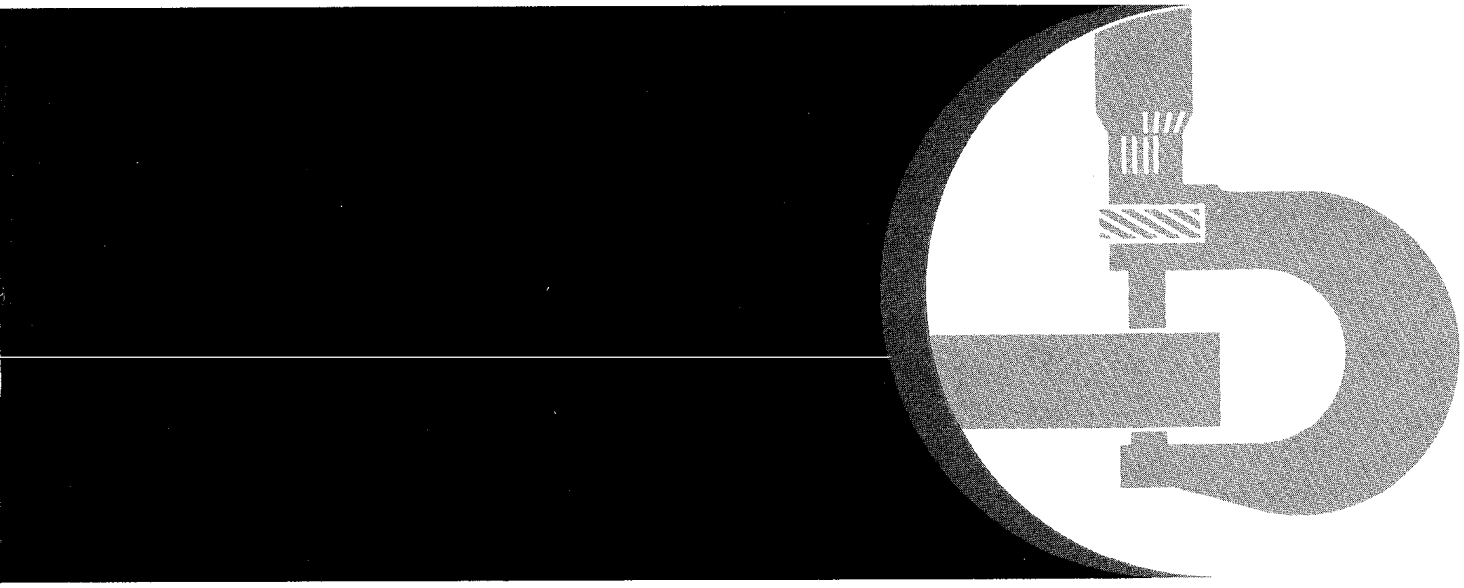
John Deere
JD302
Tractor and Loader



TECHNICAL MANUAL

TM-1089

Litho in U.S.A.

JD302 TRACTOR AND LOADER

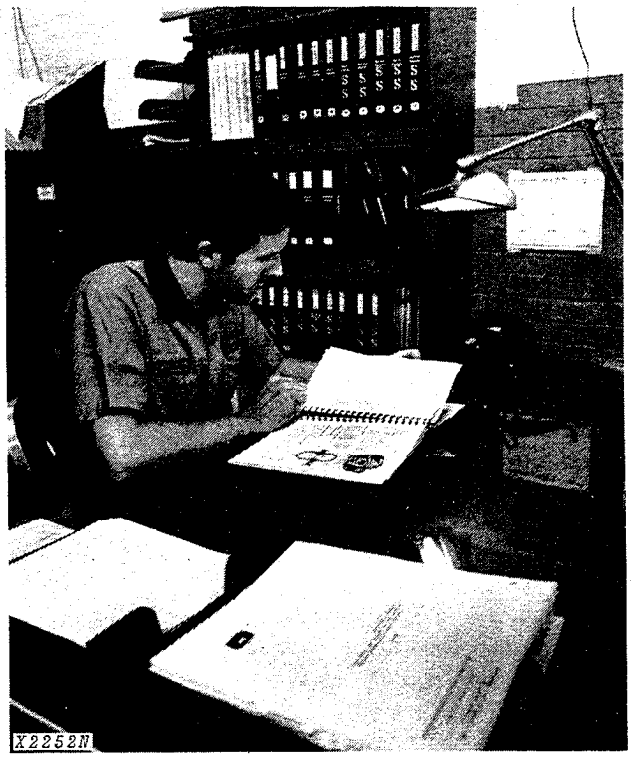
Technical Manual
TM-1089 (Dec-78)

CONTENTS

The specifications and design information contained in this manual were correct at the time it was printed. It is John Deere's policy to continually improve and update our machines. Therefore, the specifications and design information are subject to change without notice. Wherever applicable, specifications and design information are in accordance with SAE and ICED standards.

Litho in U.S.A.

INTRODUCTION



Use FOS Manuals for Reference

Use Technical Manuals for Actual Service

This technical manual is part of a twin concept of service:

The two kinds of manuals work as a team to give you both the general background and technical details of shop service.

- **FOS Manuals—for reference**

Fundamentals of Service (FOS) Manuals cover basic theory of operation, *fundamentals* of trouble shooting, *general* maintenance, and *basic* types of failures and their causes. FOS Manuals are for training new personnel and for reference by experienced technicians.

When service personnel should refer to a FOS Manual for more information, a FOS symbol like the one at the left is used in the TM to identify the reference.

- **Technical Manuals—for actual service**

Technical manuals are concise service guides for a *specific* machine. Technical manuals are on-the-job guides containing only the vital information needed by an experienced service technician.

This technical manual was planned and written for you—an experienced service technician. Keep it in a permanent binder in the shop where it is handy. Refer to it whenever in doubt about correct service procedures or specifications.

Some features of this manual:

- Inside front cover - "Table of Contents" and "Maintenance Without Accident"
- Section 10 - General specifications and services.
- Sections 20 through 60 - Removal, repair, testing (components removed), installation, and adjustment.
- Section 70 - Detailed explanation of system operation, diagnosis, visual inspection, testing, and adjustments.
- Specifications grouped and illustrated at the end of each section.
- Inside rear cover - Index.

Litho in U.S.A.

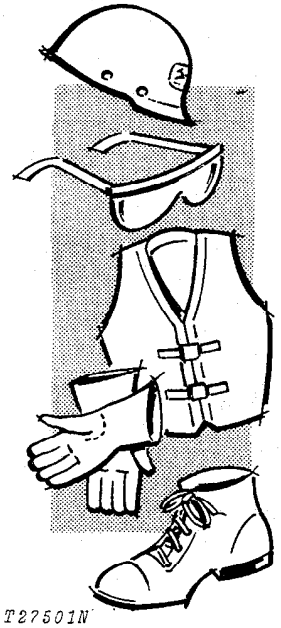
MAINTENANCE WITHOUT ACCIDENT

WORK SAFELY

T27999N

This safety alert symbol identifies important safety messages in this manual and on the tractor. When you see this symbol, be alert to the possibility of personal injury and carefully read the message that follows.

EVERY EMPLOYER HAS A SAFETY PROGRAM. KNOW WHAT IT IS!



T27501N

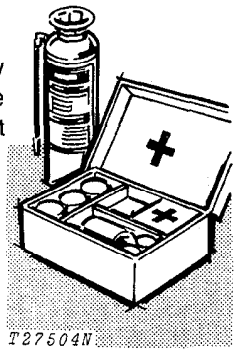
Consult your shop foreman for specific instructions on a job, and the safety equipment required.

For instance, you may need: Hard hat, safety shoes, safety goggles, heavy gloves, reflector vests, ear protectors, respirators.

T27502N

BE ALERT!

Plan ahead—work safely—know how to use a first-aid kit and a fire extinguisher—and where to get aid and assistance.



T27504N

Maintenance Area

Make sure the maintenance area is adequately vented.

Keep maintenance area CLEAN AND DRY. Oily and wet floors are slippery; greasy rags are a fire hazard; wet spots are dangerous when working with electrical equipment.

