

Third in a Series

## EPA2010

Detroit Diesel's DD13 and DD15 gain some complexity for 2010 — and performance, too.

**C**all it pre-need planning. When Detroit Diesel rolled out its DD15 engine in October 2007, the company said it was a clean-sheet design, birthed EPA-'07-compliant and 100 percent ready for EPA-2010. Much of the fuss surrounding the use of selective catalytic reduction to meet 2010 standards may have overshadowed the fact that this engine — and the DD13 and DD16 engines like it — will not change come 2010.

Engineering tweaks have been performed since the launch, software upgrades, changes in material, component design, etc., but all are part of the natural evolution of any complex machine. Readers may recall my initial impressions of the DD15 back in October '07 were very favorable, so what I've been waiting for is the addition of the 2010-related hardware. I can say confidently that DD15's on-road performance hasn't changed a bit, and may have improved in ways I can't quantify in a three-hour test drive. I should say, too, that I suffered no ill effects from my brief exposure to diesel exhaust fluid.

All the new stuff, of course, is downstream of the turbocharger — software, controllers, sensors, etc. notwithstanding. If there's any noticeable difference in the engine, I think it's even quieter than previ-

# driving with SCR

ous versions I've driven. At the Engineering Test Center garage in Portland, Ore., techs had a truck hooked up to some monitoring equipment. I walked within 20 feet of the truck — which was running — and all I could hear was a subtle rumble and the clicking of what I presume were the injectors, valves, and things under the rocker cover. It was amazingly quiet, I tell you, and equally so out on the road at speed.

### Aftertreatment system

For those who never thought an exhaust system had a place in a test drive ... welcome to 2010. The exhaust/aftertreatment system is

very much a part of the engine now, and a big consideration for chassis fitters, body builders, and truckers.

There was much discussion in the early years of SCR development about where they'd hang all that new hardware. It's been resolved. Daimler Trucks North America will offer three aftertreatment configurations based on chassis requirements and the intended application.

In addition to the BlueTec 1-Box system (see box on page 32), a two-box vertical system called 2V2 features separate SCR and diesel oxidation catalyst/diesel particulate filter units mount-

ed vertically behind the cab. This configuration lends itself to applications where frame space and ground clearance are larger concerns than a clear back-of-cab area. It

The BlueTec 1-Box aftertreatment system, right, fits neatly beneath the passenger door. The black box contains the dosing meter. The hose on the right leads to the injector nozzle.

