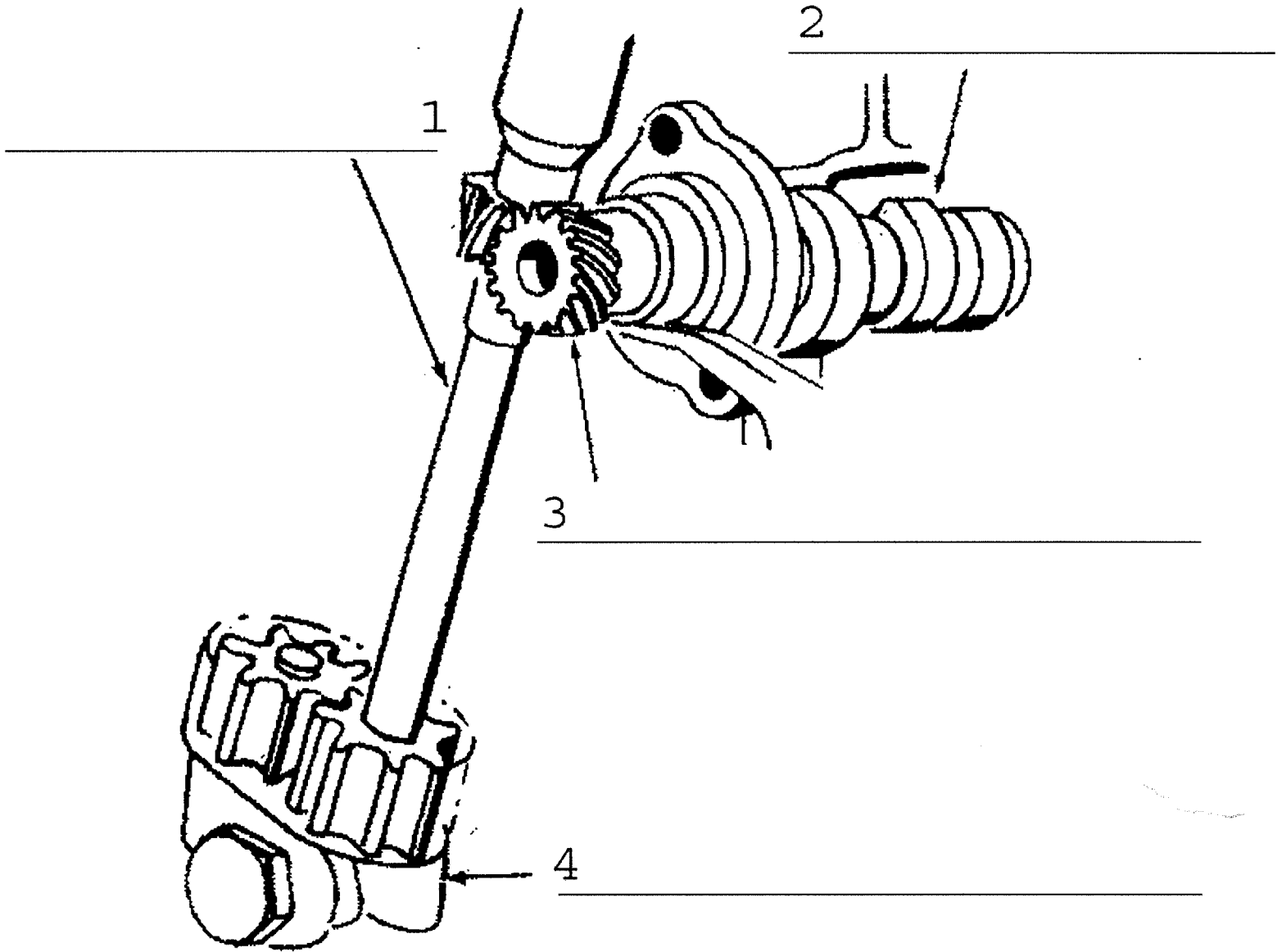
