

COOLING 06

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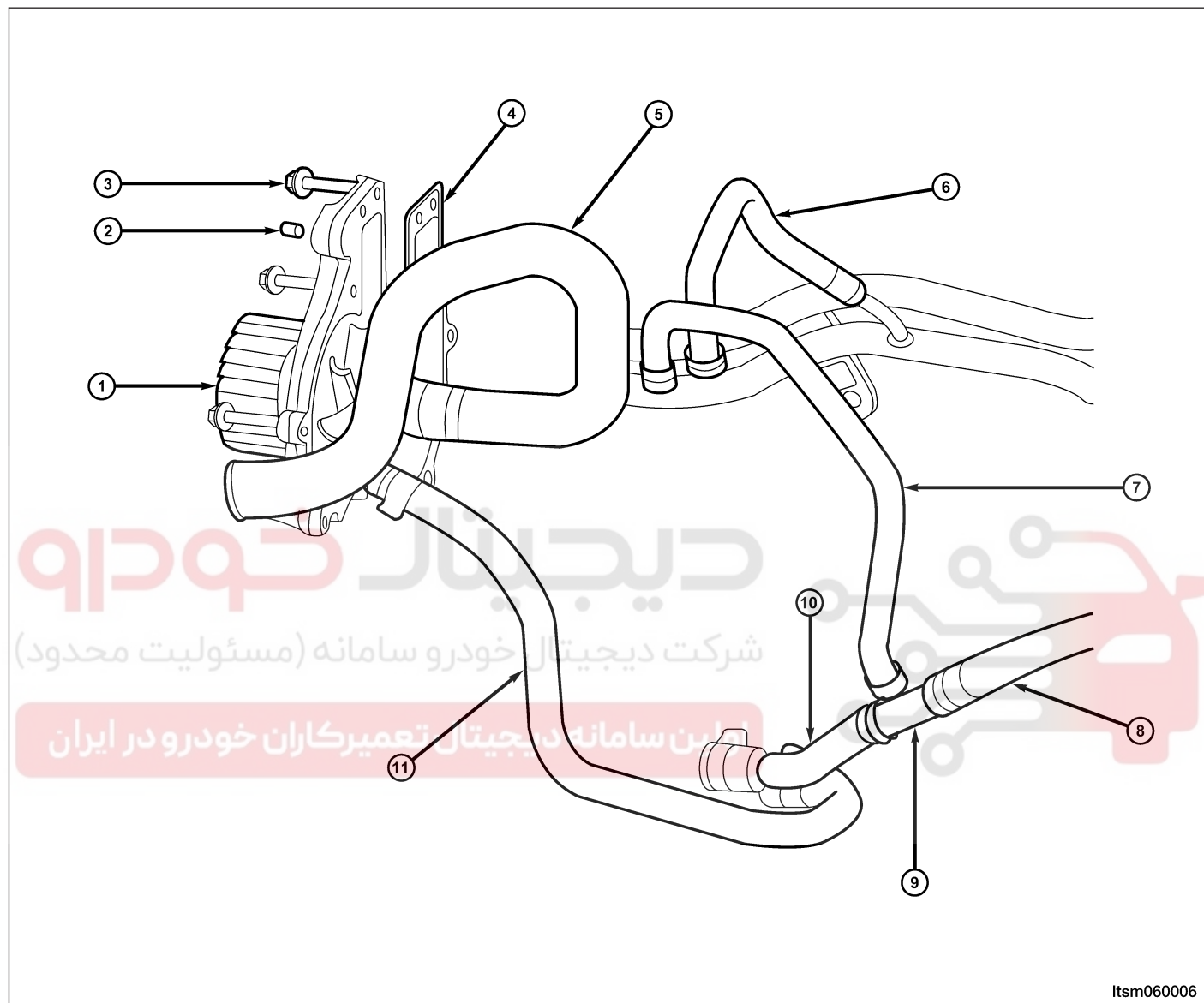
COOLING SYSTEM

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GENERAL INFORMATION

Description

Water Pump Assembly - 1.6L & 1.8L & 2.0L



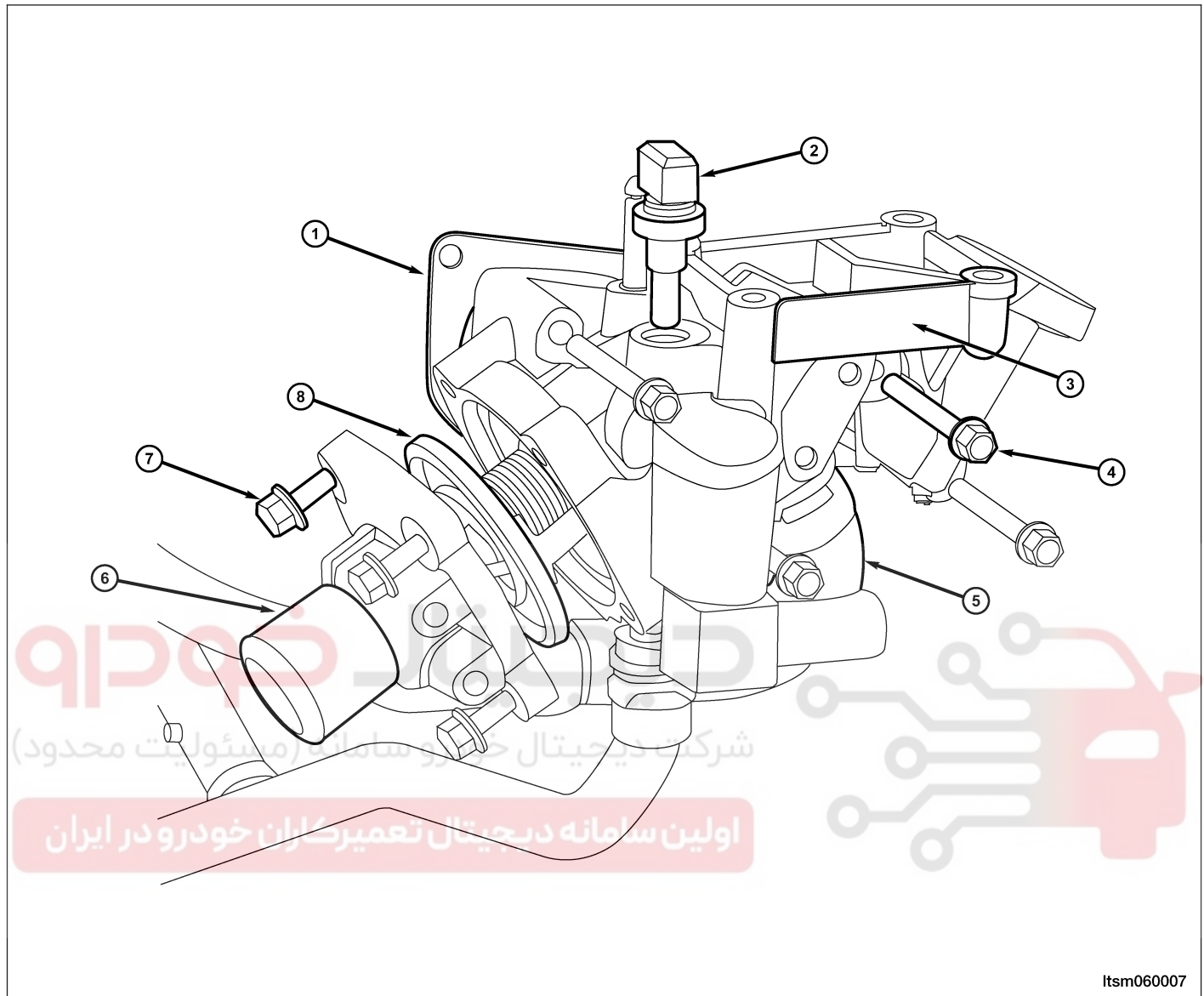
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1 - Water Pump Assembly
2 - Water Pump Alignment Pin
3 - Water Pump Bolt
4 - Gasket
5 - Engine Inlet Hose From Radiator
6 - Restrictor Outlet Hose

