HOW TO BUILD A HIGH-PERFORMANCE CUMMINS DIESEL ENGINE

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Keep in mind while reading this document that it is a gathering of all the articles Bruce has written over the last ten years. There may be some old prices discussed so, to get the latest pricing, check the main page. If you have any questions feel free to call us at 724-274-4080 and we can discuss your horsepower needs. Please have your CPL#. If you are looking for upgrades for your Electronic Celect/Celect Plus Cummins engine visit our Pittsburgh Power site at Pittsburghpower.com.

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This is a very controversial subject and 99% of the mechanics who build diesel engines will disagree with what we have to say and will probably refuse to build the engine for you.

For the owner-operator who loves horsepower do not give up when you speak to the negative mechanic. There are a few good shops throughout the states that will build the ultimate performance engine. Or you can build it yourself as long as you have mechanical knowledge and tools.

BUILDING THE ENGINE: In order to have the engine live with high horsepower and run efficiently you must have the right combination of compression ratio, fuel, air and timing. Please do not try to get extreme power simply by increasing the fuel pressure on a stock engine. You will obtain some horsepower, however your compression ratio, air and timing will be wrong. The best time to obtain horsepower is during a rebuild. Since you are going to buy new parts anyway you might as well buy the right combination that produces horsepower and generally the price of the high performance parts is the same as the stock parts.

NOW TO THE NUTS AND BOLTS : The compression ratio of the pistons and the timing must go together. High compression pistons belong only in gasoline engines that are naturally aspirated. Turbocharged diesel engines must have low compression pistons in order to produce high horsepower. The lower the compression ratio the less wear on rod bearings and the lower the internal pressure will be when the injector fires. High internal pressure is very detrimental to the life of a piston. When you see a piston with a hole burned through, it's not the fault of the injector it is a result of internal pressure.

To control the pressure we lower the compression ratio and retard the timing. If you compare the compression ratio and timing of an NTC 290 versus an NTC 400 you will see the difference. Where do you think we have to be on the timing to produce 700 horsepower from an NTC?

All NTC Cummins engines manufactured after Sept. of 1987 were cut for the LPF liner. If your engine was manufactured before Sept. 1987 you will have to have your block machined to accept the LPF liner. The price to cut the block in the chassis is approximately $450. The advantages are as follows: (1) The liner is now a press fit into the block and held more securely (2) With the liner being held tightly in the block you eliminate seeping head gaskets (3) Eliminate liner cavitation or liner pitting (4) Eliminates blow-by. This may sound absurd however, when the injector fires, the pressure distorts the liner until it comes in contact with the block. Your piston rings stay perfectly round and now, with the distorted liner, the rings lose contact with the cylinder wall and thus you have blow-by. Lower press fit liners help to eliminate this distortion and (5) Eliminate cracking of head bolt-holes. With LPF the pressure from the liner is moved down in the block by approximately 3\8&";.

Please keep in mind that if the surface of your block is rough and should be resurfaced, remove it from the chassis and have it resurfaced. Inspect the block

for cracks from the head bolt holes into the counterbore area. The cracks are hard to see and can be repaired by having head bolt hole repair sleeves installed. The water holes can also corrode and crack. Salvage sleeves, too, can repair them.

To build a strong running engine you must start with a good foundation, which is your block. If you ignore block problems they may come back to haunt you.

TURBOCHARGERS : One of the most important components on the diesel engine is the turbo. Many trucks come equipped with a 3-series Holset turbo. That is fine for stock engines. The 3-series Holset is adequate for engines up to 450 horsepower. For higher horsepower you must have a 4-series Holset. Preferably one with a mapwidth enhancer. The mapwidth enhancer consists of the 3 slots in the compressor housing that allows more air to the lower fin. With dual exhaust and dual air cleaners it is possible to obtain 42 to 45 lbs. of manifold pressure.

PISTONS : When building an engine that is turbocharged you must lower the compression ratio when increasing the horsepower. The efficiency gained from increasing the manifold pressure will more than compensate for the compression ratio. Cummins also offers a high strength piston that we have ceramic coated on the top and Teflon coated on the skirts. The ceramic coating helps to keep the heat out of the piston and in the combustion chamber where it can further help to burn the fuel. The cooler we keep the piston the longer it will live. The Teflon coating on the piston skirt helps to remove the piston slap on the side of the liner. Teflon is the most slippery substance known to man and will allow your engine to more smoothly and quietly.

TURBINE HOUSINGS : Many people believe that going to a larger turbo will give them an increase in power. The problem with this change is that the turbine housing of the turbo is also much larger. Which, in turn, decreases the amount of backpressure in the engine. This is good because it allows the engine to run more freely, but with the loss of manifold pressure. The engine will run much hotter. As the size of the turbine housing increases the speed of the turbine wheel and shaft decreases manifold pressure also decreases and the response time or turbo lag also increases. All are negatives.

When purchasing a larger turbo you must find out how many sizes of turbo housings are available for the particular turbo you are choosing. The larger the compressor wheel (fresh air side) the greater the volume of air available to the engine. Now, you must be able to spin the larger compressor wheel at low RPM and to do this you need a smaller turbine housing on the exhaust side to increase the velocity on the exhaust. The sizing of the turbine housing effects the speed of the turbine wheel and how fast the wheel comes up to full speed the same way lower gears in your differentials effect how fast your truck can accelerate.

If you live mostly in high country (5000 ft. elevation or greater) you will want to decrease the turbine housing size one step lower than if you lived at or near sea level.

CAMSHAFTS : The big cam I, II and III engines all used the same basic camshaft except for the flange and flangeless design. However, the lift of the injector and valves were the same.

The big cam IV 400 camshaft did have more lift to the valves. Therefore, you must use a B.C. IV piston with deep valve pockets so that the valves will not hit the pistons. Please be careful when working with a big cam IV.

For building horsepower we prefer to use the high-lift cam along with the mechanical variable timing. This particular cam has .266 inches travel to the injector where the standard cam has .224 inches travel. The longer the travel of the injector the greater the amount of fuel can be injected. Fuel makes horsepower and you need a lot of it to produce 700 to 800 HP. Manifold pressure or turbo boost burns the fuel to produce the power. However, all boost and little fuel will give you little horsepower. You must get fuel injected and atomized into the combustion chamber to produce power.

MECHANICAL VARIABLE TIMING : MVT has a very poor repore with mechanics of

Cummins diesel engines. The main problem was that the steel piston in a cast-iron bore that was moved by compressed air from the air compressor would rust to the walls because of lack of lubrication. We now have an automatic oiling system that constantly lubricates the piston which makes the MVT almost trouble-free. The advantages to this timing system are many but the first and most important benefit is decrease white smoke when the engine is idling or cold.

With the mechanical variable timing your engine idles in the advanced mode and when you accelerate the timing will change to a retarded setting. The retarded mode is great for making power and the major benefit of this is piston and rod bearing life. Retarded timing is much easier on the engine components than fast timing. Many of the mechanics that work on Cummins engines do not understand the MVT and may not be able to set the timing properly. So if you decide to build an engine with mechanical variable timing please call us and we will explain it to you.

When building your high-performance diesel engine you must build a strong basic engine. However, regardless of how good your turbo, heads and pistons are, if your injector pump and injectors are not high pressure and volume, the engine just will not perform up to your expectations. You must have fuel to make horsepower. Air from the turbocharger makes it possible to burn the fuel but you must have plenty of fuel available.

The best way to increase horsepower is to install larger injectors or injectors that flow more fuel. One of the reasons for larger flow is that it helps to relieve the pressure on the camshaft. With stock injectors and stock fuel pressure there is a 3,000-lb. shock load on the push rod. Did you ever wonder why injector push rods bend? If we have 3,000 lbs. of shock load at stock fuel pressure such as 180 lbs. Just think what the shock load is at 250 or 300 lbs. of fuel pressure. It could possibly be around 4,200 lbs. on the push rod. By increasing the flow of the injector you help to eliminate the excessive pressure on the push rods and camshaft and the horsepower increases greatly. The only negative to high flow injectors is you should not idle your engine for excessive periods of time. Cummins Engine Co. states that it is three times harder on an engine when idling than pulling a load down the highway. It is much more economical to purchase a generator or a diesel-fired cab and engine heater than to idle your engine. Diesel engines are not built to be used as heaters.

When installing injectors use a mixture of STP. and engine oil (70% S.T.P. and 30% engine oil). Coat each injector o-ring with the mixture and also coat the injector hole once it is cleaned. The STP. mixture will keep you from cutting or nicking the o-rings. Straight engine oil is not slippery enough. Once the injector and the hole are lubricated place the injector in the hole and with a hammer handle push the injector into place with one hard push. It's better to seat the o-rings quickly. If your engine is cold, plug in the block heater for several hours before installing new injectors. This will allow the new injector to slide in easier thus reducing your chances of cutting the o-rings.

When setting the valve and injector clearances do not use the five in. lb. torque wrench to set the injector. Instead, set the rocker arm finger tight. You should be able to turn the pushrod once the jam nut is tightened but with a little drag. Set the valves for .011 intake and .023 for the exhaust.

Lets start with a question: Have you ever wondered why some Cummins engines run better than others even though they are both stock? Why there are over 6,000 different calibration codes? The answer to the first question is the torque curve which is determined by two springs. One of the springs is the governor spring and the other is the torque spring. These two springs can drastically change the pulling power that your engine delivers. Of the 6,000 different calibration codes we use about fifteen of them. Since 1978 we have been documenting the calibration codes of the engines that perform well versus the engines that are sluggish regardless of what you do to them. The answer has always been in the torque curve. When building your high-performance engine you

must match the torque curve with the compression ratio of the pistons, camshaft timing and the injector flow rate. This is done when we build your fuel pump. It is calibrated accordingly.

Another method for increasing the torque, or pulling power, of your engine is to change the gear pump. This is the heart of the entire Cummins fuel system and it is located at the rear of the injection pump where the incoming fuel line is attached. The stock gear pump produces 1175 pounds of fuel in one hour running at 2100 RPM. The gear pump we use for performance will produce 1200 pounds of fuel in one hour at 1400 RPM. Did you notice the difference? Our high-performance gear pump produces 25 more pounds at 700 RPM. less. The greatest advantage of this gear pump is when you're cruising along the flats at 1500 or 1600 RPM. and a situation arises and you need power right now all you have to do is gently push on the throttle and your truck will accelerate as though the Jolly Green Giant reached down and gave you a push. Keep in mind that your engine will respond at 1400 RPM. as it does currently at 2100 RPM., and what a difference in pulling power it will make in the mountains, hills and against head winds out on the plains.

Another item that should be changed every six or seven years is the fuel suction hose coming from the fuel tank to the fuel filter then onto the injection pump. The diesel fuel attacks the rubber in Stratoflex and Aeroquip hose and swells it shut. This is the cause of many power problems, especially with the trucks that are from 1985 or earlier. If you are planning to build a high-performance Cummins, replace the #10 fuel line with #12 The injector pump will not have to work so hard to get the fuel out of the fuel tank.

This month we will discuss exhaust, air and fuel flow. If you restrict any of the three the result will be a loss of power or high operating temperature. The principles that apply to racing vehicles also pertain to trucks. After all, when a truck us pulling up a mountain the engine needs an unrestricted supply of fuel and air. If the engine is getting all the fuel and air it can consume can it get rid of all the exhaust that has been produced?

Let's start with the air intake system. Most truck manufacturers supply an air filter and housing with enough CFM (cubic feet of air per minute) to satisfy the horsepower of the truck when it's being built. If you purchase a used truck with a 290 or 300 HP. engine then rebuild the engine to 400 or more horsepower your air filter is too small. Almost all trucks with the air filter stuck under the hood suffer from lack of cool air. This is the new aerodynamic look with the filter under the hood. However, it is terrible for performance. Why preheat the air before it gets to the turbo? Think about how hot it is under your hood in the summer when your 3,500-lb. engine is operating at 185 degrees and your air filter is right above it. We all know what high pyrometer temperatures do to aluminum pistons. Heat and metal fatigue are a trucker's biggest enemy. If you do not own a conventional, or cannot mount your air filter out in the air stream, then mount a second filter under your hood on the opposite side of your current filter. On a cabover it's fairly simple to mount a secondary air filter and plumb it into your existing air pipe going to the turbo.

The most economical and easiest filter and housing to work with is the Farr Ecolite. At 24" long and 13.5" in diameter, this filter has an amazing capacity of 1500 CFM The price is $139 and for installations you need two clamps at $15 each. The air inlet and outlet is 7" in diameter and you will have to obtain 7" aluminum piping to complete the installation. The extra clean air entering your engine will lower your pyrometer temperature and allow your engine to run as it does on a cool, damp night.

In the previous articles we discussed what it takes to build horsepower and torque. Now we will concentrate on pyrometers, manifold pressure, liquid-filled fuel pressure and air and fuel filter restriction gauges. These five gauges work in unison to monitor your engine as you drive. It's like having a portable dyno in your cab at all times. With the gauges, we can diagnose ninety-five percent of all power problems over the phone. Most of the time you will be able to cure

the problem yourself. This will help avoid expensive repairs in an out-of-town shop that probably cannot diagnose the problem properly anyway.
Let's start with the pyrometer. Always install the thermocouple, or probe, in the exhaust manifold. If you use a Hewitt pyrometer or thermocouple it will not burn off and wipe out the turbo. We have been doing this for 21 years and have never lost one. You will have to drill and tap the pulse manifold to install the probe. To do this, use a 7\16" drill bit and a 1\4" pipe tap. Install the thermocouple in the back three cylinders approximately one inch from the end of the center section where the turbo bolts onto the manifold. With the pyrometer installed on the hot side the critical temperature is 1200 deg. Do not operate the engine above 1200 deg. for an extended period of time.
Manifold Pressure Gauge : All turbocharged engines, gasoline and diesel, should have a manifold pressure gauge. This gauge is one of the best diagnostic tools a mechanic or owner-operator can have. A 290 or 300 HP. Cummins must have between 15 and 20 lbs. of boost, or manifold pressure. A 350 HP. must have 18 to 22 lbs. and a 400 HP. Cummins must have at least 25 lbs. We prefer 28 lbs. out of a stock NTC 400 HP. If you increase the fuel pressure, the boost will also increase. Manifold pressure makes it possible to burn the fuel and keep the exhaust temperature down. Every four lbs. of boost lowers the exhaust temperature by 100 degrees. If you feel your 400 is running sluggish, install the gauge. Go for an uphill ride wide open and see how much manifold pressure your engine will develop. If it's below 25 lbs. you definitely have a power problem. If boost is down then your exhaust temperature is high, which means you are killing your pistons and rings on every grade. It does not take a mountain, just a slight grade or head wind. You must have boost to have power.
LIQUID-FILLED PRESSURE GAUGES: This gauge will change your driving habits and increase fuel mileage and engine life. On high-performance engines we use as much as sixty-five percent over on our fuel settings and many times, as you are driving, you will use more power than what is necessary. This gauge will let you know exactly how much power you are developing.
As a diagnostic tool this gauge is as important as a manifold pressure gauge. When your pump is calibrated on a test stand at your local fuel injection shop and they tell you it has 170 lbs. of pressure, which is stock, and your engine is still a sled, how do you know that pump is producing 170 lbs. of fuel on your engine? Keep in mind that the pump stand drives your fuel pump. However, when your pump is on the engine, the pump does the driving. Over the years we have seen as much as 30 lbs. of fuel difference from the pump stand to the truck. When you have your own fuel pressure gauge (liquid-filled) you will know when your pump is producing what you want it to. Forget what the person says it has on the pump stand. Let's see what it says on the engine.
This month we will talk about oil filtration. Even though this is not horsepower related it is still very critical to the life of the engine. Remember the 750 luberfiners? Almost everyone has removed them by now. If you have the filter housing put it back on your truck and install a Harvard 750 filter in it. The Harvard 750 is made from one-micron paper and it actually polishes the oil. Remember, oil does not wear out. It becomes contaminated with dirt. That is why your engine will use a gallon of oil around 8,000 mi. after an oil change. The dirt gets between the rings and the liner. This forces the piston rings to ride on particles of metal and dirt. When you have extra filtration on your engine the oil stays much cleaner. Your rings, liners and bearings last much longer. Now that you will not be adding a gallon at 8,000 mi. you can extend your drain intervals to 15,000 mi.
Also, the spinner II centrifuge oil cleaner is a great idea. This unit actually spins the oil and throws the dirt and metal particles out of the oil. The particles collect on the wall of the centrifuge, which is approx. four inches in diameter. To clean it, all you have to do is remove the lid and scrape the black dirt out with a knife every 30,000 mi. I personally did not believe that the Spinner II would clean the oil until I installed one on my brother's 444XT. Now,

every 30,000 mi., we clean it and the dirt is about 1\2 " thick on the centrifuge wall. The cleaner the oil the longer the engine will live.

This is a review of the major components needed to build a high-performance Cummins diesel engine:

1. TURBO: It takes a lot of manifold pressure, or turbo boost, to burn the additional fuel necessary to make horsepower. If you do not have fuel you will not have power. Burning the fuel produces the horsepower. The turbocharger supplies the necessary air to complete the burn and keep the exhaust temperature low.
2. INJECTORS: Stock flow injectors are very limited on the amount of fuel they will inject into the combustion chamber. This is where the power comes from; the injection of fuel. The more you inject the more horsepower and torque your engine will produce. Stock injectors are very hard on camshafts when the fuel pressure has been increased. Always install the next size larger injector if you want power.
3. FUEL PUMPS: Now that the injectors are larger the fuel pump has to deliver more volume and pressure. You have to have a high output pump for performance.
4. PISTONS: When performance increases the internal pressure on the piston also increases. This is why we have our pistons ceramic-coated on the top and Teflon-coated on the sides.
5. TIMING: Retarded timing will also enable your pistons to live longer. Do not advance timing in a Cummins engine.
6. FUEL SUCTION LINE: Install number twelve line and fittings from the tank to the pump.
7. AIR FILTERS: Two are much better than one. Freightliners with one filter under the hood are very restrictive: we do have an economical solution for this.
8. DUAL EXHAUST: Runs fifty deg. cooler on exhaust temperature than single exhaust.

Approximately two months ago, a young owner-operator by the name of Dwain Pyeatt from Butler, Missouri read one of our articles on horsepower and torque. He called us for the other articles. After receiving our booklet he read the articles several times, called the writer several times, then loaded his Peterbilt and headed for Pittsburgh. After spending several hours at Diesel Injection he left for Missouri loaded with high-performance engine parts. The next week he and a mechanic friend of his proceeded to convert his B.C. III 350 HP. engine to an N.T.C. 700 HP. single turbo engine. Please keep in mind that the Freightliner and Kenworth dealers in Kansas City told Dwain that it would not work and he should not build the engine. In my first article I mentioned to beware of the negative mechanic. They will disagree with what we have to say. Dwain Pyeatt kept the faith and continued to build his engine. The results are as follows: On mountains that he used to drop two gears on he can now hit the bottom at sixty m.p.h. and go over the top at 80 m.p.h. That is an increase of four to five gears. As a 350 HP. engine, Dwain averaged five and one half m.p.g. Now at 700 HP. loaded heavy, he is still at five and one half m.p.g. On lighter loads his mileage climbs as high as six and one-fifth m.p.g. Not bad, considering the two Kansas City truck dealers told him it would not run. Dwain also installed dual Vortox air filters on his Peterbilt. He already had dual-exhaust and he installed a number twelve line from his fuel tank to his fuel pump.

Mark Yoder from Calgary, Canada is another example of an owner-operator who built his engine using our high-performance parts. Mark has cleaned the clock of every Caterpillar and K.T.A. 600 Cummins in western Canada.

I have not had the pleasure of meeting Mark Yoder in person. However, I have spoken with him numerous times on the phone. We are hoping Mark can get a load to Pittsburgh and stops in to see us.

The first high-performance engine we built with mechanical variable timing belongs to Elam Riehl from Middlebury, Indiana. This engine is still running strong with 370,000 mi. on it and there is no excessive blowby or oil

consumption. Elam stops in our shop once a year to have his valves and injectors set.
When you are rebuilding your engine remember this statement: The bitterness of poor quality remains long after the sweetness of a low price is forgotten.
Now let's discuss parts of the Cummins engine: One item that is always overlooked is the viscous damper located in front of the engine on the crankshaft. The damper has a large steel ring floating in a gel that resembles silicone. After a period of years or around 380,000 mi. the silicone can get hard and the damper is no longer functional.
WHAT DOES THE DAMPER DO ? Each time the injectors fire the steel disc inside the damper moves to absorb shock waves from the crankshaft. Other components that are affected by these shock waves are the camshaft and the accessory drive shaft. The bolts that hold the flywheel to the drive shaft will also snap when the viscous damper is defective. If you ever break the accessory drive shaft, front of the camshaft, or the flywheel bolts always replace the viscous damper.
If you have an N.T.C. 290, 300 or 350 and are rebuilding the engine to an N.T.C. 400 or larger horsepower engine you should update the damper to the one used on the 475 HP. engine. If you purchase this from Cummins it's rather expensive. We purchase ours directly from the manufacturer and can save you several hundred dollars the next time your engine needs a new damper. Cummins Recon will only exchange your damper like for like. You cannot trade a smaller one in for a larger one. Ours are brand new, no core is needed, and the price is less than a Recon.
One of the methods for checking the viscous damper is to remove it from the engine and "mike" the thickness at 12, 3, 6, and 9 o'clock. Or, at the top, bottom, left and right side. If your thickness varies more than 10 thousandths, scrap the damper.
Lead, follow or get out of the way. Lee Iacocca must have been driving one of our high-performance Cummins diesel engines when he came up with that statement. However, when driving one of our engines you will never have to follow. You will always lead. In fact, nobody else even comes close.
Dwain Pyeatt, the owner-operator from Missouri who built one of our high-performance engines two months ago, if you recall. We wrote about him in last month's article. Dwain loaded in New Jersey grossed out at 80,000 lbs. and drove to California. The whole time Dwain never came out of twelfth gear. I know this seems hard to believe running east coast to west coast without dropping a gear except when stopping for food, fuel and sleep. On 12-15-92 Dwain put his Peterbilt on the chassis dyno at Cummins in Strasburg, Ohio. John Lorenz, the service manager, had to use multiple chains to hold the truck to his dyno. The results are as follows: 750 horsepower at 2100 RPM. at the rear wheels. With 50 lbs. of fuel pressure remaining, John Lorenz shut down at 750 HP. because that is all the power his dyno will accept. With 50 lbs. of fuel pressure remaining, Dwain's Peterbilt could have easily topped 800 HP. to the ground. Keep in mind that this was at 2100 RPM. The fuel pump is governed much higher than that. How much horsepower is at the flywheel when you have 750HP to the ground? How about 937 HP. If you lose about 20% through the drive train. 882 HP. if there is a 15% loss, and 833 HP. if only a 10% loss of power occurs through the transmission and rears. Anyway you look at it, we are developing one horsepower per cubic inch. Not bad for diesel fuel.
A question that I am frequently asked is: How does Cummins Engine Company feel about all this power? Well, to find out I asked Dwain to stop at the factory the next time he is in the area. On 12-17-92 Mr. Pyeatt and his N.T.C. 900 HP. Cummins engine visited the factory with a gross weight of 82,000 lbs. This is what happened: After a brief meeting with the Cummins engineer, who does all of the performance testing, they went for a drive to confirm the horsepower. He was impressed with how effortlessly the engine handled the 82,000 lbs. This particular engineer is the person who has helped us with our high-performance engines So he was well aware of everything that was inside the engine.

Dwain's next stop was to the technical center where there were several Cummins employees who were non-believers. After riding and driving the 900 HP. N.T.C. Cummins they now believe that it is possible with one turbocharger.
NOW ON TO PERFORMANCE : The pistons that we use are genuine Cummins. However, they are made of a stronger aluminum alloy than standard 350 and 400 HP. pistons. We also have the top of the piston ceramic-coated and the skirt is Teflon-coated. The Teflon on the sides greatly reduces piston slap against the liner. Teflon is the slipperiest material known to man. With a film of oil on the Teflon we now have a very smooth riding piston in the liner.
The ceramic coating on top of the piston protects the piston from cracking and melting. For those people who are technical, this is how the ceramic is generated: Inside an 80-K.W. electric plasma-generating gun, an accurately controlled, high-density arc is created by ion flow between an anode and a cathode. This excites an inert gas such as Argon or Nitrogen. Metal, ceramic, carbide, cermet (ceramic particles bonded to metal), or polymer powder injected into the ionized plasma stream, is propelled at a supersonic velocity onto the surface of the piston. The "splat structure" of semi-molten particles impinging on the piston and each other forms a high-density interlocking structure.
I never try to get that technical because it takes a ceramic engineer to figure that process out. To me, it sounds like something from Star Wars. All I can say is it really works to keep your pistons alive. If you want high-performance spend the additional $358.50 to have your pistons coated.

The following article is by Dwain Pyeatt: Owner-operator.

In recent weeks, Bruce Mallinson of Diesel Injection of Pittsburgh and I have discussed the extraordinary performance on the engine that he helped me build. He asked me to let readers know what it is like to drive a high-performance engine.
As you might have read in previous articles, I contacted Bruce late last summer about designing and building a high-performance Cummins. My truck was a 350 B.C. IV. Cummins, 13 over, geared with a 3.55 ratio and running high profile 11 R 24.5 tires. I wanted an engine with 600-700 HP. I had previously talked to truck dealers and Cummins distributors about added horsepower and they informed me that it was not possible. After many hours of research and discussing the idea with Bruce I decided that he had the ability to build this engine. I have not been disappointed.
I was frequently in contact with Bruce while building the engine and I followed each of his suggestions for increasing the horsepower and life of the engine. One of these suggestions was installing gauges such as the liquid-filled pressure gauge, manifold pressure gauge and the air and fuel restriction gauges. I have never believed that these gauges have any usefulness but Bruce showed me that with them you have an engine diagnostic center in the cab of your truck. You can evaluate the performance of your engine and troubleshoot problems simply by reading the gauges.
Once the engine was built I realized the true meaning of performance. High-performance is the combining of proper parts to create an engine that snaps to life with the gentlest touch. High-performance is pushing technology to its limits to create a bigger, more powerful engine.
While driving through the Midwest and the Appalachians in the east I have never found a hill big enough to have to shift down. Therefore, I was glad to get a dispatch from Philadelphia to Los Angeles. I wanted to see what my engine would do in the southern California Mountains. During this trip I found that I did not encounter one hill that required shifting below direct. Since I usually drive in direct I never had to shift down. Probably the most incredible thing about this engine is that the fuel mileage hasn't dropped. When it was a 350 B.C. IV. Cummins I averaged 5.6 m.p.g. and my average is still the same.
Bruce asked me to stop by and let the Cummins engineers in Indiana see my

engine. A couple of the engineers were skeptical about the power. They quickly changed their minds after driving the truck. They equated the experience to driving a high-performance sports car.
I also had a dyno run done on the truck at Cummins in Ohio. I was excited when we topped the dyno out at 750 HP. with 50 lbs. of fuel pressure left. We estimated that I have 800 HP. at the wheels with approx. 900 HP. at the flywheel.
So what is it like to drive a high-performance Cummins? The answer is simple. It is exciting. Each new mountain or hill is a challenge. I no longer ask myself if I will have to shift down to reach the top. I now ask myself how fast can I top the hill. It is an incredible experience to know that all you have to do is ease down on the throttle and feel the surge of power as you start up the hill.
Remembering back to when I first contacted Bruce, I can recall that he told me that it would be like the Jolly Green Giant reached down and pushed me up the hill. He was right. All of my expectations have been exceeded.
End of article
Please keep in mind that all of our high-performance engines are not always built for maximum horsepower. Many owner-operators are pleased with 450 to 500 HP. This is not a problem because the same care and technology and many of the same parts are used in horsepower ratings from 450 to 700. Whatever your requirements for horsepower are we can help you obtain your goal.
Can we build high-horsepower engines in our shop here in Pittsburgh, PA? This question is asked many times by those who call for the first time, and the answer is "Yes." At our facility in Pittsburgh we have three garage bays, an overhead crane, all of the factory tools and factory-trained technicians. Our parts department is very well stocked with high-performance and standard genuine Cummins parts. We do build stock engines as well as our high-performance engines.
Our component rebuilding room has a Bacharach pump stand for custom-calibration of your fuel pump and also a Hartridge injector machine for injector blueprinting. We also rebuild turbochargers, oil coolers, aftercoolers, M.V.T. cam followers and water and oil pumps.
We are a small self-contained Cummins engine dealer that will listen to what you have to say and we will build your engine to meet your horsepower requirements. Our latest task is to build a K.T.T.A. 1150 cu. inch twin-turbo K-series engine to 1,400 HP. Talk about unusual. This engine is going to be canary-yellow and chrome per the customer's request.
TORQUE : How many foot lbs. of torque do we produce with 700+ HP? About 2200 - 2400. That's enough to get the job completed or to run east coast to west coast without dropping a gear. Several years ago Cummins had a song titled "Reserve Power. That's what a trucker needs". Well, that's the kind of engines we build at Diesel Injection of Pittsburgh.
Many people ask if their transmission, drive shaft and rear ends will hold up to the extra torque. Heavens no! Not if you drive like a maniac, do jack rabbit starts, or mash your motor in the low side of the transmission. However, owner-operators do not drive in that manner when they have a thoroughbred under the hood. Instead, they are gentle with the throttle and use the power to maintain the speed once they are up and rolling. When properly driven, the extra torque will not harm your drive train. We have been building high-performance engines for 20 years and have never had a premature failing of any drive line component. If you ever have the opportunity to drive an N.T.C. 700+ HP. engine you will soon realize that moving your big toe on the throttle is all you need to make this baby come to life.
Now let's talk about air filters and how long you should run them before changing. Dirt is a killer to any engine and if we could keep all the dirt out of the air and oil the engine would never wear out. Engines are designed to run on a film of oil. Metal should never touch metal. You obtain the dirt in the engine in two ways. One is the air, which passes through the filters, still have

a small amount of dirt particles in it. New filters are 97 to 98.9% effective in dirt removal. The second way is by burning hydrocarbon fuels such as diesel fuel and\or gasoline. These fuels are dirty by nature and, after combustion, small amounts of carbon are left in the combustion chamber. That is why an engine needs good oil filtration. Now, on to the air filters. It is a proven fact that air filters that are slightly dirty filter air better than a new filter. This is another reason we insist on having larger filters than an engine actually needs. Because the cubic feet of air per minute that the filter will pass is slightly less. All trucks should have an air filter restriction gauge in the instrument panel and I don't mean the pop-up style. With the restriction gauge and by doing oil analysis you will be able to determine when your air filters are plugged.
This article is for the owner-operator who drives an N.T.C. 290, 300, or 350 HP. engine that needs an in-chassis rebuild. It never ceases to amaze me as to why you rebuild these engines to stock low horsepower. I realize that your decision is based upon the knowledge of a mechanic or service manager who doesn't understand what makes this great Cummins engine perform. After you finish this article you will know and understand what the difference is between a 290, 300, 350 and 400 engine. Now if you haul U.S. Mail, plastic, insulation or any other light loads all the time, an N.T.C. 350 HP. is fine. This information is for owner-operators who usually gross between 65,000 to 80,000 lbs. or more.
Let's look at what is the same in all N.T.C. b.c. I, II, and III engines. The block, crankshaft, camshaft, connecting rods, heads, aftercooler, oil cooler, water pump, oil pump, exhaust or pulse manifold, accessory drive, air compressor, oil pan and oil pump. Isn't it amazing how many of the components are the same regardless of the amount of horsepower the engine produces? This is one of the greatest aspects of a Cummins engine. Most of the components are identical.
Now let's discuss what the difference is between a N.T.C. 290, 300, 350, and 400 h.p. engine. The compression ratio is different. The timing of the camshaft and the offset cam key changes. Not the camshaft. The amount of fuel injected by the injector, the torque curve, and the fuel pressure supplied by the fuel pump all differ. Lastly, the amount of compressed air from the turbocharger fluctuates from engine to engine. Let's take a more in depth look at each of the differences.
Compression ratio of the piston: An N.T.C. 290 and 300 h.p. engine has a compression ratio of 15.0 to 1. A non-turbocharged diesel or gasoline engine does increase power with high-compression pistons. A turbocharged diesel or gasoline engine increases power and volumetric efficiency by lowering the compression ratio. An N.T.C. 350 engine uses a 14.5 to 1 compression piston and an N.T.C. 400 uses a 14.0 to 1 compression ratio. Can you see the difference between the 290, 300, 350 and 400 pistons? Now, think about this: the price of the cylinder kits are exactly the same. It doesn’t cost any more money for the 400 h.p. pistons so why not install them during your next rebuild? It's a step in the right direction for power.
Injectors: The price of a 290, 300, 350 or 400 injector is the same. 400 h.p. injectors do not cost any more money. So why not install them along with the 400 pistons? After all, you must increase the flow from the injector to increase horsepower.
Turbochargers : The big cam 350 and 400 engines have almost identical turbos: You can use an HT3B Holset or T-46 Cummins turbo from an N.T.C. 350 or an N.T.C. 400 engine. For 400 h.p. engines you must have at least 24 lbs. of turbo boost (manifold pressure). Purchase a manifold pressure gauge for $40 and you will know if your turbo is adequate for an N.T.C. 400. If you have an N.T.C. 290 or an N.T.C. 300 you will have to purchase a turbo for the N.T.C. 400.
Fuel pumps : The difference between a 290, 300, 350 or 400 is the torque curve which consists of two springs. These springs are very economical to purchase. However, your pump must be calibrated on a pump stand when changing these springs. If your fuel pump is fairly new, or in excellent shape, you should be

able to find a fuel injection shop like ours to recalibrate your pump for around $200 to $250. Keep in mind that this is not a rebuilt pump for that price. Just a torque curve and fuel pressure change. But remember, if you want it to pull it's best let us choose the springs and do the recalibration for you.

