
GROUP 15

INTAKE AND EXHAUST

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GENERAL INFORMATION

M1151000100480

SUPERCHARGING PRESSURE CONTROL

By controlling the duty of the waste gate solenoid valve, the waste gate actuator functions to control the supercharging pressure. This allows a supercharged pressure matching the engine operation state to be attained. Control is carried out to prevent excessive supercharging and thereby prevent engine damage.

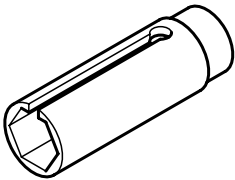
SERVICE SPECIFICATIONS

M1151000300699

Item	Standard value	Limit
Turbocharger supercharging pressure (waste gate solenoid valve not operating) kPa	96 – 121	–
Initial activation pressure of waste gate actuator (at the stroke of approximately 1 mm) kPa	Approximately 100	–
Waste gate solenoid valve coil resistance (at 20°C) Ω	29 – 35	–
Initial activation pressure of air bypass valve kPa	Approximately 59	–
Manifold distortion of the installation surface mm	0.15 or less	0.20

SPECIAL TOOL

M1151000600463

Tool	Number	Name	Use
	MD998770	Oxygen sensor wrench	Removal and installation of oxygen sensor

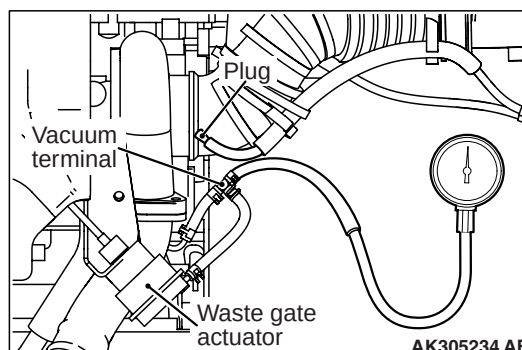
ON-VEHICLE SERVICE

TURBOCHARGER SUPERCHARGING PRESSURE CHECK

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CAUTION

Two persons should be in the vehicle when the test is conducted; the person in the passenger seat should read the indications shown by the pressure meter.



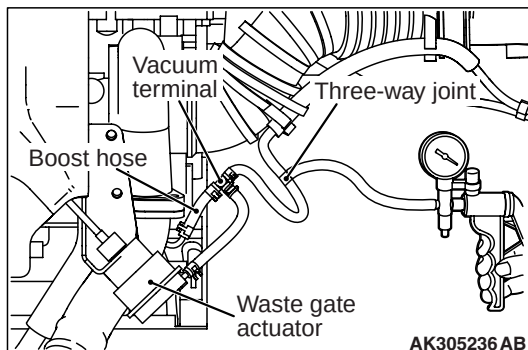
1. Disconnect the hose (black) from the vacuum terminal, and connect the plug to the hose. Connect a pressure gauge to the vacuum terminal nipple.
2. Drive at full-throttle acceleration in second gear and then measure the supercharging pressure when the engine speed is about 3,000 r/min.

Standard value: 96 – 121 kPa

3. If the supercharging pressure deviates from the standard value, check the following items for possible cause.
 - Malfunction of the waste gate actuator
 - Leakage of supercharging pressure
 - Malfunction of the turbocharger
4. When the indicated supercharging is more than standard value, supercharging control may be faulty, therefore check the followings.
 - Malfunction of the waste gate actuator
 - Malfunction of waste gate valve
 - Disconnection or cracks of the waste gate actuator rubber hose

SUPERCHARGING PRESSURE CONTROL SYSTEM CHECK

M1151001100160



1. Disconnect the hose (black) from the vacuum terminal, and connect a three-way joint between the hose and the vacuum terminal.
2. Connect a hand vacuum pump to the three-way joint.
3. Disconnect the hose from the turbocharger waste gate actuator control boost nipple and plug the nipple.

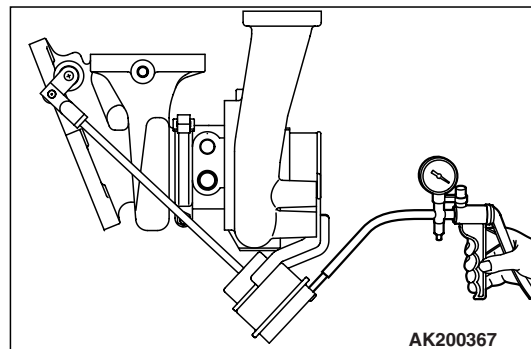
4. Applying a negative pressure with the hand vacuum pump, check tightness both when the hose end is closed and when it is open.

Engine state	Hose end	Normal state
Stop (Ignition switch: ON)	Opened	Negative pressure leaks.
	Closed	Negative pressure is maintained.
Idling (after warm-up)		Negative pressure leaks.

NOTE: If this check indicates an abnormal condition, the turbocharger waste gate actuator, turbocharger waste gate solenoid or hose is broken.

WASTE GATE ACTUATOR CHECK

M1151001200178



1. Connect a manual pump (pressure-application type) to nipple.

CAUTION

In order to avoid damage to the diaphragm, do not apply a pressure of 117 kPa or higher.

2. While gradually applying pressure, check the pressure that begins to activate (approximately 1 mm stroke) the waste gate actuator rod.

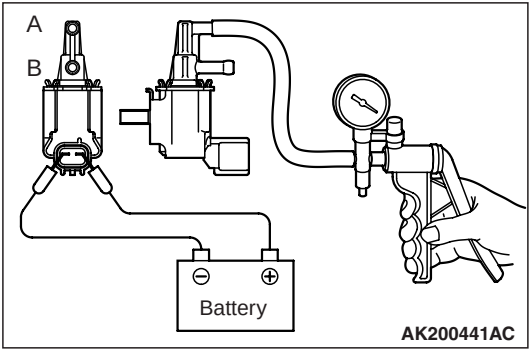
Standard value: Approximately 100 kPa

3. If there is a significant deviation from the standard value, check the actuator or the waste gate valve, replace actuator or turbocharger assembly if necessary.

