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# ENGINE

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## 6.1 EXHASUST SYSTEM

### 1 Warning and Precaution

#### 1.1 Warning

Be sure to observe the following instructions before repairing, to prevent property damage, personal injury or even death:

- (1) Before repairing the exhaust system, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.

#### 1.2 Precaution

In order to avoid dangerous operation and damage to the vehicle, always follow the instructions below before repair:

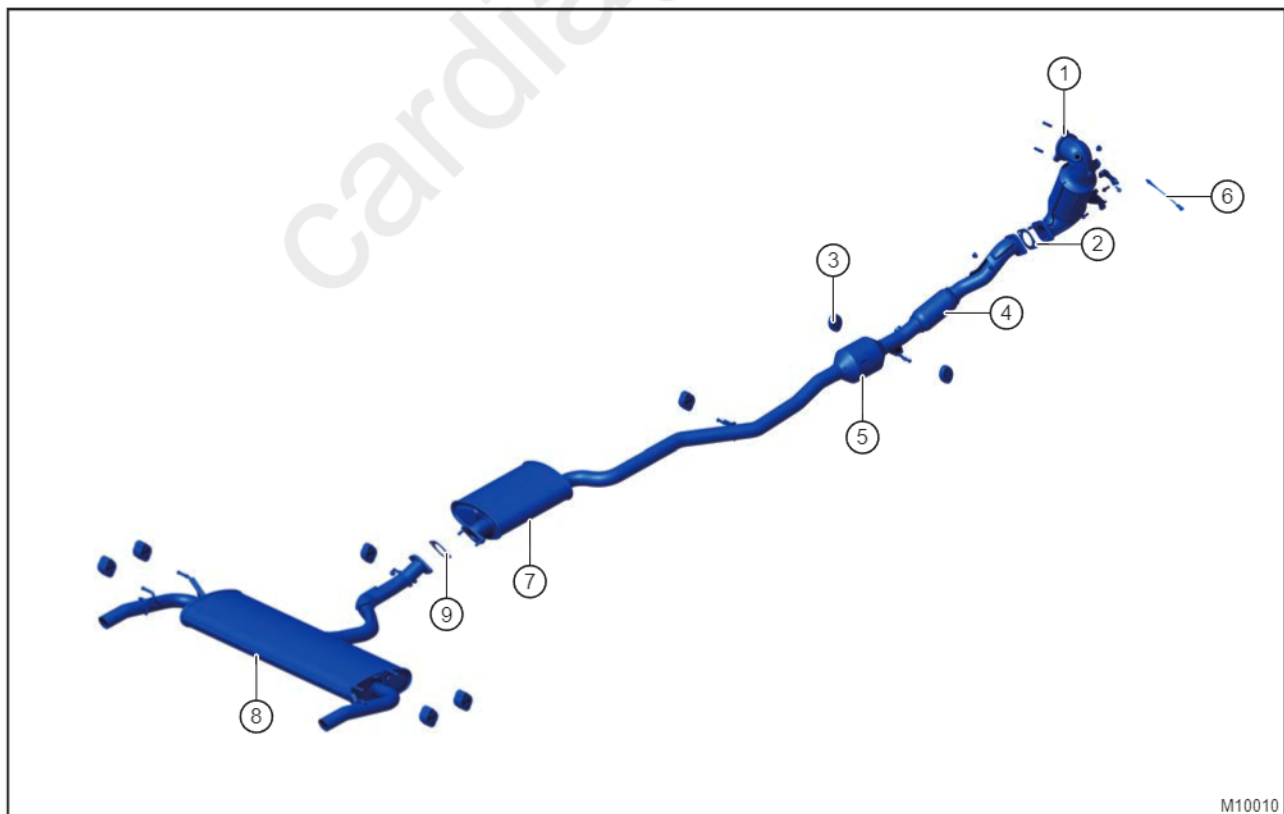
- (1) If exhaust gasket is damaged, replace it, and remove foreign matters on joints and threads.
- (2) Check exhaust gas for leakage. If gas leaks, tighten malfunctioning part to prevent leakage. Replace damaged parts as necessary.

### 2 System Overview

#### 2.1 System Description

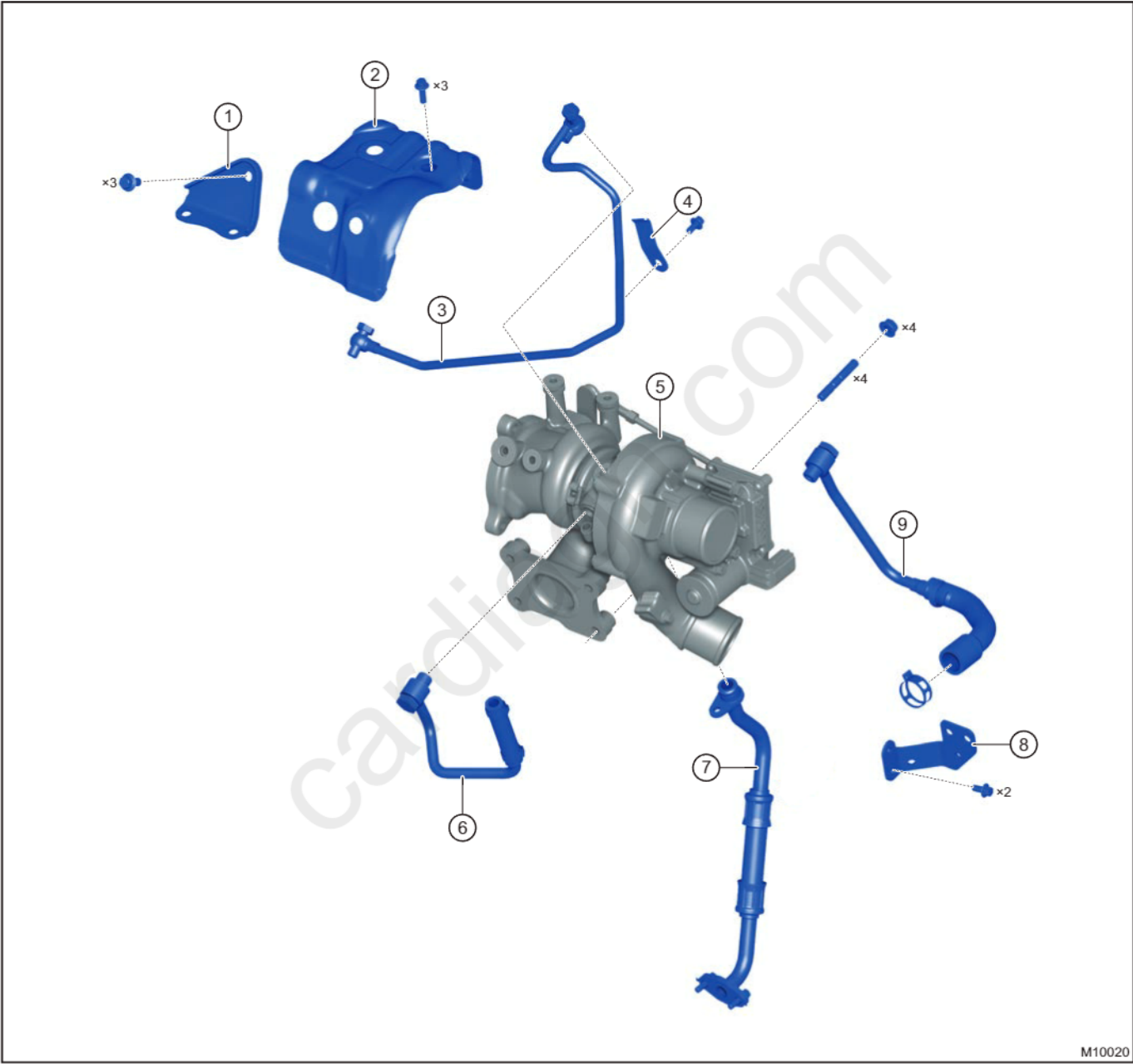
Exhaust system controls engine exhaust, reducing vehicle emissions by precatalytic converter and main catalytic converter, and eliminating exhaust noise by muffler. When exhaust system discharges exhaust gas, oxygen sensor monitors oxygen content in exhaust gas. Engine control module adjusts air-fuel ratio of combustible gas mixture to control vehicle emissions and achieve optimal fuel economy and satisfy the emissions standard of regulation according to feedback signals of oxygen sensor and combining with other sensor signals.

