

Hybrids & Alternative Fuel Vehicles

Chapter 15 Ford/Mercury Hybrid Vehicles

Opening Your Class








KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of Hybrid and Alternative Fueled Vehicles . 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. <ol style="list-style-type: none">1. Explain the operation of a Ford/Mercury hybrid electric vehicle (HEV).2. Describe the features of a Ford/Mercury HEV.3. Discuss the safety precautions to be followed whenever working on a Ford/Mercury HEV.4. Explain how the electronically controlled continuously variable transmission (eCVT) allows the Ford/Mercury HEV to achieve maximum efficiency.5. Describe the service procedures for Ford/ Mercury HEVs.
Establish the Mood or Climate	Provide a <i>WELCOME</i> , 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 Hybrids 4th Edition

Chapter Images found on Jim's web site @

www.jameshalderman.com

LINK CHP 15: [Chapter Images](#)

ICONS	Ch15 Ford/Mercury Hybrid Vehicles
      	<p>1. SLIDE 1 FORD/MERCURY HYBRID VEHICLES</p> <p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED</p> <p>At the beginning of this class, you can download the crossword puzzle & Word Search from the links below to familiarize your class with the terms in this chapter & then discuss them</p> <p>Crossword Puzzle (Microsoft Word) (PDF) Word Search Puzzle (Microsoft Word) (PDF)</p> <p>2. SLIDE 2 EXPLAIN FIGURE 15-1 Ford Escape hybrid looks very similar to a conventional Ford Escape except for the hybrid emblems and several other details.</p> <p>3. SLIDE 3 EXPLAIN FIGURE 15-2 Mariner Hybrid SUV. The Ford/Mercury hybrids can be identified by the battery vent located in the left rear quarter window.</p> <p>4. SLIDE 4 EXPLAIN FIGURE 15-3 dash display shows when the vehicle is being propelled using the electric motor alone, shown by green area on speedometer and labeled "EV." The gauge on left of tachometer indicates whether electrical system is being charged by gasoline engine or regenerative braking and when electric motor is being used to assist gasoline engine during acceleration.</p> <p>5. SLIDE 5 EXPLAIN FIGURE 15-4 Ford/Mercury hybrid SUV, showing major components & location</p> <p>6. SLIDE 6 EXPLAIN FIGURE 15-5 2.3-liter four-cylinder all-aluminum ICE used in the Ford Escape and the Mercury Mariner hybrids uses a modified Atkinson cycle design to achieve maximum efficiency.</p> <p>DISCUSS FREQUENTLY ASKED QUESTIONS</p>

ICONS



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- 7. SLIDE 7 EXPLAIN FIGURE 15-6** Ford/Mercury 2.3-liter ICE is also equipped with an active engine mount that effectively dampens engine vibration during start/stop. The parts involved include a control solenoid, the active engine mount and a vacuum reservoir tank.
- 8. SLIDE 8 EXPLAIN FIGURE 15-7** Atkinson cycle delays the closing of the intake valve, which reduces the pumping losses on compression stroke, yet results in a greater amount of expansion on power stroke compared to a conventional (Otto cycle) gasoline engine design.
- 9. SLIDE 9 EXPLAIN FIGURE 15-8** cam lobe on left is from a Ford/ Mercury hybrid and shows the longer-duration intake cam lobe as compared to the intake cam lobe from a conventional gasoline engine on the right.
- 10. SLIDE 10 EXPLAIN FIGURE 15-9** Air inlet to ICE on Ford/Mercury hybrid electric vehicle contains a charcoal filter that is used to trap and hold hydrocarbons and keep them from being released to the atmosphere.
- 11. SLIDE 11 EXPLAIN FIGURE 15-10** cutaway of Ford Escape/Mercury Mariner hybrid transaxle, which includes the traction motor and the generator motor.
- 12. SLIDE 12 EXPLAIN FIGURE 15-11** Series mode operation
- 13. SLIDE 13 EXPLAIN FIGURE 15-12** Positive split mode operation.
- 14. SLIDE 14 EXPLAIN FIGURE 15-13** Ford Escape system chart showing the various sensors and components. The functions are distributed among engine, transaxle, and brake control modules. The VSC controls approximately 200 functions with about 600 signals between components.
- 15. SLIDE 15 EXPLAIN FIGURE 15-14** transaxle is used to blend torque from gasoline engine and traction motor together. Generator motor controls sun gear rotation; therefore, the effective gear ratio can vary anywhere from reduction all the way to overdrive. eCVT is a continuously variable automatic transmission.
- 16. SLIDE 16 EXPLAIN FIGURE 15-15** high-voltage (traction) battery pack is located under cargo floor area.
- 17. SLIDE 17 EXPLAIN FIGURE 15-16** battery pack from a Ford/Mercury hybrid showing cooling ducts at bottom.

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18. **SLIDE 18 EXPLAIN FIGURE 15-17** traction battery cooling unit is located on driver's side of cargo area and houses battery zone A/C evaporator (labeled as "A").

EXPLAIN TECH TIP

19. **SLIDE 19 EXPLAIN FIGURE 15-18** button is located behind a cover on the driver's side kick panel. By depressing this button, the 12-volt battery will charge the high-voltage batteries through the DC-DC converter.

20. **SLIDE 20 EXPLAIN FIGURE 15-19** 2-volt auxiliary battery is located under hood on driver's side, as shown

21. **SLIDE 21 EXPLAIN FIGURE 15-20** cooling system for the transaxle also cools the DC-DC converter.

22. **SLIDE 22 EXPLAIN FIGURE 15-21** Ford/Mercury hybrid uses an electric power steering assembly.

23. **SLIDE 23 EXPLAIN FIGURE 15-22** electric power steering assembly partially disassembled showing the DC motor and electrical connector for the torque sensor.

24. **SLIDE 24 EXPLAIN FIGURE 15-23** electric power steering torque sensor housing with connector.

DISCUSS WARNING









25. **SLIDE 25 EXPLAIN FIGURE 15-24A** After removing the trunk liner, look for the two spot welds near the speaker for the location of the back seat release lever.

26. **SLIDE 26 EXPLAIN FIGURE 15-24B** View of HV battery safety plug from inside the vehicle after the rear seat has been released.

27. **SLIDE 27 EXPLAIN FIGURE 15-25** buffer zone is an area that should be marked with cones to warn others to avoid the area because of a high-voltage danger.

28. **SLIDE 48 EXPLAIN FIGURE 15-26** To depower the HV system, start by rotating the service disconnect plug CCW to the UNLOCK position.

DISCUSS CAUTION

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	<p>29. SLIDE 29 EXPLAIN FIGURE 15-27 service disconnect plug should be lifted & placed back in SERVICE SHIPPING position before servicing</p>
 	<p>30. SLIDE 30 EXPLAIN FIGURE 15-28 fiberglass pole/steel hook assembly is required equipment for Ford dealerships that service Ford/Mercury HEVs.</p>
 	<p>DISCUSS WARNING</p>
	<p>DISCUSS REAL WORLD FIX</p>
	<p>31. SLIDE 31 EXPLAIN FIGURE 15-29 Using pressure bleeder to bleed the brakes.</p>
	<p>EXPLAIN TECH TIP</p>
	<p>32. SLIDE 32 EXPLAIN FIGURE 15-30 battery zone air filter must be serviced regularly to prevent overheating of the high-voltage battery.</p>