

INTAKE AND EXHAUST

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INTAKE AND EXHAUST

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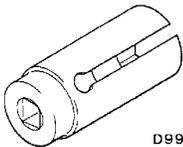
SERVICE SPECIFICATIONS

Items		Standard value	Limit
Waste gate actuator activation pressure kPa	4D5	Approx. 92	-
	4M4	Approx. 161	-
Manifold distortion of the installation surface mm		0.15 or less	0.20

SEALANT

Item	Specified sealant	Remarks
Thread of the intake manifold mounting bolts	3M Stud Locking No.4170 or equivalent	Anaerobic sealant

SPECIAL TOOL

Tool	Number	Name	Use
 D998770	MD998770	Oxygen sensor wrench	Removal/Installation of oxygen sensor <6G7>

ON-VEHICLE SERVICE

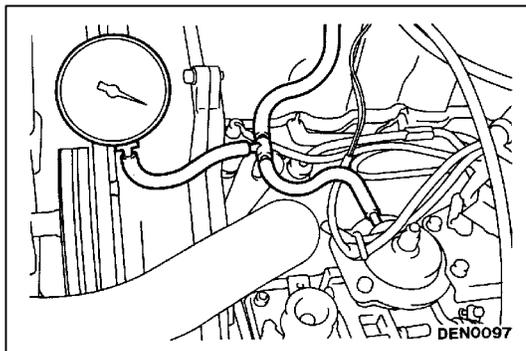
INTAKE MANIFOLD VACUUM CHECK <6G7>

Refer to GROUP 11A - On-vehicle Service

TURBOCHARGER SUPERCHARGING CHECK <4D5>

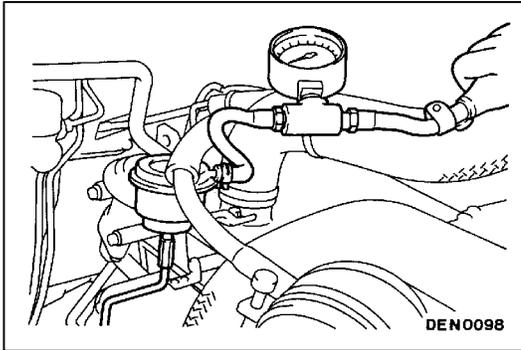
Caution

Conduct the driving test in a location where driving at full acceleration can be done with safety. Two person 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. Remove the boost compensator hose from the fuel injection pump, and install a pressure gauge as shown in the illustration.
2. Drive at full-throttle acceleration in second gear and then measure the supercharging when the engine speed in about 3,000 r/min.
3. When the indicated supercharging does not become positive pressure, check the following items.
 - Malfunction of the waste gate actuator
 - Leakage of supercharging pressure
 - Malfunction of the turbocharger

4. When the indicated supercharging is 84 kPa or more, supercharging control may be faulty, therefore check the followings.
 - Disconnection or cracks of the waste gate actuator rubber hose.
 - Malfunction of the waste gate actuator.
 - Malfunction of the waste gate valve.



WASTE GATE ACTUATOR CHECK <4D5>

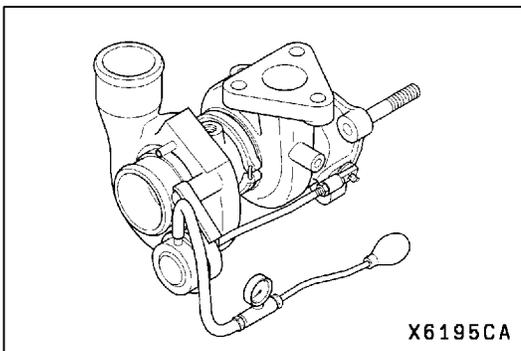
1. Connect a manual pump (pressure-application type) to nipple.
2. While gradually applying pressure, check the pressure that begins to activate (approx. 1 mm stroke) the waste gate actuator rod.

Standard value: Approx. 92 kPa

Caution

In order to avoid damage to the diaphragm, do not apply a pressure of 105 kPa or higher.

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



WASTE GATE ACTUATOR CHECK <4M4>

1. Connect a manual pump (pressure-application type) to nipple.
2. While gradually applying pressure, check the pressure that begins to activate (approx. 1 mm stroke) the waste gate actuator rod.

Standard value: Approx. 161 kPa

Caution

In order to avoid damage to the diaphragm, do not apply a pressure of 181 kPa or higher.

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

AIR CLEANER

REMOVAL AND INSTALLATION

Caution

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

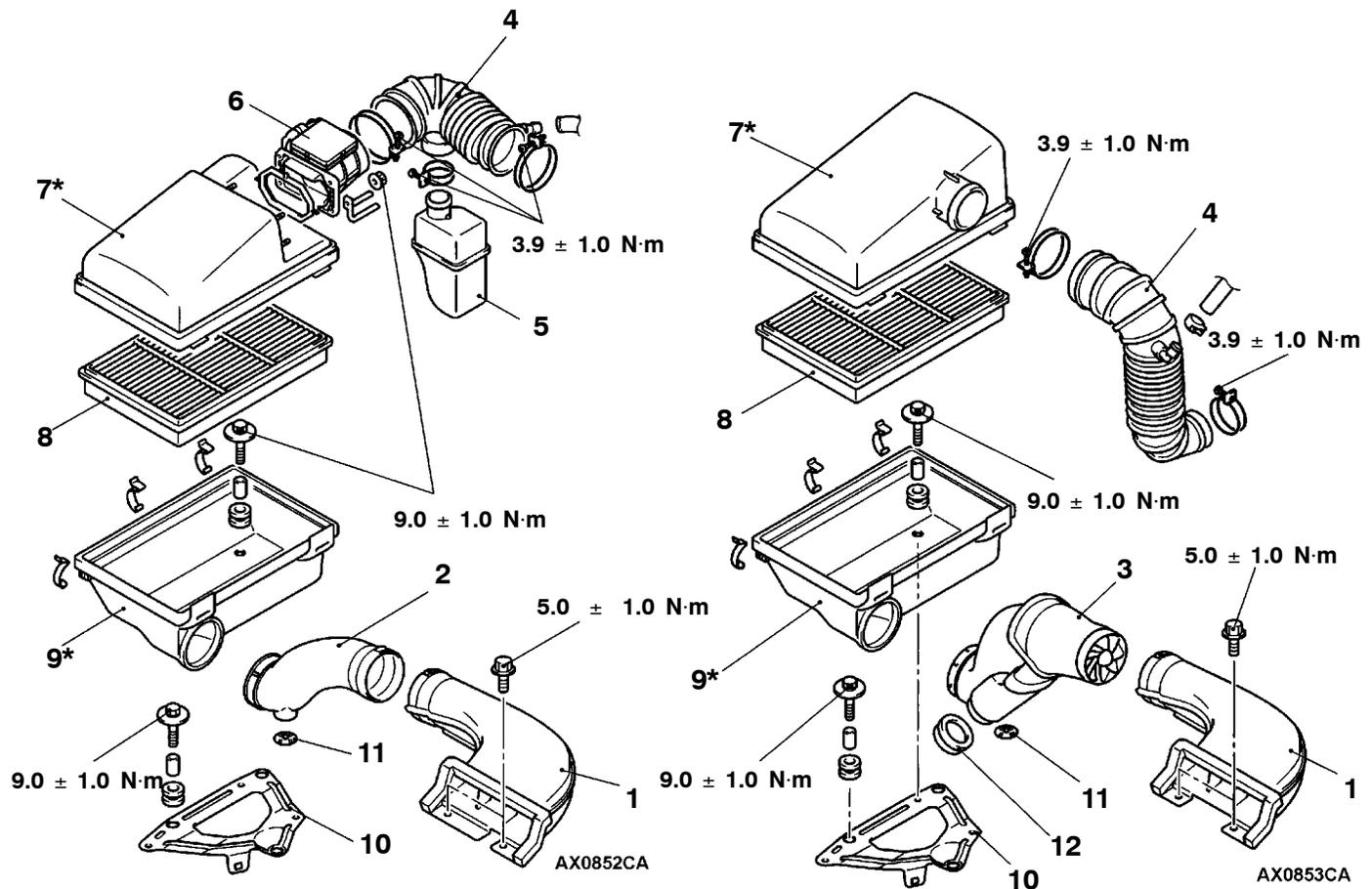
1. Avoid any shock or load to these parts when removing and installing them.
2. Engage the case hinges securely when assembling these parts.

NOTE

Parts marked by * are made of recycled-paper mixed plastic material, so can be disposed of by incineration.

<6G7>

<4D5, 4M4>



Removal steps

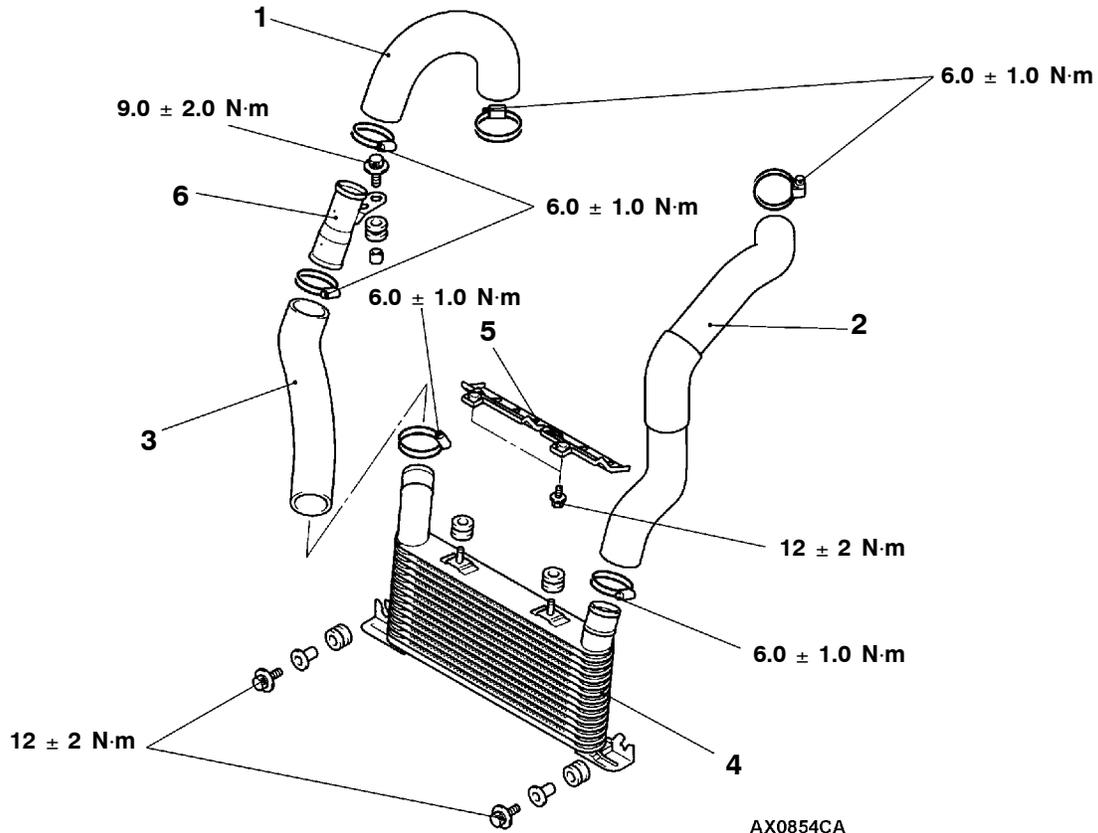
- | | |
|------------------------------------|-------------------------------|
| 1. Air duct (A) | 7. Air cleaner cover |
| 2. Air duct (B) <6G7> | 8. Air cleaner element |
| 3. Pre-cleaner assembly <4D5, 4M4> | 9. Air cleaner body |
| 4. Air intake hose | 10. Air cleaner bracket |
| 5. Resonator <6G7> | 11. Unloader valve |
| 6. Air flow sensor assembly <6G7> | 12. Unloader valve <4D5, 4M4> |

INTERCOOLER <4D5, 4M4>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Air Cleaner Removal and Installation (Refer to P.15-4)
- Skid Plate and Under Cover Removal and Installation
- Radiator Shroud Cover Removal and Installation (Refer to GROUP 14.)



