
INTAKE AND EXHAUST

INTAKE AND EXHAUST

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GENERAL INFORMATION

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The intake manifold is made of an aluminium alloy, and the shape provides an increased intake inertia effect and has a good volumetric efficiency.

The exhaust pipe is divided into three parts; the front pipe, the center pipe, and the main muffler.

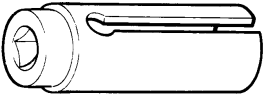
SERVICE SPECIFICATIONS

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Item	Standard value	Limit
Manifold distortion of the installation surface mm	0.15 or less	0.20

SPECIAL TOOL

15100060073

Tool	Number	Name	Use
	MD998770	Oxygen sensor wrench	Removal/Installation of oxygen sensor

ON-VEHICLE SERVICE

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INTAKE MANIFOLD VACUUM CHECK

Refer to GROUP 11 – On-vehicle Service.

INTAKE MANIFOLD

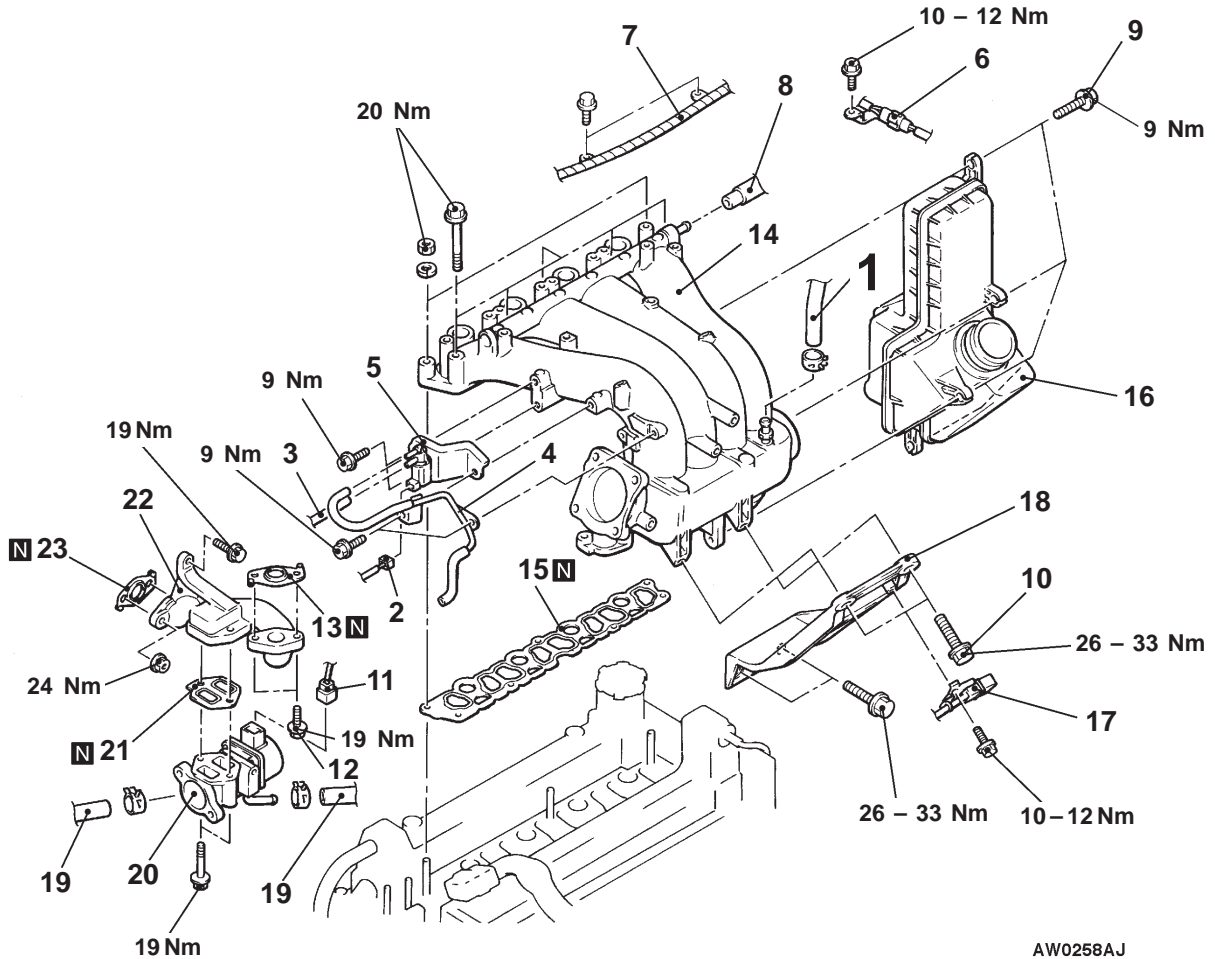
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REMOVAL AND INSTALLATION

<GDI>

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying (Refer to GROUP 14 – On-vehicle Service.)
- Engine Cover Removal and Installation
- Air Cleaner Removal and Installation
- Ignition Coil Removal and Installation (Refer to GROUP 16.)
- Throttle Body Removal and Installation (Refer to GROUP 13A.)



Intake manifold removal steps

1. Brake booster vacuum hose connection
2. Purge control solenoid valve connector
3. Vacuum hose connection
4. Vacuum pipe and hose assembly
5. Purge control solenoid valve
6. Connector bracket (for crank angle sensor)
7. Harness clamp
8. PCV hose connection
9. Intake manifold to surging resonator connecting bolt
10. Intake manifold to intake manifold stay connecting bolt
12. Intake manifold to EGR valve support connecting bolt

13. EGR valve gasket
14. Intake manifold assembly
15. Intake manifold gasket
16. Surging resonator
17. Harness connector clamp (for oxygen sensor)
18. Intake manifold stay

EGR valve removal steps

11. EGR servo connector
12. Intake manifold to EGR valve support connecting bolt
13. EGR valve gasket
19. Water hose connection
20. EGR valve assembly
21. EGR valve gasket
22. EGR valve support
23. EGR valve gasket

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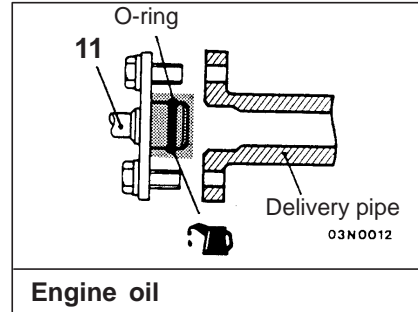
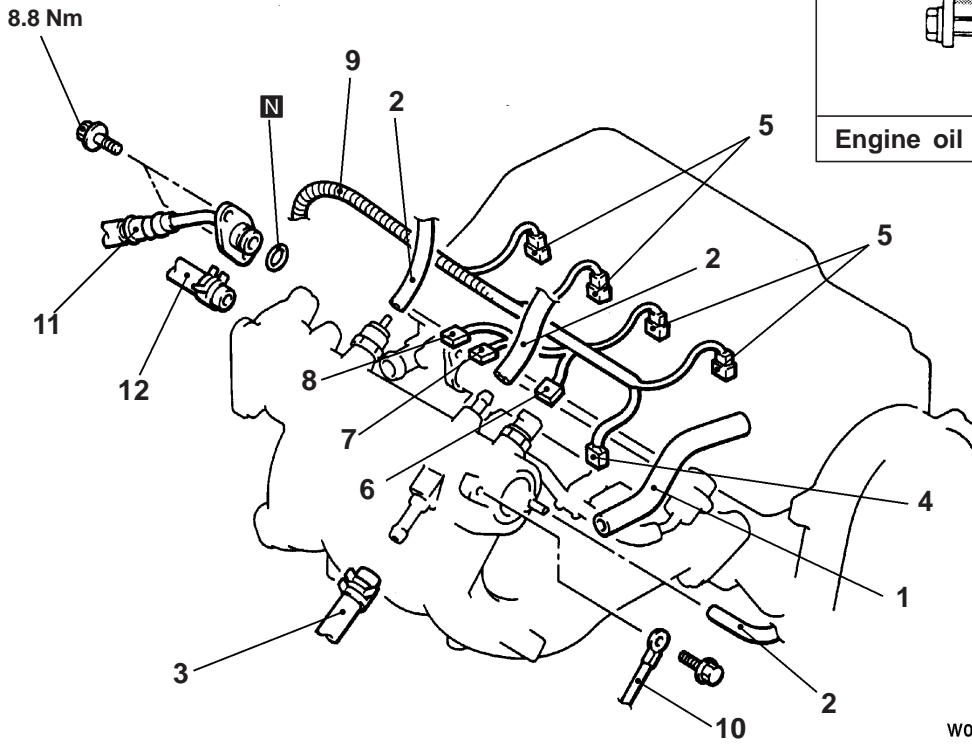
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Pre-removal Operation

- Fuel Discharge Prevention (Refer to GROUP 13B – On-vehicle Service.)
- Engine Coolant Draining (Refer to GROUP 14 – On-vehicle Service.)
- Air Cleaner Removal
- Throttle Body Removal (Refer to GROUP 13B.)

