

Automotive Technology 6th Edition

Chapter 28 Engine Removal & Disassembly

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This Automotive Technology 6th text provides complete coverage of automotive components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and ASEducation (NATEF) and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Case Studies, Videos, Animations, and ASEducation (NATEF) Task Sheets.
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 as listed: <ol style="list-style-type: none"> 1. Discuss the different engine repair options. 2. Explain the engine removal procedure. 3. Explain the engine disassembly procedure. 4. Explain disassembly of the short block, removal of rotating engine assemblies, and cylinder head disassembly.
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 the 6th Edition Chapter Images found on Jim's web site @

www.jameshalderman.com

DOWNLOAD Chapter 28 Chapter Images: From

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[automotive_principles.html](http://www.jameshalderman.com/automotive_principles.html)NOTE: You can use Chapter Images or possibly Power Point files:

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1. SLIDE 1 CH 28 ENGINE REMOVAL & DISASSEMBLY

Check for **ADDITIONAL VIDEOS & ANIMATIONS**
@ <http://www.jameshalderman.com/>
WEB SITE IS CONSTANTLY UPDATED

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Crossword Puzzle (Microsoft Word) (PDF)

Word Search Puzzle (Microsoft Word) (PDF)

ENGINE REMOVAL

Videos

2. **SLIDE 2 EXPLAIN** Figure 28-1 worn timing sprocket that resulted in a retarded valve timing and reduced engine performance.
3. **SLIDE 3 EXPLAIN** Figure 28-2 crate engine from Chrysler to be used in a restored muscle car. Using complete new engine costs more than rebuilding an existing engine, but has warranty and uses all new parts.

EXPLAIN TECH TIP: Picture Is Worth a Thousand Words: Take pictures with a cell phone camera, digital camera, or a video camcorder of the engine being serviced. These pictures will be worth their weight in gold when it comes time to reassemble or reinstall the engine. It is very difficult for anyone to remember the exact location of every bracket, wire, and hose. Referring back to the photos of the engine before work was started will help you restore the vehicle to like-new condition.

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	<p>EXPLAIN TECH TIP: Tag and Bag: All components and fasteners should be marked for future reference. Large components should be marked or a tag installed that identifies the part. Smaller parts and fasteners should be placed in plastic bags and labeled as to what they are used for, such as the water pump bolts.</p>
	<p>A minor repair on one vehicle can be a major repair in another. EG: most people would think that an oil pan gasket is a minor repair, but on some vehicles, entire engine must be removed to access oil pan.</p>
	<p>CRATE ENGINES are usually for dealership replacement in vehicles under warranty with low mileage. Costs for just engine can be \$4,000 or more!</p>
	<p>DEMONSTRATION: Show students how to identify an engine in order to replace it. This includes knowing how to decode the VIN & finding certification labels.</p>
	<p>HANDS-ON TASK: Have students locate & identify different engines in the shop as if they were going to replace them. Be sure to have them decode VIN.</p>
	<p>Be sure to reference ON-LINE SERVICE INFORMATION before attempting to remove engine. Some engines can be much harder to remove and install than others. ENGINES TODAY ARE INSTALLED FROM BOTTOM</p>

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4. **SLIDE 4 EXPLAIN Figure 28-3** An engine must be tipped as it is pulled from the chassis.
5. **SLIDE 5 EXPLAIN Figure 28-4** When removing just the engine from a front-wheel drive vehicle, the transaxle must be supported. Shown here is a typical fixture that can be used to hold the engine if the transaxle is removed or to hold the transaxle if the engine is removed.
6. **SLIDE 6 EXPLAIN Figure 28-5** entire cradle, which included the engine, transaxle, and steering gear, was removed and placed onto a stand. Rear cylinder head has been removed to check for root cause of a coolant leak.

DEMONSTRATION: Show students how to properly use a transverse engine support bracket.

HANDS-ON TASK: Have students set up transverse engine support bracket on LAB VEHICLE

ON-VEHICLE ASE EDUCATION TASK Remove and reinstall engine in an OBD II or newer vehicle; reconnect all attaching components & restore vehicle to running condition (P-2)

7. **SLIDE 7 EXPLAIN Figure 28-6** Always use graded bolts—either grade 5 or 8 bolts—whenever mounting an engine to a stand
8. **SLIDE 8 EXPLAIN Figure 28-7** Keeping the pushrods and the lifters sorted by cylinder, including the spark plugs, is a wise way to proceed when disassembling the cylinder heads
9. **SLIDE 9 EXPLAIN Figure 28-8** Sometimes after the cylinder head has been removed, the engine condition is discovered to be so major that the entire engine may need to be replaced rather than overhauled

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EXPLAIN TECH TIP: Disassembly Is the Reverse Order of Assembly: Cylinder heads often warp upward in the center. Loosening the center head bolts first will tend to increase the warpage, especially if the head is being removed to replace a head gasket because of overheating. Always follow the torque table backwards, starting with the highest-number bolt and working toward the lowest number. In other words, always loosen fasteners starting at the end or outside of the component and work toward the inside or center of the component.



Use an engine parts holder to help keep parts organized.



