Wiring Diagram

The individual components of the electrical system are identified by the following numbers:

1 Head lights
2 Combined rear work light and tail light
3 Warning lamps (tractors without canopy)
4 Socket (for hand lamp)
5 Connector, L. H.
6 Connector, R. H.
7 Connector
8 Flasher relay
9 Light switch
10 Key switch
11 Circuit breaker
12 Fuel gauge
13 Engine oil pressure indicator light
14 Alternator indicator light
15 Air cleaner restriction indicator light
16 Batteries
17 Start safety switch
18 Engine oil pressure warning switch
19 Regulator
20 Starting motor
21 Alternator
22 Capacitor
23 Fuel gauge sending unit
24 Air cleaner restriction warning switch
25 Turn signal switch (if equipped)
26 Transmission oil pressure indicator light
27 Transmission oil pressure warning switch
28 Resistor for low beam headlights (0.7 ohm)
29 Front warning lamps } Tractors with canopy
30 Rear warning lamps }

Cables and wires have different colors to facilitate identification. Each component and wire in the wiring diagram is identified by a number. From these numbers which are indicated below and on page 40-10-6 it is possible to establish the color, size and purpose of each wire or cable.

No.	Cables and Wires mm²	Gauge	Color	Component	from No.	Terminal No.	Component	to No.	Terminal No.
31	Ground straps			Batteries	16	–			Ground
32	25	2	black	Batteries	16	+	Starting motor	20	30
33	6	12	red	Starting motor	20	30	Alternator	21	B+
34	2.5	14	white	Start safety switch	17		Starting motor	20	50
35	1	16	blue	Alternator	21	D+	Regulator	19	D+
36	1	16	brown	Alternator	21	D-	Regulator	19	D-
37	1	16	green	Alternator	21	DF	Regulator	19	DF
38	1	16	blue	Regulator	19	D+	Alternator indicator light	14	
39*	1	16	green and green/white (diode cable)	Engine oil pressure indicator light	13		Transmission oil pressure indicator light	26	
40	1	16	red	Alternator indicator light	14		Transmission oil pressure indicator light	26	
41	1	16	black	Air cleaner restriction warning switch	24		Air cleaner restriction indicator light	15	
42	6	12	red	Starting motor	20	30	Circuit breaker	11	
43	1	16	black/white	Fuel gauge sending unit	23		Fuel gauge	12	G
44	1	16	red	Fuel gauge	12	+	Engine oil pressure indicator light	13	
45	1	16	red	Engine oil pressure indicator light	13		Alternator indicator light	14	
46	1	16	red	Fuel gauge	12	+	Key switch	10	ACC
47	2.5	14	black	Key switch	10	ST	Start safety switch	17	
48	1	16	green	Engine oil pressure warning switch	18		Engine oil pressure indicator light	13	

* Connect part of wire 39 (diode cable) colored green to green wire 48 (engine oil pressure indicator light) and part of wire colored green/white to green/white wire 67 (transmission oil pressure indicator light)

