I am gas guy; I’ve always been a gas guy. To my way of thinking fuel was always meant to be ignited by spark. Those smelly things marketed by GM for their light trucks were gutless and smoky. One of my employees bought one many years ago and was so disgusted with the performance that he ended up pulling the diesel out and replacing it with a 403 Olds gasoline engine. Nevertheless, in the last couple of years several things have coalesced to change my mind about the fuel ignited by heat of compression; yep, now I’m a diesel convert.

Diversification

While many management consults are promoting specialization as a means to reduce capital costs and increase expertise in a more narrow range of vehicles, I have found it necessary to go in a completely opposite direction to survive in today’s marketplace. Improvements in vehicle quality in the last ten years and reductions in service intervals (many of which are very realistic in spite of our efforts to illustrate the contrary opinion in certain cases) have reduced by a large margin the number of vehicles showing up in my service bays in a broken condition. I needed to broaden my range of expertise, not narrow it down. I began to explore the option of servicing light truck diesels. What pushed me over the edge into buying one for myself was the birth of my first granddaughter, an epiphany which influenced me to purchase a 2001 Duramax-power GMC 2500HD and a 5th wheel travel trailer. Besides wanting to spend time with my granddaughter, I rationalized that there is nothing like owning a vehicle to gain experience in its service. That assumption turned out to be more than correct.

The common rail diesel

My early impressions of the diesel motor were largely influenced by GM’s poor showing with their 6.2 naturally aspirated and 6.5 turbo diesel motors. Though the turbo was definitely a step in the right direction, real success came to GM when in 2001 they went to the high-pressure, common rail, Bosch fuel injection system coupled with the turbo-charged motor licensed by Isuzu, the Duramax 6.6 liter. Factory rated at 300 horse power and 520 ft/lbs of torque, this isn’t your grandfather’s Olds diesel. Anyone who has driven one cannot help but be impressed the way this power plant will push you back in the seat and light up the rear tires on most road surfaces. This is a direct-injection, 4 valve per cylinder motor without the pre-combustion chamber used on older diesel motors. Fuel pressure varies between 34mpa (5000psi) to 160mpa (23,000psi).

Figure 1: The biggest and most public issue with the motor was its tendency to crack the fuel injectors here.
The LB7 VIN 1 motor, 2001-2004

This first rendition of the Duramax was called the LB7, distinguished from the LLY VIN 2 motor that came out in 2004.5. As might be expected with technology new to GM, there were some issues with this motor and fuel system, though overall it was a smashing success. The biggest and most public issue with the motor was its tendency to crack the fuel injectors (Figure 1).

The tell-tale sign of this issue was a steady climbing of the engine oil level as the diesel fuel under very high pressure leaked into the engine oil. Other problems existed too, such as erosion of the injector seat, which made for white smoke at idle and occasional hard starting/long crank issue. GM recognized these problems early on and issued several campaign’s, such as this one dated 11/19/2007:

Subject: Special Coverage Adjustment - Injectors-Replace # 04039B - (11/19/2007)

Models:
2001-2004 Chevrolet Silverado
2001-2004 GMC Sierra
2004 Chevrolet Kodiak
2004 GMC TopKick

Equipped with 6.6L Duramax Diesel (RPO LB7 - VIN Code 1) Engine

THIS BULLETIN IS BEING REVISED TO ADD 2004 MODEL YEAR TRUCKS. PLEASE DISCARD SPECIAL POLICY BULLETIN NUMBER 04039A, DATED OCTOBER, 2006.

Figure 2: LB7 injectors sit in a coolant-cooled sleeve that is pressed into the hole in the cylinder head with GM special tool J 45910.
**Condition:**

Some customers of 2001-04 model year Chevrolet Silverado; GMC Sierra; 2003 Chevrolet Kodiak and GMC TopKick vehicles, equipped with a 6.6L Duramax Diesel (RPO LB7 - VIN Code 1) engine, may experience vehicle service engine soon (SES) light illumination, low engine power, hard start, and/or fuel in crankcase, requiring injector replacement, as a result of high fuel return rates due to fuel injector body cracks, ball seat erosion, or high pressure seal extrusion (refer to Corporate Bulletin Number 04-06-04-007G and SI).

**Special Policy Adjustment:**

This special policy covers the condition described above for a period of 7 years or 200,000 miles (320,000 km), whichever occurs first, from the date the vehicle was originally placed in service, regardless of ownership. The repairs will be made at no charge to the customer.

