Engine: Testing and Inspection
Intake Manifold Vacuum Test

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Bring the engine to normal operating temperature. Connect the Vacuum/Pressure Tester to the intake manifold. Run the engine at the specified idle speed.

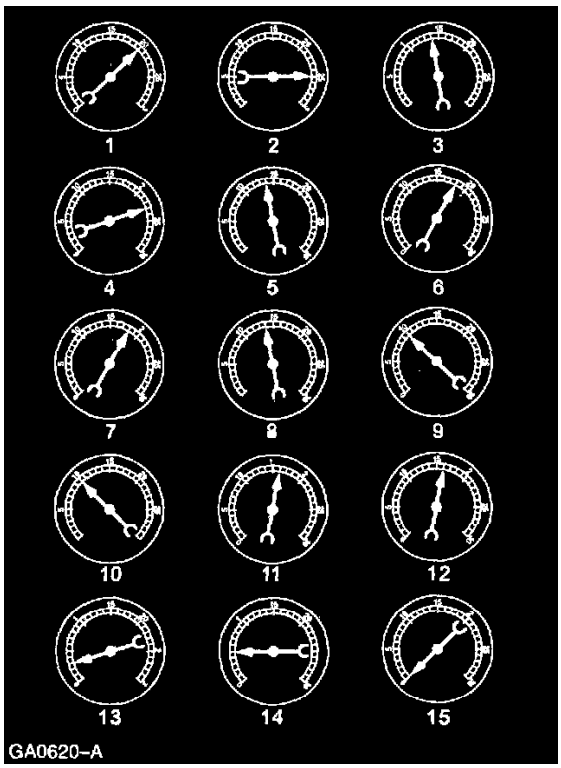
The vacuum gauge should read between **51 - 74 kPa (15 - 22 in-Hg)** depending upon the engine condition and the altitude at which the test is performed. Subtract **4.0193 kPa (1 in-Hg)** from the specified reading for every **304.8 in (1,000 feet)** of elevation above sea level.

The reading should be steady. If necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust the damper until the needle moves easily without excessive flutter.

Intake Manifold Vacuum Test-Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas. Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.



Vacuum Gauge Readings

The following are potential gauge readings. Some are normal; others should be investigated further.

1. NORMAL READING: Needle between **51 - 74 kPa (15 - 22 in-Hg)** and holding steady.
2. NORMAL READING DURING RAPID ACCELERATION AND DECELERATION: When the engine is rapidly accelerated (dotted needle), the needle will drop to a low reading (not to zero). When the throttle is suddenly released, the needle will snap back up to a higher than normal figure.
3. NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP: The needle will register as low as **51 kPa (15 in-Hg)** but will be relatively steady. Some oscillation is normal.
4. WORN RINGS OR DILUTED OIL: When the engine is accelerated (dotted needle), the needle drops to **0 kPa (0 in-Hg)**. Upon deceleration, the needle runs slightly above **74 kPa (22 in-Hg)**.
5. STICKING VALVES: When the needle (dotted) remains steady at a normal vacuum but occasionally flicks (sharp, fast movement) down and back about **13 kPa (4 in-Hg)**, one or more valves may be sticking.
6. BURNED OR WARPED VALVES: A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or warped valves. Insufficient hydraulic lash adjuster or Hydraulic Lash Adjuster **(HLA)** clearance will also cause this reaction.
7. POOR VALVE SEATING: A small but regular downscale flicking can mean one or more valves are not seating.
8. WORN VALVE GUIDES: When the needle oscillates over about a **13 kPa (4 in-Hg)** range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.
9. WEAK VALVE SPRINGS: When the needle oscillation becomes more violent as engine rpm is increased, weak valve springs are indicated. The

reading at idle could be relatively steady.

10. LATE VALVE TIMING: A steady but low reading could be caused by late valve timing.
11. IGNITION TIMING RETARDING: Retarded ignition timing will produce a steady but somewhat low reading.
12. INSUFFICIENT SPARK PLUG GAP: When spark plugs are gapped too close, a regular, small pulsation of the needle can occur.
13. INTAKE LEAK: A low, steady reading can be caused by an intake manifold or throttle body gasket leak.
14. BLOWN HEAD GASKET: A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head-to-cylinder block surface.
15. RESTRICTED EXHAUST SYSTEM: When the engine is first started and is idled, the reading may be normal, but as the engine rpm is increased, the back pressure caused by a clogged muffler, kinked tail pipe or other concerns will cause the needle to slowly drop to **0 kPa (0 in-Hg)**. The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.
16. When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory unit such as the power brake booster, the unit will not function correctly. Always fix vacuum leaks.