

GROUP 15

INTAKE AND EXHAUST

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GENERAL DESCRIPTION

M1151000100338

The exhaust pipe is of three-piece type.

INTAKE AND EXHAUST DIAGNOSIS**INTRODUCTION**

M1151006900279

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

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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 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

M1151007100276

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.

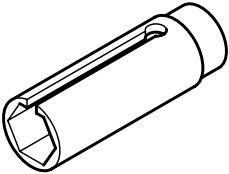
Q: Are any heat protectors loose or damaged?
YES : Tighten or replace, then go to Step 1.
NO : Go to Step 6.

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 (For the removal of the pipes, catalytic converters and muffler, refer to [P.15-13](#)).
NO : There is no action to be taken.

SPECIAL TOOL

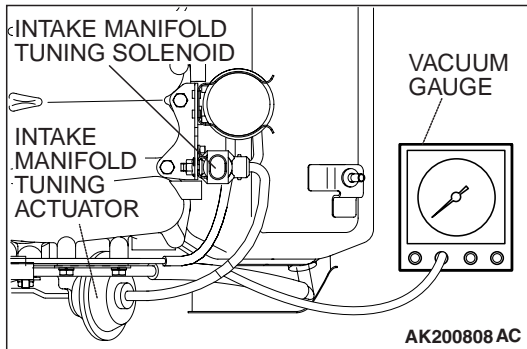
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TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
	MD998770 Oxygen sensor wrench	MD998770-01 or General service tool	Removal and installation of heated oxygen sensor

ON-VEHICLE SERVICE

INTAKE MANIFOLD TUNING SYSTEM CHECK

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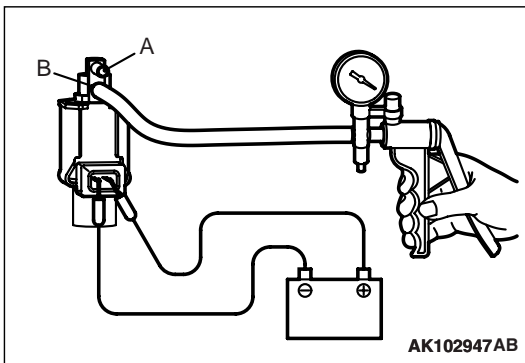
1. Warm up the engine.
2. Disconnect the vacuum hose from the intake manifold tuning (IMT) actuator, and then connect a vacuum gauge via the Tee-fitting.
3. Start the engine and verify that a vacuum is applied to the vacuum gauge.
4. As described in the chart below, vary the engine speed to inspect the vacuum conditions. During this inspection, verify that the rod of the IMT actuator is operating.

ENGINE SPEED	NORMAL CONDITION	CONTROL VALVE
3,750 r/min or less	Vacuum maintained	Closed
Within 3,750 r/min or less, engine is suddenly raced	Vacuum not change	Closed
4,050 r/min or more	Vacuum leaks	Open

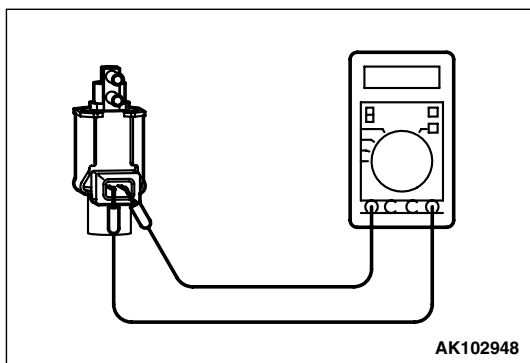
INTAKE MANIFOLD TUNING SOLENOID CHECK

M1151010000053

1. Disconnect the vacuum hoses from the intake manifold tuning (IMT) solenoid.
NOTE: When disconnecting the vacuum hose, always make sure that it can be reconnected at its original position.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to nipple (B) of the IMT solenoid.
4. As described in the chart below, check airtightness by applying a vacuum with voltage applied directly from the battery to the IMT solenoid, and without applying voltage.



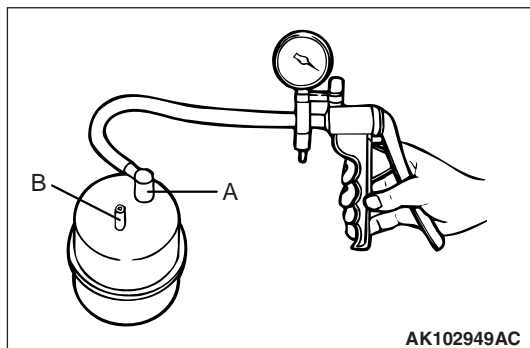
BATTERY POSITIVE VOLTAGE	NIPPLE (A) CONDITION	NORMAL CONDITION
Applied	Open	Vacuum leaks
	Closed	Vacuum maintained
Not applied	Open	Vacuum leaks