7 - Restrictor Inlet Hose
8 - Engine Oil Cooler Inlet Hose (Part 1)
9 - Three Way Connector
10 - Engine Oil Cooler Inlet Hose (Part 2)
11 - Engine Oil Cooler Outlet Hose

GENERAL INFORMATION

Thermostat Housing Assembly - 1.6L & 1.8L & 2.0L



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1 - Gasket

2 - Coolant Temperature Sensor

3 - Thermostat Housing Assembly

4 - Thermostat Housing Mounting Bolts

5 - Minor Cycle Water Hose

6 - Thermostat Housing Cover

7 - Thermostat Housing Cover Mounting Bolts

8 - Thermostat Assembly

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as soon as possible, maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system.

The cooling system consists of the following components:

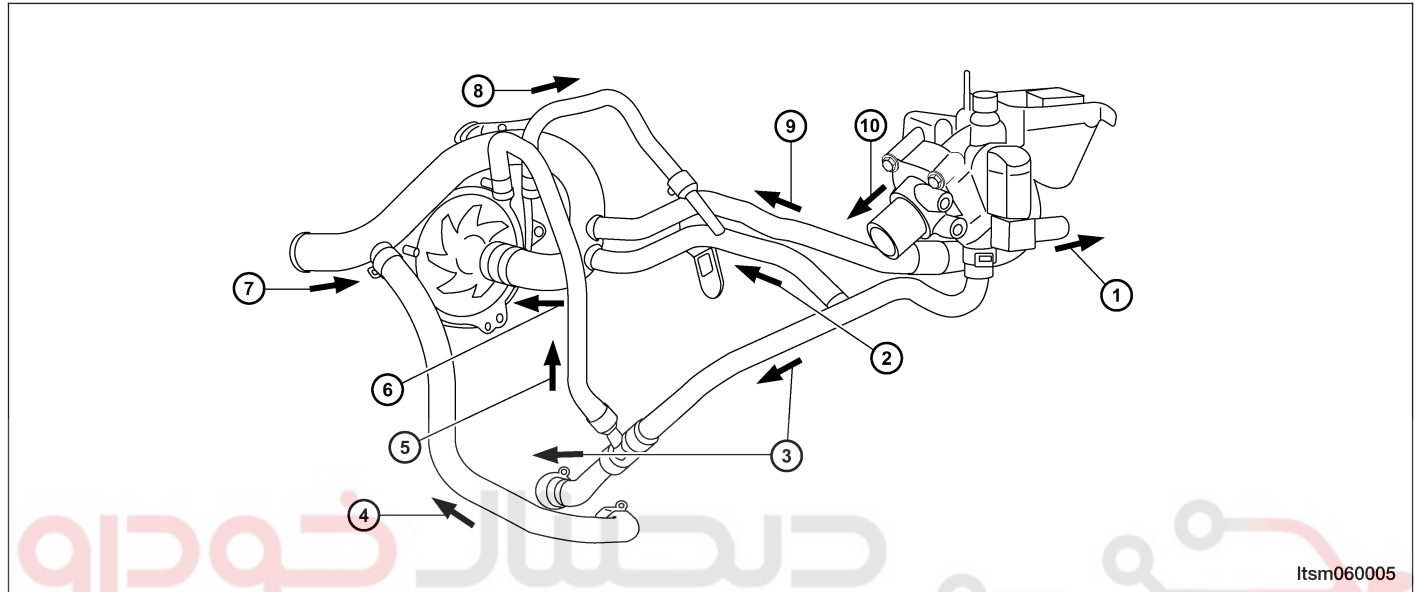
- Radiator
- Coolant
- Coolant pump
- Electric cooling fans
- Electric cooling fans control module
- Thermostat
- Coolant reservoir

GENERAL INFORMATION

- Hoses and clamps
- Coolant temperature sensor
- Coolant temperature sensor (for instrument cluster) (with 2.4L engine)
- Heater core

Operation

Engine Coolant Flow Diagram - 1.6L & 1.8L & 2.0L



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1 - To Heater Core	6 - To Engine
2 - Heater Core Return	7 - Radiator Return
3 - To Oil Cooler	8 - Restrictor Return
4 - Oil Cooler Return	9 - Minor Cycle Coolant Hose
5 - To Restrictor	10 - To Radiator

The primary purpose of a cooling system is to maintain engine temperature in a range that will provide satisfactory engine performance and emission levels under all expected driving conditions. It also provides hot coolant for heater performance and cooling for automatic transmission oil. This is done by transferring heat from engine metal to coolant, moving the heated coolant to the radiator, and then transferring the heat to the ambient air.

GENERAL INFORMATION

Specifications

Torque Specifications

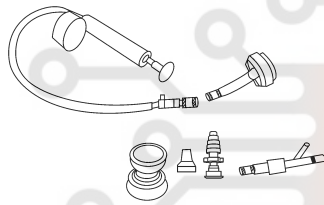
DESCRIPTION	TORQUE (N.m)
Coolant Pump Mounting Bolts	14
Radiator Support Mounting Bolts	5
Coolant Fan Mounting Bolts	5
Thermostat Mounting Bolts	13