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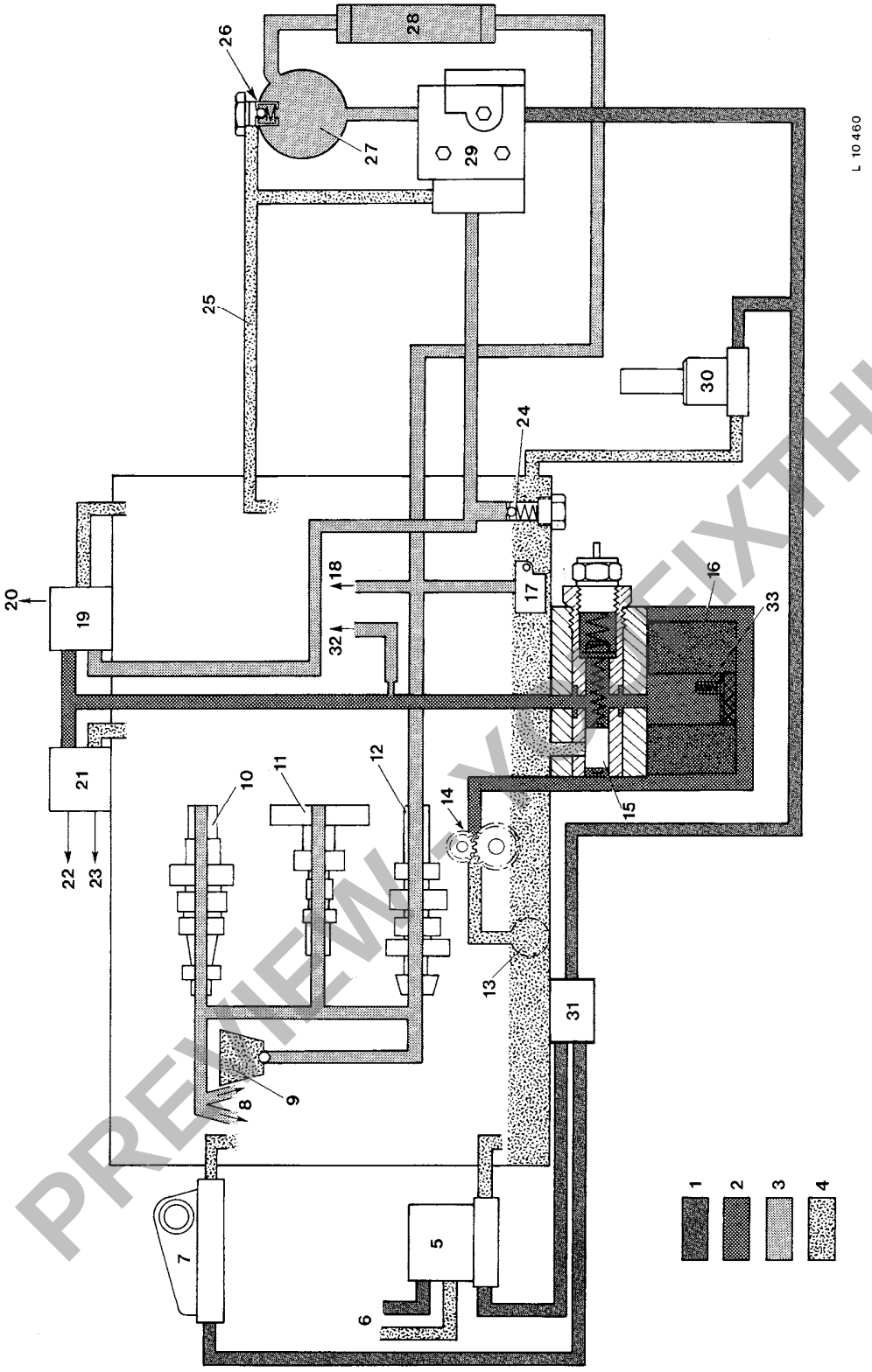


Fig. 1 — Hydraulic Circuit Flow Diagram

1 High pressure oil
2 Medium pressure oil
3 Low pressure oil
4 Pressure-free oil
5 Selective control valves
6 To and from couplers
7 Rockshaft
8 Final drive and PTO shaft lubrication
9 Transmission oil cup
10 Transmission drive shaft
11 Countershaft
12 Differential drive shaft
13 Intake screen
14 Transmission oil pump
15 Transmission oil filter by-pass valve
16 Transmission oil filter
17 Brake valve
18 To Lo-brake of Hi-Lo shift unit (lubrication)
19 Hi-Lo control valve assembly including pressure regulating valve
20 To Hi-Lo disk packs
21 PTO clutch control valve assembly
22 To PTO clutch
23 To PTO brake
24 Surge relief valve
25 Leak-off and bleed line
26 Check valve
27 Auxiliary oil reservoir
28 Oil cooler
29 Hydraulic pump
30 Power steering
31 Pressure control valve
32 To Hi-clutch and front bushings of Hi-Lo shift unit (lubrication)
33 By-pass valve of transmission oil filter element.

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STANDARD TORQUES

Recommended torques in Nm and ft-lb for UNC and UNF cap screws

Head marking (identifying strength)	 or 6.8**		 or 10.9**		 or 12.9***	
Thread-O.D.(in.)	Nm	ft-lb	Nm	ft-lb	Nm	ft-lb
1/4	—	—	15	10	20	14
5/16	—	—	30	20	40	30
3/8	—	—	50	35	70	50
7/16	50	35	80	55	110	80
1/2	80	55	120	85	170	120
9/16	100	75	180	130	240	175
5/8	150	105	230	170	320	240
3/4	260	185	400	300	580	425
7/8	220 ****	160 ****	600	445	930	685
1	340	250	910	670	1400	1030
1-1/8	450	330	1240	910	1980	1460
1-1/4	650	480	1700	1250	2800	2060

NOTE: A variation of ± 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.

