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430, 530, 470 AND 570 TRACTORS

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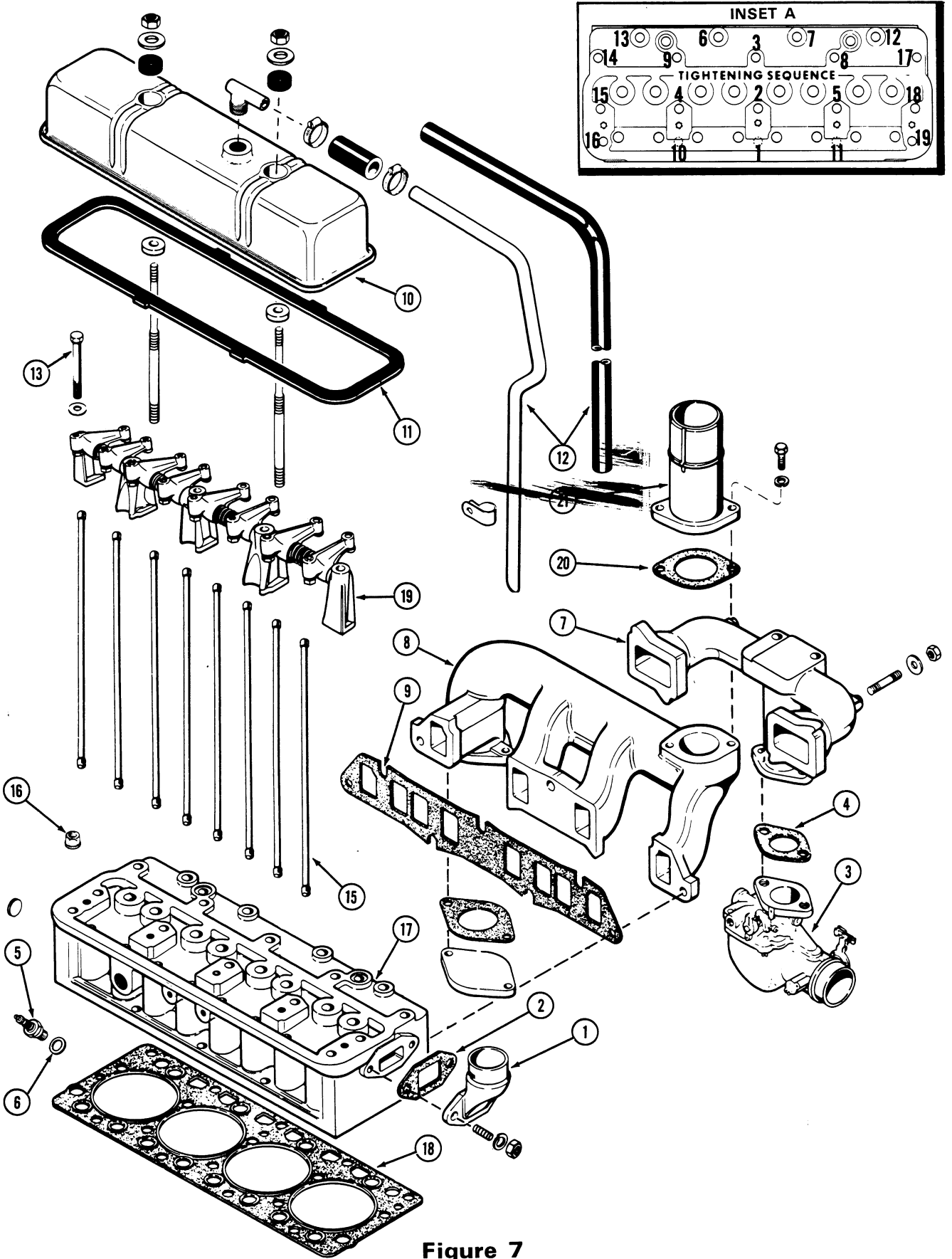


Figure 7

ROCKER ARM ASSEMBLY

148 AND 159

(Refer to Figure 8)

Disassembly

1. Remove the rocker arm shaft bracket bolts (1) and studs (9). **NOTE:** The center bracket is drilled for oil passage to the rocker arm shafts.
2. Remove and tag each rocker arm bracket (2 & 10) for proper location when assembling. **NOTE:** The end brackets will have to be moved outward slightly in order to remove the retainer pins (4) from the shafts (5) before the end brackets can be removed.
3. Remove the shaft springs (8) and spacers (11) from the shafts (5). Tag the front and rear shafts (5) for proper location when assembling.
4. Remove the tappet adjusting screws (12) from the rocker arms. Remove the push rods and tag them for proper location.

Inspection

Check the shaft springs for damage and proper tension.

SPRING SPECIFICATIONS

Free Length	1-3/16
Wire Diameter072"
I.D.	11/16"
Compressed to 11/16"	7.5 to 8.5 lbs.

Flush the shafts to remove any residual material. Inspect the shafts for excessive wear or worn spots on the bottom side of the shaft. Replace the shaft if any of these conditions exists.

Inspect the rocker arms by installing each rocker arm on the shafts in its proper location.

The rocker arm must be free on the shaft without any side wobble. If any is noted, replace the rocker arm bushing. Clean the oil passage in the rocker arms, Inset A, to insure free oil flow. Inspect the valve stem contact area on the rocker arm for wear. Replace if worn.

Clean and check the oil passage in the tappet adjusting screws.

Inspect the push rods for straightness, cracked or worn ends, replace if these conditions exist.

Clean and check the oil passage in the center rocker arm bracket, Inset B.

Assembly

With all component parts cleaned thoroughly and worn parts replaced, coat them with clean engine oil.

1. Install the plugs (3) in to the outer ends of the shafts (5), if they were removed, to a point which will allow the retainer pins (4) to be installed and not block any oil holes. **NOTE:** If the plugs (3) are installed too far they will block the flow of oil to one or more rocker arms.
2. Install the end brackets (2) part way on the shafts (5) so the retaining pins (4) can be installed in shaft. Tap the end brackets further on the shafts so the pin engages the slot in the bracket and the oil holes in the shaft are toward the valve side of the bracket.
3. Install new rocker arm bushing (13) in to the rocker arms (6 & 7) if they are being replaced. **NOTE:** The bushing (13) must be pressed into the rocker arm and reamed to .624"-.625", Inset A.
4. Starting with the front shaft install a rear rocker arm (7), spring (8), front rocker arm (6), intermediate bracket (2), spacer (11), rear rocker arm (7), spring (8) and front rocker arm (6).
5. Starting with the rear shaft install a front rocker arm (6), spring (8), rear rocker arm (7), intermediate bracket (2), spacer (11), front rocker arm (6), spring (8) and rear rocker arm (7).
6. Install these two rocker arm shaft assemblies into the center bracket (10) and wire the complete assembly together.
7. Install the tappet adjusting screws (12) into the rocker arms (6 & 7) as far as possible.
8. Install the push rods in their proper location. Install the rocker arm assembly to the cylinder head with the bracket bolts (1) and studs (9). Torque the bracket bolts and stud nuts 25-30 ft. lbs.
9. Adjust the tappets, refer to Page 26.

