Orest Lazarowich

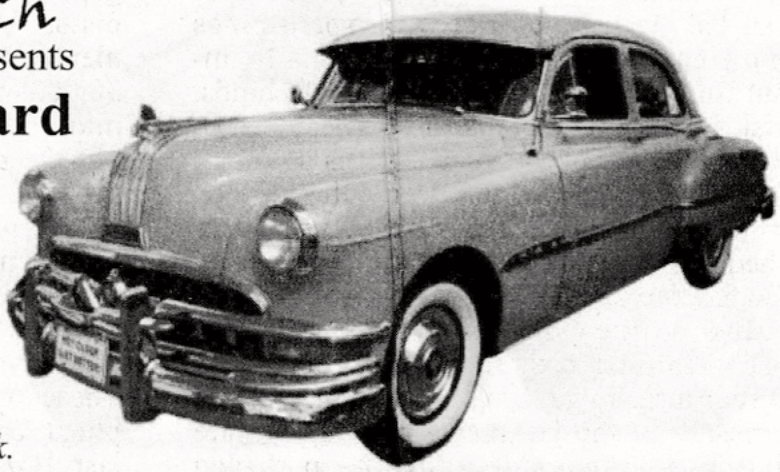
Presents

Looking Backward

but

Moving Forward

A Continuing Series focused on the Repair and Restoration of your old Car and Truck.



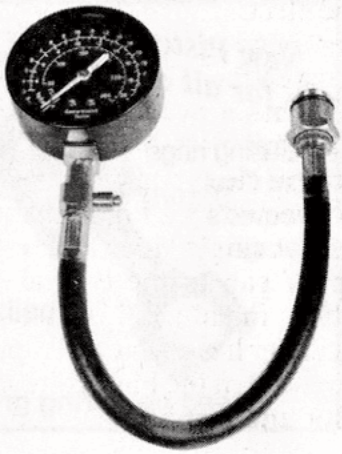
Troubleshooting OHV Top End Noise

All engines make some noise when they are running. It is the unusual noises that they make that cause problems and cost money. The top end in mechanic's talk includes the heads, valves, intake manifold and carburetion. A problem in one area can lead to problems in the other areas in the top end. The overhead valve train consists of the valves, rocker arms, pushrods, lifters and camshaft. Camshafts that are located in the engine block are serviced during the top end. Engines with the camshaft located in the cylinder head(s) either single overhead cam (SOHC) or double overhead cam (DOHC) would also be serviced during the top end procedure. Although rings and pistons are at the top end of the engine during compression and exhaust strokes they are usually serviced with the bottom end which includes the crankshaft and bearings.

Unusual engine noise is the main reason for checking the top or bottom end of an engine. A tapping noise near the top of the engine can be caused by incorrect valve clearances or weak/broken valve springs which cause the valves to open and close too early or too late. A defective hydraulic valve lifter will produce a similar noise. If the engine uses hydraulic valve lifters, shut the engine down, and after a few minutes check the oil level. Add oil as necessary, and start the engine. If the noise continues, check the oil pressure reading. If the oil gauge reading is low or the engine oil light is on, do not drive the vehicle. Have it towed home where you can do some troubleshooting. Worn camshaft lobes and valve tips can cause a clicking noise. Camshaft damage can include breakage, sheared gear or worn camshaft bearings. The sound frequency of valve train noise is one-half the crankshaft speed. Remember - the camshaft gear has twice as many teeth as the crankshaft gear. A problem in the valve train components will reduce engine power because the engine does not get enough air/fue mix to run at peak rpm.