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Group 25
Tractor Separation

10

SEPARATING BETWEEN ENGINE AND TRACTOR FRONT END

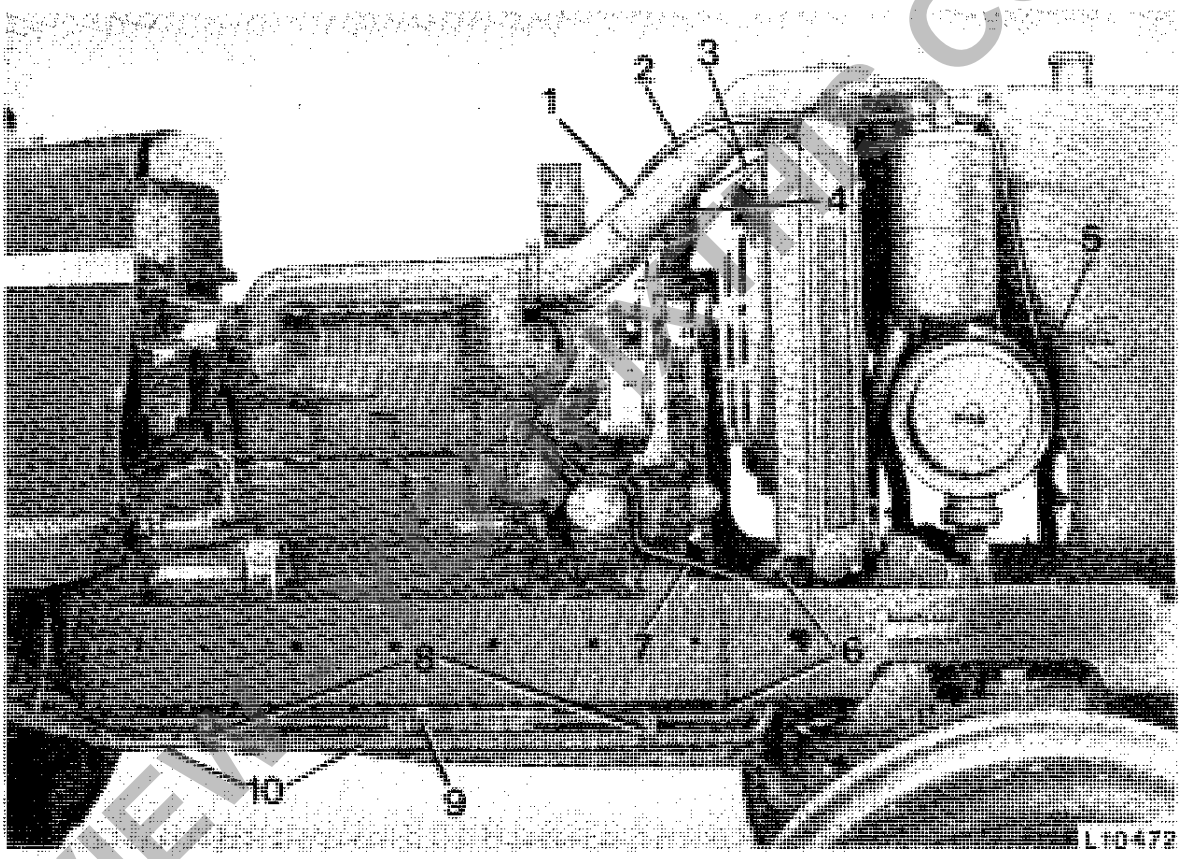


Fig. 1 — Separating between Tractor Front End and Engine

1 Air intake pipe
2 Leak-off and vent line
3 Fuel return line
4 Upper water hose
5 Cable of fuel gauge sending unit
6 Oil cooler return line
7 Fuel inlet line, tank to transfer pump
8 Hose clamps
9 Hydraulic pump inlet line
10 Hydraulic pump pressure line

REMOVAL

For safety disconnect ground straps from batteries. Remove front end weights (if equipped). Remove radiator cap and fuel tank cap. Remove radiator side grilles and hood.

Remove side frames.

Reinstall radiator and fuel tank caps.

Disconnect fuel return line 3 (fig. 1) at tank.

Disconnect cable 5 of fuel gauge sending unit at tank.

Disconnect cable at air cleaner restriction warning switch.

Disconnect air intake pipe 1 at engine intake manifold.

