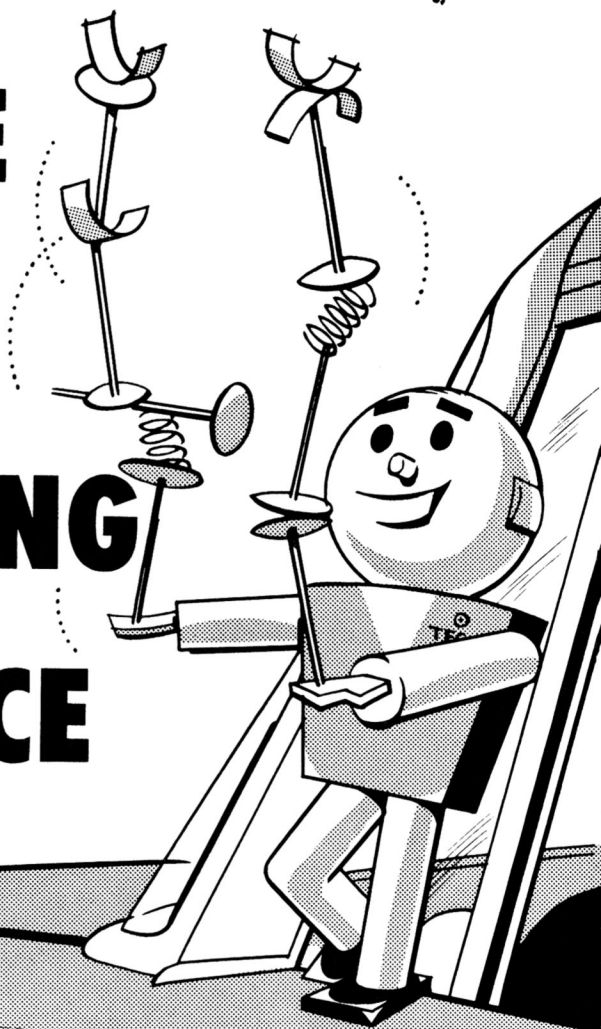
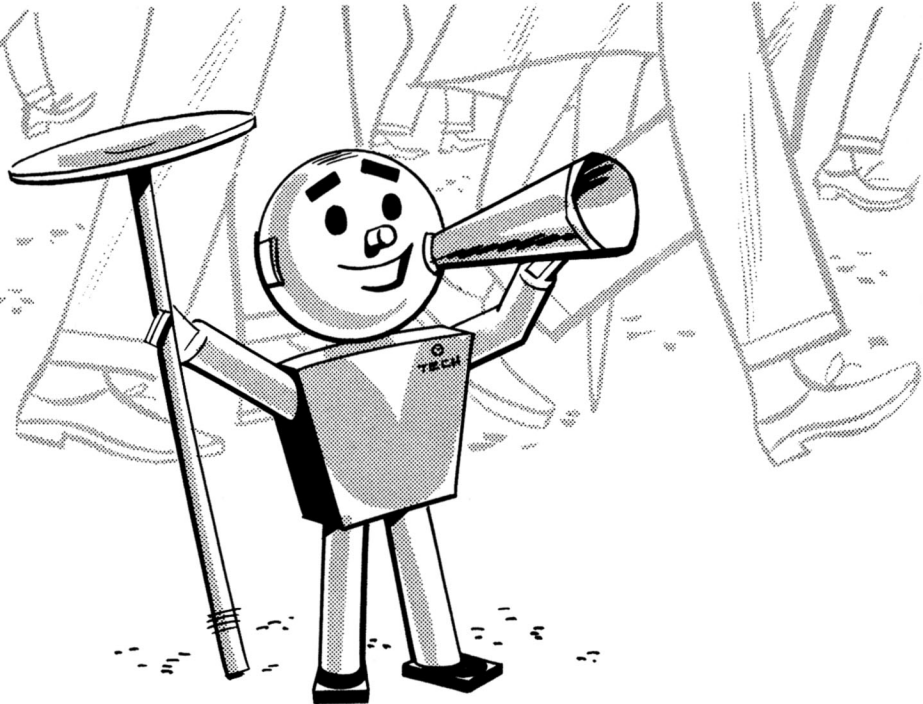


VALVE and BEARING SERVICE



PREPARED BY CHRYSLER CORPORATION
Plymouth • Dodge • De Soto • Chrysler • Imperial



***Tech Sez:* "PACK 'EM IN WITH GOOD
VALVE AND BEARING SERVICE!"**

In the service business, all-around skill in engine reconditioning often separates the men from the boys. As an example, how well you service valves and bearings has an important influence on how well you pack in the customers. When owners learn that your technicians know the score, they'll bring their cars to you for service.

To help you maintain service leadership, this reference book offers the latest information on valve and bearing reconditioning on our V-8 engines. Step-by-step operations on a typical engine job are outlined with all the recent procedures and specifications that apply. It's "bread-and-butter" reading for every man in your shop.

