
ENGINE

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9.1 COOLING 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) Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.
- (2) If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.

1.2 Precaution

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

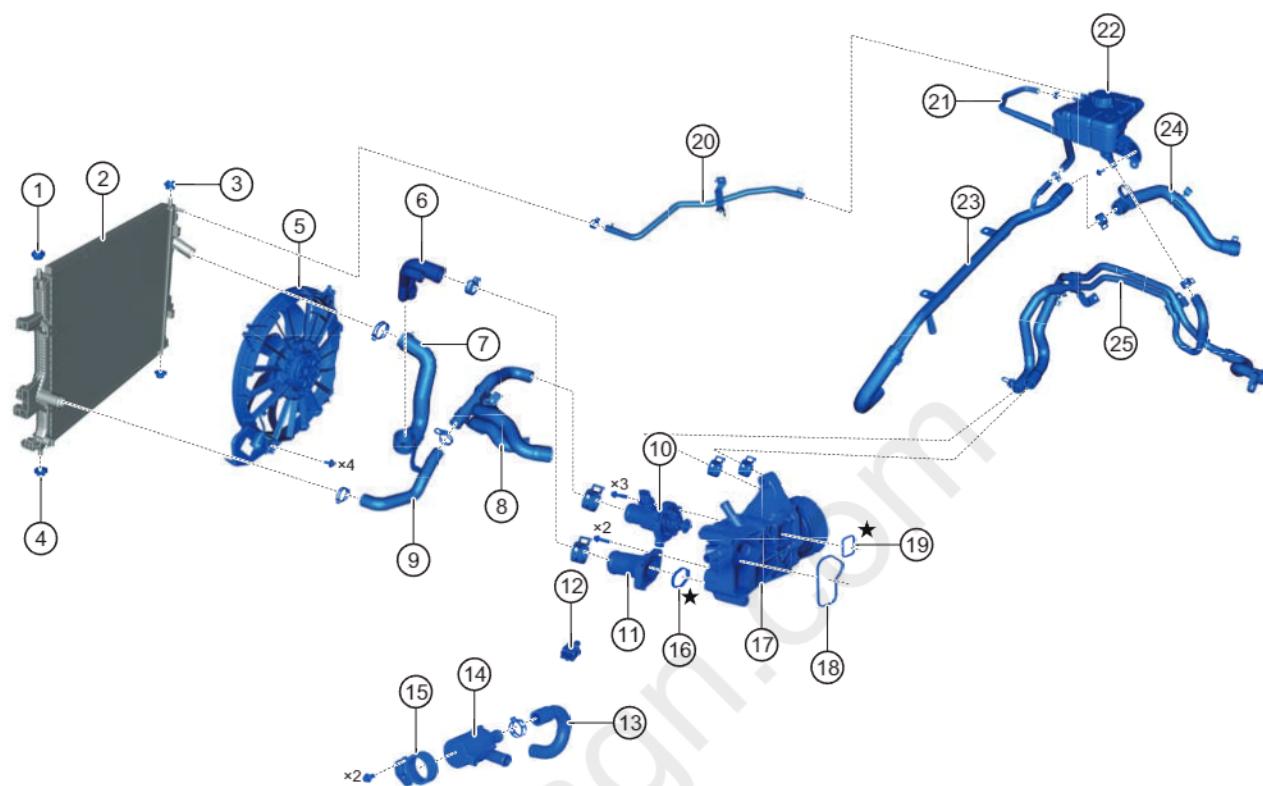
- (1) When testing cooling system, please pressurize the system to specified pressure. Otherwise, system components may be damaged.
- (2) DO NOT mix different colors or types of coolant.
- (3) Please select coolant which is suitable for local climate in different areas.

2 System Overview

2.1 System Description

Engine cooling system adjusts engine operating temperature by the flow of coolant and makes engine operate normally under various operating conditions. And effectively improve the service life and fuel economy of the engine.

2.2 System Components Diagram

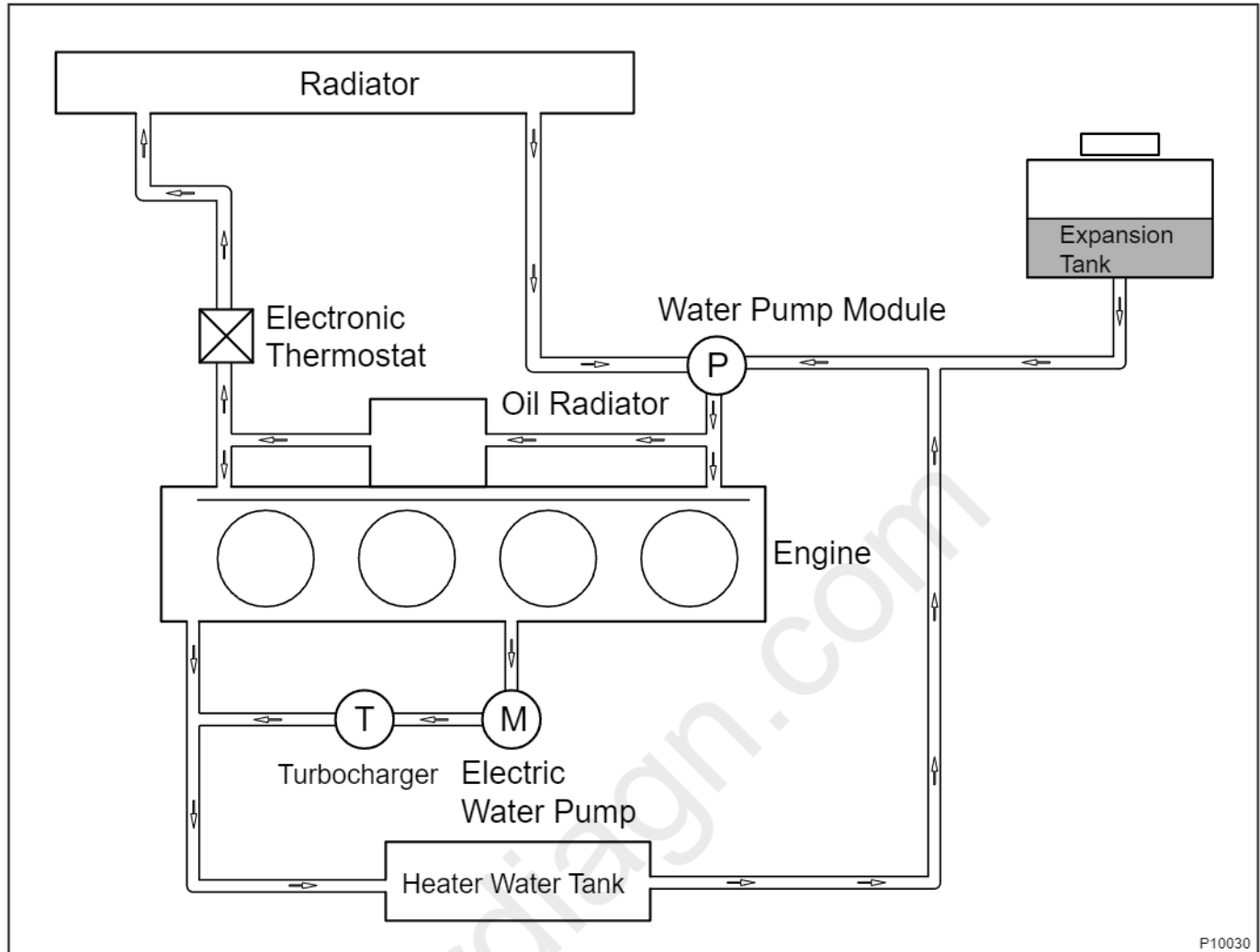


★ : Indicates that it is a non-reusable part

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1	Rubber Bushing	14	Electric Water Pump
2	Radiator Assembly	15	Electric Water Pump Bracket
3	Rubber Bushing	16	Seal Ring
4	Rubber Cushion	17	Water Pump Module
5	Cooling Fan Assembly	18	Seal Ring
6	Engine Outlet Pipe Assembly - Rear	19	Seal Ring
7	Engine Outlet Pipe Assembly - Front	20	Radiator Outlet Pipe Assembly
8	Engine Inlet Pipe Assembly - Rear	21	Engine Discharge Pipe
9	Engine Inlet Pipe Assembly- Front	22	Expansion Tank
10	Electronic Thermostat	23	Cooling Pipe Assembly
11	Engine Outlet Port Cover	24	Heating Inlet Pipe
12	Coolant Temperature Sensor	25	Expansion Tank Inlet Pipe
13	Inlet Hose - Electric Water Pump		

2.3 System Schematic Diagram



After engine operates, the water pump starts operating. Coolant begins to flow circularly. Displacement of water pump depends on engine speed. The higher the speed, the larger the displacement, and vice versa. When the coolant temperature does not reach the opening temperature of electronic thermostat, the engine coolant circulates in cylinder block, the cylinder head, turbocharger and warm air water tank under the operation of water pump, and the coolant does not radiate through the radiator. When coolant temperature reaches the opening temperature of electronic thermostat, coolant flowing out of cylinder block enters radiator for radiating. It then returns to cylinder block for circulation by water pump. Due to radiating in radiator, engine coolant temperature decreases quickly to prevent engine from overheating.

