

Automotive Technology 6th Edition

Chapter 65 Automatic Air-Conditioning System Operation

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This Automotive Technology 6th text provides complete coverage of automotive components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and ASEEducation (NATEF) and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Case Studies, Videos, Animations, and ASEEducation (NATEF) Task Sheets.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending this session or class.	Explain learning objectives to students as listed below: <ol style="list-style-type: none"> 1. Explain airflow management and the sensors and actuators used in automatic air conditioning. 2. Discuss the filters and controls used in automatic air conditioning. 3. Explain dual-zone climate controls, rear air-conditioning system operation, and recirculation operation. 4. Describe how hybrid electrical vehicle heating and cooling systems are different from conventional systems.
Establish the Mood or Climate	Provide a <i>WELCOME</i> , Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.

NOTE: Lesson plan is based on 6th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

DOWNLOAD Chapter 65 Chapter Images: From
http://www.jameshalderman.com/automotive_principles.html

NOTE: You can use Chapter Images or possibly Power Point files:

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1. SLIDE 1 Chapter 65 AUTOMATIC AIR-CONDITIONING SYSTEM OPERATION

Check for **ADDITIONAL VIDEOS & ANIMATIONS**
@ <http://www.jameshalderman.com/>
WEB SITE IS CONSTANTLY UPDATED

http://www.jameshalderman.com/automotive_principles.html
DOWNLOAD

Crossword Puzzle (Microsoft Word) (PDF)
Word Search Puzzle (Microsoft Word) (PDF)

Videos

DISCUSSION: Ask students to talk about the airflow management components of an HVAC system. Under what conditions does the system provide airflow?

2. SLIDE 2 **EXPLAIN** Figure 65-1 The three major portions of the A/C and heat system are air inlet, plenum, and air distribution. The shaded portions show the paths of the four control doors.

DISCUSS FREQUENTLY ASKED QUESTION:

***What Is "Afterblow"?* Afterblow is a term used to describe the operation of blower motor after the ignition has been turned off. Purpose of Afterblow is to dry the evaporator to help prevent formation of mold and mildew in the evaporator case. The operation of the blower motor after the ignition is turned off has created some customer complaints. Check service information to be sure that the condition is normal or not on the vehicle being investigated. For example, in a typical GM System, following conditions must be met for Afterblow to occur:**

1. The engine has been off for 30 minutes.

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2. The outside air temperature is 70°F (21°C) or higher.

3. The battery voltage is 12 volts or higher.

If the above conditions exist, Afterblow is commanded to be on for 20 seconds, off for 10 seconds, and then back on for another 20 seconds.

DEMONSTRATION: Show students an example of a sensor from an automatic A/C system and describe its function.

3. SLIDE 3 **EXPLAIN** Figure 65-2 ambient temperature sensor in this system is located in the fresh air intake duct for the HVAC system

DISCUSSION: Break class into 2 groups. Have half class test the other on the typical settings for heating and air conditioning; then reverse groups to test settings for ventilation & defogging or defrosting the inside front windshield.

DISCUSSION: Ask students to talk about the functions of all the sensors relating to automatic A/C systems. Ask students to identify where each sensor is located and what its function is.

HANDS-ON TASK: Ask students to go to a LAB Vehicle equipped with Auto A/C & identify where each **sensor** is located and **LABEL IT** with masking tape or a sticky note.

4. SLIDE 4 **EXPLAIN** Figure 65-3 block diagram showing the inputs to electronic control assembly and the outputs; note that some of the outputs have feedback to ECM.

DEMONSTRATION: Show students an example of a vacuum control circuit. Describe how it works and where it is used. **Download one. FIGURE 65-3**

DEMONSTRATION: Show an example of an electric servomotor circuit. Describe how it works and where it is used. **FIGURE 65-3**

DEMO



DEMO

DEMO

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Faulty blower motor operation can often be traced to a bad blower motor resistor.

