

# Automotive Technology 5<sup>th</sup> Edition

## Chapter 65 Heating & Air-Conditioning System Service

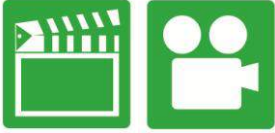
### Opening Your Class

KEY ELEMENT	EXAMPLES
<b>Introduce Content</b>	This course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references.
<b>Motivate Learners</b>	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.
<b>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.</b>	Explain learning objectives to students as listed below: <ol style="list-style-type: none"> <li>1. Discuss blower motor service, cooling system service, and refrigerant recovery procedures.</li> <li>2. Explain how to recycle refrigerants, recharge a system, and retrofit a CFC-12 system to a HFC-134A system.</li> <li>3. Describe how to service the compressor, condenser, evaporator, receiver/drier or accumulator/drier, and orifice tube/expansion valve.</li> </ol>
<b>Establish the Mood or Climate</b>	Provide a <i><b>WELCOME</b></i> , Avoid put downs and bad jokes.
<b>Complete Essentials</b>	Restrooms, breaks, registration, tests, etc.
<b>Clarify and Establish Knowledge Base</b>	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 5<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**LINK CHP 65: [ATE5 Chapter Images](#)**

## ICONS



ON-VEHICLE TASK



## Chapter 65 HVAC SERVICE

### 1. SLIDE 1 Chapter 65 HEATING & AIR-CONDITIONING SYSTEM SERVICE

Check for ADDITIONAL VIDEOS & ANIMATIONS @  
<http://www.jameshalderman.com/>  
WEB SITE IS CONSTANTLY UPDATED

### Videos

**DISCUSSION:** Ask students to talk about major components of blower motor system and their purpose. What should be checked for each component when blower motor fails to function?

**ON-VEHICLE NATEF TASK** Inspect and test A/C blower motor and circuit; perform necessary action. **Page 203**

2. **SLIDE 2 EXPLAIN** Figure 65-1 Some heater hoses are best inspected by hoisting the vehicle and inspecting them from underneath the vehicle as shown.

**DISCUSSION:** Ask students to discuss malfunctioning heater symptoms that point to a defective thermostat.

**DEMONSTRATION:** demo the below NATEF TASKS

**ON-VEHICLE NATEF TASK** Diagnose malfunctions in the HVAC electrical controls; determine necessary action. **Page 187**

**OPTIONAL ON-VEHICLE NATEF TASK** Perform cooling system pressure tests; perform necessary action. **Page 199**

**ON-VEHICLE NATEF TASK** Inspect engine cooling and heating system hoses and belts; perform necessary action. **Page 214**

## ICONS

DEMO



DEMO



DEMO



## Chapter 65 HVAC SERVICE

**DEMONSTRATION: Show students proper procedures for refrigerant recovery.**

3. **SLIDE 3 EXPLAIN** Figure 65-2 (a) A typical automotive air-conditioning service machine that is capable of handling both CFC-12 and HFC-134a systems.
4. **SLIDE 4 EXPLAIN** Figure 65-2 (b) HFC-134a systems use quick-disconnect fittings that are larger than those used for CFC-12 systems.

**HANDS-ON TASK: have students recover refrigerant from lab vehicle: FIGURE 65-2A**

[Refrigerant Service, Charge \(View\) \(Download\)](#)

[Refrigerant Service, Evacuation \(View\) \(Download\)](#)

[Refrigerant Service, Recovery \(View\) \(Download\)](#)

[Service Fitting and Quick-Connect Coupler \(View\) \(Download\)](#)

**DEMONSTRATION: Show students an example of a quick disconnect service valve for R-134a system, and discuss the purpose and function of service valves. FIGURE 65-2**

5. **SLIDE 5 EXPLAIN** Figure 65-3 (a) Refrigerant oil must be retrieved and measured when the refrigerant is recovered from the system.
6. **SLIDE 6 EXPLAIN** Figure 65-3 (b) A rubber O-ring is used to indicate the level of refrigerant oil already in the container. The exact same amount of refrigerant oil must be installed as was removed when the system is recharged.

**DEMONSTRATION: demo the below NATEF TASKS**

**DISCUSSION: Ask students to talk about impact of mixing refrigerants on high-side pressure. What are the results of such contamination?**

**ON-VEHICLE NATEF TASK Determine recommended oil for system application PG 194**

## ICONS



**DEMO**



**DEMO**



**DEMO**



**QUESTION**

## Chapter 65 HVAC SERVICE

**ON-VEHICLE NATEF TASK** Identify refrigerant type; connect the gauges and read the pressures. **Page 192**

- 7. SLIDE 7 EXPLAIN Figure 65-4** 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.
- 8. SLIDE 8 EXPLAIN Figure 65-5** Ford spring-lock coupling
- 9. SLIDE 9 EXPLAIN Figure 65-6** special tool is needed to remove and install the Ford spring-lock coupling.

**DEMONSTRATION:** Show students how to check and replace the O-ring seals on refrigerant line connectors. **FIGURE 65-6**

**HANDS-ON TASK:** Have students check and replace O-ring seals on refrigerant line connectors. **FIGURE 65-6**

- 10. SLIDE 10 EXPLAIN Figure 65-7** The service cap O-ring becomes the primary seal if the service valve leaks.