3 System Components Description

3.1 Expansion Tank

■ Main Function

The expansion tank is an integral part of the vehicle cooling system. When the engine is running, the coolant will circulate continuously in the cooling water channel, and will flow through the expansion tank at halfway. If the pressure is too high or the coolant is too much, the excess gas and coolant will flow out of the bypass water channel of the expansion tank to avoid the high pressure of the cooling system.



3.2 Radiator Assembly

■ Main Function

The radiator is composed of three parts: Inlet chamber, outlet chamber and radiator core. The coolant flows in the radiator core and the air flows outside the radiator core. The hot coolant cools down because radiating heat to air, and the cold air heats up because absorbing the heat from the coolant, so the radiator is a heat exchanger.



3.3 Cooling Fan Assembly

■ Main Function

The rotation of radiator fan helps to radiate the radiator. Fan speed is controlled by ECU according to coolant temperature.



3.4 Water Pump Assembly

■ Main Function

Pressurize coolant to ensure it can circulate in cooling system. Its displacement varies with engine speed.



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3.5 Electronic Thermostat

■ Main Function

The electronic thermostat can calculate the target temperature according to engine running speed, load state, intake air temperature, coolant temperature, etc., accurately regulate the coolant temperature to ensure that the engine always works at a reasonable temperature. According to the calculated value of the sensor signal, ECU provides the signal working voltage to heating resistance element in electronic thermostat, which makes the paraffin expand and displace. Through this displacement, the temperature regulating unit mechanically adjusts the large circulation and small circulation of water temperature.

The operation of electronic thermostat shall meet the following conditions at the same time:

- (1) Under low speed and low load, electronic thermostat controls to open at 105 °C to improve fuel economy.
- (2) Under high speed and high load, electronic thermostat controls to open at 90 °C to ensure engine safety.
- (3) If there is fault in line, electronic thermostat can be opened mechanically. Initially opening temperature: 100 °C $\pm$ 2 °C, fully opening temperature: 110 °C $\pm$ 2 °C.
- (4) Opening stroke of thermostat: 8mm.



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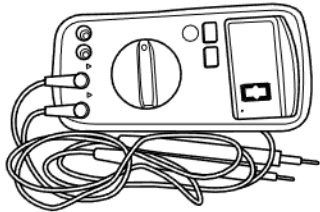
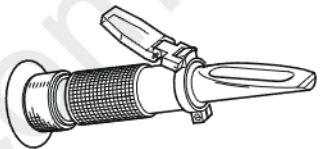
3.6 Coolant Temperature Sensor

■ Main Function

NTC thermistor packaged inside temperature sensor is used for coolant temperature sensor, its resistance changes in accordance with ambient temperature, thus accurately reflecting the small changes in coolant temperature. The temperature of contact medium can be reflected by measuring its output resistance, and the signals from both terminals of resistor are output to ECM. Engine coolant temperature can be obtained by ECU according to output signal of the sensor, thus judging the engine operating condition.

4 Special Tool and Equipment

4.1 General Tool

Tool Name	Tool Drawing
Digital Multimeter	 S00002
Freezing Point Tester	 S00005

5 DIAGNOSIS & TESTING

5.1 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.
Cooling System

Symptom	Possible Cause
Insufficient coolant	Coolant pipe (deteriorated and leaks)
	Expansion tank (leakage)
	Radiator assembly (leakage)
	Heater core (leakage)
	Electronic thermostat improperly sealed
	Water pump (improperly sealed)
	Engine cylinder head gasket (damaged)
	Engine cylinder head (cracked and Leakage)
	Engine cylinder block (water jacket leaks and cylinder block cracked)
Engine overheating	Low coolant level
	Air resistance exists in cooling pipe

Symptom	Possible Cause
	Expansion luggage cap damaged
	ECU fault
	Cooling fan assembly
	Electronic thermostat
	Radiator assembly
	Coolant temperature sensor
Engine overcooling	Electronic thermostat
	Cooling fan
Unable to reach normal engine temperature	Cooling fan (constantly operating)
	Electronic thermostat
Cooling fan does not operate or operate abnormally	Cooling fan
	Cooling fan controller
	Fan controller wire harness
	ECU fault

6 ON-VEHICLE SERVICE

6.1 Cooling System Leakage Test

■ Test Procedures

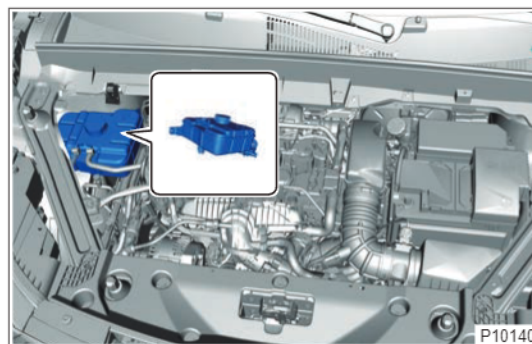
⚠ Warning

- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.

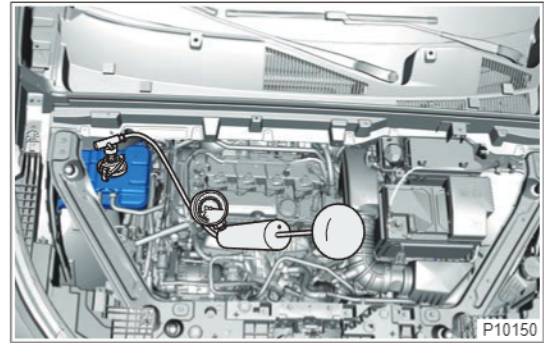
⚠ Caution

- When testing cooling system, please pressurize the system to specified pressure. Otherwise, system components may be damaged.
- Before testing cooling system, do not perform operation until coolant temperature drops to normal level. Otherwise, it may cause scald.

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Check if coolant level is between "MAX" and "MIN" lines. If coolant level is below "MIN" line, add coolant.



- (3) Connect cooling system pressure tester to coolant pressure release cap opening (expansion tank body cap opening) and tighten it slowly.



⚠ Caution

- **Make sure there is no leakage in connecting part of coolant system pressure tester, in order to avoid pressure leakage during test.**

- (4) Pressurize cooling system to 1.2 bar with the cooling system pressure tester, and then observe the pressure changes. If system pressure does not drop within 2 minutes, it indicates there is no leakage in system. If pressure changes greatly, it indicates that there is a leakage in system; find the leaking area and perform troubleshooting.

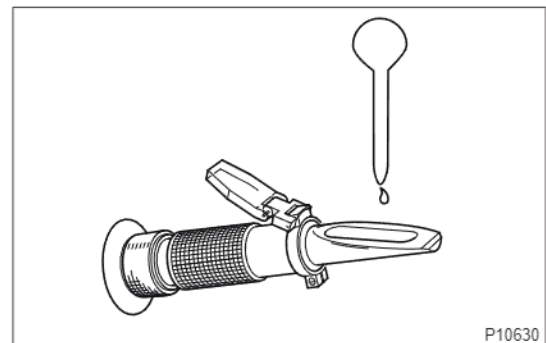
6.2 Coolant Freezing Point Test

■ Test Procedures

⚠ Caution

- **DO NOT** mix different colors or types of coolant.
- Please select coolant which is suitable for local climate in different areas.
- Please read measured value at the scale line. In order to distinguish the scale line more clearly, drip a drop of water on the glass of freezing point tester with a pipette, then the scale line can be clearly distinguished via a "waterline" .

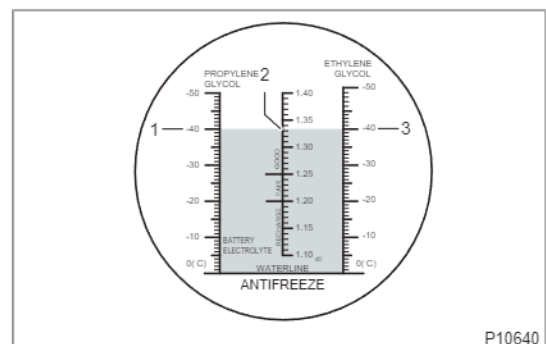
- (1) As shown in illustration, drip a drop of coolant on the glass of freezing point tester with a pipette, and then observe freezing point value of coolant.



- (2) As shown in illustration, observe scale 3 of freezing point tester to read ethylene glycol coolant freezing point value. The freezing point value must be kept at -40°C (value varies with geography, climate or freezing point).

Hint:

Scale 1 is used to measure the freezing point value of propylene glycol coolant, and scale 2 is used to measure the battery electrolyte concentration.



