

John Deere 1020, 1120 and 1630 Tractors



JOHN DEERE

TECHNICAL MANUAL John Deere 1020, 1120 and 1630 Tractors

TM4286 (01AUG73) English

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PREDELIVERY INSPECTION – Continued

Service	Specification	Reference
TIRES AND WHEELS		
Check tire inflation pressure	. . . . .	Operator's manual
Retighten wheel bolts	. . . . .	Section 80, group 15 and Operator's manual
LUBRICATION		
Check crankcase oil level	Top mark on dip stick	Operator's manual
Check transmission-hydraulic system oil level	. . . . .	Operator's manual
Lubricate all lubrication points on the tractor	. . . . .	Operator's manual
ENGINE		
Check dry type air cleaner	. . . . .	Operator's manual
Fill fuel tank and start engine	Fuel tank capacity:	Operator's manual
1020 and 1120	62.5 liters (16.5 U.S.gals., 13.75 Imp.gals.)	
1630	74 liters (19.5 U.S.gals., 16.3 Imp.gals.)	
Check lighting system, indicator lights and instruments for proper operation	. . . . .	Operator's manual
Check if speed control linkage moves easily	. . . . .	Section 20, group 40
Check engine idle speeds	. . . . .	Section 20, group 40
Check injection timing	. . . . .	Section 30, group 15
OPERATION		
Check clutch pedal adjustment	Approx. 25 mm (1 in.) clutch pedal free travel	Section 50, group 5
Check operation of HIGH-LOW shift unit	. . . . .	Section 50, group 10
Shift transmission through all gears	. . . . .	Operator's manual
Check differential lock operation	. . . . .	Operator's manual
Check PTO operation	. . . . .	Operator's manual
Check 3-point hitch operation	. . . . .	Operator's manual
Check hydraulic system operation	. . . . .	Section 70, group 5
Check brake operation	. . . . .	Section 60, group 15

STANDARD TORQUES

Recommended torques in mkp and ft.lbs. for UNC and UNF cap screws						
Head marking (identifying strength)	 or 6.8 (6. S)*		 or 10.9 (10 K)**		 or 12.9 (12 K)***	
	Thread-O.D. (in.)	mkp	ft.lbs.	mkp	ft.lbs.	mkp	ft.lbs.
1/4	1	7	1.5	10	2	14
5/16	2	14	3	20	4	30
3/8	3	21	5	35	7	50
7/16	5	35	8	55	11	80
1/2	8	55	12	85	18	130
9/16	10	75	18	130	26	185
5/8	15	105	23.5	170	34.5	250
3/4	25.5	185	41.5	300	58	420
7/8	22****	160****	61.5	445	92.5	670
1	34.5	250	92.5	670	138.5	1000

NOTE: A variation of $\pm 10\%$ is permissible for all torques indicated in this chart.

Torque figures indicated above and in the Specifications sections of this manual are valid for non-greased or non-oiled threads and heads unless otherwise specified. Therefore, do not grease or oil bolts or cap screws unless otherwise specified in this manual.

- * Regular bolts and cap screws
- ** Tempered steel high strength bolts and cap screws
- *** Tempered steel extra high strength bolts and cap screws
- **** Bolts and screws 7/8 in. and larger are often formed hot rather than cold, which accounts for the lower torque.

SPECIAL TOOLS

Part No. when ordering from		Description	Use
JD Parts Depot	Manufacturer		
19.58-90-578		Special adapter	Checking compression
19.58-90-260*		Special tool	Checking oil pressure

* Details see section 70, group 5

Move selector lever in position "L" (load control) so that the control linkage roller slides along the cam of the control arm when removing the rockshaft.

Attach engine lifting eye No. JD 244-2 to top of rockshaft housing.

Remove rockshaft attaching screws (see arrows in fig. 9). Lift rockshaft assembly off transmission case by means of a hoist.

Take care not damage both rear harnesses.

NOTE: After removing rockshaft, cover transmission case to prevent foreign particles from falling into the transmission.

INSTALLATION

Use a new gasket between transmission case and rockshaft. Make sure dowels in transmission case and seal ring of oil inlet passage are installed.

Move selector lever in position "L" so that the control linkage with roller can be slid over the cam.

Lift rockshaft on transmission case, using a suitable hoist.

If equipped: connect oil return line 2 (fig. 9) of selective control valve to rockshaft housing.

Connect lines to quick couplers.

Tighten rockshaft attaching screws to the specified torque.

Connect cable of start safety switch.

Connect both rear wire harnesses to rockshaft. Install transmission shield on transmission case.

Attach lift links to lift arms. Install operator's seat.

For adjustment of rockshaft see section 70, group 20.

IMPORTANT: Connect ground straps to negative (-) poles of batteries.

TORQUES FOR HARDWARE

Front support to engine, cap screws		
front cap screws (4 used)	23.5 mkp	170 ft.lbs.
rear cap screws (2 used)	18.0 mkp	130 ft.lbs.
Hydraulic pump drive shaft, clamping screw	4.4 mkp	32 ft.lbs.
Drag link to bell crank or steering arm, slotted nut*	7.7 mkp	55 ft.lbs.
Clutch housing to engine, cap screws	23.5 mkp	170 ft.lbs.
Oil pan to clutch housing (1630 only), cap screws	23.5 mkp	170 ft.lbs.
Clutch housing to transmission, cap screws	11.7 mkp	85 ft.lbs.
Retainer securing hydraulic lines to clutch housing, cap screw	4.5 mkp	32 ft.lbs.
Final drive housings to transmission case, cap screws	11.7 mkp	85 ft.lbs.
Roll guard to final drive housings, securing bracket, hex. nuts	13 mkp	94 ft.lbs.

* *NOTE: If cotter pin cannot be inserted when tightening to the specified torque, turn nut to next slot and secure with cotter pin.*

After having reconditioned valve insert bores in cylinder head, dip replacement inserts into liquid nitrogen and freeze to -30°C (-22°F). Place inserts into cylinder head bores, maintaining a pressure of 100 kp (220 lbs.) on each insert for one minute, to ensure that inserts do not "creep" out when warming up.

Install exhaust valves and check measurement "a" (fig. 3). If an exhaust valve recess measurement is not within specifications, remove valve and grind valve seat to dimensions (see Specifications).

Replace valve stem caps, if necessary.

Valve Springs

Check tension of valve springs.

Valve springs may have different free lengths, however, they must have the same length when compressed at the specified load.

Rocker Arm Shaft Assembly

Make sure that all oil bores in the rocker arm shaft, rocker arms and the adjusting screws are clear. Thoroughly clean cavities of rocker arm supports. This is especially important for the rear support through which the oil passes to the rocker arm shaft. Check all rocker arms for excessive wear on points of rocker arm contact. Check spring tension.

If a valve is replaced, the accompanying rocker arm and push rod should be replaced at the same time.

Injection Nozzle Bores

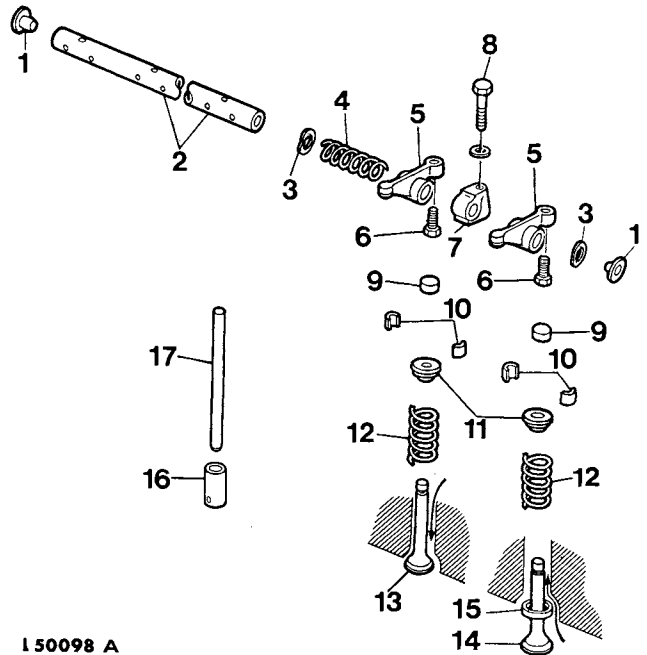
Remove carbon deposits from bores, using special tool No. JDE 39. **IMPORTANT:** Always turn the tool clockwise (also when removing) as turning it counterclockwise will dull the tool.

ASSEMBLY

Rocker Arm Shaft Assembly

Assemble the individual parts, according to fig. 5 finally placing the plug on the shaft end. Make sure rocker arms are installed in their original positions.

IMPORTANT: Make sure that oil bore in rocker arm shaft is at the side of the flywheel and facing down when assembly is installed on cylinder head.



1 50098 A

Fig. 5 — Rocker Arm Shaft Assembly and Valves, Exploded View

- | | |
|----------------------|------------------------------|
| 1 Plug | 9 Valve stem cap |
| 2 Rocker arm shaft | 10 Keepers |
| 3 Special washers | 11 Valve spring cap |
| 4 Spring | 12 Valve spring |
| 5 Rocker arm | 13 Intake valve |
| 6 Adjusting screw | 14 Exhaust valve |
| 7 Rocker arm support | 15 Exhaust valve seat insert |
| 8 Cap screw | 16 Cam follower |
| | 17 Push rod |

Lubricate all rocker arms liberally with oil and see that they move freely.

Check bushing located in front of cylinder block and provided with the sealing edge for oil pressure regulating valve, for serviceability. If necessary, remove unserviceable bushing from cylinder block and drive in a new bushing until driver contacts cylinder block, using special tools JD 248 and 813 (see fig. 2).

IMPORTANT: Do not use other unsuitable tools. Above all do not press tool against the slightly protruding inner edge of the bushing since it is a delicate sealing face.

Dowel Pins, Plugs and Studs

Check these parts for tight fit or proper sealing in cylinder block. If necessary, replace with new parts. Coat part to be inserted in cylinder block with a suitable oil and water-resistant sealant.

Threaded Bushing for Dip Stick

If the threaded bushing for the dip stick has to be replaced, coat threaded end of new bushing with an oil-resistant sealant. Thread into cylinder block as indicated under Specifications.

Fitting for Lubricating Oil Filter

If fitting has to be replaced, press in new fitting so that it is flush with the cylinder block. The threaded end should face away from the cylinder block.

CYLINDER LINERS

Measure each cylinder liner as explained below, using a suitable gauge (dimensions see Specifications):

1. Measure the liner bore parallel to the piston pin at the top end of ring travel.
2. Measure bore in same position at bottom end of ring travel.

3. Measure bore at right angles to piston pin at top end of ring travel.

4. Measure bore in same position at bottom end of ring travel.

Compare all four measurements to determine if liner has worn tapered.

If a cylinder liner is excessively worn (see Specifications), the piston, too, may be so worn that it needs replacement.

Deglazing Cylinder Liner Bores

NOTE: Remove cylinder liners and place in a suitable clamping device or in an old cylinder block for deglazing.

For deglazing cylinder liners 0.0004 to 0.0009 mm (15 to 35 micro-in.), use an 180 grit deglazing tool, a cylinder hone or a nylon cylinder brush.

Operate the tool up and down to obtain a 45-degree criss-cross pattern.



NOTE: For additional information on deglazing cylinder liners see manual: "Fundamentals of Service — Engines".

Clean cylinders thoroughly. Wipe out cylinder liners with a cloth until a clean white cloth shows no discoloration when wiped through cylinder bore.

Group 20

Crankshaft, Main Bearings and Flywheel

GENERAL INFORMATION

The crankshaft is a steel forging supported by four, replaceable aluminium, steel-backed, tinplated, main bearings.

The rear main thrust bearing has a flange on each side to support the crankshaft thrust and to limit end play.

The crankshaft is drilled for pressure lubrication to all bearings.

The flywheel ring gear engaged by the starting motor is shrunk-fit to the front of the flywheel. The flywheel has a bore for setting top dead center if the engine timing is to be adjusted.

DIAGNOSING MALFUNCTIONS

See group 5 for diagnosing malfunctions.

REMOVAL

For removal of engine, see section 10, group 25.

NOTE: Check crankshaft end play by means of a dial indicator prior to removal. If end play is excessive, reduce play by installing a new thrust bearing.

Remove starting motor.

Remove engine clutch, flywheel and flywheel housing. Place engine on assembly stand.

Remove cylinder head (see group 10).

Remove oil pan and oil pump (see group 30).

Remove pistons and connecting rods (see group 15).

NOTE: As a rule, pistons and connecting rods will have to be removed. However, removal is not required if only the crankshaft is to be lifted out of the cylinder block.

Remove timing gear cover and gears as well as cylinder block front plate (see group 25).

Remove oil slinger from front of crankshaft.

Remove crankshaft.