#### 2.2 System Components Diagram



M10010

|   |                                        |   |                             |
|---|----------------------------------------|---|-----------------------------|
| 1 | Precatalytic Converter Assembly        | 6 | Downstream Oxygen Sensor    |
| 2 | Precatalytic Converter Mounting Gasket | 7 | Front Muffler Assembly      |
| 3 | Diamond Shaped Hanger Block            | 8 | Rear Muffler Assembly       |
| 4 | Front Exhaust Pipe Assembly            | 9 | Diamond Shaped Hanger Block |
| 5 | Main Catalytic Converter Assembly      |   |                             |

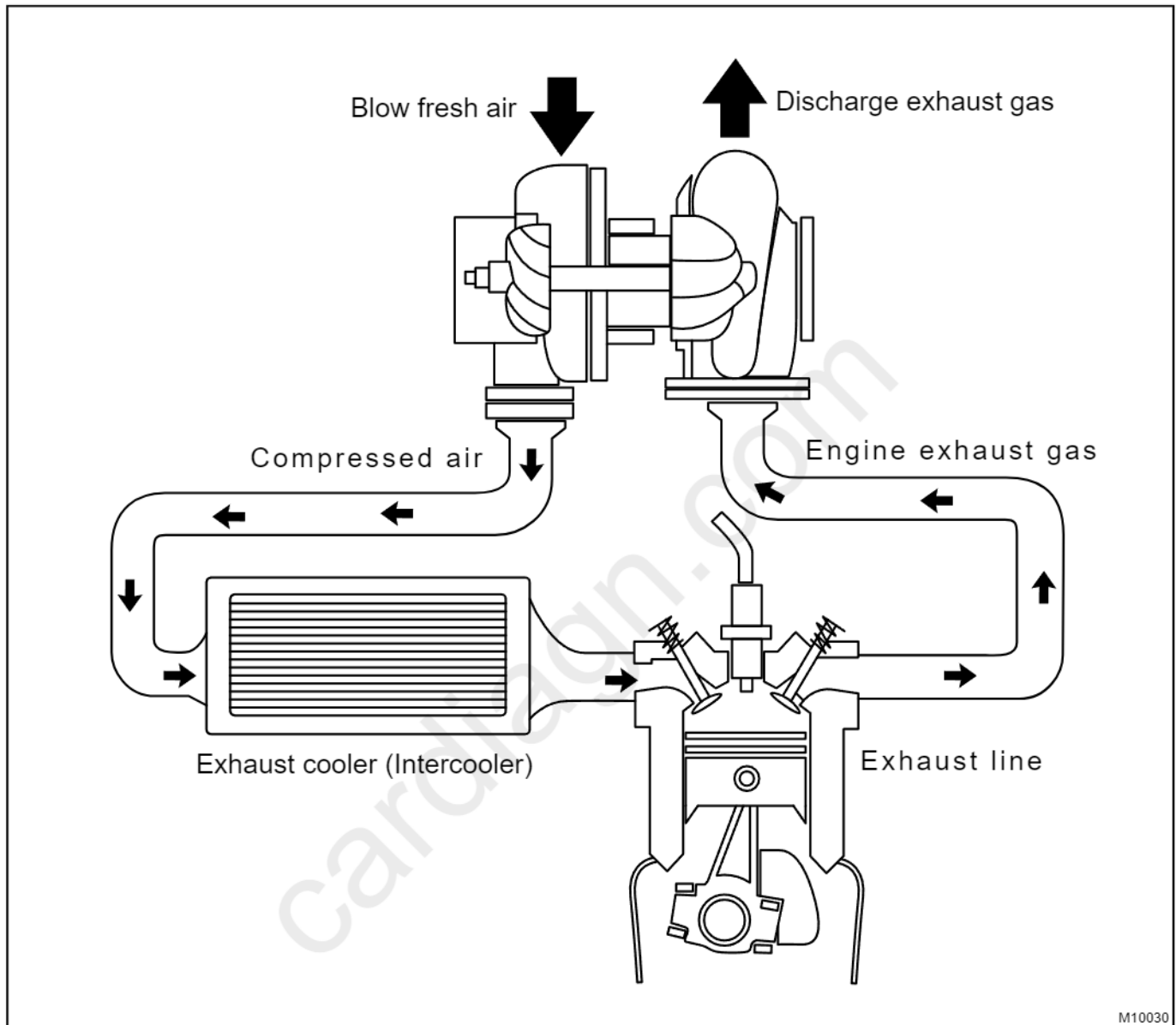


M10020

|   |                                      |   |                                         |
|---|--------------------------------------|---|-----------------------------------------|
| 1 | Turbocharger Bracket                 | 6 | Turbocharger Water Outlet Pipe Assembly |
| 2 | Turbocharger Heat Insulator          | 7 | Turbocharger Oil Return Pipe Assembly   |
| 3 | Turbocharger Oil Inlet Pipe Assembly | 8 | Electric Water Pump Bracket             |

|   |                                 |   |                           |
|---|---------------------------------|---|---------------------------|
| 4 | Oil Inlet Pipe Bracket Assembly | 9 | Water Inlet Pipe Assembly |
| 5 | Turbocharger                    |   |                           |

### 2.3 System Schematic Diagram



M10030

The fresh air filtered by the air filter enters the intercooler after being pressed by the turbocharger, and then enters the cylinder after being cooled by the intercooler. The exhaust gas drives turbo impeller to rotate, and then drives compressor impeller to press the inlet fresh air.

