

Light Vehicle Diesel Engines

Chapter 23 DURAMAX 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: <ol style="list-style-type: none"> 1. Identify the major engine components of the DURAMAX diesel engines. • 2. Explain the cooling system, air intake system, and the lubrication system service on the DURAMAX diesel engines. • 3. Explain unique features of the DURAMAX upper engine, lower engine, and the engine timing system. 4. Discuss engine and component identification. 5. Explain the location, function, and diagnosis of the low-pressure fuel system. 6. Identify the components, location, and function of the high-pressure fuel system. 7. Discuss messages associated with DEF system
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 23 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	CH23 DURAMAX DIESEL ENGINE
	<p>1. SLIDE 1 CH23 DURAMAX DIESEL ENGINE</p> <p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED</p> <p><u>Light Diesel (111 Links)</u></p> <p>http://www.jameshalderman.com/books_a9.html Crossword Puzzle (Microsoft Word) (PDF) Word Search Puzzle (Microsoft Word) (PDF)</p> <p><u>SAFETY</u> 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.</p> <p>2. SLIDE 2 EXPLAIN FIGURE 23-1 DMAX plant is located near I-75, and railroad access makes transport of materials and finished engines easy from Ohio plant.</p> <p><u>DISCUSSION:</u> CHART 23-1 First years of Duramax were labeled as LB7 and used in 2002-2004 model years.</p> <p><u>DISCUSSION:</u> CHART 23-2 second generation of Duramax Diesels were referred to as LLY</p> <p><u>DISCUSSION:</u> CHART 23-3 third generation of Duramax diesel referred to as LBZ and considered to be hot rod version because they did not use DPF</p> <p><u>DISCUSSION:</u> CHART 23-4 fourth generation of Duramax diesel were referred</p>

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      	<p>to as LLM and first version to use diesel particulate filter.</p> <p>DISCUSSION: CHART 23-5 fifth generation of Duramax diesel were referred to as LML and first version to use SCR requiring use of DEF.</p> <p>DISCUSSION: CHART 23-6 LGH Duramax diesel is a detuned version of LML and used in commercial vehicles only</p> <p>DISCUSSION: CHART 23-7 L5P version of Duramax diesel features higher horsepower & torque from previous versions, uses unique cold air intake scoop on hood.</p> <p>DISCUSSION: CHART 23-8 summary of technical specifications for 4-cylinder 2.8-liter Duramax diesel engine.</p> <p>DISCUSS FREQUENTLY ASKED QUESTION: What Happened to 4.5-liter V-8 Duramax?</p> <p>DEMONSTRATION: EITHER HAVE DURAMAX DISASSEMBLED OR TAKE ONE APART IN YOUR PRESENTATION</p> <p>HANDS-ON TASK: OPTION IS TO HAVE STUDENTS DISASSEMBLE DURAMAX</p>

ICONS



CH23 DURAMAX DIESEL ENGINE

3. **SLIDE 3 EXPLAIN FIGURE 23-2** Cylinder induction hardening is not visible on this engine, but often seen on engines that have a lot of miles on them because upper third of cylinder walls are often different color
4. **SLIDE 4 EXPLAIN FIGURE 23-3 FIGURE 23-3** connecting rods are scored and then broken. Cap stays secure because mating surfaces are perfectly matched.
5. **SLIDE 5 EXPLAIN FIGURE 23-4** Piston has 4 grooves for 3 piston rings, but one of 3 grooves is used as heat dam & often referred to as “empty piston ring groove”.













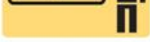
DEMONSTRATION: PASS AROUND DURAMAX PISTON & POINT OUT ITS FEATURES










6. **SLIDE 6 EXPLAIN FIGURE 23-5 (a)** openings on underside of piston are designed to allow engine oil to flow to head of piston.
7. **SLIDE 7 EXPLAIN FIGURE 23-5 (b)** oil squirters are used to keep head of pistons cooled because most of heat generated in engine is in combustion chamber. This heat needs to be transferred to the engine oil where it can be cooled by engine oil cooler











DISCUSS FREQUENTLY ASKED QUESTION: What is a “REMELTED PISTON”?

DISCUSS REAL WORLD FIX Case of the Tuner Program Gone Bad (1 of 2)

DISCUSS REAL WORLD FIX Case of the Tuner Program Gone Bad (2 of 2)

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	<p>9. SLIDE 9 EXPLAIN FIGURE 23-6 (A) Duramax uses large diameter roller solid (non-hydraulic) valve lifters</p>
	<p>10. SLIDE 10 EXPLAIN FIGURE 23-6 (B) To keep valve lifters from rotating in their bores, an anti-rotation clip is used that allows lifters to move up and down freely</p>
	<p>11. SLIDE 11 EXPLAIN FIGURE 23-7 lower oil pan is stamped steel</p>
	<p>12. SLIDE 12 EXPLAIN FIGURE 23-8 Oil cooler showing construction</p>
	<p>13. SLIDE 13 EXPLAIN FIGURE 23-9 water pump gear driven by camshaft gear</p>
	<p>14. SLIDE 14 EXPLAIN FIGURE 23-10 (a) water pump assembly as it looks after removal from engine.</p>
	<p>15. SLIDE 15 EXPLAIN FIGURE 23-10 (b) impeller & bearing assembly as it is being removed from housing</p>
	<p><u>DEMONSTRATION: HOW TO TAKE APART THE WATER PUMP</u></p>
	<p><u>HANDS-ON TASK: HAVE STUDENTS TAKE APART THE WATER PUMP</u></p>
	<p>16. SLIDE 16 EXPLAIN FIGURE 23-11 Duramax diesel engines use two thermostats, a primary and a secondary to precisely control engine temperature.</p>
	<p><u>DEMONSTRATION: HOW TO REMOVE THE 2 THERMOSTATS ON A CLASSROOM ENGINE OR LAB VEHICLE</u></p>
	<p><u>HANDS-ON TASK: HAVE STUDENTS REMOVE THE 2 THERMOSTATS ON A CLASSROOM ENGINE OR LAB VEHICLE</u></p>
	<p>17. SLIDE 17 EXPLAIN FIGURE 23-12 Rocker arms depress valve bridges which then open 2 valves at same time.</p>