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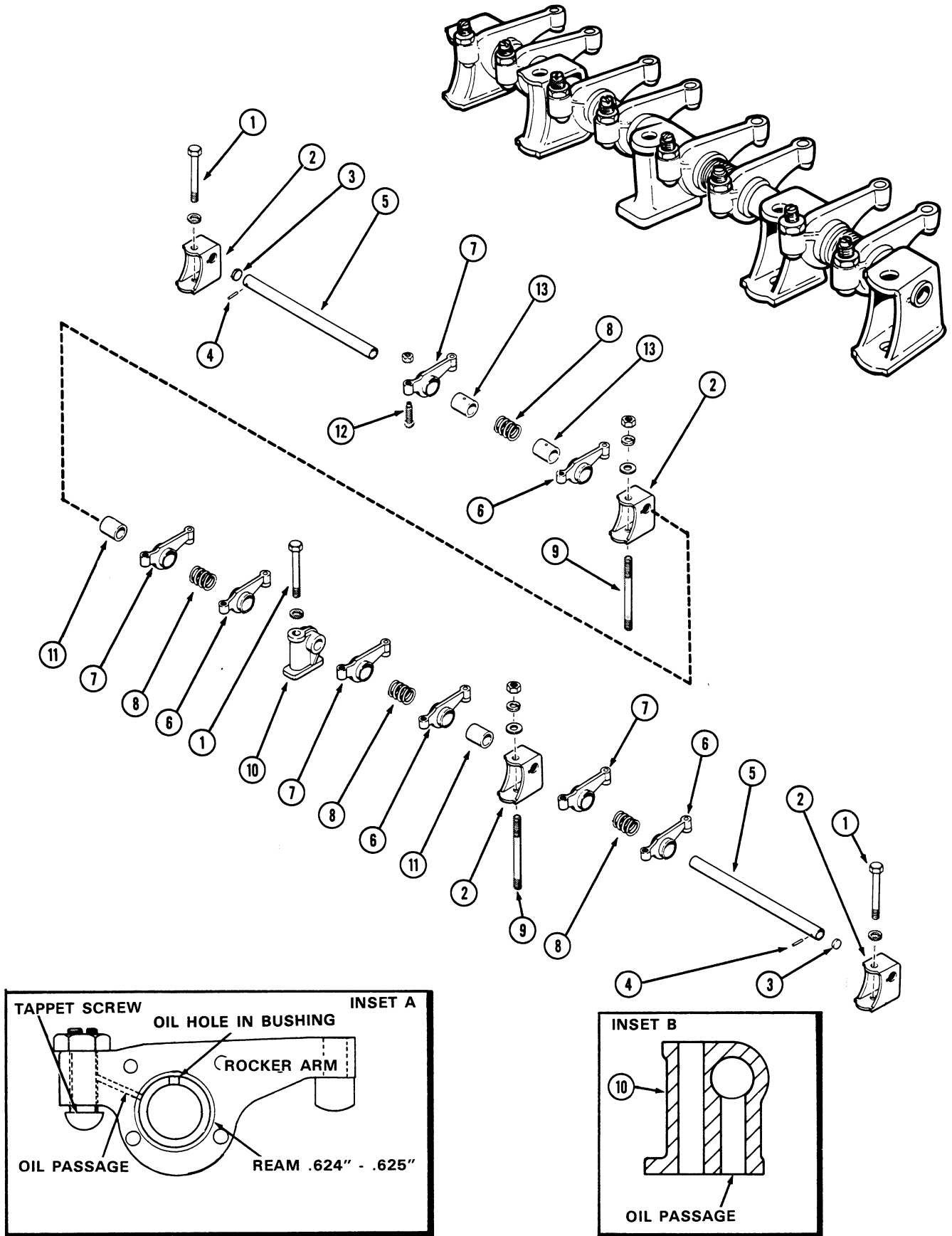


Figure 8

ROCKER ARM ASSEMBLY (Continued)

188 AND 201

(Refer to Figure 9)

Disassembly

1. Remove the rocker arm shaft bracket bolts (1 & 9). **NOTE:** The center bracket bolt is drilled for oil passage to the rocker arm shafts.
2. Remove and tag each rocker arm (4 & 7) and bracket (3, 10, 11 & 12) for proper location when assembling.
3. Remove the shaft springs (6) and tag the front and rear shafts (8).
4. Remove each tappet adjusting screw (5) from each rocker arm, refer to Inset A.

Inspection

Check the shaft springs for damage and proper tension.

SPRING SPECIFICATIONS

Free Length	2.5"
Wire Diameter072"
Compressed to 1.75"	7.5 to 8.5 lbs.

Flush the shafts to remove any residual material. Inspect the shafts for excessive wear or worn spots on the bottom side of the shaft. Replace the shaft if any of these conditions exists.

Inspect the rocker arms by installing each

rocker arm on the shafts in its proper location. The rocker arm must be free on the shaft without any side wobble. If any is noted, replace the rocker arm. Clean the oil passage in the rocker arms to insure free oil flow. Inspect the valve stem contact area on the rocker arm for wear. Replace if worn.

Clean and check the oil passage in the tappet adjusting screws, Inset A, and the center bracket retaining bolt (1).

Inspect the push rods for straightness, cracked or worn ends, replace if these conditions exist.

Assembly

With all component parts cleaned thoroughly and worn parts replaced, coat them with clean engine oil.

1. Install the intermediate brackets (10) on the shafts (8), starting with the front shaft. The front shaft is installed with the short end of the shaft (from the cut-out) toward the front of the engine, see Inset B. The rear shaft is installed with the short end of the shaft (from the cut-out) toward the rear of the engine.
2. Insert the bracket bolt (9) into the intermediate bracket (10) - it must line up with the cut-out in the shaft.
3. Install the tappet adjusting screws (5) into the rocker arms (4 & 7), make sure the screws are turned into the rocker arms as far as possible.
4. Install the rocker arms (4 & 7) and springs (6) on the rocker arm shafts (8).
5. Install the center bracket (11) to the long end (from the cut-out) of the shafts (8). Install the front (12) and rear (3) brackets to the shafts (8).
6. Before installing the rocker arm assembly on the cylinder head, crank the engine (fuel injectors removed) with the starting motor (approximately 1 to 3 minutes) until oil appears at the center oil passage in the head, see Inset C. Install the rocker arm assembly to the cylinder head with bracket bolts (1 & 9), making sure the center bracket drilled bolt (1) is installed in the cylinder head oil passage hole. Torque the bracket bolts 25-30 ft. lbs.
7. Adjust the tappets, refer to Page 26.

