

Scope testing compression and valve problems

An oscilloscope is a versatile tool that can be used in a variety of ways. PicoScope has details on some of these diagnostic tests, where a scope can be used to help you in everyday tasks.

Connect the WPS500X Pressure Transducer to PicoScope with the BNC to BNC cables provided. Attach the transducer, as you would any compression gauge, by removing a spark plug and properly disabling the fuel system (if possible) and ignition for that cylinder.

Start PicoScope and the engine. You may need to adjust the timebase and voltage scales to achieve the best signal display.

Once you have captured your waveform you will be able to see everything that is taking place in every 720° cycle of the engine. To help you understand what you are seeing, use the rotation markers (found in the bottom right-hand section of your PicoScope screen). You can adjust these markers to show 4 partitions, dividing the waveform into 180° sections and revealing the 4-stroke cycle.

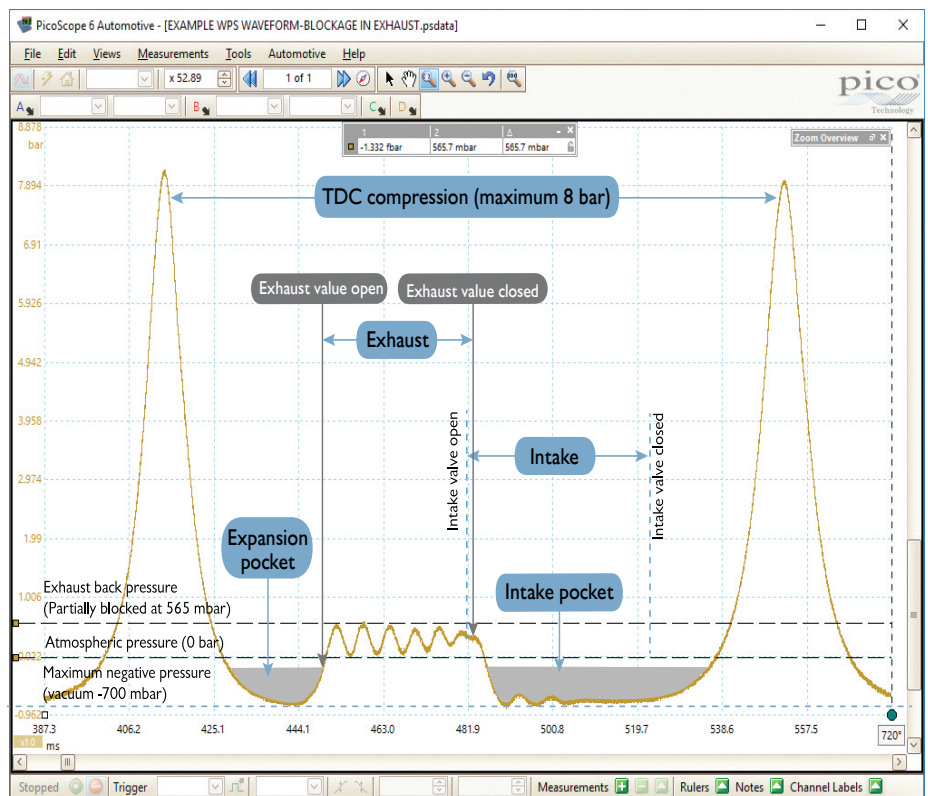
Now, with every stroke of the engine you can reveal exactly how the cylinder under test is operating:

TDC > Ex Valve Opening > Exhaust Valve Closing > Inlet Valve Opening > Inlet Valve Closing > BDC.

Switching the pressure transducer from one cylinder to the next is an easy way to have a direct and valuable comparison. Remember, it is not any more difficult to attach than a standard compression gauge, but it will give you so much more information. You can also save the first cylinder as a reference against the remaining cylinders. Viewing all this lets you make a complete and accurate engine diagnosis. You can do this before you undertake a time-consuming and expensive engine dismantle. In addition, should a dismantle be required, it lets the technician identify where a fault is most likely to be found when work begins.

Diagnosis

The pressure transducer provides a means to convert positive or negative pressures into voltage. When combined with our automotive PicoScopes, we have the distinct advantage of displaying pressure values against time, allowing technicians to view the dynamic change in cylinder pressures during the four-stroke cycle. Assessing the cylinder efficiency using a



The expansion pocket should be equal to the Intake pocket. Any anomalies here would indicate valve timing or valve seat errors.

pressure transducer will reveal more information about the condition of an engine than was ever thought possible, given the resolution and speed of the pressure transducer and PicoScope. For this reason, we have to be aware that the variety of engine designs, intakes, exhaust systems, and elaborate variable valve timings will all have an effect on the waveform and results that differ from vehicle to vehicle.

Based on this cylinder efficiency test and analysis procedure, we can confirm:

- Peak cylinder pressure to be correct for the engine under test (allow for standard compression hose volume of 5 ml).
- Confirmation of uniform and symmetrical compression towers confirming the cylinder efficiency, not only as the pressure build up, but also as it naturally decays during the expansion stroke. For the compression towers

to be symmetrical, valve timing, the valve train and the mechanical integrity of the piston and cylinder must be efficient.

- The presence of the expansion pocket confirms our cylinder can hold a vacuum and must therefore be air tight (valve seat and piston ring integrity is OK).
- Sufficient cranking speed
- Adequate intake and exhaust flow so achieving the correct peak pressure (showing there are no restrictions).
- Repeatability of peak compression for every completion of the four-stroke cycle.
- Cylinder pressure remains at zero bar during exhaust and intake events confirming no airflow restrictions during either stroke.

