

# CUMMINS COLUMN

## THE CUMMINS COLUMN: DISCUSSIONS WITH OUR VALUED CONTACTS AT CUMMINS, INC.

by Robert Patton

A while ago I took some time to pay a long overdue visit to Cummins' home offices in Columbus, Indiana. In meeting with personnel in sales, service, warranty, and product support, we decided to make this column into a forum for correspondence between Cummins and TDR's staff and members.

From time to time we will have information to share, so let's jump in with both feet.

### PRODUCT SUPPORT – 6.7 LITER RECALL NOTICE

The sensational headline caught your attention. Slow down. Back up the train and realize that this is simply a follow-up to the October '07 "Emissions Recall G30" for all '07.5 and '08 2500 and 3500 series trucks that had been built to that date.

Last fall, the purpose of the recall was to "replace the oxygen sensor module and reprogram the engine control module." The problem was described as: "The On-Board Diagnostic (OBD) system on your truck may not detect a failed oxygen sensor or illuminate the Malfunction Indicator Light as required. In addition, the OBD system may cause your truck to fail an Inspection Maintenance (Readiness) test and may not store mileage as required for certain transmission faults."

Quoting further, "The dealership will repair your vehicle free of charge (parts and labor). To do this, your dealer will replace the Oxygen Sensor Module and reprogram your truck's Engine Control Module. The new software will also improve vehicle drivability and reduce the potential for exhaust soot accumulation in your vehicle's particulate filter. The work will take about one hour to complete. However, additional time may be necessary depending on service schedules.

"Simply contact your dealer right away to schedule a service appointment. Ask the dealer to hold the part for your vehicle, or to order it before your appointment.

With an understanding that the G30 recall applied to vehicles built prior to the October 2007 timeframe, let's forge ahead and see what updates can be provided.

## The G30 Update

We first reported the October '07 G30 update in our February '08 Issue 59 magazine. The recall had only been in effect for 30 days when the text was written. I was skeptical that the G30 reprogramming of the truck's ECM would be the final iteration. It was a tumultuous time as Cummins issued updates. The confusion as to the correct update code (an A\_ designation) was compounded by the different 6.7-liter engines that were in service (see table, next page). Further, unbridled internet misinformation was detrimental to a clear understanding of the updates.

In fairness to Dodge and Cummins, in Issue 59 TDR writers Patton, Holmes, Memmolo and Cameron talked about the 6.7-liter engine and the steep learning curve that the factory folks had to address. And address the problem they did. In the spring of '08, Dodge and Cummins representatives held meetings at 50 key dealerships. Turbo Diesel customers in the surrounding areas were invited to attend an afternoon session of "Question and Answer" with the factory service team as well as local Dodge technical representatives, Dealer technicians and Dealer service managers.

I had an opportunity to attend one of the meetings and I applaud the efforts of Dodge and Cummins to get the latest information to the owners of the 6.7-liter engine as well as to educate Turbo Diesel owners with 5.9 engines.

### Dodge/Cummins Customer Appreciation Tour - 2008

So, what did I learn that can be passed on to the TDR audience that owns a 6.7-liter engine? The easiest format is to list questions that I heard and paraphrase the responses. You're reading between the lines correctly. I'm using the if-memory-serves-correctly technique in the "Question and Answer" format that I will use.

