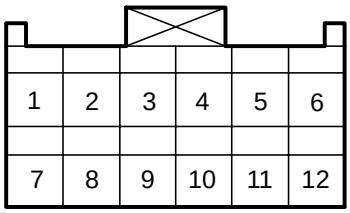
IP03 multifunction instrument harness connector



NL11-3024b

Terminal No.	Terminal definition	Terminal status	Specified conditions (voltage, current and waveform, etc.)
1	High A/T temperature indicator lamp (reserved)		/
2	Tire pressure warning (-)	Input	GND/20mA
3	Signal ground	Input	GND/1A
4	Secondary-safety belt (-)	Input	GND/20mA
5	TPMS (active when the tire is at high level and suspended)	Input	12V/20mA
6	BMBS flat tire indicator lamp (-)	Input	GND/20mA
7	BMBS system fault lamp(-)	Input	GND/20mA
8	Ignition	Input	12V/1A
9	Ground	Input	GND/1A
10	Battery	Input	12V/1A
11	Ignition (backlight)	Input	12V/1A
12	Communication port (instrument for testing)	/	

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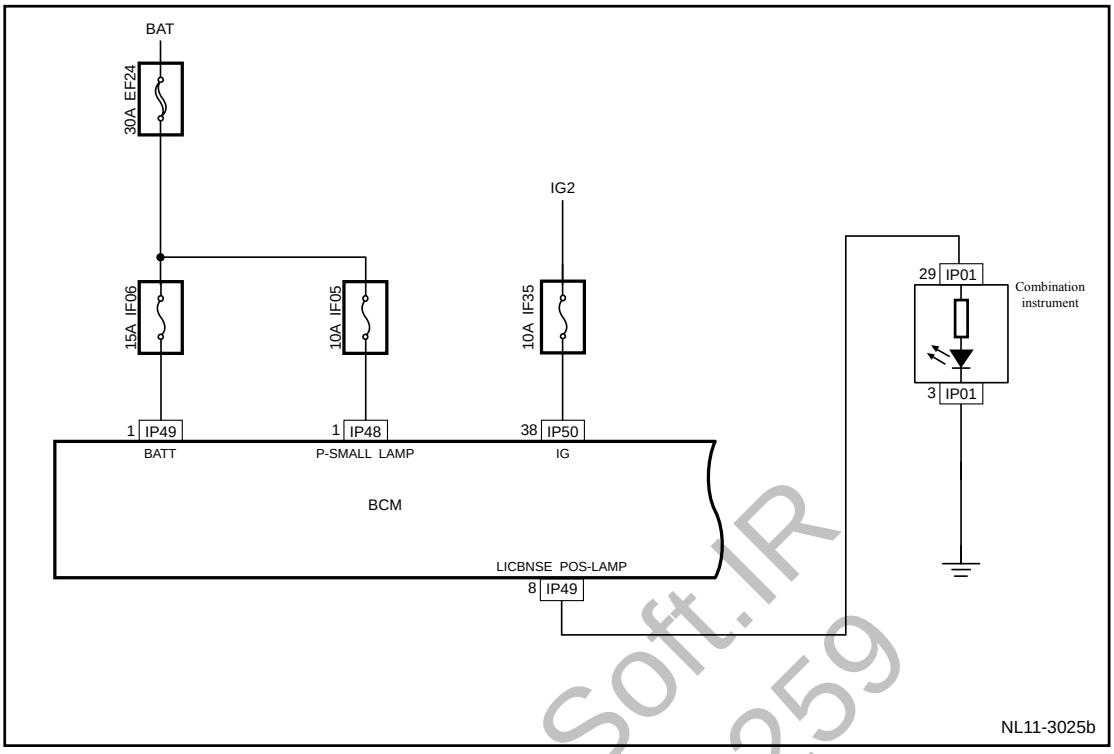
11.7.6.5 instrument cluster light in is "OFF" . diagnostic process

Circuit diagram:



Diagnostic steps:

1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal

No → Fault discovered by maintenance

Yes

2	Inspect the communication between the terminal No. 29 of the combination instrument wire harness connector IP01 and the terminal No. 8 of the BCM wire harness connector IP49.

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(a) Rotated ignition switch to "OFF" position.

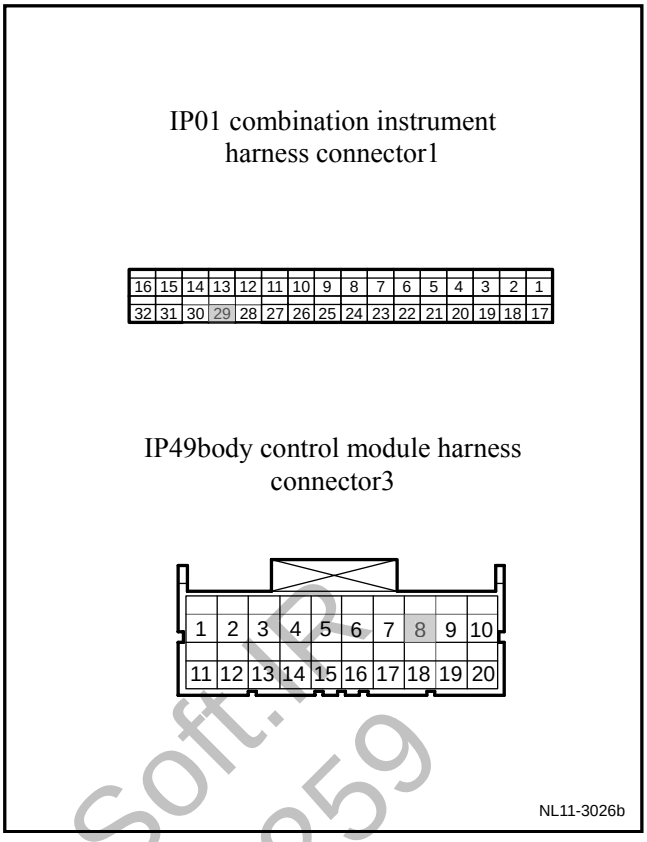
(b) Disconnect instrument cluster harness connector IP01.

(c) Disconnect BCM harness connector IP49.

(d) Measure resistance between combined instrument wire harness connector IP01 terminal No. 29 and BCM wire harness connector IP49 terminal No. 8.

Standard resistance: less than 1 ω

is the resistance at a specified value?



Yes → Go to step 4

No

3	Inspect and repair the circuit between the terminal No. 29 of the combination instrument wire harness connector IP01 and the terminal No. 8 of the BCM wire harness connector IP49.

(a) Make sure that combined instrument wire harness connector IP01 terminal No. 29 and BCM wire harness connector IP49 terminal No. 8 are connected.

Whether instrument cluster lighting work is normal or not?

Yes → The system is normal.

No

4	Inspect the communication between the terminal No. 3 of the combination instrument wire harness connector IP01 and the body grounding.

(a) Measure resistance between combined instrument connector IP01 terminal No. 3 and grounding.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?

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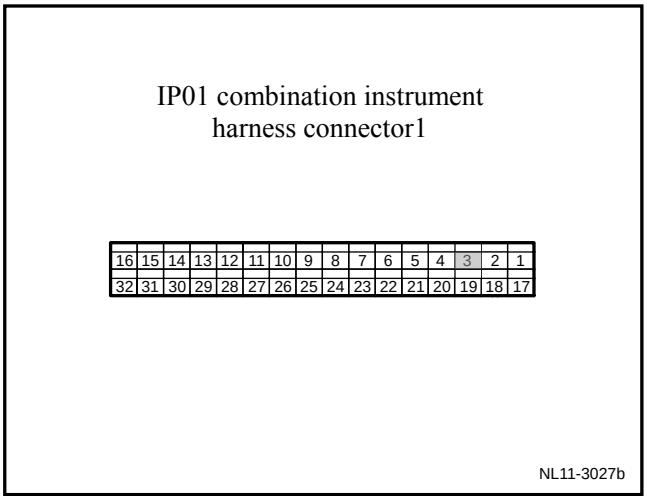

No → Go to step 6

Yes

5	Replace circuit of instrument cluster harness connector IP01 terminal No.3 and body grounding

(a) Replace circuit between IPO1 terminal No. 3 of instrument cluster harness connector and body grounding

Whether instrument cluster lighting work is normal or no?

Yes → The system is normal.

No

6	Use fault diagnosis tester to confirm if DTC is stored again .

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm the completion of repair.

Next

7	The system is normal.

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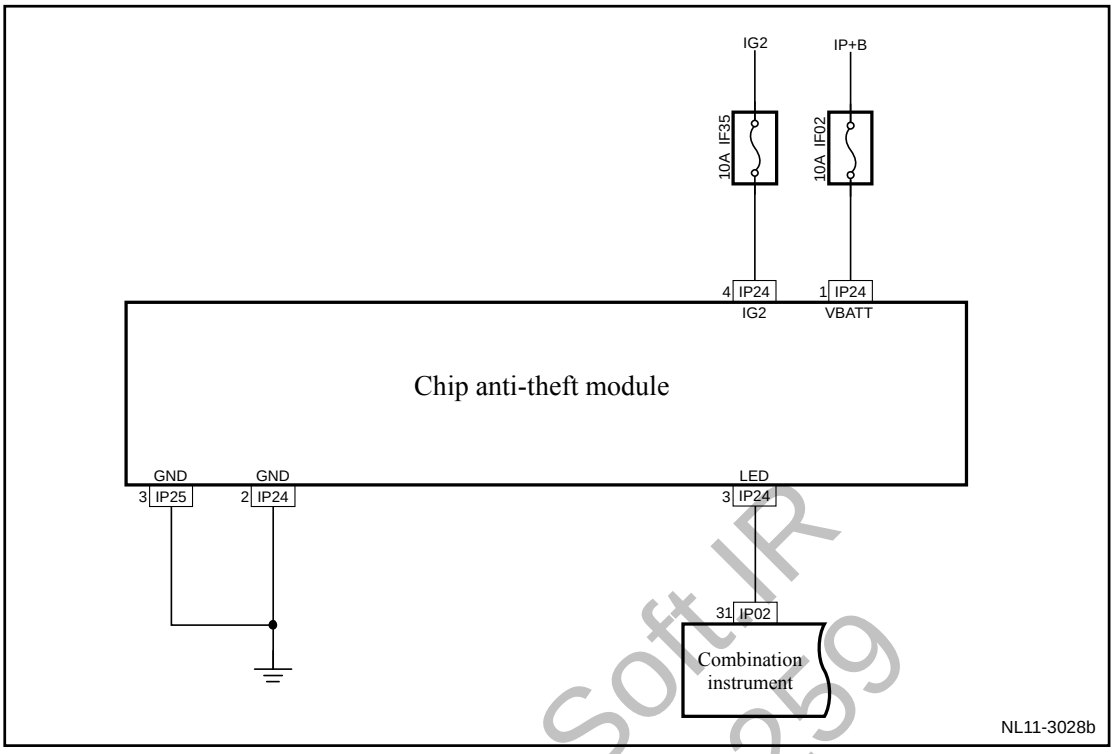
11.7.6.6 Engine anti-theft indicator lamp is not "ON"

Circuit diagram:



Diagnostic steps:

1	Inspect the working condition of the chip anti-theft module.

(a) Refer to engine anti-theft system 2.5.7.12 DTC 9000, B061

Is the engine anti-theft indicator lamp normal?

Yes — The system is normal.

No

2	Inspect the circuit communication between the chip anti-theft module and the combination instrument.

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(a) Rotated ignition switch to "OFF" position.

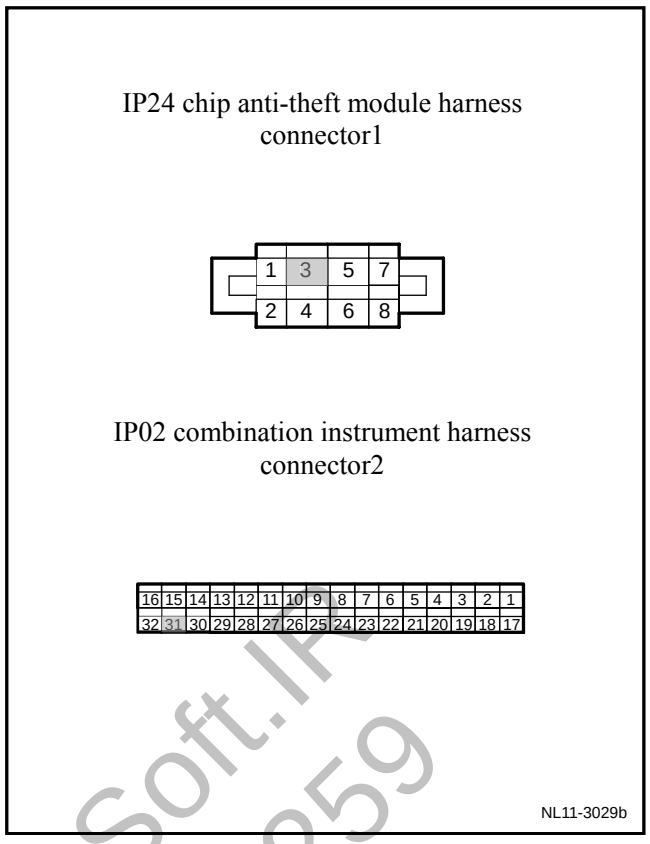
(b) Disconnect instrument cluster harness connector IP01.

(c) Disconnect chip anti-theft module wire harness connector IP24.

(d) Measure resistance between combined instrument wire harness connector IP02 terminal No. 31 and chip anti-theft module wire harness connector IP24 terminal No. 3.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 3

No

3	Repair the circuit between the terminal No. 31 of the combination instrument wire harness connector IP02 and the terminal No. 3 of the chip anti-theft module wire harness connector IP24.

(a) Make sure that combined instrument wire harness connector IP02 terminal No. 31 and chip anti-theft module wire harness connector IP24 terminal No. 3 are connected.

Does the anti-theft indicator lamp work normally?

Yes → The system is normal.

No

4	Replace instrument cluster

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm the completion of repair.

Next

7	Troubleshooting

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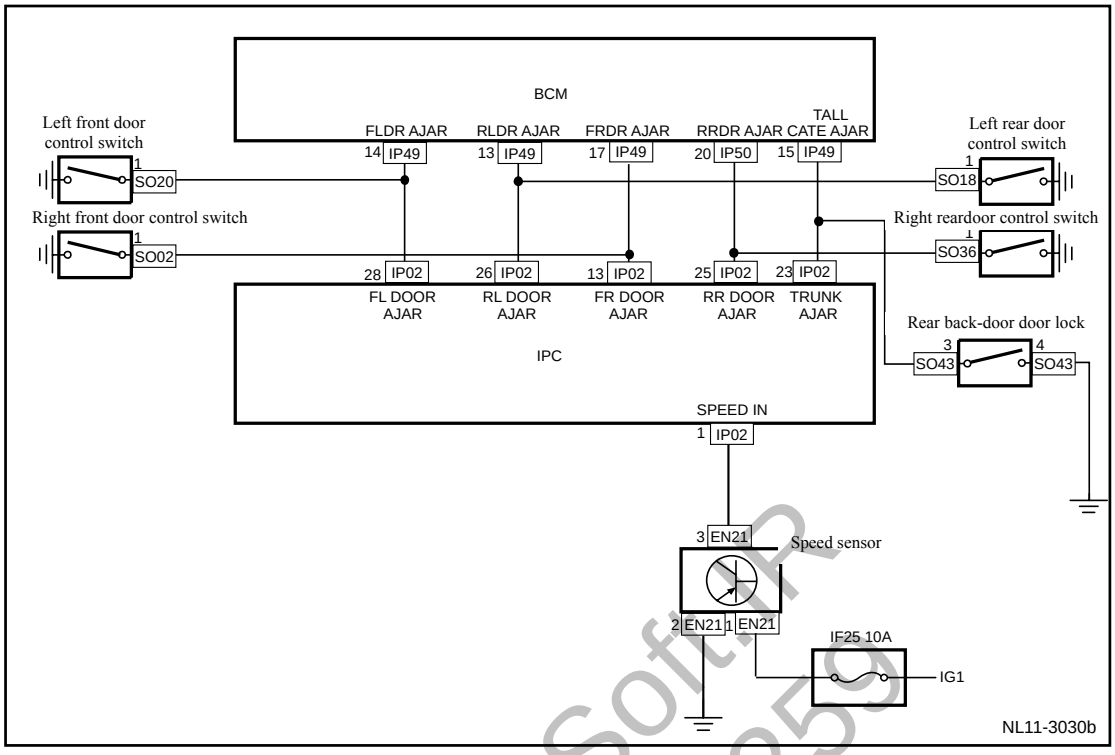
11.7.6.7 Unlock travelling vehicle alarm can not work

Circuit diagram:



Diagnostic steps:

1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal

No → Fault discovered by maintenance

Yes

2	Inspect the communication between the terminal No. 1 of the combination instrument wire harness connector IP02 and the terminal No. 3 of the speed sensor wire harness connector EN21.

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(a) Rotated ignition switch to "OFF" position.

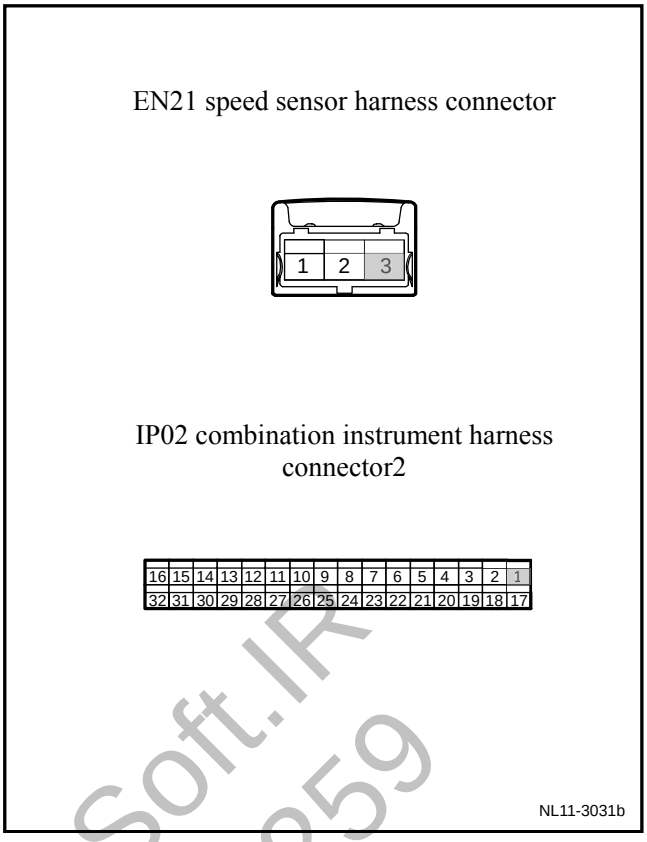
(b) Disconnect instrument cluster harness connector IP02.

(c) Disconnect speed sensor wire harness connector EN21.

(d) Measure the resistance between the combination instrument harness connector IP02 terminal No. 1 and the speed sensor harness connector EN21 terminal No. 3.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 4

No

3	Inspect and repair the circuit between the terminal No. 1 of the combination instrument wire harness connector IP02 and the terminal No. 3 of the speed sensor wire harness connector EN21.

(a) Make sure that combined instrument wire harness connector IP02 terminal No. 1 and speed sensor wire harness connector EN21 terminal No. 3 are connected.

Does alarm against travelling with door unlocked function normally.

Yes → The system is normal.

No

4	Inspect the communication between the terminal No. 2 of the speed sensor connector EN21 and the engine grounding.

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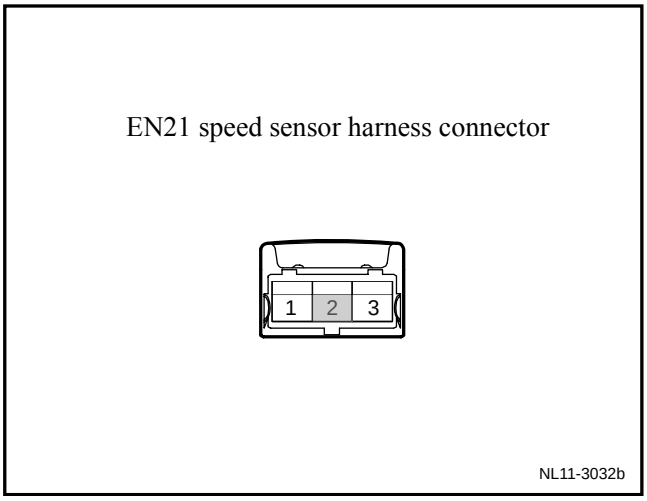
(a) Measure resistance between speed sensor wire harness connector EN21 terminal No. 2 and engine grounding.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 6

No

5	Inspect and repair the circuit between the terminal No. 2 of the speed sensor wire harness connector EN21 and the engine grounding.

(a) Make sure that speed sensor wire harness connector EN21 terminal No. 2 and engine grounding are connected.

Does alarm against travelling with door unlocked function normally.

Yes → The system is normal.

No

6	Replace the vehicle speed sensor.

Does alarm against travelling with door unlocked function normally.

Yes → The system is normal.

No

7	Inspect the communication among the terminal No. 23/25/26/13/28 of the combination instrument wire harness connector IP02, the terminal No. 15 of the BCM wire harness connector IP49, the terminal No. 20 of IP50 and the terminal No. 13/17/14 of the IP49.

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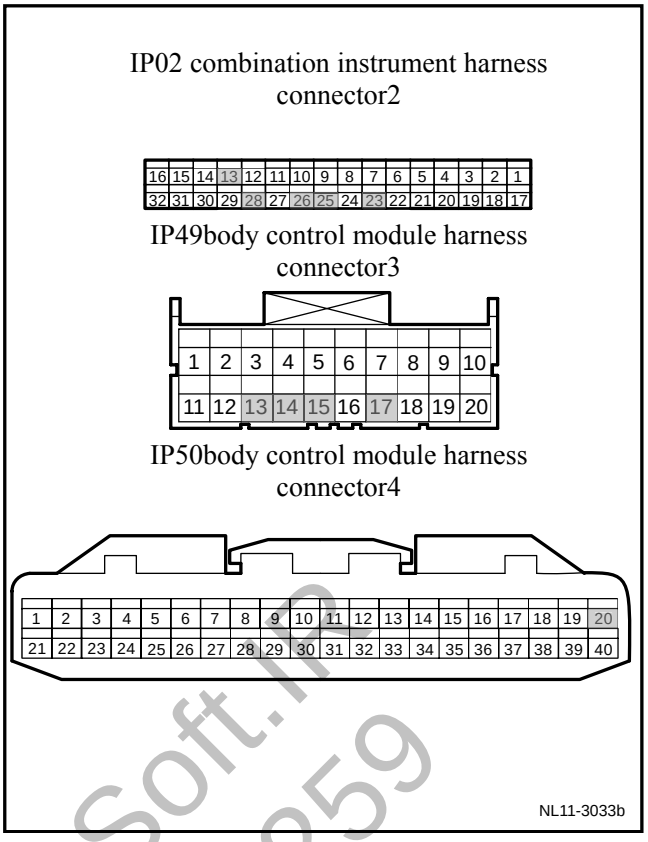
(a) Measure resistance between combined instrument connector IP02 terminal No. 23/25/26/13/28 and BCM wire harness connector IP49 terminal No. 15, IP50 terminal No. 20, IP49 terminal No. 13/17/14.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 9

No

8	Inspect and repair the circuit among the terminal No. 23/25/26/13/28 of the combination instrument wire harness connector IP02, the terminal No. 15 of the BCM wire harness connector IP49, the terminal No. 20 of IP50 and the terminal No. 13/17/14 of the IP49.

(a) Make sure that combined instrument wire harness connector IP02 terminal No. 23/25/26/13/28 and BCM wire harness connector IP49 terminal No. 15 and IP50 terminal No. 20, IP49 terminal No. 13/17/14 are connected.

Does alarm against travelling with door unlocked function normally.

Yes → The system is normal.

No

9	Inspect the communication among the terminal No. 3 of the door controlled switch wire harness connector SO43, terminal No. 1 of SO36, terminal No. 1 of SO02, terminal No. 1 of SO18, terminal No. 1 of SO20, terminal No. 15 of the BCM wire harness connector IP49, terminal No. 20 of IP50, and terminal No. 17/13/14 of IP49.

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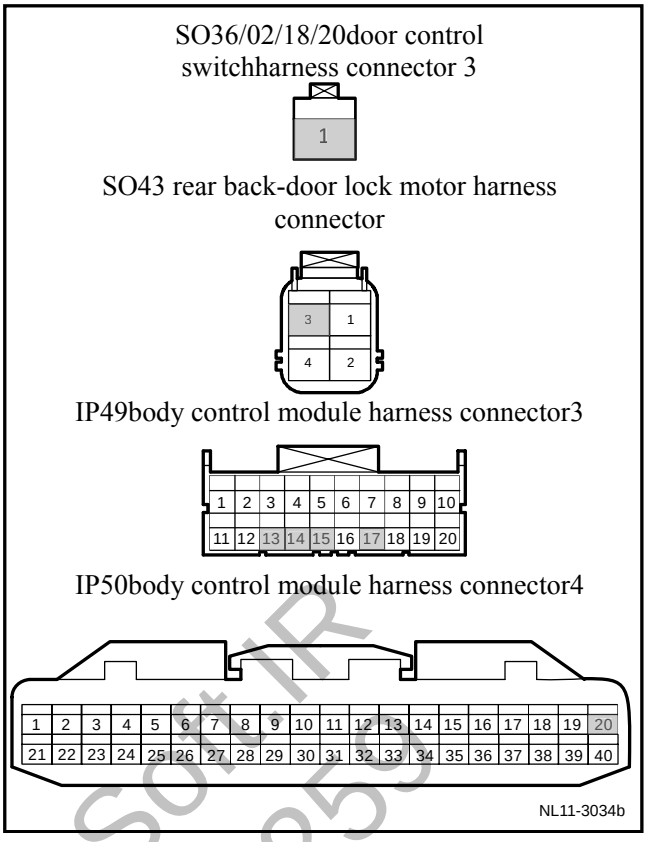
(a) Measure voltage between door control switch wire harness connector SO43 terminal No. 3, SO36 terminal No. 1, SO02 terminal No. 1, SO18 terminal No. 1, SO20 terminal No. 1 and BCM wire harness connector IP49 terminal No. 15, IP50 terminal No. 20, IP49 terminal No. 17/13/14.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 11

No

10	Inspect and repair the circuit among the terminal No. 3 of the door controlled switch wire harness connector SO43, terminal No. 1 of SO36, terminal No. 1 of SO02, terminal No. 1 of SO18, terminal No. 1 of SO20, terminal No. 15 of the BCM wire harness connector IP49, terminal No. 20 of IP50, and terminal No. 17/13/14 of IP49.

(a) Make sure that door control switch wire harness connector SO43 terminal No. 3, SO02 terminal No. 1, SO18 terminal No. 1, SO20 terminal No. 1 and BCM wire harness connector IP49 terminal No. 15, IP50 terminal No. 20, IP49 terminal No. 17/13/14 are connected.

Does alarm against travelling with door unlocked function normally.

Yes → The system is normal.

No

11	Replace door contact switch.

(a) Replace door contact switch , refer to11.8.8.3 door contact switch replacement .

Does alarm against travelling with door unlocked function normally.

12	Replace the BCM

(a) Replace BCM and refer to replacement of BCM in 11.8.8.1.

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Does alarm against travelling with door unlocked function normally.

Yes → The system is normal.

No

13	Replace the instrument cluster assembly.

(a) Replace instrument cluster assembly, Refer to11.6.7.1 instrument cluster assembly replacement.

Confirm the completion of repair.

Next

14	The system is normal.

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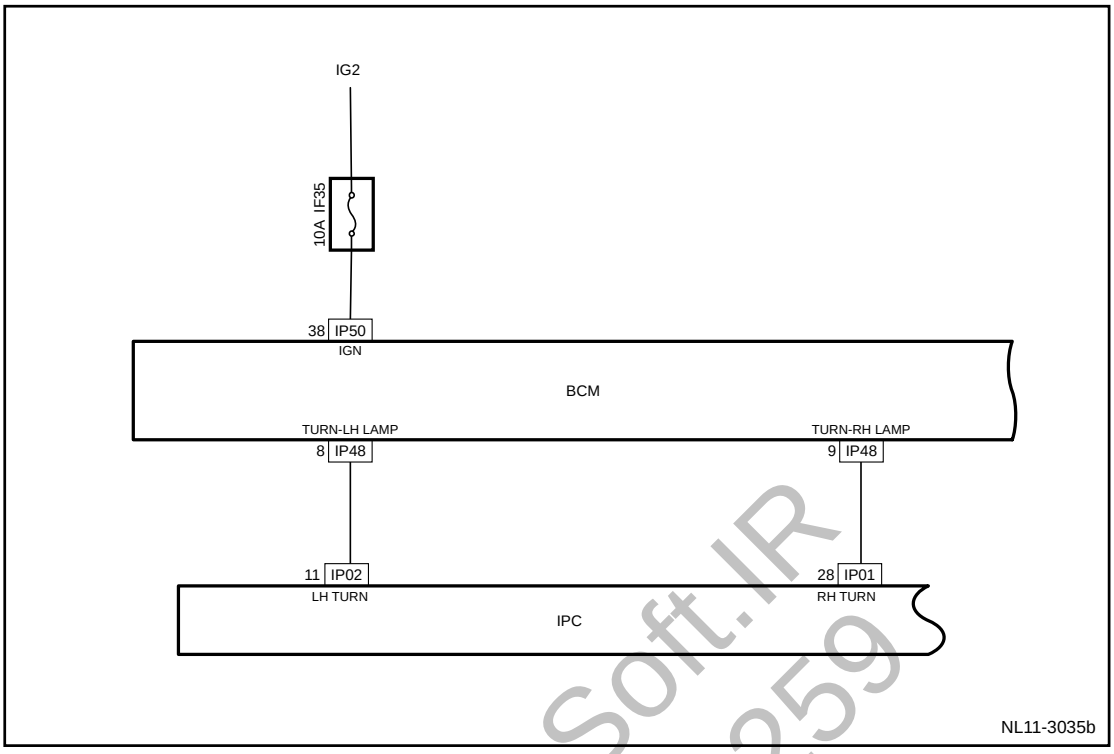
11.7.6.8 Steering signal indicator not flash

Circuit diagram:



Diagnostic steps:

1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal

Yes → Fault discovered by maintenance

No

2	Inspect the communication among the terminal No. 11 of the combination instrument wire harness connector IP02, the terminal No. 28 of the IP01 and the terminal No. 9/8 of the BCM wire harness connector IP48.

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(a) Rotated ignition switch to "OFF" position.

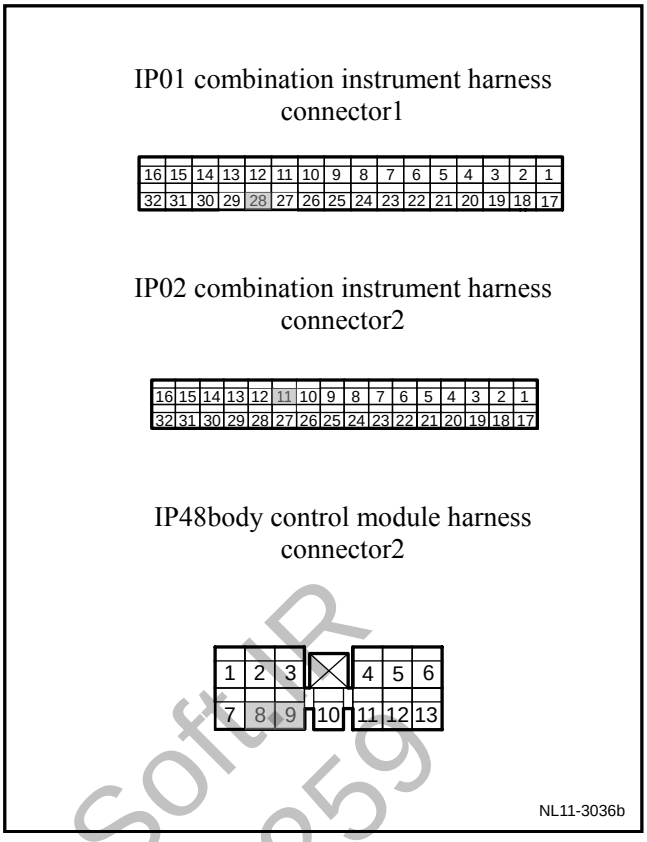
(b) Disconnect instrument cluster harness connector IP02, IP01.

(c) Disconnect BCM harness connector IP48.

(d) Measure resistance between combined instrument wire harness connector IP02 terminal No. 11, IP01 terminal No. 28 and BCM wire harness connector IP48 terminal No. 9/8.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 4

No

3	Inspect and repair the circuit among the terminal No. 11 of the combination instrument wire harness connector IP02, the terminal No. 28 of the IP01 and the terminal No. 9/8 of the BCM wire harness connector IP48.

(a) Make sure that combined instrument wire harness connector IP02 terminal No. 11, IP01 terminal No. 28 and BCM wire harness connector IP48 terminal No. 9/8 are connected.

Inspect if the result is normal

Yes → The system is normal.

No

4	Replace instrument cluster,

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm the completion of repair.

Next

5	The system is normal.

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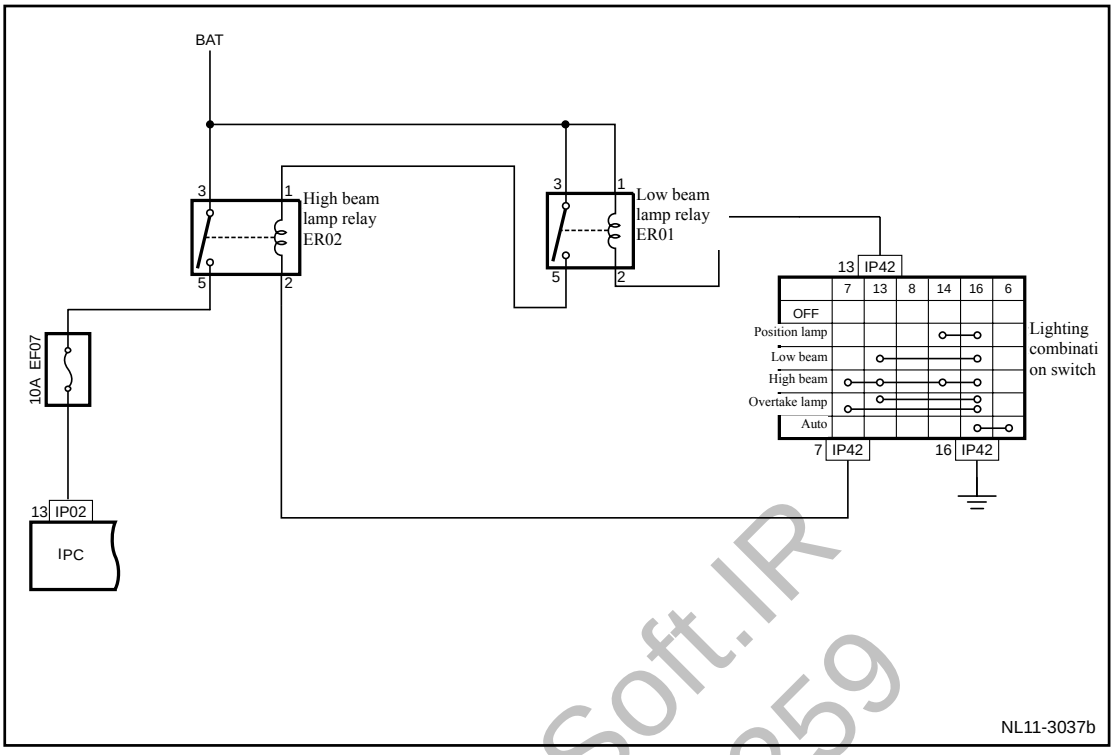
11.7.6.9 High beam indicator lamp not on

Circuit diagram:



Diagnostic steps:

1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal

No → Fault discovered by maintenance

Yes

2	Inspect the working condition of the high beam.

(a) Refer to 11.3.7.4 High-beam lamp doesn't work.

Inspect whether the high beam indicator lamp works normally.

Yes → The system is normal.

No

3	Inspect the communication between the high beam relay and the terminal No. 13 of the combination instrument wire harness connector IP02.

(a) Measure resistance between high-beam lamp relay terminal No. 5 and combined instrument wire harness connector IP02 terminal No. 13.

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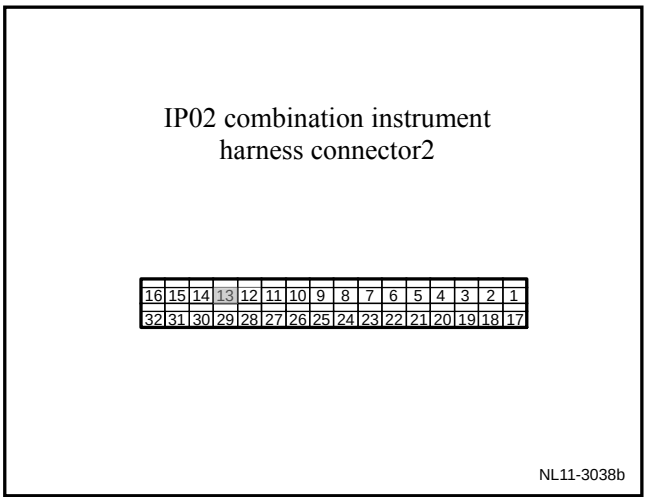
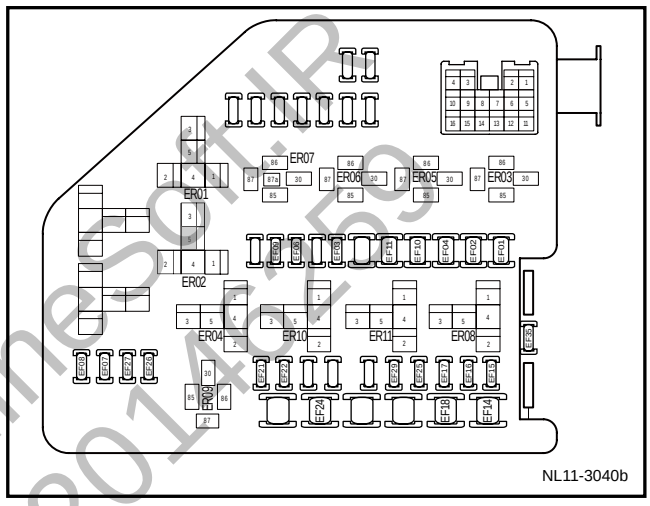
Standard resistance: less than 1 Ω

Is the resistance at a specified value?





Yes → Go to step 5

No

4	Inspect and repair the circuit between the high beam relay and the terminal No. 13 of the combination instrument wire harness connector IP02.

(a) Make sure that high-beam lamp relay and combined instrument wire harness connector IP02 terminal No. 13 are connected.

Inspect whether the high beam indicator lamp works normally?

Yes → The system is normal.

No

5	Replace instrument cluster,

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm the completion of repair.

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6	The system is normal.

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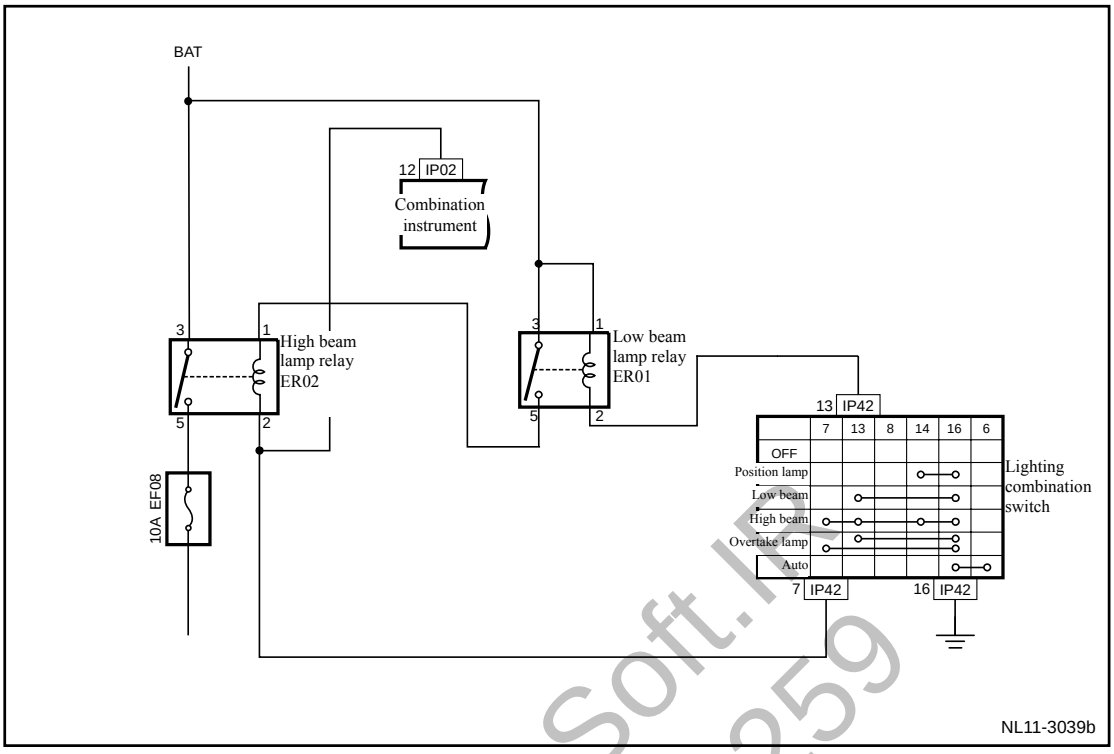
11.7.6.10 High beam lamp indicator lamp do not light on

Circuit diagram:



Diagnostic steps:

1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal

No → Fault discovered by maintenance

Yes

2	Inspect the working condition of the low beam.

(a) Refer to 11.3.7.3 Headlamp doesn't work.

Inspect whether low beam indicator lamp works normally.

Yes → The system is normal.

No

3	Replace high beam lamp relay .

(a) Replace high beam lamp relay.

Inspect whether low beam indicator lamp works normally.

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Yes → The system is normal.

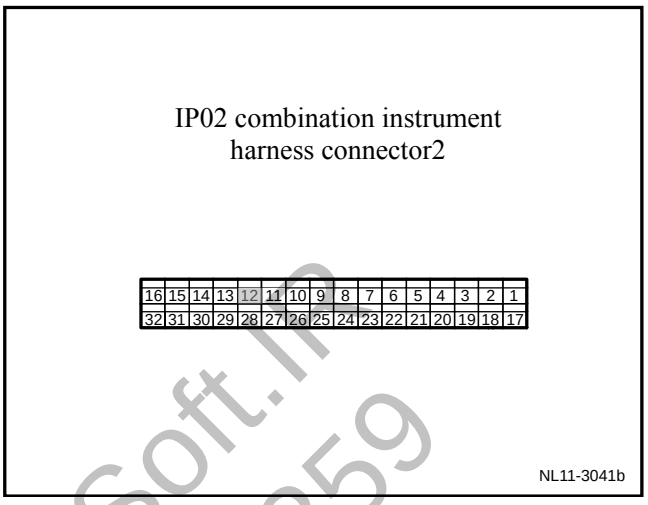
No

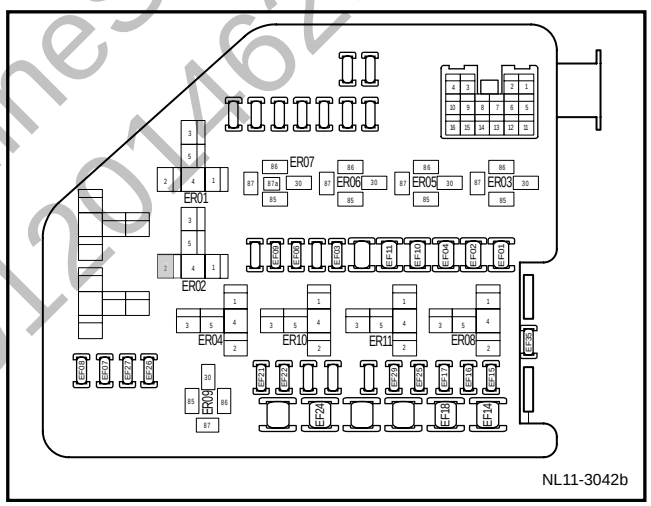
4	Inspect the communication between the high beam relay terminal No. 2 and the terminal No. 12 of the combination instrument wire harness connector IP02.

(a) Measure resistance between high-beam lamp relay terminal No. 2 and combined instrument wire harness connector IP02 terminal No. 12.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?





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Yes → Go to step 6

No

5	Inspect and repair the circuit between the high beam relay terminal No. 2 and the terminal No. 12 of the combination instrument wire harness connector IP02.

(a) Make sure that high-beam lamp relay terminal No. 2 and combined instrument wire harness connector IP02 terminal No. 12 are connected.

Inspect whether low beam indicator lamp works normally?

Yes → The system is normal.

No

6	Inspect the voltage of the terminal No. 2 of the high beam relay and the reliable body grounding point.

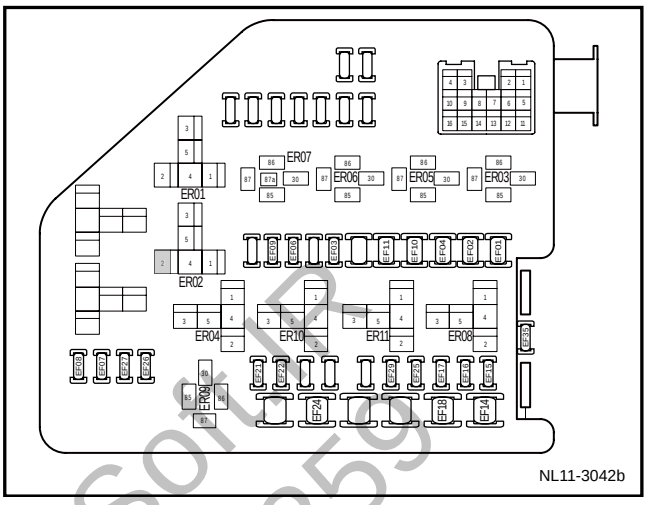
(a) Dismantle high-beam lamp relay.

(b) Turn on high beam lamp.

(c) Measure voltage between high beam lamp relay terminal No.2 and body reliable grounding point.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → The system is normal.

No

7	Repair the open circuit fault of the circuit between the low beam relay terminal No. 5 and the high beam relay terminal No. 2.

(a) Repair open-circuit between lower-beam lamp relay terminal No. 5 and high-beam lamp relay terminal No. 2.

Confirm whether the instrument low beam indicator lamp works normally.

Yes → The system is normal.

No

8	Replace instrument cluster,

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm the completion of repair.

Next

9	The system is normal.

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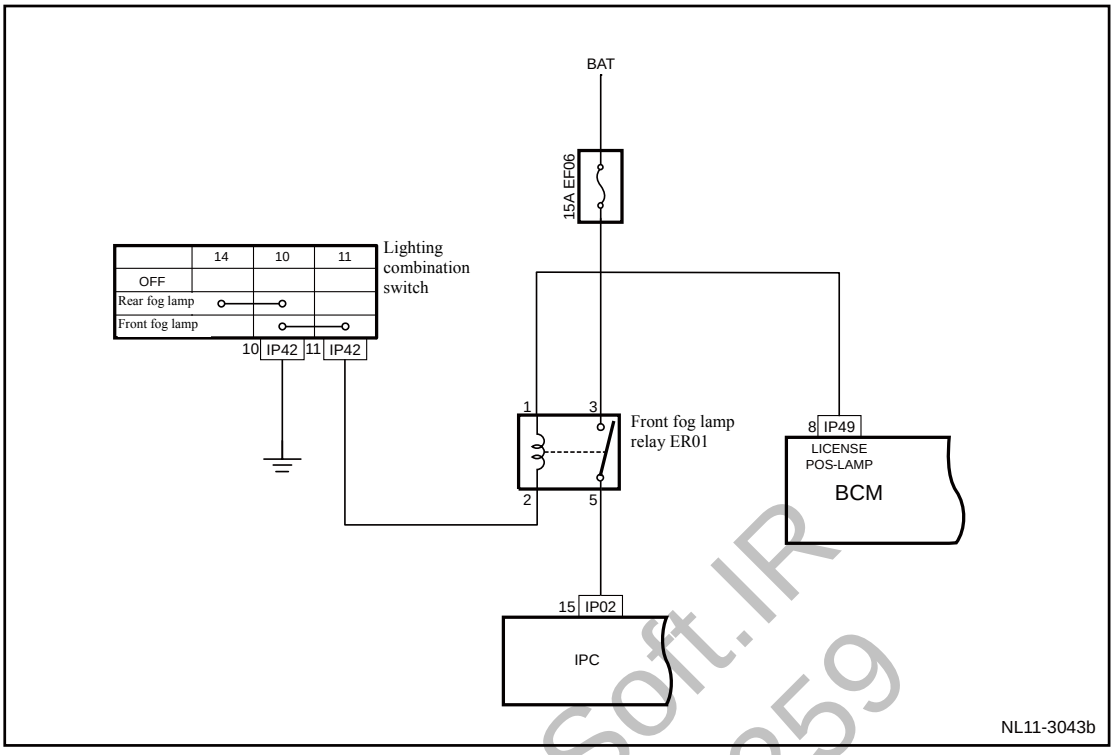
11.7.6.11 Front fog lamp indicator lamp not on

Circuit diagram:



Diagnostic steps:

1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal

No → Fault discovered by maintenance

Yes

2	Inspect the working condition of the front fog lamp.

(a) Refer to 11.3.7.6 Front fog lamp doesn't work.

Inspect whether the front fog indicator lamp works normally.

Yes → The system is normal.

No

3	Inspect the communication between the front fog lamp relay terminal No. 5 and the terminal No. 15 of the combination instrument wire harness connector IP02.

(a) Measure resistance between front fog lamp relay terminal No. 5 and combined instrument wire harness connector IP02 terminal No. 15.

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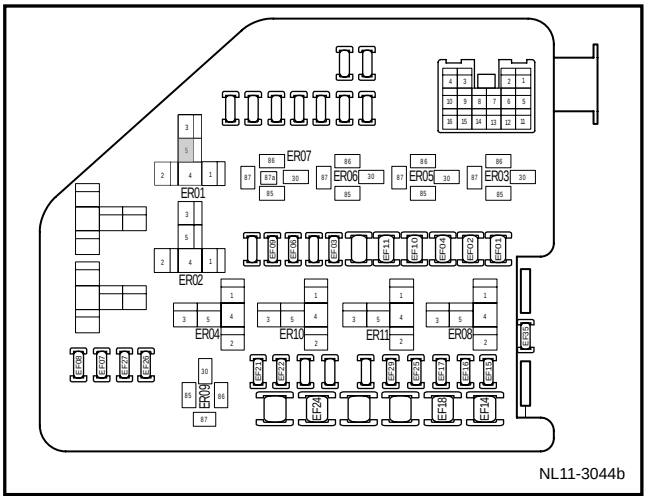
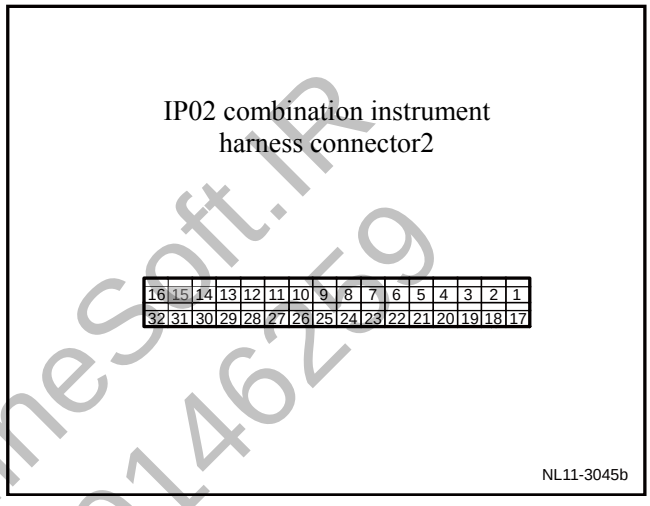
Standard resistance: less than 1 Ω

Is the resistance at a specified value?





Yes → Go to step 5

No

4	Inspect and repair the circuit between the front fog lamp relay terminal No. 5 and the terminal No. 15 of the combination instrument wire harness connector IP02.

(a) Make sure that front fog lamp relay terminal No. 5 and combined instrument wire harness connector IP02 terminal No. 15 are connected.

Standard resistance: less than 1 Ω

Inspect whether the front fog indicator lamp works normally.

Yes → The system is normal.

No

5	Inspect and repair the circuit between the high beam relay terminal No. 2 and the terminal No. 12 of the combination instrument wire harness connector IP02.

(a) Make sure that high-beam lamp relay terminal No. 2 and combined instrument wire harness connector IP02 terminal No. 12 are connected.

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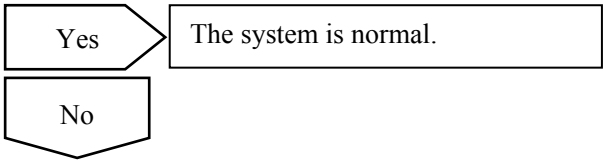
Inspect whether low beam indicator lamp works normally?



6	Replace instrument cluster,

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm the completion of repair.

7	The system is normal.

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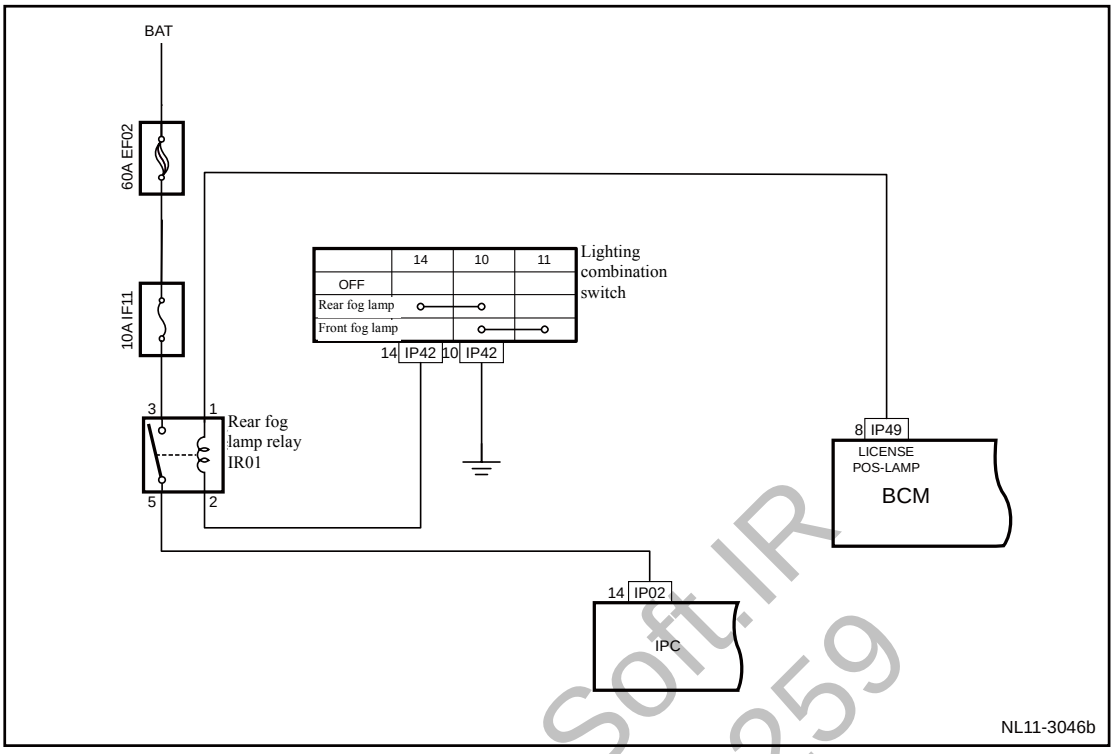
11.7.6.12 Rear fog lamp indicator lamp not on

Circuit diagram:



1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal.

No → Fault discovered by maintenance

Yes

2	Inspect the working condition of the rear fog lamp.

(a) Refer to 11.3.7.7 Rear fog lamp doesn't work.

Inspect whether rear fog indicator lamp works normally.

Yes → The system is normal.

No

3	Inspect the communication between the rear fog lamp relay terminal No. 5 and the terminal No. 14 of the combination instrument wire harness connector IP02.

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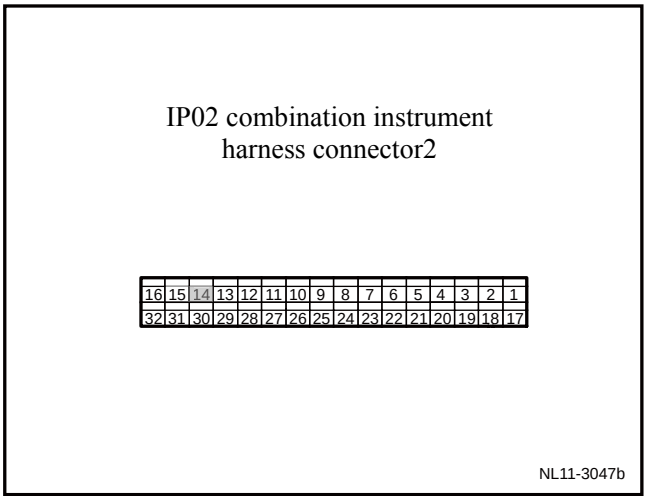
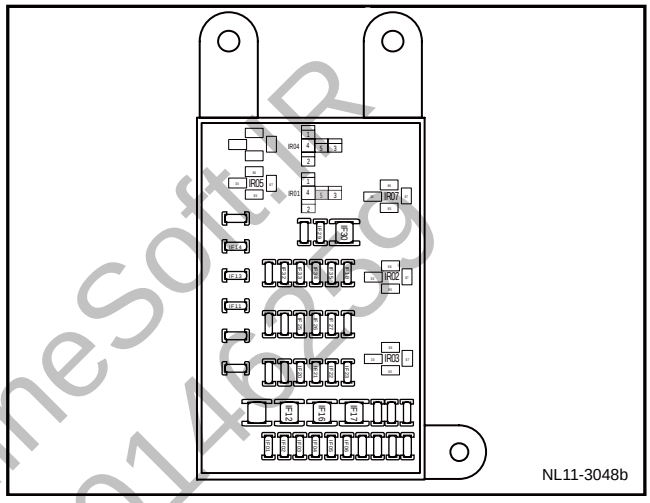
(a) Measure resistance between rear fog lamp relay terminal No. 5 and combined wire harness connector IP02 terminal No. 14.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?





Yes → Go to step 5

No

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4	Repair the circuit between the rear fog lamp relay terminal No. 5 and the terminal No. 14 of the combination instrument wire harness connector IP02.

(a) Repair open-circuit fault between rear fog lamp relay terminal No.5 and combined instrument wire harness connector IP02 terminal No.14.

Standard resistance: less than 1 Ω

Inspect whether rear fog indicator lamp works normally.

Yes → The system is normal.

No

5	Replace instrument cluster,

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm the completion of repair.

6	The system is normal.

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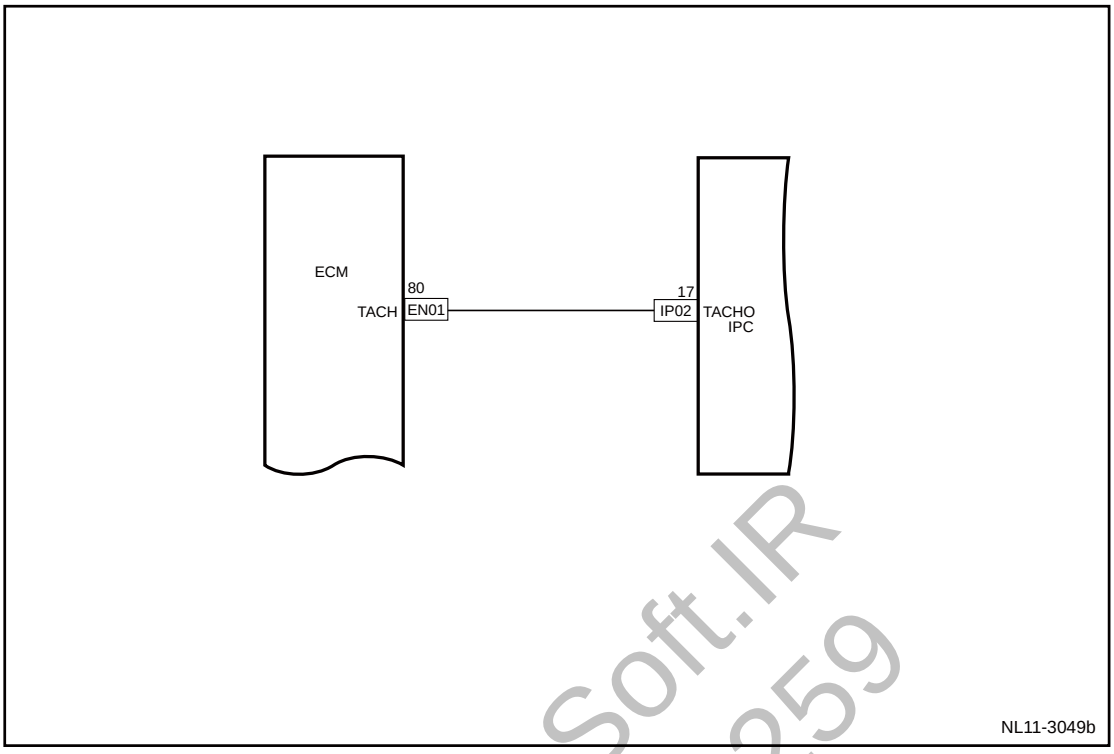
11.7.6.13 Speedometer can not indicate normally

Circuit diagram:



Diagnostic steps:

1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal

No → Fault discovered by maintenance

Yes

2	Inspect the communication between the terminal No.80 of the ECM wire harness connector EN01 and the terminal No.17 of the combination instrument wire harness connector IP02.

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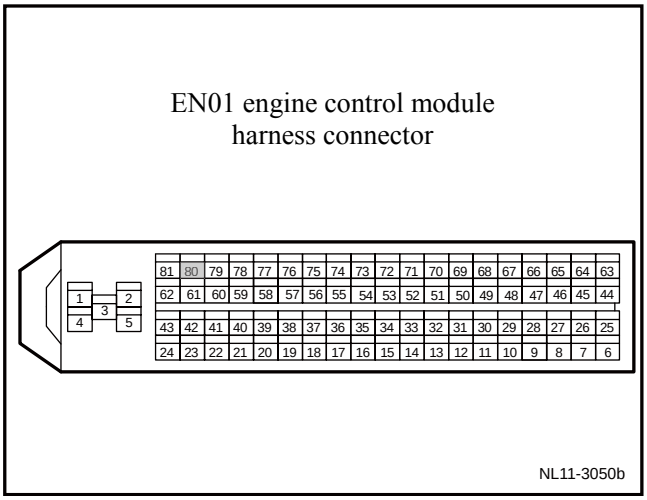
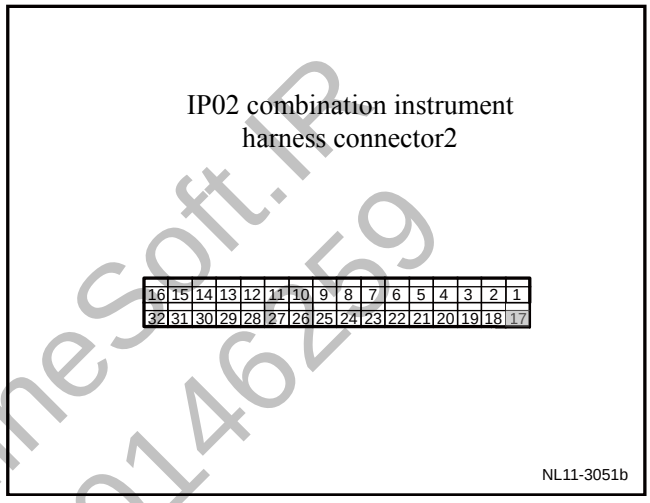
(a) Check resistance value between ECM harness connector EN01 terminal No.80 and instrument cluster harness connector IP02 terminal No.17

Standard resistance: less than 1 Ω

Is the resistance at a specified value?





Yes → Go to step 4

No

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3	Inspect and repair the circuit between the terminal No.80 of the ECM wire harness connector EN01 and the terminal No.17 of the combination instrument wire harness connector IP02.

(a) Make sure that ECU wire harness connector EN01 terminal No.80 and combined instrument wire harness connector IP02 terminal No.17 are connected.

Inspect whether the speedometer works normally.

Yes → The system is normal.

No

4	Inspect the speed sensor.

(a) Check speed sensor. Refer to2.2.7.35 DTC P0335 P0336.

Inspect whether the speedometer works normally.

Yes → The system is normal.

No

5	Replace ECM

(a) Replace ECM and refer to 2.2.8.6 "Replacement of Engine Control Module".

Inspect whether the speedometer works normally.

Yes → The system is normal.

No

6	Replace instrument cluster,

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm the completion of repair.

Next

7	The system is normal.

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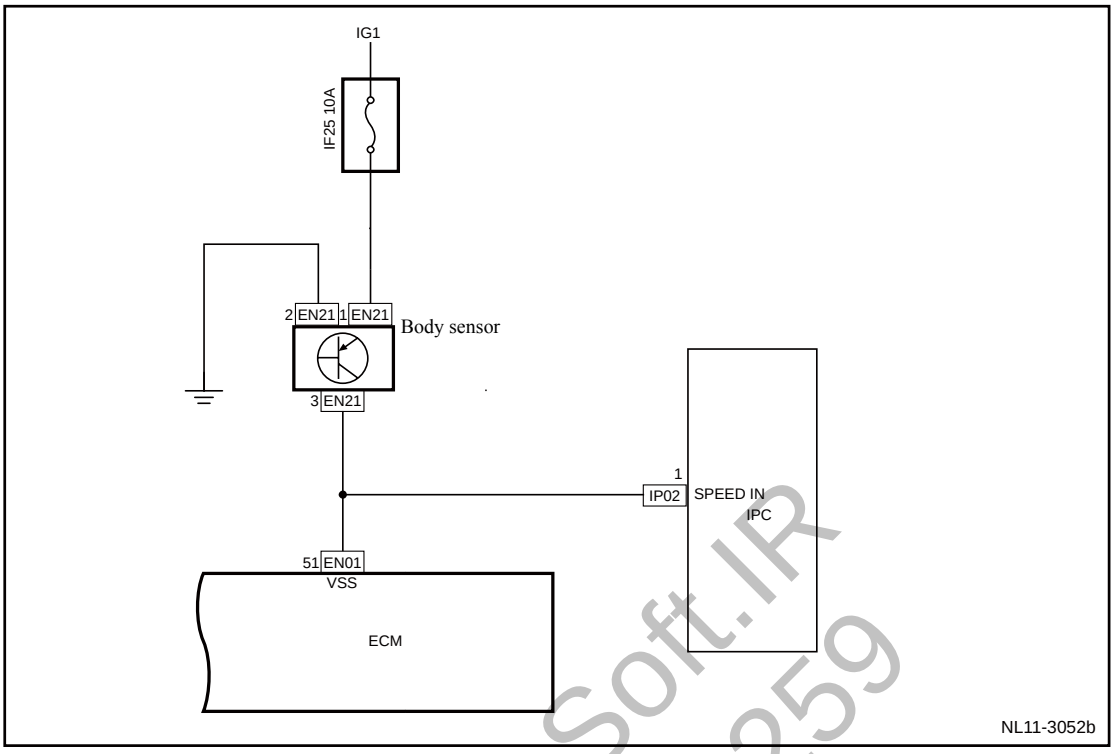
11.7.6.14 Speedometer can not indicate normally

Circuit diagram:



Diagnostic steps:

1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal

No → Fault discovered by maintenance

Yes

2	Inspect the working condition of the vehicle speed sensor.

(a) For inspection of working condition of speed sensor, refer to 2.2.7.41 DTC P0502.

Inspect whether the speedometer works normally?

Yes → Go to step 4

No

3	Inspect and repair the circuit between the terminal No.3 of the speed sensor wire harness connector EN21 and the terminal No.1 of the combination instrument wire harness connector IP02.

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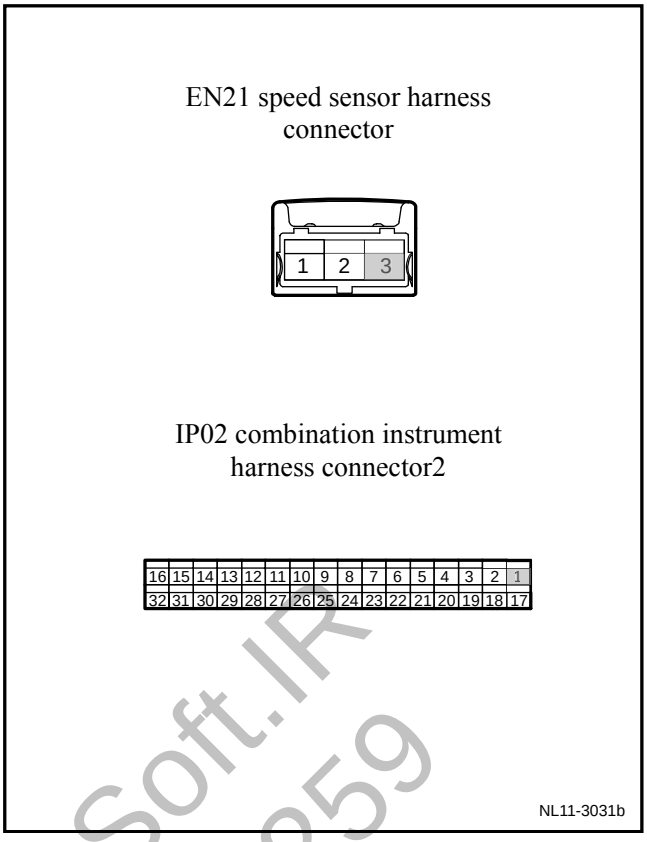
(a) Make sure that speed sensor wire harness connector EN21 terminal No.3 and combined instrument wire harness connector IP02 terminal No.1 are connected.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → The system is normal.

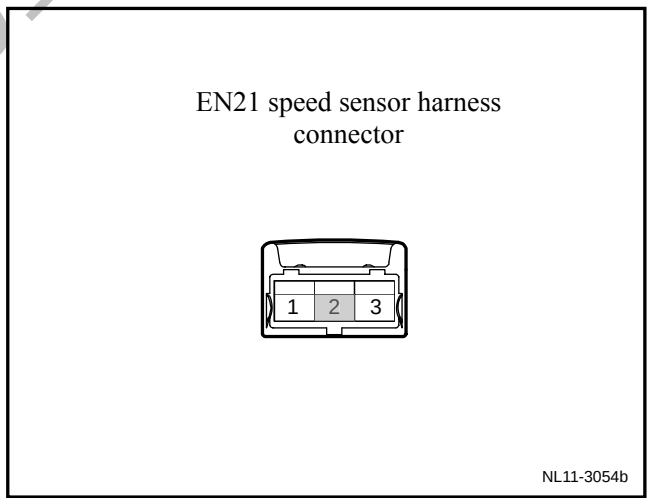
No

4	Inspect the communication between the terminal No.2 of the speed sensor connector EN21 and the engine grounding.

(a) Measure resistance between speed sensor connector EN21 terminal No.2 and engine grounding.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → The system is normal.

No

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5	Inspect and repair the circuit between the terminal No.2 of the speed sensor wire harness connector EN21 and the engine grounding.

(a) Make sure that speed sensor wire harness connector EN21 terminal No.2 and engine grounding are connected.

Inspect whether the speedometer works normally.

Yes → The system is normal.

No

6	Replace the vehicle speed sensor.

(a) Replace the vehicle speed sensor and refer to 3.3.8.2 "Replacement of Vehicle Speed Sensor".

Inspect whether the speedometer works normally.

Yes → The system is normal.

No

7	Replace instrument cluster,

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm the completion of repair.

Next

8	The system is normal.

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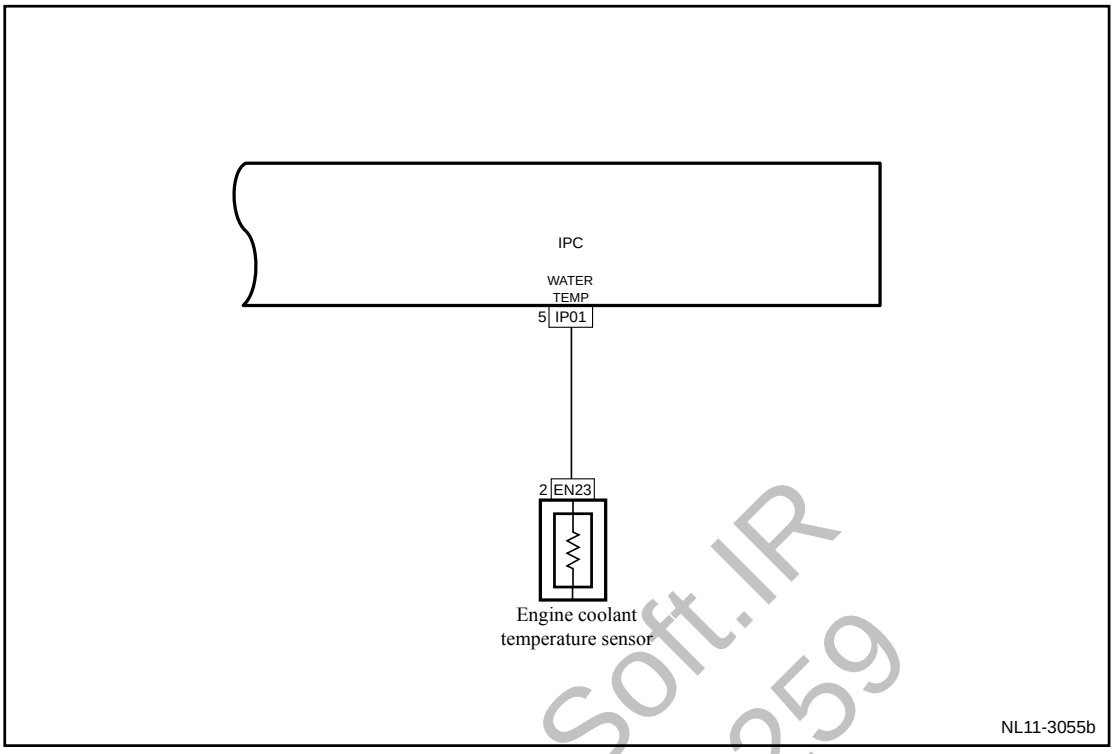
11.7.6.15 Temperature gauge can not indicate normally

Circuit diagram:



Diagnostic steps:

1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal

No → Fault discovered by maintenance

Yes

2	Inspect the communication between the terminal No.2 of the engine coolant temperature sensor wire harness connector EN23 and the terminal No.2 of the combination instrument wire harness connector IP01.

(a) Measure resistance between engine coolant temperature sensor wire harness connector EN23 terminal No.2 and combined instrument wire harness connector IP01 terminal No.2.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?

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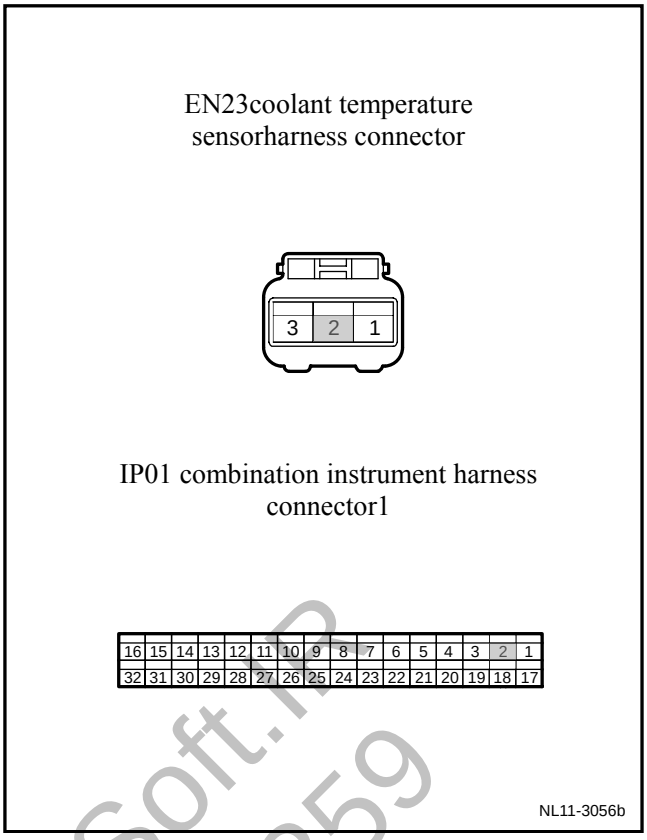

Yes → Go to step 4

No

3	Inspect and repair the wire harness between the terminal No.2 of the engine coolant temperature sensor wire harness connector EN23 and the terminal No.2 of the combination instrument wire harness connector IP01.

(a) Make sure that engine coolant temperature sensor wire harness connector EN23 terminal No.2 and combined instrument wire harness connector IP01 terminal No.2 are repaired and connected.

Inspect whether the water temperature gauge works normally.

Yes → The system is normal.

No

4	Replace the engine coolant temperature sensor.

Replace the temperature sensor of engine coolant and refer to 2.2.8.3 "Replacement of temperature sensor of engine coolant".

Inspect whether the water temperature gauge works normally.

Yes → The system is normal.

No

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5	Replace instrument cluster,

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm the completion of repair.

Next

6	The system is normal.

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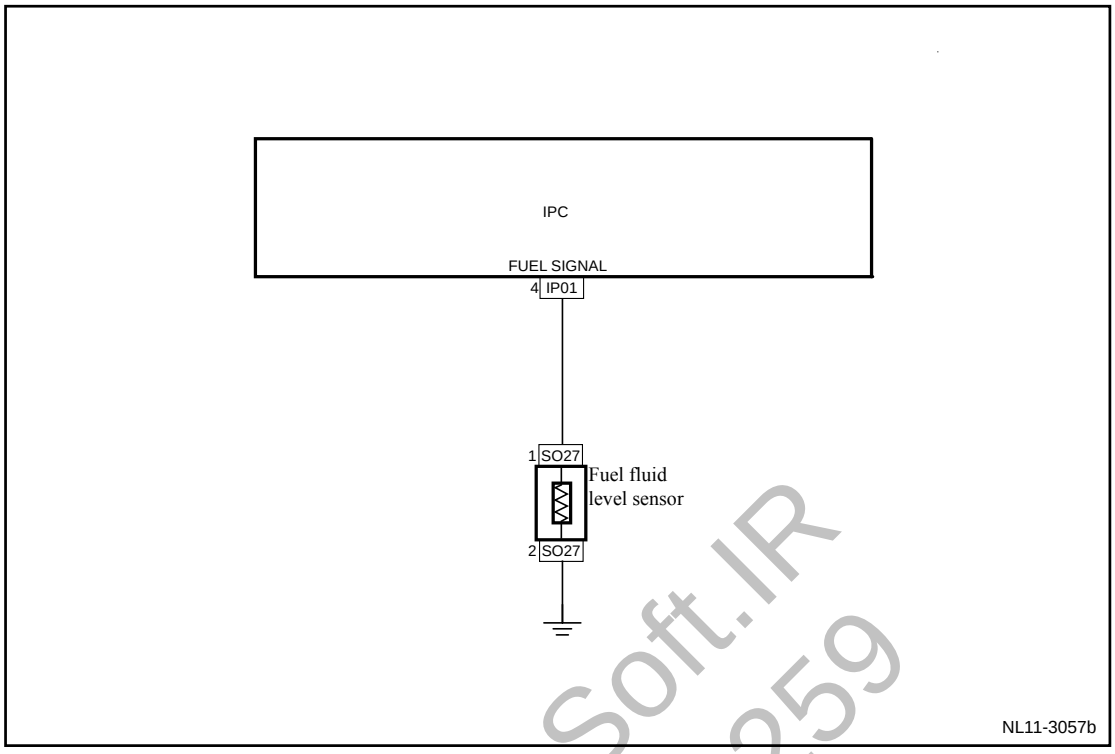
11.7.6.16 Fuel gauge do not indicate normally

Circuit diagram:



Diagnostic steps:

1	General inspection

(a) Inspect whether combined instrument wire harness connector has damage, bad connection, ageing and loose conditions.

Inspect if the result is normal

No → Fault discovered by maintenance

Yes

2	Inspect the communication between the terminal No.1 of the fuel level sensor wire harness connector SO27 and the terminal No.4 of the combination instrument wire harness connector IP01.

(a) Measure resistance between fuel level sensor wire harness connector SO27 terminal No.1 and combined instrument wire harness wire IP01 terminal No.4.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?

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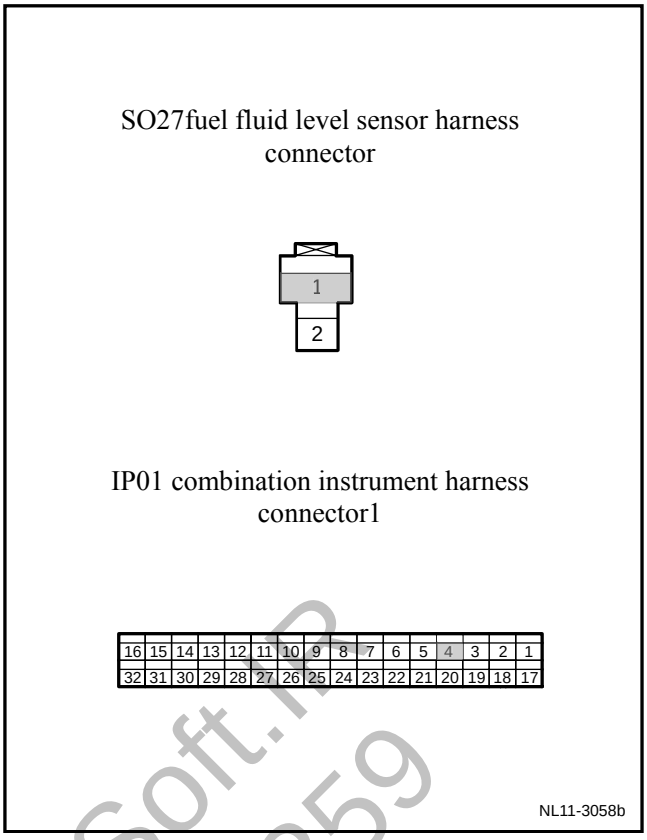

Yes → Go to step 4

No

3	Inspect and inspect the circuit between the terminal No.1 of the fuel level sensor wire harness connector SO27 and the terminal No.4 of the combination instrument wire harness connector IP01.

(a) Make sure that fuel level sensor wire harness connector SO27 terminal No.1 and combined instrument wire harness connector IP01 terminal No.4 are connected.

Check Fuel gauge work is not normal,

Yes → The system is normal.

No

4	Inspect the communication between the terminal No.2 of the speed sensor connector SO27 and the body grounding.

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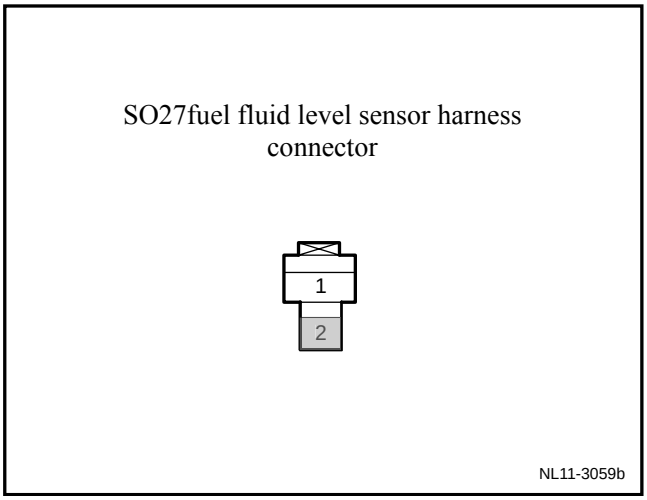
(a) Measure resistance between fuel level sensor wire harness connector SO27 terminal No.2 and vehicle body grounding.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 6

No

5	Inspect and repair the circuit between the terminal No.2 of the speed sensor connector SO27 and the body grounding.

(a) Make sure that speed sensor connector SO27 terminal No.2 and vehicle body grounding are connected.

Confirm whether the fuel gauge works normally.

Yes → The system is normal.

No

6	Check fuel level sensor resistance.

(a) Measure resistance of fuel level sensor.

Resistance standard value

Capacity:	**Resistance**
Full	40±4Ω
3/4	96.5±5Ω
1/2	150±5Ω
1/4	205±6Ω
Alarm	227±6Ω
Empty	250±7Ω

Is the resistance at a specified value?

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Yes → Go to step 8

No

7	Replace the fuel level sensor.

(a) Replace fuel level sensor , refer to 2.3.8.4 fuel level sensor replacement .

Inspect whether the fuel gauge works normally?

Yes → The system is normal.

No

8	Replace instrument cluster,

(a) Replace the combination instrument and refer to 11.6.7.1 replacement of combination instrument assembly.

Confirm the completion of repair.

Next

9	The system is normal.

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11.7.7 Diagnostic information and steps (JLD-4G2G/JLD-4G20)

11.7.7.1 Diagnosis descriptions

This instrument supports the OBD based on CAN buss.

Refer to Description and Operation of Complete Vehicle Maintenance Manual to get familiar with the system functions and operation before starting system diagnostics, so that it will help to determine the correct diagnostic steps. More importantly, it will also help to determine whether the customer described situation is normal.

11.7.7.2 Visual inspection

- Inspect installed aftermarket equipment that may affect the operation of the instrument system.
- Check the system components that is easy to access to identify whether there is significant damage or potential faults.
- Inspect whether the sensor of the instrument display information is normal.

11.7.7.3 Definition of DTC code supported by the instrument

DTC	DTC description
U100-04	EEPROM Checksum Error
U10018	A/C message time-out and lost communication with A/C
U10017	BCM message time-out and lost communication with BCM
U10011	CAN network system integrity test failure
U10010	Detect CAN BUS off state.

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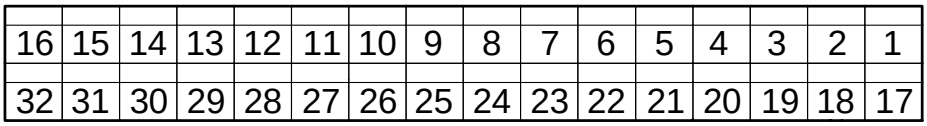
11.7.7.4 Instrument terminal list

IP01 combination instrument harness connector



NL11-3022b

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Terminal No.	Terminal definition	Diameter/color
1	Battery power supply	0.5R/G
2	Ignition switch	0.5Y
3	Instrument panel	0.85B
4	Fuel signal	0.35R
5	Brake fluid level low (-)	0.35P/Y
6	Sensor grounding	0.5B/O
7	Reverse radar	0.35L
8	Vehicle speed input	0.35W
9	Parking brake (-)	0.35P/O
10	/	/
11	Vehicle speed output	0.35B/R
12	8v power output	0.35Br
13	/	/
14	Low beam(+)	0.35O/G

15	/	/
16	Anti-theft indicator (-)	0.35L/O
17	Subsidiary safety belt output （-）	0.35G
18	DISP button	0.35R
19	Overspeed alarm off（-）（reseved ）	Reserved
20	Can high	0.5Y/G
21	Can low	0.5G/Br
22	/	/
23	Preheating wire reserve （-）	Reserved
24	Oil-water seperation reserve（+）	Reserved
25	High beam（-）	0.35O/G
26	High beam（+）	0.35O/
27	Rear fog lamps（+）	0.35R/G
28	Front fog lamp	0.35R/O
29	Position lamp（+）	0.35L
30	Battery charging indicator（-）	0.35R/W
31	Low oil pressure（-）	0.35P/
32	Reverse gear （+）	0.35G/O

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11.7.7.5 DTC U100-04

DTC	U100-04	EEPROM Checksum error

Diagnostic steps:

1	Check whether the meter power supply circuit and ground circuit are normal.

Yes → Repair the faulty part.

No

2	Replace instrument assembly, Refer to 11.1.7.1 replacement of Instrument cluster Assembly.

Next

3	Use fault diagnosis tester to confirm if DTC is stored again.

A. Connect fault diagnosis tester to the data link connector.

B. Rotated ignition switch to ON position.

C. Clear DTC code.

D. Start and run the engine at idle speed to warm up the engine for at least 5min.

E. Read the control system DTC code again.

DTC codes still exist?

Yes	Go to step 1
No	

4	Troubleshooting

11.7.7.6 DTC U1400 U1410 U1420 U1430 U1501 U1601

DTC code	Descriptions
U10018	A/C message time-out and lost communication with A/C
U10017	BCM message time-out and lost communication with BCM
U10011	CAN network system integrity test failure
U10010	Detect CAN BUS off state.

Diagnostic steps:

See 11.16.8 Diagnostic Information and procedures in "data communication system".

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11.7.8 Dismantle and install

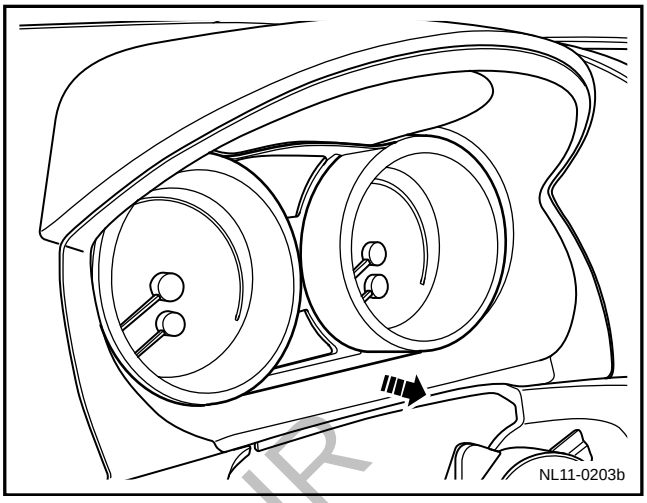
11.7.8.1 Replacement of combination instrument assembly

Dismantlement procedure

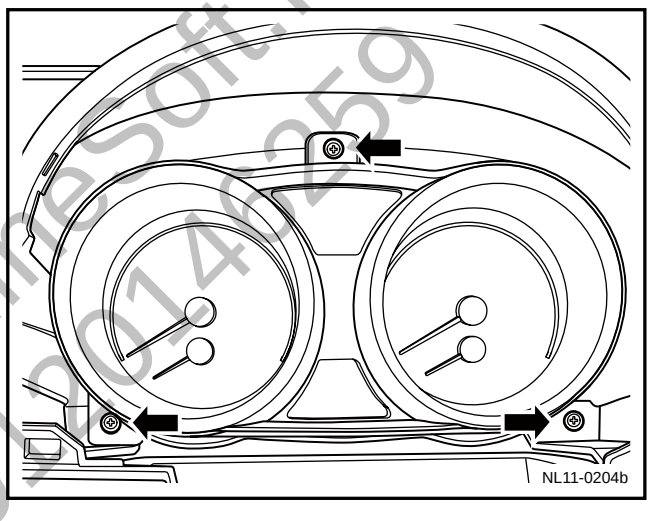
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

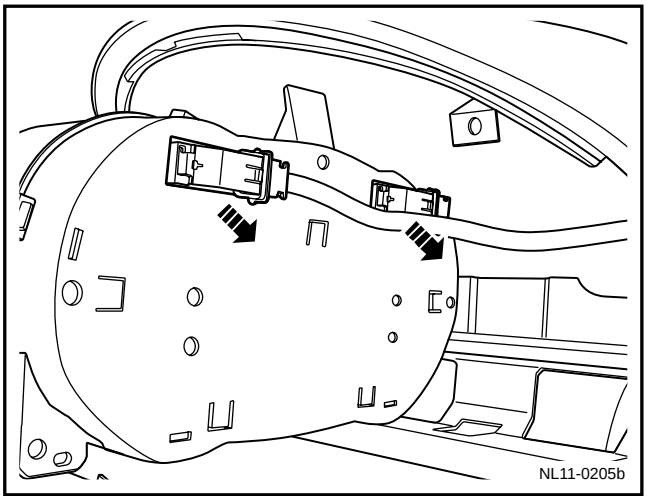
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle combined instrument cover.



3. Dismantle fixing screw of combined instrument.



4. Disconnect combined instrument wire harness connector.



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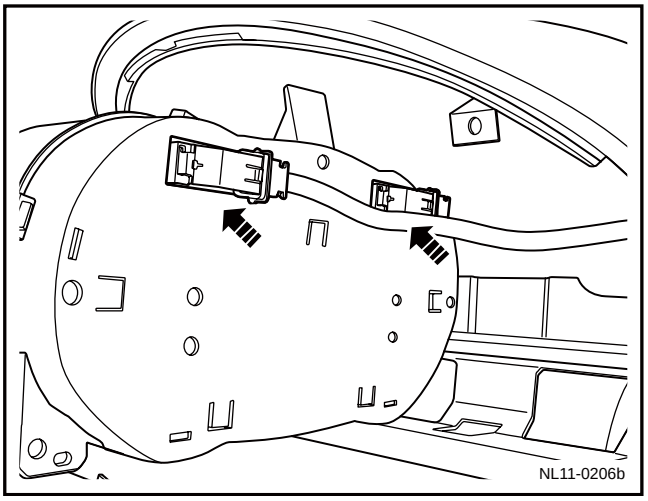
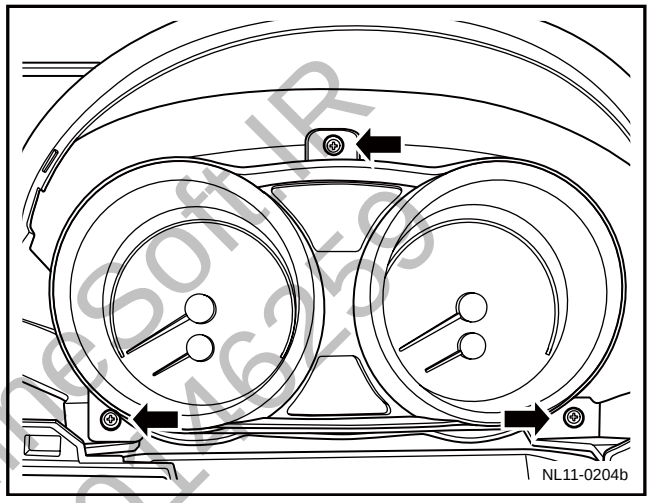
Installation procedure:

1. Connect the combination instrument harness connector.

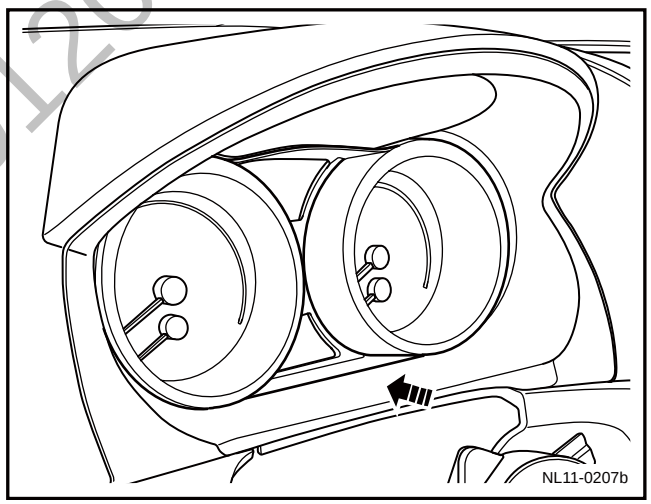


2. Install and tighten fixing screw of multi-functional instrument.

Torque :4Nm(Metric) 3lb-ft(English system)



3. Install combined instrument cover.
4. Connect the battery negative cable.



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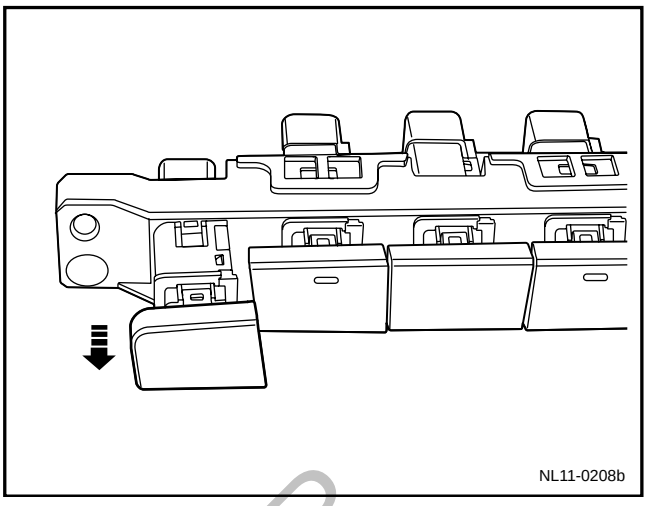
11.7.8.2 Replacement of combination adjustment switch

Dismantlement procedure

Warning!

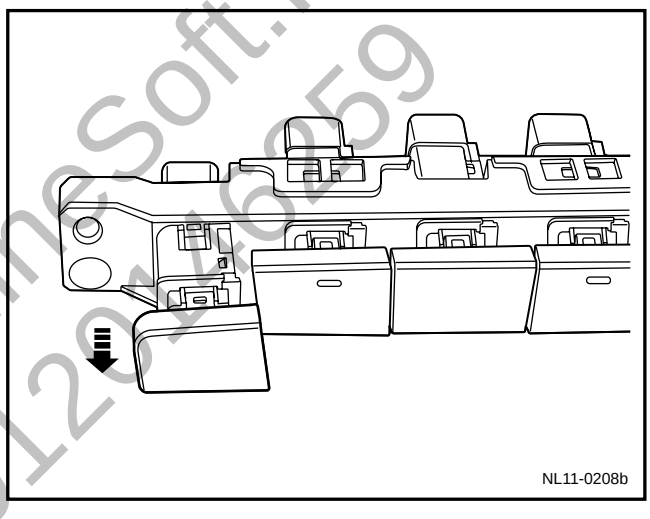
Warning: refer to "warning on battery disconnection" in "warnings and precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle the instrument panel center switch assembly. Refer to 8.2.8.1 Replacement of Air-conditioning Control Panel.
3. Remove instrument adjusting switch from central switch assembly of instrument panel.



Installation procedure:

1. Install instrument adjusting switch onto instrument panel central switch.
2. Install the instrument panel center switch.
3. Connect the battery negative cable.



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11.8 Sunroof

11.8.1 Specification

11.8.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N.m)	English system (lb-ft)
Front reading light sunroof switch assembly screws	St4.2×16	2-4	2-3
Sunroof assembly bolts	M6×20	7-9	5-7
Sunroof attachment bracket bolts	M6×14	7-10	5-8
Sunroof front/middle attachment bracket bolts	M6	7-9	5-7

11.8.1.2 Sunroof motor specification

Parameters	Rating
Working voltage range	13.5V
Naximum load rotation	102(RPM)
Maximum load current	8.1A
Minimum no-load rotation	100(RPM)
Maximum no-load current	3 (A)
Maximum locked-rotor current	17.7 (A)
Maximum locked-rotor torque	8.6（N.m）

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11.8.2 Decryption and operated

11.8.2.1 Description and operation

System components

– Sunroof control module

– Sunroof switch assembly with interior reading lamp

– Sunroof motor with Hall sensor

– Sunroof

– Sunvisor

Common operation

– Any button operation of which the swtich reaction time is less than 10ms(±5ms) is invalid.

– Sunroof switch assembly with interior reading lamp

– Fast operating mode allows sunroof automatically open or close without the need to hold the switch. This function is activated when the switch signal is more than 500ms, and can be achieved when sliding and tilting.

– Limit control: when the glass panel move from warped position to the totally closed status, the limit control shall start to work.

– Comfortable position stop: when the glass panel is opened in sliding zone, it will stop at an adjusting position before it is totally opened. When the glass panel is in an open status, this position can reduce wind noise. When the glass panel stops at this position, the user can continue opening it by switch operation if he wants to open the glass panel totally.

Anti-clamp function

During the process in which the glass panel is being closed, the Anti-clamp system shall supervise the barriers. If there is any barrier, the Sunroof shall return to the position 200mm from the normal closed position. The Anti-clamp function shall work when it is sliding quickly or the warped position is closed.

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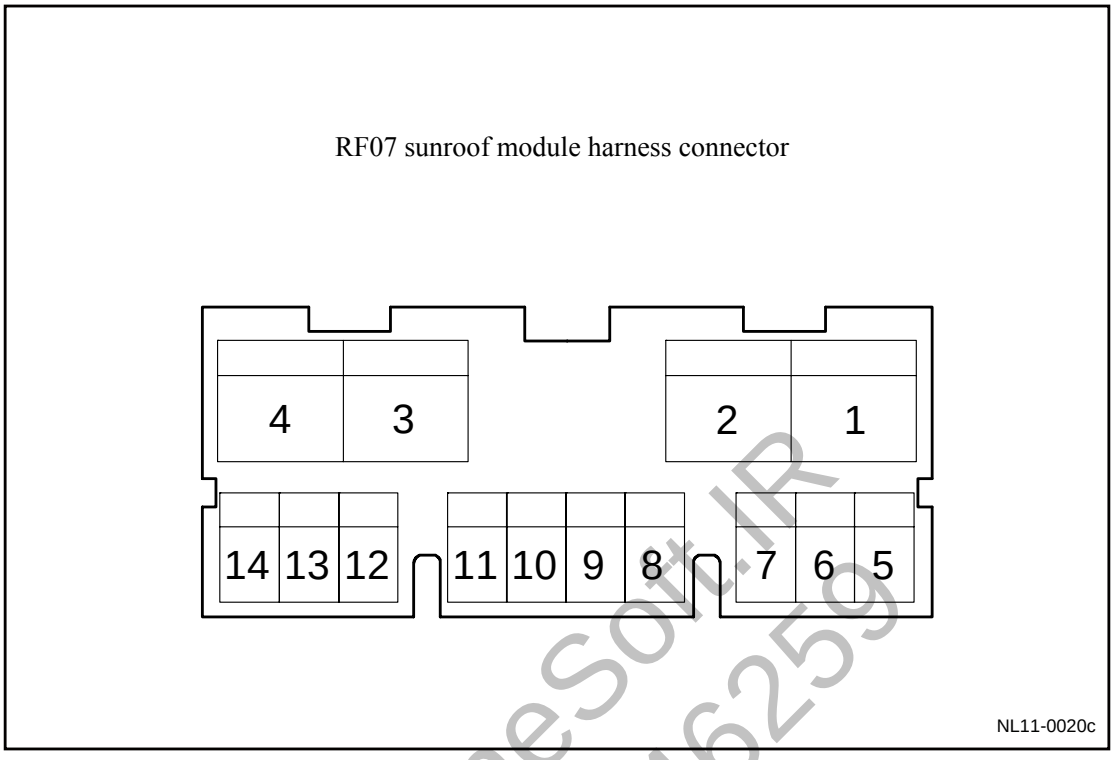
11.8.3 System work principle

11.8.3.1 System operating principle

Terminal diagram



Sunroof motor and control module are integrated with a total of 14-pin wiring harness connector. Terminals are defined as following:

Terminal No.	Terminal definition	Diameter/color	Terminal status	Descriptions
1	+B power supply	1.25R	Power supply	Battery power supply
2	Frequency signal （low）	0.5R	Output	Ground
3	Frequency signal （high）	0.5Y	IG1 power supply	Ig1 signal
4	Ground	1.25B	Ground	Ground
5	Open by sliding	0.3Y	Output	Slide on signal
6	Off by sliding	0.3L	Output	Slide off signal
7	Rapid slide	0.3O	Output	Rapid slide signal
8	Warp on	0.3B/O	Output	Warp on signal
9	Warp off	0.3P	Output	Warp off signal

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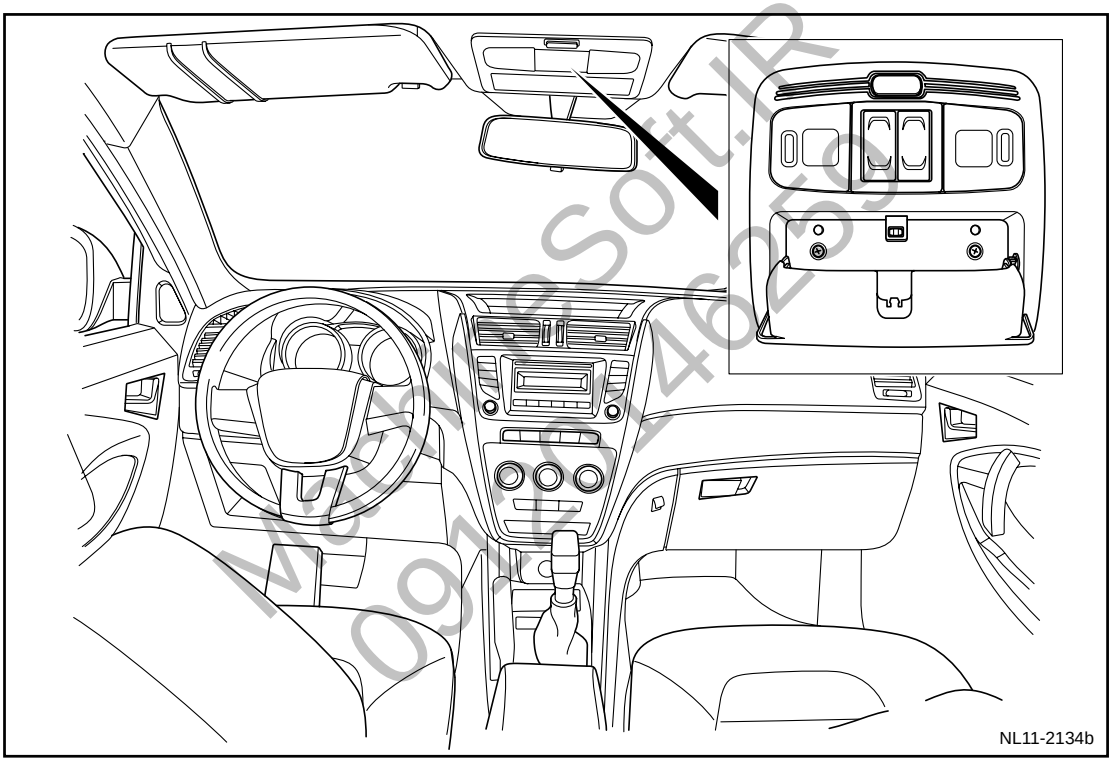
10	Rapid warp	0.3B/Y	Output	Rapid warp signal
11	/	/	/	/
12	/	/	/	/
13	/	/	/	/
14	/	/	/	/

Tilt switch and slide switch are ground signals, when the switch is pressed, the signal circuit will have a low voltage.

11.8.4 Part position

11.8.4.1 Component position

Sunroof switch assembly



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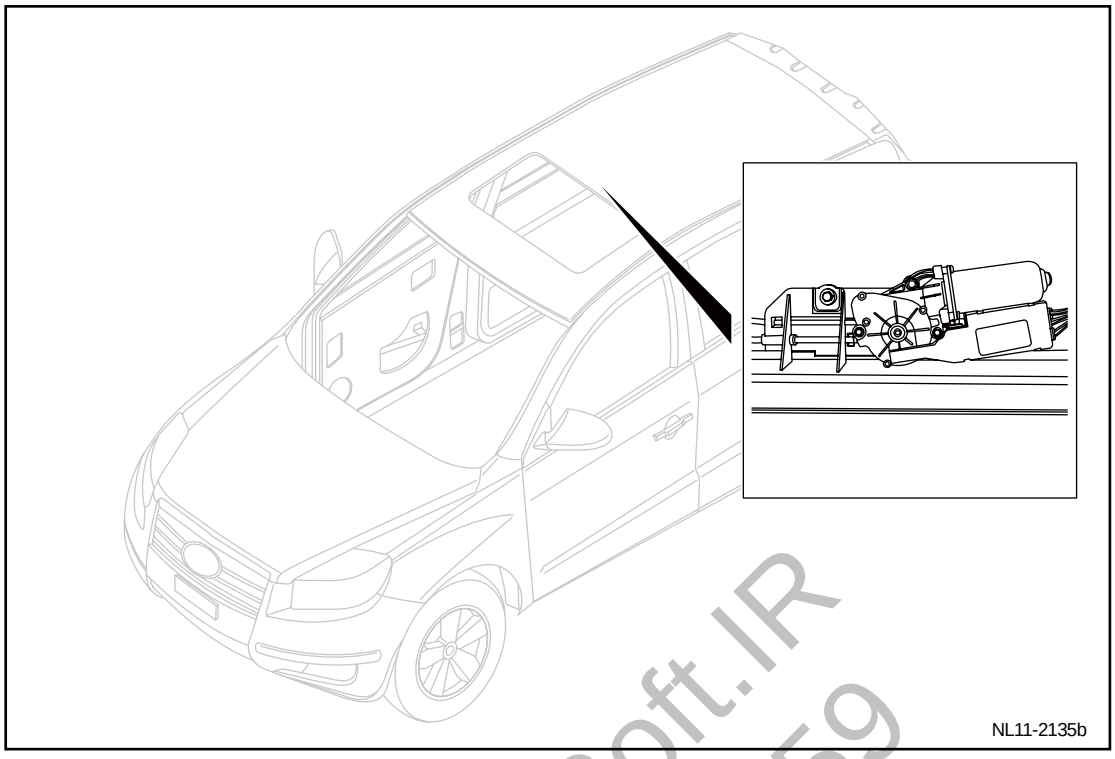
Sunroof motor



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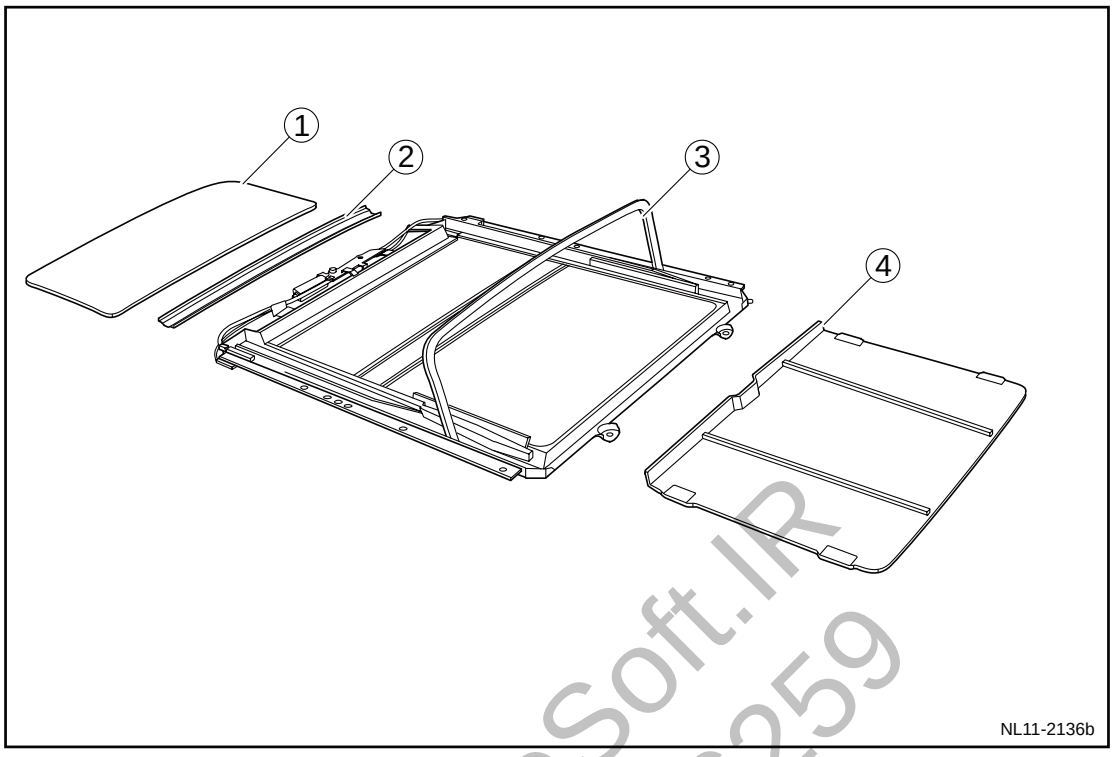
11.8.5 Disassemble drawings

11.8.5.1 Disassemble drawings



1. Sunroof window
2. Roof stiffener
3. Sunroof frame
4. Sunroof visor

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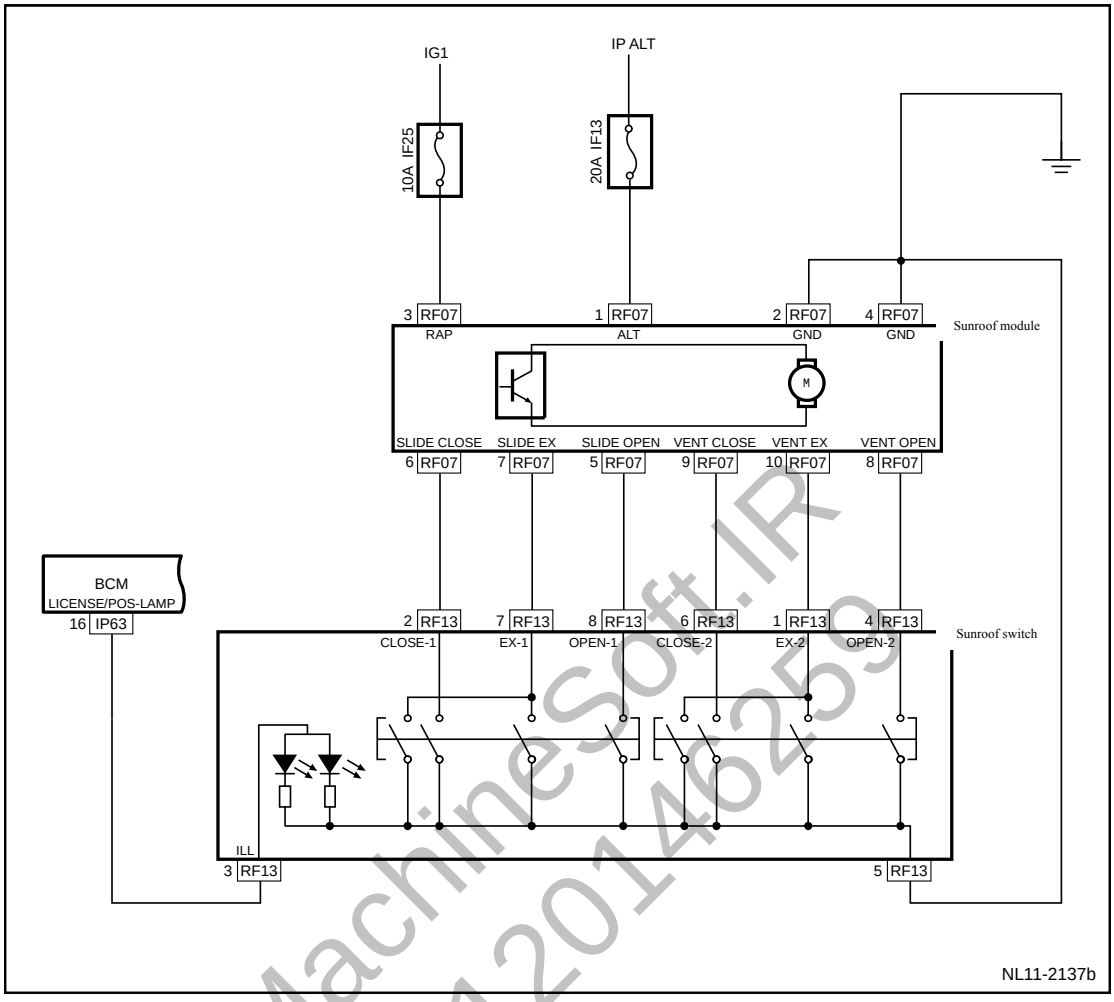
11.8.6 Schematic of electronics

11.8.6.1 Diagnostic schematic diagram



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11.8.7 Diagnostic information and steps

11.8.7.1 Diagnosis descriptions

Refer to 11.8.2 Description and Operation to get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.8.7.2 Visual inspection

– Inspect the after-sales optional device which may affect the normal operation of sunroof system.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– Inspect whether the sunroof initialization is no longer valid.

11.8.7.3 Sunroof Initialization

– When the initial position is lost, perform this procedure:

– Press the tumble switch at totally overturning position for more than 5 seconds.

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11.8.7.4 Sunroof can not work

Circuit diagram:

Circuit diagram，refer to 11.8.6.1 electrical schematic diagram

Diagnostic steps:

1	Check the fuses IF13, IF25

A. Inspect whether the fuses IF13 and IF25 are broken.

Fuse Rating: respectively 20A, 10 A

No → Go to step 3

Yes

2	Inspect the circuits of the fuses, IF13 and IF25.

A. Check whether fuse if13 and fuse if25 lines are short circuited.

B. Repair the circuits, Confirm that there are no short circuits.

C. Replace the fuses with rated current.

Confirm whether the sunroof is working properly.

Yes → The system is normal.

No

3	Carry out the sunroof initial program.

A. Execute the sunroof initial program, refer to 11.2.7.3 sunroof Initializing.

Confirm whether the sunroof is working properly.

Yes → The system is normal.

No

4	Inspect the sunroof switch harness connector RF13 and body ground.

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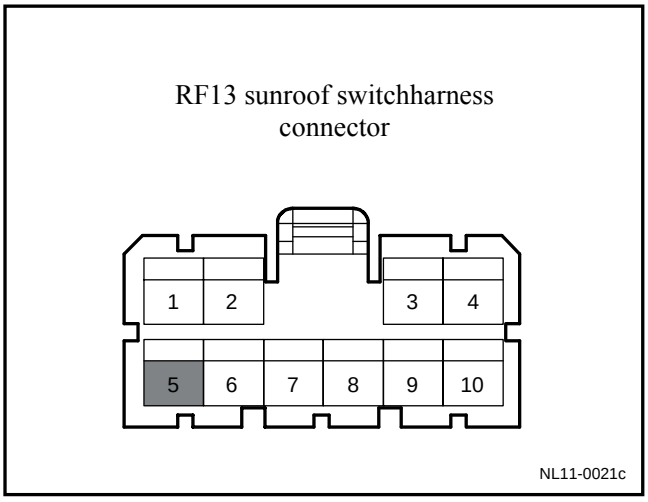
A. Remove the sunroof switch assembly, reffer to 11.2.8.3 Replacement of Sunroof Switch Assembly.

B. Measure the resistance between terminal No.5 of the sunroof switch harness connector RF13 and body ground with a multimeter.

Standard resistant value :is less than 1Ω

Confirm whether the resistance is at a specified value.



Yes → Go to step 6

No

5	Repair the open faults between the sunroof switch harness connector RF13 and body ground.

A. Confirm that open fault repair between the terminal No.5 sunroof switch harness connector RF13 and body ground is completed.

Confirm whether the sunroof is working properly.

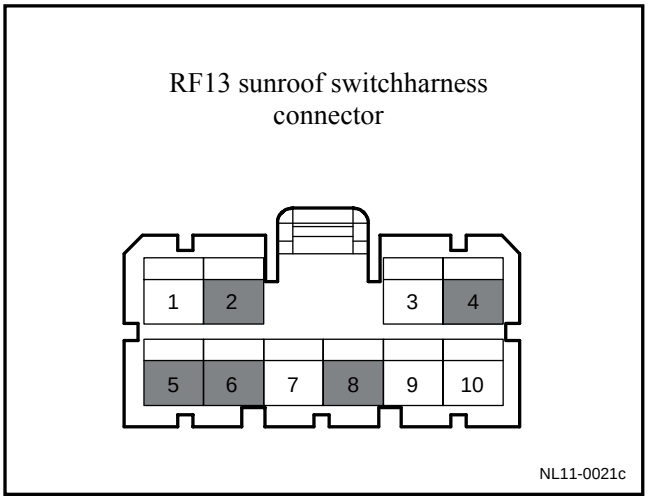
Yes → The system is normal.

No

6	Check the sunroof switch assembly.

A. Press down the continuity of Sunroof switch.

B. Test the resistance of the terminals by universal meter.



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Test terminal	Test conditions	Specified value
RF13(2)—RF13(5)	Off by sliding	Less than 1 Ω
RF13(8)—RF13(5)	Open by sliding	Less than 1 Ω
RF13(6)—RF13(5)	Warp off	Less than 1 Ω
RF13(4)—RF13(5)	Warp on	Less than 1 Ω

Confirm whether the resistance is at a specified value.

Yes → Go to step 8

No

7	Replace the sunroof switch assembly.

A. Install new sunroof switch assembly, Refer to 11.2.8.3 Replacement of Sunroof Switch Assembly.

Confirm whether the sunroof is working properly.

Yes → The system is normal.

No

8	Check RF07 terminal voltage and circuit energy transmission ability of sunroof assembly harness connector.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect the battery negative cable.

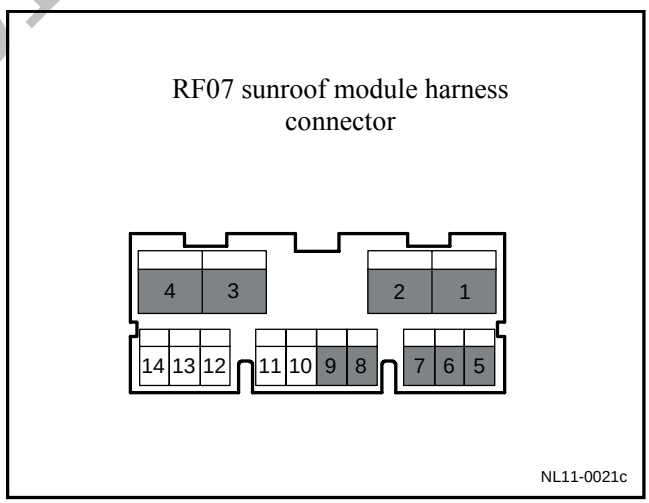
(c) Disconnect Sunroof module harness connector RF07.

(d) Disconnect Sunroof module harness connector RF13.

(e) Connect the battery negative cable.

(f) Turn the ignition switch to "ON" position.

(g) Test the terminal voltage and circuit energy transmission ability with a universal meter.



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Standard Value

Test terminal	Test conditions	Specified value
RF07(3)—Ground	11-14V	/
RF07(1)—Ground	11-14V	/
RF07(2)—Ground	/	Less than 1 Ω
RF07(4)—Ground	/	Less than 1 Ω
RF07(6)—RF13(2)	/	Less than 1 Ω
RF07(5)—RF13(8)	/	Less than 1 Ω
RF07(9)—RF13(6)	/	Less than 1 Ω
RF07(8)—RF13(4)	/	Less than 1 Ω

Yes → Go to step 10

No

9	Repair the faulty circuit.

(a) Repair the trouble spots of the circuit.

(b) Disconnect the battery negative cable.

(c) Connect the sunroof switch harness connector RF13.

(d) Connect sunroof module harness connector RF07.

(e) Connect the battery negative cable.

(f) Turn the ignition switch to "ON" position.

(g) Operate the sunroof switch.

Confirm whether the sunroof is working properly.

Yes → The system is normal.

No

10	Replace the sunroof motor assembly.

(a) Replace the sunroof module assembly and refer to 11.2.8.2 "replacement of sunroof motor".

Confirm the completion of repair.

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Next

11	The system is normal.

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11.8.7.5 Sunroof can not open

Circuit diagram:

Refer to 11.8.7.4 sunroof can not work.

Diagnostic steps:

1	Inspect the sunroof switch

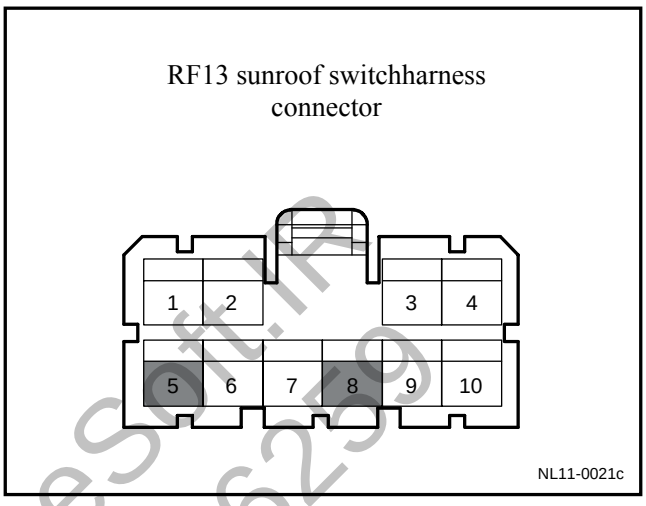
(a) Disconnect the Sunroof switch harness connector RF13.

(b) Operate the Sunroof switch to open the slide.

(c) Measure the resistance between terminals No.8 and No.5 of the sunroof switch harness connector RF13 with a multimeter.

Standard resistance: less than 1 Ω

Confirm whether the resistance is at a specified value.



Yes → Go to step 3

No

2	Replace the sunroof switch assembly.

(a) Replace sunroof switch assembly and refer to 11.2.8.3 "Replacement of Sunroof Switch Assembly".

Confirm whether the sunroof can be opened by sliding.

Yes → The system is normal.

No

3	Check the energy transmission ability of the signalling circuit of the sunroof switch and module.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect the battery negative cable.

(c) Disconnect Sunroof module harness connector RF07.

(d) Disconnect the sunroof switch harness connecter RF13.

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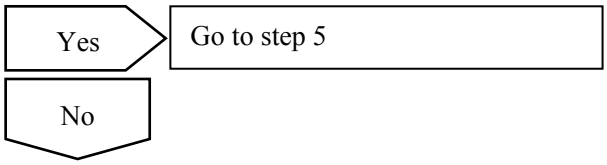
(e) Measure the resistance between terminal No.5 of the sunroof module harness connector RF07 and terminal No.8 of sunroof switch wiring harness connector RF13 with a multimeter.

Standard resistant value: is less than 1Ω

Is the resistance at a specified value?



4	Repair the signalling circuit from the sunroof switch to the Sunroof module.

(a) Repair the trouble spots between terminal No.5 of the sunroof module harness connector RF07 and terminal No.8 of the Sunroof switch harness connector RF13.

(b) Connect the sunroof switch harness connection RF13.

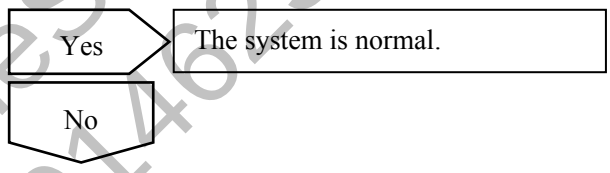
(c) Connect the sunroof module harness connecter RF07.

(d) Connect battery negative cable.

(e) Turn ignition switch to "ON" position.

(f) Operate “slide on” of the sunroof switch.

Confirm whether the “slide on” of sunroof switch works normally.



5	Replace the sunroof module

A. For the Replacement of the Sunroof motor assembly, please refer to 11.2.8.2 Replacement of Sunroof Motor.

Confirm the completion of repair.

8	The system is normal.

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11.8.7.6 Sunroof can not close

Circuit diagram:

Refer to 11.8.7.4 sunroof can not work.

Diagnostic steps:

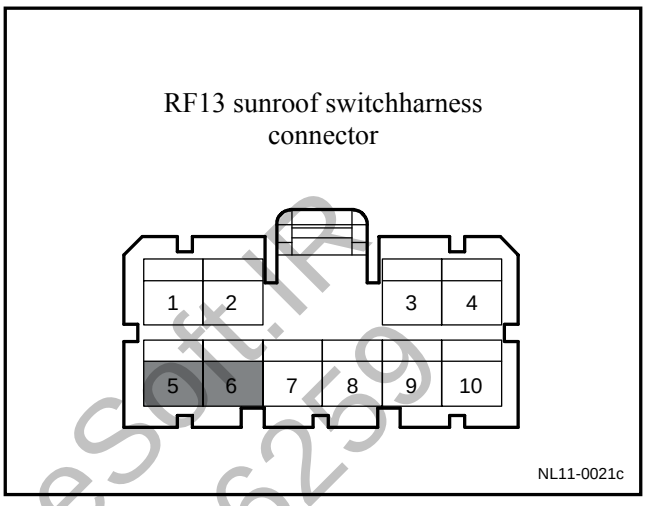
1	Inspect the sunroof switch

(a) Disconnect the sunroof switch harness connector RF13.

(b) Measure the energy transmission ability between switch terminals No.6 and No.5 with a multimeter.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 3

No

2	Replace the sunroof switch assembly.

(a) Replace the sunroof switch assembly, Refer to 11.2.8.3 replacement of sunroof switch assembly.

Confirm whether the sunroof is working properly.

Yes → The system is normal.

No

3	Check the breakover condition of the circuits of sunroof module and sunroofswitch.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect the battery negative cable.

(c) Disconnect sunroof module harness connector RF07.

(d) Disconnect sunroof module harness connector RF13.

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(e) Measure the resistance between terminal No.9 of the sunroof module harness connector RF07 and terminal No.6 of the sunroof switch wiring harness connector RF13 with a multimeter.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → Go to step 5

No

4	Repair the circuits between the sunroof module and sunroof switch.

(a) Repaire the trouble sports between terminal No.9 of sunroof module harness connecter RF07 and terminal No. 6 of sunroof switch harness connector RF13.

(b) Connect sunroof switch harness connector RF13.

(c) Connect the sunroof module harness connecter RF07.

(d) Connect battery negative cable.

(e) Turn ignition switch to "ON" position.

(f) Operate the shut down switch of sunroof warp.

Confirm whether the sunroof can be closed by warping.

Yes → The system is normal.

No

5	Replace the sunroof module

A. Replace the sunroof module, Refer to 11.2.8.2 Replacement of Sunroof Motor

Confirm the completion of repair.

Next

6	The system is normal.

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11.8.7.7 Sunroof anti-trap function inoperative

Circuit diagram:

Refer to 11.8.7.4 Sunroof Can Not Work.

Diagnostic steps:

1	Carry out the sunroof initialization.

Confirm whether the sunroof is working properly.

Yes → The system is normal.

No

2	Replace the sunroof switch assembly.

A. Install new sunroof switch assembly, Refer to 11.8.8.3 Replacement of Sunroof Switch Assembly.

Confirm whether the sunroof is working properly.

Next

3	The system is normal.

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11.8.7.8 Sunroof can not operate intermittently

Circuit diagram:

Refer to 11.8.7.4 Sunroof Can Not Work.

Fault symptom table :

Fault Symptom	Suspected Parts	Maintenance scheme
Insulation Inner Layer Wire Poor Connection	Wiring harness between Sunroof Module and The Sunroof Switch	Refer to 11.8.7.5 Sunroof Can Not Open.
Poor connection of male and female harness connector terminals	1. Sunroof switch 2. Sunroof motor harness connector 3. Sunroof switch Harness connector 4. Sunroof motor	1. Clean the connector male and female terminals. 2. Replace the sunroof switch, Refer to 11.8.8.3 replacement of sunroof switch assembly. 3. Replace the wiring harness. 4. Replace the sunroof motor, Refer to 11.8.8.2 replacement of sunroof motor.
Ground point contacts bad.	G6 earth point(ground point)	1. Fasten the fixing components of earth points. 2. Clean the joints of earth points.
Poor connection of sunroof Switch	1. Slide the Switch 2. Tilt the Switch	Replace sunroof switch, refer to 11.8.8.3 replacement of sunroof switch assembly.

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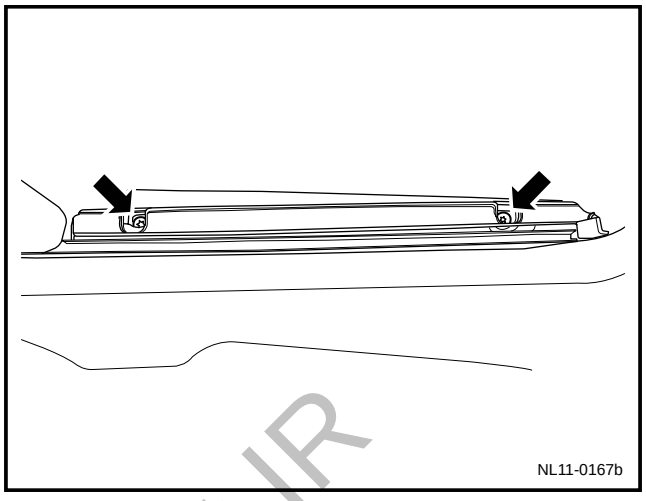
11.8.8 Dismantle and install

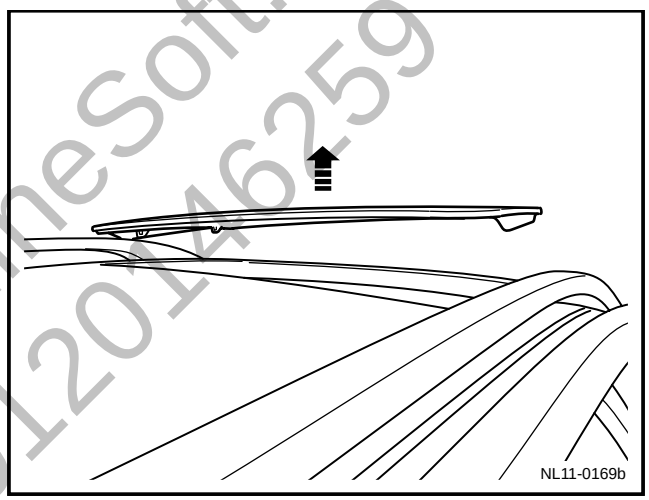
11.8.8.1 Replacement of sunroof glass

Dismantlement procedure

1. Tilt the sunroof slightly to remove the sunroof retaining bolts and remove the retaining bolts of left side sunroof.
2. Dismantle the fixing bolts of right side sunroof.



3. Move the sunroof glass upward.



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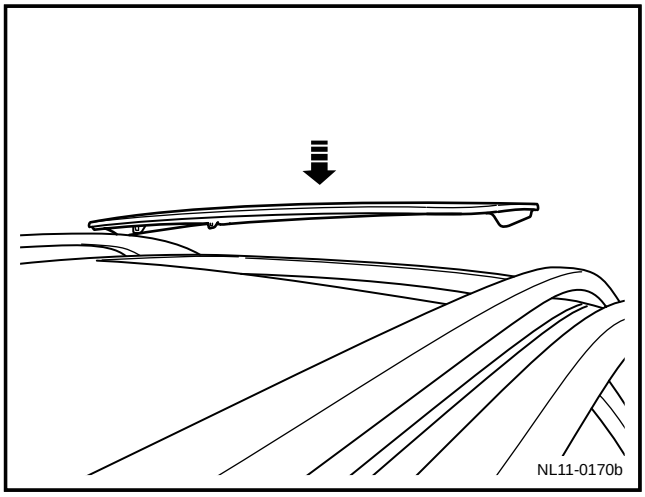
Installation procedure:

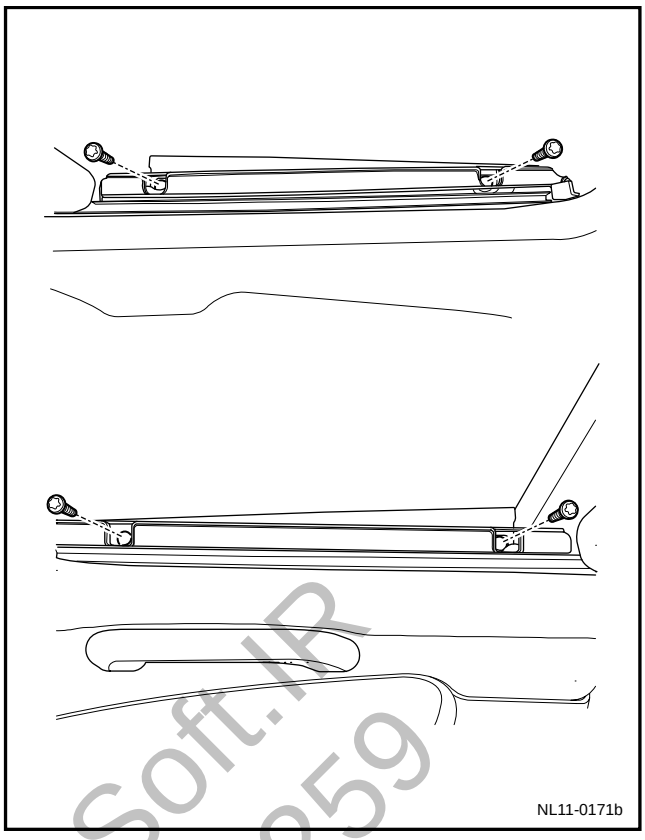
1. Install the sunroof glass, and screw the fixing bolts but do not tighten up.



Note: After installation, carry out water leaking test. Inspect whether there is water leaking to confirm the correct installation.

2. Adjust the sunroof glass to make it parallel and even with the roof and make sure the surrounding gaps are consistent. Tighten the retaining bolts.

Torque: 5 Nm (Metric system) 3.7lb-ft (English system)



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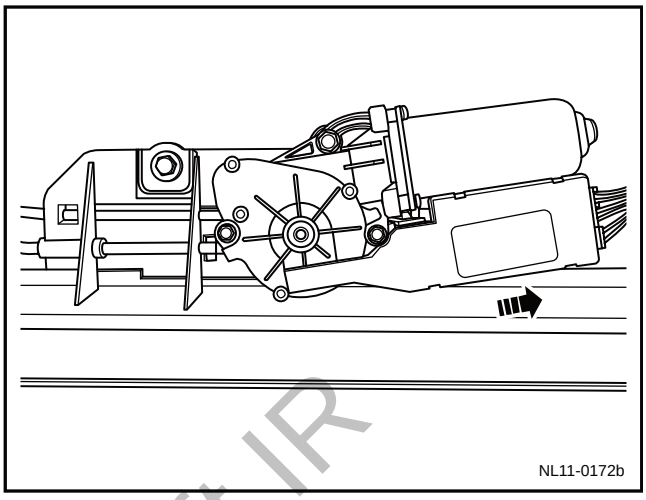
11.8.8.2 Replacement of sunroof motor

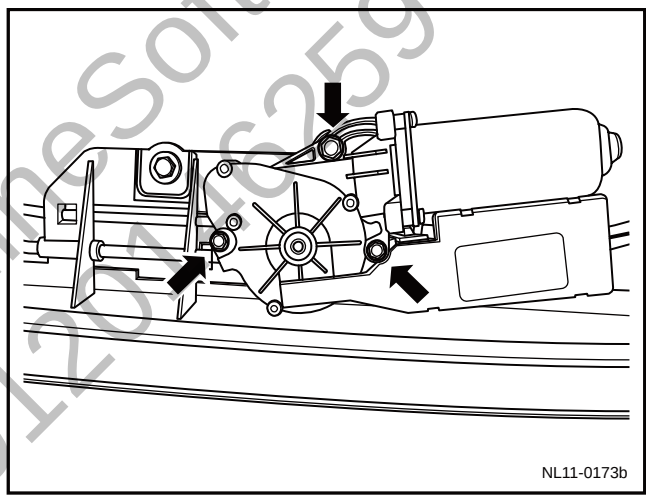
Dismantlement procedure

Warning: refer to" battery disconnection warning" in "warnings and notices".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 disconnection and connection procedures of battery cable in vehicle maintenance manual.
2. Disassemble the roof panel, Refer to 12.9.1.11 replacement of roof panel of complete vehicle maintenance manual.
3. Disconnect the sunroof motor wiring harness connector.



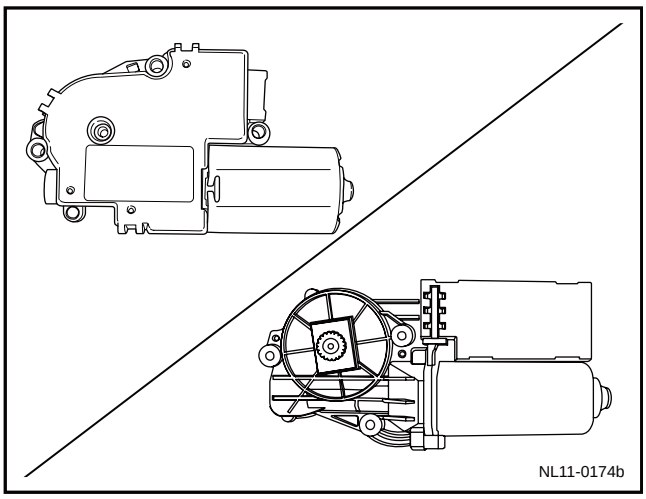
4. Dismantle the fixing bolts of sunroof motor.



5. Pull downward the sunroof motor.

Notes:

Prevent the motor gear and rack misalignment.



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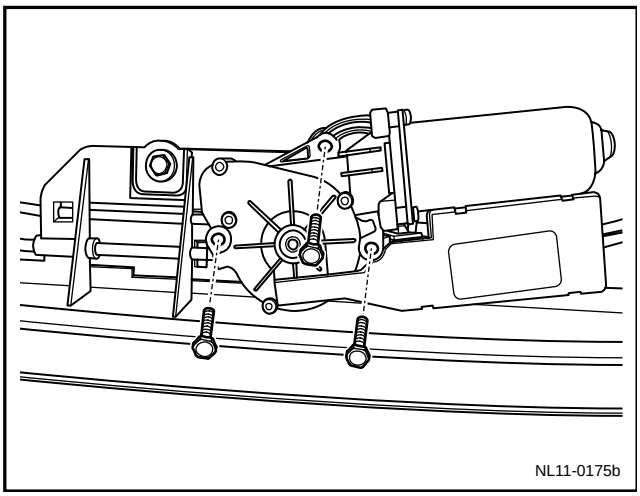
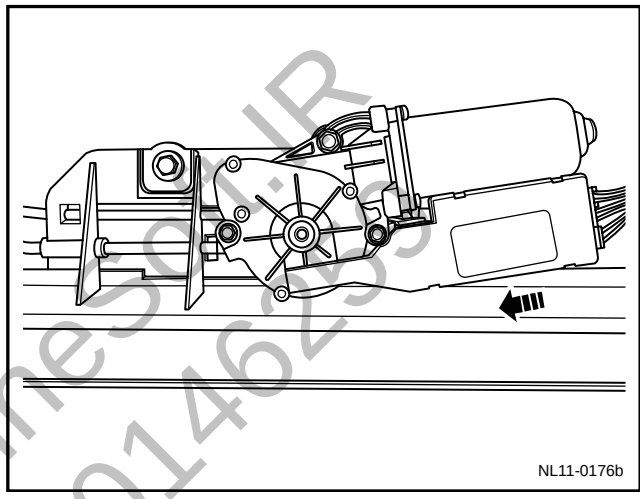
Installation procedure:

1. Install the sunroof motor and tighten the fixing bolts.

Torque 10N.m (Metric). 7. 4lb-ft (English system) .



2. Connect the motor harness connector.
3. Install the roof panel.
4. Connect the battery negative cable.



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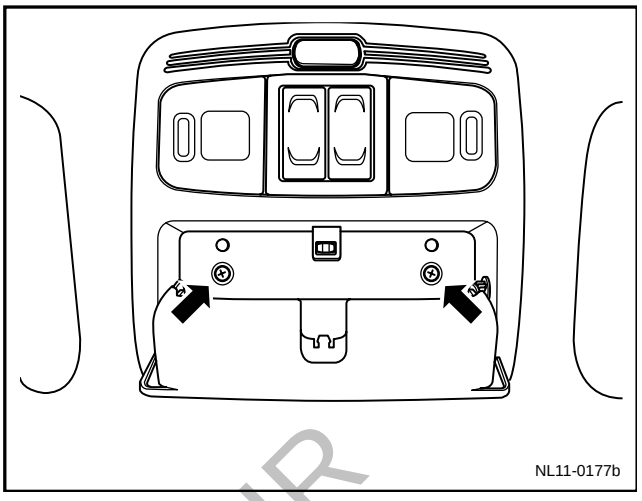
11.8.8.3 Replacement of sunroof switch assembly

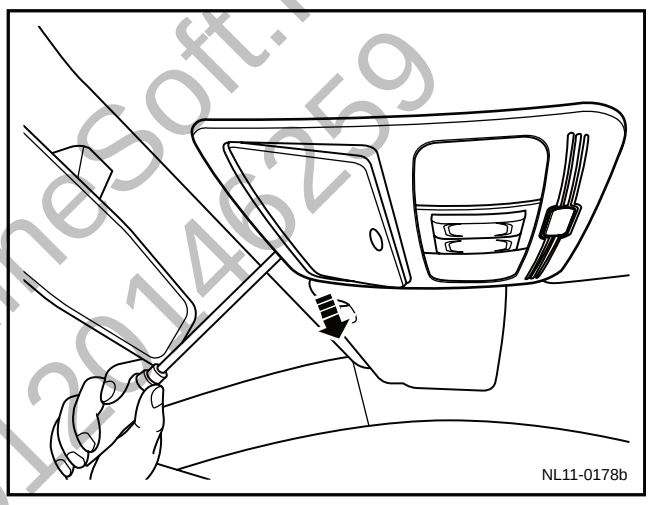
Dismantlement procedure

Warning: refer to" battery disconnection warning" in "warnings and notices".

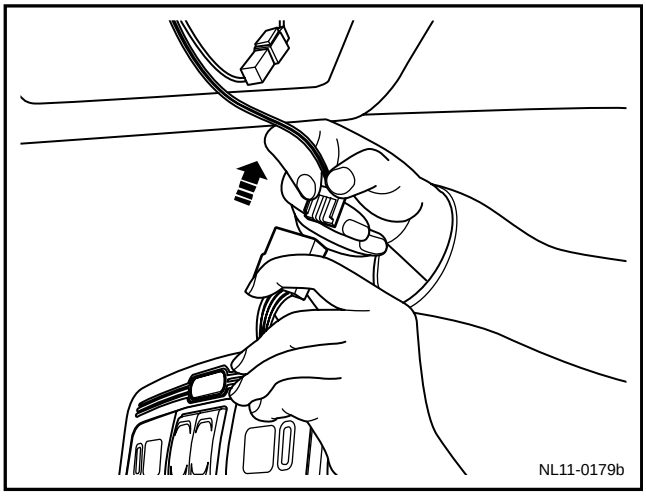
1. Disconnect the battery negative cable. Refer to 2.11.8.1 disconnection and connection procedures of battery cable in vehicle maintenance manual.
2. Open the glasses case and Dismantle the fixing bolts of sunroof switch assembly.



3. Remove the sunroof switch assembly.



4. Disconnect the harness connector of sunroof switch assembly, and take out the sunroof switch assembly.



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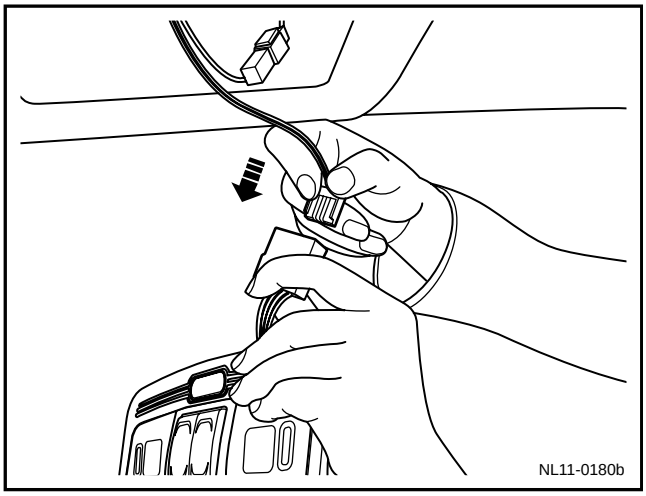
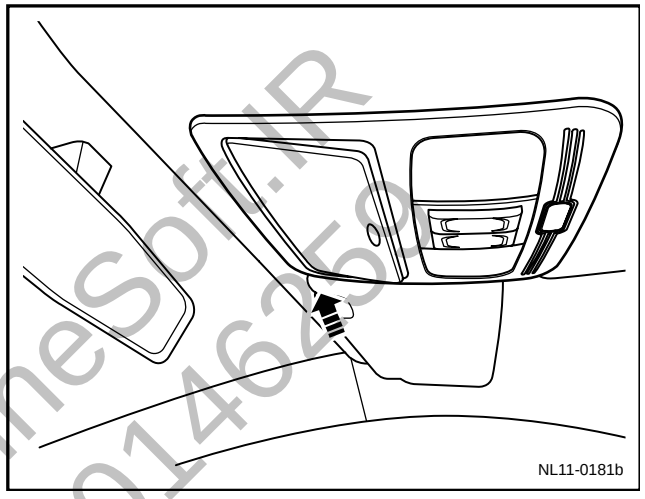
Installation procedure:

1. Connect the sunroof switch assembly harness connector.



2. Install the sunroof switch assembly.



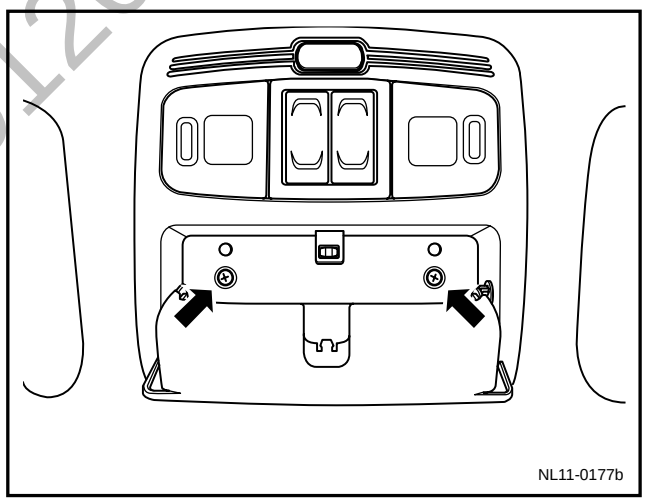
3. Install the fixing bolts of sunroof switch assembly.

Torque: 4Nm(Metric); 3lb-ft (English system)

Notes:

Refer to fastener notice in warnings and notices.

4. Connect the battery negative cable.



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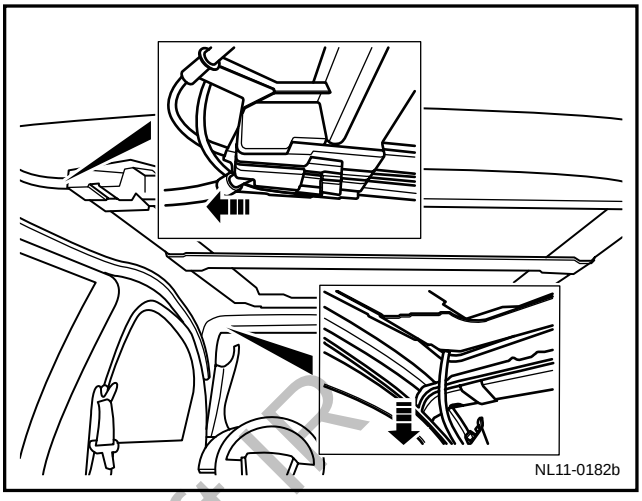
11.8.8.4 Replacement of sunroof frame

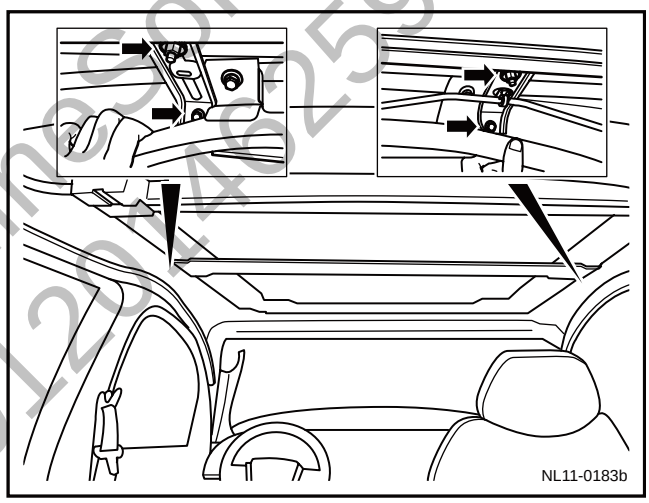
Dismantlement procedure

Warning: refer to "precautions on battery disconnection" in "warnings and precautions".

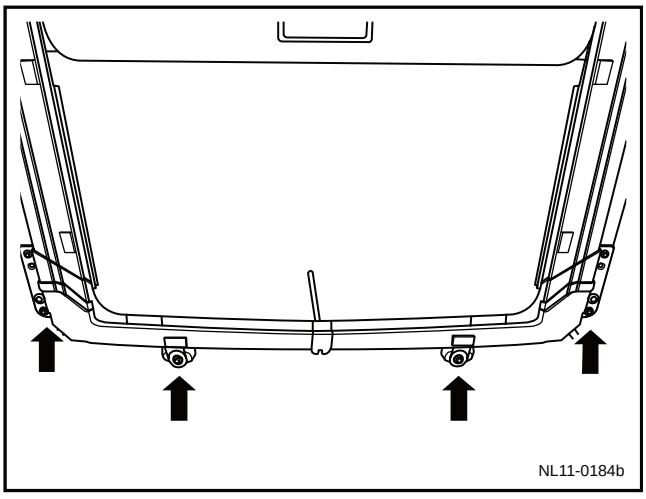
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Disconnection and Connection procedures of Battery Cable in Vehicle Maintenance Manual.
2. Disassemble sunroof glass, Refer to 11.2.8.1 Replacement of Sunroof Glass.
3. Dismantle sunroof motor, Refer to 11.2.8.2 Replacement of Sunroof Motor.
4. Disassemble the drain-pipes on the front and rear sides of sunroof.



5. Diassemble the front attachment bracket of sunroof.



6. Dismantle the fixing bolts of sunroof motor.



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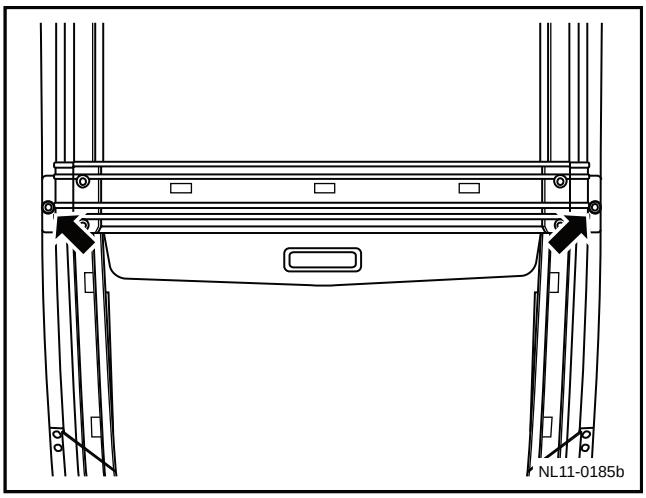
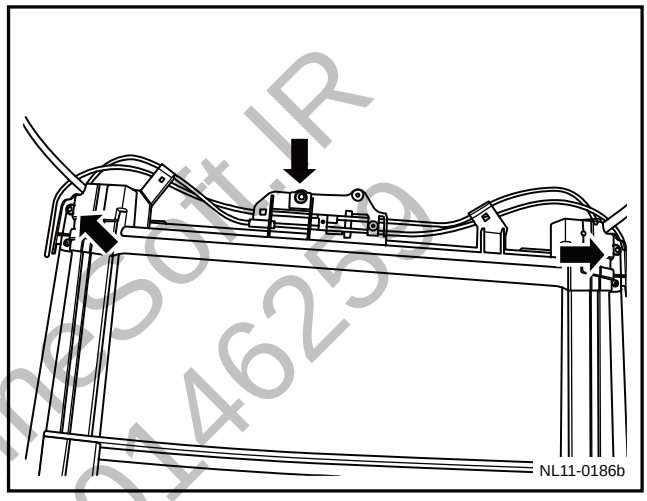
7. Dismantle the fixing nuts in the middle of sunroof.



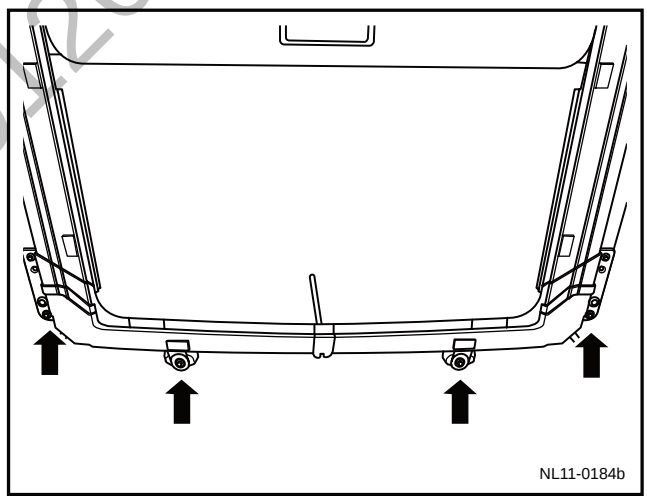
8. Dismantle the fixing bolts in the rear of the sunroof.
9. Shift out the sunroof frame.



Installation procedure:

1. Install the sunroof frame, Tighten up the retaining bolts in the front of sunroof.

Torque:10 Nm(Metric) 7.4 lb-ft (English system)



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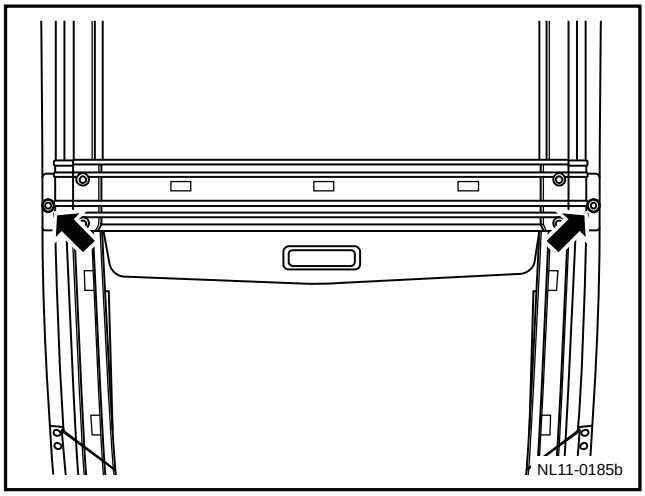
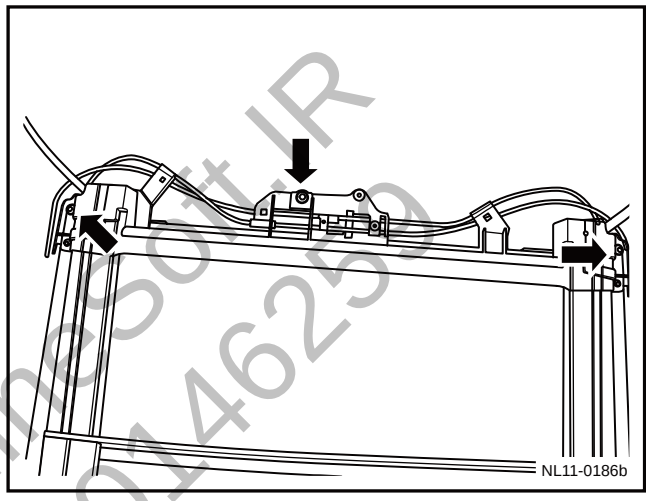
2. Tighten up the retaining nuts in the middle of the sunroof.

Torque:10Nm (Metric) 7.4lb-ft (English system)



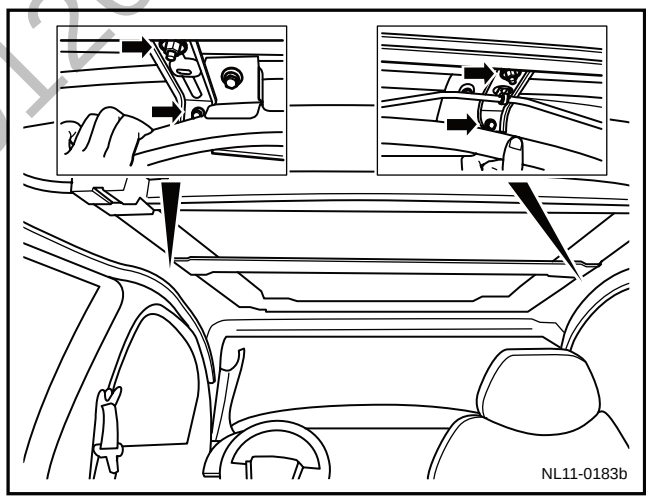
3. Tighten up the fixing bolts in the rear of sunroof.

Torque: 10Nm (Metric) 7.4 lb-ft (Inch)
7. Connection of battery negative cable.



4. Install the front attachment bracket of sunroof.

Torque:10Nm(Metric) 7.4lb-ft(English system)



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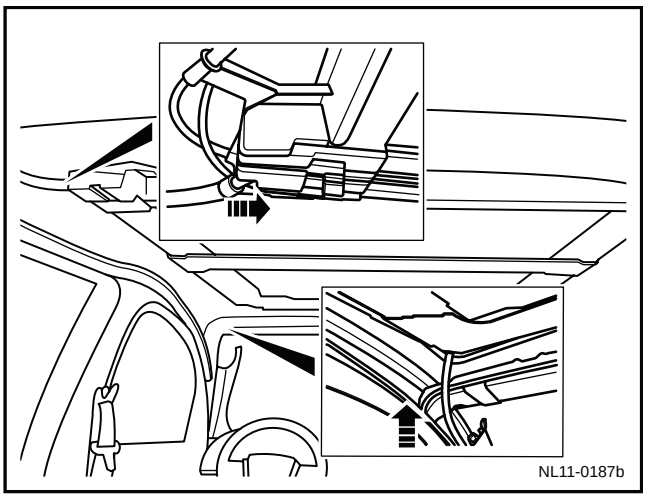
5. Install the front and rear drain pipes of sunroof.
6. Install the sunroof motor.
7. Install the sunroof glass.
8. Connect the battery negative cable.



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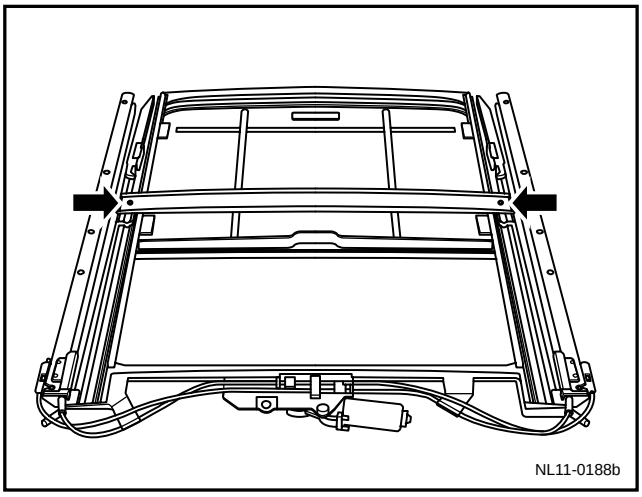
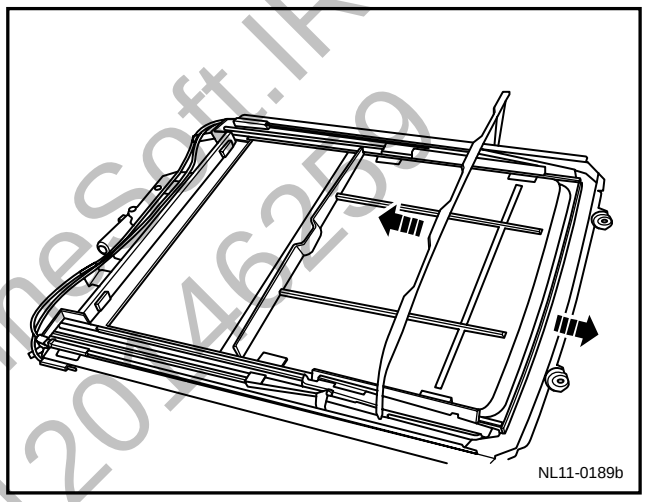
11.8.8.5 Sunroof visor replacement

Dismantlement procedure

1. Disconnect the battery negative cable. Refer to 2.11.8.1 disconnection and connection procedures of battery cable in vehicle maintenance manual.
2. Disassemble the sunroof glass, regfer to 11.8.8.1 replacement of sunroof glass.
3. Dismantle the sunroof frames, refer to 11.8.8.4 replacement of sunroof frames.
4. Disassemble the drain-tanks.