Removal steps

- | | |
|-------------------------|-------------------------|
| 1. Intercooler air hose | 4. Intercooler assembly |
| 2. Intercooler air hose | 5. Deflector plate |
| 3. Intercooler air hose | 6. Intercooler air pipe |

INSPECTION

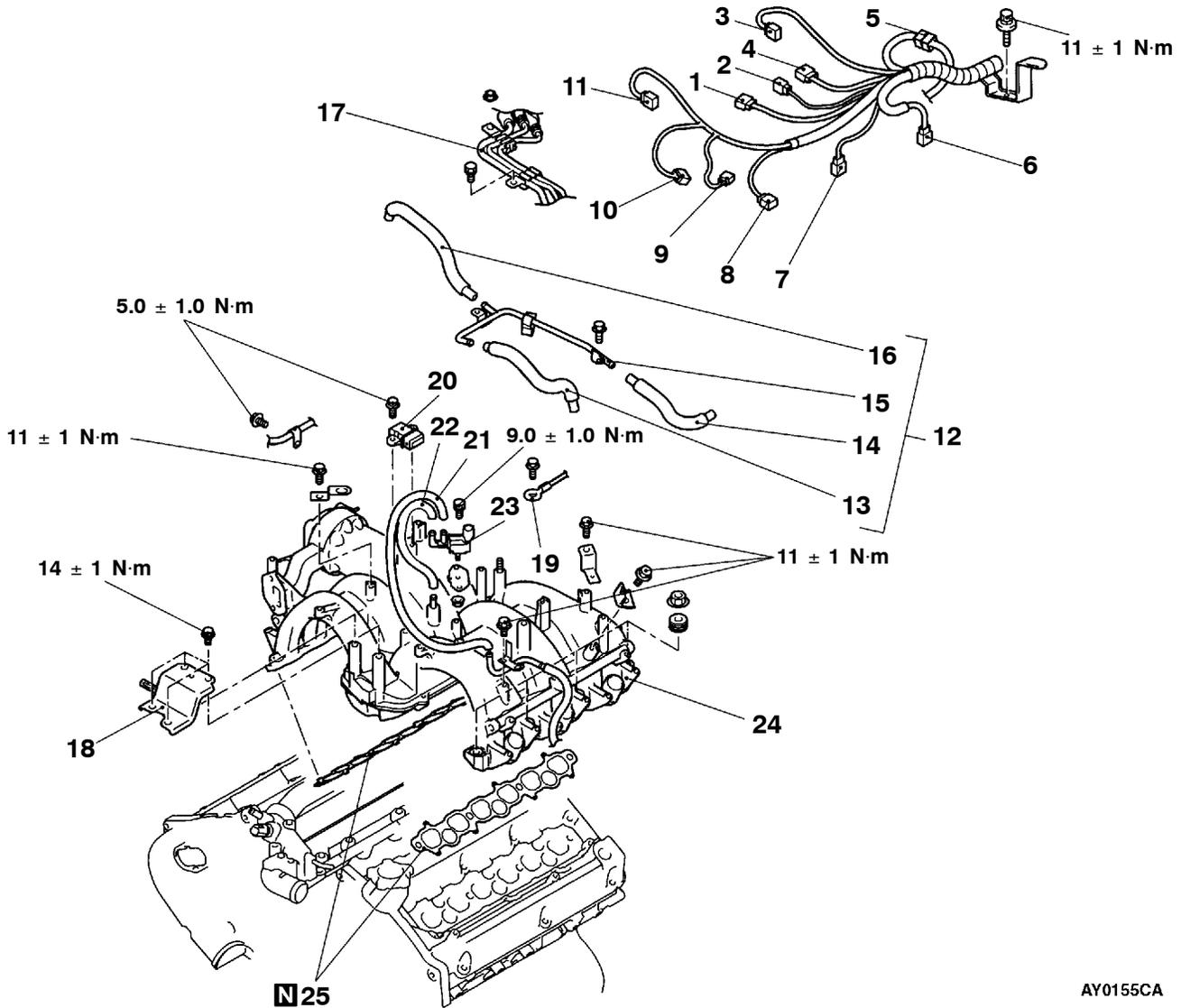
- Check the intercooler fins for bending damage or foreign matter.
- Check the intercooler hoses for cracking, damage or wear.

INTAKE MANIFOLD <6G7>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

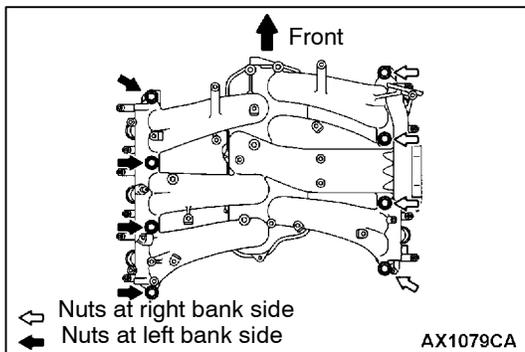
- Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Engine Cover Removal and Installation (Refer to GROUP 11A - Timing Belt.)
- Air Cleaner Removal and Installation (Refer to P.15-4.)
- EGR Valve Removal and Installation (Refer to GROUP 17.)
- Ignition Coil Removal and Installation (Refer to GROUP 16.)
- Throttle Body Removal and Installation (Refer to GROUP 13A.)



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Removal step

1. Ignition failure sensor connector
2. Detonation sensor connector
3. Throttle position sensor connector
4. Control harness and injector harness connection
5. Control harness and ignition coil harness connection
6. Control harness and fuel pressure sensor harness and camshaft position sensor harness connection
7. Purge solenoid valve connector
8. Crank angle sensor connector
9. Water temperature gauge unit
10. Engine coolant temperature sensor connector
11. Throttle control servo connector
12. PCV hose and pipe assembly
13. PCV hose A
14. PCV hose C
15. PCV hose B
16. PCV pipe
17. Fuel pipe clamp
18. Water outlet fitting bracket
19. Earth cable connection
20. Ignition failure sensor
21. Vacuum hose
22. Purge hose
23. Purge control solenoid valve
- ▶A◀ 24. Intake manifold
25. Intake manifold gasket



REMOVAL SERVICE POINT

▶A◀ **INTAKE MANIFOLD INSTALLATION**

Tighten the intake manifold mounting nuts in the order shown.

NOTE

Tighten the inside nuts first, and then outside nuts.

Order	Nuts to be tightened	Tightening torque N·m
1	Nuts at right bank side	6.5 ± 1.5
2	Nuts at left bank side	22 ± 1
3	Nuts at right bank side	22 ± 1
4	Nuts at left bank side	22 ± 1

INSPECTION

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 gas passages.
3. Check distortion of installation surface with straight edge and thickness gauge.

Standard value: 0.15 mm or less

Limit: 0.20 mm

INTAKE MANIHOOLD AND THROTTLE BODY <4M4>

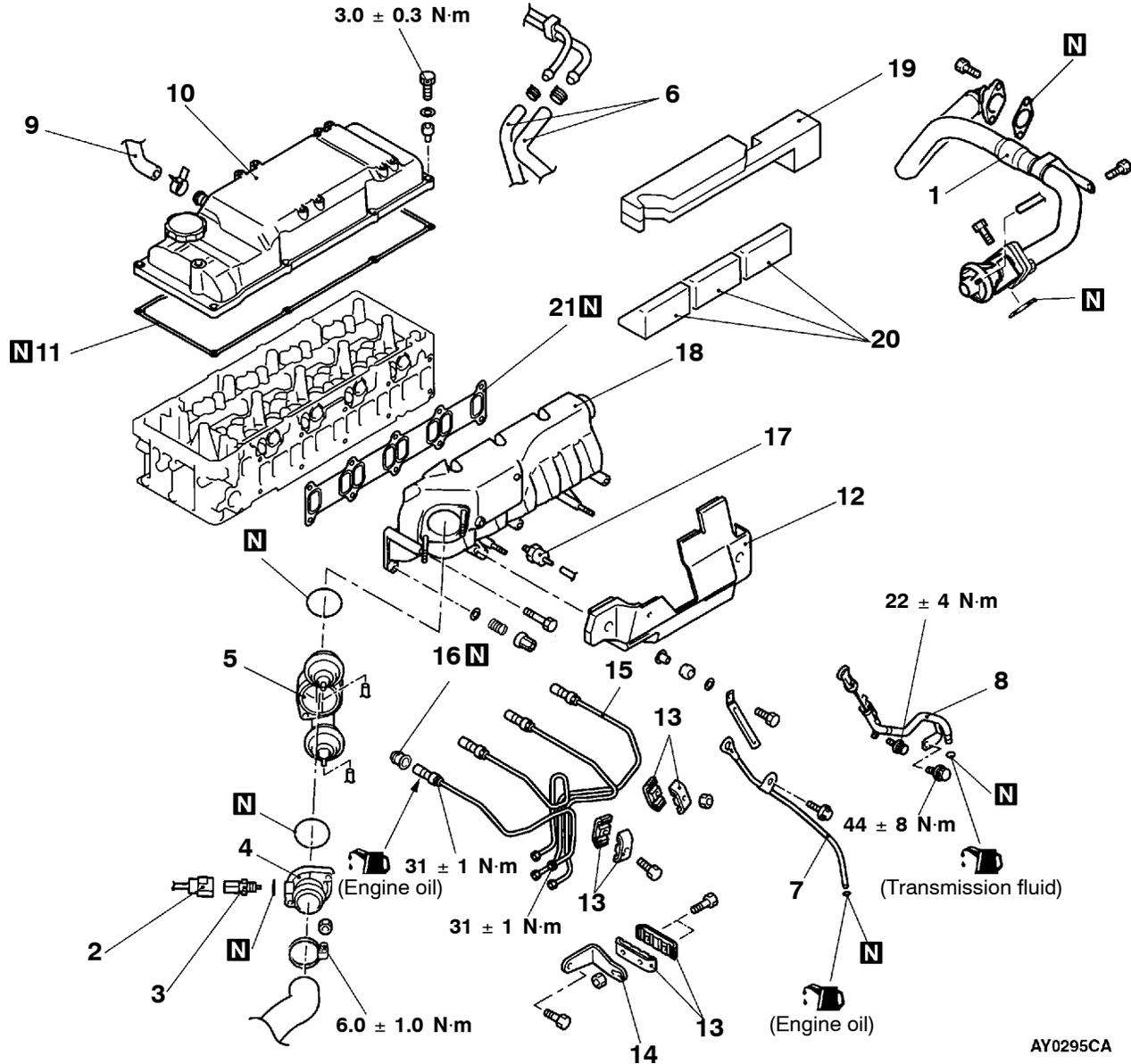
REMOVAL AND INSTALLATION

Pre-removal Operations

- Engine Cover Removal (Refer to GROUP 11B - Camshaft.)
- Battery and Battery Tray Removal
- Fuel Filter Removal (Refer to GROUP 13C.)
- Skid Plate And Under Cover Removal

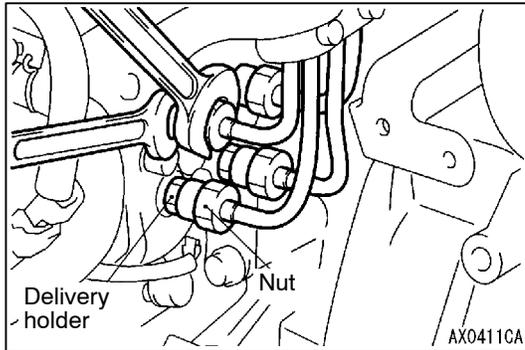
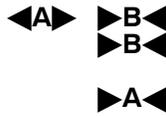
Post-installation Operations

- Skid Plate and Under Cover Installation
- Fuel Filter Installation (Refer to GROUP 13C.)
- Battery and Battery Tray Installation
- Evacuation of Air from Fuel Line (Refer to GROUP 13B – On-vehicle Service.)
- Engine Cover Installation (Refer to GROUP 11B - Camshaft.)



Removal steps

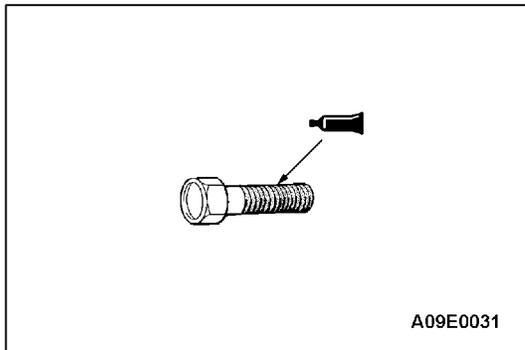
- | | |
|---|----------------------------|
| 1. EGR valve and pipe assembly | 11. Rocker cover gasket |
| 2. Boost air temperature sensor connector | 12. Intake manifold cover |
| 3. Boost air temperature sensor | 13. Clamp |
| 4. Intake air fitting | 14. Injection pipe stay |
| 5. Throttle body assembly | 15. Injection pipe |
| 6. Fuel hose connection | 16. Injection pipe seal |
| 7. Engine oil level gauge and guide | 17. Gas filter assembly |
| 8. ATF level gauge and guide | 18. Intake manifold |
| 9. Breather hose connection | 19. Spacer A |
| 10. Rocker cover | 20. Spacer B |
| | 21. Intake manifold gasket |



REMOVAL SERVICE POINT

◀A▶ INJECTION PIPE REMOVAL

Hold the injection pump side delivery holder with a open-end wrench, and loosen the nut.



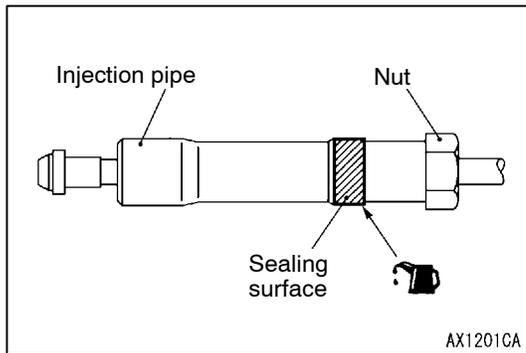
INSTALLATION SERVICE POINTS

▶A◀ INTAKE MANIFOLD INSTALLATION

1. Remove the old sealant from the intake manifold mounting bolt thread.
2. Use a tap (M8×1.25) to remove the old sealant from the bolt hole, and clean by using compressed air.
3. Apply the specified sealant to the intake manifold mounting bolt thread, and install the intake manifold by using the mounting bolts.

Specified sealant:

3M Stud Locking No. 4170 or equivalent



►B◄ INJECTION PIPE SEAL/INJECTION PIPE INSTALLATION

1. Apply a small amount of engine oil to a new injection pipe seal, and install it, being careful not to damage it.
2. Apply a small amount of engine oil to the injection pipe sealing surface, and then connect the injection pipes.
3. Use a spanner to hold the delivery holder at the injection pump side in the same manner as removal, and then install the injection pipe nuts.
4. Tighten the injection pipe nut to the specified torque.
Tightening torque: 31 ± 1 N·m

INSPECTION

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 gas passages.
3. Check distortion of installation surface with straight edge and thickness gauge.

