Intelligent Engine Analyzer

Training

Introduction to In-Cylinder Pressure Testing Part 3

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In June 2013 the article “Introduction to in-cylinder pressure testing” covered the running idle compression waveform. In May 2014 “Introduction to in-cylinder pressure testing part II” covered the cranking compression waveform. Cylinder pressure testing is becoming one of the most important new diagnostic tools for a shop to use. This technique provides valuable information to the technician that cannot be obtained in any other way. This waveform can convey such things to the technician as; true Top Dead Center (TDC), camshaft timing, ignition timing, restricted exhaust, intake valve problems, exhaust valve problems, and piston sealing problems in just seconds. By understanding the pressure changes in the combustion chamber hours of diagnostic time can be saved.

It is important to understand that the specific pressure changes that occur within the cylinder are what the in-cylinder pressure waveforms are comprised of. This means that each time the throttle valve is changed the pressure within the cylinder also changes. The three basic throttle pressure states that will be analyzed are; cranking with a closed throttle, running with a closed throttle (Idle), and running Snap throttle (WOT). Each of these pressure states will provide different information to the technician that will aide in the diagnoses of the internal combustion.

The amount of incoming air will change depending on where the throttle valve is located. The throttle valve offers resistance to the air flowing into the engine do to the air entering the engine will be regulated as the throttle valve is moved in comparison to the throttle bore. This difference of air volume flowing into the cylinder causes the in-cylinder pressures to change.

In figure 1 the in-cylinder pressure changes are shown as the engine goes from a closed throttle (Idle) to a Wide Open Throttle (WOT) Revving. During the idle state the throttle is in a closed position. At idle the throttle is allowing only enough air to enter into the engine so that, when mixed with the fuel stock, the power released from the air/fuel charge can overcome the parasitic losses of the engine. These parasitic losses include; engine pumping losses, friction losses, viscometric flow losses (pumping oil), and any external load losses (power steering, alternator, A/C, etc). The amount of air entering the engine at hot unloaded idle can be measured in grams per second and will equal approximately the liter size of the engine. So a 5 liter engine will have approximately 5 grams per second of air flow in order to overcome the patristic losses of the engine.