GROUP 15

INTAKE AND EXHAUST

CONTENTS

GENERAL DESCRIPTION

M1151000100361

The exhaust pipe is divided into three parts.

INTAKE AND EXHAUST DIAGNOSIS

INTRODUCTION

M1151006900291

Intake leaks usually create driveability issues that are not obviously related to the intake system. Exhaust leaks or abnormal noise is caused by cracks, gaskets and fittings, or by when the exhaust pipe or muffler is damaged due to impacts during travel. The exhaust leaks from these sections and causes the exhaust noise to increase. There may be cases when the system contacts the body and vibration noise is generated.

TROUBLESHOOTING STRATEGY

M1151007000291

Use these steps to plan your diagnostic strategy. If you follow them carefully, you will be sure that you have exhausted most of the possible ways to find an intake or exhaust system fault.

1. Gather information from the customer.
2. Verify that the condition described by the customer exists.
3. Find the malfunction by following the Symptom Chart.
4. Verify malfunction is eliminated.

SYMPTOM CHART

M1151007100298

SYMPTOM	INSPECTION PROCEDURE	REFERENCE PAGE
Exhaust Leakage	1	P.15-2
Abnormal Noise	2	P.15-3

SYMPTOM PROCEDURES

INSPECTION PROCEDURE 1: Exhaust Leakage

DIAGNOSIS

STEP 1. Start the engine. Have an assistant stay in the driver's seat. Raise the vehicle on a hoist. Have the assistant rev the engine while searching for exhaust leaks.

Q: Is the exhaust leaking?
YES : Go to Step 2.
NO : The procedure is complete.

STEP 2. Check the gasket for cracks, damage.

Q: Is the gasket damaged?
YES : Replace the gasket, then go Step 1.
NO : Go to Step 3.

STEP 3. Check for loosening in each coupling section.

Q: Is there any loosening in each section?
YES : Tighten, then go to Step 1.
NO : There is no action to be taken.

INSPECTION PROCEDURE 2: Abnormal Noise

DIAGNOSIS

STEP 1. Start the engine. Have an assistant stay in the drivers seat. Raise the vehicle on a hoist. Have the assistant rev the engine while searching for exhaust leaks.

Q: Is any abnormal noise generated?
YES : Go to Step 2.
NO : The procedure is complete.

STEP 2. Check for missing parts in the muffler. Tap the muffler lightly to check for loose baffles, etc.

Q: Are there any missing parts in the muffler?
YES : Replace, then go to Step 1.
NO : Go to Step 3.

STEP 3. Check the hanger for cracks.

Q: Is the hanger cracked?
YES : Replace, then go to Step 1.
NO : Go to Step 4.

STEP 4. Check for interference of the pipes and muffler with the body.

Q: Are the pipes and muffler interfering with the body?
YES : Repair, then go to Step 1.
NO : Go to Step 5.

STEP 5. Check the heat protectors.

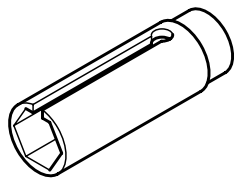
Q: Are any heat protectors loose or damaged?
YES : Tighten or replace, then go to Step 1.
NO : Go to Step 6.

STEP 6. Check the pipes, catalytic converters and muffler for damage.

Q: Are the pipes, catalytic converters and muffler damaged?
YES : Replace, then go to Step 1.
NO : There is no action to be taken.

SPECIAL TOOL

M1151000600333

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
	MD998770 Oxygen sensor wrench	MD998770-01 or General service tool	Removal and installation of heated oxygen sensor

TROUBLESHOOTING

M1151010200024

Symptom	Probable cause	Remedy
Exhaust gas leakage	Loose joints	Retighten
	Broken pipe or muffler	Repair or replace
Abnormal noise	Broken baffle in muffler	Replace
	Broken rubber hangers	Replace
	Interference of pipe or muffler with vehicle body	Correct
	Broken pipe or muffler	Repair or replace

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ON-VEHICLE SERVICE

MANIFOLD VACUUM CHECK

M1151001800158

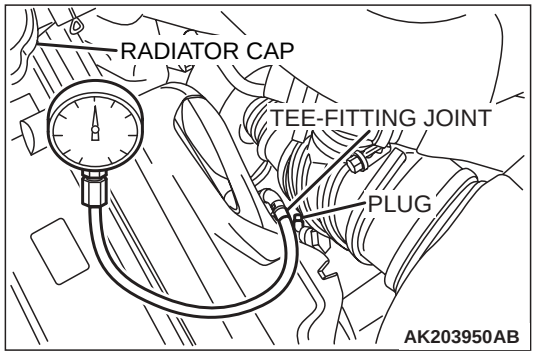
Refer to GROUP 11A, On-vehicle Service. P.11A-15

INTAKE CHARGE PRESSURE CHECK

M1151001000163

⚠ CAUTION

Do a test drive with two passengers in the vehicle and where full throttle acceleration can be safely made. A drive should not read the pressure gauge, but a front passenger should.

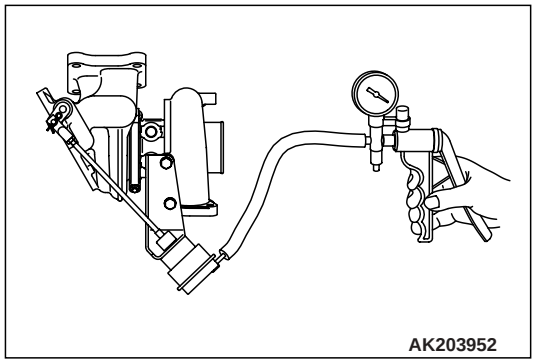


1. Disconnect the hose (black) from the tee-fitting joint and connect the pressure gauge to this joint. Plug the hose (black).
2. Drive the vehicle with full throttle and accelerate the engine to a speed of more than 3,000 r/min at 2nd gear. Measure the supercharging pressure when the pointer is stabilized.

   Standard value: 53 – 80 kPa (7.7 – 11.6 psi)
3. If the intake charge pressure is lower than the standard value, check the following items for possible cause.
   - Malfunction of turbocharger wastegate actuator.
   - Intake charge pressure leaks.
   - Faulty turbocharger.
4. If the intake charge pressure is higher than the standard value, the intake charge pressure control may be faulty. Ther fore check the following.
   - Malfunction of turbocharger wastegate actuator.
   - Malfunction of turbocharger wastegate regulating valve.
   - Disconnect or cracked turbocharger wastegate actuator hose.

TURBOCHARGER TURBOCHARGER WASTEGATE ACTUATOR CHECK

M1151001200112



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

⚠ CAUTION

In order to abovid 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 wastegate actuator rod.

   Standard value: Approximately 100 kPa
3. If there is asignificant deviation from the standard value, check the actuator or the wastegate valve: replace if necessary.

INTAKE CHARGE PRESSURE CONTROL SYSTEM CHECK

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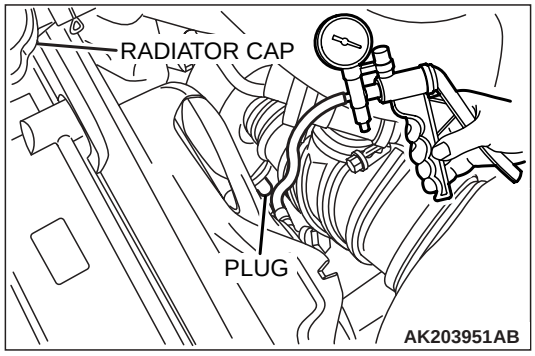


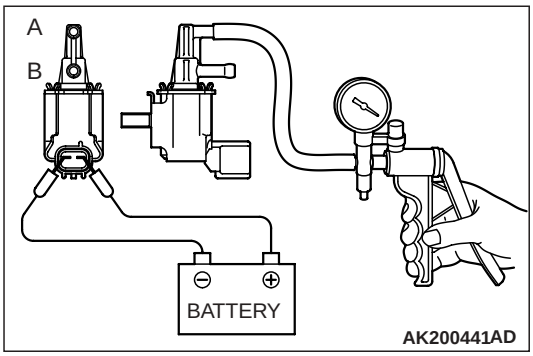
1. After the diagnostic trouble code of MFI system is completely read, turn off the ignition switch.
2. Disconnect the hose (black) from the turbocharger wastegate actuator control boost nipple at the air outlet fitting and plug this nipple.
3. Connect a hand vacuum pump to the hose (black).
4. Use the vacuum pump to apply negative pressure, and check the negative pressure condition while the engine is stopped and while it is idling.

Engine state	Normal state
Stop (Ignition switch: "ON" position)	Negative pressure is maintained
Idle (after warmup)	Negative pressure leaks

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

TURBOCHARGER TURBOCHARGER WASTEGATE SOLENOID CHECK

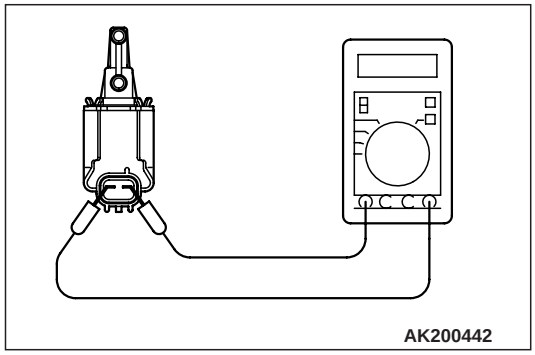
M1151001300119



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

Jumper wire	B nipple condition	Normal state
Connected	Open	Negative pressure leaks.
	Close	Negative pressure is held.
Disconnected	Open	Negative pressure is held.

COIL RESISTANCE CHECK

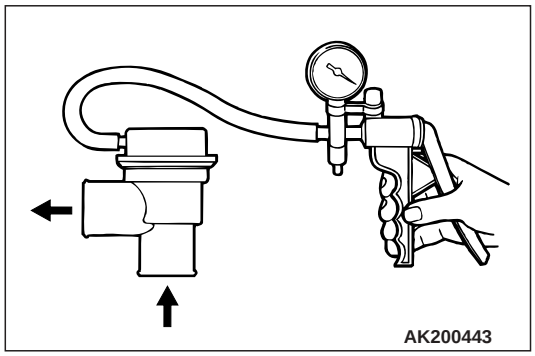


Measure resistance between solenoid valve terminals.

