

# Automotive Heating and Air Conditioning, 8e

## Chapter 5 A/C System Components, Operation, and Service

### Opening Your Class



KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of <b>Automotive Heating and Air Conditioning, 8e</b> . It correlates material to task lists specified by ASE and NATEF/ASEE Education.
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 the chapter learning objectives to the students. <ol style="list-style-type: none"><li>1. Prepare for the ASE Heating and Air Conditioning (A7) certification test content area "A" (A/C System Service, Diagnosis and Repair).</li><li>2. Discuss the purpose and function of compressors and condensers.</li><li>3. Describe the operation of thermal expansion valves.</li><li>4. Explain the construction and operation of orifice tubes.</li><li>5. Explain the purpose and function of evaporators and accumulators.</li><li>6. Discuss the use of lines and hoses in refrigeration.</li><li>7. Describe electrical switches and evaporator temperature controls used in A/C systems.</li><li>8. Explain component replacement procedures.</li></ol>
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: This lesson plan is based on the 8<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**LINK CHP 05:**

**[http://www.jameshalderman.com/links/book\\_hvac/ci/hvac\\_ci\\_ch\\_5.pptx](http://www.jameshalderman.com/links/book_hvac/ci/hvac_ci_ch_5.pptx)**

**These Power Point files contain more than just the images.**

<b>ICONS</b>	<b>Ch05 A/C System Components, Operation, &amp; Service</b>
 	<p><b>1. SLIDE 1 A/C SYSTEM COMPONENTS, OPERATION, AND SERVICE</b></p> <p><b>2. SLIDES 2-4 EXPLAIN OBJECTIVES</b></p> <p><b>Check for ADDITIONAL VIDEOS &amp; ANIMATIONS @ <a href="http://www.jameshalderman.com/">http://www.jameshalderman.com/</a> WEB SITE IS CONSTANTLY UPDATED</b></p> <p><b><u>Chapter 5 A/C Component Videos</u></b>  <a href="http://www.jameshalderman.com/links/book_hvac/vi d/ch5/video_frame.html">http://www.jameshalderman.com/links/book_hvac/vi d/ch5/video_frame.html</a></p> <p><b><u>Crossword Puzzle (Microsoft Word) (PDF)</u></b>  <b><u>Word Search Puzzle (Microsoft Word) (PDF)</u></b></p> <p><b>5. SLIDE 5 EXPLAIN background</b></p> <p><b>6. SLIDE 6 EXPLAIN Compressors and Condensers</b></p> <p><b>7. SLIDE 7 EXPLAIN Figure 5–1</b> A condenser is a heat exchanger that transfers heat from the refrigerant to the air flowing through it.</p> <p><b><u>A/C SYSTEM OPERATION</u></b></p> <p><b>8. SLIDES 8-9 EXPLAIN Thermal Expansion Valves</b></p> <p><b>10. SLIDE 10 EXPLAIN Figure 5–9</b> Pressure from the capillary tube pushes on the spring-loaded diaphragm to open the expansion valve. As the pressure in the capillary tube contracts, the reduced pressure on the diaphragm allows the valve to close</p> <p><b><u>DEMONSTRATION: SHOW EXAMPLE OF A THERMO, ICING, OR DEFROST SWITCH (THERMOSTAT), &amp; DESCRIBE HOW IT WORKS.</u></b></p> <p><b><u>DISCUSSION: DISCUSS HOW SENSING BULB, CAPILLARY TUBE, &amp; DIAPHRAGM INSIDE EXPANSION VALVE WORK TOGETHER TO REGULATE FLOW OF REFRIGERANT INTO EVAPORATOR</u></b></p>

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	<p><b><u>TXV OPERATION</u></b></p> <p><b><u>HEAT TRANSFER &amp; BOILING</u></b></p> <p><b><u>HEAT TRANSFER</u></b></p> <p><b><u>HEAT TRANSFER THROUGH LATENT HEAT</u></b></p> <p><b><u>DEMONSTRATION: SHOW STUDENTS AN EXAMPLE OF H-VALVE FROM CHRYSLER VEHICLE AND DESCRIBE HOW IT WORKS</u></b></p> <p><b><u>BLOCK-TYPE, H VALVE</u></b></p> <ol style="list-style-type: none"> <li>11. SLIDE 11 <b>EXPLAIN</b> Orifice Tube Systems</li> <li>12. SLIDE 12 <b>EXPLAIN</b> FIGURE 5–13 typical orifice tube. The refrigerant flow is from left toward right.</li> </ol> <p><b><u>DEMONSTRATION: SHOW AN ORIFICE TUBE, DESCRIBE ITS PURPOSE, AND EXPLAIN HOW IT WORKS. SHOW THEM SPECIAL TOOL REQUIRED TO REMOVE ORIFICE TUBE FROM SYSTEM</u></b></p> <p><b><u>A/C SYSTEM OPERATION</u></b></p> <ol style="list-style-type: none"> <li>13. SLIDE 13 <b>EXPLAIN</b> Evaporators</li> <li>14. SLIDE 14 <b>EXPLAIN</b> FIGURE 5–17 evaporator is part of the low pressure side of the refrigeration cycle and is used to transfer the heat from inside the vehicle to the refrigerant flowing through the internal tubes.</li> <li>15. SLIDE 15 <b>EXPLAIN</b> FIGURE 5–18 (a) older design tube-and-fin evaporator. (b) plate evaporator. Each type has a large contact area for heat to leave the air and enter the refrigerant.</li> </ol> <p><b><u>DEMONSTRATION: SHOW STUDENTS' EVAPORATOR IN AN AUTOMOTIVE A/C SYSTEM. DESCRIBE ITS PURPOSE &amp; HOW IT WORKS</u></b></p> <ol style="list-style-type: none"> <li>16. SLIDE 16 <b>EXPLAIN</b> Receiver-Driers and Accumulators</li> </ol> <p><b><u>DEMONSTRATION: SHOW STUDENTS RECEIVER-DRIER IN AN AUTOMOTIVE A/C SYSTEM AND DESCRIBE ITS PURPOSE AND FUNCTION</u></b></p>