Here's a handy guide to this engine service information:

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VALVE RECONDITIONING

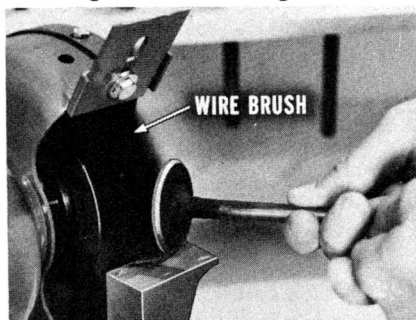
Once you decide that the valves on a V-8 engine need reconditioning, remove the cylinder heads and place them in holding fixtures (Tool C-3626) on the bench. These fixtures simplify valve removal and protect the cylinder head mating surfaces against nicks and scratches.



Before you remove the valves, inspect the valve stem lock grooves for burrs. These must be filed off or they'll score the valve guides when the valves are taken out.

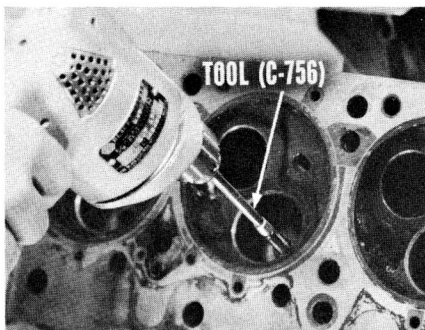
As you remove the valves, place them in a rack in order of their removal. That insures your getting the valves back properly.

Cleaning. Valve cleaning comes first, of course. So hold each valve firmly against a wire brush mounted on a bench grinder. Clean the carbon off all surfaces . . . the valve head . . . the face . . . and the stem. *Thorough* cleaning is the important thing. If any carbon or gum remains, the valve might stick.

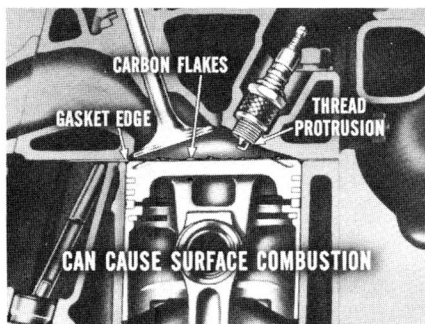


Inspect Valves and Guides. After valves are cleaned, use a micrometer to measure the stems for wear. A stem worn more than .002", means the valve must be replaced. That's because you'll want to

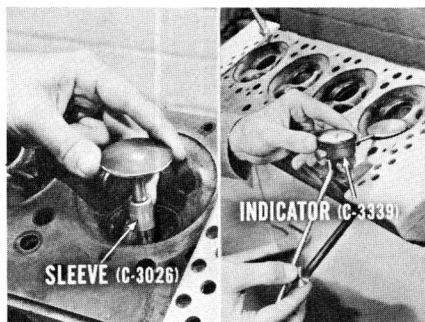
check the guide with a full-size valve stem. Valve guides, by the way, are integral with the cylinder heads on all our current V-8 engines. Before you can inspect guides for wear, you should clean out the carbon and varnish. For this job, the adjustable valve guide cleaner (Tool C-756) is especially suitable.



Clean out the carbon deposits in the combustion chambers next. Surfaces of the heads and block must be perfectly clean and free from distortion before the heads are reinstalled. Combustion chambers in particular should not have any sharp edges. Carbon flakes, spark plug thread protrusions, or gasket edges can heat up and cause surface combustion. This is a good time to eliminate any of these.



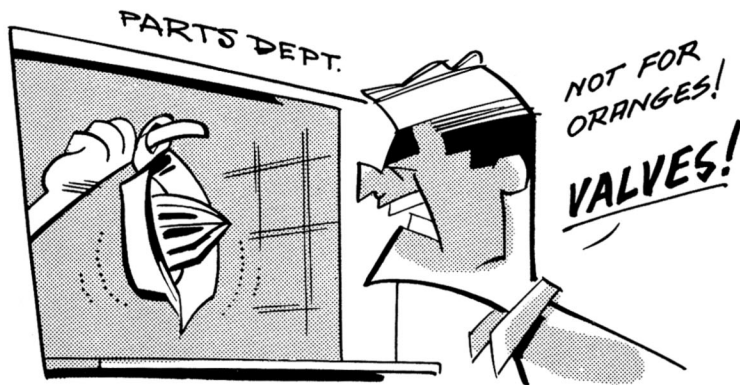
After the guides are clean, install the checking sleeve (Tool C-3026 for exhaust valves and C-3025 for intake valves) over the valve stem. Then, install the valve in the head. Mount the dial indicator (Tool C-3339) on the cylinder head so that the plunger rests on the edge of the valve head. The sleeve holds the valve at its correct height for inspecting for maximum guide wear.





Gently move the valve head toward and away from the indicator. The total indicator movement should not exceed .010" on the intake or .014" on the exhaust valves. You'll have to ream the guides and install valves with oversize stems if the guides are worn.

