THE EXTRA MILE

Engine Building and Power Techniques

BY SCOTT SEHR

Building Power Using Today's Pump Fuel

Designing an engine to build good power and torque for our hot rods today can be very tricky. The goal is to convert the chemical energy from the fuel into mechanical energy or horsepower. There are many components to building horsepower; one of them is the compression ratio of the engine. It is well known that the more compression there is, the more power the engine should make. In most cases this is true, but this can be a fine line to walk using today's available pump fuel. Static or mechanical compression ratio is the difference in volume of a cylinder from bottom dead center to top dead center with the head gasket and cylinder head in place. Dynamic compression ratio takes into consideration the conditions of the valves opening and closing, and it is common to see dynamic compression less than static compression. Forced induction engines will have a greater dynamic compression ratio because of the increase of pressure in the intake manifold when positive boost levels are present.

To design power and torque into an engine, the first thing is to determine the HUCR, highest usable compression ratio. This calculation is determined by what fuel is to be used and the combustion chamber design along with other determining factors. The closer we get to the critical compression ratio, the more sensitive the engine will be to fuel octane and ignition spark timing. If these calculations are incorrect or improper fuel for the design of the engine is used, critical failure will occur very quickly. Most fuel has an octane rating that is most commonly used to determine the HUCR; the octane number of the fuel determines the resistance to detonation, however another critical factor is the chemistry of the fuel. All fuel has a BTU rating; this is a British Thermal Unit. This rating is the heating or energy value per pound of fuel. Common pump gasoline has a heating value of around 19-20,000 BTUs per pound, methanol has a heating value of around 9,500 BTUs per pound, ethanol has a heating value close to 11,500 BTUs per pound and E-85 has a heating value of 13,500 BTUs per pound.

Another important aspect to consider about the chemistry of the fuel available today is that pump gasoline is primarily hydrogen and carbon, but there are hundreds of combinations out there and the octane ratings can range from 87 to 93. Methanol is wood alcohol, ethanol is corn alcohol, and E-85 is ethanol with a 15% gasoline addition. Methanol and ethanol are hygroscopic fuels, which means they have a tendency to absorb water from the surrounding atmosphere, changing the original chemical characteristics and water doesn't burn. These fuels can become unstable for use in a performance engine. Methanol has an octane of about 113, and E-85 has an octane rating between 100 and 105 depending on the actual gasoline percentage. There are a few certain products that are available to add octane to your fuel if the engine, or even the weather, create a need for additional octane.

There are so many factors in building power using the fuel available at the pump, but at Sehr Performance we do all the math and the investigation to determine the best for our customer so the *'EXTRA MILE'* can be enjoyed again and again.

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