Camshafts : You may find this hard to believe, however, all N.T.C. 290, 300, 350 and 400 h.p. cams from BC I, II and III engines are identical. The only difference is the offset key which sells for around $16. The timings are also different. A 400 is timed at 0.070 and a B.C. III 350 is timed at 0.065. Both engines use the same offset key. Only the gasket thickness on the cam follower is different. You can retime a B.C. III 350 to the N.T.C. 400 settings of 0.070 without removing the camshaft from the engine. An N.T.C. 290 and 300 are timed at 0.060 and it does use a different offset key. You will have to remove the cam from the engine to change the cam key for an N.T.C. 400 setting of 0.070.

There you have it. All the information you need to be armed with when you ask the service manager to build your engine to an N.T.C. 400 and he tells you it can't be done. Please keep in mind, that when we rebuild your engine, we always use the extra high strength Cummins pistons. They are 14.0 to 1 compression ratio and can be shipped to your shop or home via U.P.S. These pistons are available ceramic and teflon coated and they will take more abuse than the stock N.T.C. 400 piston. Insist on the best. It's a tough world out there and only the strong survive.

Last summer Diesel Injection of Pittsburgh supplied all the engine parts to a company called Translitre in Swadlincote, England. They compete in the European truck road racing circuit using day cabovers (strange looking trucks they are). Translitre assembled the engine with our parts and won first place seven of eight races and clinched the European Championship. The engine parts we sent to them are the same parts we use in our over-the-road high-performance engines for owner-operators. In Europe our competition consisted of factory-sponsored teams such as Volvo, Renault, Mercedes-Benz and other European truck manufacturers. We are proud that we were able to defeat the mega-buck factory-sponsored racing teams. That goes to prove the saying "Those who say it can't be done are usually interrupted by someone else doing it." That's us. We do it and we can help you become king of the mountain.

Our secret weapon for the Europeans this year is twin Extrude-honed turbos and a camshaft with .420" travel to the injector. A small cam Cummins injector travels .170", a big cam has .224" and our high lift cam for performance engines has .266" travel. Think how much fuel will be injected per stroke with almost 1\2" of injector travel. By the way, our manifold pressure is over 100 p.s.i. out of the twin-staged turbos that have been Extrude-honed. We blew apart two aftercoolers on the dyno testing this engine at 1,224 horsepower. Yes, it's an 855 cu. in. Cummins engine.

Now if you feel that 700 h.p. is not possible for on-highway it's only slightly over half of what Translitre will be racing in Europe this summer.

Marvin Winship from Buffalo, NY recently rebuilt his N.T.C. 475 twin-turbo Cummins using our ceramic and teflon coated pistons and other high-performance related items. He was able to put 853 horsepower to the ground. According to Cummins engineers in Columbus, Indiana that equated to 1,043 flywheel horsepower.

I realize that not every owner-operator wants or needs this type of excessive horsepower, but wouldn't it be nice to have 600 horsepower using only 500 h.p. to carry you over the mountain and having 100 h.p. left over just in case some hot Cat wants to go around you on the mountains?

In the past we have talked about Mechanical Variable Timing (MVT). I realize that 99% of the diesel engine shops are against this system. Please keep in mind that they really don't understand how it works or realize the many advantages of having Variable Timing. Mack and Caterpillar engines vary the timing with a device in front of the injector pump. That is why they will not smoke at an idle. With the MVT on an N.T.C. series Cummins you will not have white smoke at

an idle. But the best advantage of the MVT is the retarded timing when the engine is developing power. Retarded timing takes the shock load off the pistons, bearings, and camshaft. High horsepower and fast timing or stock timing is a killer to pistons. The black hole that burns down through the side of the piston is a result of fast timing. Not an injector failure.

Now, how do we make the MVT operate trouble-free? First, we completely rebuild the entire unit replacing all moving parts. Second, we install an automatic oiling system which was developed by Cummins engineering. It's a shame they did not install the oiling system when the MVT was first introduced. 90% of the related problems would have been eliminated. This oiling system consists of 24" of #4 Stratoflex hose and some 1\8" brass fittings. Third, we install a toggle switch in your instrument panel or on your shifter. This is to shut off the movement of the MVT unit once you get out of the low side of the transmission. The MVT advances and retards every time you shift a gear or back off the throttle. This excessive movement is hard on the rack and pinion in the MVT that actually moves the injector cam followers on the cam. You only need the engine to advance timing when you are idling, driving slowly in traffic or pulling into or out of truck stops. After you shift your first three or four gears, trip the toggle switch to allow the MVT to stay in the retarded mode and you will not have any trouble with your unit. The MVT makes 600 + horsepower possible along with engine life.

Now let's talk again about vibration dampers. Several months ago we mentioned all of the engine failures that are associated with faulty dampers such as broken flywheel bolts, broken accessory drive shafts and camshafts. Whenever you have in excess of 380,000 miles on your damper it may be scrap. With the engines running in excess of 500,000 miles between rebuilds you should replace the damper at the time of rebuild. If you have a 290, 300, 315 or 350 h.p. N.T.C. Cummins and are going to increase the horsepower to 400 or more you should install the largest damper which costs $490 new from Diesel Injection of Pittsburgh.

The next subject is about breakdowns when you are away from home. Remember this number, 1-800-DIESELS or 1-800-343-7357. This phone number will put you into the Cummins engine factory in Columbus Indiana. If you feel you are being treated unfairly or taken advantage of please call this phone number and explain, in a nice way, your problem to one of the four gentlemen that will answer the phone. Your call may be taped so please be careful of what you say. Being belligerent and yelling will get you nowhere. This phone call may save you thousands of dollars.

Would you like to be able to increase your horsepower by 75 to 100 h.p. in one day? Sound impossible? Many may think so but they don't understand what we are doing anyhow. Remember; those who say it can't be done are usually interrupted by someone doing it. We can increase your horsepower by as much as 100 h.p. in one day by reflowing your injectors, recalibrating your fuel pump, installing a Holset high altitude mapwidth enhanced turbo and a fuel pressure gauge. Please keep in mind this is intermittent horsepower and should not be run flat out for long periods of time. Always be in a gear where your engine can accelerate. Also, when working hard on a mountain, keep your engine at 2,000 r.p.m. and in a gear where your foot isn't mashed to the floor.

There seems to be a misunderstanding in the trucking industry about horsepower and fuel mileage. Why do most people feel that when horsepower increases fuel mileage goes down? Lets talk about this: my understanding is that it takes approximately 273 h.p. to maintain 70 mph in a cabover grossing 80,000 lbs. on level highway with no head wind. This information was given to me by Cummins engineering. Now if you are driving a stock NTC 290 at 1700, your foot would be flat on the floor, like driving a 318 Detroit. We all know how miserable that can be. If you have an NTC 290, 300 or 315 that is stock and you have enough gear selections to keep your rpms at 2000 or 2100 to try and maintain 70 mph your fuel mileage will be terrible. Now please keep in mind that this is on

level highway. Something we just don't have in the eastern United States. Also, in the Midwest, you're blessed with 35 mph head and side winds. Another killer to fuel mileage. In the west where the mountains are 18 miles up the low horsepower engines never get a chance to breathe.

What does all this lead to? It takes horsepower to operate a truck at a decent cruising speed to obtain fuel mileage. If your engine will produce 600 h.p. and you want to maintain 65 to 70 mph at 1600 to 1700 rpm it will only take 50 lbs of fuel pressure to accomplish this. In the small horsepower engines it will take 130 lbs. of fuel pressure and that's all you have at 2100 rpm. Which one would you rather drive?

My personal opinion is that 450 h.p. is the minimum horsepower an owner operator should have to get the job done. Even for a company driver. Give them horsepower to maintain a decent road speed on 3 and 4% grades so traffic can move along at a smoother pace. If company executives are concerned about speed, put road speed governors set at 68 mph on your company trucks. If trucks can maintain their speed uphill, along with the cars, our highways would be safer for everyone. We all know how aggravating it is when you're following two under powered company trucks up a mountain with their 4-way flashers on trying to pass one another for no apparent reason. It's time we eliminate under powered trucks from our highways and put them to work on the farms.

High horsepower, driving at moderate speeds of 60 to 70 mph, maintaining at least 55 mph up hills, using low rpm on the flats and high rpm on the mountains will give you fuel mileage and long engine life.

Several months ago we talked about injectors and always installing them with STP slightly thinned with 15-40 engine oil. Using the STP mixture on the injector "0" rings and in the injector bore in the head will insure that you will not cut, shave or nick the "0" rings. Do Not use Vaseline, straight engine oil, Murphy's oil soap or grease.

If you cut your injector "0" rings this is what can happen: first the bottom "0" ring keeps the diesel fuel from running down the sides of the injector and into the combustion chamber. If this happens, your engine will melt a piston or score a liner. The engine will idle rough and have excessive white smoke. During a hard pull you can actually flood your engine with fuel to the point that the engine will shut down.

The middle "0" ring, if cut or shaved, will allow your fuel pressure to return back to the fuel tank. The result is a loss of power, poor idling and you will think that your fuel pump is sucking air because the throttle response will be spongy. The top "0" ring keeps the fuel oil from entering your rocker boxes. If this happens you will have fuel dilution in your engine oil.

As you can see all three of the "0" rings are very important to the longevity and performance of your engine. Always use STP slightly thinned with engine oil on your injector "0" rings.

Horsepower is determined by how much fuel is injected into the combustion chamber. Always install injectors calibrated one size larger to gain increases in power. Lately, we have been going two sizes larger on NTC 350 and 400 h.p. engines with fantastic results. John Melanson from Ontario, Canada bobtailed 750 miles to have our shop rebuild his injectors, fuel pump, install a pyrometer, fuel pressure and manifold pressure gauges. We reflowed his injectors two sizes larger, set the fuel pump to match the injector flow and the results were approximately an increase of 100 horsepower. September 2, 1993 he stopped by our shop to tell us how much he enjoyed driving his truck. It will out pull stock 425 caterpillars and he gained .5 miles per gallon and never has to run his engine wide open.

The milestone was having the opportunity to meet and work with Charles Ekstam, owner operator of a 1989 Freightliner with a 444XT Cummins engine. Charles was leased to national carriers out of Liberal Kansas. Not happy with the performance, idling ability, and soot the engine produces, Chuck set out to make several changes in his fuel system. He always wondered why his fuel filter was

only two thirds full every time he changed it. His next question was why does the front cover of the fuel pump have a weep hole built in to allow air to the seals, and what if the air goes past the seals during a hard pull? Could this air be the fluttering and occasional skip or miss you feel when pulling the mountain?

Charles Ekstam and Jerald Rexroad installed his new system to eliminate air and fuel restriction on my brother's 1990 444 XT. After a brief 3 mile bobtail the engine did idle much smoother, was more responsive and had an increase in power. Chuck also tells us that we should gain approximately 1 mile to the gallon on our fuel mileage. If this does happen we will be able to obtain 7 miles per gallon out of our NTC 700 horsepower engines. Next, we will tell you the results of our testing.

This month we will discuss the manner in which we have been building and tuning the NTC BCIV 88 STC (Step Timing Control) engines.

The NTC 365 and 400 horsepower engines are identical except for the fuel pump calibration. If you want a 365 BCIV engine and would like to increase your horsepower to 400, or even to 425, just stop by our shop in Pittsburgh and we'll recalibrate your pump. You'll gain 1 gear on the mountains. Your fuel mileage will probably increase because you will not be spending so much time crawling up the hills.

Now let's compare the 365-400 horsepower engine to the NTC 444 h.p. To gain another 44 horsepower, all that Cummins Engine Company did was drop the compression ratio by .5 and retard the timing by .003 and increase the injector flow. In past articles we have talked about always increasing the flow of the injector to gain horsepower. The main reason for this is to decrease the pressure on the injector pushrod, which in turn increases pressure on the camshaft. Remember, that we mentioned that on a stock engine, the shock load on the pushrod is 3,000 p.s.i. If you increase your fuel pressure more than 10% you will damage your camshaft unless you increase the flow of the injectors.

When it's time to rebuild your NTC 365-400 always install the NTC 444 pistons and injectors and have your pump recalibrated to an NTC 444 code. Leave the timing and the turbocharger alone, and you will have 444 horsepower.

Most owner-operators would not be happy with only 444 h.p. If you purchase your parts from Diesel Injection we will ceramic and teflon coat the pistons, supply you with a mapwidth-enhanced high altitude turbo, increase the injector flow and install a high-volume gear pump on your fuel pump. That is your recipe for a nice running 600+ horsepower STC BCIV 88 Cummins engine.

We highly recommend the liquid filled fuel pressure gauge and manifold pressure gauge so that you will be able to know how much horsepower you are using.

Its a shame the STC injectors had so many problems during their first several years of production. However, we feel that most of the mechanics in this country never understood the proper method for installing and tuning an engine equipped with STC injectors. Another way to extend the injector life is to clean the oil better by installing a Harvard luberfiner filter, which filters to 1 micron in size. Your standard oil filter is around 38 micron. Another great item is the Spinner II Centrifuge oil cleaning system. This will actually spin the contaminants out of your oil and with both filtration systems you can easily increase your oil drain intervals by 50%. This will save you approximately $1,800 in oil changes plus your time. The cleaner oil will greatly extend the life of the hydraulic tappet. It fills with oil to advance the timing of the injector to eliminate white smoke during idling. Dirty oil will score this tappet and ruin a $1200.12 set of injectors. Also, your engine life will be greatly increased due to the elimination of dirt in your engine oil. Please keep this in mind, if your engine had a constant supply of clean oil, the engine would never wear out. Metal never touches metal in an engine, the contaminants or dirt in the oil causes the wearing of bearings, liners, bushings, gears and thrust washers.

Used conventional trucks with BCIV 88 STC engines (NTC 365-400 & 444) sell for $3,000 to $8,000 less than the identical truck with a 425 h.p. Caterpillar engine. Take advantage of these savings. Buy the truck and install the high flow pump, injectors and mapwidth-enhanced turbocharger and you will have a great running truck that you will love to drive.

Just a short note about camshafts: The high lift cam that we use in our engines is not the CPL 676 BCIV camshaft. The BCIV 400 cam does have more exhaust valve lift, which presents a problem for our high strength ceramic and teflon coated pistons. The exhaust valves will hit the pistons during a hard pull if you use this cam. You have to use a specific piston in CPL 676. Our high lift cam has 42 thousandths more travel to the injector than all of the standard Cummins cams.

Please do not call and ask for part numbers of the products we work with . If you world prefer to build your own engine, that's fine. We will supply the parts, technical information and answer all your questions. If I can't sell you the parts I won't be in business very long and then we won't be able to help you build your high-performance engine.

Vibration Dampers: Several months ago we talked about all of the components that break because of faulty dampers. After a brief conversation with the manufacturer of the dampers we have learned about a few more problems such as slapping belts, excessive bearing wear and excessive gear wear in the front cover of the engine.

When the injector injects the fuel, the force of the explosion pushing the piston down is like smashing the aluminum piston with a hammer. That causes a torque spike, which twists the crankshaft. When the crankshaft twists back after the pressure is gone, the result is a torsional vibration. The damper absorbs this vibration and saves the crank, cam, accessory drive shaft and flywheel mounting bolts from breaking. The manufacturer of the damper recommends changing every 380,000 miles or 15,000 hours.

Let's talk about the force that drives the piston down. In past articles we have talked about timing. As horsepower goes up timing must be retarded and the compression ratio of the piston must be lowered. When the timing is retarded the piston is closer to top dead center when the fuel is injected. While the piston is at top dead center is when the hammering effect takes place. Until the crankshaft starts its downward stroke, which is a millisecond, the piston is subjected to severe abuse. This is why we ceramic coat the top of the pistons. It's much more durable than aluminum. When working the engine on a mountain or against a headwind its much easier on the piston if you keep the rpms up around 1900 to 2100. This gets the piston out of top dead center faster. We set all of our fuel pumps to pull at least 2300 rpm on our performance engines. 2300 rpm does not hurt an NTC Cummins engine. When our owner-operators are drag racing, such as at Englishtown, NJ or pulling sleds at county fairs, they will run the engine as high as 3,000 rpm. We have never had a failure using high rpms. A smaller amount of fuel gets into the injector cup to be injected into the cylinder. Horsepower drops off after 2500 rpm. Cruise your engine at 1500 to 1700 rpm. Work it at 1900 to 2100 rpm, always are in a gear where you can accelerate if you put the throttle to the floor. By the way, check your throttle linkage to be sure your getting full throttle. The Cummins brake-a-way lever on the fuel pump should brake-a-way about 1/8" when the foot throttle is on the floor.

Air Cleaners: Just because you have a conventional with dual air cleaners doesn't mean you have enough CFM (Cubic Feet per Minute) of air. Measure the inlet and outlet of the air cleaners, if they are 5 to 5 1/2" you may be starving your engine of oxygen. The new Ford Aero Max has a very restrictive pipe coming from the air cleaner to the turbo. Be careful if you want to build a big horse in that chassis. You may have to get very creative with the air filtration system.

Driving a 700 plus horsepower Cummins engine is a unique experience. Just moving your big toe brings response. During the month of December, we built for Wayne

Reighard from Lititz, PA and Vernon Harris from Martha's Vinyard, Cape Cod, 1000 plus horsepower engines. Their trucks, a 1985 Marmon and 1983 Peterbilt came equipped with NTC 475 twin turbo engines. Wayne has a 3:36 and Vernon has a 3:42 gear ratio. Wayne, running in direct gear (12th), topped Snowshoe Mountain at 70 mph at 1800 rpm using only 200 lbs of fuel pressure while grossing 79,000 lbs. Dwain Pyeatt did the same thing last year and nobody would believe it. Wayne Reighard pulled the same mountain at 200 rpm less because he has 3:36 gears and Dwain has 3:55 gears. I'm sorry some of you have to use your four way flashers on Snowshoe Mountain. Please just make sure you stay in the right lane.

The ceramic engineer that coats our pistons with ceramic and teflon called last week to inform us that he has changed the formula and its now called Ion Bonding instead of ceramic. He claims the Ion Bonding is much stronger than the ceramic. The teflon is still on the piston skirts. This engineer also coats Paul Newman's pistons for his racecar. If you're rebuilding your engine, regardless of what it's in, you should allow us to coat your pistons with the Paul Newman formula, Ion Bonding and teflon. To keep things simple, we'll continue to call it ceramic.

We also have high performance parts available for the dodge Cummins pickups. Turbos, air to air intercoolers, exhaust systems, pyrometer and manifold pressure gauges and tachometers. If you operate your Dodge at high altitude with a stock turbo, you're in trouble. Your exhaust temperature is in excess of 1400 deg. You need our performance exhaust housing and a pyrometer.

Now, on to the block and piston preparation. When you are doing an out of Chassis rebuild and having your block resurfaced, always tell the machine shop to remove as little as possible from the deck surface and have them inform you as to how much they machined off. If you purchased your truck used, and are not sure if the block was ever resurfaced, you should check the piston to deck surface height. If too much material was machined off your block you can have the valves hitting the pistons. Always be aware of the fact that not all pistons have the same amount of depth to the valve pocket even though the compression ratio may be the same. This is especially true in BCIV 400 and newer engines.

To measure the piston to block deck height, bring the piston to top dead center and measure the distance from the top of the outer rim of the piston to the block deck surface, bridging over the liner. Do not measure into the valve pocket. The diesel shop supplying your parts will be able to give you the correct measurement for your engine. If your block is too short, we have head gaskets that are .013" thicker so you won't have to scrap the block.

Another use of these special gaskets is for lowering the compression ratio. If you have an NTC 350 and are going to install head gaskets, use the .013" gaskets. Install NTC 400 injectors and you have an NTC 400 with 350 timing. This engine will be very responsive so be gentle on the throttle. The next time your into the camshaft, time the engine to 72 or 73 and the pistons will live longer.

An NTC 350 and 400 use the same cam key so you won't have to remove the cam to change the key. just decrease the amount of gaskets on the cam followers. Any questions just give us a call and we'll make sure you have the right parts to have horsepower.

When the government of the United States made it mandatory for all of the on highway trucks to use low sulfur fuel, we suffered with low power, stuck injectors and leaking fuel pumps. We had numerous phone calls from owner operators asking what can they add to their fuel to help gain back the power and fuel mileage they lost. In my brother's 444XT and my Dodge Cummins pick up we tried many products to see if they would work. Unfortunately, no change in power or fuel economy, I thought we were going to have to live with garbage fuel.

During the month of April 1994, Bill Jones, owner-operator of a Kenworth Conventional powered by a high performance NTC BCIII 400 Cummins called Diesel Injection and asked if we have ever heard of Lucas Fuel treatment. My answer was "no but why do you ask"? Bill stated that his friend tried 1 gallon in his 400 CAT and after 100 miles of driving felt an improvement in the performance of his

engine. Bill's Kenworth has all of the necessary gauges to monitor a performance engine and he has a steady haul of bark mulch from Montreal to Boston. His trailer is 45 ft long, had ribbed sides, triaxle and a walking floor. Certainly not an easy pulling unit. Bill tried 1 gallon of the Lucas Fuel treatment and also noticed a power increase after approximately 100 miles of driving. Bill's manifold pressure increased by 2 to 3 lbs, his pyrometer was 50 deg. cooler and he pulled the hills one half gear higher than he did before.

This seemed like a truck stop story to me. However, Bill Jones from Manchester, New Hampshire is an outstanding mechanic and is very well respected by the owner-operators he works for. He trucks and wrenches. This way he never gets bored.

With this kind of recommendation I had to call Forrest Lucas in Riverside, California to find out what was in this treatment. I ordered one case, 4 gallons, at $17.99 per gallon. I gave one gallon to my brother for his 444XT and the next day he called and said that his engine was also running better. When he ran out of Lucas Fuel treatment he felt a loss of power and response.

Prior to the recession, my brother was an assistant golf pro. He understands golf clubs, not engines. For him to feel an improvement in response was surprising to me. My Dodge Cummins pickup now performs as it did with high sulfur fuel.

One gallon of Lucas fuel treatment will condition 400 gallons of diesel fuel. At $17.99 per gallon, it costs 4 cents per gallon to treat your fuel. My feeling is as follows: with this conditioner you will gain approximately 5% fuel mileage, which saves you 20 gallons of fuel every 400 used. At $1.00 per gallon your fuel savings will be $20.00 minus the $16.95 for the conditioner, or a total savings of $3.05 every 2100 miles driven, or approximately $158.60 per year. Forget the savings, I like the fact that my engine responds once again. Call us at 724-274-4080, try 1 case for $71.96 plus U.P.S. and call me with your opinions of this product.

Now for horsepower: Engine timing, you must retard the timing as the horsepower increases. Lower the compression ratio, increase injector flow, increase fuel pressure, retard the timing and increase the manifold pressure. That is the formula for increased horsepower and must always be followed. Now here's the problem. A lot of owner-operators that do their own mechanical work are not taking the time to retard the timing. They are doing everything else correctly except the timing. I realize that it's a lot of extra work when doing an in chassis rebuild. However, it's the most critical part of the horsepower formula for engine life. With stock timing the engine will be extremely responsive and great for drag racing. However, piston life will be greatly reduced. Retard the timing for piston life!

Air Cleaners: Now is the time to completely remove your air intake system for a thorough cleaning and inspection. Look for salt corrosion and rust on the air cleaner housing, especially on the inside. Wash the aluminum piping and rubber elbows and spray the inside with lubriplate white grease. The white grease will eliminate corrosion on the inside and hold any dirt that gets past the air filter. The cleaning should be performed at least once a year. Also, grease the aluminum piping where the rubber elbow fits over the piping.

The removal of air from Diesel Fuel: Charles Ekstam and his invention, the Fuel Preperator, continues to do wonderful things for the performance of diesel engines. We have installed for systems this past month and the owners are very pleased with performance and smoothness of the engine. It's truly amazing that the engineers at the diesel engine companies in the United States haven't designed a system to remove the air from fuel. They have known for many years that fuel oil was 2 to 3 percent air by volume. It's amazing what a sharp mechanical minded owner-operator can develop while driving down the highway. The Fuel Preperator comes with a 100% money back guarantee if you're not completely satisfied. Remember: Life is too short to drive slow trucks!!!!!!

Now for horsepower and torque:

If your in the market for a used truck the price is generally lower if the engine is an NTC 354, 400, or 444 with STC (step timing control). These engines are great once they have been properly tuned up. Increasing the flow from the injectors and increasing the pressure from the pump. These STC engines will fly. What is so incredible about the STC engine is how long it lives. We have never had a failure, regardless of the horsepower, from one of these engines.

Please keep in mind that the vibration damper on the front of your crankshaft is supposed to be changed every 380,000 miles. The following is list of what the damper saves in your engine: crankshafts from cracking and breaking, excessive bearing wear, excessive gear wear, broken accessory drive shafts, broken flywheel bolts, broken camshafts and reduced fuel mileage. Always replace the damper with the largest one available. We sell the highest horsepower damper for $490.00 brand new, no exchange.

What's hot? Turbo boots, a simple little item that keeps the heat in the turbine housing which in turn causes the turbo to spin faster. Its hard for me to believe that after building high performance Cummins diesel engines for 22 years that something so simple can do so much. By keeping the heat in the turbine housing the turbo boost increases, you will have more power at 1500 and 1600 rpm, and less smoke between gears. Yes, the turbo boot is the most economical performance item you can add to your engine. Performance, efficiency, horsepower and fuel mileage. What a great way to get more of it. By utilizing wasted heat going up the stack.

STC, step timing control injectors, we now have all of the new equipment to build and calibrate the NTC 365, 400 and 444 injectors. If you're unhappy with the performance of your STC engine we will custom build a set of injectors for you. The STC engine is extremely durable because of the variable timing and, as of this writing, we have never had a premature failure from one of these engines. Please keep in mind that all of the NTC 365 h.p. engines are cut back NTC 400 h.p. engines and some of the 400 h.p. engines are the same as the NTC 444 except with a 5 thousandth's timing change. However, they use the same offset cam key. As you can see its very easy to convert a 365 h.p. engine to 444 h.p. with minor changes. On the 1210 CPL 444 and the 1211 CPL 400 h.p: There is a .005 timing difference and .5 compression ratio change to the piston. Even with out changing the timing and pistons we have produced in excess of 500 h.p. from CPL 1211 and no failures!

Now lets discuss generic pistons and compare them to Cummins pistons. The following information is taken from a metallurgical engineering report.

The three pistons that were tested were Sealed Power, Perfect Circle and AEPP or Associated Engineering. Here are the results of the tests:

#1: The three pistons were manufactured from a Hypereutectic aluminum silicone alloy while the Cummins piston is make from a eutectic alloy, which is higher in silicone and nickel. The silicon and nickel give the piston higher temperature stability. In other words, when you're pulling a mountain and your pistons are hot the Cummins piston will not grow as much as the other three. Your chances of scoring a liner are less with genuine pistons.

#2: All three of the generic pistons were at the bottom of the scale for hardness and tensile strength. This means that the pistons will crack in the wrist pin area sooner than genuine Cummins pistons.

#3: FE, which stands for iron is present in the generic pistons and this reduces the ductility and tensile strength and has a significant effect on the fatigue and thermal fatigue performance of the piston.

My feelings on generic parts are as follows: Cummins engine company employs over 16,000 people. Many of which do research and testing. The amount of money spent each year on engineering and testing is astronomical. Take a tour of the testing facility in Columbus, Indiana and you will see what I'm referring to. This testing must be done in order to improve the engine. Remember that 10 to 15 years ago, if your engine ran 300,000 miles between overhauls, you were elated. Now 750,000 miles are expected before the first in chassis rebuild. That's

progress. In fact, some of the STC engines have reached 1 million miles without a rebuild. In order to keep the progress going the engine company has to make a profit and that comes from the sale of parts, genuine Cummins parts. Let Sealed Power, Clevite, Perfect Circle and AEPP manufacture gasoline engine parts. That's where they spend their engineering money. Not on diesels.

Now we're going to discuss the fleet engines of CPL 838 and 840. They are supposed to be 315 and 350 horsepower, if you're lucky. These engines, in stock form, are very sluggish. They were never meant to be driven by owner-operators. However, when these fleet trucks are sold, owner-operators buy them. Now we have the problem of trying to make a fleet engine perform up to the standards of owner-operators. The main problem with this engine is the high-compression piston, which is 17.0 total. The timing is set at .101 and the camshaft is not used in any other engine. The first time I looked at this engine I thought Cummins engineers made a mistake.

Abdul Kahn was the first person to bring one of these lemons to our shop to be rebuilt. Naturally, he wanted horsepower. We change the pistons to a different compression ratio, change the timing, turbo, injectors and fuel pump. Our goal was to take a CPL of 840 and build a high-horsepower engine that didn't smoke when it was cold because Abdul lives in New York City. We obtained our goal and Mr. Kahn is happy with his engine.

Next, we got a call from Bill Price in Phoenix, Arizona, who happens to have a fleet of CPL 838, 315 h.p. His engine does not use oil and has no blowby. Naturally, he wanted to build horsepower using fuel only. We built Bill a set of injectors going two sizes larger than stock. We installed a liquid fuel pressure gauge and increased the flow from the fuel pump by 25%. This fleet NTC 315 came to life in a huge way. It eats 425 Cats, 444 Cummins and chases his friend, John Albu's, hot NTC 475 twin-turbo from Phoenix to Los Angeles and back. How long is Bill Price's engine going to last? Who knows. It depends on Bill's right foot. So far, it has lived 8 months longer than I thought it would. He asked for power and we gave him power. Since Bill's truck runs so strong we have cut the injectors back to one size larger than stock and still we have fantastic results from these fleet engines.

Last week we installed one size larger injectors in John Farley's NTC 350, CPL 840, T600 KW and set up the pump 25% to feed the larger injectors. Now John drives a beast. John left our shop and went to New Bethlehem, PA to load 48,000 lbs. of brick. Once on exit 13 on I-80 going towards Ohio he never came out of 9th over. John called us from Ohio and told us how shocked he was at how his fleet lemon now runs.

If you own an 838 or 840 CPL engine be very careful when doing an overhaul. We have had many customers try to reconfigure this engine themselves and end up mixing in the wrong parts. This is a dangerous situation and major engine failure is the result. Also, a lot of customers are taking they're STC engines and are trying to convert them to fixed time engines. This is a very poor practice. The result is shortened engine life and less power. Again, a mismatch of parts is possible and severe engine damage can be the result.

If you're looking for a used truck, find one with an STC Cummins engine, bring it to Pittsburgh, and we'll put a smile on your face every time you see a mountain with a Cat or Bulldog pawing their way up the right lane. By the way, the left lane is no longer the Monfort lane, it's the Cummins lane.

Diesel Injection is now the proud owner of a 1995 club cab 4X4 Dodge Cummins pickup. This beautiful new truck had 17 miles on the odometer when we started making changes to the engine (for more performance, of course). On a 14% grade the 95 Dodge was 19 mph slower than our 89 Cummins Dodge although the 95 model cost almost twice as much as the 89. More money and less power. I definitely do not agree with this sort of deal. The changes have been made to the injection pump and the exhaust system. Next is the turbo and nozzles. When we're finished, the horsepower will be around 250 with 650 lbs. of torque. We will keep you posted as to the outcome of this great truck.