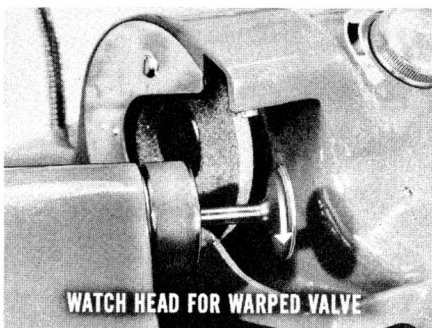
If you have to ream the valve guides, use a solid-type, spiral-flute reamer, not an expansion type. The spiral-flute reamers are stronger and more accurate than expansion reamers. Valves are available with .005", .015", and .030" oversize stems.



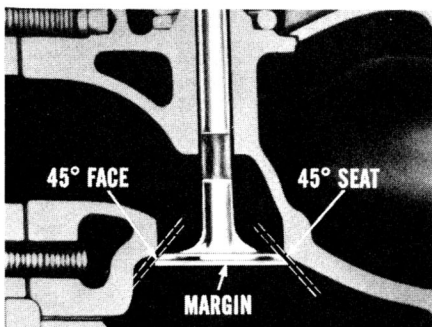
When you begin to ream, select a reamer that's the *first oversize from standard*. Work up *gradually* to get a guide size that will take the oversize valves required.

Reface the Valves. Before you reface the valves, be sure the refacing machine is in good condition. The valve chuck bearings must be good so the chuck runs true. The wheel must be dressed until its surface is smooth and true. Just start with the diamond in the center and work toward the outer edges. When the wheel feels velvety, it is properly

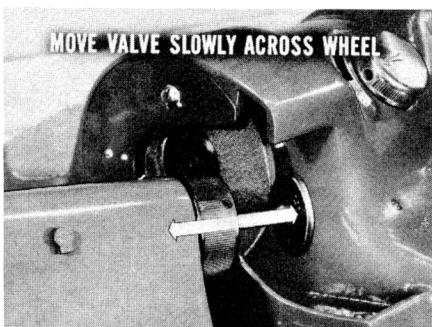
dressed. Put the valve in the chuck. Turn the motor on, and watch the head rotate to see if the valve is warped. Exhaust valves, remember, are exposed to combustion temperatures that can heat them up to 1800° F. They sometimes operate at cherry-red heat at or near wide-open throttle and are subject to warping.



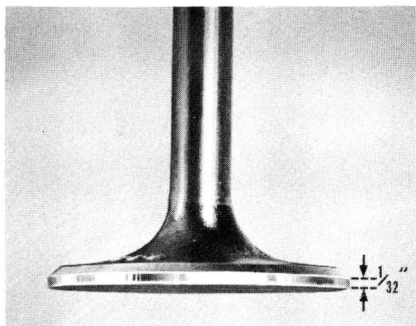
A valve slightly warped is serviceable if it can be refaced so that the margin is satisfactory. Margin is the unground edge of the valve. It extends from the top of the valve head to the upper limit of the face. What you're after is an angle of 45° on the face, and 45° on the seat.



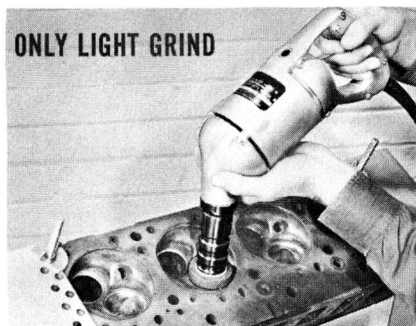
When you start your grind, feed the wheel slowly into the valve—and take a *very slight cut*—not too much pressure. Next, feed the valve slowly across the face of the wheel. Never feed the valve completely off the wheel, and don't remove any more material than is required to true up the valve. Whenever you want to inspect your work, or when grinding is finished, move the wheel away from the valve.



Shoot for a margin of at least $\frac{1}{32}$ ". Anything less than that calls for discarding the valve. Knife-edge margins weaken the head too



much and indicate that the valve had too much warpage to begin with. Too thin a margin can cause the valve to break or chip at the edges. What's more, the edges can overheat and cause pre-ignition or a popping back through the carburetor.



Reface the Seats. Truing up the valve seats is a precision operation. The seat must be square with the guide, and concentric within .002" total indicator reading. The angle of the seat must be the same as the face angle, 45° on V-8 engines.

NOTE: To get so precise an angle, be sure to use the correct size valve guide pilot with the reseating stone. A pilot that isn't self-centering in the guide can turn out a seat that's off-center. The valve face won't rest squarely on the seat.