## 3 Component Operation Description

### 3.1 Turbocharger

Turbocharger uses the exhaust gas discharged from the engine to push the turbine impeller to rotate, and then drives the compressor impeller to pressurize the air filtered by the air filter and send it to the cylinder. As more air enters the cylinder, more fuel is allowed to be injected, thus generating more power from the engine. In addition, the turbocharger can also make the engine obtain power compensation when working at high altitude.

### 3.2 Catalytic Converter

Catalytic converter is the most important external purification device fixed in vehicle exhaust system, which can convert harmful gases such as carbon monoxide, hydrocarbons and nitrogen oxides from exhaust gas into carbon dioxide, water and nitrogen by oxidation and reduction.

### 3.3 Muffler

Reduce the exhaust noise of the engine, and make high temperature exhaust gas can be safely and effectively discharged.

## 4 Special Tool and Equipment

### 4.1 General Tool

| Tool Name              | Tool Drawing                                                                                 |
|------------------------|----------------------------------------------------------------------------------------------|
| Precision Straightedge | <br>S00044 |

## 5 Fasteners Torque List

### 5.1 Torque Specifications

| Item                                                                                       | Tightening torque                    |
|--------------------------------------------------------------------------------------------|--------------------------------------|
| Precatalytic Converter Assembly Fixing Bracket Bolt                                        | $25 \pm 3.5 \text{ N}\cdot\text{m}$  |
| Coupling Nut Between Precatalytic Converter Assembly and Turbocharger                      | $20 \pm 5 \text{ N}\cdot\text{m}$    |
| Coupling Nut Between Precatalytic Converter Assembly and Main Catalytic Converter Assembly | $45 \pm 5 \text{ N}\cdot\text{m}$    |
| Coupling Nut Between Main Catalytic Converter Assembly and Muffler Assembly                | $45 \pm 5 \text{ N}\cdot\text{m}$    |
| Turbocharger Heat Insulator Fixing Bolt                                                    | $8 \text{ N}\cdot\text{m} + 3^\circ$ |
| Turbocharger Heat Insulator II Fixing Bolt                                                 | $8 \text{ N}\cdot\text{m} + 3^\circ$ |
| Turbocharger Fixing Nut                                                                    | $33 \pm 3 \text{ N}\cdot\text{m}$    |
| Hollow Bolt                                                                                | $25 \text{ N}\cdot\text{m} \pm 5$    |

## 6 DIAGNOSIS & TESTING

### 6.1 Problem Symptoms Table

**Hint:**

Use symptoms table below to help determine cause of problem. Check each suspected area in sequence. Repair, replace or adjust faulty components as necessary.  
Exhaust System

| Symptom                       | Possible Cause                                        |
|-------------------------------|-------------------------------------------------------|
| Excessive exhaust noise       | Exhaust pipe (loose connection)                       |
|                               | Turbocharger (damaged)                                |
|                               | Muffler assembly (damaged or leaked)                  |
|                               | Main catalytic converter assembly (damaged or leaked) |
|                               | Exhaust pipe gasket (damaged)                         |
| Excessive exhaust temperature | Inadequate gas mixture combustion                     |
|                               | Main catalytic converter assembly (blocked)           |
|                               | Precatalytic converter assembly (blocked)             |
|                               | Turbocharger housing (blocked)                        |
| Exhaust pipe leakage          | Main catalytic converter assembly (damaged or leaked) |
|                               | Muffler assembly (damaged or leaked)                  |
|                               | Precatalytic converter assembly (damaged or leaked)   |

## 7 ON-VEHICLE SERVICE

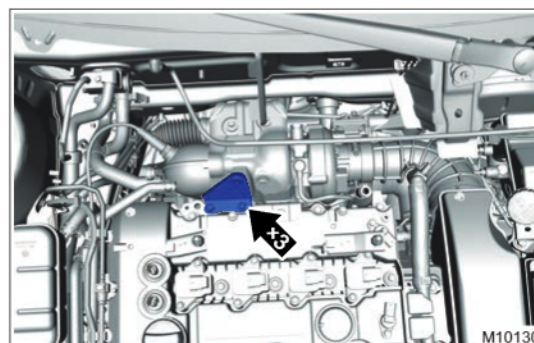
### 7.1 Turbocharger Heat Insulator

#### ■ Removal

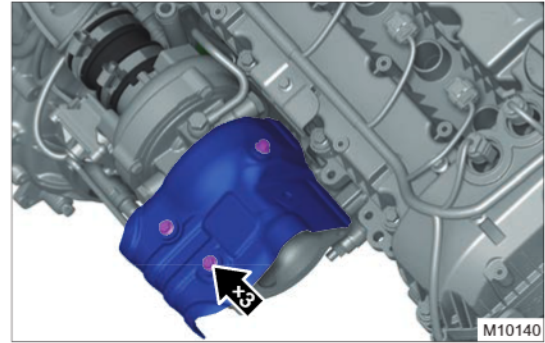
#### ⚠ Warning

- Before removing turbocharger heat insulator assembly, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.
- Be sure to wear safety equipment to prevent accidents, when removing turbocharger heat insulator assembly.
- Appropriate force should be applied, when removing the turbocharger heat insulator assembly. Be careful not to operate roughly.

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Remove the engine compartment trim cover assembly.
- (3) Remove the negative battery cable.
- (4) Remove the engine trim cover.
- (5) Remove 3 fixing bolts and turbocharger bracket.



- (6) Remove 3 fixing bolts and turbocharger bracket.



- (7) Remove turbocharger heat insulator assembly carefully.

### ■ Installation

- (1) Install 3 fixing bolts on turbocharger heat insulator assembly.

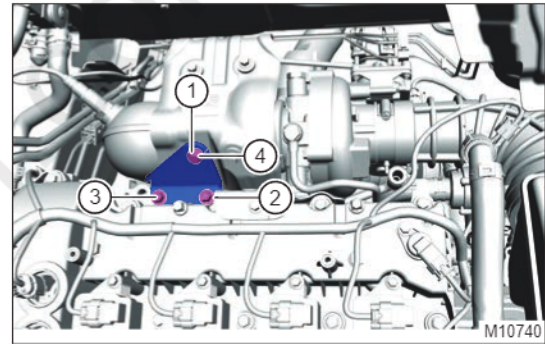
**Torque: 8 N·m + 3°**

- (2) Install 3 fixing bolts to turbocharger bracket.

**Torque: 30 ± 5 N·m (Pre-tightening torque: 6 ± 2 N·m)**

#### Hint:

- Pre-tighten the bolts in the order of 1, 2, and 3 shown in illustration, and then tighten them to specified torque the order of 1, 2, 3 and 4.
- The high temperature bolt at position 1 must be tightened first, and then tighten the bolts at positions 2 and 3, 4 is the retightening of the high temperature bolt.



- (3) Install the engine trim cover.
- (4) Install the engine compartment trim cover assembly.