Standard value: 29 – 35 Ω [at 20°C (68°F)]

TURBOCHARGER BYPASS VALVE CHECK

M1151001600109



1. Remove the turbocharger bypass valve.
2. Connect the hand vacuum pump to the nipple of the turbocharger bypass valve.
3. Apply a negative pressure of approximately 53 kPa (16 in.Hg) and check operation of the valve. Also check that air tightness is maintained.

Negative pressure	Valve operation
approximately 53 kPa (16 in.Hg)	It starts opening

AIR CLEANER

REMOVAL AND INSTALLATION

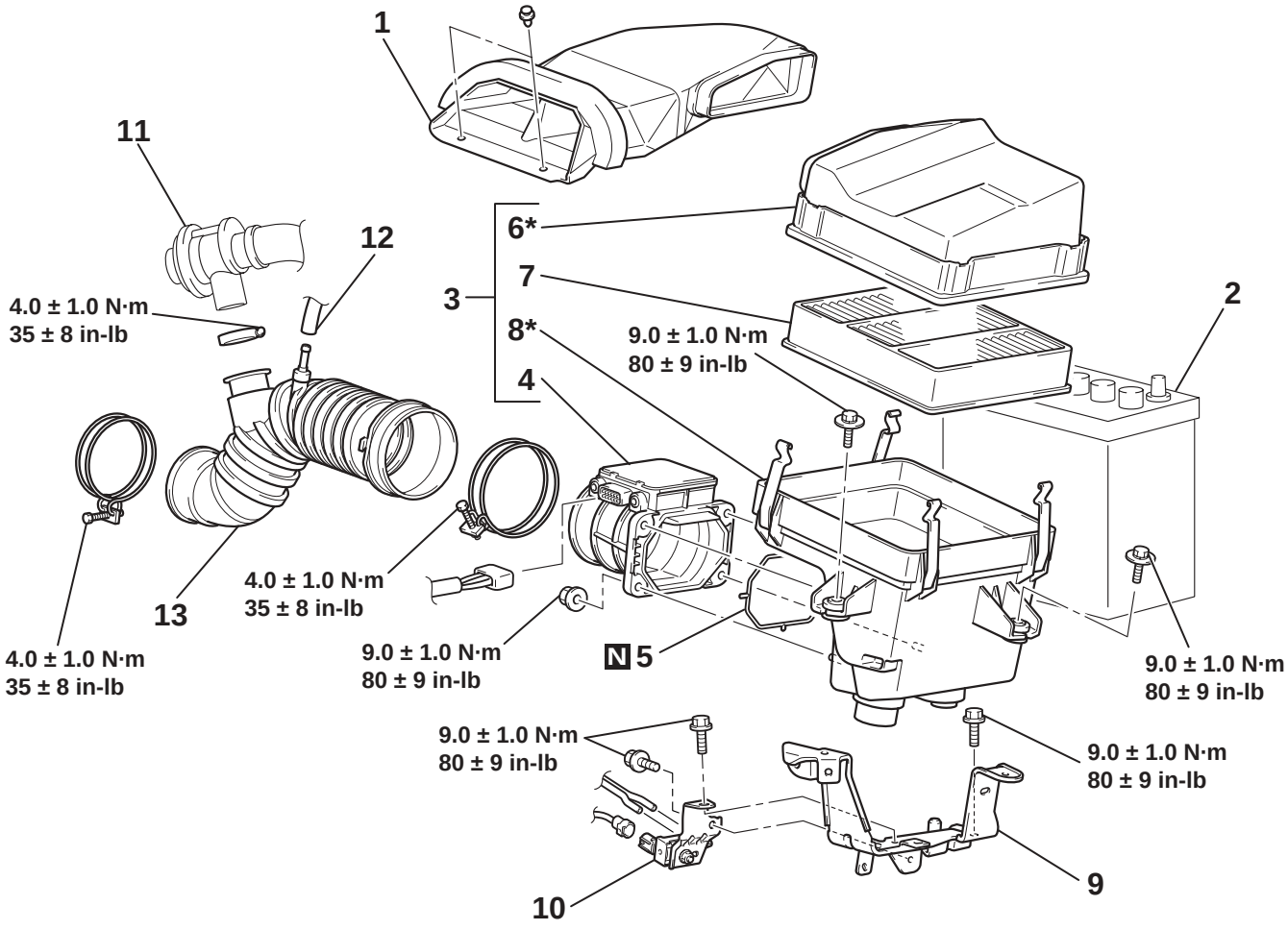
M1151002100378

⚠ 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. VOLUME AIRFLOW SENSOR ASSEMBLY
5. GASKET
6. AIR CLEANER HOUSING COVER
7. AIR CLEANER ELEMENT
8. AIR CLEANER HOUSING

REMOVAL STEPS (Continued)

9. AIR CLEANER BRACKET
10. TURBOCHARGER WASTEGATE SOLENOID
11. AIR PIPE C, AIR BY-PASS HOSE AND TURBOCHARGER BYPASS VALVE ASSEMBLY
12. VACUUM HOSE CONNECTION
13. AIR INTAKE HOSE

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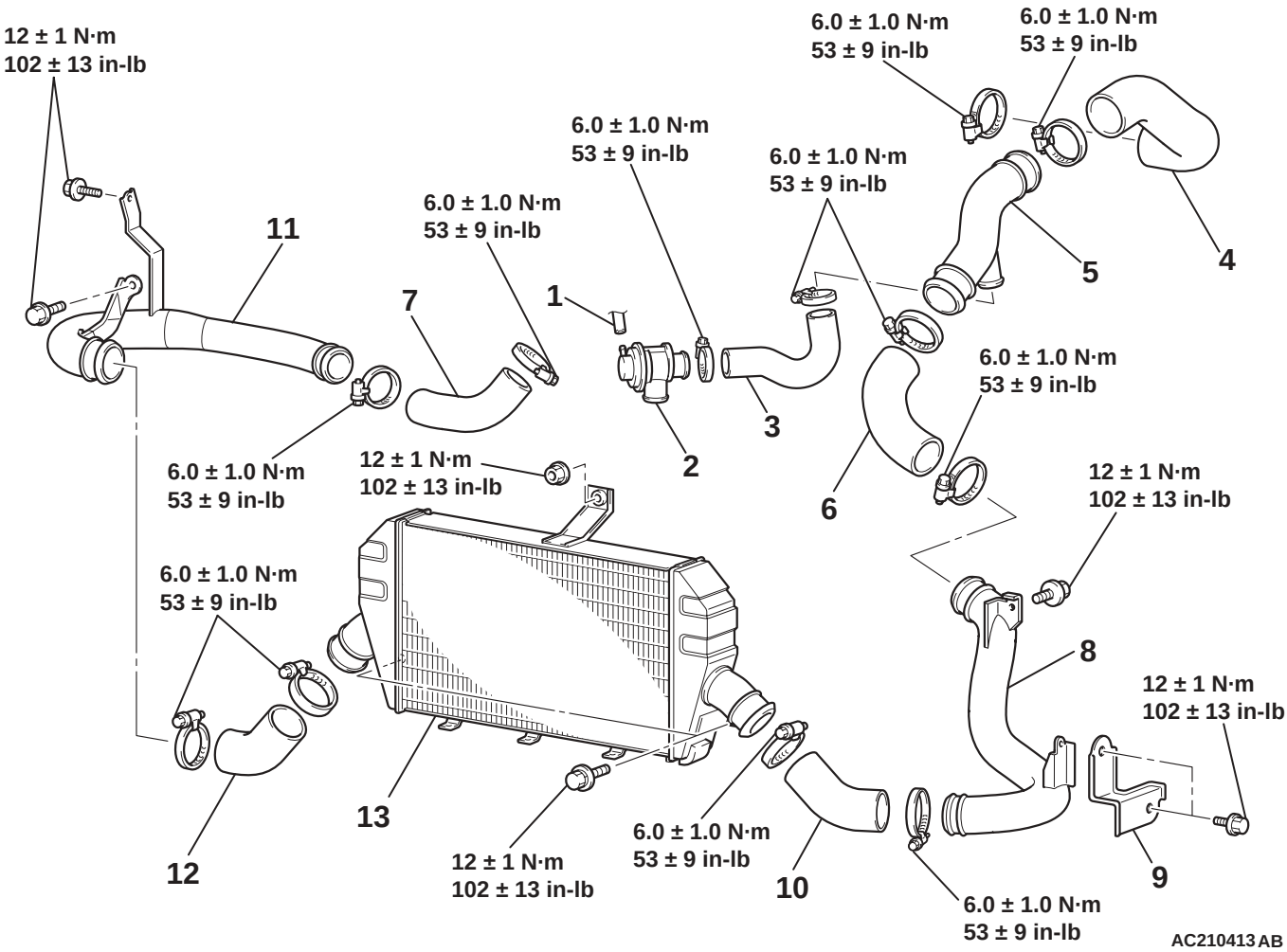
CHARGE AIR COOLER

REMOVAL AND INSTALLATION

M1151002400023

Pre-removal and Post-installation Operation
- Intake Air Duct and Air Cleaner Assembly Removal and Installation (Refer to P.15-7).