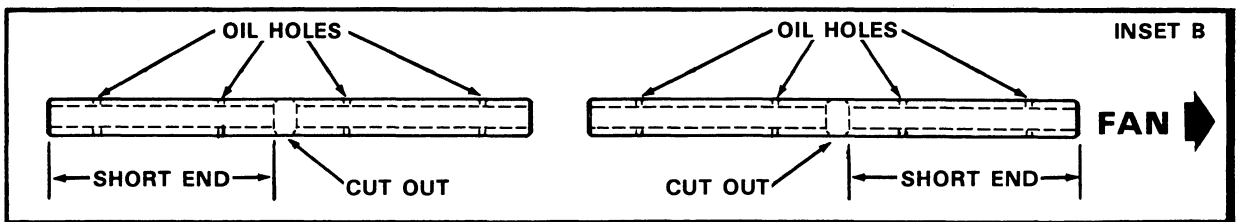
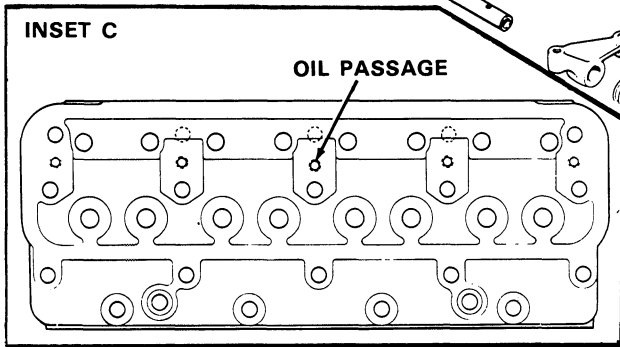
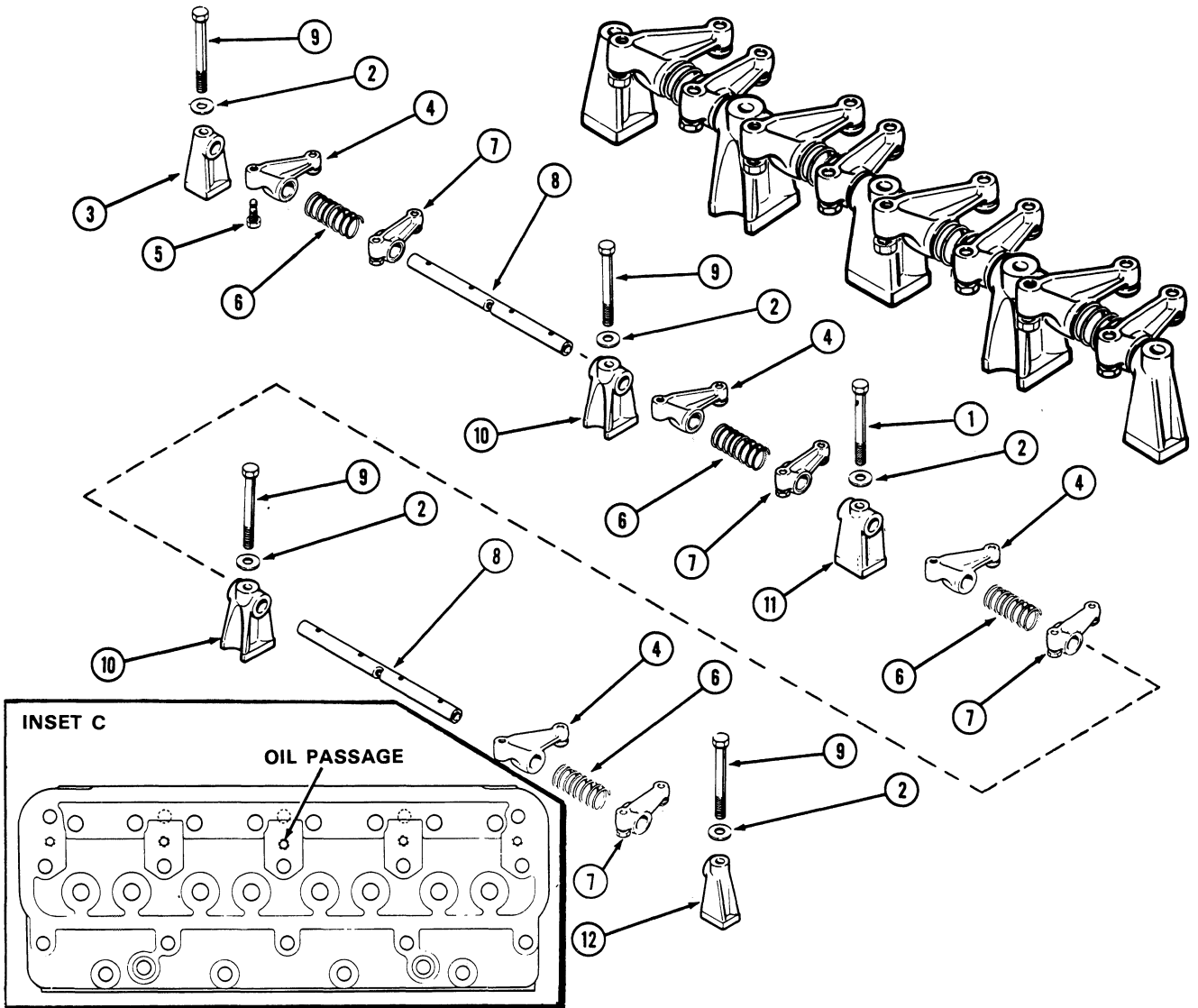
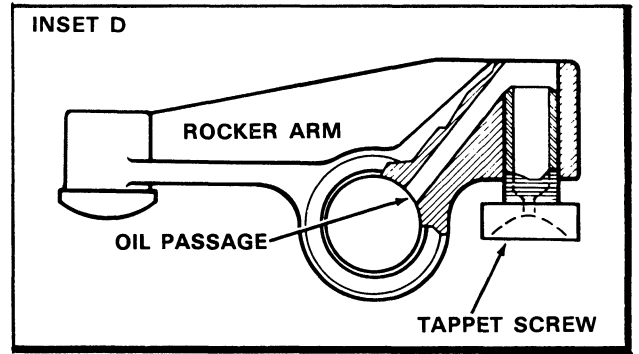
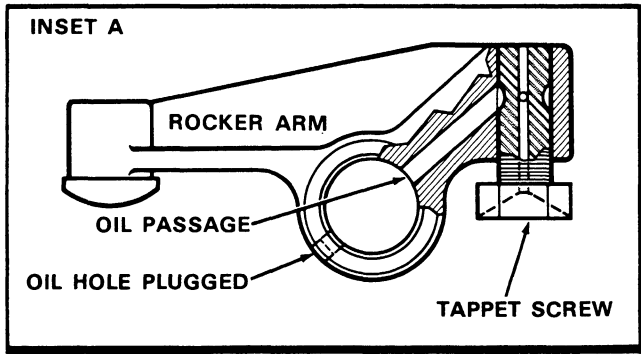


Figure 9

CYLINDER HEAD ASSEMBLY

148 AND 159

(Refer to Figure 10)

Disassembly

- Using a valve spring compressor, compress the valve spring (1) enough to remove the valve retainer locks (2). Release the spring compressor and remove the intake valve seals (3), intake valve retainers (4) and the exhaust valve rotators (5). Remove the springs (1).
- Remove any carbon from the valve stems before they are removed from the cylinder head. Remove the intake valves (6) and exhaust valves (7) from the cylinder head (9) and set them in a rack or holder. **NOTE:** Mark the valves on removal so they can be installed in their original location.
- Remove the intake valve guides (10) and the exhaust valve guides (11) by driving them down through the cylinder head (9) using an arbor.
- Remove the exhaust valve seats (8) from the cylinder head (9) using a special seat removing tool, Inset B. **NOTE:** Never attempt to remove a valve seat with a center punch, cold chisel or pry bar.
- Remove the push rod tubes (12) from the cylinder head (9) by driving them down through the head. Remove the push rod tube "O" rings (13) and discard them.
- To remove the expansion plug (14) from the cylinder head (9) it must be drilled and pryed out. **NOTE:** Refer to Inspection and Servicing on Pages 22,23, 24 and 25 prior to Assembly.