Standard value: 0.15 mm or less

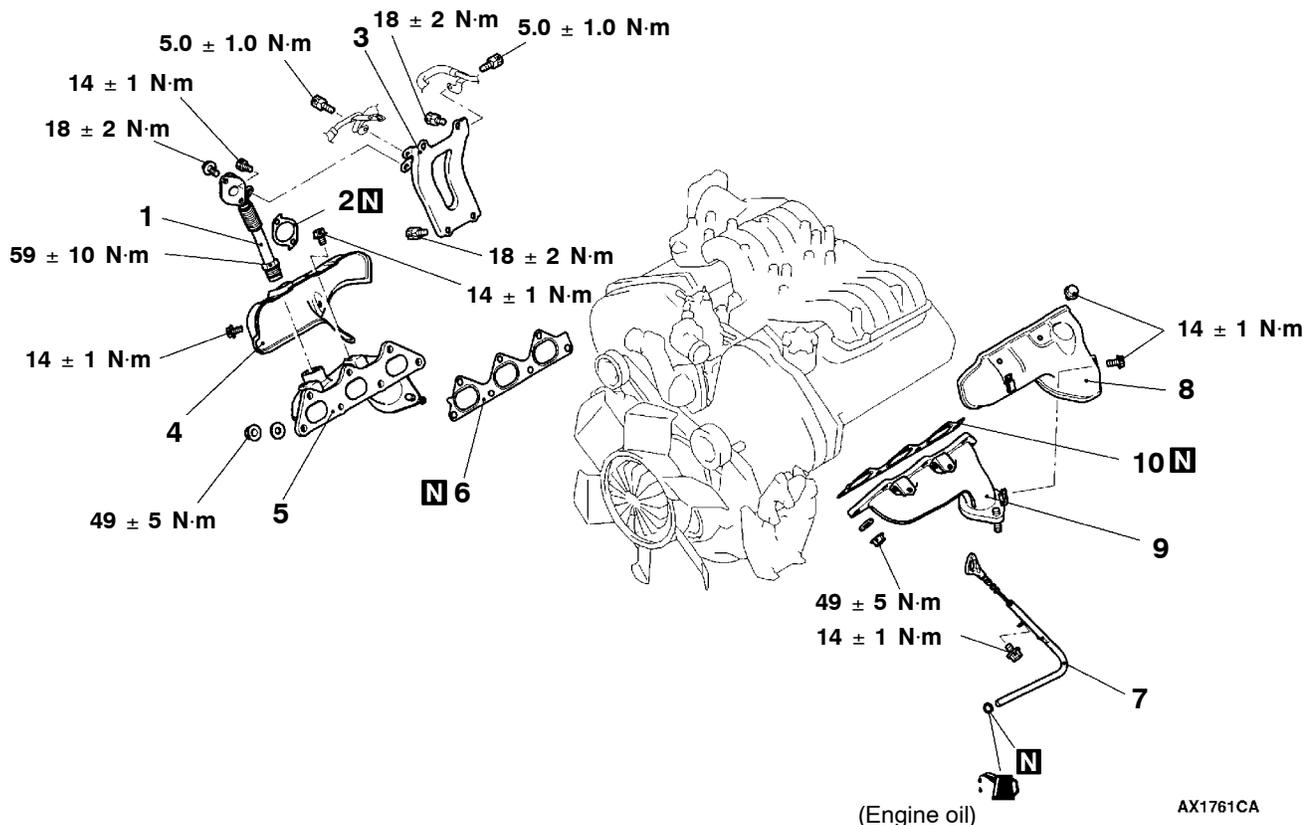
Limit: 0.20 mm

EXHAUST MANIFOLD <6G7>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations

- Engine Cover Removal And Installation (Refer to GROUP 11A - Timing Belt)
- Battery, Battery Tray Removal And Installation
- Air Cleaner Assembly Removal And Installation (Refer to P.15-4.)
- Skid Plate And Under Cover Removal And Installation
- Front Exhaust Pipe Removal And Installation (Refer to P.15-21.)
- Front Catalytic Converter Removal And Installation (Refer to GROUP 17.)



Removal steps

- | | |
|--|--|
| <ol style="list-style-type: none"> 1. EGR pipe 2. EGR pipe gasket 3. Throttle body stay 4. Heat protector 5. Exhaust manifold | <ol style="list-style-type: none"> 6. Exhaust manifold gasket 7. Engine oil level gauge and guide 8. Heat protector 9. Exhaust manifold 10. Exhaust manifold gasket |
|--|--|

INSPECTION

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 thickness gauge, check for distortion of the cylinder head installation surface.

Standard value: 0.15 mm or less

Limit: 0.20 mm

INSTALLATION SERVICE POINT

▶A◀ TURBOCHARGER ASSEMBLY INSTALLATION

1. Check the internal surface, the eye bolt and the mating surface of the oil pipe and water pipe for clogging, and clean if necessary.
2. If deposits of carbon are accumulated on the turbocharger oil passage, remove them and clean using the compressed air.

Caution

Be careful not to allow foreign material to enter the turbocharger.

3. Add clean engine oil through the oil feed pipe port on the turbocharger.

INSPECTION

TURBOCHARGER ASSEMBLY CHECK

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

OIL PIPE AND OIL RETURN PIPE CHECK

Check the oil pipe and oil return pipe for clogging, bending, or other damage. If there is clogging, clean it.

EXHAUST MANIFOLD CHECK

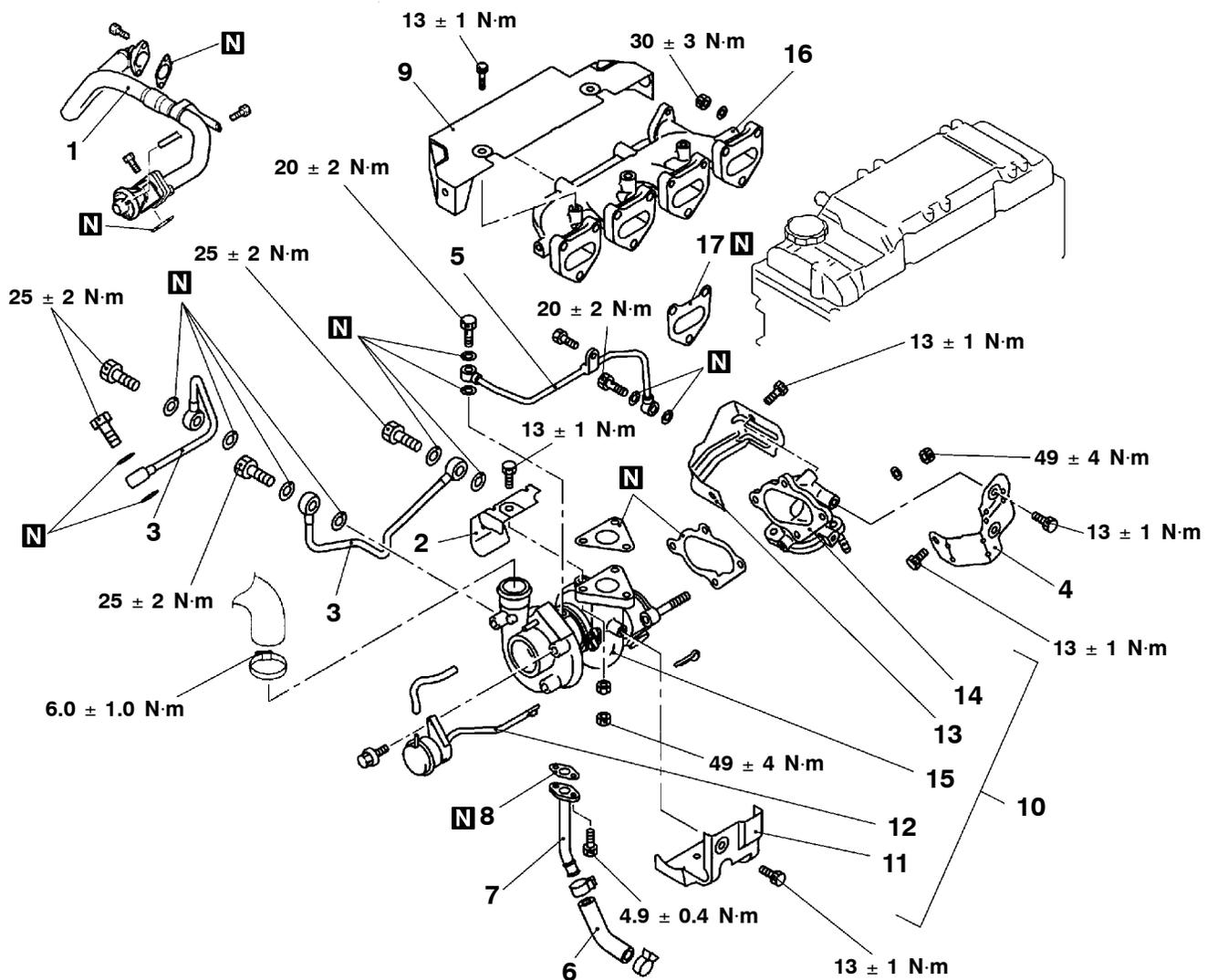
Damage or cracking of any part.

TURBOCHARGER AND EXHAUST MANIFOLD <4M4>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations

- Engine Coolant Draining and Refilling (Refer to GROUP 14 - On-vehicle Service.)
- Engine Cover Removal and Installation (Refer to GROUP 11C - Camshaft)
- Air cleaner Assembly Removal and Installation (Refer to P.15-4.)
- Skid Plate and Under Cover Removal and Installation
- Front Exhaust Pipe Removal and Installation (Refer to P.15-25.)



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Removal steps

1. EGR valve and pipe assembly
2. Turbocharger cover
3. Water pipe
4. Turbocharger cover
5. Oil pipe
6. Oil return hose
7. Oil return pipe
8. Oil return pipe gasket
9. Heat protector
10. Turbocharger and exhaust fitting assembly
11. Turbocharger cover
12. Waste gate actuator
13. Turbocharger cover
14. Exhaust fitting
15. Turbocharger assembly
16. Exhaust manifold
17. Exhaust manifold gasket



INSTALLATION SERVICE POINT

►A◀ TURBOCHARGER ASSEMBLY INSTALLATION

1. Check the internal surface, the eye bolt and the mating surface of the oil pipe and water pipe for clogging, and clean if necessary.
2. If deposits of carbon are accumulated on the turbocharger oil passage, remove them and clean using the compressed air.

Caution

Be careful not to allow foreign material to enter the turbocharger.

3. Add clean engine oil through the oil feed pipe port on the turbocharger.

INSPECTION

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 thickness gauge, check for distortion of the cylinder head installation surface.

Standard value: 0.15 mm or less

Limit: 0.20 mm

TURBOCHARGER ASSEMBLY CHECK

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

OIL PIPE AND OIL RETURN PIPE CHECK

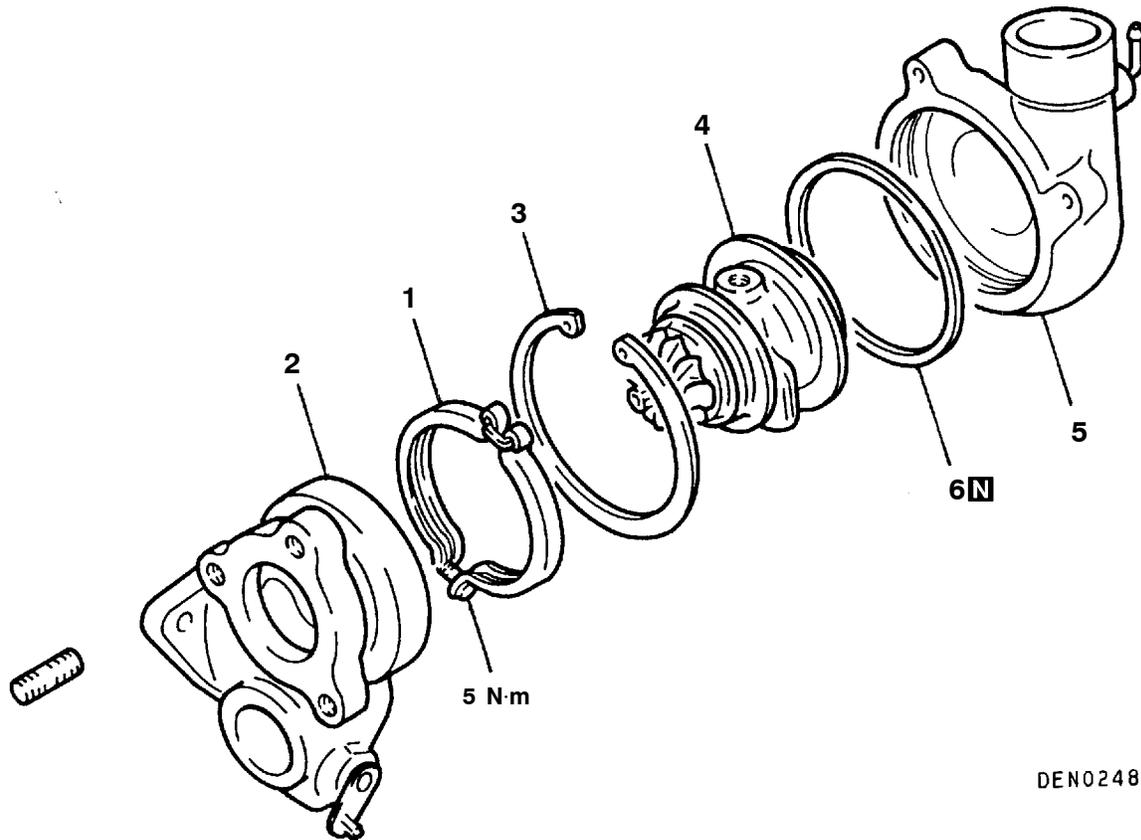
Check the oil pipe and oil return pipe for clogging, bending, or other damage. If there is clogging, clean it.

EXHAUST MANIFOLD CHECK

Damage or cracking of any part.

