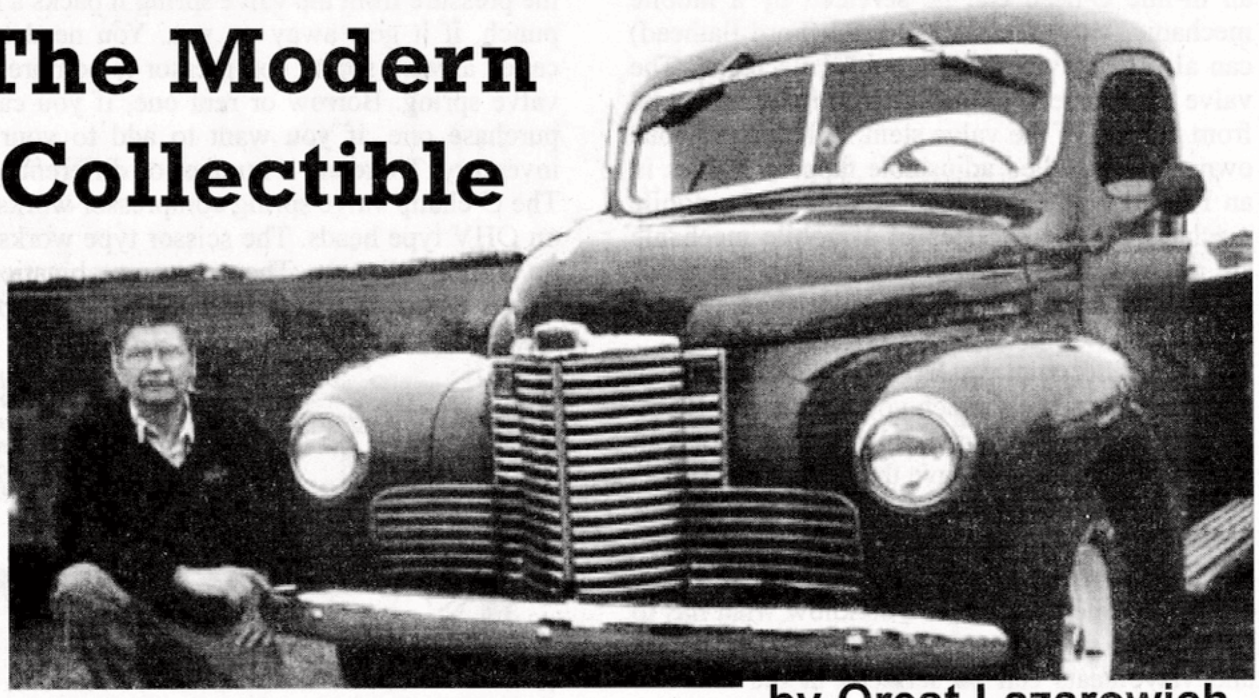
The Modern Collectible



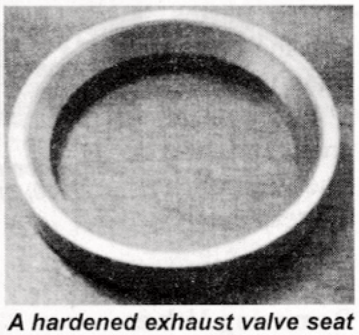
by Orest Lazarowich

A DETAILED TECHNICAL COLUMN INTENDED TO TARGET MANY MAKES AND MODELS OF POST-WAR CARS AND PICK-UP TRUCKS

Valves and Valve Seats

If you removed the head(s) to service the rings and pistons or to replace the head gasket(s), you should check for valve leakage even if the compression test indicated no valve problems. You can check for valve leakage on an OHV head by pouring solvent into the intake and exhaust ports. On an L-head pour the solvent around the valve. Do not use gasoline. Seats that leak can be hand-lapped to improve the seal, Replace the valve seals on the OHV type head(s) at this same time. If you removed the head(s) because the compression test indicated valve leakage, the valves and valve seats will have to be serviced. New exhaust valves are often needed because they get much hotter than intake valves. Discard all valves that are burned, cracked or warped. Old time Model T mechanics set warped valves by tapping the head of the valve with a hammer. They checked the valve clearance using a worn dime. We have advanced from that type of repair.