WASTE GATE SOLENOID VALVE CHECK

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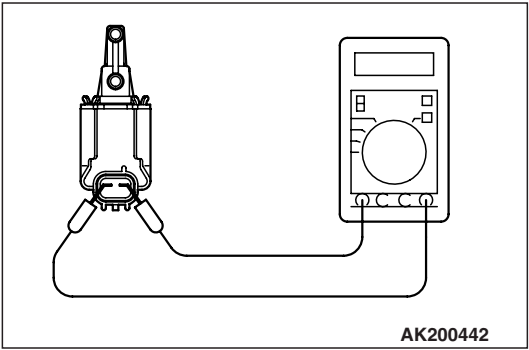
OPERATION CHECK



1. Connect a hand vacuum pump to the solenoid valve nipple A.
2. Using a jumper wire, connect between the solenoid valve terminal and battery terminal.
3. Connecting and disconnecting the jumper wire at the battery negative terminal to apply a negative pressure, check tightness.

Jumper wire	B nipple condition	Normal condition
Connected	Opened	Negative pressure leaks.
	Closed	Negative pressure is held.
Disconnected	Opened	Negative pressure is held.

COIL RESISTANCE CHECK

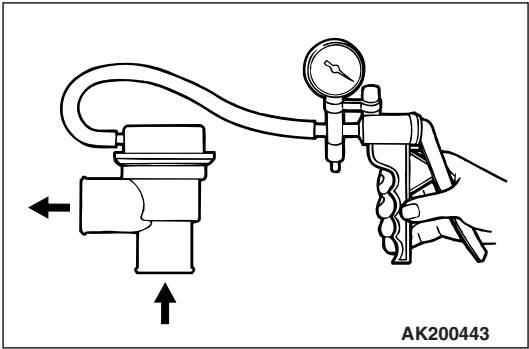


Measure the resistance between solenoid valve terminals

Standard value: 29 – 35 Ω (at 20°C)

AIR BY-PASS VALVE CHECK

M1151001600121



1. Remove the air bypass valve.
2. Connect the hand vacuum pump to the nipple of the air bypass valve.
3. Apply a negative pressure of approximately 54 kPa, and check that air tightness is maintained.
4. Also check operation of the valve.

Standard value:

Negative pressure	Valve operation
Approximately 59 kPa	It starts opening

INLET MANIFOLD VACUUM CHECK

M1151001800192

Refer to GROUP 11A – On-vehicle Service
[P.11A-12.](#)

AIR CLEANER

REMOVAL AND INSTALLATION

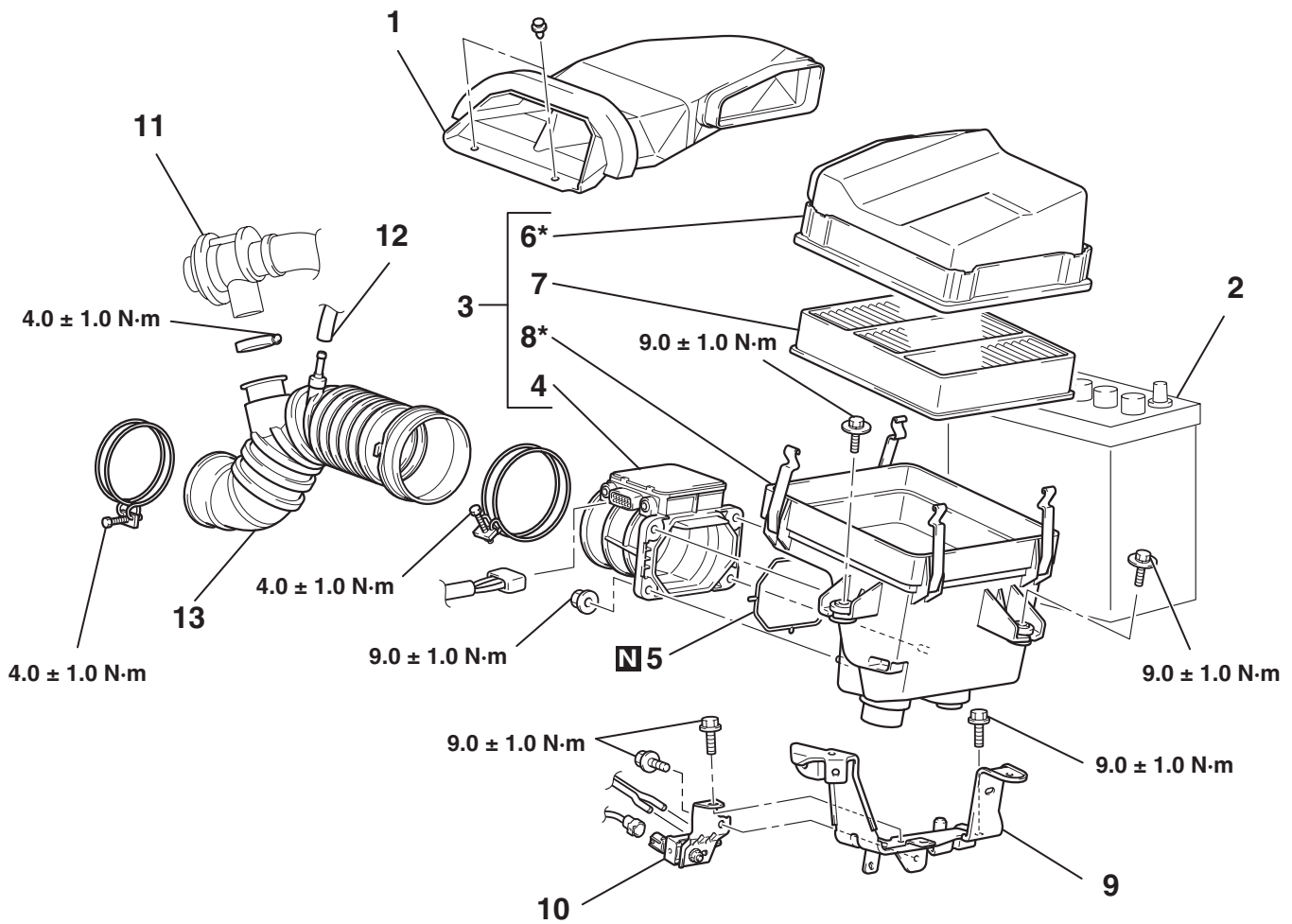
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CAUTION