## 7.2 Turbocharger Assembly

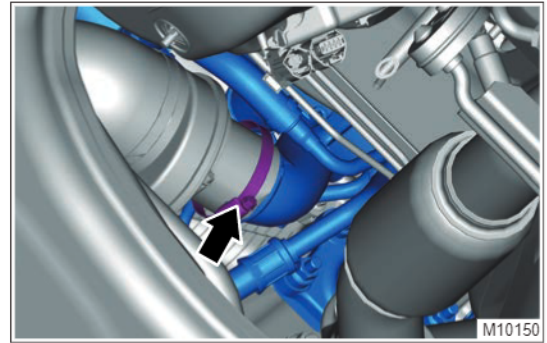
### ■ Removal

#### ⚠ Warning

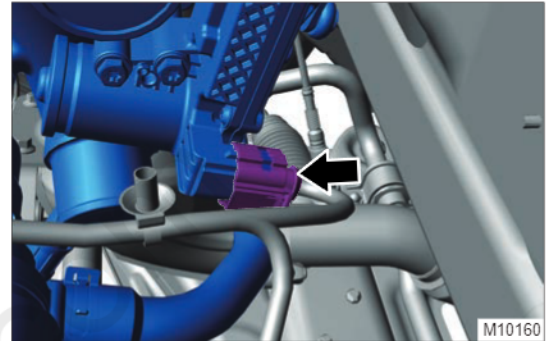
- **Before removing turbocharger assembly, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.**
- **Be sure to wear safety equipment to prevent accidents, when removing turbocharger assembly.**
- **Appropriate force should be applied, when removing turbocharger assembly. Be careful not to operate roughly.**

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Remove the engine compartment trim cover assembly.
- (3) Disconnect the negative battery cable.
- (4) Remove the air filter assembly.
- (5) Remove the intake hose assembly.
- (6) Remove the coolant pipe assembly.
- (7) Remove the precatlytic converter assembly.

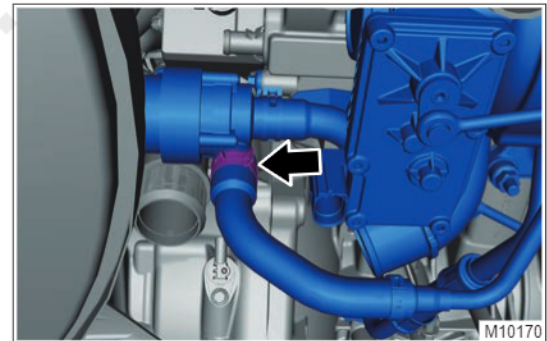
- (8) Loosen worm clamp and disconnect connection between intercooler intake pipe 1 and turbocharger assembly.



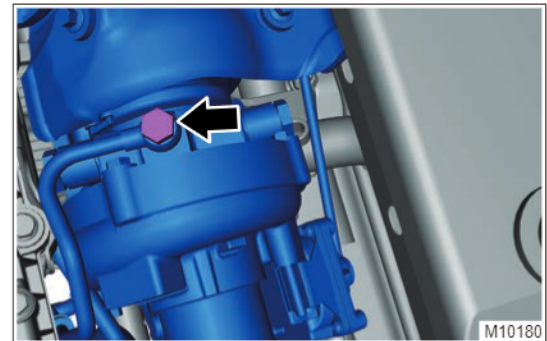
- (9) Disconnect turbocharger exhaust valve connector.



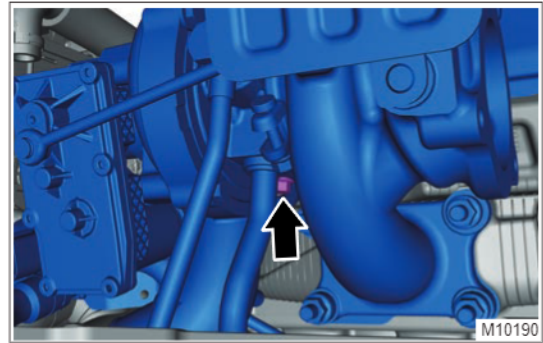
- (10) Loosen elastic clamp and disconnect connection between water inlet hose and electric water pump.



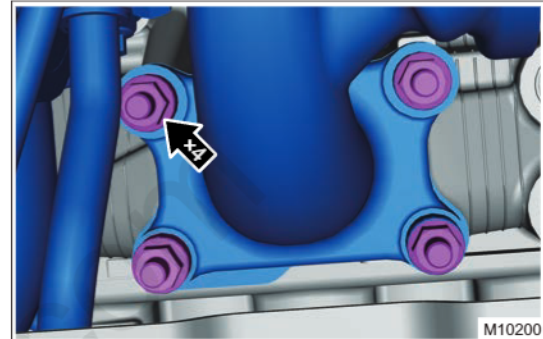
- (11) Remove 1 fixing bolt between oil inlet pipe assembly and turbocharger assembly, and remove gasket carefully.



- (12) Remove 1 fixing bolt between oil return pipe assembly and turbocharger assembly, and remove gasket carefully.

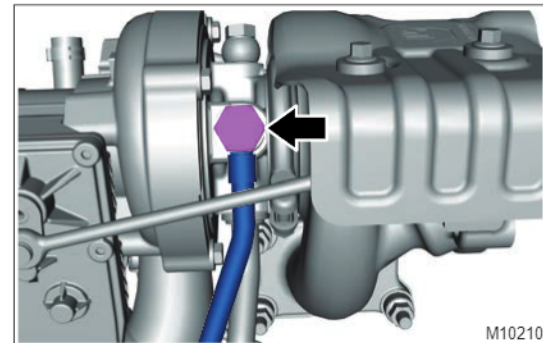


- (13) Remove 4 high temperature nuts from turbocharger assembly.

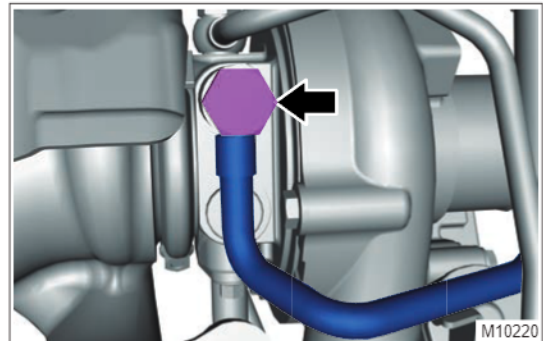


- (14) Remove the turbocharger assembly carefully. And remove gasket from cylinder head flange.

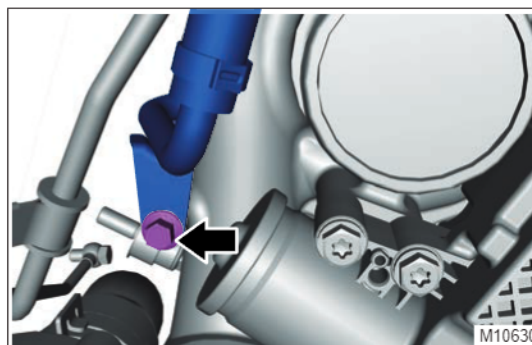
- (15) Remove the hollow bolt of turbocharger water inlet pipe and remove turbocharger water inlet pipe.