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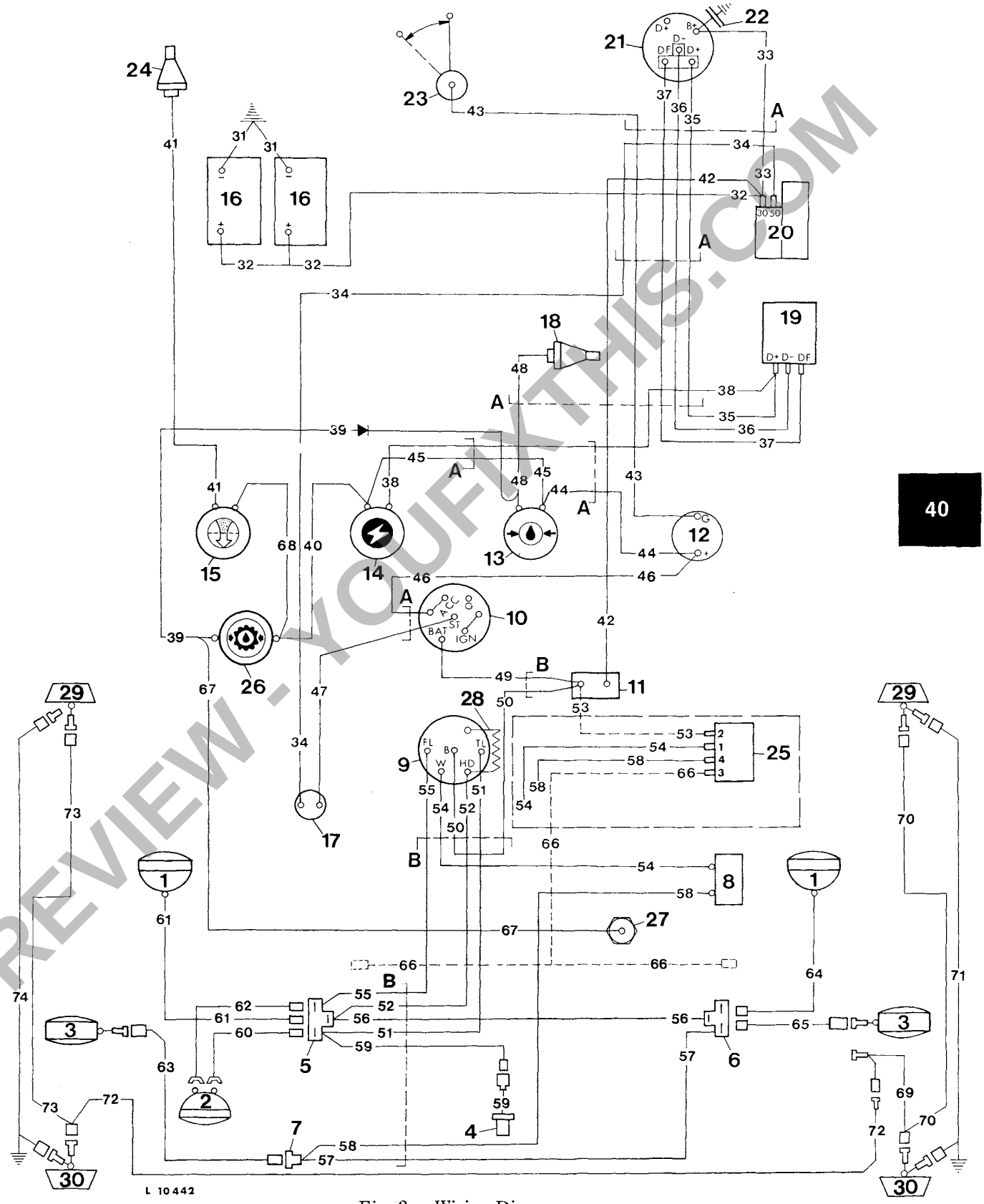


Fig. 3 — Wiring Diagram

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HYDRAULIC PUMP TESTS

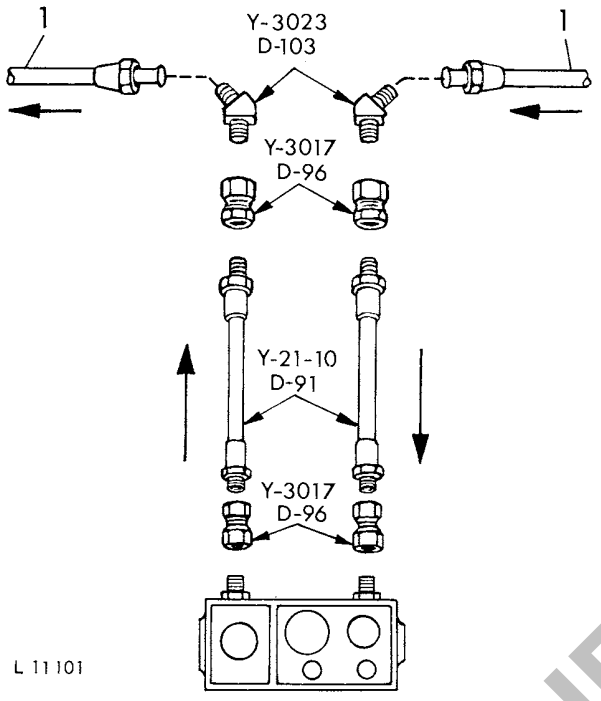


Fig. 6 — Testing Hydraulic Pump

1 Hydra' 'ic pump pressure line

Disconnect pressure .e at power steering T-fitting and install hydraulic test unit as shown in fig. 6.

