

Automotive Heating And Air Conditioning
Eighth Edition

Chapter 9

Heating System Operation and Diagnosis

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Learning Objectives (1 of 2)

- 9.1** Prepare for the ASE Heating and Air Conditioning (A7) certification test content area "C" (Heating and Engine Cooling Systems Diagnosis and Repair).
- 9.2** Discuss the operation of heating systems.
- 9.3** Discuss the diagnosis of heating systems.

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Learning Objectives (2 of 2)

- 9.4** Explain the operation of electrically heated seats.
- 9.5** Explain the operation of heated and cooled seats.
- 9.6** Explain the operation of heated steering wheel.

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Heating Systems (1 of 2)

- The inlet hose to the heater core connects to an outlet fitting near the engine thermostat, or an area of the engine with the hottest coolant.
- The outlet hose from the heater core is connected near the inlet of the water pump, which is the area with the lowest coolant pressure.

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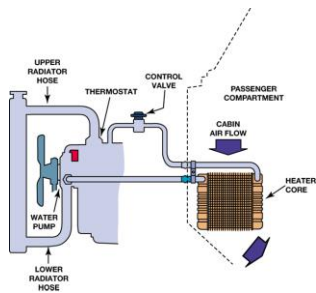
Heating Systems (2 of 2)

- When the engine runs, coolant flows through the engine's water jackets, past the thermostat, and through the heater core.
- The heated coolant warms the heater core and the air passing through it.

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FIGURE 9-1 The main parts of a vehicle's heating system are the heater core, blower, heater hoses, and, in some cases, a heater control valve.



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Dual Heating Systems

- Larger vehicles with rear A/C systems include a heater in the rear unit.
 - These rear units include a heater core and temperature-blend door.
 - Heater hoses

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Heater Diagnosis (1 of 5)

- Visual Inspection
 - Coolant level and condition
 - Water pump drive belt condition and proper tension
 - Belt tension gauge
 - Marks on the tensioner
 - Torque wrench reading
 - Deflection

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Heater Diagnosis (2 of 5)

- To check a radiator or condenser for possible clogged or restricted areas
 - Check the temperature of the heater hoses
 - Check for proper airflow across the heater core
 - Pressure test the cooling system

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Heater Diagnosis (3 of 5)

- Scan Tool Diagnosis
 - Use a scan tool and check for any stored or pending diagnostic trouble codes, especially those that pertain to the HVAC controls.

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Heater Diagnosis (4 of 5)

- Scan Tool Diagnosis
 - Check that the coolant temperature as measured by the engine coolant temperature (ECT) sensor is correct, usually 180°F to 200°F (82°C to 93°C). Check service information for the specified coolant temperature for the vehicle being checked.

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Heater Diagnosis (5 of 5)

- Scan Tool Diagnosis
 - Perform a bidirectional control of the blend door and blower motor speed, if possible, to confirm that these are operating correctly.

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FIGURE 9-4 A special wrench being used to remove the tension from the accessory drive belt so it can be removed.



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Electrically Heated Seats (1 of 3)

- Heated seats use electric heating elements in the seat bottom, as well as in the seat back in many vehicles.
- The heating element is designed to warm the seat and/or back of the seat to about 100°F (37°C) or close to normal body temperature (98.6°F).

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Electrically Heated Seats (2 of 3)

- A temperature sensor in the seat cushion is used to regulate the temperature.
- The sensor is a variable resistor that changes with temperature and is used as an input signal to a heated seat control module.

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Electrically Heated Seats (3 of 3)

- The heated seat module uses the seat temperature input, as well as the input from the high–low (or variable) temperature control, to turn the current on or off to the heating element in the seat.
- Some vehicles are equipped with heated seats in both the rear and the front.

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FIGURE 9-6 The heating element of a heated seat is a replaceable part, but service requires that the upholstery be removed. The yellow part is the seat foam material and the entire white cover is the replaceable heating element. This is then covered by the seat material.



