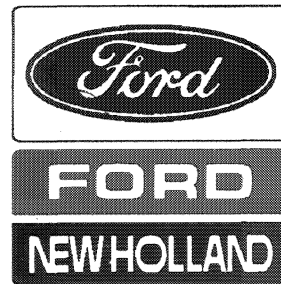
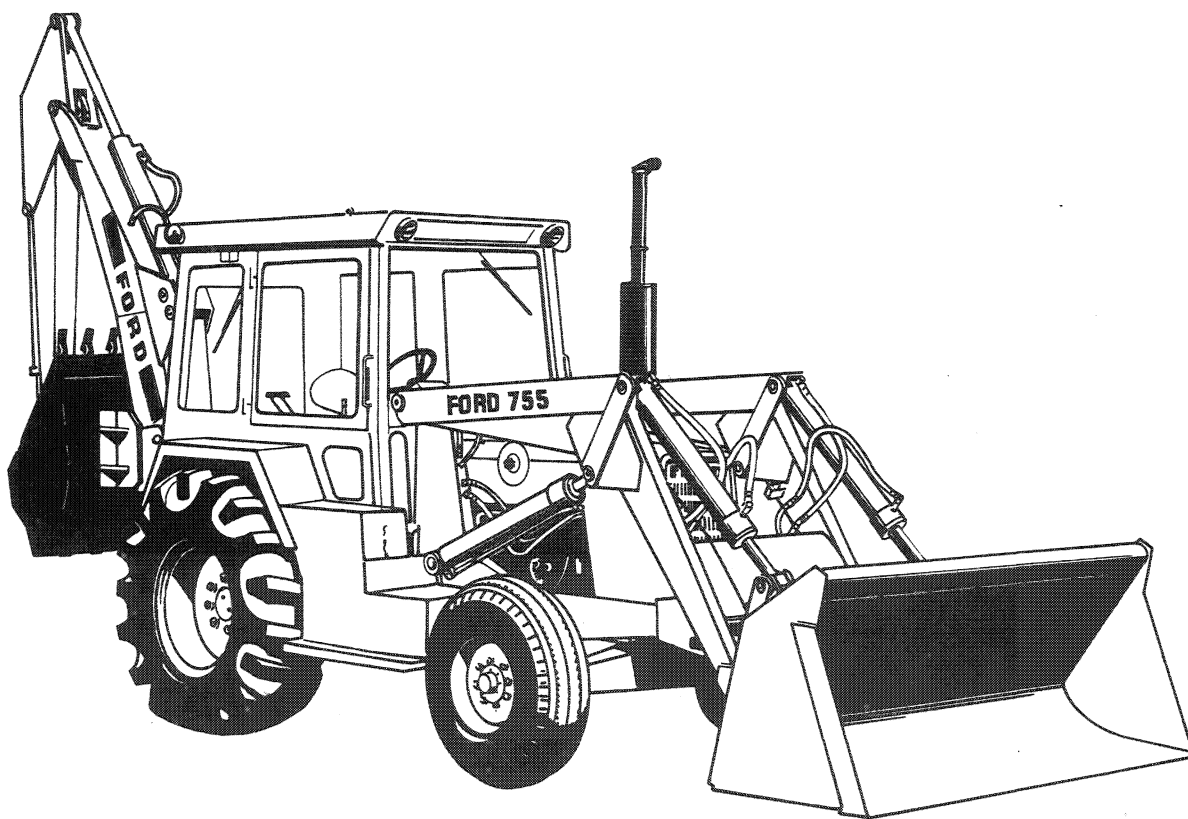


# FORD

## Service Manual



### Tractor Loader Backhoe 755, 755A, and 755B



# FOREWORD

This manual provides information for the proper servicing of the Ford Models 755, 755A, and 755B tractor loader backhoes. Keep this manual readily available for reference at all times. Although the primary subject of this manual is the Model 755, most of the information which follows is also useful for the Models 755A and 755B.

The manual is grouped into parts, each containing chapter divisions. The chapters contain such information as general operating principles, detailed inspection and repair procedures, and full specifics regarding troubleshooting, specifications, and special tools. Whenever possible, the special tools are illustrated performing their specific operations. Because the operating position of the seat is different for loader operation than it is for backhoe operation, left and right as applied to the loader does not apply to the backhoe and vice versa.

The material contained in this manual was correct at the time the manual was approved for printing. Ford policy is one of continuous improvement and the Ford Motor Company reserves the right to discontinue models at any time or change specifications or design without notice and without incurring obligation.



## SAFETY PRECAUTIONS

*Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all tractor loader backhoes as well as the personal safety of the individual doing the work. This manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help ensure reliability.*

*There are numerous variations in procedures, techniques, tools, and parts for servicing tractor loader backhoes, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this manual must first establish that he compromises neither his personal safety nor the machine integrity by his choice of methods, tools, or parts.*

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# Part 1

# ENGINES

## Chapter 1

## ENGINES AND LUBRICATION SYSTEM

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### 1. DESCRIPTION AND OPERATION

This part of the manual covers the diesel engine for the 755 Tractor. The Ford 755 engine is a 4 cylinder turbocharged diesel.

This part of the manual deals with disassembly, inspection and repair, and the assembly of engines; the lubrication system and the cooling system.

#### Cylinder Head Assembly - Including Valve Train Components

The cylinder head assembly incorporates the valves, valve springs, and rotators. The valve rocker arm shaft assembly is bolted to the head. The intake and exhaust manifolds are bolted to the head. The intake manifold is on the right side from the rear of the engine, and the exhaust manifold is on the left side. The water outlet connection and thermostat are attached to the front of the cylinder head. Valve guides are an integral part of the cylinder head, and valves with oversize stems are available for service. Special replaceable cast alloy

