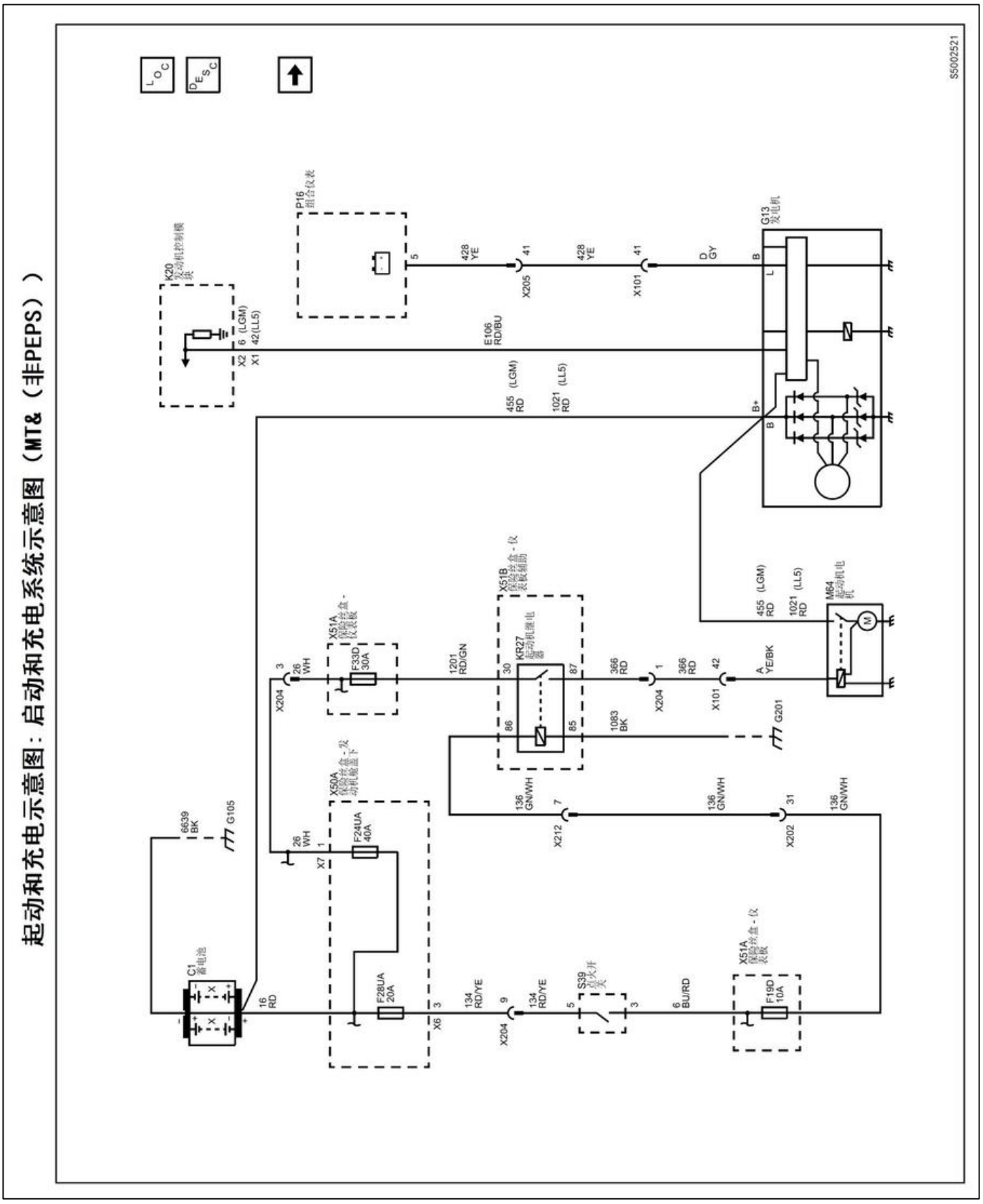
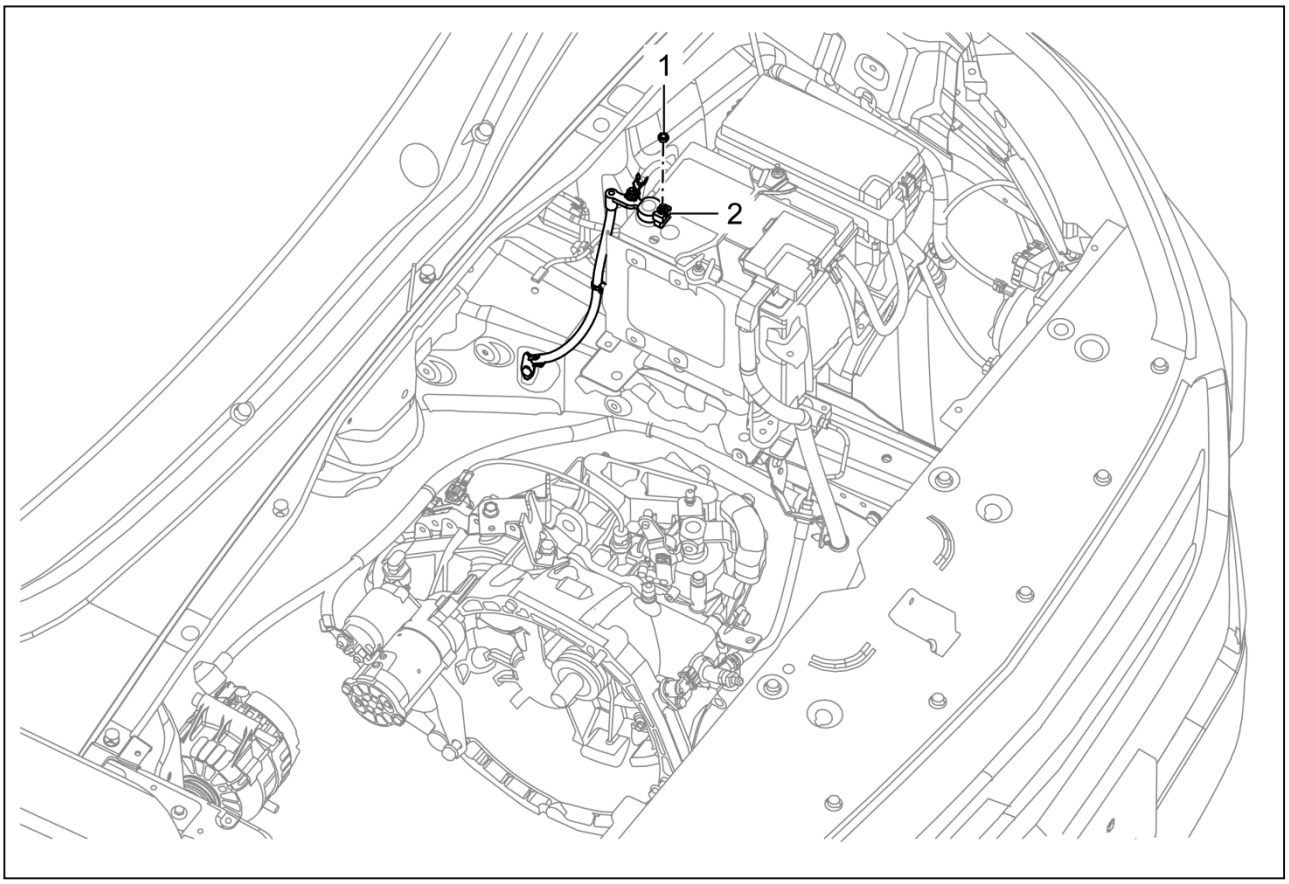
9.1.2 Schematic and Routing Diagrams