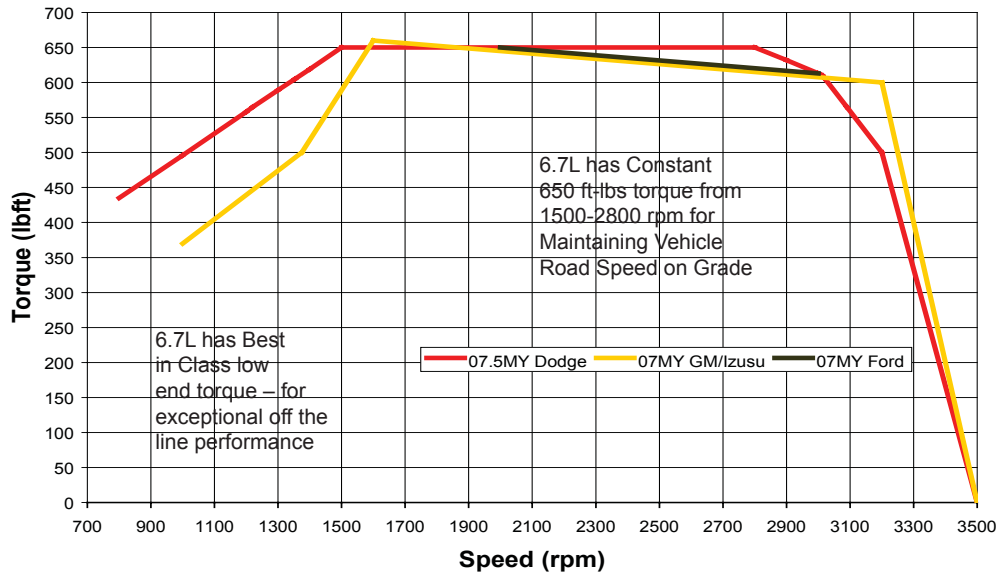
**Q** – Is the 6.7-liter engine a clean sheet design versus the "legendary" 5.9-liter engine?

**A** – Glad you asked. No, in fact, what Cummins did was take the best of the 5.9-liter engine and carry that same DNA over to the new 6.7-liter engine and made further improvements to its capability. A large portion of the componentry for the 6.7-liter engine are "brothers or sisters" to the 5.9-liter engine equivalent part or, in some cases, the same part. The expectation for the 6.7-liter engine is to maintain or enhance the legacy of the 5.9-liter engine in this application. The key thing that is new for 2007 is the addition of advanced aftertreatment technology and the systems integration.

When we introduced the engine in '07.5, we could boast the best-in-class horsepower and torque, but as the advertising and marketing groups will do, we've been out-papared by GM's horsepower and torque ratings of 365hp and 660 ft-lbs, but remember, the peak torque occurs at only one RPM value whereas the Dodge/Cummins gives you a full 650 ft-lbs from 1500 rpm all the way to 2800 rpm. Ford does a similar trick but maxes out at 2000 rpm at 650 ft-lbs. See curves in the following graph.

We're very proud to say that we have the quietest diesel engine on the market. The quietness was documented in your TDR magazine, Issue 59, page 44.

07.5MY Dodge, 07MY GM/Izusu, and 07MY Ford Pickup Torque Curve Comparison



Most important to all of us in attendance, we have the cleanest diesel engine and after-treatment package in the marketplace. The 6.7-liter package already meets the 2010 emissions schedule. This is a huge competitive advantage. GM will do a complete engine redesign to meet the 2010 regulations. Ford will have to make some major changes to meet 2010 as well. Dodge and Cummins will have the challenge of the engine compartment redesign into the new cab architecture that you'll see for the 1500 truck that is new for 2009. But the engine and after-treatment package is solid today and will only require subtle changes as we move to 2010. Again, this is a major competitive advantage. Tell all of your friends we have the proven package.

**Q** – What's the deal with this DVD/CD I received in the mail for the 6.7-liter engine?

**A** – There was clear learning that the customers of the new 6.7-liter engine did not fully understand how the total engine and aftertreatment system operate as a total system and how the customer's driving style can influence the performance of the system. The DVD/CD was an attempt to better educate owners to get the best performance from the system. PLEASE take the time to listen/watch the DVD/CD. *Editor's note: this video can be found at the TDR's web site in the video section called "TDR TV."*

**Q** – The overhead display on my truck alerts me to do an oil change at 2400-2600 miles. Granted, the oil is black, but only 2400-2600 miles per oil change? I have not had the G30 recall or the latest re-flash.