- (3) If freezing point is beyond the specified value, replace the coolant.

6.3 Draining and Adding Coolant

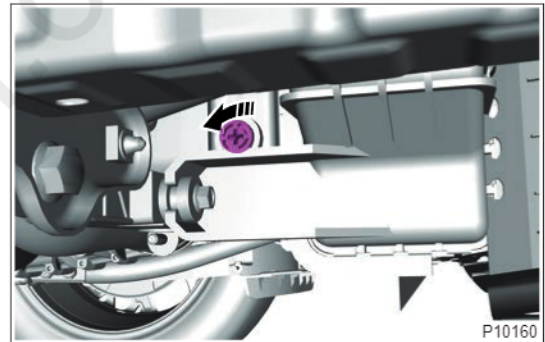
■ Draining Coolant

Warning

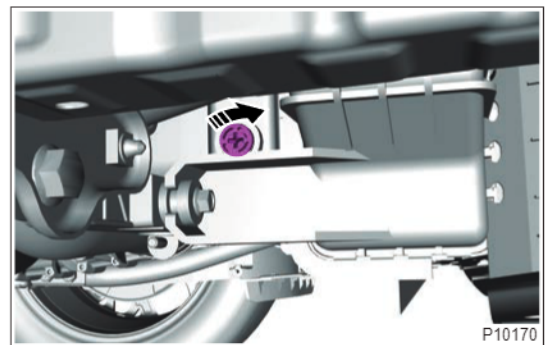
- **Never open expansion tank cap when engine is operating or temperature is high. Otherwise, it may cause scald.**
- **Be careful when opening expansion tank cap, the high-pressurized hot engine coolant and steam may flow out and cause serious burns.**
- **Wait until the engine has cooled down, and then cover the expansion tank cap with a piece of damp cloth and turn it one turn slowly (counterclockwise). Step back when releasing cooling system pressure. After confirming that all pressure has been released, turn the pressure release cap with cloth covered and remove it.**
- **Violating above descriptions may cause serious personal injury.**

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Disconnect the negative battery cable.
- (3) Remove the expansion tank cap when engine temperature is low.
- (4) Remove the engine lower protector assembly.

- (5) Put a coolant collector under the vehicle, rotate the radiator drain cock plug counterclockwise as shown in figure and drain the coolant in radiator and expansion tank.



- (6) After coolant stops flowing, re-tighten the radiator drain cock plug.



Caution

- **Tighten drain cock plug to prevent leakage.**
- **Wasted coolant should be handled by the specialized department according to local laws and regulations. Never discard it at will.**

■ Adding Coolant

Warning

- If it is necessary to add coolant when engine is hot, loosen expansion tank cap slightly first to release internal pressure and loosen the cap completely after waiting for a while, and then add coolant.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.

■ Coolant Capacity

Description	Capacity (L)
Coolant	7.95

- (1) Open expansion tank body cap until add coolant until coolant level reaches the "MAX" line.
- (2) Tighten expansion tank body cap, start and run engine. Maintain engine speed between 2000 and 2500 rpm to warm up the engine until cooling fan operates.

Caution

- If there is no coolant in expansion tank body after engine just starts, perform the followings: Stop the engine; wait until coolant cools down; add coolant to "MAX" line on expansion tank; run the engine at 2500 rpm until coolant level becomes stable.

- (3) Stop engine and wait until coolant temperature drops to the ambient temperature. Check that coolant level is between "MAX" and "MIN" lines. If coolant level is below the "MIN" line, repeat all the above procedures. Keep the coolant level between "MAX" and "MIN" lines.
- (4) Check each pipe for leaks, lack of antifreeze, if so, handle it.

Caution

- Do not open the expansion tank cap at high engine temperature to prevent burns.

6.4 Expansion Tank Body

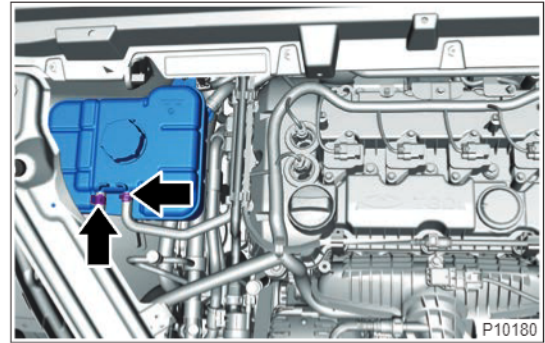
■ Removal

Warning

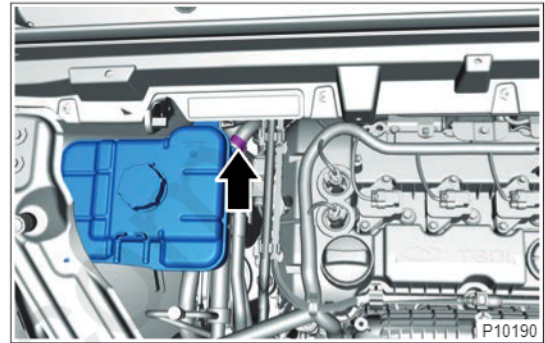
- Always make sure engine is cold before operating cooling system. Never open expansion tank body cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.
- Be sure to wear necessary safety equipment to prevent accidents when repairing.

- (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) Drain the coolant.

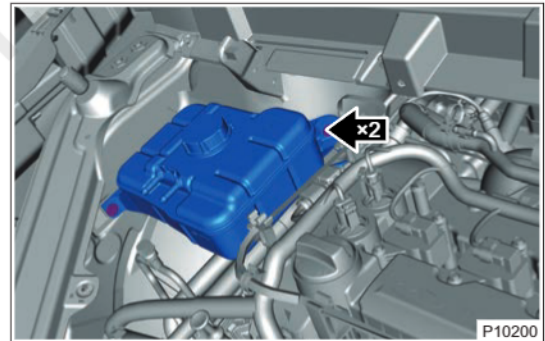
- (5) Loosen the elastic clamp and disconnect the connection between radiator discharge pipe and expansion tank.
- (6) Loosen the elastic clamp and disconnect the connection between engine discharge pipe and expansion tank.



- (7) Loosen elastic clamp and disconnect the connection between inlet pipe and expansion tank.



- (8) Remove 2 fixing bolts from expansion tank.



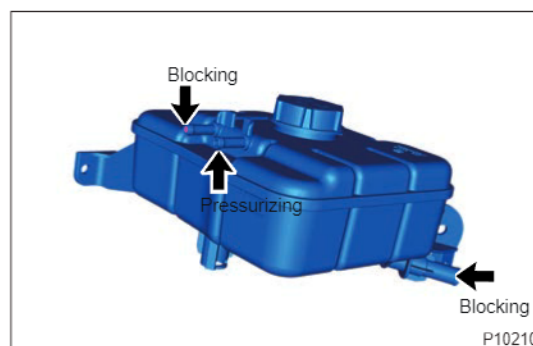
- (9) Remove the expansion tank assembly carefully.

■ Inspect the expansion tank

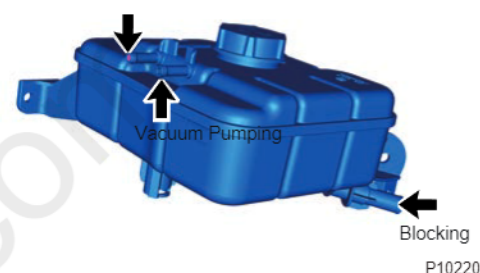
- (1) Check that the expansion tank is welded firmly, and there are no defects such as fractures and cracks at the weld.
- (2) The expansion tank should be colorless and transparent. During use of vehicle, expansion tank assembly is not allowed to have discoloration that affects the appearance and function, and scale line should be clearly visible.

■ Inspect the expansion tank

- (1) Block two holes of expansion tank and pressurize one of them. When pressure reaches the opening pressure of relief valve (120 - 150 kpa), the pressure in expansion tank should be maintained at the relief valve opening pressure value.



- (2) Block two holes of expansion tank and vacuumize one of them. When vacuum pressure reaches the opening pressure of vacuum valve (-2 - 10 kpa), vacuum pressure in expansion tank should be maintained at the vacuum valve opening pressure value.



■ Installation

⚠ Caution

- When connecting engine discharge pipe and expansion tank body, align the “±” mark on pipe port with boss, and align center position of elastic clamp tabs with “I” position of “±” mark, align the edge of elastic clamp with lower edge of “二” position of “±” mark.
- When connecting engine inlet pipe and expansion tank body, align the “±” mark on pipe port with boss, and align center position of elastic clamp tab with “I” position of “±” mark, align the edge of elastic clamp with lower edge of “二” position of “±” mark.
- When connecting radiator discharge pipe | and expansion tank body, align the “⊥” mark on pipe port with boss, and align center position of elastic clamp tabs with “I” position of “⊥” mark, align the edge of elastic clamp with lower edge of “二” position of “⊥” mark.
- Check that coolant has been added to the specified level after installation.