9.1.2.1 Starting and Charging



9.1.4 Repair Instructions

9.1.4.2 Battery Negative Cable Disconnection and Connection (37733)



Battery Negative Cable Disconnection and Connection

Callout	Component Name
Preliminary Procedure ***Warnings:*** *Refer to "**0.2.1.42 Battery Disconnect Warning**".* 1. Turn the ignition switch to the OFF position. 2. Remove the cover plate assembly at left side of engine compartment. Refer to "***2.1.2.17 Engine Compartment Side Cover Replacement***".	
1	Battery negative pole fastening nut (Qty.: 1) *Caution: Refer to "**0.2.1.30 Fastener Caution**".* Tighten 6±1 N·m
2	Battery negative cable

Reference Information

Schematic Reference

4.22.6iAMT Transmission Controls Schematics (Vehicle Speed Sensor, Cruise Control)

Connector End View Reference

K71 Transmission Control Module X1, and B115 Vehicle Speed Sensor

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Refer to "***6.1.1.1 Control Module References***" for scan tool information.

Circuit/System Inspection

1. Clear the DTC. Does the DTC reoccur?
   – Yes, an intermittent condition; refer to ***11.3.4.7 Testing for Intermittent Conditions and Poor Connections***.
   – If no, go to the next check.
2. Check the system. Are other DTCs set up?
   – If yes, clear other DTCs first.
   – If no, go to the next check.
3. Check relevant harness connectors or components. Does breakage, poor contact, aging or looseness exist?
   – If yes, inspect and remove the fault.
   – If no, go to the next check.
4. Operate the vehicle under the conditions for running the DTC and confirm that the DTC is not set again.

Circuit/System Testing

1. Turn the ignition switch to OFF position and disconnect the battery negative cable.
2. Disconnect B115 vehicle speed sensor harness connector.
3. Perform vehicle speed sensor component testing. Is it normal?
   – If no, replace the vehicle speed sensor.
   – If yes, go to the next diagnostic step.
4. Connect the battery negative cable and turn the ignition switch to ON position.
5. Check power circuit of the vehicle speed sensor. Measure the voltage between terminal 1 of B115 vehicle speed sensor harness connector and the ground. Is it the battery voltage?
   – If no, test the circuit for open circuit/high resistance.
   – If yes, go to the next diagnostic step.
6. Turn the ignition switch to OFF position and disconnect the battery negative cable.
7. Check ground circuit of the vehicle speed sensor. Measure the resistance between terminal 3 of B115 vehicle speed sensor harness connector and the ground. Is it less than 1 Ω?

– If no, test the circuit for open circuit/high resistance.

– If yes, go to the next diagnostic step.

8. Connect the battery negative cable and turn the ignition switch to ON position.
9. Measure the voltage between terminal 3 of B115 vehicle speed sensor harness connector and the ground. Is it 0 V?
   - If no, test the circuit for short to power supply.
   – If yes, go to the next diagnostic step.
10. Turn the ignition switch to OFF position and disconnect the battery negative cable.
11. Disconnect K71 transmission control module X1 harness connector X1.
12. Check signal circuit of the vehicle speed sensor. Measure the resistance between terminal 2 of B115 vehicle speed sensor harness connector and terminal 23 of K71 transmission control module X1. Is it less than 1 Ω?
   – If no, test the circuit for open circuit/high resistance.
   – If yes, go to the next diagnostic step.

Action Taken When the DTC Sets

- DTC is recorded and the engine malfunction indicator lamp does not illuminate.

Conditions for Clearing the DTC

- A history DTC will clear after 40 fault - free ignition cycles.
- The body control module receives an order to clear the DTC sent by the scan tool.

Reference Information

Schematic Reference

4.10.13 Engine Controls Schematics (Accelerator Pedal Position Sensor, Electronic Throttle Control) - 1.5 T

Connector End View Reference

Q38 Throttle, and K20 Engine Control Module X1

Electrical Information Reference

- Circuit Testing
- Connector Repairs
- Testing for Intermittent Conditions and Poor Connections
- Wiring Repairs

Scan Tool Reference

Refer to "***6.1.1.1 Control Module References***" for scan tool information.

Circuit/System Inspection

1. Clear the DTC. Does the DTC reoccur?
   - Yes, an intermittent condition; refer to ***11.3.4.7 Testing for Intermittent Conditions and Poor Connections***.
   - If no, go to the next check.
2. Check the system. Are other DTCs set up?
   - If no, perform the corresponding fault diagnosis according to the DTC.
   - If no, go to the next check.
3. Check the harness connectors or components. Does breakage, poor contact, aging or looseness exist?
   - If yes, inspect and remove the fault.
   - If no, go to the next check.
4. Turn the ignition switch to ON position, and confirm the "Throttle Angle 2" and "Throttle Position Sensor 2 Voltage Original Value" displayed real - time on the scan tool. Does the parameter change as the accelerator pedal input changes and is the change within the reasonable range of 4.42 V - 0.38 V?
   - If yes, clean the throttle, carry out throttle matching/self - learning and then take a road test, if the DTC appears again, perform "Circuit/System Testing".
   - If no, perform "Circuit/System Testing".
5. Operate the vehicle under the conditions for running the DTC and confirm that the DTC is not set again.