On February 20, 1995, an N-14 430 h.p. mechanical Cummins engine is coming to our shop for a moderate horsepower increase. We will convert this N-14 to 600 horsepower. It will be interesting to see of we can hold this great engine back to 600 h.p. after our modifications are made.

The next time your engine needs injectors, please call us with several days notice and we will custom build a set of performance Cummins injectors to suit your horsepower requirements. To build horsepower, you must increase the flow and, in certain situations, the cup size of the injector. This is where it all begins; right at the injector tip, not at the fuel pump. If you're rebuilding the engine, lower the compression ratio and retard the timing. This will help produce horsepower and it is easier on the engine. With our ceramic pistons, retarded timing locked in, mapwidth enhanced turbo, and injectors two sizes larger, you can have a great running high performance engine.

Which cylinder heads do we use and recommend? We recommend the Cummins Premium Gold head with a two-year, 200,000-mi. warranty. Yes, the head costs more, but we have never had a failure with them and the warranty is outstanding.

Do we port and polish the heads? No. However, you can do yours and it's certainly worth the effort. If you have a die grinder and spare time you will be able to do a first-class job. Start with an old scrap head and cut it apart on a band saw so that you can see where the excess metal is and how much metal can be removed. If you visit your local automotive performance shop with the cut up head, I'm sure they will give you some assistance. Please keep in mind that the Cummins head was designed back in the 50's when there weren't any turbochargers. Back then they were happy with 200 h.p. Now we're building 800 h.p. and the head hasn't changed much. With four times the h.p, we need four times the air. So, please take time to port your heads. Our local speed shop will do it for you. However, it is expensive because time is money.

Remember, on a gasoline engine, horsepower is made in the heads. On a diesel engine, a good porting job will lower your pyrometer and enable your engine to run more efficiently.

At this time I would like to address an issue that has been bothering me for quite some time. It's the fact that people call us for free information such as part numbers and specifications. I have spent twenty two years developing the NTC 855 cu. in. Cummins engine. If you're interested in building your engine to our specs, please have the decency to purchase the parts from us. We will be happy to give you the specs for free. After all, how many loads of freight can you haul without being paid? We do not charge for our time on the phone, but we need to be paid the same as you do. If you want a great running engine at least purchase the parts from us and we will be here to service you years from now.

Pistons: Don't put 300 or 350 pistons back into your NTC 300 or 350 h.p. engine if you want performance. The compression ratio is too high. You can put 400 pistons in an NTC 300 (certain CPL'S) even if you're not going to change the timing. Change the injectors to one size larger to compensate for the lower compression piston and your 300 engine will jump to 350 or more horsepower right now, and you will feel the difference. Our high performance ceramic and teflon coated pistons cost $358.50 extra for the coatings. That is the best money you can spend on your engine to increase the life of the piston. Lets face it, the longer the piston stays together, the more miles you will run between engine rebuilds. If you have an NTC 290 or 300 engine and install our ceramic pistons and high flow injectors, your horsepower will be around 375 and that's leaving the cam timing alone. Retard the timing and change the turbo and you now have 450 h.p. Build the proper foundation and you will build horsepower and torque.

Please be warned, the better your truck runs, the more you'll want to drive and the prouder you'll be of the old horse. Like we used to say back in our racecar days, "If you have no pride in your ride, don't park it outside."

By the way, those of you who have fuel pumps, injectors, and turbo cores that belong to Diesel Injection, please UPS, Fed Ex. or U.S. mail them back to us. We need the cores back to be able to help other owner operators that need

horsepower.
The race of the decade took place starting at Dysarts truck stop in Bangor, Maine. Bill Jones with his 1977 K.W. Conventional pulling a tri axle rib sided trailer grossing 104,000 lbs and Lenny McMannus with his 1985 CEO K.W. with a 120" double eagle bunk pulling a 45 tandem aluminum flatbed grossing 82,000 labs. Both trucks have NTC 1000-h.p. twin turbo Cummins engines but Lenny McMannus certainly had the advantage over Bill Jones (higher gears, more speed, less weight and a much more aerodynamic trailer).
As these two high horsepower gentleman pulled out of Dysarts and headed south on I-95 they ran together for the next 185 miles. Bill Jones lead the way and used 300 lbs of fuel on the hills. Lenny McMannus only needed 250 lbs to stay right on Bill's rear. Each engine is capable of 400 lbs. plus fuel pressure and neither driver ran his engine wide open. 1000+ horsepower is excessive and Bill's transmission is only a 12-5-13 speed, and that is holding over 2,600-ft lbs. of torque. Some people say that it can't be done, but Bill's doing it.
There it was 185,000 lbs. of semis traveling south on I-95 with 2,000 h.p. between the two of them. It's a good thing that both drivers are intelligent and levelheaded.
The New England States has yet another 1000 h.p. + twin turbo Cummins which is owned by Vernon Harris of Martha's Vinyard. Also, we better not forget about Ken Hawkin's twin turbo KTA that has approximately 1000 h.p. to the ground.
Onto how to build a high horsepower Cummins engine:
Many people are still playing with the fuel pump to increase power without further modifications of the engine. Do not do this, it will deteriorate your camshaft. You should install our high flow injectors 2 sizes larger, retard the timing, install the liquid filled fuel pressure gauge and, with moderate fuel pressure, the engine will produce 500+ horsepower. If that isn't enough power to satisfy your desires then the next step is ceramic-coated pistons, high lift camshaft and mechanical variable timing.
If you are fortunate enough to own an STC engine (step timing control), then all you need are the high flow injectors, high volume fuel pump, mapwidth enhanced turbo and fuel pressure gauge. You decide what horsepower you want and we'll custom build the fuel system for you. Driving high performance Cummins engines will put a smile on your face. You don't need a new electronic engine to have 500 h.p. All you need is a good fuel system.
Mufflers: We have available high flow low restriction Donaldson mufflers. They are a straight through design and DOT legal. The diameters are 9" and 10" diameter with 5" inlet and outlet. Your exhaust temperature will be cooler with these mufflers.
I met a lot of owner operators from the western part of this country who are still driving stock engines. I can't imagine how you can drive a truck for thousands of miles that doesn't respond. Dropping gears every time your truck sees a hill is very tiring on your body. Think about this: If you can maintain 10 MPH. faster than you currently do, west coast to east coast is one full day less driving time. So in a round trip you will save two days of driving. That's 20 hours per round that your engine isn't running. Are you going to save fuel? Absolutely, almost 20 hours worth. The greatest advantage is the pleasure of driving a good running engine and two more days at home. This pertains to those of you who are driving stock 290, 300, 315 and 350 horsepower engines. To convert these engines to higher horsepower all it takes is a set of high flow injectors and a liquid filled fuel pressure gauge kit.
Many times we are asked the question of how does the transmission and rear ends handle the 2,200 to 2,500 foot pounds of torque our engines produce. The answer is, you must have a light foot and be gentle with the throttle. When you're in the low side of the transmission you don't even think about standing on the throttle. Think about how a thoroughbred horse is treated when he wins a race. They put him on display, take his picture, pet him, and cover him with a blanket.

If we build an engine for you it will be a thoroughbred and it will be the fastest truck up the mountain. How would you treat it? When you walk out of the truck stop and look across the parking lot at all of the trucks lined up you will know that yours is the most powerful of them all and you will be smiling on the inside as you head toward your beast. The best part is when you come to the mountain. You are the king of the hill!

Lets talk about timing. CPL 324 is a BC-I 400, which is timed at .053. The original piston had a compression ratio of 14.5 to 1. The replacement piston is a 14.0 to 1 compression ratio. This piston is not compatible with .053 timing and will burn holes through it at around 80,000 miles. If you have a 324 CPL you must remove the camshaft and change the timing to .070 for a stock 400. If you would prefer an NTC 500 or 550 h.p. engine give us a call and we'll supply you with the right cam key, injectors, turbo and fuel pressure gauge. With this set up your engine will crank out the horsepower and torque.

One way to determine if your timing is set at .053 is if the engine rattles or fuel knocks when you lay into the throttle. Fast timing hammers holes into pistons and flattens out rod bearings. The CPL 324 is from 1977, 78, and 79, and most of them have had the timing changed. However we still get calls from people that are timed at .053 and that timing will put holes in your pistons. Timing is everything!!!

Hot Shots: If you own a hot shot powered by a 5.9 or 8.3 Cummins we do have horsepower enhancements available for your engine. Bill Witherstein drives a 1 ton Dodge Cummins with a Spicer transmission and 2 speed rears. After we changed his turbine housing on his turbocharger, reworked the injection pump and set the timing he claims he saved 33% driving time on his normal route. Motor homes also perform well with a few diesel hot rod items.

Have you noticed the new attitude at Cummins Engine Company lately toward high performance diesel engines? The horsepower race is on and Cummins will be the champion. After all they are now sponsoring a Winston Cup race car driven by Mark Martin, an Indy race car driven by Robbie Gordon, a 1000+ horsepower N-14 International truck that raced in the Pikes Peak hill climb, a Baja racing truck and a modified pulling semi. Now that's what I call being dedicated to racing and high performance.

The N-14 Cummins engine is extremely heavy duty on the inside. The 525 h.p. engine that was used in the Pikes Peak hill climb was basically stock. The turbo and injectors were the only components that were changed along with reprogramming the electronic controls. The engine produced 1,000 horsepower and 2,700 foot pounds of torque. Many truck drivers don't believe that we can obtain 1000+ horsepower from the NTC engines and we have been claiming 2,600 foot-lbs. of torque. Well, now it's in writing in the September issue of Truckers News.

It's time to believe that Cummins is coming back with a vengeance! Those of you that have bought yellow engines in the past will soon own a black engine in the future. Unless, of course, you don't mind having the back door all the time.

Elam Riehl from Middlebury, Indiana is the proud owner of our first extremely high horsepower engines using ceramic and teflon coated pistons, mechanical variable timing and the high lift camshaft. This September, the engine finally developed excessive blowby after producing 700+ horsepower for 560,000 miles. After tearing the engine down, Elam found #1 liner had excessive wear. All the pistons were perfect--so perfect that a friend of his will reuse them after Cummins engineering inspects them. This engine could have been put back together with all the used parts, except for one liner. I think that's excellent engine life for 700+ horsepower that's never been passed on the mountains.

During my last trip to the Cummins Engine plant I learned one more advantage of our ceramic and teflon coated pistons. This new advantage is the teflon coating on the piston skirts. Several things cause cavitation, or liner pitting and one of them is piston slap. The teflon coating on the sides is .001 thick which helps to eliminate piston slap. Less slap = less noise, less cavitation and means longer cylinder liner life. The very first set of ceramic and teflon

coated pistons we used resulted in a quieter idling engine. In fact, it didn't even sound like the normal BCIII NTC 400 that we were used to.
POWER - POWER - POWER: What every politician wants. What every trucker needs. After building high performance diesel engines for 18 years it's nice to see Cummins Engine Company produce an electronic engine that runs great. Its nice to hear from people that used to own yellow engines and now drive a N-14 500 or 525 and are extremely well pleased with the performance of their Cummins.
Water leaks: We all know how much of a pain they can be. For many years we have been using a product called Irontite. This is a ceramic block sealer that does wonders for cracked upper counter bores and other leaks. Irontite comes in either a red or blue formula. The red is extremely powerful and must be drained in 24 hours. If you don't, you won't have a cooling system. Instead, you will have a solid white ceramic engine block. Here is the proper way to use Irontite. If the coolant leak is minor, dump two bottles of Irontite blue into the cooling system, turn off the water filter for two weeks and the leak will have a 90% chance of stopping. If the coolant leak is significant, flush the cooling system, install fresh water with two bottles of Irontite red and operate the truck for one day. Drain the cooling system and leave it open for 24 hours. Now install new antifreeze, water and two bottles of Irontite blue and go trucking. The reason for turning off the water filter is so the ceramic sealant doesn't get filtered out of the coolant. After you operate the truck for about two weeks, turn the filter on once again. Used car dealers buy Irontite blue from us by the case. This stuff works.
Will these engines keep up with the new electronic engines? You bet they will! The new electronic engines do have some advantages over the older engines--more fuel mileage, slightly longer engine life, cleaner burning when idling, built-in cruise control, and big payments. However, the older trucks have no truck payments, more pride in your ride when it's well maintained and you can build your engine to satisfy your horsepower and torque addiction.
Can you believe that Caterpillar is claiming to be "king of the hill"? Apparently they have never driven one of our finely tuned Cummins engines. To date we have never had any other type of engine out power our Cummins engines up any mountain in this country.
Please do not try to build our version of the high performance diesel engine without our help. Many problems will arise and you will have a costly nightmare on your hands and a hand grenade under your hood. And by all means, use genuine Cummins engine parts unless specified by one of the technicians at Diesel Injection in Pittsburgh, PA.
The end of an era has come. It's time to say good-bye to the four ring Cummins piston. In its place is a new three-ring piston called the TriTech. The technology in this piston is very similar to the N-14 three-ring piston. Please keep in mind that you cannot use an N-14 piston in the small cam, big cam I, II, III, IV, and 88 NT engines. The wrist pin bore is much larger and so is the rod bearing in the N-14 engine.
Now what is different on the TriTech piston? #1: The top compression ring has a 15-degree angle versus a 20-degree angle on the old piston. #2: There is an accumulator groove for better ring stability between the first and second ring. The accumulator relives pressure iron below the top ring in order to keep the ring on its seat. #3 The oil ring is a new patented steel "1" oil control ring. The steel oil rings are tougher and more flexible than cast iron rings. Being more flexible they conform to the cylinder liner which lowers oil consumption. #4 Contoured wrist pin bore. This is really a neat feature for high horsepower engines. The top inside edges of the pin bore has been radiused. Don't try to do this on your own, the machine cost $500,000 to perform this operation. The reason for the contoured inside edge is, as the piston is driven downward from combustion, it wants to spread out along the axis for the wrist pin. When it does this, the pressure is all on the inside edge of the piston. This is one of the reasons why cracks appear in the pin bore area. This is the same technology

that Cummins uses on the cam follower rollers. They are barrel shaped so the pressure of the roller is in the center of the cam lobe. This is one reason why camshaft failures are almost nonexistent. The wrist pin bore is only barrel shaped on the inside top edge. #5 The TriTech Plus Dual Ni-Resist piston has an anodized bowl for higher thermal fatigue strength.

How well do these pistons work in our 700 H.P. to 900 H.P. engines? We don't know, whoever we have 24 pistons out being ceramic and teflon coated as of this writhing. By March of 1996 we will have 16 engines running the TriTech Plus piston with high horsepower, we'll know if they are going to live.

Many people in the trucking industry fail to believe how tough the BC IV 88 NT engine can be when properly tuned. I'm referring to the STC (step timing control) engines. John Byrum of Virginia has a CPL 1280 with our high flow injectors, pump and a turbo boot. On the dyno at Cummins in Richmond VA his truck put 560 H.P. to the ground. That's 700 H.P. at the flywheel. The engine did develop 590 H.P. to the ground but the tires started to go up in smoke.

Know your CPL, which stands for Control Parts List, it's very important when calling our shop for technical assistance. This number is in on the data tag in front of the air compressor. Please write this number down and keep it in your wallet or head.

Now lets talk about horsepower. We need AFC fuel pump cores to rebuild. Too many owner operators are holding on to our cores. It hurts your fellow truckers, and us, when we don’t have any cores to rebuild. Everybody loses when you don’t return the injectors, fuel pumps and turbo cores to us.

Dual fuel line kit, cost $80.00, results are as follows:

1. Smoother running engine.
2. Gain 1/2 gear on the mountains.
3. Lower pyrometer temperature by 25 degrees.
4. Increased throttle response.

All this for only $80.00, the cheapest horsepower you can buy.

Here is a little trick you can do that doesn’t cost you a penny. Polish the inside of the compressor housing on your turbocharger. The compressor housing is the aluminum part of the turbo on the fresh air side. First sand the area where the compressor wheel faces. Start with 320-grit paper, and move up to 400, 500, and 600 grit. Then use a buffing wheel and aluminum polishing compound. Make that part of the turbo look as shiny as a new Alcoa aluminum wheel. On our large mapwidth enhanced high altitude turbos a gain of 2 lbs. of boost will be noticed. That might not sound like much boost however it will lower your pyrometer by as much as 50 degrees and the turbo response will be greater.

Another trick for more turbo boost is to die grind the pulse manifold where the exhaust enters. If you clean up the ports and allow the exhaust to flow easier to the turbo another 2 lbs. of boost will be realized. Now with polishing the turbo and cleaning up the entrance to the manifold the engine will develop 4 lbs. more turbo boost and the exhaust temperature will decrease by 100 degrees.

The original pulse manifolds are larger in diameter than the manifolds built from 1990 on. Don’t ever think that by restricting the exhaust in the manifold that the engine will run better. Backpressure is a wasteful item, if exhaust can’t get out, how can fresh air get in?

This is the 50th article that we have written pertaining to Cummins diesel engines and how to produce as much as 100% more power using genuine Cummins engine parts. All of this power would not have been possible if it weren’t for the help and dedication of one particular Cummins engineer, Mark Chapple of Columbus, Indiana. Mark has been my guiding light and closest friend in the relentless pursuit of producing horsepower from the Cummins engine.

Mr. Chapple started with Cummins right out of high school at the age of eighteen. His first job was on the assembly line putting engines together. While working daylight he enrolled in night school at a college in Indianapolis studying mechanical engineering. Prior to graduating from college the management at Cummins saw the potential of this young man and promoted him to the

engineering department.
I had the privilege of meeting Mr. Chapple on the phone around 1984 after placing a phone call to Columbus, Indiana asking for the engineer responsible for developing the small cam Magnum 400 Recon engine, CPL 695. I was transferred eight times before getting Mark on the phone. My question was how can this engine start, let alone run with a timing of .056 and a compression ratio of 14.0 to 1. Mr. Chapple spent the next two hours explaining to me the effects of compression ratio, timing, injector flow, injector cup size, fuel pressure and volume and what happens if you don't follow certain guidelines when increasing horsepower in a diesel engine. When that phone call ended I knew that I had a new friend and my life and the life of every owner-operator in this country that drove Cummins engines was about to change. One of the projects that Mark Chapple and I worked together on was to develop 700 horsepower from a BCIII engine using STC injectors, twin aftercoolers and twin turbos. This engine produced 700 horsepower on the dyno at Cummins in Monroeville, PA. and was installed in Jerry Hairhogger's Kenworth from Wampum, PA.
In January 1996 while I was visiting with Mark in his office he opened a letter which changed his life. At the young age of 51 he had enough seniority to retire. This man truly loved his work at Cummins Engine Company and did not want to retire. However, the retirement package was too good to refuse. Mark Chapple, Cummins engineer extrordinaire, is now at home in his own shop developing high performance engine parts for Dodge Cummins trucks. Mark's 1995 Dodge produces over 300 horsepower and runs 0 to 60 mph. in eight seconds.
For those of you who have been following our articles for the past 50 months now you know where a lot of the technical information that has been made available to you has come from. As Paul Harvey would say, now you know the rest of the story.
With great pleasure I dedicate this 50th article to you Mr. Mark Chapple for all of your help, understanding, knowledge and friendship during the past twelve years. Thank you.
On to horsepower: We have preached about retarding engine timing when the horsepower is increased to reduce internal pressure. This pertains to all Big Cam I, II, III, and early BC IV engines with locked in timing. If your engine has MVT (mechanical valve timing) or STC (step timing control) you already have retarded timing. That's why the NTC 444 runs so well with high flow injectors and high volume fuel pumps and don't forget the dual fuel line kit.
Setting valve and injectors: Years ago with small cam engines we would set the pointer on the accessory drive on A or 1-6 v.s. and set the injector and valves on no. 1 cylinder if both valves were closed. This is now called the outer base circle method. Then came the dial indicator method where we would set no. 3 injector and no. 5 valves when the accessory drive was set on A or 1-6 v.s. In 1978 top stop injectors came along. They were to be set at finger tight, zero lash or 5 to 6 inch lbs. on no. 3 injector and .011 intake valve and .023 exhaust valve on no. 5 cylinder on the "a" mark of the accessory drive. This is called the inner base circle method.
Now, in 1988 came the STC injector and we are back to setting them on the outer base circle method. Just like the old NH 250 and NTC 335's. You will need a Snap-On dial type 0 to 150 inch-pound torque wrench. Bring up "A" on the accessory drive and if both valves are closed on #1 cylinder adjust the injector and valves on that cylinder. Then proceed to the "B" mark and adjust the injector and valves on #5 cylinder. With the outer base circle method the intake valve is set at .014 and the exhaust valve is set at .027. Now here's the kicker, the CPL of your engine determines the amount of inch lbs. the injector is set to. For instance, if the CPL is 821, 833, 903, 904 or 1215 the setting is 105 in.-lbs. On CPL's of 827, 910, 1185, 1188, 1210, 1211, 1256 and 1280 the setting is 90 in-lbs. The N-14 with CPL's of 1374, 1380, 1395, 1405, 1507, 1530, 1532, 1607 and 1652 require 125 in-lbs. and the valves are all .014 intake and .027 exhaust.

If you purchase your custom flowed injectors from Diesel Injection of Pittsburgh we will furnish to you the correct settings. By keeping the valves and injectors adjusted the life of the engine will increase by about 20% and perform much better. You can purchase the Snap-On torque wrench and other necessary equipment at our shop to make it possible for you to adjust your own valves and injectors.
Crazy Norm Murakami, the high powered owner operator from Costa Mesa, Ca. wants to enter his Western Star with the 900 + H.P Cummins in the Pony Express race. This high-speed race starts at Battle Mountain Nevada and goes to Austin, NV. a distance of 84 miles wide open. Norm wants to have a G.V.W. of 60,000 and maintain 125 to 130 mph. for the distance.
Quote of the month: There are doers, and there are those who are afraid. Which are you?
Here we go again on another wild adventure with the Flyin Hawaiian, Norm Murakami, with his 900 + H.P. 1985 Western Star with 3:42 gears and a 13 over transmission. Around August 14th Norm called me and asked if I knew about the Pony Express Race from Battle Mountain Nevada to Austin Nevada, a distance of 83.55 miles via Route 305. I told Norm that I did know about the race, however it was for cars and they held it in the spring of the year. Norm said that they now hold the event twice a year and he wanted to enter his high powered Cummins in the race this September the eighth three weeks from now.
I told Norm that he was crazy and that his Bandag super single drive tires would not be able to sustain speeds of over 100+ mph. for the 83.55 miles. I told the Flyin' Hawaiian that as soon as I get off this phone I'm calling the airlines because I want to be there for this great event.
Roger Ward is the mastermind behind this race. Roger is a two time Indy 500 champion from back in the sixties so you know that racing is in his blood. Now all we have to do is get a little diesel fuel in there and he'll be complete, racing with diesels, 10 wheels and 18,000 pounds.
The racing events started on Friday September 6th in Battle Mountain 223 miles east of Reno on Interstate 80 with a high speed practice on the frontage road along side of I-80. Norm and I arrived Friday evening so we missed the practice but the Flyin Hawaiian has been pulling his loaded trailer down route 305 at very serious speeds for several weeks in anticipation of entering his Western Star in the race.
Saturday morning we arrive at the Battle Mountain Civic Center for registration and tech inspection. Here we are in a class 8 truck along with 126 beautiful racecars. The crowd didn't know what to think. They couldn't believe that we were going to race this thing. They started to ask many questions such as how fast will it go? How much horsepower does it have? How much does it weigh? Whatever gave you the idea of doing something like this with an eighteen wheeler? We tilted the hood to show them the chromed NTC 855 cu. in. Cummins. We informed them that it has a cryogenic and balanced crankshaft, ceramic and teflon coated pistons, high lift camshaft, variable timing, high altitude turbo with a Mapwidth enhanced compressor housing, huge injectors and a high volume gear pump. Our fellow race car drivers were befuddled, Norm had more high performance parts in his truck engine than they had in their car engines. We also told them that the Cummins produces over 900 H.P, 50 pounds of turbo boost and 2500 foot pounds of torque. Now the race car drivers were concerned as to what was going to happen to the aerodynamics of their cars when this big white truck blows their doors off going down the long straight-aways.
Let me explain to you how this race is operated. This is a speed, time and distance race, which is very similar to E.T. drag racing. You pick the speed that you want to maintain for the entire 83.55 miles, your navigator works two stop watches to keep you on your time. This is a two-person race, and it's a blast, legalized speeding on a closed road with course workers in case you get into trouble. Our chosen speed was 95 mph. That is 36.42 seconds per mile.
Sunday morning at 8:00 am is race day and everyone has butterflies in their stomach. This is very serious racing. The fastest average speed is 186.848 mph,

which was run by Michele Doria of Costa Mesa, Ca. in an SCCA prepared 1992 Corvette. This is the girl to beat. She has won the last three races. Michele is so fast that the two airplanes that fly the racecourse can't keep up to her.
The very first car to start the race is a highly modified Pantera with a tubular frame and an aluminum block 460 cu. in. Ford engine, which produces 900 H.P. This car was built and driven by Charles Wilson. Unfortunately Charles has never finished the race due to engine failures. I wonder if he would be interested in a 500 + H.P. 5.9 B Cummins engine?
Now for the race: Once the first car leaves the starting line the remaining cars are all in line with the fastest vehicles in the front of the line. Every 30 seconds another racecar leaves the starting line. If you maintain the speed that you dialed in there should be very little passing because all of the racing vehicles in that class are spaced 30 seconds apart. However it wouldn't be much of a race if you don't pass somebody so its hammer down until you catch the vehicle in front of you. During the end of the racecourse you slow down to your dialed in speed.
The race course is new asphalt and its a very wide two lane highway with long straight-aways, wide curves which can be negotiated in a class 8 truck at 95 mph. There are slight up and down grades and the scenery is beautiful.
This is a run what you bring type of race and if your vehicle can maintain speeds in excess of 130 mph a roll bar and 5-point shoulder harness is required.
This is a serious race with serious speed and the following is a partial list of some of the vehicles in the race with their average speed. A 1965 Nova - 139 mph, 92 Corvette - 154 mph, 90 Ford Taurus - 125 mph, 1985 Western Star - 99 mph, 1935 Ford pickup - 133 mph, 69 Camaro - 95 mph, 87 Corvette - 156 mph and a 94 Dodge Viper at 128 mph. What a way to get a great adrenaline rush.
Norm "The Flyin Hawaiian" cruised his Western Star at 2400-RPM slowing to 2100 RPM for the curves. The average fuel pressure used was 150 to 200 lbs. and 30 lbs. of turbo boost. Norm apexed all the curves in his big white beast and drove a beautiful race passing the racecar in front of him that had a 2 minute head start. Norm was flyin' high when he hammered by while I blew the air horn. In fact all of the course workers and spectators throughout the race were giving us the sign for the air horn. The crowd loved seeing the Cummins powered diesel truck in the race. This was the first time a semi ever raced with cars across Nevada! When Norm crossed the finish line with the Jake brake on and the air horn blasting racing history was established. The crowd and all the other race car drivers cheered and the first person to congratulate Norm was Michele Doria, the record holder of the race. The flyin' Hawaiian had tears in his eyes as he removed his helmet. He never thought that racecar drivers would accept a gear jamming truck driver the way they did.
The next race is June 6,7, and 8 at Battle Mountain and we need twenty class 8 trucks and some high performance Dodge Cummins pick-ups. If you are interested please send to me a picture of your truck, and list the gear ratio, transmission, engine and horsepower. We may have a class where you can pull your trailer. If this goes well next June with trucks, the city council of Battle Mountain will entertain the thought of having an all truck race. This is our chance to prove that trucks are high performance vehicles, safe, fast and have a lot of class. Your truck will have to pass tech inspection and Gary Soloway, an owner operator from Boise Idaho, will be the head tech inspector and Master of Arms.
CHEAP PISTONS: Those of you who want to rebuild your engine and pinch every penny are buying poor quality pistons or cylinder kits. Out of every part in that truck that has to work its guts out when pulling a hill, what part works the hardest? Think about it. Its the aluminum piston. When the injector fires the heat above that piston is in excess of 1500 degrees. Aluminum melts at 1350 degrees. Then what in the world keeps the piston alive you might ask? It's the oil squirter nozzle shooting oil up underneath the piston dome trying to keep it cool so it doesn't melt. How often do you replace your oil squirter nozzles?