TURBOCHARGER <4D5>

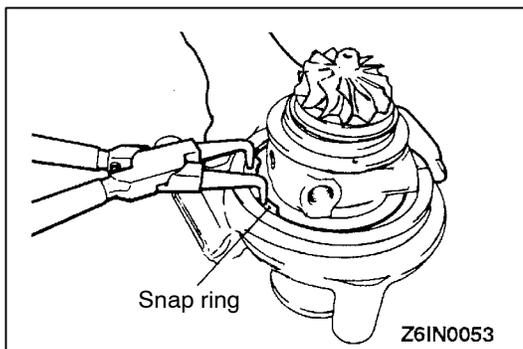
DISASSEMBLY AND REASSEMBLY



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Disassembly steps

- | | |
|-----|---------------------------|
| ▶E◀ | 1. Coupling |
| ▶D◀ | 2. Turbine housing |
| ▶C◀ | 3. Snap ring |
| ▶B◀ | 4. Turbine wheel assembly |
| ▶A◀ | 5. Compressor cover |
| ▶A◀ | 6. O-ring |



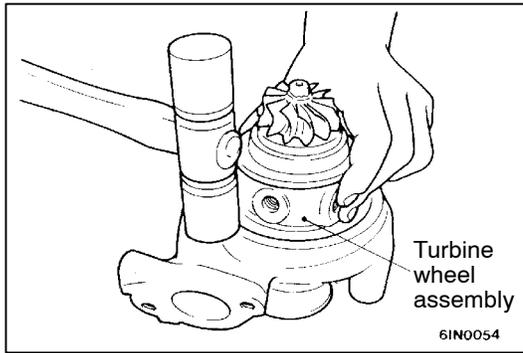
DISASSEMBLY SERVICE POINTS

▶A▶ SNAP RING REMOVAL

Lay the unit with the compressor cover side facing down and using snap ring pliers, remove the compressor cover attaching snap ring.

Caution

When removing the snap ring, hold it with fingers to prevent it from springing away.

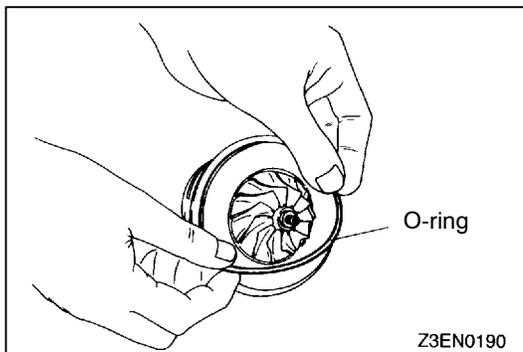


◀B▶ TURBINE WHEEL ASSEMBLY REMOVAL

Remove the turbine wheel assembly, striking the circumference of the compressor cover with a plastic hammer. The turbine wheel assembly may be a little hard to remove due to an O-ring put on the outer circumference.

CLEANING

1. Use a clean cleaning oil commercially available. Do not use corrosive cleaning oils as they could damage to some parts.
2. Use a plastic scraper or hard brush to clean aluminum parts.



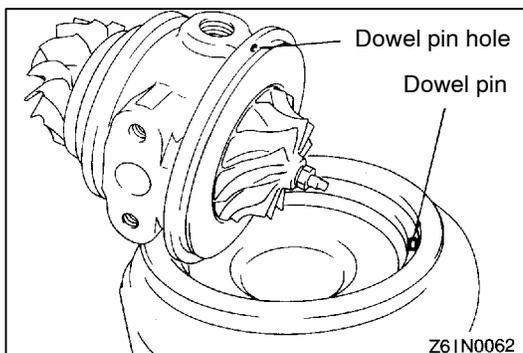
REASSEMBLY SERVICE POINTS

▶A◀ O-RING INSTALLATION

Apply a light coat of engine oil to a new O-ring and fit in the turbine wheel assembly groove.

Caution

When installing the O-ring, use care not to damage it. A damaged O-ring causes oil leaks.

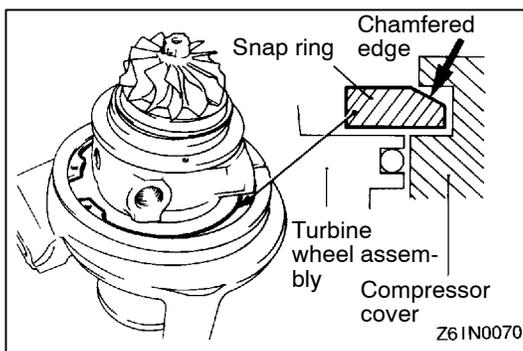


▶B◀ TURBINE WHEEL ASSEMBLY

1. Apply a light coat of engine oil to the periphery of the O-ring.
2. Install the turbine wheel assembly to the compressor cover in relation to the dowel pin.

Caution

Use care not to damage the blades of turbine wheel and compressor wheel.

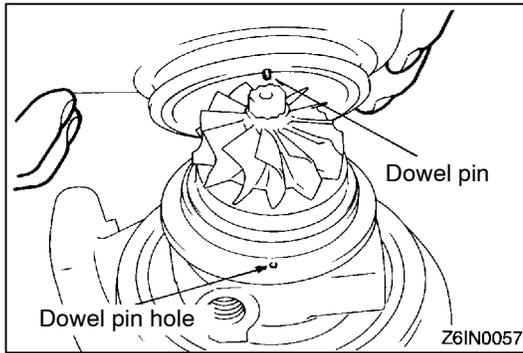


▶C◀ SNAP RING INSTALLATION

Lay the assembly with the compressor cover facing down and fit the snap ring.

Caution

Fit the snap ring with its chamfered side facing up.

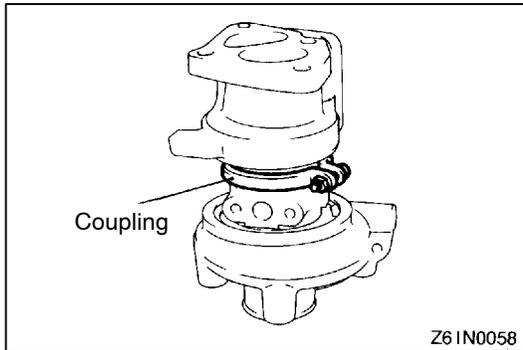


►D◄ TURBINE HOUSING INSTALLATION

Install the turbine housing in relation to the dowel pin.

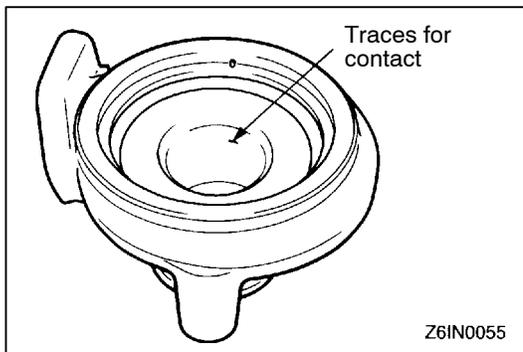
Caution

Use care not to damage the blades of turbine wheel.



►E◄ COUPLING INSTALLATION

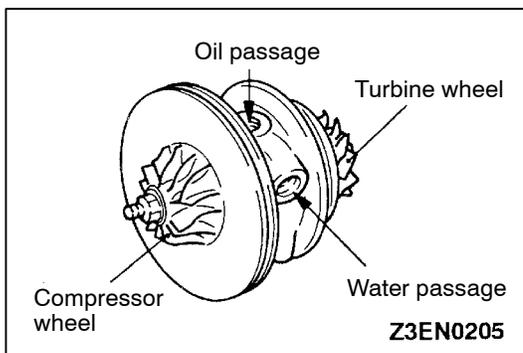
Install the coupling and tighten to specified torque.



INSPECTION

TURBINE HOUSING

1. Check the housing for traces of contact with the turbine wheel, cracks due to overheating, pitching, deformation and other damage. Replace with a new turbine housing if cracked.
2. Operate the waste gate valve lever manually to check that the gate can be operated and closed smoothly.



COMPRESSOR COVER

Check the compressor cover for traces of contact with the compressor wheel and other damage.

TURBINE WHEEL ASSEMBLY

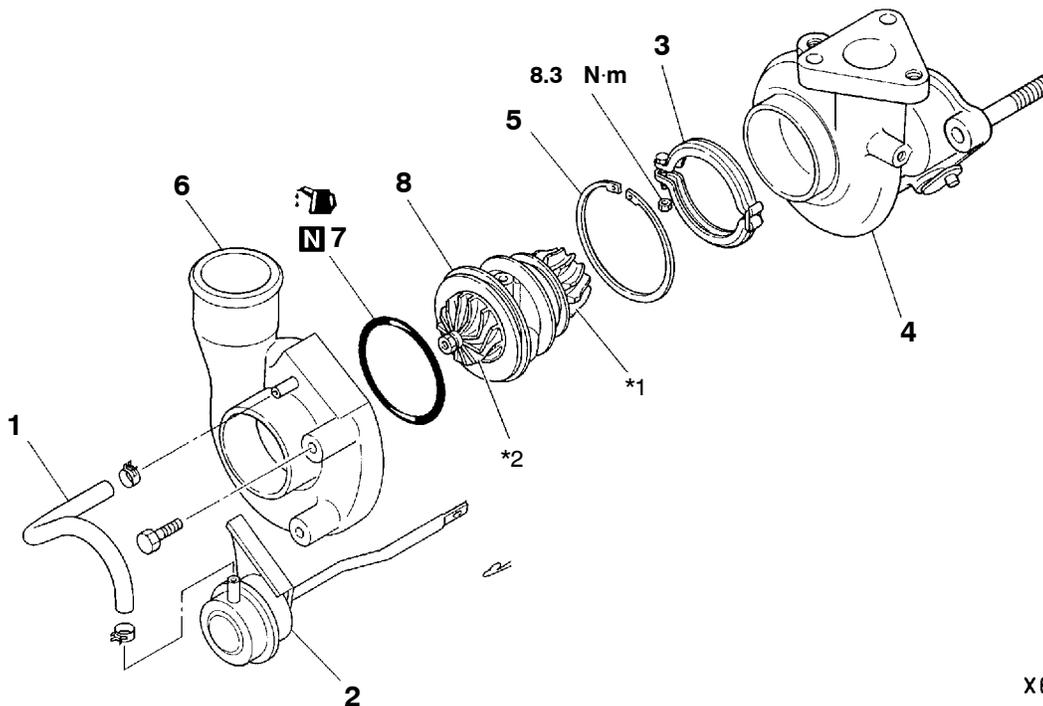
1. Check the turbine and compressor wheel blades for bend, burr, damage, corrosion and traces of contact on the back side and replace if defective.
2. Check the oil passage of the turbine wheel assembly for deposit and clogging.
3. In the case of water cooled type, check also the water passage for deposit and clogging.
4. Check the turbine wheel and compressor wheel for light and smooth turning.

OIL PIPE/OIL RETURN PIPE

Correct or replace the oil pipe and oil return pipe if clogged, collapsed, deformed or otherwise damaged.

TURBOCHARGER <4M4>

DISASSEMBLY AND REASSEMBLY



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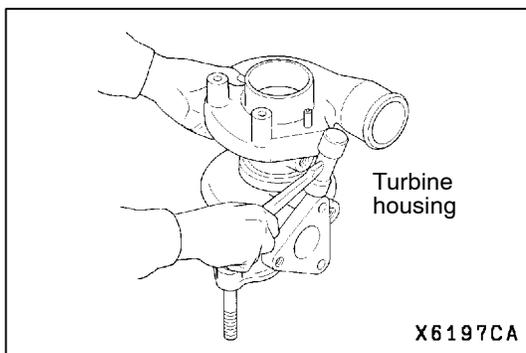
Disassembly steps

1. Hose
2. Actuator
3. Coupling
4. Turbine housing
5. Snap ring
6. Compressor cover



7. O-ring
8. Cartridge assembly

- *1: Turbine wheel
*2: Compressor wheel

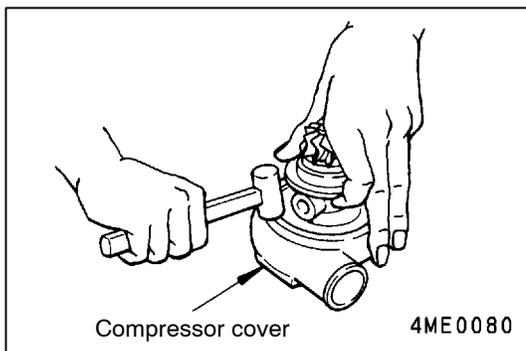


DISASSEMBLY SERVICE POINTS

◀A▶ TURBINE HOUSING REMOVAL

Caution

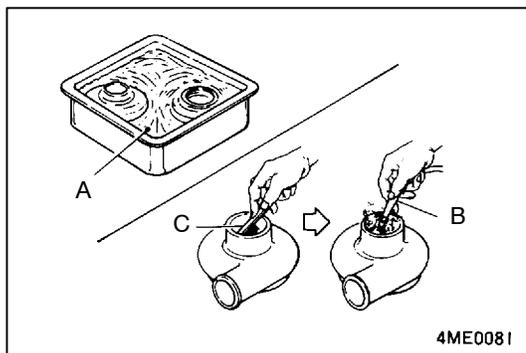
1. Tap all over the circumferential surface of the turbine housing with a rubber hammer or any other similar tool, using care not to damage it.
2. The turbine wheel blades are easy to bend. Use care so that they do not contact the turbine housing.



◀B▶ COMPRESSOR COVER REMOVAL

Caution

1. Tap all over the circumferential surface of the compressor cover with a rubber hammer or any other similar tool, using care not to damage it.
2. The compressor wheel blades are easy to bend. Use care so that they do not contact the compressor cover.



CLEANING

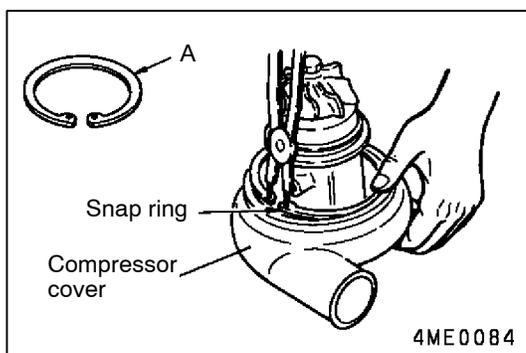
TURBINE HOUSING/COMPRESSOR COVER

1. Prior to cleaning, visually check the disassembled parts for evidences of burns, abrasions or other flaws because they may become unrecognizable after washing. Replace if necessary.
2. Immerse the disassembled parts in the nonflammable solvent A (DAI-CLEANER T-30 from Daido Chemical Industry Co., Ltd.). Remove them from the solvent and blow compressed air B against them. Scrape off foreign matters, if any, using a plastic scraper C before the immersion.