**A** – I think you'll find the answer is in the G30 recall and subsequent re-flash of the ECU. We've cleared up a lot of glitches with the latest

calibrations. The algorithm has been improved with the calibration evolution but some drive cycles will experience lower than 7500 mile drain intervals. Do not ignore the EVIC message. It is the best indicator of the oil's condition. Long term engine durability can be influenced by how well you follow its advice. Also, you need to make certain that the oil change monitor is reset when the oil is changed, even if there is no message displayed on the overhead. If the monitor is not reset, the ECM does not know the oil was changed, and you will receive a premature message on the overhead display.

For those who have not had the G30 recall/re-flash, we worked long hours to address many of the early '07.5 customer issues. Specifically:

- The oil service interval.
- Regeneration cycles to allow unlimited idle time
- Fuel Mileage.
- OBD Mil Light illuminations

**Q** – Why, after oil change does the engine oil level show over-full after the truck sits overnight?

**A** – Oil may not have been allowed to fully drain down to the oil pan when the level was checked during the fill, causing overfilling. Allowing sufficient time (10-15 min.) for the oil to drain to the oil pan during oil fill will help this. Also, with the new closed crankcase ventilation system, removing the oil fill cap during oil drain will help expedite draining the oil. Note that overfilling the engine oil can cause poor fuel economy and other issues, and should be avoided.

**Q** – I heard that there were problems with the turbocharger. Mine has had the infamous P2262 code problem. Can you give us an update?

**A** – Did we mention earlier that engineering this engine to meet the tight '07 emission compliance numbers has resulted in a steep learning curve? In our defense, the two main emissions problems with diesels are oxides of nitrogen (NO<sub>x</sub>) and particulate matter (PM). The '07 regulations cut the NO<sub>x</sub> from 2.5 to 0.2 grams/brake horsepower-hour. At the same time, the PM went from 0.10 to 0.01 grams/brake horsepower-hour. Both of these numbers represent a 90% reduction. Consider that prior to '07 we were making what we thought were huge reductions when we went from 4.0 to 2.2 for NO<sub>x</sub> while the PM stayed the same at 0.10. Hindsight is 20/20. In those prehistoric days we were loafing.

Here is an oversimplification for you to consider, then we will get to the turbocharger question. Take a look at the bullet points for NO<sub>x</sub> and PM:

Oxides of Nitrogen (NO<sub>x</sub>)

- One of the primary regulated pollutants from diesel engines.
- Reacts with hydrocarbons in the presence of sunlight to form ozone.
- Formed by reaction between nitrogen and oxygen in the combustion chamber.
- NO<sub>x</sub> formation increases with higher combustion temperature and cylinder pressures.
- Methods of reduction include lower intake manifold temperature, lower in-cycle temperature, retarded fuel injection and combustion optimization. Any in-cylinder approach to NO<sub>x</sub> reduction involves lowering the temperature and limiting the time of the combustion event.
- Potential impacts can be higher fuel consumption and requirement of a more complex cooling system.

Particulate Matter (PM)

- Often visible as black smoke.
- Formed when insufficient air or low combustion temperature prohibits complete combustion of the free carbon.
- Primarily partially burned fuel and lube oil.
- Methods of control include oil consumption reduction, catalytic converters, combustion system development and higher fuel injection pressures.

Now to oversimplify, think back to last winter and the many fireside evenings you've enjoyed. As you built the fire, there was inefficient combustion, characterized by black smoke and not much heat generation. Thirty minutes into the exercise you were sitting back in the easy chair, with a raging fire, no more black smoke, a beautiful yellow and blue flame, and lots of heat.

