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2.8 Cooling System JL4G18-D

2.8.1 Specifications

2.8.1.1 Fastener Tightening Specifications

Applications	Model	Specifications	
		Metric (Nm)	US English (lb-ft)
Long Water Pump Mounting Bolt	M6 × 35	9-13	6.7-9.6
Short Water Pump Mounting Bolt	M6 × 25	8-10	6-7.4
Engine Coolant Temperature Sensor	M12 × 1.5	16-24	12-17.7
Fan Assembly Mounting Bolt	M6 × 15	8-10	6-7.4
Fan Motor Retaining Nut	M10	10	7.4
Fan Motor Retaining Screw	M4 × 14	2.4	1.8
Radiator Retaining Bolts	M8 × 25	10-11	7.4-8.1
Coolant Recovery Reservoir Retaining Bolts	M8 × 20	25	18.5
Engine Coolant Inlet Pipe Retaining Nut	M6	9-13	6.7-9.6
Coolant Valve Component	M10 × 1	25 and above	18.5 and above
Engine Coolant Inlet Pipe Component	M6	9-13	6.7-9.6

2.8.1.2 Cooling System Specifications

Applications	Specifications
Cooling	Coolant
Engine Coolant Specifications / Grades	Comply with SH0521 (Freezing Point ≤-40°C /-40 ºF)
Engine Coolant Capacity (Coolant Recovery Reservoir)	6.5 L (11.44 pt)
Thermostat Type	Wax-Type Thermostat
Pump Type	Impeller
Blade Diameter	60 mm (2.36 in)
Blades	6
Thermostat Opening Temperature	82°C (179.6 ºF)
Thermostat Fully Open Temperature	95°C (203 ºF)
Low Speed Cooling Fan Turned On	95°C (203 ºF)
Low Speed Cooling Fan Turned Off	90°C (194 ºF)
High Speed Cooling Fan Turned On	102°C (215.6 ºF)
High Speed Cooling Fan Turned Off	97°C (206.6 ºF)

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Applications	Specifications
Low Speed Cooling Fan Resistor	0.35 Ω

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2.8.2 Description and Operation

2.8.2.1 Description and Operation

When engine is working, the mixture combustion in the cylinder combustion chamber produces heat, which transfers through the cylinder block. If it is not cooled, the engine will not work. Inside the cylinder block, there is engine coolant path. Through the engine coolant flow, heat exchanges with the outside environment. This keeps the engine operating temperature within a certain range, so that the engine can work effectively in all operating conditions. When the engine is cooled, the cooling system controls the engine coolant flow amount through the thermostat. This makes the engine warm up quickly. Cooling system includes radiator, coolant recovery reservoir, cooling fan assembly, thermostat and housing, water pump and water pump drive belt. The water pump is driven by the accessory drive belt. Only when all the above components work properly, can the cooling system to work properly. When the engine coolant reaches the thermostat operating temperature, the thermostat opens. At this point, the engine coolant returns to the radiator and gets cooled. Cooling system guides part of the engine coolant through the pipes into the heater core, used for heating and defrost. Coolant Recovery Reservoir is connected to the radiator assembly for recycling discharged engine coolant, which is expanded due to the heat. The Coolant Recovery Reservoir is to maintain the correct engine coolant level.

Coolant Recovery Reservoir is a transparent plastic container, similar to the windshield washer tank. Coolant Recovery Reservoir connects to the engine cooling system and the radiator through two separate pipes. With the vehicle driving, the engine coolant temperature gradually increases and the coolant expands. Part of the engine coolant flows from the radiator into the coolant recovery reservoir as the result of expansion. When the engine is shut down, the engine coolant cools down and contracts, previously discharged engine coolant flows back to the radiator and the engine. This makes the engine coolant radiator maintain a suitable coolant level, and improves cooling efficiency. When the cooling system is cold, the engine coolant level should be kept between the MIN (minimum) and MAX (maximum) marks in the coolant recovery reservoir.

Cooling fan assembly is installed at the rear of the radiator in the engine compartment. It increases radiator and Air-Conditioning condenser air flow, and thus help accelerate the cooling when idling or at low speed. There are dual fans, high or low speed control modes controlled by two different motors. Master fan diameter is 310 mm (12.20 in), auxiliary fan diameter is 270 mm (10.63 in), both have five blades. Cooling fan assembly is controlled by the engine control module (ECM) using Low-Speed cooling fan relay and high speed cooling fan relay. In the Low-Speed circuit, the series has a 0.35 Ω current-limiting resistor. When the engine coolant temperature reaches 95°C (203 ºF), the engine control module enables Low-Speed cooling fan assembly operation, and when the engine coolant temperature reaches 102°C (215.6 ºF), it enables the High-Speed cooling fan operation. When the temperature is back to 97°C (206.6 ºF), the engine cooling fan control module will switch the cooling fan from high to low, when the temperature drops to 90°C (194 ºF), the fan will be off.

Warning!

Even if the engine is not running, the cooling fan under the engine compartment may still start and cause injury. Keep hands, clothing and tools away from the cooling fan under the engine compartment.

Warning!

If there is any degree of fan blades bending or damage, do not repair or reuse the damaged parts. The bent or damaged fan blades must be replace. Damaged fan blades can not guarantee the normal balance and continuous use, and may fly off, which is very dangerous.

Warning!

As long as there is cooling system pressure, even though the solution in the radiator is not boiled, the solution temperature will be much higher than the water boiling point. If the engine is not cooled and the pressure is still high, and the pressure cover is opened, the engine coolant will be immediately boiled and will spray onto the engine, fenders and the person opening the radiator pressure cap.

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2.8.3 System Working Principle

2.8.3.1 System Working Principle

- Cold Engine: the engine normal operating temperature is generally around 95°C (203 ºF), in this temperature range, all the engine parts running status will be ideal. If the engine can not reach the ideal operating temperature in a long time,it will increase the parts wear and tear. Because of low temperature, the mixture combustion will be inadequate, and there will be excessive carbon residue. The engine heat exchange must be kept minimum so the engine can reach normal working temperatures in a short period of time. At this point the thermostat controls the engine coolant only circulates within the engine block, bringing the heat from the cylinder wall to the other engine parts, so that the temperature increases rapidly. Water pumps makes the engine coolant flow in the cylinder block, then in the engine block water jacket, throttle body and cylinder head cover. This is called "small loop".
- Engine at normal working temperature: With the engine running, the engine coolant temperature quickly increases, when the thermostat reaches 82°C (179.6 ºF), the engine coolant is drawn into the engine block water jacket, intake manifolds, cylinder head and radiator by the water pump. This is called "big loop".
- Thermostat: the thermostat's role is to control engine coolant flow in the cooling system. Thermostat is installed in the front of the engine and sealed by the engine intake pipe joints components, located in the front of the cylinder head cover. Thermostat can prevent the engine coolant flow from the engine to the radiator, warm up the engine quickly and adjust the engine coolant temperature. When the engine coolant temperature is low, the thermostat in the closed position, preventing the engine coolant circulating through the radiator. At this point, it only allows the engine coolant circulates through the heater core, and thus quickly and evenly warm up the engine. When the engine is warm, the thermostat opens. The engine coolant flows through radiator and exchanges the heat. Thermostat opening and closing, allow sufficient engine coolant enter into the radiator, maintain the engine at normal operating temperature range. The wax ball inside the thermostat is sealed in a metal casing. Thermostat wax ball thermal expands when warm and contracts when cold. As the vehicle drives and the engine warms up, engine coolant temperature increases. When the engine coolant reaches the required temperature, the thermostat wax ball expands, puts pressure on the metal shell and opens the valve. This allows the engine cooling fluid flow through the engine cooling system and engine cools down, when the wax ball contracts, under the action of the spring, the valve will close. Thermostat opening temperature is 82°C (179.6 ºF), and fully open temperature is 95°C (203 ºF).
- Cooling Fan Low-Speed Circuit Description: Engine cooling fan circuit controls the main cooling fan and auxiliary cooling fan. Cooling fan is controlled by the engine control module (ECM) according to the engine coolant temperature sensor and air pressure switch inputs. ECM monitors conditions that meet the cooling fan Low-Speed running conditions, ECM controls the engine wiring harness connector EN01 terminal No.62 internal ground, and the Low-Speed cooling fan relay pull-in. Power passes through the low speed relay terminal No.87 to reach the cooling fan wiring harness connector CA16 terminal No.1 and then through the speed limit resistor, and finally reaches to the paralleled two fan motors. Fan motors negative is connected to the ground through the cooling fan wiring harness connector CA16 terminal No.3. Therefore, the Low-Speed fan motor starts running.

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- Cooling Fan High-Speed Circuit Description: The engine control module receives the engine coolant temperature sensor and air pressure switch signals. ECM monitors conditions that meet the cooling fan how-speed running conditions, ECM controls the engine wiring harness connector EN01 terminal No.52 internal ground, and the how-speed cooling fan relay pull-in. Power passes through the how speed relay terminal No.87 to reach the cooling fan wiring harness connector CA16 terminal No.2 and then through the speed limit resistor, and finally reaches to the paralleled two fan motors. Fan motors negative is connected to the ground through the cooling fan wiring harness connector CA16 terminal No.3. Therefore, the how-speed fan motor starts running.

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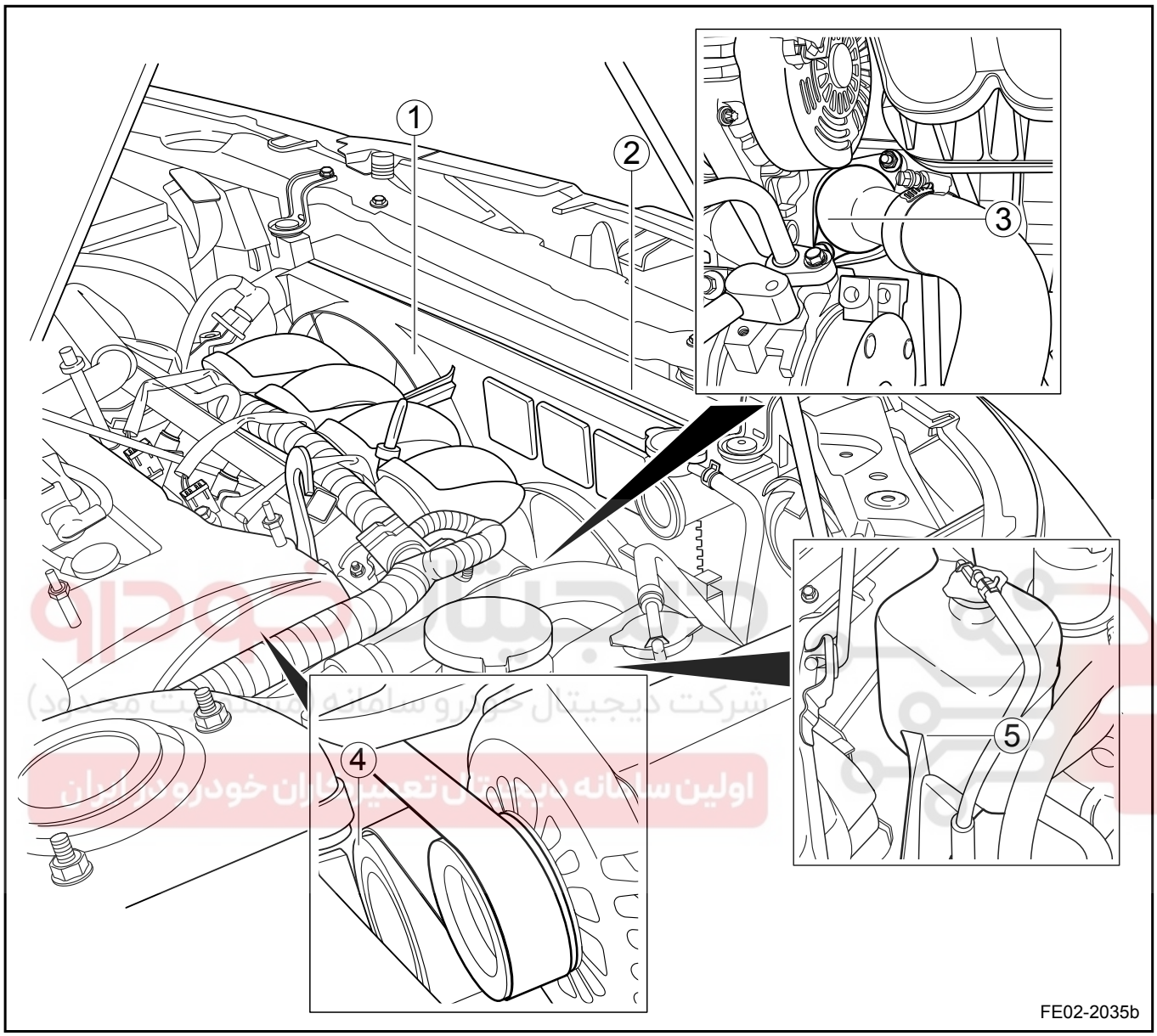
2.8.4 Component Locator

2.8.4.1 Component Locator



Legend

1. Cooling Fan
2. Radiator Assembly
3. Thermostat
4. Pump
5. Coolant Recovery Reservoir

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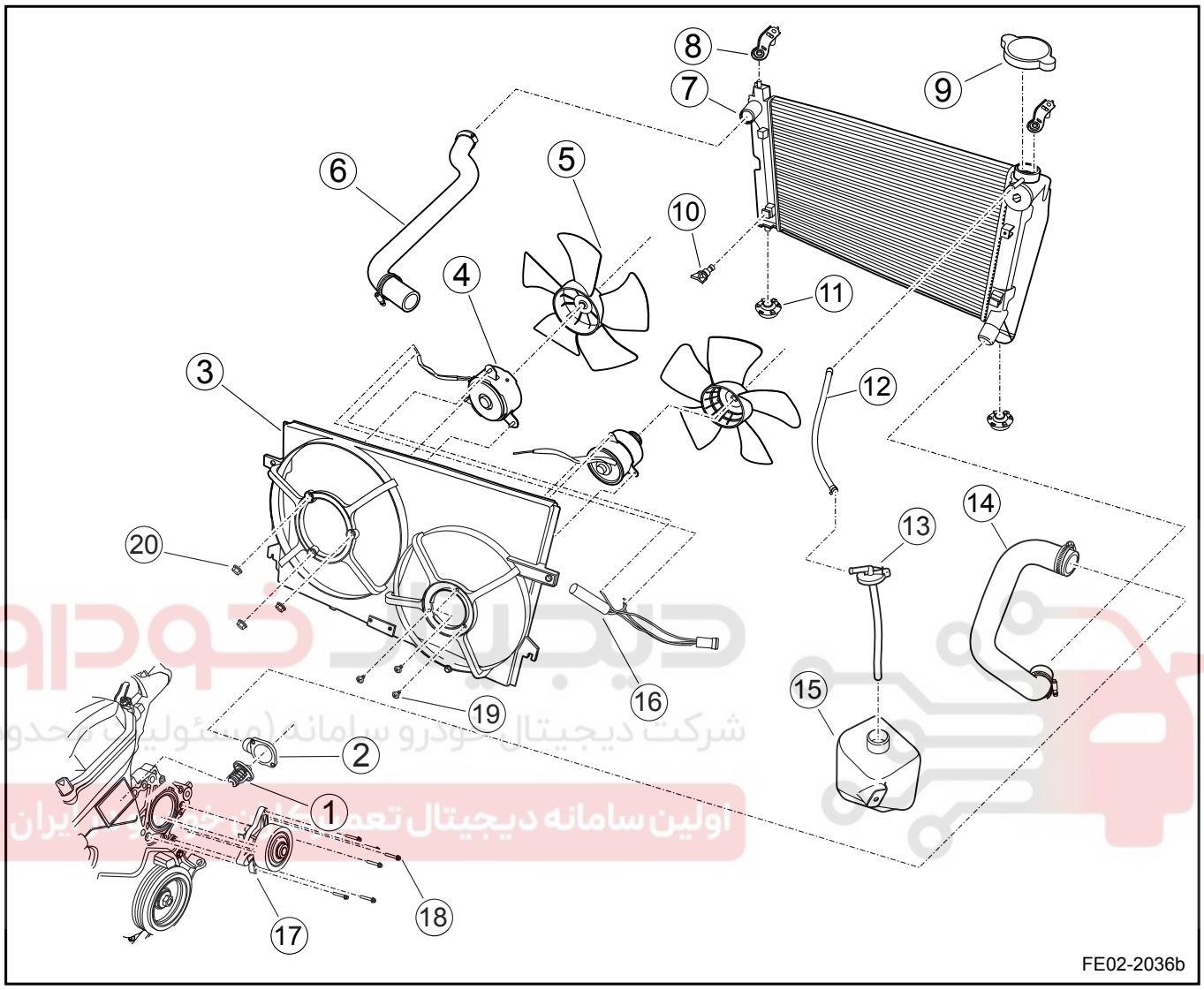
2.8.5 Disassemble View