Fluid Specifications

DESCRIPTION	CAPACITY (L)
Cooling System	7.0

Special Tools

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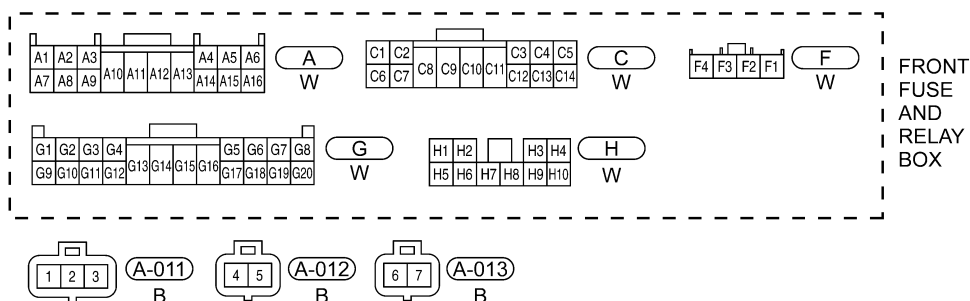
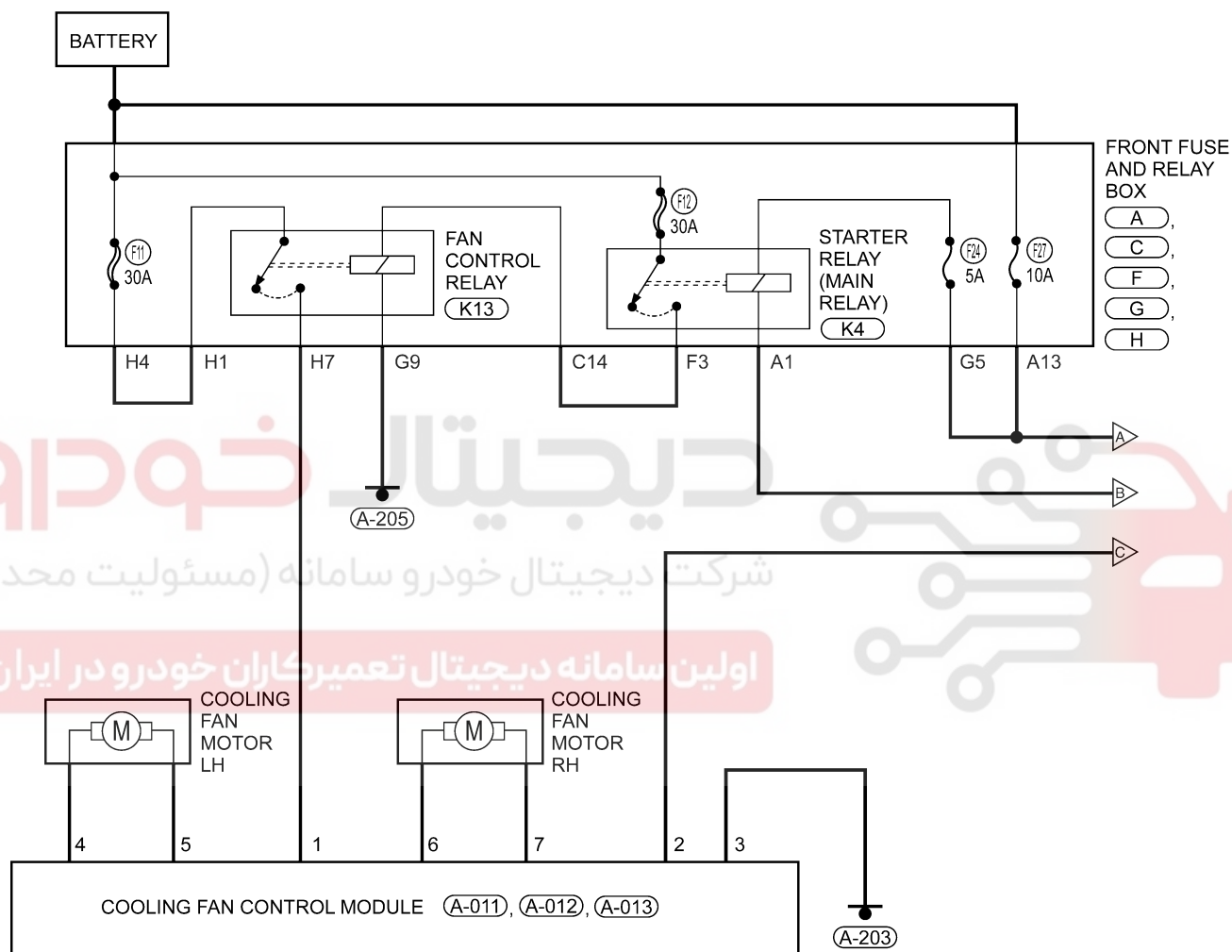
Cooling System Pressure Tester شرکت دیجیتال خودرو (مسئولیت محدود) اولین سامانه دیجیتال تعمیرکاران خودرو در ایران	 besm060005
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GENERAL INFORMATION

Electrical Schematics

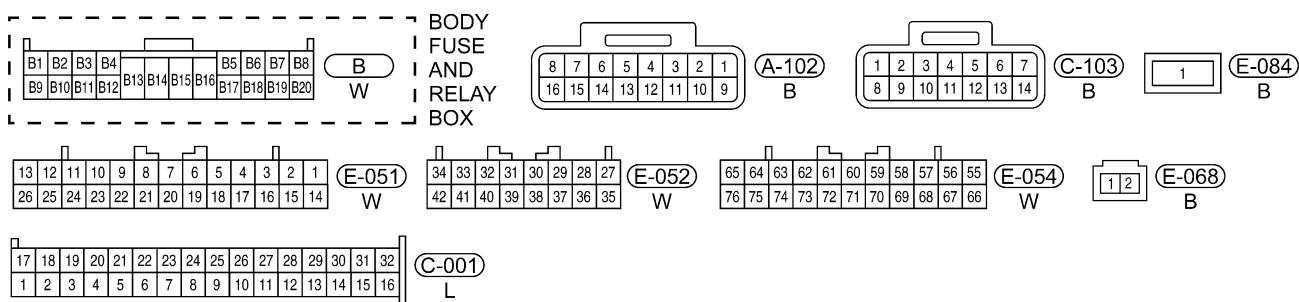
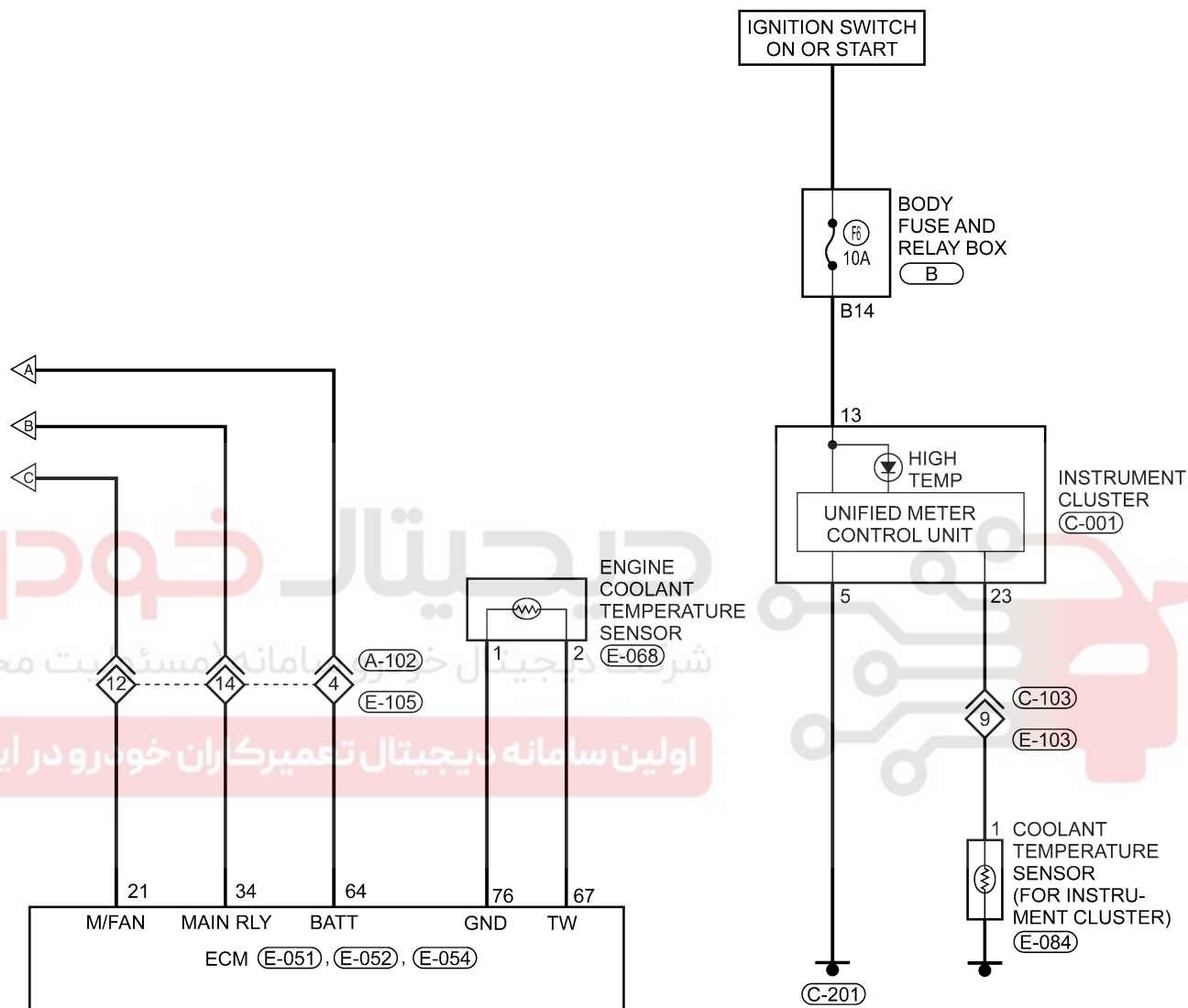
Cooling System (Page 1 of 5)