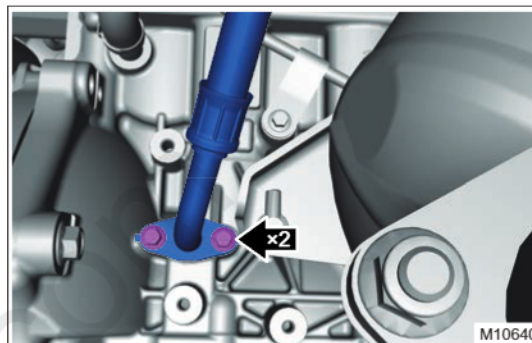
- (16) Remove turbocharger water outlet pipe hollow bolt.



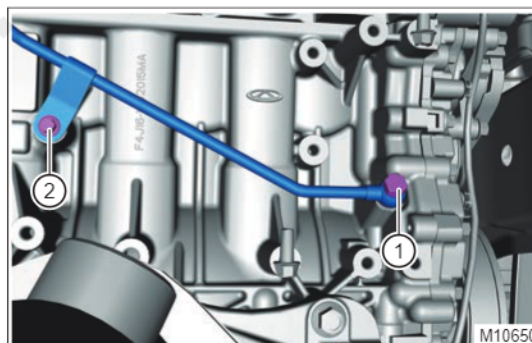
- (17) Remove the fixing bolt from turbocharger water outlet pipe bracket and remove turbocharger water outlet pipe.



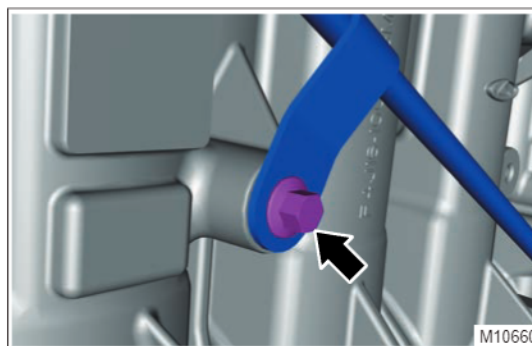
- (18) Remove 2 fixing bolts and turbocharger oil return pipe.



- (19) Remove the hollow bolt (1) and bracket fixing bolt (2) from turbocharger oil inlet pipe.



- (20) Remove the fixing bolt from turbocharger oil inlet pipe bracket and remove turbocharger oil inlet pipe.



#### ■ Daily inspection of turbocharger

- (1) Check the sealing and tightness of connecting lines between air filter and turbocharger, turbocharger and engine intake/exhaust pipe.
- (2) Check if turbocharger oil inlet pipe and return pipe are damaged or throttling, and if the connecting bolts of joints are loose.
- (3) Check the air filter and clean or replace the element regularly.

- (4) Check if engine crankcase blow-by gas is too large, breather is smooth, ensure crankcase pressure is normal.

#### ■ Other requirements of turbocharger

- (1) Avoid low engine idle for long time (maximum should not exceed 20 minutes).
- (2) Never use the operation with "Accelerate - Stall - Neutral coasting", before the engine lubricating oil pressure is established, the engine must be kept in idling condition (3 - 5 minutes).
- (3) Before stopping the engine, let it gradually decrease its temperature and speed from maximum value (3 - 5 minutes).

#### ■ Firstly perform basic inspection to turbocharger system when DTC indicating too high or too low boost pressure occurs or when power decreases.

- (1) Check there are no cracks causing by overheating, biting, deformation or other damage on exhaust turbocharger turbo housing, otherwise, replace exhaust turbocharger.
- (2) Check there are no deposition and blocking on turbo oil hole.
- (3) Check there are no blockage, squash, deformation or other damage on oil inlet and return pipes of exhaust turbocharger.
- (4) Check there is no sticking in actuator mechanism, and if actuator connector is connected normally.
- (5) Check there is no obvious deformation in turbocharger impeller, and the rotation is normal without blocking.
- (6) Check if each actuator connector is connected reliably (intake relief valve and exhaust gas bypass electric valve) and check for no damage of appearance.

#### ■ Installation



#### Caution

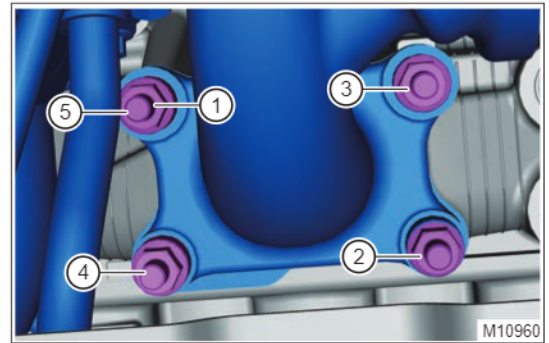
- Do not pull the turbocharger actuator rod by hand, and avoid impacting the turbocharger during assembly.
- Check for foreign matter in turbocharger and line when installing. Avoid inhaling foreign matter after turbocharger running, causing damage to the components.

- (1) Install the hollow bolts of turbocharger inlet pipe.  
**Torque: 20 N·m + 5°**
- (2) Install 2 fixing bolts on turbocharger inlet pipe bracket.  
**Torque: 8 N·m + 3°**
- (3) Install 2 fixing bolts on turbocharger oil return pipe.  
**Torque: 8 N·m + 3°**
- (4) Install fixing bolts on turbocharger outlet pipe bracket.  
**Torque: 8 N·m + 3°**
- (5) Install the hollow bolts on turbocharger outlet pipe.  
**Torque: 40 ± 2 N·m**
- (6) Install the hollow bolts on turbocharger inlet pipe.  
**Torque: 40 ± 2 N·m**

- (7) Install 4 high temperature nuts on turbocharger assembly.

**Hint:**

Tighten 4 high temperature nuts diagonally and crosswise in the order of (1) (2) (3) (4) and (5), and serial number (5) is to re-tighten the position (1) once.



- (8) Connect inlet hose to electric water pump, install elastic clamp.  
 (9) Connect turbocharger exhaust valve connector.  
 (10) Connect intercooler inlet pipe 1 to turbocharger, and tighten worm clamp.  
 (11) Install the precatytic converter assembly.  
 (12) Install the cooling pipe assembly.  
 (13) Install the intake hose assembly.  
 (14) Install the air filter assembly.  
 (15) Install the engine trim cover.  
 (16) Install the engine compartment trim cover assembly.

