INDEX
FD40B DOZER
SERVICE MANUAL SET
FORM NO. 73158173

Service manual set is arranged in the following order	Individual manuals are also available in translation in form numbers listed below				
SERVICE MANUAL	ENGLISH Form No	ESPAÑOL (Spanish)	FRANCAIS (French)	ITALIANO (Italian)	DEUTSCH (German)
Engine Related	73157200				
Turbocharger					
Transmission	73148250				
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Final Drives	73148248				
Undercarriage	73148249				
Cab	73157231				
Hydraulic System	73142645				
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The following additional Service Manuals, in English, are not included in the Manual set, but may be ordered from a Fiatallis dealer.

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Index card 73158196

FD40B DOZER SERVICE MANUAL SET FORM 73158173

Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

Never place gasoline or diesel fuel in an open pan.

Shut off engine and be sure all pressure in system has been relieved before removing panels, housings, covers, and caps. See Operation and Maintenance Instruction Manual.

Do not remove hoses or check valves in the hydraulic system without first removing load and relieving pressure on the supporting cylinders. Turn radiator cap slowly to relieve pressure before removing. Add coolant only with engine stopped or idling if hot. See Operation and Maintenance Instruction Manual.

Fluid escaping under pressure from a very small hole can almost be invisible and can have sufficient force to penetrate the skin. Use a piece of card board or wood to search for suspected pressure leaks. *DO NOT USE HANDS.* If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Never use any gas other than dry nitrogen to charge accumulators. See Operation and Maintenance Instruction Manual.

When making pressure checks use the correct gauge for expected pressure. See the Operation and Maintenance Instruction Manual or Service Manual for guidance.

For field service, move machine to level ground if possible and block machine. If work is absolutely necessary on an incline, block machine and its attachments securely. Move the machine to level ground as soon as possible.

Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of the machine by blocking or other means.

Block all wheels before bleeding or disconnecting any brake system lines and cylinders.

Never use make shift jacks when adjusting track tension. Follow the Undercarriage Service Manual.

Know your jacking equipment and its capacity. Be sure the jacking point used on the machine is appropriate for the load to be applied. Be sure the support of the jack at the machine and under the jack is appropriate and stable. Any equipment up on a jack is dangerous. Transfer load to appropriate blocking as a safety measure before proceeding with service or maintenance work according to local or national requirements.

Always block with external support any linkage or part on machine that requires work under the raised linkage, parts, or machine per local or national requirements. Never allow anyone to walk under or be near unblocked raised equipment. Avoid working or walking under raised blocked equipment unless you are assured of your safety.

When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladder or step platform that meets local or national requirements to reach the service point. If such ladders or platforms are not available, use the machine hand holds and steps as provided. Perform all service or maintenance carefully.

Shop or field service platforms and ladders used to maintain or service machinery should be constructed and maintained according to local or national requirements.

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

In lifting and handling heavy parts, slings must be of adequate strength for the purpose intended and must be in good condition.

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

When using compressed air for cleaning parts use safety glasses with side shields or goggles. Limit the pressure to 207 kPa (30 psi) according to local or national requirements.

Wear welders protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding or burning. Wear dark safety glasses near welding. *DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.*

Replace seat belts every two years on open canopy units and every three years on machines with cabs or at change of ownership.

Wear proper protective equipment such as safety goggles or safety glasses with side shields, hard hat, safety shoes, heavy gloves when metal or other particles are apt to fly or fall.

Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazards of electrical shock.

Keep maintenance area *CLEAN* and *DRY*. Remove water or oil slicks immediately.

Remove sharp edges and burrs from reworked parts.

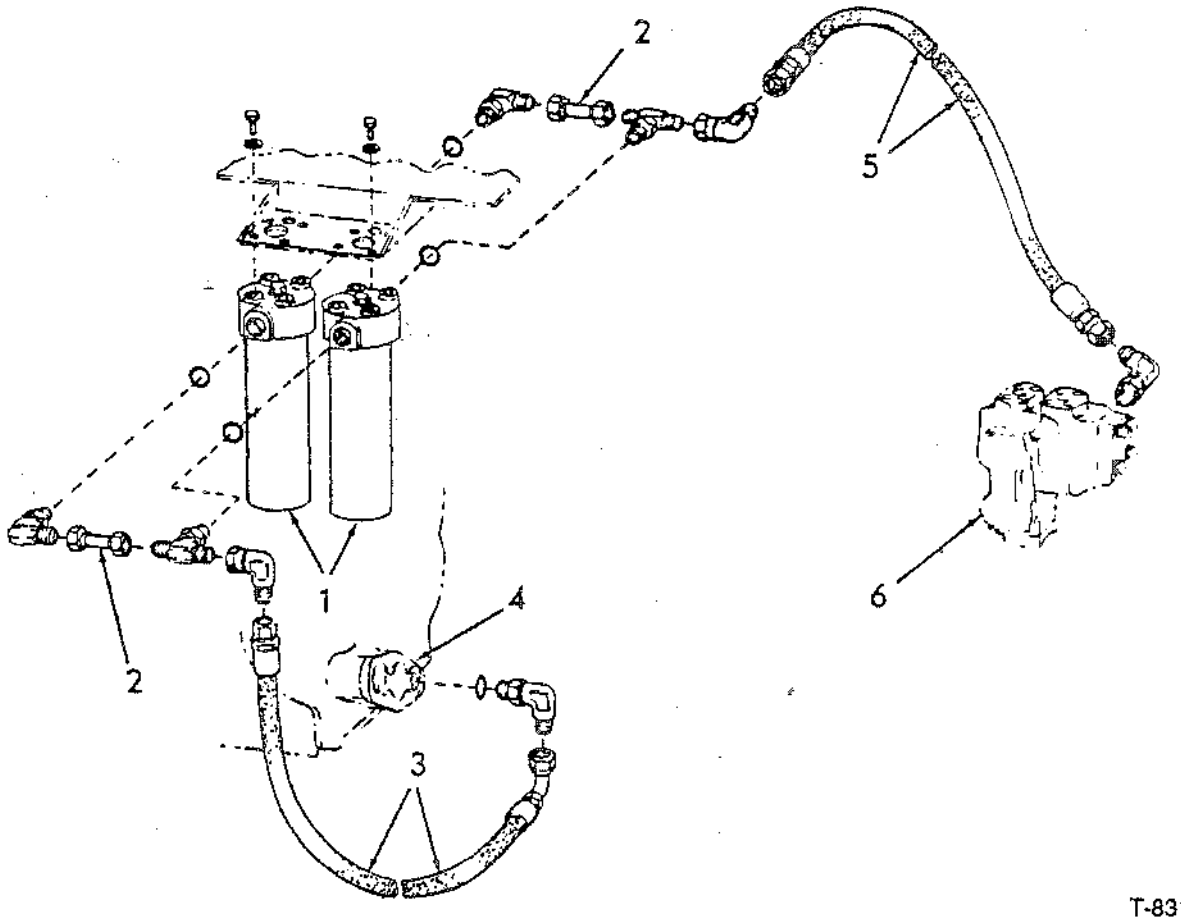
Be sure all mechanics tools are in good condition. *DO NOT* use tools with mushroomed heads. Always wear safety glasses with side shields.

Do not strike hardened steel parts with anything other than a soft iron or non-ferrous hammer.

Do not rush. Walk, do not run.

Know and use the hand signals used on particular jobs and know who has the responsibility for signaling.

TOPIC 3 MUFFLER AND AIR CLEANER



T-83190

FIG.6 TRANSMISSION OIL PUMP AND FILTER LINES

1. Filter assy.
2. Tube assy.
3. Hose
4. Pump assy.
5. Hose
6. Control valve

3.3 AIR CLEANER REMOVAL

3.3.1
Refer to 2.1 and remove engine hood. Refer to 2.3 and remove engine upper right hand side plate.

3.3.2 REMOVING AIR CLEANERS FOR ENGINE REPAIR

3.3.2.1
Disconnect hoses Fig. 6 (3,5) from fittings at filters (1). Tape or plug fittings to prevent entrance of dirt.

3.3.2.2
Remove clips holding temperature gauge line from bracket and move line away from bracket.

3.3.2.3
Loosen clamps holding hose (11) to turbocharger and loosen hose.

⚠ WARNING

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

3.3.2.4
Attach suitable slings to air cleaners. Remove four mounting capscrews securing mounting plate (9) to bracket (13) and engine. Use a suitable hoist and lift air cleaner assemblies up and out of tractor. Cover air cleaner inlet and air cleaner outlet to prevent entrance of dirt.

4.4.ENGINE PROTECTION SYSTEM (Special Equipment)

4.4.1 REMOVAL
NOTE: Identify and tag all hoses upon removal.

4.4.1.1
Disconnect hose Fig. 14 (5) from lube oil filters (6). Disconnect hose (4) from fuel supply line check valve.

4.4.1.2
Disconnect hose, Fig. 14 (3) from oil pan (left side sump area). Disconnect hose (10) from oil pan (right side sump area).

4.4.1.3
Disconnect hose, Fig. 14 (9) from fuel line. Remove clamp (14). Disconnect hose (15) at coolant sensor (13) located right side of engine behind the thermostat housing.

4.4.1.4
Remove clamp, Fig. 14 (11) and disconnect hose (12) at the thermostat housing (located on the left rear side of the thermostat housing).

4.4.1.5
Remove control (7), tube (8), valve (1), mounting bracket (2), and all hoses (3-4-5-9-10-12-15) as a unit.

4.4.2 INSTALLATION
4.4.2.1
Install control, Fig. 14 (7), tube (8), valve (1), mounting bracket (2), and all hoses (3-4-5-9-10-12-15) as a unit.

4.4.2.2
Connect hose (12) to thermostat housing (located on left rear side of thermostat housing). Install clamp(11).

4.4.2.3
Connect hose (9) to fuel line and hose (15) to coolant sensor (13)(located on right rear side of thermostat housing). Install clamp (14).

4.4.2.4
Connect hose (3) to oil pan (left side sump area). Connect hose (10) to oil pan (right side sump area).

4.4.2.5
Connect hose (4) to fuel supply line check valve and hose (5) to lube oil filters (6).

4.4.3 TROUBLESHOOTING
4.4.3.1
The engine protection system activate and functions in three ways:

1. Loss of oil pressure.
2. Excessively high coolant temperature.
3. Low coolant level, water pump failure.

If an engine protection system automatic throttle down situation occurs, one or more of the reasons discussed in 4.4.3.1 could be at fault.

If the situation permits immediately ground all implements, and monitor oil pressure and water temperature gauge. Check engine oil level, and coolant level. If necessary add engine oil and/or coolant

CAUTION: Coolant system is under pressure and care should be taken in removing radiator cap.

4.4.4 ENGINE RESTART

WARNING

Before moving machine or attachments be sure exposed people in the area are clear of the machine. Walk completely around machine before mounting. Sound horn.

Never attempt to operate machine or attachment except when seated in the operator's seat. Keep head, body, limbs, hands and feet inside the operator's compartment to reduce exposure to hazards outside operator's compartment.

Warn all people who may be servicing or working around machine before starting engine.

Do not run engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

Observe all start up and shut down procedures and *WARNINGS* listed in the Operation and Maintenance Instruction Manual

4.4.4.1
Place the transmission control lever in neutral, the engine shut off control in the UP position. Place the throttle lever in the low idle position and start the engine.

4.4.4.2
Allow the engine to operate at low idle for a few minutes. Monitor all gauges. (Consult Operator's Manual for start up procedure).

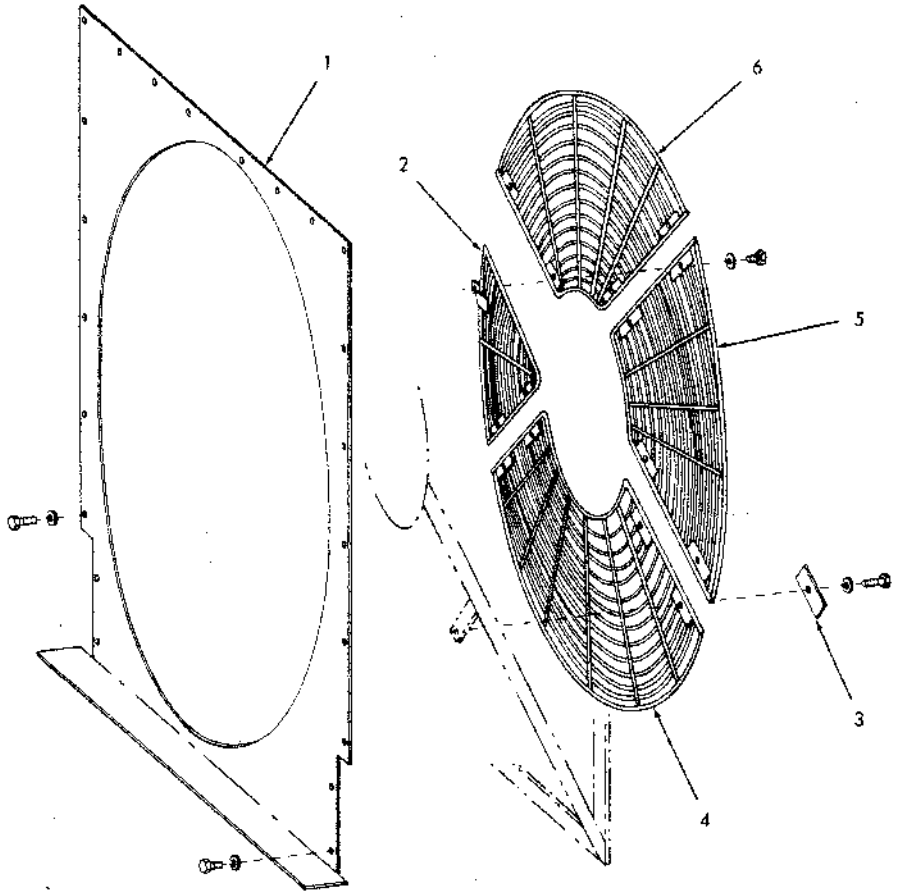


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FIG. 21 FAN GUARDS

1. Shroud
2. Guard
3. Plate
4. Guard
5. Guard
6. Guard

6.2.2.4
Install overflow tube and secure with clips and capscrews. Refer to 6.1.2 and install radiator.

6.3 IDLER ASSEMBLY

6.3.1 REMOVAL

6.3.1.1
Refer to 6.1.1 and remove the radiator. Refer to 6.2.1 and remove the fan and fan guard.

6.3.1.2
Loosen locking nut, Fig. 22 (1) and remove cotter pin (2). Rotate adapter (3) until pulley on idler assembly (6) allows enough clearance to remove or replace belt set (8).

6.3.1.3
Remove capscrews securing idler assembly, Fig. 20 (13) to radiator guard. Remove clamps (10) and removeidler assembly, with attached spring, from tractor.

6.3.2 DISASSEMBLY

⚠ WARNING

Spring may have residual tension.

6.3.2.1
Rotate adapter, Fig. 20 (28) to relieve tension on spring as much as possible. Remove spring pin and remove adapter. Remove adapter and washers (26) carefully. Spring may still be under tension. Remove block (25).

6.3.2.2
Remove cotter pin and washer and disconnect yoke (22) from idler assembly. Remove yoke, rod (23) and pin (12) from idler assembly.

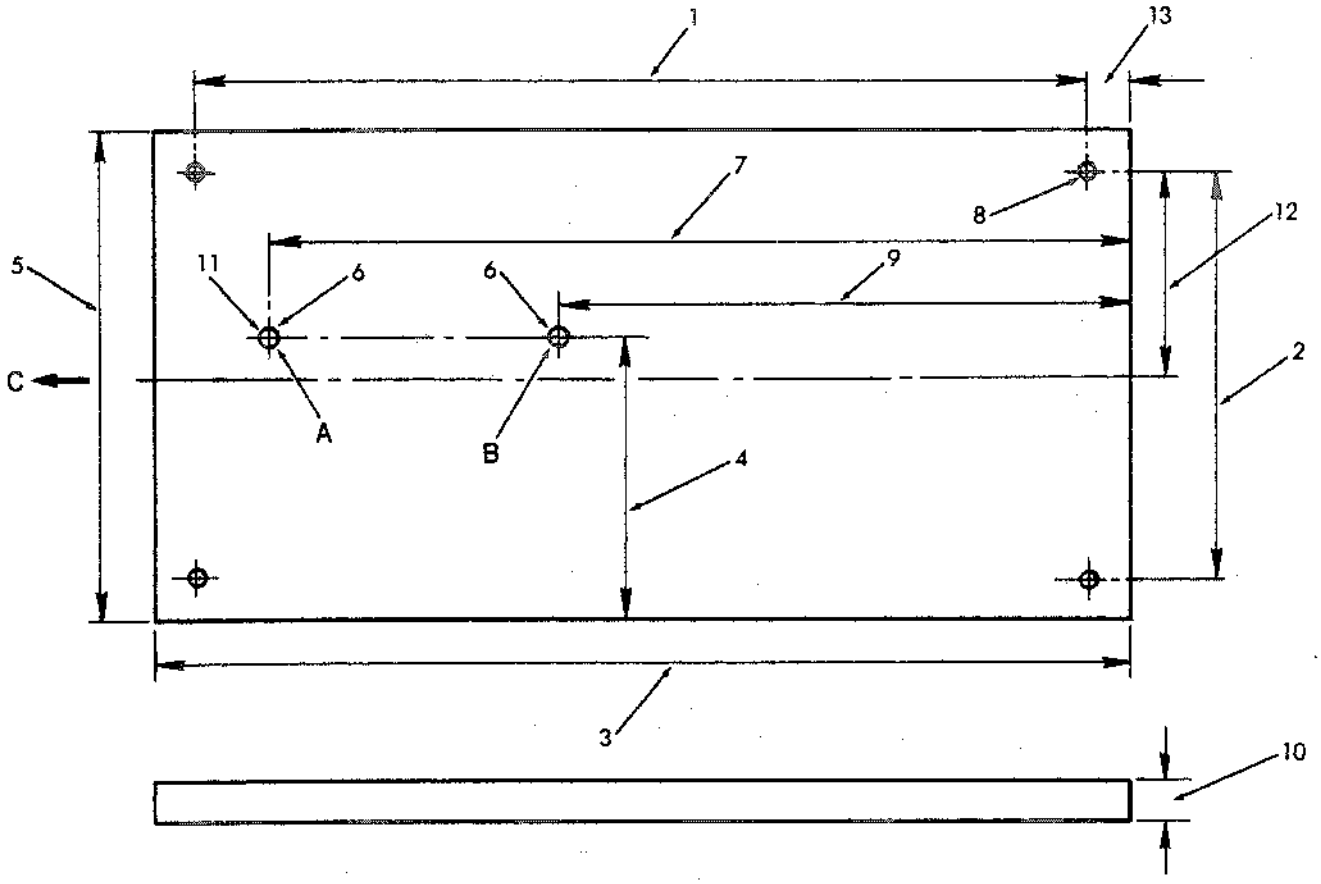

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FIG. 29 ENGINE REAR LIFTING PLATE DIMENSIONS

1. 393.7mm (15.5")
2. 304.8mm (12.0")
3. 450.8mm (17.75")
4. 190.5mm (7.5")
5. 355.6mm (14.0")
6. Two holes 19.8mm (.78125") drill
7. 368.3mm (14.5")
8. Four holes 14.2mm (.5625") drill
9. 225.4mm (8.875")
10. Plate 12.7mm (.5") thick
11. Nut (.75"NC). Two required. Weld in position on underside of plate
12. 152.4mm (6.0")
13. 19.0mm (.75")

A. Position of lifting eye for lifting engine without converter.
B. Position of lifting eye for lifting engine with converter.
C. To front of engine when installed.

FD40, FD40B

crawler tractor

Transmission

service manual

S/N 89A03001-UP

Form 73148250 English

⚠ WARNING

STUDY THE OPERATION AND MAINTENANCE INSTRUCTION MANUAL THROUGH BEFORE STARTING. OPERATING, MAINTAINING, FUELING OR SERVICING THIS MACHINE.

⚠ The Operation and Maintenance Instruction Manual provides the instructions and procedures for starting, operating, maintaining, fueling, shutdown and servicing that are necessary for properly conducting the procedures for overhaul of the related components outlined in this Service Manual.

⚠ This symbol is your safety alert sign. It MEANS ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED.

⚠ Read and heed all safety instructions carrying the signal words WARNING and DANGER.

⚠ Machine mounted safety signs have been color coded yellow with black borders and lettering for warning and red with white borders and lettering for danger points.

1.2.4 Travel Control Valve
Mounted on upper right side of transmission, valve contains two plungers which direct oil to engage transmission clutches--one for direction clutches, the other the range clutches. Plungers are mechanically controlled by the operator and are held in position by detents. Mounted on top of this is a small housing containing two check balls; its only function is to prevent range apply oil in one circuit from transferring to another.

1.2.5 Shift Inhibiting Valve
Mounted on upper right side of transmission, valve contains four principal components to regulate oil flows to other parts of the system; the components and their functions are:

1.2.5.1
DIRECTION CONTROL PISTON regulates signal oil flow to direction clutch shuttle valves. In neutral, Fig.1-1, piston is centered in its bore, blocking this oil flow. When a direction shift has been made, Fig.1-2, piston is forced off-center by oil from travel control valve. Signal oil (from main circuit) flows to the end of shuttle valve which controls main oil flow to desired direction clutch and the clutch is engaged (refer to 1.2.7 for description of the shuttle valve).As direction control piston is forced off-center, an internal oil passage leading to flow sensing piston is opened; incoming oil from travel control valve flows through this passage to flow sensing piston. This oil is restricted to assure complete engagement of direction clutch before input clutch circuit is charged with oil.

1.2.5.2
FLOW SENSING PISTON regulates main circuit oil flow to end of piston in input clutch control section of pressure regulating valve, to the brake regulator valve and to the sensing vlave located in shift inhibiting valve top cover. In neutral,Fig.1-1, flow sensing piston is held closed by spring tension to stop main circuit oil flow to these valves. When a direction shift has been made, Fig.1-2, oil from travel control valve forces flow sensing piston open, allowing oil flow to these valves. Description of the input clutch control valve piston is given in 1.2.3.4; description of sensing valve is given in 1.2.5.4; description of brake regulator valve is given in Steering Clutches and Brakes service manual.

1.2.5.3
SHIFT INHIBIT CENTER PISTON AND END PISTONS regulate main circuit oil flow to follower piston at each end of direction control piston. Movement of pistons in the bore is dependent on the operation of shift inhibiting pump. In neutral,Fig.1-1, or in PTO,the shift inhibiting pump does not operate because tractor is not moving. Pressures on each of the shift inhibit end pistons are the same and the restricted outlet to sump in the end pistons centers the pistons in the valve body, blocking main circuit flow to direction control piston follower pistons. When the tractor is moving, Fig.1-2, shift inhibiting pump is operating, creating a pressure differential on ends of piston. This pressure differential forces shift inhibit pistons off-center; main circuit oil flows through shift inhibit center piston to follower piston on depressed end of direction control piston. Fuction of this oil is described in 1.5.

1.2.5.4
SENSING VALVE located in the shift inhibiting valve top cover has no function on this tractor; oil flow to this valve is deadheaded at valve piston.

1.2.6 DECELERATING AND SAFETY BRAKE VALVE
Refer to Brake Regulator Valve in Steering CLutches and Brakes service manual for description and operation of this valve.

MEMO

Shift inhibit pump pressures can be checked at the same time by using two additional gauges with 20.7 bar (300 psi) capacity.

NOTE: To make the following procedure easier to understand, the gauge connected to point marked INH. valve FWD. on test panel will be referred to as #9 and gauge connected to point marked INH. valve REV. as #10.

4.3 PRESSURE CHECK PROCEDURES

4.3.1

The method for checking each pressure is given in 4.1 chart. One procedure not given is the direction shift. Although the same pressure readings will result from individual pressure checks, the sequence of pressure changes when a direction shift is made may give the mechanic a little better understanding of the hydraulic system.

A direction shift can be simulated by moving transmission shift lever to 3rd forward with engine at high idle and steering clutches disengaged. Remain in this position long enough to note pressures then quickly move shift lever to 3rd reverse. Observe pressures while the shift is being made and after the shift has been completed.

NOTE: The simulated shift will take longer to complete than an actual shift because the unit is not moving. The following sequence of events will take place in a properly operating system.

Assuming the gauges are connected as shown in Fig.4-2, the following pressures will be observed before the shift is made; input clutch apply on #1*, transmission clutch apply on #3 and #6, converter on #7, transmission lube on #7* and main pressure on #9. Gauge 2,4,5 and 10 will indicate zero pressure. Gauges #11 and #12 will indicate shift inhibit pump pressure differential (gauge #11 indicating the higher pressure).

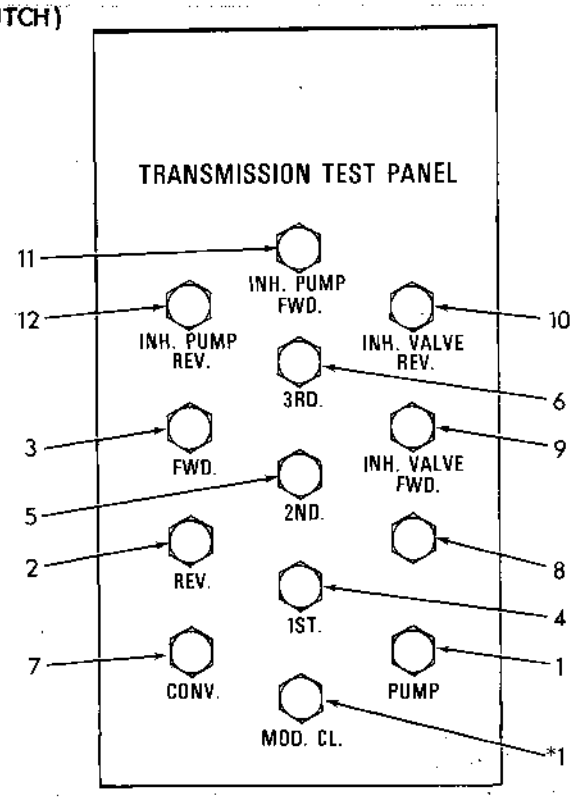


FIG.4-2 HYDRAULIC SYSTEM PRESSURE CHECK POINTS T-79713

1. Main (pump) pressure (gauge #1)
*1. Input clutch apply (use gauge #1 after checking main pressure or use additional gauge with capacity of 300 psi (21.09 kg/cm^2)
2. Reverse clutch apply (gauge #2)
3. Forward clutch apply (gauge #3)
4. 1st range clutch apply (gauge #4)
5. 2nd range clutch apply (gauge #5)
6. 3rd range clutch apply (gauge #6)
7. Converter and/or transmission lube (gauge #7)
8. Not used--prior usage was lube (gauge #8)
9. Inhibit valve forward (gauge #9)
10. Inhibit valve reverse (gauge #10)
11. Inhibit pump forward (gauge #11)
12. Inhibit pump reverse (gauge #12)

NOTE: *Input clutch usage prior to s/n 89A03103 excluding 89A03010,3017, 3022,3023,3033,3034,3035

PRESSURE (PSI) SHIFT LEVER POSITION	MAIN	CONV. OUT	LUBE		FWD	REV	1ST	2ND	3RD	SHIFT INHIBIT SYSTEM			
										INH. VALVE FWD. FIG. 4-3 (9)	INH. VALVE REV. FIG. 4-3 (10)	INH. PUMP FWD. FIG. 4-3(11)	INH. PUMP REV. FIG. 4-3(12)
NEUTRAL	175-220	80-90	60-70							0	0	80-120	80-120
PTO	175-220	80-90	60-70		175-200					175-200	0	180-200	80-120
*1 FWD.	175-220	80-90	60-70		175-200		175-200			175-200	0	180-200	Note 1
*2 FWD.	175-220	80-90	60-70		175-200			175-200		175-200	0	180-200	Note 1
*3 FWD.	175-220	80-90	60-70		175-200				175-200	175-200	0	180-200	Note 1
*1 REV.	175-220	80-90	60-70			175-200	175-200			0	175-200	Note 2	180-200
*2 REV.	175-220	80-90	60-70			175-200		175-200		0	175-200	Note 2	180-200
*3 REV.	175-220	80-90	60-70			175-200			175-200	0	175-200	Note 2	180-200

SHIFT LEVER POSITION / FLOW (GPM)	RPM	NEUT	1ST	2ND	3RD	* 1ST FWD	* 2ND FWD	* 3RD FWD	* 1ST REV	* 2ND REV	* 3RD REV
TRANSMISSION PUMP	1450	37-41									
	High Idle	56-60									
TRANSMISSION CLUTCH APPLY	High Idle	1.5-2	4-6	4-6	4-6	5-7	5-7	5-7	5-7	5-7	5-7
TORQUE CONVERTER IN	High Idle							37			37
TORQUE CONVERTER OUT	High Idle							35			35
TRANSMISSION LUBE	1450					20-25	20-25	20-25	20-25	20-25	20-25
	High Idle					36-40	36-40	36-40	36-40	36-40	36-40

NOTES:

1. 80-100 psi less than gauge #11
2. 80-100 psi less than gauge #12

1 psi 0.07 kg /cm^2

2 gpm 3.78 lit/min

* Disengage steering clutches when checking pressure and/or flow.

SPECIFIED PRESSURES AND FLOWS

(WITHOUT INPUT CLUTCH)

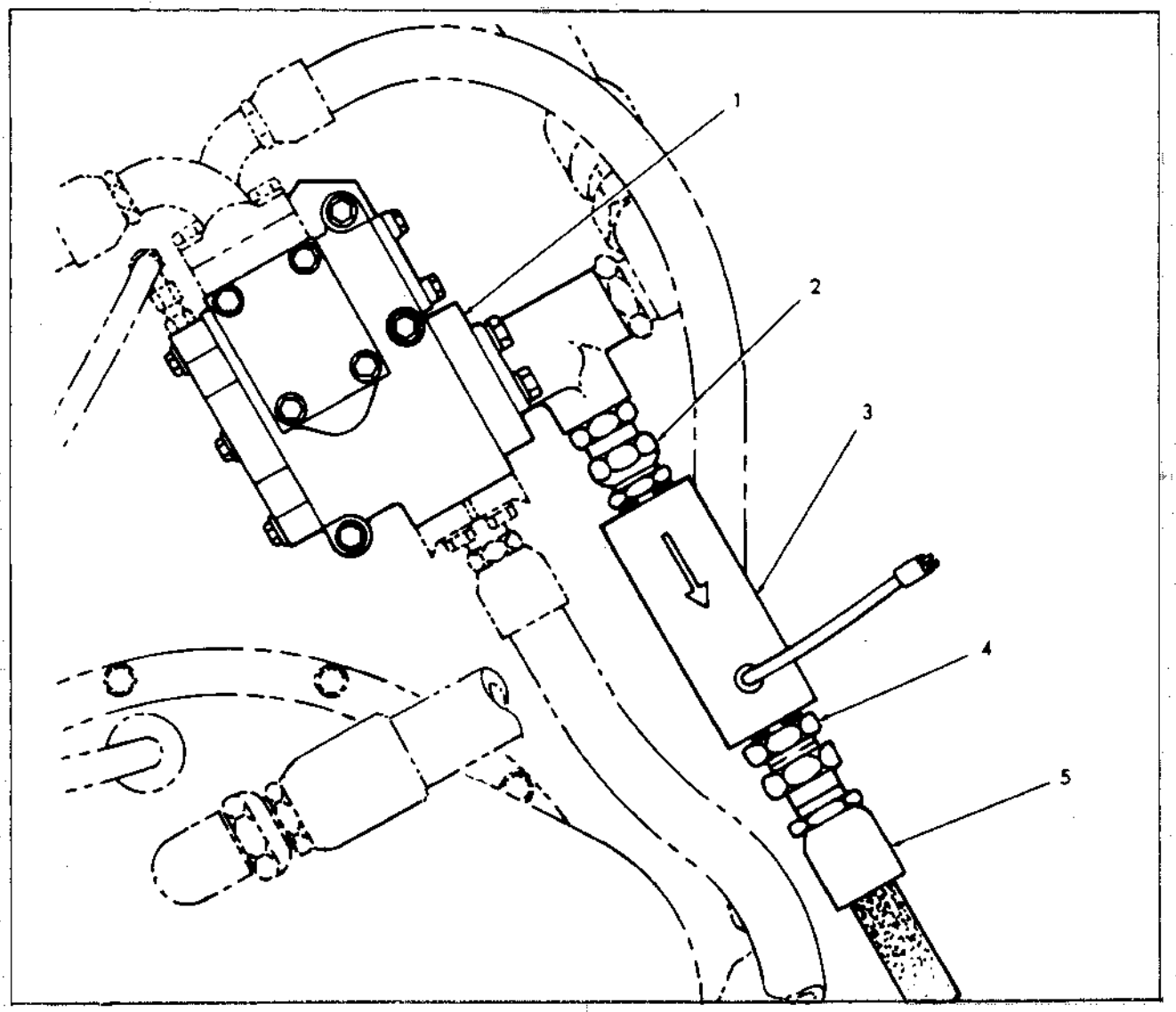
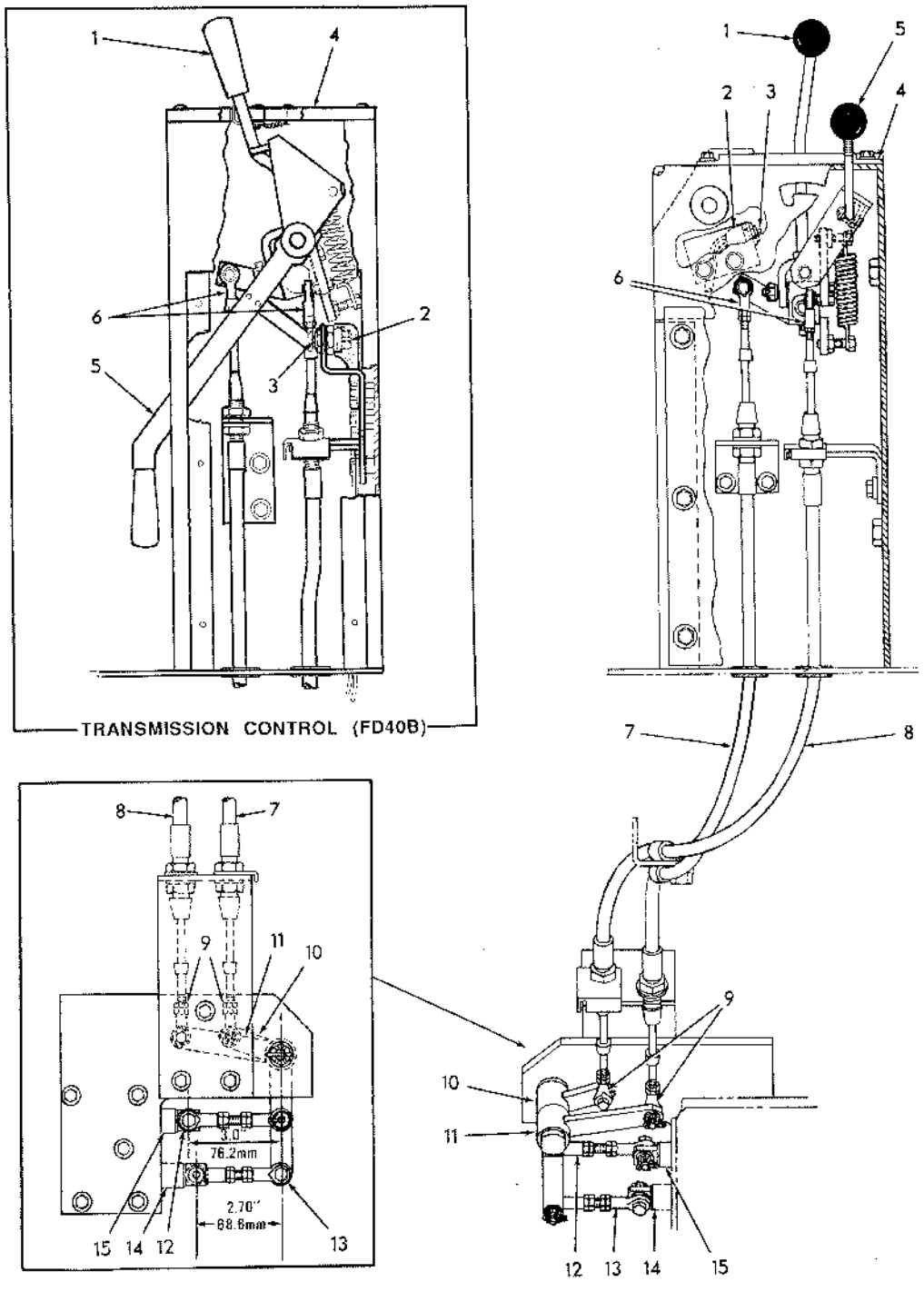


FIG.5A-2 TRANSMISSION CLUTCH APPLY FLOW CHECK T-83572

1.Pressure regulating valve
2.Adapter(Part of TG-100C test kit)
3.Flow block(Part of TG-100C test kit)
4.Connector #70935744(added to check flow)
5.Oil line to transmission oil manifold

If pump flow (5A.2) and transmission clutch apply flow (5A.3) are both O.K., regulator piston(s) may be stuck, dumping too much oil to sump. Refer to 6.1 for repair procedure. If regulator piston(s) is not at fault, leakage is in torque converter; disassemble converter and inspect for broken sealing rings.

5A.5.3.2
High flow; torque converter pressure and transmission lube pressure also high. Failure in torque converter/transmission lube section of pressure regulating valve; refer to 6.1 for repair procedure.