COOLING SYSTEM - WITH MITSUBISHI ENGINE SYSTEM



GENERAL INFORMATION

Cooling System (Page 2 of 5)



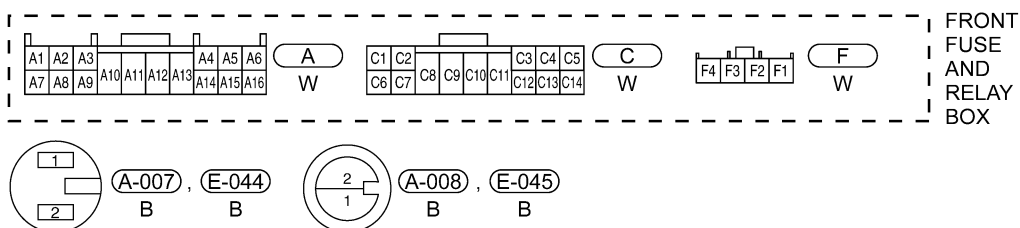
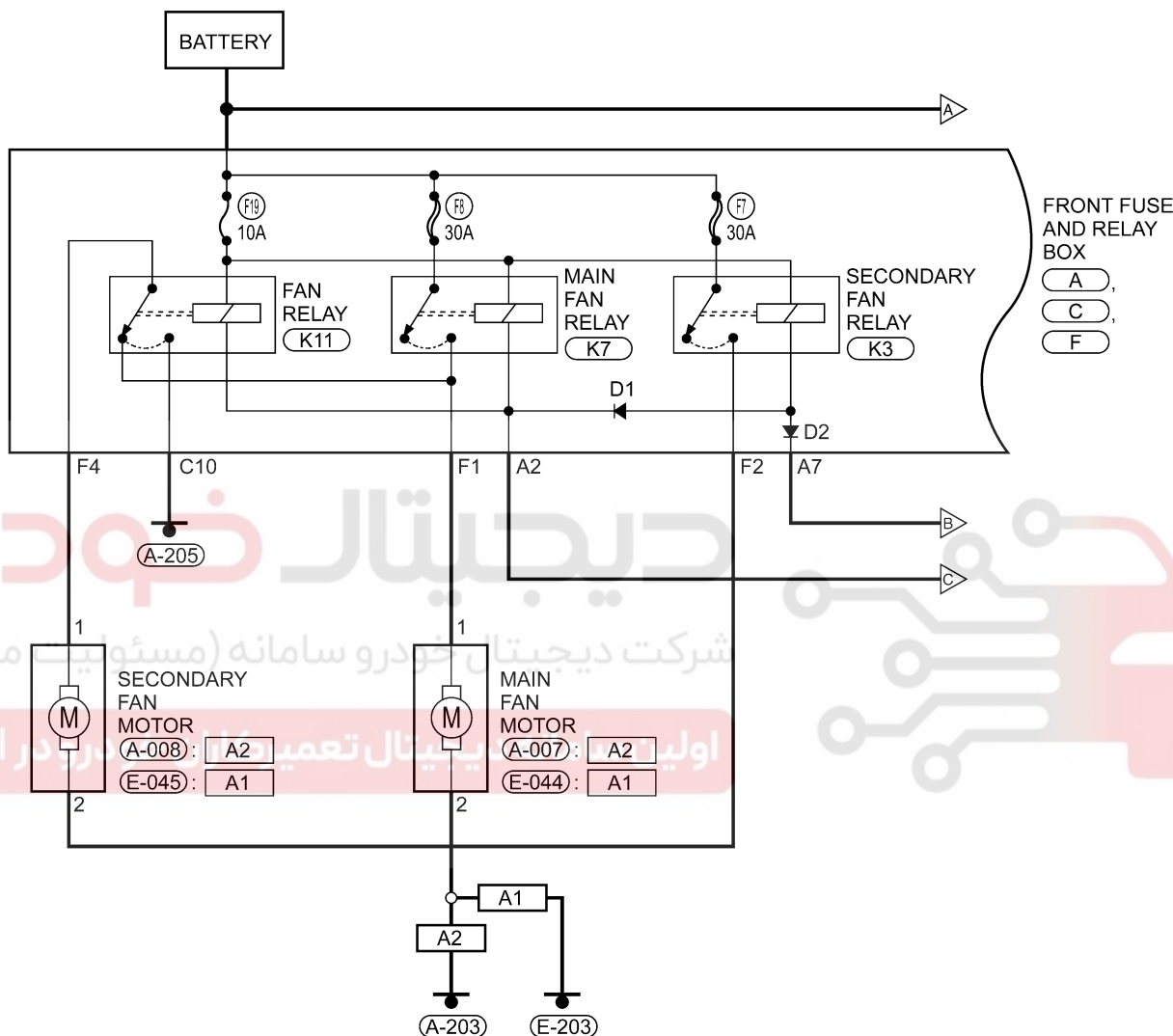
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GENERAL INFORMATION

Cooling System (Page 3 of 5)

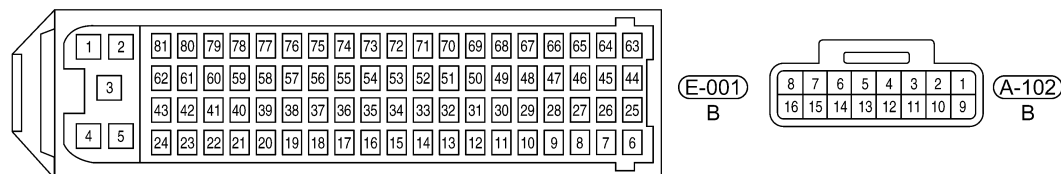
COOLING SYSTEM - WITH ACTECO ENGINE SYSTEM