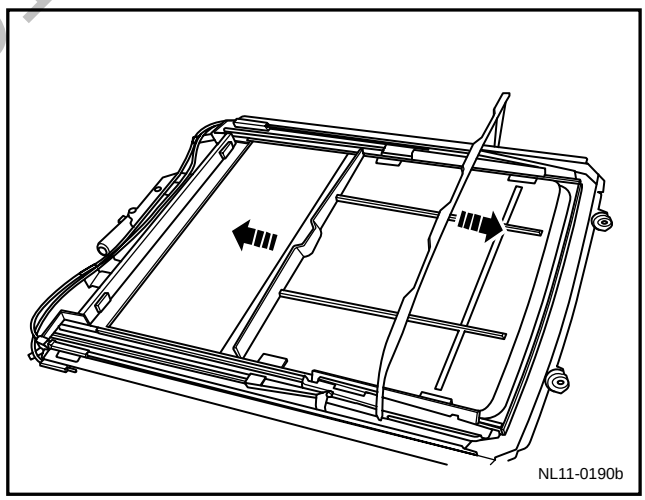


5. Disassemble the back rolling-over check rod of sunroof visor. Pull out the visor.



Installation procedure:

1. Install the sun visor and turn down the check rod of sunroof visor.



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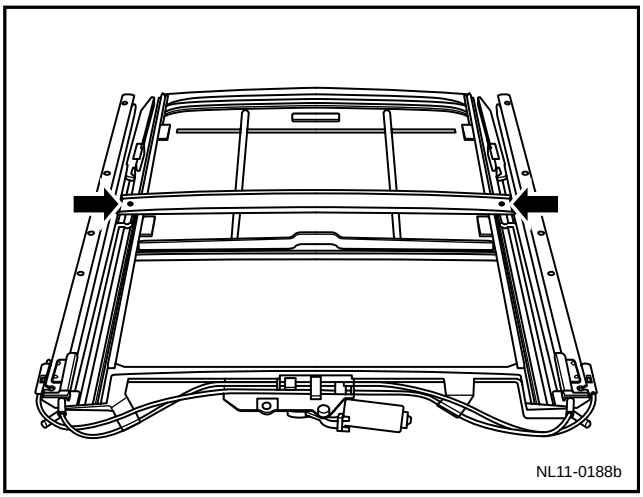
2. Install the brackets of sunroof visor.

Torque:10Nm(Metric) 7.4lb-ft(English system)

3. Install the drain-tanks.

4. Install the sunroof glass.

5. Connect the battery negative electrode cable.



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11.9 Central control door lock

11.9.1 Specification

11.9.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N.m)	English system (lb-ft)
Fixing bolt of left front door lock assembly	M6×16	7-9	5-7
Lock assembly fixing bolt of left rear door	M6×16	7-9	5-7
Fixing bolt of left front door lock seat	M8×22	18-22	13-16
Fixing bolt of left rear door lock seal	M8×22	18-22	13-16
Back door lock base fixing bolt	M6×12	8-10	6-7
Bolt of luggage compartment door lock catch assembly	M8×22	18-22	13-16

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11.9.2 Description and operation

11.9.2.1 Description and operation

Electric door locks use a solenoid valve within each door lock assembly. Door locks can only be controlled by combination switch on the left front inside door handle or the driver door lock cylinder switch (remote control key operation). When using the actuator or lock cylinder to lock or unlock the driver door, all doors will be locked or unlocked.

Lock and Unlock

- If only one of the following actions is conducted within 2s: front door key switch is placed to unlock position (lasting for no less than 0.1s), front door key switch signal should be separately unlocked driver's side door lock signal.
- If only two of the following actions are conducted within 2s: front door key switch is placed to lock position (lasting for no less than 0.1s), front door key switch signal should be unlocked three other door lock signal. Later, front door key switch is placed to the unlock position again within 2s (lasting for no less than 0.1s), the first item (above item) should be carried out.
- If conducting the following actions: front door key switch is placed to lock position (lasting for no less than 0.1s), the front door key switch signal is the signal from the closed 5 door locks.
- If the front door key switch is placed to unlock position (lasting for no less than 1s), the front door key switch signal first should be separate unlock driver's side door lock signal (100ms), and then it should be other three door lock signal (when it is 1s).

Automatic padlock

- Speed automatic lock: when key is placed in ON position of ignition switch and five doors are in closed status, if the speed increases to above 30km/h from below 30km/h, BCM will drive five door lock motors to conduct lock action. Drive time last for 200ms. If the speed is changed again or repeatedly from less than 30km/h to more than 30km/h, and the BCM memory door lock state is not closed, the BCM drives five door lock motors to lock again, with driving time for 200ms consecutively.
- Single individual interlock: automatic interlock after backdoor closed for 2s after remote control or back door unlock switch unlock the back door lock, the BCM automatically executes the backdoor lock if there is no backdoor operation within 30s.

Remind of not pulling out the key

When the key is inserted in the position OFF of the ignition lock (the position ACC is not detected), the door can not be locked; if the driver-side door is opened, the BCM will transmit a periodic alarm signal to the instrument, so that the instrument gives an alarm to remind of not pulling out the key.

Automatic unlock

- Lazy automatic unlock: When vehicle speed is lower than 5km/h, if the key isn’t place on ON position, BCM will drive four door lock motors to conduct unlock action. Drive time will last for 200ms.
- Impact unlock: when the key is placed in ON position, if BCM the air bag impact signal received by BCM is sent to BCM impack unlock signal through hard wire, BCM will drive four door motors to conduct unlock action at the same time. The drive time will last for 200ms. There are two times of unlock actions with interval of 2s. When the airbag is normal without being detonated, the periodic signal of 200ms high and 40ms low is given, and the periodic signal of 200ms low and 40ms high is output after being detonated. The specific description of airbag collision signal refers to Technical Code of Airbag Signal.

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– Key is placed inside ignition switch, driver side door is from open to close status, and BCM drives driver's side door separately unlock once.

Super Locking (such as equipment)

Realize the super-locking function through two modes.

– Press "lock" key on the remote controller twice within 300ms.

– Place the key in door lock from "unlock" to "lock" position twice within 3s.

The flash lamp will flicker once to confirm the two above modes.

Notes:

At this time, vehicle door can be only unlocked by a legal key or remote control.

Control function of center door lock

1. IF central door lock switch is placed to lock position, BCM will drive 5 door lock motors to conduct lock action. Drive time will last for 200ms.
2. When it is not on ON position, or it is on ON position but vehicle speed is lower than 15km/h, if central door lock switch is placed to unlock position, BCM dirve 4 door lock motors to conduct unlock action. Drive time will last for 200ms.
3. When it is in ON gear and vehicle speed is not less than 15km/h, central door lock switch is pressed to unlock position, all 5 door lock motors have no action.
4. If the central control door lock switch is pressed to the unlock and lock positions simultaneously, then five door lock motors will not be actuated.
5. Only when the BCM is in the "Normal" and "Waiting to Exit the Body Anti-theft Mode" mode of the "Anti-theft Alarm Function" can the central control lock switch perform the unlock/lock action.

Control function of remote control unit

In the body anti-theft alarm state, do not unlock the backdoor when pressing down the remote control unlock backdoor key.

1. The following conditions should be satisfied:

– Key is placed in a position other than ON position of ignition switch;

If the remote-control signal is as follows: individually unlock the driver-side door lock signal, the BCM drives the driver-side door lock motor to unlock, with driving time for 200ms consecutively.

2. The following conditions should be satisfied:

– Key is placed in a position other than ON position of ignition switch;

If the remote-control signal is as follows: unlock the other three door lock signals, the BCM drives the three door lock motors to unlock acutely, with driving time for 200ms consecutively.

3. If the following conditions are satisfied:

Key is placed in pull-out position of ignition switch;

– Four doors are in the closed status;

– Back-door is in the "OFF" status

– Engine hood is place at the "OFF" status,

If the remote-control signal is as follows: lock five door lock signals, the BCM drives the five door lock motors to lock, with driving time for 200ms consecutively.

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4. For opening of rear door, one of the following conditions must be satisfied:

– Key is not placed in ON position of ignition switch.

– Key is placed in ON position of ignition switch and vehicle speed is lower than 5km/h;

If the remote-control signal is as follows: unlock the back door signal, the BCM drives the back door lock motor to unlock, with driving time for 200ms consecutively.

5. When the body anti-theft system does not sound the alarm, the back door will be opened but does not exit the guard mode if the remote control signal is Unlock Back Door.

Key lock cylinder control function of front door

1. If BCM control unit detects that front door key switch is door lock signal on separate unlock driver's side, BCM will drive driver's side door lock motor to conduct unlock action. Drive time will last for 200ms.

2. If front door key switch signal is to unlock signals of other three doors, BCM will drive 3 door lock motors to conduct unlock actions. Drive time will last for 200ms.

3. IF BCM control unit detects that front door key switch signal is the signal to lock 5 doors, BCM will drive 5 door lock motors to conduct lock actions at the same time. Drive time will last for 200ms.

Priority of center controller

1. Priority level: when several signals are effective at the same time:

Collision unlock>front door key switch signal>remote control signal>remote control central lock>idle automatic unlocking and speed automatic locking function

2. When one of above signals is effective and conducts relevant action, if incurred at this time, another signal will be ignored. However, when a collision unlock signal incurs, BCM (Body Control Module) immediately carry out collision unlock action.

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11.9.3 System work principle

11.9.3.1 System operating principle

Door lock switch

– The system is equipped with two door lock switches; one is located in the left front door combination switch and the other is in the left front door key cylinder. Other key cylinders can only be used to unlock a single door and can not activate the function of central control door lock.

– Lock signals from two door lock switches are input into one input terminal of BCM, but the unlock signal is indeed input separately.

Locking operation

When the BCM receives a switch lock input signal or meets automatic locking condition, output power supply from the lock output end of the BCM to control the door lock motor of the five doors to lock.

Unlocking operation

When the BCM receives a switch unlock input signal or meets automatic unlocking condition, output power supply from the unlock output end of the BCM to control a door lock motor of the four doors and back door to unlock. (rear back door is unlocked separately)

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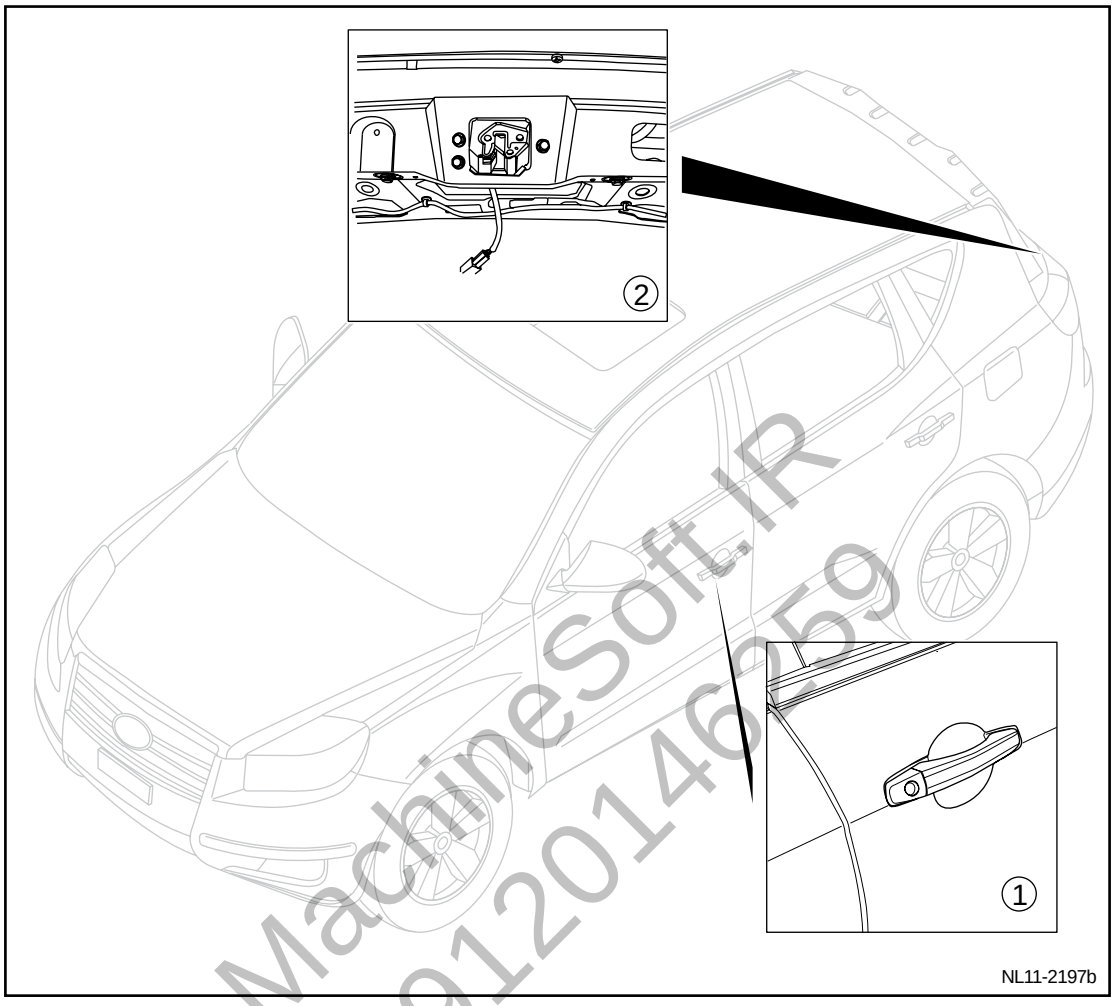
11.9.4 Part position

11.9.4.1 Component position

Mechanical lock cylinder



1. Front door lock cylinder
2. Rear back-door lock assembly

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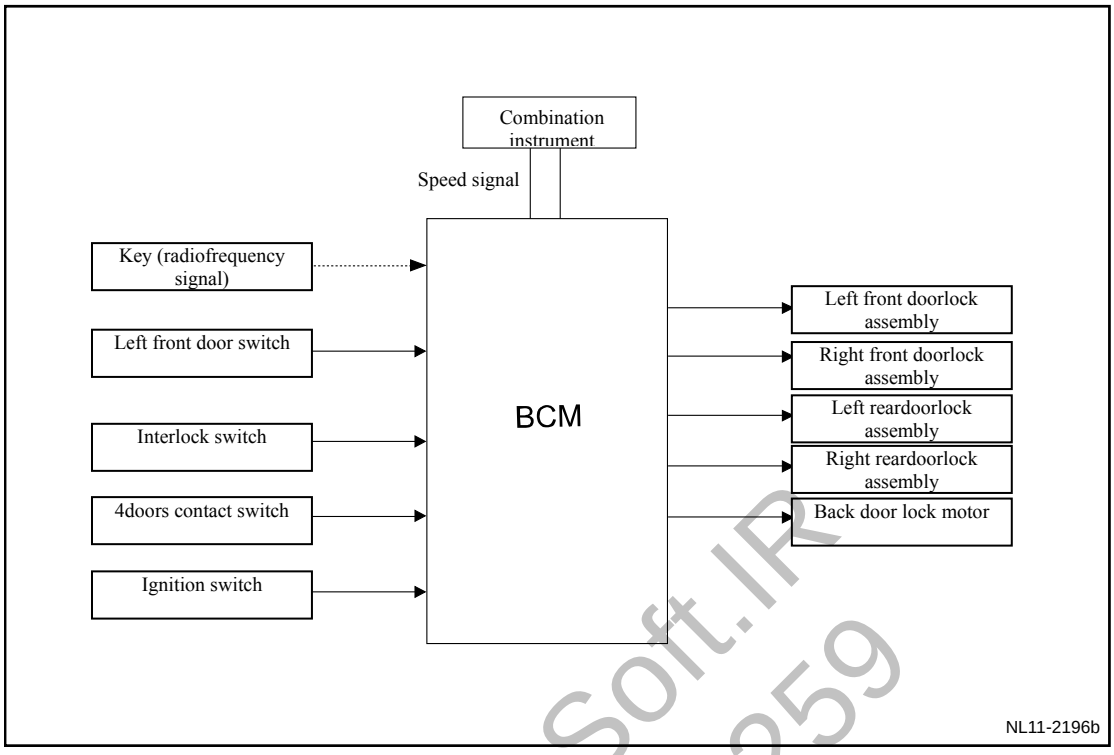
11.9.5 Electrical schematic diagram

11.9.5.1 Electrical schematic diagram



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11.9.6 Diagnostic information and steps

11.9.6.1 Diagnosis descriptions

Refer to 11.7.2 description and operation to get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.9.6.2 Visual inspection

– Inspect installed aftermarket equipment that may affect the operation of central control door lock system.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– Inspect and repair the poor connection or open circuit malfunction for power supply or ground circuit before replacing the components, if the operation of all the door lock is invalid.

11.9.6.3 Fault symptom list

Fault symptom	Suspected fault part	Maintenance scheme
Mechanical key can not lock / unlock the door	1. Power supply malfunction of central control lock 2. Poor connection of unlock / lock switch inside left front door lock 3. Poor connection of harness connector 4. Poor connection of relative ground 5. Harness malfunction 6. Malfunction of central control lock motor 7. BCM malfunctions	1. Inspect the power supply circuit. 2. Inspect the harnesses and connectors. 3. Inspect the ground malfunction 4. Replace the door lock motor assembly. 5. Service the BCM and replace if necessary.
Central control lock switch can not lock / unlock doors	1. Power supply malfunction of central control lock 2. Central control lock switch of left front window regulator switch assembly malfunction 3 Poor connection of harness connector 4. Poor connection of relative ground 5. Harness malfunction 6. Malfunction of central control lock motor 7. BCM malfunctions	1. Inspect the power supply circuit. 2. Inspect the harnesses and connectors. 3. Inspect the ground malfunction 4. Inspect the left front door window regulator switch. 5. Replace the door lock motor assembly. 6. Service the BCM and replace if necessary.
Only the left	1. Power supply malfunction of central	1. Inspect the power supply

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front door lock can not lock /unlock the door	control lock 2. Poor connection of left front door lock harness connector 3. Poor connection of left front door lock ground 4. Harness malfunction 5. Malfunction of left front door central control lock motor 6. BCM malfunctions	circuit. 2. Inspect the harnesses and connectors. 3. Inspect the ground malfunction 4. Replace the door lock motor assembly. 5. Service the BCM and replace if necessary.
The remote control unit is unable to lock/open door	1. The application environment has electromagnetic interference. 2. Remote controller malfunction 3. Power supply malfunction of central control lock 4. Poor connection of harness connector 5. Poor connection of relative ground 6. Harness malfunction 7. Malfunction of central control lock motor 8. BCM malfunctions	1. Move to a non-interference environment. 2. Inspect the remote controller battery, and replace the remote controller if necessary. 3. Inspect the power supply circuit. 4. Inspect the harnesses and connectors. 5. Inspect the ground malfunction 6. Replace the door lock motor assembly. 7. Service the BCM and replace if necessary.
Central lock under the anti-theft state is unable to automatically unlock.	1. Insufficient voltage of power supply 2. Poor connection of harness connector 3. Poor connection of relative ground 4. Harness malfunction 5. Malfunction of central control lock motor connection switch 6. BCM malfunctions	1. Inspect the power supply circuit. 2. Inspect the harnesses and connectors. 3. Inspect the ground malfunction 4. Replace the door lock motor assembly. 5. Service the BCM and replace if necessary.
Door Lock Runout during Driving	1. Mechanical lock mechanism malfunction 2. Poor connection of harness connector 3. Poor connection of relative ground 4. Harness malfunction 5. Malfunction of central control lock motor	1. Adjust door lock mechanism, if necessary, please replace it. 2. Inspect the harnesses and connectors. 3. Inspect the ground

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	connection switch 6. BCM malfunctions	malfunction 4. Replace the door lock motor assembly. 5. Service the BCM and replace if necessary.

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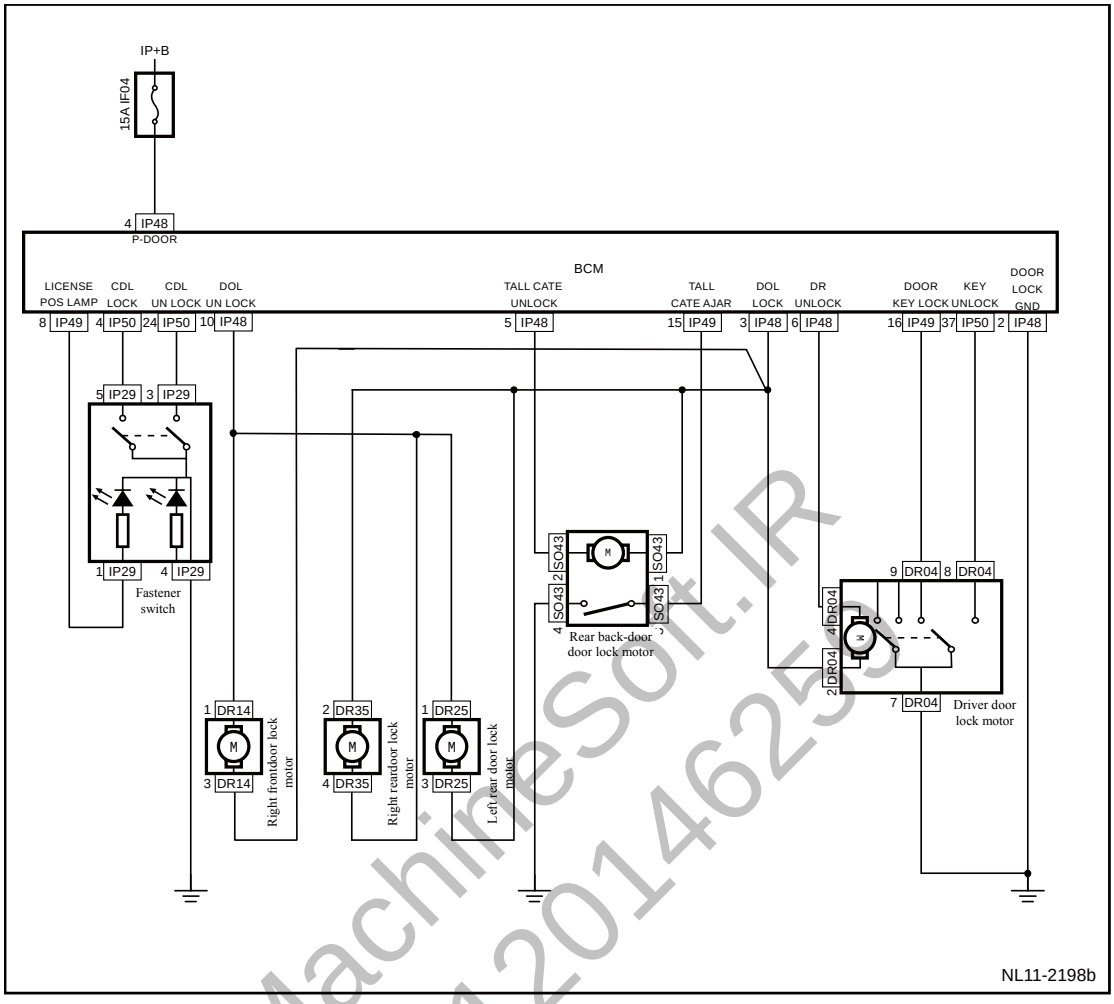
11.9.6.4 Mechanical key / central control lock switch can not lock all doors

Circuit diagram:



Diagnostic steps:

Notes:

When there is no remote control key, use the special setting function of fault diagnosis tester to drive the central control door locks. Select in sequence: the body control module/BCM special set function/lock, unlock double-lock (all doors)/lock all doors.

1	Inspect locking through the remote control key.

Confirm whether triggering to lock by the remote control key.

Yes → Go to step 3

No

2	Inspect the possible fault of the remote control anti-theft system.

A. Inspect and repair the remote anti-theft system for potential malfunction.

Confirm whether the electric door lock is working correctly.

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Yes → The system is normal.

No

3	Inspect the condition of locking through mechanical key or central control button.

(a) Use mechanical key or central control button on left front glass lifter switch to repeat lock and unlock actions, meanwhile use multimeter to measure voltage of BCM wire harness connector IP50 terminal No. 4.

Observe whether the voltage reading of the multimeter is changed between 0V and 10V.

Yes → Go to step 6

No

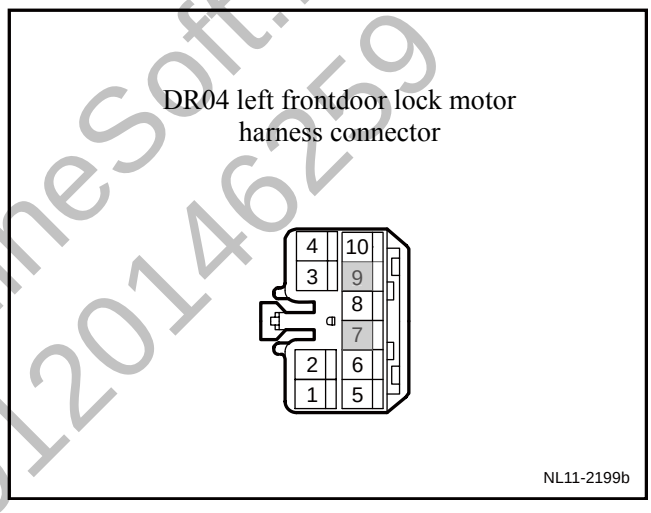
4	Inspect the left front door lock assembly.

(a) Refer to 11.7.7.1 Replacement of Left Front Door Lock Assembly to dismantle the left front door lock assembly.

(b) Simulate lock action by mechanical key, measure resistance valure between left front door lock assemblyDR04的 terminal No.9 and No.7 by millimeter

Standard resistant value :is less than 1Ω

Confirm if the resistance conforms to standard value.



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Yes → Go to step 10

No

5	Replace left front door lock motor assembly

(a) Replace the left front door lock motor assembly and refer to 11.7.7.1 "Replacement of Left Front Door Lock Assembl".

Lock by a key to confirm whether the electric door lock normally locks.

Yes → The system is normal.

No

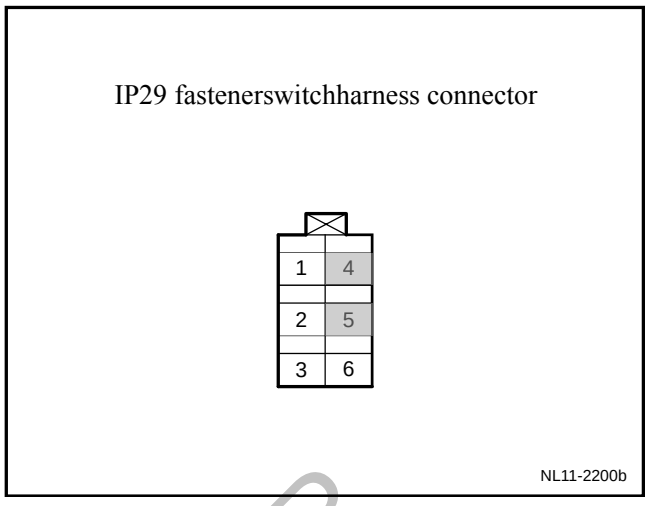
6	Inspect the fastener switch.

(a) Dismantle central control door lock button.

(b) Press central control door lock button to carry out lock action, meanwhile use multimeter to measure resistance between wire harness connector IP29 terminal No.5 and No.4 of lock switch.

Standard resistant value :is less than 1Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 8

No

7	Replace the lock switch.

(a) Replace center control lock button , Refer to11.7.7.4 lock switch replacement .

Lock by a central door lock button to confirm whether the electric door lock normally locks.

Yes → The system is normal.

No

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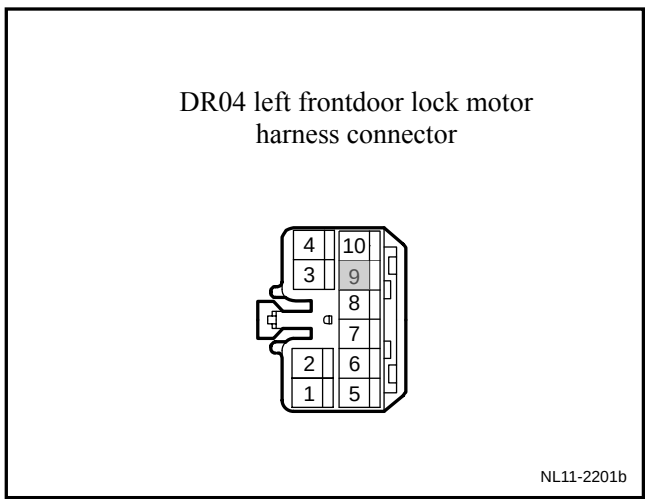
8	Inspect the circuit between the BCM wire harness connector IP49 and the left front door motor assembly wire harness connector DR04.

(a) For dismantling of BCM wire harness connector, refer to 11.8.8.1 Replacement of BCM.

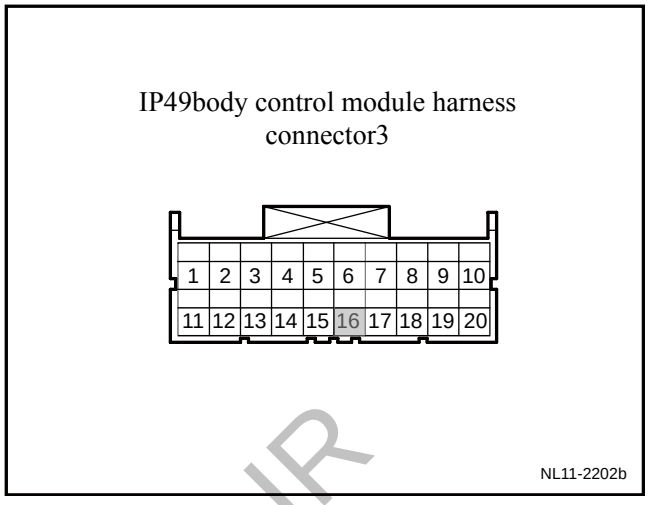
(b) Dismantle left frnt door lock motor assembly wire harness terminal. Refer to 11.7.7.1 Replacement of left front door lock assembly.

(c) Use multimeter to measure resistance between BCM wire harness connector IP49 terminal No. 16 and left front door motor assembly wire harness connector DR04 terminal No. 9.



Standard resistant value :is less than 1Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 10

No

9	Repair the open circuit fault between the BCM wire harness connector IP49 and the left front door motor assembly wire harness connector DR04.

(a) Make sure that the fault of circuits of BCM wire harness connector IP49 terminal No. 16 and circuits corresponding to left front door motor assembly wire harness connector DR04 terminal No. 9 are repaired.

Confirm whether the electric door lock is working correctly.

Yes → The system is normal.

No

10	Inspect the voltage of the terminal No. 3 of BCM wire harness connector IP48.

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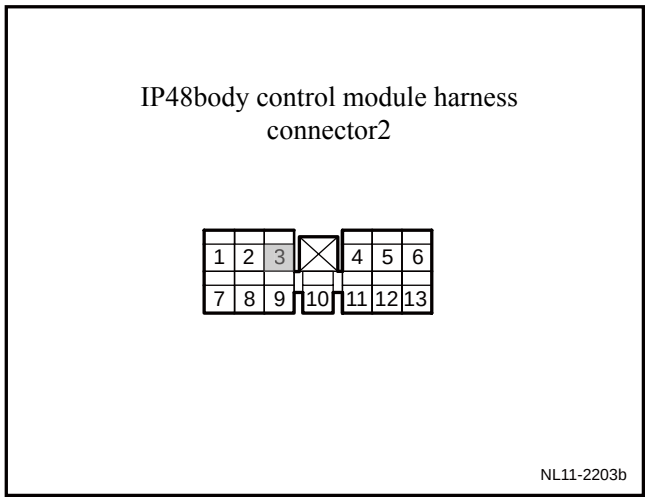
(a) Use mechanical key or central control button to conduct lock action, meanwhile use multimeter to measure voltage of BCM wire harness connector IP48 terminal No. 3.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 12

No

11	Replace the BCM

(a) Replace bcm and refer to replacement of bcm in 11.8.8.1.

Observe the multimeter to confirm whether the voltage changes repeatedly between0V and the power supply voltage.

Yes → The system is normal.

No

12	Repair the open circuit between the BCM wire harness connector IP48 and the electronic door lock assembly wire harness connector motor terminal.

(a) Make sure that the fault of circuits of BCM wire harness connector IP48 terminal No.3 and circuits corresponding to each electric door lock assembly wire harness connector motor are repaired.

Confirm the completion of repair.

Yes → The system is normal.

No

13	The system is normal.

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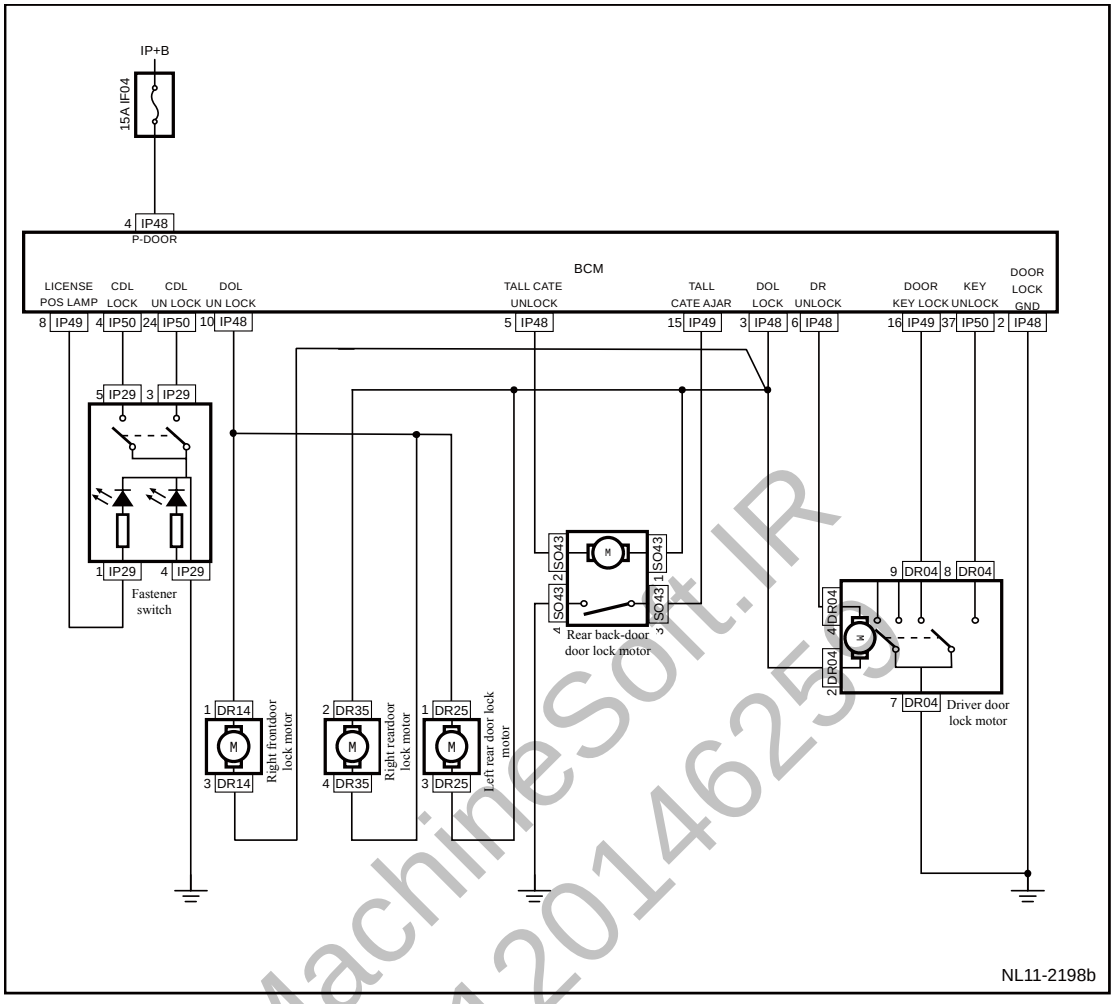
11.9.6.5 Mechanical key / central control lock switch can not unlock all doors

Circuit diagram:



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Diagnostic steps:

1	Inspect locking the key through the remote control unit.

Confirm whether the remote control unit triggers the remote control central lock to lock.

Yes → Go to step 3

No

2	Inspect the possible fault of the remote control anti-theft system.

A. Inspect and repair the remote anti-theft system for potential malfunction.

Confirm whether the electric door lock is working correctly.

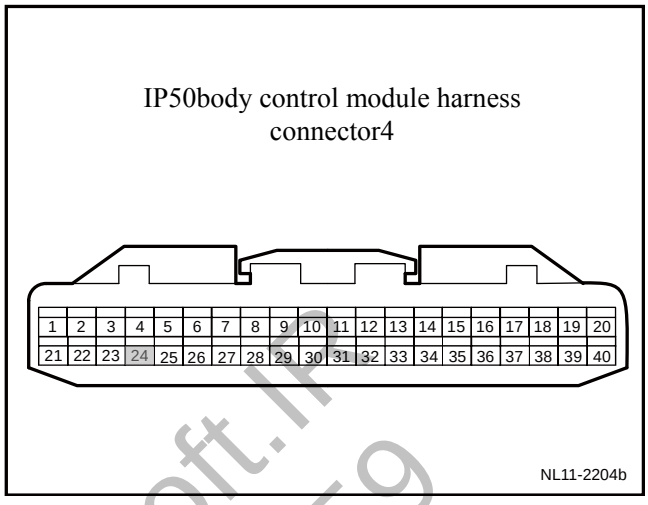
Yes → The system is normal.

No

3	Inspect the condition of unlocking through the mechanical key.

(a) Use mechanical key to repeat lock and unlock actions, meanwhile use multimeter to measure voltage of BCM wire harness connector IP50 terminal No. 24.

Observe whether the voltage reading of the multimeter is changed between 0V and 10V.



Yes → Go to step 5

No

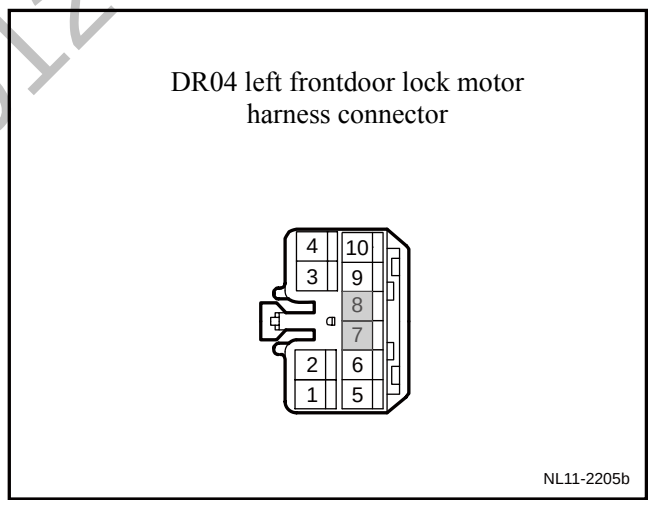
4	Inspect the left front door lock assembly.

(a) Refer to 11.7.7.1 Replacement of Left Front Door Lock Assembly to dismantle the left front door lock assembly.

(b) Simulate unlock action by using mechanical key. Use multimeter to measure resistance between left front door lock assembly DR04 terminal No.8 and No.7.

Standard resistant value :is less than 1Ω

Confirm if the resistance conforms to standard value.



No → Go to step 6

Yes

5	Replace left front door lock motor assembly ,

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(a) Replace the left front door lock motor assembly and refer to 11.7.7.1 "Replacement of Left Front Door Lock Assembl".

Lock by a key to confirm whether the electric door lock normally locks.

Yes → The system is normal.

No

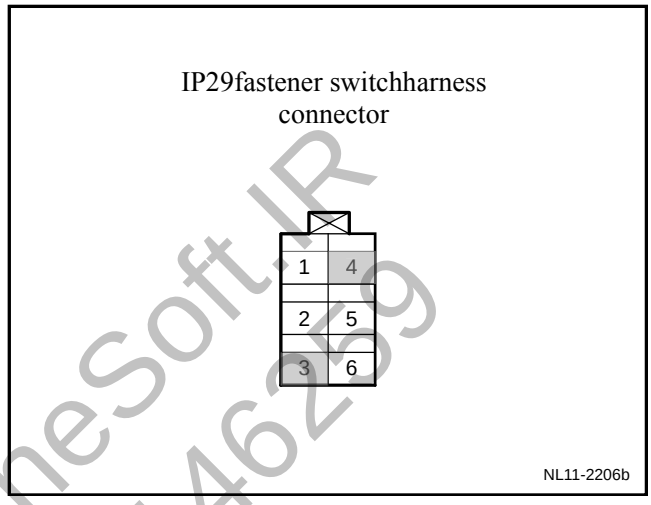
6	Inspect the fastener switch.

(a) Dismantle central control door lock button.

(b) Press central control door lock button to carry out lock action, meanwhile use multimeter to measure resistance between wire harness connector IP29 terminal No.3 and No.4 of lock switch.

Standard resistant value :is less than 1Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 8

No

7	Replace the lock switch.

(a) Replace lock switch, refer to 11.7.7.4 lock switch replacement.

Lock by a central door lock button to confirm whether the electric door lock normally locks.

Yes → The system is normal.

No

8	Inspect the circuit between the BCM wire harness connector IP50 and the left front door motor assembly wire harness connector DR04.

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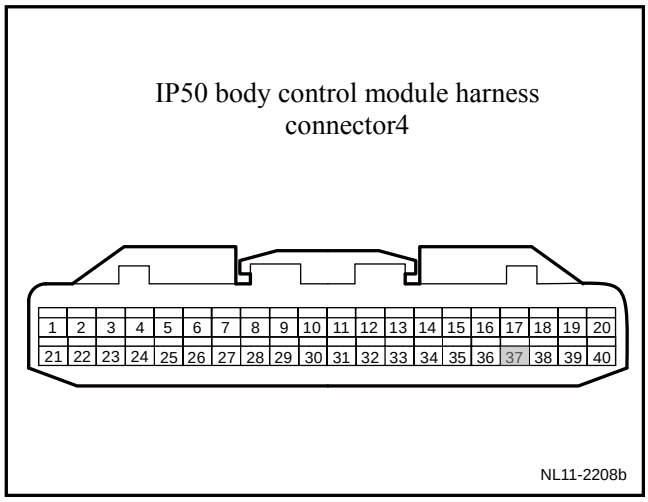
(a) For dismantling of BCM wire harness connector, refer to 11.8.8.1 Replacement of BCM.

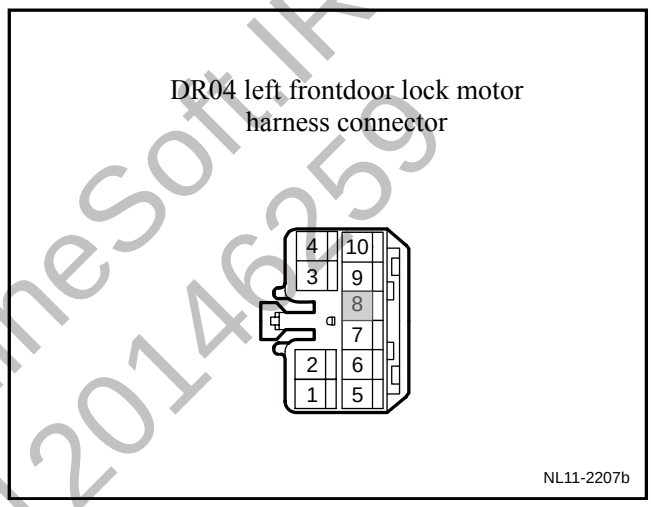
(b) Dismantle left front door lock motor assembly harness connector, Refer to11.7.7.1 Left front door lock assembly replacement.

(c) Use multimeter to measure resistance between BCM wire harness connector IP50 terminal No. 37 and left front door motor assembly wire harness connector DR04 terminal No. 8.



Standard resistant value : is less than 1Ω

Confirm if the resistance conforms to standard value.



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Yes → Go to step 10

No

9	Repair the open circuit fault between the BCM wire harness connector IP50 and the left front door motor assembly wire harness connector DR06.

(a) Make sure that the fault of circuits of BCM wire harness connector IP50 terminal No. 37 and circuits corresponding to left front door motor assembly wire harness connector DR04 terminal No. 8 are repaired.

Confirm whether the electric door lock is working correctly.

Yes → The system is normal.

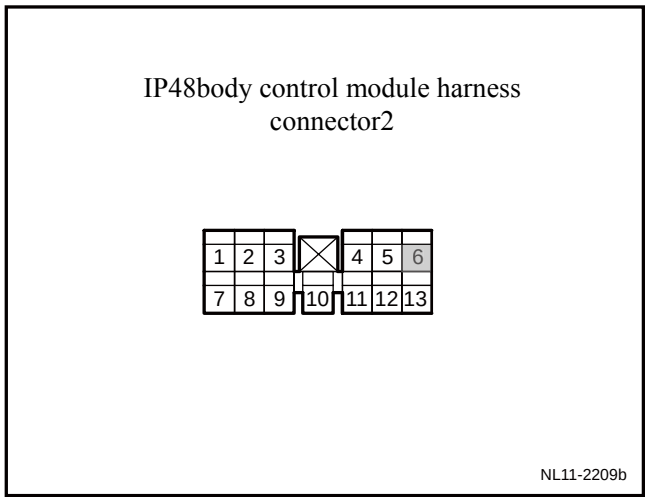
No

10	Inspect the voltage of the terminal No. 6 of BCM wire harness connector IP48.

(a) Use mechanical key or central control button to conduct unlock action, meanwhile use multimeter to measure voltage of BCM wire harness connector IP48 terminal No. 6.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 12

No

11	Replace the BCM

(a) Replace BCM and refer to replacement of BCM in 11.8.8.1.

Confirm whether the electric door lock is working correctly.

Yes → The system is normal.

No

12	Repair the open circuit between the BCM wire harness connector IP48 and the electronic door lock assembly wire harness connector motor terminal.

(a) Make sure that the fault of circuits of BCM wire harness connector IP48 terminal No. 10 and circuits corresponding to each electric door lock assembly wire harness connector motor are repaired.

Confirm the completion of repair.

Next

13	The system is normal.

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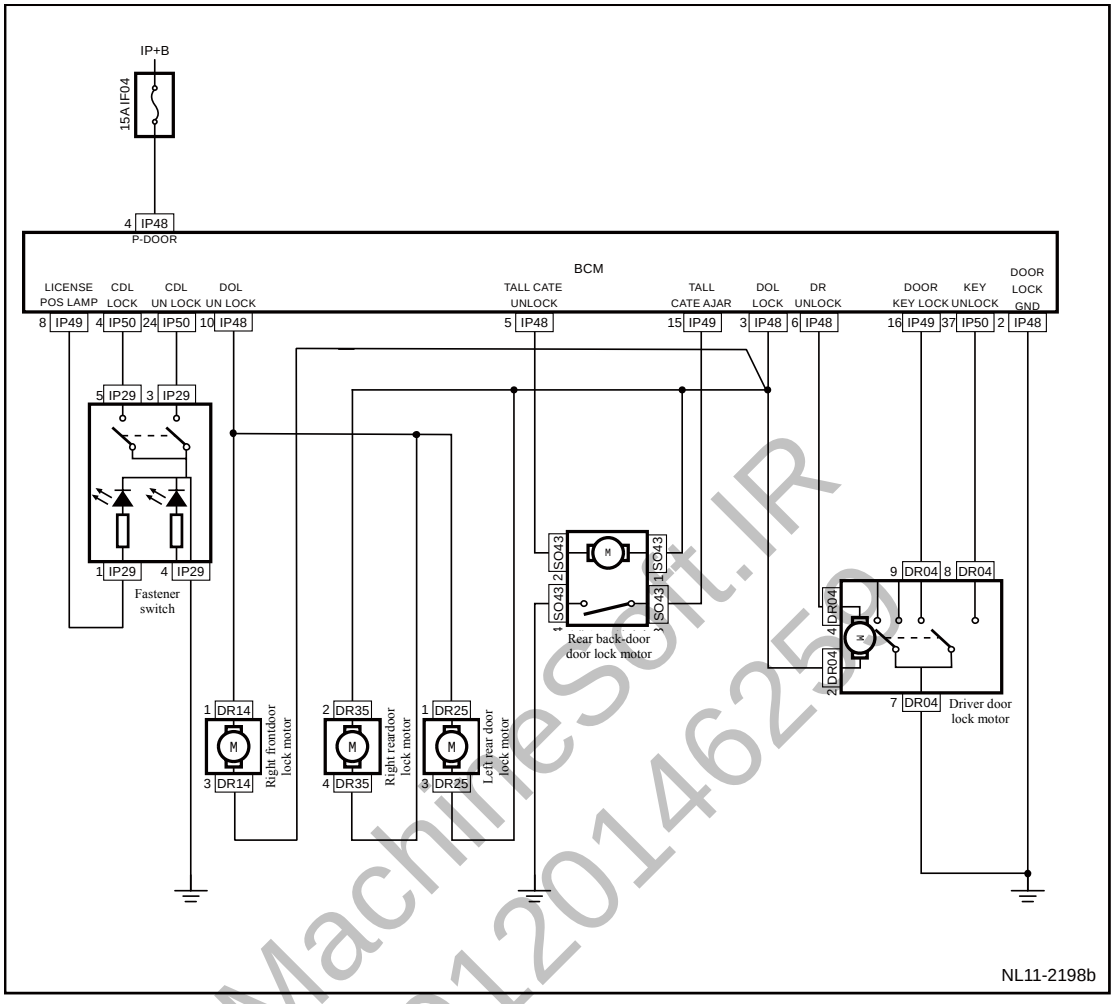
11.9.6.6 Mechanical key. central control lock switch can not lock. unlock central control door lock

Circuit diagram:



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Diagnostic steps:

1	Inspect super-locking the key through the remote control key.

A. Check whether super locking can be triggered with the remote control key.

Yes	Go to step 3
No	

2	Inspect the possible fault of the remote control anti-theft system.

A. Inspect and repair the remote anti-theft system for potential malfunction.

Confirm whether the electric door lock is normal super-locking.

Yes → The system is normal.

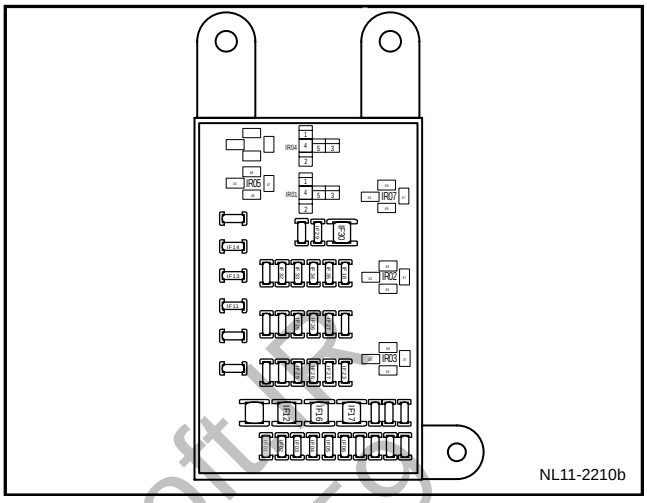
No

3	Check fuse IF01.

(a) Inspect if the fuse IF01 is blown.

Rating Value of Fuse: 20A

Confirm whether the fuses are blown.



Yes → Go to step 5

No

4	Check the fuse IF01 circuit.

(a) Check fuse IF01 circuit was short-circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the electric door lock is working correctly.

Yes → The system is normal.

No

5	Inspect the communication between the terminal No. 2 of the wire harness connector IP48 and the body grounding.

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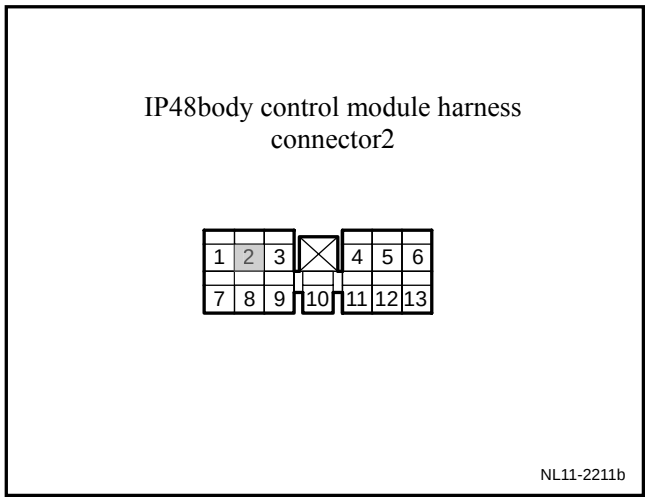
(a) Rotated ignition switch to "OFF" position.

(b) Measure resistance between BCM wire harness connector IP48 terminal No. 2 and grounding.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 7

No

6	Repair the circuit of the BCM harness connector IP48 and the body grounding.

(a) Repair circuit between BCM wire harness connector IP48 and vehicle body grounding.

Confirm whether the electric door lock is working correctly.

Yes → The system is normal.

No

7	Inspect the working condition of the central control lock.

(a) Inspect the working condition of central control lock. Refer to 11.7.6.4 Whether mechanical key/ central control lock switch can lock all central control door locks, and 11.7.6.5 Whether mechanical key/ central control lock switch can unlock all central control locks.

Confirm the completion of repair.

Next

8	The system is normal.

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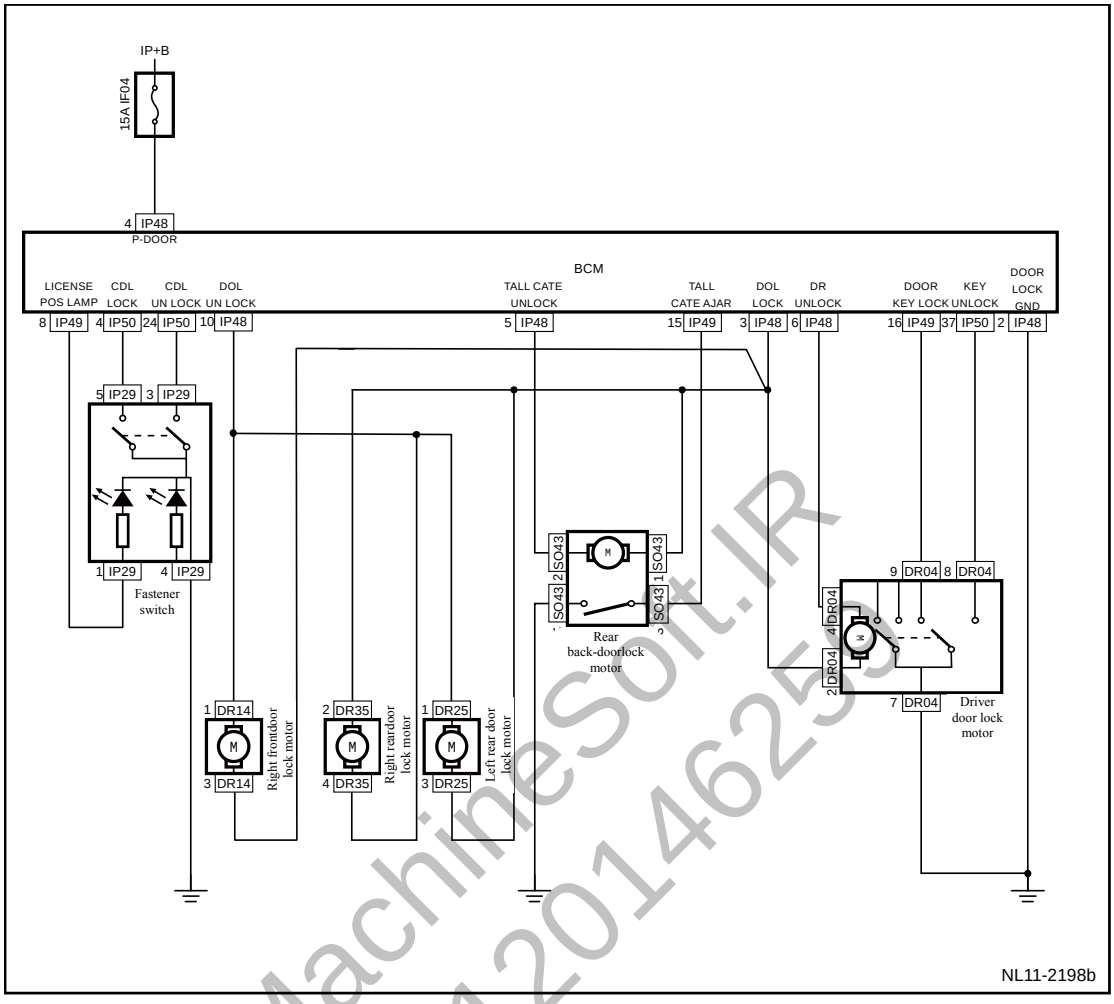
11.9.6.7 Rear back-door can not open

Circuit diagram:



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Diagnostic steps:

1	Inspect triggering the opening of the back door through the remote control key.

Confirm whether triggering the back door to open through the remote control key.

Yes	Go to step 3
No	

2	Inspect the possible fault of the remote control anti-theft system.

(a) Inspect and repair the remote anti-theft system for potential malfunction.

Confirm whether the cigarette lighter works normally.

Yes → The system is normal.

No

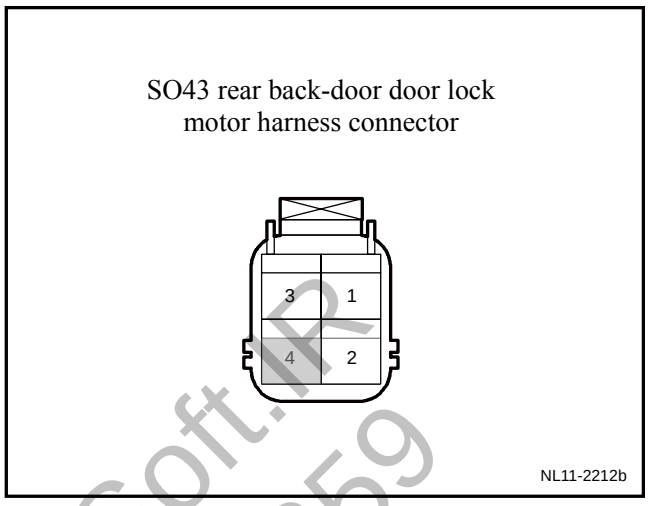
3	Inspect the voltage of the terminal No. 4 of the back door lock motor wire harness connector SO43.

(a) Carried out unlock operation.

(b) Use multimeter to measure voltage of back door lock motor wire harness connector SO43 terminal No. 4.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



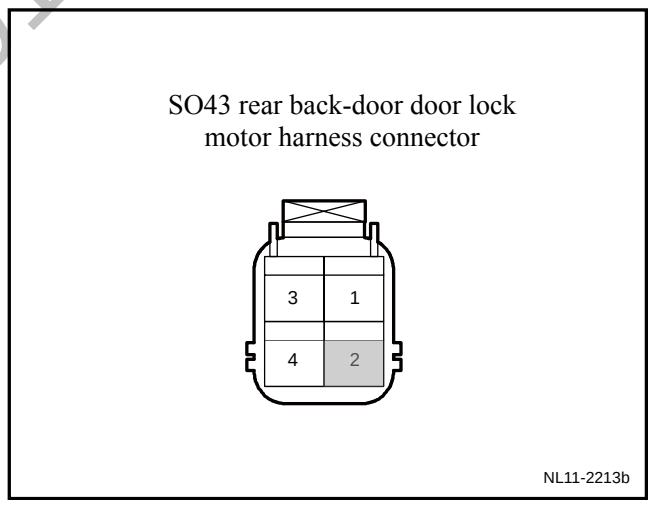
Yes → Go to step 5

No

4	Inspect the open circuit between the BCM wire harness connector IP48 and the back door lock motor wire harness connector SO43.

(a) Inspect and repair the short-circuit fault between BCM wire harness connector IP48 terminal No. 5 and rear back door lock motor wire harness connector SO43 terminal No. 2.

Confirm whether the back door is opened normally.



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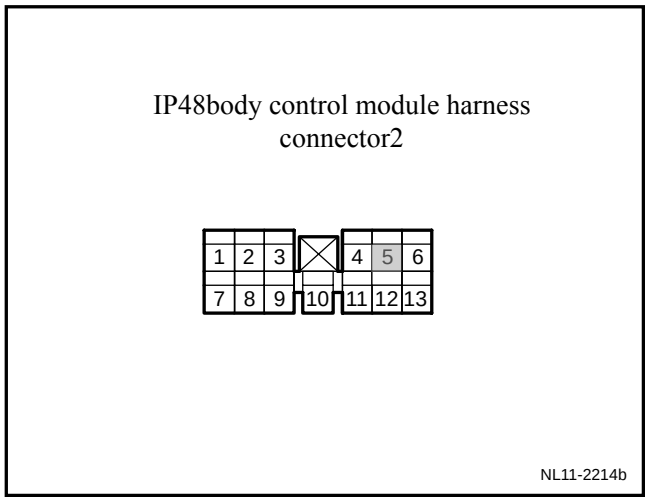


Yes → The system is normal.

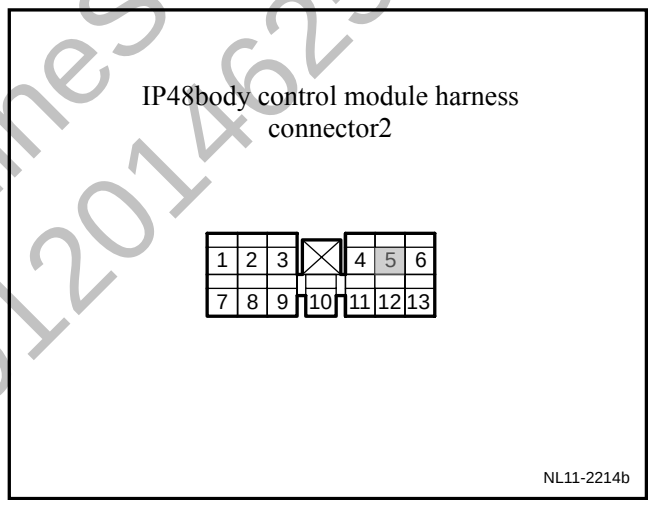
No

5	Inspect the voltage of the terminal No. 5 of BCM wire harness connector IP48.

(a) Press lock switch to measure the voltage of terminal No. 5 of BCM wire harness connector IP48.

Standard voltage: 11 - 14 V

Confirm if the voltage conforms to standard value.



Yes → Go to step 7

No

6	Replace the BCM

(a) Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm whether the compartment is working correctly.

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Yes → The system is normal.

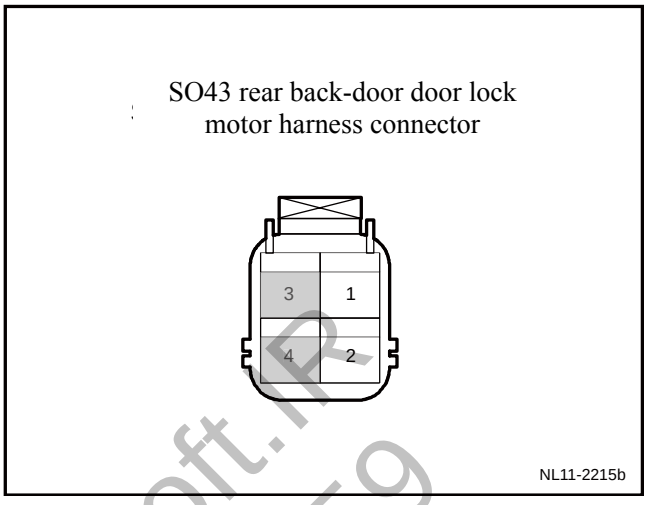
No

7	Inspect the back lock motor.

(a) Open back door, meanwhile measure resistance between door lock motor wire harness connector SO43 terminal No. 3 and terminal No. 4.

Standard resistant value :is less than 1Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 9

No

8	Replace opening switch of trunk

(a) Replace rear backdoor lock motor, Refer to11.7.7.2 rear door lock block replacement .

Confirm whether the compartment is working correctly.

Yes → The system is normal.

No

9	Inspect the circuit between the terminal No. 4 of the back door lock motor wire harness connector SO43 and the body grounding.

(a) Inspect and repair short-circuit fault between back door lock motor wire harness connector SO43 terminal No. 4 and grounding.

Standard resistant value :is less than 1Ω

Next

10	The system is normal.

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11.9.6.8 Door auto-lock (30km/h) function was failed

Diagnostic steps:

1	Inspect the DTC

A. Connect the special-purpose diagnostic tester.

B. Read the DTC

Confirm whether DTC

No → Go to step 3

Yes

2	Clear DTC

A. Remove the DTCs with a special-purpose diagnostic tester.

Confirm whether the system works normally.

Yes → The system is normal.

No

3	Perform the central locking active test function

A. Execute the active locking function of the center control lock with a special-purpose diagnostic tester.

Confirm whether the central controlled lock may be normally locked.

No → See 11.7.6.4 Mechanical Key/Central Control Lock Switch Cannot Lock the Central Control Lock.

Yes

4	Confirm the vehicle speed signal.

A. Connect the special-purpose diagnostic tester to enter the ABS system to read the vehicle speed signal data stream when the actual vehicle speed reaches 20km/h and above.

Confirm whether the vehicle speed signal exceeds 20km/h.

No → Repair the data communication network as well as the ABS system repairing speed sensor and circuit repairing ECM.

Yes

5	Repair the BCM circuit.

A. Check the BCM power supply, ground wire and data communication line.

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B. Fix the malfunctions of relevant lines of the BCM.

Confirm whether the system works normally.

Yes → The system is normal.

No

6	Replace the BCM

A. Replace BCM and refer to Replacement of BCM in 11.9.8.1.

Confirm the completion of repair.

Next

7	The system is normal.

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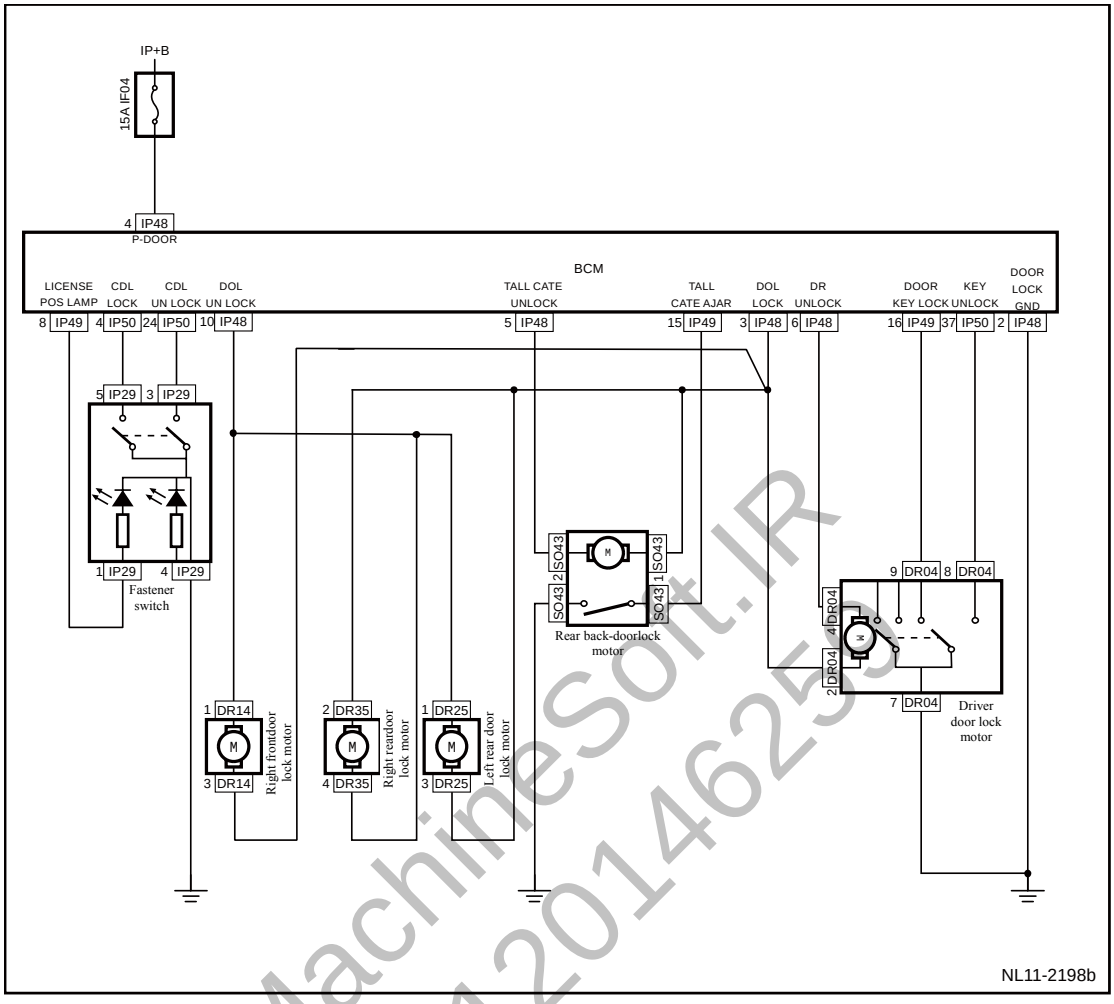
11.9.6.9 Runout during door lock travelling vehicle

Circuit diagram:



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Diagnostic steps:

1	Inspect the condition of locking through the mechanical key.

(a) Use lock switch to repeat lock and unlock actions.

Confirm whether the central controlled lock can be normally locked.

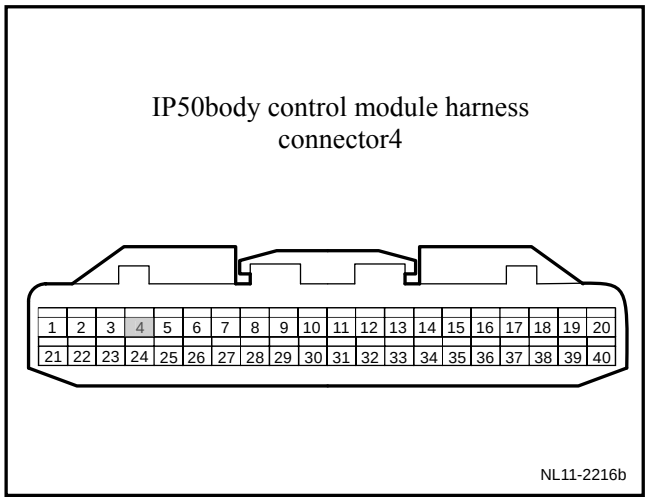
No → See 11.7.6.4 Mechanical Key/Central Control Lock Switch Cannot Lock the Central Control Lock.

Yes

2	Inspect the condition of locking through the mechanical key.

(a) Use mechanical key to repeat lock and unlock actions, meanwhile use multimeter to measure voltage of BCM wire harness connector IP50 terminal No. 4.

Observe whether the voltage reading of the multimeter is changed between 0V and 10V.



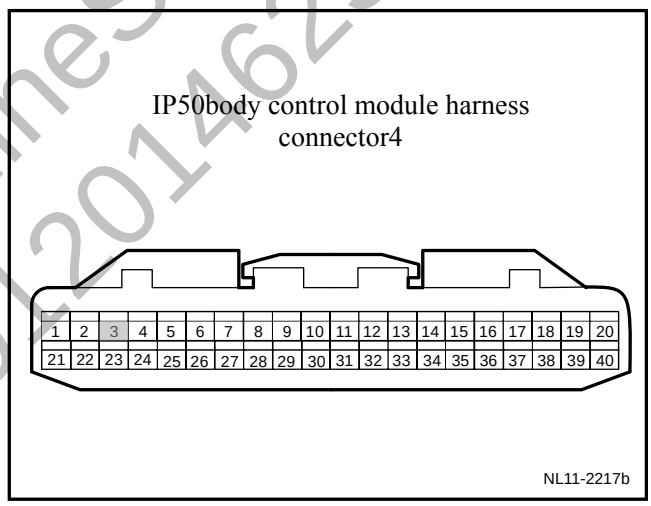
No → Go to step 5

Yes

3	Inspect the condition of unlocking through the mechanical key.

(a) Use mechanical key to repeat lock and unlock actions, meanwhile use ohmmeter to measure voltage of BCM wire harness connector IP50 terminal No. 3.

Observe whether the voltage reading of the multimeter is changed between 0V and 10V.



No → Go to step 5

Yes

4	Inspect the left front door lock assembly.

(a) For dismantle left front door motor assembly, refer to 11.7.7.1 Replacement of left front door lock assembly.

(b) Simulate unlock action by mechanical key, measure resistance value between left front door lock assembly DR04 terminal No.8 and 7 by millimeter

Standard resistant value: is less than 1Ω

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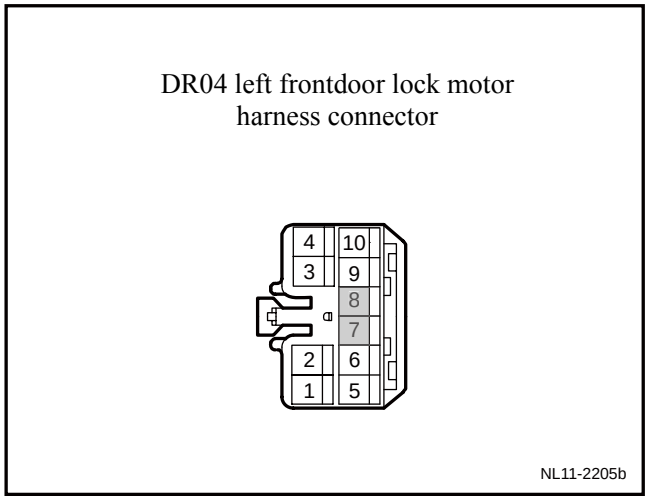
Confirm if the resistance conforms to standard value.



Yes → Go to step 6

No

5	Replace left front door motor assembly ,

(a) Replace the left front door lock motor assembly and refer to 11.7.7.1 "Replacement of Left Front Door Lock Assembl".

Lock by a key to confirm whether the electric door lock normally locks.

Yes → The system is normal.

No

6	Replace the BCM

A. Replace BCM. See 11.8.8.1 replacement of BCM.

Confirm the completion of repair.

Next

7	The system is normal.

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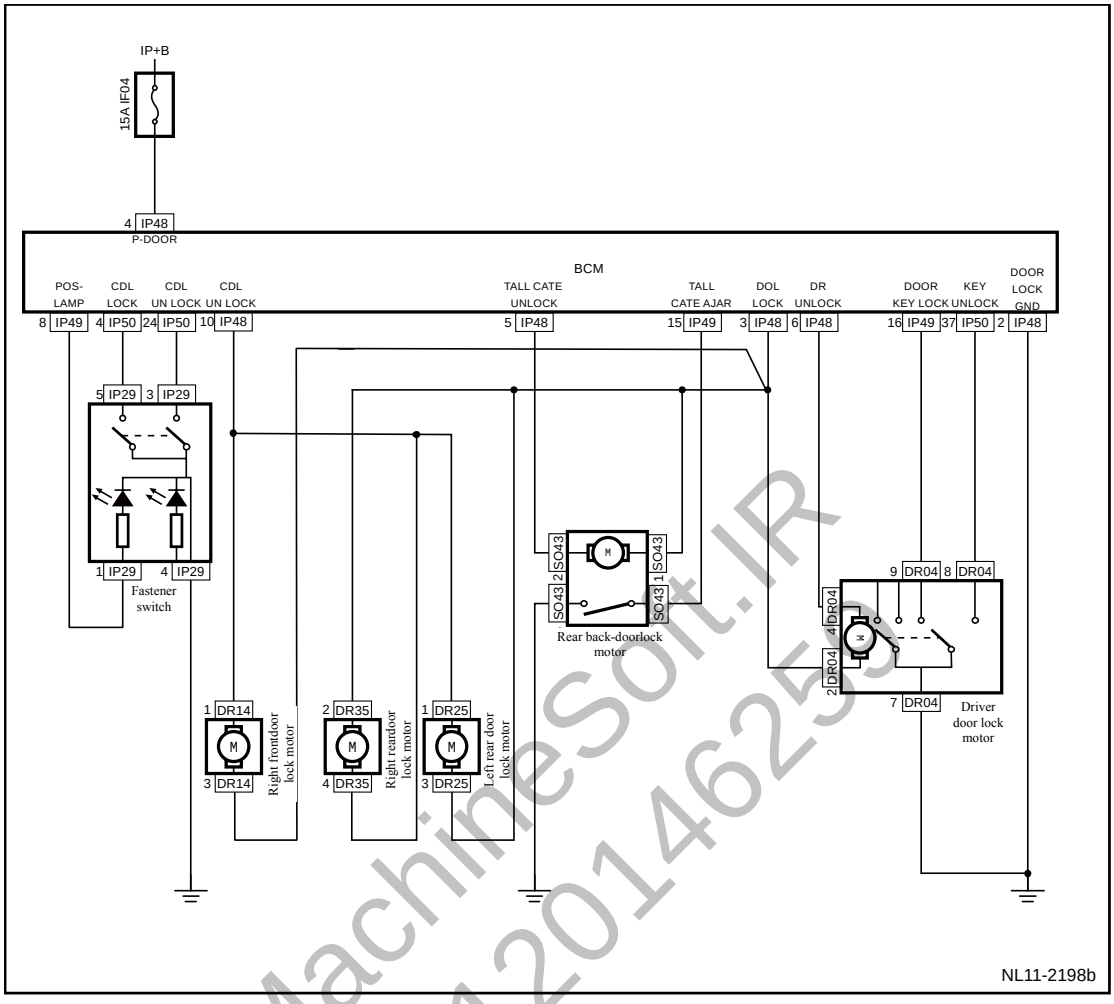
11.9.6.10 Left front door lock can't work

Circuit diagram:



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Diagnostic steps:

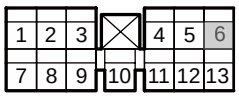
1	Inspect the voltage of the terminal No. 6 of BCM wire harness connector IP48.

(a) Turn on ignition switch.

(b) Use meachanical key or central control button to repeat lock and unlock actions, meanwhile, use multimeter to measure voltage of BCM wire harness connector IP48 terminal No. 6.

Observe the multimeter to confirm whether the voltage changes repeatedly between0V and the power supply voltage.

IP48body control module harness connector2



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No → Go to step 3

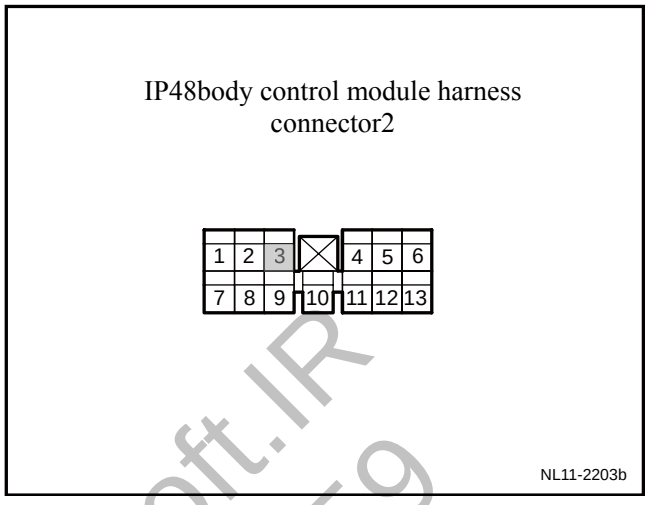
Yes

2	Inspect the voltage of the terminal No. 3 of BCM wire harness connector IP48.

(a) Turn on ignition switch.

(b) Use meachanical key or central control button to repeat lock and unlock actions, meanwhile, use multimeter to measure voltage of BCM wire harness connector iP48 terminal No. 3.

Observe the multimeter to confirm whether the voltage changes repeatedly between0V and the power supply voltage.



Yes → Go to step 4

No

3	Replace the BCM

A. Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm whether the left front door electric door lock is locked normally.

Yes → The system is normal.

No

4	Repair the open circuit between the BCM wire harness connector IP48 and the electronic door lock assembly wire harness connector motor terminal.

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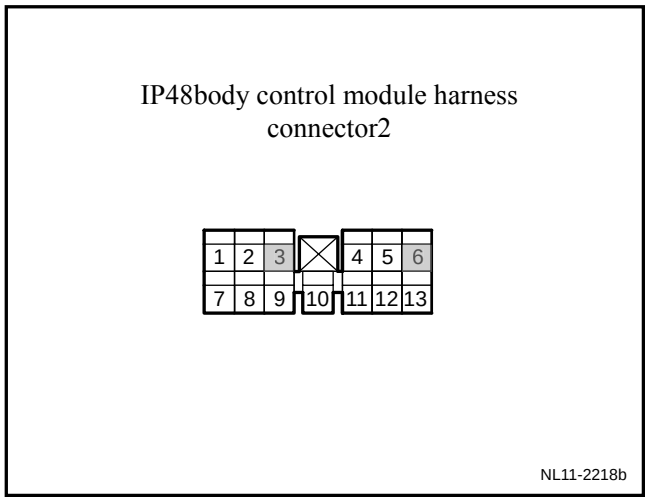
(a) Repair BCM wire harness connector IP48 No. 3 and No.6.

The circuit between the corresponding terminals of the assembly wire harness connector motor is broken.

Confirm whether the left front door electric door lock is locked normally.



Yes → The system is normal.

No

5	Replace left front door lock assembly

A. For replacement of the front left door lock motor assembly, see "11.7.8.1 Replacement of Front Left Door Lock Assembly".

Confirm the completion of repair.

Next

6	The system is normal.

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11.9.6.11 Right front door lock/left rear door lock/right rear door lock inoperation

The maintenance scheme is similar to the overhauling scheme in case the left front door lock does not work.

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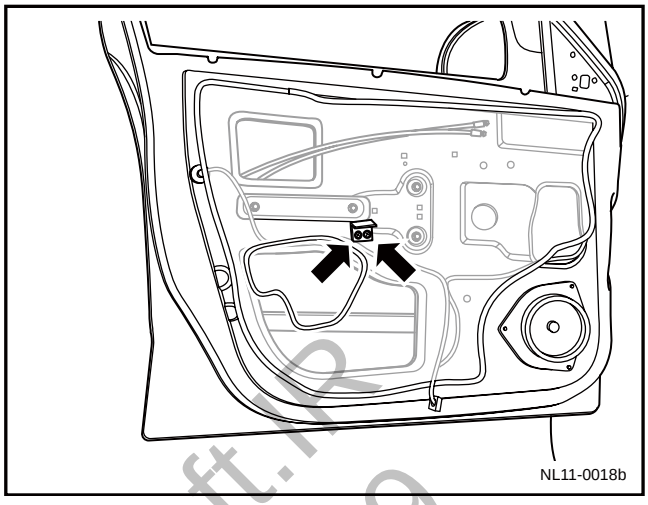
11.9.7 Dismantle and install

11.9.7.1 Left front door lock assembly replacement

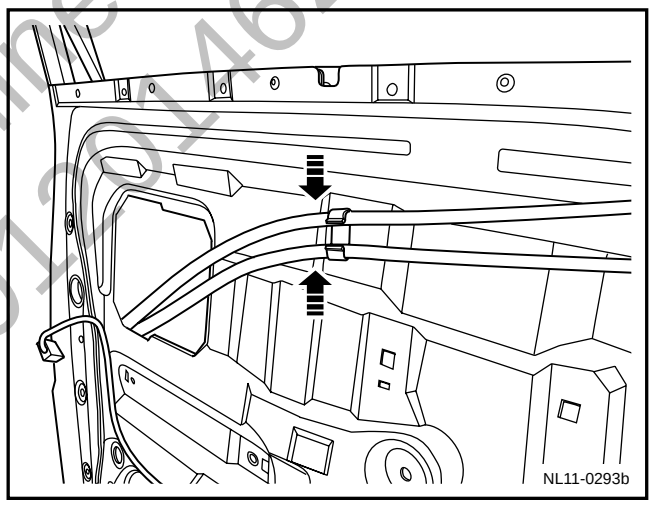
Dismantlement procedure

Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.



1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle the front door interior trim panel. Refer to12.9.1.7 Replacement of Front Door Interior Trim Panel.
3. Disconnect left front door harness connector.
4. Dismantle front door glass lifter switch bracket, and remove water retaining membrane.



5. For removal of the front door window, see 11.4.8.7 Replacement of Front Door Window Lifter.
6. For dismantlement of glass guide rail, see 11.4.8.8 Replacement of Front Door Window Guide Groove.
7. Dismantle the front door lock assembly control cable.
8. For dismantlement of the front door lock cylinder, see 12.5.2.5 Replacement of Front Door Lock Cylinder.

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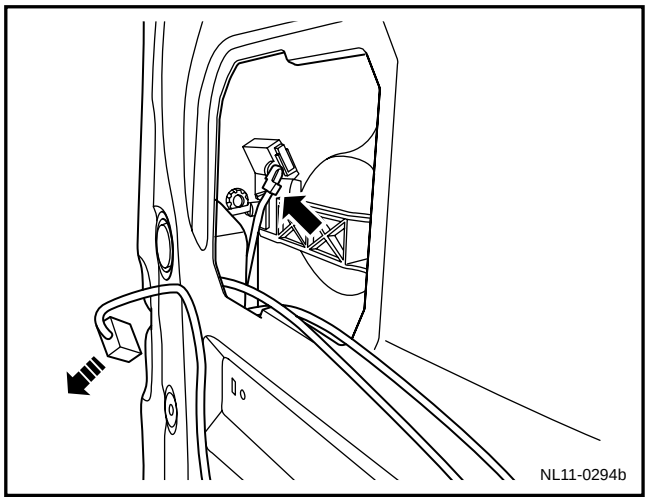
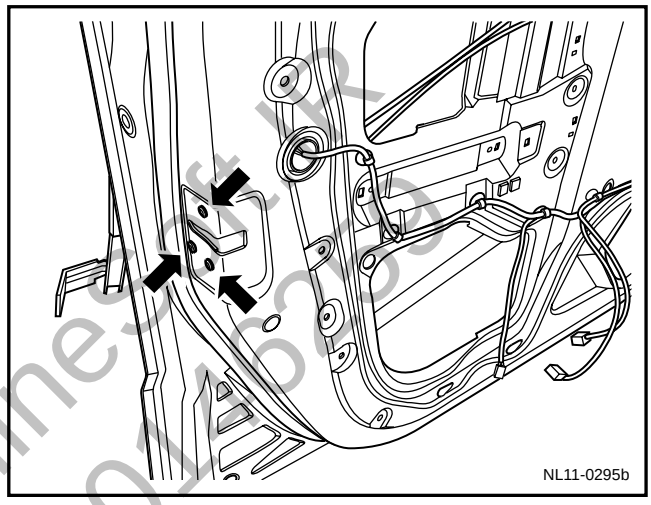
9. Disconnect the harness connector of the lock log and dismantle the push rod of the external door handle.



10. Dismantle fixing bolt front door lock block assembly.
11. Draw out lock body.

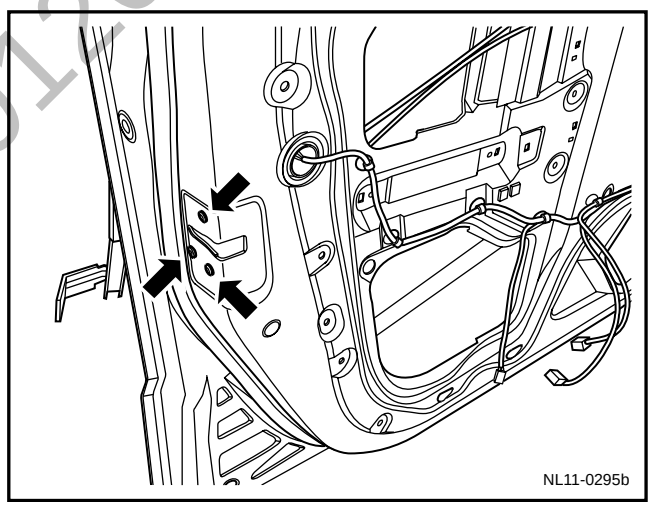


Installation procedure:

1. Install front door lock body assembly.
2. Install and tighten fixing bolt of front door lock block assembly.

Torque: 5Nm(Metric) 4lb-ft(English system)

3. Install the front door lock cylinder.



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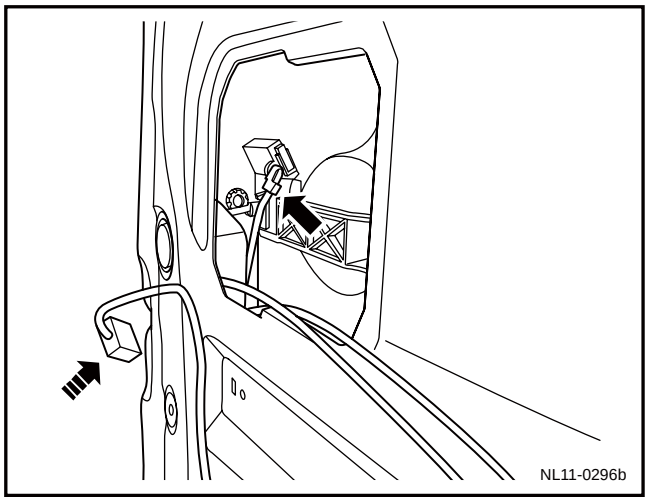
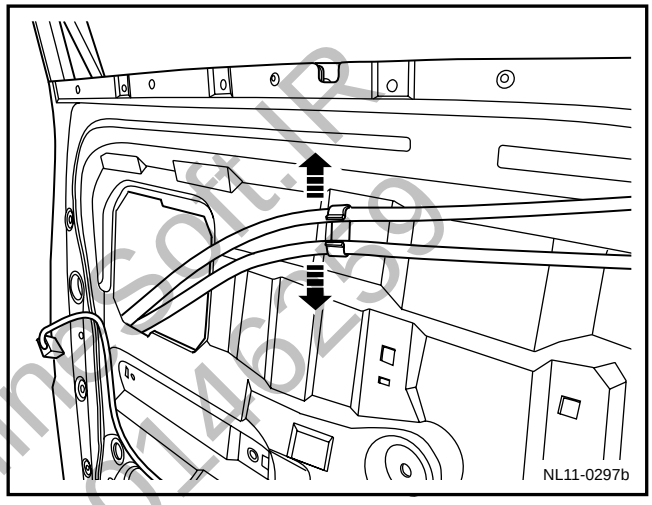
4. Connect the harness connector for the front door lock assembly and install the push rod of the external door opening handle.



5. Install the front door lock control cable assembly.

6 Install the glass guide rail.

7. Install the front door window.



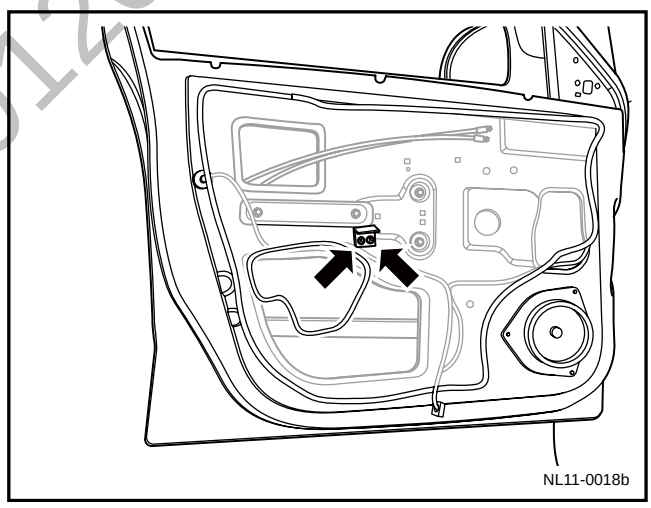
8. Paste the retaining membrane and install the front door window lifter switch bracket.

Torque: 5Nm(Metric) 4lb-ft(English system)

9. Install the front door interior trim panel.

10. Install front door treble speaker.

11. Connect the battery negative cable.



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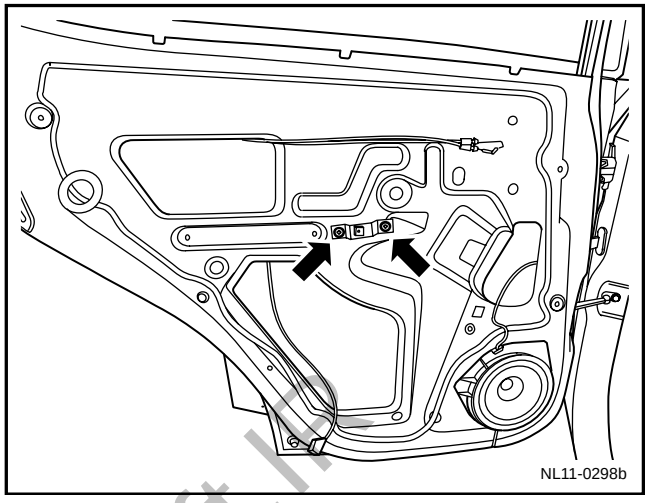
11.9.7.2 Rear door lock block replacement

Installation procedure:

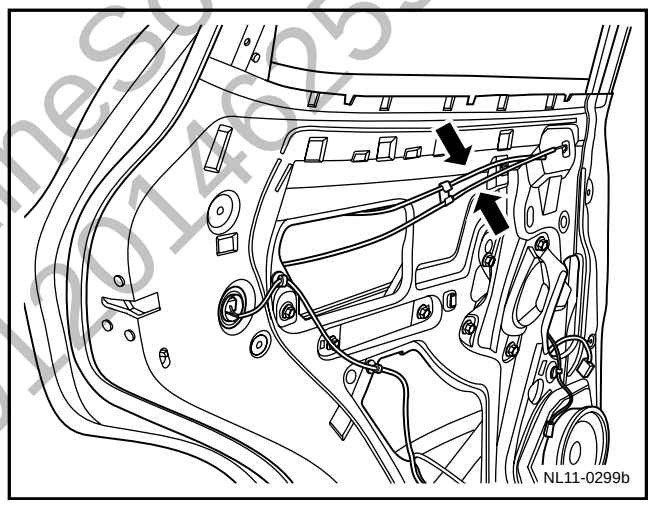
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

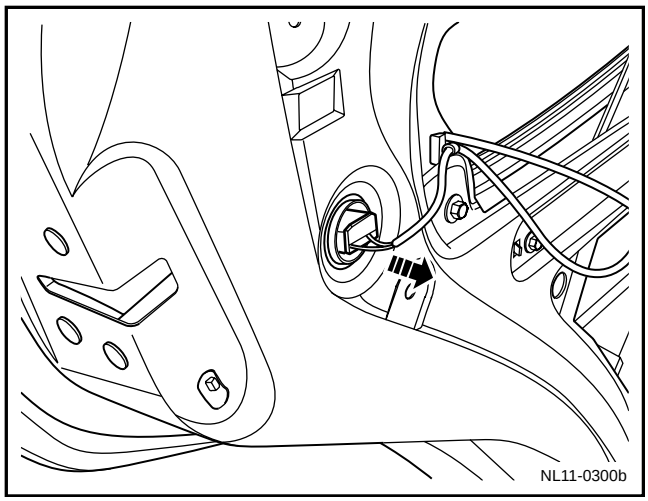
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of rear door inner trimming plate, refer to 12.9.1.9 Replacement of rear door inner trimming plate.
3. Dismantle rear door glass lifter switch bracket.
4. Tear off the retaining membrane.



5. Release the control cable of the rear door locking dog.



6. Disconnect the harness connector of the rear door lock assembly.



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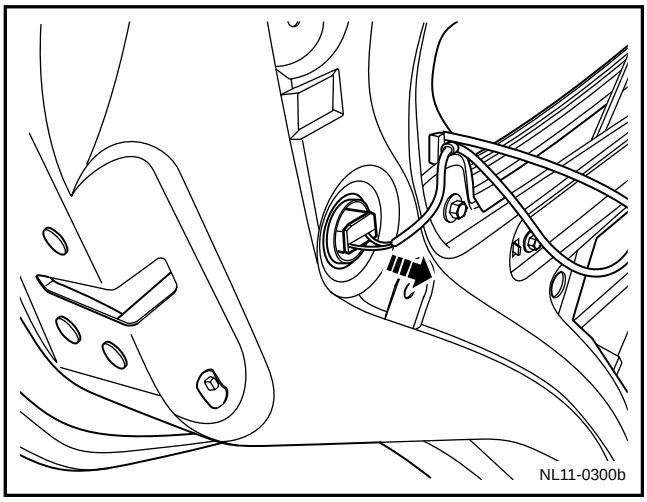
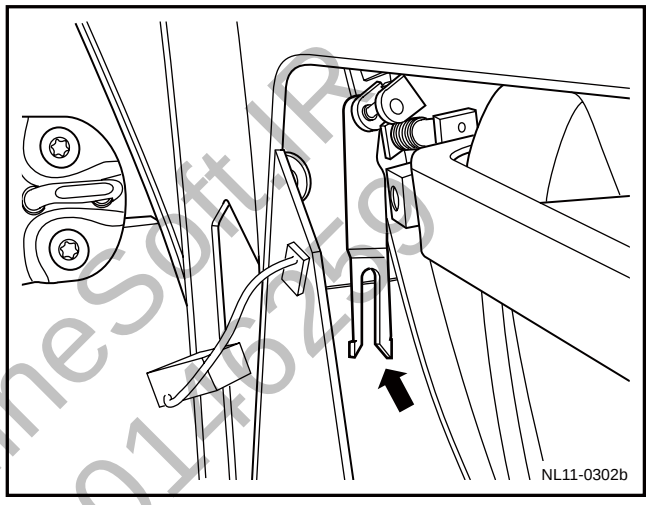
7. Remove the rear door lock assembly fixing bolt.
8. Remove the fixing bolt for the rear door lock dog assembly.
9. Extract the lock cylinder.



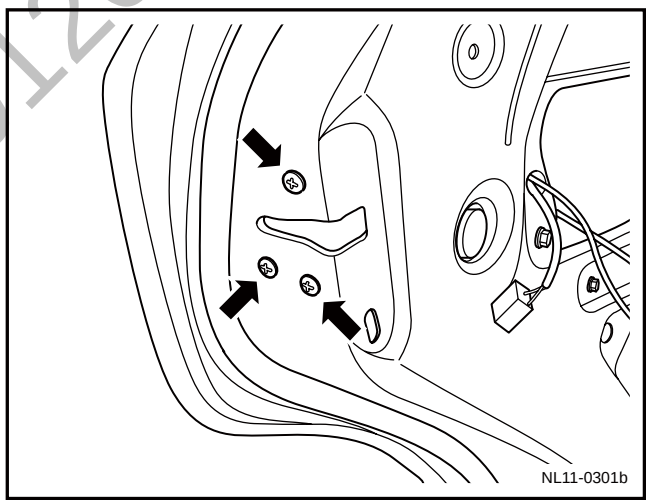
Installation procedure:

1. Install lock block into push rod of door outer open handle.



2. Install and tighten fixing bolt of rear door lock assembly.

Torque: 5Nm(Metric) 4lb-ft(English system)



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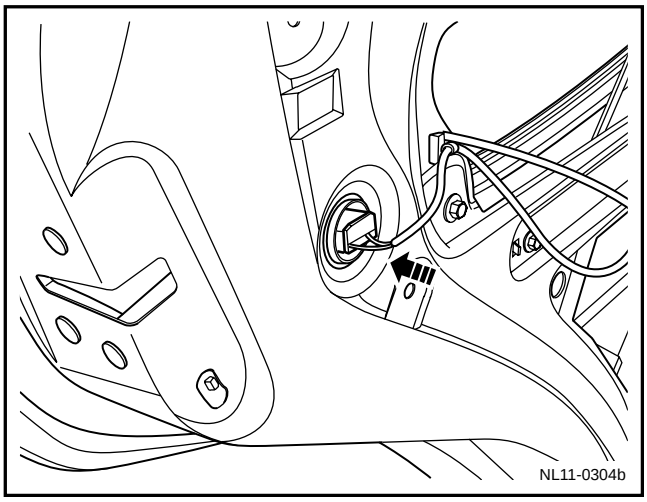
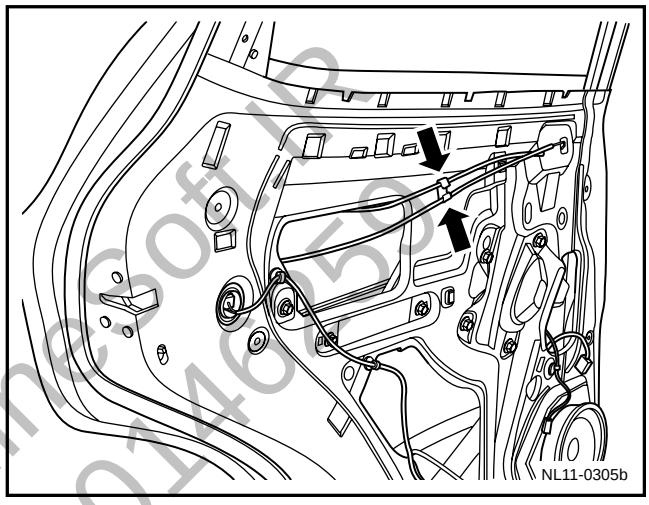
3. Connect wire harness connector of rear door lock assembly.



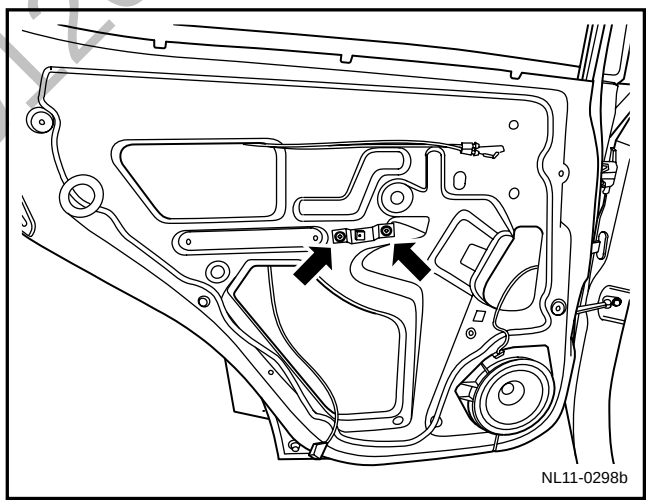
4. Fix rear door lock block cable assembly.



5. Paste the retaining membrane.
6. Install the rear door window lifter switch bracket.

Torque: 5Nm(Metric) 4lb-ft(English system)

7. Install the rear door internal trim panel.
8. Connect the battery negative cable.



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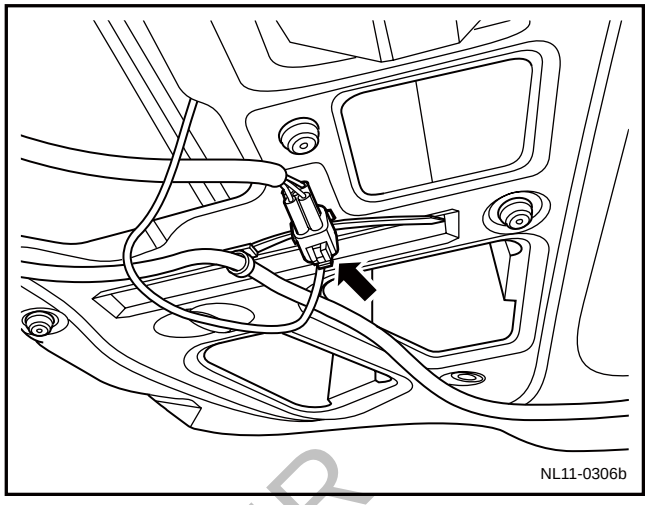
11.9.7.3 Back door lock assembly replacement

Dismantlement procedure

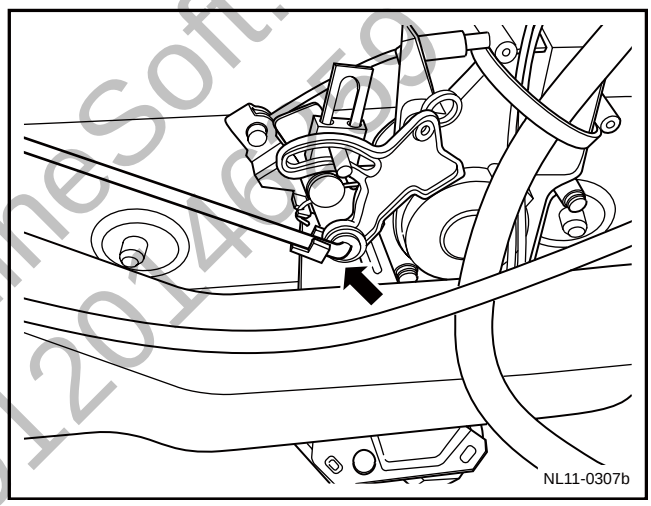
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

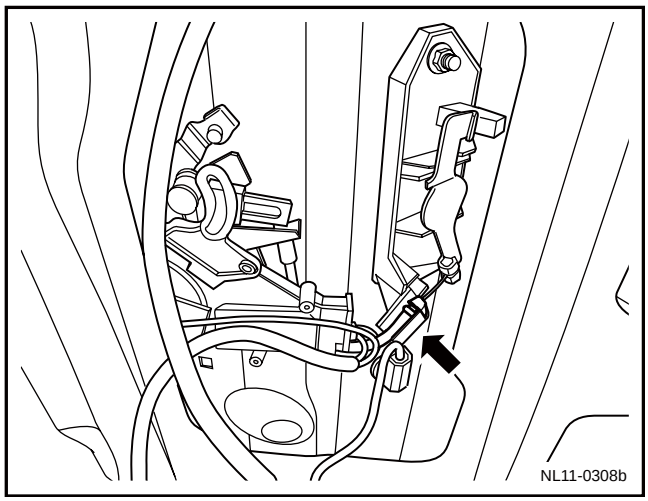
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of back door trimming plate, refer to 12.9.1.10 Replacement of back door trimming plate.
3. Disconnect back door lock assembly harness connector.



4. Dismantle back door lock opening pull rod.



5. Detach the control cable of the external back door handle.



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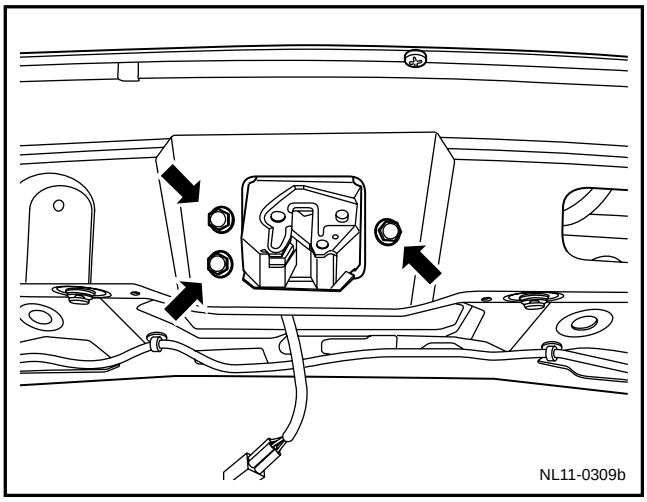
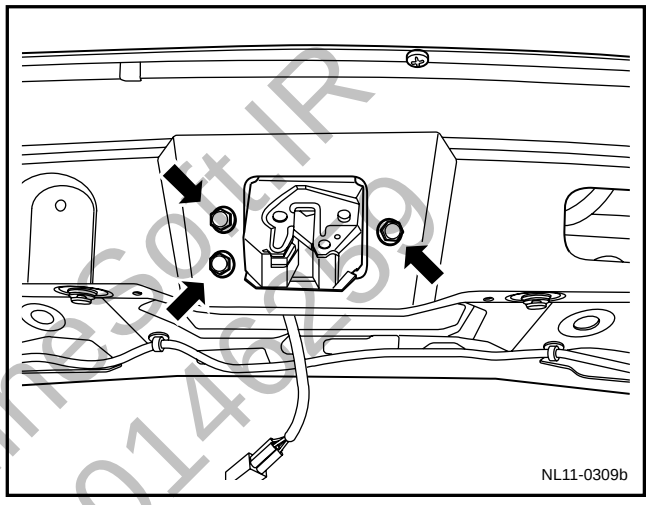
6. Remove the fixing bolt for the back door locking dog.



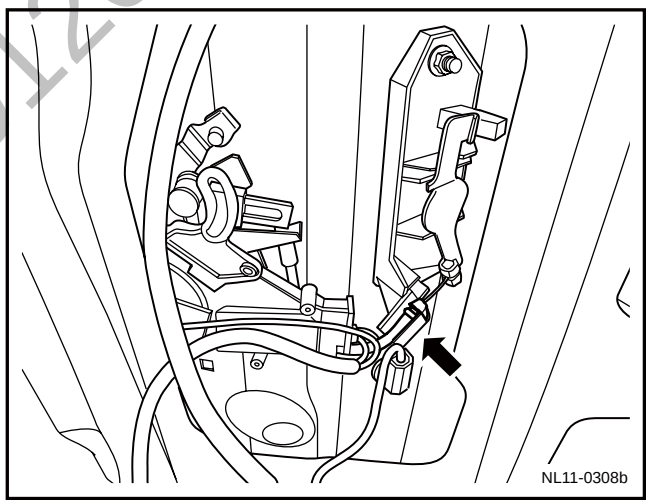
Installation procedure:

1. Install back door lock block fixing bolt.

Torque :10Nm(Metric) 7lb-ft(English system)



2. Install outer opening handle cable of back door.



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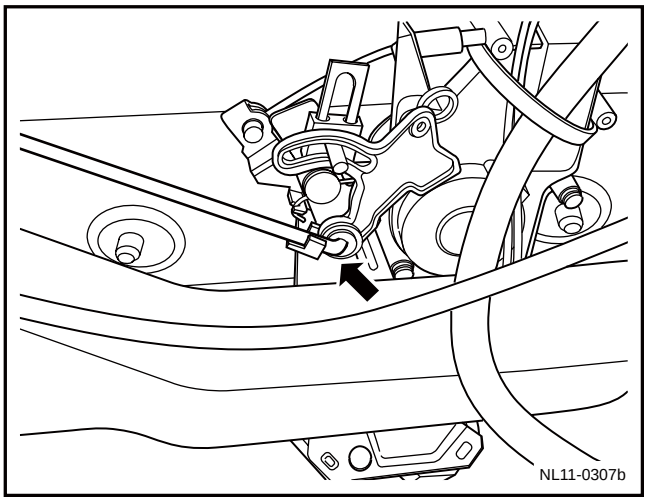
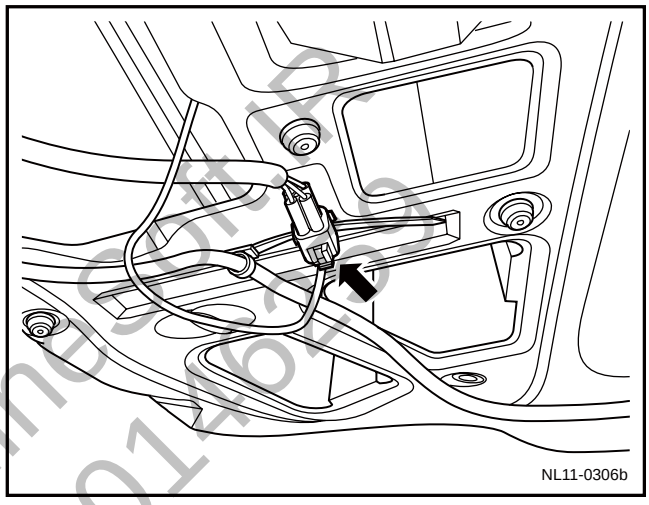
3. Install opening pulling rod of back door lock cylinder



4. Connect the harness connector for the back door lock assembly.
5. Install the back door trim panel.
6. Connect the battery negative cable.



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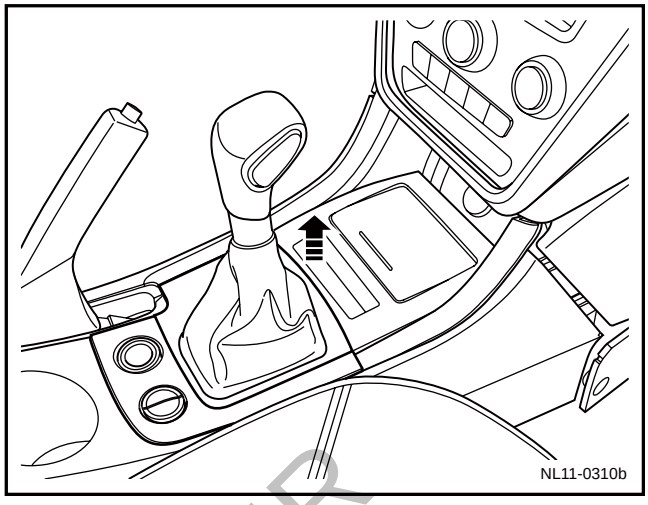
11.9.7.4 Lock switch replacement

Dismantlement procedure

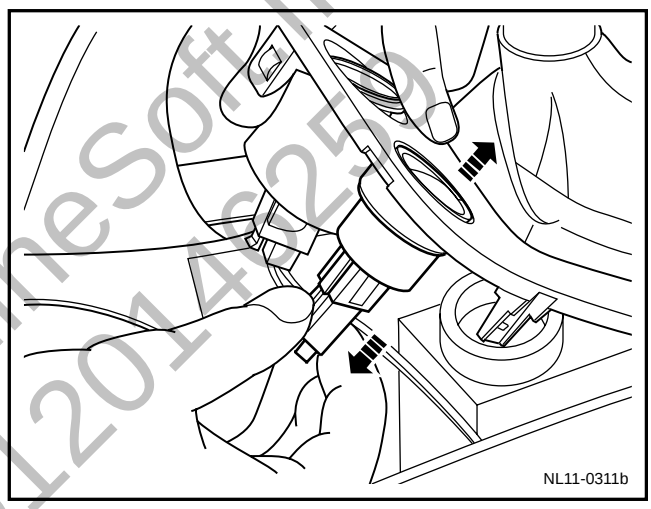
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

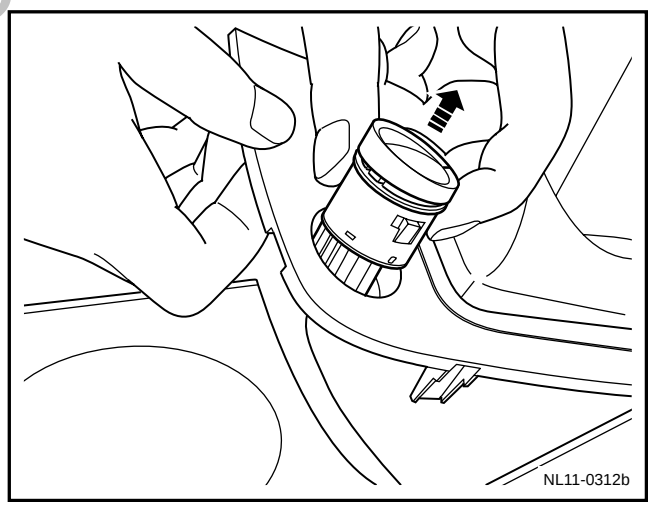
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle ashtray.



3. Dismantle gearshifting dustproof cover frame, disconnect lock switch wire harness connector.



4. Dismanle lock switch.



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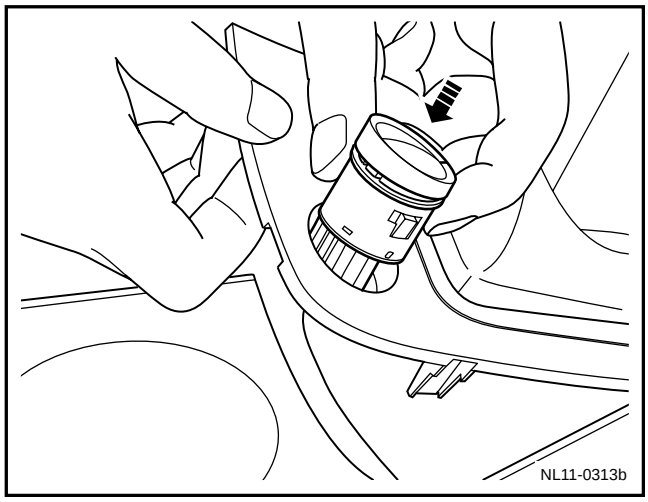
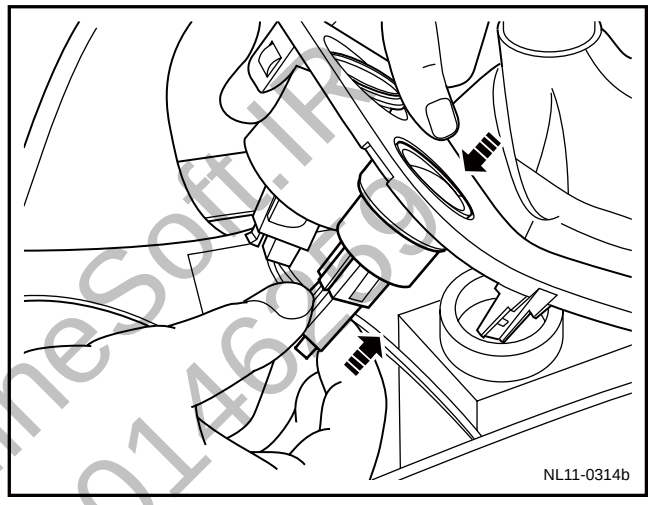
Installation procedure:

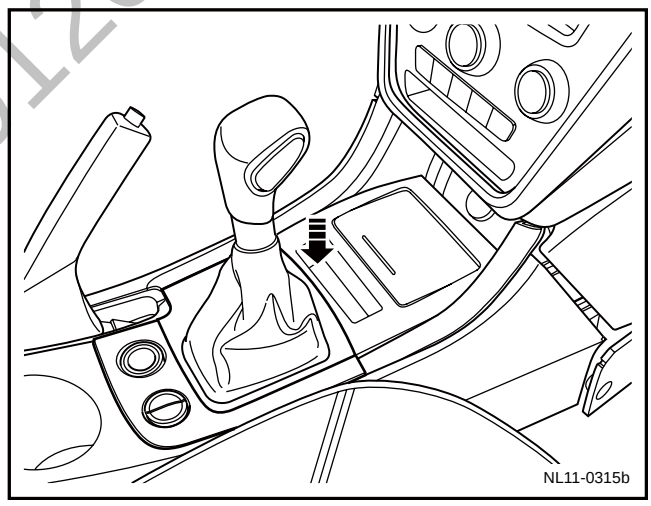
1. Install lock switch.



2. Connect lock switch wire harness connector, and install gearshifting dustproof cover.



3. Install Ashtray.
4. Connect the battery negative cable.



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11.9 Remote anti-theft system

11.9.1 Specification

11.9.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N.m)	English system (lb-ft)
BCM fixing bolt	M8×16	7-9	5.2-6.7

11.9.2 Description and operation

11.9.2.1 Description and operation

The remote control anti-theft system is an auxiliary vehicle alarm device. The alarm system is triggered when the vehicle forces to invade. The system is matched with a remote control central lock system. The system may be invalid due to the radio frequency interference or the exhaust of the electric quantity of the battery. The remote control anti-theft system admits the operation of the following parts.

– Door lock

– Anti-theft horn

– Light up steering lamp

The remote control anti-theft system comprises the following main parts:

– Sender(remote key)

– Radio frequency reception, (BCM)

– Door contact switch

When pressing down a button on an emitter, the emitter sends out a signal to the BCM. Then, BCM executes the corresponding function.

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Remote control anti-theft

The remote control anti-theft system is operated independent from the engine anti-theft system. The design of the remote control anti-theft system is to give the alarm when somebody forces to open the door. Under the alarm system, the anti-theft horn will emit an intermittent alarm sound and the steering signal lamp also flickers at the same time. After 30 seconds , the horn stops and only left and right flashlights flash for 5 minutes . After all doors are closed, the alarm buzzer will continually beep for 30s. After 30s, horn and lamp stop warning, and vehicle doors are locked, and the system will return to activation status. The remote control anti-theft system does not affect

Affect the starting or normal operation of the engine.

Rolling code

The remote control anti-theft system uses a rolling code technology. The technology can prevent anyone fro recording the information sent from the transmitter and entering the vehicle by adopting the information. The term of "rolling code" refers to the manner of transmitting and receiving signal through a remote alarm system. The emitter transmits signal in different order at every turn. The emitter and the radio frequency receiver are synchronized in corresponding sequence. If the signal sent out by a programmed emitter is inconsistent with the expected sequence of the radio frequency receiver, the emitter loses synchronization. This usually happens

after the emitter button is pressed for 255 times outside the remote control range of the vehicle.

Remote control door lock

– Non -insert status of ignition key .pressed unlock key of remote controller for one in the 2s (time of duration is less than 0.1s) driver's side door lock is "ON". Turning lamp flashing confirmed

When ignition switch is not in connection status, after pressing the unlock key on remote controller within 2s two times (lasting time should not less than 0.1s), the other three door locks will be open at the same time, and the turning lamp will flash to confirm it.

When ignition switch is not in connection status, after pressing the unlock key on remote controller for 1s, the remote controlled signal will separately release the signal of driver’s side door (100s), and then release the signal of other three door locks.

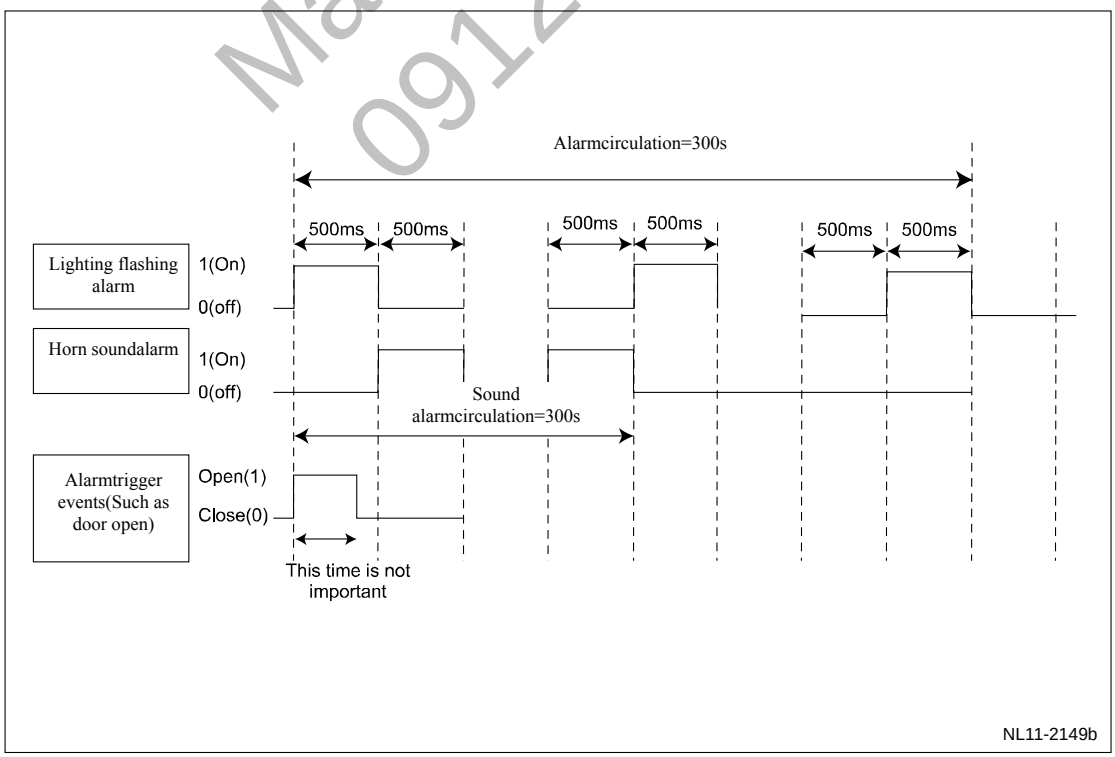
Entering anti-theft

When ignition key is pulled out and the door is closed, use remote lock key to lock the door (press the lock key once), and the turning lamp will flash once time. After 30s, it enters into anti-theft status.

– System automated access anti-theft status.

Entering anti-theft failure

When the door is locked by a remote control unit lock key, the steering lamp flickers three times and the anti-theft horn sounds three times if the door/backdoor is are not closed well; then, enter into the anti-theft alarm state after 10s (the alarm circulation is as follows: the flickering frequency of the left and right flash lamps is consistent with the sound frequency of the anti-theft alarm horn; then the horn stops sounding after 30s, and only the left and right flash lamps flicker for 5min. If not entering the anti-theft alarm state by re-pressing the lock key within 10s, but entering anti-theft alarm distribution (however, the horn does not make a sound unless other ambient condition triggers, and the steering lamp also does not flicker). In the anti-theft alarm mode, if the remote unlock button is pressed again, it will stop the alarm cycle, and the anti-theft alarm arrangement status will be deactivated. Repress the lock key to restore the initial state. It is shown in figure below:



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Learning code mode of remote control unit

Learning code mode I (switch type learning)

1. Unlock anti-theft function.
2. Open driver's side door.
3. Place IGN to OFF/ON position for 3 times within 8s, and at last, place it on ON position of IGN.
4. OPEN/CLOSE/OPEN the driver-side door once within 8s and then set in the OPEN mode.
5. Perform the IGN ON/OFF/ON operation on the IGN within 8s once to put IGN in the ON position.
6. The horn will sound once when the system successfully enters the learning mode.
7. Simultaneously press the UNLOCK and LOCK keys of the transmitter within 10s to learn the system.
8. The anti-theft horn will sound twice if the system learns successfully the codes. If the key for which the system successfully learns the codes this time is the first key in the learning process, then erase all learned codes previously. If learning code fails, the anti-theft horn sounds four times.
9. Reset 3step and 8 step. go to the next remote controller learning .

Learning code mode II: (diagnostic ceremony learning)

1. Insert ignition key.
2. Connect BCM to EOL equipment or diagnostic tester.
3. EOL equipment or diagnostic apparatus give out learning order of remote controller.
4. Successfully enter into study code mode, and EOL equipment or diagnostic tester shows studying.
5. Simultaneously press and hold the Unlock and Lock keys on the transmitter within 10s to successfully learn the codes and the EOL device or diagnostic tester displays the message "the n key has been learned". If the key which is learned successfully this time is the first in the learning process, erase all learned data previously.

   Learning code If learning code fails, EOL equipment or diagnostic unit display the learning code fails.
6. If you need to learn other remote controls, repeat Steps 3-5. 4 remote control units can be learns at most.

Remarks:

1. There are the following types to exit study process:

a. When the whole learning process takes more than 30s, the diagnostic tester displays the exit results.

b. If the ignition key is pulled out, then exit the remote control learning mode.

c. The EOL device or diagnostic tester sends out the command for stopping the learning by the remote control and the diagnostic tester displays the exit results.

2. On the first study process, it is necessary to consider first entering and first out concept as principle. During study, if the first remote controller is learned successfully, the previous 4 remote controllers require to be learned again.

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3. One controller at most can contain 4 remote controllers.

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11.9.3 System work principle

11.9.3.1 System operating principle

Door contact switch

Each door lock mechanism is equipped with a contact switch. When the door is closed, these switches are off; once a certain door is opened, the contact switch of the door is closed to transmit a ground signal to the BCM, and the BCM transmits the information of "The door is opened" to the instrument according to the signal.

Theft-deterrent light indicator

The anti-theft indicator lamp is a light-emitting diode; and the power supply is from the circuit system. After the system enters into the anti-theft state, the BCM provides the grounding circuit to control its flicker.

Anti-theft horn

After the system enters into the anti-theft triggering state, the BCM provides a horn relay grounding power supply to control its beep.

Steering lamp

See 11.3.2.1 Description and operations of external illumination system.

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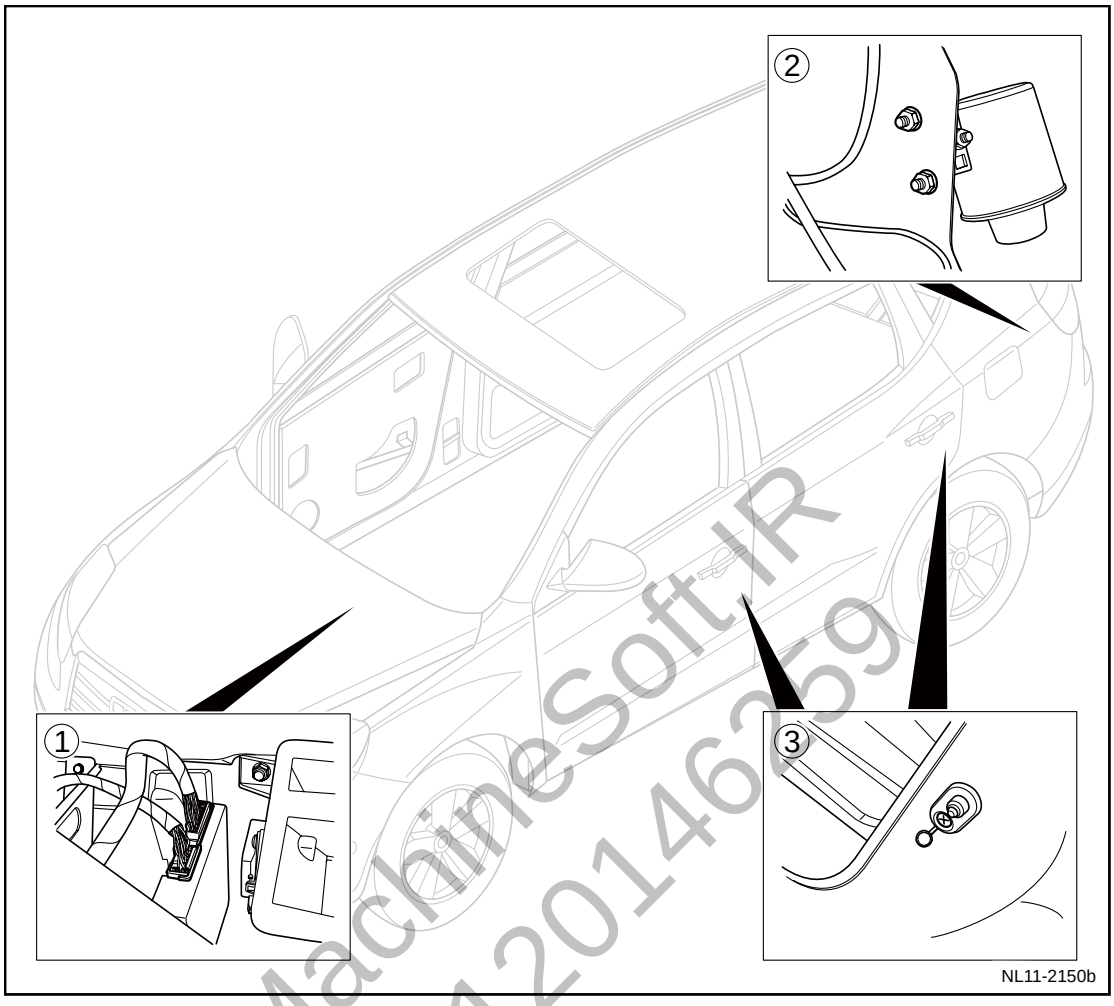
11.9.4 Part position

11.9.4.1 Component position



1. BCM
2. Door switch

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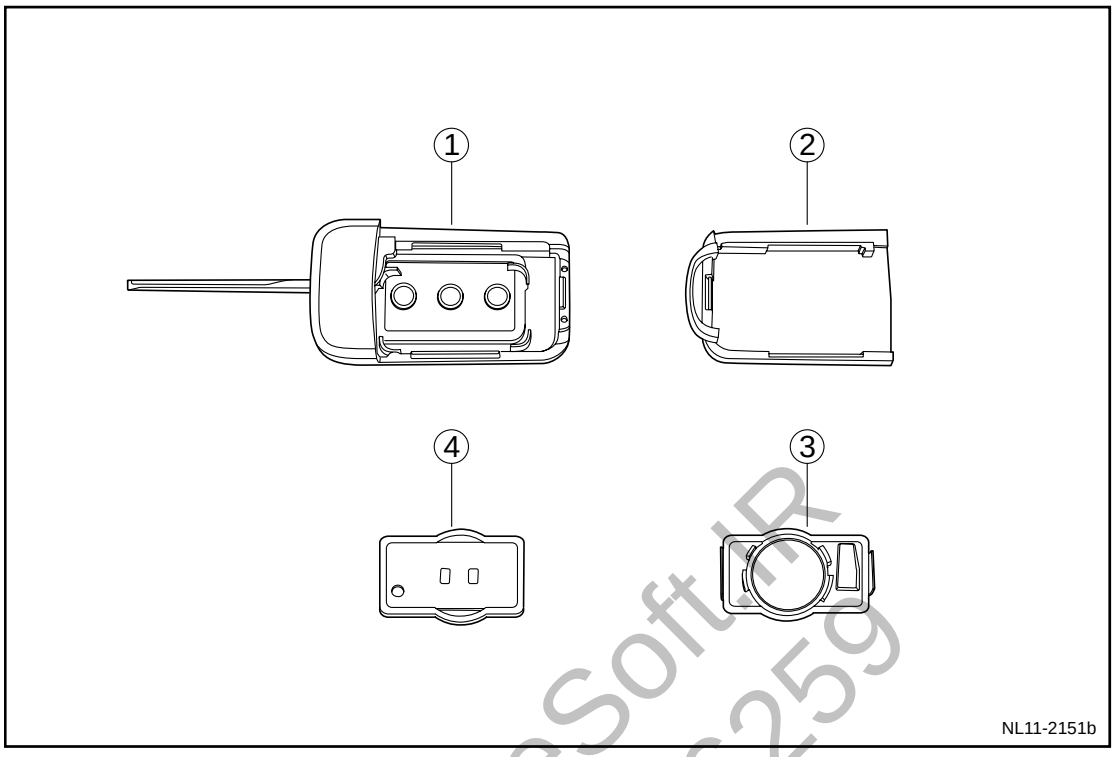
11.9.5 Disassemble drawings

11.9.5.1 Remote control key



1. Remote control key
2. Remote key cap
3. Battery
4. RKE transmitter.

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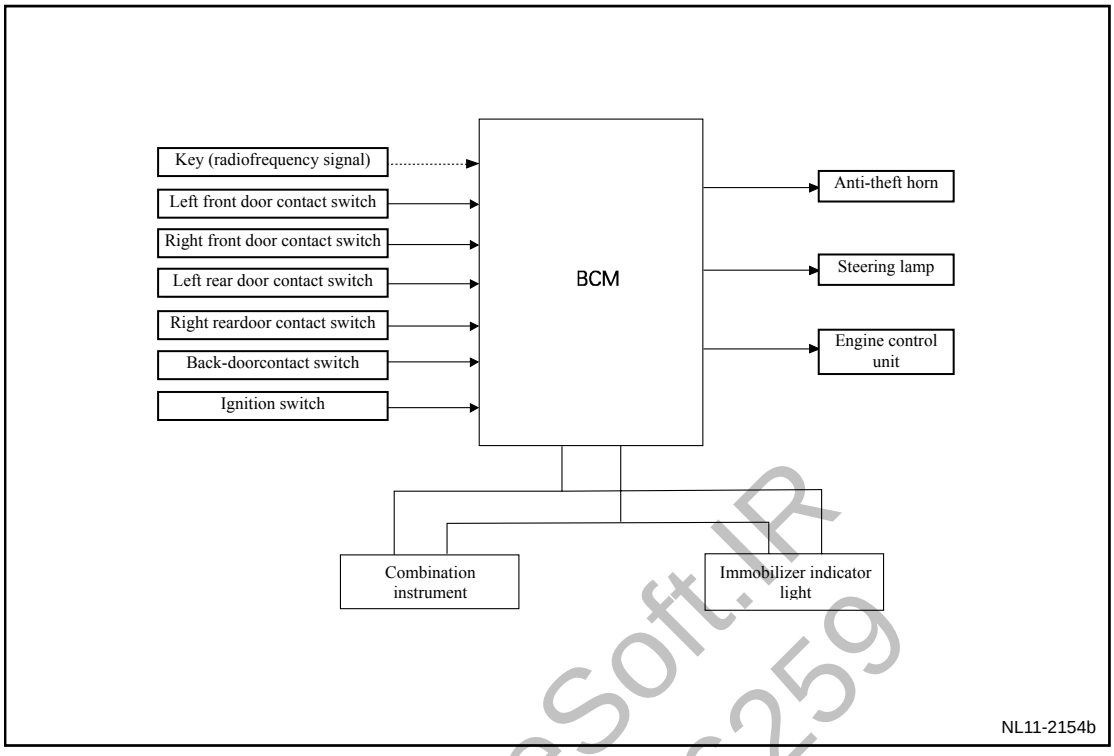
11.9.6 Electrical schematic diagram

11.9.6.1 Electrical schematic diagram



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11.9.7 Diagnostic information and steps

11.9.7.1 Diagnosis descriptions

Refer to 11.9.2 Description and Operation to get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.9.7.2 Visual inspection

– Inspect the after-sales optional device which may affect the normal operation of remote control anti-theft system.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– If some remote controller is ineffective, it is necessary to check whether the built-in battery has electricity before inspecting system fault.

11.9.7.3 Remote controller do not work

– Confirm remote controller build-in battery is in an energized state.

– Under the condition that the anti-theft function is released, open the driver's side door and turn on, off the key for 6 times within 10s and the last action is on OFF status, at this moment, anti-theft indicator lamp will light up, which means that it enters into the study status, and then press any key of remote controller, if the anti-theft indicator lamp flashes once, it indicates successful study. Four keys can be learned in turn. The learning mode will automatically withdraw in 10s or after the completion of 4 keys learning or at least learning a key rear ignition lock "ON".

Notes:

Clean the previous ID after learning the first key at every turn.

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11.9.7.4 Fault symptom table

Suggestions:

– The premise to shoot the trouble of anti-theft system: make sure that the door lock control system and remote controlled door lock control system work normally.

– Troubleshooting steps as follow table.

– Before inspecting suspicious position, first inspect fuse and relay.

Symptoms	**Suspected parts**	**Measures / refer to**
The door is unable to be locked through a remote control unit.	Door control lamp circuit.	See 11.3.7.10 Guest Lamp Does Not Work.
	Door key lock/ unlock switch electric circuit.	See 11.8.6 Electrical Principle Schematic Diagram.
	Rear back-door control lamp switch circuit	See 11.3.7.11 Trunk Lamp Does Not Work.
	BCM circuit and BCM	See 11.8.8.1 Replacement of BCM.
After the anti-theft system is set, the safety indicator lamp does not flicker.	Anti-theft indicator lamp circuit	See 11.8.7.5 Anti-theft Indicator Lamp Does Not Work.
	If it is confirmed that anti-theft indicator lamp circuit is normal after inspection, replace BCM.	See 11.8.8.1 Replacement of BCM.
When the remote control unit is electroless, the alarm sound state can not be canceled when the ignition switch is in the position ON under the anti-theft state.	Ignition switch circuit	See 2.10.7.3 Check of Ignition Switch.
	Replace remote controller battery, and after making sure that remote control system can be operated normally, replace BCM.	See 11.8.8.1 Replacement of BCM.
Even if the door is opened, the anti-theft system can also be set.	Door control lamp switch circuit.	See 11.4.7.10 Guest Lamp Does Not Work.
	If it is confirmed that door control lamp switch circuit is normal after inspection, the fault still exists, replace BCM.	See 11.8.8.1 Replacement of BCM.
When the anti-theft system	Horn circuit	See 11.8.7.6 Anti-theft Horn Does Not Work.

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is under the alarm state, the vehicle The anti-theft horn does not ring.	If it is confirmed that horn circuit is normal after inspection, replace BCM.	See 11.8.8.1 Replacement of BCM.
When the anti-theft system is under the alarm state, the hazard alarm lamp does not flicker.	Danger warning lamp circuit.	Be capable of opening the steering lamp (hazard warning lamp). If all steering lamps do not work, inspect the steering lamp circuit.
	If all turning lamp doesn't work after inspection, replace BCM.	If all steering lamps do not work, replace BCM. Refer to 11.8.8.1 Replacement of BCM.

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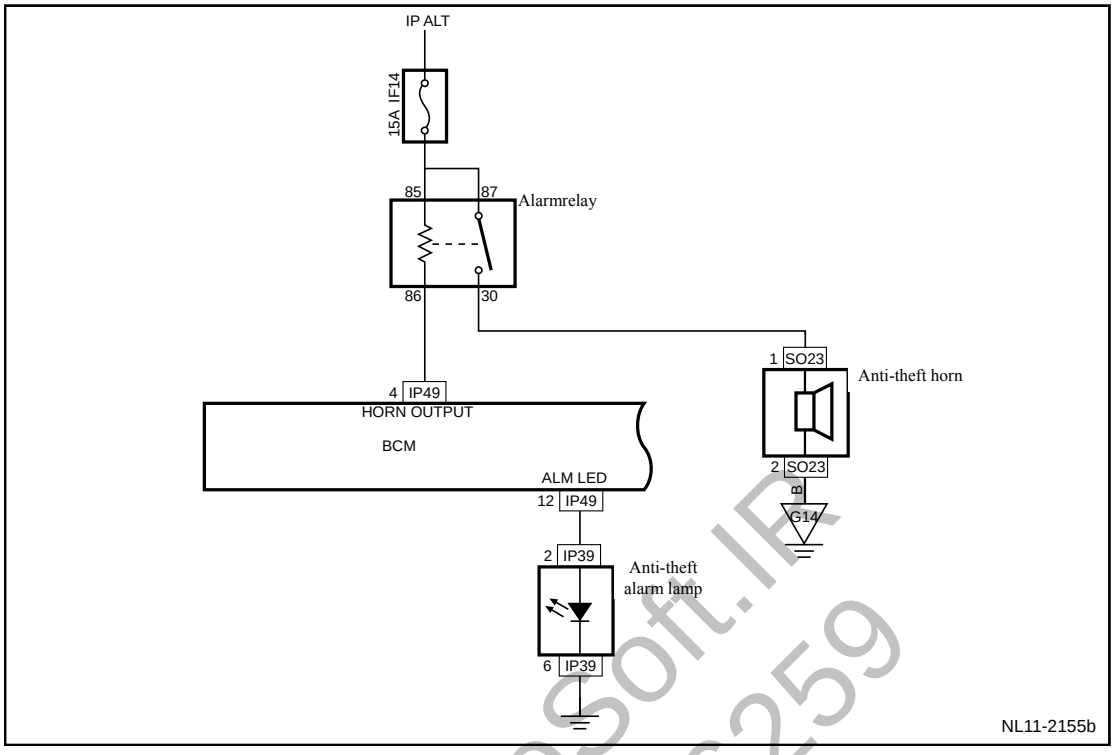
11.9.7.5 Anti-theft indicator lamp do not work

Circuit diagram:



Diagnostic steps:

Notes:

Prior to the implementation of the diagnostic procedures, firstly make use of the fault diagnostic unit, and then select body control system/BCM special set function/anti-theft indicator lamp in sequence. Compel to turn on the anti-theft indicator lamp, which is conducive to quickly troubleshoot.

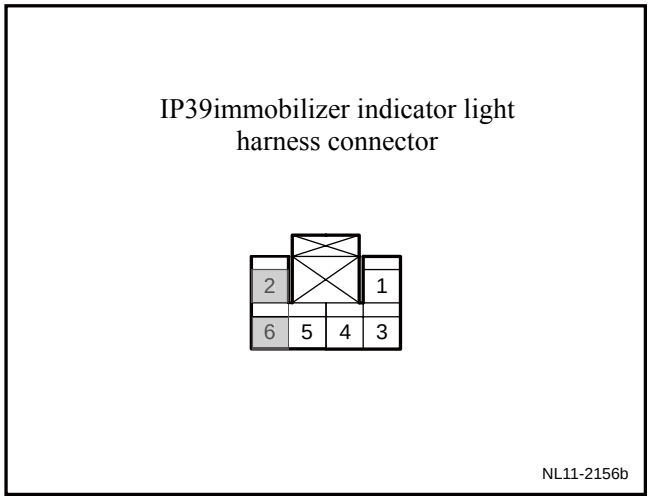
1	Measure voltage between the alarm indicator harness connector IP14 terminal No.2.and No.6.

(a) Disconnect the anti-theft indicator harness connector IP14.

(b) Measure voltage between terminal No.2 and No.6 with a universal meter.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value



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No → Go to step 6

Yes

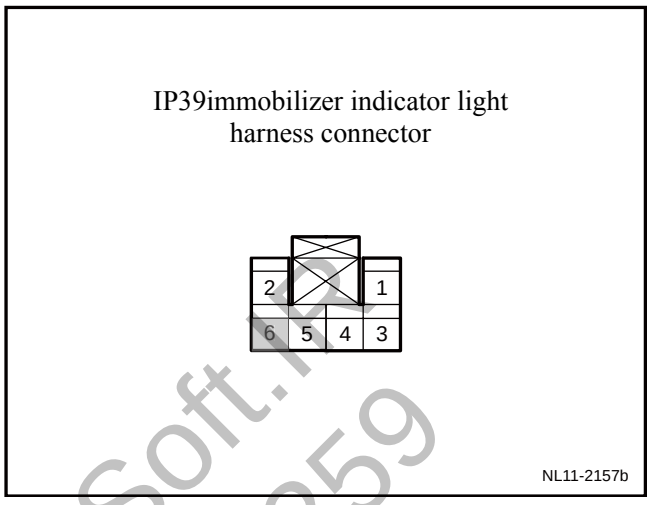
2	Check ground circuit of anti-theft indicator.

(a) Disconnect the anti-theft indicator harness connector IP14.

(b) Measure voltage between harness connector terminal No. 6 and vehicle body ground point with a universal meter.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.



Yes → Go to step 4

No

3	Repair ground circuit of anti-theft indicator.

a) Repair fault point from anti-theft indicator to body ground circuit.

Is the anti-theft indicator working correctly?

Yes → The system is normal.

No

4	Check supply circuit of anti-theft indicator.

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(a) Rotated ignition switch to "OFF" position.

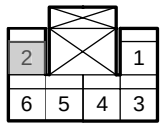
(b) Disconnect the battery negative cable.

(c) Disconnect BCM harness connector IP49.

(d) Disconnect the anti-theft indicator harness connector.

(e) Measure the resistance between terminal No. 2 of anti-theft indicator harness connector IP14 and BCM harness connector IP49 with a universal meter.

IP39immobilizer indicator light harness connector



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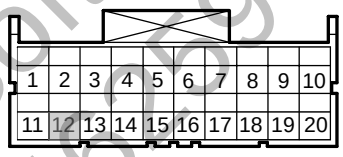
IP49body control module harness connector3



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Test Items	Specified Value
IP49(12)—IP14(2)	Less than 1 Ω

Is the resistance at a specified value?

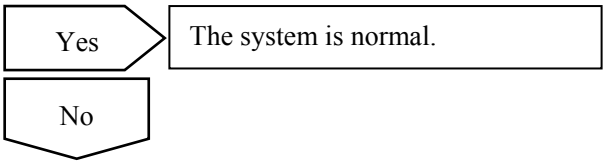
No → Repair open circuit fault between terminal 2 of anti-theft indicator harness connector IP14 and BCM harness connector IP49

Yes

5	Replace the BCM

A. Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.



6	Replace the anti-theft indicator.

(a) Replace anti-theft indicator and refer to 11.8.8.2 "Replacement of Anti-theft Indicator".

Confirm the completion of repair.

7	The system is normal.

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11.9.7.6 Anti-theft horn do not work

Circuit diagram:

Circuit diagram refers to 11.12.7.4 Horn Does not Work.

Diagnostic steps:

1	Confirm the body anti-theft system to enter the anti-theft alarm state.

Confirm the body anti-theft system to enter the anti-theft alarm state.

No → Start the body anti-theft system to enter the anti-theft alarm state.

Yes

2	Inspect the anti-theft horn.

See 11.11.7.4 Horn Does Not Work.

Confirm whether the anti-theft horn is normal.

No → Replace horn

Yes

3	Inspect the circuit between the BCM and the horn.

(a) Check if short circuit and cutting circuit exist between BCM wire and horn wire

Confirm whether short circuit or open circuit exists in the circuit between the body anti-theft module and the horn.

Yes → Repair circuit.

No

4	Replace the BCM

A. Replace BCM and refer to Replacement of BCM in 11.8.8.1.

Confirm the completion of repair.

Next

5	The system is normal.

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11.9.8 Dismantle and install

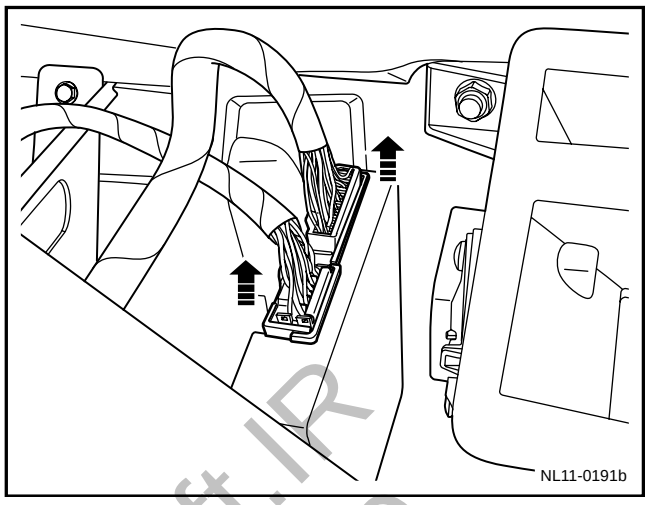
11.9.8.1 BCM replacement

Dismantlement procedure

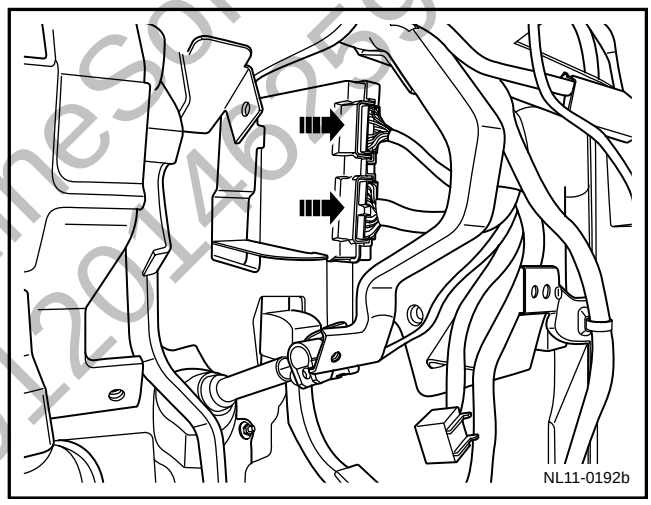
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Remove instrument panel. Refer to 12.8.3.1 Instrument Panel Replacement.
3. Disconnect BCM upper harness connector.



4. Disconnect wire harness connector under BCM.
5. Remove the BCM bracket retaining bolts.



Installation procedure:

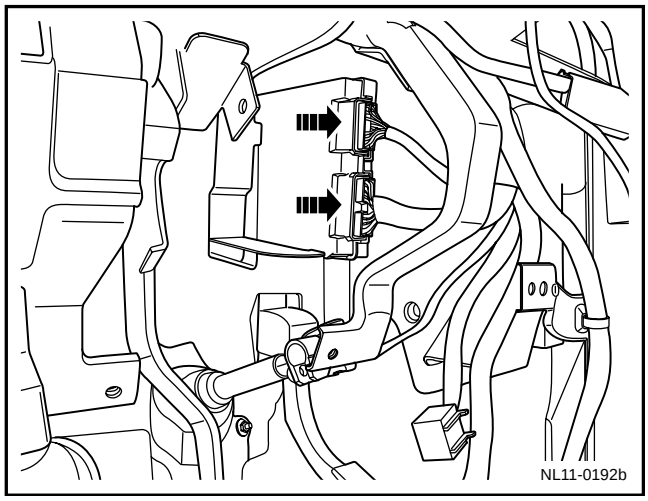
1. Install and tighten BCM bracket fixing bolt.

Torque: 8Nm(Metric) 6lb-ft(English system)

Notes:

See "Important Cautions Regarding Fastening Parts" in "Warnings and Cautions".

2. Connect BCM lower wire harness connector.



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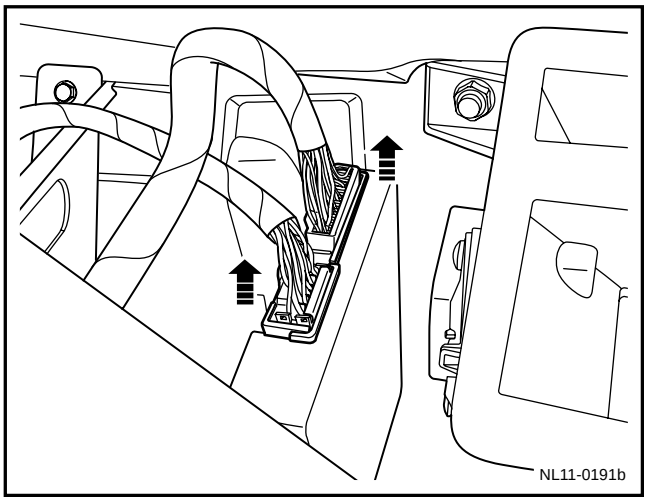
3. Connect wire harness connector on the upper of BCM.
4. Install the instrument panel.
5. Connect the battery negative cable.



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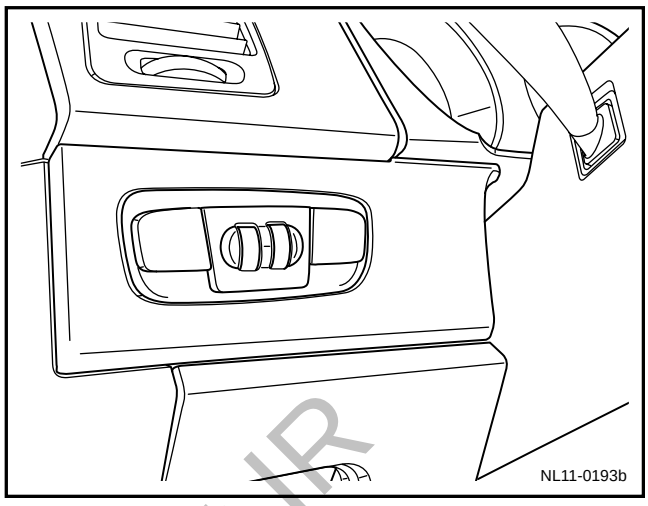
11.9.8.2 Anti-theft indicator lamp replacement

Dismantlement procedure

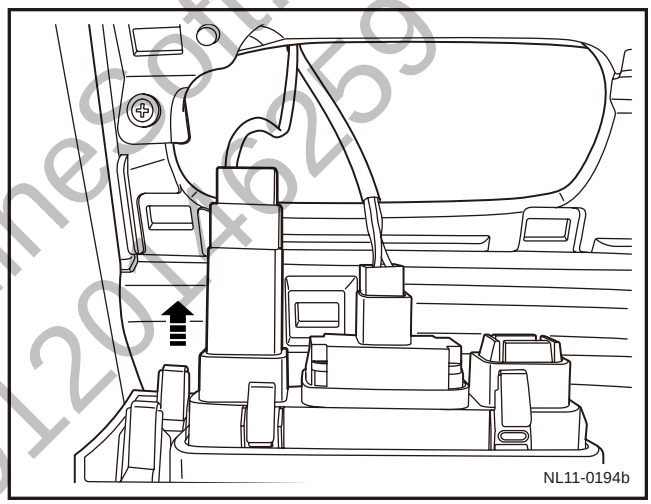
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle instrument panel switch group assembly.



3. Disconnect anti-theft indicator lamp harness connector.
4. Remove the anti-theft indicator lamp.



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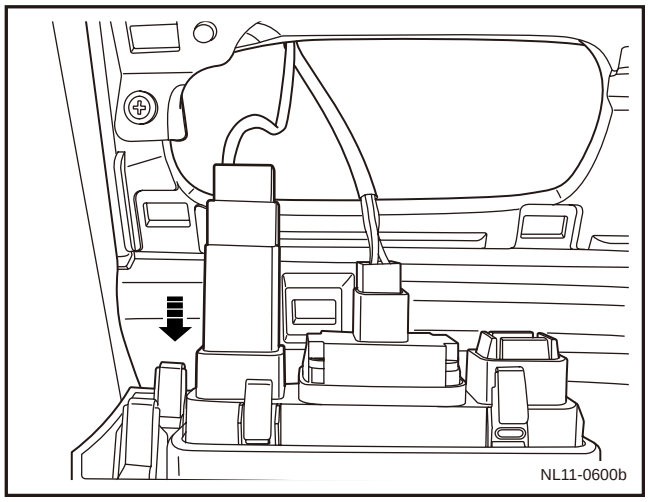
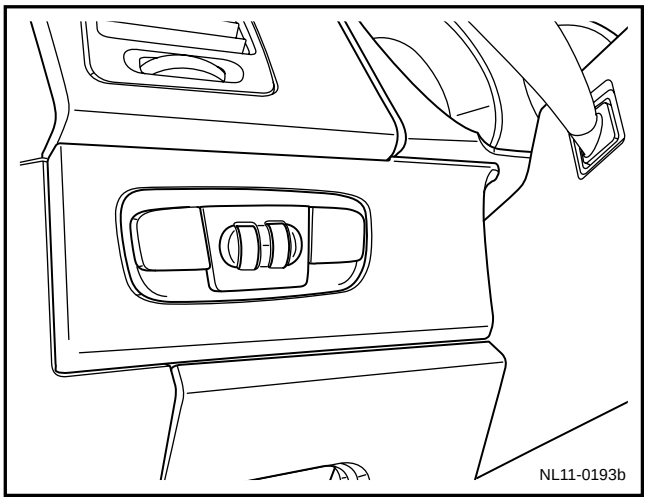
Installation procedure:

1. Install anti-theft indicator lamp on instrument panel switch assembly.
2. Connect anti-theft indicator lamp wire harness connector.



3. Install instrument panel switch onto instrument table.



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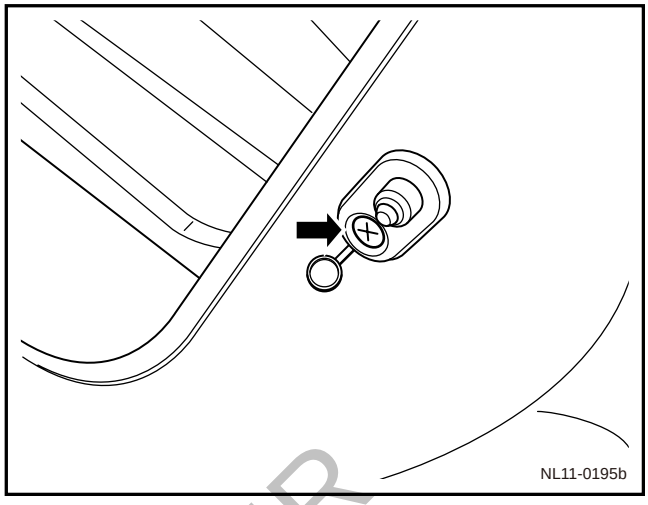
11.9.8.3 Door contact switch replacement

Dismantlement procedure

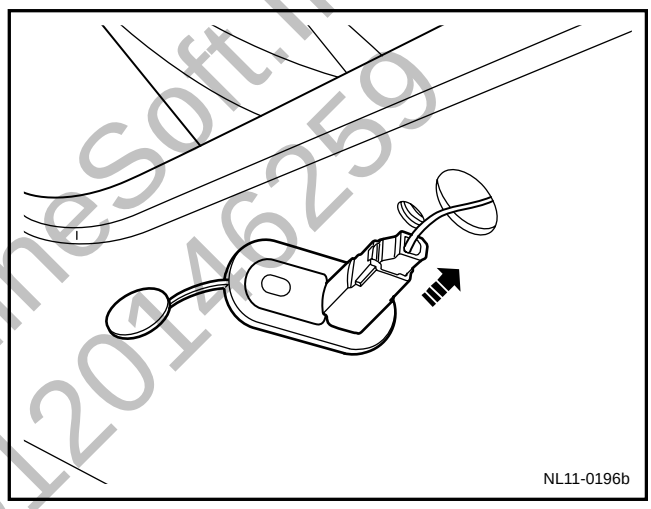
Warning!

Warning: refer to “warning on battery disconnection” in “warnings and precautions”.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle fixing bolt of door contact switch.

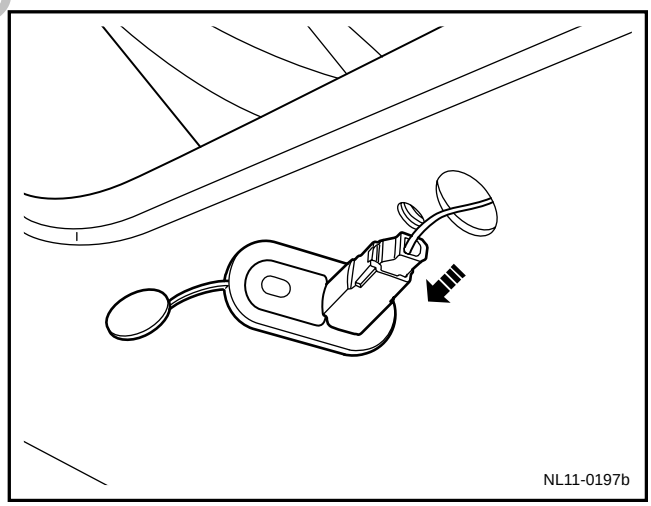


3. Disconnect door contact switch harness connector.



Installation procedure:

1. Connect to door contact switch harness connector.



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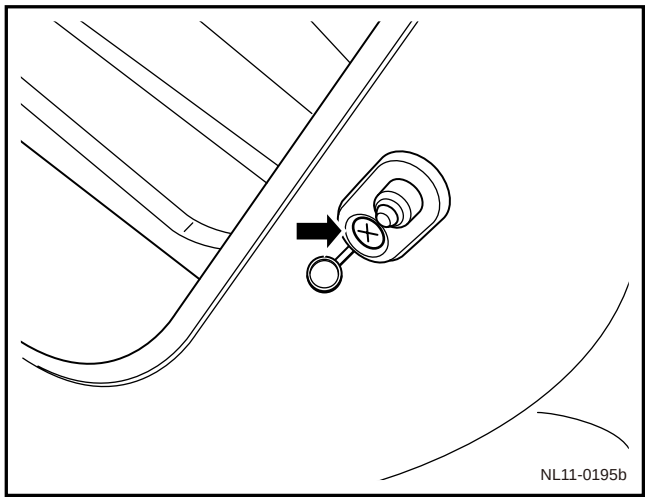
2. Install and tighten fixing bolt of door contact switch.

