

AUTO-MAINTENANCE BASICS

Fifth of a series

Check for previous #

How to use a **compression gauge**

By HERB CARRIER

Your car engine is a pump. It sucks air and gas down into its cylinders, then compresses them into a small space at the top of each cylinder. There a spark ignites the highly combustible gas-air mix, and the rapid expansion of the burning mixture forces the piston back down, turning the crankshaft. Weak compression will not bring about efficient combustion. If one or more cylinders have weak compression, you can't tune the engine for top performance.

You check compression with a reliable compression gauge costing about \$15. The gauge that incorporates a flexible hose with several adaptors for use on various spark-plug thread sizes is probably most universal and easiest to use. Engine or cylinder, compression pressure is read in pounds per square inch (p.s.i.). Here's how you do it:

Start the engine and let it run until it reaches operating temperature. Then turn off the ignition.

Working with one spark plug at a time, remove the cable from the plug, loosen the plug approximate-

ly one full turn, and replace the cable on the plug. When this is done to all plugs, start the engine and accelerate a couple of times to about 1000 rpm each time. Reduce engine speed to idle and turn ignition switch OFF. The object of this exercise is to blow out carbon flakes broken loose by turning the plugs. Otherwise a flake or two may lodge between the valve and seat, causing erratic compression readings. The procedure also helps blow away sand and other crud from the plug wells before the plugs are removed.

The test

Before you start, check your battery, using a hydrometer [PS, March, p. 90]. The battery should be at or near full charge to deliver the necessary cranking power. Then proceed:

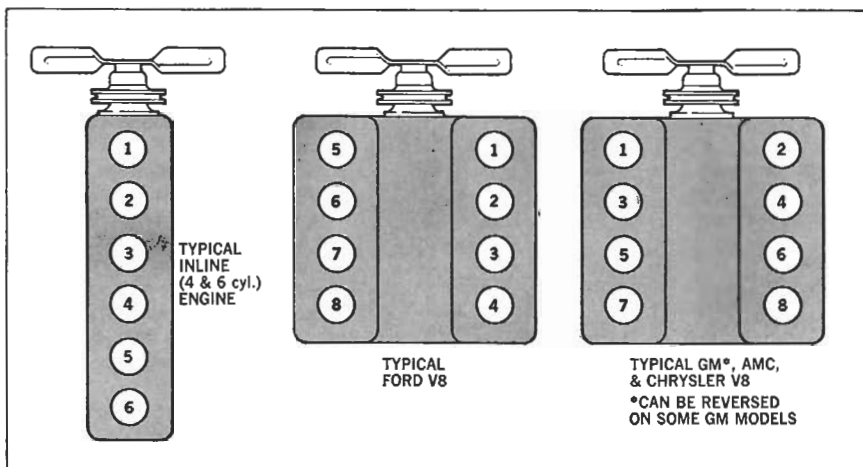
- Remove all spark plugs. Note condition of firing ends, and set plugs aside in order of removal for identification purposes.
- Remove air-cleaner assembly.
- Block carburetor throttle plate(s) and choke plate in wide-open position.

- Connect jumper wire between coil primary terminal and ground, or remove and ground distributor-cap center cable, so that engine will not start while being cranked; make sure the transmission is in neutral or park position.

- Connect the compression gauge to number-one cylinder, the most logical place to begin the test.

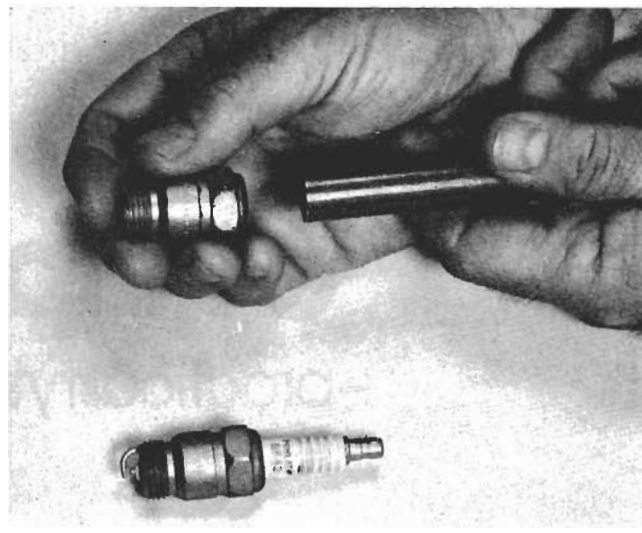
If you have a remote-control starter switch, connect it so you can operate the starting motor with one hand and hold the compression gauge with the other hand. Make sure that you know what you're doing when you use the remote-control switch. On some cars—namely GM units—it's possible to damage ignition-switch contacts if the remote-control switch is used when the ignition switch is not in the ON position. If you do not have a remote-control switch, you'll need a helper to operate the ignition switch at your call.