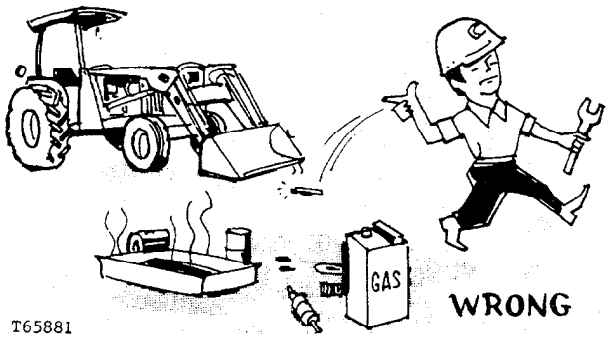
Store starting aids in a cool and well-ventilated place, out of the reach of unauthorized personnel.

Litho in U.S.A.

MAINTENANCE WITHOUT ACCIDENT

AVOID FIRE HAZARDS—

Fuel Is Dangerous!



T65881

Don't smoke while refueling.

Don't smoke while handling highly flammable material.

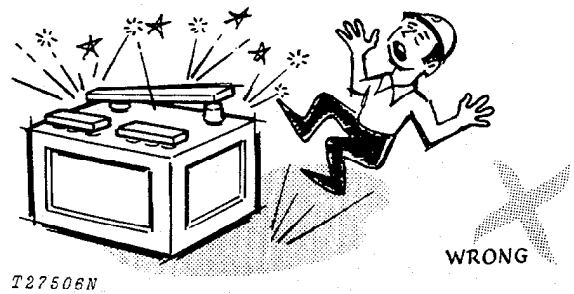
Engine should be shut off when refueling.

Use care in refueling if the engine is hot.

Don't use open pans of gasoline or diesel fuel for cleaning parts. Good commercial, nonflammable solvents are preferred.

Battery Gas Is Highly Flammable!

Provide adequate ventilation when charging batteries.



T27506N

Don't check battery charge by placing metal objects across the posts.

Don't allow sparks or open flame near batteries.

Don't smoke near battery.

Flame Is Not a Flashlight!

NEVER USE OPEN FLAME AROUND THE MACHINE.

KNOW WHERE FIRE EXTINGUISHERS ARE KEPT!

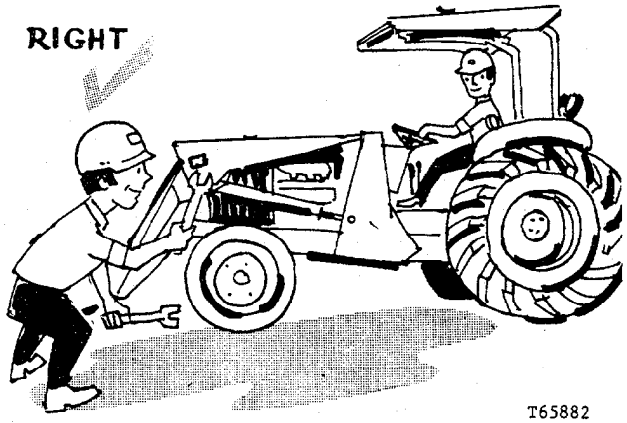
UNDER ALL MAINTENANCE CONDITIONS—

Do not perform any work on the equipment unless authorized to do so. Then be sure you know the safe and proper procedure.

Follow recommended procedures.

Never service the equipment while it is being operated.

Avoid working on equipment with the engine running.



T65882

If it is necessary to make checks with the engine running, **ALWAYS USE TWO** service technicians—one, the operator, at the controls, the other checking within sight of the operator.

KEEP HANDS AWAY FROM MOVING PARTS

Support all raised equipment.

Never work under raised bucket.

Lower bucket to ground.

If the machine is on an incline, block it securely.

Use hoisting equipment for lifting heavy parts.

TAKE CARE! WATCH OUT FOR OTHER PEOPLE IN THE VICINITY

Wear safety glasses when drilling, grinding, or hammering metal.

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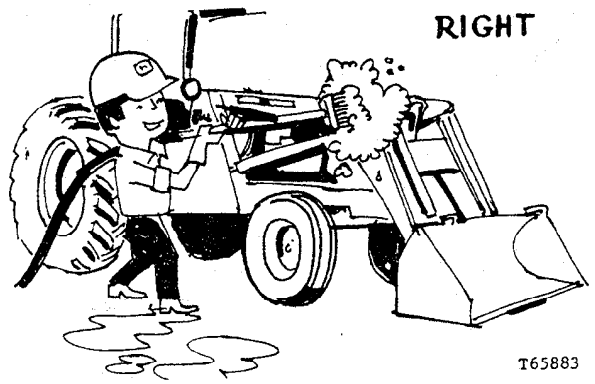
SERVICING PRECAUTIONS



Keep ALL equipment free of dirt and oil.

Be sure to clean any oil, grease, mud, ice, or snow from floor of operator's compartment and stepping points.

When preparing the engine for storage, remember that inhibitor is volatile and therefore dangerous. Seal and tape openings after adding the inhibitor. Keep container tightly closed when not in use.

Don't remove the radiator cap until coolant temperature is below the boiling point. Then loosen cap slowly to the stop to relieve pressure before removing.

Periodically check exhaust system for excessive leakage.

Relieve hydraulic pressure before working on hydraulic system: shut off engine, lower bucket to ground, and move control levers and steering wheel until no response is felt.

When checking hydraulic pressure, be sure to use the correct test gauge.

PRECAUTIONS DURING REPAIR

Before working on hydraulic system relieve hydraulic pressure.

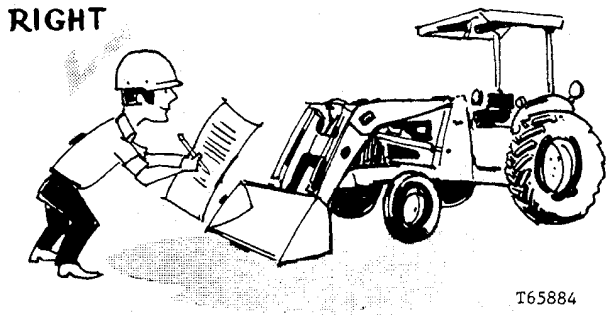
Before repairing the electrical system, or performing a major overhaul, disconnect batteries.

KNOW EQUIPMENT IS READY!

Check guards, canopies, safety guards — all protective devices installed on the unit. Every one should be in place and secure.

CHECK IT OUT!

- ☐ GUARDS
- ☐ CANOPIES
- ☐ SHIELDS
- ☐ PROTECTIVE DEVICES
- ☐ ROLL-OVER PROTECTIVE STRUCTURES
- ☐ SEAT BELTS, ETC.



Carefully inspect equipment for visual defects—leaks in fuel, lubrication, and hydraulic systems. Do not search for pressurized fluid leaks with your hands. Use cardboard or wood to search for leaks.

CYLINDER BLOCK, LINERS, PISTONS, AND RODS

REMOVAL

Remove the pistons and connecting rods noting the following:

1. Engine normally need not be removed from unit to service pistons, connecting rods, and cylinder liners. If engine has to be removed, See Group 5 of this section.
2. Do not rotate crankshaft with cylinder head removed unless all cylinder liners are bolted down. Bolt down cylinder liners before removing pistons.
3. Keep rod bearing inserts with their respective rods and caps to assure correct reassembly.
4. Each connecting rod and piston must be reinstalled in the cylinder bore from which it was removed. Observe the word "FRONT" stamped on the head of all pistons and in the rib of the diesel connecting rods. These must face toward the fan end of the engine at the time of reassembly. *Observe the "pip" marks on both the connecting rod and cap of a gasoline engine. These "pip" marks must both face towards the camshaft side of the engine at the time of assembly.*

IMPORTANT: Installing or removing connecting rod and main bearing cap screws using pneumatic wrenches may cause thread damage.

REPAIR

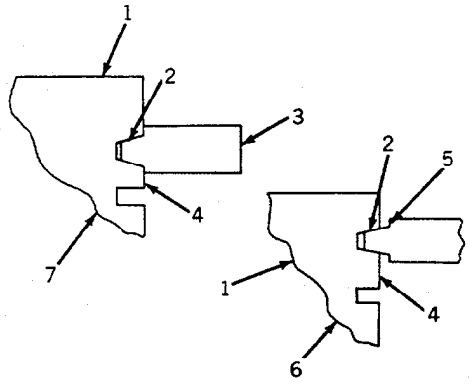
Inspect all parts and compare with "Specifications". Refer to "Basic Engine" in FOS Manual - ENGINES - for additional repair information.