Assembly

- If the valve guides are being replaced, install new guides (10 & 11) in the cylinder head using an arbor. Press the guides into the head from the top of the cylinder head. The guides must protrude above the cylinder head (intake - 1.000" and exhaust - .844"), Inset A. After the guides have been pressed into place, they must be reamed to .3422" - .3432", Inset A.
 - To install new exhaust valve seats (8), clean the recess in the cylinder head (9). Place the valve seats in dry ice to shrink them. Insert the valve seats in the head and press them in place, using a suitable press.
 - Install new push rod tube "O" rings (13) in the cylinder head recesses. Lubricate the push rod tubes (12) with clean engine oil and install them into the cylinder head. **NOTE:** The tubes must be installed from the top with the tapered end down. Be sure they DO NOT protrude below the cylinder head, See Inset C.
 - Lubricate the intake valves (6) and exhaust valves (7) with clean engine oil and install them in their original location.
 - Install valve springs (1) with closed coil end toward head, and valve retainers (4) on the intake valves (6). Compress the valve springs so that the intake valve seals (3) can be installed in the lower groove on the valve stems. Install the valve retainer locks (2) and remove the spring compressor carefully.
 - Install the valve springs (1) and the exhaust valve rotators (5) on the exhaust valves (7). Compress the valve springs so that the valve retainer locks (2) can be installed. Remove the spring compressor carefully.
 - Install new expansion plug (14) if it was removed. The plug must be pressed in place and firmly seated against the retaining ridge in the cylinder head.
- NOTE:** When engine assembly is complete, a check of the operation of the rotators must be made. It is impossible to determine whether or not the rotator is turning without an identifying mark. Place a dab of white paint on each of the rotators and note it's position. Start the engine and observe whether or not the rotator is turning. DO NOT attempt repairs on rotators. There is not a set speed at which the rotators should turn. Some rotators will turn faster than others. As long as the rotator is turning the valve, it is functioning properly.

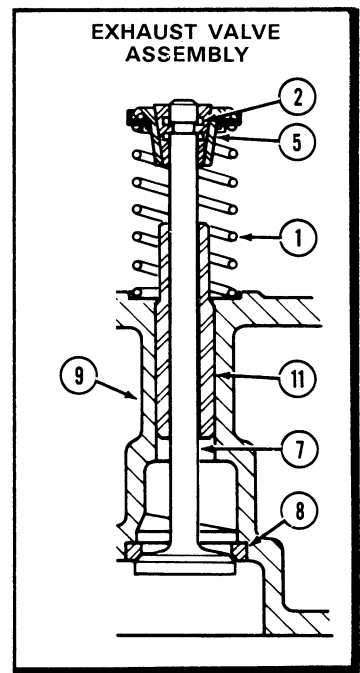
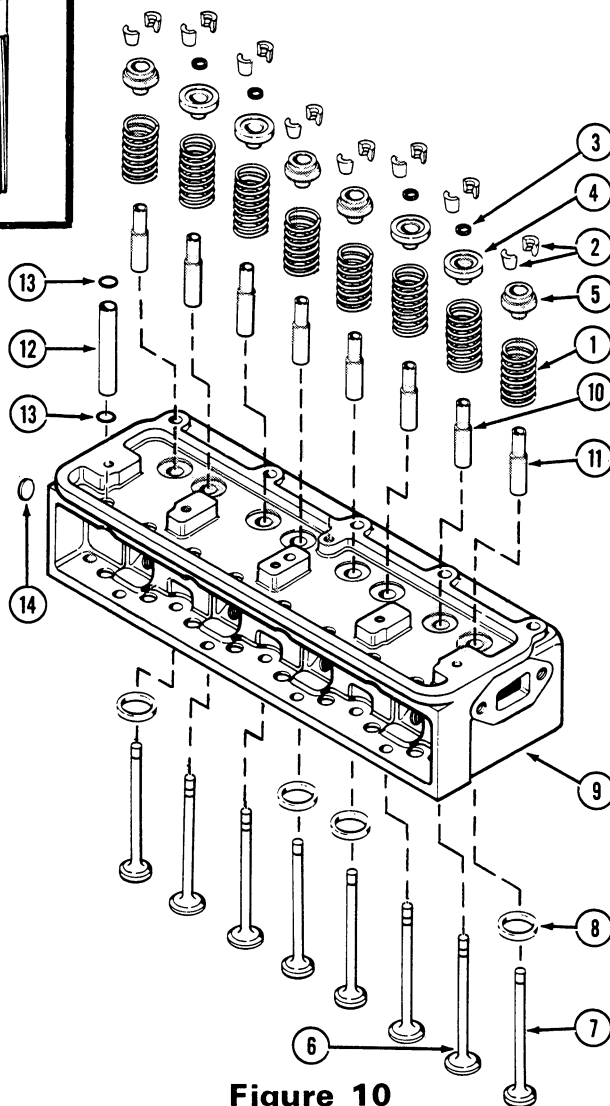
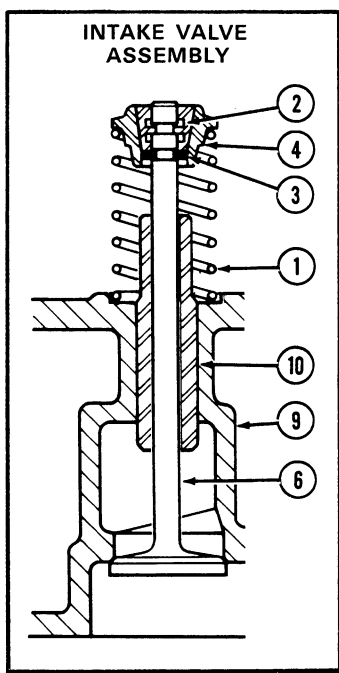
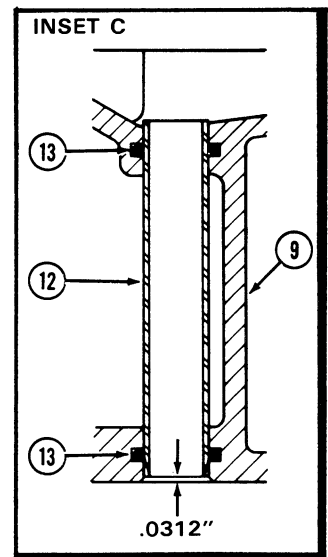
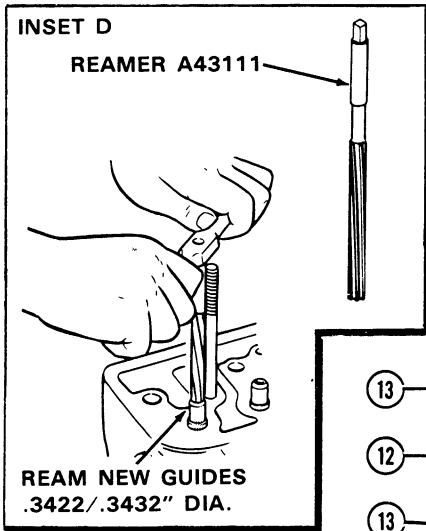
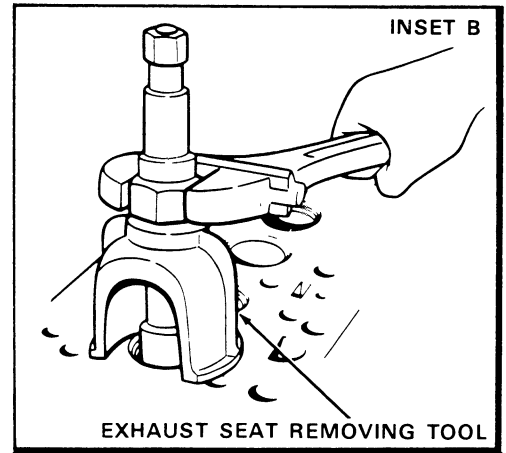
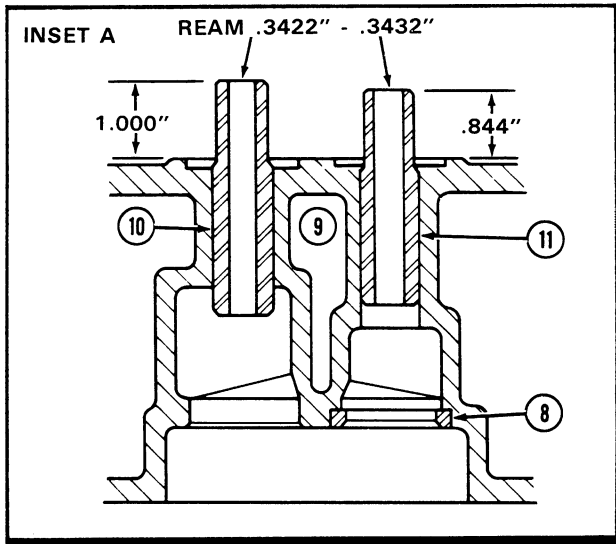