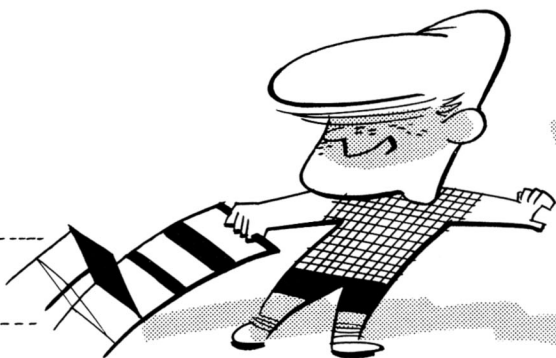
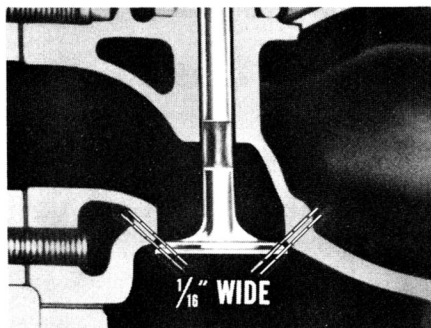
Remember . . . the valve seats in our V-8 engines are integral with the heads. Only a light grind is needed. So, support the weight of the tool and take a very light cut. When you've ground the seats, use a dial indicator, or the valve seat indicator (Tool 13725) to measure guide concentricity. They must be true within .002" total indicator reading.

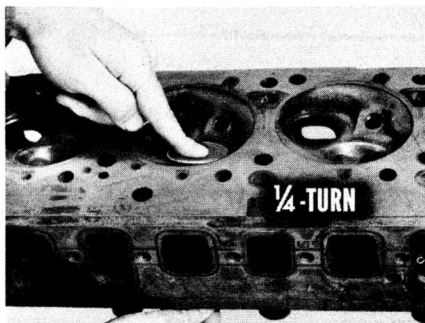
SEAT CONCENTRICITY...WITHIN .002"



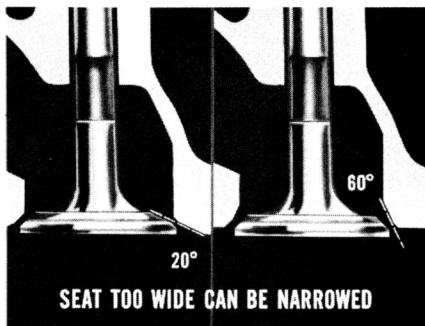
NOTE: If the seats are true, and were carefully ground, finish-grinding, or lapping in, isn't necessary.

Inspect Seat Width. Inspect seat width next. Wide seats tend to collect carbon and hold valves open so they can burn. Narrow seats don't give valves a chance to transfer the heat and they run too hot as a result. A proper seat is about $\frac{1}{16}$ " wide, and is located mid-way between the top and bottom of the valve face.

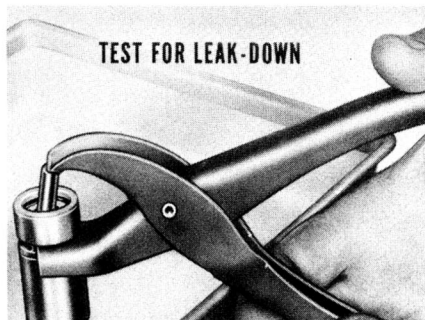




One good way to verify proper seating is to spread a thin coating of Prussian blue on the valve seat. Put the valve in the guide so the head rests on the seat. Turn the valve $\frac{1}{4}$ turn, lift it up, and inspect the contact pattern. When possible, you want contact on the top of the face near the outer diameter of the valve.



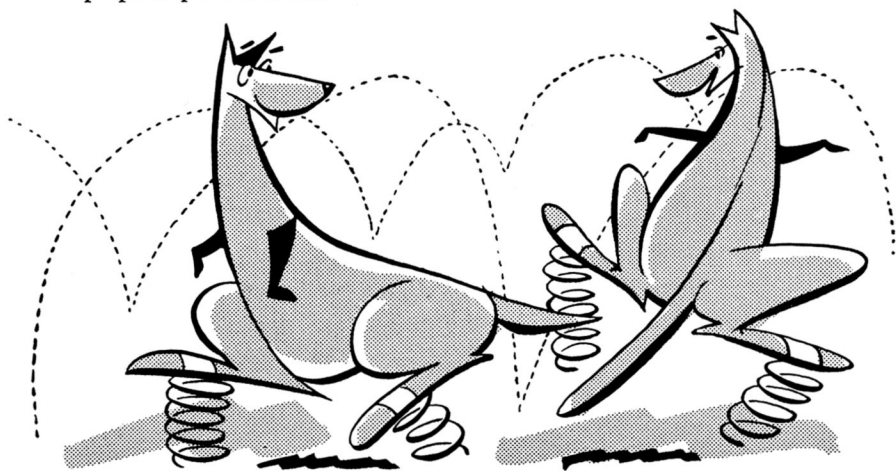
A seat too wide can be narrowed. Use a 20° stone on the upper surface, or a 60° stone on the lower surface. Location of the seat on the face will tell you which stone to use.



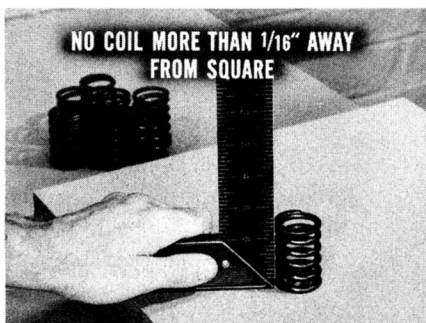
Hydraulic Tappets. If the engine has hydraulic tappets, you should remove the tappets for cleaning and inspection. Be sure to test all tappets for leak-down, and replace any that are not satisfactory.

