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LESSON 2

HVAC DIAGNOSIS

Lesson 2 covers the diagnosis, or troubleshooting, of the HVAC system and the tools used to perform that diagnosis. The lesson contains one reading assignment.

ASSIGNMENT 1

HEATING AND AIR-CONDITIONING SYSTEM DIAGNOSIS

Read this section in your study guide. Then read Chapter 64 in your textbook.

ASSIGNMENT OBJECTIVES

When you complete Assignment 1, you'll be able to

- 1.1 Explain how to diagnose a heating system problem
- 1.2 Describe how to diagnose lack-of-heat problems
- 1.3 Discuss how to check the performance of the AC system
- 1.4 Explain how the sight glass can be used to determine the state of charge
- 1.5 Describe the procedures for measuring temperature and pressure in AC systems



ASSIGNMENT 1

VOCABULARY

The terms you need to know for this assignment are

- Bleeder valves
- High-side pressure
- Low coolant level
- Low-side pressure

CHAPTER 64—HEATING AND AIR-CONDITIONING SYSTEM DIAGNOSIS

Chapter 64 explains how to diagnose a heating system problem and how to check the performance of the AC system. Most AC problems relate to a low charge due to a leak, so make sure to focus on tests for this issue. The chapter then goes on to explain the procedures for measuring AC temperature and pressure.



You'll find that the following video and animation links from the author's website may help you better understand the textbook and your assignments:

- [HVAC diagnosis \(videos and animations\)](#)
- [Heater Operation \(animation\)](#)



If water appears on passenger-side carpet, check for a clogged evaporator drip tube.

CAUSES OF ABNORMAL PRESSURE READINGS

Pressure gauge readings can be useful when determining the cause of a problem. The following is a handy chart to use when diagnosing an issue using the high- and low-pressure gauges. The chart expands on the one found on page 740 of your textbook.

AC Pressure Gauge Chart		
Low-Pressure Average (25–35 psi)	High-Pressure Average (170–200 psi)	Possible Causes
Low	Low	Low refrigerant charge
Low	Low	Obstruction in the suction line
Low	Low	Clogged orifice tube
Low	Low	TXV valve stuck closed
Low	Low	Restricted line from condenser to evaporator
Low	High	Restricted evaporator airflow
High	Low	Internal compressor damage
High	High	Refrigerant overcharge
High	High	Restricted condenser airflow
High	High	High engine-coolant temperature
High	High	TXV valve stuck open
High	High	Air or moisture in the refrigerant



Search the Internet to find the procedures for recovering an unknown refrigerant.



ASSIGNMENT 1

DISCOVER MORE

OPTIONAL EXERCISE: MEASURING AC OPERATION VIA TEMPERATURE DIFFERENCE

Note: To perform this exercise, you'll need to purchase a noncontact infrared thermometer with laser targeting. This tool is available from various retailers for prices ranging from \$10 to \$100.

One way to determine whether an AC system is working to specifications is to perform a maximum heat load stress test, which measures the system's ability to properly transfer heat. This test should be performed outside in full sunlight.

1. Use the infrared thermometer to measure ambient air temperature around the pipe entering the condenser (Figure 1).

Ambient air temperature: _____



FIGURE 1—Measuring the Temperature of Refrigerant Entering the Condenser
(Courtesy of Dr. John Kershaw)

(Continued)



ASSIGNMENT 1

DISCOVER MORE

2. Now use the infrared thermometer to measure air temperature at the center duct in the instrument panel (Figure 2).

Air temperature at center duct: _____



FIGURE 2—Air Duct Temperature (Courtesy of Dr. John Kershaw)

3. Subtract the duct temperature you recorded in Step 2 from the ambient air temperature you recorded in Step 1 to determine the drop in temperature. There should be a drop of at least 30°F (17°C) across the evaporator—that is, from Step 1 to Step 2.

Temperature drop: _____

OK _____ Not OK _____

4. Now measure the temperatures of the condenser inlet and outlet lines. Try to take your measurement as closely as possible to the condenser.

Condenser inlet-line temperature: _____

Condenser outlet-line temperature: _____

(Continued)



ASSIGNMENT 1

DISCOVER MORE

5. Subtract the outlet temperature from the inlet temperature; the difference will tell you the temperature drop across the condenser. There should be a temperature drop of 20 to 50°F (11 to 28°C). A temperature drop of less than 20°F (11°C) indicates a possible overcharge or poor condenser airflow. A temperature drop greater than 50°F (29°C) indicates a possible undercharge, air in the system, or internal condenser restriction.
6. Now measure the temperatures of the evaporator inlet and outlet lines. Try to take your measurement as closely as possible to the condenser (Figure 3). Note: On most TXV systems, you won't be able to access the line between the TXV and the evaporator inlet.

Evaporator inlet-line temperature: _____

Evaporator outlet-line temperature: _____



FIGURE 3—Measure the temperatures of the evaporator inlet and outlet lines as closely as possible to the evaporator. (Courtesy of Dr. John Kershaw)

(Continued)



ASSIGNMENT 1

DISCOVER MORE

7. Subtract the outlet temperature from the inlet temperature; the difference will tell you the amount of temperature drop across the evaporator. Ideally, there should be a temperature drop of zero degrees, Fahrenheit or Celsius. An outlet temperature that exceeds that of the inlet by 5°F (3°C) indicates a possible undercharge. Conversely, an inlet temperature that exceeds that of the outlet by more than 5°F (3°C) indicates a possible overcharge.
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ASSIGNMENT 1

REFLECT AND RESPOND

CHAPTER 64 KEY TERMS

You may wish to review the key terms of this chapter, found on page 737 of your textbook, by completing the crossword puzzle found [here](#).

Click [here](#) to check your answers.



ASSIGNMENT 5

SELF-CHECK

1. What's the first thing many technicians do when a heater isn't producing enough heat?

2. True or False? Bubbles or foam observed in a sight glass indicate a system that's partially discharged.

3. When do airflow problems commonly pop up?

4. You're working on a cooling system that isn't equipped with bleeder valves. You've filled the system with as much coolant as it will hold, but you believe that air still might be air trapped in the system. What should be your next line of attack?

5. Technician A and Technician B are discussing why air isn't flowing from a customer's air-conditioning vents. Technician A says that the evaporator is probably clogged. Technician B says that the blower motor could be defective. Who is correct?
 - a. Technician A
 - b. Technician B
 - c. Both Technicians A and B
 - d. Neither Technician A nor B

Click [here](#) to check your answers.



KEY POINTS AND RESOURCES

LESSON 2—HVAC DIAGNOSIS

To prepare for your examination, please review these key points:

- The best diagnostic resource is having the driver or owner of the car explain to you, the technician, the exact nature of the heating or air-conditioning issue.
- The easiest part of any heating or air-conditioning repair is the actual repair or service; the hardest part is diagnosing what needs to be repaired.
- The heating and air-conditioning system in today's vehicles are almost completely computer-controlled. Thus, when troubleshooting, you must be proficient in the use of the DMM (digital multimeter) and diagnostic scan tool.
- To accurately perform air-conditioning diagnosis, you must be familiar with how high- and low-side pressures relate to each other.
- A thorough knowledge of engine cooling systems is also essential to your skill in HVAC-problem diagnosis.