HOT ROD Forum

By Bruce Crower

BIG MILEAGE—A DIFFERENT APPROACH

Remember the good old days when 105-octane was readily available at the corner station? This slow-burning, ping-resistant fuel was essential for the high-compression GTOs, Chevelles, Vettes and Bosses. Compression does wonders for power and mileage; but now it's gone, along with high compression in the new Detroit iron. The musclecar era—'60s to early '70s—saw the compression ratios reach 11.5:1, and the gasoline producers followed suit by providing the high-octane fuel essential to stop pinging or combustion knock. This unpleasant noise is the signal that the combustion pressure is rising too fast and has caused the "back corners" of the combustion chamber to explode spontaneously, causing the diesel-like noises. The sound isn't the worst part, however, as engine damage will result if it is allowed to continue. Such damage may be broken rings, pistons, blown head gaskets and even cracked heads.

Now that the best available fuel is down about 12 points on octane, most engine builders have omitted high compression (ironically, the most important single factor for engine efficiency) from their engines.

A recent test of a 1976 ¾-ton 350-c.i.d. pickup has caused quite a stir, due to a phenomenal mileage increase. This truck had an automatic transmission, non-radial truck tires and a camper shell. Used as a delivery truck, the expressway mileage consistently ran in the high 9s. The engine was in good condition with excellent compression, in good tune, and the tailpipe showed a chalk-white color, indicating that it was not wasting fuel from an over-rich condition. The truck was driven from 50 to 300 miles daily, with gas costs running from $6 to $36 each day.

The owner decided to do something about his gas costs, as gasoline prices are rising as surely as death and taxes. In discussing it, I advised that the biggest efficiency gain would result from using the highest reasonable compression ratio and then doing things to control pinging and detonation, such as a programmed water-injection system and spark control. The problems faced, however, were building the water system and raising the compression in excess of OEM specifications.

Then the "better idea" flashed on . . . and we approached it this way: Build an engine with a very small chamber, but grind a cam so that the compression pressure does not exceed factory specifications! We would then be building a downsized engine on the compression stroke, but retaining a full-sized 350 on the power stroke. Another way to say this is that the engine has only a 2.5-inch effective stroke on the compression stroke, but the usual 3.48-inch stroke on the power stroke. This provides a greater expansion ratio on the power stroke, which extracts more useful work from the expanding gases.

The words to use when speaking about combustion chamber volume are "compression ratio." With today's fuels and cams, it is a fact that intolerable pinging will result in an automotive engine with over 10.5 compression ratio, and to say that it would be possible to run 15.8 compression ratio on pump gas would raise a few eyebrows among the lettered. I would like to draw attention to "effective compression ratio" compared to full-cylinder compression ratio. Another point to remember is that compression ratio does not cause pinging, but compression pressure does.

The subject Chevy 350-c.i.d. test engine has a total combustion chamber volume of 49cc. The bore is 4.030, the stroke is 3.48, the full-cylinder compression ratio is 15.84:1, but the effective compression ratio is 8.15:1, and this can be varied by the cam grind. The cranking compression is 152 psi—slightly lower than factory specifications—and this also can be varied by the cam grind. This engine with a stock cam would have a cranking compression in excess of 240 psi, and would expire quickly from uncontrollable detonation. In fact, it probably would start by auto ignition without the spark plug wires attached.

In building the engine, 327 high-dome pistons which projected out of the block .095-inch were used. The heads were counterbored .085-inch to receive the pistons, and with a gasket thickness of .037-inch, a quench clearance of .027-inch resulted. Although this is close, it is sufficient for lower rpm use. The heads were the 2.02 intake valve diameter type. The only non-stock parts used were the pistons and the "ping control" cam. Operationally, it is difficult to detect that the engine is anything other than a box-stock 350, except for a slight loss in torque below 3000 rpm. All the emissions systems are intact and functioning, including the smog pump. The idle is stock-smooth. Cranking rpm is very fast, and there is no tendency whatsoever to diesel or after-run.

Before the changes, this truck was taking nearly two full tanks of gas to make a 290-mile round trip. After the changes, the same trip was made on less than one tank. Mileage went from not quite 10 mpg to 17.6 mpg. The gas bill dropped from $35 to $20 round trip. This saves $75 per week, $300 per month and $3600 per year.

I would not recommend this system for towing or heavy hauling; it is primarily intended for light-duty pickups or passenger cars. It is a rare occasion to use full engine power in these days of conservation. The power loss is a small penalty to pay for such a remarkable mpg increase for ordinary use. This efficiency concept (patent applied for) has shown such initial promise that further tests on other engines, including generator and water-pumping applications, will be made soon. **HR**