REMOVAL STEPS
1. VACUUM HOSE CONNECTION
2. TURBOCHAREGER BYPASS VALVE ASSEMBLY
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. CHARGE AIR COOLER ASSEMBLY

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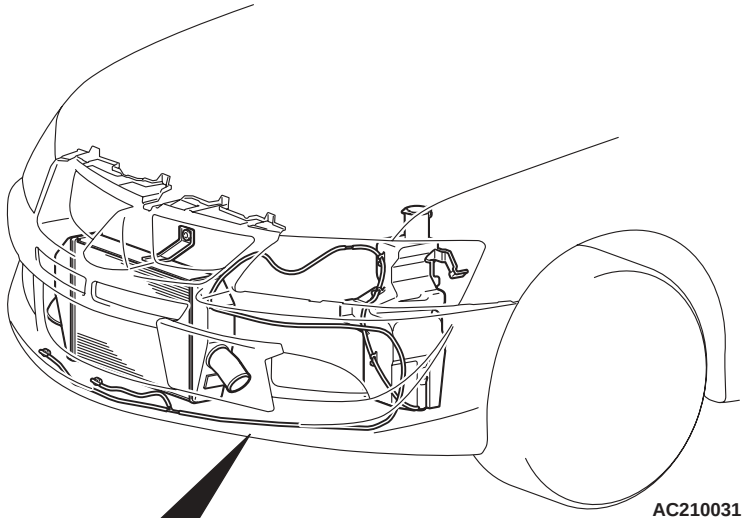
CHARGE AIR COOLER WATER SPRAY

REMOVAL AND INSTALLATION

M1151009100012

<CHARGE AIR COOLER WATER SPRAY NOZZLE, HOSE AND TANK>



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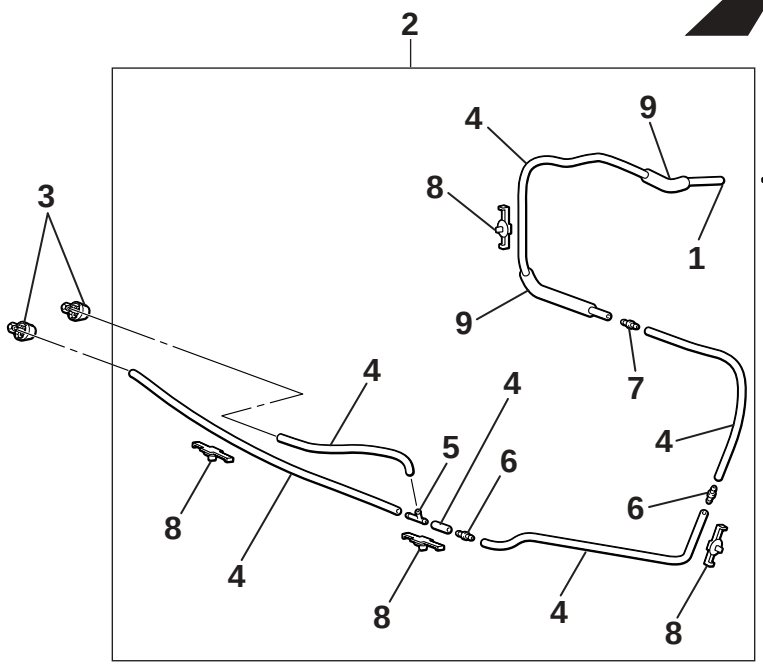

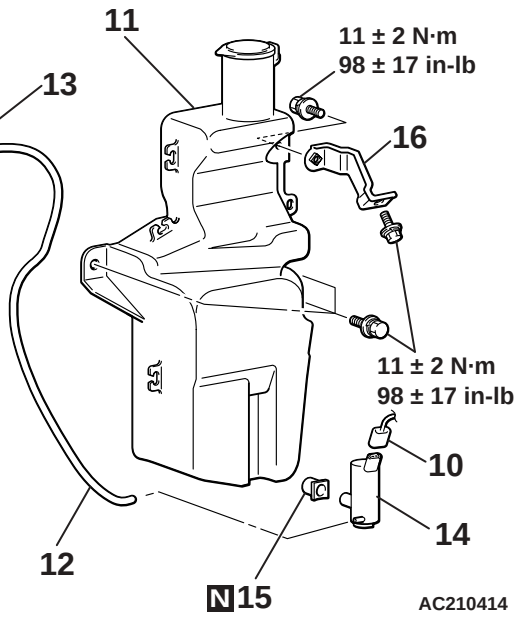

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AC210415 AB

CHARGE AIR COOLER WATER SPRAY NOZZLE/WATER HOSE REMOVAL STEPS

1. CHARGE AIR COOLER WATER SPRAY WATER HOSE CONNECTION
   - FRONT BUMPER ASSEMBLY (REFER TO GROUP 51, FRONT BUMPER ASSEMBLY P.51-2).

>>A<< 2. CHARGE AIR COOLER WATER SPRAY WATER HOSE ASSEMBLY

3. CHARGE AIR COOLER WATER SPRAY NOZZLE

CHARGE AIR COOLER WATER SPRAY NOZZLE/WATER HOSE REMOVAL STEPS (Continued)

4. RUBBER TUBE
5. THREE WAY JOINT
6. STOP VALVE
7. JOINT
8. CLIP
9. PAD

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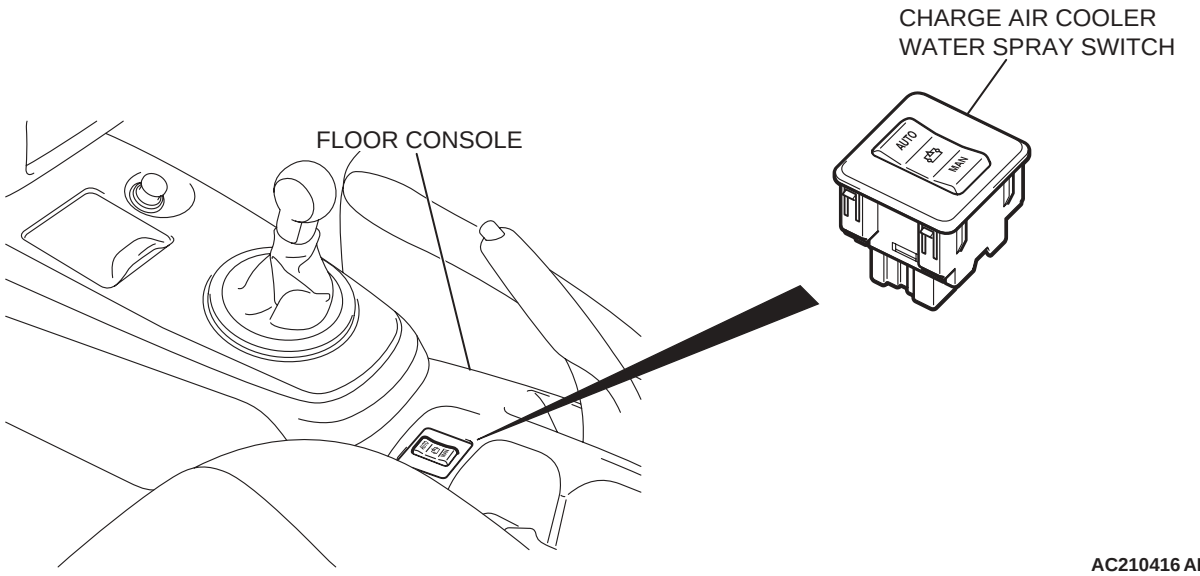
CHARGE AIR COOLER WATER SPRAY TANK REMOVAL STEPS

1. CHARGE AIR COOLER WATER SPRAY WATER HOSE CONNECTION
10. CHARGE AIR COOLER WATER SPRAY MOTOR CONNECTOR
11. CHARGE AIR COOLER WATER SPRAY TANK ASSEMBLY
12. WATER HOSE
13. STOP VALVE
14. CHARGE AIR COOLER WATER SPRAY MOTOR
15. PACKING
16. CHARGE AIR COOLER WATER SPRAY TANK BRACKET

<CHARGE AIR COOLER WATER SPRAY SWITCH>



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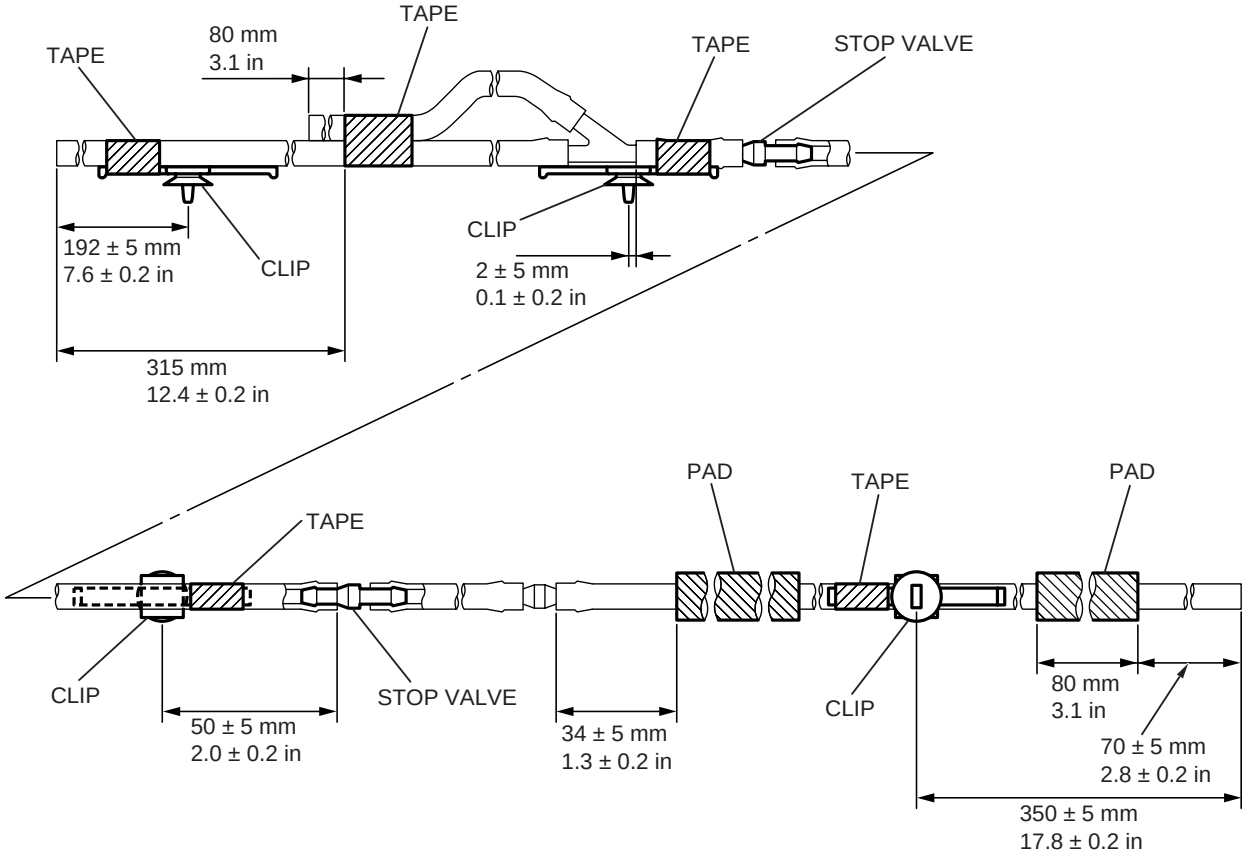
INSTALLATION SERVICE POINT