- A1** : WITH ACTECO 1.6L - 1.8L ENGINE SYSTEM
- A2** : WITH ACTECO 2.0L ENGINE SYSTEM



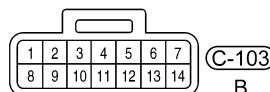
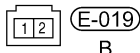
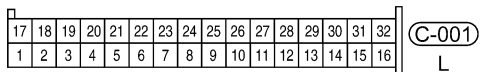
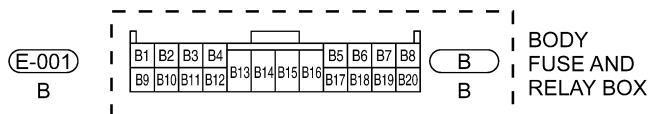
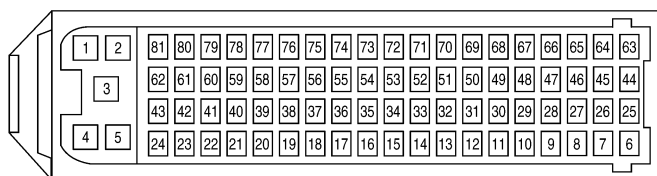
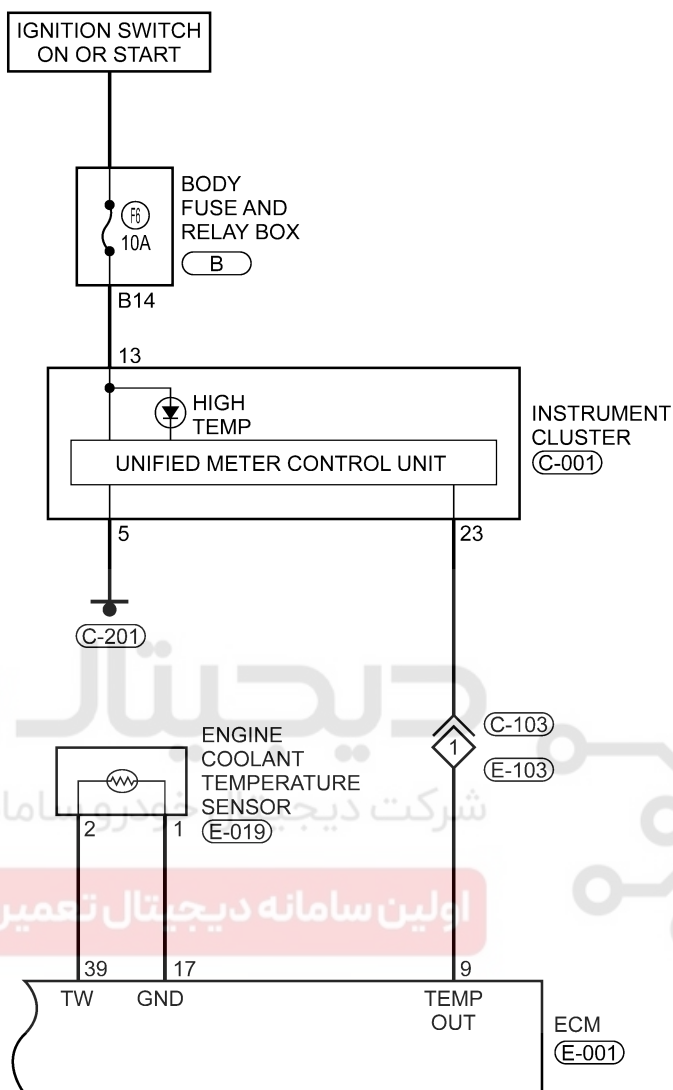
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Cooling System (Page 4 of 5)



GENERAL INFORMATION

Cooling System (Page 5 of 5)



DIAGNOSIS AND TESTING

Cooling System Pressure Test

WARNING!

Always allow the engine to cool before opening the cooling system. Do not remove the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

CAUTION:

Do not pressurize the cooling system beyond the maximum pressure listed in the specifications table in this section, or cooling system components can be damaged.

1. Turn the engine off.
2. Check the engine coolant level. Adjust the coolant level as necessary.
3. Attach the pressure tester to the coolant recovery reservoir. Install a pressure test pump to the quick-connect fitting of the test adapter.
4. Pressurize the engine cooling system to 111 kPa. Observe the gauge reading for approximately 2 minutes. Pressure should not drop during this time. If the pressure drops within this time, inspect for leaks and repair as necessary.
5. If no leaks are found and the pressure drops, the pressure relief cap may be leaking. Install a new pressure relief cap and retest the system.
6. If no leaks are found after a new pressure relief cap is installed, and the pressure drops, the leak may be internal to the radiator transmission cooler (if equipped). Inspect the coolant for transmission fluid and the transmission fluid for coolant. Repair as necessary.
7. If there is no contamination of the coolant or transmission fluid, the leak may be internal to the engine. Inspect the coolant for engine oil and the engine oil for coolant.
8. Release the system pressure by loosening the pressure relief cap. Check the coolant level and adjust as necessary.

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Cooling System Concentration Test

CAUTION:

Do not mix types of coolant, corrosion protection will be severely reduced.

Coolant concentration should be checked when any additional coolant is added to the cooling system or after a coolant drain, flush and refill. The coolant mixture offers optimum engine cooling and protection against corrosion when mixed to a freeze point of -37°C to -46°C . The use of a hydrometer or a refractometer can be used to test coolant concentration.

DIAGNOSIS AND TESTING

Cooling System Troubleshooting Chart

CONDITION	POSSIBLE CAUSES	CORRECTION
Loss of Coolant	· Coolant hoses or tubes · Hose clamps · Coolant pump gasket · Thermostat gasket · Thermostat housing · Radiator · Coolant reservoir · Pressure relief cap · Coolant pump leaking · Heater core · Engine gaskets (may leak internally or externally) · Cylinder block core plugs	· Replace coolant hoses or tubes · Replace hose clamps · Replace coolant pump gasket · Replace thermostat gasket · Repair/replace thermostat housing · Repair/replace radiator · Replace coolant reservoir · Replace pressure relief cap · Replace coolant pump · Replace heater core · Replace engine gaskets · Replace cylinder block core plugs
Engine Overheats	· Low coolant level · External engine coolant leak · Air lock in system · Pressure relief cap installation · Restricted airflow through the A/C condenser/radiator · Internal engine coolant leak · Coolant condition/concentration · Electric cooling fan · Radiator · Thermostat · Engine coolant temperature indicator gauge · Heater core · Coolant pump · Coolant flow restriction	· Add coolant as needed · Repair engine coolant leak · Bleed air from cooling system · Ensure pressure relief cap is installed correctly · Remove restriction from the A/C condenser/radiator · Repair internal engine coolant leak · Repair coolant condition/concentration as needed · Replace electric cooling fan(s) · Repair/replace radiator · Replace thermostat · Verify engine coolant temperature indicator gauge operation · Replace heater core · Replace coolant pump · Repair cause of coolant flow restriction
Engine Does Not Reach Normal Operating Temperature	· Thermostat · Electric cooling fan always on · Engine coolant temperature indicator gauge	· Replace thermostat · Repair cause of electric cooling fan always on · Verify engine coolant temperature indicator gauge operation
Electric Cooling Fan(s) Does Not Operate	· Fuse and Relay Box · Wiring · Relay(s) · Fuse(s) · Engine Control Module (ECM) · Cooling fan motor(s)	· Repair/replace Fuse and Relay Box · Repair wiring · Replace relay(s) · Replace fuse(s) · Replace the ECM · Replace cooling fan motor(s)
Electric Cooling Fan(s) On All The Time	· Wiring · Relay(s) · Engine Control Module (ECM)	· Repair wiring · Replace relay(s) · Replace the ECM

ON-VEHICLE SERVICE

Cooling System Draining and Filling

Cooling System Draining Procedure

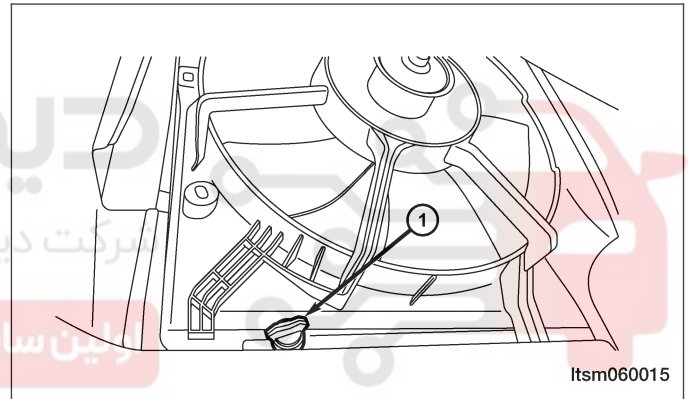
WARNING!

