Spec’ing Engines For More Than Size

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Spec’ing Engines For More Than Size

Fuel Economy, Cost Guide Shift to Smaller Diesels

By Jonathan S. Reiskin
Associate News Editor

B ack when diesel fuel prices lingered around $1.50 a gallon or less, truck buyers made sport of slamming the biggest, most powerful engines available under the hoods of their rigs, enjoying the bragging rights and freight-hauling prowess of smoke-blowers that were far simpler, and dirtier, than those sold today.

The modern Class 8 engine is actually more powerful and far cleaner than its ancestor of 10 to 15 years ago, but it’s also more complex and expensive.

Fuel prices have increased, too, fluctuating from week to week but likely never returning to yesteryear’s lows.

These higher costs compel serious fleet managers to make careful choices when specifying engine preferences, especially since the federal environmental changes that took effect for diesel engines in January 2010.

The complex challenge for fleet executives: Balance torque and horsepower needs against fuel economy and weight factors while keeping durability and price in mind.

“Spec’ing has changed over time. It’s not so much the absolute size of the engine at issue but making sure you get the fuel economy for the geography you cover,” said Frank Nicholson, vice president of maintenance for refrigerated truckload carrier TransAm Trucking, Olathe, Kan. “It used to be the case that bigger is better for engine size, but that’s gone away.”

Nicholson is also chairman of the engine study group of American Trucking Associations’ Technology & Maintenance Council.

“You won’t get the fuel economy you’re looking for if you go straight to bigger displacement. I want to be able to get more with less,” he said, referring to more mileage with less displacement.

The top dog of mass-produced Class 8 engines is the 16-liter model. Detroit Diesel Corp., Mack Trucks and Volvo Trucks North America all make them, but representatives from those OEMs do not recommend engines this large for general over-the-road trucking. These

Deciding the Right Engine Displacement

Determining the proper fit is important to maximizing the benefits of each product. The guide below shows some factors to consider in the decision-making process.

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<th>13 Liter</th>
<th>15 Liter</th>
<th>16 Liter</th>
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<td><strong>13 Liter</strong></td>
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<td>- Less than 90,000 miles per year</td>
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<td>- Higher HP/HP</td>
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<td>- Less than 495 HP</td>
<td>- Optimum HP range of 460-500 HP</td>
<td>- Higher HP &gt; 1750 ft. lb.</td>
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<td>- Less than 1,510 ft.-lb. target</td>
<td>- Optimum Torque Range of 1,350 to 1,700 ft.-lb. target</td>
<td>- GTM from 80,000 - 120,000 lbs.</td>
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<td>- GVW less than 80,000 lbs.</td>
<td>- Exhaust emissions not critical</td>
<td>- Most aggressive average fuel factors greater than 50%</td>
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<td>- Day Cab</td>
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<td>- Weight over 15%</td>
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<td>- Medium to High</td>
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<td>- Shop &amp; Car Application</td>
<td>- High Mileage</td>
<td>- Not applicable</td>
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This chart, created by engine manufacturer Detroit Diesel Corp., provides general guidance for the suitability of three different engine sizes for various applications.
big-bore variants, they said, are better suited to super-heavy-haul carriers, lumber and mining work, and other specialty applications.

“A 16-liter has been a badge of honor for some owner-operators and fleets, but I think that’s dwindling. It’s not very popular any more,” said Timothy Tindall, general manager of sales components for DDC, the Redford, Mich., division of Daimler Trucks North America.

For tractor-trailers pulling loads approaching 80,000 pounds, an 11-liter engine is the bare minimum. From there, the debate turns to the merits of 13-liter and 15-liter engines.

Navistar Inc. and VTNA place a strong emphasis on their 13-liter models, and both say their 13s are their most popular models.

Ed Saxman, VTNA’s product manager, told EMU that 60% to 70% of the tractors the company sells in the United States and Canada have 13-liter engines.

Navistar has not yet formally introduced its 15-liter model, so it is currently selling 11-liters and 13-liters on the heavy-duty side.

The lower half of the heavy-duty Class 8 range — “Baby 8” trucks, as they’re sometimes called — will take 8-liter to 10-liter engines, said Tim Shick, Navistar’s director of engine sales and marketing.

“You don’t need a lot of horsepower for these, but they do need torque. They often have just 300 hp,” Shick said, adding that their applications are usually metropolitan area routes or vocational tasks.

For a Class 7 truck, the heaviest grouping of the medium-duty sector,
the engineers interviewed for this story recommended 7-liter to 9-liter diesel engines. Navistar’s engines in that range produce between 220 and 300 horsepower and 560 to 950 pound-feet of torque.

Mack Trucks, Greensboro, N.C., uses 9-liter engines for residential refuse vehicles that weigh approximately 63,000 pounds.

“They usually travel short distances at 2.2 miles per hour, so you can get by with a ‘torque-y’ 9-liter engine,” said David McKenna, Mack’s director of powertrain sales and marketing.

In general, the manufacturers agreed that LTL carriers with day cabs should opt for 13-liters, and truckload carriers with sleeper cabs hauling full 80,000-pound loads over long distances will want 15-liters.

DDC’s Tindall said fleet managers always should first discuss their needs with their engine representatives, but he did outline factors that should be considered.

Start with driving distances and load factors. Are the routes longhaul, regional or just through a metropolitan area? Does the freight weigh out or cube out, and are the loads constant or do they diminish because deliveries are made in several stages rather than all at once?