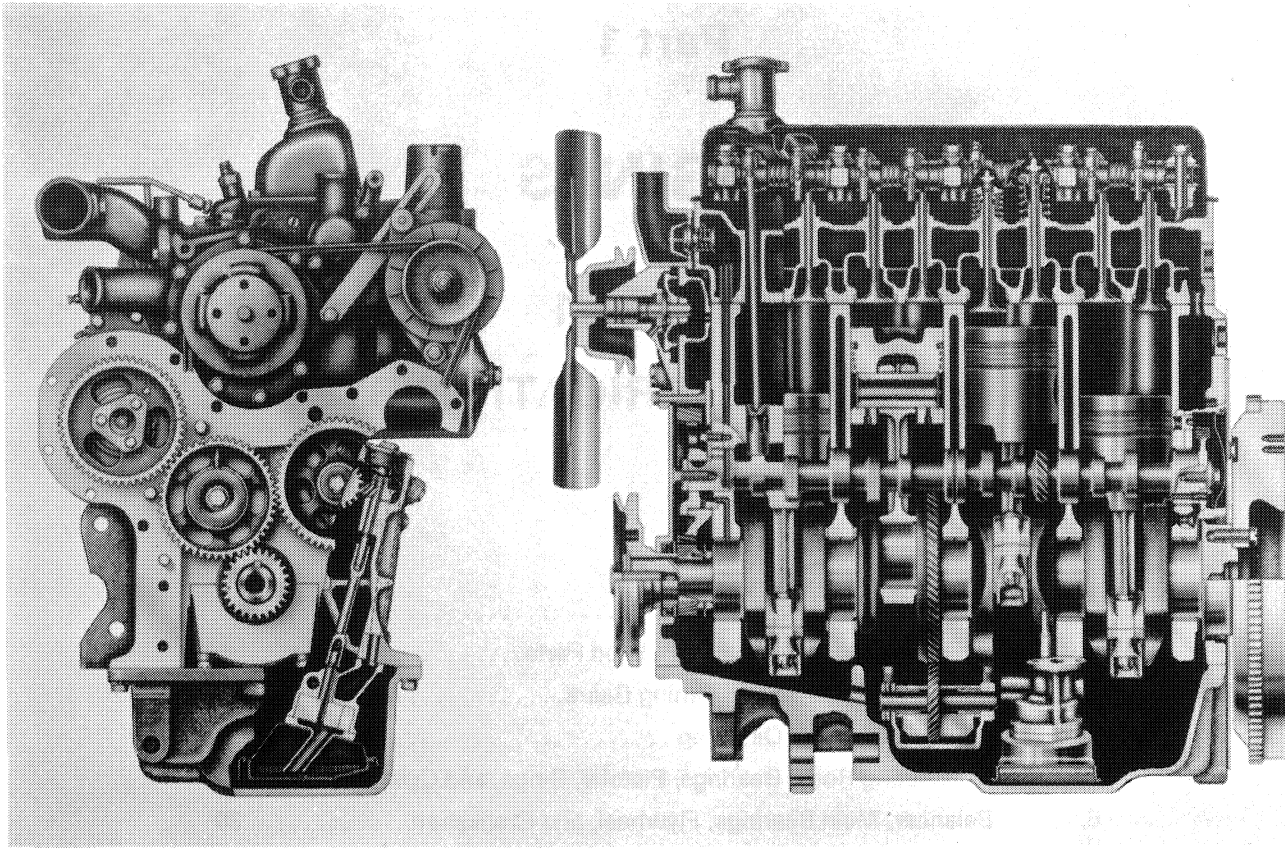
valve seats are pressed into each valve port of the cylinder head. The exhaust valves are fitted with positive valve rotators. The Ford 755 intake valves do not have seals.

Exhaust valves have a square section O-ring seal.

Valve lash is maintained by self-locking adjusting screws. The camshaft is supported by five replaceable bearings. The camshaft is driven by the camshaft drive gear which is in mesh with the camshaft gear. Camshaft thrust is controlled by a plate secured to the block and located between the camshaft gear and the front journal of the camshaft.

The cylinder head has six evenly spaced head bolts per cylinder. The fuel injectors are mounted outside the rocker cover.

The engine cylinder head is designed with the face of the cylinder head flat. The combustion chambers are in the heads of the pistons.



**Figure 1**  
**Four Cylinder Diesel Sectional View**

### Manifolds

The aluminum alloy intake and cast iron exhaust manifolds are on opposing sides of the cylinder head to provide better heat distribution in the head. Tractors can be equipped with exhaust manifolds for either horizontal or vertical exhaust systems. The intake manifolds are connected through tubing to the air cleaner and are provided with a tapped hole for installation of a thermostart or an ether cold starting aid kit.

**NOTE:** *If cold start equipment is not installed, the plug assembled in the manifold should remain securely assembled at all times. Considerable damage to the cylinder bores could result from its absence. The cylinder bores can also be damaged by grit and other foreign matter passing through the air cleaner hose connections if they are not properly secured.*

### Cylinder Block Assembly

The cylinder block is alloy cast iron with heavy webbing and deep cylinder skirts. The block features full length water jackets, bored integral with the block, to cool the cylinders. Cylinder arrangement is vertical in-line with the cylinders numbered from 1 to 4, starting at the front of the block. The firing order is 1 - 3 - 4 - 2.

The oil pan sump is heavy cast iron. The cast iron pan is used as part of the attaching area for the front axle of the tractor. The oil pan is attached to the bottom of the cylinder block and is the sump for the lubrication system. The engine front cover is attached to the front engine adapter plate, forming a cover for the timing gears. The crankshaft gear is keyed and press fitted on the front of the crankshaft. The crankshaft gear drives the camshaft drive gear, which is attached to the front of the cylinder block. The camshaft drive gear drives the camshaft gear and the injection pump drive gear.

The camshaft gear is attached to the front of the camshaft by a bolt, lock washer, flat washer, and a spacer. The gear is keyed to the camshaft to maintain the position of the gear and drive the shaft. All the timing gears can be checked by observing the timing punch marks on the gears. The crankshaft is supported in the cylinder block by five main bearings. The bearing liners are copper-lead or aluminum-tin alloy with a flange-type thrust bearing liner to control crankshaft end play. The thrust bearing is the third intermediate. A slinger is machined to the rear of the crankshaft to direct oil away from the rear seal. The rear seal is a circular lip-type rubber seal that fits into a pocket machined into the cylinder block and rear main bearing cap. The cap has two composition side seals.

The engine is equipped with a dynamic balancer to smooth out engine vibrations. The balancer assembly consists of a housing attached to the bottom of the cylinder block containing a drive gear and a driven gear. The balancer is driven by a gear machined on the crankshaft, and the balancer gears are timed from the crankshaft balancer drive gear.

Diesel engines have trunk-type pistons with a continuous skirt around the entire piston. Each piston has three compression rings and one oil control ring, all of which are above the piston pin.

The piston is connected to the crankshaft by a heavy I-beam connecting rod. The crankshaft end of the connecting rod has an insert-type copper-lead or aluminum-tin alloy bearing. The piston end of the connecting rod has a replaceable bronze bushing. The piston pin is a free-floating steel pin held in place in the piston by two snap rings (circlips).

### **Lubrication System**

Oil from the oil pan sump is pumped through the pressure lubrication system by a rotor-type oil pump mounted on the bottom of the cylinder block and driven from a gear on the camshaft. The pump body incorporates a spring-loaded relief valve that limits the maximum pressure of the system. Oil relieved by the valve is directed back to the intake side of the pump.

Oil, after leaving the pump, passes through an external filter. Engines are equipped with a one-quart can type filter assembly with a replaceable cartridge. The filter incorporates a relief valve. The relief valve permits oil to bypass the filter if the filter becomes clogged, thereby maintaining oil to the engine at all times.

From the filter, the oil flows through a drilled passage in the block to the main oil gallery. The oil gallery is a drilled passage running the full length of the cylinder block which intersects the tappet chambers for lubrication of the tappets. The main oil gallery also supplies oil to the crankshaft main bearings through a drilled passage in the cylinder block, and from the main bearing journals through the crankshaft, to the connecting rod journals. Camshaft bearings are lubricated by drilled passages in the cylinder block from each main bearing.