Parts marked by * are made of recycled-paper mixed plastic material, so observe the following precautions.

1. Avoid any shock or load to these parts when removing and installing them.
2. Engage the case hinges securely when assembling these parts.

NOTE: Parts marked by * are made of recycled-paper mixed plastic material. Dispose of according to state and local laws



AC210412 AB

Removal steps

1. Intake air duct
2. Battery
3. Air cleaner assembly
4. Airflow sensor assembly
5. Gasket
6. Air cleaner housing cover
7. Air cleaner element

Removal steps (Continued)

8. Air cleaner housing
9. Air cleaner bracket
10. Waste gate solenoid valve
11. Air pipe C, air by-pass hose and air by-pass valve
12. Vacuum hose connection
13. Air intake hose

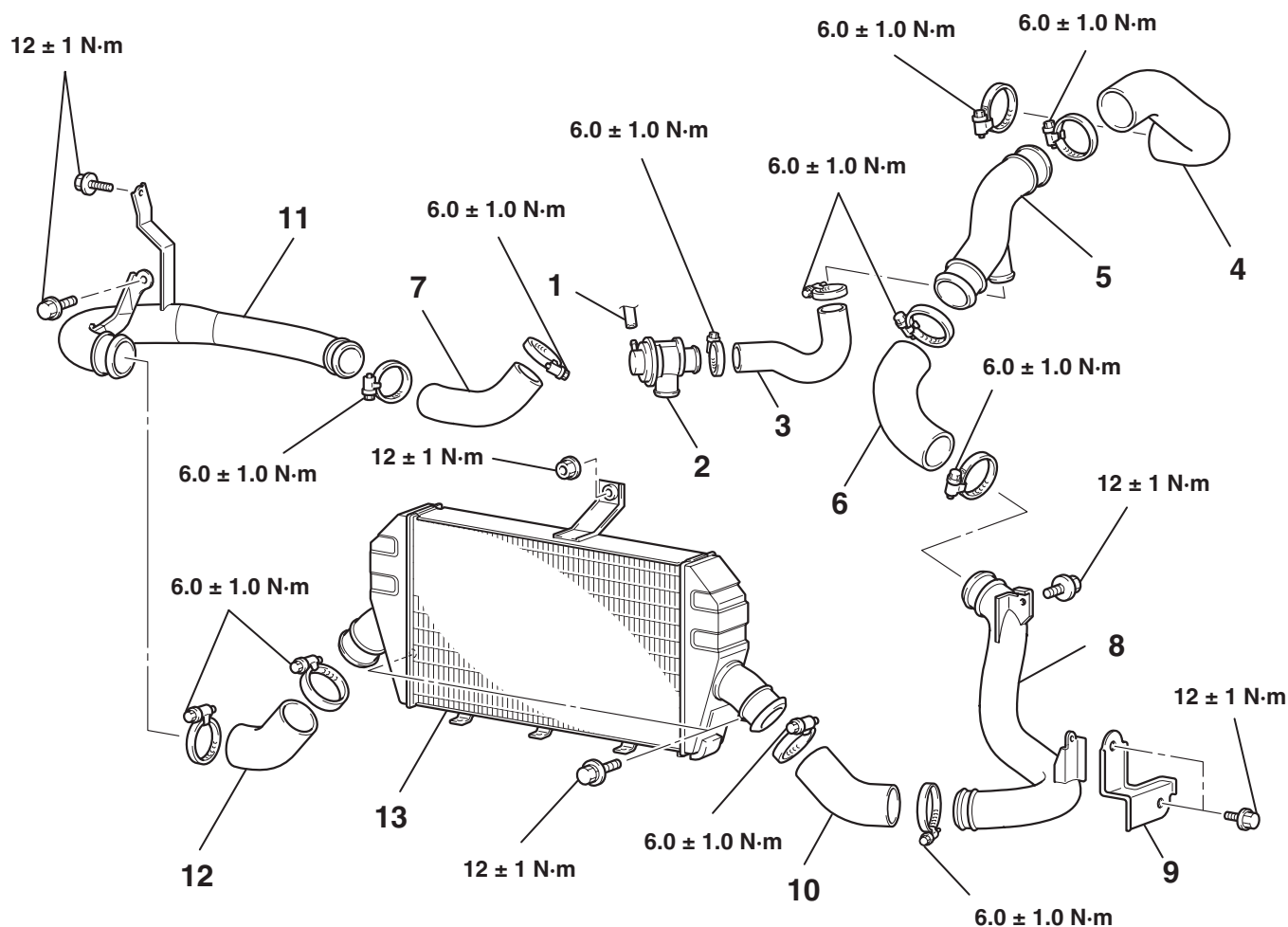
INTERCOOLER

REMOVAL AND INSTALLATION

M1151002400045

Pre-removal and Post-installation Operation

- Intake Air Duct and Air Cleaner Assembly Removal and Installation (Refer to [P.15-5](#)).