Compression Test

A compression test will reveal the condition of the engine's valves, valve seats and piston rings. The readings should be compared to the specifications, but there should not be more than 10% variation between the highest and lowest reading. This test is for a carbureted engine. Wear eye protection and work safely. Gloves are a good idea to prevent bruised knuckles. To do a compression test without a helper use the type of compression gauge that threads into the spark plug hole. With this compression tester you can

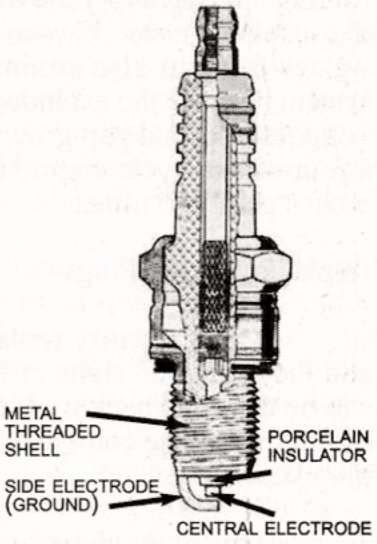


take the readings by yourself while your helper is busy baking pies. Remove the spark plugs when the engine is cold. This is especially important for aluminum heads. If the plug binds, you risk stripping the threads in the head. Clean the area around the spark plugs using compressed air, and remove the spark plugs. Keep them in order on a piece of cardboard.with holes punched in it so you can check the firing ends. Disconnect the coil wire. Connect the compression gauge to one cylinder. Prop the gas pedal into open throttle position. Crank the engine about four turns to get a stable reading. Release the pressure at the gauge. Mark the pressure reading down on the cardboard at the spark plug that came out of that cylinder. Test all the cylinders.

If compression is low in one or more cylinders, squirt a teaspoon of engine oil into the cylinder and retest. If the reading increases, the cylinders and piston rings are worn. If the reading does not increase, the valves are the problem. Low compression in two adjacent cylinders indicates the head gasket needs replacing. Low compression in all cylinders tells you the rings and cylinders are worn and you should be looking for an engine overhaul or a similar engine with low mileage. A puff of blue smoke out the tail pipe on start up can be caused by worn valve seals or worn valve guides. If the engine has good compression, check the firing end of the spark plugs.

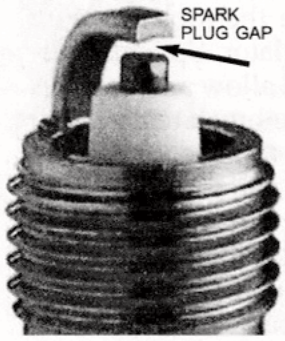
The Spark Plug

The spark plug is a means of delivering the electric spark from the ignition system to the combustion chamber of a spark ignited compressed fuel/air mixture gasoline engine. A spark plug has a metal threaded shell, insulated from a central electrode by a porcelain insulator. The central electrode which may contain a resistor is connected by a high-tension wire to the ignition coil. A single side electrode (ground) provides a spark gap to the central electrode. The spark plug's metal shell is threaded into the engine's cylinder head which completes the electrical circuit. When the high voltage timed by the distributor and provided by the coil jumps the spark gap the fuel/air mixture is ignited and drives the piston down rotating the crankshaft. Replacement intervals for standard type plugs are around 30,000 miles. In the mid-1980s spark plug manufacturers started making spark plugs with platinum or gold-plated electrodes instead of nickel alloy electrodes. These extended life plugs can usually last 100,000 miles with little or no electrode wear. However, they will foul like standard plugs, if oil consumption is excessive. Extended life spark plugs cost more but are an excellent upgrade for early model engines that are in good mechanical condition.



Reading Spark Plugs

Even if the compression is A OK examine the insulator firing nose color before replacing the plugs into the engine. The spark plugs are matched to the cylinders, Generally a light tan/gray color means the engine is operating at optimum temperature and the engine is in good condition. An overheated plug will have accumulated engine deposits melted on the insulator tip giving the tip a glazed or glossy appearance. Dark coloring, such as a heavy black wet or dry deposit indicates a 'rich' carburetor setting, a heat range too cold for the plug, possible vacuum leak, low compression, retarded ignition timing or too large a plug gap. A wet deposit indicated by antifreeze, oil or gasoline means a head gasket leak,



Normal gap growth on a spark plug in a four-stroke cycle engine is 0.00063"-0.000126" per 1000 miles.