- (1) Install fixing bolts to expansion tank assembly.

Torque: 5 ± 1 N·m

- (2) Connect expansion tank inlet pipe and install elastic clamp.
- (3) Connect radiator discharge pipe and install elastic clamp.
- (4) Connect radiator to expansion tank water pipe and install elastic clamp.
- (5) Add the coolant.
- (6) Install the engine compartment trim cover assembly.

6.5 Expansion Tank Inlet Pipe

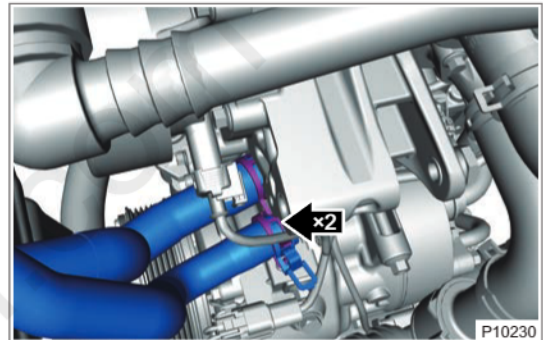
■ Removal

⚠ Warning

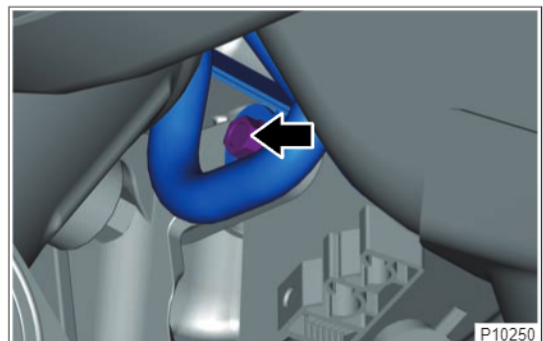
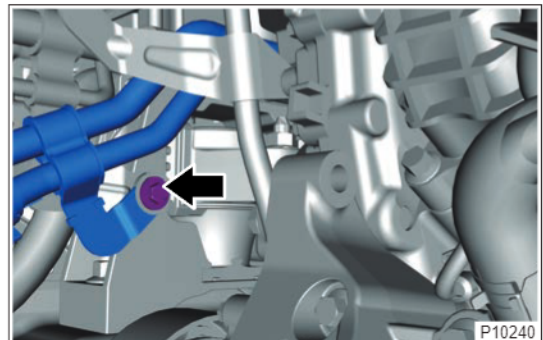
- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.
- Be sure to wear necessary safety equipment to prevent accidents when repairing.

- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Remove the engine compartment trim cover assembly.
- (3) Drain the coolant.

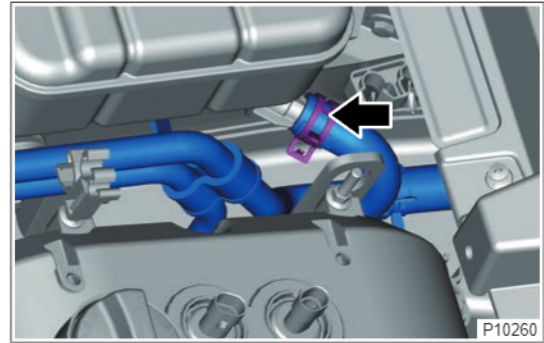
- (4) Loosen 2 elastic clamps and disconnect the connection between expansion tank inlet pipe and water pump module.



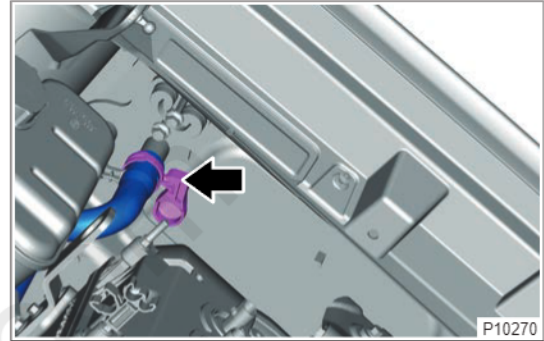
- (5) Remove 2 fixing bolts and expansion tank inlet pipe.



- (6) Loosen elastic clamp and disconnect the connection between expansion tank inlet pipe and expansion tank assembly.



- (7) Loosen elastic clamp and disconnect connection between expansion tank inlet pipe and warm air water tank.



- (8) Remove expansion tank inlet pipe.

■ Inspection

Check expansion tank inlet pipe for damage or crack, and replace it as necessary.

■ Installation

- (1) Install 2 fixing bolts to expansion tank inlet pipe.

Torque: $5 \pm 1 \text{ N}\cdot\text{m}$

- (2) Connect expansion tank inlet pipe and warm air water tank, install elastic clamp.
 (3) Connect expansion tank inlet pipe and expansion tank assembly, install elastic clamp.
 (4) Connect expansion tank inlet pipe and water pump module, install 2 elastic clamps.
 (5) Add the coolant.
 (6) Install the engine compartment trim cover assembly.

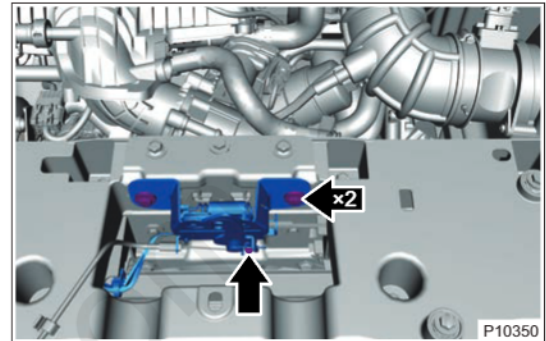
6.6 Cooler Upper Bracket Assembly

■ Removal

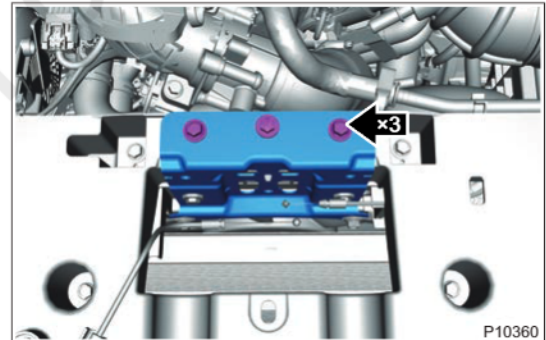
⚠ Warning

- Temperature in engine compartment is very high when engine is running. Before removal, you must make sure that engine has shut off, and engine compartment has cooled down sufficiently, otherwise, there is a risk of scald injury.
- Be sure to wear necessary safety equipment to prevent accidents, when removing the front plastic end.
- Appropriate force should be applied when removing the front plastic end. Be careful not to operate roughly.

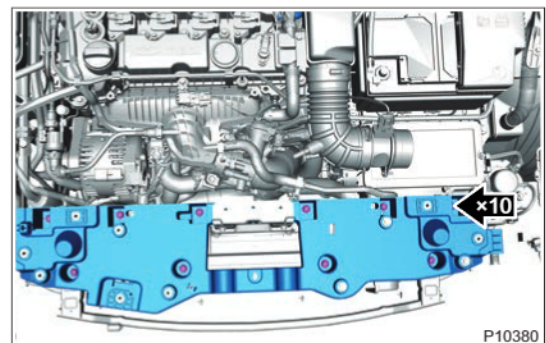
- (1) Turn off all electrical equipment and ENGINE START STOP switch.
- (2) Remove the engine compartment trim cover assembly.
- (3) Disconnect the negative battery cable.
- (4) Remove the air filter assembly.
- (5) Remove the front bumper assembly.
- (6) Remove the right headlight assembly.
- (7) Remove the left headlight assembly.
- (8) Remove the right headlight crossmember assembly.
- (9) Remove the left headlight crossmember assembly.
- (10) Remove 2 fixing bolts from engine hood lock assembly and disengage cable.



- (11) Remove 3 fixing bolts from engine hood lock bracket.



- (12) Remove 10 fixing bolts from cooler upper bracket.



- (13) Remove cooler upper bracket assembly carefully.

■ Installation

- (1) Install 10 fixing bolts to cooler upper bracket.
- (2) Install 3 fixing bolts to engine hood lock bracket.
- (3) Install 2 fixing bolts to engine hood lock assembly and secure cable in place.

- (4) Install the left and right headlight crossmember assembly.
- (5) Install the left and right headlight assembly.
- (6) Install front bumper assembly.
- (7) Install the air filter assembly.
- (8) Install the engine compartment trim cover assembly.

