Light Vehicle Diesel Engines

Chapter 2 Diesel Engine Blocks & Rotating Assemblies

Opening Your Class

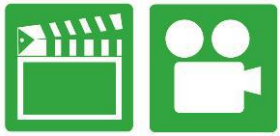
KEY ELEMENT	EXAMPLES
Introduce Content	This Light Vehicle Diesel Engines 1st text provides complete coverage of light duty diesel engine components, operation, and diagnosis. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, and Real World Fixes..www.jameshalderman.com contains Videos, Animations, and NATEF 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 to take the ASE A9 certification test in area "C" (Engine Block Diagnosis and Repair). 2. Discuss the difference between gray cast iron and compacted graphite iron (CGI). 3. Explain the difference between a girdle and a bedplate engine design. 4. Explain the purpose of Nitriding and Tuftriding. 5. Describe how surface finish is measured. 6. Discuss engine bearing types and materials used in diesel engines.
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 02 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	Ch02 Diesel Engine Blocks
	**1. SLIDE 1 CH2 Diesel Engine Blocks & Rotating Assemblies**
	**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 **CROSSWORD PUZZLE (MICROSOFT WORD) (PDF)** **WORD SEARCH PUZZLE (MICROSOFT WORD) (PDF**
	2. **SLIDE 2 EXPLAIN FIGURE 2–1** Core plugs on a Fiat Chrysler 3.0 liter V-6 diesel engine.
	**DEMONSTRATION: Have a classroom diesel engine available to show the casting number and engine serial numbers along with other block components**
	3. **SLIDE 3 EXPLAIN FIGURE 2–2** casting number is shown literally cast with the block for identification.
	4. **SLIDE 4 EXPLAIN FIGURE 2–3** deck of the block of a Duramax diesel engine showing the location of the cylinder head bolts and the coolant passages. 5. **SLIDE 5 EXPLAIN FIGURE 2–4** Cummins 6.7 liter inline six-cylinder diesel engine that shows the coolant jackets and some of the lubrication holes.
	**DISCUSS FREQUENTLY ASKED QUESTION: Where Is Block Heater Located? Block heater is used in many diesel engines operating in cold climates to electrically heat coolant to make the engine start easier. It is normally installed in one of core (freeze) plugs where an electrical current from a 120-volt electrical outlet is used to heat the**

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	**coolant in block. FIGURE 2–5.** 6. **SLIDE 6 EXPLAIN FIGURE 2–5** block heater shown in one of the core plugs in a GM Duramax V-8 diesel engine. 7. **SLIDE 7 EXPLAIN FIGURE 2–6** main bearing caps used on the Cummins 6.7 liter inline six-cylinder diesel engines. 8. **SLIDE 8 EXPLAIN FIGURE 2–7** GM Duramax V8 diesel engine uses 2 vertical bolts plus two crossbolts from the side of the block to support each main bearing cap.
	**DISCUSSION: Host a discussion on the use and need for four-bolt main bearing caps**
	**DEMONSTRATION: demonstrate how to remove a main bearing cap**
	**HANDS-ON TASK: have your students remove a main bearing cap**
	9. **SLIDE 9 EXPLAIN FIGURE 2–8** A typical girdle as found on a Duramax V-8 diesel used to strengthen and help tie together all of the main bearing caps.
	10. **SLIDE 10 EXPLAIN FIGURE 2–9(A)** A bedplate is a structural part of the engine which is attached between the block and the oil pan and supports crankshaft.
	**DISCUSS FREQUENTLY ASKED QUESTION: What Is the Difference between Girdle & Bedplate? Many engines use a girdle, which ties all of main bearing caps together, to add strength to lower part of block. This type of design uses a solid steel support that attaches to the main bearing caps & and ties the entire lower part of the block together.** **SEE FIGURE 2– 8.** **A bedplate, also called a frame-ladder design, is a structural member that attaches to the bottom of e block and supports the crankshaft. The oil pan is mounted under the bedplate, which in most cases**

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	is also part of the structure and support for the block assembly. SEE FIGURE 2–9.
	11. **SLIDE 11 EXPLAIN FIGURE 2–9(B)** A bedplate on a Fiat Chrysler 3.0 liter V-6 Diesel engine. The Ford 6.0 and 6.4 liter Power Stroke V-8 diesel engines also use a frame-ladder block design. 12. **SLIDE 12 EXPLAIN FIGURE 2–10** Typical crankshaft with main journals supported by main bearings in block. Rod journals are offset from crankshaft centerline. 13. **SLIDE 13 EXPLAIN FIGURE 2–11** crankshaft rotates on main bearings. Longitudinal (end-to-end) movement is controlled by the thrust bearing.
	**DEMONSTRATION: with the pan removed on a school diesel engine show the girdle and/or bedplate**
	**DISCUSSION: host a discussion on the use of bedplates and girdles**
	14. **SLIDE 14 EXPLAIN FIGURE 2–12** A view of the crankshaft of a Duramax V-8 diesel engine with the oil pan removed. Note there are two connecting rods attached to the same throw of the crank. 15. **SLIDE 15 EXPLAIN FIGURE 2–13** distance from the crankpin centerline to centerline of crankshaft determines the stroke, which is leverage available to turn crankshaft.
	**Show ANIMATION Crankshaft Removal (View) (Download)**
	16. **SLIDE 16 EXPLAIN FIGURE 2–14** Wide separation lines of a forged crankshaft.
	17. **SLIDE 17 EXPLAIN FIGURE 2–15** A billet crankshaft showing how it is machined from a solid chunk of steel, usually 4340 steel, at the right and finished crankshaft on the left. 18. **SLIDE 18 EXPLAIN FIGURE 2–16** Crankshaft sawed in half, showing drilled oil passages between the main and rod bearing journals.