Post-installation Operation

- Throttle Body Installation (Refer to GROUP 13B.)
- Air Cleaner Installation
- Engine Coolant Supplying (Refer to GROUP 14 – On-vehicle Service.)



Engine oil

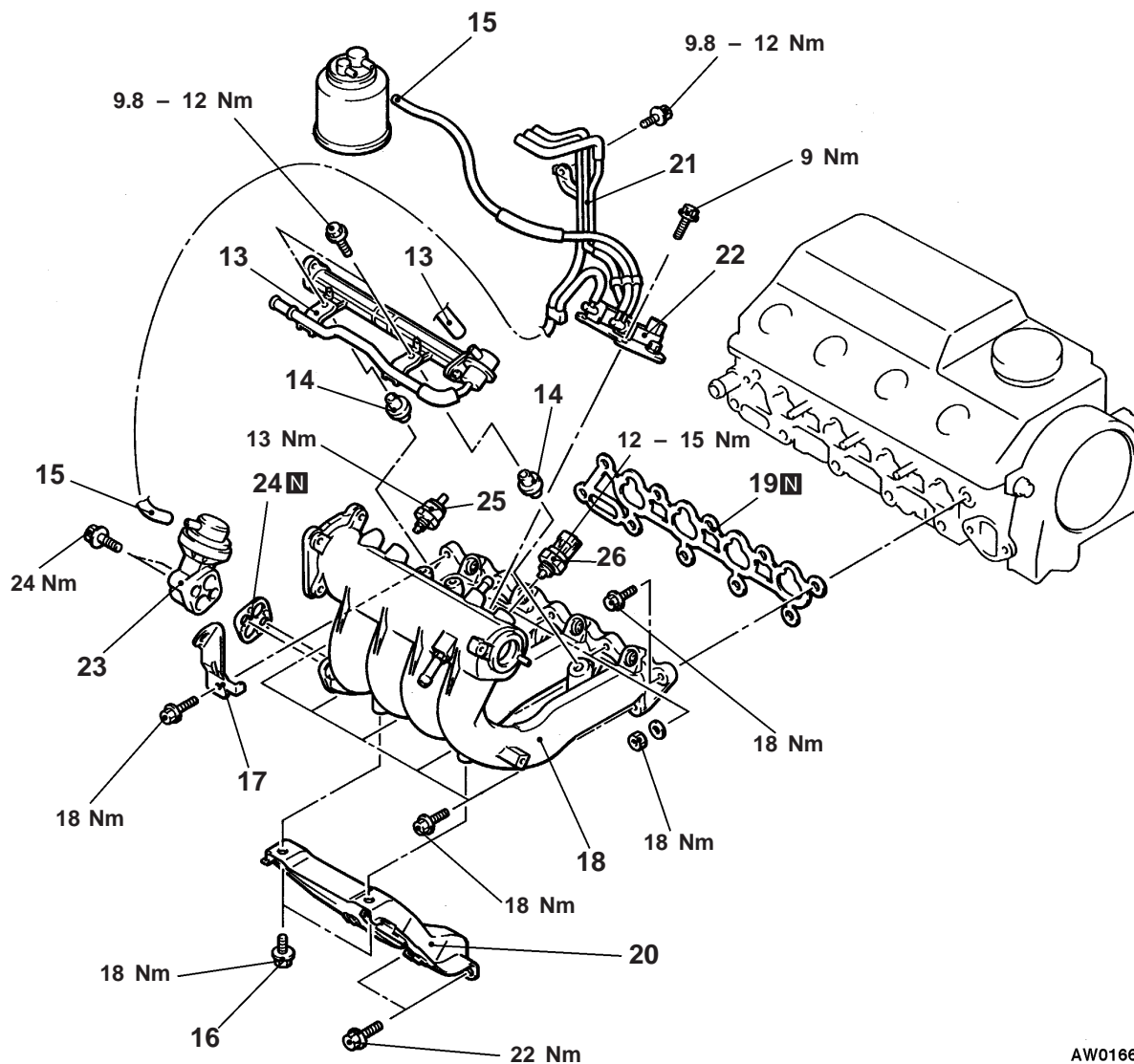
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Removal steps

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. PCV hose 2. Vacuum hose connection 3. Brake booster vacuum hose connection 4. Detonation sensor connector 5. Injector connector 6. Intake air temperature sensor connector | <ol style="list-style-type: none"> 7. Purge control solenoid valve connector 8. EGR solenoid valve connector 9. Control wiring harness 10. Earth wire connection 11. High-pressure fuel hose connection 12. Fuel return hose connection |
|--|---|





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- 13. Delivery pipe, fuel return pipe, injector and pressure regulator assembly
- 14. Insulator
- 15. Vacuum hose connection
- 16. Intake manifold stay upper installation bolt
- 17. Engine hanger
- 18. Intake manifold assembly

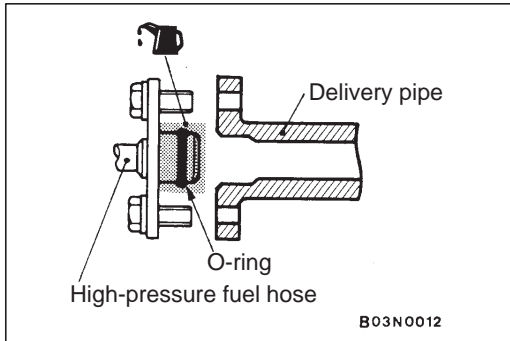
- 19. Intake manifold gasket
- 20. Intake manifold stay
- 21. Vacuum pipe and hose assembly
- 22. Solenoid valve assembly
- 23. EGR valve
- 24. Gasket
- 25. Gas filter assembly
- 26. Intake air temperature sensor

REMOVAL SERVICE POINT**◀A▶ DELIVERY PIPE, FUEL RETURN PIPE, INJECTOR AND PRESSURE REGULATOR ASSEMBLY REMOVAL**

Remove the delivery pipe (with the fuel return pipe, injectors and pressure regulator attached to it).

Caution

Care must be taken, when removing the delivery pipe, not to drop the injector.

**INSTALLATION SERVICE POINT****▶A◀ HIGH-PRESSURE FUEL HOSE INSTALLATION**

1. When connecting the high-pressure fuel hose to the delivery pipe, apply a small amount of new engine oil to the O-ring and then insert the high-pressure fuel hose, being careful not to damage the O-ring.

Caution

Be careful not to let any engine oil get into the delivery pipe.

2. While turning the high-pressure fuel hose to the left and right, install it to the delivery pipe.
3. Check to be sure that the high-pressure fuel hose turns smoothly.

If it does not turn smoothly, the O-ring may be trapped, remove the high-pressure fuel hose and then re-insert it into the delivery pipe and check once again.

INSPECTION

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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. Check for obstruction of the negative pressure (vacuum) outlet port, and for obstruction of the gas passage.
3. Using a straight edge and thickness gauge, check for distortion of the cylinder head installation surface.