The camshaft drive gear bushing is pressure-lubricated through a drilled passage from the front main bearing. The camshaft drive gear has a bushing which has spiral grooves to direct oil toward the outside of the gear, and on both sides of the gear. The gear has small oil passages machined on both sides which allows the oil to exhaust. The timing gears are splash-lubricated by oil from the tappet chamber and from the pressure-lubricated camshaft drive gear. The balancer is pressure lubricated through a drilled passage from the block intermediate thrust bearing web to the balancer housing. Oil flows through the balancer housing to the hollow balancer shafts and to the bushings in the balancer gears.

The cylinder walls, pistons, and piston pins are splash lubricated by the crankshaft. An intermittent flow of oil is fed to the valve rocker arm shaft assembly through a drilled passage in the cylinder block at the No. 1 camshaft bearing, which indexes with a hole in the cylinder head. From the head, the oil flows up around the No. 1 rocker arm support bolt to the rocker shaft. The oil from the shaft flows through drilled holes in each rocker arm to lubricate the valve end and the adjusting screw end of the rocker arm. Oil from the ball ends of the rocker arms flows down the push rods and assists in lubricating the tappets and push rods. Excess oil drains into the push rod chamber through the push rod holes in the cylinder head and then back to the oil pan sump through cored openings in the block.

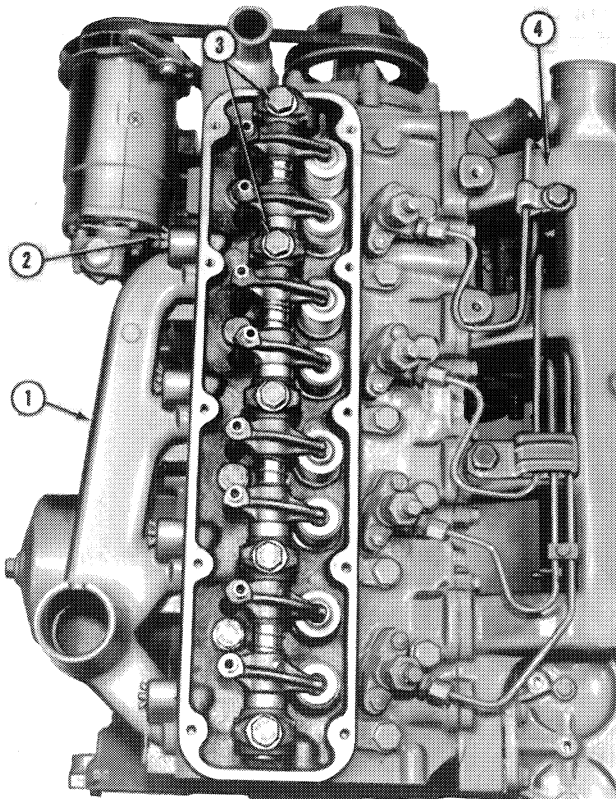
## 2. CYLINDER HEAD, VALVES, AND RELATED PARTS

### Cylinder Head

The cylinder head can be removed from the engine for service with the engine installed in the tractor. When removing the Ford 755 cylinder head, first remove the turbocharger. For instructions, see Chapter 2, Part 1.

#### A. Removal

1. Remove the vertical muffler, if so equipped, and disconnect the main wiring harness from the hood panel assembly. Remove the hood panel assembly.
2. Remove the air cleaner assembly and related components. Remove the radiator shell support. Disconnect the exhaust pipe from the exhaust manifold on units that are equipped with horizontal exhaust systems. Drain the radiator and cylinder block.
3. Bend the lock tabs back. Figure 2, and remove the bolts that secure the exhaust manifold to the cylinder head.



**Figure 2**  
**Engine with Rocker Arm Cover Removed**

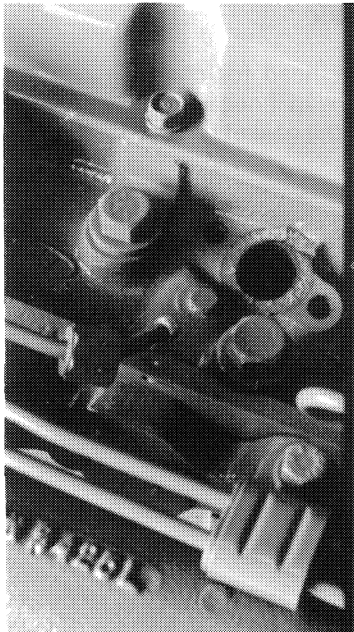
1. Exhaust Manifold
2. Lock Tabs
3. Rocker Arm Bolts

4. Intake Manifold

4. Remove the exhaust manifold and metal gasket, Figure 2.
5. Remove the injector lines from the injection pump and from the injectors. Cap the exposed openings in the pump and in the injectors, and all tube ends to prevent the entry of dirt.
6. Disconnect cold start equipment where equipped.
7. Disconnect the air inlet hose at the clamp at the intake manifold.
8. Remove the fuel filter from the manifold by disconnecting the fuel lines and removing two bolts and flat washers and cap the openings.
9. Remove the bolts and lock washers that retain the intake manifold, Figure 2, to the cylinder head and remove the manifold and gasket.
10. Disconnect the ventilation tube from the rocker cover. Remove the bolts that attach the rocker arm cover to the cylinder head and remove the rocker arm cover and gasket.
11. Disconnect the injector leak-off line. Remove the two nuts from the studs that retain each injector, Figure 3, and remove each injector from its bore in the cylinder head. Be sure the area surrounding the injectors is clean. If the injectors can not be readily pulled by hand, it may be necessary to pry the injectors out.
12. Visually check the push rods for straightness before they are removed by rotating them with the valve closed. Loosen the bolts that retain the rocker shaft to the cylinder head, Figure 2, evenly and alternately until all tension has been relieved, and lift the rocker shaft assembly from the cylinder head.

**NOTE:** *The rocker shaft retaining bolts should be left in place in the rocker shaft supports during removal. The bolts hold the rocker shaft assembly together; therefore, only remove the bolts when it is necessary to disassemble the rocker shaft.*

13. Remove the valve push rods from their holes in the cylinder head and arrange them in a rack in the order in which they were removed.
14. Remove the remaining cylinder head attaching bolts and carefully lift the cylinder head from the block.