5. Measure the resistance between the terminals of the IMT solenoid.

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

6. Replace solenoid resistance is out of specification.



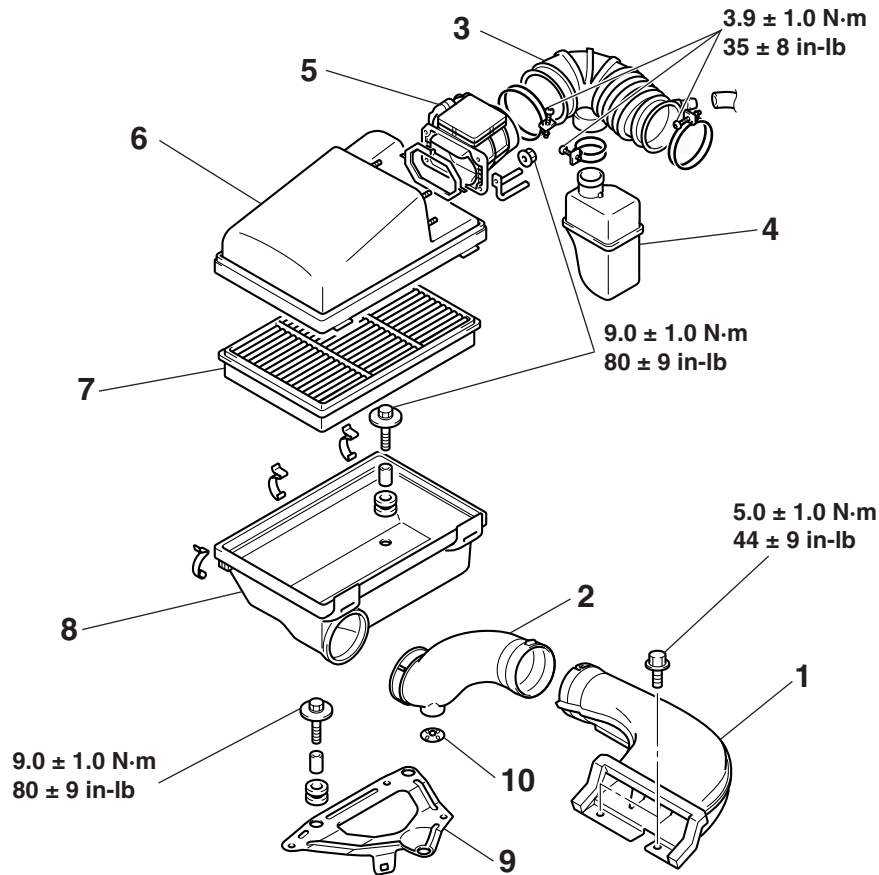
VACUUM TANK CHECK

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1. Disconnect the vacuum hoses from the vacuum tank.
NOTE: When disconnecting the vacuum hose, always make sure that it can be reconnected at its original position.
2. Connect a hand vacuum pump to nipple "A" of the vacuum tank, apply a vacuum of 67 kPa (19.7 in. Hg), and verify that the vacuum is maintained.
3. Disconnect the hand vacuum pump from nipple "A" and connect it to nipple "B".
4. Block nipple "A" with your finger and apply a vacuum of 67 kPa (19.7 in. Hg) to nipple "B". Release your finger from nipple "A" and verify that the vacuum leaks immediately.
5. Replace the vacuum tank if it is faulty.

AIR CLEANER**REMOVAL AND INSTALLATION**

M1151002100293



AC204103 AB

REMOVAL STEPS

1. INTAKE AIR DUCT A
2. INTAKE AIR DUCT B
3. AIR INTAKE HOSE
4. RESONATOR
5. VOLUME AIRFLOW SENSOR

REMOVAL STEPS (Continued)