AC210413AB

Removal steps

1. Vacuum hose connection
2. Air by-pass valve
3. Air by-pass hose
4. Air hose E
5. Air pipe C
6. Air hose D
- Under cover (Refer to GROUP 51, Front Bumper Assembly [P.51-2](#)).
7. Air hose A

Removal steps (Continued)

- Front bumper assembly (Refer to GROUP 51, Front Bumper Assembly [P.51-2](#)).
- 8. Air pipe B
- 9. Bracket
- 10. Air hose C
- 11. Air pipe A
- 12. Air hose B
- 13. Intercooler assembly

INLET MANIFOLD

REMOVAL AND INSTALLATION

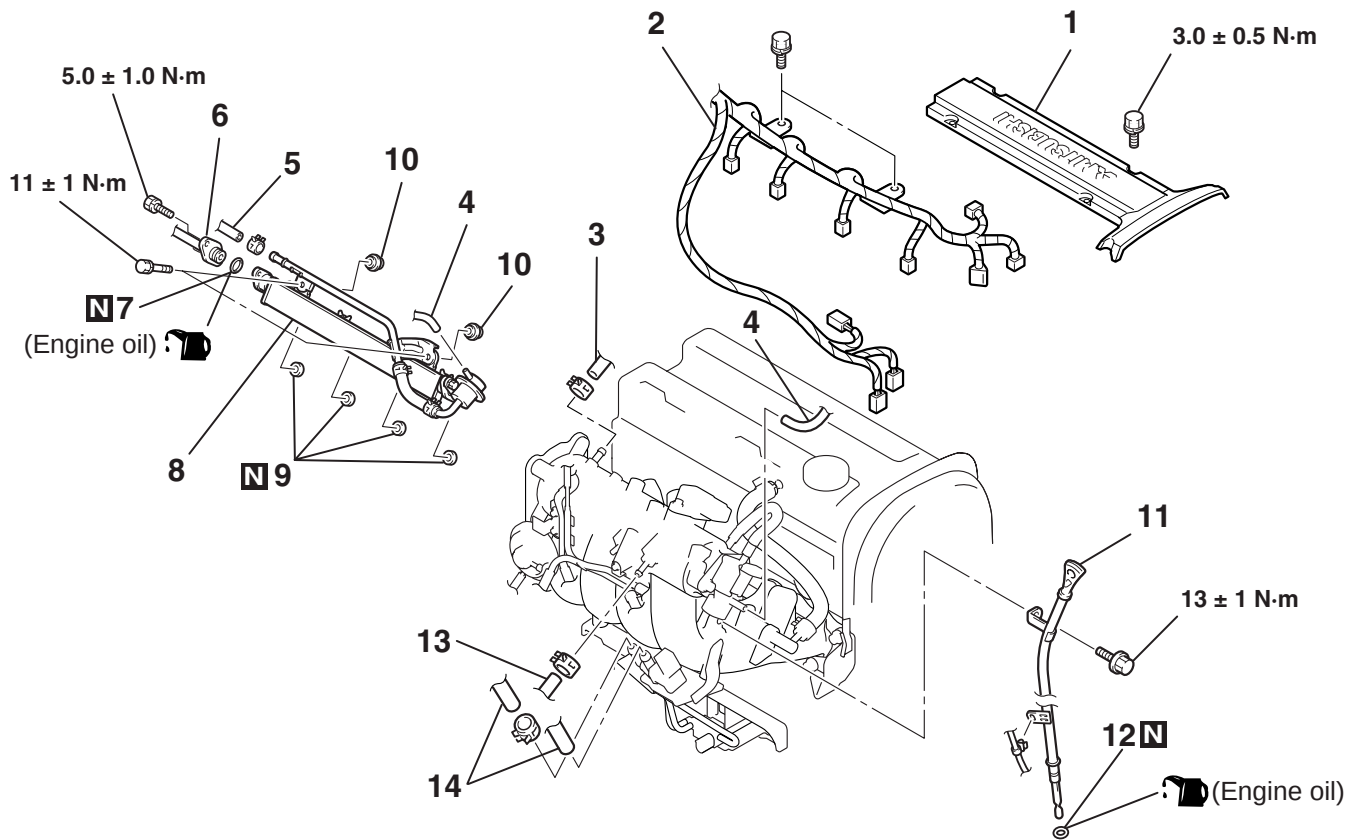
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Pre-removal Operation

- Fuel Discharge Prevention (Refer to GROUP 13A, On-vehicle Service [P.13A-398](#)).
- Under Cover Removal (Refer to GROUP 51, Front Bumper [P.51-2](#)).
- Engine Coolant Draining (Refer to GROUP 14, On-vehicle Service [P.14-15](#)).
- Intake Air Duct Removal (Refer to [P.15-5](#)).
- Strut Tower Bar Removal (Refer to GROUP 42, Strut Tower Bar [P.42-9](#)).
- Throttle Body Removal (Refer to GROUP 13A, Throttle Body [P.13A-413](#)).
- Crossmember Bar Removal (Refer to GROUP 32, Engine Roll Stopper, Centremember [P.32-7](#)).
- Front Exhaust Pipe Removal (Refer to [P.15-13](#)).

Post-installation Operation

- Front Exhaust Pipe Installation (Refer to [P.15-13](#)).
- Crossmember Bar Installation (Refer to GROUP 32, Engine Roll Stopper, Centremember [P.32-7](#)).
- Throttle Body Installation (Refer to GROUP 13A, Throttle Body [P.13A-413](#)).
- Strut Tower Bar Installation (Refer to GROUP 42, Strut Tower Bar [P.42-9](#)).
- Intake Air Duct Installation (Refer to [P.15-5](#)).
- Engine Coolant Refilling (Refer to GROUP 14, On-vehicle Service [P.14-15](#)).
- Under Cover Installation (Refer to GROUP 51, Front Bumper [P.51-2](#)).
- Accelerator Cable Adjustment (Refer to GROUP 17, On-vehicle Service [P.17-2](#)).