They are made out of plastic and are crucial to the life of your pistons.
I hope you can sense by the manner and tone of my writing that poor quality upsets me. Cheap does not belong in the trucking industry. Especially when it comes to engine parts. Nothing in this world can reflect more heat than ceramic and for the life of me I can't believe that anybody would build an internal combustion engine without ceramic coating aluminum pistons. My Jet Ski and snow mobile have ceramic-coated pistons and when my chain saw wears out it also will be rebuilt with ceramic coated pistons. Recently an OEM built a diesel powered vehicle to set the land speed record, and it did, and they came to us for ceramic-coated pistons. They know the value of ceramic. It cost $358.00 to ceramic and teflon coat six pistons for an NTC Cummins engine. In my mind that's pretty cheap insurance to extend the life of the pistons and please remember that this is the part of the truck that pulls you and your load up the mountain.
Every day we receive phone calls from owner operators that want to build high performance engines with cheap parts. I'm sorry, but the two just don't mix. The corner that you cut will come back to haunt you along the interstate some dark cold night. Please don't try to build my style of engine with inferior parts. I have spent hundreds of hours with several of the engineers and technicians at Cummins Engine Company in Columbus Indiana to design and build the world's most powerful diesel engine. Please believe me when I tell you that these engines are based around the highest of quality parts that we can obtain.
Who is Forest Lucas? What drives this man? Why are his products so damn good? In the next article we are going to let the cat out of the bag and explain to you what is in his oil products and why they work. After all forest was an owner operator born and raised in Columbus Indiana, same as Clessie Cummins. In 1962 he, his truck and his lovely wife Charlotte moved to Riverside California and began building a trucking company. There was one major problem however. The California and Nevada desert and trying to haul freight across them. Forest was forced to develop his own oil and grease additives so he could exist. You've heard the terms, fight or die, sink or swim. Well Forest Lucas loves life and the desert was his enemy and he won the fight. We will tell you the rest of the story in the next article.
Have you ever read the label on Paul Newman's salad dressing where he mentions that he is chained to the stove until he produces a barrel of his Newman's Own Salad Dressing? Well that is how I felt the week before Christmas in Clearwater Florida. Chained to eight motor homes powered by the "B" and "C" series engines. Several weeks ago I received a phone call from Ken Turner of Tampa FL. asking if I could increase the horsepower of his 190 H.P. "B" series Cummins in his motor home. Being this is the same engine that's in the Dodge pick up there is no problem, how much would you like? Ken asked for 230 H.P. and I said that's not enough. With our performance options he would have at least 250 to 280 H.P. With his loaded coach weighing around 20,000 lbs. he was willing to accept the additional power and torque.
To make the trip to Florida I would need at least six motor homes to work on so Ken went to work and came up with eight coaches requesting more power. Even retired people enjoy the feeling of horsepower and torque when moving a load. When I arrived at the beautiful home of Dottie and Martin Pierce in Clearwater Fl. on Monday morning there were six coaches waiting for me. It was an overwhelming feeling having all of that work waiting to be done and knowing my plane leaves the following weekend. We finished the last coach on Friday at 4:10 PM so there are now eight high powered motor homes roaming the streets of the sunshine state. Dottie Pierce is the president of Family Motor Coach and her husband Martin were wonderful hosts for this high powered tune up convention. Thank you Ken Turner, Dottie and Martin Pierce for making this possible. You're all wonderful people.
Here we go writing about something I said that I would never write about, Caterpillar engines. We do have the genuine Caterpillar cylinder kits available in ceramic and teflon just like the Cummins cylinder kit. If you're interested

in Cat ceramic-coated pistons please allow at least three weeks for delivery.
What we do have readily available is a high performance high output mapwidth enhanced turbocharger that will increase the manifold pressure by 5 pounds of boost and lower the exhaust gas temperature by approximately 100 degrees. This increase in manifold pressure is obtained on a stock 3406 B air to air engine. If the fuel is increased the boost will greatly increase. My understanding of the stock turbo on these engines is that they are almost inadequate for 425 H.P. at sea level let alone at high altitude. It always amazes me at how many trucks running across the Rocky Mountains at 1100 degrees exhaust gas temperature on the cold side. On the hot side, that equates to 1400 degrees. Keep in mind that aluminum melts at 1350 degrees. Thank goodness for oil cooling nozzles or you would not be able to cross the mountains.
High flow Caterpillar nozzles are the next item you need to produce horsepower from your 3406 B&C engine. Our nozzles are available from 10% to 40% more flow. You decide what you want and we'll build them for you and they will have warranty in case one should fail. Please keep in mind that we use all genuine Cat parts. We also increase the pop off pressure to clean up the black smoke and bring the injection timing back into specification. Did you ever wonder why a 425 Cat smokes when you increase the fuel delivery at the pump? Its because as the amount of fuel being pumped through the nozzles increases the nozzle opens sooner and closes later than it was designed for and the timing is being advanced with the nozzle opening sooner. As we all know advanced timing is bad for high horsepower diesels regardless of whose name is on the valve cover. With the pop off pressure increased the nozzle opens at the proper time and closes sooner also. This is why Cummins went to the big cam engine in 1978 to inject more fuel over a shorter period of time and with the Cat fuel system you want to obtain more fuel being delivered through the nozzle but at the same millisecond as the stock engine. By increasing the flow through the nozzle tip and increasing the pop off pressure we can obtain this. If you're interested in these high performance nozzles please allow three weeks delivery.
RESTRICTION: It will rob your engine of power. Whether it's an air, water, exhaust or fuel restriction. We are going to address the area of fuel restriction. In previous articles we talked about the advantages of replacing the standard number ten fuel suction hose from the fuel tank to the fuel pump with number twelve hose. The engine will perform better with less pressure from your right foot on the accelerator. When making this change, remove the existing hose and fittings and take them to your local Stratoflex dealer so that he will be able to supply you with the proper fittings. We also suggest the large Cummins spin on fuel filter designed for the 1710 cu. inch V-12 engine. This filter and remote mount base is very economical and will easily run for 30,000 miles before requiring a change. If your truck is equipped with a fuel filter restriction gauge you could possibly run this Fleetguard filter for 60,000 miles. The remote mount base will accept number twelve Stratoflex fittings and you conveniently mount this filter along the frame rails where a fuel filter should be. When you think about how many times you had to change the fuel filter late at night along side the interstate this conversion becomes very cost effective.
This large filter will reduce fuel restriction to the fuel pump and the engine will perform better and run smoother. The price of the filter and base is $44.78. The fuel filter, when its due for a change, is $16.27 and is available at any Cummins distributor. By the way, we always use genuine Fleetguard filters on our Cummins engines because Cummins owns Fleetguard and if there is ever a filter related problem you are covered by a very good warranty. I know a gentleman that had a brand X oil filter disintegrate and pollute the oil system on a V-12 in a drag line which resulted in spun bearings. The reply he received from the filter manufacturer was, we're sorry for any inconvenience our filter may have caused you however, we feel that we are not responsible for the spun main bearings in your engine. Since that experience there has only been

Fleetguard filters on my Cummins and Nissan filters on my wife's Maxima.
Cost Effective: How many times have you heard this since the recession of 1983. Every company wants everything to be cost effective. My personal feelings are, I could care less, especially when it pertains to my vehicles. If the item that I'm going to purchase will increase performance, improve handling, increase longevity, look good or make me feel better about what I'm doing, then that is good enough for me. Cost effective takes the enjoyment out of life and I'm only here for a short time. Think about every dollar that you spend and you'll realize that the majority of the money you spent in your lifetime was not cost effective. When your time on this earth has come to an end will you be able to look back over the years and say to yourself that you've enjoyed it?
Now here is a cost-effective log hauling Kenworth built by Leroy Cuttler and Marvin Hamilton. This is a man on a mission who must thoroughly love his work. After all, how many men take the time to maintain an older truck let alone build a twin turbo 1000+ horsepower KTTA Cummins just to haul logs? It doesn't matter what you haul, it's how you arrived! Leroy's truck is a 1978 A model with an 18 speed transmission. We will feature this truck again after we get to talk to Leroy.
Turbo Boots: What are they and why do they work. Why does keeping your exhaust system insulated allow for a cooler running engine? We all should know that restriction in the exhaust system will rob the engine of performance but why do we want to keep the turbine housing and exhaust pipes insulated? After we realized the benefits of insulating the turbine housing we were informed that we should wrap the first three feet of exhaust pipe from the turbo. Well, that seemed simple enough to us and we'll always try anything that will enhance performance without sacrificing engine life or fuel mileage. So we ordered a box of header wrap and on the end of the box was a paragraph titled, "How does it work"? One thing that is commonly overlooked by most racers is the matter of heat retention in the exhaust pipes. We have to remember that as soon as the combusted gasses leave the combustion chamber they start to cool down. As they cool they lose velocity and the scavenging effect is reduced. If the temperature of the gasses inside the pipes is kept as high as possible the net effect will be greater velocity, greater pressure drop in the system and higher efficiency. Very recently we have experimented with heat retention materials to improve the efficiency of exhaust systems. These shields retain heat in the exhaust pipes so the exhaust velocity remains very high. This will improve the scavenging effect. This is from Smokey Yunick's Chevy engine guide in Hot Rod magazine's high performance series. For those of you who were hot rodders from the 60's and 70's you must recognize the name Smokey Yunick.
More on exhaust systems: We recently rebuilt a CPL 1211 NTC 365 H.P. into a 700+ H.P. STC engine. This International was equipped with one straight through muffler so we thought that it would be OK. The story we hear all the time is "I only have one turbo and one pipe coming off the turbo why do I need two mufflers?
Here's why: With this particular International we installed our manometer to check the backpressure in the exhaust system. Using 1/2 of the fuel pressure available or 150 lbs. we had 40 inches of backpressure in the exhaust system. This was far too much. So we installed a second pipe with a KTA 600 straight through muffler and, on the next test ride using all 300 pounds of fuel pressure, we had only 8 inches of back pressure. That's an incredible drop for the addition of one more muffler and pipe. When the exhaust gasses are released into the exhaust pipe they immediately start to cool causing the density of the gasses to increase. Increased density means slower movement through the exhaust system. This causes the pistons to work harder to push the gasses through the mufflers and causes horsepower loss.
Another owner operator with an NTC 350 slightly turned up installed a dual 6" exhaust system on his truck and informed us that he gained 1/2 gear on the hills with a 13 speed transmission. One half gear increase is about 25 horsepower. If

he installs our dual fuel line kit he will gain another 1/2 gear or another 25 horsepower without touching his fuel pump or injectors. You see, building performance from an engine requires more than just turning the fuel to it. If your engine continues to gain horsepower without increasing fuel delivery what do you think is going to happen to the fuel mileage? Also do you think that you're going to enjoy driving this engine more? Remember the old saying: "Getting there is half the fun". Well in trucking getting there is all of the fun unless of course you enjoy loading and unloading your trailer. With a high performance engine your driving pleasure will be enhanced and you'll enjoy your work much more and have more pride in your ride.

Speaking of pride in their ride and appearance take a close look at Ron Kelsey of Peoria AZ. and his beautiful 1981 Peterbilt with 2,225,000 total miles. This truck is gorgeous and is equipped with a NTC Big Cam II 700+ horsepower Cummins engine built by Buffington's Diesel in Phoenix AZ. using Diesel Injection Of Pittsburgh high performance genuine Cummins engine parts. The 700 H.P. is routed through a 6X4 Spicer transmission both with overdrive and then onto a set of 3:90 Rockwell rears. This Pete is equipped with 11.25X5 rubber and has an estimated top speed of 120 MPH. At 1900 RPM the speedometer is pegged at 100 MPH. Exhaust back pressure? There isn't any because of straight 6" chrome stacks and dual Vortox 15" diameter 1700 CFM each stainless air cleaners. Needless to say this great running Cummins gets plenty of air to breathe. Polished dual 160-gallon fuel tanks and a lot of chrome accent the beautiful custom paint job. The paint is Tangelo orange, which is faded to a Wheatland yellow with gold sunrise pearl and is clear coated.

This Ron Kelsey Special truly deserves the title "Large Car". Not only is this beast powerful and fast, she looks great also!

Forget low gears. With today's engines you don't need low gears to have power on the mountain. Lets take a paragraph and talk about the Dodge Cummins pick up trucks. Many people are buying the 4:10 gear ratio versus the 3:54 gear ratio because they think that the truck will pull well on the hills. And what's worse is that the incompetent salesman at the Dodge dealership will talk them into the 4:10 gears. With a long stroke in line six-cylinder turbocharged diesel you don't need low gears for pulling. Keep in mind that many states have a 75-mph. speed limit on the interstates. With the 4:10 gear ratio the engine is way out of the horsepower and torque curve. In fact the governor is starting to cut the power back. With the 3:54 gear ratio at 70 mph is 1800 rpm. and 75 mph. is 2,000 rpm. The perfect rpm for pulling because peak torque is at 1500 rpm. on the "B" engine. I tuned up a 95 Dodge one ton dualie 5 speed manual transmission in Denver this past March and at stock settings the truck empty would only pull 68 mph. on I-70 at the 470 bypass intersection with my foot flat on the floor. This truck has 4:10 gears. After changing the torque plate, turbine housing, installing a turbo boost gauge and pyrometer this same truck held 80 mph. past the 470 bypass and on up the 8% grade into the Rocky mountains without having your foot flat on the floor.

Unless your Dodge is to be used to pull extremely heavy loads and your only going to operate off road or on two lane roads stay away from the 4:10 gear ratio. Low gears are a poor way to substitute for low horsepower.

Even in an 18 wheeler I feel that you're better off pulling the load in direct gear versus overdrive. I like overdrive transmissions but I feel you should be able to cruise along the flats and uphill grades in direct gear. Overdrive is for going down grades, running empty or if you're going to run in excess of 70 mph. The 13 speed transmission is only 13% overdrive and that's OK for cruising. Keep in mind that it takes 268 horsepower to maintain 70 mph. on the level pulling a van with no head wind. More horsepower gets to the rear wheels in direct gear.

Air cleaners: If you have an FLD Freightliner and need more air for the engine there is room in front of the steering tire on the right side. Its just a short distance to the turbo from there and we draw air from behind the front spoiler.

We use a Farr Ecolite air cleaner that is 1500 CFM and coupled with the stock air cleaner gives the engine about 2700 CFM. Air filter restriction drops to about 2" with this combination.
Marion Robertson of John's Island, South Carolina was the first owner-operator to try this combination on his Freightliner and we tried it on Chris Vasileff's 770 H.P. STC Cummins engine.
Freight Rates: This is a subject that I should avoid however you're being raped at 83 cents per mile. Take an average of 2500 miles per week and figure out what it costs you to live each day. My figures are low but this is the minimum it cost you to pull a load across the interstate. At $1.17 per mile go and get a calculator and list every dollar you spend per month on truck payments, fuel, gas for your family, food for you and your family, clothing, insurance, trailer payments, taxes, license plates, tires, oil. Engine, transmission, clutch, and differentials wear out at about 2 cents per mile, drivers wages of only 10 cents per mile, mortgage or rent payment and don't forget the utilities at home and you'll find that $1.17 per mile is very low. The average owner-operator being on the road for five days put in 120 hours per week and this doesn't count working on the truck on Saturday. I may be wrong, if you have some figures of what it cost per mile please mail them to me. Guy Gregg, President of Herb Gregg Trucking from New Kensington, PA, has some detailed figures for his fleet of trucks and next month we will publish his figures.

A woman's point of view on horsepower:

Phyliss McCauley of Kansas started driving the family farm tractor at the young age of 9 years old. She knew at this young age that the better the tractor would pull the plow the easier her day would be. Phyliss has been driving a semi for 27 years and in 1974 she purchased a 1693 T Cat and had it opened up. She thought that she had the cats meow. Several trucks later Phyliss purchased a 1987 T-600 Kenworth ex fleet truck. This K.W. was equipped with an NTC BC IV 315 horsepower, 9 speed direct transmission, 3:36 gear ratio, single air cleaner and single exhaust. About 3 years ago Phyliss came across our horsepower and torque articles in Truckin' Magazine and knew that she wanted an 800 H.P. NTC Cummins engine. She got her husband Gregg involved and they started making changes to the T-600. First was dual exhaust with KTA 600 mufflers for low backpressure. Now it was time to rebuild the engine, which had 1,100,000 miles on the odometer. Todd Petrowsky of Kansas Truck Center assembled the engine using our ceramic and Teflon coated pistons, high lift cam, mechanical variable timing, premium gold heads, high flow injectors, high volume fuel pump, dual power valve, mapwidth enhanced turbo, turbo boot, fuel pressure gauge and dual fuel line kit. End result: Turbo boost, 50 lbs, fuel pressure, 450 lbs., horsepower, 800 plus.
Quote from Phyliss McCauley, "This high performance Cummins engine is the ultimate in driving pleasure." She also says that some younger drivers will try to block her in because they don't want to be passed by a woman.
Gregg has said, that while he was sleeping in the bunk, he would feel and hear the raw horsepower coming to life. As he peered from the bunk there was Phyliss, at 2400 RPM, 450 lbs. fuel pressure and 50 pounds of turbo boost as she was hammering another man into the asphalt.
With 3:36 gears and a 9 speed direct transmission this T-600 climbs Vail Pass on I-70 east bound in 8th gear at 50 mph. using only 150 to 200 lbs. fuel pressure at 80,000 lbs gross weight. When leaving Kansas and going to the west coast via I-70 to I-25 to I-80 across Wyoming the McCauley's never shift out of 9th gear. Cabbage Mountain in Oregon going east bound Gregg was loaded and running with a empty 3408 Cat. Gregg was using up to 300 lbs of fuel pressure in 8th gear because of the curves.
Future plans for this Kenworth are new frame rails to make room for the new 134" sleeper, 13 speed or a 4 speed auxiliary transmission and a new paint job. Phyliss and Gregg have redone the interior and don't wear their shoes in this clean truck. She keeps white towels over the black carpet. I had a three-hour

breakfast with Phyliss and Gregg in Salina Kansas this past March and it was a pleasure to spend time with a husband and wife team that love what they do. It's really neat to meet a woman that enjoys horsepower as much as I do.

The Pony Express race from Battle Mountain Nevada south on Rt.. 305 to Austin Nevada. A distance of 83.55 miles is on schedule for June 6,7, and 8, 1997. So far we have 24 class eight trucks registered to race. We even have a Ford pickup truck with an 8V92 stuffed under the hood that ran the Bonneville Salt Flats at 154 MPH, it's going to be there. Also a 1946 Corbett with an NTC 475 Cummins and a LTL Ford 9000 with a VT-903 Cummins, double over 13 speed trans. with 3:55 Gears. The Corbett and the Ford are ex racing trucks from Great American truck racing. By the way the Corbett can run 157 mph, not bad for a 1946. We also have several Peterbilts, Kenworths, one Freightliner and two cabovers that are going to race. One of the Peterbilts has a 550 Cat with a double overdrive 18-speed transmission with 3:08 rears on tall rubber. He will be fast. My old friend Dwain Pyeatt will be racing a 96 Peterbilt with a 525 Cummins, double over 18 speed transmission with 3:36 gears however his computer will limit the speed to 99 mph so now we have to find a way to bypass the speed sensor on Dwain's truck. My good friend Larry Selkirk is racing his cabover K.W. with an NTC 475 Cummins built by Diesel Injection. We are going to have a great time. So if you're in the area plan to spend the weekend with a great group of racers at Battle Mountain. Please keep in mind the person to beat is Michele Doria in a 1992 Modified Corvette with an average speed of 186.848 mph. She's sharp and she is fast!

MVT, which stands for mechanical variable timing, has a bad rap bestowed upon it from uninformed mechanics. Because of this bad rap many owner operators are afraid of this great item. With the MVT you will gain engine life from your B.C. II, III, or IV if you're building high horsepower. Because of the constant supply oil system and the manual cut off switch the MVT is living for the entire life of the engine. With the MVT, high lift camshaft and our ceramic and Teflon coated pistons 700+ H.P. is developed easily.

Our booklet on high performance Cummins engines is getting so big that we can no longer afford to give them away for free. We regret having to charge for the booklet however, the elaborate copy machine, paper and toner is costing over $1000.00 per month and our postage bill is around $1800.00 per month. Because of this high expense we now have to charge $9.00 for the booklet. To offset the expense to our future clients we are enclosing a $10.00 rebate coupon toward their next purchase of high performance Cummins parts from us.

Think about this statement: Life in itself is good, it's length we cannot control, only it's quality. Yes, you can control your own quality of life and horsepower and torque in excessive amounts is one way to do that. Especially when you drive 2,000 miles per week. Low power in a truck equates to low quality of life during your working career. You may never live to see retirement so you might as well enjoy your work.

High horsepower does not mean high fuel consumption. In fact just the opposite is true. The majority of the time fuel mileage increases with power. The beautiful NTC 444 Cummins engine, beginning with CPL 910 through 1280, produces excellent horsepower. Simply by increasing the injector flow by two sizes, setting up the fuel pressure, installing the dual fuel lines to the heads, #12 suction line from the fuel tank and of course the mapwidth enhanced high altitude turbo and this beauty develops 618 H.P. to the ground or 770 flywheel horsepower.

We are out of space so next month we will tell you more about Charles Chaney's NTC 444 900+ H.P. Cummins engine and how it charges up Fancy Gap mountain in Virginia at 65 mph. with a G.V.W. of 80,000 lbs. Charles will be racing this truck in the Pony Express race across Nevada with us. Actually the race is only 83.55 wide-open miles but it's a blast!

You missed one great race and a super time at Battle Mountain Nevada. The race is called the Pony Express Race, which is on RT... 305 from Battle Mountain to

Austin a total of 83.55 miles and you can drive your vehicle at any speed above 95 mph. Roger Ward, his lovely wife Sherry and their beautiful daughter Denise, promotes the race. Roger won the Indy 500 twice back in the 60's.

The festivities started on Friday June the 6th, with registration and a five mile flat out race to establish an average speed. Friday evening an hors d'oeuvre party and a light parade through town with all class eight trucks and one Dodge Cummins pickup.

Saturday morning was set aside for cleaning the vehicles, registration and a car and truck show was scheduled for the afternoon. Saturday evening was a racecar show through town with 145 cars entered. Sunday morning we all meet at the high school parking lot for the start of the race. Norm Murakami was on an adrenaline high even before the race started. If you recall Norm "The Flyin Hawaiian" was the first class 8 tractor to ever enter this type of racing. Norm was representing Lucas oil products and distributing Lucas fuel conditioner and oil stabilizer to all the big trucks in the race. Forest Lucas is a stock car racer and loaned his racing suit to Norm. He was high from the moment he put that suit on.

This is a time, distance and speed race. You pick the speed you want to average and you must cross the finish line on that second. The navigator works two stop watches and has a printout of the mile markers and its his job to slow down or speed up the driver.

In the truck division we had seven entries, Norm Murakami in his Cummins powered Western Star, Butch Schuman in his hand built Kenworth that is Cummins powered, Dwain Pyeatt and his lovely wife Cozette with their new Peterbilt also Cummins powered, Jim Hagemann with his Peterbilt COE Caterpillar powered. The only Cat in the race and there were more Caterpillar powered pre registered trucks than Cummins, but only one showed up. What happened to all you proud Cat owners? When it came time to race and show us die-hard Cummins people how a Caterpillar performs you don't show up! Rumor has it that the same thing happens out on the highway when your approaching a mountain when you know there is a high performance Cummins on your back door. Jim Hageman is a fine gentleman and we enjoyed having him with his beautiful cabover. The first COE to ever do this type of race. Rex Oneto raced a "A" model Kenworth logging truck. Rick Trotter raced a Volvo with an 8V92 Detroit. This is a retired G.A.T.R. circle track L-9000 Ford with a VT-903 Cummins that was built and raced back in the 1980's. Art Dick has an 8V92 Detroit in a 1985 Ford pick up F-250 with an F 450 front axle and a 38,000 lbs. rear axle. This pickup runs across the salt flats at 156 mph.

Last but not least we had a genuine Cummins engineer race his high performance Dodge Cummins pick up. His name is James Ray and his daughter Jeanie navigated him across the finish line to a first place in the 95 mph. class. James is the builder of the "LSR" (land speed record) Dodge that Richie Petty drove on the Bonneville Salt Flats last September.

Last to start the race was Charles Chaney and myself, Bruce Mallinson. I was the navigator for Charles in his 900+ H.P. 444 Cummins powered Peterbilt. We did not win. His truck was too fast and we crossed the finish line 66 seconds too soon. However we had a great time and even called his wife on the cellular phone at 118 mph across the desert to let her know that everything was just fine.

We have got to tell you about Butch Schuman's hand built 79 Kenworth. The wheelbase is 310 inches long with a double high rise bunk. The top of the bunk is 13' high. This truck is equipped with a KTTA twin turbo 1150 cu. in. Cummins engine producing around 1,200 H.P. H.V.T., which is the same as S.T.C., or step timing control with tall rubber 3:55 gear ratio and a double overdrive 13 speed transmission. This K.W. will fly. At 85 mph. Butch can break the rear tires loose pulling an empty livestock trailer. Now if you don't believe that just ask Norm Murakami because he was riding in this truck and felt the drive wheels spin. Butch is one great Texan with a huge K.W. After all, isn't everything big in Texas. Butch has a rear door to the bunk, which opens to the back porch that

has a removable beach umbrella. The fellow car racers were so impressed with this truck they voted it the best in the show and he won second place in the 100 mph. division.
My good friend Charles Passmore from Tampa Diesel Service spent the weekend with us and he enjoyed the race and we enjoyed his company. Charles Passmore was the originator of Diesel Injection in Pittsburgh and he gave me his business so he could move to Florida in 1977. This is our twenty-second year anniversary.
It's hard for me to believe that there are some mechanics in this country that do not believe in LPF or Lower Press Fit cylinder liners. Remember when the NTC series of engines would only run for about 300,000 miles before there was holes in the liners or the blowby was excessive and they had high oil consumption. The lower press fit liner is the main reason that all of these problems are way behind us now. Before lower press fit, the top of the block would hold the liners from moving. The block would wear from front to back causing the round hole to become egg shaped or oblong. When the injector would fire the compression would force the liner oblong so now the perfectly round piston ring could not seal properly in an egg shaped liner. This situation caused blow by but worse than blow by was the liner cavitation or holes right through the liner. The holes are caused by piston slap against the liner creating bubbles in the cooling system. These bubbles form on the outside of the cylinder liners and implode (collapse inward) with enough force to blast the liner and create pits. The amount of pressure that is created as the bubbles implode is about 14,500 psi. Micro jet shock waves can also be generated and the speed of these waves is about 1,200 mph. This is one of the reasons holes develop in the liners and the other is using hard water and not enough DCA #4 coolant additives. Try to use soft water, pre charge Fleetguard water filters with 15 units of DCA when changing the coolant. Normally a standard 4-unit Fleetguard water filter will maintain the system when replaced at every oil change. Your local Cummins dealer or distributor can test the coolant for a proper "charge".
When your mechanic is from the old school and states that he doesn't believe in lower press fit liners, I would suggest finding another mechanic. It's my opinion that this is the main reason why the NTC series engines will run 700,000 to 800,000 miles between rebuilds.
By the way, ceramic and teflon coated pistons also help eliminate piston slap because the teflon on the piston skirts is soft and eliminates about .001 thousands piston to wall clearance. The engine runs quieter because of the reduced piston slap.
Lucas oil products now has a green chassis lubricant that has a better spec than the leading synthetic grease. I used this red synthetic grease for the past 19 years and it worked fine on ball joints and tie rod ends. However, on wheel bearings on snowmobile and boat trailers it would turn a milky brown in about 1500 miles. The Lucas green grease stayed green and holds its consistency after 6500 miles of towing in snow country. Compare the specs of a tube of Lucas grease with the grease you are now using and you may want to switch brands. If you know a lubrication engineer have them help define what the spec. means. I had one explain to me the difference in greases. Or if you would prefer just give Forest Lucas or Marty a call at Lucas Oil Products in Corona Ca. 800-342-2512.

"Quote of the month."
"When health is absent, wisdom cannot reveal itself, strength cannot be executed, wealth is useless and reason is powerless."
This month we are going to feature a particular NTC 444, CPL 821 which is in a 1987 W900B Kenworth owned by Don Stouffer of Dixon, Ill.
Before we talk about the performance enhancements that were performed to this 444 I would like to thank Chuck Norton of Truckin' Magazine for printing our articles for the past five years. Chuck is the owner/publisher of Truckin' Magazine and is taking a temporary leave of absence from the world of

publication.
Now on to horsepower and torque: About 4 years ago an owner operator by the name of Don Stouffer contacted us to see what could be done to his NTC 444 Cummins engine to gain more performance. The engine had recently been rebuilt and was running fine as a stock 444. However Don Stouffer is addicted to performance and is not satisfied with stock horsepower. His Kenworth does have dual exhaust and dual air cleaners, which are a must for performance. The transmission is a 14-6-13 speed and the rears are 40,000 lbs. and a ratio of 3:70. So he had many of the right components. The first changes were to build a much larger set of STC injectors, a high volume, high pressure fuel pump, mapwidth enhanced turbo with a turbo boot, dual fuel line kit and a liquid filled fuel pressure gauge.
The boost gauge and pyrometer were already in the instrument panel however the thermocouple for the pyrometer was in the exhaust pipe so Don installed another pyrometer and installed the thermocouple in the exhaust manifold right in front of the turbo.
The next item installed on this truck was a Harvard 750 Luberfiner bypass oil filter. The Harvard element is a 1-micron paper element that will absorb water and actually polishes the oil.
The cooling system: all Cummins engines were equipped with a low flow cooling system since 1986 so we had Don install another air tank and run coolant lines from the block to the tank and back to the water manifold to add seven more gallons of coolant.
Timing of the engine: As horsepower goes up the timing must be retarded to ensure piston life. Fast timing will crack pistons. Being an ex drag racer Don had no problems doing his own mechanical work and changing the timing.
The end result of this work is one terrific running NTC 444 CPL 821 Cummins engine. This engine now has 345,000 miles since the high performance parts were installed and there is no oil consumption, no leaks of any kind and Don recently checked the main and rod bearings and they were fine.
Driving this KW gives Don great pleasure. The additional 300 horsepower removes the boredom from those long weeks where he has to drive up to 4,000 miles. Don says that his Cummins never dies on a hill or a mountain. When pulling the long grades he usually keeps the fuel pressure around 200 PSI and the boost around 30 PSI. The pump will develop 350-lbs. of fuel pressure and the turbo will produce 42 lbs. of manifold pressure. However there is never any reason to run this beast wide open and if you do you can feel the power right up through the seat. Don claims that he is a power nut and the engine gives him a thrill on every hill and with all of the gauges monitoring the engine its amazing the picture you get while working this beast. Don Stouffer is a very knowledgeable gentleman. If you ever have the chance to have dinner or run down the interstate with him you will enjoy his company.
At this time I would like to mention a father and son team that are very good friends of mine. We snowmobile, ski and go truck pulling together. Their names are Jim and Jon Anderson from Allison Park, Pennsylvania. Their shop is located just south of exit 4 of the PA. Turnpike. Jim has been involved with trucks for 40 years and his son Jon was a jet engine technician for Delta Airlines. Their main business is selling and building tow trucks and rollbacks. I don't think that there is a man alive today that knows more about wreckers than Jim Anderson. As for his son Jon, he is one sharp fabricator and welder. He is also a drag racer and he won the national street car drag championships this past October in Gainsville Fl. with a time of 8.01, 176 MPH in his big block 1978 Malibu. Jon, his other brother Ken and father Jim built this car in their clean facility in Allison Park. At the present time Jon is building a sub frame under a T600 Kenworth cab and double bunk sleeper and at the rear of the subframe will be a Cabmate 3 bag 4 shock air ride system. We are using Dodge pickup cab mounts in front to help absorb road shock and noise.
Diesel fuel, you've got to get it into the combustion chamber quickly, air free, and at the precise time in order to develop horsepower and torque. Once

ignition occurs the piston is forced downwards creating the power stroke. Then on the upstroke the exhaust or burned hydrocarbons must be evacuated from the combustion chamber. All camshafts have what is called valve overlap and what that means is the intake valve begins to open just before the exhaust valve closes. This is the beauty of a turbocharged engine. The compressed air or intake manifold pressure enters the combustion chamber and forces out the burned hydrocarbons or exhaust. This process is called scavenging the combustion chamber. Now, what happens when all of the exhaust doesn't get evacuated out past the exhaust valves and through the turbocharger? Simply put if the exhaust backpressure is greater than the intake manifold pressure, the exhaust will enter the intake manifold once the intake valve opens during valve overlap. This is not a good situation and you certainly don't want this taking place in your engine. The results of excessive backpressure are high exhaust temperatures, poor fuel mileage and a tight running engine. What do I mean by a tight running engine? If your engine feels like you always have to push it, your foot is always into the throttle, the engine feels as though its being choked at highway speeds it just doesn't want to glide along the highway, this is what I call a tight running engine. Too small of an air cleaner can also cause this problem, however in this article we are going to concentrate on the turbocharger and exhaust system. In today's society everybody wants more boost or intake manifold pressure and to obtain more boost you decrease the size of the turbine housing (exhaust housing) of the turbocharger. Now that the exhaust has to pass through a smaller orifice or turbine housing, the velocity of the exhaust increases and the turbine wheel (exhaust wheel) spins faster which in turn spins the compressor wheel forcing more air into the intake manifold. Now all of this may sound good so far however once the size of the exhaust housing is decreased the piston on its upstroke must now work harder to force the exhaust out of the combustion chamber through the turbocharger.

The smaller the exhaust housing of the turbocharger the greater the back pressure in the exhaust manifold and combustion chamber, the tighter the engine will feel, and this is not so good. Now don't be thinking that going to a larger turbine housing is the answer because if you go to the large the back pressure will drastically drop and so will the intake manifold pressure and the exhaust gas temperature will rise. So how do we keep the boost up, exhaust manifold pressure down and also keep the exhaust gas temperature down so that we can have a free running engine?

No. 1: Make sure that your truck is equipped with dual air cleaners and they are large enough for your engine, remember as horsepower and intake manifold pressure increased so does the required CFM (cubic feet of air per minute). A stock BCIII 400 uses 1060 CFM when boosted to 500 H.P. the CFM is 1325, at 600 H.P. the CFM is 1590, 700 H.P. is 1855 CFM. Large air cleaners outside of the engine compartment are invaluable.

No. 2: Dual exhaust with straight through mufflers, 6" or 7" exhaust is much better than 5" keep the 90 deg. bends to a minimum.

No. 3: Install a turbo boost gauge in the exhaust manifold before the turbocharger. Drill a 29/64" or 7/16" hole in the exhaust manifold and tap the hole with a 1/4" pipe tap. Now install a brass fitting with 1/4" pipe threads and a coupler for 1/4" dia. brass or steel tubing. Use about 3' of the 1/4" tubing then you can reduce down to 1/8" plastic tubing to go through the fire wall and into the instrument panel and couple the tubing to the boost gauge. Now you have two boost gauges, one for the intake boost pressure and one for the exhaust manifold pressure.

What are these gauges going to inform you of? During cruising speeds on the level the exhaust backpressure should be approximately 66% of intake pressure. While pulling moderate grades the exhaust backpressure will increase more than the intake pressure will however it should still be less than the intake. At wide open throttle the exhaust pressure may be greater than the intake pressure but only by 2 to 3 pounds of pressure.

What does all of this mean? If most of you trucking is on level ground or rolling short hills, its best to have a larger turbine housing to minimize the back pressure. If the majority of your trucking is in the city with a lot of stop and go driving, than a slightly smaller turbine housing is preferred. The smaller housing is good for quick turbo response and instant boost, however on the open road the backpressure may be too high.

High altitude operation of 5,000 feet or more will also require a smaller turbine housing because at 10,000 feet elevation there is one half of the molecules of oxygen than at sea level and a loss of 3% horsepower for every 1,000 altitude your climbing. So at the Eisenhower tunnel on I-70 in Colorado the altitude is 11,400 feet and your 400 horsepower engine is now 268 horsepower. The pyrometer heat or exhaust gas temperature will be about 200 degrees hotter at the top of the mountain also. If you spend the majority of your time at high altitude you may have to experiment with several different turbos to find the one that meets your particular requirements.