**DEMONSTRATION:** Show students how to use a vacuum gauge when evacuating an A/C system. **FIGURE 65-7**

- 11. SLIDE 11 EXPLAIN Figure 65-8** A depressor pin on the gauge set opens the Schrader valve when the connection is almost completely tightened. This prevents accidental refrigerant discharge.

**DEMONSTRATION:** Show example of a **Schrader valve for an R-12 system.** Discuss the difference between how Schrader valves function vs. R-134a service valves.

**ON-VEHICLE NATEF TASK** Identify and recover the air conditioning system refrigerant. **Page 216**

**DISCUSSION:** Ask students to discuss **evacuation procedures** for refrigerant. What is purpose of applying a vacuum to A/C system during this procedure?

## ICONS



## Chapter 65 HVAC SERVICE

**ON-VEHICLE NATEF TASK** Evacuate & charge air conditioning system. Page 218

**HANDS-ON TASK:** Have students perform procedures to check refrigerant for the presence of air. What problems can result from the presence of this non-condensable gas in the refrigerant? How can its presence be remedied?

**DISCUSSION:** Ask students to talk about the procedures for recycling refrigerant. What are the consequences for failing to follow proper recycling procedures?

**ON-VEHICLE NATEF TASK** Using a scan tool, record the HVAC-related data/DTCs; diagnose A/C system conditions. PAGE 195

**ON-VEHICLE NATEF TASK** Perform correct use and maintenance of refrigerant handling equipment. Page 215

**ON-VEHICLE NATEF TASK** Recycle the refrigerant. Page 217

12. **SLIDE 12 EXPLAIN** Figure 65-8 A depressor pin on the gauge set opens the Schrader valve when the connection is almost completely tightened
13. **SLIDE 13 EXPLAIN** Figure 65-10 A typical under-hood sticker that identifies the refrigerant and the amount needed to change the system in kilograms (0.96 kg is equal to 0.44 pounds).
14. **SLIDE 14 EXPLAIN** Figure 65-11 A temperature and humidity gauge is a useful tool for air-conditioning work. The higher the relative humidity, the more difficult it is for the air-conditioning system to lower the temperature inside the vehicle

**DISCUSSION:** Ask students to discuss how to recharge an A/C system. Where is information on the proper amount of refrigerant found?

## ICONS



## Chapter 65 HVAC SERVICE

**HANDS-ON TASK:** Have students recharge an air-conditioning system, following procedures they have learned.

Some shops add yellow dye to AC system during a recharge to help locate a leak

15. **SLIDE 15 EXPLAIN** Figure 65-12 (a) When a system is retrofitted from CFC-12 to HFC-134a, the proper service fittings have to be used to help assure that cross-contamination does not occur.
16. **SLIDE 16 EXPLAIN** Figure 65-12 (b) An under-hood sticker is also installed indicating that the system was retrofitted to HFC-134a and when it was done and by whom.

**DISCUSSION:** Ask students to discuss procedures for retrofitting a CFC-12 system on older vehicle to HFC-134a system. How can you determine amount of HFC-134a required to recharge system?  
**FIGURE 65-12 A & B**

Check the under-hood sticker to determine the correct refrigerant to use & amount.

17. **SLIDE 17 EXPLAIN** Figure 65-13 A special tool is needed to remove and install the magnetic clutch on the air-conditioning compressor

**DISCUSSION:** Ask students to talk about the major components of a compressor system. What should be checked on each component when the compressor fails? **FIGURE 65-13**

**HANDS-ON TASK:** Have students follow procedures to remove a compressor. What safety precautions should be taken prior to removing compressor?

Any time you replace a compressor due to mechanical problems, flushing AC system is recommended. This helps ensure that new compressor is free from metal debris that could shorten its life.

## ICONS



## Chapter 65 HVAC SERVICE

**ON-VEHICLE NATEF TASK** Inspect and replace A/C compressor drive belt(s); determine necessary cause. [Page 207](#)

**ON-VEHICLE NATEF TASK** Test and diagnose A/C compressor clutch control system; determine necessary action. [Page 204](#)

18. **SLIDE 18 EXPLAIN** Figure 65-14 fin comb is used to straighten the fins on the condenser to help increase airflow and heat transfer

**DEMONSTRATION:** Show students how to use a fin comb to **straighten fins of condenser**. Why might this action be necessary? **FIGURE 65-14**

**ON-VEHICLE NATEF TASK** Inspect A/C condenser for airflow restriction; perform necessary action. [Page 208](#)

**ON-VEHICLE NATEF TASK** Remove, inspect, and replace condenser; determine required oil quantity. [Page 213](#)

Use a biocide to get rid of mildew that forms in the evaporator.

**DISCUSSION:** Ask students to discuss recommended servicing procedures for evaporator, receiver/drier or accumulator drier, & orifice tube or expansion valve

**ON-VEHICLE NATEF TASK** Inspect evaporator housing water drain; perform necessary action. [Page 211](#)

**ON-VEHICLE NATEF TASK** Remove, inspect, and reinstall evaporator; determine required oil quantity. [Page 212](#)

**Crossword Puzzle (Microsoft Word) (PDF)**  
**Word Search Puzzle (Microsoft Word) (PDF)**