STAND-BY PRESSURE CHECK

Open test unit control valve. Run engine at 2000 rpm and close test unit control valve.

Test unit pressure gauge should now show a pressure of 15.5 mPa (155 bar) (2250 psi).

If pressure is not as specified, adjust pump stroke control valve (see group 15).

FLOW CHECK

Run engine at 2000 rpm.

Open test unit control valve until a pressure of 13.8 mPa (138 bar) (2000 psi) is shown. This is the pump system pressure.

Delivery from the hydraulic pump should be 68 liters per minute (18 gpm).

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 "Testing Hydraulic Pump."

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 2000 rpm.

Place rockshaft selector lever in "L" position. Close test unit control valve until a pressure of 11.7 mPa (120 bar) (1750 psi) is shown. Raise rockshaft and record flow. If necessary, adjust rockshaft flow control valve until a flow of 25 to 28 liters per minute (6.5 to 7.5 gpm) has been obtained.

ROCKSHAFT THERMAL RELIEF VALVE CHECK

Connect a hydraulic hand pump equipped with a 35 mPa (350 bar) (5000 psi) pressure gauge to the single remote cylinder outlet.

Raise pressure to valve slowly. Valve should begin to discharge at a minimum of 24 mPa (242 bar) (3500 psi) and a maximum of 31 mPa (310 bar) (4500 psi). The valve should close when pressure is reduced to 17.2 mPa (172 bar) (2500 psi).

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

IMPORTANT: Do not exceed 35 mPa (350 bar) (5000 psi) pressure when checking the valve on the tractor as damage to seal might result.

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TORQUES FOR HARDWARE

Front support to engine, cap screws	230 Nm	170 ft-lb
Front support to oil pan, cap screws	400 Nm	300 ft-lb
Hydraulic pump drive shaft, clamping screws	50 Nm	35 ft-lb
Drag link to bell crank or steering arm, slotted nut*	75 Nm	55 ft-lb
Clutch housing to engine block, cap screws	230 Nm	170 ft-lb
Oil pan to clutch housing, cap screws	230 Nm	170 ft-lb
Clutch housing to transmission, cap screws	160 Nm	120 ft-lb
Retainer of hydraulic lines to clutch housing, cap screw	45 Nm	32 ft-lb
Final drive housings to transmission case, cap screws	230 Nm	170 ft-lb
Rockshaft housing to transmission case, cap screws	120 Nm	85 ft-lb
Wheel disk to hub (rack-and pinion axle) wheel bolts	400 Nm	300 ft-lb
Roll gard support to final drive housing, cap screws	400 Nm	300 ft-lb

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

SPECIAL TOOLS

No.	Description	Use
JD 244-1*	Lifting eye, straight	Removing and installing assemblies
JD 244-2*	Lifting eye, bent	Removing and installing assemblies

* SERVICE TOOLS, BOX 314, OWATONNA, MINNESOTA 55060

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Disconnect leak-off and vent line 2 leading to transmission shift cover at hydraulic oil reservoir.

Drain coolant and disconnect upper and lower water hoses at radiator.

Close fuel shut-off valve at bottom of fuel tank.

Disconnect fuel inlet line 7 at fuel tank and at fuel transfer pump. Remove fuel inlet line.

Relieve pressure in hydraulic system.

CAUTION: Escaping fluid under pressure can have sufficient force to penetrate the skin, causing serious personal injury. Before disconnecting lines, be sure to relieve all pressure. Before applying pressure to system, be sure all connections are tight and that lines, pipes and hoses are not damaged. Fluid escaping from a very small hole can almost be invisible. Use a piece of cardboard or wood, rather than hands, to search for suspected leaks.