2.8.5.1 Disassemble View



Legend

1. Thermostat
2. Engine Coolant Inlet Component
3. Cooling Fan Shroud
4. Fan Motor
5. Fan Blades
6. Radiator Inlet Hose
7. Radiator
8. Radiator Upper Mounting Brackets
9. Radiator Cap
10. Engine Coolant Outlet Valve
11. Radiator Lower Vibration Pad
12. Radiator Overflow Pipe
13. Coolant Recovery Reservoir Pressure Cap
14. Radiator Outlet Hose
15. Coolant Recovery Reservoir
16. Fan Low-Speed Current-Limiting Resistor
17. Water Pump
18. Water Pump Bolts
19. Fan Motor Retaining Bolt
20. Fan Motor Retaining Nut

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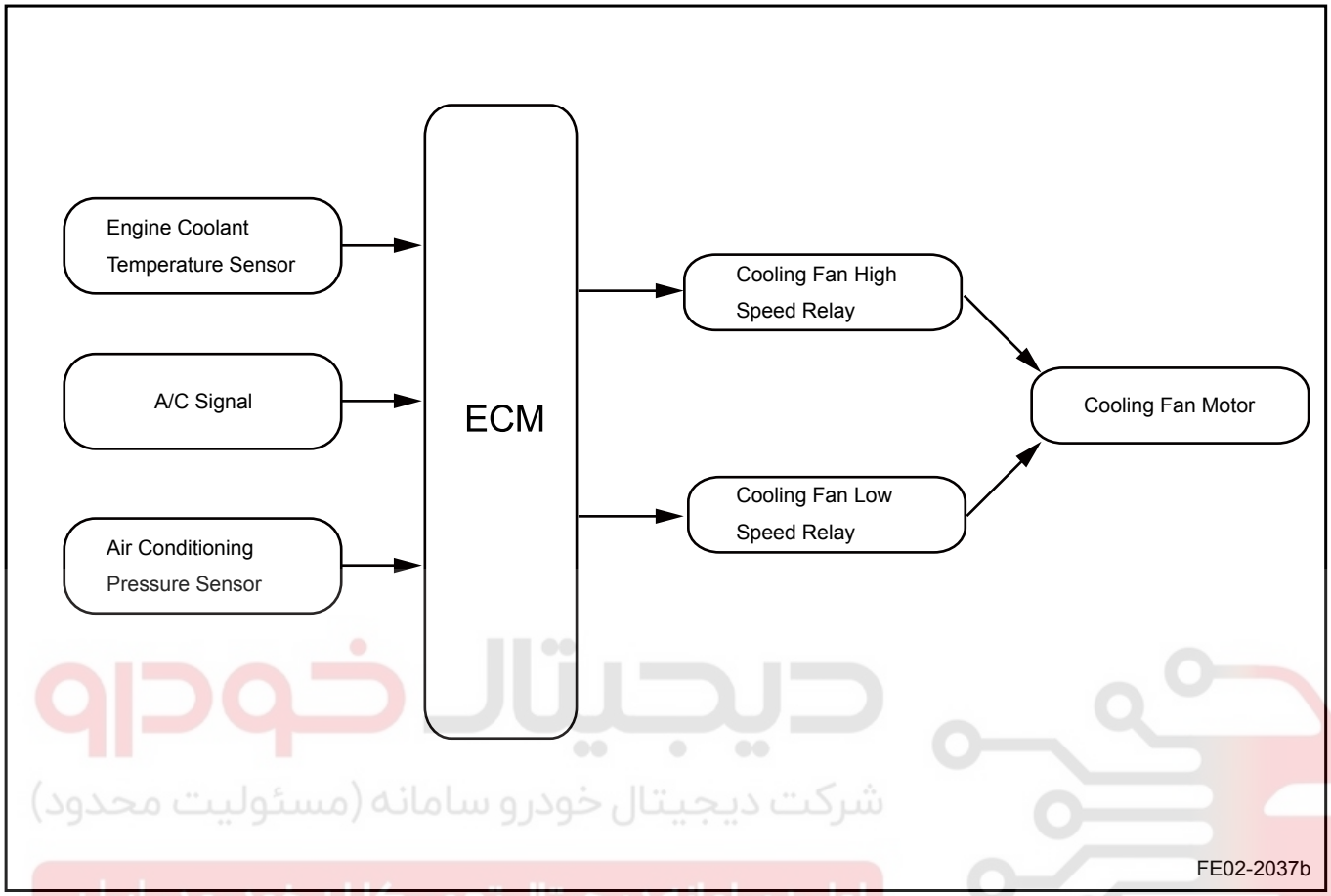
2.8.6 Schematic

2.8.6.1 Schematic



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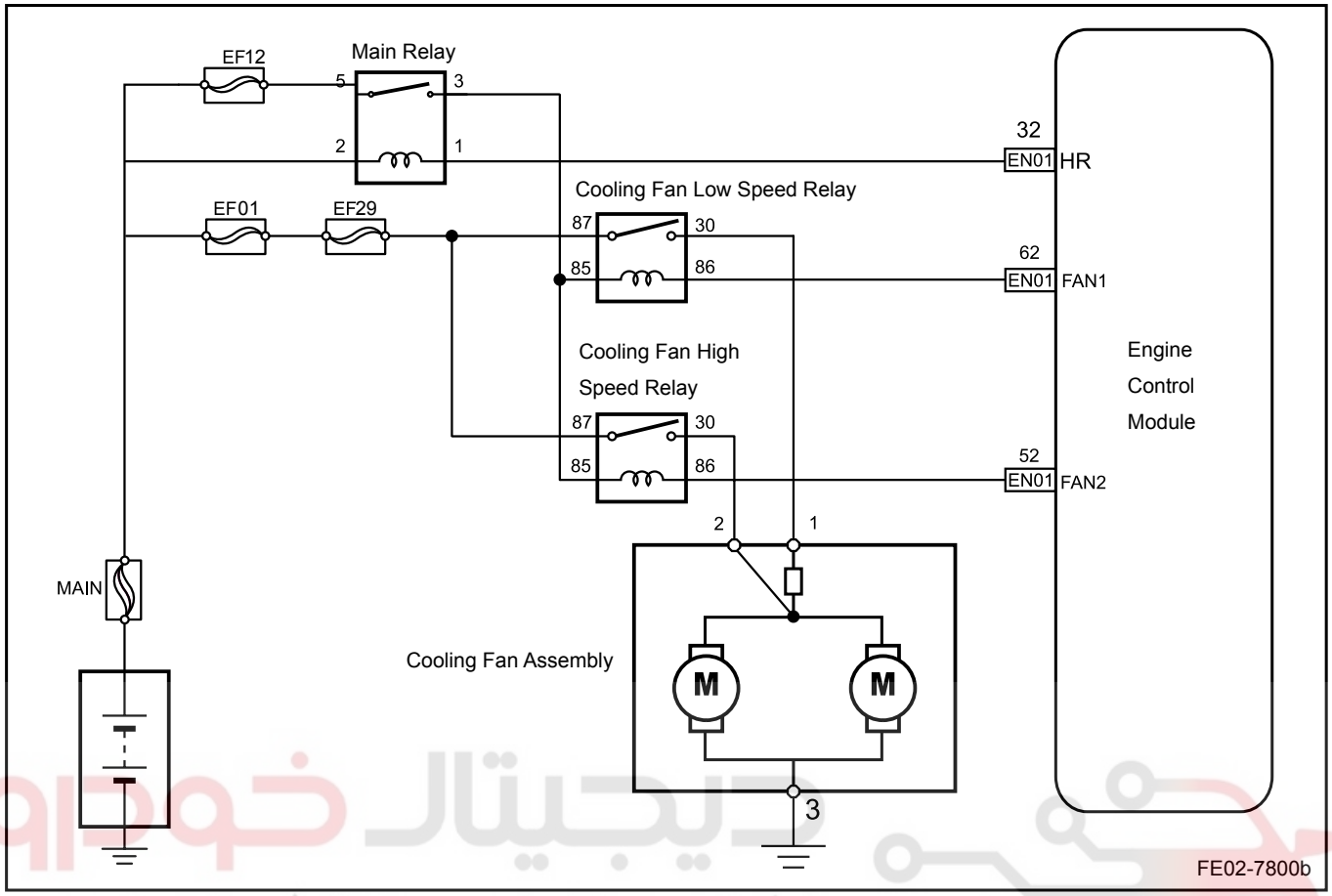

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2.8.7 Diagnostic Information and Procedures

2.8.7.1 Diagnosis Description

Refer to 2.8.2.1 Description and OperationGet familiar with the system functions and operation before start system diagnostics, so that it will help to determine the correct diagnostic steps, more importantly, it will also help to determine whether the customer described situation is normal.

2.8.7.2 Cooling Fan Circuit Diagnosis

Diagnostic Tips:

- If a customer complains an overheating fault, verify whether it is because the engine coolant boiling or the engine coolant temperature gage is indicating overheating. If the engine is overheated, but the cooling fan still runs normally, check the engine cooling system.
- If the underhood fuse EF29 fuses immediately after installation, check whether the cooling fan high and low speed relay and cooling fan motor wire is short to ground. If the fuse fuses immediately after the engine control module pull-in, then the cooling fan motor may be faulty.
- When the air-conditioning system is running, the engine control module controls the cooling fan running at low speed. When the air-conditioning high pressure reaches 1,520 kPa (220.5 psi), the engine cooling fan control module will switch the cooling fan from low to high speed. When the air-conditioning high pressure drops back to 1,450 kPa (210.3 psi), the cooling fan will return low-speed.
- Scan tool can be used in the "Function Test" to drive high or low speed cooling fan relay pull-in. Check whether the fan works normally in order to quickly determine the fault.

Note

Before carry out this diagnostic procedures, check whether the underhood fuse EF29 is normal and main relay is working properly. When use scan tool "Action Test", make sure the scan tool communication with ECM is normal.

Step 1	Verify the fault.

Next

Step 2	Confirm whether the Low-Speed cooling fan runs.

(a) Turn the ignition switch to "OFF" position.
(b) Connect scan tool to the datalink connector.
(c) Start the engine to normal working temperature.
(d) Turn off the A/C switch.
(e) Select in sequence: Engine / Data List / Engine Coolant Temperature.
(f) When the engine coolant temperature displays 95°C (203 ºF) the cooling fan should be running at low speed.

Does the low speed cooling fan run?

No → Refer to 2.8.7.4 Low-Speed Cooling Fan Does Not Run

Yes

Step 3	Confirm whether the high-speed cooling fan runs.

(a) Turn off the A/C switch.

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(b) When the engine coolant temperature displays 102°C (215.6 °F) The cooling fan should be running at high speed.

Does the high speed cooling fan run?

No → Refer to 2.8.7.3 High-Speed Cooling Fan Does Not Run

Yes

Step 4	Turn on the A/C switch, confirm whether the Low-Speed cooling fan runs.

(a) Turn the ignition switch to "OFF" position.
(b) Connect scan tool to a datalink connector.
(c) Select in sequence: Engine / Data List / Engine Coolant Temperature.
(d) When the engine coolant temperature is below 90°C (194 °F) Start the engine, turn on the A/C switch, cooling fan should be running at low speed.

Does the low speed cooling fan run?

No → A/C system fault. Refer to 8.2.7 Diagnostic Information and Procedures

Yes

Step 5	Intermittent Fault. Refer to 2.2.7.3 Intermittent Fault Check.

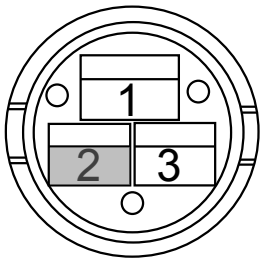
2.8.7.3 High-Speed Cooling Fan Does Not Run

Note

Before carry out this diagnostic procedures, please Refer to the 2.8.7.2 Cooling Fan Circuit Diagnosis, which will facilitate the Diagnostic.

Step 1	check the high-speed cooling fan power supply .

Cooling Fan Harness Connector CA16



FE02-7801b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cooling fan wiring harness connector CA16.
(c) Turn the ignition switch to "ON" position.
(d) Connect scan tool to the datalink connector.
(e) Select in sequence: Engine / Action Test / Fan 2.
(f) Make the high-speed relay work.
(g) Measure voltage between CA16 cooling fan wiring harness connector terminal No.2 and a reliable ground.

Standard Voltage: 11-14 V

Is the voltage specified Value?

No → Go to step 4

Yes

Step 2	Check the cooling fan ground circuit.

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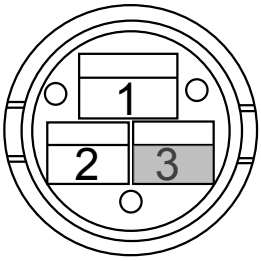
Cooling Fan Harness Connector CA16



FE02-7802b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cooling fan wiring harness connector CA16.
(c) Measure resistance between cooling fan wiring harness connector CA16 terminal No.3 and a reliable ground.

Standard Resistance: Less than 1 Ω

Is the resistance specified Value?

No → CA16 terminal No.3 poor connection to ground. inspect and repair faulty parts.

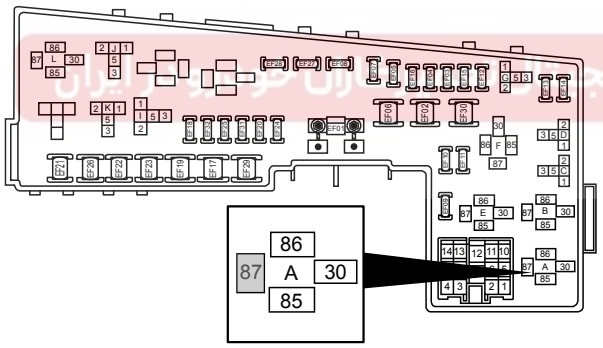
Yes

Step 3	Replace the cooling fan assembly.
Step 4	Use scan tool "Action Test" to drive the fan 2. Does the High-Speed relay work?