T-79721

FIG. 6-7 TRANSMISSION CONTROL LINKAGE

1. Transmission shift lever
2. Neutral safety switch
3. Button
4. Shift guide plate
5. Safety lock lever
6. Rod ends (upper)
7. Range control cable
8. Direction control cable
9. Rod ends (intermediate)
10. Bellcrank (direction)
11. Bellcrank (range)
12. Lower control rod (direction)
13. Lower control rod (range)
14. Range plunger
15. Direction plunger

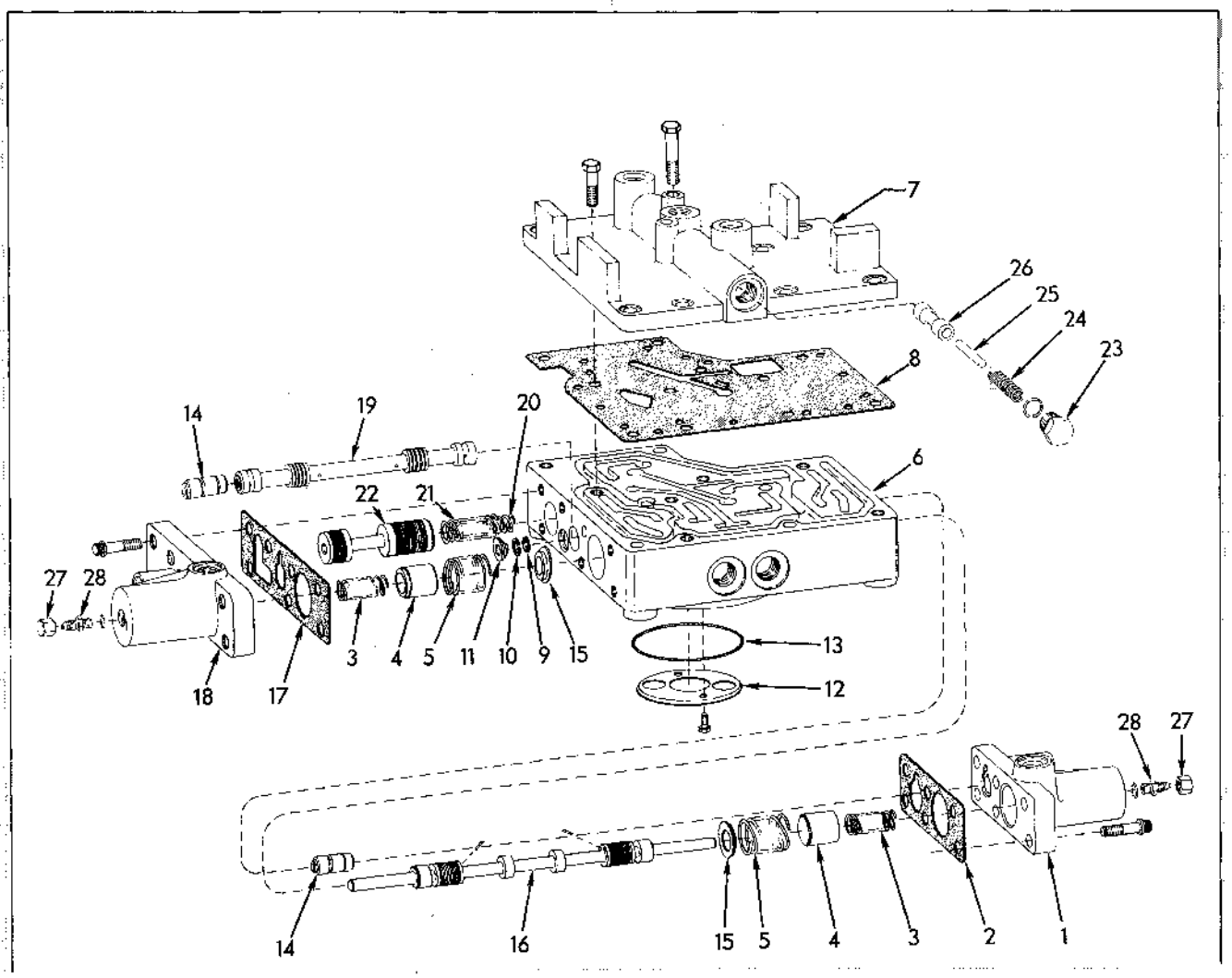


FIG.6-12 SHIFT INHIBITING VALVE (With Input Clutch) T-75518

1.Side cover
2.Gasket
3.Follower piston spring
4.Follower piston
5.Direction control piston spring
6.Body
7.Top cover
8.Gasket
9.Oil screen
10.Snap ring
11.Check valve w/1.57mm(.062")orifice
12.O-ring retainer
13.O-ring
14.Shift inhibit end piston
15.Retainer
16.Direction control piston
17.Gasket
18.Side cover
19.Shift inhibit center piston
20.Flow sensing piston inner spring
21.Flow sensing piston outer spring
22.Flow sensing piston
23.Plug w/o-ring
24.Sensing valve spring
25.Dowel pin
26.Sensing valve piston
27.Cap
28.Connector w/o-ring

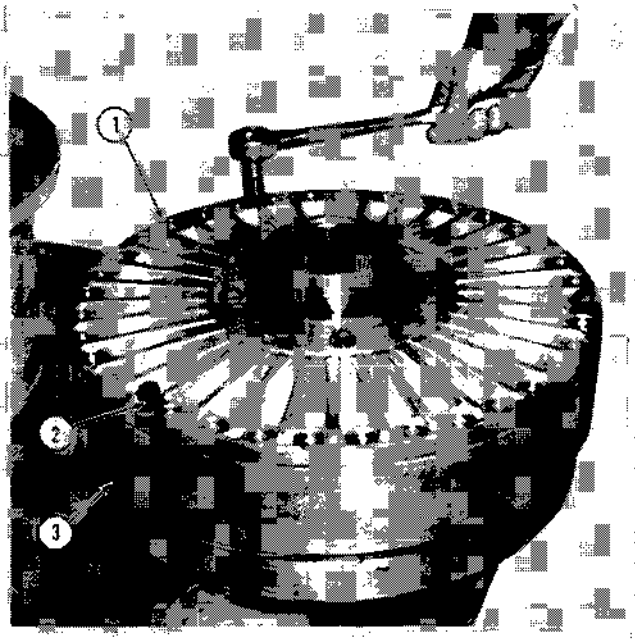


FIG.7-13 REMOVING IMPELLER WHEEL FROM ROTATING HOUSING T-79734

1. Impeller wheel
2. Pusher screw (3 required)
3. Rotating housing

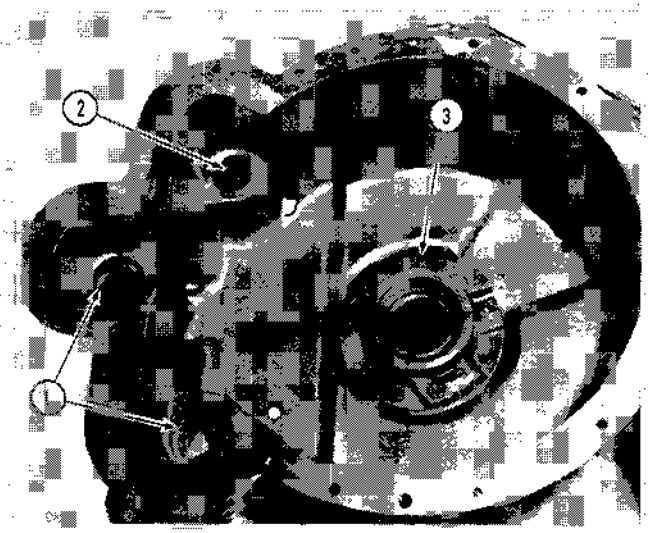


FIG.7-14 INSTALLING GUIDE WHEEL CARRIER SUPPORT T-79735

1. Snap ring
2. Snap ring
3. Guide wheel carrier support

7.5 INSPECTION

7.5.1 Input Clutch

PILOT BEARING. Replace if worn, pitted or chipped.

SEALING RINGS. All sealing rings should be replaced when clutch is rebuilt.

SEALING RING WEAR SLEEVE. Replace if excessively grooved.

FRICTION PLATES(STEEL). Thickness of a new plate is 2.61-2.66 mm(.103"-.105"); replace if thickness is less than 2.41 mm.(095").

FRICTION PLATES(BI-METALLIC). Thickness of a new plate including friction material is 3.556 - 3.683 mm (.140"-.145"); depth of friction material grooves is 0.304 - 0.508 mm(.012" - .020").Replace plate if thickness is less than 3.302 mm (.130") or if thickness varies more than .050 mm (.002").

NOTE: If friction plates are severely scored or burned, they must be replaced regardless of wear.

ACCESSORY DRIVE GEAR & BUSHING. Replace if gear teeth are chipped or worn,or if I.D. of bushing is more than 101.85 mm (4.010").

BRONZE THRUST WASHER. Replace if washer is grooved or severely worn, or if clutch hub shows any signs of contact with spider.

7.5.2 Gear Housing

BEARINGS. Bearings must roll smoothly and be free of pitted, cracked, or worn balls,rollers,and races; retainers must not be dented or damaged. Badly worn ball bearings can be detected by presence of excessive end play between outer and inner races. Hold one race steady and move other race endwise; compare difference in movement of used bearing with a new bearing. Check outer and inner races for indications of bearing creepage.

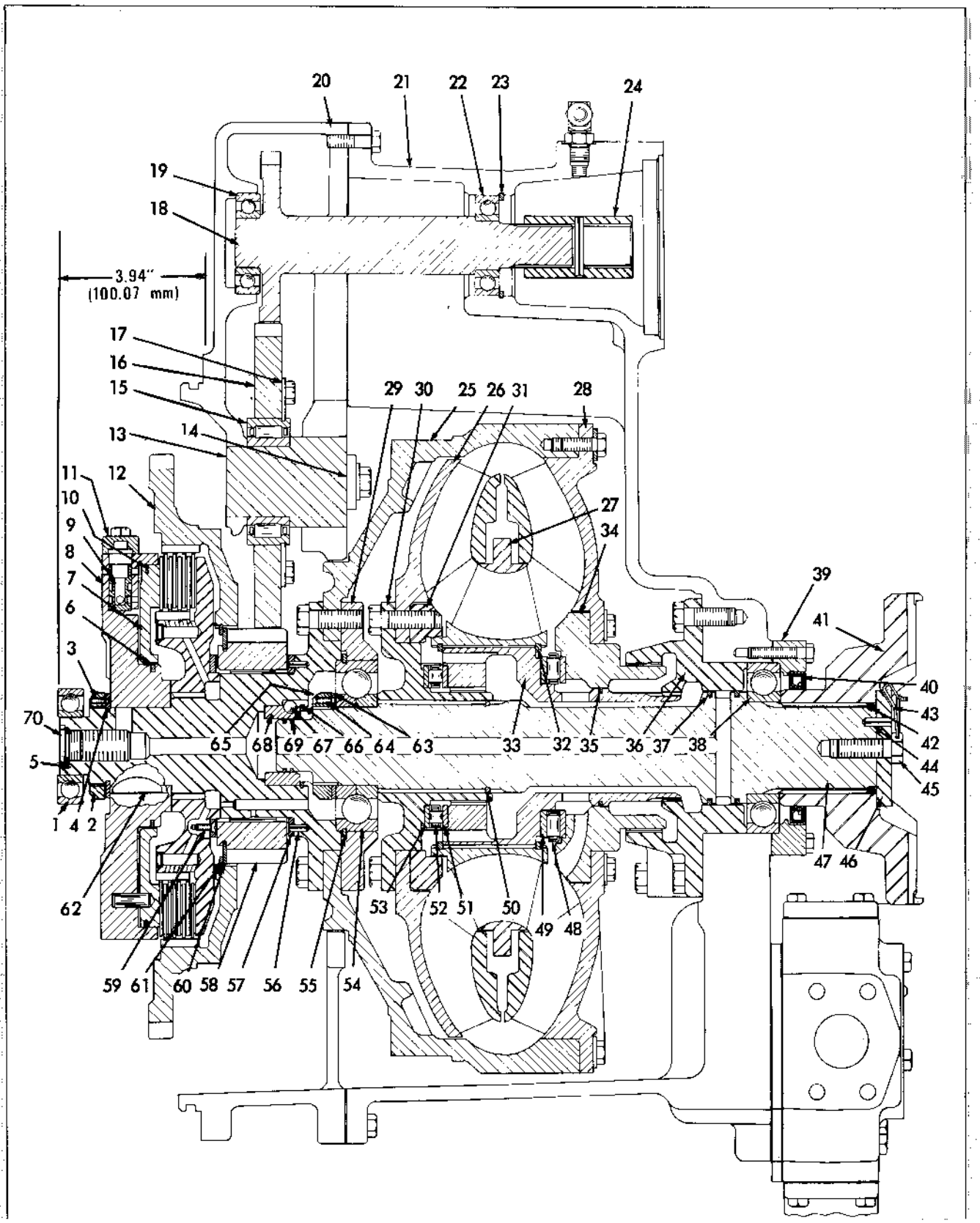


FIG.7-37 INPUT CLUTCH AND TORQUE CONVERTER T-79689

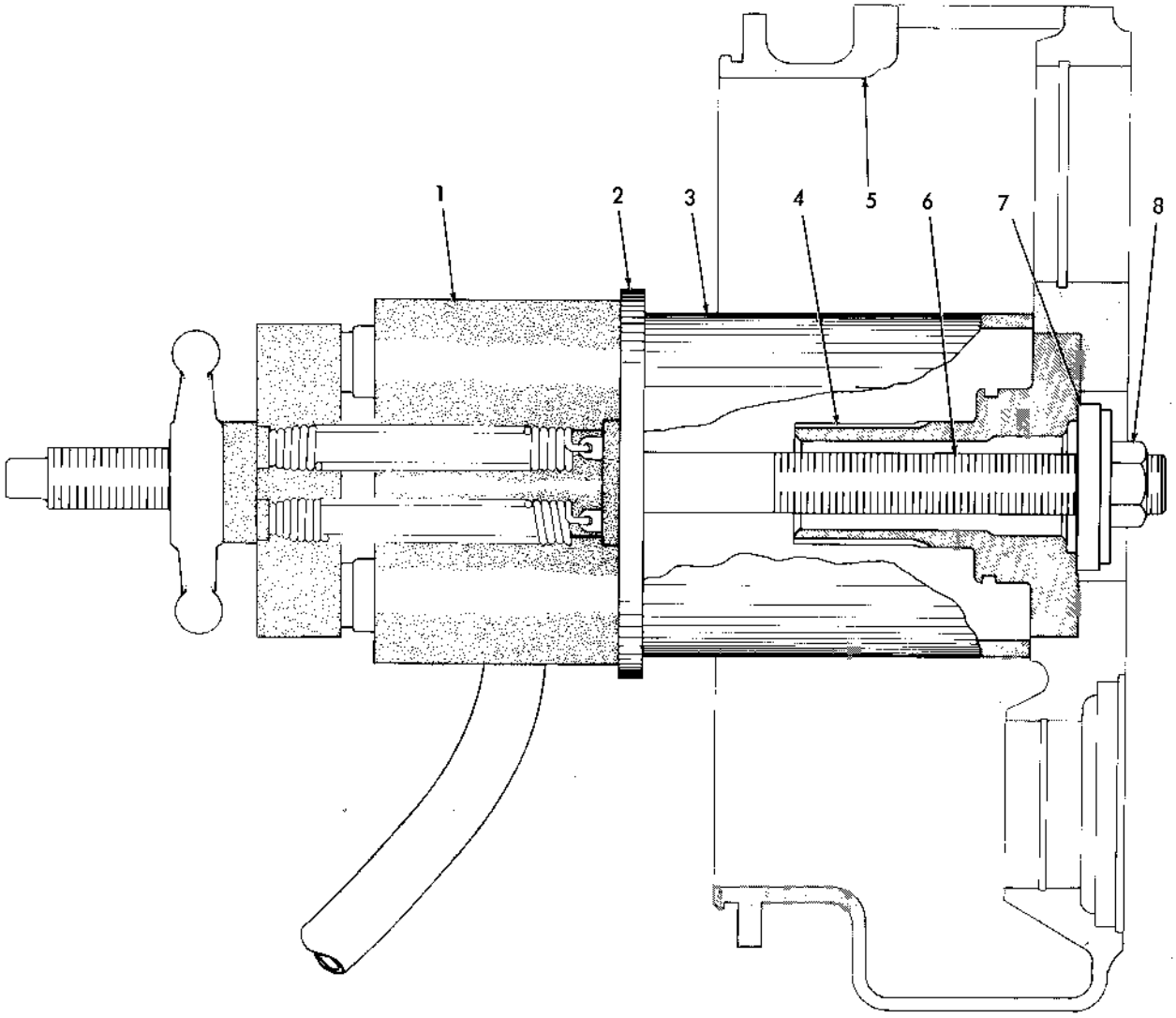


FIG. 8.17 REMOVING GROUND SLEEVE T-74893

1.Hydraulic ram
2.Plate (12.7mm[.50"] thick)
3.Tube (165-167.6mm[6.50"-6.60"] I.D.; 6.3mm[.25"] wall thickness)
4.Ground sleeve
5.Housing
6.Forcing screw
7.Plate (81.2-86.3mm[3.30"-3.40"] O.D.; 12.7mm[.50"] thick)
8.Nut with flat washer

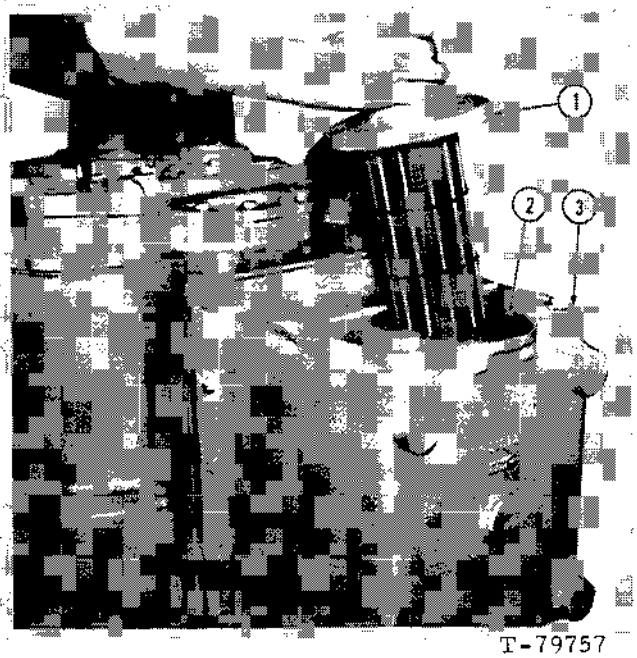


FIG. 9-2 REMOVING SUCTION LINE FILTER

1. Suction line filter
2. Suction line housing
3. Sump pan

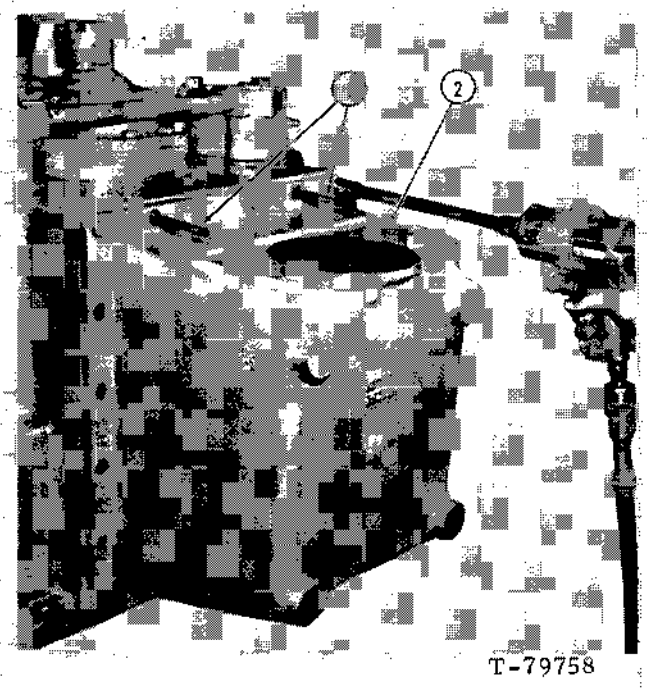


FIG. 9-3 REMOVING SUMP PAN

1. Guide screws
2. Sump pan

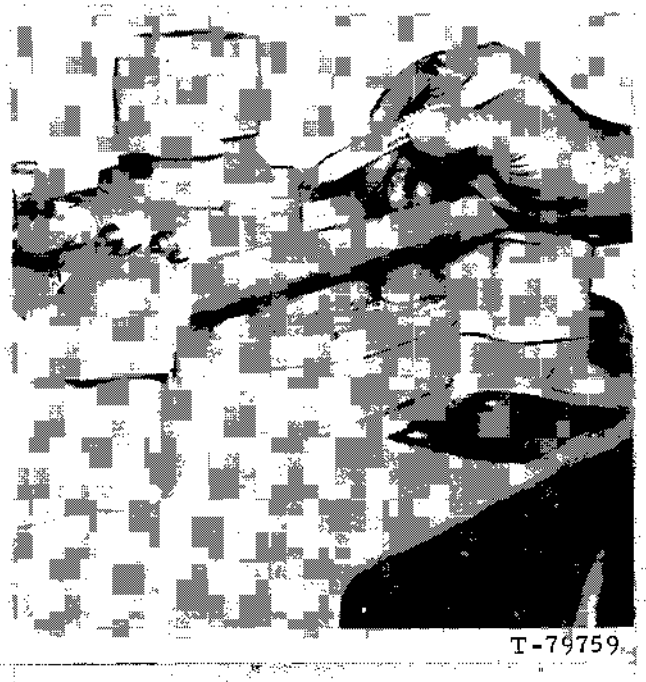


FIG. 9-4 MARKING SHIFT INHIBITING PUMP

9.1 REMOVAL

9.1.1
The easiest way to remove the transmission is out the bottom of the tractor. In order to provide clearance, run tractor up on 304 × 304 × 3048 mm (12 in. × 12 in. × 10 ft.) planks.

9.1.2
Remove transmission bottom guards. Drain transmission approximately 94.63 lit. (25 gal.) bevel gear compartment approximately 215.7 lit. (57 gal.)

9.1.3
If tractor is not equipped with a cab, remove floor plates; if tractor is equipped with a cab, refer to Cab Service Manual and tilt the cab; secure in tilted position with lock provided.

9.1.4
Remove brake pedals, cross shaft and support as an assembly. Remove drive shaft universal joint assembly. Disconnect and remove all oil lines and linkage connected to the transmission. Remove inhibiting valve. Identify parts as they are removed.

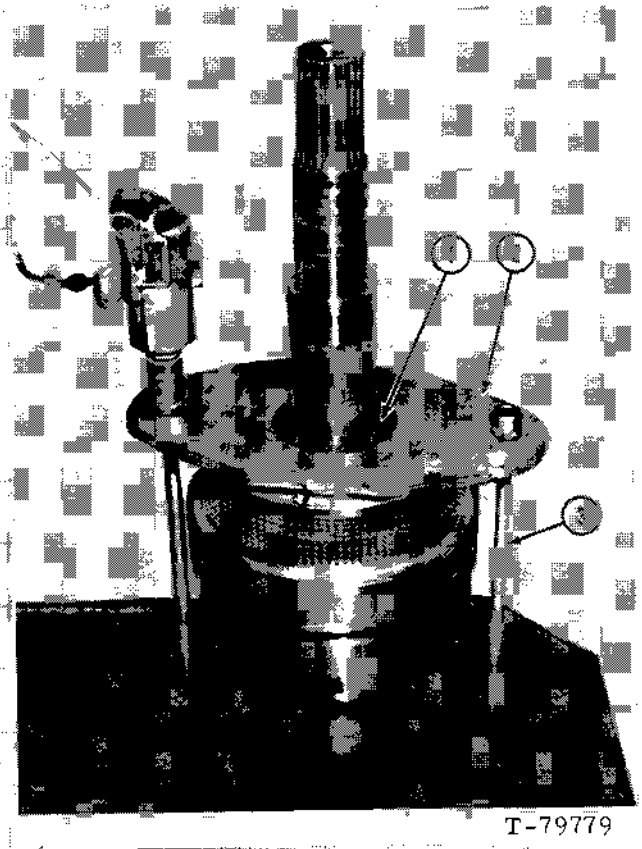


FIG. 9-26 COMPRESSING CLUTCH PISTON RETURN SPRING

1. Snap ring
2. Spring compressing plate
3. Studs

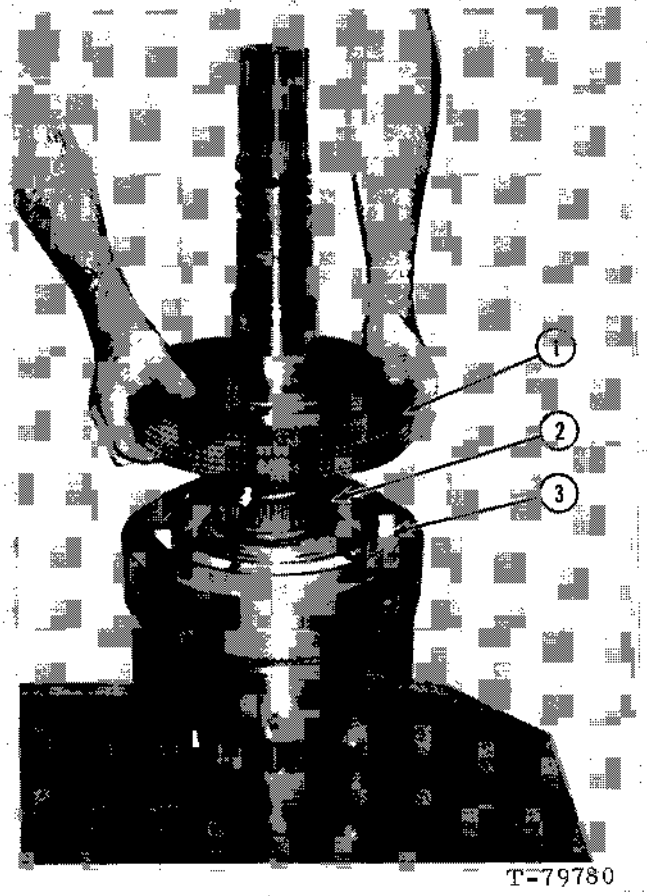


FIG. 9-27 REMOVING CLUTCH ASSEMBLY FROM SHAFT

1. Clutch assembly
2. Clutch piston return spring
3. Clutch actuating spring

9.3.7 SHUTTLE VALVE BODIES

9.3.7.1
Replace if I.D. is severly indented or grooved by clutch shaft front sealing rings.

9.3.7.2
Be sure shuttle valves slide freely in their bores. Make certain oil passages in valve bodies are not blocked or restricted.

9.3.7.3
Check shuttle valve springs for proper tension (refer to 12.7.6 for spring specifictions.

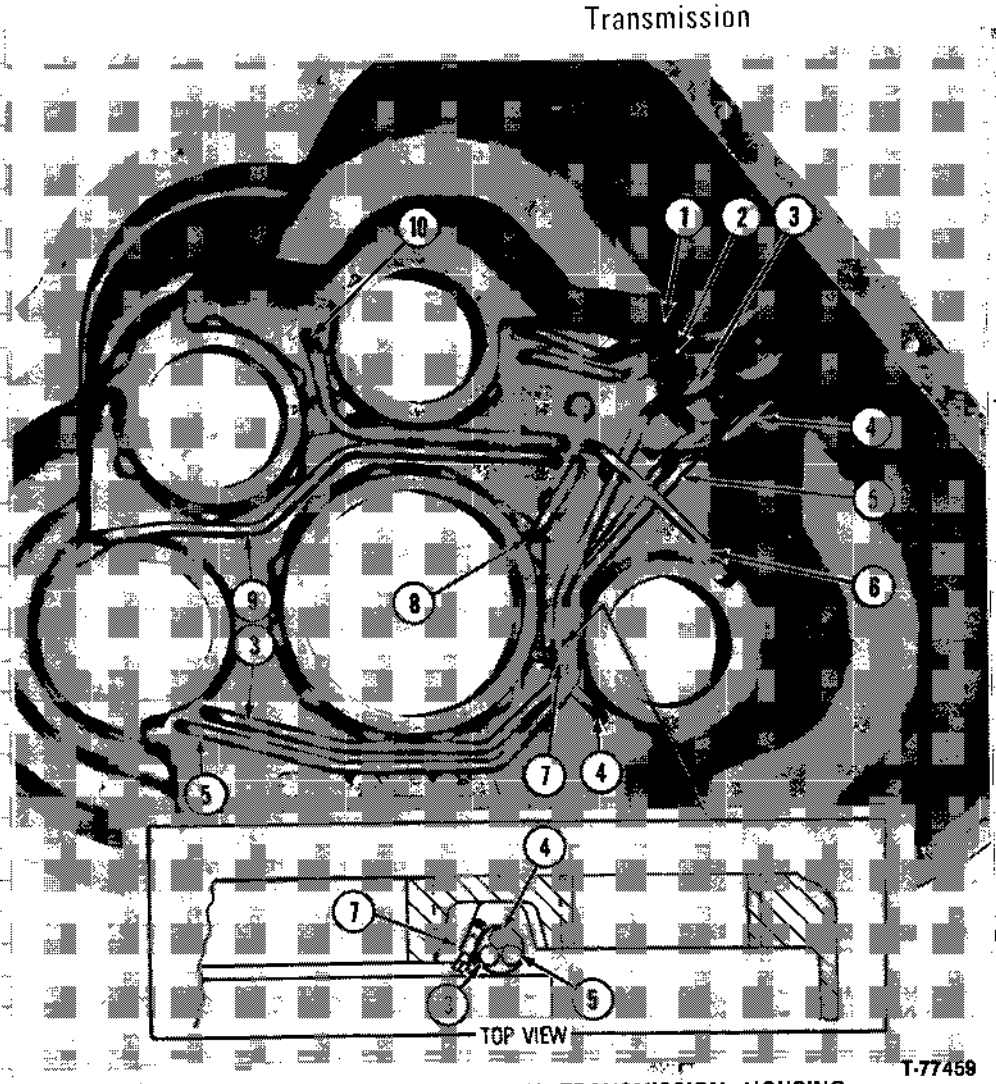
9.3.7.4
Check shuttle valve plugs for identations; replace if necessary.

9.3.8 SHIFT INHIBIT SYSTEM CONTROL VALVES

9.3.8.1
Valves are located in bevel pinion shaft front bearing retainer. Make certain oil passages in retainer are not blocked or restricted, make sure relief valves slide freely in their bores.

9.3.8.2
Check tension of relief valve springs (refer to 12.7.5 for spring specifictions).

9.3.8.3
Size of orifice in pipe plugs is 1.14 - 1.21 mm (.045″ - .048″). Be sure orifice is not clogged.



1. Forward apply tube
2. Reverse apply tube
3. 2nd range apply tube
4. 3rd range apply tube
5. 1st range apply tube
6. 3rd range lube tube
7. Clamp
8. Bevel pinion shaft front bearing lube tube
9. 1st/2nd range lube tube
10. Forward/reverse lube tube

FIG.9-34 TUBES INSTALLED IN TRANSMISSION HOUSING

9.5.1.2
Be certain the plug, Fig. 9-30 (21) is installed in the rear end of shaft. Forward/reverse shaft plug is solid; plugs in both range clutch shafts have drilled centers.

9.5.1.3
Position clutch shaft on table with rear end up, Fig. 9-35. Use spacer sleeve (2) with forward/reverse shaft only.

9.5.1.4
Install dump valve spool, Fig. 9-36 (2) in piston housing - large end of spool in first. Install sleeve (1) over spool - small end first. Secure sleeve with snap ring. Turn clutch shaft 180° and repeat this procedure for other dump valve (third range clutch shaft has only one dump valve).

9.5.1.5
Install shaft sealing ring, Fig. 9-37 (3) on shaft; interlock ends of ring. Make certain ring turns freely in groove.

9.5.1.6
Install sealing ring, Fig. 9-37 (2) in groove around clutch actuating piston (1). Slide piston over shaft sealing ring (3) and seat it on pins (4) in piston housing.

NOTE: Make certain pins, Fig. 9-37 (4) enter holes in piston (1) and piston is fully seated in piston housing as shown in Fig. 9-38.

Install actuating piston ring spring, Fig. 9-38 (1)

9.5.4.5
Install forward/reverse shaft rear oil seal, Fig. 9-57 (16) lip of seal toward front. Install pilot washer, Fig. 9-56 (1) seated against seal (2).

9.5.4.6
Install the clutch shaft rear bearings and countershaft rear bearing in rear cover; make certain bearings are seated properly in their bores.

9.5.4.7
Install spacer, Fig.9-20 (30). Install bevel pinion shaft low speed gear, Fig. 9-20 (14) with long hub up, 3rd speed gear (13), sleeve (24) and 2nd speed gear (11). Install countershaft; seat bearing race in rear bearing.

9.5.4.8
Install clutch shafts with lifting tool shown in Fig. 9-11. Seat bearing races in rear bearing; guide forward/reverse shaft through the pilot washer.

9.5.4.9
Install bearing cup in idler gear, Fig. 9-20 (10); secure with snap rings (26). Heat idler gear bearing cones to 121°C. (250°F) with bearing heater similar to that shown in Fig. 9-51. Use a temperature indicating crayon to control temperature. Install rear cone on shaft; seat bearing cone against shoulder on shaft. Install idler gear - either end first and front bearing cone.

NOTE: If old bearing is being re-used, cup and cone assemblies must be installed in their original positions. However, a new bearing may be installed either way, regardless of any marking that may be on the bearing.

9.5.4.10
Make certain the inside of transmission housing is clean and that all the internal tubes are properly installed (9.4). Install clutch shaft front bearings and countershaft front bearing in proper bores in housing. Install gasket between rear cover and transmission housing. Lower housing over the shafts and install housing attaching capscrews.

9.5.4.11
Seat bevel pinion shaft front bearing cup in bearing support, Fig. 9-20 (6). Heat bevel pinion shaft front bearing cones to approximately 121°C.(250°F.); install rear cone on shaft, seating against shoulder (see NOTE with 9.5.4.9).

9.5.4.12
Install guide studs in front of transmission housing; install original shim pack, Fig. 9-20 (7) over guide studs. Install front bearing support with new O-ring over guide studs; seat it solidly against front of housing. Install front bearing cone on shaft.

NOTE: If the original shim pack is lost, or a new shaft and gear are being installed, the shim pack required for the initial pinion depth adjustment can be calculated by subtracting the dimension etched on rear face of bevel pinion from 336.65 mm (13.250″) Fig. 9-60. 13.250″ (10.636″ + 2.614″) is the distance from face of transmission rear cover to the centerline of bevel gear shaft; dimension etched on rear face of bevel pinion is the distance which must be between the centerline of bevel gear shaft and the rear face of bevel pinion. Therefore, the difference between these two dimensions is the distance the rear face of bevel pinion should extend from face of transmission rear cover. Shim under bevel pinion shaft front bearing support to obtain this dimension.

Shims are available in three sizes - 0.12 - 0.17 and 0.50 mm (.005″, .007″ and .020″)thick. Shims are split to allow adjustments to be made without removing the front bearing support, so be sure the shim halves are kept properly matched while making the shim pack.

⚠ **WARNING It is unsafe to strike hardened steel parts with anything other than a soft iron or non-ferrous hammer. When installing such parts wear heavy gloves and safety glasses with side shields to reduce possibility of injury.**

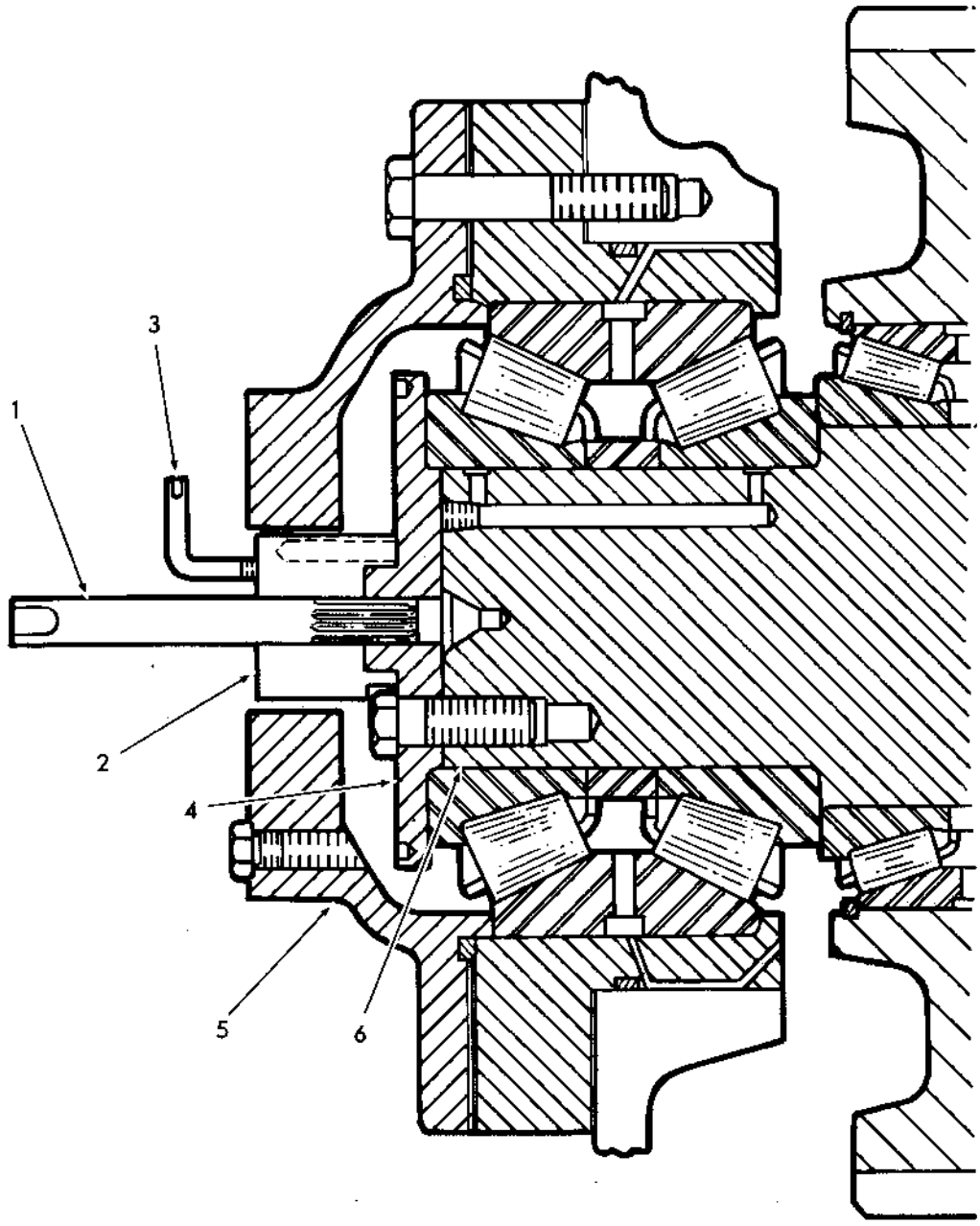


FIG. 9-68 SPECIAL TOOLS INSTALLED FOR CHECK BACKLASH BETWEEN BEVEL GEAR AND PINION T-81756

1. Adapter 75300102
2. Indicator base 75300103
3. Indicator arm
4. End retainer
5. Bearing retainer
6. Bevel pinion shaft

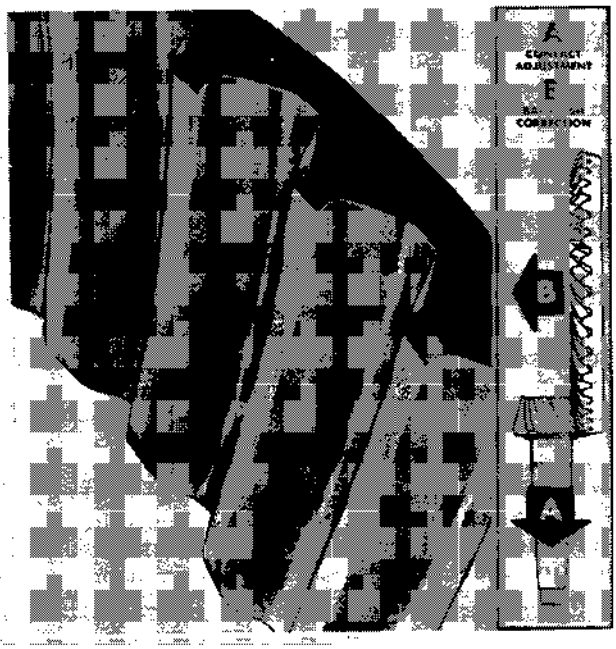


FIG. 10-11 LOW CONTACT - NO LOAD T-26963

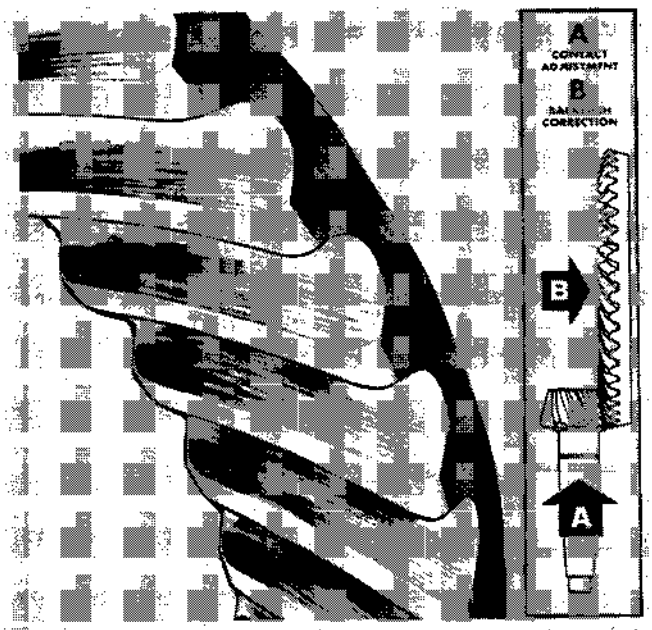


FIG. 10-12 SHORT TOE CONTACT - NO LOAD T-71901

1. Area of contact (no load) must favor toe of gear tooth.
2. Area of contact must start 3.0 - 6.35 mm (.12 - .25 in.) from toe and extend a third to half of the length of the tooth, Fig. 10-7.
3. Area of contact must be centered between top and bottom of tooth, Fig. 10-7.
4. The pattern on reverse side of bevel gear tooth should start 6.3 -9.6 mm (.25 - .38 in.) from the toe and extend half of the length of the tooth.
5. Both of these patterns will fill out and cover a greater area, especially towards heel of tooth, when gears are loaded, Fig. 10-9.