6.7 Front Plastic End Assembly

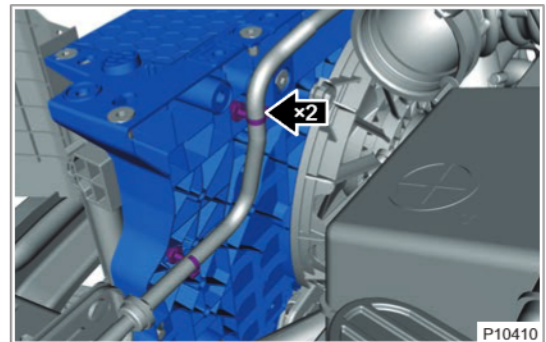
■ Removal

⚠ Warning

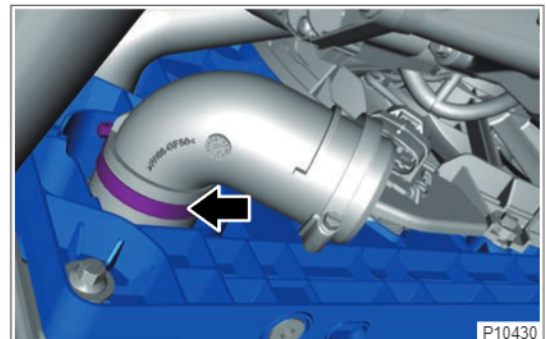
- **Temperature in engine compartment is very high when engine is running. Before removal, you must make sure that engine has shut off, and engine compartment has cooled down sufficiently, otherwise, there is a risk of scald injury.**
- **Be sure to wear necessary safety equipment to prevent accidents, when removing the front plastic end.**
- **Appropriate force should be applied when removing the front plastic end. 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 front bumper assembly.
- (6) Remove the right headlight assembly.
- (7) Remove the left headlight assembly.
- (8) Remove the right headlight crossmember assembly.
- (9) Remove the left headlight crossmember assembly.
- (10) Remove cooler upper bracket assembly.
- (11) Drain the coolant.
- (12) Recover the refrigerant.

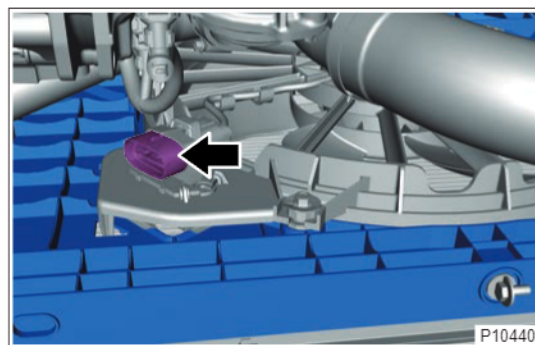
- (13) Disengage 2 fixing clips from vacuum brake pipe and front plastic end.



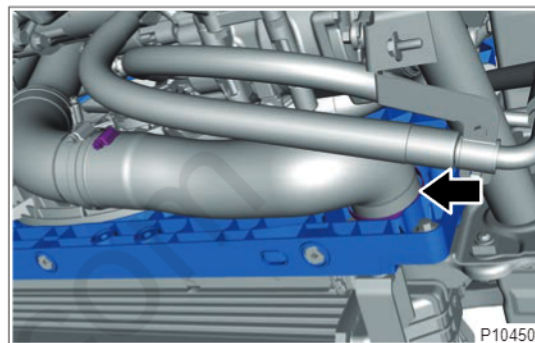
- (14) Loosen worm clamp and disconnect intercooler intake pipe.



(15) Disconnect the cooling fan assembly.

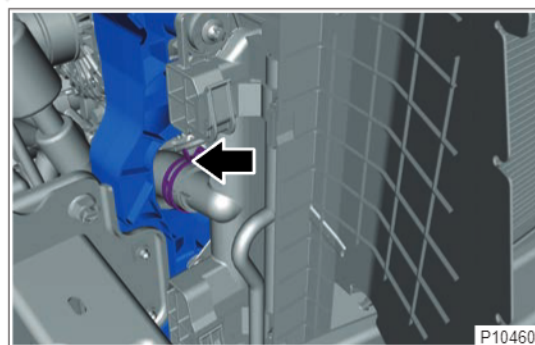


(16) Loosen worm clamp and disconnect intercooler outlet pipe assembly I.

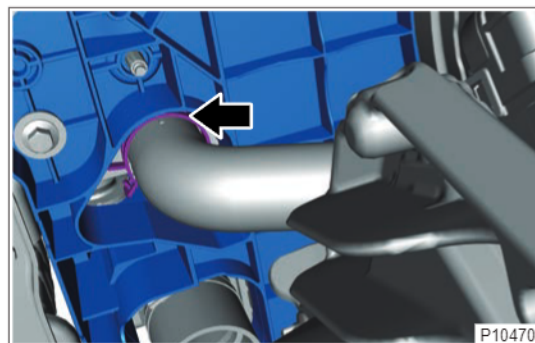


(17) Disconnect the condenser pipeline.

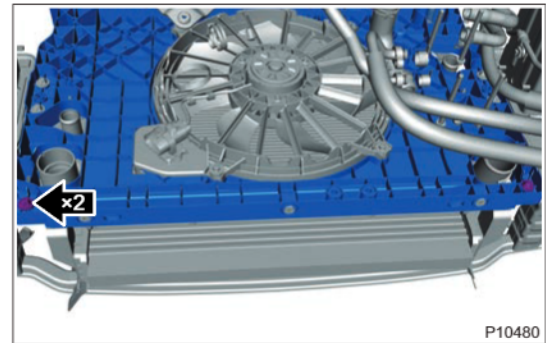
(18) Loosen elastic clamps and disconnect engine outlet pipe connection.



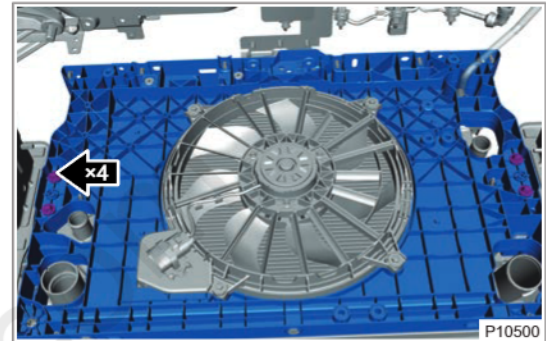
(19) Loosen elastic clamps and disconnect engine inlet pipe connection.



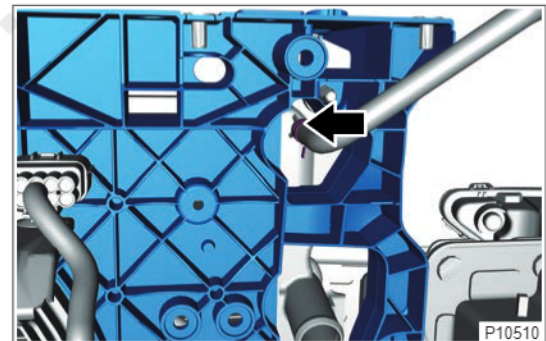
- (20) Remove 2 fixing bolts from lower support beam and front plastic end.



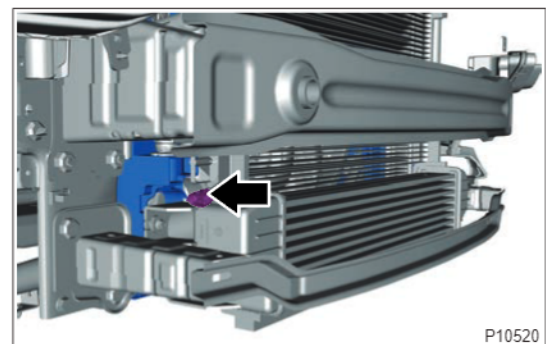
- (21) Remove 4 fixing bolts from front upper impact beam assembly.



- (22) Loosen the elastic clamp and disconnect the radiator discharge pipe.



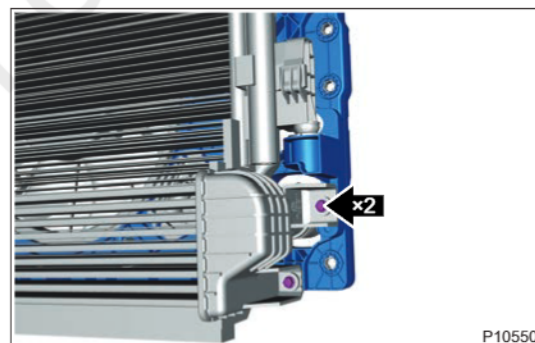
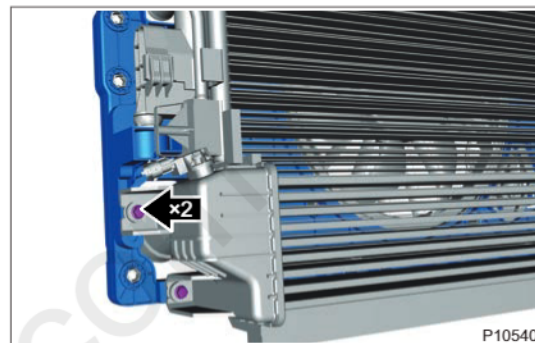
- (23) Disconnect the boost pressure sensor connector.