No → Go to step 8

Yes

Step 5	Check the high-speed relay A terminal No.87 input power supply.



FE02-7803b

(a) Turn the ignition switch to "OFF" position.
(b) Remove the high-speed cooling fan relay A.
(c) Measure voltage between high-speed cooling fan relay A terminal No.87 and a reliable ground.

Standard Voltage: 11-14 V

Is the voltage specified Value?

No → Relay A terminal No.87 circuit is faulty. inspect and repair the faulty parts

Yes

Step 6	Check the fan high-speed relay A wiring harness and cooling fan harness connector CA16 wiring harness..

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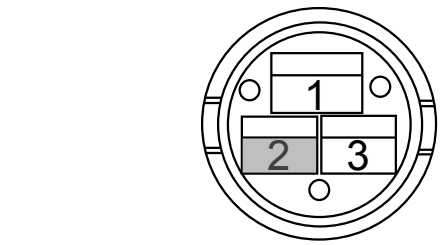
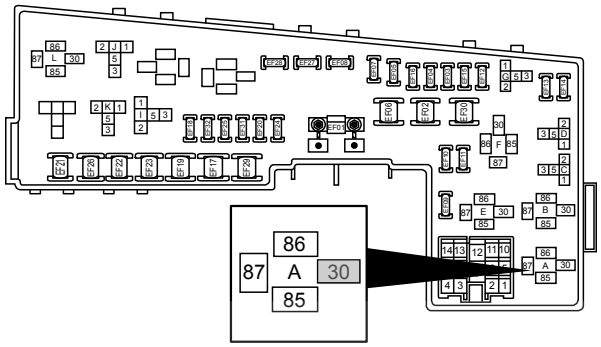
Cooling Fan Harness Connector CA16





FE02-7804b

(a) Turn the ignition switch to "OFF" position.
(b) Remove the high-speed cooling fan relay.
(c) Disconnect the cooling fan wiring harness connector CA16.
(d) Test the continuity between the high-speed cooling fan relay A terminal No.30 and the cooling fan wiring harness connector CA16 terminal No.2.
(e) Measure resistance between the high-speed cooling fan relay A terminal No.30 and a reliable ground. check whether there is a short to ground circuit.

Standard Value:

Test Items	Specified Value
Relay A (30)-CA16 (2)	Less than 1 Ω
Resistance Between Relay A (30) and A Reliable Ground	10 kΩ or higher

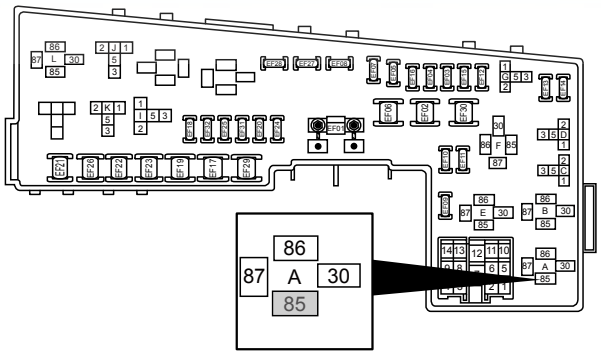
Is the measured value specified value?

No

Circuit between the relay terminal No.30 and the cooling fan wiring harness connector CA16 terminal No.2 is fault. check and Repair the faulty part.

Yes

Step 7	Replace the high-speed cooling fan relay A. Confirm the fault has been fixed.
Step 8	Check high-speed relay A coil power supply.



FE02-7805b

(a) Turn the ignition switch to "OFF" position.
(b) Remove the high-speed cooling fan relay A.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between high-speed cooling fan relay 85 terminal A and a reliable ground.

Standard Voltage: 11-14 V

Is the voltage specified value?

No

Circuit between relay 85 terminals and the main relay terminal No.3 is open.

Yes

Step 9	Check the high-speed relay A control circuit.

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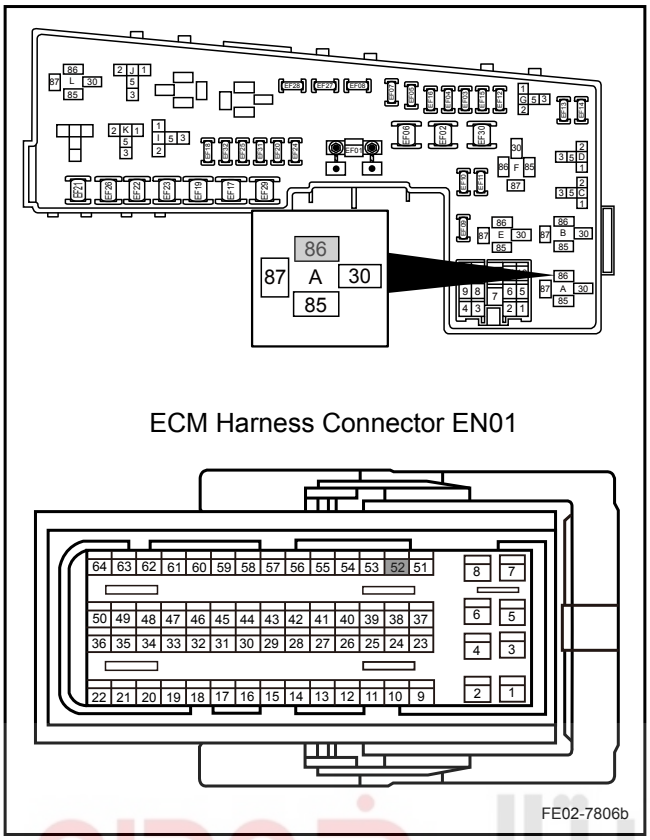

ECM Harness Connector EN01

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EN01.
(c) Remove the high-speed cooling fan relay A.
(d) Test the continuity between the high-speed cooling fan relay 86 terminal A and EN01 terminal No.52.
(e) Measure voltage between high-speed cooling fan relay 86 terminal A and a reliable ground. check whether the circuit is short to power supply.

Standard Value:

Test Items	Specified Value
Relay A (86)-EN01 (52)	Less than 1 Ω
Relay A (86) - A Reliable Ground	0 V

Is the measured value specified value?

No → Circuit between Relay 86 terminal A and EN01 terminal No.52 is open. check and repair the relevant parts.

Yes

Step 10	Check ECM circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 11	Replace ECM.

Next

Step 12	Diagnostic completed.

2.8.7.4 Low-Speed Cooling Fan Does Not Run

Note

Before carry out this diagnostic procedures, please Refer to the2.8.7.2Cooling Fan Circuit Diagnosis, which will facilitate the Diagnostic.

Step 1	Check the low-speed cooling fan power supply.

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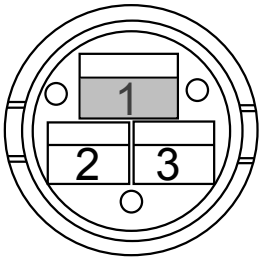
Cooling Fan Harness Connector CA16



FE02-7807b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect cooling fan wiring harness connector CA16.
(c) Turn the ignition switch to "ON" position.
(d) Connect scan tool to the datalink connector.
(e) Select in sequence: Engine / Action Test / Fan 1.
(f) Make low-speed relay work.
(g) Measure voltage between CA16 cooling fan wiring harness connector terminal No.1 and a reliable ground.

Standard Voltage: 11-14 V

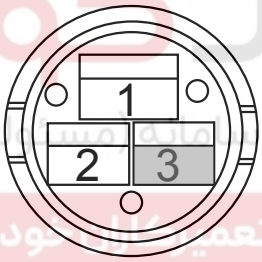
Is the voltage specified value?

No → Go to step 4

Yes

Step 2	Check the cooling fan ground circuit.

Cooling Fan Harness Connector CA16



FE02-7802b

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect the cooling fan wiring harness connector CA16.
(c) Measure resistance between cooling fan wiring harness connector CA16 terminal No.3 and a reliable ground.

Standard Resistance: Less than 1 Ω

Is the resistance specified value?

No → CA16 terminal No.3 poor connection to ground. Inspect and repair the faulty parts.

Yes

Step 3	Replace the cooling fan assembly.
Step 4	Use scan tool "Action Test" to drive fan 1. Does the low speed relay work?

No → Go to step 8

Yes

Step 5	Check relay B terminal No.87 power supply.

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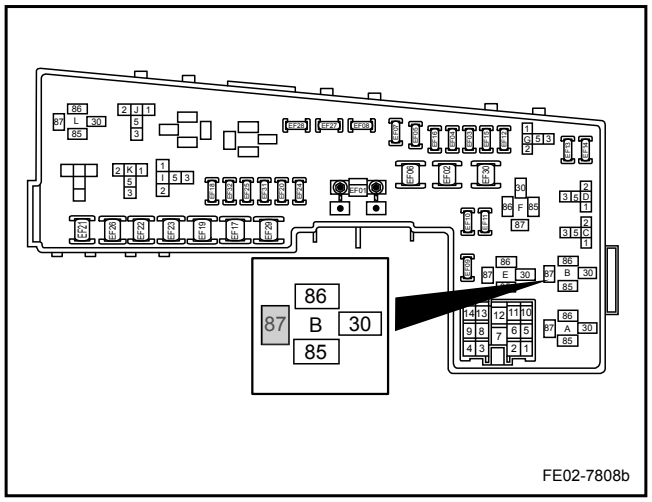


(a) Turn the ignition switch to "OFF" position.
(b) Remove the low-speed cooling fan relay B.
(c) Measure voltage between cooling fan relay B terminal No.87 and a reliable ground.

Standard Voltage: 11-14 V

Is the voltage specified value?

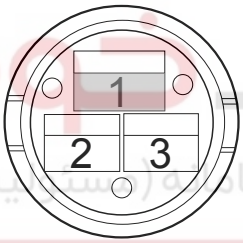
No

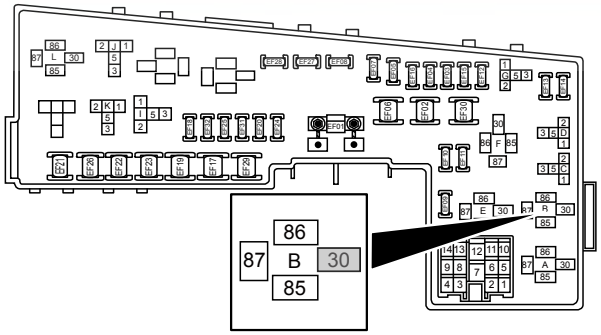
Relay B terminal No.87 power circuit is faulty. Inspect and repair the faulty parts.

Yes

Step 6	Check the circuit between low-speed cooling fan relay and cooling fan wiring harness connector CA16.

Cooling Fan Harness Connector CA16





(a) Turn the ignition switch to "OFF" position.
(b) Remove low-speed cooling fan relay.
(c) Disconnect cooling fan wiring harness connector CA16.
(d) Test the continuity between the Low-Speed cooling fan relay B terminal No.30 and cooling fan wiring harness connector CA16 terminal No.1.
(e) Measure resistance between cooling air speed relay B terminal No.30 and a reliable ground. check whether there is a short to ground circuit.

Standard Value:

Test Items	Specified Value
Relay B (30)-CA16 (1)	Less than 1 Ω
Resistance Between Relay B (30) and A Reliable Ground	10 kΩ or higher

Is the voltage specified value?

No

Circuit between the relay terminal No.30 and the cooling fan wiring harness connector CA16 terminal No.1 is faulty. Check and Repair the faulty part.

Yes

Step 7	Replace the cooling fan low speed relay B. Confirm whether the fault has been fixed.
Step 8	Check low-speed relay B coil power supply.

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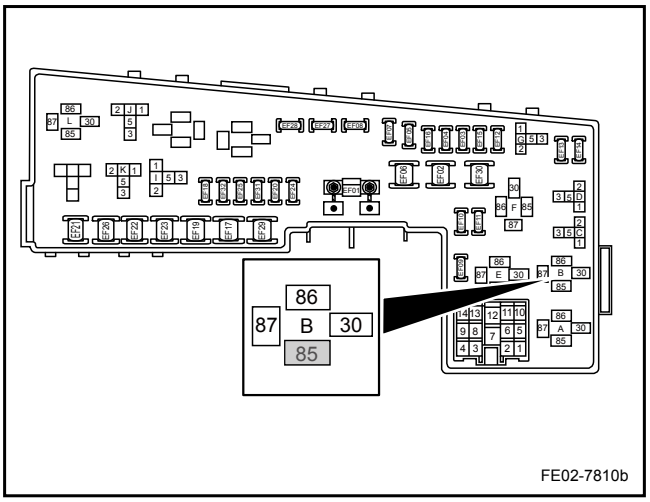


(a) Turn the ignition switch to "OFF" position.
(b) Remove the low-speed cooling fan relay B.
(c) Turn the ignition switch to "ON" position.
(d) Measure voltage between relay B terminal No.85 and a reliable ground.

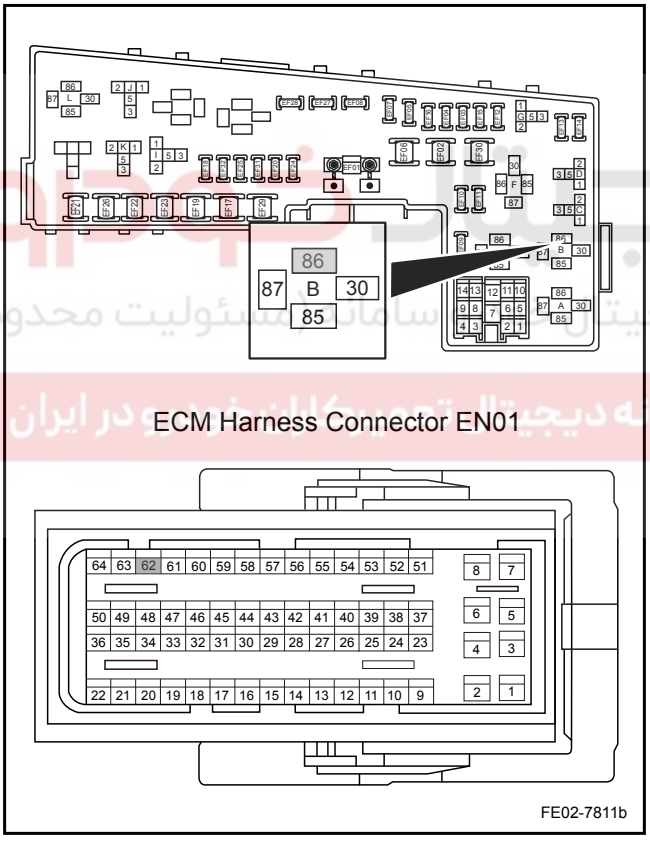
Standard Voltage: 11-14 V

Is the voltage specified value?

No → Circuit between relay terminal No.85 and the main relay terminal No.3 is open.

Yes

Step 9	Check low-speed relay B control circuit.



(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EN01.
(c) Remove the low-speed cooling fan relay B.
(d) Test the continuity between the cooling fan low speed relay B terminal No.86 and EN01 terminal No.62.
(e) Measure voltage between high-speed cooling fan relay B terminal No.86 and a reliable ground. Check whether there is a circuit short to power supply.