Never remove the pressure relief cap, under any conditions, while the engine is operating or hot. Failure to follow these instructions could result in personal injury or damage to the cooling system or engine. To avoid having scalding hot coolant or steam blow out of the cooling system, use extreme care when removing the pressure relief cap. Wait until the engine has cooled, then wrap a thick cloth around the pressure relief cap and turn it slowly one turn (counterclockwise). Step back while the pressure is released from the cooling system. When you are certain all the pressure has been released, using a cloth turn and remove the pressure relief cap. Failure to follow these instructions may result in serious personal injury.

Perform the following procedure when draining the cooling system.

1. Do not remove the pressure cap first.
2. With the engine cold, remove the pressure cap.
3. Raise and support the vehicle and locate the radiator drain plug.
4. Attach one end of a hose to the drain plug (1). Put the other end into a clean container. Open the drain plug and drain the coolant from the radiator.

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5. Tighten the radiator drain plug.

Cooling System Filling Procedure

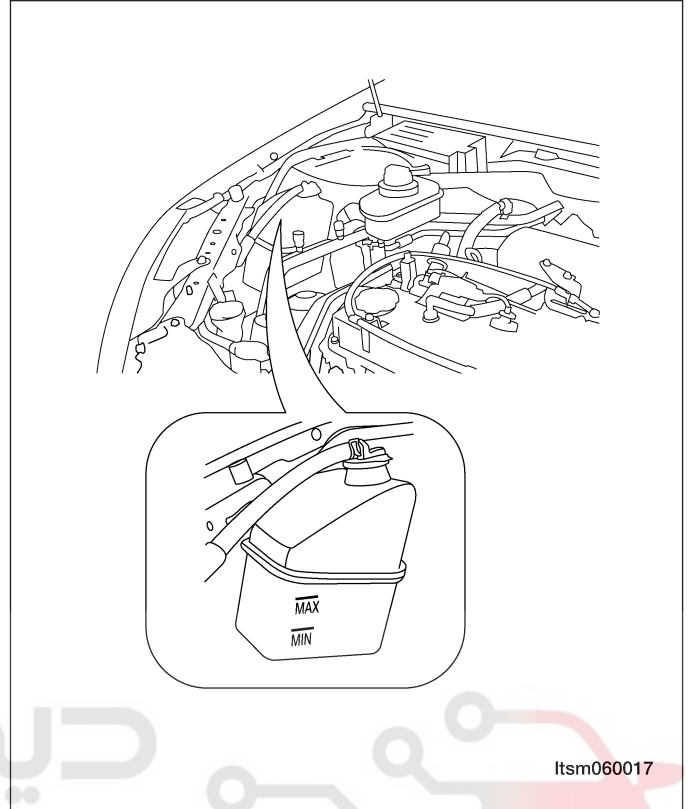
CAUTION:

Failure to purge air from the cooling system can result in an overheating condition and severe engine damage.

ON-VEHICLE SERVICE

Perform the following procedure when filling the cooling system.

1. Fill the system using the proper mixture of anti-freeze/coolant and water. Fill the coolant recovery reservoir to the "MAX" line and install the pressure cap.



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2. With the heater control in the HEAT position, start and operate the engine with coolant recovery reservoir cap in place.
3. Add coolant to the coolant recovery reservoir as necessary. Only add coolant to the coolant recovery reservoir when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.

Thermostat**Description**

The thermostat is located in the thermostat housing. The thermostat housing is located on the top of the engine between the engine and the radiator.

Operation

The thermostat controls the operating temperature of the engine by controlling the amount of engine coolant flow to the radiator. The thermostat opens when the engine coolant temperature is approximately 90°C. At this temperature, engine coolant is allowed to flow to the radiator. The thermostat provides quick engine warm up and overall temperature control. The thermostat begins to close below 90°C. The thermostat controls this by the use of a wax pellet located in a sealed container at the spring end of the thermostat. When heated, the pellet expands and overcomes the closing spring tension to force the valve to open, and when cooled, the pellet contracts and the closing spring then forces the valve to close.

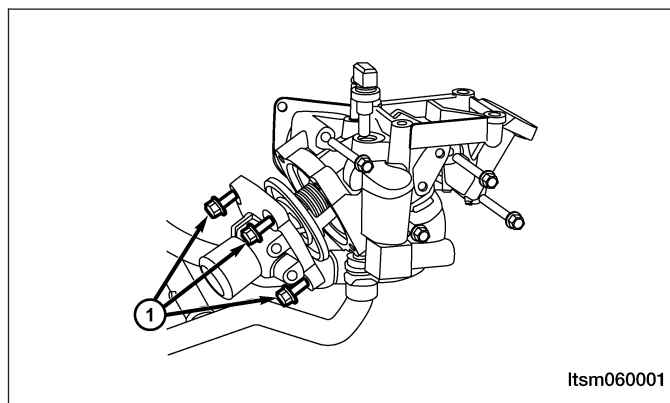
Removal & Installation - 1.6L & 1.8L & 2.0L**WARNING!**

Always allow the engine to cool before opening the cooling system. Do not remove the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

1. Drain the cooling system (See Cooling System Draining Procedure in Section 06 Cooling System).

ON-VEHICLE SERVICE

2. Remove the thermostat mounting bolts (1).
(Tighten: Thermostat mounting bolts to 15 N·m)



3. Remove the thermostat and gasket.
4. Installation is in the reverse order of removal.

Installation Notes:

- Install a new thermostat gasket during installation.
- Verify the cooling system is filled to proper specifications.

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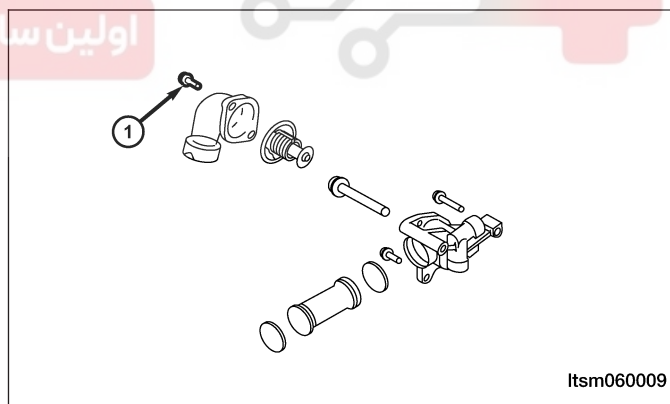
Removal & Installation - 2.4L**WARNING!**

Always allow the engine to cool before opening the cooling system. Do not remove the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

1. Drain the cooling system (See Cooling System Draining Procedure in Section 06 Cooling System).
2. Remove the thermostat mounting bolts (1).
(Tighten: Thermostat mounting bolts to 13 N·m)
3. Remove the thermostat and gasket.
4. Installation is in the reverse order of removal.

