

Automotive Heating and Air Conditioning, 8e

Chapter 8 Cooling System Operation and Diagnosis

Opening Your Class



KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of Automotive Heating and Air Conditioning, 8e . 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.	<p>Explain the chapter learning objectives to the students.</p> <ol style="list-style-type: none"> 1. Explain the purpose and function of the cooling system and cooling system operation. 2. Explain the purpose of thermostats, radiators, pressure caps, and water pumps. 3. Explain coolant flow in the engine and coolant recovery systems. 4. Explain the purpose of cooling fans and heater cores. 5. Describe cooling system testing and explain the purpose of the coolant temperature warning light. 6. Explain cooling system inspection and cooling system service.
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 8th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

LINK CHP 08:

<http://www.jameshalderman.com/links/book hvac/ci/hvac ci ch 8.pptx>

These Power Point files contain more than just the images.

ICONS	Ch08 Cooling System Operation & Diagnosis
 	<p>1. SLIDE 1 COOLING SYSTEM OPERATION & DIAGNOSIS</p> <p>2. SLIDES 2-3 EXPLAIN OBJECTIVES Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED</p> <p><u>Chapter 8 Cooling System OP & Diag Videos</u></p> <p><u>Crossword Puzzle (Microsoft Word) (PDF)</u> <u>Word Search Puzzle (Microsoft Word) (PDF)</u></p> <p>4. SLIDE 4 EXPLAIN Cooling System</p> <p>5. SLIDE 5 EXPLAIN FIGURE 8–1 Typical combustion and exhaust temperatures</p> <p>6. SLIDE 6 EXPLAIN Cooling System Operation</p> <p>7. SLIDE 7 EXPLAIN FIGURE 8–3 Coolant flow through a typical engine cooling system.</p> <p>8. SLIDE 8 EXPLAIN Cooling System Operation</p> <p><u>DISCUSSION: HAVE STUDENTS DISCUSS HEAT GENERATED IN AN ENGINE. ASK: "IF ONE-THIRD OF THE HEAT IS REMOVED THROUGH THE COOLING SYSTEM, AND ONE-THIRD IS REMOVED THROUGH THE EXHAUST SYSTEM, WHAT IS THE OTHER ONE-THIRD USED FOR?" (ANSWER: PUSHING PISTONS DOWN.)</u></p> <p><u>COOLANT FLOW-WORLD ENGINE</u></p> <p><u>COOLANT REPLACEMENT</u></p> <p><u>COOLING SYSTEM HEAT STORE</u></p> <p>ENGINES THAT DO NOT REACH PROPER OPERATING TEMPERATURE MAY LEAVE WATER IN OIL, WHICH CAN CAUSE ENGINE FAILURES, SUCH AS BEARING FAILURE.</p> <p><u>DISCUSSION: DISCUSS HOW IMPROPER COOLANT TEMPERATURE CAN HARM FUEL ECONOMY. WHY DOES TEMPERATURE AFFECT FUEL ECONOMY? (ANS: CHANGES FUEL</u></p>

