Automotive Heating and Air Conditioning, 8e

Chapter 15 A/C System Diagnosis and Repair

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/ASEEducation.
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. Prepare for the ASE Heating and Air Conditioning (A7) certification test content area "A" (A/C System Service, Diagnosis and Repair). 2. Describe the eight-step diagnostic procedure for an A/C system. 3. Explain how to perform a visual inspection of an A/C system. 4. Discuss how to perform an A/C performance test. 5. Describe how to determine the root cause of the problem in an A/C system.
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.

NOTE: This lesson plan is based on the 8th Edition Chapter Images found on Jim's web site @ www.jameshalderman.com
LINK CHP 15:
http://www.jameshalderman.com/links/book_hvac/ci/hvac_ci_ch_15.pptx
These Power Point files contain more than just the images

ICONS	Ch 15 A/C System Diagnosis and Repair
 	**1. SLIDE 1 A/C SYSTEM DIAGNOSIS & REPAIR** **2. SLIDES 2-3 EXPLAIN OBJECTIVES** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **Chapter 15 VIDEOS** **http://www.jameshalderman.com/links/book_hvac/vid/ch15/video_frame.html** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)** **4. SLIDES 4-5 EXPLAIN** Eight-step Diagnostic Procedure for an A/C system **6. SLIDE 6 EXPLAIN** Step 1 Verify the Customer Concern **7. SLIDES 7-9 EXPLAIN** Step 2 Visual Inspections **DISCUSSION: ASK STUDENTS TO DISCUSS HVAC DIAGNOSTIC PROCEDURES. HAVE THEM EXPLAIN WHY ALL THE STEPS ARE NECESSARY.** **10. SLIDE 10 EXPLAIN FIGURE 15–1** A visual inspection checks all of the visible, underhood components for possible wear or damage. The underdash components are checked for noise and proper airflow. **11. SLIDES 11-13 EXPLAIN** Step 2 Visual Inspections **DEMONSTRATION: POINT OUT HIGH-PRESSURE & LOW-PRESSURE HOSES AND LINES IN A HVAC SYSTEM AND DISCUSS THEIR SIGNIFICANCE.** **DEMONSTRATION: SHOW STUDENTS HOW TO USE AN INFRARED THERMOMETER TO MEASURE TEMPERATURE OF A/C INLET & OULET LINES** **DEMONSTRATION: SHOW STUDENTS HOW TO USE A PYROMETER TO MEASURE TEMPERATURE OF UPPER RADIATOR HOSE & AREA AROUND THERMOSTAT HOUSING.**

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 	14. **SLIDE 14 EXPLAIN FIGURE 15–2** When a system is operating properly, the suction line to the compressor should be cool, and the discharge line should be hot to very hot. The liquid lines should also be hot. **DISCUSSION: ASK STUDENTS TO DISCUSS METHODS FOR DETECTING LEAKS IN AN A/C SYSTEM.** **HANDS-ON TASK: HAVE STUDENTS USE FLUORESCENT DYE AND A BLACK LIGHT TO DETECT REFRIGERANT LEAKS** **DISCUSSION: ASK STUDENTS TO TALK ABOUT HOW TO REPAIR MOST COMMON REFRIGERANT LEAKS. WHAT PARTS SHOULD ALWAYS BE REPLACED?** **ANIMATION: SERVICE VALVE ID** **Service Fitting and Manual Coupler** **Service Fitting and Quick-Connect Coupler** 15. **SLIDES 15-16 EXPLAIN FIGURE** Step 3 Check Diagnostic Trouble Codes 17. **SLIDE 17 EXPLAIN Step 4** Check for Technical Service Bulletins 18. **SLIDE 18 EXPLAIN FIGURE 15–5** After checking for stored diagnostic trouble codes (DTCs), the wise technician checks service information for any technical service bulletins that may relate to the vehicle being serviced.. 19. **SLIDES 19-21 EXPLAIN Step 5** Perform A/C Performance Test 22. **SLIDE 22 EXPLAIN Figure 15–6** center, yellow hose is used to connect the air conditioning system to a vacuum pump or refrigerant cans. When the hose is not being used, it should be attached to the blanks fitting to seal the system. **NATEF MASK TASK A7A3 PERFORMANCE TEST A/C SYSTEM; IDENTIFY PROBLEMS. P1**

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DISCUSSION: DISCUSS **CAUSE OF LOW READINGS** FOR BOTH LOW SIDE & HIGH-SIDE PRESSURE? WHAT ABOUT HIGH READINGS FOR BOTH LOW-SIDE & HIGH-SIDE PRESSURE?

OPTIONAL HANDS-ON TASK: STUDENTS CREATE A CHART FOR SYMPTOMS OF LOW SIDE & HIGH-SIDE PRESSURE

Low-Side Pressure	High-Side Pressure	Causes
25-35 psi	170 - 200	Normal
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

23. **SLIDES 23-25 EXPLAIN Step 6** Determine the Root Cause
26. **SLIDE 26 EXPLAIN FIGURE 15–12** A partially restricted orifice tube should be replaced if discovered during service
27. **SLIDE 27 EXPLAIN Step 6** Determine the Root Cause
28. **SLIDE 28 EXPLAIN Step 7 Repair the System**.
29. **SLIDE 29 EXPLAIN Step 8 Verify the Repair**

DEMONSTRATION: SHOW STUDENTS HOW TO PERFORM FIRE EXTINGUISHER TEST TO CHECK FOR A FAULTY EXPANSION VALVE IN AN A/C

NATEF MASK TASK A7A1 IDENTIFY AND INTERPRET HEATING AND AIR CONDITIONING PROBLEMS; DETERMINE NECESSARY ACTION. P1

NATEF MASK TASK A7A2 RESEARCH APPLICABLE VEHICLE AND SERVICE INFORMATION, VEHICLE SERVICE HISTORY, SERVICE PRECAUTIONS, AND TECHNICAL SERVICE BULLETINS. P1

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	**NATEF MASK TASK A7A4** IDENTIFY ABNORMAL OPERATING NOISES IN THE A/C SYSTEM; DETERMINE NECESSARY ACTION. P1
	**NATEF MASK TASK A7A5:** IDENTIFY REFRIGERANT TYPE; SELECT AND CONNECT PROPER GAUGE SET; RECORD TEMPERATURE AND PRESSURE READINGS. P1
	**NATEF MASK TASK A7A6:** LEAK TEST A/C SYSTEM; DETERMINE NECESSARY ACTION. P1
	**NATEF MASK TASK A7A7:** INSPECT CONDITION OF REFRIGERANT OIL REMOVED FROM A/C SYSTEM; DETERMINE NECESSARY ACTION. P2
	**NATEF MASK TASK A7A8:** DETERMINE RECOMMENDED OIL AND OIL CAPACITY FOR SYSTEM APPLICATION. P1
	**NATEF MASK TASK A7A9:** USING A SCAN TOOL, OBSERVE AND RECORD RELATED HVAC DATA AND TROUBLE CODES. P3
	30. SLIDES 30-32 EXPLAIN Summary
	33. SLIDES 33-50 EXPLAIN SLIDE SHOW