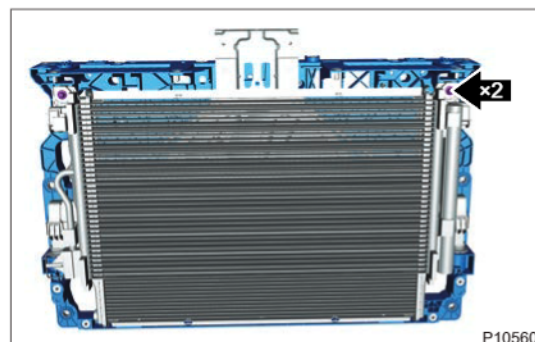
- (24) Remove front plastic end and cooling module assembly.



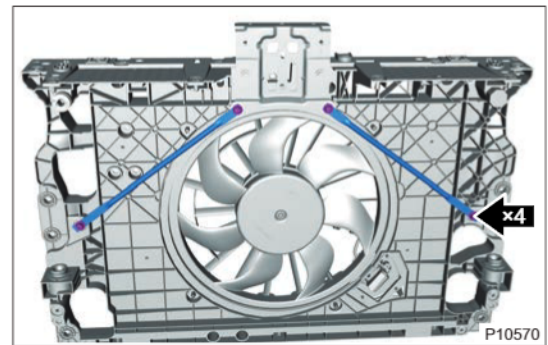
- (25) Remove 4 fixing bolts from front plastic end and intercooler assembly.



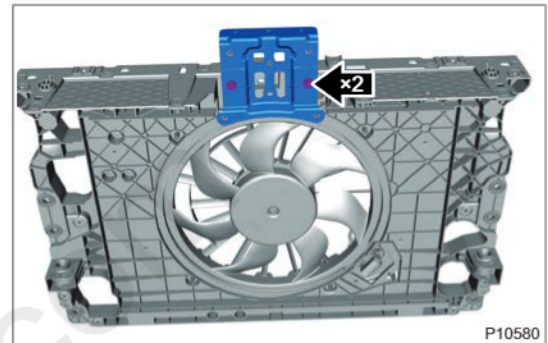
- (26) Remove 2 hexagon flange bolts and cooling module assembly carefully.



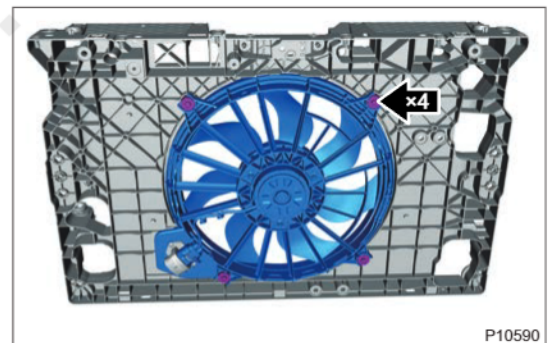
- (27) Remove 4 fixing bolts from front end bracket reinforcement lever and front plastic end, and remove front end bracket reinforcement lever.



- (28) Remove 2 fixing bolts from engine hood lock bracket and remove engine hood lock bracket.



- (29) Remove 4 fixing bolts and cooling fan assembly.



■ Installation

- (1) Install cooling fan assembly to front plastic end and tighten 4 fixing bolts.
- (2) Install 2 fixing bolts to engine hood lock bracket.
- (3) Install front end bracket reinforcement lever and tighten 4 fixing bolts.
- (4) Install cooling module to front plastic end, and tighten 2 fixing bolts.
- (5) Install Intercooler assembly to front plastic end and tighten 4 fixing bolts.
- (6) Install and tighten 4 fixing bolts to upper impact beam.
- (7) Install and tighten 2 fixing bolts to lower support beam.
- (8) Connect boost pressure sensor.
- (9) Connect intercooler pipeline.
- (10) Connect condenser pipeline.
- (11) Connect radiator pipeline.
- (12) Connect the cooling fan connector.
- (13) Install cooler upper bracket assembly.
- (14) Install the left and right headlight crossmember assembly separately.
- (15) Install the left and right headlight assembly separately.
- (16) Install front bumper assembly.
- (17) Install the A/C filter assembly.
- (18) Add the coolant.
- (19) Vacuum pumping/refrigerant recharging
- (20) Install the engine compartment trim cover assembly.

6.8 Radiator Assembly

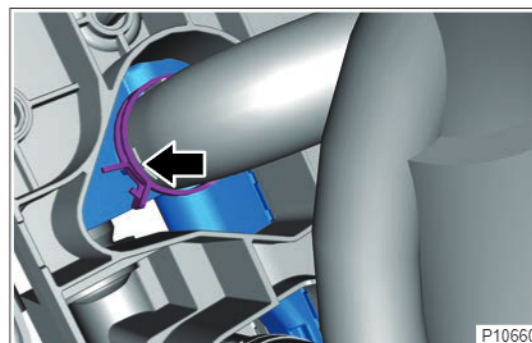
■ Removal

Warning

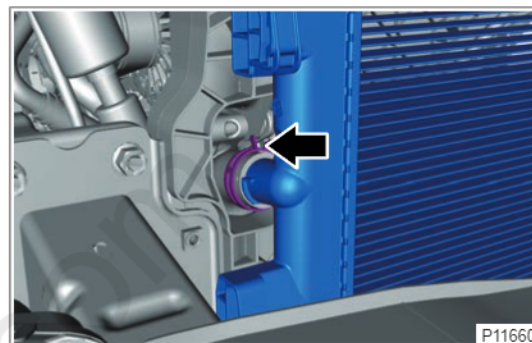
- **Temperature in engine compartment is very high when engine is running. Before removal, you must make sure that engine has shut off, and engine compartment has cooled down sufficiently, otherwise, there is a risk of scald injury.**
- **Be sure to wear safety equipment to prevent accidents, when removing radiator assembly.**
- **Appropriate force should be applied, when removing the radiator 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 front bumper assembly.
- (6) Remove the right headlight assembly.
- (7) Remove the left headlight assembly.
- (8) Remove the right headlight crossmember assembly.
- (9) Remove the left headlight crossmember assembly.
- (10) Remove cooler upper bracket assembly.
- (11) Drain the coolant.
- (12) Recover the refrigerant.
- (13) Remove the condenser assembly.

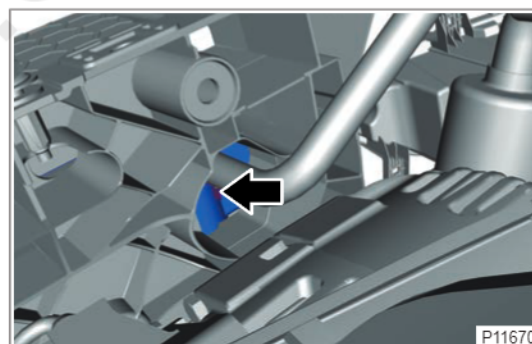
- (14) Loosen elastic clamps and disconnect engine inlet pipe connection.



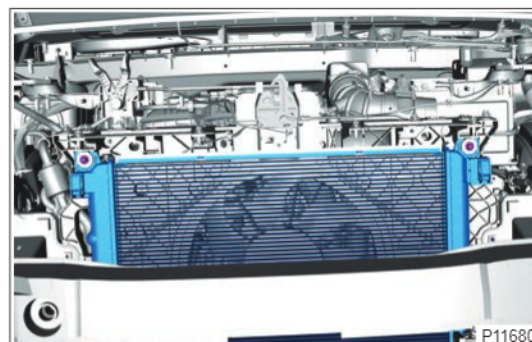
- (15) Loosen elastic clamps and disconnect engine outlet pipe connection.



- (16) Loosen the elastic clamp and disconnect the radiator discharge pipe.



- (17) Remove 2 fixing bolts and radiator assembly.



■ Inspection

- (1) Appearance inspection: Radiator is not allowed to be impacted and damaged, the fins are not allowed to be lodged and deformed. No residue is allowed inside the assembly and its section should smooth and flat.
- (2) Sealing inspection: Block water inlet and water outlet with expansion rubber plug, inject 30 - 80 KP compressed air to radiator. Soak radiator assembly into water tank, if there are bubbles, it indicates there is leakage in radiator assembly.

■ Installation

- (1) Remove 2 fixing bolts to cooling fan assembly.
- (2) Connect radiator discharge pipe and install elastic clamp.
- (3) Connect engine inlet pipe and install elastic clamp.
- (4) Connect engine outlet pipe and install elastic clamp.
- (5) Install condenser assembly.
- (6) Install cooler upper bracket assembly.
- (7) Install the left headlight crossmember assembly.
- (8) Install the right headlight crossmember assembly.
- (9) Install the left headlight assembly.
- (10) Install the right headlight assembly.
- (11) Install front bumper assembly.
- (12) Install the air filter assembly.
- (13) Connect the negative battery cable.
- (14) Install the engine compartment trim cover assembly.