The condition of the tip can be an indication of engine problems.

poor oil control from the rings or valve train or a poorly adjusted carburetor. This fouls the spark plug gap and the engine is hard to start. Lead fouling appears as a yellowish brown deposit on the insulator nose. A worn spark plug not only wastes fuel but also strains the entire ignition system because the extended gap requires higher voltages. Normal gap growth on a spark plug in a four-stroke cycle engine is 0.00063-0.000126 inches per 1000 miles.

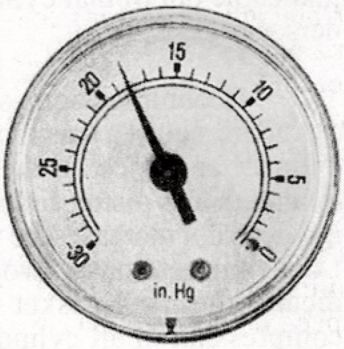
Replacing Spark Plugs

If you recently replaced the spark plugs and they show no signs of fouling or wear, they can be threaded back in. If the plugs show signs of fouling but the compression is okay, check the plug heat range.

If the plugs show signs of fouling and the compression is low, correct the engine problem. If the plugs are old and show a large gap and worn electrode edges combined with combustion deposits, replace the spark plugs with new ones that are for your particular engine. I don't feel it is worth the time to clean old plugs, and certainly not worth the time for a service center to do it. If you want to clean the plugs yourself, that is up to you. Do not sand-blast the plugs. Grit can be caught between the insulator and the shell and an air blast may not clean it out. As the shell expands due to engine heat the grit has no place to go except into the cylinder. To clean old plugs after they are removed wipe them clean. Wire buff the shell but not the insulator. Spray the firing tip with brake cleaner and allow any deposits to loosen up. Use a hand wire brush to clean off any loosened material. Blow the end clean with compressed air. Use a point file and square up any worn edges on the center electrode and side electrode. Electricity discharges best from sharp edges. Re-gap to vehicle specifications. If the plug doesn't come clean or cannot be adjusted, replace the plug(s). Use a new gasket, if the plug has a flat seat or adjust the torque. Torque to specifications according to plug size. (Autolite 10 mm with cast iron head 7-10 ft/lbs. Aluminum head 7-8 ft/lbs.) Without a torque wrench, tighten an Autolite 10 mm with a gasket finger tight and then 1/4 turn more with a plug wrench.

Vacuum Gauge Readings

If you recently replaced the plugs and have a vacuum gauge, you can do an engine diagnosis with a vacuum gauge. Some vehicles have a vacuum gauge on the instrument panel or in the console. The face of the gauge is graduated in inches of mercury. Vacuum gauges are calibrated for sea level and for every 1000 feet above sea level you lose one inch of vacuum. Attach the vacuum hose to a vacuum port below the carburetor or to the hose that connects the PCV valve to the intake manifold. Start the engine, and let at reach normal operating temperature. An engine in good condition, idling at about 550 rpm should give a steady reading of 17 to 22 inches on the vacuum gauge. A low steady reading can be caused by blow-by due to worn piston rings. If the needle drops to a low reading, returns to normal and drops again at regular intervals, there is a sticking, burnt or leaking valve. A fluttering needle as engine speed increases can be caused by weak or broken valve springs. If a reading drops very low on acceleration, check for an exhaust restriction. Conversely, a very high reading indicates a plugged air cleaner.