Figure 10

CYLINDER HEAD ASSEMBLY (Continued)

188 AND 201

(Refer to Figure 11)

Disassembly

- Using a valve spring compressor, compress the spring (1) enough to remove the valve retainer locks (2). Release the spring compressor and remove the intake valve seal (3) intake valve retainers (4) and the exhaust valve rotators (5). Remove the springs (1) and valve spring seats (6).
 - Remove any carbon from the valve stems before they are removed from the cylinder head. Remove the intake valves (8) and the exhaust valves (7) from the cylinder head (9) and set them in a rack or holder. **NOTE:** Mark the valves on removal so they can be installed in their original location.
 - Remove the intake valve guides (10) and the exhaust valve guides (11) by driving them down through the cylinder head (9) using an arbor.
 - Remove the exhaust valve seats (12) from the cylinder head (9) using a special seat removing tool, Inset B. **NOTE:** Never attempt to remove a valve seat with a center punch, cold chisel or pry bar.
 - To remove the expansion plug (13) from the cylinder head (9) it must be drilled and pryed out.
- NOTE:** Refer to Inspection and Servicing on Pages 22,23, 24 and 25 prior to assembly.

Assembly

- If the valve guides are being replaced, install new valve guides (10 & 11) into the cylinder head using an arbor. Press the guides into the head from the top of the cylinder head. The guides must protrude above the cylinder head (intake and exhaust) 1.000", Inset A. After the guides have been pressed into place, they must be reamed to .3422"-.3432", Inset A.
 - To install new exhaust valve seats (12), clean the recess in the cylinder head (9). Place the valve seats in dry ice to shrink them. Insert the valve seats in the head and press them in place, using a suitable press.
 - Lubricate the intake valves (8) and exhaust valves (7) with clean engine oil and install them in their original location.
 - Install the valve spring seats (6), valve springs (1) with closed coil end toward head, and the valve retainers (4) on the intake valves (8). Compress the valve spring so the intake valve seals (3) can be installed in the lower groove on the valve stems. Install the valve retainer locks (2) and remove the spring compressor carefully.
 - Install the valve spring seats (6), valve springs (1) and the exhaust valve rotators (5) on the exhaust valves (7). Compress the valve springs so that the valve retainer locks (2) can be installed. Remove the spring compressor carefully.
 - Install new expansion plug (13) if it was removed. The plug must be pressed in place and firmly seated against the retainer ridge in the cylinder head.
- NOTE:** When engine assembly is complete, a check of the operation of the rotators must be made. It is impossible to determine whether or not the rotator is turning without an identifying mark.
- Place a dab of white paint on each of the rotators and note it's position. Start the engine and observe whether or not the rotator is turning. DO NOT attempt repairs on rotators.
- There is not a set speed at which the rotators should turn. Some rotators will turn faster than others. As long as the rotator is turning the valve, it is functioning properly.

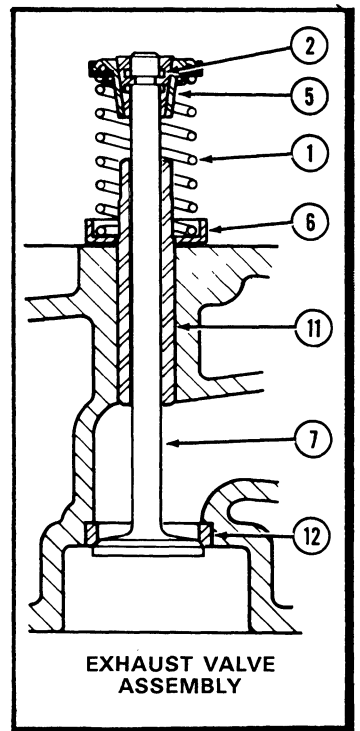
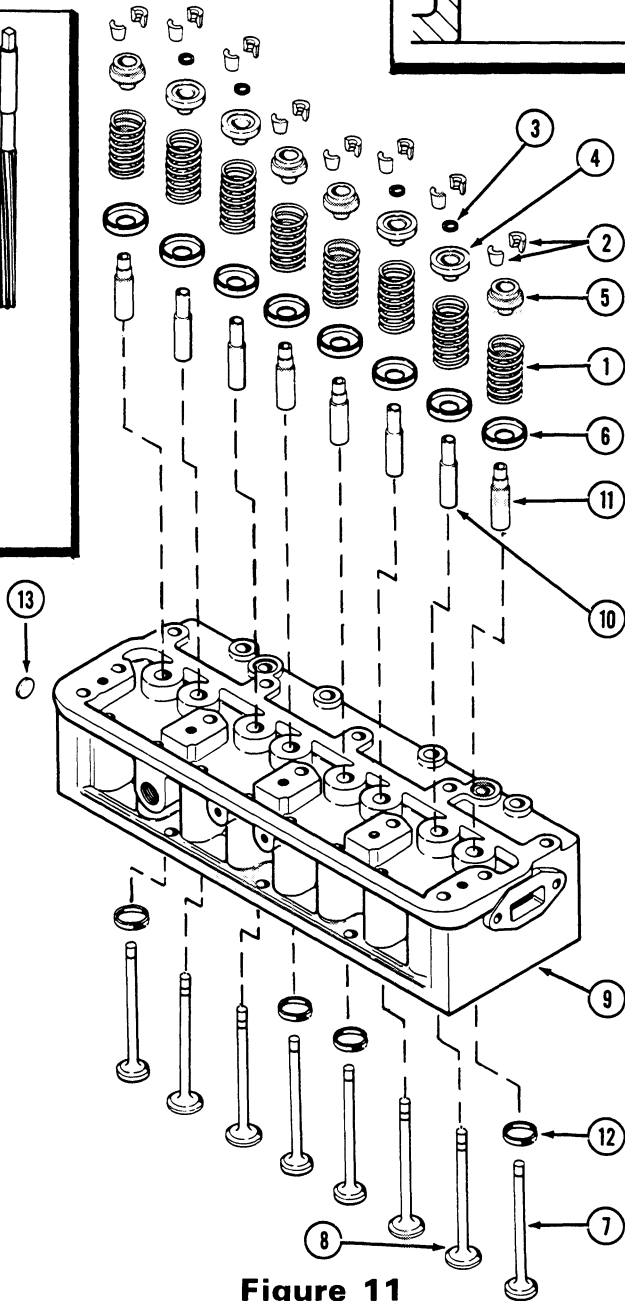
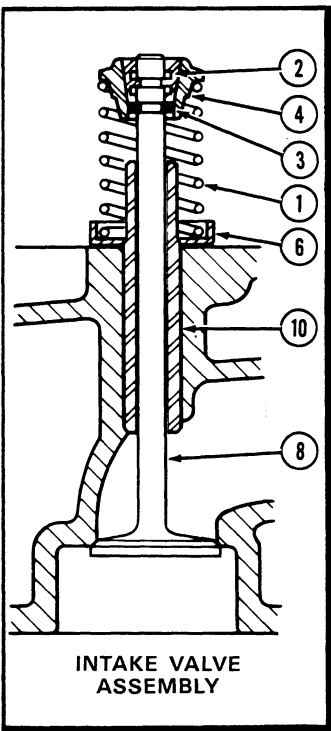
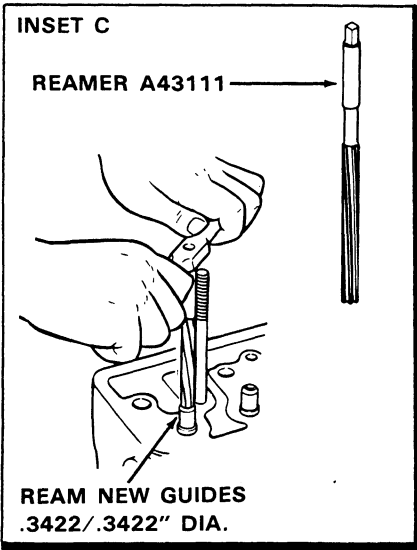
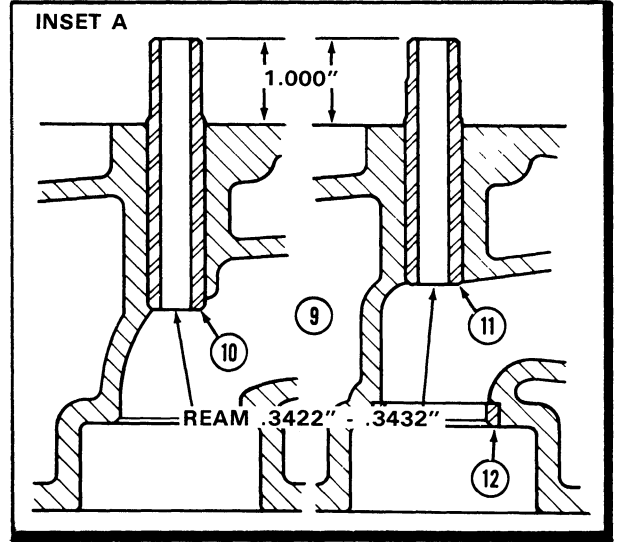
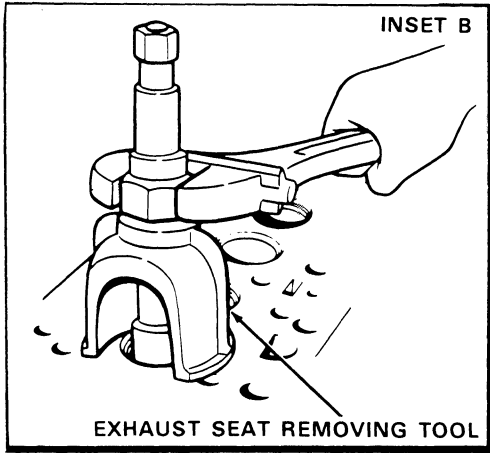