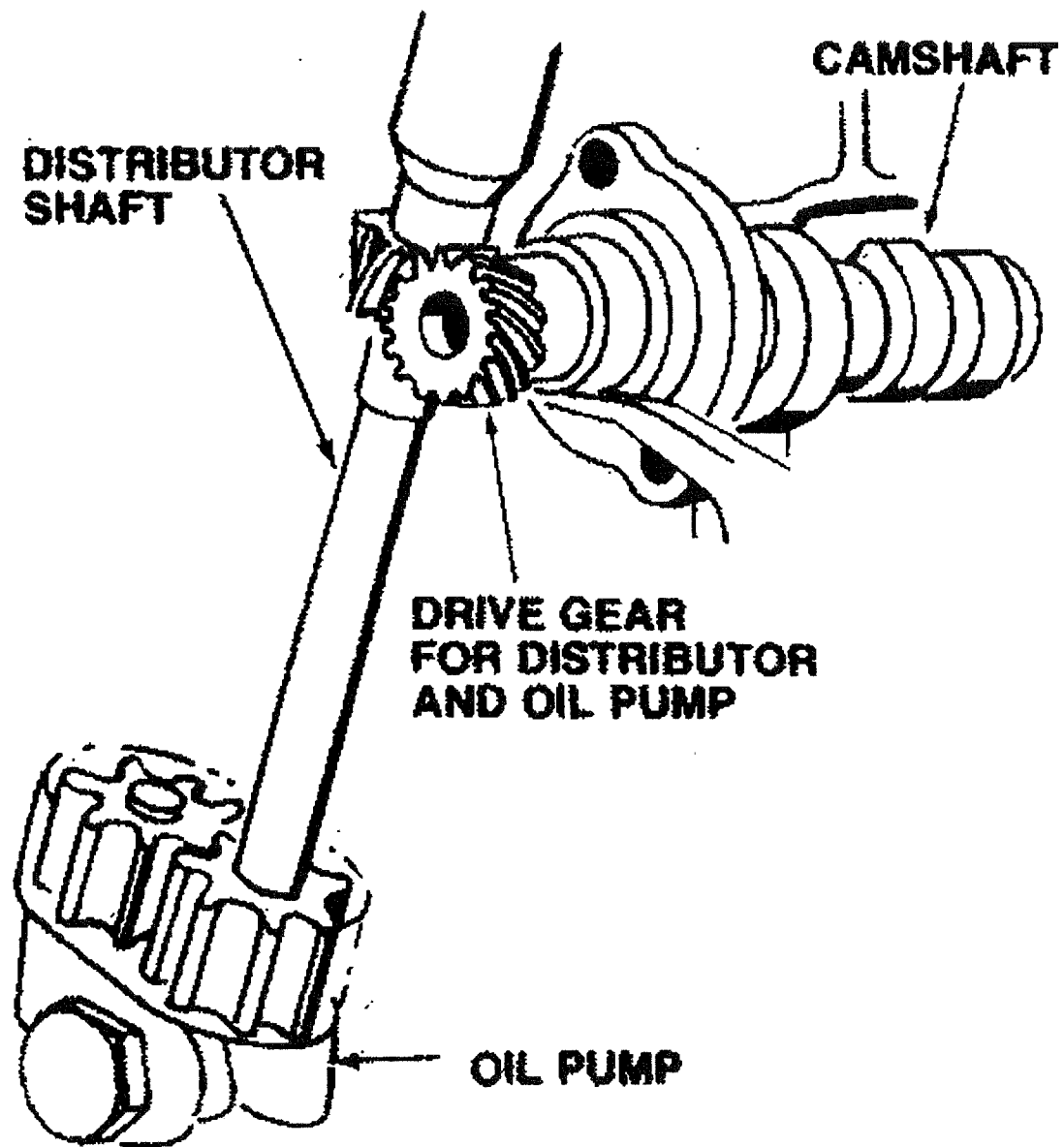