6. AIR CLEANER HOUSING COVER
7. AIR CLEANER ELEMENT
8. AIR CLEANER HOUSING
9. AIR CLEANER BRACKET
10. UNLOADER VALVE

INTAKE MANIFOLD

REMOVAL AND INSTALLATION

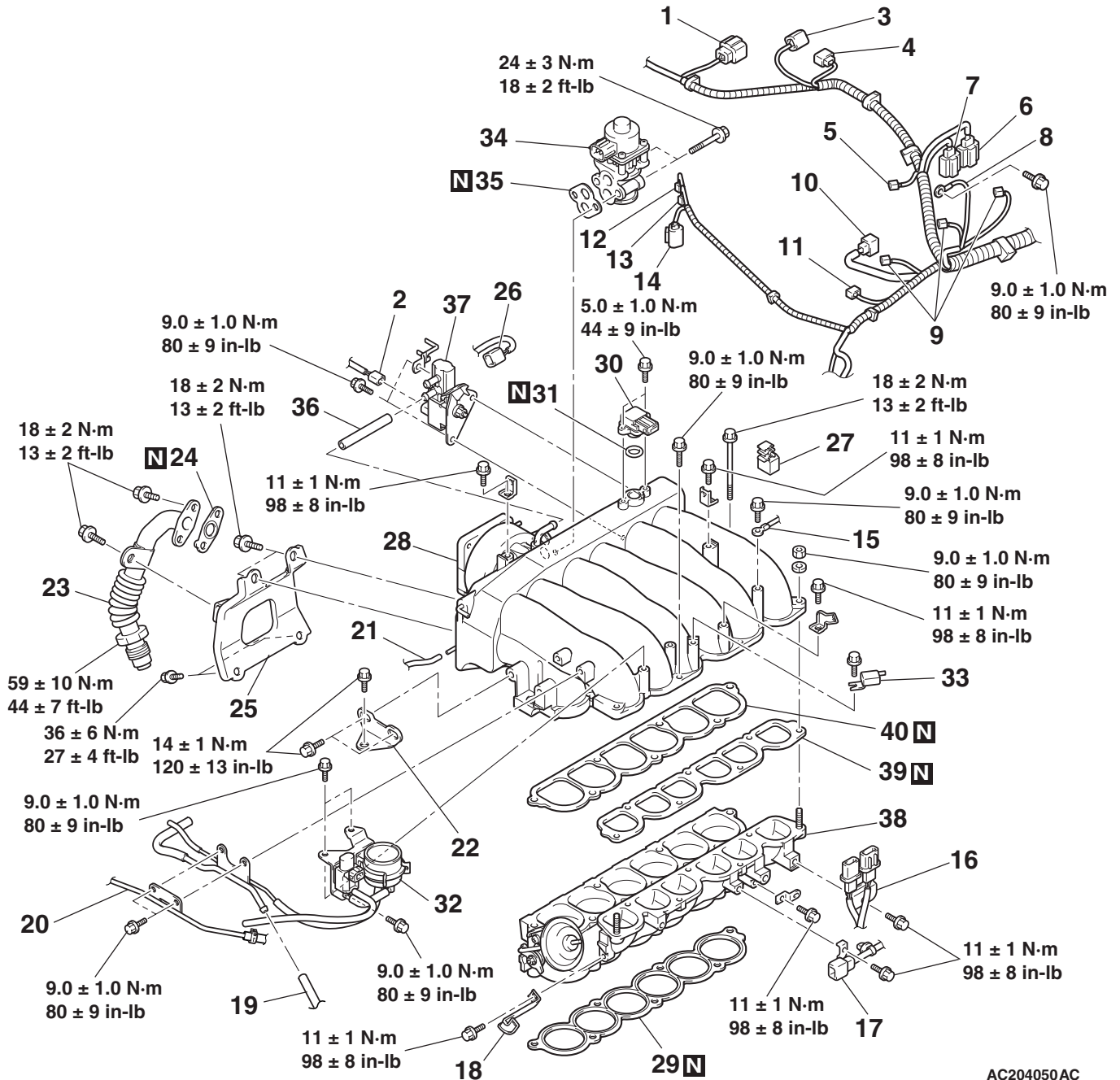
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Pre-removal Operation

- Fuel Discharge Prevention (Refer to GROUP 13A, On-vehicle Service P.13A-1051.)
- Throttle Body Removal (Refer to GROUP 13A, Throttle Body P.13A-1064.)

Post-installation Operation

Throttle Body installation (Refer to GROUP 13A, Throttle Body P.13A-1064.)



AC204050AC

REMOVAL STEPS

- EGR VALVE CONNECTOR CONNECTION
- EVAPORATIVE EMISSION PURGE SOLENOID VALVE CONNECTOR CONNECTION

REMOVAL STEPS (Continued)

- RIGHT BANK HEATED OXYGEN SENSOR (FRONT) CONNECTOR CONNECTION

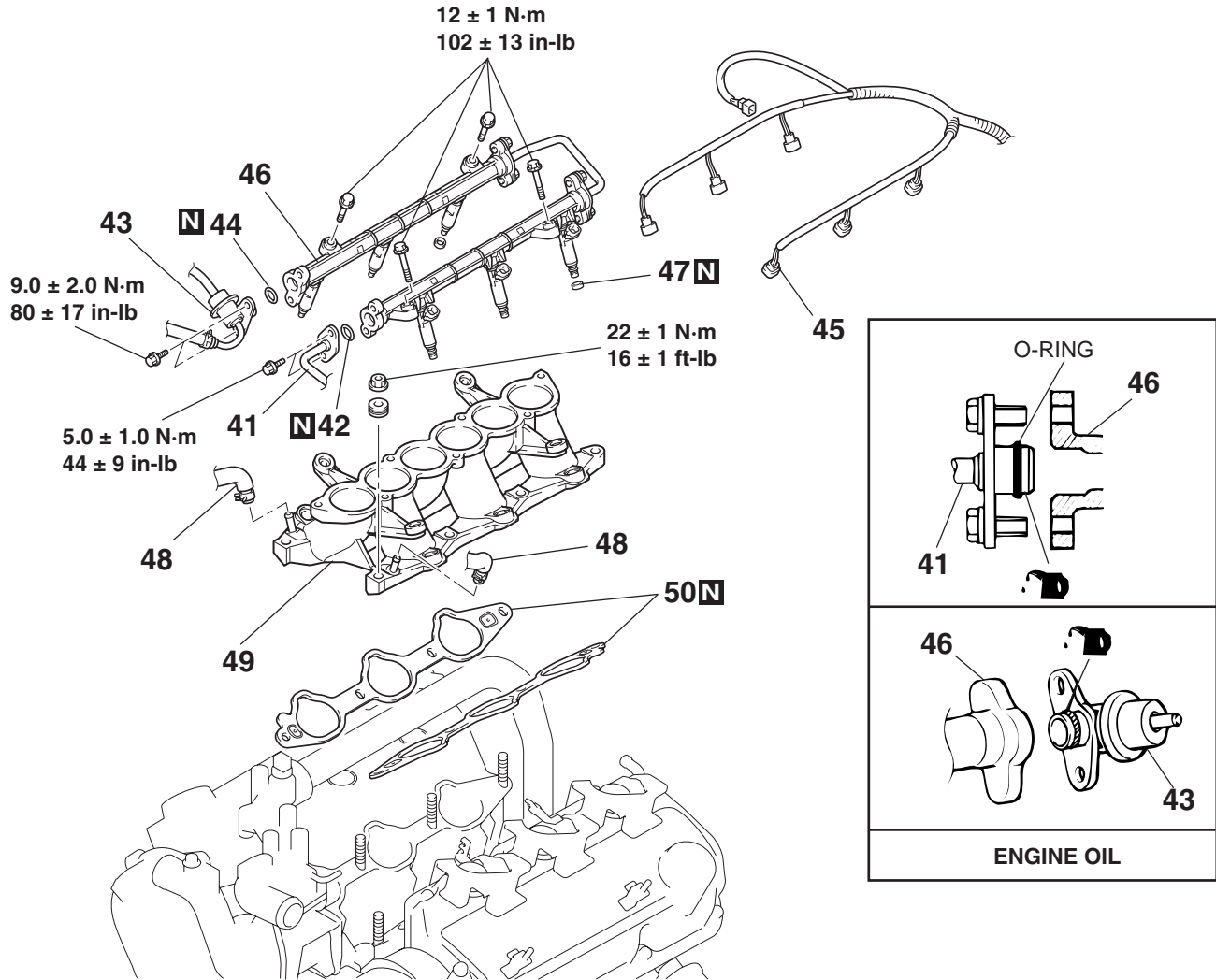
REMOVAL STEPS (Continued)

