Light Vehicle Diesel Engines
Chapter 24 CUMMINS DIESEL ENGINE
Opening Your Class

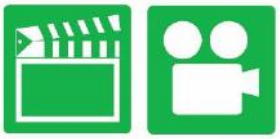
KEY ELEMENT	EXAMPLES
Introduce Content	This Light Vehicle Diesel Engines 1st text provides complete coverage of light duty diesel engine components, operation, and diagnosis. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, and Real World Fixes: www.jameshalderman.com contains Videos, Animations, and Task Sheets for use in the lab and classroom.
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.
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 as listed: 1. Prepare for the Light Vehicle Diesel Engine (A9) ASE certification test content area "A" (General Diagnosis). 2. Explain the unique features of each generation of 5.9-liter Cummins engines used in the Ram truck. • 3. List the specific characteristics of the Cummins 6.7-liter engine. 4. Discuss the Cummins 5.0-liter engine used in the Nissan Titan
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 1st Edition Chapter Images found on Jim's web site @ www.jameshalderman.com

LINK CHP 24 Chapter Images USE BELOW LINK

http://www.jameshalderman.com/books_a9.html

NOTE: You can use Chapter Images or Power Point files: Though out Power Point Presentations, you will find questions and answers on slides that can be used for discussion.

ICONS	CH24 CUMMINS DIESEL ENGINE
	1. SLIDE 1 CH24 CUMMINS DIESEL ENGINE
	Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED
	**Light Diesel (111 Links)**
	http://www.jameshalderman.com/books_a9.html Crossword Puzzle (Microsoft Word) (PDF) Word Search Puzzle (Microsoft Word) (PDF)
	**SAFETY** ALWAYS BE VERY CAREFUL WHEN WORKING ON A DIESEL ENGINE THAT IS RUNNING WITH AIR INTAKE REMOVED. BECAUSE MOST DIESEL ENGINES DO NOT USE A THROTTLE PLATE, OBJECTS CAN VERY EASILY BE SUCKED INTO ENGINE, CAUSING SERIOUS ENGINE DAMAGE. MOST OEMS OFFER INTAKE COVERS.
	DISCUSSION: CHART 24-1 First generation Cummins diesel engine used in a pickup truck.
	DISCUSSION: CHART 24-2 second generation Cummins diesel engine used in Ram pickup.
	DISCUSSION: CHART 24-3 Third generation Cummins engine used in Ram trucks.
	DISCUSSION: CHART 24-4 6.7-liter Cummins engine used in a pickup or chassis cab model.

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	2. **SLIDE 2 EXPLAIN FIGURE 24–1** Cummins inline 6-cylinder diesel engine
	**DEMONSTRATION: EITHER HAVE AN ENGINE DISASSEMBLED OR TAKE ONE APART IN YOUR PRESENTATION**
	**HANDS-ON TASK: OPTION IS TO HAVE STUDENTS DISASSEMBLE AN ENGINE**
	3. **SLIDE 3 EXPLAIN FIGURE 24–2** label on oil cooler boss identifies engine serial number and part number.
	4. **SLIDE 4 EXPLAIN FIGURE 24–3** breather cover must be removed to service CCV filter. 5. **SLIDE 5 EXPLAIN FIGURE 24–4** push rod and rocker arm bridge assembly must be carefully installed to ensure proper valve operation.
	**DISCUSS FREQUENTLY ASKED QUESTION: What Do the Markings on the Head Gasket Mean? SEE FIGURE 24-5**
	6. **SLIDE 6 EXPLAIN FIGURE 24–5** markings on head gasket indicates thickness and unless engine has been machined, same thickness head gasket should be installed when reassembling engine.
	**DEMONSTRATION: HOW TO REMOVE THE HEAD ON A CLASSROOM ENGINE OR LAB VEHICLE**
	**HANDS-ON TASK: HAVE STUDENTS REMOVE THE HEAD ON CLASSROOM ENGINE OR LAB VEHICLE**

