

Engine Vacuum Gauge Testing

Vacuum gauges have been a valuable tool to mechanics for years. Even with modern computer controlled engines a vacuum gauge is still a valuable tool for diagnosing engine and transmission problems.

Engine/Transmission Relations

An important part of transmission diagnosis is to make certain the engine operates properly. If the engine performance is incorrect, the transmission will receive the wrong information. Many times what is perceived as a transmission problem is in actuality an engine problem. The engine sends signals to the transmission through a vacuum line, throttle cable or both. These signals basically synchronize torque with transmission line pressure, shift feel and shift timing. Malfunctions in items like the air filter; spark plugs, EGR valves and other parts of the fuel, electrical and emission systems could result in improper transmission performance.

Vacuum Gauge Engine Performance Testing

A vacuum gauge shows the difference between outside atmospheric pressure and the amount of vacuum present in the intake manifold. The pistons in the engine serve as suction pumps and the amount of vacuum they create is affected by the related actions of:

- Piston rings
- Valves
- Ignition system
- Fuel control system
- Other parts affecting the combustion process (emission devices, etc.).

Each has a characteristic effect on vacuum and you judge their performance by watching variations from normal. It is important to judge

engine performance by the general location and action of the needle on a vacuum gauge, rather than just by a vacuum reading. Gauge readings that may be found are as follows:

Normal Engine Operation

At idling speed, an engine at sea level should show a steady vacuum reading between 17" and 21" HG. A quick opening and closing of the throttle should cause vacuum to drop below 5" then rebound to 21" or more.

General Ignition Troubles Or Sticking Valves

With the engine idling, continued fluctuation of 1 to 2 inches may indicate an ignition problem. Check the spark plugs, spark plug gap, primary ignition circuit, high tension cables, distributor cap or ignition coil. Fluctuations of 3 to 4 inches may be sticking valves.

Intake System Leakage, Valve Timing, Or Low Compression

Vacuum readings at idle much lower than normal can indicate leakage through intake manifold gaskets, manifold-to-carburetor gaskets, vacuum brakes or the vacuum modulator. Low readings could also be very late valve timing or worn piston rings.

Exhaust Back Pressure

Starting with the engine at idle, slowly increase engine speed to 3,000 RPM, engine vacuum should be equal to or higher than idle vacuum at 3,000 RPM. If vacuum decreases at higher engine RPM's, an excessive exhaust back pressure is probably present.

Cylinder Head Gasket Leakage

With the engine Idling, the vacuum gauge pointer will drop sharply, every time the leak occurs. The drop will be from the steady reading shown by the pointer to a reading of 10" to 12" Hg or less. If the leak is between two cylinders, the drop will be much greater. You can determine the location of the leak by compression tests.

Fuel Control System Troubles

All other systems in an engine must be functioning properly before you check the fuel control system as a cause for poor engine performance. If the pointer has a slow floating motion of 4 to 5 inches - you should check the fuel control.

Recap

- Engine problems can affect transmission performance.
- If you suspect an engine problem, connect a vacuum gauge to the intake manifold.
- Note the location and action of the vacuum gauge needle.

- Use the information in this article to determine the engine problem.
- Correct the engine problem before doing extensive calibration work on the transmission.

Performing A Vacuum Gauge Test

Connect the vacuum gauge hose as close to the intake manifold as possible and start engine. Run engine until normal operating temperature has been reached and then allow to idle. On V type engines having two manifolds, make separate tests on each manifold. If required, set the idle adjustment on the carburetor so that the engine idles smoothly.

NOTE: Vacuum readings will vary according to the altitude in different localities. From sea level to 2,000 feet elevation all normal engines should show a **vacuum reading between 17 to 21 inches**. Above 2,000 feet elevation the vacuum reading will be about one (1) inch lower per each 1,000 feet rise in elevation.

CHART OF VACUUM READINGS		
Engine Speed	Reading	Indication of Engine Condition
Smooth and steady idle (800 to 1200 RPM)	Between 17 to 21 inches	Engine is in Good Condition, but perform next test to be sure.
Open and close throttle quickly	Jumps from 2 to about 25 inches	Engine is in Good Condition.
Smooth and steady idle	Steady, but lower than normal reading	Worn rings, but perform next test to be sure.
Open and close throttle quickly	Jumps from 0 to 22 inches	Confirms worn rings.

Steady idle	Intermittent dropping back 3 or 5 divisions and returns to normal	Sticky Valves. If injection of penetrating oil into intake manifold temporarily stops pointer from dropping back, it's certain the valves are sticking.
Steady 3000 RPM	Pointer fluctuates rapidly, faster engine speed causes more pointer swing	Weak valve springs.
Steady idle	Fast fluctuation between 14 to 19 points	Worn intake valve stem guides. Excessive pointer vibration at all speeds indicates a leaky head gasket.
Steady idle	Constant drop	Burnt valve or insufficient tappet clearance holding valve partly open or a spark plug occasionally miss firing.
Steady idle	Steady 8 to 14 inches	Incorrect valve timing. It must also be remembered that vacuum leaks and/or poor compression can result in a low vacuum reading.
Steady idle	Steady 14 to 16 inches	Incorrect ignition timing.
Steady idle	Drifting from 14 to 16 inches	Plug gaps too close or points not synchronized..
Steady idle	Drifting 5 to 19 inches	Compression leak between cylinders.
Steady idle	Steady below 5 inches	Leaky manifold or carburetor gasket, or stuck manifold heat control valve.
Steady idle	Floats slowly between 12 and 16 inches	Carburetor out of adjustment.
Blipping engine speed	Quick drop to zero then return to normal reading	Muffler is clear.
Blipping engine speed	Slow drop of pointer then slow return to normal reading	Muffler is choked or blocked.