If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

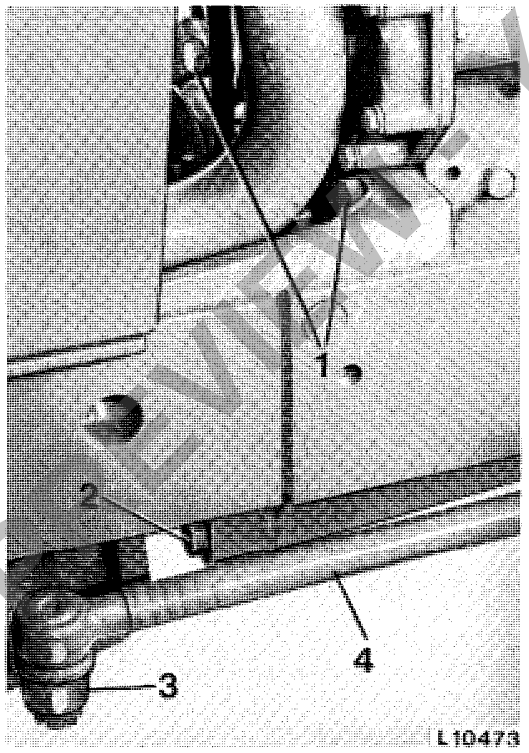


Fig. 2 — Attaching Points of Tractor Front End

1 Cap screws (4 used)
2 Cap screws (2 used)
3 Bell crank
4 Drag link

Disconnect hydraulic pump pressure line 10 (fig. 1) at T-piece. Disconnect inlet line 9 and disconnect return line 6 at oil cooler. Remove both hose clamps 8.

Disconnect drag link 4 (fig. 2) at bell crank 3.

Loosen clamping screws of hydraulic pump drive shaft.

Securely support rear of tractor under clutch housing.

Insert wooden blocks between front axle and front support to prevent the latter from tipping sideways. Attach front of tractor to a suitable hoist.

Remove cap screws 1 and 2 (fig. 2) of front support and separate front end from engine.

CAUTION: Take measures to prevent front of tractor from tipping to the front. If tank contains too much fuel, drain it or safely support front of tractor.

INSTALLATION

Make sure woodruff key is installed in shaft of hydraulic pump.

Move front of tractor toward engine.

Engage pump shaft in hydraulic pump drive shaft.

Connect pressure line 10 (fig. 1) and inlet line 9 of hydraulic pump and attach return line 6 to oil cooler.

Attach front of tractor to engine by means of cap screws 1 (fig. 2) and tighten to specified torque (see Torques for Hardware).

Make sure oil pan is flush against clutch housing. Attach oil pan to clutch housing, tightening cap screws to specified torque (see Torques for Hardware).

Eliminate gap between front support and crankcase by means of shims and attach front support to oil pan, tightening both cap screws 2 (fig. 2) to specified torque (see Torques for Hardware).

Also tighten pump shaft clamping screws to the specified torque.

IMPORTANT: Tighten pump shaft clamping screws only when tractor front end has been attached to engine and oil pan.

Connect fuel return line to fuel tank.

Connect fuel inlet line to fuel tank and fuel transfer pump.

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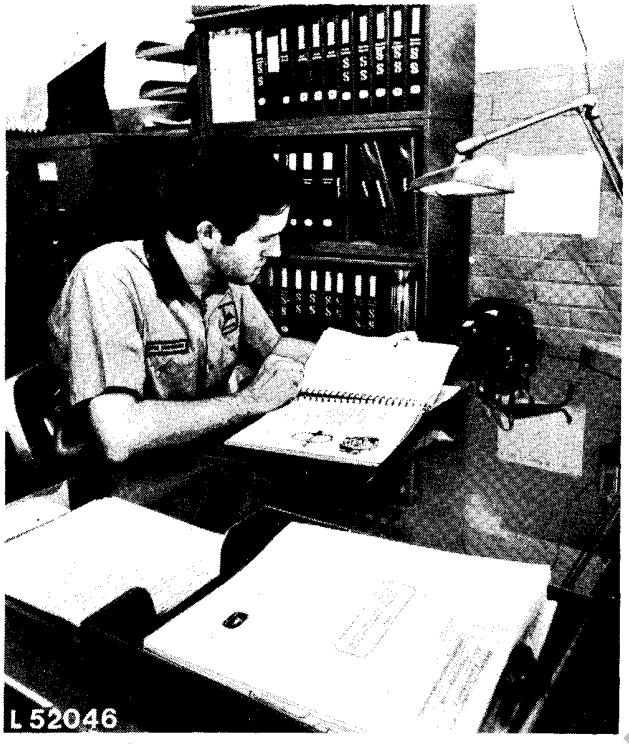
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Introduction



Use FOS Manuals for Reference



Use Technical Manuals for Actual Service

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

- **FOS Manuals – for reference**
- **Technical Manuals – for actual service**

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

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.

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 technician.

