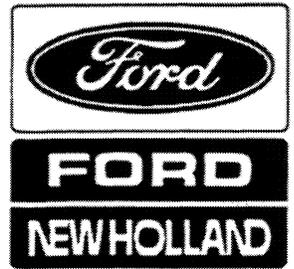


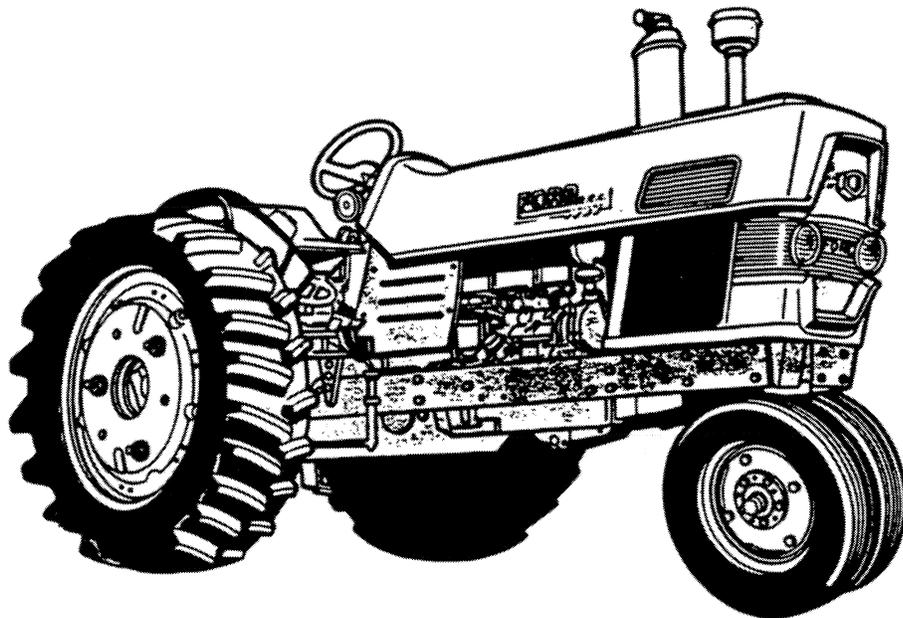
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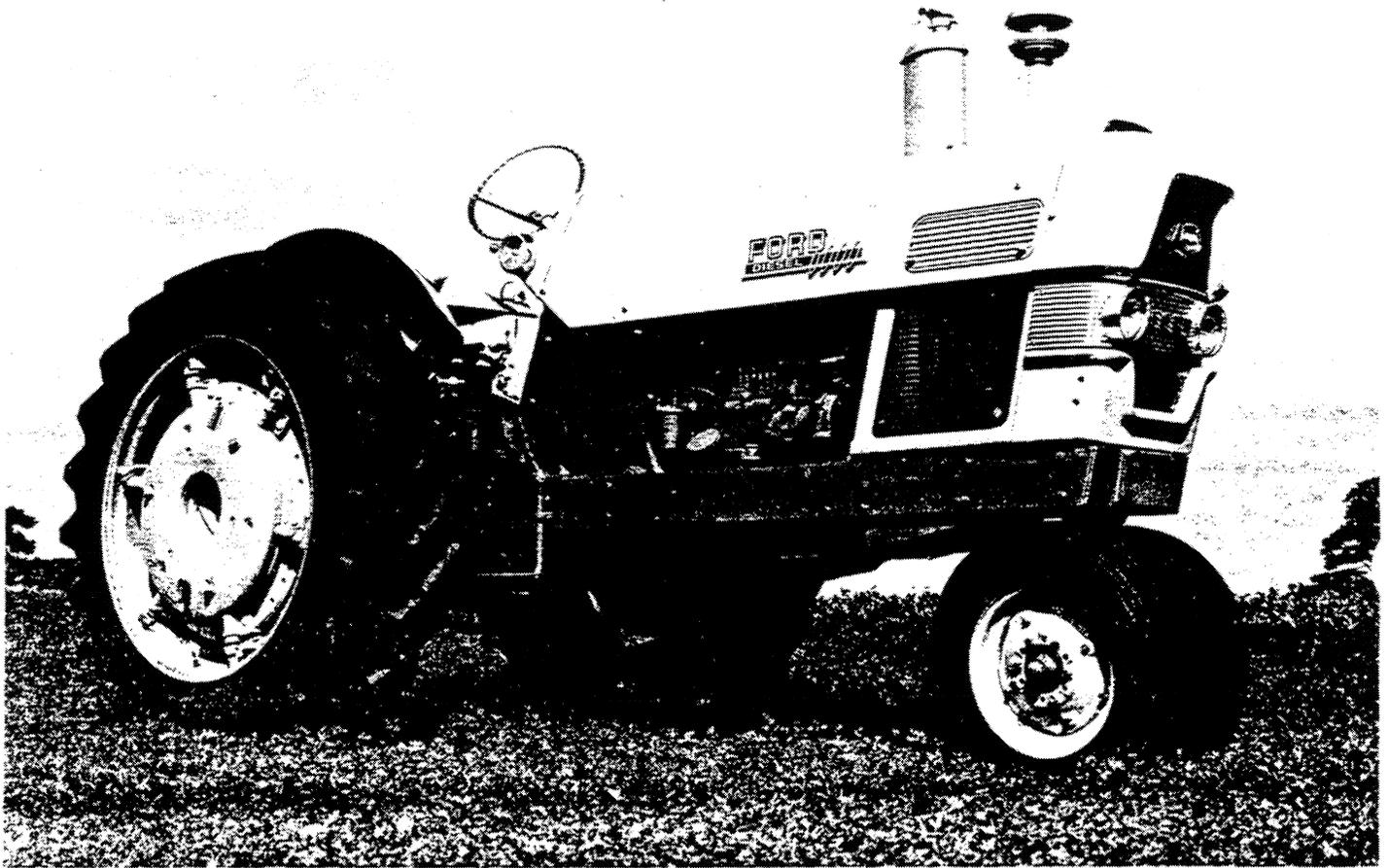
248 Pages
- Ignition
- Gas Fuel.

FORD TRACTOR SHOP MANUAL

for
SERIES 6000
TRACTOR

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Ford Motor Company

Prepared by
TRACTOR AND IMPLEMENT OPERATIONS (U.S.)
FORD TRACTOR DIVISION FORD MOTOR COMPANY
BIRMINGHAM, MICHIGAN



FORD SERIES 6000 TRACTOR

Part ONE

POWER PLANT

Chapter I

ENGINE

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1. ENGINE REMOVAL AND INSTALLATION

The engine used in the 6000 Series Ford Tractors, both gasoline and diesel, are of the six cylinder, four cycle, overhead valve type. The diesel engine has a 3.62 inch cylinder bore and a 3.90 inch stroke, giving a 242 cubic inch piston displacement. The gasoline engine has a 3.62 inch bore, 3.60 inch stroke, giving a 223 cubic inch piston displacement.

A. Engine Removal

1. Deactivate the hydraulic system (with the tractor engine "off") by depressing and releasing the brake pedals and by raising and lowering the hydraulic lift arms until the oil pressure is completely relieved.
2. Remove the air pre-cleaner and air inlet stack, which is a slip fit into the air cleaner inlet.
3. Remove the two screws which secure the muffler cover to the muffler and remove the cover. Loosen the muffler clamp nuts and lift the muffler off the exhaust pipe.
4. Remove the radiator and fuel tank caps.
5. Remove the front air inlet screens and upper screens and the rear side panels.
6. Remove the three Phillips head screws at the rear of the center hood section, the two bolts that secure the front hood support to the hood support rails, and the two slotted head screws that secure the hood to the front side panels. Remove the center hood section by lifting it out of position.
7. Remove the front side panels.
8. Remove the air intake lower baffle and splash shield and the upper air baffle.
9. Replace the radiator cap, the fuel tank cap, and position the exhaust rain cap on the exhaust pipe.
10. Clean the tractor thoroughly. The components immediately in front, behind, over, and under the radiator should be especially clean.
11. Position the tractor in the work area and again be sure the hydraulic system pressure is relieved as in step 1.

12. Disconnect the battery cables from the battery (ground cable first), and remove the battery.
13. Remove the air cleaner oil cup and chaff screen, close the fuel tank valve, and drain the radiator coolant and engine oil.
14. Separate the fuel sender lead from the fuel sender switch but leave the headlight harness in position.
15. Disconnect the generator, starter, manifold heater, temperature sender, and oil sender leads; separate the harness from the retainer clips and lay the harness on the operator's platform.
16. Remove and discard the engine oil filter, separate the tachometer cable from the injection pump (or distributor on gasoline models) and move the free end back behind the brake pedals.
17. Disconnect the fuel shut-off cable at the fuel injection pump (the choke cable at the carburetor on gasoline models). Separate the cable from the retaining clips and position it behind the inching pedal.
18. Disconnect the throttle control rod at the injection pump throttle arm (the governor arm on gasoline models) and the throttle bellcrank and remove the rod.
19. Remove the generator and bracket as an assembly by freeing the adjustment arm and by removing the two bolts which secure the bracket to the block.
20. Remove the starter assembly.
21. Remove the air intake tube and hose by freeing the hose clamps and by removing the bolts and nut which secure the tube to the radiator support.
22. Disconnect the engine ventilation tube at the engine rocker cover.
23. Disconnect the transmission oil cooler tubes at the front of the radiator lower tank. Leave the tubes in position.
24. Remove the upper and lower radiator hoses.
25. Remove the fan support adjusting bolts and remove the fan assembly.

26. Remove the excess fuel line (Diesel) and the fuel line.
 27. Remove the rear hood support brace from the upper hood support rails.
 28. Remove the four "J" bolts which secure the fuel tank to the support rails and remove the fuel tank.
- NOTE:** *Observe the fuel level and use a hoist if necessary. Assume the fuel weighs approximately 7 lbs. per gallon for estimating the weight.*
29. Remove the left hood support rail by removing the seven bolts, nuts, and washers, which secure the rail to the steering column, exhaust pipe bracket, air cleaner supports, reservoir upper clamp, and grille casting.
 30. Remove the two self-locking nuts which secure the radiator to the radiator support, and the two bolts which secure the air baffle to the manifold heat baffle.
 31. Remove the two nuts which secure the exhaust pipe to the exhaust manifold and remove the exhaust pipe.
 32. Remove the radiator and baffle assembly by lifting it up and out of position.

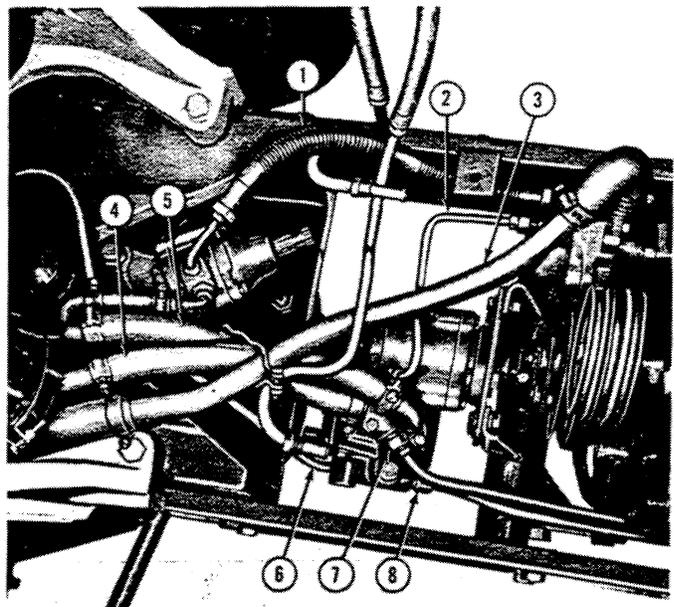


Figure 1
Hydraulic Lines

SECTION 1 - ENGINE REMOVAL AND INSTALLATION

33. Drain the hydraulic system by disconnecting the reservoir hoses (4) and (5), Figure 1, at the unload valve and direct the oil (3-1/2 gal.) into a clean container.
34. Refer to Figure 1, and disconnect all the remaining hydraulic tubes and hoses at the unload valve. Disconnect the power steering hose (3), Figure 1, at the power steering motor and remove the power steering pump tube (2), Figure 1. Cap or plug all openings to prevent dirt entry. Use a plastic adhesive tape if caps or plugs are not available.
35. Remove the bolt which secures the hydraulic system supply and return tube bracket to the left side of the engine block. Tie the tubes to the left-hand tractor side rail at the front end of the tubes to give clearance for engine removal.
36. Remove the center steering shaft assembly by removing the two nuts and lock washers which secure the shaft bearings to the side rails and by backing off the spline anchor bolts. Work the assembly down and out of position.

NOTE: When reinstalling the shaft be sure the splines are aligned with both the steering wheel and front wheels in the straight-ahead position.

37. Position a floor jack under the front of the transmission.
38. Remove the manifold heat baffle and fire wall and attach the N-6000-AB Engine Lifting Fixture as shown in Figure 2, using two N-6000-A (Diesel) or two N-6000 (Gas) hex head bolts. Attach the lifting fixture to a suitable hoist and apply a very slight lifting pressure.
39. Loosen the hydraulic pump drive clamp bolt (15-18 lb.-ft.) and remove the hydraulic pump and engine front support as an assembly by removing the 8 bolts and two bolt anchor plates which secure the front engine support to the oil pan and side rails. The oil pan-to-support bolt torque specification is 120-130 lb.-ft.

NOTE: Separate the hydraulic pump and unload valve assembly from the front engine support before reassembly. Refer to the hydraulic section of this manual for pump installation instructions.