Use a strong household detergent to remove all dirt and carbon from pistons. Clean carbon from piston ring grooves. Wash all parts thoroughly in cleaning solvent.

Inspect and measure piston pin, pin bore in piston, and connecting rod bushing for wear or damage. Excessive wear can cause scored pistons or broken connecting rods. Specifications are as follows:

Item	New Part	Wear Tolerance
O.D. of Pin	1.3748 to 1.3752 in. (34.920 to 34.930 mm)	0.005 in. (0.0127 mm)
I.D. of Bore	1.3753 to 1.3757 in. (34.9362 to 34.9428 mm)	0.0010 in. (0.0254 mm)
I.D. of Bushing	1.376 to 1.377 in. (34.950 to 34.976 mm)	0.0020 in. (0.0508 mm)

Use keystone ring groove wear gauge (JDE-62) as shown in Fig. 11 to measure wear to the top piston ring groove. If gauge shoulder touches ring land, the top groove is excessively worn and the piston should be replaced.



T27564

1—Piston
2—Keystone Ring Groove
3—Wear Gauge
4—Ring Land
5—Gauge Shoulder
6—Good Ring Groove
7—Worn Ring Groove

Fig. 11-Using Ring Groove Wear Gauge

Check the other two grooves for wear by inserting a new ring in the proper groove at several points around the piston. Measure clearance with a feeler gauge. If the clearance exceeds 0.008 inch (0.20 mm), replace the piston.

Check clearance between piston and cylinder liner bore to determine if replacement is necessary. Measure clearance with a feeler gauge at the bottom of piston skirt 90° to pin bore. To establish taper and out-of-round, check liner 1 inch (25.4 mm) from bottom and 1 inch (25.4 mm) from top, lengthwise and crosswise. Wear limits are as follows:

Specifications	Measurement
Liner Taper (max.)	0.0020 in. (0.051 mm)
Liner Out-of-Round (max.)	0.0020 in. (0.051 mm)
Clearance Between Liner and Piston at Bottom of Skirt (max.)	0.008 in. (0.203 mm)

Piston rings should never be reinstalled on a piston once they have been removed. Throw away old rings and replace with new ones.

Clean and inspect rods, caps, bearings, and piston pin bushings for wear or damage.

Check rod bearings for excessive wear. Use "Plastigage" or equivalent as directed by the manufacturer, if rods are connected to the crankshaft.

NOTE: The use of "Plastigage" or equivalent will determine clearance between bearing and crankshaft journal, but will not determine which surface is worn or the condition of either bearing or journal surface.

If rod is out of engine, assemble and measure the I.D. of the rod bearing, and the O.D. several places on the crankshaft rod journal. Specifications are as follows:

I.D. of Bearing	**O.D. of Journal**
2.7502 to 2.7522 in.	2.7480 to 2.7490 in.
(69.855 to 69.901 mm)	(69.799 to 69.825 mm)

Bearing Bore I.D.
2.9000 to 2.9010 in.
(73.660 to 73.685 mm)

Oil clearance should be 0.0012 to 0.0040 inch (0.030 to 0.102 mm) between rod bearings and crankshaft journals. Maximum bearing clearance is 0.006 in. (0.15 mm). Replace bearings as necessary. Undersize bearing inserts are available in 0.002, 0.010, 0.020, and 0.030 inch (0.05, 0.25, 0.51 and 0.76 mm) sizes.

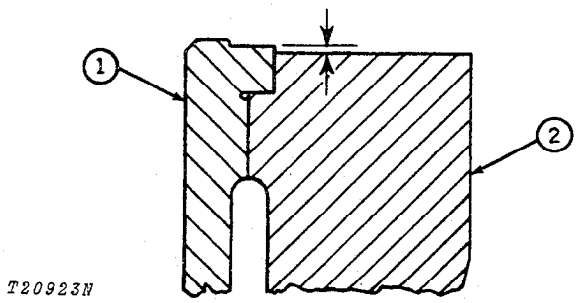
Piston pin bushing must be reamed after it is pressed into position to provide a "thumb press fit" for pin.

Clean block thoroughly with cleaning solvent or by pressure steam cleaning.

Check oil pressure regulating valve bushing in front end of block for wear or damage. If necessary, replace as directed in Group 15 of this Section.

If dipstick nipple has been removed, coat threads of nipple with joint sealing compound and install in cylinder block. Measure from block rail vertically to center of nipple end. Measurement must be 6 inches (152.4 mm) (-208266) 8 inches (203.2 mm) (208267-).

If filter base nipple is damaged remove it and press in a new nipple flush with face of bore in block. Position nipple so that threaded boss is away from side of block as far as possible.



1—Liner **2—Block**

Fig. 12-Location of Liner in Cylinder Block

When installing new cylinder liners in block, use a depth gauge to check the height of the flange on the liner in relation to the cylinder block (Fig. 12). The top of the flange should be 0.001 to 0.004 inch (0.03 to 0.10 mm) above the cylinder block with packings removed from the bottom of the liner. Check this several places around the liner to make sure the liner is seated squarely in the bore of the cylinder block.

IMPORTANT: Be sure to pull cylinder liner and reinstall all packings before final assembly.

Deglazing Cylinder Liners

Use D17003BR Cylinder Brush to deglaze the cylinder liners, but not to rebore. When the liner taper exceeds 0.002 inch (0.0508 mm) maximum or liner out-of-round exceeds 0.002 inch (0.0508 mm), the liner should be replaced.

Use a 180-grit honing stone and light pressure to produce the desired 15 to 35 micro-inch R.M.S. cylinder wall finish (Fig. 13).

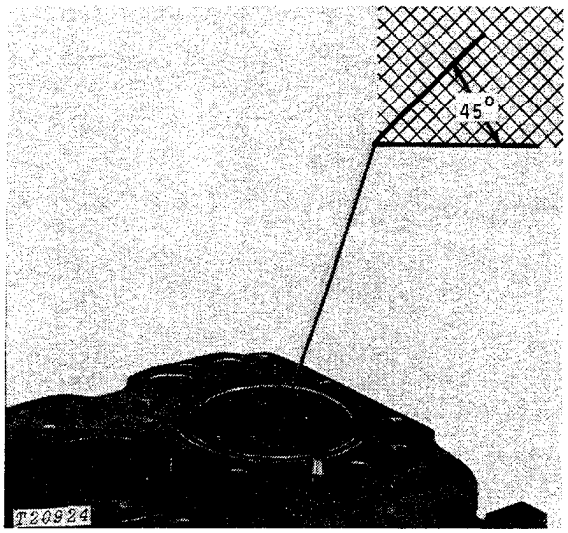


Fig. 13-Deglazing Cylinder Liner

Immediately after deglazing, clean liner bores with hot water, soap and scrub brush. Rinse cylinder liner bores with clean water until rinse water is clear. Dry liners with clean towels. Wipe bores with clean engine oil.

IMPORTANT: Solvents will not remove honing residue.

ASSEMBLY

Assembling Connecting Rod and Piston

Assemble pistons and connecting rods making sure that identification marks on piston and rod are in the same relative position as they were in at time of disassembly.

Each connecting rod and piston must be reinstalled in the cylinder liner from which it was removed.

Observe the word "FRONT" stamped on the head of all pistons and in the rib of the connecting rods. These must face toward the fan end of engine.

Coat piston pin with a light film of oil and insert into piston pin bore through connecting rod bushings and on into opposite pin bore. A properly fitted piston pin can be pressed into position with the thumb. Install new piston pin snap rings and check that rings are in grooves of piston pin bore.

Installing Piston Rings on Piston

Coat the outside of the pistons and rings with a light film of oil. Using a JDE-135 Universal Piston Ring Expander or JDE-45 Limiting Piston Ring Expander, install rings in their respective grooves.

IMPORTANT: Use of incorrect size ring expander will cause damage to rings.