DEMONSTRATION: Show an actuator from an automotive A/C system and describe its function

DISCUSSION: Ask students to discuss the electronic controls of an automatic A/C system. Which are input and which are output controls?

[Automatic Temperature Control, ATC Sun Load \(View\) \(Download\)](#)

[Automatic Temperature Control, ATC Temperature, Heat \(View\) \(Download\)](#)

[Automatic Temperature Control, ATC Air Quality \(View\) \(Download\)](#)

[Automatic Temperature Control, ATC Temperature, Cool, Adjust \(View\) \(Download\)](#)

[Automatic Temperature Control, ATC Temperature, Cool \(View\) \(Download\)](#)

[Automatic Temperature Control, ATC Temperature, Humidity \(View\) \(Download\)](#)

[Compressor Temperature Sensor \(View\) \(Download\)](#)

HANDS-ON TASK: Have Students LABEL Electronic controls of an automatic A/C system & SHOW which are input and output controls? USE STICKY NOTES OR MASKING TAPE

5. SLIDE 5 EXPLAIN Figure 65-4 typical cabin filter being removed from behind the glove compartment.

Cabin filters remove dust and dirt from air before they can enter the passenger cabin. FIGURE 65-4

Cabin filters should be serviced at regular intervals.

DISCUSSION: Ask students to discuss purpose of afterblow feature of a blower motor.

DISCUSSION: Ask students to discuss electronics that control the blower motor settings.

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6. **SLIDE 6 EXPLAIN Figure 65-5** With no vacuum signal, the spring extends the actuator shaft to place the door in a certain position (top). A vacuum signal pulls the shaft inward and moves the door to the other position (bottom).

DISCUSSION: Ask students to discuss the types of actuators found in automotive A/C systems. Students should describe what each actuator does & provide an example of each use. FIGURE 65-5

7. **SLIDE 7 EXPLAIN Figure 65-6** Three electric actuators can be easily seen on this demonstration unit. However, accessing these actuators in a vehicle can be difficult.
8. **SLIDE 8 EXPLAIN Figure 65-7** The feedback circuit signals the AC control unit with the blend door position.
9. **SLIDE 9 EXPLAIN Figure 65-8** A typical blower motor assembly with attached squirrel cage blower. A replacement motor does not include the squirrel cage blower so it needs to be switched to the replacement motor.
10. **SLIDE 10 EXPLAIN Figure 65-9** “credit card” resistor used in the rear blower assembly in a Dodge minivan
11. **SLIDE 11 EXPLAIN Figure 65-10** A dual climate control system showing the airflow and how it splits.

DISCUSSION: Ask students to talk about how dual-zone air climate controls work. What cars can they name that have this feature? FIGURE 65-10 & 11

12. **SLIDE 12 EXPLAIN Figure 65-11** A typical dual-zone climate control panel showing left and right side temperature control levers.

DISCUSSION: Ask students to talk about rear-seat A/C systems. What special components are needed for these systems to operate effectively? FIGURE 65-10 & 11

13. **SLIDE 13 EXPLAIN Figure 65-12** Heated or cooled air is supplied to the rear seat passengers of most vehicles through ducts that run under the front seats.

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QUESTION



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14. SLIDE 14 **EXPLAIN** Figure 65-13 A rear heat and air conditioning system on a Honda Odyssey minivan.

ON-VEHICLE ASE EDUCATION TASK A1

Research Auto/DUAL Climate A/C vehicle and service information.

ON-VEHICLE ASE EDUCATION TASK D8

Check operation of automatic or semi-automatic HVAC control systems; determine needed action.

DISCUSSION: Ask students to discuss the principles behind the recirculation operation in an A/C system.

DISCUSSION: Have students discuss how the heating and cooling systems on hybrid electric vehicles (HEVs) work. How do these differ from similar systems on conventionally vehicles?

ON-VEHICLE ASE EDUCATION TASK B4

Identify hybrid vehicle A/C system electrical circuits, service, and safety precautions.