Intelligent Engine Analyzer

Training

The Pressure is On

James Garrido - Have Scanner Will Travel

While engine mechanical diagnostics dates back to, well, ever since the first engines were made, the way we diagnose those defects continues to evolve. The toughest aspect of engine mechanical diagnostics may not be as sophisticated as electronic control systems diagnostics but due to disassembly requirements inherent in mechanical inspection it can be just as time consuming. However there are some relatively new techniques we can use to pinpoint engine mechanical defects in both a timely and accurate manner without disassembly by using pressure transducers. A transducer is anything that senses one type of physical quantity and outputs another physical quantity in proportion to the first.

In this case I am speaking of an “In Cylinder Pressure Transducer” which reacts to cylinder pressure by outputting a corresponding electrical signal to an oscilloscope. This pressure transducer is installed in the cylinder in the place of a removed spark plug. Then the engine is cranked, started and run while the transducer is used to graph pressure changes in the cylinder as the pistons is moving and the valves are opening and closing the way they would during normal combustion. Only there is no combustion due to the spark plug energy being shorted to ground to facilitate use of the tester. In this way we can watch each of the mechanical aspects of the engine and determine if any part of the equation is defective with out disassembling the engine!

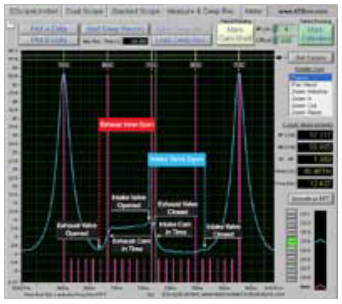

Fig. 1

In figure 1 we will take a brief look at what a good in cylinder pressure waveform should look like relative to possible cam timing issues. For a much more detailed explanation of the information contained these types of waveforms visit see the following article: "Anatomy of a Compression Waveform"

On a normal engine as the piston begins to rise from the 180 degrees of rotation the BDC marker should dissect the exhaust stroke pressure rise ramp at approximately 50% of the total height of the waveform. If the 180 degree marker falls as much as 10° below or 15° above the 50% point, exhaust cam timing is within a normal range.

Fig. 2

When viewing the intake stroke pressure drop ramp, a cursor placed 20 degrees after the 360 degree TDC marker (or 380 degrees). This cursor should intersect the downward slope of the waveform at the 50% point, give or take 10°, to be within a normal range.
Normal cam timing design tends to fall in these ranges due to the influences of ambient pressures and the requirements of fuel mileage and emission control priorities. Non-normally aspirated engines, vario-cam and high performance engines may vary further from these general specifications but not drastically.