>>A<< CHARGE AIR COOLER WATER SPRAY WATER HOSE ASSEMBLY INSTALLATION



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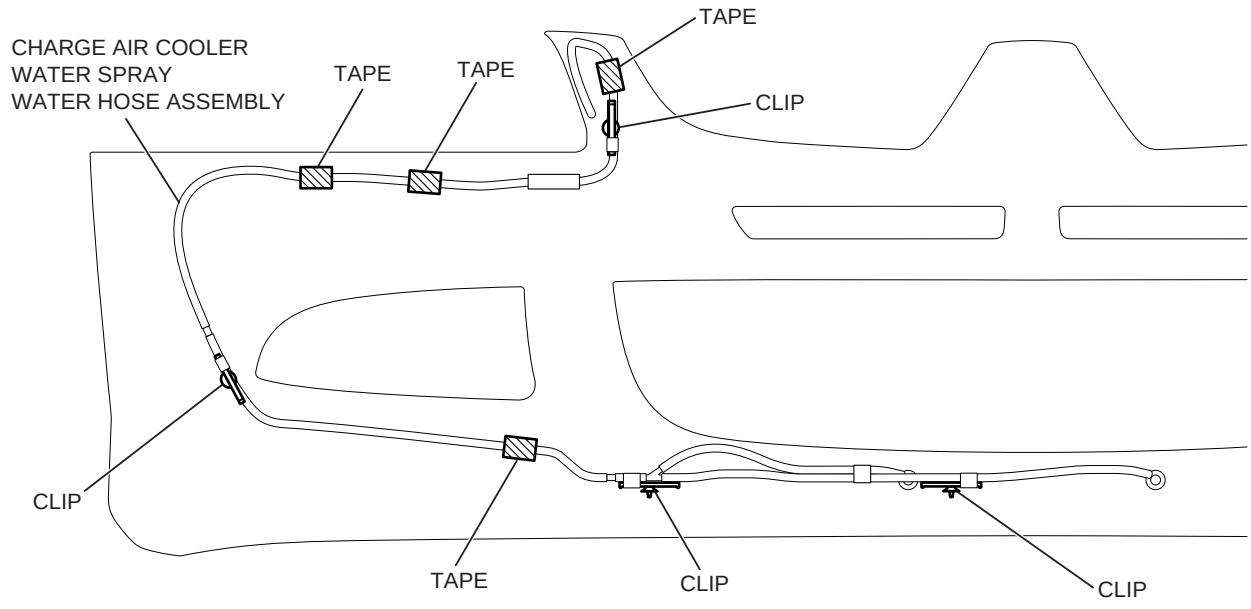
1. After the rubber tubes, the three-way joint, the stop valves and the joint are assembled, stick the clips, the pads and tape to the rubber tubes as shown.

<VIEWED FROM INSIDE OF FRONT BUMPER>



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2. Use the clips and tapes to locate the charge air cooler water spray water hose assembly in position.

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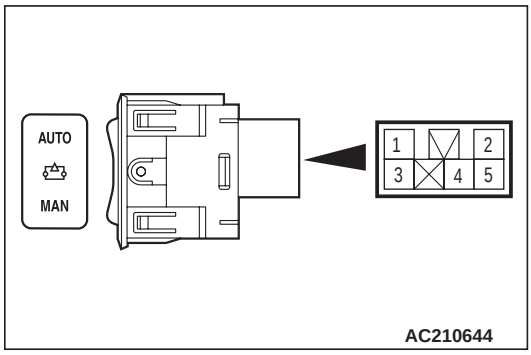
INSPECTION

M1151009200019

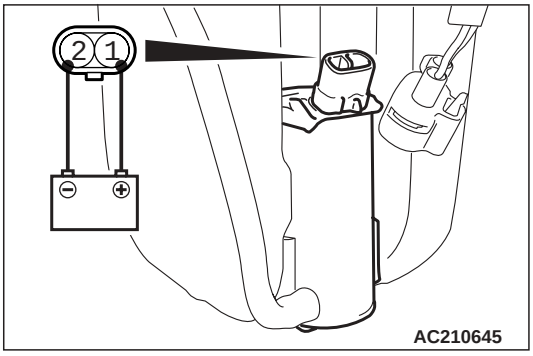
Charge Air Cooler Water Spray Switch Check



SWITCH POSITION	TESTER CONNECTION	SPECIFIED CONDITION
AUTO	2 – 4	Less than 2 ohms
	2 – 3	Open Circuit
Neutral	2 – 4	Open Circuit
	2– 3	Open Circuit
MAN	2 – 4	Open Circuit
	2 – 3	Less than 2 ohms

Charge Air Cooler Water Spray Motor Check

1. Check the charge air cooler water spray motor with the charge air cooler water spray tank attached after the tank is supplied with water.
2. Check that the water is supplied with strong pressure after energizing terminal number 1 with battery voltage and grounding terminal number 2.

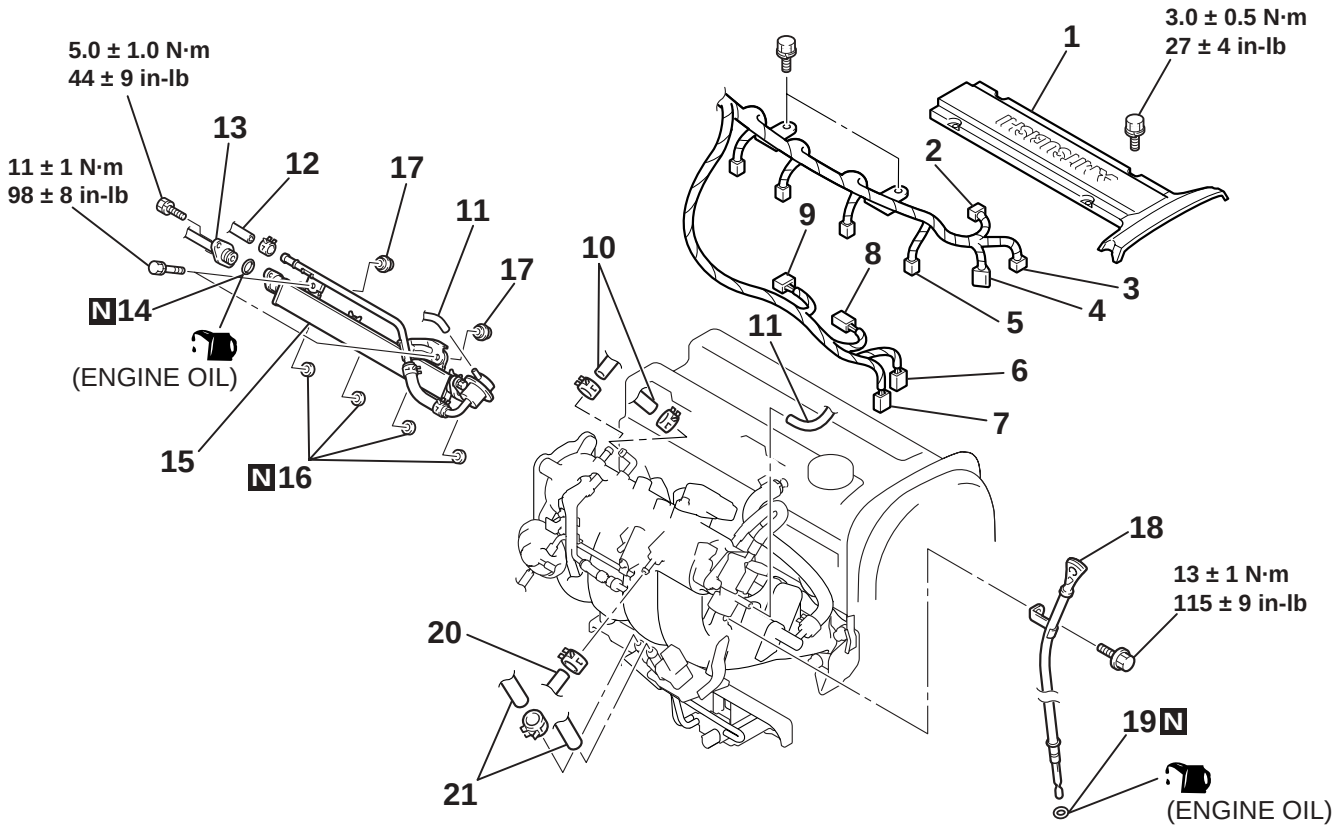


INTAKE MANIFOLD

REMOVAL AND INSTALLATION

M1151003000608

Pre-removal Operation	Post-installation Operation
• Fuel Discharge Prevention (Refer to GROUP 13A, On-vehicle Service P.13A-765). • Under Cover Removal (Refer to GROUP 51, Front Bumper P.51-2). • Engine Coolant Draining (Refer to GROUP 14, On-vehicle Service P.14-18). • Intake Air Duct Removal (Refer to P.15-7). • Strut Tower Bar Removal (Refer to GROUP 42, Strut Tower Bar P.42-12). • Throttle Body Removal (Refer to GROUP 13A, Throttle Body P.13A-779). • Crossmember Bar Removal (Refer to GROUP 32, Engine Roll Stopper, Centermember P.32-6). • Front Exhaust Pipe Removal (Refer to P.15-23).	• Front Exhaust Pipe Installation (Refer to P.15-23). • Crossmember Bar Installation (Refer to GROUP 32, Engine Roll Stopper, Centermember P.32-6). • Throttle Body Installation (Refer to GROUP 13A, Throttle Body P.13A-779). • Strut Tower Bar Installation (Refer to GROUP 42, Strut Tower Bar P.42-12). • Intake Air Duct Installation (Refer to P.15-7). • Engine Coolant Refilling (Refer to GROUP 14, On-vehicle Service P.14-18). • Under Cover Installation (Refer to GROUP 51, Front Bumper P.51-2). • Accelerator Cable Adjustment (Refer to GROUP 17, On-vehicle Service P.17-4).