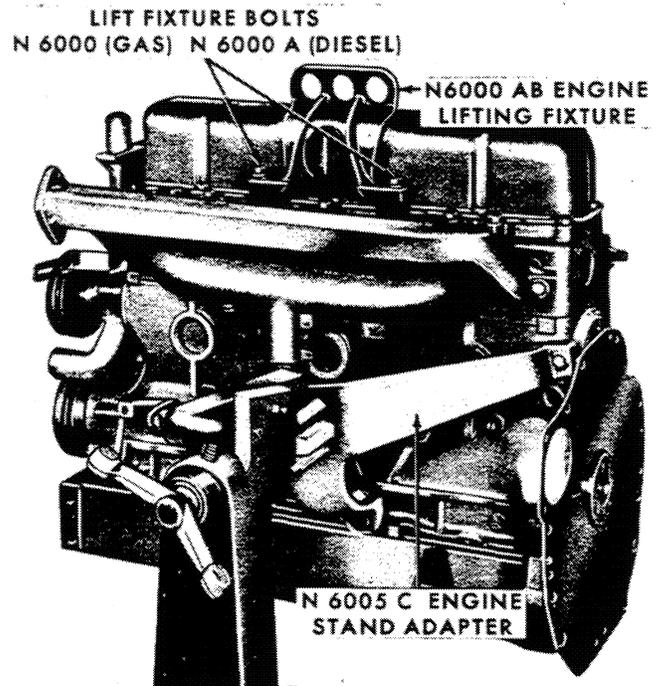


Figure 2
Engine Stand and Lifting Tool

40. Remove the power steering pump and hose as an assembly.
41. Remove the right and left transmission-to-side rail spacer blocks.
42. Remove all engine-to-transmission case mounting bolts.
43. Move the engine forward and up to the left, out of position. Mount the engine on an engine stand, as shown in Figure 2.

B. Engine Installation

1. Attach the N-6000-AB Engine Lifting Fixture to the engine using the two N-6000 A (Diesel) or N-6000 (Gas) hex head bolts.
2. Lift the engine into place, being careful to align the torque limiting clutch and transmission input shaft splines.
3. Install the engine-to-transmission mounting bolts. Tighten the 3/4" bolts to 200 ft. lbs. and the 5/8 inch bolts to 135 ft. lbs.

4. Reassemble the tractor in the reverse order of disassembly and note the following special instructions:
 - a. When tightening bolts or nuts, refer to the torque specification chart at the end of this chapter if the specification is not given in the instruction.
 - b. Refer to the thread and gasket sealer usage chart

at the end of this chapter and use the sealer as recommended.

- c. Check all systems for correct operation before returning the tractor to the owner. Instruct the owner in the correct procedure for breaking in the engine. The preferred method of engine break-in is by use of a dynamometer.

2. CYLINDER HEAD AND VALVES

The cylinder head assembly consists of the rocker arm mechanism, valves, springs, and valve guides.

The procedures below, cover the removal, disassembly, cleaning, inspection, repair and assembly of the cylinder head and valves.

A. Cylinder Head Removal

1. Remove the hood.
2. Drain the coolant from the radiator and cylinder block. Disconnect the radiator upper hose.
3. Loosen the fan support bracket and remove the fan belt from the fan pulley. Remove the fan and support assembly.
4. Close the fuel shut-off valve and remove the fuel tank.
5. Disconnect the ventilation tube from the side of the valve cover. Remove the eight valve cover attaching bolts and remove the valve cover and gasket.

Diesel Engine: Disconnect the air cleaner hose from the manifold. Disconnect the manifold heater wires from the manifold heaters. Disconnect the excess fuel line at the at the cylinder head.

Gasoline Engine: Disconnect the fuel line, remove the two nuts attaching carburetor to manifold, and lower carburetor out of the way. Disconnect the spark plug wires from the plugs. Remove the two bolts attaching the coil bracket to the cylinder head and remove the coil and bracket.

and exhaust manifold to the cylinder block. Remove the manifolds.

7. Disconnect the water temperature gauge wire from the cylinder head.
8. Remove the oil inlet and outlet lines from the rocker arm. Discard the oil inlet tube "O" ring seal.
9. Loosen the rocker arm support attaching bolts evenly and alternately until all tension has been relieved, then remove the bolts and washers. Lift the rocker arm assembly from the cylinder head.
10. Lift the push rods out of the cylinder head and place in a numbered rack so that they may be reinstalled in their respective positions.
11. Remove the exhaust valve caps.

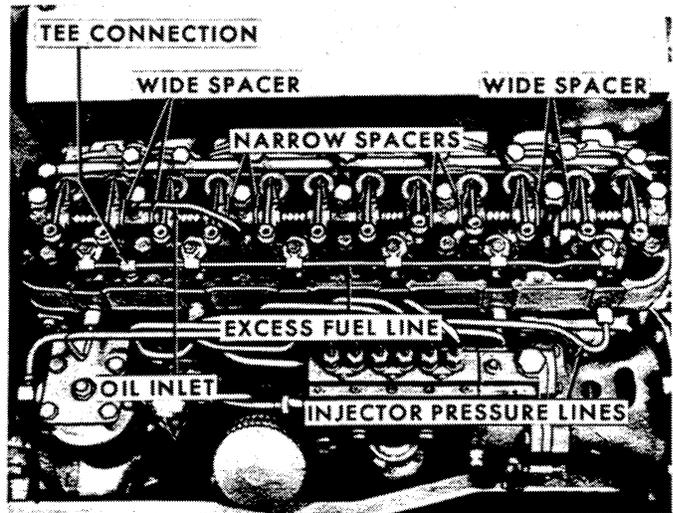


Figure 3
Diesel Engine - Valve Cover Removed

6. Remove the nuts and washers that attach the intake

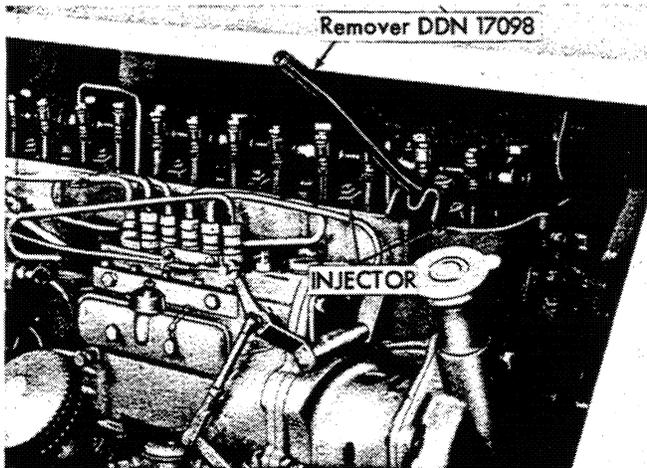


Figure 4
Removing Injectors

Diesel Engine:

- a. Loosen the excess fuel line "T" fitting from the cylinder head, Figure 3. Remove the fuel line banjo fitting bolt from each injector and remove the fuel line. Remove the grommet from the cylinder head beneath the "T" connection.
- b. Remove all dirt from the fuel injector pressure line connections. Disconnect the pressure line at each injector. Cap off the exposed ends of the injector and the lines to prevent the entry of dirt.
- c. Remove the two attaching bolts from each injector. Attach Injector Lifting Bar, EIADDN-17098, to the injectors as shown in Figure 4. Make sure the legs of the tool bear against the top edge of the cylinder head rather than the rubber injector seal. Remove the fuel injector and the injector seat washers and injector seals from the cylinder head.
- d. Remove the two bolts and lock washers that attach the fuel filter to the cylinder head.

12. Remove the cylinder head attaching bolts and carefully lift the cylinder head from the block.

B. Cylinder Head Disassembly

1. Remove the four bolts and lock washers that attach the water outlet elbow to the cylinder head. Remove the elbow and thermostat.

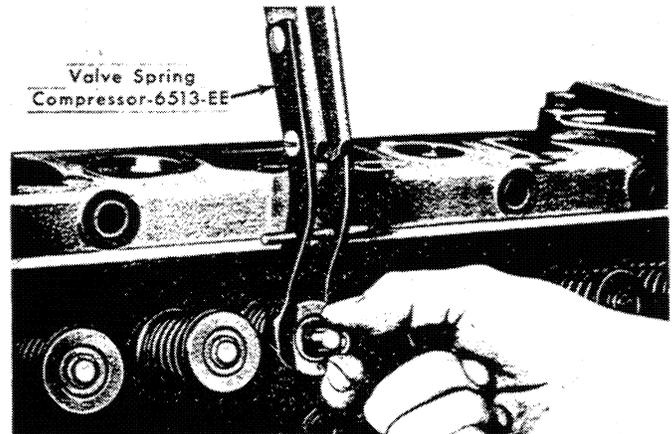


Figure 5
Removing Valve Spring Retainer Locks

2. Prior to removing the valves, clean all carbon deposits from the combustion chambers. Position Valve Spring Compressor 6513-EE over the valve and spring, as shown in Figure 5, and compress the spring. Remove the valve spring retainer locks, sleeve, retainer, and spring from each valve. Lift the valves from the head and place them in a numbered rack so they can be reinstalled in their respective guides.

NOTE: Remove and discard the valve seals (used on Diesel intake valves only and used on both intake and exhaust valves on gasoline models).

3. Remove the shaft retainers on #1 & #2 supports. Remove the rocker arms and rocker arm locating springs from the shaft. Drill a hole through an end plug of the rocker arm shaft. Insert a rod through the hole that is long enough to contact the opposite plug, then drive the plug out of the shaft. Drive the remaining plug out of the shaft.

NOTE: Diesel engines are provided with a rocker arm spacer on each side of Nos. 2, 3, 5, and 6 rocker shaft supports, Figure 3. The narrower spacers are used at support Nos. 3 and 5.

C. Cleaning

Gasoline Engines: Remove all dirt, grit and grease from the cylinder head with cleaning solvent. Scrape any carbon that was not previously removed with a scraper. Clean the valve guides with a valve guide cleaning tool. Scrape all gasket surfaces clean.

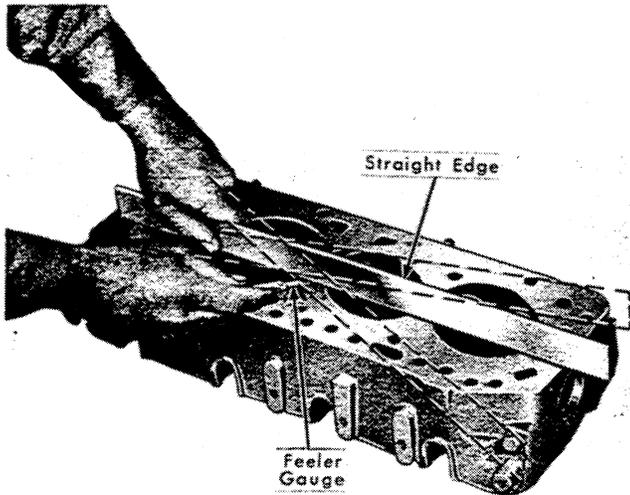


Figure 6
Checking Cylinder Head Flatness

Diesel Engines: Remove any injector washers that remained in the bores with a screwdriver that has approximately the same width blade as the I.D. of the washer. Tap the screwdriver so that the blade bites into the washer, then twist the screwdriver to free the washer. Clean all carbon and dirt from the injector bores. 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.



CAUTION: Do not allow paint remover to contact the body or clothing.

D. Inspection

1. Inspect the cylinder head for being cracked, nicked, or burred on the gasket surfaces. Replace the head if it is cracked. Remove all burrs or nicks with an

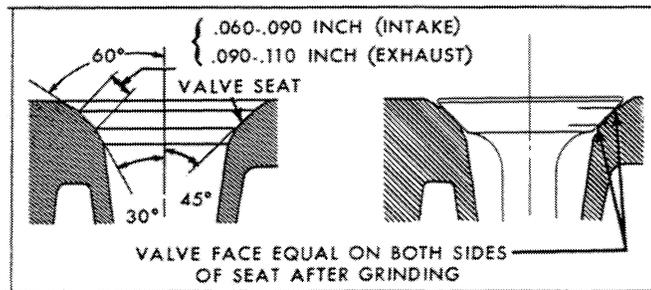


Figure 7
Valve Seat Width

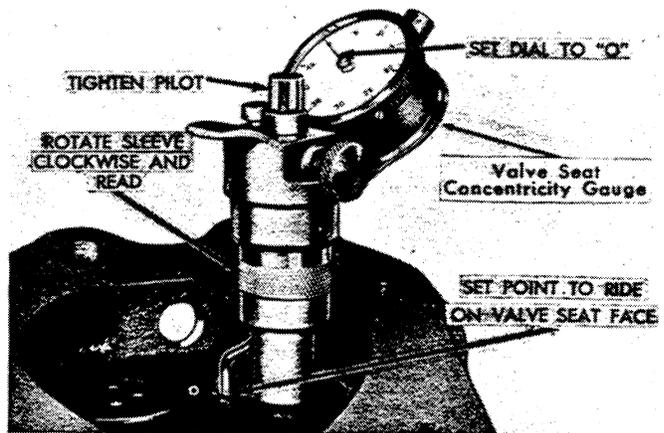


Figure 8
Valve Seat Concentricity

oil stone. With a straight edge and thickness gauge, check the flatness of the cylinder head as shown in Figure 6. Specifications for flatness are 0.005" maximum over-all.

Check the exhaust valve seat inserts for cracks, looseness, or excessive wear. Replace the inserts if any of these conditions exist. Check the width and concentricity of the valve seat, Figures 7 and 8. Reface the seats if they are pitted, if they are wider than specified in Figure 7, or if the runout exceeds 0.0015" replace the seats.

2. Discard burned, cracked, or warped valves that show any evidence of heat checks on the face of the valve or that have a head margin of less than 1/32" after being refaced, Figure 9. Reface all valves.
3. Discard valve springs that show evidence of rust. Check each valve spring for squareness as shown in Figure 10. Discard valve springs that are in excess of 1/16" of being square. Check the spring pressure.