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 	<p>VAPORIZATION RATE)</p> <p>9. SLIDES 9-10 EXPLAIN Thermostat Temperature Control</p> <p>11. SLIDE 11 EXPLAIN FIGURE 8-5 (a) When the engine is cold, the coolant flows through the bypass. (b) When the thermostat opens, the coolant can flow to the radiator.</p> <p>12. SLIDE 12 EXPLAIN Radiators</p> <p>13. SLIDE 13 EXPLAIN FIGURE 8-11 tubes and fins of the radiator core</p> <p><u>THERMOSTAT OPERATION</u></p> <p>14. SLIDE 14 EXPLAIN Pressure Cap</p> <p>15. SLIDE 15 EXPLAIN FIGURE 8-14 pressure valve maintains the system pressure and allows excess pressure to vent. The vacuum valve allows coolant to return to the system from the recovery tank.</p> <p><u>SAFETY TIP: ALWAYS REMOVE PRESSURE CAP SLOWLY USING RAGS OR HEAVY GLOVES FOR PROTECTION. A HOT COOLING SYSTEM CAN SPRAY COOLANT OR STEAM UNDER PRESSURE. EVEN A COLD SYSTEM MAY HAVE PRESSURE THAT CAN SPRAY COOLANT INTO EYES OR DAMAGE PAINT. COLLAPSED HOSES MAY BE CAUSED BY PRESSURE CAP NOT VENTING CORRECTLY.</u></p> <p><u>PRESSURE CAP OPERATION</u></p> <p>16. SLIDE 16 EXPLAIN Coolant Recovery System</p> <p>17. SLIDE 17 EXPLAIN FIGURE 8-15 level in the coolant recovery system raises and lowers with engine temperature.</p> <p><u>DEMONSTRATION: SHOW STUDENTS DIFFERENT TYPES OF COOLANT RECOVERY BOTTLES</u></p> <p><u>DISCUSSION: DISCUSS WITH STUDENTS WHY RECOVERY BOTTLE IS IMPORTANT TO LONGEVITY OF THE COOLING SYSTEM'S EFFECTIVENESS.</u></p>



18. SLIDE 18 **EXPLAIN** Water Pump
19. SLIDE 19 **EXPLAIN FIGURE 8–19** This severely corroded water pump could not circulate enough coolant to keep the engine cool. As a result, the engine overheated and blew a head gasket

WATER PUMP OPERATION




20. SLIDE 20 **EXPLAIN Coolant Flow in the Engine**
21. SLIDE 21 **EXPLAIN FIGURE 8–22** Chevrolet V-8 block that shows the large coolant holes and the smaller gas vent or bleed holes that must match the head gasket when the engine is assembled.
22. SLIDES 22-23 **EXPLAIN** Thermostatic Fans

FAN CONTROL

FAN, ELECTRONIC CONTROL

24. SLIDE 24 **EXPLAIN FIGURE 8–23** A typical electric cooling fan assembly showing the radiator and related components.
25. SLIDE 25 **EXPLAIN** Heater Cores
26. SLIDE 26 **EXPLAIN FIGURE 8–25** A typical heater core installed in a heating, ventilation, and air-conditioning (HVAC) housing assembly
27. SLIDES 27-28 **EXPLAIN** Cooling System Testing and Warning Light
29. SLIDE 29 **EXPLAIN FIGURE 8–29** Use dye specifically made for coolant when checking for leaks using a black light.
30. SLIDE 30 **EXPLAIN FIGURE 8–30** When an engine overheats, often the coolant overflow container boils
31. SLIDES 31-32 **EXPLAIN** Cooling System Inspection and Cooling System Service

DEMONSTRATION: SHOW WHERE RADIATOR PETCOCK IS LOCATED AND HOW TO PROPERLY OPEN AND CLOSE IT WITHOUT BREAKING IT.

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  	<p><u>ON-VEHICLE NATEF TASK</u> PERFORM COOLING SYSTEM PRESSURE TESTS; DETERMINE NECESSARY ACTION</p> <p><u>ON-VEHICLE NATEF TASK</u> IDENTIFY AND INTERPRET ENGINE CONCERN; DETERMINE NECESSARY ACTION</p> <p>33. SLIDE 33 EXPLAIN FIGURE 8–31 Typical marks on an accessory drive belt tensioner.</p> <p>34. SLIDE 34 EXPLAIN FIGURE 8–32 (a) Many vehicle manufacturers recommend that the bleeder valve be opened whenever refilling the cooling system. (b) Chrysler recommends that a clear plastic hose (1/4 inch ID) be attached to the bleeder valve and directed into a suitable container to keep from spilling coolant onto the ground and on the engine and to allow the technician to observe the flow of coolant for any remaining air bubbles.</p> <p>35. SLIDES 35-37 EXPLAIN Summary</p>

