Introduction to Automotive Service
Chapter 25 Lighting System Inspection
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class serves as an introduction to the world of automotive service. 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 learning objectives to students. 1. Prepare for ASE Electrical/Electronic Systems (A6) certification test content area "F" (Gauges, Warning Devices, and Driver Information System Diagnosis and Repair). 2. Determine which replacement bulb to use on a given vehicle. 3. Describe how interior and exterior lighting systems work. 4. Describe how HID lights work. 5. Read and interpret a bulb chart.
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.

ICONS	Chapter 25 Lighting System Inspection
	**1. SLIDE 1 Ch25 LIGHTING SYSTEM INSPECTION**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED**
	**2. SLIDE 2 EXPLAIN** Exterior Lighting **3. SLIDE 3 EXPLAIN** Bulb Numbers **4. SLIDE 4 EXPLAIN Figure 25-1** Dual-filament (double-contact) bulbs contain both a low-intensity filament for taillights or parking lights and a high-intensity filament for brake lights and turn signals. Bulbs come in a variety of shapes and sizes. Numbers shown are the trade numbers. **5. SLIDE 5 EXPLAIN Chart 25-1** Bulbs that have same trade number have the same operating voltage and wattage. NA means the bulb uses a natural amber glass ampoule with clear turn signal lenses. **6. SLIDE 6 EXPLAIN Chart 25-1 (continued)** . **7. SLIDE 7 EXPLAIN Chart 25-1 (continued)** **8. SLIDE 8 EXPLAIN Chart 25-1 (continued)** **9. SLIDE 9 EXPLAIN Figure 25-2** Bulbs that have the same trade number have the same operating voltage and wattage. The NA means that the bulb uses a natural amber glass ampoule with clear turn signal lenses.
	**DEMONSTRATION: Pass a dual-filament bulb around classroom and point out double contacts on the bottom and the metal case used for ground**
	**DISCUSSION: Have students discuss how a dual filament bulb works. What are advantages of a dual filament bulb versus single filament bulb?**
	**DISCUSSION: Have students discuss benefits of using LEDs in place of conventional lamps. What are environmental impacts? What are cost benefits?**
	**10. SLIDE 10 EXPLAIN Figure 25-3** Close-up a 2057 dual-filament (double-contact) bulb that failed. Notice that the top filament broke from its mounting and melted onto the lower filament. This bulb caused the dash lights

to come on whenever the brakes were applied.

DEMONSTRATION: Show examples of 3157, 3157NA, and 3157A bulbs, or similar bulbs, to help them distinguish difference between bulb suffixes

11. **SLIDE 11 EXPLAIN Figure 25-4** Corrosion caused the two terminals of this dual-filament bulb to be electrically connected.
12. **SLIDE 12 EXPLAIN Figure 25-5** This single-filament bulb is being tested with a digital multimeter set to read resistance in ohms. The reading of 1.1 ohms is the resistance of the bulb when cold. As soon as current flows through the filament, the resistance increases about 10 times. It is the initial surge of current flowing through the filament when bulb is cool that causes many bulbs to fail in cold weather as a result of reduced resistance. As temperature increases, resistance increases.

DEMONSTRATION: Show the students how to test the resistance of bulb using a DMM.

Bulb Test, Meter SHOW ANIMATION
http://www.jameshalderman.com/

DISCUSSION: Have students talk about importance of selecting correct bulb for a lab vehicle. How is the amount of light produced by a bulb determined?

DEMONSTRATION: BUILD a light bulb circuit on PROJECT BOARD measure resistance of each bulb with a DMM & using Ohm's Law and calculate the resistance of several different lamps with a given source voltage of 9 and 12 volts.

Tail Lights SHOW ANIMATION
http://www.jameshalderman.com/

HANDS-ON TASK: Then have students build and measure the same circuit FROM THE DEMO on PROJECT BOARD

ICONS	Chapter 25 Lighting System Inspection
	13. **SLIDE 13 EXPLAIN Brake Lights** 14. **SLIDE 14 EXPLAIN Turn Signals**
	15. **SLIDE 15 EXPLAIN Figure 25-6** typical turn signal switch includes various springs and cams to control switch & to cause switch to cancel after a turn has been completed. 16. **SLIDE 16 EXPLAIN Figure 25-7** Two styles of two-prong flasher units. 17. **SLIDE 17 EXPLAIN Figure 25-8** A hazard warning flasher uses a parallel resistor across the contacts to provide a constant flashing rate regardless of the number of bulbs used in the circuit.
	**DEMONSTRATION: Show students what a single element stop lamp/turn signal looks like in operation on vehicle. Do same with a vehicle that has dual element bulbs in stop lamp/turn signal circuit.**
	**DISCUSSION: Discuss operation of stop lamp/turn signal circuit with a single filament bulb. How many wires are found at terminal connector? Discuss operation of a stop lamp/turn signal circuit with a dual filament bulb.**
	**DISCUSSION: Discuss function of TURN SIGNAL FLASHER. How does each different type of flasher accomplish this task? Discuss how to locate turn signal flasher. Use component location view in ON-LINE service information to find flasher**
	**DEMONSTRATION: Display a schematic of a typical turn signal circuit & show students which switches are ganged together. Show how ganged switches change state at same time.**
	**Turn Indicators SHOW ANIMATION** **http://www.jameshalderman.com/**