REPAIR



NOTE: For additional information see "Fundamentals of Service, Engines" manual.

CHECKING FLYWHEEL AND HOUSING

Inspect flywheel ring gear for serviceability and tight fit on flywheel. Check if flywheel seat, dowel bore and ball bearing are in proper condition. Inspect flywheel friction face contacting driven disk for heat cracks and rough spots.

Prior to installing new oil seal, coat outer surface of seal with an oil-resistant sealing compound. Press in oil seal until it bottoms in bore. The spring-loaded lip of the seal should face the timing gears. Use special tools No. 815 and JD 250.

IMPORTANT: When installing oil seal, support timing gear cover to prevent distortion.

INSTALLATION

NOTE: If engine has been completely disassembled, install crankshaft before installing cylinder block front plate.

Coat side of front plate gasket facing cylinder block with a film of "PERMATEX Type 3", "TEROSON Atmosit", "COLLEX Aviation" or "HERMETIC HERMALEX".

IMPORTANT: Cut off protruding edge of gasket only after timing gear cover has been tightened. Tighten front plate attaching screws to the specified torque (see Torques for Hardware).

INSTALLATION AND ADJUSTMENT OF TIMING GEAR TRAIN

Align timing marks of camshaft and injection pump gears with center of crankshaft after having installed them. Install and adjust timing gears as follows:

1. Install camshaft (see group 10).
2. Rotate crankshaft clockwise (seen from radiator) until piston No. 1 (radiator side) is at TDC. Insert timing pin (8 mm = 0.32 in. dia. and a minimum length of 80 mm = 3.15 in.) in bore of flywheel housing and flywheel.

NOTE: With the engine disassembled, rotate crankshaft so that piston No. 1 bearing journal is in its top position facing the cylinder head. In this position the keyway of the crankshaft gear faces exactly upward (cylinder head side).

IMPORTANT: Do not rotate crankshaft after having determined TDC.

3. Install oil pump and oil pump gear (see group 30).

NOTE: Tighten hex. nut of pump shaft only after timing gears have been adjusted and lower idler gear has been installed so that the gear pair can be blocked by means of a clean rag.

4. Install fuel injection pump and gear (see section 30).

5. With the crankshaft set at TDC (see step 2), align timing mark stamped onto camshaft gear (see "b", fig. 3) with center of crankshaft as shown in fig. 3, using timing tool No. JD 254.

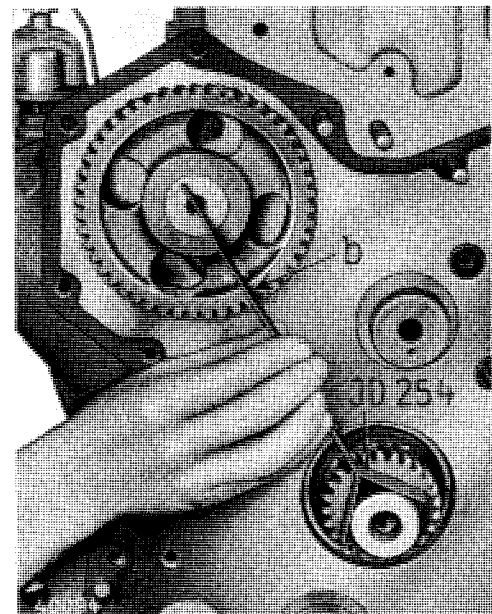


Fig. 3 — Timing Camshaft Gear by means of Timing Tool No. JD 254

b Timing mark

6. With the crankshaft set at TDC (see step 2), align timing mark (see "c", fig. 4) stamped onto injection pump gear with center of crankshaft as shown in fig. 4, using timing tool No. JD 254. **IMPORTANT:** Use timing mark indicating number of cylinders on respective engine.

Group 35

Engine Cooling System

GENERAL INFORMATION

COOLING SYSTEM

The pressure cooling system includes mainly the radiator, the water pump, the multi-blade fan and the thermostat.

The pump draws cooled water from the radiator and pumps it through a passage integral with the pump housing to the cylinder block. After the coolant has passed the cylinder liners, it flows through the cylinder head to the thermostat housing where the thermostat is located. With the engine hot, the thermostat is open and the coolant returns to the radiator. If the engine has not yet reached operating temperature, the thermostat remains closed; the coolant flows from the manifold through a by-pass hose back into the water pump (suction side). In this case it only circulates through the engine and the pump. This way the coolant temperature is automatically regulated by the thermostat. For observing the coolant temperature, a temperature gauge is provided on the dash.

RADIATOR

The radiator is of the conventional design with cooling tubes through which the coolant passes and with soldered exterior cores.

The filler neck of the radiator is provided with a filler cap with built-in relief valve.

THERMOSTAT

The thermostat is located in a housing attached to the cylinder head and is available in several types to suit different operating conditions. These thermostats open at different temperatures of the coolant (see Specifications).

WATER PUMP

The coolant is circulated by means of a centrifugal-type pump which is mounted on the front of the cylinder block. The pump is driven by a V-belt which also drives the alternator and the fan. The pump shaft runs in a pre-lubricated special bearing. The pump housing is sealed against the bearing with a seal ring. If this seal ring leaks, water escapes through a bore in the pump housing (see "a", fig. 1).

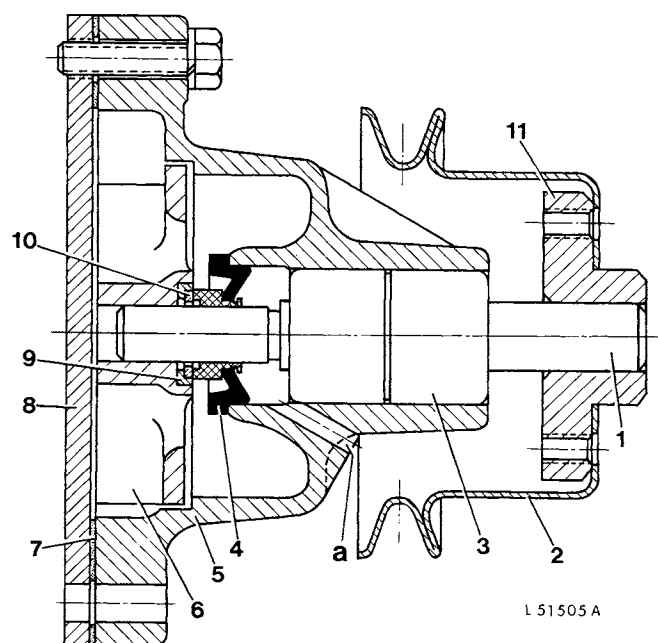


Fig. 1 — Water Pump, Sectional View

- | | |
|----------------------|-----------------------|
| 1 Pump shaft | 8 Cover |
| 2 V-belt pulley | 9 Rubber cup |
| 3 Pump shaft bearing | 10 Ceramic washer |
| 4 Seal ring | 11 Fan securing plate |
| 5 Pump housing | a Leakage hole |
| 6 Impeller | |
| 7 Gasket | |

Make all speed adjustments in the order shown below.

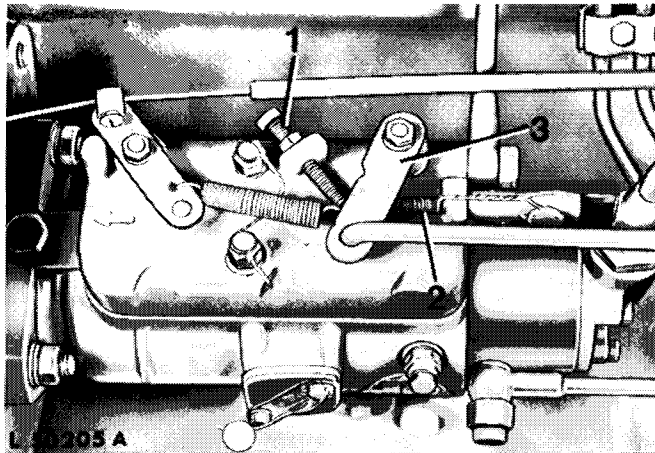


Fig. 5 — ROTO DIESEL Injection Pump, Installed

- 1 Slow idle adjusting screw
- 2 Fast idle adjusting screw
- 3 Pump throttle lever

1. Disconnect speed control rod at injection pump.

2. Move pump throttle lever 3 (fig. 5) against pump fast idle adjusting screw 2.

Now engine speed should be 2650 rpm.

If this is not the case, adjust pump fast idle adjusting screw 2 for fast idle and lead-seal screw.

3. Move pump throttle lever in slow idle position against slow idle adjusting screw 1. Engine speed should now be 650 rpm. If not, adjust screw 1 accordingly.

Adjusting Hand Throttle

4. Make sure speed control rod is still disconnected from pump throttle lever. Move hand throttle first clockwise and then counterclockwise to the stop. Adjust length of rod to match pump throttle lever position where it just starts to increase engine speed. Lengthen rod two turns and connect to pump throttle lever.

5. Move hand throttle clockwise to the stop (fast idle speed). The engine speed should now be 2650 rpm.

If this is not the case, adjust fast idle stop screw 2 (fig. 4) located in stop 12 (fig. 4) of dash accordingly.

Adjusting Foot Throttle

6. Depress foot throttle until it contacts the footrest. Engine speed should now be 2650 rpm.

If not, adjust effective length of foot throttle rod 6 (fig. 4) accordingly.

Adjusting Shut-Off Cable

7. Completely push in shut-off knob and make sure there is no gap between shut-off lever of pump and its stop. If shut-off lever is not in contact, disconnect steel cable at injection pump and pull slightly rearward so there will be a gap between the knob and the retainer fastened to the dash.

Push pump shut-off lever by hand against the stop and attach steel cable. To check, run engine until hot. Pull out shut-off knob as far as possible and make sure engine stops quickly.

SPECIFICATIONS

Low idle speed	650 rpm.
Fast idle speed	2650 rpm.

