

# Light Vehicle Diesel Engines

## Chapter 22 FORD Power Stroke Diesel Engines

### Opening Your Class

| KEY ELEMENT  | EXAMPLES  |
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| <b>Introduce Content</b>   | 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: <a href="http://www.jameshalderman.com">www.jameshalderman.com</a> contains Videos, Animations, and Task Sheets for use in the lab and classroom.  |
| <b>Motivate Learners</b>   | 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.  |
| <b>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.</b> | Explain the chapter learning objectives to the students as listed: <ol style="list-style-type: none"> <li>1. Identify the major engine components on the 7.3, 6.0, 6.4, and 6.7 liter diesel engines. •</li> <li>2. Explain the cooling system, air intake system, and the lubrication system service on the various Power Stroke diesel. •</li> <li>3. Explain unique features of the Ford Power Stroke upper engine, lower engine, and the engine timing system.</li> <li>4. Perform component identification; verify the location and function of the major engine inputs and outputs of the Ford Power Stroke diesel engines.</li> <li>5. Explain the location, function, and diagnosis of the low-pressure fuel system.</li> <li>6. Identify the components, location, and function of the high-pressure fuel system.</li> </ol> |
| <b>Establish the Mood or Climate</b>   | Provide a <b>WELCOME</b> , Avoid put downs and bad jokes.   |
| <b>Complete Essentials</b>   | Restrooms, breaks, registration, tests, etc.  |
| <b>Clarify and Establish Knowledge Base</b>  | 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 1<sup>st</sup> Edition Chapter Images found on Jim's web site @ [www.jameshalderman.com](http://www.jameshalderman.com)




**LINK CHP 22 Chapter Images USE BELOW LINK**

[http://www.jameshalderman.com/books\\_a9.html](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.

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| ICONS  | CH22 FORD Power Stroke Diesel Engines  |
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|  | <p><b>1. SLIDE 1 CH22 FORD POWER STROKE DIESEL ENGINES</b></p> <p>Check for <b>ADDITIONAL VIDEOS &amp; ANIMATIONS</b><br/> @ <a href="http://www.jameshalderman.com/">http://www.jameshalderman.com/</a><br/> <b>WEB SITE IS CONSTANTLY UPDATED</b></p> <p><b><u>Light Diesel (111 Links)</u></b></p> <p><a href="http://www.jameshalderman.com/books_a9.html">http://www.jameshalderman.com/books_a9.html</a><br/> <b>Crossword Puzzle (Microsoft Word) (PDF)</b><br/> <b>Word Search Puzzle (Microsoft Word) (PDF)</b></p> <p><b><u>SAFETY</u></b> Always be very careful when working on a Diesel engine that is running with air intake removed. Because most diesel <b>ENGINES DO NOT USE</b> a throttle plate, objects can very easily be sucked into engine, causing serious engine damage. <b>MOST OEMs offer intake covers.</b></p> <p><b><u>DISCUSSION:</u></b> CHART 22-1 specifications for 7.3-liter Ford Power Stroke diesel engine used in 1994–2003 model years (MY).</p> <p><b>DISCUSS REAL WORLD FIX</b> Case of Noisy 7.3-Liter Power Stroke Starter (1 of 2)</p> <p><b>DISCUSS REAL WORLD FIX</b> Case of Noisy 7.3-Liter Power Stroke Starter (2 of 2)</p> <p><b><u>DISCUSSION:</u></b> CHART 22-2 specifications for 6.0-liter Ford Power Stroke diesel engine 2003–2007 model years (MY).</p> <p><b>EXPLAIN TECH TIP USE 6.4L STARTER ON 6.0L</b></p> <p><b><u>DISCUSSION:</u></b> CHART 22-3 specifications for 6.4-liter Ford Power Stroke diesel engine 2008–2010 model years (MY)</p> |









| <b>ICONS</b>  | <b>CH22 FORD Power Stroke Diesel Engines</b>  |
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| <br><br> | <p><b>EXPLAIN TECH TIP</b> Purchase International Parts for Ford Power Stroke Diesels</p> <p><b>DISCUSSION:</b> CHART 22-4 specifications for 6.7 liter Ford Power Stroke diesel engine used in the 2011+ model years (MY).</p> <p><b>EXPLAIN TECH TIP</b> Be Sure to Check Cylinder Numbering: SEE FIGURE 22-1</p> |