10.3.2.6
HIGH CONTACT as shown in Fig. 10-10 is not desirable and will result in galling and rolling over of top edges of teeth. To correct high contact move bevel pinion toward bevel gear by removing portion of pinion depth adjusting shims under transmission bevel pinion shaft front bearing support. This adjustment will decrease backlash between bevel pinion and bevel gear. Specified backlash is 0.30 - 0.45 mm (.012 - .018 in.). Increase backlash by moving bevel gear away from bevel pinion. Move gear away from pinion by transferring bevel gear shaft bearing adjustment shims from bearing cage on tooth side of gear to bearing cage on flat side of gear.

NOTE: Each 0.13 mm (.005 in.) shim transferred will change backlash approximately 0.10 mm (.004 in.).

10.3.2.7
LOW CONTACT as shown in Fig. 10-11 will result in galling and grooving in teeth. To correct low contact, move bevel pinion away from bevel gear by adding pinion depth adjustment shims under transmission bevel pinion shaft front bearing support. This adjustment will increase backlash between bevel pinion and bevel gear. Specified backlash is 0.30 - 0.45 mm (.012 - .018 in.). Decrease backlash by moving bevel gear toward bevel pinion; move gear toward bevel pinion by transferring bevel gear shaft bearing adjustment shims from bearing cage on flat side of gear to bearing cage on tooth side of gear.

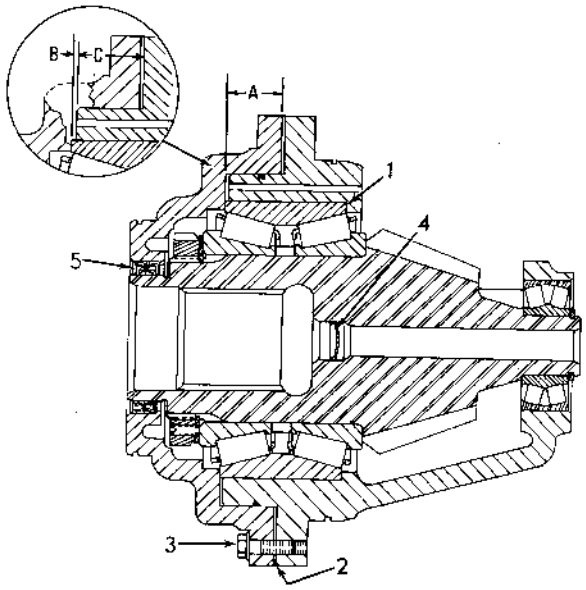


FIG. 10-35 T-84997

1. Race
2. Shim pack
3. Capscrews
4. Plug
5. Seals

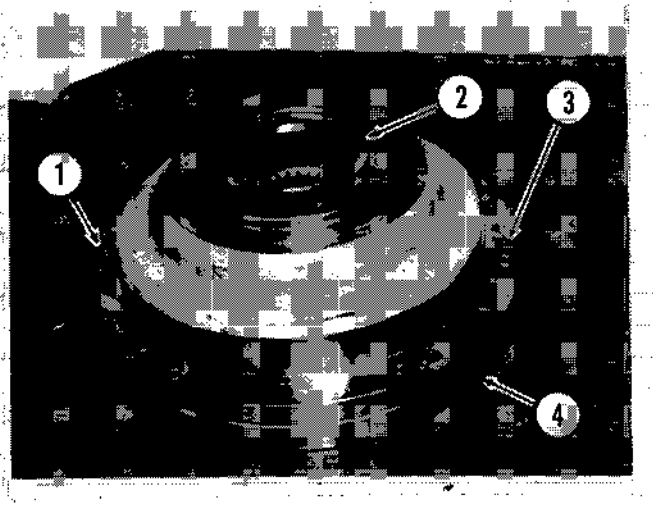


FIG. 10-36 RETAINER INSTALLED ON PINION ASSEMBLY T-85039

1. Retainer
2. Seals
3. Capscrews
4. Cage

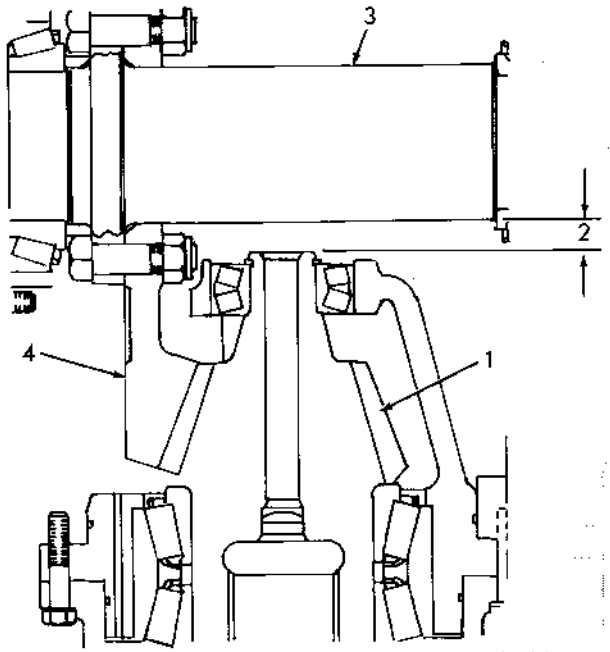


FIG. 10-37 MEASURING MOUNTING DISTANCE T-85001

1. Pinion
2. Dimension
3. Cross shaft
4. Bevel gear

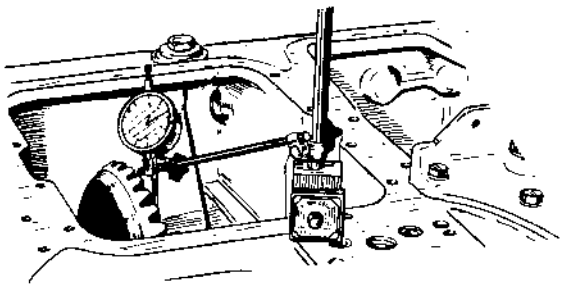


FIG.10-38 T-85010

TOPIC 13 SERVICE TOOLS

Service tools required to perform the various repairs explained in this manual are listed below. Order service tools from your Fiatallis dealer.

IMPORTANT: Refer to Fiatallis Tool Catalog No. 73128466 for complete illustrations, descriptions and usage.

FIGURE NO.	FIATALLIS PART NO.	DESCRIPTION
4-1	75294308	Transmission/Converter Tester (TG-100C)
7-1	75292914	Load Rotor 2 ton
8-12, 8-15, 8-17, 8-20, 9,9 8-10, 8-17, 8-19, 8-23	75300882	Ram Set 17½ Ton
7-22, 8-22	75300932	Bearing Heater
9-11	75294236	Clutch Shaft Lifting Bracket
9-18, 9-55	75300850	Bearing and Seal Master Driver Kit
9-22, 9-28, 9-44	75295295	Snap Ring Pliers
9-33	75294305	Tube Expander for 5/8 In. Tube
9-54	75300127	Bevel Pinion Seal Driver
9-67	75300928	Dial Indicator
	75300102	Adapter
	75300103	Shaft Indicator
10-2	75294727	Bevel Gear Shaft Puller
	75294726	Bevel Gear Spacer
	75294725	Bevel Gear Shaft Bearing Removal Sleeve
10-6	75300179	Bevel Pinion Depth Gauge
9-14	75300188	Lifting Bracket
	75300052	Puller Segment
	75300053	Segment Retaining Ring
10-19	75301117	Lock Nut Socket

SAFETY RULES

To prevent entrapment in cabs or mounted enclosures, observe and know the mechanics of alternate exit routes.

On machines equipped with suction radiator fans, be sure to periodically check all engine exhaust parts for leaks as exhaust gases are dangerous to the operator. Keep a vent open to outside air at all times when operating within a closed cab.

STARTING FLUID IS FLAMMABLE. Follow the recommendations as outlined in the Operation and Maintenance Instruction Manual and as marked on the containers. Store containers in cool, well-ventilated place secure from unauthorized personnel. *DO NOT PUNCTURE OR BURN CONTAINERS.*

Follow the recommendations of the manufacturer for storage and disposal.

Wire rope develops steel slivers. Use authorized protective equipment such as heavy gloves, safety glasses when handling.

OPERATION

Before starting machine, check, adjust and lock the operator's seat for maximum comfort and control of the machine.

DO NOT START OR OPERATE AN UNSAFE MACHINE. Before working the machine, be sure that any unsafe condition has been satisfactorily remedied. Check brakes, steering and attachment controls before moving. Advise the proper maintenance authority of any malfunctioning part or system. Be sure all protective guards or panels are in place, and all safety devices provided are in place and in good operating condition.

Check instruments at start-up and frequently during operation.

Do not run the engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

Be sure exposed personnel in the area of operation are clear of the machine before moving the machine or its attachments. *WALK COMPLETELY AROUND* the machine before mounting. Sound horn. Obey flag man, safety signals and signs.

Know the principles of cross steering of crawler tractors. Read section in Operation and Maintenance Instruction Manual on cross steering.

Keep engine exhaust system and exhaust manifolds clear of combustible material. Equip machine with screens and guards when working under conditions of flying combustible material.

If engine has a tendency to stall for any reason under load or idle, report this for adjustment to a proper maintenance authority immediately. Do not continue to operate machine until condition has been corrected.

Never use bucket as a man-lift.

Use recommended bucket for machine and material load ability and heaping characteristics of material, terrain, and other pertinent job conditions.

Avoid abrupt starts and stops when transporting a loaded bucket.

Inspect your seat belt webbing and hardware at least twice a year for signs of fraying, wear or other weakness that could lead to failure.

Use only designated towing or pulling attachment points. Use care in making attachment. Be sure pins and locks as provided are secure before pulling. Stay clear of draw bars, cables or chains under load.

When pulling or towing through a cable or chain, do not start suddenly at full throttle. Take up slack carefully. Guard against kinking chains or cables. Inspect carefully for flaws before using. Do not pull through a kinked chain or cable due to the high stresses and possibility of failure of the kinked area. Always wear heavy gloves when handling chain or cable.

Be sure cables are anchored and the anchor point is strong enough to handle the expected load. Keep exposed personnel clear of anchor point and cable or chain. *DO NOT PULL OR TOW UNLESS OPERATOR'S COMPARTMENT OF MACHINES INVOLVED ARE PROPERLY GUARDED AGAINST POTENTIAL CABLE OR CHAIN BACKLASH.*

During operation always carry ripper in full raised position when not in use and lowered to ground when parked.

When counterweights have been provided, do not work machine if they have been removed unless their equivalent weight has been replaced. See the Operation and Maintenance Instruction Manual.

When operating a machine know what clearances will be encountered, overhead doors, wires, pipes, aisles, roadways; also the weight limitations of ground, floor, and ramps.

Know bridge and culvert load limits and do not exceed them. Know machine's height, width, and weight. Use a signal person when clearance is close.

Be sure that the exact location of gas lines, utility lines, sewers, overhead and buried power lines, and other obstructions or hazards are known. Such locations should be precisely marked by the proper authorities to reduce the risk of accidents. Obtain shut-down or relocation of any such facilities before starting work, if necessary.

Be certain to comply with all local, state, and federal regulations regarding working in the vicinity of power lines.

When roading find out what conditions are likely to be met - clearances, congestion, type of surface, etc. Be aware of fog, smoke or dust element that obscure visibility.

When backing, always look to where the machine is to be moved. Be alert to the position of exposed personnel. *DO NOT OPERATE* if exposed personnel enter the immediate work area.

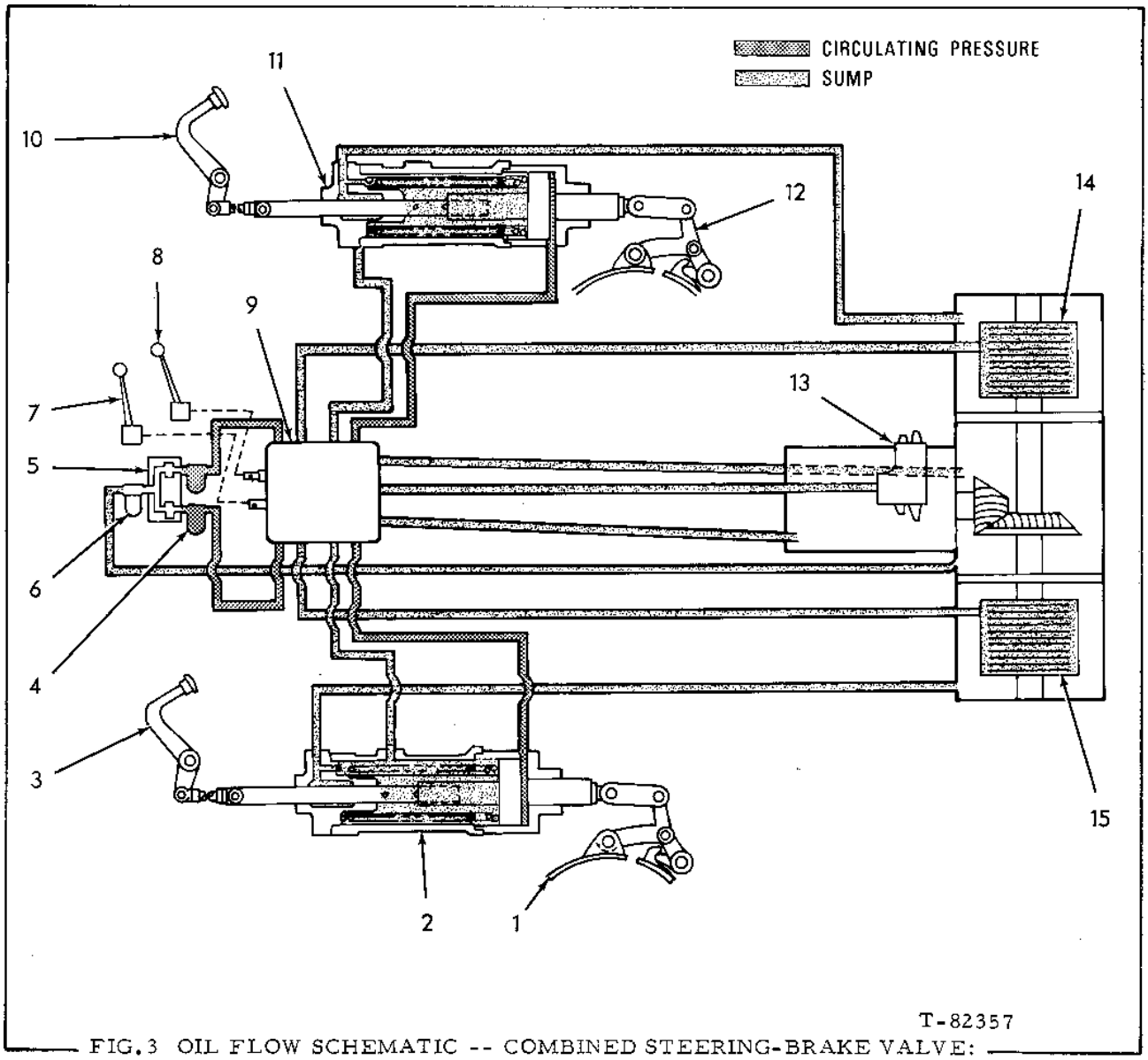
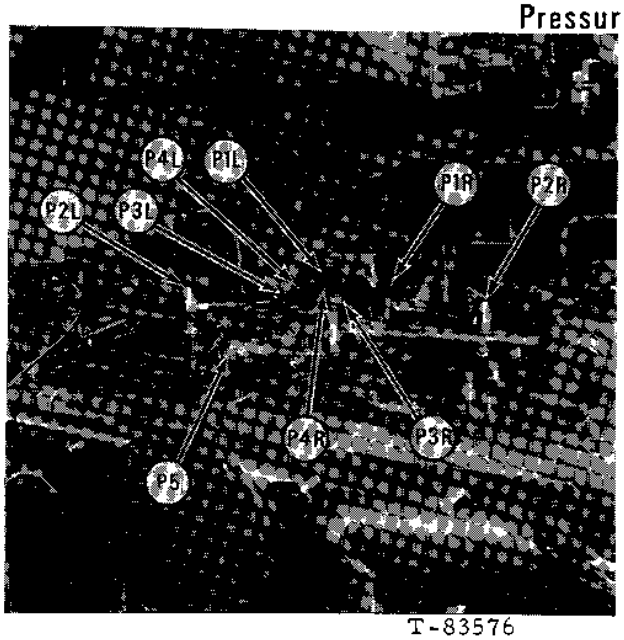


FIG. 3 OIL FLOW SCHEMATIC -- COMBINED STEERING-BRAKE VALVE: TRANSMISSION IN NEUTRAL NO STEERING OR BRAKE APPLIED

1. Left brake
2. Left brake valve
3. Left brake pedal
4. Steering filter
5. Steering pump
6. Suction line filter
7. Left steering-brake lever
8. Right steering-brake lever
9. Combined steering-brake valve
10. Right brake pedal
11. Right brake valve
12. Right brake
13. Transmission
14. Right steering clutch
15. Left steering clutch



T-83576

FIG. 9 PRESSURE CHECK POINTS

Legend for Fig. 9

P1L. Inlet pressure (left)
P2L. Steering clutch pressure (left)
P3L. Brake apply pressure (left)
P4L. Brake release pressure (left)
P5. Transmission signal pressure

P1R. Inlet pressure (right)
P2R. Steering clutch pressure (right)
P3R. Brake apply pressure (right)
P4R. Brake release pressure (right)

TEST CONDITIONS	CHECK POINT	PRESSURE		
		bar	kg/cm^2	psi
1. Transmission in neutral: Foot brakes not applied: Steering levers in neutral position:	P1 Inlet P3 Brake apply P4 Brake release	4.3-5.3 0.6-0.8 3.4-4.1	4.4-5.4 0.6-0.8 3.5-4.2	63-77 9-11 50-60
2. Transmission in P. T. O. Foot brakes not applied Steering levers in neutral position:	P1 Inlet P3 Brake apply P4 Brake release	13.8-16.6 0.3-0.7 12.4-15.2	14.1-16.9 0.3-0.7 12.7-15.5	200-240 5-10 180-220
3. Transmission in P. T. O. Foot brakes not applied Steering levers in first position (1/2 total travel or steering clutch release position)	P1 Inlet P2 Clutch release P3 Brake apply P4 Brake release	31.4-34.8 31.4-34.8 0.3-0.7 12.4-15.2	32.0-35.5 32.0-35.5 0.3-0.7 12.7-15.5	455-505 455-505 5-10 180-220
4. Transmission in P. T. O. Foot brakes not applied Steering levers at full travel (clutch release--brake apply position)	P1 Inlet P2 Clutch release P3 Brake apply P4 Brake release	31.4-34.8 31.4-34.8 0.3-0.4 0.9-1.2	32.0-35.5 32.0-35.5 0.3-0.4 0.9-1.2	445-505 455-505 4-6 13-17
5. Transmission in P. T. O. Foot brakes applied Steering levers in neutral position	P1 Inlet P3 Brake apply P4 Brake release	18.6-22.8 16.2-19.7 17.6-21.0	19.0-23.2 16.5-20.0 17.9-21.4	270-330 235-285 255-305

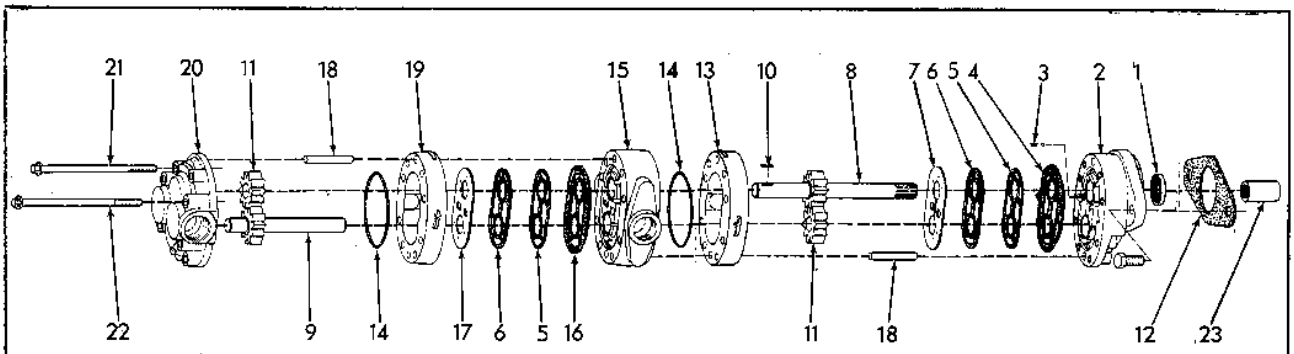


FIG. 15 HYDRAULIC PUMP (FD40)(First type*)

1.Drive shaft seal
2.Front plate
3.Spring and ball
4.Diaphragm seal
5.Gasket(thin)
6.Gasket(thick)
7.Diaphragm
8.Drive shaft & gear assy.
9.Idler shaft & gear assy.
10.key
11.Gear
12.Gasket
13.Gear body (front)
14.O-ring
15.Center body
16.Diaphragm seal
17.Diaphragm
18.Dowel pin
19.Gear body (rear)
20.Rear plate
21.Capscrew(short)
22.Capscrew(long)
23.Coupling

*Prior to S/N 89A03103 excluding 03010,03017,03022,03023,03033,03034,03035

5.6.1.5
Mark position of pump gear,Fig.15(9, 11) ; slide idler gear from shaft and pull drive gear from key in shaft. Remove key(10),center body (15) and front gear body(13). Separate center body and front gear body; remove and discard o-ring(14).

5.6.1.6
Mark position of remaining pump gear, Fig.15(8,11); remove idler gear(11). Pull drive shaft (8) from front plate (2).

5.6.1.7
Remove diaphragms,Fig.15(7)(17), diaphragm gaskets(5)(6), and diaphragm seals(4)(16) from center body and front plate; remove springs and balls(3) from front plate.Remove drive shaft oil seal (1) from front plate.

5.6.2 INSPECTION

WARNING

Never use gasoline, solvent or other flammable fluids to clean parts.

5.6.2.1
Wash parts in commercial,non-flammable, non-toxic solvent; dry with compressed air. Remove burrs from gear teeth and mating machined surfaces of gear bodies, center body and front and rear plates. Wash after deburring.

5.6.2.2 Gear Bodies
Replace if I.D. of gear pocket is more than 1.719" (43.66mm).

5.6.2.3 Shafts and Gears
Replace if gears are chipped or worn, or if shaft O.D. at bushing locations is less than .685" (17.4mm). Replace if drive shaft is rough at oil seal location or if splines are excessively worn.

NOTE: Following procedures apply to either steering clutch.

6.1 REMOVAL

WARNING

Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of machine by blocking or other means.

Always turn the master switch to the "OFF" position before cleaning, repairing or servicing the unit to prevent injury.

6.1.1
Turn the electrical system master switch off. Drain the oil from the steering clutch and bevel gear compartments; clean the drain plugs and reinstall in their respective locations.

6.1.2
Remove cab or canopy. Remove all capscrews necessary for removal of fuel tank including oil lines, brackets, etc., to permit removal of steering clutch compartment covers.

6.1.3.
Disconnect the fuel lines from the fuel tank shut off cocks and use protection caps on the openings.

6.1.4
Attach a suitable sling and hoist on fuel tank and raise the fuel tank slightly; move the tank rearward until it is free. Set fuel tank on floor, resting on wood blocks. Also remove hydraulic tank.

6.1.5
Clean the top of steering clutch and bevel gear covers and the surrounding area thoroughly.

6.1.6
Refer to 5.5 and Fig. 12; remove brake valve and rear housing assemblies from steering clutch compartment cover and brake linkage, making certain all openings are protected from entrance of dirt.

NOTE: If tractor is equipped with ripper, remove brackets and oil lines as necessary for access to steering clutch compartments.

6.1.7
Remove the steering compartment cover plate and band lever bracket capscrews and remove the cover (brake adjuster need not be disassembled since a slip joint is used in compartment).

6.1.8
Back off the brake adjuster universal drain assembly, Fig. 27 (5) until it is free of the adjusting screw lower pin (2).

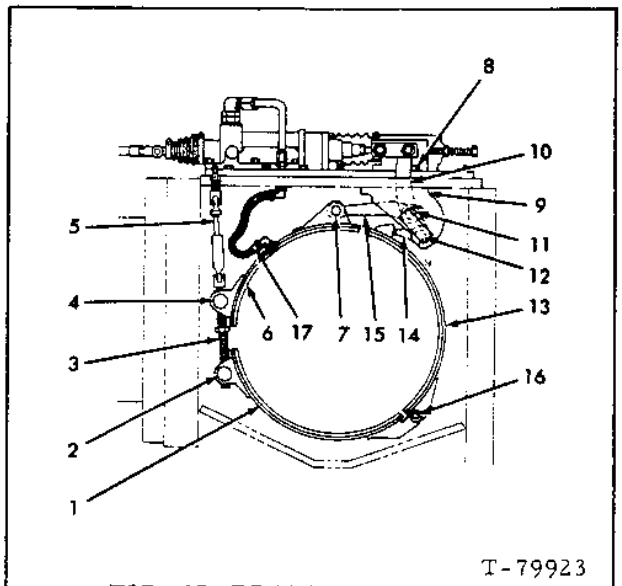


FIG. 27 BRAKE BANDS AND LINKAGE INSTALLED

1. Lower band
2. Lower adjuster pin
3. Adjusting screw
4. Upper adjuster pin
5. Universal (slip joint)
6. Upper front band
7. Front pin
8. Bracket capscrew
9. Bracket
10. Lever
11. Lever upper pin
12. Lever lower pin
13. Rear band
14. Yoke
15. Lever yoke
16. Lower band connecting pin
17. Lube hose

6.1.9
Remove cotter pin from outer end of top band pin, Fig. 27 (7) and remove pin. Remove band lever bracket assembly (9) with lever, yokes and pins. Remove top band section (6).

6.1.10
Remove place bolts, Fig. 26 (5 and 11) attaching steering clutch assembly to steering clutch driving hub and brake drum to brake drum hub; leave one each of the bolts installed at top.

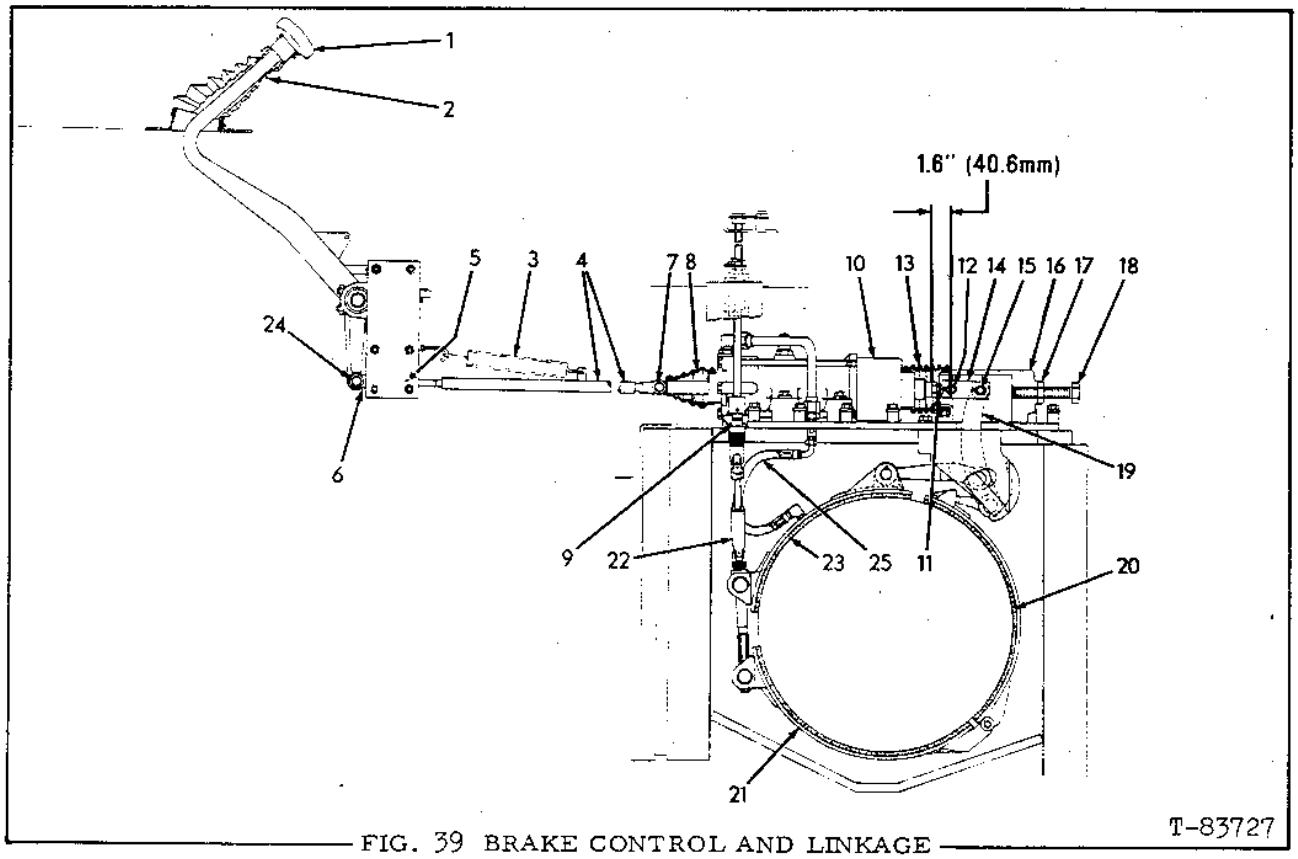


FIG. 39 BRAKE CONTROL AND LINKAGE

1. Brake pedal
2. Boot
3. Pedal return spring
4. Control rod
5. Jam nut
6. Yoke end
7. Yoke pin
8. Boot
9. Brake band adjuster
10. Brake valve
11. Eyebolt
12. Pin
13. Boot
14. Link
15. Link pin
16. Linkage cover
17. Jam nut
18. Brake over-ride screw
19. Band actuating lever
20. Rear band
21. Bottom band
22. Adjustment drive assembly
23. Top band
24. Yoke pin
25. Lube hose

scored. If splines are heavily indented, causing disc to hang up, replace the drum.

7.2.3
Replace pins, yokes, bushings and/or levers if excessively worn; lubricate pins and bushings sparingly when assembled.

7.3 ASSEMBLY AND INSTALLATION

NOTE: Before installing band assemblies, steering clutch driving hub and brake drum driving hub should be checked for looseness.

7.3.1
Connect rear and bottom band sections, Fig. 38 (2) (1) with hinge pin (4), washers and cotter pins (if disassembled).

7.3.2
Position the band assembly at rear of brake drum and rotate assembly down and around drum.

NOTE: Several repositionings may be necessary before band assembly will rotate around drum and slide into position.

7.3.3
Assemble the adjusting screw (5), upper pin (6), Assemble lower pin (7) and turn pin on screw (5) about 2 turns. Attach adjusting screw (5) to universal drive assembly (8) with pin.

7.3.4
Install top band section (3), hook lower pin (7) in bottom band section bracket (2) and hook upper pin (6) in position on top band section bracket (3). Start upper adjuster into sleeve of lower portion, if adjuster had been removed see step below.

7.3.5
The brake band adjustment assembly does not require removal from compartment cover to remove the steering clutch and brakes; how-

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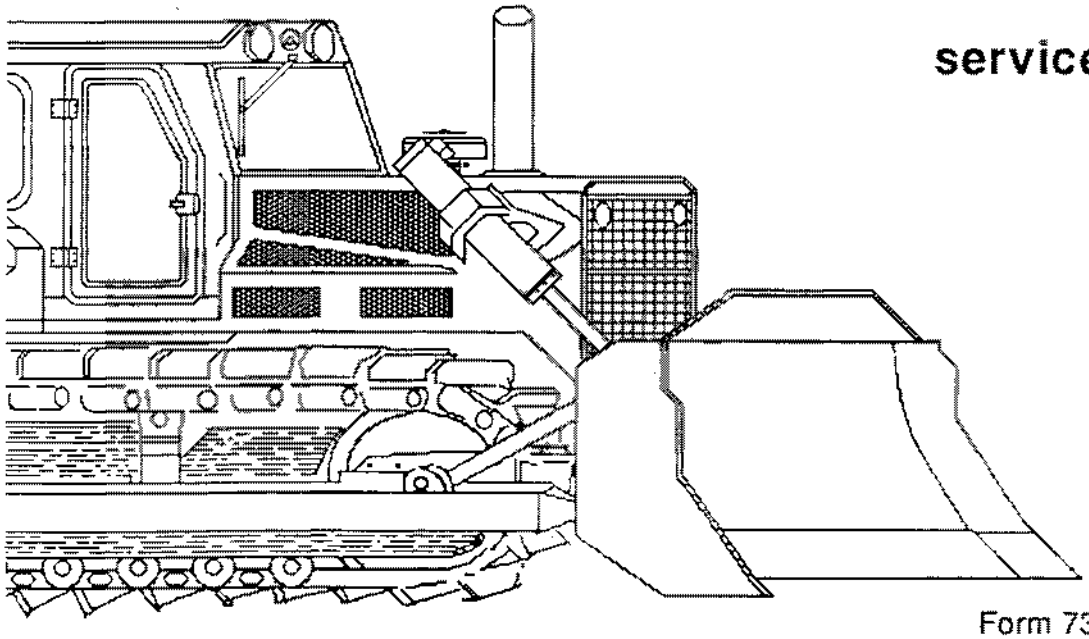
service manual



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Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

Never place gasoline or diesel fuel in an open pan.

Shut off engine and be sure all pressure in system has been relieved before removing panels, housings, covers, and caps. See Operation and Maintenance Instruction Manual.

Do not remove hoses or check valves in the hydraulic system without first removing load and relieving pressure on the supporting cylinders. Turn radiator cap slowly to relieve pressure before removing. Add coolant only with engine stopped or idling if hot. See Operation and Maintenance Instruction Manual.

Fluid escaping under pressure from a very small hole can almost be invisible and can have sufficient force to penetrate the skin. Use a piece of card board or wood to search for suspected pressure leaks. *DO NOT USE HANDS.* If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Never use any gas other than dry nitrogen to charge accumulators. See Operation and Maintenance Instruction Manual.

When making pressure checks use the correct gauge for expected pressure. See the Operation and Maintenance Instruction Manual or Service Manual for guidance.

For field service, move machine to level ground if possible and block machine. If work is absolutely necessary on an incline, block machine and its attachments securely. Move the machine to level ground as soon as possible.

Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of the machine by blocking or other means.

Block all wheels before bleeding or disconnecting any brake system lines and cylinders.

Never use make shift jacks when adjusting track tension. Follow the Undercarriage Service Manual.

Know your jacking equipment and its capacity. Be sure the jacking point used on the machine is appropriate for the load to be applied. Be sure the support of the jack at the machine and under the jack is appropriate and stable. Any equipment up on a jack is dangerous. Transfer load to appropriate blocking as a safety measure before proceeding with service or maintenance work according to local or national requirements.

Always block with external support any linkage or part on machine that requires work under the raised linkage, parts, or machine per local or national requirements. Never allow anyone to walk under or be near unblocked raised equipment. Avoid working or walking under raised blocked equipment unless you are assured of your safety.

When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladder or step platform that meets local or national requirements to reach the service point. If such ladders or platforms are not available, use the machine hand holds and steps as provided. Perform all service or maintenance carefully.

Shop or field service platforms and ladders used to maintain or service machinery should be constructed and maintained according to local or national requirements.

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

In lifting and handling heavy parts, slings must be of adequate strength for the purpose intended and must be in good condition.

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

When using compressed air for cleaning parts use safety glasses with side shields or goggles. Limit the pressure to 207 kPa (30 psi) according to local or national requirements.

Wear welders protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding or burning. Wear dark safety glasses near welding. *DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.*

Replace seat belts every two years on open canopy units and every three years on machines with cabs or at change of ownership.

Wear proper protective equipment such as safety goggles or safety glasses with side shields, hard hat, safety shoes, heavy gloves when metal or other particles are apt to fly or fall.

Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazards of electrical shock.

Keep maintenance area *CLEAN* and *DRY*. Remove water or oil slicks immediately.

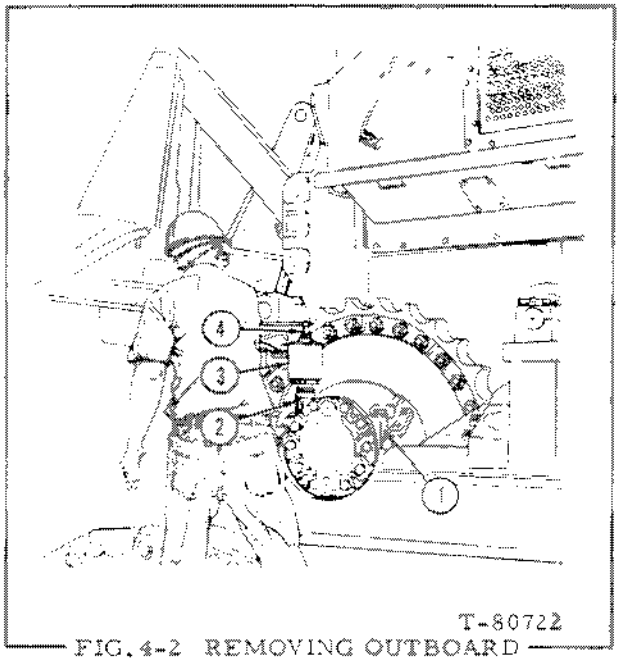
Remove sharp edges and burrs from reworked parts.