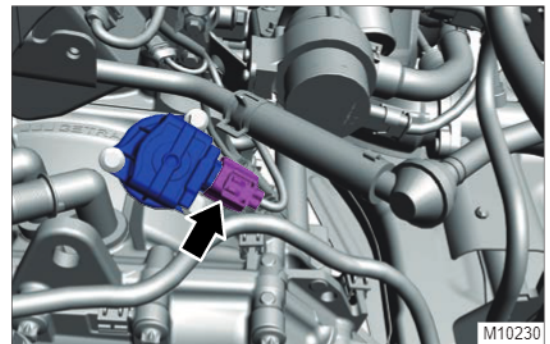
### 7.3 Relief Control Solenoid Valve

#### ■ Removal

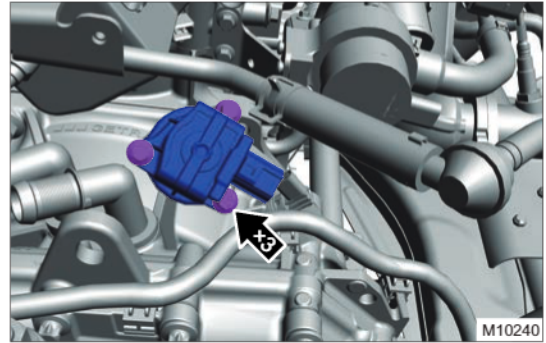
#### ⚠ Warning

- **Before removal of pressure discharge control solenoid valve assembly, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.**
- **Be sure to wear safety equipment to prevent accidents, when removing relief control solenoid valve assembly.**
- **Appropriate force should be applied, when removing relief control solenoid valve assembly. Be careful not to operate roughly.**

- (1) Turn off all electrical equipment and ENGINE START STOP switch.  
 (2) Disconnect the negative battery cable.  
 (3) Remove the engine trim cover.  
 (4) Remove the intake hose assembly.  
 (5) Disconnect the relief control solenoid valve connector.



- (6) Remove 3 fixing bolts from relief control solenoid valve.



- (7) Remove the relief solenoid valve assembly.

### ■ Installation

- (1) Install relief control solenoid valve and tighten 3 fixing bolts.

**Torque: 8 N·m + 3°**

- (2) Connect the relief control solenoid valve connector.  
 (3) Install the intake hose assembly.  
 (4) Install the engine compartment trim cover assembly.

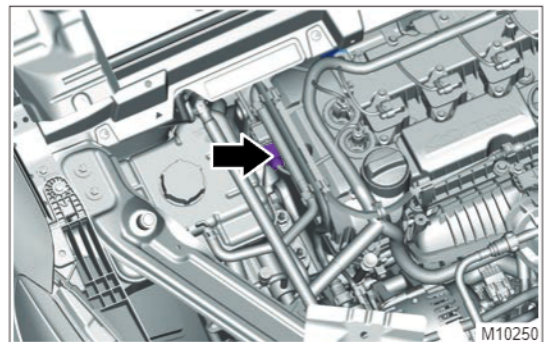
## 7.4 Precatalytic Converter Assembly

### ■ Removal

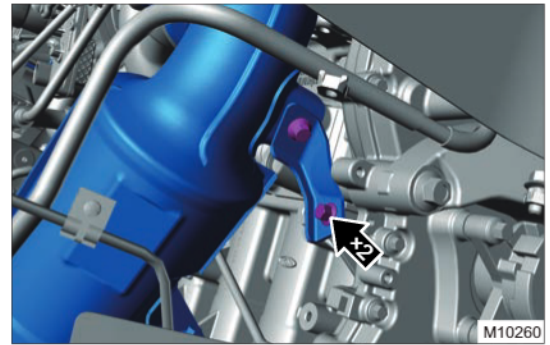
#### ⚠ Warning

- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.
- Be sure to wear safety equipment to prevent accidents, when removing precatalytic converter assembly.
- Appropriate force should be applied, when removing the precatalytic converter assembly. Be careful not to operate roughly.

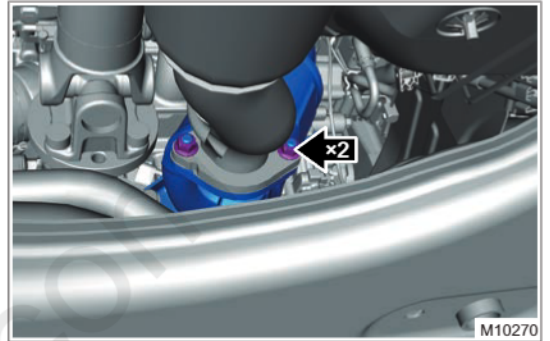
- (1) Turn off all electrical equipment and ENGINE START STOP switch.  
 (2) Remove the engine compartment trim cover assembly.  
 (3) Disconnect the negative battery cable.  
 (4) Remove the engine trim cover.  
 (5) Removal turbocharger heat insulator assembly.  
 (6) Disconnect the upstream oxygen sensor connector.



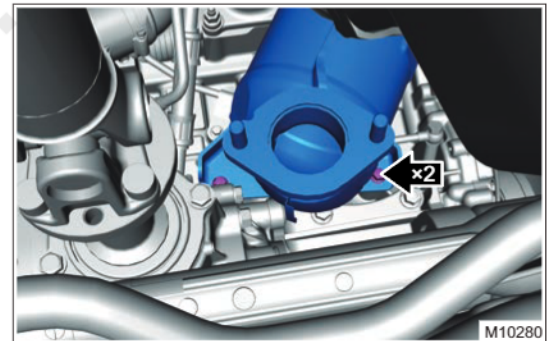
- (7) Remove 2 fixing bolts and precatalytic converter bracket.



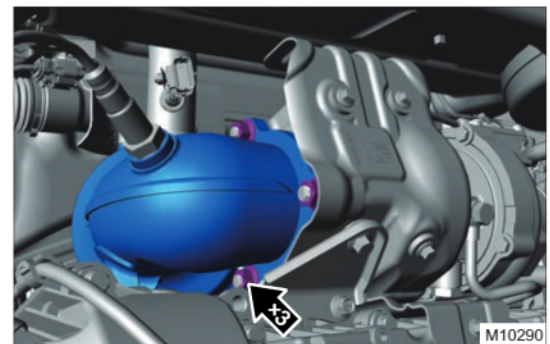
- (8) Remove 2 fixing nuts between precatalytic converter and main catalytic converter.



- (9) Remove 2 fixing bolts between precatalytic converter bracket and cylinder block.



- (10) Remove 3 fixing nuts between precatalytic converter and turbocharger assembly.



- (11) Remove the precatalytic converter assembly carefully and slowly, and remove the washer of precatalytic converter.

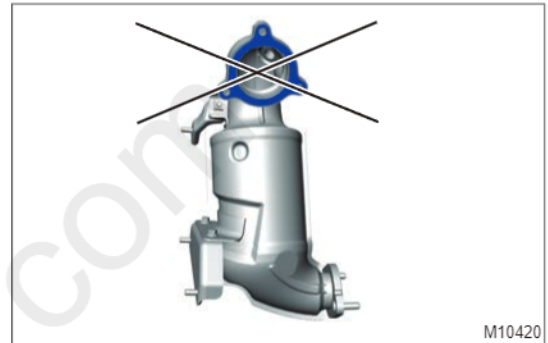
- (12) Remove the upstream oxygen sensor from precatalytic converter.