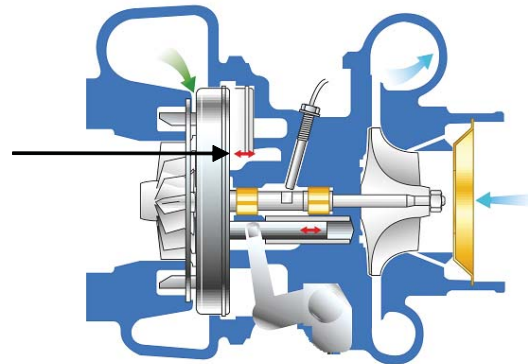
Refer back to the NO<sub>x</sub> and PM bullet statements and reflect on the following: the design engineers could control particulates (PM) by raising the combustion efficiency (temperatures and pressures). But, raising temperatures and pressures causes the formation of oxide of nitrogen (NO<sub>x</sub>) to go out of the emissions box. Likewise, efficiency and heat of combustion can be sacrificed to meet the NO<sub>x</sub> legislation, but the particulates go out of the emissions box. How does the engineer get the teeter-totter level?

In the diesel engine, NO<sub>x</sub> formation can be correlated to engine performance; the higher the rate of formation, the more efficient the engine. As most are aware, the impact of reducing NO<sub>x</sub> emissions is increased fuel consumption, which is the result of reduced efficiency.

The method of attack in reducing NO<sub>x</sub> formation in the diesel engine is basically twofold: a) reduce the in-cylinder temperature and/or, b) reduce the time for the reaction to occur. Control of the temperature within the cylinder is managed in part by reduced intake manifold temperature (an intercooler/charge air cooler). Exhaust gas recirculation (EGR) is another method used to control the in-cylinder temperature and, in turn, NO<sub>x</sub> formation. Re-circulated exhaust gas is oxygen-depleted and the inert gas acts to buffer the combustion event, thus lowering the in-cylinder temperature. Reduced reaction time is controlled largely by retardation of the injector timing. The 6.7 Turbo Diesel engine with its high-pressure, common-rail (HPCR) fuel injection system gives a pilot shot of fuel prior to, and after the larger injection event. The pilot shots of fuel help control the temperature and reduce NO<sub>x</sub> formation. Pilot injection also has greatly reduced the noise level that is associated with diesel combustion.

So you want to discuss P2262? That was the question, right? Calibration improvements have been made to reduce the soot make from combustion process and improve turbo reliability. A recent Technical Service Bulletin also covers how to clean the turbo if it does become "contaminated" from soot.

The Holset Variable Geometry Turbocharger



In this picture the vane is closed. Exhaust gas flow is restricted and, thus, the turbocharger is acting like an exhaust brake. Allow the vane to move to the right and the exhaust gas flow is "full-on" spinning the turbine (exhaust) blades of the turbocharger.

As engineers, we think you purchase the diesel engine and use it hard. The reality is that the engine can be idled for long periods and used to putter around. Remember, the fireside chat that I discussed—a hot fire is maximum efficiency and is minimal soot. So, I say to you, "Run the engine like you stole it!" But, as a consumer of \$5.00/gallon diesel fuel, you say, "No!"

Let's strive for a happy medium—Don't be afraid to put the pedal-to-the-metal to help reduce the accumulation of soot.

To complete the P2262 discussion, we released Technical Service Bulletin 11-003-07 last October. That gives the service technician the correct repair procedure for turbocharger replacement and

intake tract cleaning. This TSB was just updated and re-released as 11-002-08 with a discussion of the turbo cleaning process, which is covered in the new TSB 11-001-08.

**Q** – Have there been any other TSBs relating to the 6.7-liter engine performance or emissions?

**A** – There is bulletin 11-002-07 that was released in September of '07 that outlines the inspection and test of the diesel particulate filter (DPF). If one of the three trouble codes (P1451, DPF system performance; P2463 DPF soot accumulation; P242F DPF restriction/ash accumulation) is found, the bulletin explains how to troubleshoot the DPF system.

As an owner your tip-off that there is a DPF problem will be the words, “Catalyst Full Service Required” on the truck’s message center. The dealer will zero in on the problem with their scan-tool to read the code. Basically, if you have codes P1451 or P2463, the technician will perform the exhaust system after-treatment regeneration procedure. Should P242F be present, the DPF may need to be replaced. Additional technical assistance is available from Chrysler LLC’s STAR hotline for these cases.