4. MANIFOLD ABSOLUTE PRESSURE SENSOR CONNECTOR CONNECTION
5. CAPACITOR CONNECTOR CONNECTION
6. KNOCK SENSOR CONNECTOR CONNECTION
7. CONTROL WIRING HARNESS AND CAMSHAFT POSITION SENSOR WIRING HARNESS COMBINATION CONNECTOR CONNECTION
8. GROUNDING CABLE CONNECTION
9. IGNITION COIL CONNECTOR CONNECTION
10. CONTROL WIRING HARNESS AND INJECTOR WIRING HARNESS COMBINATION CONNECTOR CONNECTION
11. INTAKE MANIFOLD TUNING SOLENOID CONNECTOR CONNECTION
12. ENGINE COOLANT TEMPERATURE SENSOR CONNECTOR CONNECTION
13. ENGINE COOLANT TEMPERATURE GAUGE UNIT CONNECTOR CONNECTION
14. CRANKSHAFT POSITION SENSOR CONNECTOR CONNECTION
15. GROUNDING CABLE CONNECTION
16. KNOCK SENSOR AND CAMSHAFT POSITION SENSOR WIRING HARNESS COMBINATION CONNECTOR BRACKET

REMOVAL STEPS (Continued)

17. CONTROL WIRING HARNESS AND INJECTOR WIRING HARNESS COMBINATION CONNECTOR
18. CONNECTOR BRACKET
19. PCV HOSE CONNECTION
20. FUEL PIPE
21. VACUUM HOSE CONNECTION
22. WATER OUTLET FITTING BRACKET
23. EGR PIPE
24. EGR PIPE GASKET
25. INTAKE MANIFOLD PLENUM STAY
26. RIGHT BANK HEATED OXYGEN SENSOR (FRONT) CONNECTOR
27. FUEL PIPE CLIP
28. INTAKE MANIFOLD PLENUM
29. INTAKE MANIFOLD PLENUM GASKET
30. MANIFOLD ABSOLUTE PRESSURE SENSOR
31. O-RING
32. SOLENOID VALVE AND VACUUM HOSE ASSEMBLY
33. CAPACITOR
34. EGR VALVE
35. EGR VALVE GASKET
36. PURGE HOSE
37. EVAPORATIVE EMISSION PURGE SOLENOID VALVE
38. INTAKE MANIFOLD TUNING VALVE ASSEMBLY
39. INTAKE MANIFOLD TUNING VALVE GASKET P
40. INTAKE MANIFOLD TUNING VALVE GASKET S

>>D<<



AC204059AB

REMOVAL STEPS

- >>C<< 41. FUEL HIGH-PRESSURE HOSE CONNECTION <<A>>
- >>C<< 42. O-RING
- >>C<< 43. FUEL PRESSURE REGULATOR
- >>C<< 44. O-RING
- 45. INJECTOR CONNECTOR

REMOVAL STEPS (Continued)

- 46. FUEL RAIL (WITH INJECTORS)
- 47. INSULATORS
- 48. WATER HOSE CONNECTION
- >>B<< 49. INTAKE MANIFOLD
- >>A<< 50. INTAKE MANIFOLD GASKET

REMOVAL SERVICE POINT

<<A>> FUEL RAIL (WITH INJECTORS) REMOVAL

⚠ CAUTION

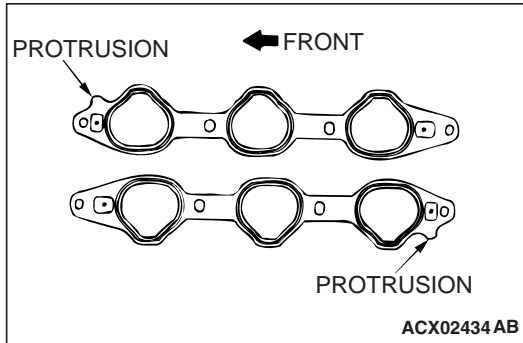
Care must be taken when removing the fuel rail: Do not drop the injectors.