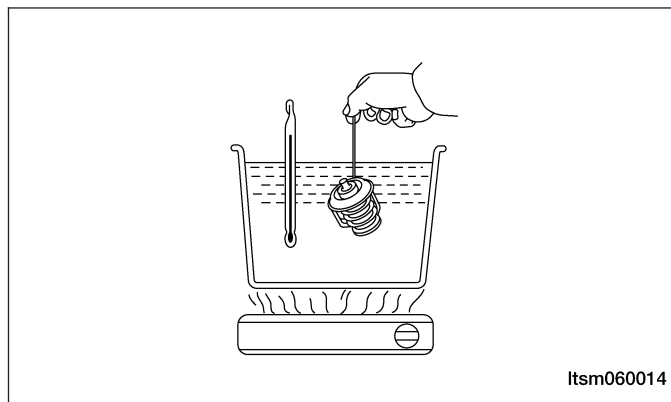
Installation Notes:

- Install a new thermostat gasket during installation.
- Verify the cooling system is filled to proper specifications.



Thermostat Inspection

1. Inspect the sealing surface of the thermostat (the seat should be tight at room temperature).
2. Inspect the opening temperature and maximum stroke of the thermostat.
 - Opening temperature of the thermostat is $87^{\circ} \pm 2^{\circ}\text{C}$
 - Maximum stroke of the thermostat is 8 mm
 - Full opening temperature of the thermostat is 104°C
3. Verify the thermostat closes 5°C lower than the opening temperature.
4. If the thermostat fails any of the inspection steps, replace the thermostat.



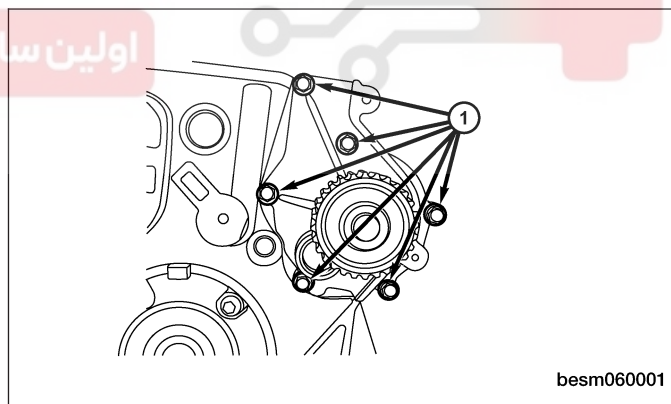
Coolant Pump

Removal & Installation - 1.6L & 1.8L & 2.0L

WARNING!

Always allow the engine to cool before opening the cooling system. Do not remove the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

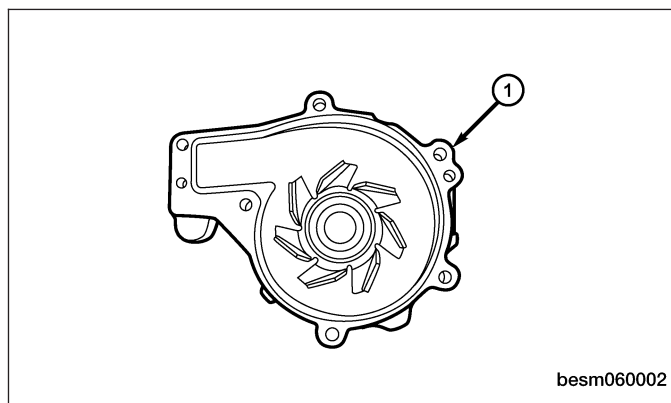
1. Drain the cooling system (See Cooling System Draining Procedure in Section 06 Cooling System).
2. Remove the timing belt (See Timing Belt Removal & Installation in Section 02 Engine).
3. Remove the coolant pump mounting bolts (1).
(Tighten: Coolant pump mounting bolts to 15 N·m)



4. Remove the water pump and gasket.
5. Installation is in the reverse order of removal.

Installation Notes:

- Install a new coolant pump gasket during installation (1).
- Verify the cooling system is filled to proper specifications.

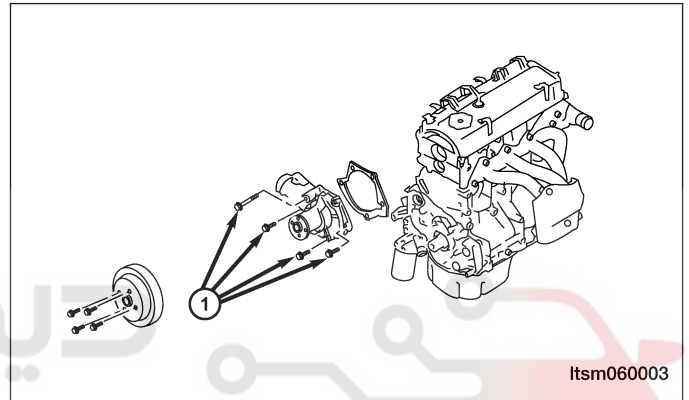


Removal & Installation - 2.4L

WARNING!

Always allow the engine to cool before opening the cooling system. Do not remove the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

1. Drain the cooling system (See Cooling System Draining Procedure in Section 06 Cooling System).
2. Remove the accessory drive belt (See Accessory Drive Belt Removal & Installation in Section 02 Engine).
3. Remove the engine timing belt (See Engine Timing Belt Removal & Installation in Section 02 Engine).
4. Remove the upper balance shaft timing belt (See Upper Balance Shaft Timing Belt Removal & Installation in Section 02 Engine).
5. Remove the coolant pump mounting bolts (1).
(Tighten: Coolant pump mounting bolts to 14 N·m)



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6. Remove the coolant pump and gasket.
7. Installation is in the reverse order of removal.

Installation Notes:

- Install a new coolant pump gasket during installation.
- Verify the cooling system is filled to proper specifications.

Coolant Pump Inspection

Check coolant seal of the coolant pump for coolant leak. If coolant pump bearing is loose, replace the assembly.

Radiator**Description**

The radiator is a cross-flow type (horizontal tubes) with design features that provide greater strength, as well as sufficient heat transfer capabilities to keep the engine coolant within operating temperatures.

Operation

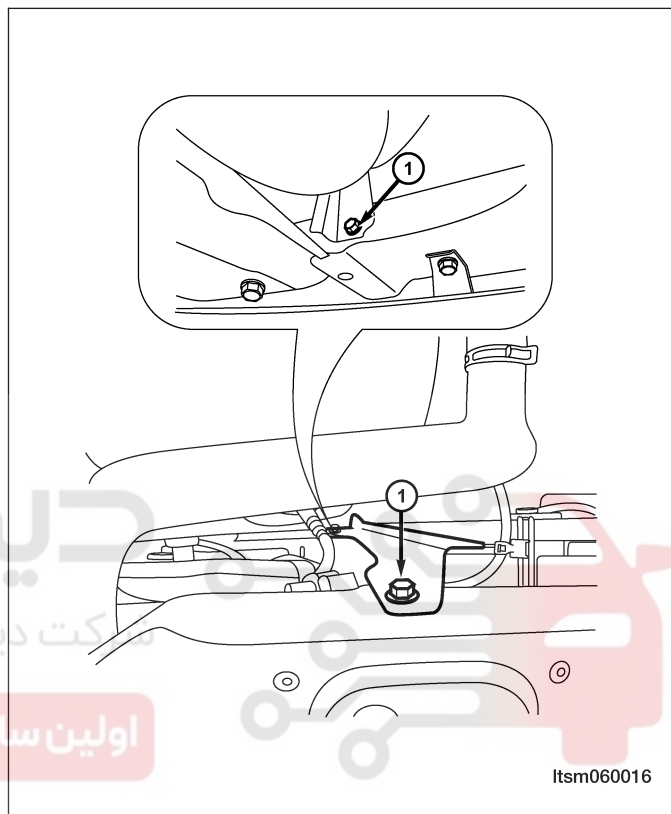
The radiator functions as a heat exchanger, using air flow across the exterior of the radiator tubes. Heat from the coolant is then transferred from the radiator into the moving air.

