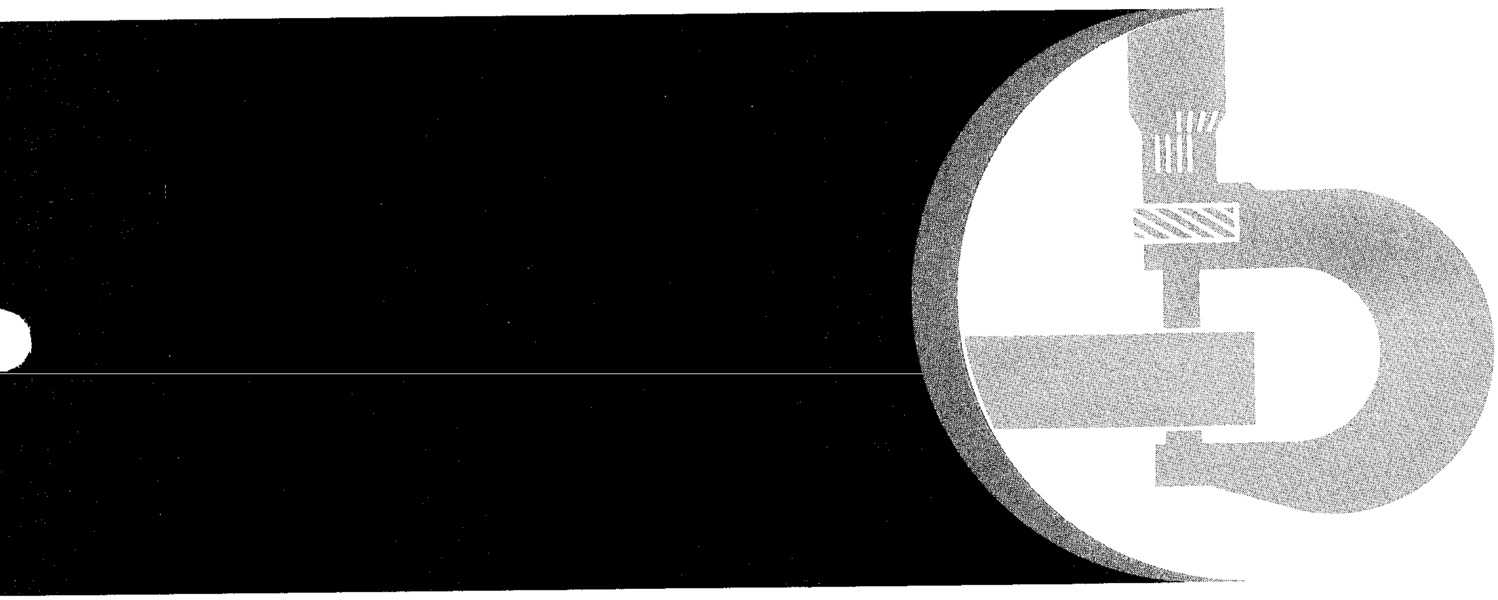
John Deere
310A and 310B
Backhoe Loaders



TECHNICAL MANUAL

John Deere Dubuque Works
TM-1158 (Dec-82)

Litho in U.S.A.

310A and 310B BACKHOE LOADER

TECHNICAL MANUAL
TM-1158 (NOV-86)

SECTION AND GROUP CONTENTS

All information, illustrations and specifications contained in this technical manual are based on the latest information available at the time of publication. The right is reserved to make changes at any time without notice. Wherever applicable, specifications and design information are in accordance with SAE and ICED standards

Litho in U.S.A.

SECTION AND GROUP CONTENTS - Continued

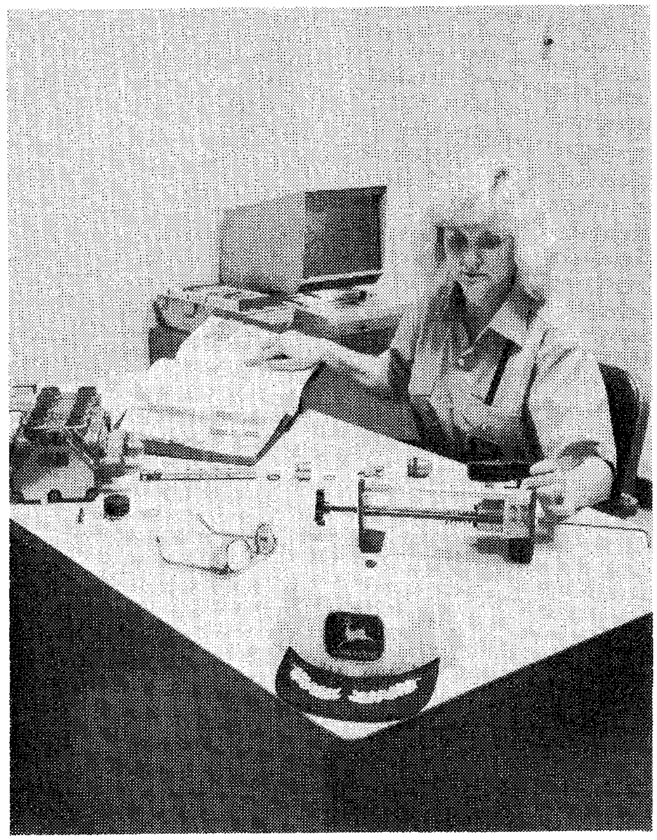
Group I

INTRODUCTION AND SAFETY INFORMATION

INTRODUCTION

T85958

Use FOS Manuals for Reference



T85959

Use Technical Manuals for Actual Service

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

FOS Manuals - for reference

Technical Manuals - for actual service

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

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

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

This technical manual was written for you—an experienced service technician. Keep it in a permanent binder in the shop where it is handy. Refer to it when you need to know correct service procedures or specifications.

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

Some features of this manual:

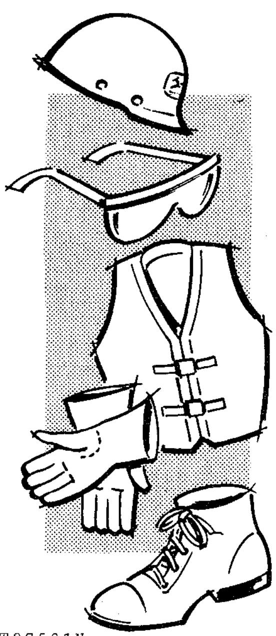
- Inside front cover - "Table of Contents".
- Section I - Contents, safety information, general specifications and general services.
- Sections 1 through 33 - Removal, repair, testing (components removed), installation, and adjustment.
- Section 90 - Detailed explanation of system operation, diagnosis, visual inspection, testing, and adjustments.
- Specifications and Special Tools are listed and illustrated at the end of each section.

MAINTENANCE WITHOUT ACCIDENT WORK SAFELY

T27999N

This safety symbol is used for important safety messages. When you see this symbol, follow the safety message to avoid personal injury.

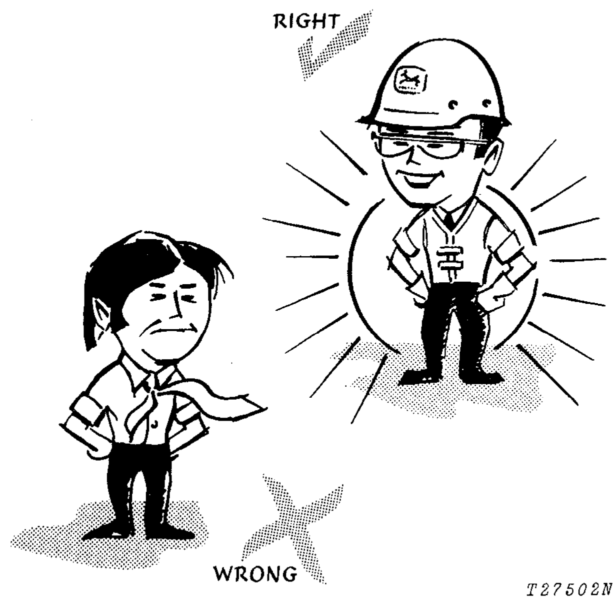
EVERY EMPLOYER HAS A SAFETY PROGRAM. KNOW WHAT IT IS!



T27501N

See your shop supervisor for specific instructions on a job, and the safety equipment required.

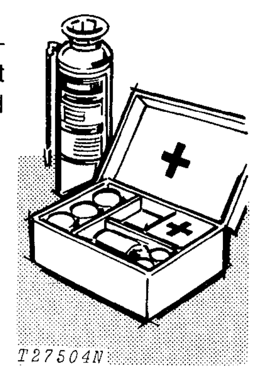
For instance, you may need: Hard hat, safety shoes, safety goggles, heavy gloves, reflector vests, ear protectors, respirator.



T27502N

BE ALERT!

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



T27504N

Maintenance Area

Make sure the maintenance area has enough ventilation.

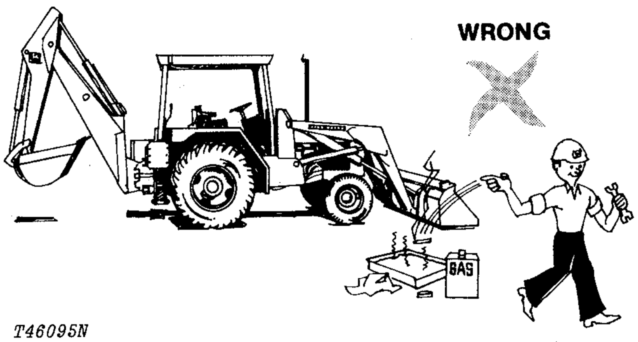
Keep the maintenance area CLEAN AND DRY. Oily and wet floors are slippery. Greasy rags are a fire hazard. Wet spots are dangerous when working with electrical equipment.