Standard value: 0.15 mm or less

Limit: 0.20 mm

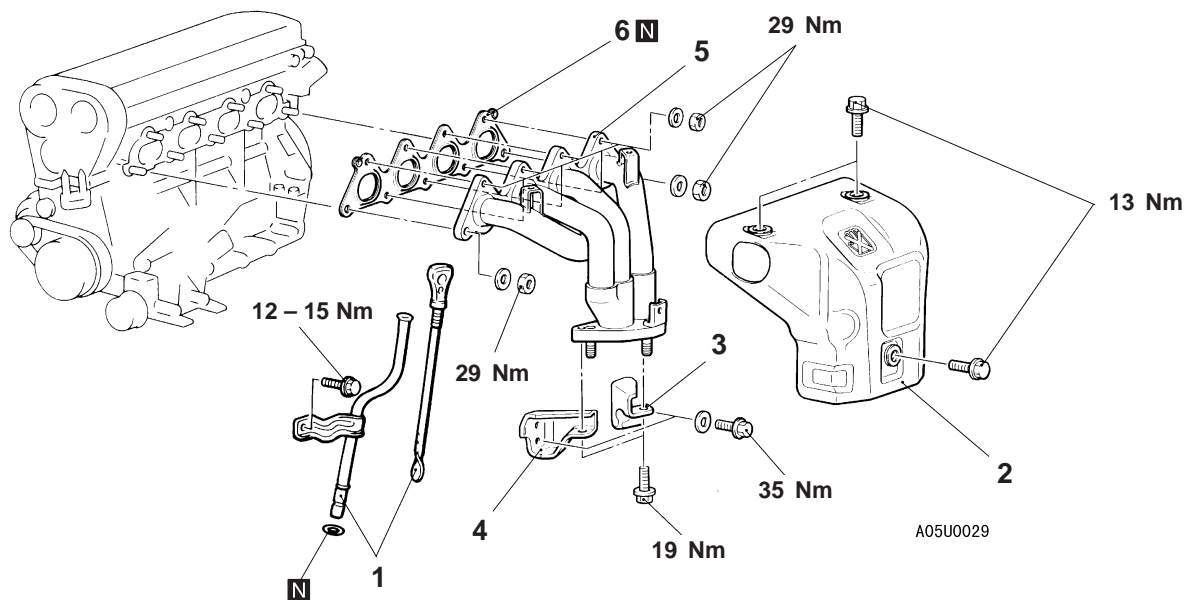
EXHAUST MANIFOLD

15100330532

REMOVAL AND INSTALLATION

<GDI>

Pre-removal and Post-installation Operation
 Front Exhaust Pipe Removal and installation
 (Refer to P.15-10.)



Removal steps

1. Oil level gauge guide assembly
2. Heat protector
3. Exhaust manifold bracket (A)
4. Exhaust manifold bracket (B)
5. Exhaust manifold
6. Exhaust manifold gasket

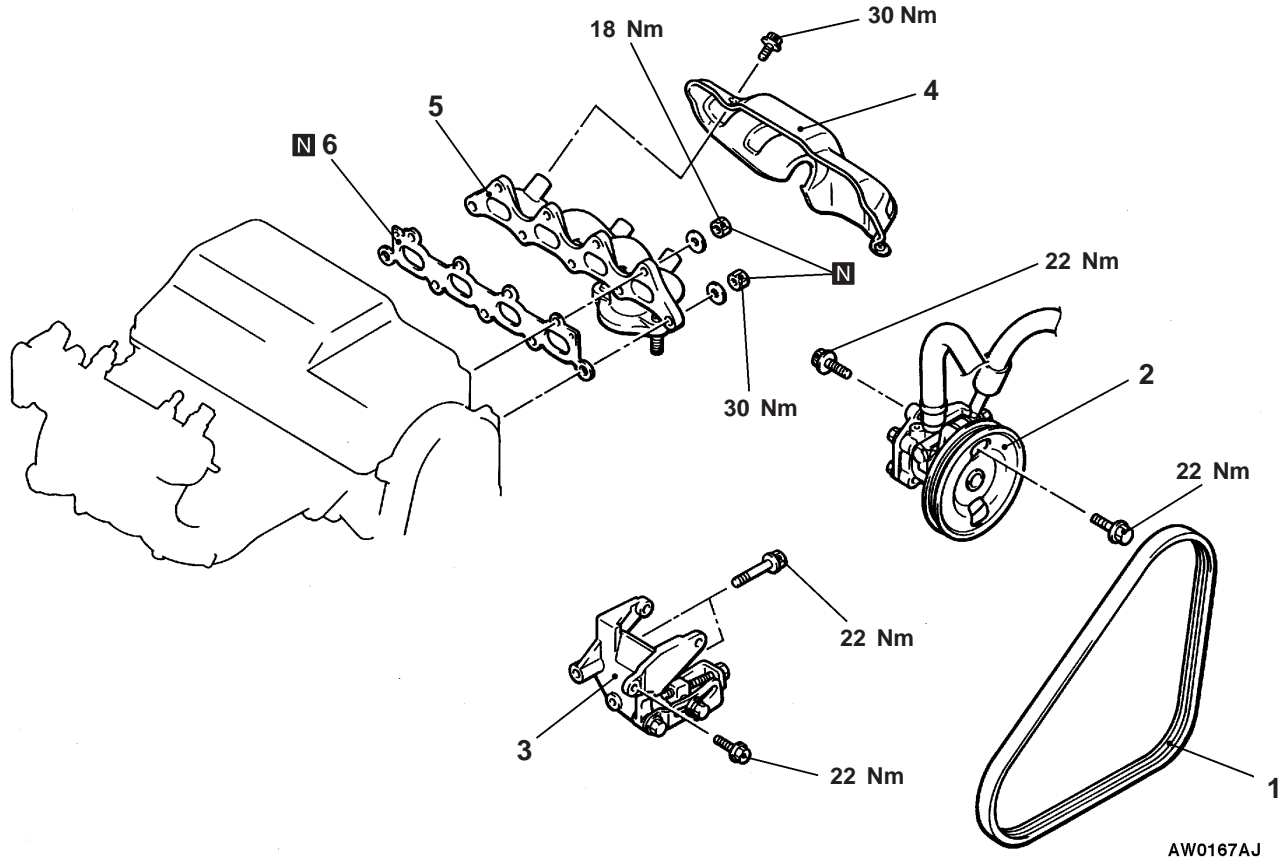
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Pre-removal Operation

- Front Exhaust Pipe Removal (Refer to P. 15-10.)

Post-installation Operation

- Front Exhaust Pipe Installation (Refer to P. 15-10.)
- Drive Belt Tension Adjustment (Refer to GROUP 11B – On-vehicle Service.)



Removal steps

1. Drive belt (Power steering)
2. Power steering oil pump
3. Power steering oil pump bracket
4. Exhaust manifold cover
5. Exhaust manifold
6. Exhaust manifold gasket



REMOVAL SERVICE POINT**◀A▶ POWER STEERING OIL PUMP REMOVAL**

Remove the power steering oil pump from the engine with the hose attached.

NOTE

Place the removed power steering oil pump in a place where it will not be a hindrance when removing and installing the exhaust manifold, and tie it with a cord.