Figure 11

INSPECTION OF VALVES, GUIDES, HEAD AND SPRINGS

Clean the cylinder head completely. Remove all traces of carbon and other deposits. Check for cracks and any evidence of fretting or erosion existing in the area of fire ring contact. Check the head for evidence of warpage. If warpage exists and is more than .006", the cylinder head must be resurfaced or replaced.

Valve springs should be checked for flat squared ends, broken coils and correct spring pressure. Use a Valve Spring Tester referring to the spring specifications below:

EXHAUST VALVE SPRINGS

Valve Position	Compressed Height	Spring Pressure	Replace if Less than
Valve Open	1.332"	114 lbs.	110 lbs.
Valve Closed	1.686"	56 lbs.	50 lbs.

INTAKE VALVE SPRINGS

Valve Position	Compressed Height	Spring Pressure	Replace if Less than
Valve Open	1.521"	114 lbs.	110 lbs.
Valve Closed	1.875"	56 lbs.	50 lbs.

Remove all carbon from the bore of the valve guides with a fine wire brush and blow clean with compressed air. Valve guides can be checked for wear by using a bore gauge and micrometer, refer to Figure 12, Inset A. The valve guides should be checked at the top, middle and bottom of the guide bore for wear, Figure 12. If the diameter is greater than .3452" at any point along the bore, the guide must be replaced. Use an arbor equal to the inside diameter of the valve guide to keep the guide from collapsing when pressed into place. Press in from the top of the head until the guide protrudes a distance of .844" on 148 & 159 exhaust valves, 1.000" on 188 & 201

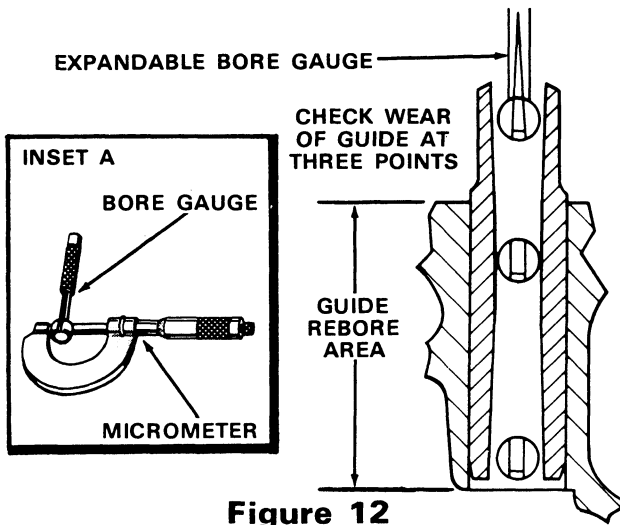


Figure 12

exhaust valves and 1.000" on all intake valves, above the head. Replacement guides must be reamed after installation. Ream new guides .3422" to .3432" diameter.

Clean the valves with a power driven fine wire brush, being very careful not to scratch the valve stems. Refer to Figure 13 for valve nomenclature.

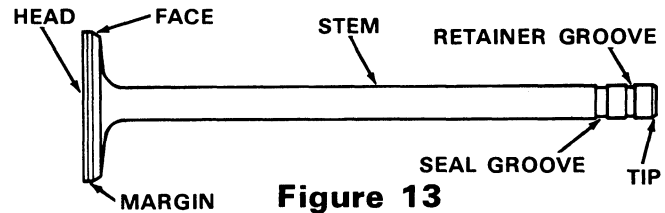


Figure 13

Inspect the valves for excessive wear or necked stems, Figure 14. This can be caused by lack of lubrication, plugged water passages or operating the engine under continuous overload at excessive engine RPM. Replace valves if this condition exists.

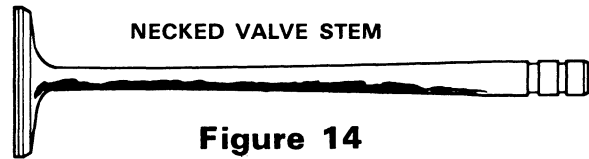


Figure 14

Inspect the valves for deep grooves in the face, Figure 15. This can be caused by abrasives entering the engine through the intake system or not servicing the air cleaner regularly. If grinding the valve face will not correct this condition, replace the valve.