Standard Value:

Test Items	Specified Value
Relay B (86)-EN01 (62)	Less than 1 Ω
Relay B (86) - Reliable Ground	0 V

Is the measured value specified values?

No → Circuit between relay B terminal No.86 and EN01 terminal No.62 is open.

Yes

Step 10	Check ECM circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

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Yes

Step 11	Replace ECM.

Next

Step 12	Diagnostic completed.

2.8.7.5 Cooling Fan Always Runs At Low Speed

Note

When the cooling fan always runs at low speed, it is recommended to carry out diagnostic when the engine is completely cooled down.

Step 1	Verify the fault.

Next

Step 2	Check the engine coolant temperature sensor signal.

(a) Turn the ignition switch to "OFF" position.
(b) Connect scan tool to the datalink connector.
(c) Turn off the A/C switch.
(d) Turn the ignition switch to "ON" position.
(e) Select in sequence: Engine / Data List / Engine Coolant Temperature.
(f) Observe the temperature measured by the engine coolant temperature sensor. When the engine is completely cooled down, this temperature should be slightly higher than the ambient temperature.

Confirm whether the measured temperature is normal.

No → Temperature sensor or circuit is faulty. Refer to the2.2.7.19DTC P0117 P0118

Yes

Step 3	Remove and check the cooling fan low speed relay. Does the cooling fan still run?

No → Go to step 5

Yes

Step 4	Check and repair the circuit between low-speed cooling fan relay and cooling fan wiring harness connector CA16.

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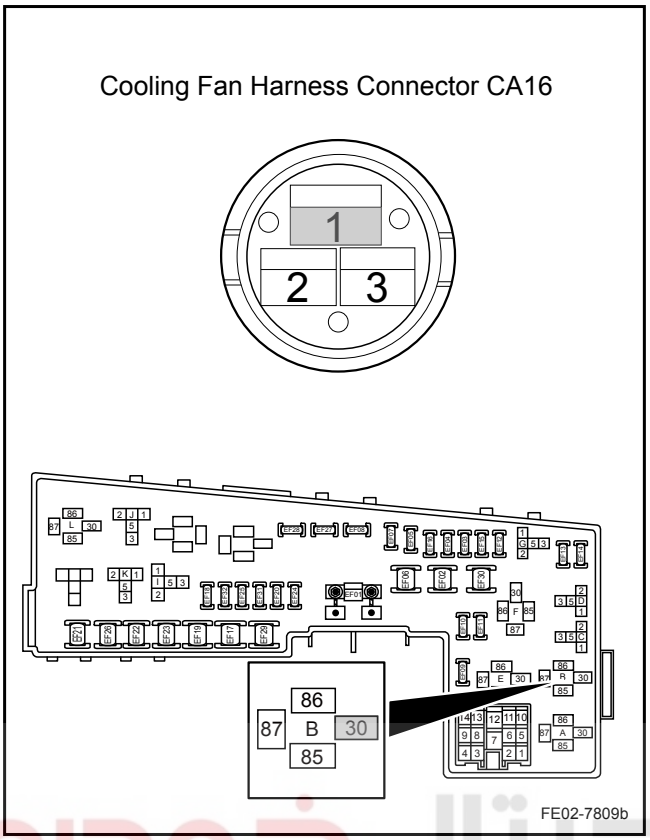

(a) Turn the ignition switch to "OFF" position.
(b) Remove of low-speed cooling fan relay.
(c) Disconnect cooling fan wiring harness connector CA16.
(d) Check and repair circuit between relay and connector short to power supply.

Step 5	Check cooling fan low speed relay.

(a) Measure resistance between relay terminal No.87 and terminal No.30.

Standard Resistance: 10 kΩ or higher

Is the resistance specified value?

No → Replace the relay.

Yes

Step 6	Check low-speed relay B control circuit.

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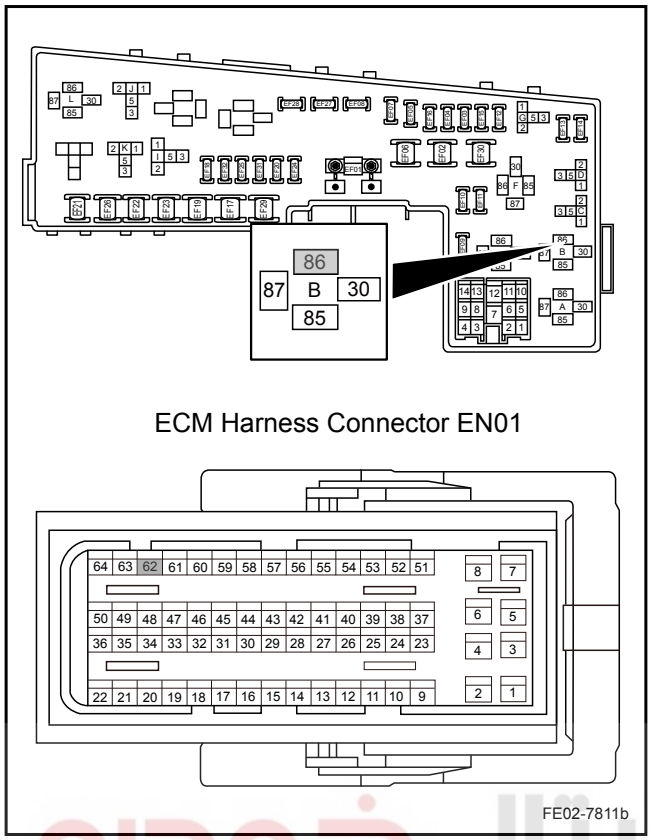

ECM Harness Connector EN01

(a) Turn the ignition switch to "OFF" position.
(b) Disconnect ECM harness connector EN01.
(c) Remove low-speed cooling fan relay B.
(d) Test the continuity between cooling fan low speed relay B terminal No.86 and ECM harness connector EN01 terminal No.62.
(e) Measure resistance between cooling fan low speed relay B terminal No.86 and a reliable ground. check whether there is a short to ground circuit.

Standard Value:

Test Items	Specified Value
Relay B (86)-EN01 (62)	Less than 1 Ω
Relay B (86) - Reliable Ground	10 kΩ or higher

Is the measured value specified Value?

No → Circuit between relay B terminal No.86 and EN01 terminal No.62 is faulty.

Yes

Step 7	Check ECM circuit.

(a) Check whether ECM power supply circuit is normal.
(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

Next

Step 9	Diagnostic completed.

2.8.7.6 Cooling Fan Always Runs At High Speed

Note

When the cooling fan always runs at high speed, it is recommended to carry out diagnostic when the engine is completely cooled down.

Step 1	Verify the fault.

Next

Step 2	Check the engine coolant temperature sensor signal.

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(a) Turn the ignition switch to "OFF" position.
(b) Connect scan tool to the datalink connector.
(c) Turn off the A/C switch.
(d) Turn the ignition switch to "ON" position.
(e) Select in sequence: Engine / Data List / Engine Coolant Temperature.
(f) Observe the temperature measured by the engine coolant temperature sensor. When the engine is completely cooled down, this temperature should be slightly higher than the ambient temperature.

Confirmation shows the temperature is normal.

No → Temperature sensor or circuit is faulty. Refer to 2.2.7.19 DTC P0117 P0118

Yes

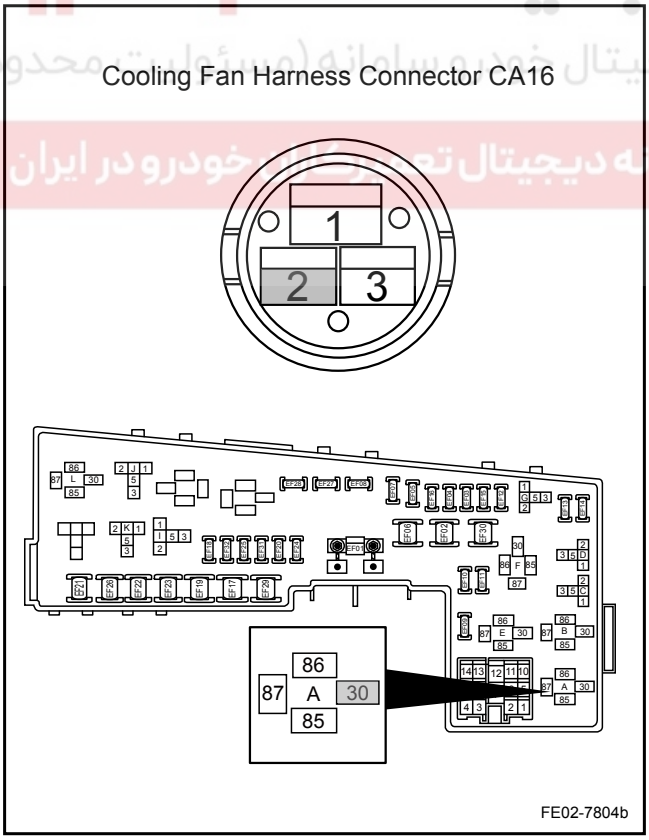
Step 3	Remove and check the cooling fan high speed relay. Does the cooling fan still run?

No → Go to step 5

Yes

Step 4	Check and repair the circuit between high-speed cooling fan relay and cooling fan wiring harness connector SCA16.

Cooling Fan Harness Connector CA16



(a) Turn the ignition switch to "OFF" position.
(b) Remove High-Speed cooling fan relay.
(c) Disconnect cooling fan wiring harness connector CA16.
(d) Check and repair the circuit between relay and connector short to power supply.

Step 5	check cooling fan high speed relay.

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(a) Measure resistance between relay terminal No.87 and terminal No.30.

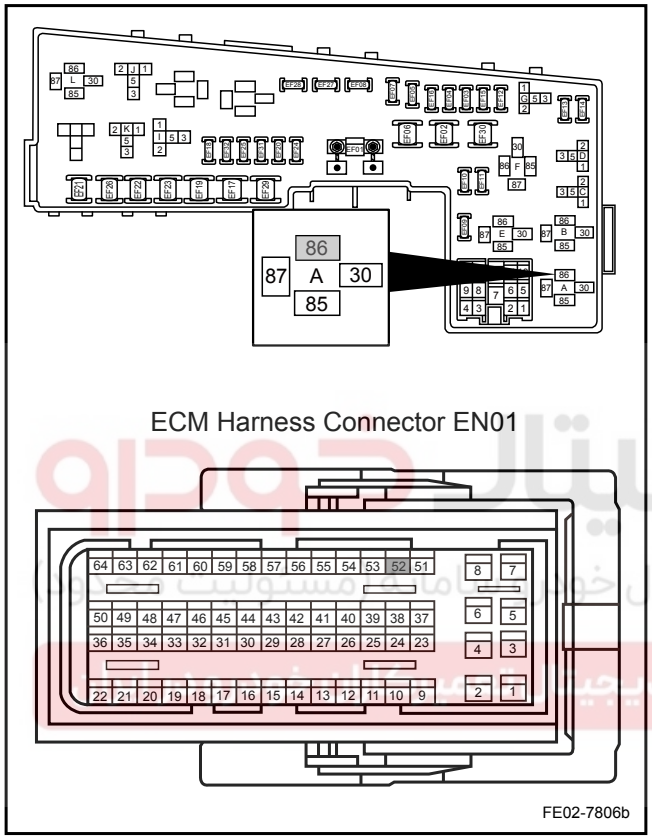
Standard Resistance: 10 kΩ or higher

Confirm whether the measured resistance is normal.

No → Replace the relay.

Yes

Step 6	Check high-speed relay A control circuit.



(a) Turn the ignition switch to "OFF" position.

(b) Disconnect ECM harness connector EN01.

(c) Remove high-speed cooling fan relay A.

(d) Test continuity between high-speed cooling fan relay A terminal No.86 and ECM harness connector EN01 terminal No.52.

(e) Measure resistance between high-speed cooling fan relay A terminal No.86 and a reliable ground. Check whether the circuit is short to ground.

Standard Value:

Test Items	Specified Value
Relay A (86)-EN01 (52)	Less than 1 Ω
Relay A (86) - Reliable Ground	10 kΩ or higher

Is the measured values specified value?

No → Circuit between relay A terminal No.86 and EN01 terminal No.52 is short to ground.

Yes

Step 7	Check ECM circuit.

(a) Check whether ECM power supply circuit is normal.

(b) Check whether ECM ground circuit is normal.

No → Repair the faulty part.

Yes

Step 8	Replace ECM.

Next

Step 9	Diagnostic completed.

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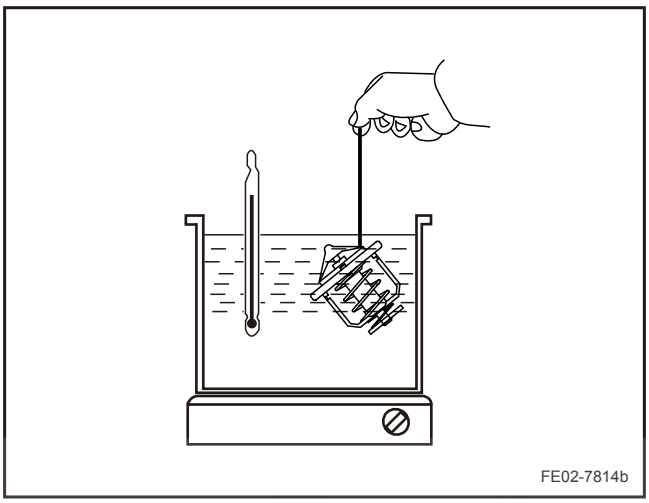
2.8.7.7 Thermostat Diagnostic

Step 1	Remove the thermostat. Refer to 2.8.8.4 Thermostat Replacement.

Next

Step 2	Soak the thermostat in water and heat the water.



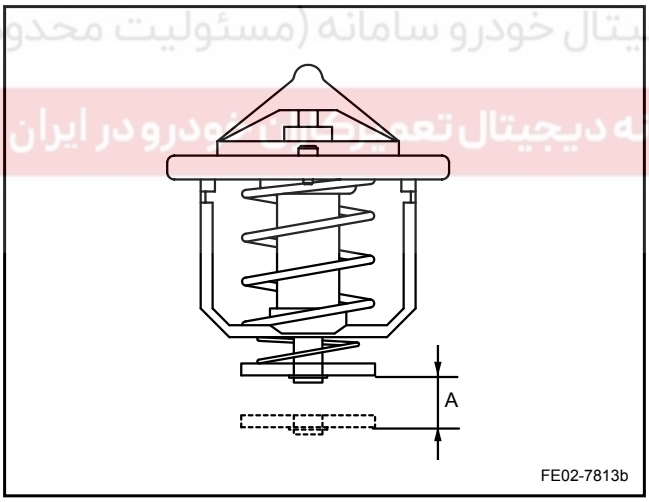
(a) Check the thermostat switch on temperature.
Standard Value: 82°C (179.6 ºF)

Is the thermostat switch on temperature normal?

No → Replace the thermostat. Refer to 2.8.8.4 Thermostat Replacement

Yes

Step 3	Check the thermostat valve lift travel distance.



Standard Valve Lift: 10 mm (0.39 in) or higher at 95°C(203 ºF)

Confirm whether the valve lift is normal.