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17. **SLIDE 17 EXPLAIN FIGURE 5–20** Water in an A/C system can combine with the refrigerant to form acid. These acids can etch and dissolve components, causing rusting of metal parts, and ice blockage at the expansion device.

**DISCUSSION: DISCUSS HOW AN EVAPORATOR HELPS REMOVE MOISTURE FROM THE AIR AND LOWER HUMIDITY.**

**DISCUSSION: ASK STUDENTS TO TALK ABOUT THE ROLE OF THE DESICCANT IN THE DRIER. WHAT WOULD HAPPEN IF IT WERE OMITTED?**

**DEMONSTRATION: SHOW STUDENTS THE ACCUMULATOR ON AN ORIFICE TUBE SYSTEM. DESCRIBE ITS PURPOSE AND HOW IT WORKS**

18. **SLIDE 18 EXPLAIN** Use of Lines and Hoses in Refrigeration
19. **SLIDE 19 EXPLAIN FIGURE 5–24** Rigid lines and flexible hoses are used throughout the air-conditioning system. The line to and from the compressor must be flexible because it is attached to the engine, which moves on its mounts during normal vehicle operation.

**DISCUSSION: ASK STUDENTS TO DISCUSS HOW REFRIGERANT LINES AND HOSES DIFFER FROM RADIATOR COOLING SYSTEM HOSES.**

20. **SLIDES 20–28 EXPLAIN** Electrical Switches and Evaporator Temperature Controls Used in A/C Systems
29. **SLIDE 29 EXPLAIN FIGURE 5–32** Many early A/C systems used a simple electrical circuit.
30. **SLIDE 30 EXPLAIN FIGURE 5–33** pressure switch is either on or off. The contacts are closed by gas pressure on the diaphragm; they are opened by the spring.
31. **SLIDE 31 EXPLAIN Rear A/C Systems**

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- 32. SLIDE 32 **EXPLAIN** FIGURE 5–35 rear HVAC module assembly used on a Honda Odyssey minivan
- 33. SLIDES 33-35 **EXPLAIN** Component Replacement Procedures
- 36. SLIDE 36 **EXPLAIN** Figure 5–36 line to the condenser from the compressor includes a flange mount with an O-ring. This line is being replaced with a new original equipment line as a result an accident, which caused the line to be kinked.

**DISCUSSION: ASK STUDENTS TO DISCUSS RECOMMENDED SERVICING PROCEDURES FOR CONDENSER, EVAPORATOR, RECEIVER/DRIER OR ACCUMULATOR DRIER, & ORIFICE TUBE OR EXPANSION VALVE**

**NATEF MAST TASK A7B5: DETERMINE NEED FOR AN ADDITIONAL A/C SYSTEM FILTER; PERFORM NECESSARY ACTION. P3**

**NATEF MAST TASK A7B6: REMOVE AND INSPECT A/C SYSTEM MUFFLERS, HOSES, LINES, FITTINGS, O-RINGS, SEALS, AND SERVICE VALVES; PERFORM NECESSARY ACTION. P2**



**DEMONSTRATION: SHOW HOW TO USE FIN COMB TO STRAIGHTEN FINS OF CONDENSER. WHY MIGHT THIS ACTION BE NECESSARY?**

**NATEF MAST TASK A7B7: INSPECT A/C CONDENSER FOR AIRFLOW RESTRICTIONS; PERFORM NECESSARY ACTION. P1**

**NATEF MAST TASK A7B8: REMOVE, INSPECT, AND REINSTALL RECEIVER/DRIER OR ACCUMULATOR/DRIER; DETERMINE RECOMMENDED OIL QUANTITY. P2**

**NATEF MAST TASK A7B9: REMOVE, INSPECT, AND INSTALL EXPANSION VALVE OR ORIFICE (EXPANSION) TUBE. P1**



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 	<p><b><u>NATEF MAST TASK A7B10:</u> INSPECT EVAPORATOR HOUSING WATER DRAIN; PERFORM NECESSARY ACTION. P1</b></p> <p><b><u>NATEF MAST TASK A7B11:</u> DIAGNOSE A/C SYSTEM CONDITIONS THAT CAUSE PROTECTION DEVICES (PRESSURE, THERMAL, &amp; PCM) TO INTERRUPT SYSTEM OPERATION; DETERMINE NECESSARY ACTION. P2</b></p> <p>37. SLIDE 37 <b>EXPLAIN</b> Summary</p>