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

MAINTENANCE WITHOUT ACCIDENT

AVOID FIRE HAZARDS

Fuel Is Dangerous!



T46095N

Do not smoke while putting fuel in the fuel tank.

Do not smoke while working with material that will start on fire easily.

Stop the engine before filling the fuel tank.

Do not use gasoline or diesel fuel for cleaning parts. Use solvents that will not start on fire.

Battery Gas Is Highly Flammable!

When charging batteries, be sure there is enough ventilation.

T27506N

Do not check the battery charge by putting metal objects across the posts.

Do not let sparks or open flame near batteries.

Do not smoke near battery.

Flame Is Not a Flashlight!

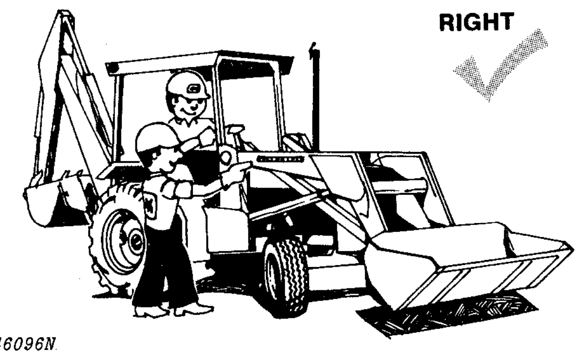
NEVER USE OPEN FLAME AROUND THE MACHINE.

KNOW WHERE FIRE EXTINGUISHERS ARE KEPT!

UNDER ALL MAINTENANCE CONDITIONS

Do not work on the equipment unless you are approved to do so. Then be sure you know the safe and correct procedure.

Never work on equipment while it is being operated.



T46096N

When the engine is running, avoid working on equipment.

If you must work on the machine with the engine running, ALWAYS USE TWO service technicians. One must be at the controls. The other must be within sight of the operator.

KEEP HANDS AWAY FROM MOVING PARTS

Put a support under all raised equipment.

Never work under a raised bucket.

Lower the bucket to the ground.

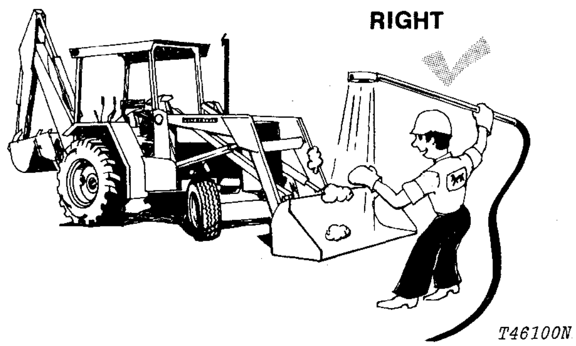
If the machine is on a slope, use blocks to hold it in place.

Do not lift heavy parts by yourself. Use hoisting equipment for this.

TAKE CARE! WATCH OUT FOR OTHER PEOPLE IN THE AREA

When drilling, grinding, or hammering metal, wear safety glasses.

BE CAREFUL DURING SERVICE AND REPAIR



T46100N

Keep ALL equipment free of dirt and oil.

Clean oil, grease, mud, ice or snow from the operator's station, steps and hand rails.

When getting the engine ready for storage, remember that inhibitor changes easily into gas and is dangerous. After adding the inhibitor, seal and tape openings. When you are not using the inhibitor, keep the can tightly closed.

Do not remove the radiator cap unless you can hold your hand on the radiator tank. First, loosen the cap slowly to the stop. Then release all pressure in the cooling system before removing the cap.

Check the exhaust system regularly for leaks.

Release hydraulic pressure before working on the hydraulic system. Stop the engine. Lower both buckets to the ground. Move the control levers until the buckets do not move.

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

Before working on the fuel system, close the fuel shut-off valve.

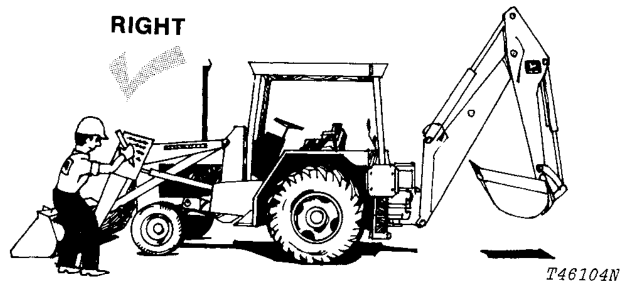
Before working on the electrical system, or making a major overhaul, disconnect the batteries.

KNOW EQUIPMENT IS READY!

Check all guards, shields, and safety bars. Every one must be in place and tight.

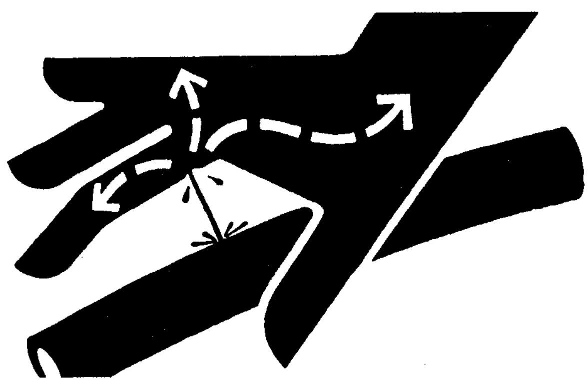
CHECK IT OUT!

- ☐ GUARDS
- ☐ SHIELDS
- ☐ SAFETY BARS
- ☐ ROLL-OVER PROTECTIVE STRUCTURES
- ☐ SEAT BELTS, ETC.



T46104N

Carefully inspect all systems for leaks.



X9811

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

Group II
CAP SCREW TORQUE VALUES

CUSTOMARY TORQUE SPECIFICATIONS

NOTE: Wrench torque tolerance is ± 10%.

Cap Screw	Plain Head*		Three Dashes*		Six Dashes*	
in.	(lb-ft)	N·m	(lb-ft)	N·m	(lb-ft)	N·m
1/4	------	------	(10)	14	(14)	19
5/16	------	------	(20)	27	(30)	41
3/8	------	------	(35)	47	(50)	68
7/16	(35)	47	(55)	75	(80)	108
1/2	(55)	75	(85)	115	(120)	163
9/16	(75)	102	(130)	176	(175)	237
5/8	(105)	142	(170)	230	(240)	325
3/4	(185)	251	(300)	407	(425)	576
7/8	(160)	217	(445)	603	(685)	929
1	(250)	339	(670)	908	(1030)	1396
1-1/8	(330)	447	(910)	1234	(1460)	1979
1-1/4	(480)	651	(1250)	1695	(2060)	2793

All torques are dry torque unless noted.

*Dashes identify the grade of hardware.

METRIC TORQUE SPECIFICATIONS

NOTE: Wrench torque tolerance is ± 10%.

Cap Screw	Property Class 8.8*		Property Class 10.9*	
Diameter	(lb-ft)	N·m	(lb-ft)	N·m
M5	(4.4)	6.0	(6.3)	8.5
M6	(7.4)	10.0	(10.7)	14.5
M8	(18.1)	24.5	(25.8)	35.0
M10	(36.1)	49.0	(51.6)	70.0
M12	(62.7)	85.0	(89.2)	121.0
M16	(154.9)	210.0	(221.2)	300.0
M20	(265.5)	360.0	(368.7)	500.0
M24	(457.2)	620.0	(634.2)	860.0
M30	(885.0)	1200.0	(1224.2)	1660.0
M36	(1541.3)	2090.0		

All torques are dry torque unless noted.

*Numbers identify the grade of hardware.

Group III
GENERAL SPECIFICATIONS

(Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with ICED and SAE standards. Except where otherwise noted, these specifications are based on a unit equipped with 16.9-24, 8-ply-rating, R4 rear tires; 11L-15, 8-ply-rating front tires; 3/4-cu. yd. (0.57 m³) loader bucket, 24-in. (610 mm) standard backhoe bucket, and standard equipment.)

Power (@ 2500 engine rpm):

	SAE	DIN
Gross	62 hp (46.2 kW)	
Net	58 hp (43.3 kW)	61.6 PS

Net engine flywheel power is for an engine equipped with fan, air cleaner, water pump, lubricating oil pump, fuel pump, alternator, and muffler. Gross engine power is without fan. Flywheel power ratings are under SAE standard conditions of 500-ft. (150 m) altitude and 85°F (29°C) temperature and DIN 70 020 standard conditions of 760 mm Hg barometer (sea level) and 20°C temperature.

Engine: John Deere 4-cylinder diesel, valve-in-head, 4-stroke cycle.

Bore and stroke . . . . 4.02x4.33 in. (102x110mm)
Piston displacement . . . . 219 cu. in. (3 588 cm³)
Compression ratio . . . . 16.2 to 1
Maximum torque @ 1300 rpm . . . . 150 lb-ft (203 N•m) (20.7 kg-m)
NACC or AMA (U.S. Tax) horsepower 25.65
Main bearings 5
Lubrication . . . . Pressure system with full-flow filter
Cooling . . . . Pressurized with thermostat and fixed bypass
Fan . . . . Suction
Air cleaner . . . . Dry
Electrical system . . . . 12 volt with alternator
Batteries . . . . Two 6 volt, 340 min. reserve capacity connected in series

Engine Clutch . . . . . . Foot-operated automotive-type clutch with 10-in. (254 mm) plate.

Transmission:
Constant mesh, 8 speeds forward, 4 reverse. Standard hydraulic direction reverser permits no-clutch reversing in all gears.