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Heated and Cooled Seats (1 of 2)

- Most electrically heated and cooled seats use a thermoelectric device (TED) located under the seat cushion and seat back.
- The thermoelectric device uses the Peltier effect.
- Most vehicles equipped with heated and cooled seats use two modules per seat.

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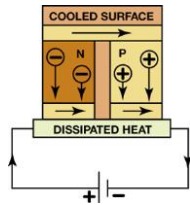
Heated and Cooled Seats (2 of 2)

- Each thermoelectric device has a temperature sensor, called a thermistor.
- The control module uses sensors to determine the temperature of the fins in the thermoelectric device so the controller can maintain the set temperature.

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FIGURE 9-7 A Peltier effect device is capable of heating or cooling, depending on the polarity of the applied current.



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Heated Steering Wheel (1 of 2)

- A signal is sent to the control module and electrical current flows through the heating element in the rim of the steering wheel.
- The system remains on until the ignition switch is turned off or the driver turns off the control switch.

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Heated Steering Wheel (2 of 2)

- The temperature of the steering wheel is usually calibrated to stay at about 90°F (32°C), and it requires three to four minutes to reach that temperature depending on the outside temperature.

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FIGURE 9-8 The heated steering wheel is controlled by a switch on the steering wheel in this vehicle.



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Summary

- The heater core resembles a small radiator, and it is connected to the engine by a pair of hoses.
- Heated seats can use either a resistance type heater located under the seat covering or a thermoelectric (TE) device.
- Heater diagnosis includes verifying the problem, visual inspections and scan tool usage.

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1 The diagnosis of a lack of heat from the heater started by checking the temperature of the heater hoses. The return hose was colder than the inlet hose.



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2 A test strip was used to check the coolant pH and freezing point. The coolant did not look fresh, but the test strip results were normal.



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3 The refractometer test confirmed that the freezing protection was -32°F (-36°C).



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4 The heater core was flushed and the coolant flow through the hoses seemed to be normal.



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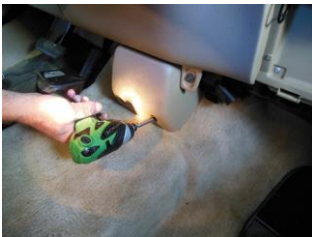
5 The heater core had to be removed and this required that the dash assembly be removed. Starting to remove the dash components to get access to the heater core.



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6 The fasteners used to retain the dash to the bulkhead being removed.



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7 The A/C system was evacuated because it was necessary to remove HVAC module which contained the evaporator.



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8 The dash was pulled back and the heater core became visible.



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9 The vacuum connection for the HVAC vacuum actuators was disconnected from under the hood.



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10 The AC hose connections to the evaporator were removed.



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11 The heater core being removed from inside the vehicle.



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12 The heater core was removed from the inside of the vehicle and connected to the heater hoses and then the engine was started. The heater core felt hot across the entire surface.



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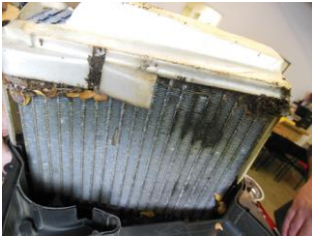
13 However, when an infrared temperature gun was used, the temperature measured about 20 degrees different depending on where it was measured.



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14 The evaporator had signs that it was leaking as indicated by the oil seen on the surface. It was replaced at the same time as the heater core.



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15 The replacement heater core was made of aluminum instead of brass like the original but it fit correctly.



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16 Fresh coolant was added to a coolant exchange machine. Conventional green (IAT) coolant was used because it had been converted to this coolant during a previous service.



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17 The coolant was replaced using the exchange machine, which also purged any air from the system. The heater worked great and was very hot and the vehicle owner was pleased.



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18 The end cap was removed from the old heater core and connected to a water hose. Only about half of the tubes were flowing water indicating that this heater core did require replacement.



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