Crank the engine through a minimum of six compression strokes. Record the gauge readings. The accompanying chart shows Buick's recommended method of recording readings. The cylinder numbers listed on the chart are *not* the firing order. Generally, inline engines (fours and sixes) are numbered front-to-back (fan end is front) in 1-2-3-4-etc. fashion. On V8's, Ford likes to go 1-2-3-4 down the left side (when viewed from the front of the car) and 5-6-7-8 down the other side. American Motors and Chrysler number cylinders 2-4-6-8 down the left side (when viewed from the front of the car) and 1-3-5-7 down the other side. GM follows the AMC and Chrysler pattern in most cases but some GM





Needle on compression-gauge dial holds at maximum reading. After noting it, press valve to allow needle to drop to zero before you check the next cylinder's compression.



For cylinder-leakage test you can make your own adaptor for compressed-air hose by driving the insulator out of an old spark plug and brazing a section of copper tubing onto it.

engines are numbered 1-3-5-7 down the left side and 2-4-6-8 down the right side. *The message here is: For the validity of this test, do not take cylinder numbering for granted.* If you aren't certain of the cylinder numbering on your engine, make it a point to find out. Call a dealer if necessary.

Interpreting readings

Engine manufacturers now lean away from quoting any "correct" figures for compression pressures. Buick, for example, says that the lowest reading must be 70 percent of the highest reading. Ford says that it must be 75 percent. Chrysler recommends that minimum compression pressure must be 100 p.s.i., with a maximum variation of 40 p.s.i. between cylinders. A good consensus would be a minimum 100 p.s.i. for the engine to run properly. Above this pressure, it's the variation between cylinders that's important.

If one or more cylinders should read too low, use a pump-type oil can to inject about one tablespoon of engine oil through the open spark-plug hole onto the top of the low-reading piston(s). Repeat the compression test. If the oil treatment causes an increase in compression pressure, it indicates piston-ring or cylinder-wall troubles that are being sealed temporarily by the injected oil. If compression pressure does not rise with the shot of oil, it indicates valve or valve-seat problems.

Low compression pressure on adjacent cylinders indicates a blown cylinder-head gasket between these cylinders. This diagnosis is supported if the spark plugs that were

removed from these cylinders are wet with oil.

Don't jump to conclusions, however. Sustained low-speed driving with leaded fuel can result in excessive deposit build-up on exhaust valves and seats, which can cause temporary lowering of compression pressure and poor engine performance. A series of hard accelerations on a throughway will often "blow out" the engine to restore proper compression. A commercial combustion-chamber cleaner can also do the job, but in some extreme cases cylinder-head removal and hard scraping is the only thing that will do the job. Excessive deposit build-up can also lead to excessively high compression-pressure readings. Here, too, a throughway speed run is a possible and inexpensive fix. Before you use commercial combustion-chamber solvents for deposit removal, make sure the solvent you are using is okay for use with catalytic converters (if your vehicle has one).

Cylinder-leakage test

If you have access to compressed air (70 p.s.i. minimum, 200 p.s.i. maximum) you can perform a cylinder-leakage test on those cylinders that show low compression. The object of the leakage test is to pinpoint the exact cause of pressure loss. You will need an adaptor, something to fix the compressed-air hose to the spark-plug hole. Commercial adaptors are available, but you can make one by driving the insulator assembly from a suitable spark plug, leaving only the plug shell. Then braze a section of steel or copper tubing to the shell. The air hose is applied to the open end

of the tubing, and the shell is screwed securely into the plug hole.

To make the test, place the piston in the suspected cylinder on top dead center. If necessary, crank the engine over while sealing the spark-plug hole with your thumb to determine when the piston is coming up on compression stroke. Then screw in the adaptor and apply the compressed air.

Interpreting results

Air escaping at various points is interpreted as follows:

- *Out tailpipe:* leaking exhaust valve.
- *Out carburetor* (air cleaner removed): leaking intake valve.
- *Into crankcase* (oil filler cap removed): worn piston or cylinder walls, stuck or broken piston rings, cracked piston.
- *Through radiator* (radiator cap removed and bubbles noted in the coolant): leaking cylinder-head gasket or crack in cylinder head or block.

Some air leakage is usually considered normal if all cylinders leak about the same amount. As with compression pressure, variation between cylinders is more important than the actual amounts. **PS**

Sample recording chart

Cylinder number	1	2	3	4	5	6	7	8
Comp. pressure (p.s.i.)	129	135	146 ²	121	120	100 ¹	130	126

¹ Lowest reading
² Highest reading
 146 (Highest reading)
 x .70 (70 percent)
 102.2 (Acceptable lowest reading)^o

^o Compression in cylinder no. 6 is too low to be accepted. Use oil treatment (see text) and/or cylinder-leakage test to pinpoint cause of low compression.