Remove the fuel rail with the injectors attached to it.

INSTALLATION SERVICE POINTS

>>A<< INTAKE MANIFOLD GASKET INSTALLATION

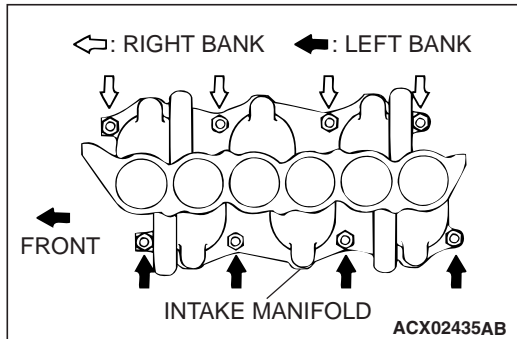
Install the gasket with the protrusions in the position illustrated.



>>B<< INTAKE MANIFOLD INSTALLATION

Tighten the nuts by the following procedure.

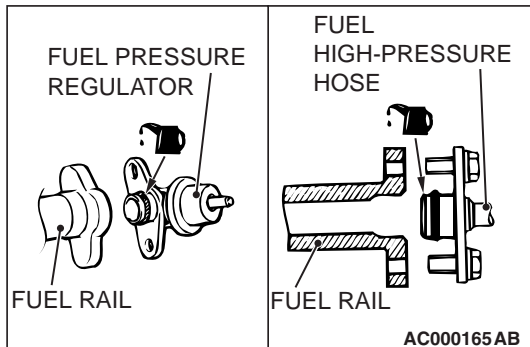
ORDER	MOUNTING NUTS	TIGHTENING TORQUE
1st	Right-bank nuts	6.5 ± 1.5 N·m (58 ± 13 in-lb)
2nd	Left-bank nuts	22 ± 1 N·m (16 ± 1 ft-lb)
3rd	Right-bank nuts	22 ± 1 N·m (16 ± 1 ft-lb)
4th	Left-bank nuts	22 ± 1 N·m (16 ± 1 ft-lb)
5th	Right-bank nuts	22 ± 1 N·m (16 ± 1 ft-lb)



>>C<< O-RING/FUEL PRESSURE REGULATOR/FUEL HIGH-PRESSURE HOSE INSTALLATION

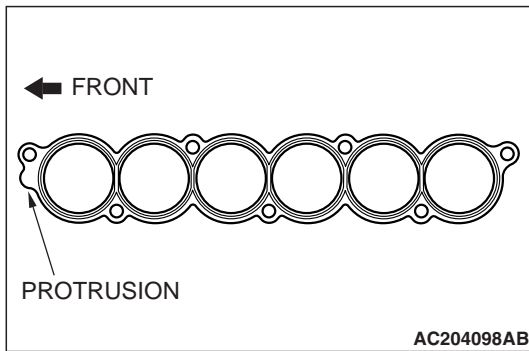
⚠ CAUTION

Be careful not to allow any engine oil to enter the fuel rail. When connecting the fuel pressure regulator and the fuel high-pressure hose to the fuel rail, apply a small amount of new engine oil to the O-ring. Then insert the fuel high-pressure hose, being careful not to damage the O-ring.



**>>D<< INTAKE MANIFOLD PLENUM GASKET
INSTALLATION**

Install the gasket with the protrusion in the position illustrated.