1. Install the expander in the oil ring groove. Install the oil ring with dots (or "Top") facing up towards the top of the piston and position oil ring gap opposite expander (Fig. 14).

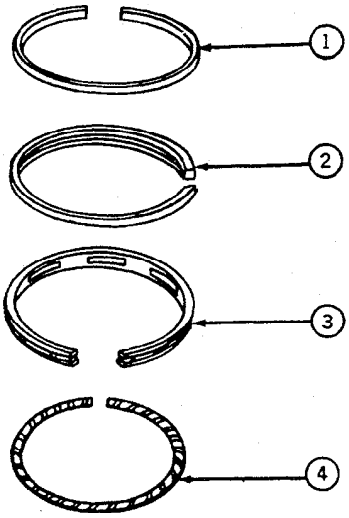
2. Install second compression ring (Fig. 14) with dots (or "Top") facing up towards the top of the piston.

3. Install the first compression ring with dots (or "Top") facing up towards the top of the piston.

4. Be sure rings move freely in their grooves.

NOTE: If rings are not marked, install with either side up.

Gasoline and diesel engines use same ring sets for service replacement.



T20925N

1—1st Comp. Ring
2—2nd Comp. Ring
3—Oil Ring
4—Oil Ring Expander

Fig. 14-Ring Installation

INSTALLATION

Installing Cylinder Liners

Before installing liners it is important to make sure the counterbore, under the liner flange at top is completely free from dirt or nicks.

Carefully install a new, dry black, rectangular packing over the bottom end of the cylinder liner. Slide packing firmly against the shoulder of the liner, making sure the packing is not twisted or crimped.

Dip cylinder bore O-ring into John Deere Soap Lubricant (AR54749) or equivalent and install red O-ring in upper groove and black O-ring in lower groove in cylinder block. Check that O-rings do not protrude outside the grooves and are not twisted.

Coat the liner packing, seating area of the liners, and new cylinder bore O-rings with John Deere Soap Lubricant (AR54749) or equivalent.

NOTE: If you suspect that a packing may have sheared or displaced during lowering into position, the liner and packing assembly should be removed and examined.

Work liners gently in place as far as possible by hand. Finish seating liners by placing a wood block over upper end and tapping block lightly with hammer.

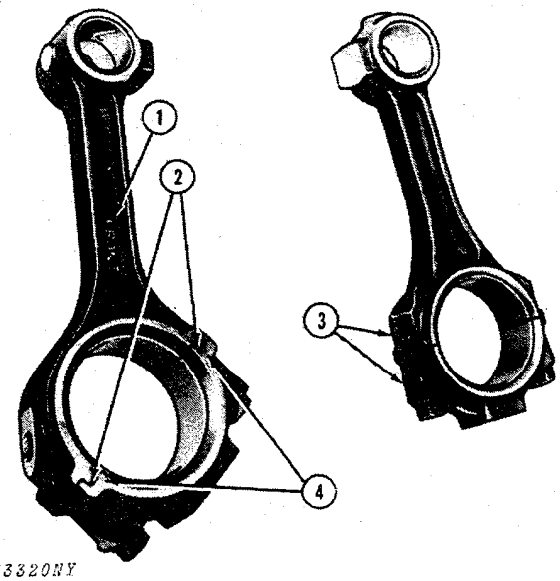
Cylinder liner will protrude over the top of the cylinder block more than normal due to the uncompressed packing.

Clean cylinder liner bores with waterless hand cleaner after installation in block. Wipe dry with clean towels. Coat cylinder liner bores with engine oil just before installing pistons.

Installing Pistons

Use short cap screws and large flat washers to retain liners in position while pistons are installed.

Install top piston ring with gap above one end of piston pin and stagger ring gaps before installing them in cylinder liners.



T63320NY

1—"FRONT"
2—Tangs
3—"PIP"
4—Slots

Fig. 15-Connecting Rods

Be sure the word "FRONT" stamped on the head of the pistons faces toward the fan end of the engine before installing them in liners. On diesel connecting rods, be sure the word "FRONT" faces toward the fan end of engine. On gasoline connecting rods, be sure the "pip" mark faces toward the fan end of engine.

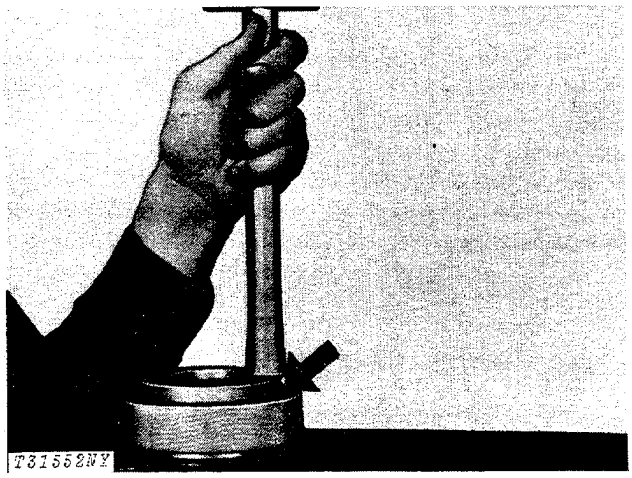


Fig. 16-Installing Pistons, Using JD271 Compressor

Use special compressor tool JD-271 to install pistons (Fig. 16).

Apply light-weight oil to the bearing inserts and crankshaft rod journals.

IMPORTANT: Installing or removing connecting rod and main bearing cap screws using pneumatic wrenches may cause thread damage.

Dip connecting rod cap screws in oil and tighten to 65 lb-ft (9 kg-m) for diesel and 45 lb-ft (6.2 kg-m) for gasoline.

Installing Oil Pan

Apply Permatex No. 3 Sealing Compound or equivalent to oil pan gasket and cylinder block pan surface.

Tighten oil pan-to-cylinder block and timing gear cover cap screws with 35 lb-ft (4.84 kg-m).

Engine Break-In

Refer to specifications and perform the break-in steps to insure proper run-in of new parts during the first hours of a rebuilt engine. (See Group 40 of this section).

CRANKSHAFT, MAIN BEARINGS, AND FLYWHEEL

REMOVAL

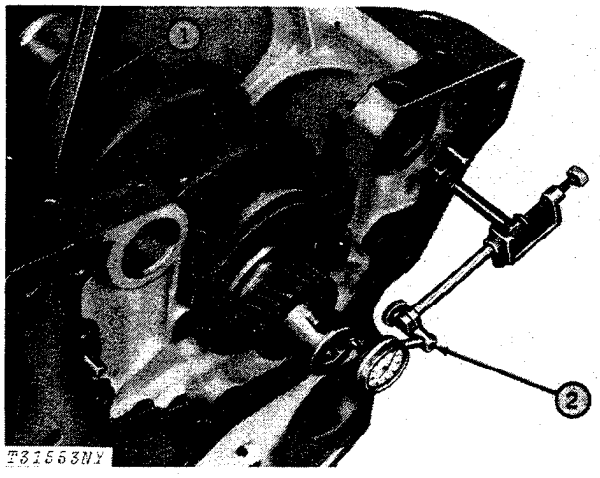
To service crankshaft, main bearings and flywheel, it is necessary to remove engine from the unit (see Group 5 of this section).

Remove oil pan, timing gear cover, starting motor, flywheel, and pistons.

REPAIR

Checking Crankshaft End Play

Measure crankshaft end play and determine if it is within 0.0020 to 0.0080 inch (0.0508 to 0.2032 mm). End play exceeding this specification indicates a worn thrust bearing. However, a maximum end play of 0.0150 inch (0.381 mm) is acceptable.



1—Pry Bar **2—Dial Indicator**

Fig. 17-Checking Crankshaft End Play

Crankshaft and Flywheel

Examine clutch friction surface on flywheel for heat check or roughness.

CAUTION: Oil fumes or oil can ignite above 380°F (193.3°C). Use a thermometer and do not exceed 360°F (182.2°C). Do not allow a flame or heating element to be in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

Examine flywheel ring gear for wear or damage. If new gear is needed, heat gear evenly (to not more than 360°F [182.2°C]) and install hot, with chamfered edge of teeth toward front of flywheel.