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	7. **SLIDE 7 EXPLAIN FIGURE 24–6** gears are properly timed and torqued 8. **SLIDE 8 EXPLAIN FIGURE 24–7** angle of vanes is varied to regulate boost pressure 9. **SLIDE 9 EXPLAIN FIGURE 24–8** EGR cooler lowers exhaust gas temperatures. Cooled EGR gases allow for a greater reduction of NOx emissions. 10. **SLIDE 10 EXPLAIN FIGURE 24–9** default position of airflow control blade is wide open. 11. **SLIDE 11 EXPLAIN FIGURE 24–10** intake heater grids are serviced together after airflow control valve assembly is removed from intake manifold
	**DEMONSTRATION: HOW TO DRAIN THE FUEL FILTER**
	**HANDS-ON TASK: HAVE STUDENTS DRAIN THE FUEL FILTER**
	**DEMONSTRATION: HOW TO REPLACE THE FUEL FILTER**
	**HANDS-ON TASK: HAVE STUDENTS REPLACE THE FUEL FILTER**
	12. **SLIDE 12 EXPLAIN FIGURE 24–11** high-pressure fuel pump is timed to camshaft and provides the needed pressure to common rail.
	**SAFETY HIGH-PRESSURE FUEL LINES DELIVER FUEL UNDER EXTREME PRESSURES. USE EXTREME CAUTION WHEN LOOKING FOR LEAKS AS FUEL UNDER PRESSURE MAY PENETRATE SKIN CAUSING INJURY OR DEATH**
	**DEMONSTRATION: HOW TO TIME THE 6.7L HPFP TO ENGINE**

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	**HANDS-ON TASK: HAVE STUDENTS TIME THE 6.7L HPFP TO ENGINE**
	13. **SLIDE 13 EXPLAIN FIGURE 24–12** injector is sealed to cylinder head with an O-ring and a sealing washer.
	14. **SLIDE 14 EXPLAIN FIGURE 24–13** common rail stores high-pressure fuel and serves as mounting point for fuel pressure sensor.
	**DISCUSS REAL WORLD FIX Case of the P0251 DTC (1 of 3)**
	**DISCUSS REAL WORLD FIX Case of the P0251 DTC (2 of 3)**
	**DISCUSS REAL WORLD FIX Case of the P0251 DTC (3 of 3)**
	15. **SLIDE 15 EXPLAIN FIGURE 24–14** crankshaft position sensor is mounted on front of engine near crankshaft damper.
	16. **SLIDE 16 EXPLAIN FIGURE 24–15** EGR valve meters exhaust gasses into intake manifold to lower combustion temperatures and pressures.
	**DEMONSTRATION: HOW the FUEL INJECTORS OPERATE, USE SCAN TOOL TO DEMO OPERATION USING PARAMETERS**
	**DEMONSTRATION: IF YOU HAVE TRAINER USE IT TO EXPLAIN ECM/PCM OPERATION. IF NOT USE THE SCAN TOOL & SHOW INPUTS PROVIDING DATA TO COMPUTER**
	**DEMONSTRATION: POINT OUT ALL INPUT SENSORS & OUTPUT ACTUATORS ON ENGINE**
	17. **SLIDE 17 EXPLAIN FIGURE 24–16** aftertreatment system reduces the levels of hydrocarbons, carbon monoxide, oxides of nitrogen and particulate matter to meet emission regulations.

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	18. **SLIDE 18 EXPLAIN FIGURE 24–17** Cummins 5.0-liter V-8 diesel engine
	**DISCUSSION: CHART 24-5 Cummins 5.0-liter engine used in the Nissan Titan**
	19. **SLIDE 19 EXPLAIN FIGURE 24–18** Stage 1 filter assembly is mounted on left frame rail just forward of fuel tank.
	20. **SLIDE 20 EXPLAIN FIGURE 24–19** stage 2 filter housing contains 3-micron filter and serves as return after high-pressure portion of fuel system.
	21. **SLIDE 21 EXPLAIN FIGURE 24–20** Bosch CP 4.2 high-pressure pump is timed to engine for proper fuel delivery and minimal vibrations.
	22. **SLIDE 22 EXPLAIN FIGURE 24–21** high-voltage piezoelectric injector uses a hold down clamp that secures it in cylinder head.
	23. **SLIDE 23 EXPLAIN FIGURE 24–22** electronic pressure sensor used to determine air filter restriction instead of traditional manometer.
	**DISCUSS FREQUENTLY ASKED QUESTION: How Will I Know When I Need to Replace Air Filter Element?**