Circuit/System Testing

1. Turn the ignition switch to OFF position and disconnect the battery negative cable.
2. Disconnect Q38 throttle harness connector.
3. Connect the battery negative cable and turn the ignition switch to ON position.
4. Check the throttle power circuit. Measure the voltage between terminal 4 of Q38 throttle harness connector and the ground. Is it about 5V?
   - If no, perform the following test:

   (1) Turn the ignition switch to the OFF position and disconnect the battery negative cable.

   (2) Disconnect K20 engine control module harness connector X1.

   (3) Measure the resistance between terminal 4 of Q38 throttle harness connector and terminal 43 of K20 engine control module harness connector X1. Is it less than 1 Ω?
   - If no, test the circuit for open circuit/high resistance.
   - If yes, go to the next diagnostic step.

   (4) Measure the resistance between terminal 4 of Q38 throttle harness connector and the ground. Is it infinite?
   - If no, test the circuit for short to ground.
   - If yes, go to the next diagnostic step.

12. Measure the resistance between terminal A2 of K20 engine control module harness connector X2 and the ground. Is it infinite?
    - If no, test the circuit for short to ground.
    – If yes, go to the next diagnostic step.
13. Connect the battery negative cable and turn the ignition switch to ON position.
14. Measure the voltage between terminal A2 of K20 engine control module harness connector X2 and the ground. Is it 2.3 ± 0.1 V?
    - If no, test the circuit for short to power supply.
    – If yes, go to the next diagnostic step.
15. Turn the ignition switch to OFF position and disconnect the battery negative cable.
16. Replace the engine control module and the vehicle stability control module. Operate the vehicle under conditions for running the DTC. Is the DTC set?
    – If no, diagnosis ends.
    – If yes, install the original module back and contact the technician.

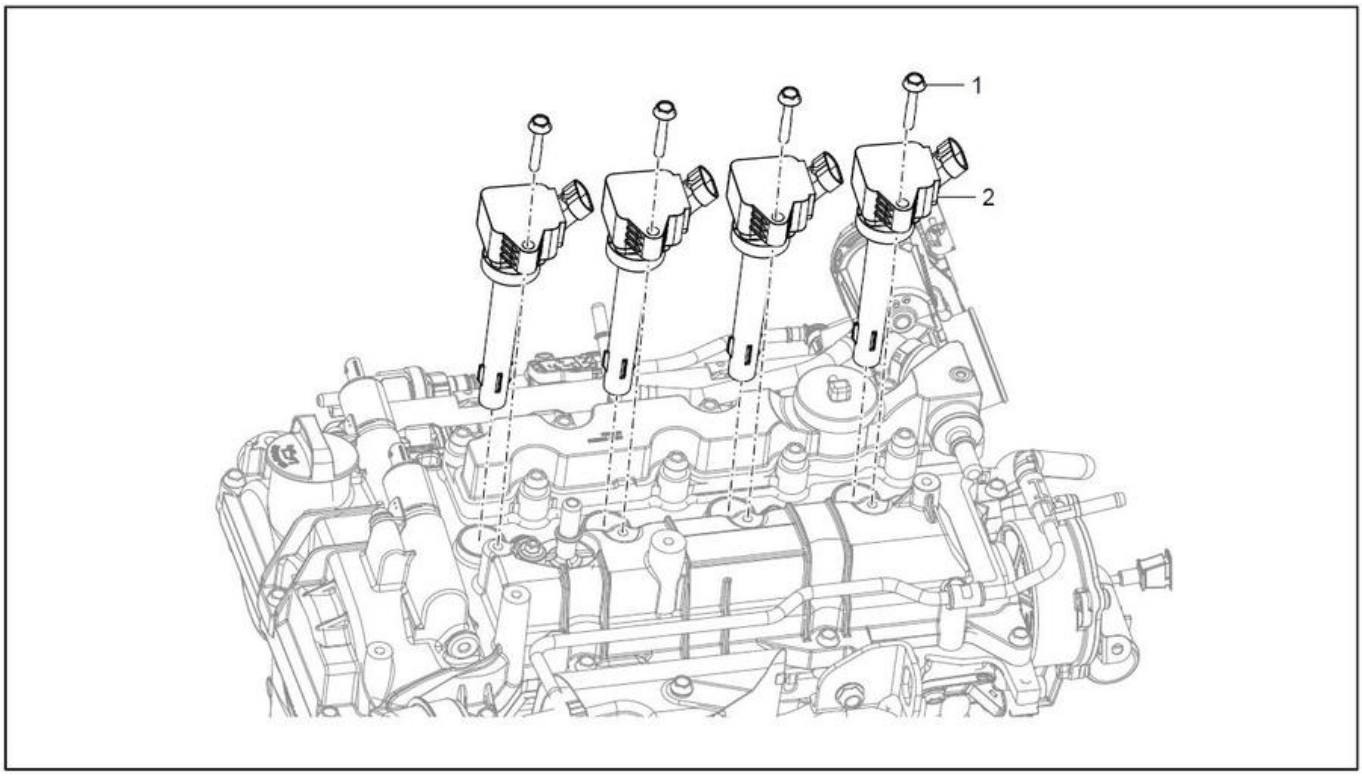
LV3 (Autoliv)

Confirm the following conditions:

- Control module and local interconnect network device equipped for vehicle
- Control module position on CAN serial data circuit
- Power supply+, ignition, ground, communication enabling and serial data circuit terminals of control module

1. Before diagnosis, it should be confirmed that there is no DTC in communication among other modules. If there is a DTC, diagnose it first.
2. Turn the ignition switch to OFF position and disconnect the battery negative cable.
3. Measure the resistance between terminal 3 (CANH) and terminal 11 (CANL) of X84 whole vehicle diagnostic interface under the following conditions:
    ○ Condition A: Measure the resistance under the connection state of all connectors. Is it 60±5 Ω?
    ○ Condition B: Measure the resistance with 1 control module separated from the engine control module or body control module. Is it 120±5 Ω?
    ○ Condition C: Measure the resistance with connectors of engine control module and body control module being separated. Is it infinite?
4. If the above - mentioned resistance does not meet the standard value, disconnect the harness connector at the control module which cannot communicate.
5. Disconnect K20 engine control module harness connector X2 and K102 vehicle stability control module harness connector.
6. Check the CAN network H circuit. Measure the resistance between terminal A1 of K20 engine control module harness connector X2 and terminal 5 of K102 vehicle stability control module harness connector. Is it less than 1 Ω?
    – If no, test the circuit for open circuit/high resistance.
    – If yes, go to the next diagnostic step.
7. Measure the resistance between terminal A1 of K20 engine control module harness connector X2 and the ground. Is it infinite?
    - If no, test the circuit for short to ground.
    – If yes, go to the next diagnostic step.
8. Connect the battery negative cable and turn the ignition switch to ON position.
9. Measure the voltage between terminal A1 of K20 engine control module harness connector X2 and the ground. Is it 2.7 ± 0.1 V?
    - If no, test the circuit for short to power supply.
    – If yes, go to the next diagnostic step.
10. Turn the ignition switch to OFF position and disconnect the battery negative cable.