Be sure all mechanics tools are in good condition. *DO NOT* use tools with mushroomed heads. Always wear safety glasses with side shields.

Do not strike hardened steel parts with anything other than a soft iron or non-ferrous hammer.

Do not rush. Walk, do not run.

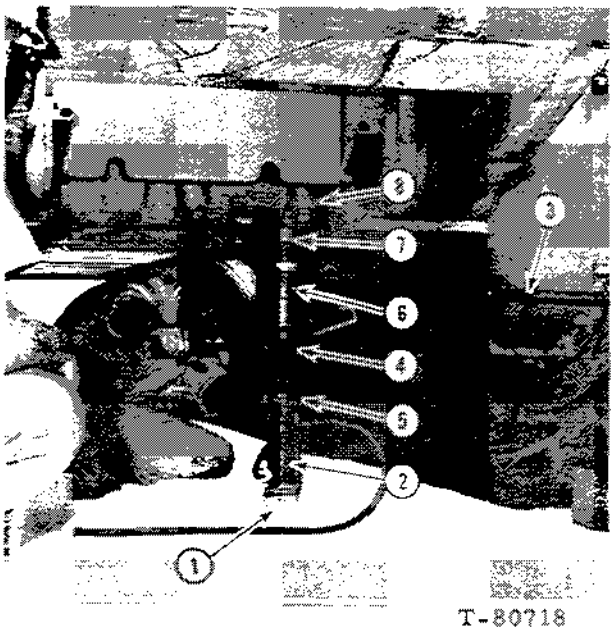
Know and use the hand signals used on particular jobs and know who has the responsibility for signaling.



T-80722

FIG. 4-2 REMOVING OUTBOARD BEARING CAGE CAP CAPSCREWS

1. Cap
2. Socket
3. Torque multiplier (28:1)
4. Socket



T-80718

FIG. 4-3 TOOL FOR REMOVING PIVOT CAP CAPSCREWS

1. Wood block
2. Ram
3. Extension
4. Socket w/rachet
5. Torque multiplier stand (75300046)
6. Torque multiplier (28:1)
7. Socket
8. Pivot cap

4.1 RAISING AND BLOCKING TRACTOR

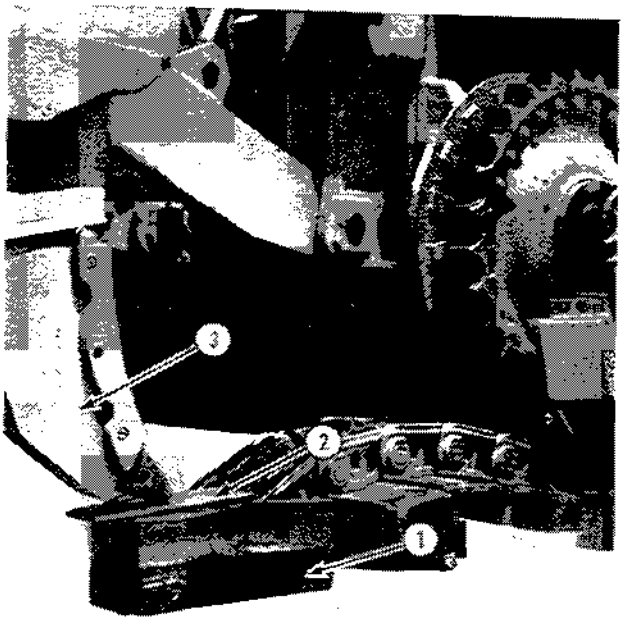
4.1.1
Position the tractor on level solid ground. Refer to Undercarriage Service Manual, uncouple and remove track. Drain the oil from final drive compartment. Refer to Fig. 4-1 and remove the front and rear sprocket guards. Remove the capscrews (4) attaching outboard bearing cage to track frame.

4.1.2
Refer to Fig. 4-2 and remove the outboard bearing cage cap attaching capscrews from side to be removed.

NOTE: The following steps pertain to side that frame is to be removed from.

4.1.3
Refer to Fig. 4-3 and remove the track frame pivot cap attaching capscrews and cap(s) located beneath main housing.

4.1.4
The tractor can be raised with ripper if so equipped (see 4.1.5) or by jacking (see 4.1.6). In either case the tractor must be blocked after raising.



T-80723

FIG. 4-4 BLOCKING LOCATION FOR LIFTING TRACTOR WITH RIPPER

1. Oak wood blocks
2. Steel Plate
3. Ripper shanks (tooth removed)

LEGEND FOR FIG. 4-25

1. Segment
2. Bolt
3. Hub
4. Lock
5. Nut
6. Outboard bearing
7. Shim (track frame positioning)
8. Shim (outboard bearing)
9. Capscrew
10. Retainer
11. Pin
12. Nut
13. O-ring
14. Capscrew
15. Outboard bearing cage
16. Outboard bearing cap
17. Seal assembly
18. Washer
19. Capscrew
20. Seal assembly
21. Cone assembly
22. Cup
23. Lock
24. Dowel
25. Capscrew
26. Cover
27. O-ring
28. Plate
29. Capscrew
30. Outer bearing cover
31. O-ring
32. Outer bearing assembly
33. Inner race
34. Snap ring (outer race)
35. Snap ring (inner race)
36. Lock ball
37. Outer race and roller assembly
38. Inner race
39. Inner bearing cage
40. Shim
41. Hub
42. O-ring
43. Lock
44. Seal
45. Capscrew w/lockwire
46. Capscrew
47. Washer assembly
48. Pinion
49. Gear
50. Lock
51. Inner bearing cage
52. O-ring
53. Shim (carrier bearing endplay adjusting)
54. Capscrew
55. Inner bearing retainer
56. Plug
57. Snap ring
58. Dowel pin
59. Cone assembly
60. Cup
61. Spacer
62. Capscrew
63. Lockwire
64. Carrier assembly
65. Ring gear (outer)
66. Pin
67. Snap ring
68. Ring gear (inner)
69. Capscrew
70. O-ring
71. Spacer

4.3.14
If the bearing cage is pushed in too far due to insufficient shim pack, insert the plate shown in Fig. 4-27 through the hole in the bearing cage. Attach the 17-1/2 ton hydraulic ram to the plate and pull the bearing cage back to bottom in the bore, Fig. 4-17. Repeat the end play adjustment in its entirety.

4.3.15
When final shim adjustment is made, remove tools. Install o-ring(52), shims(53) and retainer(55), Fig. 4-25.

4.3.16
Tighten retainer capscrews (54) as follows:

3/4"diam.--360-400 lbs.ft(48-55 m-kg)
7/8"diam.--420-460 lbs.ft(58-64 m-kg)

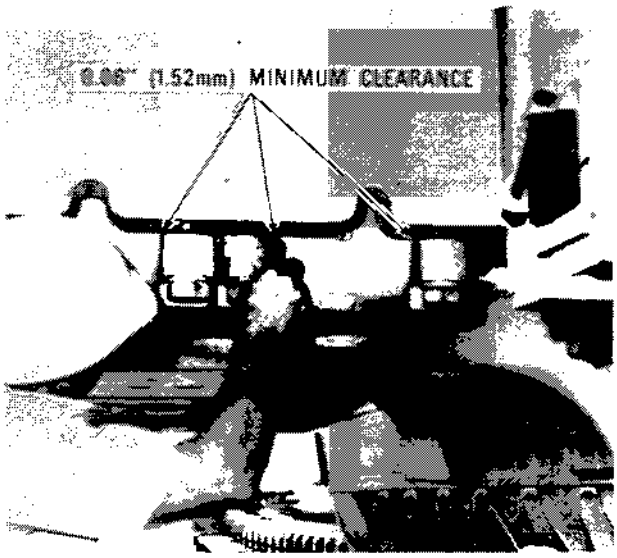
Install plug (56) and o-ring.

4.3.17
Refer to Fig. 4-24, install the shim pack on outboard bearing cage and align the holes in shim to cage. Secure the shims to the cage with small wire.

WARNING

Obey flagman, safety signals and signs.

Warn all people who may be servicing or working around your machine before starting engine.



T-80746

FIG. 4-26 CHECKING PIVOT ARM CLEARANCE

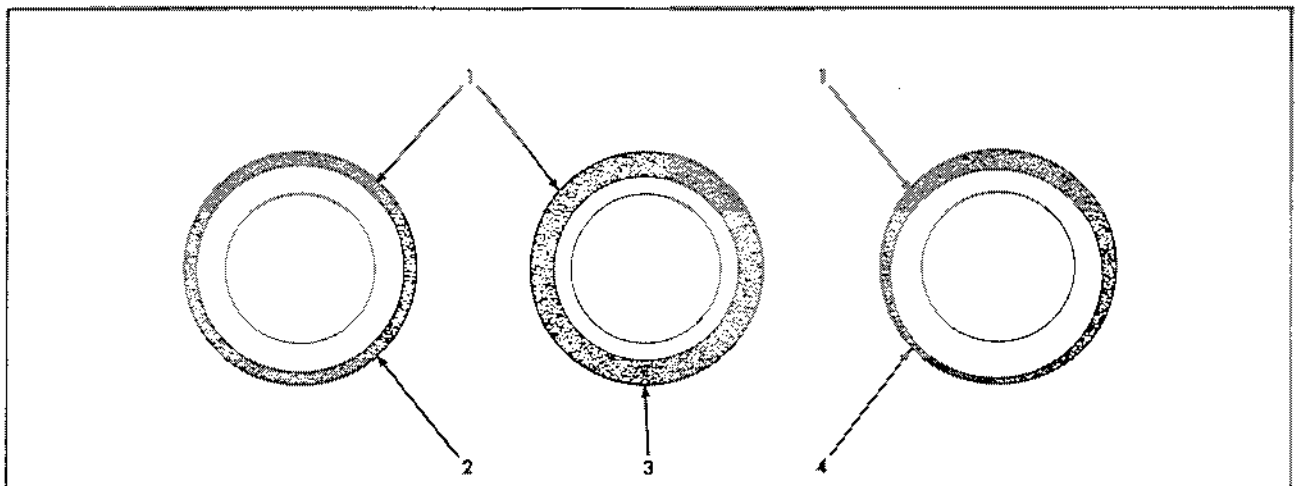


FIG. 5-24 METAL SEAL RING INSPECTION

1. Area of contact
2. Reusable. Contact is on center and within outer half of face
3. Not reusable. Contact is not within outer half of face
4. Not reusable. Contact is off center

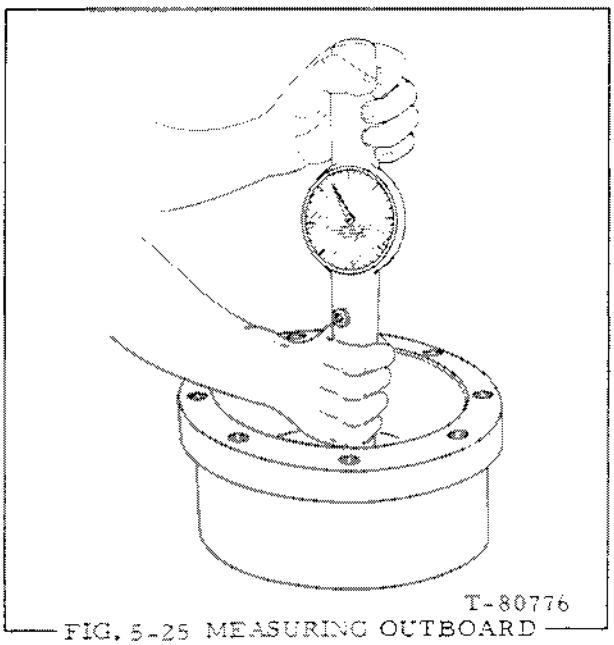


FIG. 5-25 MEASURING OUTBOARD BEARING CAGE

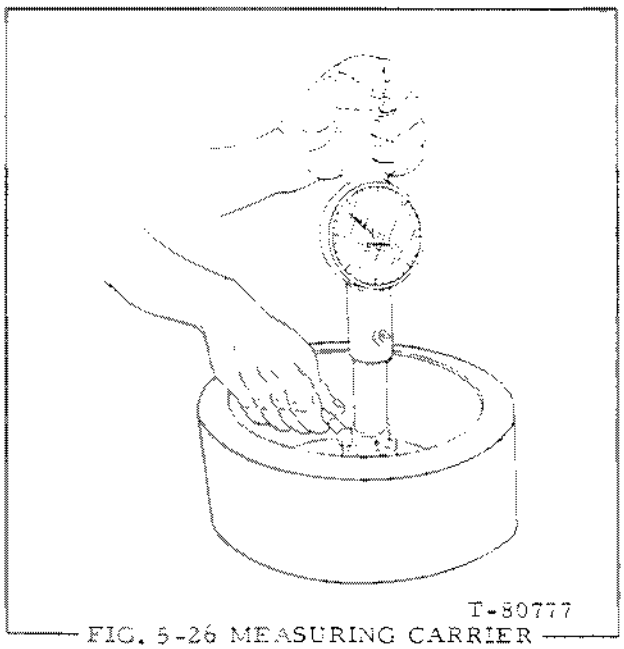
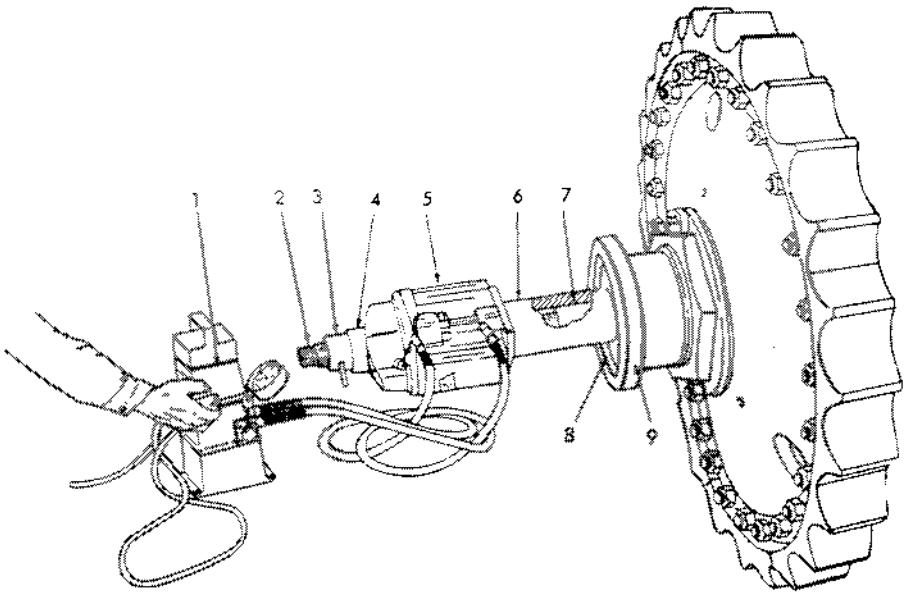


FIG. 5-26 MEASURING CARRIER INNER BEARING CAGE

5.2.6.2
Measure the O. D. of cage at the track frame location in three places. The dimensions must be within the range given in Topic 9 and must be within .002" (0.05 mm) of each other.

5.2.6.3
Inspect for any indication of binding or distortion. Place a straight edge across the outer face and check flatness. The cage face must be flat within .005" (0.12 mm). Check in three places.



T-79018

FIG. 5-47 INSTALLING OUTBOARD BEARING AND CAGE

1. Power unit
*2. Ram screw
*3. Speed nut
*4. Plain hole insert
*5. Hydraulic ram (100 ton)
*6. Spacer tube
*7. Shaft adapter (threaded)
8. Outboard bearing
9. Outboard bearing cage

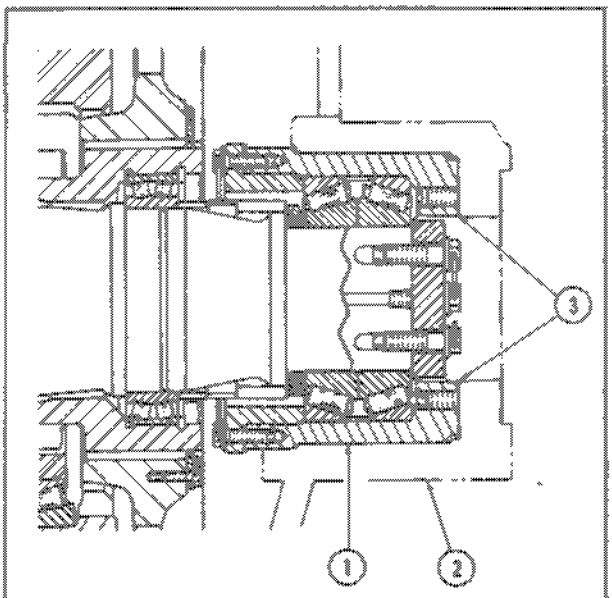
*See SERVICE TOOLS

5.7.6
Lubricate threads and bearing contact surface of outboard bearing retaining nut with final drive lubricant. Install the nut and torque it to 500-2000 lbs.ft. (69-276 m-kg), Fig.5-48. Lock nut with roll pin, (3) Fig.5-45.

5.8 OUTBOARD BEARING SHIMS

5.8.1
Hold retainer,Fig.5-45(1) firm on bearing cage without any shims. Be certain the retainer flange is butted solidly against outboard bearing cup.

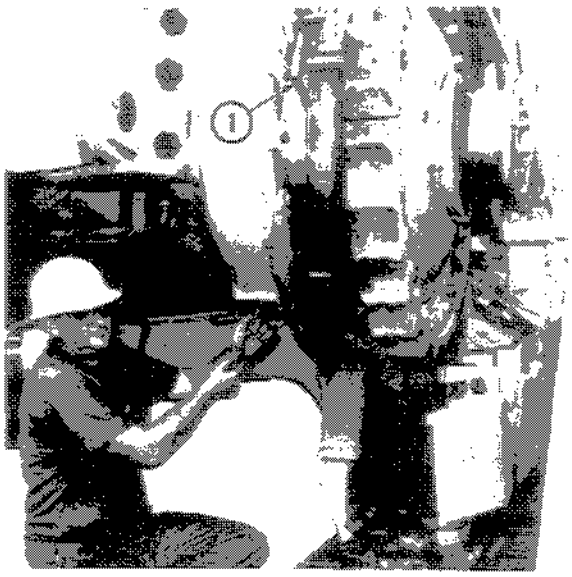
5.8.2
Use a feeler gauge to measure the gap between retainer and cage in three places,Fig.5-46. The required shim pack must equal the average of the three measurements MINUS .004"--.006"(0.10 — 0.15 mm). This step must be performed accurately in order to properly clamp outer race. (An example follows. See 5.8.3)



T-84085

FIG. 6-18 INNER BEARING SEAT

1. Inner bearing cage
2. Main housing
3. Bearing cage to main housing seat



T-80742

FIG. 6-19 ALIGNING CARRIER GEAR TO PINION

1. Cover stabilizing spacer 75301116 (1 each side)

T-80743

FIG. 6-20 ACCESS HOLES FOR COVER CAPSCREWS

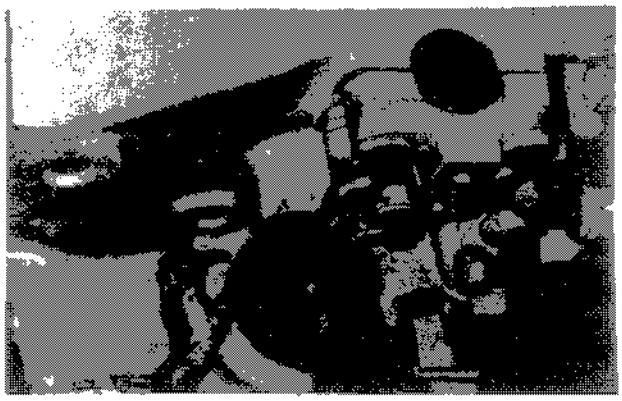


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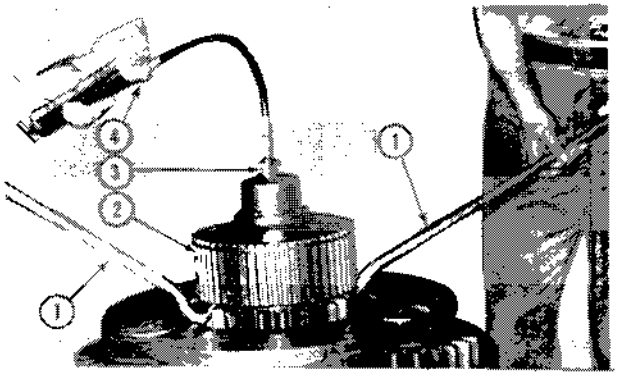
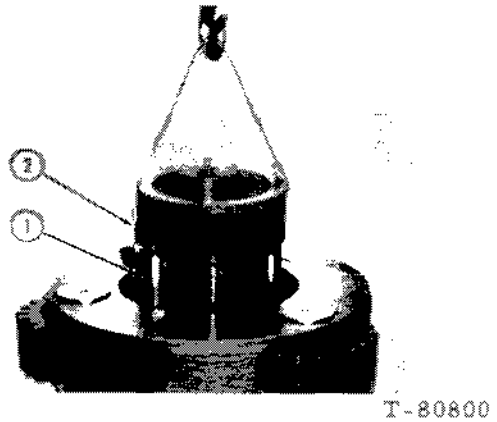
FIG. 6-21 INSTALLING INNER BEARING RETAINER



T-80763

FIG. 7-13 REMOVING SUN GEAR FROM SHAFT

1. Pry bar
2. Sun gear
3. Lube fitting (consists of 1/4" pipe nipple 70911078, reducing coupling 70907061, lube fitting 70914465).
4. Grease gun



T-80800

FIG. 7-14 SUN GEAR LIFTING TOOL

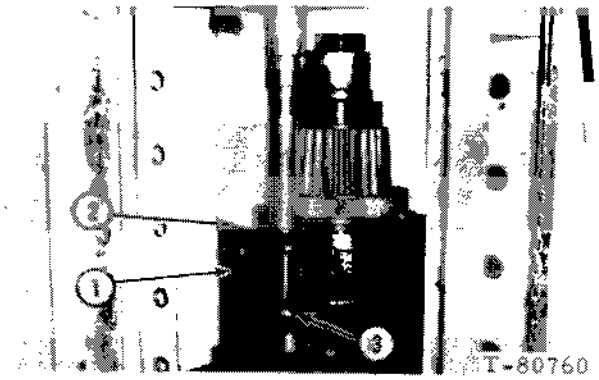
1. Sun gear 2. Lifting bracket 75300033

7.1.16
Refer to Fig. 7-11. Hook a chain in holes of gear (1). Remove lock wire, capscrews and locks (2) holding gear. Remove gear.

7.1.17
Remove spacers, Fig.7-11 (3)(4).

7.1.18
Refer to Fig.7-12. Use a screw driver to remove the snap ring from sun gear.

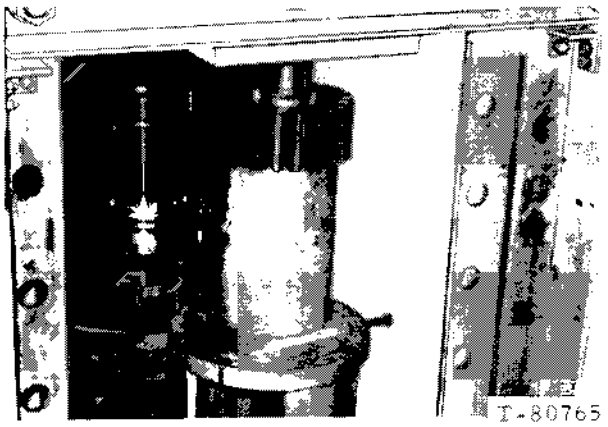
7.1.19
Install lube fitting, Fig. 7-13(3) in shaft. Attach a grease gun(4) on lube fitting and while pumping grease pry the sun gear (2) from shaft. Refer to Fig.7-14; using lifting tool shown to remove sun gear.



T-80760

FIG. 7-15 REMOVING PLANET PIN FROM CARRIER

1. Planet gear 2. Carrier 3. Planet pin



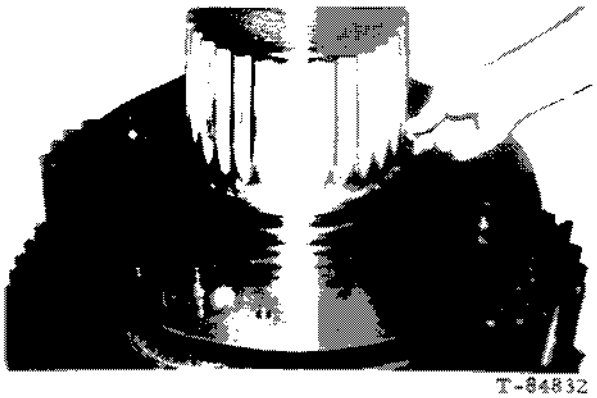
T-80765

FIG. 7-16 PRESSING BEARING FROM PLANET GEAR

7.1.20
Position sun gear in press (gear end up). Insert a 6.88"(174 mm) diameter plate on bearing and press bearing from sun gear. Clean sun gear thoroughly. Refer to INSPECTION and Fig.7-20; make certain sun gear is in good condition and within specification.

7.1.21
Install lifting tool on outboard end of carrier assembly and position it in press. Refer to INSPECTION, and Fig.7-18A; check for looseness of shaft in carrier to determine whether carrier is reusable.

7.1.22
Refer to Fig. 7-15; remove tie wire and capscrews from lock plate. Remove lock plate and shims from carrier. Press the planet pins (3) from the carrier (2) as shown, making certain pins do not drop and get damaged. Remove the planet gears from the carrier. Refer to INSPECTION, and Fig. 7-19; check pin bores in carrier and planet pin diameters.



T-84832

7-39A INTERMEDIATE BEARING SPACER

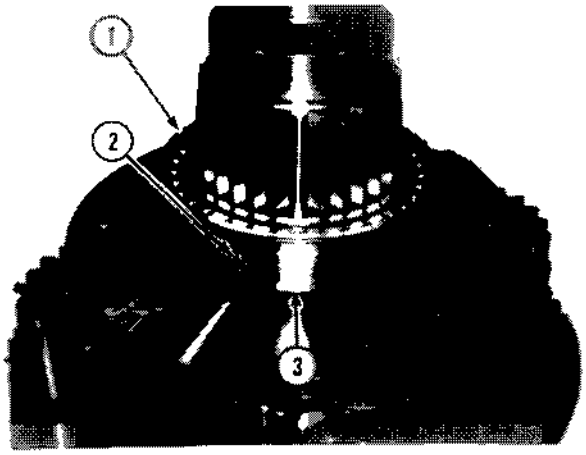


FIG.7-40 INTERMEDIATE BEARING INSTALLED

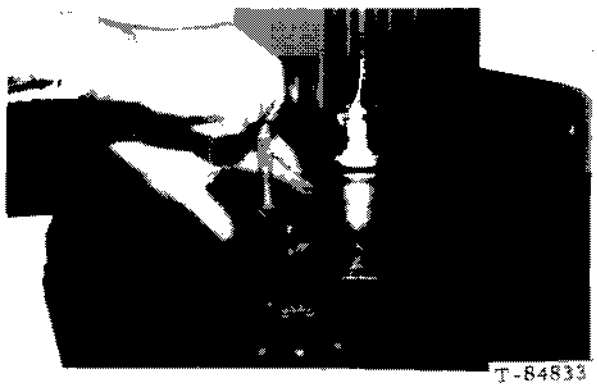
1. Bearing
2. Lockpin
3. Spacer

7.3.13
Turn assembly over and set on floor stand. Install intermediate bearing spacer, Fig. 7-39A on carrier shaft, chamfered side down.

7.3.14
Install heated intermediate bearing on carrier shaft. Use a punch and hammer for proper seating. See Fig.7-40.

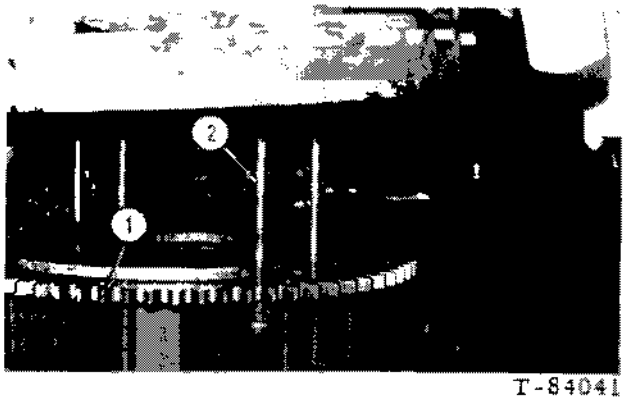
7.3.15
Measure from end of planet pin to face of carrier, Fig.40A. Assemble a shim pack that is 0.001" - 0.004" (0.025 - 0.10 mm) less than the measurement.

7.3.16
Install planet pin shims and locks. Torque capscrews to 220-280 lbs.ft. (30-38 kgm). Install lockwire.



T-84833

7-40A MEASURING FOR PLANET PIN SHIMS



T-84041

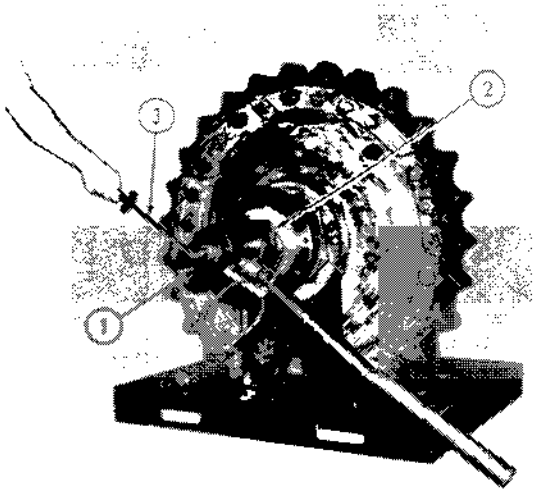
FIG.7-41 GUIDE PINS IN INNER RING GEAR

1. Inner ring gear
2. Guide pins #75300025

7.4 ASSEMBLY OF OUTER COVER AND RING GEARS

7.4.1
Invert the carrier support stand on shop press table.

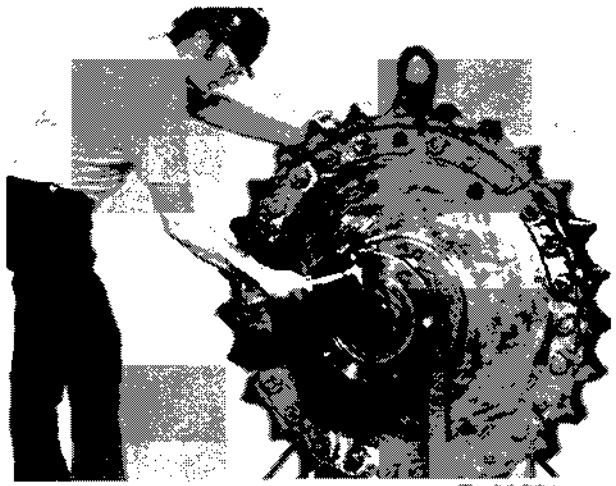
7.4.2
Install inner ring gear on stand and install guide pins as shown in Fig. 7-41. Coat o-rings with grease and insert them in counterbores in cover. Carefully invert the cover making certain o-rings are in place and lower cover over guide pins. Make certain o-rings are not damaged when guide pins enter the cover. Refer to Fig.7-42; attach the inner ring gear to the cover with four capscrews. Do not tighten the capscrews; the inner ring gear must be free to move and yet keep o-rings in place.



T-80790

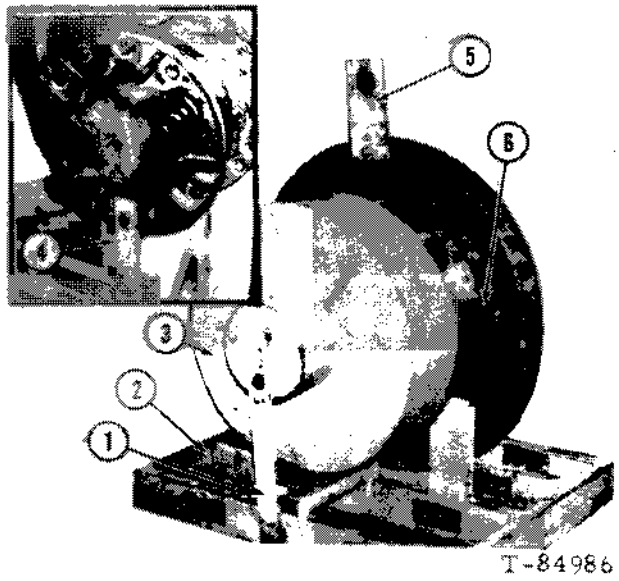
FIG. 7-60 TOOL FOR TORQUING OUTBOARD BEARING NUT

1. Torque multiplier
2. Socket 75300027
3. Torque wrench



T-80791

FIG. 7-61 LOCKING OUTBOARD BEARING NUT (Roll pin)



T-84986

FIG. 7-62 FINAL DRIVE CARRIER ASSEMBLY MOUNTED IN STORAGE STAND

1. Holding strap w/bolt
2. Storage stand
3. Protection cover
4. Holding plate w/ bolt and eyebolt
5. Lifting bracket
6. Cover stabilizing spacer(one each side)

9.3.11 OUTBOARD BEARING CAGE

O.D.	11.996" - 11.998" (304.598 - 304.749 mm)
I.D.	10.6289" - 10.630" (269.974 - 270.004 mm)

9.3.12 CARRIER COVER

Bore diameter for ring gear dowels	.8745" - .8755" (22.21 - 22.24 mm)
Diameter of ring gear dowels	.8755" - .8758" (22.24 - 22.25 mm)
Bore diameter for intermediate bearing	
3 planet gear*	13.997" - 13.999"(355.52 - 355.57 mm)
4 planet gears**	14.1732" - 14.1752"(360.0 - 360.05 mm)

9.3.13 INNER RING GEAR

Diameter of dowel holes	.8758" - .8767" (22.25 - 22.27 mm)

9.3.14 INTERMEDIATE BEARING

O.D. cup (3 planet gear*)	14.000" - 14.002" (355.6 - 355.65 mm)
I.D. cone (3 planet gear*)	10.500" - 10.501" (266.7 - 266.73 mm)
O.D. (4 planet gears**)	14.1716" - 14.1732" (359.96 - 360.0 mm)
I.D. (4 planet gears**)	10.2348" - 10.2362" (259.96 - 260.0 mm)

9.4 TRACK FRAME

9.4.1

Bore diameter for outboard bearing cage	11.998" - 12.000" (304.74 - 304.80 mm)

9.5 BEARING ADJUSTMENT

9.5.1

Pinion shaft	.010" - .050" (0.25 - 1.27 mm) shaft end play

9.5.2

Carrier shaft (3 planet gears*)	.012" - .015" (0.305 - 0.381 mm) tight

9.5.3

Outboard bearing	.004" - .006" (0.10 - 0.15 mm) tight

9.5.4

Carrier shaft inner bearing (4 planet gear**)	.004" - .006" (0.10 - 0.15 mm) tight

9.6 TORQUES

NOTE: Threads should be lubricated unless stated otherwise.

Brake drum hub capscrew	500 - 550 lbs. ft. (69 - 76 m-kg)
Carrier cover capscrew	380 - 420 lbs. ft. (52 - 58 m-kg)
Carrier inner bearing cage retainer capscrews	
3 planet gear* 3/4" diam.	360 - 400 lbs.ft (48-55 m-kg)
3 planet gear* 7/8" diam.	420 - 460 lbs.ft (58-64 m-kg)
4 planet gear** 5/8" diam.	230 - 270 lbs.ft (32-37 m-kg)
4 planet gear ** 1/2" diam.	125 - 135 lbs.ft (17-19 m-kg)
Carrier inner bearing plate capscrews	
4 planet gears**	230 - 270 lbs.ft (32 - 37 m-kg)
Outboard bearing nut	500 - 2000 lbs. ft. (69 - 276 m-kg)
Outboard bearing retainer capscrews	5/8" - 170 - 187 lbs. ft. (23.5 34.4 m-kg)
	3/4" - 300 - 330 lbs. ft. (41.4 - 45.6 m-kg)

*3 planet gears used on FD40 prior to s/n 89A03068 excluding 03034,03035,03036,03038

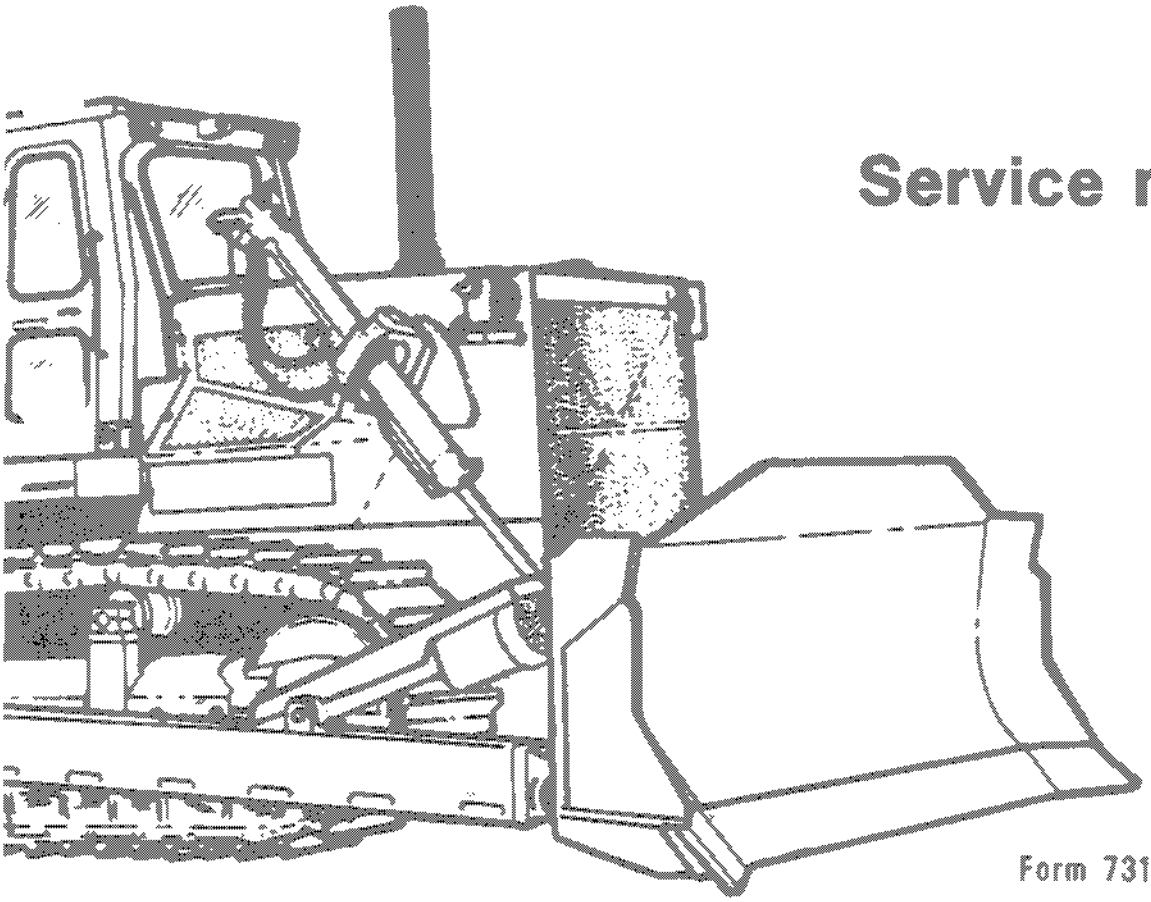
**4 planet gears used on FD40 s/n 89A03068 & up including 03034,03035,03036,03038; all FD50. Also service replacement for FD40 prior to S/N 89A03068.