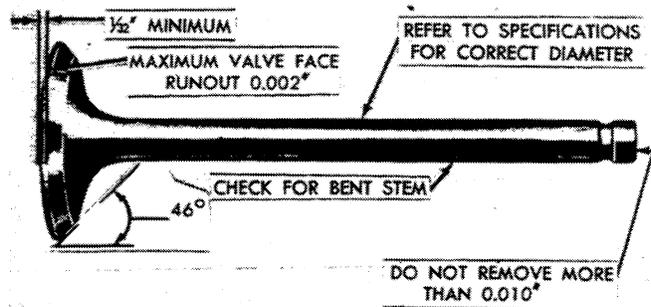


Figure 9
Valve Reconditioning

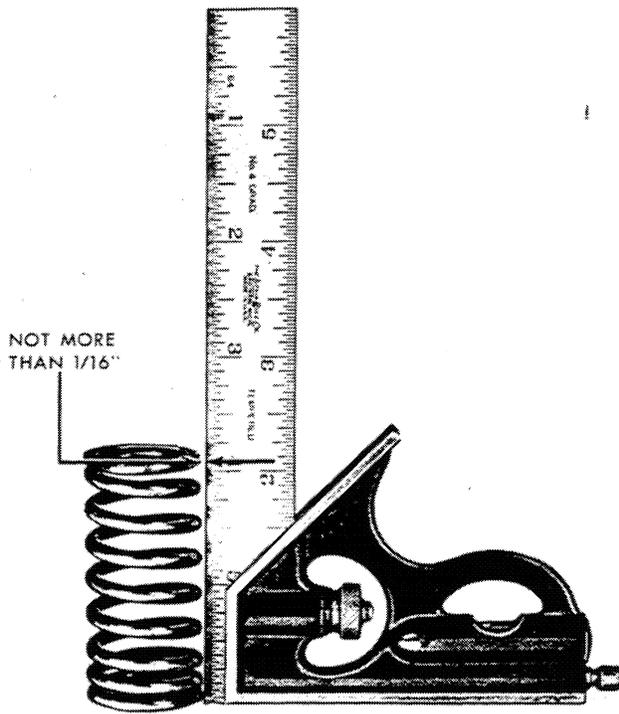


Figure 10
Valve Spring Squariness

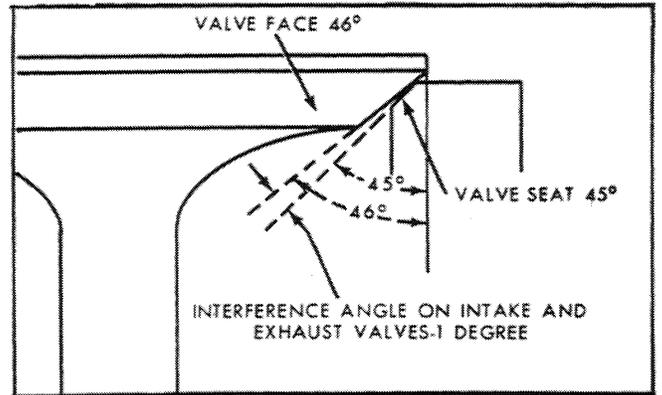


Figure 12
Interference Angle on Valve Seat

Gasoline engine springs should exert a pressure of 71-79 lbs. when compressed to a length of 1.78" or 161-177 lbs. when compressed to 1.39". Diesel engine springs should exert a pressure of 54-62 lbs. when compressed to 1.82" or 124-140 lbs. when compressed to 1.505". If the spring pressure is seven or more pounds below specifications, replace the spring. If the valve spring tester tool is used as shown in Figure 11, the torque reading multiplied by 2, equals the spring pressure specified.

NOTE: Never immerse valve springs in a caustic cleaning solution as it may remove the protective coating and cause them to rust.

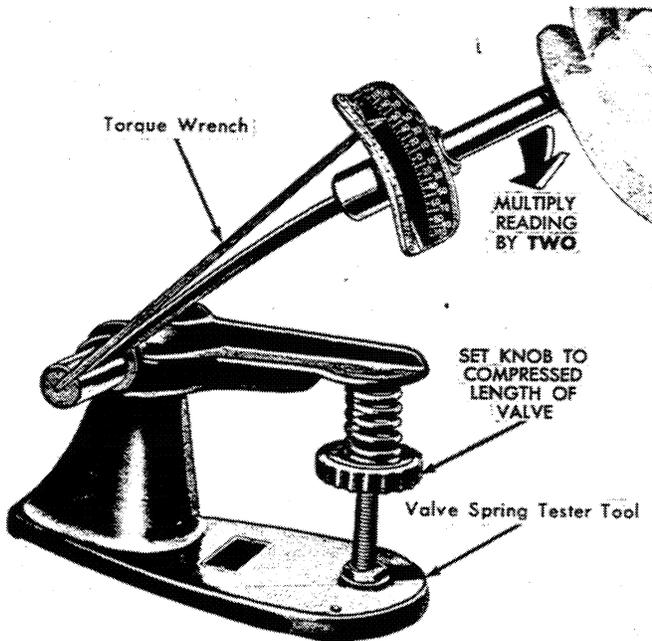


Figure 11
Valve Spring Tension

4. Check the rocker arm-to-shaft clearance with a micrometer and a telescope gauge. If the clearance exceeds 0.007", replace the defective parts. (Inspect the pad end of the rocker arm for roughness or grooves. Replace the rocker arms if these conditions exist. (Inspect the rocker arm adjusting screws and the push rod end of the rocker arms for stripped or worn threads, and the ball end of the screw for nicks, scratches, or excessive wear.) Inspect rocker arm locating springs and oil tubes for breaks or other damage.

E. Repair

1. The valve refacing operation should be closely coordinated with the valve seat refacing operation so the finished angle of the valve is 1° more than the valve seat to provide an interference angle for better seating, Figure 12. Adjust the refacing tool to obtain a face angle of 46° as shown in Figure 12. Remove only enough stock to clean up the pits and grooves. Check the edge of the valve head; if less than 1/32"

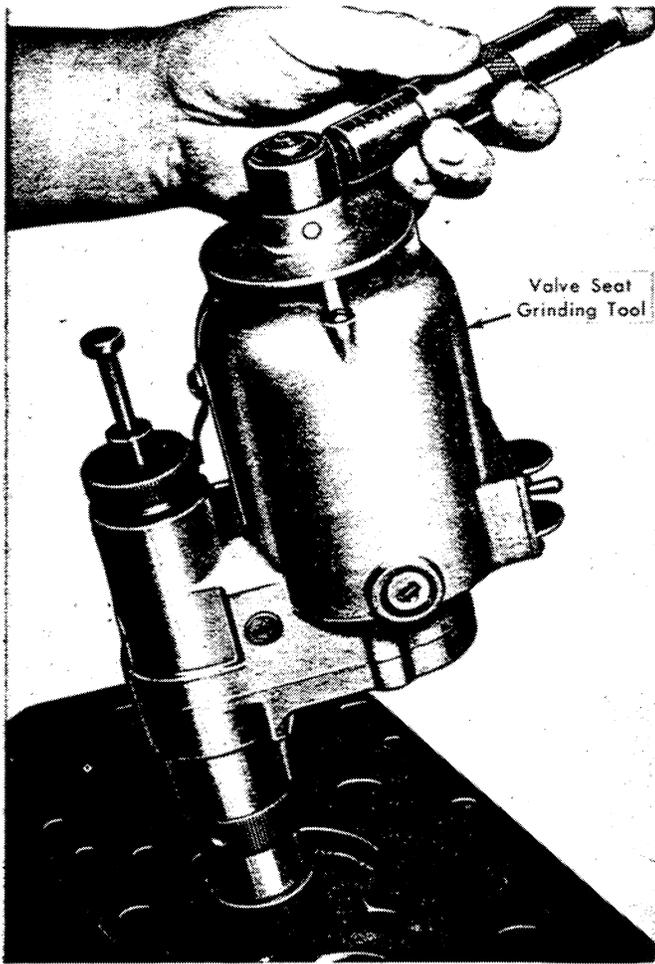


Figure 13
Grinding Valve Seats

margin, replace the valve. Groove or score marks may be ground off the end of the intake valve stem, then the sharp edge chamfered slightly.

NOTE: Do not remove more than 0.010" from the end of the valve stem.

2. Position the valve spring retainer and valve retainer locks on the exhaust valve stem as shown in Figure 14. Exert pressure against the valve spring retainer to seat the locks against the valve stem. Install the rotating cap on the end of the valve stem and press firmly on the cap while exerting pressure on the spring retainer. If no movement is felt at the retainer, the cap is seating at the valve. Remove enough stock from the end of the valve stem to obtain a clearance of 0.002–0.004" between the cap and stem, Figure 14. Keep each rotating cap with

its respective valve after the correct clearance has been established.

3. Insert the seat refacing pilot into the valve guide and expand the pilot until it fits tightly. Make certain that the stone is dressed to a 45° angle and is of the correct grit.

NOTE: The stone must be dressed frequently to assure correct grinding of all valve seats. Grind the seat, as shown in Figure 13, only enough to remove all pits and grooves or to eliminate an out-of-round condition. After refacing, if the seat exceeds the width shown in Figure 7, it must be narrowed. Remove enough stock from the top of the seat (lower the seat) with a 60° stone and enough from the bottom with a 30° stone (raise the seat) to make the width within specifications. Check the valve seat concentricity after the refacing operation. The finished valve seat should contact the approximate center of the valve face circumference. To determine where the valve seat contacts the face, coat the seat with prussian blue, then set the valve in place. If the blue is transferred to the center of the valve face, the seat contact is satisfactory. If the blue is transferred to the top edge of the valve face, lower the valve seat. If the blue is transferred to the bottom edge of the valve face, raise the valve seat.

~~B. Valve Guides~~

The valve guides in the 6000 Tractor engine (gas and diesel) are an integral part of the cylinder head. Valves with both standard and oversize valve stems are available for service.

	Oversize Valve Stems		
Gas	.003	.015	.030
Diesel	.003	.015	

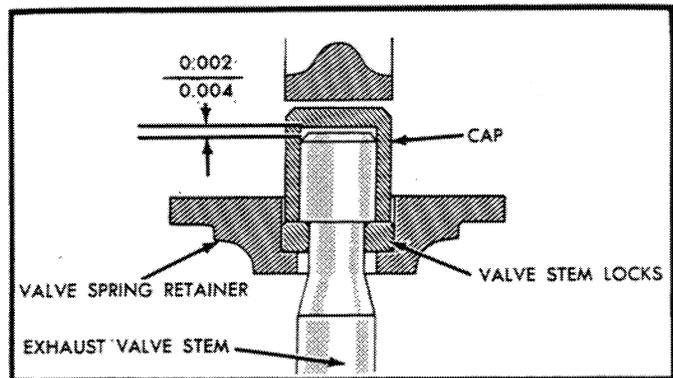


Figure 14
Exhaust Valve Stem-to-Cap Clearance

Reaming Valve Guides:

If it becomes necessary to ream a valve guide to install a valve with an oversize stem, reaming kits can be purchased locally. The kits should contain the following combinations: a 0.003 inch oversize reamer with a standard diameter pilot, a 0.015 inch oversize reamer with a 0.003 inch oversize pilot, and a 0.030 inch reamer with a 0.015 inch oversize pilot.

IMPORTANT: When going from a standard size valve to an oversize valve always use the reamers in sequence.

Afterreaming a valve guide, always reface the valve seat.

F. Cylinder Head Assembly

1. Lubricate all moving parts with engine oil prior to assembly.
2. Apply sealer to two new rocker shaft plugs and install them in the shaft with a driver. Make sure that they are only in the shaft far enough to permit installation of the cotter pin (on gasoline engines).
3. Assemble the rocker arms, springs, and brackets in the sequence shown in Figure 3.

NOTE: Diesel engines use eight spacers to locate the rocker arms. Make certain that the two narrower spacers are installed at Nos. 3 and 5 supports and the wider spacers are at Nos. 2 and 6 supports, Figure 3.

4. Position a spring washer between the two flat washers and position them on each end of the shaft. Secure the washers in place with cotter pins (on gasoline engines).

NOTE: Diesel engines use 2-pan head machine screws to retain the rocker arms.

5. Insert each valve in the guide from which it was re-

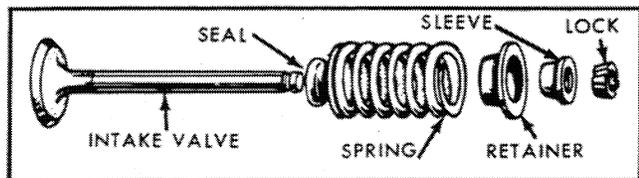


Figure 15
Intake Valve Assembly

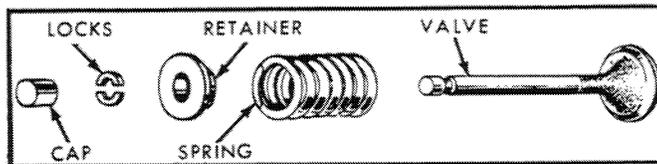


Figure 16
Exhaust Valve Assembly

moved. Position a new valve seal over each intake valve and guide, (also on exhaust for gasoline).

6. Install the valve springs over the valve guides, making sure the close wound coils are contacting the head.
7. Install the spring retainer sleeve as shown in Figure 15, on the intake valves. Install the spring retainer as shown in Figure 16, on the exhaust valves. Compress the spring with Valve Spring Compressor 6513-EE and install the valve locks, Figure 6.
8. Place the rotating cap that was previously selected on its respective valve (exhaust only).
9. Install the thermostat, water outlet elbow, and new gasket on the cylinder head.