Do not attempt any valve work unless you have the proper tools to remove and replace the valves. In addition you need valve and valve seat resurfacing equipment, if the valves are burned. In some cast-iron heads, the valve seats are cut directly into the edge of the valve port, and the valve seat is hardened during manufacture. In others a hard metal seat is pressed into a machined hole. With unleaded gasoline, cast iron heads should have hardened valve sets. Unleaded gasoline does not leave a deposit on the valve that will protect the valve seat.



A hardened exhaust valve seat is highly recommended with unleaded gasoline.

If you do not have use of valve and valve seat refacing equipment, the OHV style head(s) can be delivered to a machine shop for service or can be serviced by a mobile mechanic. Valves in

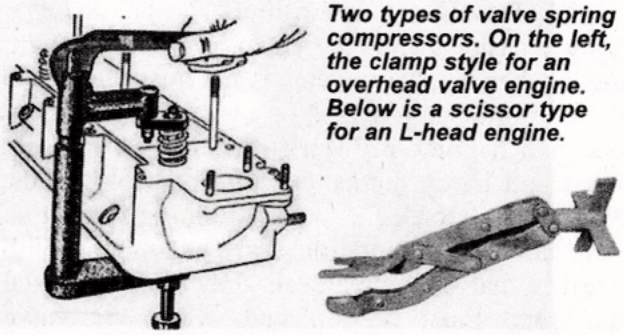
an in-line L-head can be serviced by a mobile mechanic. Valves in a V8 L-head (Ford flathead) can also be serviced by a mobile mechanic. The valve clearance is adjusted by removing metal from the end of the valve stem, unless a previous owner has installed adjustable tappets. Valves in an F-head type engine can be done by a mobile mechanic. If the services of a mobile mechanic are not available, a vehicle running an L-head or F-head has to be towed to a service shop.

At this point you have to decide how much you can do, and how much you want to do. If you borrow or buy a few specialized tools, you can remove the valves and save the labor cost. This is not a difficult procedure. With the valves removed, you can check wear of the valves and valve seats, valve guides and valve springs. Write all measurements down so you know what has to be replaced and what can be reused. The valves and valve seats can be serviced at the machine shop, and you can finish the assembly. If the valves are not damaged, you can smooth out minor pitting by lapping the valve face and valve seat. Lapping involves rotating the valve in the seat with a fine abrasive paste to seal the valve against the seat. You will need a lapping stick with suction cups at each end and a tin of fine abrasive paste either water or oil based. There are double sided tins available that have fine and coarse pastes. Use the coarse paste to obtain a full contact area and the fine to polish the seat and the valve.

Two grades of lapping abrasive are fine (#280) and coarse (#120).

Removing Valves

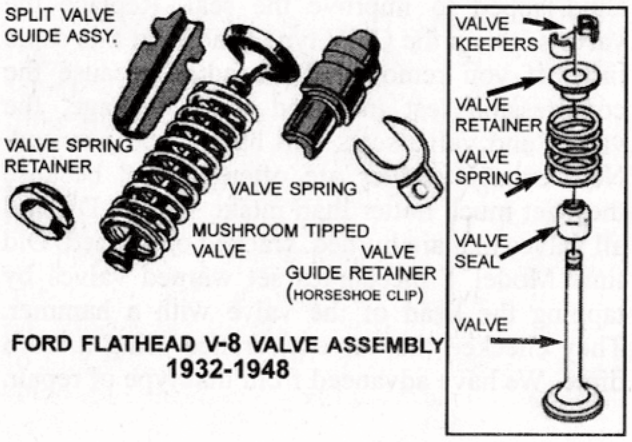
The cause of valve leakage could be a burned valve, a warped valve face or carbon build-up on the valve face and seat. To remove the valves you have to compress the valve spring so the valve keepers can be removed and then the valve spring retainer and the valve spring. Do not try some Rube Goldberg idea. When you release the pressure from the valve spring it packs a lot of punch, if it gets away on you. You need a tool called a valve spring compressor to compress the valve spring. Borrow or rent one, if you can, or purchase one, if you want to add to your tool inventory. There are a number of different types. The C-clamp valve spring compressor works best on OHV type heads. The scissor type works best on in-line L-heads. There is a combination C-clamp type that works on both I- heads and L-heads.