Group 15

ROTO-DIESEL Fuel Injection Pump

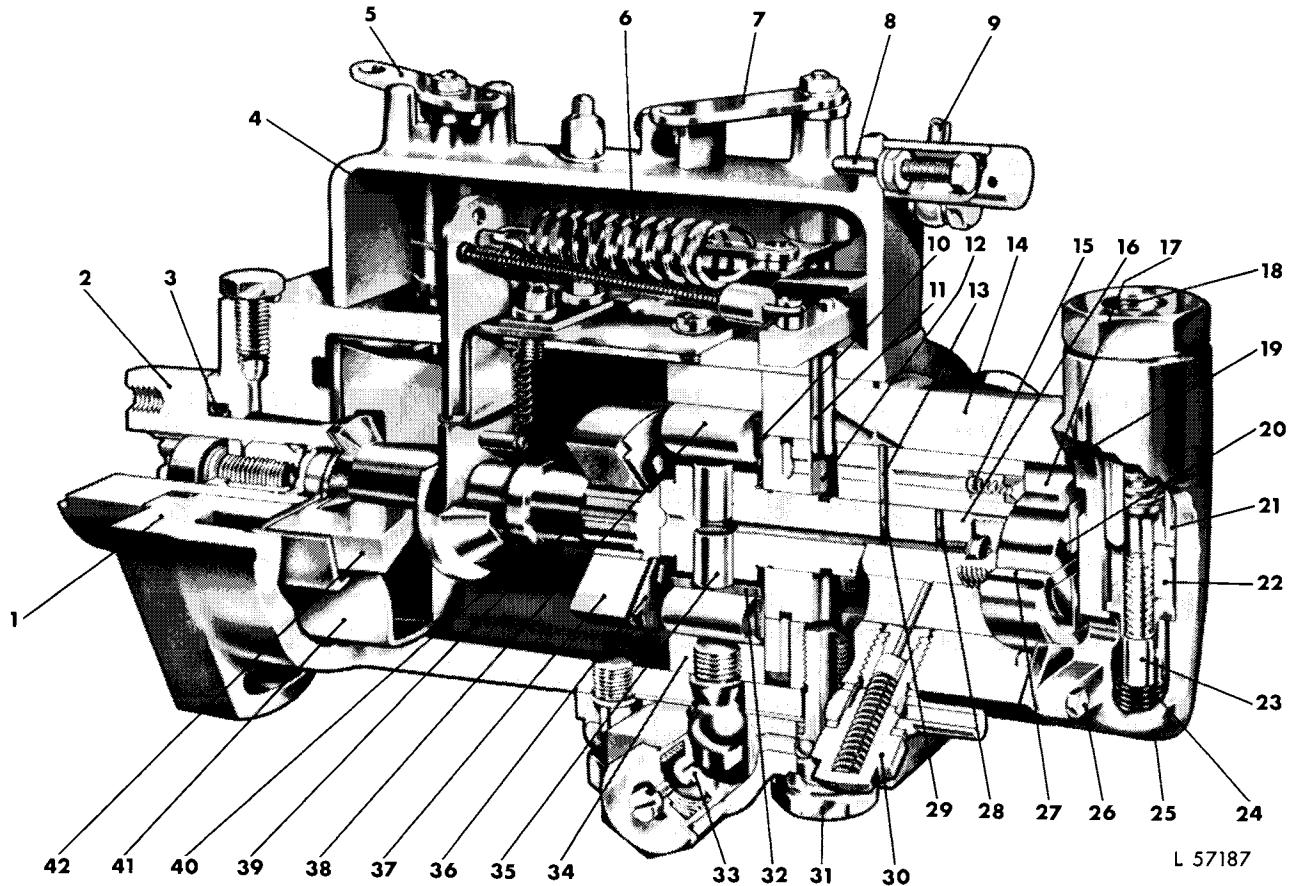


Fig. 1 — ROTO DIESEL Injection Pump

- | | | |
|---------------------------------|---|---|
| 1 Pump housing | 16 Pump and distributor rotor | 30 Pressurizing valve (one for each cylinder) |
| 2 Drive hub | 17 Eccentric sleeve of transfer pump | 31 Hollow screw |
| 3 Seal ring | 18 Fuel inlet | 32 Race |
| 4 Governor housing | 19 Seal | 33 Automatic hydraulic speed advance |
| 5 Shut-off lever | 20 Rotor of transfer pump | 34 Cam ring |
| 6 Governor spring | 21 Filter | 35 Plunger |
| 7 Speed control lever | 22 Pressure regulating valve sleeve | 36 Front adjusting plate |
| 8 Fast idle adjusting screw | 23 Pressure regulating valve piston | 37 Drive plate |
| 9 Leak-off line | 24 Bleed spring | 38 Cam roller |
| 10 Rear adjusting plate | 25 End plate | 39 Pump shaft |
| 11 Metering valve | 26 Cap screw | 40 Internal chamber of pump housing |
| 12 Metering valve chamber | 27 Rotor blades of transfer pump | 41 Governor cage |
| 13 Metering channel | 28 Distributor channel | 42 Flyweights |
| 14 Pump head | 29 Radial bore (one bore for each cylinder) | |
| 15 Internal recirculation valve | | |

IMPORTANT: Do not use screw drivers or similar tools for this as they might damage the injection nozzle irreparably.

As long as the carbon stop seal is in good condition, no carbon deposits will form in the cylinder head bore and the injection nozzle can therefore be removed without using a tool.

REMOVAL OF THE FUEL PRESSURE LINES

NOTES

Carefully clean fuel pressure lines, injection nozzles and injection pump externally before removing lines to prevent dirt entering the nozzles and pump through the exposed openings. Plug the openings immediately with caps or plugs. Each fuel pressure line is fitted to the injection pump and nozzle free of tension. Consequently, do not bend lines when removing them, as this reduces their durability. Before removing one or all fuel pressure lines, remove the two clamps.

IMPORTANT: When loosening the union nut of the fuel pressure line, hold male union firmly.

TESTING AND INSPECTION

TESTING INJECTION NOZZLE IN ENGINE

Allow the engine to run at high speed under no load. Loosen the fuel pressure line at one of the injection nozzles (so that the fuel escapes at the line connection and is not forced through the nozzle). If there is no change in the engine's speed, it is a sign that this particular nozzle is not in order. Repeat test consecutively at each of the remaining nozzles.

Remove faulty nozzle and check thoroughly by means of a nozzle tester.

EXTERNAL CLEANING OF AN INJECTION NOZZLE

NOTE: Before testing an injection nozzle with a nozzle tester, remove both sealing rings and thoroughly clean the outside of the injection nozzle.

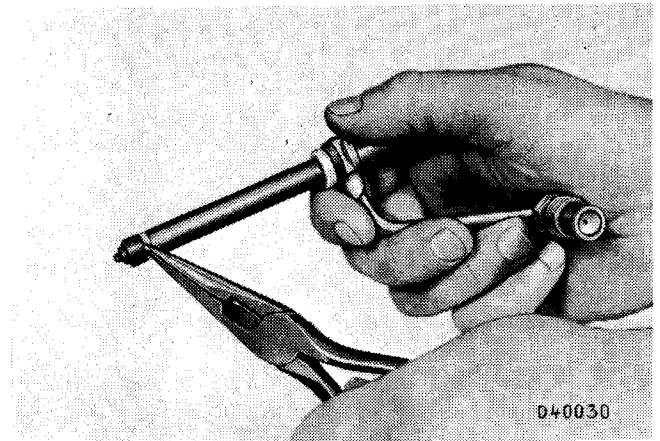


Fig. 5 — Removal of Carbon Stop Seal

Remove carbon stop seal from the groove in the nozzle body, using suitable pliers (see fig. 5). Pull seal washer from the nozzle body and discard carbon stop seal and seal washer.

Place the injection nozzle in solvent or clean Diesel fuel until the accumulated deposits are saturated. Clean the body and tip in particular, up to the groove for the carbon stop seal, with brass wire brush No. 16488 provided with special injection nozzle cleaning kit, using ample Diesel fuel or solvent. NEVER USE A STEEL WIRE BRUSH OR A SCRAPER FOR THIS PURPOSE.

IMPORTANT: When removing the sealing rings and when cleaning the nozzle, take care not to damage the Teflon coating of the nozzle body above the groove for the carbon stop seal.

SPECIAL TOOLS

Part No. when ordering from		Description	Use
JD Parts Depot	Manufacturer		
.....	65-030 D**	BACHARACH nozzle tester.....	Testing injection nozzles
.....	EFEP 60 A	BOSCH nozzle tester.....	Testing injection nozzles
1958-90.577	.....	Pressure line.....	Injection nozzle to BOSCH tester
L 48544	JDE 38*	Sliding hammer puller.....	Removing nozzles
L 48545	JDE 39*	Cleaning tool.....	Cleaning cylinder head bores for nozzles
L 48546	16494*	1 set of tools.....	Servicing nozzles
L 48554	16487*	Magnifying glass.....	Checking nozzle parts
L 48555	16475*	Special holding fixture.....	Clamping complete nozzle in a vise
L 48557	16485*	5 nozzle cleaning wires..... (0.28 mm = 0.011 in. dia)	Cleaning nozzles
L 48568	16476*	2 Sac hole drills.....	Cleaning nozzle sac hole bore
L 48569	16482*	Scraper.....	Cleaning nozzle valve seat
L 48570	16490*	Honing stone.....	Flattening nozzle cleaning wires
.....	16544*	Felt cleaning pad (not available individually).....	Cleaning nozzle valves
L 48571	16483*	Pin vise.....	Holding nozzle cleaning wires
L 48572	16504*	Screwdriver.....	Adjusting needle stroke
L 48573	16488*	Brass wire brush.....	Cleaning nozzle parts
L 48574	16481*	Valve retractor.....	Pulling nozzle valve
L 48576	16478*	Special adapter for torque wrench	Tightening lock nuts of adjusting screws
L 48577	16492*	Connector.....	Injection nozzle to BACHARACH tester
L 48578	16489*	1 can of special lapping compound	Lapping nozzle valve in nozzle body
L 48531	16477*	.....	.....
.....	JD 258*	Pilot tool.....	Installing carbon stop seal
.....	16493*	Tool kit case (not available individually).....	Tool storage

* SERVICE TOOLS INC., 1901 INDIANA AVENUE, CHICAGO, ILLINOIS 60616, USA

** BACHARACH INDUSTRIAL INSTRUMENT CO., 200 NO. BRADDOCK Ave., PITTSBURGH 8, PA., USA

Quick Check: Disconnect wire at both ends; connect new length of wire to both terminals, install fuse, switch on circuit, and watch fuse for a few minutes. If it does not blow, install the new cable which should have at least the same gauge as the original (s. wiring diagram), using the necessary insulation and cable holders. Remove possible corrosion from fuse box contacts or replace fuse box.

Fuses with corroded ends should be replaced.

KEY SWITCH

When checking the key switch, ensure that connected circuits are in good condition (see wiring diagram).

NOTE: Take out switch key in position "O" or "P" only.

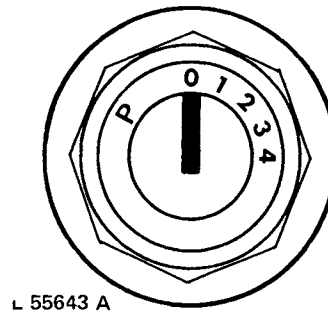


Fig. 3 — Key Switch — Positions

<i>Switch Key Position (see fig. 4)</i>	Components Receiving Current
<i>Key in position "O"</i>	No current, except for horn, socket for handlamp, and hazard warning lights (if equipped)
<i>Key turned clockwise to position "1"</i>	Horn, socket for handlamp, hazard warning lights (if equipped), fuel gauge, oil pressure indicator lights and alternator indicator light, air cleaner restriction indicator light, start safety switch, starter button, turn-light switch, flasher, tractor and trailer turn signal lights, tractor and trailer turn signal indicator lights, stop light switch and stop lights
<i>Key turned clockwise to position "2"</i>	As in position "1"; in addition: coolant temperature gauge (lamp), fuel gauge (lamp), speed-hour meter (lamp); both clearance lights, both tail lights of tractor and trailer; rear work light
<i>Key turned clockwise to position "3"</i>	As in position "1"; in addition: coolant temperature gauge (lamp), fuel gauge (lamp), speed-hour meter (lamp), both clearance lights, both tail lights of tractor and trailer, dim headlights; rear work light
<i>Key turned clockwise to position "4"</i>	As in position "3", the only difference being: headlights switched to full beam and full-beam indicator light on
<i>Key turned counter-clockwise to position "P" (parking position)</i>	Horn, socket, hazard warning lights (if equipped), coolant temperature gauge (lamp), fuel gauge (lamp), speed-hour meter (lamp), both clearance lights, both tail lights of tractor and trailer, rear work light.

NOTE: If switch terminals are faulty (e.g. lights are weak or flicker on and off), install a new key switch.

Group 15

Sealed-Beam Lighting System

(Earlier Tractor Models)

Important Notes

1. With the engine running, do not short or ground (even momentarily) alternator and regulator terminals.
2. If the tractor is to be operated for a short time without battery (using a slave battery for starting), do not, under any circumstances, interrupt the circuit by switching off the key switch before stopping the engine by means of the fuel pump shut-off cable. Further it is recommended to use additional current (lights) while engine is running. Insulate battery end of disconnected starter cable properly to avoid damage to alternator and regulator.
3. Connect batteries or battery charger in the proper polarity. If they are improperly connected, the rectifier diodes will be immediately destroyed.
4. Before carrying out electric welding repairs on the tractor, remove three-terminal plug from alternator and disconnect red cable at alternator terminal "B+". Connect ground terminal of welding apparatus directly to the part being welded.

General Information

SYSTEM

The electrical system is a 12-volt negative grounded system.

The charging system has a 14-volt alternator with a separate regulator (see group 25 of this section).

The starting system has a 12-volt starting motor with solenoid switch (see group 20 of this section). The starting motor has a totally enclosed shift lever and a roller type overrunning clutch.

BATTERIES

Tractors are equipped with two 12-volt batteries connected in parallel. The batteries are located in front of the dash and under an access door.

The negative poles of the left-hand and right-hand batteries are each grounded by means of a ground strap attached to the cowl.

The positive pole of the left-hand battery is connected to the positive pole of the right-hand battery by means of the battery cable to the starting motor.

The red wire to the key switch is connected to the positive pole of the left-hand battery.



NOTE: For additional battery information see "Fundamentals of Service — Electrical Systems" manual.

CONTROLS AND INSTRUMENTS

Most of the controls and instruments are located in the dash (see fig. 1).

Other controls are located as follows: Engine oil pressure warning switch in the flywheel housing; fuel gauge sending unit in the fuel tank; air cleaner restriction warning switch in air cleaner outlet manifold; transmission oil pressure warning switch in transmission oil filter by-pass valve; start safety switch in rockshaft housing and an outlet socket (for handlamp) below the operator's seat on rockshaft housing.

Group 16

Sealed Beam Lighting System

(Later Tractor Models)

Important Notes

1. With the engine running, do not short or ground (even momentarily) alternator and regulator terminals.
2. If the tractor is to be operated for a short time without battery (using a slave battery for starting), do not, under any circumstances, interrupt the circuit by switching off the key switch before stopping the engine by means of the fuel pump shut-off cable. Further it is recommended to use additional current (lights) while engine is running. Insulate battery end of disconnected starter cable properly to avoid damage to alternator and regulator.
3. Connect batteries or battery charger in the proper polarity. If they are improperly connected, the rectifier diodes will be immediately destroyed.
4. Before carrying out electric welding repairs on the tractor, remove three-terminal plug from alternator and disconnect red cable at alternator terminal "B+". Connect ground terminal of welding apparatus directly to the part being welded.