INSPECTION

M1151003100467

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

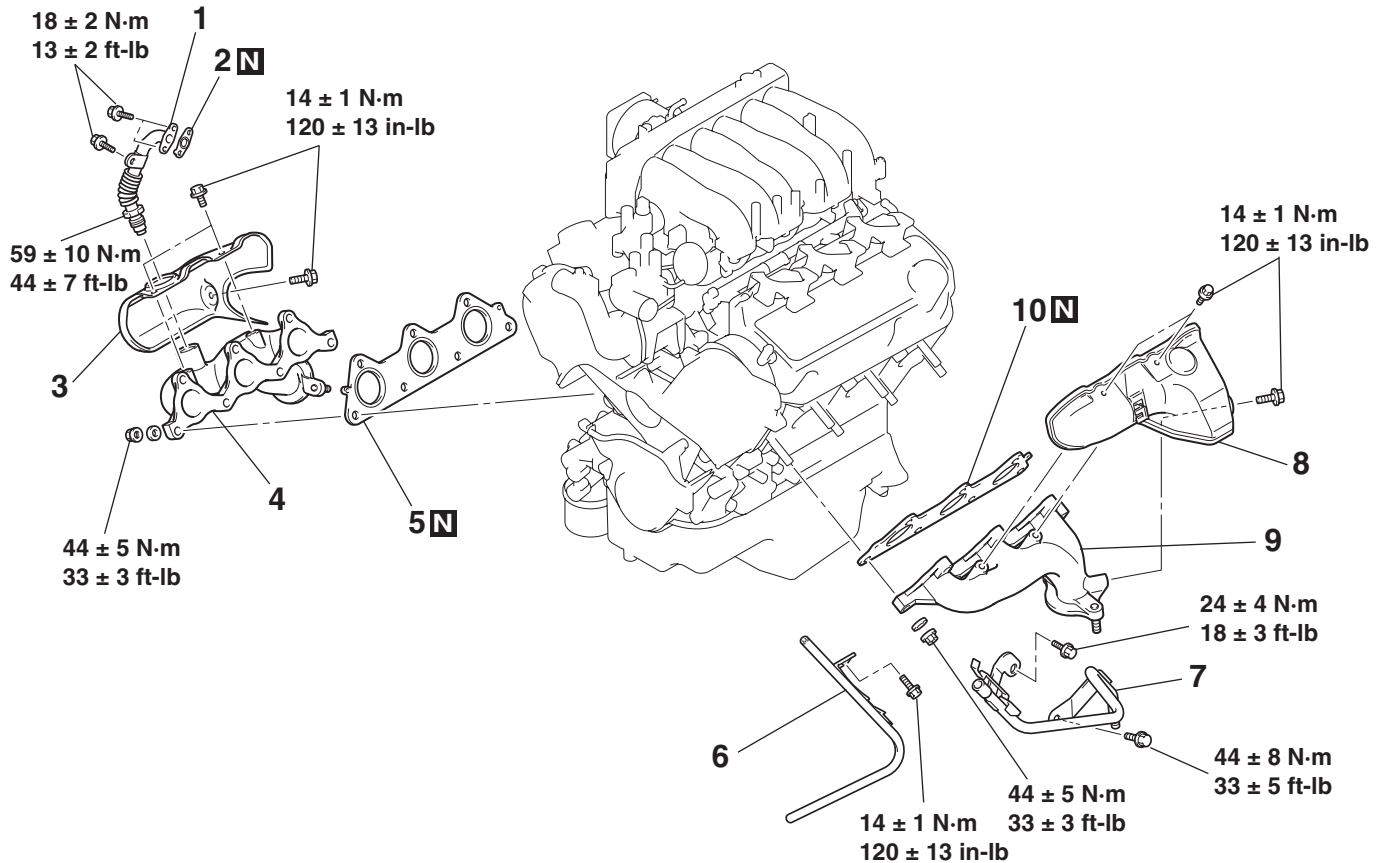
Limit: 0.20 mm (0.008 inch)

EXHAUST MANIFOLD**REMOVAL AND INSTALLATION**

M1151003300416

Pre-removal and Post-installation Operation

- Front Exhaust Pipe Removal and Installation (Refer to P.15-13.)
- Air Cleaner Removal and Installation (Refer to P.15-6.)
- Battery and Battery Tray Removal and Installation



AC204049 AB

REMOVAL STEPS

1. EGR PIPE
2. EGR PIPE GASKET
3. HEAT PROTECTOR <RH>
4. EXHAUST MANIFOLD <RH>
5. EXHAUST MANIFOLD GASKET <RH>
6. ENGINE OIL DIPSTICK GUIDE

REMOVAL STEPS (Continued)

7. TRANSMISSION FLUID DIPSTICK GUIDE
8. HEAT PROTECTOR <LH>
9. EXHAUST MANIFOLD <LH>
10. EXHAUST MANIFOLD GASKET <LH>

INSPECTION

M1151003400402

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.