G. Cylinder Head Installation

1. Place a new head gasket on the cylinder block, then carefully position the cylinder head on the gasket. Lubricate the bolt threads and install the cylinder head bolts finger tight.
2. Tighten the cylinder head bolts in the proper sequence shown in Figure 17. Tighten the bolts progressively in three steps to the torque shown below.

- | | |
|------------|------------------|
| 1st. step | 55–65 ft. lbs. |
| 2nd. step | 75–85 ft. lbs. |
| Final step | 105–115 ft. lbs. |

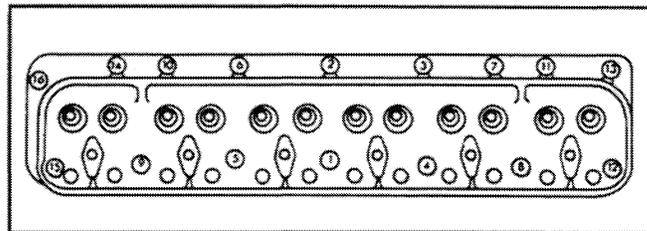


Figure 17
Cylinder Head Bolt Tightening Sequence

Diesel Engine:

- a. Install a new seat washer in each injector bore in the cylinder head. Position new seals on the injector inlet adapters.
 - b. Install each injector by positioning the nozzle end into its bore in the end and by guiding the injector rubber seal into its slot in the cylinder head wall. Work each assembly down by hand as far as possible. Do not use a hammer.
 - c. Install the mounting bolts and torque each bolt to 12-15 ft. lbs.
 - d. Insert a new rubber grommet in the cylinder head and tighten the excess fuel line "T" connection. Install the excess fuel line on the injectors. Position copper washers under each bolt and tighten the bolts to 7-9 ft. lbs. torque.
 - e. Install the fuel filter assembly on the cylinder head. Connect the fuel lines from the injection pump to the fuel filter. Connect the fuel lines from the injection pump to the injectors.
3. Install the push rods with the cupped end upward.
 4. Position the rocker arm assembly on the cylinder head. Install the rocker arm attaching bolts finger tight making sure the ball end of the rocker arm adjusting screws are seated in the cupped end of the push rods. Back off the rocker arm adjusting screws one turn. Tighten the rocker arm attaching bolts evenly and alternately to 45-55 ft. lbs. torque. Rotate the engine and set the preliminary valve lash to .015 inch cold.
 5. Install a new "O" ring seal on the oil inlet tube. Install the inlet and outlet oil tubes in the cylinder head and rocker arm support making sure they are free of the valve mechanism.
 6. Install the intake and exhaust manifold using a new gasket.

Diesel Engine: Connect the air cleaner hose to the manifold. Connect the manifold heater wires to the manifold heater.

Gasoline Engine: Install the carburetor on the mounting flange and connect the fuel line. Install the coil bracket and coil on the cylinder head and connect the spark plug wires.

7. Connect the water temperature gauge wire to the cylinder head.
8. Install the fuel tank. Install the fan and support assembly and the fan belt. Connect the upper radiator hose. Check the fan blades to be sure they do not contact the radiator fan shroud.
9. Install coolant in the radiator.
10. Start the engine and allow it to run until it reaches normal operating temperature.
11. Remove the rocker arm assembly and tighten the cylinder head bolts to 105-115 ft. lbs. torque.
12. Install the rocker arm assembly.
13. Adjust the valve lash to .015" clearance while the engine is running at idle speed, as shown in Figure 18.
14. Install the rocker arm cover and new gasket. Tighten the cover attaching bolts to:
 - Gas 3-5 ft. lbs.
 - Diesel 12-15 ft. lbs.
15. Install the hood.

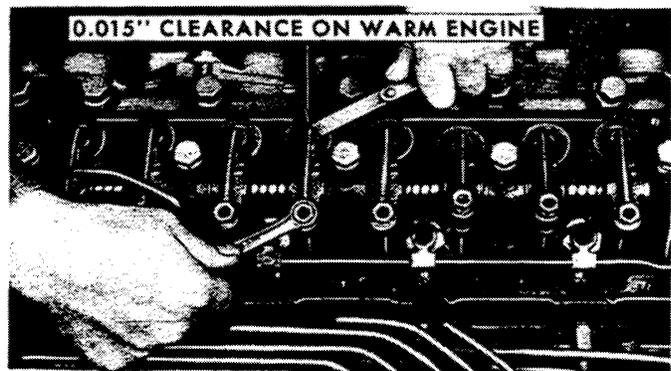


Figure 18
Adjusting Valve Lash

3. OIL PAN, OIL PUMP, AND OIL FILTER

The lubrication system used in the Ford Series 6000 Tractor engine is shown in Figure 19. Oil is picked up from the sump by means of the oil pump and is pumped through the full flow oil filter. From the filter, the oil

flows into the main oil gallery. The oil gallery supplies oil to all the camshaft and main bearings through a drilled passage in each main bearing web.

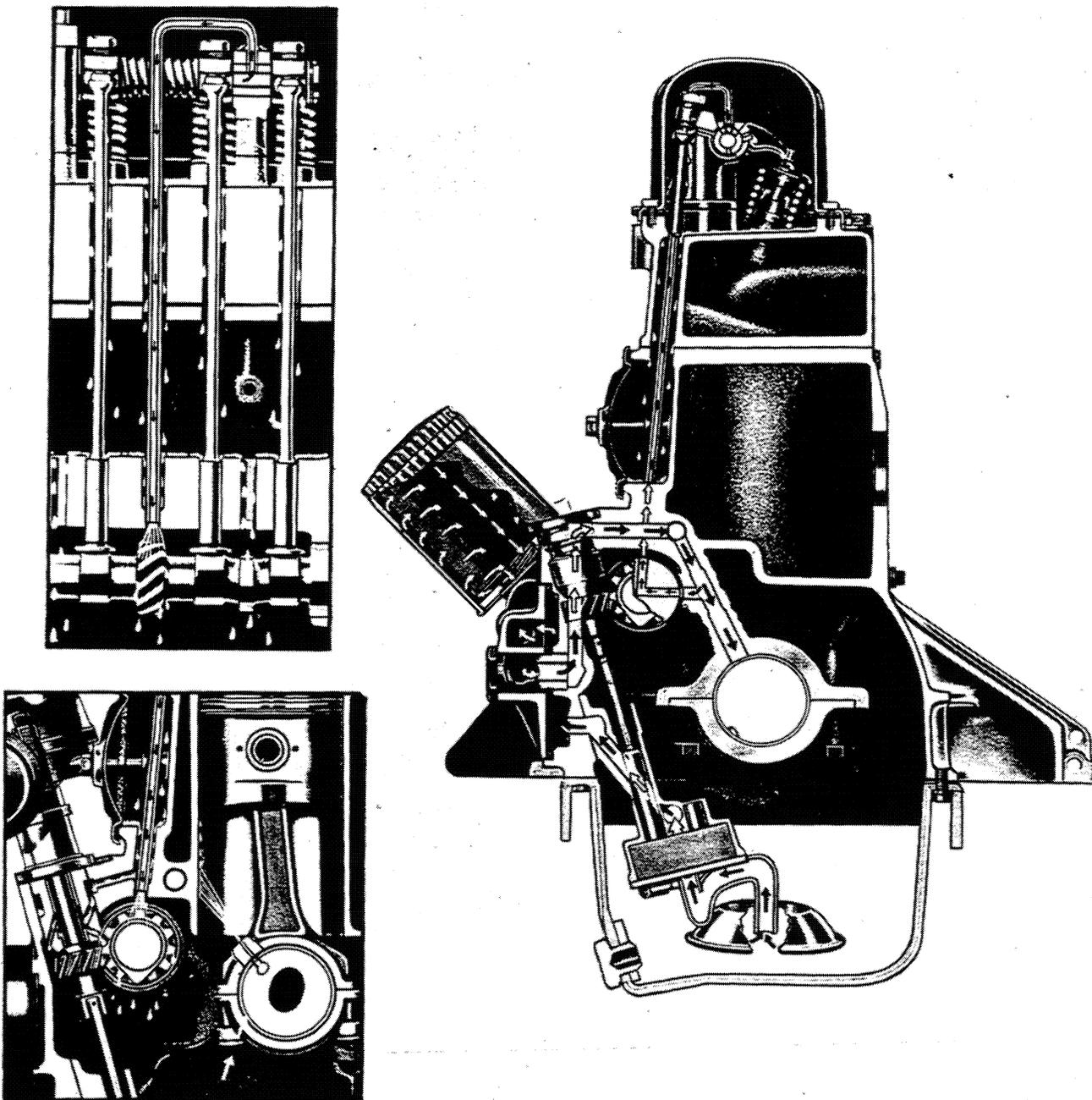


Figure 19
Engine Lubricating System

Cylinder walls, pistons and piston pins are lubricated through a drilled hole in each connecting rod which indexes with a hole in the connecting rod journal of the crankshaft.

Oil is fed to the valve rocker arm shaft assembly through a drilled passage in the cylinder block at the No. 3 camshaft bearing which indexes with a hole in the cylinder head. An oil inlet tube directs the oil into the rocker shaft. The oil from the shaft flows through drilled holes at each rocker arm to lubricate the shaft bore and the valve and ball end of the rocker arm. The excess oil spirals down the rotating push rod and lubricates the tappet and push rod seat. An oil outlet tube exhausts excess oil from the rocker shaft to lubricate the distributor lower bushing (gasoline engines) and the oil pump drive gear. The oil from each rocker arm drains into the push rod chamber through holes provided in the cylinder head. The oil in the push rod chamber drains back into the oil pan through an opening at the back of the block.

OIL PAN

A. Removal

1. Place a drain pan under the oil pan drain-plug and remove the plug.
2. Position a floor jack under the center of the pan to assist in lowering the pan after the bolts are removed. Position a floor jack under the front of the transmission.
3. Remove the lower side rail spacer to transmission bolts and the two bolts which secure the spacer to the side rails on both right-hand and left-hand spacers. Loosen the upper spacer to transmission case bolts on both left-hand and right-hand spacers. Drive the lower end of the spacers slightly to the rear to provide clearance for removing the transmission to oil pan bolts. Remove the four bolts and locks holding the front of the oil pan to the Engine front support.
4. Remove the twenty-four cap screws that attach the oil pan to the cylinder block and front cover.
5. Using the floor jack, carefully lower the oil pan to the floor.

B. Inspection

1. Scrape all dirt and metal particles from the inside of

the pan. Scrape all gasket material from the mounting surface. Wash the pan in cleaning solvent and dry with a clean rag.

2. Inspect the pan for cracks, holes, damaged drain plug threads or damaged mounting surface. Repair all damage or replace pan.

C. Installation

Refer to the torque specifications Section 10, to correctly tighten all bolts.

1. Place a new gasket on the oil pan mounting surface.
2. Using a floor jack, raise the oil pan into position under the cylinder block.
3. Apply thread sealer to the front right bolt thread. Install and tighten the bolts to the correct torque. See Torque Chart, Section 10.
4. Install the locking plates and four bolts that attach the oil pan to the engine front support. After the bolts have been tightened, bend the locking plate corners over against the bolt heads to hold them in position.
5. Install and tighten the attaching bolts which secure the engine to the transmission. Position the siderail spacers. Install and tighten the spacer bolts.
6. Place a new gasket on the oil pan drain plug, and install the plug.
7. Realign the hydraulic pump as outlined in the "Hydraulic Section" of this manual.
8. Fill the crankcase to the correct oil level and install a new oil filter.
9. Start the engine and check for oil leaks.

OIL PUMP

A rotor-type oil pump is used in the Ford Series 6000 Tractor engines. The pump is mounted on the right forward side of the engine inside the crankcase. The pump is operated by a gear driven off the engine camshaft. The oil pressure relief valve is incorporated in the pump body. The pump capacity is 3.5 gpm at 1400 rpm.

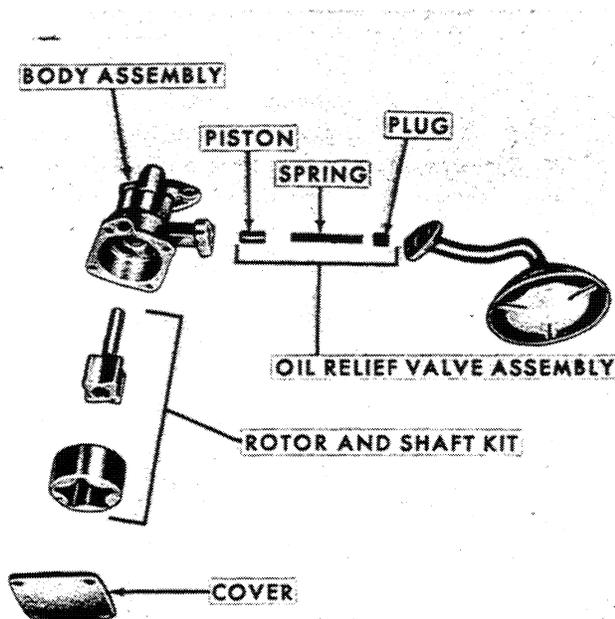


Figure 20
Oil Pump - Exploded View

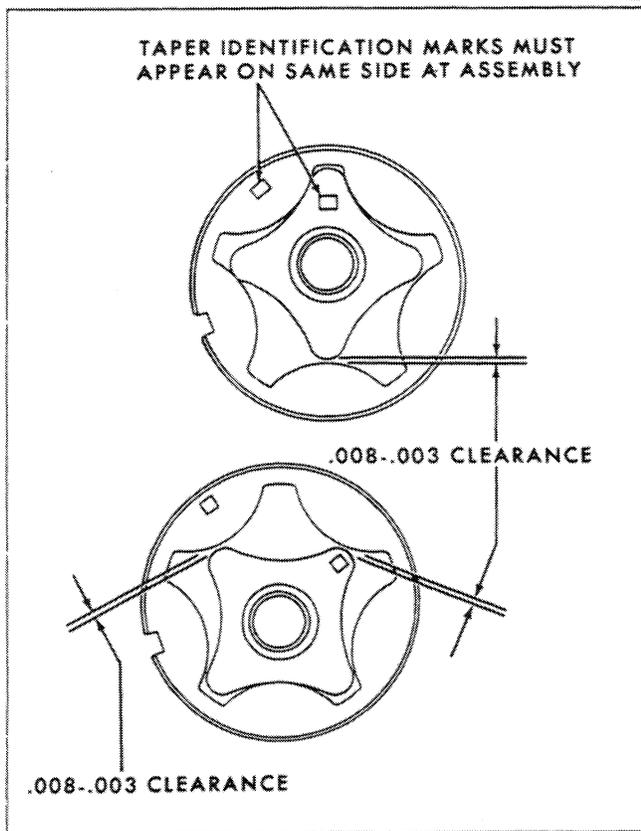


Figure 21
Oil Pump Rotor Clearance

A. Oil Pump Removal

1. Remove the oil pan.
2. Remove the two nuts and lock washers that attach the pump to the cylinder block. Remove the pump and inlet tube as an assembly.