General Information

SYSTEM

The electrical system is a 12-volt negative grounded system.

The charging system has a 14-volt alternator with a separate regulator (see group 25 of this section).

The starting system has a 12-volt starting motor with solenoid switch (see group 20 of this section). The starting motor has a totally enclosed shift lever and a roller type overrunning clutch.



NOTE: For additional information see "Fundamentals of Service — Electrical Systems" manual.

BATTERIES

Tractors are equipped with two 12-volt batteries connected in parallel. The batteries are located in front of the dash and under an access door.

The negative poles of the left-hand and right-hand batteries are each grounded by means of a ground strap attached to the cowl.

The positive pole of the left-hand battery is connected to the positive pole of the right-hand battery by means of the battery cable to the starting motor.

The red wire to the circuit breaker is connected to the positive pole of the left-hand battery.



NOTE: For additional battery information see "Fundamentals of Service — Electrical Systems" manual.

CONTROLS AND INSTRUMENTS

Most of the controls and instruments are located in the dash (see fig. 1), including thermostart aid button (if equipped).

Other controls are located as follows: Circuit breaker under the cowl; engine oil pressure warning switch in the flywheel housing; fuel gauge sending unit in the fuel tank; air cleaner restriction warning switch in air cleaner outlet manifold; transmission oil pressure warning switch (on tractors with HIGH-LOW shift unit) in transmission oil filter by-pass valve; start safety switch in rockshaft housing and an outlet socket (for handlamp) behind the operator's seat on rockshaft housing.

COMMUTATOR

The commutator may be turned down to a minimum O.D. of 39.5 mm (1.555 in.). After initial surface turn-down, use a commutator saw to undercut insulation appr. 0.5 to 0.8 mm (0.02 to 0.03 in.) and give final polish.

Maximum permissible out-of-roundness of commutator is 0.03 mm (0.0012 in.), and that of the armature plates 0.05 mm (0.002 in.).

Check for good soldering joints between commutator segments and lugs.

Recheck again for grounding or a short circuit.

FIELD FRAME

Check field windings for a grounded circuit. Testing voltage: 40 volts, a.c.

Check field windings for open circuit. Test lamp voltage: 6-12 volts, d.c.

Replace burnt or damaged windings.

Replacing windings

Mark position of pole shoes and end of windings

Place field frame in a suitable clamping device, such as Bosch EFAW 9.

Place pole shoe screwdriver with suitable blade in spindle of clamping device.

Insert pole shoe screwdriver in screw slot and tighten guide tube.

Loosen pole shoe screws.

Clean frame and pole shoes thoroughly in a solvent and dry by means of compressed air.

A mandrel is necessary when reinstalling the windings. Manufacture a mandrel to measurements given in fig. 7.

Slightly warm windings.

Insert coils with pole shoes in field frame and enter pole shoe screws. Note markings made before disassembly.

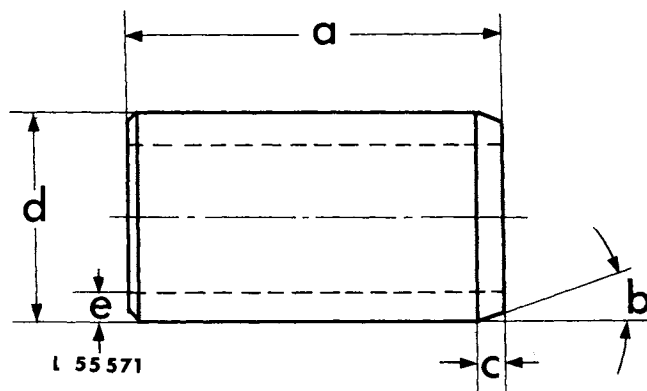
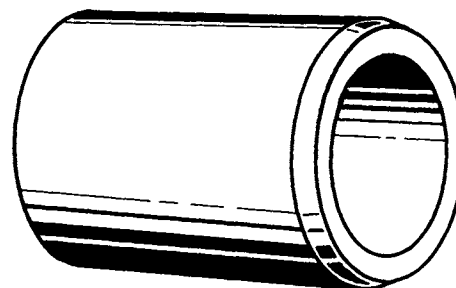


Fig. 7 — Mandrel for Field Windings

- a 85 mm (3.346 in.)
- b 5° Chamfer
- c 12 to 14 mm (0.472 to 0.551 in.)
- d 75.80 to 75.85 mm (2.9842 to 2.9862 in.)
- e 12 to 15 mm (0.472 to 0.590 in.)

Press suitable mandrel (see fig. 7) between the pole shoes.

Place field frame in a clamp.

Tighten pole shoe screws securely and remove mandrel by means of a suitable press.

Check installed windings for grounds or open circuit.

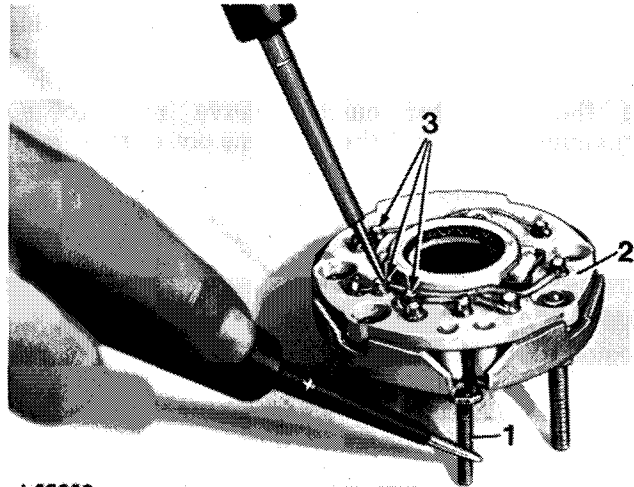
COMMUTATOR END FRAME

Test insulated brush holders for grounds. Test voltage: 40 volts, a.c.

Brushes should move freely so they can follow the commutator. Minimum brush length is 15.5 mm (0.625 in.). Replace if necessary.

Replace springs which are damaged or show evidence of overheating. Install new springs correctly. Brush spring tension should be 1.0 to 1.3 kp (35 to 46 ounces) as brush spring leaves brush holder.

Testing Exciting Diodes

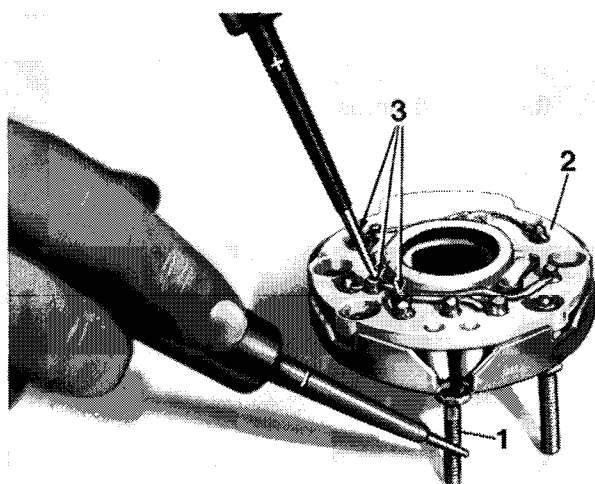


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Fig. 13 — Testing Exciting Diodes (Positive Test Point on "D+", Negative Test Point on Diode Lead)

- 1 Connection "D+"
- 2 Diode plate
- 3 Diode leads

Testing of exciting diodes is carried out in a similar manner to that of testing positive diodes (see page 5 of this group), the only difference being that positive or negative test points are placed on connection "D+" instead of connection "B+" or the positive heat sink of the diode plate (see figs. 13 and 14). All other test phases are identical.



I 52860

Fig. 14 — Testing Exciting Diodes (Negative Test Point on "D+", Positive Test Point on Diode Lead)

- 1 Connection "D+"
- 2 Diode plate
- 3 Diode leads

Whenever a fault is discovered on a diode, the complete diode plate must be replaced.

ASSEMBLY

For assembly of alternator, reverse steps explained under "Disassembly".

When assembling the diode plate to the end frame, be sure connection "B+" and "D+" as well as the positive diode heat sink opposite the end frame are properly insulated.

When soldering the stator windings onto the diode plate, make sure no solder is running onto the diode plate and avoid overheating of diodes.

When fitting the drive end frame over the rotor shaft, use a sleeve to apply pressure to the thrust washer and/or the bearing cone. Never apply pressure to the drive end frame.

Coat bearing seat of end frame with a high temperature grease such as Bosch Ft 70 v 1. Place bearing spring washer inside the end frame and carefully assemble rotor and drive end frame to the stator and slip ring end frame, aligning the marks made during disassembly.

Tighten drive end frame-to-end frame screws to specified torque (see "Torques for Hardware").

Cautiously insert brushes and/or brush bracket and be sure diode plate contact spring is in proper contact with the brush bracket.

Install fan and belt pulley. Tighten belt pulley hex. nut to specified torque (see "Torques for Hardware").

Secure capacitor to alternator housing and cable to terminal "B+" of alternator.

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REPAIR

DRIVEN DISKS

Check all rivets and facings on driven disks for serviceability. Facings should be smooth, even and free of grease and oil, nor should they be glazed.

If any rivets or facings are loose or if facings are excessively worn (see Specifications), replace defective disk. Check each disk for distortion. Inspect disk splines for wear and damage.

PRESSURE PLATES AND BASE PLATE

Check friction faces of pressure plates and base plate for wear and flatness by means of a feeler gauge and a true square (see Specifications for wear tolerance). Replace pressure plates or base plate if scored or otherwise damaged.

FLYWHEEL AND PILOT BEARING

See section 20, group 20 for checking and repair of flywheel and pilot bearing.

DIAPHRAGM SPRING

Check diaphragm spring for heat cracks or distortion. Do not hesitate to replace spring if operation is doubtful.

RELEASE PINS AND OPERATING BOLTS

Check release pins and operating bolts for wear on contact faces. Check threads of operating bolts for wear.

RELEASE LEVERS

Check front faces of release levers for wear and pitting.

LOOP SPRINGS

Inspect loop springs for rusty spots, fatigue and distortion. Replace, if necessary.

ASSEMBLY

When assembling, observe the following:

Coat the indicated faces and bores of the following parts with MOLYKOTE BR 2 grease:

The sides of the three lugs of front pressure plate 3 (fig. 6) and rear pressure plate 5, the sides of the three longitudinal flywheel grooves, the bores of base plate 7 for seating the three release pins 8 and the three operating bolts 16 as well as the bores of the six bushings 9, the faces of diaphragm spring 4 which contact front and rear pressure plates, surfaces of three release pins 8 and bearing surfaces of the three pivot pins 13.

The clutch assembly is balanced. Therefore, when reassembling observe the marks made during disassembly.

Install front driven disk 2 (fig. 6) in flywheel with long part of hub facing toward flywheel. Align with pilot bearing by means of centering tool No. 19.58-90.486.

To facilitate assembly, the heads of the three operating bolts should be flush against front pressure plate. For this purpose, place a suitable spacer between each operating bolt and flywheel.

Place diaphragm spring 4 with cupped face on front pressure plate 3.