What works good for your friends truck might not be the ideal set up for you. Naturally trucks that run along the East Coast and stay near sea level are the least complicated to work with. About the East Coast, high humidity displaces oxygen so that can throw another monkey wrench into the equation.

Now that you have this additional knowledge you'll find out that there is no perfect turbocharger for all situations. You have to compromise. What's good for the city driving is not perfect for highway driving. What's good for the open level road isn't perfect for high mountains.

Wastegated turbochargers are not the answer. The wastegate is set to open at a predetermined PSI setting and at cruising speeds. The backpressure is usually equal to the intake pressure. Wastegated turbos usually use a very small turbine housing for quick response. This is great for city driving, but not ideal for over the road. At high altitude why would you want to dump the exhaust overboard when you need the extra boost to keep the engine cool.

The newer turbos that are used on the electronic engines should not be installed on the older mechanical engines. The electronic engines use very high compression ratio pistons, which produce less exhaust volume so they need smaller exhaust housings than the older low compression mechanical engines.

Westbound and down and you'll never guess who is back on the road once again. In 1989 this man parked his last truck to devote more time to his oil business.

Four years ago I had the pleasure of meeting the man who developed the finest fuel conditioner that we have ever tested in our 21 years with Cummins diesel engines. We invited Forrest Lucas to join us for a day of testing and he was shocked at how 800 horsepower walked 80,000 pounds over Indio Mountain. That feeling of power has stayed with Forrest for the past four years and this past month had the opportunity to purchase a T-800 Kenworth with a Diesel Injection of Pittsburgh NTC 800+ horsepower Cummins engine. At the time of this writing Forrest Lucas and his T-800 KW are in our shop being super tuned by Pete Sharp our vice president.

There is an old saying, "You can take the driver out of the truck, but you can't take the truck out of the driver." This is a very true statement and this T-800 KW is going to be used by Forrest to take an occasional run across this country to deliver Lucas oil products to his clients.

Forrest is a circle track stock car driver and is known to be aggressive on the track, so if you see a dark green T-800 KW charging up the mountain behind you, move over because here comes an ex truck driver with a new toy!

The KTA 525-600 Horsepower, 1150 cubic inch Cummins engine is still the largest engine ever developed for on highway use and this is our engine of choice for heavy hauling. Another old saying is "You can't beat cubic inches." That certainly holds true for this engine. We still have high performance parts available such as twin turbo's, high flow injectors and high volume high-pressure fuel pumps. If you want 800 to 1,200 horsepower this is the easiest way to get it.

In the United States, and probably the world, we have two king of the highways when it comes to brute power, Butch Shuman from Tye Texas and Ken Hopkins from Rhode Island each have approximately 1,200 horsepower Cummins Diesel engines. I sure wish Hawthorne Power Equipment, the Caterpillar distributor in southern California, would have their Dyno Days again. We would show them and the world that Cummins is the undisputed power champion of the world.

Good luck and have fun, please write to me with your intake and exhaust back pressures, lets make your engine run more freely.

The answer is NO! I did not sell Diesel Injection. I love this business.

However, we have made some changes in the management department. Gary Hoffman has moved from service manager to the position of President. Gary has been with us for over 19 years and is considered by many of our clients to be the finest Cummins engine diagnostician in the country.

Peter Sharp, our number one technician, has been promoted to Vice President. Pete has been with us for 15 years and also is an excellent troubleshooter and mechanic. If you purchase your parts from us these two gentlemen will be your tech advisors and will assist and advise you in any way they can with your engine building needs.

I have moved into the position of CEO. That is a big title for a small company. Because of the popularity of all the Cummins engines I have been doing a lot of traveling.

Now, on to Horsepower and Torque. Would you believe that lobster boat owners enjoy high horsepower. We now have two 800+ horsepower marine engines running off of the coast of Maine. In fact, we are supplying the parts for a 1200HP NTC BC III marine racing engine for a lobster boat. Did you ever think that captains of lobster boats race in the ocean? It is certainly a power hungry world out there. While we are on the subject of marine engines some of our high performance B engine parts are in use in the Florida Keys.

Now, on to trucks: Shell oil company has a calendar that feature beautiful trucks owned by owner operators. We at Diesel Injection of Pittsburgh, Pa. are proud to say that two of the twelve trucks featured are running our 800+ horsepower engines. Great looking trucks with awesome running engines. It just all fits together and life is good! The proud owners of these two trucks are Dave Brewer and Billy Baker. Dave owns a '72 Pete and is from Tulsa Ok. And Billy is from Ontario Ca. Keep up the great work and attitude gentleman. It's a pleasure doing business with you.

The following list are the 5 easiest items you can change on your engine to increase performance:

1. Dual fuel line kit (approx. 25HP). This kit evens out the fuel pressure in the heads.

   Replace the fuel suction lines with number 12 hose. Try to eliminate 90-degree fittings if possible.

   High-pressure fuel pump with the high flow gear pump. This combination makes driving a pleasure. Fuel mileage may improve and horsepower will increase by 100 to 150 if you change the injectors to our high flows and go with our big turbo.

   Liquid filled fuel pressure gauge installed in the dash. This gauge will increase your fuel mileage if you pay attention to it and it will keep you informed as to the condition of your fuel pump. The fuel pressure, turbo boost, pyrometer and tachometer gauges are the crucial ones needed to properly drive a high performance engine.

   Large V-12 remote mount fuel filter. This filter lasts longer, is economical and reduces fuel restriction. The filter head will accept #12 fuel line fittings.

The above items can be added in any order and as you change each item you will notice a power improvement. Also, don't forget about the Donaldson KT-600 mufflers. They are economical and low restriction.

One more thing: Our engines do not smoke. If your engine smokes at an idle, when

the water temperature is above 160 degrees, the valves and injectors may need adjusted. If the adjustments only hold a setting for a few thousand miles the engine has one or several of the following problems:

1. worn rocker boxes

worn adjusting screws
worn injector push rods
worn injector links

If the parts are worn replace them or the smoke will never clear up.

With this issue of the magazine we are going to change the format of this article to a question and answer column. You ask the questions, we'll supply the answers.

John C. of Charleston, West Virginia sent the first question to us: I own a BCII NTC 350 CPL 632, what should I do to obtain more power? My engine has 236,000 miles since the last in chassis rebuild and I don't want to change the pistons.

This is a good question and asked quite often. The first thing we need to know is how much horsepower and torque do you want? So we are going to answer this question based on a horsepower requirement of 400 to 425 and then 450 to 500 H.P.

For 400 to 425 H.P. the first item to be added to the engine is a dual fuel line kit, this evens the flow of fuel to all the injectors. The next item is the injectors. BCII and III 350's have very small injectors and the flow must be increased by two sizes in order to obtain power. In order to supply fuel to larger injectors the fuel pump must be re-calibrated to supply more volume. Those three changes will deliver the additional 75 horsepower. We recommend that a turbo boost gauge, pyrometer, and liquid filled fuel pressure gauge be installed to monitor the engine.

For 450 to 500 horsepower the head gaskets should be replaced with our .013" thicker gaskets to lower the compression ratio. The camshaft should be removed and the off set key changed to retard the timing. With these two changes we would go to a larger cup on the injector and increase the flow by four sizes and naturally the flow on the pump would be increased. The fuel suction line should be increased to size number 12. This line runs from the fuel tank to the fuel pump. As the horsepower goes up the volume of exhaust also increases so a larger turbocharger should be installed. With more flow in the exhaust system dual exhaust is preferred with straight KTA 600 mufflers made by Donaldson. On the intake side dual air cleaners make for a nice finishing touch.

Question number two is from Sam W. of Hartford, CT: What is a dual fuel line kit?

Several years ago while troubleshooting a power problem on a small cam 350 we made this discovery. This truck would only run 26 MPH and the injectors were one size larger. The flow of the fuel pump was increased by 50%. This COE Kenworth would not perform even though the fuel pressure gauge, that was recording fuel pressure at the shut down solenoid, was recording 250 PSI. I removed the fan support to gain access to the plug in the front head of the fuel galley and installed a second fuel pressure gauge and went for another test ride. There was still 250 PSI at the fuel pump. However, there was zero fuel pressure at the front head. The fuel was not getting through the heads. While standing there, staring at the engine, I noticed the fuel line from the solenoid to the rear head was #6 Aeroquip rubber hose. Upon removing the hose we cut it into small sections and found the hose was swelled shut from the reaction of diesel fuel to rubber. A Cummins copper-coated steel line was installed and the power problem was resolved. During the final test run we had 250 lbs. fuel pressure at the pump but only 200 lbs. fuel pressure at the front head. From injector number 6 to injector number 1 there was a loss of 50 lbs. pressure. Since some Cummins engines produce two horsepower per pound of fuel there would be a 100 H.P. loss from the rear cylinder to the front cylinder. Could this be why the rear pistons usually are the first to fail, and could this be why the engine runs rough when

pulling a hill?
Marvin Winship from Buffalo, NY. was our first client to try the dual fuel line kit on his NTC 475. On the Cummins dyno in Buffalo his Peterbilt put an additional 21 H.P. to the ground with the dual fuel line kit. That is 26.25 H.P. at the flywheel without increasing the fuel pressure.
Each day we receive phone calls and letters from owner-operators and mechanics asking various questions and this question is asked quite often. I have an older truck in great shape and its time for a new engine, what should I build, an MVT or STC engine? If you have been following our technical articles for the past six years it is quite evident that we have been very successful producing in excess of 700 horsepower from either engine. So to answer this question we are going to list the advantages and disadvantages of each engine.
To build high horsepower with a big cam II, III, or early BCIV is it more feasible and economical to use the high lift camshaft and mechanical variable timing (MVT)? This system was designed for use on the BC II and III so there are no other modifications that must be made other than increasing the travel of the top stop setting on the injector. Years ago the MVT units had some engineering problems and reliability was a major concern. This has all been corrected and our MVT units are 98% trouble free. Most mechanics in the United States are not familiar with how the MVT operates and instead of learning they usually denounce the advantage of the system and remove it. One man's trash is another man's gold and the mechanical variable timing system with the automatic oiling system and shut down toggle switch have been a life saver for owner-operators wanting in excess of 600 H.P.
The step timing control (STC) engine also has benefits if the truck was originally designed for this application. There are only two negative aspects of the STC engine, which are the low flow cooling system and the price of the injectors. As for power, this engine is a beast with injectors flowed two sizes larger, a dual fuel line kit and high volume fuel pump. On the dyno at 300 pounds of fuel pressure the STC engine will produce 618 horsepower to the ground which is 772 flywheel horsepower.
By now most of the mechanics throughout this country understand the STC engine more than the MVT engine. Both engines idle with advanced timing to eliminate white smoke and when producing more than 100 horsepower the timing is retarded to extend piston life.
It is possible to convert the low flow cooling system to a high flow system if water temperature is a problem. Here are the items that must be changed. (May vary depending on CPL)

1. Water tube to the water pump
   Water tube to the oil cooler
   thermostat, seal gaskets and bolts
   Water pump and bolts
   Water filter head, bracket, and shut off valves
   Idler pulley and bolt.

Many times the radiator can have the baffle plates removed and on the top tank a hose inlet for returning hot water be installed so the existing rad can be utilized.
In conclusion: Both the NTC/MVT and STC Cummins engines perform superbly above 600 horsepower. When properly built using ceramic and teflon coated pistons and premium gold Cummins Recon heads a high performance engine will run a full service life. Always use genuine Cummins engine parts. The engineering, testing and quality of genuine parts far exceed the other brands.
On every great running engine there must be a high volume fuel pump and six high flow injectors. Regardless of how extravagant you go on building the engine, the fuel pump and injectors along with a few other factors, determine how much horsepower and torque will be developed. If the engine was a human body the fuel pump would represent the heart, the injectors would be the veins and arteries, and the turbocharger would be the lungs. Naturally they are very important

components and they help each other function, but the heart (fuel pump) must be strong if you are going to gallop over the mountains like a thoroughbred.
At Diesel Injection of Pittsburgh, PA. we have only one Cummins fuel pump specialist and his name is Pat Sharp. Pat started with Diesel Injection in 1984 and to this date has built 3,584 performance fuel pumps. When Gary, Pete or myself are designing a performance Cummins engine Pat Sharp engineers the components that make up the fuel pump. He assembles and calibrates the pump so your truck will fly. Pat also rebuilds all of the mechanical variable timing (MVT) units for us. His fuel pumps, MVT units, work area, and appearance are always immaculate.
It takes big injectors to make big power. Stock injectors are fine for level country and city driving. When it comes to rolling hills and mountains the larger the injector the greater the power available. Larger injectors equate to less fuel pressure to develop the same amount of horsepower. High fuel pressure is harder on the camshaft.
Along with high flow injectors we prefer to use the high volume gear pump on the fuel pump. The larger flow gear pump produces the same volume of fuel at 1400 rpm as the stock gear pump does at 2100 rpm. Think about this, you never cruise along the level country at 2100 rpm. When power is needed all you have to do is roll your foot slightly. The high volume gear pump will supply fuel to the high flow injectors, through our dual fuel line kit, and its adios you're out of here.
Please don't forget to always be in a gear where you can accelerate and keep the engine rpm at 1700 or above when using power in the hills or mountains. Low rpm with high power will crack the pistons.
At Diesel Injection in Pittsburgh we always use ceramic and Teflon coated pistons in our performance Cummins engines. Even in my snowmobile engines we ceramic and Teflon coat the pistons. That coating is a key item in producing horsepower and engine life.

Did you miss the Louisville Kentucky truck show? The weather was good and there were a lot of new products and services being introduced to the trucking industry. The show and shine section of this truck show just keeps growing. It's such a pleasure to see working trucks so perfectly maintained. Some of the tractors had beautiful matching trailers and the entire rig was on carpet. These trucks and trailers were spotless under the hood and the complete undercarriage was immaculate. One owner operator had a purple undercarriage and on his last haul was caught in an ice storm and the roads were treated with salt or magnesium chloride. Needless to say he had his own paint put into spray cans and was repainting the trailer axles the day before the show opened.
If you have never seen a show and shine truck contest then make plans for the International Truck Show in Las Vegas on June 9, 10 and 11. Peter Sharp the Vice President and head wrench at Diesel Injection and I will be there in booth #732. In fact Peter and I will be there two days early to go on a Harley Davidson motorcycle cruise of Nevada.
It was amazing to see just how many owner operators are still running mechanical Cummins and Caterpillar engines. We had our BCIII NTC 800+ HP chromed Cummins engine on display at Louisville and we will have it at the Las Vegas show.
Now to horsepower! Grant Waller, from Bourbon Missouri, is a gravel hauler who contracted our shop to build him a 700 + horsepower STC BCIV engine. Grants haul is 40 miles each way and with the added power he now makes two extra loads per day. That's an extra 160 miles per day. Now lets assume each load pays approximately 100 dollars. Grant now earns 200 dollars more per day or 52,000 dollars per year. Now to run 160 more miles each day he must be using most of the power throughout the day. Even if he wears out the engine in 400,000 miles vs. 750,000 miles who cares? Grant is making an additional $52,000 per year. You see, when you make big bucks, you really don't have to worry about what things cost. Not only does this high performance engine make money it also

gives the owner great pleasure while he drives his truck. There's something special about owning an older truck that looks good and runs like a thoroughbred .

If you have the pleasure of owning an STC 365, 400 or 444 engine horsepower is rather simple to obtain. Just replace your injectors with our high flow units, high pressure high volume fuel pump, dual fuel line kit, mapwidth enhanced turbo and liquid filled fuel pressure gauge and you have an instant 200 more horsepower. Will the engine live? Of course it will. The retarding of the timing in the STC system reduces internal pressure on the pistons. It's the pressure that cracks pistons and usually cracks them from the wrist pin bore up to the piston crown. Then, the fire burns down through the crack. Most people feel that when they burn a hole down through the piston a bad injector causes it. It's never the injector. It's the crack from the wrist pin bore up to the piston crown.

The performance question of the month comes from John Burke of Tarentum, Pa. "My NTC BCII 400 skips, misses or just runs rough on a hard pull. I keep changing injectors but the engine never gets any smoother. What's wrong with all of these new injectors?"

Twenty-two years ago when I was learning the fundamentals of the Cummins engine I was told that a hot diesel engine pulling a mountain would run on straight 15W40 engine oil and not miss. The compression and heat are so great in the combustion chamber that almost any petroleum product will burn.

During November of 1997 I purchased a used T600 KW with an NTC 350 formula 1800-RPM engine having a CPL of 840. This truck was equipped with a 9 speed direct transmission, which I had a 13-speed box installed on the back of. Needless to say I lasted about 1 hour with an 1800-RPM slug driving from Kansas City to Pittsburgh, Pa. and I was bob tailing. After a few changes to the fuel pump I now had 2500 RPM and this baby was ready for some serious cruising. This Recon engine, with only 74,652 miles, ran good. However, it was very rough in 12th and 13th gear. Eleventh gear while pulling a hill was smoother so I started thinking that the high-speed miss I was experiencing was not the engine but the transmission. After all, the Kenworth had 974,000 total miles and it probably had the original transmission. Several transmission shops assured me that it was an engine problem and not the transmission so while the truck was being converted to suit my needs we installed 6 new injectors opened one size larger, a dual fuel line kit, rebuilt the fuel pump, new vibration damper and new fuel suction lines. Now I was sure the high-speed skip or miss was gone. After all, we changed everything that pressurized, metered and injected fuel. While leaving Pittsburgh, pulling a 20,000-pound trailer up Greentree hill, I knew the problem was still there. This KW shook and vibrated up the entire length of the hill. In fact, anytime I used 175 lb. of fuel pressure or more the truck felt as though it was missing. Was I disgusted? You bet I was! When you're a perfectionist and you cover all the bases and the problem is still there you want to rip your hair out.

One of the things we learn while building racecars is vibrations can come from the differential and travel up the drive shaft through the transmission to the engine. What gets blamed for the roughness is the engine. The next stop is to the driveshaft shop for new universal joints, carrier bearings, balancing and check for straightness. We thought we found the problem. One of the shafts was bent 6 thousands. After straightening the shaft and pulling the next hill the engine still missed or skipped in the two highest gears.

In my mind its got to be the transmission even though everybody kept telling me it's impossible. Here's my theory: This 1800-RPM 350 horsepower KW single axle pulled doubles all its life. With a 9 speed direct transmission the RPM would have to be pulled down to 1200 RPM in order to drop a gear. At 1200 RPM a lot of vibrations pass through the transmission which were being absorbed by the gears it spent most of its life in, 8th and 9th gear. Maybe it's not the gears

but could it be the shafts, the bearings or the transmission case?
After replacing the transmission with a rebuilt 18 speed in Denver Colorado I headed west on I-70 to pull some real mountains. As I passed the exit for the 470 bypass and started into the first steep section of the highway my motor was mashed at 300 pounds of fuel pressure. The turbo boost gauge was pegged at 30+ pounds of boost, the pyrometer was sitting on 1200 degrees and I was elated. I mean I was smiling from ear to ear. My high-speed engine miss was gone. And the whole time everyone that rode in the truck blamed the injectors. They said it can't be the transmission but it was.
Does your engine have a high speed miss? Do you keep blaming injectors or the fuel pump? How many miles are on your transmission? Could your driveshaft be slightly bent? Have you ever had a differential failing and felt it through the engine?
By the way, please have your valves and injectors adjusted between 50,000 and 70,000 mile intervals. And always check the valve crossheads while you're there. This pertains mainly to the older mechanical engines.
The summer heat is upon us and the same problems keep surfacing with the low flow cooling on the 1986 through 1991 NTC Cummins engines.
Roger, from Phoenix Az. wrote to us about his low flow cooling 1990 NTC 444XT CPL 1280. My engine runs great. I've installed your ceramic-coated pistons, mapwidth enhanced turbo, dual fuel line kit, high volume fuel pump, high flow injectors and premium gold heads. On the dyno I've got 618 H.P. to the ground and Cummins says that's 772 flywheel horsepower. I love my old Pete and the 444 engine. How can I keep it cool?
Yes the low flow cooling system is a problem if you are developing more than 500HP. Gary Hoffman, president of Diesel Injection in Pittsburgh, Pa. has been working with this problem for 10 years and highly recommends that you convert the low flow system back to the high flow system that was used on all small cam and big cam I, II, and III engines. Regardless of the horsepower output of the engine the high flow systems that Cummins used through 1985 worked superbly. We never experienced high water temperature so long as the radiator, water pump and radiator cap was functioning properly.
Gary has compiled a list of the parts necessary to convert the low flow to high flow 88 NT engine and they are as follows: The thermostat housing, seals, bolts, and gaskets. New thermostat housing to water pump transfer tube, tab for the water tube, water transfer tube to the oil cooler, water pump bolts, water filter, water filter head, water filter head bracket, water filter shut off valves, idler pulley and adjustment bolt and water pump belt.
As you know I cannot give you the part numbers. However, Diesel Injection does have the complete kit available and all you have to do is call. Now, the expensive part of this conversion is the radiator. Gary highly recommends a new BCIII style radiator. However, some of the low flow radiators can be used by removing the baffle in the tank. You will have to install a top inlet hose fitting and a bottom hose outlet fitting when using your existing radiator.

Opening Pandora's box. How to protect yourself from escalating repair bills.
Have you ever taken your truck into a repair facility, received an estimate for the repairs and when you return the invoice is much greater than the estimate? Now you have a pit in your stomach. Your adrenaline starts to flow and you became angry. The same thing happens to the person that has to give you the bad news. It's an extremely uncomfortable situation for both parties and you can't get the truck until the bill is paid in full. Without the truck how do you make the money to pay for the repairs? Back in the 70's most owner operators had excess money. Freight rates were high and the cost of parts and labor was low. Today freight rates are extremely low and the cost of parts and labor are very high. Labor rates in large cities are half the rate that lawyers and accountants charge.
How do you protect yourself from escalating charges? #1. Review the estimate

with the shop foreman and make certain that he is able to look you in the eye. If he stares at the floor be careful. In fact this holds true in all business transactions throughout your life.
#2. Stay with your truck during the disassembly process. Once the failed parts are removed and cleaned for inspection the actual cost of the repair should be obtainable. Please keep in mind that mechanics and service managers do not have x-ray eyes and cannot see inside your engine, transmission and differentials until it's disassembled. If you're not allowed in the shop, stay in your bunk or drivers lounge and ask them to show you the parts upon removal. Its impossible for anyone to give you a firm price until the failed parts are removed and inspected. Now you may ask for a signed quote and please explain that this amount is all that you are going to pay. If the repair facility has a problem with doing the quote you only have to pay the tear down labor. Gather your parts and have the truck towed to another repair facility.
Now allow me to explain to you what happens from a mechanics standpoint. This is a true story and it just happened to us. We receive a phone call from Mr. Owner operator asking about a 100 + horsepower tune up. The price for this procedure is $1600.00 for this particular engine. When the truck arrived there was a small amount of white smoke pulsating from the stacks. After removing the injectors we then removed the injector push rod and with a long magnet we are able to lift the injector cam follower arm to inspect the roller, which rides on the camshaft. The roller on #3 injector lobe was pitted. Now the fuel pump and center cam follower are removed only to reveal a bad #3 injector cam lobe. The camshaft must now be removed which requires 40 hours of labor to remove and install the camshaft. The original tune up was quoted at 10 hours of labor.
The owner of the truck did not know he had a bad camshaft. Our mechanic, after looking at the pattern of the exhaust smoke, suspected a faulty cam.
Fortunately the owner operator was with us during the entire diagnostics procedure. To remove the camshaft the harmonic balancer or vibration damper has to be removed and that item is supposed to be replaced every 380,000 miles. This damper had over 1,000,000 miles so now that it's off it should be replaced at a cost of $490.00. Once the cam gear is removed from the camshaft you must inspect the gear for fretting. If the fretting line is greater than 1/8" the gear must be replaced. This one was and the cost is $466.00. If the gear is reused with fretting it will work its way loose on the nose of the cam and when this happens the valves are driven into the pistons and all of the pushrods will bend along with the valves. So do you replace it now that it's off or do you cut the corner, reuse the gear and hope that the gear doesn't come loose for as long as you own the truck? Remember; the corner that you cut may come back to bite you!
Now you need a camshaft and with an NTC Non STC Cummins you have two choices, a standard camshaft for $596.00 or a high lift cam for $1049.00. If you enjoy horsepower you'll choose the high lift cam. After all, this cam will produce in excess of 800 horsepower with the proper fuel pump, turbo, injectors and timing.

Timing: To protect the warranty of the new cam you must install three recon cam followers at a price of $749.00. Or you have another option. For $1600.00 the MVT (mechanical variable timing) system does an excellent job to eliminate white smoke during idling and extended engine life while pulling mountains.
Now you can see how a $1600.00 estimate over the telephone can result in an $8000.00 repair bill. We haven't mentioned all of the small parts involved while performing this repair like cam bearings, antifreeze, oil and filters.
Should the radiator be cleaned and checked now that it's out?
Protect yourself; be there when the failed part of the truck is being dissembled. Speak to the mechanic and service manager and discuss what other options you have. Would an exchanged transmission, differential or engine be the best avenue for you? To keep the repair cost down many times good used parts can be installed and the average price is one half the price of a new

part. Keep in mind that used parts do not have a warranty and the labor cost remains the same.

Here are a few ways of approaching service managers and mechanics; use statements such as, “If you were me what would you do”? “I don’t suppose that it would be possible for you to give me a written quote once the failed part is dissembled?” or “May I please see the parts”? They have a job to do just like you do. Treat them with respect and kindness. They will return the same to you. It’s a two way street. What you put out is what you’ll get back.

Stay out of repair facilities that have a poor reputation. It may be more economical to have a friend rent a lowboy trailer and haul your truck home.

The question of the month is from Jack Post of Idaho. Jack wrote to us asking what gear ratio we would recommend for this new Signature Series 565 H.P. Cummins engine. Jack mentioned that his truck dealer recommended a 3:55 gear ratio.

I felt that 3:55 gears were much too low for the 16-6-18 Eaton transmission which has a final gear ratio of .85 with low pro 22.5 tires which have 518 revolutions per mile his cruising speed at 1600 RPM would be 63 miles per hour. Jack lives in Idaho and their speed limit is 75 MPH. A 63 MPH cruising speed would be unacceptable for most owner operators. By the way, the best fuel consumption from the signature 565 and 600 horsepower engines is between 1500 and 1600 RPM.

With the Eaton .85 overdrive 18 speed transmission a 3:08 gear ratio would be necessary in order to cruise at 1600 RPM at 74 miles per hour. Eaton informed me that with 11R 24.5 tires the speed would be 76 MPH. My experience has been that the difference from low pro 22.5 tires to tall 11R 24.5 tires is between 5 and 6 MPH.

Now, why did Jack’s truck dealer recommend a 3:55 gear ratio? On Monday July 26, 1999 I called Eaton to discuss transmission and differential gear ratios. I was informed that the 16-8-18 transmission, with a final drive of .85, has been replaced with a RTLO 20-9-18B transmission. It has a final drive ratio of .73 and with low pro 22.5 tires and a 3:55 rear end a cruising speed of 75 MPH will be possible at 1680 RPM.

Now my next question to Eaton is with the large gap between direct and overdrive gears, how much of a drop in speed will there be when pulling a mountain in direct vs. overdrive? As it turns out there is another overdrive gear in this transmission, which is a .86 and is only to be used for pulling hills and not cruising on the level or the transmission can possibly overheat. Do not spec the truck to use the .86 overdrive gear as a cruising gear. Use the .73 gear for cruising in level terrain. Eaton does not consider this transmission a double over 18 speed even though there are two overdrive gears.

My next question to Eaton was: Can you use the first overdrive gear (.86) to pull long 18 mile grades such as Baker mountain in California without overheating the transmission? The answer is yes.

Now I’m confused. In my mind a lot more heat is generated while pulling for 18 miles up a grade as, opposed to cruising on the level ground. Eaton clearly stated to me to spec the truck for your cruising speed using 18th gear, which is .73 overdrive. So now 16th gear is the direct gear, 17th gear is .86 and 18th gear is .73. With this in mind just how fast will we climb a grade in 16th or direct gear with a 3:55 ratio and low pro 22.5 tires.

16 gear (direct)	17 gear (.86 overdrive)
1600 RPM 52.5 MPH	1600 RPM 61 MPH
1700 RPM 55 MPH	1700 RPM 65 MPH
1800 RPM 58.5 MPH	1800 RPM 68 MPH
1900 RPM 62.5 MPH	1900 RPM 72 MPH
2000 RPM 65.5 MPH	2000 RPM 76 MPH

It appears that the RTLO 20-9-18B Transmission has approximately a 300 RPM drop

between gears just like its older brother the 16-6-18, however with 18th gear being a higher overdrive, the final gear ratio in the differentials can be lower to make it easier to start out on a hill, in sand, gravel or mud. I think your going to like this transmission.

Please keep in mind that everybody does not want to have an average speed of 75 MPH at 1680 RPM. If this is your scenario and 68 to 70 MPH is your ideal speed compare the 3:70 and 3:90 gear ratios. Also ask your truck dealer for a print out of the speed versus the RPM of the transmission and rear end gears and the tire size that you choose. Go to your local Cummins distributor, Eaton and Rockwell and request the same information. You may find that each company's figures may vary somewhat. Eaton's phone number is 1-800-826-4357 and Rockwell's number is 1-800-416-8199. Enjoy your new Signature Series Cummins engine.

Doug Forraht sent us an E-mail asking if any of our performance products for the NTC engines would work on the L-10. His truck is an IH2375 L-10-270 HP. Our answer is yes. The fuel system on the L-10 engine is the same as the NTC engine. Since Doug's engine does not need to be rebuilt we are going to outline external changes that will result in an increase of horsepower and torque.

#1: Not knowing the age of Doug's truck our first recommendation is to replace the fuel suction line and increase the size by two numbers. The stock size is #10. A #12 will allow more fuel to pass with less restriction.

#2: Send the fuel pump and injectors to our shop in Pittsburgh, PA. to be re-calibrated. It takes fuel to make power and without a matched set of high flow injectors and a high volume fuel pump there will be no power.

#3: Install a liquid filled fuel pressure gauge, turbo boost gauge, exhaust manifold pressure gauge and pyrometer so you will be able to monitor the performance of the engine while driving.

#4: Remove restrictions from the exhaust system and especially the baffles inside the muffler. Dual exhaust always helps to relieve backpressure.

#5: Air cleaner: We will determine the CFM (cubic feet of air per minute) requirements of the engine and you will have to call Donaldson with the part number of the air cleaner housing to obtain your current CFM rating.

#6: Turbocharger: With the turbo boost gauge and exhaust backpressure gauge installed we can now determine if the turbocharger is large enough to supply air to the engine. The truck should be loaded and driven up a hill at wide-open throttle and the gauge readings recorded.

#7:: Always use Lucas fuel conditioner with every tank of fuel. Diesel fuel is very dry today and does a poor job of lubricating the fuel system. The Lucas fuel conditioner does an excellent job of lubricating the barrels and plungers in the fuel system. Many owner-operators have reported back to us that an increase of 2 to 3 pounds of turbo boost is noticed after using the Lucas. Also, the Lucas oil stabilizer helps to protect the rod and main bearings in a performance engine. Added power increases the load on the bearings and its nice to have that extra lubrication in the oil.

Doug, remember this: Trucks are like racecars. They work their heart out on every hill they come to. All of the changes we have listed do not have to be made at once. Do one change per month and with each change you will notice an increase in performance. With each change there will be a cumulative effect. However, each change will be small. The final result will be a huge increase in performance and the truck will be fun to drive. The fuel pump and injectors will result in the largest increase in power.

When its time to rebuild the engine we have a genuine Cummins performance piston available. The advantages of this piston over the stock piston are as follows:

1. Dual Ni ring lands. The two top rings have the steel insert.
2. The wrist pin bore has been contoured to more evenly distribute the stress loading on the piston.
3. The wrist pin is 4mm longer.
4. The top of the piston has been anodized to relieve stress.

During the rebuilding process a different cam key will be supplied to retard the timing. The retarding of the timing allows the piston to be closer to top dead center before the injector fires. The retarding of timing reduces the combustion pressure on the piston.
Camshaft: If your camshaft needs to be replaced the new design camshaft is microfinished and must be used with microfinished cam follower rollers to achieve durability improvements.
Head bolts: If your engine currently has flange style cap screws they must be replaced with the new design head bolts and washers. The new bolts are torque-to-yield style cap screws. If your engine is equipped with this style cap screw you must use gauge part # 3823546 to check for proper length. Head bolts do stretch.

