

Compression Testing

Description

This Activity Plan is designed as one among many through which students will rotate in small groups.

An automotive compression test is very important for determining the internal condition of an engine. In addition, the compression test allows automotive technicians to evaluate engine problems that may exist in a wide range of engine areas. The compression test gives the automotive technician vital information about engine health, performance and/or problems.

Lesson Outcomes

The student will be able to:

- Properly use tools that are required to do a compression test
- Remove and replace spark plugs in an effective manner
- Retain an understanding of the proper steps or procedures required to do a compression test
- Use compression testing equipment in a safe, effective, and accurate process.

Assumptions

The student will have a general understanding of basic four-stroke engine theory.

Terminology

Compression tester: a specific compression gauge used to determine how much pressure an engine can produce.



Figure 1—Compression tester



Fuel pump relay: the electrical component that energizes the fuel pump.

Ignition system: the electrical system within a vehicle that delivers spark or ignition to the engine.

Spark plug socket: a specific socket designed to remove and install a spark plug. Although it may look like a regular deep socket, it is different. Inside the cavity of the socket is a rubber sock that protects the spark plug from scratching, cracking or breaking. In addition, most spark plug sockets have a hex on the top of the socket so a wrench can be used on it for hard to reach or awkwardly-placed spark plugs.



Figure 2—Spark plug socket

Spark plug wire pliers: pliers that are designed to remove the spark plug wire from the spark plug without causing any damage.



Figure 3—Spark plug boot puller



Figure 4—Spark plug boot pliers

Wide open throttle: a condition where the maximum amount of air is allowed into the engine.

Estimated Time

1 hour

Recommended Number of Students

20, based on the *BC Technology Educators' Best Practice Guide*

Facilities

Automotive shop or a technology education shop that will accommodate a vehicle

Tools

- Spark plug socket
- Spark plug wire pliers
- 12" $\frac{3}{8}$ " extension
- $\frac{3}{8}$ " ratchet
- Compression tester
- Oil squirt can

Materials

You will need a vehicle in order to do the compression test. Ideally the vehicle will be smaller and preferably a four cylinder. It is much easier to do a compression test with this type of vehicle.

Resources

Compression Testing and What You Can Learn from It

www.youtube.com/watch?v=X_tbksFYhl4

How to Do a Compression Test

www.youtube.com/watch?v=YnV7FjLLt2s

Activity 1: Dry Compression Test

1. The teacher will demonstrate how to correctly do a compression test. After the students have viewed the demonstration they will be given the opportunity to do the compression test. This is usually done in a lab-based format with instructor signatures required at various stages.
2. Start the vehicle and warm it up until the engine is at normal operating temperature (approximately 5–10 minutes). **Note: Only the instructor should operate the vehicle.**



Figure 5—Spark plug wires attached to engine

3. Remove all of the spark plug wires from the spark plugs. It is a good idea to label the spark plug wires so you know which cylinder they came from. **Note:** Grasp and twist the spark plug boot (not the wire) in order to remove. Sometimes due to the heat of the engine, spark plug boots get stuck on the spark plugs. In such cases it may be necessary to use spark plug boot puller/pliers.
4. Disable the ignition system by removing and then grounding the high-tension lead.

- Remove the fuel pump relay. This relay is usually found in the fuse box under the hood and is labelled as such.



Figure 6—Typical fuel pump relay location

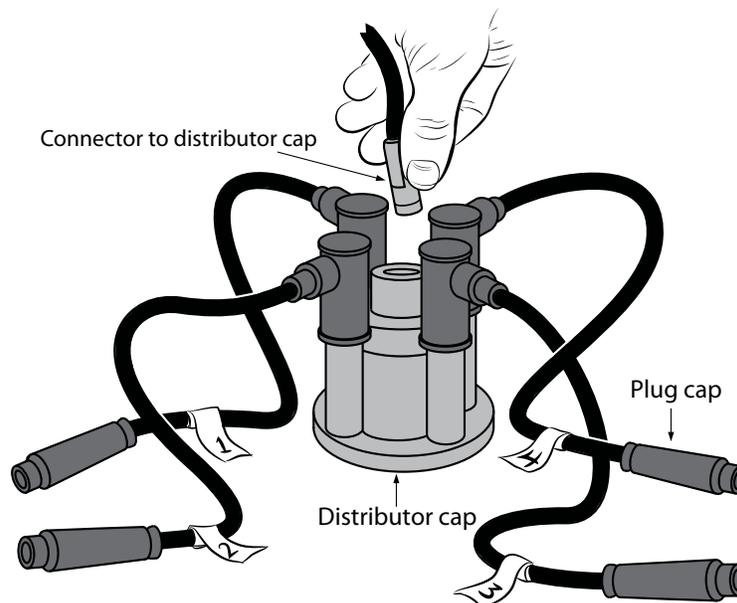


Figure 7—Label the spark plug wires so they do not get mixed up. Then remove the centre wire and ground this high-tension lead.

6. Remove all of the spark plugs using a spark plug socket.
7. Insert the compression tester into one of the spark plug holes.



Figure 8—Remove centre wire



Figure 9—Compression gauge inserted into spark plug hole

8. With a partner crank the engine over for 5 seconds. One person will be holding the compression tester and the other will be inside the vehicle cranking the engine over.
Note: Make sure to have the gas pedal all the way to the floor when performing this operation, as this will allow for maximum air into the engine.
9. Write down the reading and repeat for the rest of the cylinders.
10. Compare all of the compression test results. They should be within 20% of each other.

Activity 2: Wet Compression Test

A wet compression test is similar to a dry compression test except it has the addition of oil placed in each cylinder. A wet compression test is done for two reasons:

- One or more cylinders has a reading of less than 100 psi on the dry compression test.
- One or more cylinders is more than 20% different from the other cylinders on a dry compression test.

The extra oil in the cylinder should temporarily seal the piston rings in the cylinder. The results can help diagnose possible engine problems.

Procedure:

1. Perform a dry compression test and record the results.
2. With an oil squirt can, place approximately one tablespoon of oil (15 mL) into the first cylinder—this is roughly two squirts of oil.
Note: Do not put excess oil in the cylinder!
3. Crank the engine approximately four times to move the oil around the cylinder.
4. Insert the compression gauge and check the compression as before.
5. Record the new reading.
6. Repeat this process on each cylinder. **Note:** Squirt oil into one cylinder at a time. Squirting oil into all the cylinders at once and then doing the compression test will skew the results, since by the time you get to the last cylinder the oil will have lost its effectiveness.
7. Compare the results of the wet test with those of the dry test. In particular, pay attention to the cylinders that were questionable from the dry compression test. One of two things should happen:

- a. The results remain about the same. **Example:**

Dry test: 115

Wet test: 120

Diagnosis: The low compression is likely due to wear in the valves or valve guides.

- b. The results improve significantly. **Example:**

Dry test: 115

Wet test: 135

Diagnosis: The low compression is likely due to wear in the piston rings.

Note: When starting the vehicle for the first time after a wet compression test, excess smoke may come out of the exhaust. This is perfectly normal and should only last for 2–5 minutes.

Evaluation Guidelines

- The students use the required tools in a safe and effective manner.
- The ignition system is disabled properly.
- The fuel system is disabled properly.
- The students can remove and replace the spark plugs correctly without damaging them.
- The compression test itself is carried out in a safe and effective manner.
- The student's evaluation of the compression test data is a correct interpretation of the health of the engine.