

# Automotive Heating and Air Conditioning, 8e

## Chapter 12 Hybrid and Electric Vehicle HVAC Systems

### Opening Your Class




KEY ELEMENT	EXAMPLES
<b>Introduce Content</b>	This course or class covers operation and service of <b>Automotive Heating and Air Conditioning, 8e</b> . It correlates material to task lists specified by ASE and NATEF/ASEEducation.
<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>	<p>Explain the chapter learning objectives to the students.</p> <ol style="list-style-type: none"> <li>1. Prepare for the ASE Heating and Air Conditioning (A7) certification test content area "A" (A/C System Service, Diagnosis and Repair).</li> <li>2. Explain the basic operation of the air-conditioning system used in hybrid electric vehicles.</li> <li>3. Discuss the types of compressors used in a hybrid electric vehicle.</li> <li>4. Explain the components and modes of operation of a coolant heat storage system.</li> <li>5. Describe the parts and operation of cabin heating systems.</li> <li>6. Explain the effect of heat on the electrical/ electronic systems of a hybrid electric vehicle.</li> </ol>
<b>Establish the Mood or Climate</b>	Provide a <i>WELCOME</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 8<sup>th</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)**

**LINK CHP 12:**

<http://www.jameshalderman.com/links/book hvac/ci/hvac ci ch 12.pptx>

These Power Point files contain more than just the images

ICONS	Ch12 Hybrid/Electric Vehicle HVAC Systems
   	<p><b>1. SLIDE 1 HYBRID &amp; ELECTRIC VEHICLE HVAC SYSTEMS</b></p> <p><b>2. SLIDES 2-3 EXPLAIN OBJECTIVES</b>  Check for <b>ADDITIONAL VIDEOS &amp; ANIMATIONS @</b>  <a href="http://www.jameshalderman.com/">http://www.jameshalderman.com/</a>  <b>WEB SITE IS CONSTANTLY UPDATED</b></p> <p><b><u>Chapter 12 HEV VIDEOS</u></b>  <a href="http://www.jameshalderman.com/links/book_hvac/video_frame.html">http://www.jameshalderman.com/links/book_hvac/video_frame.html</a></p> <p><b>Crossword Puzzle (Microsoft Word) (PDF)</b>  <b>Word Search Puzzle (Microsoft Word) (PDF)</b></p> <p><b>4. SLIDES 4-6 EXPLAIN Hybrid Vehicle Air-Conditioning Systems</b></p> <p><b><u>SAFETY HAVE STUDENTS TALK ABOUT NEED FOR SAFETY PRECAUTIONS WHEN WORKING AROUND &amp; WITH HYBRID ELECTRIC VEHICLES. BOTH HYBRID ELECTRIC VEHICLES &amp; ALL-ELECTRIC VEHICLES USE HIGH-VOLTAGE CIRCUITS THAT CANNOT BE TOUCHED WITHOUT PROTECTION.</u></b></p> <p><b>7. SLIDE 7 EXPLAIN FIGURE 12–1</b> The A/C compressor clutch allows the compressor to engage and disengage as necessary while the ICE continues to run.</p> <p><b>8. SLIDE 8 EXPLAIN Hybrid Electric Vehicle Compressors</b></p> <p><b>9. SLIDE 9 EXPLAIN FIGURE 12–4</b> Basic components of a scroll compressor. Note the “pockets” of refrigerant that occupy the spaces labeled with red arrows.</p> <p><b><u>HYBRID AC COMPRESSOR</u></b></p> <p><b>10. SLIDES 10-12 EXPLAIN</b> Components and Modes of Operation of a Coolant Heat Storage System</p> <p><b>13. SLIDE 13 EXPLAIN FIGURE 12–9</b> Toyota’s coolant heat storage system. Note that the electric storage tank pump is located behind the coolant storage tank</p>

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14. **SLIDE 14 EXPLAIN FIGURE 12–10** A vacuum exists between the inner and outer casing of the coolant heat storage tank. The outlet temperature sensor and the drain plug are located in the manifold at the bottom of the tank
15. **SLIDE 15 EXPLAIN FIGURE 12–11** The valve position sensor in the water valve provides feedback to the ECM concerning the position of the water valve.
16. **SLIDE 16 EXPLAIN FIGURE 12–12** The storage tank and pump assembly as removed from underneath the vehicle. This pump is energized when coolant must be moved through the tank but the ICE is shut off.
17. **SLIDE 17 EXPLAIN** Cabin Heating Systems
18. **SLIDE 18 EXPLAIN FIGURE 12–17** heater core is located in plenum chamber. Air temperature in system controlled by position of air mix valve (blend door)
19. **SLIDE 19 EXPLAIN** Cabin Heating Systems
20. **SLIDE 20 EXPLAIN** HEV Electric Motor and Control System Cooling
21. **SLIDE 21 EXPLAIN FIGURE 12–21** The motor and HV battery electronics on Honda hybrid vehicles are air cooled. Note the cooling fins for the modules.
22. **SLIDES 22-23 EXPLAIN** Service Procedures

**NATEF MAST TASK A7B4: IDENTIFY HYBRID VEHICLE A/C SYSTEM ELECTRICAL CIRCUITS AND SERVICE/SAFETY PRECAUTIONS.P2**

24. **SLIDES 24-25 EXPLAIN** Summary