Check clutch pilot bearing for wear or tight spots. To install new pilot bearing, pack with high temperature grease (AT30408) and drive in (shielded side out) to bottom of bore. Reinstall snap ring if used.

Check crankshaft gear for wear or damage. To replace, remove gear with knife edge puller. To install, heat gear to approximately 360°F (182.2°C) (do not overheat), place Woodruff key in keyway and support crankshaft under first throw while pressing on gear.

Inspect crankshaft journals. Dress journals with fine emery cloth as needed.

Check thrust surfaces on thrust bearing journals to make sure they will not damage the thrust bearing flanges.

Check each journal with a micrometer at several points to determine if journal is out-of-round by more than 0.0030 inch (0.0762 mm) or if tapered more than 0.0010 inch (0.0254 mm) per inch (25.4 mm) of journal length.

Excessively eccentric or tapered journals will give an uneven clearance between journal and bearing insert. Regrind such journals and use the proper undersize bearing inserts.

Note O.D. of journals for later use to determine clearance between journal and bearing insert.

Main Bearings

Examine all main bearings for wear, scoring, or damage.

Check main bearing caps for identifying numbers. If there are no numbers, stamp corresponding numbers in one oil pan rail and in main bearing cap. Stamp the number in each main bearing cap off center to the same side as the number in the oil pan rail. This will assure correct indexing of main bearing caps during installation.

Check thrust bearing thrust surfaces to confirm that thrust bearing wear was the cause for excessive crankshaft end play.

On diesel engines, remove piston cooling orifices from main bearing webs and check for damage or clogging. Repair or replace as necessary. Install orifices and tighten with 85 to 110 lb-in (0.98 to 1.27 kg-m).

Main Bearing Clearance

If the crankshaft is out of the engine block, check main bearing clearance by measuring I.D. of the bearing halves assembled in the block. Compare with the crankshaft journal O.D. measurements to determine clearance. Specified new part diameters and clearance are as follows:

O.D. of main bearing journal	3.1230 to 3.1240 in. (79.3242 to 79.3496 mm)
I.D. of main bearing (assembled)	3.1256 to 3.1276 in. (79.390 to 79.441 mm)
Bearing to journal clearance	0.0016 to 0.0046 in. (0.041 to 0.117 mm)
Main bearing bore I.D.	3.3250 to 3.3260 in. (84.455 to 84.480 mm)

A maximum clearance of 0.0060 inch (0.152 mm) is acceptable.

Clearance can be determined with the use of "Plastigage" or equivalent while the main bearings are assembled on the crankshaft. Follow the instructions supplied by the manufacturer.

NOTE: If the engine is still in the tractor, use a light jack to raise the crankshaft against the upper half of the bearing. Keep all caps tight except the bearing being checked. Do not turn crankshaft.

The use of "Plastigage" or equivalent will give bearing clearance, but will not reveal whether wear is on the crankshaft journal or on the bearing.

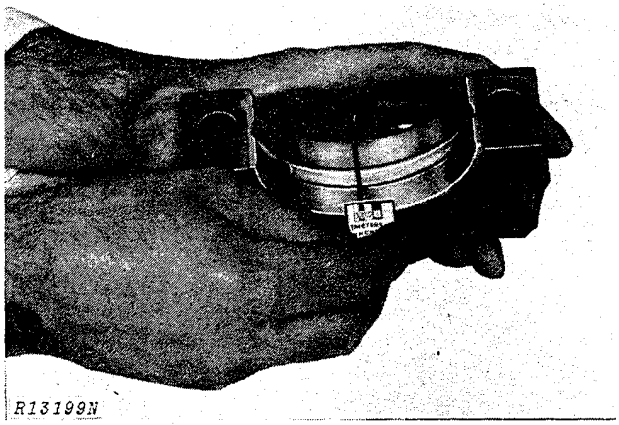
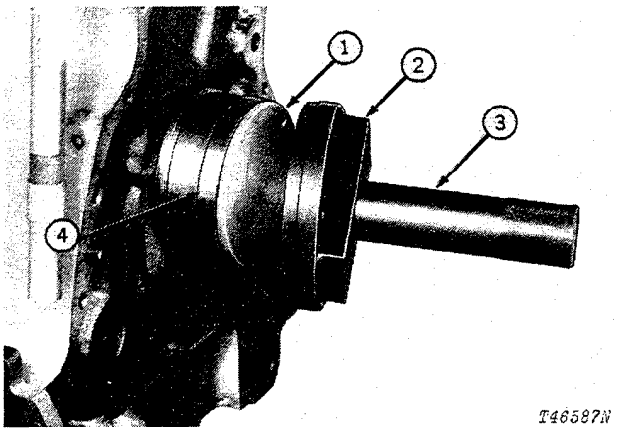


Fig. 18-Determining Main Bearing Clearance

If bearing clearance exceeds wear tolerance, replace with new undersize bearings or regrind the crankshaft. Be sure to use the proper undersize bearings, 0.002, 0.010, 0.020 and 0.030 inch (0.05, 0.25, 0.51 and 0.76 mm) undersize bearings are available.

To remove old seal wear ring from crankshaft, scribe lines across wear ring with the aid of a dull chisel until ring can be removed. **IMPORTANT: Do not scribe lines too deep in wear ring, as crankshaft wear ring surface may be damaged.**

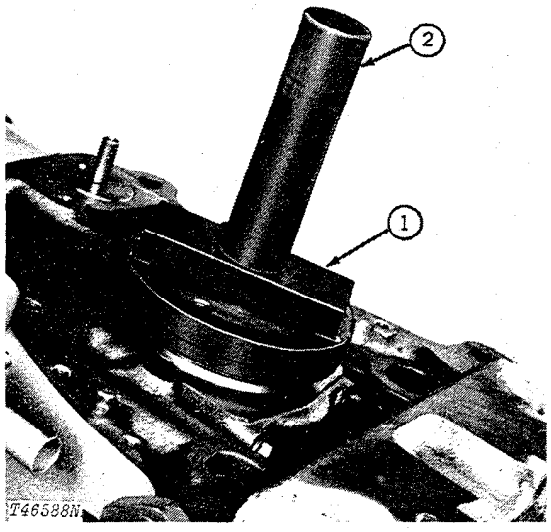


1—JD-251-2 Pilot Plate
2—JD-297-1 Driver
3—27489 Handle
4—Wear Ring

Fig. 19-Positioning Wear Ring

It is not necessary to use the JD-251-2 Pilot Plate or 27489 Handle to install a new wear sleeve. However, these tools help in installation (Fig. 19).

If the JD-251-2 Pilot Plate is used, it must be removed once the wear sleeve is started so the JD-297-1 Driver will bottom on the crankshaft to properly seat the wear ring.



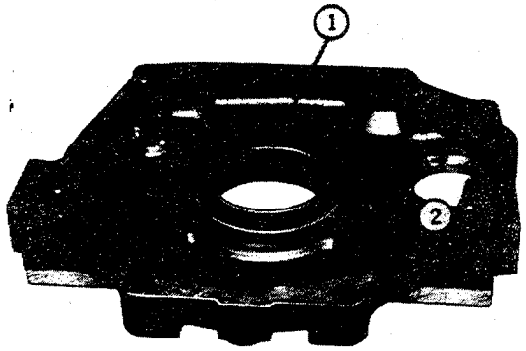
1—JD-297-1 Driver
2—27489 Handle

Fig. 20-Installing Crankshaft Seal Wear Ring

Slide new wear ring (rounded edge of ring outward) over JD-251-2 Pilot Plate (if used) and start wear ring onto crankshaft flange by hand (avoid heavy pressure or cocking of wear ring). Place JD-297-1 Driver (1, Fig. 20) over pilot plate until it contacts wear ring. Tap driver with mallet to start wear ring. Remove pilot plate. Drive wear ring onto flange until the driver bottoms.

Do not nick or damage wear ring oil seal surface. Check crankshaft and wear ring surfaces for nicks and clean up if necessary.

Remove old oil seal from flywheel housing.