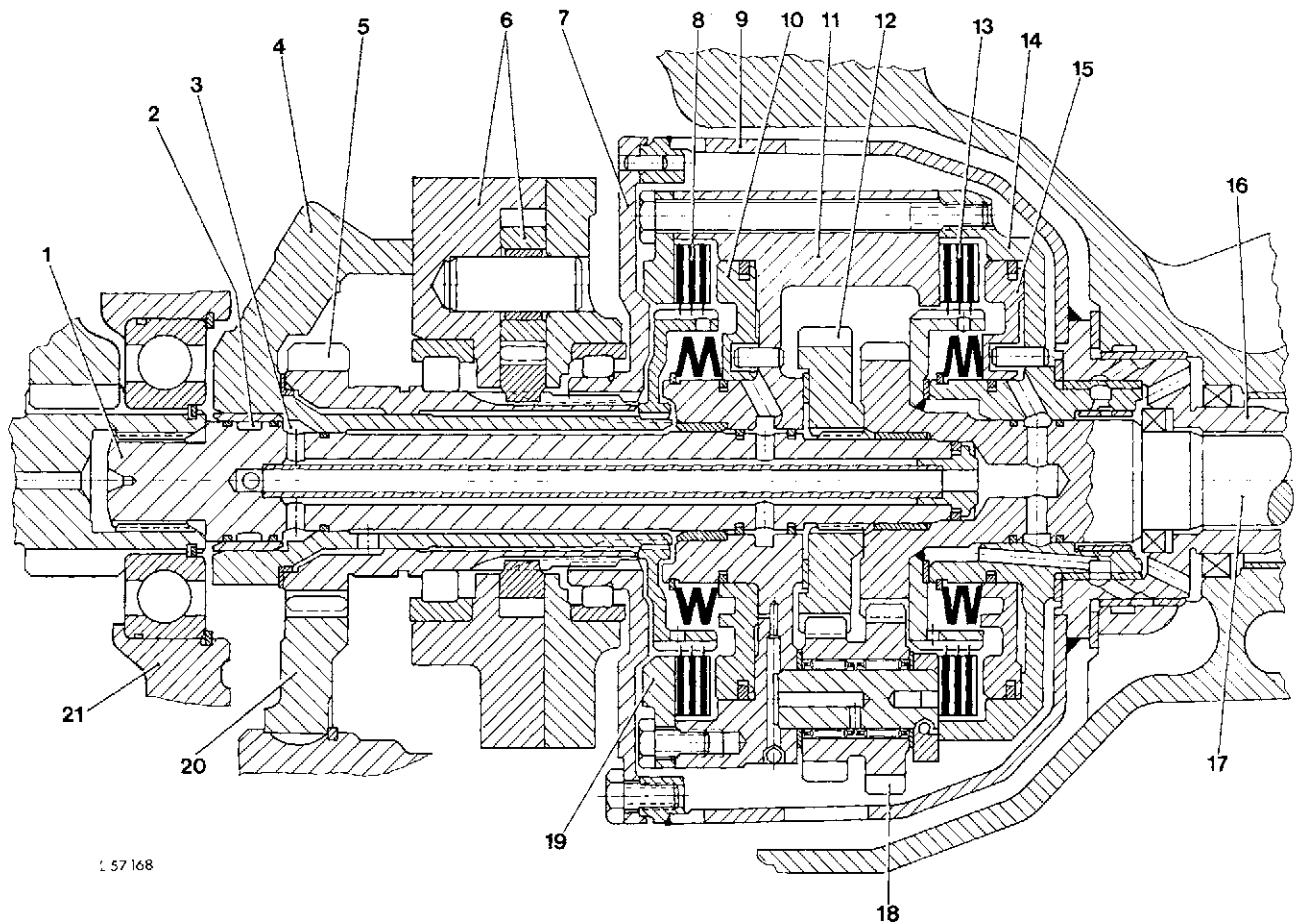
When placing rear pressure plate 5 on diaphragm spring, move diaphragm spring so that it aligns properly with pressure plate.

Position rear driven disk 6 on rear pressure plate 5 with long hub end facing away from flywheel.

When base plate 7 and release pins 8 have been installed, align front driven disk 2 and rear driven disk 6 with pilot bearing in flywheel by means of centering tool No. 19.58-90.486 (see fig. 7). This applies especially to rear driven disk 6, which, if misaligned, will impede assembly of engine to clutch housing.

Group 10 High-Low Shift Unit

GENERAL INFORMATION



1 57168

Fig. 1 — HIGH-LOW Shift Unit, Sectional View

- | | | |
|---|--|--|
| 1 Transmission input shaft | 8 LOW brake | 16 Hollow drive shaft (integral with HIGH-LOW housing 9) |
| 2 Oil inlet from control valve to HIGH clutch | 9 HIGH-LOW housing | 17 Drive shaft |
| 3 Oil inlet from control valve to LOW brake | 10 LOW brake piston | 18 Planet gear (3 used) |
| 4 Oil manifold | 11 Planet pinion carrier | 19 Backing plate |
| 5 Hollow gear shaft (for driving transmission oil pump and PTO) | 12 Planet sun gear | 20 Drive gear for single, independent PTO |
| 6 Transmission oil pump | 13 HIGH clutch for normal travel speed | 21 Front bearing support of transmission case |
| 7 HIGH-LOW cover | 14 HIGH clutch drum | |
| | 15 HIGH clutch piston | |

HIGH-LOW SHIFT UNIT

NOTE: Refer to fig. 6 for parts identification. For repair of transmission oil pump see section 70, group 15.

Check transmission oil pump cover 19 for wear and damage, especially sliding area of pump gears 16 and 17. Replace cover, if necessary.

Check LOW brake piston 34 and HIGH clutch piston 44 for wear or damage. Replace sealing rings 33 and O-rings 35.

Check spring washers 32 for damage or flattening; place each washer on a flat support with cupped side down and measure height of washer (see Specifications).

Check disks 28 and separator plates 29 for wear. Make sure grooved pattern of disk facings is not worn or rubbed off. Otherwise replace disk. Check disk splines for broken teeth. For thickness of an individual disk as well as total stacked height of a new disk pack see Specifications.

Check planet pinion carrier 36 for cracks or other damage and replace, if necessary.

Inspect brake hub 30, gear and hub of drive shaft 47, sun gear 40 and planet pinions 43 for chipped or worn teeth. Replace parts, if necessary.

NOTE: If one or two planet pinions must be replaced, install a complete set (3) of pinions as they are matched and are available only as a complete set.

Check needle bearings 42 supporting planet pinions for worn spots.

Check transmission input shaft 2 for wear and damage and replace, if necessary. Replace sealing rings 1, 4 and 6 on input shaft. When replacing sealing ring 4, first remove retaining ring 5 from input shaft.

Now, if necessary, pull oil tube 3 out of input shaft. Press new oil tube in retaining ring 5. Slide sealing ring 4 on retaining ring and push oil tube with retaining ring and sealing ring in transmission input shaft.

Examine drive shaft 47 for wear or damage. If bushing 46 is damaged, remove it from shaft and press in new bushing with open ends of oil grooves facing outward. Replace sealing rings 1 on drive shaft.

Inspect oil manifold 9 and its bushing for damage. Replace complete oil manifold, if necessary.

Check HIGH-LOW housing and hollow drive shaft 54 (forming an integral unit) for damage. Check oil seal 52 and bushing 51 for serviceability. Press in new oil seal with numbered side facing driver.

If necessary, remove unserviceable bushing 51 from HIGH-LOW housing. Press in new bushing by means of driver No. 19.58-90.613 and mandrel No. 815 until driver is flush against HIGH-LOW housing.

ASSEMBLY

NOTE: Refer to fig. 6 for parts identification.

When assembling, principally reverse disassembly procedure. Observe the following:

When installing annular pistons, make sure O-rings are not inverted or damaged when pistons are pressed into clutch drum or planet pinion carrier. Do not mix up pistons.

Place a spring washer 32 on piston with concave side facing upward. Then place second spring washer on first washer with concave side facing downward. Put other two washers, concave side to concave side, over first pair.

Compress washer spring pack as shown in fig. 5 until snap ring 31 can be inserted in groove, using a press and special tool No. 19.58-90.617.



CAUTION: Be careful when compressing spring washer pack.

Install two needle bearings 42 into each planet gear.

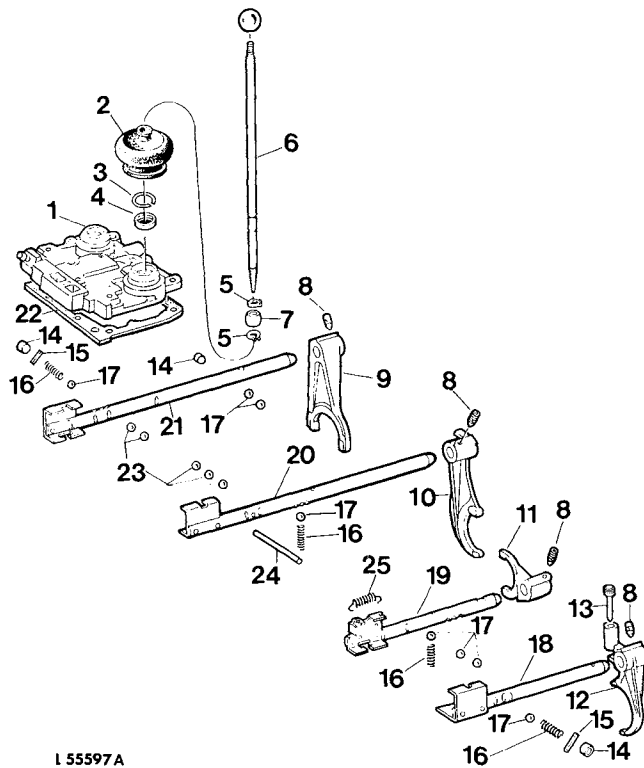


Fig. 3 — Shifter Mechanism, Exploded View

- 1 Shift cover
 - 2 Boot
 - 3 Snap ring
 - 4 Retaining ring
 - 5 Snap rings
 - 6 Shift lever
 - 7 Knob
 - 8 Self-locking set screws
 - 9 1st and 5th, 2nd and 6th speed shifter fork
 - 10 3rd and 7th, 4th and 8th speed shifter fork
 - 11 Range II and parking lock shifter fork
 - 12 Range I and reverse range shifter fork
 - 13 Start safety switch pin
 - 14 Caps
 - 15 Spring pins
 - 16 Detent springs
 - 17 Lock and detent balls
 - 18 Range I and reverse range shifter shaft
 - 19 Range II and parking lock shifter shaft
 - 20 3rd and 7th, 4th and 8th speed shifter shaft
 - 21 1st and 5th, 2nd and 6th speed shifter shaft
 - 22 Gasket
 - 23 Lock balls
 - 24 Lock pin
 - 25 Spring
- } Only on tractors equipped with parking lock

Checking shifter forks

Examine shifter forks for excessive wear or distortion. Replace, if necessary.

Checking shifter shafts

Make sure shifter shafts are not distorted. Check faces around pawls and bores of shifter shafts for wear; also check sliding faces of shafts and shaft bearing bores of transmission case.

Checking interlock pin, balls and springs

NOTE: The interlock pin is not provided on 8-speed transmission without parking lock.

Check if springs are still in proper condition (rusty spots, resilience). If necessary, replace spring.

Check ball surfaces for flat spots which could prevent them from rolling freely. Check interlock pin for serviceability.

NOTE: If the interlock pin has to be replaced, drive spring pin 2 (fig. 2) out of transmission case, using a suitable spring pin. Then pull spring pin used as tool sufficiently out of case to withdraw interlock pin. When a new interlock pin is installed, coat new cap with a film of oil-resistant sealant and drive into bore of transmission case.

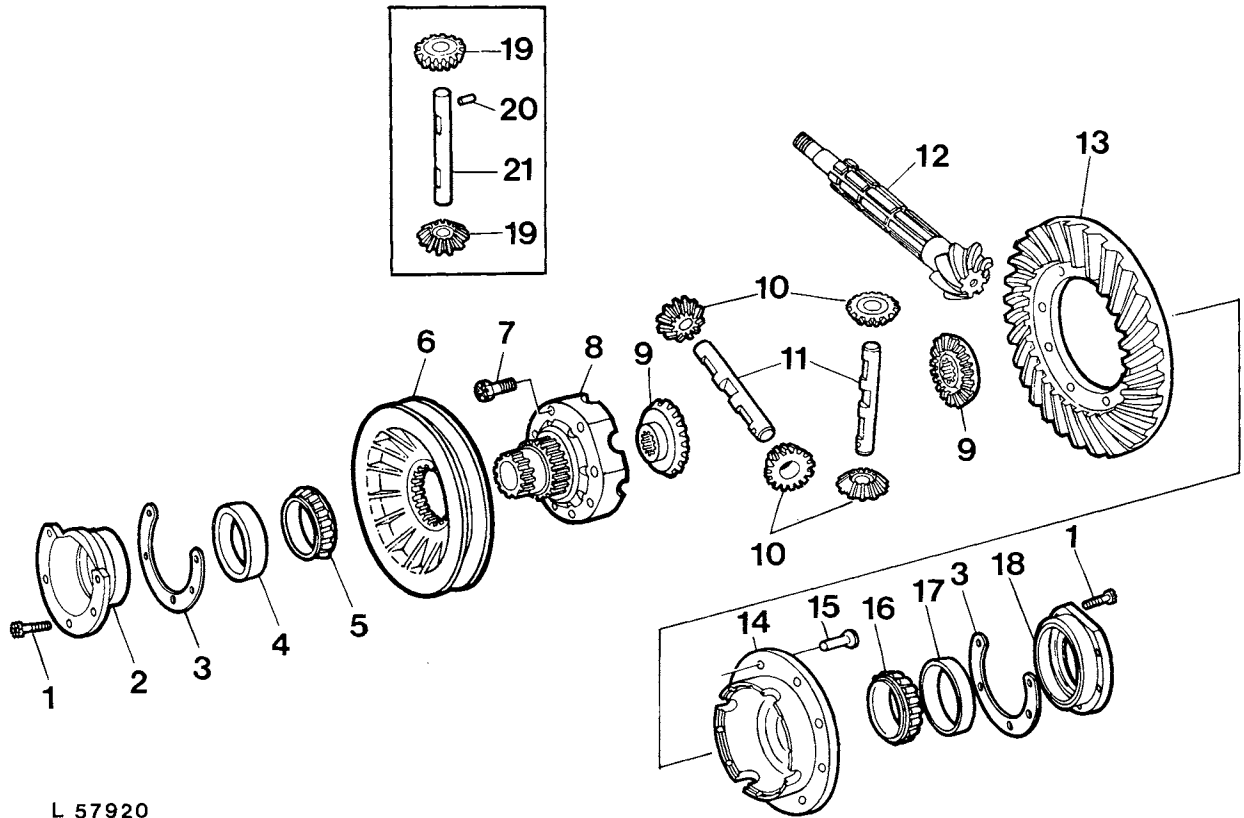
For installation of shifter mechanism reverse removal sequence, observing figs. 2 and 3.