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My own truck was purchased at 148,000 miles. I was happy as a clam for the first 4 or 5,000 miles with everything about the truck, including its 18mpg mileage on the highway. But I started to notice the white smoke issue at idle fairly soon. I had heard about the injector problems and called my friend Jim Wilson, a Chev dealer technician, and asked him to check my VIN to see if the injector campaign had already been done. He found that it had not been done, and in fact almost no warranty work at all had been done on the truck, which gave me reason for encouragement. I ignored the white smoke for a while along with the climbing level of oil in the crankcase. But soon I had a bigger problem to worry about; my low coolant light came on after a trip out to the desert. I was disconcerted to find that it took a full gallon of coolant to refill the cooling system. Unfortunately, it was only 100 miles later that the light came on again, and another gallon was added.

**Diesel engine design and durability**

What I’m about to tell you I’m not particularly proud of, but I tell you anyway because it proves a point about the cooling characteristics of this diesel engine. As might be expected, the heat of combustion in a diesel motor is high. In order to protect hot pistons, the Duramax has oil jets that shoot oil up at the bottoms of the pistons. The oil is then cooled in the oil cooler, and this becomes an integral part of the cooling system. I knew I was in trouble with my motor. I was using coolant without a leak, and two minutes after starting the motor, my upper hose was rock hard, indicating undue pressure in the cooling system. I had a teaching gig up in central California and had planned to combine it with a few days in Yosemite National Park, using my travel trailer at a campground outside the park. Being a hard-head, I hooked up the 5th wheel and took off, taking the precaution of adding 6 gallons of coolant to my truck bed contents. As it turns out, I needed all six gallons, but the amazing truth is that the temperature gauge never cleared 200 degrees, even with the weight of a 32 foot, 10,000 lbs trailer behind the truck. On my way back from the trip, my passenger side running board became liberally coated with anti-freeze from the pressure forcing the coolant out the overflow. But, the truck never even thought about overheating.
Having made it safely home, I had to confront the looming issue of my diesel fuel contaminated engine oil and my over-pressurized coolant system. But where these two issues somehow related? And was there any chance the long warranty on the fuel injectors would somehow be extrapolated to include the repair of my coolant consumption? In theory, it was possible for the two issues to be related due to the design of the Duramax LB7 injectors and cylinder heads. Note the two illustrations in Figure 2.

LB7 injectors sit in a coolant-cooled sleeve that is pressed into the hole in the cylinder head with GM special tool J 45910. That taper you see at the bottom of the sleeve seals against the surface of the bore in the cylinder head with nothing but Locktite and are held in place by the injector hold-downs themselves.

So, nothing but a press-fit aluminum sleeve under the injector separate the coolant from combustion pressure (Figure 3)! Is it not possible, then, that combustion could push past the sleeve and get into the coolant? The answer is yes; but herein lies the controversy. Does this condition EVER happen due to normal wear and tear? Or maybe due to Dexcool extended life coolant (known for eating up lots of other stuff; how about aluminum?) So, if my truck needs injectors replaced, and those injectors
are covered under an extended warranty, AND the campaign includes replacing the injector sleeves “as needed”; maybe I can get all my problems solved at GM’s expense!

**Injector replacement procedures, flat-rater style**

As you can readily see, this sort of situation quickly becomes complicated. Some very experienced GM techs say that injector sleeves NEVER leak until the injectors are done without proper care. If the technician doing the job is a “flat-rater” he might choose to ignore injector sleeves that pulled up slightly when the injector was removed. If that happens, it means more work for the technician. The sleeves must be extracted, the bores carefully cleaned, o-rings replaced, and sleeves reinstalled using appropriate locktite sealer. Technicians that skip this step are likely to generate a come-back with coolant consumption and a pressurized cooling system.

But, my injectors had never been touched before, as near as could be told based on available information. So, my coolant problem was much more likely due to a head gasket issue than to an injector sleeve issue. I was going to have to pull my cylinder heads to find the answer.

**MLS head gaskets**

The Duramax motor uses multi-layered steel head gaskets due to the expansion rates of the aluminum heads versus the cast iron block. As has been known to happen with MLS gaskets, constant warm-up and cool-down can eventually scrub the coating off the gasket and allow combustion to leak into the coolant passages. GM has updated the head gaskets from a crimped type (Figure 4: First design) to a riveted type (Figure 5: Second design) gasket.