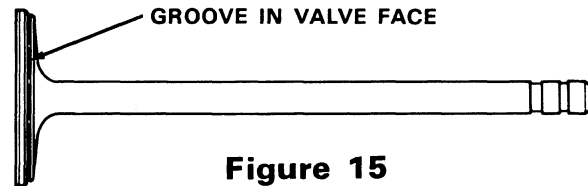


Figure 15

Inspect the valve face and stem for rust or pitting, Figure 16. Rust or pitting can usually be removed by grinding the valve face. If rust or pitting on the valve stem exists, replace the valve. These conditions can be caused by using poor quality engine oil or fuel that does not meet the specification given in Section 11 and by improper storing of the engine.

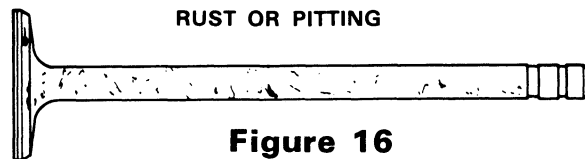


Figure 16

INSPECTION OF VALVES, GUIDES, HEAD AND SPRINGS (Cont'd)

Heavy carbon or varnish deposits on the valves, Figure 17, should be removed before valves are ground. This condition is usually caused by worn piston rings and sleeves which allow too much oil to reach the combustion chamber. This conditions could also be caused by worn valve guides or bad seals on the valves. Low operating temperature is still another cause.

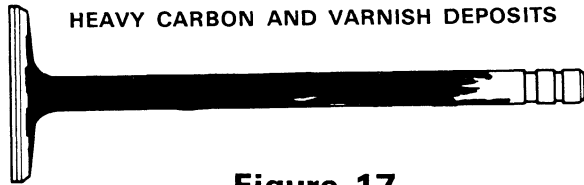


Figure 17

Inspect the valve head for dishing and the valve face for deep burned spots, Figure 16. These conditions cannot be corrected by grinding the valves. The valves must be replaced. These conditions are usually caused by running the engine under excessive loads at high engine temperatures.

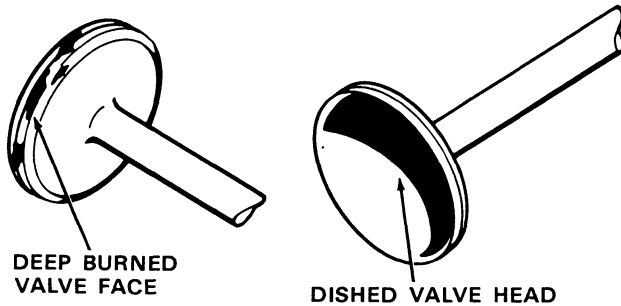


Figure 18

Valves with worn keeper grooves or if the stem tip is worn or dished beyond the chamfer, replace the valves, Figure 19.

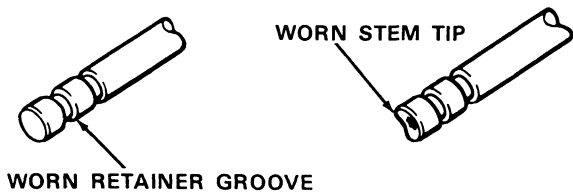


Figure 19

The checking of the valve stem diameter can be best be done with a good, accurate micrometer, Figure 20. The valve stem being straight, should be measured at three points along the stem, Figure 20. Wear limit must not exceed .002" at all points of measurement. If the wear is greater, replace the valve.

CHECK DIAMETER OF STEM AT THREE POINTS

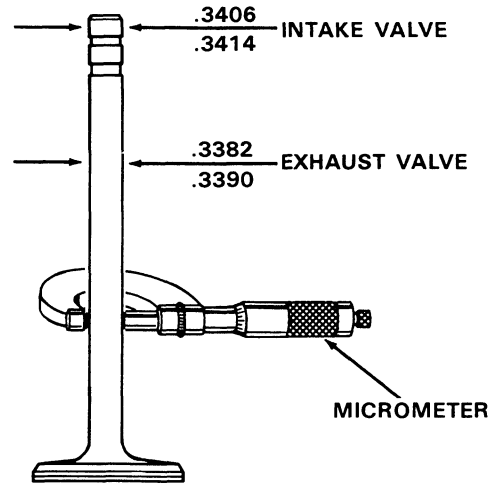


Figure 20

The checking of the valve face runout should be done after the valves have been ground. A Vee block type holder with a dial indicator, Figure 21 can be used to check the valve face and stem runout. The valve face runout should not exceed more than .002". The valve stem runout should not exceed .002". If the valve face and/or valve stem runout is greater, the valve must be replaced.

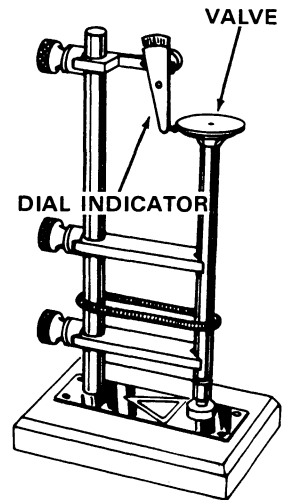


Figure 21

NOTE: Small amounts of very fine pitting, Figure 22, may be found on the surfaces of the valves faces and seats after the valves are cleaned. These are normal and will not affect engine performance. This fine pitting is caused by a normal oxidation process and can happen on any engine during the run-in period. It is not necessary to grind valves or seats if this fine pitting is found as the pitting will generally reoccur after the engine is run for a few hours.

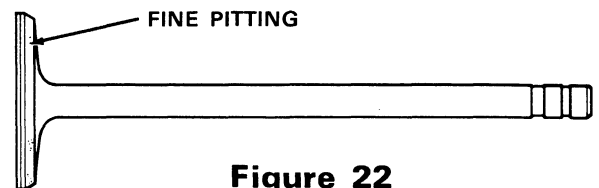


Figure 22

REFACING INTAKE AND EXHAUST VALVES

Before refacing the valves, they should be wire brushed, cleaned and inspected. A 44° angle on exhaust valves and 29° angle on intake valves is the correct valve face grinding angle. Set the refacing machine protractor at this angle. Be sure the chuck of the machine is clean before installing the valve. Dress the grinding wheel before starting to reface the valves. Take only light cuts as the valve is refaced. The last cut must be very fine so the valve face will have a polished finish.

IMPORTANT: Replace any valve that has a thin edge or margin, Figure 23. If the margin on the ground valve is less than half the margin on a new valve, replace the valve.

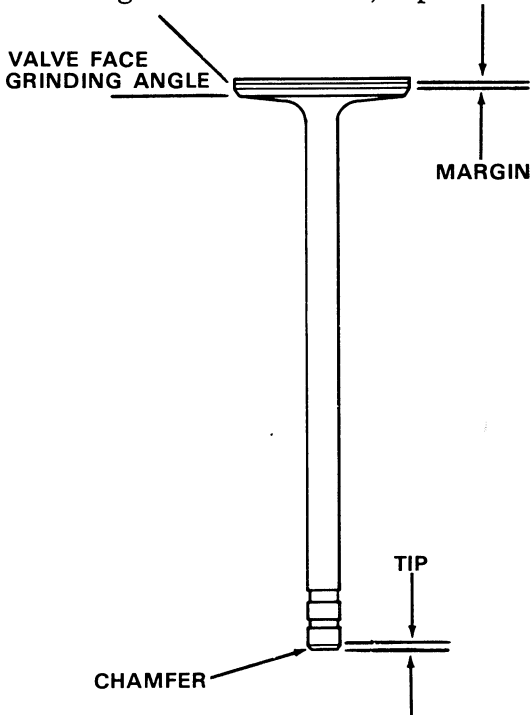


Figure 23

The tip end of the valve should be checked for roughness or wear. Usually this can be removed with some very light cuts against the side of the grinding wheel and will square up the end. Never grind off the valve stem end beyond the chamfer.