Install rockshaft unit, see section 10, group 25.

Attach transmission case to clutch housing, see section 10, group 25.

Check operation of transmission by shifting through all ranges and speeds.

Group 20 Differential



L 57920

Fig. 1 — Differential Assembly, Exploded View

- 1 Cap screw (10 used)
- 2 Bearing quill l.h.
- 3 Shims
- 4 Bearing cup
- 5 Bearing cone
- 6 Brake disk and hub (only on tractors with handbrake)

- 7 Cap screw (8 used)
- 8 Differential housing cover
- 9 Bevel gears
- 10 Bevel pinions
- 11 Bevel pinion shafts
- 12 Differential drive shaft
- 13 Ring gear

- 14 Differential housing
 - 15 Rivet (8 used)
 - 16 Bearing cone
 - 17 Bearing cup
 - 18 Bearing quill r.h.
 - 19 Bevel pinions
 - 20 Bevel pinion shafts
 - 21 Dowel pin
- } on some 1020 models

GENERAL INFORMATION

The differential rotates on two adjustable taper roller bearings. It is equipped with four bevel pinions, two bevel gears and two bevel pinion shafts, both being secured by a recess in the center of each shaft. The differential on some model 1020 tractors is equipped with two bevel pinions and one bevel pinion shaft which is secured by a dowel pin. The ring gear is in mesh with the differential drive shaft bevel gear.

The backlash of this bevel gear drive is adjusted by shims. These shims also serve for adjusting the preload of the differential taper roller bearings. A differential lock is located at the left-hand side of the differential.

DIAGNOSING MALFUNCTIONS

OIL LEAKAGE

Too much or improper oil (see Operator's Manual)

Loose transmission oil drain plug

Transmission case broken

Damaged seals

Screws not tightened to the specified torque

OPERATION

HYDRAULIC FUNCTION

When the PTO control lever is moved forward, spool 10 (fig. 1) is pushed into transmission shift cover with the aid of a lever, two springs and actuators 14.

By this means pressure oil passage 18 is connected to pressure oil passage 17 leading to the PTO clutch. At the same time oil flows under pressure behind spool 10 until passage to the rear of spool is completely closed (see fig. 1). During the engaging operation, pressure oil from behind the spool drains off through orifice 9 thus counteracting the engaging movement until the PTO clutch is completely engaged. In this way an abrupt engagement of the PTO is prevented and a smooth engagement guaranteed.

To disengage the PTO the spool is moved in the opposite direction. First pressure oil passage 17 is closed and then opened to return oil passage 8 so that oil from the PTO clutch can dump into the transmission case. Afterwards the spool opens pressure oil passage 16 and at the same time pressure oil passage 17 is opened fully so that pressure oil can flow from there to the PTO brake.

Oil flowing through passage 16 to the PTO brake gets behind brake piston 21, which operates brake band 20 with the aid of a brake arm. The brake band stops PTO shaft rotation through a hub splined and thus positively engaged onto PTO clutch shaft 4.

When the PTO is engaged again, pressure oil from behind the piston is drained and a spring releases the brake band (see fig. 1).

The control lever and spool are locked in both end positions, ("engaged" and "disengaged"), by means of two detent balls and springs.

The oil pressure required for operating the PTO clutch and brake is maintained by a pressure regulating valve located in the transmission shift cover. This valve is the same as installed on tractors equipped with HIGH-LOW shift unit (see group 10).

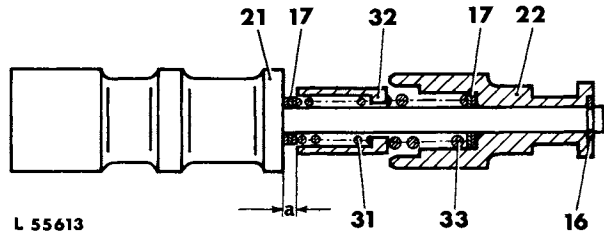


Fig. 11 — Adjustment of Actuators and Spool

- | | |
|----------------------------------|-------------|
| a 1.5 to 2 mm (0.06 to 0.08 in.) | 22 Actuator |
| 16 Snap ring | 31 Spring |
| 17 Shims (use as required) | 32 Sleeve |
| 21 Spool | 33 Spring |

After having obtained correct spring preload by installing the correct number of shims, again remove parts from spool 21. Place some of the shims on spool 21 and the remainder in actuator 22 so that there is a distance of 1.5 to 2 mm (0.06 to 0.08 in.) between sleeve 32 and spool shoulder (see "a", fig. 11).

Slide control valve assembly into bore of transmission shift cover. Drive cap (fig. 10) into bore of transmission shift cover (open end first) until flush with inner side of shift cover. If cap is driven too far into transmission shift cover, this will adversely affect correct shifting of spool.

ADJUSTING INTERLOCK MECHANISM OF PTO CONTROL LEVER

Coat both hex. socket screws with sealing compound and screw flush into transmission cover, that is until springs are fully compressed. After that unscrew both hex. socket screws two turns.

MID PTO AND SHIFTER MECHANISM

See group 35 for details regarding mid PTO and PTO shifter mechanism.

SPECIFICATIONS

Dimensions of New Parts

CONTROL VALVE ASSEMBLY

Clutch and brake oil pressure at 2100 rpm	8.8 to 9.5 kp/cm ²	125 to 135 psi
Pressure regulating valve adjustment at 2100 rpm	8.8 to 9.5 kp/cm ²	125 to 135 psi
Pressure regulating valve spring		
Free length, approx	79 mm	3.11 in.
Spring tension at a length of 65 mm (2.56 in.)	18.4 to 22.4 kp	40 to 50 lbs.
O.D. of spool	17.404 to 17.430 mm	0.6852 to 0.6862 in.
Diameter of spool bore in transmission shift cover	17.450 to 17.476 mm	0.6870 to 0.6880 in.
Preload of special pin spring (approx. 3 washers)	2.7 to 3.7 kp	6.9 to 7.1 lbs.
Preload of valve spool spring (approx. 5 washers)	5.7 to 6.1 kp	12.5 to 13.5 lbs.
Special pin spring		
Free length, approx	48.5 mm	1.91 in.
Spring tension at a length of 33.8 mm (1.33 in.)	9 to 11 kp	20 to 24.5 lbs.
Spool spring (smaller one)		
Free length, approx	22.2 mm	0.875 in.
Spring tension at a spring length of 15.9 mm (0.625 in.)	5.5 to 6.8 kp	12 to 15 lbs.
Spool spring (larger one)		
Free length, approx.	20.6 mm	0.81 in.
Spring tension at a length of 13.7 mm (0.54 in.)	20.4 to 24.8 kp	45 to 55 lbs.
Detent springs of control lever		
Free length	15.8 mm	0.62 in.
Spring tension at a length of 10.9 mm (0.43 in.)	2.0 to 2.5 kp	4.5 to 5.5 lbs.

REPAIR

REPAIRING PTO SHAFT

Check PTO shaft, PTO shaft pilot, stub shaft and rear quill for damage. Replace, if necessary.

Check ball bearing of PTO shaft pilot for damage. If required, remove snap ring and drive ball bearing off pilot. Press new bearing onto pilot until snap ring fits in groove.

REPAIRING PTO DRIVE SHAFT AND GEARS

Check PTO shaft gears and drive shaft for wear or damage. Inspect bushing in bore of PTO drive shaft for wear and replace, if necessary.

Check bushing of PTO drive shaft in front transmission case for wear and replace, if necessary.

Check spring of PTO drive shaft for damaged or broken coils and replace, if necessary.

Check front quill and front quill needle bearing for serviceability and replace, if necessary.

INSTALLATION

INSTALLING PTO SHAFT

When installing the PTO shaft, reverse removal procedure.

Make sure thrust washer 16 (fig. 7) is installed between PTO drive shaft 1 and PTO shaft 17.

NOTE: When installing PTO stub shaft, use a new O-ring.

INSTALLING PTO DRIVE SHAFT

Slide PTO drive shaft into transmission case, with splined end first, and insert in shifter collar. Slide large 540 rpm PTO gear with long hub end facing transmission case as well as small 1000 rpm gear with long hub end facing away from transmission case onto drive shaft.

Attach front PTO quill to clutch housing (if removed).

Attach clutch housing to transmission case and tighten screws to the specified torque (see section 10, group 25).

Fill transmission case with proper oil (see Operator's Manual).

On tractors with power steering stops should **not** contact when wheels are turned full left or right. If necessary, adjust tie rods so there is an equal amount of clearance between stops of knuckles and knees on both sides (see Group 10).

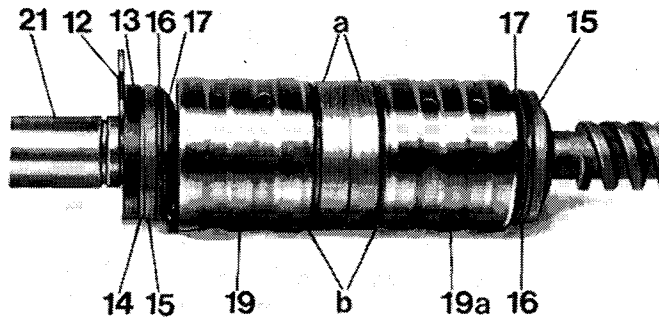
On tractors with manual steering stops on knuckles should contact stops on knees when wheels are turned full left or right. If necessary, adjust tie rods so stops on axle knuckles contact stops on axle knees equally on both sides (see Group 10).

SPECIFICATIONS

Dimensions of New Parts

I.D. of rear pivot pin bushing pressed into axle center	40.077 to 40.197 mm	1.5777 to 1.5827 in.
I.D. of front pivot pin bushing pressed into front end support	31.754 to 31.874 mm	1.2500 to 1.2550 in.
Dia. of front pivot pin bore in axle center	31.509 to 31.559 mm	1.2405 to 1.2425 in.
O.D. of front pivot pin	31.597 to 31.623 mm	1.2440 to 1.2450 in.
Dia. of rear pivot pin bore in front end support	39.853 to 39.903 mm	1.5695 to 1.5705 in.
Dia. of rear pivot pin	39.927 to 39.953 mm	1.5720 to 1.5730 in.
Dia. of bell crank shaft (seated in needle bearings) . . .	31.725 to 31.738 mm	1.2490 to 1.2495 in.
Thrust bearing seat of knuckle, dia.	34.886 to 34.902 mm	1.3735 to 1.3741 in.
Dia. of front axle knee bore for knuckle bushings	38.075 to 38.125 mm	1.4990 to 1.5010 in.
I.D. of knuckle bushing pressed into front axle knee	34.938 to 35.038 mm	1.3755 to 1.3795 in.
Maximum permissible end play of bell crank	0.10 mm	0.004 in.
Maximum permissible end play of knuckles in front axle knee	0.76 mm	0.03 in.
Maximum permissible end play of front axle	0.4 mm	0.015 in.
Front wheel toe-in	3 to 6.5 mm	0.125 to 0.25 in.

IMPORTANT: Slide thrust washer 17 on steering wheel shaft so that its large chamfer faces the upper valve body.



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Fig. 5 — Determining Thickness of Shim Pack between Thrust Washer and Special Washer

- | | |
|-------------------|-------------------------------|
| a Spacers | 16 Thrust bearings |
| b Shims | 17 Thrust washers |
| 12 Snap ring | 19 Upper valve body assembly |
| 13 Special washer | 19a Lower valve body assembly |
| 14 Shims | 21 Steering wheel shaft |
| 15 Thrust washers | |

5. Position some shims 14 (figs. 3 to 5) on thrust washer 15. Then place one of the two special washers 13 on the shims with the recess facing downward. Adjust total thickness of shims so that snap ring 12 just fits into groove of steering wheel shaft 21. At this moment it is not necessary that the snap ring is fully seated in its groove. However, make sure that the snap ring really fits in the groove.

Add as many shims 14 as are required to obtain the specified pre-load (see Specifications).

Insert lower snap ring 12 in its groove. Install second special washer 13 on steering wheel shaft with the recess facing downward and fit upper snap ring 12.

If required, insert one O-ring 29 (fig. 4) and one back-up ring 28 each in bore of piston rod guide 37 and in bore of steering valve housing 22. Install O-ring 35 and back-up ring 36 in groove of guide 37.