Water temperature: With the addition of horsepower the water temperature may rise an additional 12 degrees. During the rebuild process it is advisable to replace the water pump and have a radiator shop clean and flush the radiator.

The block: It is recommended that your engine block be 1988 or newer. Starting with serial number 34569763 the structural integrity of the block is greater.
Strictly my opinion: The L-10 is a great medium duty engine and should be used as such. To me, medium duty is 60,000 GVW or less. Remember the old saying from back in the 60's "You can't beat cubic inches." If you're around 80,000 lb. build an NTC 14-liter engine. Heavy haulers: The 1150 cu. Inch "K" series is still the ultimate engine. Don't ask a boy to do a man's job.

The question this month came from Dave Lanz of Hendrick IA. His question is: "Just how important is the vibration (viscous) damper on the front of the crankshaft"?
Dave is the owner of a 1974 Kenworth conventional that was re-powered in 1991 with a CPL 625 NTC 400 Cummins engine. In 1993 Dave brought his KW to Diesel Injection in Pittsburgh, Pa. To have the engine built to 800 plus horsepower. Around 490,000 miles into the engine Dave noticed a noise coming from the front of the engine. Shortly after the noise was audible two thermostat housings broke, the alternator pulley on the front of the crankshaft broke and twice the flywheel bolts broke and that ruined the flywheel once. The serpentine water pump pulley belt would not stay in the grooves and after every repair the noise still remained in the engine.
When we built his engine in 1993 a new vibration damper was installed on the front of the crankshaft. Now keep in mind that the Cummins engineers recommend changing the viscous damper every 380,000 miles. However, very few truck owners do so.
Dave Lanz finally grew tried of replacing parts that were breaking for no apparent reason, started reading our high performance booklet and answered his own question as to why all the breakage of parts. His viscous damper had 110,000 miles over what was recommended by the engine company. He called us, ordered a new damper and installed it. The engine noise that he searched for over the past year is gone. No further breakage of parts either. After this experience Dave says that he will religiously change the crankshaft vibration damper every 380,000 miles.
Just think, Mr. Lanz, you could have broken the crankshaft or the camshaft. You were lucky. My hat is off to Dave Lanz. He kept his cool and was very persistent in trying to find the noise problem. Dave is going to retire in six more years and at that time the 1974 Kenworth is going to be converted into a recreational vehicle hauler so he can cruise the highways of the USA at a more leisurely pace.
The next question is from Harry Brady in Panama City FL. "My NTC BCII 350 won't pull over 1600 RPM in the high side of the transmission. I installed your high

performance fuel pump and matching high flow injectors and it still only goes to 1600 RPM and then falls flat on its face. What is wrong"?
After reviewing the specification to which we built Harry's pump and injectors his 350 should produce 440 horsepower. The top RPM is set for 2400 RPM and in the high side of the transmission this engine should just pull right up to 2400.

For the next 45 minutes Harry and I talked about how he set the overhead, what type of lubrication he used on the injector o rings and is the throttle shaft in the fuel pump going to wide open throttle.
Next we talked about fuel restriction and being his Kenworth is a 1980 when was the last time the fuel suction lines were replaced? Harry stated that the filter head was on the passenger side of the truck and he has never changed the lines. Why is your filter on the right side instead of the left side where it should be? Harry stated that the KW was originally powered by a 430 8V92 Detroit diesel and that is where Kenworth mounted the filter.
As it turns out the fuel filter and filter head are remnants from the 8V92 Detroit and do not flow enough fuel for the NTC Cummins. We shipped Harry our V-12 Cummins fuel filter and filter head and he replaced his suction lines with #12 Stratoflex.
After the new parts were installed I had the opportunity to speak with Mrs... Brady and she informed me that the NTC 350 Cummins will now nail you to the back of the seat in any gear. Thank you for your help.

HAULING YOUR MOTORCYCLE:
Did you ever wonder how nice it would be to have your motorcycle with you when your rig is parked at a truck stop for a weekend? There are a lot of beautiful places to see throughout the USA. However, your eighteen-wheeler isn't very practical for touring the backcountry. It sure would be nice to have your motorcycle with you however its back home and your 1,000 miles away. If only there was a way to carry the bike on the truck.
The first question that must be answered is how much space is available from the back of the sleeper to the front of the trailer? Second question is when the trailer is jack knifed 45 degrees from the tractor how many inches is the corner of the trailer from the back of the bunk? This is the critical measurement because you would not want to crush the motorcycle while backing into a tight dock on an angle. The space required is approximately 5 feet with the rig straight and 3'8" when the tractor is on a 45-degree angle to the trailer. If you do not have the required space the frame will have to be lengthened or you'll just have to leave the bike at home.
Now that you've determined that there is enough room behind the bunk for the motorcycle how in the world are you going to get it up there? A ramp is the most logical way. However, you may feel like your trying to be Evel Knievel riding the cycle up to an elevation of 4 feet. If you have the ability to ride up the ramp where are you going to carry this ramp on your rig? Don't even think about an 8 foot ramp its too short you will need a 12 to 16 foot ramp similar to what the furniture haulers use. You may be able to store a ramp of this size under the trailer. However, in my case the trailer is very close to the ground.
Instead of a ramp we chose to construct an aluminum boom and use a 3500-lb. capacity super winch. The reason for using a 3500 lb. winch to pick up a 700 lb. motorcycle is the winches are rated to pull a 3500 lb. load horizontal and are not rated for a vertical lift. To take some of the pressure off the winch a snatch or pulley block is also used. The pulley block doubles the lifting capability of the winch. The boom is constructed of thick wall 4" diameter aluminum tubing. To enable the boom to pivot, a ¾ ton Chevrolet pick up truck axle housing was used . The axle hub assembly is mounted vertical and steel braces mount it to the truck frame rail. The aluminum boom is now bolted to the eight wheel studs on the pickup truck axle housing assembly. The winch is also

mounted under the truck and the cable is routed up through the axle hub assembly and through the aluminum boom. Pulleys are used to direct the cable through the boom assembly.
The motorcycle is strapped to an H style frame assembly and the boom lifts the frame, not the motorcycle, into its storage area behind the bunk. The storage area is a standard side kit from a steel-hauling trailer. The side kit consists of 4 aluminum uprights, 2 96" wide bows and 2 panels, which are 4' wide and 6' high. A custom tarp was made to go over the headache rack, the two bows and down to the platform that the motorcycle sits upon. The platform is constructed from 2" square aluminum tubing and covered with 1/8" thick aluminum diamond plate. The motorcycle is 4" wider than the 8' platform so a dog box was fabricated into one of the side kit panels to cover the rear tire of the bike.
The total weight added to the truck with the motorcycle, boom, winch, platform and side kit is about 1,000 pounds.

Question of the month is from Sam Pierson of Provo Utah; "I am in the process of rebuilding a KT 450 to be used in a new Kenworth glider kit. The truck will be used for heavy hauling and I would like to have around 800 horsepower. What pistons can you furnish to me and where should I set the timing"?
Dear Sam, there are three pistons available for the K series Cummins engine. The 450 horsepower engine has a rather weak piston that usually cracks up the skirt, across the dome and down the other skirt 90 degrees from the wrist pin. Many times we have pulled pistons out of a KT 450 only to find the rings and wrist pin holding the piston together. Do not use this piston when rebuilding a K series engine. The compression ratio is too high at 15.1 to 1. The KTA 525 and 600 uses a piston with a compression ratio of 14.5 to 1, which works very well when the timing is set at .126 to .128. The stock timing on the K525-600 is .118 however, when building horsepower the timing must be retarded to keep from cracking or melting a piston.
The strongest K series piston to use is the KTTA 700 horsepower, which has a compression ratio of 13.7 to 1. This piston develops tremendous power when timed at .126 to .128 when used in conjunction with our high flow injectors and high volume fuel pump.
800 horsepower is possible with one Holset turbocharger however there is a killer twin turbo system available for this engine and it looks totally awesome when coated with Jet Hot ceramic coatings.
You will have to fabricate your own dual fuel line system for the K engine however, we will instruct you on how to build the kit.
As with any diesel engine liner protrusion is critical. Do not settle for anything less than .007 liner protrusion. To hold the power we use a head gasket that has been cut to accept a fire ring. This is an old drag racing engine-building trick that works well with the K series engine. Cummins Recon has many heads available for this engine and you should contact Gary at our shop to discuss the various heads.
Sam, you are making a very wise choice of engines for heavy hauling. The K series engine has the strongest bottom end of any diesel engine ever built for on highway use.
Bill Toste of Girard, Ohio, asked another good question this month. Is there a new method of torque for the connecting rods of my N14-500 horsepower engine?
Yes, the connecting rod for the 1994 and newer engines with articulated pistons. This is the two-piece steel top aluminum skirt piston used in N-14 460 horsepower and higher engines. This piston is stronger than all aluminum pistons and can handle more internal combustion pressure.
The new torque specification is 95 ft. lbs. plus 60 degrees, plus or minus 5 degrees. Wow, this sounds really confusing. So, to make the job easier Cummins has a service tool called a torque angle socket gauge. The part number is 3824520. This socket is marked with a zero (start) point, a specification window, and an out of limits (OOL) line.

Here are the instructions for using the torque angle socket gauge. Torque both connecting rod cap screws to 95 ft lbs. With the socket on the cap screw, draw a line from zero (start) point across each cap screw head to a point on the rod cap. This line is the gauge line for the angle portion of the specification (60 degrees). With the zero point on the socket gauge aligned with the mark on the cap screw head, torque both cap screws to 205 ft. lbs. With the socket gauge in position, check to see if the fixed mark (on rod cap) is within the window of the gauge. If the fixed line is between the "O" line and the "Out Of Limits (OOL)" line tighten or loosen the cap screw until it is within the window. If the fixed line is past the "OOL" line, replace the cap screw. If it goes past the "OOL" line that is because the bolt is stretched and will not hold the 205 ft lbs of torque. If you don't replace the bolt the rod bearing may spin. Stop by your local Cummins distributor and ask for service parts topic no. 94T1-5. There are pictures in this service parts topic that will help you understand how to properly torque the rod bearings. Good Luck!

The time has come for us to finally have a high performance computer for the N14 Celect engines. The world's very first computer of this kind will be tested this April at our shop in Pittsburgh, Pennsylvania. Significant gains in horsepower and torque will be available at the touch of a switch. This computer will not replace the stock engine computer. However, it will be a separate computer that will work in conjunction with the existing engine computer. Our performance computer will be able to be moved from one truck to another. The first series of this type of computer will only work on the Celect engines, NOT the Celect Plus engines. By the end of this year the Celect Plus performance computer will be ready.

We have started a list of owner operators who are anxious to have more power from their N14 Celect engines. If you would like to be on the list please send your name, address and phone number to Aimee at our shop. Please do not call and ask particulars about the performance computer because we do not have any more information until the first computer is tested.

Question of the month: "With the high price of diesel fuel how can I improve my fuel mileage"?

Ever since the East Coast has tried to out do the West Coast to see who could charge more for diesel fuel we have been bombarded with E-Mail asking this question. I need more fuel mileage.

Install the dual fuel line kit on your mechanical NTC series Cummins engine. This kit will enable the engine to produce an additional 25 horsepower. Which equates to pulling the mountains ½ gear higher. The dual fuel line kit distributes the fuel more evenly throughout the engine which results in a smoother running better pulling engine.

Do you have a turbo boost or manifold pressure gauge? This gauge only costs $38.00 and if your truck is not eget a boost gauge. Install it and drive by it. An NTC 350 quipped with one call our shop and develops 18 lbs. of boost. A 400 develops 25lbs. An N14 500 has 30 lbs and the 525's have 32 lbs. Why do I need to know this information you may ask? Simply, boost equates to horsepower. If you are using excessive boost to move the load your fuel mileage will suffer.

The higher horsepower 855 cubic inch Cummins engines develop 16.5 horsepower per pound of turbo boost. On level ground try to maintain your desired speed using about 15 lbs of boost. You may find it impossible to maintain 75 mph using only 15 lbs of boost. If that's the case then slow down to 68 or 70 mph and see just how much the boost gauge drops. Speed takes power and that kills fuel mileage. Head and side winds will rob the truck of fuel mileage also. When it's windy slow down and shift into direct gear. Don't use a lot of power just to buck the wind.

Liquid filled fuel pressure gauges are also a great gauge to drive by. The

lower you can keep the fuel pressure on mechanical engines, while still maintaining a reasonable speed, the greater the fuel mileage will be. High fuel pressures develop high turbo boost, which produces high horsepower. The trick is to have excessive power and not have to use it to maintain a reasonable cruising speed.

Lucas fuel conditioner: this stuff works. Many times we have had reports that the engine will develop 3 more lbs of turbo boost while using Lucas in the fuel. When turbo boost increases without increasing fuel delivery the exhaust gas temperature will drop by 25 degrees per pound of boost. Lucas also adds lubricity to the fuel, which greatly expends the life of the fuel pump and injectors.

If you have been following my articles since 1992 you are well aware of the fact that I love horsepower, torque and reasonable speed. High horsepower and torque can result in good fuel economy when used properly.

Two last items on fuel mileage: keep your air filters clean and make sure that there are no leaks in the charge air cooler. Please don't forget to adjust the valves and injectors at least every 60,000 miles. A properly set overhead also translates to fuel economy. If you're still running a small cam engine set the overhead at least every 50,000 miles. There are a lot of mechanics in this country that do not know how to properly set an overhead. Choose your mechanic wisely. The life of your engine may depend on it.

Slow down, don't push it and keep your boot out of the throttle until the price of fuel comes down. Also, raise your freight rates. You are the hardest working people in this country and you make all of our lives possible. You deserve to make more money.

Did you miss the Louisville truck show? If you did you missed the best truck show of all times. The weather was perfect for the owner operator show and shine contest and the trucks were absolutely beautiful.

We had our chromed NTC 700+ horsepower Cummins engine on display. The number one question asked was: "How much torque will it produce and will my transmission hold up"? This engine will produce in excess of 2200 foot-pounds of torque. As for the transmission we recommend a 14-6-13 or the newer 18 speed. Many of these engines are coupled to a 12-5-13 speed and they are holding up just fine. We do not experience driveline failures with our high performance engines. It is our opinion that driveline failures are a result of using too much power when starting out and accelerating through the gears. It's not how fast you go from 0 to 70 mph that matters. It's how well you maintain your desires cruising speed. If the power is used to maintain speed the driveline will not suffer from the additional torque. When building the high performance engines we always install a liquid filled fuel pressure gauge, turbo boost gauge and a pyrometer. When accelerating from a dead stop you never need to use an excess of 75 lbs of fuel pressure in the low side of the transmission. A stock NTC 350 develops 155 lbs of fuel pressure and 18 lbs of turbo boost. A 400 produces 176 lbs fuel pressure and 25 lbs of turbo boost. With these figures in your mind all you have to do is drive by the gauges and stay under 25 lbs turbo boost when accelerating through the gears. Why 25 lbs or less? A 14-6-13 speed trans is rated for 1400 ft lbs of torque and that is what a stock NTC 400 Cummins engine produces. If you divide 1400 by 25 you get 56, which means that for every pound of turbo boost the NTC 855 cu inch engine develops 56 lbs. of torque. You, the owner and driver, decide how much power is necessary to move the load. Now get out your calculator and make a list and tape it to your instrument panel until you have it memorized. 15 lbs boost = 840 ft. lbs. torque, 20 lbs. boost = 1120 ft. lbs. torque, 25 lbs. boost = 1400 ft. lbs. torque, 30 lbs boost = 1680 ft. lbs. torque, 35 lbs. boost = 1960 ft. lbs. torque, 40 lbs. boost = 2240 ft. lbs. torque, 45 lbs boost = 2520 ft. lbs. torque, 50 lbs. boost = 2800 ft. lbs. torque. Some of our high horsepower Cummins engines will produce 52 pounds of turbo boost.

If you are of the chosen few owner operators that own a KTA 1150 cu inch Cummins

engine your multiplier is 66 ft lbs of torque per 1 pound of turbo boost. Butch Shuman of Tye Texas has one of our Twin-Turbo HVT-KTTA 1150 cu inch Cummins engines that produces in excess of 54 pounds of turbo boost which equates to 3564 foot pounds of torque and Mr. Shuman does not destroy transmissions. If you're passing through Tye, Texas stop by Shuman Equipment Co. Butch could love to show you his 1978 extended hood Kenworth. This truck will spin the drive tires while pulling an empty bull rack at 85 miles per hour and using 54 pounds of turbo boost. Tire and drive line life are all controlled by the drivers right foot.

CPL stands for control parts list. Please know your CPL when you call our shop and want to discuss horsepower or order parts. The CPL will inform us as to which engine you have. With this number we will know which injector, turbo, camshaft, engine timing, piston and what year your engine was manufactured with. If you don't have the CPL number when you call we will ask you to please get this number off the engine tag. If the tag is gone then you will have to get the engine serial number off the block, which is below the rear head on the driver's side of the engine. You would keep both of these numbers in your wallet at all times. Thank you for your consideration.

The next question from the Louisville show was fuel mileage. What kind of fuel mileage does a 700 horsepower engine get? Cummins and Caterpillar did a study on how much horsepower it takes to pull a loaded van grossing 80,000 lbs. across a level interstate at 70 mph with no head or side winds. The two companies were within 6 horsepower of each other and the required horsepower is 273. Now, if your engine only produces 300 hp. at 2100 rpm where do you think your foot is to maintain 70 mph? Flat on the floor and forget 70 mph when you come to a slight grade. Your dropping a gear and putting your foot flat on the floor again.
What a terrible way to have to drive. Now back to the boost gauge. Each pound of boost equates to about 16 horsepower. Seventeen lbs. of boost will produce 272 horsepower and that is what you need to maintain 70 mph on the level with no head or side wind while pulling a van. A flat bed or drop deck trailer loaded with plate steel should require less power because of wind resistance. And I'm sure that I don't need to tell you that a bull rack pulls harder than a van.
Drive by the boost gauge. The more boost that you use the more horsepower your using. Speed takes power and power is fuel consumed.
Because of the ½ inch longer stroke of the 3406 Caterpillar engine each pound of boost equates to about 19.3 horsepower. Stroke produces torque and that's why a V8 diesel engine is low on torque. It has a short stroke. Someday Ford will figure that out and eliminate that 7.3 V8 Diesel and get a good inline 6 cylinder long stroke diesel engine.
The recipe for 1000+ horsepower that is streetable! During the past 23 years of working with Cummins diesel engines we, at Diesel Injection of Pittsburgh, Pa. have always looked for ways of producing more horsepower, better fuel mileage and longer engine life from the NTC series Cummins engine.
Back in the early 1980's we did a lot of semi truck drag racing at Keystone Raceway Park in New Alexandria, Pa. That is why a lot of our products were developed. We knew back then what the engine was capable of producing. However, we did not know if the engine would live pulling 80,000 pounds over the mountains. Then we got involved with our owner operators in semi truck pulling at local county fairs. To be the top dog in the working truck class takes a tremendous amount of horsepower and torque. The trucks are supposed to be stock but none of them are. If it will produce power in a diesel engine it will be used to pull the sled down the track and out the gate. What a great natural high to see your engines pull the sled through the gate!
The high lift camshaft that we use in the NTC Cummins engine was first used in Stan Caroline's 1971 Autocar. It was re-powered with an NTC 290. To figure out how to set the timing of this camshaft Stan's mechanic Johnny Walko and I had

the cam in and out of this Autocar five times. It's a good thing that we were young and determined to make this cam work. The old Autocar, with a butterfly hood, is one tough truck to work on. Once this cam was dialed in the horsepower was unbelievable. Stan now had the most powerful tri-axle dump truck in Western Pennsylvania. Stan, being a stock car driver, knew when and how to use the power and the engine never failed. 300,000 miles later the Autocar was sold for a newer truck and the engine continued to run for several years for the new owner. Now the high lift camshaft was ready to be used for drag racing and truck pulling. With our high flow injectors, high pressure and high volume fuel pump, mapwidth enhanced turbo, ceramic-coated pistons, dual fuel line kit and 3000 RPM our clients won many drag races and truck pulls. At the end of the pull, when the sled was holding back the truck, the front tires were 12 inches off of the ground. What an amazing sight and sound to be standing at the end of the track looking at the front of truck hanging in the air. The Cummins engine is turning at 3000 RPM, the drive tires digging into the clay track and throwing dirt 50 feet into the air. And best of all there was never an engine failure on the track! This, my friends, is raw horsepower.

Whenever we would set up an engine in this manner it was to be used strictly for competitive events. After the race the injectors and fuel pump were to be removed from the engine and milder ones installed to make the engine suitable for work. However due to the nature of the trucking industry the next load had to be pulled and pulled it was with 1000 horsepower. Once you give a truck driver 1000 raw horsepower you're taking your life into your hands if you try to take it away. Fortunately the owner operators that own these engines are sharp operators. They monitor the turbo boost, fuel pressure, pyrometer, and tachometer closely.

You can also own an engine of this magnitude. However, there are three negatives with this combination. Number one: This engine will make white smoke until the water temperature reaches 160 degrees. If white smoke bothers you or if you park your truck in an area where the smoke is a problem then you can't have this engine. Number two: This engine should not be idled through the night in order to run your heater or air conditioner. You will have to purchase a generator to make heat or cool air. Number three: If the operator of this engine abuses the power on most mountains he will be rewarded with holes in the pistons. Our ceramic and Teflon coated pistons are tough however they are made out of aluminum and can only withstand only so much abuse. If we had steel top pistons available for the NTC series Cummins engine our problem would be solved.

If you know of any piston manufacturer that would be interested in producing this piston please have them call us.

The reason we use MVT (mechanical variable timing) is to retard the timing to decrease the internal pressure to help keep the piston alive. The MVT also advances the timing at idle in order to eliminate white smoke. The MVT does not make power. It makes the engine more livable. Some of you have run our high lift camshaft and wanted more power so we had you install an MVT, larger injectors and higher pressure pump. What you found was that it took more fuel pressure to pull the load up the hill at the same speed as when you had the locked in timing. The reason for this is the MVT retards the timing much further in order to decrease the pressure the piston will experience when it's at top dead center (TDC). This pressure cracks a piston. That is why the RPM should be between 1800 and 2200 when power is being used. Always use high RPM when using power. Cruise along the level at low RPM, drop out of overdrive before the hill and increase the RPM to 2000 bringing the fuel pressure to around 200 pounds. This type of driving will increase the piston life. If you wait until you're into the mountain to increase power its too late. You might as well start dropping gears and settle in at a comfortable power level for your engine.

We are still working on the high performance computer for the N-14. Every test has been positive and soon we will have a finished product. If you're

interested in getting on the waiting list to have a performance computer just call our shop or write us with your name and phone number and we will put you on our waiting list. Please do not call and ask particulars about the performance computer because we do not have any more information until the first computer is fully tested.
What a wonderful world this can be if you have the power to get the job done!

Great news: We have leased a truck with an N-14 electronic Cummins engine to do the final testing of the performance computer. Our initial plans were to have the computer ready for the Louisville truck show. However, not having a test truck greatly slowed the testing and developing process. That problem is behind us now and the performance computer is nearing production.
Please keep in mind that when more fuel is injected into the combustion chamber the volume of exhaust also increases. Today's engine manufacturers are using very small wastegated turbine housings on the turbocharger, which in turn, are very restrictive. We will be testing the various N-14 engines with the increased horsepower to determine the back pressure in the exhaust manifold and we will be able to advise you as to which housing is the most efficient for your particular application.

Next in line are the mufflers. Recommended are straight through style that is now available at your local Cummins distributor. Cummins has purchased Nelson exhaust systems and Nelson has an inexpensive muffler that can be converted to a straight through flow style simply by forcing open a cone in the top of the muffler. That is what is on my truck and they have a deep sound. My primitive style of testing showed that the cheaper the muffler the least amount of backpressure. Now that sounds great. It's cheap and it works. Expensive mufflers are very quiet. However, to make the quietness the backpressure greatly increases.
Yes the performance computer will enable you to develop horsepower and torque easier on the electronic engine than it was on the mechanical engine. However, the same principals apply. Plenty of fresh air must be available through the air cleaners and the exhaust system must be able to evacuate the burned hydrocarbons from the engine.

During my travels I am finding many NTC engines that are not using the duel fuel line system. I'm surprised that owners of trucks are not taking the time to install such a simple thing as this. The engine will run smoother gain 25 more horsepower without increasing fuel pressure and as a result fuel mileage will also increase. All of this for 75 bucks. How can you beat it?

How many of you are still using the #10 Stratoflex suction line? Changing to a #12 line from the fuel tank to the injection pump greatly decreases fuel restriction and again the end result is more horsepower without increasing fuel pressure. Don't forget to install the larger fuel filter and filter head designed for #12 fittings while installing the #12 line.

Power at your fingertips! Our new high-performance computer for the N-14 Celect Cummins engine is now ready for your truck. The Celect engine was produced from 1992 through 1995. The Celect Plus engine began production in 1996. Testing has begun on the computer for this engine along with one for the 3406E Caterpillar Engine. After developing high-performance Cummins parts since 1977 Diesel Injection of Pittsburgh, PA. is now expanding to cover Cat electronic engine computer upgrades. We plan on having a product ready for release some time within the next 12 months. Keep an eye on my articles for the upcoming details.
The performance computer will be called "Pittsburgh Power." Measuring 7"x7" the computer must be mounted inside the cab with an LED readout attached by Velcro

to the top of the instrument panel. This will display turbo boost, exhaust gas temperature (EGT/pyrometer reading) and estimated horsepower. When the engine reaches 1300 deg. the computer will cut back on the added horsepower until the EGT drops back to under 1300. In addition there are six green lights spanning the bottom of the display panel. Each lights to show that the injector it represents is receiving additional fuel.

The LED readout will also have a selection dial with seven positions. Setting "0" signifies that the computer is turned off while the others increase horsepower in increments of twenty. This boils down to a maximum increase of 140HP. For example: an engine rated at 460HP will now be able to achieve 480 at setting #1, 500 at setting #2 and so on until setting #7 where it will max out at 600HP. While driving in snow, heavy traffic, fog, rain, off highway or if excitement levels become uncomfortable simply turn the knob back to zero where your engine will once again run at stock specs.

At idle the computer renders the engine back to stock fuel settings. There will be absolutely no smoke exiting the stacks at idle because no additional fuel will be delivered to the engine. As pressure is applied to the throttle and the turbocharger begins to develop boost the computer will turn itself on and begin to add fuel at ½ lb. of boost. Say goodbye to the turbo lag. Your foot will feel as though it's connected to a mechanical injector pump. As you push so shall you accelerate. Your driving pleasure will be enhanced with Pittsburgh Power!!

The biggest, baddest on highway truck engine ever produced has just been purchased by Mr. Frank Hieden of Houston, Texas. Frank is now a member of the KTTA-HVT exclusive club that has only about five members in the United States. The Cummins KTTA-HVT is a mechanical K series 1150 cubic inch engine that is equipped with twin turbos and hydraulic variable timing (HVT). The stock factory horsepower rating is 750. Pat Sharp, the fuel pump technician and Brian Moan, the injector specialist at Diesel Injection of Pittsburgh, PA. have the combination of fuel settings to enable this beast of an engine to produce between 1,000 and 1,200 horsepower. As far as the writer knows there are only five of these engines in use in trucks in the USA.

What a great engine this would be for the Australian's to pull their trains. Also, the heavy haulers of our country would greatly benefit from this engine. Being this is a mechanical engine there are only a few available. So, if you think you might want a KTTA-HVT please don't wait too long. Our supply is running out. If you're into computer engines we have one of those available also. The price of the mechanical KTTA-HVT is $44,000. If you don't have a KTA to trade in the core charge is another $15,000. So raise your freight rates, order your special K and you too can be a member of the world's largest car that truly carries a big stick.

If you recall, in the past, I have written about Butch Shuman from Tye, Texas. His reworked 1978 A model Kenworth has this same engine and will break the tires loose at 84 mph using 52 pounds of turbo boost and pulling an empty bull rack. Now Texas, the land of big, has two KTTA-HVT Cummins engines roaming the streets and Frank and Butch happen to be very good friends. Frank Hieden's truck is also a Kenworth A model which he purchased new and it was equipped with a KTA 600 single turbo Cummins engine. The 81 A model is equipped with a two stick 6x4 transmissions and 3:55 gears on 11-24-5 tall rubber. While Frank is replacing the engine he's also installing new frame rails.

Now, on to the high performance diesel computer. In the last issue of LandLine we mentioned that the "Pittsburgh Power" computer will increase the total engine output horsepower by 140. We have now increased the power to 175 horsepower at 25 horsepower increments. The dial on the LED readout, that will be mounted above your instrument panel, will have seven power levels. Each click of the dial will increase the horsepower by 25. Settings one through four, 25 to 100 horsepower, the LED readout will remain the same. Level 5 and 6, 125 to 150 horsepower increase, will have a red light to keep you informed as to the power

level. At level seven the LED number will blink at you to remind you that the horsepower has been increased by 175.
Please keep in mind this computer is for the N-14 Celect engines. We are working on the Celect plus engine as of this writing.
November 9th, 10th and 11th were three monumental days in our history. We installed the new Pittsburgh Power computer on Tom Davis' 1995 W-900L Kenworth. The Cummins engine in Tom's truck was an N-14 Celect, 435 horsepower. Cummins, in Pittsburgh, Pa., reprogrammed the computer to allow the engine to produce 500 H.P.. As of this writing the engine has 465,000 miles on the odometer and only two injectors have ever been replaced.
This K.W. pulls a 42-foot covered wagon with three axles and is generally in excess of 80,000 pounds. During the testing of the Pittsburgh Power computer the rig was grossing 89,245 pounds. Route 28 north of Pittsburgh was our test road. The hills on this section of highway has several grades of 6 to 8 percent. That made it possible to give the Cummins powered Kenworth a good workout. Once the Pittsburgh Power computer was installed, which takes about three hours, we headed for the hills. Our team of engineers were controlling the performance of the engine while riding in the bunk. Tom Davis was driving, Gary Hoffman, president of Diesel Injection was monitoring the engine functions with our lap top computer, and I was in the bunk with the engineers laying out our final programming for the new performance computer. For three days we rode, tested and computed the functions of this N-14 Celect engine before we came to the conclusion of how we wanted the engine to perform. One year ago, in November of 1999, is when the work had begun to develop the performance computer. Many hours of dyno testing had taken place on numerous N-14 Celect engines at Stoops Freightliner in Indianapolis, IN. Peter Turke is the dyno technician at Stoops and is certainly an expert in his field. We really enjoy working with this gentleman.
After one solid year of work the Pittsburgh Power computer is ready for your truck. With the turn of the dial, you the driver can change the horsepower output of your N-14 Celect Cummins engine from stock to a total increase of 175 horsepower. Previously we had the computer set for a maximum of 140 horsepower. However, after road testing, we increased the power level to 175 horsepower.
The dial which will be mounted in the control panel on top of the instrument panel will have 7 positions numbering zero through seven. At the zero setting there will be no power increase. Setting #1 will increase the power by 25 horsepower and #2 will be 50 horsepower. Each setting will continue to add 25 more horsepower all the way up to level seven which will be a 175 horsepower increase. Tom Davis has used the computer for one week and loves the additional horsepower and response. The truck was loaded with an 80,249-pound chill (steel coil) giving the rig a 120,426 lbs. Gross vehicle weight. Tom was able to pull the hills one gear higher with the computer set on the number four position adding approximately 100 additional horsepower. He easily out pulled his good friend JR's N-14 Celect Plus 525 and Rick Thompson's 3406B 425 Cat which has the fuel screws bottomed out and a turbo from a 3406 E Cat which produces 41 pounds of boost. Quote from Tom Davis " This performance computer is phenomenal. I love the response. It feels like my old NTC BCIV 676 CPL which produced 700 horsepower. I now have to learn how to drive this truck all over again because I only have to rest my foot on the throttle. All week long I kept the power selector on number 4 because it had all the power I needed."
We at Diesel Injection of Pittsburgh, Pa. have been developing ways of increasing horsepower with the Cummins diesel engine since 1977. When the electronic engine was released in 1991 we knew that the factory computer could not be hot-rodded. The day of the owner-operator enjoying 700 to 900 horsepower was over. Regardless of what we tried the horsepower from these engines would not increase. Finally in November of 1999 we were able to assemble a group of electrical, mechanical and computer engineers who were willing to work with us to develop an adjustable performance computer for owner-operators that desire

more than stock power. The name of our computer is “Pittsburgh Power”. This computer is only for owner-operators that demand, respect and deserve a great running truck. As for the rest of you, I’m sorry. However, somebody has to drive stock sluggish trucks.