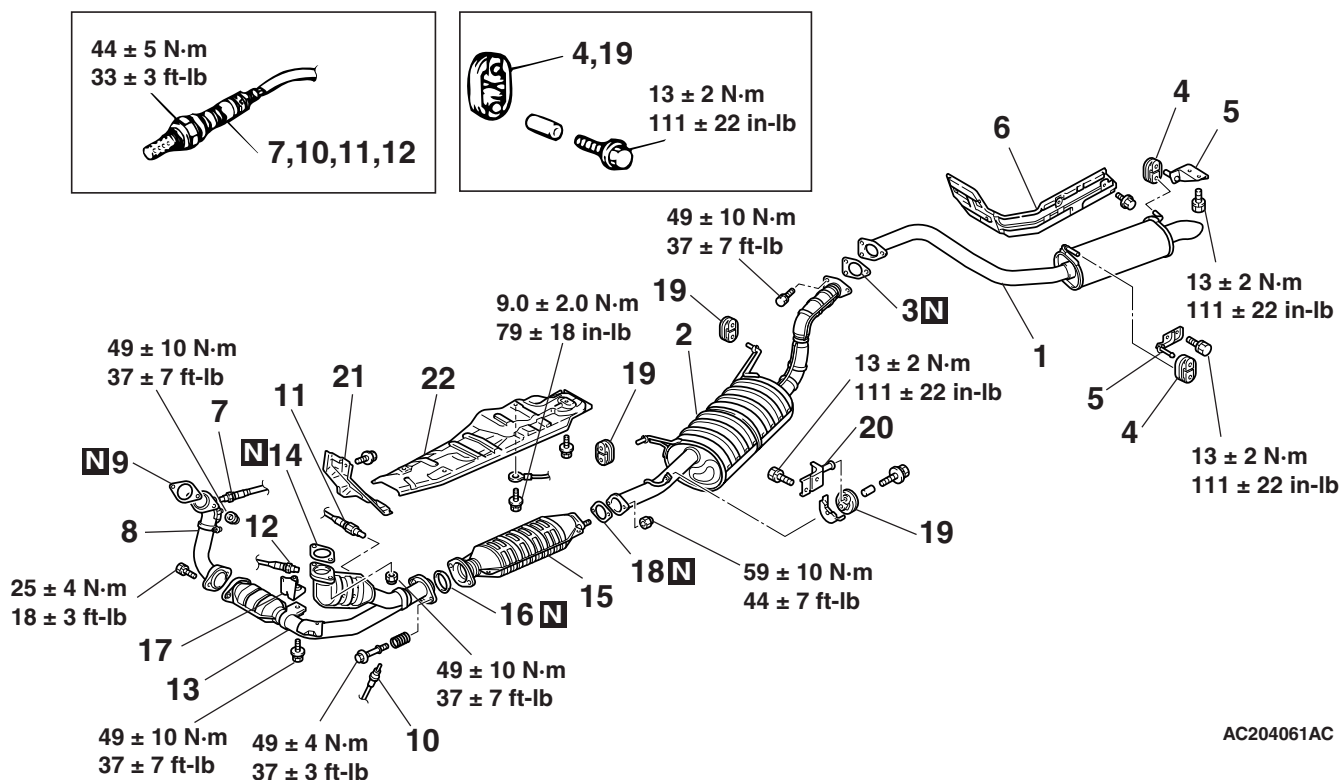
Standard value: 0.15 mm (0.006 inch) or less
Limit: 0.20 mm (0.008 inch)

EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

M1151008700828

Pre-removal and Post-installation Operation
Front Under Cover Removal and Installation



AC204061AC

TAIL PIPE REMOVAL STEPS

1. TAIL PIPE
3. EXHASUT PIPE GASKET
4. HANGER
5. HANGER BRACKET
6. REAR FLOOR HEAT PROTECTOR

MAIN MUFFLER REMOVAL STEPS

2. MAIN MUFFLER
3. EXHAUST PIPE GASKET
18. EXHAUST PIPE GASKET
19. HANGER
20. HANGER BRACKET

FRONT EXHAUST PIPE REMOVAL STEPS

- <<A>> >>A<< 7. RIGHT BANK HEATED OXYGEN SENSOR (FRONT)
8. FRONT EXHAUST PIPE
9. EXHAUST PIPE GASKET
- <<A>> >>A<< 10. RIGHT BANK HEATED OXYGEN SENSOR (REAR)

FRONT EXHAUST PIPE REMOVAL STEPS (Continued)

- <<A>> >>A<< 11. LEFT BANK HEATED OXYGEN SENSOR (REAR)
- <<A>> >>A<< 12. LEFT BANK HEATED OXYGEN SENSOR (FRONT)
13. WARM-UP THREE-WAY CATALYTIC CONVERTER
14. EXHAUST PIPE GASKET
15. CATALYTIC CONVERTER
16. SEAL RING
17. BRACKET
18. EXHAUST PIPE GASKET
21. DASH HEAT PROTECTOR
22. FRONT FLOOR HEAT PROTECTOR

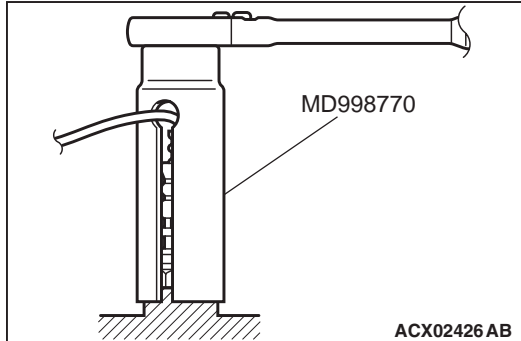
Required Special Tool:

- MD998770: Oxygen sensor wrench

REMOVAL SERVICE POINT

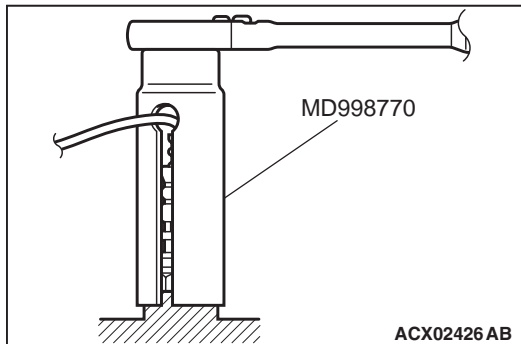
**<<A>>RIGHT BANK HEATED OXYGEN SENSOR (FRONT)/
RIGHT BANK HEATED OXYGEN SENSOR (REAR)/LEFT
BANK HEATED OXYGEN SENSOR (REAR)/LEFT BANK
HEATED OXYGEN SENSOR (FRONT) REMOVAL**

Use special tool MD998770 to remove the oxygen sensor.