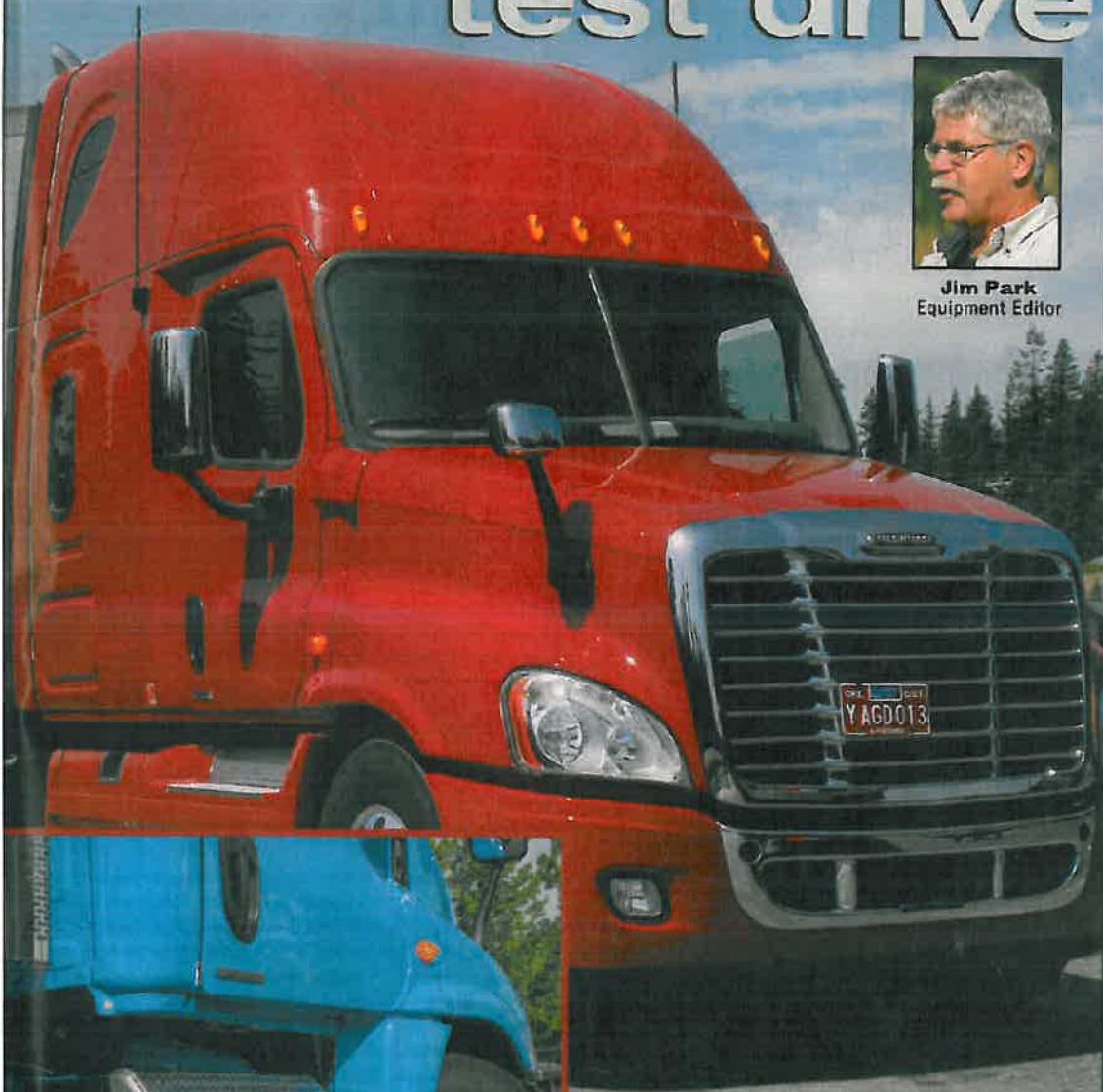


Jim Park • Equipment Editor

# test drive



**Jim Park**  
Equipment Editor



This 2011 Cascadia with EPA 2010 DD15 engine, above, is a customer demo unit already in revenue service. We drove it first. We liked it a lot.

# EPA2010

## DETROIT DIESEL EPA 2010 RATINGS

(proposed)

DD13: Disp. 12.8L Dry wt. 2,540 lb (1,152 kg)	
Horsepower @ 1800 rpm	Torque (lb ft) @ 1100 rpm
350	1350
370	1250
380	1350
380	1450
410	1450
410	1550
410	1650
435	1550
450	1550
450	1650
470	1650*
500	1650*

DD13 Multi-Torque Power Ratings	
380	1350/1650
410	1450/1650

DD15: Disp. 14.8L Dry wt. 2,880 lb (1,306 kg)	
Horsepower @ 1800 rpm	Torque (lb ft) @ 1100 rpm
455	1550
455	1650
475	1650
505	1650
475	1850
500	1850
530	1850
560	1850
475/505	1650
465/475	1550

DD15 Multi-Torque Power Ratings	
455	1550/1750
475	

\*Fire apparatus ratings

permits larger fuel tanks and a right-hand PTO option. It's available on day cabs in left- and right-hand mounting. The back-of-cab protrusion is said to be similar to the EPA '07 vertical DPF.

There's also the 2HV system – 2-box, horizontal DPF/vertical SCR – designed for fleets demanding large-capacity fuel tanks on shorter, 220- to 230-inch-wheelbase tractors. It'll be available on day cabs and sleeper cabs, but not on 58/60- and 70/72-inch models.

"If we hadn't chosen SCR at a very early stage, we wouldn't be ready with these various configurations now," said Randy DiBortoli, Daimler program manager for EPA 2010. "It's taken four years to get this packaging right."

Cummins will supply engines with proprietary aftertreatment systems, different from those used on Detroit Diesel engines.

### DEF tanks

Also new for 2010 is the tank for the diesel exhaust fluid. They're mounted on the left-hand side under and just behind the cab. The fill necks are fitted with a 19mm orifice so you can't get a diesel pump nozzle in there. There's also a magnetic lock ring fitted into the filler neck. DEF dispensing pumps will need to detect this ring before the fluid will flow, preventing DEF from being pumped into a diesel fuel tank.