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REMOVAL STEPS
1. CENTER COVER
2. IGNITION COIL CONNECTOR
3. HEATED OXYGEN SENSOR (FRONT) CONNECTOR
4. CRANKSHAFT POSITION SENSOR CONNECTOR
5. FUEL INJECTOR CONNECTOR
6. KNOCK SENSOR CONNECTOR
7. EVAPORATIVE EMISSION PURGE SOLENOID CONNECTOR
8. FUEL PRESSURE SOLENOID

REMOVAL STEPS (Continued)
9. MANIFOLD DIFFERENTIAL PRESSURE SENSOR CONNECTOR
10. VACUUM HOSES CONNECTION
11. VACUUM HOSE
12. FUEL RETURN HOSE CONNECTION

>>A<< 13. FUEL HIGH-PRESSURE HOSE CONNECTION

14. O-RING

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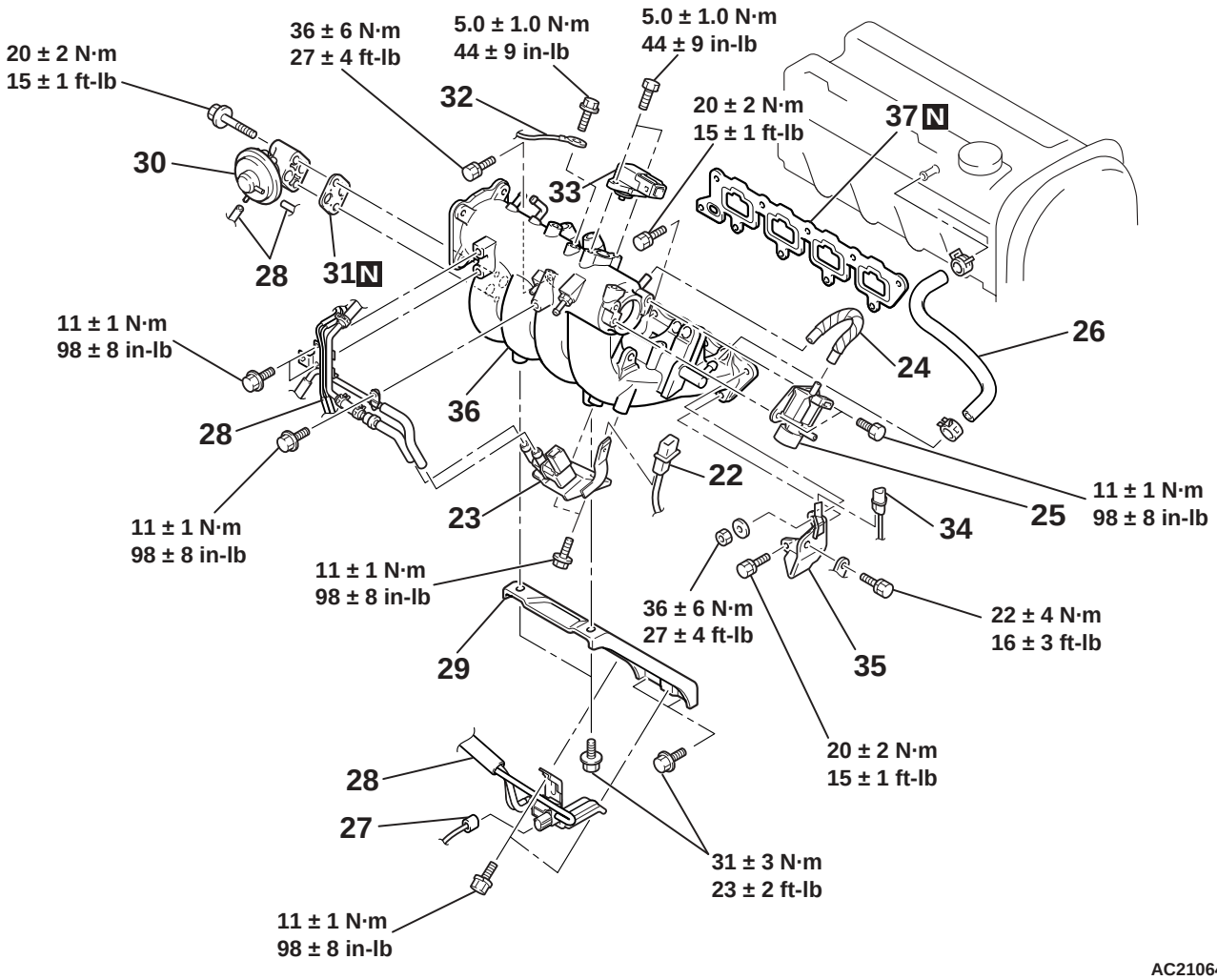
REMOVAL STEPS (Continued)

<<A>>
15. FUEL RAIL, FUEL INJECTOR, FUEL RETURN PIPE AND FUEL PRESSURE REGULATOR ASSEMBLY
16. INSULATORS
17. INSULATORS
18. OIL LEVEL GAUGE AND GUIDE ASSEMBLY

REMOVAL STEPS (Continued)

19. O-RING
20. BRAKE BOOSTER VACUUM HOSE CONNECTION
21. EVAPORATIVE EMISSION PURGE HOSES CONNECTION



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REMOVAL STEPS

22. KNOCK SENSOR CONNECTOR
23. EVAPORATIVE EMISSION PURGE SOLENOID
24. VACUUM HOSE
25. FUEL PRESSURE SOLENOID
26. PCV HOSE
- GENERATOR (REFER TO GROUP 16, CHARGING SYSTEM - GENERATOR ASSEMBLY P.16-14)

27. EGR VACUUM REGULATOR SOLENOID CONNECTOR
28. EGR VACUUM REGULATOR SOLENOID AND VACUUM PIPE & HOSE ASSEMBLY

REMOVAL STEPS (Continued)

29. INTAKE MANIFOLD STAY
30. EGR VALVE
31. EGR VALVE GASKET
32. GROUND CABLE CONNECTION
33. MANIFOLD DIFFERENTIAL PRESSURE SENSOR
34. CRANKSHAFT POSITION SENSOR CONNECTOR
35. GENERATOR BRACE STAY
36. INTAKE MANIFOLD
37. INTAKE MANIFOLD GASKET

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REMOVAL SERVICE POINT

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

⚠ CAUTION

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

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

INSTALLATION SERVICE POINT

>>A<< FUEL HIGH-PRESSURE HOSE INSTALLATION

⚠ CAUTION

Don not let the engine oil get into the fuel rail 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 fuel rail.
   Be careful not to damage the O-ring. After installing, check that the fuel high-pressure hose turns smoothly.
3. If 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 nose into the fuel rail and check again.
4. Tighten the fuel high-pressure hose to the specified torque.

   Tightening torque: 5.0 ± 1.0 N·m (44 ± 9 in-lb)

INSPECTION

M1151003100519

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

Intake 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.

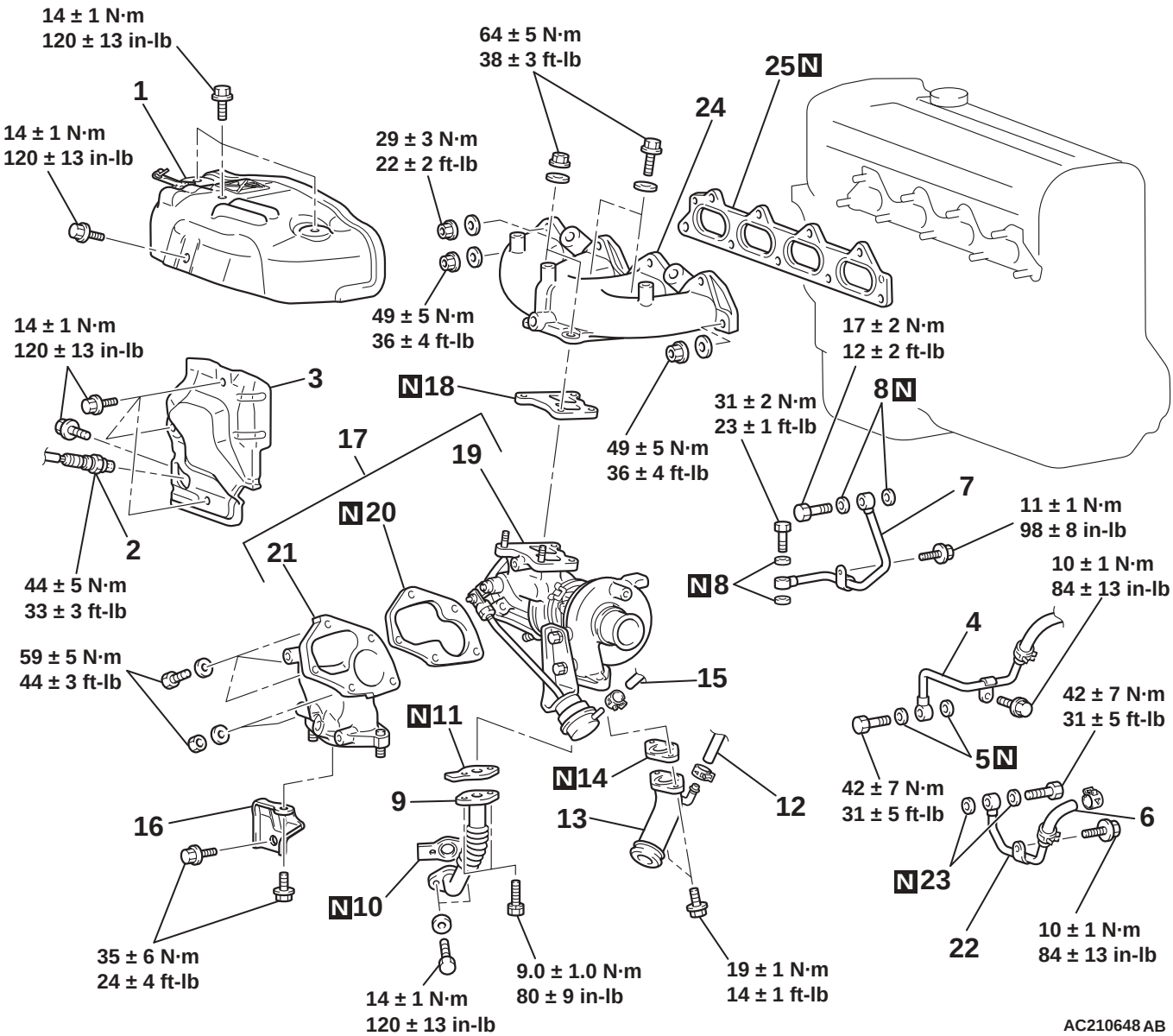
   Standard value: 0.15 mm (0.006 inch) or less
   Limit: 0.20 mm (0.008 inch)