**INSTALLATION SERVICE POINT**

**>>A<< LEFT BANK HEATED OXYGEN SENSOR (FRONT)/
LEFT BANK HEATED OXYGEN SENSOR (REAR)/RIGHT
BANK HEATED OXYGEN SENSOR (REAR)/RIGHT BANK
HEATED OXYGEN SENSOR (FRONT) INSTALLATION**

Use special tool MD998770 to install the oxygen sensor.



SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

M1151006800540

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)
Air duct bolt	5.0 ± 1.0 N·m (44 ± 9 in-lb)
Volume airflow sensor nut	9.0 ± 1.0 N·m (80 ± 9 in-lb)
Air intake hose clamp bolt	3.9 ± 1.0 N·m (35 ± 8 in-lb)
Exhaust manifold	
EGR pipe bolt	18 ± 2 N·m (13 ± 2 ft-lb)
EGR pipe flare nut	59 ± 10 N·m (44 ± 7 ft-lb)
Engine oil dipstick guide bolt	14 ± 1 N·m (120 ± 13 in-lb)
Exhaust manifold nut	44 ± 5 N·m (33 ± 3 ft-lb)
Heat protector bolt	14 ± 1 N·m (120 ± 13 in-lb)
Transmission fluid dipstick guide to engine hanger bolt	24 ± 4 N·m (18 ± 3 ft-lb)
Transmission fluid dipstick guide to transmission bolt	44 ± 8 N·m (33 ± 5 ft-lb)
Exhaust pipe and main muffler	
Bracket bolt	49 ± 10 N·m (37 ± 7 ft-lb)
Warm-up three-way catalytic converter bolt	49 ± 4 N·m (37 ± 3 ft-lb)
Warm-up three-way catalytic converter nut	49 ± 10 N·m (37 ± 7 ft-lb)
Front exhaust pipe bolt	25 ± 4 N·m (18 ± 3 ft-lb)
Front exhaust pipe nut	49 ± 10 N·m (37 ± 7 ft-lb)
Ground cable bolt	9.0 ± 2.0 N·m (79 ± 18 in-lb)
Hanger bolt	13 ± 2 N·m (111 ± 22 in-lb)
Hanger bracket bolt	13 ± 2 N·m (111 ± 22 in-lb)
Heated oxygen sensor	44 ± 5 N·m (33 ± 3 ft-lb)
Main muffler bolt	49 ± 10 N·m (37 ± 7 ft-lb)
Main muffler nut	59 ± 10 N·m (44 ± 7 ft-lb)
Intake manifold	
Control wiring harness clamp bolt	11 ± 1 N·m (98 ± 8 in-lb)
EGR pipe flare nut	59 ± 10 N·m (44 ± 7 ft-lb)
EGR pipe bolt	18 ± 2 N·m (13 ± 2 ft-lb)
EGR valve bolt	24 ± 3 N·m (18 ± 2 ft-lb)
Evaporative emission purge solenoid valve bolt	9.0 ± 1.0 N·m (80 ± 9 in-lb)
Fuel high-pressure hose bolt	5.0 ± 1.0 N·m (44 ± 9 in-lb)
Fuel pipe bolt	9.0 ± 1.0 N·m (80 ± 9 in-lb)
Fuel pressure regulator bolt	9.0 ± 2.0 N·m (80 ± 17 in-lb)
Fuel rail bolt	12 ± 1 N·m (102 ± 13 in-lb)
Grounding cable bolt	9.0 ± 2.0 N·m (79 ± 18 in-lb)

ITEM		SPECIFICATION
Intake manifold tuning valve bolt and nut		9.0 ± 1.0 N·m (80 ± 9 in-lb)
Injector wiring harness connector clamp bolt		11 ± 1 N·m (98 ± 8 in-lb)
Intake manifold nut		22 ± 1 N·m (16 ± 1 ft-lb)
Intake manifold plenum stay bolt	M8	18 ± 2 N·m (13 ± 2 ft-lb)
	M10	36 ± 6 N·m (27 ± 4 ft-lb)
Intake manifold plenum bolt		18 ± 2 N·m (13 ± 2 ft-lb)
Manifold absolute pressure sensor bolt		5.0 ± 1.0 N·m (44 ± 9 in-lb)
Knock sensor and camshaft position sensor connector clamp bolt		11 ± 1 N·m (98 ± 8 in-lb)
Solenoid valve and vacuum hose bracket bolt		9.0 ± 1.0 N·m (80 ± 9 in-lb)
Water outlet fitting bracket bolt		14 ± 1 N·m (120 ± 13 in-lb)

SERVICE SPECIFICATION

M1151000300440

ITEM	STANDARD VALUE	LIMIT
Intake manifold tuning solenoid coil resistance [at 20°C (68°F)] Ω	29 – 35	–
Manifold distortion of the installation surface mm (in)	0.15 (0.006) or less	0.20 (0.008)