LINDER TECHNICAL SERVICES

Networking

Newsletter

JANUARY 2006

More adventures from " Bubba Land"

Over the last couple of years, we have built a couple of hot rods and sold a few of our "Tear Drop Trailers". I started out using the 30-G building for Injector inventory and built the trailers in over at our main 4-D location. Sometime last year we switched the locations and moved our injector inventory into the main business location to include a new office for Doug and a new clean area for injector assembly.

The 30G location became (for a short while) my secret hide away. At the end of 2005, there were two additional units available on each side of 30-G, giving us about 4500 square feet of space. I decided to clean out the storage sheds that I had used for many years and use the three units at 30-G for storage, car stuff, teardrop trailer show room and hot rod service shop. The business plan was written and away we went.

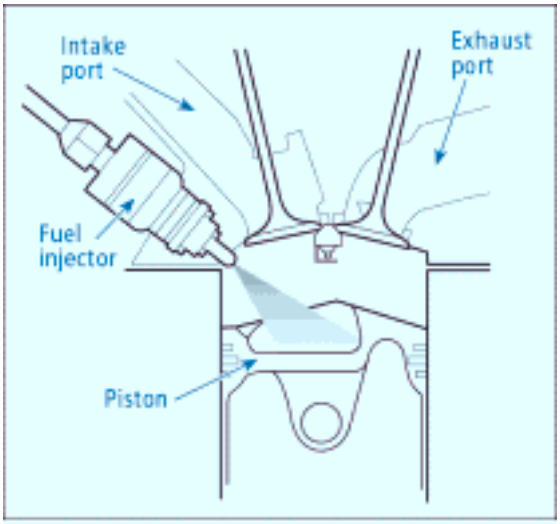
Clearing out the storage sheds was a mess. I found some things I had forgotten that I owned and other things I really don't know why I kept it in the first place. We divided the three buildings (now linked together with interior door ways) into three sections. Section 1 is now wall-to-wall shelves with parts storage and additional room for three to four cars.

Section 2 (30G) is now the Bubbas Trailer Park, complete with 4-5 trailers on display as well as a small diner area equipped with a hot dog machine, coke cooler, moon pies, etc. Our first informal hot dog day at Bubbas Trailer park consumed 165 Hot Dogs. This area will be used as a show room for the trailers and trailer parts as well as a hot rod club meeting place for any and all interested car groups. Many clubs have already scheduled meetings at 30-G for 2006. Nothing wrong with having a few hundred gear heads looking at your products!

The third section is equipped with a small portable lift and wall-to-wall tools on peg boards for easy access when working on projects. A distributor room is also on this side to build and curve distributors as well as rebuilding stromberg 94's and 97's. Flathead fords are one of our specialties as is the 302 GMC six cylinder. We are presently finishing a rat road VW with primer and 35 Ford wire wheels. Another model T speedster vehicle is also laying around ready to jump together as well. The other issue is we are treating this as a business and expect it to actually turn a profit for the year! Look forward to some articles on builds and different cars as the spring approaches.

—Jim Linder, The Injector "Guru"

From the "Wizard"….Direct Gasoline Injection



Reprinted with permission from Toyota Motor Corporation.

Lately I have been doing some reading about Direct Gasoline Injection. My first experience with one of these systems was a few years ago when we did some injectors off a marine application (see our newsletter August 2003). After spending many hours of reading through websites, SAE documents and watching a Bosch DVD, I'm finding out that there is a bunch of information on DGI. (By the way, if you have heard it called Gasoline Direct Injection, GDI, that is a Mitsubishi patented system) The information is endless and I have some concerns as to how much of it relevant to the technician. So with that said, I thought I would share some of what I have learned.

We know how inefficient the internal combustion engine is. When fuel is put in the intake manifold, as with a carburetor or port injection, there is always the potential for puddling and/or deposit build up on the valves. There is also scavenging that robs the cylinder of the Air/Fuel mixture. Rich mixture operation during cold starts that increase HC emission is another concern. Manufactures have made considerable improvements in lowering emissions and increasing fuel economy while maintaining performance with the use of Computer Controlled MPFI. Advancements in combustion chamber flow dynamics and intake design has also helped. This still leaves some limits to fuel supply response and the combustion control. Direct Gasoline Injection looks like the next step for anymore-major improvements in these areas.

The first thing that got my attention was the fuel system pressure. These systems operate anywhere from 50-120 bar, that's like 700-1700 psi. They can operate up to a 40 to 1 A/ F Ratio. This extremely lean and precise fuel control is achieved by various modes of injection timing to match engine load. Most manufactures use two modes of operation.