Removal & Installation**WARNING!**

Always allow the engine to cool before opening the cooling system. Do not remove the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

ON-VEHICLE SERVICE

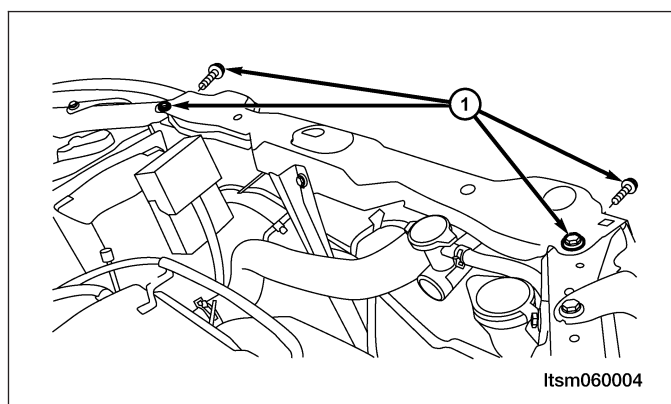
1. Disconnect the negative battery cable.
2. Drain the cooling system (See Cooling System Draining Procedure in Section 06 Cooling System).
3. Disconnect the upper radiator hose from the radiator.
4. Disconnect the lower radiator hose from the radiator.
5. Disconnect the cooling fan electrical connectors.
6. Remove the cooling fan (See Cooling Fan Removal & Installation in Section 06 Cooling).
7. Remove the automatic transaxle fluid hose connecting bolts to radiator (only with 2.0L engine).
8. Remove the radiator support lever retaining bolts (1).



9. Remove the radiator support mounting bolts (1).
(Tighten: Radiator support mounting bolts to 5 N·m)
10. Remove the radiator from the engine compartment.
11. Installation is in the reverse order of removal.

Installation Notes:

- Verify the cooling system is filled to proper specifications.

**Cooling Fan****Description**

The radiator cooling fans are dual-speed electric motor driven fans. The radiator fan assembly includes two electric motors, two five-blade fans, and a support shroud that is attached to the radiator. The radiator fans are serviced as an assembly.

Operation

The radiator cooling fan operation is controlled by the Engine Control Module (ECM) and the fan relays, with inputs from the following:

- Engine coolant temperature
- Automatic transaxle fluid temperature (with DP0 transaxle)
- A/C signal

Inspect the cooling fan for proper low speed and high speed operation:

- The low speed fan should be switched on at 98°C and switched off at 94°C.
- The high speed fan should be switched on at 105°C and switched off at 101°C.
- If the water temperature is greater than 101°C after the fan is switched off, the fan will continue to operate for 1 minute.
- If the water temperature is greater than 94°C after the fan is switched off, the fan will continue to operate for 0.5 minute.
- If the water temperature is less than 85°C after the fan is switched off, the fan will stop operating.

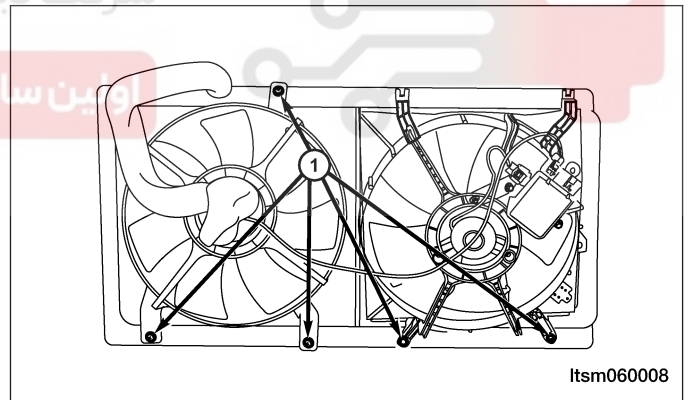
Removal & Installation

WARNING!

Always allow the engine to cool before opening the cooling system. Do not remove the coolant pressure relief cap when the engine is operating or the cooling system is hot. The cooling system is under pressure; steam and hot liquid can come out forcefully when the cap is loosened slightly. Failure to follow these instructions may result in serious personal injury.

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1. Disconnect the negative battery cable.
2. Drain the cooling system (See Cooling System Draining Procedure in Section 06 Cooling System).
3. Disconnect the upper radiator hose from the radiator.
4. Disconnect the cooling fan electrical connector and the cooling fan ground cable connected to the body.
5. Remove the cooling fan mounting bolts (1) to the radiator.
(Tighten: Cooling fan mounting bolts to 5 N·m)



6. Remove the radiator fan from the engine compartment.
7. Remove the cooling fan from its support, if necessary.
8. Installation is in the reverse order of removal.

Installation Notes:

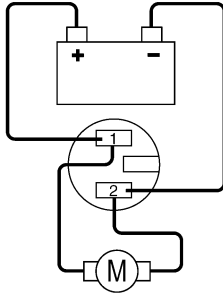
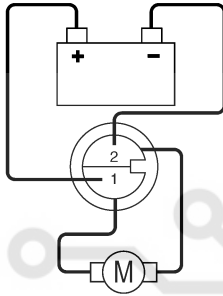
- Verify the cooling system is filled to proper specifications.

Cooling Fan Inspection

1. Using the following table, apply battery voltage to the specified connector terminals.
2. Verify that the fan motor operates smoothly when voltage is applied.
3. If the test results are not as specified, replace the fan motor.

ON-VEHICLE SERVICE

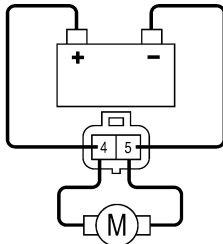
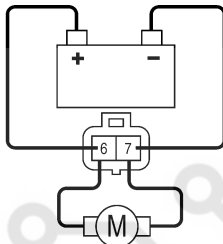
With 1.6L & 1.8L & 2.0L Engine

MEASURING CONDITION	OPERATION	INSPECTION DIAGRAM
Battery positive (+) to terminal – 1 Battery negative (-) to terminal – 2	Turns smoothly	 Itsm060012
Battery positive (+) to terminal – 1 Battery negative (-) to terminal – 2	Turns smoothly	 Itsm060013

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ON-VEHICLE SERVICE

With 2.4L Engine

MEASURING CONDITION	OPERATION	INSPECTION DIAGRAM
Battery positive (+) to terminal – 4 Battery negative (-) to terminal – 5	Turns smoothly	 Itsm060010
Battery positive (+) to terminal – 6 Battery negative (-) to terminal – 7	Turns smoothly	 Itsm060011

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اولین سامانه دیجیتال تعمیرکاران خودرو در ایران