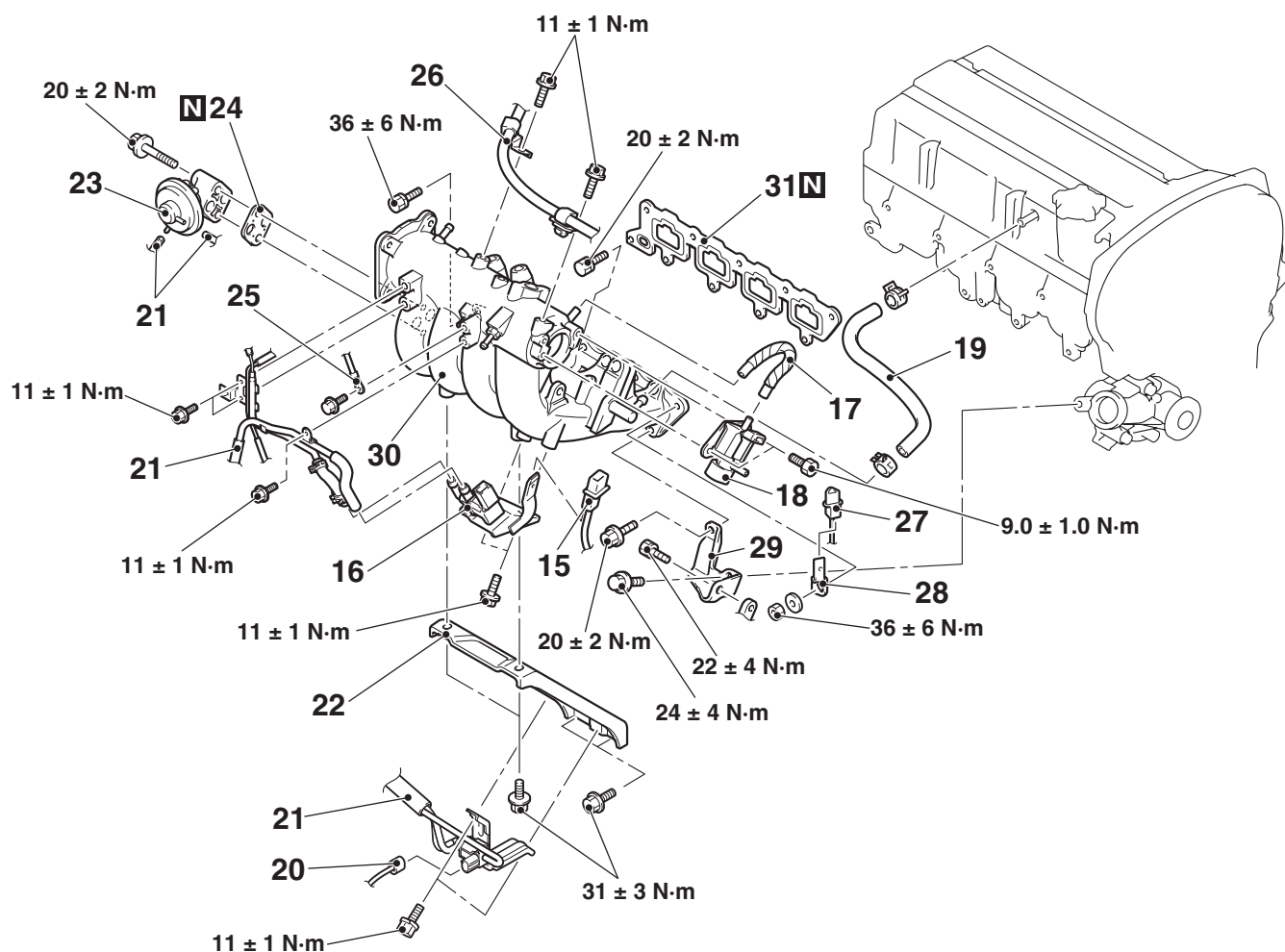
AC310728AB

Removal steps

1. Rocker cover centre cover
2. Control wiring harness connection
3. Vacuum hose connection
4. Vacuum hoses connection
5. Fuel return hose connection
- >>A<< 6. Fuel high-pressure hose connection
- >>A<< 7. O-ring
- <<A>> 8. Delivery pipe, fuel injector, fuel return pipe and fuel pressure regulator assembly

Removal steps (Continued)

9. Insulators
10. Insulators
11. Oil level gauge and guide assembly
12. O-ring
13. Brake booster vacuum hose connection
14. Purge hoses connection



AC504960AB

Removal steps

15. Detonation sensor connector
16. Purge control solenoid valve
17. Vacuum hose
18. Fuel pressure solenoid valve
19. PCV hose
- Alternator (Refer to GROUP 16, Charging System – Alternator Assembly [P.16-12](#)).
20. EGR solenoid valve connector
21. EGR solenoid valve, vacuum pipe and hose assembly

Removal steps (Continued)

22. Inlet manifold stay
23. EGR valve
24. EGR valve gasket
25. Earth cable connection
26. Harness connection
27. Crank angle sensor connector
28. Harness bracket
29. Alternator brace stay
30. Inlet manifold
31. Inlet manifold gasket

REMOVAL SERVICE POINT

<<A>> DELIVERY PIPE, FUEL INJECTOR, FUEL RETURN PIPE AND FUEL PRESSURE REGULATOR ASSEMBLY REMOVAL

CAUTION

Be careful not to drop the fuel injector when the delivery pipe is removed.