Correct refacing of intake and exhaust valves and valve seats will provide a 1° interference angle. This angle is important since it aids in cutting carbon and helps seat the valves.

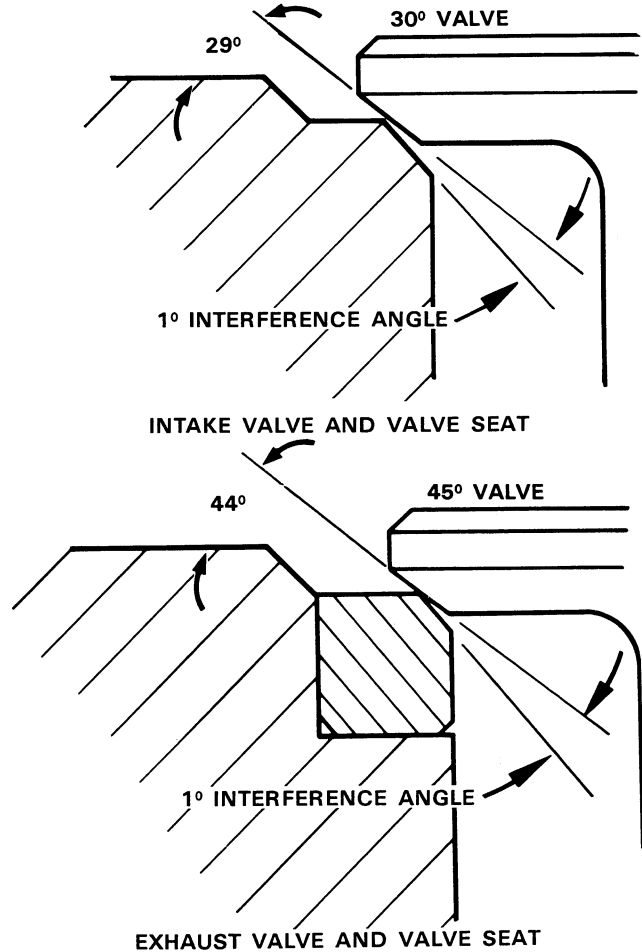


Figure 24

When the top edge of the contact area is too high or low on the valve face, the seat contact area must be moved. This is done by using the narrowing stones. Refer to Page 25. The contact area width should never exceed the specified dimensions.



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GRINDING INTAKE AND EXHAUST VALVE SEATS

Always use a precision seat grinder. Take very light cuts with the grinding stones so just enough metal is removed to end up with a good smooth seat finish.

The proper angle of grind is 45° for exhaust valve seats and 30° for intake valve seats, Figure 25. The seat grinding angle of the stone should be dressed frequently on a stone dresser to maintain a clean accurate surface.

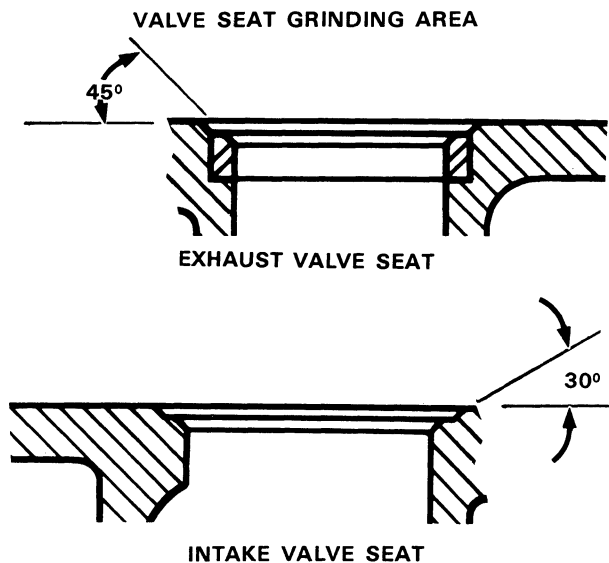


Figure 25

IMPORTANT: The valve seat runout should be checked after finish grinding with a dial indicator and seat grinding pilot, Figure 26. The runout of the valve seat must not exceed .002" .

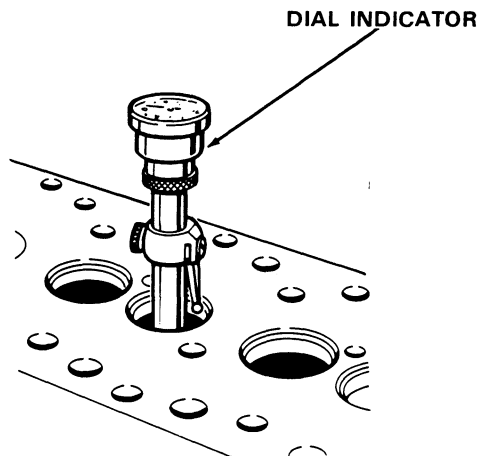


Figure 26

The valve seat contact area width and location can be changed by using 15°, 30° and 60° narrowing stones, Figure 27.

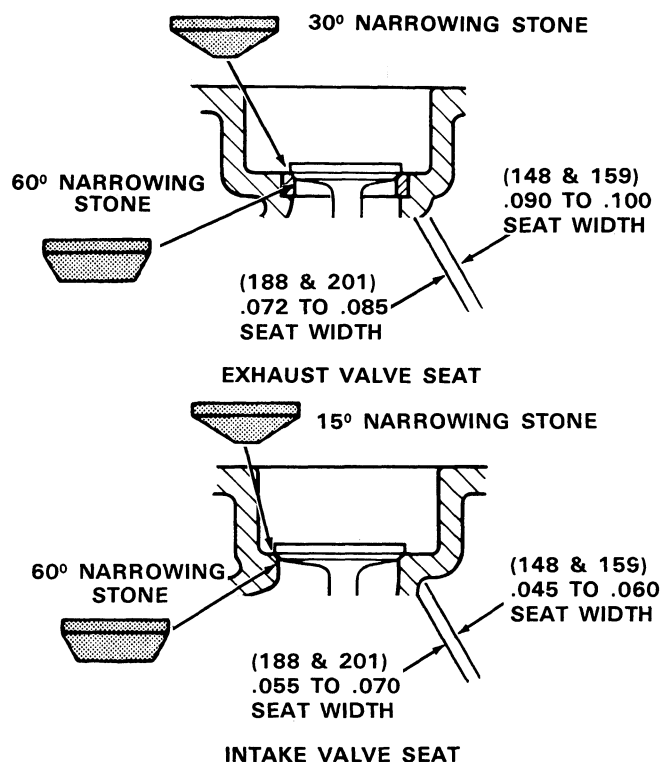


Figure 27

If the valve head has receded more than the "A" and "B" dimensions below the cylinder head surface, the valve, valve insert (exhaust) or cylinder head must be replaced. **NOTE:** Measure from the valve head edge to the cylinder head face using a depth micrometer.

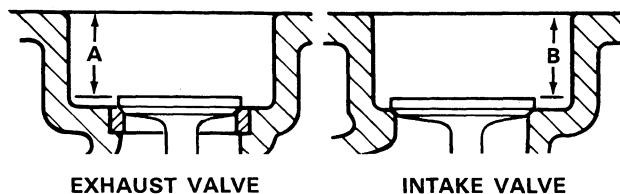


Figure 28

Engine	A	B
148 & 159	.940"	.940"
188 & 201	1.060"	1.000"

IMPORTANT: Do not attempt to salvage a cylinder head by installing inserts for intake valves.

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