LESSON4_ HANDOUTS

Name _____





SESSION #5 HANDOUTS

HOW TO USE TESTER

1. **IMPORTANT:** BE SURE REGULATOR KNOB IS TURNED FULLY COUNTER-CLOCKWISE BEFORE CONNECTING TO SHOP AIR. OVER PRESSURIZED GAUGES ARE NOT GUARANTEED.

2. **WARNING:** Be certain vehicle is in "Park" or "Neutral" and hands are clear of engine compartment, as engine rotation may occur when using this tool. Disable by grounding the distributor-coil lead.

3. Run engine until it reaches operating temperature.

4. Remove car parts specified in (2) on page 1.

5. Remove all the plugs and position the cylinder to approximate TDC on the compression stroke so both valves are closed. Rotate engine only in engine direction.

To position cylinder correctly:

- A. Rotor points to cylinder coming up on compression.
- B. Piston is at approximately TDC when reluctor teeth align with stationary core.
- C. A whistle is available from your tool man that whistles on the compression stroke and stops at approximately TDC. The whistle can be quickly coupled to the cylinder hose of your tester.

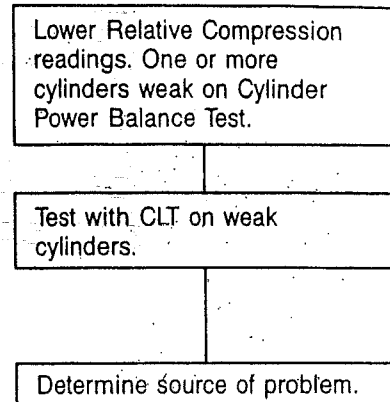
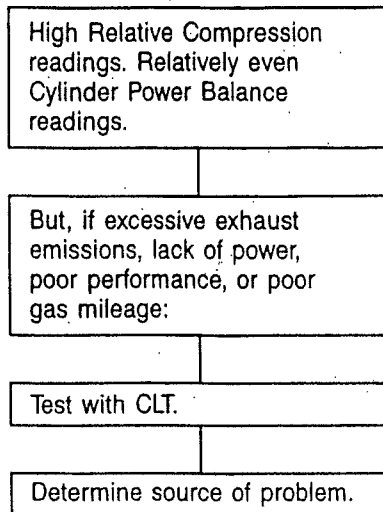
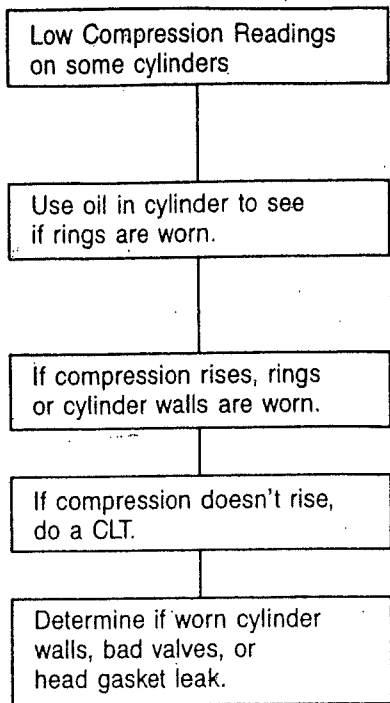
6. Turn the regulator knob fully counter-clockwise. Then connect shop air 45-150 PSI to the regulator w/o cylinder hose connected. Turn regulator clockwise until gauge reads zero at the end of the yellow set band.

7. Screw the cylinder hose into the spark plug hole, and then connect plug end onto quickcoupler of tester. The amount of leakage will now show on the gauge as a percentage loss. Locate the source of leakage if it is excessive.

8. Test the rest of the cylinders and compare leakage to determine which cylinders are bad and why.

HELPFUL SUGGESTIONS

1. If 100% or excessive leakage shows on the percentage gauge the cylinder may not be at approximately TDC on the compression stroke. Check to make sure that cylinder is correctly positioned to have valves closed.
2. If rings are broken or cylinder walls are scored excessive leakage will show.
3. Like in compression testing, it is important that all cylinders have fairly uniform readings. Differences of 15 to 30% indicate excessive leaking. Large engines tend to leak more than small ones.
4. There will always be leakage past the rings even in a new engine.
5. If leakage is excessive on a vehicle with relatively low mileage, piston rings may be stuck. Treat the engine with a quality tune-up oil for a period of time and retest before disassembling.
6. The lower the pitch of the leakage sound, the greater the leakage.
7. Good listening devices are a length of hose or a mechanics' stethoscope with the probe removed.
8. Gauge readings may easily vary 10% or more when making repeat tests on the same cylinder(s). The piston position and the temperature of the engine can cause readings to vary.
9. If a car has multiple problems such as bad rings and burned valves, the tester may only show the most serious of the problems.
10. Try to position just before TDC for uniform results.