FD40
FD50

crawler tractor

Undercarriage

Service manual



Form 73148249 English

Reprinted

FOREWORD

Always furnish serial number if making an inquiry to dealer or factory about this machine.

Many equipment owners employ the Dealer's Service Department for all work other than routine lubrication and minor service. This practice is encouraged, as our Dealers are well informed and equipped to render efficient service by factory trained mechanics.

Illustrations show standard and optional items.

IMPORTANT

The information in this manual was current at the time of publication. It is our policy to constantly improve our product and to make available additional optional items. These changes may affect procedures outlined in this manual. If variances are observed, verify the information through your Dealer.

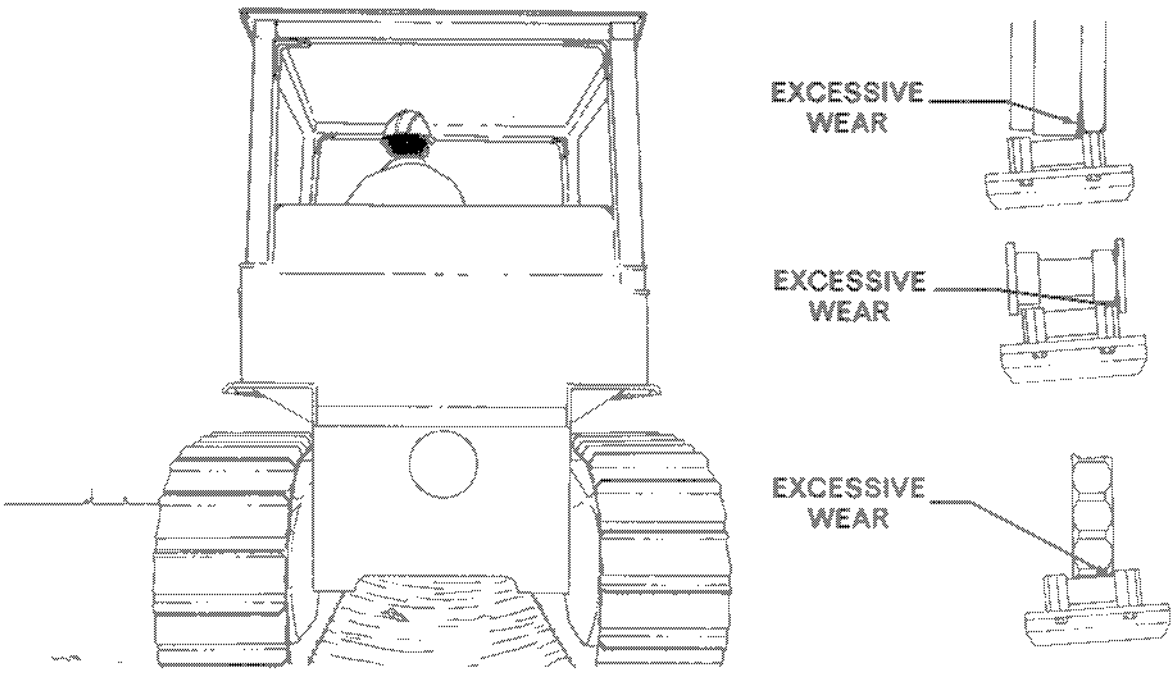


FIG. 3 UNDERCARRIAGE WEAR FROM OPERATING BEHIND NARROW SCRAPER T-72921

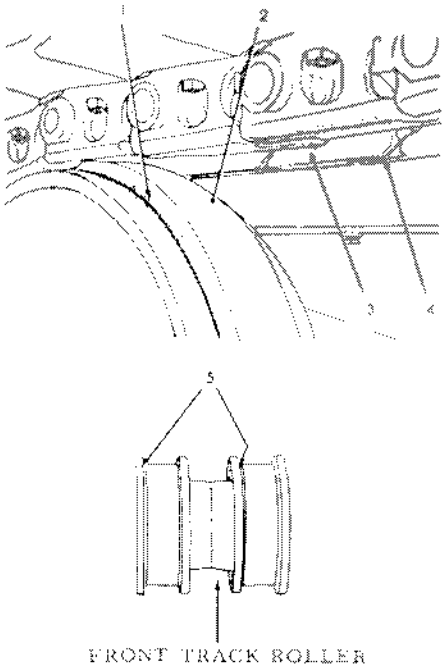
3.2.3 Operating Behind Scraper

Tractors operating behind scrapers are subjected to undue undercarriage wear because of high speed return trips in reverse to start of cut, sometimes only to wait for scraper to re-enter cut. If return speed is slowed to allow both units to arrive at start of cut at same time, undercarriage wear will be reduced considerably.

Operating behind scraper with narrow cut, Fig. 3, will cause rapid wear to outer flange of track rollers, outer side of idler center flange, and sides and edges of track links, with resulting wear to sprocket teeth and carrier rollers. Nothing can be done to eliminate rapid wear, but undercarriage life can be extended by switching track assemblies and idlers, and changing track rollers to another position as wear becomes pronounced.

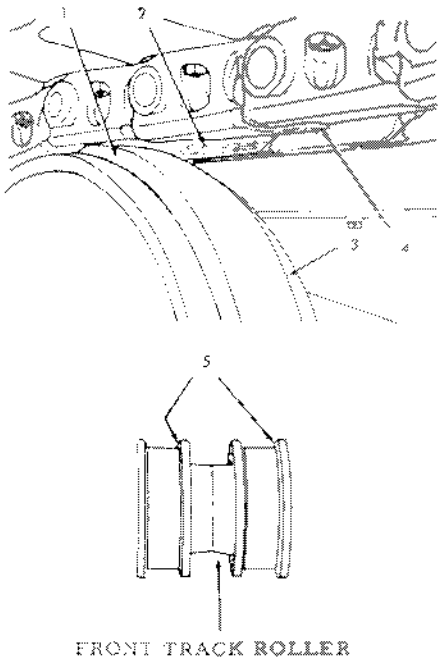
3.2.4 HILLSIDE OPERATION

Accelerated undercarriage wear will be evident if tractor is used on hillside, Fig. 4. Track on high side will wear outer flange on track rollers, inner side of idler center flange, and inner side of sprocket. Track on low side will wear inner flange on track rollers, outer side of idler center flange, and outer side of sprocket. Most practical way to prolong undercarriage life is to operate tractor in both directions to equalize wear on each track. If this is not possible or practical, undercarriage life can be prolonged by switching track assemblies and idlers. If wear on one side of sprocket teeth is pronounced, sprocket segments can also be switched to obtain new wear surface.



1. HEAVY CONTACT ON IDLER OUTER FLANGE
2. LIGHT TO NO CONTACT ON IDLER INNER FLANGE
3. HEAVY CONTACT ON INNER SIDE OF OUTER TRACK LINK
4. LIGHT TO NO CONTACT ON INNER SIDE OF INNER TRACK LINK
5. MORE CONTACT ON FLANGES.

FIG. 18 WEAR PATTERN – IDLER OFF-CENTER TOWARD OUTSIDE T-72954



1. LIGHT TO NO CONTACT ON IDLER OUTER FLANGE
2. HEAVY CONTACT ON INNER SIDE OF INNER SIDE LINK
3. HEAVY CONTACT ON IDLER INNER FLANGE
4. LIGHT TO NO CONTACT ON INNER SIDE OF OUTER SIDE LINK
5. MORE CONTACT ON INNER FLANGE THAN OUTER FLANGES.

FIG. 19 WEAR PATTERN – IDLER OFF-CENTER TOWARD INSIDE T-72954

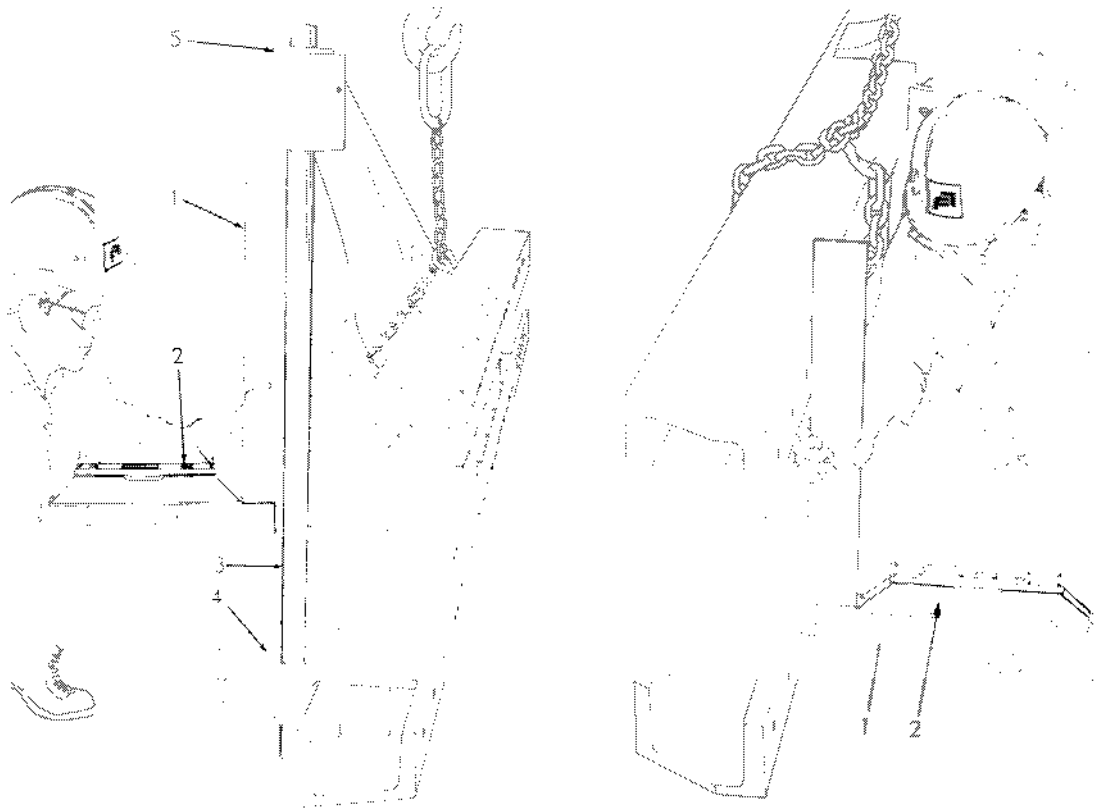


FIG. 34 CHECKING LEVEL OF SLIDE BAR MOUNTING SURFACES (Typical) T-72980
1. Square 2. Master level 3. Alignment bar
4. Outboard bearing bore insert 5. Pivot shaft bore insert

NOTE: If dial indicators at pivot pin locations are near limits of 0.508 mm (.02 in.) (either slightly over or under), then replacement of pivot pins and bushings will normally restore the track frame parallelism. Alignment checks of the other undercarriage components will be necessary.

4.6 "OFF UNIT" ALIGNMENT CHECKS

4.6.1 Position of Track Frame for Alignment Checks

All checks can be made with track frame resting level on its outside channel, Fig. 33. Position track frame as shown. Remove rollers, guards, idler, yoke, carrier roller bracket and slide bars from track frame. Remove pivot shaft bushing from bore.

Lay track frame on outer channel, with leveling jacks under outer channel and one under track release housing, Fig. 33.

Install alignment bar and inserts, Fig. 31 and 32; hold square and level against rear side of alignment bar, Fig. 32 and adjust leveling jacks to level track frame from front to rear. Hold square and level against top side of alignment bar, Fig. 32 and adjust leveling jack beneath track release housing to level track frame from top to bottom. Recheck and adjust until track frame is level.

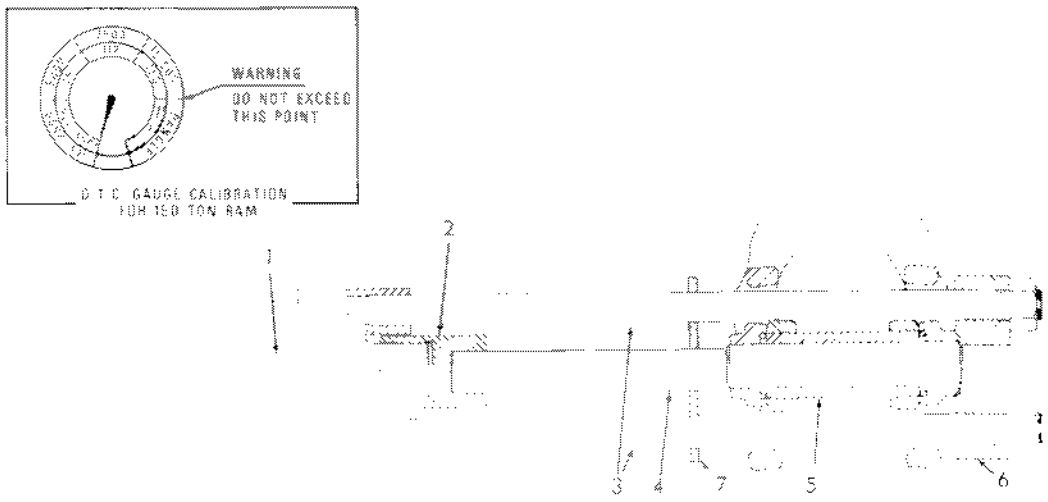


FIG. 49 MASTER PIN PRESS INSTALLED T-75947

1. Hydraulic cylinder
2. Piston rod cap
3. Connecting rods
4. Forcing pin
5. Track assembly
6. Bolster
7. Guide plate (pin)

Remove all master pin press components except for the forcing pin. Move the tractor to position the forcing pin just below the centerline of the track idler as shown in Fig. 50. Place blocking in front of the idler and track below the pin. Remove the forcing pin from the track allowing the links to separate.

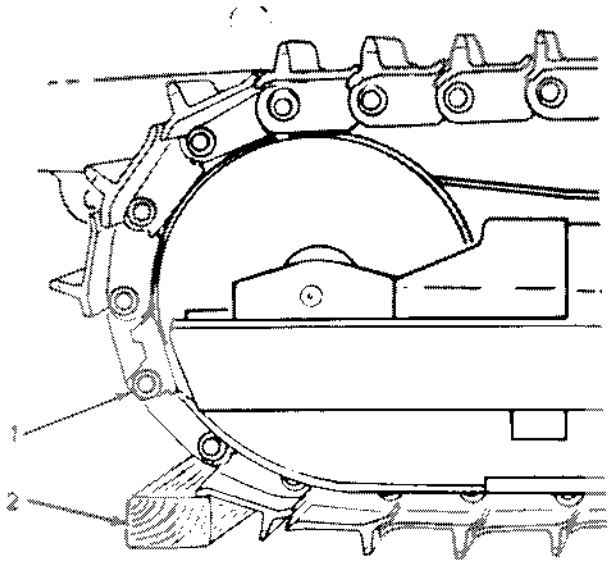


FIG. 50 POSITION OF FORCING PIN FOR REMOVAL T-84976

1. Forcing pin 2. Block

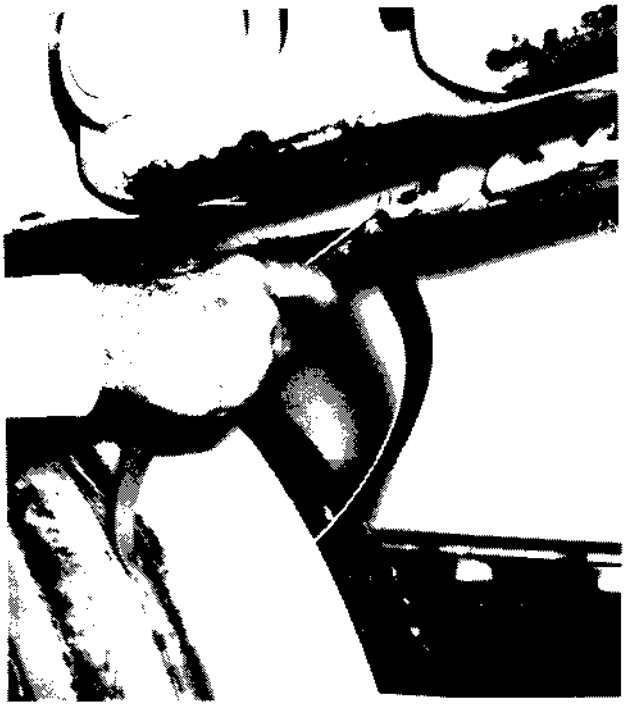


FIG. 62 CHECKING IDLER FLANGE WEAR T-79024

FIG.63 CHECKING IDLER RIM WEAR T-79024

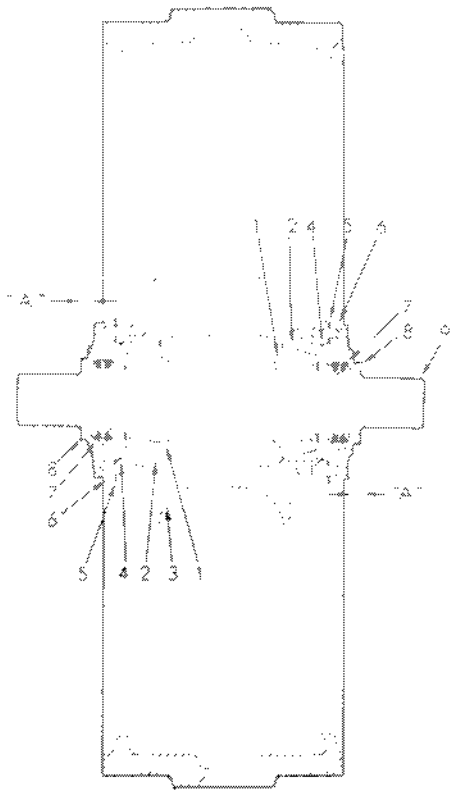


FIG. 64 TRACK IDLER (Sectional View) T-75844

1.Bearing cone	6.Bearing retainer
2.Bearing cup	7.Seal assembly
3.Track idler	8.Seal retainer
4.O-ring	9.Idler shaft
5.Bearing adjusting shims	DIM "A"-12.6-13.1 mm (.495-.515 in.)

6.1 GENERAL DESCRIPTION

6.1.1

Idlers are the solid type with the rims and flanges machined for precision alignment and heat treated on the wear surfaces to prevent flaring and to resist abrasive wear. Idler bearings are tapered rollers which are permanently lubricated at time of assembly and require no further service. Double faced rubber and steel seals are used to retain lubricant in bearings.

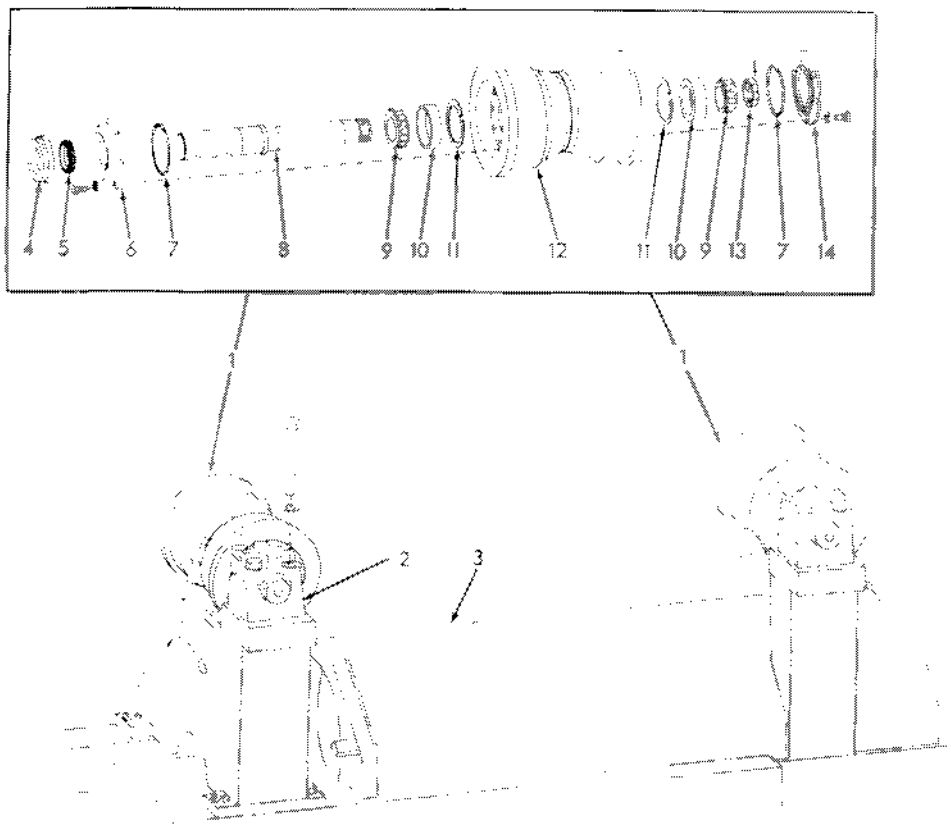


FIG. 70 TRACK CARRIER ROLLER T-75943

1. Carrier roller
2. Roller bracket
3. Track frame
4. Seal retainer
5. Seal assembly
6. Bearing retainer
7. O-ring
8. Shaft
9. Bearing cone
10. Bearing cup
11. Snap ring
12. Roller
13. Nut w/pin
14. Plate

7.1 DESCRIPTION

The track carrier roller consists of a shaft, tapered roller bearings, positive type seals, and a forged, heat-treated roller. The rollers are permanently lubricated when assembled and require no further lubrication service.

7.2 MAINTENANCE

7.2.1

Alignment of carrier rollers to track sprocket teeth and idler and proper track adjustment are important factors determining the life of the rollers. Periodic checks should be made as follows:

Check guide flanges of roller; if one flange is worn more than the other, carrier roller must be shifted in bracket to provide equal clearance between track links and flanges of the rollers.

Raise and block the track assembly above the carrier rollers; using a pry bar, check the rollers for end play in the bearings. Should any end play exist, roller assembly must be removed and repaired.

Inspect rollers for lubricant leakage. If leakage is apparent, carrier roller should be removed and repaired.

8.5.11
Repeat steps 8.5.7 thru 8.5.10 to assemble parts on other end of roller.

8.5.12
Rotate the shaft 5 to 10 revolutions to seat the seals.

8.5.13
Refer to Fig. 78 and install pressure test fixture on threaded end of roller shaft. Do not connect the air to fixture at this time.

8.5.14
Turn the handle on pressure regulator to make certain there is no chance of regulator providing more than 1.72 bar (25 psi) when air is connected and turned on. Turn the hand valve to the shut-off position.

8.5.15
Connect the air line to the test fixture and open the hand valve. Turn the handle on pressure regulator until a pressure of 1.72 bar (25 psi) is indicated on pressure gauge, then turn hand valve to shut off air. Check pressure gauge and if air pressure in roller does not drop in 15 seconds, the seals are holding properly.

8.5.16
Remove the test fixture from the roller and fill the roller (through plug hole) with 0.58 lit (0.62 qts.) of specified oil (see 2.1). Install O-ring and plug; torque the plug to 149-190 Nm (110-140 lbs.ft.).

8.5.17
Place track roller in position on track frame making certain flat surfaces on shaft and cap are against bottom of track frame. Insert the capscrews through cap and into track frame. Tighten capscrews to a torque of 950-1045 Nm (700-770 lbs.ft.).

8.5.18
Install track guards and secure with necessary capscrews and nuts.

8.5.19
Raise tractor and remove all blocking; then lower tractor to the surface.

8.5.20
Refer to 5.2 and adjust the track to proper tension.

⚠ **WARNING**-When any supporting machine component must be removed or installed and jacks are used, be sure the support of the jack at the machine and on the ground are appropriate to the load to be applied. Transfer the load to authorized blocking or jack stands immediately. Do not work on or under the machine or its components while supported only on a jack or other lifting device, according to local or national requirements.

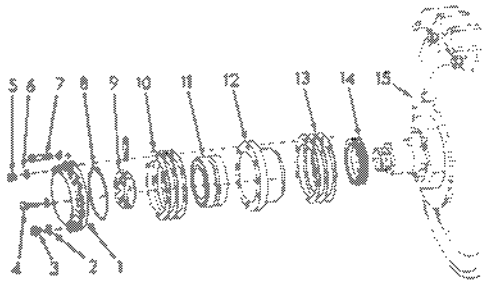


FIG.85 SPROCKET SHAFT OUTBOARD BEARING COMPONENTS T-75929

1. Bearing retainer
2. Gasket
3. Magnetic plug
4. Capscrew
5. Filler plug
6. Gasket
7. Capscrew
8. O-ring
9. Nut w/pin
10. Shims (outboard bearing)
11. Outboard bearing
12. Bearing cage
13. Adjusting shims (track frame)
14. Seal
15. Sprocket

10.1 PERIODIC CHECKS

10.1.1
Periodically check track frames and related components for alignment and wear; also check pivot shafts and bushings.

10.1.2
The pivot shafts and bushings are pressure gun lubricated periodically. The pivot shaft inner and outer cap retaining capscrews should be periodically checked for proper torque of 4284-4827 Nm (3160-3560 lbs.ft.)

10.2 REMOVAL

NOTE: If tractor is equipped with dozer, remove trunnion cap from trunnion and remove cylinder piston rod to dozer from connecting pins. If equipped with tilt cylinder, disconnect hoses and cap them.

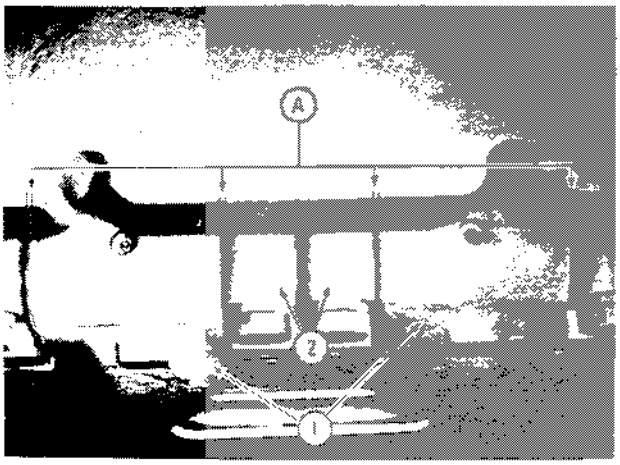


FIG. 86 TRACK FRAME PIVOT CAPS T-79957

1. Track frame 2. Pivot caps
A- 1.5 mm (.06 in.) minimum clearance

10.2.1
Refer to 5.3 and uncouple track; move tractor backward until track is off idler carrier rollers and sprocket, and rear track roller is even with rear end of track.

10.2.2
Remove carrier roller/oscillating beam saddle retaining capscrews and track release/idler yoke guards.

10.2.3
Refer to Fig. 86, and remove track frame pivot shaft caps located at bottom rear of main housing. The caps are identified and must be installed in same location. Remove sprocket guards.

10.2.4
Remove sprocket shaft outboard bearing cage cap; remove outboard bearing retainer, Fig. 85 (1), and tie shims (10) to retainer. Remove roll pin, and loosen bearing retaining nut (9) five or six turns.

OSCILLATING BEAM (FD50 Only)

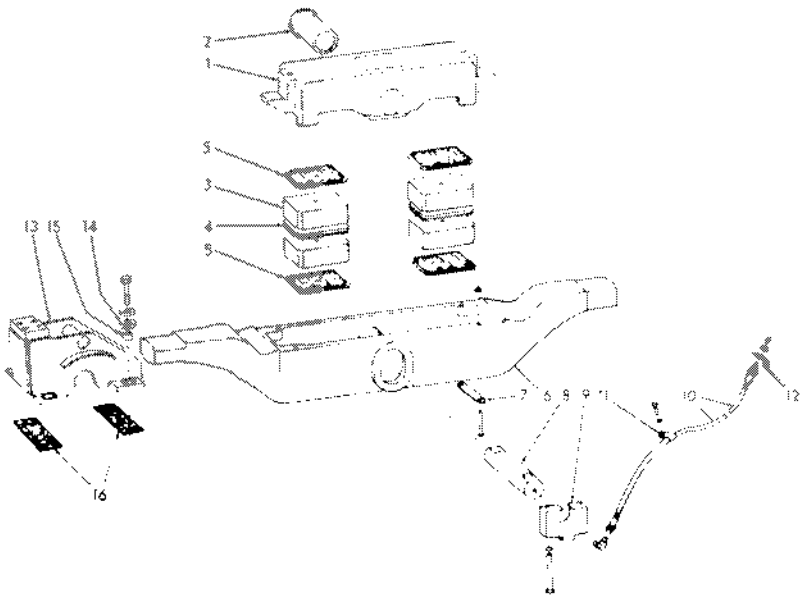


FIG. 97 OSCILLATING BEAM COMPONENTS T-75934

1. Housing
2. Bushing
3. Block
4. Shim
5. Pad
6. Oscillating beam
7. Housing retaining blocks
8. Pivot cap
9. End cap
10. Lube hose
11. Clips
12. Angle
13. Saddle
14. Shim
15. Bushing
16. Pad

11A.2.3
Raise tractor with suitable hoist or jack so the saddle (with bar) and pivot pin can be removed; then block tractor in this position.

11A.2.4
Refer to Fig. 97 and remove beam saddle (13) and push bar from beam and track frame.

11A.2.5
Remove pivot pin (8) from oscillating beam shock pad housing (1).

11A.2.6
Using a suitable sling and hoist or rolling floor jack, remove oscillating beam assembly from tractor. A 4 ton capacity hoist or floor jack must be used.

11A.2.7
Refer to Fig. 97 and remove capscrews that attach blocks (7). Place oscillating beam in a suitable press (100 ton) or use 2 long capscrews 31.7 x 508.0 mm (1.25 x 20 in.) 203.2 mm (8 in.) of NF threads and high nuts with plain washers; then compress the housing until blocks (7) can be removed. Remove blocks and release all compression on the housing. If a sprocket hub puller (100 ton) is available, refer to Fig. 98 and disassemble the oscillating beam as follows:

Raise the oscillating beam assembly approximately 152.4 mm (6 in.) above the floor and block beneath each end making certain that the 152.4 mm (6 in.) clearance is maintained.

Position the cross bar (9) beneath the beam as shown and install the two puller legs on bar and secure with capscrews.

Install the puller head on end of ram (100) ton and secure with capscrews.

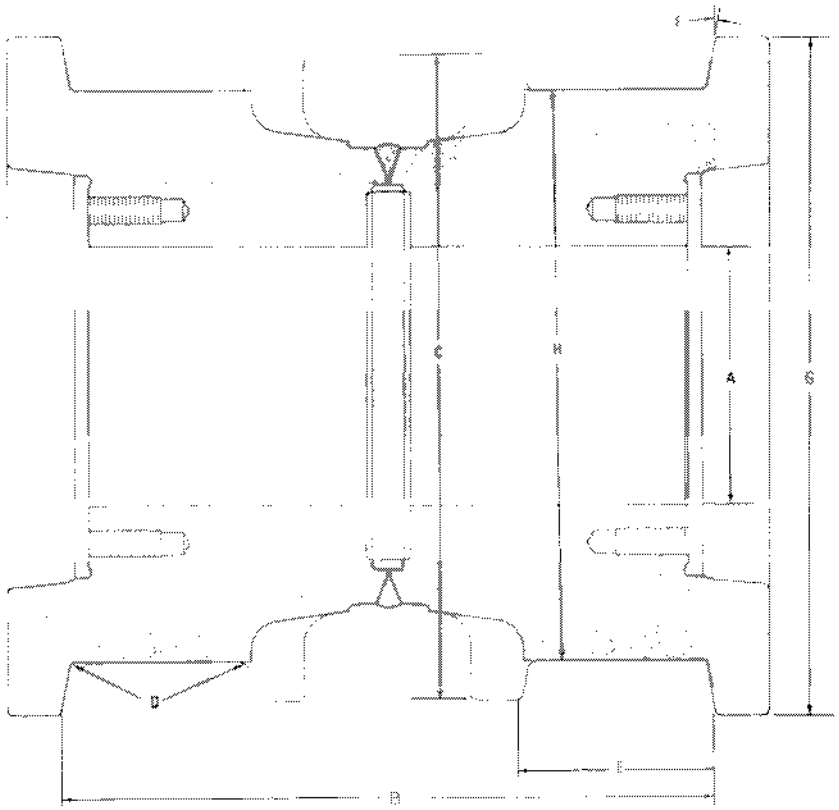


FIG. 105 TRACK ROLLER T-75905

13.4 TRACK ROLLER (Fig. 105)

FD40/FD50

A	B	C	D	E	F	G	H
133.604mm (5.260")	334.01mm (13.15")	332.74mm (13.10")	2.286mm (.09"R)	92.329mm (3.635")	10°	344.88mm (13.57")	292.1mm (11.5")

TOLERANCE: Dimension A – minus .0508 mm (.002")
Dimension C – plus or minus 1.5 mm (.059")
Dimension E – plus or minus .25 mm (.010")
Dimension H – plus or minus .50 mm (.020")

SAFETY RULES

To prevent entrapment in cabs or mounted enclosures, observe and know the mechanics of alternate exit routes.

On machines equipped with suction radiator fans, be sure to periodically check all engine exhaust parts for leaks as exhaust gases are dangerous to the operator. Keep a vent open to outside air at all times when operating within a closed cab.

STARTING FLUID IS FLAMMABLE. Follow the recommendations as outlined in the Operation and Maintenance Instruction Manual and as marked on the containers. Store containers in cool, well-ventilated place secure from unauthorized personnel. *DO NOT PUNCTURE OR BURN CONTAINERS.*

Follow the recommendations of the manufacturer for storage and disposal.

Wire rope develops steel slivers. Use authorized protective equipment such as heavy gloves, safety glasses when handling.

OPERATION

Before starting machine, check, adjust and lock the operator's seat for maximum comfort and control of the machine.

DO NOT START OR OPERATE AN UNSAFE MACHINE. Before working the machine, be sure that any unsafe condition has been satisfactorily remedied. Check brakes, steering and attachment controls before moving. Advise the proper maintenance authority of any malfunctioning part or system. Be sure all protective guards or panels are in place, and all safety devices provided are in place and in good operating condition.

Check instruments at start-up and frequently during operation.

Do not run the engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

Be sure exposed personnel in the area of operation are clear of the machine before moving the machine or its attachments. *WALK COMPLETELY AROUND* the machine before mounting. Sound horn. Obey flag man, safety signals and signs.

Know the principles of cross steering of crawler tractors. Read section in Operation and Maintenance Instruction Manual on cross steering.

Keep engine exhaust system and exhaust manifolds clear of combustible material. Equip machine with screens and guards when working under conditions of flying combustible material.

If engine has a tendency to stall for any reason under load or idle, report this for adjustment to a proper maintenance authority immediately. Do not continue to operate machine until condition has been corrected.

Never use bucket as a man-lift.

Use recommended bucket for machine and material load ability and heaping characteristics of material, terrain, and other pertinent job conditions.

Avoid abrupt starts and stops when transporting a loaded bucket.

Inspect your seat belt webbing and hardware at least twice a year for signs of fraying, wear or other weakness that could lead to failure.

Use only designated towing or pulling attachment points. Use care in making attachment. Be sure pins and locks as provided are secure before pulling. Stay clear of draw bars, cables or chains under load.

When pulling or towing through a cable or chain, do not start suddenly at full throttle. Take up slack carefully. Guard against kinking chains or cables. Inspect carefully for flaws before using. Do not pull through a kinked chain or cable due to the high stresses and possibility of failure of the kinked area. Always wear heavy gloves when handling chain or cable.

Be sure cables are anchored and the anchor point is strong enough to handle the expected load. Keep exposed personnel clear of anchor point and cable or chain. *DO NOT PULL OR TOW UNLESS OPERATOR'S COMPARTMENT OF MACHINES INVOLVED ARE PROPERLY GUARDED AGAINST POTENTIAL CABLE OR CHAIN BACKLASH.*

During operation always carry ripper in full raised position when not in use and lowered to ground when parked.

When counterweights have been provided, do not work machine if they have been removed unless their equivalent weight has been replaced. See the Operation and Maintenance Instruction Manual.

When operating a machine know what clearances will be encountered, overhead doors, wires, pipes, aisles, roadways; also the weight limitations of ground, floor, and ramps.

Know bridge and culvert load limits and do not exceed them. Know machine's height, width, and weight. Use a signal person when clearance is close.

Be sure that the exact location of gas lines, utility lines, sewers, overhead and buried power lines, and other obstructions or hazards are known. Such locations should be precisely marked by the proper authorities to reduce the risk of accidents. Obtain shut-down or relocation of any such facilities before starting work, if necessary.

Be certain to comply with all local, state, and federal regulations regarding working in the vicinity of power lines.

When roading find out what conditions are likely to be met - clearances, congestion, type of surface, etc. Be aware of fog, smoke or dust element that obscure visibility.

When backing, always look to where the machine is to be moved. Be alert to the position of exposed personnel. *DO NOT OPERATE* if exposed personnel enter the immediate work area.

2.2.13
Remove the floor mat. Remove the center and left floor olates.

2.2.14
Refer to Fig.9 and remove the instrument panel attaching capscrews(3). Push panel assembly forward as far as possible and secure with tie-wire.

NOTE: Since electrical master switch is in "OFF" position no concern for shorts is necessary; however, DO NOT damage instrument lugs or tubing on rear side of panel.

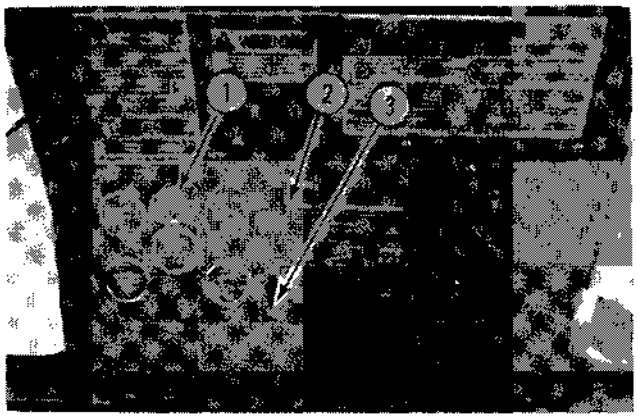


FIG. 9 INSTRUMENT PANEL T-0665
1. Dash light
2. Instrument panel
3. Capscrew

2.2.15
Disconnect the two control levers by means of the two quick disconnect couplings. These couplings are found after opening the control valve access door.

