How to Master the VACUUM GAGE

It's got more tricks than a barrel of monkeys. Learn to use it now.

THEY used to tell the story of Cpl. Willie McHugh whose squad was the best-behaved in the old Rainbow Division. Willie never had any trouble.

One day the sergeant asked Willie how he did it, and Willie answered, "Oh, I can read their minds."

When the sergeant denied this on the grounds that you can't read a vacuum, Willie just smiled and pulled forth a gage about the size of an alarm clock with a long rubber hose attached to it.

It was a vacuum gage.

Now although that story about what Willie did with it sounds a little like noise, the things you can do with a vacuum gage are remarkable and no end helpful.

It shortcuts diagnosis and leads like a bloodhound to the probable sources of engine trouble; in the hands of a mechanic who knows how to use it, the vacuum gage is a crystal ball - sees all, knows all and tells all.

The reason, of course, is that the vacuum in an engine must behave in a certain way under certain conditions. Any misbehavior is a clue to trouble. The vacuum gage detects misbehavior.

Specifically, the vacuum gage, attached to any manifold outlet, can tip you off to worn rings, weak valve springs, gum on the valves, inoperative distributor advance-mechanisms, clogged muffler, leaky gaskets and manifolds, poor idling mixture adjustment, and a kitful of similar aches and pains.

Just hook up the hose, watch the gage needle dance, and go to work happy.

But first, of course, there's a couple of things you'll have to know:

How is vacuum formed in the engine? What disturbances and trouble cause reactions on the vacuum gage? What are the reactions?

Well, vacuum is formed on the downward stroke of the piston that draws fuel into the cylinder. The exhaust valve is closed and the intake valve is open — the intake manifold and the cylinder are as one single chamber. The piston moves downward increasing the area of the chamber which reduces the pressure to a point well below atmospheric pressure.

And there you have your vacuum.

The natural and expected thing is for outside air to rush in and fill the vacuum. If the air finds its way into the chamber by the approved or sunshine route — through the throat of the carburetor, past the butterfly valve and into the manifold and cylinder, all's well and good. If it leaks in from any other place, engine operation suffers.

That's where your vacuum gage steps in. Attached to any manifold outlet, it indicates the possible sources of the leak. We said sources because the gage can only give you an approximation, it narrows the possibilities down - which is a lot better than hunting high and low over the vehicle for the trouble.

The reactions on the gage are many and varied and to the experienced or interested mechanic, read almost as simply as McGuffy's First Reader. Our little chart on the next page is about as complete a catalogue of vacuum-gage reactions as you could want.

Before using your vacuum gage, there are a couple little things you've got to check. Does your vehicle have a combination fuel and vacuum-booster pump (for the windshield wipers)?

You'll have to disconnect the booster pump from the manifold before attaching the gage. Otherwise your readings won't be dependable. Either plug the connection or attach the gage at this point for the test.

Are your head-nuts, manifold-nuts, and vacuum connections from the manifold tight? Tighten them. Leakage at any of these points not only upsets the air-fuel ratio, but also produces low vacuum readings.

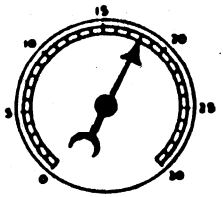
Give your vacuum gage every break.

To the tune up man, the vacuum gage is a friend indeed. It saves time wasted on a tune-up job where the compression factor in the cylinders is not up to scratch. Trying to tune an engine with low or uneven compression in the cylinders, is like trying to tune a nickle whistle — it can't be done.

And, of course, you can't cure a low or uneven compression by a tune-up, so take

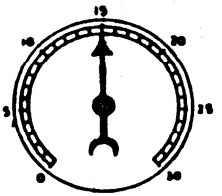
Vacuum Gage Reactions

STEADY NEEDLE BETWEEN 17-21



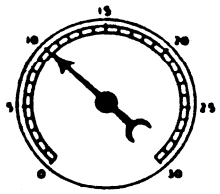
1. Normal motor.

STEADY NEEDLE BETWEEN 14-16



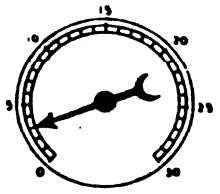
2. Poor rings or oil. Late ignition timing. (Possibly some needle motion).

STEADY NEEDLE LOW VACUUM



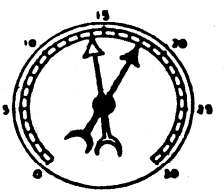
3. Loose valve guides. See also Nos. 2 and 4.

STEADY NEEDLE LOW VACUUM



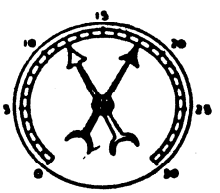
4. Intake manifold or heat riser leak. Also see Nos. 2 and 3.