Con-way Freight, Ann Arbor, Mich., was forced to change its spec’ing habits recently when one of its key truck suppliers closed its doors.

Con-way, No. 6 on the Transport Topics Top 100 list of for-hire carriers, used to operate Class 7 and 8 tractors from Sterling Trucks. When DTNA ceased production of Sterling in March 2009, Con-way had to pick a replacement.

Mike Grima, vice president of maintenance for the less-than-truckload carrier, said that Con-way had grown dissatisfied with using two different weight classes, so a complete change was in order. Based on the company’s linehaul needs, rather than pickup and delivery, Grima said that Con-way opted for Freightliner Cascadia tractors with DD13 engines.

“Toonage was up, so we went to a single level for tractors and don’t mix the fleet anymore. We migrated to a single spec,” he said. Even for east-west linehaul work, Grima said he gets all of the torque he needs out of a 13-liter engine and doesn’t need a 15.

“You get more torque now than from the big-bore engines of the past. You used to get 1,150 pound-feet out of a 13-liter in 1992, and now it’s 1,450 pound-feet.

“We’re at the point where the driveline and tires can’t take any more torque at the current spec level — unless we were to go to a gravel-train spec. We’re benefiting from a smaller

Cleaner, More Powerful

Torque and horsepower ratings changed when new federal engine regulations on nitrogen oxides took effect in January 2010. But original equipment manufacturers claim that, in many cases, the new rules have led to their engines delivering more force and power from slightly smaller displacements.

“Power density,” measured in horsepower per liter of displacement, is a good way to consider the issue, said David McKenna, director of powertrain sales and marketing for Mack Trucks, Greensboro, N.C.

For high-horsepower diesel engines made since January 2010, McKenna said, a range of 29.5 to 36.6 hp/l works well. If it’s less than 28 hp/l, then there is too much engine for the horsepower needed — a big engine with insufficient power output.

“That adds unnecessary weight and cost to the vehicle. Imagine taking an additional 400 to 500 pounds around for a ride every day with absolutely no return on your investment,” McKenna said.

If the power density is greater than 40 hp/l, then the engine starts to tear itself apart. McKenna said that makes for “a smaller-displacement engine producing a lot of power that could impact [negatively] the B50 life.” (For more on B50 life, see related story.)

The “sweet spot” range for power density can change over time. McKenna said the standard used to be 21.2 to 28.5 hp/l, but that has gone up. If engineers are clever, this measure of output per size will rise in the future.

“We look for fuel economy, weight and performance, and by performance, I mean start-ability and grade-ability,” Mike Grima, vice president of maintenance for less-than-truckload carrier Con-way Freight, said when asked what he wants in an engine.

For Grima, start-ability and grade-ability mean lots of torque, either to get his 80,000-pound rigs rolling from a standstill or moving up a 6% grade.

—Jonathan S. Reiskin
bore but with higher torque,” Grim a said.

Navistar’s Shick noted that the 11-, 13- and 15-liter designations establish only general engine families because, for each displacement, there are several horsepower and torque options, and picking one creates a ripple effect for spec’ing and pricing through the transmission, clutch, axles and brakes.

It is no surprise that LTL carrier Con-way is using 13-liters, but Nicholson said TransAm is using them as well. TransAm’s 1,200 power units do longhaul refrigerated work, a classic 15-liter application, but Nicholson said the carrier is currently buying Paccar’s new 13-liter MX engines.

“Step back 10 to 15 years and look at the ground-pounding cars from then. They had V-8 engines, but now you get more from a V-6. Electronics changed all of the automotive world, and now it’s done it with trucking.”

He mentioned fan usage and automated transmissions as important examples.

“Are there guys who can out-drive an automated transmission manually? Sure, but they’re few and far between. We’re seeing 13-liter engines doing what 15-liters used to do.” He also noted that speeds at TransAm are governed at 62 mph.

Nicholson said he agrees with DDC’s Tindall that fleet managers must “work closely with your vendors. I get all parties involved.” Nicholson said he started in the business by “turning a wrench,” but now he’s talking to truck, engine, axle, brake and transmission manufacturers to develop spec’ing preferences for TransAm.

“It all goes into the calculations for fuel economy,” he said.

Nicholson admitted a fondness for the old-style tractors but said business is different now, and he has made an effort to adapt.

“My job is to know who to get information from,” he said. “I don’t know everything, and I can’t know everything. That was a hard curve to learn.

“I’m an old gearhead,” he said, “but to stay in the game, you have to outgrow that tendency to keep doing things the old ways.”

Volvo Trucks North America insists that its 13-liter engines are more powerful than earlier versions because SCR allows them reduce the level of EGR in the engines, which they said increases horsepower. It also means fleet managers can consider moving to smaller engines to improve fuel mileage, said VTNA drive-train product manager Ed Saxman.

Navistar is the only major heavy-duty OEM not using SCR. It is relying on a third generation of EGR, and Schick said that makes his engines an ideal solution for carriers concerned about weight. The company estimates fleets can save 1,000 pounds by using a MaxxForce 13-liter rather than an SCR-equipped 15-liter. The 1,000-pound differential comes from three factors: the basic 13-15 differential; the use of CGI, compacted graphite iron; and the absence of an SCR system with diesel exhaust fluid. CGI is for the engine block rather than standard gray iron.

“With advanced turbocharging, we can get more horsepower. We can get 400 to 500 hp, and that lines up perfectly with our longhaul needs,” said Tim Shick, Navistar’s director of engine sales and marketing.

— Jonathan S. Reiskin
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