Automotive Heating and Air Conditioning, 8e

Chapter 14 Refrigerant Recovery, Recycling, & Recharging

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. Explain the steps involved in the service and repair of A/C systems. 3. Discuss the procedure for identifying refrigerants in an A/C system. 4. Explain the procedure for refrigerant recovery in A/C systems. 5. Explain the procedure for recycling refrigerant in A/C systems. 6. Discuss the purpose of flushing an A/C system. 7. Explain the procedure for evacuating an A/C system. 8. Discuss the procedure for recharging an A/C system. 9. Explain how to retrofit an R-12 system to a R-134a system. 10. Explain the purpose of sealants and stop leaks.
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 14:
http://www.jameshalderman.com/links/book_hvac/ci/hvac_ci_ch_14.pptx
These Power Point files contain more than just the images

ICONS	Ch14 Refrigerant Recovery, Recycling, & Recharging
 	**1. SLIDE 1 REFRIGERANT RECOVERY, RECYCLING, & RECHARGING** **2. SLIDES 2-4 EXPLAIN OBJECTIVES** **Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **Chapter 14 VIDEOS** **http://www.jameshalderman.com/links/book_hvac/vid/ch14/video_frame.html** **Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)** **5. SLIDE 5 EXPLAIN Clean Air Act** **6. SLIDE 6 EXPLAIN A/C Service Operations** **7. SLIDES 7 EXPLAIN FIGURE 14–1** A recovery unit removes refrigerant vapor from the vehicle. Then it filters the refrigerant before compressing it so it condenses and can be stored as a liquid in the storage tank. **8. SLIDES 8-9 EXPLAIN** Service and Repair of A/C Systems **DEMONSTRATION: SHOW TESTER FOR IDENTIFYING REFRIGERANT GASES** **DISCUSSION: ASK STUDENTS TO TALK ABOUT THE TYPES OF REFRIGERANTS THAT HAVE BEEN USED IN AUTOMOTIVE SYSTEMS AND IN RESIDENTIAL HOME AC SYSTEMS. HOW DO THESE REFRIGERANTS WORK? WHY IS CFC-12 NO LONGER USED?** **10. SLIDE 10 EXPLAIN FIGURE 14–3** typical refrigerant identification machine. The readout indicates what kind of refrigerant is in the system. If a blend or some other contaminated refrigerant is discovered, it should be recovered and stored in a separate container to keep it from contaminating fresh refrigerant.

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	**11. SLIDES 11-12 EXPLAIN Refrigerant Identification** **13. SLIDE 13 EXPLAIN FIGURE 14–4** typical printout showing that the system has 100% R-1234yf refrigerant in the system. **14. SLIDES 14-16 EXPLAIN** Refrigerant Recovery **17. SLIDE 17 EXPLAIN FIGURE 14–5** During the recovery process, oil from the system is separated into a container so the technician will know how much oil was removed. **REFRIGERANT SERVICE, RECOVERY**
	**NATEF MAST TASK A7E2: IDENTIFY AND RECOVER A/C SYSTEM REFRIGERANT P1**
	**18. SLIDE 18 EXPLAIN Recycling Refrigerant** **19. SLIDE 19 EXPLAIN FIGURE 14–7** Recycling machines have a filter and desiccant that must be replaced after a certain amount of use. **20. SLIDE 20 EXPLAIN Flushing an A/C System** **21. SLIDE 21 EXPLAIN FIGURE 14–8** Portions of an A/C system can be flushed to remove debris and excess oil. Adapters are used to connect a flushing unit, which pumps the flushing material through the components. Most flushing machines are fully automated, meaning that it will vacuum, flush, recover, recycle, vacuum, and purge the cleaning solvent all automatically.
	**22. SLIDE 22 EXPLAIN Replacing Components** **23. SLIDE 23 EXPLAIN FIGURE 14–9** O-rings are usually made of neoprene rubber or highly saturated nitriles (HSN) to withstand high temperatures and flexing. O-rings should be changed during a retrofit procedure
	**24. SLIDE 24 EXPLAIN In-Line Filter** **25. SLIDE 25 EXPLAIN FIGURE 14–14** typical aftermarket filter is installed in the suction line at the entrance to the compressor that is designed to catch any debris that could harm the compressor**.**

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	**26. SLIDE 26 EXPLAIN Refrigerant Oil** **27. SLIDE 27 EXPLAIN FIGURE 14–15** variety of oil injectors are available for purchase. Some can be used while the system is under a vacuum, and some can force oil into a charged system.
	**28. SLIDES 28-30 EXPLAIN Evacuating a System** **31. SLIDE 31 EXPLAIN FIGURE 14–16** An air-conditioning vacuum gauge that reads in microns. **REFRIGERANT SERVICE, EVACUATION**
	**32. SLIDE 32 EXPLAIN Recharging the System** **33. SLIDE 33 EXPLAIN FIGURE 14–19** underhood decal states that this vehicle requires 1.81 pounds (0.822 Kg) of R-134a refrigerant. **REFRIGERANT SERVICE, CHARGE**
	**NATEF MAST TASK A7E4: EVACUATE AND CHARGE A/C SYSTEM; ADD REFRIGERANT OIL AS REQUIRED.P1**
	**NATEF MAST TASK A7E3: RECYCLE, LABEL, AND STORE REFRIGERANT P1**
	**NATEF MAST TASK A7E1: PERFORM CORRECT USE AND MAINTENANCE OF REFRIGERANT HANDLING EQUIPMENT ACCORDING TO EQUIPMENT MANUFACTURER'S STANDARDS. P1** **34. SLIDES 34-38 EXPLAIN** How to Retrofit a R-12 System to a R-134a System **39. SLIDE 39 EXPLAIN FIGURE 14–21** When a system is retrofitted from R-12 (CFC-12) to R-134a (HFC-134a), the proper service fittings have to be used to help assure that cross-contamination does not occur. **40. SLIDE 40 EXPLAIN** Purpose of Sealants & Stop Leaks **41. SLIDE 41 EXPLAIN FIGURE 14–23** Use A/C stop leak with caution. To help prevent sealant from getting

into the RRR machine, use a sealant filter. For more information, visit http://www.airsept.com.

42. **SLIDES 42-44 EXPLAIN Summary**