IMPORTANT: Your technical manual contains the new SI metric measurements which have been standardized internationally.

Example:

New	Old
10 N (Newton)	1 kp
10 Nm (Newton-Meter)	1 mkp
1 bar	1 kp/cm2
1 kW	= 1.36 PS (1.34 HP)



When a technician 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.

Some features of this technical manual:

- *Table of contents at front of whole Manual*
- *Contents at front of each Section*
- *Exploded views showing parts relationship*
- *Photos showing service techniques*
- *Specifications at end of each Group*
- *Special tools at end of each Group*

This technical manual was planned and written for you — an experienced 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.

Using the technical manual as a guide will reduce error and costly delay. It will also assure you the best in finished service work.

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

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INSTALLATION AND ADJUSTMENT

INSTALLING THE INJECTION PUMP

NOTE: Outlets on the fuel injection pump head to which the pressure lines are connected are identified by numbers.For identification the letters V, U, Z, Y, X and W are used in relation to cylinders 1, 5, 3, 6, 2 and 4 in firing order.

1. Fit a new gasket onto the pump housing and slide the housing onto the three studs. Fit pump shaft hub into drive gear and make sure that the dowel fits into bore in pump shaft hub. Insert pump housing into bore in cylinder block front plate. Screw the gear onto pump shaft and tighten three cap screws to the specified torque. Finally screw the three hex. nuts onto the studs and tighten only finger-tight.

2. Set the injection timing accurately (by pivoting the pump housing) (see "Timing the Injection Pump"). Then tighten the mounting nuts to the specified torque.

3. Install mounting hole cover on timing gear cover and tighten securely.

4. Install and connect all fuel lines, the speed control linkage and the shut-off cable. Bleed the fuel system (see below).

Installing Injection Pump with Pump Drive Gear Removed From Engine

1. Mount the injection pump and secure it with the three nuts (the position of the rotor is of no significance).

2. Mount the drive gear onto the pump shaft hub and make sure that the dowel fits into the groove in the shaft hub. At the same time adjust the gear to the injection timing (see section 20, group 25). Tighten the cap screws to the specified torque.

NOTE: By adjusting the gear to the injection timing, the rotor of the injection pump is also turned into the correct position with regard to injection timing.

3. Adjust (see below) and completely install fuel injection pump.

ADJUSTING FUEL INJECTION PUMP

NOTE: After having installed the injection pump, accurately determine the injection timing. This is made by means of the timing marks (see 3 and 4, fig. 5) on the cylinder block front plate 1 (fig. 5) and on the injection pump flange 2.

Loosen attaching nuts of injection pump and pivot pump housing first away from cylinder block as far as slots will allow. Then pivot it back again, but only far enough to place timing mark on the pump flange 2 (see 4, fig. 5) exactly opposite timing mark on the cylinder block front plate 1 (see 3, fig. 5).

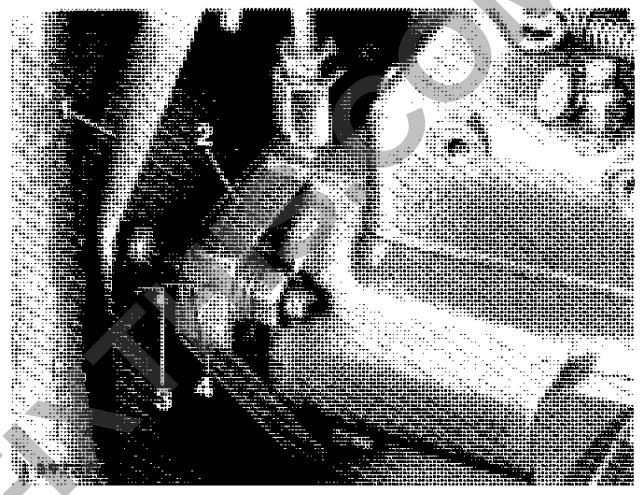


Fig. 5 — ROTO DIESEL Injection Pump Timing Marks

1 Cylinder block front plate
2 Pump securing flange
3 Timing mark on front plate
4 Timing mark on pump flange

NOTE: If the pump housing has been turned too far when timing the injection pump, pivot pump towards cylinder block as far as the slots will allow. Then pivot pump slowly away from cylinder block until the adjustment is just right. This is necessary to eliminate timing gear backlash.

After correct timing, re-tighten the three pump attaching nuts to the specified torque, making sure that the timing has not altered.

Bleed fuel system and injection pump thoroughly (see page 6).

NOTE: Cylinder block front plates 1 (fig. 5) supplied as spare parts are not provided with a timing mark (see 3, fig. 5).