Torque:10Nm(Metric) 7.4lb-ft(English system)

3. Connect the battery negative cable.



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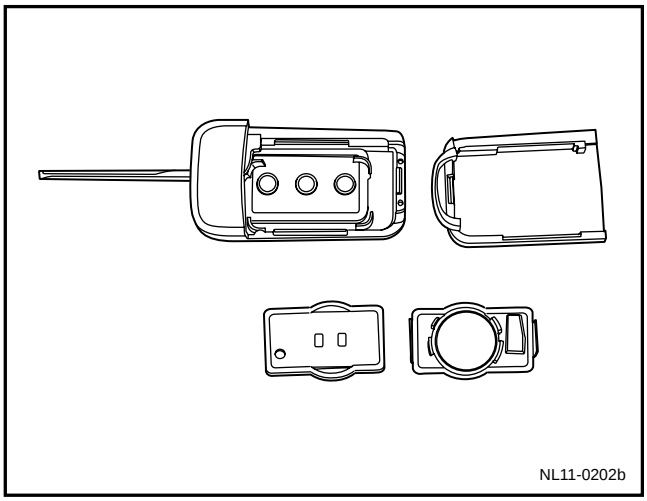
11.9.8.4 Remote emitter battery replacement

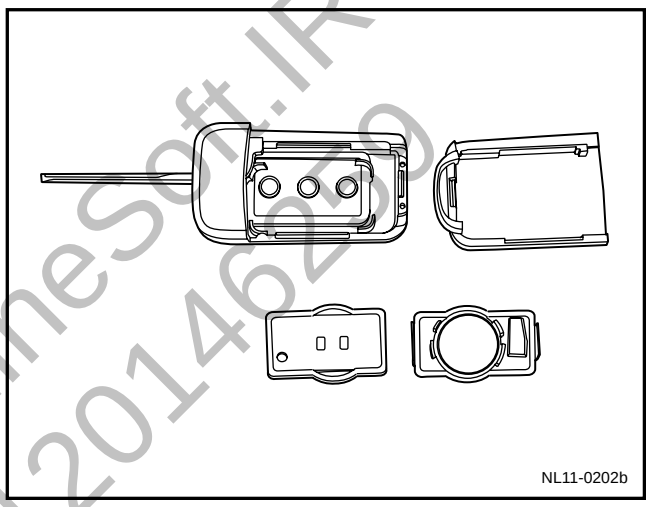
Dismantlement procedure

1. Dismantle key cover.
2. Dismantle remote control emitter cover.
3. Take out remote control transmitter battery



Installation procedure:

1. Install Remote control transmitter battery
2. Install Remote emitter cover.
3. Install remote control emitter into the key and install key cover.



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11.10 Power seat

11.10.1 Specification

11.10.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N·m)	English system (lb-ft)
Power seat assembly fixing bolt	M10×30	40-50	29.6-37
Power seat side trim plate fixing screw	ST4.2×9.5	3-4	2-3
Power seat backrest fixing bolt	M10×20	25-35	18.5-25.9
Power seat fixing nut	M8×20	20-25	14.8-18.5

11.10.2 Description and operation

11.10.2.1 Description and operation

Electric seat systems for driver and passenger include the following parts respectively:

– Power seat adjusting switch

– Seat front and rear adjusting motor

– Adjusting motor of driver seat height

– Seat backrest adjusting motor

– Seat breaker

The seat front and rear, the cushion up and down and the backrest front and rear inclination can be electrically regulated through the seat regulating switch.

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11.10.3 System work principle

11.10.3.1 System operating Principle

Seat regulator switch

The seat regulator switch provides power supply and ground circuit to the seat motor selected; and the driving motor regulates.

Motor

All seat motors work independently. Each motor comprises an electronic circuit breaker (PTC). The circuit breaker is disconnected in case of circuit overload, but only reset after the circuit voltage is cut off. There are totally seat regulating motors. They are front and rear regulating motors.

Height adjustment motor and back adjustment motor Front and rear adjusting motor moves the whole seat forward and backward. The height adjustment motor can enable the whole cushion to move upward or downward. The backrest regulating motor enables the backrest to move forward or backward.

Front and rear adjustment

When a seat regulating switch is operated to move the whole seat forward, the battery positive voltage is applied to a motor through a switch contact and front and rear regulating motor forward control circuit. The motor is grounded through adjusting motor backward switch contact and motor backward control circuit back and forth. The motor is running, so that the seat back moves forward until the switch is released. The operating process of moving the whole seat backward is similar to that of moving the whole seat forward; but the difference is as follows: the battery positive voltage and the grounding are applied on the motor through reverse circuit so as to reversely run the motor.

Rear height adjustment

When the seat switch is operated to move the front of the cushion upward, the battery positive voltage is applied to a front height regulating motor through a front height regulating motor upward switch contact and a front height regulating motor upward control circuit. Ground through downward switch contact and front height regulating motor downward control circuit.The front height adjustment motor drives the whole seat to move upward until the switch is released. The operating process of moving the whole seat downward is similar to that of moving the whole seat upward; but the difference is as follows: the battery positive voltage and the grounding are applied on the motor through reverse circuit so as to reversely run the motor.

Rear height adjustment

When the seat switch is operated to move the front of the rear cushion upward, the battery positive voltage is applied to a rear height regulating motor through a rear height regulating motor upward switch contact and a rear height regulating motor upward control circuit. Ground through downward switch contact and rear height regulating motor downward control circuit. The rear height adjustment motor drives the whole seat to move forward until the switch is released. The operating process of moving the whole seat downward is similar to that of moving the whole seat upward; but the difference is as follows: the battery positive voltage and the grounding are applied on the motor through reverse circuit so as to reversely run the motor.

Backrest adjustment

When the seat regulating switch is operated to move the seat back forward, the battery positive voltage is applied to the motor through a switch contact and a back regulating motor forward control circuit.

The motor is grounded through adjusting control backward control circuit by the backward switch contact and the back. The motor is running, so that the seat back moves forward until the switch is

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released. The operating process of moving the whole seat backward is similar to that of moving the whole seat forward; but the difference is as follows: the battery positive

Pole voltage and grounding are applied to the motor through reverse circuits, thereby reversely running the motor.

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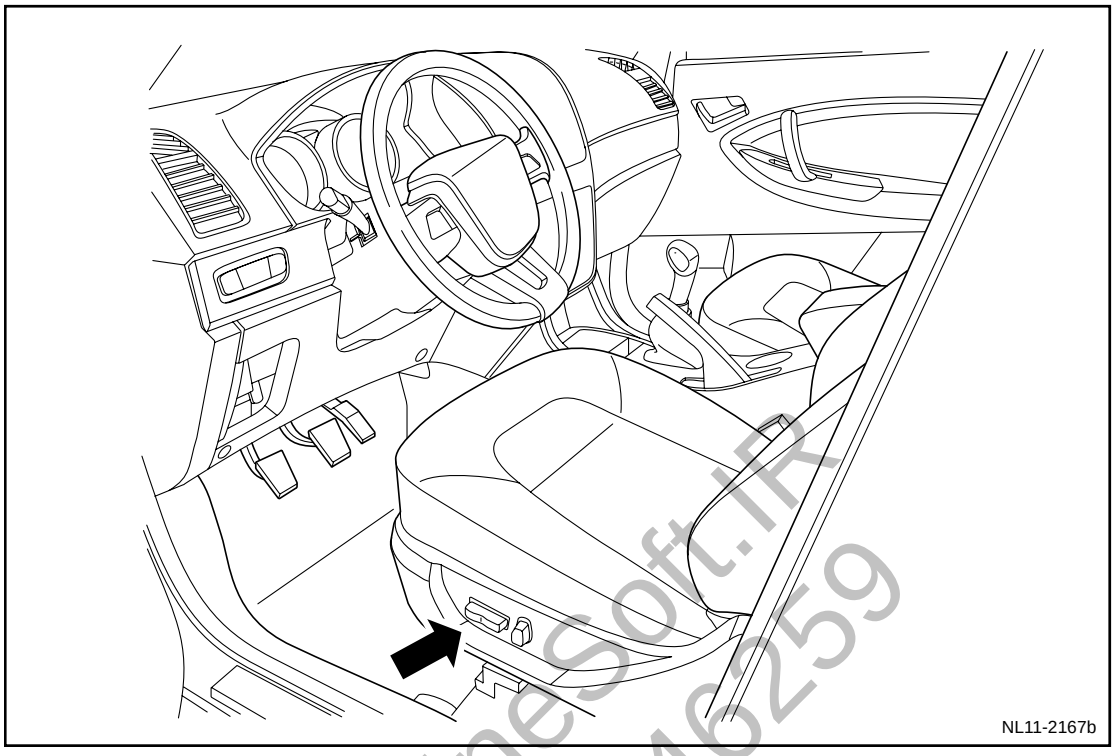
11.10.4 Part position

11.10.4.1 Component position

Power seat adjusting switch



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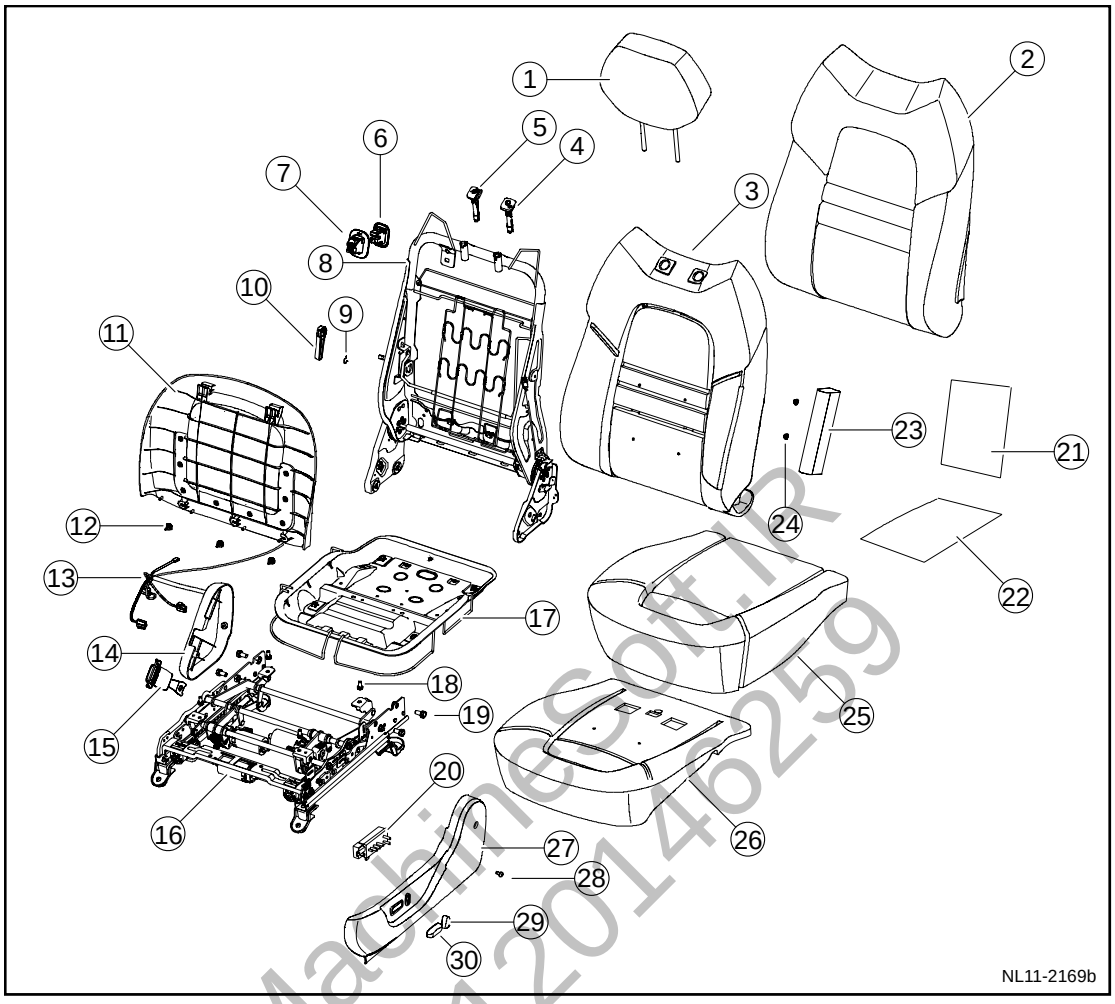
11.10.5 Disassemble drawings

11.10.5.1 Disassemble drawings



1. Headrest assembly.
2. Back surface assembly.
3. Back cotton assembly
4. Head restraint plastic-rubber socket A
5. Headrest plastic rubber socket b assembly
6. Hook assembly
7. Fixing seat
8. Back iron table assembly
9. Handle spring
10. Adjusting handle for back straight
11. Plastic back plate assembly
12. Back plate buckle.
13. Left inside guard cover
14. Harness assembly
15. Safety belt buckle
16. Sliding plate & lifting mechanical assembly
17. Seat frame assembly
18. Hexagon gasket bolt M8
19. Hexagon gasket bolt M10
20. Electric switch assembly
21. Front left side airbag
22. Lock screw plug of hexagon washer
23. Seat surface assembly
24. Seat cotton assembly
25. Left outer guard cover
26. Cross round head self tapping screw wiper end
27. Electric switch button A
28. Power switch button

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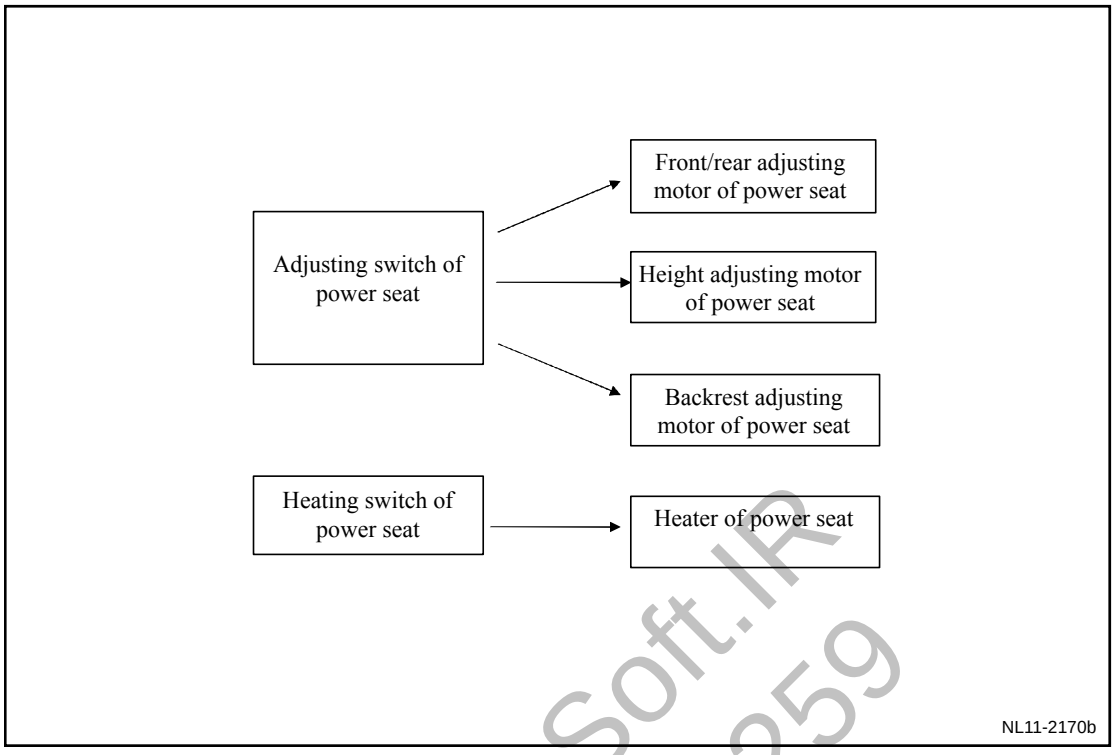
11.10.6 Electrical schematic diagram

11.10.6.1 Electrical schematic diagram



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11.10.7 Diagnostic information and steps

11.10.7.1 Diagnosis descriptions

Refer to 11.10.2 Description and Operation to get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.10.7.2 Visual inspection

– Inspect the after-sales optional device which may affect the normal operation of electric seat system.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– If all electric seat operation is ineffective, it is necessary to inspect and repair power supply or bad grounding connection or short-circuit faults before diagnosing fault.

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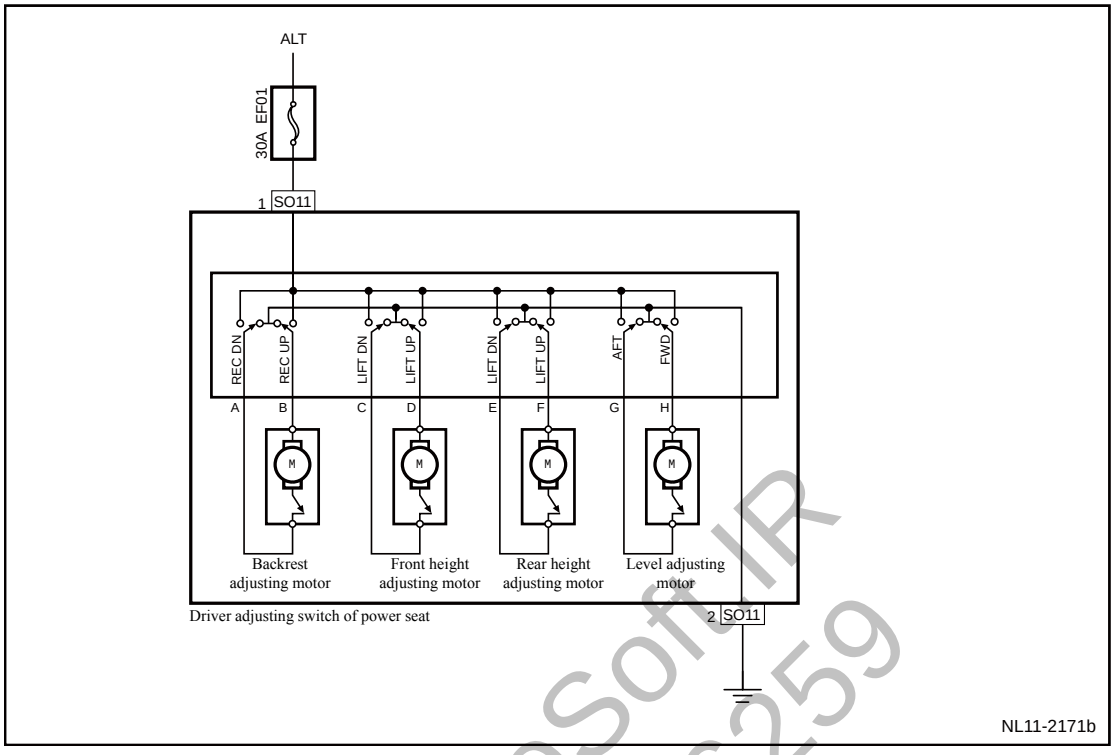
11.10.7.3 Power seat can't level adjustment

Circuit diagram:



Diagnostic steps:

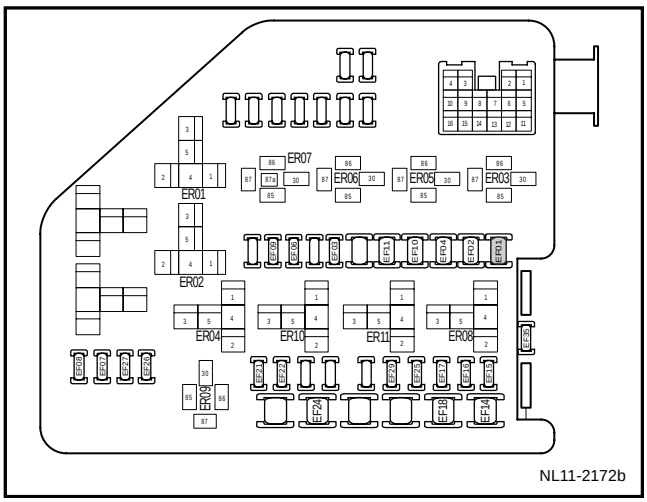
Notes:

The following maintenance procedures referring to the driver-side power seat and passenger-side power seat maintenance procedure. Refer to this maintenance procedure.

1	Check fuseEF01.

(a) Whether fuse EF01 is burned out.

Rating Value of Fuse: 30A



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No → Go to step 3

Yes

2	Check fuseEF01 line.

(a) Inspect for short circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the electric seat works normally.

Yes → The system is normal.

No

3	Inspect the electric seat horizontal regulating switch.

(a) Operate electric seat horizontal adjusting switch.

(b) Meanwhile, use multimeter to measure voltage between electric seat adjusting switch outlet G and H.

Test terminal	Test conditions	Standard voltage
P—E	Forward	11-14 V
P—E	Forward	11-14 V

Confirm whether the terminal voltage accords with the standard value?

Yes → Go to step 5

No

4	Replace power seat adjusting switch

(a) Replace power seat adjusting switch. Refer to 11.9.8.3 Power seat adjuster assembly replacement.

Confirm whether the electric seat works normally.

Yes → The system is normal.

No

5	Inspect the replacement of the electric seat regulating switch.

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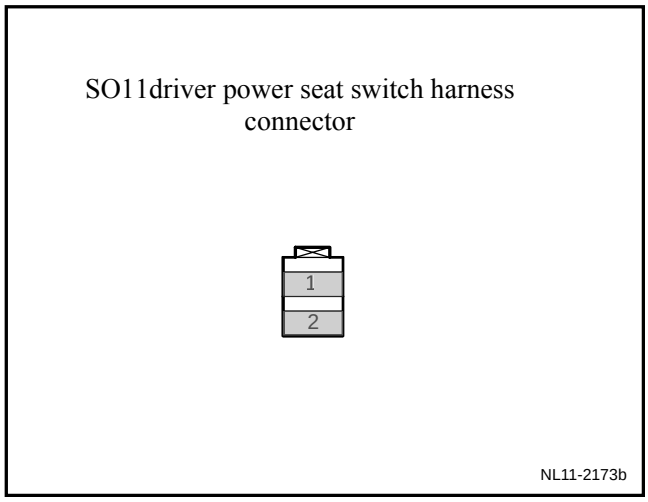
(a) Operate electric seat horizontal adjusting switch.

(b) Meanwhile, use multimeter to measure voltage between electric seat front rear adjusting motor wire harness connector SO11 terminal No. 1 and No.2.



Test terminal	Test conditions	Standard voltage
1—2	Forward	11-14 V
1—2	Forward	11-14 V

Confirm whether voltage meet standard value between terminals or not ?

Yes → Go to step 7

No

6	Inspect the circuit between the electric seat regulating switch and the electric seat front and rear regulating motors as well as between the horizontal regulating switch and the effective body grounding point.

(a) Inspect circuit between electric seat adjusting switch and horizontal adjusting motor, between horizontal adjusting switch and vehicle body effective grounding point.

(b) Cut off fault point for cutting broken circuit.

Confirm whether the electric seat works normally.

Yes → The system is normal.

No

7	Replace horizontal adjusting motor.

(a) Inspect circuit between electric seat adjusting switch and front rear adjusting motor.

Confirm the completion of repair.

Next

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8	The system is normal.

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11.10.7.4 Power seat can't height adjusting

Circuit diagram:

Circuit diagram refers to 11.10.7.3 Electric Seat Is Unable to Horizontally Adjust.

Diagnostic steps:

Notes:

The following maintenance procedures referring to the driver-side power seat and passenger-side power seat maintenance procedure. Refer to this maintenance procedure.

1	Inspect EF01 fuse.

(a) Whether fuse EF01 is burned out.

Check fuse rated value: 30A

No → Go to step 3

Yes

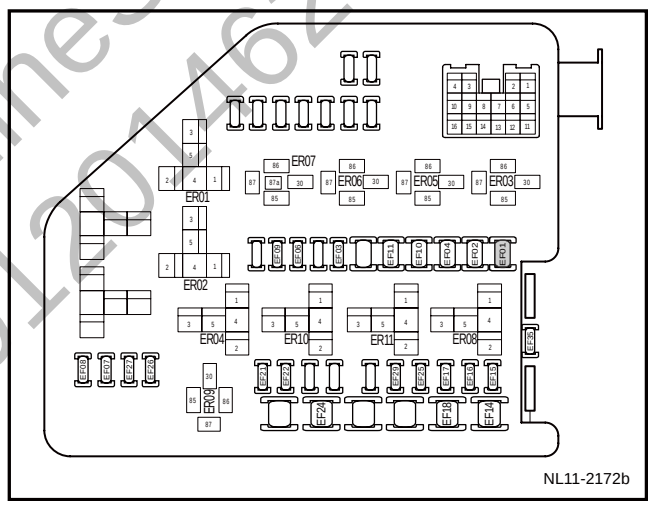
2	Inspect EF01 fuse circuit.

(a) Inspect for short circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the electric seat works normally.



Yes → The system is normal.

No

3	Check power seat front height adjusting switch.

(a) Operate electric seat front height adjusting switch.

(b) Meanwhile, use multimeter to measure voltage between electric seat adjusting switch outlet C and D.

Test terminal	Test conditions	Standard voltage

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C—D	Upward	11-14V
C—D	Downward	11-14V

Confirm whether the terminal voltage accords with the standard value?

Yes → Go to step 5

No

4	Replace power seat adjusting switch

(a) Replace power seat adjusting switch. Refer to 11.9.8.3 Power seat adjuster assembly replacement.

Confirm whether the electric seat front height adjustment is normal.

Yes → The system is normal.

No

5	Check power seat height adjusting motor.

(a) Operate electric seat front and rear adjusting switch.

Notes:

Do not unplug the height regulation motor harness connector.

(b) Meanwhile, use multimeter to measure voltage between electric seat height adjusting motor wire harness connector terminal No. 1 and No.2.

Test terminal	**Test conditions**	**Standard voltage**
1—2	Upward	11-14V
1—2	Downward	11-14V

Confirm whether the terminal voltage accords with the standard value?

Yes → Go to step 7

No

6	Inspect the circuit between the electric seat front height regulating switch and the electric seat front height regulating motors as well as between the regulating switch and the effective body grounding point.

(a) Inspect circuit between electric seat adjusting switch and front height adjusting motor, between adjusting switch and vehicle body effective grounding point.

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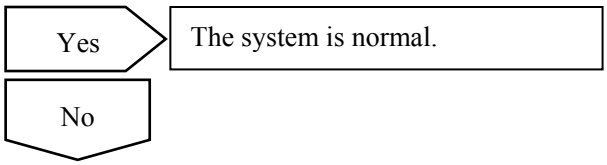
(b) Cut off fault point for cutting broken circuit.

Confirm whether the electric seat front height adjustment is normal.



7	Replace the front height regulating motor.

(a) Replace Power seat front height adjusting motor. Refer to power seat support assembly replacement.

Confirm the completion of repair.

8	The system is normal.

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11.10.7.5 Power seat backrest can not adjust

Circuit diagram:

Circuit diagram refers to 11.10.7.3 Electric Seat Is Unable to Horizontally Adjust.

Diagnostic steps:

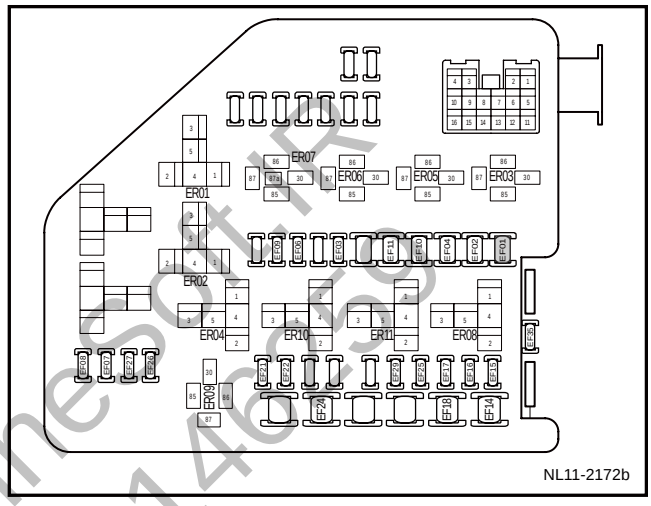
Notes:

The following maintenance procedures referring to the driver-side power seat and passenger-side power seat maintenance procedure. Refer to this maintenance procedure.

1	Inspect EF01 fuse.

(a) Check if fuse EFO1 was blown.

Rated Current of Fuse: 30A.



No → Go to step 3

Yes

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2	Inspect EF01 fuse circuit.

(a) Inspect for short circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the electric seat works normally.

Yes → The system is normal.

No

3	Check power seat backrest adjusting switch .

Check power seat backrest adjusting switch .

Test terminal	Test conditions	Standard voltage
A—B	Forward	11-14V
B—A	Forward	11-14V

Confirm whether the terminal voltage accords with the standard value?

Yes → Go to step 5

No

4	Replace power seat adjusting switch,

(a) Replace power seat adjusting switch. Refer to 11.9.8.3 Power seat adjuster assembly replacement.

Confirm whether the electric seat works normally.

Yes → The system is normal.

No

5	Check power seat backrest adjusting motor

(a) Operate electric seat front and rear adjusting switch.

(b) Meanwhile, use multimeter to measure voltage between electric backrest adjusting motor wire harness connector terminal No. 1 and No.2.

Test terminal	Test conditions	Standard voltage
1—2	Forward	11-14V
1—2	Forward	11-14V

Confirm whether the terminal voltage accords with the standard value?

Yes → Go to step 7

No

6	Inspect the circuit between the electric seat regulating switch and the electric seat back regulating motor as well as between the back regulating switch and the effective body grounding point.

(a) Inspect circuit between electric seat adjusting switch and backrest adjusting motor, between backrest adjusting switch and vehicle body effective grounding point.

(b) Cut off fault point for cutting broken circuit.

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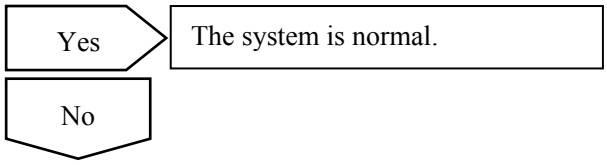
Confirm whether the electric seat works normally.



7	Replace backrest adjusting motor

(a) Replace Power seat backrest adjusting motor. Refer to11.9.8.3 power seat adjuster assembly replacement.

Confirm the completion of repair.

8	The system is normal.

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11.10.8 Dismantle and install

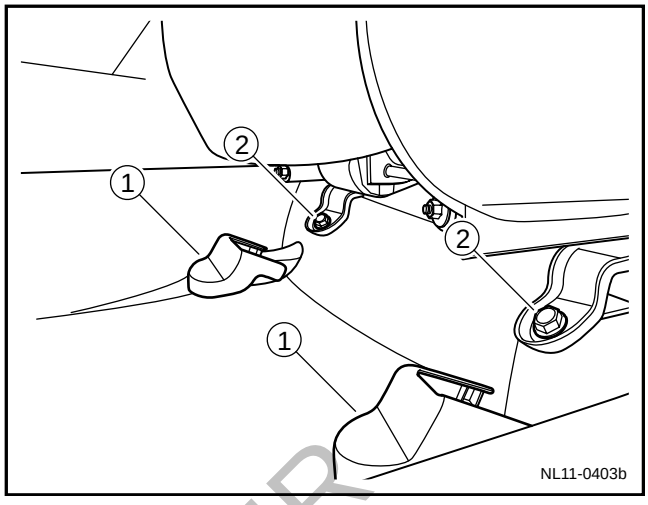
11.10.8.1 Front power seat replacement

Dismantlement procedure

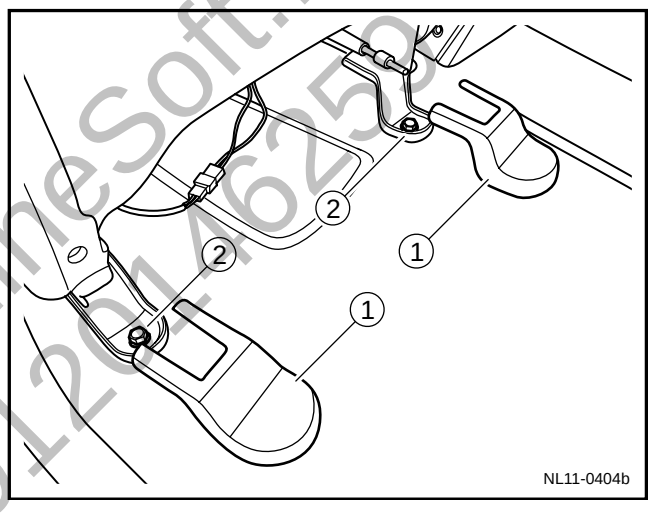
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

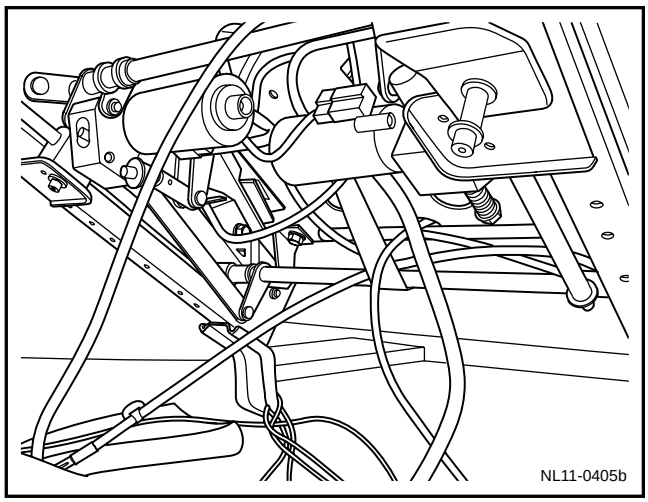
1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle front end lower protective cover 1 of electric seat.
3. Dismantle fixing bolt 2 on the front of electric seat.



4. Dismantle lower protective cover 1 on the rear of electric seat.
5. Remove Fixing Bolt 2 on the back of the power seat.



6. Disconnect the harness connector at the bottom of the power seat.



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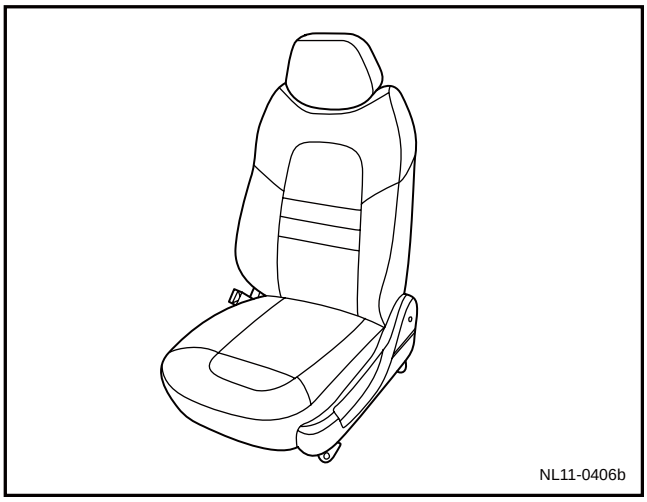
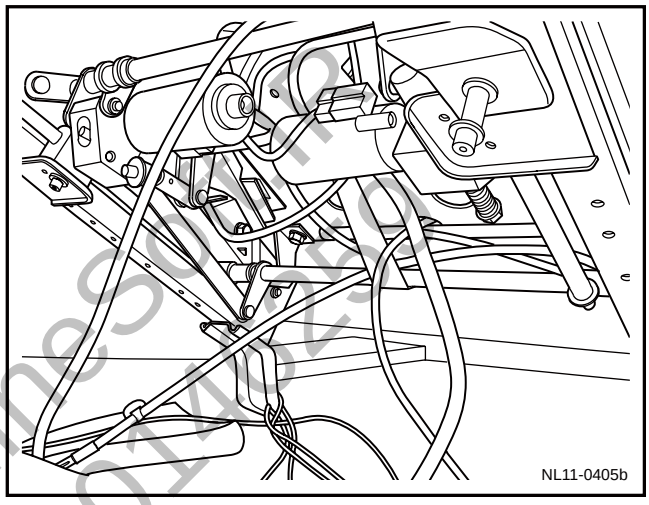
7. Move out Power seat.



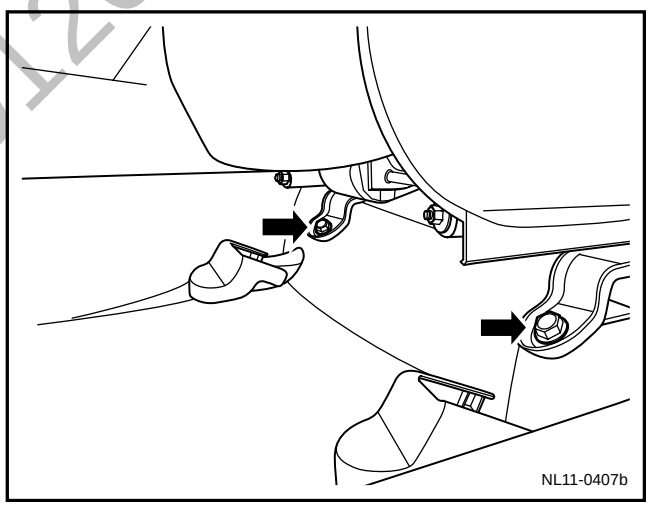
Installation procedure:

1. Install the power seat.
2. Connect electric seat adjusting bottom wire harness connector.



3. Install electric seat front fixing bolt.

Torque: 45Nm (Metric) 33. 3 lb-ft (English system)



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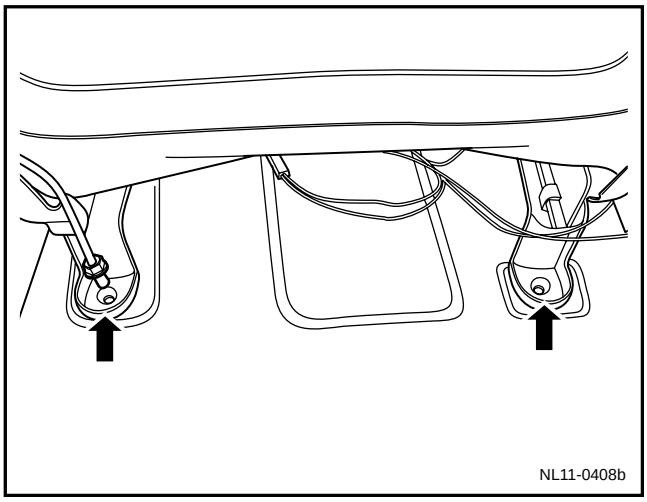
4. Install fixing bolt on the rear of electric seat.

Torque: 45Nm (Metric) 33. 3 lb-ft (English system)

5. Install the front and rear bottom protective covers for the power seat.

6. Connect the battery negative cable.



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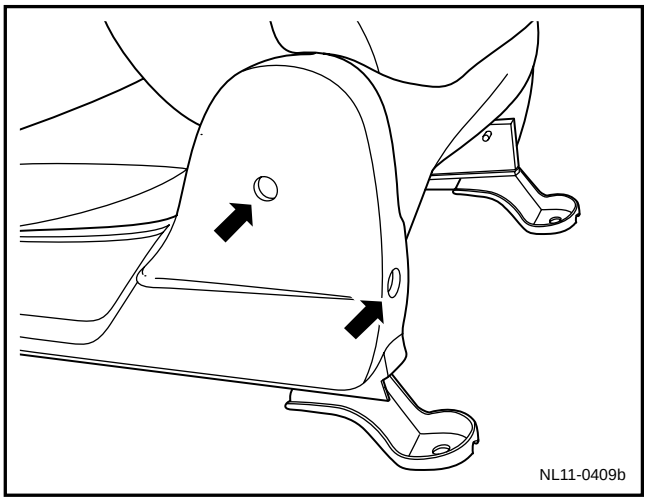
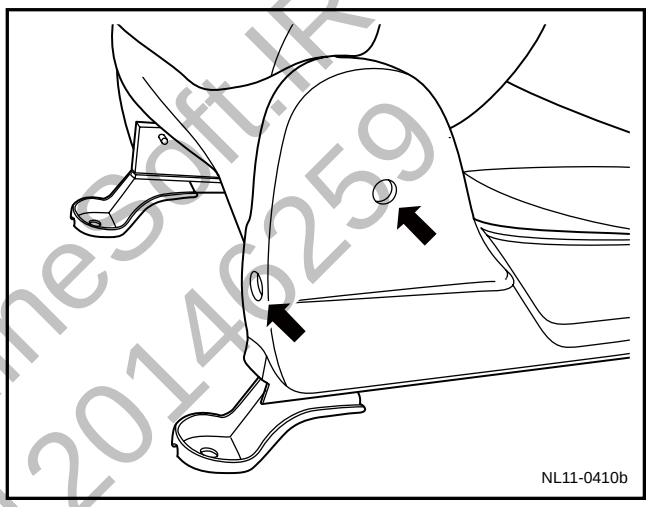
11.10.8.2 Replace seat side trim plate

Dismantlement procedure

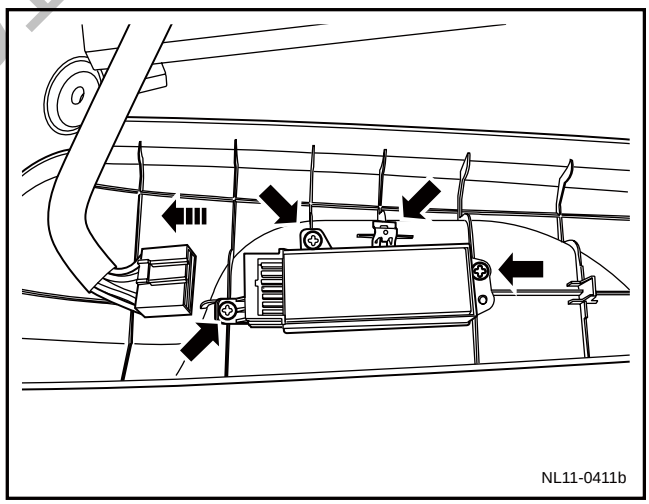
1. For dismantling of electric seat, refer to 11.9.8.1 Replacement of front electric seat.
2. Dismantle screw of left trimming plate of seat.



3. Dismantle screw of right trimming plate of seat.



4. Disconnect electric seat adjusting switch wire harness connector.
5. Remove the power seat adjustment switch.



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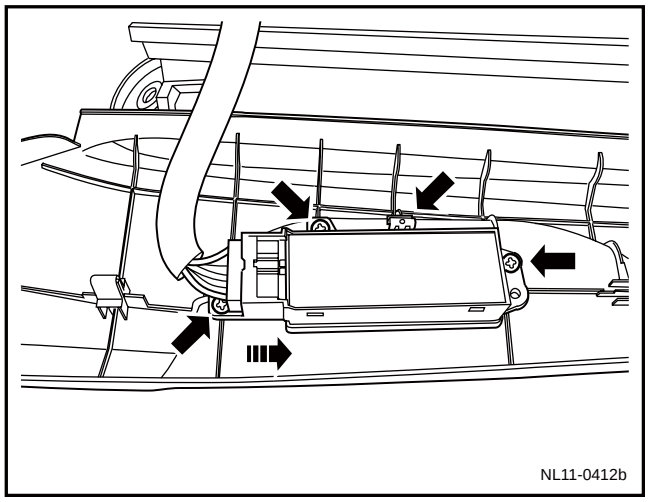
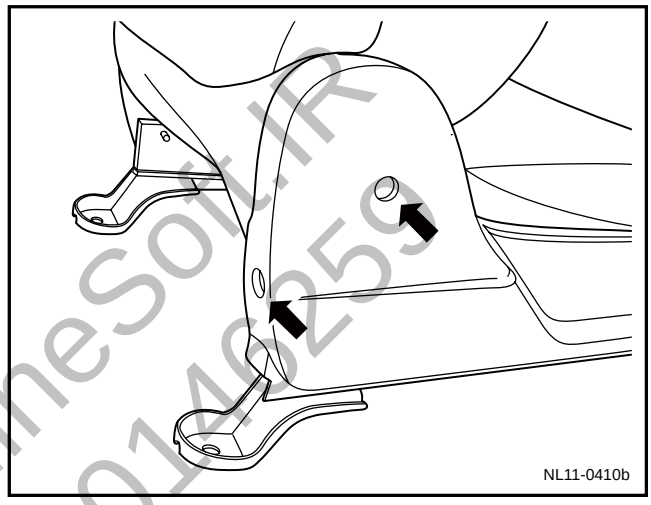
Installation procedure:

1. Install electric seat adjusting switch.
2. Connect electric seat adjusting switch wire harness connector.
3. Install and tighten fixing screw of electric seat adjusting switch.

Torque: 4Nm(Metric) 3lb-ft(English system)



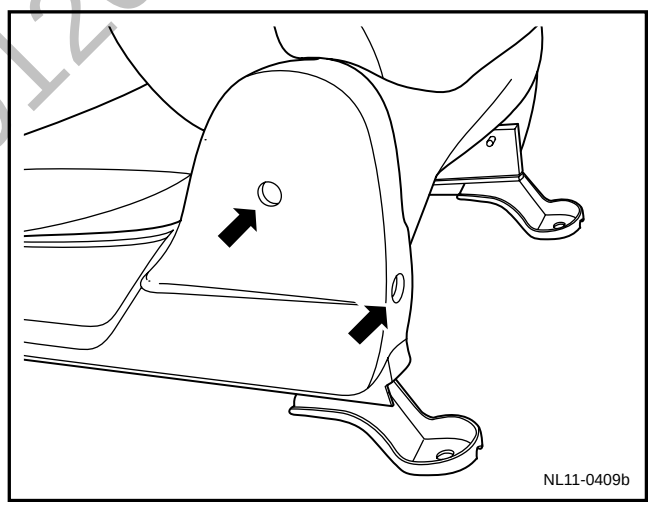
4. Install trimming plate on right side of electric seat, and tighten it with screw.



5. Install and tighten the left trim panel of the power seat with screws.

Torque : 4Nm(Metric) 3lb-ft(English system)

6. Install the power seat.



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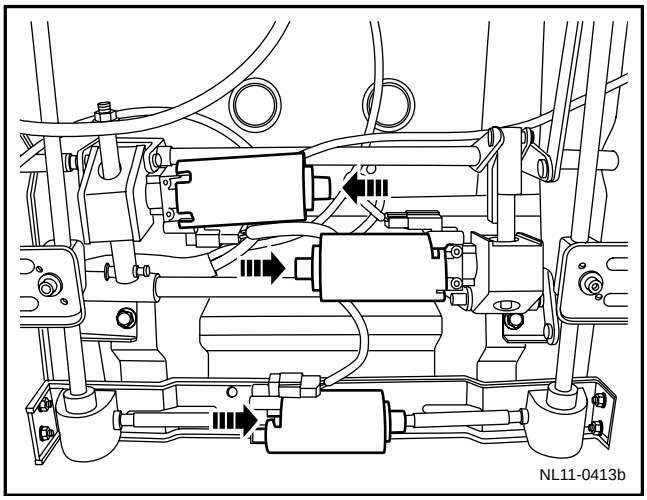
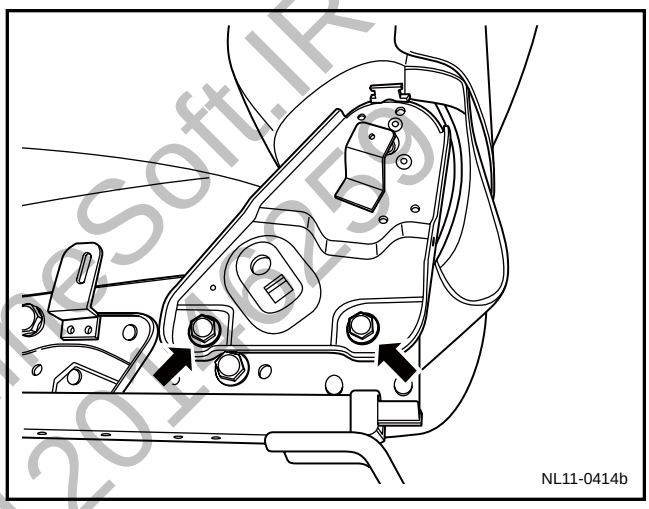
11.9.8.3 Power seat adjuster assembly replacement

Dismantlement procedure

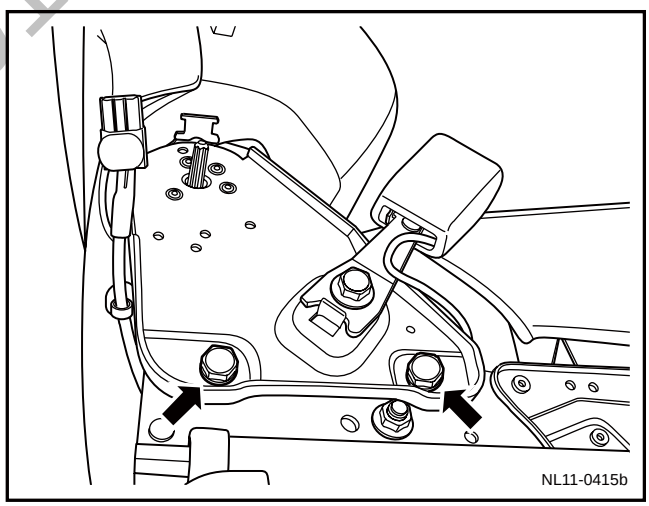
1. For dismantling of electric seat, refer to 11.9.8.1 Replacement of front electric seat.
2. For dismantling of seat side trimming plate, refer to 11.9.8.2 Replacement of seat side trimming plate.
3. Disconnect adjusting motor harness connector.



4. Dismantle left fixing bolt.



5. Remove the right fixing bolt.



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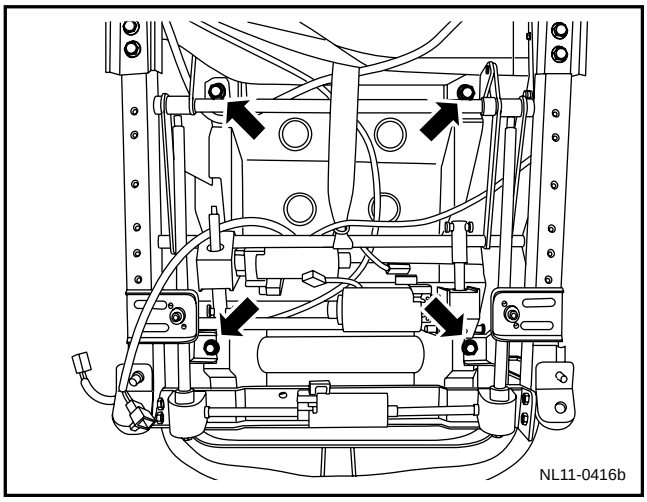
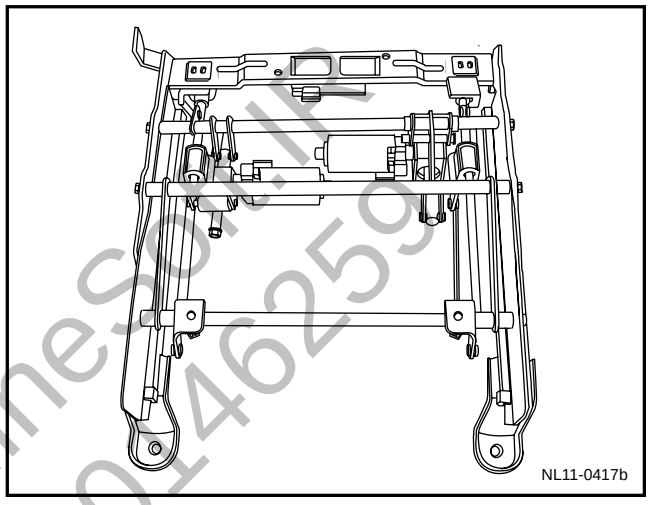
6. Remove the fixing bolt between the regulator assembly and the seat bottom.



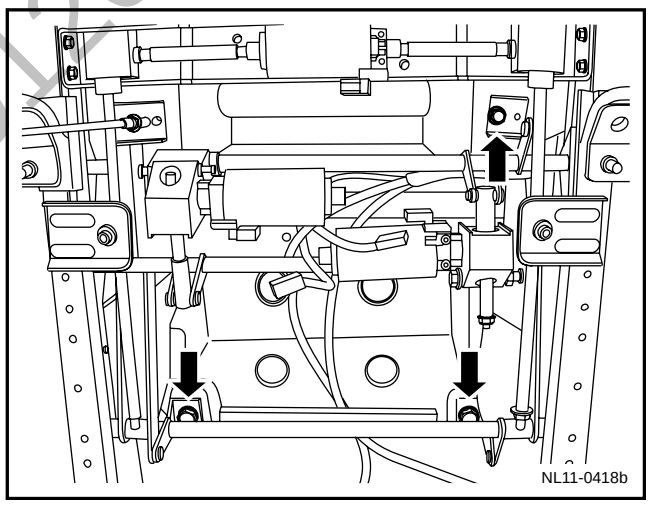
7. Extract the power seat regulator assembly.



Installation procedure:

1. Install electric seat adjuster assembly.
2. Install fixing bolt of adjuster and bottom bracket of seat.

Torque: 26Nm (Metric) 19.2 lb-ft (English system)



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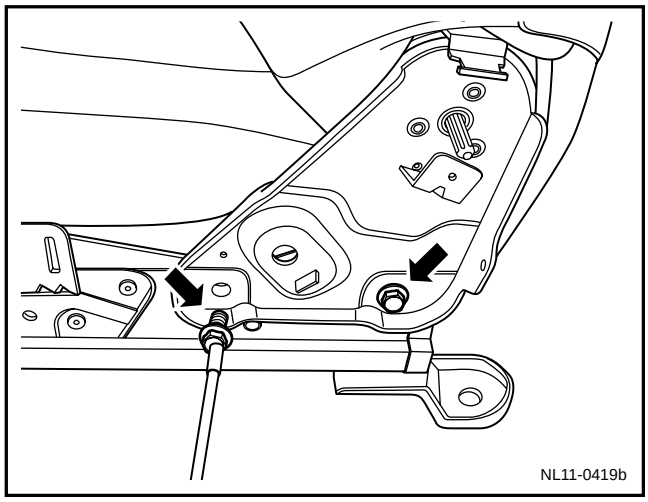
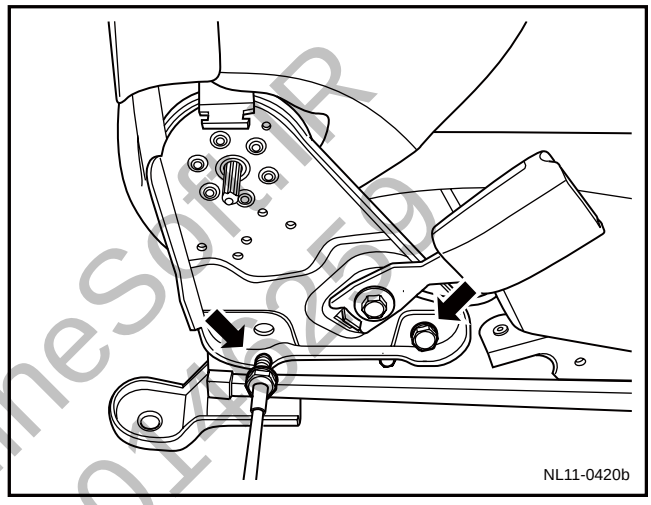
3. Install left fixing bolt and tighten it.

Torque: 45 Nm (Metric) 33.3 lb-ft (English system)

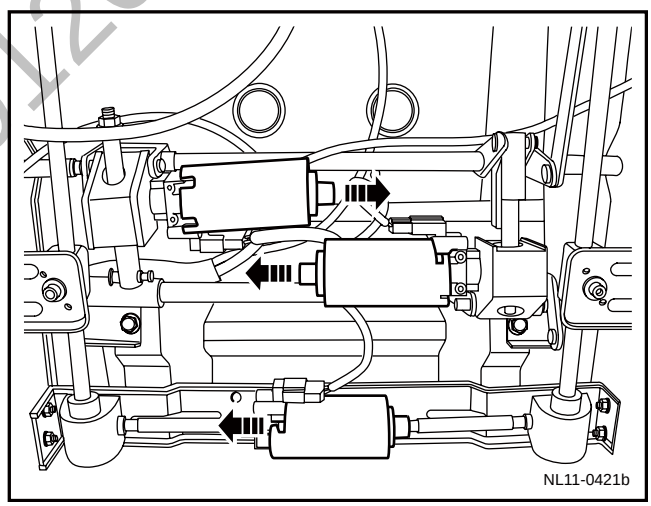


4. Install right fixing bolt and tighten it.

Torque: 45 Nm (Metric) 33 . 3 lb-ft (English system)



5. Connect the harness connector of the regulator motor.
6. Install the side trim panel.
7. Install the power seat.



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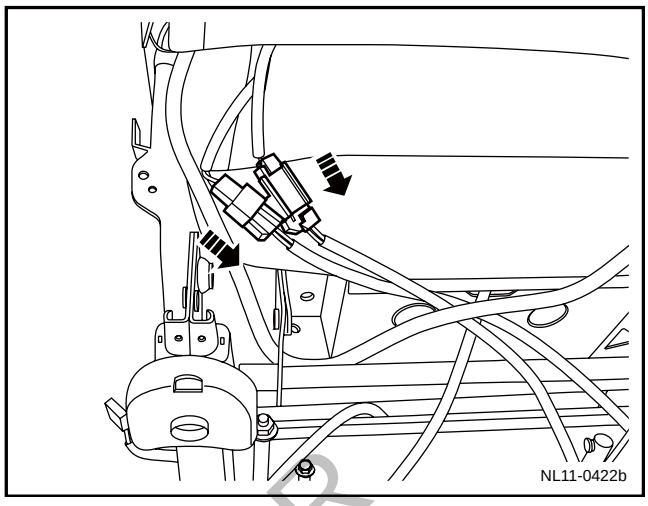
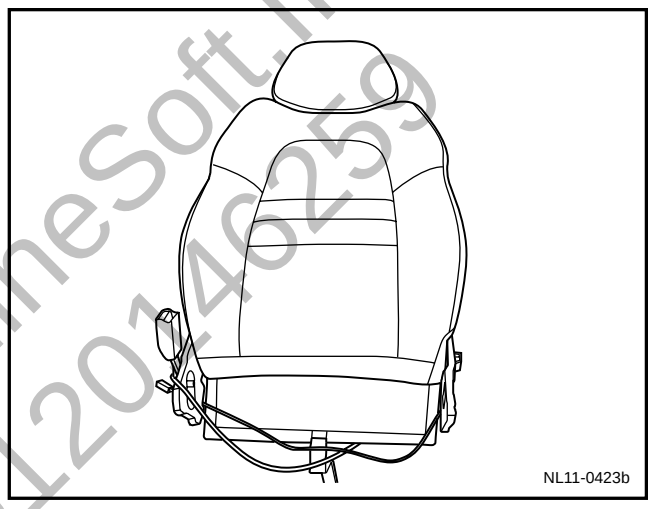
11.9.8.4 Power seat backrest replacement

Dismantlement procedure

1. For dismantling of electric seat, refer to 11.9.8.1 Replacement of front electric seat.
2. For dismantling of seat side trimming plate, refer to 11.9.8.2 Replacement of seat side trimming plate.
3. For dismantling of electric seat adjusting motor assembly, refer to 11.9.8.3 Replacement of electric seat adjuster assembly.
4. Disconnect wire harness connector of seat backrest.

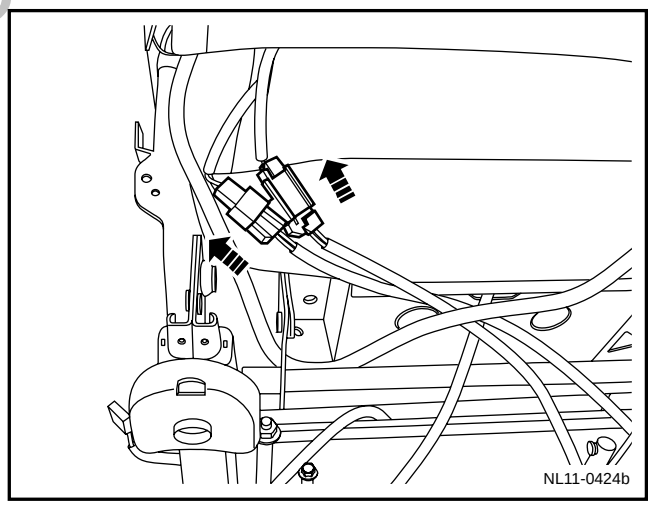


5. Remove the seat back.



Installation procedure:

1. Install seat backrest.
2. Connect seat backrest wire harnes connector.
3. Install electric seat adjuster assembly.
4. Install trimming plate on seat side.
5. Install the power seat.



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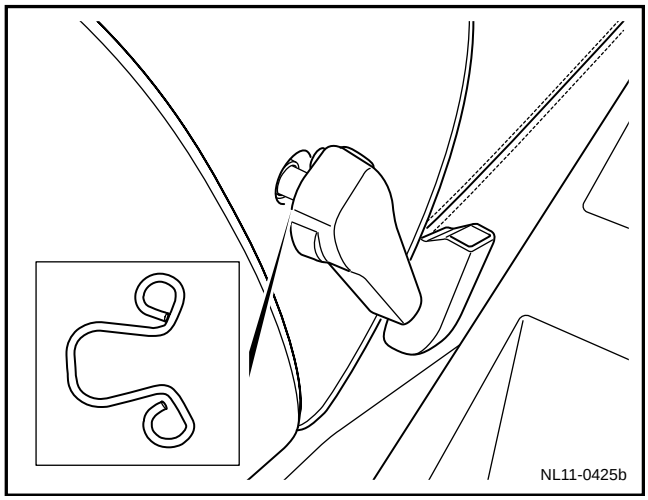
11.9.8.5 Front seat waist support knob replacement

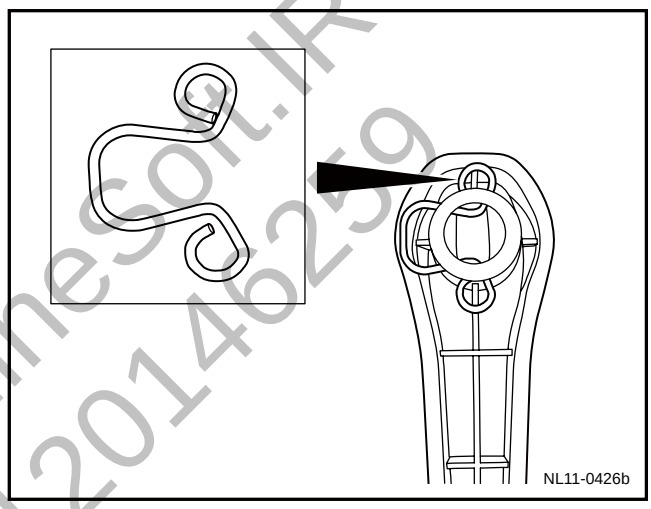
Dismantlement procedure

1. Unscrew seat waist support adjusting handle fixing snap ring.
2. Take out waist support adjusting handle.

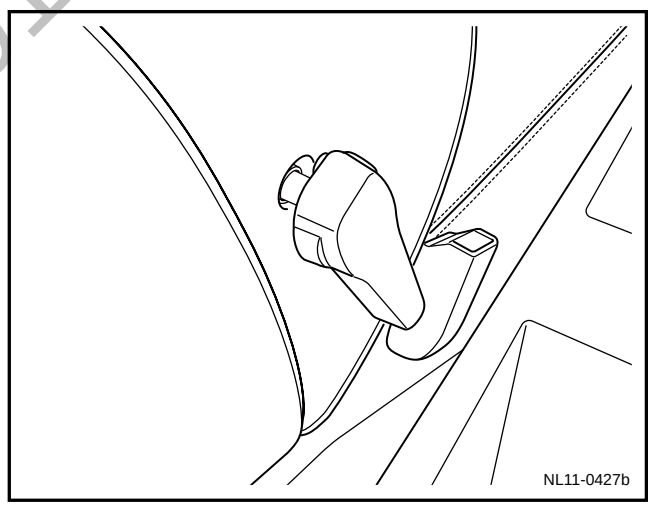


Installation procedure:

1. Install fixed snap spring of seat waist support adjusting handle.



2. Install seat waist support adjusting handle



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11.11 Defrost

11.11.1 Specification

11.11.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N.m)	English system (lb-ft)
Self-tapping screw for defrosting switch	ST4.2×13	2-4	4.5-3

11.11.1.2 Defrost work condition requirement.

State of ignition switch	Battery voltage (V)	Defrosting Operation Status
OFF	---	OFF
ON	＞10.7	Normal
ACC/ON/START	＜10.3	Stop working

11.11.2 Description and operation

11.11.2.1 Description and operation

The defrosting system consists of the following main components:

– Defrost switch

– Left, right rearview mirror heater

– Heater of rear backdoor glass

The defrosting switch is located on the instrument panel central switch assembly, the back door window heater is located inside the back door window and the left and right rearview mirrors are integrated with a rearview mirror heater.

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11.11.3 System work principle

11.11.3.1 Work principle

Install the backdoor window defrosting switch on the instrument panel center switch assembly. Transmit the defrosting request signal to the air conditioner control module which then receives the input signal for the defrosting switch to control the backdoor defrosting relay to close. The backdoor defrosting relay outputs power to the backdoor defrosting grille and left and right rearview mirror heaters and at the same time the rear defrosting/rearview mirror heating signal will be sent to the ECM via a dedicated line. The ECM will increase the RPM of the engine according to needs. Rear defrosting switch is an inching button switch, and rearview mirror heating switch is a gyration button.

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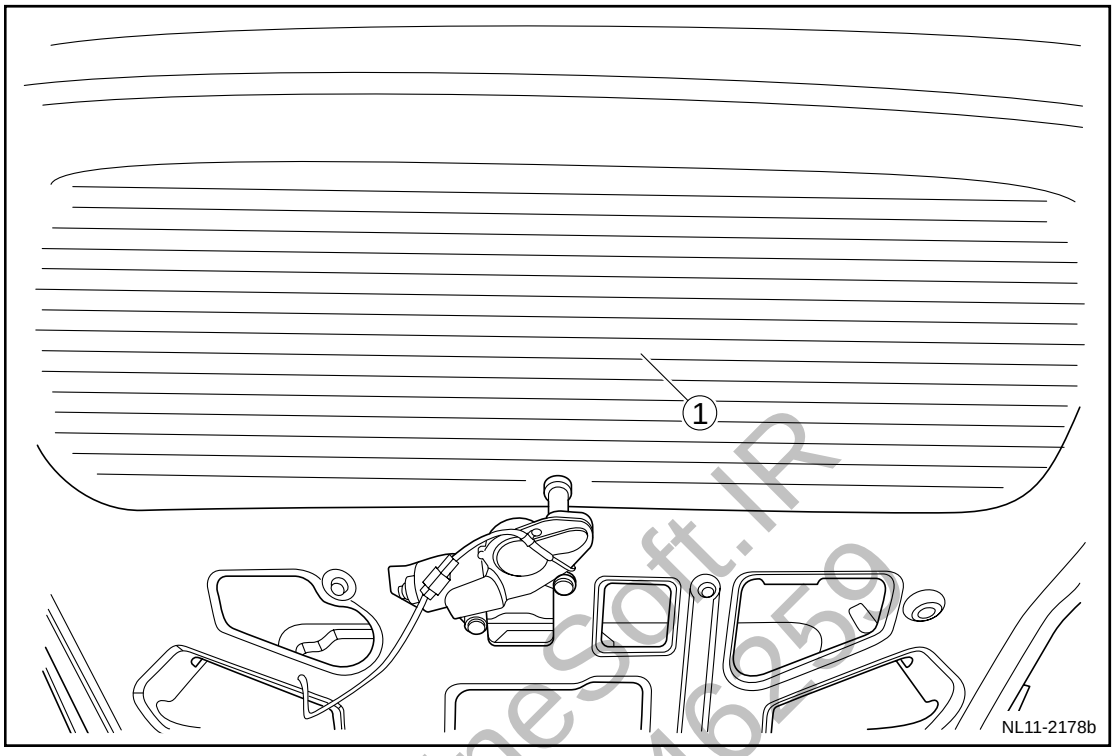
11.11.4 Part position

11.11.4.1 Component position

Defrost grille of rear back-door glass



1. Defrost grille of rear back-door glass

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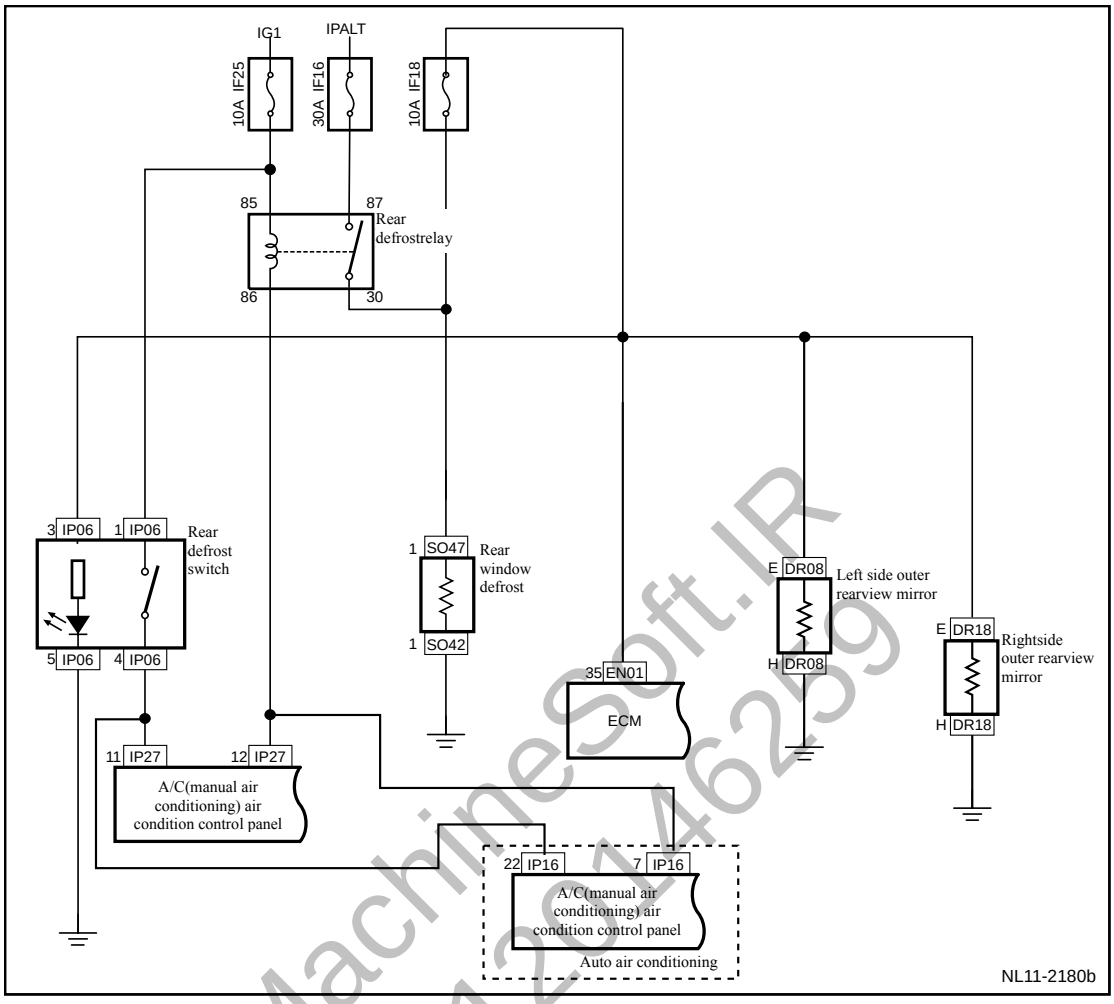
11.11.5 Electrical schematic diagram

11.11.5.1 Electrical schematic diagram



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11.11.6 Diagnostic information and steps

11.11.6.1 Diagnosis descriptions

Refer to 11.11.2 Description and Operation to get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.11.6.2 Visual inspection

– Inspect the after-sales optional device which may affect the normal operation of defroster.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– If both the rear window defroster and rearview mirror don't work, it is necessary to inspect and repair power supply or bad grounding connection or short-circuit faults before diagnosing fault.

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11.11.6.3 Rear windscreen defrost can not work

Circuit diagram:

Circuit diagram，refer to 11.11.5.1 electrical schematic diagram

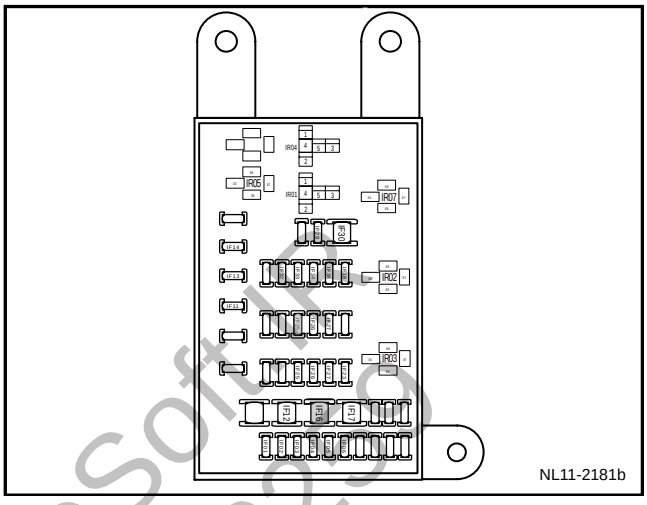
Diagnostic steps:

1	Check fuseIF25, IF16.

(a) Check fuse IF25, IF16was blown

Fuse rated current: 10A and 30A

Confirm whether the fuses are blown.



No → Go to step 3

Yes

2	Check fuseIF25. IF16 circuit.

(a) Inspect for short circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the function is normal.

Yes → The system is normal.

No

3	Inspect the defrosting switch.

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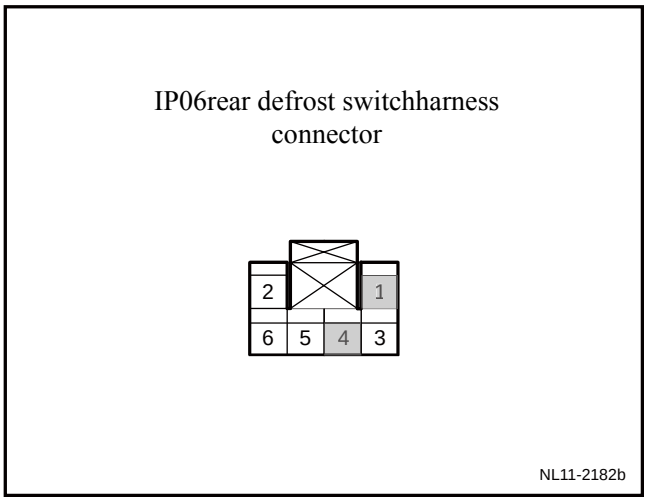
(a) Disconnect defroster switch wire harness connector.

(b) Energy guide of defrost switch after test



Test terminal	Test conditions	Conduction condition
IP06(1)—IP06(4)	Release	10 kΩ or higher
IP06(1)—IP06(4)	Press down	Less than 1 Ω

Confirm whether the resistance conforms to standard value.

Yes	Go to step 7
No	

4	Replace the defrosting switch.

(a) Replace defrost switch. Refer to11.10.7.3 rear windscreen glass defrost switch replacement.

Confirm whether the rear window defrosting function is normal.

Yes	The system is normal.
No	

5	Does the rear defrosting relay work after the defrosting switch is pressed?

(a) Press defroster switch. Does the rear defroster relay still work?

Yes	Go to step 7
No	

6	Inspect the relay coil circuit.

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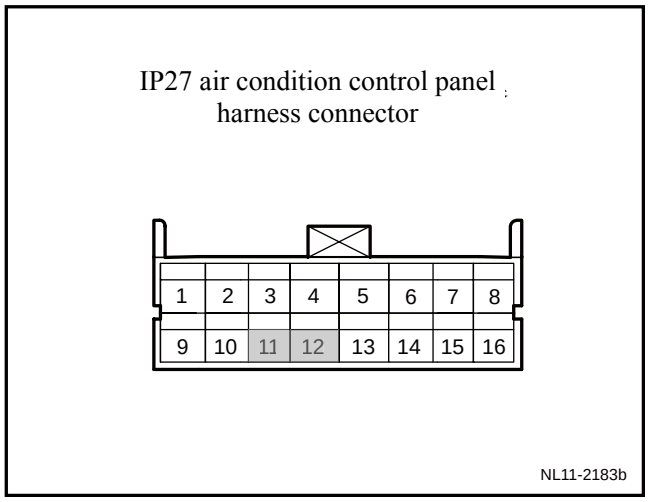
(a) Turn on ignition switch to ON position.

(b) Press down rear defrost switch.

(c) Use multimeter to measure effective grounding voltage between air conditioner panel wire harness connector IP27 terminal No. 11, 12 and vehicle body.

Standard voltage: 11-14V

Confirm if the voltage conforms to standard value.



Yes → Go to step 8

No

7	Replace defrost relay of rear windscreen.

8	Replace A/C control panel.

(a) Replace A/C control panel, refer to A/C control panel replacement.

9	Inspect the voltage of the terminal No. 1 of the rear defroster wire harness connector SO47 and the effective body grounding.

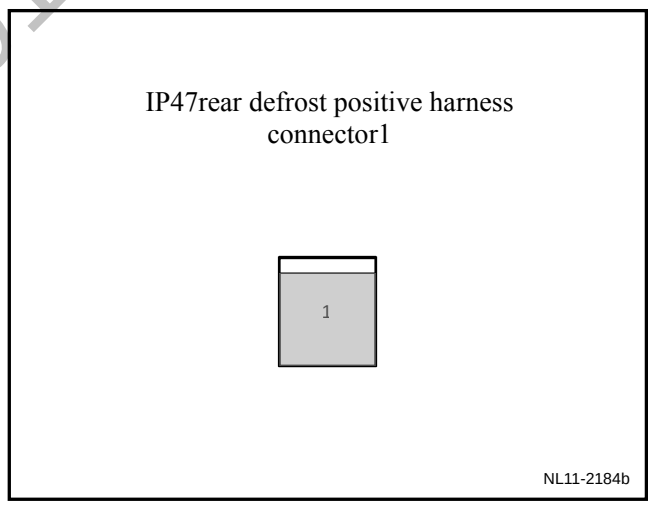
(a) Turn on ignition switch to ON position.

(b) Press down defrost switch.

(c) Use multimeter to measure effective grounding voltage of rear defroster wire harness connector SO47 terminal No. 1 and vehicle body.

Standard voltage: 11-14V

Confirm if the voltage conforms to standard value.



Yes → Go to step 11

No

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10	Repair the circuit.

(a) Repair the open-circuit fault between rear defroster wire harness connector SO47 terminal No. 1 and rear windshield relay jack 30.

Confirm whether the rear window defrosting function is normal.

Yes → The system is normal.

No

11	Inspect the rear defroster wire harness connector grounding circuit.

(a) Use multimeter to measure resistance between rear defroster wire harness connector SO42 terminal No. 1 and vehicle body effective grounding.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → The system is normal.

No

12	Repair the circuit.

(a) Repair the trouble spots of the circuit.

Confirm whether the defrosting function is normal.

Yes → The system is normal.

No

13	Repair backdoor glass defogging and defrosting woven lead.

Confirm the completion of repair.

Next

14	The system is normal.

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11.11.6.4 Power rearview mirror defrost can not work

Circuit diagram:

See 11.10.5.1 electrical principle diagram.

Diagnostic steps:

1	Confirm whether the rear window defrosting is normal.

No → See 11.10.6.3 rear air window defroster does not work.

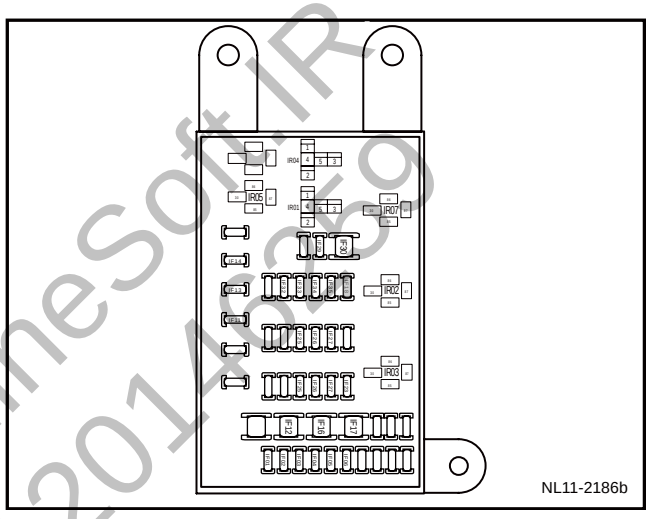
Yes

2	Check fuseIF18.

(a) Whether fuse IF18 is burned out.

Fuse rated current:10A

Confirm whether the fuses are blown.



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Yes → The system is normal.

No

3	Repair IF18 circuit.

(a) Inspect for short circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the function is normal.

Yes → The system is normal.

No

4	Inspect the left rearview mirror grounding.

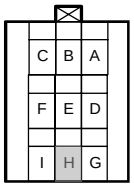
(a) Disconnect left rearview mirror harness connector DR08.

(b) Use multimeter to measure resistance of left rearview mirror wire harness connector DR08 terminal H and vehicle body effective grounding.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.

DR08 left side outer rearview mirrorconnector



NL11-2187b

Yes → The system is normal.

No

5	Replace rearview mirror

(a) Replace rearview mirror, Refer to11.4.8.3 power rearview mirror glass replacement.

Confirm the completion of repair.

Next

6	The system is normal.

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11.11.7 Dismantle and install

11.11.7.1 Rear windscreen defrost grille replacement

See 11.4.8.14 replacement of back door window.

11.11.7.2 Power rearview mirror heater replacement

See 11.4.8.3 replacement of electric rearview mirror glass.

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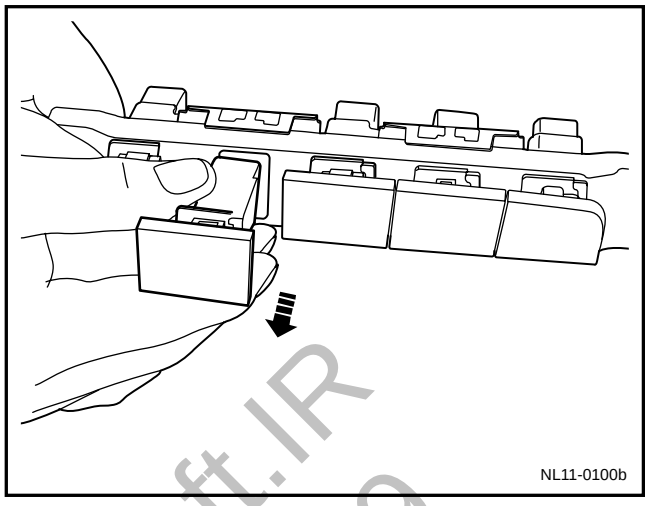
11.11.7.3 Rear windscreen glass defrost switch replacement

Dismantlement procedure

Warning!

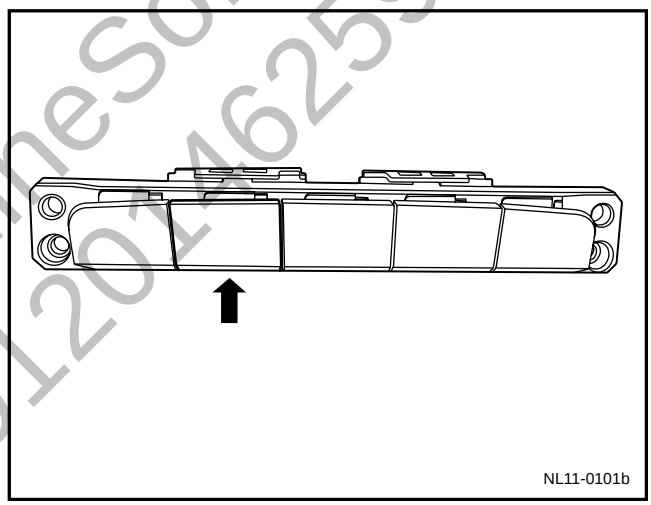
Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle the instrument panel center switch assembly. Refer to 8.2.8.1 replacement of air-conditioning control panel.
3. Dismatle back door glass defroster switch from central switch assembly of instrument panel.



Installation procedure:

1. Install back door glass defrosting switch onto instrument panel central switch assembly.
2. Install central switch assembly of instrument panel onto control panel of air conditioner.
3. Install the air-conditioning control panel.
4. Connect the battery negative cable.



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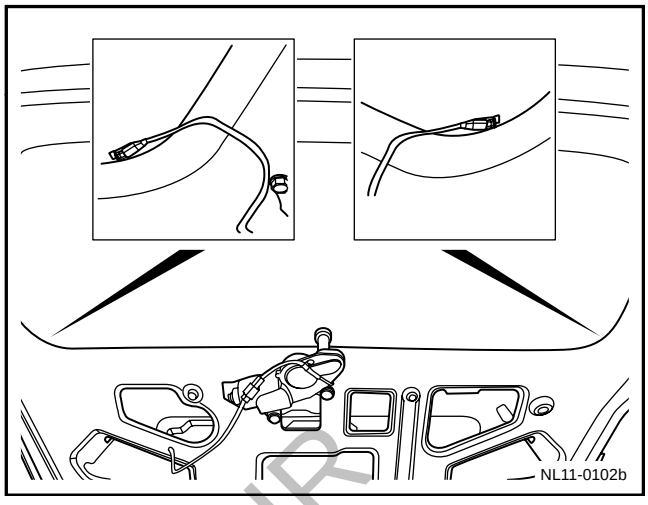
11.11.7.4 Woven leading wire repair of rear windscreen glass defrost

Notes:

The rear windshield defroster bus lead or terminal can be reconnected through re-brazing. Weld through a welding rod containing 3% of silver and rosin.



1. Before welding lead line of CAN, it is necessary to clean repair position to bright condition with fine steel wire.
2. Apply a little amount of resin to repair positions of lead wire and CAN line by using brush.
3. Use soldering iron to dip welding material enough to ensure repair use.
4. Only apply the heat sufficient to melt the solder. Be sure not to overheat the conductor when leading the re-soldered bus.

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11.12 Horn

11.12.1 Specification

11.12.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N·m)	English system (lb-ft)
Fastening bolt of electric horn device	M8×16	18 - 22	13 — 16

11.12.1.2 Horn specification

Sound level	105-118dB	
Audio frequency	Treble	500±25Hz
	Bass	400±25Hz

11.12.2 Description and operation

11.12.2.1 Description and operation

The horn is arranged in the engine cabin and fixed at the both sides of the radiator at the front of the vehicle. The high tone horn arranged at the right side and the bass horn arranged at the left side are controlled by a steering wheel horn switch jointly. When the steering wheel horn button is pressed down, the horn circuit is electrified, so that the horn makes a sound.

A compound horn is used as anti-theft horn at the same time, which is driven to beep by controlling the relay grounding through the BCM.

11.12.3 System work principle

11.12.3.1 System operating Principle

The control mode of the horn is to control the power supply end, i.e., the horn switch controls the closing of the horn relay, then the relay provides supply to the horn; and the horn is normally grounded. The BCM controls the grounding of the relay and sounding by the horn to achieve an anti-theft action.

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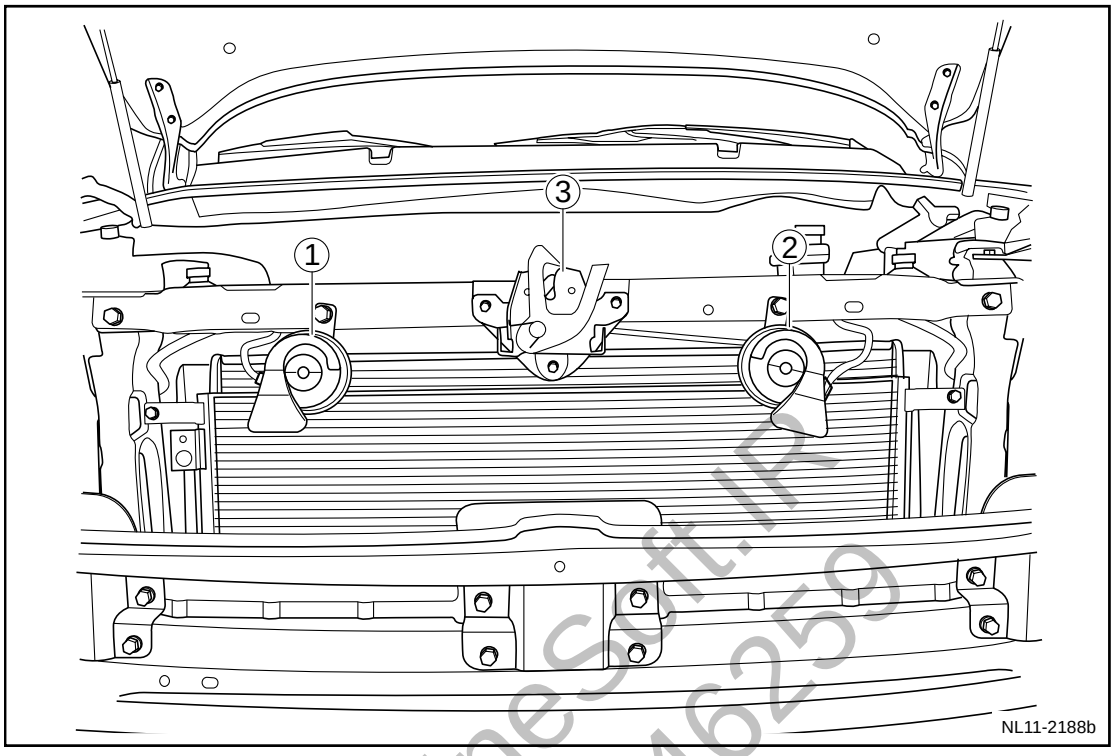
11.12.4 Part position

11.12.4.1 Component position

Horn



1. High-pitch horn
2. Bass horn.
3. Engine hood plunger latch

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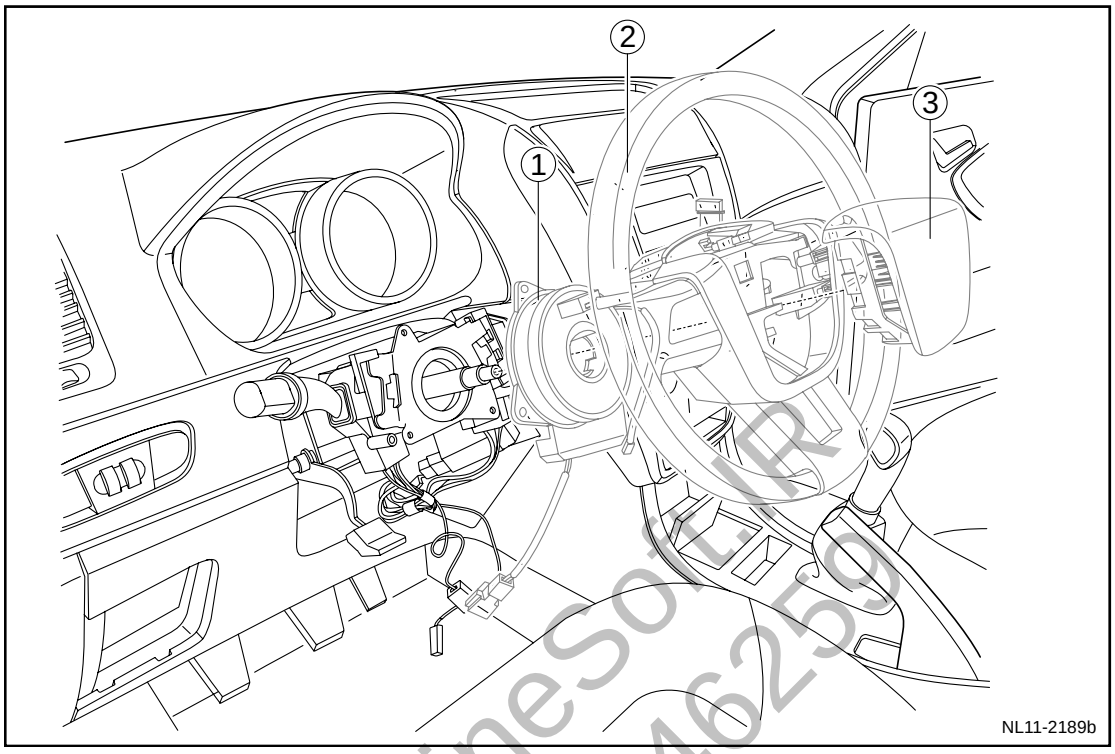
11.12.5 Disassemble drawings

11.12.5.1 Disassemble drawings

Horn
switch



1. Timer spring.
2. Steering disc
3. Driver side airbag (Horn switch)

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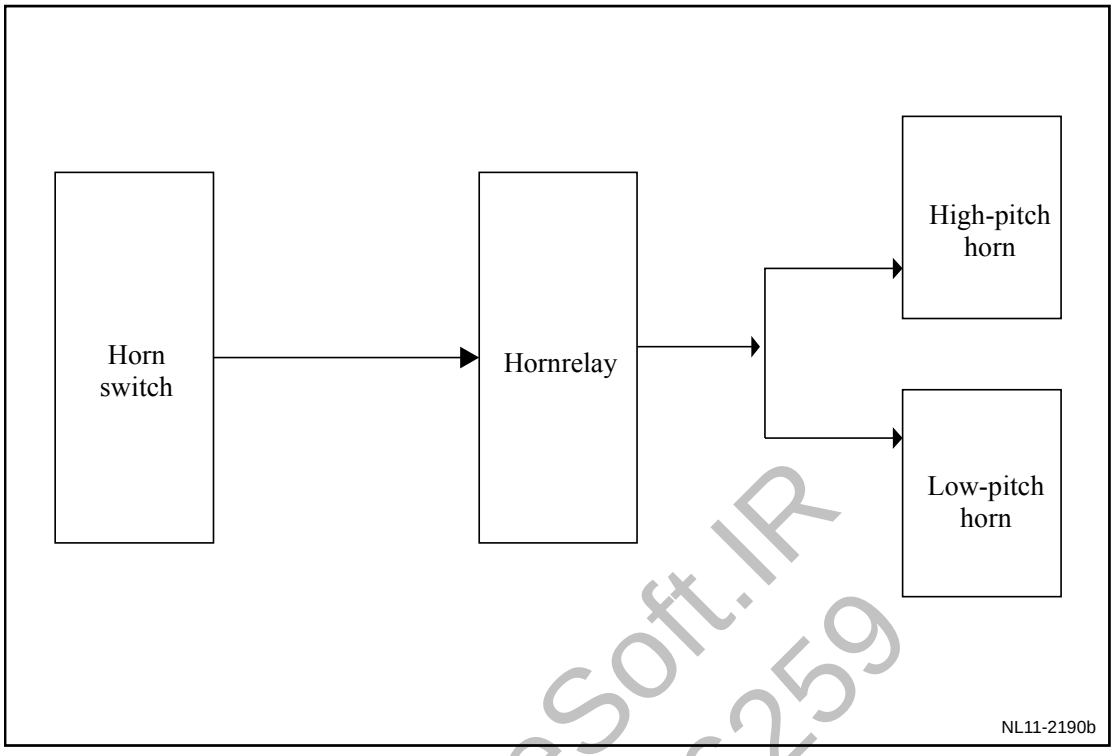
11.12.6 Electrical schematic diagram

11.12.6.1 Electrical schematic diagram



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11.12.7 Diagnostic information and steps

11.12.7.1 Diagnosis descriptions

Refer to 11.12.2 Description and Operation to get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.12.7.2 Visual inspection

– Inspect the after-sales optional device which may affect the normal operation of horn.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– If two horns don't work, it is necessary to inspect and repair power supply or bad grounding connection or short-circuit faults before diagnosing fault.

Warning!

You should comply with the safety operation procedures for the airbag strictly during the dismantlement and inspection of the horn clock spring. See "Warnings Regarding Airbag System".

11.12.7.3 Horn switch contact adjustment

The horn switch contact is likely to contact bad if the horn does not work discontinuously or the horn switch is invalid when pressing one side of the steering wheel; thus, at this time, the horn switch contact below the airbag at the side of the driver should be adjusted.

Warning!

You should dismantle the airbag module in strict accordance with the safety operation procedures for the airbag system. See "Warnings Regarding Airbag System".

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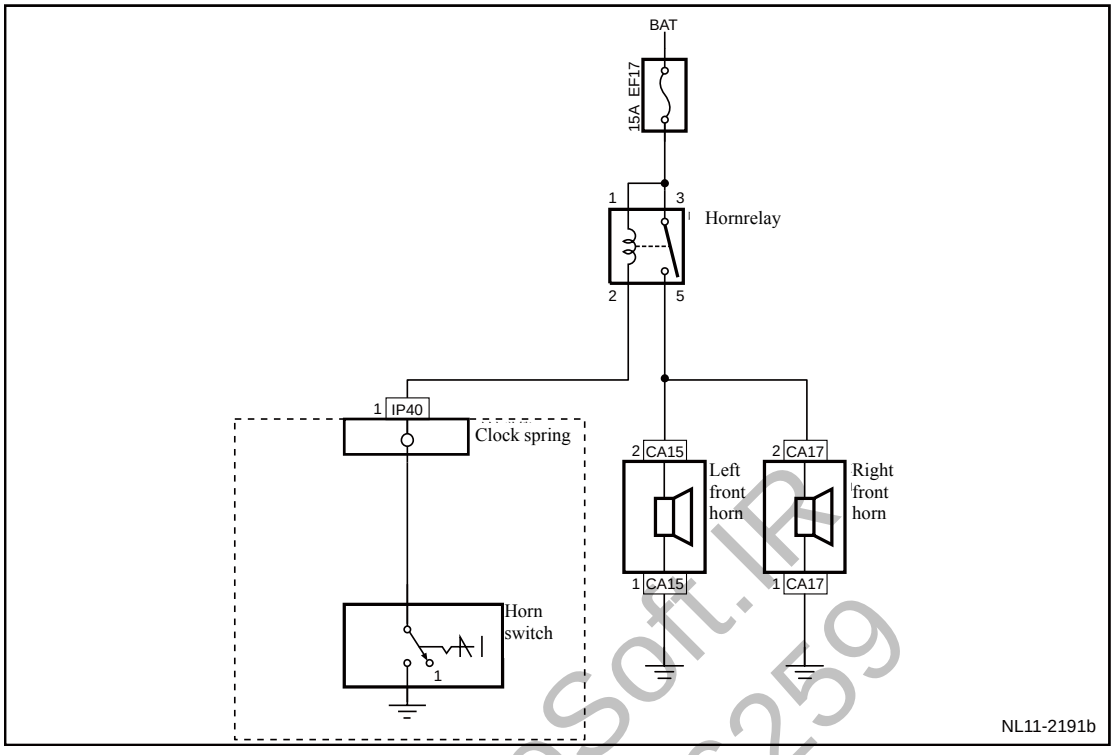
11.12.7.4 Horn do not work

Circuit diagram:



Diagnostic steps:

1	Does the horn relay work after the horn switch is pressed?

(a) Press horn switch to confirm whether horn relay still works.

Yes → Go to step 8

No

2	Check fuseEF17.

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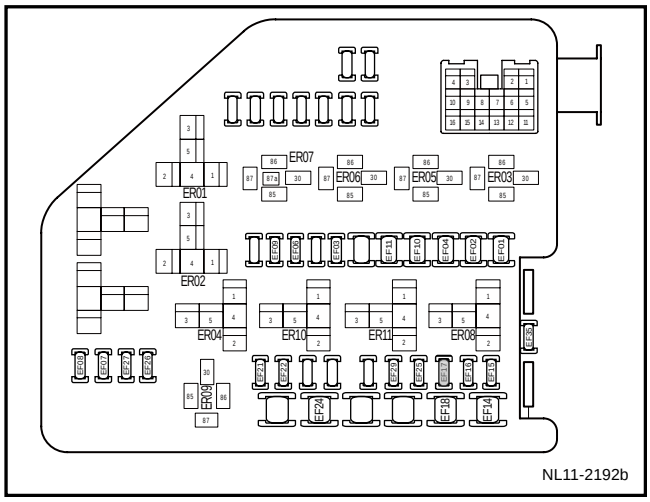
(a) Whether fuse EF17 is burned out.

Fuse rated current:15A

Confirm whether the function is normal.



No → Go to step 3

Yes

3	Check fuseEF17 line.

(a) Inspect for short circuit.

(b) Repair circuit (note: when fuse is inserted, fuse will be burned out. Inspect short-circuit between fuse to horn switch; when fuse is pressed, fuse will be burned out. Inspect short-circuit between fuse to horn), to ensure that there is no short-circuit.

(c) Replace the fuses with rated current.

Confirm whether the function is normal.

Yes → Go to step 5

No

4	Inspect the horn switch.

(a) Press horn switch

(b) Meanwhile, use multimeter to test the connection of horn switch wire harness connector terminal No. 1 and grounding circuit.

Test terminal	Test conditions	Conduction condition
Terminal1—body grounding	Release	10 kΩ or higher
Terminal1—body grounding	Press down	Less than 1 Ω

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Yes → Go to step 6

No

5	Adjust horn switch contact.

(a) For adjustment of horn switch touch, refer to 11.11.7.3 Adjustment of horn switch touch.

Confirm whether the horn works normally.

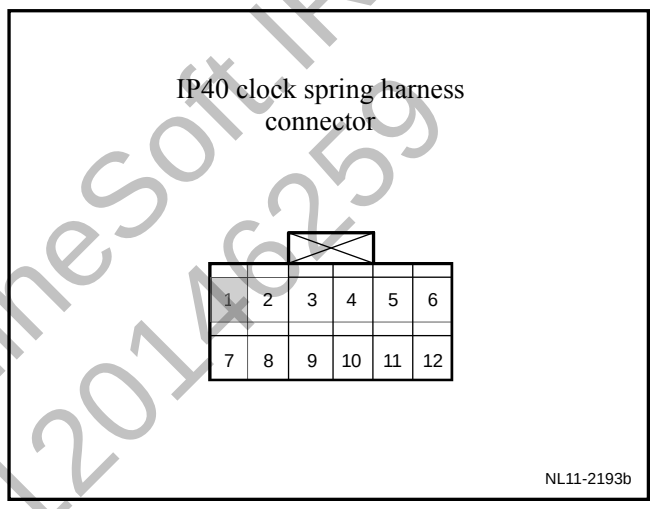
Yes → The system is normal.

No

6	Check clock spring

(a) Press horn switch

(b) Meanwhile, use multimeter to test the connection of timer spring wire harness connector IP40 terminal No. 1 and grounding circuit.



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Test terminal	Test conditions	Conduction condition
IP40(1)—body grounding	Release	10 kΩ or higher
IP40(1)—body grounding	Press down	Less than 1 Ω

Confirm if the resistance conforms to standard value.

Yes → Go to step 8

No

7	Repair the open circuit fault of the clock spring circuit and replace the clock spring if necessary.

(a) Turn off the ignition switch.

(b) Repair timer spring short-circuit. If necessary, replace timer spring.

(c) Turn on ignition switch to position OFF .

Yes → Go to step 9

No

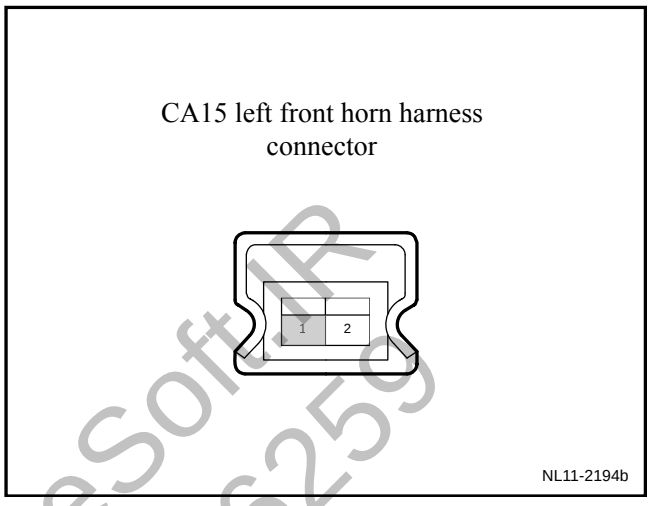
8	Inspect the horn grounding circuit.

(a) Disconnect left side horn harness connector CA15.

(b) Use multimeter to measure resistance between left horn wire harness connector CA15 terminal No. 1 and vehicle body effective grounding point.

Standard resistance: less than 1 Ω

Confirm if the resistance conforms to standard value.



No → Repair the horn grounding circuit fault.

Yes

9	Replace horn

(a) Replace horn. Refer to11.11.8.1 horn replacement

(b) Confirm the repair is completed.

Next

10	The system is normal.

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11.12.8 Dismantle and install

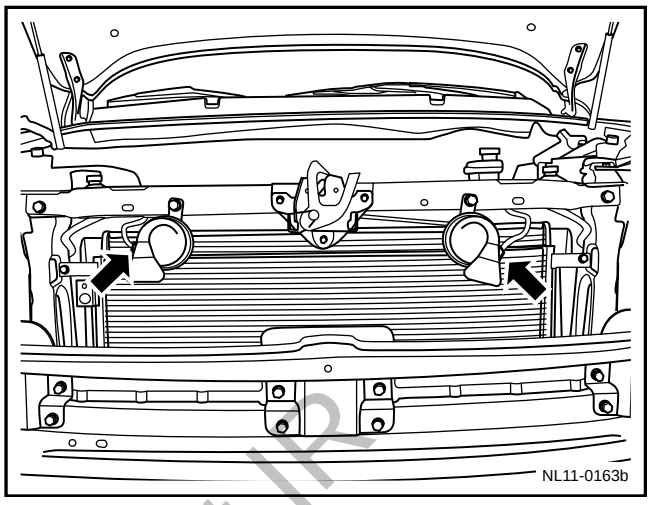
11.12.8.1 Horn replacement

Dismantlement procedure

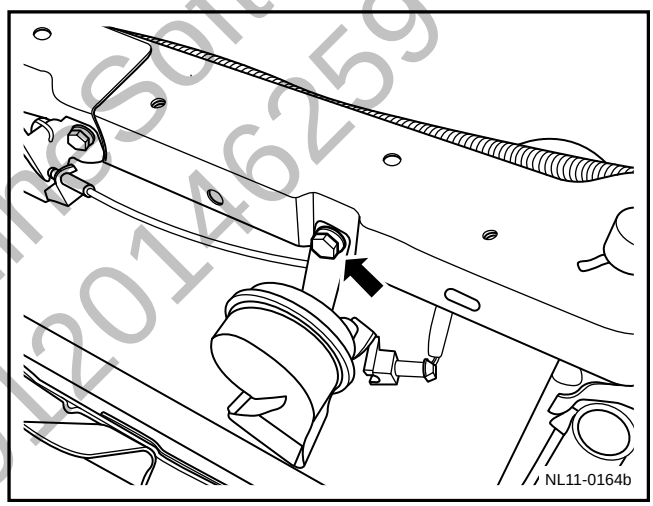
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle front bumper. Refer to 12.4.3.1 Replacement of Front Bumper.
3. Disconnect horn harness connector.



4. Dismantle horn fixing bolt.



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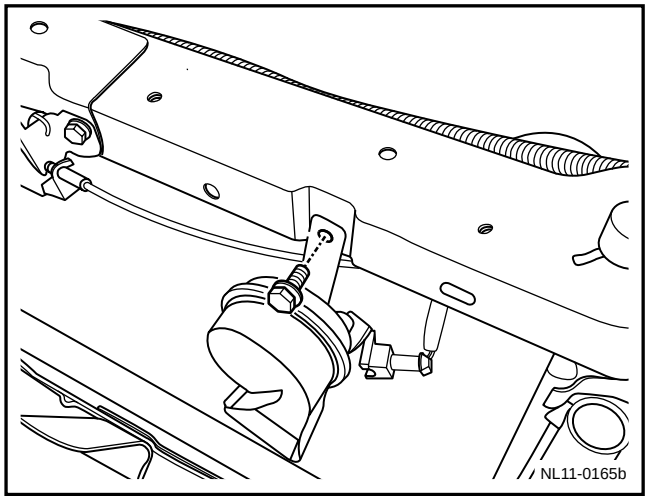
Installation procedure:

1. Tighten horn fixing bolt.

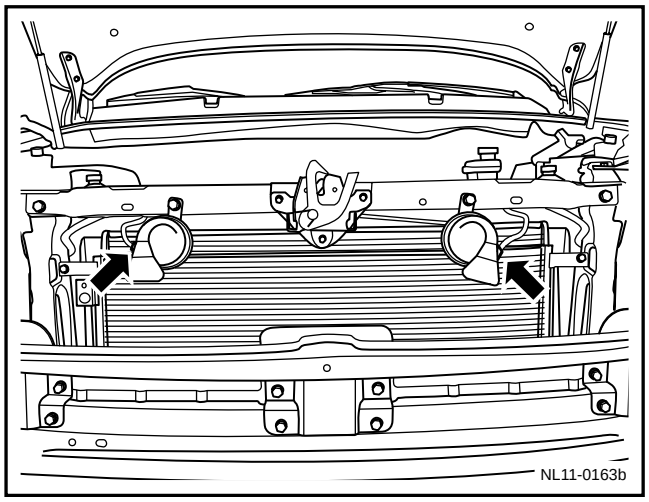
Notes:

See "Important Cautions Regarding Fastening Parts" in "Warnings and Cautions".

Torque 20Nm (Metric) 14. 8lb-ft(English system)



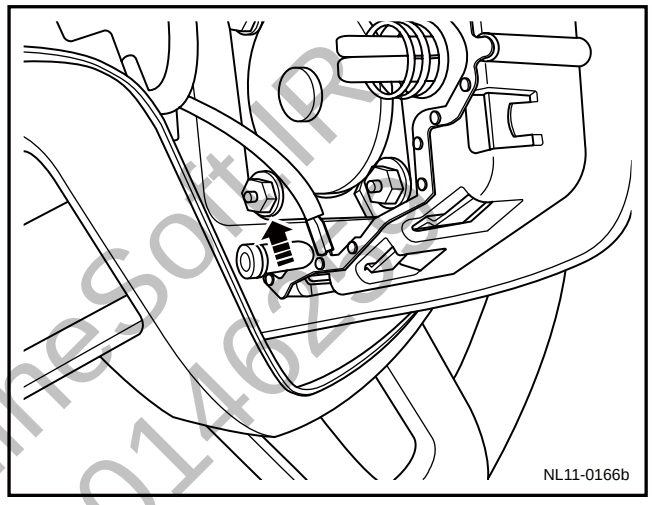
2. Connect horn wire harness connector.
3. Install front bumper.
4. Connect the battery negative cable.



5. Note: the driver's airbag is integrated with the horn switch. Dismantle the horn switch.

Warning!

You should comply with the safety operation procedures for the airbag strictly during the dismantlement and inspection of the horn clock spring. See "Warnings Regarding Airbag System".



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11.13 Parking motor

11.13.1 Specifications

11.13.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N·m)	English system (lb-ft)
Fixing bolt of reversing radar module	M5×16	3-5	2-4

11.13.1.2 Product specification

Items	Rating
Rated voltage	12VDC
Operating voltage	9.6V-16VDC
Operating temperature	-40℃-85℃
Storage temperature	-40℃-85℃
Relative humidity without dew	Max:70%RH
Max. work current	Max:120mA@12VDC
Sensor operating frequency	48KHz±1KHz
Maximum vehicle speed	10km/h
Detect distance.	30cm-150cm

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11.13.1.3 Camera specification

Items	Rating
Rated voltage	12VDC
Operating voltage	9~16VDC
Operating temperature	-40℃~85℃
Storage temperature	-40℃~95℃
Brake type	PAL

Max. work current	Max:≤100mA
Horizontal view angle	120°±3°
Vertical angle of view.	100°±2°
Diagonal	134°±3°

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11.13.2 Description and operation

11.13.2.1 Description and operation

1. When parking vehicle (vehicle speed is lower than 5km/h), parking radar system send relevant warning signal through detecting distance between barrier and vehicle to ensure safe parking, but barrier which is 30cm (11.8in) from rear bumper can't be detected totally.

2. Parking radar control unit can determine the distance of barrier by switching signal transmission time from sensor to barrier, and from barrier to sensor.

3. GX718 is reversing warning system with 5 passages. Three sensor are located at the rear of the vehicle, the front two sensors Under the control of the controller, the sensor emits ultrasonic signals, when encountering an obstacle, generate an echo signal; the sensor performs the data processing (calculating the distance of the obstacle by calculating the time difference from the emission of the ultrasonic wave to the reception of the echo) through the controller after receiving the echo signal to determine the position of the obstacle; the obstacle distance data is sent to the dashboard by the ECU controller; the dashboard handles the obstacle data to display the corresponding distance and gives the corresponding alarm to ensure the safe parking.

Notes:

1. According to distance of barrior, this system can provide driver with relevant warning signal (buzz), so as to provide parking information for driver. But on this process, it doesn't mean that the driver can ignore effect of parking vehicle, so as to exempt from obligation of fail parking vehicle.

2. This system has limit effect on detecting distance and barrier, driver must pay attention to some situation that the system can't detect. Especially, the driver can not simply depend on the system when crossing the obstacle.

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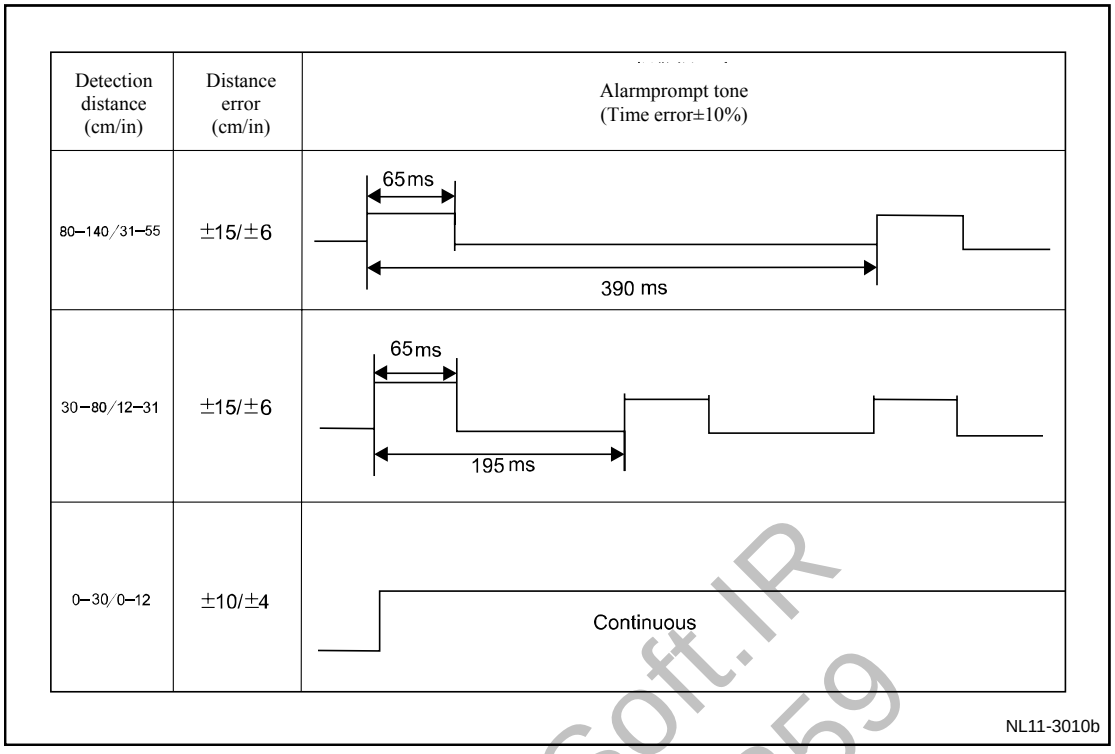
11.13.2.2 Sound level of alarm prompt tone



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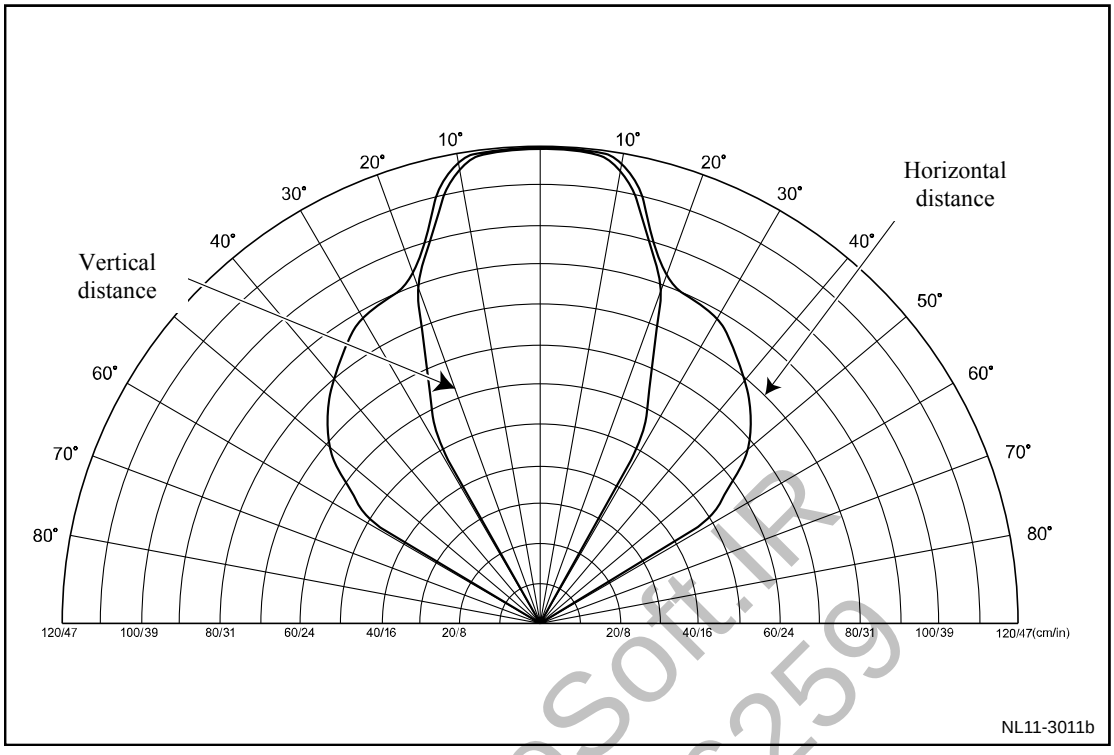
11.13.2.3 Sensor area

Sensor coverage map



Test conditions

– Use Φ750mm PVC pipe to cover the complete vehicle.
– Testing temperature 25℃
– Testing wetness 45-75 % RH

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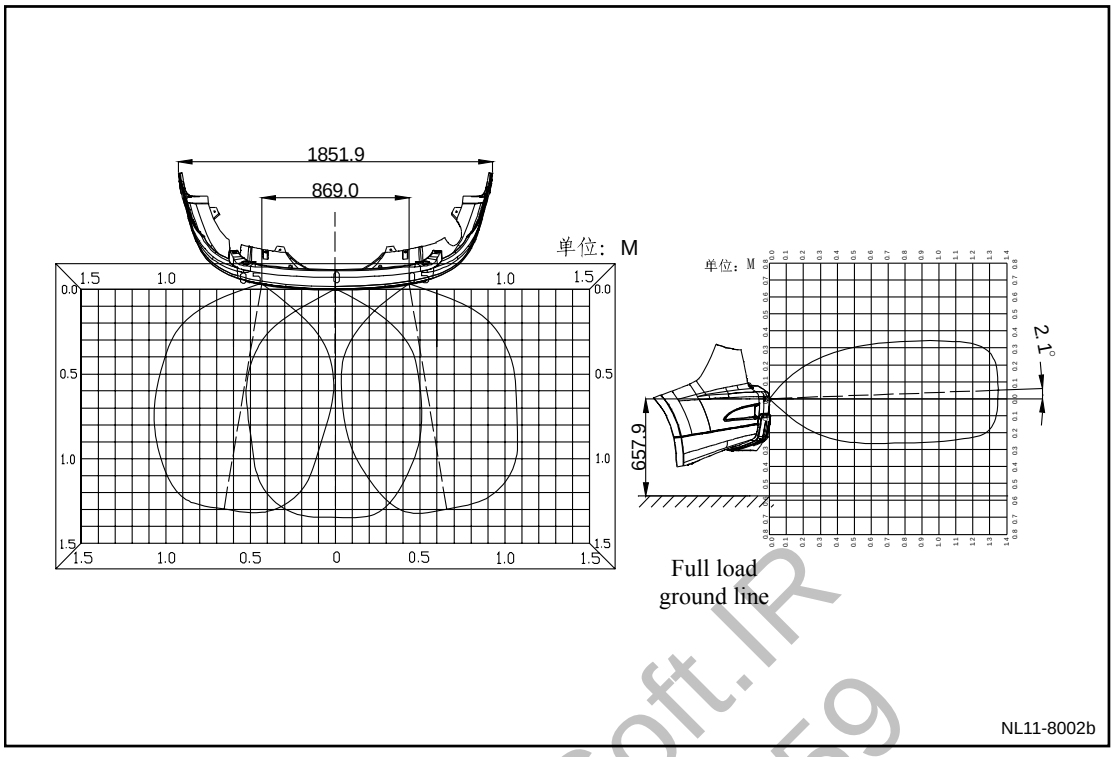
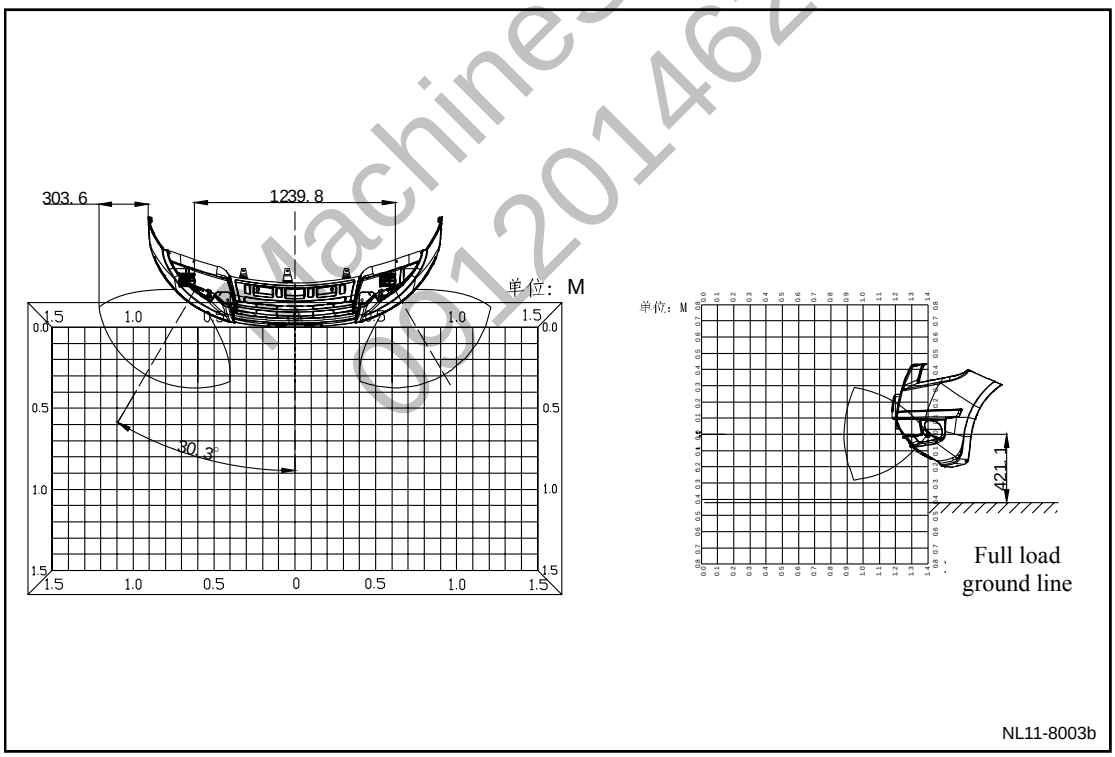
Rear three-probe overall coverage diagram



Front two-probe overall coverage diagram



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11.13.3 System operating principle

11.13.3.1 Control unit function of parking motor

NO	Functional planning	NO	Functional planning
1	Generate the TX (48KHz square wave) signal driving the sensor and USART signal (bit rate 2400bps) of the instrument panel.	6	Detect the driver's reversing signal (0V low. The level is valid; and if invalid, the level is +12V.
2	Receive RX (obstacle echo) signal from the sensor.	7	Detect the vehicle transmitted back through wheel speed sensor. Speed signal
3	The RX signal from the sensor is converted as digital pulse signal after being filtered and demodulated by the module.	8	Sensor Malfunction Diagnosis
4	The module detection calculates the distance of the obstacle and the corresponding frequency alarming digital signal to the dashboard within specified range.	9	Detect the key signal input by the driver. (reserve+12V HF is effective)
5	Provide the stable driving voltage to the sensor.	10	Detect the driver's reversing signal (+12V. High level is valid.)

11.13.3.2 Parking motor work logic

Work mode	Dashboard input signal acquisition state	Enabling state of the front and rear sensors
Reversing mode	R speed effective	All the sensors work.
Parking mode	Stop mode (Gear P or hand brake signal)	All the sensors do not work.
Forward mode	Running speed ≤ 10km/h	Left front/ right front sensor working
	Running speed > 10km/h	All the sensors do not work.
Mute button reserved	Close buzzer beeps. For non-self-locking key, operate once, and switch the silent alarm state.	

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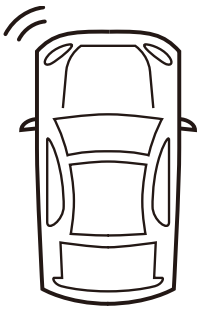
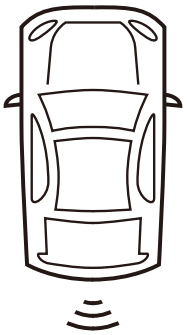
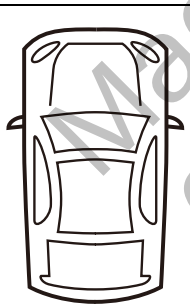
11.13.3.3 Parking motor display

 **0.45** m	According to the operating logic, after two current sensors are enabled to work, the front left sensor direction indicator lamp displays if the front left sensor detects the obstacle, as shown in figure, the current distance is "0.45m", "logistics trolley" body displays, and the buzzer beeps with frequency of 4Hz.
 **1.25** m	According to the operating logic, after all current sensors are enabled to work, the rear medium sensor direction indicator lamp displays if the rear medium sensor detects the obstacle, as shown in figure, the current distance is "1.25m", "logistics trolley" body displays, and the buzzer beeps with frequency of 2Hz.
 Free time of radar	If reverse radar system detects the obstacle, as shown in figure, the "logistics trolley" body displays "radar in idle" in Chinese; all sensor indicator lamp do not display, which indicates that all sensors do not detect the obstacle.

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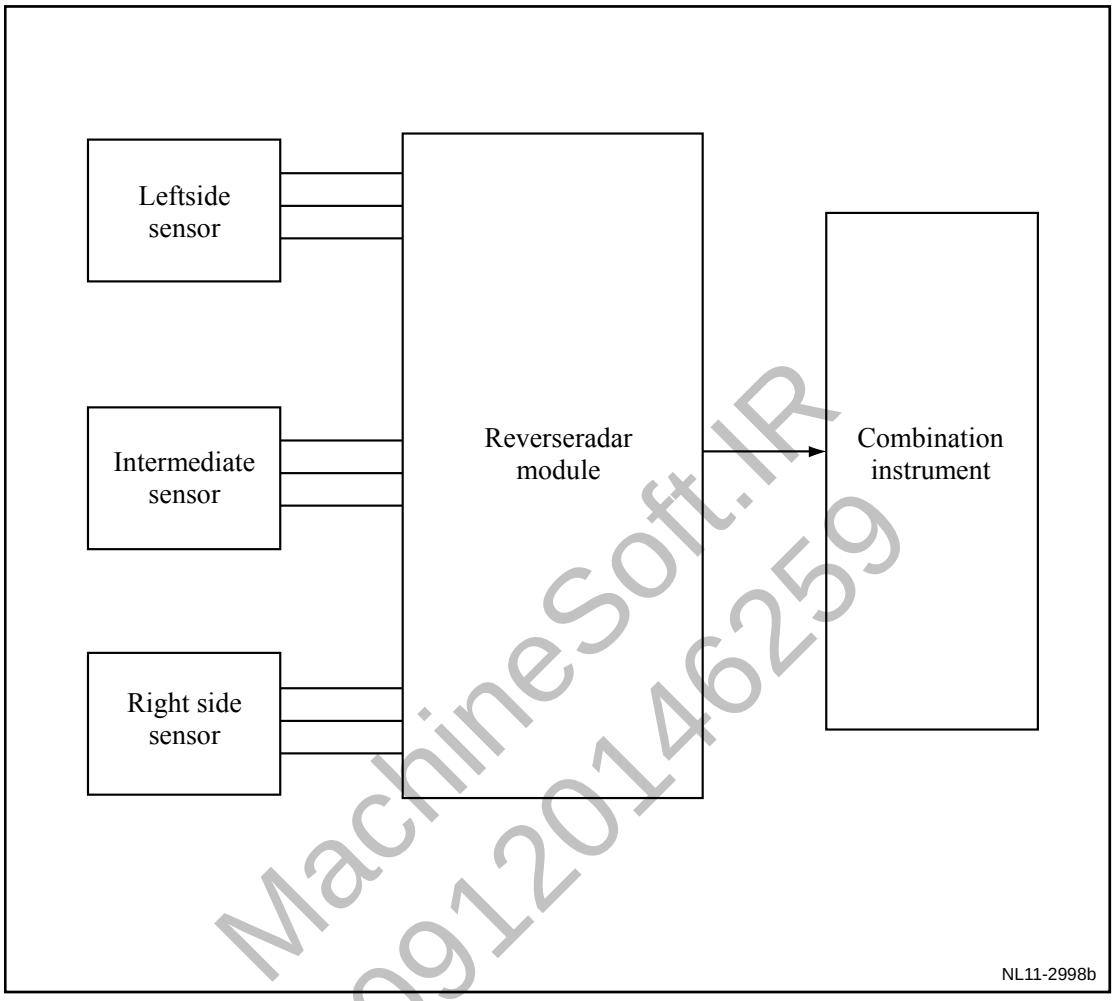
11.13.3.4 Buzzer drive

The buzzer is integrated in the combination instrument and connected with the parking radar control module through a hard wire.

Schematic diagram of buzzer driving



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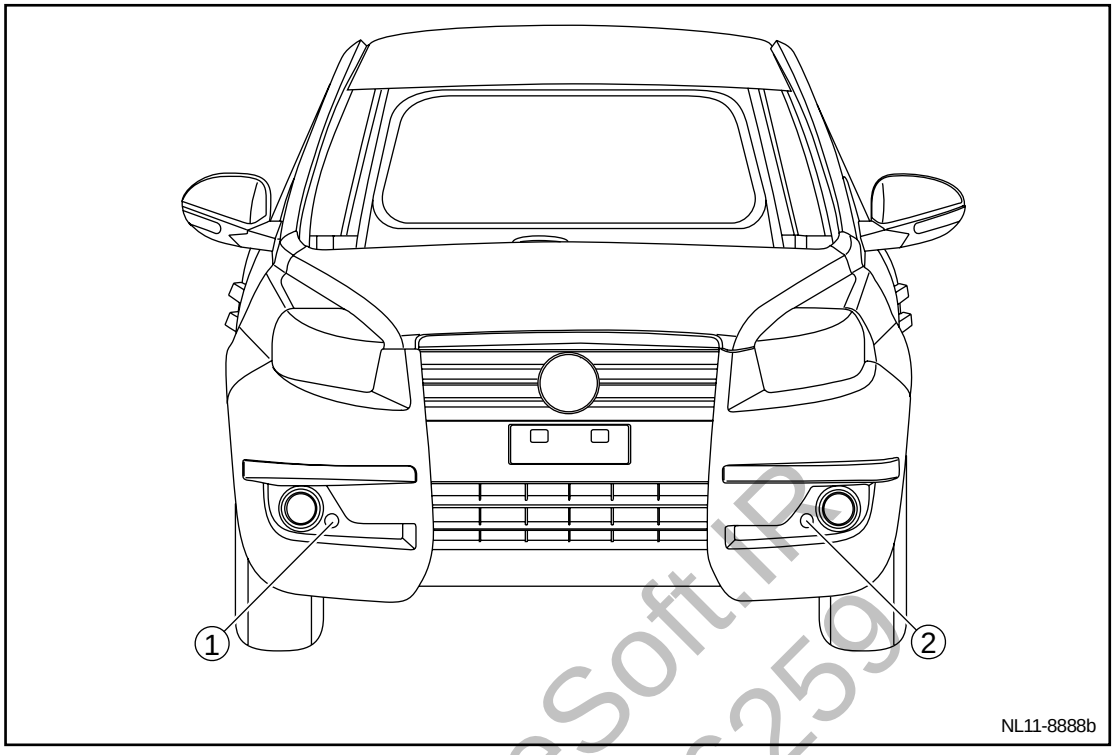
11.13.3.5 Camera

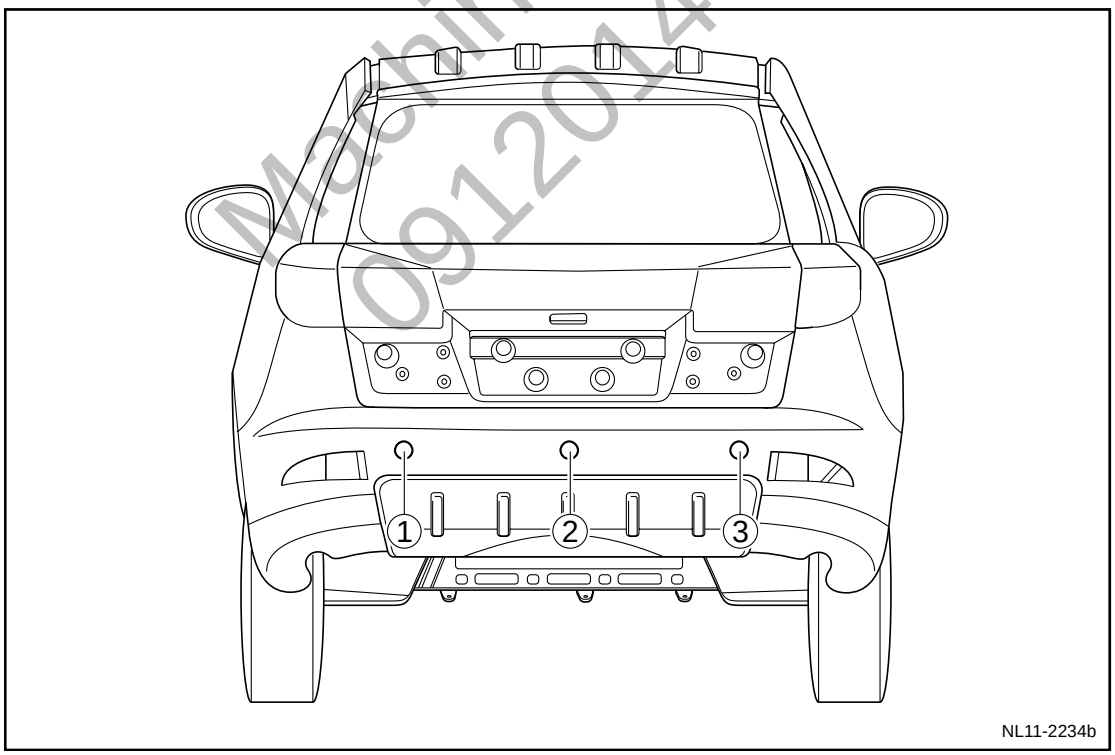
During reversing, the reversing rearview system is operated; the system takes the picture of the rear of the body and converts into the standard video signal. The video signal is transmitted to a vehicle-mounted non-core navigation end through the body harness, the vehicle-mounted non-core navigation end is automatically switched into the reversing picture after detecting the reversing information (a rearview system is in the highest priority during reversing). The driver judges the road condition and obstacles behind the body through observing the reversing picture on the non-core navigation, thereby improving reversing safety.

11.13.4 Component position

11.13.4.1 Component position



1. Right front sensor
2. Left front sensor



1. left side sensor
2. Middle sensor.
3. Right sensor

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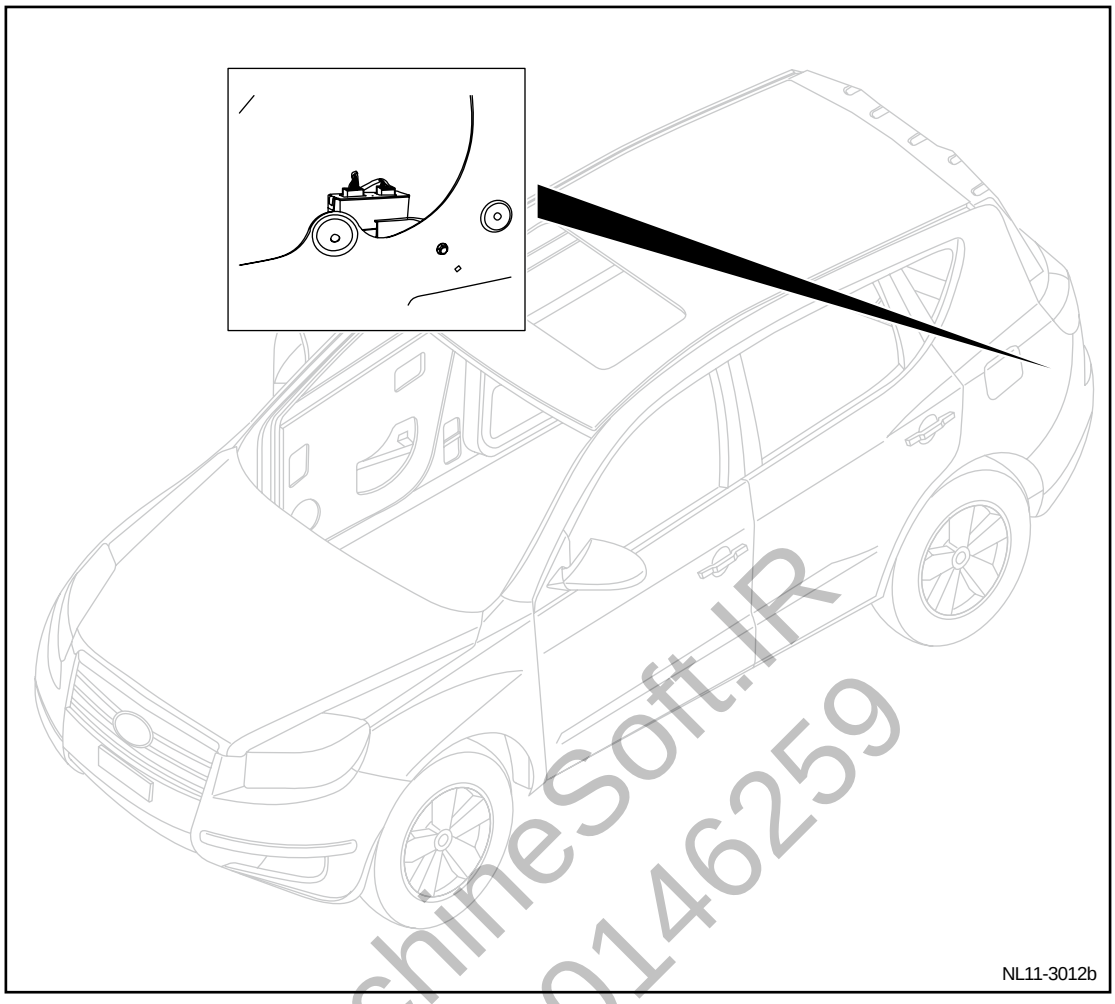
Parking motor control module



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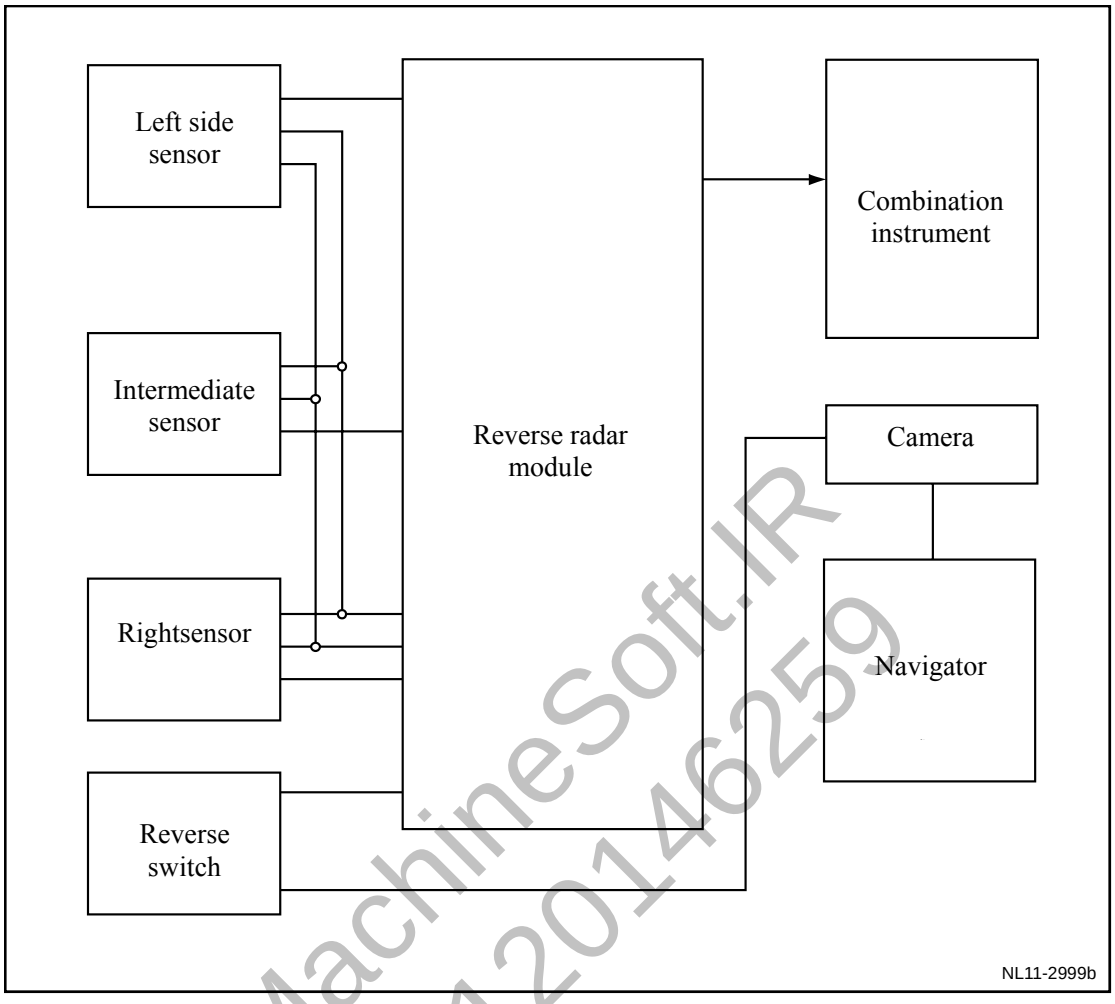
11.13.5 Electrical schematic diagram

11.13.5.1 Electrical schematic diagram



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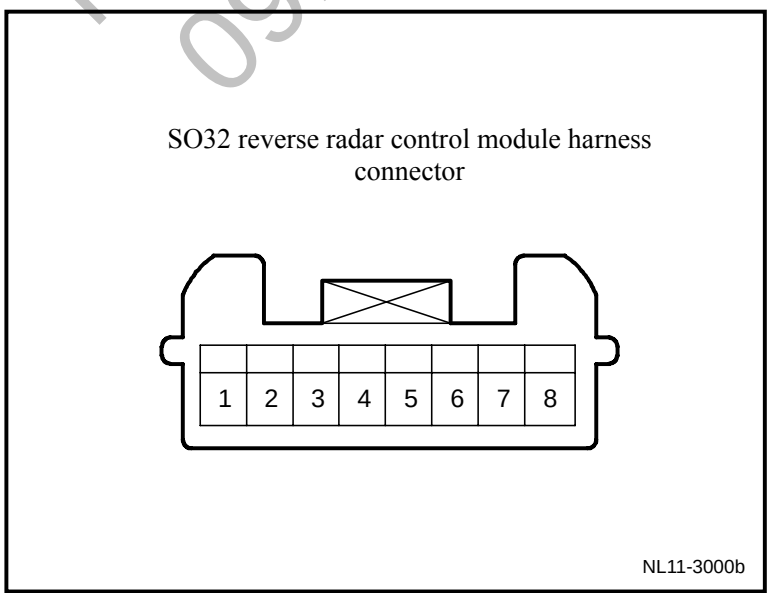
11.13.5.2 Parking motor control module terminal list



Terminal No .	Signal type	Description	Terminal No .	Signal type	Description
1	IGN	Ignition signal	17	GND	Power ground
2	NC	No Connect	18	KEY-IN	Key Input (active for reserved 12V high level)
3	Speed IN	Speed pulse signal	19	NC	No Connect
4	R-DANG	Reversing signal	20	NC	No Connect
5	P-DANG	Parking signal	21	NC	No Connect
6	Data Out	Standard serial port signal (0-12V)	22	NC	No Connect
7	NC	No Connect	23	NC	No Connect
8	R Sensor	Right rear sensor	24	NC	No Connect
9	NC	No Connect	25	NC	No Connect
10	C Sensor	Rear intermediate sensor	26	NC	No Connect
11	NC	No Connect	27	NC	No Connect
12	NC	No Connect	28	NC	No Connect
13	L Sensor	Rear left sensor	29	NC	No Connect
14	FR Sensor	Front right sensor	30	NC	No Connect
15	NC	No Connect	31	PGND	Sensor grounding
16	FL Sensor	Front left sensor	32	SEN POWER	Sensor +8V power supply

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11.13.6 Diagnostic information and procedures

11.13.6.1 Diagnosis descriptions

Refer to 11.13.2 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.13.6.2 Visual inspection

– Inspect the after-sales optional device which may affect the normal operation of parking radar system.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

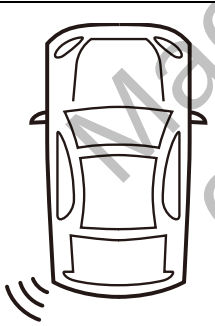
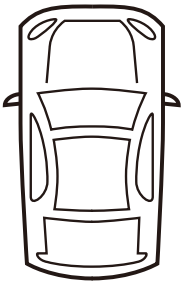
– Inspect the installation of parking radar control unit and whether the wire harness connector is installed properly.

11.13.6.3 Sensor fault diagnosis

Starting for self-checking

Head unit energized automatically detects whether the system function is normal; the system energized delays for about 0.6s, with self-check for about 0.2s; if all sensors have no failure, self-check data of about 0.5 s is sent to the dashboard, with data packet interval of 0.1s, all indicator lamps turn on for 0.5s after the reception of the dashboard, meanwhile, the buzzer beeps for 0.5s; there is sensor in five sensors damaged or in poor contact, the self-check data of about 2s is sent to the dashboard, with data packet interval of 0.1s; the indicator lamp corresponding to the fault sensor turns on for 2s after the reception of the dashboard, and meanwhile, the buzzer beeps for 2s.

Fault figure

 **Sensorfault**	If electrified, the rear sensor works normally, as shown in the figure, the "logistics trolley" body displays to prompt "sensor fault" in Chinese. Rear left sensor direction indicator lamp turns on for 2s; at the same time, the buzzer beeps for 2s, which indicates left sensor error.
 **Good-working**	If electrified, 5 sensors work normally, as shown in the figure, the "logistics trolley" body displays to prompt "normal operation" in Chinese; all sensor indicator lamps turn on for 0.5s; meanwhile, the buzzer beeps for 0.5s, which indicates all sensor normally work.

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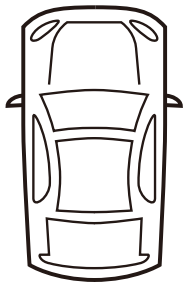 **Radar communication fault**	If the body harness or the reverse radar system is damaged to cause that the dashboard can not receive the data from the reverse radar system, display as shown in the left figure: in this state, the "logistics trolley" body displays "radar communication failure" in Chinese; and five sensor indicator lamps do not display.

Reasons for System may be not work [properly

1. When external decoration outside sensor is frozen.
2. Sensor surface has snow or water drips, etc.

Reasons for Sensor detecting ability may drop

1. When snow or water drops into the probe of sensor.
2. Under extreme hot or cold weather.
3. Obstacle diameter is less than 14cm(5.5in) and length is less than 1m(39in)。

11.13.6.6 Possible reason of error warming for system

1. On unflat road, pebble road and grass road.
2. System is near other ultrasonic wave source, such as vehicle horn, motorcycle engine noise, commercial vehicle air brake interference, etc.
3. Heavy rain and splashing water.
4. Approach such radio equipment as walkman, etc.
5. When the sensor is covered by snow.

11.13.6.7 System can not detect the object as follow

1. Object with sharp angle .rope and so on
2. It can absorb ultrasonic wave matters, such as cotton, snow and sponge, etc.

11.13.6.8 Condition may be occur

1. According to vehicle speed and shape of barrier, warning level may be incontinuous.
2 Whne height of sensor and rear bumper changes or vehicle loading article is located on detection area, system may send error warning.
3. Attention should be paid that the system can't detect metter which is more than 30cm (11.8in) away from sensor.
4. When sensor error is detected, inspect whether there is dust, snow and water, etc. on the surface of sensor, if yes, remove dust, snow and water from the surface.
5. Avoid the sensor surface from being compressed, impacted and scratched.
6. Inform another user of this vehicle lent to him of these instructions.

11.13.6.9 Possible cause for visual back-up system unworn

1. No core navigation damaged or part damaged (video module damaged, incapable of

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effectively detecting the reversing gear information and the like);

2. Connection error of reversing rearview camera wire harness;
3. During reversing, the system power end has no +12V voltage or the system power ground is not connected with the body ground well;
4. The transmission harness for the video signal output by the system is damaged (rearview system end has a signal and the non-core navigation end has no video signal), so that the signal is lost in the transmission process.

11.13.6.10Possible reason of rear camera image-line resolution reduced (Definition reduced)

1. The camera lens surface is dirty (such as waterlogging, muddy water, oil and dust etc.).
2. When the camera is in the condition of low temperature (high temperature) for a long time, enter into the condition of high temperature (low temperature) suddenly;
3. Because the camera lens is damaged to human factors, the glass lens on the lens surface is damaged (with cracks).
4. On rain days, in heavy fog and at night (in the environment with insufficient light)

11.13.6.11 Routing maintenance precaution of reverse rearview mirror camera

1. Ensure the normal use of the system and you need to clean the surface of the camera lens at regular intervals (it is recommended to wipe with dustless cloth dipped with alcohol).
2. To avoid the camera from being damaged due to external force, please do not impact the camera (particularly the lens) due to hard object.
3. In order to ensure that the definition of the camera is not affected, please do not scrap or scratch with sharp objects (hard object) or rub the surface of the lens.
4. When failing to troubleshoot through the method recommended in the manual, it is recommended to repair through professionals.
5. If the vehicle is lent to the other people for use, please inform the user these precautions.

11.13.6.12 Fault symptom list

Symptoms	Suspected Parts	Refer to Page
System Unable to Self-test (Buzzer Did Not Ring)	1. Reverse radar control module power supply circuit	See 11.13.6.10 System Self-inspection Testing Failure (Buzzer Does Not Sound).
	2. Wiring Harness and Connector	
	3. Instrument	
Buzzer Continuously Sound with Gear at R	1. Wiring Harness and Connector	See 11.13.6.11 Buzzer Normally Sounds When Shift Lever Is in R Position.
	2. Reverse radar control module	
	2. Wiring Harness and Connector	

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	3. Reverse radar control module	
Self- inspection right side sensor fault	1. Sensor	Refer to 11. 13. 6. 12 self-inspection right side sensor fault .
	2. Wiring Harness and Connector	
	3. Reverse radar control module	
Self- inspection right intermediate sensor fault	1. Sensor	Refer to11 . 13 . 6 . 13 self-inspection right intermediate sensor fault .
	2. Wiring harness and Connector	
	3. Reverse radar control module	
Self- inspection left intermediate sensor fault	1. Sensor	Refer to 11. 13. 6. 14 self-inspection left intermediate sensor fault .
	2. Wiring harness and Connector	
	3. Reverse radar control module	
Self- inspection left side sensor fault	1. Sensor	Refer to11.13.6.15 self- inspection left side sensor fault .
	2. Wiring harness and Connector	
	3. Reverse radar control module	
Left front sensor fault	1. Sensor	See 11.12.6.16 front left sensor malfunctions.
	2. Wiring harness and connector	
	3. Parking radar control module	

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11.13.6.13 System can not check by self (buzzer can not be sound)

Diagnostic steps:

Note: Inhibit starting the vehicle when performing this inspection step; otherwise, the damage to the vehicle and personal injury may be caused!

1	Inspect whether the reversing lamp works?

(a) Rotated ignition switch to "ON" position.

(b) Place gearbox gear to "R" gear.

(c) Obverse whether reserving lamp lights up.

Does the reversing lamp turn on normally?

Yes	Go to step 3
No	

2	Inspect whether the power and grounding of the parking radar control module are normal.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect parking motor control module harness connector SO32.

(c) Rotated ignition switches to "ON" position.

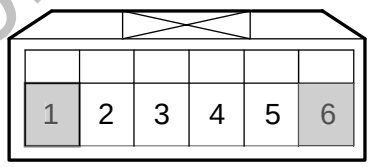
(d) Place gearbox to "R" position.

(e) Measure resistance between parking radar wire harness connector SO32 terminal No. 1 and reliable grounding.

Standard voltage: 11-14 V

(f) Measure effective grounding resistance between parking radar wire harness connector SO32 terminal No. 17 and vehicle body.

SO33 reverse radar control module harness connector



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Standard resistance: less than1 Ω

Is measured value normal?

Yes	Go to step 4
No	

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3	Repair the wire harness

(a) Repair open-circuit fault between parking radar control module wire harness connector SO32 terminal No. 1 to reserving lamp, and fault between parking radar control module wire harness connector SO32 terminal No. 6 and effective grounding of vehicle body.

(b) Connect to parking motor control module harness connector SO32.

(c) Rotated ignition switch to "ON" position.

(d) Place gearbox to "R" position.

Confirm whether the buzzer is normal.

Yes	The system is normal.
No	

4	Inspect whether the buzzer driving circuit is normal.

(a) Rotated ignition switch to "OFF" position.

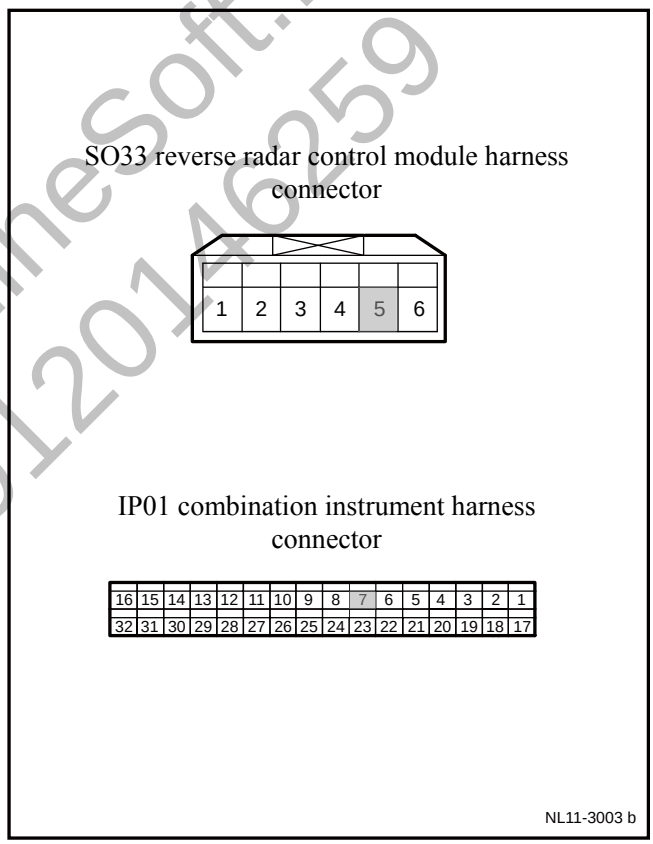
(b) Disconnect parking motor indicator harness connector IP10.

(c) Disconnect the combination instrument p harness connectorIP01.

(d) Use multimeter to measure resistance between parking radar indicator lamp wire harness connector IP10 terminal No. 6 and combined instrument wire harness connector IP01 terminal No. 7.

Standard resistance: less than1 Ω

Confirm whether the resistance conforms to standard value.



Yes	Go to step 6
No	

5	Repair the wire harness

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(a) Repair circuit fault points between parking radar indicator lamp wire harness connector IP10 terminal No. 6 and combined instrument wire harness connector IP01 terminal No. 7.

(b) Connect to parking motor indicator lamp harness connector IP10.

(c) Connect to instrument cluster harness connector IP01.

(d) Turn on ignition switch.

(e) Place gearbox to "R" position.

Confirm whether the parking radar buzzer works normally.

Yes → The system is normal.

No

6	Inspect whether the other warning sound of the combination instrument is normal.

(a) Ensure whether other warning lamp sound of combined instrument is normal.

Confirm whether the parking radar buzzer is normal.

Yes → Go to step 8

No

7	Replace instrument cluster,

(a) Replace the combination instrument and refer to 11.6.7.1 Replacement of Combination Instrument Assembly.

Confirm whether the parking radar buzzer is normal.

Yes → The system is normal.

No

8	Replace parking motor control module.

Replace parking motor control module, refer to11.12.7.1 replace parking radar module .

Confirm the completion of repair.

Next

9	Troubleshooting

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11.13.6.14 When shift lever is in the R gear, buzzer is always sound

Notes:

Inhibit starting the vehicle when performing this inspection step; otherwise, the damage to the vehicle and personal injury may be caused.

Diagnostic steps:

1	Inspect the parking radar module buzzer driving circuit.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect parking motor indicator harness connector IP10.

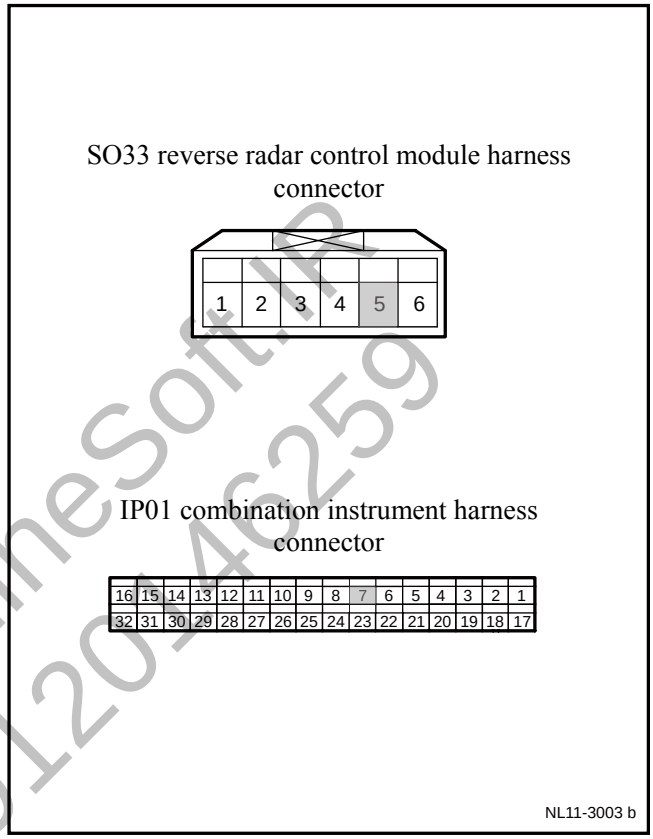
(c) Disconnect the combination instrument p harness connectorIP01.

(d) Measure resistance between parking radar indicator lamp wire harness connector IP10 terminal No. 6 and reliable grounding.

(e) Turn ignition switch to "ON" position.

(f) Measure voltage between parking radar indicator lamp wire harness connector IP10 terminal No. 6 and reliable grounding.

Standard Value:



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Test items	Specified conditions
IP10(6)——grounding	**10 kΩ or higher**
IP10(6)——grounding	**0V**

Are the values specified values?

Yes	Go to step 3
No	

2	Repair the parking radar module buzzer driving circuit.

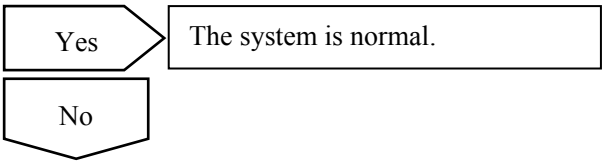
(a) Repair parking radar buzz drive circuit.

(b) Connect reversing radar indicator lamp wire harness connector IP10.

(c) Connect to instrument cluster harness connector IP01.

(d) Turn on ignition switch to ON position.

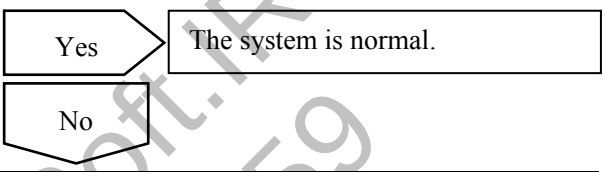
Confirm whether the parking radar buzzer works normally.



3	Inspect the power circuit of the parking radar control module.

(a) Refer to 11.12.6.10 System can't self-inspect (buzz doesn't make a sound)

Confirm whether the parking radar buzzer works normally.



4	Replace parking motor control module.

(a) Refer to 11.12.7.1 Replacement of parking radar module.

Confirm the completion of repair.

5	Verify the maintenance effect.

6	Troubleshooting

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11.13.6.15 Right side sensor fault

Diagnostic steps:

Notes:

Inhibit starting the vehicle when performing this inspection step; otherwise, the damage to the vehicle and personal injury may be caused.

1	Perform the following initial inspection.

(a) Inspect and ensure that the surface of sensor can't be covered by foreign matters.

(b) Inspect and make sure that the sensor surface has no damage or other situations.

(c) For painting process of rear bumper which may cause large deposit of sensor, inspect whether there is any abnormal condition.

Is the sensor surface checked OK?

No → Clean the surface of the sensor and replace the sensor if necessary.