The delivery pipe must be removed with the fuel injector, fuel return pipe and fuel pressure regulator attached.

INSTALLATION SERVICE POINT

>>A<< O-RING/ FUEL HIGH-PRESSURE HOSE INSTALLATION

CAUTION

Do not let the engine oil get into the delivery pipe, or it will be damaged.

1. Apply a drop of new engine oil to the O-ring.
2. Turn the fuel high-pressure hose to the right and left to install to the delivery pipe.

Be careful not to damage the O-ring. After installing, check that the fuel high-pressure hose turns smoothly.

3. If the fuel high-pressure hose does not turn smoothly, the O-ring may be trapped. Remove the fuel high-pressure hose, re-install the fuel high-pressure hose into the delivery pipe and check again.
4. Tighten the fuel high-pressure hose to the specified torque.

Tightening torque: 5.0 ± 1.0 N·m

INSPECTION

M1151003100694

Check the following points; replace the part if a problem is found.

Inlet Manifold Check

1. Check for damage or cracking of any part.
2. Clogging of the negative pressure (vacuum) outlet port, or clogging of the exhaust gas recirculation passages.
3. Using a straight edge and feeler gauge, check for distortion of the cylinder head installation surface.

Standard value: 0.15 mm or less

Limit: 0.20 mm

EXHAUST MANIFOLD AND TURBOCHARGER

REMOVAL AND INSTALLATION

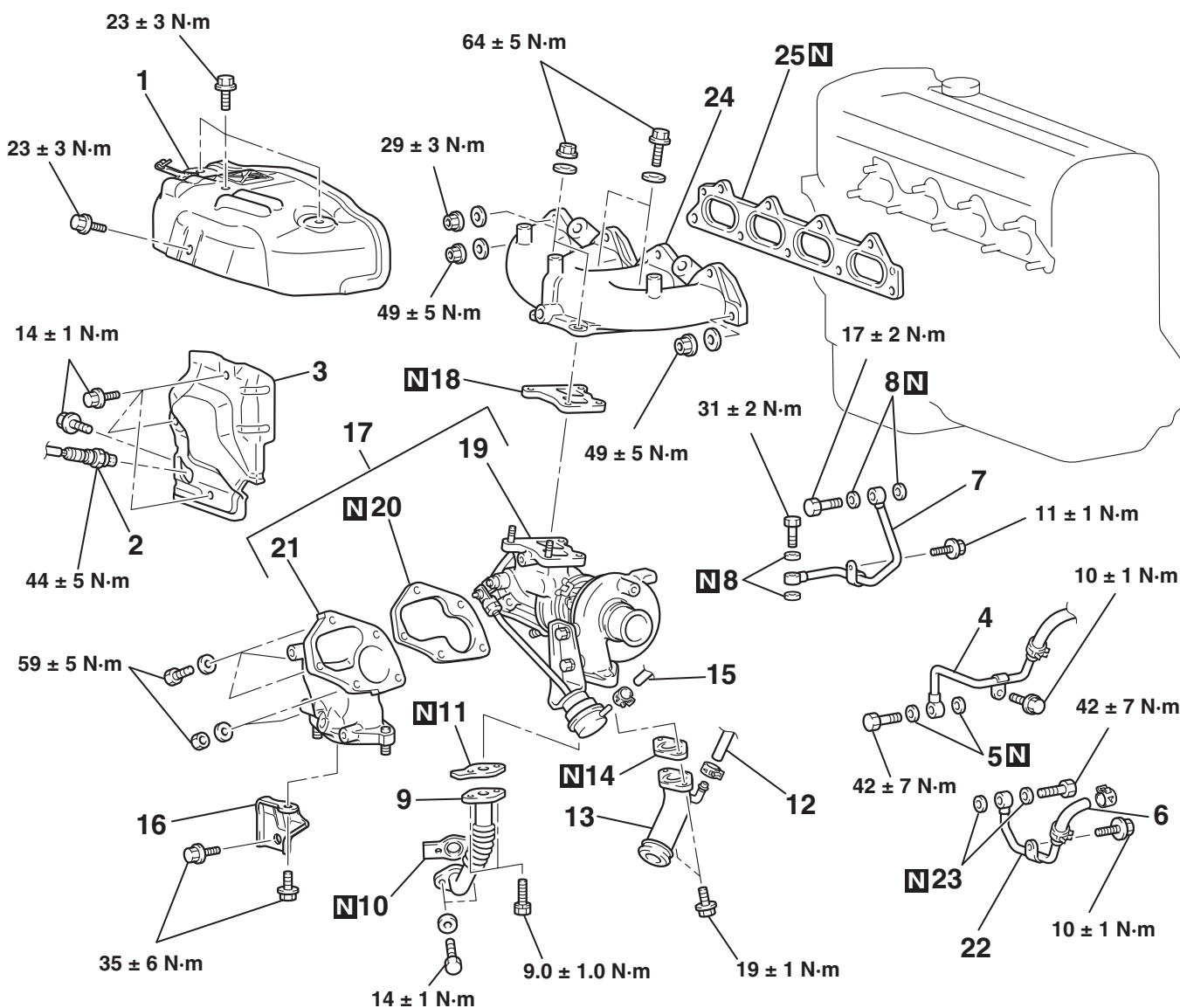
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Pre-removal Operation

- Under Cover Removal (Refer to GROUP 51, Front Bumper [P.51-2](#)).
- Radiator Removal (Refer to GROUP 14, Radiator [P.14-24](#)).
- Air Intake Hose Removal (Refer to [P.15-5](#)).
- Air Pipe A, Air Pipe B, Air Pipe C, Air Hose A and Air Hose D Removal (Refer to [P.15-6](#)).
- Crossmember Bar Removal (Refer to GROUP 32, Engine Roll Stopper, Centremember [P.32-7](#)).
- Front Exhaust Pipe Removal (Refer to [P.15-13](#)).

