

## THE TRUTH ABOUT COMPRESSION TESTING

by Mull Engineering

We would like to take the chance to answer some general questions and myths about compression testing an engine. Compression testing is a method of using a pressure testing device to measure the “cranking” pressure developed in the combustion chamber during cranking speeds of kick or electric starting. These engine speeds are generally between 100 and 400 rpm. This is usually accomplished by removing the spark plug and installing a pressure tester in place of the spark plug and cranking the engine over. This pressure can be somewhat indicative of the condition of an engine and is often used to trouble shoot an engine.

We get a lot of questions about what the pressure should be for a given engine and especially, what is safe for certain fuels. Well, hate to break the news but if you are going to rely on compression testing to determine your fuel selection, you are asking for trouble. The reason is that cranking compression numbers can vary greatly from actual running compression due to many variables such as volumetric efficiency or air fill into the cylinder at cranking speeds, and the wet fuel that is added by the carburetor as rpms come up to operating speeds which does not compress as easily as air. These do not even consider the high pressures of burning fuel in the combustion chamber. The only way to correctly determine the right fuel for an engine is by comparing the swept volumes of an engine when the piston is at top dead center and bottom dead center. This is expressed as the compression ratio or CR. There are also other considerations like head design, piston design, squish clearance, etc, but we will keep it simple for this discussion.

Checking compression is a great way to check the condition of an engine and determine if an engine is in need of service providing additional tests are performed. This is only applicable if there is a base line measurement to refer to, either from a manual, or from testing a given engine when it is new and considered a valid value. Regarding four strokes, this form of testing is also a great way to determine if valves are seating properly and at the right time. This form of testing, however, may not give accurate data as to the piston ring seal, wear on the piston rings, or piston condition itself. Bottom line is that many other things can be going wrong in the engine and the compression test will not show it! This is why experienced technicians use this form of testing only as a guide and usually along with other tests. This testing might be compared to testing a child's temperature to determine illness, it is simply not enough data to give the full picture.

However, by compression testing, one can easily determine, if an engine has lost substantial compression and if an engine is in need of service. Many people will look to perform a compression test at home and this can be done with just as much accuracy as any service shop, given the right equipment and knowledge. Contrary to popular myth, an actual pressure gauge bought about anywhere, can be rather accurate. This, however, is only looking at the dial gauge portion though. There is also a hose extension and the adaptor component that will screw into the head in place of the spark plug.

One of the most common mistakes is selecting a tester in which the head adaptor does not screw into the cylinder head with the same amount of thread as the spark plug that came out. This lack of thread can be compared directly to adding extra volume in the cylinder head and will not represent the same pressure numbers as if the spark plug were reinstalled. Obviously selecting a tester with the correct length of threads will eliminate this problem. You must also be careful not to use too long of an adaptor as well because of the opposite effects as well as potentially causing internal engine damage from mechanical contact from moving parts in the engine and the tester adaptor.

The next and most common problem we see is when a tester is selected, it should have a "Schrader valve" in the very tip of each adaptor. A Schrader valve is the same valve used in the valve stem of a tire and is a one way or check valve device. What this does is isolate the volume in the cylinder head from the volume in the tester adaptor and extension hose. Without this valve in place at the very tip of the adapter, the extra volumes in the hose and adaptor will act to increase the cylinder head volume and give a false (low) reading. The Schrader valve must be in good condition and work correctly and it is common to replace them regularly.

The method for compression testing an engine is rather elementary but certain things must be considered. First, you want to turn the ignition switch off so you don't get surprised. Install the tester adaptor in place of the spark plug and either hold the throttle wide open to allow the most air to the engine or you can simply remove the carburetor entirely. Then either kick or electrically crank the engine over until the compression gauge will not go any higher. This process generally takes around 50-200 revolutions of the engine to complete the test. Excessive cranking while the gauge is still climbing is sign of leakage somewhere in the engine.

When the test is complete, the gauge should hold the tested pressure at the gauge indefinitely. If not, there is certain leakage of the tester, either the mentioned Schrader valve, or other unions should be inspected. It is NOT a requirement to purchase an expensive compression tester but one should certainly be selected of decent quality and include the considerations listed above.

Regarding four strokes, it should be mentioned many engines use a form of compression release to lower cranking compression to make an engine easier to turn over and start. This compression release is usually turned of by mechanical means right after starting. This mechanism will directly affect accurate compression testing. You may need to refer to your manual for an estimated compression value with the compression release in use, or you may need to render the release mechanism ineffective for testing. If the engine uses electric start, it may be impossible to turn over without the compression release so derated numbers from a service manual will be required.