The tanks have a temperature-controlled coolant-loop heater to keep the DEF warm in winter, and fluid lines running from the tank to the metering unit are electrically heated. A transfer pump is located on the side of the DEF tank.

The Environmental Protection Agency has granted a 70-minute



DEF tanks come in three sizes, mated to the vehicle's fuel capacity (13-gallon shown above). The filler necks are sonically welded and are sized to prevent the insertion of diesel nozzles.

grace period at startup in cold weather before DEF injection is required. On the coldest days, when the DEF might be frozen, dosing won't be required until the fluid thaws. During recent winter testing at ambient temps of minus 20 and minus 30 degrees, even with a cold-soaked, frozen-solid DEF supply, the system was dosing in just 50 minutes (tested using EPA guidelines). Real-world operating conditions will see the fluid heated faster in most cases.

In other words, you won't be sitting idle waiting for the tank to thaw. You can start up, warm up for a few minutes, and then drive away.

### Drive time

I split my day of driving between three trucks on two laps of the 165-



mile loop Daimler uses to test trucks. It's a combination of four-lane Interstate, two-lane road with mountain grades, and stop-and-go urban traffic. It runs east out of Portland on I-84, around Mt. Hood on Highways 26 and 35, and back into the city from the south.

I got to drive three engines, actually, two DD15s and a DD13. My first drive was the red Cascadia—a customer-spec'd demo unit awaiting delivery. Its DD15 was mated to a 9-speed manual transmission, attached to a rather tall set of rear ends. It clearly wasn't set up for this terrain. It cruised 1,150 rpm at 55 mph—150 rpm above peak torque—which is rather low for the DD15's sweet spot. It did better at 65 mph, but Oregon has a 55-mph speed limit.

On the first loop, I ran alongside a day cab equipped with a DD13 and a 10-speed, which actually out-pulled the gear-bound DD15 I was driving on the uphill side of the loop—though not through any fault of the bigger engine. I couldn't keep the engine within the proper torque range for the pull (1,100-1,200 rpm) at an appropriate road speed because the gear steps of the 9-speed were so vast. Dropping a gear put the engine speed too high, or the road speed too low. It's a flatlander, that truck.

I switched to the day cab halfway around the loop, on the downhill side, and have to say the difference in driveability was stunning. The closer steps of the 10-speed and the more reasonable 3.70 gears made all the difference. >>



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Later in the day, I made the entire loop in a third truck, equipped with a DD15, a 10-speed Eaton UltraShift, and even taller gears than the first one. 2.64:1. A direct-drive transmission and low-pro wide-base single drive tires leveled the playing field. It worked like a charm, too.

The second DD15 and the DD13 both did a remarkable job in the hills, and pulled like champs in their peak torque ranges. Likewise on the downside, the engine brake was so strong at higher rpm that it was slowing the truck down on the grade. Switching the Jake to position 2 was the solution.

The DD13 boasts all the same features as its bigger brother (it's essentially the same engine, just a smaller package), including the

broad, flat torque curve. You actually gain about 150 pounds-feet of torque as the revs fall from 1,400 to 1,100 rpm, meaning it pulls harder as the revs drop. Throttle and turbo response are like no other North American engine — in my opinion — and will please performance-demanding drivers immensely.

## Driving with SCR

So, what about the SCR implications? There weren't any. The system is totally transparent to the driver. There's no need to manually intervene at any time, no switches to flip or gauges to watch — save for the tank level for the diesel emissions fluid. So, 2010 is something

of a non-event in that regard.

Another OEM has stated its engines will not need active regen events in normal service. Detroit Diesel is being a little more circumspect. DiBortoli told me that in over-the-road service, passive regeneration will continue as it always has — completely unbeknownst to the driver, and driven entirely by exhaust temperature. He said active regen events will occur under conditions where exhaust temps are insufficient to maintain passive regeneration of the DPF, but he stressed those occasions will be rare.

"Treating NOx downstream has allowed us to optimize combustion efficiency and minimize soot accumulation," he said, "while keeping DEF consumption at about 2 percent of diesel consumption." >>

## RIGHT-HAND UNDERSTEP AFTERTREATMENT SYSTEM

- 1) Diesel oxidation catalyst (DOC)
- 2) Diesel particulate filter
- 3) DEF hydrolysis pipe
- 4) SCR devices



The BlueTec 1-Box system is the industry's only single-package DPF/DOC/SCR aftertreatment system, including the diesel particulate filter, the diesel oxidation catalyst, and the selective catalytic reduction equipment. No larger than the toolbox formerly occupying the space, it fits neatly under the right-hand door. It features dual DOC/DPF units mounted in parallel (access to both units for cleaning is very easy) running front-to-back.