6.9 Cooling Fan Assembly

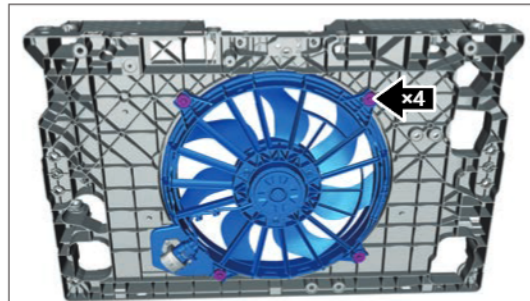
■ Removal

⚠ Warning

- **Temperature in engine compartment is very high when engine is running. Before removal, you must make sure that engine has shut off, and engine compartment has cooled down sufficiently, otherwise, there is a risk of scald injury.**
- **Be sure to wear safety equipment to prevent accidents, when removing cooling fan assembly.**
- **Appropriate force should be applied, when removing cooling fan 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 front bumper assembly.
- (6) Remove the right headlight assembly.
- (7) Remove the left headlight assembly.
- (8) Remove the right headlight crossmember assembly.
- (9) Remove the left headlight crossmember assembly.
- (10) Remove cooler upper bracket assembly.
- (11) Drain the coolant.
- (12) Recover the refrigerant.
- (13) Remove front plastic end and cooling module assembly.

- (14) Remove 4 fixing bolts from cooling fan assembly and front plastic end, and remove cooling fan assembly.



P10590

■ Installation

- (1) Remove 4 fixing bolts to cooling fan assembly.
- (2) Install front plastic end and cooling module assembly.
- (3) Install cooler upper bracket assembly.
- (4) Install the left and right headlight crossmember assembly separately.
- (5) Install the left and right headlight assembly separately.
- (6) Install front bumper assembly.
- (7) Install the A/C filter assembly.
- (8) Add the coolant.
- (9) Vacuum pumping/refrigerant recharging
- (10) Install the engine compartment trim cover assembly.

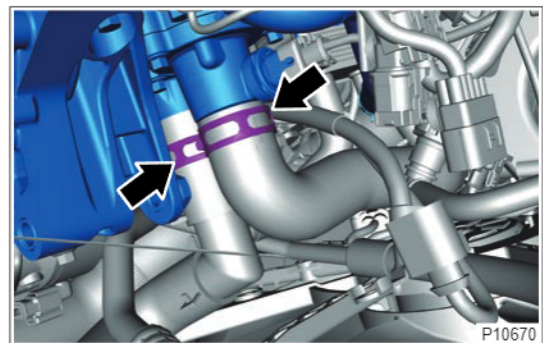
6.10 Water Pump Module Assembly

■ Removal

⚠ Warning

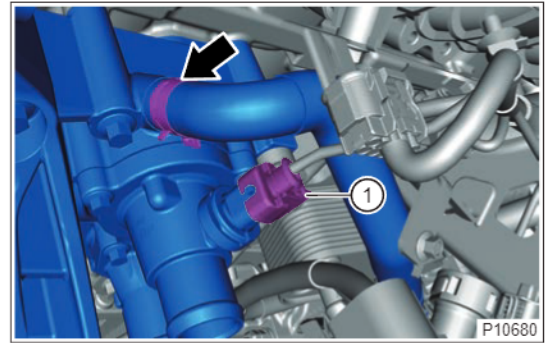
- **Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.**
- **If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.**
- **Be sure to wear necessary safety equipment to prevent accidents, when removing water pump module.**
- **Appropriate force should be applied when removing water pump module. 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 compartment lower protector assembly.
- (5) Remove the engine accessory belt.
- (6) Drain the coolant.
- (7) Remove the alternator assembly.
- (8) Loosen the elastic clamp and disconnect the connection between water pump module assembly and engine inlet pipe.
- (9) Loosen elastic clamp and disconnect connection between water pump module assembly and engine outlet pipe.

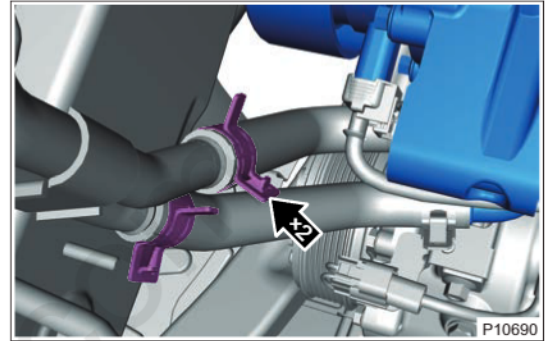


P10670

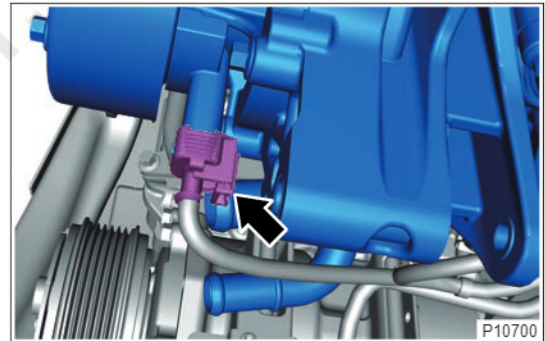
- (10) Disconnect the electronic thermostat connector (1), loosen elastic clamp and disconnect cooling pipe.



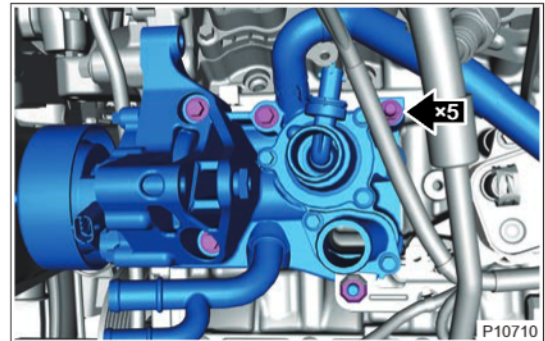
- (11) Loosen elastic clamp and disconnect connection between expansion tank and water supply pipe.



- (12) Disconnect the switch type water pump connector.



- (13) Remove 5 fixing bolts from water pump module.



- (14) Remove water pump module assembly carefully.

■ Inspection

- (1) Inspect water pump module gasket for wear or deterioration. If there is wear or deterioration, replace gasket.

■ Installation

- (1) Installation 5 fixing bolts to water pump module.

Torque: 20 + 5 N·m

- (2) Connect the switch type water pump connector.
- (3) Connect expansion tank inlet pipe and install elastic clamp.
- (4) Connect cooling pipe and install elastic clamp.
- (5) Connect the electronic thermostat connector.
- (6) Connect engine inlet pipe and install elastic clamp.
- (7) Connect engine outlet pipe and install elastic clamp.
- (8) Install the alternator assembly.
- (9) Install the engine accessory belt.
- (10) Add the coolant.
- (11) Install the front compartment lower protector assembly.
- (12) Install the engine compartment trim cover assembly.

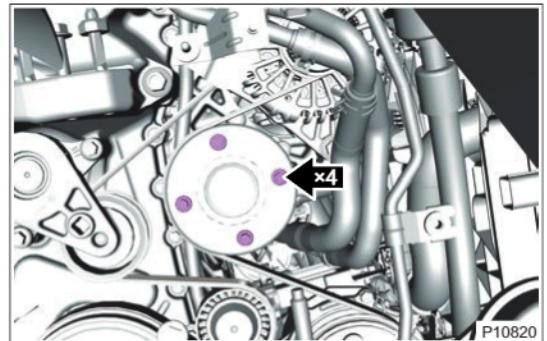
6.11 Water Pump Assembly

■ Removal

⚠ Warning

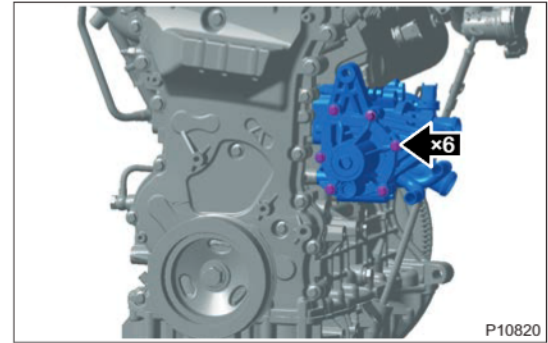
- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.
- Be sure to wear safety equipment to prevent accidents, when removing water pump assembly.
- Appropriate force should be applied, when removing water pump 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) Drain the coolant.
- (5) Loosen 4 fixing bolts from water pump pulley.



- (6) Remove fixing bolt and water pump pulley after engine accessory belt is removed.

- (7) Remove 6 fixing bolts from water pump assembly.



- (8) Remove the water pump assembly.