Yes

2	Check harness and connector

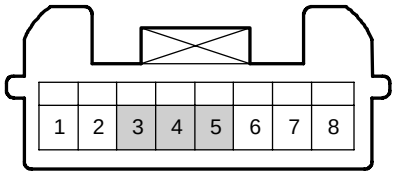
(a) Rotated ignition switch to "OFF" position.

(b) Disconnect parking motor control module harness connector SO32.

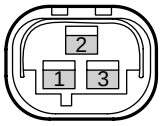
(c) Disconnect parking motor right side sensor SO49.

(d) Measure the connection situation of each terminal in the following table.

SO32 reverse radar control module harness connector



SO49 reverse radar right side Sensor harness connector



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Test Items	Specified Value
SO32(31)—S049(1)Resistance value	Less than 1Ω
SO32(32)—S049(3)Resistance value	Less than 1Ω
SO32(8)—S049(2)Resistance value	Less than 1Ω
S049(1)—effective grounding voltage value	10 kΩ or higher
S049(3)—effective grounding voltage value	10 kΩ or higher
S049(2)—effective grounding voltage value	10 kΩ or higher
S049(1)—effective grounding voltage value	0V
S049(3)—effective grounding voltage value	0V
S049(2)—effective grounding voltage value	0V
S049(1, 2, 3)Inter-voltage value	10 kΩ or higher

Are all tests normal?

No → Repair or replace the harness.

Yes

3	Inspect the power and grounding circuit of the parking radar control module.

(a) Refer to 11.12.6.10 System can't self-inspect (buzz doesn't make a sound)

Confirm whether various tests are normal.

No → Repair or replace the harness.

Yes

4	Replace right side sensor .

(a) Replace right side sensor, refer to11.12.7.2 parking motor sensor replacement .

Next

5	Inspect the parking radar self-inspection function to confirm the fault has been removed.

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11.13.6.16 Intermediate sensor fault

Diagnostic steps:

Notes:

Inhibit starting the vehicle when performing this inspection step; otherwise, the damage to the vehicle and personal injury may be caused.

1	Perform the following initial inspection.

(a) Inspect and ensure that the surface of sensor can't be covered by foreign matters.

(b) Inspect and make sure that the sensor surface has no damage or other situations.

(c) For painting process of rear bumper which may cause large deposit of sensor, inspect whether there is any abnormal condition.

Is the sensor surface checked OK?

No → Clean the surface of the sensor and replace the sensor if necessary.

Yes

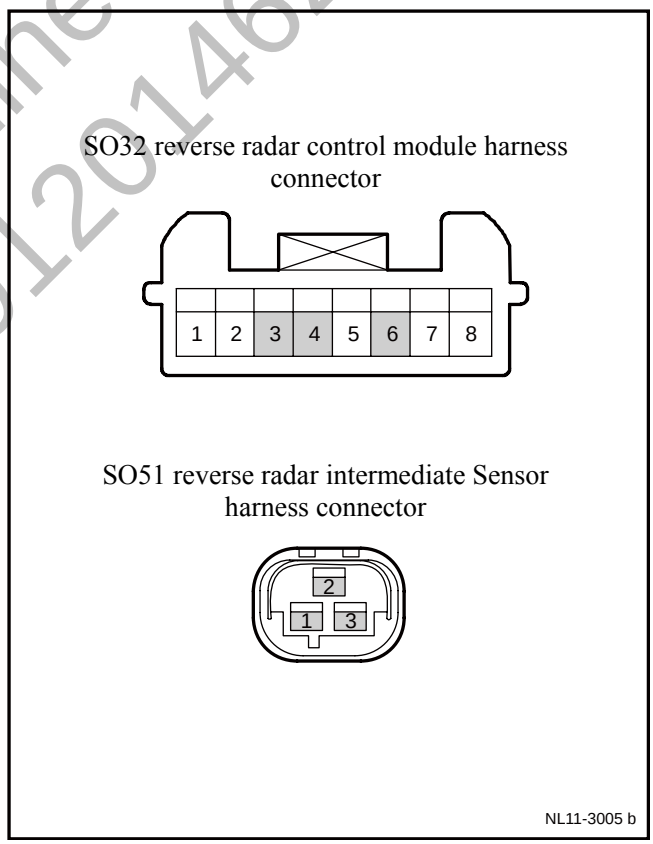
2	Check harness and connector.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect parking motor control module harness connector SO32.

(c) Disconnect parking motor right side sensor SO51.

(d) Measure the connection situation of each terminal in the following table.



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Test Items	Specified Value
SO32(31)—S051(1)Resistance value	Less than 1Ω
SO32(32)—S051(3)Resistance value	Less than 1Ω
SO32(10)—S051(2)Resistance value	Less than 1Ω
S051(1)—effective grounding voltage value	10 kΩ or higher
S051(3)—effective grounding voltage value	10 kΩ or higher
S051(2)—effective grounding voltage value	10 kΩ or higher
S051(1)—effective grounding voltage value	0V
S051(3)—effective grounding voltage value	0V
S051(2)—effective grounding voltage value	0V
S051(1, 2, 3)Inter-voltage value	10 kΩ or higher

Are all tests normal?

No → Repair or replace the harness.

Yes

3	Inspect the power and grounding circuit of the parking radar control module.

(a) Refer to 11.12.6.10 System can't self-inspect (buzz doesn't make a sound)

Confirm whether the circuit is normal.

No → Repair or replace the harness.

Yes

4	Replace intermediate sensor ,

(a) Refer to 11.12.7.2 Replacement of parking radar sensor.

Next

5	Inspect the parking radar self-inspection function to confirm the fault has been removed.

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11.13.6.17 Left side sensor fault

Diagnostic steps:

Notes:

Inhibit starting the vehicle when performing this inspection step; otherwise, the damage to the vehicle and personal injury may be caused.

1	Perform the following initial inspection.

(a) Inspect and ensure that the surface of sensor can't be covered by foreign matters.

(b) Inspect and make sure that the sensor surface has no damage or other situations.

(c) For painting process of rear bumper which may cause large deposit of sensor, inspect whether there is any abnormal condition.

Is the sensor surface checked OK?

No → Clean the surface of the sensor and replace the sensor if necessary.

Yes

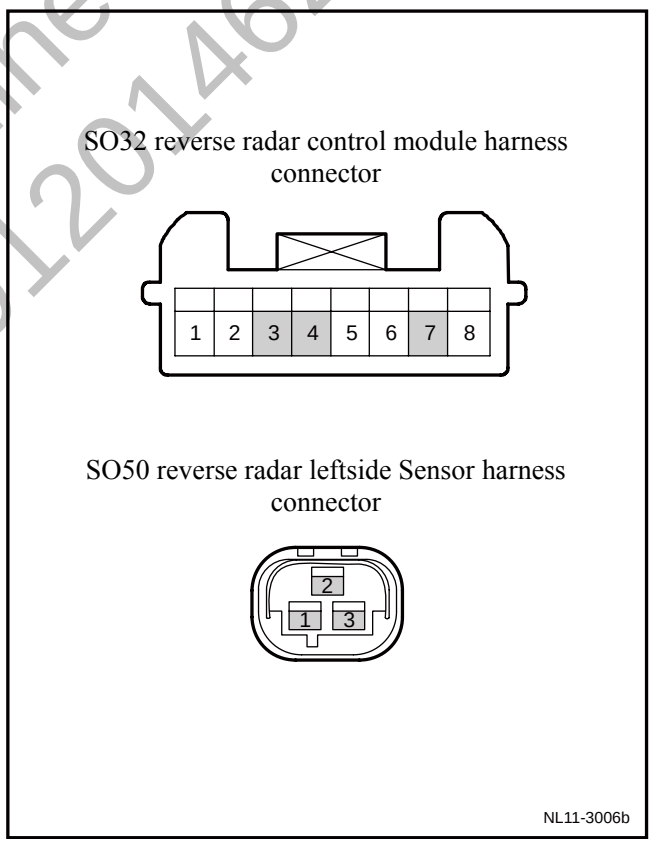
2	Check harness and connector.

(a) Rotated ignition switch to "OFF" position.

(b) Disconnect parking motor control module harness connector SO32.

(c) Disconnect parking motor right side sensor SO50.

(d) Measure the connection situation of each terminal in the following table.



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Test Items	Specified Value
SO32(31)—S050(1)Resistance value	Less than 1Ω
SO32(32)—S050(3)Resistance value	Less than 1Ω
SO32(13)—S050(2)Resistance value	Less than 1Ω
S050(1)—effective grounding voltage value	10 kΩ or higher
S050(3)—effective grounding voltage value	10 kΩ or higher
S050(2)—effective grounding voltage value	10 kΩ or higher
S050(1)—effective grounding voltage value	0V
S050(3)—effective grounding voltage value	0V
S050(2)—effective grounding voltage value	0V
S050(1, 2, 3)Inter-voltage value	10 kΩ or higher

Are all tests normal?

No → Repair or replace the harness.

Yes

3	Inspect the power and grounding circuit of the parking radar control module.

(a) Refer to 11.12.6.10 System can't self-inspect (buzz doesn't make a sound)

Confirm whether the circuit is normal.

No → Repair or replace the harness.

Yes

4	Replace left side sensor

(a) Replace left side sensor. Refer to11.12.7.2 parking motor sensor replacement.

Next

5	Inspect the parking radar self-inspection function to confirm the fault has been removed.

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11.13.6.18 Right front sensor fault

Diagnostic steps:

Notes:

Inhibit starting the vehicle when performing this inspection step; otherwise, the damage to the vehicle and personal injury may be caused.

1	Perform the following initial inspection.

A. Check that the sensor surface must not be covered by foreign matters.

B. Check that the sensor surface is free from breakage.

C. Incorrectly painting the rear bumper will cause excessive paint coating to be accumulated on the sensor surface. Check whether this abnormality exists.

Is the sensor surface checked OK?

No → Clean the surface of the sensor and replace the sensor if necessary.

Yes

2	Check harness and connector.

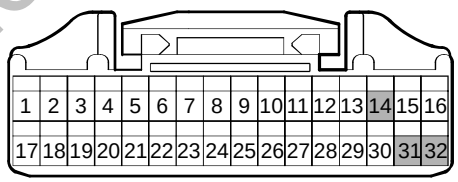
(a) Rotated ignition switch to "OFF" position.

(b) Disconnect parking motor control module harness connector SO32.

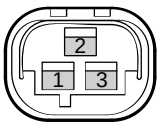
(c) Disconnect parking motor right side sensor CA30.

(d) Measure the connection situation of each terminal in the following table.

SO32 reverse radar control module harness connector



CA30 reverse radar Right front Sensor harness connector



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Test Items	Specified Value
SO32(3)—CA30(1)Resistance value	Less than 1Ω
SO32(4)—CA30(3)Resistance value	Less than 1Ω
SO32(5)—CA30(2)Resistance value	Less than 1Ω
CA30(1)—effective grounding voltage value	10 kΩ or higher
CA30(3)—effective grounding voltage value	10 kΩ or higher
CA30(2)—effective grounding voltage value	10 kΩ or higher
CA30(1)—effective grounding voltage value	0V
CA30(3)—effective grounding voltage value	0V
CA30(2)—effective grounding voltage value	0V
CA30(1, 2, 3)Inter-voltage value	10 kΩ or higher

Are all tests normal?

No → Repair or replace the harness.

Yes

3	Inspect the power and grounding circuit of the parking radar control module.

(a) Refer to 11.12.6.10 System can't self-inspect (buzz doesn't make a sound)

Confirm whether various tests are normal.

No → Repair or replace the harness.

Yes

4	Replace right side sensor.

(a) Replace right side sensor, refer to11.12.7.2 parking motor sensor replacement.

Next

5	Inspect the parking radar self-inspection function to confirm the fault has been removed.

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11.13.6.19 Left front sensor fault

Diagnostic steps:

Notes:

Inhibit starting the vehicle when performing this inspection step; otherwise, the damage to the vehicle and personal injury may be caused.

1	Perform the following initial inspection.

A. Check that the sensor surface must not be covered by foreign matters.

B. Check that the sensor surface is free from breakage.

C. Incorrectly painting the rear bumper will cause excessive paint coating to be accumulated on the sensor surface. Check whether this abnormality exists.

Is the sensor surface checked OK?

No → Clean the surface of the sensor and replace the sensor if necessary.

Yes

2	Check harness and connector.

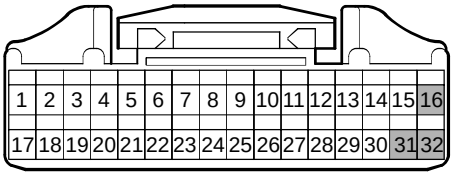
(a) Rotated ignition switch to "OFF" position.

(b) Disconnect parking motor control module harness connector SO32.

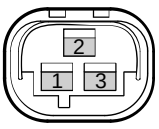
(c) Disconnect parking motor right side sensor CA29.

(d) Measure the connection situation of each terminal in the following table.

SO32 reverse radar control module harness connector



CA29 reverse radar left front Sensor harness connector



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Test items	Specified value
SO32(31)—CA29(1) resistance value	Less than 1Ω
SO32(32)—CA29(3) resistance value	Less than 1Ω
SO32(16)—CA29(2) resistance value	Less than 1Ω
CA29(1)—effective grounding voltage value	10 kΩ or higher
CA29(3)—effective grounding voltage value	10 kΩ or higher
CA29(2)—effective grounding voltage value	10 kΩ or higher
CA29(1)—effective grounding voltage value	0V
CA29(3)—effective grounding voltage value	0V
CA29(2)—effective grounding voltage value	0V
CA29(1, 2, 3)Inter-voltage value	10 kΩ or higher

Are all tests normal?

No → Repair or replace the harness.

Yes

3	Inspect the power and grounding circuit of the parking radar control module.

(a) Refer to 11.12.6.10 System can't self-inspect (buzz doesn't make a sound)

Confirm whether various tests are normal.

No → Repair or replace the harness.

Yes

4	Replace right side sensor.

(a) Replace right side sensor, refer to11.12.7.2 parking motor sensor replacement .

Next

5	Inspect the parking radar self-inspection function to confirm the fault has been removed.

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11.13.7 Removal and installation

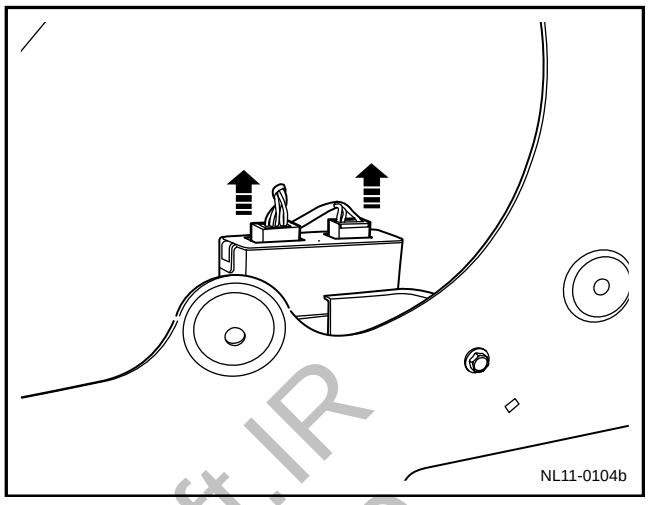
11.13.7.1 Replace parking radar module

Dismantlement procedure

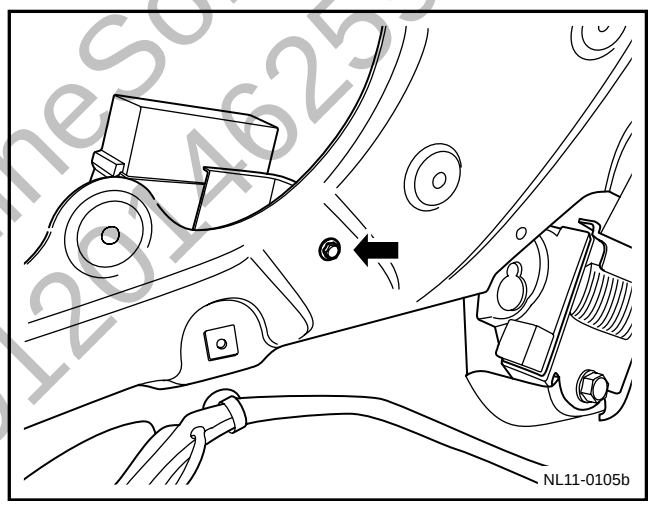
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of upper trimming plate on the left of rear column, refer to 12.9.1.10 Replacement of rear column upper trimming plate assembly.
3. Disconnect parking motor module harness connector.



4. Dismantle fixing bolt of parking radar sensor.



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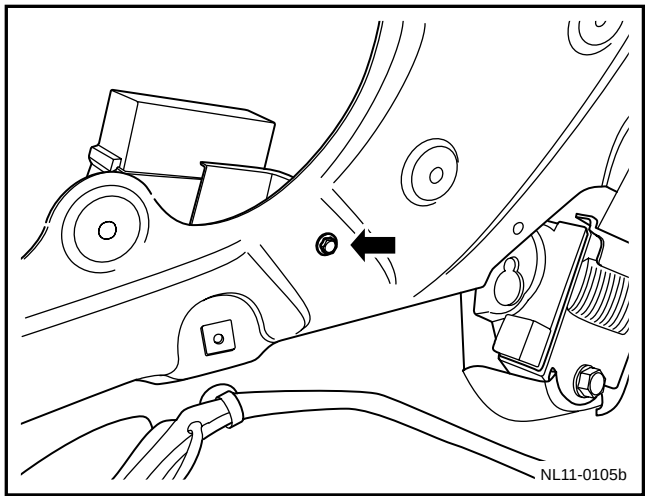
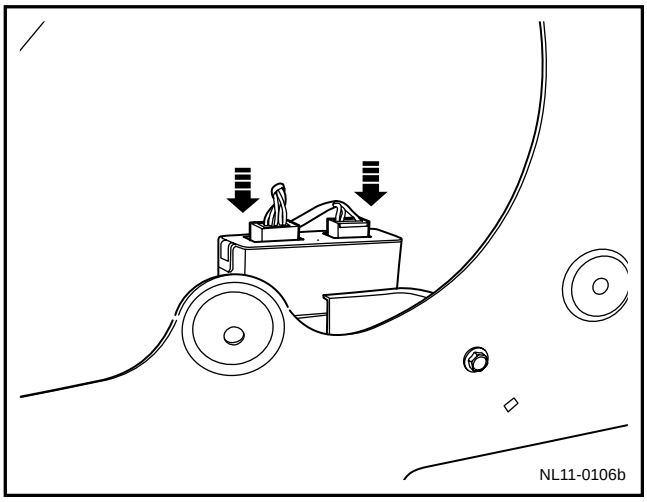
Installation procedure:

1. Install and tighten parking radar module fixing bolt.

Torque:5 Nm(Metric) 3.7 lb-ft(English system)



2. Connect parking radar module wire harness connector.
3. Install trimming plate on left side of boot.
4 Connect the battery negative cable.



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11.13.7.2 Parking motor sensor replacement

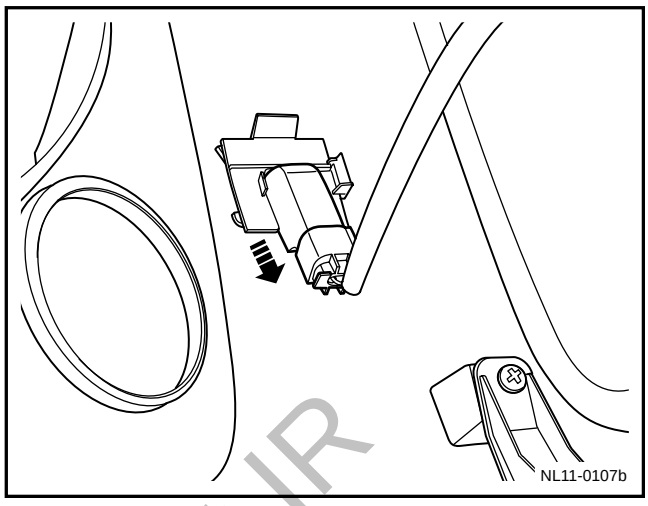
Replacement of rear parking radar sensor

Dismantlement procedure

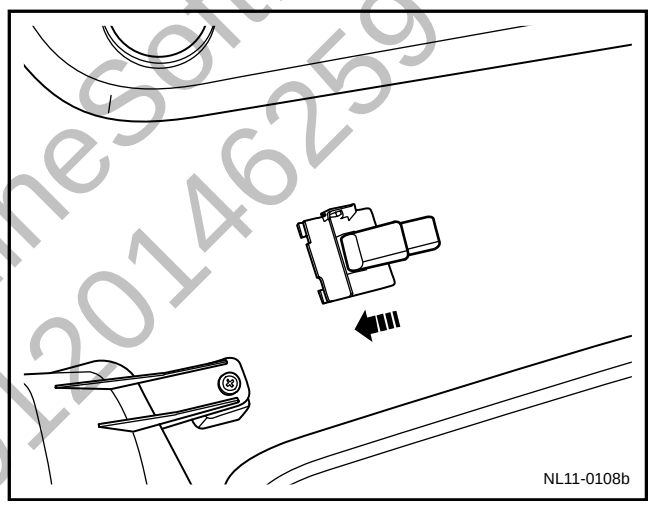
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of rear bumper, refer to 12.4.3.3 Replacement of rear bumper.
3. Disconnect the harness connector of the parking radar sensor.



4. Dismantle fixing retaining plate of parking radar sensor.
5. Extract the parking radar sensor.



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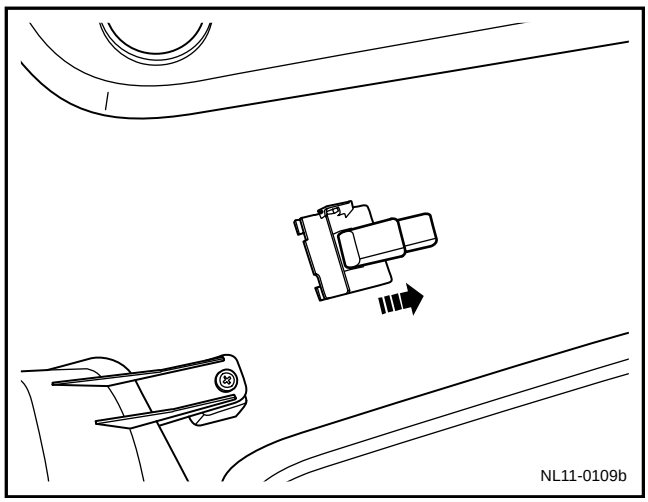
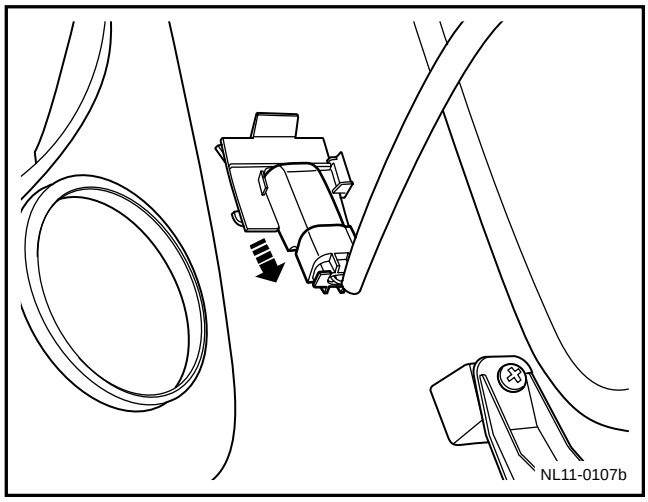
Installation procedure:

1. Install parking radar sensor onto rear bumper.
2. Install parking motor sensor fixing clamp plate.



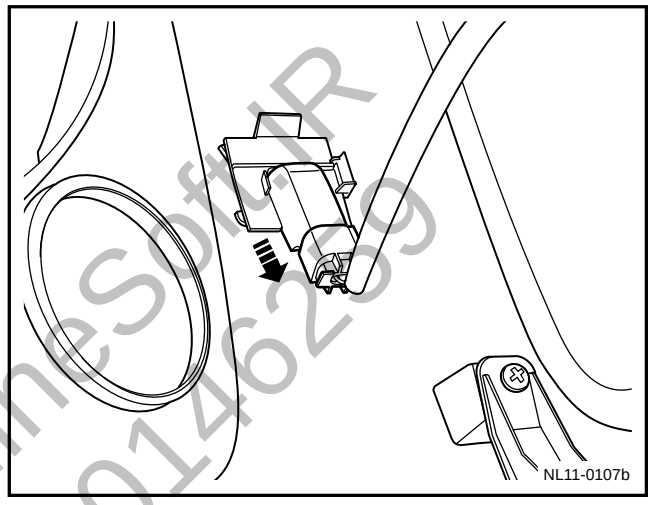
3. Connect the harness connector of the parking radar sensor.
4. Install the rear bumper.
5. Connect the battery negative cable.



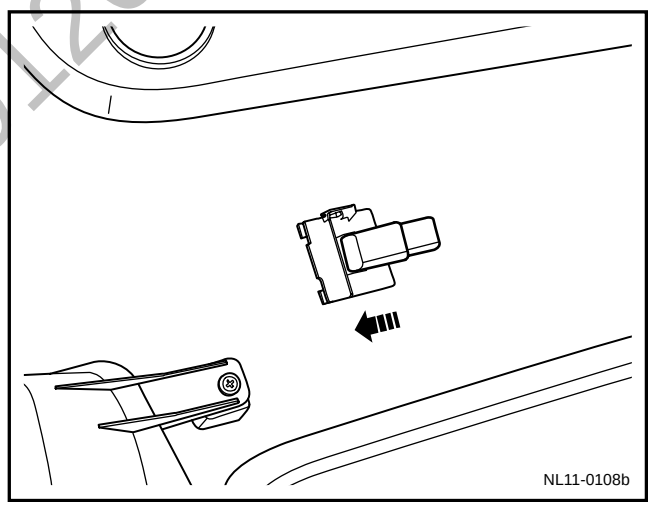
Replacement of front parking radar sensor

Dismantlement procedure

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle front bumper. Refer to 12.4.3.1 Replacement of Front Bumper.



3. Disconnect the harness connector of the parking radar sensor.
4. Dismantle fixing retaining plate of parking radar sensor.
5. Extract the parking radar sensor.



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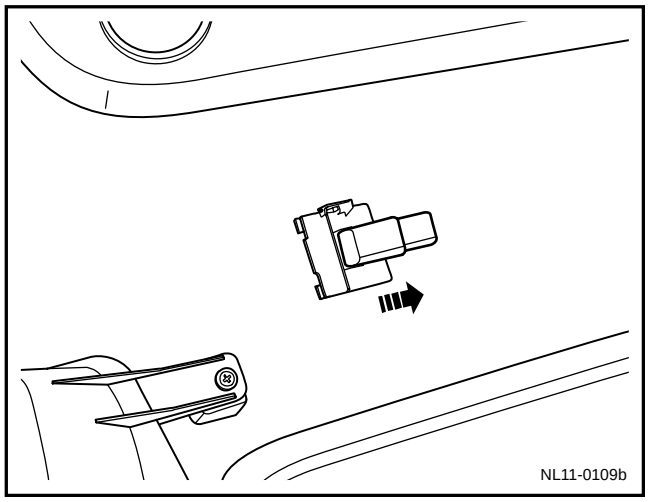
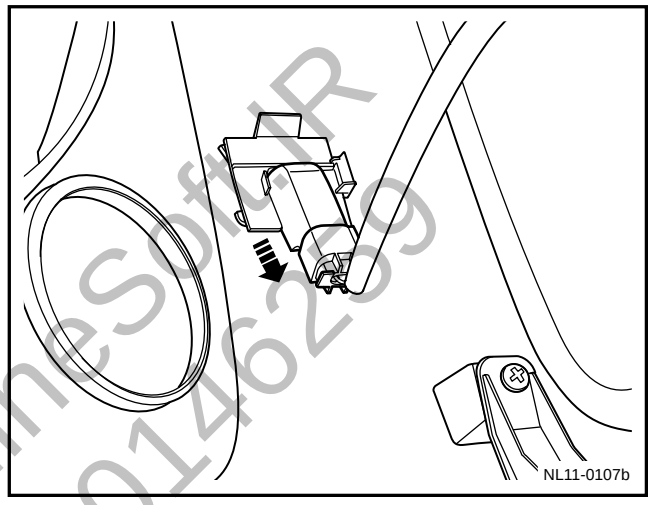
Installation procedure:

1. Install parking radar sensor onto front bumper.
2. Install parking motor sensor fixing clamp plate.



3. Connect the harness connector of the parking radar sensor.
4. Install front bumper.
5. Connect the battery negative cable.



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11.14 Functional instrument

11.14.1 Specifications

11.14.1.1 Fastener specifications

Fastener name	Model	Torque range	
		Metric (N·m)	English system (lb-ft)
Multi-function Instrument Assembly Self- Tapping Screws	ST4.2×9.5	2-4	2-3

11.14.1.2 Indicator descriptions

The multifunctional assembly is provided with a total of 6 warning lamps to provide warning or prompt message to the user.

Lamp symbols	Indicator	Color
	Passenger Seat Belt Unfastened Warning Lamp	Red
	Tire pressure warning lamp	Yellow
	Compass on blue	White characters
	Altitude	White letters on blue

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11.14.2 Description and operation

11.14.2.1 Description and operation

Compass

– The compass totally points at 8 directions (east, south, west, north, southeast, southwest, and, northwest).

– Angle range in each range is 40 degree, and there is 5 degree of transition area between adjacent direction.Display the corresponding font in the corresponding direction.

– The function display can be achieved mainly relying on "magnetic field sensor".

Altitude

– Altitude height display range is -100～5000m.

– Near-surface resolution is 10～20m.

– Not display Max.height“0”.

Realizing principle of altitude instrument:

The instrument detects atmospheric pressure through the pressure sensor to calculate the altitude through the atmospheric pressure detected.

Altitude adjustment:

Operation method: press for a short period of time to adjust the unit digits and press for a long period of time for regulation. Press for a short period of time again to confirm. Then, regulate the tens digit by short press, regulate by long press and confirm by short press again, and so forth. The OK status is by default when the button is not long pressed.

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11.14.3 System operating principle

11.14.3.1 Warning lamp control

When starting the ignition switch in position ON at every turn, the multifunctional instrument inspects the warning lamp by itself, and the self-check process lasts for 3s; and when the warning lamp circuit faults or receives a signal of compelling to turn on the fault warning lamp, turn on the fault lamp to remind the driver.

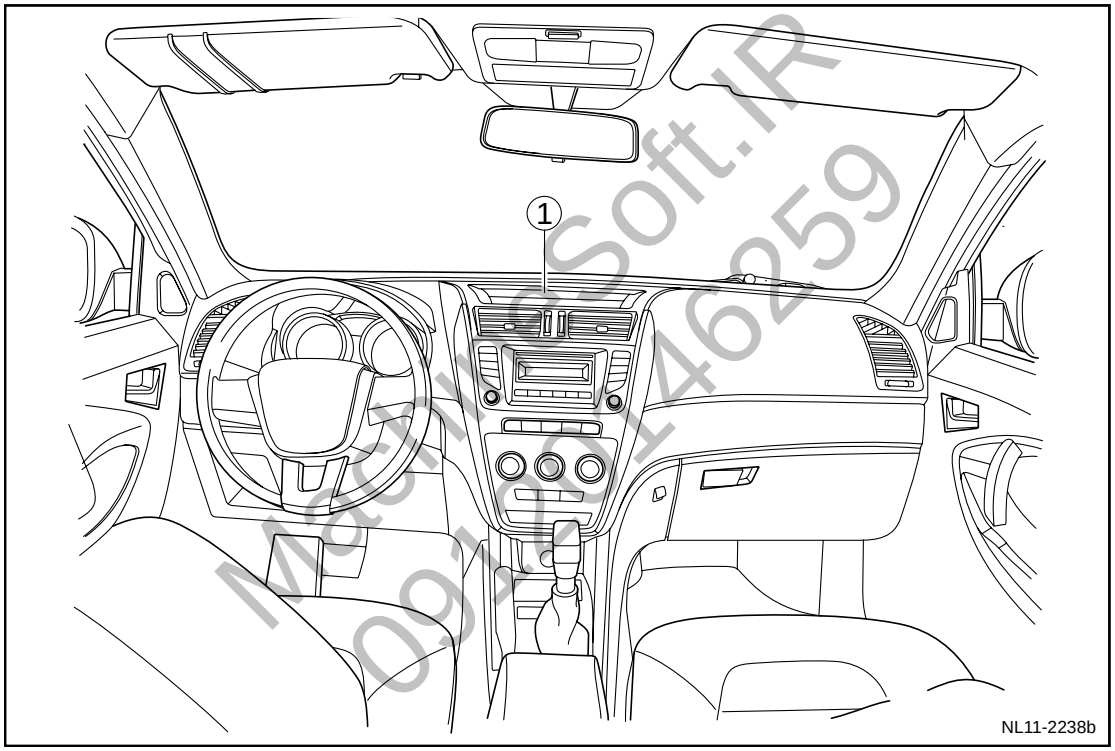
The following warning lamps in the multifunctional instrument are directly controlled by hardware as follows:

– Sub-safety belt unsecured warning lamp

– Tire-pressure warning lamp

11.14.4 Component position

11.14.4.1 Component position



1. Multi-function instrument

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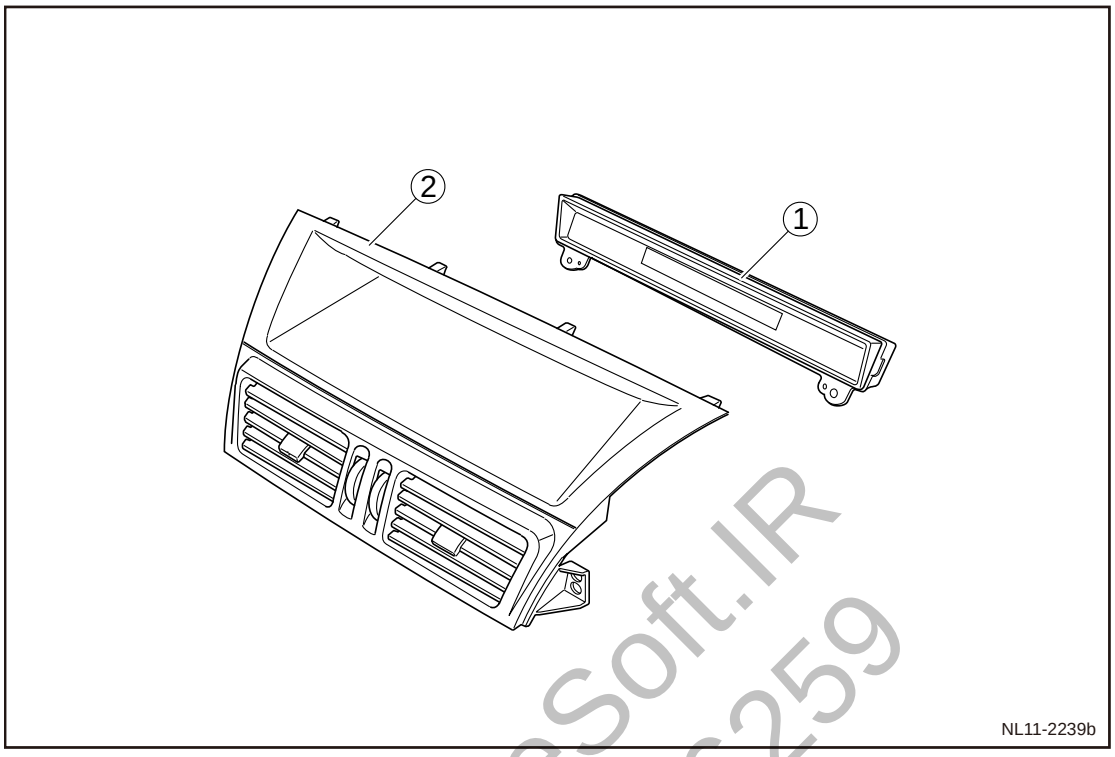
11.14.5 Disassemble drawings

11.14.5.1 Disassemble drawings



1. Functional instrument
2. Multi-functional instrument cover.

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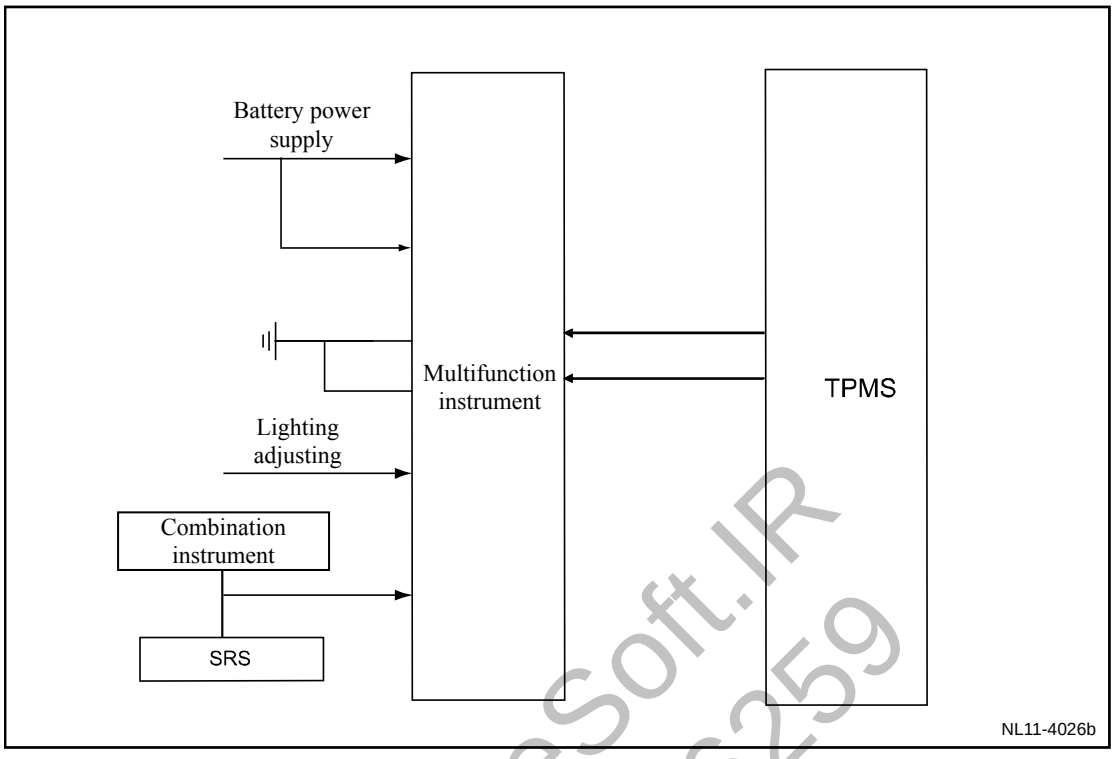
11.14.6 Electrical schematic diagram

11.14.6.1 Electrical schematic diagram



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11.14.7 Diagnostic information and procedures

11.14.7.1 Diagnostic Information and procedures

After being familiar with the system function and the operation content and then start the system diagnosis, so that it is conducive to the determination of the correct steps of fault diagnosis in the event of a failure; what's more, it is further conducive to determining whether the condition described by the customer belongs to the normal operation.

11.14.7.1 Diagnostic information and steps

– Inspect the after-sales optional device which may affect the normal operation of multi-functional instrument.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– Inspect whether the system of each instrument displaying information is in normal condition.

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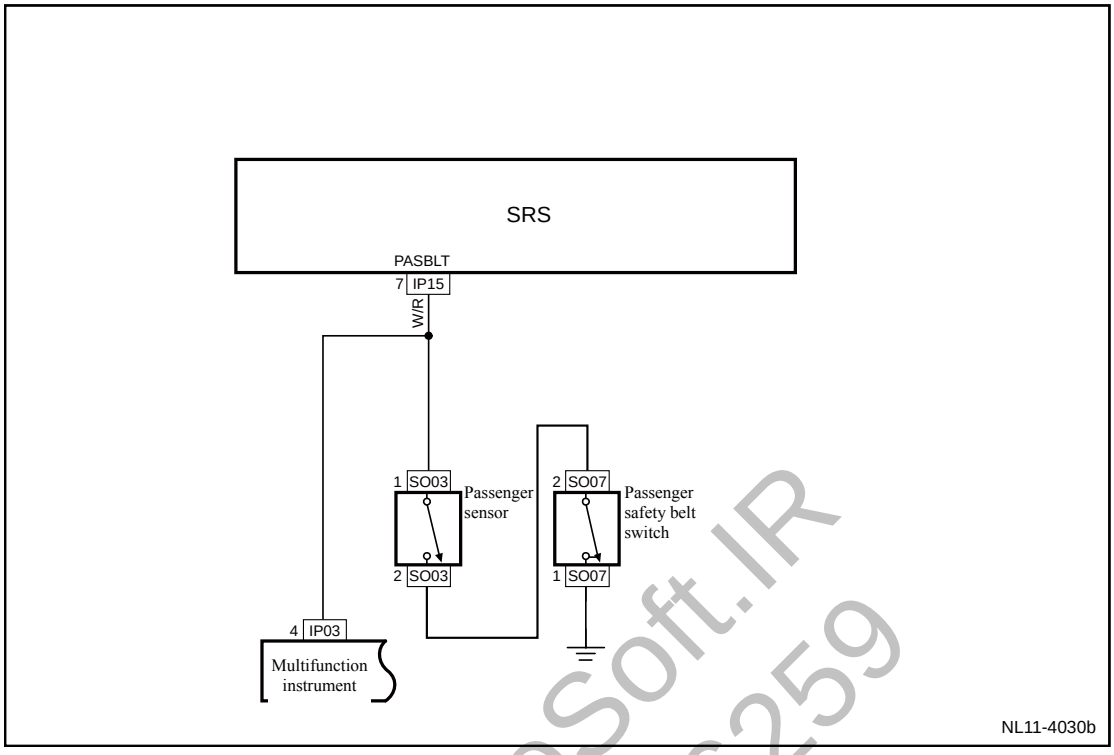
11.14.7.3 Unsecure warning lamp for passenger side safety belt is always "ON"

Circuit diagram:



Diagnostic steps:

1	Inspect the manned sensor.

(a) Disconnect manned sensor harness connector.

(b) Use multimeter to measure the connection situation of switch.

Test Terminal	Conditions	Specified Value
S013(1)--S013(2)	Passenger Side Not Occupied	Less than 1 Ω
S013(1)--S013(2)	Passenger Side Occupied	10 kΩ or higher

Confirm whether the resistance is at a specified value.

Yes	Go to step 3
No	

2	Replace the manned sensor.

(a) Refer to 9.2.7.10 Replacement of passenger detection sensor.

Confirm whether the alarm lamp displays normally if the multifunctional instrument passenger-side safety belt is not worn.

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Yes → The system is normal.

No

3	Inspect the passenger-side safety belt switch.

(a) Disconnect wire harness connector SO07 of passenger's side safety belt.

(b) Use multimeter to measure resistance between passenger's side safety belt wire harness connector SO07 terminal No. 1 and No.2.

Test Terminal	Conditions	Specified Value
S007(1)--S007(2)	Insert safety belt	Less than 1 Ω
S007(1)--S007(2)	Remove the safety belt.	10 kΩ or higher

Yes → Go to step 5

No

4	Replace passenger-side safety belt buckle assembly.

(a) Replace passenger side safety belt buckle assembly.

Confirm whether the alarm lamp displays normally if the multifunctional instrument passenger-side safety belt is not worn.

Yes → The system is normal.

No

5	Inspect the circuit.

(a) Closed ignition switch to OFF

(b) Disconnect multi-functional instrument wire harness connector IP03.

(c) Use multimeter to measure test circuit.

Test Terminal	**Conditions**	**Specified Value**
IP03(4)——effective grounding	Passenger Side Not Occupied and Seat Belt Not Fastened	Less than 1 Ω
IP03(4)——effective grounding	Passenger Side Not Occupied and Seat Belt Fastened	10 kΩ or higher

Confirm if the resistance conforms to standard value.

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Yes → Go to step 7

No

6	Repair the circuit.

(a) Inspect and repair circuit fault points.

Confirm whether the alarm lamp displays normally if the multifunctional instrument passenger-side safety belt is not worn.

Yes → The system is normal.

No

7	Inspect the multifunctional instrument power and ground lines.

(a) Refer to the diagnosis

Confirm whether the alarm lamp displays normally if the multifunctional instrument passenger-side safety belt is not worn.

Yes → The system is normal.

No

8	Replace function instrument

(a) Refer to 11.13.8.1 Replacement of multi-functional instrument.

Confirm the completion of repair.

Next

9	The system is normal.

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11.14.8 Removal and installation

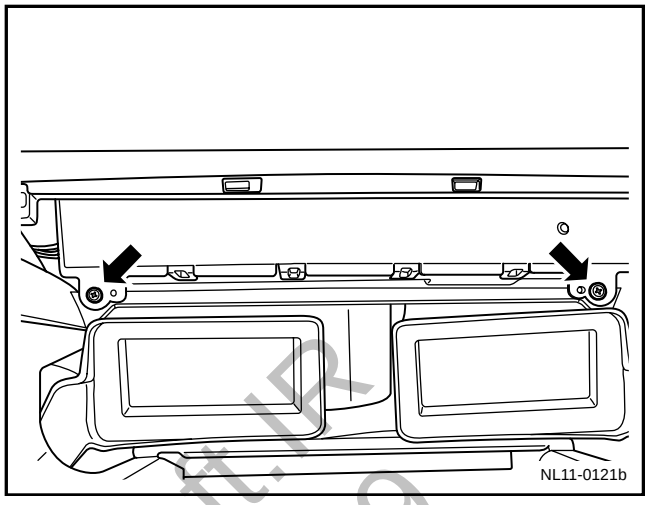
11.14.8.1 Multi-function instrument replacement

Dismantlement procedure

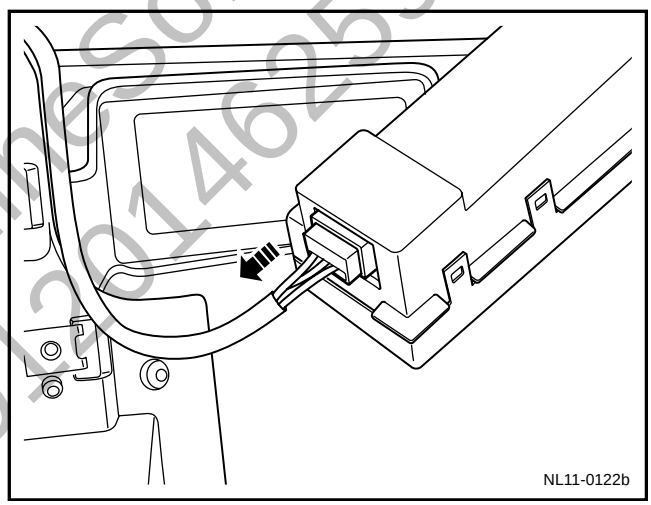
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. For dismantling of central vent port, refer to 8.2.8.18 Replacement of vent port of instrument panel.

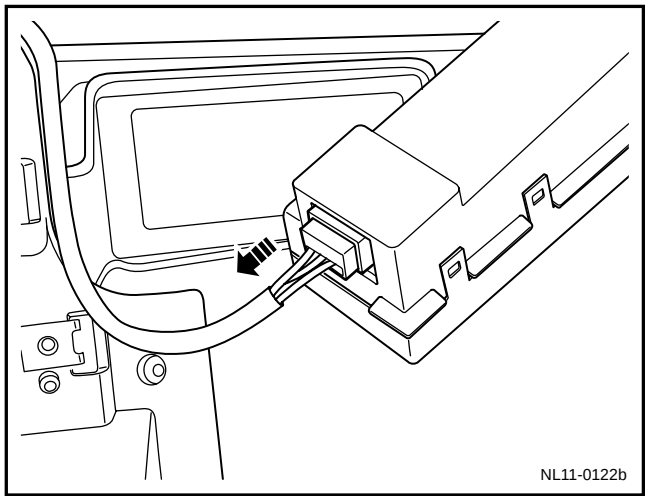


3. Dismantle fixing screw of multi-functional instrument.
4. Disconnect multi-functional instrument wire harness connector.



Installation procedure:

1. Connect to multi-function instrument harness connector



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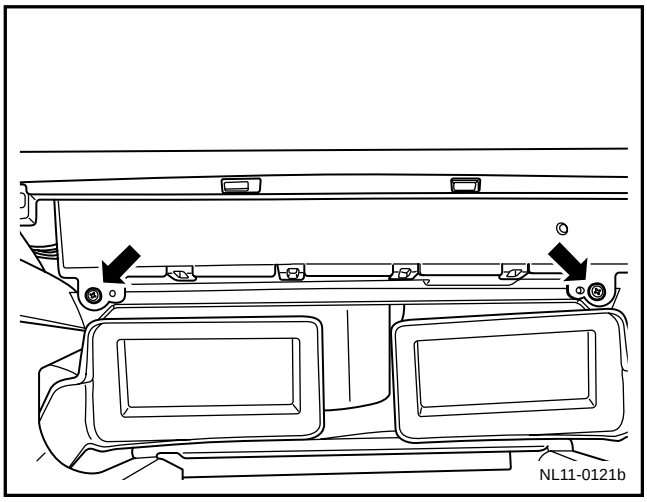
2. Install and tighten fixing screw of multi-functional instrument.

   Torque :4Nm(Metric)
   3lb-ft(English system)

3. Install center outlet port.

4. Connect the battery negative cable.



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11.15 Cigarette lighter

11.15.1 Specifications

11.15.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N·m)	English system (lb-ft)
Fasten screw of central trim plate	ST4 . 2×16	5-7	3-5

11.15.2 Description and operation

11.15.2.1 Description and operation

This vehicle is equipped with a backup power outlet in addition to a cigarette lighter. The cigarette lighter is installed behind the shift lever and the backup power outlet is installed in front of teh ashtray.

The power supply of the cigarette lighter and the standby power socket is from ACC power supply. An illuminating lamp is further arranged on a cigarette lighter race, which is convenient to use at night.

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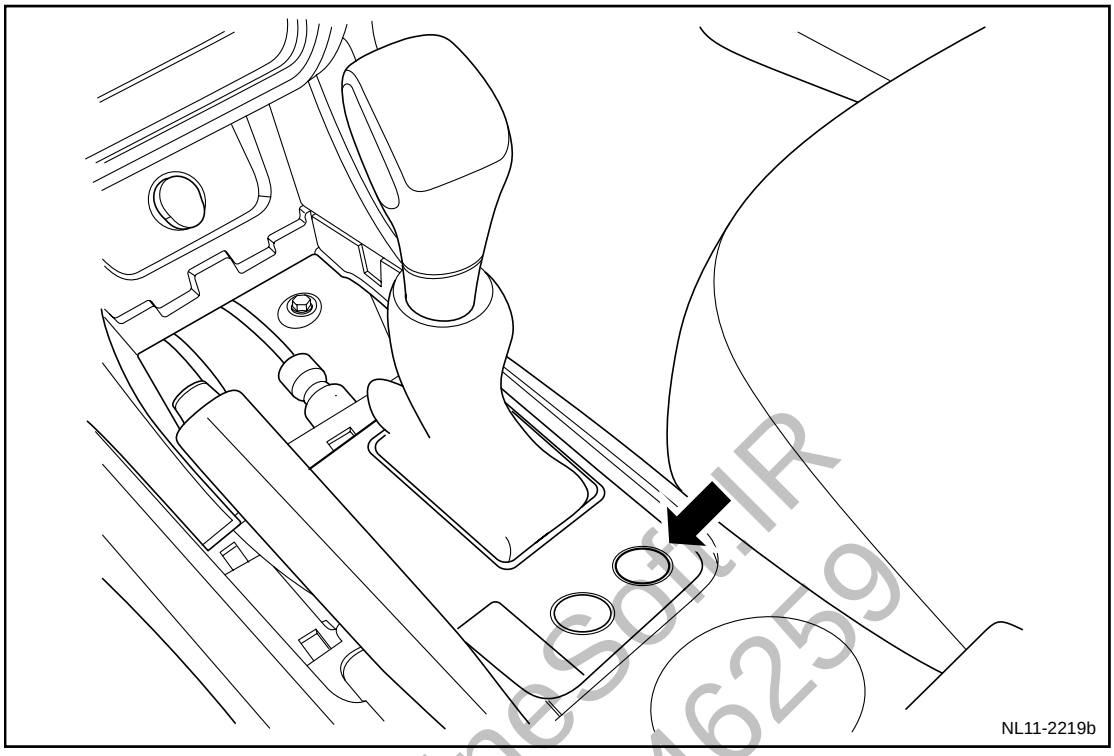
11.15.3 Component position

11.15.3.1 Component position

Cigarette Lighter



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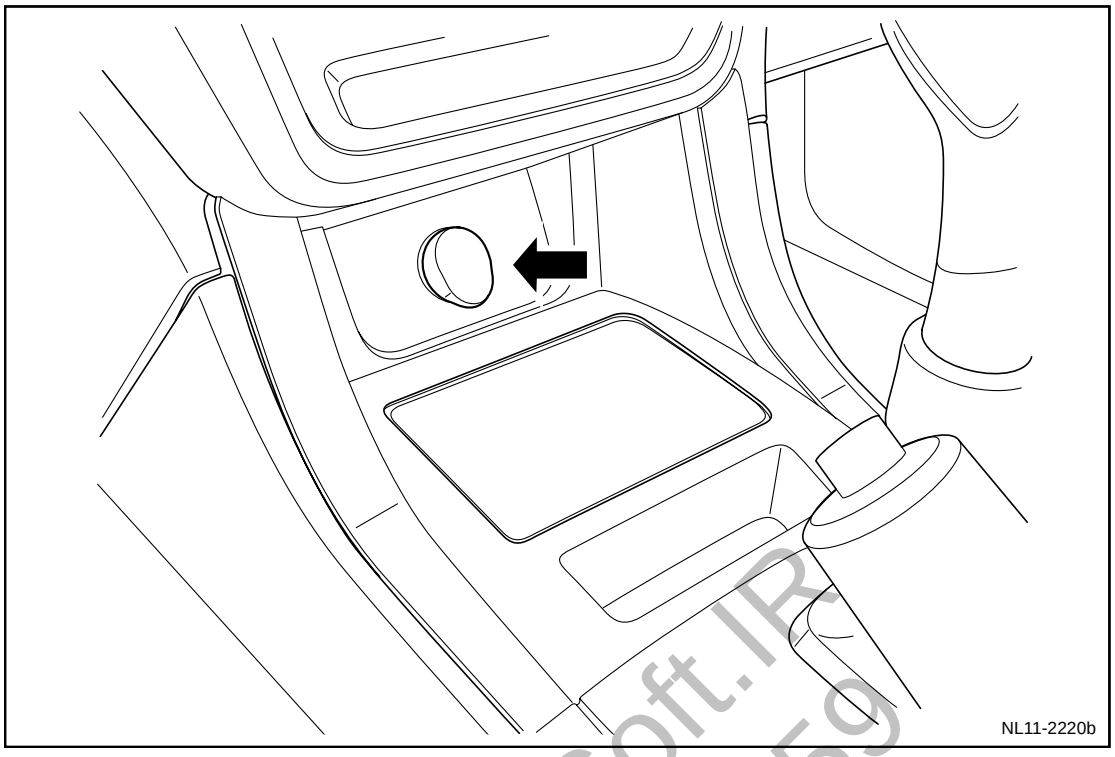
Standby power supply



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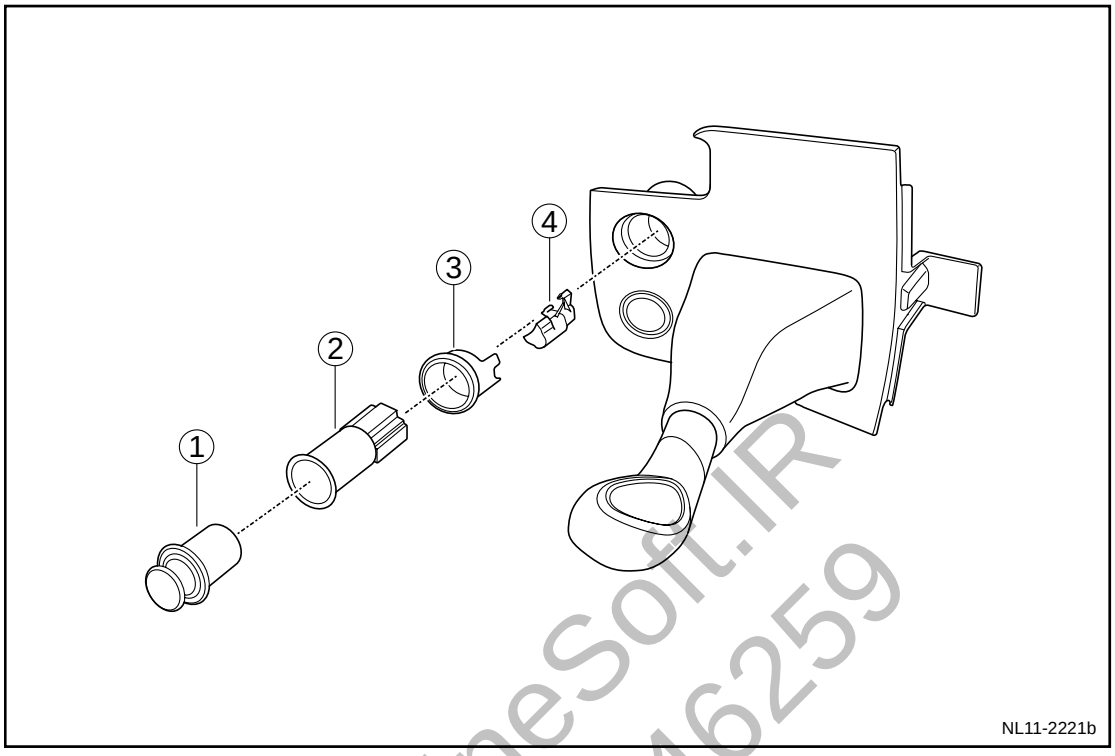
11.15.4 Disassemble drawings

11.15.4.1 Disassemble drawings

Cigarette Lighter



1. Cigarette lighter
2. Cigar lighter jack.
3. Fixing sleeve of cigar lighter.
4. Background lamp.

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11.15.5 Diagnostic information and procedures

11.15.5.1 Diagnosis descriptions

Refer to 11.15.2 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.15.5.2 Visual inspection

– I inspect the after-sales optional device which may affect the normal operation of cigar lighter and standby power supply outlet.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– I If both the cigar lighter and standby power supply outlet don't work, it is necessary to inspect and repair ACC power supply or bad grounding connection or short-circuit faults before diagnosing fault.

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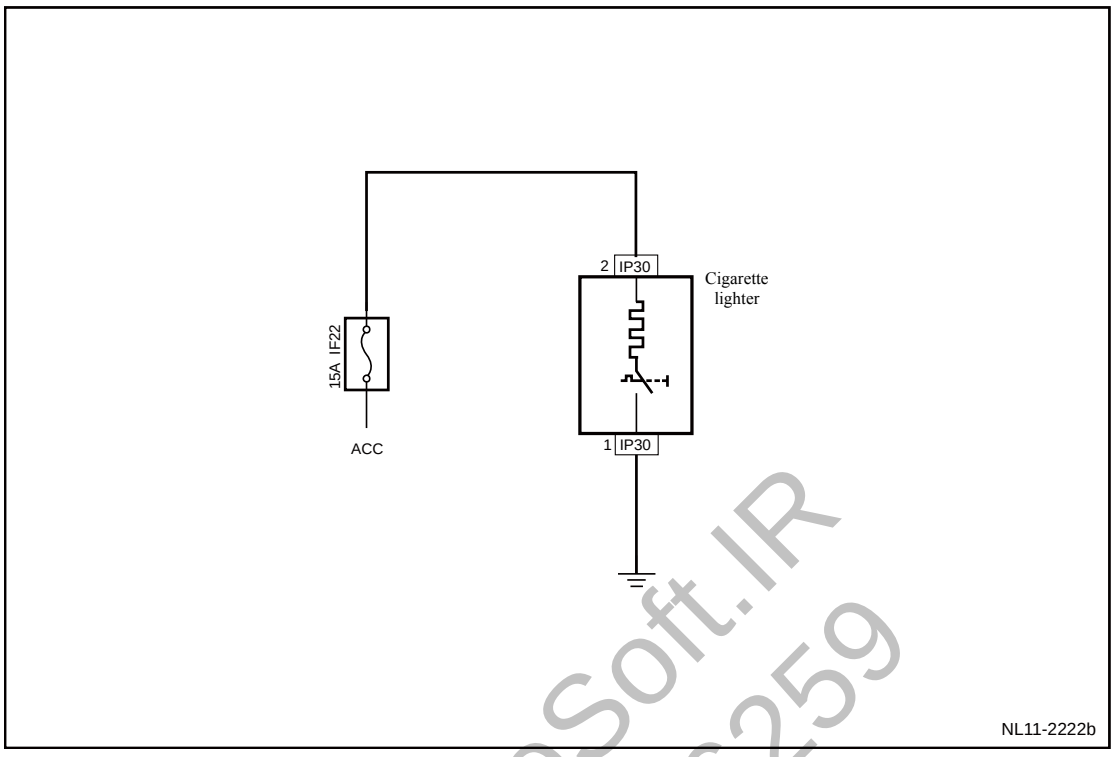
11.15.5.3 Cigarette lighter can not be work

Circuit diagram:



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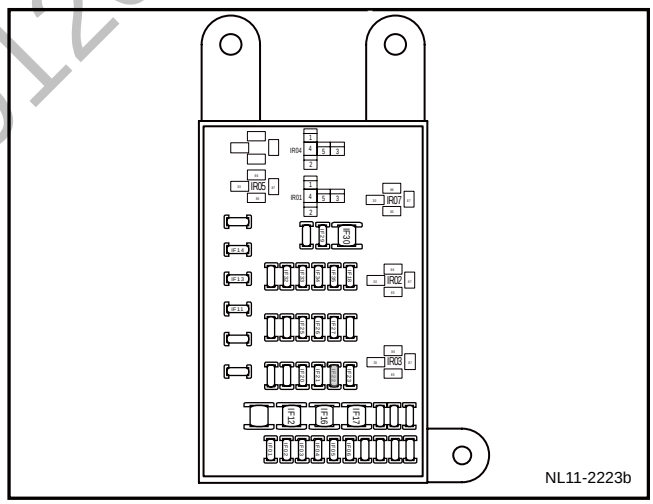
Diagnostic steps:

1	Check fuseIF22

(a) Check fuse IF22 was blown

Rated Current of Fuse: 15A.



No — Go to step 3

Yes

2	Check the fuse IF26 circuit.

(a) Inspect for short circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the cigarette lighter works normally.

Yes	The system is normal.
No	

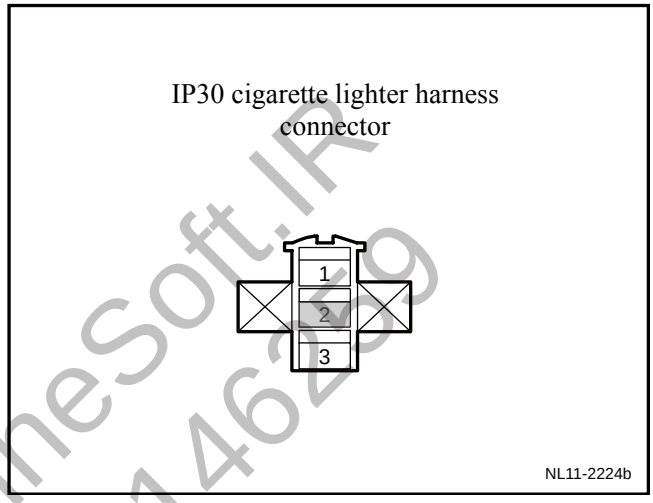
3	Check cigarette lighter power supply circuit.

(a) Make ignition switch turn to ACC gear.

(b) Meanwhile, use multimeter to measure voltage of cigar lighter wire harness connector IP30 terminal No. 2.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes	Go to step 5
No	

4	Repair the open circuit fault of the cigarette lighter supply circuit.

(a) Repair short-circuit fault between cigar lighter wire harness connector IP30 terminal No. 2 and fuse IF15.

Confirm whether the cigarette lighter works normally.

Yes	The system is normal.
No	

5	Check cigarette lighter grounding circuit.

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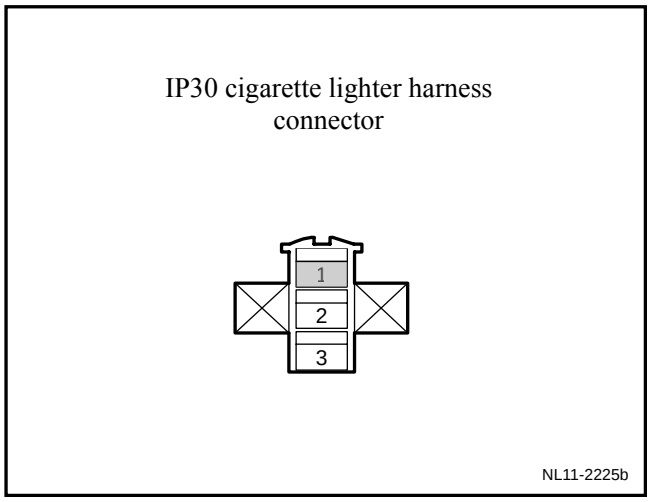
(a) Disconnect cigar lighter wire harness connector.

(b) Meanwhile, use multimeter to measure resistance between cigar lighter wire harness connector IP30 terminals No. 1 and grounding circuit.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 7

No

6	Repair the open circuit fault of the cigarette lighter grounded circuit.

(a) Repair short-circuits fault between cigar lighter wire harness connector IP30 terminal No. 1 and grounding.

Confirm whether the cigarette lighter works normally.

Yes → The system is normal.

No

7	Replace cigarette lighter

A. Replace cigarette lighter, refer to“11.14.6.1 cigarette lighter replacement ”

Confirm the completion of repair.

Next

8	The system is normal.

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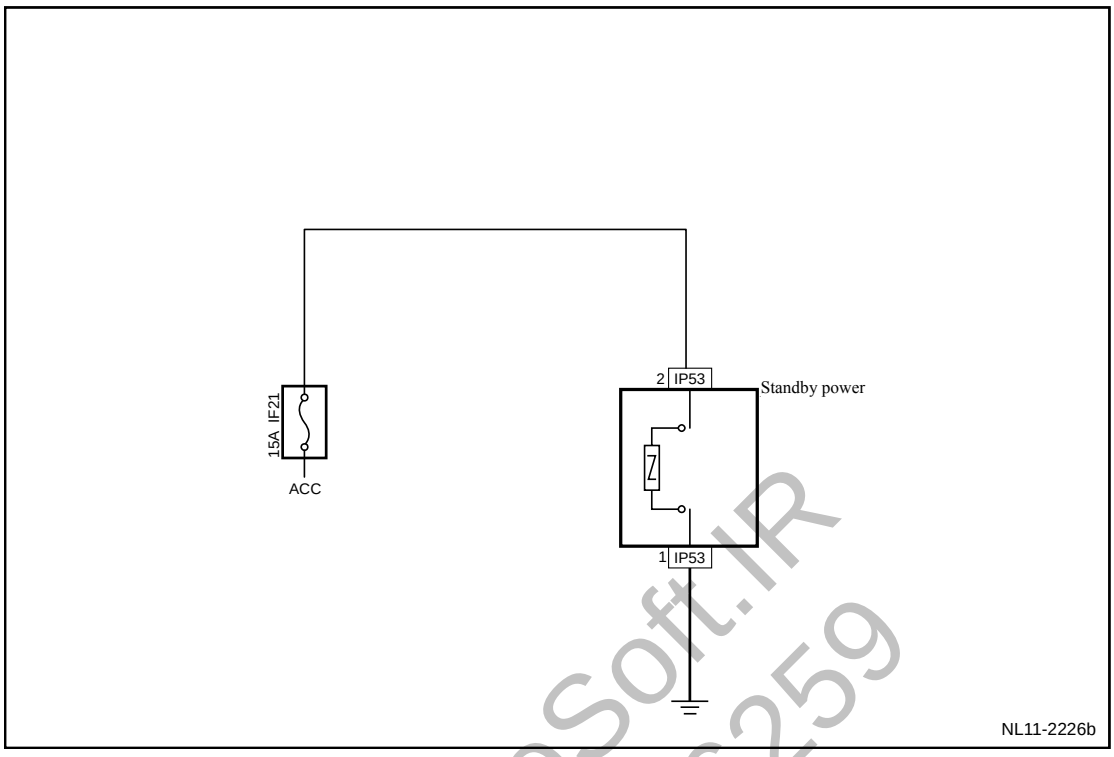
11.15.5.4 Standby power supply socket can not be work

Circuit diagram:



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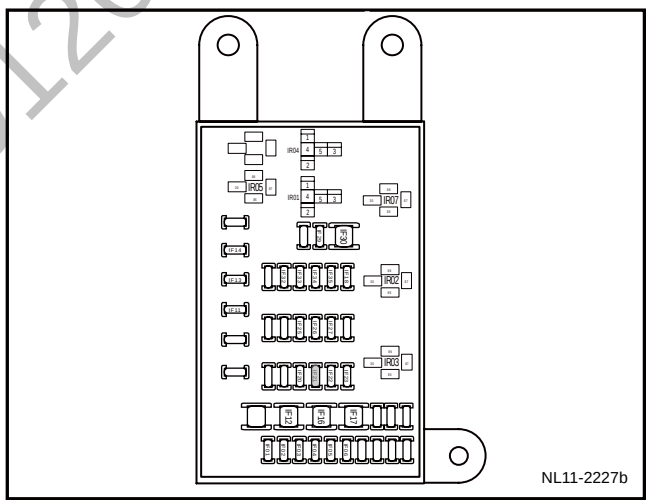
Diagnostic steps:

1	Check fuses IF21.

(a) Check fuse IF21was blown

Rated Current of Fuse: 15A.



Yes — Go to step 3

No

2	Inspect the fuse IF21 circuit.

(a) Inspect for short circuit.

(b) Repair the circuits. Confirm that there are no short circuits.

(c) Replace the fuses with rated current.

Confirm whether the standby power socket works normally.

Yes	The system is normal.
No	

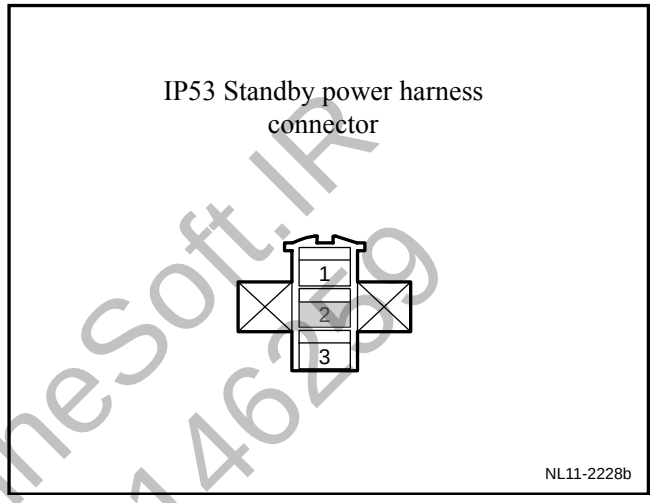
3	Inspect the standby power socket power circuit.

(a) Make ignition switch turn to ACC gear.

(b) Meanwhile, use multimeter to measure voltage of power supply outlet wire harness connector IP53 terminal No. 2.

Standard voltage: 11-14 V

Confirm if the voltage conforms to standard value.



Yes	Go to step 5
No	

4	Repair the open circuit fault of the emergency power supply socket supply circuit.

(a) Repair short-circuit faults occurred between standby power supply outlet wire harness connector IP53 terminal No. 2 and fuse IF21.

Confirm whether the standby power socket works normally.

Yes	The system is normal.
No	

5	Inspect the standby power socket grounding circuit.

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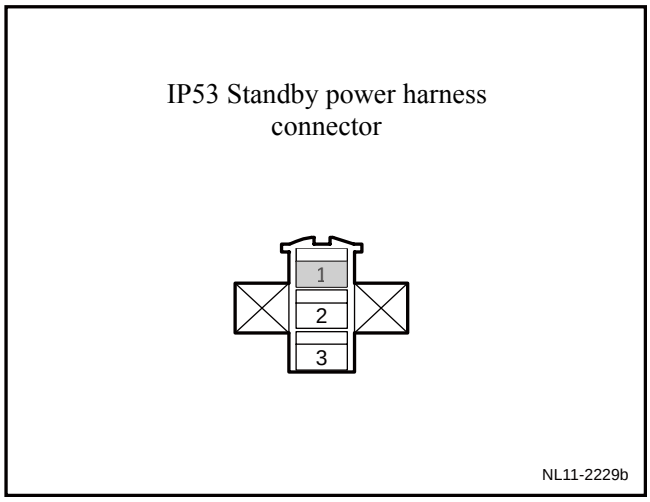
(a) Disconnect wire harness connector of standby power supply outlet.

(b) Meanwhile, use multimeter to measure resistance between standby power supply outlet wire harness connector IP53 terminals No. 1 and grounding circuit.

Standard resistance: less than 1 Ω

Is the resistance at a specified value?



Yes → Go to step 7

No

6	Repair the open circuit fault of the emergency power supply socket grounding circuit.

A. Repair the fault point of the open circuit between the terminal No. 1 of the emergency power supply socket wire harness connector IP53 and the grounded circuit.

Confirm whether the standby power socket works normally.

Yes → The system is normal.

No

7	Replace the standby power socket.

A. Refer to 11.14.6.2 "Replacement of Standby Power Supply" to replace the standby power socket.

Confirm the completion of repair.

Next

8	The system is normal.

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11.15.6 Removal and installation

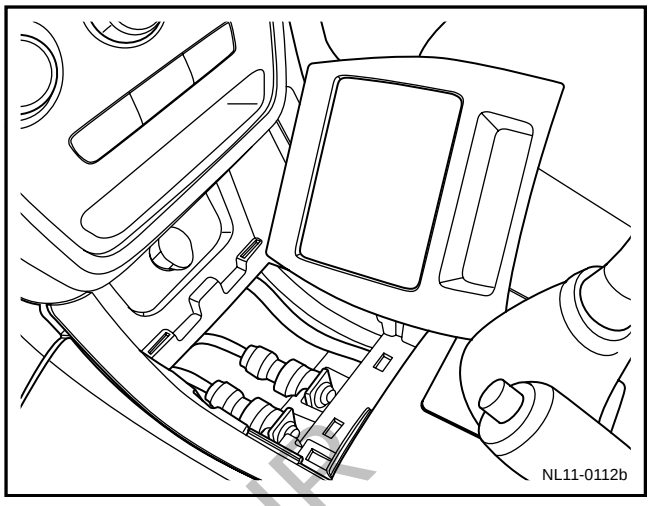
11.15.6.1 Cigarette lighter replacement

Dismantlement procedure

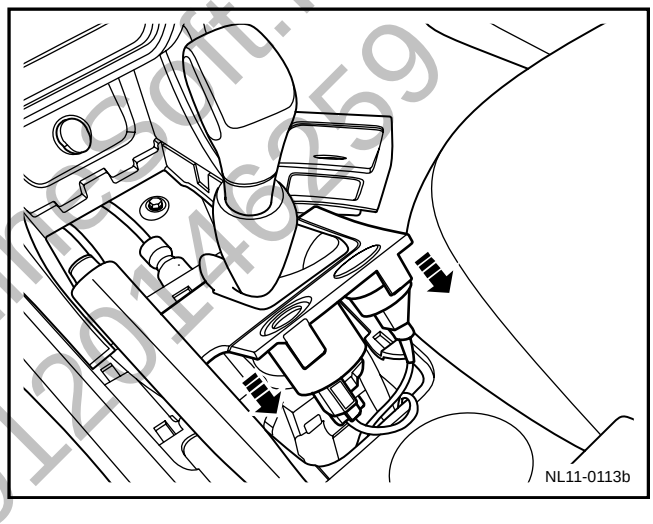
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

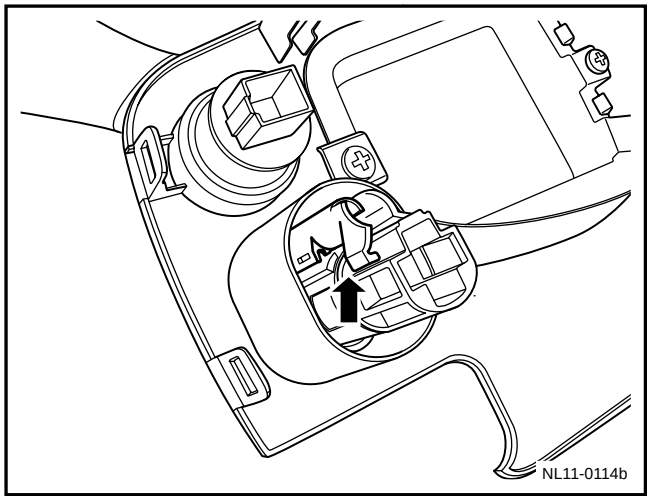
1. Dismantle battery negative cable , refer to 2.11.8.1 Disconnect connecting process of battery cable
2. Dismantle front ashtray panel of auxiliary instrument panel.



3. Separate gearshifting handle assembly from auxiliary instrument panel.
4. Disconnect the harness connector between the cigarette lighter and locking switch.
5. Loosen the shift lever ball and remove the shift lever.



6. Detach the clamp from the cigarette lighter.



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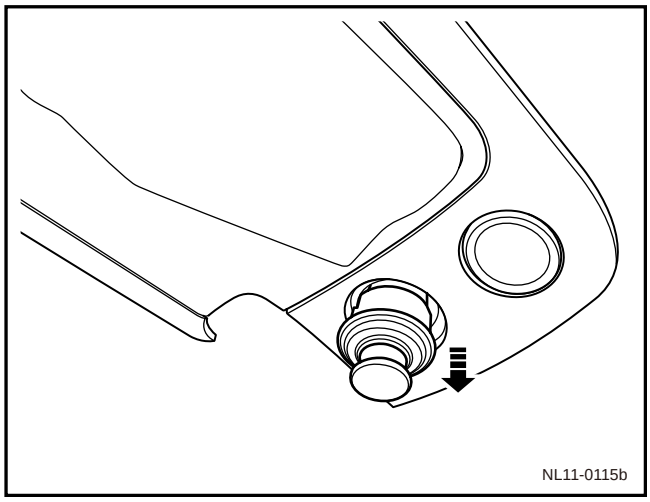
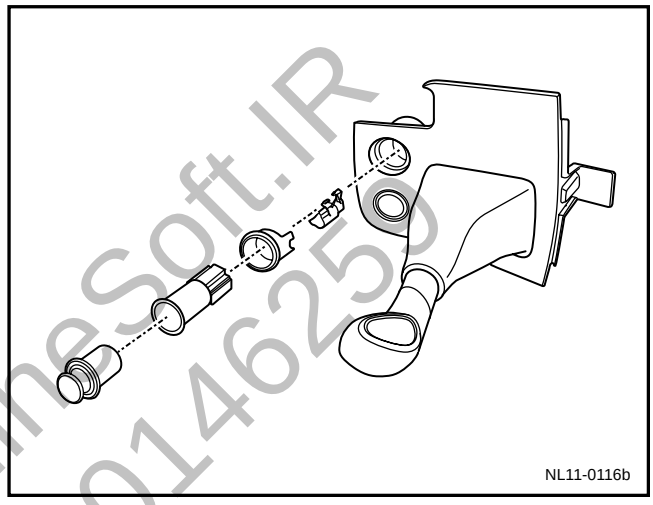
7. Dismantle the cigarette lighter.

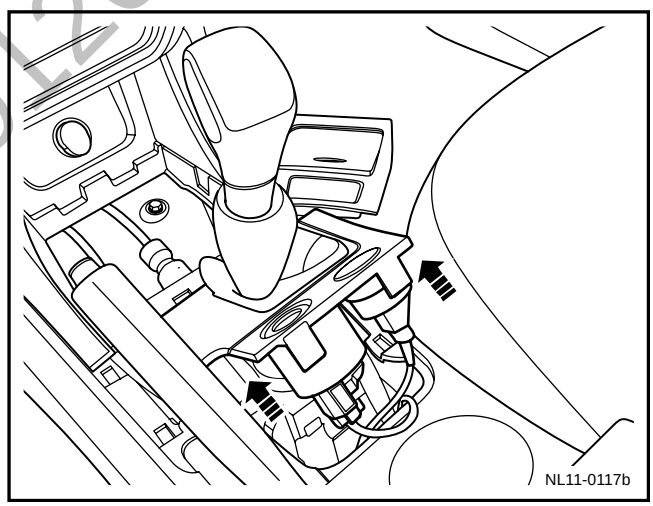


Installation procedure:

1. Install cigar lighter.



2. Tighten gearshifting rod ball head.
3. Connect cigar lighter and lock switch wire harness connector.
4. Install gearshifting handle assembly.



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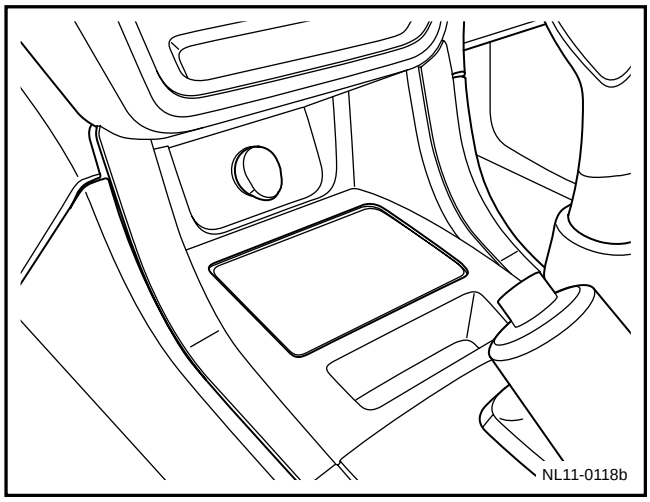
5. Install front ashtray panel of auxiliary instrument
6. Connect the battery negative cable.



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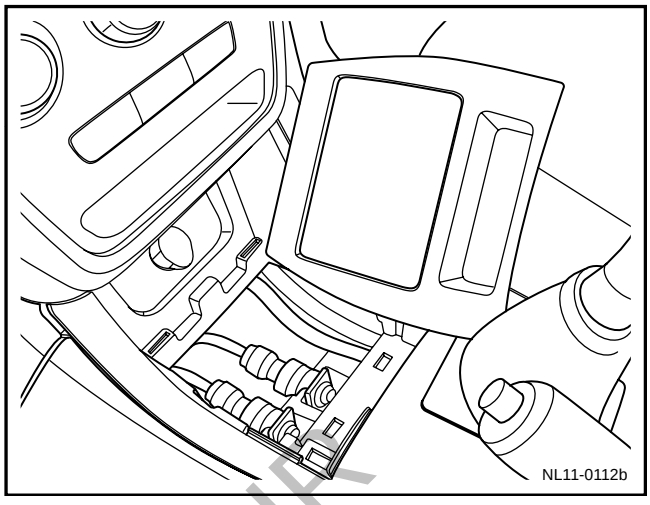
11.15.6.2 Standby power supply replacement

Dismantlement procedure

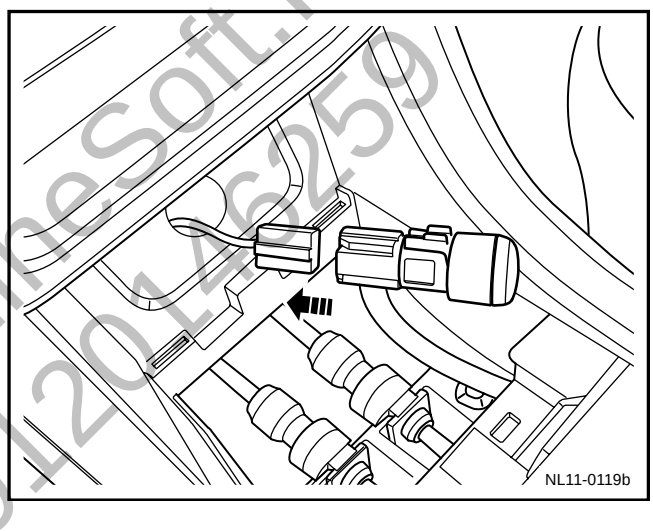
Warning!

Warning: refer to warning on battery disconnection in warnings and precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 battery cable disconnection/connection procedures.
2. Dismantle ashtray panel of auxiliary instrument table.

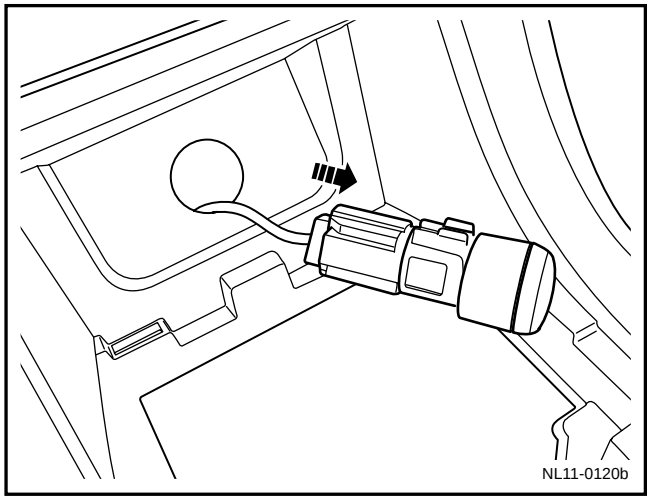


3. Push out standby power supply from inside section.
4. Disconnect standby power supply wire harness connector.
5. Remove the backup power supply.



Installation procedure:

1. Connect the backup power supply harness connector.



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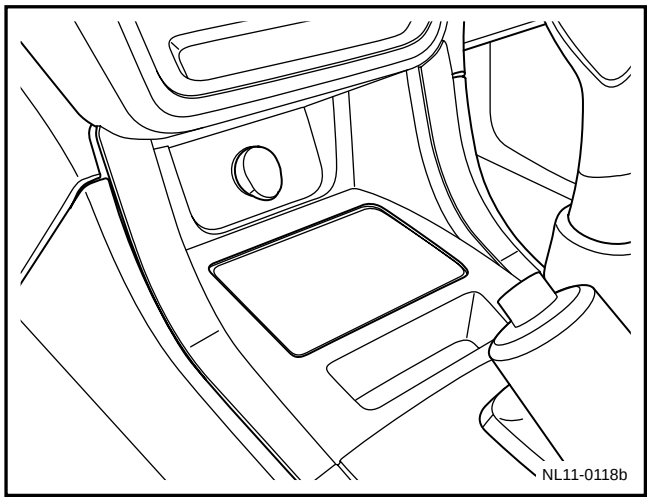
2. Install standby power supply.
3. Install auxiliary instrument panel ashtray panel.
4. Connect the battery negative cable.



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11.16 Data communication system

11.16.1 Specifications

11.16.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N·m)	English system (lb-ft)
Fixing Bolts of ECM	M6×16	8-10	6-8
Fixing Bolts of ABS	M8×20	15-21	11.1-15.5
ACU Braket Retaining nuts	M6×20	8-10	6-8
BCM Bracket Retaining nuts	M6×16	8	6
Instrument Assembly Self-Tapping Screws	ST4 . 8×16	4-6	3-4.4
Fixing bolt of air-conditioning head unit assembly	M6×12	6-7	4.4-5.2
Fixing nut of air-conditioning head unit assembly	M6	6-7	4.4-5.2
IMMO support fixing bolt	M6×16	7-9	5.2-6.7

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11.16.2 Description and operation

11.16.2.1 System work principle (without CAN)

Overview

This vehicle uses three types of data communication:

– K-LINE

– LIN

LIN Bus Description

– LIN is a new type of low-cost serial communication system used for automotive distributed electronic control system, mainly applied for the serial communication of intelligence sensors and actuators.

– LIN bus features:

Contrastive rhetoric and discourse is base on the UART data format

Single wire transmission: 0-12 V

Communication speed: 19.2 kbps

K Bus Description

– K bus is for the diagnostic communication between the vehicle-mounted ECM and the external test equipment. Transfer rate is 10.47 kbps. Voltage is switched between 0 V and 12 V: 12 V, logic "1"; 0 V, logic "0".

Datalink connector description

Datalink connector (DLC) is the result of consultation and regulations between the international automotive manufacturers. The connector must be used when using a fault diagnosis tester to communicate with the vehicle and make a program for all vehicle communication systems.

The connector must meet the following conditions:

– It can connect the 16-pin connector of all fault diagnosis testers.

– Always use No.16-pin to provide power of battery for the fault diagnosis tester.

– Always use No.4-pin to provide earthing point for the fault diagnosis tester.

– The rest pins are designed for vehicle serial data communications. The modules controlled by a microprocessor of the vehicle communicate with each other and between the fault diagnosis testers by the serial data circuit.

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11.16.2.2 System work principle (with CAN)

Overview

This vehicle uses three types of data communication:

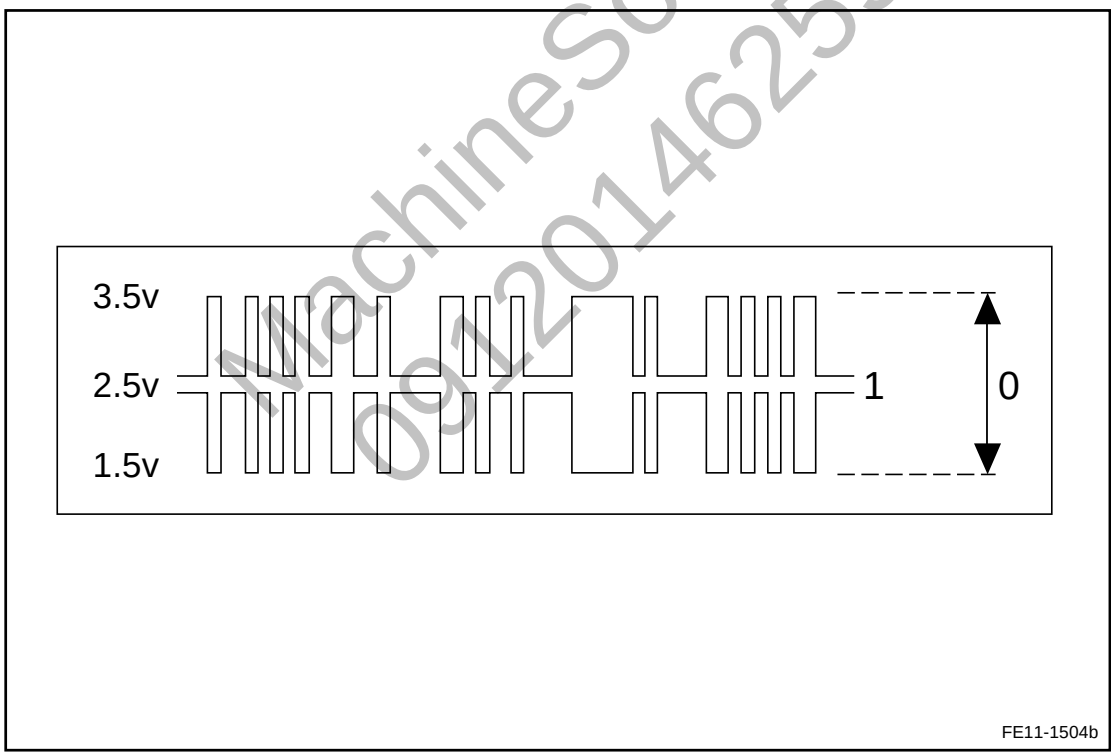
– CAN

– K-LINE

– LIN

CAN Bus Description

– CAN is the acronym for Controller Area Network, standing for Controller Area Network bus, meaning that the control devices are connected to each other to exchange data. CAN bus communication medium is a twisted-pair, in which the communication speed of high-speed CAN bus is 500 kbps. Twisted-pair terminals are two 120 Ω resistors, one end is in the engine control module (ECM), the other side is in the body control module (BCM). High-speed CAN bus is a differential bus. High-speed CAN bus serial data bus (H) and high-speed CAN bus serial data bus (L) are driven from a stationary or idle-level to the opposite limit. About 2.5 V idle levels is considered to be recessive transmission of data and interpreted as logic 1. When the circuit is driven to the limit, high- speed CAN bus serial data bus (H) would increase by 1V and the high-speed CAN bus serial data bus (L) will reduce by 1 V. Limiting voltage difference 2 V is considered to be dominant transmission of data and is interpreted as logic 0 (as shown by the following diagram).



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– If the communication signal is lost, the program will target the control module settings losing communication fault diagnosis codes. The fault diagnosis codes can be read by a fault diagnosis tester.

Notes:

Serial data loosing the fault diagnosis codes does not mean that the module which sets the fault diagnosis codes is out of order.

– The advantages of CAN bus:

1. Reduce the number of sensors and signal conducting wires.
2. Reduce the number of conducting wires in wiring harness.
3. Greatly reduce the weight of the conducting wiring harness.
4. Smaller quantity of pins in control devices.
5. Improve the reliability and durability.

– In this vehicle, high-speed CAN bus allows the communications between BCM, ECM, ABS, ACU, IP Cluster and DLC.

LIN Bus Description

– LIN is a new type of low-cost serial communication system used for automotive distributed electronic control system, mainly applied for the serial communication of intelligence sensors and actuators.

– LIN bus features:

Based on UART data format

Single-master multi-slave structure

Single wire transmission: 0-12 V

Communication speed: 19.2 kbps

K Bus Description

– K bus is for the diagnostic communication between the vehicle-mounted ECM and the external test equipment. Transfer rate is 10.47 kbps. Voltage is switched between 0 V and 12 V: 12 V, logic "1"; 0 V, logic "0".

Datalink connector description

Datalink connector (DLC) is the result of consultation and regulations between the international automotive manufacturers. The connector must be used when using a fault diagnosis tester to communicate with the vehicle and make a program for all vehicle communication systems.

The connector must meet the following conditions:

– It can connect the 16-pin connector of all fault diagnosis testers.

– Always use No.16-pin to provide power of battery for the fault diagnosis tester.

– Always use No.4-pin to provide earthing point for the fault diagnosis tester.

– The rest pins are designed for vehicle serial data communications. The modules controlled by a microprocessor of the vehicle communicate with each other and between the fault diagnosis testers by the serial data circuit.

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11.16.3 System operating principle

11.16.3.1 System work principle (without CAN)

Composition of Data Communication System

Use fault diagnosis tester to access the following control module data circuits:

– ECM

– ABS

– ACU

– BCM

LIN Bus Applications

LIN bus is arranged on the vehicle with electric window anti-trapping function for connecting the BCM and 4 window and door lifter, thereby realizing the remotely rising and Anti-clamp ing function of the power window. Refer to 11.5.2 Description and Operation of 11.5 Glass/Window/Rearview Mirror.

K Bus Applications

Carry out fault diagnosis on ECM, ABS, SRS and BCM of the vehicle through K line.

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11.16.3.2 System work principle (with CAN)

Composition of data communication zystem

Use fault diagnosis tester to access the following control module data circuits:

– ECM

– ABS

– IP Cluster

– IMMO

– ACU

– BCM

LIN bus applications

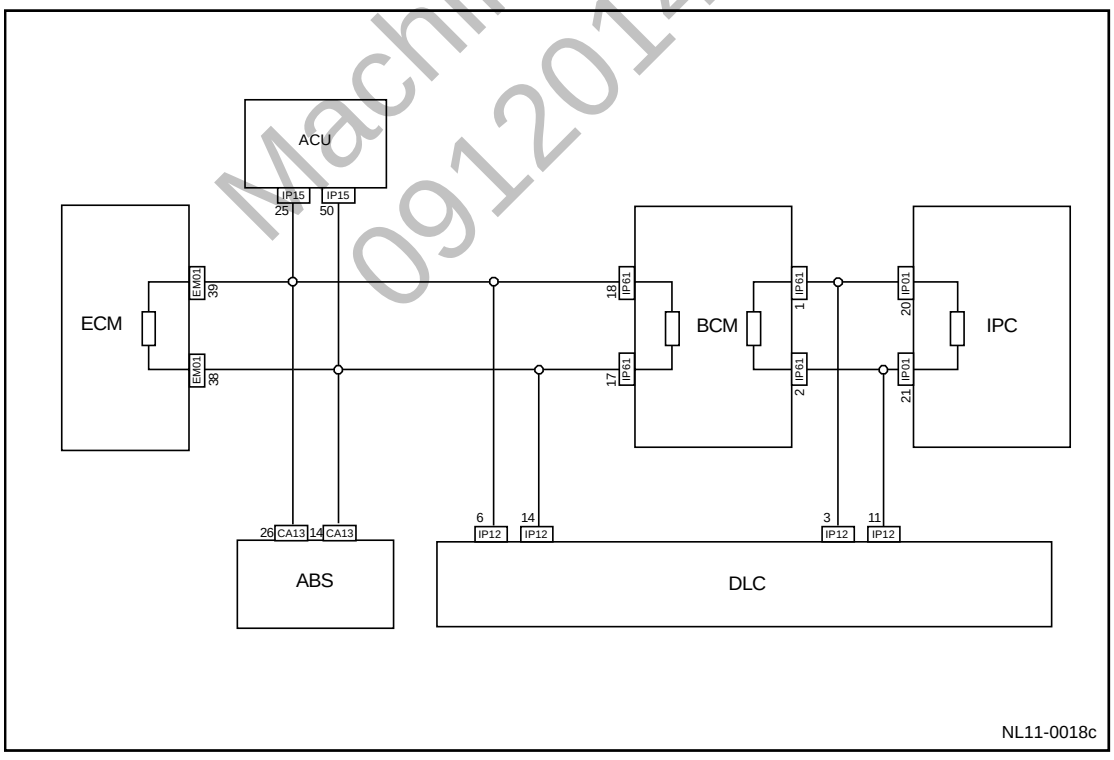
The vehicle with power window anti- pinch function is equipped with a LIN bus, connecting BCM and 4 window regulators to achieve the remote control and Anti-clamp function of power window, refer to 11.5.2.1 Description and Operation.

K Bus applications

This vehicle uses the K-bus to achieve the IMMO fault diagnosis.

CAN Bus applications

There are two high speed CAN bus network in this vehicle. The five modules including ABS, ACU, BCM, ECM, and IP Cluster are parallelly connected to the CAN bus to form a CAN bus network architecture. The terminal resistors are set inside the BCM, ECM and IP Cluster. Refer to figure below:



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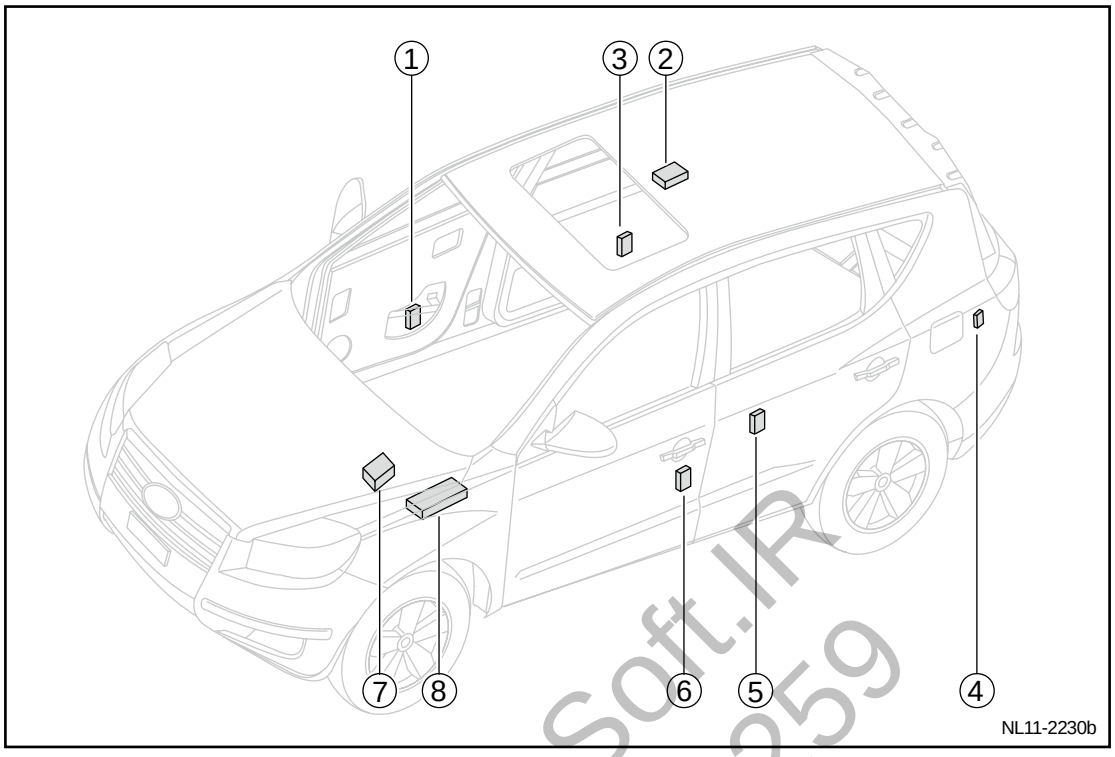
11.16.4 Component position

11.16.4.1 Module position



1. Right front window regulator motor with module assembly (anti-clamp)
2. Right rear window regulator motor with module assembly (anti-clamp)
3. Parking radar control module
4. Left rear window regulator motor with module assembly (anti-clamp)
5. Left front window regulator motor with module assembly (anti-clamp)
6. ABS control module
7. Underhood Relay Fuse Block

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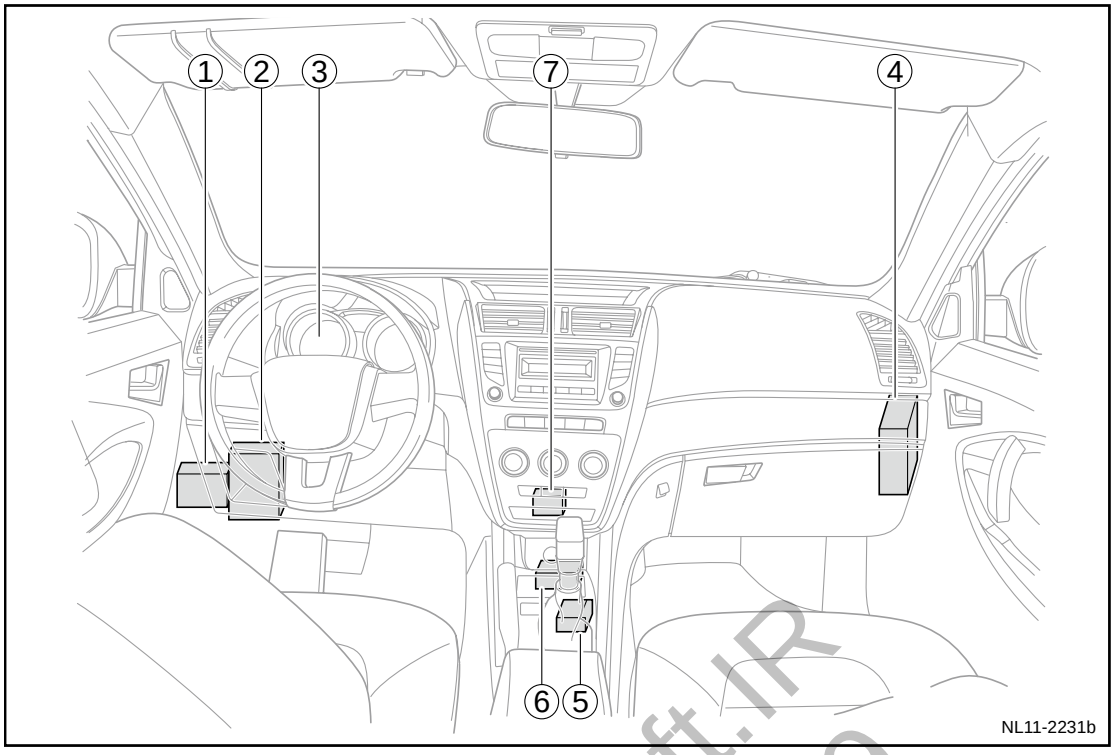

1. Interior fuse relay block
2. Body control module
3. Combination instrument
4. Engine control module
5. Airbag control module
6. Engine anti-theft control module

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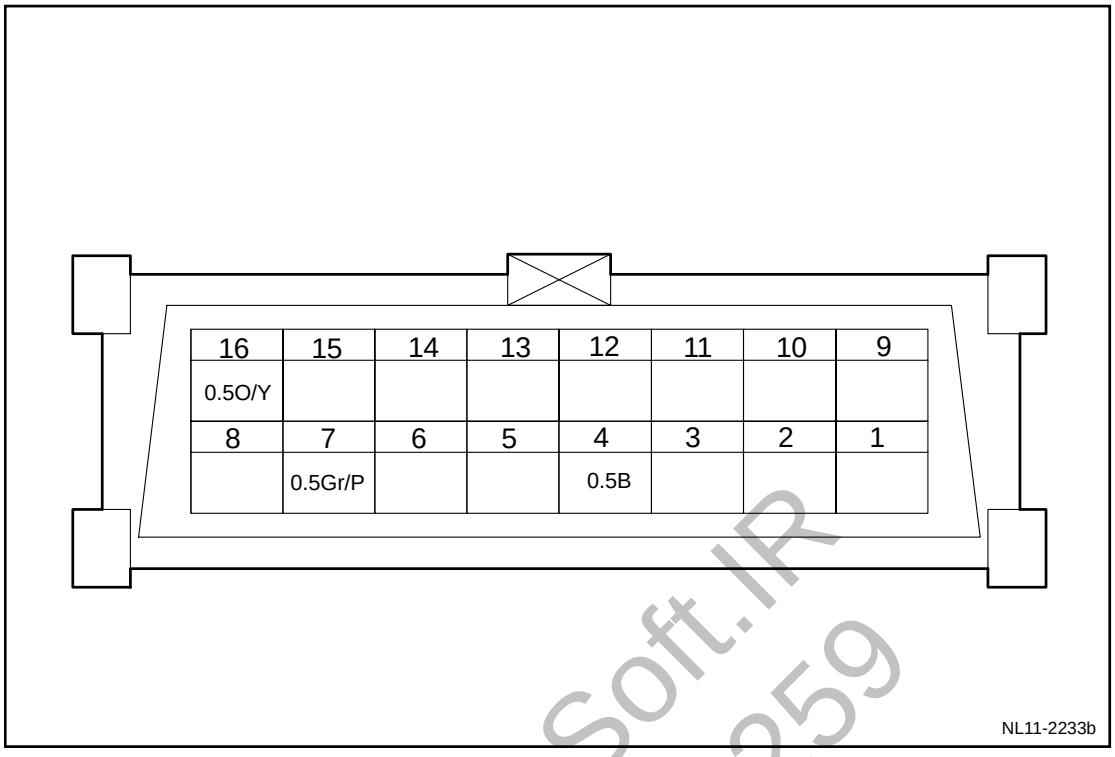
11.16.5 Disassemble drawings

11.16.5.1 Trouble diagnostic communication link (without CAN)



1. PIN 4—ground
2. PIN 7—K-LINE
3. PIN 16—power supply

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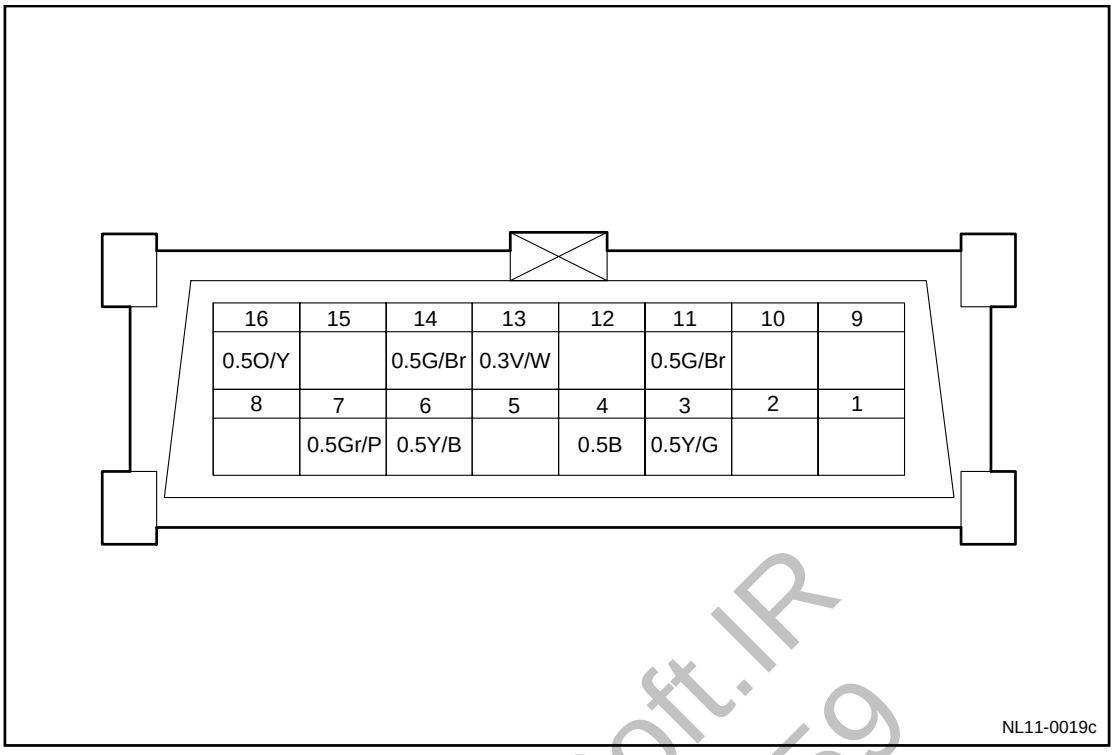
11.16.5.2 Trouble diagnostic communication link (with CAN)



1. PIN 3—CAN H2
2. PIN 4—ground
3. PIN 6—CAN H1
4. PIN 7—K-LINE
5. PIN 11—CAN L2
6. PIN 13—LIN
7. PIN 14—CAN L1
8. PIN 16—power supply

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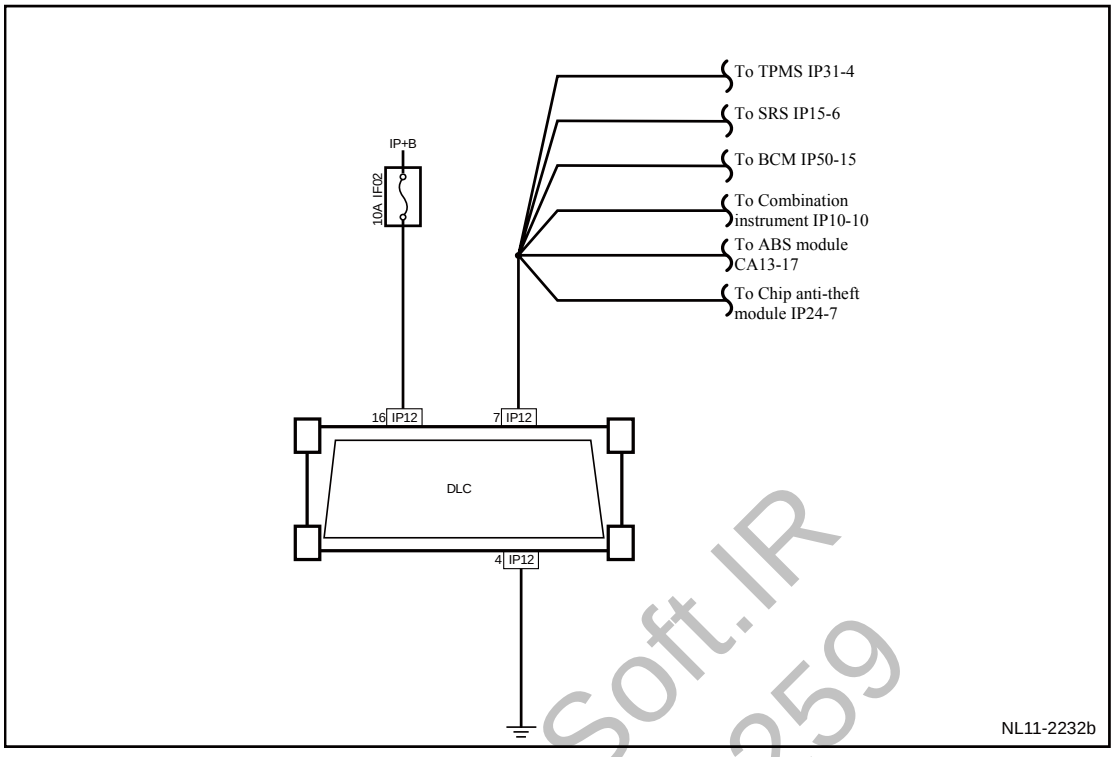
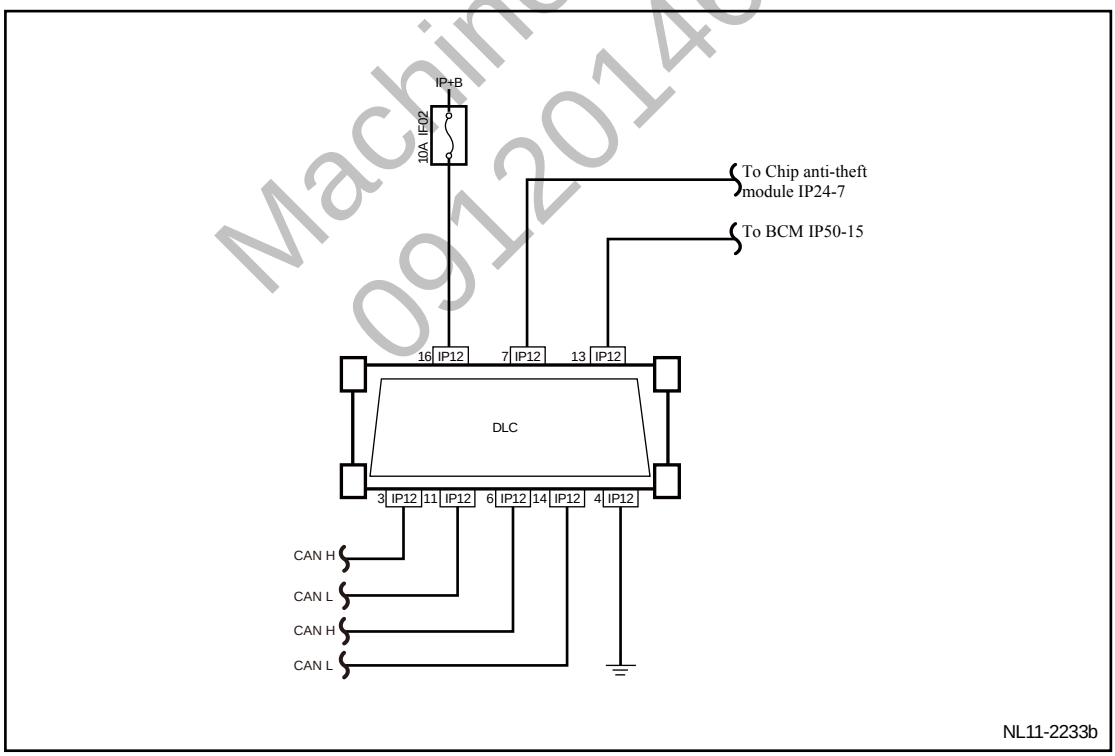
11.16.6 Electrical schematic diagram

11.16.6.1 Data communication principle diagram (without CAN)



11.16.6.2 Data communication principle diagram (with CAN)



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11.16.7 Diagnostic information and steps (without CAN)

11.16.7.1 Diagnosis descriptions

Refer to 11.16.2 Description and Operation, get familiar with the system functions and operation before starting system diagnosis, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer is normal.

11.16.7.2 Visual inspection

Inspect the after-sales optional device which may affect the normal operation of data communication system.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– If the data communication system has a fault, inspect whether all data communication system control module harness connectors have been correctly connected before repairing.

11.16.7.3 Fault symptom table

Symptoms	Probability and Cause	Measures
The diagnostic unit is connected with the DLC. The backlight of the diagnostic unit does not turn on and is unable to enter the main interface.	– Diagnostic unit – Wire harness and connector – Fuse	– Replace diagnostic apparatus – Repair circuit. – Replace fuse
The diagnostic unit is unable to be communicated with all controllers.	– Diagnostic unit – Wire harness and connector	– Replace diagnostic apparatus – Repair circuit.
The diagnostic unit is unable to be communicated with the ECM.	– Wire harness and connector – Engine anti-theft system control module – ECM	– Repair circuit. – Replace engine anti-theft system control module – Replace ECM
The diagnostic unit is unable to be communicated with the ABS hydraulic electronic control unit.	– Wire harness and connector – ABS hydraulic electric control unit	– Repair circuit. – Replace ABS hydraulic electronic control unit
The diagnostic unit is unable to be communicated with the SRS control module.	– Wire harness and connector – SRS airbag control module	– Repair circuit. – Replace SRS (Supplementary Restraint System) control module
The diagnostic unit is unable to be communicated with the BCM.	– Wire harness and connector – BCM	– Repair circuit. – Replace BCM
The diagnostic unit is unable to be communicated with the engine anti-theft system control module.	– Wire harness and connector – Engine anti-theft system control module	– Repair circuit. – Replace engine anti-theft system control module

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11.16.8 Diagnostic information and step (with CAN)

11.16.8.1 Diagnosis descriptions

Refer to 6.4.2.1 System Working Principle to get familiar with the system functions and operations before starting the system diagnosis, so that it will facilitate the correct diagnostic steps, more importantly, it will also help to determine whether the situation described by the customer described is normal.

11.16.8.2 Visual inspection

Inspect the after-sales optional device which may affect the normal operation of data communication system.

– Inspect components easy to access system to identify whether there is a significant damage that may lead to the fault.

– If the data communication system has a fault, inspect whether all data communication system control module harness connectors have been correctly connected before repairing.

11.16.8.3 CAN bus fault prevention

– Do not stretch CAN bus wiring harness.

– Do not disassemble the CAN bus wiring harness by more than 4 cm (1.6 in).

– Do not connect CAN bus wiring harness with other conducting wires.

– Use the fault diagnosis tester recommended by the manufacturer to do the diagnosis.

11.16.8.4 CAN bus Integrity diagnosis

To check whether CAN bus is normal, perform the CAN bus integrity diagnosis to confirm whether the fault is caused because the physical circuit CAN bus is open. For specific operations. Please refer to 5.4.7.1 CAN Bus Network Integrity Checking.

11.16.8.5 CAN bus wiring harness repair specification

– CAN_H and CAN_L two lines must use articulated way.

– When CAN bus circuit fault occurs, the length of wire joints should not exceed L1: 50 mm (1.97 in).

– If the circuit is open at two or more places. The distance between the two places must be more than L2: 100 mm (3.94 in), then it is allowed to repair. Otherwise replace the CAN bus wiring harness.

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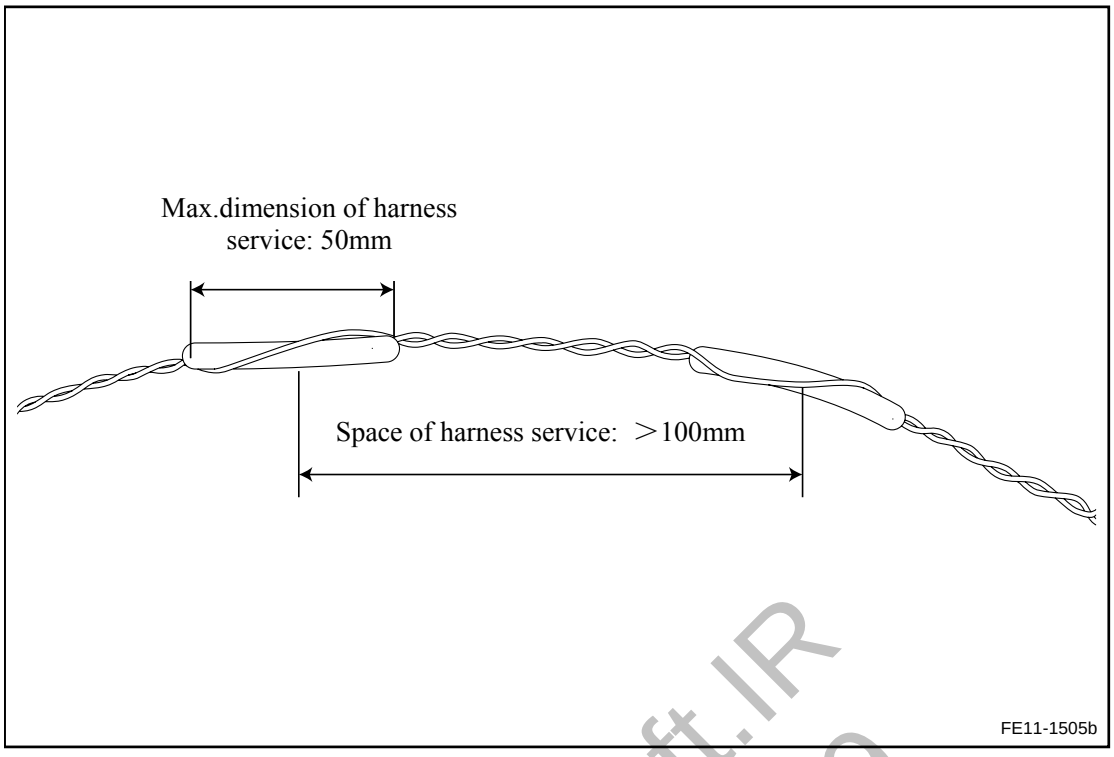

11.16.8.6 CAN bus signal diagnostic

The oscilloscope dual-channel input can be used to monitor the signal on the CAN bus. The signal should have the following features:

1. CAN_H bus voltage signal is 2.5-3.5 V, CAN_L bus voltage signal is 1.5-2.5 V.
2. Two signals mirror each other.
3. The signal transmission starts while the ignition switch is turned on, but stops 2 s after the ignition is switched off.

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11.16.9 Removal and installation

11.16.9.1 Fault diagnosis tester can not start up normally

The diagnostic step refers to 2.2.7.2 Inspection of Control System.

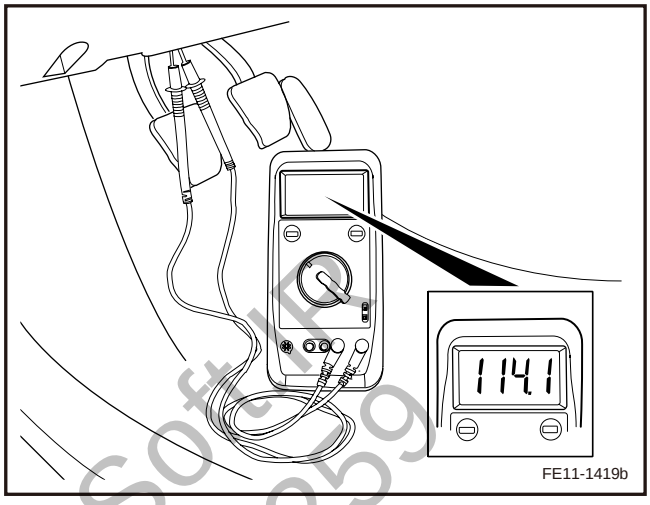
11.16.9.2 CAN bus network integrity inspection

1. Turn off ignition switch, and use ohmmeter to measure fault diagnosis interface PIN6 and PIN14.

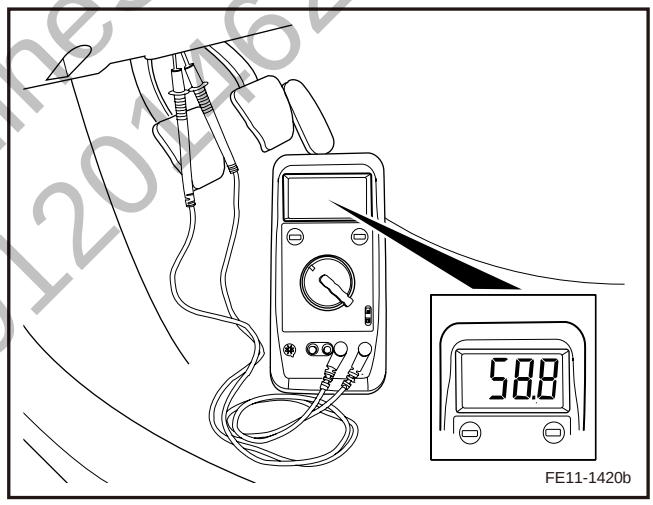
2. If the ohmmeter shows about 110-125 Ω resistance or non-conduction, the CAN bus is incomplete.

3. Inspect the ECM and the BCM harness connectors in order to confirm the CAN bus connection is normal. If there are undesirable situations such as open circuit or bad connection, carry out repairs.

Note: CAN bus repairs must follow the repair specification. Refer to 6.4.6.5 CAN Bus Wiring Harness Repair Specification.



4. If the ohmmeter shows that the resistance is about 55-63 Ω, it means the CAN bus from the BCM to ECM is complete.



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12.1 Warning and precaution

12.1.1 Warning and precaution

Warning for collision cutting

Warning!

Only cut in the recommended part. Failure to do so may compromise the structural integrity of the vehicle and cause personal injury if the vehicle is in a collision.

Warning for window crack

Warning!

If part of glass for vehicle window is cracked but still intact, crisscross the glass for vehicle window with masking tape in order to reduce the risk of damage or personal injury.

Glass and Sheet Metal Handling Warning

Warning!

When handling any types of glass or metal plate with sharp edges or burrs, please wear permissive safety goggles and gloves to reduce the personal injury risk.

Warning relating to safety goggles and compressed air

Warning!

Wear the safety goggles in the course of the use of the compressor air in order to avoid from damaging eyes.

Precautions of dismantling external logo

Notes:

Dismantle the brand plate/name plate with a plastic flat blade tool to avoid damaging the paint.

Important precaution on Machined Surface Damage

Notes:

Be sure not to carve, scratch or damage the sealing surface. The sealing surface is a machined surface. Damage to the machined surface can cause leakage.

Important precaution on Sealant

Notes:

Do not have the sealant which hardens at room temperature enter the tapped blind hole. RTV sealant that is allowed to enter a blind threaded hole can cause hydraulic lock of the fastener when the fastener is tightened. Hydraulic lock of a fastener can lead to damage to the fastener and/or the components. Hydraulic lock of a fastener can also prevent the proper clamping loads to be obtained when the fastener is tightened. Improper clamping loads can prevent proper sealing of the components allowing leakage to occur. Preventing proper fastener tightening can allow the components to loosen or separate leading to extensive engine damage.

Important precaution on Window Edge Damage

Notes:

Avoid an impacting object from damaging the window due to the exposed edge. The window must be 1mm (0.025in) lower than the metal plate surface to avoid the window from being damaged.

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12.2 Front -end of body

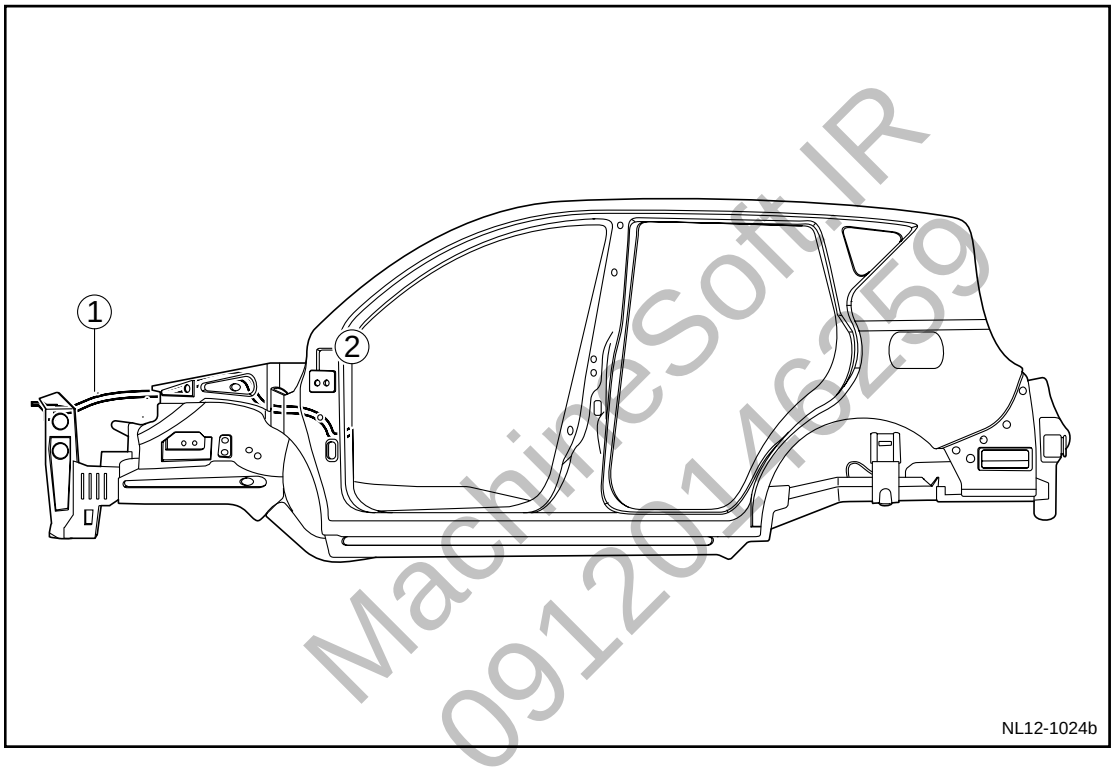
12.2.1 Specification

12.2.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (NM)	English system (lb-ft)
Engine hood lock assembly	M6×16	7-9	5.2-6.7

12.2.2 Part position

12.2.2.1 Component position



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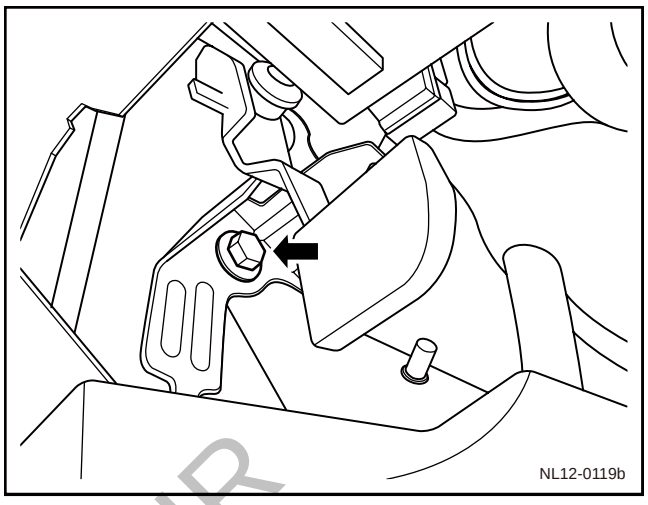
1. Engine hood lock.
2. Engine hood lock cable assembly

12.2.3 Dismantle and install

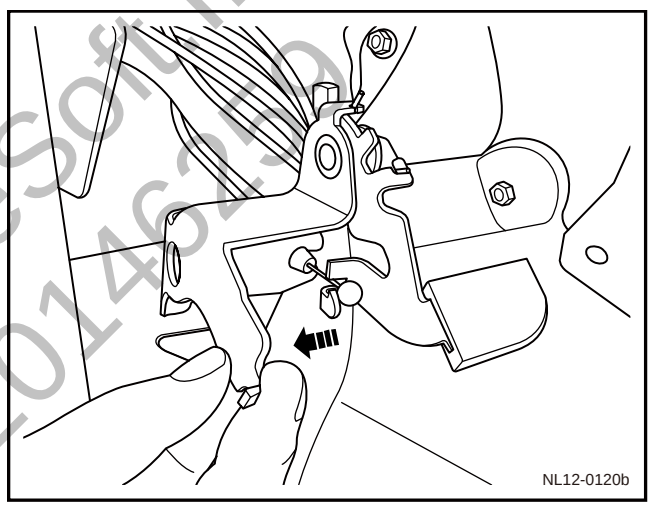
12.2.3.1 Engine hood lock cable assembly replacement

Dismantlement Procedure

1. Dismantle engine hood opening handle fixing bolt.

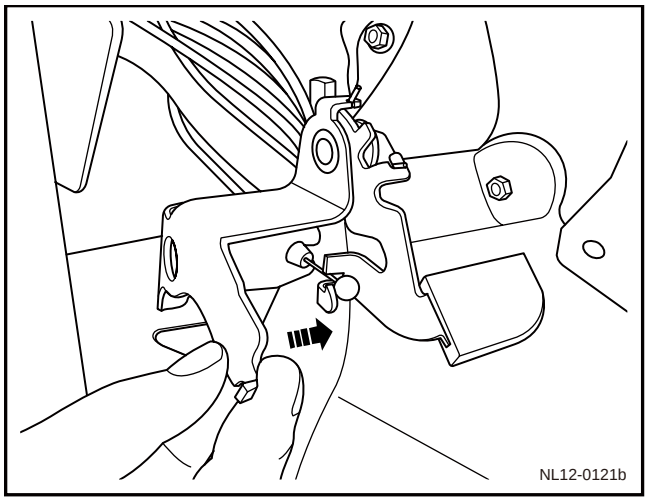


2. Loosen cable from opening handle.
3. For dismantling of engine hood lock, refer to 12.2.3.2 Replacement of engine hood lock.
4. Disengage the guy cable fixing buckle and extract the hood lock guy cable assembly out from the cab compartment.



Installation Procedure:

1. Put engine hood lock cable pass through engine hood from driver's cab.
2. Install the engine hood latch.
3. Insert opening cable into opening handle.



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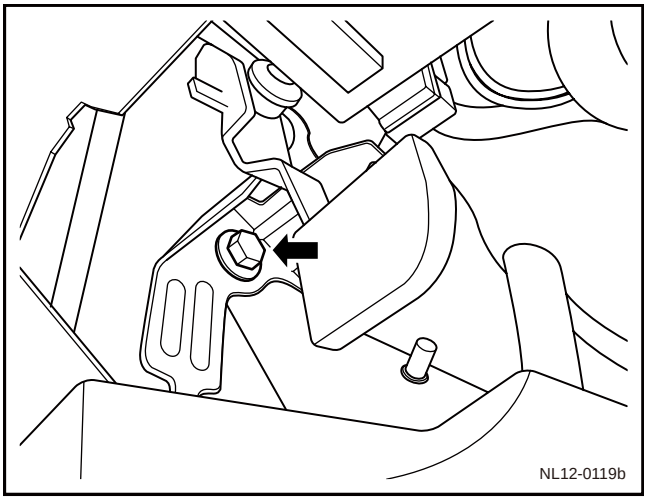
4. Install opening handle and tighten bolt.

Torque: 8Nm(Metric) 6lb-ft(English system)



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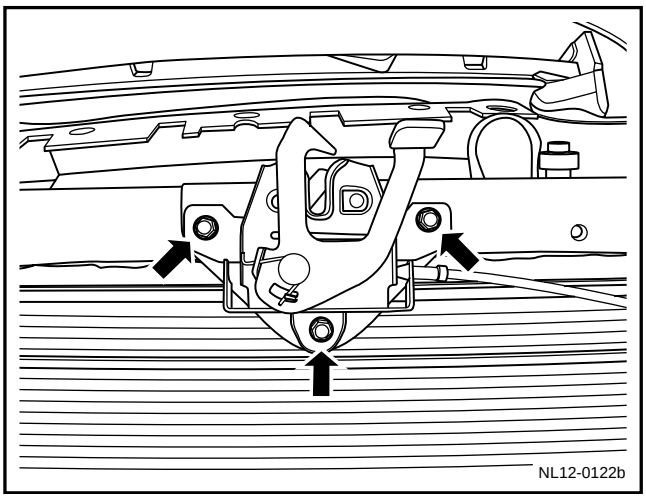
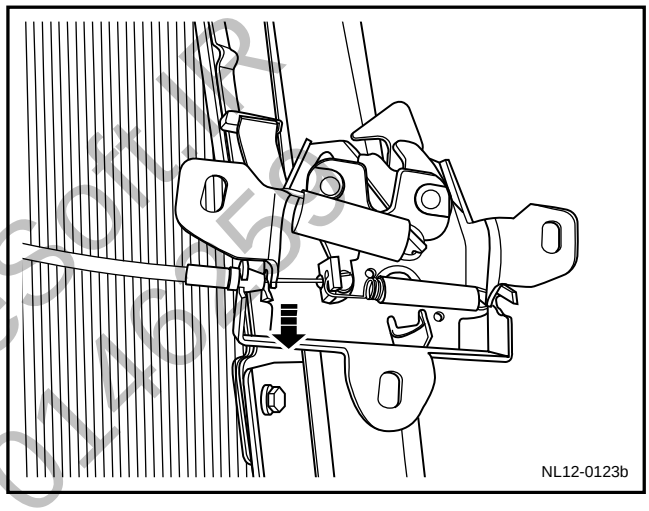
12.2.3.2 Engine hood lock replacement

Dismantlement Procedure

1. Turn on engine hood.
2. Dismantle front bumper. Refer to 12.4.3.1 Replacement of Front Bumper.
3. Dismantle 3 fixing bolts of engine cover lock.

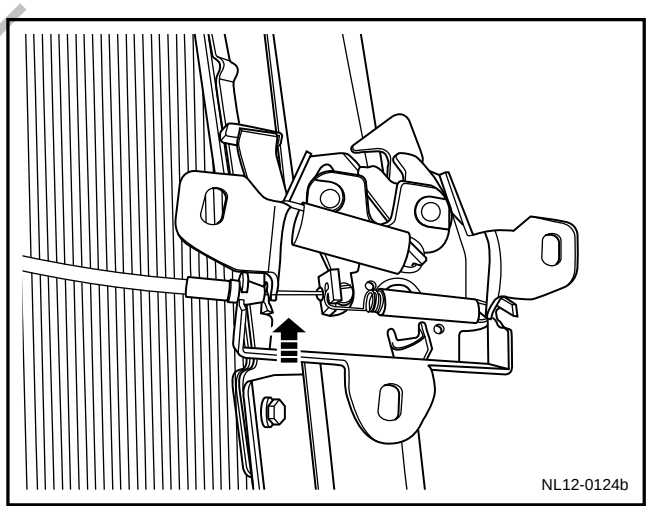


4. Dismantle engine hood lock, and remove opening cable of engine hood lock.



Installation Procedure:

1. Insert engine hood open cable into engine hood lock cable slot.



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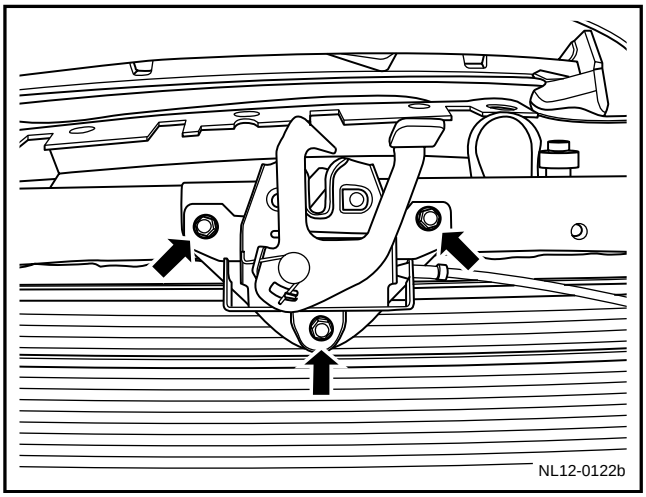
2. Fixing engine hood lock and tighten 3 bolts.

Torque:9 Nm (Metric) 6.7 lb-ft (English system)

3. Install front bumper.

4. Close engine hood.



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12.2.3.3 Engine hood and hinge replacement

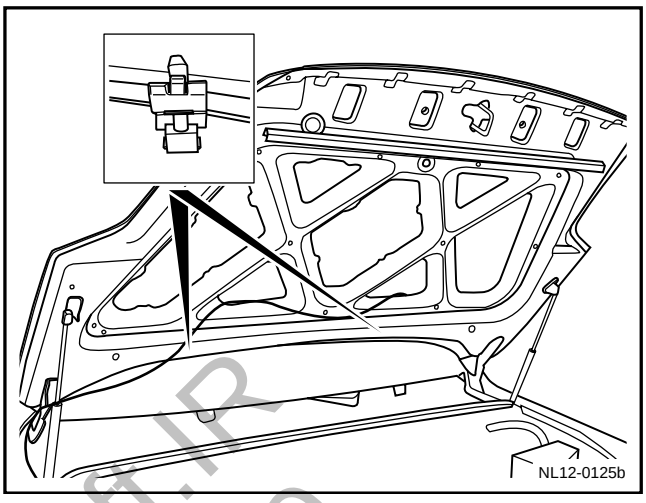
Dismantlement Procedure

Notes:

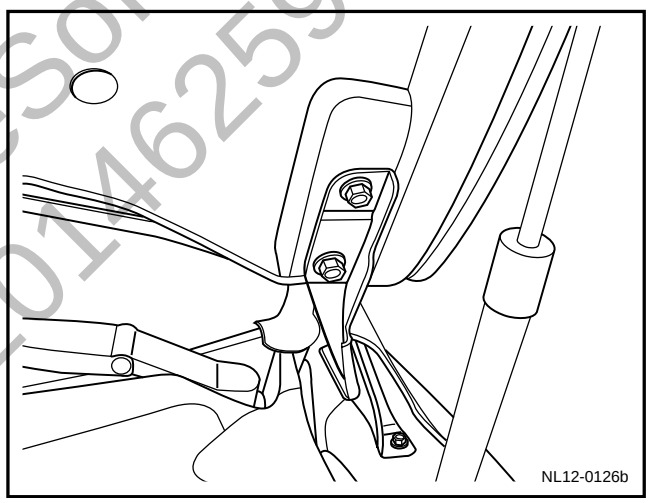
The protective hood **is mounted on the fender and the front windshield in order to avoid dismantling and installing.**

Paint, glass and moulded pieces may be damaged when the engine hood is assembled.

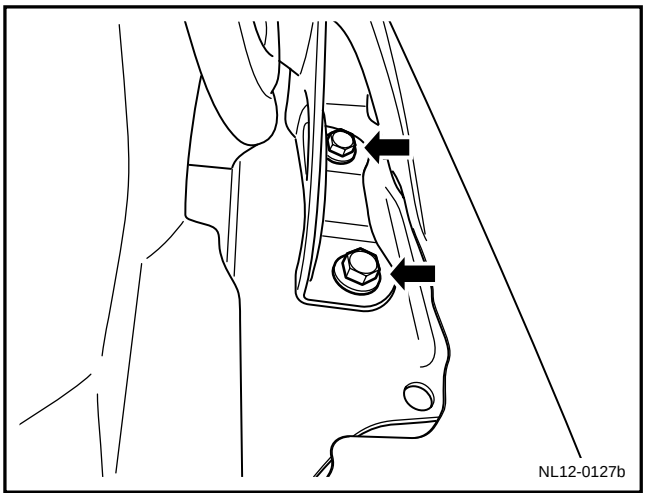
1. Turn on engine hood and support it.
2. Mark the position of hinge corresponding to engine hood, to facilitate positioning during installation.
3. For dismantling of engine hood vibration insulation pad, refer to 12.10.1.2 Replacement of engine hood vibration insulation pad.
4. Disconnect washer hose.



5. Remove the left 2 fixing bolts for connecting the hood and hinge and the right 2 in the same way.



6. Dismantle the engine hood with the help from an assistant.
7. Remove the left 2 fixing bolts for the hood plate hinge fixing plate assembly and the right 2 in the same way.



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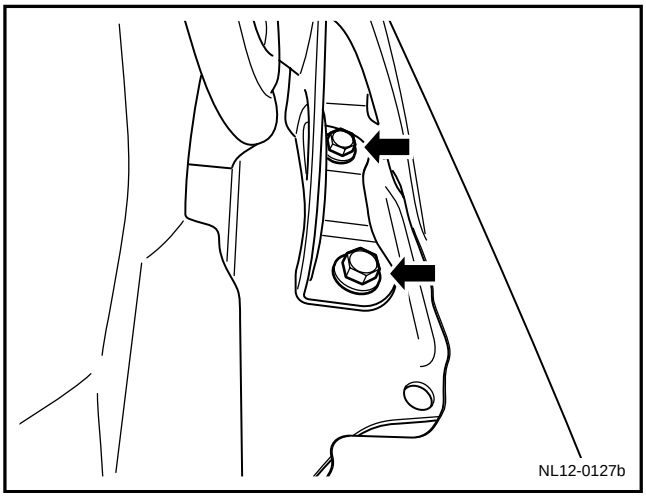
Installation Procedure:

1. Install engine hood hinge, and tighten left bolt, meanwhile install and tighten right bolt.

Torque: 25Nm (Metric) 18. 5lb-ft(English system)



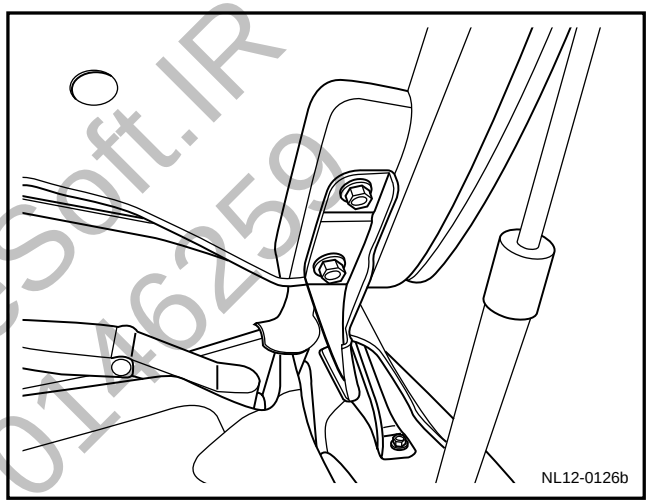
2. Install the engine hood with the help of an assistant.

Notes:

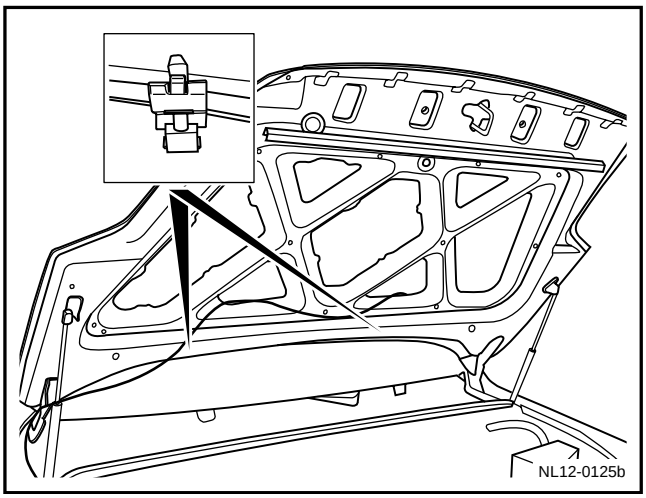
The hood cap aims at the position marked during dismantling.

3. Install engine hood to hinge, tighten left bolt. At the same time, fasten the right bolt.

Torque: 25Nm (Metric) 18. 5lbf-ft(English system)



4. Connect the window glass washer hose.
5. Install the soundproof pad of the engine hood.



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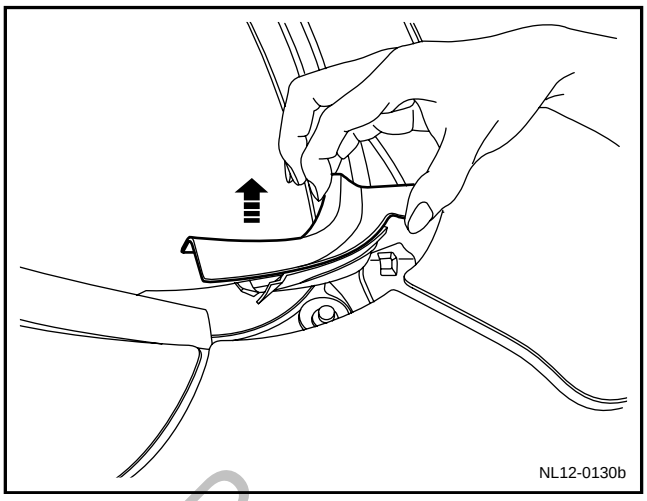
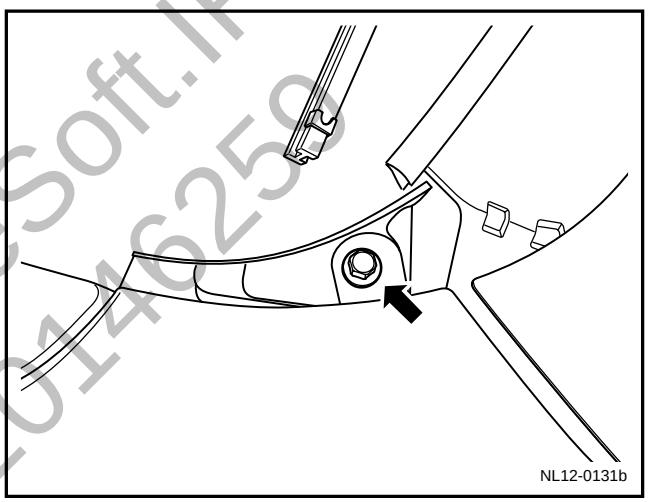
12.2.3.4 Front fender replacement

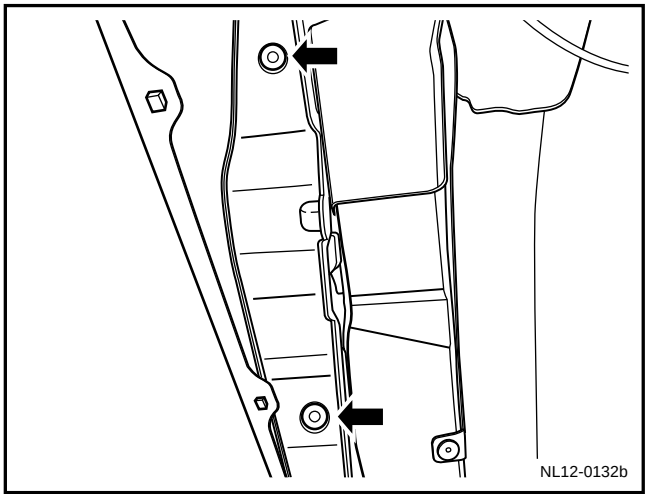
Dismantlement Procedure:

1. For dismantling of front bumper and front bumper mounting support, refer to 12.4.3.1 Replacement of front bumper.
2. For lifting of the vehicle, refer to 1.3 Lifting of Vehicle.
3. For dismantling of front wheels, refer to 4.4.5.1 Replacement of wheels.
4. For dismantling of front fender lining plate, refer to 12.10.1.9 Replacement of front fender lining plate.
5. For removal of the lower threshold trim panel, refer to 12.10.1.11 Replacement of Lower Threshold Trim Panel.
6. Dismantle the headlamp. Refer to 11.3.8.7 Replacement of Headlamp.
7. Dismantle the side trim panel of the ventilation cover plate.
8. Remove the front fender fixing bolt below the side trim panel of the ventilation cover plate.





9. Remove the fixing buckle of the front fender wind screen and remove the wind screen.



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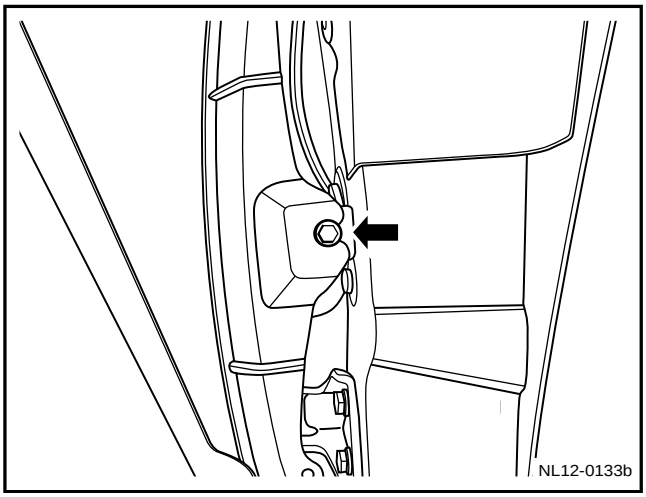
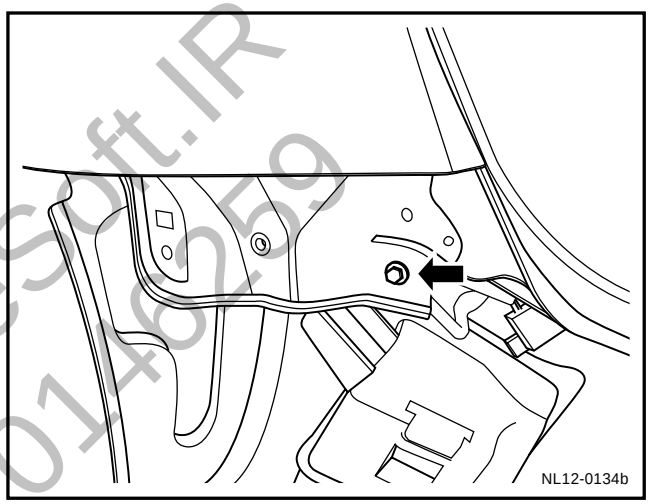
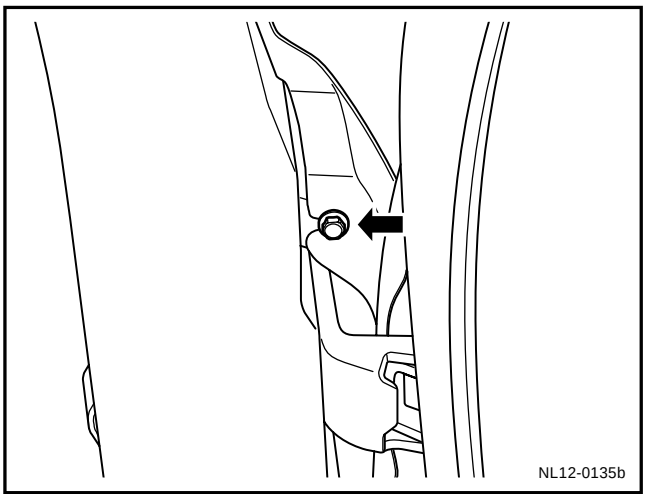
10. Dismantle fixing bolt in the middle of front fender side.



11. Dismantle front fixing bolt in front of front fender bumper



12. Turn on front door. Dismantle upper fixing bolt on the side face of front fender.



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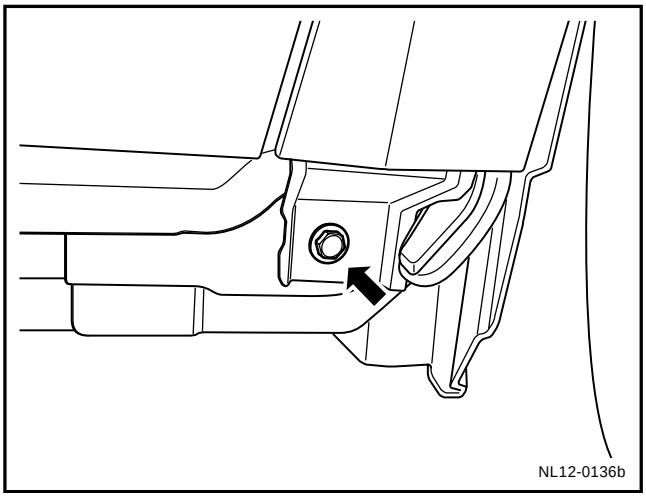
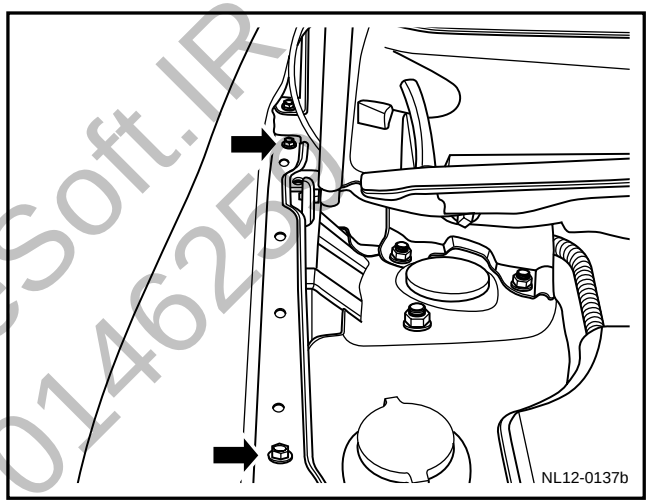
12. Dismantle lower fixng bolt of front fend side.



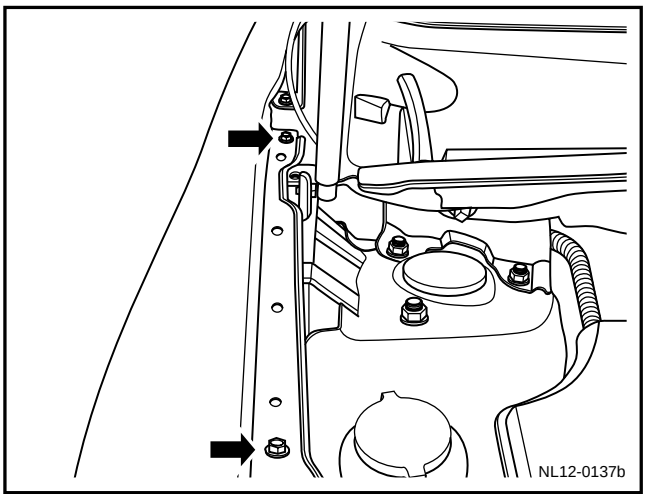
14. Dismantle fixing bolt at the top of front fender.



Installation Procedure:

1. Install front fender and tighten upper fixing bolt.

Torque: 9Nm (Metric system) 6.7lb-ft (English system)



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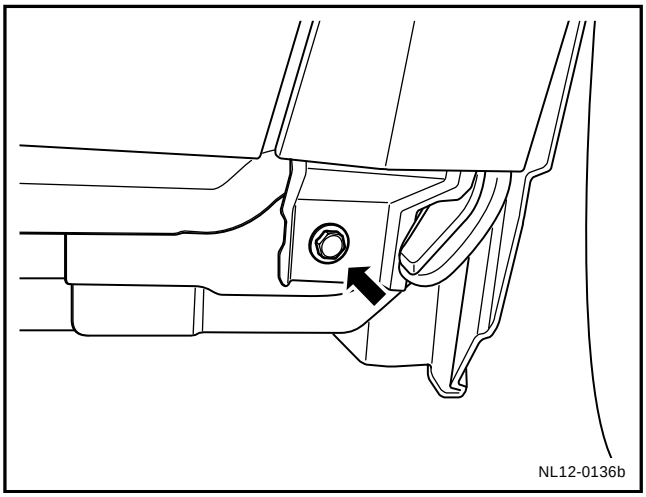
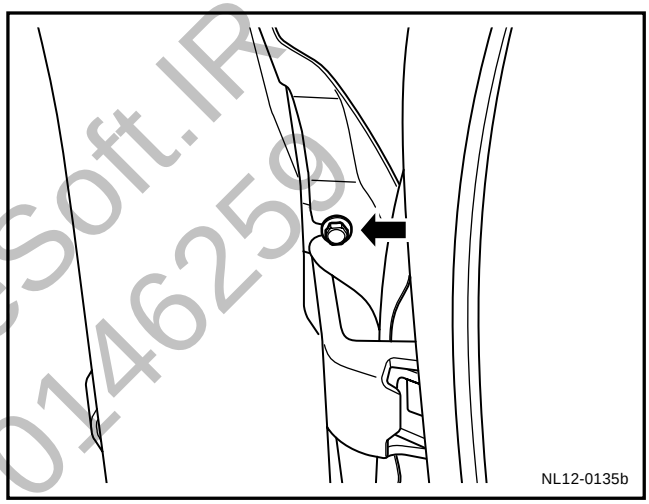
2. Install and tighten lower fixing bolt of side section of front fender.

Torque: 9Nm (Metric system) 6.7lb-ft (English system)



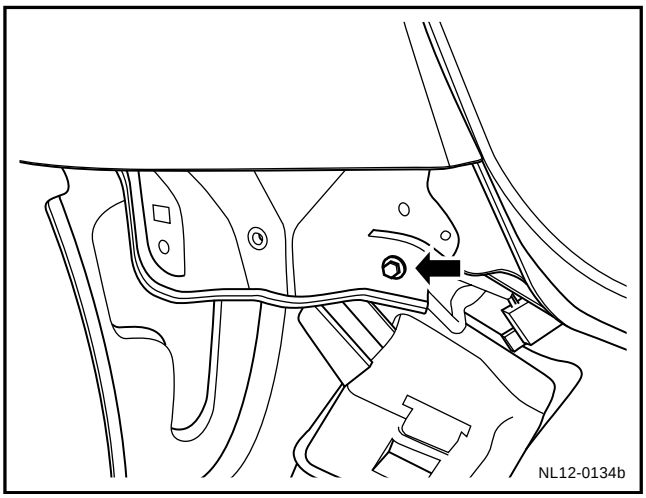
3. Install and tighten fixing bolt on the upper section of front fender.

   Torque: 9Nm (Metric system) 6.7lb-ft (English system)



4. Fixing bolt between front fender and bumper.

Torque: 9Nm (Metric system) 6.7lb-ft (English system)



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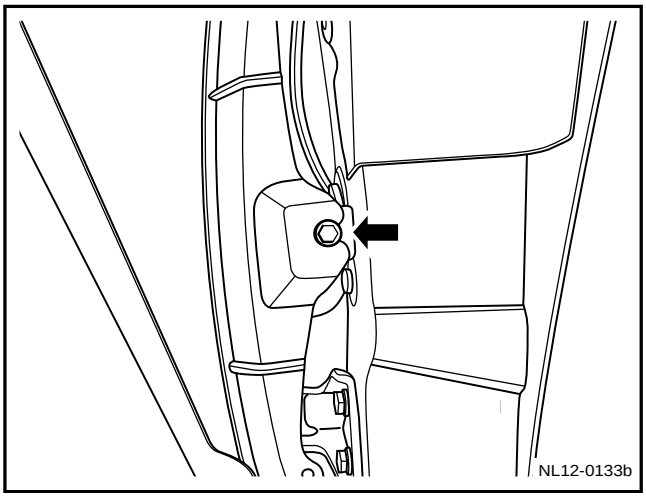
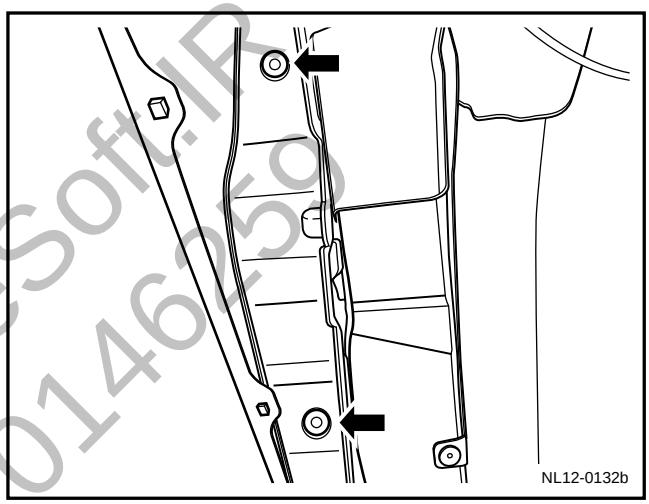
5. Install and tighten the fixing bolt in the middle of the side surface of the front fender.