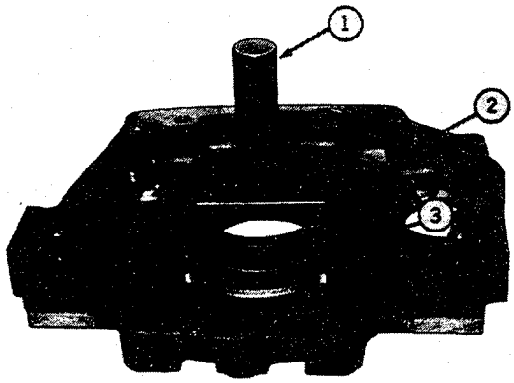
T46608N

1—JD-297-2 Pilot **2—Crankshaft Rear Oil Seal**

Fig. 21-Pilot and Oil Seal in Place

Place flywheel housing on a flat, even surface to install the oil seal.

Place JD-297-2 Pilot and oil seal in flywheel housing as shown in Fig. 21.



T46609N.

1—27489 Handle **3—Oil Seal**
2—JD-297-1 Driver

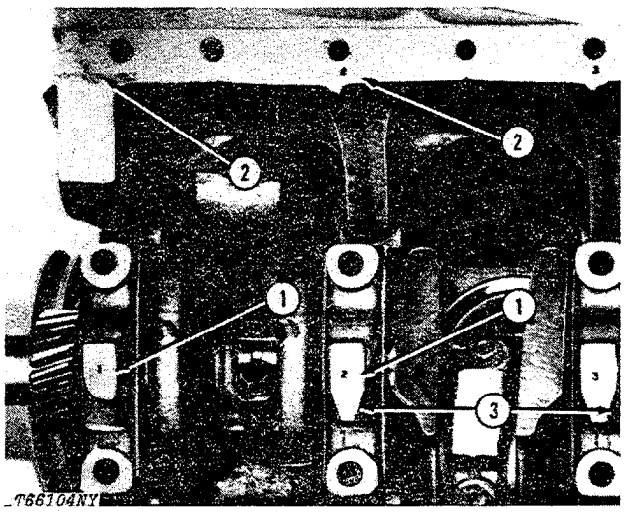
Fig. 22-Installing Crankshaft Rear Oil Seal

It is not necessary to use 27489 Handle with the JD-297-1 Driver to install the oil seal but it does help (Fig. 22).

Use a mallet to drive in the oil seal until the driver bottoms on the pilot.

Installation

Install main bearing caps with numbers corresponding to numbers in oil pan rail and to the same side as the numbers in the oil pan rail.



T66104NY

1—Number in Main Bearing Cap **3—Arrow**
2—Number in Oil Pan Rail

Fig. 23-Main Bearing Cap Positions

If numbers were stamped in main bearing caps (1, Fig. 23) at factory, install main bearing caps with numbers corresponding to numbers in oil pan rail (2). The "arrow" (3) machined on the main bearing cap number pad must point toward the cam shaft side of the cylinder block.

Install inserts with thrust faces in rear main bearing bore. Install plain inserts in other main bearing bores. Make sure that tangs on all inserts fit the locking grooves in the bores and that the oil holes in inserts line up with oil passages in the block.

Make sure bearing caps are installed on the mains from which they were removed by referring to identification marks made at the time of removal. Dip each main bearing cap screw in oil. Loosely install cap screws in main bearing caps until finger tight.

Align upper and lower thrust flanges on rear main bearings as follows: Tap the crankshaft to the rear to line up the front flanges. Then tap the crankshaft to the front to line up the rear flanges. Tighten main bearing cap screws to 85 lb-ft (11.752 kg-m).

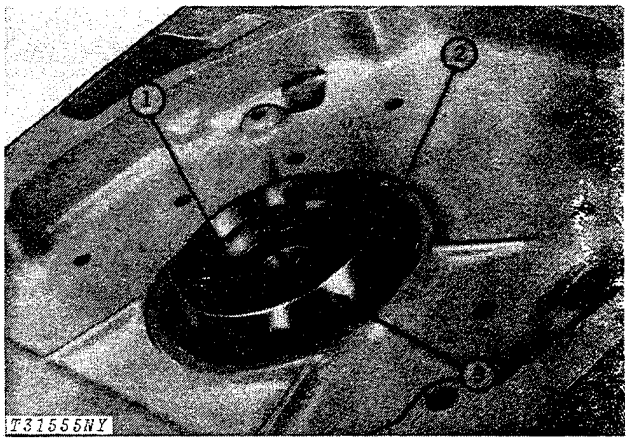
If crankshaft end play has not been checked with all repair parts installed, check it by method given on page 20-10-10. End play is 0.0020 to 0.0080 inch (0.0508 to 0.2032 mm). End play up to 0.0150 inch (0.3810 mm) is acceptable.

Position JD251-4 seal protector over rear of crankshaft and coat protector and wear ring with engine oil. Install flywheel housing on rear of engine. Be careful not to invert oil seal lip in flywheel housing. Tighten flywheel housing cap screws to 35 lb-ft (5 kg-m).

To facilitate installation of flywheel, screw two pilot studs into flywheel mounting screw holes in crankshaft.

NOTE: It is recommended that "D" grade cap screws be replaced with "F" grade cap screws and hardened washers.

Install cap screws. Tighten "D" grade cap screws to 85 lb-ft (12 kg-m). "F" grade cap screws to 120 lb-ft (18 kg-m).



1—Crankshaft **3—JD251-4**
2—Wear Ring

Fig. 24-Installing Flywheel Housing

Place crankshaft oil slinger over front end of crankshaft with inside diameter of slinger against front gear on crankshaft.

Install all other parts removed.

Install engine (See Group 5 of this section).

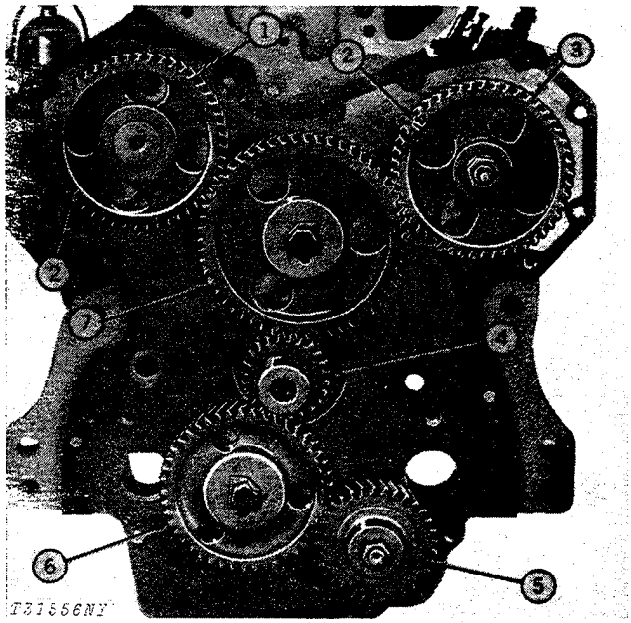
TIMING GEAR TRAIN

REMOVAL

To service gear train and related parts, with the exception of the crankshaft, engine normally need not be removed. If engine must be removed, see Group 5 of this Section.

Whenever an engine is being completely reconditioned or the crankshaft is being removed, the engine front plate with gear assemblies should be removed from the engine using the following steps:

1. Remove oil pressure regulating valve and timing gear cover.
2. Remove hex. nuts from the oil pump, drive gears and cap screws from upper and lower idler gears.
3. Remove upper and lower idler gears from engine front plate. Attach a puller to oil pump gear and pull gear from shaft. NEVER PRY GEAR FROM SHAFT.
4. Remove oil pump (Group 15).
5. On diesel engines, remove fuel injection pump and drive gear (Group 25). On gasoline engines, remove governor (Group 25).
6. Remove camshaft.



1—Camshaft Gear
2—Timing Mark
3—Injection Pump Gear (Diesel)
4—Crankshaft Gear
5—Oil Pump Gear
6—Lower Idler Gear
7—Upper Idler Gear

Fig. 25-Engine Timing Gear Train

REPAIR

For gear inspection and repair, refer to the section and group in the manual which covers the assemblies which the gears drive. The camshaft and crankshaft must be removed from the engine to replace their gears.