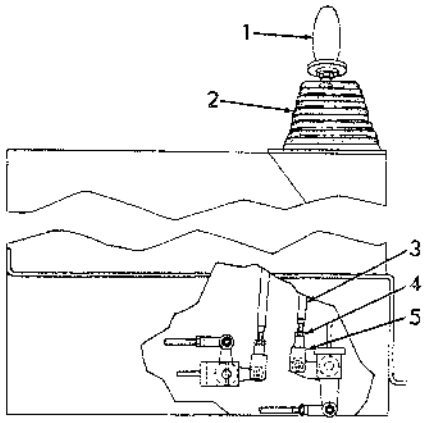


FIG. 10 DOZER CONTROLS T-0695
1. Knob
2. Boot
3. Dozer control rod
4. Jam nut
5. Quick disconnect

2.2.16
Hold the lever and pull upward on the coupling. Slipp coupling from the lever ball.

2.2.17
If tractor is equipped with ripper, refer to Fig.14 and remove yoke pin (4) by reaching through the dozer rod opening . Disconnect ripper pitch control rod (if so equipped).

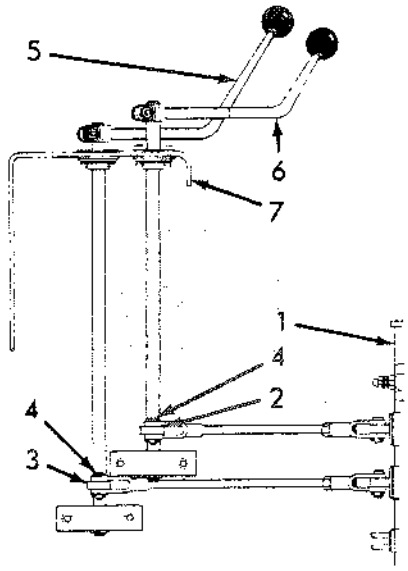


FIG. 11 RIPPER CONTROLS T- 79871
1. Valve assembly
2. Pitch lever
3. Lift lever
4. Pin w/cotter pin
5. Lift control lever
6. Pitch control lever
7. Seat support

2.2.18
Remove the vertical trim strip located to left of seat and against the control tower, Fig.12.

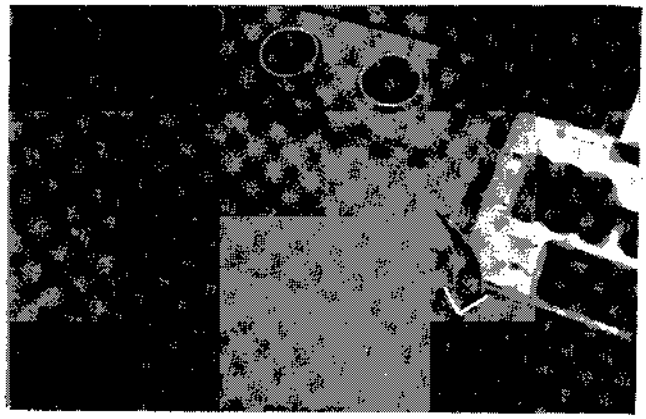


FIG.12 CONTROL TOWER TRIM STRIP
T-0670

4.3.3 AIR CONDITIONER CONDENSER

4.3.3.1
When the air conditioner efficiency has dropped because the condenser coils are dirty or plugged, it should be cleaned as outlined in following steps.

⚠ WARNING

Always turn the master switch to the off position before cleaning, repairing or servicing the unit to prevent injury.

4.3.3.2
Open left battery compartment cover and turn electrical master switch to "OFF" position.

4.3.3.3
Remove condenser housing plate, Fig. 28 (1).

4.3.3.4
Use care to prevent damage to fan blades, motors and wiring while cleaning.

⚠ DANGER

Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles. Limit the pressure to 2 bar (30 psi) according to local or national requirements.

4.3.3.5
Using an air hose and nozzle (maximum of 2 bar - 30 psi air pressure), blow the dirt from the coils, directing the air through coil from motor side toward cab. If air pressure does not remove caked residue then use a solution of water and low detergent to remove the residue. (Protect motors with plastic cover). Flush with clean water and dry with compressed air.

4.3.3.6
Install condenser housing plate, Fig. 28 (1) and secure with attaching capscrews. Tighten to specified torque.

4.3.3.7
Clean the cab rear window. Turn electrical master switch to the "ON" position.

4.3.4 COMPRESSOR BELT ADJUSTMENT

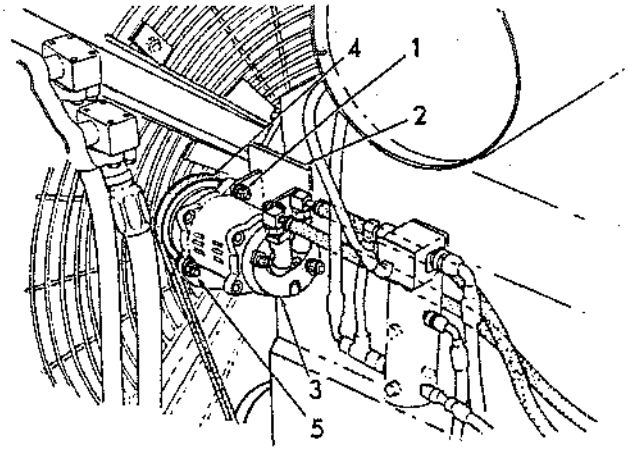


FIG. 29 COMPRESSOR BELT ADJUSTMENT
T-0688

1. Clamping capscrew
2. Mounting bracket
3. Compressor
4. Drive belt
5. Adjusting screw

⚠ WARNING

Do not check or adjust belts when engine is running.

4.3.4.1
Compressor is located in engine compartment on left side. Belt is correctly adjusted if there is 12.7 mm (0.5") deflection when pressed by hand at a point midway between compressor pulley and drive pulley with a force of 11 kg (25 lbs).

If checking with a belt tension gauge (#75300811) correct adjustment is 135 lbs tension for new belt, 85 - 95 lbs for used belt (cold).

4.3.4.2
To adjust belt, loosen four clamping capscrews, Fig. 29 (1). Loosen jam nut on adjusting screw (5).

Turn adjusting screw (5) clockwise to tighten belt, counterclockwise to loosen belt.

When correct adjustment is obtained tighten jam nut on adjusting screw (5) and the four clamping capscrews (1).

NOTE: Compressor has a small steel plate bolted to the bottom of it to absorb the thrust of the adjusting screw. If the compressor is changed, install this plate on the replacement compressor.

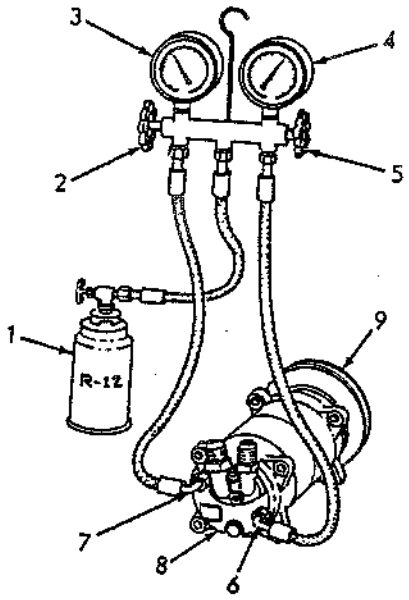


FIG. 39 CHARGING SYSTEM T-0691

1. R-12 refrigerant
2. Low pressure/vacuum valve
3. Low pressure/vacuum gauge(compound)
4. High pressure gauge
5. High pressure valve
6. Discharge service valve
7. Suction service valve
8. Compressor
9. Drive end (for clutch)

8.5 PARTIAL CHARGE

When it has been determined that air conditioner system is low on refrigerant, a partial charge is required.

⚠ WARNING

Refrigerant is extremely cold and will freeze flesh on contact. Use care to prevent contact with skin, eyes or other parts of the body to avoid personal injury.

Wear goggles to protect your eyes when handling refrigerant or when checking refrigerant lines for leaks. Liquid refrigerant in the eyes can cause injury.

8.5.1
Refer to 8.4.2 and install the manifold and gauge set on compressor service valves.

8.5.2
Connect the manifold center hose to refrigerant (R-12), making certain hose is purged with refrigerant at manifold connector before tightening.

⚠ WARNING

Observe all start up and shut down procedures and listed in the Operation and Maintenance Instruction Manual.

Do not run engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

Warn all people who may be servicing or working around machine before starting engine.

8.5.3
Start engine and run at low idle. Turn air conditioner on cold and pressurizer blower on high speed.

8.5.4
Open refrigerant supply valve, Fig. 38 (1) slightly and allow refrigerant vapor into system through manifold hand valve (2) on the suction side.

IMPORTANT: Keep refrigerant supply container in upright position to insure that only non-liquid refrigerant is introduced into the system.

The flow of refrigerant can be increased by placing refrigerant container in a pan of hot water. Do not use water above 50°C (125°F) to heat container. Do not apply direct heat to container. Direct heat or water hotter than 50°C (125°F) will cause excessive pressure in container and possible container explosion.

8.5.5
Observe sight glass while adding refrigerant. When sight glass , Fig. 40, is clear and free of bubbles, close refrigerant supply valve.

8.5.6
Run engine at 1500 RPM for 5 to 10 minutes. Observe gauges, Fig.39. Gauge (3) should read 20 - 40 psi; gauge (4) should read 125 - 225 psi. If pressures remain constant, system is normal. If pressures gradually drop, then the system should be checked for leaks. Refer to 8.6.

8.5.7
Refer to 8.4.3 and remove the manifold and gauge set.

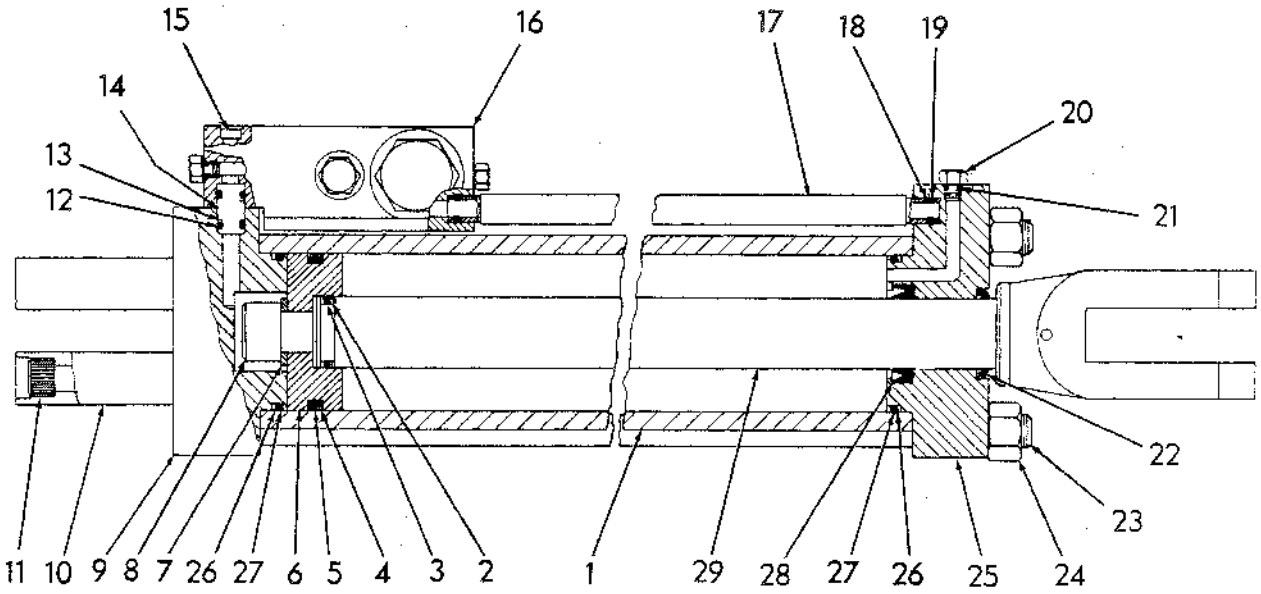


FIG. 45 TILT CYLINDER -SECTIONAL VIEW T-79647

1. Cylinder
2. Back-up washer
3. O-ring
4. Back-up ring
5. "T" seal
6. Piston
7. Washer
8. Screw
9. Cylinder end cap
10. End block
11. Capscrew
12. O-ring
13. Back-up washer
14. Bushing
15. Screw
16. Valve assembly
17. Tube
18. Back-up washer
19. O-ring
20. Fitting
21. O-ring
22. Packing Cup
23. Rod
24. Rod nut
25. Cylinder end cap(Rod end)
26. Back-up washer
27. O-ring
28. Packing cup
29. Piston rod

9.1 GENERAL INFORMATION

⚠ WARNING

Never use gasoline, solvent or other flammable fluids to clean parts.

Wear safety glasses with side shields or goggles when using compressed air for cleaning to reduce the danger of personal injury from flying particles.

Limit the pressure to 2 bar (30 psi), according to local or national requirements.

9.1.1
Service parts for tilt cylinder are listed in Service Tools.

9.1.2
The valve assembly Fig. 49 (16),attached to the tilt cylinder should be checked periodically for proper relief pressures; however repairs other than adjustment should not be attempted. Make certain tilt cylinder is in good condition before checking and adjusting valve (9.3).

FD40
FD50

crawler tractors

service manual

IMPLEMENT HYDRAULICS

S/N 89A 01821 - UP (FD40)
S/N 42S 04001 - UP (FD50)

FORM 73142645 English

⚠ WARNING

STUDY THE OPERATION AND MAINTENANCE INSTRUCTION MANUAL THROUGH BEFORE STARTING, OPERATING, MAINTAINING, FUELING OR SERVICING THIS MACHINE.

The Operation and Maintenance Instruction Manual provides the instructions and procedures for starting, operating, maintaining, fueling, shutdown and servicing that are necessary for properly conducting the procedures for overhaul of the related components outlined in this Service Manual.

This symbol is your safety alert sign. It MEANS ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED.

Read and heed all safety instructions carrying the signal words WARNING and DANGER.

Machine mounted safety signs have been color coded yellow with black borders and lettering for warning and red with white borders and lettering for danger points.

SAFETY RULES

Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

Never place gasoline or diesel fuel in an open pan.

Shut off engine and be sure all pressure in system has been relieved before removing panels, housings, covers, and caps. See Operation and Maintenance Instruction Manual.

Do not remove hoses or check valves in the hydraulic system without first removing load and relieving pressure on the supporting cylinders. Turn radiator cap slowly to relieve pressure before removing. Add coolant only with engine stopped or idling if hot. See Operation and Maintenance Instruction Manual.

Fluid escaping under pressure from a very small hole can almost be invisible and can have sufficient force to penetrate the skin. Use a piece of card board or wood to search for suspected pressure leaks. *DO NOT USE HANDS.* If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Never use any gas other than dry nitrogen to charge accumulators. See Operation and Maintenance Instruction Manual.

When making pressure checks use the correct gauge for expected pressure. See the Operation and Maintenance Instruction Manual or Service Manual for guidance.

For field service, move machine to level ground if possible and block machine. If work is absolutely necessary on an incline, block machine and its attachments securely. Move the machine to level ground as soon as possible.

Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of the machine by blocking or other means.

Block all wheels before bleeding or disconnecting any brake system lines and cylinders.

Never use make shift jacks when adjusting track tension. Follow the Undercarriage Service Manual.

Know your jacking equipment and its capacity. Be sure the jacking point used on the machine is appropriate for the load to be applied. Be sure the support of the jack at the machine and under the jack is appropriate and stable. Any equipment up on a jack is dangerous. Transfer load to appropriate blocking as a safety measure before proceeding with service or maintenance work according to local or national requirements.

Always block with external support any linkage or part on machine that requires work under the raised linkage, parts, or machine per local or national requirements. Never allow anyone to walk under or be near unblocked raised equipment. Avoid working or walking under raised blocked equipment unless you are assured of your safety.

When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladder or step platform that meets local or national requirements to reach the service point. If such ladders or platforms are not available, use the machine hand holds and steps as provided. Perform all service or maintenance carefully.

Shop or field service platforms and ladders used to maintain or service machinery should be constructed and maintained according to local or national requirements.

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

In lifting and handling heavy parts, slings must be of adequate strength for the purpose intended and must be in good condition.

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

When using compressed air for cleaning parts use safety glasses with side shields or goggles. Limit the pressure to 207 kPa (30 psi) according to local or national requirements.

Wear welders protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding or burning. Wear dark safety glasses near welding. *DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.*

Replace seat belts every two years on open canopy units and every three years on machines with cabs or at change of ownership.

Wear proper protective equipment such as safety goggles or safety glasses with side shields, hard hat, safety shoes, heavy gloves when metal or other particles are apt to fly or fall.

Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazards of electrical shock.

Keep maintenance area *CLEAN* and *DRY*. Remove water or oil slicks immediately.

Remove sharp edges and burrs from reworked parts.

Be sure all mechanics tools are in good condition. *DO NOT* use tools with mushroomed heads. Always wear safety glasses with side shields.

Do not strike hardened steel parts with anything other than a soft iron or non-ferrous hammer.

Do not rush. Walk, do not run.

Know and use the hand signals used on particular jobs and know who has the responsibility for signaling.

LEGEND FOR FIG. 2-6
1. High pressure oil
2. Main return ports
3. Main poppet
4. Main poppet spring
5. Pilot return ports
6. Pilot valve
7. Pilot valve spring

2.2.6 MAIN RELIEF VALVES

The two main relief valve sections are located at either end of the control valve stack, Fig.2-5(1) and (12). Refer to paragraph 1.4 for opening pressures.

The function of the main relief valves is to protect the system (pump, cylinders,and linkage) from overload when the control lever is in a work position and the cylinder piston rods cannot move (rods have reached an extreme in or out position, or imposed load prevents rod movement).

IMPORTANT: Main relief valves have no function when the control lever is in the "hold" position, or overload relief valves have a lower relief setting (in this latter case,overload relief valves will act prior to main relief valve).

Fig.2-5. The lower main relief valve(1) limits the main pressure in the moldboard tilt circuit. The top main relief valve(12) limits the main pressure in the ripper circuit. If neither the tilt or ripper circuit is being actuated, both relief valves protect the dozer circuit from excessive main pressure.

The main relief valve, Fig.2-6(A) consists of a main poppet(3) that is held in place by spring(4),and a pilot valve (6) that is held in place by spring(7). Incoming oil(1), at normal operating pressure, enters the valve from the right and passes through the small center orifice in the main poppet(3). Oil on both sides of the main poppet is thus at the same pressure. Therefore, spring(4) holds the poppet stationary.

As the pressure of the incoming oil(1) increases, it reaches the point(View B) where it overcomes the pressure of spring(7) and opens pilot valve (6). This allows oil on the left side of main poppet(3) to flow back to the hydraulic tank through pilot return ports (5).The flow out of these ports is much larger than the flow in through the center orifice in the main poppet, exhausting the trapped oil from the left side of the main poppet very quickly, creatinng a pressure differential.Pilot valve(6) closes but poppet(3) remains open until the oil pressure at each end of poppet equalizes.This allows a large by-pass of oil flow(1)to the tank. When oil pressure is equalized on each end of poppet(3),spring(4)closes the poppet (View A). This process is repeated each time main pressure exceeds the pressure specification, adjusted by the tension on spring(7).

2.2.7 OVERLOAD RELIEF VALVES

There are two overload relief valves located in the tilt control valve to prevent overloading the outer edges of the moldboard. Two overload valves are located in the ripper control valve to help prevent ripper damage when an obstacle tends to pull the ripper down or to push it up. Two overload relief valves are also located in the ripper pin puller control valve.

2.2.8 POWER ASSIST RELIEF VALVE

The purpose of the power assist relief valve is to maintain hydraulic pressure in the power assist circuit at 17.2 bar (250 psi).

2.2.9 POWER ASSIST VALVES

2.2.9.1 Each operational control valve section (dozer, tilt, ripper lift and ripper pin puller) has a power assist valve attached to it. The power assist valve provides hydraulic power to move the spool of the control valve, reducing the effort which the operator must exert on the control lever.

LEGEND FOR FIG. 2-11

1. Main hydraulic pump
2. Power assist pump
3. Upper main relief valve
4. Power assist relief valve
5. Overload relief valve
6. Oil return to tank
7. Ripper pin puller control section
8. Ripper lift control section
9. Dozer control section
10. Moldboard tilt control section
11. Lower main relief valve

2.3.2 DOZER,TILT & RIPPER-HOLD POSITION

Fig.2-11. While the control lever is moving to the "hold" position a portion of the oil from the power assist pump (2) is used within the respective power assist valve.

When the "hold" position is reached, the power assist valve is held stationary by a self-centering spring. Oil flow within the valve ceases and all power assist oil flows to the tank through relief valve(4).

Pump oil from both sets of pump gears of main hydraulic pump(1) circulates. All control valve spools prevent oil circulation to and from the hydraulic cylinders. If an excessive load is imposed on either end of the tilt or ripper cylinders, overload relief valve (5) will prevent damage to the system by allowing oil to escape from the end of the cylinder that is overloaded (this allows the ripper or dozer to give and prevent shock damage). The dozer cylinder limit travel valves and quick-drop valve (Fig.2-8,2-9), main relief valves(3 and 11) and the control spool check valves have no function in the "hold" position.

LEGEND FOR FIG.2-16

1. Main hydraulic pump
2. Power assist pump
3. Upper main relief valve
4. Power assist relief valve
5. Overload relief valve
6. Oil return to tank
7. Ripper pin puller control section
8. Ripper lift control section
9. Dozer control section
10. Moldboard tilt control section
11. Lower main relief valve
12. Check valve

2.3.7 RIPPER-RAISE POSITION

Fig.2-16. While the ripper lift control lever is moving to the"raise" position, a portion of the oil from power assist pump(2) is used within the ripper lift power assist valve.When movement of the control lever stops, the power assist valve becomes stationary and all power assist oil flows through relief valve (4) to the tank.

Pump oil from rear set of gears of main hydraulic pump(1)circulates and returns to the tank.Oil from the front set of gears flows past main relief valve (3) and into ripper lilt control spool (8). Pushing check valve(12) off its seat, the oil flows to the ripper lilt cylinder and forces the piston rod in to raise the ripper. Oil from the opposite end of the ripper cylinder flows through the control spool and back to the tank.

If the piston rods reaches the end of its travel, or the ripper cannot move due to an excessive load, pressure builds in the work circuit until the main relief valve opening pressure is reached and the valve opens. If overload relief valve(5) jams in the open position or is adjusted incorrectly(set lower than the main relief valve), the raise power will be affected.

The purpose of check valve(12) in the control spool is to prevent a momentary reverse flow of oil when changing spool positions. If the valve on the pressure side fails, the ripper may hesitate or tend to drop before raising.

25. NOTE: This remedy applies only to the dozer cylinders. Remove and inspect the quick-drop valves, Fig. 2-9, in each cylinder. Valve (2)(on one or both sides) must be stuck open and valve (1) on one or both sides must not be seating. If the valves or their seats are scored, lapping is recommended (refer to paragraph 7.1.8.9).

26. Refer to Topic 6, paragraph 6-3 or 6-4 and check for defects in the inoperative power assist valve.

27. Check adjustment and operation of the power assist relief valve, paragraph 3.7.5.

28. Check power assist suction line, pressure lines and pump.

3.3 METHODS OF TESTING HYDRAULIC SYSTEM

3.3.1 INTRODUCTION

The two methods of testing the hydraulic system, covered in this topic, are by use of a flow meter and by use of a pressure gauge. Flow testing the system is the most advantageous in that more information is presented to the user. This decreases the time and effort involved in the troubleshooting process by eliminating much of the costly guess work.

3.3.2 FLOW METER

Flow meter is a device used to measure pressure, temperature and the volume of oil being pumped through a hydraulic system or circuit. Pressure is indicated in pounds per square inch(psi); degrees fahrenheit(^{o}F); and volume is indicated in gallons per minute (gpm). The flow meter also contains a load valve, used to restrict oil flow through the meter thereby creating a variable pressure load against the hydraulic system. The temperature of the oil is very critical when making measurements with a flow meter. For best results, tests should be conducted at an oil temperature of 71-82^{o}C (160-180^{o}F). This temperature has been determined to provide the most accurate readings regardless of the meter brand.

IMPORTANT: All tests must be made at identical temperatures or the value of the test will be inconclusive.

There are two common types of flow meters, the series type and the parallel type. The series type flow meter may be used in either a series or parallel hookup as such meters will usually withstand back-pressure in the output line in excess of 206.8 bar (3000 psi). The parallel type flow meter operates on a different principle and usually cannot be used where back-pressure exceeds 13.8-20.7 bar (200-300 psi). The flow meter used in testing the hydraulic system must have a capacity of at least 568 L/min.(150 gpm)and 207 bar (3000 psi). All test hoses must be of the high pressure type, capable of withstanding pressures to the capacity of the flow meter.

IMPORTANT: If a parallel type flow meter is used at back-pressure in excess of the meter manufacturer's recommendations, the meter overload plugs will blow open and may damage the recording mechanism.

bar	psi	Insert flow	Extract flow
34.5	500	- - -	- - -
68.9	1000	- - -	- - -
103.4	1500	- - -	- - -

3.6.4.8 Analysis of the results of paragraph 3.6.4.7 is as follows:

a. If everything is normal up to this point, the flow readings should drop off slightly, from that recorded in paragraph 3.6.4.3, as pressure (load) is increased. There should be NO noticeable difference between the flow readings (insert" or "extract" each pressure point.

b. If the flow readings drop off in ONLY ONE direction ("insert" or "extract" the overload relief valve associated with that control position is probably stuck open, defective or misadjusted. This can be checked by shutting off the engine, relieving hydraulic pressure and interchanging the overload relief valves. Start the engine and repeat paragraph 3.6.4.7. If the results are reversed from what they were ("insert" readings are now "extract" readings and visa versa) the valve is at fault. Refer to paragraph 3.8 for overload relief valve adjustment.

c. If the flow readings dropped off significantly from that recorded in paragraph 3.6.4.3 and there is NO noticeable difference between the readings ("insert" or "extract") at each pressure point, the ripper pin puller cylinder piston packing is probably at fault.

3.6.5 FLOW TESTING THE DOZER CIRCUIT

3.6.5.1 Make sure the flow meter is connected as described in paragraph 3.6.2.

⚠ DANGER - Fluid under pressure. Always lower hydraulic equipment to ground. Shut off engine, move control levers to each position several times and loosen and retighten hydraulic tank filler cap to relieve trapped pressure before loosening hydraulic connections.

3.6.5.2 Relieve hydraulic pressure. Refer to Fig.3-5, and locate the dozer power down hose connections at the rear of each cylinder. Loosen the flange capscrews and insert a flow block plate, Fig.3-4, between the tube and hose to block each line. Tighten the flange capscrews.

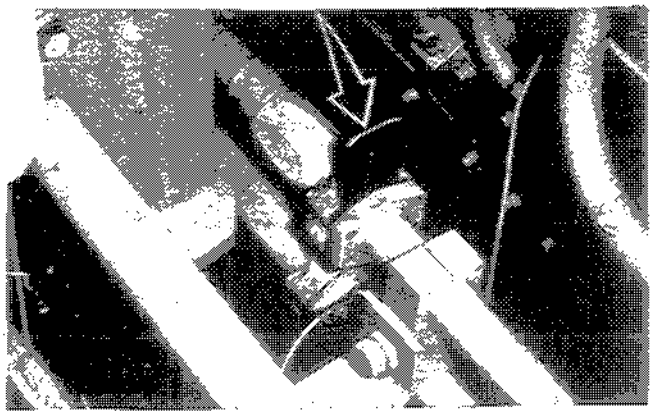


FIG.3-4 TYPICAL USEAGE OF A FLOW BLOCK PLATE T-79707

3.6.5.3 Start the engin. With a tachometer, set engine speed @ high idle (2200-2400 rpm). Allow the temperature of the hydraulic oil to reach 71-82°C (160-180°F).

3.6.5.4 With the flow meters load valve open, place the dozer control lever to the "lower" position. No pressure should register on the flow meter but oil flow volume should be 356-420L/min. (94-111 gpm). Record the volume obtained.

NOTE: Since there is no resistance to oil flow through the meter, and considerable resistance through the blocked lines, all oil will flow through the meter at this time.

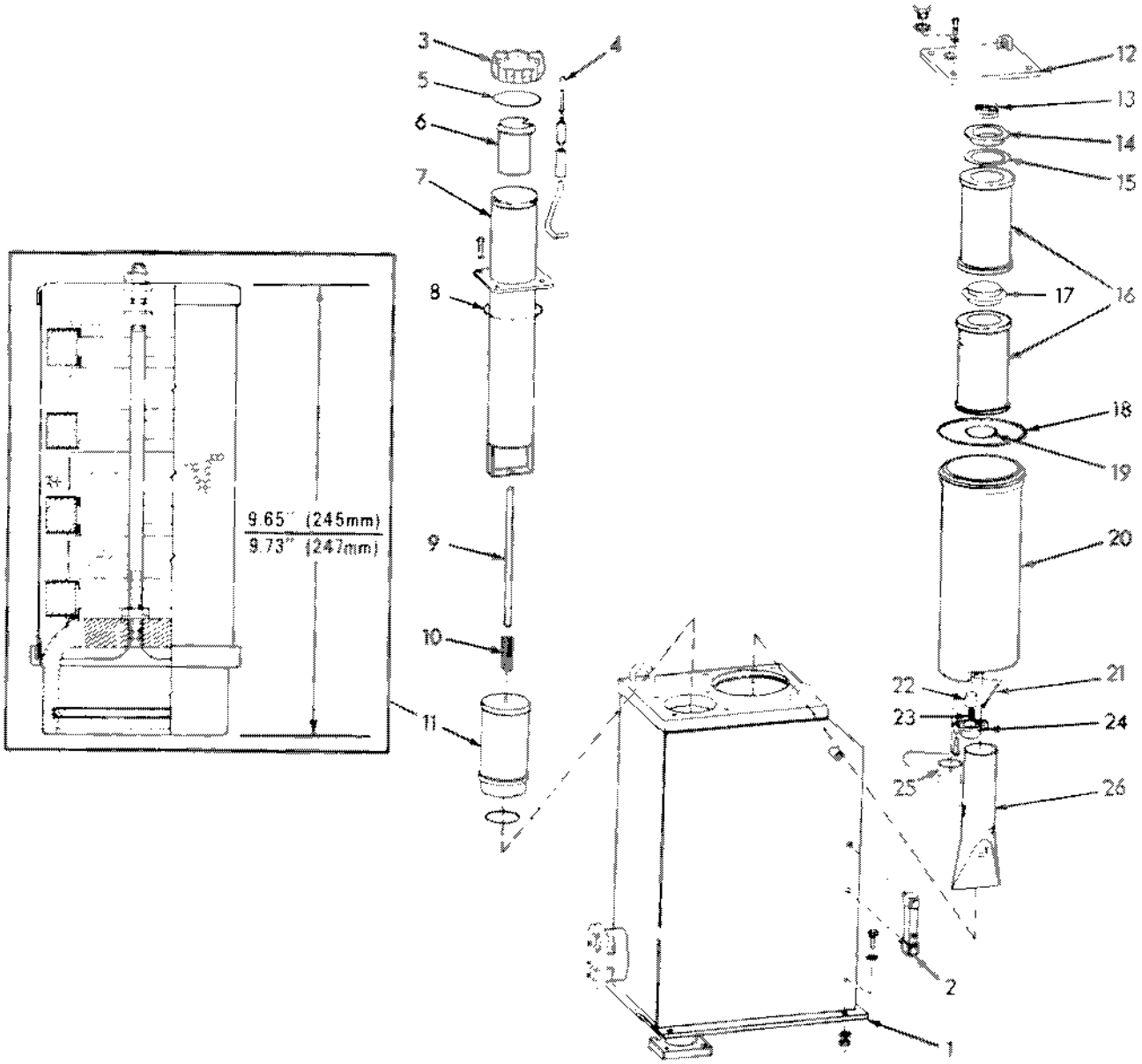


FIG. 4-2 HYDRAULIC TANK (FD50) T83663

1. Hydraulic tank
2. Sight gauge
3. Cap
4. Valve assembly
5. O-ring
6. Strainer,filling
7. Tube
8. O-ring
9. Rod
10. Spring
11. Strainer,suction line
12. Cover
13. Spring
14. Cap
15. Gasket
16. Filter elements
17. Connector
18. O-ring
19. O-ring
20. Housing,filter
21. Cotter pin
22. Valve
23. Spring
24. Cap
25. O-ring
26. Discharge screen

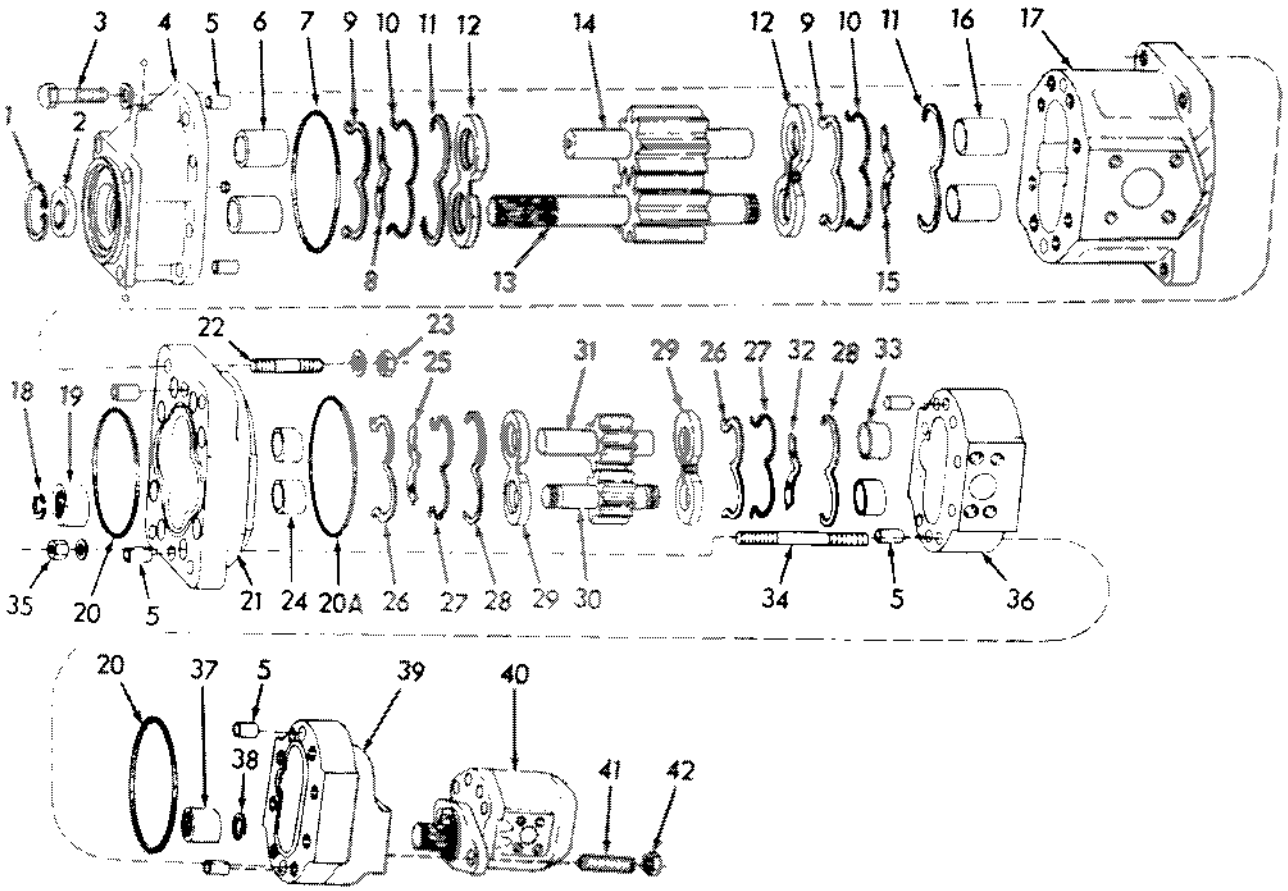


FIG.5-15 IMPLEMENT PUMP (FD50) T-82098

1.Snap ring
2.Oil seal
3.Capscrew
4.Mounting flange*
5.Dowel
6.Bushing
7.O-ring
8.Isolation plate
9.Back-up ring(telfon)
10.Sealing ring (rubber)
11.Seal ring retainer(nylon)
12.Wear plate
13.Front drive gear
14.Front idler gear
15.Isolation plate
16.Bushing
17.Front body assy
18.Snap ring
19.Gear coupling
20.O-ring
20A.O-ring
21.Center plate assy
22.Stud
23.Hex nut
24.Bushing
25.Isolation
26.Back-up ring(telfon)
27.sealing ring(rubber)
28.Seal ring retainer(nylon)
29.Wear plate
30.Rear drive gear
31.Rear idler gear
32.Isolation plate
33.Bushing
34.Stud
35.Socket nut
36.Rear body assy
37.Gear coupling
38.Snap ring
39.Rear plate assy
40.Power assist pump
41.Stud
42.Hex nut

*include plug in discharge side.

NOTE: Rings 9,10,11 (and all similar rings) must be installed with open portion of ring toward suction side of pump.
NOTE: Plate 12 (and all similar plates) must be installed with bronze side toward gears and relief pocket toward discharge side of pump.

4.A seal and repair kit is available to supply items 14,18,19,19A,22,31, 32,33 and 34. Items 32 and 34 may also be ordered separately and items 18 and 19A are also a part of the piston subassembly.

5.Centering spring assembly(20) (consisting of a spring,two spring retainers and a centering washer) must be ordered as a complete subassembly.

6.A detent kit is available to supply items 24,25,26,27,28 and 29. Item 25 may also be ordered separately.

6.3.3 DOZER CONTROL VALVE ASSEMBLY

6.3.3.1 Fig.6-5. It is recommended that all seals, back-up rings, o-rings and snap rings be replaced with new parts during assembly.

6.3.3.2 Lubricate all internal parts with clean hydraulic oil before beginning assembly.

6.3.3.3 Install o-ring(5) back-up ring (6) plate(7)and end cap(11) to one end of control valve housing(1) using the four capscrews and lockwashers removed in paragraph 6.3.2.11.

6.3.3.4 Clamp valve spool(5A) in a soft jawed vise.DO NOT mar the finish and DO NOT hold the spool by inserting a tool into the holes. Place check valve (2) spring(3) and spacer(4) into the proper end of the spool, see para. 6.3.2.10. Place back-up ring(9) and o-ring (8) over the threaded end of bolt(10).Apply a light coat of #75000776 (Loctite 262) to the threads on the bolt. Insert the bolt into the end of the spool and tighten securely.