Troubleshooting In-line or
V-type OHV Train Noise

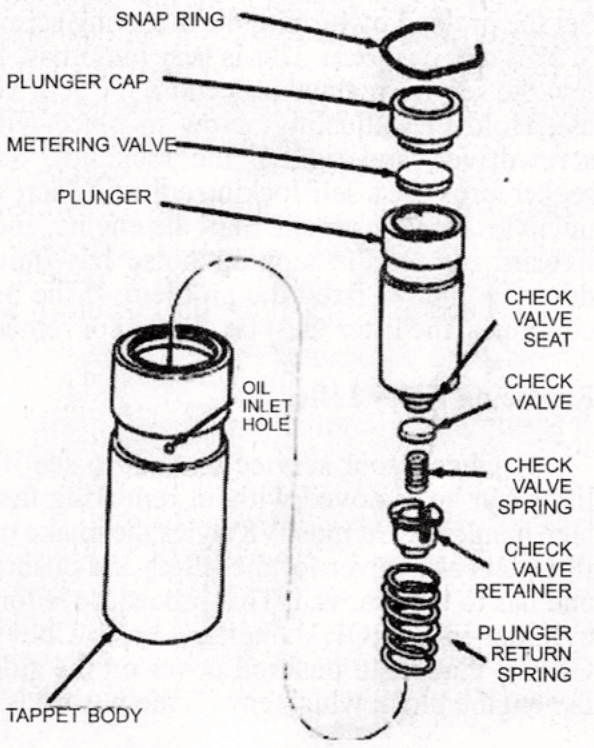
Sometimes if you can amplify the sound and trace it to where it is the loudest, you will find the reason for the noise. I use a mechanic's stethoscope and through a process of elimination can usually find what is causing the noise. Whether I fix it or live with it is another story. A screwdriver that has the metal shank running up through the handle can also be used as a stethoscope. Locate the handle of the screwdriver in front of your ear and the tip at the source of noise. Do not touch any moving parts with either device. You are going to hear a range of sounds because metal is a good conductor, so move the probe or screwdriver to pinpoint the source of noise.

With the transmission in neutral, and the parking brake on, start the engine and bring it up to operating temperature. Locate the sounding device on the location of the bearings in the water pump and/or generator/alternator. A grinding noise indicates worn bearings. Exchange the water pump with a Reman pump and change out the generator/alternator bearings as necessary. A tapping noise coming from the top of the engine with adjustable rocker arms can be caused by excessive valve clearance or a defective hydraulic valve lifter. A clattering noise can be caused by a broken valve spring. In an I-head engine using solid valve lifters the clearance between the valve tip and the rocker arm is called valve lash and is set by the engine maker at the factory. When adjustment is necessary check the service manual to see if the valves are adjusted 'hot' or 'cold'. Clearances may be different for intake and exhaust valves. Setting the valves 'cold' is easier and less messy than setting 'hot'.

If adjusted 'hot', start the engine and let it run until it reaches normal operating temperature. Remove the rocker arm cover(s). Bring the speed down to idle. Use some cardboard deflectors along the sides of the head(s) to keep the oil spray contained. You can also use a spare rocker arm cover with the top cut off to contain the oil spray. Locate the noisy valve and do a visual check for broken valve springs. If the valve springs are solid, loosen the locknut on the rocker with a box end wrench, and hold the adjustment screw with a screwdriver. Check the clearance with a flat feeler gauge by holding it at the same angle as the valve tip. Set the clearance by turning the adjustment screw until there is a drag on the feeler gauge as you pull it out. Hold the adjustment screw in this position and tighten the locknut. Check the other valves and adjust as needed. To set the valves cold the engine should sit until the exhaust manifold is cold to the touch. The crankshaft only needs to be positioned twice. Follow the procedure in the service manual for setting solid lifters. Engines with solid lifters are noisy on start up. As the different parts of the valve train warm up you will hear a bit of 'clatter' that develops into a rhythm. Live with it, and do not adjust the noise out of the valves. Check the timing and carburetor, and readjust them only if necessary. Valves set too tightly will not seat properly and will cause loss of power and in time burnt valves. Valves set too loose are noisy and wear valve train parts out prematurely.