CYLINDER LEAKAGE TESTER

Pin-points problem shown by Compression Test or Cylinder Balance Test. Uses shop air to determine leakage source and the amount of leakage measured in percentage of loss.

HOW IT WORKS

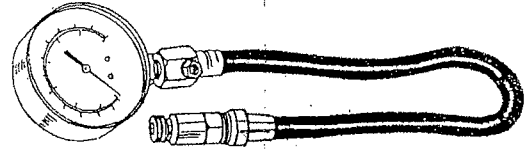
1. Regulated shop air is supplied to each cylinder and the gauge measures the rate of leakage.
2. Remove oil dipstick and radiator cap and disconnect one end of PCV hose. If has carburetor, remove air cleaner and open throttle all the way. If fuel injected, remove air cleaner or throttle body hose to listen at throttle body.
3. To locate source, listen at these places:

- | | |
|---------------------------------|---------------------------------|
| A. Oil dipstick tube | for bad rings, cylinder leakage |
| B. Radiator filler | for cylinder wall cracks |
| C. Adjacent port | for head gasket leakage |
| D. Tail pipe | for exhaust valve leakage |
| E. Carburetor air horn | for intake valve leakage |
| F. Fuel Injection throttle body | for intake valve leakage |

There will always be some leakage past the piston rings even in a new engine. Therefore, you will always hear some leakage at the oil dipstick tube.

ENGINE COMPRESSION TESTER**Instructions:**

1. Remove all spark plugs from engine.
2. Disable ignition system to prevent spark.
3. Always blow out any foreign matter from cylinder before testing.
4. Screw the threaded tool portion into one of the spark plug openings.
5. Crank the engine for several revolutions and read the compression gauge.
6. Continue pressure readings for all cylinders.



This compression tester has been tested for accuracy and leakage before shipment. If, at some point after usage the tool does not hold pressure, the probable cause is foreign matter in either the release valve or the valve core in the adapter. To remove foreign matter, hold down the side release valve with the engine running.

Note: To reorder compression tester check valve, specify part number 20100.

7. Compare each cylinder pressure reading with the vehicle service manual. A low or inconsistent cylinder reading may indicate compression problems.

OPERATING INSTRUCTIONS

VACUUM & PRESSURE TESTER

MANIFOLD VACUUM TEST

Properly handled, a vacuum gauge can provide considerable information about the interior condition of an engine. However, it is easy to misinterpret the readings of the instrument and thereby reach false conclusions. When using a vacuum gauge on an engine, it is far more important to note the ACTION of the gauge rather than the reading of the numbers on the dial.

On an engine which is in good internal condition and properly adjusted, the vacuum gauge indicator will hold steady at a reading somewhere between 17 and 21 at idling speed. There will be some variations as altitude and atmospheric conditions vary. Generally speaking, every 1,000 feet above sea level will lower the reading about one division. Also, an 8 cylinder engine will ordinarily read higher than a 4.

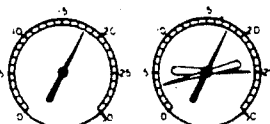
TESTING MANIFOLD VACUUM

1. The engine should be warmed up to operating temperature and idling slightly higher than normal idling speed.
2. Connect the vacuum gauge to the intake manifold. Whenever possible connect the gauge to the vacuum pipe on the inlet manifold in order to avoid any leaks that might exist in the windshield wiper or other connections.
3. With engine running at idle speed and choke valve fully Open, record Vacuum reading.

4. Rapidly increase engine speed and record reading. (Open throttle).
5. Rapidly decrease engine speed and record reading. (Close throttle).
6. Add required correction factor to adjust readings to altitude where tests are performed.
7. Compare readings with typical indications given in the following examples.