No → Replace the thermostat. Refer to 2.8.8.4 Thermostat Replacement

Yes

Step 4	Check whether the thermostat is completely switched off at low temperature.

When the thermostat temperature islower than 77°C (171 ºF), check whether the thermostat is completely switched of.

No → Replace the thermostat. Refer to 2.8.8.4 Thermostat Replacement

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Yes

Step 5	Thermostat normal.

2.8.7.8 Engine Overheating

Warning!

Refer to "Cooling System Service Warning" in "Warnings and Notices".

Step 1	Is there engine coolant loss?

Yes → Add engine coolant.

No

Step 2	Is the engine coolant concentration inadequate?

Yes → Use "Geely Genuine ultra-long-acting engine coolant" or the same level of high-quality ethylene glycol base engine coolant, model or standard number: comply with SH0521.

No

Step 3	Check whether there is dust, leaves or insects and other debris at the radiator front?

Yes → Clean up the front of the radiator.

No

Step 4	Check coolant pipes, pumps, engine coolant inlet components and radiator. Check for blockage and cylinder head gasket leaking.

Yes → Replace any damaged parts.

No

Step 5	Connect scan tool, with the data flow showing the engine coolant temperature reaches 95°C (203 ºF). Check the radiator inlet and outlet hoses coolant temperature. There should be no temperature difference. Is the temperature difference big?

Yes → 1. Check whether the thermostat is working properly. 2. Check whether there is radiator blockage.

No

Step 6	Use ignition timing gun to check whether the ignition is too late.

Yes → Check engine ignition timing. Carry out ECM diagnostic.

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No

Step 7	Check whether the cooling fan is working properly.

Yes → Check the cooling fan circuit. Refer to 2.8.7.2 Cooling Fan Circuit Diagnosis

No

Step 8	Check whether there is water pump fault.

Yes → Replace the water pump. Refer to 2.8.8.6 Water Pump Replacement

No

Step 9	Check whether radiator cap is faulty.

Yes → Replace the faulty radiator cap.

No

Step 10	Check whether there is cylinder head cover and engine block cracking or blockage. Is cylinder block gasket sealing poor

Yes → Repair the damaged cylinder head cover and engine block

No

Step 11	Confirme that the fault has been fixed.

2.8.7.9 Engine Does Not Reach Normal Operating Temperature

Step 1	Check whether coolant recovery reservoir coolant level is abnormal?

Yes → Add engine coolant to specified level.

No

Step 2	Check the cooling system temperature.

(a) Turn the ignition switch to "OFF" position.
(b) Connect the scan tool to a datalink connector.
(c) Turn the ignition switch to "ON" position.
(d) Select in sequence: Engine / Data List / Engine Coolant Temperature.
(e) Maintain the engine speed at 2,000 rpm and observe the data flow for the engine coolant temperature.

Does the engine coolant temperature increase?

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Yes → Instrument cluster is faulty. Refer to 11.7.6 Diagnostic Information and Procedures

No

Step 3	Check whether the cooling fan rotates normally?

Yes → Refer to 2.8.7.5 Cooling Fan Always Runs At Low Speed

No

Step 4	Check whether the thermostat is working as per normal?

(a) Check whether the installed thermostat type is correct.
(b) Check whether the thermostat is stuck at the open position.

Yes → Replace with the correct type of thermostat.

No

Step 5	Check whether engine coolant pipes are blocked.

Yes → Flush the cooling system or check the radiator flow.

No

Step 6	Road test vehicle. Confirm the fault has been fixed.

2.8.7.10 Excessive Engine Coolant Loss

Step 1	Check whether the radiator is leaking?

Yes → Replace the damaged radiator. Refer to 2.8.8.5 Radiator Replacement

No

Step 2	Check for leaking at the following locations: A, Coolant Recovery Reservoir. B, Coolant Pipes.

Yes → If necessary, replace the following components: Coolant Recovery Reservoir, Plumbing.

No

Step 3	Check whether the radiator pipes and joints are loose or damaged?

Yes → Reinstall the coolant pipes or the clamp.

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No

Step 4	Check whether the water pump seal is leaking.

Yes → Replace the Pump Seal.

No

Step 5	Check whether the cylinder head cover torque is appropriate.

Yes → Tighten the cylinder head gasket bolts to the specified torque. If necessary, replace the cylinder head gasket

No

Step 6	Check for leaking at the follows locations:

(a) Intake Manifold
(b) Cylinder Head Gasket
(c) Cylinder Block Bolt
(d) Heater Core
(e) Radiator Discharge Plug

Yes → When necessary, repair or replace parts to eliminate leakage faults.

No

Step 7	Confirm that the fault has been fixed.

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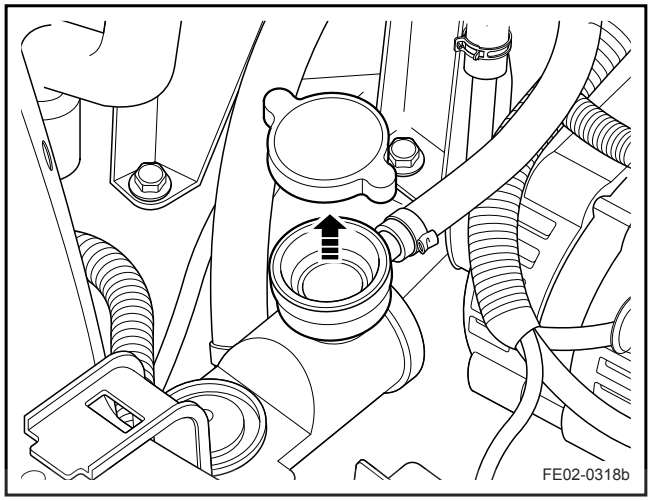
2.8.8 Removal and Installation

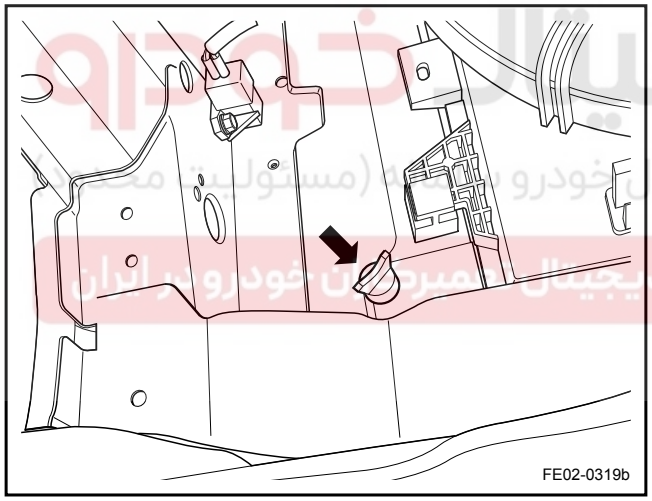
2.8.8.1 Engine Coolant Discharge and Filling

Warning!

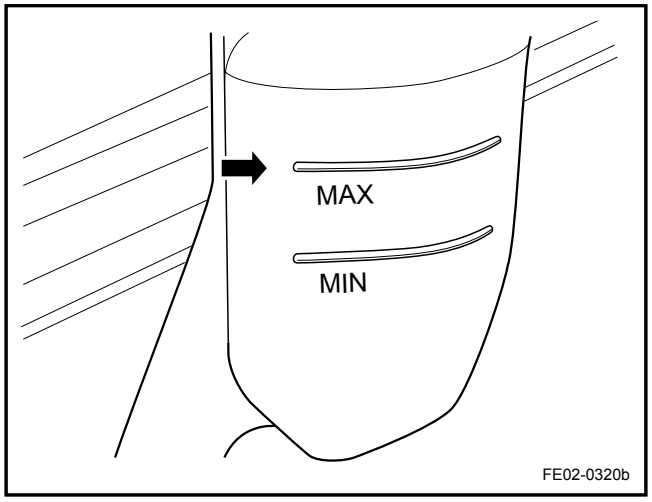
Refer to "Cooling System Service Warning" in "Warnings and Notices".



1. Place a recycling container under the vehicle to contain the discharged engine coolant.
2. Remove the radiator cap.



3. Remove the engine coolant drainage valve.



4. Contain the discharged engine coolant with the container.

   Note

   Handle the recycled old engine coolant, waiting for scrap or recycling. Do not dispose the old engine coolant into the water sewage to protect the environment.

5. Install the engine coolant drainage valve.
6. Clean the Coolant Recovery Reservoir. Refer to 2.8.8.2 Coolant Recovery Reservoir Replacement.

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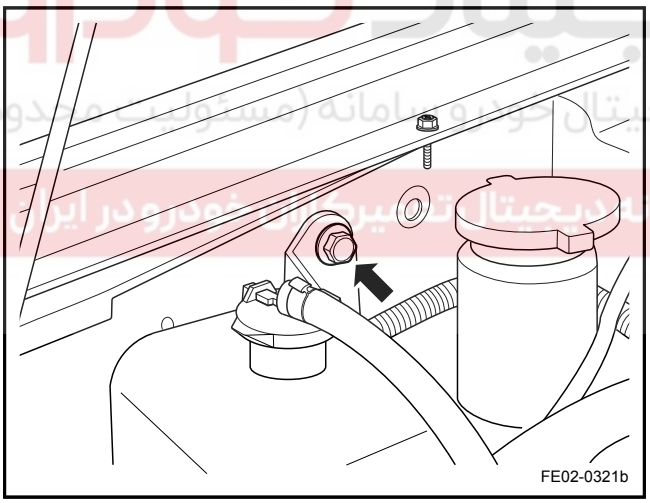
7. Slowly fill the engine coolant into the Coolant Recovery Reservoir to the standard scale, so that the air will be discharged from the cooling outlet pipe.
8. Start the engine until the thermostat switches on. When the radiator inlet and outlet pipes are hot, it can be identified that the thermostat is switched on.
9. Shut down the engine. Confirm that the engine coolant drainage valve is not leaking. (Repeat the above steps until the discharged coolant is free of bubble.)
10. Fill the engine coolant so that the engine coolant Coolant Recovery Reservoir coolant level reaches the highest scale (MAX location).

2.8.8.2 Coolant Recovery Reservoir Replacement

Removal Procedure:

Warning!

Refer to "Warnings and Notices" in the "warning on cooling system maintenance."



1. Discharge the engine coolant.
2. Remove the coolant recovery reservoir upper retaining bolt.

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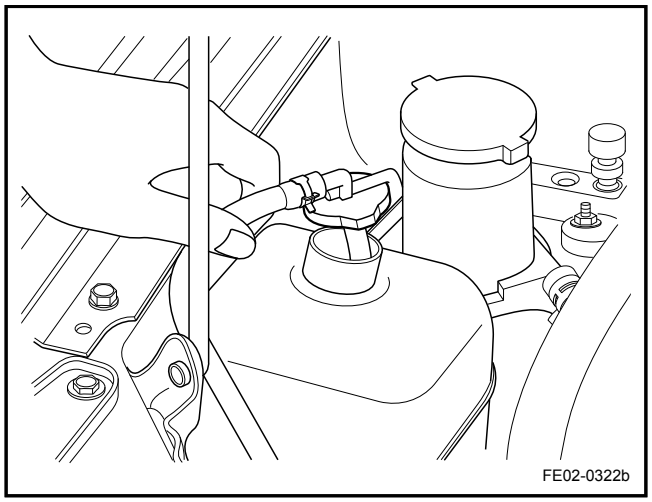
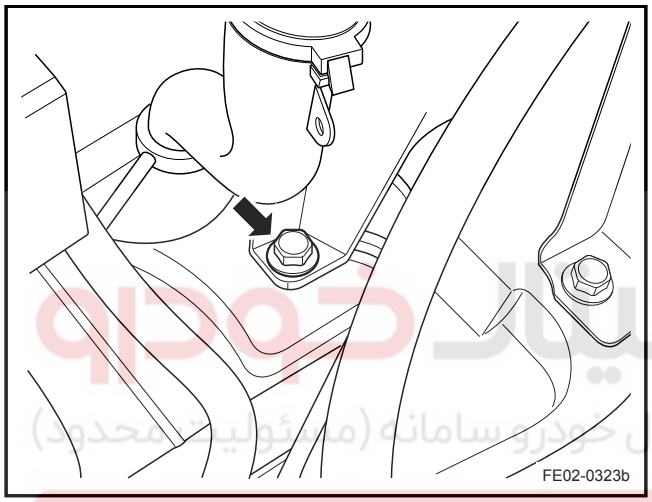


3. Remove the engine coolant overflow pipe.



4. Remove the coolant recovery reservoir lower retaining bolt.

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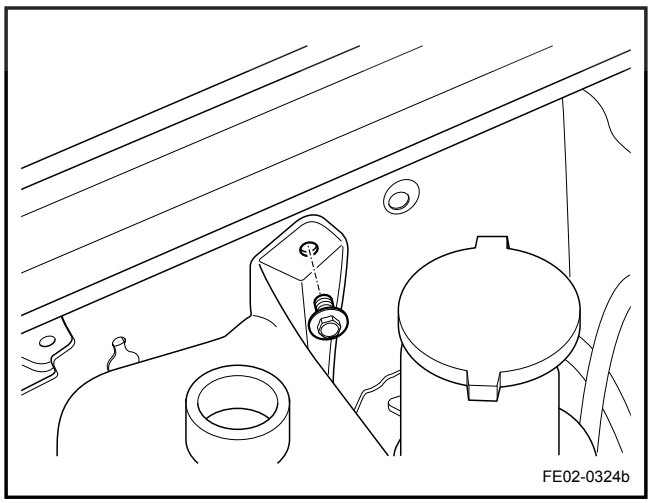
Installation Procedure:



1. Install the coolant recovery reservoir upper retaining bolt.

   Torque: 25 Nm (Metric) 18.5 lb-ft (US English)

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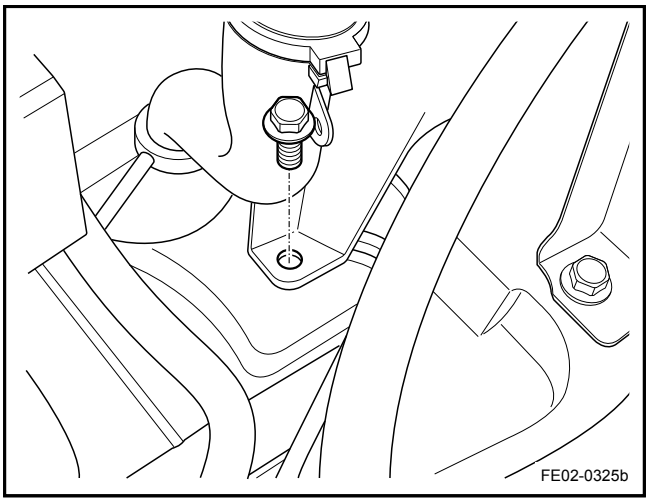
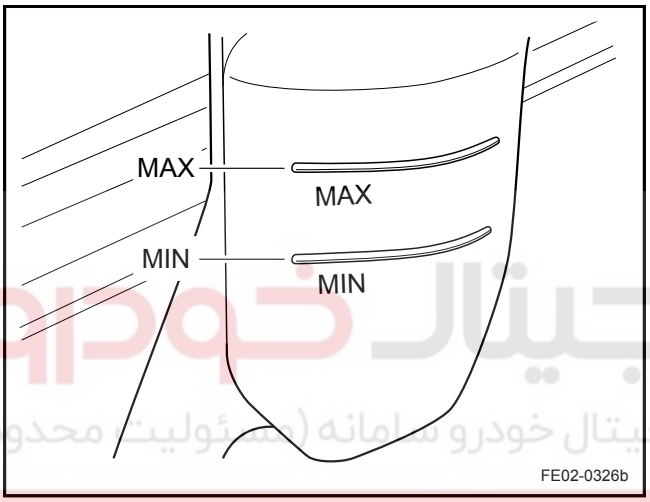
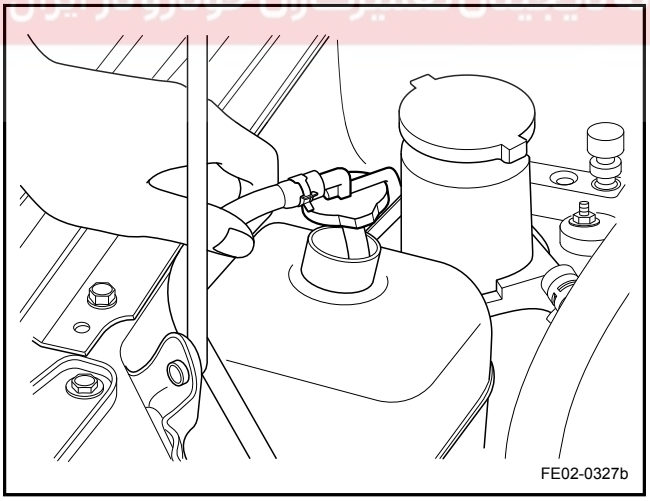


2. Install the coolant recovery reservoir lower retaining bolt.

   Torque: 25 Nm (Metric) 18.5 lb-ft (US English)



3. Fill the engine coolant to the level between the MIN and MAX.



4. Install the coolant recovery reservoir cap and the engine coolant overflow pipe.

2.8.8.3 Cooling Fan Replacement

Removal Procedure:

Warning!