DISCUSSION: Ask students if using machine shop to perform certain engine repairs (valve job) is better or worse than having technician do job themselves. Have them explain their reasoning.



10. **SLIDE 10 EXPLAIN** Figure 28-9 connecting rods were numbered from the factory. If they are not, then they should be marked.



DEMONSTRATION: Show students how to identify rod caps, main bearing caps, and camshaft journals. Include bearings as well so students will be able to understand how they work.



11. **SLIDE 11 EXPLAIN** Figure 28-10 Most of the cylinder wear is on the top inch just below the cylinder ridge. This wear is due to the heat and combustion pressures that occur when the piston is near the top of the cylinder.

12. **SLIDE 12 EXPLAIN** Figure 28-11 This ridge is being removed with one type of ridge reamer before the piston assemblies are removed from the engine

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EXPLAIN TECH TIP: Measure Cylinder Bore before Further Disassembly: As soon as the cylinder head has been removed from engine, take a measurement of the cylinder bore. This is done for the following reasons.

- To verify that the engine size is the same as specified by the vehicle identification number (VIN)
- To measure the bore and compare it to factory specifications, to help the technician determine if the cylinder(s) is too worn to use or cannot be restored

13. **SLIDE 13 EXPLAIN** Figure 28-12 Puller being used to pull the vibration damper from the crankshaft.

An engine vibration dampener (harmonic balancer) is made up of 2 pieces that are held together by a rubberlike substance to absorb the vibration. Sometimes rubber material can tear, causing a possible timing issue or other performance problems.

14. **SLIDE 14 EXPLAIN** Figure 28-13 When the timing chain cover was removed, the broken timing gear explained why this GM 4.3 liter V-6 engine stopped running.

15. **SLIDE 15 EXPLAIN** Figure 28-14 Most engines such as this Chevrolet V-8 with four-bolt main bearing caps have arrows marked on the bearing caps which should point to the front of the engine.

16. **SLIDE 16 EXPLAIN** Figure 28-15 This small block Chevrolet V-8 had water standing in the cylinders, causing a lot of rust, which was discovered as soon as the head was removed.

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 	<p><u>ON-VEHICLE ASE EDUCATION TASK</u> Disassemble engine block; clean and prepare components for inspection and reassembly (P-1)</p>
	<p><u>DEMONSTRATION:</u> Show students how to measure a cylinder bore. Most measurements will be taken to 0.0001" (one ten-thousandth of an inch). Measurements this precise cannot be seen or felt with fingers.</p>
	<p><u>HANDS-ON TASK:</u> Have students measure cylinder bores on an engine. Have them write down their measurements and identify any that are out of specification.</p>
	<p><u>DISCUSSION:</u> Ask students if 0.100" is same as 0.1". (It is not, because other zeros display accuracy in measurement.)</p>
	<p><u>DEMONSTRATION:</u> Show students the proper equipment used to secure and hold cylinder heads. Cylinder heads should never laid flat on a table.</p>
	<p><u>EXPLAIN TECH TIP: The Wax Trick</u> Before the engine block can be thoroughly cleaned, all oil gallery plugs must be removed. A popular trick of the trade for plug removal involves heating the plug (not the surrounding metal) with an oxyacetylene torch. The heat tends to expand the plug and make it tighter in the block. Do not overheat. As the plug is cooling, touch the plug with paraffin wax (beeswax or candle wax may be used). • SEE FIGURE 28-16. Wax will be drawn down around the threads of the plug by capillary attraction as the plug cools and contracts. After being allowed to cool plug is easily removed.</p>

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17. **SLIDE 17 EXPLAIN** Figure 28-16 torch is used to heat gallery plugs. Paraffin wax is then applied and allowed to flow around the threads. This procedure results in easier removal of the plugs and other threaded fasteners that cannot otherwise be loosened.
18. **SLIDE 18 EXPLAIN** Figure 28-17 valve spring compressor is used to compress the valve spring before removing the keepers (locks).
19. **SLIDES 19-30 EXPLAIN ENGINE REMOVAL or COMPLETE NATEF TASK FOR ENGINE REMOVAL**

EXPLAIN TECH TIP: Mark It to Be Safe

Whenever you disassemble anything, it is always wise to mark the location of parts, bolts, hoses, and other items that could be incorrectly assembled. Remember, the first part removed will be the last part that is assembled. If you think you will remember where everything goes—forget it! It just does not happen in the real world. One popular trick is to use correction fluid to mark the location of parts before they are removed. Most of these products are alcohol or water-based, dry quickly, and usually contain a brush in the cap for easy use.

HANDS-ON TASK: Have students remove crankshaft and head from an engine. Then have them properly reinstall them.

ON-VEHICLE ASE EDUCATION TASK Remove cylinder head; inspect gasket condition; install cylinder head, gasket; tighten according to specifications & procedures (P-1)

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DISCUSSION: Most technicians do not rebuild the entire engine on their own. Ask students what jobs a technician would contract out and why. The most common reasons are time and cost savings

SEARCH INTERNET: Have students use Internet to search for additives for engine protection and repair. Have them prepare to report to the class on five different additives and what they do. Also ask them to comment on any reviews they found about the additives and whether they would use any of additives in their own vehicles.