Gear:	Travel Speeds mph		km/h	
	Fwd.	Rev.	Fwd.	Rev.
1	1.4	1.6	2.3	2.6
2	2.0	2.3	3.2	3.7
3	3.0	3.5	4.8	5.6
4	4.2	4.8	6.8	7.7
5	5.5	6.3	8.9	10.1
6	7.8	9.0	12.7	14.5
7	11.7	13.5	18.8	21.7
8	16.4	18.7	26.4	30.1

Final Drives . . . . Inboard, planetary.

Brakes . . . . Hydraulically power actuated, fully enclosed wet-disk. Self-equalizing. Foot-operated individually or simultaneously.

Steering: Power
Turning radius (brake applied) . . . . 10 ft. 2 in. (3.10 m)
Loader clearance (brake applied) . . . . 30 ft. (9.14 m)
Number of turns, far left to far right 3.0
Number of turns, far right to far left 2.75

Hydraulic System: Closed-center
Pressure . . . . 2350 psi (162 bar) (165.2 kg/cm²)
2320 psi (16 000 kPa) (163 kg/cm³)*
Loader control . . . . Single-lever
Backhoe control . . . . Two-lever
Pump . . . . Piston, constant pressure, variable-displacement, 28 gpm (1.76 L/s) @ 2500 engine rpm, 38 gpm (2.4 L/s) @ 2500 engine rpm.
Filter . . . . 25-micron steel-enclosed paper cartridge in return.

*310B only

Hydraulic Cylinders:

	Bore	Stroke
Loader boom	3.25 in. (83 mm)	28.7 in. (729 mm)
Loader bucket	3.25 in. (83 mm)	16.2 in. (411 mm)
Backhoe Boom	4.50 in. (114 mm)	34.0 in. (864 mm)
Backhoe crowd	4.00 in. (102 mm)	33.0 in. (838 mm)
Backhoe bucket	3.50 in. (89 mm)	27.4 in. (695 mm)
Backhoe swing	4.00 in. (102 mm)	9.3 in. (236 mm)
Stabilizer	3.50 in. (89 mm)	16.9 in. (429 mm)

Cylinder rods .... Ground, heat-treated, chrome-plated, polished
Loader backhoe swing and stabilizer cylinder rods ...... 1.75 in. (44 mm) dia.
Backhoe boom and bucket cylinder rods .... 2.25 in. (57 mm) dia.
Backhoe crowd cylinder rod ..... 2 in. (51 mm) dia.

Tires:

Front	Rear
11L-15, 8 ply rating, F3	16.9-24, 8 ply rating, R4
7.50/8.00-16, 10 ply rating, F3	19.5L-24 8 ply rating, R4
	19.5L-24, 12 ply rating, R4

Wheel Treads:
Front .... 58 in. (1.47 m)
Rear .... 65 in. (1.65 m)

Capacities:

	U.S.	Imp.	Liters
Cooling system	12 qt.	10.0 qt.	11.4
Fuel tank	19.5 gal.	16.3 gal.	73.8
Engine lubrication, including filter	9 qt.	7.5 qt.	8.5
Transmission and hydraulic system	20.5 gal.	17.1 qt.	77.6
Transmission only	10 gal.	8.3 gal.	37.8

Buckets:

LOADER	Nominal Heaped Capacity	Width
	3/4 cu. yd. (0.57 m^3)	89.4 in. (2.27 m)
	1 cu. yd. (0.76 m^3)	89.4 in. (2.27 m)
BACKHOE	**Struck Capacity**	**Width**
Standard	2.5 cu. ft. (0.071 m^3)	12 in. (305 mm)
	3.6 cu. ft. (0.102 m^3)	16 in. (406 mm)
	4.4 cu. ft. (0.125 m^3)	18 in. (457 mm)
	6.0 cu. ft. (0.170 m^3)	24 in. (610 mm)
	7.6 cu. ft. (0.215 m^3)	30 in. (762 mm)
	7.2 cu. ft. (0.204 m^3)	36 in. (914 mm)
Heavy-duty	4.4 cu. ft. (0.125 m^3)	18 in. (457 mm)
	6.0 cu. ft. (0.170 m^3)	24 in. (610 mm)
	7.6 cu. ft. (0.215 m^3)	30 in. (762 mm)
Ejector	4.2 cu. ft. (0.119 m^3)	24 in. (610 mm)

Additional Standard Equipment:

ROPS with seat belt and canopy
Key switch with push-button safety start
Cushion-mount platform
Oil pressure indicator light
Alternator charge indicator light
Transistorized voltage regulator
Lights
Coolant temperature gauge
Fuel gauge
Electric hour meter
Fenders
Differential lock
Bucket level indicator
Horn
Deluxe swing-around seat
Foot throttle
Antifreeze
Vandal protection
Rear reflector
Horizontal muffler with vertical exhaust
Electrically operated destroke valve for hydraulic pump
Cigar lighter
Air cleaner restriction indicator
Tachometer
Cold weather starting aid

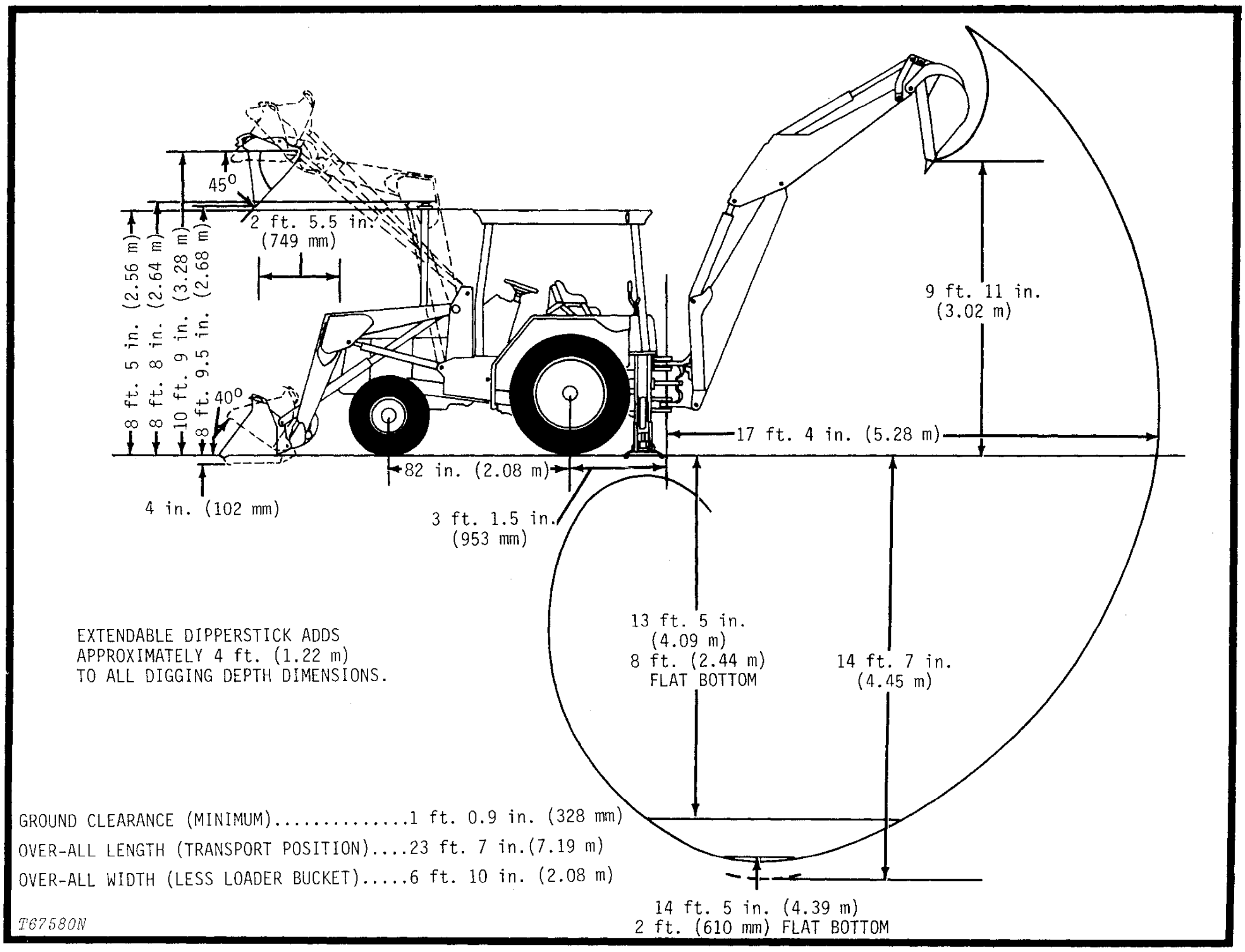
SAE Operating Weight with ROPS

310A .... 13,520 lb. (6 133 kg)
310B .... 13,200 lb. (5 990 kg)

Special Equipment:

Front axle counterweight
Cab w/front and rear windshield wipers (includes ROPS)
Cab heater
Cab pressurizer
24-in. (610 mm) ripper tooth for backhoe
Bolt-on stabilizer street pads
Locking instrument panel cover
Parking brake
Backup alarm
Reversible stabilizer pads
Extendable dipperstick

BACKHOE LOADER OPERATING DIMENSIONS



T67580N

Operating Information
Loader:

Rollback at ground level .... 40 deg.
Breakout force ...... 7500 lb. (33.62 kN) (3 402 kg)
7600 lb. (34.06 kN) (3500 kg)*
Digging depth below ground level
(with bucket level) .... 4 in. (102 mm)
Lifting capacity, full height ...... 5000 lb. (2 268 kg)
Height to bucket hinge pin ..... 10 ft. 9 in. (3.28 m)
Maximum dump angle .... 50 deg.
Clearance, bucket dumped
at 45 degrees............. 8 ft. 9.5 in. (2.68 m)
Reach at maximum height, bucket
dumped at 45 degrees..... 2 ft. 5.5 in. (749 mm)
Raising time to full height .... 3.7 sec.
Bucket dump time .... 1.7 sec.
Lowering time (power).................. 2.8 sec.