INSPECTION

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EXHAUST MANIFOLD CHECK

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

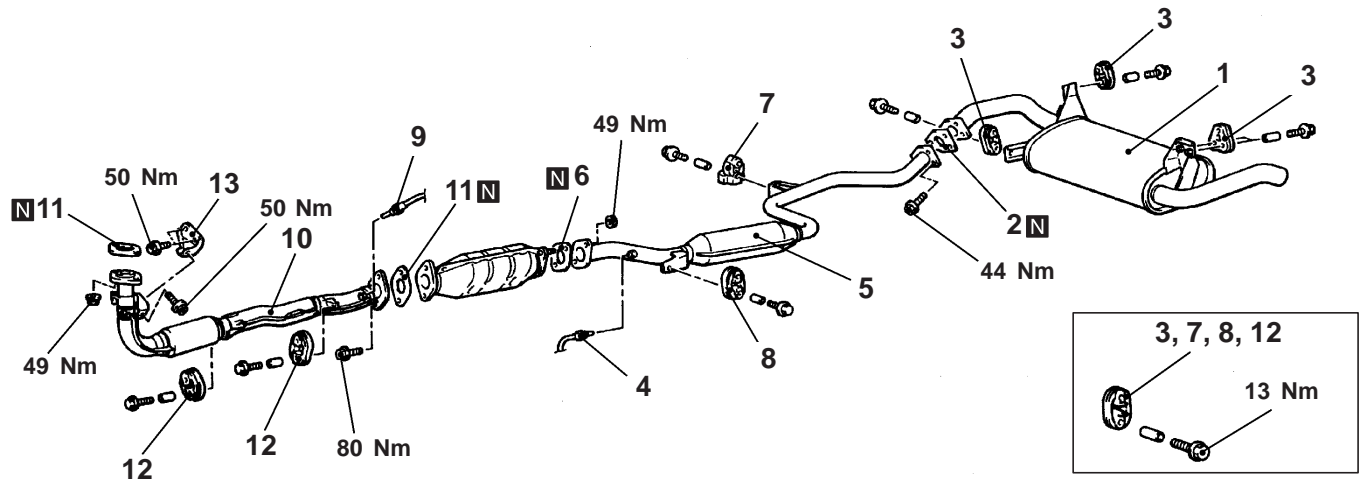
Standard value: 0.15 mm or less

Limit: 0.20 mm

EXHAUST PIPE AND MAIN MUFFLER

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REMOVAL AND INSTALLATION



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Main muffler removal steps

- 1. Main muffler
- 2. Gasket
- 3. Hanger

- 7. Dynamic damper
- 8. Hanger

Center exhaust pipe removal steps

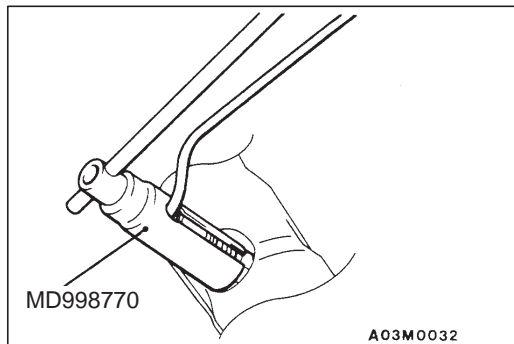


- 4. Oxygen sensor
- 5. Center exhaust pipe
- 6. Gasket

Front exhaust pipe removal steps



- 9. Oxygen sensor
- 10. Front exhaust pipe
- 11. Gasket
- 12. Hanger
- 13. Front exhaust pipe bracket



REMOVAL SERVICE POINT

◀A▶ OXYGEN SENSOR REMOVAL

INSTALLATION SERVICE POINT

▶A◀ OXYGEN SENSOR INSTALLATION

INTAKE AND EXHAUST

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GENERAL

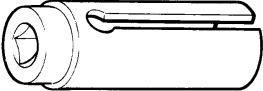
OUTLINE OF CHANGES

- The service procedures have been established due to the adoption of the intake manifold made of resin for the 4G93-GDI engine and the change of the exhaust pipe.
- The service procedures have been established due to the adoption of the intake manifold made of steel pipe for the 4G13-MPI engine and the exhaust manifold incorporated with the catalytic converter.
- The service procedures have been established due to the introduction of the F9Q1 diesel engine. Other service procedures are the same as before.

SERVICE SPECIFICATION

Item	Standard value
Turbocharger waste gate solenoid coil resistance Ω (at 25°C)	15.5 – 17.5

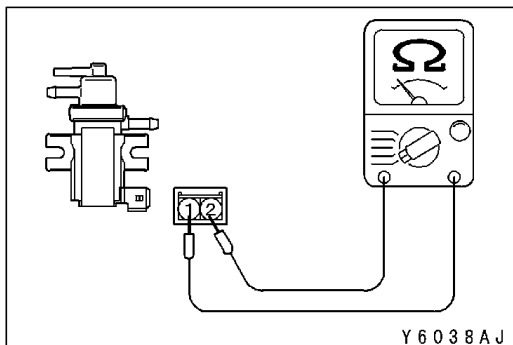
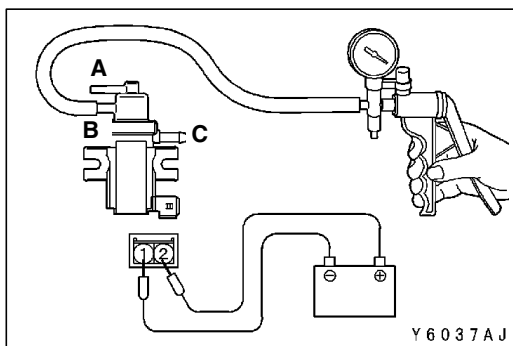
SPECIAL TOOL

Tool	Number	Name	Use
	MD998770	Oxygen sensor wrench	Removal/Installation of oxygen sensor

ON-VEHICLE SERVICE <F9Q1>

WASTE GATE ACTUATOR CHECK

1. Disconnect the vacuum hose from the waste gate actuator nipple.
2. Connect a hand vacuum pump to the nipple.
3. Check the rod for smooth movement as vacuum pressure is gradually applied.



TURBOCHARGER WASTE GATE SOLENOID CHECK

NOTE

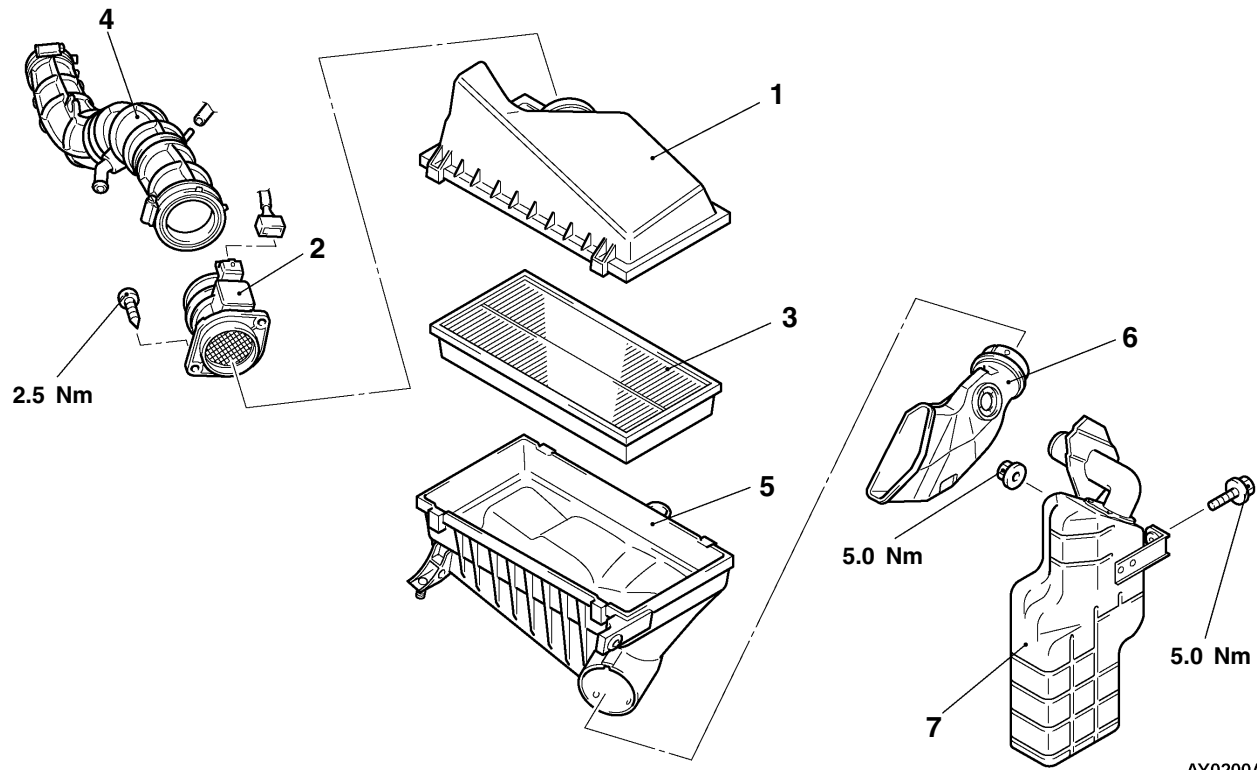
When disconnecting the vacuum hose, always make a mark so that it can be reconnected at original position.

1. Disconnect the vacuum hose from the solenoid.
2. Disconnect the solenoid connector.
3. Connect a hand vacuum pump to the nipple (B) of the solenoid (refer to the illustration at left).
4. Check the air-tightness by applying a vacuum with voltage applied directly from the battery to the solenoid and without applying voltage.

Battery 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.

Standard value: 15.5 – 17.5 Ω (at 25°C)

AIR CLEANER <F9Q1>**REMOVAL AND INSTALLATION**

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Removal steps

1. Air cleaner cover
2. Air flow sensor assembly
3. Air cleaner element
4. Air intake hose
- Battery

5. Air cleaner body
6. Air duct
- Splash shield
7. Resonator

INSTALLATION SERVICE POINT**▶A◀ AIR FLOW SENSOR ASSEMBLY INSTALLATION**

Make sure that the mesh of the air flow sensor assembly is not contaminated with dirt, then install the air flow sensor.