   Torque: 9Nm (Metric system) 6.7lb-ft (English system)

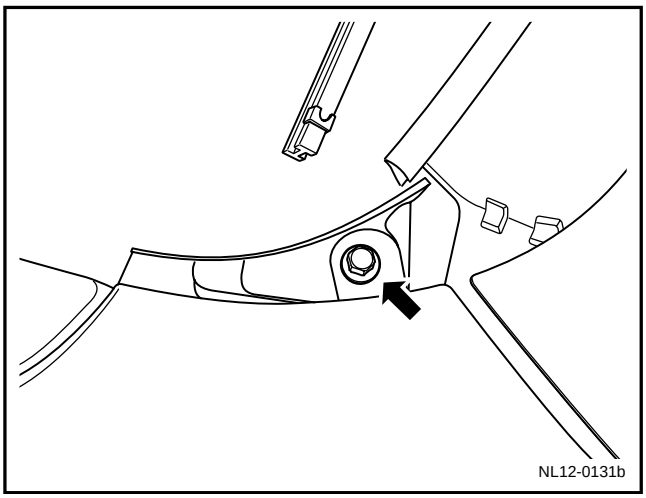


6. Install the front fender wind board and the retaining buckle.



7. Install and tighten the front fender fixing bolt below the ventilation cover plate.

   Torque: 9Nm (Metric system) 6.7lb-ft (English system)



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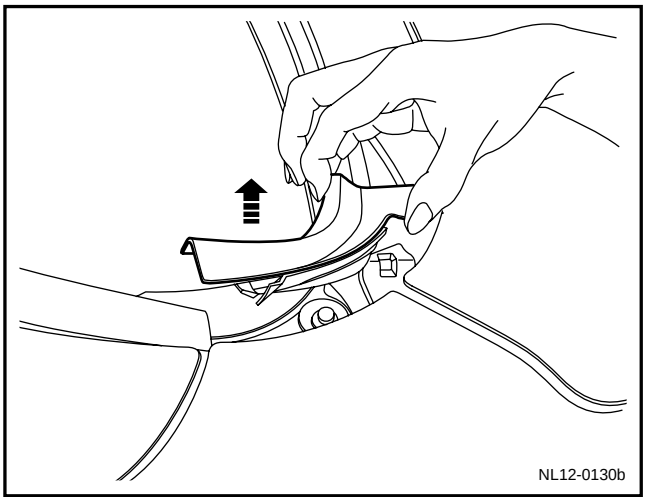
8. Install the side trim panel of the ventilation cover plate.
9. Install the headlamp.
10. Install doorsill lower trimming plate.
11. Install the front fender liner.
12. Install the wheel.
13. Lower the vehicle.
14. Install front bumper support and front bumper.



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12.3 Rear end of body

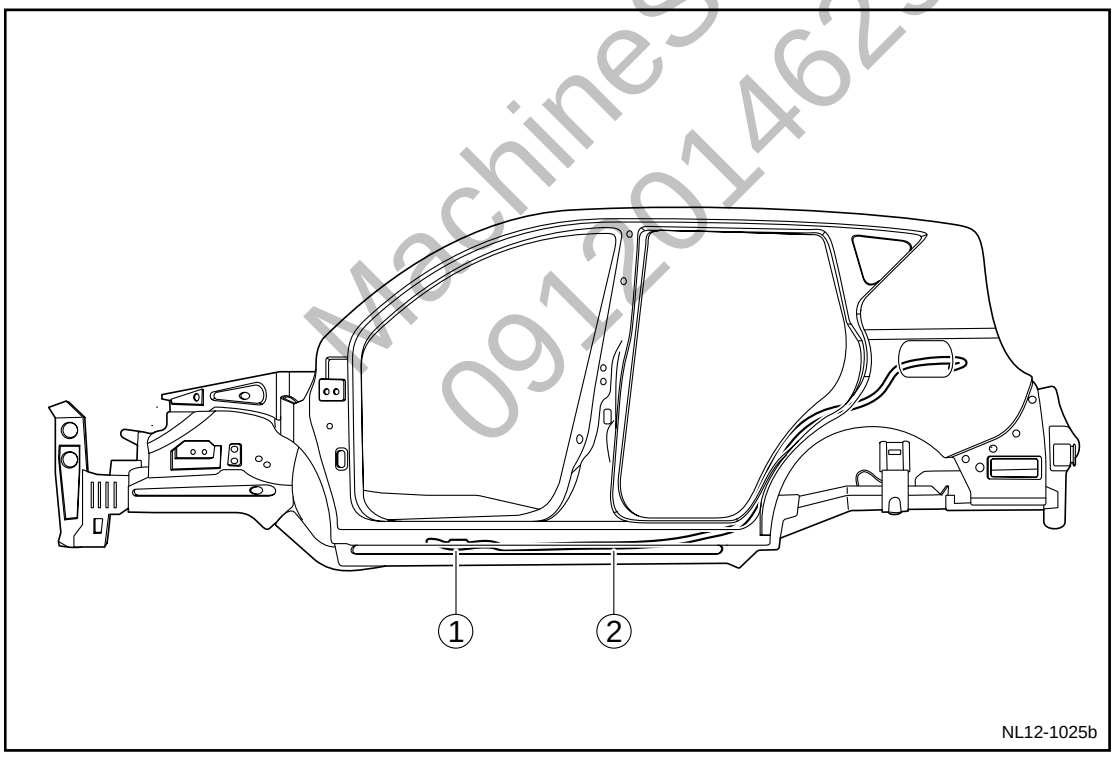
12.3.1 Specification

12.3.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (NM)	English system (lb-ft)
Fixing bolt of filler cap opening handle	M6×20	7-9	5.2-6.7
Back door handle fixing nut	M6	8-10	5.9-7.4
Back door lock catch fixing bolt	M8×22	18-22	13.3-16.3
Back door lock cylinder assembly	M6	8-10	5.9-7.4
Back door hinge assembly	M8×35	22-26	16.3-19.3

12.3.2 Part position

12.3.2.1 Component position



1. Release handles of fuel tank cap
2. Cable of fuel tank cap

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12.3.3 Dismantle and install

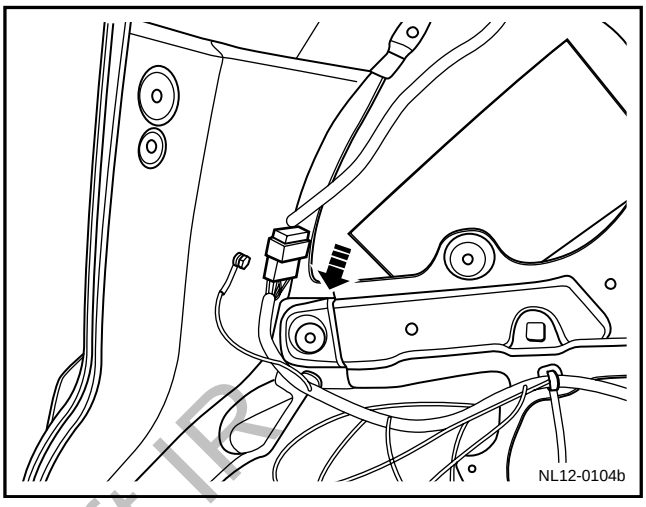
12.3.3.1 Back-door and back-door hinge replacement

Dismantlement Procedure

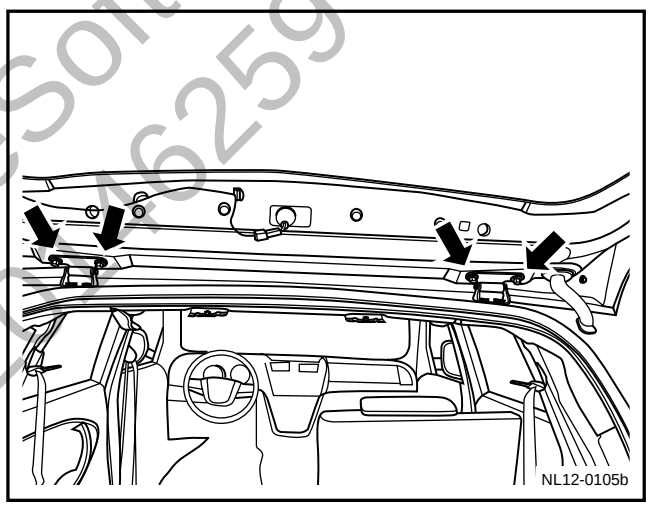
Warning!

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

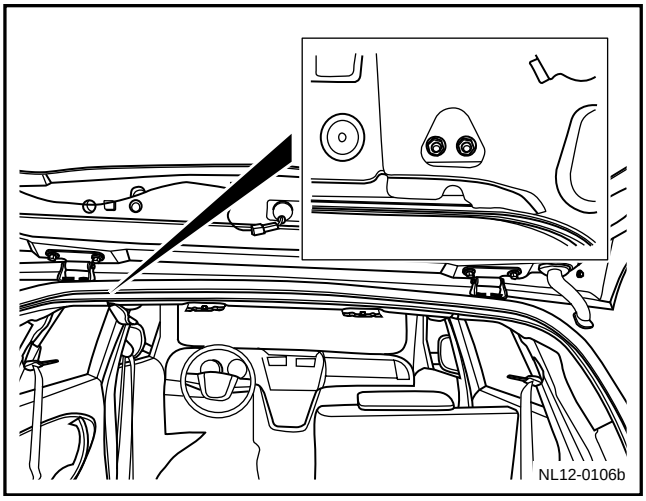
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Turn on and support back-door.
3. For dismantling of rear column trimming plate, refer to 12.9.1.6 Replacement of upper trimming plate assembly of rear column.
4. Disconnect back door wire harness connector.



5. For removal of the back door interior, refer to 12.9.1.10 Replacement of Back Door Trim Panel.
6. For dismantlement of the strut bar of the back door, refer to 12.3.3.2 Replacement of Back Door Air Spring.
7. For dismantlement of rear wiper nozzle, refer to 11.5.8.6 Replacement of Rear Wiper Nozzle.
8. Remove the 2 left and 2 right connecting bolts of the back door hinge.



9. Dismantle the back door with the help from the assistant.
10. Dismantle 2 fixing nuts respectively on left and right sides of back door hinge fixing plate.
11. Dismantle rear back-door hinge



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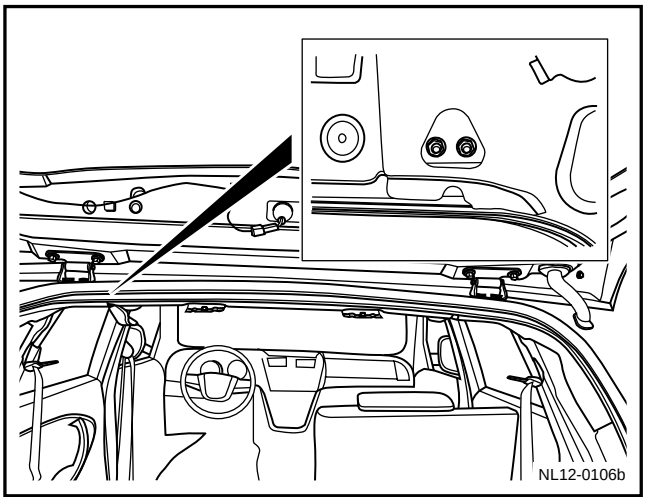
Installation Procedure:

1. Install rear back door hinge fixing plate, and tighten nut.

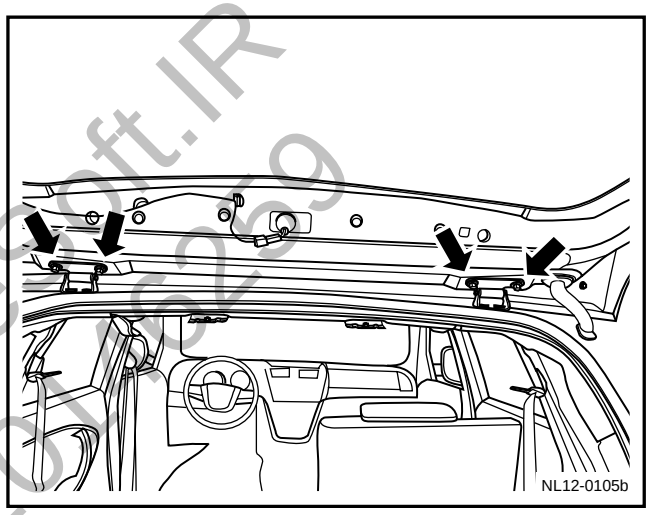
Torque: 25Nm (Metric) 18. 5lb-ft(English system)



2. Install rear back door to hinge fixing plate, and tighten bolt.

Torque: 25Nm (Metric) 18. 5lb-ft(English system)

3. Pass wire harness connector from top section to boot, and connect wire harness connector.
4. Install rear wiper nozzle.
5. Install the boot interior.
6. Install the back door interior.



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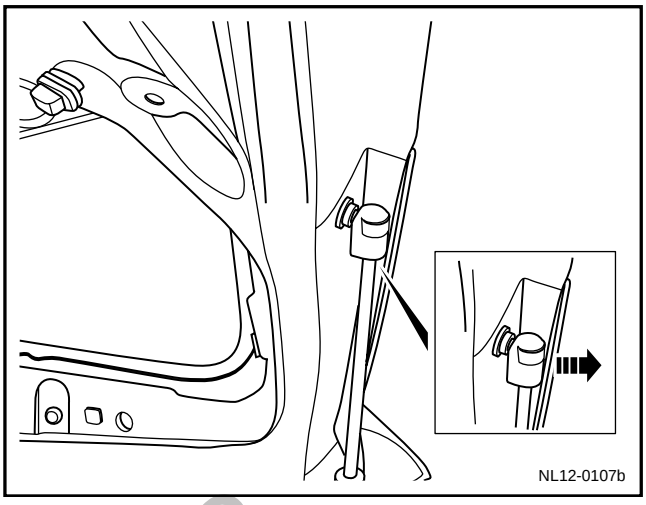
12.3.3.2 Back-door gas spring replacement

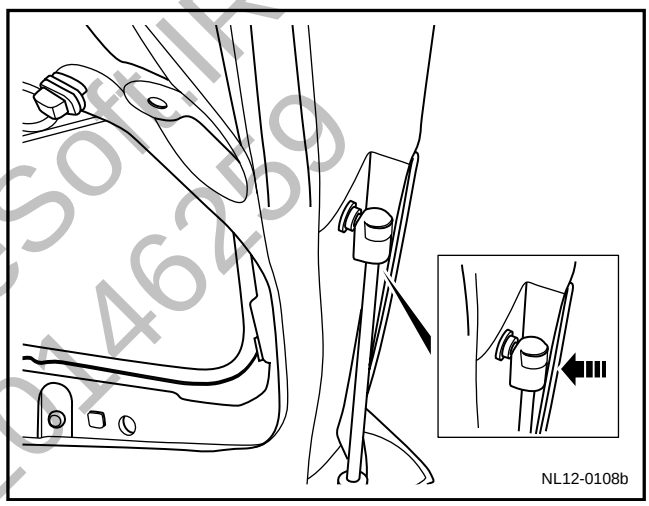
Dismantlement Procedure:

1. Turn on and support back-door.
2. Install snap ring on air spring ball seat, and use flat screwdriver to pry up some height, and then push out air spring ball seat by force. For lower ball seat, the method is the same.
3. Dismantle back door air spring.



Installation Procedure:

1. Press ball seats on both sides of back door air spring back to ball head. Pay attention that ball seat on rod end of air spring is located on back door ball head.
2. Close back door.



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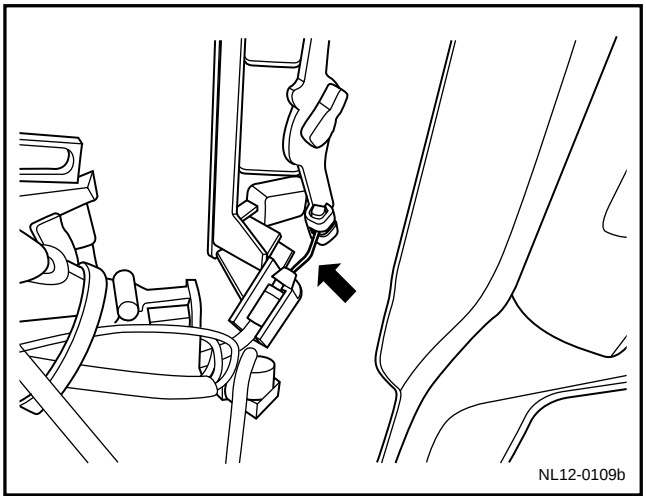
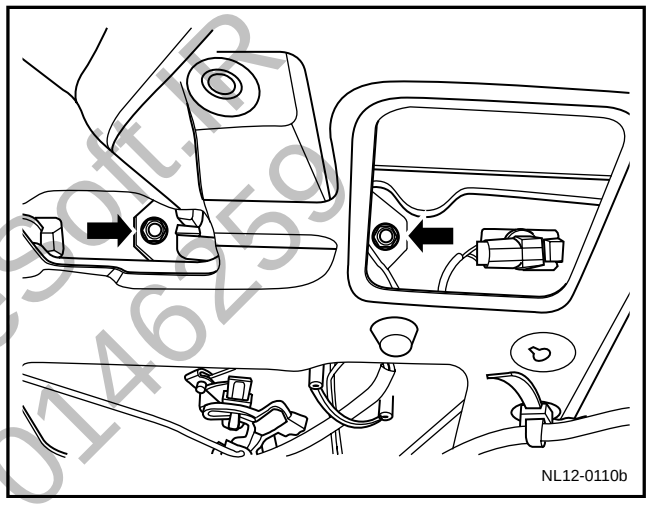
12.3.3.3 Back-door open replacement

Dismantlement Procedure

1. For removal of the back door interior, refer to 12.9.1.10 Replacement of Back Door Trim Panel.
2. Remove outer opening handle cable from back door lock catch.



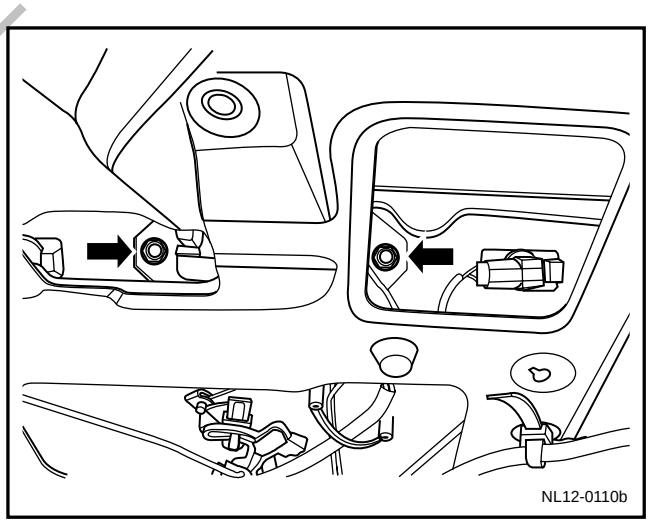
3. Dismantle 2 fixing nuts of rear back door outer opening handle.
4. Dismantle rear back door outer opening handle.



Installation Procedure:

1. Install back door outer opening handle, and tighten nut.

Torque:10 Nm (Metric) 7.4 lb-ft (English system)



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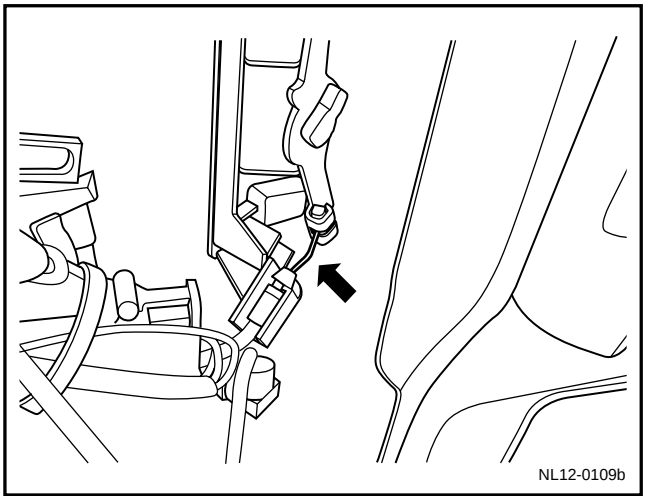
2. Connect back door outer opening handle cable to back door lock.
3. Install the back door interior.



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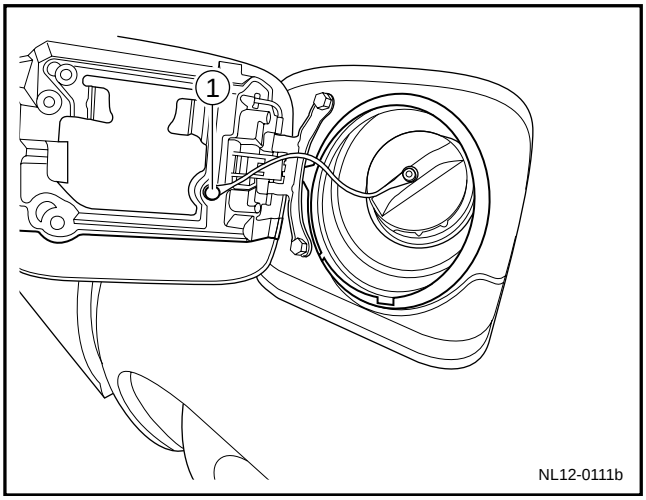
12.3.3.4 Filler cap assembly replacement

Dismantlement Procedure:

1. Turn on filler cap.
2. Disconnect limit cable 1 from oil filler cap.
3. Dismantle fixing ring 2 of oil filling pipe sealing pad (inside oil pipe sealing pad).
4. Remove Filler Pipe Gasket 3 and dismantle 2 6×11 Fixing Rivets 4 in the filler cap.
5. Remove the filler cap.

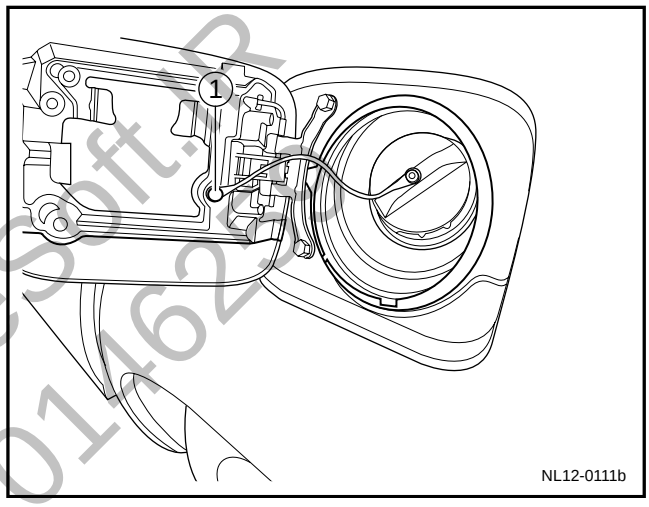


Installation Procedure:

1. Install filler cap, and install two 6×11 fixing rivet 4 on filler cap.

Torque:10Nm(Metric) 7.4lb-ft(English system)

2. Remove sealing pad 3 of oil filling pipe.
3. Install fixing ring 2 of oil filling pipe sealing pad (inside oil pipe sealing pad)
4. Install Limiting Stay 1 onto the filelr cap.
5. Close the filler cap.



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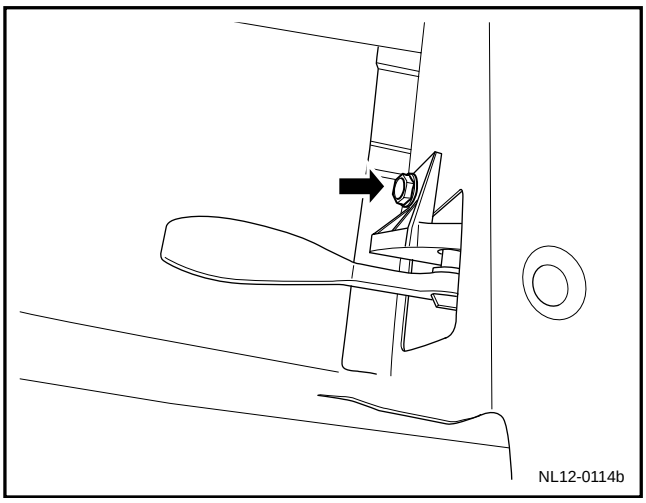
12.3.3.5 Filler cap open handle and cable replacement

Dismantlement Procedure:

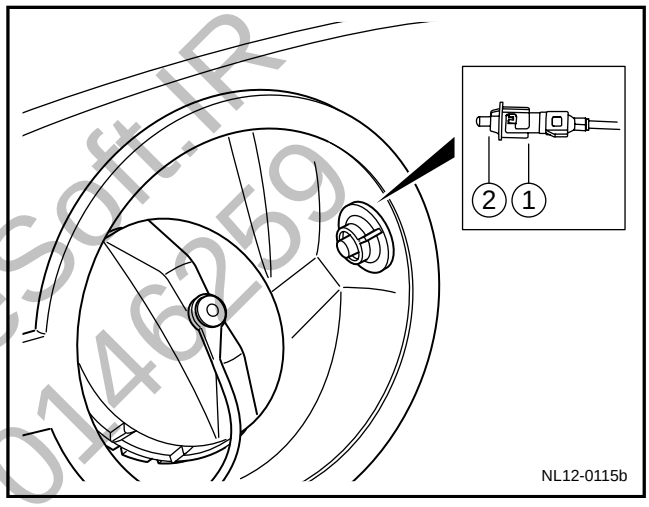
1. For dismantling of driver's seat, refer to 11.9.8.1 Replacement of front electric seat.
2. For dismantling of trimming plates on driver and rear row passenger left door, refer to 12.9.1.1 Replacement of left/ right front doorsill inner trimming plate assembly.
3. For dismantling of lower inner trimming plate of middle column, refer to 12.9.1.3 Replacement of trimming plate of middle column.
4. Remove the door-side carpet and the fixing bolt on the release handle of the filler cap.



5. For removal of the trunk interior, refer to 12.9.1.5 Replacement of Rear Pillar Lower Trim Panel.
6. Dismantle Open Stay Guy Release Lock Catch 1 in the trunk.

Notes:

Firstly rotate counterclockwise to unlock the lock catch 1, and then pull out the lock catch from the lock catch holder 2.



7. Dismantle the lock catch bearing seat 2 from the filler pipe side.
8. Detach the control cable from the harness buckle of the underframe to extract the control cable.

Installation Procedure:

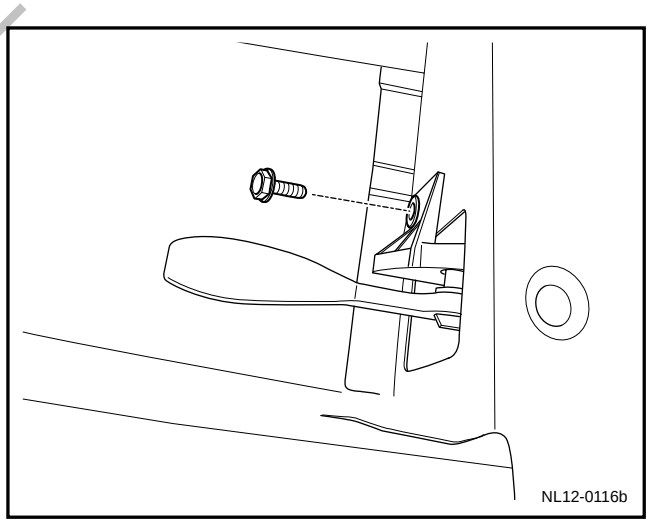
1. Install filler cap cable handle fixing bolt.

Torque: 9Nm (Metric system) 6.7lb-ft (English system)

2. Arrnage cable.

Notes:

The cable position shall be consistent with that before dismantling.



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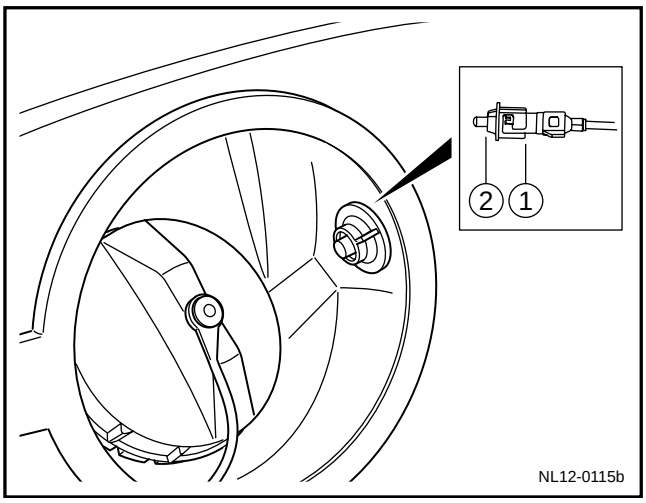
3. Insert buckle support 2 into the groove of filling pipe.
4. Install Release Latch 1 into Latch Seat 2.
5. Install the boot interior.
6. Install the lower trim panel for the center pillar.
7. Install the threshold trim panels on the driver side and left side of the rear row seat.
8. Assemble driver chair.



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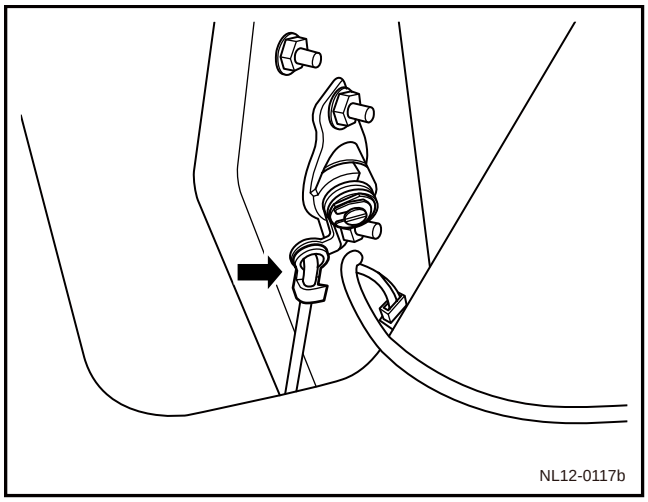
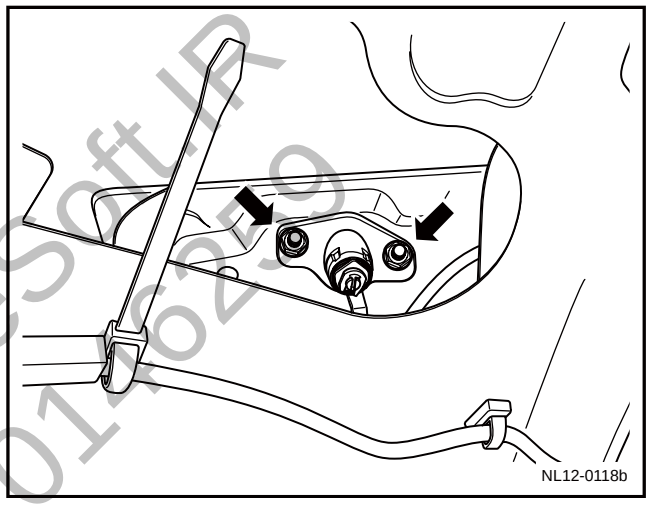
12.3.3.6 Back-door cylinder core replacement

Dismantlement Procedure

1. For removal of the back door interior, refer to 12.9.1.10 Replacement of Back Door Trim Panel.
2. Disconnect back door lock core connecting rod from back door lock.



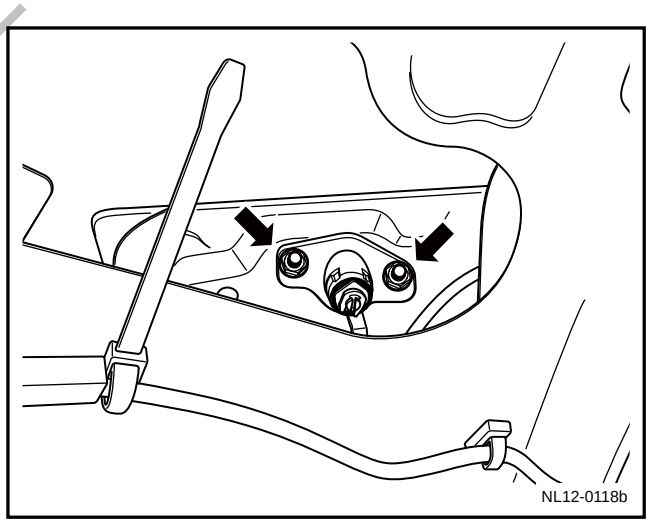
3. Dismantle fixing nut of back door lock catch.
4. Remove the back door lock cylinder.



Installation Procedure:

1. Install back door lock core, and tighten nut.

Torque:10Nm(Metric) 7.4lb-ft(English system)



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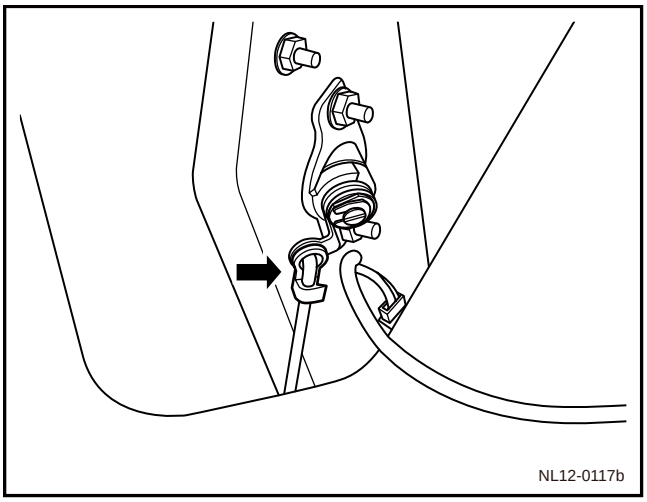
2. Insert back door lock catch into back door lock.
3. Install the back door interior.



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12.4 Bumper

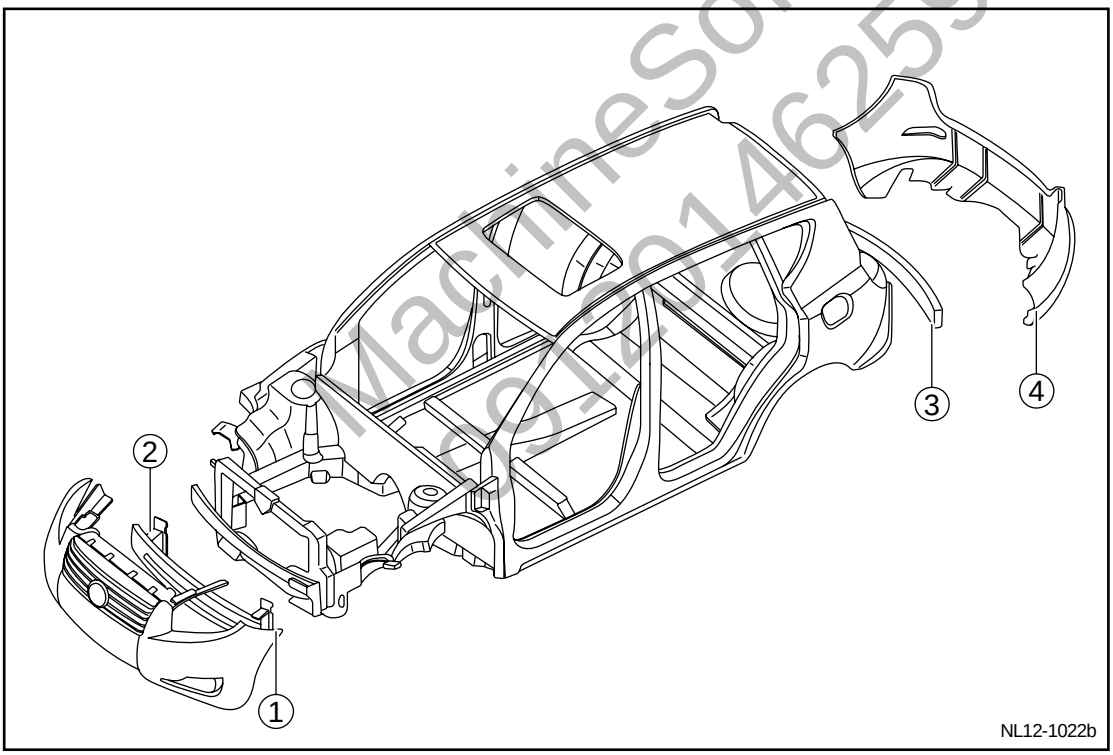
12.4.1 Specification

12.4.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (NM)	English system (lb-ft)
Front bumper device	M6×20	7-9	5.2-6.7
Left right mounting support of front bumper	M6×20	7-9	5.2-6.7
Right installing support assembly of rear bumper	ST4 . 8×16	4 - 6	2.9 - 4.4

12.4.2 Part position

12.4.2.1 Component position



1. Front bumper assembly
2. Front cross beam assembly
3. Rear cross beam assembly
4. Rear bumper assembly

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12.4.3 Dismantle and install

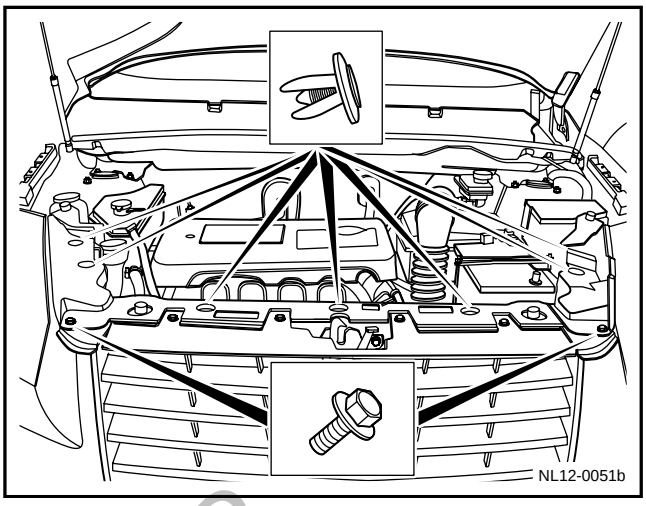
12.4.3.1 Front bumper replacement

Dismantlement Procedure

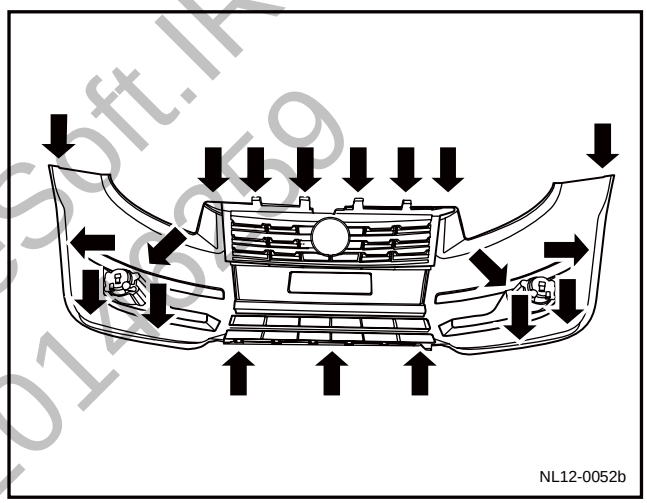
Warning!

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

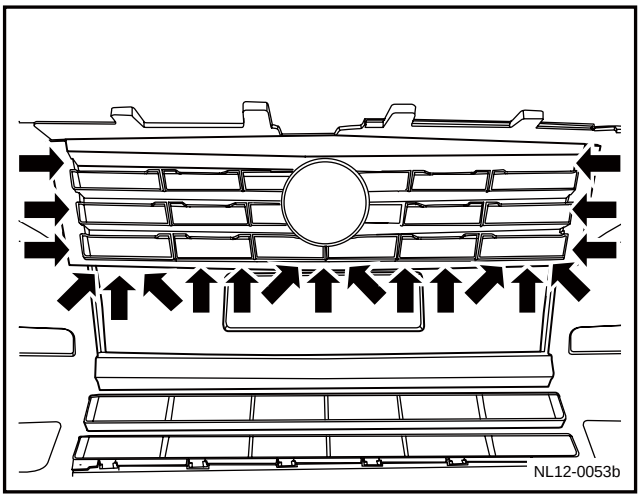
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Dismantle upper trimming plate of front bumper.



3. Dismantle left and right and bottom screws.
4. Dismantle front bumper.
5. Disconnect the harness connector of the front fog lamp.
6. For dismantlement of the front fog lamp assembly, refer to 11.3.8.4 Replacement of Front Fog Lamp.
7. Dismantle the front bumper fog lamp housing.



8. Dismantle the radiator grille fixed by 19 clamping tongues.



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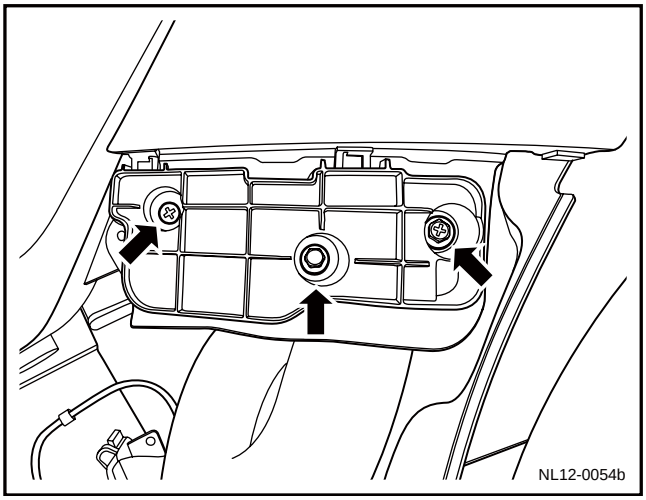
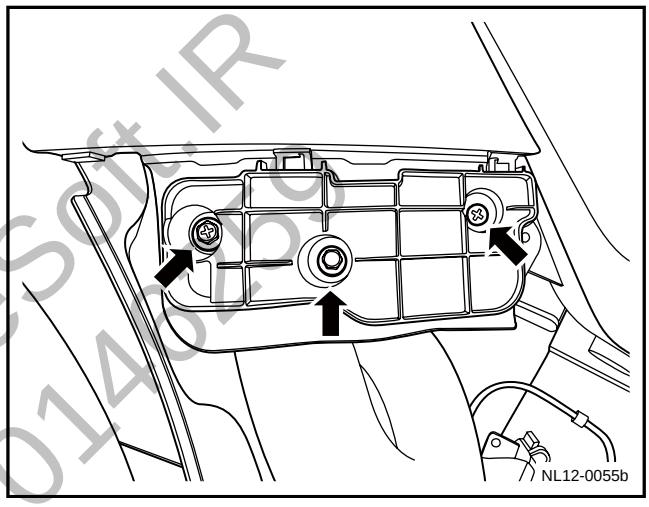
9. Remove 1 fixing bolt and 2 screws of the right bracket of the bumper.



10. Dismantle 1 fixing bolt and 2 screws on left bracket of bumper.



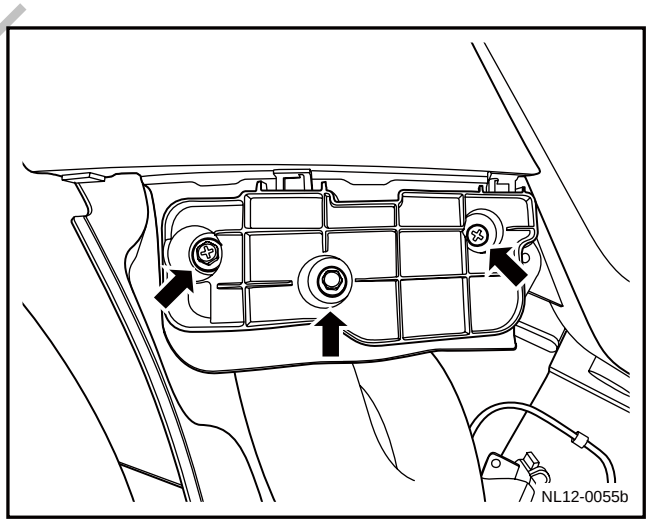
Installation Procedure:

Notes:

Fixed buckle must be replaced by new part.

1. Install bracket on left side of bumper.

Torque: 8 Nm (Metric) 5.9 lb-ft (English system)



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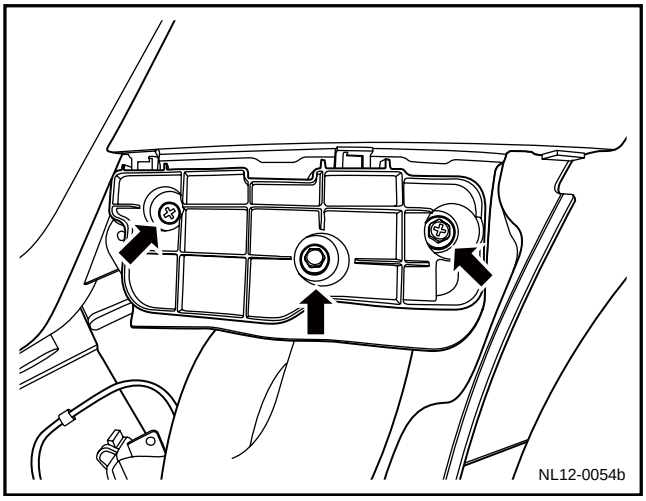
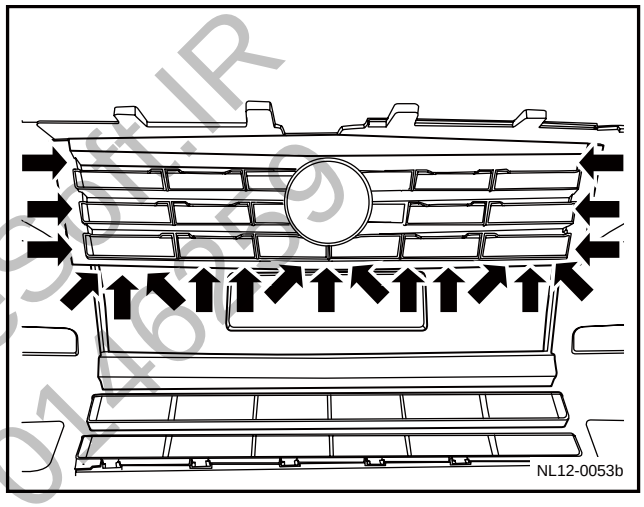
2. Install right bracket of bumper.

Torque: 8 Nm (Metric) 5.9 lb-ft (English system)

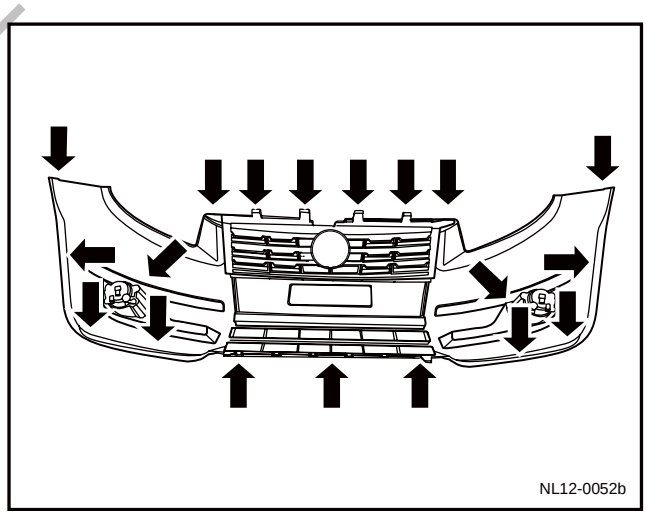


3. Install grille of radiator onto front bumper.



4. Install fog lamp shield of front bumper.
5. Install the front fog lamp assemblies.
6. Connect the harness connector of the front fog lamp.
7. Install front bumper.
8. Install and tighten the screws on both sides and bottom of the front bumper.

Torque: 8 Nm (Metric) 5.9 lb-ft (English system)



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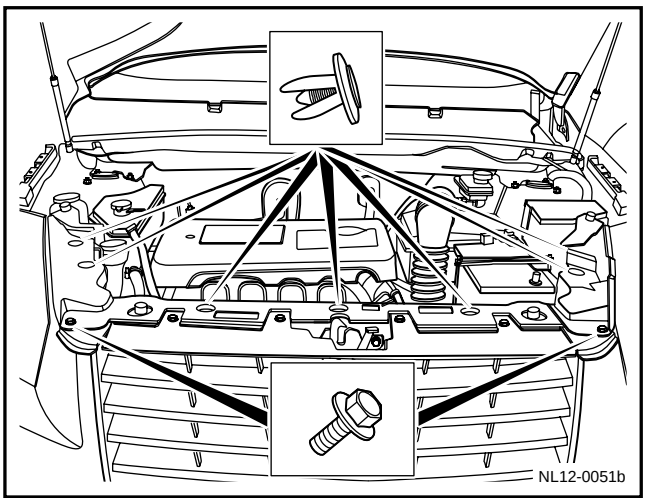
9. Install Upper trim plate of front bumper.

Torque: 8 Nm (Metric) 5.9 lb-ft (English system)

10. Connect the battery negative cable.



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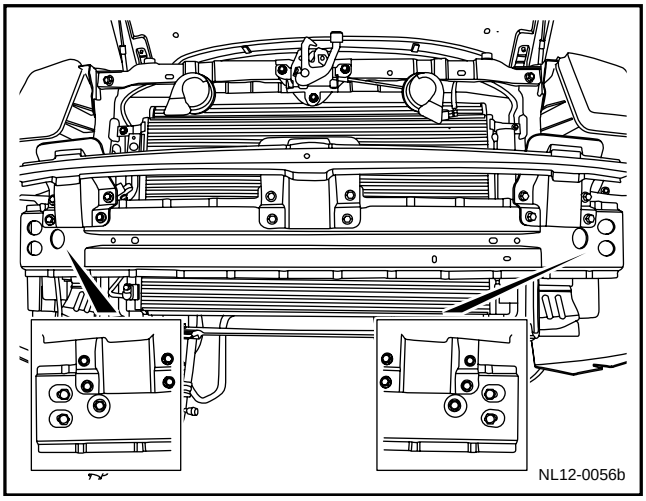
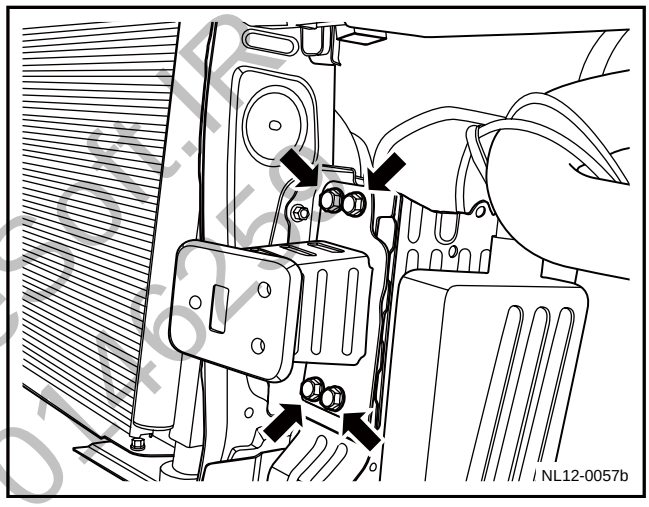
12.4.3.2 Front cross beam replacement

Dismantlement Procedure

1. Dismantle front bumper. Refer to 12.4.3.1 Replacement of Front Bumper.
2. Dismantle 6 fixing bolts on front horizontal beam body.



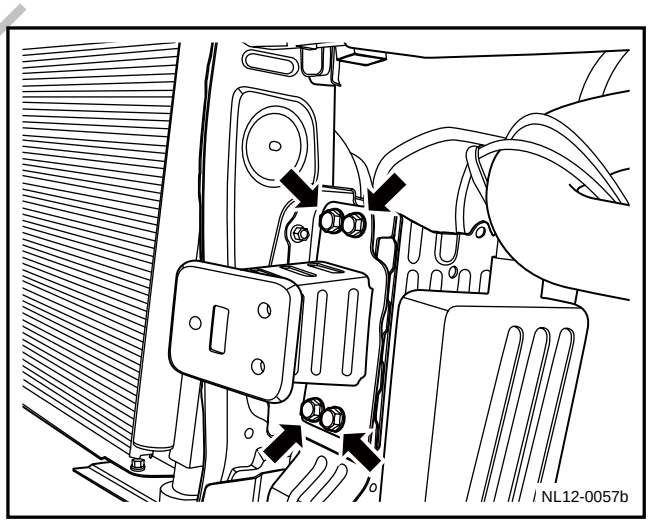
3. Dismantle 4 fixing bolts on each of energy absorption beam of left and right front horizontal beams.



Installation Procedure:

1. Install horizontal beam 4 fixing bolts on left and right sides of engery absorption beam.

Torque : 73Nm(Metric) 54lb-ft(English system)



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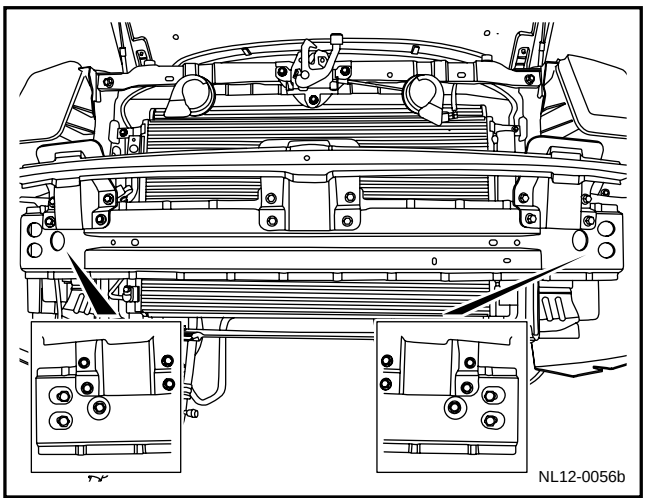
2. Install 6 fixing bolt of front horizontal beam body.

Torque : 73Nm(Metric) 54lb-ft(English system)

3. Install front bumper.



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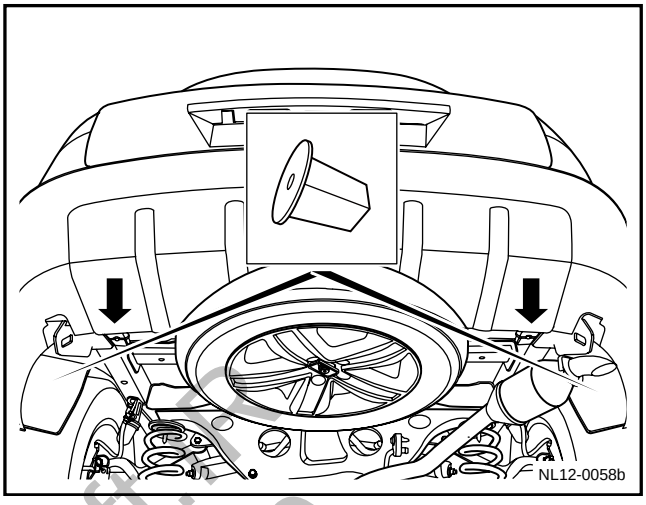
12.4.3.3 Rear bumper replacement

Warning!

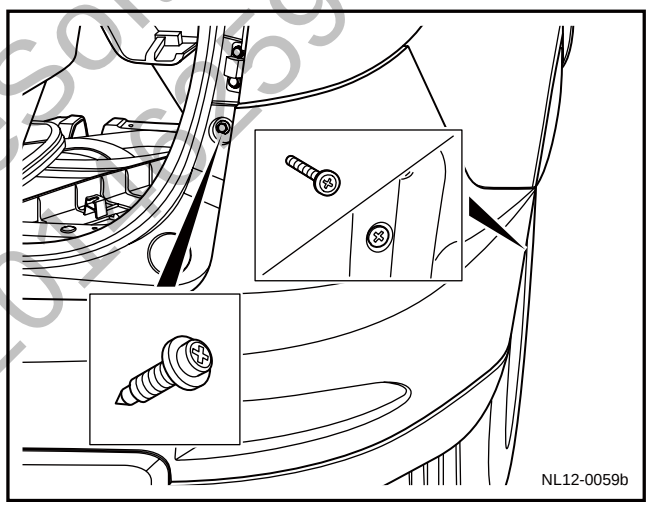
Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

Dismantlement Procedure

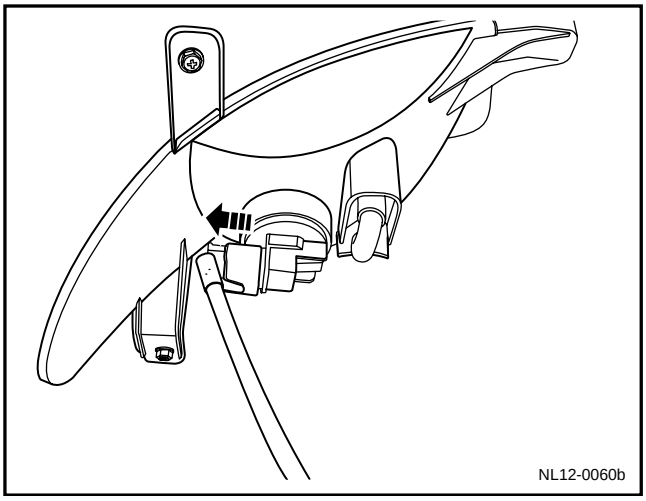
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Dismantle 2 screws and 2 buckles under the rear bumper.



3. Dismantle 2 screws respectively on left and right sides of the upper section of rear bumper.
4. Detach the rear bumper from the installation bracket.



5. Disconnect the harness connectors of the left and right rear fog lamps.



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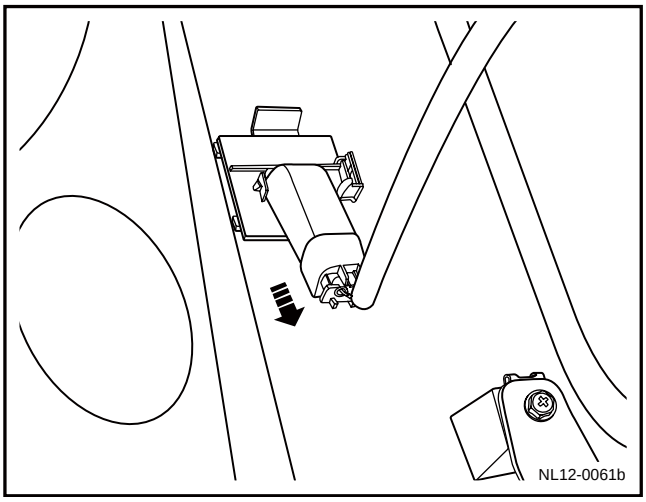
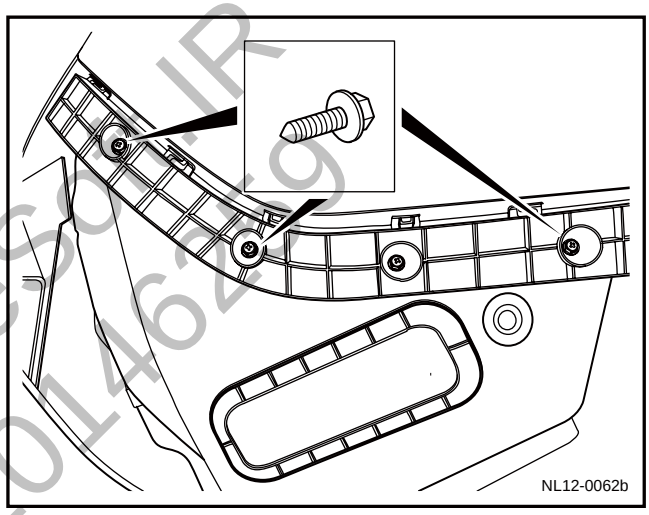
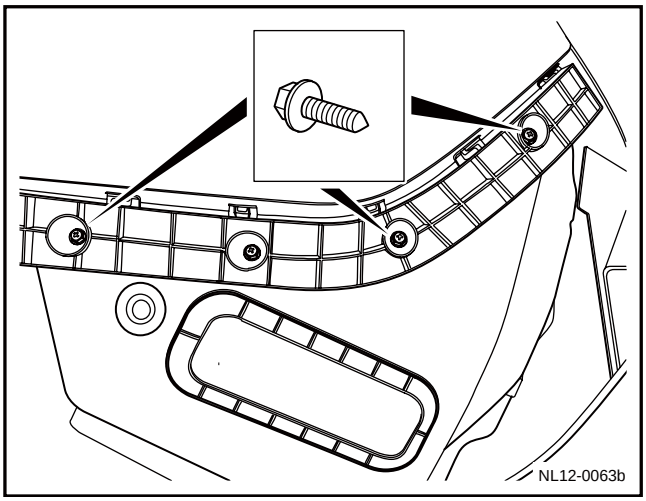
6. Disconnect the harness connector of the parking radar sensor.
7. Dismantle the left and right rear fog lamp assembly and 3 parking radar sensors.



8. Dismantle the rear right bumper mounting bracket.



9. Dismantle the rear left bumper mounting bracket.



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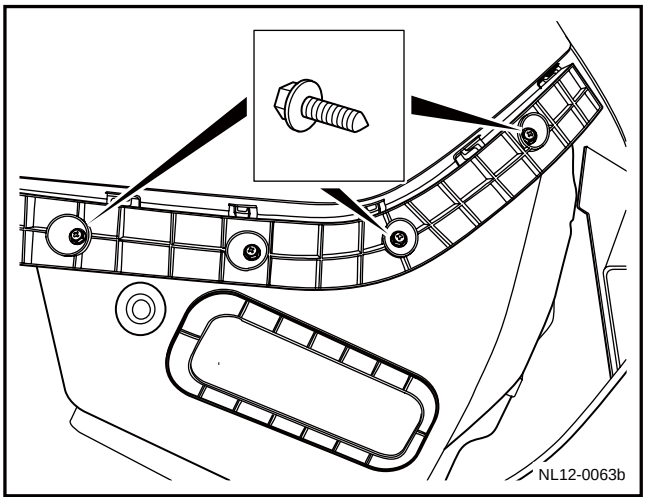
Installation Procedure:

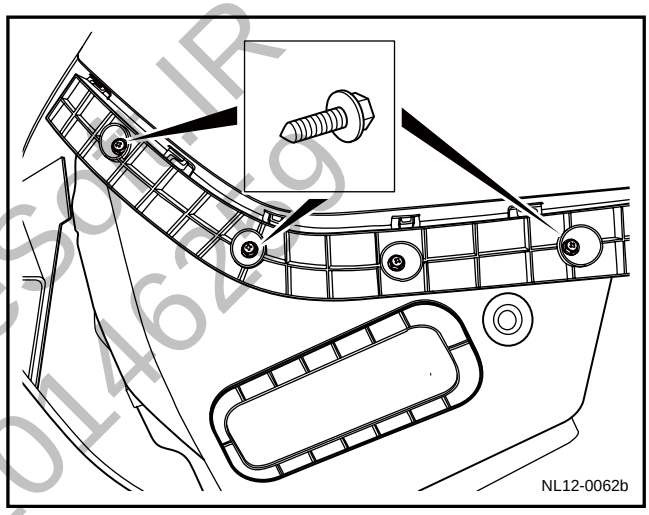
1. Install left rear bumper mounting support and fixed screw.

Torque: 5 Nm (Metric) 3.7 lb-ft (English system)

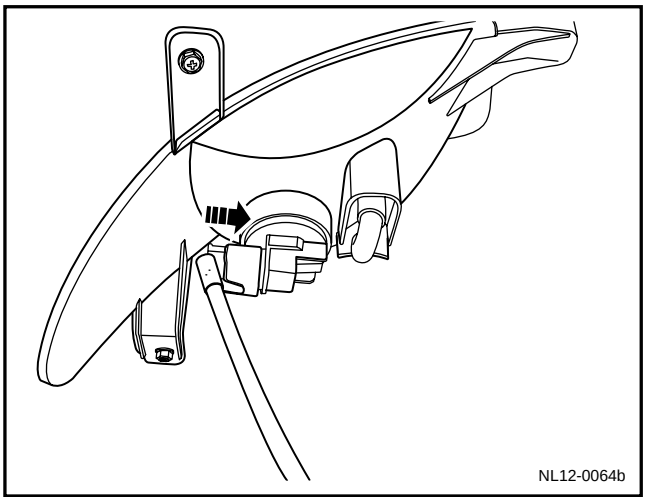


2. Install Right rear Bumper mounting support and tighten screw.

Torque: 5 Nm (Metric) 3.7 lb-ft (English system)



3. Installleft and right rear fog assembly and 3 parking radar sensors.
4. Connect the rear fog lamp harness connector.



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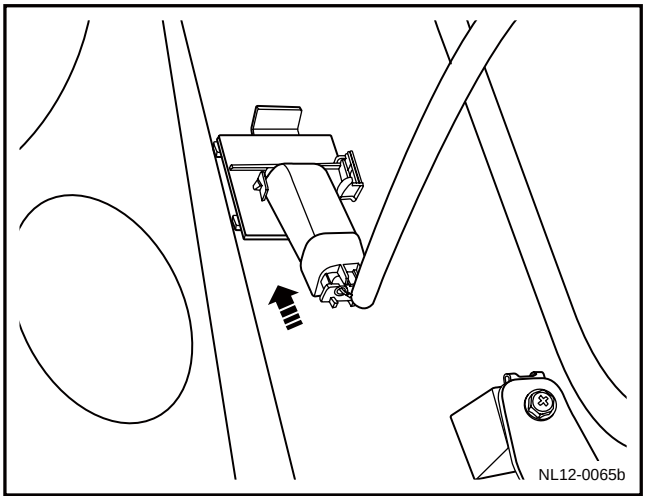
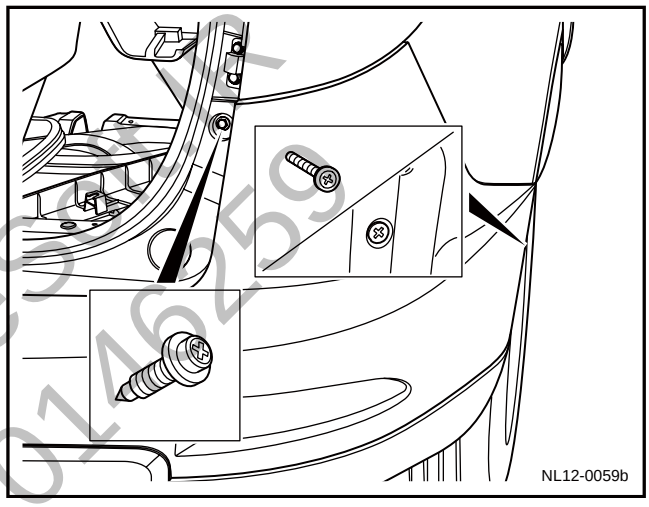
5. Connect the harness connector of the parking radar sensor.



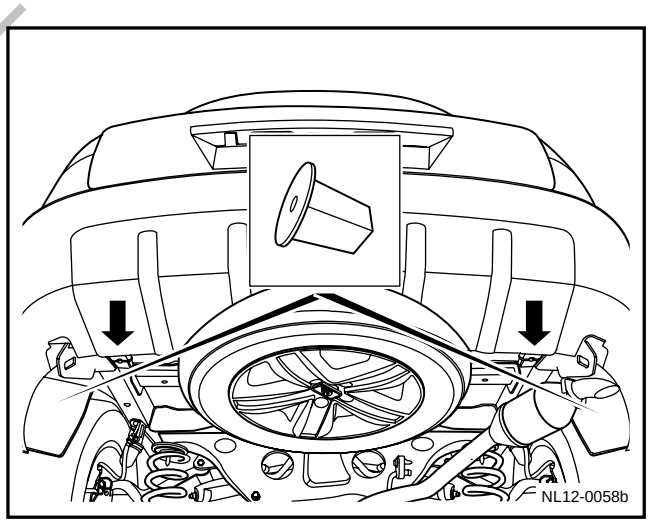
6. Install the rear bumper.
7. Install and tighten the left and right 2 screws on the top of the rear bumper.

Torque : 4Nm(Metric) 3lb-ft(English system)



8. Install 2 screws and 2 buckles on the bottom of the rear bumper and tighten the screws.

Torque : 4Nm(Metric) 3lb-ft(English system)



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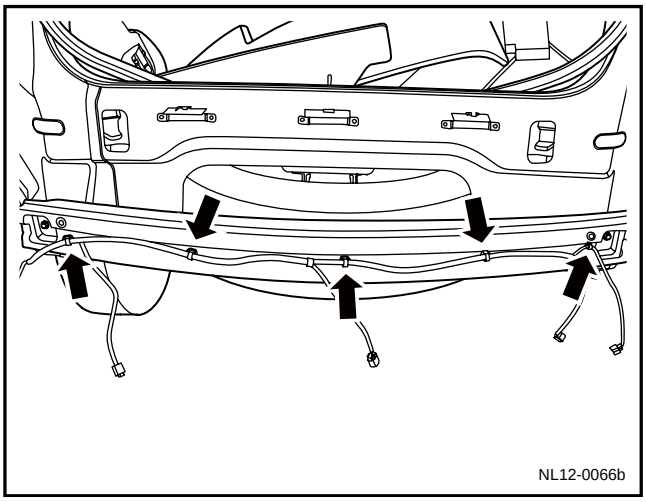
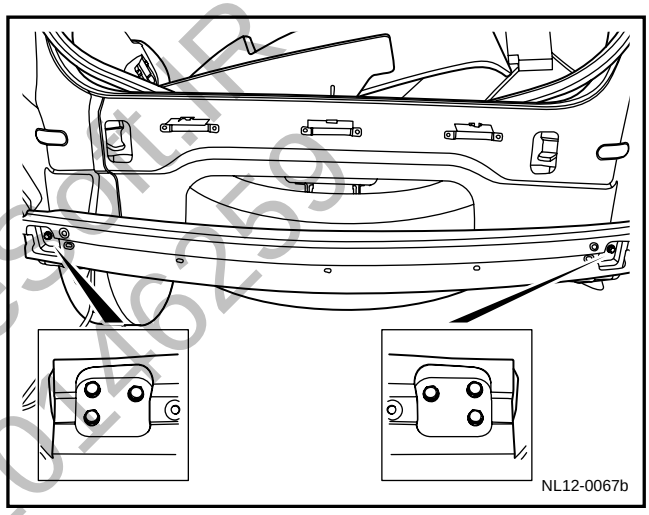
12.4.3.4 Rear cross beam replacement

Dismantlement Procedure

1. For dismantling of rear bumper, refer to 12.4.3.3 Replacement of rear bumper.
2. Loosen wire harness buckle on rear horizontal beam.



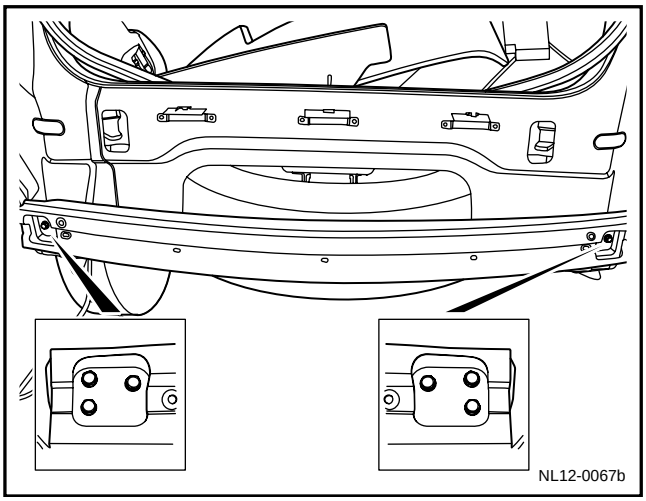
3. Dismantle 3 fixing bolts on left and right sides of rear horizontal beam.



Installation Procedure:

1. Install 3 fixing bolts respectively on left and right sides of rear horizontal beam and tighten them.

Torque: 25Nm (Metric) 18. 5lb-ft(English system)



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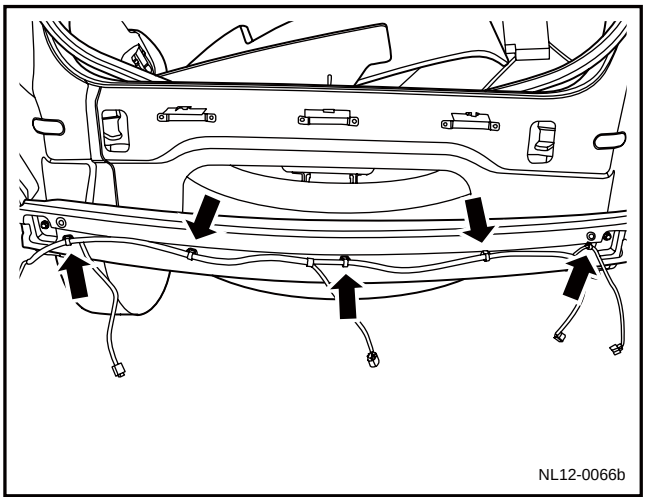
2. Fix wire harness of rear horizontal beam.
3. Install the rear bumper.



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12.5 Door

12.5.1 Specification

12.5.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (NM)	English system (lb-ft)
Fixing Bolts of Left Front Door Assembly	M8X30	33 - 38	24.4 - 28.1
Fixing Bolts of Right Front Door Assembly	M8X30	33 - 38	24.4 - 28.1
Fixing bolt of left rear door assembly	M8X30	33 - 38	24.4 - 28.1
Fixing Bolts of Right Rear Door Assembly	M8X30	33 - 38	24.4 - 28.1
Door lock catch	M8×22	18 - 22	13.3 - 16.3
Fixing Bolts of Door Lock	M8X30	33 - 38	24.4 - 28.1
Door stopper assembly	M8×20	22 - 26	16.3 - 19.2

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12.5.2 Dismantle and install

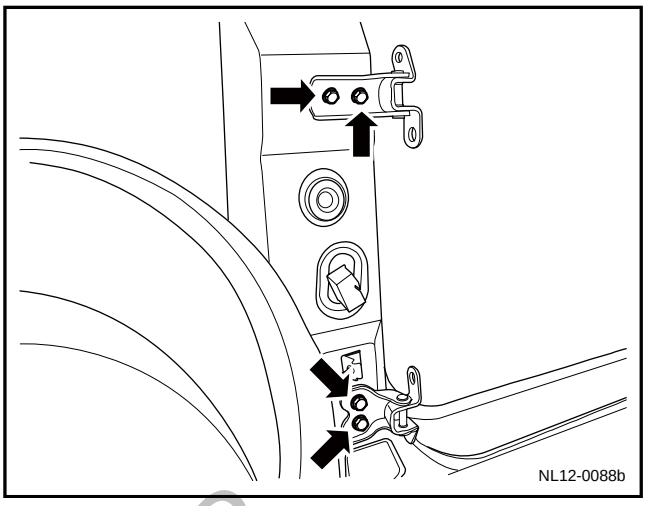
12.5.2.1 Door and hinge replacement

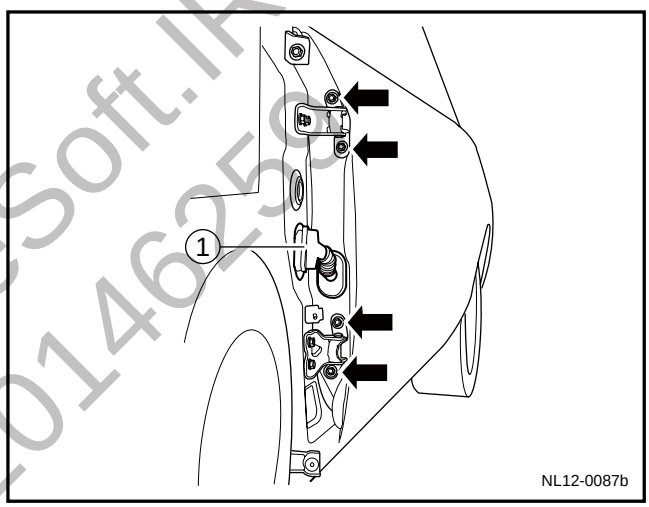
Dismantlement Procedure

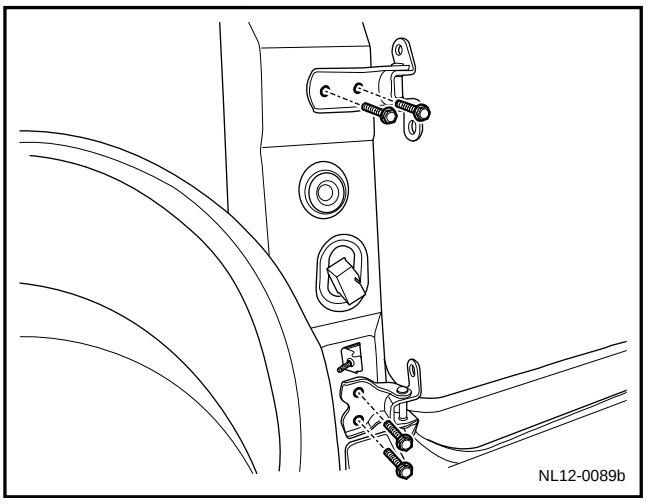
Warning!

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of front fender, refer to 12.2.3.4 Replacement of front fender.
3. Loosen door electric appliance wire harness dustproof cover, and disconnect wire harness connector 1.
4. For dismantling of door limit stopper, refer to 12.5.2.2 Replacement of door limit stopper.
5. Clean the assembly surface of the door hinge with cleaning cloth and mark the position of the hinge on the surface of the door using an oil pen or other marking tools.
6. Remove the body side fixing bolts for the upper and lower hinges.
7. Dismantle the door.
8. Clean the side body hinge assembly surface with cleaning cloth and mark the position of the hinge on the body surface with an oil pen or other marking tools.
9. Remove the fixing bolts for the upper and lower hinges on the door side.
10. Dismantle upper, lower hinges.







Installation Procedure:

1. Install the hinge on the door and install the door with preloaded hinge on the body. After the fine tuning, tighten the door to the specified torque.

Torque :24Nm(Metric) 17 . 8lb-ft(English system)

Notes:

See "Special Cautions Regarding Fastening Parts" in "Warnings and Cautions".

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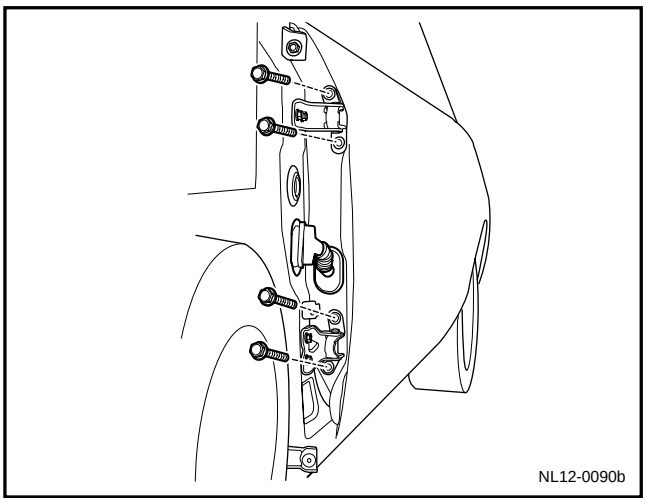
2. Install door.
3. Connect door wire harness connector, and install it into the vehicle body, and then install dustproof cover.
4. Install door limit stopper.
5. Close the door to see whether the door clearance is proper. If necessary, please adjust the clearance.
6. Tighten the fixing bolts of door.

Torque: 36Nm (Metric) 26. 7lb-ft(English system)

7. Install the fender.
8. Install the front fender liner.
9 . Connect the battery negative cable.



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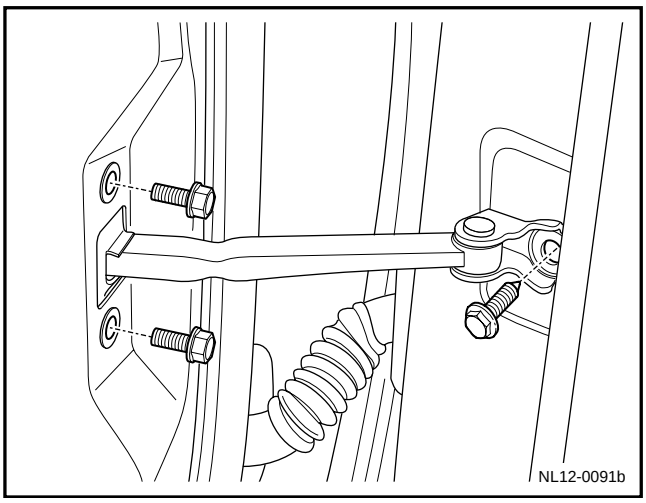
12.5.2.2 Door limiter replacement

Dismantlement Procedure

1. For dismantling of door inner trimming plate, refer to 12.9.1.7 Replacement of left front door inner trimming plate.
2. Dismantle fixing bolt of door stopper.
3. Take out limit stopper from vehicle door.

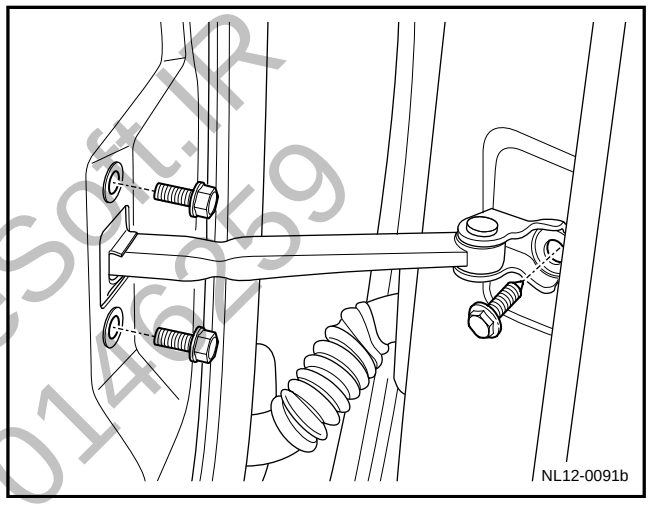


Installation Procedure:

1. Install limiter.
2. Tighten fixing bolt.

Torque: 24Nm (Metric) 17. 8lb-ft(English system)

3. Install the door interior trim panel.



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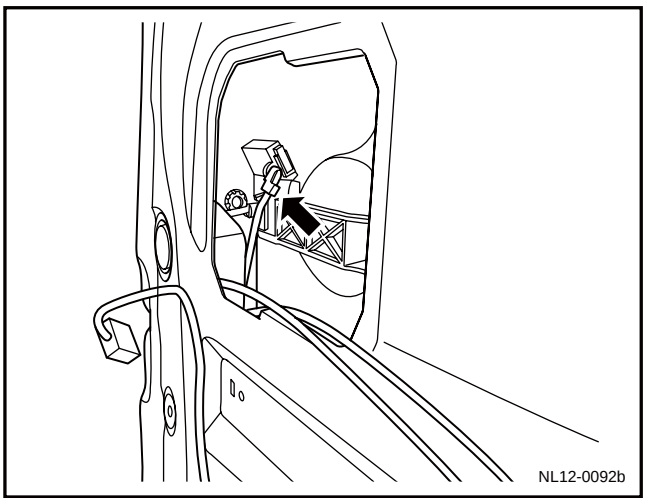
12.5.2.3 Front door outer opening handle replacement

Dismantlement Procedure

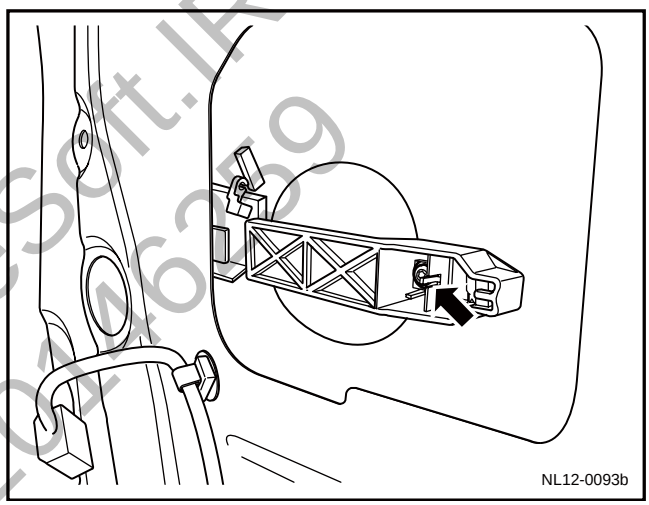
Warning!

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Dismantle the front door interior trim panel. Refer to12.9.1.7 Replacement of Front Door Interior Trim Panel.
3. Loosen door outer opening handle rod.
4. For dismantling of front door lock catch, refer to 12.5.2.5 Replacement of front door lock catch.



5. Remove the fixing bolt for the external door handle mounting lining seat to facilitate the removal of the external door handle.

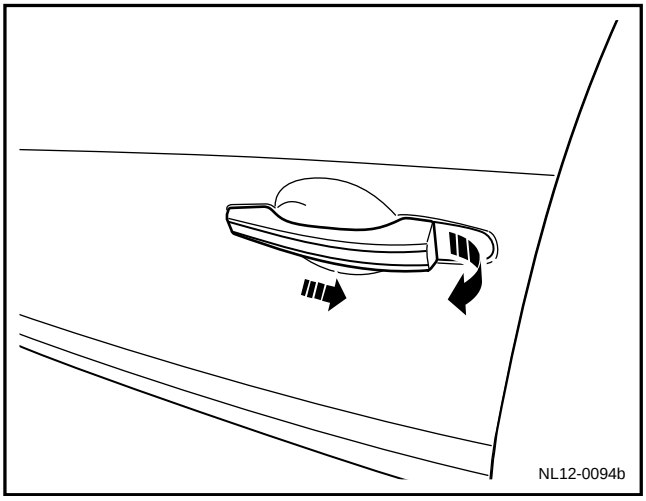


6. Lift and extract the external door handle.

Notes:

Please don't loss the sealing gasket.

7. Dismantle the external door handle mounting lining seat.



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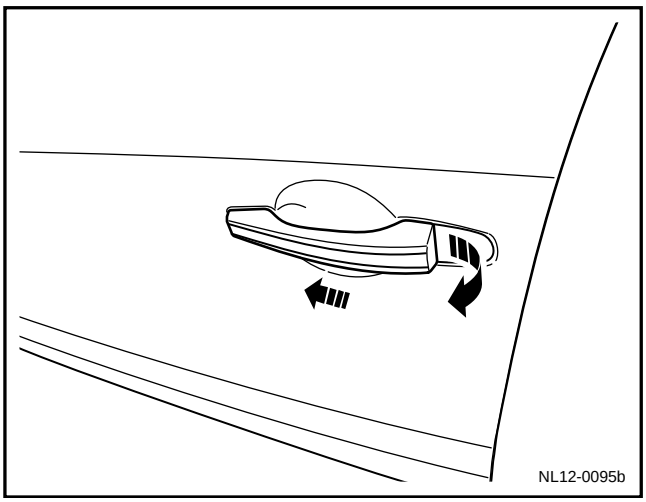
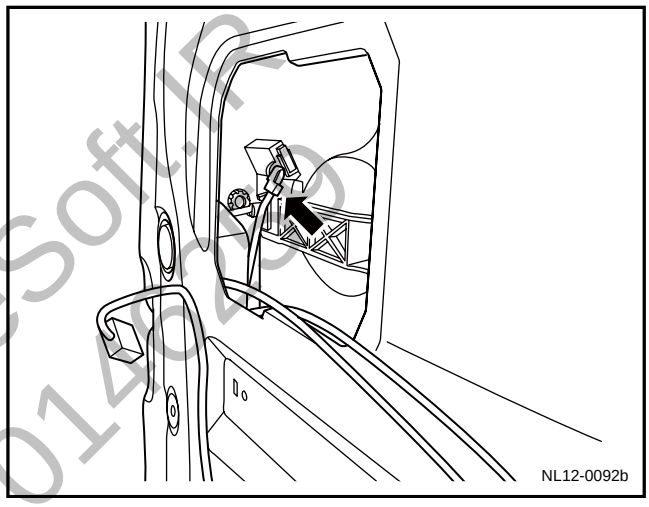
Installation Procedure:

1. Install door outer opening handle mounting bushing seat.
2. Install the door outside release handle.
3. Install the front door lock cylinder.



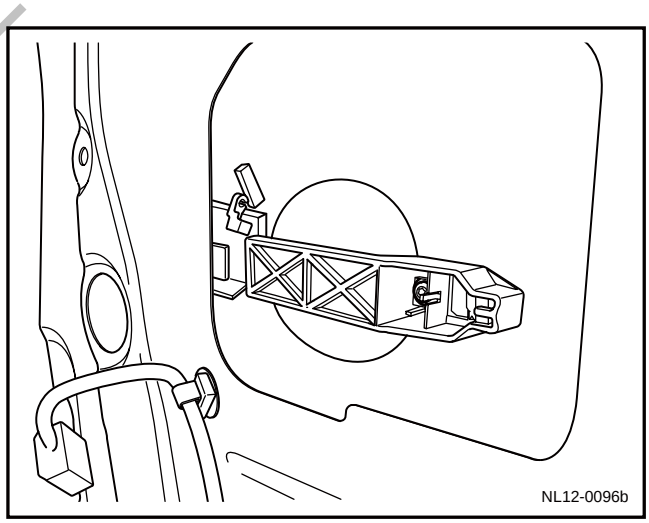
4. Install door outer opening handle pull rod.



5. Tighten the fixing bolt for the external door handle mounting lining seat.

Torque :8Nm(Metric)6lb-ft (English system)

6. Install the front door interior trim panel.
7. Connect the battery negative cable.



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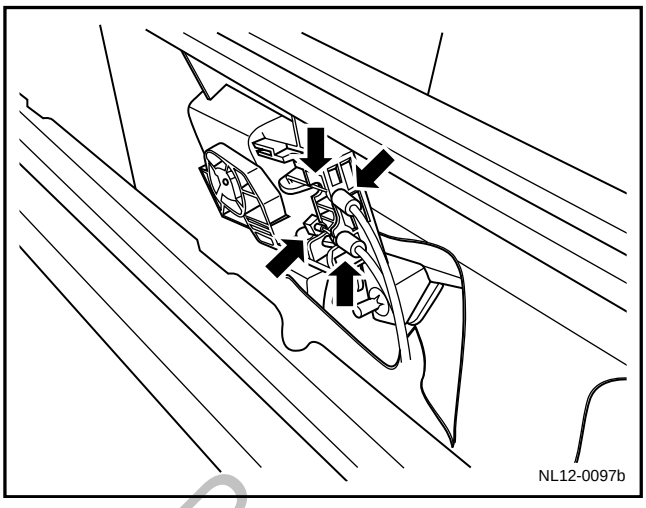
12.5.2.4 Inner open handle replacement of front door

Dismantlement Procedure

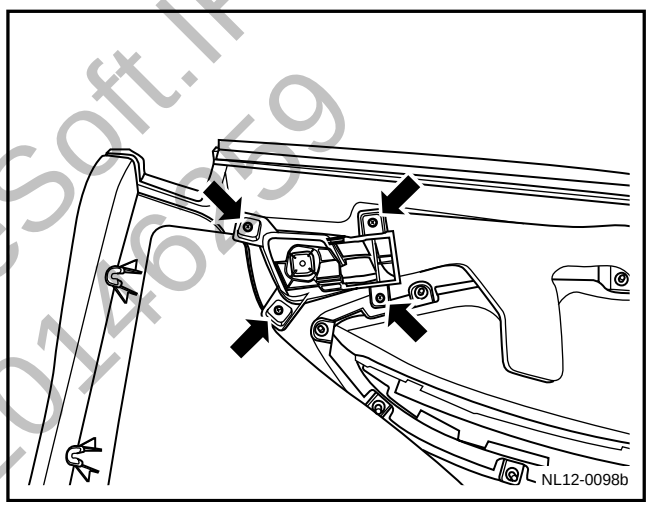
Warning!

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of door inner trimming plate, refer to 12.9.1.7 Replacement of left front door inner trimming plate.
3. Loosen inner opening handle cable.



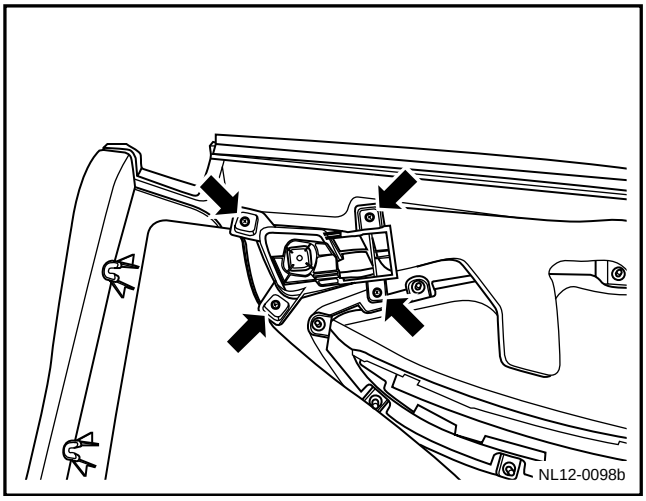
4. Dismantle fixing screw of inner opening handle of front door.



Installation Procedure:

1. Install front door inner opening handle fixing screw.

Torque :8Nm(Metric)6lb-ft (English system)



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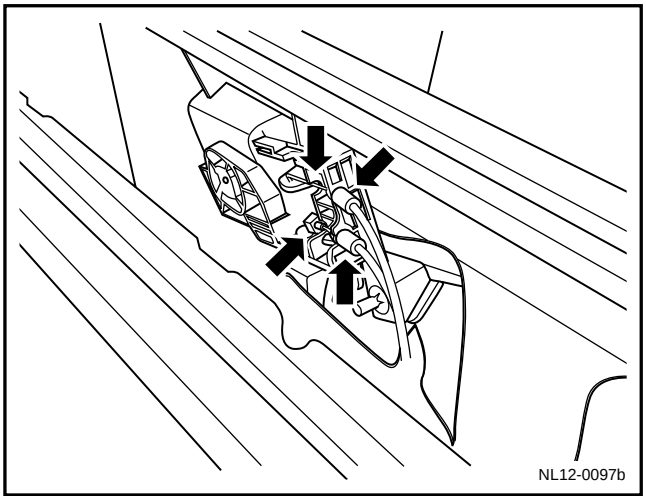
2. Fix inner opening handle cable.
3. Install the front door interior trim panel.
4. Connect the battery negative cable.



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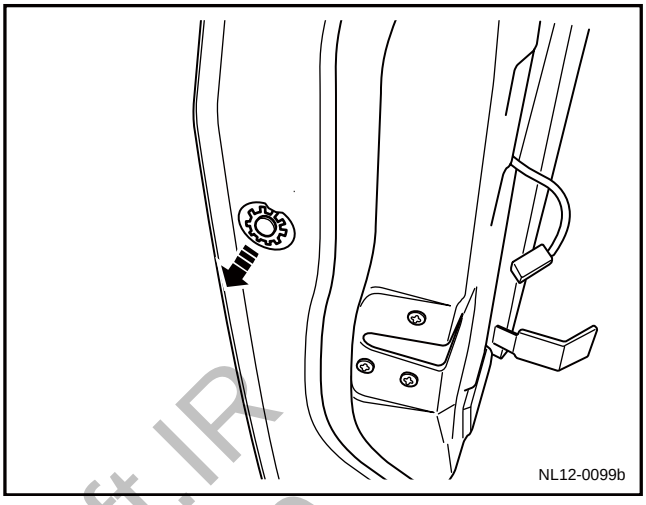
12.5.2.5 Front door lock cylinder replacement

Dismantlement Procedure

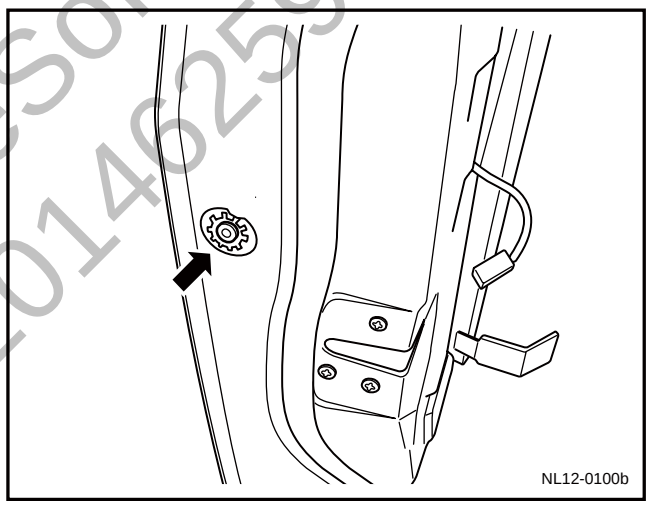
Warning!

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

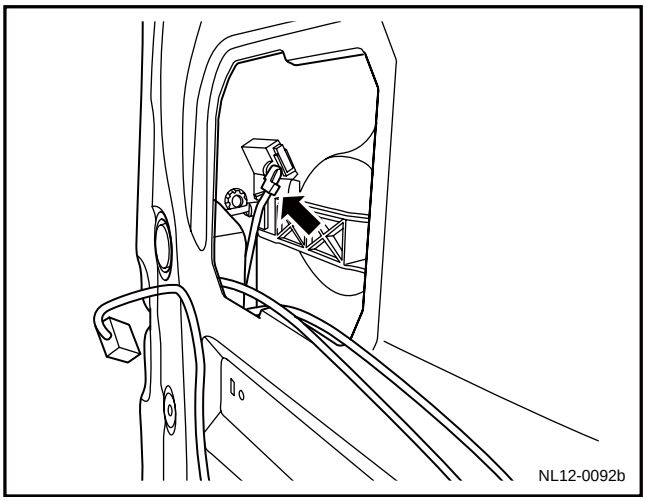
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of door inner trimming plate, refer to 12.9.1.7 Replacement of left front door inner trimming plate.
3. For dismantling of front door glass, refer to 11.4.8.5 Replacement of left front glass lifter motor.
4. For dismantling of front door glass guide groove, refer to 11.4.8.8 Replacement of front door glass guide groove.
5. Remove the lock cylinder fixing bolt closure.



6. Remove the lock cylinder fixing bolt.



7. Dismantle the external door handle push rod.



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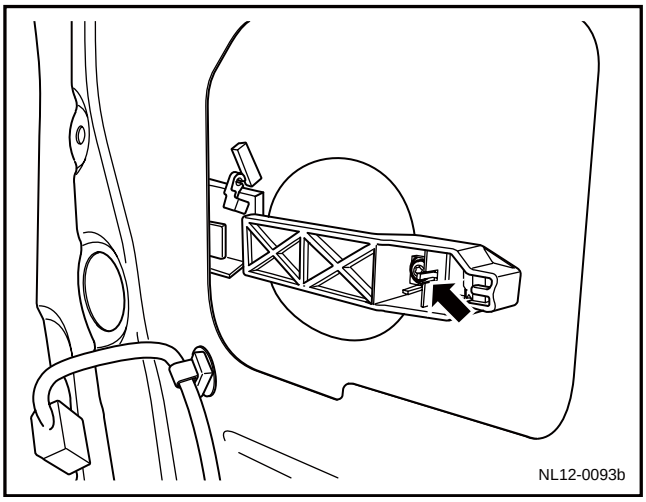
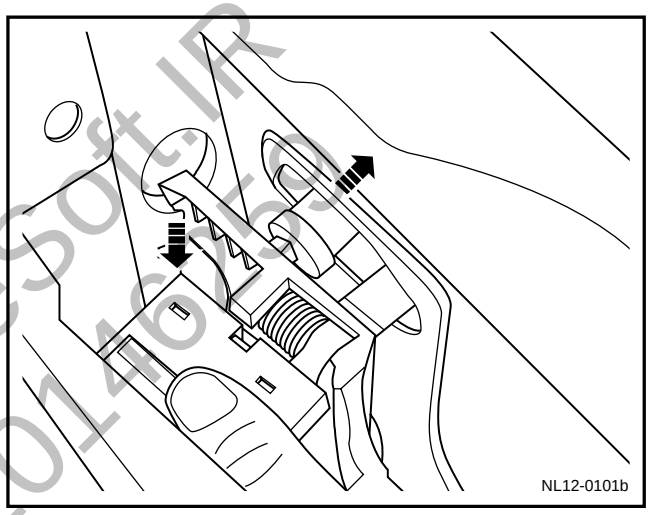
8. Loosen the fixing bolt for the external door handle mounting lining seat.

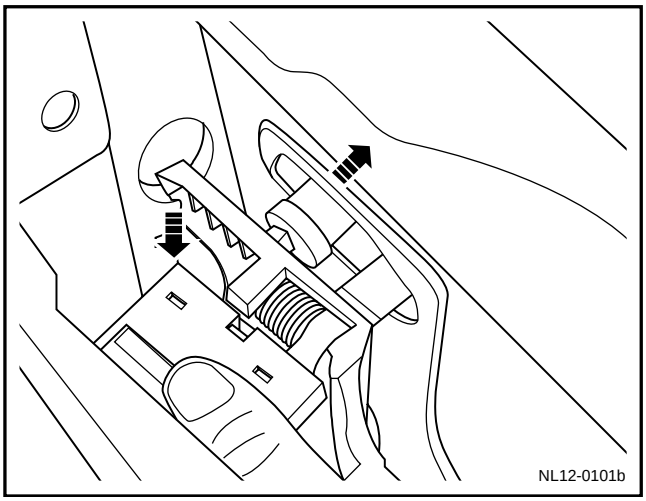


9. Detach and push out the external door handle to facilitate the dismantlement of the lock cylinder.
10. Draw out lock core.



Installation Procedure:

1. Remove and push out door outer opening handle to facilitate installation of lock core.
2. Insert lock core into lock block.



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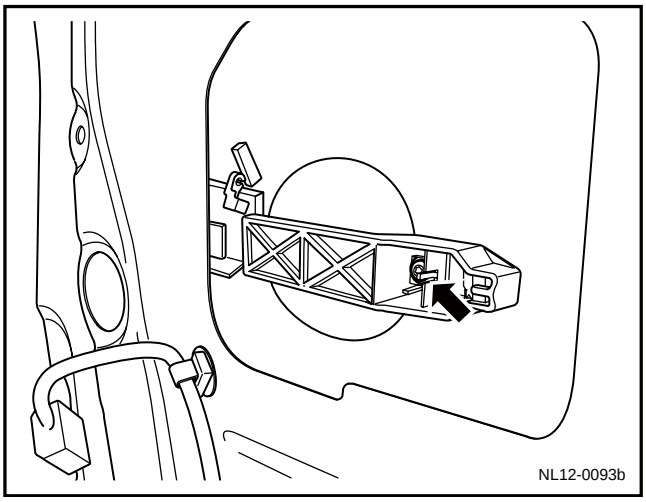
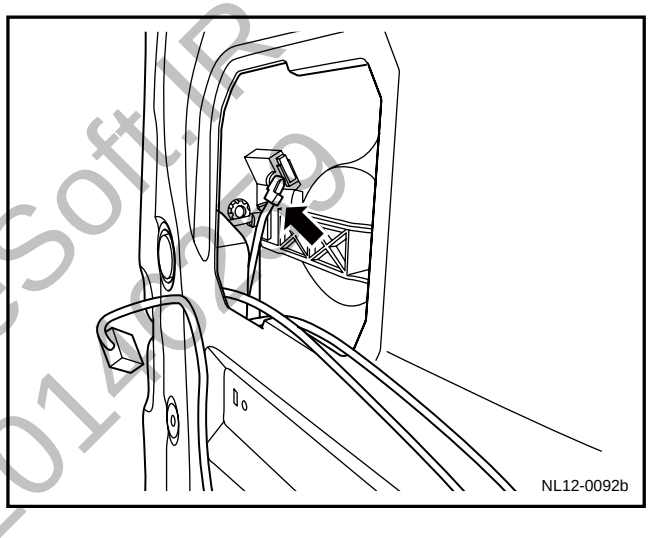
3. Tighten fixing bolts of mounting lining seat of door outer opening handle.

Torque: 8Nm(Metric) 6lb-ft(English system)

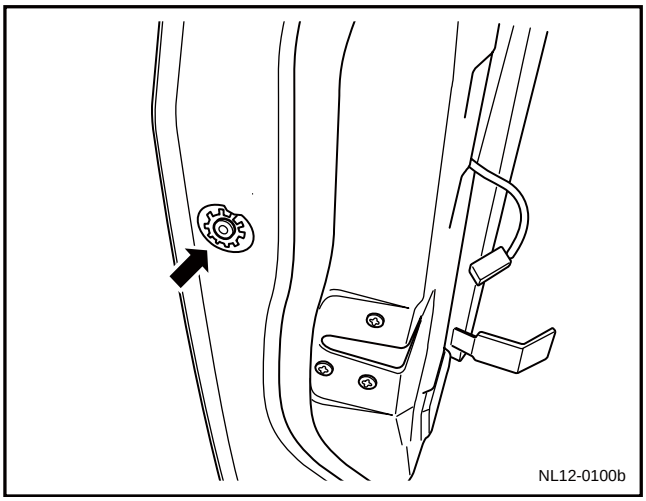


4. Install door outer opening handle push rod.



5. Install the lock cylinder fixing bolt.

Torque :36Nm(Metric) 26 . 6lb-ft(English system)



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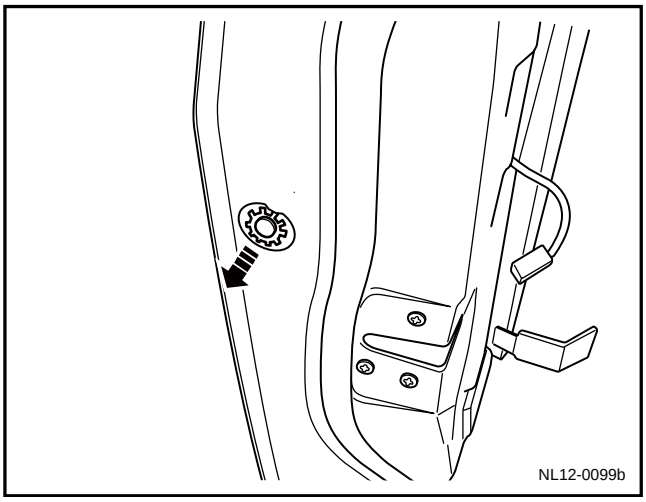
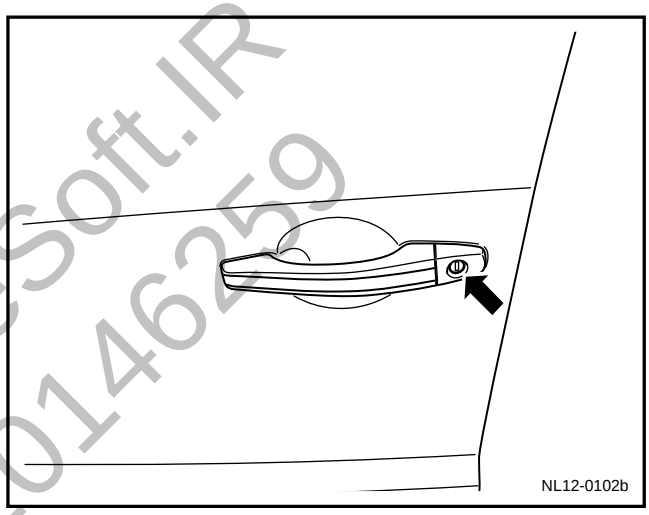
6. Install the lock cylinder retaining bolt blocking cap.



7. Install the lock cylinder cover plate.
8. Install the front door window guide groove.
9. Install front door glass.
10. Install the door interior trim panel.
11. Connect the battery negative cable.



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12.6 Frame and body bottom

12.6.1 Specification

12.6.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (NM)	English system (lb-ft)
Connecting bolt of longitudinal beams and sub-frame	M12×1.25×25	79 - 95	58.5 - 70.3
Front mounting bolt of front sub-frame	M14×1. 5×133	133 - 157	98.4 - 116.2
Front mounting bolt flat washer combination member of rear subframe	M14×1. 5×90	138 - 162	102 - 120
Rear mounting nut of rear sub frame	M14×1.5	180 - 220	133.2 - 162.8

12.6.2 Description and operation

12.6.2.1 Bottom of frame and body

The frame at the front and rear of vehicle is a subframe which is isolated from the body by rubber bushings. It provides support to the powertrain, the lower control arms of front suspension and the power steering gear with tie rod assembly. Any misalignment will lead to the wheels misalignment. The frame is bolted to the body by the rubber bushings. The underbody must be properly positioned in order to ensure proper suspension and wheels positioning. The individual underbody components contribute directly to the overall strength of unibody. Use proper welding techniques during maintenance operations to the unibody. The part must be protected against corrosion as long as the body repair operation is damaged or the original surface is damaged, refer to 12.12.2.4 Corrosion Prevention in description and operation of "Collision Maintenance".

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12.6.3 Diagnostic information and steps

12.6.3.1 Diagnostic Information and Procedures

Inspect the underbody.

If the size of the body bottom does not accord with standard, a body correcting frame is used for correcting the size of various parts of the body in accordance with the requirement, refer to 12.12.1 Specification.

Inspect the Frame and the Body Positioning

Perform the installation procedure of frame. If the frame can not be correctly installed to the body, the frame and body positioning is incorrect. Confirm the body positions exactly to replace the frame.

12.6.4 Dismantle and install

12.6.4.1 Maintenance of frame

Inspect for the possible damage to the frame and indirectly judge the frame positioning by the following.

The frame can not be correctly installed to the body.

– The right geometric relationship among the steering arms.

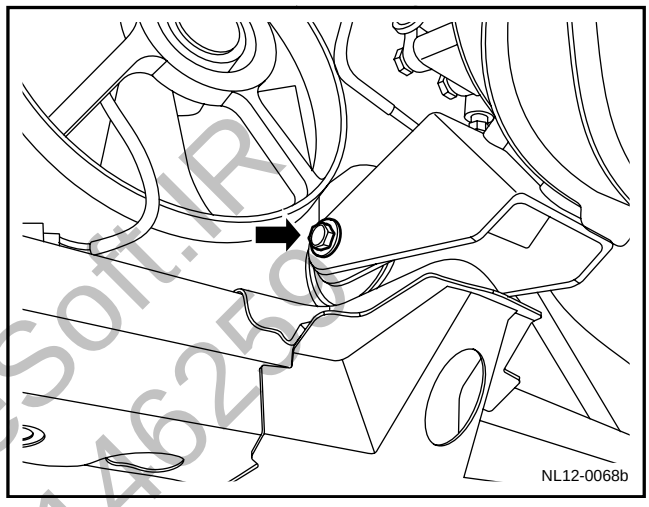
– Correct wheel position

If the frame is damaged in any form, replace the frame. Do not attempt to repair the frame.

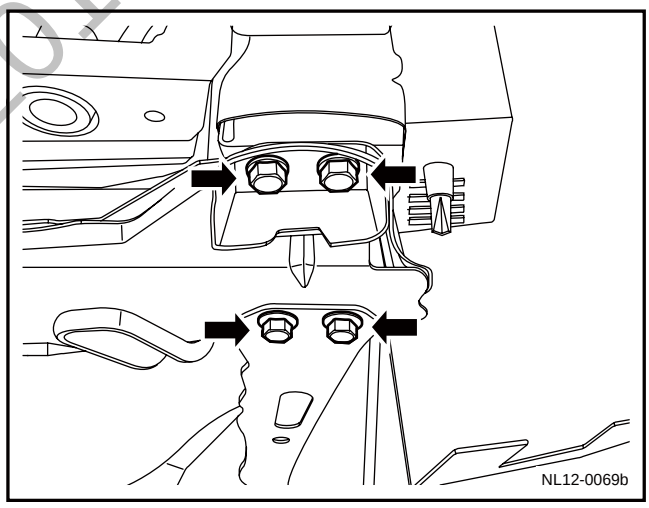
12.6.4.2 Front suspension cross beam assembly replacement

Dismantlement Procedure

1. Dismantle front bumper. Refer to 12.4.3.1 Replacement of Front Bumper.
2. For lifting of the vehicle, refer to 1.3 Lifting of Vehicle.
3. Dismantle through bolt of engine front vibration insulation pad.



4. Dismantle fixing bolt on both sides of front suspension horizontal beam assembly.
5. Remove the front suspension cross member assembly.



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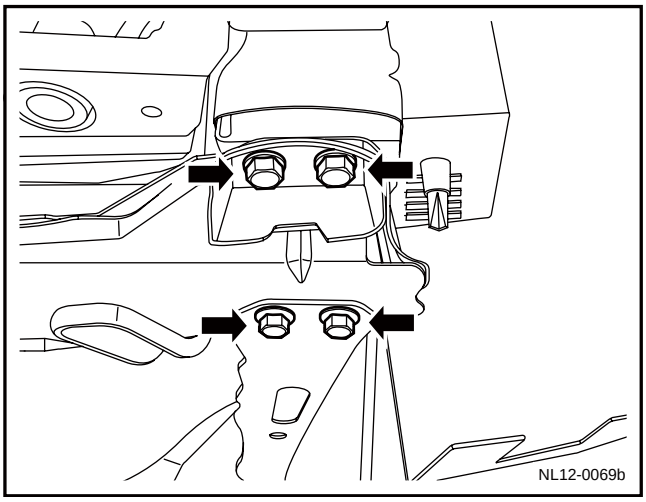
Installation Procedure:

1. Install front suspension horizontal assembly, screw fixing bolts on two sides of front suspension horizontal beam assembly, but do not tighten too much.



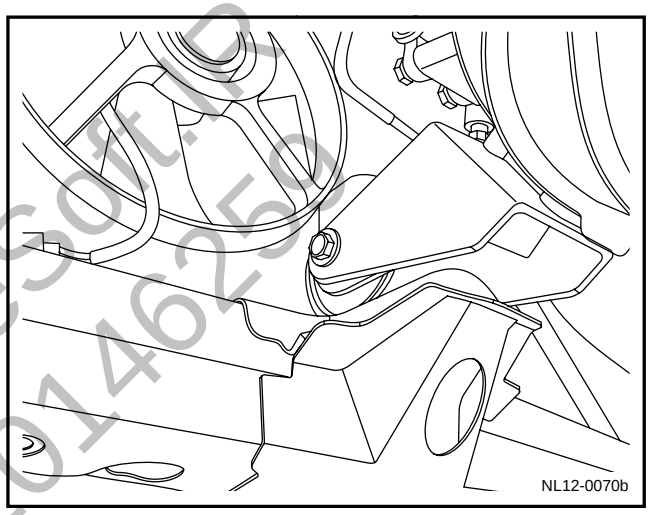
2. Install and tighten through bolt on front vibration insulation pad

Torque: 52 Nm (Metric) 38.5 lb-ft (English system)

3. Tighten fixing bolts on both sides of front suspension horizontal beam assembly.

Torque: 65 Nm (Metric) 48.1 lb-ft (English system)

4. Lower the vehicle.



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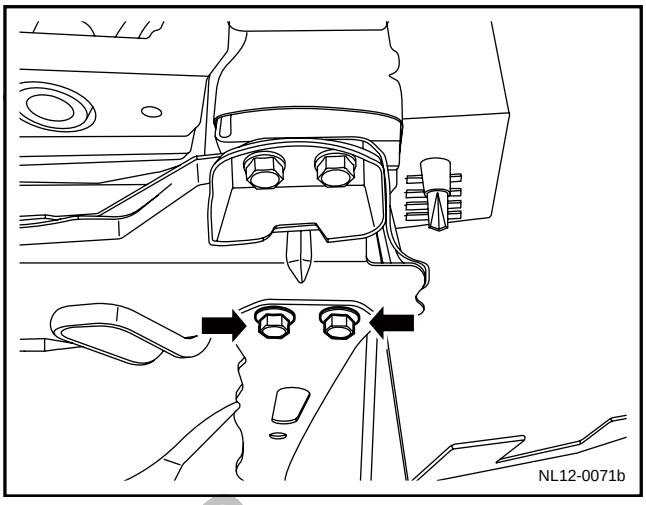
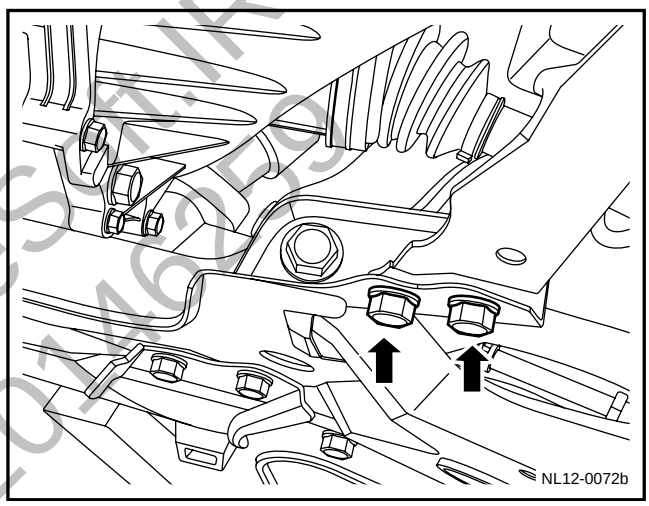
12.6.4.3 Front suspension longitudinal beam replacement

Dismantlement Procedure

1. For lifting of the vehicle, refer to 1.3 Lifting of Vehicle.
2. Fixing bolt on the front of front vertical beam.

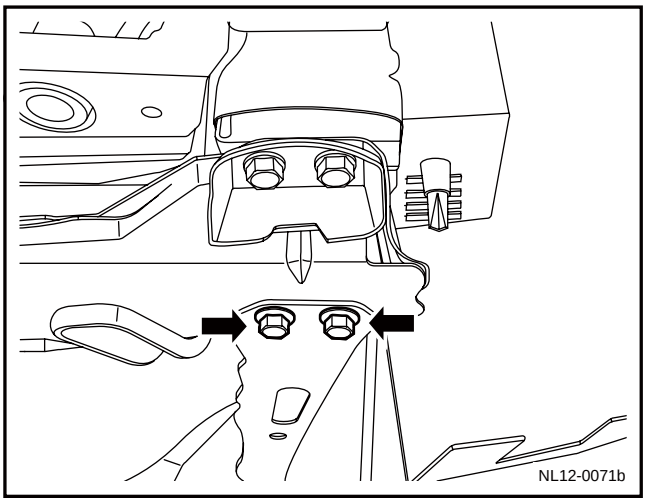


3. Dismantle fixing bolt at the rear end of front vertical beam.
4. Remove the front longeron.



Installation Procedure:

1. Install front suspension longitudinal beam.
2. Install fixing bolt on the front of front suspension vertical beam, but do not tighten too much.



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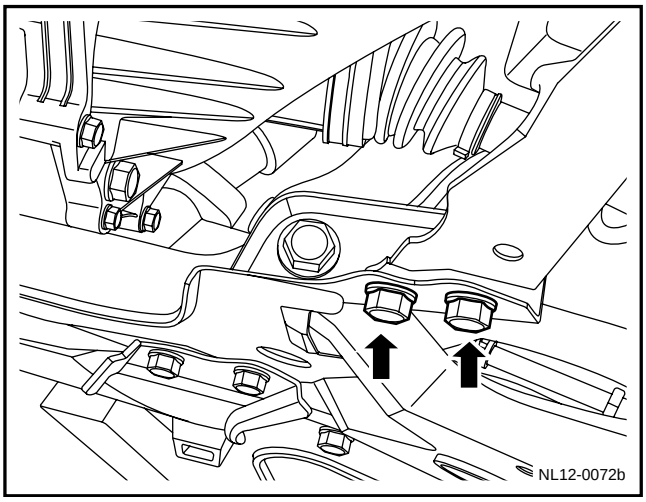
3. Install fixing bolt on the rear end of vertical beam of front suspension.

Torque : 85Nm(Metric)34lb-ft (English system)

4. Tighten the front fixing bolts for the front suspension longeron.

Torque : 85Nm(Metric)34lb-ft (English system)

5. Lower the vehicle.



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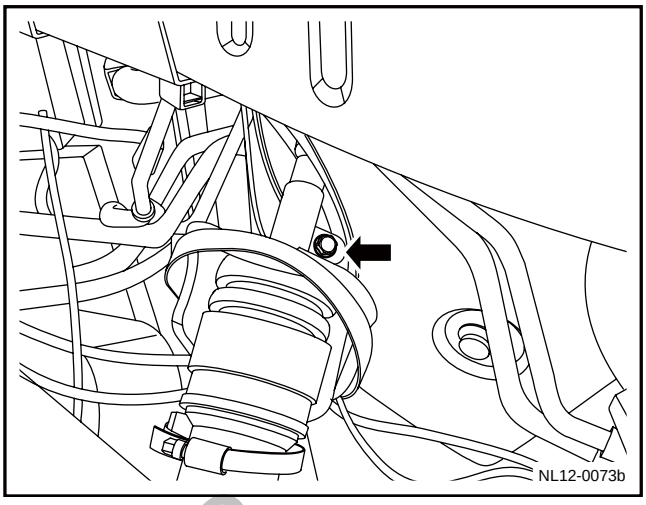
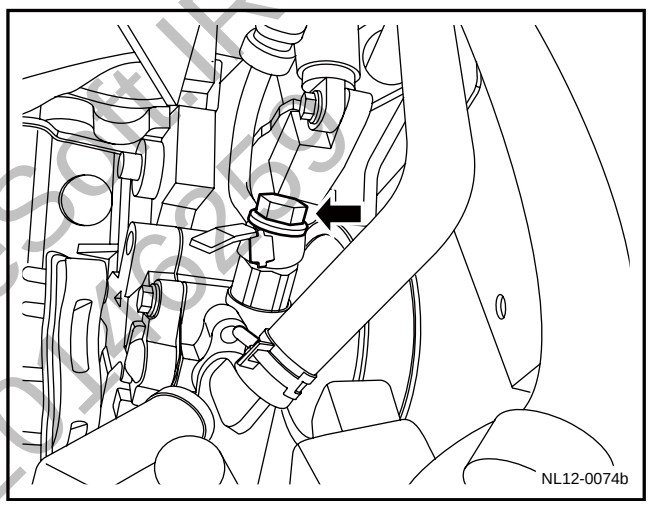
12.6.4.4 Front subframe replacement

Dismantlement Procedure

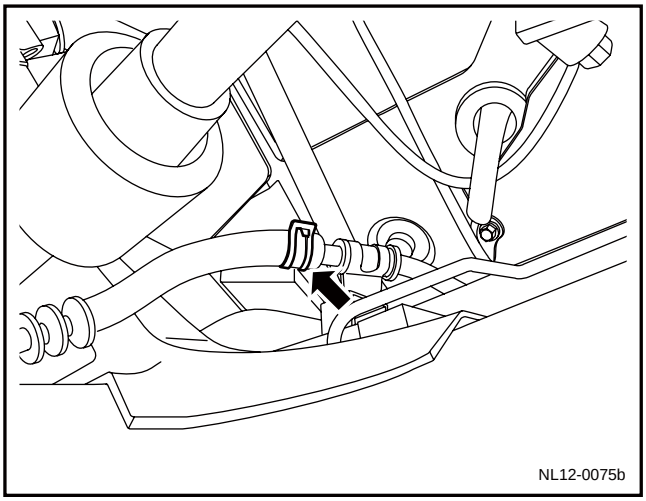
1. Align steering disc and lock it.
2. For dismantling of left, right front wheel, refer to 4.4.5.1 Replacement of wheels.
3. For lifting of the vehicle, refer to 1.3 Lifting of Vehicle.
4. Dismantle horizontal pin bolt between steering gear and steering pipe column universal joint.



5. Remove the connecting bolt between the power steering pump and the high pressure oil pipe.



6. Remove the steering gear oil return pipe fixing clamp.



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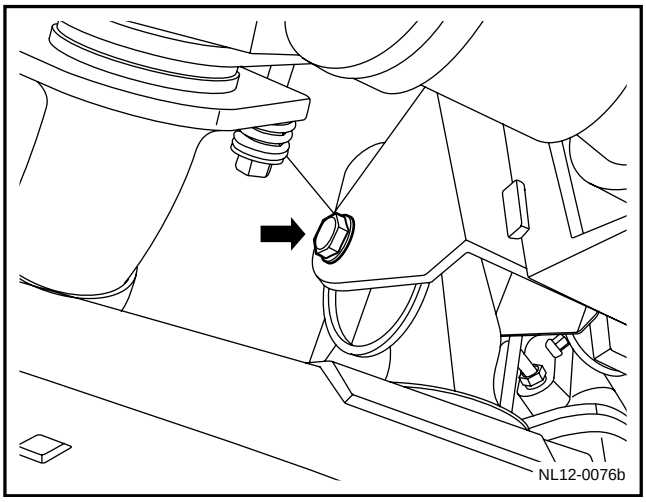
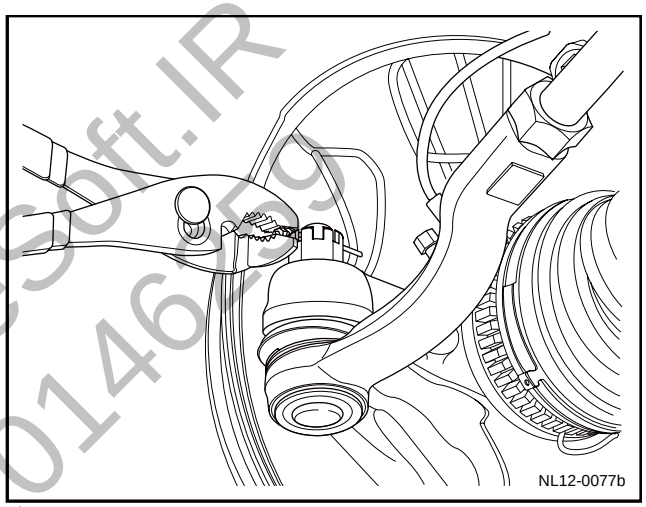
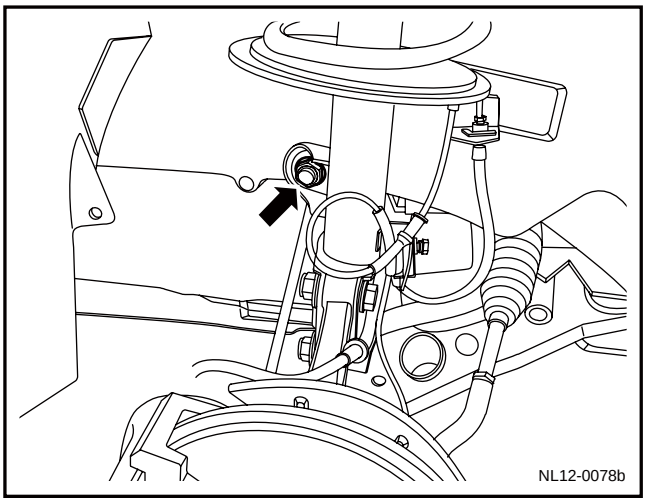
7. Remove the through bolt between the engine rear soundproof pad and front subframe.



8. Extract the cotter pins of the fixing bolts for the tie rods on both sides and remove the fixing bolts.



9. Remove the connecting nut between the connecting rod between the stabilizer bars on both sides and front shock absorber.



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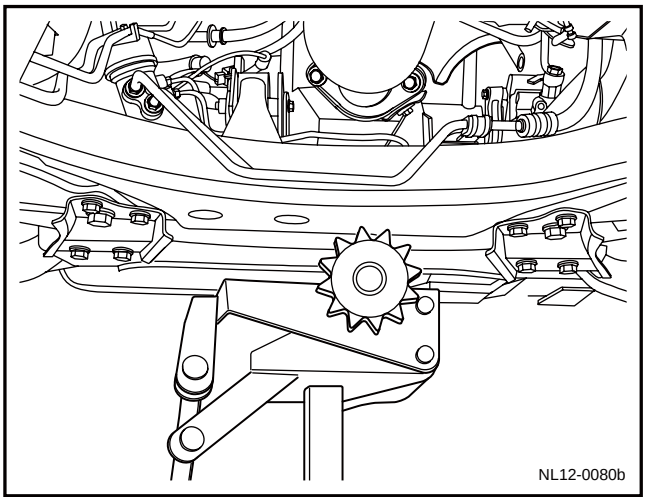
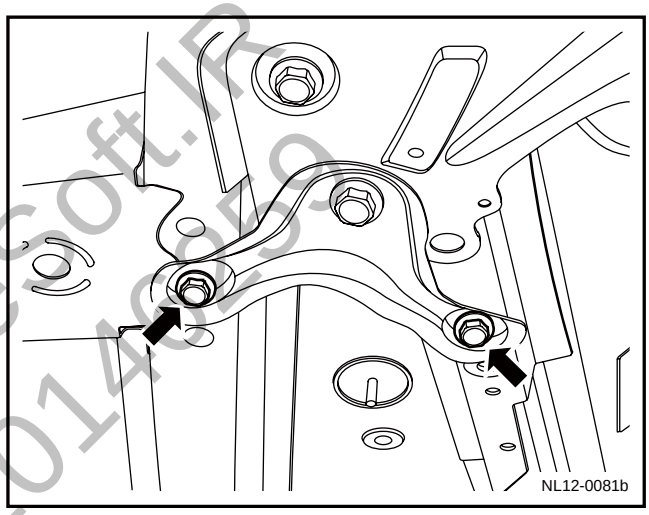
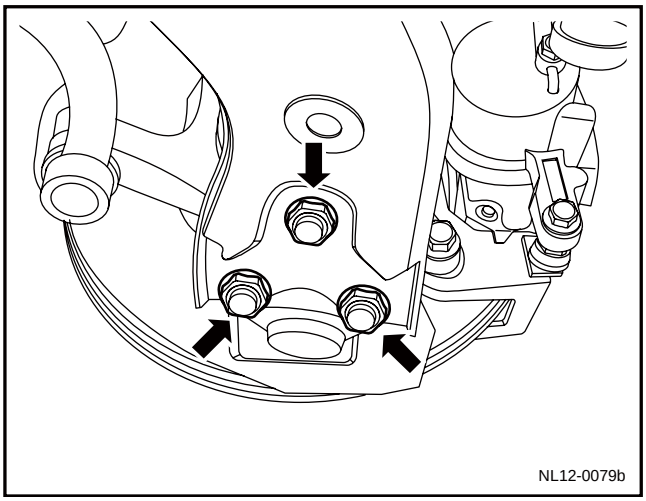
10. Dismantle lower fixing bolt and nut of lower swing arm ball head on both sides.



11. Use flat plate jack to support sub frame.



12. Dismantle fixing bolt of reinforcement plate3 of subframe of both side.



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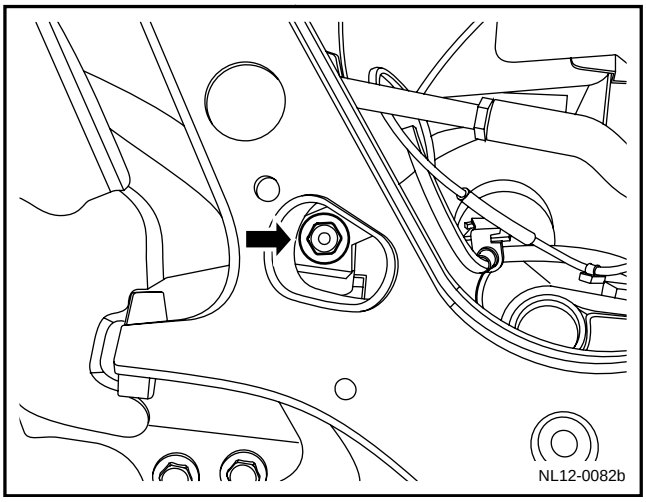
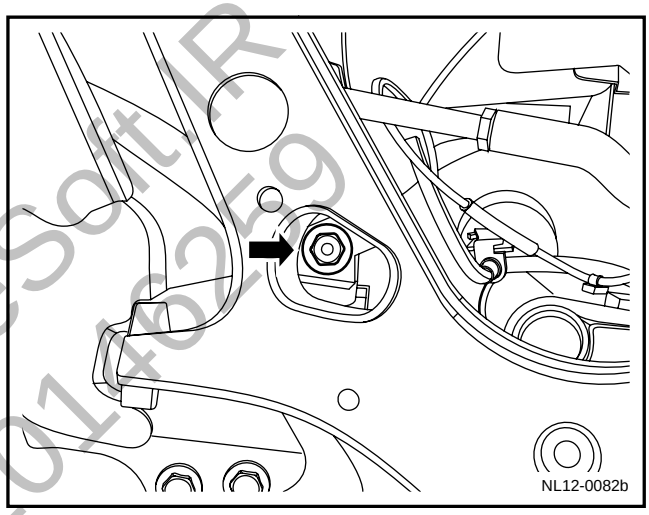
13. Dismantle front auxiliary frame on both sides and vehicle connecting bolt.
14. Slowly lower jack and remove front auxiliary frame.
15. For dismantling of steering gear from front auxiliary frame, refer to 7.2.8.13 Replacement of power steering gear with tie rod assembly.
16. For dismantling of front stabilizer rod from front auxiliary frame, refer to 4.2.7.5 Replacement of stabilizer rod.



Installation Procedure:

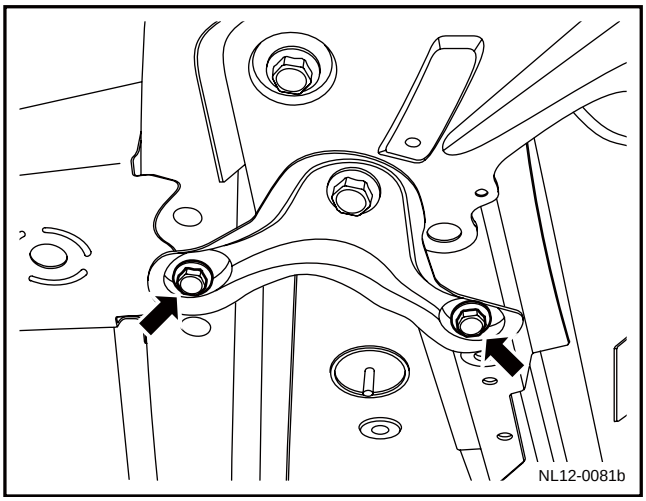
1. Install front stabilizer rod on front auxiliary frame.
2. Install steering wheel onto front auxiliary frame.
3. Use pallet jack to slowly lift front auxiliary frame.
4. Install and tighten connecting bolt between front auxiliary frame on both sides and vehicle body.



Torque: 145 Nm (Metric) 107.3 lb-ft (English system)

5. Install and tighten the front subframe reinforcing plate fixing bolt.

Torque: 145 Nm (Metric) 107.3 lb-ft (English system)



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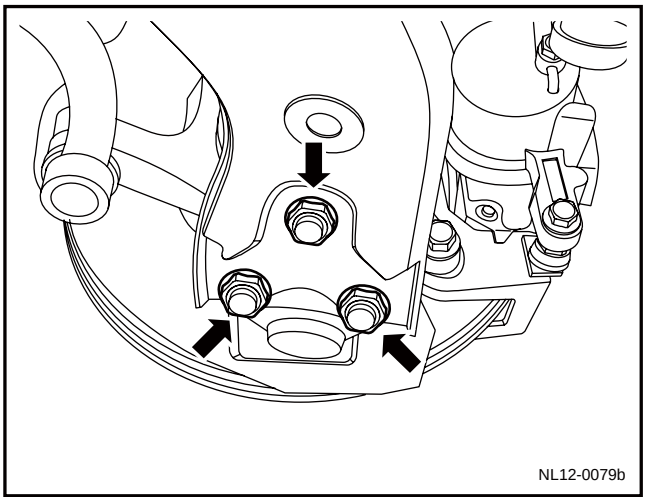
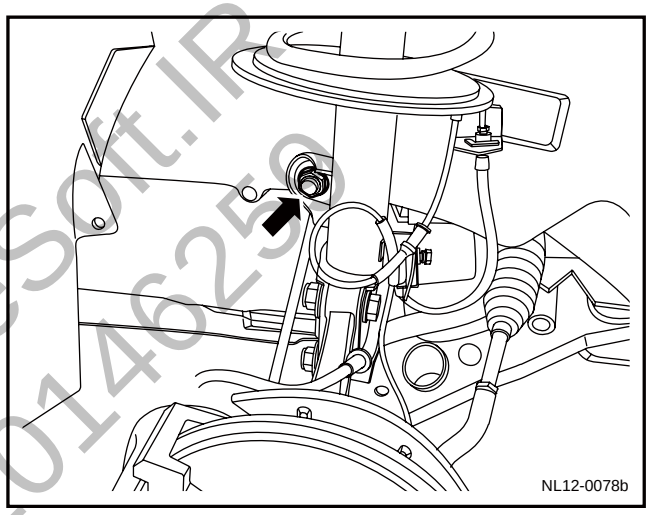
6. Install and tighten the fixing bolt and nut on the bottom of the both side lower swing arm ball ends.

Torque :135Nm(Metric)100lb-ft(English system)



7. Remove the connecting nut between the connecting rod between the stabilizer bars on both sides and front shock absorber.

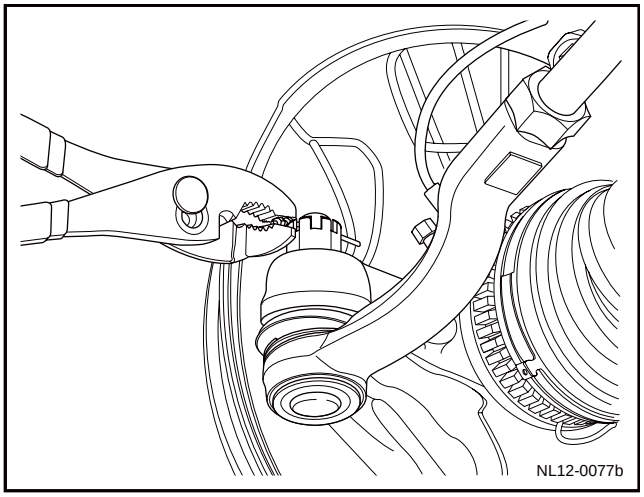
Torque: 74 Nm (Metric) 54.8 lb-ft (English system)



8. Install and tighten the fixing bolt between both side tie rod external ball ends and steering joint.

Torque: 33 Nm (Metric) 24.4 lb-ft (English system)

9. Install both sides tie rod outer ball head and knuckle fixing nut split pin .



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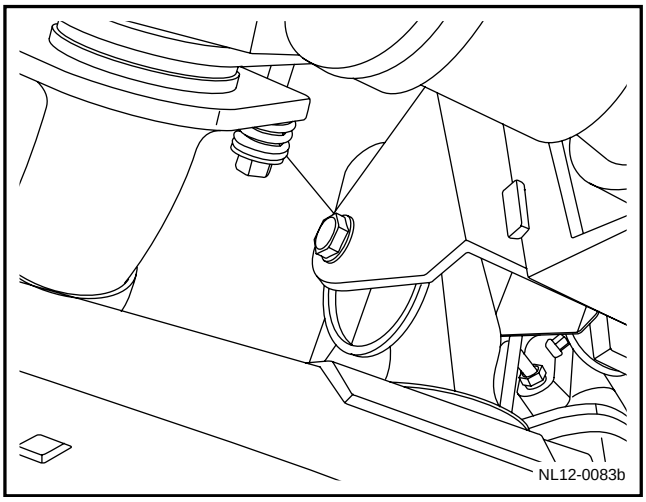
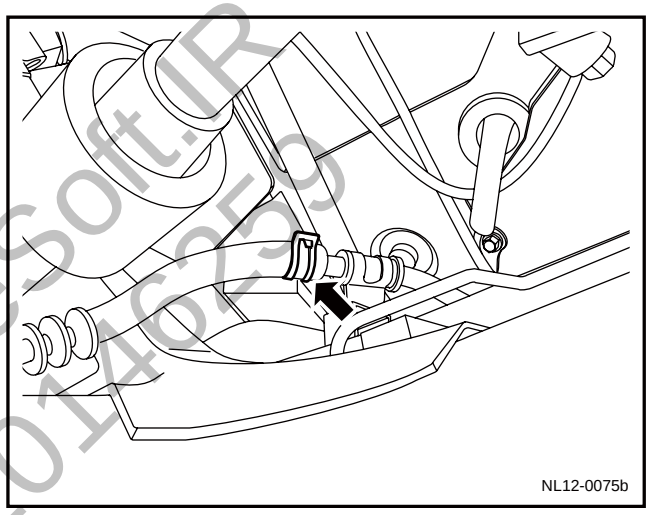
10. Install and tighten through bolt between engine rear vibration insulation pad and auxiliary frame.

Torque: 55 Nm (Metric) 40.7 lb-ft (English system)

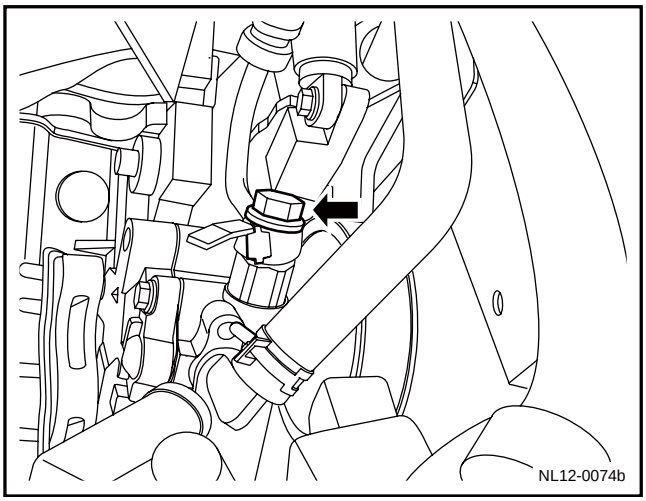


11. Connect steering gear oil pipe and install fixing snap ring.



12. Install and tighten high pressure oil pipe fixing bolt of power steering pump.

Torque: 25Nm (Metric) 18. 5lb-ft(English system)



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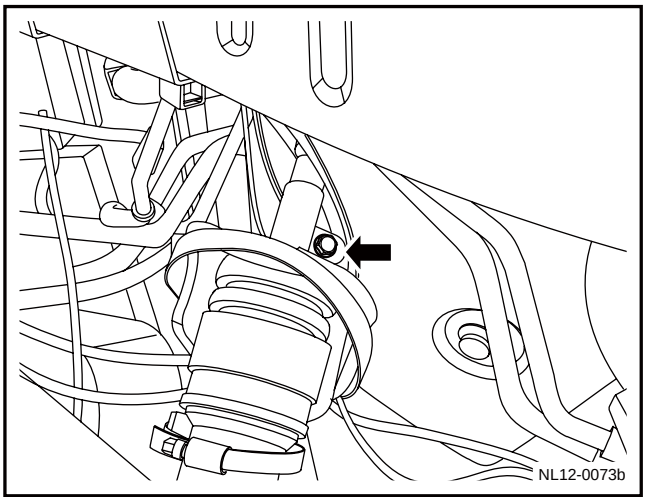
13. Install and tighten horizontal pin bolt for connection of steering wheel and steering pipe column knuckle.

Torque: 30Nm (Metric) 22 . 2lb-ft(English system)

14. Lower the vehicle.
15. Install left and right front wheels.
16. Add booster steering fluid.



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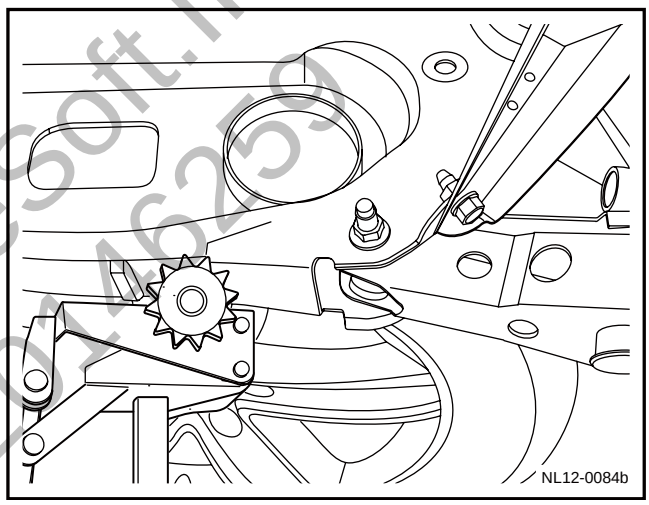
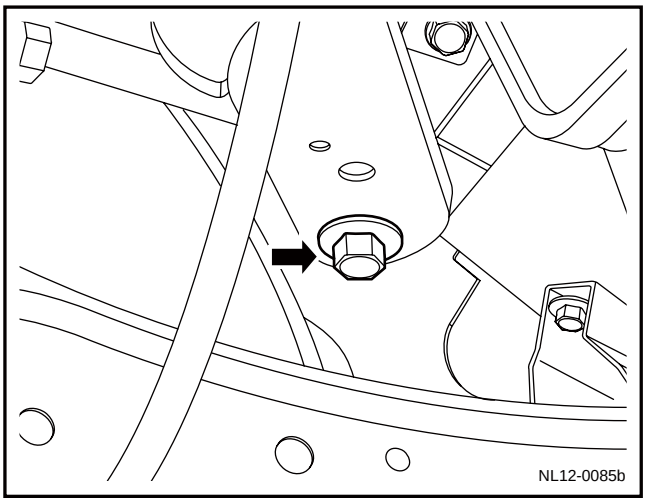
12.6.4.5 Rear subframe replacement

Dismantlement Procedure

1. For lifting of the vehicle, see 1.3 Lifting of Vehicle.
2. For dismantling of rear muffler, refer to 2.7.6.4 Replacement of rear muffler.
3. Use pallet jack to support rear auxiliary frame.
4. For dismantling of rear vertical arms on both sides, refer to 4.3.7.8 Replacement of rear vertical arm.
5. For removal of the rear suspension #1 swing arms on both sides, see 4.3.7.3 Replacement of Rear Suspension Swing Arms.
6. For removal of the rear suspension #2 swing arms on both sides, see 4.3.7.2 Replacement of Rear Suspension Swing Arms.
7. For dismantlement of top swing arms for both side rear suspensions, see 4.3.7.7 Replacement of Rear Suspension Top Swing Arms.
8. For dismantlement of the parking brake control mechanism assembly control cable, see 6.5.5.3 Replacement of Parking Brake Control Mechanism Assembly Control Cable.
9. For dismantlement of two rear wheel speed sensors, see 6.6.7.3 Replacement of Wheel Speed Sensors (Rear).
10. For dismantling of rear stabilizer rod connecting rod on both sides, refer to 4.3.7.5 Replacement of rear stabilizer rod connecting rod.
11. Dismantle rear stabilizer rod. Refer to 4.3.7.6 rear stabilizer rod replacement.
12. Dismantle rear damper of both sides refer to 4.3.7.1 rear shock absorber replacement.
13. For dismantling of support of rear axle ball heads on both sides, refer to 4.3.7.9 Replacement of support of rear axle ball head.
14. For dismantling of rear wheel hub unit on both sides, refer to 4.3.7.10 Replacement of rear wheel hub unit.
15. Dismantle fixing bolts on both sides of front section of rear auxiliary frame.





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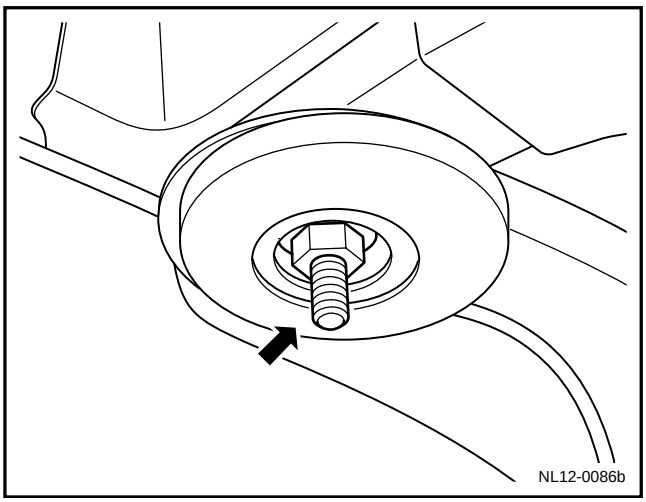
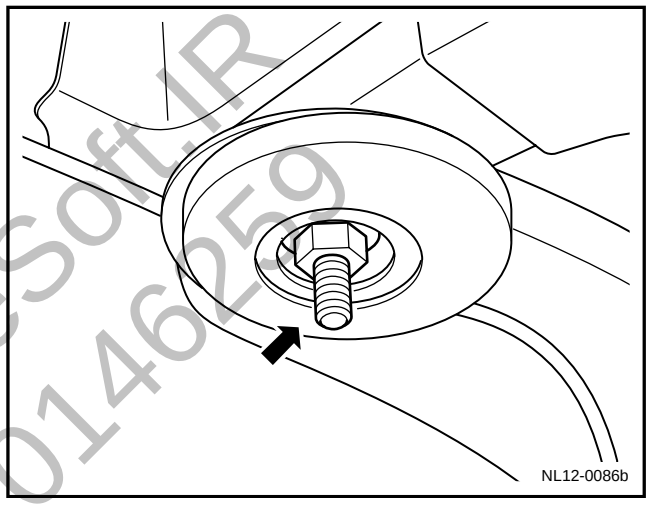
16. Dismantle fixing bolt on both sides of rear end of rear auxiliary frame.
17. Slowly lower jack and remove rear auxiliary frame.



Installation Procedure:

1. Use flat plate jack to slowly lift rear auxiliary frame.
2. Install and tighten fixing bolts on both sides of rear end of rear auxiliary frame.

Torque :200 Nm(Metric)148lb-ft (English system)



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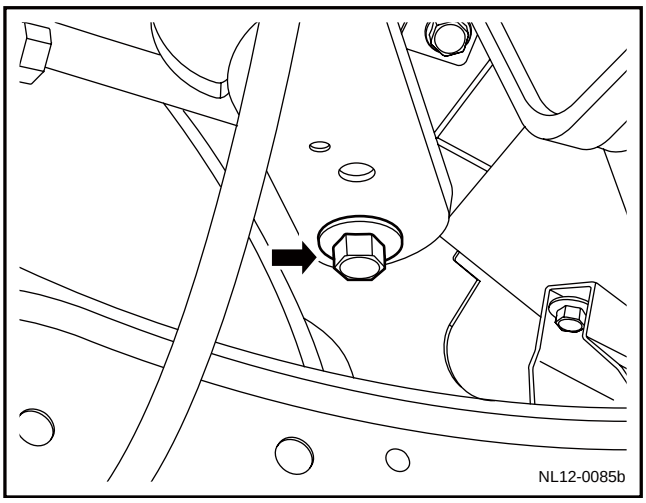
3. Install and tighten fixing bolt on both sides of front end of rear auxiliary frame.

Torque: 150 Nm (Metric) 111 lb-ft (English system)

4. Install rear wheel hub units on both sides.
5. Install the spindle head bearing seats for the rear axles on both sides.
6. Install the two side reaer shock absorbers.
7. Install the rear stabilizer bar.
8. Install the connecting rod between both side rear stabilizer bars.
9. Install two rear wheel speed sensor .
10. Install parking operation mechanical assembly cable.
11. Install upper swing arm at both side of rear suspension.
12. Install swing arm 2 on both sides of rear suspension.
13. Install swing arm 1 on both sides of rear suspension.
14. Install rear vertical arm on both sides.
15. Install rear muffler.
16. Lower the vehicle.
17. Install left right rear wheel.



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12.7 Seat

12.7.1 Specification

12.7.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (N.m)	English system (lb-ft)
Left front seat assembly(manual)and front floor	M10×1.25×30	40 - 50	29.6 - 37
Right front seat assembly (manual)and front floor	M10×1.25×30	40 - 50	29.6 - 37
Left middle seat assembly and rear floor	M10×1.25×25	40 - 50	29.6 - 37
Right central seat assembly and rear floor	M10×1.25×25	40 - 50	29.6 - 37
Left rear seat assembly and rear floor	M10×1.25×25	40 - 50	29.6 - 37
Right rear seat assembly and rear floor	M10×1.25×25	40 - 50	29.6 - 37

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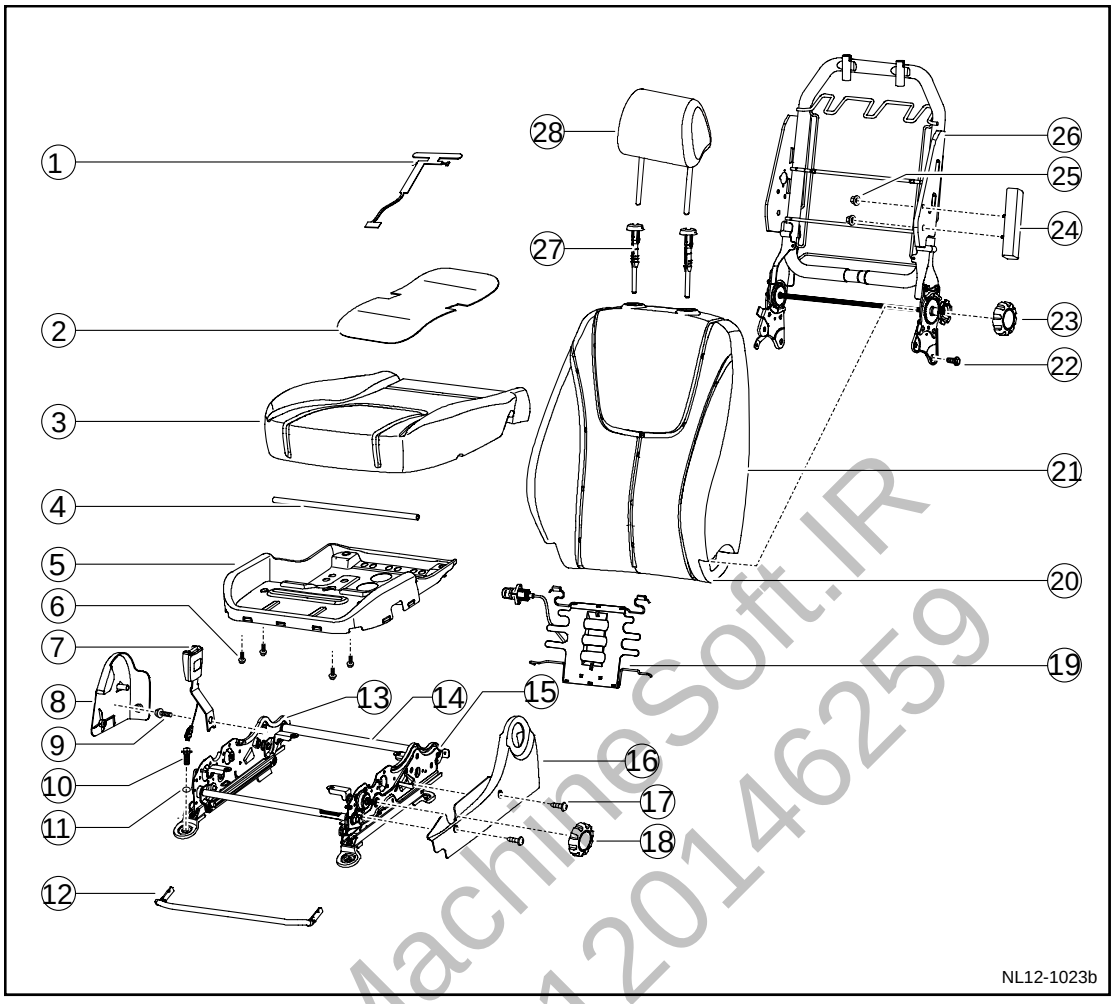
12.7.2 Disassemble drawings

12.7.2.1 Disassemble drawings



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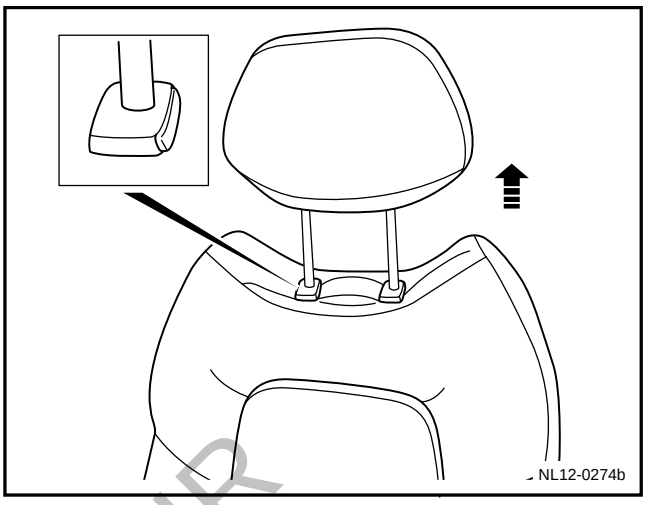
1. Headrest assembly.
2. Back surface assembly.
3. Back cotton assembly
4. Head Restraint Plastic-rubber Socket A
5. Headrest Plastic Rubber Socket B Assembly
6. Hook assembly
7. Fixing seat
8. Back iron table assembly
9. Plastic back plate assembly
10. Left inner protective cover
11. Safety belt buckle
12. Seat frame assembly
13. Sliding plate & lifting mechanical assembly
14. Back plate buckle.
15. Heat pad of seat cushion.
16. Seat surface assembly
17. Seat cotton assembly
18. Left outer guard cover
19. Recliner handle
20. Lift hand wheel
21. Hexagon gasket bolt M8
22. Hexagon gasket bolt M10
23. Hand spring wire
24. Cross round head self tapping screw wiper end

12.7.3 Dismantle and install

12.7.3.1 Front row seat headrest replacement

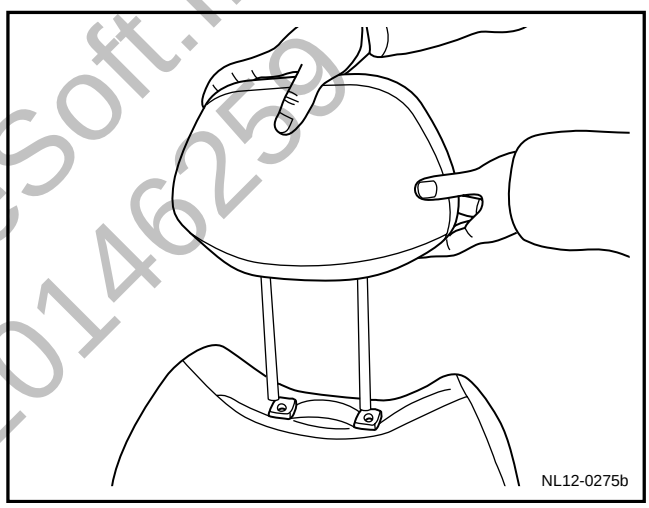
Dismantlement Procedure

1. Press headrest adjusting button and lift headrest.



Installation Procedure:

1. Depress the headrest height adjuster button by pushing it into the headrest guides.



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12.7.3.2 Front row seat replacement

Refer to 11.9.8.1 Replacement of Front Power Seat.

12.7.3.3 Rear row seat headrest replacement

The replacement of rear row of seat headrest is similar to that of the front row. Refer to 12.7.3.1 Front Row of Seat Headrest.

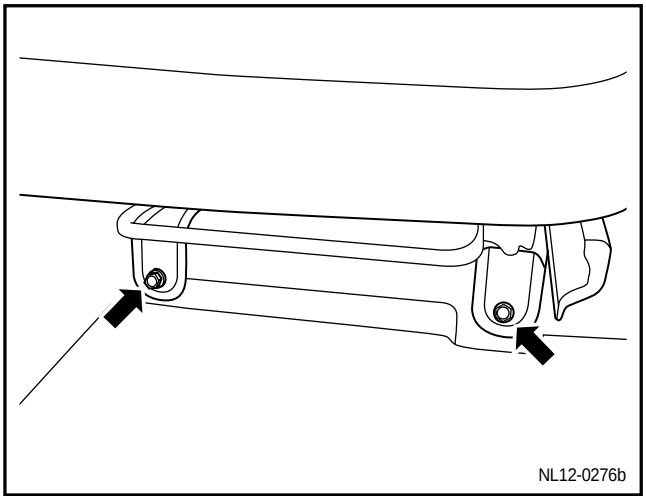
Replacement

12.7.3.4 Intermediate row seat replacement

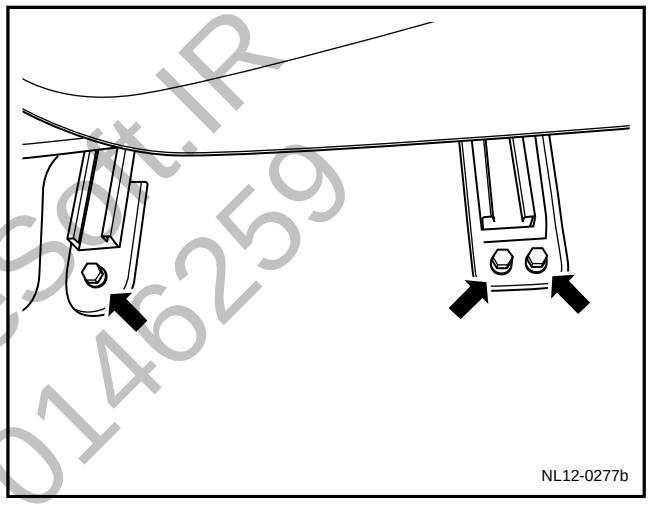
Replacement of middle row of left seat

Dismantlement Procedure

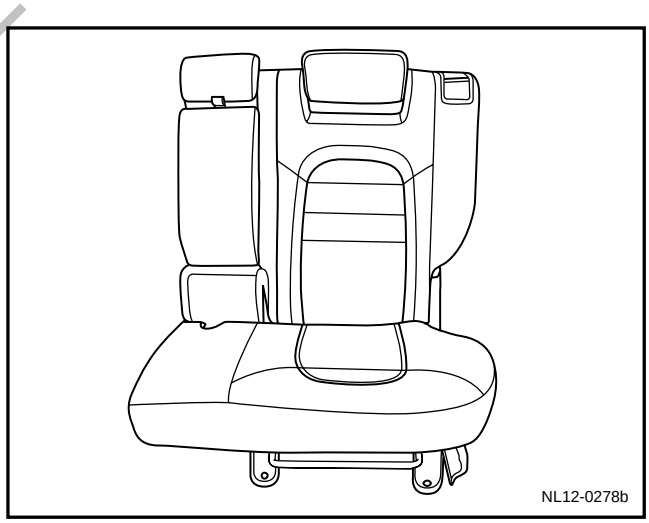
1. Dismantle fixing bolt on front of middle row seat.