Stabilizer Width:

Transport position .... 7 ft. 3 in. (2.21 m)
Operating position (overall) ..... 10 ft. 2 in. (3.10 m)
Operating position (ICED) .... 8 ft. 9 in. (2.67 m)
* 310B only

Backhoe:

Digging depth (ICED):
Maximum .... 14 ft. 7 in. (4.45 m)
2-ft. (610 mm) flat bottom .... 14 ft. 5 in. (4.39 m)
8-ft. (2.44 m) flat bottom ..... 13 ft. 5 in. (4.09 m)
Swing arc.......................... 180 deg.
Lifting capacity (SAE):
Boom at full reach and
full height .... 1500 lb. (680 kg)
Dipper lifting, boom holding,
full height .... 1900 lb. (860 kg)
Digging force (bucket cylinder in
power-dig position) 9600 lb. (43 kN (4 55 kg)
Digging force, crowd
cylinder............. 6000 lb. (27 kN) (2 720 kg)
Reach from center of
swing mast................ 17 ft. 4 in. (5.28 m)
Reach from center of
rear axle .... 20 ft. 5.5 in. (6.24 m)
Loading height (truck-loading
position) .... 9 ft. 11 in. (3.02 m)
Transport height.............. 11 ft. 3 in. (3.43 m)
Bucket rotation . Adjustable for 123, 126 or 154 deg.
Bucket positions ...... Adjustable for 24 or 16 deg.
rollback and 2 deg. forward.

Group IV
PREDELIVERY, DELIVERY, AND AFTER-SALE SERVICES

TEMPORARY STORAGE

After receiving your unit from the factory and before putting the backhoe loader into temporary storage, perform the following checks and services.

For long-term storage information, read your 310A or 310B operator's manual.

1. Check battery electrolyte level. Charge the battery if necessary.

2. Check coolant level in the radiator. The coolant should be halfway between the radiator core and filler neck.

3. Check engine oil level. Oil must be between marks on dipstick after machine has been shut down for 10 minutes.

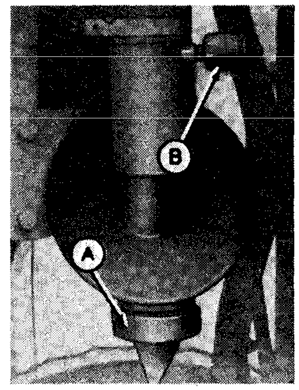
4. Release hydraulic pressure by stopping engine, lowering boom, and operating control levers until boom and bucket do not move.

PREDELIVERY SERVICE

The service technician must carefully check and service the machine before the dealer delivers it to the customer. When the customer receives a machine that is correctly prepared, the customer is well-satisfied. For these reasons, correct predelivery service is very important to the dealer and the customer.

Use the following list when getting a unit ready for delivery to the customer.

1. Air Cleaner



T85044

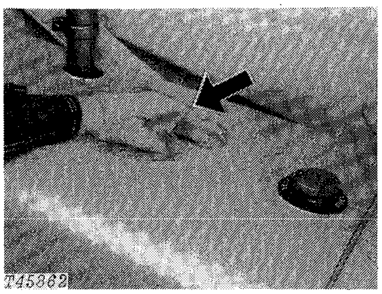
A—Dust Unloader Valve **B—Restriction Indicator**

Fig. 1-Air Cleaner

Check the restriction indicator (B). If the red signal can be fully seen, check the air intake system for a restriction.

Air cleaner checked *Yes* *No*

2. Radiator



T45862

Fig. 2-Radiator Filler Cap

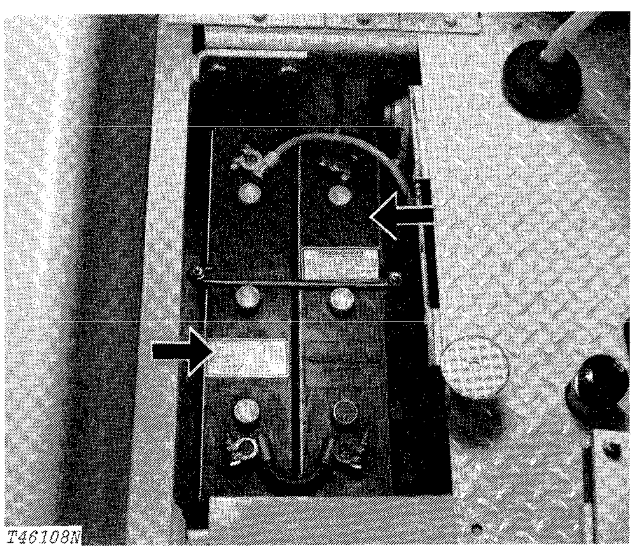
CAUTION: Do not remove the radiator filler cap unless the engine is cool. Then loosen the cap slowly to the stop. Release all pressure before you remove the cap.

Check the level of the coolant in the radiator. Coolant must be halfway between the radiator core and filler neck. Use clean, soft water for warm weather. Use a solution of 50% clean, soft water and 50% permanent antifreeze (ethylene glycol with approved rust inhibitor) for cold weather.

Check the cooling system for loose connections and leaks. Remove trash from the radiator.

Coolant level checked *Yes* *No*

3. Batteries



T46108N

Fig. 3-Batteries

Check the electrolyte level of the batteries. Add distilled water, if necessary. Do not use hard water. Remove dirt from the top of the batteries with a damp cloth. Put petroleum jelly on terminals.

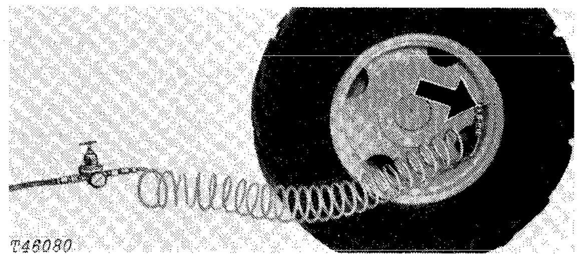
IMPORTANT: Do not add water to the batteries in freezing weather unless you run the engine 2 or 3 hours or charge the batteries.

Check battery connections.

Punch the date code on the battery.

Batteries checked *Yes* *No*

4. Tires



T46080

Fig. 4-Correct Tire Filling Procedure

Check air pressure in the tires with an accurate gauge having 1 psi (0.07 bar) (0.07 kg/cm²) graduations.

Front Tires

Tire Size	Type	Ply Rating	Inflation Pressure
7.50-16	F-3	10	60 psi (4.2 bar) (4.2 kg/cm²)
11L-15	F-3	8	44 psi (3.1 bar) (3.1 kg/cm²)

Rear Tires

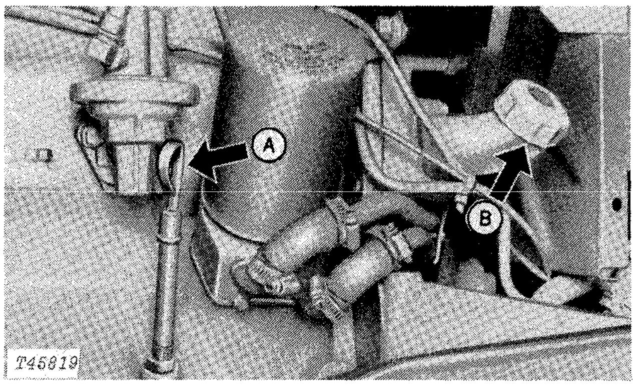
Tire Size	Type	Ply Rating	Inflation Pressure
16.9-24	R-4	8	28 psi (2.0 bar) (2.0 kg/cm²)
19.5L-24	R-4	8	34 psi (2.4 bar) (2.4 kg/cm²)
19.5L-24	R-4	12	34 psi (2.4 bar) (2.4 kg/cm²)

CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious bodily injury. DO NOT attempt to mount a tire unless you have the proper equipment and experience to perform the job safely.

Detailed tire mounting instructions, including necessary safety precautions, are contained in John Deere Fundamentals of Service (FOS) Manual 55, Tires and Tracks.

Tire pressure checked *Yes* *No*

5. Crankcase Oil Level



A—Dipstick **B—Oil Filler Cap**

Fig. 5-Crankcase Oil Level

Check the oil level when the backhoe loader is on a level surface. Wait ten minutes after stopping the engine before checking the oil level. If the oil level is at or below the bottom mark on the dipstick, add oil specified on page I-V-2. Do not operate the engine when the oil level is below the bottom mark. Keep the oil level between the marks on the dipstick.

Crankcase oil level checked *Yes* *No*
Oil added ________*qts. (L)*

6. Transmission Oil Level

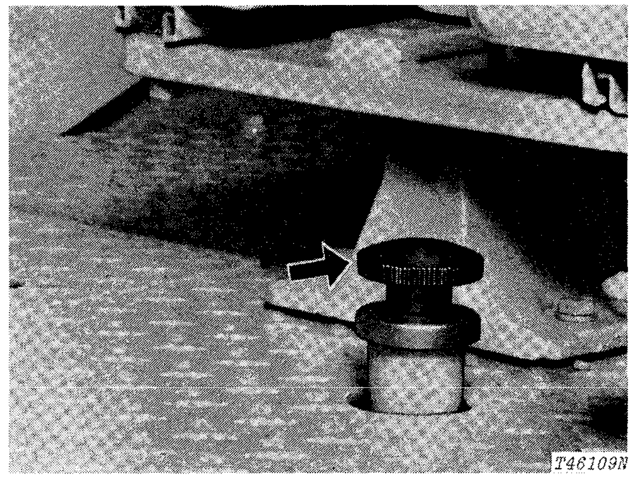


Fig. 6-Transmission Oil Level Dipstick and Filler Cap

Run engine two to three minutes.