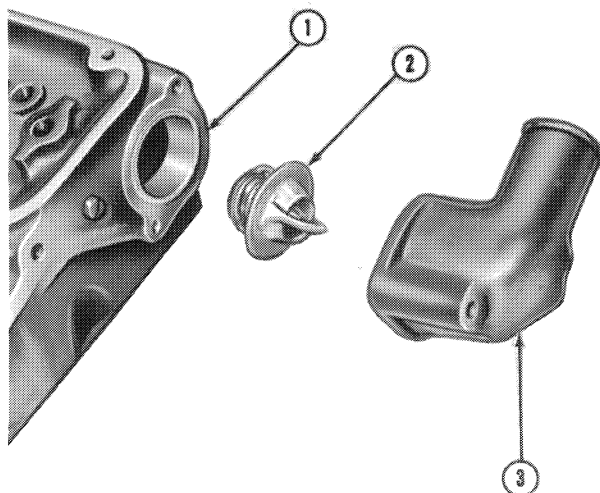


**Figure 3**  
**Engine Injector Removed**

- 1. Dust Seal
- 2. Injector Sealing Washer
- 3. Injector

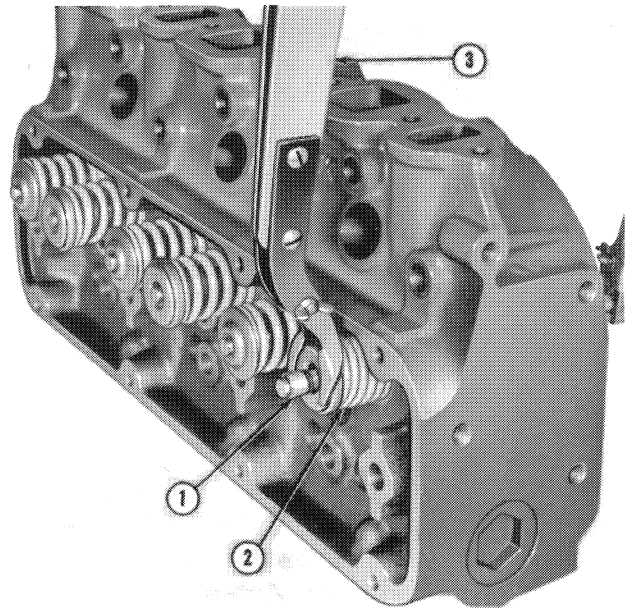
**B. Disassembly**

1. Remove the two bolts that attach the water outlet connection to the cylinder head. Remove the connection, thermostat, and gasket, Figure 4.



**Figure 4**  
**Engine Thermostat**

- 1. Gasket
- 2. Thermostat
- 3. Coolant Outlet Connection



**Figure 5**  
**Removing Valves**

- 1. Retainer Locks
- 2. Valve Spring
- 3. Valve Spring Compressor

2. Before removing the valves from the cylinder head, clean any carbon deposits from the area of the valve heads.
3. Position the valve spring compressor over the valve and spring, as shown in Figure 5, and compress the spring.

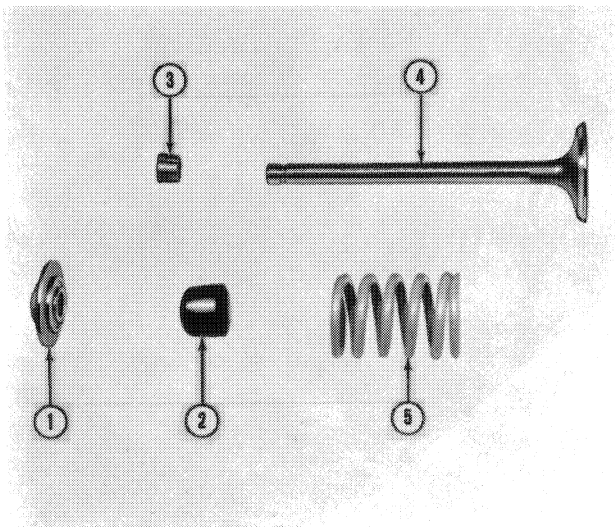
**INTAKE VALVES:** Remove the retainer locks, spring retainer, spring, and valve stem seal. The parts are shown in Figure 6.

**EXHAUST VALVES:** Remove the retainer locks, the seal from its groove, and the valve rotator and spring. The parts are shown in Figure 7.

4. Lift the valves from the cylinder head and place them in a numbered rack so they can be reinstalled in their respective guides. Keep the exhaust valve rotators with the valves from which they were removed.

**C. Cleaning**

1. After the valves are removed, clean the valve guide bores with a valve guide cleaning tool.
2. Remove all dirt, grit, and grease from the cylinder head with cleaning solvent.
3. Scrape all gasket surfaces clean. If necessary, soak the head gasket surface with paint remover to loosen the gasket material. Carefully scrape the gasket from the head, applying the paint remover as required.



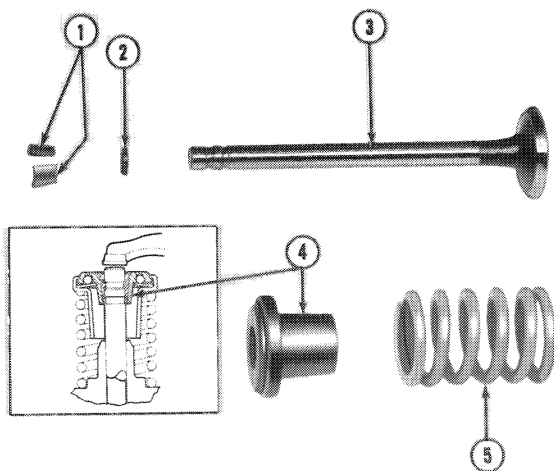
**Figure 6**  
**Intake Valve Assembly**

- |                   |                 |
|-------------------|-----------------|
| 1. Retainer       | 4. Intake Valve |
| 2. Seal           | 5. Spring       |
| 3. Retainer Locks |                 |



**CAUTION:** Be careful when working with paint remover, as it is highly combustible.

Be sure to remove any injector washers that may have remained in the bores.



**Figure 7**  
**Exhaust Valve Assembly**

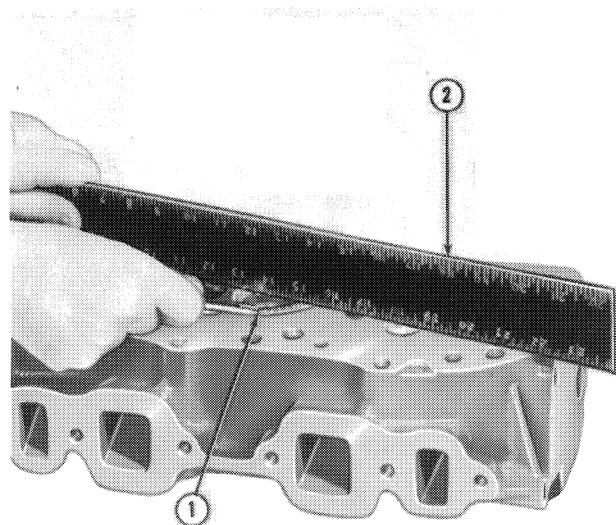
- |                   |                 |
|-------------------|-----------------|
| 1. Retainer Locks | 4. Rotator      |
| 2. Seal           | 5. Valve Spring |
| 3. Exhaust Valve  |                 |

#### D. Inspection and Repair

1. Inspect the cylinder head for cracks, nicks, or burrs. Install a new head if necessary. Remove all burrs or nicks from the gasket surface with an oil stone.
2. With a straight edge and feeler gauge, check the flatness of the cylinder head lengthwise, diagonally, and crosswise as shown in Figure 8. Specifications for flatness are 0.006 in. (0.15 mm) maximum overall or 0.003 in. (0.076 mm) in any six inches (152.40 mm).