Checking Gear Train Backlash

Gear train noise can be an indication of excessive gear lash or damaged teeth. Check backlash before removing gears. Specified timing gear train backlash is as follows:

Gear	Backlash
Crankshaft to upper idler	0.0027 to 0.0116 in. (0.065 to 0.295 mm)
Upper idler to camshaft	0.0028 to 0.0135 in. (0.071 to 0.343 mm)
Upper idler to injection pump	0.0028 to 0.0135 in. (0.071 to 0.343 mm)
Crankshaft to lower idler	0.0027 to 0.0137 in. (0.069 to 0.348 mm)
Lower idler to oil pump	0.0016 to 0.0147 in. (0.043 to 0.373 mm)
Upper idler to governor	0.0023 to 0.0127 in. (0.058 to 0.323 mm)
Camshaft to distributor	0.0005 to 0.0075 in. (3.013 to 0.191 mm)

Replace gears as necessary.

Idler Gears

Be sure that oil hole in upper idler gear is open.

Check both idler gears for excessive end play. New part end play should be 0.0010 to 0.0070 inch (0.025 to 0.178 mm). A maximum 0.0150 inch (0.381 mm) end play is acceptable.

Measure I.D. of bushing and O.D. of shaft to determine oil clearance of 0.0015 to 0.0035 inch (0.038 to 0.089 mm). A maximum 0.0061 inch (0.1524 mm) clearance is acceptable. New bushing I.D. is 1.7520 to 1.7530 inches (44.501 to 44.526 mm). New shaft O.D. is 1.7495 to 1.7505 inches (44.437 to 44.463 mm).

If excessive wear or oil clearance is indicated, use JD-252 Bushing Driver to install new bushing flush with either side of gear.

If idler gear shaft replacement is necessary, press in new spring pins to 0.20 to 0.28 inch (5.1 to 7.1 mm) above shaft.

Front Plate and Timing Gear Cover

Never pry or press against timing gear cover with excessive force. The cover is cast aluminum alloy and might be sprung or warped.

On gasoline engines, inspect governor shaft bushing in timing gear cover for galling or excessive wear. Replace if necessary. Using tool JD-246, press in new bushing until flange on bushing contacts timing gear cover.

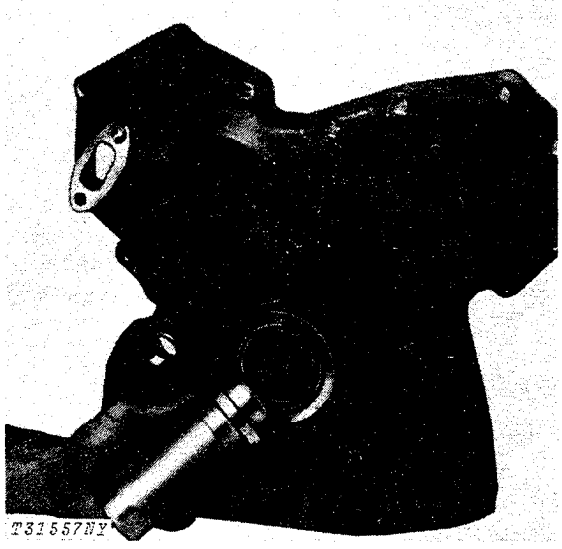


Fig. 26-Installing Oil Seal in Timing Gear Cover Using JD-250 Driver

If there is evidence of oil leakage on outside of timing gear cover, replace crankshaft front oil seal.

Coat outer surface of seal with joint sealing compound and inside surface with multi-purpose grease. Support the oil seal bore area of timing gear cover. Press in oil seal to bottom of bore with spring loaded lip facing inward using special JD-250 driver (Fig. 26).

INSTALLATION

Installing and Timing the Gear Train

The camshaft gear and injection pump gear must be timed to the crankshaft when they are installed. Install and time gear assemblies using the following steps:

1. Turn crankshaft until No. 1 piston is at top dead center (TDC) of its compression stroke. Remove timing hole cover and screw on flywheel housing. Reversing the screw, insert the smooth end into the flywheel housing bore. Rock the flywheel until the screw slides into hole in flywheel.

If engine is stripped, position crankshaft so that No. 1 (fan end) connecting rod journal is at its highest point toward the deck of the engine at this time. The keyway in the crankshaft front gear (not pulley keyway) should now point straight up toward the top of the engine.

Do not rotate crankshaft after "TDC" setting has been made.

2. Install camshaft.

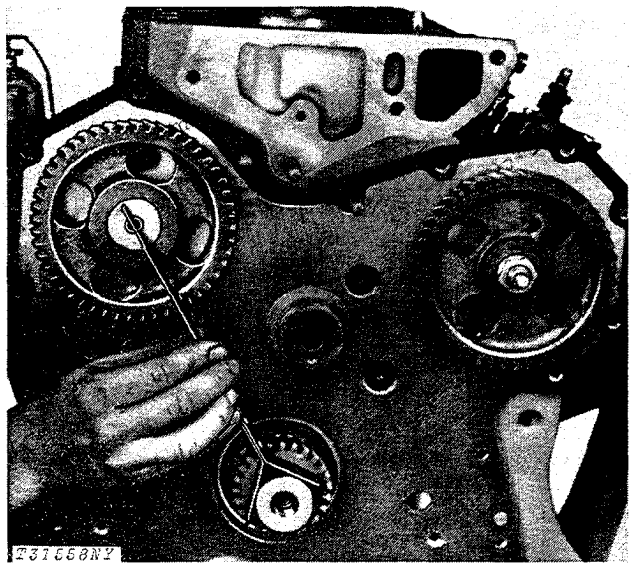


Fig. 27-Timing the Camshaft Gear with JD-254 Tool

With engine at "TDC," use special tool JD-254 to align the timing mark on the camshaft gear between centers of the crankshaft and camshaft (Fig. 27).

3. Install fuel injection pump and drive gear or governor (Group 25).

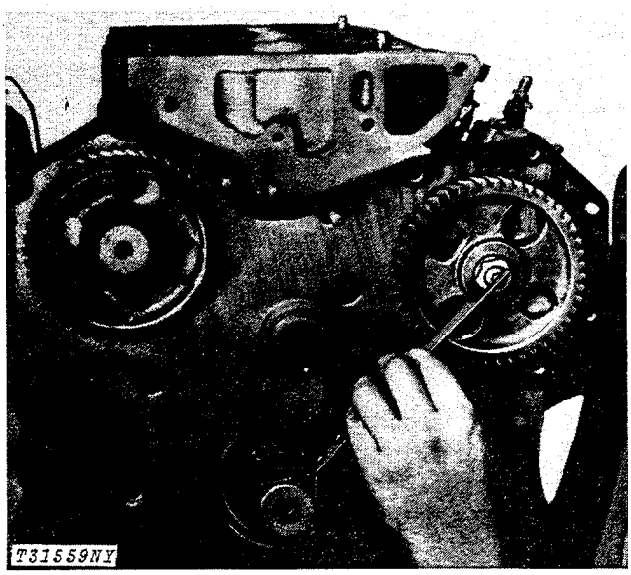


Fig. 28-Timing the Injection Pump Gear with JD-254 Tool

On diesel engines, with engine at "TDC," use special tool JD-254 to align the timing mark on the injection pump gear between centers of crankshaft and injection pump shaft (Fig. 28).

Use the timing mark on the injection pump drive gear which indicates the number of cylinders in the engine.

4. With camshaft and injection pump gear or governor installed and timed, carefully install upper idler gear into position using care not to rotate the timing gears. Be sure inner thrust washer and idler gear shaft are in place behind idler gear.

Install outer thrust washer, making sure holes in inner and outer thrust washers fit over spring pin or idler gear shaft. Install special washers and cap screw and tighten to 65 lb-ft (9 kg-m).

5. Install oil pump and drive gear (Group 15).

Tighten oil pump gear hex. nut 35 to 45 lb-ft (4.8 to 6.2 kg-m) after gears have been timed and lower idler gear installed so that gears may be restrained with a screwdriver. Then stake threads on shaft.

6. With oil pump gear installed, install lower idler gear into position, using care not to rotate any gears. Be sure inner thrust washer is in place on rear of idler gear shaft.

Install outer thrust washer, making sure holes in inner and outer thrust washers fit over spring pin in idler gear shaft. Install inner and outer special washers and cap screws and tighten to 95 lb-ft (13.1 kg-m).