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 	19. **SLIDE 19 EXPLAIN FIGURE 2–17** Typical chamfered hole in a crankshaft bearing journal. **DEMONSTRATION:** **show the lubrication drilling in the crankshaft and DISCUSS any service issues**
	20. **SLIDE 20 EXPLAIN FIGURE 2–18** fully counterweighted four-cylinder crankshaft with 5 main bearings. 21. **SLIDE 21 EXPLAIN FIGURE 2–19** A crankshaft broken as a result of a defective torsional vibration damper. 22. **SLIDE 22 EXPLAIN FIGURE 2–20** hub of the harmonic balancer is attached to front of crankshaft. The elastomer (rubber) between inertia ring and center hub allows the absorption of crankshaft firing impulses.
 	**DISCUSSION:** **Host a discussion on crankshaft balance** 23. **SLIDE 23 EXPLAIN FIGURE 2–21** S cored connecting rod bearing journal. 24. **SLIDE 24 EXPLAIN FIGURE 2–22** All crankshaft journals should be measured for diameter as well as taper and out-of-round.
 	**DEMONSTRATION:** 25. **SLIDE 25 EXPLAIN FIGURE 2–23** Check each journal for taper and out-of-round. 26. **SLIDE 26 EXPLAIN. FIGURE 2–24** Crankshafts should be stored vertically to prevent possible damage or warpage. This clever bench-mounted tray for crankshafts not only provides a safe place to store crankshafts, but is also out of the way and cannot be accidentally tipped. 27. **SLIDE 27 EXPLAIN FIGURE 2–25** Two halves of a plain bearing meet at parting faces.
	**DEMONSTRATION:** **with a crankshaft removed from the engine, show rolled radius fillets and wide separation areas of a diesel crankshaft. DEMO How to measure a crankshaft.**

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	**Measure Crankshaft Out of Round (View)(Download)**
	**Measure Crankshaft Taper (View) (Download)**
	**HANDS-ON TASK: have the students measure a crankshaft.**
	28. **SLIDE 28 EXPLAIN FIGURE 2–26** Bearing wall thickness is not the same from the center to the parting line. This is called *eccentricity* and is used to help create an oil wedge between the journal and the bearing. 29. **SLIDE 29 EXPLAIN FIGURE 2–27** Typical two and three-layer engine bearing inserts showing the relative thickness of the various materials. 30. **SLIDE 30 EXPLAIN FIGURE 2–28** Typical bearing shell types found in modern engines: (a) half-shell thrust bearing, (b) upper main bearing insert, (c) lower main bearing insert, (d) full round-type camshaft bearing.
	31. **SLIDE 31 EXPLAIN**. FIGURE 2–29 Bearings are often marked with an undersized dimension. This bearing is used on a crankshaft with a ground journal that is 0.020 inch smaller in diameter than the stock size.
	**DEMONSTRATION: have several different main and rod bearings for display. Show and explain the term Bearing Undersize. When you say bearing undersize, this means the journal is undersized and the bearing thickness is greater**
	32. **SLIDE 32 EXPLAIN**. **FIGURE 2–30** width of plastic gauging strip determines the oil clearance of the main bearing. An alternate method of determining oil clearance includes careful measurement of the crankshaft journal and bearings after they are installed, and the main housing bore caps are torqued to specifications.
	**DEMONSTRATION: demo the use of Plastigage and measuring bearing clearance using both methods**

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  	**HANDS-ON TASK: Have the students measuring bearing clearance using both methods** 33. **SLIDE 33 EXPLAIN FIGURE 2–31** Bearing spread and crush. **34. SLIDE 34 EXPLAIN FIGURE 2–32** Bearings are thinner at the parting line faces to provide crush relief. **35. SLIDE 35 EXPLAIN FIGURE 2–33** tang (lug) and slot help index the bearing in the bore. **36. SLIDE 36 EXPLAIN. FIGURE 2–34** Many bearings are manufactured with a groove down the middle to improve the oil flow around the main journal. **37. SLIDE 37 EXPLAIN. FIGURE 2–35** Cam-in-block engines support the camshaft with sleeve-type bearings. **38. SLIDE 38 EXPLAIN. FIGURE 2–36** Camshaft bearings must be installed correctly so that oil passages are not blocked. **ON-VEHICLE NATEF TASK**