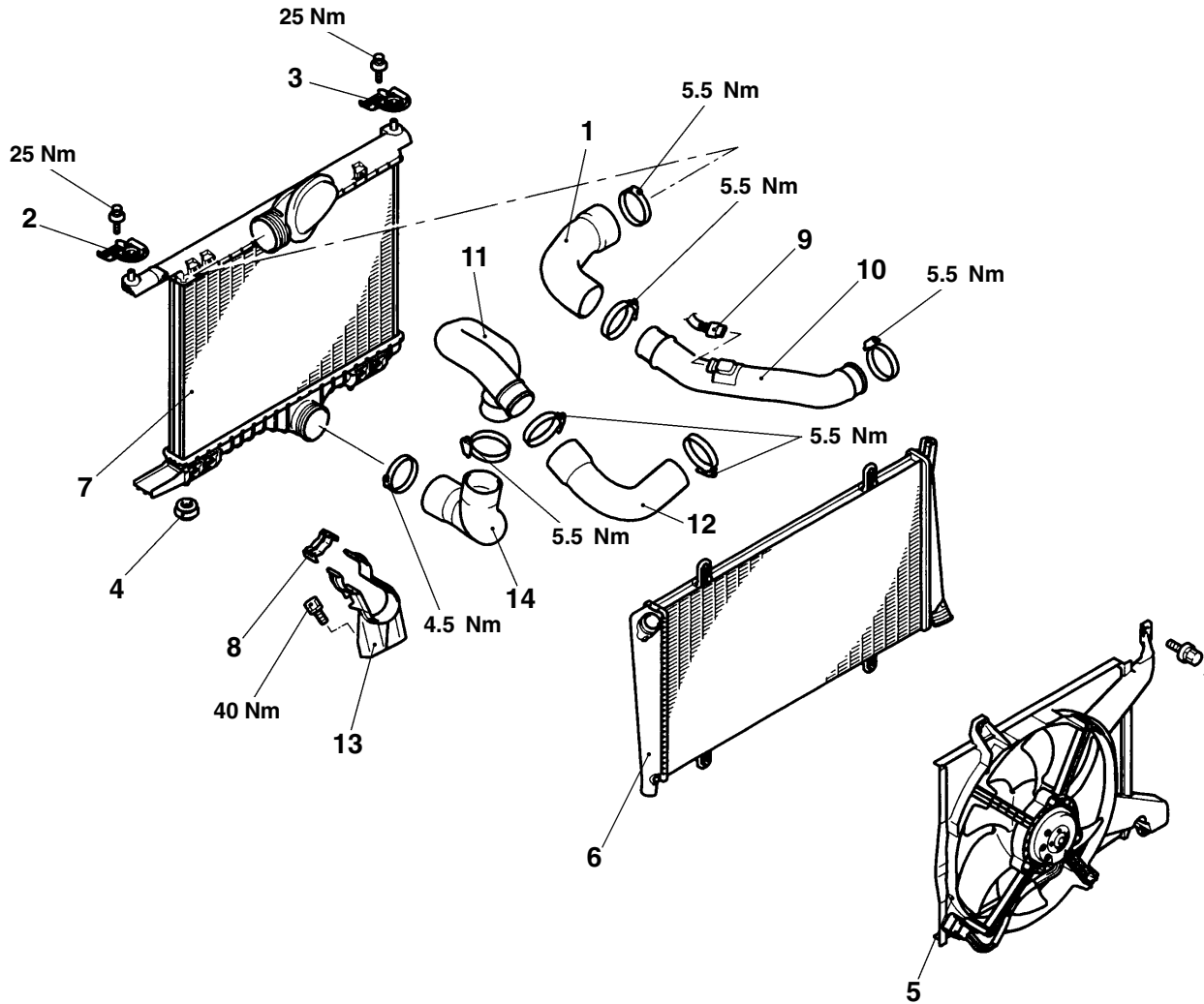
Caution

If the sensor mesh remains contaminated, the air flow sensor could not sense air flow volume exactly.

INTERCOOLER <F9Q1>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
 Radiator Fan Motor, Radiator and Intercooler assembly
 Removal and Installation
 (Refer to GROUP 14 – RADIATOR <F9Q1>.)



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Removal steps

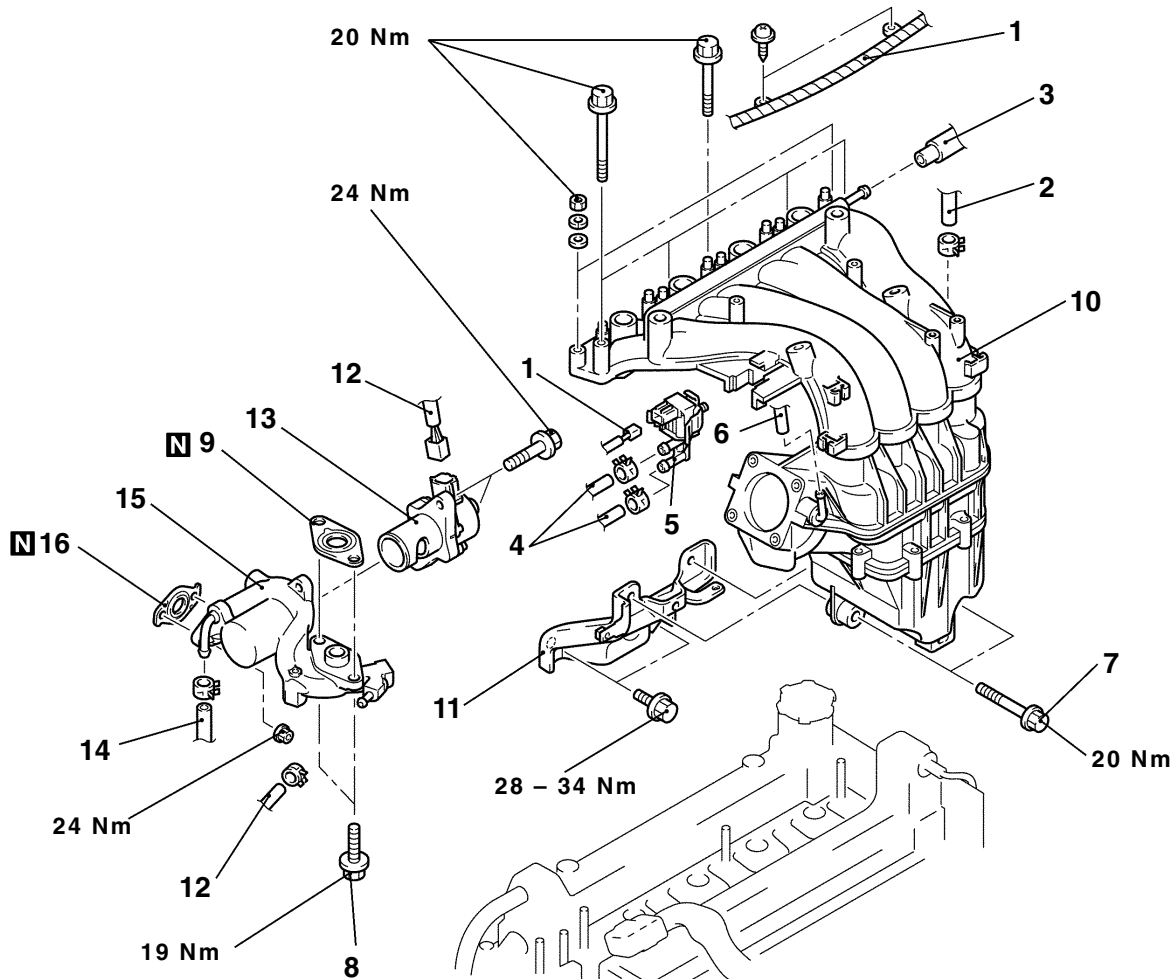
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| <ol style="list-style-type: none"> 1. Air hose 2. Upper insulator (L.H.) 3. Upper insulator (R.H.) 4. Insulator 5. Radiator fan motor assembly 6. Radiator assembly 7. Intercooler assembly | <ol style="list-style-type: none"> 8. Clip 9. Boost sensor connector 10. Air pipe 11. Air pipe 12. Air hose 13. Hose bracket 14. Air hose |
|--|--|

INTAKE MANIFOLD <4G93-GDI>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying
- Air Cleaner Removal and Installation
- Ignition Coil Removal and Installation (Refer to GROUP 16.)
- Throttle Body Removal and Installation (Refer to GROUP 13A.)
- Fuel Injector Removal and Installation (Refer to GROUP 13A.)



