FIGURE 20.1 Blowby gases coming out of the crankcase vent hose. Excessive amounts of combustion gases flow past the piston rings and into the crankcase.

FIGURE 20.2 White steam is usually an indication of a blown (defective) cylinder head gasket that allows engine coolant to flow into the combustion chamber where it is turned to steam.
FIGURE 20.3 What looks like an oil pan gasket leak can be a rocker cover gasket leak. Always look up and look for the highest place you see oil leaking, then troubleshoot from there.

FIGURE 20.4 The transmission and flexplate (flywheel) were removed to check the exact location of this oil leak. The rear main seal and/or the oil pan gasket could be the cause of this leak.
FIGURE 20.5 Using a black light to spot leaks after adding dye to the oil.

FIGURE 20.6 An accessory belt tensioner. Most tensioners have a mark that indicates normal operating location. If the belt has stretched, this indication mark will be outside of the normal range. Anything wrong with the belt or tensioner can cause noise.

CHART 20.2
A cracked exhaust manifold on a Ford V-8.

To measure engine oil pressure, remove the oil pressure sending (sender) unit usually located near the oil filter. Screw the pressure gauge into the oil pressure sending unit hole.

The paper test involves holding a piece of paper near the tailpipe of an idling engine. A good engine should produce even, outward puffs of exhaust. If the paper is sucked in toward the tailpipe, a burned valve is a possibility.
FIGURE 20.10  A two-piece compression gauge set. The threaded hose is screwed into the spark plug hole after removing the spark plug. The gauge part is then snapped onto the end of the hose.

FIGURE 20.11  Use a vacuum or fuel line hose over the spark plug to install it without danger of cross-threading the cylinder head.

FIGURE 20.12  Badly burned exhaust valve. A compression test could have indicated a problem, while a cylinder leakage test (check below test) would have been useless in detecting this exact problem.
Figure 20.13 A typical handheld cylinder leakage tester.

Figure 20.14 A whistle stop used to find top dead center. Remove the spark plug and install the whistle stop, then rotate the engine by hand. When the whistle stops making a sound, the piston is at the top.

Figure 20.15 Using a vacuum hose and a test light to ground one cylinder at a time on a distributorless ignition system. This works on all types of ignition systems and provides a method for grounding out one cylinder at a time without fear of damaging components. Do not short out a cylinder for longer than five seconds.
Chapter 20
Engine Condition Diagnosis

FIGURE 20.16 An engine in good mechanical condition should produce 17 to 21 inches Hg of vacuum at idle at sea level.

FIGURE 20.17 A steady but low reading could indicate retarded valve or ignition timing.

FIGURE 20.18 A gauge reading with the needle fluctuating 3 to 9 inches Hg below normal often indicates a vacuum leak in the intake system.
A leaking head gasket can cause the needle to vibrate as it moves through a range from below to above normal.

An oscillating needle 1 or 2 inches Hg below normal could indicate an incorrect air-fuel ratio, yellow too rich or blue lean.

A rapidly vibrating needle at idle that becomes steady as engine speed is increased indicates worn valve guides.
FIGURE 20.22 If the needle drops 1 or 2 inches Hg from the normal reading, one of the engine valves is burned or not seating properly.

FIGURE 20.23 Weak valve springs will produce a normal reading at idle, but as engine speed increases, the needle will fluctuate rapidly between 12 and 24 inches Hg.

FIGURE 20.24 A steady needle reading that drops 2 or 3 inches Hg when the engine speed is increased slightly above idle indicates that the ignition timing is retarded.
FIGURE 20.25 A steady needle reading that rises 2 or 3 inches Hg when the engine speed is increased slightly above idle indicates that the ignition timing is advanced.

FIGURE 20.26 A needle that drops to near zero when the engine is accelerated rapidly and then rises slightly to a reading above normal indicates an exhaust restriction.

FIGURE 20.27 A technician-made adapter used to test exhaust system back pressure.
FIGURE 20.28 A tester that uses a blue liquid to check for exhaust gases in the exhaust, which usually indicates a head gasket leak problem.

FIGURE 20.01 The tools and equipment needed to perform a compression test include a compression gauge, an air nozzle, and the socket ratchets and extensions that may be necessary to remove the spark plugs from the engine.

FIGURE 20.02 To prevent ignition and fuel-injection operation while the engine is being cranked, remove both the fuel-injection fuse and the ignition fuse. If the fuses cannot be removed, disconnect the wiring connectors for the injectors and the ignition system.
Block open the throttle (and choke, if the engine is equipped with a carburetor). Here a screwdriver is being used to wedge the throttle linkage open. Keeping the throttle open ensures that enough air will flow into the engine so that the compression test results will be accurate.

Before removing the spark plugs, use an air nozzle to blow away any dirt that may be around the spark plug. This step helps prevent debris from getting into the engine when the spark plugs are removed.

Remove all of the spark plugs. Be sure to mark the spark plug wires so that they can be reinstalled onto the correct spark plugs after the compression test has been performed.
UNFIGURE 20.06 Select the proper adapter for the compression gauge. The threads on the adapter should match those on the spark plug.

UNFIGURE 20.07 If necessary, connect a battery charger to the battery before starting the compression test. It is important that consistent cranking speed be available for each cylinder being tested.

UNFIGURE 20.08 Make a note of the reading on the gauge after the first "puff," which indicates the first compression stroke that occurred on that cylinder as the engine was being rotated. If the first puff reading is low and the reading gradually increases with each puff, weak or worn piston rings may be indicated.
UNFIGURE 20.09 After the engine has been cranked for four "puffs," stop cranking the engine and observe the compression gauge.

UNFIGURE 20.10 Record the first puff and this final reading for each cylinder. The final readings should all be within 20% of each other.

UNFIGURE 20.11 If a cylinder is lower than most of the others, use an oil can and use two squirts of engine oil into the cylinder and repeat the compression test. This is called performing a wet compression test.
If the gauge reading is now much higher than the first test results, then the cause of the low compression is due to worn or defective piston rings. The oil in the cylinder temporarily seals the rings, which causes the higher reading.