When hydraulic lifters are used engine oil pressure expands the lifter and provides zero valve lash clearance. When the engine is shut down a one-way check valve and spring in the lifter keep it expanded and retain the oil within the lifter. If the hydraulic lifter 'bleeds down' meaning the oil drains from the lifter, it will take a few seconds on start-up to fill the lifter with oil. The tapping noise you hear is between the rocker arm and the valve tip while the lifter fills with oil to provide the zero lash clearance. A small amount of bleed down is allowed with each valve cycle so the lifter can readjust itself to maintain zero clearance. A common cause of lifter noise can be worn lifters or dirty oil deposits. A high quality oil additive can dampen lifter noise. Check engine oil level and the number of miles since the last oil change. If the oil is dirty, it needs changing. Make sure you are using the correct viscosity grade for the engine. Change the oil and filter, and add a can of oil additive. Start the engine and drive the vehicle until operating temper-

HYDRAULIC LIFTER



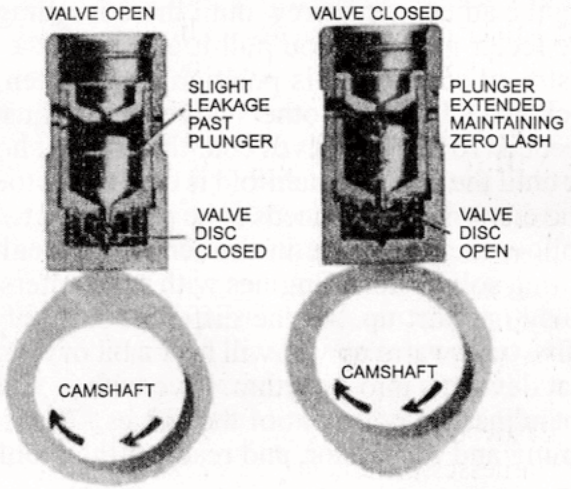
ature is reached. If the noise has quieted down or is gone completely, this is your lucky day. If you start the engine the next day and the noise is still there, the lifters are worn and need replacing. If only one or two lifters are noisy, check for excessive clearances at the rocker arms.

Stop the engine and remove the valve cover(s). Check for a bent pushrod or broken valve springs. Isolate the noisy lifter by pushing down on each rocker arm on the pushrod side. If the rocker arm is free to move or there is a spongy feeling, the valve lifter is leaking down too fast which may be caused by the ball check valve not seating because of a very tiny piece of dirt on the check valve. If the isolated lifter does not leak down, it may need adjustment. Check the service manual for setting the preload on the lifters in your vehicle. The following is one way to set the lifter preload when the engine is not running. Use a remote starter switch to 'bump' the starter until the cylinder with the noisy lifter is up on compression and both valves are closed. Check the rocker arm for any side-play which should be minimal. Loosen the lock nut on the rocker arm, and back off the adjustment screw until you can move the pushrod up and down and the turn the adjustment screw in until there is no movement of the pushrod. This is zero preload. Set the preload by turning the adjusting screw in ½ or ¾ turn past zero. This is very important. Follow the service manual procedure for your vehicle. Hold the adjusting screw in place with a screwdriver, and tighten the lock nut. Some rocker arms use a self-locking adjusting screw or nut to set the adjustment. Start the engine, and let it warm up. If the tapping noise has quieted down, you have fixed the problem. If the noise continues, the lifter must be cleaned or replaced.

Replacing Noisy Lifter

Check your service manual to see if the lifter can be removed without removing the intake manifold. On most V8 styles the intake manifold acts as a cover for the lifters and pushrods, and has to be removed. This procedure is for a 6 cylinder in-line OHV engine (Ford, Chevy or GMC) that has a pushrod cover on the side of the engine block which covers the pushrods and lifters. Disconnect the rocker arm oil line from the rocker arm connector, if of this style. Remove the rocker arm shaft assembly. Do not loosen the adjusting screw. Remove the pushrod cover and gaskets. Pull the pushrod away from the noisy lifter. Turn the engine over to bring the lifter up as high as it will go. The bottom of the lifter may be coated with varnish and oil residue which makes it difficult to pull out. Spray some penetrating oil around the lifter, and try to move it up and down while twisting/pulling on the lifter. Do not damage the lifter body. Use a tool that is made for lifter removal. If you plan to use vise grips, wrap a few layers of black tape around the lifter body to protect it from damage. Order the valve cover gasket and the pushrod cover gasket. They are available in cork or rubber. Buy the best you can afford.