**NOTE:** If the cylinder head face is not within flatness specification, it may be skimmed provided the depth from the top of the valve head to the cylinder head face after skimming is not less than 0.061 in. (1.55 mm).

3. If the head has been skimmed, check to determine whether the head bolts will bottom. To do this, place the cylinder head, less gasket, on the block and install and finger tighten all the head bolts (rocker arm shaft supports and washers should be used under the long bolts). Using a feeler gauge, check the clearance between the underside of the head bolts and the cylinder head rocker arm support. If the clearance is 0.010 in. (0.254 mm) or greater for any bolt, use a 1/2" X 13 UNC-2A thread tap and increase the tap depth. The head bolts should be marked so they are reinstalled in the hole in which they were checked.



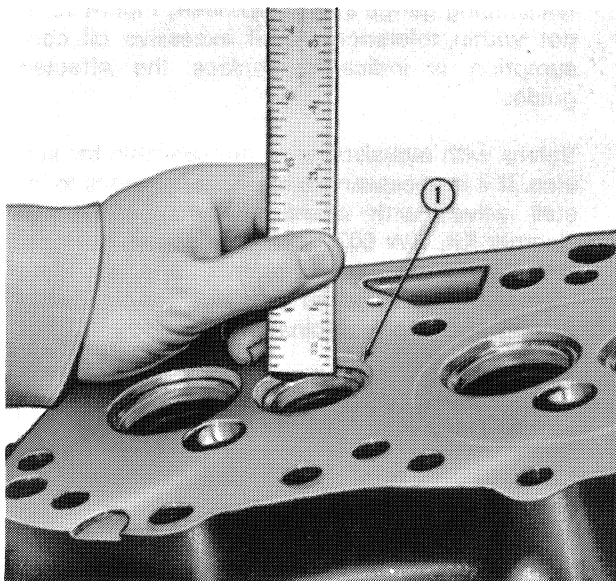
**Figure 8**  
**Measuring Cylinder Head Flatness**

- |                 |                  |
|-----------------|------------------|
| 1. Feeler Gauge | 2. Straight Edge |
|-----------------|------------------|

**IMPORTANT:** Valve seat inserts of 0.010 in. (0.25 mm) and 0.020 in. (0.508 mm) oversize in diameter have been fitted to some cylinder heads in production. Heads having oversize inserts fitted are stamped with the following identification marking  $\frac{S010}{OS}$  and  $\frac{S020}{OS}$  on the exhaust manifold side of the cylinder head in line with the valve seat concerned.

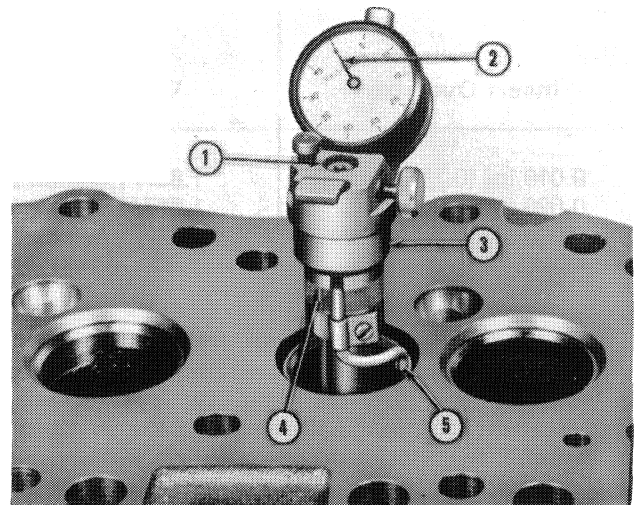
4. The intake and exhaust valve ports in the cylinder head are equipped with removable valve seat inserts. Check the inserts for cracks, looseness, or excessive wear. If any of these conditions exist, remove the inserts and install new ones. See Table 1.
5. To install a larger insert than originally fitted, machine the counterbore for the seat in the cylinder head to the dimension shown in Table 1. The insert must be thoroughly chilled in dry ice before installation.
6. Measure the width of the valve seats, Figure 9, and reface the seats if they do not meet the specifications shown in Figures 11 and 12.
7. Measure the concentricity of the valve seat with a suitable gauge, Figure 10, or with Prussian Blue. If the seat runout exceeds 0.002 in. (0.0508 mm), reface the seat.

**NOTE:** Refacing the valve seat should be coordinated with refacing the valve face so the finished measurements will correspond to Figure 11.



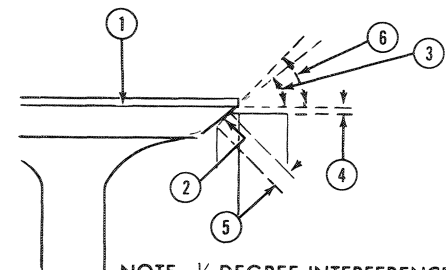
**Figure 9**  
**Measuring Valve Seat Width**

1. Valve Seat



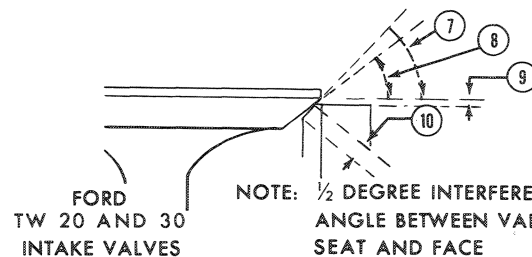
**Figure 10**  
**Checking Valve Seat Concentricity**

- |                                   |  |
|-----------------------------------|--|
| 1. Tighten Pilot                  | 4. Rotate Sleeve Clockwise and Read Dial |
| 2. Set Dial at "0"                | 5. Set Point to Ride on Valve Seat Face  |
| 3. Valve Seat Concentricity Gauge |  |



**NOTE:** 1/2 DEGREE INTERFERENCE ANGLE BETWEEN VALVE SEAT AND FACE

FORD TW 10 INTAKE AND EXHAUST VALVES  
FORD TW 20 AND 30 EXHAUST VALVES



**NOTE:** 1/2 DEGREE INTERFERENCE ANGLE BETWEEN VALVE SEAT AND FACE

FORD TW 20 AND 30 INTAKE VALVES

**Figure 11**  
**Valve Face and Seat Angles and Measurements**

- |                                  |                                     |
|----------------------------------|-------------------------------------|
| 1. Valve Face                    | 6. Valve Seat Angle-45°             |
| 2. Valve Seat                    | 7. Valve Seat Angle-30°             |
| 3. Valve Face Angle-44°          | 8. Valve Face Angle-29°             |
| 4. 1/16 in. (1.59 mm)            | 9. 1/16 in. (1.59 mm)               |
| 5. Seat Width-3/32 in. (2.38 mm) | 10. Seat Width - 3/32 in. (2.38 mm) |

Insert Oversize	Exhaust Valve Insert Counterbore Diameter In Cylinder Head	Intake Valve Seat Insert Counterbore Diameter In Cylinder Head
0.010 in. (0.254 mm)	1.607/1.608 in. (40.82/40.84 mm)	1.907/1.908 (43.44/43.46 mm)
0.020 in. (0.508 mm)	1.617/1.618 in. (41.07/41.10 mm)	1.917/1.918 (43.69/43.72 mm)
0.030 in. (0.762 mm)	1.627/1.628 in. (41.33/41.36 mm)	1.927/1.928 (43.95/43.97 mm)

Table 1

Remove only enough stock from the seat to clean up the pits and grooves, or to correct the seat runout. After refacing, the seat should measure 3/32 in. (2.38 mm) ± 1/64 in. (0.40 mm). If the refaced seat exceeds this width, narrow the seat by removing stock from the top or bottom of the seat. See Step 8. If the seat measures less than this width, widen the seat.