B. Oil Pump Disassembly

1. Remove the two bolts that attach the oil inlet tube to the pump. Remove the inlet tube and screen assembly from the oil pump body. See Figure 20.
2. Remove the four bolts that attach the cover to the body. Remove the cover and the rotor assembly.
3. Remove the plug from the inlet tube body flange and remove the relief valve spring and valve.

C. Oil Pump Inspection

1. Check the mating surface of the pump cover for wear. If the cover is visibly worn, scored, or damaged, replace it.
2. Check the pump housing for scores, cracks, or damage and replace as necessary.
3. Install the rotor and shaft assembly in the housing and check the rotor-to-outer race clearance. With the rotor positioned as shown in Figure 21, the clearance should not exceed .008" at the points indicated.
4. With the rotor assembly installed in the housing, place a straight edge over the rotor assembly and the housing, as shown in Figure 22. Measure the

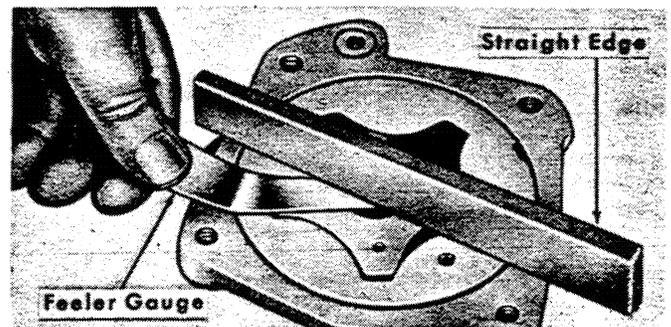


Figure 22
Checking Rotor End Play

clearance between the straight edge and the rotor and outer race. If the clearance exceeds .004", replace the rotor and race assembly and/or the pump body.

5. Check the pressure relief valve spring tension. The pressure should be 8.9-9.7 lbs. when compressed to 1.53". If the spring is not within these specifications, replace it.

D. Oil Pump Assembly

1. Oil all parts with engine oil.
2. Install the pump relief valve plunger and spring in the oil pump housing, Figure 20. Position a new plug in the housing and stake the plug securely in place.
3. Position the rotor and race assembly in the pump body so the identification dots shown in Figure 21 are both facing outward.
4. Place the pump cover on the housing and install the four attaching bolts.
5. Position a new pick-up tube gasket and the oil inlet tube and screen assembly on the housing. Install the two attaching bolts and lock washers.

E. Oil Pump Installation

1. Coat the pump housing-to-crankcase mounting surface with a light film of grease and position a new gasket on the housing.
2. Install the two oil pump attaching bolts to the crankcase.
3. Install the oil pan gasket, and oil pan.
4. Fill the crankcase to the proper level with the recommended oil. Start the engine and check for leaks.

F. Oil Pump Pressure Check

The engine is equipped with a low oil pressure warning lamp located in the instrument cluster. The lamp is controlled by a pressure operated sender switch connected to the engine oil gallery at the rear right-hand side of

the cylinder block. The pressure switch is "closed" and the warning lamp is "ON" when the oil pressure is dangerously low. The switch is "open" and the warning lamp is "OFF" when the oil pressure is high enough to operate the pressure switch and supply the bearings with oil. Oil in the crankcase can become dangerously low and, therefore, over-heated even though the oil pressure is high enough to prevent the lamp from signaling the danger. The engine oil level dipstick should, therefore, be checked frequently to be sure there is sufficient oil in the engine crankcase. Low oil pressure may be caused by a clogged oil pump screen, damaged oil pump, defective oil pressure relief valve, worn crankshaft, connecting rod, or camshaft bearings, or by a worn valve rocker arm shaft or rocker arms. A defective oil sender pressure switch may also falsely indicate low oil pressure.

Use the following procedure to check faulty oil pressure:

1. Remove the oil pressure sender switch from the block and connect a master gauge in its place.
2. After the engine has reached normal operating temperature, the oil pressure gauge should read approximately 48 psi at 1400 rpm. Oil is thick when cold, therefore, oil pressure will be higher than normal when the engine is cold.
3. As the engine speed increases, the oil pressure will increase until the relief valve opens, and decrease when the engine speed is decreased. Extremely low oil pressure at engine idle speed is generally caused by worn bearings or oil pump gears. The oil pressure should be high enough at the minimum idle speed to keep the oil warning lamp "OFF".

OIL FILTER

The oil filter used in the Ford Series 6000 Tractor engine is the full flow, throw-away type. A bypass valve is incorporated in the filter, oil flows through the filter into the hollow center tube, then into the main oil gallery. Under this condition, the pressure at both ends of the bypass valve is equal, and the valve remains closed. If the filter becomes clogged, pressure in the tube at the bottom of the valve becomes lower than at the top of the valve. When the pressure differential equals 8-10 psi, the valve opens, permitting unfiltered oil to flow through the bypass valve and into the main oil gallery.

SECTION 4 – CONNECTING ROD, BEARINGS, PISTON, RINGS, AND CYLINDER BLOCK

A. Oil Filter Removal

1. Place a pan under the filter to catch the small amount of oil that may drip down.
2. Turn the filter counterclockwise until it is free of the mounting bolt and remove the filter.
3. Clean the mounting surface thoroughly.

B. Oil Filter Installation

1. Thread the oil filter onto the mounting stud until

the filter seal contacts the mounting surface, then turn the filter an additional half turn.

IMPORTANT: Do not over-tighten the filter.

2. Check the engine oil level. Start the engine and check for oil leaks.
3. Check the engine oil level and add oil as necessary.
4. Remove the drain pan from under the tractor.

4. CONNECTING ROD, BEARINGS, PISTONS, PISTON RINGS, AND CYLINDER BLOCK

This section outlines the removal, inspection, and installation procedures for connecting rods, pistons, and pins. Complete data is given on the fitting of connecting rod bearings and the fitting of new rings, pistons, and preparing the cylinder block for oversize pistons.

Do not scratch the crankpin or the cylinder wall when removing the piston and rod. Repeat this procedure for each piston assembly.

NOTE: Keep the connecting rod bearing caps, fasteners and bearings with their respective rods.

PISTON AND CONNECTING ROD ASSEMBLY

A. Removal

1. Remove the cylinder head and the oil pan from the engine.
2. Remove the oil pump from the engine.
3. Remove the ridge from the top of each cylinder with Cylinder Ridge Reamer 6011-E, Figure 23.

NOTE: Do not attempt to remove a piston and connecting rod from the cylinder without first removing the ridge. Forcing the pistons past the ridge may break the lands on the pistons.

4. Turn the crankshaft until a piston is at the bottom of the stroke, then remove the nuts from the connecting rod bolts. Remove the rod bearing cap from the rod and push the rod and piston assembly out of the top of the cylinder with the handle end of a hammer.

5. Remove the piston rings from the pistons with a 3-5/8" Piston Ring Expander, Figure 24.

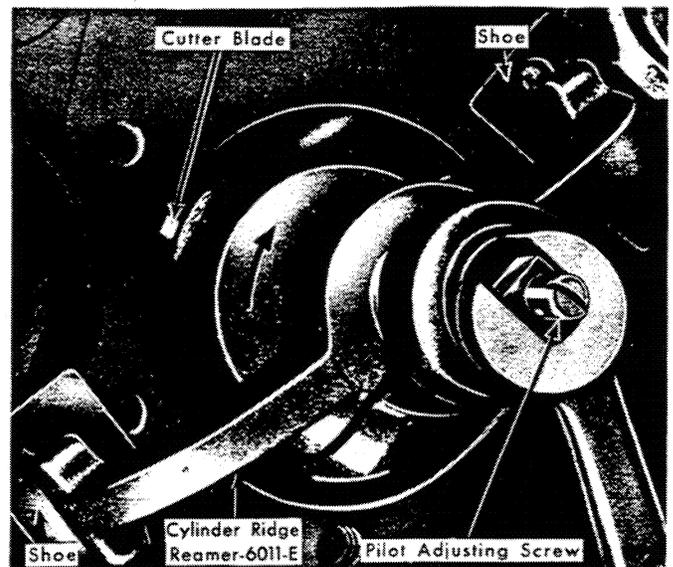


Figure 23
Removing Cylinder Ridge

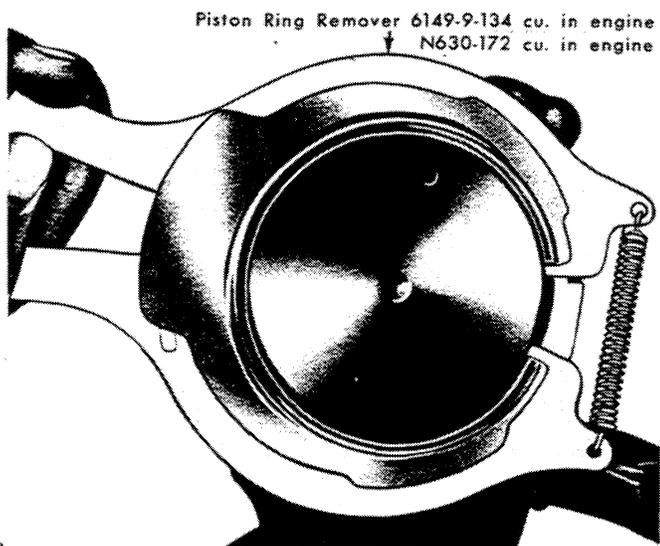


Figure 24
Removing Rings



Figure 25
Cleaning Piston Ring Grooves

B. Cleaning

Clean the piston ring grooves with Piston Ring Groove cleaner, LM-6610, Figure 25, or a broken ring. Be careful not to score the sides or bottom of the grooves. Clean all the passages in solvent (do not use caustic cleaning solution) then clean the rod bore and the back of the connecting rod bearings thoroughly. Dry the parts with compressed air.

C. Disassembly

1. Mark each piston to make sure that it will be assembled on the rod from which it was removed. Remove the piston pin retainer from each side of the piston.
2. Drive the pin out of the piston with Bushing Driver Set 818.

D. Inspection

Connecting Rods:

1. Connecting rod bolts or nuts with damaged threads and rods with deep nicks, signs of fractures, scored bores, or bores out-of-round more than .002" should be replaced.

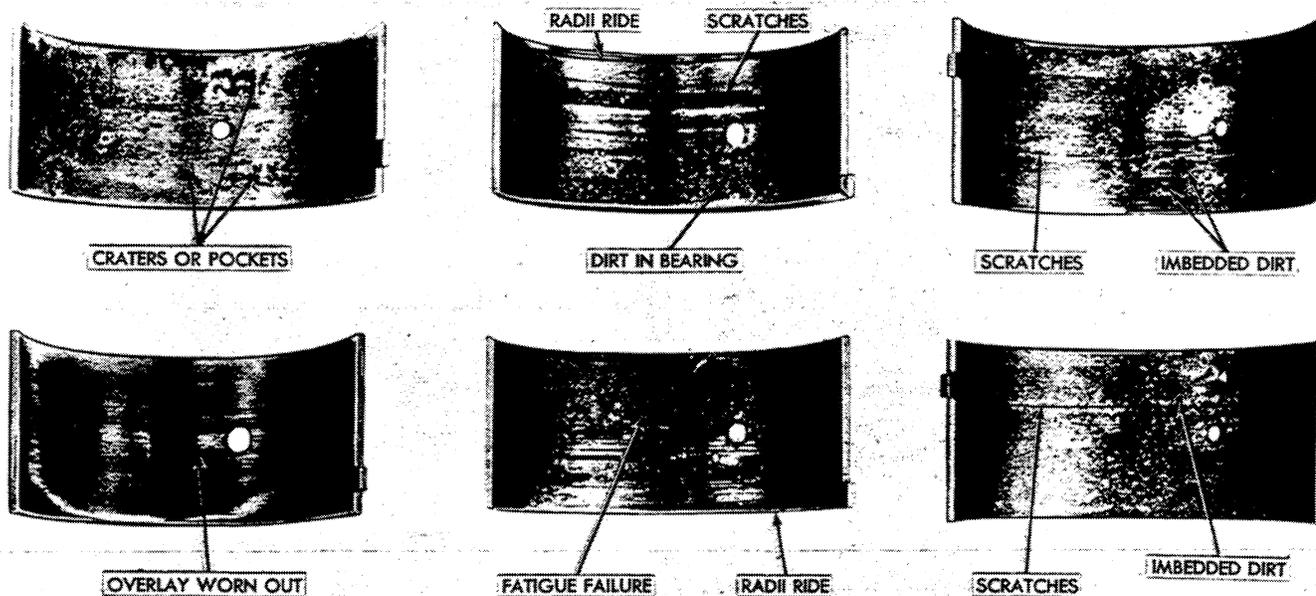


Figure 26
Detective Rod Bearings

SECTION 4 – CONNECTING ROD, BEARINGS, PISTON, RINGS, AND CYLINDER BLOCK

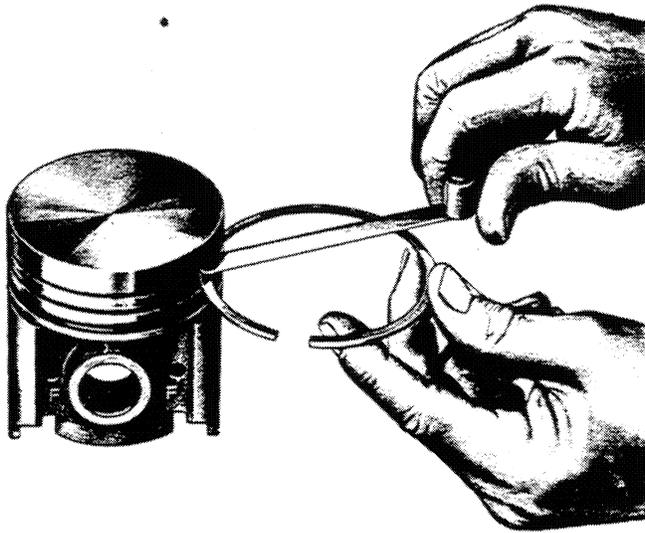


Figure 27
Checking Ring Land Clearance

2. Use a new piston pin to check the piston pin bushing in the connecting rod for wear. The pin should have a $0.0001''-0.0003''$ clearance in the rod bushing. If a new pin falls through a dry bore by its own weight, replace the bushing and ream it to fit the new pin.