REASSEMBLY SERVICE POINTS

▶A◀ O-RING INSTALLATION

Apply a thin coat of engine oil evenly to the entire circumferential surface of O-ring before installing it.



▶B◀ SNAP RING INSTALLATION

Install the snap ring in the compressor cover with the tapered surface A facing upward.

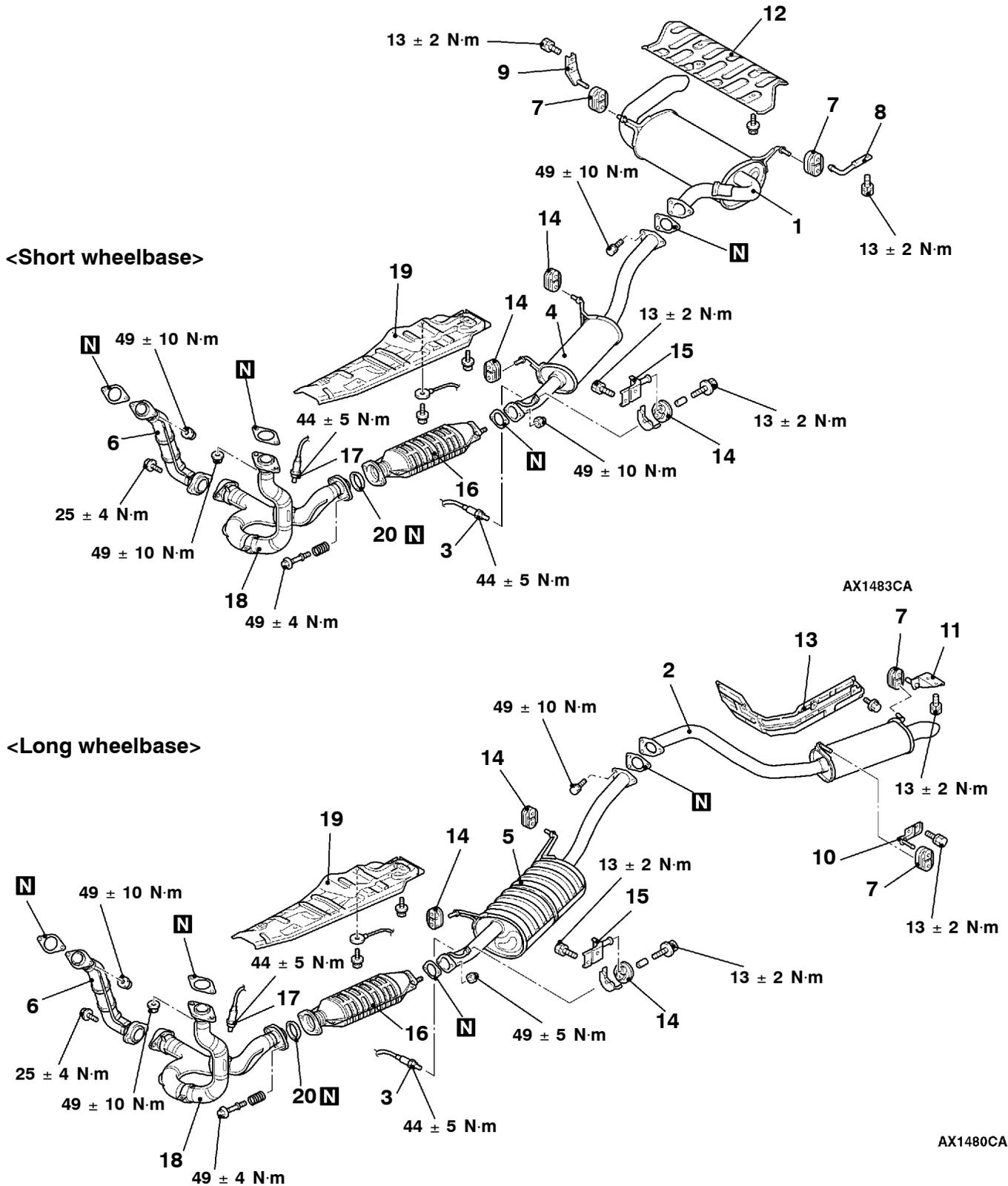
Caution

Hold the snap ring with one hand not to let it bounce out.

EXHAUST PIPE AND MAIN MUFFLER <6G7>

REMOVAL AND INSTALLATION

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



Exhaust main muffler and rear floor heat protector removal steps <Short wheelbase>

1. Exhaust main muffler
7. Hanger
8. Hanger bracket
9. Hanger bracket
12. Rear floor heat protector

Tail exhaust pipe and rear floor heat protector removal steps <Long wheelbase>

2. Tail exhaust pipe
7. Hanger
10. Hanger bracket
11. Hanger bracket
13. Rear floor heat protector

Center exhaust pipe removal steps <Short wheelbase>

- ◀A▶ ▶A◀
3. Oxygen sensor (rear) <M/T>
 4. Center exhaust pipe
 14. Hanger
 15. Hanger bracket

Exhaust main muffler removal steps <Long wheelbase>

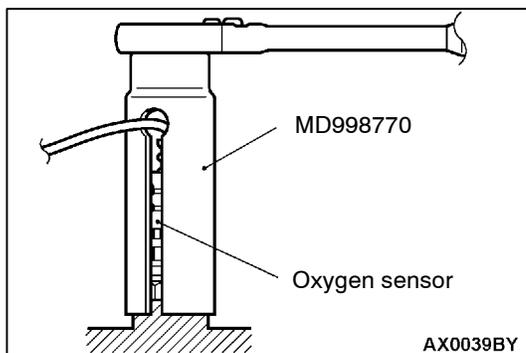
- ◀A▶ ▶A◀
3. Oxygen sensor (rear) <M/T>
 5. Exhaust main muffler
 14. Hanger
 15. Hanger bracket

Front exhaust pipe removal

- Under cover
- 6. Front exhaust pipe (R.H.)
- 17. Oxygen sensor (front)
- 18. Front exhaust pipe (L.H.)
- 20. Seal ring

Front floor heat protector removal steps

- ◀A▶ ▶A◀
16. Catalytic converter
 17. Oxygen sensor (front)
 18. Front exhaust pipe (L.H.)
 19. Front floor heat protector
 20. Seal ring



REMOVAL SERVICE POINT

◀A▶ OXYGEN SENSOR REMOVAL

Use special tool to remove the oxygen sensor.

INSTALLATION SERVICE POINT

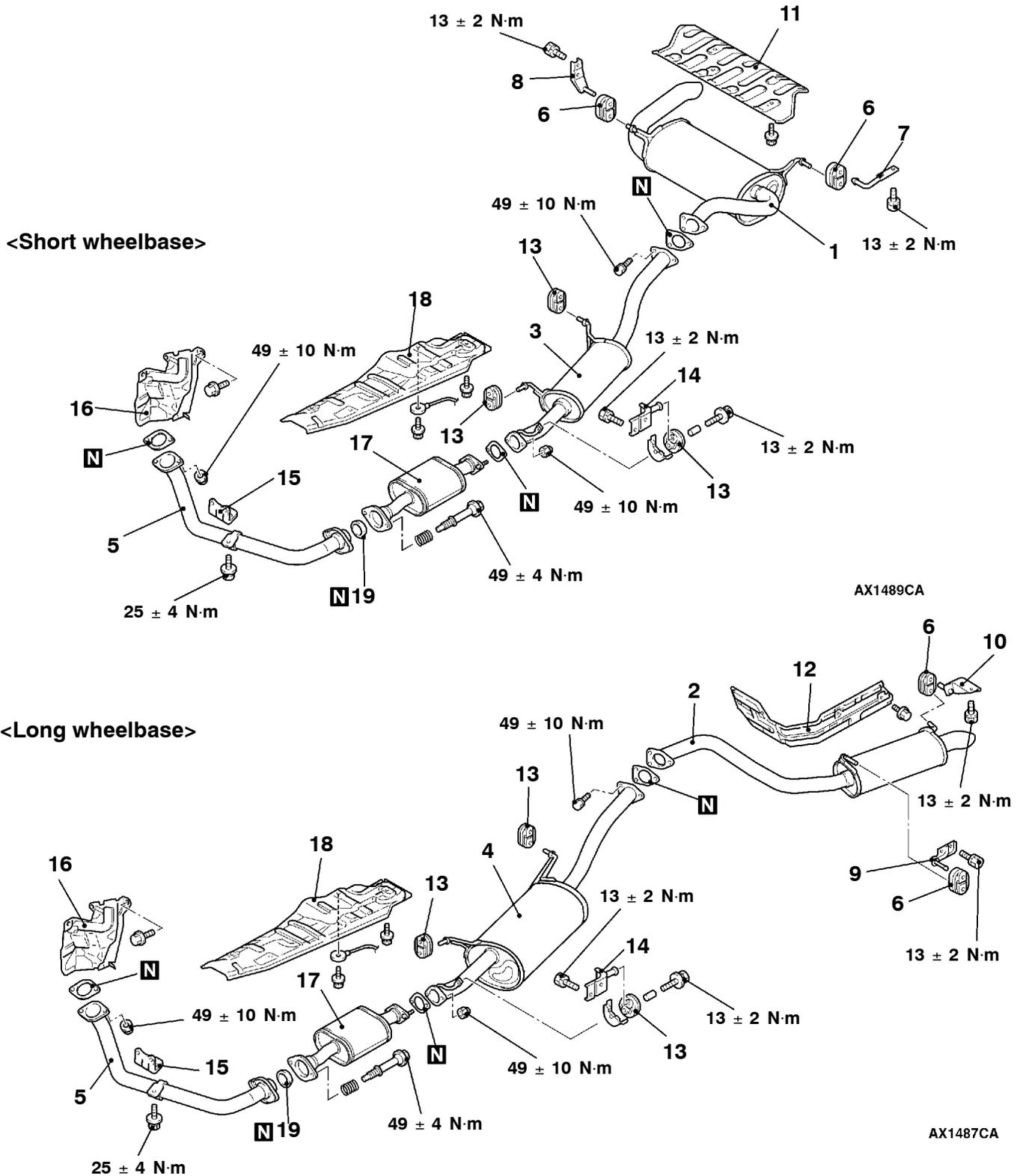
▶A◀ OXYGEN SENSOR INSTALLATION

Use special tool to install the oxygen sensor.

EXHAUST PIPE AND MAIN MUFFLER <4D5>

REMOVAL AND INSTALLATION

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



**Exhaust main muffler and rear floor heat protector removal steps
<Short wheelbase>**

1. Exhaust main muffler
6. Hanger
7. Hanger bracket
8. Hanger bracket
11. Rear floor heat protector

**Tail exhaust pipe and rear floor heat protector removal steps
<Long wheelbase>**

2. Tail exhaust pipe
7. Hanger
9. Hanger bracket
10. Hanger bracket
12. Rear floor heat protector

**Center exhaust pipe removal steps
<Short wheelbase>**

3. Center exhaust pipe
13. Hanger
14. Hanger bracket

**Exhaust main muffler removal steps
<Long wheelbase>**

4. Exhaust main muffler
13. Hanger
14. Hanger bracket

Front exhaust pipe and dash heat protector removal steps

- Under cover
- 5. Front exhaust pipe
- 15. Exhaust support bracket
- 16. Dash heat protector

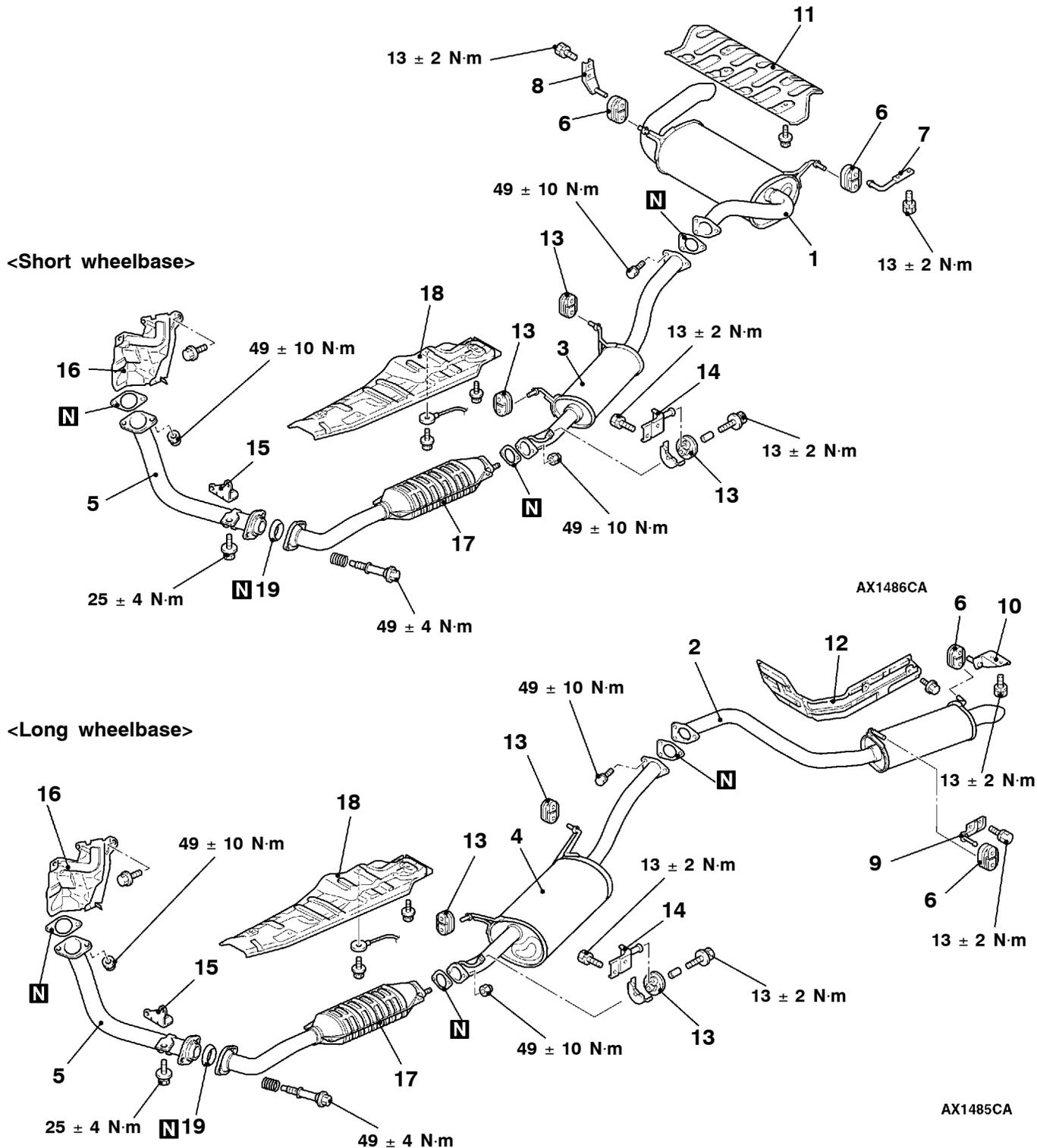
Pre-muffler and front floor heat protector removal steps