6.3.3.5 Place check valve(2) and spring (3) into the other end of spool(5A). Place back-up ring(9)and o-ring(8) over the threaded end of spool lug(15).Apply a light coat of #75000776 (Loctite 262) to the threads on the spool lug. Insert the spool lug into the end of the valve spool and tighten securely.

6.3.3.6 Insert valve spool(5A) into control valve housing(1) with the spool lug protruding from the open end of the housing. The valve spool may have to be turned as it is inserted into housing due to the close tolerances. Insert o-ring(5) and pilot sleeve(13) into the open end of the control valve housing.

6.3.3.7 assemble piston(16) and spool (16A) using pin(17). Place o-ring(18) into the groove on the piston.Place the piston and spool assembly into power assist housing(12). With a soft hammer, lightly tap on the piston lug until the piston o-ring is just seated into the housing.

6.3.3.8 Insert o-ring(14) into the groove in the end of the power assist housing. Place the piston lug into the slot in the end of spool lug(15). With the soft hammer, lightly tap on the other end of the power assist housing until it is seated against the control valve housing. Secure the power assist housing to the control valve housing, using four capscrews(21) and lockwashers.

6.3.3.9 Insert centering spring assembly(20) into the power assist housing. Check to see that the centering spring washer is up against snap ring(19A). If not, hold the shaft of spool(16A) while tapping lightly on the end of the power assist housing. Secure the centering spring assembly by installing snap ring (19) into the groove in front of the centering spring washer.

6.3.3.10 Insert o-ring(22) into the groove in the end of detent housing (23). Place the detent housing over the shaft of spool(16A)and position it with repsect to power assist housing(12). Place the assembled unit in a vertical position, resting on end cap(11).

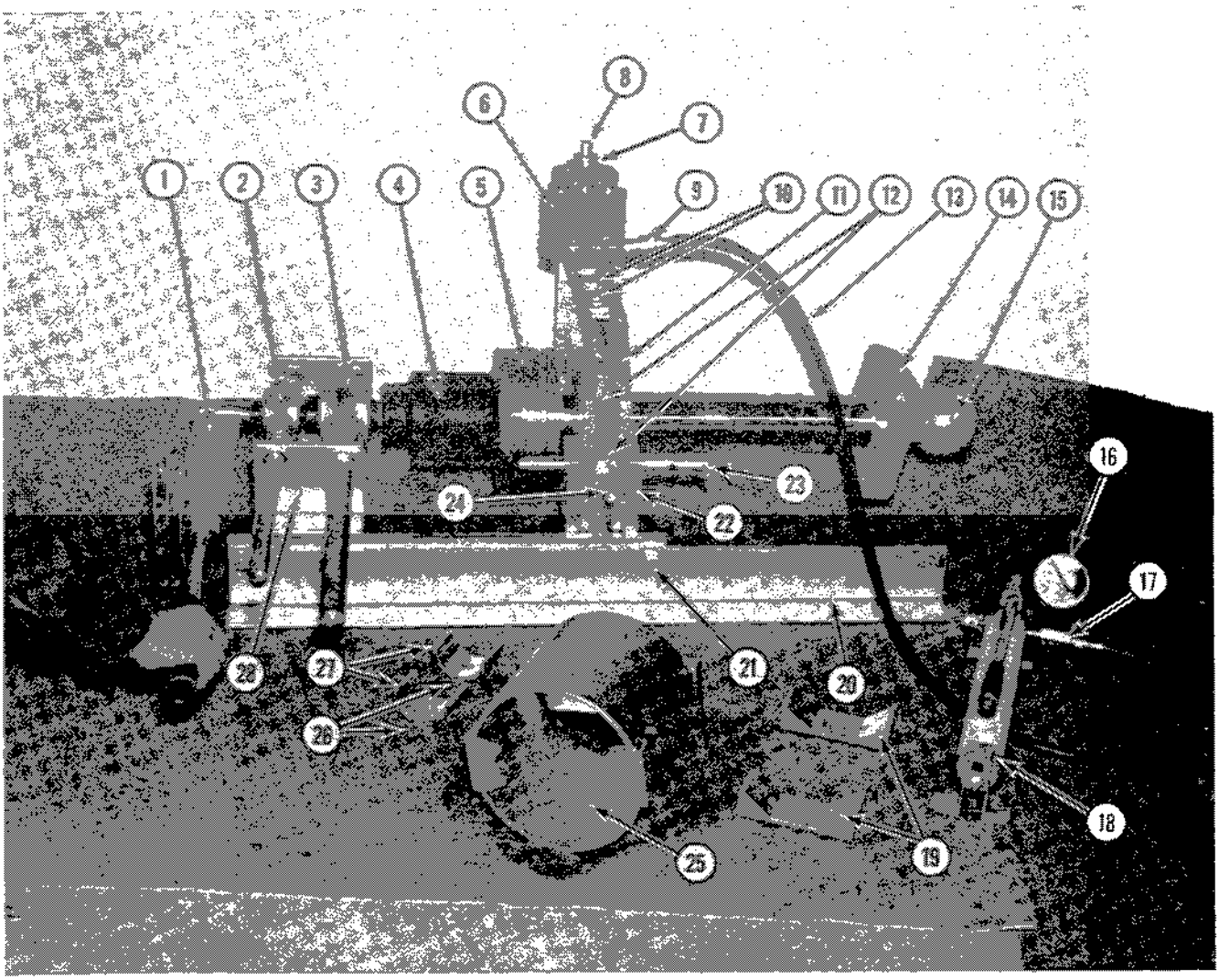


FIG.7-3 DOZER TILT CYLINDER ROD CLAMPED IN TORQUING FIXTURE T-79152

1.Torque wrench-406 Nm(300 lbs.ft).
2.Torque multiplier-4 to 1 ratio 2711 Nm (2000 lbs.ft)
3.Torque multiplier-4 to 1 ratio 5423 Nm (4000 lbs.ft)
4.Socket
5.Tilt cylinder piston
6.Hydraulic ram
7.Ram head insert
8.Adjusting screw
9.Quick coupler
10.Capscrew(1/2"nc x 4-1/2")
11.Top clamping fixture
12.Clamping blocks
13.Hydraulic hose
14.Cylinder rod collar
15.Cylinder rod
16.Pressure gauge
17.Tee adapter
18.Head pump
19.Vee block
20.R. H. angle
21.Capscrew(3/4"-10 x 1-3/4")*
22.Bottom clamping fixture
23.Pin assembly
24.Handle
25.Cylinder head socket (dozer and ripper cylinders)
26.Machine screw
27.Cylinder rod insert(dozer and ripper cylinders)
28.Torque multiplier support
*includes hex nut

Refer to Fig.7-13, and install wear ring(12) into the wide groove in the piston.

7.2.7.6 Install the piston assembly and spacer(14) on the piston rod. Lubricate the threads on the end of the piston rod and install locknut(17).

7.2.7.7 Refer to Fig.7-3, and install rod assembly into the torquing fixture. The speecified torque for locknut(17) is 7185-7860 Nm (5300-5800 lbs.ft).

7.2.7.8 Using the tools shown in Fig. 7-3, input torque required to tighten locknut(17) is 450-490 Nm (330-360 lbs.ft).

7.2.7.9 Make certain that the cylinder tube is clean and lubricated. Place shim stock around piston and carefully insert piston rod assembly into the cylinder tube. Remove the shim stock.

7.2.7.10 Using capscrews and lockwasher, secure cylinder head(7) to tube assembly(15). Torque the capscrews to 407 Nm (300 lbs.ft). Torque capscrews in end plate(3) to 54 Nm (40 lbs. ft).

7.2.7.11 Install cylinder on tractor per instructions in paragraph 7.2.3. Check piston rod packing adjustment per instructions in paragraph 7.2.4.

7.3 RIPPER LIFT CYLINDERS

7.3.1 GENERAL DESCRIPTION

Ripper lift cylinder is double acting. The piston packing is a teflon seal ring with a rubber inner ring. The piston is also equipped with a wear ring. The piston rod packing is multi-lip, spring loaded and shim adjusted.

7.3.2 RIPPER LIFT CYLINDER REMOVAL

==========

⚠ WARNING - Before moving machine or attachments be sure exposed people in the area are clear of the machine. Walk completely around machine before mounting. Sound horn.

==========

⚠ WARNING - Never attempt to operate machine or attachment except when seated in the operator's seat. Keep head, body, limbs, hands and feet inside the operator's compartment to reduce exposure to hazards outside the operator's compartment.

==========

⚠ WARNING - Warn all people who may be servicing or working around machine before starting engine.

==========

⚠ DANGER - Do not run engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

==========

⚠ WARNING - Keep people clear of attachments and tools while in raised position, to prevent possible injury.

==========

⚠ WARNING - Do not work under or near unblocked or unsupported linkage, parts or machine.

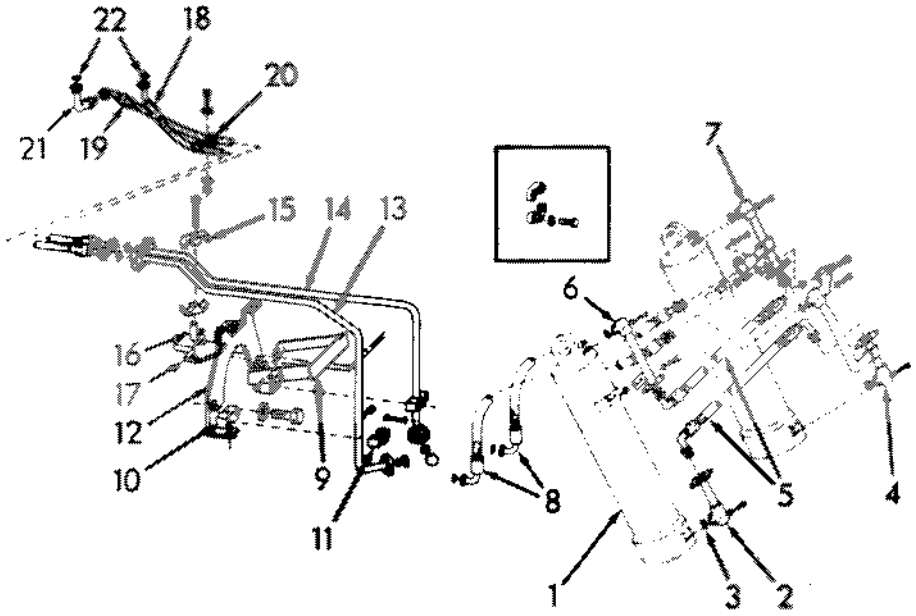
==========

⚠ WARNING - When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladded or step platform that meets local or national requirements to reach the service point. Perform all service or maintenance carefully.

==========

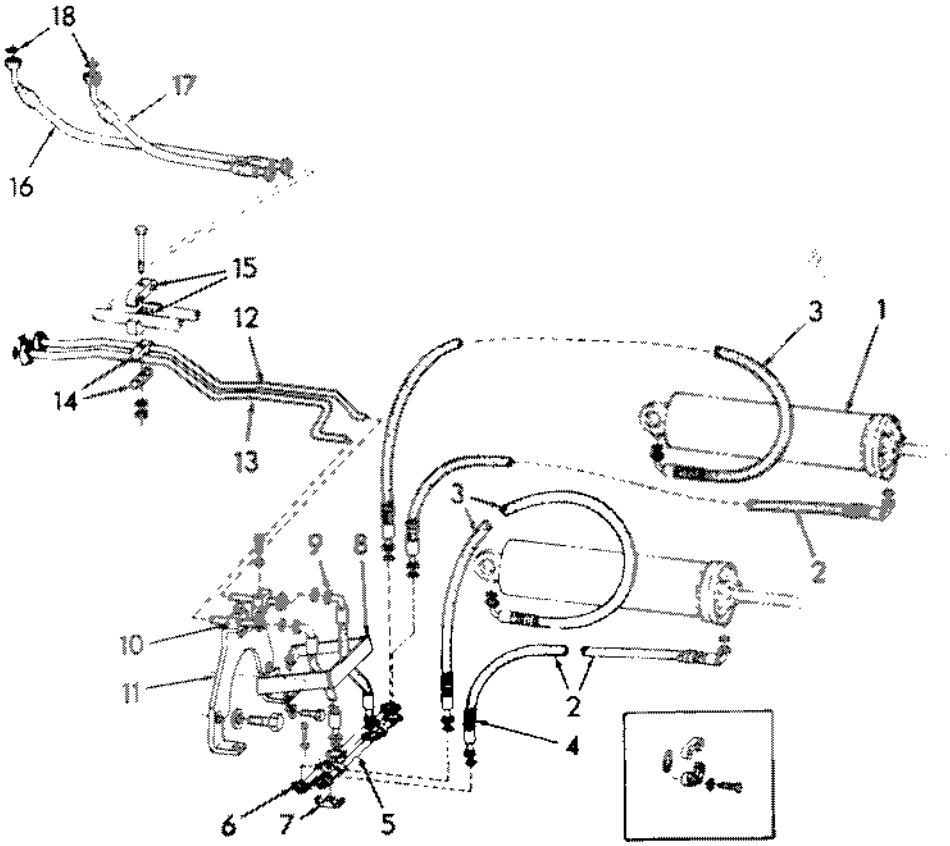
⚠ DANGER - Fluid under pressure. Always lower hydraulic equipment to ground. Shut off engine, move control levers to each position several times and loosen and retighten hydraulic tank filler cap to relieve trapped pressure before loosening hydraulic connections.

7.3.2.1 Lower ripper to ground;shut off engine and relieve trapped pressure. Attach a hoist to cylinder for support. Disconnect piston rod from the lower ripper beam.



1.Cylinder
2.Tube
3.O-ring
4.Tube
5.Hose
6.Tube
7.Tube
8.Hose
9.Bracket
10.Block
11.Clamp
12.Bracket
13.Tube
14.Tube
15.Clamp
16.Tube
17.Plate
18.Hose
19.Hose
20.Clamp
21.Tube
22.O-ring

FIG.7-21 (FD50) RIPPER LIFT CYLINDER PIPING T-83778



1.Cylinder
2.Hose
3.Hose
4.Guard
5.Tube(35")
6.Tube(40")
7.Clamp
8.Bracket
9.Hose
10.Clamp
11.Bracket
12.Tube
13.Tube
14.Clamp
15.Clamp
16.Hose
17.Hose
18.O-ring

FIG.7-22 (FD50) RIPPER PITCH CYLINDER PIPING T-83739

Service tools required to perform the various repairs expalined in this manual are listed below.

Order service tools from your local Fiatallis dealer.

IMPORTANT: Refer to Fiatallis Tool Catalog, as follows, for complete tool illustrations, descriptions and usage:

English..... No. 73128466
French..... No. 73128467
Spanish..... No. 73128468
Italian..... No. 73128469

FIG.NO.	DESCRIPTION	FA PART NUMBER
3-3	FLOW MEETER (200 GPM)	75300836
3-3	FLOW METER CONNECTOR KIT	75300700
3-4	FLOW BLOCK PLATE SET	75294511
---	CYLINDER HEAD SOCKET INSERT (RIPPER)	75294504
	(DOZER)	75294619
7-3	CYLINDER HEAD SOCKET (1.5 IN DRIVE)	75294506
7-3	ROD HOLDING INSERT (TILT & RIPPER)	75300129
7-3	ROD HOLDING BLOCK (DOZER)	75300131
7-3	CYLINDER HOLDING BLOCK (DOZER AND/OR RIPPER)	75300130
7-3	TORQUING FIXTURE (INCLUDES HYD. RAM)	75300551
---	PRESSURE GAUGE (150-600-5000 PSI)	75300110
7-3	4 TO 1 TORQUE MULTIPLIER (2000 LB.FT)	75300812
7-3	4 TO 1 TORQUE MULTIPLIER (4000 LB.FT)	75291279
7-3	HYDRAULIC PUMP (HAND OPERATED)	75295016
7-3	TORQUE WRENCH (600 LBS.FT)	75300810
7-3	CYLINDER ROD NUT SOCKET 4 IN 1	75294258
7-3	CYLINDER ROD NUT SOCKET 3.125 IN	75300441
7-5	PISTON ROD PILOT SLEEVE 3.0 IN	75294254
	-3.5 IN	75294255
7-9	CYLINDER PORT FILLER PLUG SET	75294309
7-10	PISTON PACKING GUIDE (DOZER)	75294256
	(RIPPER)	75294257

SAFETY RULES

Face the access system when climbing up and down.

Apply the parking device and place the transmission in neutral before starting the machine.

Do not bypass the starter safety switch. Repair the starter safety controls if they malfunction.

Fasten seat belt before operating.

Steering should be checked to both right and left. Brakes should be tested against engine power. Clutch and transmission controls should be moved through or to neutral positions to assure disengagement. Operate all controls to insure proper operation. If any malfunctions are found, park machine, shut off engine, report and repair before using machine.

If the power steering or the engine ceases operating, stop the machine motion as quickly as possible. Lower equipment, set parking device and keep machine securely parked until the malfunction is corrected or the machine can be safety towed. Never lift loads in excess of capacity.

Should the machine become stuck or frozen to the ground, back out to avoid roll over.

Know and understand the job site traffic flow patterns.

Keep the machine in the same gear going down hill as used for going up hill.

When roading a machine, know and use the signaling devices required on the machine. Provide an escort for roading where required.

Always use the recommended transport devices when roading the machine.

Do not attempt repairs unless proper training has been provided.

Use extreme caution when removing radiator caps, drain plugs, grease fittings or pressure taps. Park the machine and let it cool down before opening a pressurized compartment.

Release all pressure before working on systems which have an accumulator.

When necessary to tow the machine, do not exceed the recommended towing speed, be sure the towing machine has sufficient braking capacity to stop the towed load. If the towed machine cannot be braked, a tow bar must be used or two towing machines must be used - one in front pulling and one in the rear to retard. Avoid towing over long distances.

Observe proper maintenance and repair of all pivot pins, hydraulic cylinders, hoses, snap rings and main attaching bolts.

Always keep the brakes and steering systems in good operating condition.

Replace all missing, illegible or damaged safety signs. Keep all safety signs clean.

Do not fill the fuel tank to capacity. Allow room for expansion.

Wipe up spilled fuel immediately.

Always tighten the fuel tank cap securely. Should the fuel cap be lost, replace it only with the original manufacturers approved cap. Use of a non-approved cap may result in overpressurization of the tank.

Never drive the machine near open fires.

Use the correct fuel grade for the operating season.

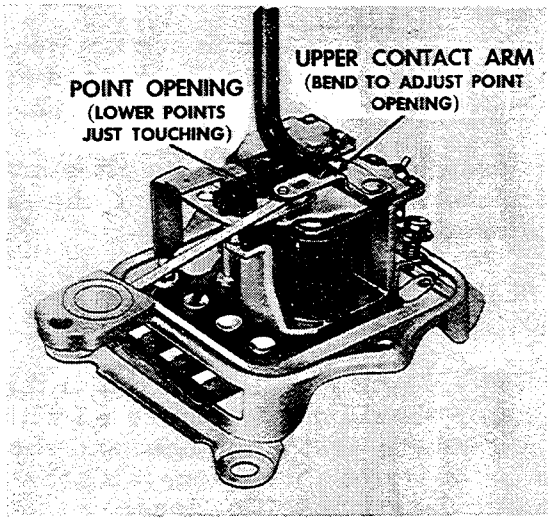


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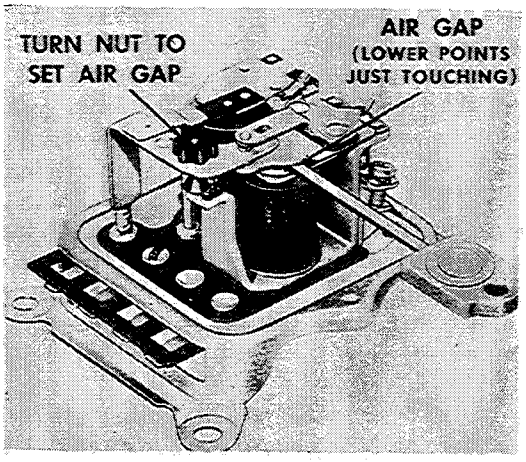
FIG. 9 CHECKING VOLTAGE REGULATOR POINTS A.C.



T-73520

FIG. 10 CHECKING VOLTAGE REGULATOR AIR GAP A.C.

battery remains undercharged, raise the voltage setting by .3 volts and then check for improved state of charge of the battery after a reasonable period of service. If the battery remains consistently overcharged, lower the voltage setting by .3 volts and recheck for improved battery condition. Voltage setting procedures are covered below.

3.4.2.1
Point opening - With the lower contacts points touching, check the point opening of the upper contacts as shown in Fig. 9 . If necessary, reset the opening to .010 - .020 in. (.254 -.507 mm) by bending the upper contact arm as shown in Fig. 9 .

3.4.2.2
Air gap - Measure the air gap between the armature and core, when the lower contacts are touching, as shown in Fig. 10 . The approximate setting is .067 in (1.702 mm). This setting is called approximate because the final setting must be whatever is required to obtain the specified difference in voltage (.1 - .8 volts) between the upper and lower sets of contacts as covered in the next subparagraph.

3.4.2.3
Voltage setting - The voltage at which the regulator operates varies with ambient (surrounding) temperatures. The ambient temperature is that measured 1/4 in. (6.350 mm) from the regulator cover.

Temperature Voltage Setting	65°F(21°C) 27.7-29.8	85°F(32°C) 27.4-29.4
Temperature Voltage Setting	105°F(40°C) 27.1-29.0	125°F(54°C) 26.8-28.5
Temperature Voltage Setting	145°F(66°C) 26.6-28.2	165°F(77°C) 26.3-27.9
Temperature Voltage Setting	185°F(88°C) 26.0-27.6	

3.4.2.4
To check and adjust setting, proceed as follows:

3.4.2.4.1
Connect an ammeter and a 1/4 ohm resistor with rating of 25 watts or more in series in the circuit at the "BAT" terminal on the alternator as shown in Fig. 11 .

2. Remove the distributor cap, the rotor, and the cover. Check and adjust the point gap as previously described, and reinstall the rotor on the distributor shaft. The rotor should be facing opposite the primary lead terminal. Loosen the distributor retaining clamp capscrews, and turn the distributor housing until the primary lead terminal is opposite the rotor, and the points are just beginning to open as the distributor is rotated counterclockwise. The distributor is now properly timed to the engine. The firing order of the engine is 1-2-4-3.

3. Tighten the distributor retaining clamp capscrews. Remove the rotor, and reinstall the cover. Then reinstall the rotor and the distributor.

   If the distributor has been removed from the engine, the timing procedure will be the same as the one previously described, after the distributor is reinstalled. When the distributor is installed on the distributor drive housing, the rotor must be turned so that it faces opposite the primary terminal and so that the primary terminal faces the coil.

4. After the timing has been adjusted, a timing light should be used to check the timing in the following manner:

   a. With the engine at normal operating temperature, set the engine speed at 250 to 300 rpm. At this speed, the distributor should be in the fully retarded position, and the plain timing mark should be visible and centered in the timing hole. If the timing mark is not clearly visible to make these adjustments, mark it with white chalk or paint.

   b. If the mark is not centered in the timing hole, the two distributor retaining clamp capscrews must be loosened, and the distributor housing must be turned to advance or retard the timing as necessary. (Turning the distributor housing clockwise retards the timing; turning the housing counterclockwise advances it.)

      NOTE: The automatic spark advance is set to automatically advance the spark 25° between 300 and 1600 rpm.

   c. Operate the engine at 1600 to 1700 rpm. The distributor should now be in the fully advanced position (25°), and the F25 timing mark should be visible and centered in the timing hole. If the F25 timing mark is not visible, the automatic advance mechanism in the distributor should be checked for worn or damaged parts.

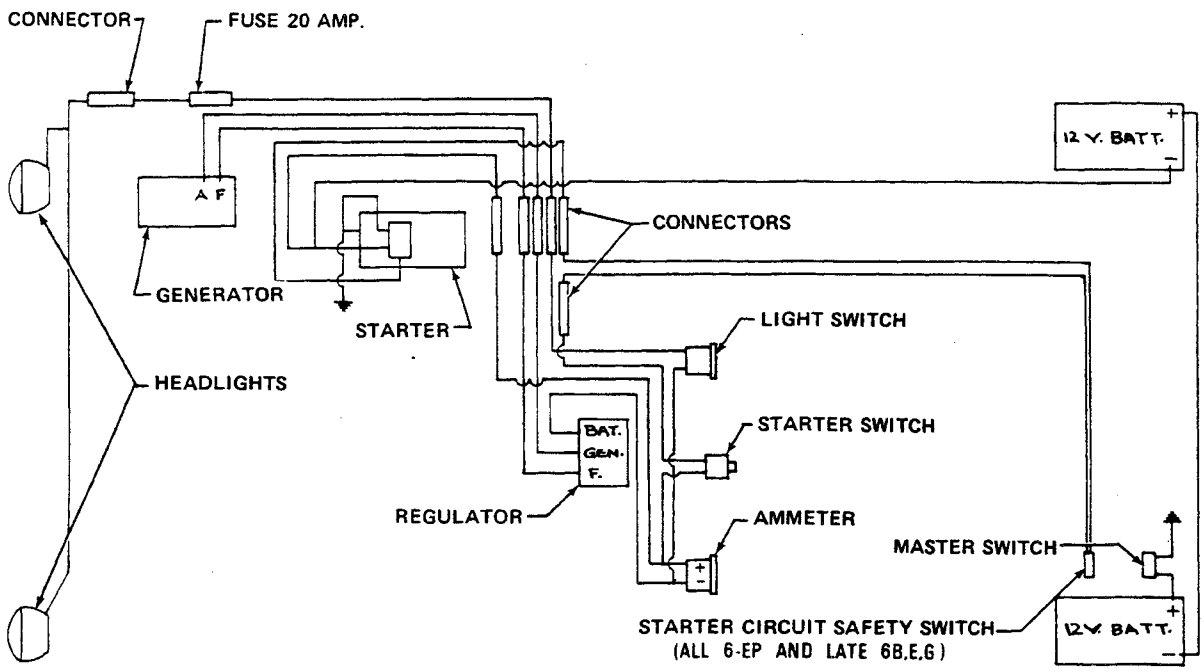


FIG. 24 HD-6 CRAWLER TRACTOR, 6G CRAWLER LOADER (Standard generator)

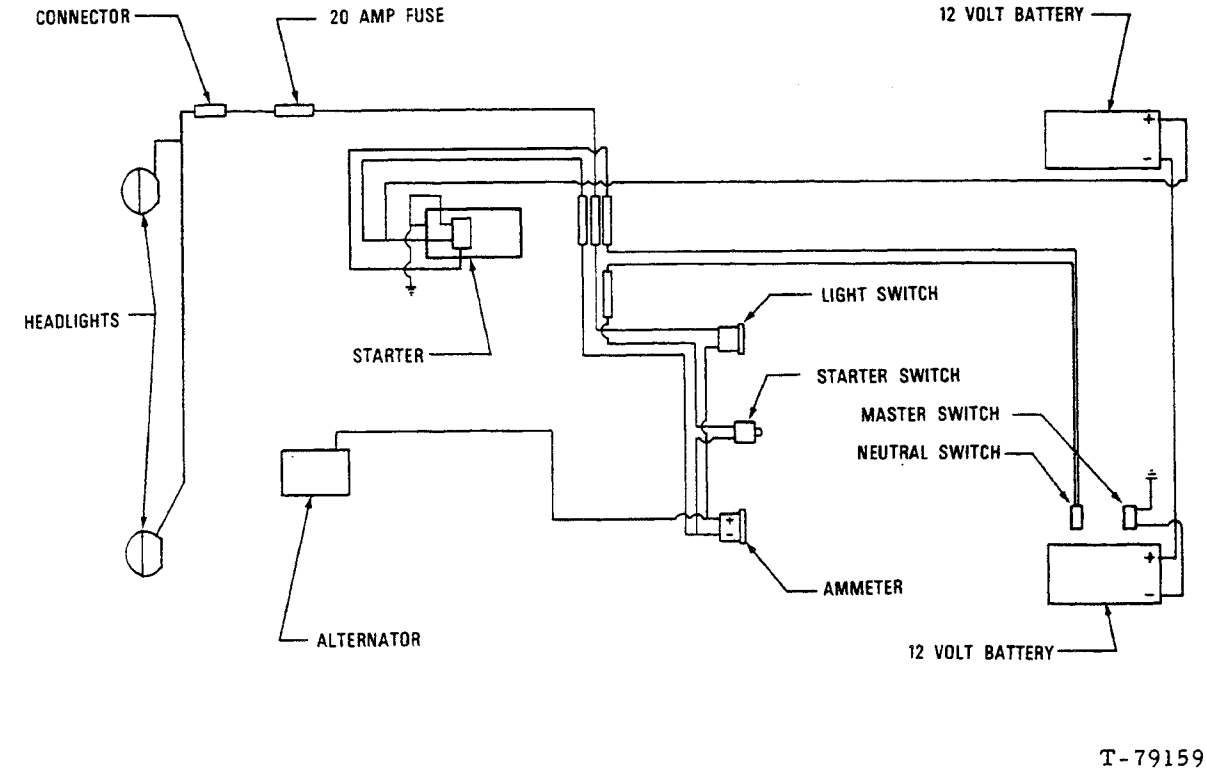


FIG. 25 6EP CRAWLER TRACTOR (Special 50 amp. alternator)

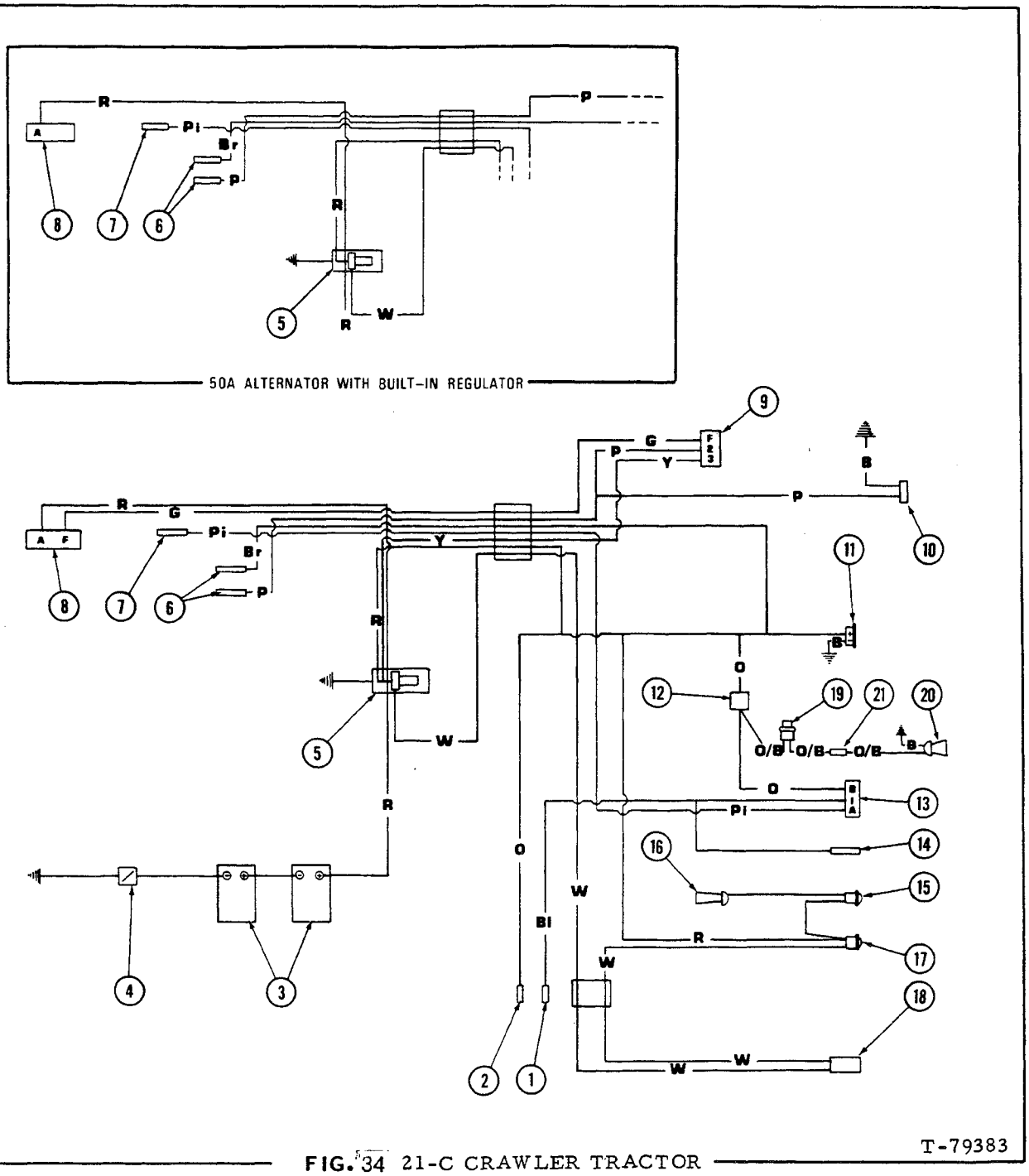


FIG. 34 21-C CRAWLER TRACTOR

1. Rear flood lights
2. Cab accessories
3. Batteries
4. Master switch
5. Starter solenoid
6. Pressure switch
7. Head lights
8. Alternator
9. Voltage regulator
10. Hour meter
11. Voltmeter
12. Circuit breaker
13. Light switch
14. Dash light
15. Horn switch
16. Horn
17. Starter switch
18. Neutral switch
19. Pressure switch
20. Back-up horn
21. Connector

B. black
Br. brown
Bl. dark blue
G. light green
O. orange
P. purple
Pi. pink
R. red
W. white
Y. yellow
O/B. Orange/Black

Study SAFETY RULES in the front of this manual thoroughly for the protection of machine and safety of personnel.