■ Inspection

- (1) Check if water pump bearing is excessive looseness; If there is excessive looseness, replace water pump assembly.

■ Installation

- (1) Install 6 fixing bolts to water pump assembly.

Torque: 8 + 3 N·m

- (2) Install water pump pulley.
 (3) Install the engine accessory belt.
 (4) Add the coolant.

6.12 Electronic Thermostat Assembly

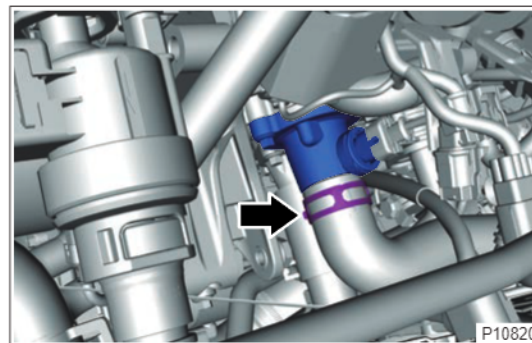
■ Removal

⚠ Warning

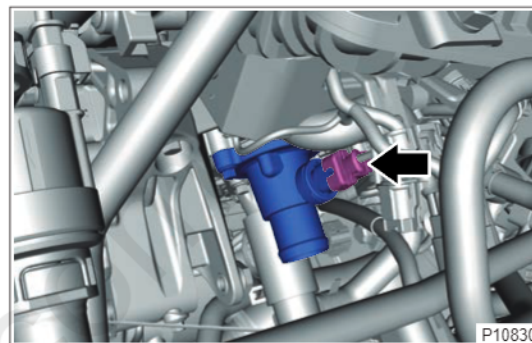
- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.
- Be sure to wear necessary safety equipment to prevent accidents, when removing water pump module.
- Appropriate force should be applied when removing water pump module. 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) Drain the coolant.
 (5) Remove the alternator assembly.

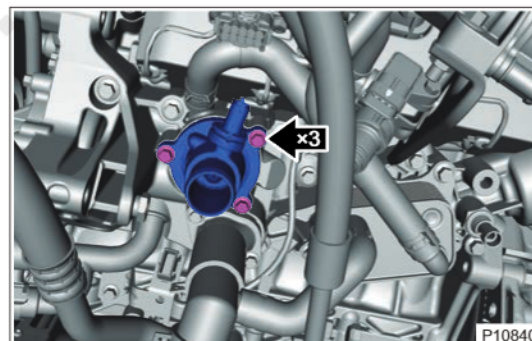
- (6) Loosen the elastic clamp and disconnect the connection between water pump module assembly and engine inlet pipe.



- (7) Disconnect the electronic thermostat connector.



- (8) Remove 3 bolts from electronic thermostat.



- (9) Remove the electronic thermostat.

■ Inspection

- (1) Check electronic thermostat grommet for damage.
- (2) As shown in illustration, check the electronic thermostat heating resistance with ohm band of multimeter.

Multimeter Connection	Specified value (Ω)
Terminal 1 - Terminal 2	15.3



⚠ Caution

- If resistance is not as specified, replace the electronic thermostat.

■ Installation

- (1) Install 3 fixing bolts to electronic thermostat.

Torque: 8 + 3 N·m

- (2) Connect the engine inlet pipe to water pump module, and install elastic clamp.
- (3) Connect the electronic thermostat connector.
- (4) Install the alternator assembly.
- (5) Install the engine compartment trim cover assembly.
- (6) Add the coolant.

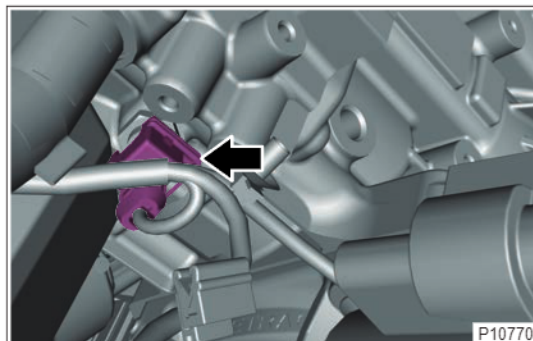
6.13 Coolant Temperature Sensor

■ Removal

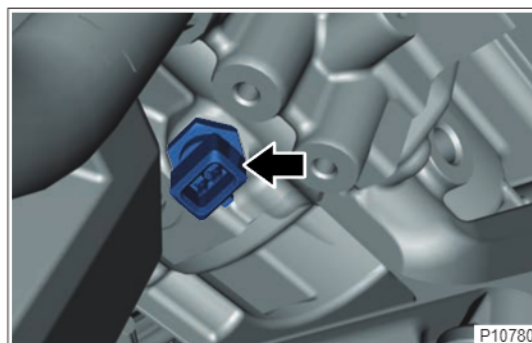
⚠ Warning

- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.
- Be sure to wear necessary safety equipment to prevent accidents, when removing coolant sensor.
- Appropriate force should be applied when removing coolant temperature sensor. 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 intake hose assembly.
- (5) Remove inter-cooling intake pipe II.
- (6) Disconnect the coolant temperature sensor connector.



- (7) Remove the coolant temperature sensor.



■ Inspection

- (1) The rated resistance measured by multimeter ohm band should be $2.5\text{ K}\Omega \pm 5\%$ at normal temperature, blow air to sensor with a hair dryer (be careful not to get too close), observe the changes of resistance, it should decrease with the increase of temperature.

■ Installation

- (1) Install the coolant temperature sensor.

Torque: $15 \pm 1\text{ N}\cdot\text{m}$

Seal gum: Loctite 577

- (2) Connect the coolant sensor connector.
 (3) Install intercooler intake pipe II .
 (4) Install the intake hose assembly.
 (5) Add the coolant.
 (6) Install the engine compartment trim cover assembly.

6.14 Electric Water Pump and Bracket

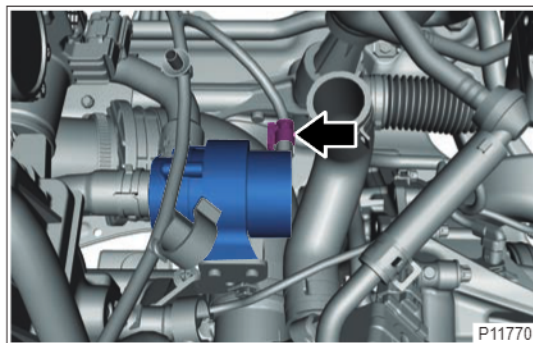
■ Removal

⚠ Warning

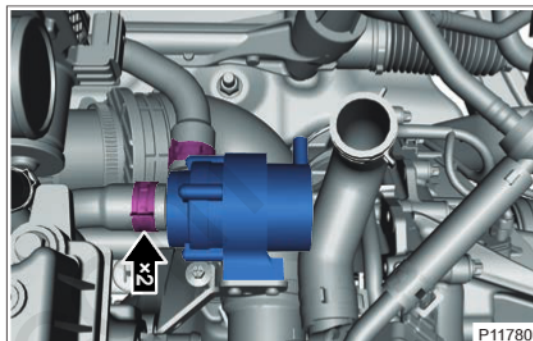
- Always make sure engine is cold before operating cooling system. Never open expansion tank cap or remove drain cock plug, when engine is operating or cooling system temperature is high. High-pressurized hot engine coolant and steam may flow out and cause serious burns.
- If your body contacts coolant accidentally, clean it with water immediately. If it is serious, please go to hospital.
- Be sure to wear safety equipment to prevent accidents, when removing electric water pump and bracket.
- Appropriate force should be applied when removing electric water pump and bracket. 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) Drain the coolant.
 (5) Remove the intake hose assembly.

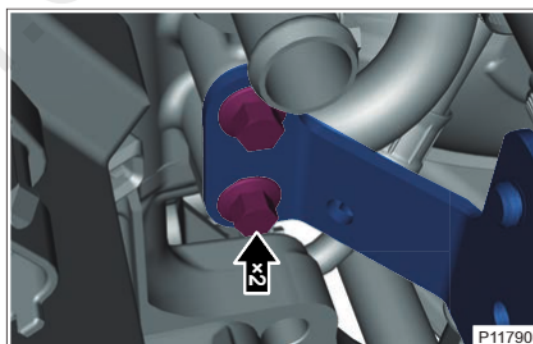
- (6) Disconnect the electric water pump connector.



- (7) Loosen elastic clamp and disconnect connection between water pipe and electric water pump



- (8) Remove 2 fixing bolts from electric water pump bracket and remove electric water pump and bracket.



■ Installation

- (1) Install 2 fixing bolts to electric water pump bracket.

Torque: 8 + 3 N·m

- (2) Install connection between water pipe and electric water pump, and install elastic clamp.
 (3) Connect the electric water pump connector.
 (4) Install the intake hose assembly.
 (5) Install the engine compartment trim cover assembly.
 (6) Add the coolant.