Don Phillips of Williamsport, PA. has brought to my attention that several newcomers to the trucking industry have never heard of a “K” series Cummins engine.

Don, here are two pictures of the special “K” we sold to Frank Heidon. Cummins released this engine for the truck market in 1974. The engine is 19 liters, 1150 cu.in. bore 6.25”, stroke 6.25” and stock settings were 450, 525, and 600 H.P. The engine in the pictures has twin turbos, hydraulic variable timing, (HVT), which is very similar to the step timing control of the BCIV 444 NTC. The advantages of the HVT are no white smoke when the engine is cold and retarded timing when using power. This engine at stock specifications is 700 to 750 H.P. With a few changes this engine produces in excess of 1,000 H.P. Not bad for something developed in the 1970’s. This 700 to 750 H.P. version engine was not intended to be used in a class eight truck. It was developed for off highway and locomotive use. Today’s version of this engine is computer controlled.

Frank Heidon now has his special “K” A model 1981 extended hood, double bunk, two sticked Kenworth on the road. He wants to give special thanks to the technicians at West Texas Peterbilt in Lubbock Texas for the great installation job they performed to his truck.

As far as driving his special “K”, Frank says that when the turbos start producing turbo boost, the hair on his legs and arms stand up, he gets goose bumps, muscles start to twitch and it reminds him of his youth when he drove a bored small block 57 Chevy, dual quads with 4:56 posi rear end. For you younger gentlemen, dual quads mean two four barrel carburetors. If you want to see the racer come out of Frank Heidon, pull up beside him, and try to beat him.

Now, on to the “Pittsburgh Power” computer for electronic engines: As of this writing, many of our customers are experiencing the pleasure of driving high performance N-14 Celect engines. With a turn of the dial they can go from stock H.P. to an additional 175 H.P. Tom Davis, the test truck on January 10, 2001 was hauling a chill coil weighing 80,260 pounds. This gave his T-900 Kenworth a gross weight of 132,497 lbs. Tom Pulled Somerset Mountain on the Pennsylvania turnpike traveling westbound at 50 MPH with the Pittsburgh Power computer set on level five. At this position the N-14 Celect was producing 625 H.P. Near the top of the mountain Tom turned the power dial back to zero rendering the engine to a stock 500 H.P. and the truck slowed to 36 mph. That is Fourteen miles per hour faster with an additional 125 H.P. That’s two full gears higher with the 13-speed transmission.

As of this writing there is 100% satisfaction with the Pittsburgh Power computer. Currently one owner-operator is testing the performance computer on an N-14 525 Celect Plus. There are several changes that must be made before the Celect Plus computer is ready for on highway use. By the time you read this article the changes may already have been made and the “Pittsburgh Power” black box for the Celect Plus engines may be in production.

Don’t loose this part number: 3885737. This is diesel engine injector cleaner and can be purchased at any Cummins distributorship. The cleaner comes in a box that contains 1.25 gallons and must be used in its entirety.

To use this box of cleaner the fuel suction line and return fuel line will have to be removed from the engine. Cummins has a hose kit part number 3885739, fleet price of $30.30, which is designed to be used with the injector cleaner. The directions are on the side of the box in English and Spanish.

The injector flushing should be performed outside because the engine will have to idle at 1200 RPM for one hour. After the flushing or cleaning process is completed, the valves and injectors are now ready to be adjusted.

Why clean or flush injectors prior to setting the overhead? Carbon, which is a

by-product of diesel fuel which has been burned in a combustion chamber will travel up through the small holes in an injector cup and form carbon deposits inside the cup and on the injector plunger. If the injector settings are loose, there will be a greater amount of carbon in the cup. Once the injector adjustments are properly set, the carbon is compacted into some of the holes in the injector cup. I'm sure that you have heard people say, I had my rack run and now my truck runs worse. Did you ever wonder why? Now you know what happened. Some of the holes are plugged with carbon. By the way, the injector flush should be used the evening before you plan to set the overhead because the engine will have to cool down to 70 degrees Fahrenheit in order to properly set the overhead.

Carbon in injector cups can only be removed with an ultrasonic cleaner once the injectors are disassembled. When you send your injectors to us to be cleaned and calibrated the carbon cannot be removed from the tips at that time. Our Hartridge 290 injector test stand hammers very hard when carbon is present in the injector cup. Please purchase the injector cleaner and hose kit from Cummins and flush the injectors prior to removing them for recalibration. It is a good practice to flush the injectors once a year even if you are not going to reset the overhead. The cost of the cleaner is $37.87.

DO NOT use this injector cleaner in electronic engines. This caustic cleaner was designed only for mechanical engines. It was developed for use in STC (step timing control) engines, however it works great in small cam through BC IV engines and STC N-14's.

Clean, properly adjusted injectors, diesel fuel fortified with Lucas fuel conditioner and clean engine oil will enable the injectors to atomize the fuel to a fine mist state. The end result is better fuel mileage, greater performance and longer injector life.

A note from Gary Hoffman, president of Diesel Injection of Pittsburgh.

Once an engine has been rebuilt, start the engine and idle for a maximum of two minutes. Reset the valves and injectors and take the truck for a ten-mile ride preferably on an interstate with hills or mountains. Once there is six to eight miles on the engine wring its neck, ease the throttle to the floor, check the fuel pressure gauge, turbo boost gauge and pyrometer, ease out of the throttle and return to the garage. Now its time to hook into a loaded trailer and go to work.

DO NOT allow the new engine to idle for more than FIVE MINUTES. Gary's recommendation is to have about 2000 loaded miles on the engine prior to doing any excessive idling.

The old school of letting a new engine idle in the parking lot for several hours is a guaranteed way of building an engine that will consume oil.

TRUCK RACING USA STYLE

1977 Keystone Raceway Park, New Alexandria, Pa. on route 22 east of Pittsburgh. Chuck Passmore, who was the founder of Diesel Injection of Pittsburgh, took me to my very first semi truck drag race. After many years of street, drag, road course and hill climb racing of Corvettes, I was amazed at the speed of the class eight trucks and how well the owner-operators could shift the gears while smoking the tires coming off the line. At that time I was not involved with Cummins engines. However, I was in the management side of the trucking industry. After speaking with the owner operators at the semi-truck drag race it was clear to me that these men loved performance and have raced drag cars, stock cars, motorcycles, boats and snowmobiles during various stages of their life.

The Mike Gentile family of Pittsburgh, Pa, owners of a fleet of tri-axle dump

trucks and Keystone Raceway Park, sponsored this annual event. Because of the generosity of the Gentile family I knew that the diesel engine business that I was about to take over from Chuck Passmore was something I would enjoy for the rest of my life.

Twenty-three years later we have drag raced in the U.S., the island of Malta, road raced in Europe, Australia, New Zealand and pulled sleds at county fairs all over the eastern United States. Do we love high performance diesel engines? You bet we do and we receive a tremendous amount of pleasure by making you thrilled with the performance of your diesel engine.

Now it's our turn to sponsor the first semi-truck drag race in Salem Ohio on August 18, 2001. Joe and Betty Jo Seamen of Missouri, an owner –operator and semi-truck drag racer, is the promoter of 14 truck drag races in the eastern United States. The Seaman's can be reached at 417-426-5918 for more information. Along with Diesel Injection of Pittsburgh, the other sponsor will be Lucas oil.
Even if you choose not to race your truck please come and support the owner-operators that are racing and visit the booth of the sponsoring companies. We will have performance Cummins engine parts available along with the Pittsburgh Power diesel engine computers for the N-14 Cummins and the 3406 E Caterpillar engines. This computer will increase the horsepower by 175 over the stock engine.

Dodge Cummins Pickups: This is the first time that we have written about this great truck in a class eight-truck magazine. However, we have driven, owned and hot rodded the "B" 5.9 Cummins since its inception in 1989. It was a joint effort between Diesel Injection of Pittsburgh and a few performance Cummins engineers that made possible all of the performance parts available for the "B" 5.9 engine.

Whether it's in a pickup truck, motor home, boat or industrial equipment, the engine lives very comfortable with an additional 80 to 100 horsepower. The stock "B" engine in a Dodge has a base horsepower of 160 and now a top horsepower of 245. The mechanical engines were 160 to 215 HP and with our engine enhancements for working pickups the horsepower would increase to 280 to 320 horsepower. By the way, we have never had a "B" or "C" 8.3 liter engine fail when properly set up by our technicians. For pickups that were toys not towing heavy trailers we are able to extract 400 HP from the 5.9 liter Cummins engine.

August 17th and 18th western Pennsylvania and eastern Ohio were the place to be if you enjoy high performance diesel engines.

New Castle Pennsylvania farm show and semi truck pulls, total domination by the KTA, 1150 cubic inch Cummins engine. Doc Snyder, of Snyder farms, took first place driving his KTA series Cummins Peterbilt called "Mr. Nasty". Aimee Lindsay was in second place also driving a "KTA" in a Peterbilt and Pat Riggle of Riggle trucking Apollo, PA. was in third place in a "KTA" powered Kenworth.

My very good friend, Jerry Hairhogger, came to pull for the first time in his 1973 extended hood double bunk KTA Kenworth. Unfortunately his clutch would not hold the 1,200 horsepower produced by his KTA Cummins. We hope to see Jerry back with a stronger clutch. Jerry is the Godfather of high performance trucks in western Pennsylvania.
Saturday August 18th, Quaker City raceway in Salem, OH. hosted its first time ever "Diesel Drags" which is promoted by Joe and Betty Jo Seaman of Missouri. It was a beautiful day and 77 trucks came to drag race. Smith transport of

Roaring Springs, PA. stole the show with their highly modified 12V71 Detroit Diesel. Jeff Musselman drove the Tornado I cab over for a best time of 13.54 seconds at 107.92 mph and Galen Hoover drove the Tornado II conventional Pete for the fastest time of 12.97 at 105.39 mph. These two trucks ran side by side doing awesome burn outs filling the staging area with white tire smoke.

My hat is off to Barry Smith for the show and display that he has put together for semi truck drag racing.

CFI of Joplin Missouri was there with their T-2000 Kenworth powered by two Signature 600 Cummins engines. Driver Mike Goucher ran for a time of 13.44 seconds at 107.92 mph.

Now on to the working class trucks. Sonny Trapp took home the first place prize money with his 86 cab over Freightliner powered by a twin turbo NTC 475 Cummins engine that produces 900 plus horsepower. Diesel Injection of Pittsburgh supplied the parts and Willie of Diesel Rite, Brooklyn Park, Maryland assembled the engine. His time was 15.17 seconds 86-87 mph.

Sonny has 16 tri-axle dumps and five tractors in his small fleet. His trucks are extremely clean and neatly detailed. Sonny's daughter Jodi drives a 1999 Peterbilt tri-axle dump powered by an NTC 750HP. Cummins also from Diesel Injection of Pgh and Diesel Rite. This truck was built from a glider kit. Jodi stands 5 feet tall and weighs 100 pounds and doesn't mind taking a day off from driving to get her nails done. The Trapp family brought fifteen people to the track from Maryland to watch the races. A true racing family. If there were two words to describe Sonny Trapp it would be clean and consistent. Second place went to Billy Prest of New Brighton, PA. Billy drives an A model Kenworth with a 400 Cummins engine. Billy is an avid weekend drag racer.

Third place went to Bobby Springer of Aliquippa, PA. Bobby's truck is a 1976 Freightliner conventional powered by another NTC 1000 plus Cummins engine. Diesel Injection of Pgh. supplies the parts and Bobby does the wrenching. This truck is a sled puller and won first place in Butler, PA. the previous week. Bobby Springer is a great competitor. He owns five trucks and started wrenching on the trucks with his grandfather at age 6. When Bobby hooks into the sled he tightens the chain, then slowly rolls his right foot to the floor. The tachometer is buried past 3500 rpm. When the engine starts to shutter from excessive rpm he slowly releases the clutch and he is on his way for one wild ride with the left front tire 12 inches in the air. This man is a real crowd pleaser at the local western Pennsylvania truck pulls.

Joe Seaman owned a single axle 359 Pete with an NTC Cummins engine producing about 800 hp, 3:42 Rockwell rears and a 9 speed direct transmission. Joe was very gracious and offered his Pete to me to race. I have never drag raced a class eight truck, only Corvettes, so with a few lessons from Joe I made two time trial runs. It's been 30 years since I sat in front of a Christmas tree to watch the lights descend from yellow to green. Holding the engine at 2500 rpm, slightly nervous, I eased out the clutch on the last yellow light with a reaction time of .860 I was on my way with the tack buried at 3500 rpm. Starting out in sixth gear I pulled the shifter as fast as I could, (remembering the days of my Hurst shifter) into 7th gear. With that 3500-rpm shift I felt the old Pete leap a full truck length on the truck beside me. My motor was mashed, the tach bouncing on 3500, turbo boost was in excess of 40 PSI, 480 pounds of fuel pressure, Liberator mufflers screaming. My adrenaline was flowing as fast as the black smoke was rushing from the twin stacks. I was high on life and turned a time of 17.90 at a speed of 78.53 mph. I could not stop with just one run so Joe let me take a second run. The 4300 IHC in the left

lane was driven by a gentleman that doesn't like to loose, but what he did not know was the rookie in Joe's Pete has no room in his vocabulary for second place, only first. Again when I pulled that shifter into seventh gear I knew I had my second victory. With a time of 17.64 and a speed of 80.36 mph I was reluctant to give Joe back his truck. I'm ready to build an "A" model Kenworth with a KTA Cummins engine for drag racing and sled pulling.

Pittsburgh Power Computers:

As of this writing there are now 48 Pittsburgh Power performance computers on Celect and Celect plus Cummins engines. On the average one half mile per gallon fuel mileage increase is being attained by the owner-operators with the computer set on level 4 which is about 100 horsepower increase over the stock horsepower.

Ed Cooley of Flatwoods, WV. says that he is getting over one mile per gallon better fuel mileage from his CPL 1844 Celect engine. Ed owns an international with a 15-speed transmission, 3:70 rears, tall rubber and hauls logs and lumber on a flat bed. Ed's average fuel mileage was 5.5 mpg and now it's as high as 6.8 mpg.

One old A model Kenworth saved for the torch and one young man's soul saved from hell!

Don't ever think that an old truck can't turn around a young mans life.

Jerry Ray Hairhogger was a young welder at East trailer manufacturing and didn't care for his job. He wanted to be like his father Gerald, who has been driving over the road since 1960. However, dad kept telling his son to stay out of the trucking industry. Young Jerry Ray was very unhappy with his life and would conjure up every excuse he could to skip work. At the age of 24 Jerry Rays dream came true. He and his father went to West Point Truck Parts and Salvage and found a 1977 A model Kenworth conventional with a short hood and a 36" bunk. However, under that short hood was an 1150 cu. Inch KT 450 hp Cummins engine. The very next day this KW was going to fall victim to the torch. West Point was going to cut the truck apart and sell the components.

For 12,000 dollars Gerald and Jerry Ray Hairhogger saved this old KW's life. That afternoon Jerry Ray took the old girl home to Wampum PA. Exit 2 of the PA. turnpike. The very next day they dissembled the engine then traveled to Diesel Injection of Pittsburgh and spent $13,500 on genuine Cummins high performance engine parts. You see, Jerry Ray insisted on out pulling his fathers "K" which is in a 1973 conventional KW and has between 850 and 900 horsepower. So we lowered the compression ratio of the pistons, retarded the timing, built a huge set of injectors and set the fuel pressure to 320 PSI on the fuel pump. Father and son reassembled the engine and she flies!

Jerry Ray's good friend, Andy Koshner from Pittsburgh, has a 550 Caterpillar and was grossing 80,000 lbs. Jerry Ray was grossing 87,000 lbs. They both hit the bottom of Cuyahoga Mountain on the Ohio turnpike at 60 mph. Andy topped the hill at 65 mph and Jerry Ray topped the hill at 72 mph while using only 150 lbs. Fuel pressure. At 250 lbs fuel pressure the old K powered KW will top this hill at 90 mph. Jerry Ray has never used all 325 lbs fuel pressure on this particular hill. To run with a 600 Cat, Jerry Ray uses only 150 lbs fuel pressure. Fuel mileage with this boost is 5.25 mpg.

The wheelbase of this truck was changed from 204" to 262". This was to make room for a 60" double bunk and extended hood. The transmission is a 14-6-13

speed and the rears are Eaton DS402-3:55 ratio. The brown and cream paint was stripped off and dark blue is the new color. Total investment is 38,000 dollars and this does not include Jerry Ray and Gerald's time. Jerry Ray is one happy man of 29 years, happily married, and loves his trucking career!

Pittsburgh Power news!
Scott Johnson of Farwell Texas just purchased the Pittsburgh Power computer and it will be installed on a John Deere forage harvester. This machine is also called an Ensilage machine. Which chops green corn and the corn stalk. The N-14 Cummins is CPL 1924 and produces 540 horsepower stock.

Looks like Scott will be the world's first high performance John Deere harvester. We will inform you as to how the Deere performs with the additional horsepower.
Fuel mileage: We continually receive calls from owner operators that installed the Pittsburgh Power computer with increases in fuel mileage of .3 to 1.2 mpg. We were not expecting this, however we gladly accept more miles per gallon!

The B&C series Cummins engine.

We purchased our first Dodge Cummins in 1989 and it ran quite well. Troy Simonsen who at that time was the head engineer of Dodge trucks agreed to build our truck with a 5 speed manual transmission and a limited slip 3.08 differential. At that time the 3:54 gear ratio came with the 5 speed. It took several conversations with Troy, then he decided to build our truck our way and it is still running today. Troy Simonsen is the man responsible for getting the "B" series Cummins into the Dodge pickup.

In 1991 on a trip to Brackenridge Colorado we discovered the turbine housing on the 1989 "B" engine was too large for high altitude. While leaving Denver on I-70 westbound at the intersection of C-470 the exhaust gas temperature was 1200 deg. In 4th gear using only 15 pounds of turbo boost. Forget fifth gear, I had plenty of power available, but could not use it because of the heat. Stopping at my friend's home in Morrison CO. I called Richard Beech who was the general manager of Holset turbochargers. I explained to Richard that I was running too hot and needed a smaller turbine housing. He left the phone for approximately 15 minutes. Upon his return he told me there was a housing used strictly in Europe that was two square centimeters smaller than my stock unit. I took two months to obtain the European housing but it was well worth the wait. The exhaust temperature dropped 200 degrees turbo response increased and the "B" engine produced three more pounds of boost. Along with the addition of an intercooler, the following year (1992) I was able to cruise up to the Eisenhower tunnel on I-70 in fifth gear. The European housing is excellent on all Dodge Cummins engines from 1989 through 1993.

In 1994 Cummins went to a much smaller turbine housing which is waste gated. This small housing is still in production in 2001. This waste gated turbine housing is so restrictive that the exhaust gas pressure in the exhaust manifold is greater than the intake manifold pressure. During valve overlap exhaust can flow into the intake manifold, this is not a good condition. With the installation of the European housing on the 94 and newer engines, you will feel the engine run freely and fuel mileage will improve.

POWERFUL, PERFECT AND CLEAN.

Crazy, you have got to be crazy! This is what I thought of Al Puhlman when he stood in the doorway of my office in Pittsburgh, Pa. and proclaimed to me that

he had a motor home with a BCII 400 Cummins engine laying on its side halfway back in the coach.

My thoughts were, mister, you may be able to BS some of the people you run into about Cummins engines but you're not going to BS me. I've been around these engines too long. However this man was tall, handsome, clean cut, well dressed and spoke quite well. My next thought was that maybe he does have a 400 Cummins laying on its side under a bus converted into a motor home. My next statement was "when can I see this motor home"? "Tomorrow" replied Al, "It's at a camp ground in Washington, PA. "

The following morning into our parking lot pulled a gorgeous black and silver motor home unlike any I have ever seen and Al was behind the wheel. Upon exiting the coach he opened the side compartment and there it was. A chromed BCII 400 Cummins lying on its side. Actually it's on a 15-degree angle so the oil will drain into a strange shaped oil pan. The workmanship on this motor home was superb. Everything was clean and meticulously fabricated. I asked Al "where in the world did you get this thing"? He replied, "I built it"! This is a one of a kind motor home. Originally built in 1965 to be a US mail "on highway" post office bus. The original engine was a horizontal NH220 Cummins with a Fuller 10 transmission.

Al Puhlman purchased this bus in 1975 with only 98,000 miles on the odometer. The conversion started immediately to transform the bus to a motor home. The NH220 was turbocharged to make it a 262 horsepower engine. This conversion was completed in 1980 and used by the Puhlman family until 1989 and then was sold. In 1996 they bought the coach back from the family they sold it to and started a second conversion. The new interior consisted of seventeen hides of leather and a 32-inch color television that rises out of a table with the touch of a button. A horizontal BCII 400 Cummins engine mounted to an HT754 CR Allison 5 speed transmission became the new power plant. The differential is a Rockwell 140 with a 3.33 gear ratio. The drivers cockpit is a work of art with twenty four gauges, thirty eight switches, four suspension air valve controls and of course a mahogany steering wheel. This bus was originally manufactured by Crown Royale and then remanufactured by the Puhlman family.

Al has been married to a wonderful lady named Carole for the past 42 years. She prefers to remain a passenger as opposed to being the pilot of this vehicle because of the massive amount of gauges and switches in the cockpit.

Back to the engine: Power was low and the air cleaner was too small. We did some work on the fuel pump and installed a 1500 CFM Farr Ecolite air filter. Al was surprised at the difference in power on his return trip to Redding, Ca. We then supplied Al with a huge set of injectors, high volume and high pressure fuel pump with a large V-12 gear pump, duel fuel line kit, pyrometer for the hot side, V-12 fuel filter and specifications for a larger charge air cooler. Al and his son Scott installed the new high performance parts and reworked the exhaust system. This motor home is now the worlds most power coach in existence producing over 600 horsepower. Keep in mind that this vehicle only weighs 35,500 pounds and with the Jeep in tow the gross combination weight is 43,500 pounds and cruises up El Cajon pass on I-15 in California towards Victorville at 75 mph using only 25 pounds of turbo boost and 200 pounds of rail pressure. The engine is capable of producing 35 pounds of boost and 350 pounds of fuel pressure. It's a street rod that you can sleep in!

Now don't ever think that Al's love of Cummins performance stops here. You see, the family business is Outdoor Creations, which manufactures concrete vandalism proof one-piece picnic tables and benches, which are used at rest areas along

the interstate system. To deliver these heavy tables they purchased a 1996 Freightliner, which was assembled in 1995. The engine is an N-14 500 HP Celect Cummins driven by Randy Marquard. He is a reader of Land Line magazine and the person who originally told Al Puhlman about Diesel Injection of Pittsburgh. So now the Freightliner has the help of the Pittsburgh Power computer which added another one half mile to the gallon. Randy normally keeps the power selector switch at position number four or five that makes it possible to run the mountains one gear higher. At position # 4 the N-14 500 now produced 600 HP. Occasionally Randy will use position #7 or 675 HP when he needs to prove a point.

Al and son Scott's love of Cummins engines continues to grow. Now, they went and purchased a new 2001 Dodge Cummins 6 speed one ton dually pick-up. Did they need the pick-up? Heavens no. Scott drives a custom Chevy 396 pick-up with a flamed paint job and Al has a 454 Chevy pick-up. But those Chevy's don't have a Cummins diesel.

Now our phone rings in Pittsburgh, its Al and he wants to know when I'm coming to Redding, CA. to hot-rod the new Dodge. That April upon completion of the Escapees RV show in Chico, CA. I drive my KW RV to the Puhlman's ranch just east of Redding. Al, Scott and I start immediately on the Dodge. We changed the injectors, added the stage 3 Power Max computer, changed the turbine housing, changed the muffler and added a turbo boost and pyrometer gauge.

This fire breathing Dodge-Cummins six speed has come to life! Look out, 42 pounds of turbo boost and with this package the engine produces 11 horsepower per pound. Driving up the twisty mountain roads just east of Redding, this black dually will break the tires loose coming out of the tight corners in third and fourth gear.

Now do you think that Al and Scott are finished building Cummins power? Heavens no, they read Land Line magazine and know that Frank Heidon out of Houston and Butch Shuman out of Tye, Texas have KTTA twin turbo 1150 cubic inch Cummins engines producing 1200 horsepower.

With some research we found KTTA horizontal Cummins engine in Europe powering people hauling trains. However, this engine cost $84,000 dollars, a bit much for a street rod motor home. It took an act of congress to obtain a parts manual from Europe but we have it! Some day the Puhlman's may have a 1200 Cummins horse powered Crown Royale motor home. The seed has been planted in Al's head!

The Cat is out of the bag and ready to prance up the highway. Pittsburgh Power has perfected the high performance "Cat Box" for the 3406E engine. You can have more power at the turn of a dial. Twenty-five horsepower per click and there are seven clicks on the dial. One hundred seventy five more total horsepower from your 3406E Cat diesel engine. Can you imagine a 550 Cat now producing 725 horsepower! That would probably scare the average driver of today however, the owner-operators who drove high performance mechanical engines will feel right at home with the "Pittsburgh Power" Cat box.
Now for some more good news! Do you remember dyno days at Hawthorne Equipment in San Diego? They dropped this event 10 years ago. Well Mike Robinson, a great Caterpillar technician from Washington D.C., has been working for the past two years to bring Dyno Days to the Baltimore – Washington D.C. area. Gary Shields of Alban Engine Power Systems, a Caterpillar distributor in Elkridge Maryland, has agreed to host the event. This event will be called "Alban Engines Power Day 2002". This event will start on Friday afternoon May 17th and finish Saturday night the 18th. This is a class 8-truck event only so bring

your truck, put it on the dyno and see if your truck will win its class. There will be stock and modified classes and a grand prize for the truck that puts the most horsepower to the ground for 5 seconds. Mechanical and electronic engines will have their own classes.
There will also be a show and shine corral with several prizes and different classes for this event. Older trucks will not have to compete with the new trucks. This is a family event so there will be food and entertainment for the children. This is a competition event so please, no alcohol.
Our guests of honor will be Forest Lucas of Lucas Oil Products, Mark Chapple, retired high performance Cummins engineer, now part owner of Pittsburgh Power and TST products, and of course Mike Robinson, the Cat man that made this event possible. If you're into trucks and horsepower this will be the place to be on May 18th.
Did you know that the Baltimore – Washington D.C. area has more high performance Cummins and Caterpillar powered trucks than any other city in the USA?
I personally will bet anyone, that the working truck that puts the most power to the ground will be a Cummins powered truck. You see, we have a group of Pittsburgh men, Jerry Hairhogger, Jerry Ray Hairhogger and Bobby Springer that run A model Kenworths and they really don't understand second place. Also, there is Chris Jones and Sonny Trapp from the D.C. area. Sonny has a cabover Freightliner that is set up for drag racing and is the most consistent drag race truck on the circuit. Chris Jones runs a 359 Pete that is Cummins powered. Chris only knows one place and that's first.
So you Caterpillar guys better gather around the flagpole and get your ducks or Cats in order because the big Cummins are coming to town. The dyno will once again prove who is truly the "King of the Mountain".

Fretting, what is fretting? And is it occurring in your engine?

Fretting is the wearing away of metal between two machined surfaces that were designed for no movement. Several years ago we wrote about fretting between the cam gear and the camshaft. Now there is a possible problem on M-11, ISM, and N-14 electronic engines. If you've had a main bearing failure, this is probably the cause.
As you read this article, please do not panic. Do not pull your oil pan and look for fretting. However, when the time comes for rebuilding or a bearing change please pay close attention and look for the fretting.
The fretting will occur on the main bearing cap where it seats to the engine block. This is a press or interference fit and when the main bearing bolts are removed the main bearing cap should remain in the block. If there is side clearance between the main bearing cap and the engine block the engine will have to be removed, disassembled, a new cap installed and the engine block will have to be line bored.
On stock engines the main bearings are living as long as the engine and in many cases this is in excess of 1,000,000 miles.
Fretting will remove enough metal between the main bearing caps and the engine block to eliminate the clearance between the crankshaft and main bearings. On N-14 engines the fretting usually occurs on number 2, 4, and 6 main bearing caps. On M11 and ISM engines the fretting usually occurs only on number 2 and 6 main bearings.
If the main bearings are showing accelerated wear Plastigage should be used to check for bearing to crank clearance. Anyone who has built racing engines knows what Plastigage is. For those of you who have never heard of Plastigage, it's a special extruded plastic thread that is used to determine the clearance in a rod or main bearing. It's available in various diameters. PG-1 green must be used on the Cummins engines. It will check the clearance from .001 to .003 inches. The minimum clearance on a Cummins crank is .002 inches.
In order to check the clearance on number 2 main bearing you need to remove #1

and #3 caps. Remove the lower bearing half from each cap and keep them in order. Now you need to fabricate a shim.
To fabricate the shim, take a 1.5 in. long piece of 4" schedule 40 PVC. That should be approximately .25 inch thick. Now, cut the circle in half having two pieces 180 degrees in circumference. Now cut approximately 1/8 to ¼ inch off the end of each half piece. Place one of the plastic half pipes in number 1 and number 3 main bearing caps. Re-install the caps into the engine and torque the main bearing bolts to only 25 ft-lbs. This shim will hold the crankshaft up into the upper half of the main bearings.
Now remove the oil from number 2 main bearing and cap, cut a piece of Plastigage the width of the bearing laying it across the bearing 1/4 inch off of bottom dead center. Re-install the bearing and cap then torque to 90 ft. lbs. Then, 170 ft. lbs. and a final torque of 255 ft. lbs. This torque is for N-14 engines built on or before November 24, 1997 and prior to engine serial number 11871545. Be certain to coat the capscrew with engine oil to obtain the proper torque without having the bolt creek.
For N-14 engines built after November 24, 1997 and beginning with serial number 11871541, up to January 5,1998 and serial number 11875596 use the following torque specs. 90 ft lbs, 170 ft lbs and 248 ft lbs. This series of N-14's use a modified grade 8 bolt. The part number is 208346. This bolt has an orange painted head.
For engines built on or after January 5, 1998 engine serial number 11875596, you must use a 12.9 grade bolt part number 3411337. The torque specs are as follows: 50 ft lbs, 100 ft lbs, 140 ft lbs, then turn the bolt an additional 90 degrees. This is called the torque plus angle method.
Now remove number 2 main bearing cap, or which ever cap your checking and measure the width of the Plastigage with the drawing on the envelope that the Plastigage came in. If the clearance is less than .002 inches do not run the engine. A new main bearing cap must be installed and the block line bored. I know this must sound extremely confusing so if you're doing this work yourself and not familiar with Plastigage invite a friend to your garage that builds racecar engines. He knows all about Plastigage.
On the M-11 and ISM engines only Locktite 620 may be used to stop minor fretting. The mating surfaces must be cleaned and sprayed with Locktite Primer-N and allowed to dry for 5 minutes. The crank and main bearing saddle should be masked prior to spraying the primer. A bead of Locktite 620 around the bolt hole and on the 45-degree bevel of the main bearing cap. This cap must be installed within 15 minutes or the Locktite will be to dry. The 620 Locktite adds an additional 70 percent to the shear strength of the main bearing cap joint.
Locktite and Plastigage are available at local auto parts stores. You may have to purchase the Plastigage at a speed shop.
I have more to say however I'm out of space. Don't forget to remove the PVC spacer out of the other two main bearing caps and re-install the main bearings.