Check oil level with:

Unit on level ground.
Engine at slow idle (800 rpm).
Loader bucket on ground.
Backhoe in transport position.
Range shift lever in (P) park or parking brake engaged.
Gear shift lever in neutral.
Clutch engaged.

Oil level must be to top mark on dipstick. If not, add oil specified on page I-V-2.

Oil level checked *Yes* *No*
Oil added ________*qts. (L)*

7. Fuel Tank

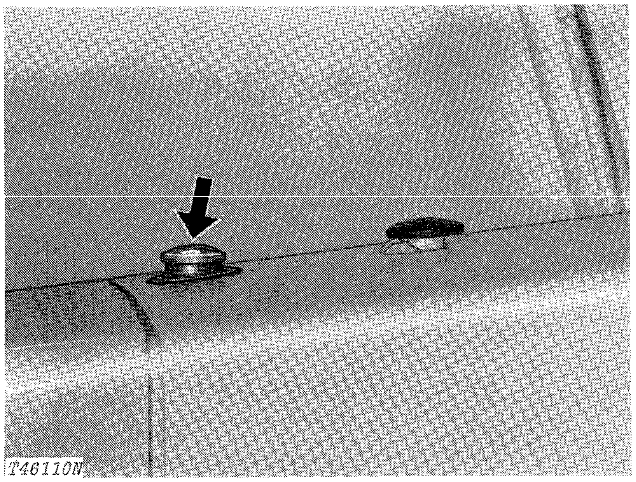
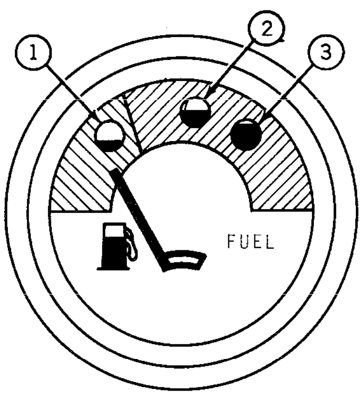


Fig. 7-Fuel Tank Filler Cap

Fill the fuel tank with correct fuel. Check the action of the fuel gauge.



T31392

1—Empty Tank
2—Half Full Tank
3—Full Tank

Fig. 8-Fuel Gauge

Fuel tank filled	*Yes*	*No*
Fuel gauge checked	*Yes*	*No*

8. Grease Fittings

All grease fittings were checked and lubricated before the backhoe loader left the factory. However, to make sure of customer satisfaction, check each lubrication point shown on the following pages. Lubricate with several strokes of John Deere Multi-Purpose Grease or equivalent, if necessary.

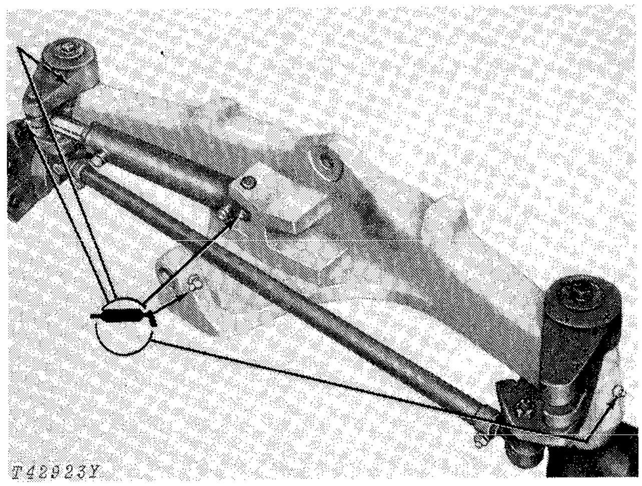


Fig. 9-Front Axle (5 points)

Lubrication required *Yes* *No*

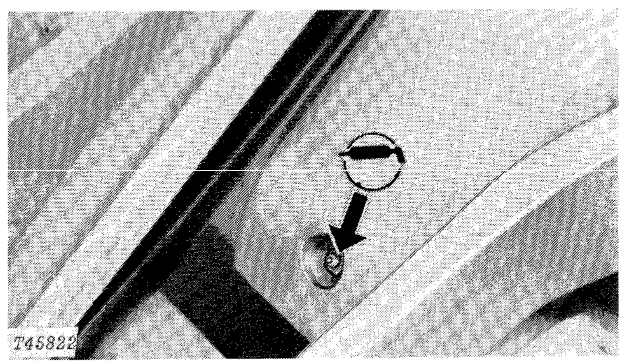
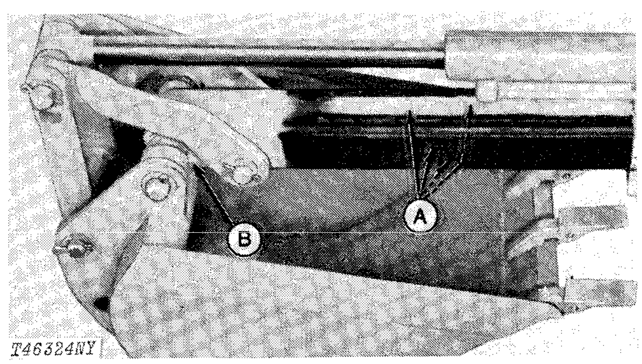


Fig. 10-Extendible Dipperstick (1 point)

Lubrication required *Yes* *No*



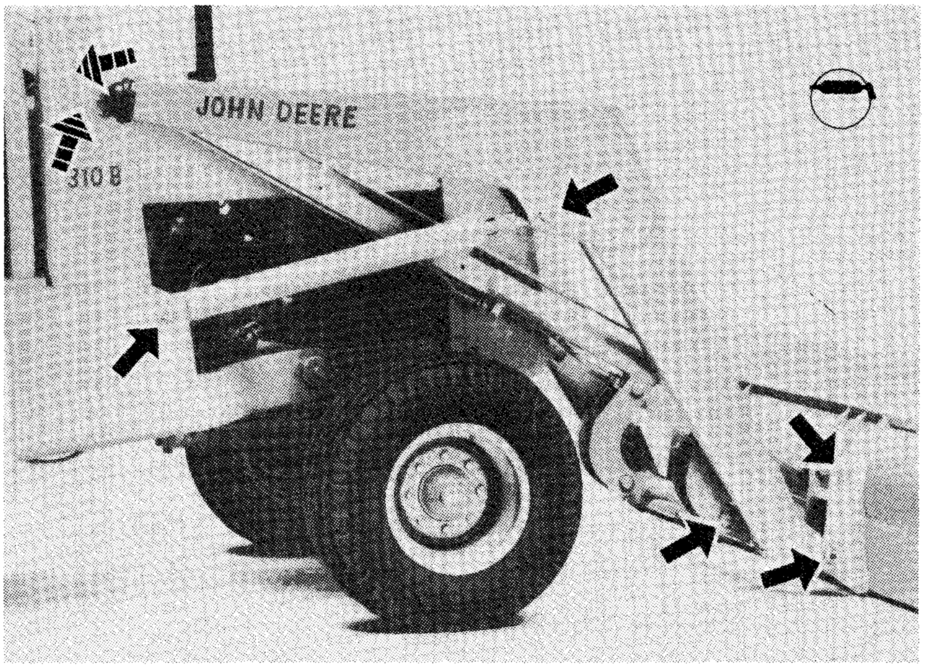
A—Bearing Strips **B—Drain Port**

Fig. 11-Bearing Strips and Drain Port (Extendible Dipperstick)

Clean bearing strips. Tighten and stake screws (-368874). Lubricate strips with Digmor Special Lube (dry film).

Be sure drain port is clean.

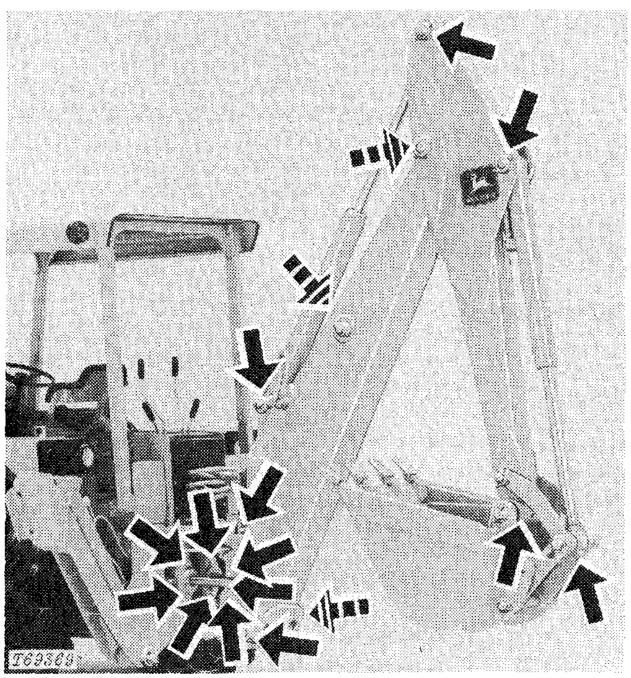
Lubrication required *Yes* *No*



T84884

Fig. 12-Loader (14 points)

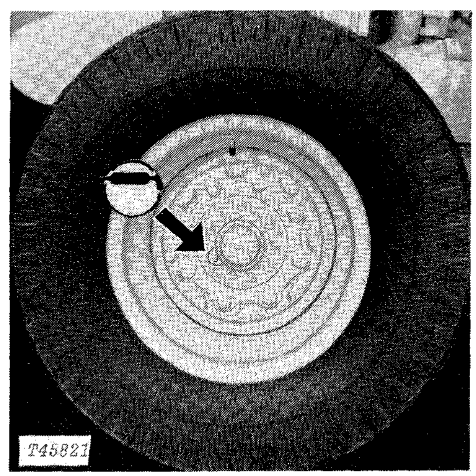
Lubrication required *Yes* *No*



T69369

Fig. 13-Backhoe (23 points)

Lubrication required *Yes* *No*



T45821

Fig. 14-Front Wheel Bearing (2 points)

If lubrication is needed, remove pipe plug from each front wheel. Install grease fittings.