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	<p>18. SLIDE 18 EXPLAIN FIGURE 23–13 markings on head gasket include left (L) and right (R) heads, as well as thickness for LMM, LML and LGH Duramax diesel engines with location of a hole within an oval. Check service information for exact marking and specifications for engine being serviced.</p>
	<p>DISCUSSION: CHART 23-9 gasket thickness and piston intrusion (distance piston rises above block at TDC). This measurement seldom needed unless engine has been machined. In most cases, all that is needed is to replace head gasket with replacement of same thickness</p>
	<p>DEMONSTRATION: HOW TO REMOVE THE HEAD ON A CLASSROOM ENGINE OR LAB VEHICLE</p>
	<p>HANDS-ON TASK: HAVE STUDENTS REMOVE THE HEAD ON CLASSROOM ENGINE OR LAB VEHICLE</p>
	<p>EXPLAIN TECH TIP Quick and Easy Test for Diesel Fuel in the Oil</p>
	<p>19. SLIDE 19 EXPLAIN FIGURE 23–15 Depressing primer pump bleeds air from system.</p>
	<p>20. SLIDE 20 EXPLAIN FIGURE 23–16 low-pressure fuel system on a Duramax is under a vacuum created by suction pump inside high-pressure fuel pump assembly.</p>
	<p>DISCUSSION: CHART 23-10 vacuum values when testing low side of Duramax diesel engine fuel system. If this vacuum test fails, it is usually due to a restricted fuel filter.</p>
	<p>DEMONSTRATION: HOW TO DRAIN THE FUEL FILTER & CHECK INLET FUEL PRESSURE</p>

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	<p>HANDS-ON TASK: HAVE STUDENTS DRAIN THE FUEL FILTER & CHECK INLET FUEL PRESSURE</p>
	<p><u>DEMONSTRATION:</u> HOW TO REPLACE FUEL FILTER</p>
	<p>HANDS-ON TASK: HAVE STUDENTS REPLACE FUEL FILTER</p>
	<p>21. SLIDE 21 EXPLAIN FIGURE 23–17 high-pressure fuel pump (HPFP) driven by camshaft gear at front of engine.</p>
	<p><u>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</u></p>
	<p>22. SLIDE 22 EXPLAIN FIGURE 23–18 Green area represents fuel being drawn into pump. Orange area low-pressure fuel from suction pump, feeding fuel to high-pressure pistons and for lubrication. Red sections represent high-pressure fuel that is delivered to fuel lines. blue area is fuel return and lube circuit.</p>
	<p>23. SLIDE 23 EXPLAIN FIGURE 23–19 fuel high-pressure lines are highlighted to show how they are routed.</p>
	<p>24. SLIDE 24 EXPLAIN FIGURE 23–20 typical Duramax fuel control system showing the role of the ECM/PCM & FICM (EARLY ENGINES LB7 LBZ & LLY, Dropped in 2006 with Bosch ECM)</p>
	<p><u>DEMONSTRATION:</u> IF YOU HAVE TRAINER USE IT TO EXPLAIN ECM/PCM OPERATION. IF NOT USE THE SCAN TOOL & SHOW INPUTS PROVIDING DATA TO COMPUTER</p>
	<p><u>DEMONSTRATION:</u> HOW the FUEL INJECTORS OPERATE, USE SCAN TOOL TO DEMO OPERATION USING PARAMETERS</p>

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        	<p><u>DEMONSTRATION:</u> POINT OUT ALL INPUT SENSORS & OUTPUT ACTUATORS ON ENGINE</p> <p>25. SLIDE 25 EXPLAIN FIGURE 23–21 modifiers for each cylinder are displayed on scan tool and are shown in cubic millimeters (mm³).</p> <p>26. SLIDE 26 EXPLAIN FIGURE 23–22 EGR valve is complex unit and includes passages that allow exhaust gases to bypass cooler when at idle speed and is located over rear of right head.</p> <p>DISCUSS REAL WORLD FIX Case of the Limited Engine Speed (1 of 2)</p> <p>DISCUSS REAL WORLD FIX Case of the Limited Engine Speed (2 of 2)</p> <p>27. SLIDE 27 EXPLAIN FIGURE 23–24 Snap-on scan tool screen shot of PTO status</p> <p><u>DEMONSTRATION:</u> FORCED REGERNATION USING SCAN TOOL ON LAB VEHICLE</p>