Two types of valve spring compressors. On the left, the clamp style for an overhead valve engine. Below is a scissor type for an L-head engine.

You can use a pair of needle-nosed pliers or a magnet to remove the valve keepers. DO NOT attempt to remove the valve keepers with your fingers. Should the spring compressor slip, you might be visiting the ER. To replace the valve keepers on an in-line L-head, buy a valve keeper insertion tool. It will save you a lot of swearing when you replace the valve keepers into the groove on the valve stem. Wear safety glasses, and follow the manufacturer's instructions for proper valve spring compressor use. Get in the habit of wearing safety glasses, and you will soon forget you have them on.

You might have to disconnect the exhaust pipe from the exhaust manifold on some in-line



FORD FLATHEAD V-8 VALVE ASSEMBLY 1932-1948

L-head engines. This will give better access to the valve chamber after the valve chamber cover is removed. Work around the exhaust manifold; do not remove it or the intake manifold unless absolutely necessary. On some vehicles you can remove a front tire and an inner fender panel to get more working room. Cover the holes in the base of the valve chamber. It's not a sin to drop a valve keeper into the oil pan, but you might do a bit of swearing. You will have to do some looking to find another keeper or two, if this is an older engine. The valves in an in-line I Head or an OHV V8 are easier to remove because the head(s) are on the bench. As the valves are removed keep them in order. Use a rack or a cardboard box you can punch holes in. Mark an arrow to indicate front and index marks for left and right heads. You have to track the valve to the valve seat so you can troubleshoot the valve problem. With engines that use valve seals they may be baked hard and must be replaced. Keep the valve springs, valve retainers/rotators and valve keepers in a container. Make a note whether the tightly coiled end of the valve spring goes toward the head or toward the valve lifter.

Valve and Valve Seat Inspection

Before cleaning the valves and the valve seats inspect them for wear. Examine the surface of the valve face and the valve seat. The seating pattern of the valve and the valve seat should be about in the middle of the valve face and valve seat. An uneven wear pattern may indicate it is time to resurface the valve and seat. Inspect each valve for signs of burning, pitting and heavy carbon deposits. Roll the valve on a flat surface to check for bends. Burned valves can be caused by insufficient tappet clearance, weak valve springs, warped valve stem or clogged coolant passageways. Heavy carbon deposits, especially under the head of the intake valve, can indicate worn valve guides or damaged valve stem seals. Replace any valves that are badly burned, cracked or warped. There is not enough material on the valve face to clean up a valve in this condition and still leave a valve margin of proper width. The valve margin is the width of the edge of the valve between the top of the valve and the edge of the face. Too narrow a margin will cause pre-ignition and valve damage through overheating.

Use a wire wheel, and clean all the carbon from the valve head and stem. Heavy carbon deposits under the intake valve head and in each valve port indicate the valve guide is worn. Rinse all the valves in solvent, and blow dry. Run your fingernail along the valve stem, and, if you feel a ridge, the valve should be replaced. The valve stem must be smooth. The valve guide may also be worn. Inspect the valve stem tip and the keeper groove. The valve stem end must be flat. A worn valve stem tip will cause tappet or rocker arm damage. If the keeper grooves and valve stem are worn, the valve and valve keepers should be replaced. A keeper that slips out of place on an OHV engine will cause the valve to drop in the cylinder causing engine damage.