Do not place hands in between fan blades running area when the fan is not switched off.

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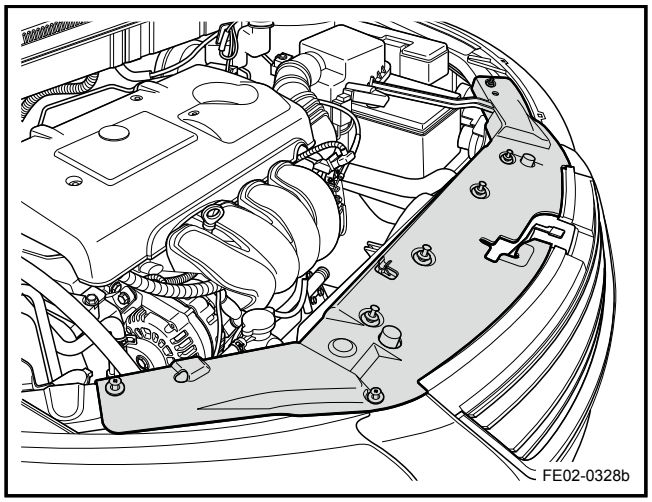
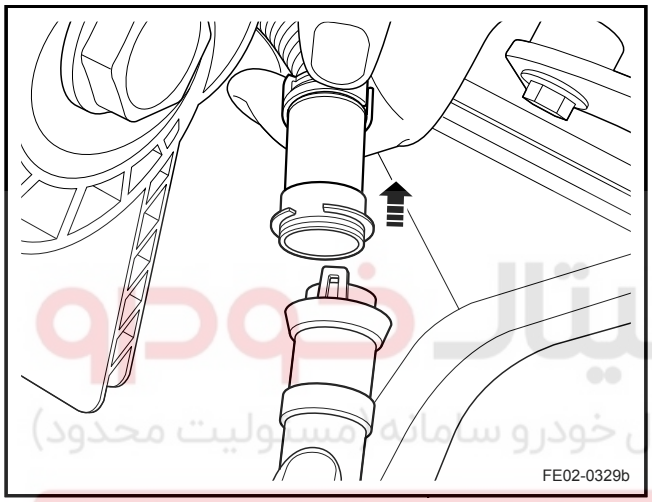
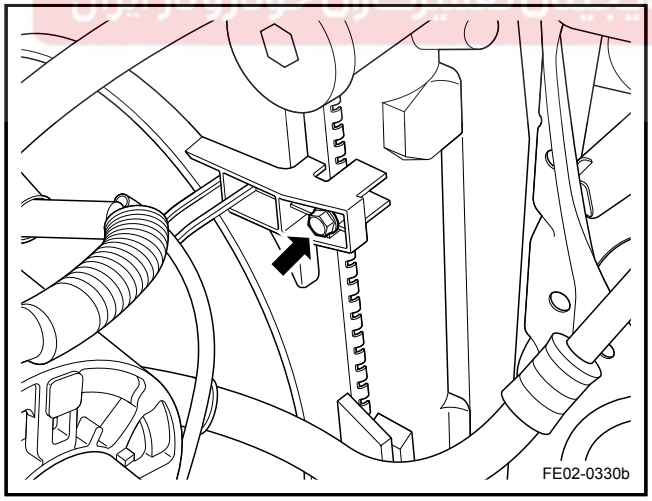


1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Remove the radiator air baffle and deflector.



3. Disconnect the fan motor wiring harness connector.



4. Remove the right side of the fan cover retaining bolt.

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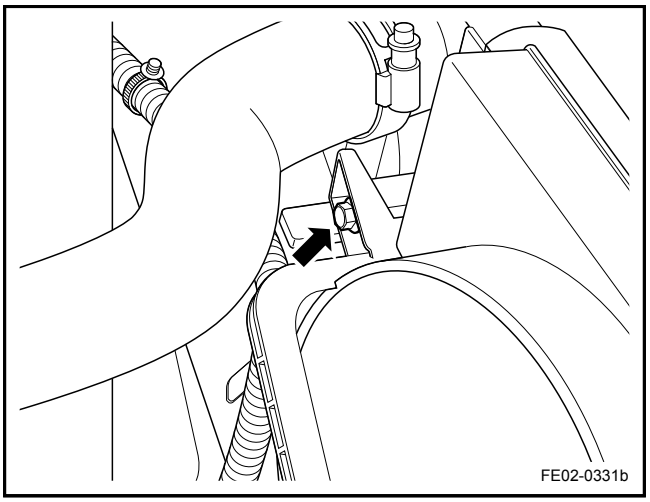
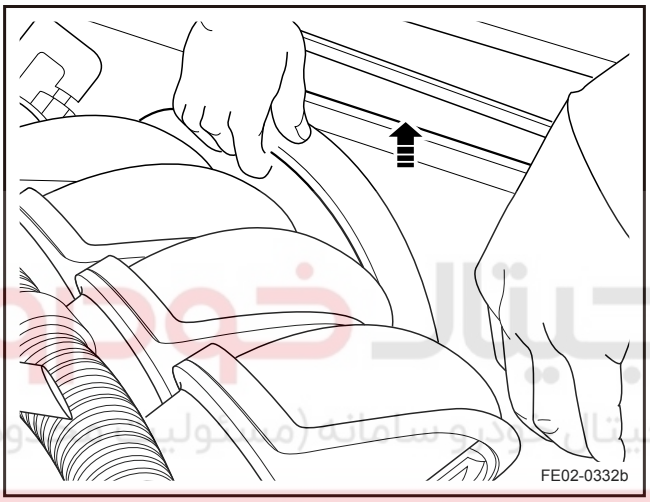


5. Remove the left side of the fan cover retaining bolt.



6. Remove the fan assembly from the vehicle.

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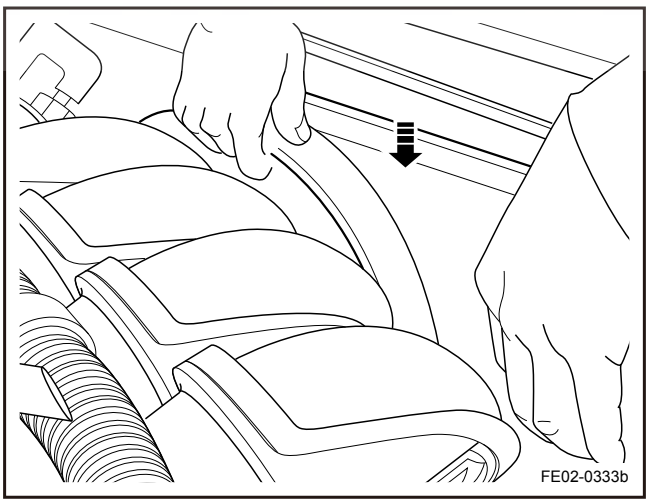
Installation Procedure:



1. Install the fan assembly to the vehicle.

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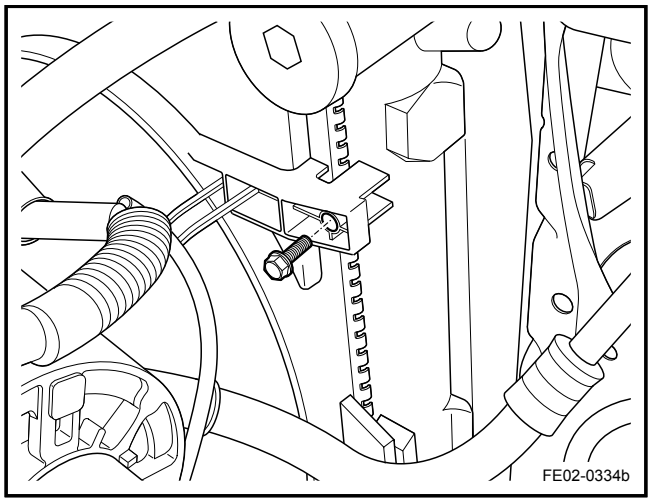
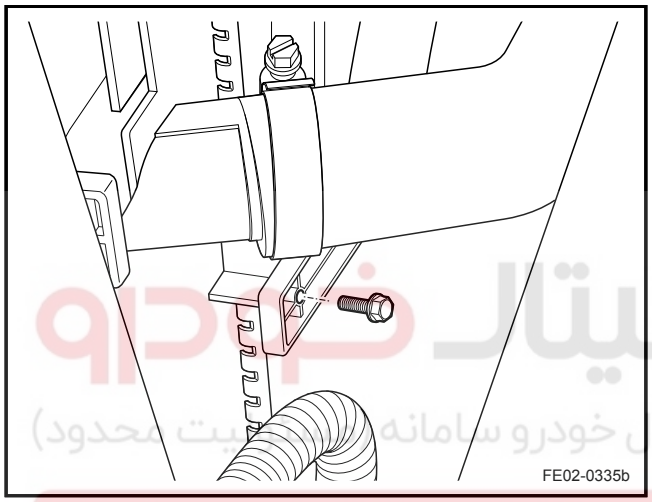


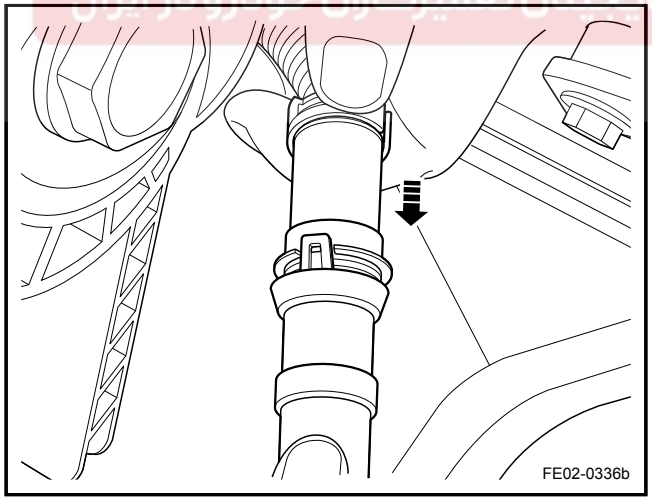
2. Install the right side of the fan cover retaining bolt.

   Torque: 9 Nm (Metric) 6.7 lb-ft (US English)



3. Install the left side of the fan cover retaining bolt.

   Torque: 9 Nm (Metric) 6.7 lb-ft (US English)



4. Connect the cooling fan motor wiring harness connector.

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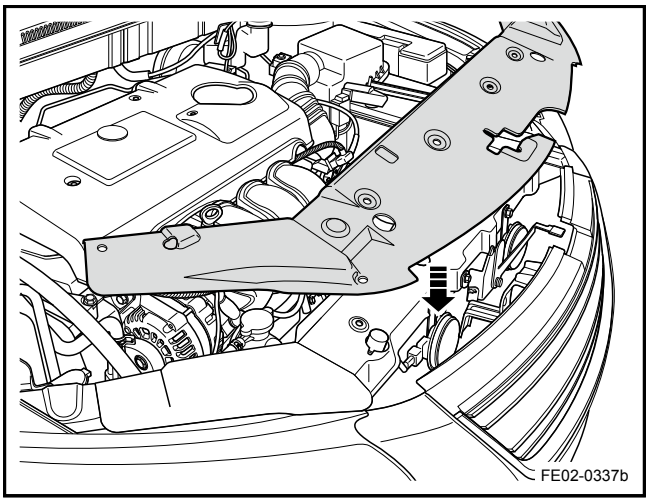


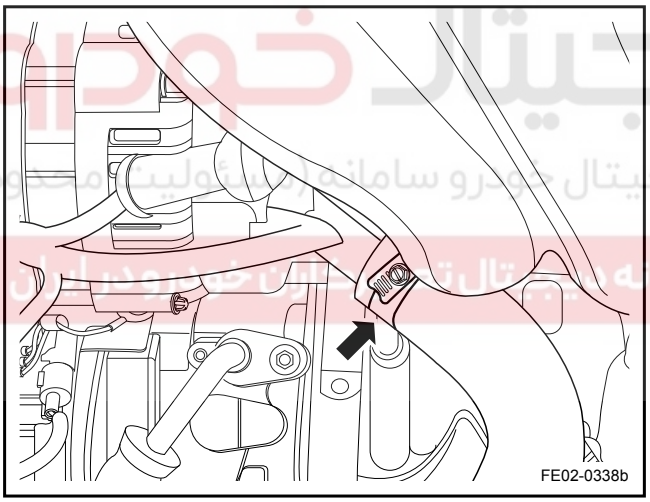
5. Install the radiator air baffle and deflector.
6. Connect the battery negative cable.

2.8.8.4 Thermostat Replacement

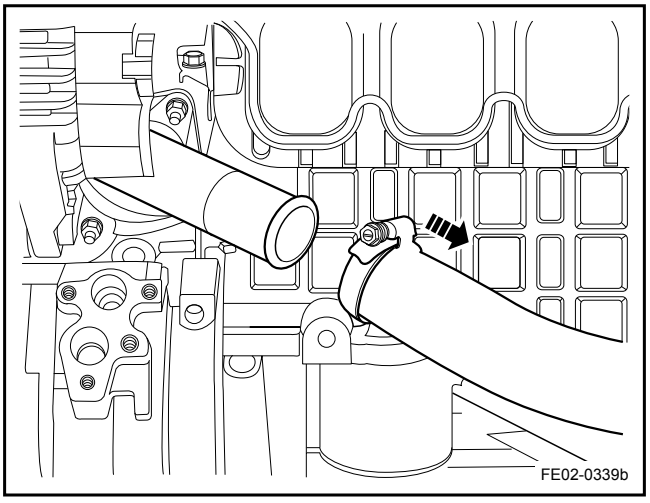
Removal Procedure:

Warning!