17. Pre-muffler
18. Front floor heat protector
19. Seal ring

EXHAUST PIPE AND MAIN MUFFLER <4M4>

REMOVAL AND INSTALLATION

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



**Exhaust main muffler and rear floor heat protector removal steps
<Short wheelbase>**

1. Exhaust main muffler
6. Hanger
7. Hanger bracket
8. Hanger bracket
11. Rear floor heat protector

**Tail exhaust pipe and rear floor heat protector removal steps
<Long wheelbase>**

2. Tail exhaust pipe
7. Hanger
9. Hanger bracket
10. Hanger bracket
12. Rear floor heat protector

**Center exhaust pipe removal steps
<Short wheelbase>**

3. Center exhaust pipe
13. Hanger
14. Hanger bracket

**Exhaust main muffler removal steps
<Long wheelbase>**

4. Exhaust main muffler
13. Hanger
14. Hanger bracket

Front exhaust pipe and dash heat protector removal steps

- Under cover
- 5. Front exhaust pipe
- 15. Exhaust support bracket
- 16. Dash heat protector

Front floor heat protector removal steps

17. Catalytic converter
18. Front floor heat protector
19. Seal ring

INTAKE AND EXHAUST

CONTENTS

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SEALANT	3	MANIFOLD, THROTTLE BODY AND	
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Turbocharger Supercharging Check	4	TURBOCHARGER AND EXHAUST	
Supercharging Pressure Control		MANIFOLD <4M4>	12
System Check	5	EXHAUST PIPE AND MAIN MUFFLER	
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GENERAL

OUTLINE OF CHANGES

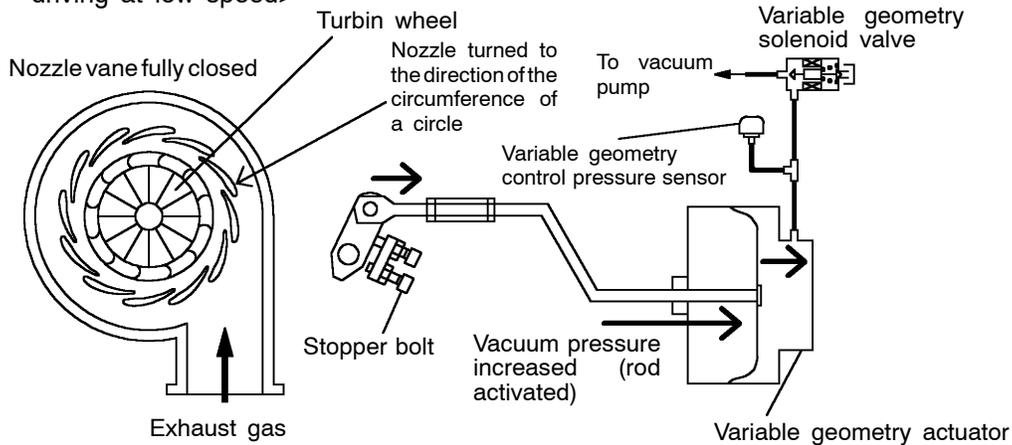
Some service procedures have been established as the following changes have been made due to the compliance with the Emission Regulation Step III.

- An oxygen sensor (rear) has been added. Its service procedure is the same as for the previous MT models <6G7-A/T>.
- The turbocharger has been changed to a Variable Geometry (VG) type <4D5>.
- A catalytic converter has been added <4D5>.
- The intake manifold has been reshaped <4M4>.
- An EGR cooler has been added <4M4>.
- The variable geometry turbocharger can not be disassembled, and must be always replaced as an assembly.

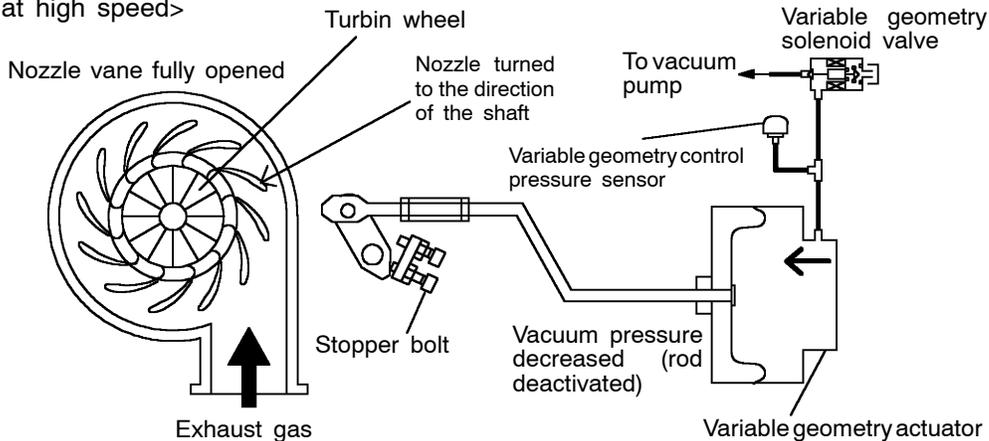
GENERAL INFORMATION

The variable geometry solenoid valve is duty controlled to control the variable nozzle opening angle of the variable geometry turbocharger. This allows to obtain the characteristic of boost pressure corresponding to the engine operation status.

<At starting - driving at low speed>



<Driving at high speed>



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At starting and driving at low speed, the duty control value of the variable geometry solenoid valve is increased to apply the vacuum pressure of the vacuum pump to the variable geometry actuator. Applying the vacuum pressure to the variable geometry actuator pulls the actuator rod so that it can move towards the direction of closing the variable nozzle of the variable geometry turbocharger. As closing the nozzle reduces the exhaust gas mass, the speed of exhaust gas flow will be increased and efficiency will be improved. Since the characteristic of boost pressure becomes a low speed type, boost pressure will suddenly rise from low speed.

At driving at high speed, the duty control value of the variable geometry solenoid valve is decreased to reduce the vacuum pressure from the vacuum pump so that the actuator rod can return to the deactivated status and move towards the direction of opening the nozzle of the variable geometry turbocharger.

Opening the nozzle allows the characteristic of boost pressure to become a high speed type so that the appropriate boost pressure can be maintained.

Therefore, boost pressure can be controlled by appropriate duty control of the variable geometry solenoid valve. The engine-ECU calculates the correct boost pressure based on the engine speed and fuel injection amount. Furthermore, the duty control of the variable geometry solenoid valve is given feedback of the signals from the variable geometry control pressure sensor and the boost pressure sensor so that the variable nozzle opening angle of the variable geometry turbocharger can be quickly adjusted to obtain the desired boost pressure.

SERVICE SPECIFICATIONS

Items	Standard value
Variable geometry actuator activation vacuum (Approximately 1 mm stroke) kPa	Approximately 10.5 - 12.5
Variable geometry solenoid valve coil resistance (at 20°C) Ω	29 - 35

SEALANT

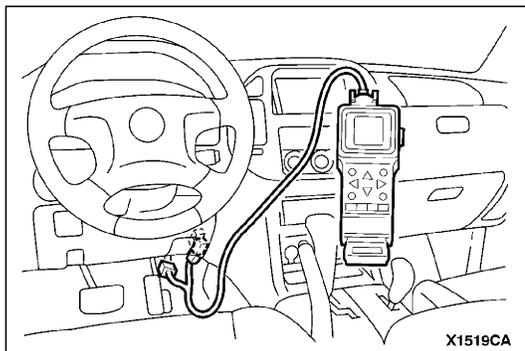
Item	Specified sealant	Remarks
Thread of the intake manifold mounting bolts	3M Stud Locking No.4170 or equivalent	Anaerobic sealant

ON-VEHICLE SERVICE

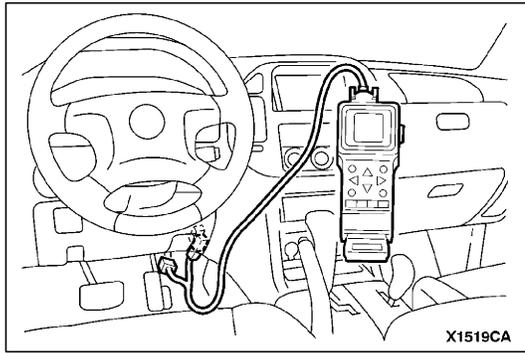
TURBOCHARGER SUPERCHARGING CHECK

Caution

Conduct the driving test in a location where driving at full acceleration can be done with safety. Two person should be in the vehicle when the test is conducted; the person in the passenger seat should read the indications shown by the MUT-II.



1. Set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to "LOCK" (OFF) position, and connect the diagnosis connector to the MUT-II.
3. Use the data list function named "Item No. 04" boost pressure sensor of the MUT-II to check the supercharging pressure when the engine speed increases to approximately 3,000 r/min or more by driving at full acceleration in 2nd.
4. When the indicated supercharger does not become positive pressure, check the following items.
 - Malfunction of the boost pressure sensor
 - Leakage of supercharging pressure
 - Malfunction of the turbocharger
5. When the indicated supercharger is 133 kPa or more, supercharging control may be faulty, therefore check the followings.
 - Malfunction of the variable geometry actuator
 - Malfunction of the variable nozzle
 - Malfunction of the variable geometry solenoid valve
 - Malfunction of the boost pressure sensor
 - Malfunction of the variable geometry control pressure sensor



SUPERCHARGING PRESSURE CONTROL SYSTEM CHECK

1. Set the vehicle to the pre-inspection condition.
2. Turn the ignition switch to "LOCK" (OFF) position, and connect the diagnosis connector to the MUT-II.
3. Start the engine, and let it run at idle.
4. Select the actuator testing function named "Item No. 35 or No. 36" of the MUT-II to check that the variable geometry actuator vacuum and the supercharging pressure increase when the variable geometry solenoid valve is activated.

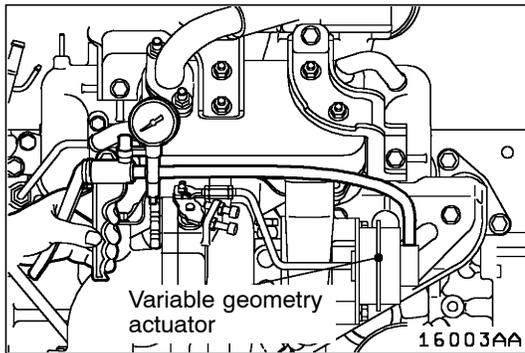
Variable geometry solenoid valve condition	Variable geometry actuator vacuum	Supercharging pressure
OFF	0 kPa	Approximately -1 kPa
ON	Approximately 80 kPa	Approximately 3 kPa

NOTE

- (1) If the variable geometry actuator vacuum is not in a normal condition, the variable geometry actuator, variable geometry solenoid valve, variable geometry control pressure sensor, vacuum pump or hose may be faulty.
- (2) If the variable geometry actuator vacuum is in a normal condition but the supercharging pressure is not in a normal condition, the variable geometry turbocharger nozzle, boost pressure sensor, or hose may be faulty.

Caution

Be careful not to forcibly activate the variable geometry solenoid valve to the fullest degree when running at a high speed. Too much supercharging pressure could damage the engine or the turbocharger.



VARIABLE GEOMETRY ACTUATOR CHECK

1. Connect the hand vacuum pump to nipple.
2. While gradually applying vacuum, check the vacuum that begins to active (approximately 1 mm stroke) the variable geometry actuator rod.

Standard value: Approximately 10.5 - 12.5 kPa

Caution

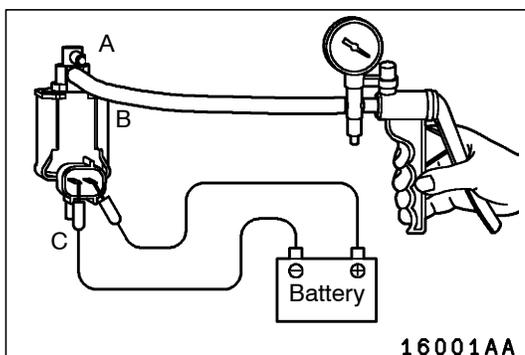
In order to avoid damage to the diaphragm, do not apply a vacuum of 59 kPa or higher.

3. If there is a significant deviation from the standard value, check the actuator or the variable nozzle: replace if necessary.