AY0066AU

Removal steps

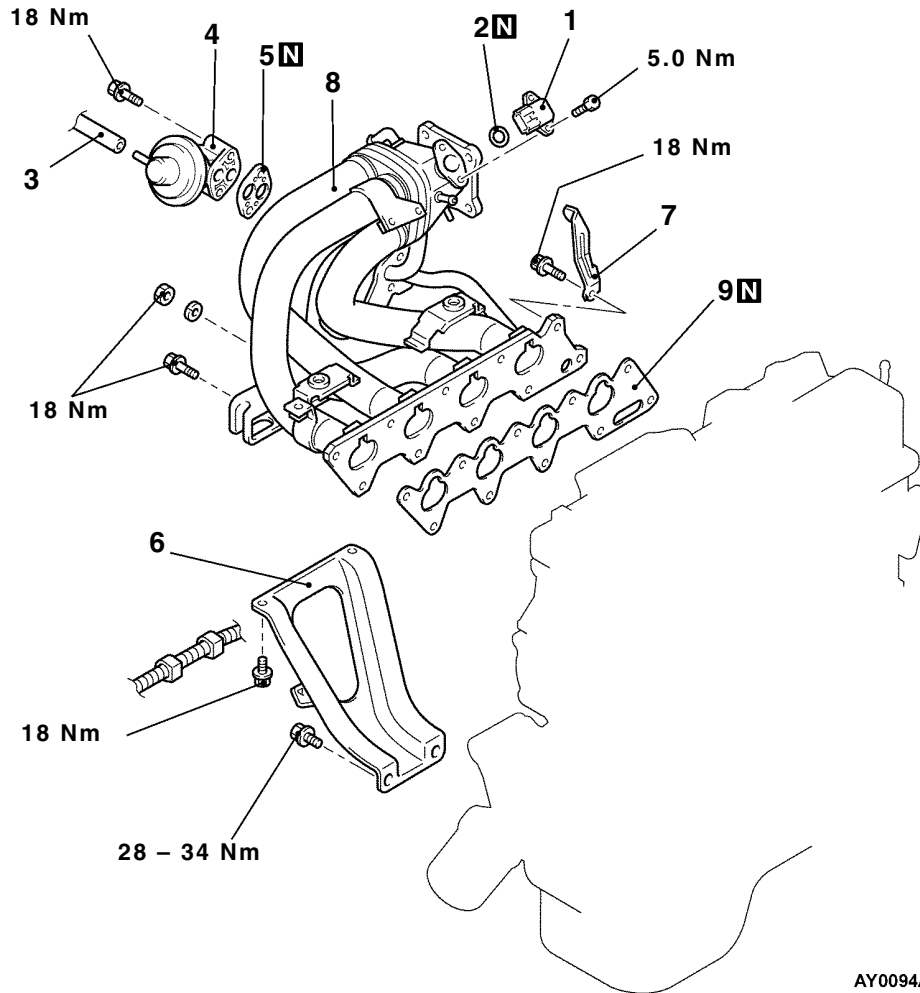
1. Control wiring harness, connector
2. Brake booster vacuum hose connection
3. PCV hose connection
4. Vacuum hoses connection
5. Purge control solenoid valve
6. Purge hose connection
7. Intake manifold to intake manifold stay connecting bolt
8. Intake manifold to EGR valve support connecting bolt
9. EGR valve support gasket
 - Injector driver
10. Intake manifold assembly
11. Intake manifold stay
12. EGR valve connector
13. EGR valve
14. Water hose connection
15. EGR valve support
16. EGR valve support gasket

INTAKE MANIFOLD <4G13-MPI>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Engine Coolant Draining and Supplying
- Air Cleaner Removal and Installation
- Throttle Body Removal and Installation (Refer to GROUP 13B.)
- Fuel injector Removal and Installation (Refer to GROUP 13B.)



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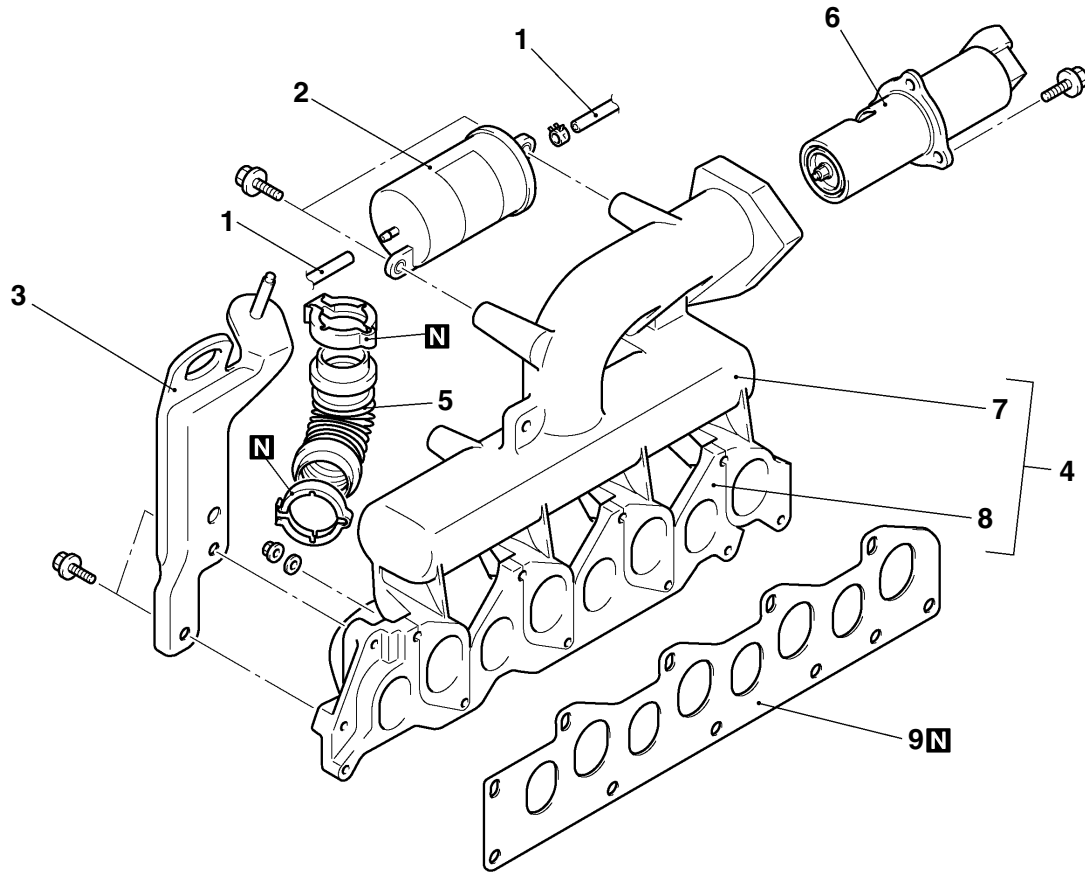
Removal steps

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| <ul style="list-style-type: none"> 1. Boost sensor 2. O-ring 3. Vacuum hose connection 4. EGR valve 5. EGR valve gasket | <ul style="list-style-type: none"> 6. Intake manifold stay 7. Engine hanger 8. Intake manifold 9. Intake manifold gasket |
|--|--|

INTAKE MANIFOLD AND EXHAUST MANIFOLD <F9Q1>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation
Turbocharger Assembly Removal and Installation
(Refer to P.15-10.)