IRREGULAR DROP NORMAL VACUUM



5. Gummy valve stems. Mixture too rich or too lean. Occasional plug miss. Internal carburetor trouble Also see No. 8.

REGULAR DROP NORMAL VACUUM

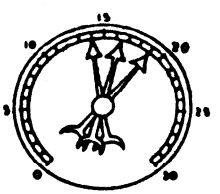


6. Valve held open. Valve chipped, or burnt, or leaks. Warped valve seat. Head gasket leak.

SLOW MOVEMENT LOW VACUUM

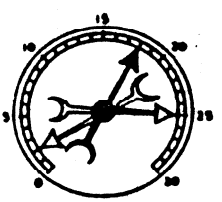
7. Late valve timing. Also see No. 8.

SLOW MOVEMENT LOW VACUUM

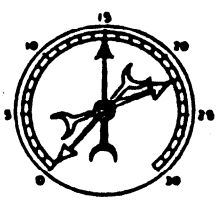


8. Carburetor out of adjustment. Plug gaps too close. Points not synchronized. See also No. 5.

OPERATING MOTOR BY QUICKLY OPENING AND CLOSING THROTTLE

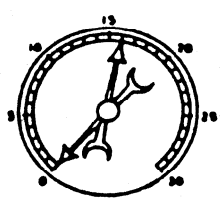


9. Needle drops to 2 when opening throttle, and rebounds to 25 when closing, indicates normal motor.



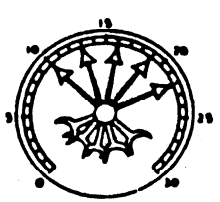
10. Needle drops to 0 when opening throttle, and does not rebound to 25 on closing. Poor rings, pistons, or oil.

MOTOR RACING OR IDLE



11. Normal reading at start, but gradually drops, indicates choked muffler.

MOTOR RACING



12. Wide variations of needle increasing with motor speed indicate weak, or broken valve springs.

your vacuum gage in hand and find the deficiency before attempting a tune-up.

You can make the vacuum-lift test before tune-up without starting the engine, for the readings are taken at starter speed. Attach the gage to the manifold, disconnect the throttle-shaft connector link, turn the throttle-arm stop screw out so that the butterfly valve is completely closed, and then with the ignition switch *off*, spin the engine with the starter. If everything is in good shape, the hand will lift to 17 or more inches of vacuum — which is another way of saying the compression factor is normal. Don't worry about the slight waver in the needle - it's due to the valve overlap which is registered at this low rpm.

With the compression factor declared by your vacuum gage to be normal, go ahead with your tune-up. (Incidentally, vacuum gage readings vary with altitude above sea level, because atmospheric-pressure decreases with altitude. Deduct approximately 1 inch from suggested readings at sea-level, for each one-thousand feet above that point that the reading is taken).

But what if the vacuum gage doesn't give you the high sign? What if the needle doesn't lift to 17 or more inches?

Trouble.

If the needle fails to rise above the *five-inch* mark—the intake manifold, manifold gaskets, or the heat riser sleeve is faulty or leaking — and should be removed and checked.

If the hand moves up to a point between *10 and 15 inches*, and vibrates back and forth badly — look for a blown cylinder-head gasket or bad valve-condition. By attaching a compression gage to the cylinders individually, you'll more likely be able to isolate the weak sisters before pulling the head.

Other vacuum gage tests are made with the engine running. For instance if a tachometer is not available for setting engine idle-speed adjustments, jack the rear wheels up clear of the floor, and with the transmission in high gear, turn the throttle stop-screw until the speedometer reads 7MPH. Then adjust the idle air-needle until you get the highest reading possible on the gage. Check the speedometer and see if the speed is above or below the 7 MPH minimum. If it has drifted, reset the throttle stop-screw to bring it back to that speed.

Here's some more tests:

Having secured the proper idle-mixture by setting the engine idle-speed to the highest vacuum-reading, race up the engine quickly, then release the throttle arm. The vacuum-gage needle should drop to 2 inches, and recoil to 24 inches of more. If the needle recoil is less than 24 inches, chances are you've got diluted oil or leaky piston rings.

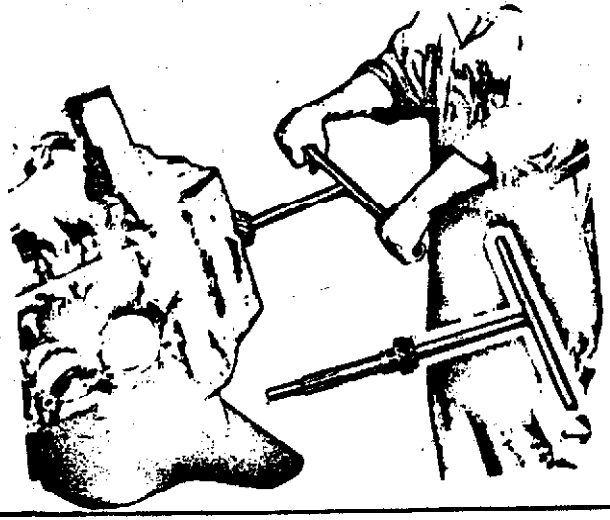
Rev up the engine to about 30 MPH and hold the throttle stationary. Does the needle at first drop back, then gradually climb up to a peak of from 1 to 2 inches higher than the idling reading and remain steady? No? The automatic advance mechanism in the distributor is off the beam. Inspect it.