- Rotate a new or refaced valve lightly in the seat, using Prussian Blue. If the blue is transferred to the valve face 1/16 in. (1.59 mm) below the upper edge of the valve face, the contact is satisfactory. If the blue is transferred to the valve face above or below this point, raise or lower the seat as follows.

EXHAUST VALVES

Lower the valve seat by removing stock from the top of the seat with a 30° grinding wheel. Raise the seat by removing stock from the bottom of the seat with a 60° grinding wheel. See Figure 12.

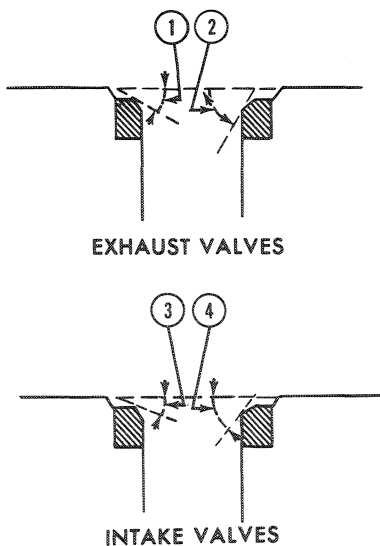


Figure 12 Dressing Valve Seats

- |        |        |
|--------|--------|
| 1. 30° | 3. 15° |
| 2. 60° | 4. 30° |

INTAKE VALVES

Lower the valve seat by removing stock from the top of the seat with a 15° grinding wheel. Raise the seat by removing stock from the bottom of the seat with a 45° grinding wheel. See Figure 12.

**IMPORTANT:** Some cylinder heads may have one or more 0.003 in. (0.0762 mm) or 0.015 in. (0.381 mm) oversize valves and guides installed. The exhaust manifold side of the cylinder head opposite these valves will be stamped "03" or Y003 OS; "15" or Y015 OS as appropriate.

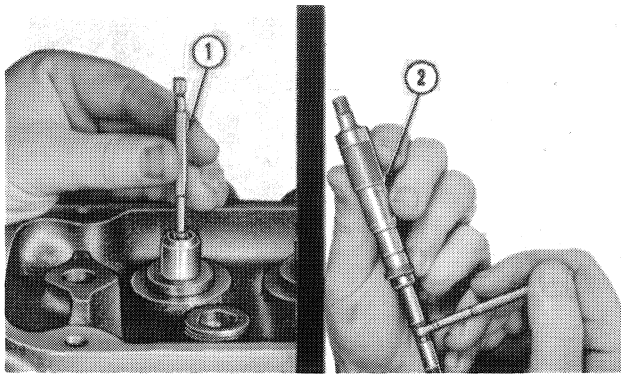
- Valve stem-to-guide clearance tolerances are as follows. Intake valves, 0.0010 - 0.0045 in. (0.0245 - 0.114 mm); exhaust valves, 0.0020 - 0.0055 in. (0.0508 - 0.139 mm).

Measure stem-to-guide clearance with a telescoping gauge and micrometer, Figure 13. If not within tolerances, or if excessive oil consumption is indicated, replace the affected guides.

Valves with oversize stems are available for service. If it is necessary to ream valve guides to install valves with oversize stems, use Valve Reamer Kit, SW 502, and ream guides in steps, first using the small reamer and standard diameter pilot. The kit contains the following reamer and pilot combinations.

Reamer Diameter	Pilot Diameter
0.003 in. (0.0762 mm) oversize	Standard Diameter
0.015 in. (0.3810 mm) oversize	0.003 in. (0.0762 mm) oversize
0.030 in. (0.7620 mm) oversize	0.015 in. (0.3810 mm) oversize

**NOTE:** Always reface valve seats after reaming a valve guide.



**Figure 13**  
**Measuring Valve Guide**

1. Telescope Gauge                      2. Micrometer

**Valves and Push Rods**

**A. Inspection**

**NOTE:** *The Ford 755 intake valves do not have umbrella seals.*

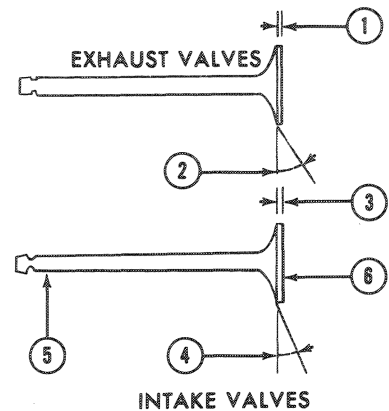
The critical inspection points of the valves are shown in Figure 14. Inspect the valve face and the edge of the valve head for pits, grooves, or other defects. Inspect the stem for a bent condition and the end of the stem for grooves or scores. Check the valve head for cracks, erosion, warpage, or burn. Minor defects such as small pits or grooves can be removed. Check the valve tip for pits or grooves and replace the valve if such a condition exists. Discard valves that are severely damaged.

Discard valve springs that show signs of erosion or rust. Check each valve spring for squareness, as shown in Figure 15. Discard valve springs that are out of square in excess of 1/16 in. (1.5873 mm).

Check specified free length and loaded height of the valve springs. Weak valve springs cause poor engine performance; therefore, if the pressure of any spring is below specification, install a new spring.

Check the valve spring retainer locks to be sure they are in good condition. Rotate the exhaust valve positive rotator to be sure it is not binding or excessively worn. Install new rotators if necessary.

Check the ends of the push rods for nicks, grooves, roughness, or excessive wear. If the push rods were not straight when checked in Step 12 of "Removal," or if any of the above wear conditions exist, install new rods. Do not attempt to straighten push rods.