**Hint:**

Remove it by using special tool of oxygen sensor.

**■ Inspect warpage on precatalytic converter connection surface**

- (1) Using a precision straightedge and feeler gauge, measure the connection surface between precatalytic converter body and turbocharger, replace it if the surface warpage is above 0.5mm.
- (2) Check precatalytic converter internal carrier for cracked, blocked, etc. If so, replace precatalytic converter assembly.

**■ Installation**

- (1) Install precatalytic converter washer.
- (2) Install 2 fixing nuts (non-reusable part) between precatalytic converter and main catalytic converter.  
**Torque:  $45 \pm 5 \text{ N}\cdot\text{m}$**
- (3) Install 2 bolts between precatalytic converter bracket and cylinder block.  
**Torque:  $25 \pm 3.5 \text{ N}\cdot\text{m}$**
- (4) Install 2 fixing bolts to precatalytic converter bracket.  
**Torque:  $25 \pm 3.5 \text{ N}\cdot\text{m}$**
- (5) Install 3 fixing bolts between precatalytic converter and turbocharger.  
**Torque:  $45 \pm 5 \text{ N}\cdot\text{m}$**
- (6) Install the upstream oxygen sensor connector.
- (7) Install turbocharger heat insulator assembly.
- (8) Install the engine trim cover.

## 7.5 Main Catalytic Converter and Front Muffler

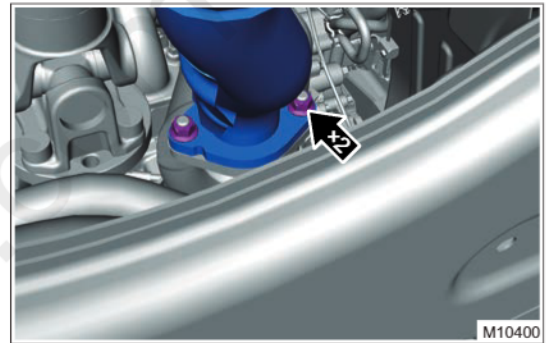
### ■ Removal

#### ⚠ Warning

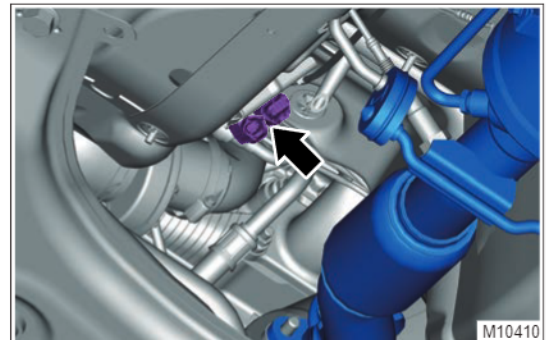
- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.
- Be sure to wear safety equipment to prevent accidents, when removing main catalytic converter and front muffler.
- Appropriate force should be applied, when removing the main catalytic converter and front muffler. Be careful not to operate roughly.

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Disconnect the negative battery cable.
- (3) Raise the vehicle to a proper position.

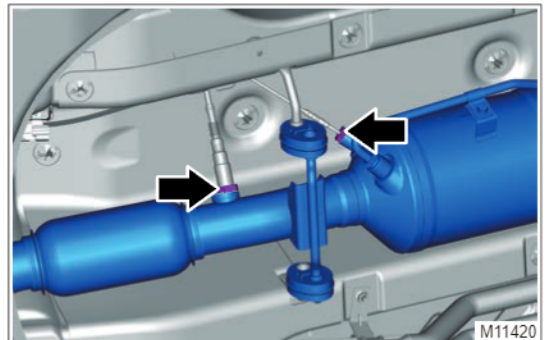
- (4) Remove 2 fixing nuts from precatalytic converter assembly.



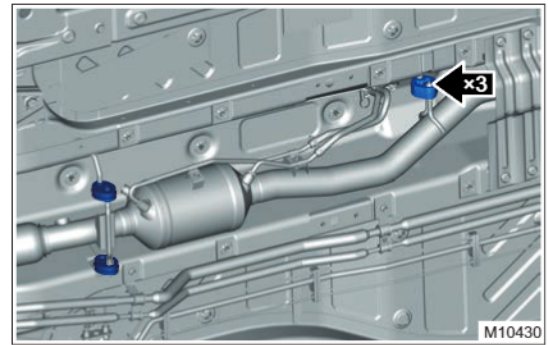
- (5) Disconnect the downstream oxygen sensor connector.
- (6) Disconnect the exhaust temperature sensor connector.



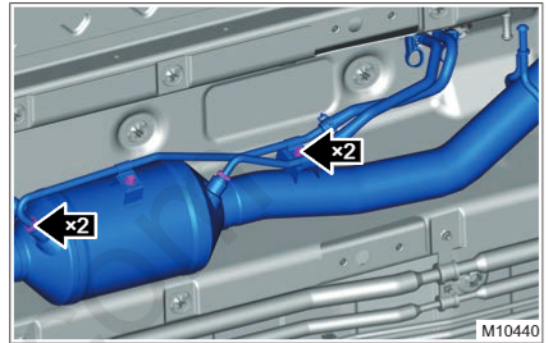
- (7) Remove rear oxygen sensor and exhaust temperature sensor.



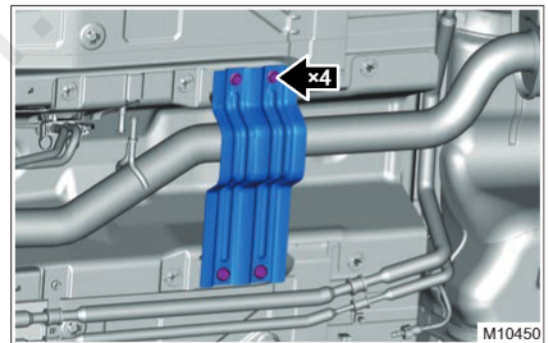
- (8) Disengage 3 hanger blocks from main catalytic converter and muffler.



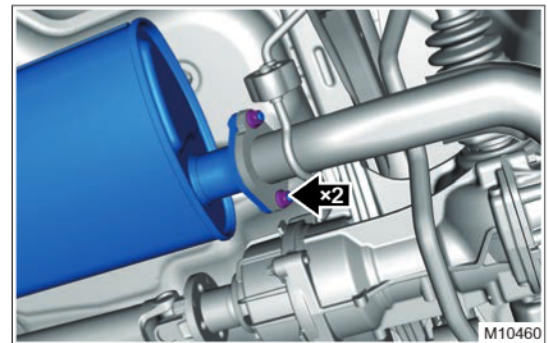
- (9) Remove 2 fixing bolts from pipe for measuring pressure difference, separate pipe joint and main catalytic converter.



- (10) Remove 4 fixing bolts from rear passage rear mounting board.



- (11) Remove 2 fixing nuts from rear muffler assembly.



- (12) Remove the main catalytic converter and muffler carefully.