## ICONS













## CH22 FORD Power Stroke Diesel Engines

2. **SLIDE 2 EXPLAIN FIGURE 22–1** Older Ford Power Stroke diesel engines (7.3, 6.0, and 6.4 liter) were built by International and used by International cylinder numbering as shown on left. 6.7-liter Power Stroke is built by Ford and uses typical Ford cylinder numbering as shown on right
3. **SLIDE 3 EXPLAIN FIGURE 22–2** primary cooling system uses 2 thermostats designed to precisely control coolant temperature. One thermostat opens at 194°F (90°C) and the other opens at 201°F (94°C)..
4. **SLIDE 4 EXPLAIN FIGURE 22–3** overflow and Degas bottle located under hood on driver's side
5. **SLIDE 5 EXPLAIN FIGURE 22–4** oil filter used on 6.7 Power Stroke is a spin-on type. Oil pan was updated for 2012 model year with stamped steel lower pan with conventional plug instead of plastic (composite) pan used with plastic drain plug on 2011 model year version.
6. **SLIDE 6 EXPLAIN FIGURE 22–5** Large rubber coolant hoses are used to supply coolant to and from the oil cooler.
7. **SLIDE 7 EXPLAIN FIGURE 22–6** 6.7 block made from compacted graphite iron (CGI) & uses cross-bolted main bearing caps for strength.
8. **SLIDE 8 EXPLAIN FIGURE 22–7** aluminum cylinder head features intake ports on outside of head where exhaust ports are usually located. This design allows exhaust posts to be close to turbocharger, making it more efficient.
9. **SLIDE 9 EXPLAIN FIGURE 22–8 (a)** patented dual hydraulic lash adjusters within one roller lifter, allows 6.7 liter Power Stroke diesel to use single rocker arm for each valve.
10. **SLIDE 10 EXPLAIN FIGURE 22–8 (b)** Each valve is opened by its own stamped steel rocker arm. Using incorrect engine oil can often lead to wear problems especially on push rods and rocker arm fulcrums and pads
11. **SLIDE 11 EXPLAIN FIGURE 22–9** forged module steel crankshaft uses a shrink fit front drive gear to rotate camshaft gear, which is timed to high-pressure fuel pump (HPFP)...

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| <br><br>    | <p><b><u>DEMONSTRATION:</u> HOW TO TIME THE 6.7L HPFP TO ENGINE</b></p><br><p><b><u>HANDS-ON TASK:</u> HAVE STUDENTS TIME THE 6.7L HPFP TO ENGINE</b></p><br><p>12. <b>SLIDE 12 EXPLAIN FIGURE 22–11</b> water-in-fuel sensor is a two-wire sensor shown with the connector disconnected.</p> <p>13. <b>SLIDE 13 EXPLAIN FIGURE 22–13</b> return volume from the injectors and the high-pressure pump is being measured.</p>  |
| <br><br> | <p><b><u>DEMONSTRATION:</u> HOW TO DRAIN THE FUEL FILTER ON THE 6.7L</b></p><br><p><b><u>HANDS-ON TASK:</u> HAVE STUDENTS DRAIN THE FUEL FILTER ON THE 6.7L</b></p><br><p>14. <b>SLIDE 14 EXPLAIN FIGURE 22–12</b> Use 32 mm socket with a ratchet to loosen filter housing. After loosening, housing can often be removed by hand, rotating it counterclockwise.</p> <p>15. <b>SLIDE 15 EXPLAIN FIGURE 22–13</b> old filter is removed for housing over an oil drain unit so as to not spill diesel fuel onto floor</p> <p>16. <b>SLIDE 16 EXPLAIN FIGURE 22–14</b> Lubricating the O-ring with grease will allow the housing to move freer when the housing is being rotated back into the DFCM.</p> <p>17. <b>SLIDE 17 EXPLAIN FIGURE 22–15</b> connector tabs are depressed to release them from the fuel filter.</p> |
| <br>   | <p><b><u>DEMONSTRATION:</u> HOW TO REPLACE THE FUEL FILTER ON THE 6.7L</b></p><br><p><b><u>HANDS-ON TASK:</u> HAVE STUDENTS REPLACE THE FUEL FILTER ON THE 6.7L</b></p>   |