Remove all the carbon from the valve ports using a wire brush in a power drill. Clean the head(s) or the cylinder block of any carbon with a rotary wire brush or a scraper. Do not scratch the surface(s). If this is an OHV head, clean up the combustion chamber. To clean the valve guides you will need a spring-type valve guide cleaner or a 'bore' brush that will fit a drill chuck. You should be able to find a 'bore' brush at a gun shop. Clean the guides using lacquer or carburetor cleaner to remove the varnish and carbon. Run the drill slowly, and move the guide cleaner or brush up and down in the valve guide. Blow all the dust and carbon particles from the valve guides. The head(s) should be checked for warpage using a steel straight edge and a 0.003" flat feeler gauge. Check the service manual for allowable clearances for your engine. Check diagonally, and if the feeler gauge fits between the head and the straight edge, the head should be machined flat so that the head gasket will seal properly.

Valve Guide Clearance

This is a very important measurement, and is decided by engine design (amount of lubrication) and the type of oil seal used when this is an OHV engine. Excessive clearance will promote oil usage, poor valve seating and possible valve breakage. If you did feel a wear ridge on the stem, measure the stem with a micrometer or vernier calliper. Check

allowable wear against engine specifications. If wear exceeds 0.002", replace the valves. Now check the valve guide clearance. You can use a small hole gauge and measure the center and end clearance of the valve guide. Compute the difference between the valve stem and hole gauge as measured by a micrometer, and note the difference. Check engine specifications to see if valve guides have to be replaced. When the valve guide is cast as part of the head or block, a new oversize valve, if available, is used, and the worn guide is reamed to fit. Do not attempt this type of repair unless you have the proper tools and experience. It should be done at a machine shop. If the guides are replaceable, have the machine shop remove and replace them.

Valve Springs

The basic purpose of the valve spring is to close the valve and keep the valve train in contact with the cam lobe. Valve springs that have lost their tension will cause valves to chatter and limit the engine RPMs because they 'float' around the valve seat. They also wear valve stems and guides very rapidly. Wash the valve springs in solvent, and brush them clean. If the valve springs are painted, do not remove the paint; it is there to prevent rust. Check the springs for any signs of rusting, corrosive etching or cracks. Check the valve spring for free length by sliding a combination square up to the spring. Measure the length, and check it against the specifications. Check all the springs, and if more than half are under the specs, replace all the springs. You can use valve spring inserts (shims) to bring the valve spring up to proper height. Next, check the spring for squareness. Set the spring on a flat surface. Place the combination square against the spring, and rotate the spring as you check for any gaps around it. If the spring is parallel or there is no more than 1/16" difference between the top and bottom, you can reuse the spring, if it passes the other tests. If the springs check out for height and squareness, they should be checked for tension.

To test for spring tension you need a spring load tester. The spring is compressed to the compression height listed in the service manual. If the compressed height of the spring is not up to specifications, it must be replaced. Have the springs checked at a machine shop or by a mobile mechanic, if you do not have the use of a spring load tester. By now you should have all the measurements that you need so you can make a decision on the necessary repair. If the measurements are at maximum wear, this will be an expensive repair and should be done at the machine shop or by the mobile mechanic. The repair we will consider is one where the measurements are at minimum wear and the valve seats do not show excessive burning or pitting and have an even wear pattern in the middle of the valve seat. The valves will be ground and, if the margins are okay and the valves reusable, they will be lapped into their seats.

EDITOR'S NOTE: *for an easy-to-make spring tension tester,* *see instructions on page 23.*

In-line L-head

Lower the tappet adjusting screws on the valve lifters just a bit to make up for the material removed during valve grinding. Start at the front of the block with the first valve. Spread a small amount of fine grinding compound around the valve face, and set it down on its seat. Wet the end of the suction-cup, and grip the top of the valve head. Rotate the tool handle between the palms of your hands, a half turn or less each time. Lift it slightly after each rotation. Clean the surface, and check your progress. Lap only enough to create a thin continuous gray stripe around the valve face and valve seat. The stripe on the valve face should be the same width as the valve seat. If it is not, apply a little more compound and repeat. Do NOT remove any more metal than necessary.