2. Dismantle fixing bolt on the rear of middle row left seat.



3. Move middle row left seat out.



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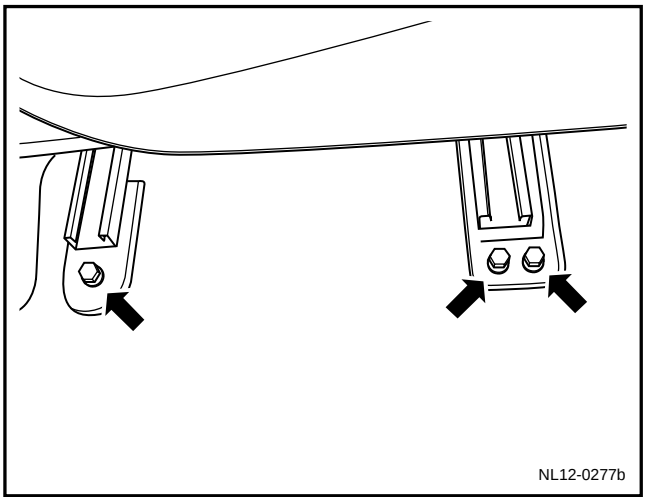
Installation Procedure:

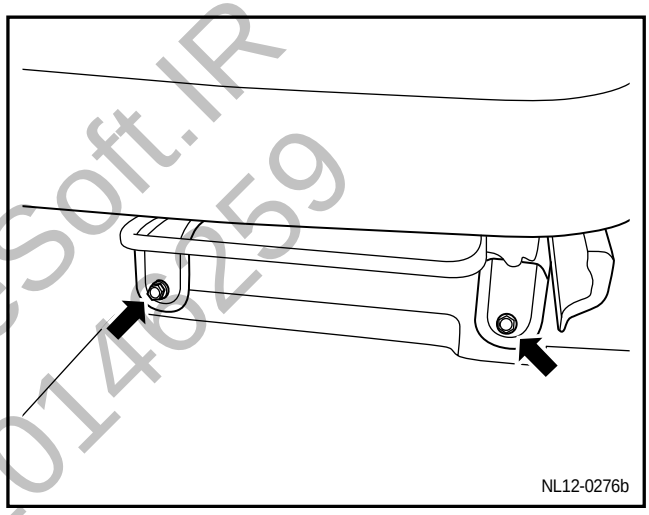
1. Install middle row left side seat.
2. Install Middle row left side seat front fixing bolt.

Torque: 45 Nm (Metric) 33. 3 lb-ft (English system)



3. Install Middle row left side seat rear fixing bolt .

Torque: 45 Nm (Metric) 33. 3 lb-ft (English system)



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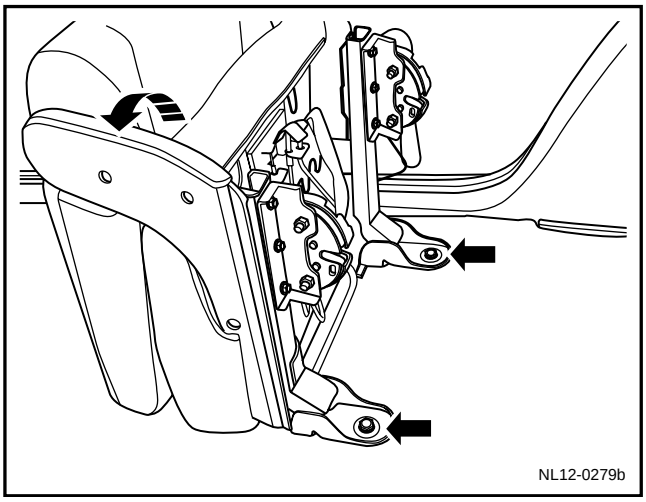
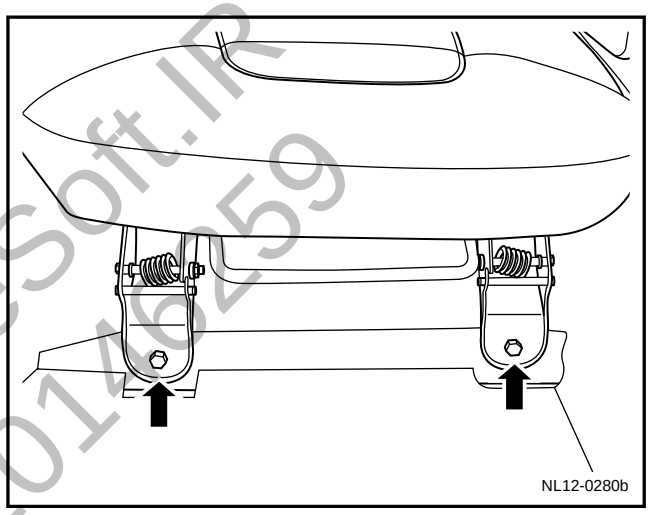
Replacement of middle row of right seat

Dismantlement Procedure

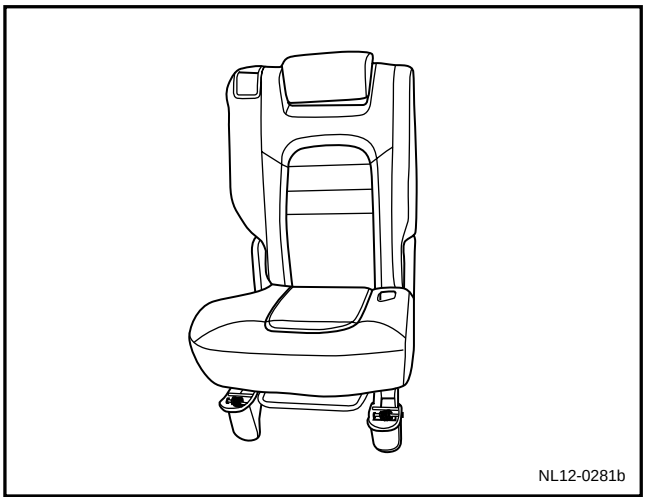
1. Lift forward middle row right seat.
2. Dismantle fixing bolt on the inside section of middle row seat.



3. Dismantle fixing bolt at the outside of middle row right seat.



4. Move the right intermediate seat out.



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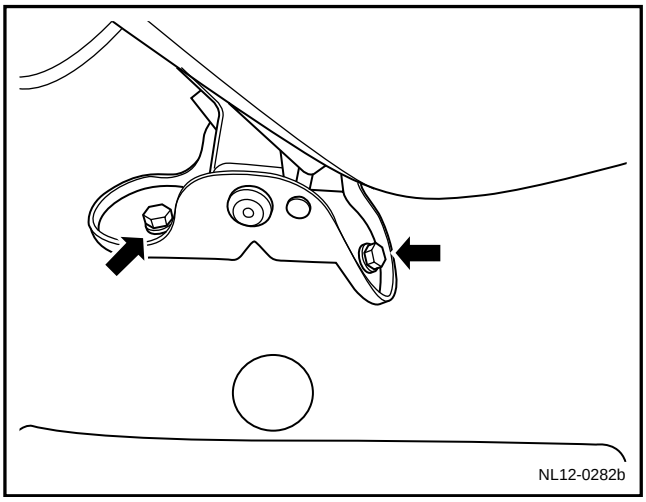
Installation Procedure:

1. Install middle row right side seat.
2. Install 2 bolts the both sides of middle row right side seat and tighten them.

Torque: 45 Nm (Metric) 33. 3 lb-ft (English system)

3. Flat middle row right side seat.



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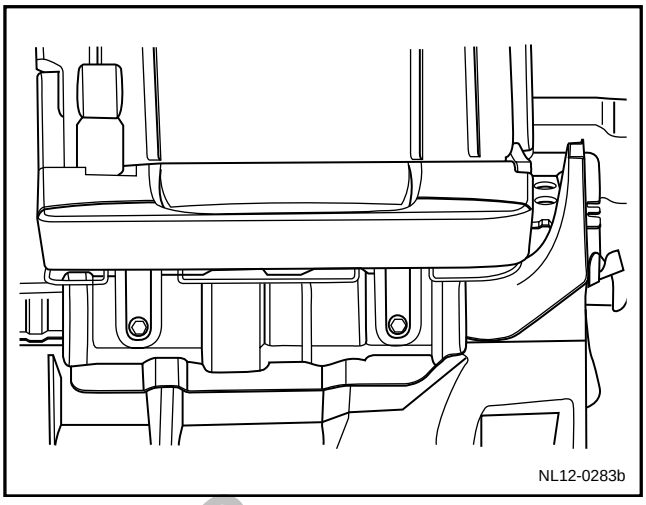
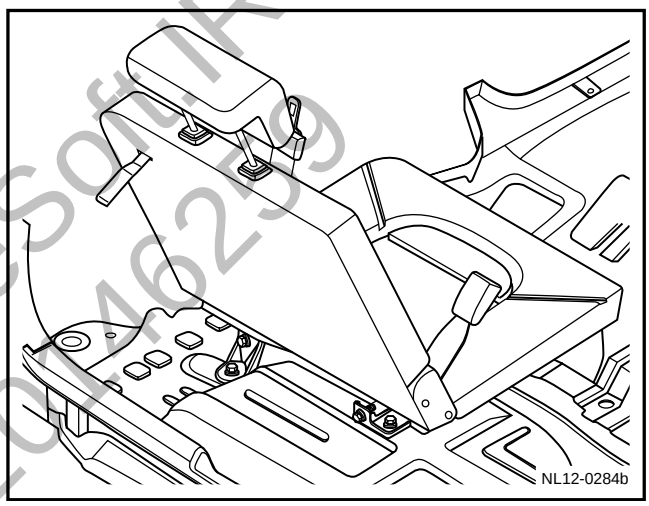
12.7.3.5 Rear row seat washer replacement

Dismantlement Procedure

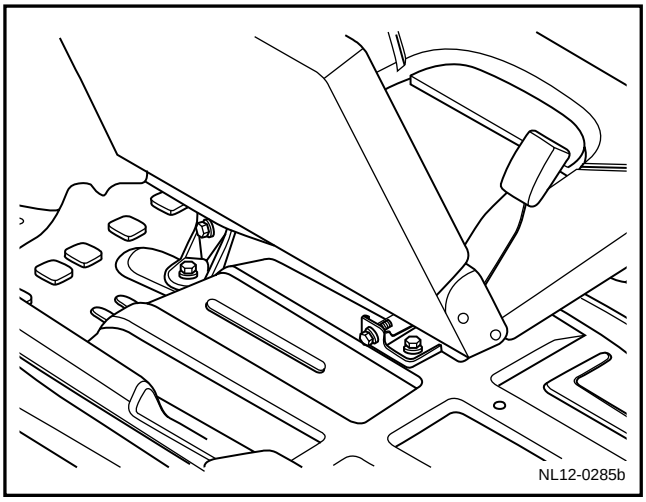
1. Dismantle rear row seat front fixing bolt.



2. Dismantle rear fixing bolt of rear row seat.



3. Move rear row seat out.



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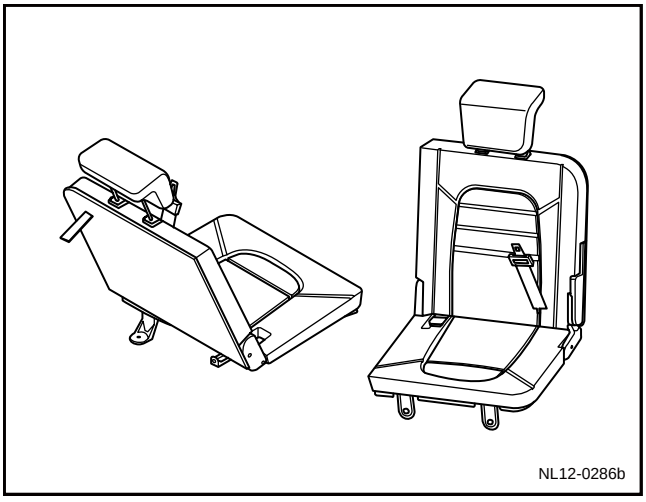
4. Dismantle middle fixing bracket assembly of rear seat, rear row left safety belt with buckle assembly.

Notes:

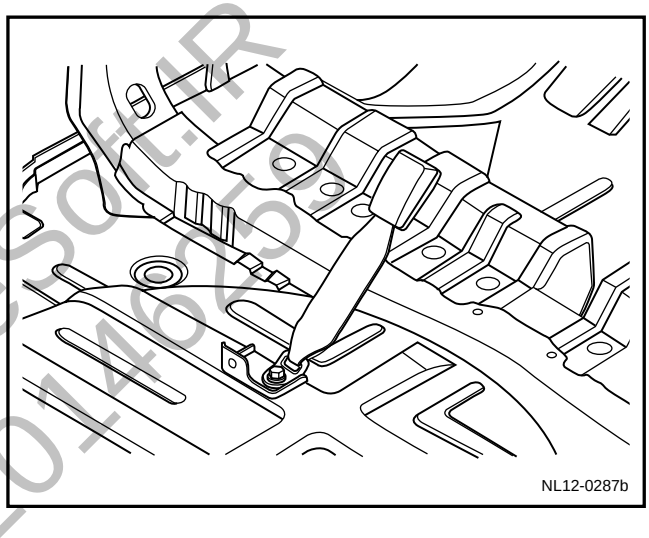
The dismantling mode of the rear row of left and right seats is similar.



Installation Procedure:

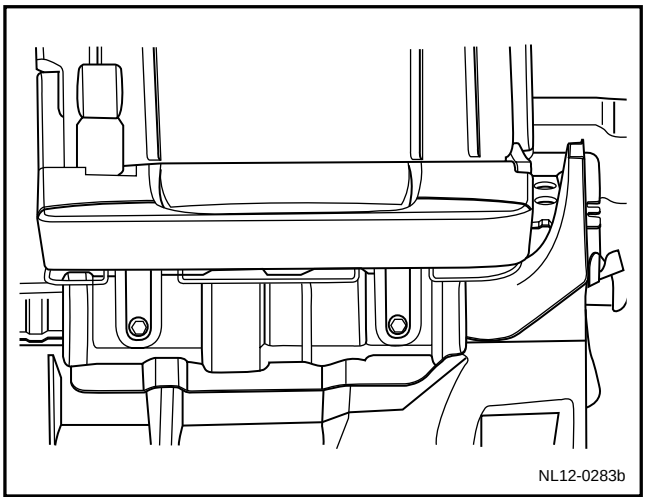
1. Install rear seat middle fixing bracket assembly, rear row left side safety belt buckle assembly.

Torque: 45Nm (Metric) 33. 3lb-ft(English system)



2. Install rear row seat assembly.
3. Install fixing bolt on the front end of rear row seat.

Torque: 45Nm (Metric) 33. 3lb-ft(English system)



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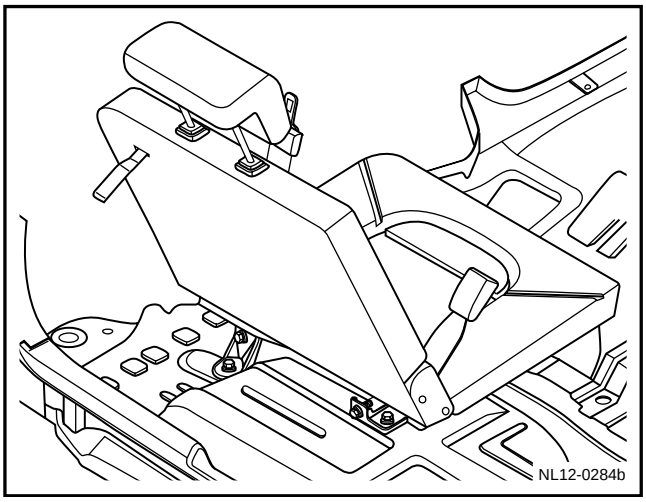
4. Install fixing bolt on the rear of rear row seat.

Torque: 45Nm (Metric) 33. 3lb-ft(English system)

Notes:

The installing mode of the rear row of left and right seats is similar.



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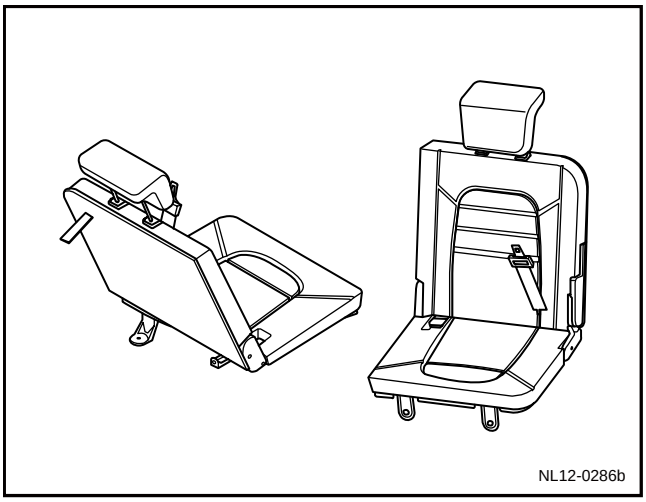
12.7.3.6 Intermediate row right side, replace seat side trim plate

Dismantlement Procedure

1. Turn over middle row right side seat.
2. Dismantle fixing screw of seat side trimming plate, and remove seat side trimming plate.



Installation Procedure:

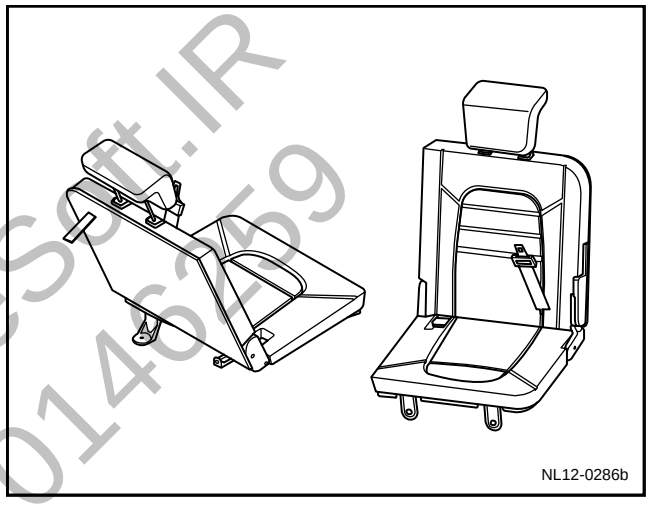
1. Install seat side trim plate and fasten fixing screw.

Torque : 4Nm(Metric) 3lb-ft(English system)

2. Turn down middle row right seat.

Notes:

The method for disassembling and assembling the middle row of right seat two-side trim panel is similar.



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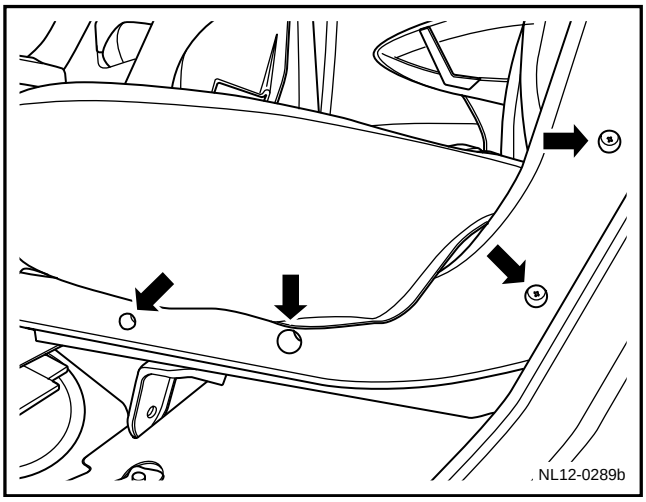
12.7.3.7 Intermediate row left side, replace seat side trim plate

Dismantlement Procedure

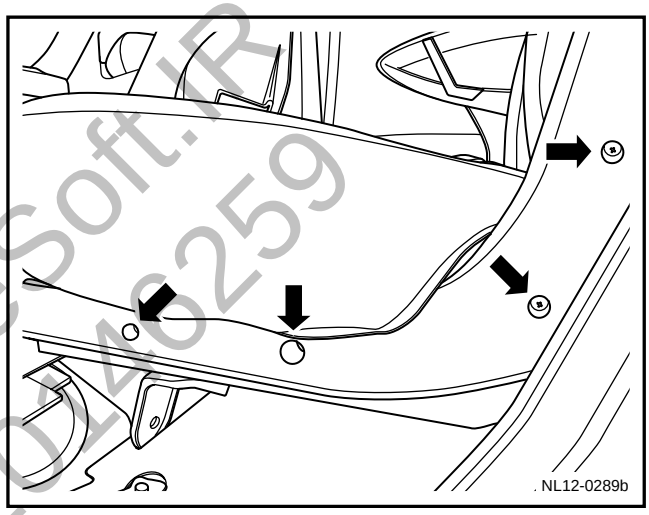
1. Move the middle row left seat to the most front end of slideway.
2. Dismantle fixing screw of trimming plate on side of middle row seat and take of seat side trimming plate.



Installation Procedure:

1. Install and tighten middle row seat side triming plate fixing screw.

Torque: 4Nm (Metric) 3lb-ft (Inch)



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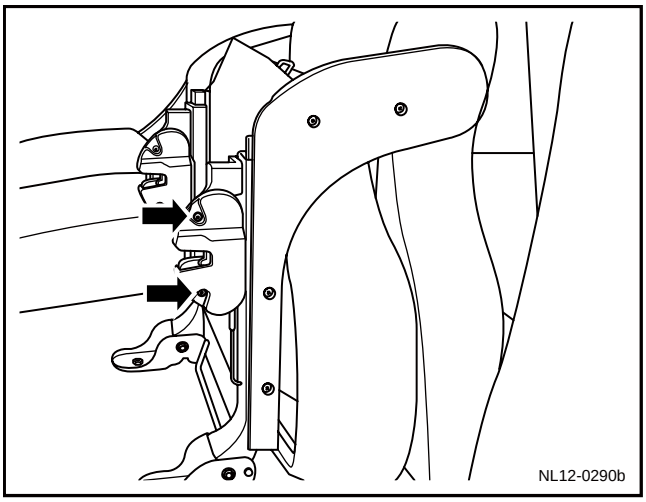
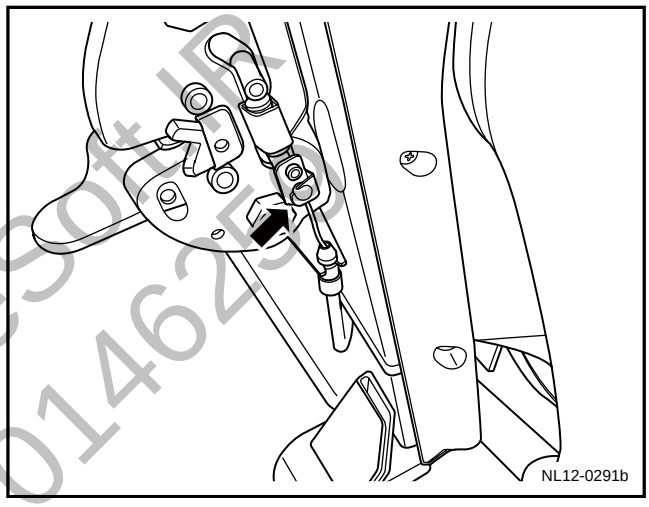
12.7.3.8 Replacement of Rock Row of Right Seat Rear Fixing Lock

Dismantlement Procedure

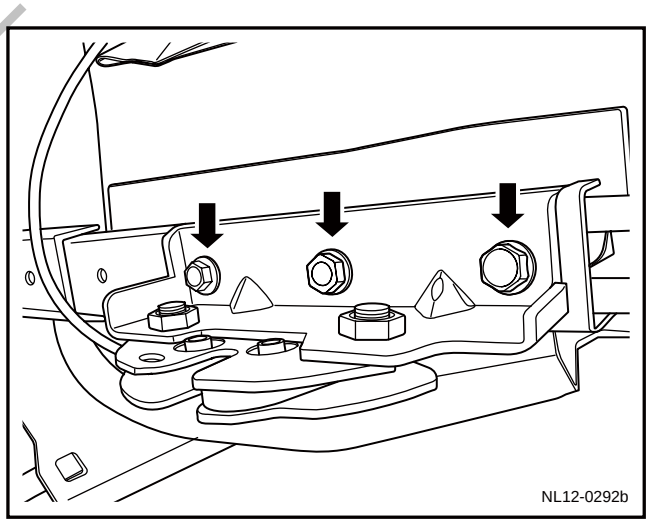
1. Turn over middle row right side seat .
2. Dismantle fixing screw of lower protective cover of middle row right seat and take of lower protective cover.



3. Disconnect middle row right side seat rear fixing lock cable.



4. Dismantle fixing nut of rear fixing lock of middle row right seat.



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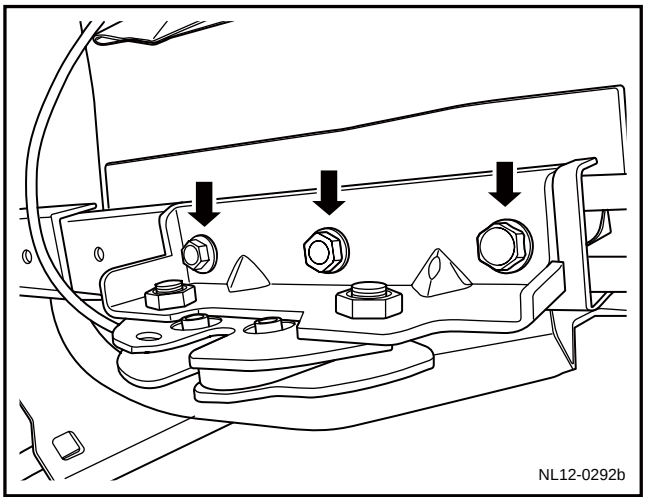
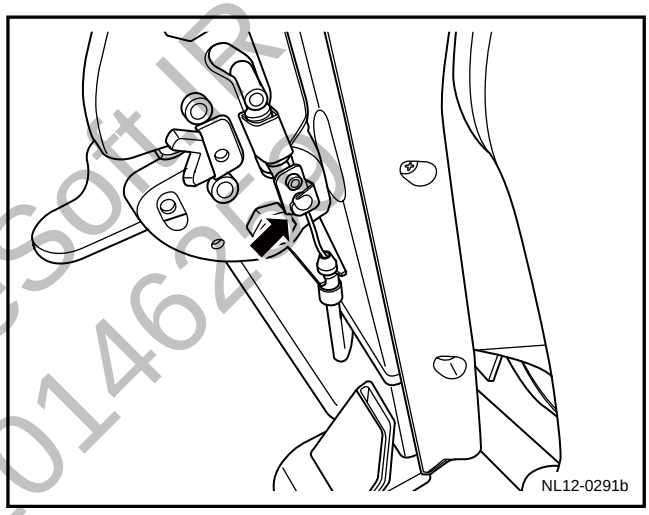
Installation Procedure:

1. Install and tighten middle row right side seat rear fixing nut.

Torque: 45Nm (Metric) 33. 3lb-ft(English system)



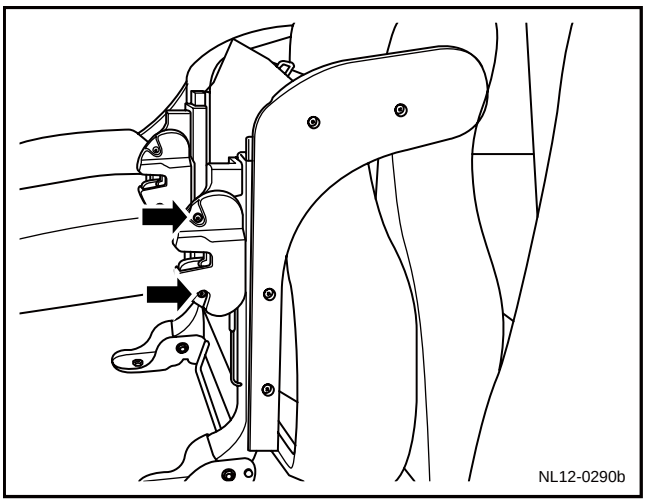
2. Install Middle row right side seat rear fixing lock cable.



3. Install Middle row right side seat lower guard cover and fasten fixing screw.
4. Turn down middle row right seat.

Notes:

The method for disassembling and assembling the middle row of right seat rear fixing lock is similar.



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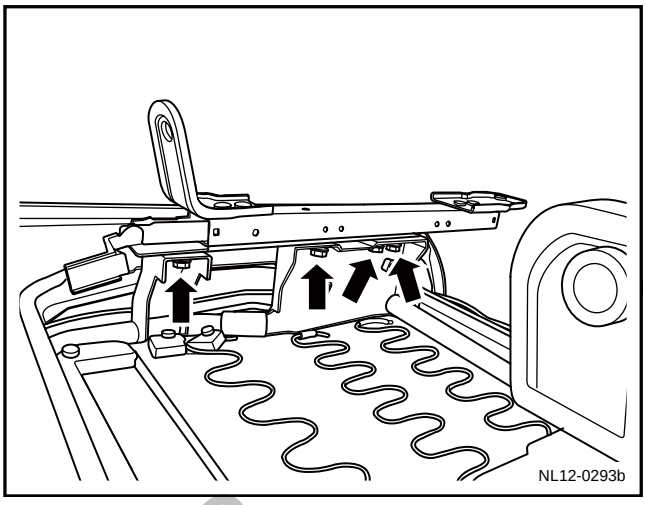
12.7.3.9 Middle row left side seat lower sliding rail replacement

Dismantlement Procedure

1. For dismantling of middle row left seat, refer to 12.7.3.5 Replacement of middle row seat.
2. Dismantle fixing nut on both sides of lower slideway of middle row seat side trimming plate.
3. Remove lower slideway of middle row left seat.

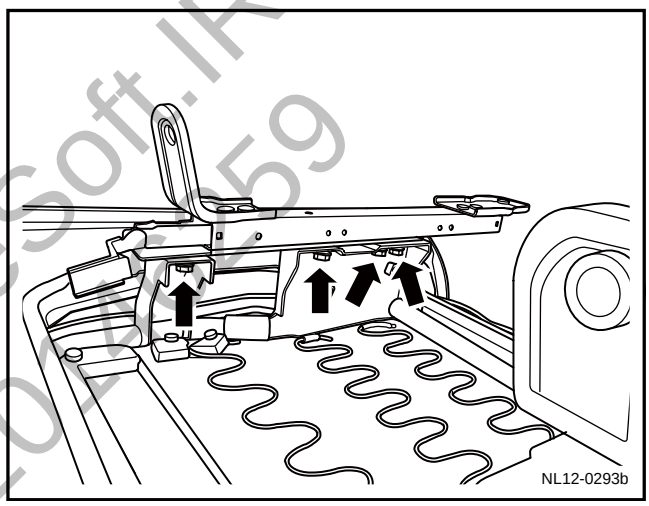


Installation Procedure:

1. Install middle row left side seat lower sliding rail and tighten fixing nut.

Torque: 45Nm (Metric) 33. 3lb-ft (English system)

2. Install middle row left side seat.



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12.8 Instrument desk and control console

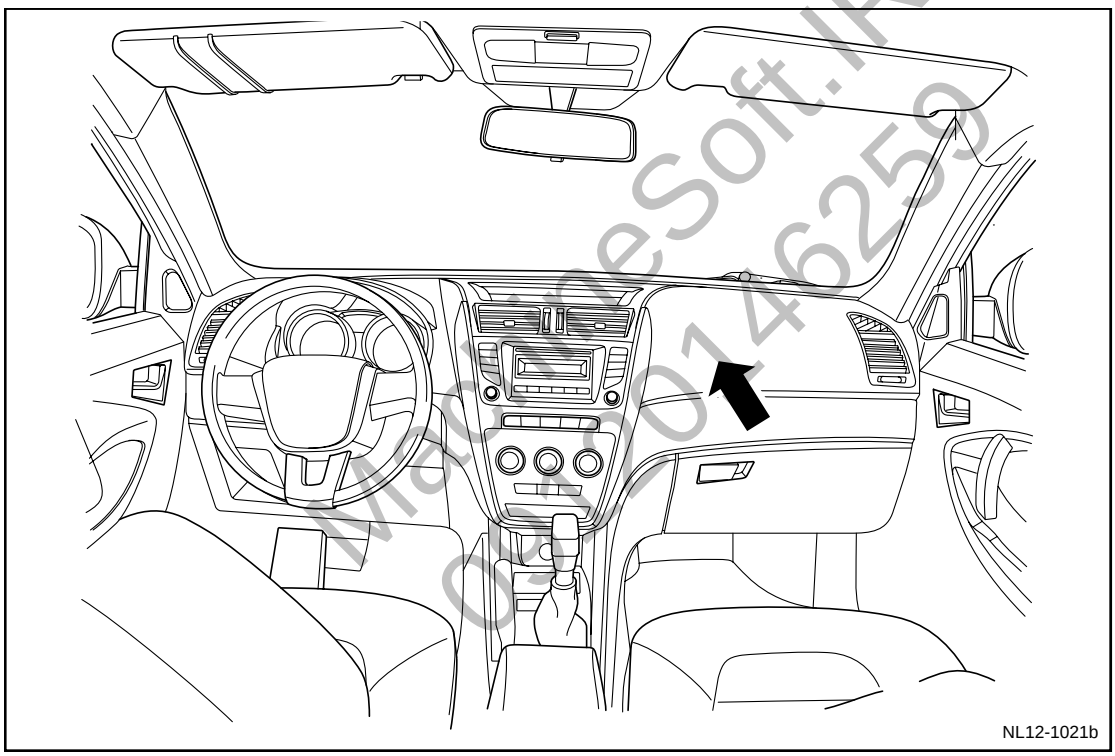
12.8.1 Specification

12.8.1.1 Fastener specifications

Fastener Name	Model	Torque Range	
		Metric (NM)	English system (lb-ft)
Cross Beam of Instrument Panel Assembly	M8×16	22-26	16.9-19.2
Secondary instrument panel assembly	M6	21	5.2-6.7

12.8.2 Part position

12.8.2.1 Component position



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12.8.3 Dismantle and install

12.8.3.1 Instrument desk replacement

Dismantlement Procedure

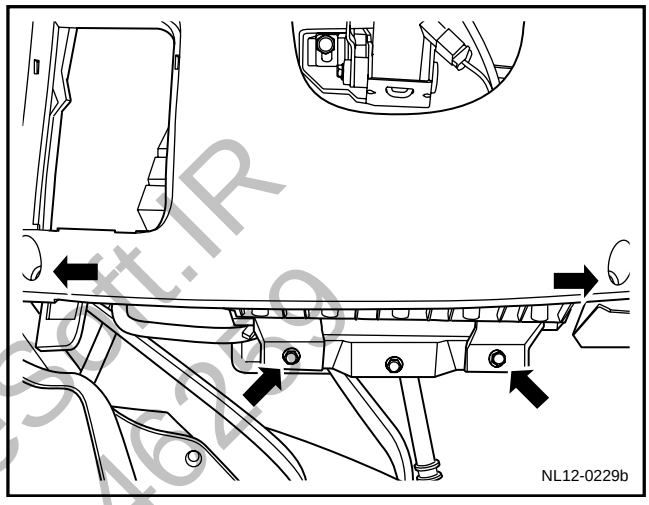
Warning!

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

Notes:

Please dismantle the trim panel assembly with a special-purpose body repair tool; otherwise this will easily cause the trim panel to be damaged.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Dismantle the auxiliary instrument panel assembly. Refer to 12.8.3.2 Replacement of Auxiliary Instrument Panel.
3. Dismantle the steering wheel. Refer to 7.3.6.3 Replacement of Steering Wheel.
4. For dismantling of light combined switch and upper and lower protective plates, refer to 11.3.8.1 Replacement of light combined switch.



5. Dismantle the combination instrument cover and the combination instrument assembly. Refer to 11.6.7.1 Replacement of Combination Instrument Assembly.
6. For dismantlement of the AC control panel, see 8.2.8.1 Replacement of Air Conditioner Control Panel.
7. For dismantlement of the central air outlet panel, see 8.2.8.18 Replacement of Instrument Panel Air Outlet.
8. For dismantlement of the audio unit, see 11.2.7.4 Replacement of Audio Unit.
9. For dismantlement of the multi-functional instruments, see 11.13.8.1 Replacement of Multi-functional Instruments.
10. For dismantling of environment light and sun sensor, refer to 11.3.8.16 Replacement of environment light and sun sensor.
11. For dismantling of left and right front vertical upper trimming plate, refer to 12.9.1.2 Replacement of left/right front vertical upper trimming plate assembly.
12. Refer to 12.8.3.3 Replacement of Glove Box of the Instrument Panel to dismantle the glove box of the instrument panel.
13. Dismantle 2 fixing screws and 2 bolts of instrument table left lower trimming plate.

Notes:

2 fixing screws of the left lower trim panel of the dashboard only need to be dismantled in the vehicle without knee SRS.

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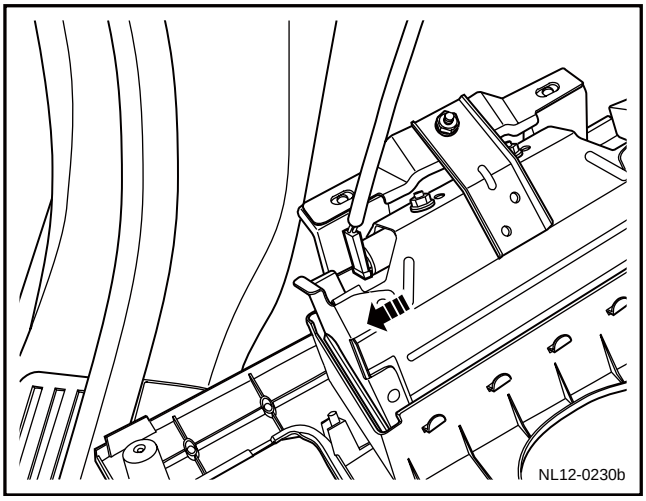
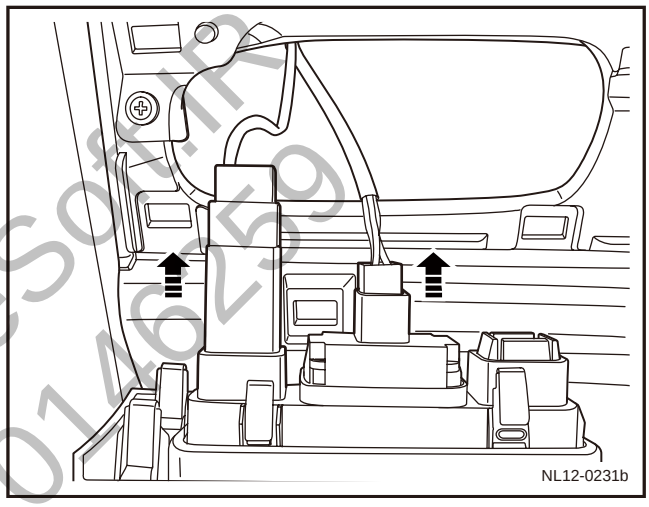
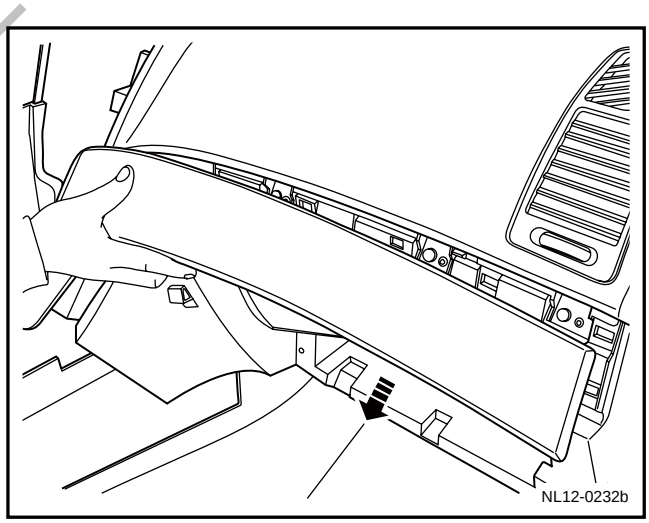
14. Disconnect wire harness connector of knee safety airbag.



15. Respectively disconnect anti-theft indicator lamp and headlamp height adjusitn switch wire harness connector.



16. Dismantle right trimming plate of instrument panel.



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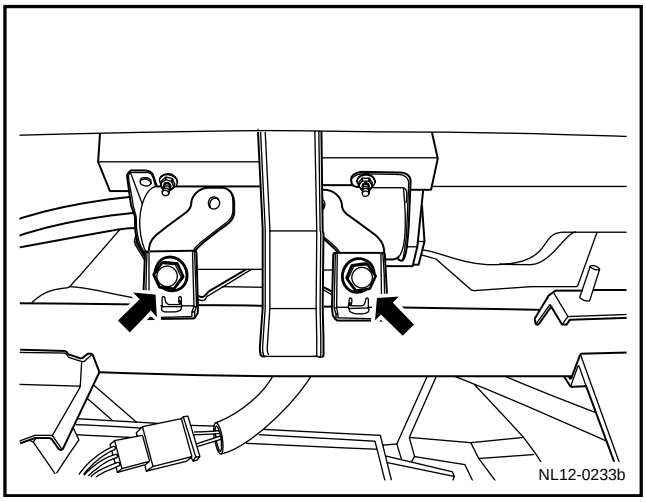
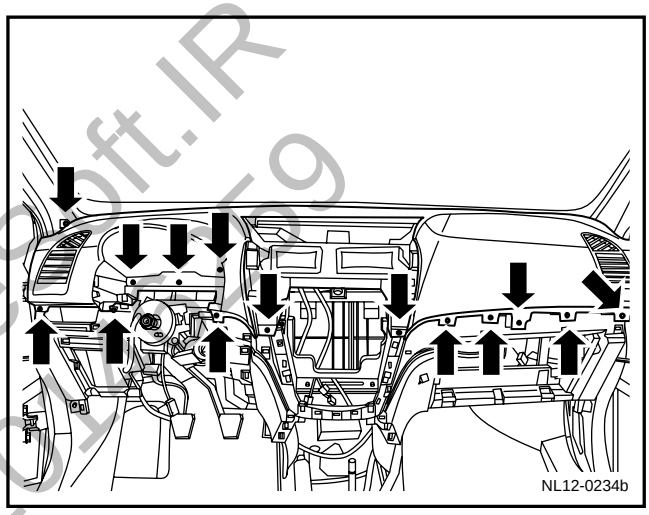
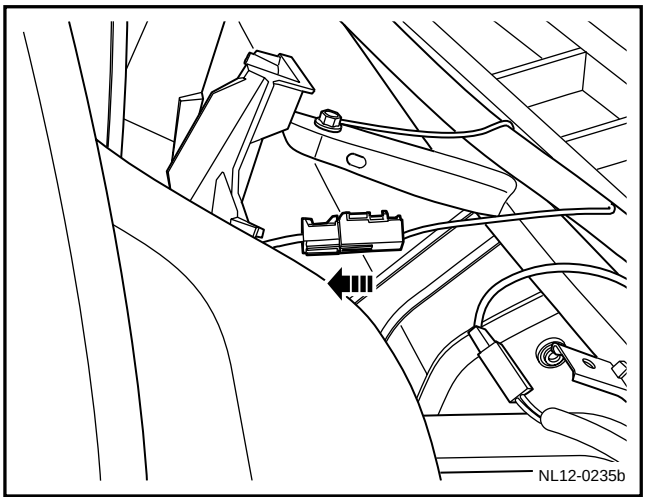
17. Dismantle 2 fixing bolts of safety airbag on passenger's side.



18. Dismantle 4 fixing bolts and 111 screw rod on the instrument desk.
19. Upper cover and lower cover of separation instrument desk



20. Disconnect harness connector of Upper cover of instrument desk back passenger side airbag
21. Take down upper cover of instrument desk assembly.



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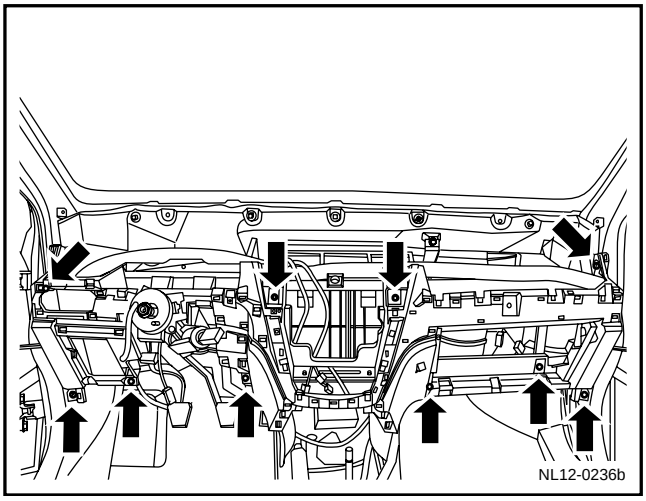
22. Dismantle 4 fixing screws on the upper part of lower cover of instrument panel and 6 bolts on lower part.

23. Remove lower cover of instrument desk.

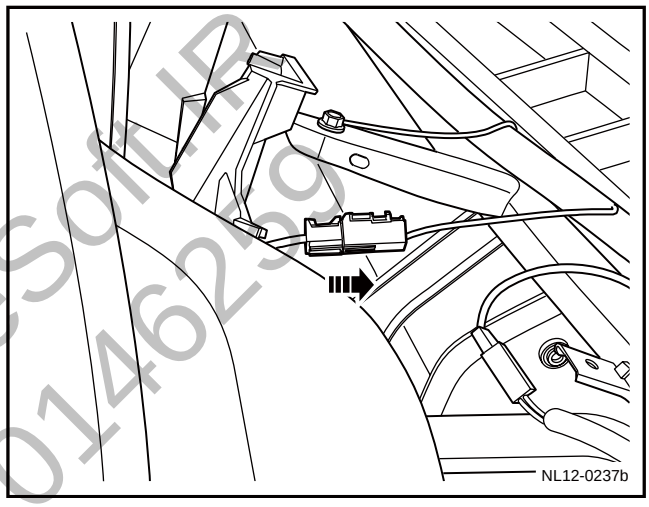


Installation Procedure:

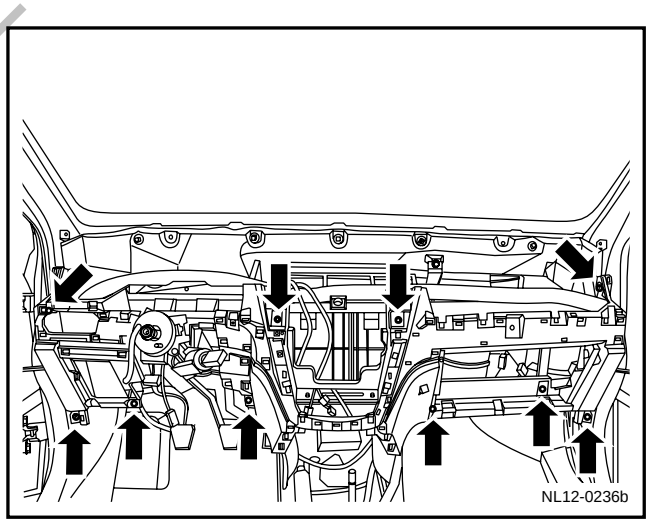
1. Install low shield of instrument desk on the cross beam of instrument panel 上.

2. Install 4 fixing screw and 6 bolts of lower cover of instrument desk and tighten them.

Torque: 20Nm (Metric) 14. 8lb-ft(English system)



3. Move upper cover of instrument table into, and connect wire harness connector of passenger's side safety airbag.



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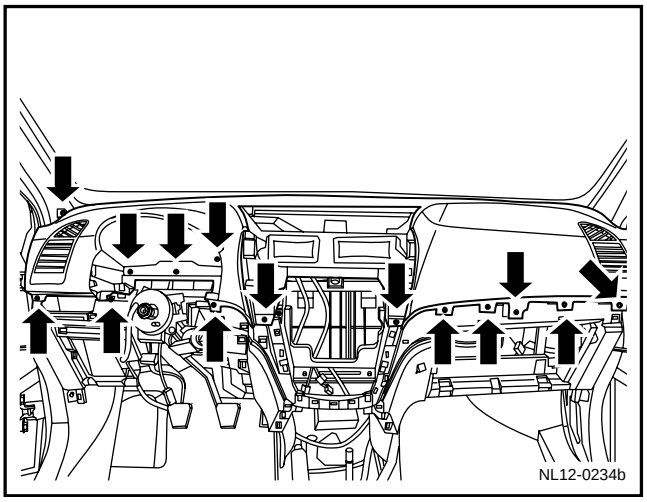
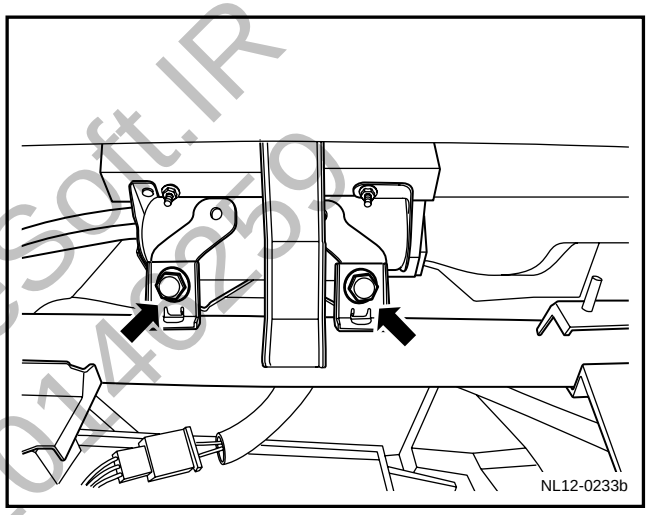
4. Install 4 fixing bolts and 11 screws of upper cover of instrument table, and tighten them.

Torque: 20Nm (Metric) 14. 8lb-ft(English system)

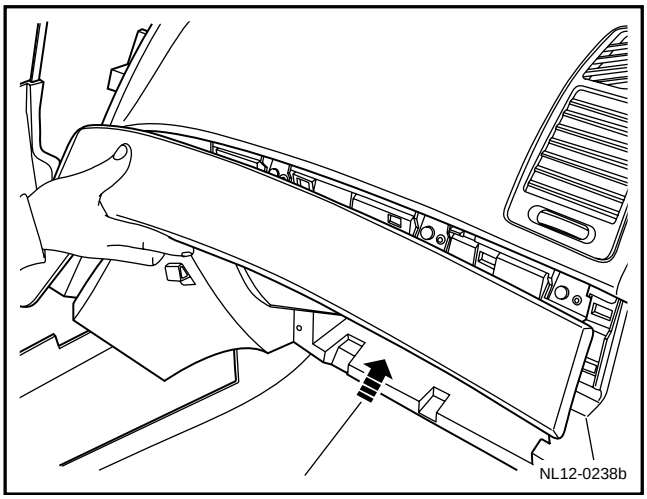


5. Install and tighten 2 bolts for the passenger side airbag.

Torque: 24Nm (Metric) 17. 8lb-ft(English system)



6. Install the right dashboard trim panel.



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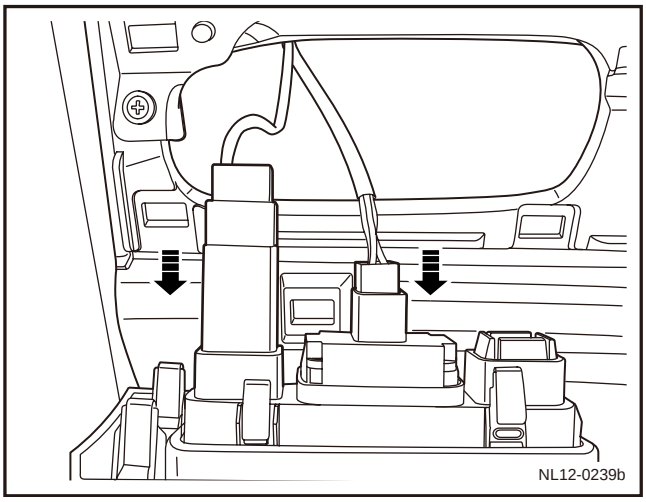
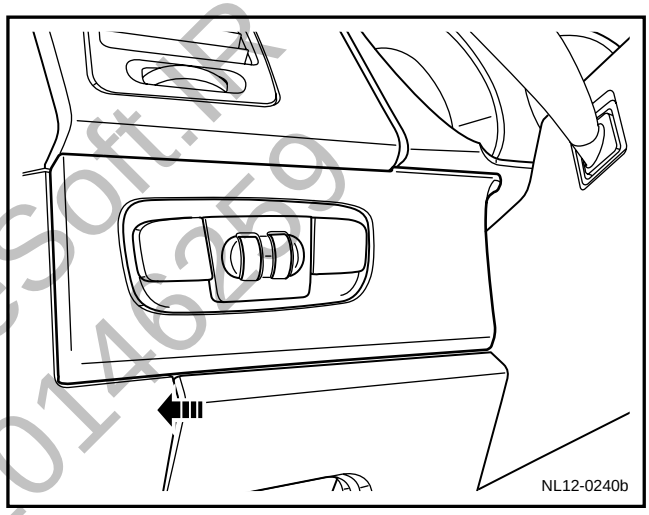
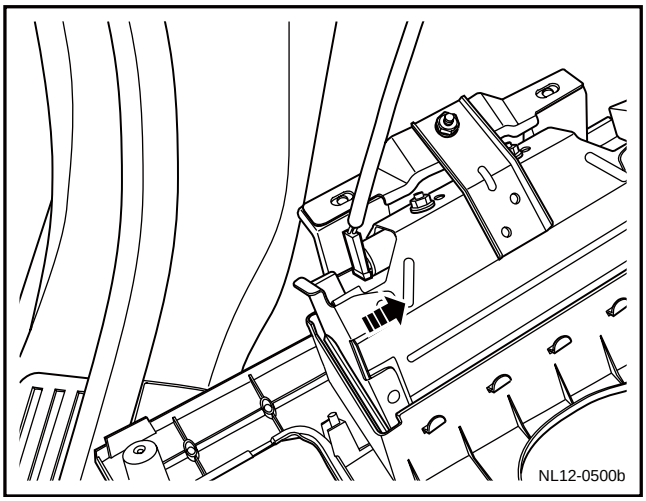
7. Connect the anti-theft indicator lamp and headlight height adjustment switch harness connectors.



8. Install the instrument panel switch assembly.



9. Install the harness connector of the knee airbag.



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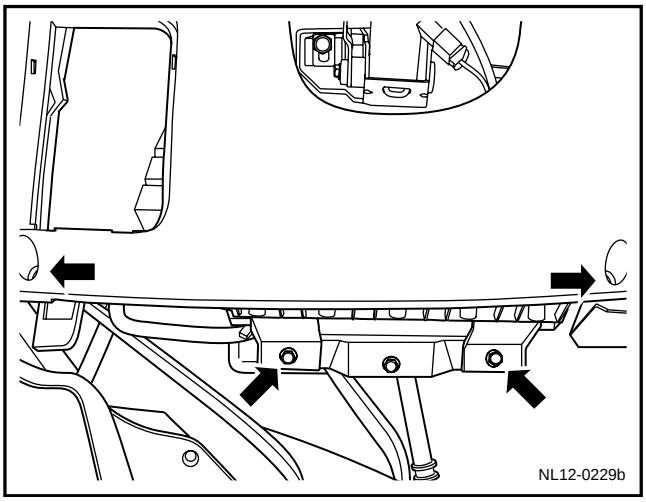
10. Install instrument table left lower trimming plate, tighten 2 fixing screws and 2 bolts.

Torque: 20Nm (Metric) 14. 8lb-ft(English system)

Notes:

2 fixing screws only need to be installed in the vehicle without knee SRS.



11. Install grove box of instrument desk.
12. Install front left right post trim plate
13. Install environment and sun sensor.
14. Install multi-functional instrument.
15. Install the audio head unit.
16. Install central vent port panel.
17. Install the air-conditioning control panel.
18. Install the combination instrument cover and combination instrument assembly.
19. Install combined lamp light switch and upper and lower protective plate.
20. Assemble steering wheel
21. Install the auxiliary instrument panel assembly.
22. Connect the battery negative cable.

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12.8.3.2 Auxiliary instrument panel replacement

Dismantlement Procedure

Warning!

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

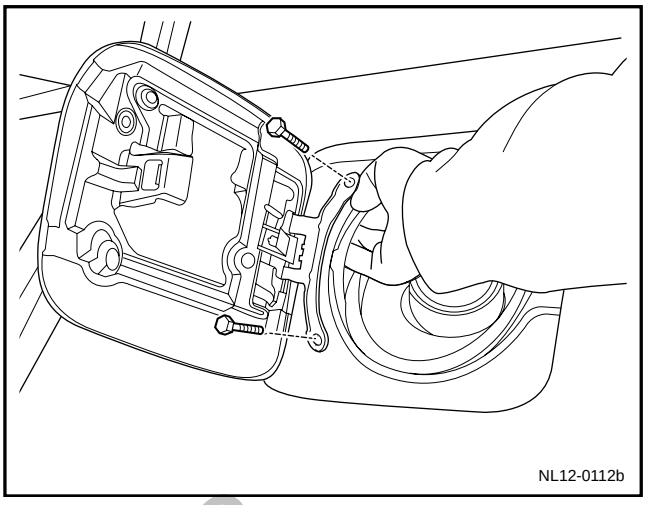
Notes:

Please dismantle the trim panel assembly with a special-purpose body repair tool; otherwise this will easily cause the trim panel to be damaged.

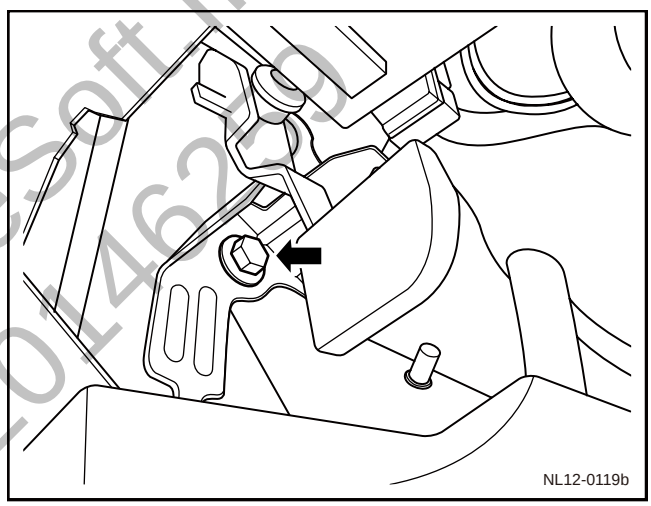
1. For disconnection of negative cable of battery, refer to 2.11.8.1 Disconnection procedures of battery cable.

Connecting Procedure:

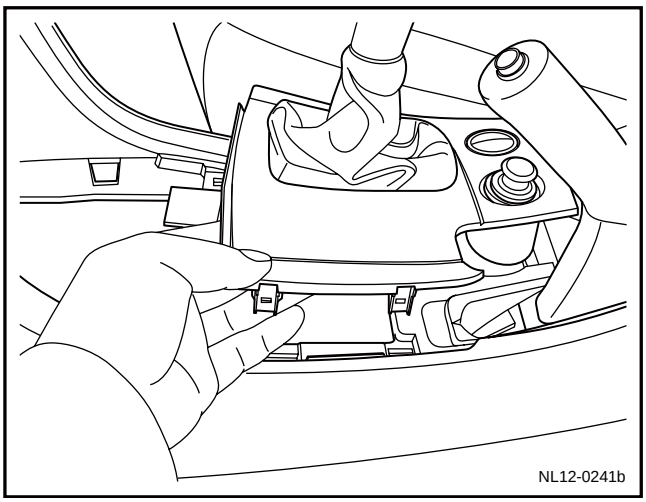
2. Dismantle front ashtray panel of auxiliary instrument panel.



3. Dismantle standby power supply and disconnect wire harness connector.



4. Separate the shift mechanism decoration panel from the floor console.



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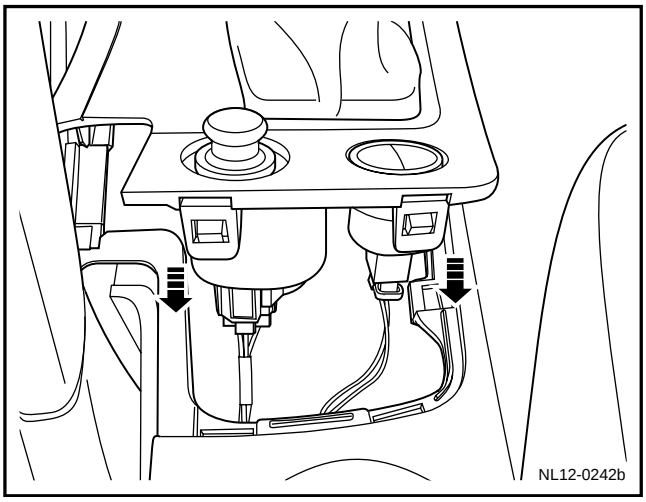
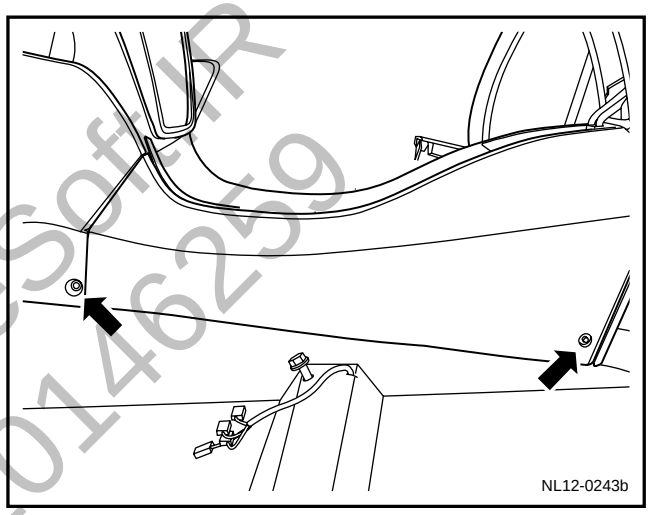
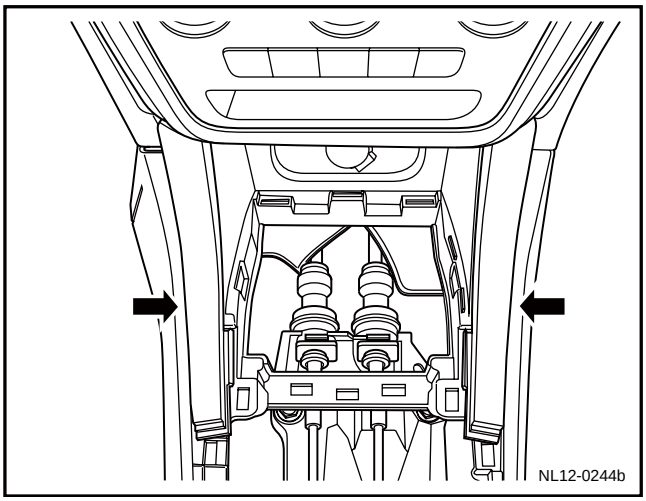
5. Disconnect the harness connector between the cigarette lighter and locking switch.
6. Dismantle the shift lever assembly.



7. Remove 2 fixing screws on both sides of the floor console.
8. Dismantle the front shield plates on both sides of the floor console.



9. Dismantle the front left/right trim panel of the floor console.



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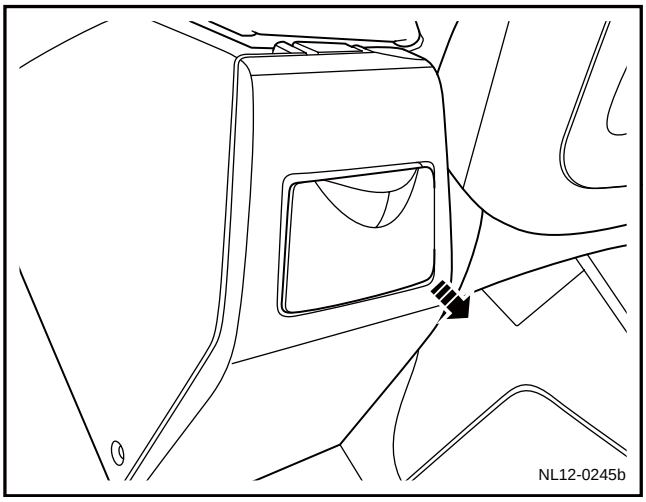
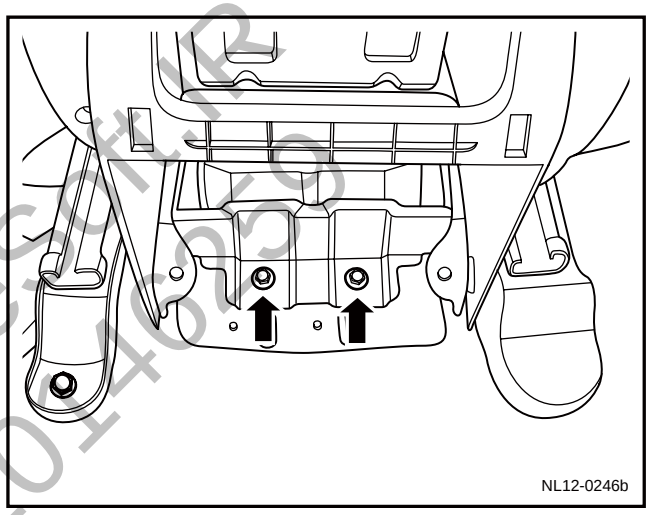
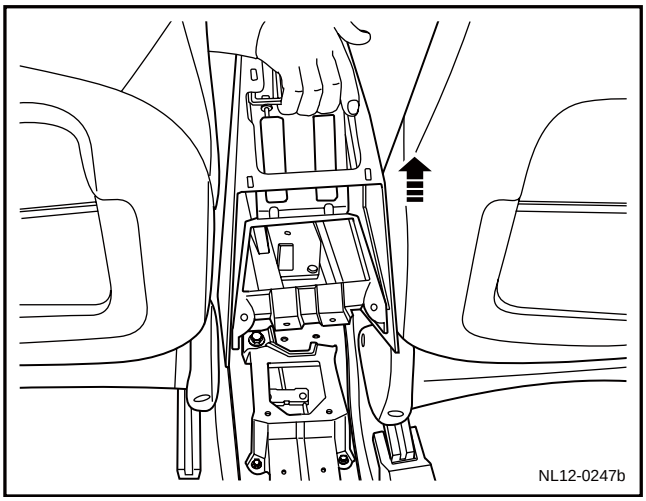
10. Dismantle auxiliary instrument plate rear panel.



11. Dismantle 2 fixing bolts in back of the auxiliary instrument panel



12. Dismantle auxiliary instrument panel assembly



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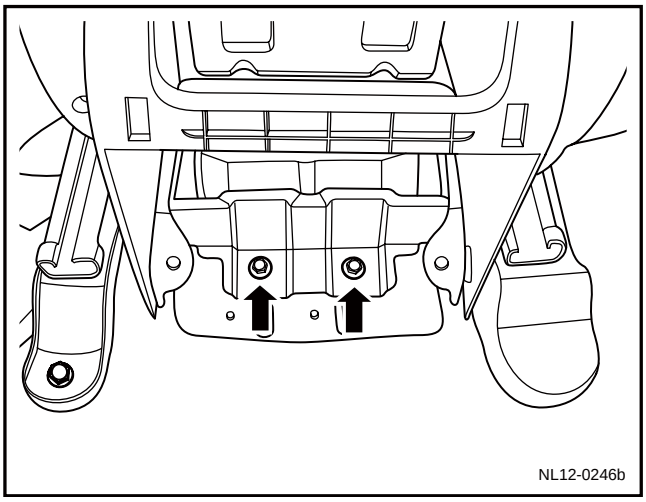
Installation Procedure:

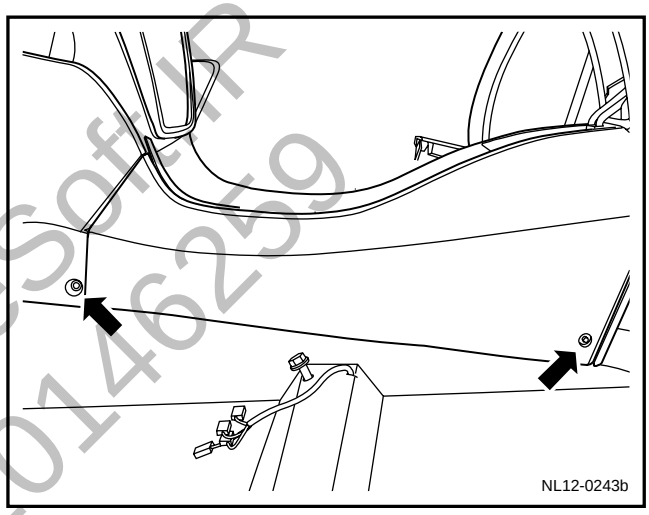
1. Install the auxiliary instrument panel assembly.
2. Install fixing bolt inside auxiliary instrument panel and tighten it.

Torque: 9 Nm (Metric) 6.7 lb-ft (English system)

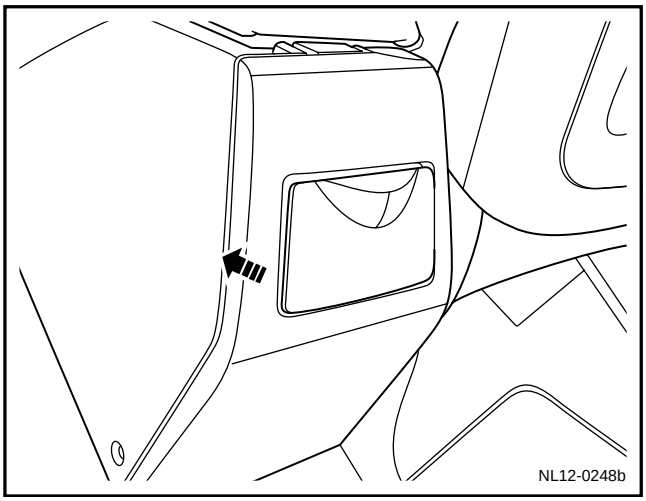


3. Install front baffle on both sides of auxiliary instrument panel.
4. Install fixing screws on both sides of auxiliary instrument panel.

Torque: 5Nm (Metric system) 3.7lb-ft (English system)



5. Install the rear trim panel of the floor console.



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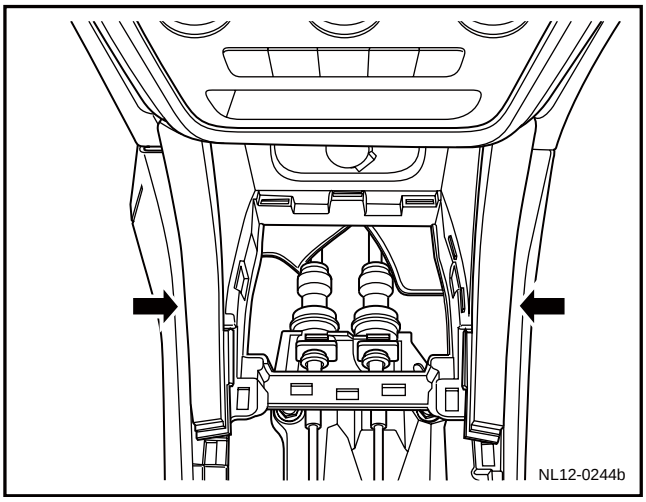
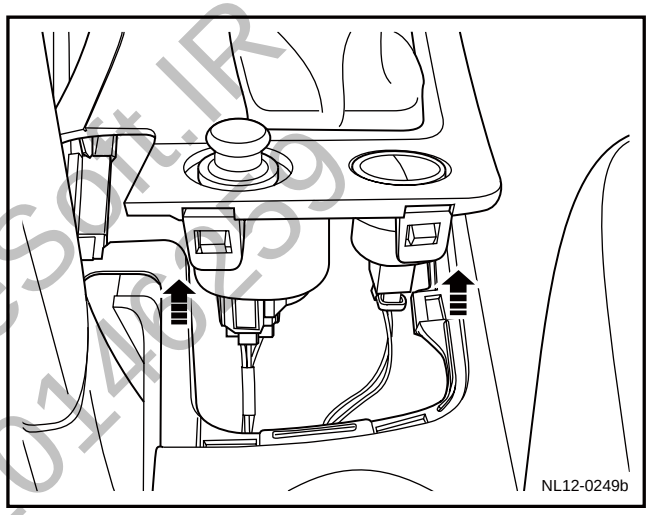
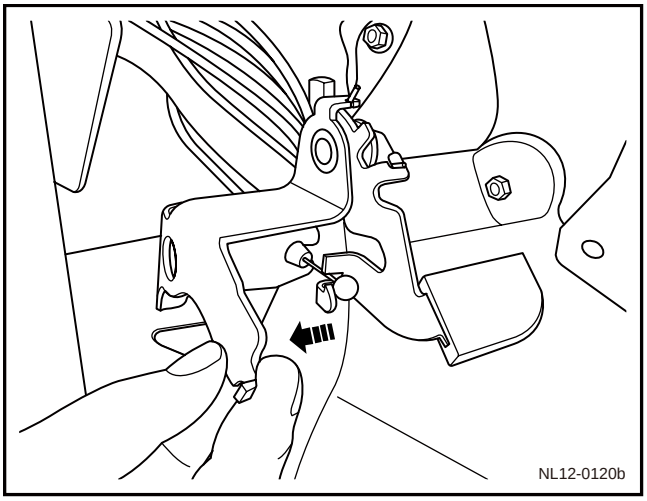
6. Install the front left/right trim panel of the floor console.



7. Connect the cigarette lighter and locking switch harness connectors.
8. Install the shift lever assembly and fasten the shift mechanism decoration panel by pressing it.



9. Connect the backup power supply harness connector.



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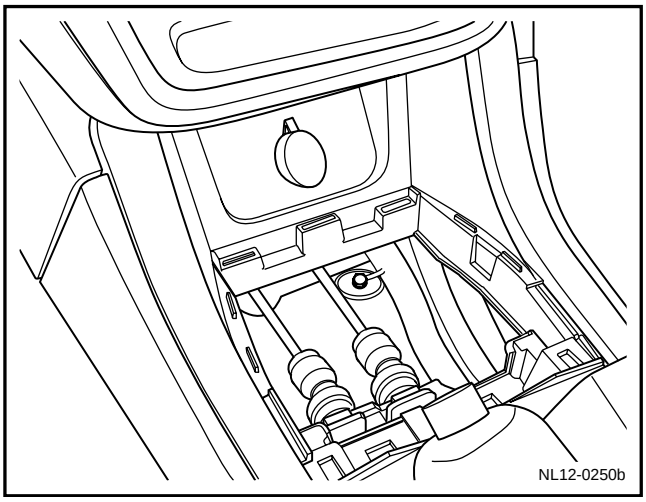
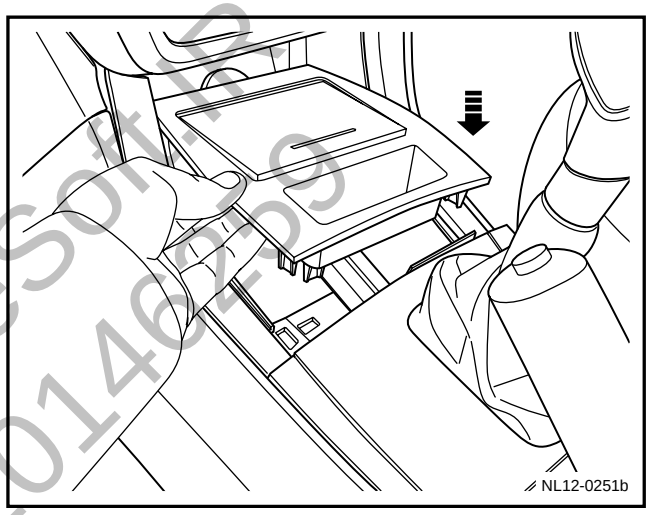
10. Install standby power supply.



11. Install front ashtray panel of auxiliary instrument
12. Connect the battery negative cable.



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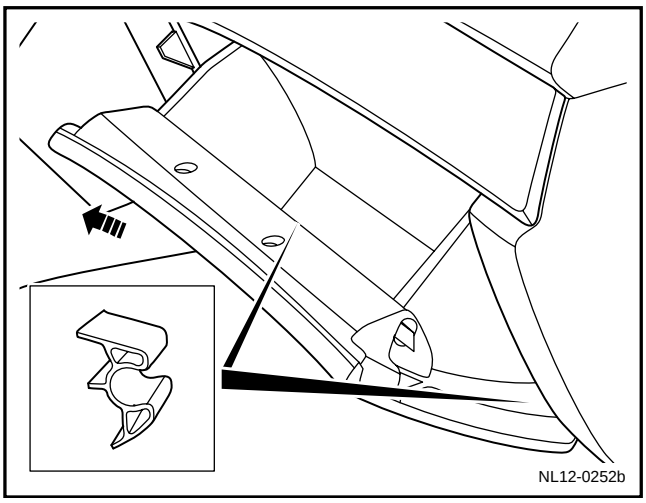
12.8.3.3 Grove box of instrument desk replacement

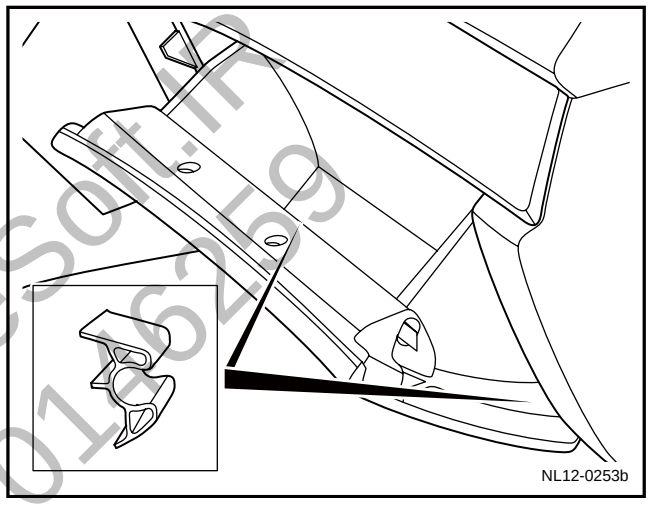
Dismantlement Procedure

1. Turn on grove box of instrument desk.
2. Draw out sundries box.



Installation Procedure:

1. Align and insert 2 clips under sundries box into sundries box.
2. Close sundries box of instrument table.



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12.8.3.4 Cross beam of instrument panel replacement

Dismantlement Procedure

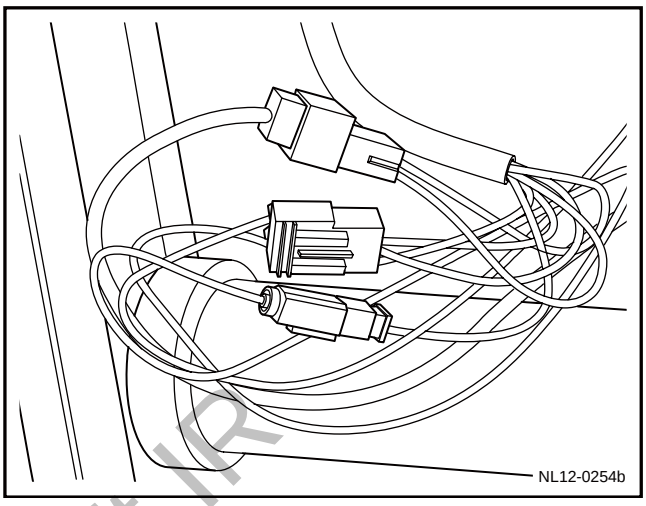
Warning!

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

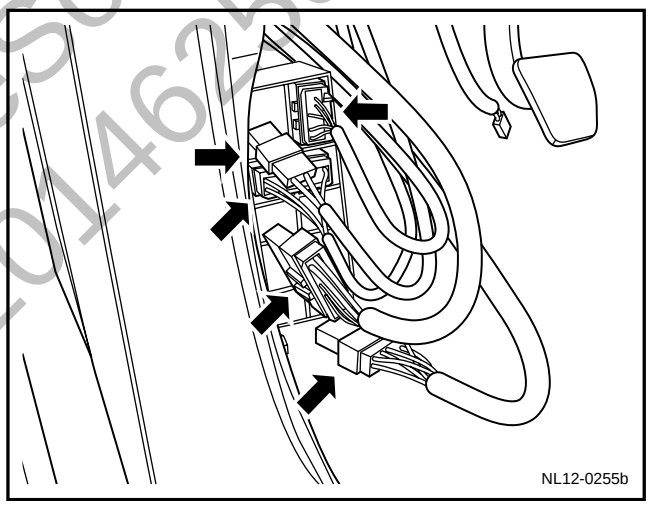
Notes:

Please dismantle the trim panel assembly with a special-purpose body repair tool; otherwise this will easily cause the trim panel to be damaged.

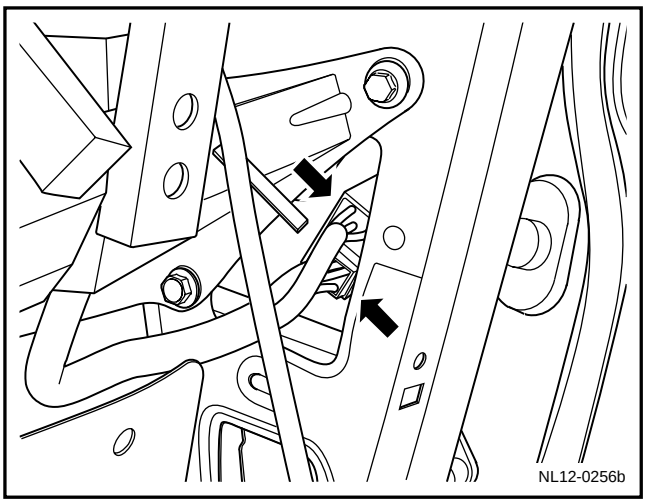
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of instrument table, refer to 12.8.3.1 Replacement of instrument table.
3. For dismantling of mechanical steering column assembly, refer to 11.3.8.12 Replacement of mechanical steering pipe column assembly.
4. Disconnect 3 connectors of instrument panel wire harness and indoor lamp wire harness.



5. Disconnect 5 connectors between the dashboard harness and engine harness and floor harness.



6. Disconnect the dashboard harness connector and front right door harness connector.



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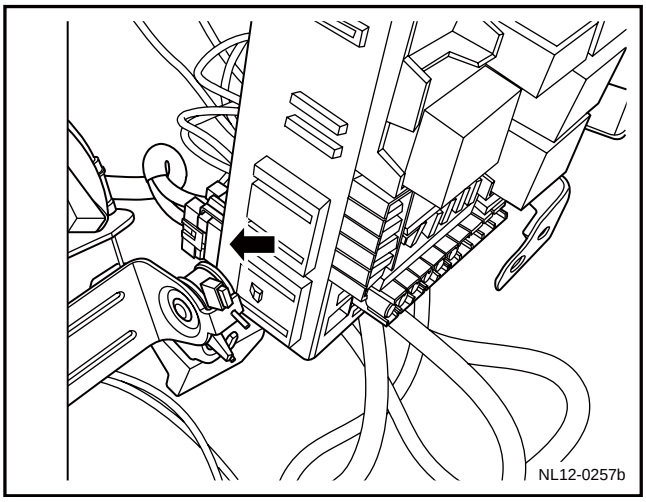
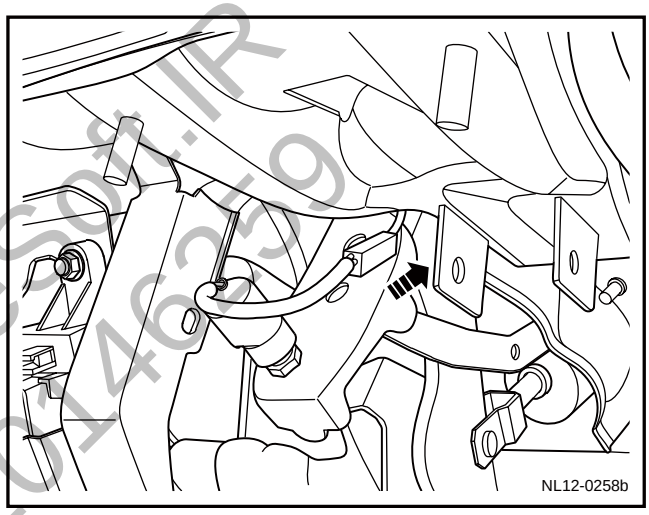
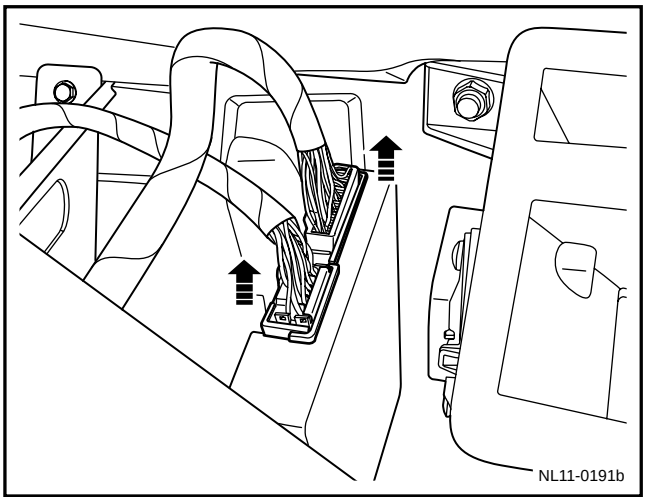
7. Disconnect the engine compartment harness connector and fuse box harness connector.



8. Disconnect the brake lamp switch harness connector.



9. Disconnect the dashboard harness connector and the upper BCM harness connector.



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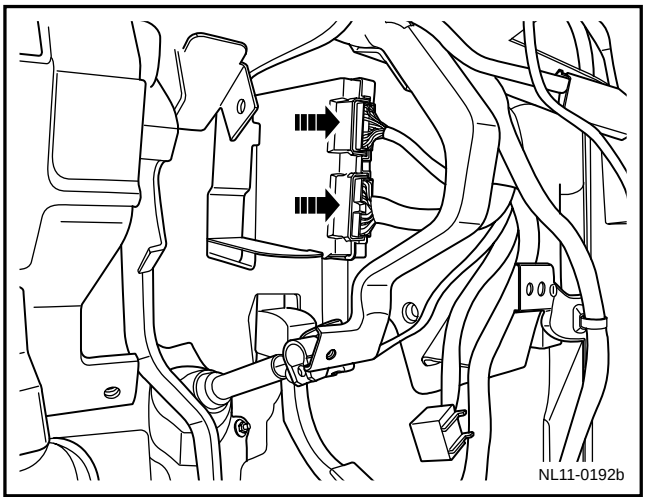
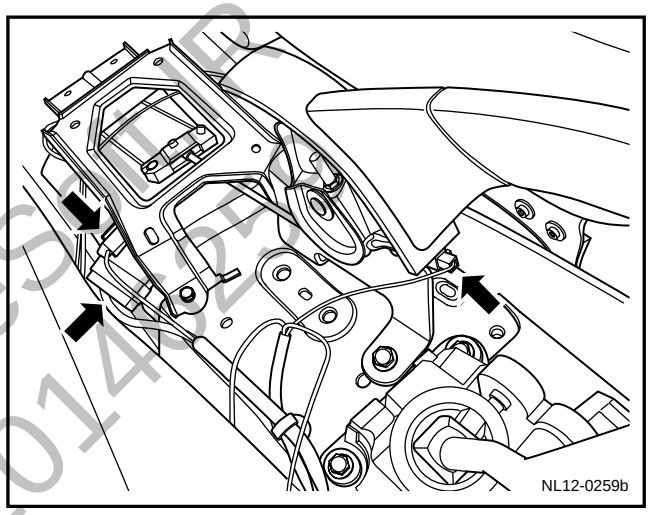
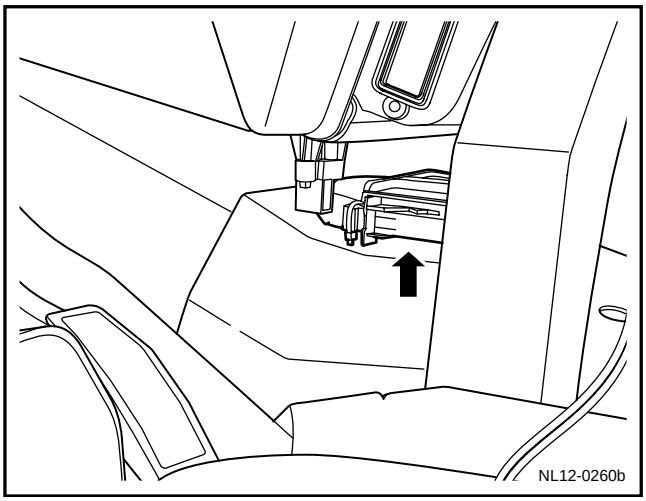
10. Disconnect 2 connectors under the BCM.



11. Dismantle auxiliary instrument table parking brake switch connector and floor wire harness connector.



12. Disconnect connector of safety airbag module.



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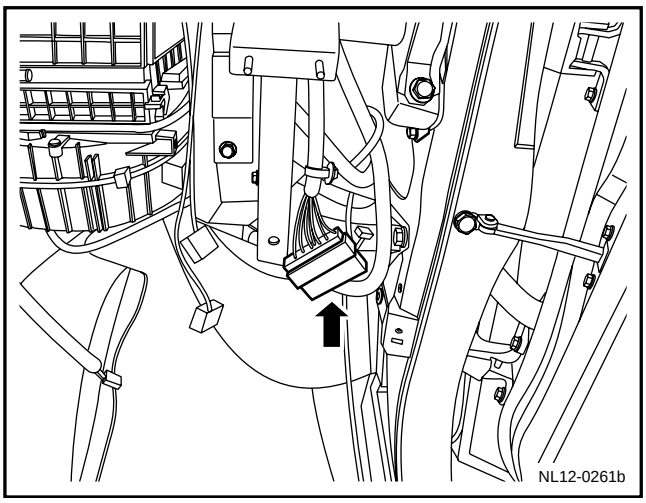
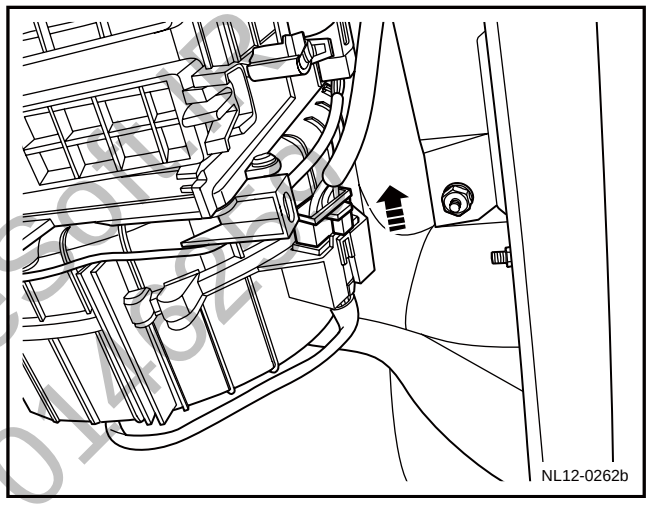
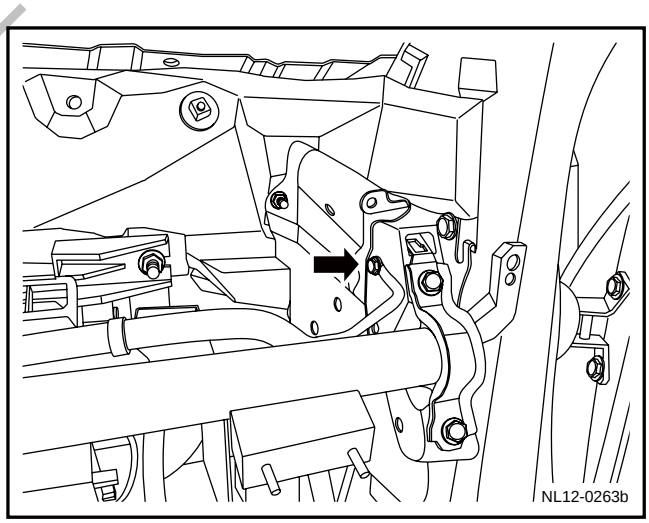
13. Disconnect instrument panel wire harness and engine wire harness connector.



14. Disconnect blower motor wire harness connector.



15. Dismantle fxing bolt of right grounding wire.



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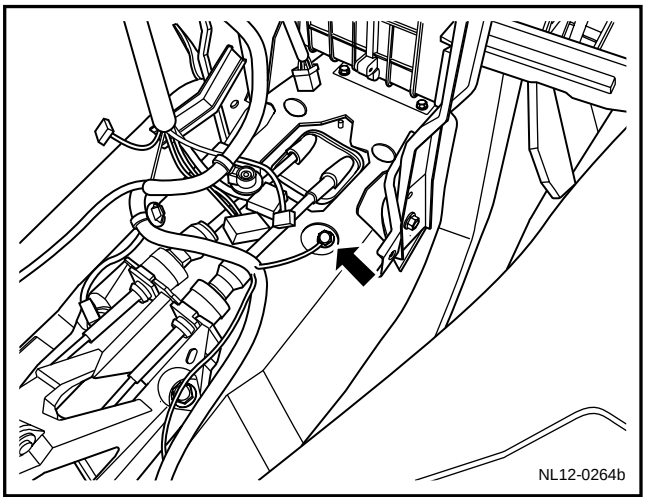
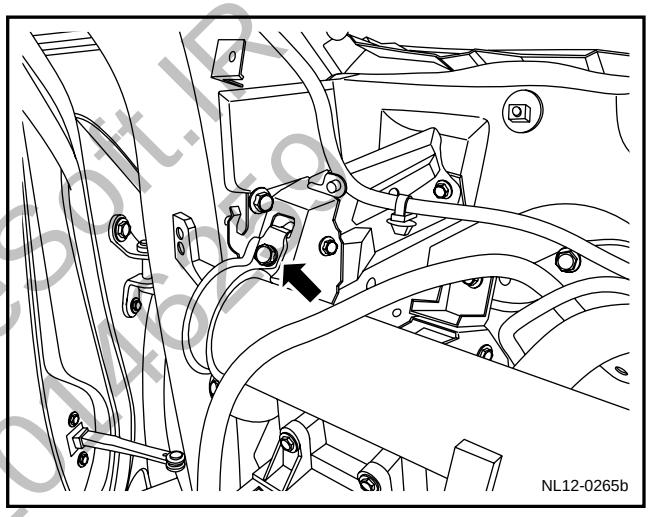
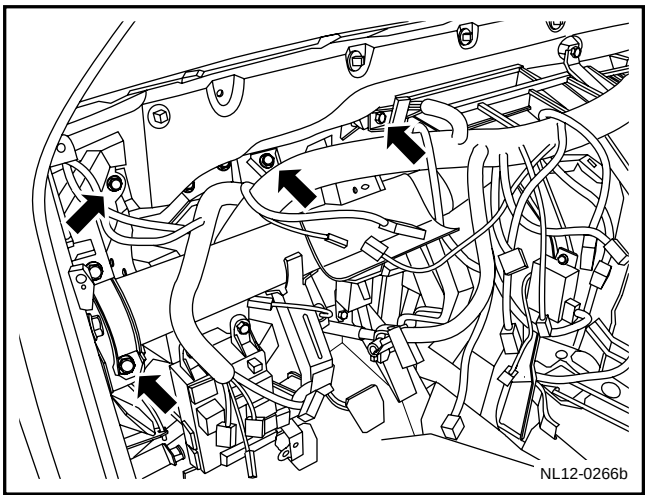
16. Dismantle fixing bolt in the middle of grounding wire.



17. Dismantle fixing bolt of left grounding wire.



18. Dismantle 4 fixing bolts of left side of Cross beam and body.



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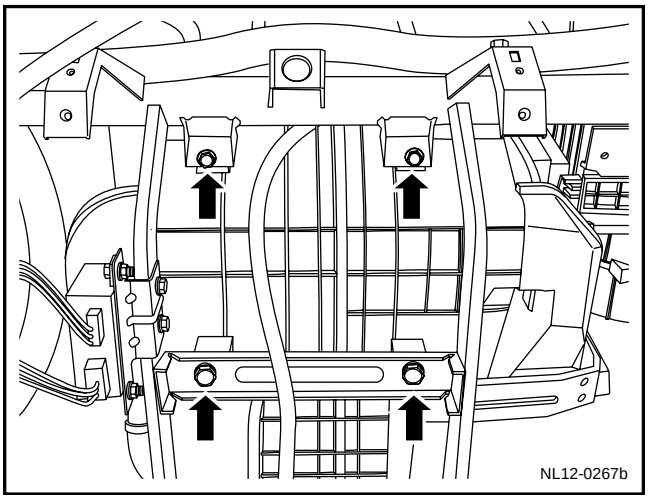
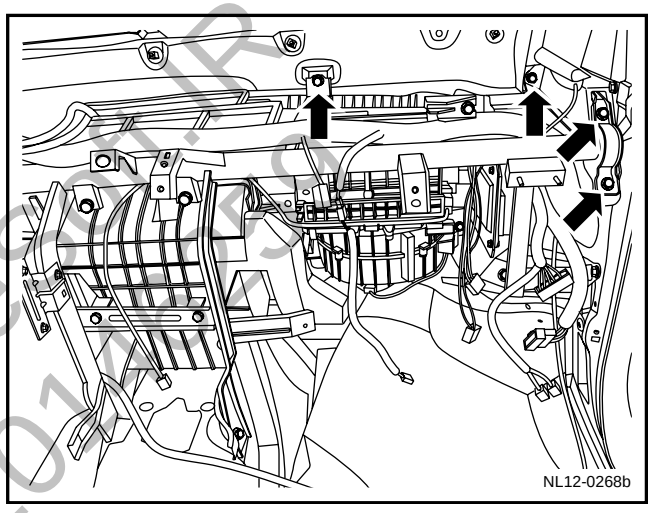
19. Dismantle 4 fixing bolts of horizontal beam and main host of air conditioner.



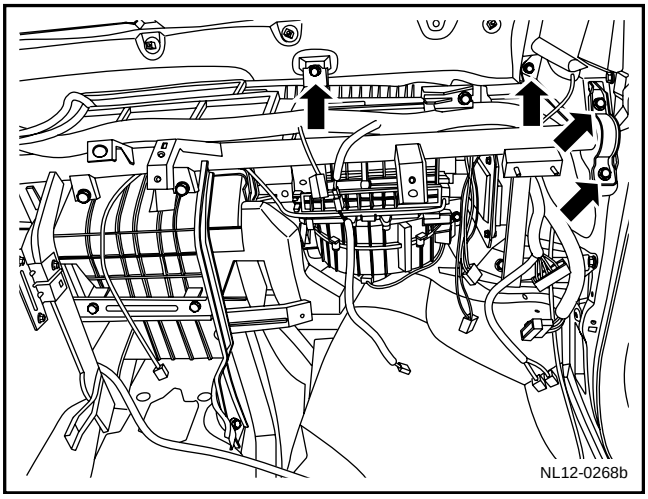
20. Dismantle 4 fixing bolts of right side of cross beam and body.
21. Remover instrument desk cross beam



Installation Procedure:

1. Install cross beam of instrument panel.
2. Install 4 fixing bolts of right side of horizontal beam and vehicle body.

Torque: 24Nm (Metric) 17. 8lb-ft(English system)



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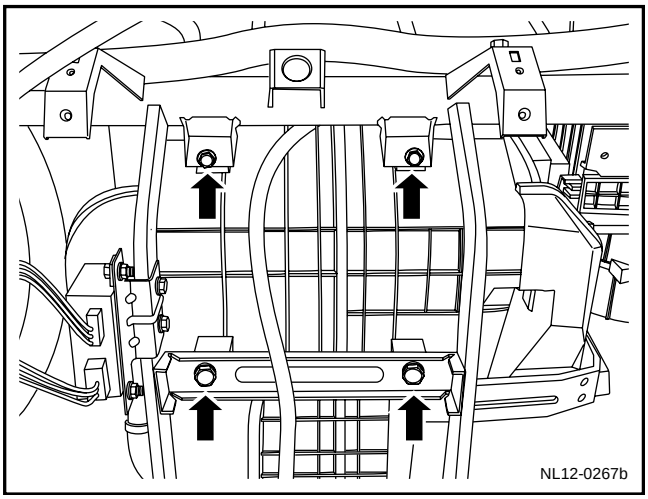
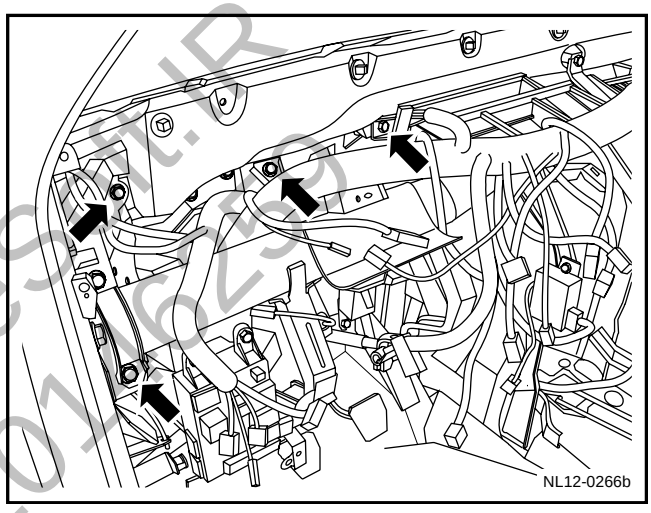
3. Install 4 fixing bolts of horizontal beam and main host of air conditioner.

Torque: 9Nm (Metric system) 6.7lb-ft (English system)



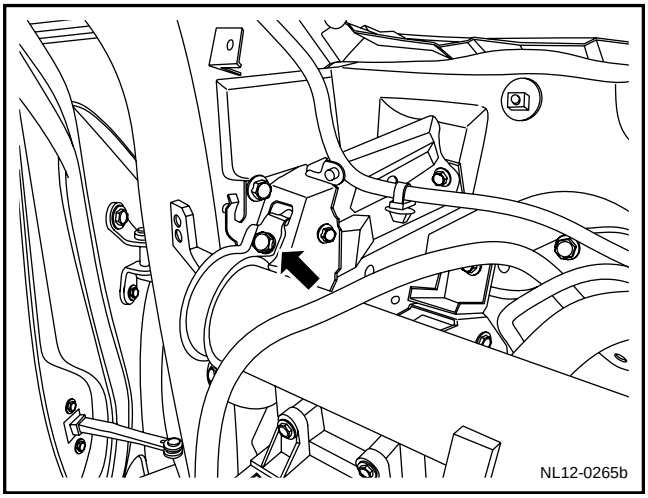
4. Install 4 fixing bolts between the left side of horizontal beam and vehicle body.

Torque: 24Nm (Metric) 17. 8lb-ft(English system)



5. Install and tighten the left bond strap fixing bolt.

Torque:10Nm(Metric) 7.4lb-ft(English system)



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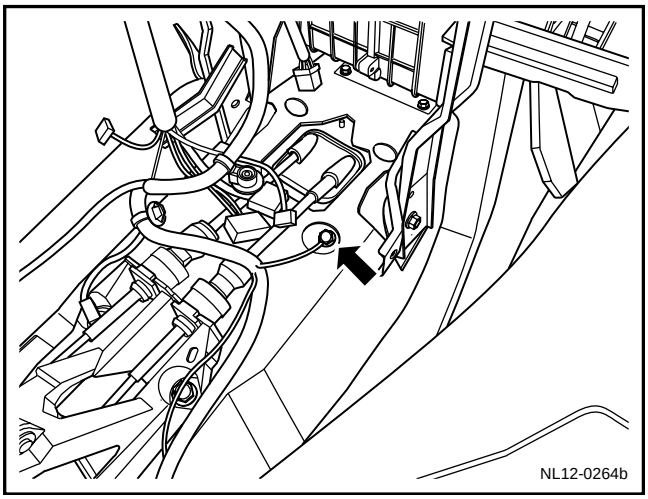
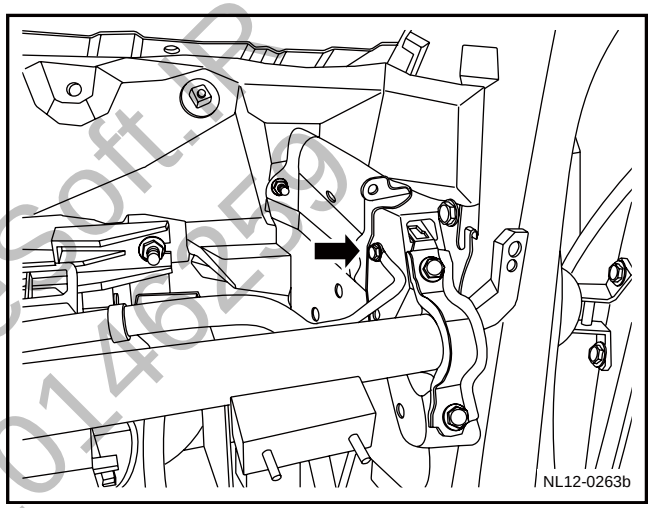
6. Install the fixing bolt for the central ground wire.

Torque:10Nm(Metric) 7.4lb-ft(English system)

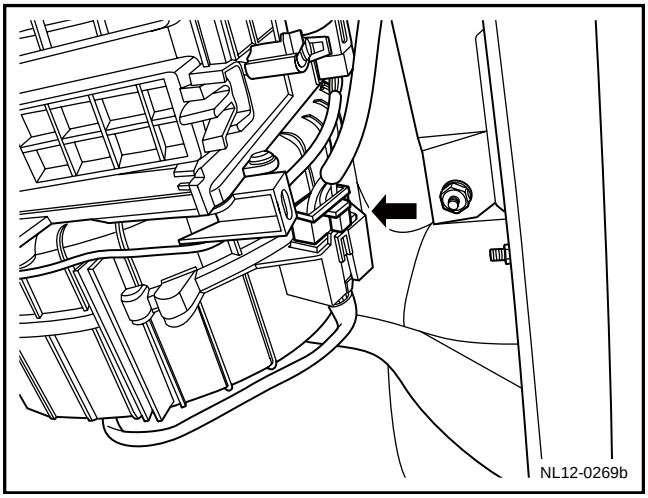


7. Install the right ground wire fixing bolt.

Torque:10Nm(Metric) 7.4lb-ft(English system)



8. Connect the harness connector of the blower motor.



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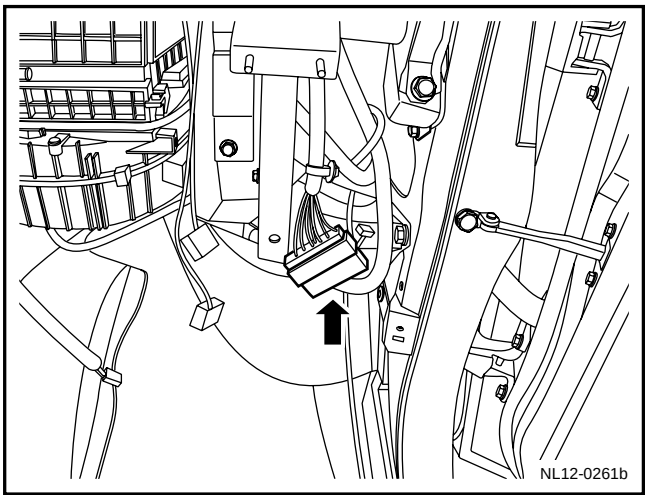
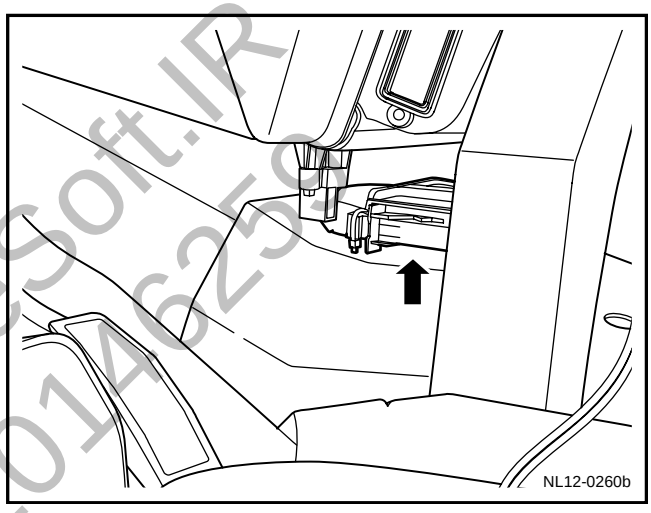
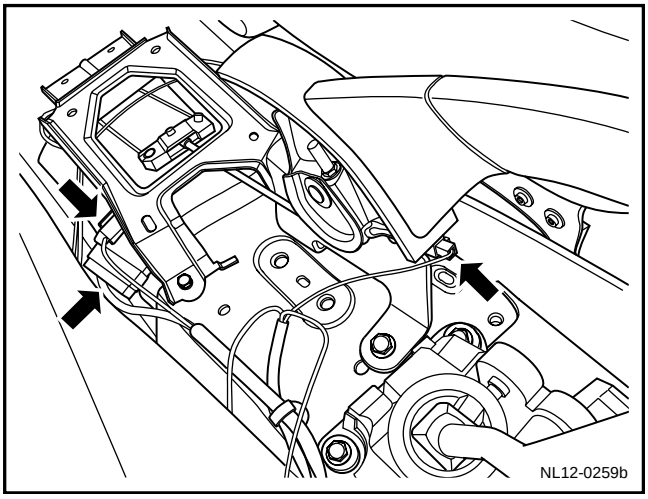
9. Conenct the dashboard harness connector and engine harness connector.



10. Connect to airbag module connector.



11. Connect auxiliary instrument table parking brake switch connector and floor wire harness connector.



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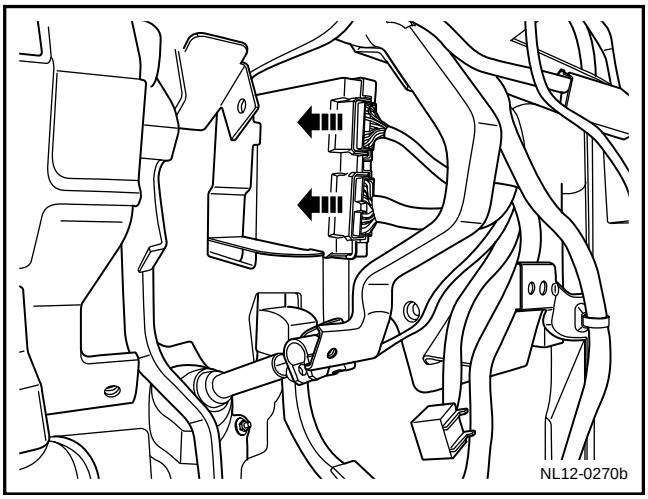
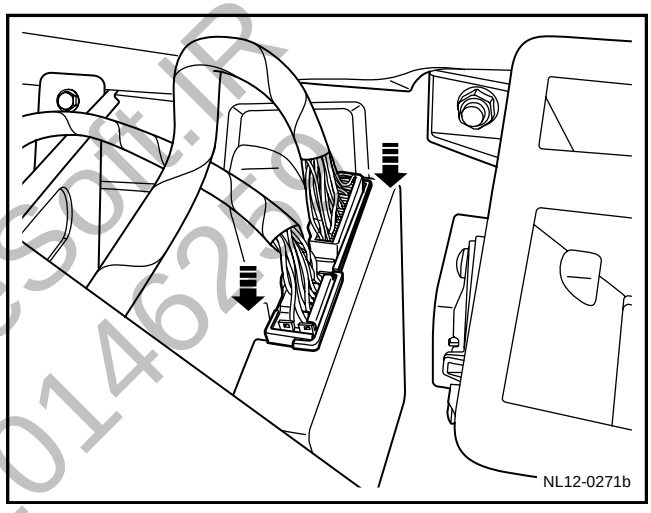
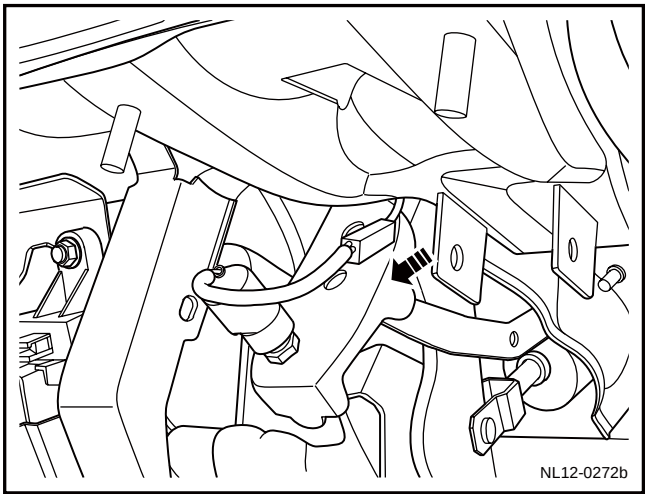
12. Connect to 2 connector under the BCM



13. Connect instrument panel wire harness and 2 wire harness connectors on the top of BCM.



14. Connect the brake lamp switch harness connector.



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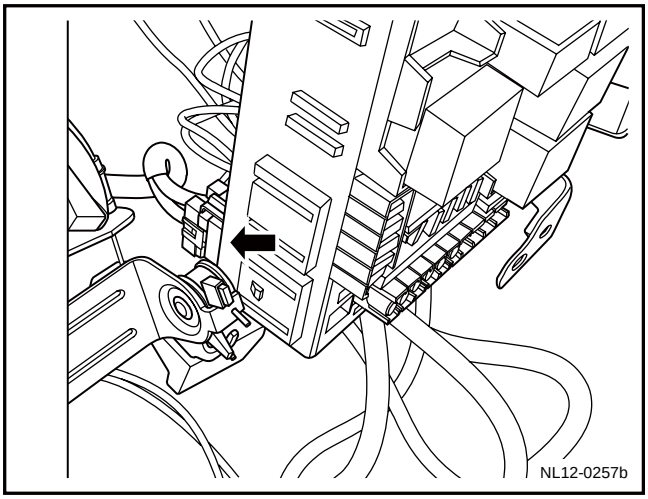
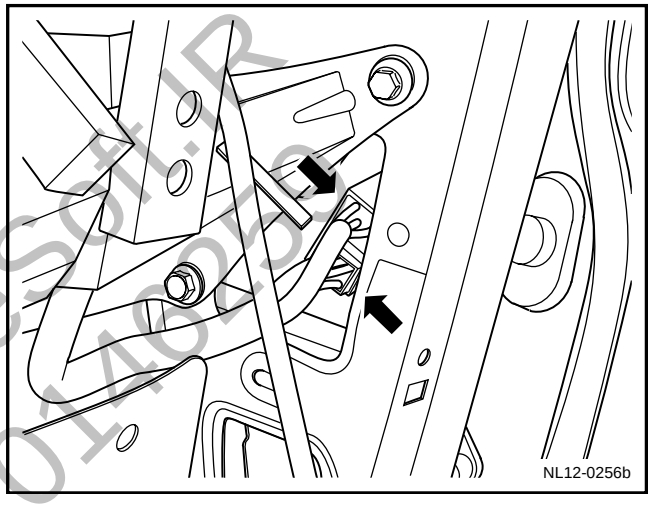
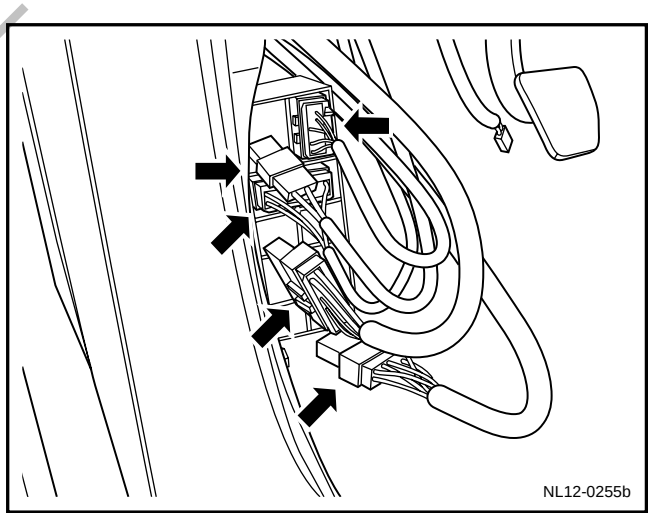
15. Connect wire harness connector between engine compartment wire harness and fuse box.



16. Connect 2 connectors between instrument panel wire harness and right front door wire harness.



17. Connect 5 connectors between instrument panel wire harness and engine wire harness and floor wire harness.



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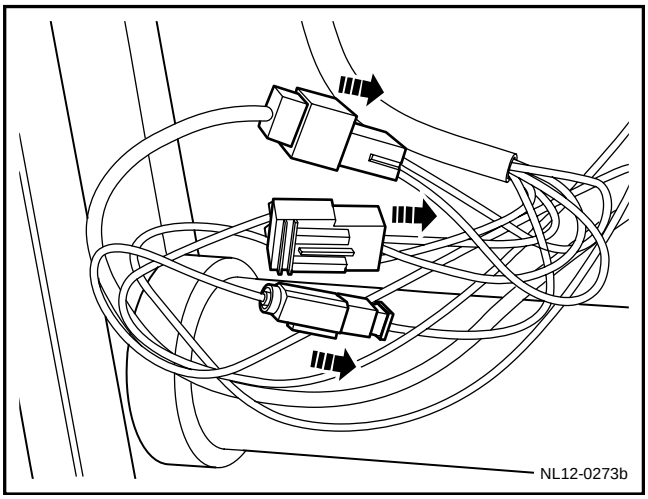
18. Connect to 3 harness connectors of instrument panel harness and ceiling harness.
19. Install mechanical steering column assembly.
20. Install the instrument panel.
21. Connect the battery negative cable.



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12.9 Interior trim

12.9.1 Dismantle and install

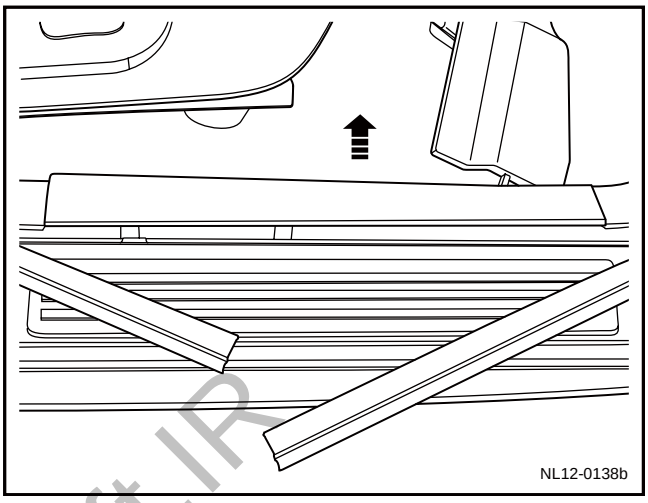
12.9.1.1 Left /right front doorsill inner trim plate assembly replacement

Dismantlement Procedure

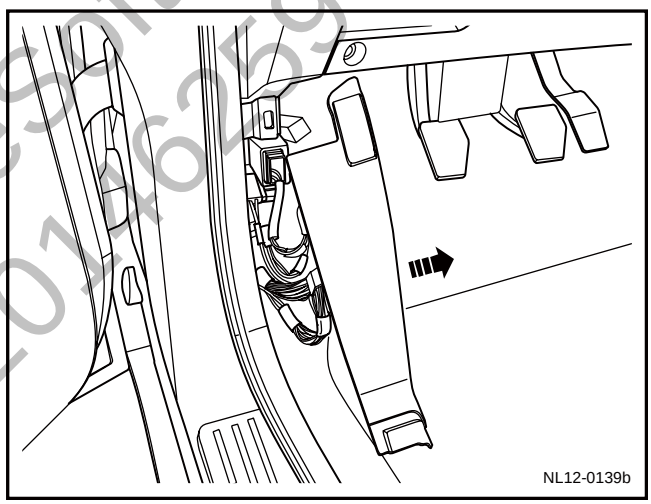
Notes:

Dismantle the front left/right threshold trim panel assembly with body repair tool; otherwise the internal threshold trim panel edge will be easily scratched.

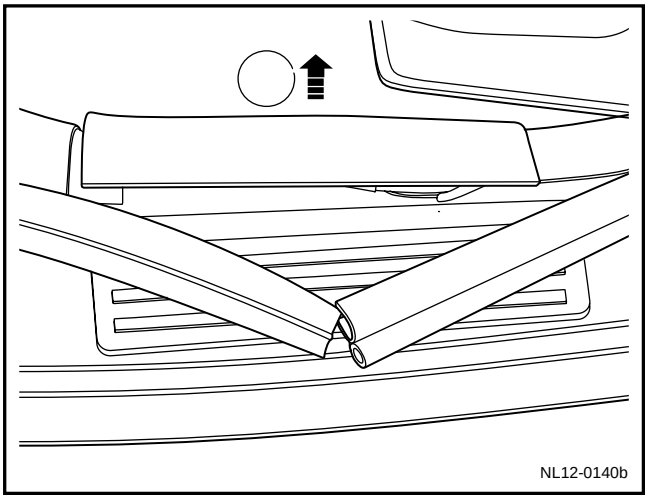
1. Remove previous section of front door frame sealing strip.
2. Upward draw inner trimming plate of front doorsill.



3. Dismantle lower trimming plate assembly of front vertical column.



4. Uncover a section of the rear door frame sealing bar.
5. Pull up the rear threshold internal trim panel assembly and extract.



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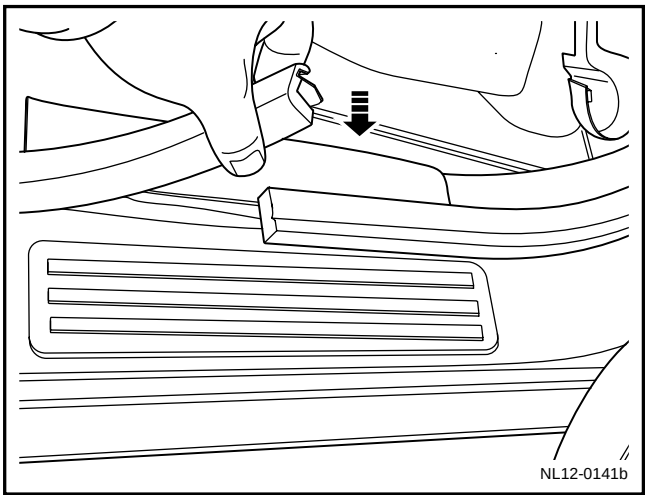
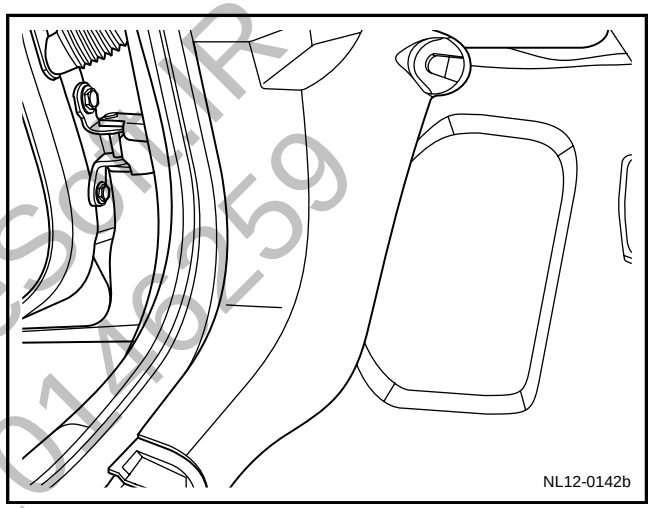
Installation Procedure:

1. Install rear doorsill inner trimming plate assembly.
2. Install rear door frame sealing strip.



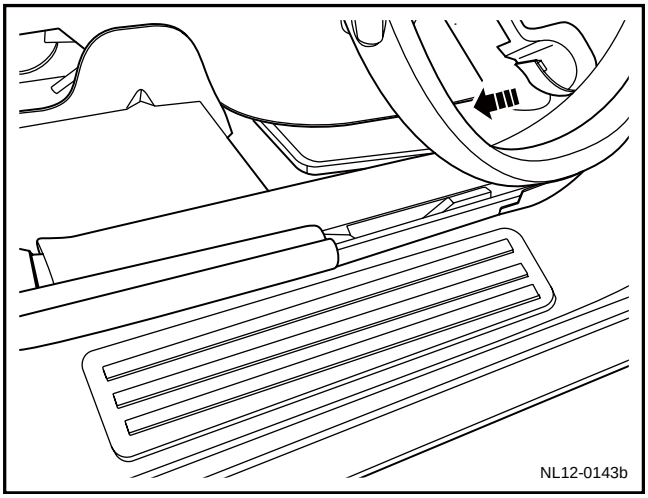
3. Install lower trimming plate assembly of front column.



4. Install inner trimming plate assembly of doorsill.
5. Install the front door frame sealing strips.

Notes:

Same way of dismantle and install of left /right doorsill inner trim plate



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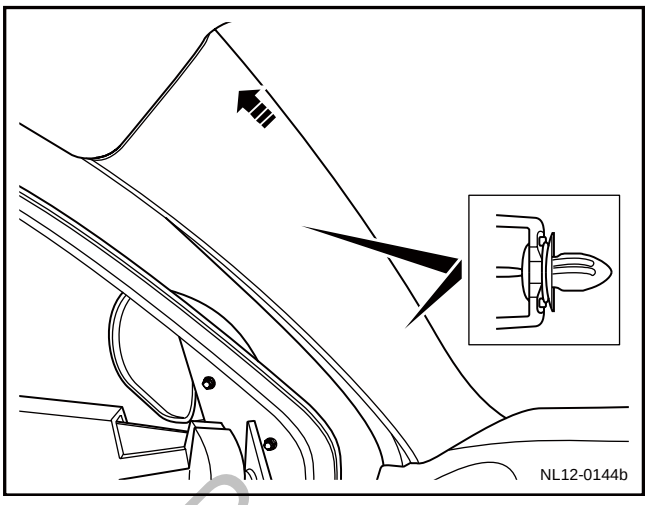
12.9.1.2 Left/right front post trim plate assembly replacement

Dismantlement Procedure

Notes:

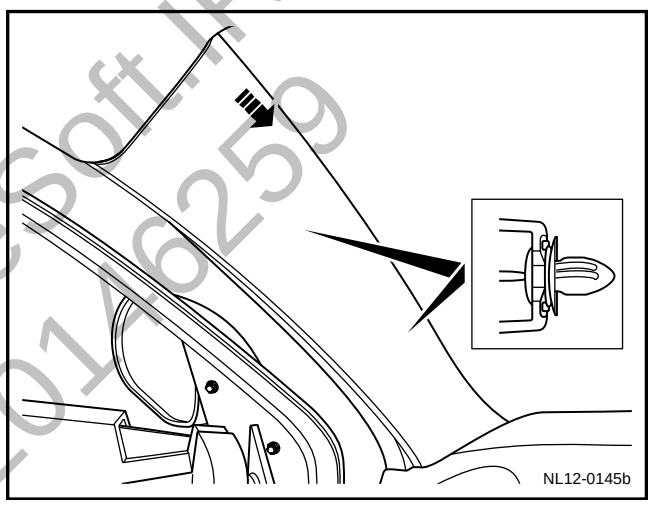
Please dismantle the front left/right pillar top trim panel assembly with a aspecial-purpose body repair tool, otherwise this will easily cause the pillar trim panel to be damaged.

1. Remove 2 D buckles and 1 connecting buckle on the back of front column upper trimming plate.
2. Upward draw out upper trimming plate of front column.



Installation Procedure:

1. Insert front column upper trimming plate lower end into instrument table clip slot.
2. Align buckle of upper trimming plate of front column with mounting hole, and tighten buckle by force.



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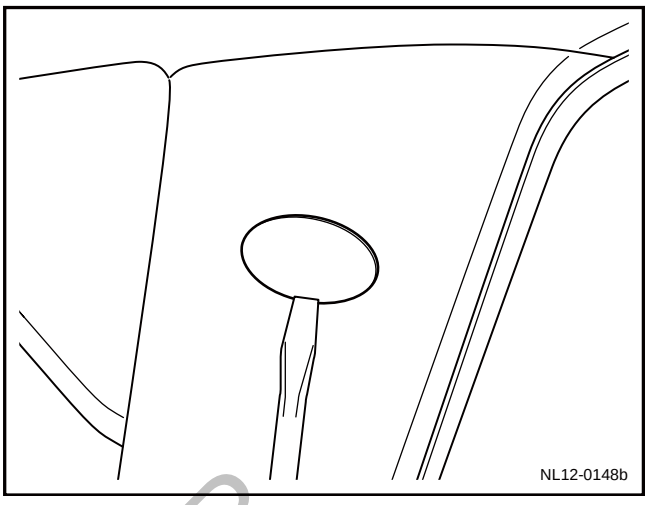
12.9.1.3 Middle post trim plate replacement

Dismantlement Procedure

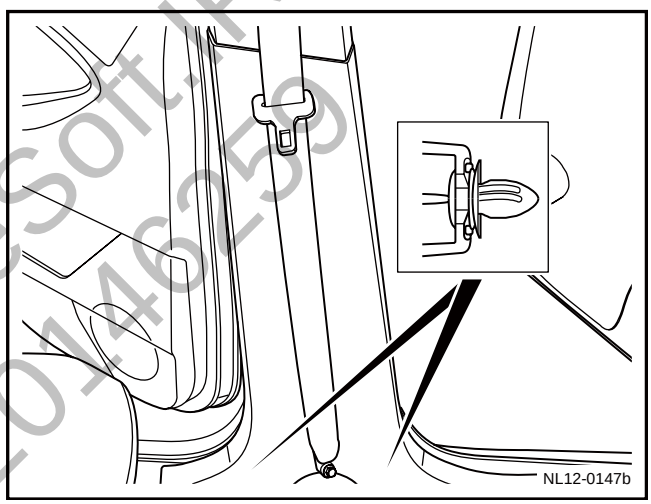
Notes:

Please dismantle the pillar trim panel assembly with a special-purpose body repair tool, otherwise this will easily cause the pillar trim panel to be damaged.

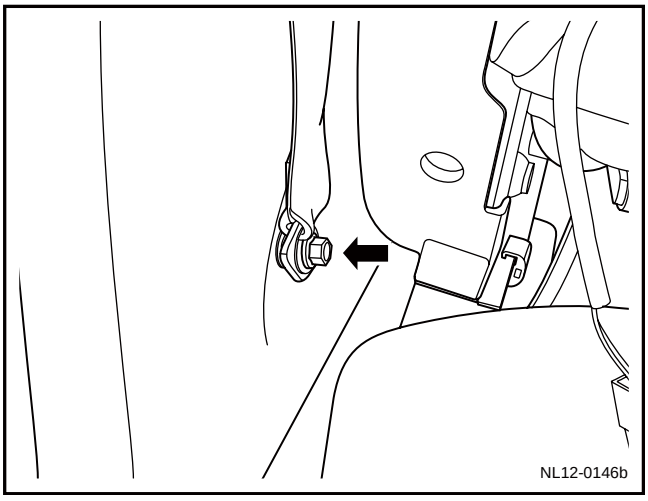
1. For dismantling of front and rear doorsill inner trimming plate assembly, refer to 12.9.1.1 Replacement of left/right front doorsill inner trimming plate assembly.
2. Dismantle the fixing bolt of middle column lower seat belt mounting panel.



3. Loosen middle 2 D-buckles under the back of lower trimming plate of middle column and two equipped clip tones on the upper of back side of lower trimming plate of middle column.
4. Dismantle lower trimming plate of middle column.



5. Dismantle the fixing screw cap for the upper trim panel of the center pillar.



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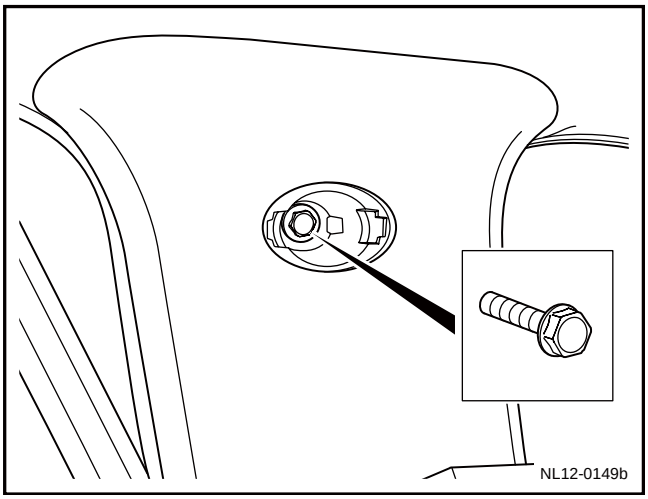
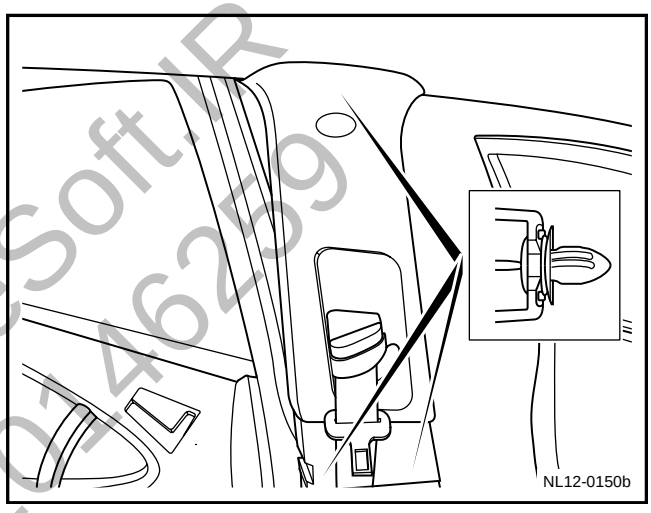
6. Remove the hexagon bolt on the upper trim panel on the center pillar.



7. Detach 3 buckles on the back of the center pillar top trim panel.
8. Take down upper trim plate of intermediate post.



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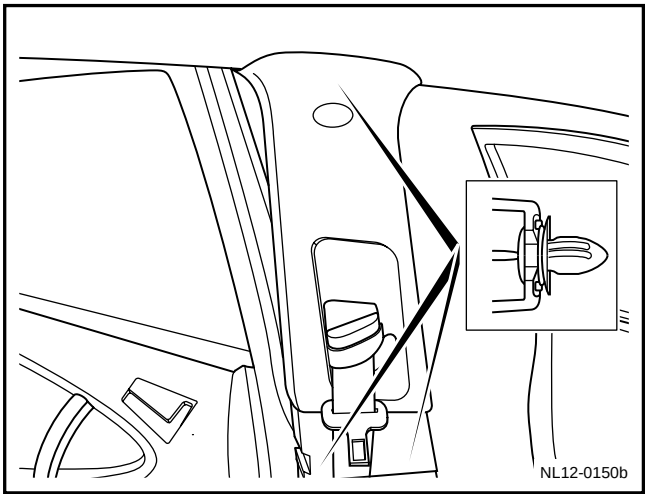
Installation Procedure:

Notes:

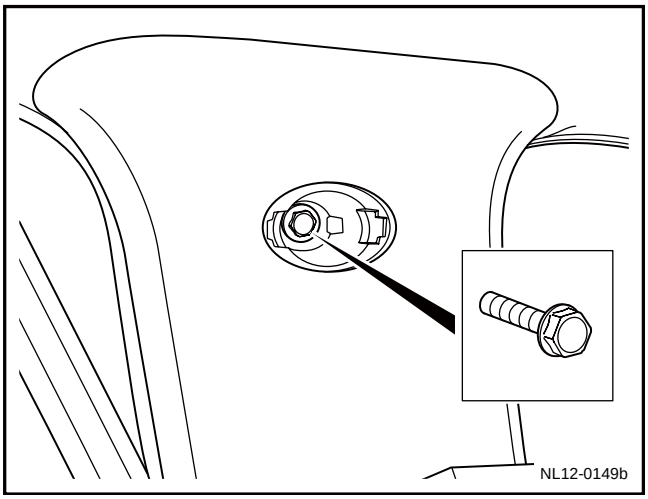
Fixed buckle must be replaced by new part.

1. Install 3 D-buckles onto the back of upper trimming plate of middle column.
2. Align buckle of upper trimming plate of middle column with mounting hole, and press trimming plate to tighten buckle.

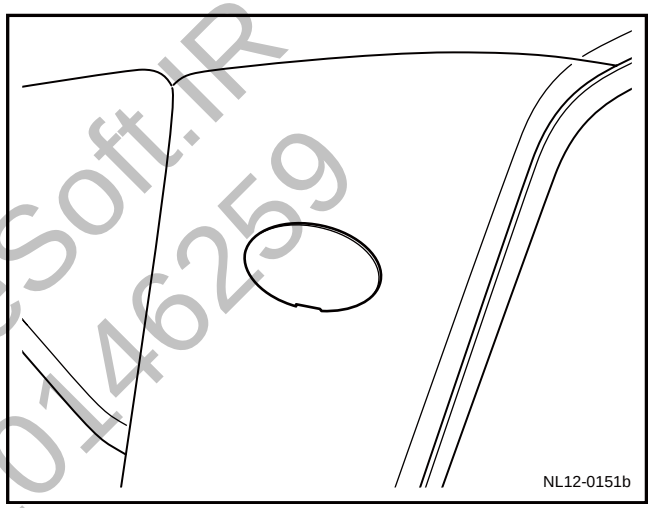


3. Install 6. hexagon bolts on the intermediate post upper trim plate

Torque: 8Nm (Metric system) 5.9lb-ft (English system)

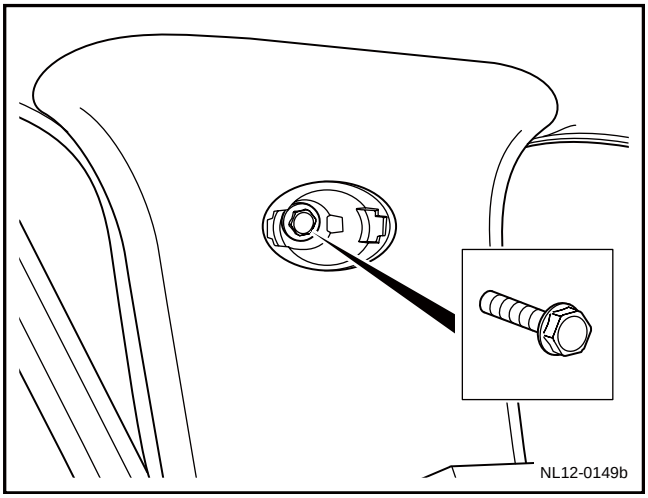


4. Install trimming cover of upper trimming plate screw hole of middle column.



5. Align 2 buckles on the bottom of the back of the lower trim panel of the center pillar and the clamping tongues on both sides to the installation holes.

6. Fasten the buckle and clamping tongue by pressing the lower center pillar trimp panel.



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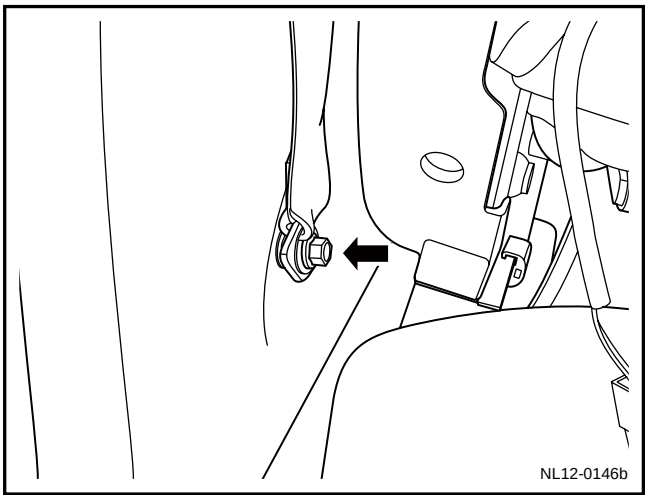
7. Install and tighten the fixing bolt for the seat belt fixing plate on the bottom of the center pillar.

Torque: 50Nm (Metric system) 37lb-ft (English system)



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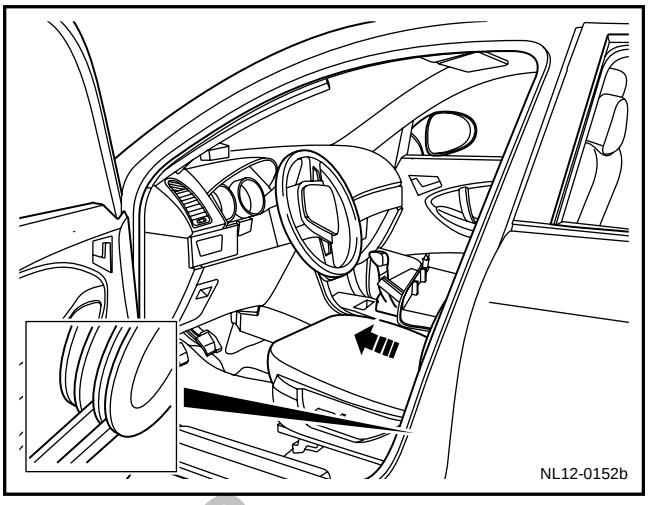
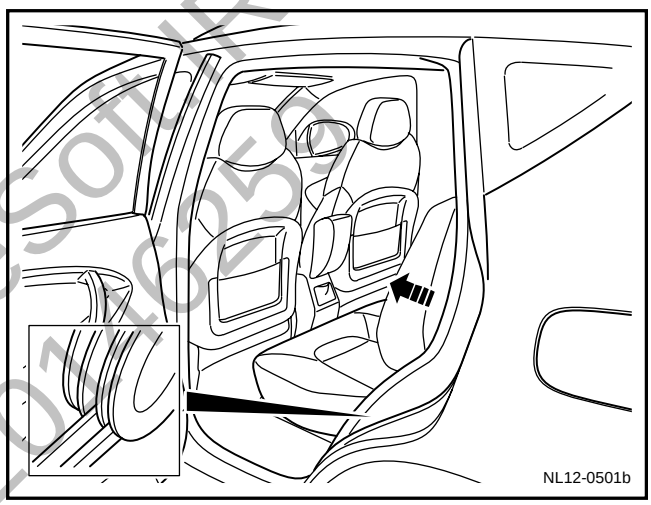
12.9.1.4 Indoor side seal strip and seal part replacement

Dismantlement Procedure

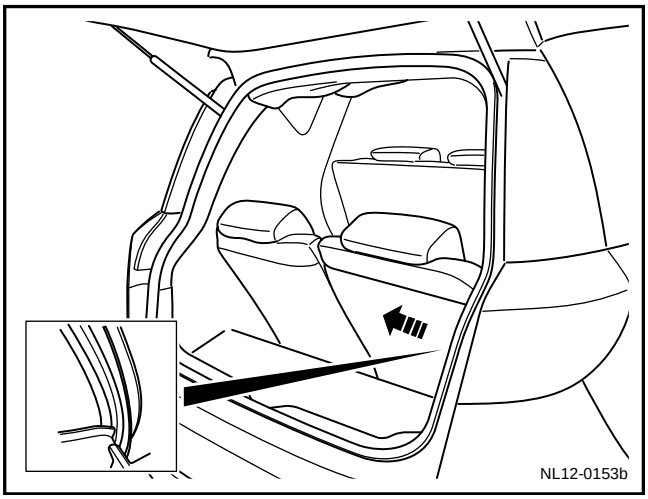
1. Dismantle front door frame sealing strip.



2. Dismantle rear door frame sealing strip.



3. Dismantle back door sealing strip.



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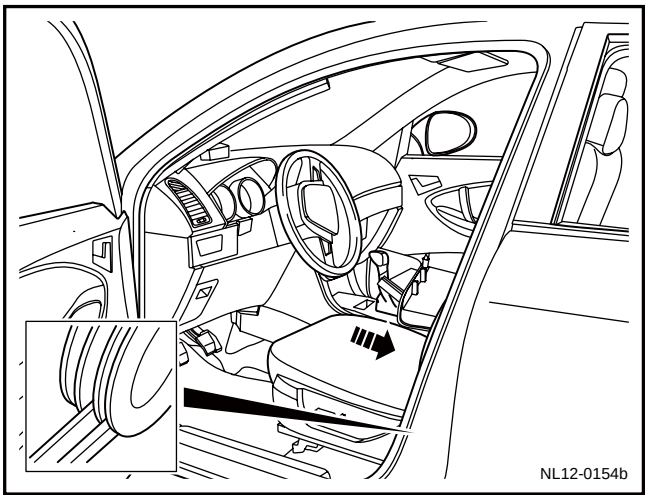
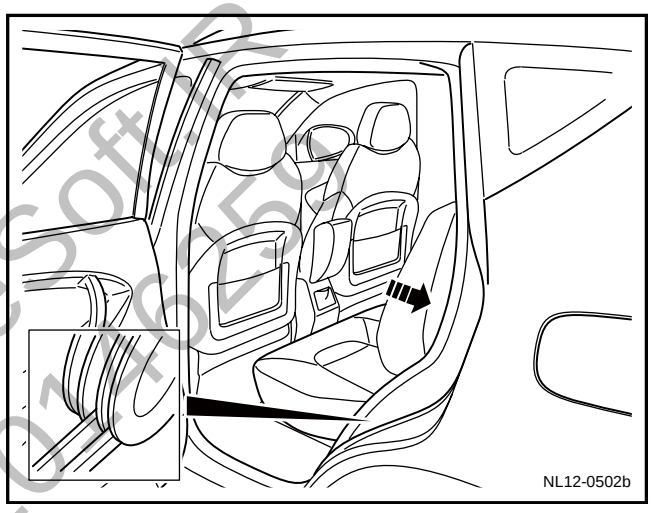
Installation Procedure:

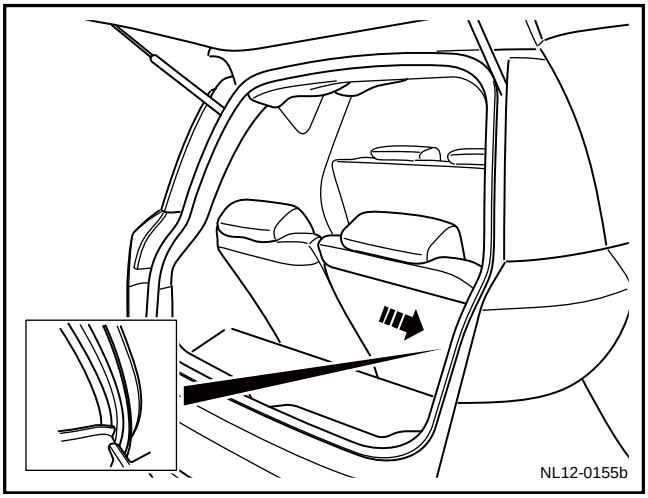
1. Install front door frame sealing strip.



2. Install rear door frame sealing strip.



3. Install the back door seal.



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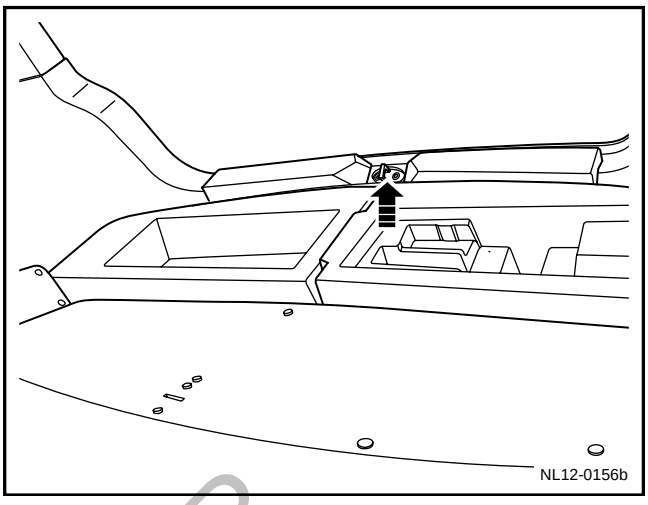
12.9.1.5 Rear post lower trim plate replacement

Dismantlement Procedure

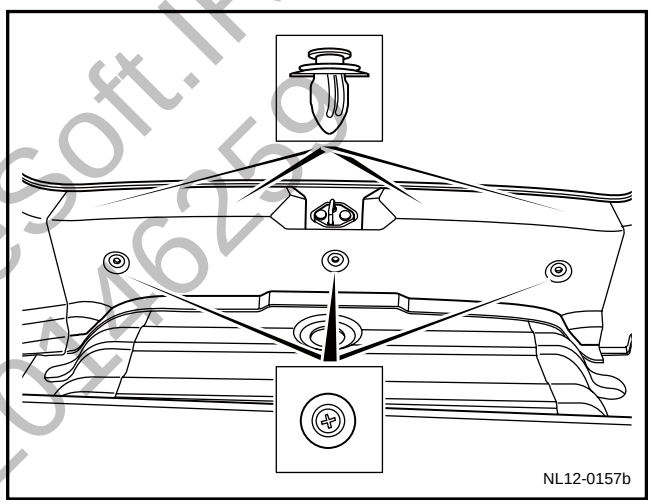
Notes:

Please dismantle the rear pillar bottom trim panel assembly with a special-purpose body repair tool, otherwise this easily causes the trunk trim panel to be damaged.

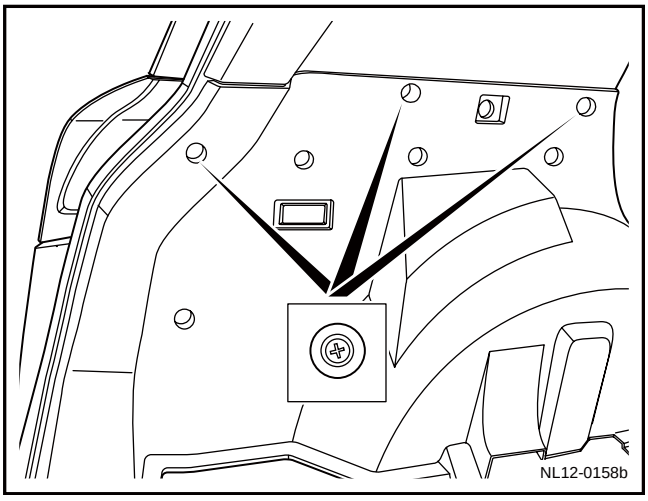
1. For dismantling of rear doorsill inner trimming plate, refer to 2.9.1.1 Replacement of left/right front doorsill inner trimming plate assembly.
2. Lay down the last row seat, curl up floor rug, and take out attached tool box.



3. Loosen 3 buckles on the side of upper trimming plate of back door buckle.
4. Disengage 4 buckles on the upper side of the upper trim panel for the back door lock catch.
5. Remove the upper trim panel of the lock catch of the back door.



6. Remove the 3 fixing screws for the rear pillar lower trim panel.



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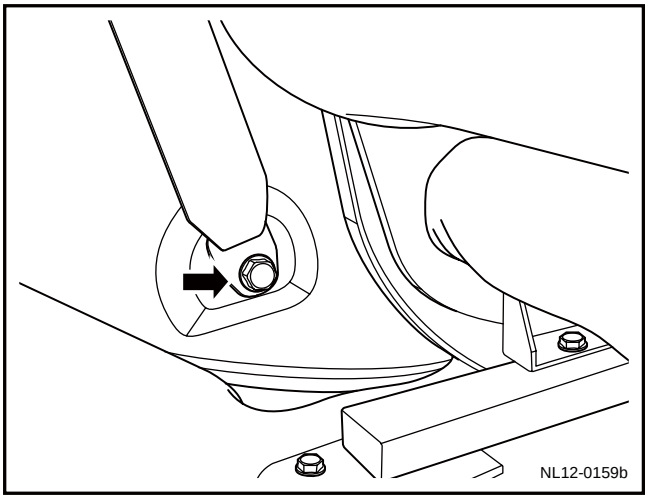
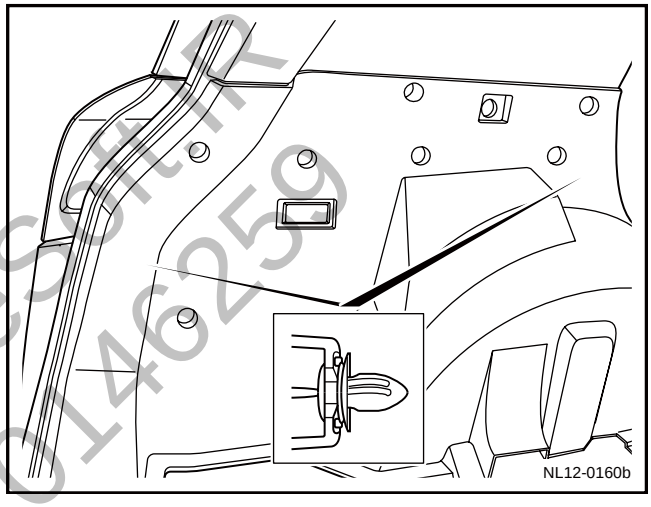
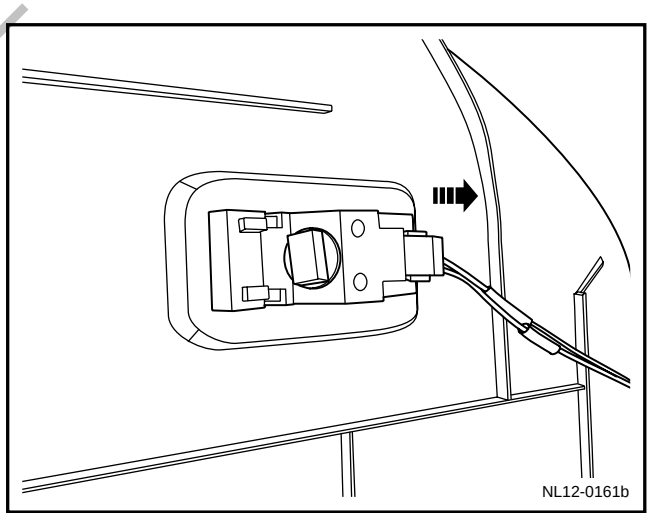
7. Remove the seat belt fixing bolt on the bottom of the rear pillar bottom trim panel.



8. Disengage the clamping tongue and 2 buckles on the back of the lower trim panel of the rear pillar.



9. Disconnect the trunk lamp harness connector of the rear pillar lower trim panel.
10. Dismantle boot lamp assembly on side trimming plate.



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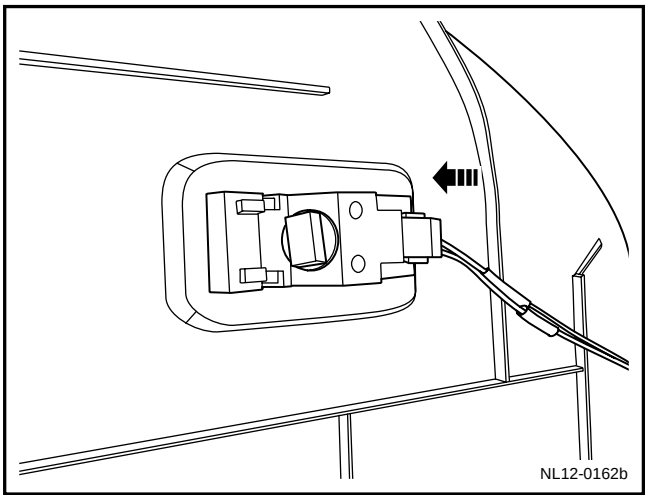
Installation Procedure:

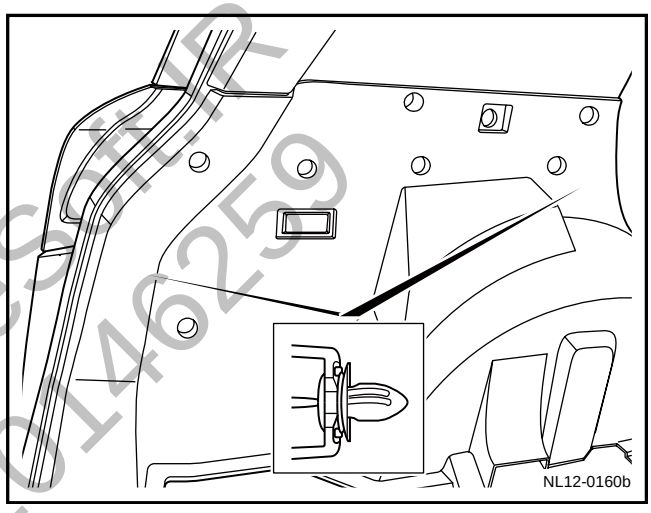
Notes:

Fixed buckle must be replaced by new part.

1. Install boot lamp on side trimming plate.
2. Connect boot wire harnes connector.

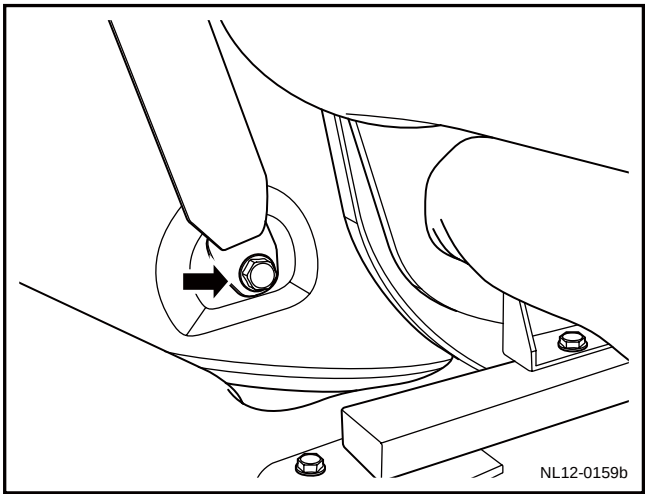


3. Align buckle on side trimming plate with mounting hole of vehicle body and install them in good condition.



4. Install and tighten fixing bolt of safety belt under lower trimming plate of rear column.

Torque: 4Nm (Metric) 3 lb-ft (Inch)



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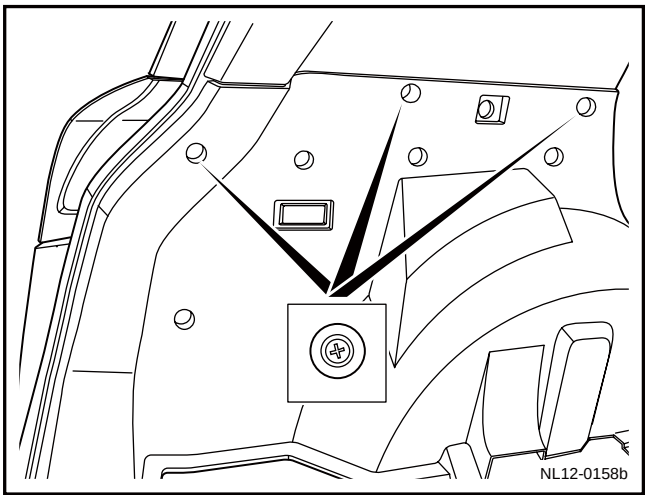
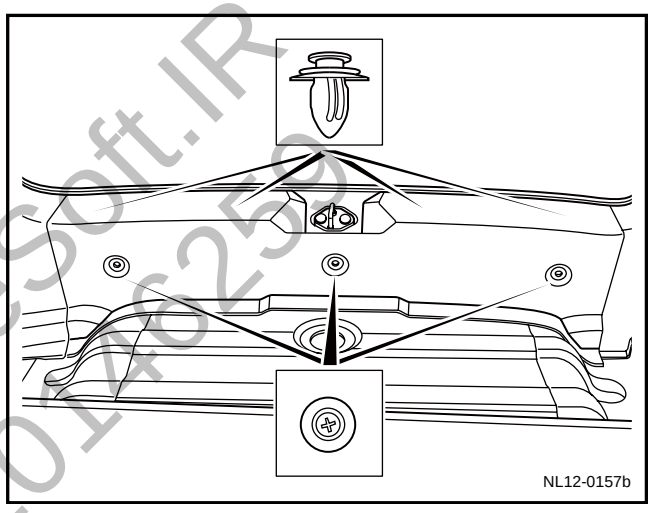
5. Installation of 3 fixing bolts at the upper part of the back column lower decorating plate.

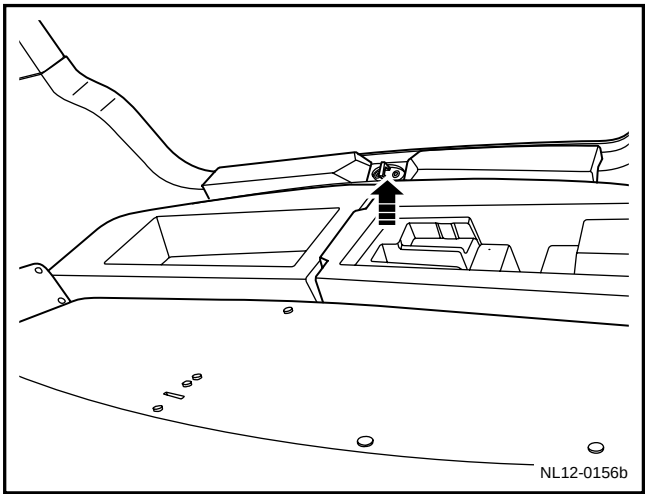
Torque: 4Nm (Metric) 3lb-ft (Inch)



6. Press 4 buckles on the top of the upper trim panel for the back door lock catch into the installation holes and install 3 buckles on the side surface of the trim panel.



7. Install the tool box and replace the floor mat in the trunk.
8. Install the rear threshold internal trim panel.



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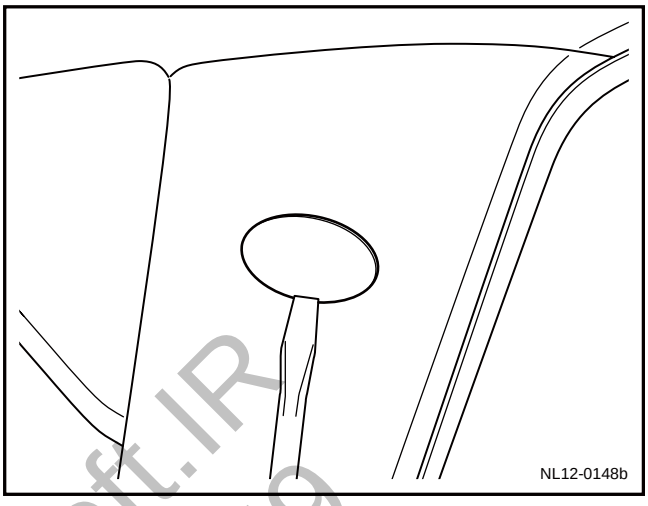
12.9.1.6 Rear post upper trim plate assembly replacement

Dismantlement Procedure

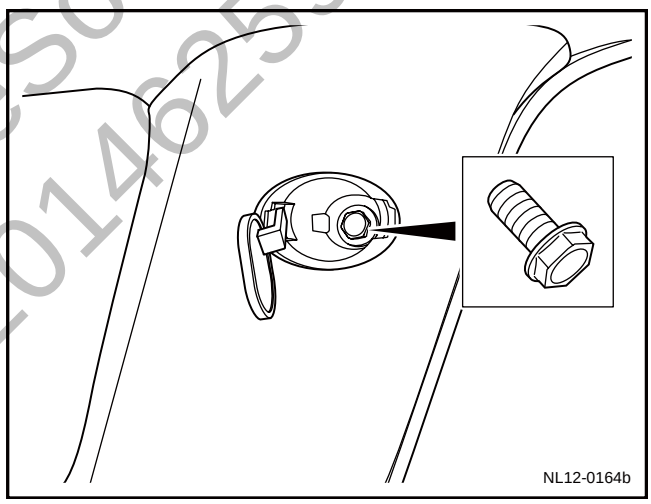
Notes:

Please dismantle the rear pillar top trim panel assembly with a special-purpose body repair tool, otherwise this easily causes the rear pillar top trim panel to be damaged.