Remove the lifter. Examine the bottom of the lifter for wear. The bottom should be smooth and free of grooving, chipping and pitting. The bottom is not flat; it is slightly convex so it rotates in the lifter bore. It should be smooth and free of grooving, chipping and pitting. If it shows any pattern of a groove, replace the lifter. The working range of a lifter is about 0.160" and a worn lifter bottom changes the valve geometry and may result in damage to the camshaft lobe profile. If the bottom of the lifter is okay, disassemble the lifter. Clean your hands and take the lifter to a clean work area on the bench. With the lifter in your hand use a pick and remove the lock ring. Keep your thumb on the lock ring to



prevent it from jumping out. Remove the pushrod seat and the metering valve (washer). Use a curved pick and catch it in the oil feed hole in the plunger and pull out the plunger assembly. Remove the retaining clip on the bottom of the plunger, and you will find a check valve (disc/ball), check valve spring and a retainer. Drop the plunger spring out of the lifter body.

Soak all the parts in carburetor cleaner for a couple of hours. Use an old toothbrush to clean off the varnish, carbon and oil residue. Clean the oil feed holes with a stiff wire. Spray the parts with brake cleaner, and wipe clean with a lint free cloth. Check the springs. They should not be broken or collapsed. If a ball check valve is used, the ball must be perfectly round with no pits. The ball seat must be smooth with no slings or pitting. Lifter parts are not available; the lifter must be replaced, if it shows damage or wear. The fit between the plunger and the lifter body is 0.0002" or less. If the plunger falls into the body by its own weight, replace the lifter. A worn plunger and/or lifter body will cause excessive 'bleed down' which causes the tapping noise on start up.

Assemble the check valve to the plunger and install the retaining clip. Use a very light coating of clean engine oil during assembly. Too much oil and you will have difficulty pushing the plunger into the lifter body. Place the plunger spring on the plunger, and insert the plunger into the lifter body with the oil feed holes in line with one another. Depress the plunger and fit the metering valve and pushrod seat. Install the lock ring. Oil the outside of the lifter, and fit it into the lifter bore. Make sure the lifter rotates freely in the bore. Check the pushrod for straightness by rolling it on a piece of window glass. Replace bent pushrod(s). Do not try to straighten them. Drop the pushrod in place, and install the rocker arm assembly. Make sure the rocker arm adjusting screws are mated to the pushrods. Torque the rocker arm assembly to specifications.

There will be some lifter noise on start up as the lifter fills with oil. Observe the action of all the lifters and pushrods.They should rotate as the engine is running. Increase the engine speed and, if the lifters do not rotate, the problem can be worn lifters or worn cam lobes. This is serious and can be an expensive repair. Let's assume replacing/cleaning the lifter has solved the lifter noise problem. Clean the side of the engine block, and scrape away any old gasket material and cement. Lay the side cover on a flat surface and check for any warpage. Straighten as necessary. Clean the cylinder head and the rocker arm cover. Check the rocker arm cover for warpage and straighten with gentle metal work. Check the gasket(s) for alignment before spraying a thin coating of Permatex on the covers to hold the gasket(s) in place. Let the coating get tacky for 30-45 seconds, and set the gasket in place. Spray the top side of the gasket. Position the pushrod cover in place, and torque the bolts working from the center outward. Install the gasket in the rocker arm cover in a similar manner. Install the rocker arm cover on the cylinder head. Tighten the cover screws gradually in several passes to avoid warping the cover. Over-torquing will cause oil leakage. Do not squash the gasket at the bolt position. Happy motoring.

S.K.

NEXT MONTH:
L-head Valve Noise