To determine if there is an even pattern around the valve face make pencil marks around the valve seat. Insert the valve, and turn it a few times. Lift out the valve, and examine the valve seat. If all the pencil marks are smudged, the seat is okay. If not, do a little more grinding. When the face and seat are okay, wipe away all traces of the grinding compound on the valve face and valve seat with a cloth moistened with solvent. Do not get any grinding compound on the valve stem or

in the valve guide. Any compound that remains will damage valves and other engine parts. Move on to the next valve, and continue until all the valves are lapped in.

Install the valve springs and the retainers. You may have to pry the spring over the valve lifter. As a rule, the end of the spring with the tightest coils goes toward the head, but check the service manual. Coat the valve stem with oil, and insert it in the valve guide. Position the spring compressor under the valve spring retainer, and tighten it just enough to install the keepers. If you bought the valve keeper insertion tool, load it with two valve keepers tapered end up. Insert the tool so the valve keepers line up with the groove in the valve stem. Release the spring compressor slowly, making sure the valve keepers are positioned within the valve spring retainer. Remove the insertion tool. Sometimes a dab of grease on the inside of the valve keepers helps to keep them in place on the valve stem. Remove the valve spring compressor. If you have no insertion tool, you can use a magnet or grease on the inside of the valve keeper. Careful with your fingers in case the spring compressor slips off. Install all the other keepers.

Adjusting Valves

You will need two open end wrenches of the proper size to hold the tappet in place and one to turn the adjusting nut. You also need a flat feeler gauge(s) of proper gap size. Set the valves to the cold setting listed in the service manual. To adjust the valves follow the firing order. The following example is a 4 cylinder in-line L-head firing order: 1-3-4-2. With #1 cylinder at TDC on the compression stroke, and both valves closed, adjust both valves. Turn the crankshaft clockwise to #3 on compression, and adjust both valves. Continue the adjustments with #4 on compression and then #2 on compression. Reinstall the valve chamber cover using a new gasket. Do not over tighten the bolts. Reinstall the cylinder head with a new head gasket. Torque the head bolts in circular order or follow the sequence listed in your service manual, Chilton's or Motor's manual. Install the spark plugs. Connect any gas linkage. Connect the cooling system. Fill with coolant, and check for coolant leaks. Make sure the oil pan has oil in it to the proper level.

The OHV Head(s)

Position the head on the workbench so you can work on it comfortably. Lap the valves in the same manner as for the in-line L-head. Select the proper valve for the valve guide, and oil the valve stem and the valve guide. Insert the valve into the guide. If oil seals are used, there are two main types. The umbrella (cup) type fits over the valve guide and keeps the oil from going down the valve guide. The O-ring type seals the gap between the valve spring retainer and the valve stem. The valve gasket set will include the necessary valve seals. Hold the valve in place, and install the stem to guide the oil seal. Place the spring or springs with tightly spaced coils toward the head. Install the retainer, and compress the spring with the spring compressor just far enough to expose the valve stem oil seal groove. Slide the O-ring into the groove. Make sure that it is not twisted. Insert the valve keepers, and slowly release the spring. Keep your face out of the way in case the valve keepers are not locked in position. Install the remaining valves.

Inspect the push rods, and roll them on a piece of glass to make sure they are straight. Leave the solid lifters in place. If hydraulic lifters are used and have been noisy in the past, this is a good time to replace them. It is not practical to overhaul noisy hydraulic lifters. Check the rocker arms and the rocker arm shafts for excessive wear. Install the head(s) and new head gaskets. Torque the head bolts. Install the pushrods and rocker arm assemblies. Install the valve chamber cover, if used. Adjust the valves, if the rocker arms have adjusting screws. Install the intake manifold. Leave the valve covers off for now. If the distributor was removed, the engine will have to be timed. Follow the procedure in the service manual. Connect all wiring. Connect the exhaust. Connect the cooling system, and fill with coolant. Make sure there is oil in the oil pan.