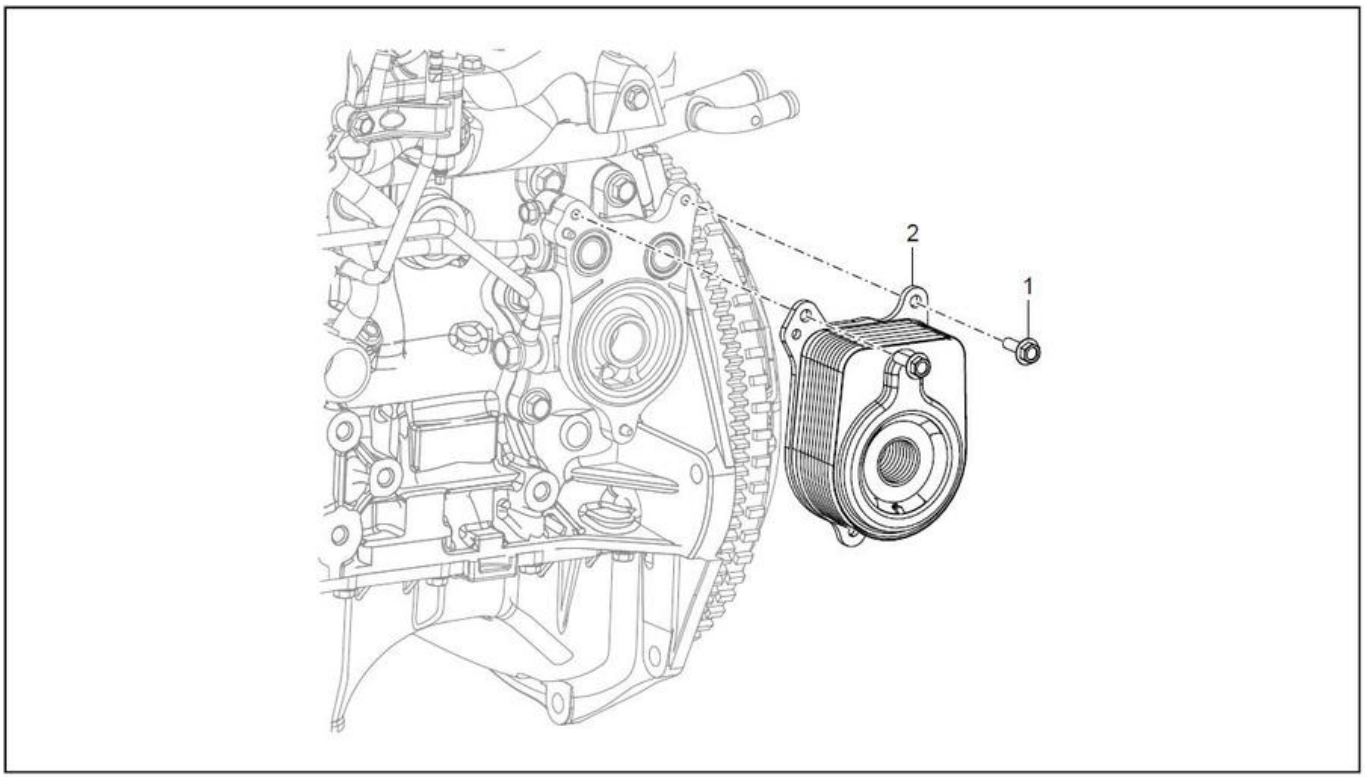
9.2.4.29 Ignition Coil Replacement (1.5T) (208560)



Ignition Coil Replacement

Callout	Component Name
Preliminary Procedure 1. Disconnect the battery negative cable. Refer to "***9.1.4.2 Battery Negative Cable Disconnection and Connection***".	
1	Ignition coil bolt (Qty.: 4) **Procedure** 1. Disconnect the ignition coil wiring harness. 2. Screw off the ignition coil bolts. *Caution: Refer to "**0.2.1.30 Fastener Caution**".* **Tighten** 10±2 N·m
2	Ignition coil **Procedure** 1. Pull the ignition coil upwards and out with great effort.

9.4.4.26 Engine Oil Cooler Replacement (1.5T)



Engine Oil Cooler Replacement

Callout	Component Name
Preliminary Procedure 1. Remove the oil filter and the oil filter mounting stud. Refer to "***9.5.4.1 Engine Oil and Oil Filter Replacement***".	
1	Engine oil cooler mounting bolt (Qty.: 2) *Caution: Refer to "**0.2.1.30 Fastener Caution**".* Tighten 10±2 N·m
2	Engine oil cooler

9.5.3 Diagnostic Information and Procedures

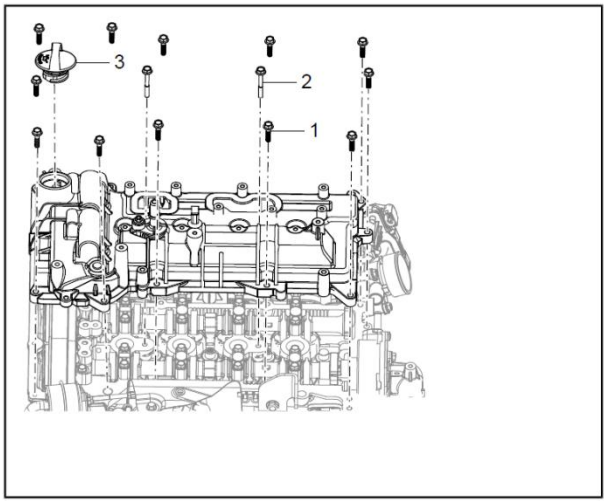
9.5.3.1 Base Engine Misfire with Abnormal Internal Lower Engine Noises (1.5T) (208580)