Refer to "Cooling System Service Warning" in "Warnings and Notices".



1. Discharge the engine coolant. Refer to 2.8.8.1 Engine Coolant Discharge and Filling.
2. Loosen the radiator outlet pipe clamp from the engine coolant inlet pipe.



3. Disconnect the radiator outlet pipe from the engine coolant inlet pipe.

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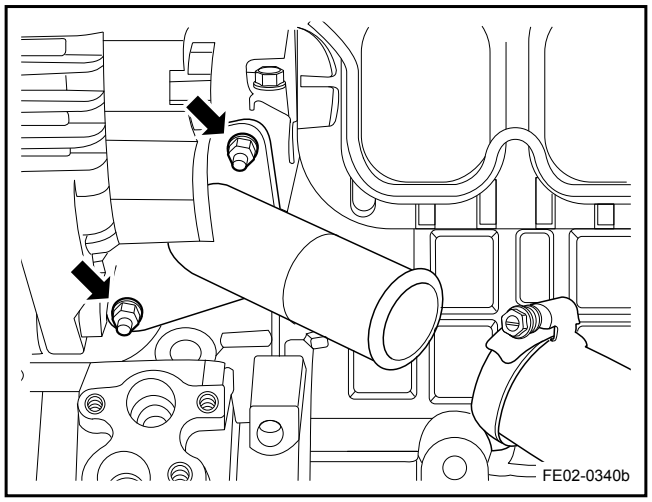
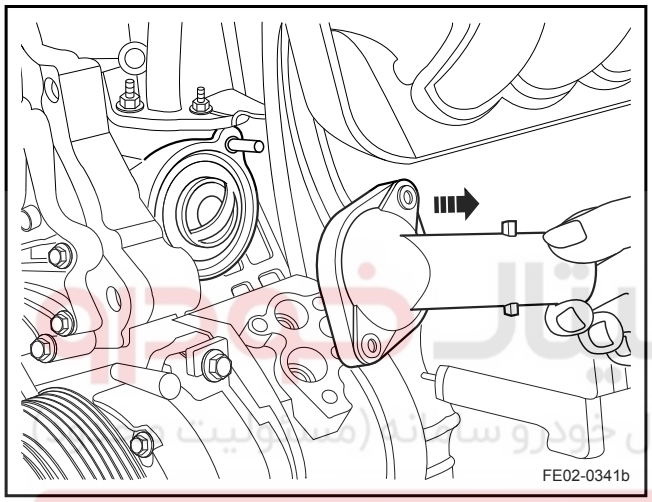
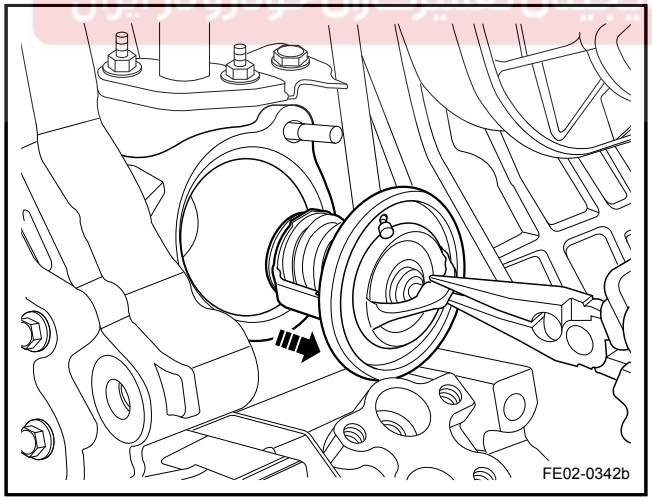


4. Remove the engine coolant inlet pipe to the cylinder block retaining nuts.



5. Remove the engine coolant inlet pipe component from the cylinder block.



6. Remove the thermostat from the cylinder block.

Note

The thermostat and seals are integrated.

7. Clean the engine coolant inlet pipe and cylinder block mating surface.

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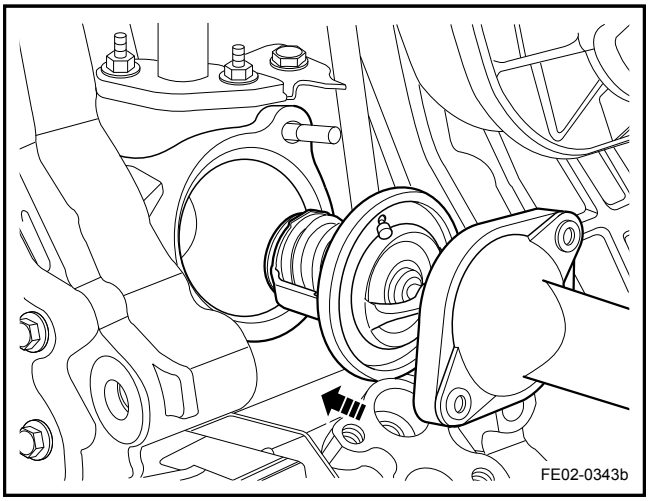
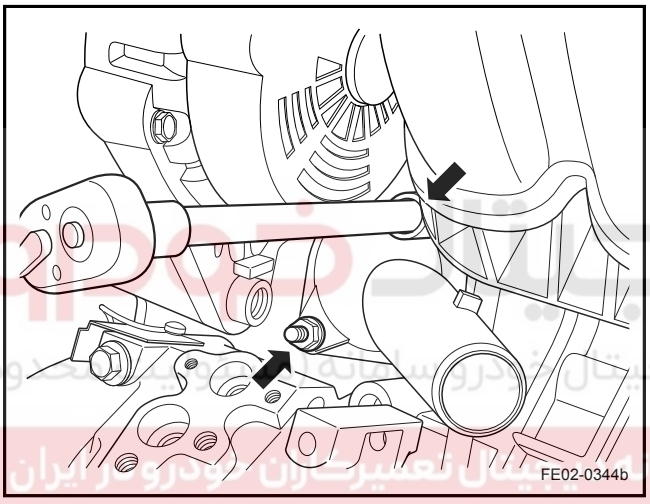
Installation Procedure:

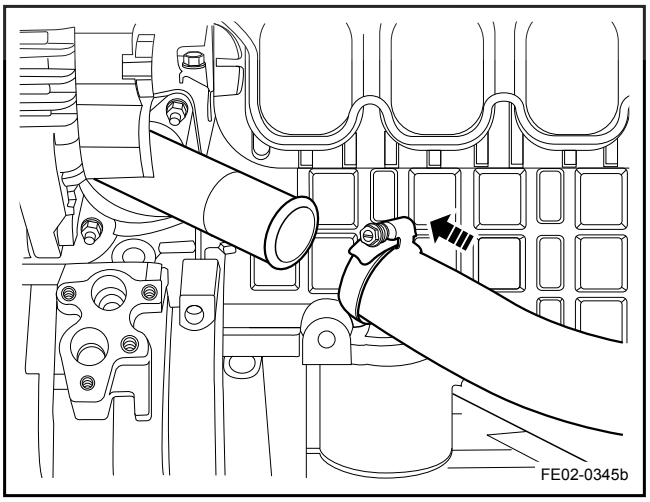


1. Install the thermostat to the cylinder block.
2. Install the engine coolant inlet pipe component to the cylinder block.



3. Install the engine coolant inlet pipe component to the cylinder block retaining nuts.

   Torque: 11 Nm (Metric) 8.2 lb-ft (US English)



4. Install radiator outlet pipe to the engine coolant inlet pipe component.

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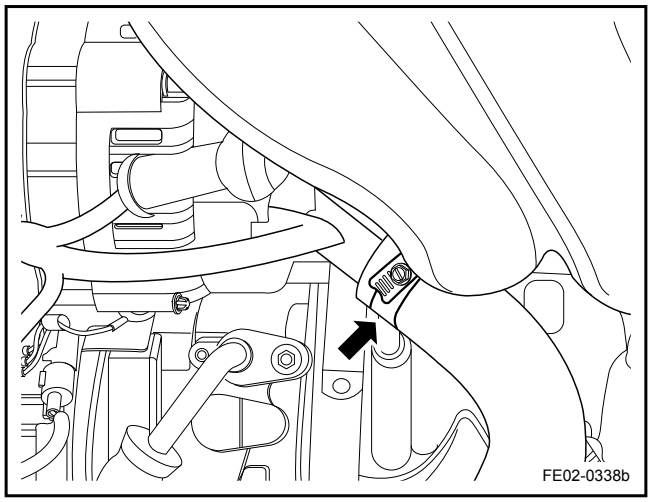


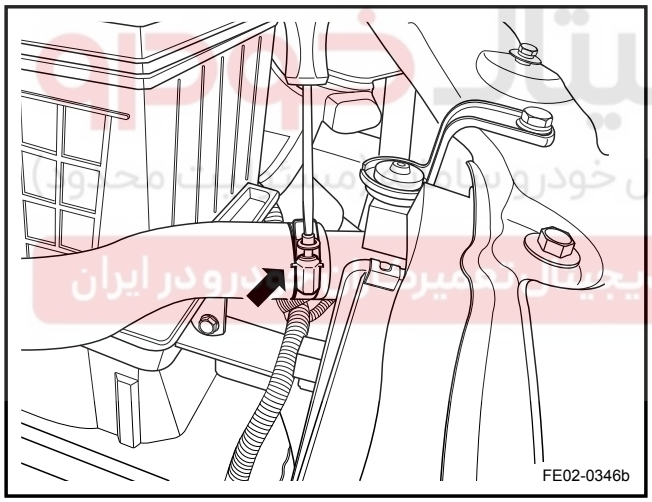
5. Tighten the radiator outlet pipe clamp.
6. Fill the engine coolant.

2.8.8.5 Radiator Replacement

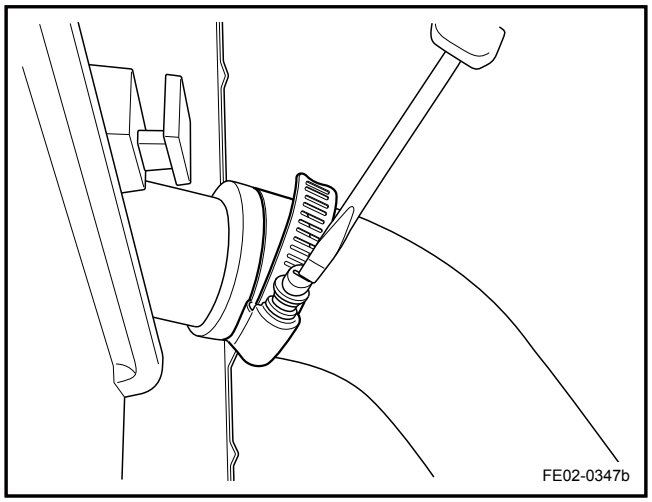
Removal Procedure:

Warning!

Refer to "Battery Disconnection Warning" in "Warnings and Notices".



1. Disconnect the battery negative cable. Refer to 2.11.8.1 Battery Disconnection.
2. Discharge the engine coolant. Refer to 2.8.8.1 Engine Coolant Discharge and Filling.
3. Remove the cooling fan. Refer to 2.8.8.3 Cooling Fan Replacement.
4. Remove the radiator inlet pipe clamp, disconnect the radiator inlet pipe from the radiator.



5. Remove the radiator inlet pipe clamp, disconnect the radiator outlet pipe from the radiator.

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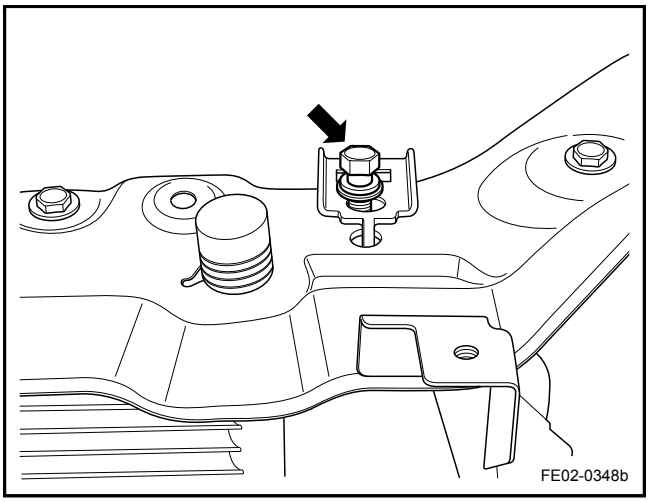
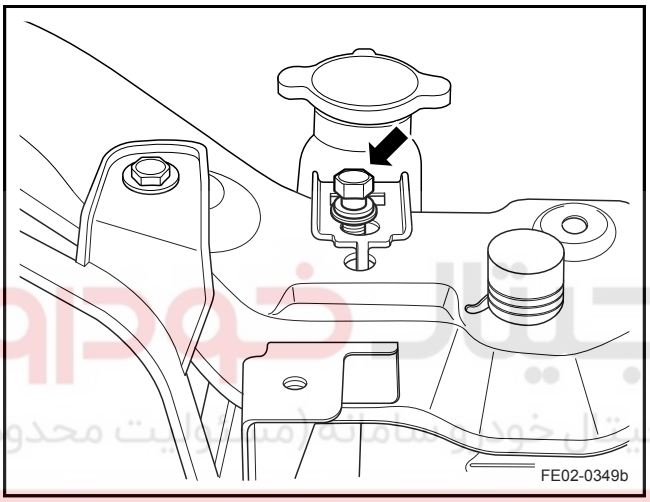


6. Remove the left side of radiator retaining bolts.



7. Remove the right side of radiator retaining bolts and remove the radiator.

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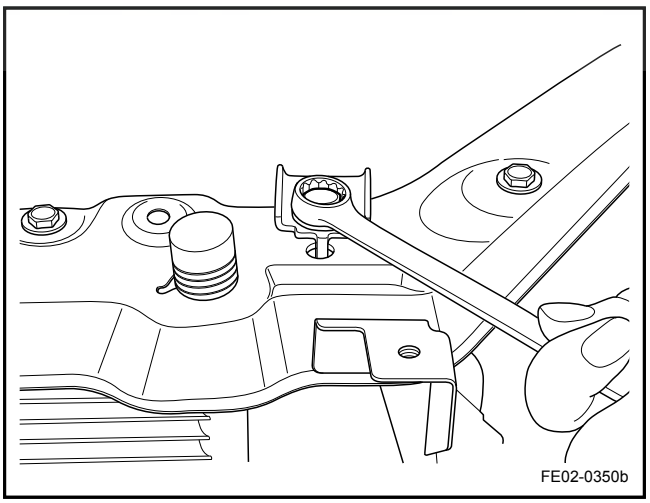
Installation Procedure:



1. Install the radiator and tighten the left side of radiator retaining bolts.

   Torque: 10.5 Nm (Metric) 7.8 lb-ft (US English)