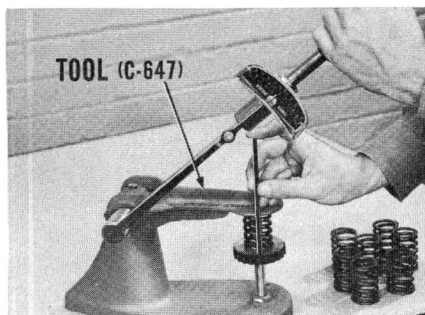
Valve Springs. Whenever you do a valve job, inspect the valve springs for distortion, free length and compressed pressure. Valve springs, remember, work under pretty rugged conditions. One end rests on the hot cylinder head. The springs flex constantly, and operate under the rocker cover where little cool air can strike them.

Springs that become overheated lose tension. They won't open or close valves as quickly as needed. Of even greater importance, they might not hold the valves tightly seated, or close them fast enough without bouncing. Bouncing can cause a high-speed miss or poor top-speed performance.



So examine springs for distortion first. Use a square and surface plate to see how squarely the spring sits. And make this check of the spring at both ends. No coil should be more than $\frac{1}{16}$ " away from the square.



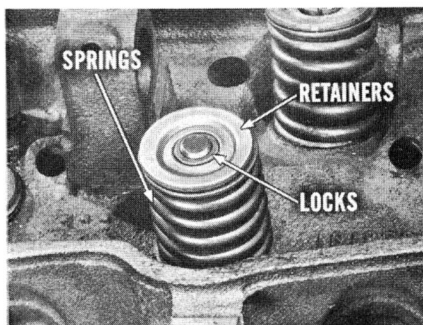


Use the valve spring tester (Tool C-647) next to see if compressed pressure and spring height at which you get the pressure are the same as that specified in the Service Manual. Any springs that do not measure up to specifications should be discarded.

Install the Valves. If you're sure that all the springs are serviceable, it's time to install the valves. Use compressed air to clean off the cylinder heads. Then, coat the valve stems with oil and install each valve in the guide from which it was removed. Note: Use Gauge

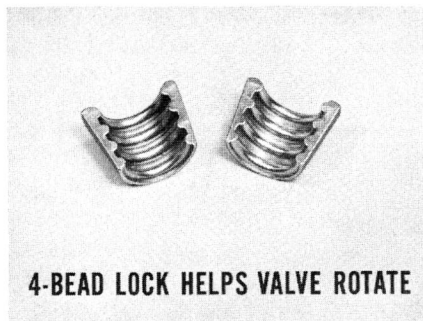


C-3648 to check the installed height of valves on all engines fitted with hydraulic tappets. Install new cup seals, too. Push them down into position over the end of the stem guides. If both the intake and exhaust valves had seals originally, replace *all* the seals with new ones. But if the engine you're servicing just had *intake* seals, replace only those.

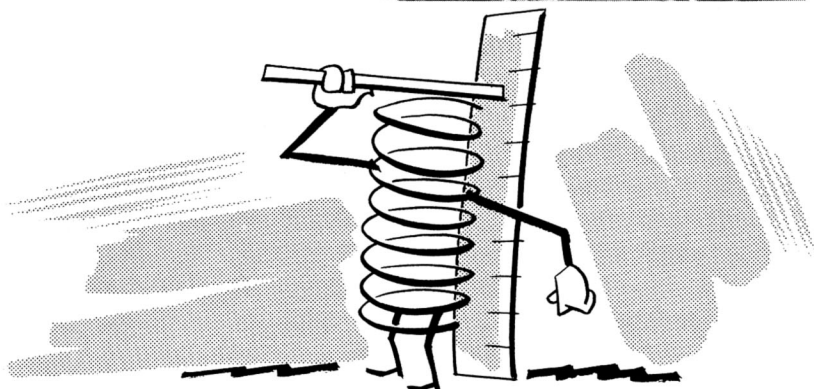
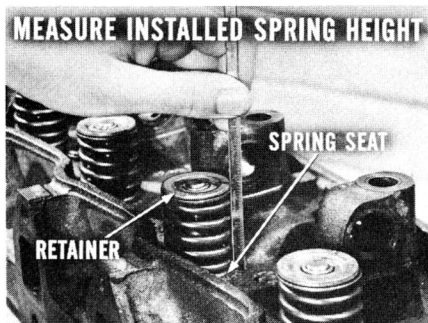


After the seals, install the valve springs, retainers, and locks. Springs with two or more closed coils at one end should have that end installed toward the cylinder head.

Now, the intake stems on some engines are grooved to take a valve lock with two beads; exhaust valves are grooved to take a lock with four beads. In case you wondered about it, the four-bead valve lock is a design feature that helps the valve rotate during operation. That, of course, minimizes the possibility of burning.