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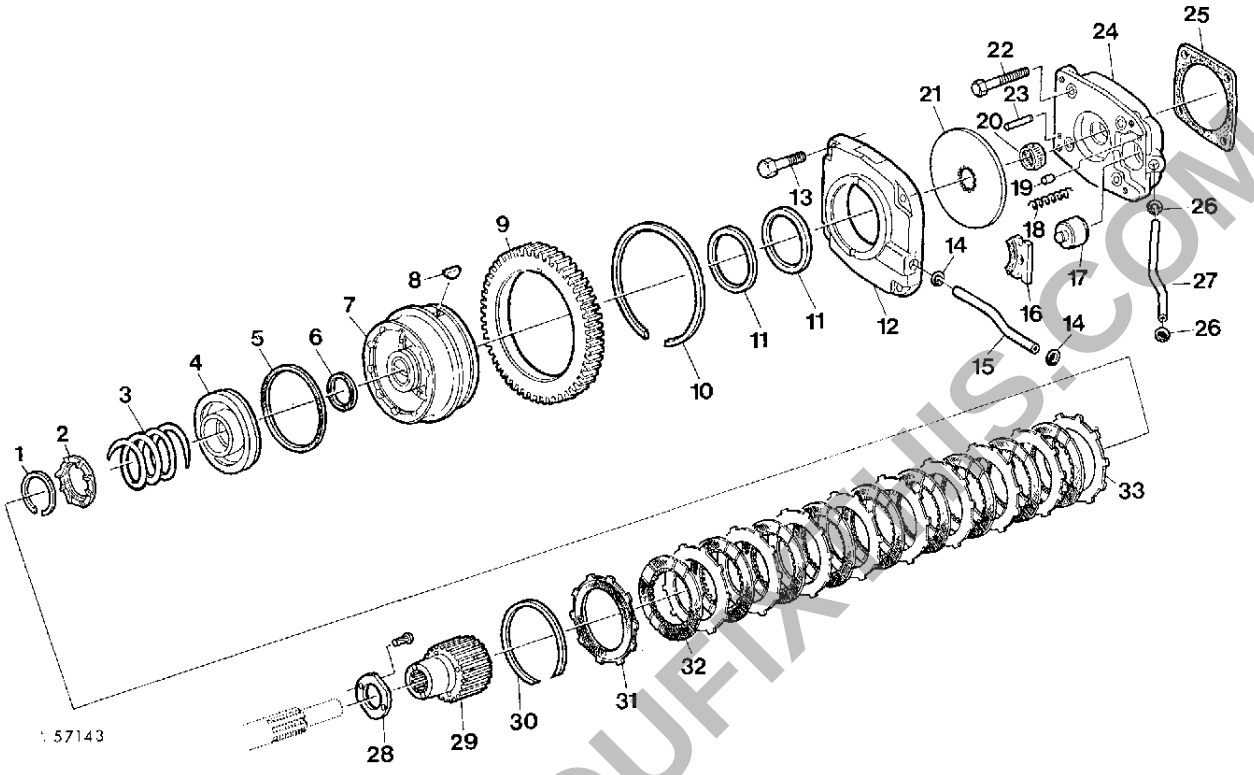


Fig. 7 — PTO Clutch, Exploded View

1 Snap ring
2 Spring retainer with fins
3 Spring
4 Piston
5 Seal
6 Seal
7 Clutch drum
8 Woodruff key
9 Drive gear
10 Snap ring
11 Seals
12 Oil manifold
13 Cap screw (4 used)
14 O-rings
15 Oil line
16 Brake plate
17 Brake piston
18 Spring
19 Dowel
20 Needle bearing
21 Brake disk
22 Cap screw (4 used)
23 Dowel
24 Bearing support
25 Gasket
26 O-rings
27 Oil line
28 Thrust washer
29 Hub
30 Snap ring
31 Cover plate
32 Disks (internal splines) (9 used)
33 Plates with tangs (9 used)

50

DISASSEMBLY

MULTIPLE-DISK CLUTCH

Remove snap ring 30 (fig. 6 and 7) from clutch drum 7. Lift out hub 29 with cover plate 31 and disk pack, indexing cover plate and plates 33 with slots of clutch drum.

Remove snap ring 1 from clutch drum. Take out spring retainer 2, spring 3 and piston 4.

Remove and discard seal 5 of piston and seal 6 of clutch drum.

CONTROL VALVE ASSEMBLY

Separate lever 18 (fig. 8) at valve spool. Remove control plate 16, driven plate 17 and lever 18.

Screw plug 1 out of valve housing 9.

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