Starting The Engine

If the rings were replaced, read the manufacturer's instructions regarding the procedure for seating the rings. Recheck all the fluid levels. Make sure there is gasoline in the tank. Have a

fire extinguisher handy in case of emergency, and know how to use it. Connect the battery. Disconnect the high tension lead to prevent the engine from firing, and crank the engine a few times to get the oil into the system Connect the high-tension lead. Loosen the thumb screw on the air cleaner, and pour a shot of gasoline into the carburetor. Operate the gas pedal to get the gasoline into the intake manifold, and start the engine. If the engine does not fire within 10 seconds, stop cranking and do some troubleshooting to find out why.

When the engine starts, bring the RPMs up to about 2000, and check for oil pressure. Run the engine at this speed until normal temperature is reached. If there is NO oil pressure, shut the engine down, and find the problem. If the oil pressure is okay, listen for any unusual engine sounds. Check that oil is going to the rocker arms on an OHV engine. Shut the engine off, and recheck the intake manifold and head bolt torque. Install the valve covers. Connect a timing light to check/adjust the timing. Road test, and drive the vehicle at different highway speeds. Return home and check for any leaks. Change the oil and filter at 500 miles. Happy motoring.

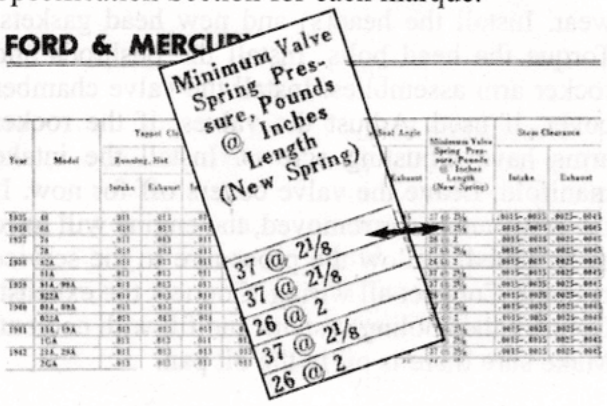
S.K.

NEXT MONTH
Correcting Crankshaft Pulley Leaks

An easy-to-make, inexpensive SPRING TENSION TESTER

As Orest pointed out in the article above, the correct tension for valve springs is necessary to keep the valve closed and to provide contact with the lobes of the cam shaft. Too weak a spring may keep a valve from closing completely, resulting in lost power, lost RPM, burned valves and premature stem and guide wear.

The correct compressed spring length and tension specifications can often be found in a copy of a Chilton's or Motor's manual in the Specification Section for each marque.



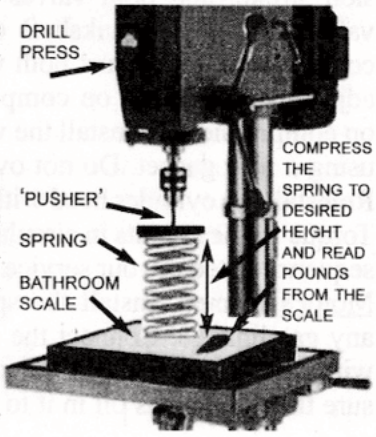
The relaxed length of the spring is very easy to determine with a basic measuring tool, but the specifications call for measuring tension and a pre-determined compressed length. This means that a special tool is required to #1) compress the spring to the desired length, and #2) measure the pounds (per inch) of the partially compressed spring.

Using items normally found around the shop and home, you can construct a reasonably accurate tester. You will require a drill press, a bathroom scale, and a ruler or caliper. The drill press will NOT be turned on; it is used merely to compress the spring to the desired height. To do so, you will need a disc larger than the outside diameter of the spring which will fit into the chuck of the press. A large washer welded to a bolt is fine. This will be your 'pusher'.

A bathroom scale placed on the base of the drill press measures the pounds. Be sure that the scale is on solid footing. If necessary, a piece of plywood will provide a solid base.

Place the spring on the scale, and compress the spring to the desired length. Set the depth stop gauge on the drill press for additional spring measurements. Read the 'pounds' directly from the bathroom scale.

Compress the spring to the desired height, lock the quill and read the pounds off the bathroom scale.



S.K.