Notice too, the right side end of the gasket and the hole at the extreme end of the elongated passage. The position of that hole identifies the thickness of the head gasket. There are three different gasket thicknesses, and left and right are not necessarily the same. Since these identifying holes cannot be seen with the heads installed, the ordering of the proper head gaskets has to wait until the heads are off.

**Block cleanup**

Most of us by now have stopped using 3M brillo pad type sanding disks for cleaning off head and block surfaces, since we have been warned that residue from these disks may get into the engine oil and wipe out the bearing. But how about using the plastic bristle type clean up disks? Not on this motor, according to GM. Out of GM service information:

1. Inspect the gasket sealing surfaces for corrosion, especially in the areas that were in contact with the crimped tabs of the first generation head gasket. If corrosion is present, continue with the rest of the steps in this procedure for proper cleaning. If the sealing surface is sufficiently clean and smooth, use the revised torque specification listed towards the end of this bulletin and continue with published service manual procedures to complete the repair.

2. For surfaces that have corrosion or pitting, wrap a piece of flat steel (4”x 2” or larger) with 600 grit wet grade sand paper. Using Moisture
Displacing Lubricant, P/N 88862629 (in Canada, use 89020803) or equivalent, wet sand the block surface to remove any remaining gasket material or corrosion. Do not use any paper coarser than 600 grit.

Notice:
• Do not use any power type sanding devices.
• Do not use a wire brush or wheel to clean gasket surfaces.

They seem pretty serious about it, don’t they?

Removing the heads

The actual job of pulling the heads was not much different than a gas motor, with a few notable exceptions. First, there is a lot of stuff in the way. The high and low pressure fuel lines are a real tangle with lots of complicated brackets holding various items. While I am rarely brilliant, I had a flash of intuition on this particular job and used my digital camera to shoot pictures as stuff came apart. My only regret was that I should have taken more pictures more often, as I became engrossed in working my way down to the heads and sometime forgot to shoot my pictures.

Figure 7 gives some idea of the spider web of the high pressure fuel lines.

Removing the inner plastic fender panels gave pretty good access to the exhaust manifolds, glow plugs, and lower valve cover gasket bolts. Probably the most difficult part was the removal of the 12mm head, 12 point bolts that held the turbo exhaust tubes to the back of the right side exhaust manifold and to the back of the turbo. The intense heat of the turbo causes these bolts to become very, very tight. Access to the bolts is very limited and only a box wrench will fit. You had better make sure it is a very good quality wrench, because a rounded off bolt in one of these places would be a nightmare I don’t even want to think about. The second big issue is the lower rear head bolt on the driver’s side head will not come out because it hits the cowl. This also means that it must be installed...
in the head before the head is set down on the block on the way back together. I solved this problem by securing the head bolt with a rubber band, just high enough to clear the gasket surface, but low enough to clear the body obstruction.

The turbo itself does not need to come off, nor does the high pressure pump, which sits in the valley of the block, just ahead of the turbo (Figure 8).

Once I got the heads off, the blocked sanded per GM instructions, and had the correct thickness head gaskets, assembly was pretty much the reverse of disassembly, but I took the precaution of replacing every single one of the injector sleeves, even though I probably didn’t need to, as there was not the slightest evidence that any of them had been leaking. My local GM parts supplier was gracious enough to allow me to install the warranty injectors so that I didn’t have to risk a flat rater doing the job with the heads already installed. And then there was the exhausting process of head bolt torqueing. 22 torque-to-yield head bolts are used to hold down the heads in four separate steps; 1st step, 37 lbs. 2nd step, 59 lbs. 3rd step, 60 degrees, 4th step, a final 60. Multiply all that by 44 head bolts and the Snap On electronic torque wrench with audible and vibration signals to tell me when I had reached the appropriate torque or rotational angle became worth the price of admission. Even so, the day after this job, I awoke feeling like someone had beat me with a stick.

Final assembly became a matter of following my photographs. Lack of experience made them an invaluable aid to avoid repeating endlessly the installation and the dis-installation of the many brackets and holders which had to go back on in the right order. The job ended up taking me 30 hours to complete, and with a book time of 23 hours, I didn’t feel too bad about having completed the job in that much time. The GM dealer in Fresno, California had quoted me $4,500 to do the job, a not-unreasonable price given the level of difficulty. I felt confident when I was done that our shop was completely capable of doing this kind of work on light truck diesels, in our ultimate quest to remain profitable within the framework of our rapidly changing industry.