EXHAUST MANIFOLD AND TURBOCHARGER

REMOVAL AND INSTALLATION

M1151008900048

Pre-removal Operation	Post-installation Operation
• Under Cover Removal (Refer to GROUP 51, Front Bumper P.51-2). • Radiator Removal (Refer to GROUP 14, Radiator P.14-22). • Air Intake Hose Removal (Refer to P.15-7). • Air Pipe A, Air Pipe B, Air Pipe C, Air Hose A and Air Hose D Removal (Refer to P.15-8). • Crossmember Bar Removal (Refer to GROUP 32, Engine Roll Stopper, Centermember P.32-6). • Front Exhaust Pipe Removal (Refer to P.15-23).	• Front Exhaust Pipe Installation (Refer to P.15-23). • Crossmember Bar Installation (Refer to GROUP 32, Engine Roll Stopper, Centermember P.32-6). • Air Pipe A, Air Pipe B, Air Pipe C, Air Hose A and Air Hose D Installation (Refer to P.15-8). • Air Intake Hose installation (Refer to P.15-7). • Radiator Installation (Refer to GROUP 14, Radiator P.14-22). • Under Cover Installation (Refer to GROUP 51, Front Bumper P.51-2).



AC210648 AB

REMOVAL STEPS

<<A>> >>D<<
1. EXHAUST MANIFOLD COVER
2. HEATED OXYGEN SENSOR (FRONT)
3. TURBOCHARGER HEAT PROTECTOR

REMOVAL STEPS (Continued)

4. TURBOCHARGER WATER FEED PIPE CONNECTION
5. GASKET
6. TURBOCHARGER WATER RETURN HOSE CONNECTION

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REMOVAL STEPS (Continued)

<<B>>
7. TURBOCHARGER OIL FEED PIPE
8. GASKET
- STARTER MOTOR (REFER TO GROUP 16, STARTING SYSTEM - STARTER MOTOR ASSEMBLY P.16-24).

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

REMOVAL STEPS (Continued)

15. VACUUM HOSE CONNECTION
16. EXHAUST FITTING BRACKET
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. GASKET
24. EXHAUST MANIFOLD
25. EXHAUST MANIFOLD GASKET

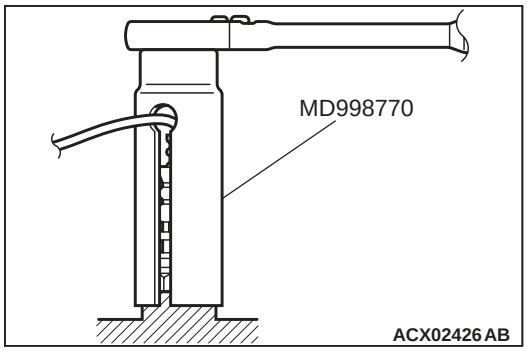
Required Special Tool:

- MD998770: Oxygen sensor wrench

REMOVAL SERVICE POINTS

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

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



<<B>> TURBOCHARGER OIL FEED PIPE REMOVAL

⚠ CAUTION

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

INSTALLATION SERVICE POINTS

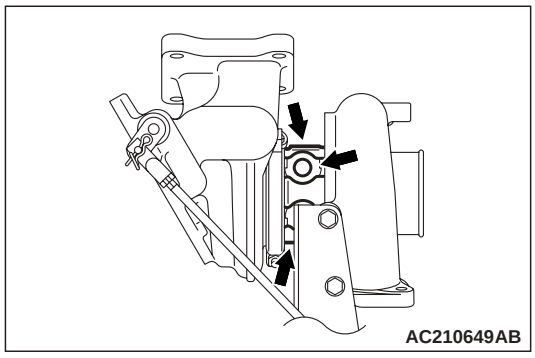
>>A<< TURBOCHARGER ASSEMBLY INSTALLATION

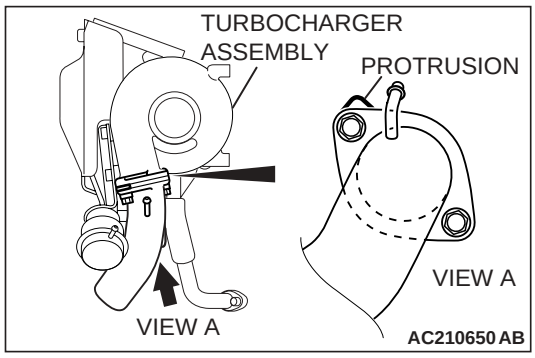
1. Clean the oil pipe and water pipe fitting, the inside of eye bolts, and individual pipe for clogs.

⚠ CAUTION

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

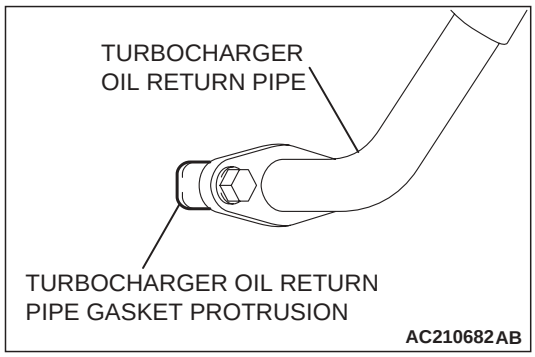
2. Clean or blow the air if carbon particles are stuck to the oil passage of the turbocharger assembly.
3. Refill new engine oil at the oil feed pipe fitting hole of the turbocharger assembly.





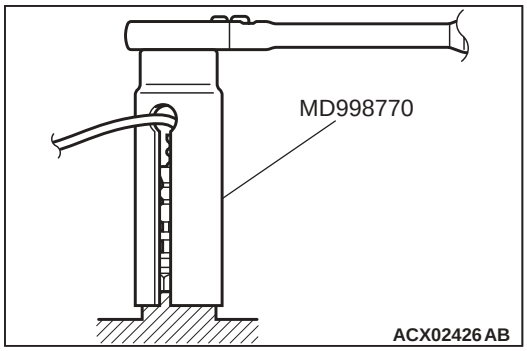
>>B<< AIR OUTLET FITTING GASKET INSTALLATION

Install the gasket so that its protrusion can face towards the direction as shown in the illustration.



>C<< TURBOCHARGER OIL RETURN PIPE GASKET INSTALLATION

Install the gasket so that its protrusion can face towards the direction as shown in the illustration.



>>D<< HEATED OXYGEN SENSOR (FRONT) INSTALLATION

Use special tool MD998770 to installation the heated oxygen sensor (front).

INSPECTION

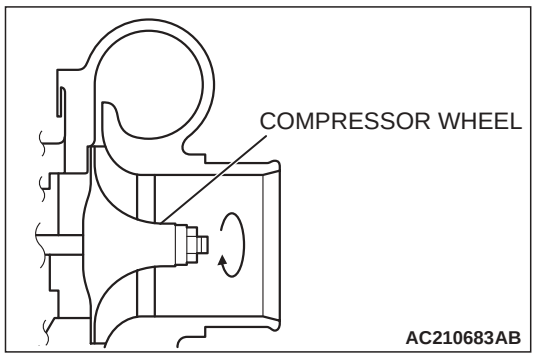
M1151003400457

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 (0.006 inch) or less
   Limit: 0.20 mm (0.008 inch)

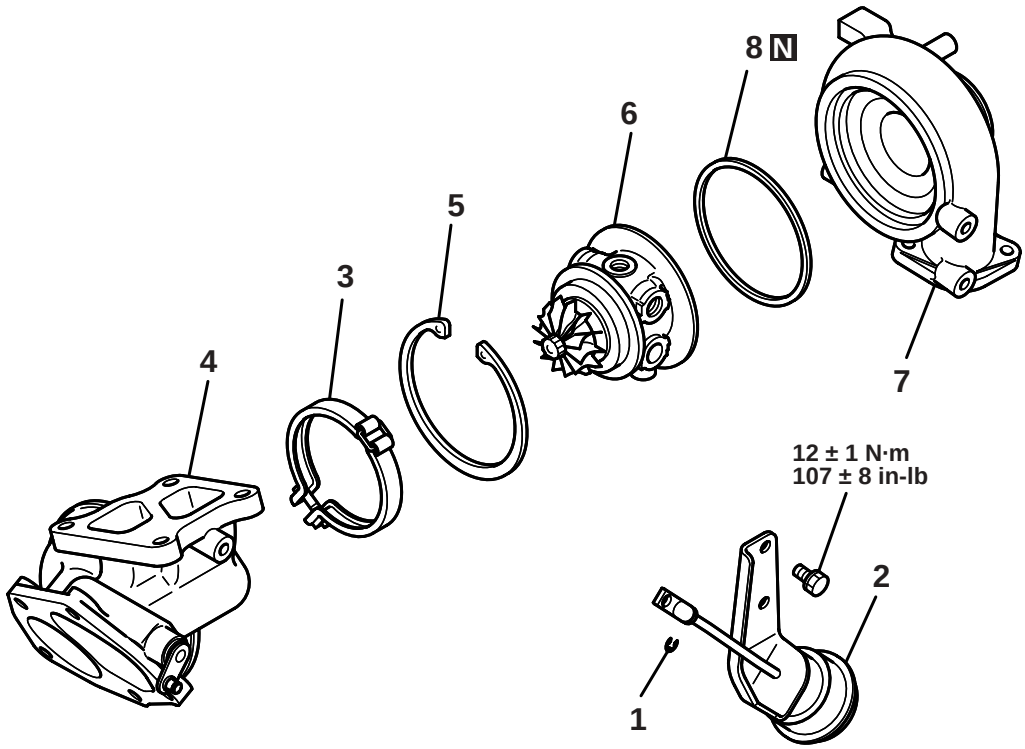


Turbocharger assembly Check

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 wastegate regulating valve remains open. If any problem is found, replace the part after disassembly.