Post-installation Operation

- Front Exhaust Pipe Installation (Refer to [P.15-13](#)).
- Crossmember Bar Installation (Refer to GROUP 32, Engine Roll Stopper, Centremember [P.32-7](#)).
- Air Pipe A, Air Pipe B, Air Pipe C, Air Hose A and Air Hose D Installation (Refer to [P.15-6](#)).
- Air Intake Hose installation (Refer to [P.15-5](#)).
- Radiator Installation (Refer to GROUP 14, Radiator [P.14-24](#)).
- Under Cover Installation (Refer to GROUP 51, Front Bumper [P.51-2](#)).



AC210648 AB

Removal steps

- <<A>> >>D<<
1. Exhaust manifold cover
 2. Oxygen sensor (Front)
 3. Turbocharger heat protector
 4. Turbocharger water feed pipe connection

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Removal steps (Continued)

5. Gaskets
6. Turbocharger water return hose connection
7. Turbocharger oil feed pipe
8. Gaskets

Removal steps (Continued)

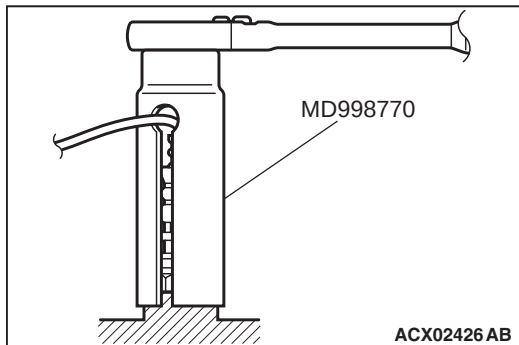
- Starter motor (Refer to GROUP 16, Starting System – Starter Motor Assembly P.16-20).
- 9. Turbocharger oil return pipe
- >>C<< 10. Turbocharger oil return pipe gasket
- 11. Turbocharger oil return pipe gasket
- 12. Vacuum hose connection
- 13. Air outlet fitting
- >>B<< 14. Air outlet fitting gasket
- 15. Vacuum hose connection
- 16. Exhaust fitting bracket

Removal steps (Continued)

- 17. Turbocharger and exhaust fitting assembly
- 18. Turbocharger gasket
- >>A<< 19. Turbocharger assembly
- 20. Exhaust fitting gasket
- 21. Exhaust fitting assembly
- 22. Turbocharger water return pipe and hose assembly
- 23. Gaskets
- 24. Exhaust manifold
- 25. Exhaust manifold gasket

REMOVAL SERVICE POINTS

**<<A>> OXYGEN SENSOR (FRONT)
REMOVAL**



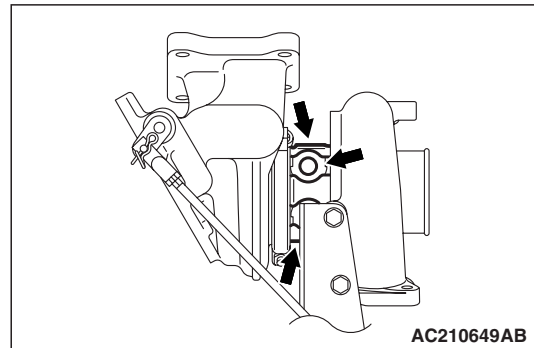
Use special tool oxygen sensor wrench (MD998770) to remove the oxygen sensor (front).

**<> TURBOCHARGER OIL FEED PIPE
REMOVAL**

⚠ CAUTION

Take care not to allow foreign objects to get into the oil passage hole of the turbocharger assembly after the turbocharger oil feed pipe is removed.

**INSTALLATION SERVICE POINTS
>>A<< TURBOCHARGER ASSEMBLY
INSTALLATION**



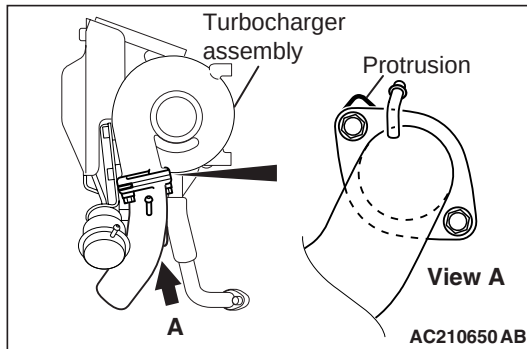
1. Clean the oil pipe and water pipe fitting, the inside of eye bolts, and individual pipe for clogs.

⚠ CAUTION

Take care not to allow foreign objects to get into the turbocharger assembly.

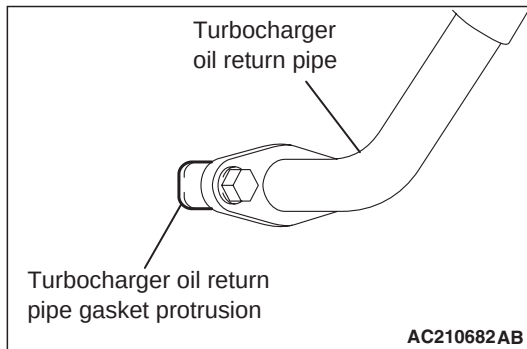
2. Clean or use compressed air to remove any carbon particles stuck to the oil passage of the turbocharger assembly.
3. Refill new engine oil at the oil feed pipe fitting hole of the turbocharger assembly.