Connecting Rod Bearings:

1. Replace bearing inserts that are scored, have the overlay wiped out, show fatigue failure, or that are badly scratched as shown in Figure 26.
2. If the bearings appear to be serviceable, they will have to be checked for clearance when installing the rods in the engine. If the clearance exceeds the specified limits (see Section 10) the bearing must be replaced. Connecting rod bearing inserts are available in $0.001''-0.002''-0.003''-0.010''-0.020''-0.030''$ and $0.040''$ undersize for Gasoline Engines and $0.001''-0.002''$ and $.003''$ for Diesel Engines.

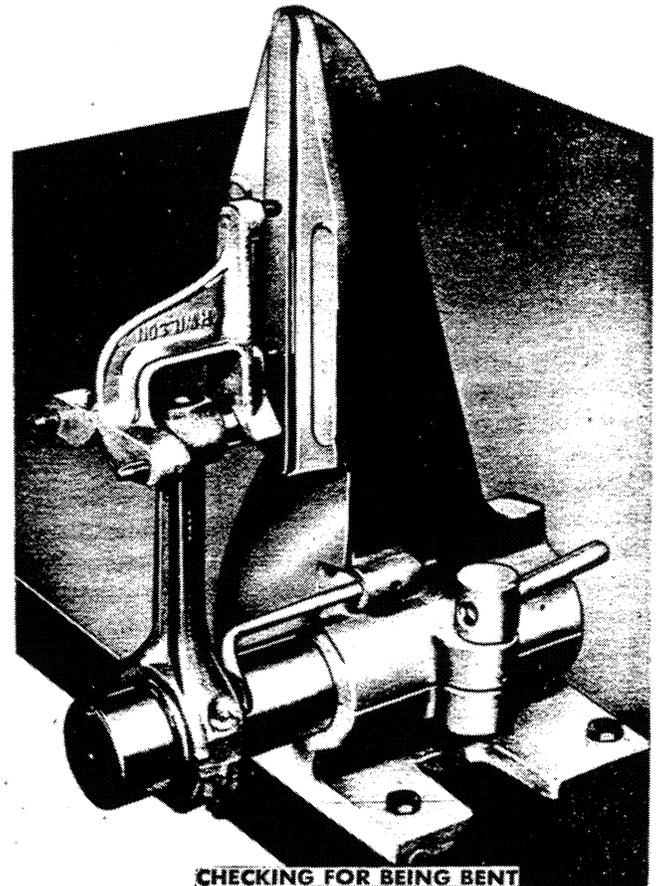
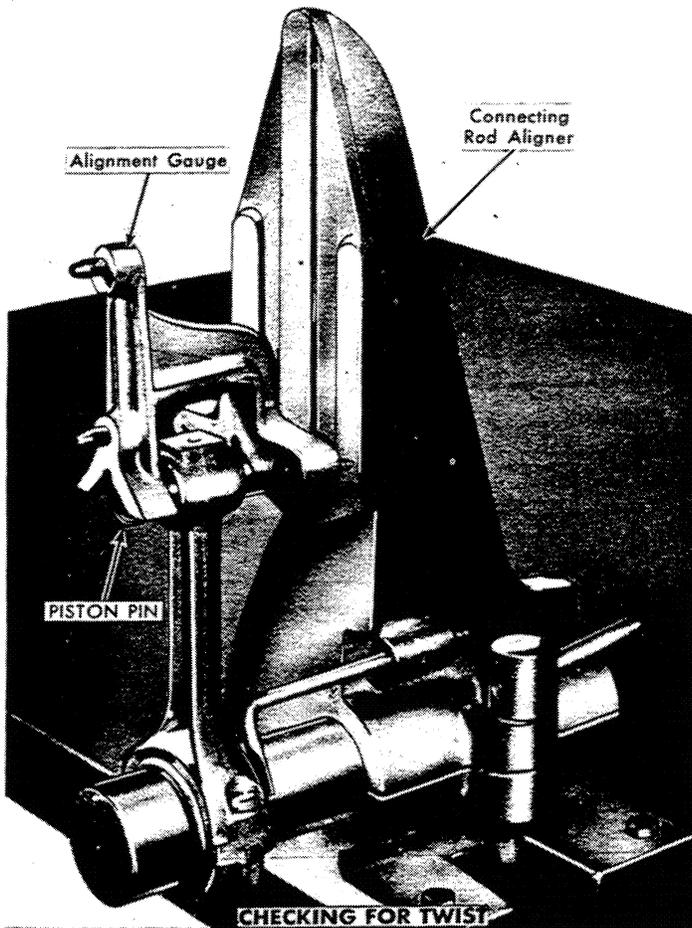


Figure 28
Checking Connecting Rod Alignment

Diesel Engine Crankshaft Journals must not be ground. (See Section 5).

Pistons:

1. Inspect pistons for fractures at the ring lands, skirts and pin bosses. Check for wear at the ring lands by using new rings and a feeler gauge as shown in Figure 27. The rings should have the clearances shown in the ring set instructions which are packaged with the rings.
2. Replace pistons showing signs of excessive skirt clearance, wavy ring lands, worn ring lands, fractures or damage from detonation. Spongy, eroded areas near the edge of the piston top are caused by detonation. In some instances, severe detonation causes holes to be burned through the top of the piston.
3. Replace piston pins showing signs of fractures or etching. Piston pins that show wear or that fit loosely in the piston or rod bushing, should be replaced. Replace all piston pin retainers.

E. Repair

Connecting Rod Bushing Replacements:

1. Press the old bushing out of the connecting rod with Bushing Driver 818 (gasoline engines) or Bushing Driver T-818 (diesel engines).
2. Carefully press a new bushing into the connecting rod with the same bushing driver that was used when removing the old bushing.
3. Using the existing hole in the top of the connecting rod as a guide, drill a 0.187" diameter hole in the bushing. Ream the bushing with Connecting Rod Bushing Reamer 6207-D to obtain 0.0001"-0.0003" clearance between the bushing and piston pin. Refer to Section 10 for piston pin dimensions.

Connecting Rod Alignment:

1. Place the connecting rod in an alignment fixture as shown in Figure 28.
2. If the connecting rod is twisted more than 0.012" or bent more than 0.004", it should be straightened or replaced.

Fitting Pistons:

1. Proper piston tolerances must be maintained if satisfactory engine operation is to be obtained. Pistons are available in standard and .002, .020, .030, .040 oversizes for both Gasoline and Diesel Engines plus .060" oversize for Gasoline engines.
2. Cylinder bores must be checked for taper and out-of-round condition before fitting a piston.
3. Before installing a piston and new rings in a used block, remove the high polish on the cylinder wall to aid ring seating. This is done by passing a hone or glaze removing tool through the cylinder bore a few times.
4. Do not hone more than enough to rough up the polish.
5. To fit a new piston in a new bore, attach Tension Scale, TR-512 to the end of a feeler ribbon 1/2" wide and having the correct thickness as outlined in the following tables.

TABLE I - GASOLINE ENGINES					
Fit New Piston In New Bore		Fit New Piston In Used Bore (Or Used Piston In New Bore)		Fit Used Piston In Used Bore	
Gauge Thickness Lbs. (Inch) Pull		Gauge Thickness Lbs. (Inch) Pull		Gauge Thickness Lbs. (Inch) Pull	
0.0015	5-10	0.002	5-10	0.003	5-10
TABLE II - DIESEL ENGINES					
Fit New Piston In New Bore		Fit New Piston In Used Bore (Or Used Piston In New Bore)		Fit Used Piston In Used Bore	
Gauge Thickness Lbs. (Inch) Pull		Gauge Thickness Lbs. (Inch) Pull		Gauge Thickness Lbs. (Inch) Pull	
0.005	5-10	0.006	5-10	0.007	5-10

SECTION 4 – CONNECTING ROD, BEARINGS, PISTON, RINGS, AND CYLINDER BLOCK

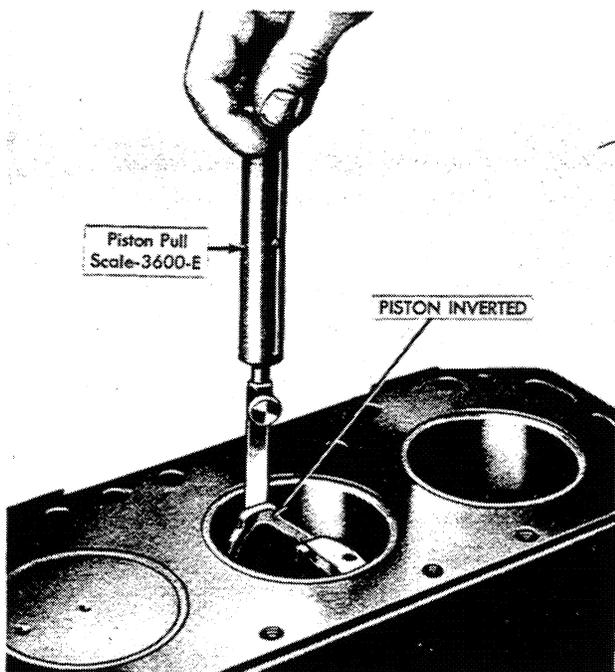


Figure 29
Fitting Pistons

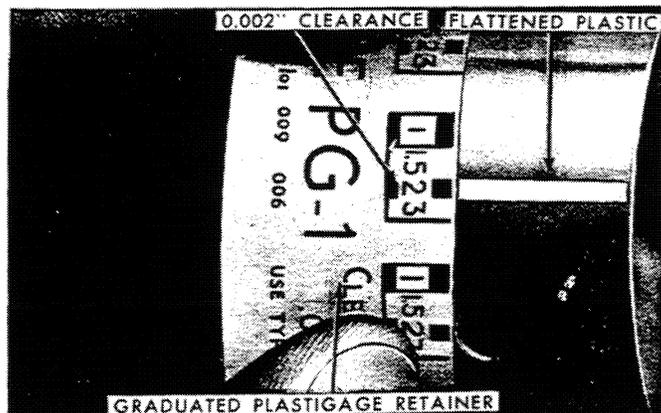


Figure 31
Measuring Plastigage

- Position the feeler ribbon on the side of the piston 90° from the piston pin hole. Invert the piston, then push the piston and feeler gauge into the cylinder so that the end is about 1/2" below the top of the block as shown in Figure 29. Keep the piston pin bores parallel with the crankshaft axis. Pull out the feeler gauge while noting the scale reading.

- The pull limits for new pistons and used pistons in new or used bores are given in Tables I and II.

- If the scale reading is greater than the maximum allowable pull, try another piston or hone the cylinder bore to obtain the proper fit. If the scale reading is less than the minimum allowable pull, try another piston. If none can be fitted, rebore the cylinder to the next oversize piston.

NOTE: Standard high and standard low pistons are available. Refer to the Series 6000 Tractor Parts Catalog for Part Numbers.

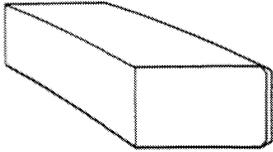
Fitting Piston Rings:

NOTE: Production installed and service installed rings normally have slightly different construction. Also, while the first or second compression rings may appear identical, there are important differences. It is, therefore, extremely important to follow the installation instructions contained in each ring set package to obtain the best possible service life.



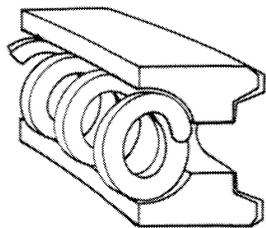
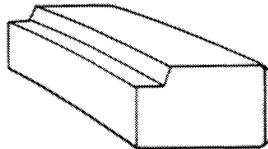
Figure 30
Checking Piston Ring End Gap

The following illustrations show a cross sectional view of the piston rings used in the 6000 Series Tractor Engines, both Gasoline and Diesel.



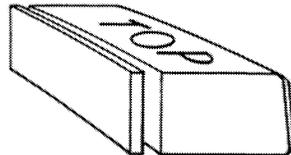
Service: Not Used.
Production: Top Compression Ring for Gas and Diesel.