Exhaust enters from the front, and passes through parallel DOC/DPF units (said to reduce back-pressure and improve fuel economy). It then travels down into a collection chamber where the DEF dosing occurs. Exhaust then flows forward through the hydrolysis pipe where it mixes

with the DEF. Exhaust flow reverses once again for the trip through the SCR catalysts where NOx scrubbing takes place.

Three tailpipe configurations are available: horizontal single, and vertical single or dual. Intended chassis configurations include truckload and less than truckload, bulk tanker, mixer, dump, utility, refuse, logging, plows without scrapers, and RVs. The BlueTec 1-Box system allows clear access for a right-hand PTO, and clear back-of-cab chassis installations.

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### Product validation

As of this writing, there are 29 customer demo trucks in revenue service around the country, accumulating miles and sending back data. Schneider got the first two in January '09, and each has accumulated more than 140,000 miles with very few incidents, DiBartoli says.

"We've seen a total of five EPA-related diagnostic codes between the two trucks, but since we implemented the latest software update on June 12, no codes have been thrown. We've seen no EPA-related service interruptions at all on those two trucks."

Daimler has just over 3 million real-world miles of testing in the 2010 hardware. Customers such as

Ryder, Walmart, Schneider and others report driveability, engine brake performance, and exhaust noise are all exceptional, and have commented that DEF refill and handling tasks are "non-problematic," according to the company.

Customer feedback so far says there is a fuel economy improvement over EPA-'07 generation engines, though DiBartoli wouldn't say exactly how much.

"Fuel economy testing is a very tricky exercise. Exact, exact, spec-for-spec comparisons are needed to ensure validity," he said. "It's very difficult to narrow it down to one number that would be valid for

every application. We have to give it a range. Our testing and customer feedback indicate our 'up to 5 percent' claim is accurate."

Seven years ago, Detroit Diesel's heavy-duty engine platform was just a twinkle in some engineer's eye. The company has invested close to \$2 billion turning that twinkle into the DD13, DD15 and DD16. They're remarkable machines offering good fuel economy and terrific performance, and they're among the cleanest engines on the planet right now. The recently announced nine-grand upcharge sounds like a lot until you consider what you get for your money. ■



## What Happens When I Run Outta DEF?

**F**rankly, it's difficult to imagine any driver "accidentally" running the truck out of diesel exhaust fluid. Chassis tanks come in three sizes, dependent on the truck's fuel-carrying capacity: 6-, 13-, and 23-gallon. Detroit Diesel says trucks will travel roughly 300 miles per gallon of DEF. That's 1,800 miles, 3,900 miles, and 6,900 miles, respectively, per fill up. Even if consumption is higher, you're still looking at a minimum of two days of driving on even the smallest

tank, and nearly 10 days with the largest tank.

All Daimler trucks will be equipped with two-part fluid gauges: a standard sweep fuel gauge, with an integrated DEF gauge consisting of colored and flashing indicator lamps.

- Four green = 75%-100%
- Three green = 50%-75%
- Two green = 25% - 50%
- One green = 10% - 25%
- One Yellow+DEF lamp = 5%-10%
- One red+DEF lamp = 0%-5%
- One flashing red+DEF lamp = empty

Under no circumstances will the engine shut down if the vehicle runs out of DEF. The driver will, however, experience varying degrees of inconvenience. Between the 5-percent level and empty, engine power is cut back (derated) by 25 percent and a 55-mph road speed limit is imposed.

Even after the tank has been sucked dry, the engine will continue running (derated) until the fuel tank is refilled by more than 30 percent, or until it consumes

350 gallons of fuel and is restarted. At that point, road speed will be limited to 5 mph, which isn't much, but it's enough to get you from the back row of the parking lot to the fuel island.

If you try filling the tank with something other than DEF, the NOx input and output sensors will detect non-compliant performance, and apply the same 25-percent, 55-mph derate — plus, you'll have to pay to have the DEF tank emptied and cleaned.