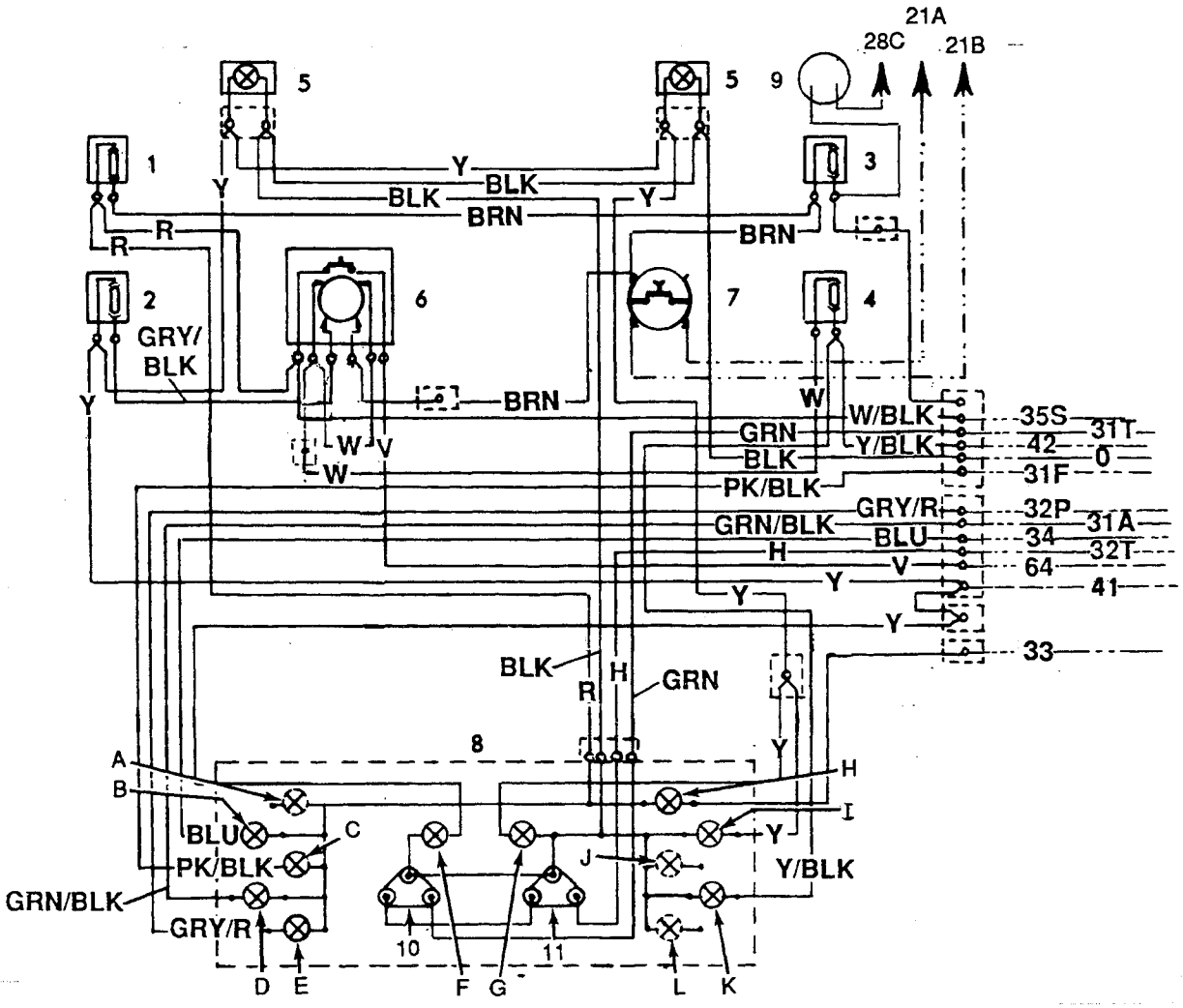


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FIG. 43 FD30B INSTRUMENT PANEL SCHEMATIC

Legend for Fig. 43

1. Fuse, instruments (8A)
2. Fuse, front lights (8A)
3. Fuse, receptacle (8A)
4. Fuse, rear lights (8A)
5. Panel lights
6. Light switch and horn button
7. Starter button
8. Instrument panel
9. Ether primer switch (special equipment)
10. Engine water temperature gauge
11. Transmission oil temperature gauge

INDICATOR LIGHTS

A. Not applicable
B. Battery charge
C. Low fuel pressure
D. Air cleaner restriction
E. Transmission low oil pressure
F. Not applicable
G. Not applicable
H. Not applicable
I. Head light high beam
J. Not applicable
K. Rear flood light (special equipment)
L. Not applicable

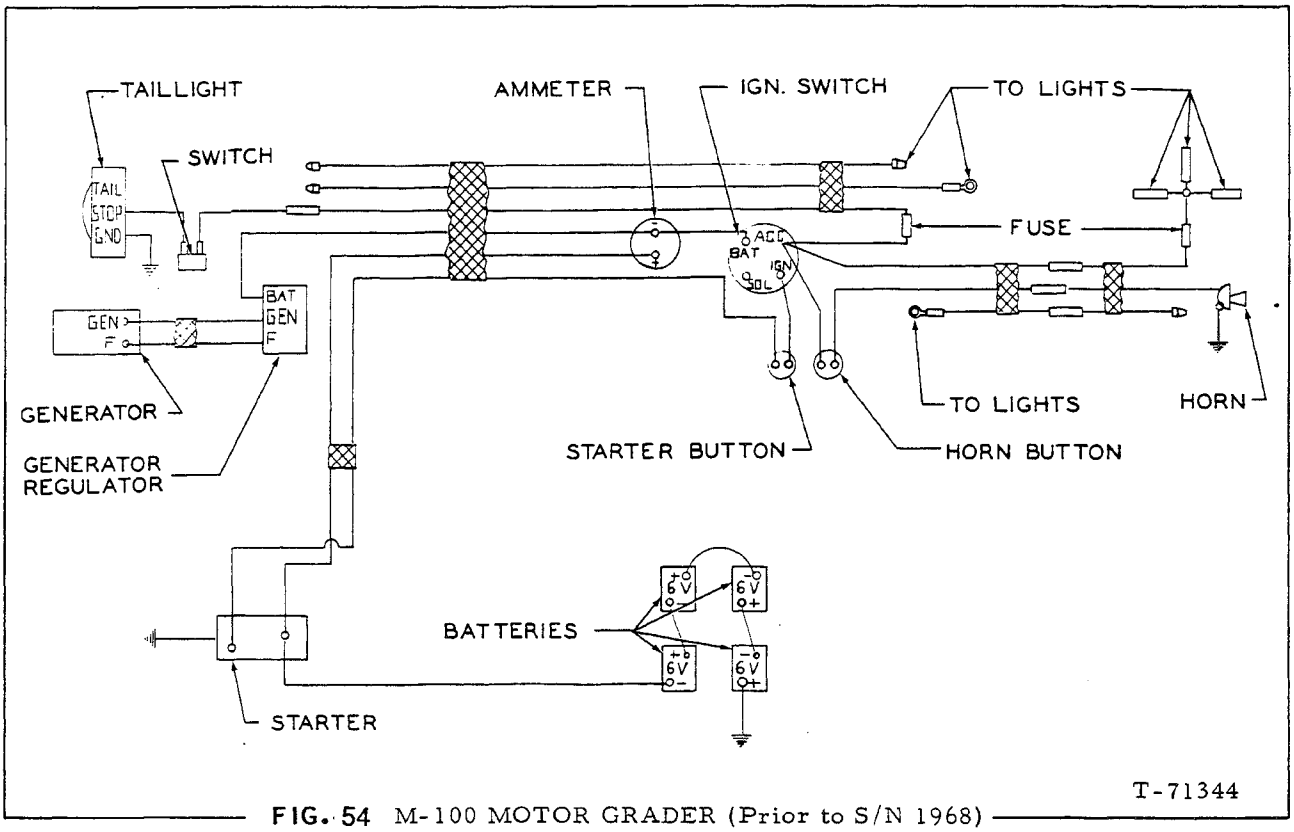

FIG. 54 M-100 MOTOR GRADER (Prior to S/N 1968)

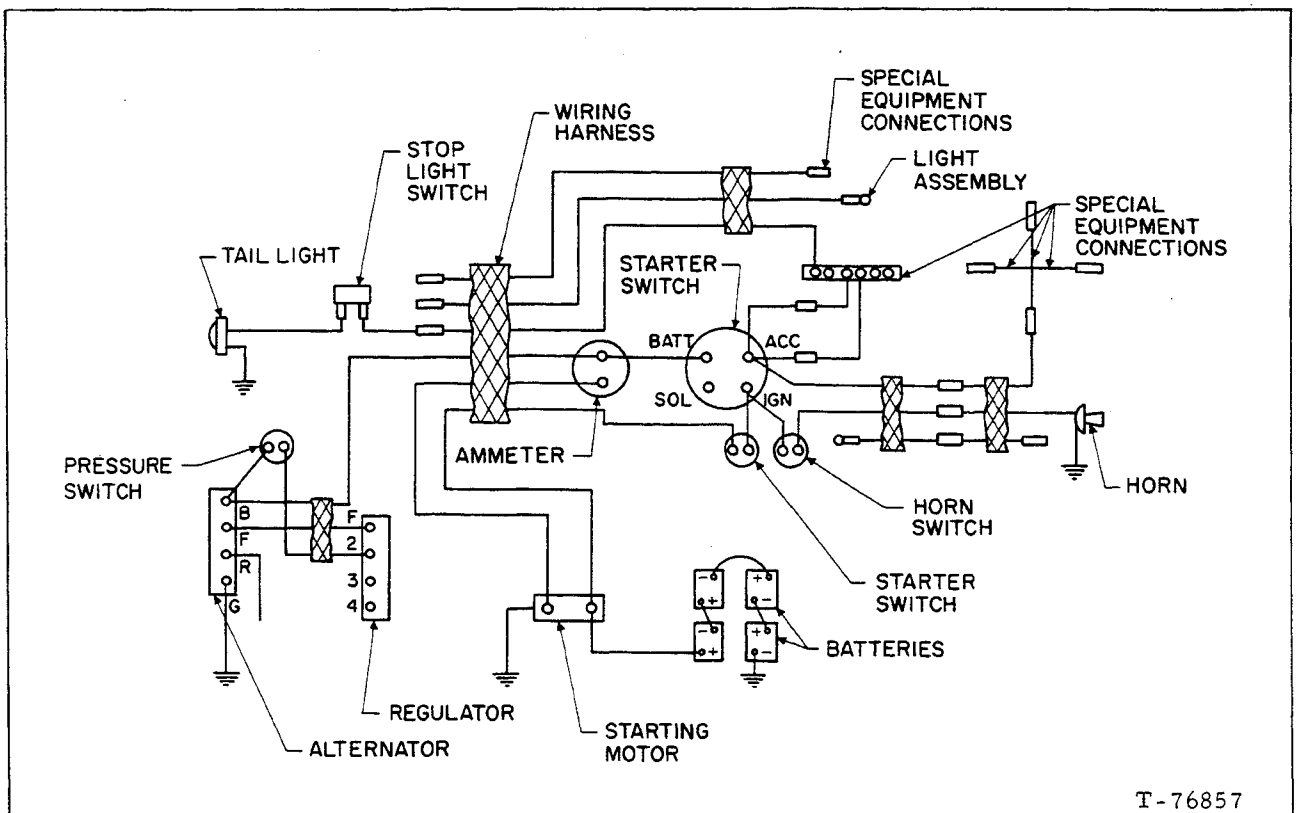

FIG. 55 M-100 MOTOR GRADER, 100-B MOTOR GRADER (S/N 1968-up; 67S05001-up)

Electrical System Schematics

Legend for Fig. 62

1. Circuit Breaker
2. Circuit Breaker
3. Circuit Breaker
4. Circuit Breaker
5. Circuit Breaker
6. Circuit Breaker
7. Circuit Breaker
8. Circuit Breaker
9. Key switch
10. Floodlight
11. Floodlight switch
12. Heater fan switch
13. Heater
14. Horn switch
15. Horn

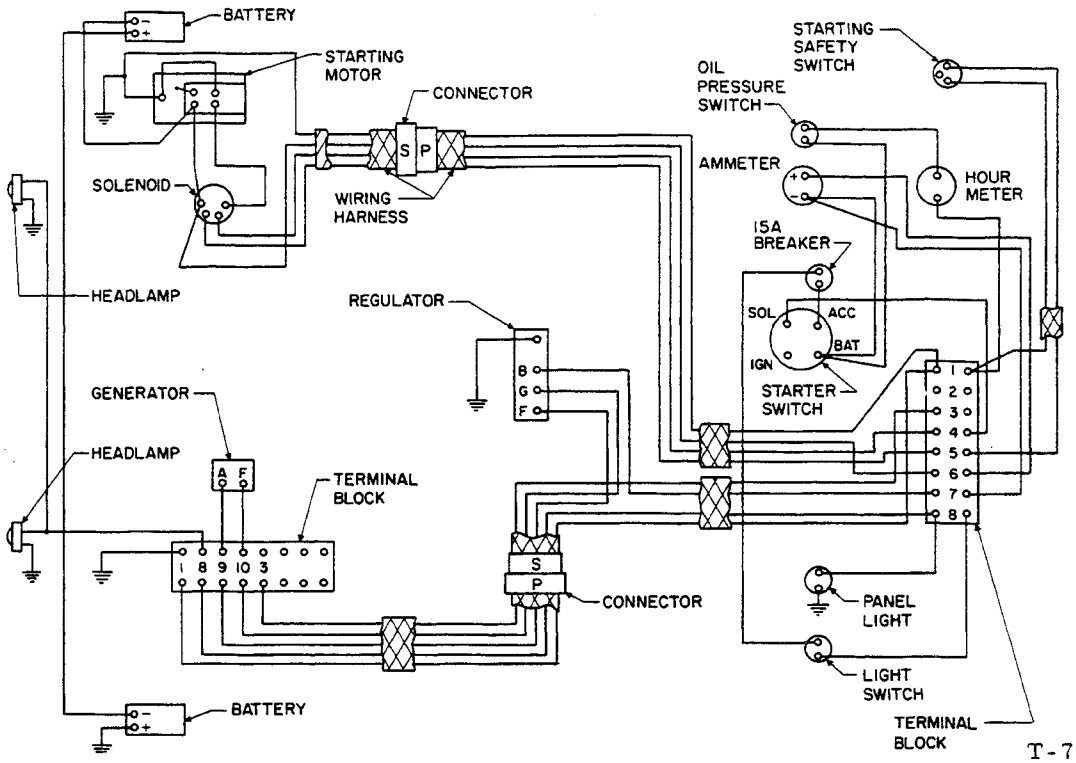

FIG. 68 260-A TRACTOR SCRAPER, 260E-A ELEVATING SCRAPER
(Standard generator; S/N 8051-up; 65A09501-up; 98C09501-up)

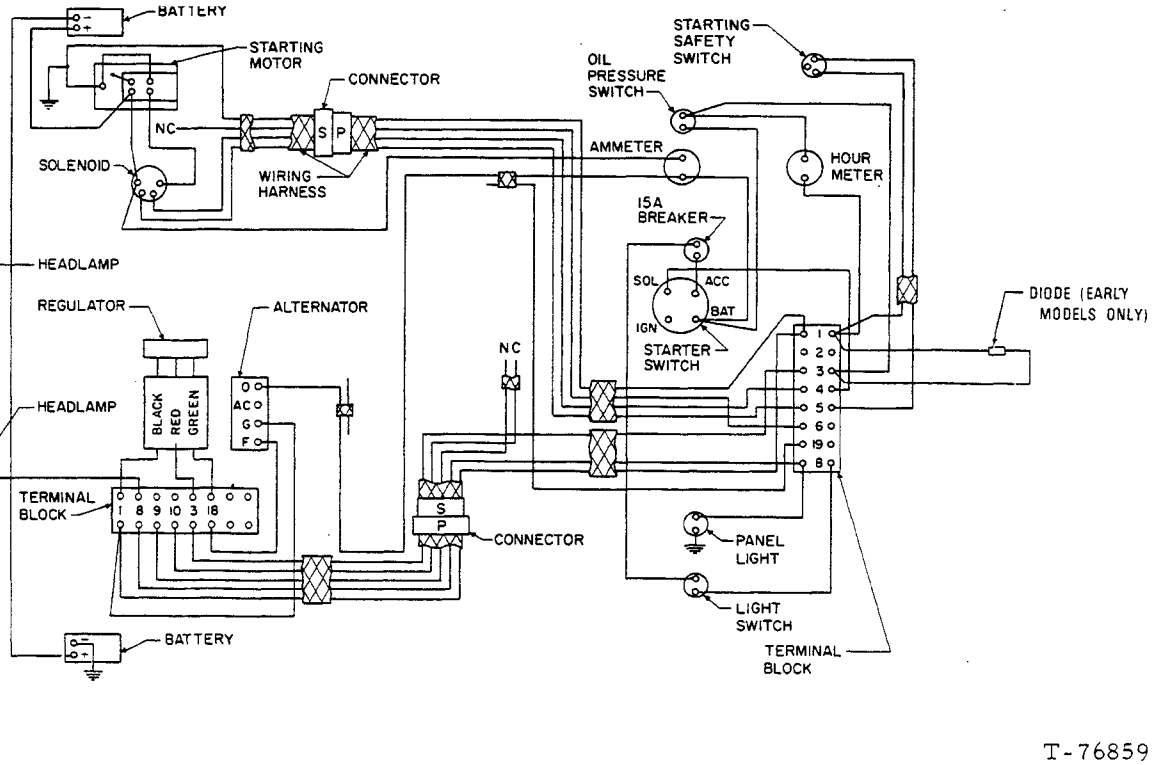

FIG. 69 260-A TRACTOR SCRAPER, 260E-A ELEVATING SCRAPER
(Special alternator; S/N 8051-up; 65A09501-up; 98C09501-up)

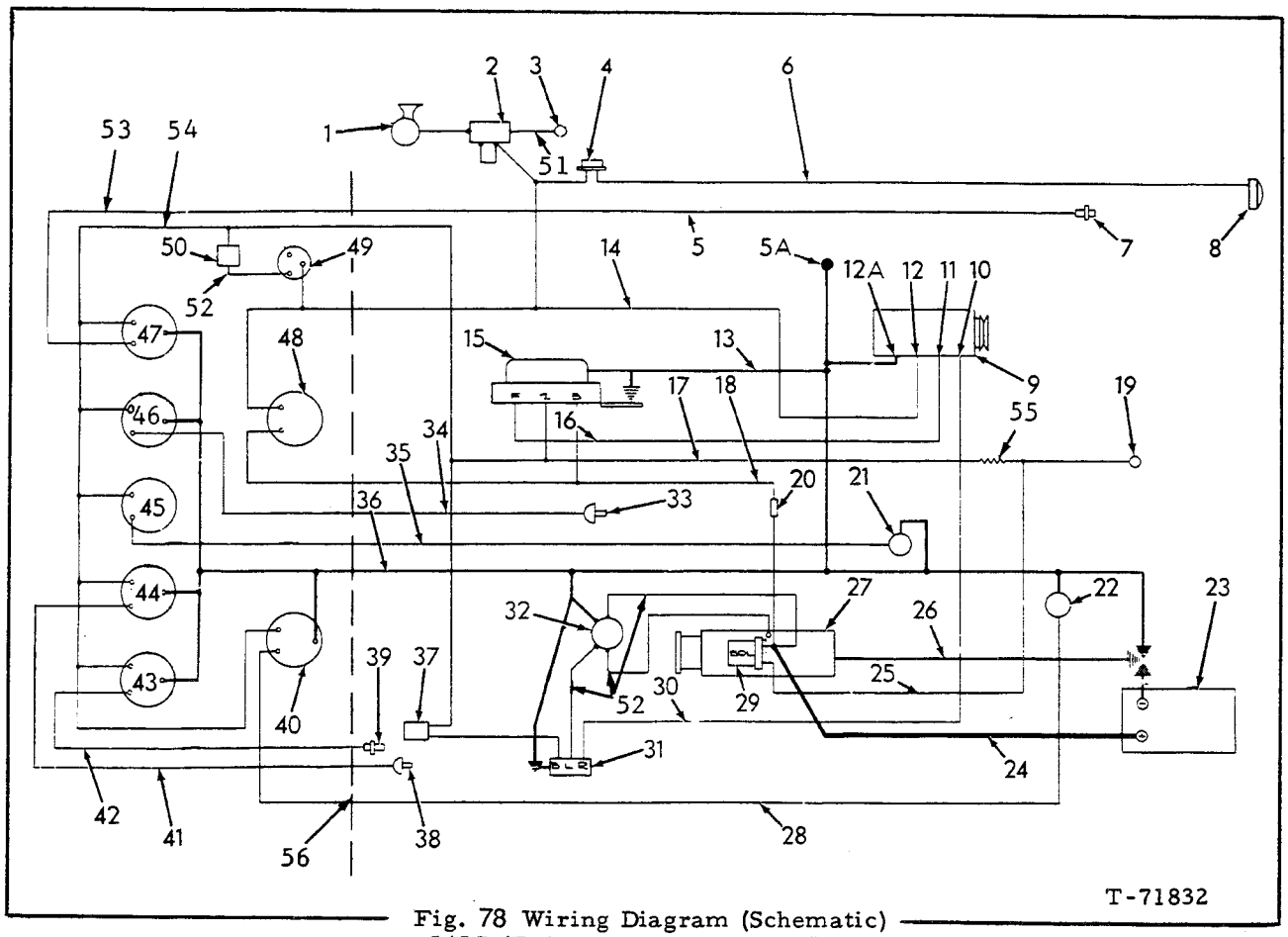

Fig. 78 Wiring Diagram (Schematic)
545G (Prior to loader serial #1759)

1. Horn
2. Relay
3. Horn button
4. Stoplight switch
5. Blue
5a. Engine ground
6. Tan
7. Engine temperature sender
8. Stoplight
9. Generator (alternator)
10. Relay terminal
11. Field terminal
12. Battery terminal
12a. Ground terminal
13. Black
14. Orange
15. Generator regulator
16. Light green
17. Purple
18. Red
19. Ignition coil
20. Fuse
21. Hour meter pressure switch
22. Fuel sender
23. Battery
24. Red
25. Gray and white
26. Black
27. Starting motor
28. Pink
29. Starting motor solenoid
30. Brown
31. Relay
32. Auxiliary solenoid
33. Engine oil pressure sender
34. Black and white
35. Yellow
36. Black
37. Starter switch
38. Transmission oil pressure sender
39. Transmission temperature sender
40. Fuel gauge
41. Dark green
42. Read and white
43. Transmission temperature sender
44. Transmission pressure gauge
45. Hour meter
46. Engine oil pressure gauge
47. Engine temperature gauge
48. Ammeter
49. Key switch
50. Circuit breaker (6 amp)
51. Gray
52. Black
53. Blue
54. Purple
55. Resistor
56. Harness connection

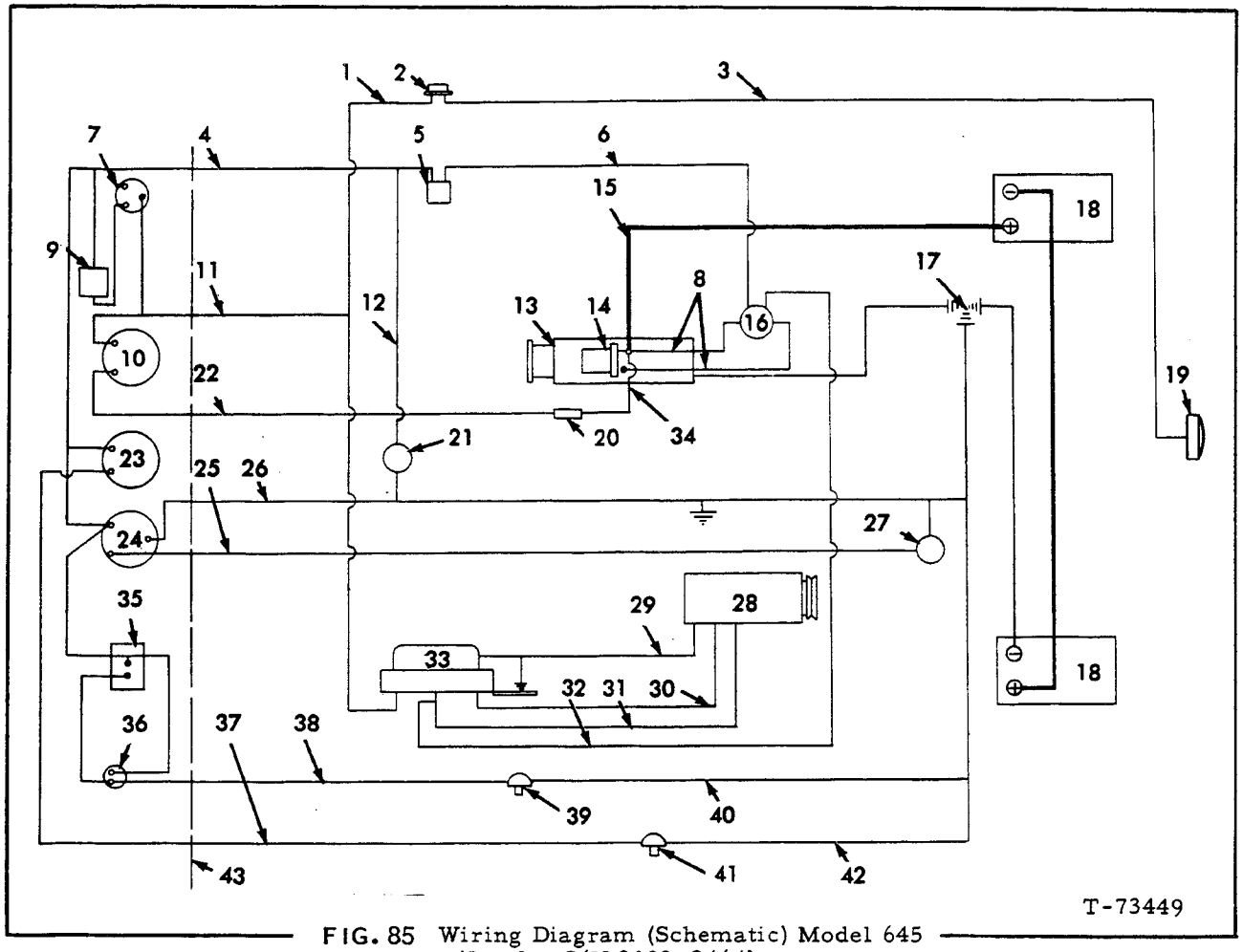

FIG. 85 Wiring Diagram (Schematic) Model 645
(Loader S/N 2032-2464)

1. Orange
2. Stoplight switch
3. Tan
4. Purple
5. Starter switch
6. White
7. Key switch
8. Black
9. Circuit breaker (2 amp)
10. Ammeter
11. Orange
12. Purple
13. Starting motor
14. Starting motor solenoid
15. Black
16. Auxiliary solenoid
17. Black (ground)
18. Battery (two)
19. Stoplight
20. Fuse (30 amps)
21. Fuel shut-off
22. Red
23. Hour meter
24. Fuel gauge
25. Pink
26. Black
27. Fuel sender
28. Generator
29. Black
30. Light green
31. Brown
32. Brown
33. Generator regulator
34. Gray
35. Buzzer (low air pressure)
36. Warning light (low air pressure)
37. Yellow
38. Yellow and black
39. Air pressure switch
40. Black
41. Hour meter pressure switch
42. Black
43. Harness connections

WIRING COLOR CODE — FIG. 91

B - Black	PI - Pink
LBL - Light blue	R - Red
BL - Blue	T - Tan
BR - Brown	W - White
G - Green	Y - Yellow
LG - Light green	BWR - Brown with white tracer
GY - Grey	OB - Orange with black tracer
O - Orange	PIB - Pink with black tracer
P - Purple	YB - Yellow with black tracer

LEGEND FOR FIG. 91

1. Fuse and holder
2. Switch
3. Defroster fan
4. Rear wiper
5. Cab ground
6. Front wiper
7. Panel light
8. Turn signal flasher
9. Cab turn signals (optional)
10. Key switch
11. Ammeter
12. Junction box (circuit breakers, 12A thru 12F)

12A. Stop light, 8 amp.
12B. Tail light, 8 amp.
12C. Flood light, 15 amp.
12D. Head light, 8 amp.
12E. Starting circuit, 15 amp.
12F. Cab heater, 8 amp.

13. Light switch
14. Low air pressure warning light
15. Low air pressure warning buzzer
16. Rear floodlights (optional)
17. Cab heater
18. Cab heater switch
19. Stop and tail lights
20. Alternator
21. Frame ground
22. Starter switch
23. Pressure switch
24. Voltage regulator
25. Starting motor
26. Stop light switch
27. Battery
28. Front flood lights (optional)
29. Head lights
30. Fuse

MEMO

LEGEND FOR FIG. 99

1. Right front flood light
2. Right front head light
3. Right cab flood light
4. Right front turn signal light
5. Left front turn signal light
6. Left front cab light
7. Left front head light
8. Left front flood light
9. Right turn indicator
10. Hour meter
11. Panel lights
12. Engine oil pressure switch
13. Buzzer
14. Brake system fault light
15. Panel light
16. Cab flood light switch
17. Front windshield wiper switch
18. Front windshield wiper motor
19. Left turn indicator
20. Key switch
21. Rear windshield washer switch
22. 10 amp fuse
23. Rear windshield washer pump
24. Voltmeter
25. Air pressure switch
26. Parking brake light
27. Parking brake switch
28. Emergency steering light
29. Low air pressure light
30. Front windshield defog switch
31. Front windshield defog fan
32. Rear windshield defog switch
33. Rear windshield defog fan
34. Light switch
35. Flow switch
36. Rear windshield wiper motor
37. Rear windshield wiper switch
38. Front windshield washer pump
39. Front windshield washer switch
40. Heater assembly
41. Heater switch
42. Flasher
43. Turn signal switch
44. Dome light
45. Thermo guard
46. Ether start assembly
47. Ether start switch
48. Diode assembly
49. Overstroke sensor switch
50. Relay
51. Neutral safety switch
52. Brake light switch
53. Circuit breaker assembly
54. Alternator
55. Back up alarm
56. Alarm switch
57. Batteries
58. Excess fuel solenoid
59. Starter solenoid
60. Starter motor
61. Battery disconnect switch
62. Axle disconnect light (Optional)
63. Rear axle disconnect switch
64. Right rear flood light
65. Right rear turn signal light
66. Right tail light
67. Left tail light
68. Left rear turn signal light
69. Left rear flood light
70. Transmission neutralizer switch
71. Transmission neutralizer valve

WIRE COLOR CODE

B - Black
G - Green
O - Orange
R - Red

SERVICE NOTES:

1. Circuits are identified by a number, or by a number and letter, contained in a square box. Metal tags bearing circuit identification number are attached to each wire at all connectors and/or connection points.
2. Componsnts are designated by a number in a circle. The legend for Fig. 6-1 identifies each designated component by its noun name.
3. Circuits and components shown in dashed lines are optional or accessory items.

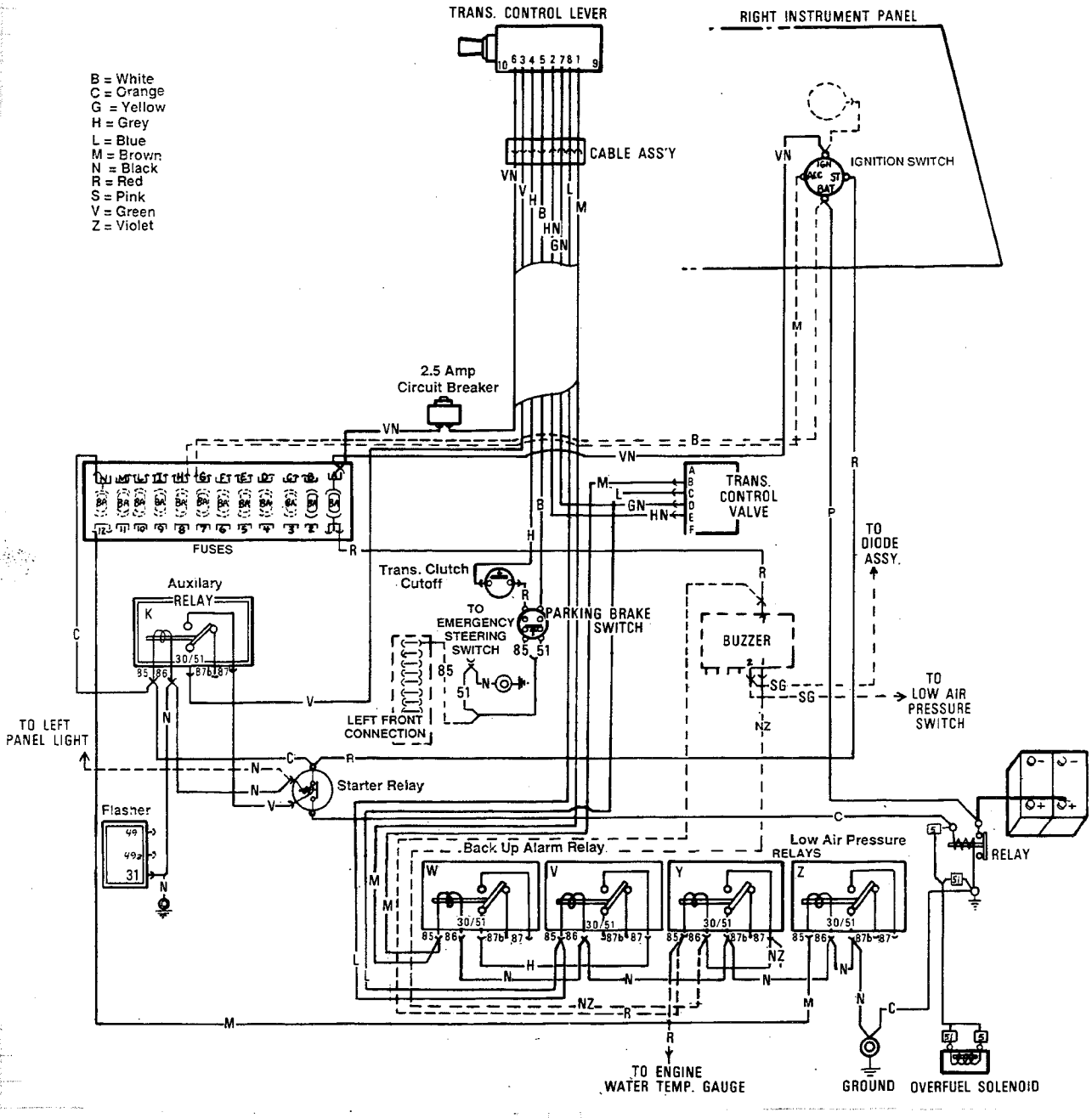

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FIG. 103 FR15 (S/N 575403-UP) TRANSMISSION CONTROL

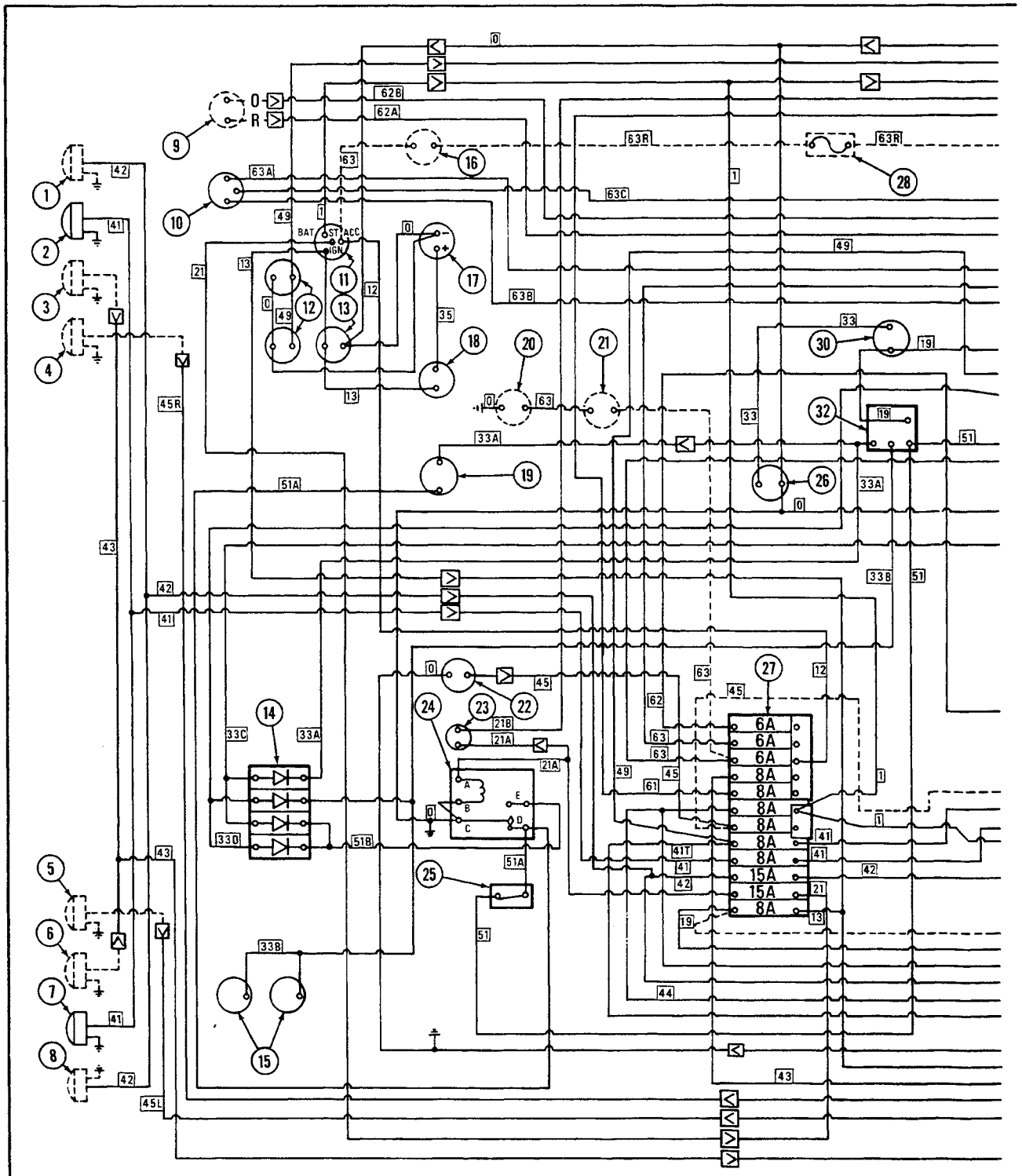

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FIG. 112 - FR 20 ELECTRICAL

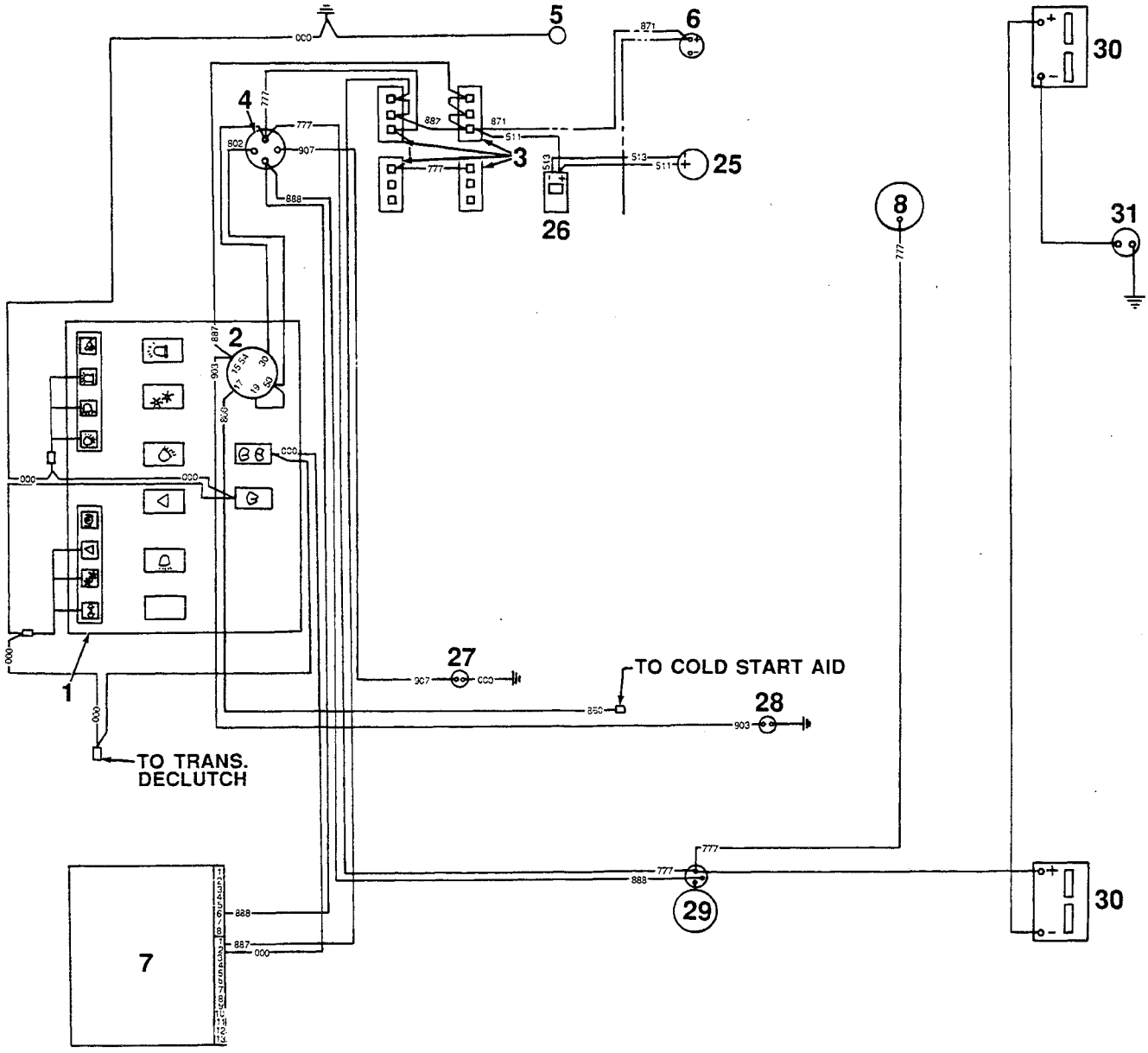

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FIG. 116 FR10B BATTERY FEED

Legend for Fig.s 125 thru 131

1. Transmission control lever
2. Left dash light
3. Right dash light
4. Engine oil pressure gauge
5. Low air pressure switch
6. Hourmeter
7. Battery charge indicator
8. Low air pressure light
9. Parking brake "ON" light
10. Brake system fault light
11. Emergency steering activated light (optional)
12. Engine coolant temperature gauge
13. Transmission oil temperature gauge
14. Key switch
15. Tranmission oil pressure gauge
16. Air cleaner clogging indicator
17. Light "ON" indicator
18. Floodlight switch
19. Main beam warning light
20. Floodlight warning light
21. Light switch
22. Front windshield wiper switch
23. Rear windshield wiper switch
24. Cab flood light switch
25. Cold starting switch (air pre-heater)(optional)
26. Front windshield washer switch(optional)
27. Fuse box
28. Relay
29. Beacon light and overall dimension lights (optional)
30. Safety switch relay
31. Air cleaner clogging indicator switch
32. Hourmeter switch
33. Transmission oil pressure sending unit
34. Engine oil pressure sending unity.
35. Neutral safety switch
36. Transmission neutralizer (actuated by brake pedal)
37. Parking brake switch
38. Overstroke sensor switch
39. Brake light switch
40. Transmission control valve solenoids
41. Tranmission oil temperature sending unit
42. Engine coolant temperature sending unit
43. Diode assembly
44. Buzzer
45. Right front head lights
46. Flashing indicator warning light (optional)
47. Hazard warning light(optional)
48. Starter motor
49. Alternator with voltage regulator
50. Excess fuel solenoid(optional)
51. Master switch
52. Rear flood lights
53. Stop rear lights
54. Batteries
55. Cab connection

B - WHITE
C - ORANGE
G - YELLOW
H - GREY
M - BROWN
N - BLACK
R - RED
S - PINK
V - GREEN
Z - VIOLET