#### ■ Inspection

- (1) Check main catalytic converter internal absorber for damage, and replace the assembly if necessary.
- (2) Check the appearance of the main catalytic converter and muffler for deformation and cracks condition and, and replace the assembly if necessary.

## ■ Installation

- (1) Install downstream oxygen sensor.

**Torque:  $45 \pm 5 \text{ N}\cdot\text{m}$**

- (2) Install the exhaust temperature sensor.

- (3) Install 2 fixing nuts from rear muffler assembly.

**Torque:  $45 \pm 5 \text{ N}\cdot\text{m}$**

- (4) Install 4 fixing bolts on center passage rear mounting board.

- (5) Install 2 fixing bolts on pressure difference pipe, and connect pipe joint and main catalytic converter in place.

- (6) Install 2 fixing nuts on the precatalytic converter assembly.

**Torque:  $45 \pm 5 \text{ N}\cdot\text{m}$**

## 7.6 Rear Muffler Assembly

### ■ Removal

#### ⚠ Warning

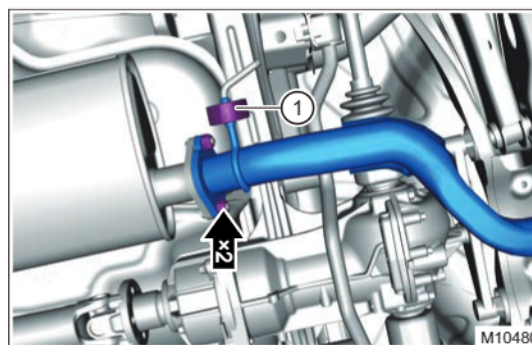
- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.
- Be sure to wear safety equipment to prevent accidents, when removing rear muffler assembly.
- Appropriate force should be applied, when removing the rear muffler assembly. Be careful not to operate roughly.

- (1) Turn off all electrical equipment and ENGINE START STOP switch.

- (2) Disconnect the negative battery cable.

- (3) Disengage fixing hanger block (1).

- (4) Remove 2 fixing nuts between rear muffler assembly, main catalytic converter and front muffler assembly.



- (5) Disengage the 4 fixing hanger block from muffler assembly.



- (6) Carefully remove the rear muffler assembly.

### ■ Installation

- (1) Install the 5 fixing hanger blocks on rear muffler assembly.
- (2) Tighten 2 fixing nuts between rear muffler and main catalytic converter and front muffler assembly.

**Torque:  $45 \pm 5$  N·m**

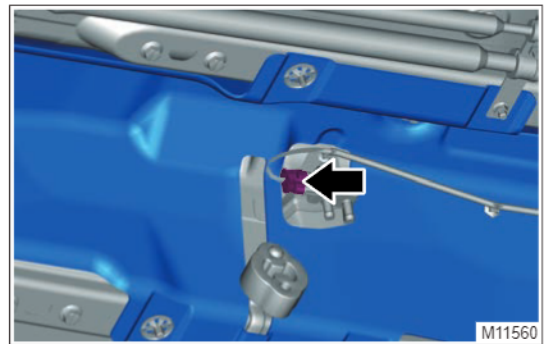
## 7.7 Center Passage Heat Insulator

### ■ Removal

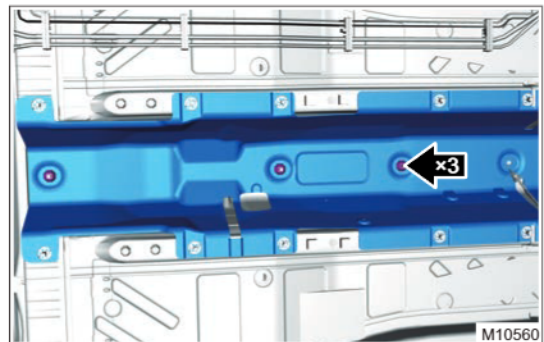
#### ⚠ Warning

- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.
- Be sure to wear safety equipment to prevent accidents, when removing center passage heat insulator assembly.
- Appropriate force should be applied, when removing the center passage heat insulator assembly. Be careful not to operate roughly.

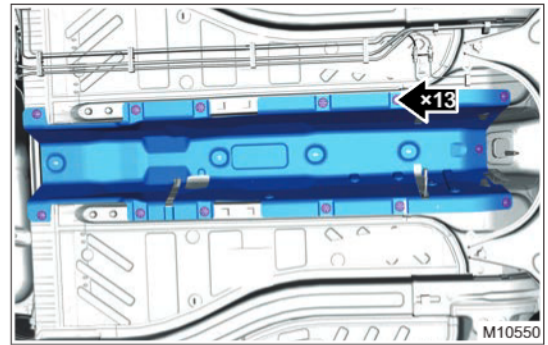
- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Disconnect the negative battery cable.
- (3) Remove the main catalytic converter and front muffler assembly.
- (4) Remove the propeller intermediate shaft assembly.
- (5) Disconnect the differential pressure sensor.



- (6) Remove 3 fixing nuts from center passage heat insulator.



- (7) Remove 13 clamping washers from center passage heat insulator.



- (8) Remove center passage heat insulator carefully.

### ■ Installation

- (1) Install 13 clamping washers to tighten center passage heat insulator.
- (2) Install 3 fixing nuts on center passage heat insulator.
- (3) Connect the differential difference sensor connector.
- (4) Install the propeller intermediate shaft assembly.
- (5) Install the main catalytic converter and front muffler assembly.

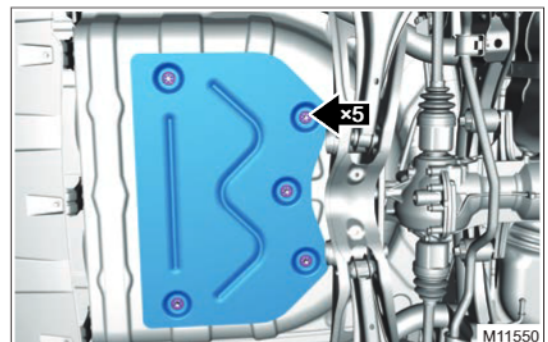
## 7.8 Rear Side Exhaust Pipe Heat Insulator

### ■ Removal

#### ⚠ Warning

- Temperature of exhaust system is very high when engine is running. Before removal, make sure that engine has stopped running and exhaust system has cooled down sufficiently, otherwise, there is a risk of scald injury.
- Be sure to wear necessary safety equipment to prevent accidents, when removing rear side exhaust pipe heat insulator.
- Appropriate force should be applied, when removing rear side exhaust pipe heat insulator. Be careful not to operate roughly.

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Disconnect the negative battery cable.
- (3) Remove the rear muffler assembly.
- (4) Remove 5 clamping washers from rear side exhaust pipe heat insulator.



- (5) Remove the rear side exhaust pipe heat insulator carefully.

■ **Installation**

- (1) Install 5 clamping washers to tighten rear side exhaust pipe heat insulator.
- (2) Install the rear muffler assembly

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