The recent move to clean up inner city exhaust emissions has resulted in renewed interest in the use of LPG (Liquefied Petroleum Gas) as a motor fuel. Tax incentives are being offered to encourage fleet operators to convert to gaseous fuels and more vehicles are being offered by the OEMs that are already converted. What does this mean for cylinder head rebuilders today?

There are great opportunities out there for the shop that does the work right the first time. Let's look at this fuel and what its use means to the rebuilder.

Gaseous fuels burn with an almost complete absence of ashy deposits. These deposits in gasoline engines protect the valve and seat faces from wear. Their absence gives rise to the name "Dry Fuel" commonly used to describe LPG. The lack of these deposits allows direct contact between the valve and seat mating surfaces in the combustion chamber. This direct contact causes micro welding to occur with metal from one surface transferring to the other.

During the next open-close cycle, the deposits heat up and oxidize. These oxides are both corrosive and abrasive and explain why some non-OE-converted engines suffer severe and rapid valve and seat wear. Another cause of rapid seat wear is that valve heads flex under combustion pressures. In some applications this can accelerate a wear problem and lead to early failure. To combat this wear, various techniques should be used. The first plan of attack is to widen the seat contact point to around 0.100". A full 76% of the heat transferred out of the valve goes out through the valve face to seat contact point. Widening the seat contact area allows more heat transfer and spreads the compressive load over a larger area. This helps prevent the welding process. The next concern is to ensure that there is good contact between the valve and seat faces. It is not recommended to machine an interference angle between these faces today and this is particularly important for LPG heads. It is also good practice to "blue" the contact area and hand lap if necessary. Valve rotators should be replaced or welded up to prevent excessive face wear. While these are techniques to aid the rebuilder, the parts manufacturers can do their part to help the valves and seats survive. One action taken is to upgrade the materials the valves and seats are made from. Valves for LPG engines are specifically designed to withstand the extra wear experienced with the use of LPG fuels. The valve faces need to be protected as do the seat contact surfaces. In the case of valves, the addition of hard facing materials, usually Stellite, is considered essential in preventing valve failures. In some cases the valve head can
be made from a nickel based super alloy such as Inconel. This alloy flexes less than regular exhaust material thus preventing wear due to valve head bending. In some cases, 454 GM for example, both of these techniques are required to provide acceptable service life. The valve can also be internally cooled with sodium if required. The valve seat in the head also needs some attention. If the head was not designed to run on LPG, the valve seats need to be inserted with a material specifically designed for gaseous fuel use. These seats are very hard even at operating temperatures. They are generally made with a high Nickel and/or Stellite content to withstand the corrosive and abrasive action present in LPG fueled engines.

It is often after sales service that can make the difference to engine survival. When an engine has been converted to LPG use and the cylinder head has been built specifically for the fuel, it can still fail without attention to both the ignition system and the fuel mixture. The distributor must be recurved to provide total advance of 36&deg; at 1000 RPM (15" of vacuum) and total advance of 42&deg; at 3000 RPM. Initial timing can be advanced about 10% but if this is done, an equal amount must be removed from the total advance curve. The fuel delivery system is also important. Most LPG systems require a 2% oxygen exhaust content to ensure adequate cooling in the combustion chamber. Unlike gasoline engines, a rich LPG mixture overheats the valves and seats causing seat recession. The only way to ensure the correct fuel mixture is to use an exhaust gas analyzer. One source for this tool is NeoTronics in Georgia (Tel. 1-800-535-0606).

S.B. International, Inc. has made a commitment to the rebuilders by stocking E-Loy Stellite Valves and J-Loy "Star Series" Seats for the most popular LPG engines in use. These valves and seats are listed in the SBI Catalog or call 1-800-THE-SEAT for specific application details.