Lubrication required *Yes* *No*

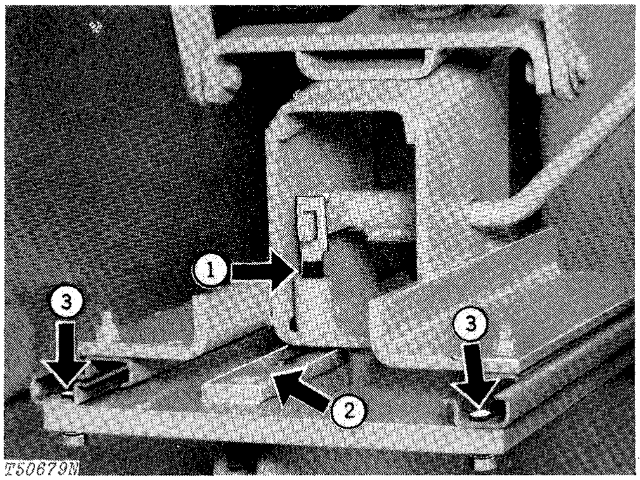


Fig. 15-Seat Lubrication

1 - Lubricate swivel locking pin with engine oil.

2 - Lubricate locking pin slide plate with John Deere Multi-Purpose Grease or equivalent.

3 - Lubricate bearing contact areas—both ends of adjuster. Use John Deere Multi-Purpose Grease or equivalent.

Lubrication required *Yes* *No*

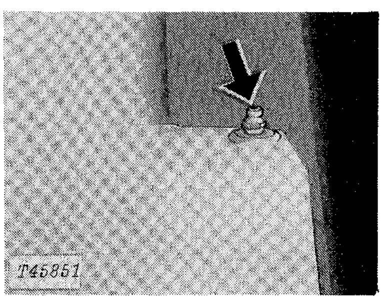


Fig. 16-Rear Axle Bearing (2 points)

Lubrication required *Yes* *No*

9. Air Intake Hose

Check clamps on hoses connecting air cleaner and engine. Tighten four hose clamps. Inspect hoses, for cracks.

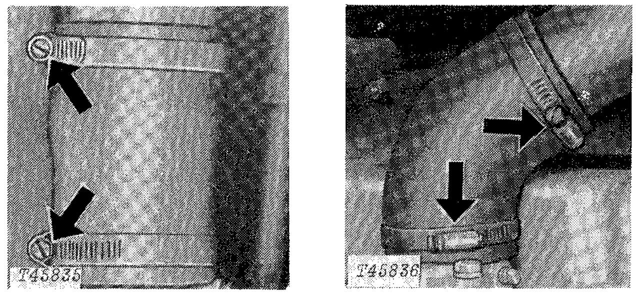


Fig. 17-Air Intake Hose Connections

Air intake hoses checked *Yes* *No*

10. Belt Tension

Check the tension of the alternator-fan belt.

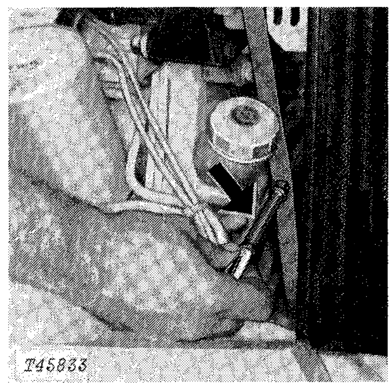


Fig. 18-Checking Tension With Tension Tester

Tension Tester

A 20 lb. (89 N) force halfway between pulleys must move the belt 3/4 in. (19 mm).

Strand Tension Gauge

Tighten a new fan belt to 135 lb. (601 N) and a used belt to 90 lb. (391 N).

Immediately after stopping the engine (run the engine 5 minutes or more), check the belt tension. If tension is less than 50 lb. (223 N), wait ten minutes. Then change tension to 90 lb. (391 N).

If adjustments are needed, see page I-IV-23.

Belt tension checked *Yes* *No*

11. Engine Speeds

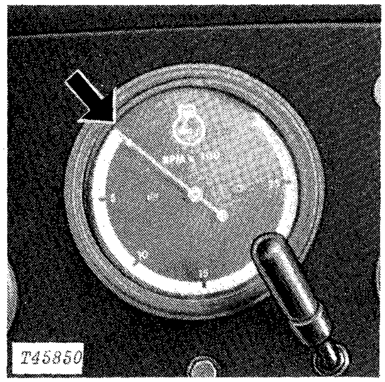
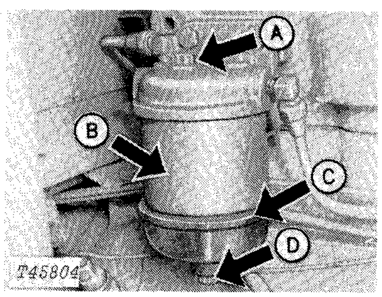

T45850

Fig. 19-Tachometer

Warm-up the engine. Use the tachometer to check speeds.

If engine speeds need adjustment, see page I-IV-23.

12. Fuel Filter



T45804

A—Bleed Plug
B—Filter Element
C—Sediment Bowl
D—Drain Plug

Fig. 20-Fuel Filter (-382507)

Check fuel filter for sediment. Drain if necessary. Loosen the drain plug (D) (-382507). Drain liquid for several seconds. Tighten the plug.

Units with S.N. (382508-) are equipped with a glass enclosed fuel filter with drain plug located in lower left corner of filler housing.

NOTE: If the sediment bowl and filter are completely drained, remove air from the fuel system. See page I-IV-24.

Sediment present in filter *Yes* *No*

ENGINE RPM			
Throttle Position	**Throttle**	**Load RPM**	**No Load Idle RPM**
Rearward to stop	Hand	....	800 rpm
Forward past intermediate stop	Hand	2500 rpm	2650 rpm
Pedal down	Foot	....	2800 rpm

13. Indicator Lights and Gauges

Check operation of indicator lights.

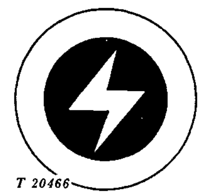

T20466

Fig. 21-Alternator Indicator Light

This light glows when alternator is not charging. If light goes on when engine is running, stop the engine. Find the cause. The light will go on when the key is in start position and engine off.

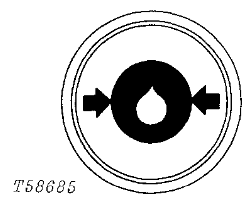

T58685

Fig. 22-Engine Oil Pressure Indicator Light

This light will go on when the crankcase oil level is low or when the oil pressure is low. When the light goes on, stop the engine. Check engine oil level. If oil level is not low, check for restrictions or wrong oil.

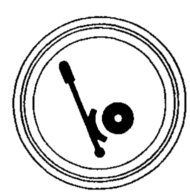
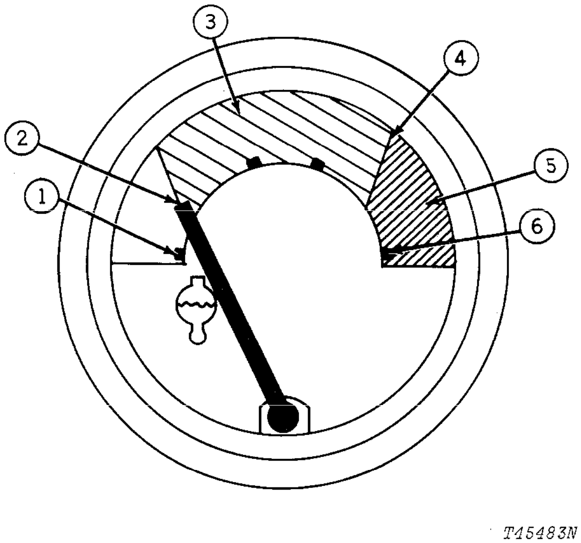

T62798N

Fig. 23-Parking Brake Indicator Light

This light will go on when the parking brake is engaged and the key switch is on.

Check the operation of the gauges.



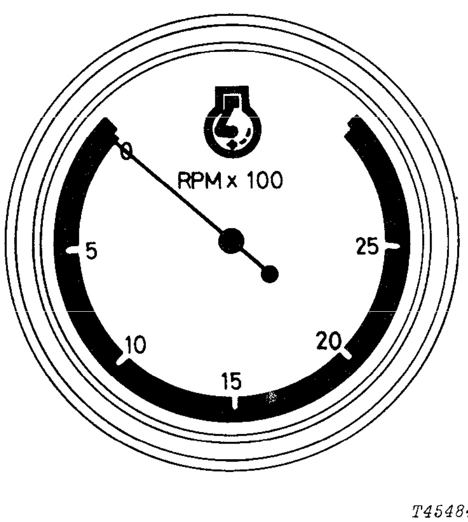
T45483N

1—100°F (38°C)
2—135°F (57°C)
3—Light Green
4—224°F (107°C)
5—Red - Orange
6—240°F (116°C)

Fig. 24-Engine Coolant Temperature Gauge

The light green zone (3) shows the normal operating temperatures.