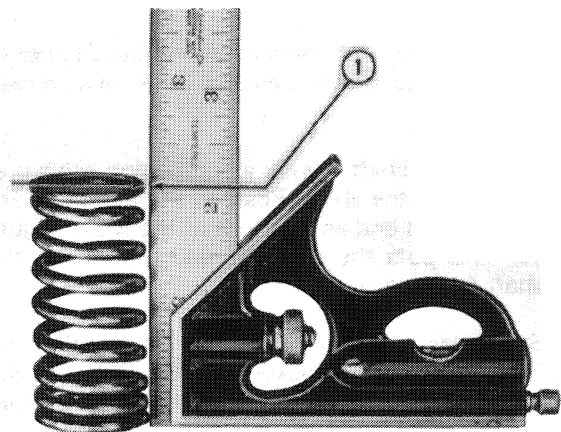


**Figure 14**  
**Critical Valve Measurements and Inspection Checks**

- |                                    |   |
|------------------------------------|---|
| 1. 1/32 in. (0.7937 mm)<br>Minimum | 4. 29°  |
| 2. 44°                             | 5. Check for Bent Stems<br>and Correct Diameter |
| 3. 1/16 in. (1.58 mm)<br>Minimum   | 6. Check Maximum Valve<br>Face Runout           |

**B. Refacing Valves**

The valve refacing operation should be closely coordinated with the valve seat refacing operation so the finished angle of the valve face is 1° less than the valve seat to provide an interference angle for better seating. Adjust the refacing tool to obtain a valve face angle of 44° or 29° as applicable. See Figure 11.



**Figure 15**  
**Checking Valve Spring Squareness**

1. Not more than 1/16 in. (1.587 mm)

Remove only enough stock to clean up the pits and grooves. Check the edge of the valve head; if less than 1/32 in. (0.7937 mm) or 1/16 in. (1.58 mm) margin, install a new valve, Figure 14.

Remove all grooves or score marks from the valve tip, then chamfer as necessary. Do not remove more than 0.010 in. (0.2540 mm) from the tip.

## Rocker Arms and Shaft

### A. Disassembly

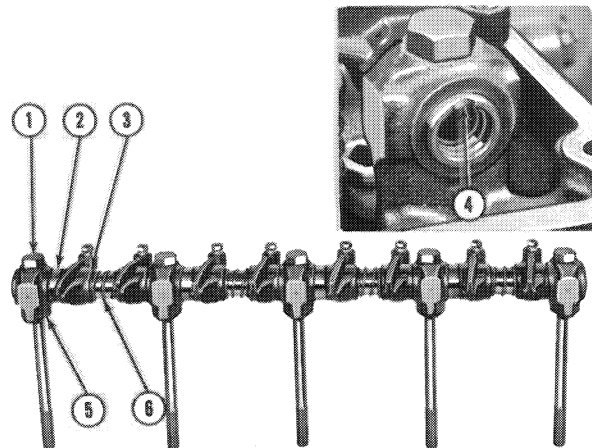
To disassemble the rocker shaft assembly, remove the bolts that attach the rocker shaft to the cylinder head from the rocker shaft supports, Figure 16.

### B. Inspection

1. Inspect the rocker arm adjusting screws and the push rod ends of the rocker arms for stripped or worn threads.
2. Check the ball end of the screws for nicks, scratches, or excessive wear.
3. Check the rocker arm locating springs and spacers for breaks or damage.
4. Inspect the pad end of the rocker arm for roughness, grooves, or excessive wear. If any of the above conditions exist, install new parts.
5. Check the rocker arm and rocker shaft diameters. If the diameters are outside of specifications, page 75, install a new part. If the shaft meets specifications, clean it thoroughly in solvent. Make sure the oil passages are clean of obstructions.

### C. Installation

1. Coat the rocker arm shaft with engine oil prior to assembly. Lubricate the valve pads on all rocker arms.
2. The rocker shaft has an identification groove at one end of the shaft. Position the mark upward and use this end as the front of the shaft, Figure 16. This puts the oil holes and grooves in the shaft facing down.
3. Start reassembly from the rear of the shaft by first positioning a rocker arm support with the notch on the support to the right of the shaft facing forward.
4. Be sure the springs and spacers are in their correct position, Figure 16, then proceed with the assembly.



**Figure 16**  
**Rocker Arm Shaft**

- |               |                             |
|---------------|-----------------------------|
| 1. Bolt       | 5. Rocker Arm Shaft Support |
| 2. Spacer     |                             |
| 3. Rocker Arm | 6. Spring                   |
| 4. Notch      |                             |

## Cylinder Head

### A. Assembly

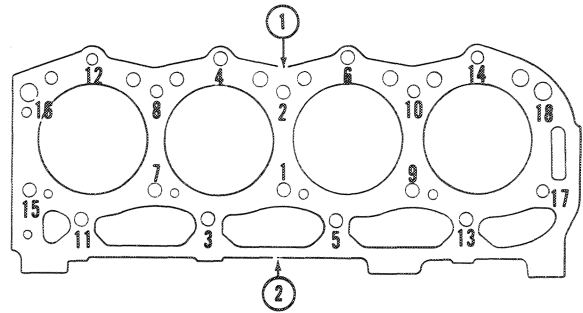
1. Insert each valve in the guide bore from which it was removed and lap it in position to give an even seat around the valve. On completion of this operation remove the valve and carefully clean the valve seat and seat insert of any lapping compound.
2. Lubricate all moving parts with engine oil prior to installation. Refer to Figures 6 and 7 for reference to parts of the intake and exhaust valves.
3. Insert each valve in the guide bore from which it was removed or to which it was fitted.
4. Install the valve springs over the valve guides.
5. On intake valves, compress the springs and spring retainer as shown in Figure 5 and install the retainer locks. On exhaust valves, compress the spring and the valve rotator. Be sure to install the rotator onto the valve from which it was removed.
6. On exhaust valves install a new sealing ring into the second groove from the top of the valve stem and install the retainer locks.
7. Install the thermostat (spring end towards head) and water outlet connections, Figure 4, to the front of the cylinder head. Use a new gasket.
8. If service is required on the thermostat or water outlet, refer to Chapter 3, "COOLING SYSTEM."

**B. Installation**

1. Place a new head gasket on the cylinder block, then carefully position the cylinder head on the gasket. Two dowels are incorporated on the top of the cylinder block at opposite corners to aid in positioning the cylinder head and gasket.
2. Lubricate the cylinder head bolts and washers and install them finger tight.
3. Install the valve push rod, with cupped end up, in the holes in the cylinder head from which they were removed. Be sure the ball ends of the push rods are seated in the tappet sockets.
4. Position the rocker shaft assembly on the cylinder head, the long cylinder head bolts and washers in the respective holes. Refer to Figure 2. Make sure that the ball ends of the rocker arm adjusting screws are seated in the cupped end of the push rods.
5. Tighten the cylinder head bolts in the proper sequence, as shown in Figure 17. Tighten the bolts progressively in three steps; first to 90 lbs. ft. (121.9 Nm), then to 100 lbs. ft (135.5 Nm), and finally to 110 lbs. ft. (149.0 Nm).