1. For dismantling of rear column lower trimming plate, refer to 12.9.1.5 Replacement of rear column lower trimming plate.
2. Dismantle fixing bolt trimming cover of upper trimming plate of rear column.



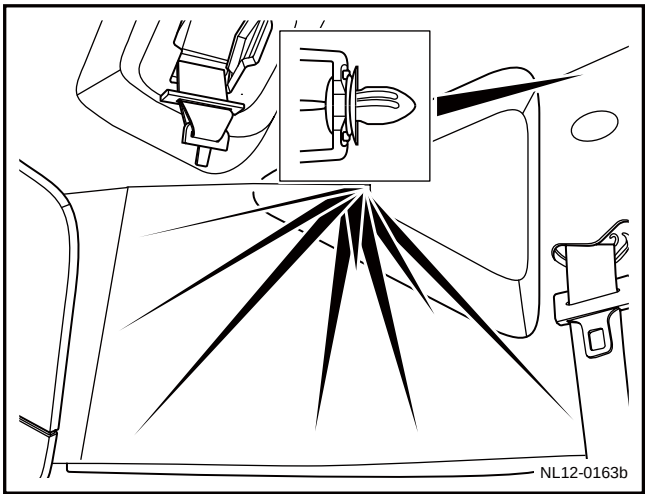
3. Dismantle hexagonal fixing bolt of upper trimming plate of rear column.



4. Disengage 9 fixing buckles on the back of the upper trim panel of the back column.
5. Remove the upper trim panel assembly of the rear pillar.

Notes:

Remove the lower fixing bolt for the seat belt and extract the seat belt from the rear pillar top trim panel.



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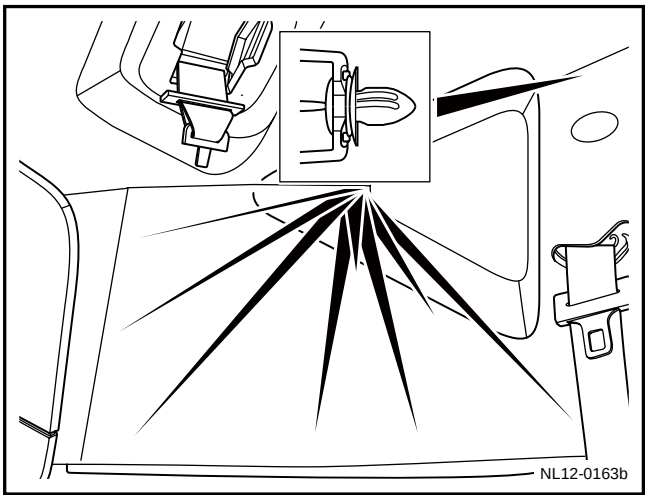
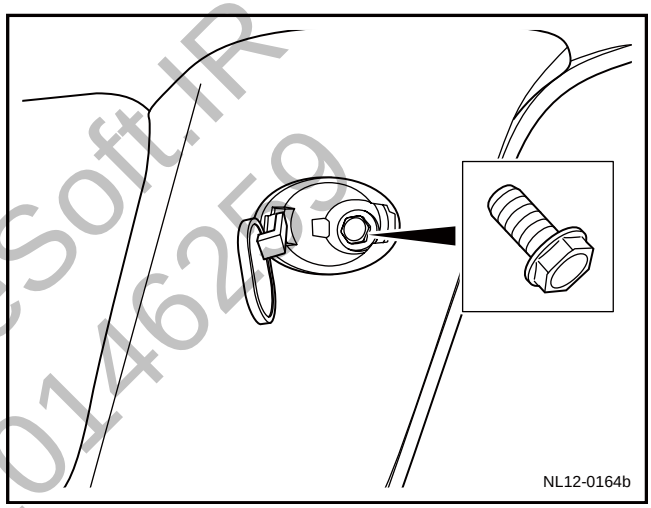
Installation Procedure:

1. Align 9 buckles at the back of rear column upper trimming plate with mounting hole, and press trimming plate fixing buckle.

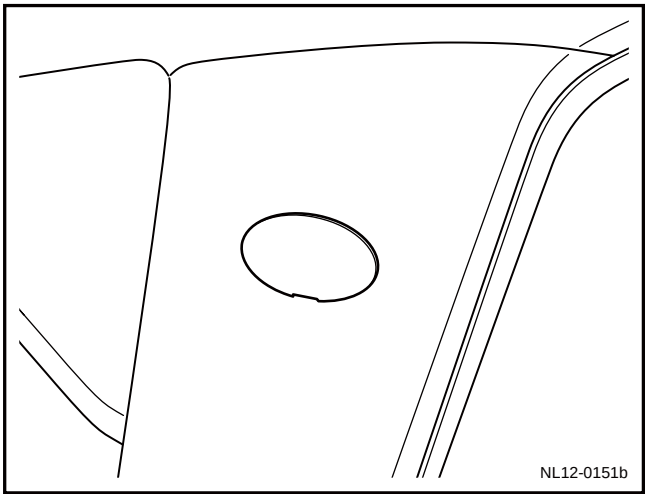


2. Install hexagonal fixing bolt of rear column upper trimming plate.

Torque: 8 Nm (Metric) 5.9 lb-ft (English system)



3. Install fixing bolt trimming cover of upper trimming plate of rear column.
4. Install the rear column lower trim panel.



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12.9.1.7 Left front door interior trim plate replacement

Dismantlement Procedure

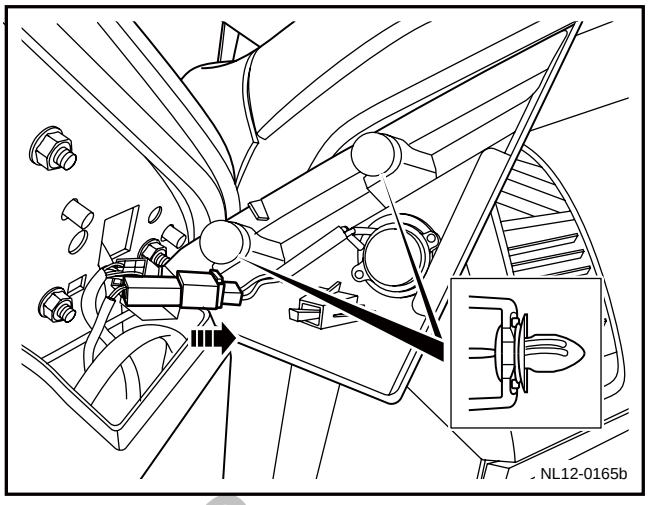
Warning!

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

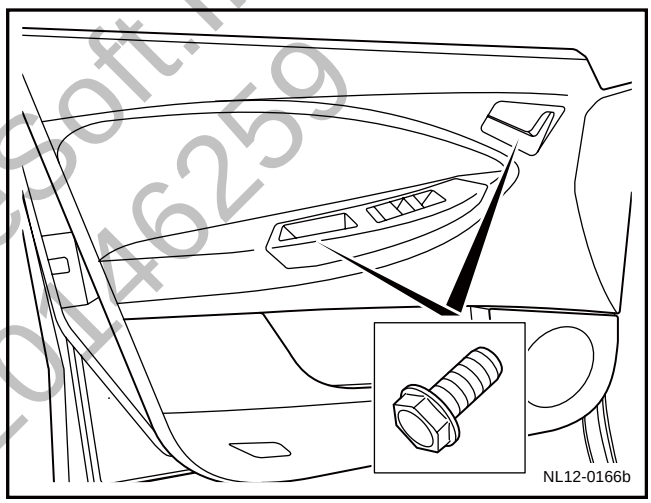
Notes:

Please dismantle the trim panel with a special-purpose body repair tool; otherwise this will easily cause the trim panel to be damaged.

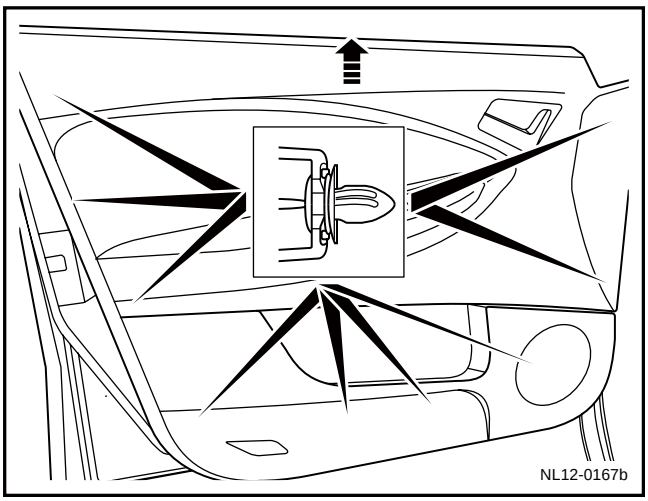
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Loosen 2 buckles of door inner angle trimming.
3. Disconnect high -pitch speaker harness connector, Dismantle angle trim.



4. Remove 2 cross recessed screws used to fix front door inner trimming plate.



5. Disengage 9 internal buckles for the internal trim panel of the front door.
6. Disconnect the harnes connectors of the front door lamp and window lifter switch.
7. Dismantle the front door trim panel.
8. Detach the control cable of the internal door handle.



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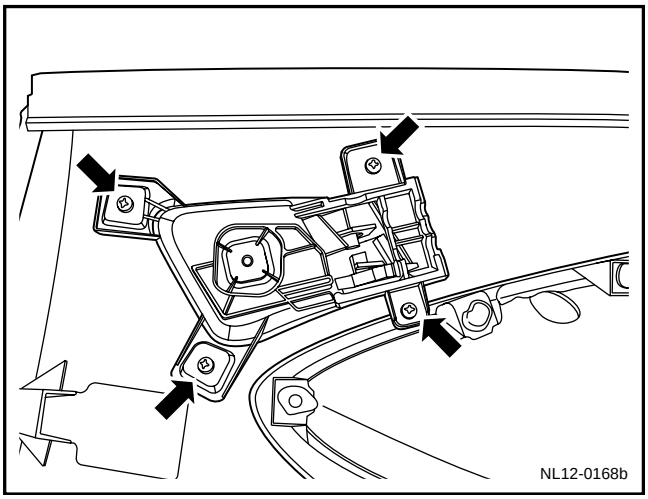
9. Dismantle the internal door handle assembly.

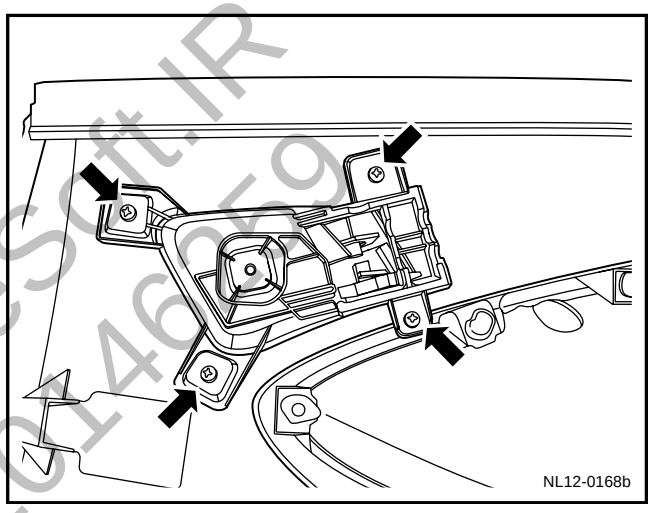


Installation Procedure:

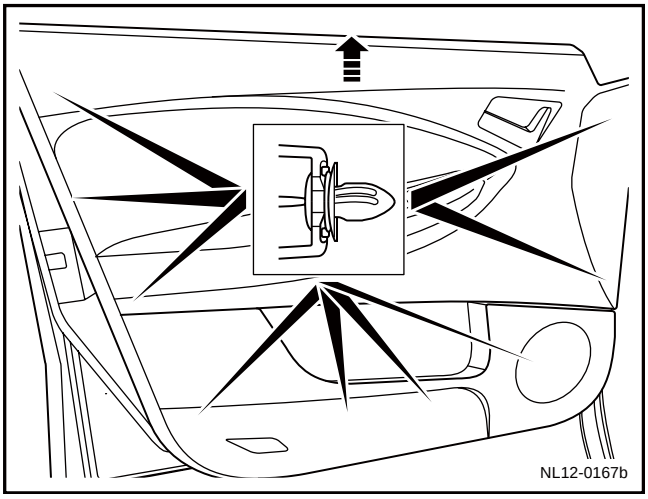
Notes:

Fixed buckle must be replaced by new part.

1. Install door outer opening handle.



2. Connect door inner opening handle cable.
3. Connect wire harness connector between front door inner trimming plate door lamp and glass lifter switch.
4. Secure the front door trim buckle aligning to the installation hole and pressing the car trim tab.



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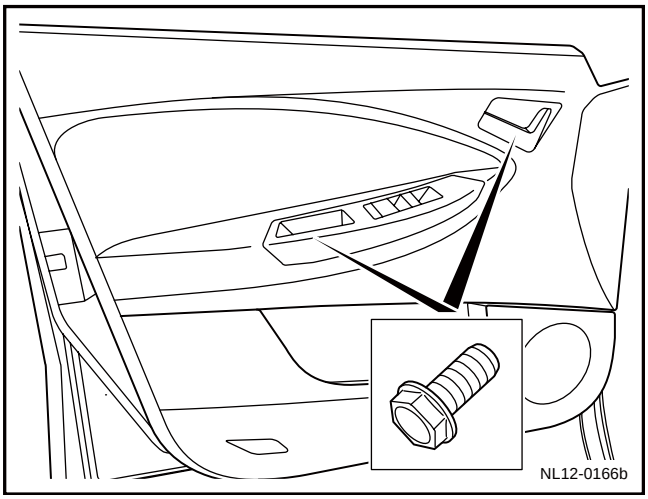
5. Install and fix 2 cross recessed screws for the internal trim panel of the front door.

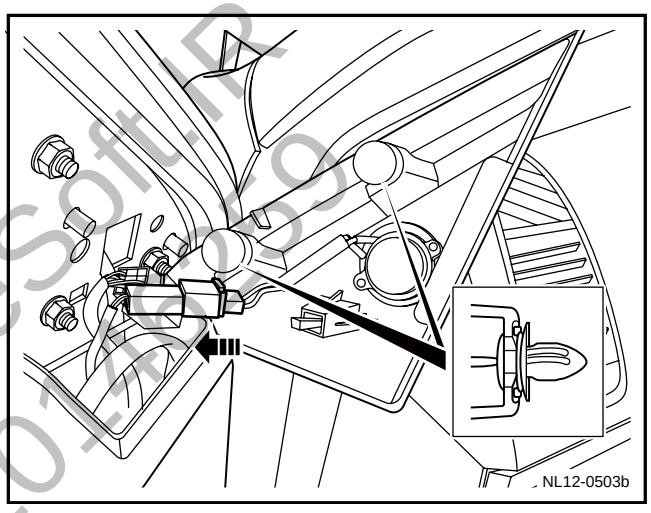
Torque: 5 Nm (Metric) 3.7 lb-ft (English system)



6. Connect the front door high pitch loudspeaker harness connector and align 2 buckles for the internal door trim corner to the installation holes and press the internal door trim panel to engage the buckles.

Notes:

The method for disassembling the left and right front door inner trim panels is similar.



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12.9.1.8 Right front door interior trim plate replacement

Dismantlement Procedure

Warning!

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

Notes:

Please dismantle the trim panel with a special-purpose body repair tool, otherwise this will easily cause the trim panel to be damaged.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of right front door inner handle, refer to 12.9.1.9 Replacement of rear door inner trimming plate.
3. For dismantling of inner trimming plate of right front door, refer to 12.9.1.7 Replacement of inner trimming plate of left front door.

Installation Procedure:

Notes:

Fixed buckle must be replaced by new part.

1. Install right front door interior trim plate
2. Install right front interior handle of door.
3. Connect the battery negative cable.

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12.9.1.9 Rear door interior trim plate replacement

Dismantlement Procedure

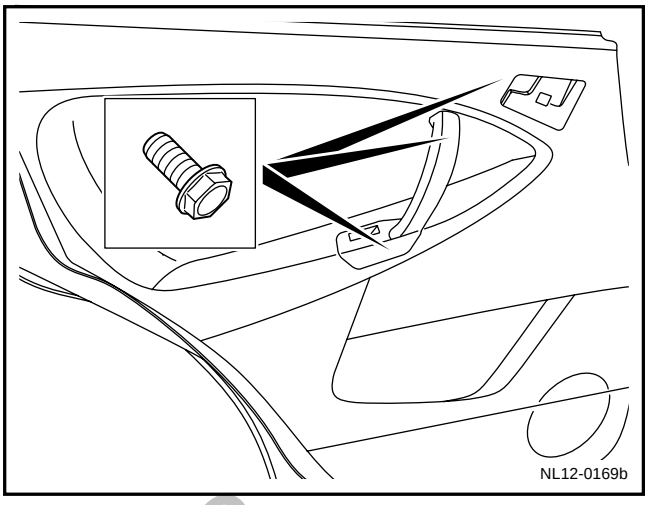
Warning!

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

Notes:

Please dismantle the trim panel with a special-purpose body repair tool, otherwise this will easily cause the trim panel to be damaged.

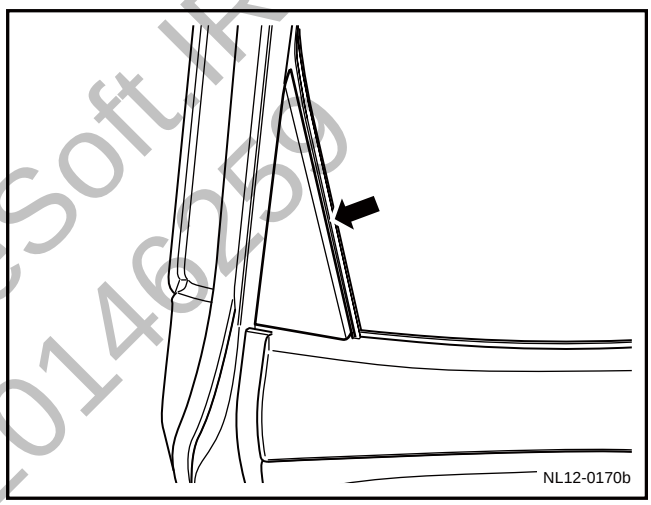
1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. Dismantle 3 fixing screws on rear door inner trimming plate.



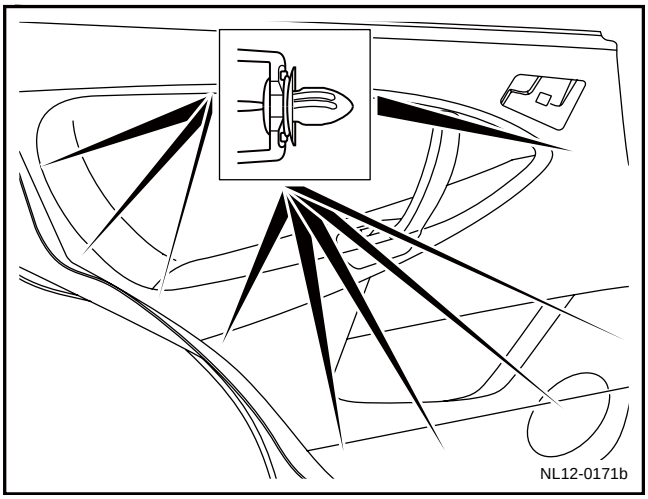
Notes:

Need to dismantle the rear door trim panel handle cover plate.

3. Loosen buckle and dismantle rear door angle decoration.



4. Disengage 9 buckles on the rear door internal trim panel.
5. Disconnect the harness connector of the rear door window lifter switch and the internal rear door handle zip fastener.
6. Remove the rear door internal trim panel.



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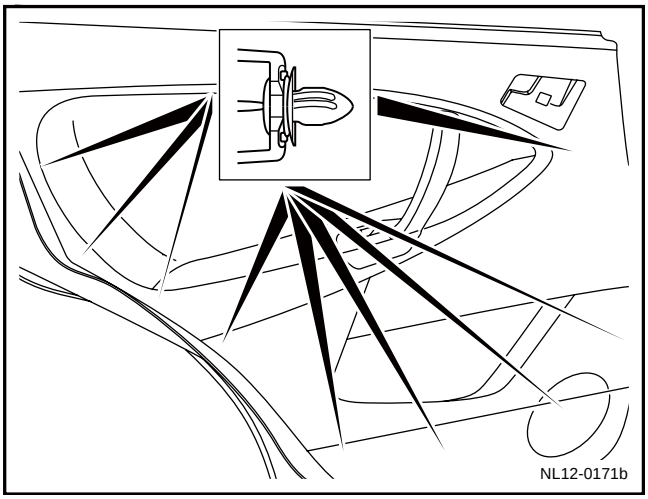
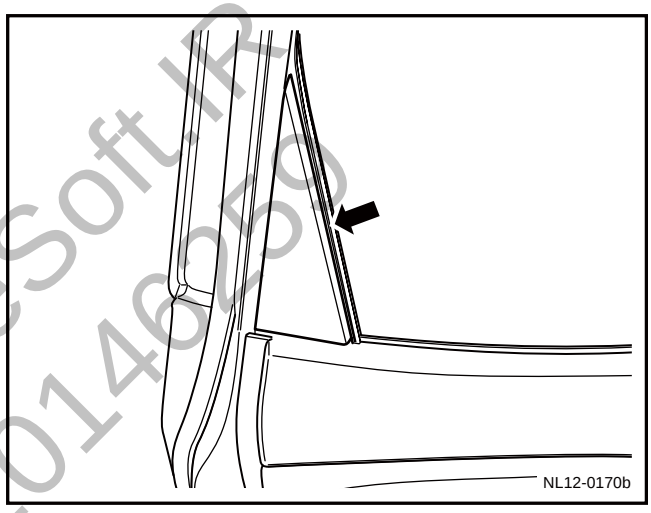
Installation Procedure:

Notes:

Fixed buckle must be replaced by new part.

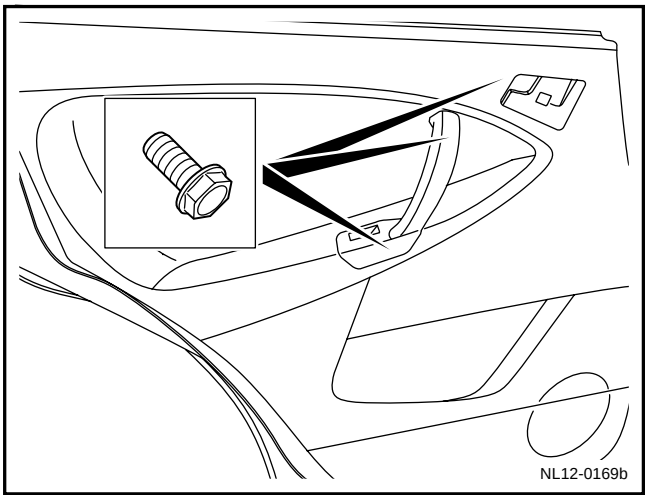
1. Install glass lifter switch and door inner opening handle.
2. Connect wire harness connector between door inner opening handle cable and glass lifter switch.
3. Align buckle of inner trimming plate of rear door with mounting hole, and press inner trimming plate buckle.
4. Secure the door trim buckle aligning to the installation hole and pressing the car trim tab.





5. Install 3 fixing screws for the internal trim panel of the rear door.

Torque: 5 Nm (Metric)3. 7 lb-ft(English system)



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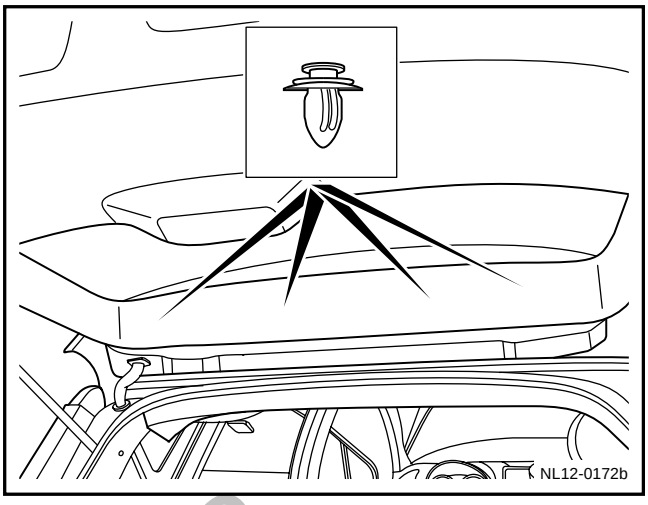
12.9.1.10 back-door trim plate replacement

Dismantlement Procedure

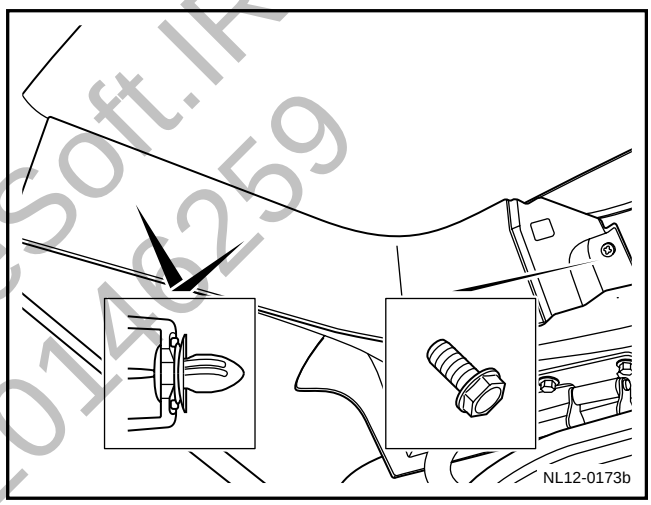
Notes:

Please dismantle the trim panel with a special-purpose body repair tool; otherwise this will easily cause the trim panel to be damaged.

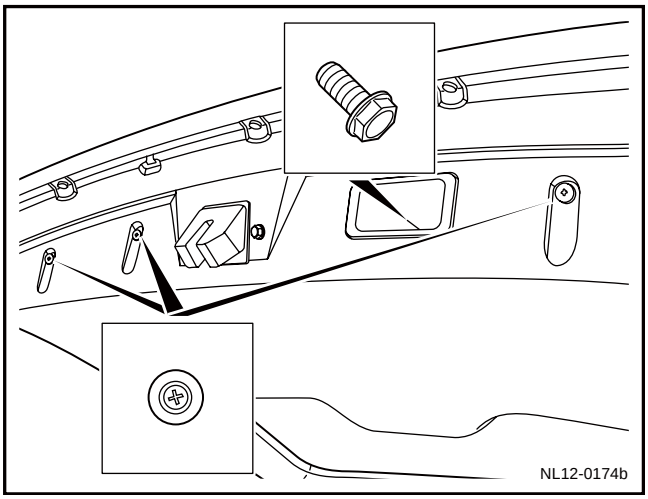
1. Remove 4 buckles on upper inner trimming plate of back door.
2. Dismantle back door middle and upper inner trimming plate.



3. Dismantle fixing screw on left upper trimming plate of back door.
4. Disengage 2 fixing buckles on the front-left internal trim panel of the back door.
5. Remove the top left internal trim panel of the back door.
6. Dismantle the top right internal trim panel on the back door in the same way.



7. Remove 1 fixing screw and 3 buckles on the bottom of the back door internal trim panel.



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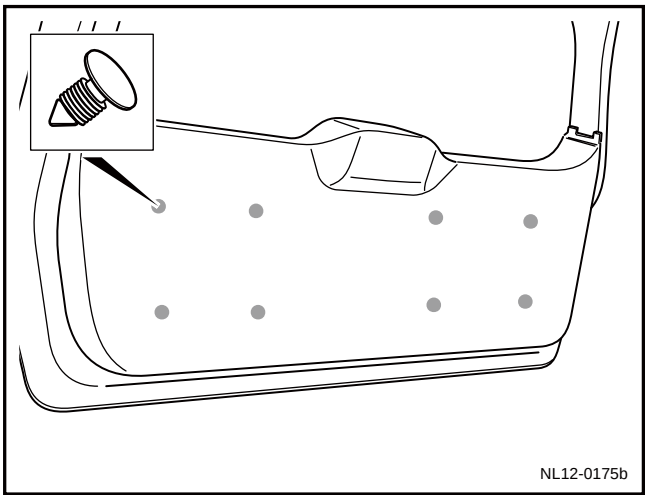
8. Disengage 8 fixing buckles of the back door bottom trim panel.
9. Dismantle the internal trim panel of the back door.

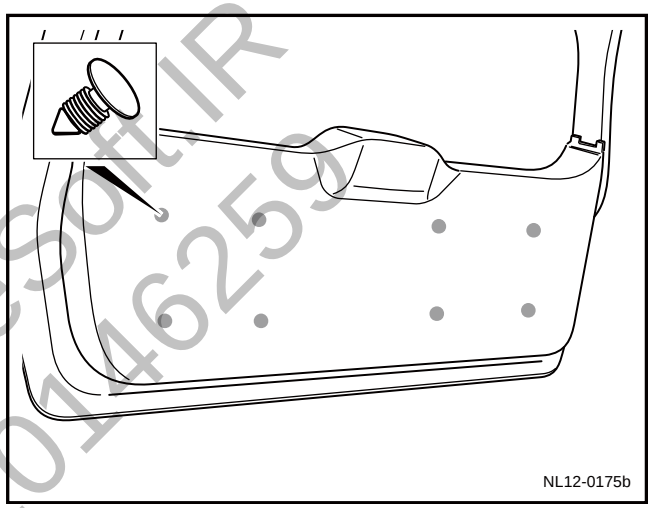


Installation Procedure:

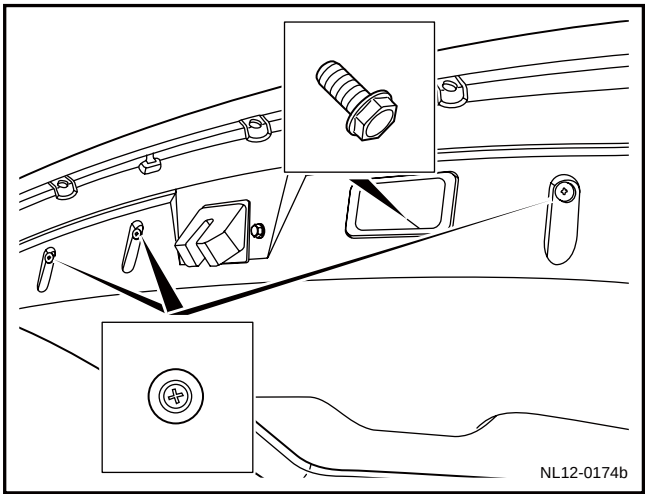
Notes:

Fixed buckle must be replaced by new part.

1. Align 8 buckles of back door inner trimming plate with mounting holes, and press trimming plate buckle.



2. Install 1 fixing screw and 3 buckles under back door trimming plate.



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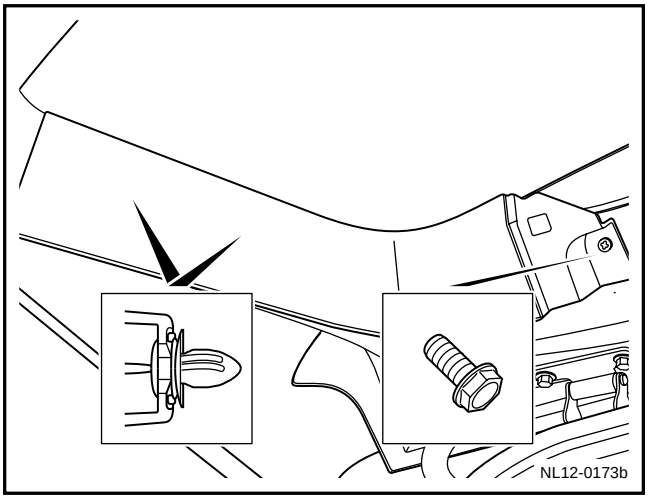
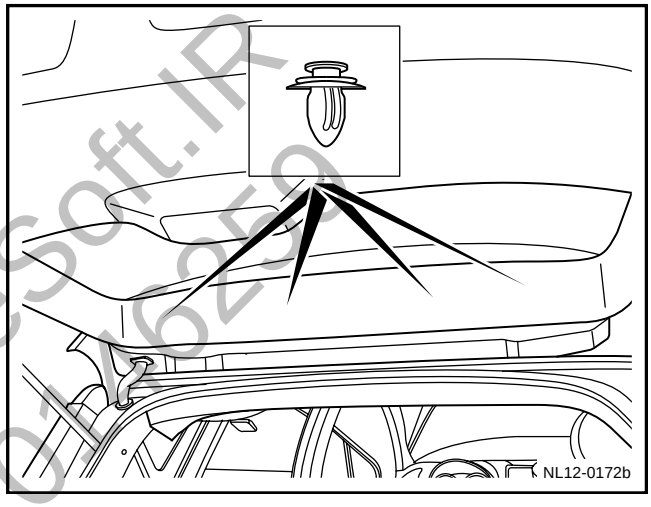
3. Align 2 buckles on left upper trimming plate of back door with mounting hole, press buckle of trimming plate.
4. Install fixing screw of left upper inner trimming plate of back door.
5. Install the top right internal trim panel on the back door in the same way.



6. Align 4 buckles of the middle and top internal trim panels of the back door to the installation holes and press the trim panel to engage the buckles.



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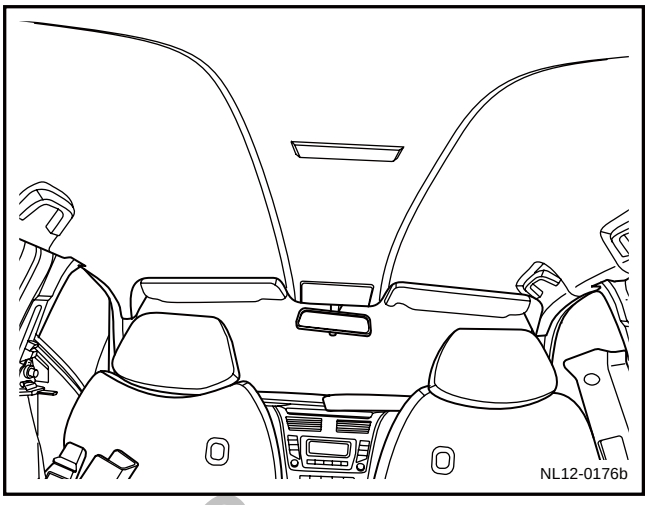
12.9.1.11 Top cover interior trim plate replacement

Dismantlement Procedure

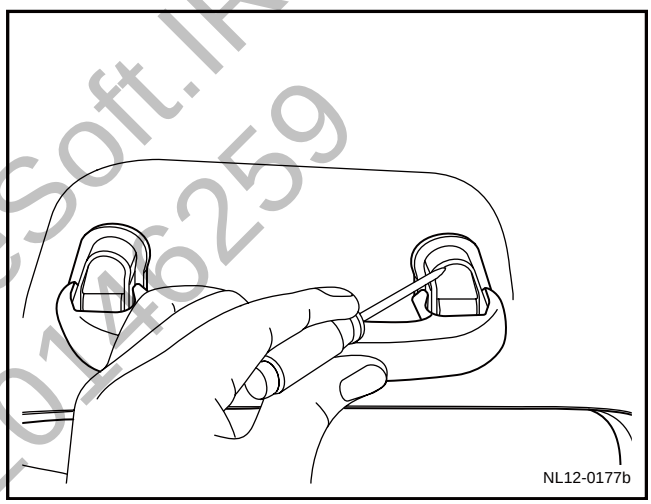
Warning!

Warning: Refer to "Warning on Battery Disconnection" in "Warnings and Precautions".

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of 4-door doorsill inner trimming plate, refer to 12.9.1.1 Replacement of left/ right front doorsill inner trimming plate assembly.
3. For dismantling of front column trimming plate, refer to 12.9.1.2 Replacement of upper trimming plate assembly of left/right front vertical column.



4. For dismantling of middle column trimming plate, refer to 12.9.1.3 Replacement of middle column trimming plate.
5. For removal of the rear pillar trim panel, see 12.9.1.6 Replacement of Rear Pillar Upper Trim Panel.
6. For dismantlement of the in-vehicle reading lamp, see 11.3.8.2 Replacement of Roof Lamp and Reading Lamps.
7. Dismantle 3 in-vehicle roof safety handles and front 2 sunvisors.
8. Dismantle the decoration covers on both sides of the front right safety handle.



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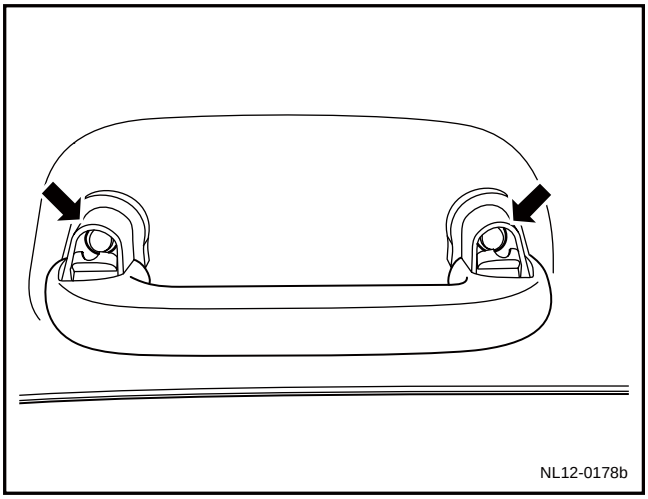
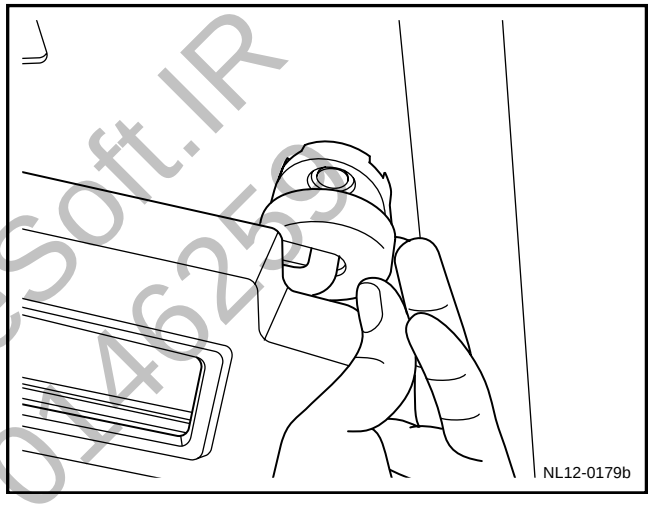
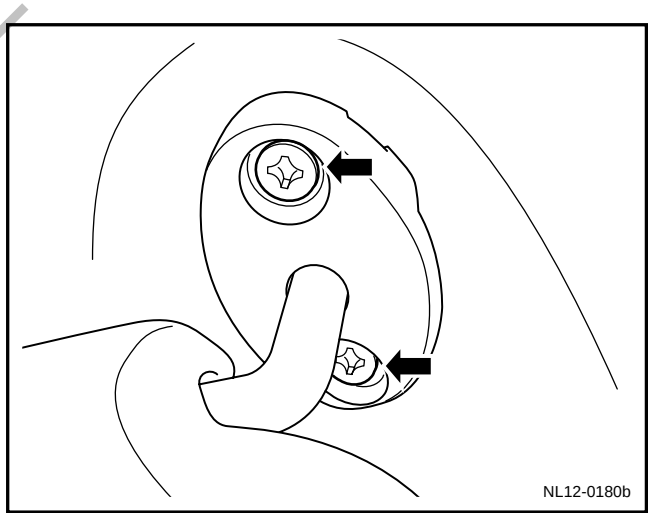
9. Remove the fixing bolt of the front right safety handle and the safety handle. The disassembly of the left rear and right rear safety handles is the same.



10. Dismantle trimming cover at fixing bolt of left sun shield.



11. Dismantle fixing screw of left sun shield, and then dismantle lower left sun shield.



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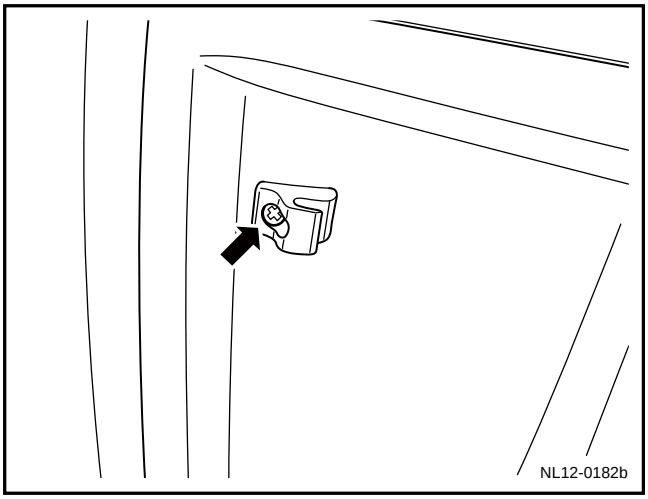
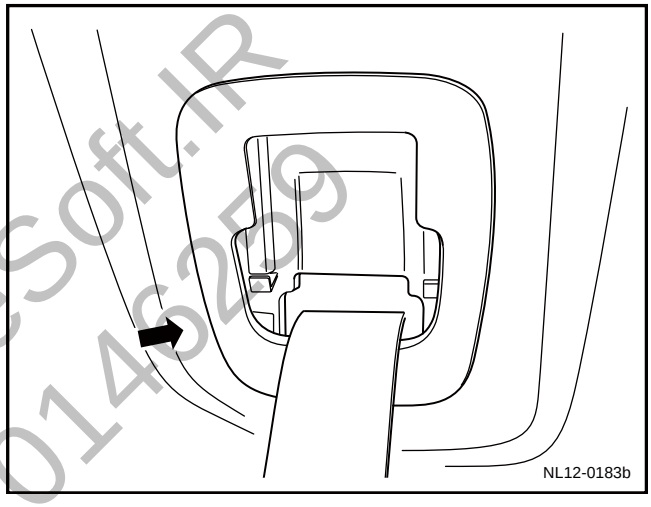
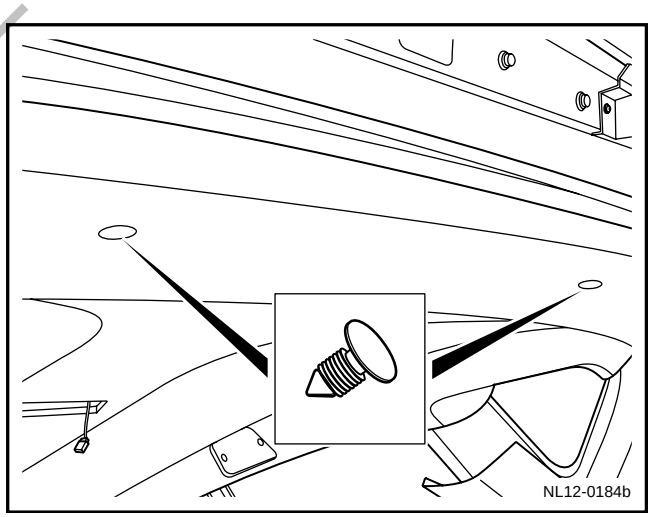
12. Dismantle left side fixing bolt of sunvisor hook .and take out sunvisor hook. Right sunvisor hook dismantle method is same with it



13. Dismantle the second row middle safety belt lock tone box trimming cover.



14. Dismantle 2 buckles at the back of top trimming plate.



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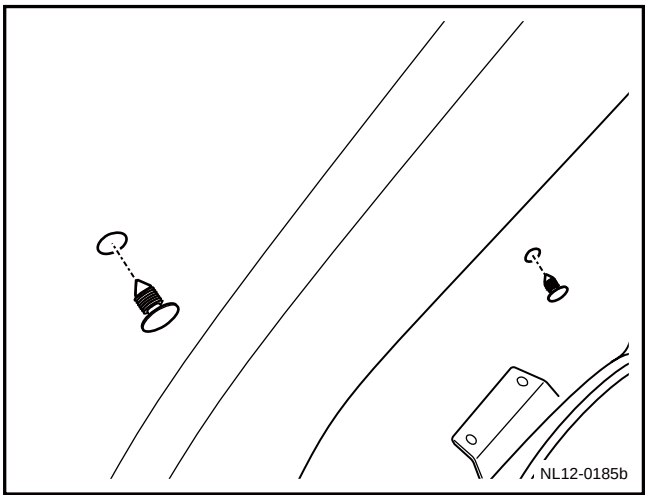
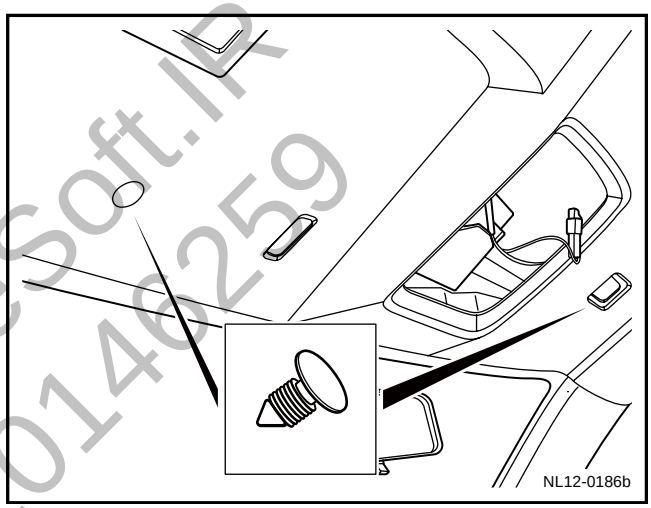
15. Dismantle 2 buckles in the middle of top trimming plate.



16. Dismantle 2 buckles on front of top trimming plate.
17. Lay down rear-row seat, dismantle top trimming plate, and move the trimming plate out of boot.



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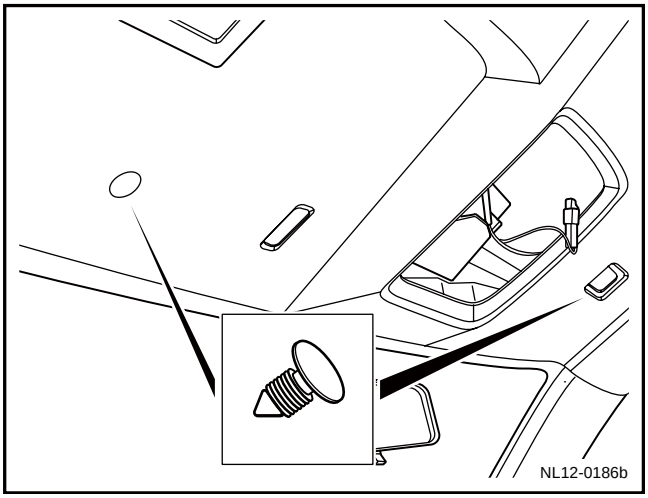
Installation Procedure:

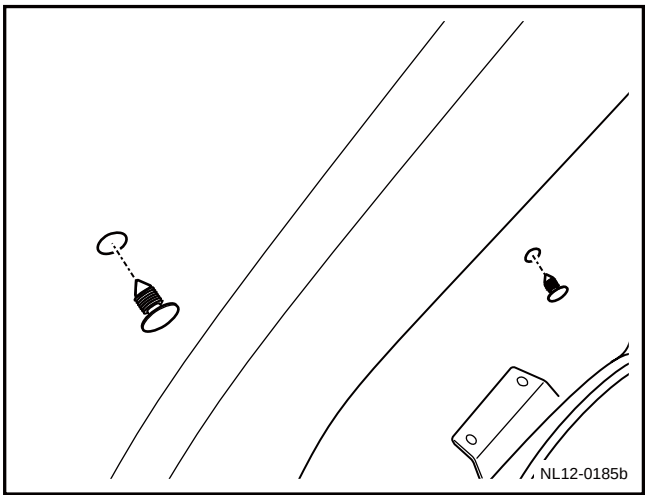
Notes:

Fixed buckle must be replaced by new part.

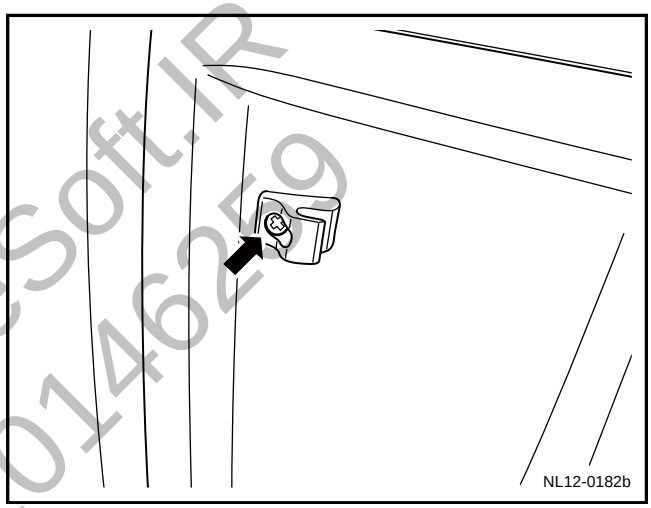
1. Flat on rear row seat, make ceiling trim plate move in the vehicle from trunk Install the roof trim panel.
2. Keep the top trimming plate flatly attach on the top inside vehicle.
3. Install 2 buckles on the front of top trimming plate.



4. Install 2 middle buckles of top trimming plate.

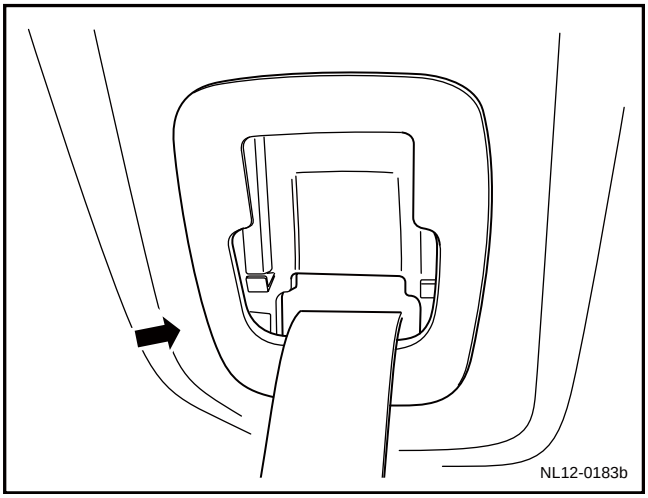


5. Install the trim cover of the lock tongue case for the middle seat belt on the second row seat.



6. Install and tighten the fixing bolt for the left sunvisor hanging hook. Right sunvisor hook installing method is same with it

Torque: 8 Nm (Metric) 5.9 lb-ft (English system)



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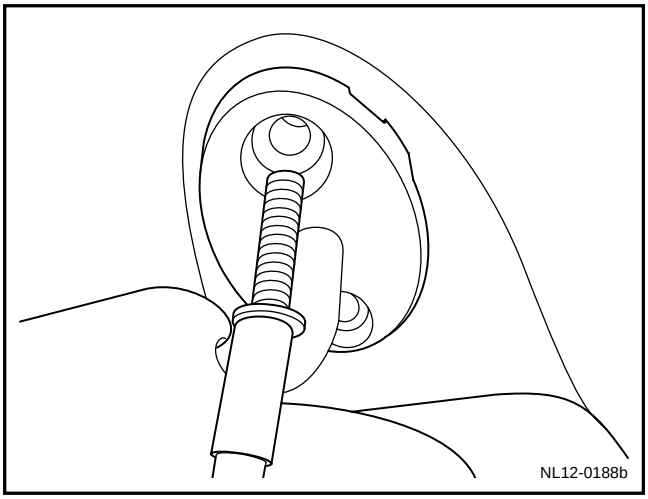
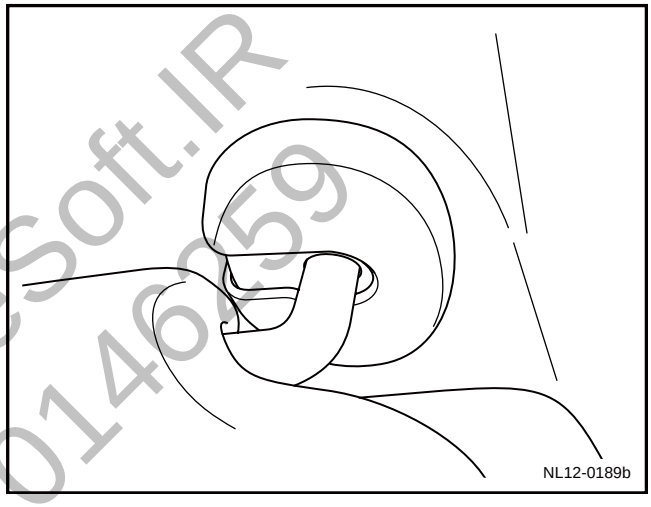
7. Install the left sunvisor fixing bolt.

Torque: 8 Nm (Metric) 5.8 lb-ft (English system)

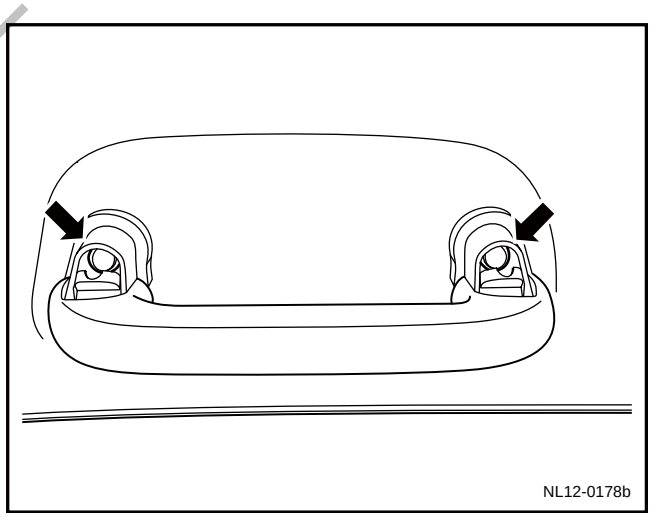


8. Install the trim cover at the fixing bolt of the left sunvisor. Right sunvisor installing method is same with it



9 . Install right front safety handle fixing bolt .

Torque: 8 Nm (Metric) 5.8 lb-ft (English system)



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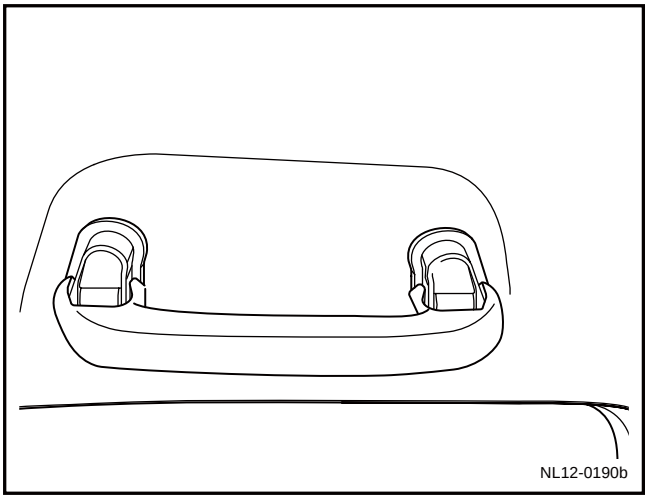
10. Install trimming covers on both sides of right front safety handle. The installation of the left rear and right rear safety handles is the same.
11. Install interior reading lamp .
12. Install Rear post trim plate
13. Install middle column trimming plate.
14. Install front column trimming plate.
15. Install doorsill inner trimming plate of four-door vehicle.
16. Connect the battery negative cable.



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12.9.1.12 Indoor carpet replacement

Dismantlement Procedure

Warning!

Warning: Refer to Warning on Battery Disconnection in Warnings and Precautions.

1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Cable Disconnection/Connection Procedures.
2. For dismantling of left, right front row seat, refer to 12.7.3.2 Replacement of front row seat.
3. For dismantling of left and right middle row seats, refer to 12.7.3.4 Replacement of middle row seats.
4. For dismantling of auxiliary instrument table assembly, refer to 12.8.3.2 Replacement of auxiliary instrument panel.
5. For dismantlement of the left/right internal threshold trim panel, see 12.9.1.1 Replacement of Left/Right Front Threshold Internal Trim Panel Assembly.
6. For dismantlement of lower trim panels for left and right center pillars, see 12.9.1.3 Replacement of Center Pillar Trim Panels.
7. For dismantlement of the rear pillar top trim panel, see 12.9.1.6 Replacement of Rear Pillar Top Trim Panel.
8. For dismantlement of the right intermediate seat belt lock catch assembly, see 9.3.7.5 Replacement of 2nd Row Right Seat Belt Lock Catch.
9. Remove the in-vehicle carpet.

Installation Procedure:

1. Install the passenger compartment floor carpet.
2. Install left / right middle row seat
3. Install left and right front row seats.
4. Install right safety belt buckle assembly of middle row seat.
5. Install the trim panel for the boot.
6. Install the left and right lower center pillar trim panels.
7. Install the left/right threshold internal trim panel.
8. Install the floor console assembly.
9. Connect the battery negative cable.

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12.10 Exterior trim

12.10.1 Dismantle and install

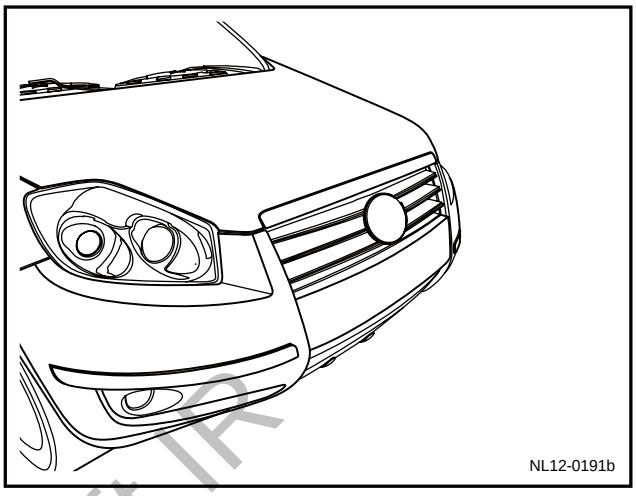
12.10.1.1 Front/rear logo front/rear replacement

Dismantlement Procedure

1. Dismantle logo on the front of vehicle by using slotted screwdriver.

Notes:

The screwdriver port is covered by the adhesive tape to protect the parts.

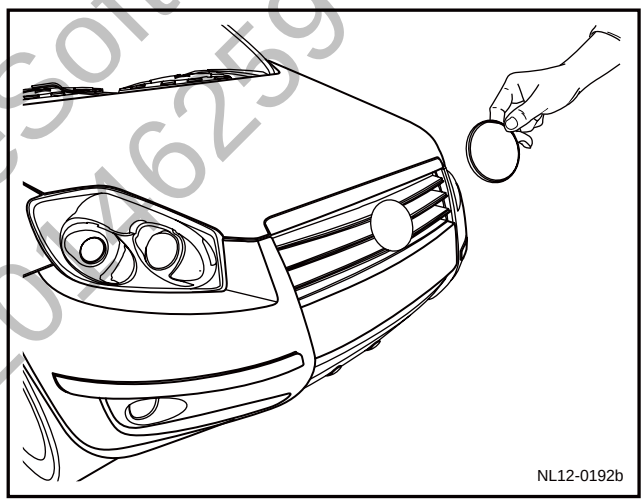


Installation Procedure:

1. Use a special cleaning solution to clean the front emblem attached surface.
2. Install logo on the front of vehicle to the specified position.

Notes:

For the method for replacing the logo on the tailing of the body, refer to the method for replacement of the logo on the head of the body.



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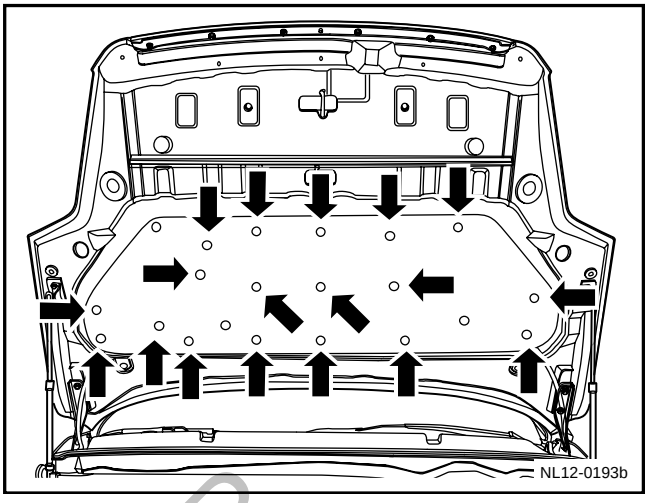
12.10.1.2 Engine hood sound insulation cushion replacement

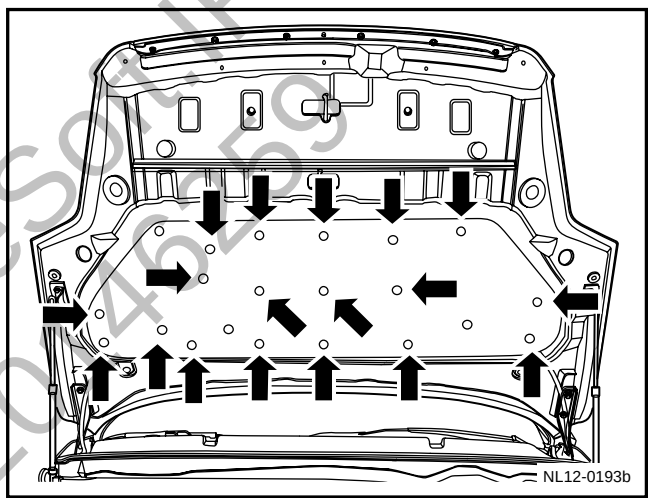
Dismantlement Procedure

1. Dismantle the retaining clips for engine hood interior trim panel, and dismantle the sound insulation pad.



Installation Procedure:

1. Install engine cover inner trimming plate buckle, and fix sound insulation pad.



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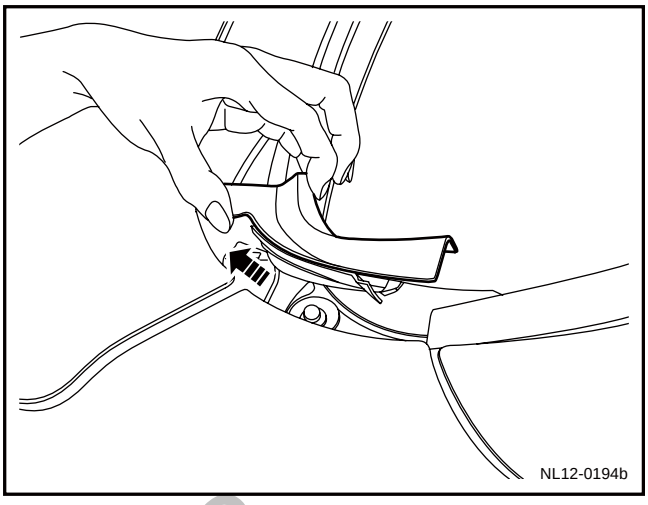
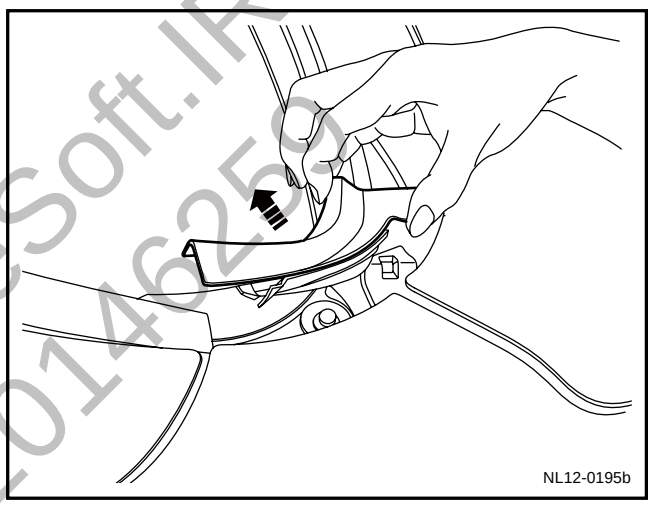
12.10.1.3 Venting cover plate replacement

Dismantlement Procedure

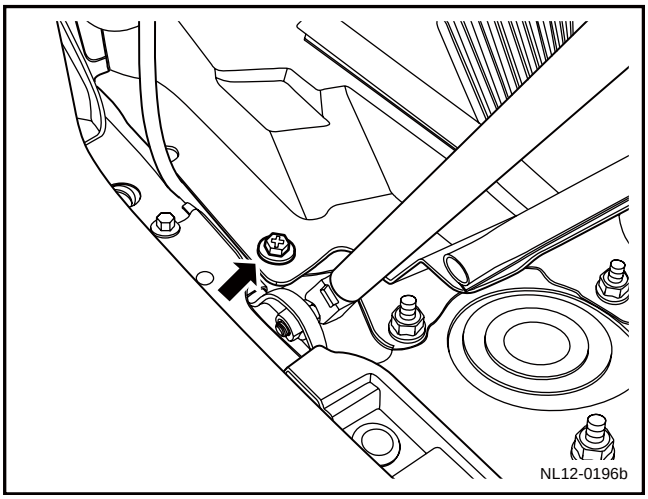
1. For dismantling of front wiper arms on both sides, refer to 11.5.8.2 Replacement of front wiper arm.
2. Dismantle trimming plate on the left of vent cover plate.



3. Dismantle trimming plate on the right of vent cover plate.



4. Dismantle fixing bolt on the left of vent cover plate.



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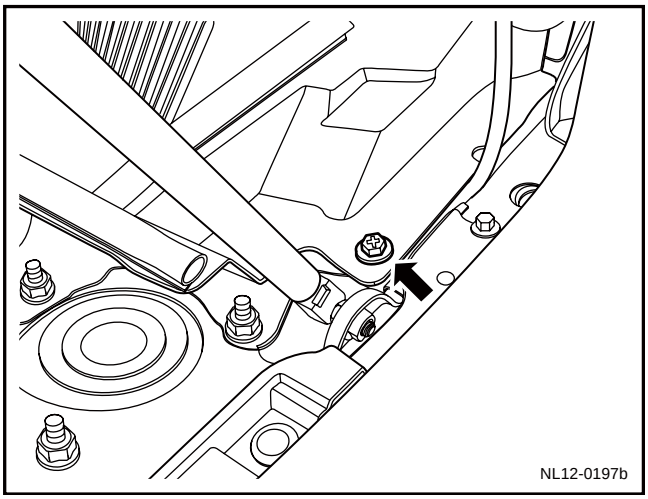
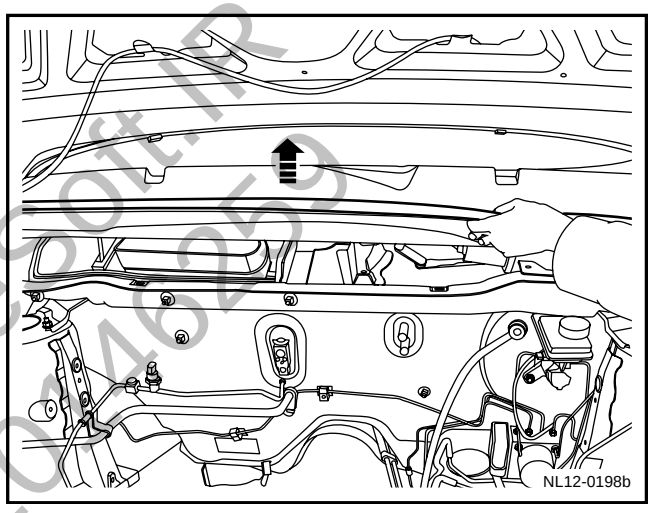
5. Remove the right fixing bolt on the ventilation cover plate.

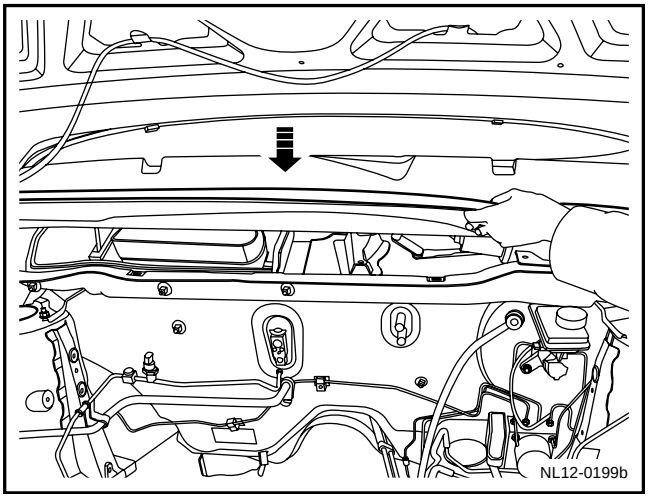


6. Dismantle the ventilation cover plate.



Installation Procedure:

1. Install the ventilation cover plate.



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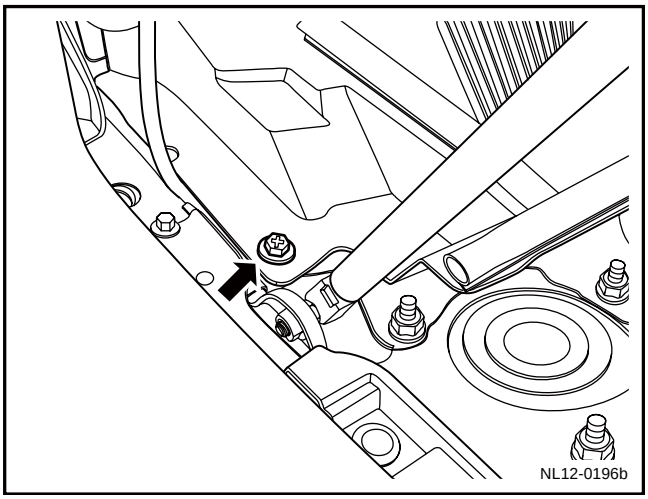
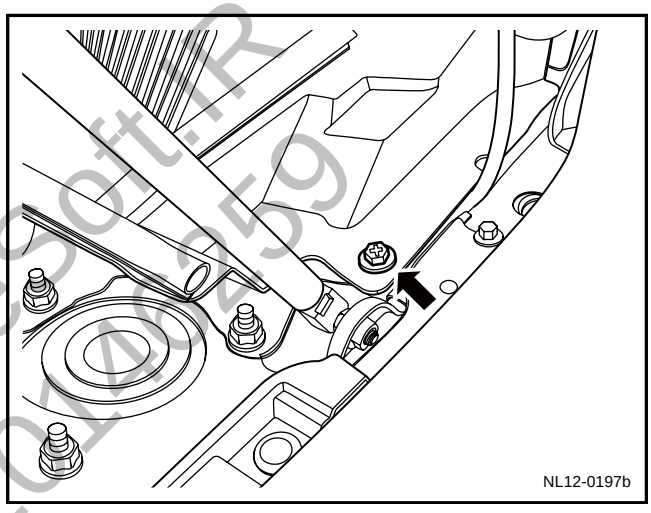
2. Dismantle fixing bolt on the left of vent cover plate.

Torque: 10 Nm (Metric) 7.4 lb-ft (English system)

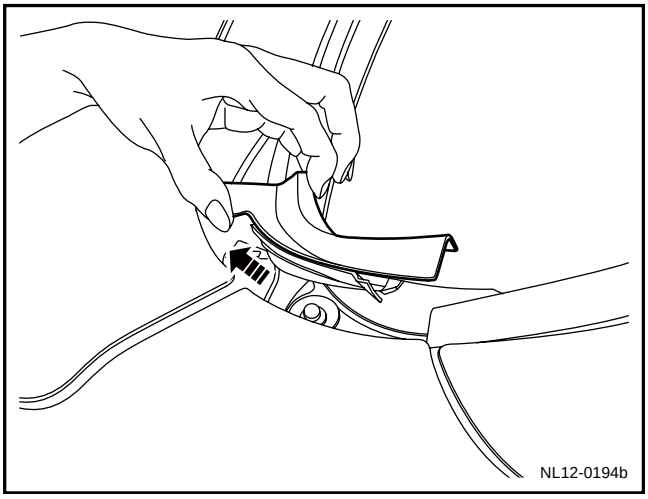


3. Remove the right fixing bolt on the ventilation cover plate.

Torque: 10 Nm (Metric) 7.4 lb-ft (English system)



4. Install left trimming plate on the left of vent cover plate.



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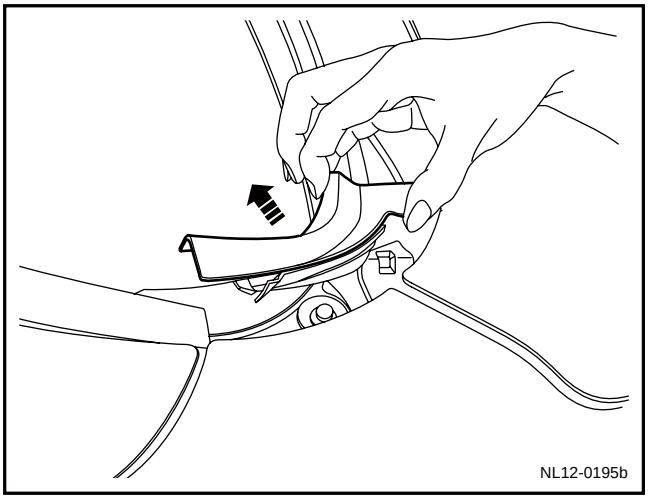
5. Install the right trim panel of the ventilation cover plate.



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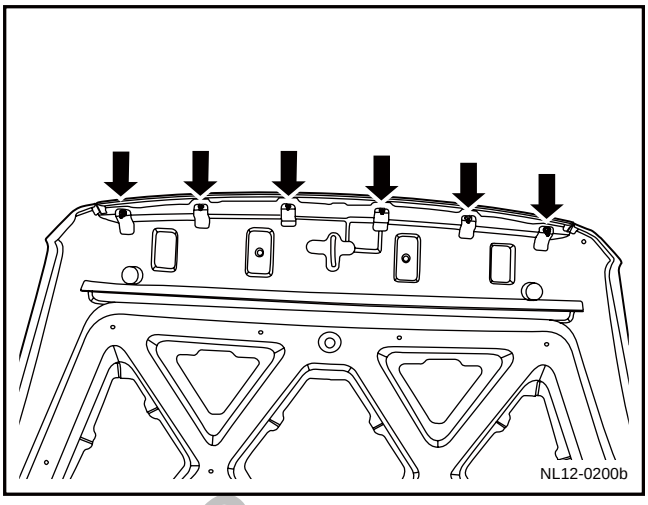
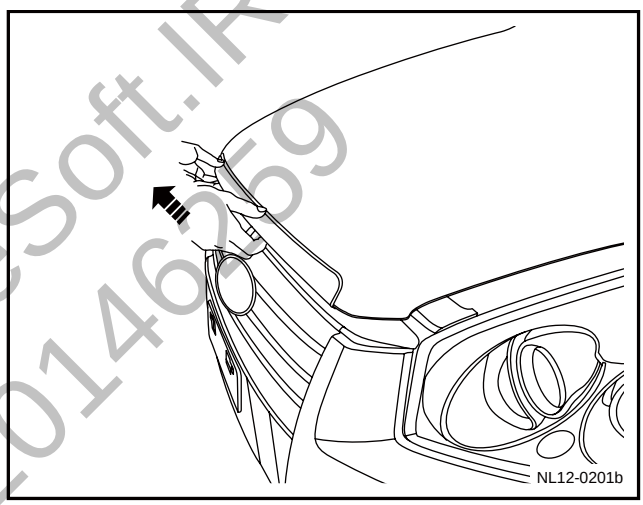
12.10.1.4 Engine hood strip replacement

Dismantlement Procedure

1. Dismantle engine hood trimming strip fixing nut.

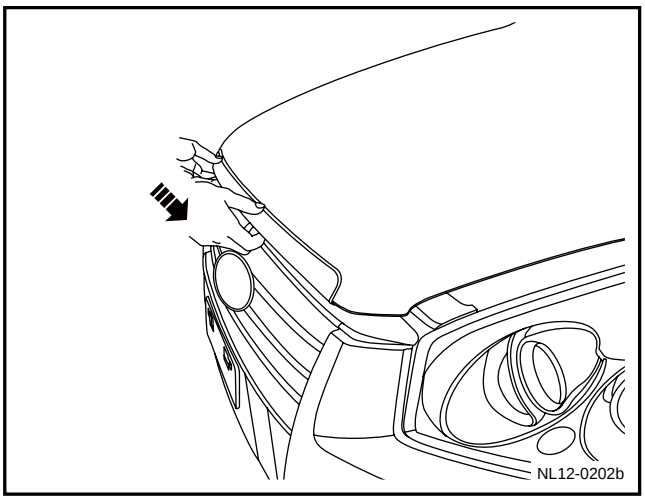


2. Dismantle engine cover trimming strip.



Installation Procedure:

1. Install engine hood trimming strip.



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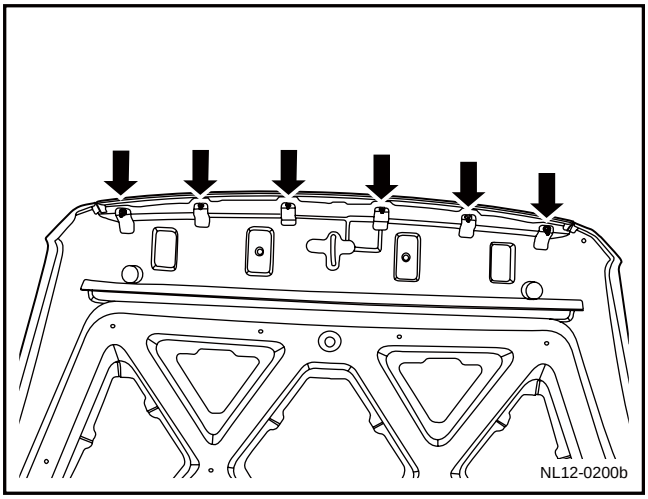
2. Install fixing nut of engine hood trimming strip.

Torque:10Nm(Metric) 7.4lb-ft(English system)



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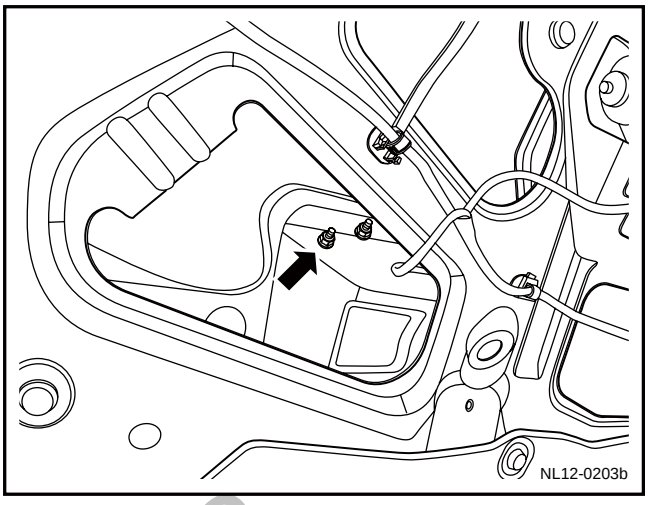
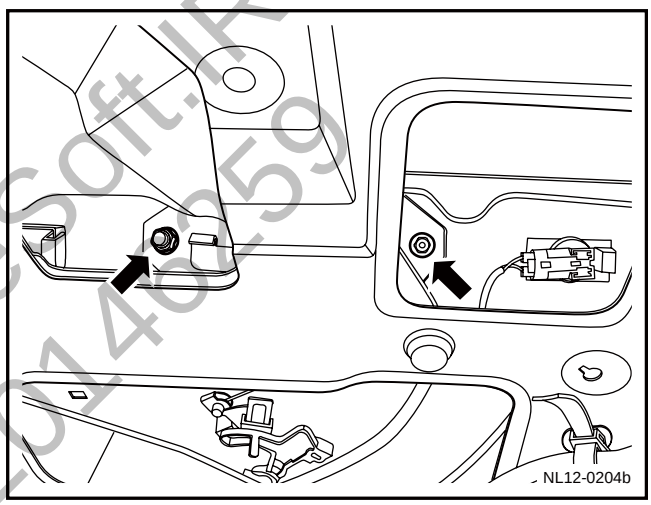
12.10.1.5 Back-door strip replacement

Dismantlement Procedure

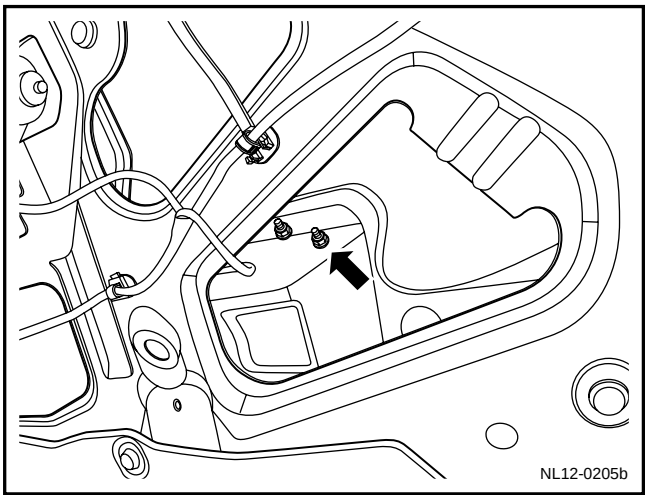
1. For dismantling of back door inner trimming plate, refer to 12.9.1.10 Replacement of back door trimming plate.
2. Dismantle fixing nut on the left of back door trimming strip.



3. Dismantle fixing nut in the middle of back door trimming strip.



4. Dismantle right fixing nut of back door trimming strip.



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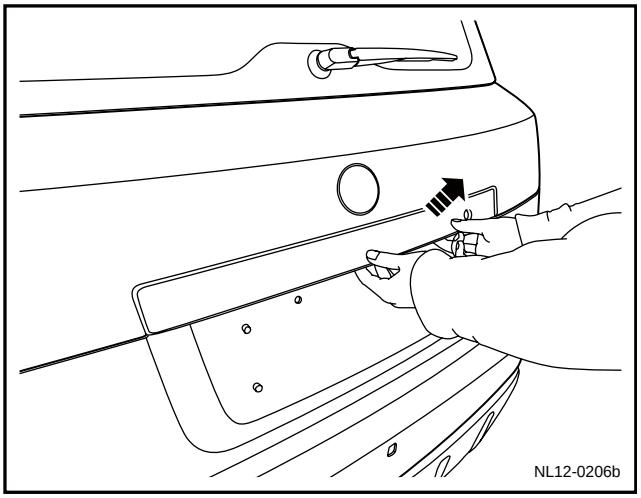
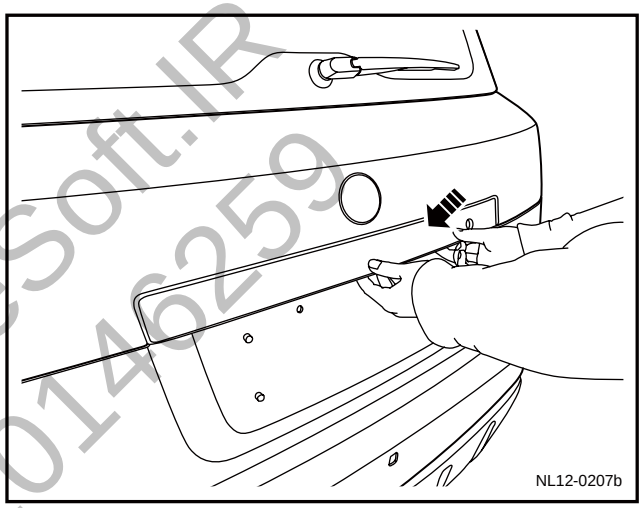
5. Remove the back door trim strip.



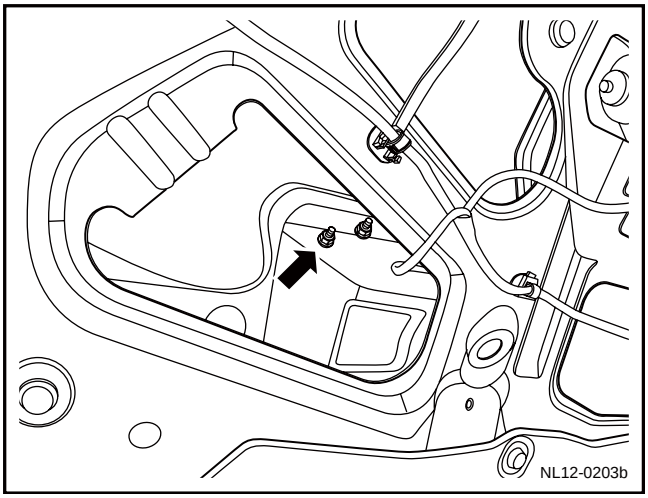
Installation Procedure:

1. Install back door trimming strip.



2. Install left fixing nut of back door trimming strip.

Torque:10Nm(Metric) 7.4lb-ft(English system)



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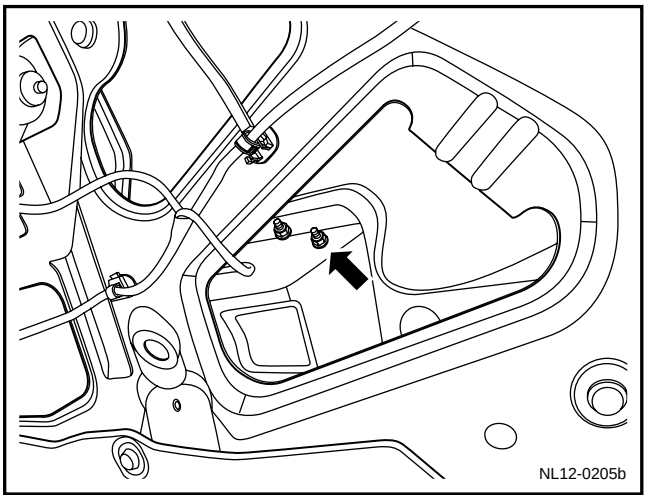
3. Install intermediate fixing nut of strip of back door.

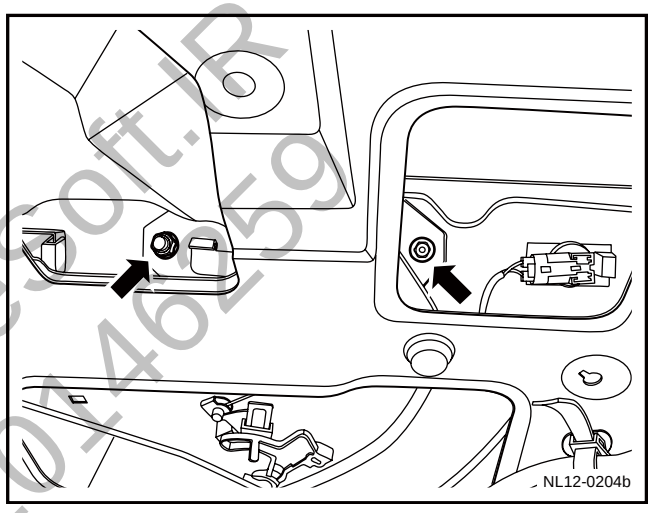
Torque:10Nm(Metric) 7.4lb-ft(English system)



4. Install fixing nut on right side of back door trimming strip.

Torque:10Nm(Metric) 7.4lb-ft(English system)

5. Install the back door interior trim panel.



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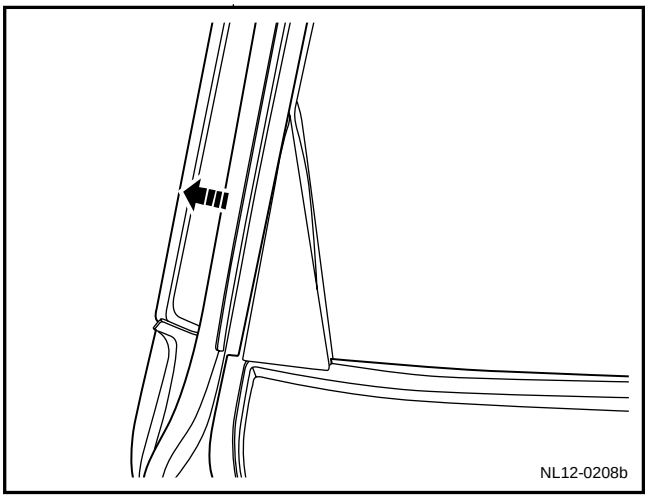
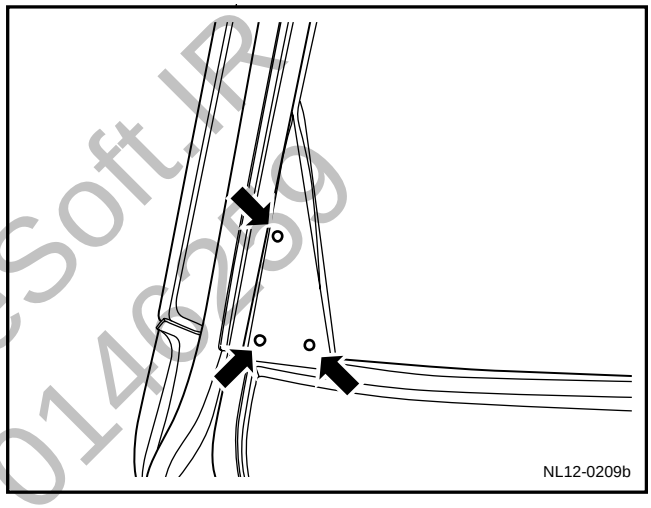
12.10.1.6 Triangular outer trim plate replacement of rear door

Dismantlement Procedure

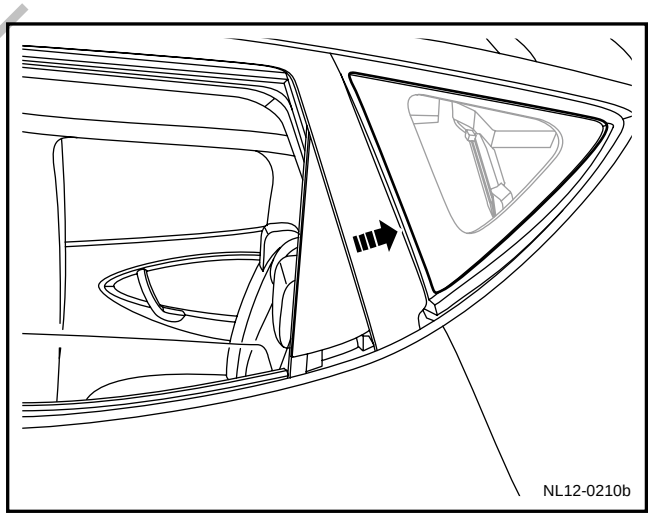
1. Dismantle door inner trimming plate angle decoration.



2. Dismantle fixing bolt of rear door triangle outer trimming plate.



3. Dismantle triangle outer trimming plate of rear door.



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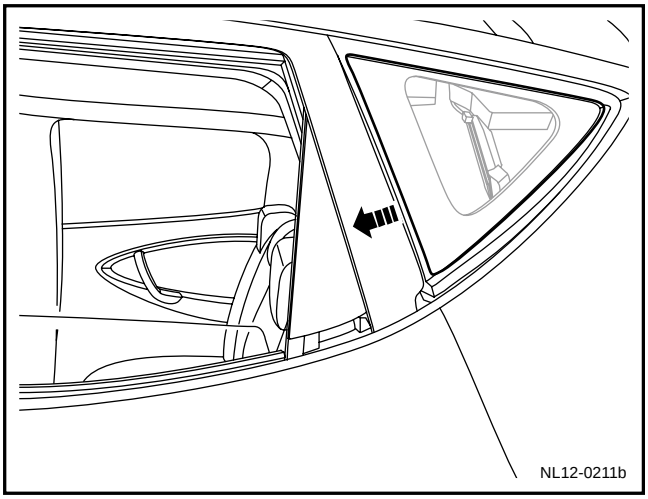
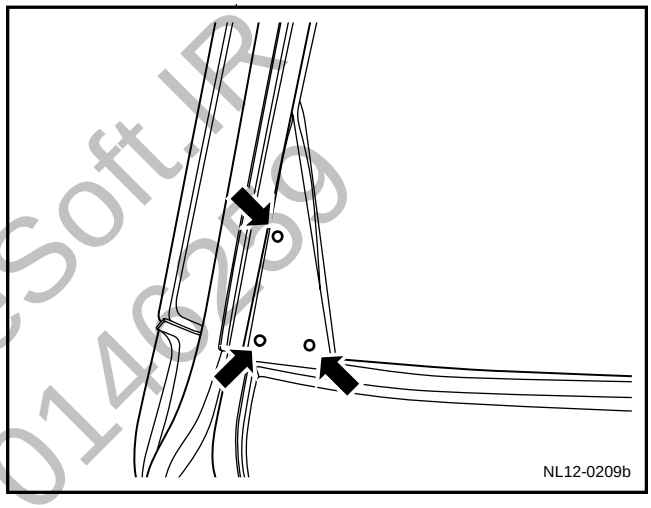
Installation Procedure:

1. Install rear door triangle outer trimming plate.

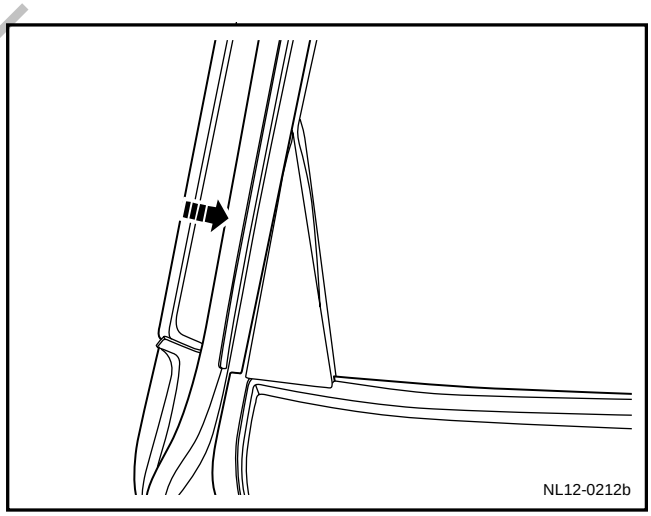


2. Install fixing bolt of triangle outer trimming plate

Torque: 4Nm(Metric) 3lb-ft(English system)



3. Install angle decoration of door inner trimming plate.



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12.10.1.7 Top cover trim plate replacement

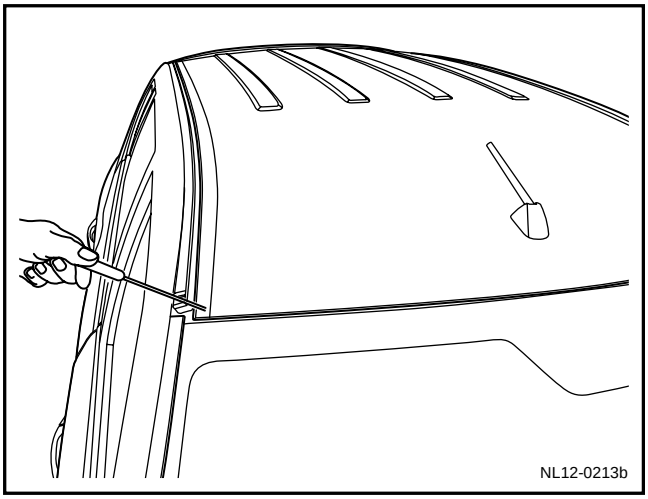
Dismantlement Procedure

1. Dismantle top cover trimming strip by using slotted screwdriver.

Notes:

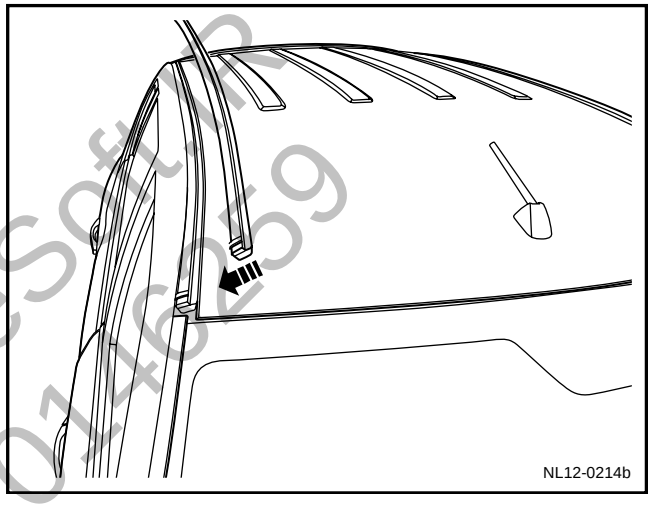
The screwdriver port is covered by the adhesive tape to protect the parts.

2. Remove residual fixing adhesive from top cover.



Installation Procedure:

1. Apply fixing glue to new top cover trimming strip.
2. Install top cover trimming strip on limit groove.



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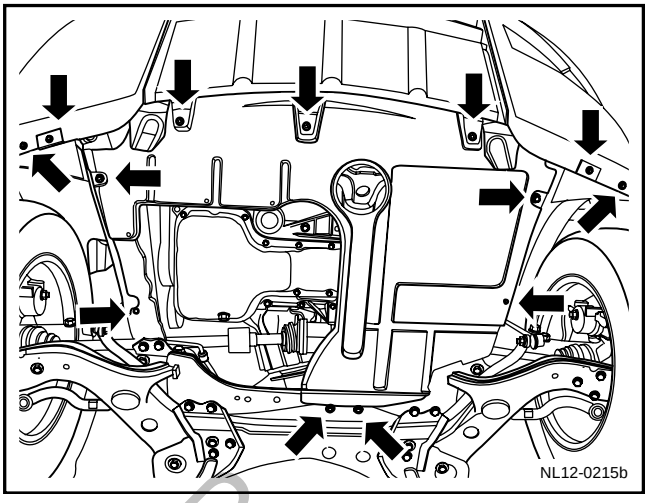
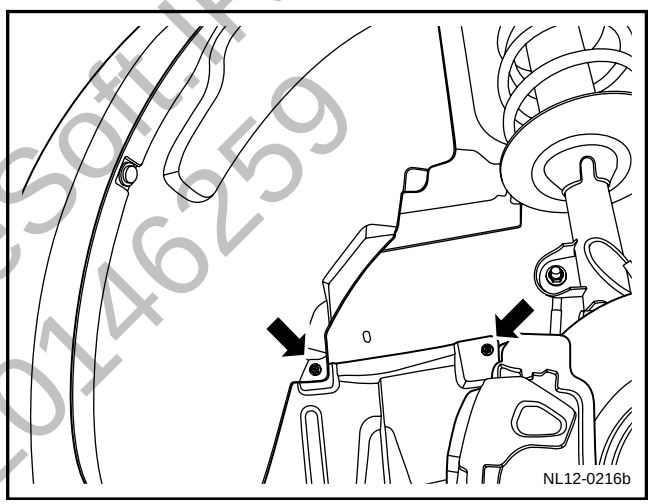
12.10.1.8 Right guard plate replacement under the engine

Dismantlement Procedure

1. For lifting of the vehicle, see 1.3 Lifting of Vehicle.
2. Dismantle fixing bolt of engine bottom protective plate.
3. Remove engine bottom protective plate.



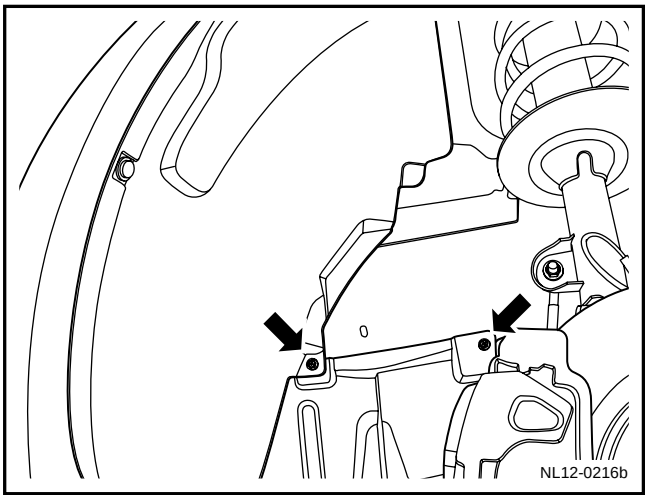
4. Dismantle fixing screw of left and right protective plates at the bottom of the engine.
5. Remove the bottom side guard for the engine.



Installation Procedure:

1. Install engine bottom left, right side protective plate.
2. Install fixing screw of side protective plate at the bottom of engine.

Torque : 5Nm(Metric) 4lb-ft(English system)



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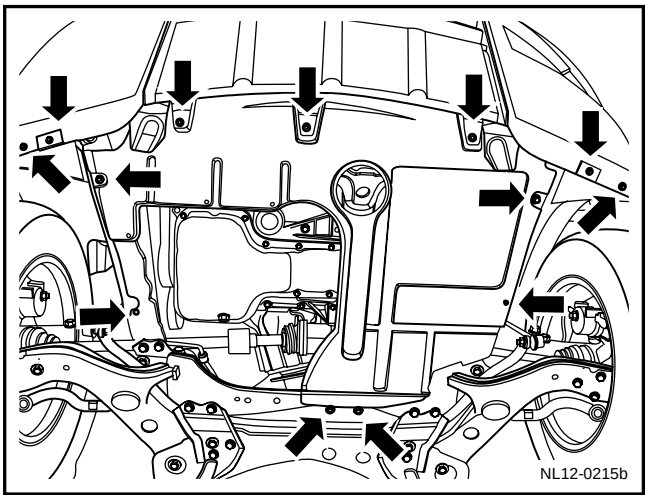
3. install engine bottom guard plate

4. Install fixing screw of protective plate at the bottom of engine.

Torque:5Nm(Metric) 4lb-ft(English system)

5. Lower the vehicle.



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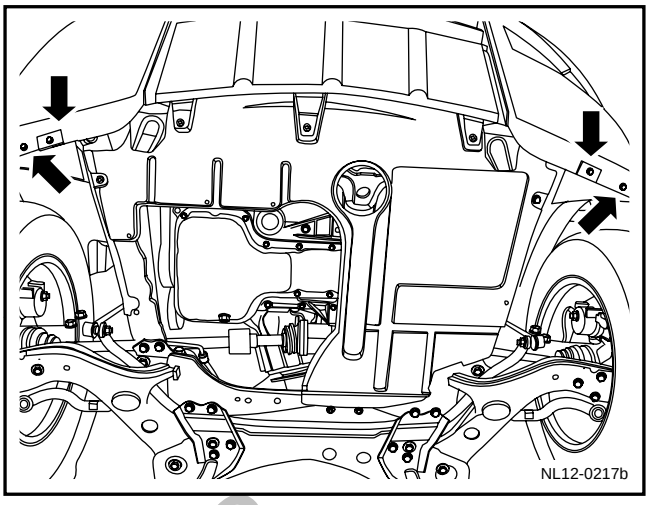
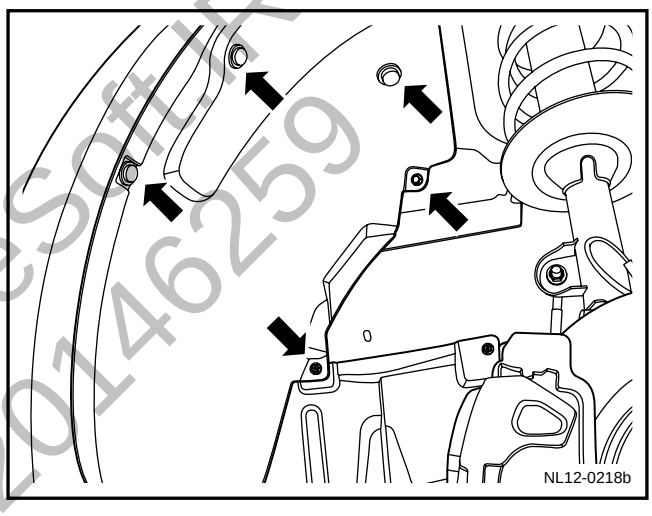
12.10.1.9 Front fender lining plate replacement

Dismantlement Procedure

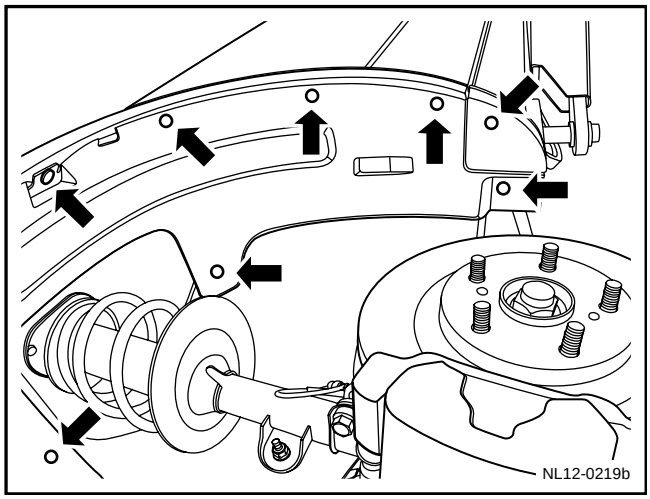
1. Dismantle fixing bolt at the bottom of front fender bushing plate.



2. Dismantle fixing bolt and buckle at the bottom of front fender bushing plate.



3. Dismantle fixing bolt and buckle at the rear of front fender lining plate.



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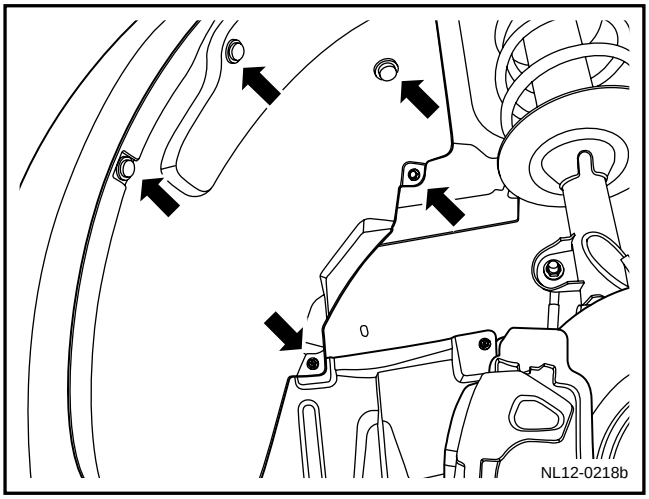
Installation Procedure:

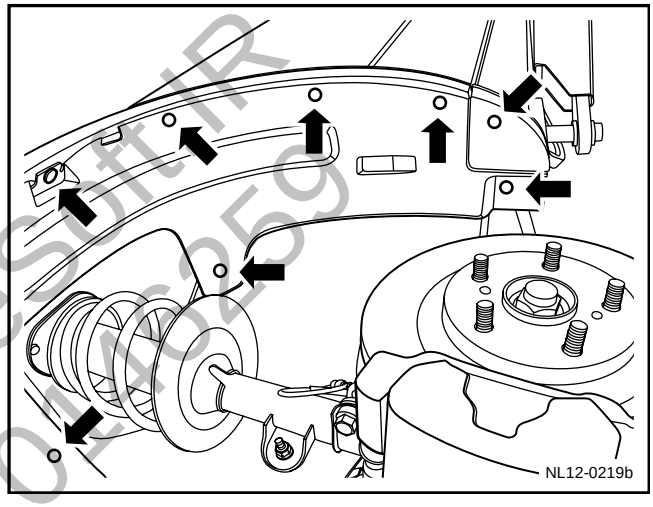
1. Dismantle fixing bolt and buckle at the bottom of front fender bushing plate.

Torque: 5Nm (Metric system) 3.7lb-ft (English system)



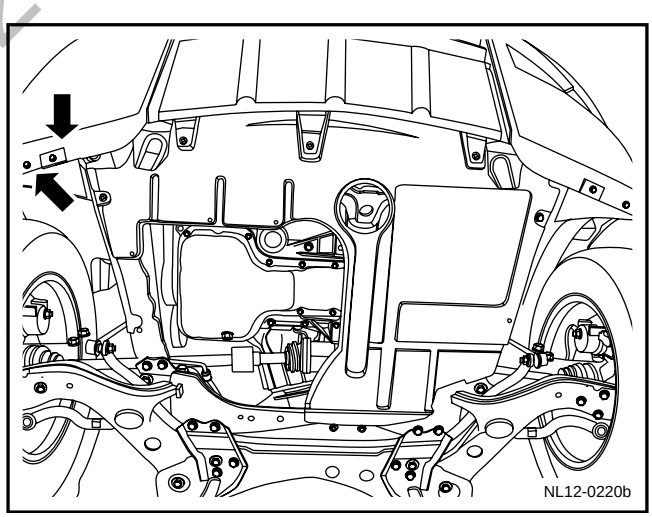
2. Dismantle fixing bolt and buckle at the rear of front fender lining plate.

Torque : 4Nm(Metric) 3lb-ft(English system)



3. Dismantle fixing bolt at the bottom of front fender bushing plate.

Torque: 4Nm (Metric) 3lb-ft (Inch)



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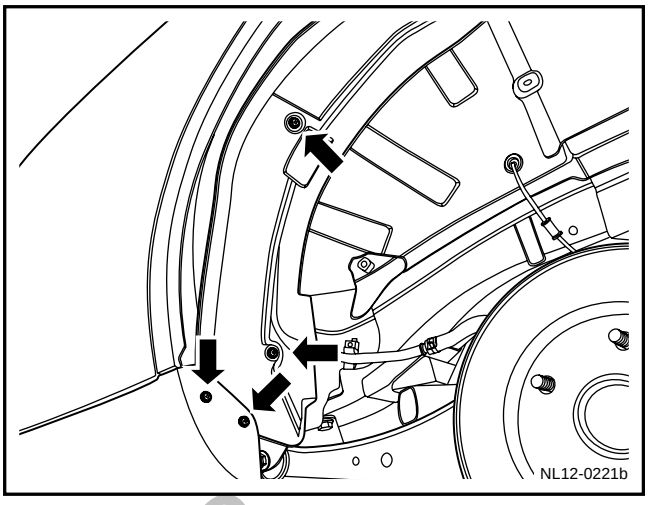
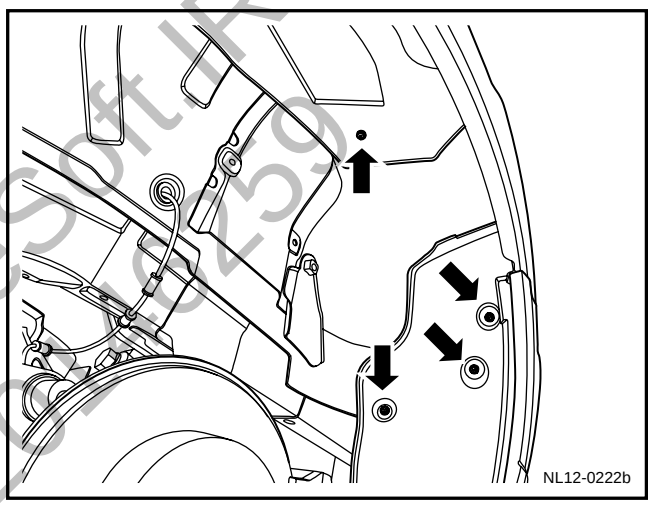
12.10.1.10 Replacement of Rear Fender Liner

Dismantlement Procedure

1. Dismantle front fixing bolt ofrear fender bushing plate.



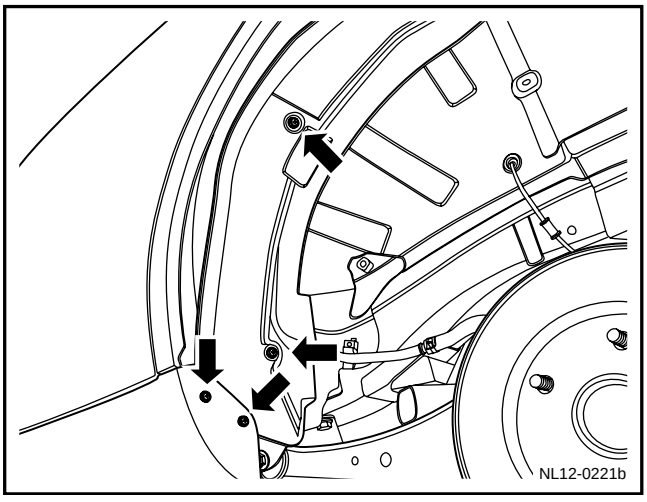
2. Dismantle fixing bolt on the rear of rear fender bushing plate.



Installation Procedure:

1. Install rear fender lining plate front fixing bolt.

Torque: 4Nm(Metric) 3lb-ft(English system)



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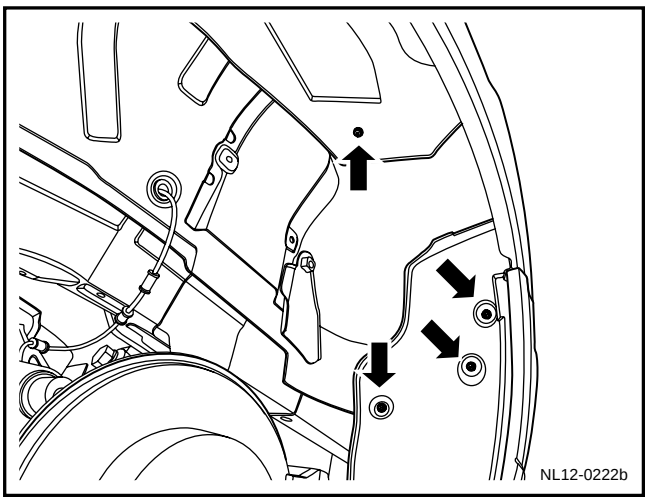
2. Install fixing bolt on the rear of rear fender bushing plate.

Torque: 4Nm(Metric) 3lb-ft(English system)



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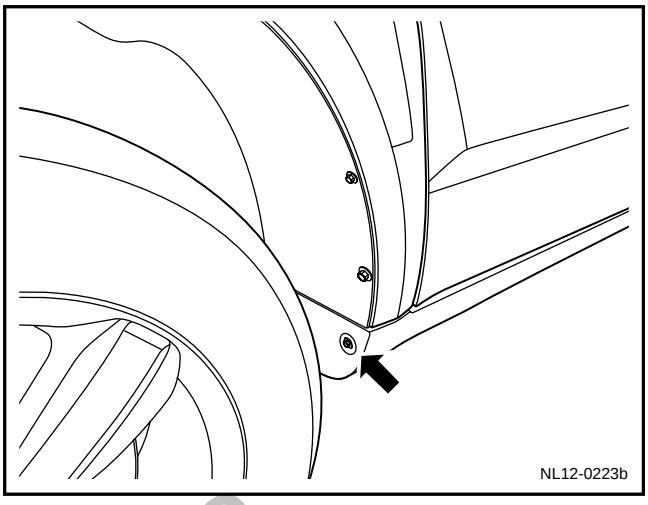
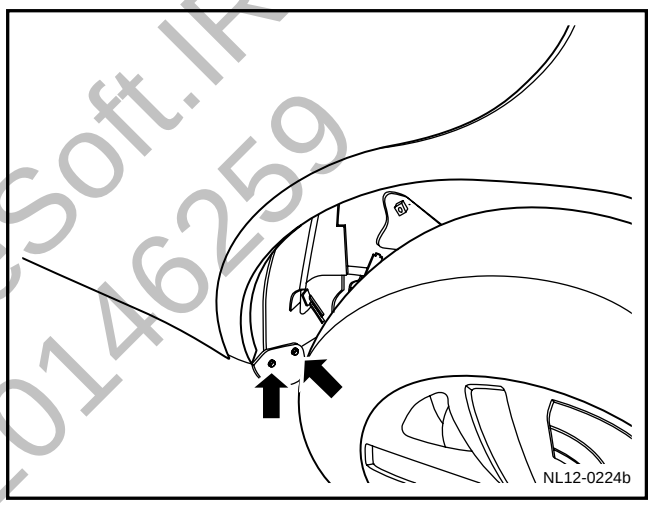
12.10.1.11 Doorsill lower trim plate replacement

Dismantlement Procedure

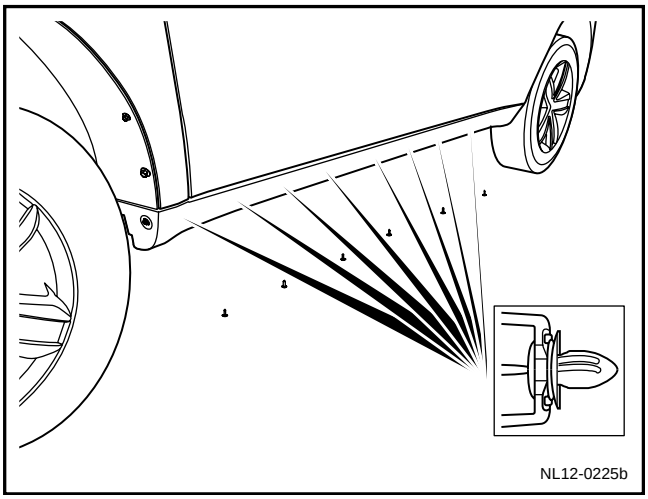
1. Dismantle fixing bolt on front of doorsill lower trimming strip.



2. Dismantle fixing bolts on the rear of doorsill lower trimming strip.



3. Dismantle fixing bolt at the bottom of lower trimming strip of doorsill.
4. Disengage the internal side buckle and detach the lower trim strip on the threshold.



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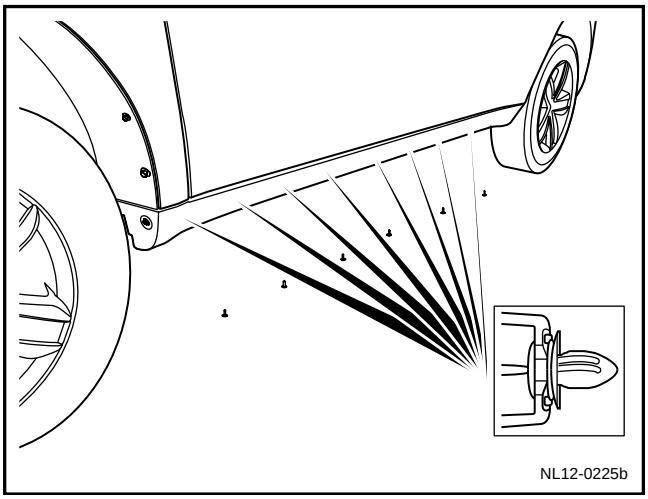
Installation Procedure:

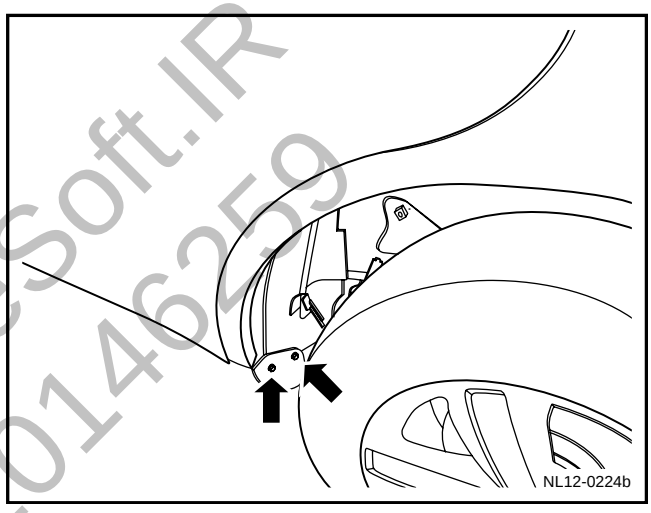
1. Align doorsill lower trimming strip inner buckle with its mounting hole, and press trimming plate buckle.
2. Install fixing bolt at the bottom of doorsill lower trimming strip.

Torque : 4Nm(Metric) 3lb-ft(English system)



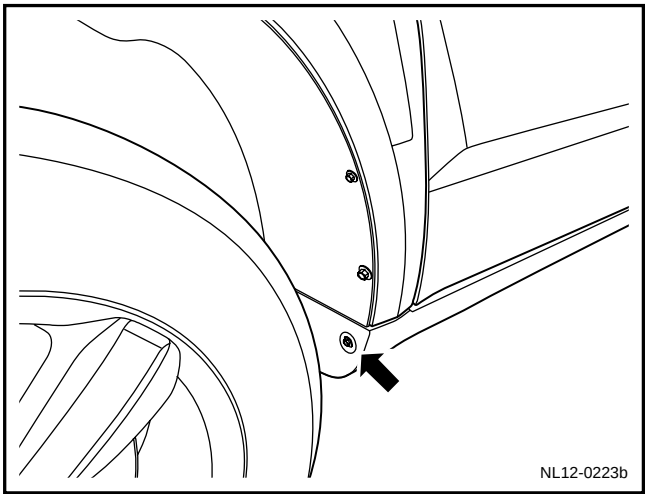
3. Install fixing bolt on the rear end of lower trimming strip of doorsill.

Torque : 4Nm(Metric) 3lb-ft(English system)



4. Install fixing bolt on the front of lower trimming strip of doorsill.

Torque: 4Nm (Metric) 3lb-ft (Inch)



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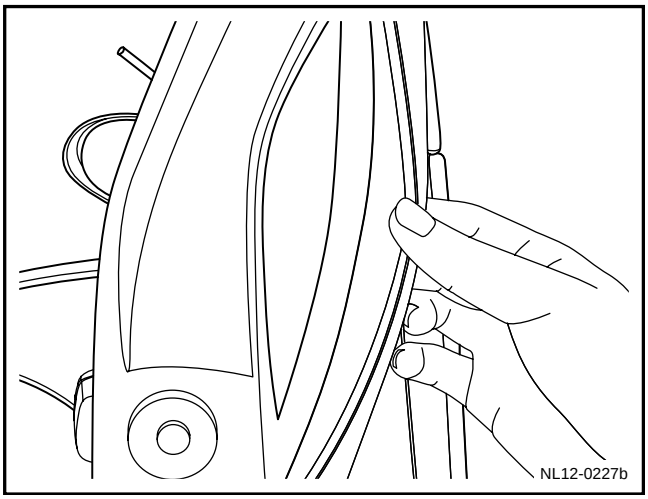
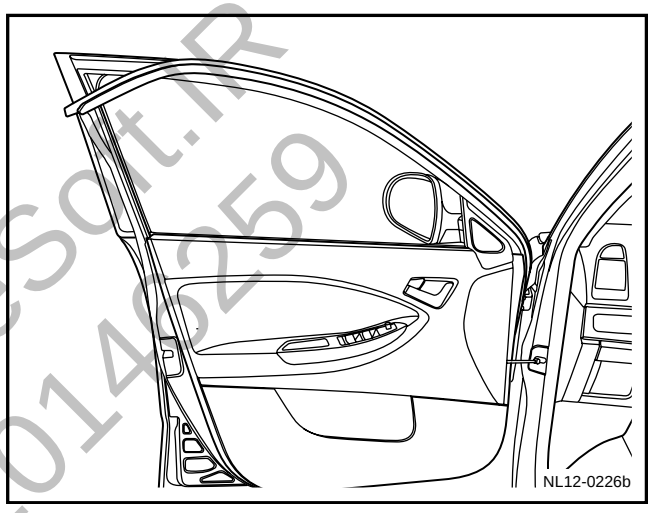
12.10.1.12 Replacement of Door Sealing Strip

Dismantlement Procedure

1. Dismantle door sealing strip.



2. Take the door frame sealing strip out of platic buckle.



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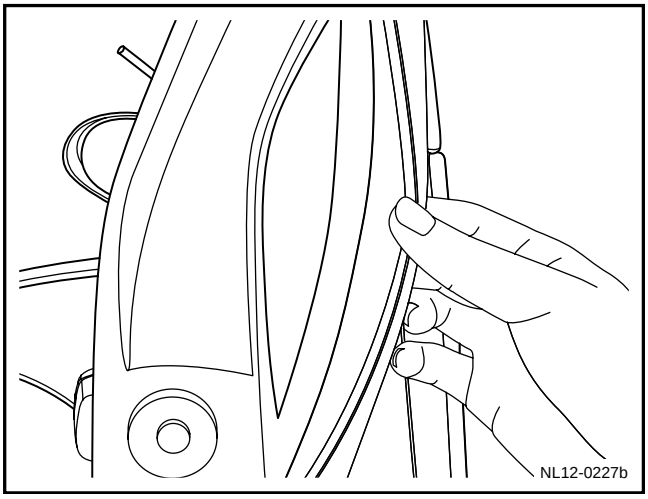
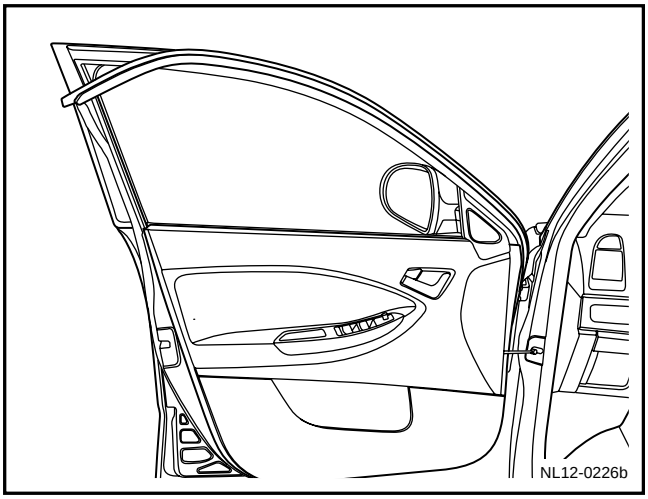
Installation Procedure:

1. Install door sealing strip into plastic buckle.



2. Insert sealing strip into door sealing strip fixing clip groove.



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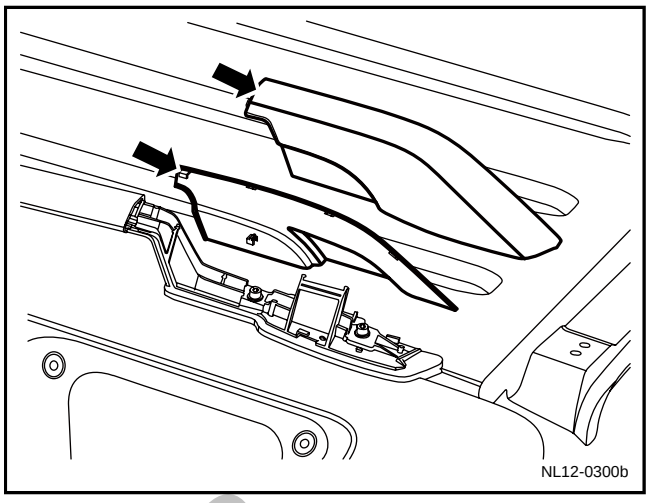
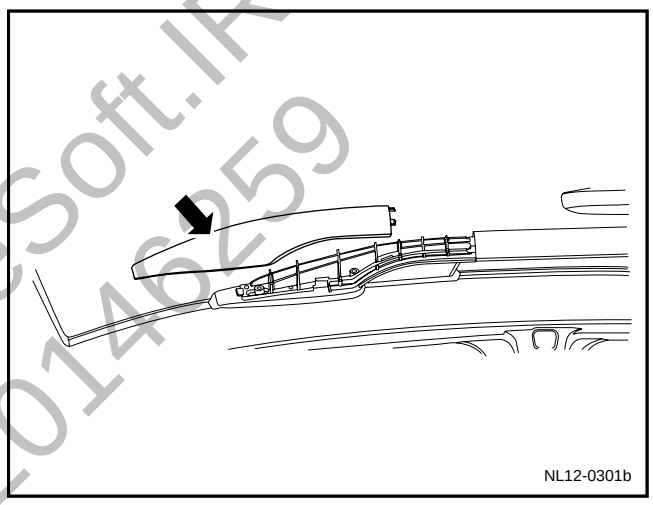
12.10.1.13 Luggage frame replacement

Dismantlement Procedure

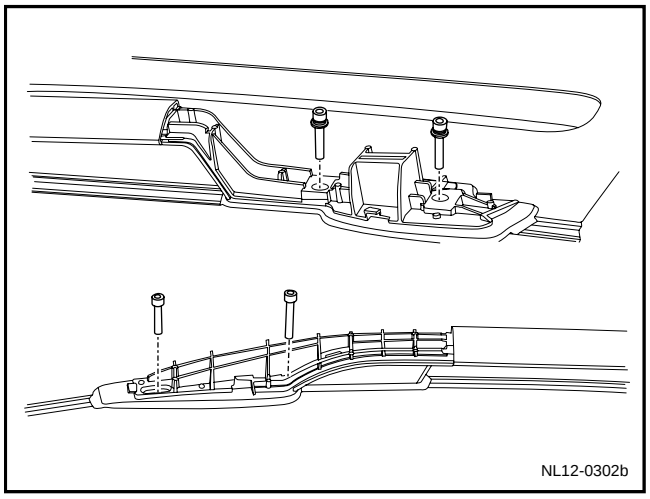
1. Dismantle rear trimming cover on both sides of luggage rack



2. Dismantle front trimming cover of luggage rack.



3. Dismantle 4 bolts on the front and rear luggage rack.



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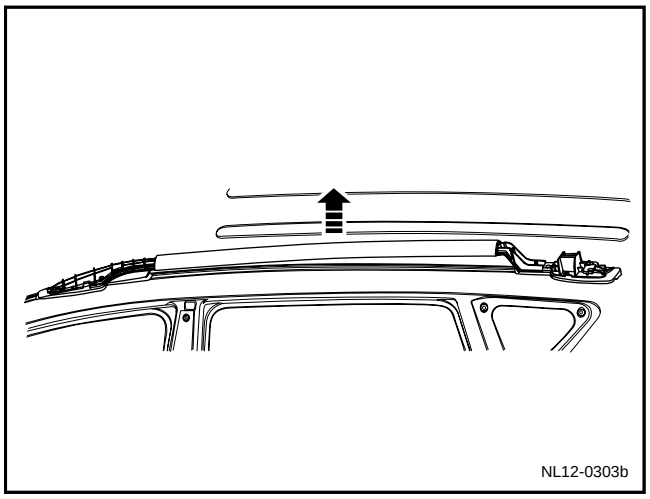
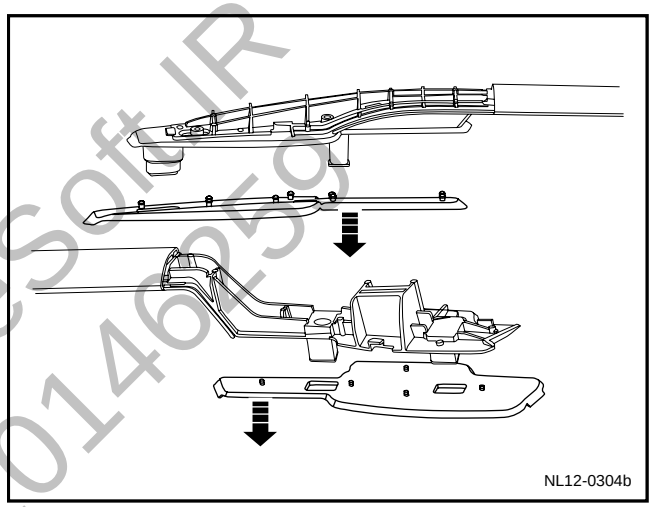
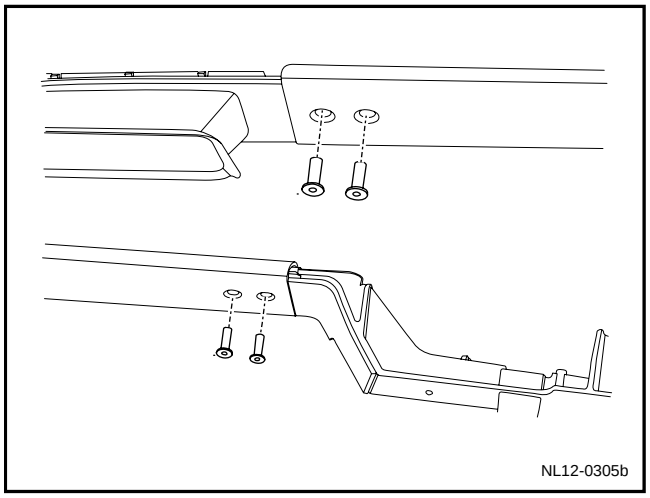
4. Remove the luggage rack as a whole from the body.



5. Remove the front and rear sealing strips of the luggage rack.



6. Remove front and rear 4 luggage rack connecting rod fixing bolts.



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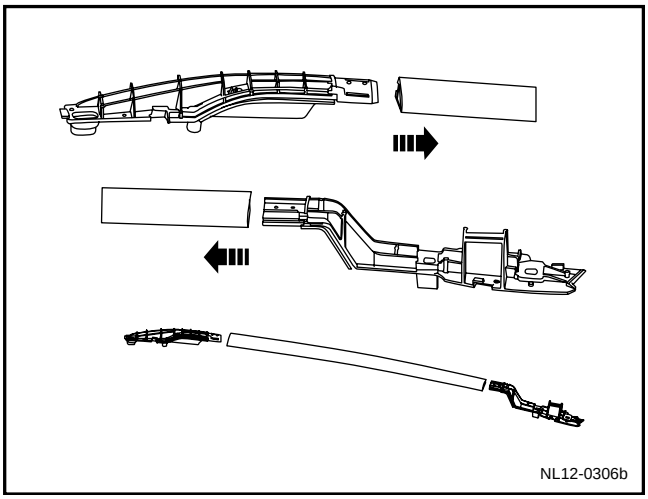
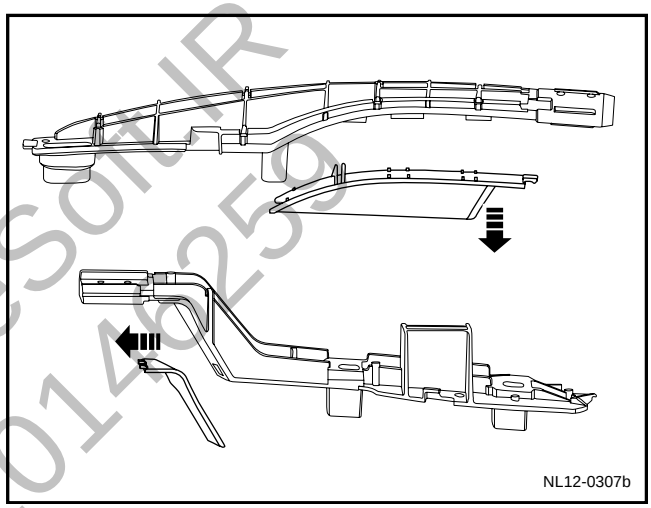
7. Disconnect the front and rear mounting seats from the connecting rod.



8. Remove the front and rear lower bottom casings from the fitting seat.



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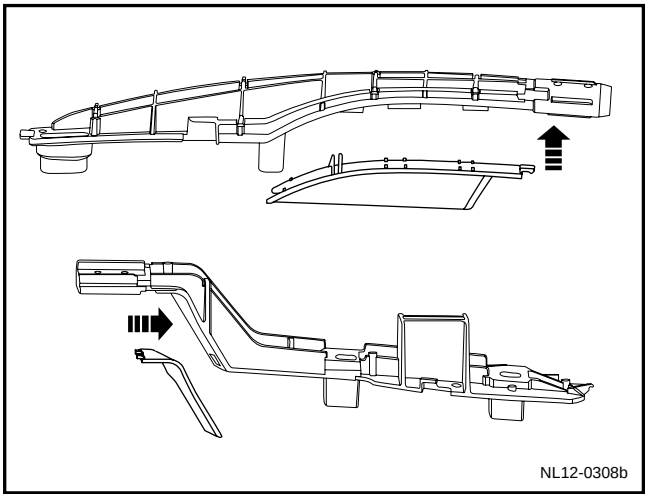
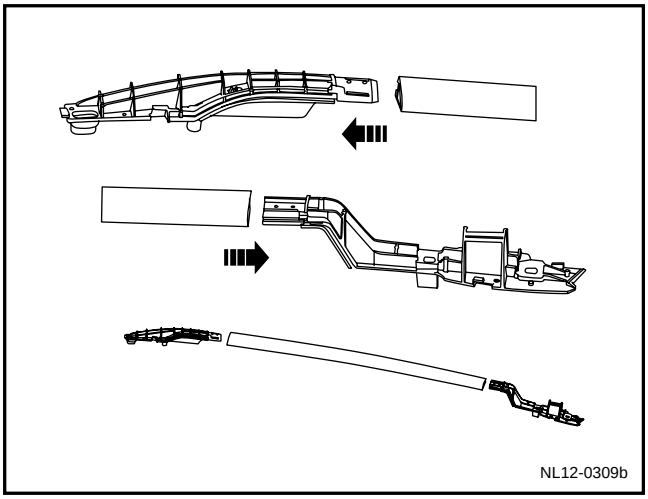
Installation Procedure:

1. Install front and rear covers onto mounting seat.

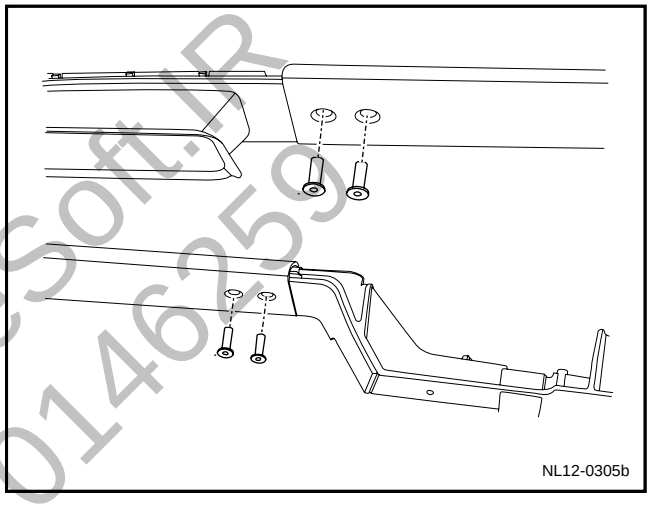


2. Install front and rear mounting seat onto connecting rod.

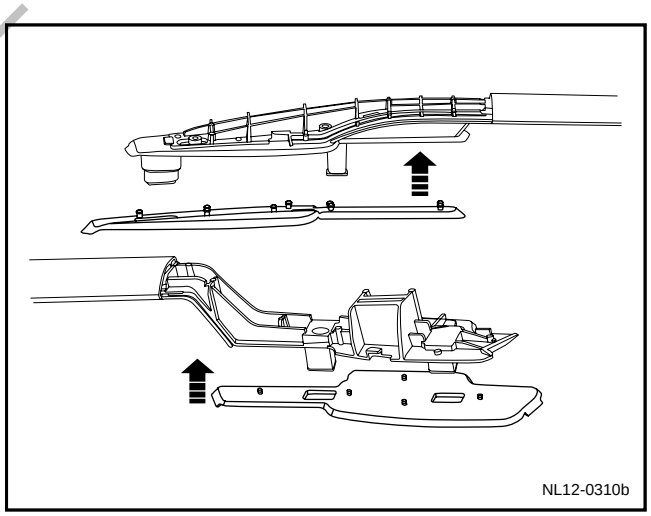


3. Install 4 fixing bolts of luggage rack connecting rod on front and rear sides.

Torque:10Nm(Metric) 7.4lb-ft(English system)



8. Install front and rear sealing strip of luggage rack.



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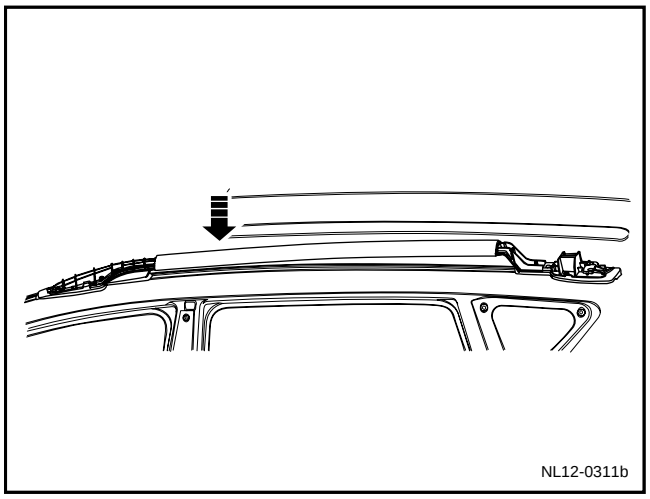
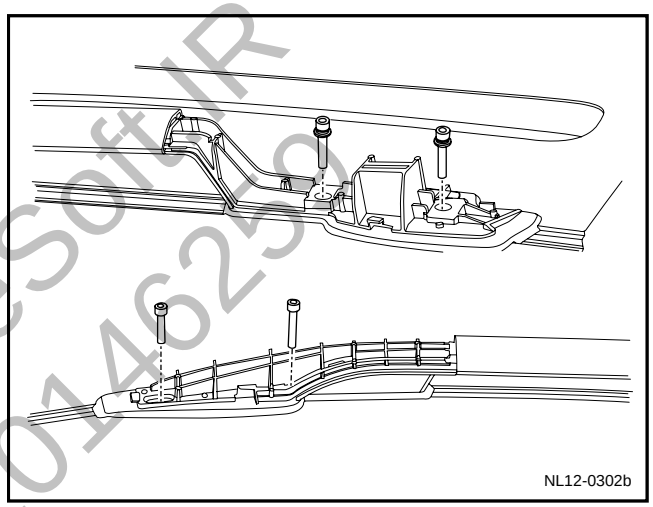
5. Install the luggage rack as a whole to the body.

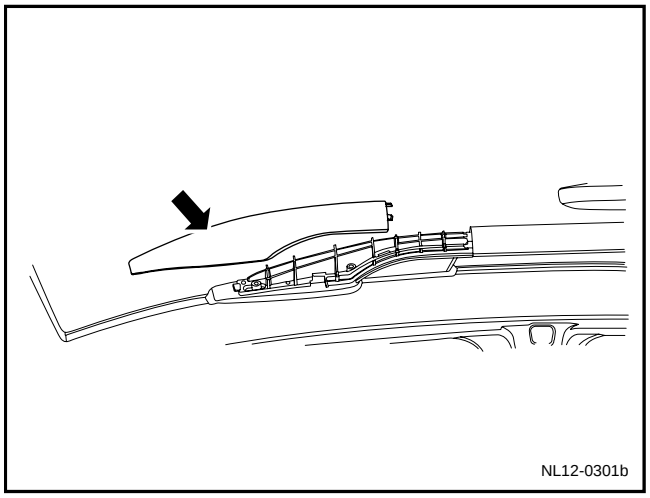


6. Install the front and rear 4 bolts on the luggage rack.

Torque:10Nm(Metric) 7.4lb-ft(English system)



7. Install the luggage rack front decoration cover.



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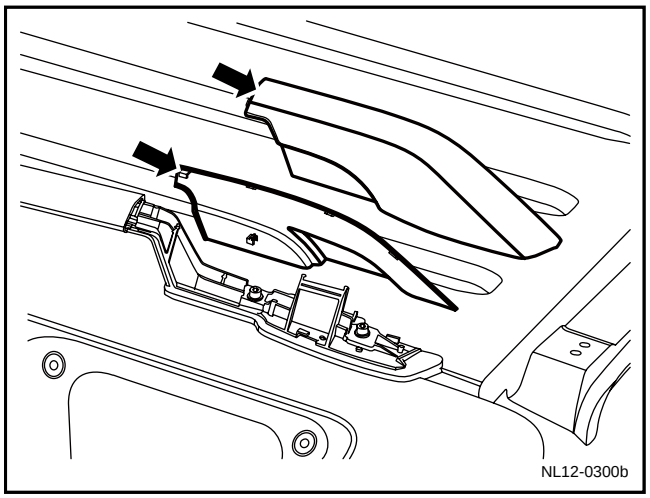
8. Install two rear decoration covers of the luggage rack.



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12.11 information and maintenance of plastic panel

12.11.1 Description and Operation

12.11.1.1 Description and operation

Currently, the interior and exterior surface covering parts are mainly made of modified PP, ABS, PC+ABS and PVC (artificial leather material), which are thermoplastic and modified material thereof. The interior and exterior trim non-surface covering part are further made of POM, PA class and HDPE material, etc. Thermosetting plastics are seldom used for interior and exterior trim. Only the ashtray adopts phenolic plastic. The thermosetting plastics are mainly applied in electric products and safe components to be as structural members. The thermoplastic plastics parts are better maintained by hot soldering iron plastic material filling welding machine, but the thermoplastic plastics are usually replaced for maintenance. For thermosetting plastics, the maintenance materials can be epoxy resin and other harder two-component materials. In this chapter, the maintenance methods are simply introduced and maintenance is not recommended.

Classification of plastic:

The thermosetting plastic refers to that is able to cure through heating or under the other conditions or has the insoluble (non-melting) property, such as phenolic plastic and epoxy plastic, etc. The thermoplastic plastics are the plastics which can be softened by heating and hardened by cooling repeatedly under specific temperature range, such as polyethylene, polytef and so on. The thermosetting plastics and thermoplastic plastics can be the hard plastics and also can be the soft plastics.

12.11.2 Dismantle and install

12.11.2.1 Maintenance precaution of plastic part

1. Apply defense ointment on the exposed skin to avoid irritating skin.
2. Wear rubber gloves.
3. Wear protective goggles when compressed air and sanding are used.
4. Clear away any mixture which touches the skin immediately, because the curing velocity of mixture is very fast.
5. Please wear dust mask and protective goggles when grinding and sanding.
6. Clean the skin with cold water to reduce resin and dusts' weak irritation on skin.
7. Do not make maintenance materials on clothes.
8. Maintenance materials shall be used under the environment with good ventilation, because the smoke andparticulate pollutant caused by maintenance materials is poisonous.
9. After use, enclose all maintenance material containers. Dust or moisture will contaminate maintenance materials and thus compromise the maintenance effects.

12.11.2.2 Maintenance of thermosetting plastic pit

1. Clean and dry the components for repairing.
2. Heat the pit position with hot air of blower until the proper tool can flatten the pit.
3. Polish the pit area with sand paper/emery paper.
4. Clean the maintenance position with cleaning agent and dry it in the air for 5 min.
5. Apply with a layer of thin adhesion agent and dry in the air for 10 min.
6. Fill the uneven surface with adhesion agent and smooth it with slice.
7. Accelerate the curing process with an infrared lamp and adjust the temperature to 60 -70℃ (140-158ºF) to heat for 15min.
8. Polish the pit area with sand paper.

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9. Wipe off the dust / abrasive dust.

10. Apply with a layer of thin adhesion agent and dry in the air for 10 min.

11. Recover the painted surface with the patching procedure for painted surface of plastic parts surface.

12.11.2.3 Scratch maintenance of thermosetting plastic

1. Clean and dry the positions for repairing.
2. Remove the bulged materials with sand paper.
3. Clean the maintenance position with cleaning agent and dry it in the air for 5min.
4. Apply with a layer of adhesion agent and dry in the air for 10 min.
5. Stuff the irregular surface with adhesive agent and trowel the adhesive agent with a trowel.
6. Accelerate the curing process with an infrared lamp and adjust the temperature to 60 -70℃ (140-158 ºF) to heat for 15 min.
7. Polish the pit area with sand paper.
8. Wipe off the dust/abrasive dust.
9. Apply with a layer of thin adhesion agent and dry in the air for 10 min.
10. Recover the painted surface with the patching procedure for painted surface of plastic parts surface.

12.11.2.4 Crack maintenance of thermosetting plastic (Length is below 100 mm)

1. Clean and dry the positions for repairing.
2. Chisel 5mm (0.19 in) length of end of crack and polish the crack to be V-shaped incision o remove the internal stress and bulged position.
3. Clean the maintenance position with cleaning agent and dry it in the air for 5min.
4. Apply with a layer of adhesion agent and dry in the air for 10 min.
5. Adhere the reinforcing band to the back of maintenance parts with adhesion agent and make it lap with damaged components for 20 mm (0.79 in).
6. Accelerate the curing process with an infrared lamp and adjust the temperature to 60 -70℃ (140-158 ºF) to heat for 15 min.
7. Fill the polished front end of crack with adhesion agent and smooth it with slice.
8. Accelerate the curing process of front end of crack with infrared lamp.
9. Polish the pit position with sand.
10. Apply with a layer of thin adhesion agent and dry in the air for 10 min.
11. Remove dust/ abrasive dust.
12. Apply with a layer of adhesion agent and dry in the air for 10 min.
13. Recover the painted surface with the patching procedure for painted surface of plastic parts surface.

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12.12 Collision maintenance

12.12.1 Specification

12.12.1.1 Collision maintenance material

For the body collision accidents, some phenomena will appear, such as structural distortion, steel plate crack, welding spot disordering and so on. Sometimes partial damage to assembly parts such as engine and chassis,can also appear. When collision maintenance of body is performed, adhesion agent, sealant, looseness-proof agent, surface protective materials, anti-corrosive materials, chemical materials may be used. So please use these products according to the application, application range and specification. During the maintenance process of body, maintenance materials shall be selected according to the functional requirements for parts materials. The following table lists the maintenance materials which may be used during the maintenance process of body. It can only be referred during the maintenance process of body.

Adhesive for body maintenance

Products	Material	Function	Recommended Model
Vehicle sealant	Monocomponent polyurethane	Bonding of body skin, interior and exterior trim and body structure and other components. The sealant has strong binding power and cohesion. This sealant has good cohesive property with metal and various painted surfaces.	Tangshan kesaixin®: 1922、1923/
Welded seam sealant	Monocomponent polyurethane	Room temperature curing-type adhesive is used for the seal of the welding line of the body. Room temperature curing-type adhesive is used for the fine seal of the door, engine cabin lid and the trunk flanging.	Chinese automotive components industry company:C8802
Chip-resistant primer	Rubber and Resin	It is anti-collision glue for chassis of curing type under room temperature. A layer of permanent protective coating of elastic corrosion resistance and anti-aging is formed in the underbody and wheel casing. No crack appears under low temperature. These kinds of products can replace PVC coating and have various functions, such as good anti-corrosive function, sound insulation, anti-stone, anti-oxidation and protective coating functions.	Chinese automotive components industry company:C312DW
Windscreen glue	Monocomponent polyurethane	Polyurethane adhesive cured at room temperature is used for sealing glass for vehicle window. This glue has good bonding property and can react with moisture in the air. The glue has strong strength, age resistance, vibration and fatigue resistance, low temperature resistance and no corrosion and other good properties	China Auto Parts & Accessories Corporation C8802 Tianshan kesaixin®: 1956、1924

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		after curing.	
Primer	——	A kind of primer shall be applied on the body and glass before applying with the windscreen glue to make windscreen and vehicle bonded firmly.	
Detergent	——	Be used for clean all surfaces in contact with the primer and adhesive.	
Pressure-sensitive adhesive tape	Acrylic adhesive tape	It is used for bonding of rubbing strips, nameplates, guard plates, splash guard, door protection, body, various trim strips and so on. It has good weather resistance and durability.	3M 4229P、4215、4221L
Heat-Sensitive Adhesive Tape	Acrylic adhesive tape	It is mainly used for sealing strips system of rubber. This adhesive tape has good bonding force and strong sealing property to avoid clearance and corrosion because of unstable bonding.	3M 4237P
Adhesive with primer	——	Different primers are selected for different materials of bonding surface. The bonding surface must be clean, the primer is uniformly applied on the sticky surface via a brush after completely drying, and the adhesive tape is pasted after driving. The adhesive tape has strong adhesive property.	3M C-100、K-500\520、N-200

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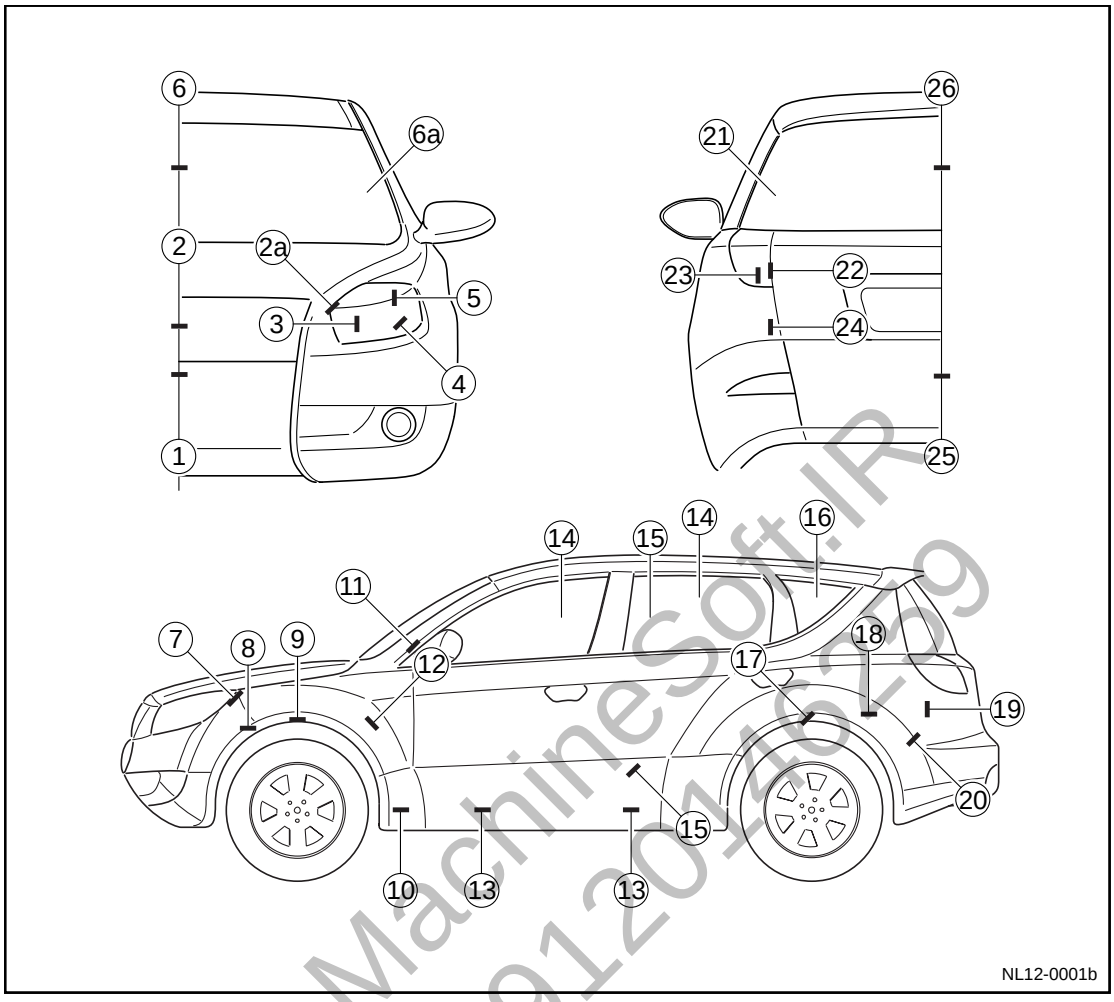
12.12.1.2 Clearance and face differential of body surface

– Adjust or inspect the clearance dimension with plastic clearance adjustable gauge.

– The clearance dimension's units are millimeter/inch.

Engine cabin assembly and surrounding clearance, level difference definition



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Serial Number	Component Name	Adjacent Component Name	Specifications			
			Clearance	Deviation	Tolerance	Deviation
1	Front Bumper	Front Grille Panel	1.5	+0.5. -0.5	--	--
2	Engine Hood	Front Grille Panel	--	--	-13.5	+0.0. -1.0
2a	Engine Hood	Front Bumper	8.0	+1.0. -0.0	2a	
3	Front Bumper	Front combination lamp	3.0	+0.0. -1.0	+0.5	+0.5. -0.5
4	Front Bumper	Front combination lamp	3.0	+0.0. -1.0	+0.5	+0.5. -0.5
5	Engine Hood	Front combination lamp	5	+1.0. -0.0	-1	+0.5. -0.5

6	Roof	Front windshield	4	+1.0. -1.0	-1.5	+0.5. -0.5
6a	Side Frame	Front windshield	4.0	+1.0. -1.0	-15.3～-9.4	+1.0. -1.0
7	Fender	Front Bumper	0.0	+1.0. -0.0	-0.5	+0.5. -0.5
8	Fender	Front combination lamp	1.5	+0.5. -0.5	--	--
8a	Engine Hood	Front combination lamp	5.0	+0.5. -0.0	-1.0	+0.5. -0.5
9	Engine Hood	Fender	4.0	+1.0. -0.0	0.0	+1.0. -0.0
10	Rocker panel	Fender	2.0	+0.5. -0.5	+6.0～0.0	+0.5. -0.5
11	A-column	Fender	2.0	+0.5. -0.0	0.0	+0.5. -0.5
12	Front door	Fender	4.0	+1.0. -0.0	0.0	+1.0. -0.0
13	Rocker panel	Door	5.0	+1.0. -0.0	-6.5	+1.0. -1.0
14	Upper Part of Side Frame	Door	4.0	+1.0. -1.0	-6.0	+1.0. -1.0
15	Front door	Rear door	4.0	+1.0. -0.0	0.0	+0.0. -1.0
16	Rear door	Rear window glass	4.0	+1.0. -0.0	--	--
17	Side Frame	Rear door	4.0	+1.0. -0.0	0.0	+0.5. -0.5
18	Side Frame	Fuel Filler Cap	3.5	+0.5. -0.0	-1.0	+0.0. -0.5
19	Side Frame	Rear Combination Lamp	2.0	+0.5. -0.5	-1.0	+0.5. -0.5
20	Side Frame	Rear Bumper	0.0	+1.0. -0.0	-0.5	+0.5. -0.5
21	Rear back door glass	Rear trim panel of side wall.	5.0	+1.0. -1.0	1.0	+1.0. -0.0
22	Rear back door	Rear Combination Lamp	5.0	+1.0. -1.0	+1.0	+1.0. -1.0
23	Rear Bumper	Rear Combination Lamp	2.0	+0.5. -0.5	-0.5	+0.5. -0.5
24	Rear back door	Rear Bumper	5.0	+1.0. -1.0	1.5	+1.0. -1.0
25	Rear back door	Rear Bumper	6.5	+1.0. -1.0	--	--

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26	Roof	Rear back door	8.0	+1.0. -0.0	--	--
27	Front Bumper	Front fog lamp	2.0	+0.5. -0.5	--	--
28	Front door	Rearview mirror mounting plate	--	--	--	--
29	Side Frame	Rear window glass	--	--	--	--
30	Side Frame	Rear trim panel of side wall.	2.0	+0.5. -0.5	-0.5	+0.5. -0.5
31	Rear Combination Lamp	Rear trim panel of side wall.	2.0	+0.5. -0.5	--	--
32	Rear back door	Back door decoration strip	0.5	+0.5. -0.0	--	--
33	Rear Bumper	Rear Fog Lamps	2.0	+0.5. -0.5	--	--
34	Side Frame	Spoiler	5.0	+1.0. -0.0	---	--
35	Rear Bumper	Rear Combination Lamp	2.0	+0.5. -0.5	1.0	+0.5. -0.5
36	Rear back door	Rear windshield glass	2.0	+0.5. -0.5	--	--
37	Rear trim panel of side wall.	Spoiler	2.5	+0.5. -0.0	--	--

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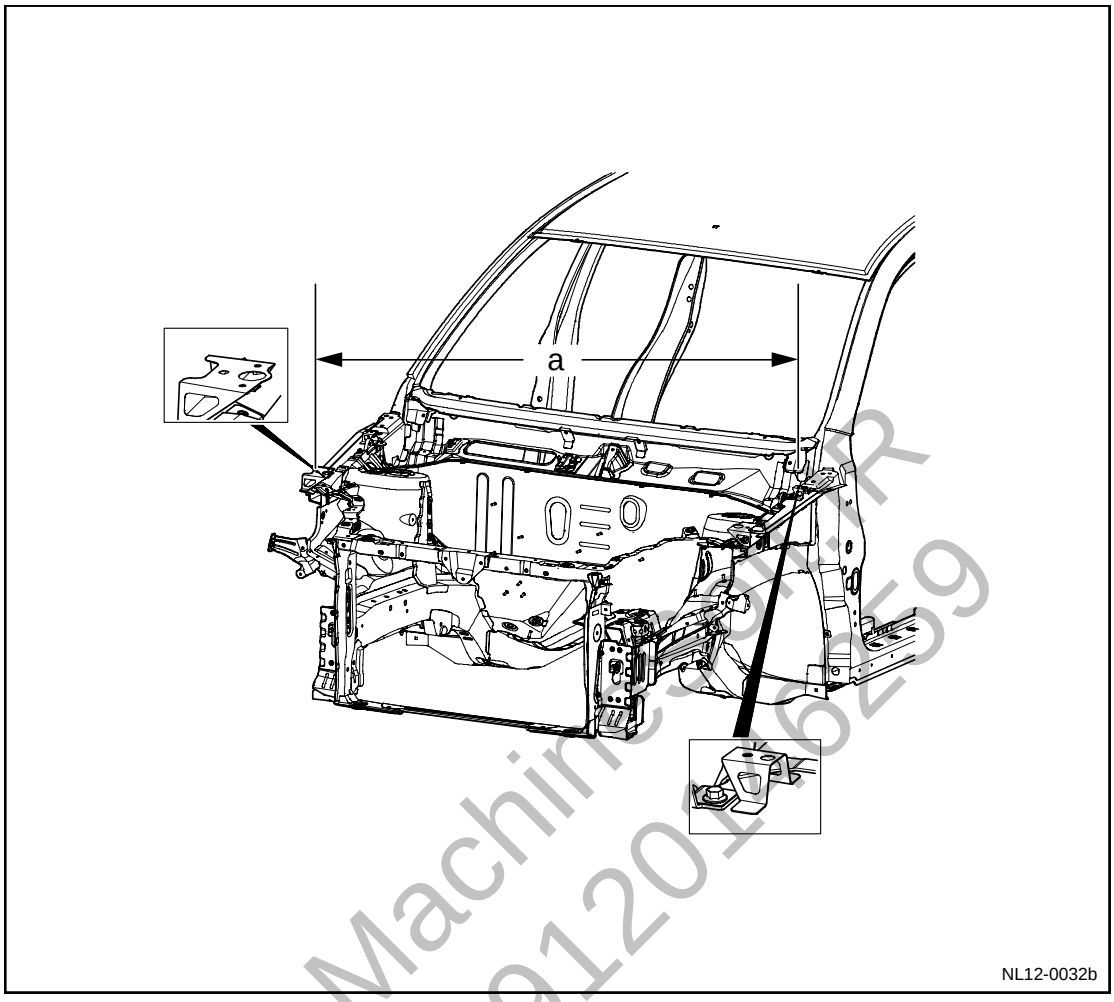
12.12.1.3 Body size

– The body dimensions are used for body inspection.

– Professional extension scale is used for measuring body dimensions.

Front part of body



Diagonal size a of the fender mounting hole (front) and fender mounting hole (rear) is equal to 1524mm (60 in).