IMPORTANT: If the indicator hand goes into the RED-ORANGE ZONE (5), stop the engine. Find the cause.



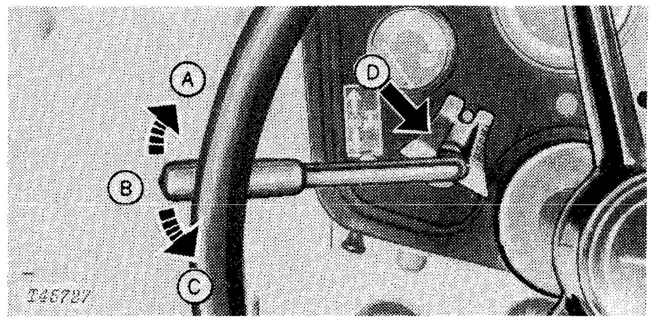
T45484N

Fig. 25-Tachometer

The tachometer shows engine rpm.

Indicator lights and gauges checked Yes No

14. Reverser



T45727

A—Forward
B—Neutral
C—Reverse
D—Neutral Lock

Fig. 26-Reverser Lever

Move the reverser lever to change the direction of travel in any gear while moving without using the clutch or shift levers.

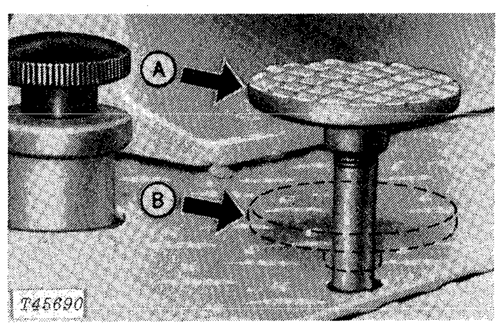
IMPORTANT: Do not change direction at high speeds.

Do not operate the backhoe with the reverser lever in reverse position.

See page I-IV-26 for reverser speed-of-shift adjustment.

Reverser checked Yes No

15. Differential Lock



T45690

A—Disengaged **B—Engaged**

Fig. 27-Differential Lock Pedal

Check differential lock operation.

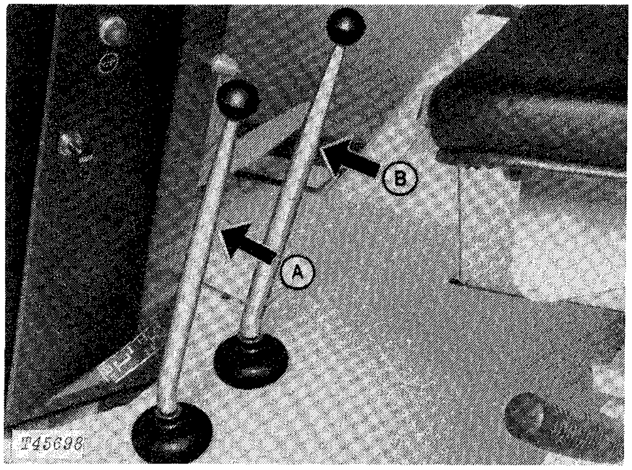
1. Extend one stabilizer to lift one rear wheel off the ground.

2. Stop the engine. Engage the differential lock (push the pedal down).

3. Attempt to turn the raised wheel manually. If the differential lock is working correctly, the raised wheel will lock in place.

Differential lock checked Yes No

16. Transmission Shifting



1—Range Shift Lever **2—Gear Shift Lever**

Fig. 28-Transmission Shift Levers

Check operation of the transmission in all ranges and gears.

Transmission checked *Yes* *No*

17. Brakes

Check the operation of the hydraulic brakes.

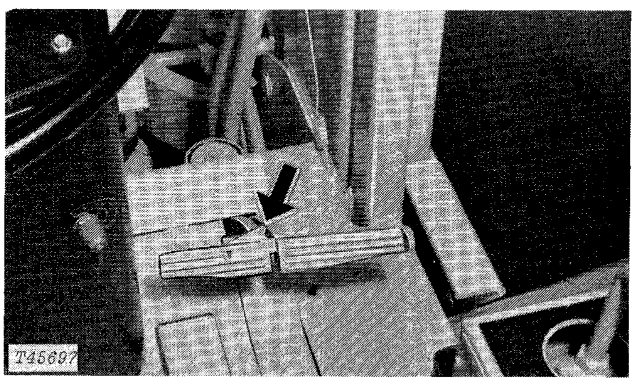


Fig. 29-Brake Pedals Connected

Put the machine in gear. Push down the brake pedal. Moderate pedal force must hold the machine in place.

Remove air from the brake system:

1. If moderate pedal force does not hold the machine in place.
2. If the pedal feels spongy.
3. If the pedal has too much travel.

See page I-IV-27 for the correct procedure.

Brakes checked *Yes* *No*

18. Clutch

A—0.75 in. (19 mm) Maximum Clearance **B—Clutch Pedal Stop**

Fig. 30-Clutch Pedal Adjustment

Check the clutch pedal adjustment.

Put the clutch pedal stop down. Push down the clutch pedal until the throwout bearing contacts the clutch fingers.

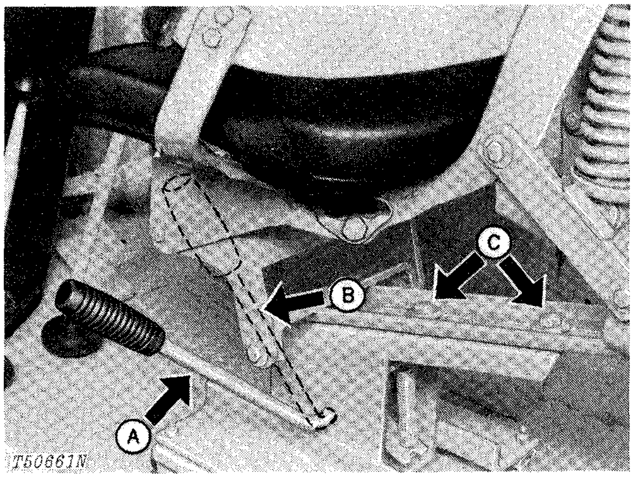
Clearance between the platform and the stop must not be greater than 0.75 in. (19 mm).

If adjustment is needed, see page I-IV-28.

Clutch pedal adjustment checked *Yes* *No*

19. Seat

Check the operation of the seat.



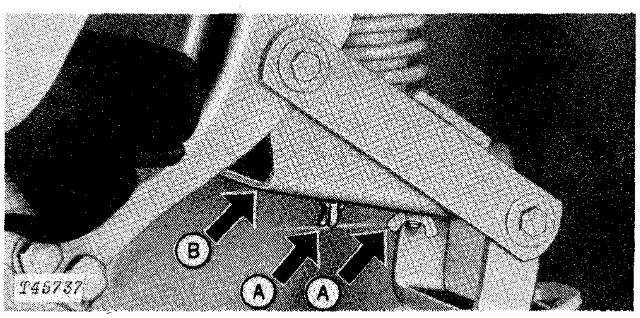
T50661N

A—Seat Control Handle Locked
B—Seat Control Handle Unlocked
C—Height Adjustment

Fig. 31-Seat Control and Adjustment

To move the seat for loader or backhoe operation:
1. Lift the seat control handle (B).
2. Slide the seat forward or to the rear.
3. Turn the seat 180°.
4. Release the handle (A). Seat must lock in place.

To change the height of the seat:
1. Loosen cap screws (C).
2. Slide the seat to the desired position.
3. Tighten the cap screws.

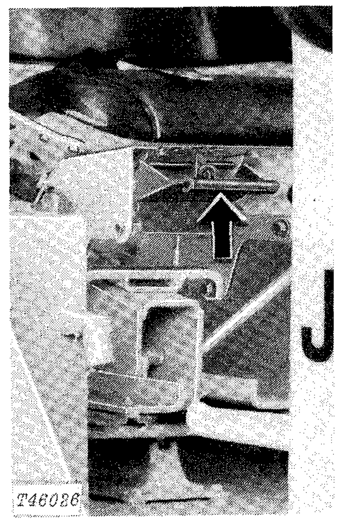


T45737

A—Wing Nuts
B—Slide

Fig. 32-Ride Adjustment

To change the ride adjustment:
1. Move seat to the upper rear position. See step 1 below.
2. Loosen wing nuts (A).
3. Move the slide to the desired position.
4. Tighten wing nuts.
5. Move seat to normal position. Seat must lock in position when you sit on it.



T46026

Fig. 33-Seat Release Latch

To move the seat to the upper rear position:
1. While seated, lift the latch.
2. Move the seat to the upper rear position.
3. When moving seat forward to normal position, stay in the seat.

Seat checked *Yes* *No*

20. Accumulator

Check the accumulator action.

Run the engine five to ten minutes. Stop the engine. The steering wheel must turn easily until all hydraulic pressure is released.

If the steering wheel cannot be turned immediately after stopping the engine, the accumulator needs repair.

CAUTION: The accumulator is charged with nitrogen gas under high pressure. When servicing accumulator, see Group 2160.

Accumulator checked *Yes* *No*

1. Power Steering

Check the operation of the power steering. Start the engine. The steering wheel must turn easily in both directions.

Number of turns:
Far left to far right 3
Far right to far left 2-3/4

Check lines and cylinders for leakage.