Measure Installed Spring Height. Once the valves are installed, measure installed spring height. Use a narrow scale to measure from the bottom of the spring seat in the cylinder head, to the bottom of the valve spring retainer. Look up the installed spring height measurements in the Service Manual that applies. If your measurement is too high, install a $\frac{1}{16}$ " spacer in the head counterbore.



NOTE: If spacers have already been used, make your measurements from the top of the spacer.

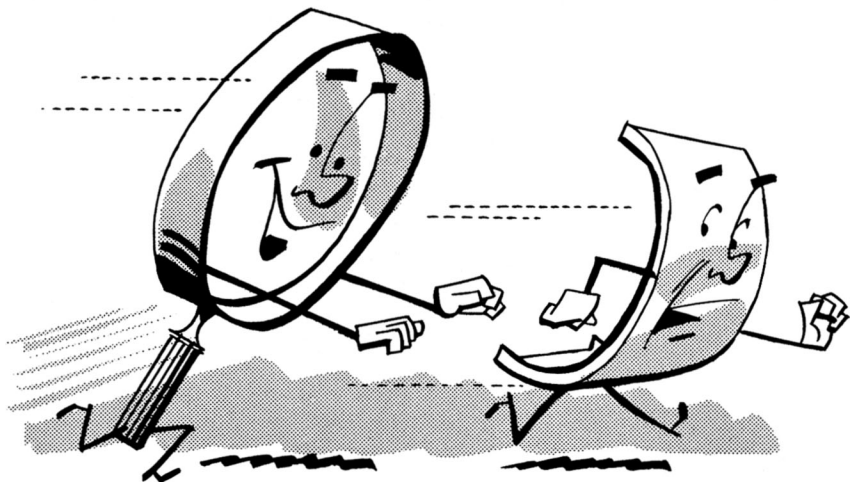
Always measure installed height so you'll know whether the spring (in operating position) will have the proper tension to do its job.

BEARING RECONDITIONING

If you have some reason to suspect that there's a bearing condition that needs close inspection, this is a good time to do it. So . . . before you reinstall the heads . . . drain the oil and drop the oil pan.

Connecting Rod Bearings

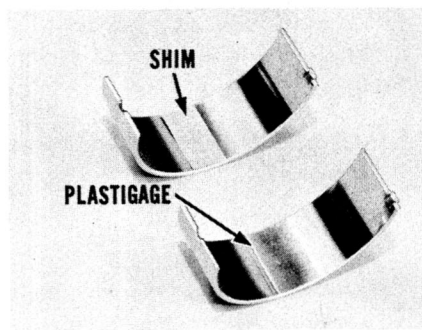
Inspection. Remove the bearing caps from the connecting rods. If caps aren't marked, mark them to keep them in order, along with their bearings. Then you'll be able to reinstall them properly. Next, examine each bearing for grooving, scoring, or foreign matter embedded in the lining material. Discoloration, or dull appearance, doesn't affect serviceability if the surface shows no damage and the clearance is correct. So many different bearing materials are being used today and they usually discolor under service. Only signs of pitting, flaking, or scoring will tell you whether a bearing is damaged.



Shiny spots, caused by wiping action from too little clearance, can happen when foreign matter gets between the back of the bearing shell and the rod, or cap, or by a journal which has worn tapered or out-of-round. Discard any damaged bearings and correct the condition causing the damage.

Inspect Journals. Before checking bearing clearance, wipe the journals clean and examine them for scoring or scratches. With a micrometer, check the journals to see that they aren't tapered or out-of-round more than .001". If they are, the damaged journals will have to be reground.

Measuring Clearance. Bearings are originally fitted to have .0005" to .0015" clearance. So, the best way to tell whether new bearings are needed is to measure their clearances. There are two methods of



checking. In the first, you can use a small piece of oiled .002" brass shim stock, 1/2" x 3/4" with smooth edges. Or, you can use the Plastigage method of measuring clearance. Whichever method you use, be sure to wipe the journal, cap and bearings clean first.

Shim Method. If the car has been in service, the bearings are not disfigured, and the connecting rod journal is standard size, place the .002" brass shim in the lower bearing so it is parallel with the shaft. Install the bearing cap and bearing and torque the rod bolt nuts to 45 foot-pounds. Then, turn the shaft *slightly* by hand and feel the amount of drag caused by the shim. Don't turn the shaft a complete revolution, just enough to tell whether the shim puts a drag on the shaft. If little or no drag is felt as the crankshaft is turned, it indicates there is more than .002" clearance. Continue checking by using thicker shim stock until the shaft can no longer be turned by hand. This will then indicate the actual clearance between the bearing and journal.



If the connecting rod journal is not worn, it will be satisfactory to install a set of standard size rod bearings. When doing this, however, recheck the clearance of the new bearings by temporarily installing the .002" shim. This should result in a definite drag when turning the crankshaft. If the clearance is satisfactory, remove the shim and tighten the rod bolt nuts to their recommended torque.

Plastigage Method. Put a small piece of plastic material in the bearing, parallel to the shaft, and tighten the cap to its specified torque.