1) **Stratified Mode** – Stratified Mode is used under normal driving conditions where the engine is at low to moderate loads. In this mode, fuel is injected in the combustion chamber just before a spark occurs. This means there is very little time for the fuel to mix with the air, so there is a rich mixture near the spark plug and progressively leaner regions further away from the plug. The rich mixture near the plug aids in ignition but the overall mixture is lean, which reduces fuel consumption.
2) **Homogeneous Mode** – Homogeneous mode is used when a DGI engine is operating at high loads or high speeds. In this mode fuel is injected in the combustion chamber during the intake stroke. This gives the necessary time from the air and fuel to mix. This evenly distributed mixture insures maximum power and minimizes the possibility of engine knock.

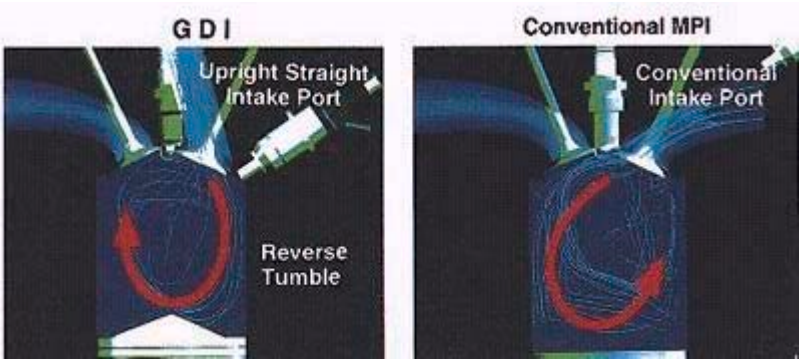
Some systems may have the programming to use double injection pulses. The first pulse would be during the intake stroke and the second during the compression cycle. This would a form a homogeneous lean mixture with a rich, easy to ignite stratified mixture around the spark plug. This may be activated for the transition period from Stratified to Homogeneous mode.
Double injection pulses may also be used to warm up the catalytic converter. This time the second injection pulse would be after top dead center. The fuel of the second pulse would burn late and heat up the exhaust system thus bringing the converter up to operating temperature quicker.

DGI engines have some changes from conventional engines. Upright straight intake ports for optimal airflow are used to generate a tumble (swirl) with a direction of rotation opposite to that of a convention (horizontal ports) engines.

Continued on page 3

Direct Gasoline Injection (Cont. from pg. 2)

This also increases the volume of air entering the engine, which increases volumetric efficiency. DGI engines can have higher compression ratios. Curved top pistons, with or without a cavity in the top, play an important role in maintaining a compact A/F mixture that is directed towards the spark plugs. This provides a better, more complete, combustion and lowers emissions.



The injectors on a DGI system have been redesigned. Then I first looked at one I thought "heavy duty", this was because the body is much bigger then a conventional port injector. Manufactures refer to these injectors as "swirl injectors". This is because they have incorporated a swirl plate directly in front of the outlet bore that creates a swirl in the fuel, which causes better atomization.

Fuel spray characteristics are very important to DGI combustion at different operating conditions. When fuel is injected during the intake stroke a wide cone spray is used, but if the fuel is injected during the compression stroke a compact spray is used. Varying system pressure and injector on time achieve the different spray configurations. There is the question, "will the injectors have a higher tendency to clog at the discharge tip with them exposed to the combustion process?" Most manufactures feel that the higher system pressure will keep the tips from accumulating any deposits. This still leaves the chance of deposits forming during a hot soak period. Only time will tell.

Direct Gasoline Injected engines, as any other lean burning engines produce low Carbon Monoxide (CO) and Hydrocarbon (HC) emissions but usually produce high Nitrogen Oxide (NOx) emission. This is because of the high combustion chamber temperatures that exist with a lean mixture. There are a couple of different ways to reduce these NOx emissions. One is by inducing a higher volume of Exhaust Gas Recirculation (EGR) during lean operation ranges.
Another method reduces NOx emission by collecting them in a NOx absorber catalyst trap.
This would hold the unwanted gases that are produced during lean operation and release them during rich operating periods to react with other exhaust components, forming harmless Nitrogen.

So, if this technology can reduce emissions and increase fuel economy while boosting power, why hasn't it been implemented? Well, in Europe and Japan it has, but in the United States we have too much sulfur in our fuel. This would cause the special catalytic converters to deteriorate too rapidly. A change maybe coming, U. S. fuels will have a lower sulfur level by law in the future. Some states such as California already require low-sulfur fuels and will surely see these vehicles soon.

LINDER
TECHNICAL
SERVICES

4-D GASOLINE ALLEY
INDIANAPOLIS INDIANA 46222

Phone: **(317) 487-9460**
Fax: **(317) 487-1868**
Toll Free: **(888) 809-FUEL (3835)**
out of the (317) area code only

AUTOMOTIVE SOLUTIONS FOR TODAYS TECHNICIANS!

www.lindertech.com

Keeping it Light

Since gas prices started going up, it seems like the only thing our customers are concerned with is how they can improve their gas mileage. I couldn't help but laugh when this picture was sent to me in an e-mail recently. Thanks to Joe Rossman for making me laugh!