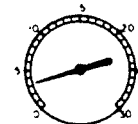
NORMAL ENGINE

The needle should be steady between 17 and 21 while idling. Then, when the throttle is suddenly opened and closed, it should drop to below 5 and then bounce up to around 25.



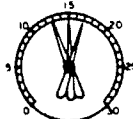
LEAKING INTAKE

A steady needle but extremely low reading indicates a probable air leak in the carburetor, intake manifold or gaskets.



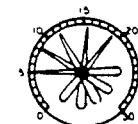
CARBURETOR OUT OF ADJUSTMENT

When the needle fluctuates very slowly over a range of 4 or 5 divisions, the probable trouble is a faulty carburetor adjustment.



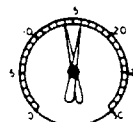
LEAKING HEAD GASKET

If the needle fluctuates regularly between a high and a low reading, the cylinder head gasket has probably blown out between two adjacent cylinders. Make Compression Test.



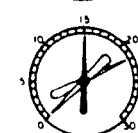
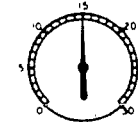
SPARK PLUG GAPS

A needle fluctuation over a much narrower range, perhaps about 2 points, indicates that the spark plug gaps may be spaced too close.



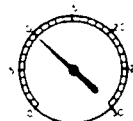
LEAKING PISTON RINGS

The gauge behavior will be very much like a normal engine above, except that all readings are down about 3 or 4 divisions. Thus, the reading when idling will be about 13 to 17 and when the throttle is suddenly opened and closed, the needle may drop to zero and then bounce back to around 22. Make Compression Tests to verify.



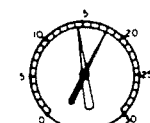
SLOW TIMING

If the engine compression is known to be good and yet the needle reads lower than it should, the ignition timing may be slow. Make Power Timing Light Tests. A considerably lower than normal reading may be due to slow valve timing.

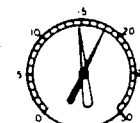


DEFECTIVE VALVE ACTION

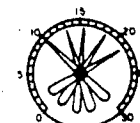
If the needle vibrates rapidly at idle speed, the intake valve guides are probably worn. If the needle vibrates rapidly when the engine is accelerated, there is probably one or more weak valve springs. An intermittent drop of 3 or 4 points indicates sticking valves whereas a regular drop indicates a burned or leaking valve.



Regular drop. Burned or leaking valve



Occasional drop. Sticking valve



Fast vibration at idle. Worn valve guides

MECHANICAL CONDITION OF ENGINE

If a vacuum or compression test indicates a serious mechanical abnormality, such as a bad valve action or loss of compression, it is futile to try to proceed with a tune-up until the problem is

corrected. If, however, the tests indicate problems which may be corrected by either adjustment or minor repair, the corrections may be made during the course of the tune-up.

TESTING FUEL PUMP VACUUM

1. Disconnect gas line from fuel pump inlet. Cap or plug line to prevent fuel leakage.
2. Connect Tester to fuel pump and start engine while observing gauge. If fuel pump is in good condition, reading will gradually increase to approximately 10 inches (250 mm) of vacuum.
3. Stop engine. Remove tester and reconnect gas line.

then specified pressures can cause carburetor flooding, too rich a fuel mixture and poor gas mileage.

3. Stop engine and observe Tester reading for several minutes. Pressure reading should stay steady, then slowly decrease to zero. If pressure drops as soon as engine is stopped, check for worn fuel pump valve or leaking pump housing or diaphragm.
4. Remove Tester and reconnect gas line to fuel pump.

TESTING FUEL PUMP PRESSURE

1. Disconnect fuel line at fuel pump outlet. (Between pump and carburetor).
2. Connect Tester to fuel pump and start engine. With engine running at idle speed, observe reading on pressure half of dial face.
 - Readings during idle should be from 1 1/2 to 4 pounds (.10 to .30 kilograms) as specified by engine manufacturer. Higher

SERVICING TESTER

The Vacuum and Fuel Pump Tester is equipped with an impulse dampener hole in the universal adapter cone or in the gauge fitting at the base of the gauge. After considerable use, this small hole can become clogged with fuel or dirt. To clean, remove hose and force a short length of fine, stiff wire through the hole.