Base Engine Misfire with Abnormal Internal Lower Engine Noises

Condition	Actions
Abnormalities (server cracking, bumps or missing areas) in the drive belt	Abnormalities in the drive belt and/or components may cause engine RPM variations, noises similar to faulty lower engine and also lead to a misfire condition. A misfire code may be present without an actual misfire condition. 1. Inspect the accessory drive components. 2. Repair or replace all damaged components.
Worn, damaged, or misaligned drive components or excessive pulley runout	A misfire code may be present without an actual misfire condition. 1. Inspect the accessory drive components. 2. Repair or replace all damaged components.
Loose and/or damaged crankshaft pulley	A misfire code may be present without an actual misfire condition. 1. Inspect crankshaft pulley and pulley bolt. 2. Repair or replace the damaged components.
Loose connecting bolt to the transmission	A misfire code may be present without an actual misfire condition. 1. Inspect the torque converter bolt and the flywheel. 2. Repair or replace all damaged components.
Loose and/or damaged flywheel	A misfire code may be present without an actual misfire condition. 1. Inspect flywheel and flywheel attaching bolts. 2. Repair or replace all damaged components.
Excessive piston - to - cylinder bore clearance	1. Perform cylinder leak down and compression tests. 2. Inspect the piston, piston rings and cylinder bore. 3. Repair or replace all damaged components.
Excessive crankshaft thrust bearing clearance	Severely worn thrust surfaces on the crankshaft and/or thrust bearing may permit fore and aft movement of the crankshaft and create a misfire code without an actual misfire condition. 1. Inspect the crankshaft end play and crankshaft thrust bearings. 2. Repair or replace all damaged components.

High fuel consumption	Cooling system fault: Thermostat fault	Replace the thermostat.
	Compression pressure drop Fuel system fault: Restricted fuel line Restricted or fouled fuel filter Incorrect or impure fuel Fuel pump fault Fuel injector fault	Refer to information given above. Clean the fuel line. Replace the fuel filter. Clean the fuel and the fuel line. Replace the fuel pump. Replace the fuel injector.
	Others: Improperly installed valve Slipping clutch Low tire pressure	Repair or replace the valve. Repair or replace the clutch. Adjust the tire pressure.
Low oil pressure	Lubricant system fault: Insufficient oil viscosity Loose oil pressure switch Insufficient engine oil Restricted oil filter screen Poor oil pump performance	Replace the engine oil with the specified oil. Tighten the oil pressure switch. Refill the engine oil. Clean the filter screen. Replace the oil pump.
Large knock noise (the engine makes sharp metallic knocks that change with throttle opening.)	Engine overheating Fuel system fault: Restricted or fouled fuel filter Leaking intake system gasket Excessive carbon deposits due to abnormal combustion	Refer to "***9.4.3.2 Engine Heating***". Replace the fuel filter. Replace the intake system gasket. Clean the carbon deposits.
Excessive oil consumption	Leakage of engine oil Loose drain plug Loose oil pan bolt Poor liquid gasket performance Loose oil filter cap Loose oil pressure switch Leaking camshaft front oil seal Leaking crankshaft front oil seal Leaking crankshaft rear oil seal Cylinder head cover gasket leakage Cylinder head gasket leakage	Tighten the drain plug. Tighten the oil pan bolt. Clean and trim the liquid gasket. Tighten the oil filter cap. Tighten the oil pressure switch. Replace the camshaft front oil seal. Replace the crankshaft front oil seal. Replace the crankshaft rear oil seal. Replace cylinder head cover gasket. Replace cylinder head gasket.

Installation Procedure



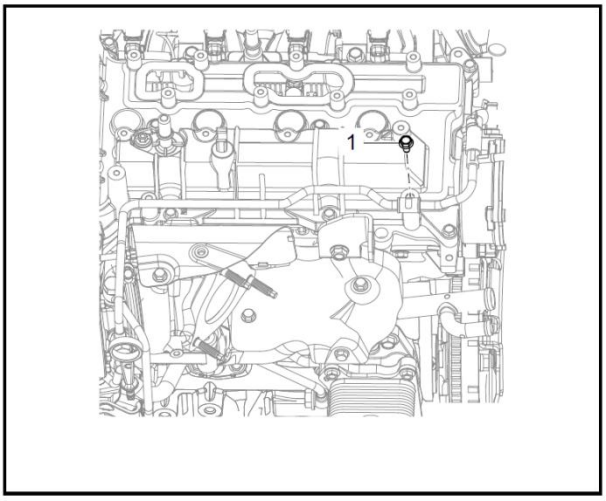
*Caution: Refer to "**0.2.1.30 Fastener Caution**".*

1. If all the gaskets have been removed before, install them to the camshaft cover first.
2. Install the camshaft cover to the engine cylinder head and tighten the 12 short bolts along the edge and the two long bolts in the middle diagonally. Tighten camshaft cover bolt to: 10±2 N·m.