Hold the throttle arm steady at about 30 MPH engine speed. If the needle fluctuates rapidly between 10 and 21 inches, you've got weak valve-springs that aren't closing the valves properly. (The fluctuations will in-

(Continued on next page)

DURING a bench overhaul, you're continually turning the crankshaft over to install rings, adjust connecting-rod bearings, valves, etc. There are several ways of doing this, but we like this one best: Make a "T" handle by welding two pieces of round bar-stock together to form a handle 20 inches long and a shaft 12 inches long. Then weld the shaft into the spline-shaft pilot-bearing-end of a junked main-drive-gear. When the splines of the gear are placed in the clutch disc, the crankshaft can be turned with the handle.

This is a lot better than jerking the crankshaft around with a screwdriver stuck in the flywheel teeth.



crease with the increased engine-speed).

Worn intake-valve guides are notorious power and oil thieves. They introduce oil from the valve chamber into the firing chamber and at the same time allow atmospheric pressure to enter the manifold. This lowers the vacuum reading just like a leaky manifold gasket. To distinguish between a manifold gasket leak and a valve-guide leak, try this stunt: Pour heavy oil over the intake manifold gaskets. This will seal them temporarily. If the vacuum reading does not immediately rise, the valve guides are pretty certain to be the offenders.

Your vacuum gage can set ignition-timing suprisingly close when a neon timing-light is not available: With rear wheels off the floor and transmission in high gear, set the throttle stop screw until speedometer shows 14 to 15 MPH, (no more). Loosen the distributor-lock-plate screw and turn the distributor body in retard direction until the needle reaches 16 or 17 inches. Then turn the body in the opposite direction to advance until needle reaches its highest point and starts to fluctuate ahead. Hold it at this point for an instant, then turn the distributor body back slowly – just enough to remove the fluctuation. At that highest point on the gage where the needle holds steady, lock the screw. This is the best timing setting. Prove it to yourself by a short road-test.

If your gage is a combination vacuum and pressure gage (as most in the field are) you can test fuel-pump vacuum and pressure. Test the vacuum with the engine idling or turning at starter speed, and with the gage attached to the intake side of the pump. The reading should be 8 inches or more.

Test the pressure with the gage connected to the outlet side of the pump and the engine running from idling to 30 M.P.H. The pounds-of-pressure reading should conform to the recommendations for the particular pump on your truck.

You can uncover a clogged muffler with your vacuum gage. It'll be indicated by a normal vacuum reading when the engine is first started, and then a gradual fade or drop in the reading, as the muffler area is filled up with exhaust-gases, and back-pressure is formed.

Among the lesser uses of the vacuum gage, is the windshield-wiper-hose test at the wiper motor The reading should be the same at that point as at the manifold. Leaky or restricted hoses can be quickly located in this manner.

With the vacuum gage, you can give your drivers a very convincing demonstration showing that a fast and heavy foot on the accelerator does nothing but waste gas.

Hook the gage in at the windshield wiper motor and drive off in the truck, jamming the accelerator to the floor-boards and feeding it too much gas as so many drivers do. There will be a big drop in the vacuum, the needle will read low. Explain to the driver that any time the vacuum drops excessively, gas is being wasted. An exhaust analyzer attached to the exhaust pipe would confirm your story.

But you can state it as a rule that excess vacuum drop means wasted gas.

The vacuum gage can answer a multitude of questions if the operator has his head plugged in while making use of it. The fact that it won't take you by the hand, and lead you to the actual trouble on a moment's notice is apt to be a little disturbing at first. But a short term of practice and study will prove that the instrument can say 'hot' and 'cold' with amazing accuracy, when tracing down a complaint.

Now pull your vacuum gage out of that pile of grease rags where you threw it when they first gave it to you, dust it off, and use it.

Fire Extinguisher • Refill

Something is being done with our carbon tetrachloride fire extinguishers that's a big waste of time, labor and materials.

According to reports reaching the pink and shell-like ears of Ft. Wayne, Michigan, the fluid in fire extinguishers is being emptied every six months and replaced with new fluid.

Since the fluid used in our fire extinguishers is carbon tetrachloride; and since carbon tet does not lose its effectiveness in a fire extinguisher because it is not exposed to the atmosphere – to change it every six months is a waste of time, labor and material.

Don't.

However, if you do need carbon tet for a legitimate refill of your extinguishers, jot this down on your cuff: Carbon tetrachloride has been purchased for every depot in 55 gallon drums. Order from your favorite depot by Federal Stock No. 51-F-353.

In case you didn't know, carbon tet is a "dehydrated" fluid (no water), and can be used with the utmost safety on a blaze where a high-voltage current is present – it is not a conductor of electricity.

P.S. We don't mean to imply that every fire extinguisher uses carbon tet – some use other materials. Check the nomenclature plate of your fire extinguishers and use only the material it recommends.