>>B<< AIR OUTLET FITTING GASKET INSTALLATION



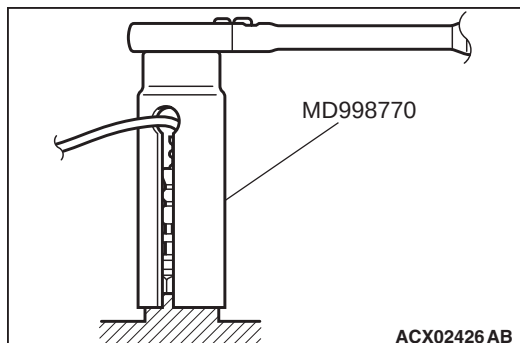
Install the gasket so that its protrusion faces in the direction shown in the illustration.

>>C<< TURBOCHARGER OIL RETURN PIPE GASKET INSTALLATION



Install the gasket so that its protrusion faces in the direction shown in the illustration.

>>D<< OXYGEN SENSOR (FRONT) INSTALLATION



Use special tool oxygen sensor wrench (MD998770) to install the oxygen sensor (front).

INSPECTION

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Check the following points; replace the part if a problem is found.

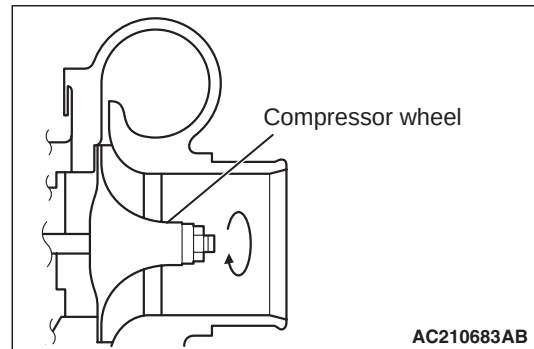
Exhaust Manifold Check

1. Check for damage or cracking of any part.
2. Using a straight edge and a feeler gauge, check for distortion of the cylinder head installation surface.

Standard value: 0.15 mm or less

Limit: 0.20 mm

Turbocharger Assembly Check

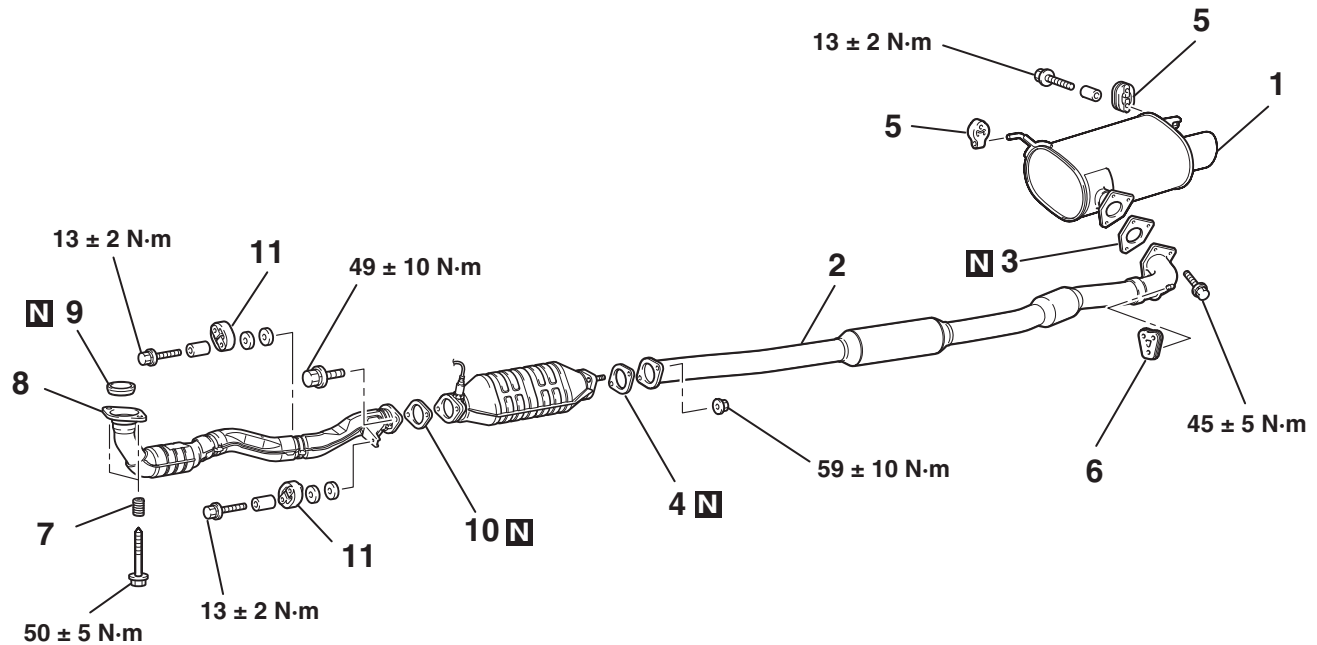


1. Visually check the turbine wheel and the compressor wheel for cracking or other damage.
2. Check whether the turbine wheel and the compressor wheel can be easily turned by hand.
3. Check for oil leakage from the turbocharger assembly.
4. Check whether or not the turbocharger waste gate regulating valve remains open. If any problem is found, replace the part after disassembly.

EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

M1151008700390



AC310642AB

Exhaust main muffler removal steps

1. Exhaust main muffler
3. Exhaust pipe gasket
5. Exhaust muffler hangers

Centre exhaust pipe removal steps

2. Centre exhaust pipe
3. Exhaust pipe gasket
4. Exhaust pipe gasket
6. Exhaust pipe hanger

Front exhaust pipe removal steps

- Under cover (Refer to GROUP 51, Front Bumper Assembly P.51-2).
- Crossmember bar (Refer to GROUP 32, Engine Roll Stopper, Centremember P.32-7).
- 7. Springs
- 8. Front exhaust pipe
- 9. Seal ring
- 10. Exhaust pipe gasket
- 11. Exhaust pipe hangers

NOTES