Do not turn the shaft. This flattens the plastic material. So, remove the cap and check width of the plastic against the graduated scale supplied with the Plastigage set. The scale reading will indicate the exact clearance. You can select the proper undersize bearing that will take up the clearance and leave the recommended .001" running clearance.



NOTE: When replacing bearings, use *both* halves of the new bearing. Never use a new half as a mate to a used half. And be sure that the tabs on the bearings line up with the grooves on the rods.

Main Bearings

Inspection. When you inspect main bearings for condition and clearance, remove only one at a time. Leave the other mains tightened to support the crankshaft. Inspection is the same as that for the connecting rod bearings. And remove only the lower half. Its condition will tell you how serviceable the upper half may be. Discoloration alone doesn't indicate damage. The bearing must show signs of scoring, pitting, chipping, or wiped areas that mean too little clearance.

NOTE: Bearing shells of Nos. 1, 2, 4 and 5 are interchangeable, but the caps are not. If they are installed in the incorrect positions, the caps can be easily damaged. So, before removing the caps for bearing inspection, be sure they are marked for identification. If they are not marked, mark them so they will be properly installed.

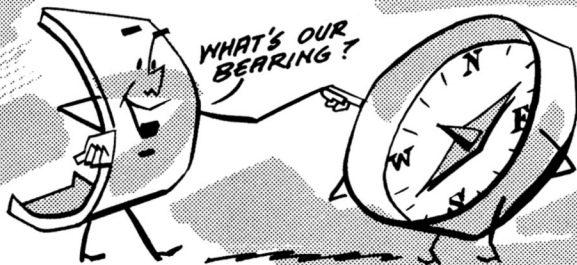
Clearance. You can measure main bearing clearance with shims or the Plastigage, following almost the same methods described in the section on connecting rod bearing clearance. When you use Plastigage to measure clearance, there is one important caution to observe.

CAUTION: If bearings are measured with the engine in the chassis, be sure to support the crankshaft to take up clearance between the upper bearing insert and the crankshaft journal. You can do this by snugging bearing caps of the adjacent bearings with .005" to .015" cardboard between the lower bearing shell and journal. Do this very carefully to avoid unnecessary strain on the crankshaft or bearings, or you may get false readings. Do not turn the crankshaft while the Plastigage is installed. And don't forget to remove the cardboard before you reinstall the oil pan.

It is also good practice to support the crankshaft with a high-stand service jack.

Main bearings are supplied in standard size, and in .001", .002", .003", .010", and .012" undersizes. Upper main bearing halves are grooved for oil distribution. They have a feed hole which lines up with the oil passage to the camshaft bearing. The lower halves are not grooved and do not contain oil feed holes. The Number 3 bearing is flanged on each side to carry the crankshaft thrust load.

NOTE: Every now and then a production engine is built with .001" undersize bearings. Engines of this type have a Maltese Cross stamped on the engine numbering pad. Look for the letter "M" on the Number 3 counterweight and see if it is followed by a number. As an example, "M-1" means the Number 1 main bearing is fitted with a .001" undersize bearing. If you find "R-1" on the counterweight, it means that the Number 1 connecting rod is fitted with a .001" undersize bearing.



Replacing Main Bearings. Again, remember to use both halves of the new bearing. Never use a new half to mate with a used half. If you have to remove the upper half, insert Tool C-3059 into the oil hole of the crankshaft. Then, slowly rotate the crankshaft clockwise which will force out the upper half. Use the same tool to roll the new bearing into place. Be sure to tighten all bearing caps to the specified torque.

Rear Main Bearing Oil Seal

If there is evidence of leakage or the seals are not serviceable, remove the old seals and clean the cap surface. Install new seals, using Tool C-3511 or C-3625, depending upon the type of engine being worked on. Then, trim off the ends of the seal that extend above the cap. Install the two side seals in their grooves, and reinstall the cap. Tighten the cap 80 to 85 foot-pounds.

NOTE: To install the rear main bearing *upper* oil seal, the crankshaft must be removed.

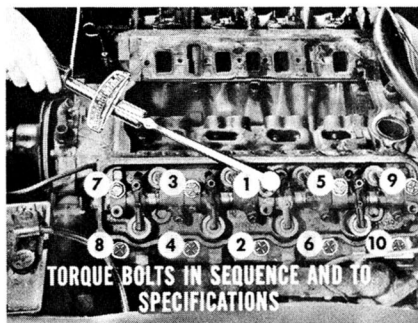
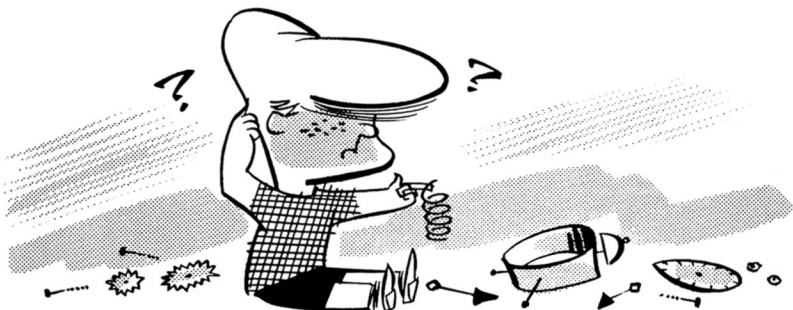
ENGINE REASSEMBLY

When you're sure the valves and bearings have been thoroughly reconditioned, you're ready to reassemble the engine. Clean both sides of the oil pan and reinstall it. And when you reinstall the cylinder heads, use new gaskets. Coat the gaskets with sealer before you install them.