Production: 2nd and 3rd Compression Ring Diesel. 2nd Compression Ring Gas. **Service:** Top Compression Ring Gas & Diesel. 2nd Compression Ring Diesel.



Production and Service: Oil Control Ring for Gas and Diesel.

Production: Not Used.
Service: 3rd Compression Ring Diesel. 2nd Compression Ring Gas.



Fitting Connecting Rod Bearings-Plastigage Method:

1. Place a piece of the correct size Plastigage plastic across the length of the insert or journal. Install the bearing cap and tighten the nuts to 45-50 ft. lbs. torque.

NOTE: Do not turn the crankshaft with the Plastigage in place.

2. Remove the bearing cap and use the Plastigage scale to measure the width of the flattened plastic at the widest point, as shown in Figure 31.
3. If reading is within limits (see Section 10), the fit is satisfactory. Fit the remaining connecting rod bearings in the same manner.

F. Assembly

1. Lubricate all parts with engine oil.
2. Position a piston on its respective connecting rod as shown in Figure 32 and install the piston pin. Install two new piston pin retainers, Figure 33.

NOTE: The piston must be assembled on the connecting rod so that the indentation is toward the front of the engine while the oil squirt hole in the rod is toward the camshaft side of the engine.

3. Install the rings on the pistons in accordance with the instructions contained in the piston ring carton. Use a 3-5/8" Piston Ring Expander to prevent distorting or breaking the rings, Figure 24.

G. Installation

1. Turn the crankshaft to position No. 1 crankpin at the bottom of its stroke.
2. Lubricate the rings on No. 1 piston with engine oil. Compress the rings with Piston Ring Compressor 6149-E (gasoline) or 850-T (diesel) as shown in Figure 34. Install the bearing inserts in the rod and the cap if not already installed.
3. Position the piston and rod assembly less cap in the cylinder block with the indentation facing toward the front of the engine.

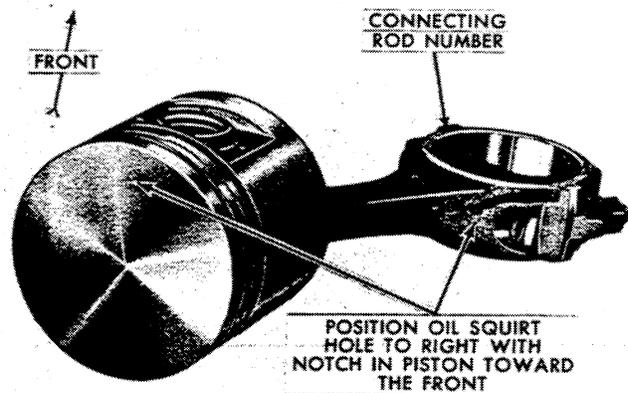


Figure 32
Position of Piston in Relation to Rod

SECTION 4 – CONNECTING ROD, BEARINGS, PISTON, RINGS, AND CYLINDER BLOCK

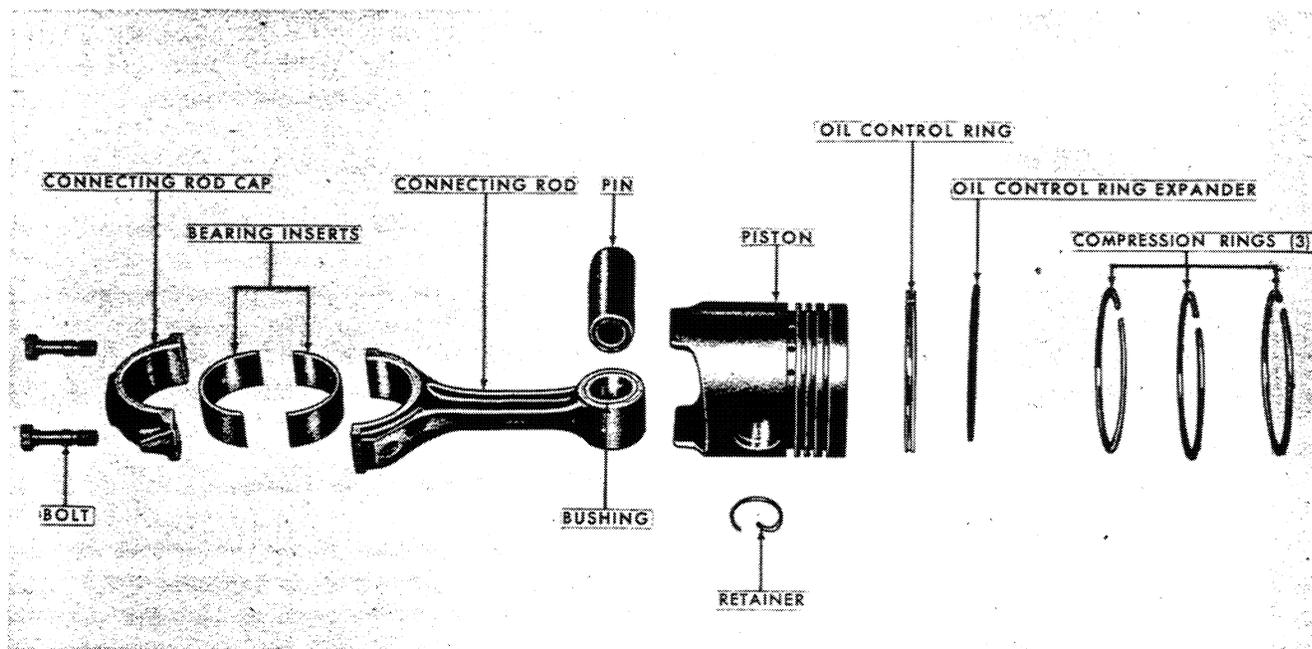


Figure 33
Piston and Connecting Rod Components

4. Tap the piston down into the bore with the handle end of a hammer until the connecting rod is seated on the crankpin. Install the bearing cap on the rod with the cylinder number facing opposite the camshaft side of the engine. Install and tighten the nuts to 45–50 ft. lbs. torque. Install the remaining pistons and rods in the same manner.
5. Install the oil pump and oil pan.
6. Install the cylinder head and new gasket.
7. Fill the radiator with coolant. Fill the crankcase to the proper level with the recommended oil.
8. Start the engine and check for leaks.

(white lead) dissolved in wood alcohol. If cracks are present, the white coating will become discolored at the defective area.

2. Inspect the expansion plugs for rust. Rust indicates leakage. If leakage is indicated, replace the plug.

CYLINDER BLOCK

A. Inspection

1. Make a thorough check for cracks. Minute cracks, not visible to the naked eye, may be detected by coating the suspected area with a mixture of 25% kerosene and 75% light motor oil. Wipe the part dry and immediately apply a white coating of zinc oxide

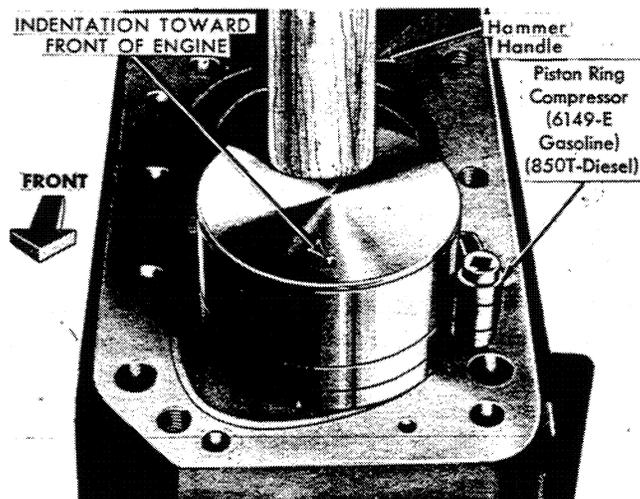


Figure 34
Installing Piston and Rod

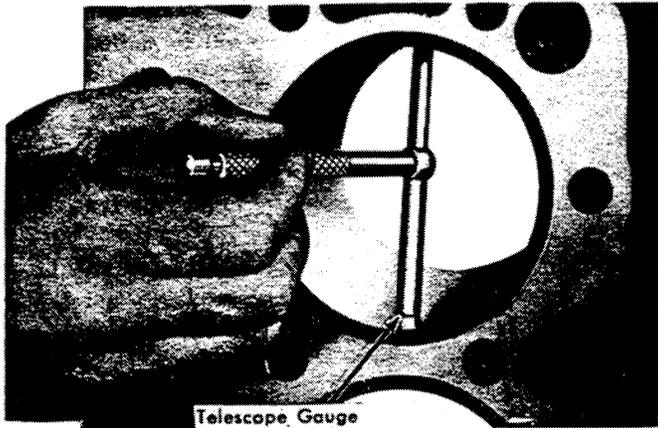


Figure 35
Measuring Cylinder Bore

3. Inspect the cylinder bores for scoring, taper, out-of-round, and wear, with a cylinder bore gauge, telescope gauge or inside micrometers, Figure 35.
4. Record measurements taken lengthwise and crosswise at the top and bottom of piston ring travel, as follows:
 - a. Lengthwise of the block, measure and record as "A" the diameter of the cylinder at the section of greatest ring wear near the top of the cylinder.
 - b. Also, lengthwise of the block, measure and record as "B" the cylinder diameter at the bottom of the piston skirt travel.
 - c. Crosswise of the block, measure and record as "C" the diameter of the top of the cylinder at the greatest wear point.
 - d. Measure and record as "D" the diameter at the bottom of the cylinder bore, and crosswise of the block.
 - e. Reading "A" compared to reading "B" and reading "C" compared to reading "D", indicates cylinder taper.
 - f. Reading "A" compared to reading "C" and reading "B" compared to reading "D" indicates whether the cylinder is out of round.
 - g. The maximum allowable taper is 0.008", and the

maximum allowable out-of-roundness is 0.003". If either condition exceeds the allowable specification, the cylinder should be bored and honed to fit the next available oversize piston.

B. Repair

The Ford Series 6000 gas and diesel engines are the sleeveless type which can be rebored for fitting .020", .030", or .040" (plus .060" for gasoline) oversize pistons and rings. In addition, cylinder sleeves are available which in turn can be fitted with standard pistons and rings then rebored during subsequent overhaul to allow fitting oversize pistons and rings.

Boring Cylinder and Cylinder Sleeves:

1. To provide maximum engine performance and perfect balance of the reciprocating parts of the engine, all cylinders must be bored to the same size when oversize pistons beyond the high standard piston are installed, even though only one cylinder requires reboring and the others are within tolerance. Manufacturers' recommendations on use of boring equipment should be followed, and the work should be performed by experienced personnel.
2. Bore the cylinder with the most wear first, to determine the proper oversize. If the cylinders will not clean up at 0.060" on gasoline engines or 0.040" on diesel engines, the block must be fitted with sleeves. When reboring, allow 0.0015" stock for honing to a final finish. Use a number 220 to 280 grit hone for this operation.
3. Follow these steps when fitting the engine with sleeves.
 - a. Bore the block to 3.7585"—3.7595" (including final honing).
 - b. Counterbore the block to:

Diameter of 3.906"—3.910"

Depth of 0.177"—0.181"
 - c. Use semi-finished sleeves and install with a constant pressure Sleeve Installation Tool.
 - d. After installation, hone the sleeves to fit pistons.

5. MAIN BEARINGS, FLYWHEEL AND CRANKSHAFT

The main bearings can be replaced with the engine in the tractor. The flywheel can be removed only by removing the engine or by splitting the tractor between the engine and transmission leaving the frame rails with the front half. The engine must be removed before removing the crankshaft.

MAIN BEARINGS

A. Removal

1. Remove the oil pan and oil pump screen and tube assembly.
2. Remove the two bolts that attach the main bearing cap to the cylinder block and remove the cap and bearing. Install a bearing insert remover in the oil passage of the crankshaft as shown in Figure 36. Turn the crankshaft counterclockwise slowly until the tool forces the bearing out of the cylinder block.

NOTE: If a bearing insert tool is not available, flatten the head of a 1" x 1/8" cotter pin and bend the head at approximately a 30° angle to conform to the angle of the oil passage in the crankshaft, see Figure 37. Use the fabricated tool in the same manner to remove and install bearing inserts. The shorter cotter pin must be used to remove the center main bearing insert.

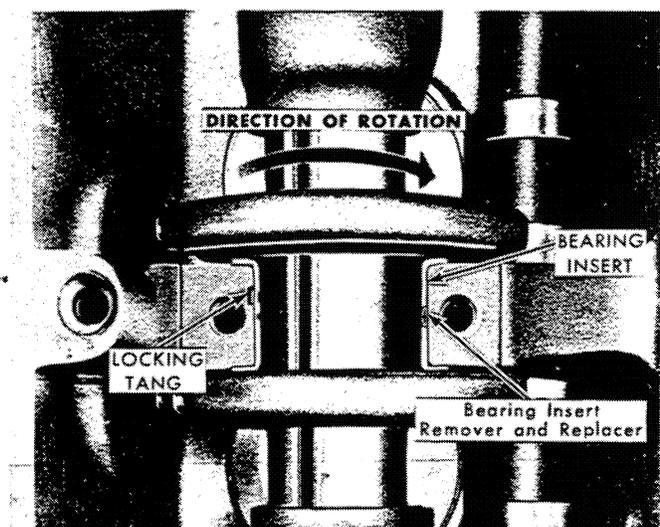


Figure 36
Removing Main Bearing Inserts

B. Inspection

Clean the bearing inserts, journals, and cap thoroughly. Inspect each bearing carefully. Bearings that have a scored, chipped, or worn surface should be replaced. Typical examples of bearing failures and their causes are shown in Figure 38. Check the clearance of bearings that appear serviceable with Plastigage, following the recommended procedure.