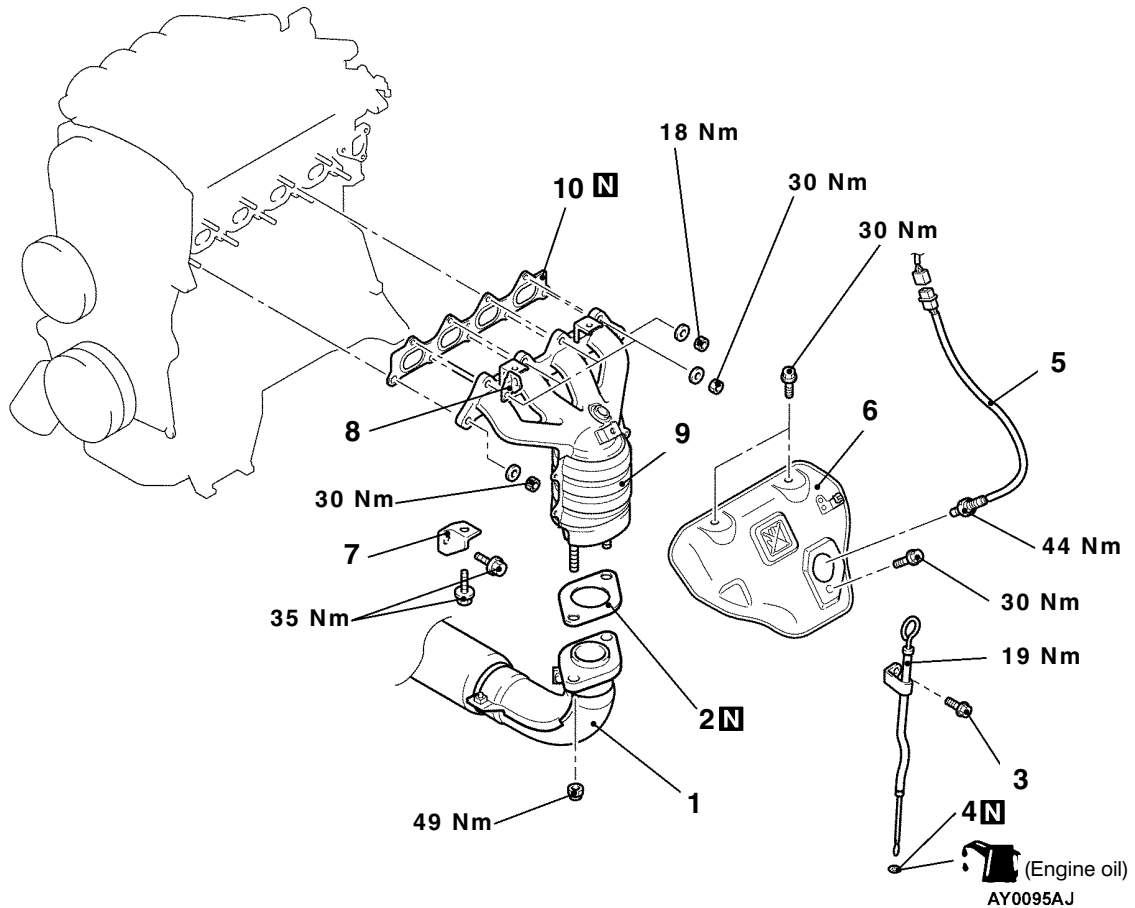


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Removal steps

1. Vacuum hose connection
2. Vacuum tank assembly
3. Engine hanger
4. Intake and exhaust manifold assembly
5. EGR pipe
6. EGR valve assembly
7. Intake manifold
8. Exhaust manifold
9. Intake and exhaust manifold gasket

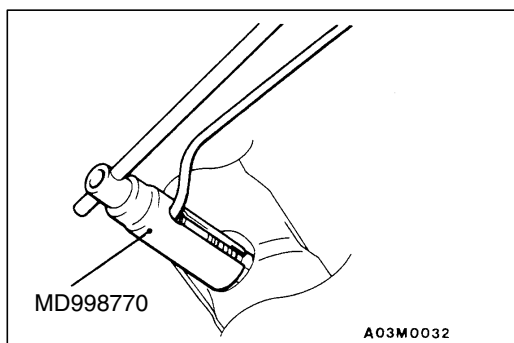
EXHAUST MANIFOLD <4G13-MPI>



Removal steps

1. Front exhaust pipe connection
2. Front exhaust pipe gasket
3. Engine oil level gauge assembly
4. O-ring
5. Oxygen sensor (front)

6. Exhaust manifold cover
7. Exhaust manifold bracket B
8. Engine hanger
9. Exhaust manifold
10. Exhaust manifold gasket



REMOVAL SERVICE POINT

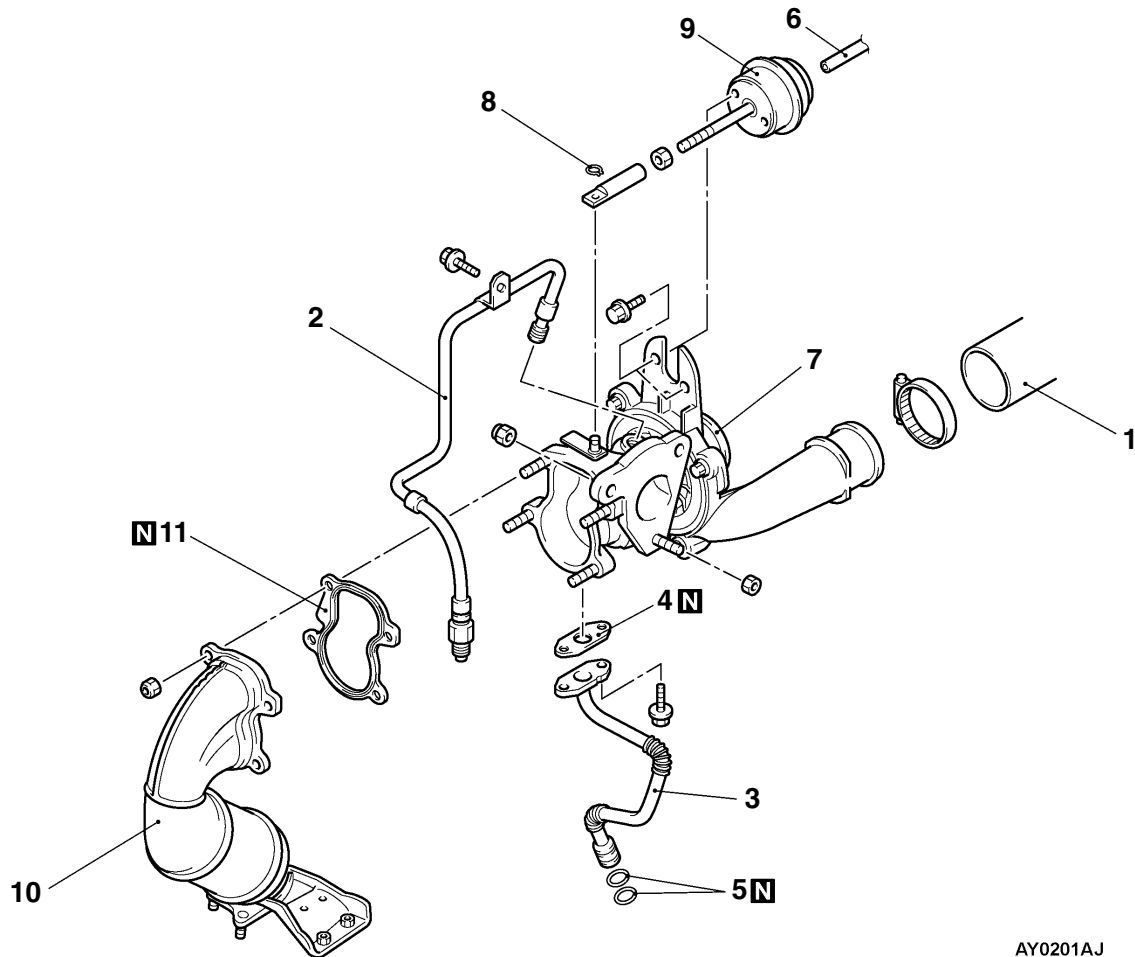
◀▶ OXYGEN SENSOR (FRONT) REMOVAL

INSTALLATION SERVICE POINT

▶◀ OXYGEN SENSOR INSTALLATION

TURBOCHARGER <F9Q1>**REMOVAL AND INSTALLATION**

Pre-removal and Post-installation Operation
 Air Intake Hose Removal and Installation
 (Refer to P.15-4.)