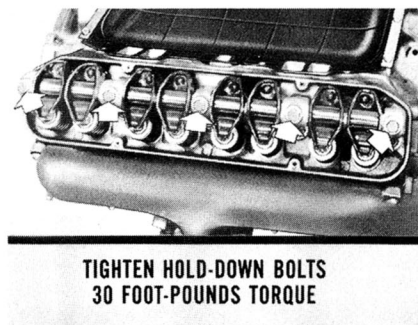
NOTE: Before you install and tighten the heads, inspect the ends of the rocker arms for wear and replace any that are worn. Adjusting screws should have a minimum of 18 inch-pounds torque or they'll back out and increase the clearance. If you can't get that torque, the adjusting screws, and possibly the arms, should be replaced.





After you install the heads, rocker arm brackets and arms, use a torque wrench to tighten the head bolts in their proper sequence. After you've drawn down each bolt to 50 foot-pounds, go around again and pull them down to the final torque specifications, 70 foot-pounds on this engine.

Push Rods. Inspect the push rods next. Replace any that are worn or bent. Install the push rods with the small ends toward the tappets, and slide the rocker arms over the push rods.



When you work on an engine with hydraulic tappets, you torque the head bolts down in proper sequence. Then you install the rocker arm shaft brackets and tighten their hold-down bolts to 30 foot-pounds torque.

CAUTION: When you're reassembling an engine with hydraulic tappets, allow time for the tappets to bleed down

to normal operating length. In other words, tighten the hold-down bolts *slowly*.

If you didn't allow enough time for hydraulic tappet bleed-down and tightened hold-down bolts too quickly, you would bend the push rods and bulge the tappet bodies. An engine in this condition would be noisy in operation.



NOTE: On any engine, be sure to tighten down the manifold bolts *evenly* as well as the head bolts. Many a valve job is spoiled by careless or improper tightening.

Here's another tip. Install and properly tighten new spark plugs of the correct type for the engine being worked on. All new parts, in fact, should be factory-recommended. Don't let a good job fall short because plugs or parts that you're not sure of are installed.

Change the oil filter and put in the proper amount of fresh M-S oil of the viscosity recommended for the temperature. Also, put in some break-in oil.

On an engine with mechanical tappets, adjust the intake tappet clearance to .010"—the exhaust clearance to .018". Run the engine at slow idle long enough for both the oil and coolant to reach operating temperature. Then, go back and reset tappet clearances and you're ready to road-test the car.



A FINAL WORD . . .

Valve and bearing reconditioning are good tests of any technician's all-around service ability. When you can perform these basic engine operations well, your customer will realize thousands of trouble-free miles and the greater satisfaction that comes with new-engine performance. An owner treated this way, will show his appreciation by doing *more* than returning for additional work as the need arises. He'll tell his friends, his neighbors—and your service business will grow. Take advantage of this opportunity to win new customers by paying close attention to the suggestions in this reference book.



**RECORD YOUR ANSWERS
TO THESE QUESTIONS
ON QUESTIONNAIRE NO. 142**

When checking stem-to-guide clearance, if total movement of intake valve is more than .010", or total movement of exhaust valve is more than .014", the guides will have to be reamed and valves with over-size stems installed.

☐ RIGHT

1

☐ WRONG

Use an expansion-type reamer instead of a spiral-flute reamer to ream guides for oversize valves.

☐ RIGHT

2

☐ WRONG

When reaming valve guides, select a reamer that is the first oversize from standard. Gradually increase reamer size until you get the guide size that will accommodate the oversize valve stem available.

☐ RIGHT

3

☐ WRONG

Finish-grinding (lapping in) must be done after reseating the valves.

☐ RIGHT

4

☐ WRONG

When checking valve springs for distortion, no coil should be more than $\frac{1}{16}$ " away from the square.

☐ RIGHT

5

☐ WRONG

Maximum allowable taper or out-of-round wear of crankshaft journals is .010".

☐ RIGHT

6

☐ WRONG

Foreign material behind a bearing can cause a high spot that results in damage to the bearing surface.

☐ RIGHT

7

☐ WRONG

Tabs on connecting rod bearings must be lined up with the grooves on the rods.

☐ RIGHT

8

☐ WRONG

Use a torque wrench to tighten head bolts in proper sequence, and recheck each bolt.

☐ RIGHT

9

☐ WRONG

Tighten rocker arm and shaft assembly hold-down bolts slowly, to allow time for hydraulic tappets to bleed down to normal length.

☐ RIGHT

10

☐ WRONG