C. Fitting Main Bearing—Plastigage Method

1. Remove the oil pan and oil pump. Remove a main bearing cap and wipe the oil from the bearing and crankshaft journal. *Follow the directions under Removal*
2. Place a piece of the correct size Plastigage, the full width of the bearing journal, if the engine is inverted. Place the Plastigage in the bearing cap, if the engine is in the normal operating position. Install the bearing cap and tighten the retaining bolts to 105–115 ft. lbs. torque. (Lubricated)

IMPORTANT: Do not turn the crankshaft while the Plastigage is between the bearing and the journal.

3. Remove the bearing cap. Without moving the plastic, check its width at the widest point with the graduations on the Plastigage container, as shown in Figure 31.

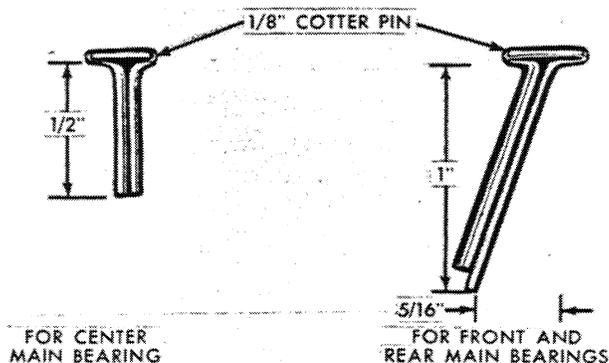


Figure 37
Fabricated Main Bearing Insert Tool

NOTE: Normally, main bearing journals wear evenly and are not out of round. However, if a bearing is being fitted to an out-of-round journal, which is within specifications, be sure to fit the bearing to the maximum diameter of the journal.

4. If the bearing is fitted to the minimum clearance of 0.0019" on the minimum diameter of the journal, and the journal is out of round 0.0005" or more, interference between the journal and bearing could result in rapid failure of the bearing.
5. If the clearance is not within limits, try the selective fit undersize bearings to bring the clearance within limits, see Section 10. If the selective fit undersize bearings do not bring the clearance within limits, it will be necessary to regrind the crankshaft journals on Gasoline Engines for use with the next undersize bearing. Diesel engine crankshafts must not be re-ground.

NOTE: If the flattened plastic is not uniform in width from end to end, the journal or bearing is tapered. Be sure to check the journal with micrometers if the flattened plastic indicates more than 0.001" difference.

D. Installation

1. Lubricate the bearing insert with engine oil.
2. With the bearing insert installation tool in the crankshaft at the manifold side of the engine, hold the bearing in place on the crankshaft with the plain end of the bearing at the locking tang side of the cylinder block. Turn the crankshaft clockwise until the bearing is seated in the block.

NOTE: Pressure may have to be applied on the bearing insert to prevent the installation tool from slipping under it.

3. Install the lower half of the bearing insert in the bearing cap and lubricate the bearing with engine oil. Hold the bearing cap in place with the locking tang toward the camshaft side of the engine and install the two bolts and washers. Tighten the bolts to 105-115 ft. lbs. torque.
4. Install the oil pump screen and tube assembly. Install a new oil pan gasket and install the oil pan.

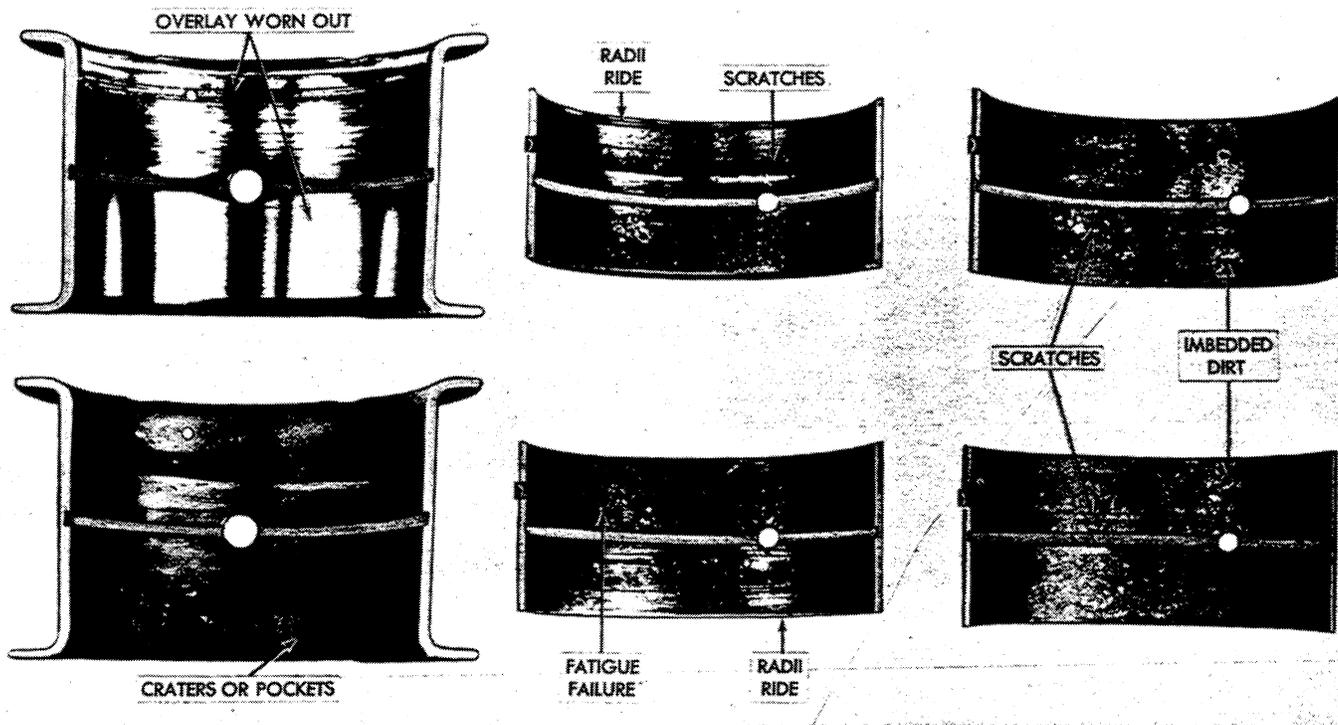


Figure 38
Main Bearing Failures

FLYWHEEL

The inertia of the flywheel is used to eliminate engine roughness and the rear face is used as a friction surface for the torque limiting clutch. A ring gear is mounted on the flywheel to provide a means of starting the engine. The flywheel mounts on a flange at the rear of the crankshaft and is retained by six bolts. The mounting holes are unevenly spaced so that it can be mounted in only one position.

A. Removal

1. Split the tractor between the engine and transmission, leave the siderails with the front axle support, or remove the engine.
2. Remove the torque limiting clutch.
3. Before removing the flywheel attaching bolts, check the runout with a dial indicator, see Figure 39. Remove the six flywheel attaching bolts. Tap the flywheel with a soft mallet or hammer to loosen it on the crankshaft. Lift the flywheel from the crankshaft.



CAUTION: Grasp the flywheel firmly while tapping it with a hammer to prevent dropping it and causing personal injury.

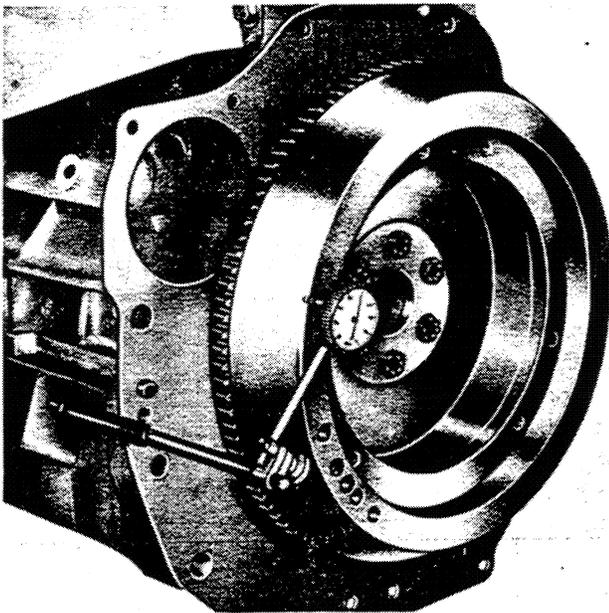


Figure 39
Checking Flywheel Run Out

B. Inspection

1. Replace the flywheel if the runout exceeds 0.008". Inspect the friction surfaces of the flywheel for score marks, check marks, and for evidence of overheating.
2. Replace the ring gear if loose on the flywheel or if the teeth are worn or broken.

C. Flywheel Ring Gear Replacement

1. Drill a 1/4" hole nearly through the ring gear. Do not drill into the flywheel. Split the gear with a chisel. Wipe the replacement gear and flywheel mating surfaces clean before installing the new gear.
2. Expand the gear by uniformly heating it to approximately 360° (gear will appear to change from a light to a dark yellow color at this temperature) then quickly transfer it to the flywheel and allow it to cool. Use a temperature indicating crayon available from welding supply sources.

IMPORTANT: Do not heat the gear to more than 360° as softening will result.

3. Check the gear runout after the flywheel is installed on the crankshaft. The runout must not exceed 0.008".

D. Installation

1. Clean both mating surfaces before installing the flywheel.
2. Check the runout of the crankshaft flange with an indicator before installing the flywheel. Runout must not exceed 0.001".
3. Place the flywheel in position on the crankshaft, install the cap screws and tighten them to 75-85 ft. lbs. torque.
4. After installation, check the flywheel runout. If the runout exceeds 0.008" total indicator reading, the flywheel should be replaced.
5. Install the torque limiter clutch.
6. Install the engine or connect the transmission to the engine.

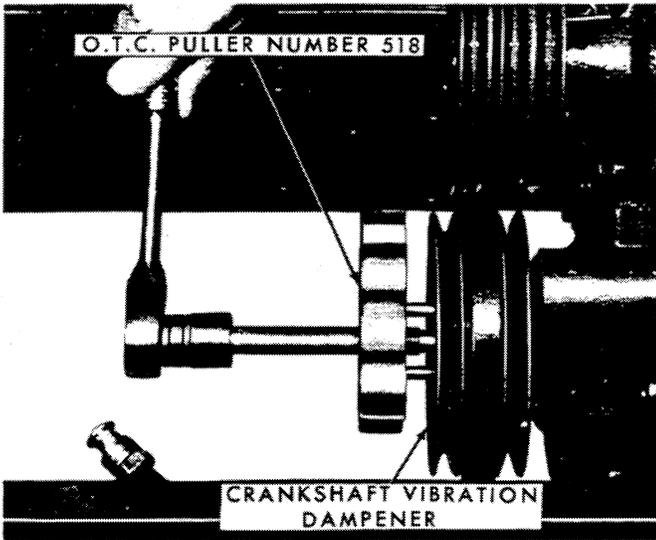


Figure 40
Removing Crankshaft Damper

CRANKSHAFT

A. Removal

1. Remove the engine from the tractor and place it in an engine stand.
2. Remove the oil pan, oil pump, flywheel, and rear cover plate. Remove the crank bolt and washer. Remove the damper pulley which is a force fit on the crankshaft using the two bolts which secure the hydraulic pump coupler to the pulley in conjunction with Tool No. OTC 518, as shown in Figure 40.
3. Remove the bolts that attach the cylinder front cover to the cylinder block and remove the cover. Slide the governor off the crankshaft. (Gasoline engines).
4. Remove the connecting rod bearing caps and, if they are not numbered, mark them so that they can be reinstalled on the same rod assembly. Remove the main bearing caps and the crankshaft. Remove the rear main bearing seal from the cylinder block. Reinstall the bearing caps on the cylinder block for safe keeping, after the crankshaft is removed.

B. Inspection

1. Clean the crankshaft in a tank of solvent. Clean all drilled passages with a rifle brush then blow out the passages with compressed air.

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2. Place the crankshaft on "V" blocks to check the runout at the intermediate journals with a dial indicator. Replace the shaft if the runout exceeds 0.003". Replace the crankshaft gear if worn or chipped.
3. Measure each journal at a minimum of four places to determine the wear, out-of-round, and taper. If the out-of-round is in excess of 0.0005" and the taper is more than .0005", or the wear is more than 0.003":
 - On Gasoline engines, regrind the journal to the next undersize bearing available.
 - On Diesel engines replace the crankshaft.

Main and connecting rod bearings are available in 0.001", 0.002", 0.003", for Gasoline and Diesel, and 0.010" and 0.020" undersize for Gasoline. New crankshaft dimensions are as follows:

Main Journal Diameter - 2.4971"-2.4963"

Connecting Rod Journal Diameter - 2.2988"-2.2980"

C. Repair

1. Remove the crankshaft gear with Remover 6306-AE as shown in Figure 41.
2. Replace the gear with Installer 6306-AF as shown in Figure 42.

D. Installation

1. Be sure the main bearing bores and oil seal groove

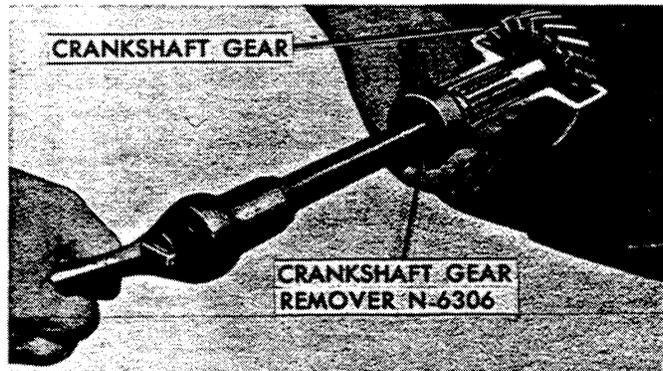


Figure 41
Removing Crankshaft Gear