DISASSEMBLY AND REASSEMBLY

M1151006000027



Disassembly steps

1. Snap ring
2. Waste gate actuator
3. Coupling

>>D<< 4. Turbine housing

Disassembly steps (Continued)

<<A>> >>C<< 5. Snap ring

<<B>> >>B<< 6. Cartridge assembly

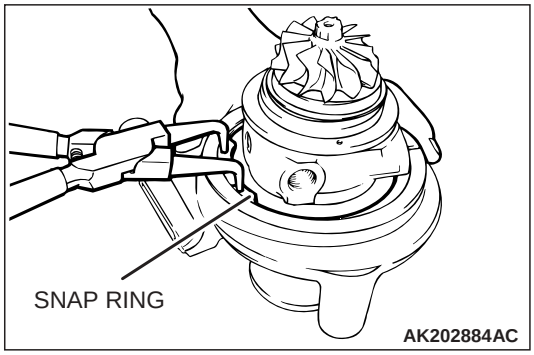
7. Compressor cover

>>A<< 8. O-ring

TSB Revision

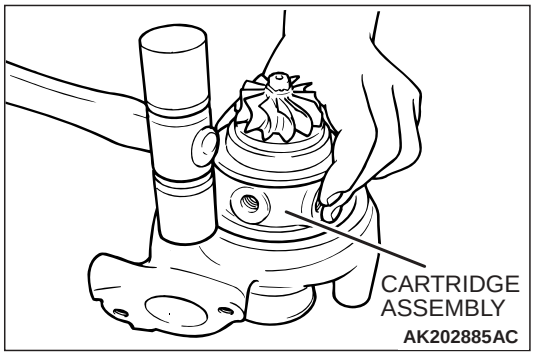
DISASSEMBLY SERVICE POINTS

<<A>> SNAP RING REMOVAL



⚠ CAUTION
Hold the snap ring with fingers during its removal to prevent it from springing away.
Remove the compressor cover retaining snap ring using a snap ring pliers.

<<B>> CARTRIDGE ASSEMBLY REMOVAL



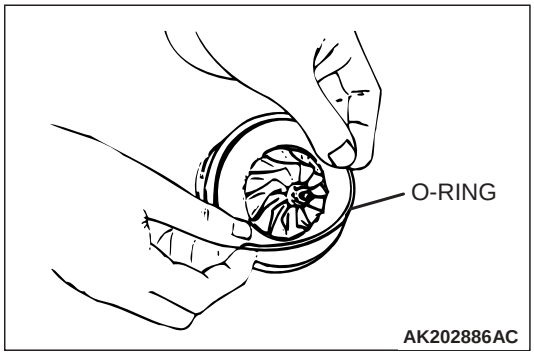
⚠ CAUTION
The cartridge assembly may be stuck on the compressor cover as its periphery is fitted with the O-ring.
Loosen the cartridge assembly before removal by lightly tapping the compressor cover all around with a plastic hammer.

CLEANING

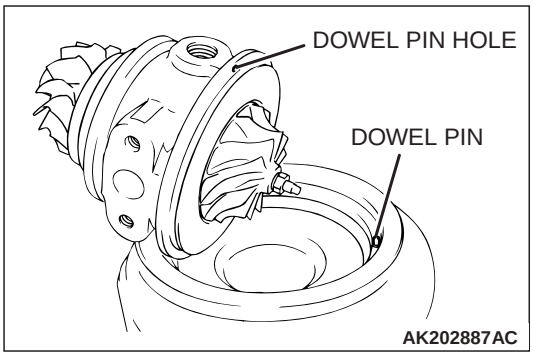
1. Use a clean washing solvent available on the market to wash the turbocharger components.
2. Use a plastic scraper or bristle brush for cleaning aluminum parts.

REASSEMBLY SERVICE POINTS

>>A<< O-RING INSTALLATION



⚠ CAUTION
Be careful not to damage the O-ring during installation. Damaged O-ring could cause leaks.
Smear engine oil on the inside surface of a new O-ring and fit it in the groove of the cartridge assembly.



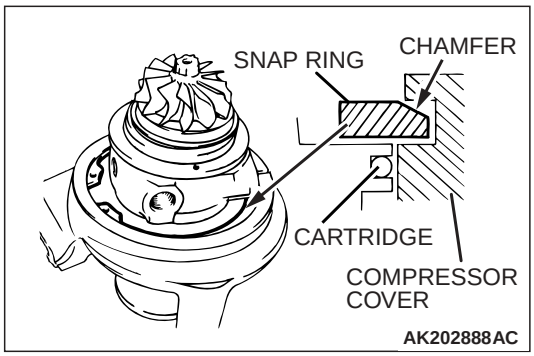
>>B<< CARTRIDGE ASSEMBLY INSTALLATION

1. Smear engine oil to the periphery of the O-ring fitted on the

⚠ CAUTION

Be careful not to damage the vanes of the cartridge assembly when installing the cartridge assembly onto the compressor cover.

2. Install the cartridge assembly onto the compressor cover while aligning the dowel pin with its hole.

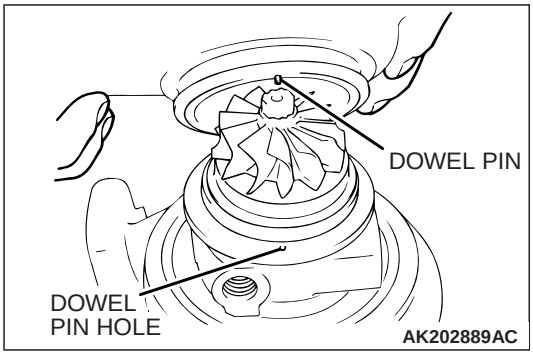


>>C<< SNAP RING INSTALLATION

⚠ CAUTION

Install the snap ring with its chamfer facing up.

Place the set of cartridge assembly and compressor cover upright on the compressor cover and install the snap ring in position.



>>D<< TURBINE HOUSING INSTALLATION

⚠ CAUTION

- **Be careful not to damage the vanes of the cartridge assembly when installing the turbine housing.**
- **Pay attention to alignment of the turbine housing.**

Assemble the set of compressor cover and cartridge assembly with the turbine housing while aligning the dowel pin with its hole.

CHECK (DISASSEMBLY AND REASSEMBLY)

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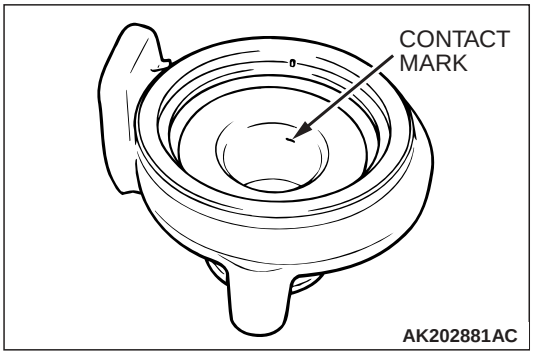
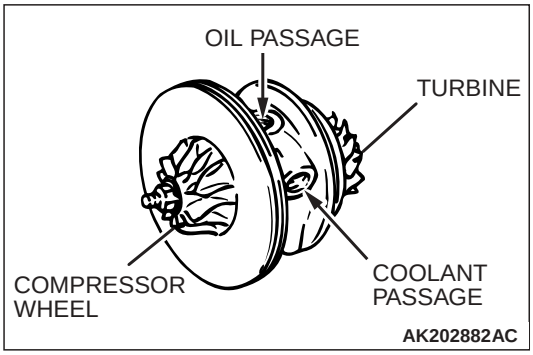


TURBINE HOUSING

1. Check the turbine housing for turbine wheel contact marks, cracks due to overheating, pitting, deformation, or other kinds of damage. Replace the turbine housing if any crack is found.
2. Operate the waste gate valve lever by hand to check that the valve can be opened and closed smoothly.

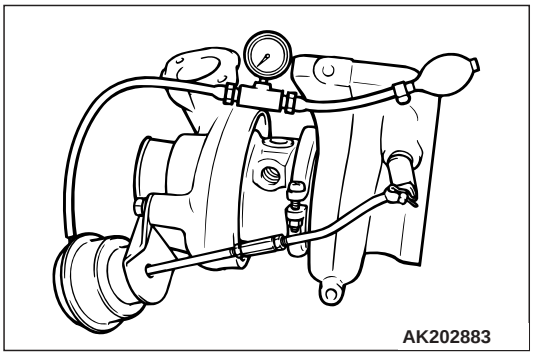
COMPRESSOR COVER

Check the compressor cover for compressor wheel contact marks or other damage.



CARTRIDGE ASSEMBLY

1. Check the vanes of the turbine and compressor wheel for deformation, damage on edges and other surfaces, corrosion, contact marks on back surfaces, and any other defect. Replace the cartridge assembly if any of the defects is present in the vanes.
2. Check the oil and coolant passages for clogging and scale.



WASTE GATE ACTUATOR

⚠ CAUTION

Never apply a pressure greater than 113.3 kPa. Applying a larger pressure could result in a broken diaphragm.

Check that the rod moves when a pressure of the standard value level is applied to the actuator using a tester.