The newest reflash bulletin, 18-013-08, also addresses some DPF issues. It offers greatly improved extended idle capability, and includes an update for the messaging on the overhead, along with a new sun visor label and Owner’s Manual supplement. The new messages are easier to understand, and the label and manual are intended to help you better understand what you need to do when a message is displayed on the overhead.

**Q** – Is there a particular problem that is causing the re-flashes?

**A** – Suffice it to say that it is a steep learning curve. Being out in the field where you guys use these trucks is greatly beneficial. As an example, we’ve learned that it is a fact-of-business that these trucks

can be idled 24/7. You think you’ve engineered to handle that duty cycle. (Is it not safe to say someone drives the truck hard during a 24-hour period?). However, reality shows that we missed the mark.

You think you’ve engineered for high altitude.

You think you’ve engineered for cold and hot temperatures.

You think you’ve engineered for long downhill operation with the turbo brake on.

You think you’ve engineered for the DPF to operate safely at idle rpm.

You think you’ve got the sensors and computer algorithms set correctly.

Add to all of these “you think” situations the competitive business of being best-in-class for horsepower, torque, fuel mileage, durability and reliability; and it is a difficult task.

**Q** – Is the G30 recall the final re-flash?

**A** – Never say never, but the last update has been in the field since January '08.

**Q** – Why so many re-flashes?

**A** – This answer is not meant to evade the question, but there really have not been that many re-flashes issued. I can see where confusion lies, in that there are so many A\_ letter combinations that are being used. But, when you consider that each engine certification (we call them CPL numbers) has a unique re-flash A\_ letter combination, it does look to be far too numerous. In actuality there have only been 3 major re-flashes. Below is most current calibration/reflash level:

Model Year	HP@RPM	Torque@RPM	CPL	Transmission	Comments	Flash	Boost Specification
'07.5 6.7 HPCR	350@3000	610@1600	8233	6 Manual	EPA	AY	28*
			8234	“	CARB	AY	28*
		650@1600	8230	68RFE Auto	EPA	AY	28*
			8231	“	CARB	AY	28*
'07.5 6.7L Cab/ Chassis	305@2900	610@1600	8232	6 Manual	EPA	AU	26*
			1264	“	CARB	AU	26*
			2885	Aisin Auto	EPA	AU	26*
			1257	“	CARB	AU	26*
'08 6.7 HPCR	350@3000	610@1600	1489	6 Manual	All Certifications	AP/AQ	28*
		650@1600	1490	68RFE Auto	All Certifications	AP/AQ	28*
'08 6.7L Cab/ Chassis	305@2900	610@1600	8235	6 Manual	All Certifications	AH	26*
			2886	Aisin Auto	All Certifications	AH	26*

\*The boost numbers for the '07.5 and newer 6.7-liter engine applications are approximate. There can be variance based on the amount of exhaust gas recirculation in the intake air, the intake thru the opening and variable geometry turbocharger's position.

**Q** – What is Cummins stance on performance chips or programmers?

**A** – Did we not give you enough power?

Seriously, the four word short answer: **Do not use them.**

The long answer: Legally speaking, the use of a performance chip will not void your warranty. However, the use of a chip does put your rights to warranty consideration in serious jeopardy.

Cummins and Dodge invest great resources in engineering the 6.7 for the best fuel economy, performance, durability, and emissions. Performance chips and boxes may make sacrifices in one or more of these areas, such as emissions and durability, to show gains in others. These changes may be illegal, in the case of emissions. They can also dramatically change the way the engine and aftertreatment system operate. With a chip, programmer, or box, the engine operates differently than Cummins and Dodge engineered it to operate. This can cause expensive failures of engine systems.

The P2262 is a perfect example. Was the code caused by a defect in material and workmanship or by the owner's installation of a performance module? On the new 6.7-liter engine with its complex emissions system, the engine is not going to be as tolerant of performance chips as the previous engines were. The exhaust emissions are critical. Leave the engine and aftertreatment system alone.