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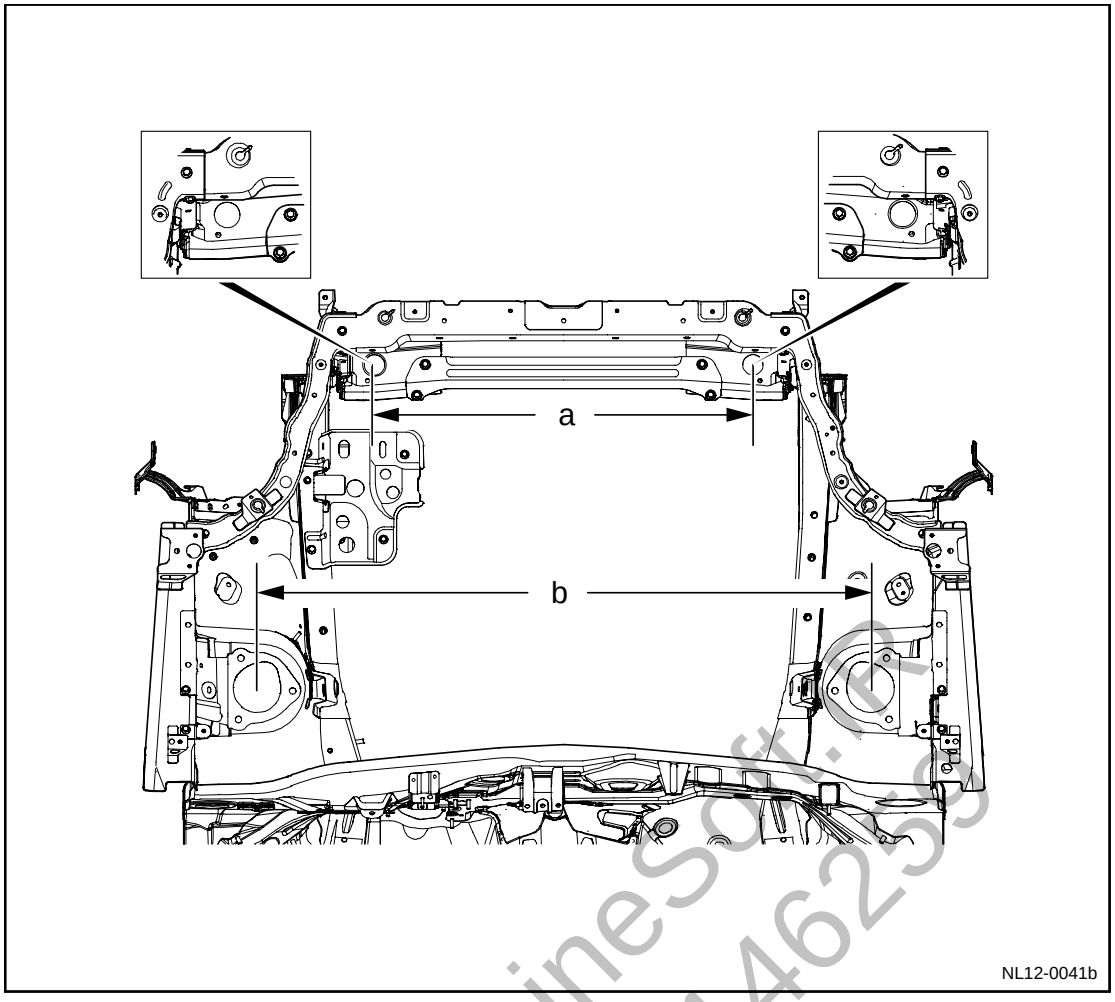

Size between the mounting holes of the radiator

Size a=738mm (29in)

Size between the front damper seat plate center holes

Size b=1198.5mm (47in)

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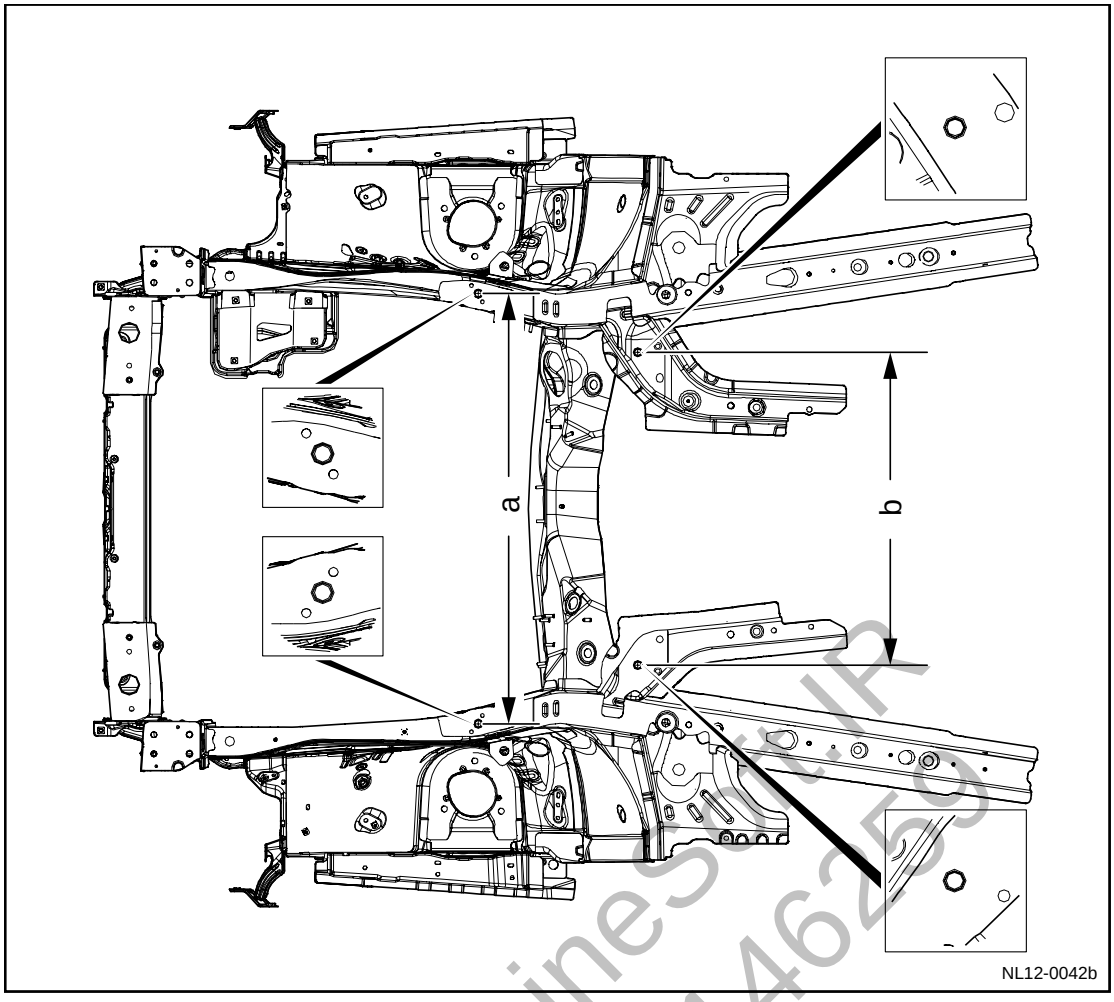

Size among front suspension mounting holes (front)

Size a=902mm (36 in)

Size among front suspension mounting holes (rear)

Size b=656mm (26 in)

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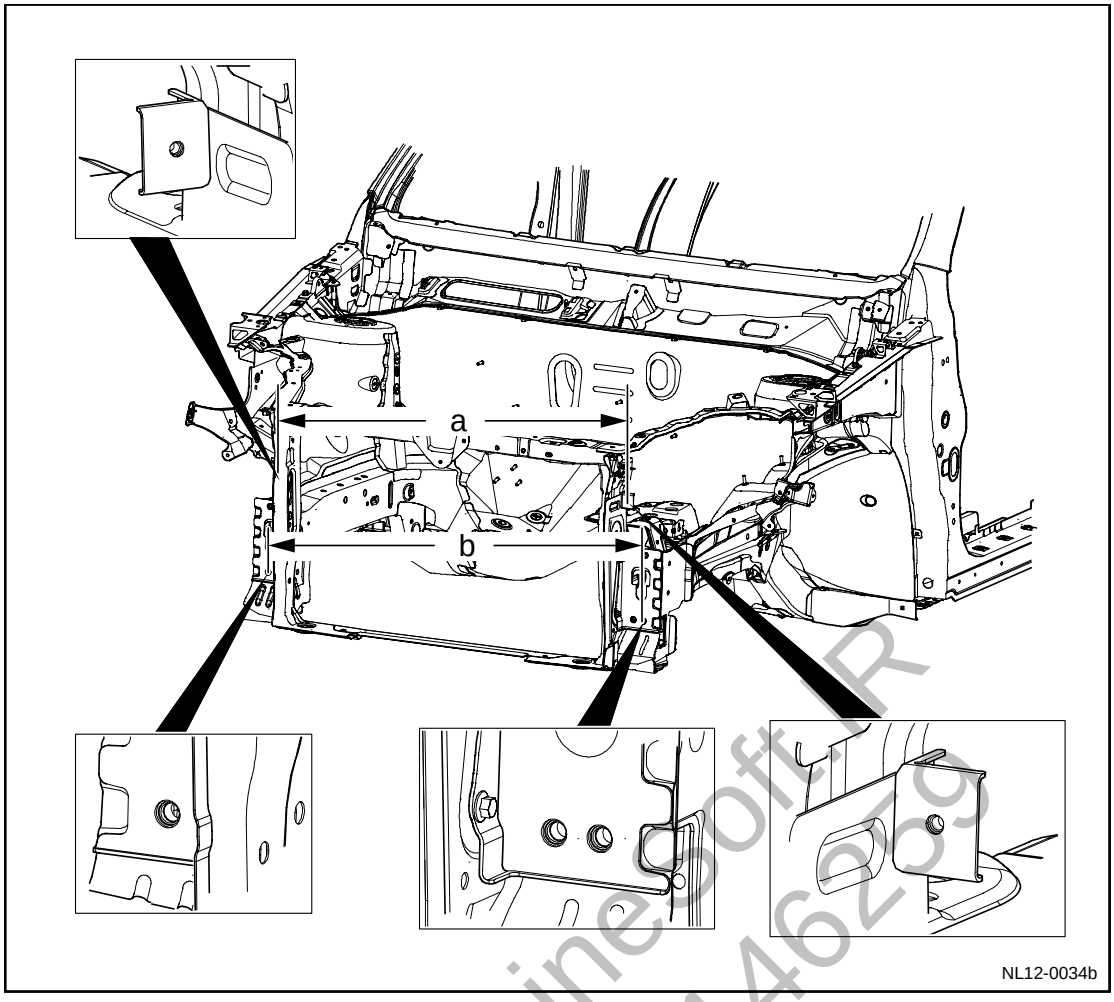

Size between the mounting holes of the front combination lamp

Size a=922mm (39in)

Size between the mounting holes of the front beam

Size b=1006mm (39.6 in)

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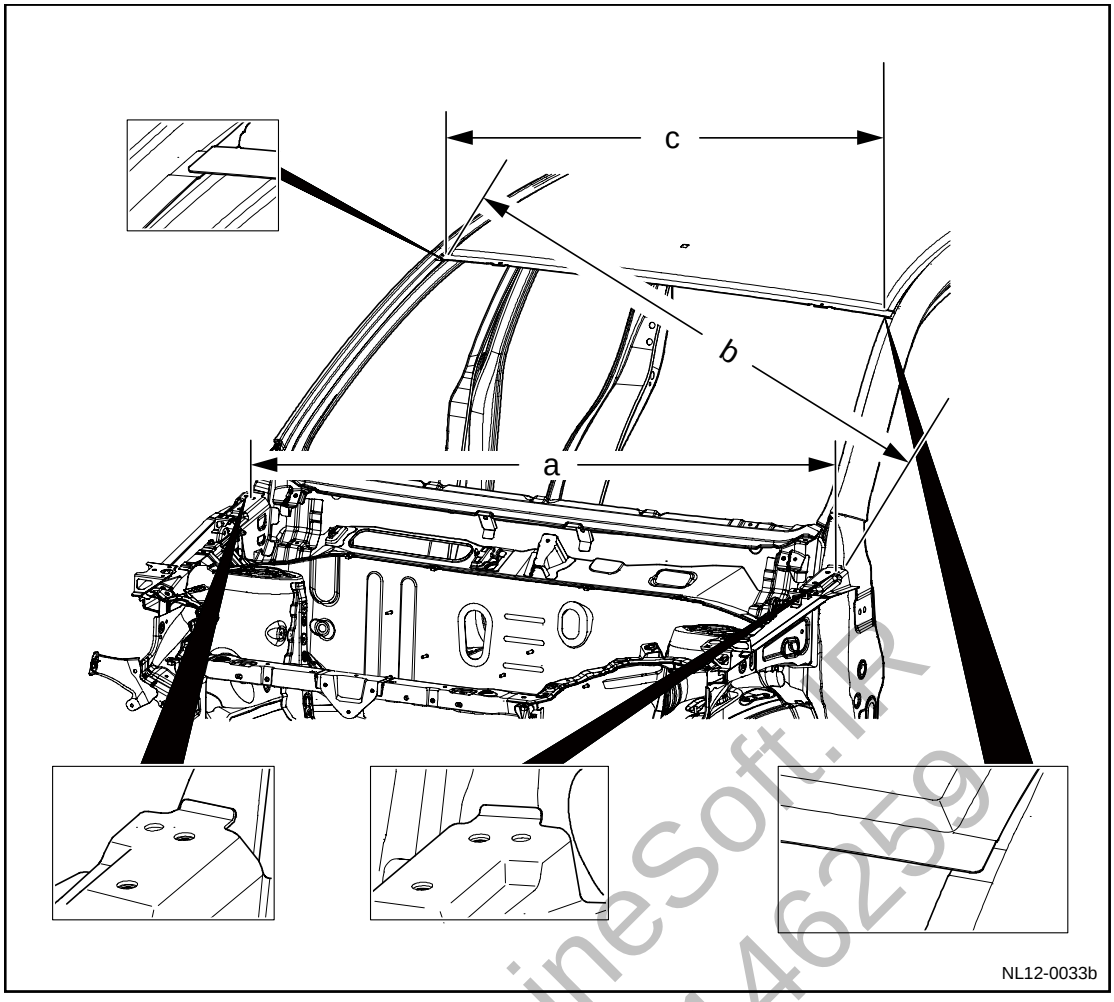

Size of clearance between side wall / top of front wall connection position.

Size a=1556mm (61 in)

Size of clearance between side wall /front wall connection position and side wall /roof connection position.

Size b=1580mm (62in)

Size of clearance between the side wall/roof connection position.

Size c=1161mm (46in)

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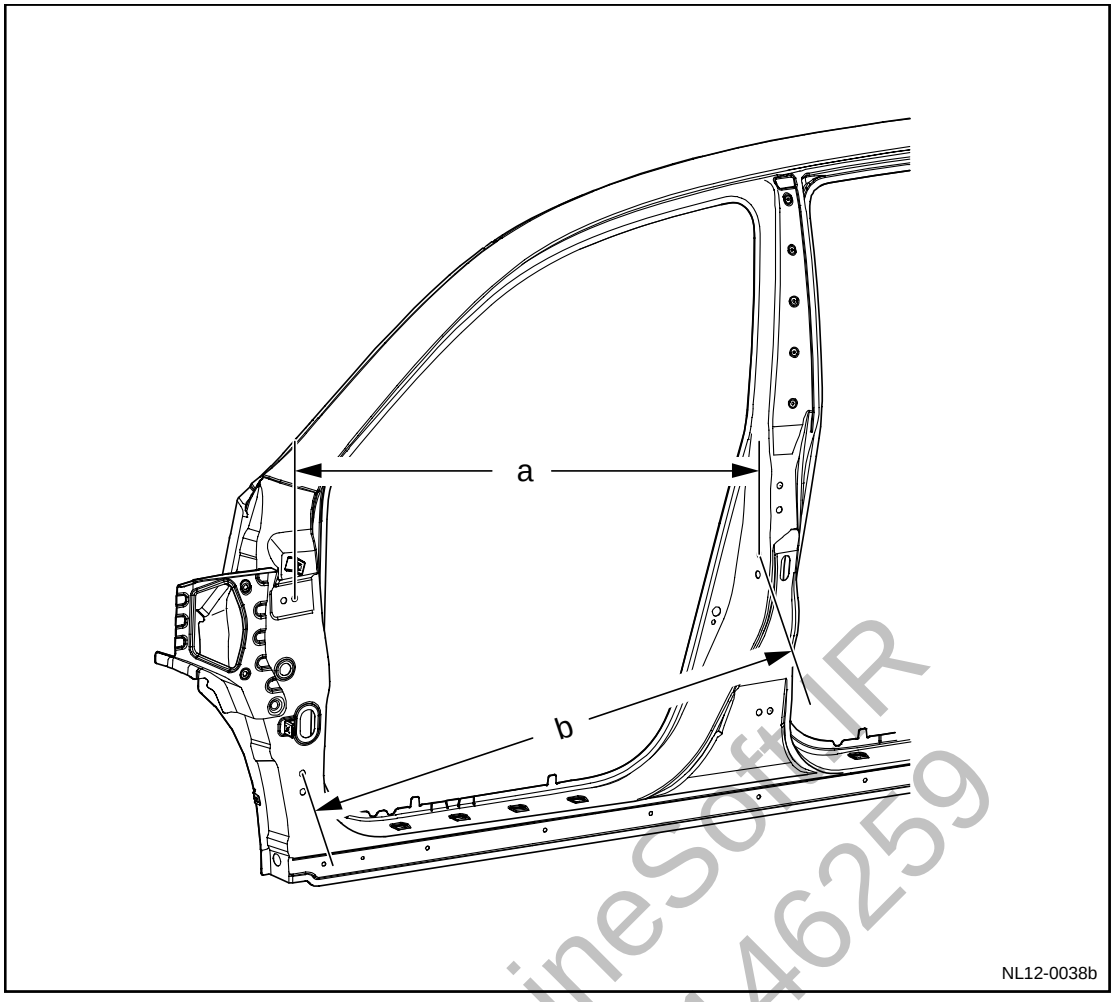

Size between front door upper hinge mounting hole and front door buckle mounting hole

Size a=1071mm (42 in)

Size between front door lower hinge mounting hole and front door buckle mounting hole

Size b=1091mm (43in)

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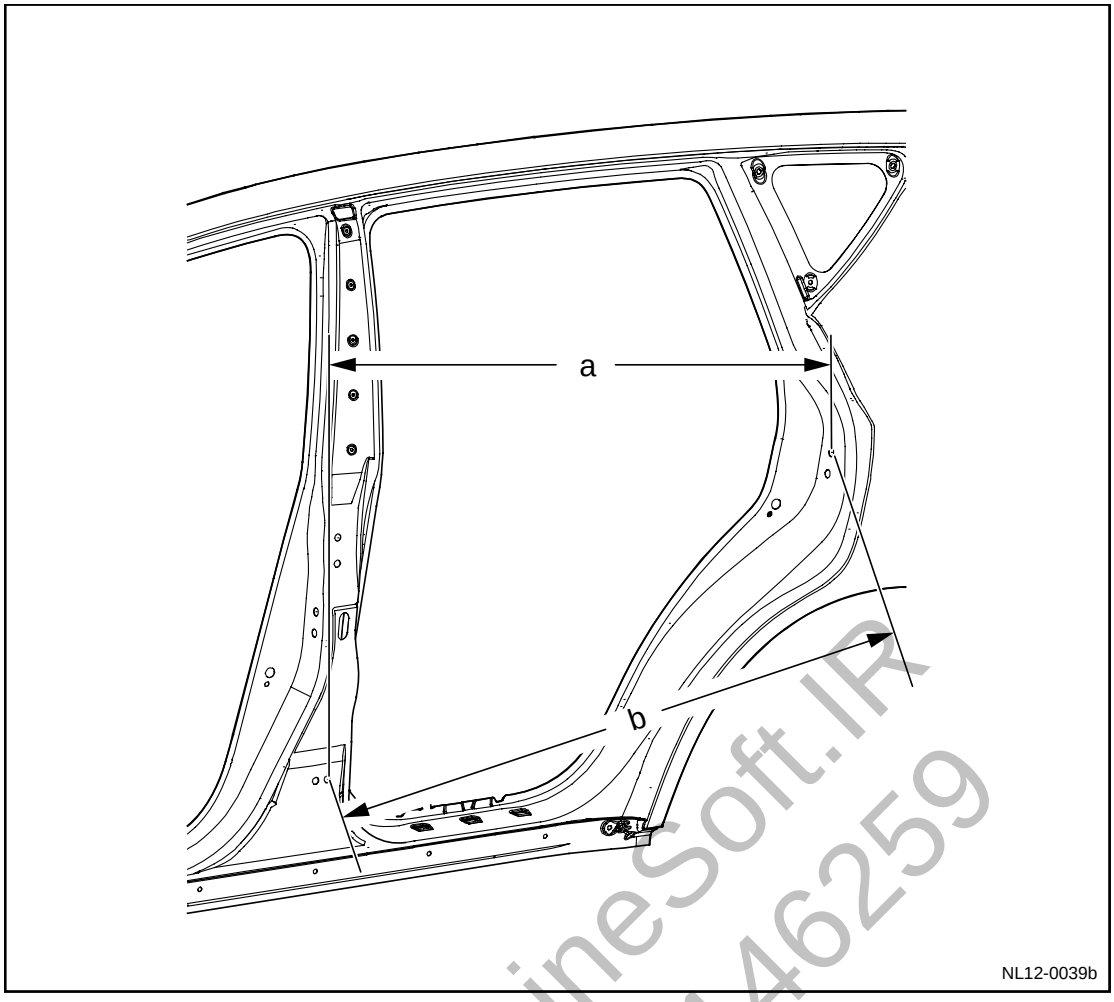

Size between upper hinge mounting hole of rear door and buckle mounting hole of rear door

Size a=1064mm (42 in)

Size between lower hinge mounting hole of rear door and buckle mounting hole of rear door

Size b=1180mm (46 in)

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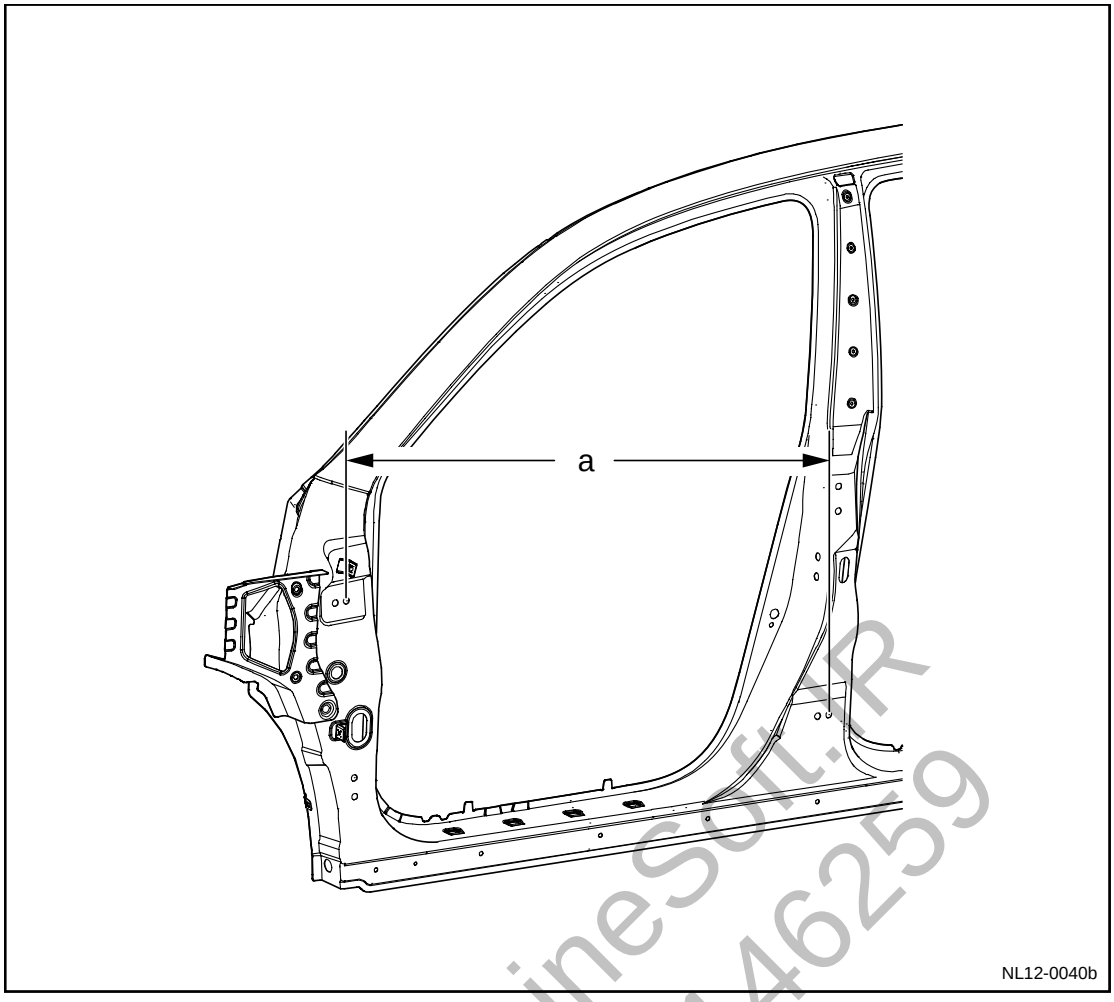

Size between the front door upper hinge mounting hole and rear door lower hinge mounting hole a=1,148mm (45 in)

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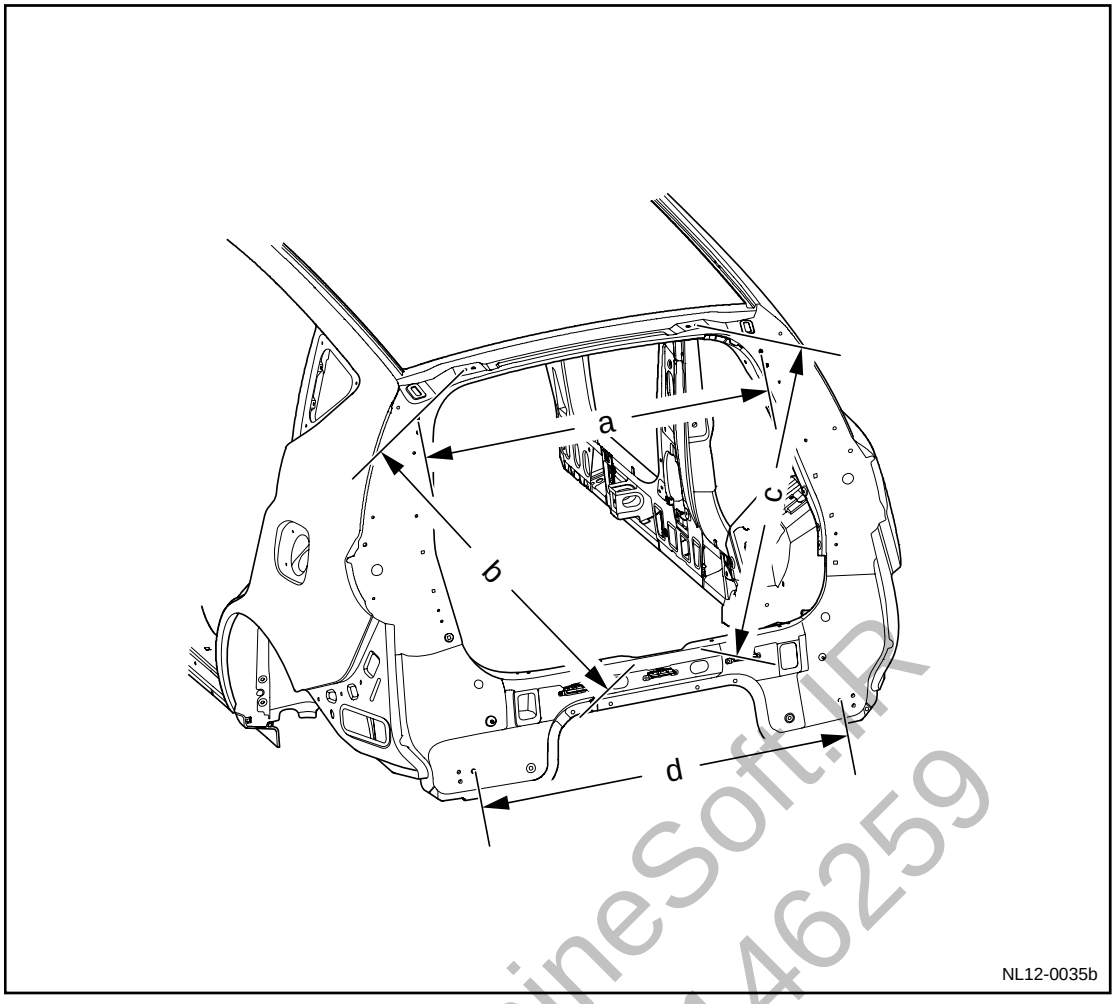

Distance between back door pneumatic jack installation holes

Size a=1029mm (41 in)

Size between the left back door hinge mounting hole (left hole) and rear door lock catch mounting hole (right hole)

Size b =965mm (38 in)

Size between the right back door hinge mounting hole (right hole) and rear door lock catch mounting hole (right hole)

Size c=950mm (37 in)

Size between rear frame plate positioning holes

Size d=1097mm (43in)

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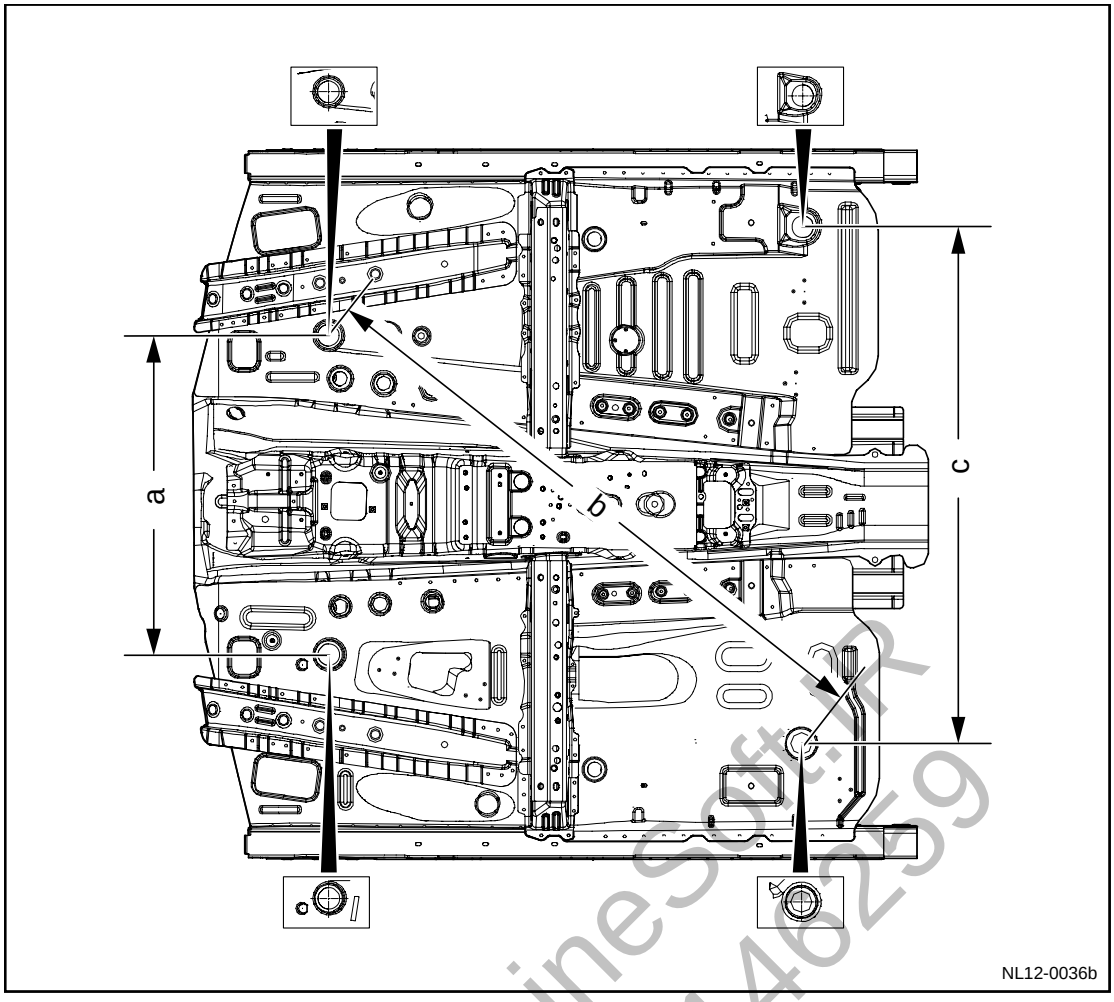

Size between (before) front floor positioning holes

Size a=665mm (26 in)

Diagonal size between (before) front floor positioning hole and (after) front floor positioning hole

Size b=1306.8mm (51.4 in)

Size between (after) front floor positioning holes

Size c=1076mm (42in)

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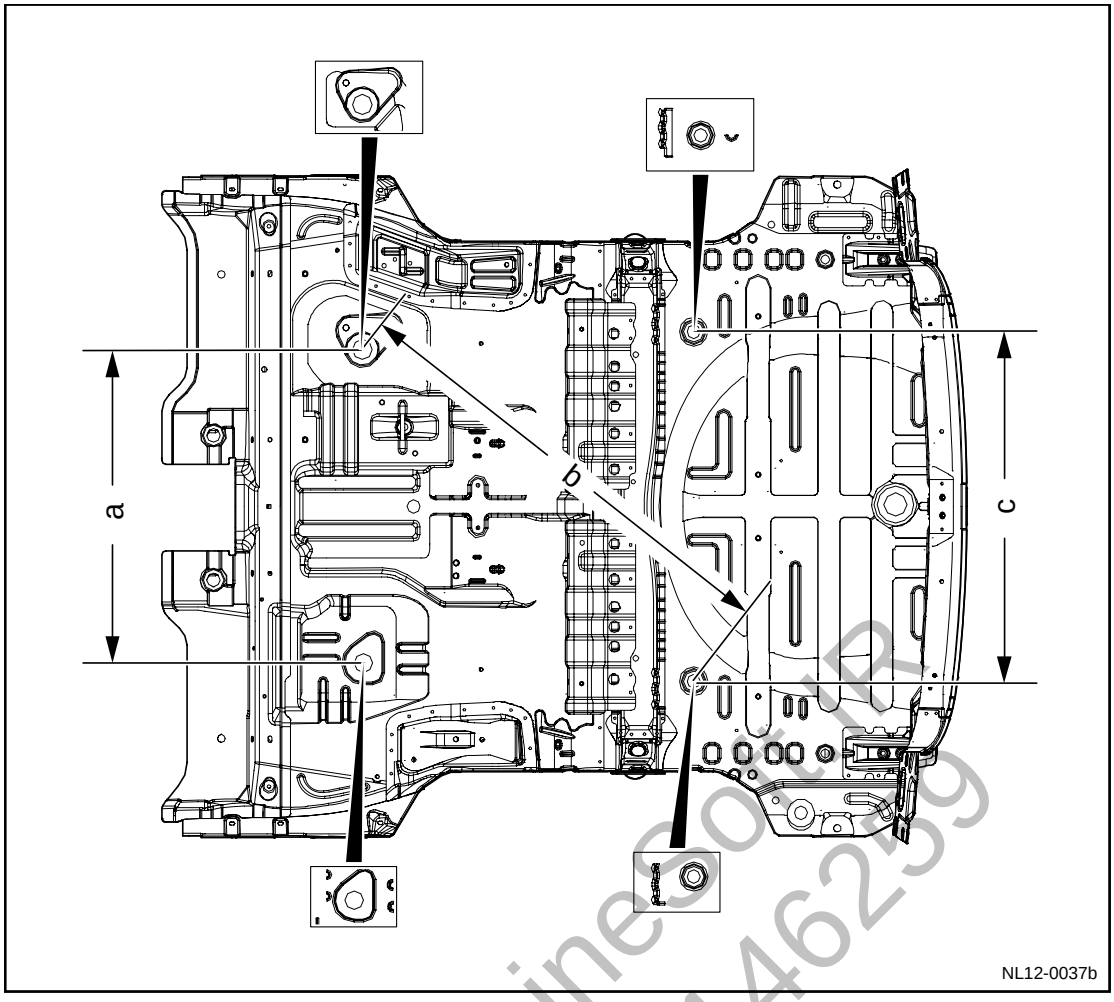

Size between (before) rear floor positioning holes

Size a=699. 8 (27. 6in)

Diagonal size between (before) rear floor positioning hole and (after) rear floor positioning hole

Size b=1053.8mm (41.5 in)

Size between (after) rear floor positioning holes

Size c=780mm (31 in)

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12.12.2 Description and operation

12.12.2.1 Precautions of Safety

When maintenance is performed for body and sheet metal, the following precautions of safety shall be strictly observed:

1. When the body and sheet metal is welded, cut or polished, please wear protective clothing, protective goggles, gloves and working shoes.
2. The welded area shall be in an environment with good ventilation.
3. Before welding, please disconnect the battery and cover terminal.
4. If sparks may be produced when operation is performed near the battery, please dismantle the battery.
5. Before components of the complete vehicle are dismantled, please fix the vehicle on vehicle suspension to avoid the center of gravity of complete vehicle changes to influence operational safety.
6. Connect the grounding wire of welding equipment directly on parts for welding. Please make sure no electric conduction parts exist between grounding point and point of welding when operating.
7. Grounding wire and electric welding electrode shall not contact with electronic control unit and wire.
8. Vehicles without protection cannot stop in the maintenance area of body, because splashed sparks can cause fire and damage the painted surface and glass.
9. Please polish and weld carefully nearby the fuel tank or components with fuel. Please dismantle all components which may influence safety.
10. Do not weld, perform hard soldering and soldering on any component of air-conditioning system with refrigerant and do not weld other components which can make the temperature of components of air-conditioning system rise, because it may result in explosion of air-conditioning system. If it must be soft in the refrigerant

    If electrically welding close to the pipe, the refrigerant must be recovered; because invisible ultraviolet generated by electric welding penetrates through the refrigerant hose, the refrigerant decays.
11. When operating safety airbag system or correcting vehicle body, battery grounding wire must be disconnected ambient temperature around safety airbag part must not exceed 100℃(212 ºF).

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12.12.2.2 State of Components

Before the repaired vehicles or components are sent to the paint plant for spray paint, the surface shall be smooth and the seam shall be filled. The surface shall be polished by sand paper. The preparatory process shall be finished by metaler, The components of body and floor are mainly formed by cold stamping of steel plate. Therefore, the damaged positions caused by accidents shall be recovered through the same method. If the damaged positions cannot be recovered as original shape, please correct the adjacent position, dismantle the damaged positions and replace it according to parts integrity. Do not cut single part, because after the cutting and welding, the rigidity, travel safety and maintainability of complete vehicle will be influenced.

12.12.2.3 Description of Varieties of Welding

Common varieties of welding are spot welding, gas shield welding and brazing. Number of spots cannot be reduced when spot welding is performed. Generally speaking, when spot welding equipment cannot be performed, plug welding can be performed with gas shield welding after drilling. When spot welding is adopted for connecting three layers of plates, please replace the outer plate. The welding spot shall be placed on the original welding spot. When spot welding is performed, single row of welded seam, double rows of welded seam and double rows offset welded seam can be generated. When gas shield welding is adopted, lap welded seam, continuous welded seam and continuous welded seam (interrupted) can be generated. Brazing is usually used for welding and repairing the area with strength of extension not strong enough and low component thickness.

12.12.2.4 Anti-corrosion Treatment

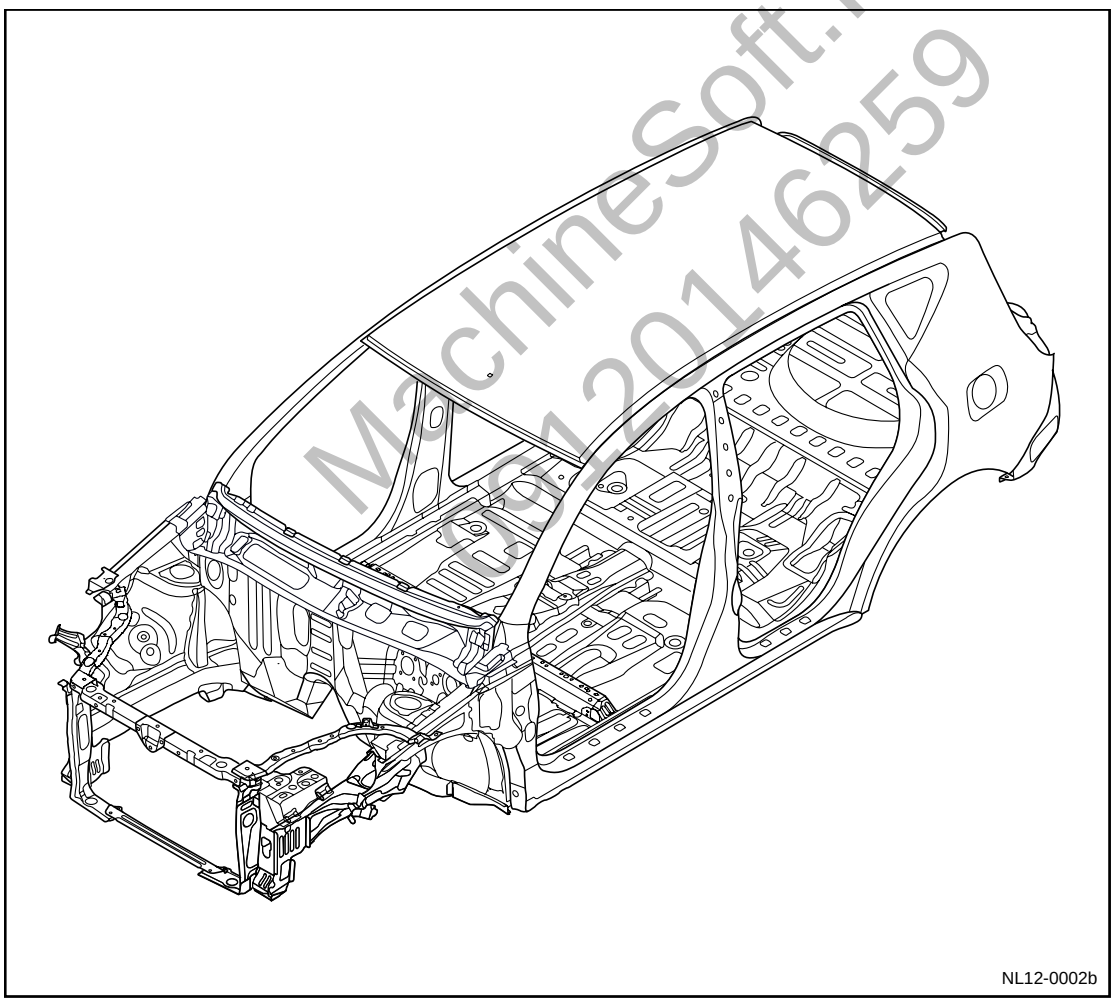
1. The standard anti-corrosive coating shall be recovered by approved materials after maintenance.
2. Before sealing, all inside and outside of welded seam shall be applied with primer.
3. Metal plates with primer shall be applied with sealant.
4. Lap metal panels, metal edges, butt-jointed welded seam and welded seam shall be sealed up with sealant.
5. The vehicle base plate shall be applied with long-acting protective agent.
6. After the finished paint is painted, please treat the cavity in the maintenance area with cavity protective materials.
7. After the cavity protective materials are dried, please clean outlet.

12.12.2.5 Environmentally Friendly Disposal Approach for Scrapped Components

1. After the maintenance for vehicle, please collect the waste materials according to their types.
2. Classify the waste materials to inspect whether they can be used again.

12.12.3 Disassemble drawings

12.12.3.1 Vehicle body assembly



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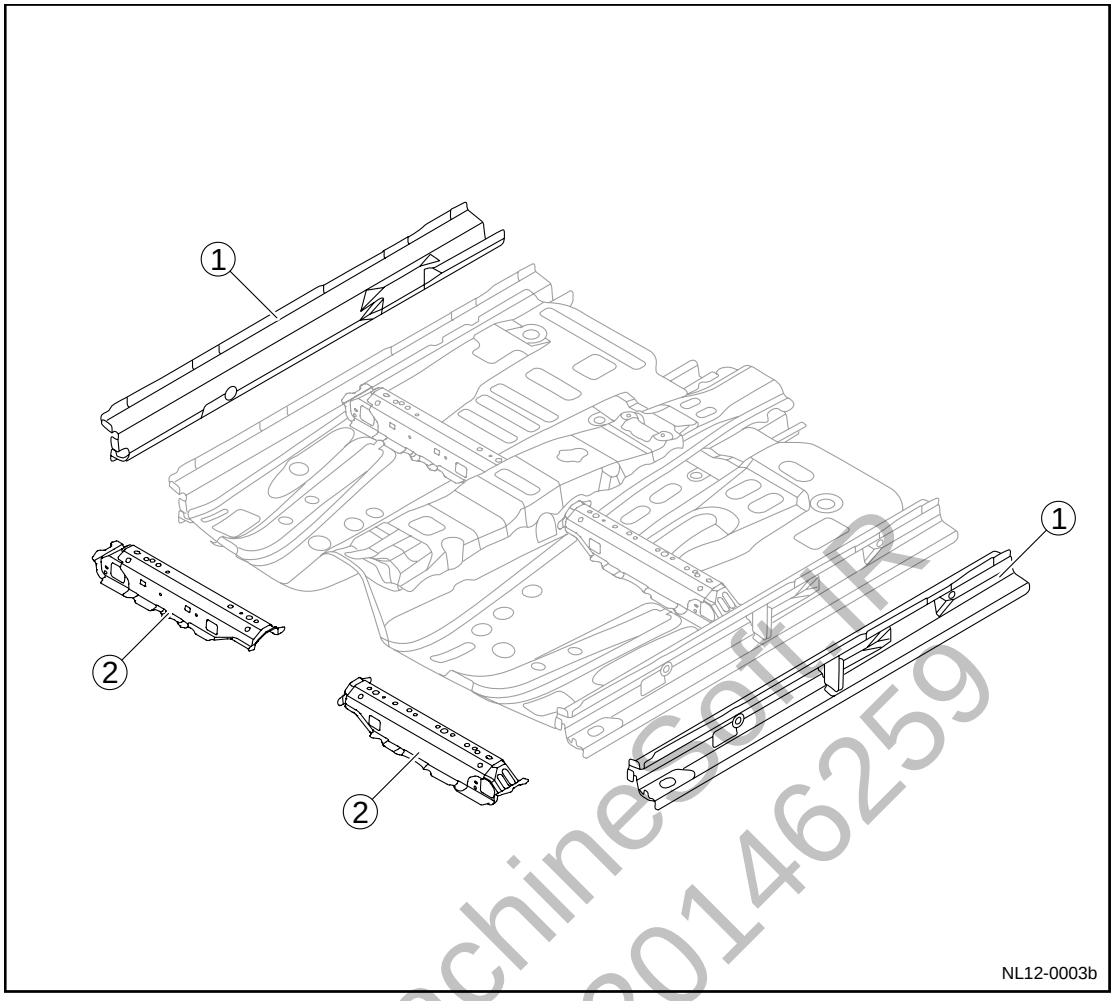
Legend

1. Vehicle body assembly

12.12.3.2 Front Floor



Legend

1. Inner plate assembly of lower boundary beam of left/right door frames
2. Front Seat (LH/RH) Mounting Cross Beam Assembly

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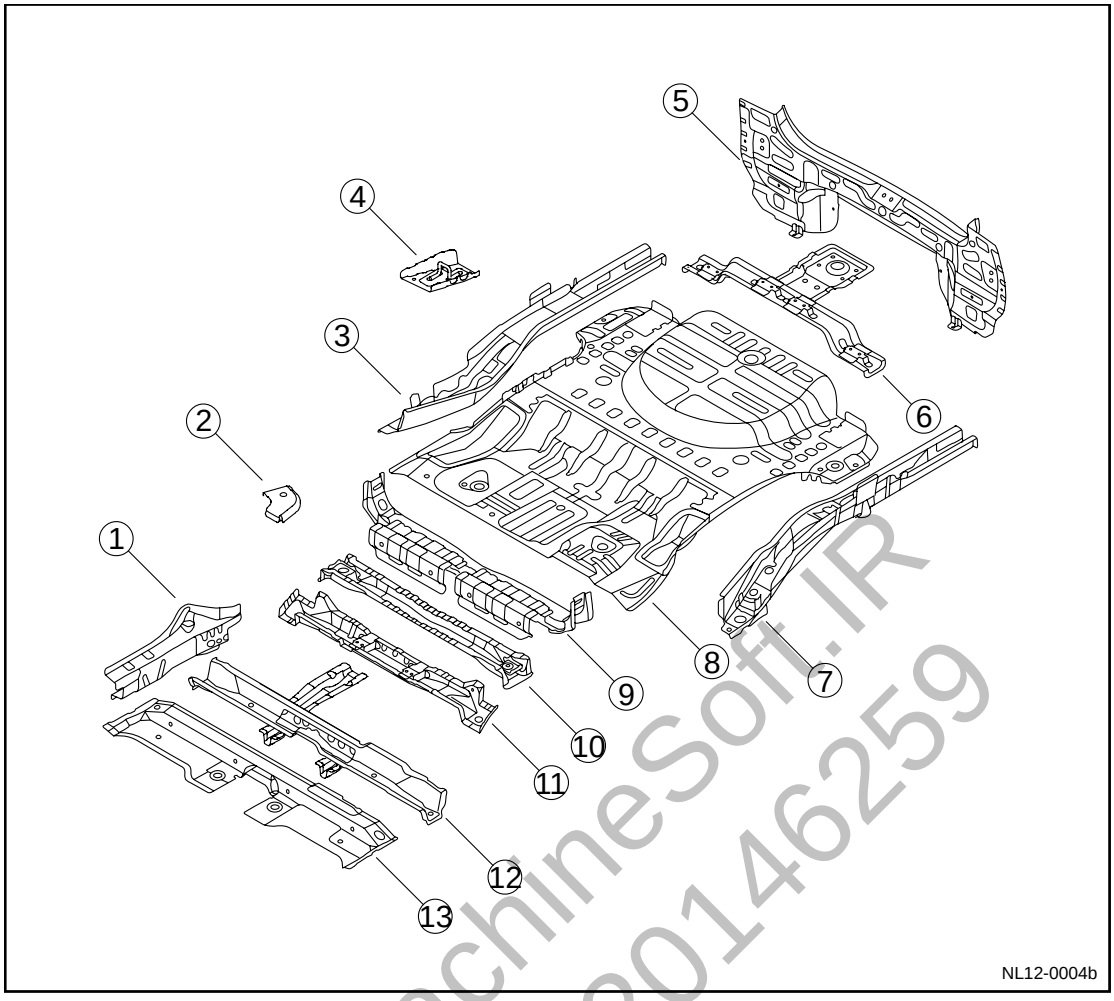
12.12.3.3 Rear floor of body



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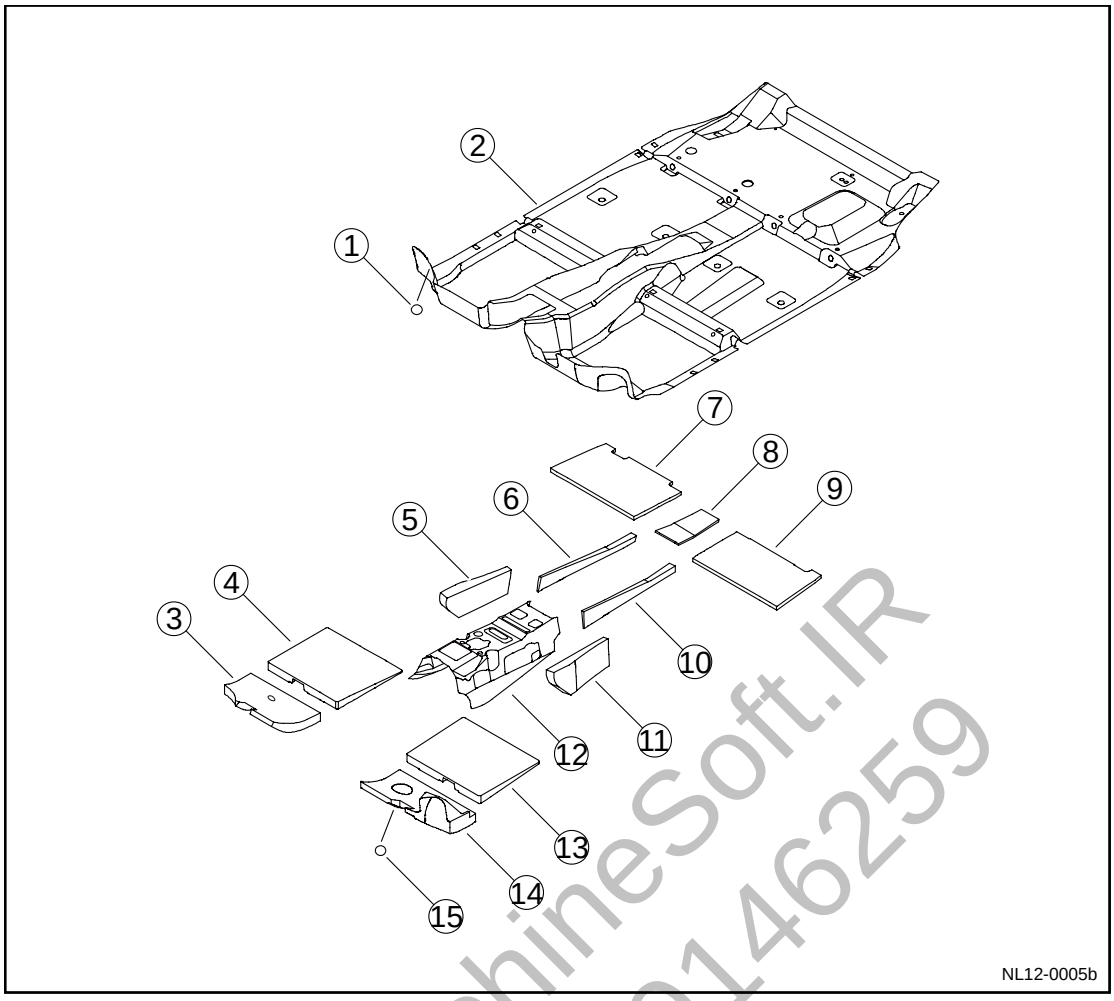
Legend

1. Front connecting plate assembly of right longitudinal beam
2. Middle row seat right middle reinforced plate assembly
3. Rear floor right side longitudinal beam
4. Right buckle assembly for intermediate seat
5. Rear wall internal panel assembly
6. Standby tire mounting beam assembly.
7. Rear floor left side longitudinal beam
8. Rear floor body assembly
9. Upper cross beam assembly of rear floor
10. Rear cross beam assembly of rear floor
11. Rear cross beam assembly of middle row seat
12. Intermediate seat front cross beam assembly
13. Middle row seat floor assembly.

12.12.3.4 Heating insulation cushion of floor



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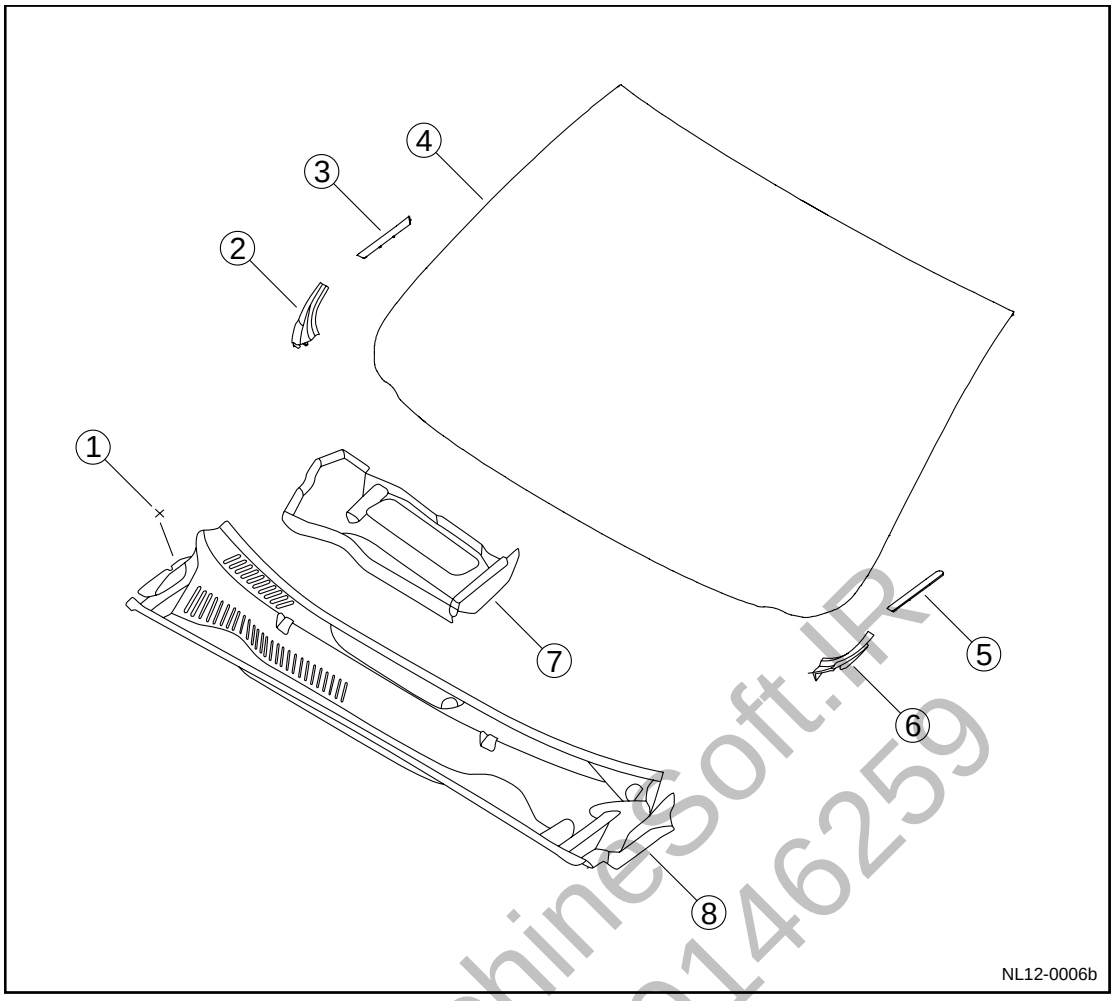
Legend

1. E -buckle
2. Rug
3. Left leg rest plate
4. Front floor left front sound insulation pad.
5. Front right soundproof pad for center channel
6. Back right carpet soundproof pad
7. Right rear tappet sound insulation cushion
8. Intermediate sound insulation cushion of center channel
9. Left rear tappet sound insulation cushion
10. Left rear side carpet sound insulating pad
11. Found insulating cushion of center channel
12. Sound insulation cushion of auxiliary instrument panel
13. Front floor left front sound insulation pad.
14. Driver's right foot pad.
15. Telescopic buckle.

12.12.3.5 Front windshield



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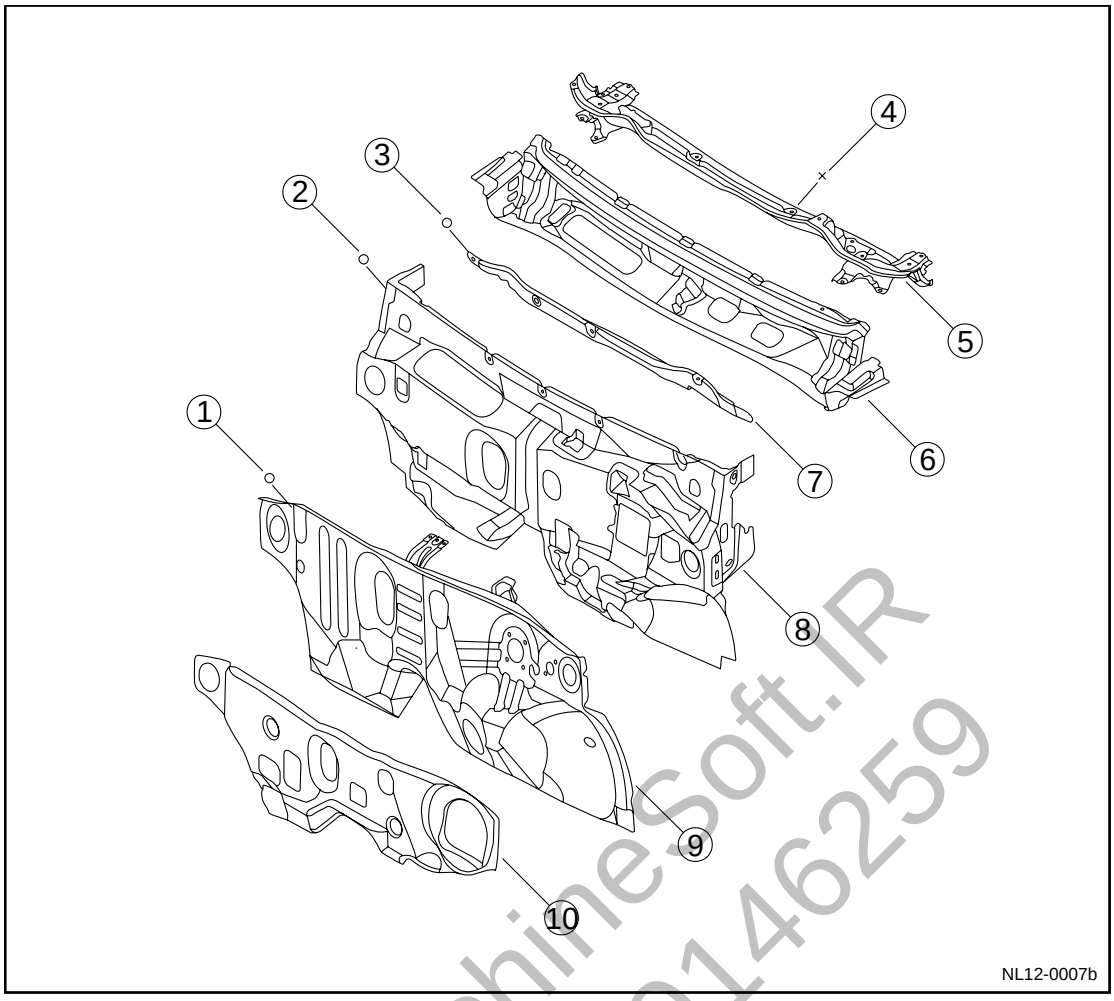
Legend

1. Recessed hexagon headed Philips bolt and flat washer combination parts.
2. Right angle trimming of vent cover plate
3. Left vent cover plate side sealing strip
4. Windshield assembly
5. Side sealing strip of left venting cover plate
6. Ventilation hood plate angle rib
7. Ventilation hood plate air inlet panel assembly
8. Ventilation hood plate assembly.

12.12.3.6 Front Panel



Legend

1. Plastic nut
2. Plastic nut
3. Plastic nut
4. Hexagonal flange bolt
5. Water-conducting main board assembly of front cabin
6. The upper part assembly of front frame
7. Front compartment water diverting plate thermal insulation pad
8. Front wall sound insulation cushion
9. Front wall lower main board assembly
10. Heating insulation cushion of front wall outer plate

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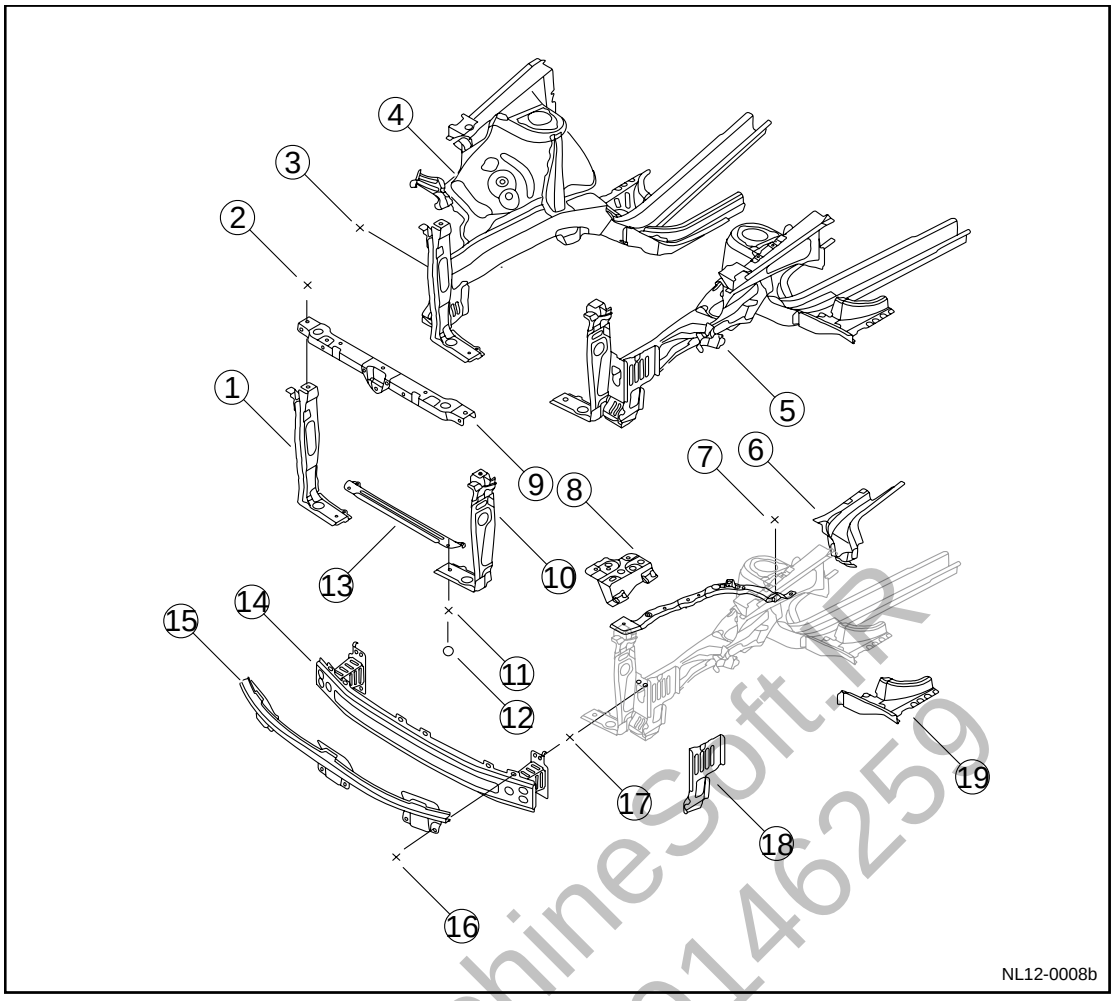
12.12.3.7 Engine cabin



Legend

1. Radiator left vertical column assembly.
2. Hexagonal flange bolt
3. Hexagonal flange bolt
4. Left longitudinal beam assembly
5. Right longitudinal beam assembly
6. Right longeron side wall limiting plate assembly
7. Hexagonal flange bolt
8. Accumulator carrier assembly
9. Upper cross beam assembly of radiator
10. Right vertical column assembly of radiator.
11. Hexagonal flange bolt
12. Flat washer
13. Lower horizontal beam of radiator.
14. Front horizontal beam lower assembly.
15. Front horizontal beam upper assembly.
16. Hexagon flange bolt and plain washer assy.
17. Hexagon flange bolt and plain washer assy.
18. Front stage side plate of left front longitudinal beam
19. Side wall limiting support of left longitudinal beam

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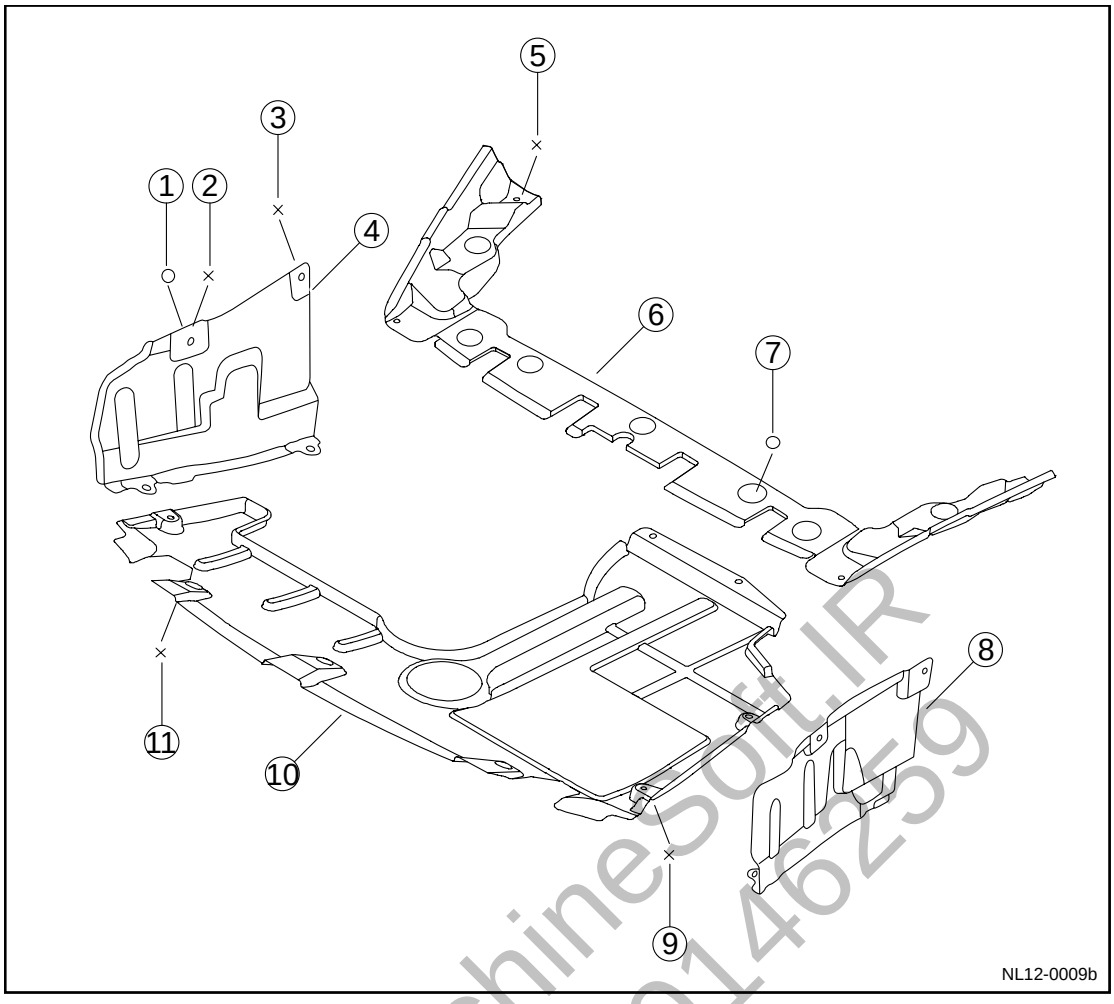
12.12.3.8 Install the engine bottom guard plate



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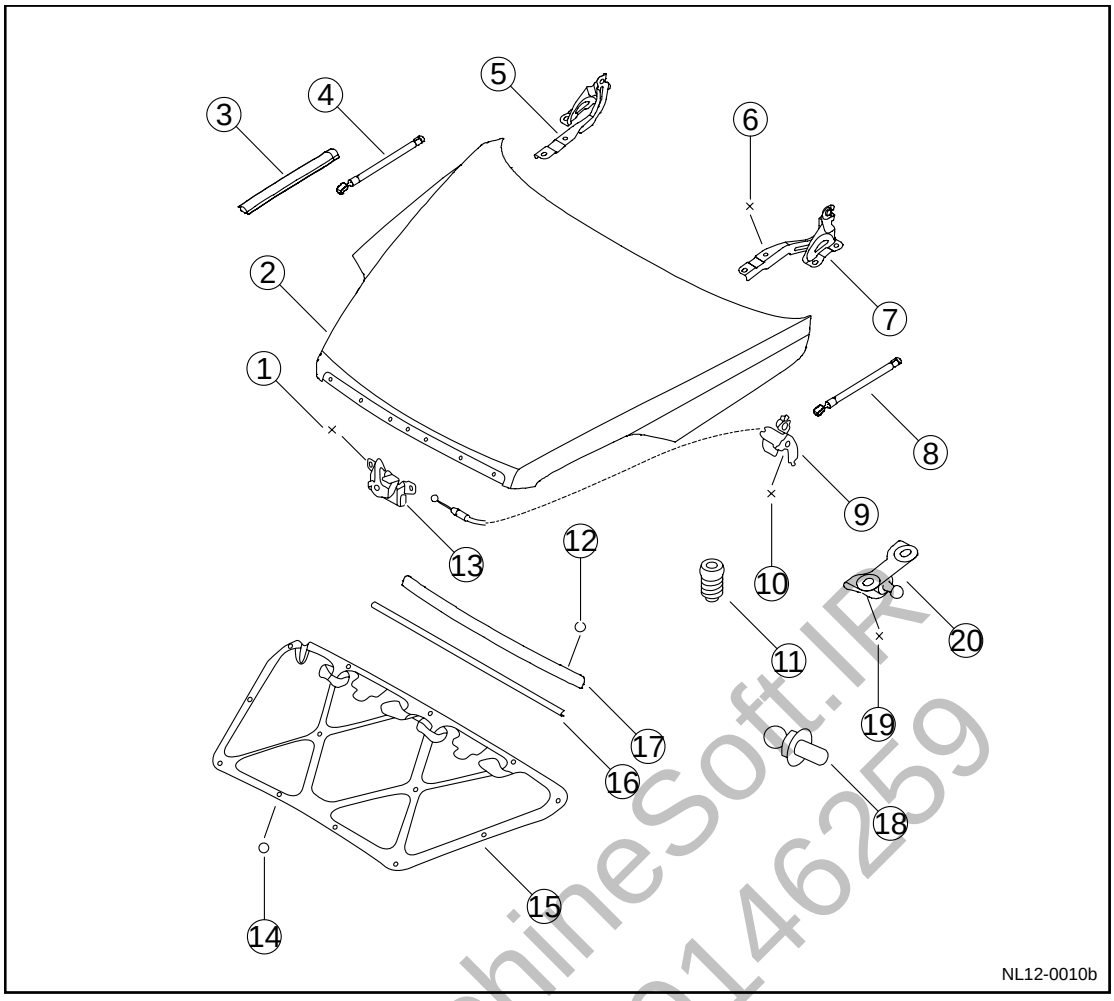
Legend

1. Closed setting-in plastic nut
2. Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly
3. Recessed hexagon headed Philips bolt and flat washer combination parts.
4. Left protective plate of the engine.
5. Recessed hexagon headed Philips bolt and flat washer combination parts.
6. Trim panel above the front bumper.
7. J-shape buckles
8. Engine right guard plate
9. Recessed hexagon headed Philips bolt and flat washer combination parts.
10. Engine button guard plate
11. Recessed hexagon headed Philips bolt and flat washer combination parts.

12.12.3.9 Engine hood



Legend

1. Hexagon flange bolt – large series - thin bar
2. Engine hood body assembly.
3. Engine compartment left side sealing strip assembly
4. Engine hood air spring assembly
5. Engine hood left hinge assembly
6. Hexagonal flange bolt
7. Engine hood right hinge assembly
8. Engine hood air spring assembly
9. Engine hood handle and control cable assembly
10. Hexagonal flange bolt
11. Bumper block φ15×35
12. Hexagon flange nuts
13. Engine hood lock assembly.
14. E -buckle
15. Hood Sound Insulation Pad
16. Sealing strip on the top of grille.
17. Engine hood trimming strip assembly
18. Air spring ball head bolt.
19. Hexagon head bolt and flat washer combination part
20. Connecting part of gas spring

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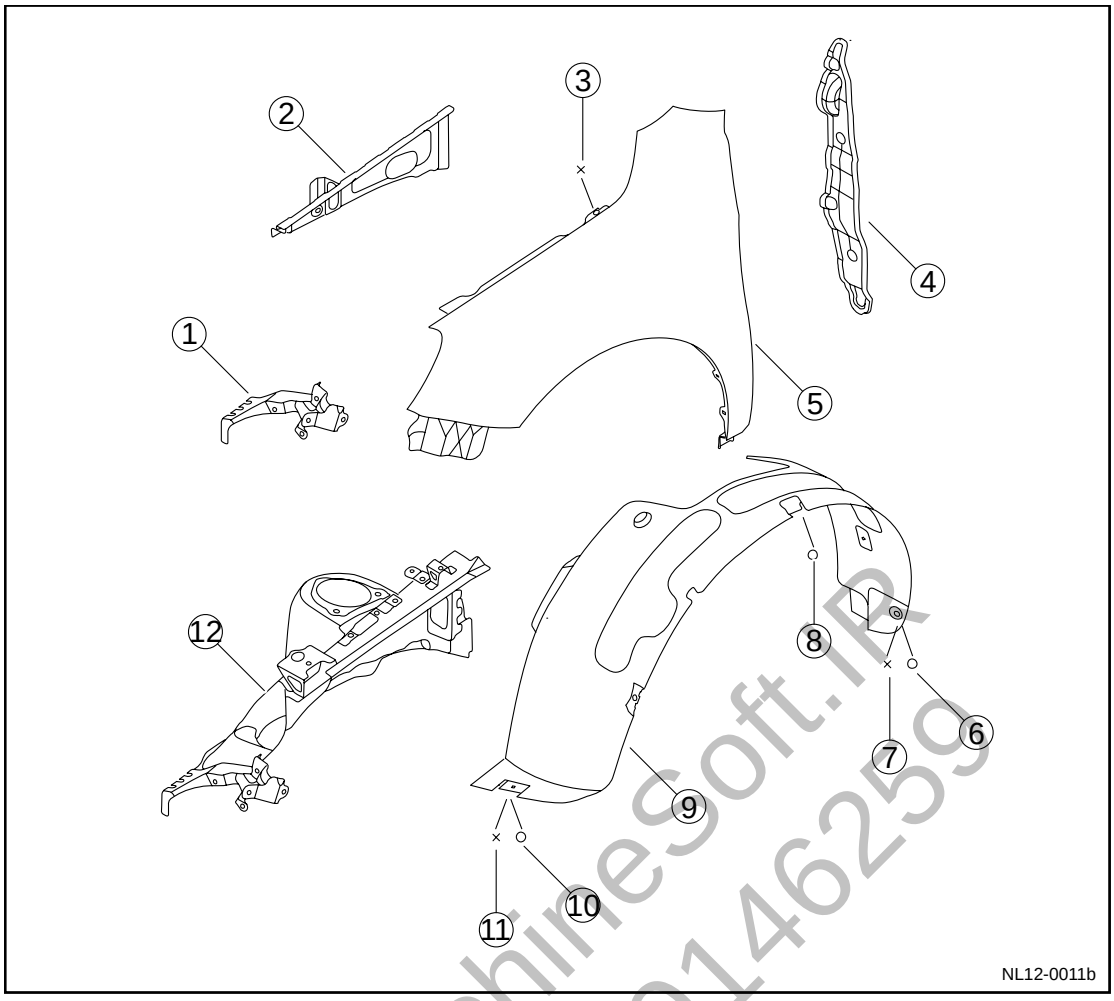
12.12.3.10 Front Fender



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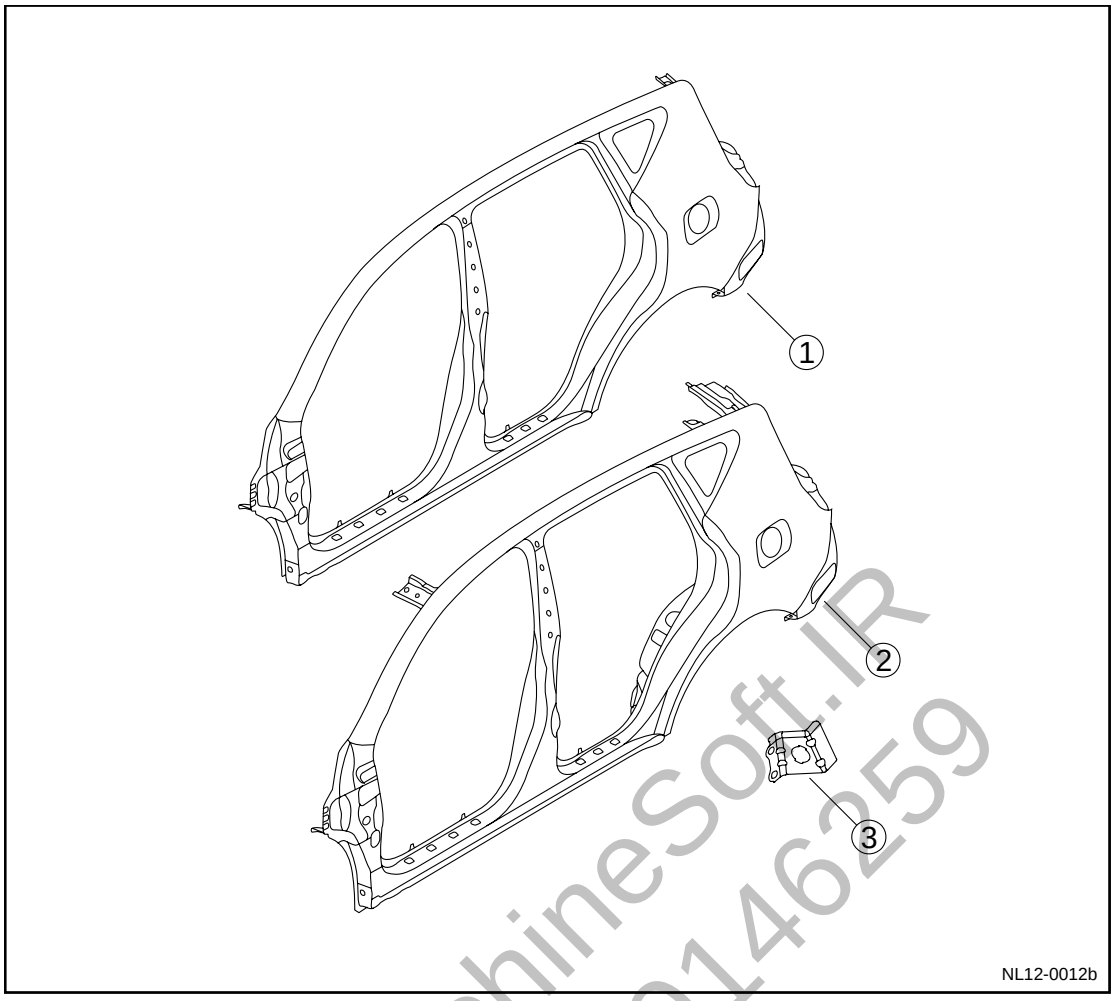
Legend

1. Main plate front stage assembly of left/right front shock absorber
2. Outer plate assembly of left /Right boundary beam
3. Hexagonal flange bolt
4. Left/right front fender wind screens
5. Left/right fender
6. Closed setting-in plastic nut
7. Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly
8. G clip
9. Left /right front fender lining plate
10. Closed setting-in plastic nut
11. Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly
12. Left /right front shock absorber frame assembly

12.12.3.11 Side frame



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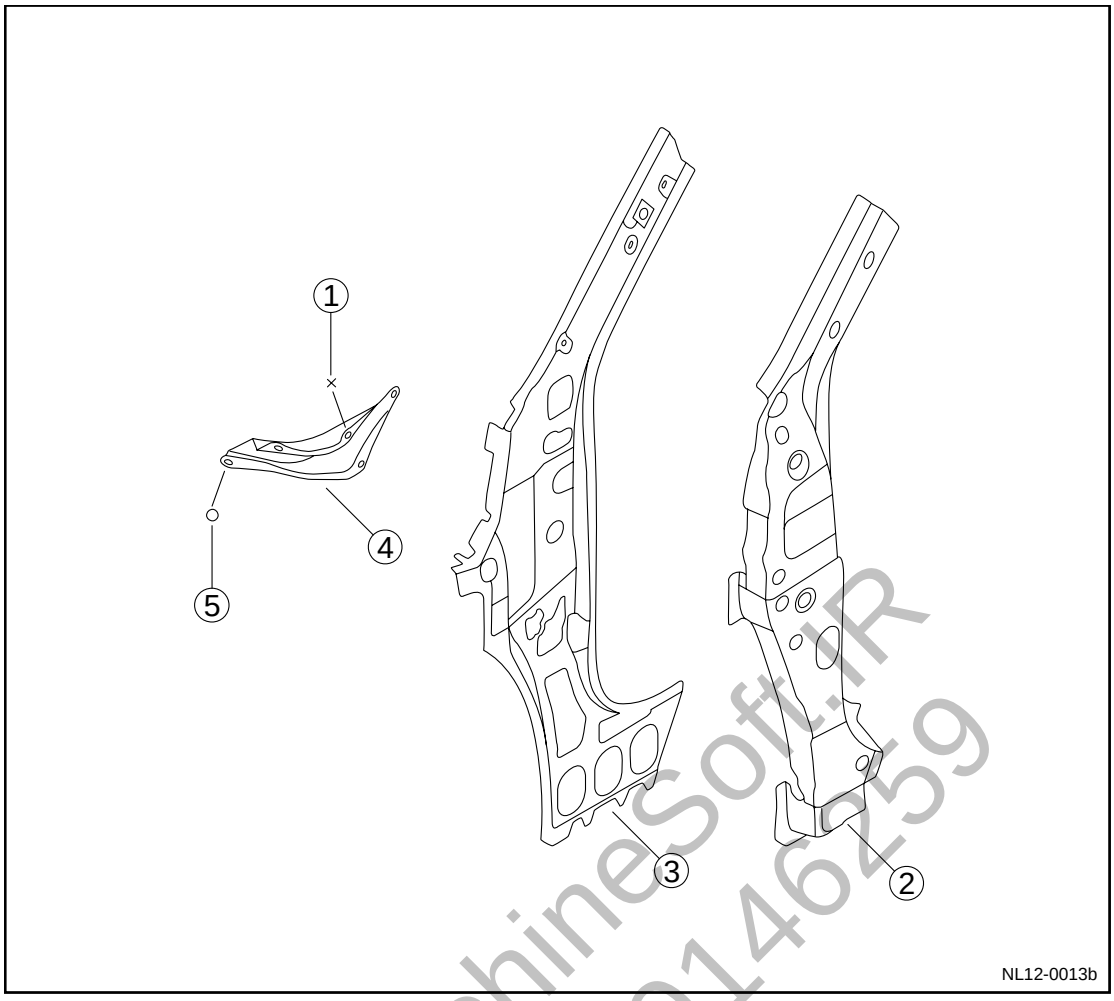
Legend

1. Left/right side frame outer plate subassembly
2. Left/Right side wall assembly
3. Filler cover latch plate

12.12.3.12 Front post of body



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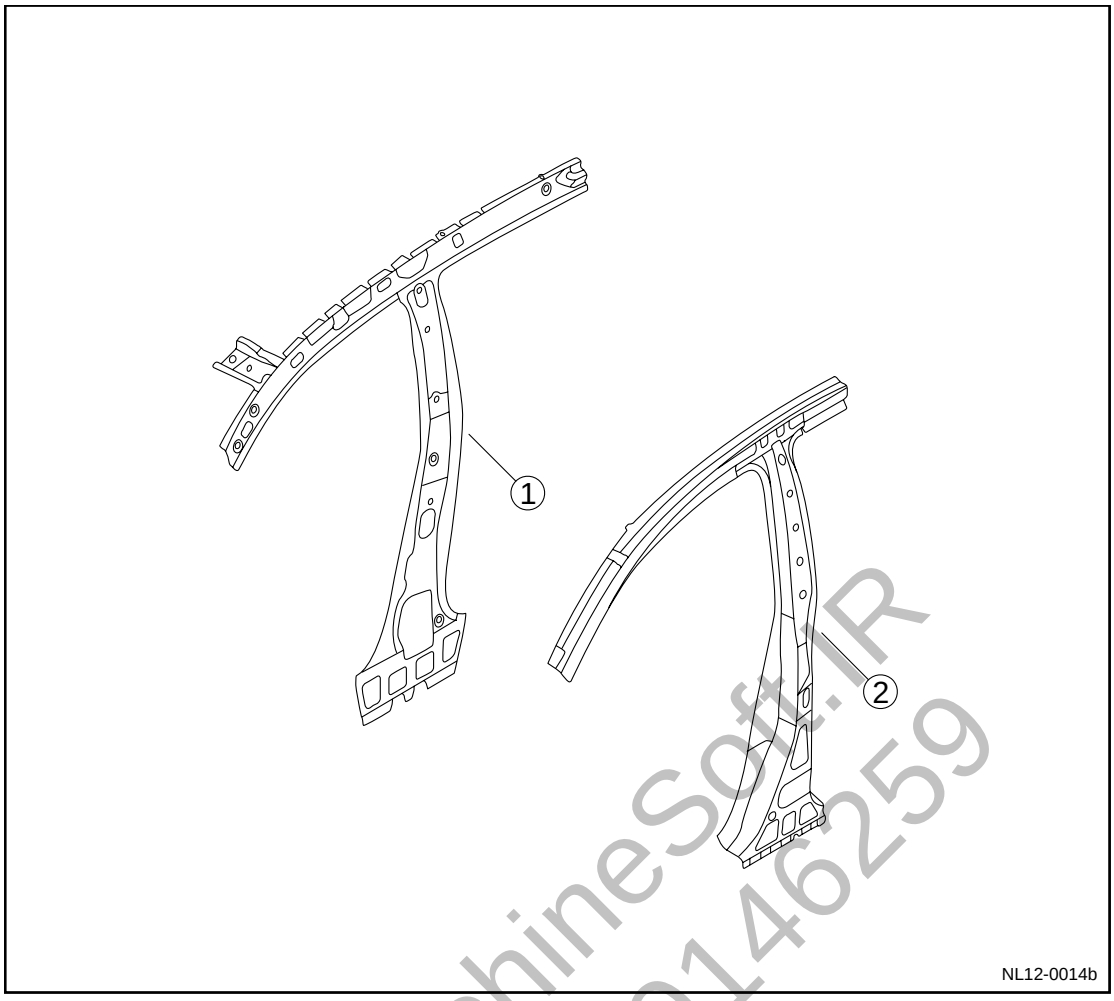
Legend

1. Hexagonal flange bolt
2. Left front /right front post reinforce plate assembly
3. Left front /right front post inner plate assembly
4. Left/right connecting panel assembly for front wall frame.
5. Hexagon flange nuts

12.12.3.13 Intermediate post of body



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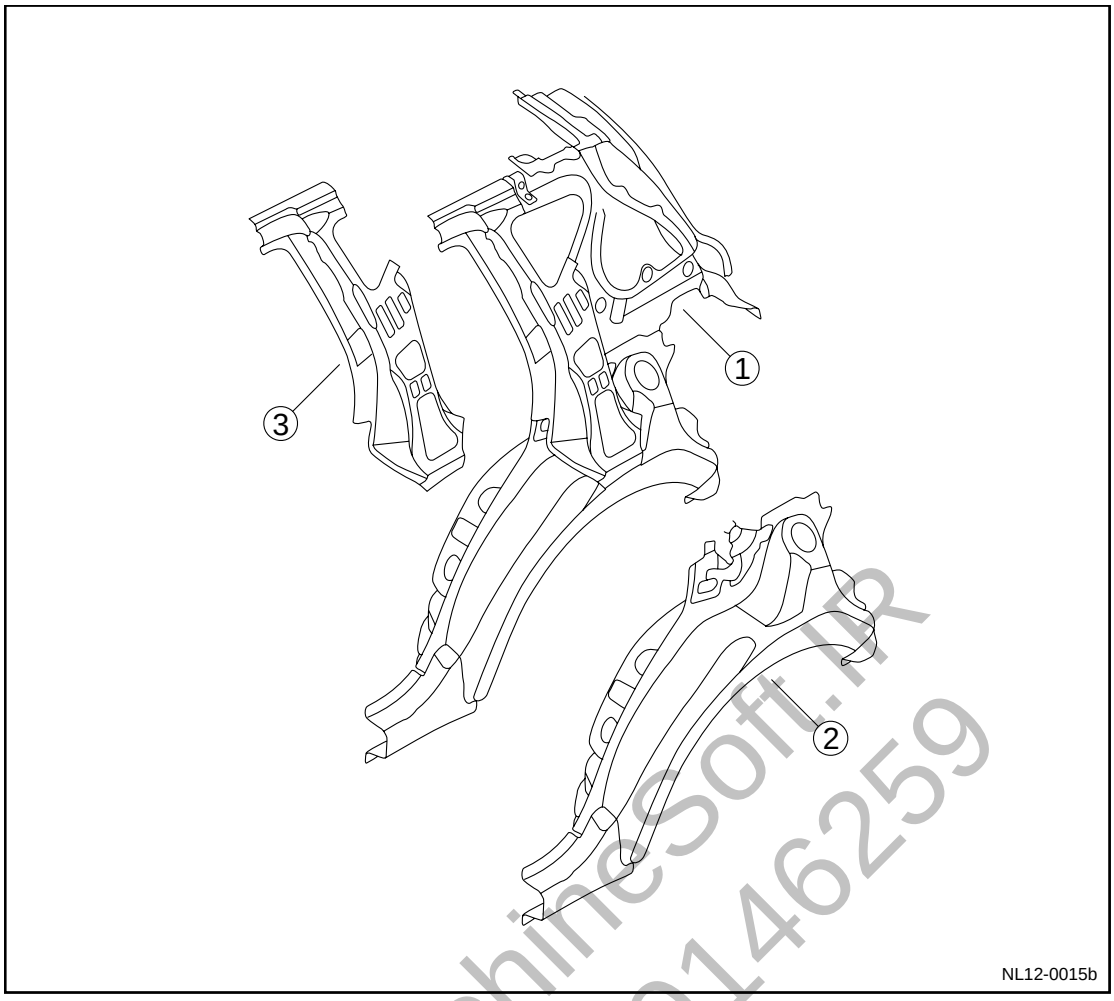
Legend

1. Left/Right intermediate post interior plate assembly
2. Left /right intermediate post reinforce plate assembly

12.12.3.14 Rear post of body



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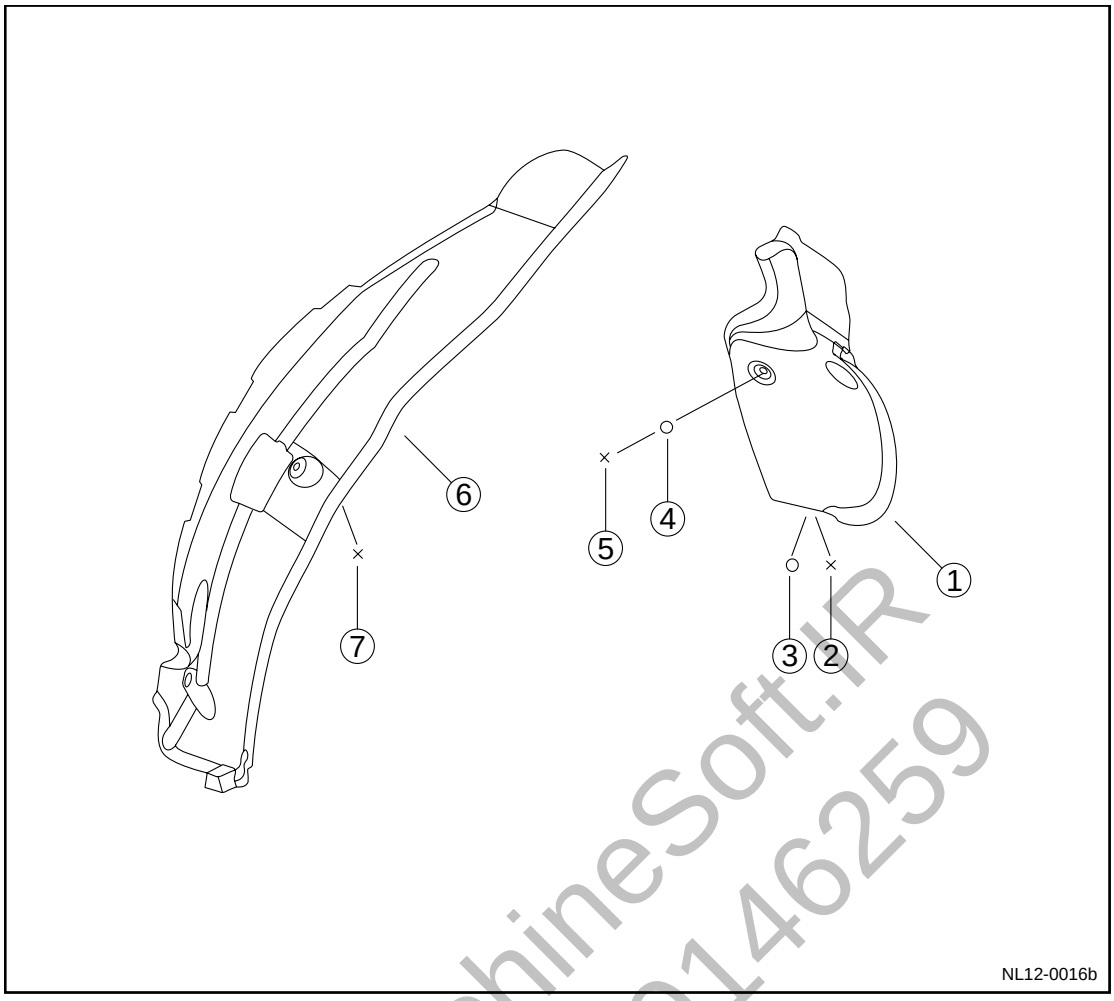
Legend

1. Left/right rear wheel cowl assembly
2. Left/right rear wheel cowl sub-assembly
3. Left/right rear post reinforcement assembly

12.12.3.15 Rear mud guard



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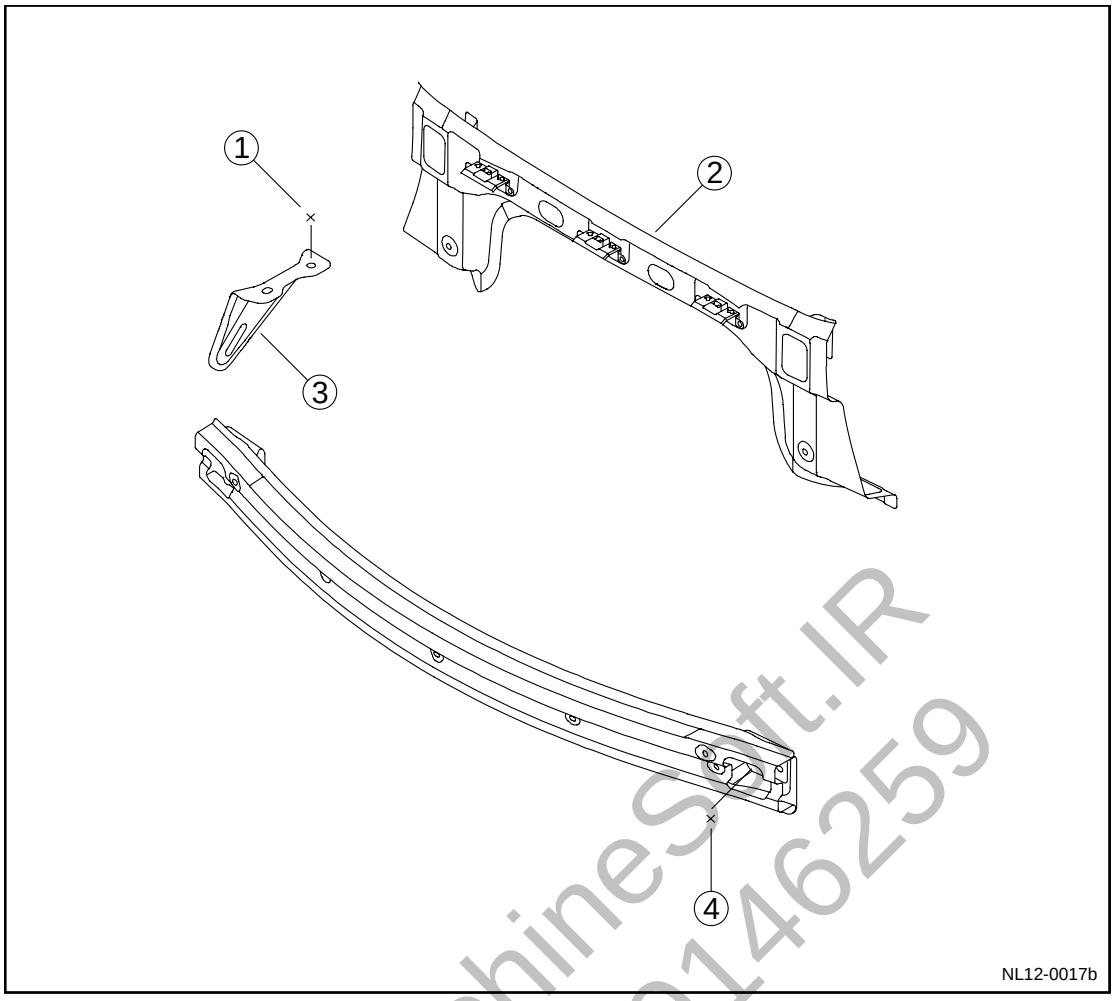
Legend

1. Left/right rear fender lining plate
2. Cross recessed hexagonal self-tapping screw and plain washer assemblies.
3. Plastic spring piece nut.
4. Closed setting-in plastic nut
5. Cross recessed cavity hexagon head self-tapping screw and big flat washer assembly
6. Recessed hexagon headed Philips bolt and flat washer combination parts.
7. Left rear wheel pipe guard plate

12.12.3.16 Rear wall



Legend

1. Hexagon head bolt and flat washer combination part
2. Pull out plate assembly of rear wall
3. Rear hook
4. Hexagon flange bolt and plain washer assy.

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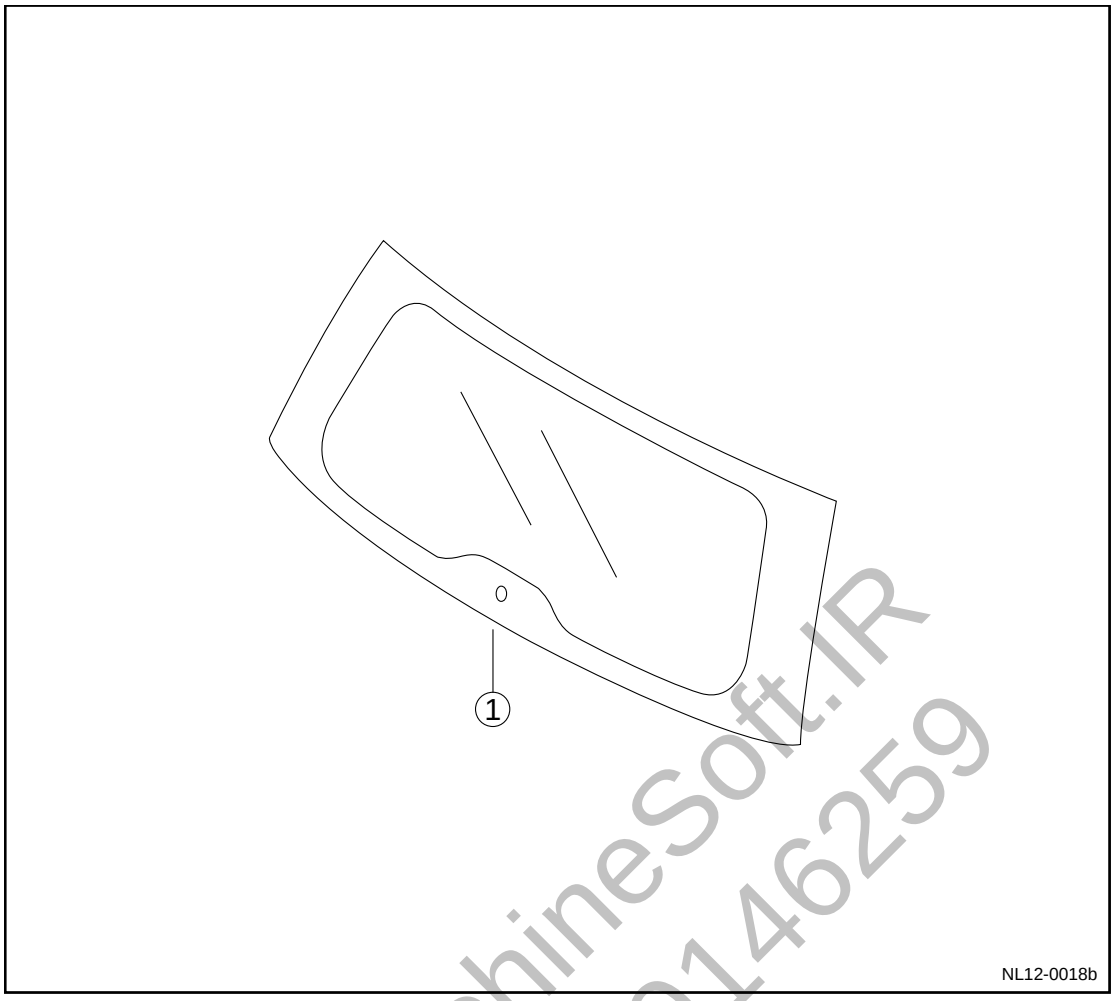
12.12.3.17 Back-door glass



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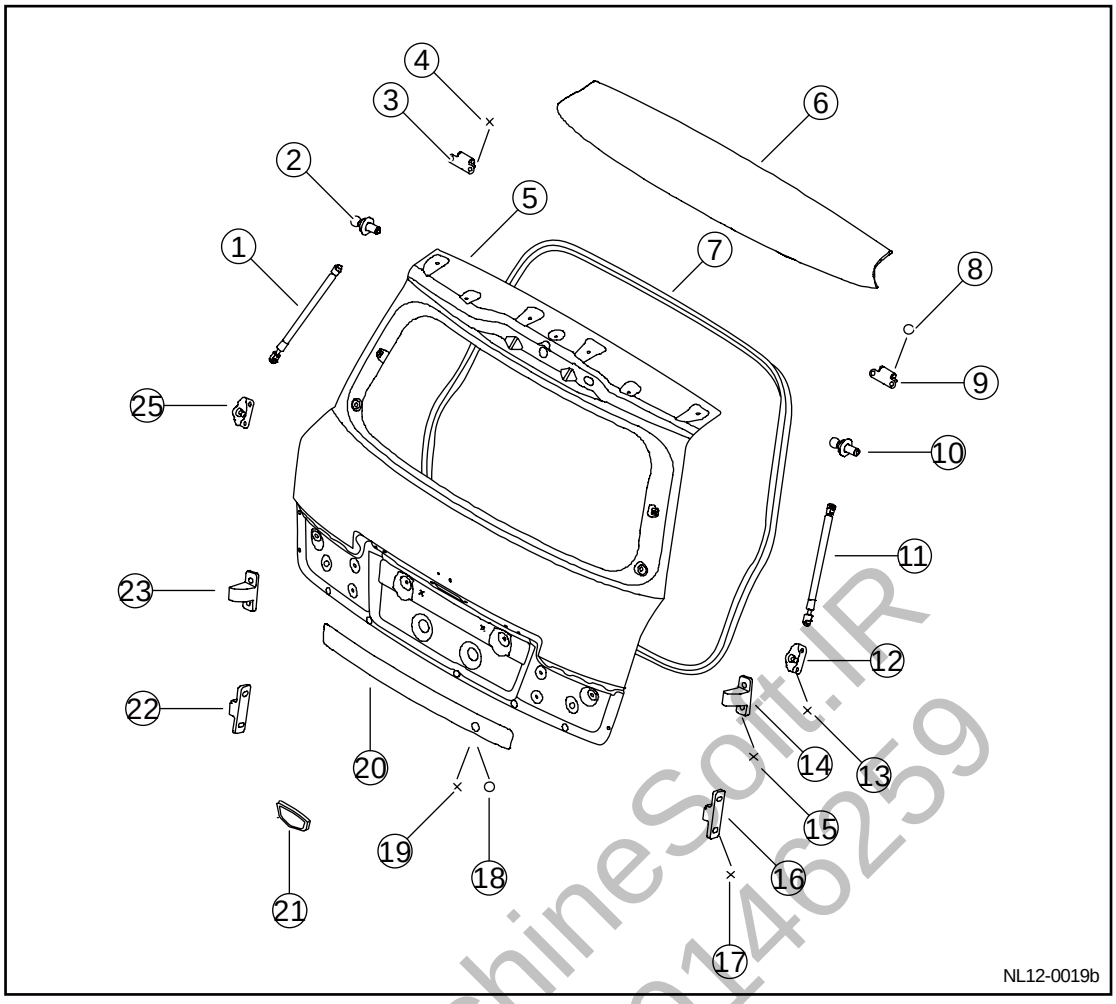
Legend

1. Back door glass/ back door glass assembly/ back door glass assembly (green heat insulation glass)

12.12.3.18 Back-door



Legend

1. Back door left air spring assembly.
2. Air spring ball head bolt.
3. Back door hinge assembly
4. Hexagonal flange bolt
5. Back door body assembly.
6. Rear spoiler assembly
7. Back door sealing strip
8. Hexagon flange nuts
9. Back door hinge assembly
10. Air spring ball head bolt.
11. Right gas spring assembly of back-door assembly
12. Connecting part of gas spring
13. Hexagon head bolt and flat washer combination part
22. Bumper block 68.7×20×35
15. Hexagon head bolt and flat washer combination part
22. Bumper block 66.8×20×12.5
17. Hexagon flange bolt and plain washer assy.
18. Hexagon flange nuts
19. Square-head bolt
20. Back-door trim plate (with camera)
21. Logo (Gleagle)
22. Bumper block 66.8×20×12.5
23. Bumper block 68.7×20×35
24. Connecting part of gas spring

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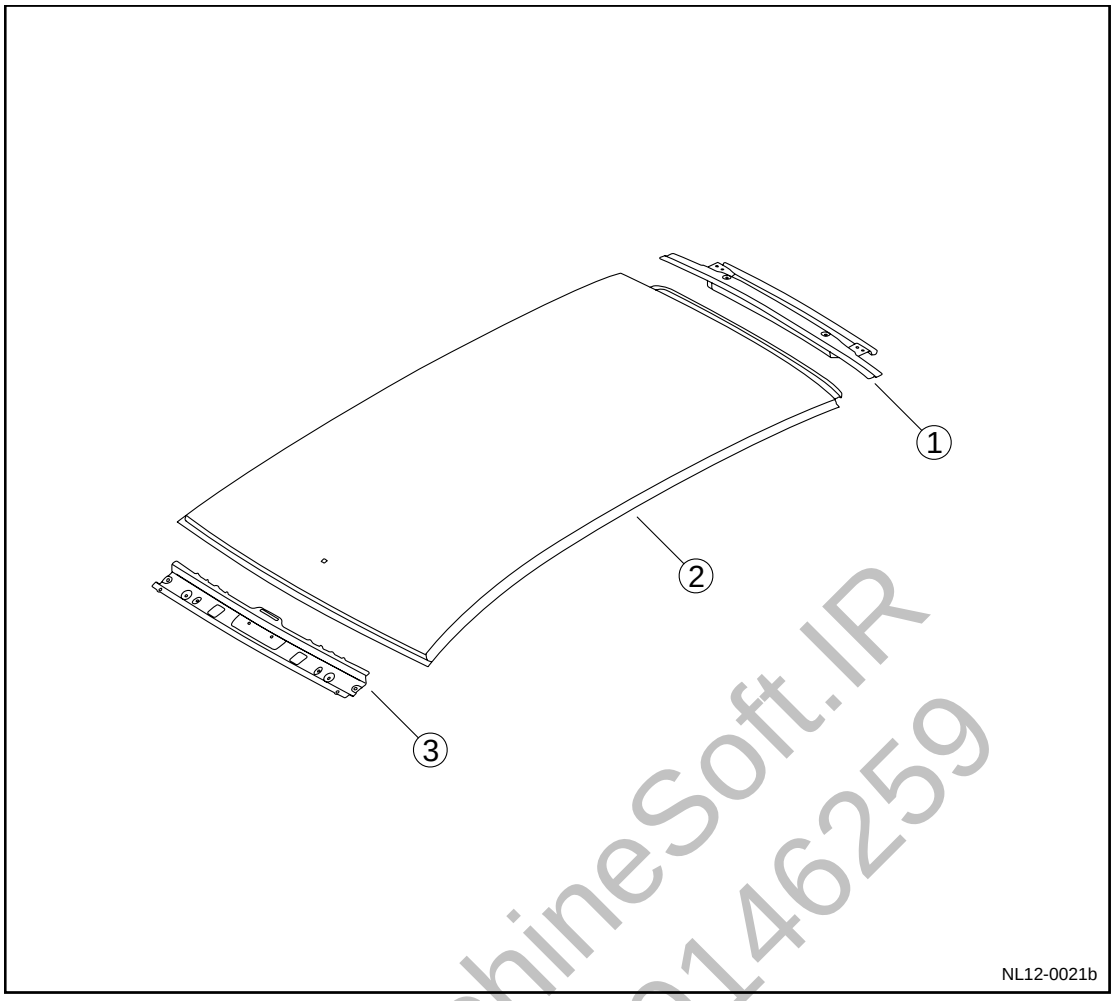
12.12.3.19 Roof



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Legend

1. Rear cross beam assembly of roof
2. Roof assembly
3. Front cross beam assembly of roof

12.12.4 Diagnostic Information and Procedures

12.12.4.1 Diagnostic Information and Procedures

Diagnosis of accident vehicle

During the process of repairing body, professional technicians use cross beam instrument calibration, electronic measurement system, sheet metal repair machine, welder and various polishing and cutting tools to make sure that vehicle's geometric dimensioning and service characters can be recovered to the level of original vehicle. But when accident vehicle is repaired, fault about drive system and assembly suspension which can result in serious results cannot be found. Therefore, in addition of necessary inspection of geometric dimensioning of body, please pay much attention to the following components:

- Inspect and make sure the steering mechanism and steering gear system can be correctly operated in the range of the number of the turning circles of steering wheel. Perform visual inspection to see whether there are curved parts or parts with crack.
- Inspect whether all components in running gear (for example, forked pipe/trailing arm, slide arm of suspension, steering knuckle, horizontal stabilizer bar, frame and suspension) are curved, distorted and crack.
- Inspect whether wheels and tires are damaged. Concentric rotation and unbalanced. Inspect whether incision exists in tire tread and tire wall and inspect the tire pressure.
- Inspect whether the engine/transmission/exhaust system suspension are damaged.
- Road test is performed to guarantee vehicle running capacity. Finally, hand the vehicle over to the user.

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12.12.5 Dismantlement and Installation

12.12.5.1 Dismantlement and Installation

Notes:

Before replacing the key components of body, please correct the body with common body alignment bracket and then determine which damaged components are needed to be replaced. Before welding, please locate the components correctly and then measure them. After components are up to the vehicle size, please begin to weld. During the process of welding, please measure usually to guarantee correct assembling.

Before dismantling, please understand the assembly and welded relation between sheet metals of body.

Please refer to the following "Figure of Sheet Metal Components of Body". Do not cut single part, because after the cutting and welding, the rigidity, travel safety and maintainability of complete vehicle will be influenced.

Dismantlement Procedure

1. Dismantle all sheet metals and components related to the replaced components.
2. If necessary, clear away the sealant and anti-corrosive materials.
3. Locate, mark and drill all welding spots connecting components which will be replaced.
4. Dismantle damaged components which will be replaced.
5. Remove the residual materials.

Installation Procedure:

1. If necessary, please perform pretreatment to coordinate the surface.
2. Select correct welding method according to welding form of the original model. For the place in which it is not convenient to perform electric resistance welding, please use shield welding. If plug welding is selected, please drill bore for plug weld and determine the plug welding bore diameter and interval according to the original welding spots.
3. Temporarily put new parts on the vehicle.
4. Assemble and fix new components with correction support (correctly locate maintenance panel).
5. Usually measure the position of new parts to guarantee correct assembling dimension.
6. Perform corresponding welding.
7. Clean all welded surfaces.
8. Spray the primer.
9. If necessary, please spray sealant and anti-corrosive materials.
10. Install all relevant plates and components.

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12.13 Paint/Coatings

12.13.1 Specifications

12.13.1.1 Specifications

See Technical Specifications as Provided by Material Supplier.

12.13.2 Description and operation

12.13.2.1 Paint Coating Description

Paint is a liquid mixture. It can be used in a variety of substrates. After the paint is dry, it will form a solid film to protect the substrate and make the exterior more appealing. Vehicles from the factory will already have the following four spraying paint, so the vehicle body skins will be corrosion resistant and shining.

1. Electrophoresis Primer
2. Middle Paint
3. Color Paint
4. Lacquer (Transparent Outer Coating)

Main Functions of Electrophoresis Primer:

1. Dust--proof
2. Enhancing Adhesion with Workpieces
3. Providing Limited Filling

Functions of Middle Paint:

1. Filling
2. Isolation/Sealing
3. Foil Color Paint

Main function of color paint:

1. Adding color
2. Give luster.

Functions of clear lacquer:

The clear lacquer is located at the outermost layer of the entire paint, with several major roles as follows:

1. Containing anti-UV materials and resistant to the sun's ultraviolet rays.
2. Resistant to environmental dust (acid rain) on the painted surfaces.
3. Make the paint surface have friction effect.
4. Provide better luster.

The requirement for spraying paint is to restore the repaired parts to the original conditions. In the repair process, you must strictly follow the Spray Paint Process in the manufacturer’s instructions. Please refer to the 12.13.4.4 Spray Paint Process of Rigid Surface.

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12.13.2.2 Routine Vehicle Paint Maintenance

When carrying out the routine maintenance of the vehicle paint, please abide by the following principles:

1. During vehicle repair and maintenance, pay attention not to touch vehicle paint with dirty hands or clean paint surface with oil cloth. Do not use oil stained tool or cloth with organic solvent to clean vehicle body, to avoid chemical reaction.

2. If there is no obvious cracks on paint surface, do not smear the second coat of paint, to prevent mismatching of paint color or bad cohesion.

3. When vehicle stops for a long time, it is necessary to stop the vehicle in garage or well-ventilated place. In winter, use special vehicle body shield to cover it. Choose a shady place when parking temporarily.

4. Avoid strong impact, bump and crack to paint film of vehicle body. Such as paint injures, depression or shedding should be repaired timely. It would be best to repair in the maintenance station authorized by Geely.

5. Wash the body trims with good quality washing agent. Do not apply excessively heavy force when applying wax to avoid the paint from being penetrated with original surface exposed. Timely clean certain special corrosive traces (such as asphalt, bird droppings and insects, etc.). Hereto,

   A special cleaning agent should be used for cleaning; the blade can not be used for scrapping or gasoline can not be used for eliminating at will in order to avoid from damaging the paint surface.

6. Prior to, during and after use of the vehicle, remove dust on the body in time and minimize the absorption of the dust by the static electricity on the body.

7. Wash in time after rain. After rain, the rain stains on the body will be gradually reduced, and the concentration of the acidic material in rain will be gradually increased. If no washing the rain stains through clear water as soon as possible, the finish paint may be damaged over time.

8. The vehicle shall be washed after the engine has been cooled down. Do not wash the vehicle under burning sun or high temperature to avoid cleaning agent from being dried, which will leave a mark. When cleaning the vehicle by oneself usually, the special detergent shall be used. Do not use alkaline washing powder, soap water and detergent.

   In order to avoid from washing the grease in the paint surface to speed up the paint surface aging. If cleaning the vehicle in a vehicle washing station, prevent the vehicle washer from using dewaxing detergent in order to avoid from damaging the paint surface. The vehicle, particularly driving in coastal or polluted areas, shall adhere to be flushed once a day.

9. Use clean and soft cleaning cloth or sponge to wipe and wash the vehicle. Prevent metallic filing and sand particles from being mixed into it. To avoid markings, do not wipe the vehicle with dry cloth, towel or sponge. During wiping, slightly wipe the surface from top to bottom along the water flowing direction and do not make circle and

   Transverse wipe .

10. Irregularly conduct protection by applying wax on the painting surface and regularly (once a quarter) go to Geely authorized repair station to maintain vehicle, and timely recover polishness of vehicle painting surface. In addition to this, you can also paste with vehicle painting surface protective membrane. 3M paint surface protective film (rhinoceros skin)

    Colorless transparent paint protecting film has superior toughness. Be capable of protecting the paint surface of body bumper, engine hood, front and rear doors and rearview mirror, etc. to prevent the paint surface from being slightly collided, resulting in scratching paint.

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12.13.2.3 Warnings and Precautions in the Paint Mixing and Spray Paint Operations

Warning!

In the paint mixing and spray paint process, the solvent vapor can cause severe respiratory diseases. The manufacturer's operation instructions for paint, equipment and safety devices must be strictly followed. To carry out the operation, the technician should wear special labor protection supplies, such as gas masks, anti-static clothing, protective goggles and gloves, to prevent injury.

Notes:

Do not use different manufacturers' paint and replacement products together. Mixing incompatible products will cause the following:

1. Primer layer peels.
2. Poor bonding between different layers of coating.
3. Cure insufficiently.
4. Reduced gloss.
5. Poor color accuracy.
6. Coating damage (pits, bubbles, orange peel-like tarnish).

12.13.2.4 Precautions on Clear Coats Repair and Maintenance

Notes:

1. Avoid washing the vehicle in direct sunlight.
2. Avoid using strong soaps and chemical detergents.
3. Use brush-less automatic car wash equipment.
4. Avoid using acid and alkali products.
5. Do not use a brush or a broom to clear snow or ice.
6. After thoroughly cleaning, immediately wipe clean water stains. Do not leave the water stains dry on the surface. It is recommended to use soft chamois leather to wipe the surface dry.
7. When the defects on the surface can be eliminated by polishing, polish the vehicle body.
8. If the surface conditions are not serious, the repair area should be kept as small as possible.
9. Avoid applying excessive lacquer, as it may lead to paint premature damage.
10. Strictly follow the polishing equipment manufacturer's recommendations when using electric polishing equipment, Do not use wax or silicone products to cover a swirl mark (it will soon be revealed and lead to customer's complaint).

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12.13.2.5 Precautions on Anti-corrosion Treatment

Notes:

1. When spraying sound insulation or anti-corrosion material, you must take preventive measures to avoid spraying into the open components (such as door locks, window lifting groove, window regulator and seat safety belt retractor), any moving parts, rotating parts, especially the parking brake pull cable. After spraying, make sure of opening all the body discharge holes.
2. When repairing body with a naked flame, you must remove the foam insulation materials in the maintenance area. Re-install sound insulation material to avoid inhaling harmful dust.
3. When carrying out this operation, you should wear special protective goggles and gloves to prevent personal injury.
4. Before the vehicle leaves the factory, the electro-coating paint has been carried out on the sheet metal panel of body. After repair and/or replacement, all exposed metal surfaces must be treated with anti-rust primer.
5. If during the welding or heating operation, the original coatings or anti-corrosion materials are burnt, the surfaces must be cleaned and treated with anti-corrosion materials.
6. Collision maintenance will expose metal panels, so these metal surfaces must be applied with special anti-corrosion materials.
7. The sealant can prevent water and dust entering the vehicle, and it also has a function of anti-corrosion. The original sealed joints are apparent. If they are damaged, they should be corrected by re-sealing. The new joint of the replaced plate should be re-sealed. The sealant must maintain flexibility after curing and painting. Openings joints should be filled with high viscosity filler. Apply it according to instructions for selected material.
8. Insulation materials can control the general noise level inside the vehicle. When the insulator is damaged during repair or replacement of new plates, replace it with the same material.

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12.13.3 Diagnostic information and procedures

12.13.3.1 Common Defects Example and Treatment for Paint Surface

Notes:

Making the box in the table black indicates the treatment for this defect.

Description	Formation causes	Treatment
Powder	The paint film is eroded strongly. Such as strong ultraviolet ray, paint ratio during construction is wrong. Coating has low resistance to sun and bad weather. Vehicle cleaning is not regular or thorough. Incorrect choice of cleaning agents or too coarse polishing wax.	1. Polishing Treatment. □ 2. Conventional grind and polishing treatment. □ 3. Treated with deep grinding, polishing and modification. □ 4. Partial paint repair. ■
Plastic Paint Peeling	Poor adhesion between the coating and the substrate or outer coating is too hard relative to under coating. Coating is too thick or erosions are caused by water vapor, acid and alkali in the air. Under coating is treated incorrectly; there are pinholes and defects in the outer paint.	1. Polishing Treatment. □ 2. Conventional grind and polishing treatment. □ 3. Treated with deep grinding, polishing and modification. □ 4. Partial paint repair. ■
Cracking	Primer is inadequately stirred prior to spraying. Base coating is too thick. Middle coating is too thick.	1. Polishing Treatment. □ 2. Conventional grind and polishing treatment. □ 3. Treated with deep grinding, polishing and modification. □ 4. Partial paint repair. ■
Bird Droppings Erosion	1. Erosion by bird manure dropping.	1. Polishing treatment (mild erosion). ■ 2. Conventional grind and polishing treatment (medium erosion). ■ 3. Treated with deep grinding, polishing and modification. □ 4. Partial paint repair (severe erosion). ■
Scratch	Film with low hardness. Scratch caused by hard objects.	1. Polishing treatment (minor scratches). ■ 2. Conventional grind and polishing treatment (thick scarring). ■ 3. Treated with deep grinding, polishing and modification. □

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		4. Partial paint repair (scratched). ■
Corrosion	Thin film of edges. Corrosion caused by hurt generated by knocks. Acid and alkali erosion.	1. Polishing Treatment. □ 2. Conventional grind and polishing treatment. □ 3. Treated with deep grinding, polishing and modification. □ 4. Partial paint repair (serious rusted metals need to be repaired before painting). ■
Paint Peeling	Poor adhesion between the coating and the substrate or outer coating is too hard relative to under coating. Coating is too thick or erosions are caused by water vapor, acid and alkali in the air. 3. Under coating is treated incorrectly; there are pinholes and defects in the outer paint.	1. Polishing Treatment. □ 2. Conventional grind and polishing treatment. □ 3. Treated with deep grinding, polishing and modification. □ 4. Partial paint repair (serious rusted metals need to be repaired before painting). ■
Acid Rain Erosion	1. Acid Rain Erosion	1. Polishing treatment (mild erosion). ■ 2. Conventional grind and polishing treatment (medium erosion). ■ 3. Treated with deep grinding, polishing and modification. □ 4. Partial paint repair(severe erosion). ■
Gloss	1. Film is eroded by the acid, alkali, electric arc, sea water and other strong corrosive salty spray. Incorrect maintenance methods in harsh conditions. 3. Poor paint durability. 4. Incorrect paint mixture ratio leads to paint durability deterioration.	1. Polishing treatment (mild loss of light). ■ 2. Conventional grind and polishing treatment (moderate loss of light). ■ 3. Treated with deep grinding, polishing and modification. □ 4. Partial paint repair (severe loss of light). ■
Bubbling	When film is exposed to a humid environment for a long period, water vapor will infiltrate into paint film, and water and gas bubbling will be generated when temperature rises. Substrate is corroded by infiltrated materials. Gasoline, acid, alkali and other erosion for film.	1. Polishing Treatment. □ 2. Conventional grind and polishing treatment. □ 3. Treated with deep grinding, polishing and modification. □ 4. Partial paint repair (serious rusted metals need to be repaired before painting). ■

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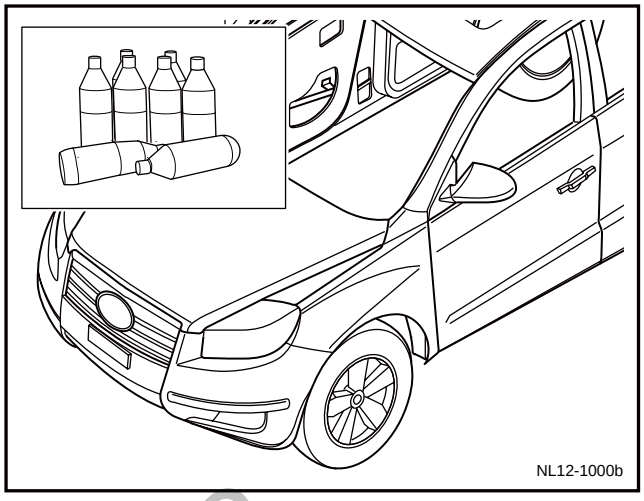
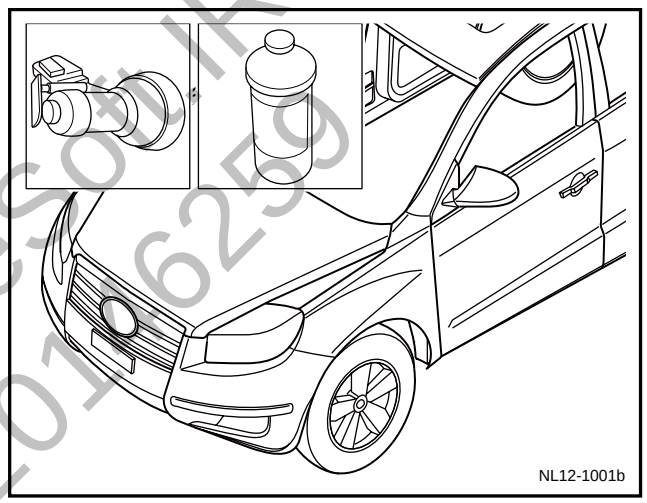
12.13.4 Removal and installation

12.13.4.1 Common Coating Film Defect Treatment Process Example

1. Before polishing, clean the surface to be polished with degreasing materials.



2. Firstly fully soak a sponge and squeeze excessive water.
3. Apply a small amount of polishing wax to the surface and adjust the polishing machine speed.

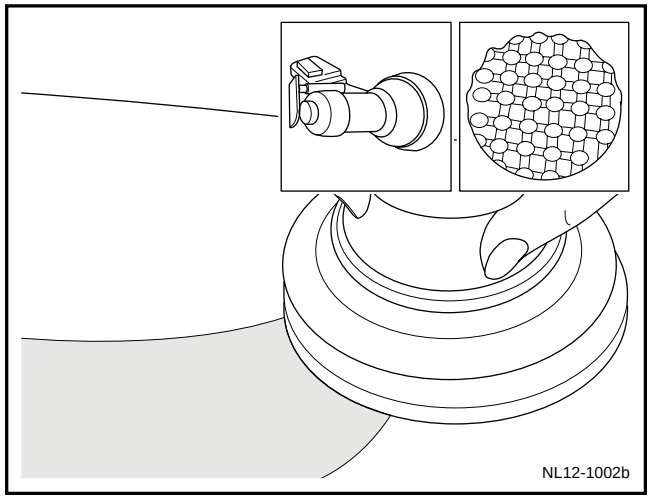


4. Put the wool ball onto the surface, turn on the machine with a speed at 2,500-3,000 r/ min. Then, slightly press for 3-5s for polishing treatment.

Notes:

During operation, keep the machine stable and move gently. Do not operate too long to avoid overheating, as the paint will be damaged by the heat.

5. Use a cleaning cloth to wipe the excessive wax.



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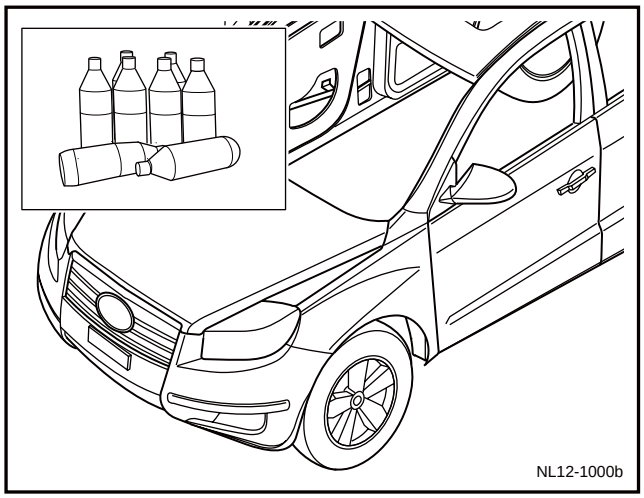
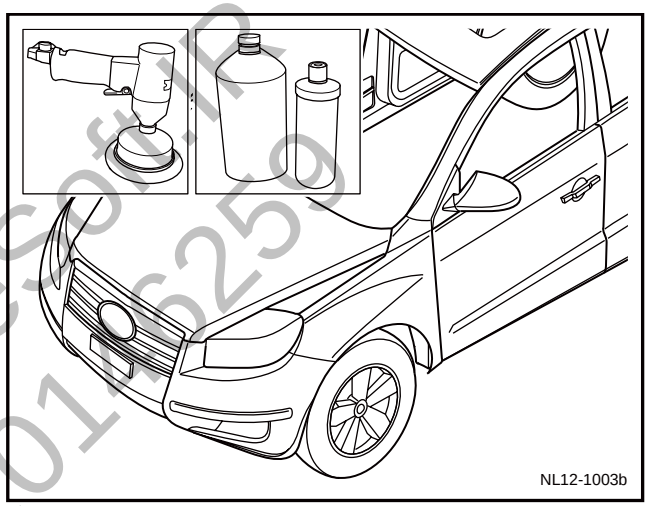
12.13.4.2 Conventional Grind and Polishing Treatment Process Example

1. Before polishing, clean the surface to be polished with degreasing materials.



2. Apply an appropriate amount of polishing wax to the surface and adjust the polishing machine speed.

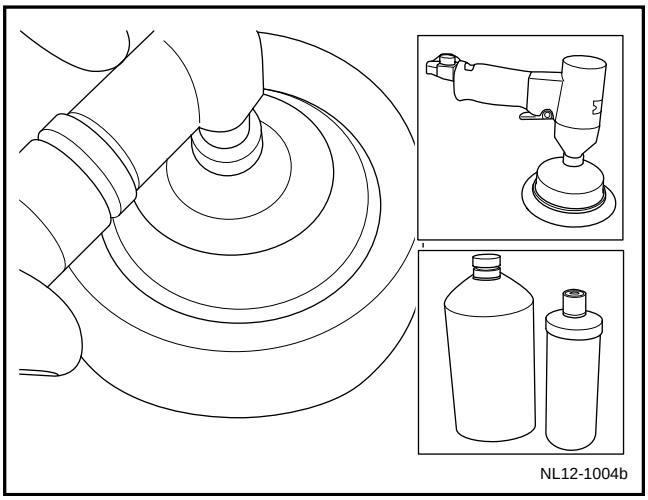


3. Put the wool ball onto the surface, turn on the machine with a speed at 2,500-3,000 r/ min.

Notes:

During operation, keep the machine stable and move gently. Do not polish too long. Keep the polishing time as short as possible, and the polishing area as small as possible.

4. Wet sufficiently the sponge and remove excessive moisture by compressing it. Apply a small amount of polishing wax to the surface to be polished and start the engine to a RPM of 2,500-3,000r/min after pressing the sponge to the surface to be polished. Then, slightly press for 3-5s for polishing treatment.



Notes:

During operation, keep the machine stable and move gently. Do not operate too long to avoid overheating, as the paint will be damaged by the heat.

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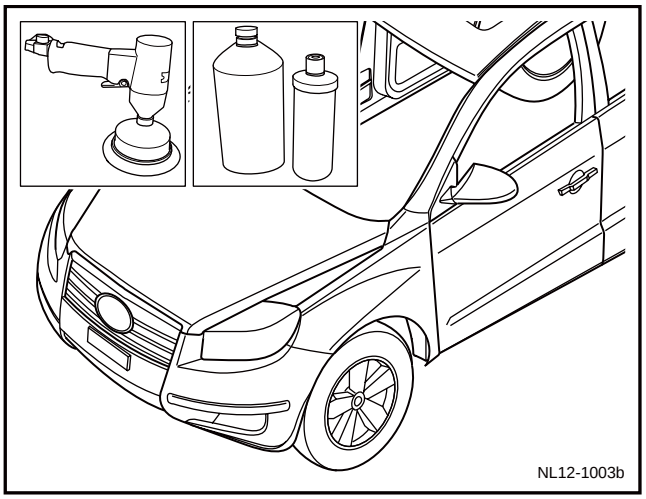
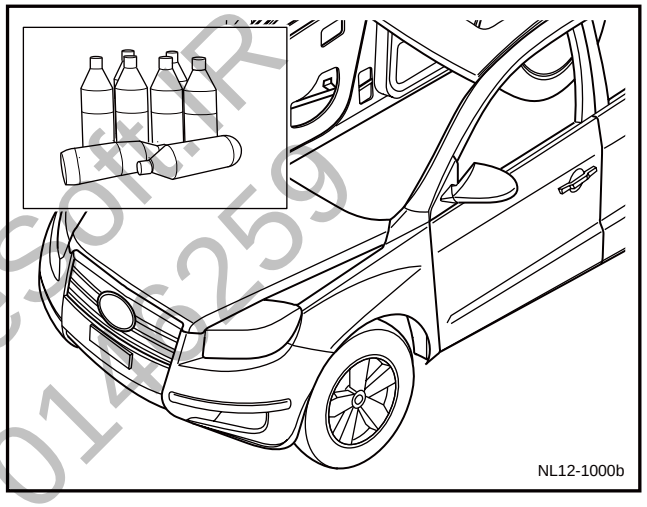
12.13.4.3 Deep Polishing Treatment Process Example

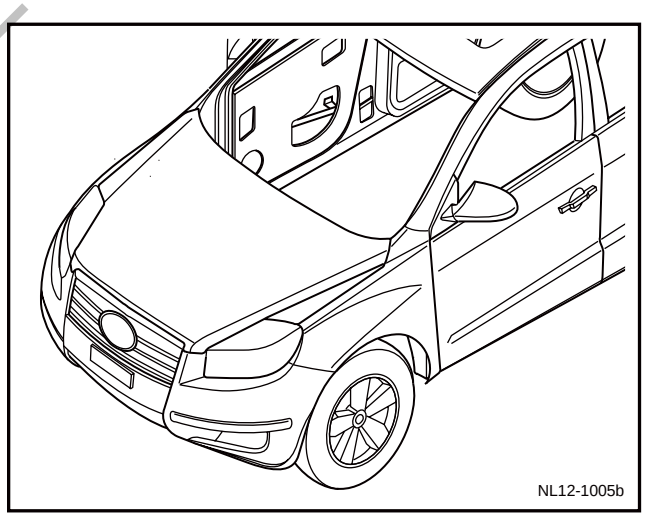
1. Sand the surface with a piece of 2000# sanding paper. Press the sanding paper very close to the surface and sand in circles.



2. Remove the polishing power from the surface.



3. Apply an appropriate amount of polishing wax to the surface and adjust the polishing machine speed.



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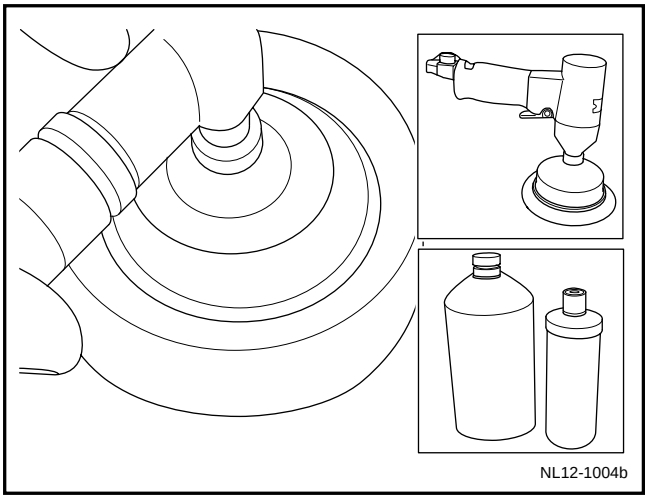
4. Put the wool ball onto the surface, turn on the machine with a speed at 2,500-3,000 r/ min.

Notes:

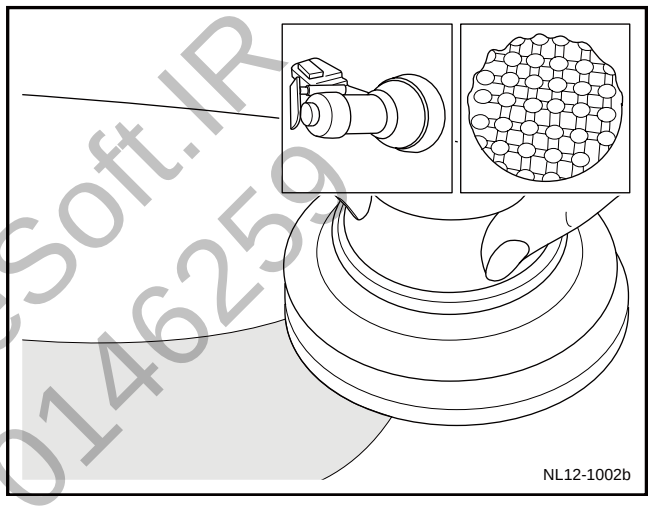
During operation, keep the machine stable and move gently. Do not polish too long. Keep the polishing time as short as possible (3-5s), and the polishing area as small as possible.



5. Wet sufficiently the sponge and remove excessive moisture by compressing it. Apply a small amount of polishing wax to the surface to be polished and start the engine to a RPM of 2, 500-3,000r/min after pressing the sponge to the surface to be polished. Then, slightly press for 3-5s for polishing treatment.

Notes:

During operation, keep the machine stable and move gently. Do not operate too long to avoid overheating, as the paint will be damaged by the heat.



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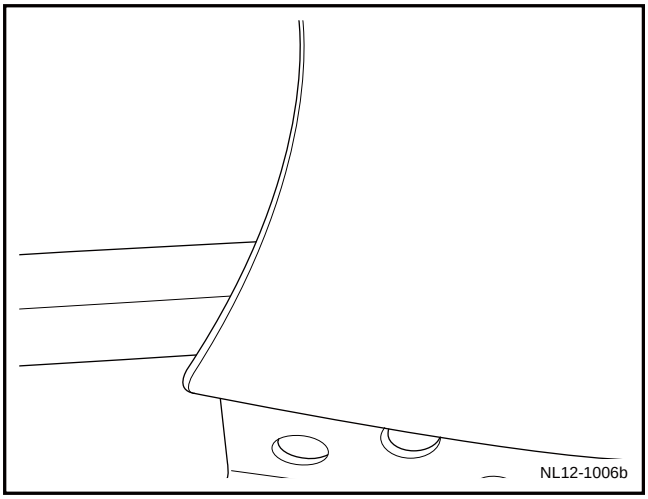
12.13.4.4 Spray Paint Process of Rigid Surface

Take the fender for example to describe the local spray finishing (painting make-up) process

Notes:

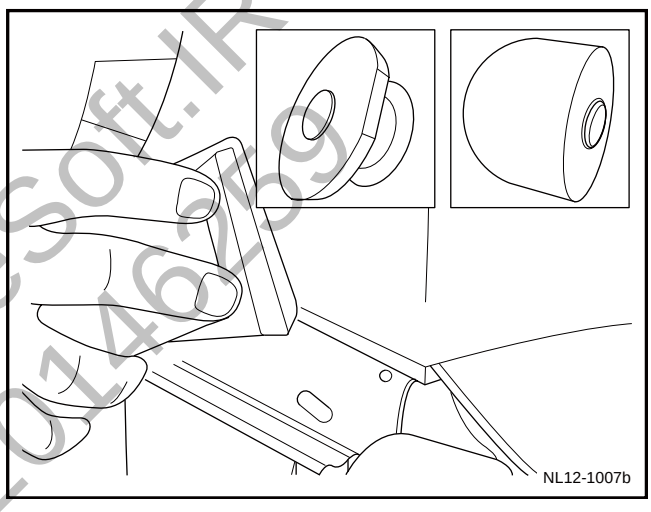
All paint repairs for rigid surface must comply with Geely standards. Confirm the repair area and select the repair range, such as the local repair, the whole repair and the whole vehicle repair.

If the damages are caused due to the collision, the vehicle will be repaired by metal plate process and then the corresponding repair will be carried out or painting will be performed after the replacement of the parts.

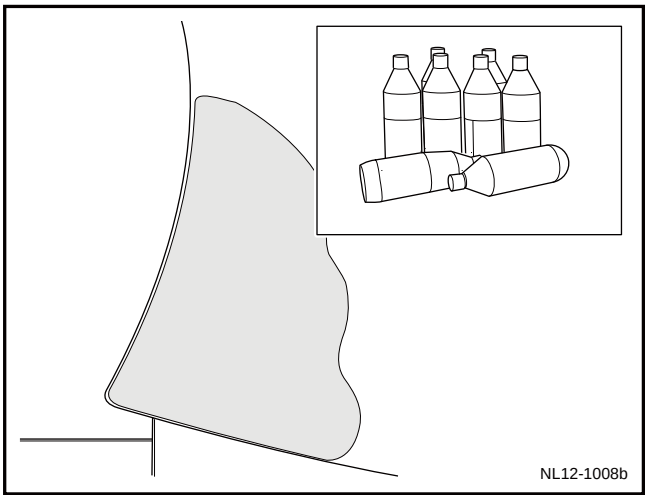


1. For serious fender scratches, use the partial paint spray (repair) process.

2. Sand the damaged surface with a piece of P500# wet sanding paper in circles.



3 . Clean the surface with the degreasing agents after polishing.



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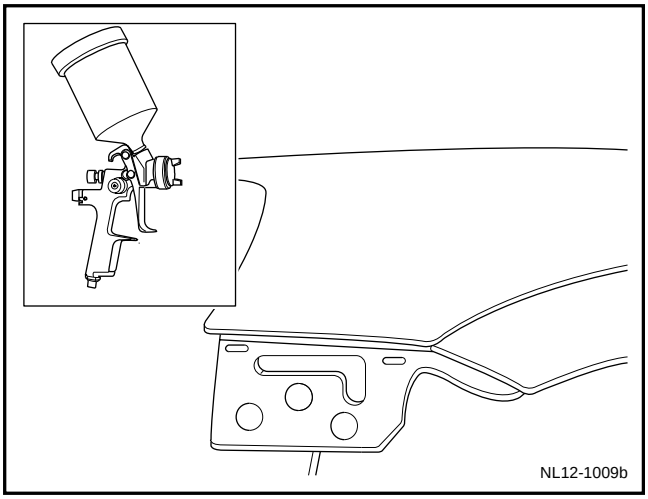
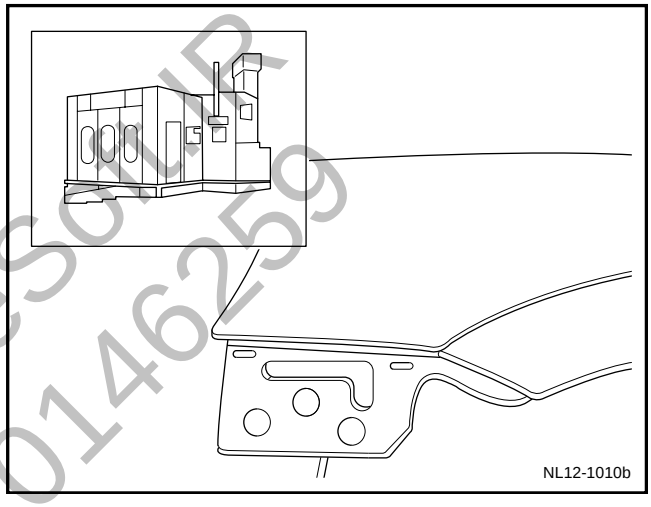
4. For primer painting, control the painting area. Gradually paint the edges. Do not overlap the paint.

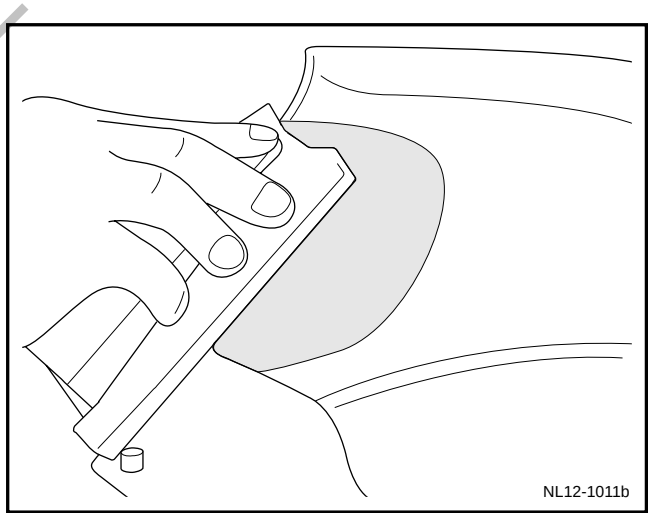


5. Leave the surface dry 4-5 min and then heat to dry 20-30 min.

   Paint room temperature 70-80℃ (158-176 ºF)



6. After drying, sand the surface with a piece of P800-1,000# sanding paper.



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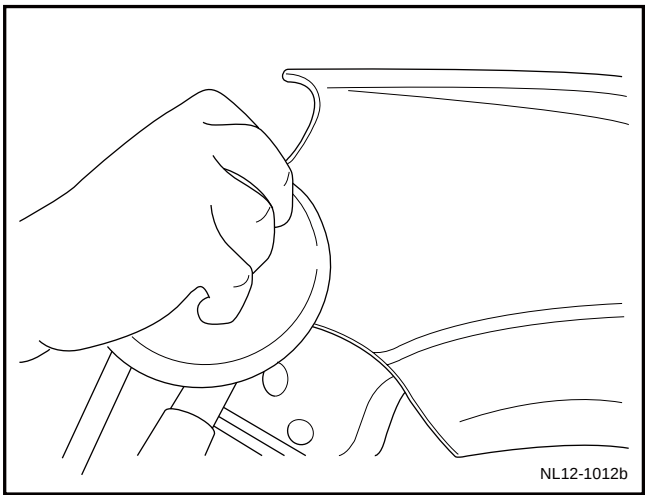
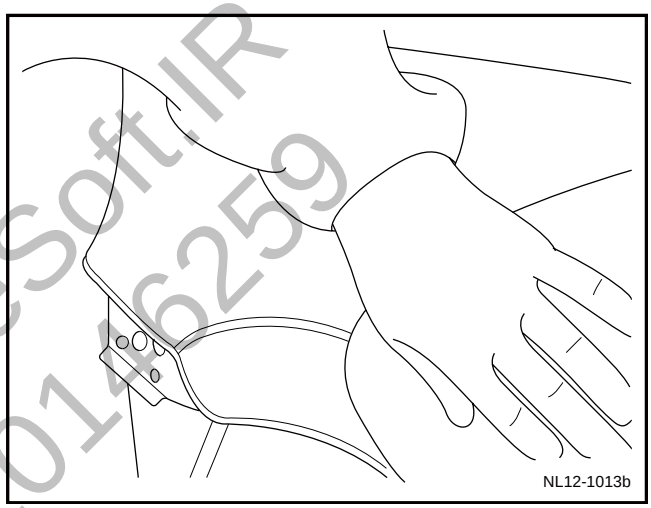
7. Sand the surface with a piece of 2000# fine sanding paper and expand the polishing area.



8. After finish polishing, remove the dust with a cloth to prepare for painting.



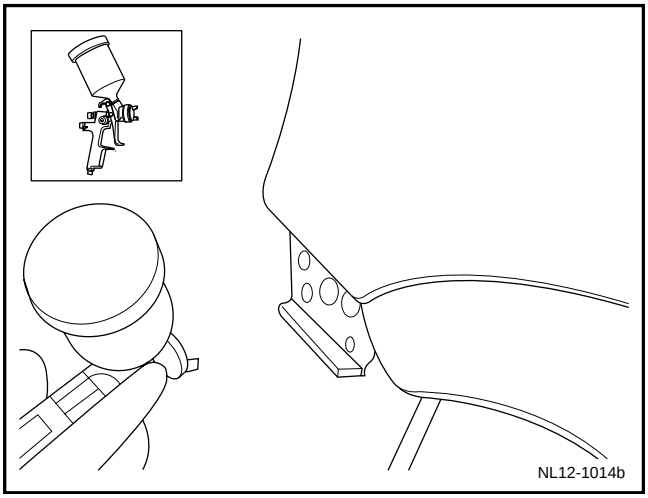
9. Spray the background color paint.

   Air pressure 150-200 kPa (21.8-29.0 psi)

   Spray Distance 20-30 cm (7.87-11.81 in)

Notes:

The spray coating range is wider layer by layer for transition.



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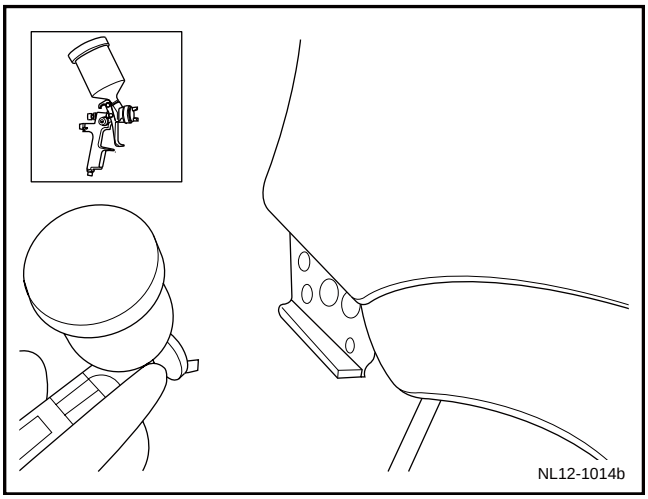
Leave the surface dry 2-3min before spraying the second layer of background paint until the layer joints become insignificant.

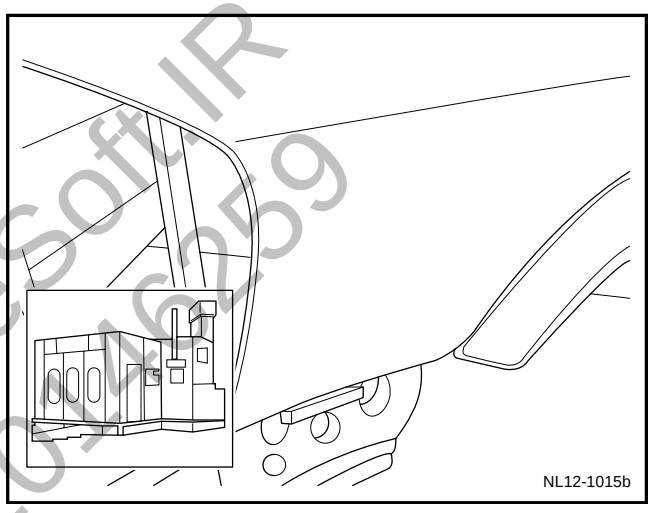
Air pressure 150-200 kPa (21.8-29.0 psi)

Spray Distance 20-30 cm (7.87-11.81 in)

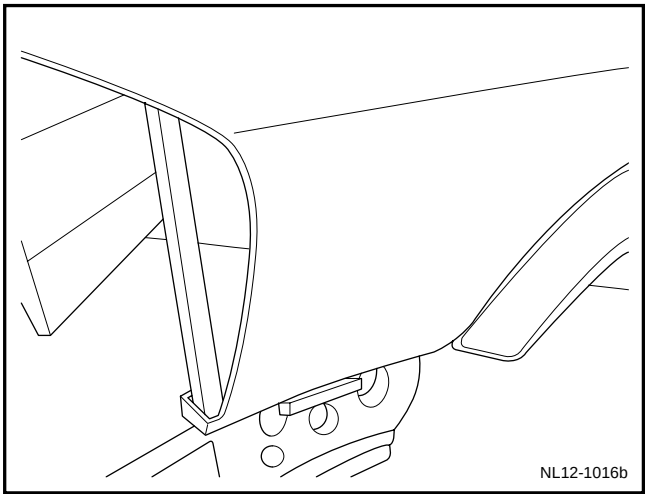


11. Leave the surface dry 4-5min and then heat to dry 20-30min.

Paint room temperature 70-80℃ (158-176ºF)



12. After drying, remove the dust with a cloth to prepare for painting work.



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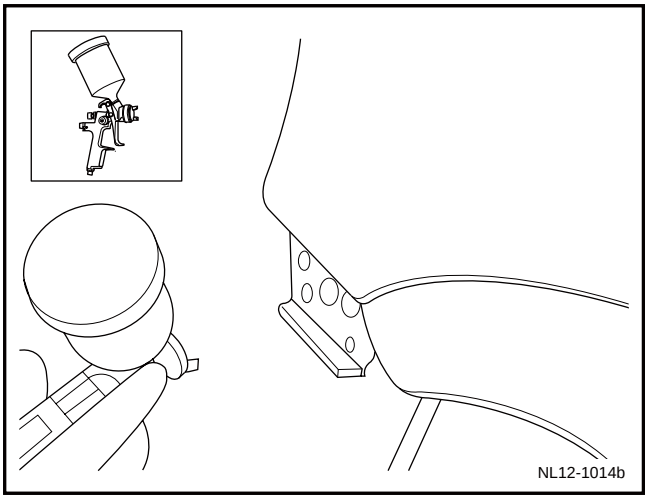
13. Spray lacquer to cover the whole background color painting area.

Air pressure 150-200 kPa (21.8-29.0 psi)

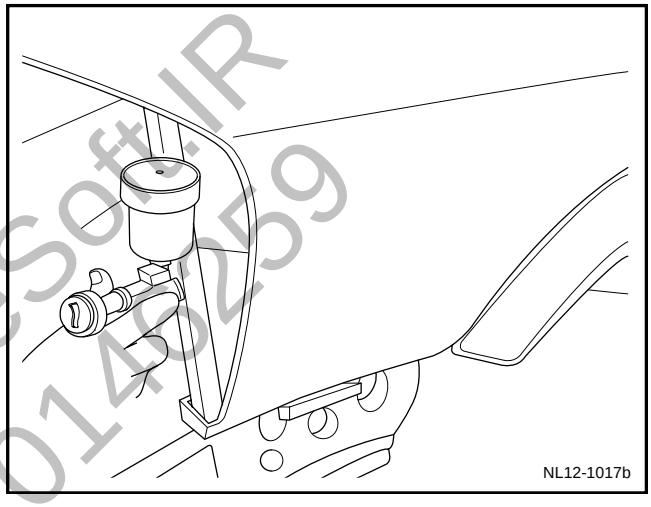
Spray Distance 20-30 cm (7.87-11.81 in)



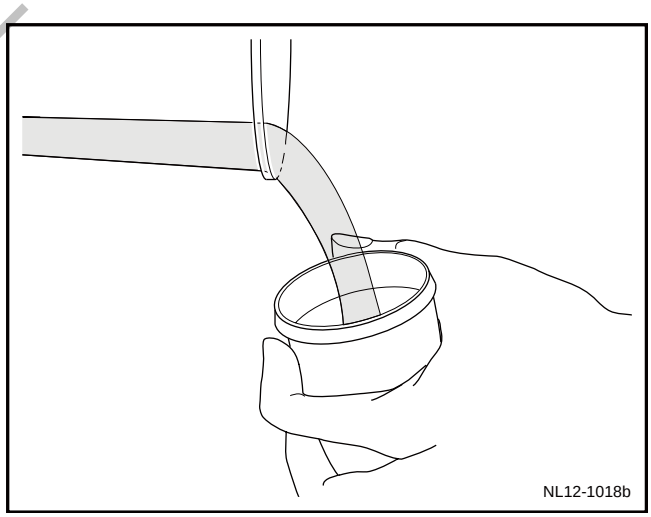
14. Flash off 2-3min, and paint the second coat of celluloid paint. Paint range is to cover all of the first coat varnish.

Air pressure 150-200 kPa (21.8-29.0 psi)

Spray Distance 20-30 cm (7.87-11.81 in)



15. After spraying the lacquer, add blending thinner or other additives to the original clear lacquer.



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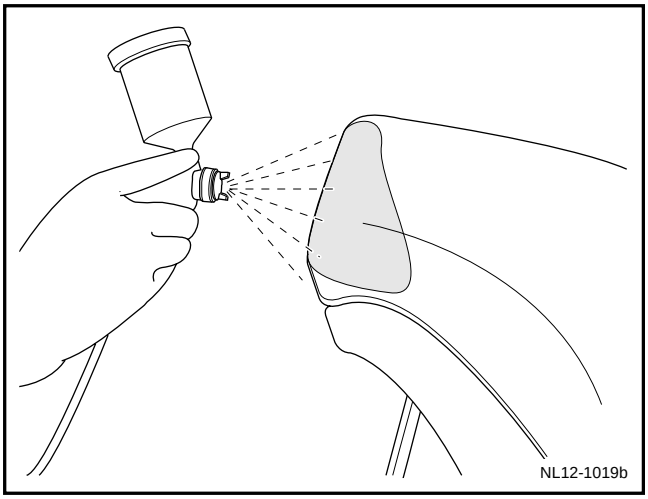
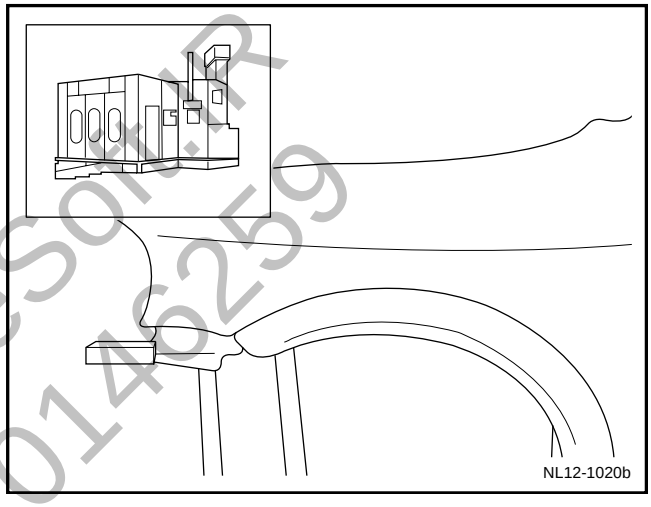
16. Spray the paint interface 2-3 times with the blending thinner or the diluted clear lacquer.



17. Dry the paint in the paint room 20-30 min.

Paint room temperature 70-80℃ (158-176 ºF)



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12.13.4.5 Spray Paint Procedure on the Repaired Rigid Sheet Metal Surface

Spraying paint on the repaired rigid sheet metal surface process is similar to spraying paint on the sheet metal surface. There are only a few additional steps between grinding and spraying background color paint as follows:

1. Apply with putty.
2. Putty grinding.
3. Removing dust, degreasing, cleaning.
4. Scratch to fill gray eye.
5. Sanding the old paint surface.
6. Cleaning, Degreasing and Covering the Unpainted Areas.

For the detailed steps, please refer to 12.13.4.4 Spray Paint Process of Rigid Surface.

12.13.4.6 Patching Procedure for Painted Surface of Plastic Parts Surface

There are three basic requirements for the plastic surface paint repair:

1. Paint and plastics have a certain adhesion, without loss of mechanical properties.

– Paint film should have sufficient flexibility and allow the plastic deformation without rupture.

– Plastic pieces can reflect some of the original particles and rough surface texture.

Patching Procedure for Painted Surface of Plastic Parts Surface

The plastic primer surface repair can refer to the local spraying process, and pay attention to the low-temperature baking.

The baking condition is at 70-80℃ (158-176 ºF) for 20-30 min.

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