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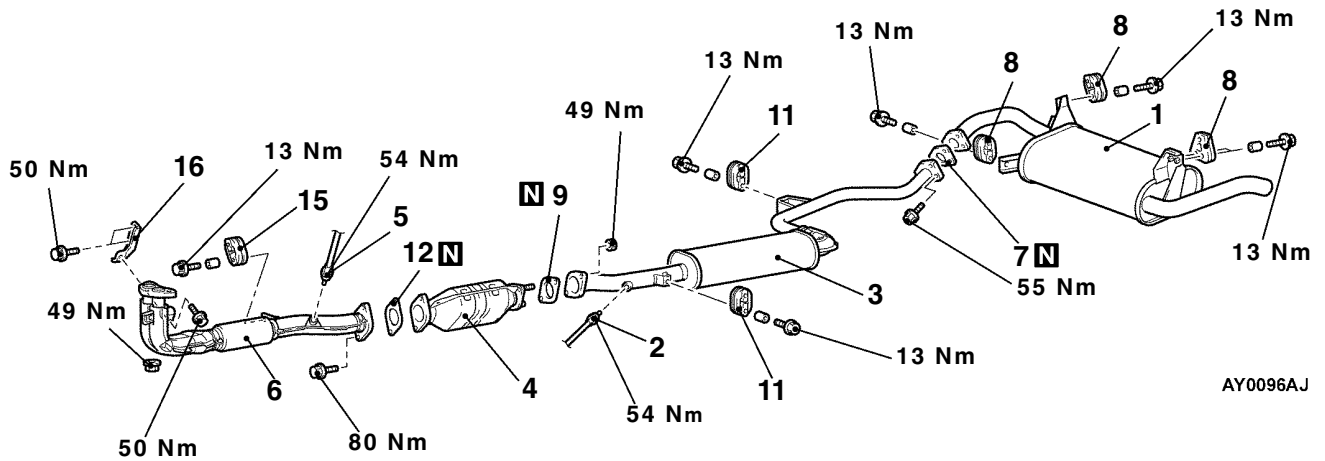
Removal steps

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| <ol style="list-style-type: none"> 1. Air hose connection 2. Oil pipe assembly 3. Oil return pipe assembly 4. Oil return pipe gasket 5. O-ring 6. Vacuum hose connection | <ol style="list-style-type: none"> 7. Turbocharger assembly 8. Circlip 9. Waste gate assembly 10. Exhaust fitting 11. Exhaust fitting gasket |
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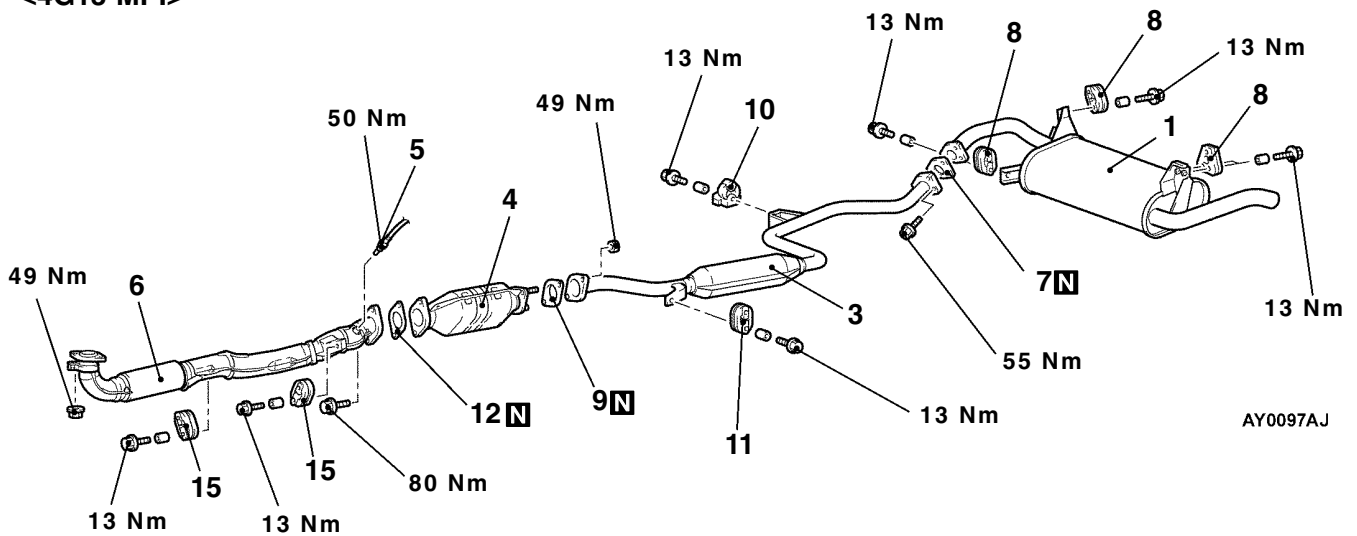
EXHAUST PIPE AND MAIN MUFFLER

REMOVAL AND INSTALLATION

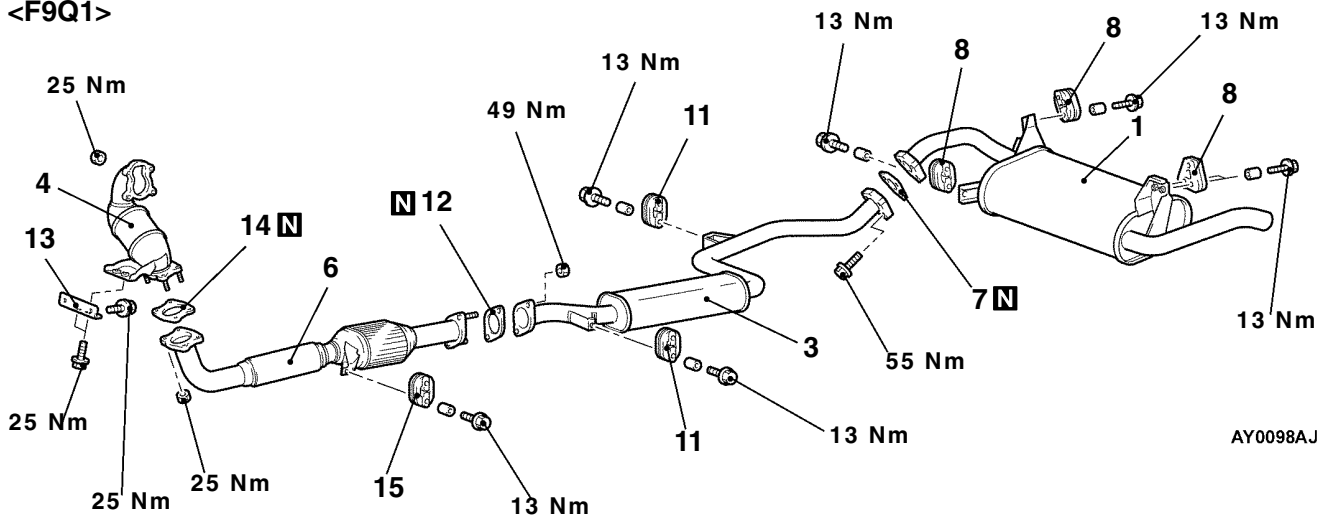
<4G93-GDI>



<4G13-MPI>



<F9Q1>



Main muffler removal steps

1. Main muffler
7. Gasket
8. Hanger

Center exhaust pipe removal steps

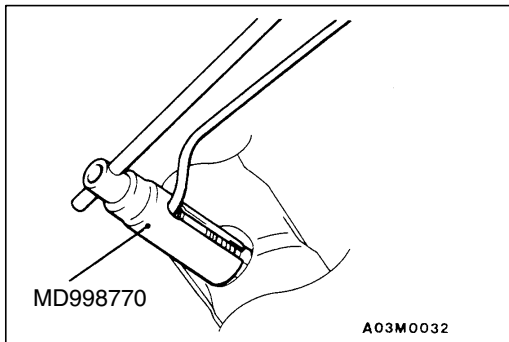
- ◀A▶ ▶A◀
2. Oxygen sensor (rear) <4G93-GDI>
 3. Center exhaust pipe
 7. Gasket
 9. Gasket <4G93-GDI, 4G13-MPI>
 10. Dynamic damper
 11. Hanger
 12. Gasket <F9Q1>

Catalytic converter removal steps

4. Catalytic converter
9. Gasket <4G93-GDI, 4G13-MPI>
12. Gasket <4G93-GDI, 4G13-MPI>
13. Bracket <F9Q1>
14. Gasket <F9Q1>

Front exhaust pipe removal steps

- ◀A▶ ▶A◀
5. Oxygen sensor (front) <4G93-GDI> or oxygen sensor (rear) <4G13-MPI>
 6. Front exhaust pipe
 12. Gasket
 15. Hanger
 16. Front exhaust pipe bracket <4G93-GDI>

**REMOVAL SERVICE POINT**

◀A▶ OXYGEN SENSOR REMOVAL

INSTALLATION SERVICE POINT

▶A◀ OXYGEN SENSOR INSTALLATION