After all gears are locked in place, recheck all timing marks with special tool JD-254, making sure that marks still align between the centers of the respective shafts and the center of the crankshaft with the engine at "TDC." Then remove timing screw from flywheel and install timing hole cover.

Final Installation

Apply a thin coat of high temperature grease to the inside lips of the front oil seal and install timing gear cover. Be careful not to invert lips of oil seal while installing cover.

Before installing gear cover on engine be sure that oil slinger is securely positioned over end of crankshaft with inside against gear. Also be sure oil pressure regulating valve and spring are in place under cover.

Group 15
ENGINE LUBRICATION SYSTEM

GENERAL INFORMATION

The engine lubrication system consists of the oil filter and oil pump.

The oil filter is mounted on the right side of the engine. It filters impurities out of the crankcase oil.

The engine oil pump is mounted in the oil pan. Oil enters the pump from the rear through the pump intake tube and is discharged at the oil outlet hole into an oil tube leading to the oil filter and an engine oil gallery.

A pressure regulating valve is located at the fan end of cylinder block in the oil gallery. Under normal conditions it is not necessary to adjust pressure but it can be done by adding or subtracting shims or adding a large aluminum washer behind the valve plug. When oil pressure is greater than the spring pressure, oil is bypassed to the crankcase and desired pressure is maintained.

OIL PUMP

Removal

Check engine oil pressure before removing pump (See Group 10, Section 70).

Drain oil from engine and remove oil pan.

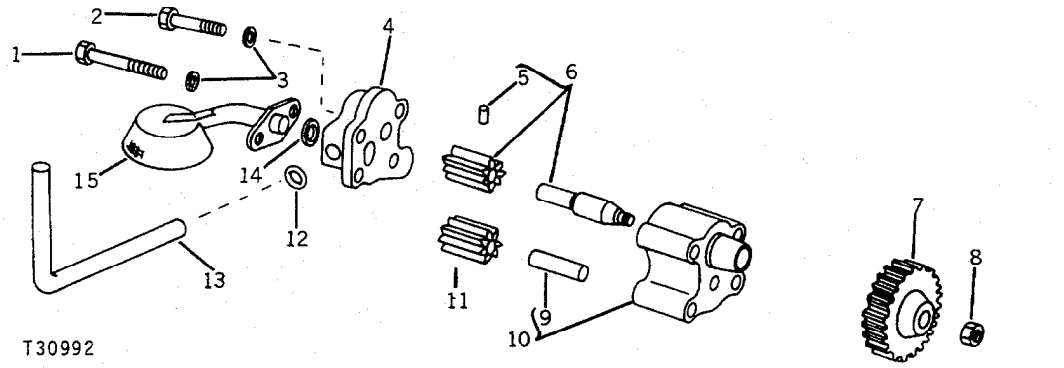
Remove cap screws holding pump to block.

Repair

Remove idler gear (11, Fig. 1) from idler shaft (19); then support housing and press out shaft.

Inspect pump housing surface which attaches to cover for rough burred or warped conditions. Replace if necessary.

Examine pump cover (4) mounting surface. A damaged cover must be replaced. The seal between cover and pump housing is dependent upon these two surfaces being perfectly flat and smooth.



1—Cap Screw (2 used)
2—Cap Screw (2 used)
3—Lock Washer (4 used)
4—Cover Assembly
5—Groove Pin
6—Drive Shaft with Gear and Pin
7—Drive Gear
8—Nut
9—Idler Shaft
10—Housing
11—Idler Gear
12—O-Ring
13—Outlet Tube
14—O-Ring
15—Oil Pump Intake

Fig. 1-Oil Pump

Examine screen on cover to be sure it is clean and the wire mesh of the screen is not damaged.

Inspect inlet and outlet tubes for clogging.

Carefully inspect pump drive shaft (6, Fig. 1) assembly for wear, especially at points of contact. Check diameter of drive shaft (0.6308 to 0.6312 inch [16.022 to 16.033 mm]) at point where it rides in bore of housing and replace if necessary. (The pump drive shaft is not available separate from the pump gear and groove pin.)

Measure width of gears (1.6203 to 1.6223 inch [41.156 to 41.206 mm]).

Install gears in housing in running position and measure radial clearance (0.0030 to 0.0060 inch [0.076 to 0.152 mm]) between gears and straightedge.

Place a straightedge across top of housing (to represent cover) and measure clearance (0.0012 to 0.0062 inch [0.031 to 0.158 mm]) between gears and straightedge.

Oil Pressure Regulating Valve

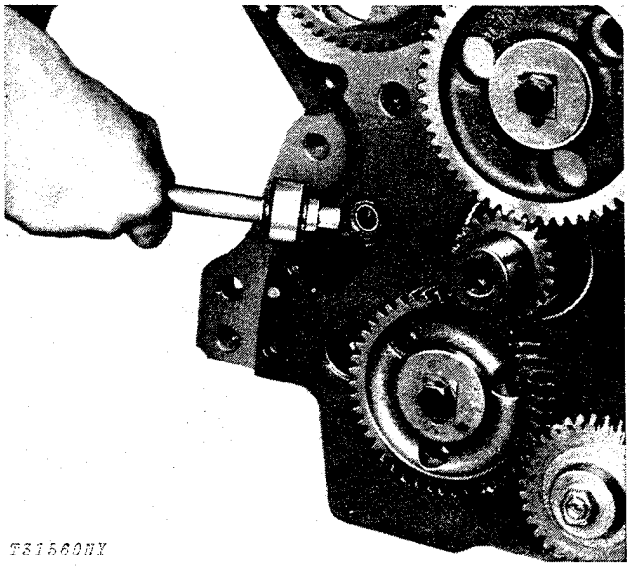


Fig. 2-Installing Pressure Regulating Valve Bushing with JD-248-A Driver

Remove oil pressure regulating plug shims (if used), spring and valve. Save any shims used for correct reassembly.

Inspect regulating valve seat in front of cylinder block for damage (especially at raised rim of bushing).

Press new bushing into block using JD248-A tool. Press in bushing until outer recessed edge of bushing is flush with bottom of counterbore in block. Do not press on raised inner rim of bushing. This rim is the regulating valve seat.

Check oil pressure regulating spring. Test length is 1.68 (42.7 mm) at 15 ± 5 lbs. (6.8 ± 2.3 kg) pressure.

Check pressure regulating valve plug threads for damage.

Assembly

Press idler shaft (9, Fig. 1) into pump housing until flush with outer surface of housing.

Place drive shaft and gear (11) in housing. Install pump idler gear on idler shaft in housing. Check to see that both gears rotate freely in housing.

IMPORTANT: Put engine oil on gears before assembling oil pump.

Install new O-ring (12) in oil outlet opening in oil pump cover.

Installation

Place pump housing with gears and drive shaft in position in engine. Install drive gear on shaft. Tighten hex. nut to 35 to 45 lb-ft (4.8 to 6.2 kg-m) and then stake nut to shaft.

Position oil pump cover and screen up against pump housing. Install pump outlet oil tube in cover. Fasten cover in place with four cap screws and lock washers. Tighten to 35 lb-ft (4.8 kg-m).

Place valve and spring in valve hole in engine timing gear cover. With an aluminum washer on valve plug and same number of shims (if used) in plug counterbore as removed, install plug in timing gear cover. This is a preliminary setting to be used until oil pressure can be checked.

Fill lubrication system with proper oil.

After installing oil pump, check engine oil pressure (see Group 10, Section 70).

ENGINE OIL FILTER

Removal

Unscrew filter element from engine and discard it. Inspect oil passages at mounting point on cylinder block for obstructions. If filter base nipple in block is damaged, refer to Group 10 of this section for replacement details.

Repair

Replace oil filter element every 200 hours of operation, or sooner if necessary.

Advise the operator to replace filter element only with a John Deere filter element supplied by his dealer.

The filter element has a special bypass valve to protect the engine in case of filter clogging.

Installation

Install new filter element. Turn element down until sealing ring just contacts mounting pad; then turn down an additional 1-1/2 turns.

Check for leaks around filter element. Retighten if necessary, but do not overtighten.