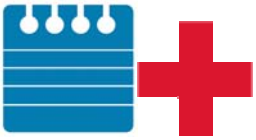
Automotive Heating and Air Conditioning, 7e

Chapter 10 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, 7e.** It correlates material to task lists specified by ASE and NATEF.
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. 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 *WELCOME,* 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.

ICONS	Ch10 Cooling System Operation & Diagnosis
	1. SLIDE 1 COOLING SYSTEM OPERATION & DIAGNOSIS
	2. SLIDES 2-3 EXPLAIN OBJECTIVES Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED
	4. SLIDE 4 EXPLAIN Cooling System Design 5. SLIDE 5 EXPLAIN Figure 10–3 Coolant flow through a typical engine cooling system. 6. SLIDES 6-7 EXPLAIN Cooling System Design
	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.)
	ENGINES THAT DO NOT REACH PROPER OPERATING TEMPERATURE MAY LEAVE WATER IN OIL, WHICH CAN CAUSE ENGINE FAILURES, SUCH AS BEARING FAILURE.
	DISCUSSION: DISCUSS WITH STUDENTS HOW IMPROPER COOLANT TEMPERATURE CAN HARM FUEL ECONOMY. WHY DOES TEMPERATURE AFFECT FUEL ECONOMY? (ANS: CHANGES FUEL VAPORIZATION RATE)
	8. SLIDES 8-9 EXPLAIN Thermostat Temperature Control 10. SLIDE 10 EXPLAIN Pressure Cap
	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.

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	**COLLAPSED HOSES MAY BE CAUSED BY PRESSURE CAP NOT VENTING CORRECTLY.**
	THERMOSTAT OPERATION PRESSURE CAP OPERATION
	COOLANT FLOW-WORLD ENGINE COOLANT REPLACEMENT COOLING SYSTEM HEAT STORE
	11. **SLIDE 11 EXPLAIN Figure 10–16** Some vehicles use a surge tank, which is located at the highest level of the cooling system, with a radiator cap.
	**DEMONSTRATION: SHOW STUDENTS DIFFERENT TYPES OF COOLANT RECOVERY BOTTLES**
	**DISCUSSION: DISCUSS WITH STUDENTS WHY THE RECOVERY BOTTLE IS IMPORTANT TO LONGEVITY OF THE COOLING SYSTEM'S EFFECTIVENESS.**
	12. **SLIDE 12 EXPLAIN** Water Pump 13. **SLIDES 13-14 EXPLAIN** Coolant Flow and Recovery Systems
	WATER PUMP OPERATION
	15. **SLIDES 15-16 EXPLAIN** Thermostatic Fans FAN CONTROL FAN, ELECTRONIC CONTROL
	17. **SLIDE 17 EXPLAIN Figure 10–23** A typical electric cooling fan assembly showing the radiator and related components.
	18. **SLIDE 18 EXPLAIN** Heater Cores

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	19. **SLIDES 19-20 EXPLAIN** Cooling System Testing and Warning Light 21. **SLIDES 21-22 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.**
	**ON-VEHICLE NATEF TASK PERFORM COOLING SYSTEM PRESSURE TESTS; DETERMINE NECESSARY ACTION**
	**ON-VEHICLE NATEF TASK IDENTIFY AND INTERPRET ENGINE CONCERN; DETERMINE NECESSARY ACTION**
	23. **SLIDES 23-25 EXPLAIN Summary**