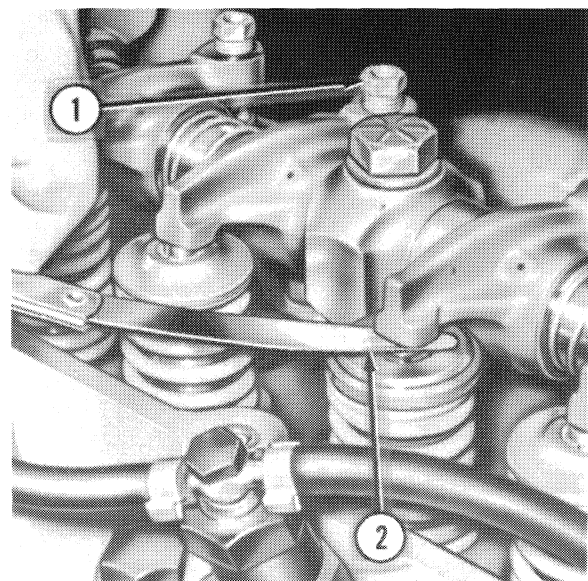
**NOTE:** *The cylinder head bolts should be torqued only when the engine is cold.*

6. Rotate the engine and set the preliminary valve lash, Figure 18, to the specified limits, page 74.
7. Install a new seat washer in each injector bore in the cylinder head. Position new cork seals over the injectors.
8. Install each injector into the cylinder head and over the two studs, as shown in Figure 3. Install the nut on each stud and tighten progressively to the specified torque, page 80.
9. Using new copper washers, install the injector leak-off line.
10. Install a new gasket and the intake manifold onto the cylinder head. Secure the manifold with the bolts and lock washers and tighten the bolts to the specified torque, page 80.
11. Attach the fuel filter to the manifold with two bolts and flat washers, and connect the fuel lines.
12. Connect the air intake hose to the intake manifold and secure with the clamp.
13. Connect the injector lines to the injection pump and to the injectors. Position the clamps on the injector lines in the same position from which they were removed.



**Figure 17**  
**Cylinder Head Tightening Sequence**

- |  |   |
|--|---|
| <ol style="list-style-type: none"> <li>1. Intake Side</li> <li>14. Reconnect cold start equipment where equipped.</li> <li>15. Position a new metal exhaust manifold gasket on the cylinder head and install the exhaust manifold, as shown in Figure 2. Use new lock tabs and tighten the bolts to the specified torque, page 80. Bend the lock tabs to retain the bolts.</li> <li>16. If the tractor is equipped with a horizontal exhaust system, connect the exhaust pipe.</li> <li>17. Connect the hose to the water outlet and secure it with the clamp.</li> <li>18. Fill the radiator with coolant.</li> <li>19. Install the radiator shell support, and connect the battery leads.</li> </ol> | <ol style="list-style-type: none"> <li>2. Exhaust Side</li> </ol> |
|--|---|



**Figure 18**  
**Adjusting Valve Lash**

- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. 1/2 in. (12.7 mm) Box End Wrench</li> </ol> | <ol style="list-style-type: none"> <li>2. Feeler Gauge</li> </ol> |
|---|---|



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20. Bleed the fuel system as outlined in Part 2, "FUEL SYSTEM." Start the engine and make a final valve lash adjustment, page 74.

**NOTE:** Do not make valve lash adjustments when the engine is operating at above normal operating temperature.

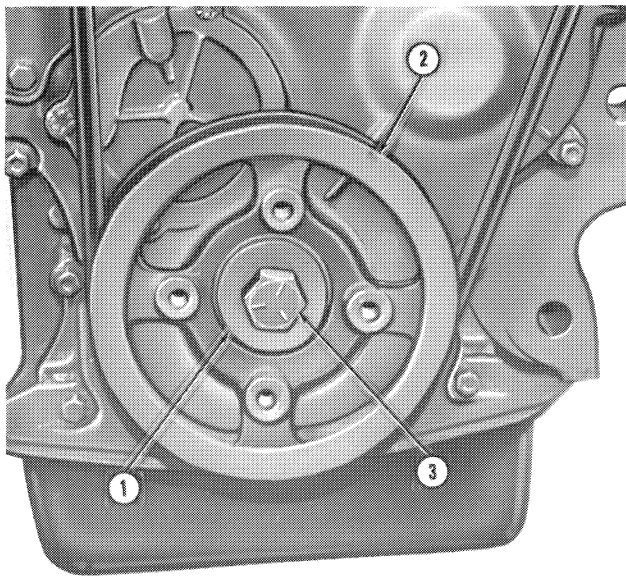
21. Install the rocker cover, using a new gasket and tighten the bolts to the specified torque, page 80. Connect the ventilation tube.
22. Install the air cleaner and related parts.
23. Install the hood panel assemblies and reconnect the wiring harness to the hood clips. Install the muffler (vertical exhaust).

### 3. ENGINE FRONT COVER AND TIMING GEARS

Engine front cover and timing gears service operation can be performed after removing the radiator and oil cooler.

#### Crankshaft Pulley Removal

1. Remove the fan belt. Remove the bolt and washer from the crankshaft pulley, Figure 19, using Puller No. 9539 and Shaft Protector No. 9212, as shown in Figure 20. To use the puller for this purpose, 7/16 in. X 14 UNC bolts have to be used and the slots in the puller enlarged.
2. Check the pulley belt groove to be sure the surface is smooth and the flanges are not cracked or broken.

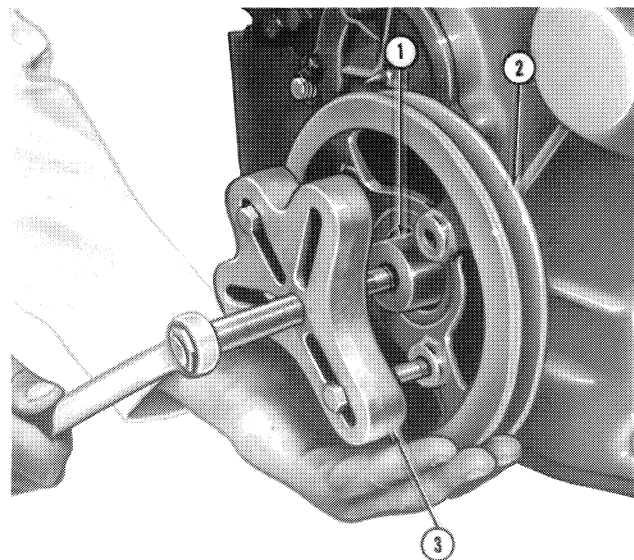


**Figure 19**  
**Crankshaft Pulley**

- |                      |                                     |
|----------------------|-------------------------------------|
| 1. Washer            | 3. Crankshaft Pulley Retaining Bolt |
| 2. Crankshaft Pulley |                                     |

#### Front Cover Removal

3. Check the shaft spacer in the area that contacts the front oil seal to be sure it is free of scratches or grooves that may cause oil leakage past the seal. Clean the seal contact surface with solvent and polish with crocus cloth prior to installation.
1. Drain the engine oil, and remove the oil pan.
2. Remove the front cover-to-front engine plate bolts.
3. Remove the alternator front mounting bracket bolt.
4. Carefully pry the front cover off of the dowel pins and remove it.



**Figure 20**  
**Removing Crankshaft Pulley**

- |                         |                |
|-------------------------|----------------|
| 1. 9212 Shaft Protector | 3. 9539 Puller |
| 2. Crankshaft Pulley    |                |

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