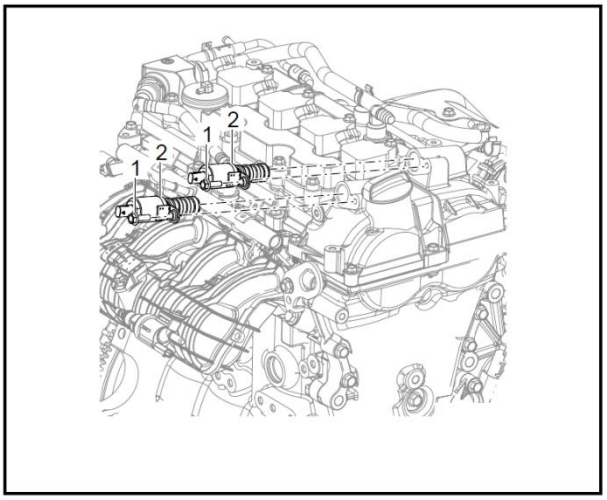
Tighten sequence

7	3	2	6	10
12	13		14	11
8	4	1	5	9

3. Tighten oil filler cap (3).

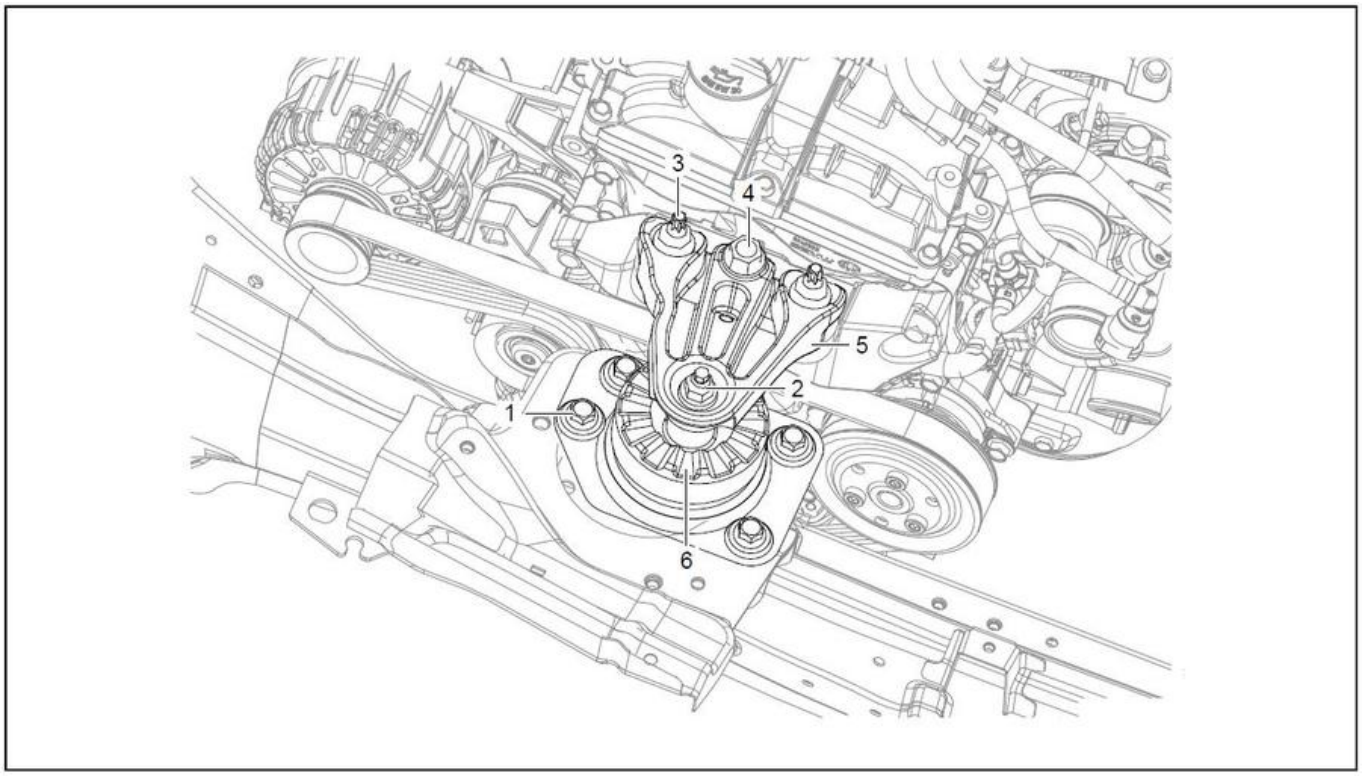


4. Install the turbocharger water return pipe to camshaft cover mounting bolt and tighten to 10±2 N·m.



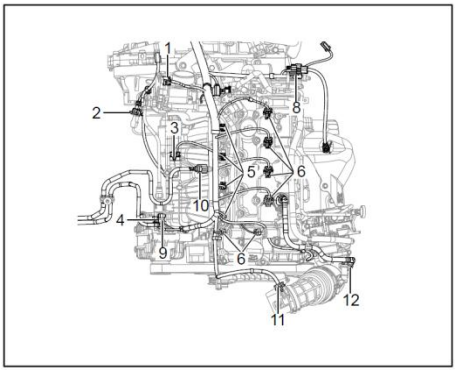
5. Install the camshaft phase actuator solenoid valve assembly (VVT assembly). Refer to "***9.3.4.18 Camshaft Position Actuator Solenoid Valve Replacement***".
6. Install the oil - gas separator.
7. Install PCV pipe assembly (high load), PCV pipe assembly (low load) and breather hose assembly. Refer to ***"9.5.5.65 Positive Crankcase Ventilation Pipe Installation"***.
8. Install the vacuum pump assembly. Refer to "***9.5.4.4 Vacuum Pump Assembly Replacement***".

9.5.4.26 Engine Mount Replacement (1.5T)

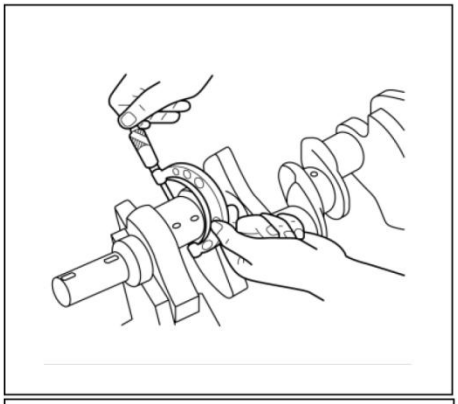


Engine Lift Bracket Replacement

Callout	Component Name
Preliminary Procedure 1. Remove the air cleaner. Refer to "***9.3.4.8 Air Cleaner Assembly Replacement***".	
1	Engine shock absorber bolt (Qty.: 4) *Caution: Refer to "**0.2.1.30 Fastener Caution**".* Tighten Tighten to 62±5 N·m
2	Engine lift bracket to engine shock absorber nut Tighten Tighten to 110±10 N·m
3	Engine mount bracket to engine lift bracket nut (Qty.: 2) Tighten Tighten to 110±10 N·m
4	Engine mount bracket to engine lift bracket bolt Tighten Tighten to 110±10 N·m
5	Engine lift bracket
6	Engine shock absorber



43. Connect throttle body harness connector (1).
44. Connect knock sensor harness connector (2).
45. Connect intake air temperature/pressure sensor assembly (high pressure) harness connector (3).
46. Connect canister solenoid valve harness connector (4).
47. Connect the engine harness to fuel rail connector (5).
48. Connect the ignition coil harness connector (6).
49. Connect intake/exhaust VVT harness connector (7).
50. Connect front oxygen sensor harness connector (8).
51. Connect fuel vapourizer tube (9) to canister solenoid valve.
52. Connect fuel feed pipe (10) to the fuel rail.
53. Connect high - load PCV pipe (12) to the air cleaner outlet duct.
54. Install the air cleaner outlet duct. Refer to "*9.3.4.22 Air Cleaner Outlet Duct Replacement*".
55. Install the air cleaner. Refer to "*9.3.4.8 Air Cleaner Assembly Replacement*".
56. Install the left and the right front wheels. Refer to "*16.6.3.3 Tire and Wheel Removal and Installation*".
57. Install the battery assembly. Refer to "*9.1.4.7 Battery Replacement*".
58. Install the coolant reservoir.
59. Install the engine control module. Refer to "*9.3.4.1 Engine Control Module Replacement*".
60. Fill engine coolant. Refer to "*9.4.4.16 Cooling System Draining and Filling*".
61. Fill engine oil. Refer to "*9.5.4.1 Engine Oil and Oil Filter Replacement*".
62. Fill the refrigerant. Refer to "*10.1.5.43 Refrigerant Recovery and Recharging*".
63. Install the battery and the tray.
64. Install the fuel pump relay/fuse.
65. Fill engine oil.
66. Inspect all harnessed and pipelines carefully to ensure they are all clamped in place without interference and all the fasteners have been wiped clean and free from oil contamination.
67. Connect the battery positive cable.
68. Connect the battery negative cable.
69. Test the engine performance.