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|    | <p>18. <b>SLIDE 18 EXPLAIN FIGURE 22–16</b> new filter is on left and old filter is on right. Dispose of old filter according to federal, state, and local laws. (SECONDARY)</p>   |
|    | <p>19. <b>SLIDE 19 EXPLAIN FIGURE 22–17</b> fuel rail temperature (FRT) sensor and the fuel rail pressure (FPS) sensor are both next to secondary fuel filter under the hood on the driver’s side</p>  |
|    | <p><b>DISCUSS FREQUENTLY ASKED QUESTION:<br/>Why Is a Fuel Cooler Used?</b></p>  |
|    | <p>20. <b>SLIDE 20 EXPLAIN FIGURE 22–18</b> partial cutaway of 6.7-liter Ford Power Stroke engine showing how HP pump is driven by camshaft gear, and timed so that pump stroke happens about same time as injection event, reducing noise</p> |
|    | <p>21. <b>SLIDE 21 EXPLAIN FIGURE 22–19</b> schematic of Ford 6.7 Power Stroke Diesel engine showing pressure and volume solenoids.</p>  |
|  | <p><b>DEMONSTRATION: HOW the FUEL INJECTORS OPERATE, USE SCAN TOOL TO DEMO OPERATION USING PARAMETERS</b></p>  |
|  | <p>22. <b>SLIDE 22 EXPLAIN FIGURE 22–20</b> A piezo fuel injector uses piezoelectric crystals to create a small movement when voltage is applied to open injector.</p>   |
|  | <p>23. <b>SLIDE 23 EXPLAIN FIGURE 22–21</b> hydraulic coupler inside injector is used to multiply small movement of piezo actuator to produce more travel.</p>   |
|  | <p>24. <b>SLIDE 24 EXPLAIN FIGURE 22–22</b> injector nozzle needle operates to open and close injector to deliver fuel to combustion chamber</p>   |
|  | <p><b>DEMONSTRATION: IF YOU HAVE TRAINER USE IT TO EXPLAIN HEUI ECM/PCM OPERATION. IF NOT USE THE SCAN TOOL &amp; SHOW INPUTS PROVIDING DATA TO COMPUTER</b></p>   |
|  | <p>25. <b>SLIDE 25 EXPLAIN FIGURE 22–23</b> relationship between crankshaft position sensor (CKP) and camshaft position sensor (CMP) over period of 2 crankshaft revolutions.</p>  |

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| <br><br><br> <br> <br><br><br> | <p><b><u>DEMONSTRATION:</u> POINT OUT ALL INPUT SENSORS &amp; OUTPUT ACTUATORS ON ENGINE</b></p> <p>26. <b>SLIDE 26 EXPLAIN FIGURE 22–24</b> EGR bypass actuator is located on top of engine above EGR cooler</p> <p>27. <b>SLIDE 27 EXPLAIN FIGURE 22–25</b> cutaway of intake air flow control valve used on 6.7-liter Ford Power Stroke diesel engine.</p> <p><b>DISCUSS REAL WORLD FIX Case of the Stuck Open EGR Valve (1 of 2)</b></p> <p><b>DISCUSS REAL WORLD FIX Case of the Stuck Open EGR Valve (2 of 2)</b></p> <p><b>DISCUSS CHART 22-5 Low DEF warnings and actions, plus instrument cluster messages</b></p> <p><b>DISCUSS CHART 22-6 specifications for 3.2 liter Ford Power Stroke diesel engine used in 2015+ model year (MY) in Transit vans</b></p> <p><b>DISCUSS CHART 22-7 specifications for 3.0 liter V-6 Ford Power Stroke diesel engine in 2018+ model year (MY) F-150 trucks.</b></p> |