Standard value: 100 kPa

EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

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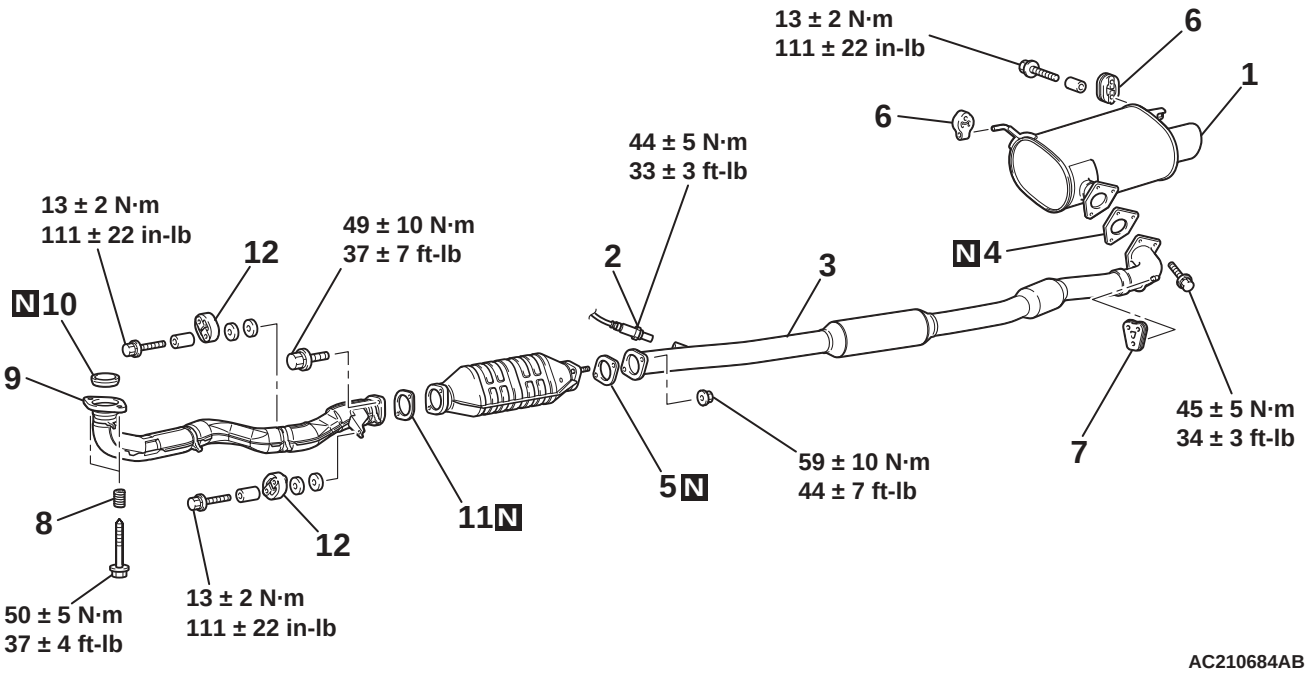

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EXHAUST MAIN MUFFLER REMOVAL STEPS

1. EXHAUST MAIN MUFFLER
4. EXHAUST PIPE GASKET
6. EXHAUST MUFFLER HANGER

CENTER EXHAUST PIPE REMOVAL STEPS

<<A>> >>A<< 2. HEATED OXYGEN SENSOR (REAR)
3. CENTER EXHAUST PIPE
4. EXHAUST PIPE GASKET
5. EXHAUST PIPE GASKET
7. EXHAUST PIPE HANGER

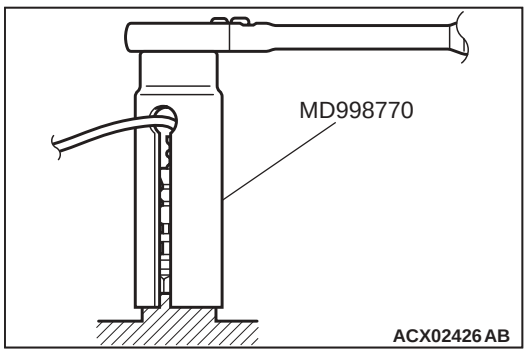
FRONT EXHAUST PIPE REMOVAL STEPS

- UNDER COVER (REFER TO GROUP 51, FRONT BUMPER ASSEMBLY P.51-2).
- CROSSMEMBER BAR (REFER TO GROUP 32, ENGINE ROLL STOPPER, CENTERMEMBER P.32-6).

8. SPRING
9. FRONT EXHAUST PIPE
10. SEAL RING
11. EXHAUST PIPE GASKET
12. EXHAUST PIPE HANGER

Required Special Tool:

- MD998770: Oxygen sensor wrench



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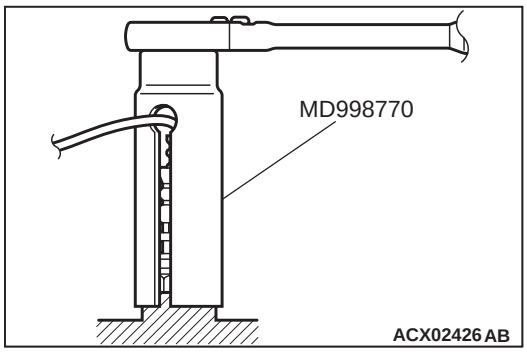
REMOVAL SERVICE POINT

<<A>> HEATED OXYGEN SENSOR (REAR) REMOVAL

Use special tool MD998770 to remove the heated oxygen sensor (rear).

INSTALLATION SERVICE POINT



>>A<< HEATED OXYGEN SENSOR (REAR) INSTALLATION
Use special tool MD998770 to installation the heated oxygen sensor (rear).

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

M1151006800302

ITEM		SPECIFICATION
Air cleaner		
Air cleaner bolt		9.0 ± 1.0 N·m (80 ± 9 in-lb)
Air cleaner bracket bolt		9.0 ± 1.0 N·m (80 ± 9 in-lb)
Volume airflow sensor nut		9.0 ± 1.0 N·m (80 ± 9 in-lb)
Air intake hose clamp bolt		4.0 ± 1.0 N·m (35 ± 8 in-lb)
Charge air cooler		
Air hose and air by-pass hose clamp bolt		6.0 ± 1.0 N·m (53 ± 9 in-lb)
Air pipe bolt		12 ± 1 N·m (102 ± 13 in-lb)
Air pipe bracket bolt		12 ± 1 N·m (102 ± 13 in-lb)
Charge air cooler bolt		12 ± 1 N·m (102 ± 13 in-lb)
Charge air cooler nut		12 ± 1 N·m (102 ± 13 in-lb)
Charge air cooler water spray		
Charge air cooler water spray tank bolt		11 ± 2 N·m (98 ± 17 in-lb)
Charge air cooler water spray tank bracket bolt		11 ± 2 N·m (98 ± 17 in-lb)
Exhaust manifold and turbocharger		
Air outlet fitting bolt		19 ± 1 N·m (14 ± 1 ft-lb)
Exhaust fitting bolt		59 ± 5 N·m (44 ± 3 ft-lb)
Exhaust fitting nut		59 ± 5 N·m (44 ± 3 ft-lb)
Exhaust fitting bracket bolt		35 ± 6 N·m (24 ± 4 ft-lb)
Exhaust manifold nut	M8	29 ± 3 N·m (22 ± 2 ft-lb)
	M10	49 ± 5 N·m (36 ± 4 ft-lb)
Exhaust manifold cover bolt		14 ± 1 N·m (120 ± 13 in-lb)
Heated oxygen sensor (front)		44 ± 5 N·m (33 ± 3 ft-lb)
Turbocharger bolt		64 ± 5 N·m (38 ± 3 ft-lb)

TSB Revision

ITEM		SPECIFICATION
Turbocharger nut		64 ± 5 N·m (38 ± 3 ft-lb)
Turbocharger heat protector bolt		14 ± 1 N·m (120 ± 13 in-lb)
Turbocharger oil feed pipe eye bolt	M10	17 ± 2 N·m (12 ± 2 ft-lb)
	M12	31 ± 2 N·m (23 ± 1 ft-lb)
Turbocharger oil feed pipe bolt		11 ± 1 N·m (98 ± 8 in-lb)
Turbocharger oil return pipe bolt (oil pan side)		14 ± 1 N·m (120 ± 13 in-lb)
Turbocharger oil return pipe bolt (turbocharger side)		9.0 ± 1.0 N·m (80 ± 9 in-lb)
Turbocharger water feed pipe eye bolt		42 ± 7 N·m (31 ± 5 ft-lb)
Turbocharger water feed pipe bolt		10 ± 1 N·m (84 ± 13 in-lb)
Turbocharger water return pipe eye bolt		42 ± 7 N·m (31 ± 5 ft-lb)
Turbocharger water return pipe bolt		10 ± 1 N·m (84 ± 13 in-lb)
Exhaust pipe and main muffler		
Center exhaust pipe nut		59 ± 10 N·m (44 ± 7 ft-lb)
Exhaust main muffler bolt		45 ± 5 N·m (34 ± 3 ft-lb)
Exhaust muffler hanger bolt		13 ± 2 N·m (111 ± 22 in-lb)
Exhaust pipe hanger bolt		13 ± 2 N·m (111 ± 22 in-lb)
Front exhaust pipe bolt (catalytic converter side)		49 ± 10 N·m (37 ± 7 ft-lb)
Front exhaust pipe bolt (exhaust manifold side)		50 ± 5 N·m (37 ± 4 ft-lb)
Heated oxygen sensor (rear)		44 ± 5 N·m (33 ± 3 ft-lb)
Intake manifold		
Center cover bolt		3.0 ± 0.5 N·m (27 ± 4 in-lb)
EGR vacuum regulator solenoid bolt		11 ± 1 N·m (98 ± 8 in-lb)
EGR valve bolt		20 ± 2 N·m (15 ± 1 ft-lb)
Evaporative emission purge solenoid bolt		11 ± 1 N·m (98 ± 8 in-lb)
Fuel high-pressure hose bolt		5.0 ± 1.0 N·m (44 ± 9 in-lb)
Fuel pressure solenoid bolt		11 ± 1 N·m (98 ± 8 in-lb)
Fuel rail bolt		11 ± 1 N·m (98 ± 8 in-lb)
Generator brace bolt		22 ± 4 N·m (16 ± 3 ft-lb)
Ground cable bolt		5.0 ± 1.0 N·m (44 ± 9 in-lb)
Intake manifold bolt	M8	20 ± 2 N·m (15 ± 1 ft-lb)
	M10	36 ± 6 N·m (27 ± 4 ft-lb)
Intake manifold nut		36 ± 6 N·m (27 ± 4 ft-lb)
Intake manifold stay bolt		31 ± 3 N·m (23 ± 2 ft-lb)
Manifold differential pressure sensor bolt		5.0 ± 1.0 N·m (44 ± 9 in-lb)
Oil level gauge guide bolt		13 ± 1 N·m (115 ± 9 in-lb)
Vacuum hose and pipe assembly bolt		11 ± 1 N·m (98 ± 8 in-lb)

SERVICE SPECIFICATION

M1151000300387

ITEM	STANDARD VALUE	LIMIT
Manifold distortion of the installation surface mm (in)	0.15 (0.006) or less	0.20 (0.008)
Turbocharger wastegate solenoid terminal resistance [at 20°C (68°F)] Ω	29 – 35	–
Intake charge pressure kPa (psi)	53 – 80 (7.7 – 11.6)	–