Method I

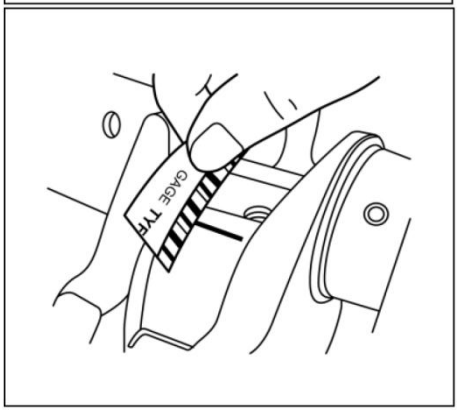
1. First measure and record the connecting rod inner diameter with the bearing shell assembled.
2. Then measure and record the connecting journal diameter.

Connecting rod journal diameter: 43 (- 0.005/ - 0.021) mm

Replace the crankshaft if it is necessary as the measured value is greater than the standard value

3. Determine the connecting rod journal to connecting rod bearing shell gap by deducting the value measured at Step (2) from that at Step (1). Standard value:

0.018~0.050 mm. Replace the bearing shell as necessary so that the gap is within the specified range.



Method II

1. Apply a small amount of engine oil on the connecting rod journal and bearing shell; cut a plastic measurement bar as long as the width of the bearing shell; place the bar between the connecting rod journal and bearing shell. Keep the bar parallel to the journal and avoid the oil hole.

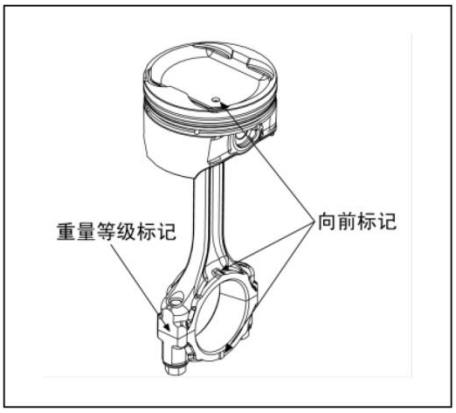
Caution: Refer to "0.2.1.30 Fastener Caution".

2. Install the connecting rod cap and the connecting rod bearing shell. Tighten

connecting rod bolt: 20 N·m + (90°±4°)

3. Remove the connecting rod cap and the bearing shell; use the provided ruler to measure the width of the plastic measurement bar to get the connecting rod journal to bearing shell gap. Standard value: 0.018~0.050 mm. Replace the bearing shell or relevant parts as necessary.

9.5.5.23 Piston and Connecting Rod Assemble (1.5T) (208665)

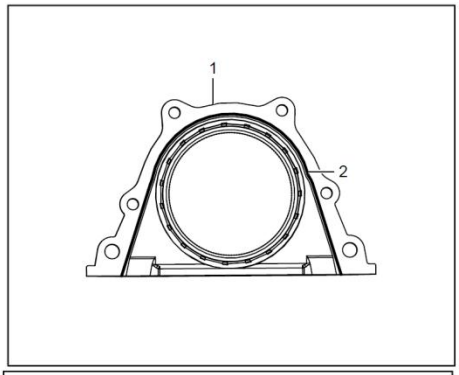


1. Apply a small amount of engine oil on the piston pin, piston pin hole and connecting rod small end.
2. Install the piston connecting rod and a new retainer at each end of the piston pin.

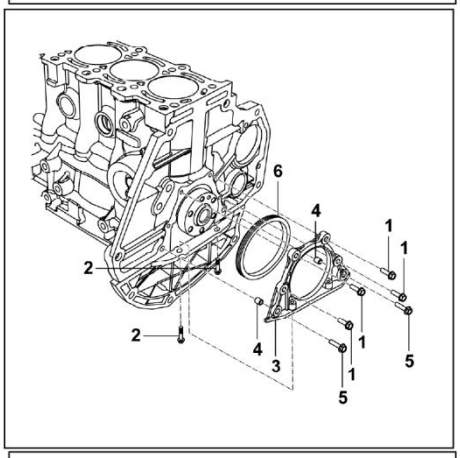
Note: When installing the piston, take care to ensure that the forward mark on the piston aligns with that on the connecting rod; if the connecting rod is a new one, ensure that the weight grade mark on the new one should be consistent with those on others.

3. Install the piston rings and keep the openings arranged like an equilateral triangle; the oil ring set openings should also be arranged alternately. Replace the air ring and oil ring set together with the piston ring.

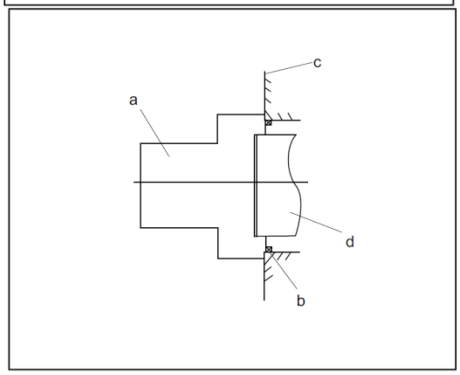
9.5.5.48 Crankshaft Rear Oil Seal Installation (1.5T) (208719)



1. Apply sealer on crankshaft rear oil seal seat to cylinder block mating face. Take care to avoid the bolt holes.
Sealer diameter: 4±0.5 mm
Distance from sealer center line to inside chamfer edge: 1±1 mm