Slide guide 37 over piston rod 33 and insert piston rod with piston, guide and connecting rod in steering valve housing.

Carefully install pre-assembled steering wheel shaft in steering valve housing and screw shaft into piston rod. Insert spacer 11 in steering valve housing.

Insert O-ring 2 in groove of adjuster 9 pre-assembled with oil seal 7 and bushing 10. Coat lip of oil seal 7 with grease. When sliding adjuster 9 on steering wheel shaft, protect oil seal lips against damage by means of a suitable sleeve etc.

Screw adjuster into steering valve housing 8 by means of a pronged wrench and tighten to the specified torque (see "Torques for Hardware"). Turn lock nut 6 on adjuster 9 and tighten to the specified torque, holding the adjuster with the pronged wrench.

INSTALLATION AND ADJUSTMENT

For installation, reverse sequence of removal.

Install new gasket between steering valve housing and clutch housing.

NOTE: Make sure that gasket does not block oil passage in clutch housing.

Tighten screws of steering valve housing assembly to the specified torque (see "Torques for Hardware")

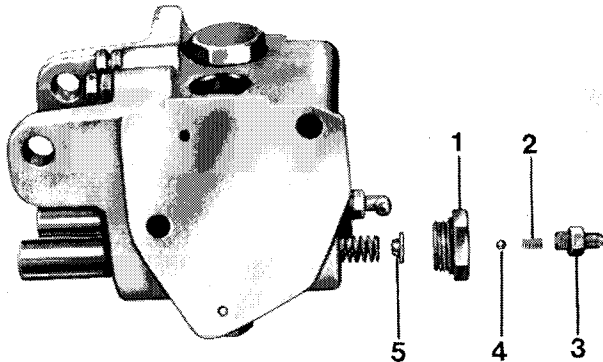
Tighten cap screw of steering shaft lock plate 11 (fig. 2) to the specified torque (see "Torques for Hardware").

Install steering shaft cover before tightening cap screw of steering arm. Use a new gasket between bearing cover and clutch housing.

NOTE: Install cap screw provided with seal ring 40 (fig. 4) in bottom bore of steering shaft cover.

Tighten steering arm cap screw to specified torque (see "Torques for Hardware"). Tap the steering arm with a hammer and re-tighten screw to the specified torque.

REPAIR



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Fig. 3 — Removing Balls, Valve Seats, Springs and Retainers of Brake Valve

- | | |
|--------------|------------|
| 1 Valve seat | 4 Ball |
| 2 Spring | 5 Retainer |
| 3 Adapter | |

Screw adapter 3 (fig. 3) and elbow out of valve seats 1 and remove balls 4 and springs 2 which are now released. Screw valve seats 1 out of brake valve housing and remove retainers 5. Withdraw pistons and springs from brake valve.

Remove plugs on top of brake valve as well as check valves.

Unscrew both plugs 10 (fig. 2) on bottom of brake valve and remove springs and balls of equalizing valves.

Check all parts for wear, scoring, cracks or other damage and replace, if necessary.

Check tension of springs.

Inspect check valves 7 (fig. 2) for wear or damage, especially in area contacting brake pistons when brake pedals are released. If necessary, replace check valve assembly 9 (fig. 2).

If pedal bushings 33 (fig. 2) have to be replaced, press in new bushings so that they are flush with outside edge of pedals.

Pre-assemble check valve (spring 8, valve 7, valve seat 5) and install in brake valve.

Coat brake pistons 14 with transmission oil and slide into bores of brake valve housing (small diameter first).

NOTE: When assembling, always use new oil seals and O-rings.

INSTALLATION

Using a new gasket, attach brake valve to clutch housing. Connect brake lines. Run engine for about 2 minutes at 2100 rpm with the clutch engaged to allow the transmission lubrication system to fill brake valve reservoir.

NOTE: If it is not desirable to run tractor engine at this time, screw out plug 3 (fig. 2) and fill brake valve reservoir manually with transmission oil.

ADJUSTMENT AND BLEEDING

BLEEDING AIR FROM BRAKE SYSTEM

Attach a plastic bleed tube to the brake bleed screw located on top of final drive housing and insert other end of tube in transmission filler hole. Turn out bleed screw by a 3/4 turn, *slowly* depress brake pedal on brake being bled and then allow it to return *slowly*. Continue operating pedal until oil in tube is free of air bubbles.

IMPORTANT: Never allow brake pedal to return sharply until brakes are completely adjusted. By permitting brake valve piston to release quickly, damage may occur to valve as piston travel is not yet closely adjusted.

Close bleed screw securely while brake pedal is depressed. Remove plastic bleed tube and repeat bleeding operation on other brake. Then adjust brakes.

Section 70 Hydraulic System

CONTENTS OF THIS SECTION

GROUP 5 — GENERAL INFORMATION, DIAGNOISING MALFUNCTIONS AND TESTS

	Page
General information	5-2
Operation	5-3
Diagnosing malfunctions	5-4
Tests	5-8
General hydraulic system testing	5-8
Time cycle tests	5-8
Pressure tests	5-9
Transmission oil pump test	5-10
Hydraulic pump tests	5-11
Rockshaft tests	5-11
Specifications	5-12
Special tools	5-13

GROUP 10 — OIL RESERVOIR, FILTER, VALVES AND OIL COOLER

Main oil reservoir, transmission oil filter and intake screen	10-1
General information	10-1
Repair	10-1
By-pass valve of transmission oil filter	10-2
General information	10-2
Repair	10-2
Surge relief valve in clutch housing	10-3
General information	10-3
Repair	10-3
Check valve in inlet line to hydraulic pump (tractors without HIGH-LOW shift unit or independent PTO)	10-3
General information	10-3
Repair	10-3
Flow control valve of power steering	10-4
General information	10-4
Repair	10-5
Pressure control valve for attached implements with hydraulic motor	10-6
General information	10-6
Repair	10-6
Auxiliary oil reservoir	10-6
General information	10-6
Repair	10-7
Oil cooler	10-7
General information	10-7
Specifications	10-7
Torques for hardware	10-8

GROUP 15 — HYDRAULIC PUMP AND TRANSMISSION OIL PUMP

	Page
Hydraulic pump	15-1
General information	15-2
Repair	15-2
Adjustment	15-7
Transmission oil pump	15-8
General information	15-8
Removal	15-8
Repair	15-8
Installation	15-8
Specifications	15-9
Torques for hardware	15-11
Special tools	15-11

GROUP 20 — ROCKSHAFT

General information	20-1
Repair	20-4
Assembly	20-8
Adjustment	20-10
Load control mechanism	20-12
Repair	20-13
Installation	20-13
Adjustment	20-14
Three-point hitch	20-15
Specifications	20-17
Adjustments	20-17
Torques for hardware	20-18
Special tools	20-18

GROUP 25 — SELECTIVE CONTROL VALVES

General information	25-1
Operation	25-2
Removal	25-3
Repair	25-4
Installation	25-6
Adjustment	25-6
Specifications	25-6
Torques for hardware	25-6

GROUP 30 — REMOTE CYLINDER

General information	30-1
Repair	30-2
Bleeding	30-3
Specifications	30-3
Torques for hardware	30-3

HYDRAULIC PUMP TESTS

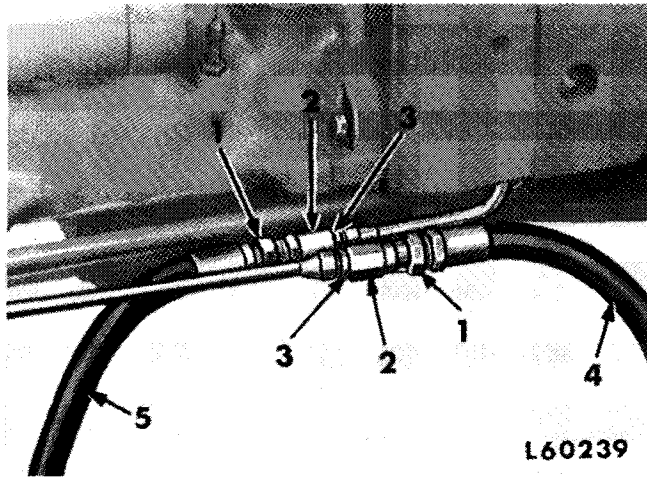


Fig. 6 — Testing Hydraulic Pump

- | | |
|------------------------|-------------------------|
| 1 Union fitting Y-3005 | 4 Test unit outlet hose |
| 2 Fitting JDH-38 | 5 Test unit inlet hose |
| 3 Connector R 34063 | |

Install hydraulic test unit as shown in fig. 6.

STAND-BY PRESSURE CHECK

Open test unit control valve. Run engine at 2500 rpm and close test unit control valve.

Test unit pressure gauge should now show a pressure of 156 to 160 kp/cm^2 (2220 to 2280 psi).

If pressure shown is not within this specified range, adjust pump stroke control valve (see group 15).

FLOW CHECK

Run engine at 2500 rpm.

Open test unit control valve until a pressure of 144 kp/cm^2 (2050 psi) is shown. This is the pump system pressure.

Delivery from a 11.3 cm^3 (0.69 cu. in.) pump should be 24 liters per minute (65 U.S./5.3 Imp.gals. per min.) and from a 22.6 cm^3 (1.38 cu.in.) pump 47 liters per minute (12.5 U.S./10.3 Imp. gals. per min.).

Service the hydraulic pump if flow is not as specified (see group 15).

ROCKSHAFT TESTS

ROCKSHAFT FLOW CONTROL VALVE* CHECK

Install hydraulic test unit as shown in fig. 6 "Hydraulic Pump Test Connections".

Check hydraulic pump and stroke control valve for proper operation before testing rockshaft flow control valve.

Open test unit control valve, start engine and run at 2500 rpm.

Place rockshaft selector lever in "L" position. Close test unit control valve until a pressure of 123 kp/cm^2 (1750 psi) is shown. Raise rockshaft and record flow. If necessary, adjust rockshaft flow control valve until a flow of 18 to 22 liters per minute (4.75 to 5.75 U.S./4.0 to 4.8 Imp. gals.) has been obtained.

ROCKSHAFT THERMAL RELIEF VALVE CHECK

Connect a hydraulic hand pump equipped with a 350 kp/cm^2 (5000 psi) pressure gauge to the single remote cylinder outlet.

Raise pressure to valve slowly. Valve should begin to discharge at a minimum of 246 kp/cm^2 (3500 psi) and a maximum of 315 kp/cm^2 (4500 psi). The valve should close when pressure is reduced to 175 kp/cm^2 (2500 psi).

When checking the thermal relief valve in this manner, any seal or valve leakage will affect the test.

IMPORTANT: Do not exceed 350 kp/cm^2 (5000 psi) pressure when checking the valve on the tractor as damage to seal might result.

* Only if equipped with 22.6 cm^3 (1.38 cu.in.) hydraulic pump

REPAIR

Remove check valve (ball 7 and spring 8) together with hollow screw 4 and hose adapter 6. Take care not to dislodge check valve assembly when withdrawing screw as it may fall into reservoir.

If the reservoir was removed, carefully clean and thoroughly flush reservoir. Check for leaks and cracked seams and replace, if necessary.

OIL COOLER

GENERAL INFORMATION

The oil cooler prevents excessive oil temperatures generated by the hydraulic system, HIGH-LOW shift unit etc.



NOTE: For cleaning the oil cooler, follow procedure for cleaning the radiator. See "Fundamentals of Service — Engines" manual.