VARIABLE GEOMETRY SOLENOID VALVE CHECK

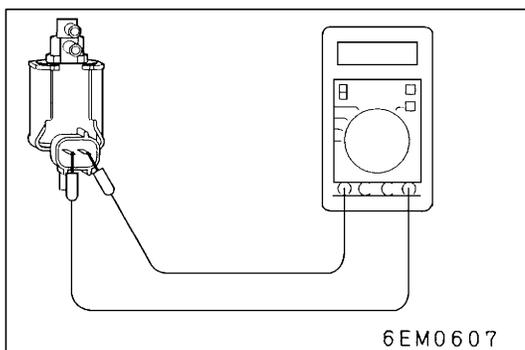
NOTE

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



1. Disconnect the vacuum hose (black, red stripe) from the solenoid valve.
2. Disconnect the harness connector.
3. Connect a hand vacuum pump to the nipple to which the red striped vacuum hose was connected.
4. Check airtightness by applying a vacuum with voltage applied directly from the battery to the variable geometry solenoid valve and without applying voltage.

Battery voltage	Nipple condition	Normal condition
Applied	Both nipples are opened.	Vacuum leaks.
	Nipple A is closed.	Vacuum is maintained.
Not applied	Both nipples are opened.	Vacuum leaks.
	Nipple C is closed.	Vacuum is maintained.



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

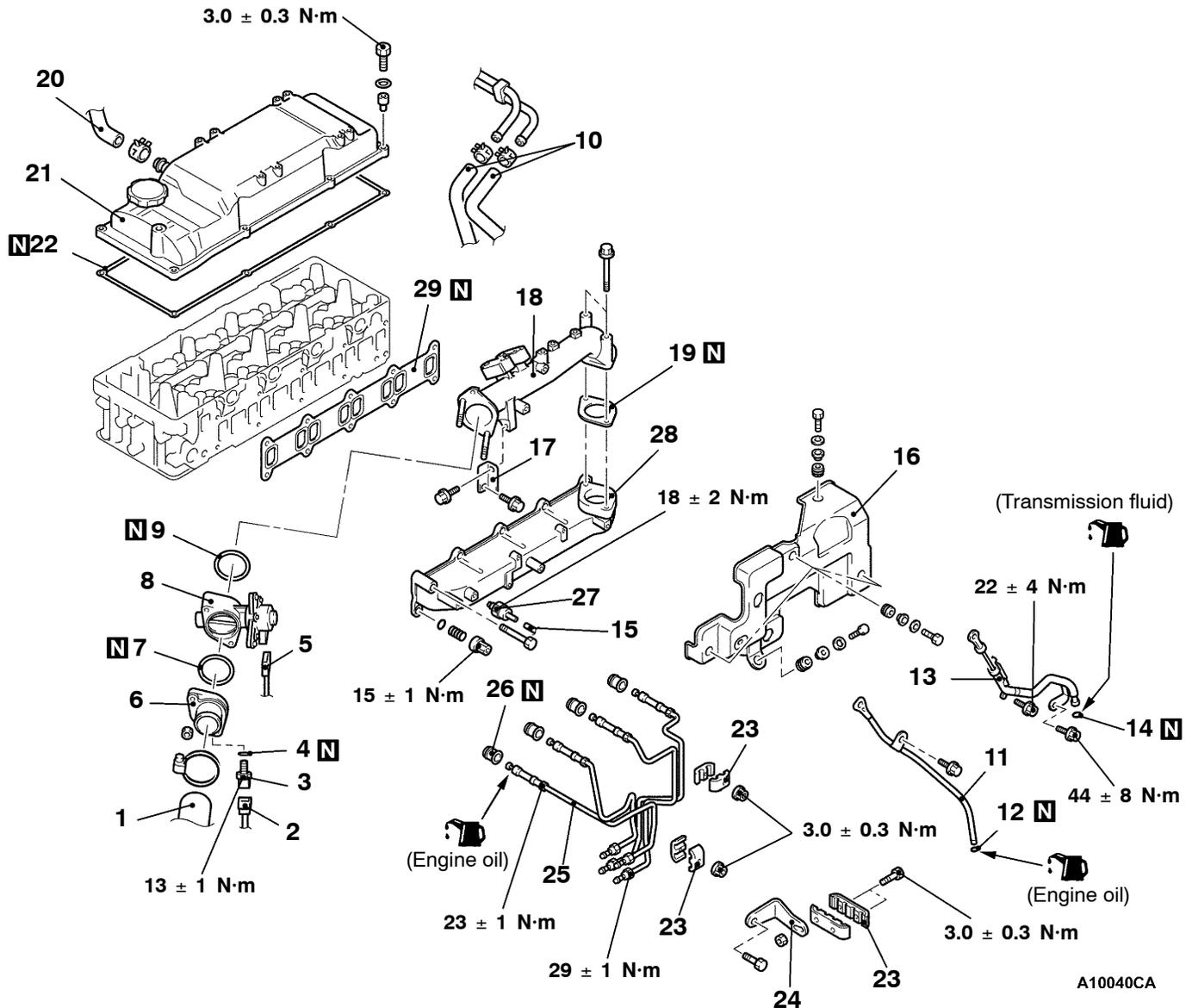
Standard value: 29 - 35 Ω (at 20°C)

INTAKE MANIFOLD AND THROTTLE BODY <4M4>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations

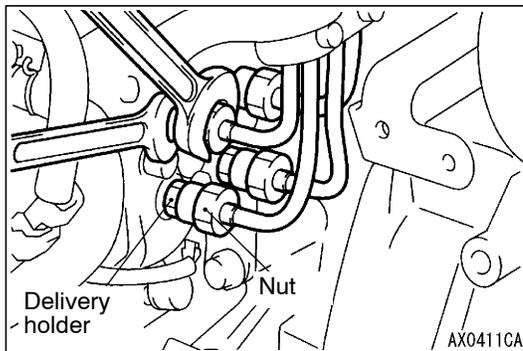
- Engine Cover Removal and Installation.
- Skid Plate and Under Cover Removal and Installation.
- Battery, Battery Tray Removal and Installation.
- Fuel Filter Removal and Installation.
- EGR Valve and EGR Pipe A Removal and Installation (Refer to GROUP 17.)



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Removal steps

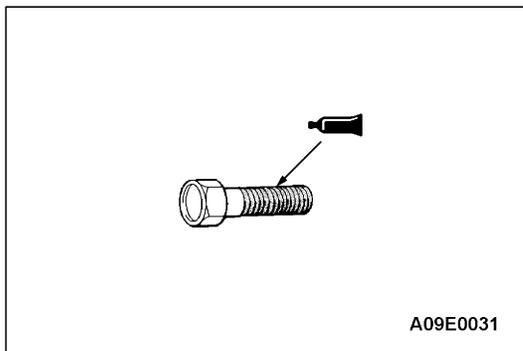
- | | | |
|---|--------------------------------|--|
| <ol style="list-style-type: none"> 1. Intercooler air hose connection 2. Boost air temperature sensor connector 3. Boost air temperature sensor 4. Gasket 5. Throttle motor connector 6. Intake air fitting 7. O-ring 8. Throttle body assembly 9. O-ring 10. Fuel hose connection 11. Engine oil level gauge and guide 12. O-ring 13. ATF level gauge and guide 14. O-ring | <p>◀A▶ ▶B▶
▶B▶
▶A▶</p> | <ol style="list-style-type: none"> 15. Vacuum hose connection 16. Intake manifold cover 17. Air intake pipe stay 18. Air intake pipe 19. Air intake pipe gasket 20. Breather hose connection 21. Rocker cover 22. Rocker cover gasket 23. Clamp 24. Injection pipe stay 25. Injection pipe 26. Injection pipe seal 27. Gas filter assembly 28. Intake manifold 29. Intake manifold gasket |
|---|--------------------------------|--|



REMOVAL SERVICE POINT

◀A▶ **INJECTION PIPE REMOVAL**

Hold the injection pump side delivery holder with a open-end wrench, and loosen the nut.



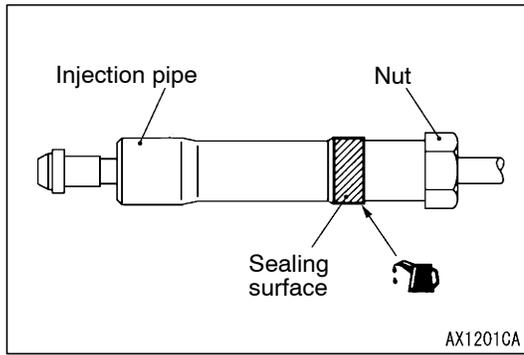
INSTALLATION SERVICE POINTS

▶A▶ **INTAKE MANIFOLD INSTALLATION**

1. Remove the old sealant from the intake manifold mounting bolt thread.
2. Use a tap (M8×1.25) to remove the old sealant from the bolt hole, and clean by using compressed air.
3. Apply the specified sealant to the intake manifold mounting bolt thread, and install the intake manifold by using the mounting bolts.

Specified sealant:

3M Stud Locking No. 4170 or equivalent



►B◄ INJECTION PIPE SEAL/INJECTION PIPE INSTALLATION

1. Apply a small amount of engine oil to a new injection pipe seal, and install it, being careful not to damage it.
2. Apply a small amount of engine oil to the injection pipe sealing surface, and then connect the injection pipes.
3. Use a spanner to hold the delivery holder at the injection pump side in the same manner as removal, and then install the injection pipe nuts.
4. Tighten the injection pipe nut to the specified torque.

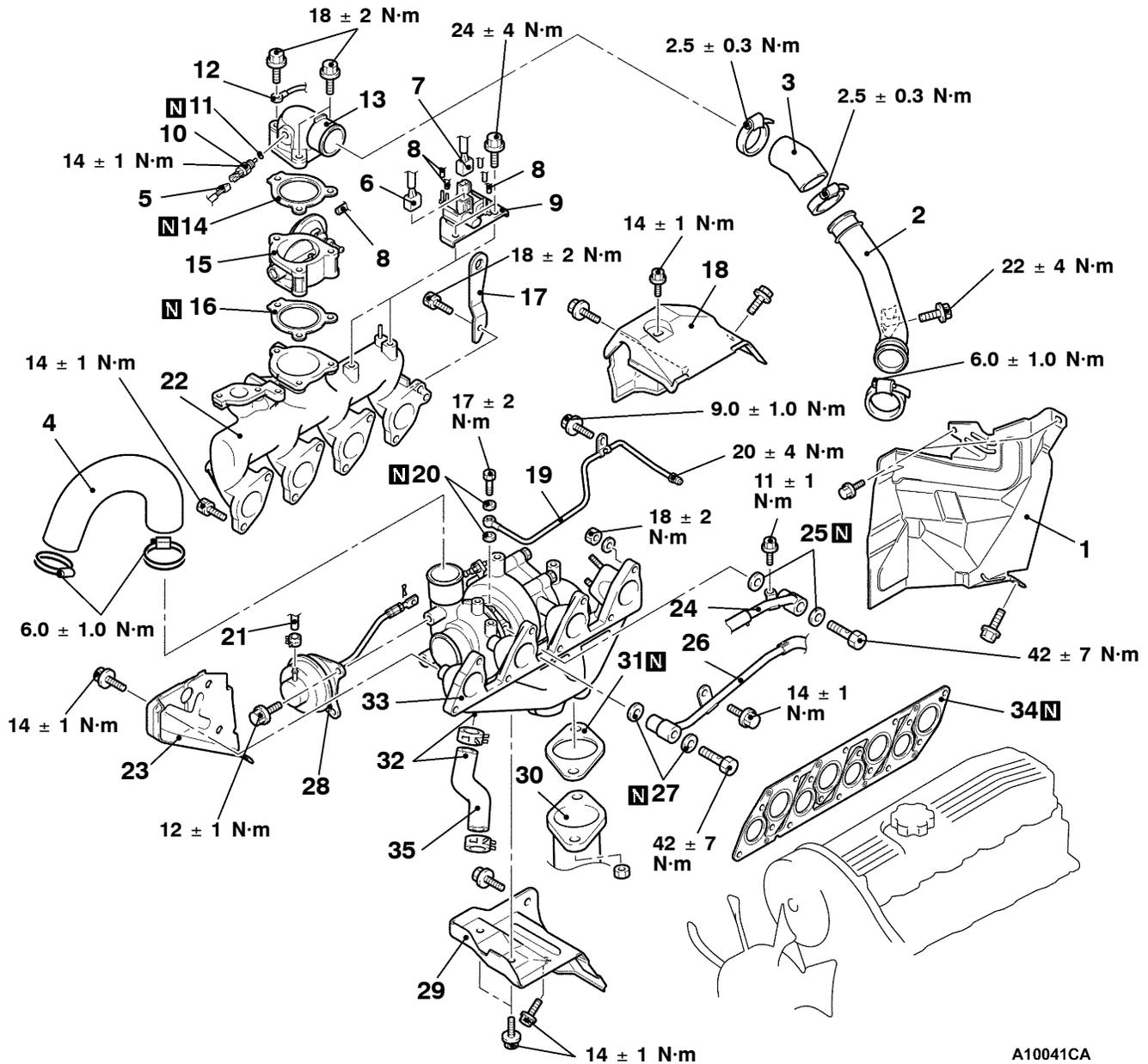
Tightening torque: 23 ± 1 N·m

INTAKE AND EXHAUST MANIFOLD, THROTTLE BODY AND TURBOCHARGER <4D5>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations

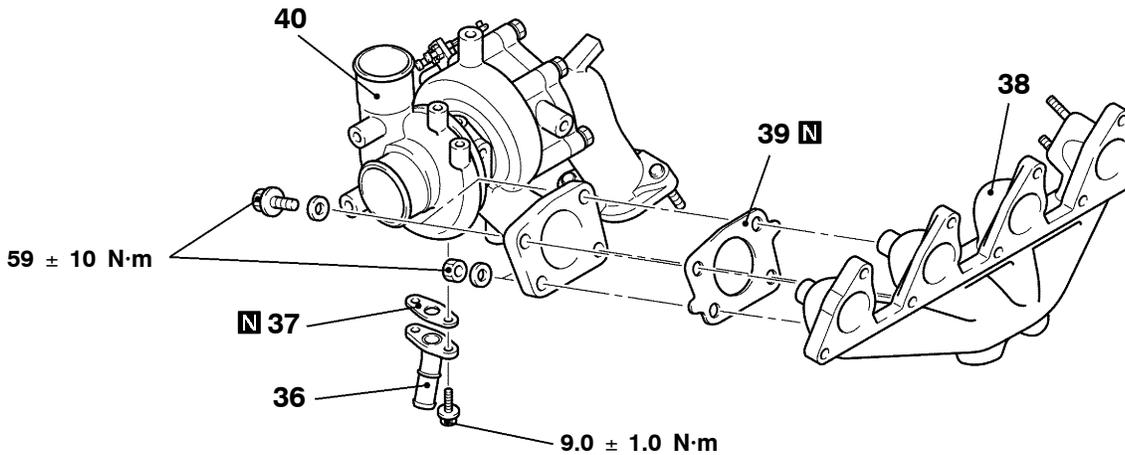
- Engine Coolant Draining and Refilling.
- Skid Plate and Under Cover Removal and Installation.
- Battery, Battery Tray Removal and Installation.
- Air Cleaner Assembly Removal and Installation.
- Front Exhaust Pipe Removal and Installation (Refer to P.15-10.)
- EGR valve and EGR cooler Removal and Installation (Refer to GROUP 17.)