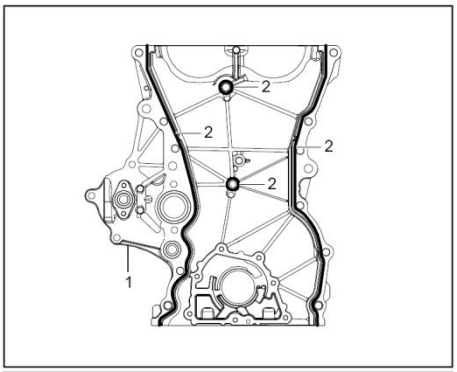


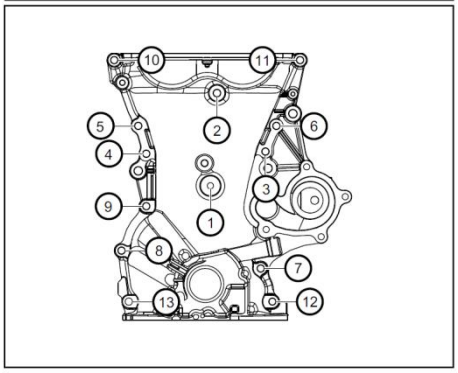
Caution: Refer to "0.2.1.30 Fastener Caution".
2. Install the crankshaft real oil seal seat to the cylinder block through the crankshaft rear oil seal seat locating pin.
Tighten
Crankshaft rear oil seal seat bolt: 10±2 N·m
Oil pan to crankshaft rear oil seal seat bolt: 10±2 N·m



3. *9.5.7.1 Special Tools*
Use special tool (a) PT - 0058 to install the crankshaft rear oil seal.

9.5.5.75 Engine Front Cover and Oil Pump Installation (1.5T) (208679)





1. Thoroughly clean the remaining sealer on mating surface between engine front cover and cylinder block & cylinder head with a clean cloth.
2. Apply new engine front cover sealer on the mating surface between cylinder block & cylinder head and engine front cover.

Sealer diameter: 4.5±0.5 mm
Distance from sealer center line to inside chamfer edge: 1±1 mm

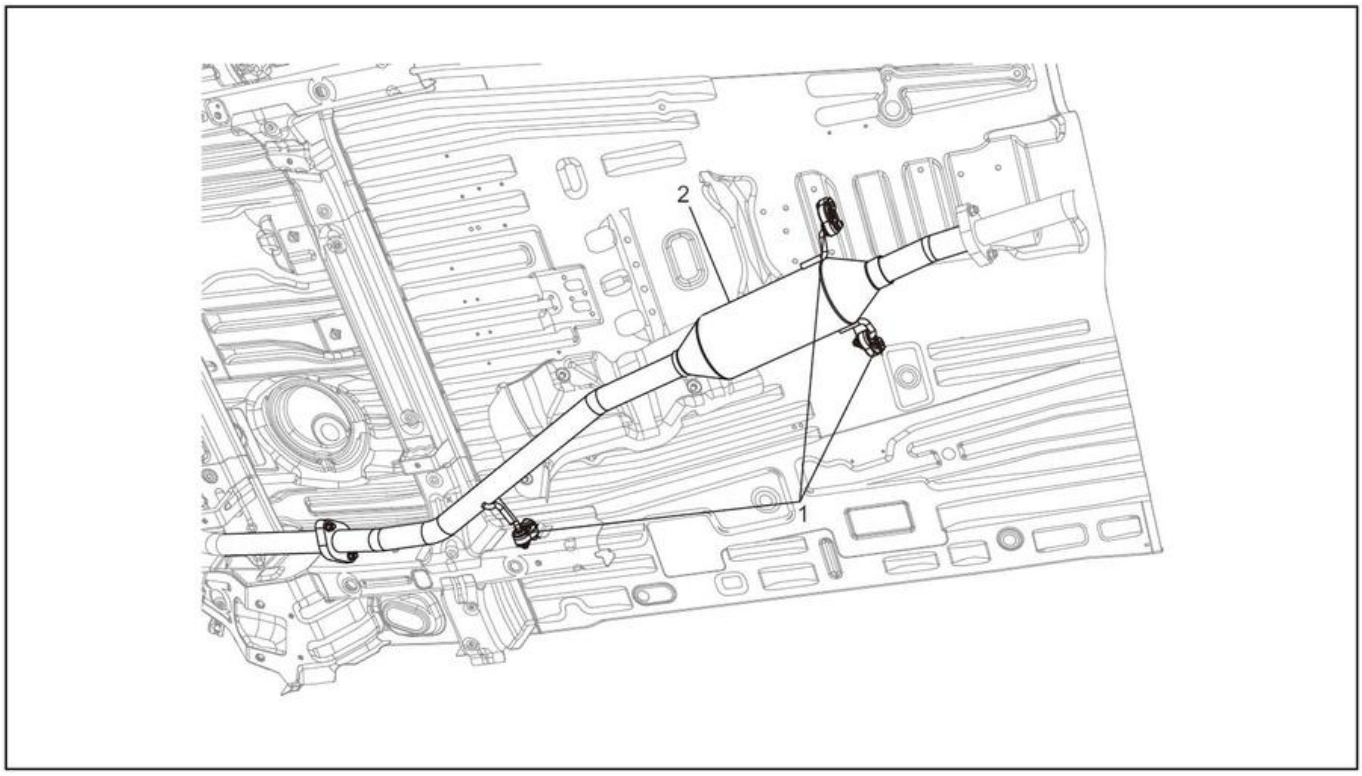
3. The sealer line should be continuous in the correct shape and position, bypassing the bolt holes successively. During installation, take care not to damage the sealer line and tighten the front cover bolts within 20 minutes after sealer application.
4. Install the front cover to the cylinder head and the cylinder block. Locate with the front cover locating pin and ensure installation in place in one time.

Caution: Refer to "0.2.1.30 Fastener Caution".

5. Tighten the 13 front cover bolts in the sequence shown in the figure and re - tighten 3 bolts (4), (3) and (6) as necessary.

Tighten
Front cover bolt: 22±2 N·m

9.7.3.6 Intermediate Pipe Replacement



Exhaust Muffler Replacement—Intermediate

Callout	Component Name
Preliminary Procedure ***Warning:*** *Refer to "**0.2.1.32 Exhaust System Inspection Warning**".* 1. Lift the vehicle. Refer to "***1.1.1.4 Lifting and Jacking the Vehicle***". 2. Disconnect the intermediate exhaust muffler from rear end of the exhaust front pipe. Refer to "***9.7.3.7 Front Exhaust Pipe Replacement***". 3. Disconnect the intermediate exhaust muffler from front end of the rear muffler. Refer to "***9.7.3.8 Rear Exhaust Muffler Replacement***".	
1	Intermediate exhaust muffler hanger (Qty.: 3) Procedure 1. Replace the aged rubber hanger.
2	Intermediate exhaust muffler