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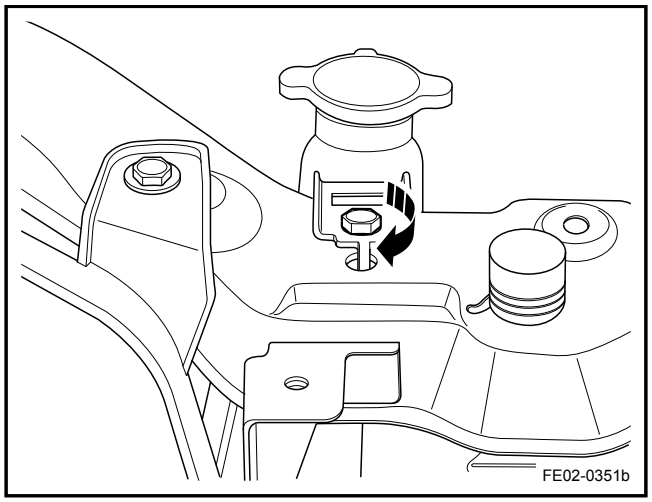
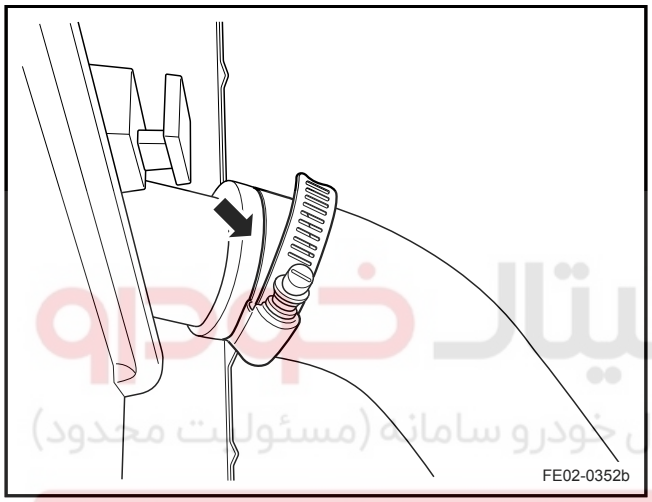
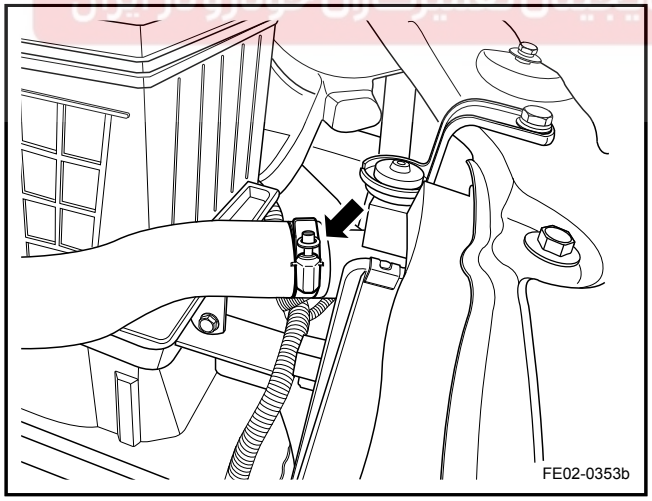


2. Install and tighten the right side of radiator retaining bolts.

   Torque: 10.5 Nm (Metric) 7.8 lb-ft (US English)



3. Install the radiator outlet pipe and tighten the clamp.



4. Install the radiator inlet pipe and tighten the clamp.
5. Install the cooling fan.
6. Fill the engine coolant.
7. Connect the battery negative cable.

2.8.8.6 Water Pump Replacement

Removal Procedure:

Warning!

Refer to "Cooling System Service Warning" in "Warnings and Notices".

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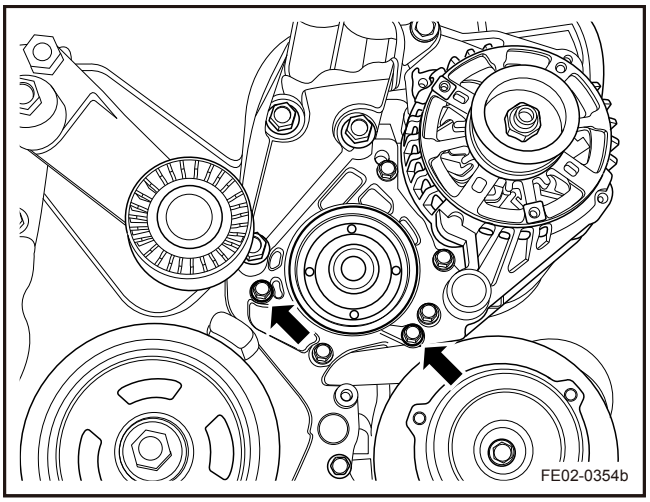
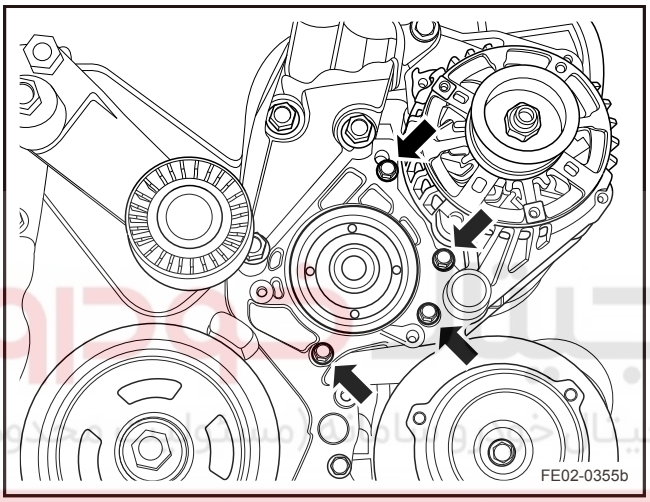
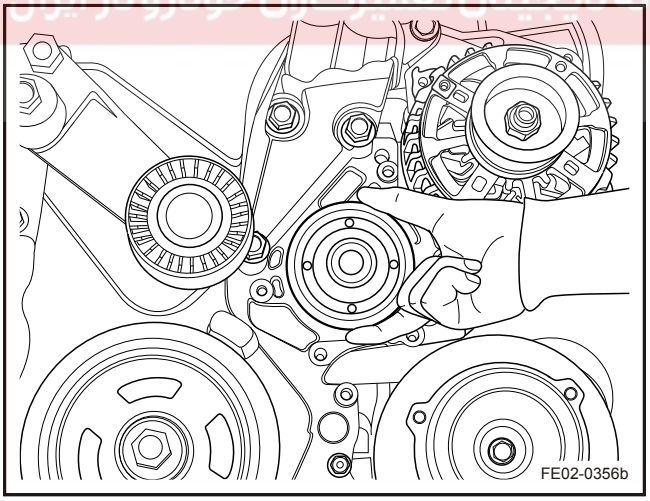


1. Discharge the engine coolant. Refer to 2.8.8.1 Engine Coolant Discharge and Filling.
2. Remove the drive belt. Refer to 2.6.8.3 Drive Belt Replacement.
3. Remove the two short water pump retaining bolts.



4. Remove the four long water pump retaining bolts.



5. Remove the water pump.

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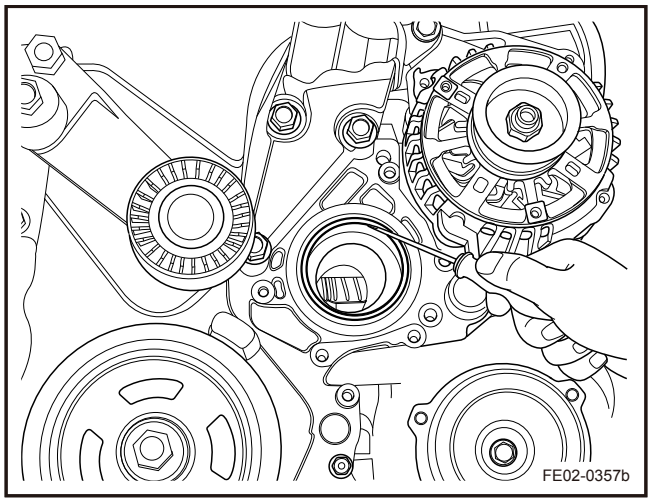
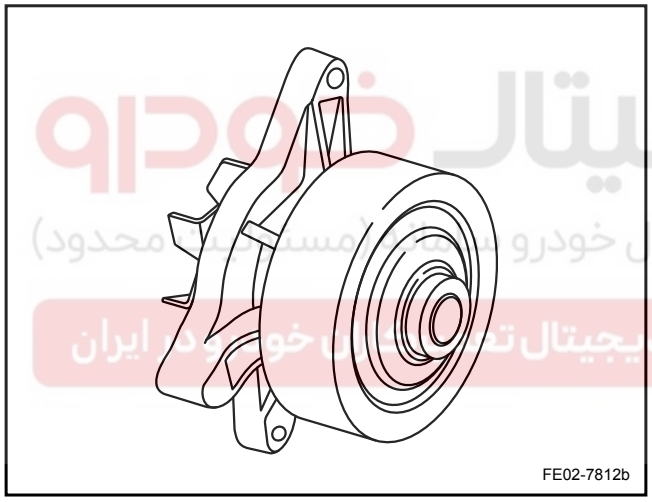


6. Remove the water pump seals.

Water Pump Inspection:

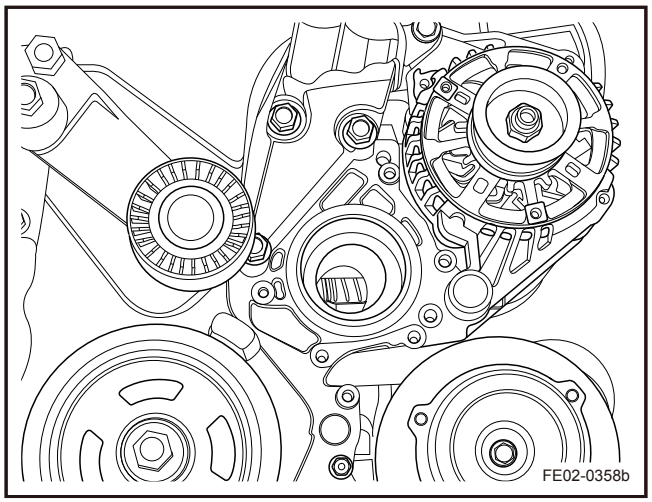
Warning!

Refer to "Protective Goggles and Glove Warning" in "Warnings and Notices".



1. Check whether the pump body is cracking and leaking.
2. Check whether the water pump bearing has a gap or abnormal sound.
3. Check whether the water pump pulley has serious wear and tear. If the pump is damaged, replace the pump.

Installation Procedure:



1. Clean the water pump seal groove and mating surface.

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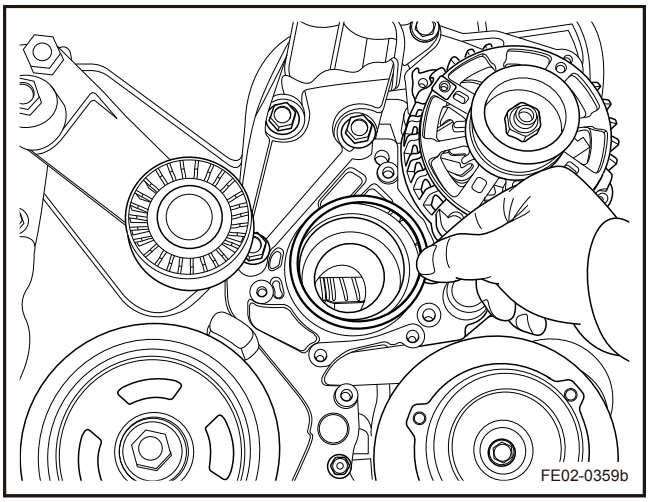
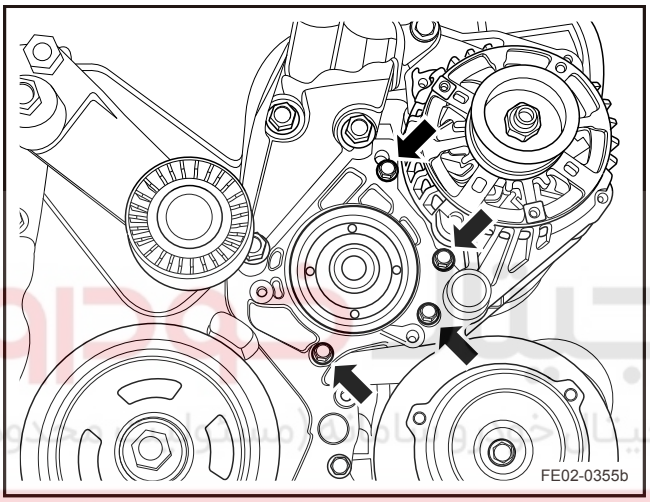


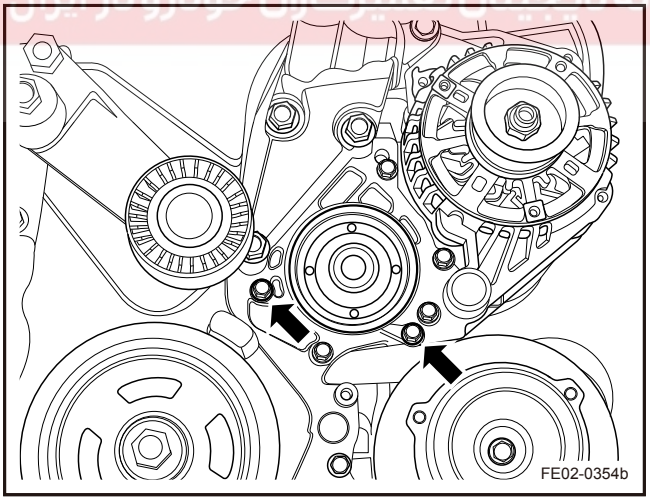
2. Install new water pump seals.

   Note

   The pump seal is a single used part and must be replaced with new parts. after removal.



3. Install the four long bolts, but do not tighten at this stage.



4. Install the two short bolts, but do not tighten at this stage.

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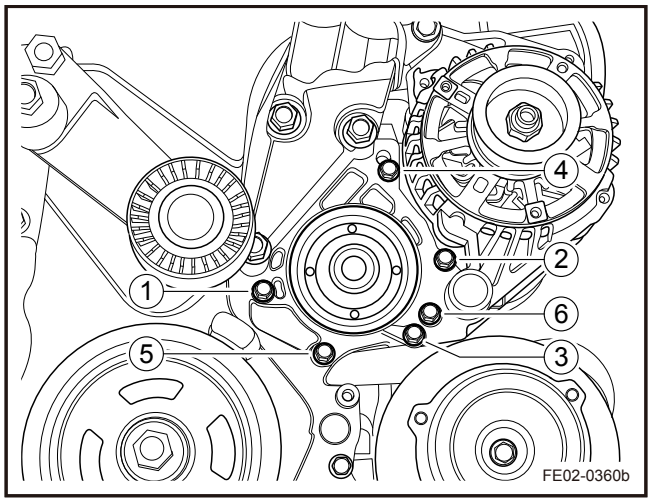

5. Tighten the water pump retaining bolts according to the sequence in the graphic.

   Torque
   Short Water Pump Retaining Bolts: 9 Nm (Metric) 6.7 lb-ft (US English)
   Long Water Pump Retaining Bolts: 11 Nm (Metric) 8.2 lb-ft (US English)

6. Install the drive belt.

7. Fill the engine coolant.

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