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Removal steps

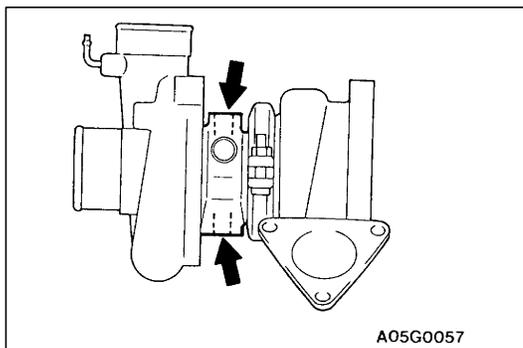
- | | |
|---------------------------------------|--|
| 1. Dash panel heat protector | 20. Gasket |
| 2. Air pipe | 21. Vacuum hose connection |
| 3. Air intake hose | 22. Intake manifold |
| 4. Intercooler air hose | 23. Exhaust manifold heat protector |
| 5. Air temperature sensor connector | 24. Water pipe A and water hose assembly |
| 6. Throttle solenoid valve connector | 25. Gasket |
| 7. VGT solenoid valve connector | 26. Water pipe B connection |
| 8. Vacuum hose connection | 27. Gasket |
| 9. Solenoid valve assembly | 28. VG actuator |
| 10. Air temperature sensor | 29. Exhaust fitting heat protector |
| 11. Gasket | 30. Front exhaust pipe connection |
| 12. Earth cable connection | 31. Gasket |
| 13. Air intake fitting | 32. Oil return hose connection |
| 14. Gasket | 33. Exhaust manifold and turbocharger assembly |
| 15. Throttle body assembly | 34. Intake and exhaust manifold gasket |
| 16. Gasket | 35. Oil return hose |
| 17. Engine hanger | |
| 18. Turbocharger upper heat protector | |
| 19. Oil pipe assembly | |



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36. Oil return pipe
37. Oil return pipe gasket
38. Exhaust manifold

- ▶A◀ 39. Turbocharger gasket
▶A◀ 40. Turbocharger assembly



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INSTALLATION SERVICE POINT

▶A◀ TURBOCHARGER ASSEMBLY INSTALLATION

1. Clean the alignment surfaces shown in the illustration.
2. Supply clean engine oil from the oil pipe mounting hole of the turbocharger assembly.

Caution

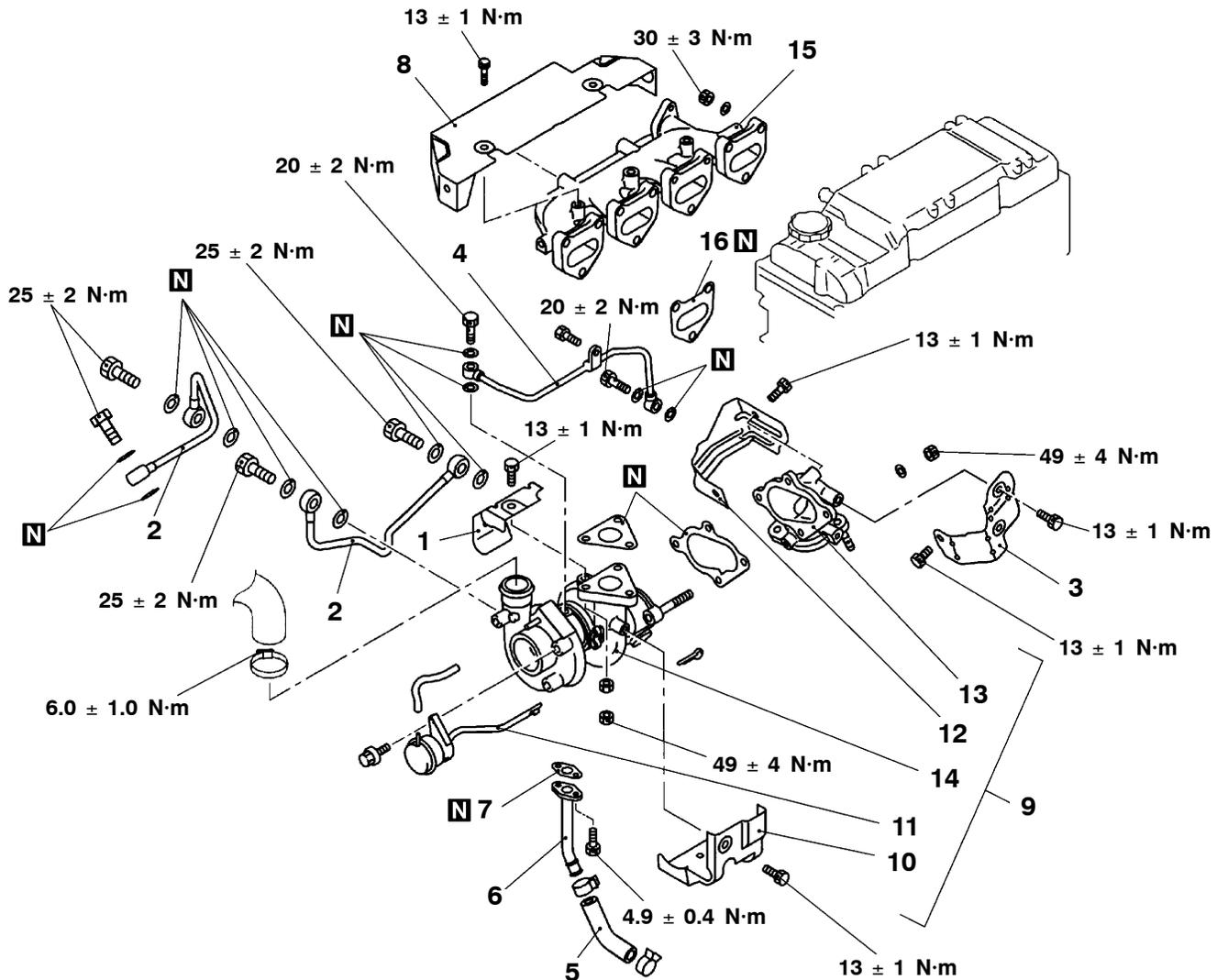
When cleaning, take care that no foreign material gets into the engine coolant or oil passages hole.

TURBOCHARGER AND EXHAUST MANIFOLD <4M4>

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operations

- Engine Coolant Draining and Refilling.
- Skid Plate and Under Cover Removal and Installation
- Engine Cover Removal and Installation.
- Air cleaner Assembly Removal and Installation.
- Battery, Battery Tray Removal and Installation.
- EGR valve and EGR cooler Removal and Installation (Refer to GROUP 17.)
- Front Exhaust Pipe Removal and Installation.



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Removal steps

1. Turbocharger cover
2. Water pipe
3. Turbocharger cover
4. Oil pipe
5. Oil return hose
6. Oil return pipe
7. Oil return pipe gasket
8. Heat protector
9. Turbocharger and exhaust fitting assembly
10. Turbocharger cover
11. Waste gate actuator
12. Turbocharger cover
13. Exhaust fitting
14. Turbocharger assembly
15. Exhaust manifold
16. Exhaust manifold gasket

INSTALLATION SERVICE POINT**▶A◀ TURBOCHARGER ASSEMBLY INSTALLATION**

1. Check the internal surface, the eye bolt and the mating surface of the oil pipe and water pipe for clogging, and clean if necessary.
2. If deposits of carbon are accumulated on the turbocharger oil passage, remove them and clean using the compressed air.

Caution

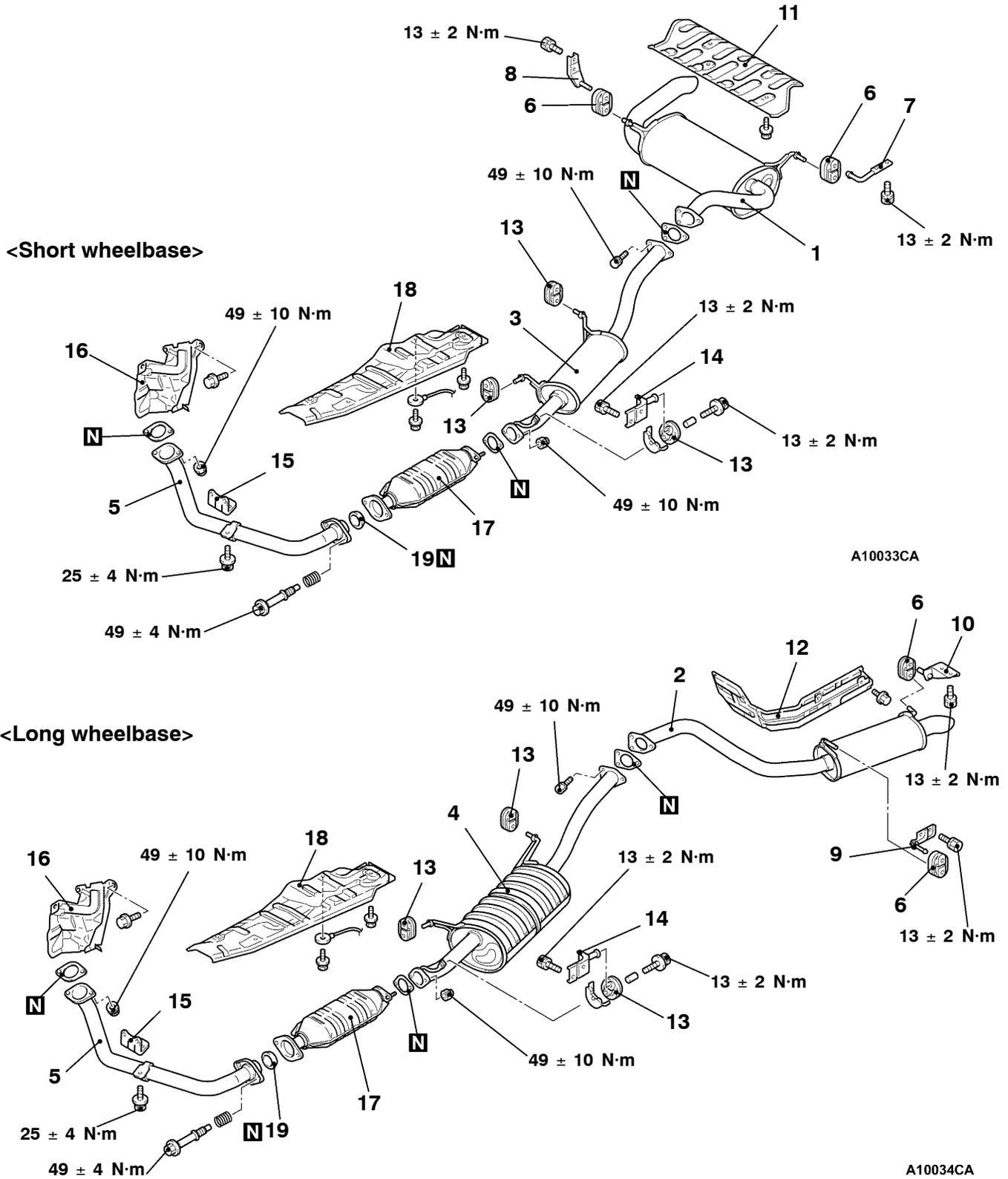
Be careful not to allow foreign material to enter the turbocharger.

3. Add clean engine oil through the oil feed pipe port on the turbocharger.

EXHAUST PIPE AND MAIN MUFFLER <4D5>

REMOVAL AND INSTALLATION

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



Exhaust main muffler and rear floor heat protector removal steps <Short wheelbase>

1. Exhaust main muffler
6. Hanger
7. Hanger bracket
8. Hanger bracket
11. Rear floor heat protector

Tail exhaust pipe and rear floor heat protector removal steps <Long wheelbase>

2. Tail exhaust pipe
6. Hanger
9. Hanger bracket
10. Hanger bracket
12. Rear floor heat protector

Center exhaust pipe removal steps <Short wheelbase>

3. Center exhaust pipe
13. Hanger
14. Hanger bracket

Exhaust main muffler removal steps <Long wheelbase>

4. Exhaust main muffler
13. Hanger
14. Hanger bracket

Front exhaust pipe and dash heat protector removal steps

- Under cover
- 5. Front exhaust pipe
- 15. Exhaust support bracket
- 16. Dash heat protector

Front floor heat protector removal steps

17. Catalytic converter
18. Front floor heat protector
19. Seal ring