Are you ready for a three day diesel truck drag racing event? This is the first time an event of this magnitude will have taken place in the United States. The Place: Quaker City Dragway, Salem Ohio. The date, August 9th, 10th and 11th, 2002. Bring your truck and your family and plan to spend all three days as a guest of Dan Swindell the new owner of Quaker City Dragway. Dan will supply the water and electricity and you may wash your truck on his pavement.
Friday night will be test and tune. Saturday night will be a diesel gamblers race and Sunday will be an all diesel drags. This event is made possible because of the help and sponsorship of Forest Lucas of Lucas Oil Products. Lucas Oil will be the main sponsor of the three day event. If you have never had the opportunity to speak with Forest about lubrication you owe it to

yourself to come to this event and spend a few minutes with this man. The knowledge that you gain will stay with you the rest of your life.
Other known sponsors will be Diesel Injection of Pittsburgh with their new Pittsburgh Power Computers. We are looking for someone to sponsor a Saturday afternoon BBQ. Maybe OOIDA would be interested.
We look forward to seeing you in August at Quaker City Dragway. For more information call Matt at 330-332-5335.
If you're into Peterbilts you should take a look at Warren Johnson's new 256-page book called Peterbilt: The Evolution of Class. L.H. Bill the founder and first president of Fageol Motors Co. laid the foundation for an enduring company when he wrote, "We will never build to a standard lower than the highest. When we can buy better parts than we can make, we will buy them. When we can make better parts than we can buy, we will make them. " Bill established the evolution of class when he vowed, "We will produce the best equipment or we will produce nothing." The company he created in 1915 became in 1939 what is now internationally known as Peterbilt Motors Company.
Theodore Alfred "Al" Peterman was a man known for his mechanical genius. He purchased Fageol Motors in 1939 for a total of $50,000. The first truck to be called a Peterbilt was a chassis for Hirst Fire Truck Company. This first completed truck was an "L" model 334 and was sold to Gannet Beckley of Stockton, CA. The second completed truck was an "M" model 260 and was sold to Pete Bordenave also of Stockton. If you love your "Pete" you'll enjoy reading this book.
N-14 Cummins oil pan leakage.
Do you remember the old aluminum oil pans on the small cam engines that would leak engine oil due to cracks around the rear corners? Weekly we would weld and reinforce these pans to stop the oil leak. Then the stamped steel oil pan was released in 1981 and our oil leaking problems were over. So we thought.
Because of the amount of engine noise emitted from the oil pan Cummins developed an insulation blanket to cover the pan. However, the insulation would retain moisture and sometimes develop rust that would eventually eat through the oil pan. A quick and inexpensive repair is to thoroughly sand or grind the rust and paint from the oil pan in a 6-inch diameter. Thoroughly clean the bare metal with brake clean or lacquer thinner to remove any dust or oil. The next step is to purchase a Swiss fiberglass repair kit from the local auto parts store.
Using the angel hair matting, not the fiberglass cloth, mix the resin and hardener according to the directions on the can. You must do this in a heated garage. Fiberglass needs heat to cure. Using a flux brush apply a coating of resin to the oil pan then a piece of angel hair matting about 1" larger than the rust hole, then more resin, tapping it into the angel hair using the flux brush.
Then another piece of angel hair matting 1" larger than the first piece along with more resin. Continue this process until you have applied about 5 layers of angel hair matting. Make sure there are no air pockets between the layers. Allow to harden for several hours before installing the oil pan to the engine. That is a $20.00 oil pan hole repair. If the metal is properly prepared the fiberglass patch will never come off.
The N-14 rear sump stamped steel oil pan will sometimes crack around the rear corner bolts. To eliminate this problem Cummins manufactures a clamping plate part number 4626248. This plate mounts to the rear six bolts below the oil pan.
This clamping plate requires four part number 4026354 and 2 part number 4026355 bolts. If your engine is equipped with the insulation cover you need 2 of part number 4058673 bolts.
Engines produced on December 7th 1999 and later beginning with serial number 11988415 without the noise insulation cover already have this clamping plate installed. If your engine has the insulation cover and was produced on March 20th, 2000 or later and beginning with serial number 12002401, it also is equipped with the clamping plate.
This is an economic way to avoid a cracked oil pan which could become a costly

repair. Do not over-tighten the oil pan bolts. The four 5/16 inch bolts located at the rear of the pan are torqued to 20 ft. lbs and the thirty two 7/16 inch bolts are torqued to 50 ft. lbs.

Not only did we leave the cat out of the bag, we now have them in our parking lot and the shop. In fact, the cats are calling on the phone in search of the Pittsburgh Power Cat Box!
Mike Robinson, the high performance Caterpiller diesel engine technician from Washington D.C. brought a test Cat which happens to be in a very clean 1999 Kenworth tri-axle dump owned by Kip Jones of Severn, MD. This 550-3406E Cat has been tweaked to 621 flywheel horsepower prior to Brain Moan of Diesel Injection of Pittsburgh installing the Pittsburgh Power Cat Box (computer). This is our first 3406E test of the new computer and what a test it was. With dual 8" straight stacks it was rather easy to hear the 7 different power levels. After the installation time of 3 ½ hours Kip and I headed for the hills on RT. 28 north of Pittsburgh. This computer has 7 different power levels, each click of the dial was adding around 30 horsepower. We hit the first hill on level 5 and the hammer lane was ours, 771 h.p. showing on the digital readout and 54 pounds of turbo boost. Kip has a switch on the instrument panel of this KW, which bypasses the waste gate on the turbocharger, that's why the boost was so high. We did not install a mechanical boost gauge to verify the boost reading. The 54 pounds of boost was showing on the digital readout on the Pittsburgh Power Box.

On the next hill I set the selector switch to zero, which means the engine is stock, and Kip rolled his foot to the floor and said the engine felt dead. Then we went to power level #1 and the sound of the exhaust changed, and the truck started to accelerate. With every additional click of the dial the exhaust was louder, the turbo began to scream and the KW accelerated up the hill. All 7-power levels were distinguishable. On level 7 the digital read out was 840 horsepower. Please keep in mind that this 550 Cat was producing 621 horsepower, we added 219 horsepower with the Pittsburgh Cat Box.
Upon returning to the shop Mike Robinson and I both took our turn at the controls of this mountain lion, which is what is painted on the back of the cab and the engine. We all were thrilled with the results of our first test so Mike and Kip took two more Pittsburgh Power Cat boxes home to the Washington D.C. area to get ready for the Alban Engines Power Day 2002 on May the 18th. It looks to me that there will be three 3406E Cats at the Power Day 2002 with an unfair advantage.
On Sunday, May 12, 2002 Mike Robinson installed the second computer on another 550 3406E Caterpiller owned by Bruce Popp of Crofton MD. This Cat is powering a 2000 378 Peterbilt with an 18 speed transmission with 4:11 rears. Bruce uses this truck for lowboy hauling in the Baltimore, Washington D.C. area. Mr. Popp was so happy with the Cat box that he only used level 3 (90 additional h.p.) all day Monday hauling the lowboy delivering forklifts. Bruce Popp's other truck is a 91 Peterbilt 379 with a 3406B Caterpiller, which produces 710 h.p. to the ground which is 835 flywheel horsepower. As you can see, Bruce Popp is a true connoisseur of horsepower and level 3 put a smile on his face. Bruce also owns a high performance Dodge pickup with a "B" series Cummins engine.
The Pittsburgh Power Box also works on a C-12 Caterpiller. Tim Soper of TWS Transportation in Indianapolis, IN. owns a fleet of 18 trucks and currently has a driver on a C-12 Cat with the Cat box set at 125 h.p.
More information on the C-12 next month and the results of Power Day 2002.
Remember: Only the strong survive!

You missed one great event
Alban Engines Power Day 2002

The elite gathering of the “Big Strappers”. Even though the weather was cool and rainy in the morning cleared up for us in the afternoon. 164 owner-operators with their wives and children came to see 28 trucks battle for king of the hill in Elkridge Maryland.

The east coast boys have done what the west coast has been trying to do for a long time and that is put over 1000 horsepower to the ground for a period of 5 seconds. This was accomplished by William “Mutt” Tayman of Upper Marlboro, MD. Mutt’s truck is a 1979 359 Peterbilt powered by a KTTA Cummins engine. This engine has 1150 cubic inches, twin turbos, hydraulic variable timing and a fuel pump built by Pat Sharp of Diesel Injection of Pittsburgh.

Please keep in mind that this is an old engine. It was released for on highway use back in 1974. But, when properly built, she will crank out the power.

Mutt’s Pete put 1007 horsepower to the ground for 5 seconds. There were a lot of trucks producing 700 to 800HP. However, when the old faded blue Pete went over 1000HP, the crowd of 164 people went into a loud cheer! The well-liked Mutt Tayman was truly the king! By the way, Mutt was the oldest owner-operator there. He is a quiet, attractive gentleman of 68 years.

Bruce Popp, of Port Republic, MD. owned the next highest powered truck. A 1990 378 Peterbilt powered by a 3406 B Cat and built for heavy hauling. This truck is equipped with a double frame, 4 axles, 18 speed transmission and 4:56 rear gear ratios. This truck produced a whopping 901 horsepower to the ground for five seconds. It was built and is driven daily by Mike Robinson.

Third place went to Jerry Hairhogger of New Galilee, PA. Jerry purchased his 1973 Kenworth conventional new in 1973 and changed the engine several times. It’s now powered by a KTA 600 Cummins, 13-speed transmission and 3:73 rear gears. This engine cranks. However, the Air Research turbo decided to handgranade at 792 horsepower. The employees of Diesel Injection of Pittsburgh, who have been supplying Jerry with his parts since 1978, knew this engine could also produce 1000 horsepower. However, the turbo felt it had enough excitement for one day and split the scene.

Bradley Owens of St. Inigoes, MD. produced 766 horsepower to the ground with his modified 3406 E Cat powered Kenworth tri-axle dump. This was the most powerful electronic engine at the event.

Kip Jones was able to hit 740 horsepower with his 550 Cat with the Pittsburgh Power Cat computer. However, the exhaust gas temperature exceeded 1350 degrees and the computer cut the power back to stock horsepower. Diesel Injection is now building a special turbocharger for Kip so he can utilize his 740 horsepower.

You’re not going to believe this one! Jeff Feight of Breezewood, PA. came to prove that Detroit diesels can produce power too. In fact, on the side of his purple W-900 Kenworth, it says “Big Smoke at Last!”. Jeff’s KW is powered by a 15 liter 550 HP Series 60 Detroit and has a modified computer he uses for truck pulling. And pull she does. 738 horsepower to the ground.

Another Detroit 60 Series owned by John Chase produced 700 horsepower to the ground.Other top finishers were David Blankenship with a mechanical Cat, 634 horsepower, Harvey Raynor with another mechanical Cat producing 543 horsepower. Two stock electronic Cats owned by Joe Malcolm produced 584 HP and Frank Winslow produced 512 HP.

Sonny Trapp, the world’s most consistent semi truck drag racer put 482 hp to the ground with one of his N-14 525 Cummins engines. Kirby Williams of Severn, MD. produced 529 horsepower with his Pittsburgh Power computer set on level number 4.

This was a special day for Kevin Duffin of Roseto PA. Kevin has dealt with Cerebral Paulsey his entire life. His dream was to ride in a W-900 Kenworth with a “studio sleeper”. On Friday the 17th of May his dream came true. Phillip Green and Bruce Mallinson drove to Kevin’s home in a beautiful 1999 W-900 Kenworth and gave Kevin a ride to a truck stop for lunch. Then, onto Alban Engines Power Day 2002. Kevin was able to mingle with the

owner-operators, watch the trucks do their power runs and eat great food that was donated by Alban Engines.
Jeff Feight took Kevin for a second ride in his purple W-900 Kenworth. This dream was made possible for Kevin because of 10-4 magazine located in Huntington Beach, CA. Kevin is a reader of 10-4 and contacted Jean of 10-4 and asked if they could arrange a ride for him in a class 8 truck. Jean called Bruce Mallinson of Diesel Injection of Pittsburgh. Bruce mentioned this to Mike Robinson of Washington DC and he spoke to Willie Goode, a large fleet owner in the DC area. Willie offered his number one driver, Phillip Green to do the honors and give Kevin his class 8 ride.
Kevin's legal guardian is his half brother that suffers from seizures. Needless to say neither can drive and Kevin has enough strength to drag his legs about 40 feet. Roseto, PA. is a quaint little town and if Kevin had a motorized scooter he would be able to ride through town.
Diesel Injection of Pittsburgh would like to help purchase an electric scooter chair for Kevin. The cost is $2400.00 plus shipping. We are looking for donations of $5.00 to help purchase this chair. If your interested please send a picture of you your family and your truck with a note addressed to Kevin, C/O Diesel injection, PO box 82 Cheswick PA. 15024. We will put the pictures and letters in an album and present this to Kevin along with the scooter. Remember drivers, what you get to do every day is Kevin's dream come true; to ride in a big truck!
At this time I would like to say thank you to all of the employees at Alban Engines that made this great event possible: Gary Shields, host and general manager, Eric Payne, marketing and driver check in, Dominic Adams, the great cook, Jim Steeves and Steve Simmons who chained the trucks to the dyno. Ted Peapos, driver of the trucks on the dyno and Gene Glancer of Taylor Dynomometer.

Next month we will have a story on the life of William "Mutt" Tayman and why he has a Pete that puts over 1000 HP to the ground!

Don't forget three days of truck drag racing at Quaker City Raceway in Salem, OH. August 9th, 10th and 11th sponsored by Lucas Oil. Sunday the 11th is diesels only.

Don't forget about the Mutt!

Mutt Taymen that is. Remember, he was the owner-operator who owns a 1979 Peterbilt that put 1007 horsepower to the ground at Alban Engines Power Day 2002 this past May the 18th.
Well, here is a little story about the Mutt! Born around 1935 on a tobacco farm in Upper Marlboro MD. with no electricity or bathroom. In fact the Mutt house was without electricity until he was 15 years old or around 1950. Life was tough for Mutt. He had to plow the fields with two horsepower, that's right, he walked behind two horses pulling a single 12" plow and plowed 140 acres. It's no wonder why this man is addicted to horsepower today.
As Mutt awoke each day he had two choices, either work in the tobacco fields or go to school. However, school was 1.5 miles away and he had to walk. It's no wonder why this man carries no extra weight around his waist today. His body is thinking it either walks to school or walks behind the plow. School was Mutt's choice, a one-room schoolhouse with only thirteen students. How could you ever get away with anything with only 12 other students? The teacher would know everything you did!
The first tractor was a 1943 H Farmall and Mutt still has this piece of equipment in the family barn today. This tractor used gasoline or kerosene for fuel. At age 15 Mutt started driving truck, a 1950 Ford F8 that hauled soybeans and corn to Baltimore. In 1958 Mutt purchased a new Ford F8 dump truck and used

this truck until 1963 when he purchased a 1963 Autocar. Mr. Taymen never liked small engines so he purchased another Autocar in 1967 with an NTC 335 Cummins engine and Fuller 13 speed transmission. Wow, talk about being the king of Capital Hill, 335 horsepower in 1967!

Now Mutt Taymen is on a roll, 1970 a new Peterbilt with a V-12 Detroit Diesel. Keep in mind that this was a tandem dump truck, 12 cylinders and only three axles. The Peterbilt apparently satisfied his desire for power because he ran this truck for 9 years. In 1979 he ordered a new Peterbilt tractor with a KTA 600 Cummins engine and a 12-5-15-speed transmission. He waited 11 months to get this truck and he picked it up at the Peterbilt factory. He apparently did not want anyone else to drive his beloved "K". Mutt is still driving this 1979 Pete today. The engine has never been out of the chassis and during the last rebuild a set of twin turbos and hydraulic variable timing was installed along with a huge set of injectors and a high volume fuel pump built by Pat Sharp of Diesel Injection of Pittsburgh. This old faded blue Pete produces serious horsepower, 1007 to the ground!

Alban Engines Power Day on May the 18th was a cool rainy Saturday morning and the parking lot was filled with beautiful shiny trucks. The Mutt was cool, he pulled his old Peterbilt through the parking lot and to the side of the building, almost out of sight from the spectators. We had no idea of what was under the hood until curiosity got the best of Jerry Ray Hairhogger. He slid under the truck and was shocked to see a twin turbo "K". Now keep in mind that Mutt was the oldest owner-operator there and every other truck out shinned his, a true sleeper indeed. This man is so cool he never said a word or showed any emotions even when his truck was backed onto the Dyno.

The old blue Pete was chained and strapped down, the shifter was placed in direct gear as the clutch came out. The dyno rollers started to turn and all 164 spectators watched as the horsepower began to climb, more fuel, more horsepower, more fuel again, the engine was roaring. The horsepower was climbing. The old Pete was shaking like a wild animal, as the roar got louder the horsepower continued to climb. When the power hit 1,000 H.P. the crowd went into a cheer, this was an unbelievable sight, the roaring "K", the trembling Pete, and the cheering crowd. The top horsepower was 1007 to the rear wheels. That's somewhere between 1185 and 1258 flywheel horsepower, and well over 3,000 pounds feet of torque through a 1200 pounds feet of torque transmission. Yes this transmission was rebuilt only one time in 23 years of driving. You see when properly driven high horsepower does not harm the drive train.

So the next time your driving around the beltway of Washington D.C. keep your eve out for the faded blue Pete pulling a dump trailer with the name "Mutt" on the drivers side door and you will have met the "king of capital hill"!

Now onto Caterpillar horsepower:

The Pittsburgh Power Cat box computer is now available for the C-16 600 horsepower Caterpillar engines. Seven power levels at 30 H.P. per level.

For the C-15 550 horsepower engines equipped with the Cat box a new turbo is now available that will lower the exhaust gas temperature by 200 degrees and increase the horsepower by 30. And along with this increase comes better fuel mileage. Anytime you can lower the pyrometer reading, increase horsepower without increasing fuel delivery the end result will be an increase in fuel mileage. This new turbo was the result of a joint effort between Mike Robinson and Diesel Injection of Pittsburgh.

Please keep in mind that the average 550 Cat runs at 1000 degrees exhaust gas temperature under a hard pull. This temperature is being measured with the thermocouple in the exhaust pipe after the turbocharger. If the thermocouple were installed before the turbo such as in the exhaust manifold, the pyrometer would show the temperature of the exhaust to be around 1300 degrees. Please keep in mind that there is a 300-degree difference between the hot side and the

cool side of the turbo. The Caterpillar exhaust manifold does have a “boss”, an extra cast iron spot on the manifold for the installation of a thermocouple.
The reason this engine can sustain high exhaust gas temperature is due to the steel top pistons. All of today’s class 8 diesel engines use a steel top piston with aluminum skirts. In fact, the Caterpillar and the Cummins piston are both made by the same company.
Remember: As horsepower goes up, the fuel mileage gets better and the truck becomes a pleasure to drive. Life is too short to drive a sluggish truck!

Did you miss the Dallas truck show? If you did, you missed a good one. Having the owner-operators show and shine in the main convention hall really adds to the quality of the show.
While in Dallas Pete Sharp, vice president of Diesel Injection of Pittsburgh and I were talking to several owner-operators about the Pittsburgh Power performance computers and how nice it is to be able to turn a dial and gain horsepower and torque. A company driver was listening to our conversation with great interest while sitting behind the wheel of his Freightliner. When we informed him that the standard Pittsburgh Power Cat box was strictly for owner-operators he immediately went into a loud howl. The rule is, if you want a large car you’ve got to own it! For the fleets we suggest one of our newly released lower cost, lower power units that have no remote and is not adjustable. These lower cost units are geared towards fleets and owner-operators that are on somewhat of a budget of under $2000.00. These are also upgradeable at a later date to a standard Pittsburgh Power adjustable unit.
During the Dallas show many questions were asked about the Pittsburgh Power computers and here are the most asked questions:

1. Is there a computer for the 60 series Detroit? No, hopefully within one year or so we will be able to help the Detroit owners.
2. How much additional torque will the Pittsburgh Power Computer produce and will it hurt my transmission? Please keep in mind that the computer has 7 power settings. Each click of the dial produces an additional 25-35 horsepower and approximately 70-85 ft. lbs of torque. However, you the driver control the power going through the driveline. With the Pittsburgh Power computer you accelerate as if you were driving a high performance mechanical engine. Remember years ago you accelerated as though there was an egg between your right foot and the throttle. You roll into and out of the throttle. Stock computer controlled engines of today will not release fuel until 8 lbs. of turbo boost is achieved. The Pittsburgh Power computer releases fuel at 1 lb. of boost. So what this means to the driver is the horrendous lag that today’s engines have when starting out or between shifts is now gone. A C-16 600 HP. Cat with the computer set on level 7 will produce around 2700 ft lbs of torque. That’s why you tread lightly on the throttle.
3. What engines will the Pittsburgh Power computer work with? The Cummins N-14 Celect and Celect Plus, the C-12, C-15 and C-16 Cat. The ISB 5.9 Cummins and the Power Stroke Ford will be ready in November.
4. How long is the warranty? One year.
5. Will the added power use additional fuel? No, in fact fuel mileage improves with the added power. The average increase is about ¼ to ¾ mpg. Occasionally we here reports of 1 mph and with the addition of the larger turbo another ½ mpg can be realized.
6. Can I do the install myself? The average person should have no problem installing one themselves. If you can drill and tap a hole, hook up some electrical connections and drill a hole in the firewall you are ready to do it yourself.

For more information go to www.pittsburghpower.com

Now lets talk about pick up truck diesel engines. Why do people purchase V8 diesel engines in pick up trucks when their class 8 truck runs an inline 6 cylinder engine? In fact there are no trucking companies in the U.S. that utilize V8 diesel engines. Lets compare the V8 to the inline 6 engines.

1. Block: Inline 6 blocks are much heavier and more rigid than V8 blocks and that is why the main bearing caps are not cross-bolted.
2. Crankshaft: The inline 6 crank utilizes 7 main bearings, the V8 has 5 main bearings. Each connecting rod on an inline 6 has its own journal on the crankshaft and the V8 has 2 connecting rods per journal on the crank.
3. Connecting rods: The inline 6 rod has a much larger rod bearing, wrist pin and wrist pin bushing than the V8 rod.
4. Pistons: The inline 6 piston has a thicker dome, longer skirt and larger wrist pin bore.
5. Exhaust manifolds: V8 diesel engines exhaust manifolds have extremely sharp 90 deg turn ups on the back side and the exhaust travel up to the turbo. The turbo is a great distance from the front cylinders thus allowing the exhaust a chance to cool down before entering the turbo. The hotter the exhaust the quicker the turbo spins. On an inline engine the turbo is positioned right between the #3 and 4 cylinder.
6. V8 engines produce more horsepower than inline 6 engines. However the inline 6 has a longer stroke, which equates to more torque and torque is what pulls a load up the mountain. Horsepower is good for acceleration with light weight.

These are only my observations and thoughts and I'm sure a lot of people will disagree with them. However, look at the various engines when they are taken apart and draw your own conclusions. The first time I looked at an 8V92 Detroit with its oil pan off I thought it very much resembled a 454 Chevy gasoline engine and you would never think to ask the 454 to pull 80,000 up the highway.

Remember: If you have no pride in your ride don't park it outside.

Did I hear you say you wanted to do semi truck pulling this next summer? Also that you are going to show Mutt Taymen that your truck will put more than 1007 horsepower to the ground next May at Alban Engines Power Day 2003. Are you sure that your right foot can control 3600 foot-pounds of torque?

Well let's talk about what it cost to build a killer K series Cummins engine. Keep in mind that this is a 19 liter 1150 Cubic inch engine diesel engine in fact it's the largest ever produced for on highway use.

Pistons KTA 700 (6 sets)	$3251.94
Liner kits (6 sets)	1812.18
Piston rings (6 sets)	646.74
Main bearings	603.90
Rod bearings	227.88
Head gasket set	420.83
Lower end gasket set	408.89
6 High flow injectors	750.00
1 Fuel pump with high flow gear pump	1182.90
Primary Turbo	1538.25
Twin turbo piping and manifold	2803.90
Secondary turbo	1538.25
6 Heads	3724.26
Total	$18909.92

This engine will produce in excess of 1,000 horsepower with a single turbo. The KTA 700 HP pistons are very expensive and their compression ratio is

13.7 to 1. The KTA 600 HP piston is 14.5 to 1 compression ratio and is a good piston for street use. The KT 450 piston is 15.5 to 1 compression and they are junk. This piston should never have been produced. They will crack into 2 pieces and the wrist pin and rings will be the only items keeping the piston in the cylinder. Never use the KT 450 and KTA 525 pistons. The compression ratio is too high, power too low and they will crack.

If you ever want to see how well the KTA 700 low compression pistons run, I'm sure Mutt Taymen, Jerry Ray Hairhogger, Frank Heidon and Butch Shuman will give you an on highway demonstration, just try to pass them!

Kevin Duffin of Roseto, PA. wants to own a truck. If you recall, Kevin is stricken with Cerebral Palsy and loves trucks. We arranged to take Kevin to the Alban Engines Power Day this past May in a 1999 W-900 Kenworth. Needless to say Kevin loved being with owner-operators and high performance trucks. Now he wants to own his own truck and plans to purchase a 2000 T-2000 Kenworth powered by a 600 HP Caterpillar with an 18 speed transmission. This truck has a 300-inch wheelbase and is equipped with a large drom box that was used to haul furniture. Kevin will have the drom box converted to a house with a shower, bed, toilet and small kitchen. The Kenworth will have to be equipped with a lift to pick up Kevin, a wheel chair and place him in the passenger side of the cab. Kevin cannot drive and will be looking for a driver and a company to sign on with. If you have any suggestion or help for this man and his project he can be reached at 610-588-5099.

If you read my articles on a monthly basis you'll recall that Mutt Taymen, of Upper Marlboro MD. won the Alban Engines Power Day this past May 18th with his 1979 Peterbilt powered with a KTTA, HVT 19 liter Cummins engine. Mutt put 1007 horsepower to the ground for 5 seconds.

Since I wrote the story about Mr. Tayman I have received a letter from a person that claims to be a struggling owner-operator. The letter reads as follows:

Dear Mr. Mallinson,

The final paragraph inside the enclosed account of one Mutt Taymen and his high power output diesel engine contains the following statement "As horsepower increases the fuel mileage gets better". Ahem, Mr. Mallinson, I beg to differ sir because a cardinal rule surrounding the internal combustion engine is a larger cubic inch displacement equates to increased fueling requirements. Always has, always will. With all due respect to Mr. Tayman and his high performance Cummins power plant, experience with a KTA 600 tells me this man remains a friend of OPEC. No mention was made of Taymens average fuel consumption in a work-a-day environment. Again, experience tells me this guy is going through plenty of push water.

Personally Mr. Mallinson I as a struggling owner-operator prefer spending the little excess cash I have on items such as supporting my church, overseas missionary funding, and in general helping a few of the worlds disadvantaged people. OPEC be dammed. Thanks for your time.

There was no signature and no return address on this letter. Please, if you take the time to write a letter to me, put your name and telephone or e-mail address on it. Now my answer to the unknown authors letter:

Fuel mileage, the better an engine runs, the better the fuel mileage. Small engines with low horsepower and torque pulling heavy weight cannot render good fuel mileage. If your foot is into the throttle, your fuel mileage is low. We have been building high performance diesel engines for 24 years and every time we give an engine excessive power the fuel mileage improves, every time. Now if the operator wants to drive his rig at 85 mph, naturally the fuel mileage will be lower. Jerry Ray Hairhoger averages 5.1 to 5.4 mpg with his KTA Cummins that produces 900 plus horsepower.

Now if you feel that 5.4 mpg is supporting OPEC, I'm sorry but you better check

the fuel mileage of your electronic engine with the odometer reading versus the gallons put into the fuel tank. Did you ever think what it takes in fuel to fly a professional football team to a distant city and fill the stadium with 60,000 people, with 30,000 cars traveling to that game? And you're worried about a few owner-operators in this country averaging in the low 5 mph supporting OPEC. Now if you want to support people in other countries, that's your business. The terrorists that are killing American's are from those foreign countries. Furthermore, people in foreign countries do not like American's they want to see us suffer. So do you feel it's a wise decision to give your hard earned money to them? The leaders of these foreign countries are building nuclear missiles while their citizens are starving. Do you really think your money is going to those who are starving?
In closing I'm sorry if you feel that I've attacked you and your letter, however, owner-operators of extremely high horse powered diesel engines will operate their trucks for months and never feel the floor boards with their right foot, just because you have 1,000 horsepower doesn't mean that you use all of the power on every hill.

On to electronic engines: While installing the Pittsburgh Power computers on Caterpillar and Cummins engines, we are checking the exhaust backpressure behind the turbo on many of the trucks and finding it to be excessive. Yes your new quiet truck will produce excessive exhaust gas temperatures because of excessive backpressure. The new ultra quiet mufflers are quiet for one reason. They are restrictive! If your stock 550 Cat will produce 1,000 to 1,100 degrees on the pyrometer and the thermocouple is in the exhaust pipe behind the turbo, you had better have your backpressure checked with a manometer. If it's over 40" of water or 3 lbs of mercury, then you need to change mufflers or remove some baffles from your existing mufflers. Just because it's new don't think that it's right. Please keep this in your mind. The more expensive the muffler, the quieter it is and the more backpressure it creates.
Low cost mufflers have less restrictor plates which equates to less backpressure and to me being a gear head, they sound much better. We have always recommended and used mufflers that were designed for the KTA600 Cummins. If your muffler is of the cross flow type under the truck, in other words, if the exhaust enters and exits the same side, eliminate it.
Its time to register for Alban Engines Power Day 2003, call 800-443-9813, the dyno day is May 17th 2003 in Elkridge MD. We can only dyno 30 trucks in a 10-hour day, don't delay!

The question of the month is; "I only need a lot of power for pulling the mountains but I don't want the engine to hurt itself. What can I do?"
Think about this statement. I don't want my engine to hurt itself. Engines don't hurt themselves. It's the man with his foot on the throttle and hand on the shifter that hurts the engine.
Years ago an older Cummins engine technician told me that an engine should always be in a gear that will allow it to accelerate while pulling a hill. This is a true statement and applies to all engines, diesel and gasoline. Let the engine breathe and run free. If your foot is flat on the floor and the rpm's are dropping get out of the throttle and shift into a gear that will allow the engine to pull the load using moderate turbo boost. We always install liquid filled fuel pressure and manifold pressure gauges in the instrument panel with every performance engine we build. An NTC BCIII engine develops approximately 17 horsepower per pound of boost. If you're pulling a mountain and using 30 lbs. of turbo boost you are developing 510 horsepower.
Now lets assume that you have installed our performance injectors, fuel pump, dual fuel line kit and mapwidth enhanced turbo on your 400 Cummins and now the turbo boost will produce 36 pounds of pressure. Take 36 times 17 and your engine

is producing 612 horsepower. If the engine has stock pistons and timing you should be very careful as to how much of this boost you use to get the job done. I personally would only use 30 pounds of boost to pull long hills or mountains. Now if you rebuild the engine and installed the ceramic and Teflon coated pistons and retarded the timing without using the MVT you can safely use up to 35 pounds boost on long pulls. With the high lift camshaft and mechanical variable timing using 40 pounds of boost or 680 horsepower is relatively safe. Please keep in mind that you do not have to use all of this power on every hill or mountain.

While traveling the interstate highway system I have noticed that many of the mountains have a break in the percentage of grade about half way up the hill. Most drivers keep their motors mashed and grab the next higher gear only to drop that gear in another half mile. This driving technique never gives the engine a rest. My suggestion is stay in the lower gear, ease up on the throttle allowing the pyrometer and water temperature to decline, thus giving the engine a rest. You know that you are going to be back in that gear anyway for the rest of the mountain. Let the engine breathe and always use high RPM when working the engine. High RPM is 1800 to 2200. This rpm range gets the piston out of top dead center faster and less damage is done to the piston. At TDC using low rpm the piston is being hammered because of internal engine pressure. Your pyrometer heat may be low but if your using high horsepower and low rpm the internal pressure is high and that is what cracks pistons. By the way, most pistons crack from the wrist pin bore up to the piston dome first. Once the crack reaches the fire it burns down through the piston.

You can have a stock engine with high horsepower but you better have the proper performance gauges and know what they are telling you. An NTC 300 has 130 pounds of fuel pressure. A 350 has 157 lbs. 400's have 176 lbs. 444's have 196 lbs. and a 475 has 200 lbs. By having the liquid filled fuel pressure gauge in the dash you know how much power your using. Let's take a look at what a stock engine has for fuel pressure. They develop slightly over 2 horsepower per pound of fuel. Now lets assume that the fuel pressure has been increased in your BCIII 400 from 176 to 225 pounds. Now you no longer have a 400 horsepower engine but you do have about a 475 horsepower engine. As fuel pressure continues to rise the rate of 2 horsepower per pound starts to diminish. The true way of producing horsepower is by lowering the compression ratio, retarding the timing, increasing the injector flow and turbo airflow. So by increasing fuel pressure and injector flow the horsepower increases at an alarming rate. You must think about how much power your using to get the job done and the more you use the less engine life you'll have in the long run. Fuel pressure, boost, pyrometer, and tachometer gauges are vital to long engine life.

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