We will fix your water pump or coolant line, or oil pump that might break. But do not expect any help should a performance-related engine component fail and you have a box or programmer on the engine. And, don't think it can be removed and brought in for service (by the way, that is fraudulent). We can tell. The boxes mess with a lot of stuff.

**Q** – This happened to me: I filled up with diesel and paid the cashier. When I put the fuel nozzle back into the pump, I noticed that the fuel was not ultra low, but rather the 500 ppm low sulfur fuel. I ran it through the engine. Should I have been concerned?

**A** – Thank you for bringing this up. To your credit, you are concerned because you've brought the topic to the attention of all here in attendance.

Long story, short version: We know mistakes like this are going to happen. One tank is acceptable. A question back to you: where did you purchase the fuel? "A Pilot station in South Carolina."

Further discussion: Pilot is a big fuel retailer. It would be my guess that the fuel probably was 15 ppm ULSD as I cannot see Pilot distributing a batch of 500 ppm and then a batch of 15 ppm. I am betting that the Pilot location had simply not yet had all of its storage tanks and pumps tested to complete the 15ppm ULSD certifications and update its decals.

The 15 ppm ULSD has several beneficial effects. It inherently produces less PM from combustion, so it is a PM control strategy for all in-use equipment. And, just like unleaded gasoline in the early '70s, ULSD enables NOx absorber catalyst (NAC) technology to be highly effective and reduces the production of sulfuric acid.

**Q** – We're considering one of those caravan trips to Baja, Mexico. I have heard the fuel quality is marginal. Does the 6.7-liter engine's requirement for ULSD fuel preclude us from going on these types of trips?

**A** – It certainly makes the issue more difficult. One to two tank fuels of non-ULSF will not harm the system although it will not perform properly relative to emissions compliance during this time period.

**Q** – How about a trip to Alaska and the route through Canada?

**A** – Same answer as above.

**Q** – What might a partial tank of unleaded gasoline do to the 6.7-liter's exhaust after-treatment?

**A** – Obvious answer is NO. Gas is not intended to operate in a diesel engine. It can cause significant damage to the aftertreatment system and the engine. With compression ratios nearly twice a gasoline engine, the peak pressures in cylinder can increase significantly resulting in excessive loads on the piston, head gasket and bearing system. PLUS, it is just plain dangerous.

So, if you make a mistake at the fuel island and put gasoline in the fuel tank you'll have to immediately remove the contaminated fuel.

**Q** – How is the fuel transfer pump that is in the fuel tank ('05 and newer trucks) performing?

**A** – To date, it has been a major improvement over the engine mounted lift pump of the past.

**Q** – Are there aftermarket products that we should consider using, specifically an additional fuel filter or fuel additives?

**A** – Some dealers offer their own "extra" fuel filter system for "severe duty cycles". Dodge and Cummins are working on a new factory authorized kit for bio-diesel operation or severe duty cycles which should be available later in 2008.

We do not recommend any current aftermarket fuel additives. Some can potentially harm the aftertreatment system and also result in possible MIL light impact. As long as good quality, climate-appropriate ULSD fuel is used, there is no need for additives with the 6.7.

**Q** – What kind of braking capability does the integrated variable geometry turbo (VGT) brake have versus other aftermarket type add-on brakes.

**A** – Glad you asked, the integrated VGT brake is a *great success* to date. It offers over 30% more braking capability than the typical 5.9-liter aftermarket brakes offered in the past. *Plus*, it comes with the vehicle purchase, validated and integrated by the factory.

**Robert Patton**  
**TDR Staff**

***My thanks to the staff at Cummins Inc. for their contributions to this article. I'm hopeful that its contents have corrected much of the mis-information that is prevalent at the fuel island, trade show, race event, RV park, Internet, etc. I'm also hopeful we'll be able to continue our correspondence with Cummins (and Dodge) using the format of this column.***