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	18. **SLIDE 18** EXPLAIN Headlights 19. **SLIDE 19** EXPLAIN **Figure 25-9** typical four-headlight system using sealed beam headlights.
	**Headlight Circuit SHOW ANIMATION** http://www.jameshalderman.com/
	**Headlight Circuit, Parking Lights SHOW ANIMATION** http://www.jameshalderman.com/
	**Headlight Circuit, High Beam SHOW ANIMATION** http://www.jameshalderman.com/
	**Headlight Circuit, Low Beam SHOW ANIMATION** http://www.jameshalderman.com/
	20. **SLIDE 20** EXPLAIN **Figure 25-10** typical composite headlamp assembly. The lens, housing, and bulb sockets are usually included as a complete assembly. 21. **SLIDE 21** EXPLAIN **Figure 25-11** Handle a halogen bulb by the base to prevent the skin's oil from getting on the glass
	**DISCUSSION: students discuss HALOGEN BULBS. Why should you never touch a halogen bulb with your fingers?**
	22. **SLIDE 22** EXPLAIN High-Intensity Discharge Headlights 23. **SLIDE 23** EXPLAIN **Figure 25-12** igniter contains the ballast and transformer needed to provide high-voltage pulses to the arc tube bulb. 24. **SLIDE 24** EXPLAIN **Figure 25-13** HID (xenon) headlights emit a whiter light than halogen headlights and usually look blue compared to halogen bulbs

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	**DISCUSSION:** Discuss operation & operational states of **HID (High-Intensity Discharge Headlights).** What components make up the system? What costs are associated with HID lights? What is a ballast resistor?
	**HID headlights are also known as xenon lights.**
	**DISCUSSION:** Have students talk about operation of a **transformer**. Why is transformer needed in **HID headlight system**?
	**ON-VEHICLE NATEF TASK (A6-E-4)** Identify system voltage and other precautions associated with HID headlights. **(P-3) Page 171**
	**HANDS-ON TASK:** Have students download Headlight Circuit for a lab vehicle & have a discussion on circuit
	25. **SLIDE 25** EXPLAIN **Figure 25-14** Typical headlight aiming diagram as found in service information. 26. **SLIDE 26** EXPLAIN **Figure 25-15** Many composite headlights have a built-in bubble level to make aiming easy and accurate. 27. **SLIDE 27** EXPLAIN Daytime Running Lights 28. **SLIDE 28** EXPLAIN **Figure 25-16** Typical daytime running light (DRL) circuit. Follow the arrows from the DRL module through both headlights. Notice that the left and right headlights are connected in series, resulting in increased resistance, less current flow, and dimmer than normal lighting. When the normal headlights are turned on, both headlights receive full battery voltage, with the left headlight grounding through the DRL module.
	
	**DISCUSSION:** Operation of **Daytime Running Lights (DRL).** What are safety benefits of daytime running lights?

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	**Daytime Running Lamps (DRLs): Vehicles with DRLs may not have flash to pass function. Newer vehicles may use a Lamp Control Module (LCM) to control DRLs electronically.**
	**29. SLIDE 29 EXPLAIN** Dimmer Switches
	**DEMONSTRATION: Build Rheostat or potentiometer circuit on TRAINER. Discuss operation of a rheostat. Show them how resistance in a rheostat changes as knob is turned. What automotive applications might use rheostats? What is difference between rheostat & potentiometer?**
	**Dimmer Switch connected mechanically to control lever & common failure item (depending on use) due to mechanical nature of switch**
	**Dome Lights may be controlled electronically through BCM**
	**30. SLIDE 30 EXPLAIN** Courtesy Lights **31. SLIDE 31 EXPLAIN Figure 25-17** typical courtesy light doorjamb switch. Newer vehicles use the door switch as an input to the vehicle computer and the computer turns the interior lights on or off. By placing the lights under the control of the computer, the vehicle engineers have the opportunity to delay the lights after the door is closed and to shut them off after a period of time to avoid draining the battery.
	**DISCUSSION: talk about operation of photoresistors & photodiodes. How could these components be incorporated into automatic Headlight circuits?**

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	**DISCUSSION:** Discuss how computer is used to control courtesy lights and illuminated entry on some vehicles. What are system's inputs and how does the computer receive data from all of them?
	32. SLIDES 32-37 OPTIONAL TAILLIGHT BULB REPLACEMENT
	38. SLIDES 38-49 OPTIONAL OPTICAL HEADLIGHT AIMING
	**Homework:** complete Ch25 crossword puzzle: http://www.jameshalderman.com/links/book_intro/cw/crossword_ch_25.pdf