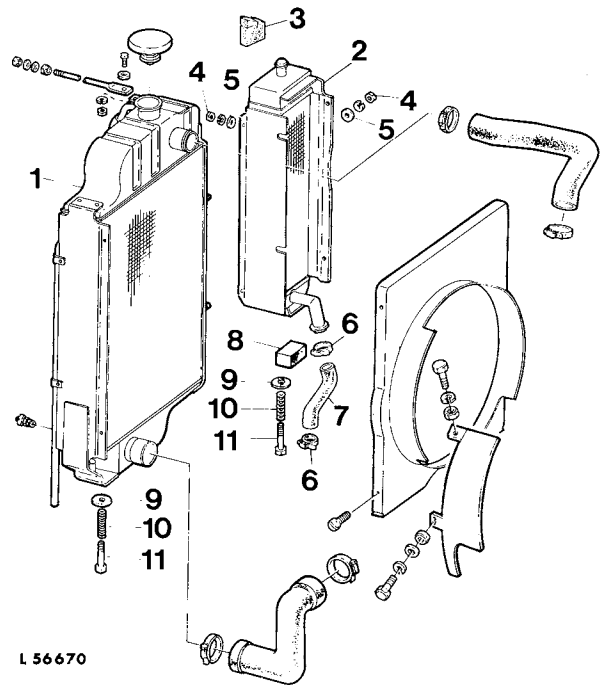


Fig. 11 — Oil Cooler

- | | |
|----------------------|---------------------|
| 1 Radiator | 7 Hose |
| 2 Oil cooler | 8 Foam rubber block |
| 3 Foam rubber block | 9 Rubber washers |
| 4 Hex. nuts (4 used) | 10 Springs |
| 5 Washers (4 used) | 11 Cap screws |
| 6 Hose clamps | |

SPECIFICATIONS

Dimensions of New Parts

BY-PASS VALVE OF TRANSMISSION OIL FILTER

Dia. of valve sleeve bore for valve body	12.687 to 12.713 mm	0.4995 to 0.5005 in.
Dia. of valve body	12.440 to 12.557 mm	0.4977 to 0.4983 in.
Valve opens on tractors without HIGH-LOW shift unit at a pressure differential of	2.0 to 3.5 kp/cm ²	28.5 to 50 psi
Valve opens on tractors with HIGH-LOW shift unit at a pressure differential of	3.5 to 5.0 kp/cm ²	50 to 70 psi
Spring of by-pass valve on tractors without HIGH-LOW shift unit		
Free length	approx. 65 mm	2.56 in.
Spring tension at a length of 33.5 mm (1.3 in.)	4.3 to 5.2 kp	9.5 to 11.5 lbs.

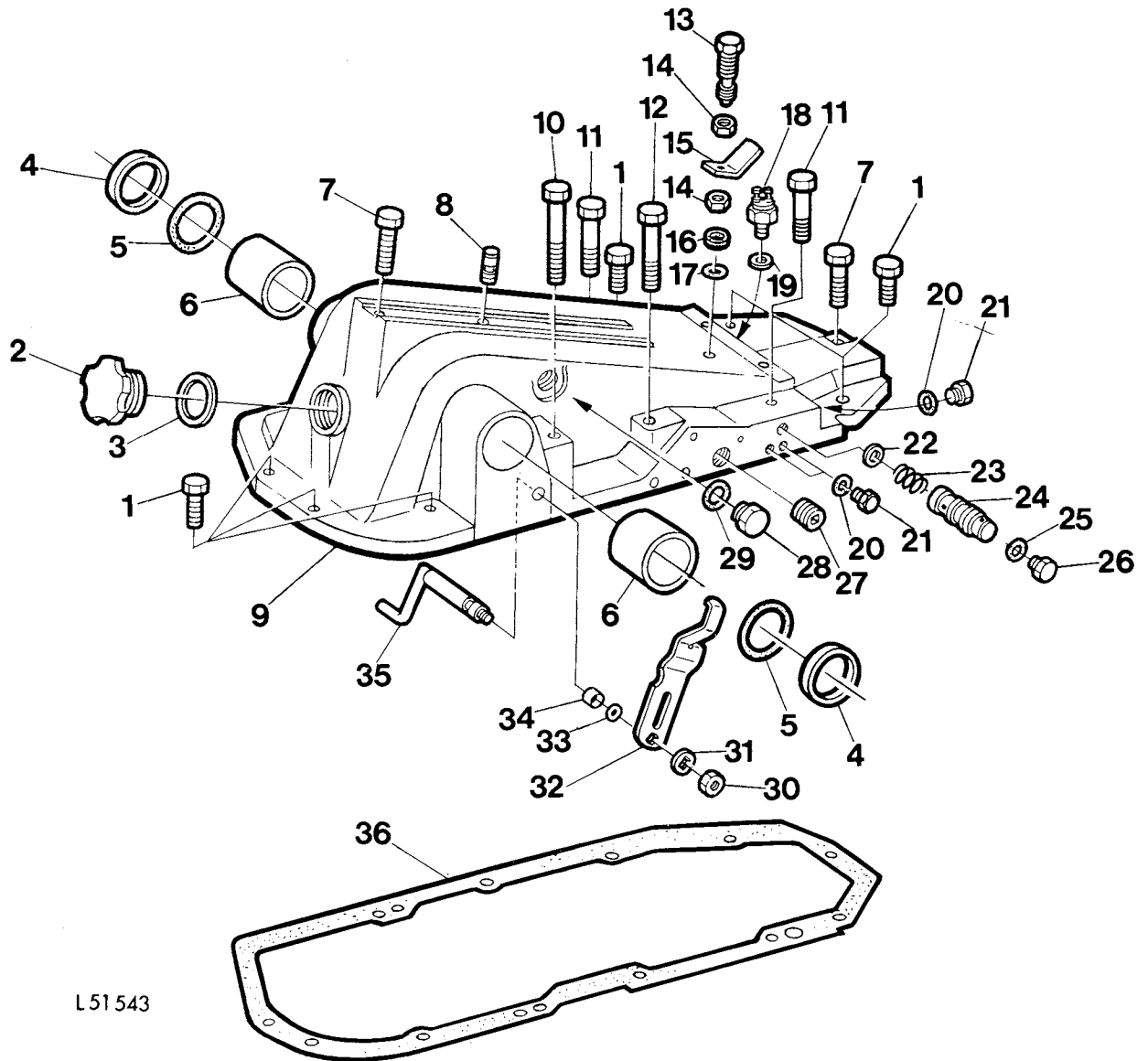
SPECIFICATIONS

HYDRAULIC PUMP

Dimensions of New Parts

Pump delivery per revolution of pump shaft		
4-piston pump	11.3 cm ³	0.69 cu. in.
8-piston pump	22.6 cm ³	1.38 cu.in.
Pump delivery at 2500 rpm engine speed and 144 kp/cm ² (2050 psi) operating pressure		
4-piston pump	24.8 lit./min.	5.3 Imp.gals./min. 6.5 U.S. gals./min.
8-piston pump	47.0 lit./min.	10.3 Imp.gals./min. 12.5 U.S.gals./min.
Stand-by pressure	156 to 160 kp/cm ²	2220 to 2280 psi
Distance from finished housing face to bottom of crankcase bore (where cam and race move)	67.564 to 67.736 mm	2.660 to 2.666 in.
Dia. of pump housing bore at groove for pump shaft quad ring	25.675 to 25.725 mm	1.011 to 1.013 in.
Dia. of pump housing bore for pump shaft oil seal	38.05 to 38.10 mm	1.498 to 1.500 in.
Dia. of pump shaft bearing bore in pump housing and cover (where needle bearings are located)	33.325 to 33.350 mm	1.3120 to 1.3130 in.
Dia. of piston bores in housing	17.277 to 17.292 mm	0.6802 to 0.6808 in.
O.D. of pistons	17.259 to 17.269 mm	0.6795 to 0.6799 in.
Bore dia. for discharge valves	15.85 to 15.90 mm	0.624 to 0.626 in.
O.D. of discharge valve seat	15.938 to 15.964 mm	0.6275 to 0.6285 in.
Dia. of discharge valve disk	15.47 to 15.52 mm	0.609 to 0.611 in.
Inlet valve springs		
Spring tension at a length of 7.8 mm (0.31 in.)	150 to 178 p	0.31 to 0.39 lbs.
Discharge valve springs		
Spring tension at a length of 7.6 mm (0.30 in.)	1.2 to 1.4 kp	2.54 to 3.14 lbs.
Bore dia. for crankcase outlet valve stop		
outlet valve stop	12.675 to 12.725 mm	0.4990 to 0.5010 in.
O.D. of crankcase outlet valve stop	12.644 to 12.670 mm	0.4978 to 0.4988 in.
Crankcase outlet valve spring		
Spring tension at a length of 52.4 mm (2.06 in.)	20 to 24.5 kp	44 to 54 lbs.
Diameter of pump shaft cam	37.770 to 37.783 mm	1.4870 to 1.4875 in.
I.D. of cam race	45.730 to 45.745 mm	1.8004 to 1.8010 in.
O.D. of cam race	56.769 to 57.023 mm	2.235 to 2.245 in.
Thickness of thrust washer	2.21 to 2.31 mm	0.087 to 0.091 in.
O.D. of stroke control valve	17.894 to 17.920 mm	0.7045 to 0.7055 in.

ROCKSHAFT HOUSING ASSEMBLY



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Fig. 5 — Rockshaft Housing, Exploded View

- | | | |
|---------------------|----------------------------|-----------------------------------|
| 1 Cap screws | 13 Special screw | 24 Spool of flow control valve* |
| 2 Oil filler cap | (regulating rate of drop) | 25 O-ring |
| 3 Seal ring | 14 Lock nuts | 26 Plug |
| 4 Back-up rings | 15 Link | 27 Plug |
| 5 O-rings | 16 Seal ring | 28 Plug |
| 6 Bushings | 17 O-ring | 29 O-ring |
| 7 Cap screws | 18 Start safety switch | 30 Hex nut |
| 8 Special screw | 19 Aluminium washer | 31 Washer |
| 9 Rockshaft housing | (use as required) | 32 Selector lever |
| 10 Cap screw | 20 O-rings | 33 O-ring |
| 11 Cap screws | 21 Plugs | 34 Bushing (selector lever shaft) |
| 12 Cap screws | 22 Shim (use as required)* | 35 Selector lever shaft |
| | 23 Spring* | 36 Gasket |

* Only if equipped with 22.6 cm³ (1.38 cu.in.) hydraulic pump

SPECIFICATIONS

Dimensions of New Parts

ROCKSHAFT

O.D. of rockshaft piston	82.398 to 82.448 mm	3.2440 to 3.2460 in.
I.D. of rockshaft cylinder	82.510 to 82.590 mm	3.2485 to 3.2515 in.
Springs of pressure and discharge valves		
Spring tension at a length of 22 mm (0.875 in.)	4.5 to 5.5 kp	11 to 13 lbs.
Check valve spring		
Spring tension at a length of 19 mm (0.75 in.)	1.8 to 2.1 kp	3.9 to 4.7 lbs.
Spring of flow control valve*		
Spring tension at a length of 21 mm (0.82 in.)	3.4 to 4.1 kp	7.5 to 9.1 lbs.
Rockshaft setting rate at hitch balls, full load on rockshaft, within 15 minutes	64 mm	2.5 in.
Opening pressure of thermal relief valve	246 to 315 kp/cm ²	3500 to 4500 psi

ADJUSTMENTS

ADJUSTING CONTROL LEVER NEUTRAL RANGE

Neutral range	4 to 6 mm	0.157 to 0.236 in.
(1/4 turn of valve adjusting screw varies control valve lever neutral range by 4 mm = 0.150 in.)		

ADJUSTING ROCKSHAFT CONTROL LEVER

Distance between control lever friction pin and front end of quadrant slot (see fig. 8)	8 mm	0.3 in.
--	------	---------

ADJUSTING LOAD CONTROL RESPONSE

Distance between control lever friction pin and rear end of quadrant slot (see fig. 10)	92 mm	3.62 in.
--	-------	----------

ADJUSTING LOAD CONTROL ARM

Turn in control arm negative stop screw until it contacts arm, then back off		
on tractors not equipped with dual, independent PTO by	1/4 turn	
on tractors equipped with dual, independent PTO by	1/3 turn	

* Only if equipped with 22.6 cm³ (1.38 cu.in.) hydraulic pump.

Install bleed and stop valve assembly 14, ensuring that ball 12 fits into recess. Push valve assembly into cylinder bore.

Push piston rod stop 32, with smooth side away from piston rod yoke end, onto piston rod. Insert piston rod 34 into cylinder.

Install O-ring 23 and both back-up rings 22 on piston, O-ring between back-up rings.

Push piston 24 onto piston rod 34 until it contacts rod shoulder. Now install self locking nut 21 and tighten to specified torque (see Torques for Hardware). Install stop screw 31, special washer 30 and adjusting lever 29 to stop 32 (if removed). Locate the piston rod stop 32 on the piston rod with adjusting lever 29 opposite the stop arm 28.

Install gasket 17 on end cap 18. Insert two oil passage gaskets 16.

Place spring 15 over end of stop valve 14 and install end cap. Tighten cap screw 20 to the specified torque (see Torques for Hardware).

BLEEDING

After the cylinder is assembled, attach the hoses to quick coupler of tractor. Connect the hose from the stop rod side of the cylinder to the inside receptacle of the right-hand coupler. This ensures that the remote cylinder extends when the selective control valve lever is moved backward.

In order to bleed, hold remote cylinder vertical with hose end upward.

Start engine and move selective control valve lever several times into positions "retract" and "extend" so that any trapped air can escape from the cylinder.

SPECIFICATIONS

Period required to extend or retract
cylinder at 2100 rpm engine speed 2 seconds

TORQUES FOR HARDWARE

Remote cylinder piston rod nut	24.5 mkp	185 ft.lbs.
Cap screws of piston rod guide	4.8 mkp	35 ft.lbs.
Cap screws of remote cylinder end cap	11.7 mkp	85. ft.lbs.

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