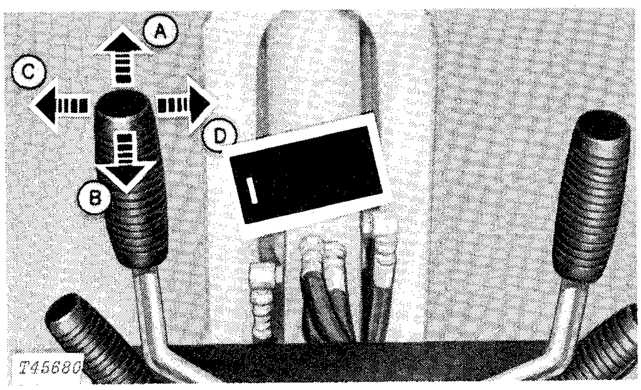
Power steering checked *Yes* *No*

22. Backhoe Controls

Check the operation of the backhoe controls.

CAUTION: Do not operate backhoe controls unless you are in the operator's seat facing the backhoe.

IMPORTANT: Do not operate the backhoe with the reverser lever in the reverse position.

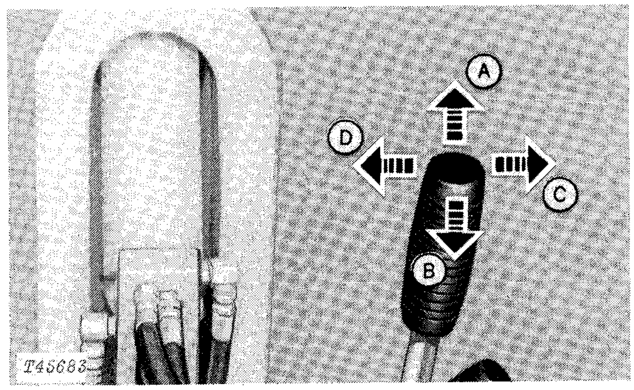


A—Lower Boom
B—Raise Boom
C—Boom Left
D—Boom Right

Fig. 34-Boom Control Lever

Move the lever to one of the intermediate positions to swing the boom left or right at the same time it is being raised or lowered.

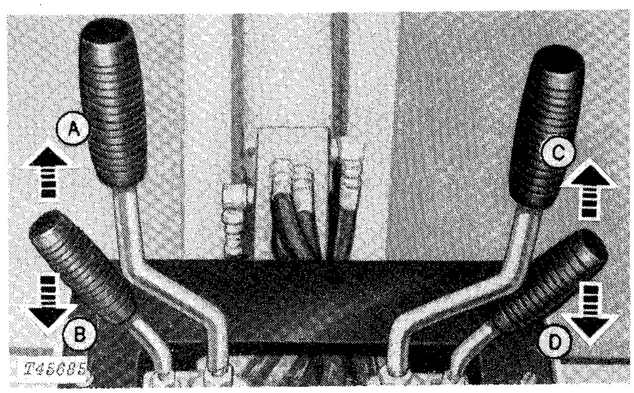
A swing brake automatically slows the boom before it hits the stops on the main frame.



A—Dipperstick Out
B—Dipperstick In
C—Dump Bucket
D—Retract Bucket

Fig. 35-Bucket and Dipperstick Control Lever

Move the lever to one of the intermediate positions to extend or retract the dipperstick at the same time the bucket is being loaded or dumped.



A—Left Stabilizer Down
B—Left Stabilizer Up
C—Right Stabilizer Down
D—Right Stabilizer Up

Fig. 36-Stabilizer Control Levers

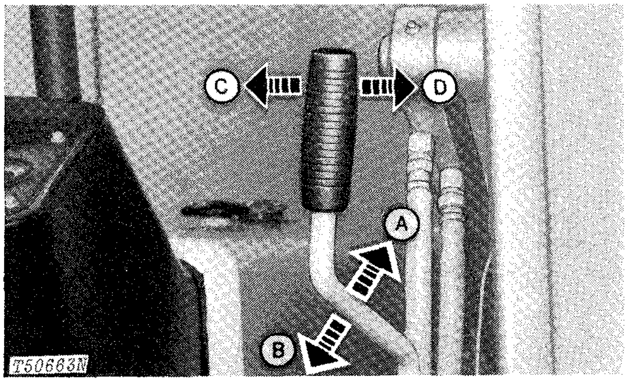
The stabilizers can be raised or lowered one at a time or together.

Backhoe controls checked *Yes* *No*

23. Loader Control Lever

Check the operation of the loader control lever.

CAUTION: Do not operate the loader control lever unless you are in the operator's seat facing forward.



A—Lower Boom **C—Retract Bucket**
B—Raise Boom **D—Dump Bucket**

Fig. 37-Boom and Bucket Control

For faster cycle times, move the lever to intermediate positions.

Move the lever farther to dump or retract the bucket faster.

After dumping the bucket, return the control lever immediately to neutral position.

If the lever is released during normal loader operation, it will return to neutral and the boom will be held in position.

Push the control lever all the way forward for float position. The lever will stay in this position until it is manually returned to neutral.

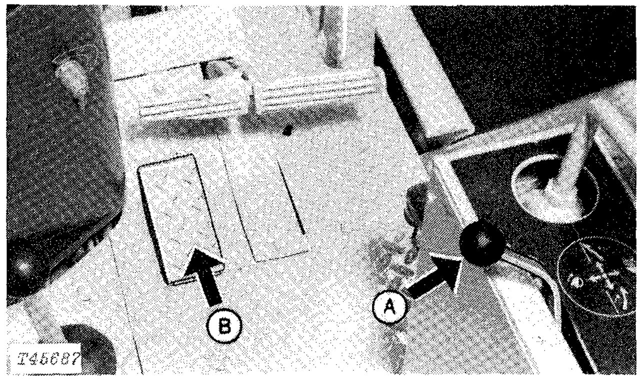
Loader control checked *Yes* *No*

24. Speed Controls

Check the operation of the accelerator pedal and the hand throttle.

Use the accelerator pedal to speed up the engine quickly. When the pedal is released, the engine speed will go back to the hand throttle setting.

Check hand throttle lever for freedom of movement



A—Hand Throttle **B—Accelerator Pedal**

Fig. 38-Speed Controls

Speed controls checked *Yes* *No*

25. Lights

Check the operation of the lights and light switch.

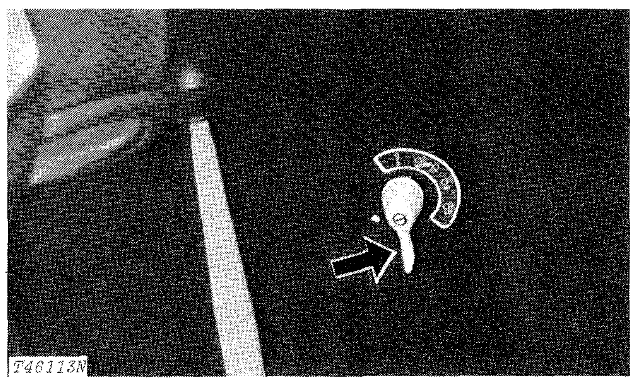
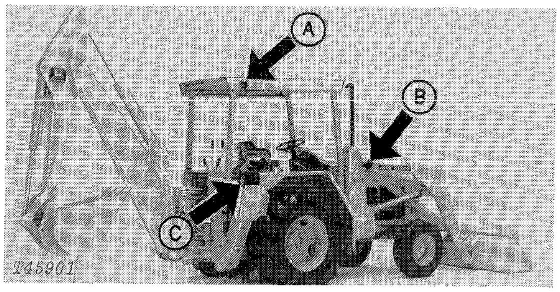


Fig. 39-Light Switch

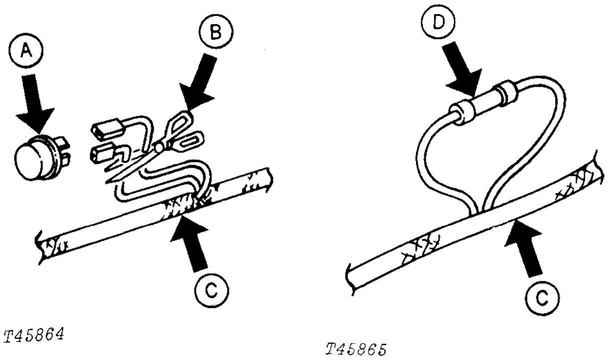
Switch Position	Lights On
Off	All lights off
Work	B (bright) and C (white)
Hi	A, B (bright) and C (red)
Lo	A, B (dim) and C (red)



T45901

A—Warning Lamps
B—Head Lights
C—Rear Combination Lights

Fig. 40-Backhoe Loader Lights



T45864 T45865

Fig. 41-Disconnecting Flashing Unit

NOTE: If flashing lights are prohibited by local regulations:

A - Disconnect flasher unit.
B - Cut off both female connectors on wiring lead from lamp circuit.
C - Connect using R32028R Splice Terminal (D) (for 10-12 gauge wire) or equivalent.

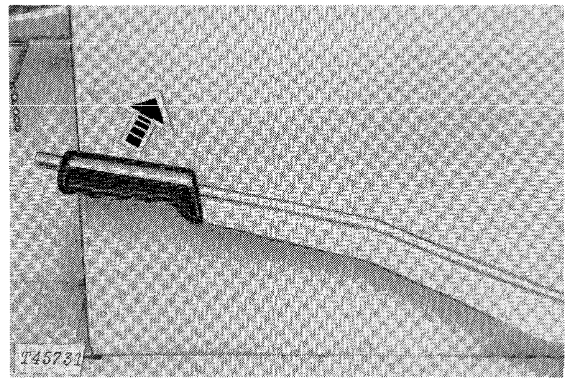
Lights and light switch checked *Yes* *No*

26. Parking Brake

Check the operation of the parking brake.

1. To engage, pull up the lever until firm resistance is felt. The brake latch must be approximately in the center notch. If not, see page I-IV-33 for adjustment.

2. To disengage, lift the lever slightly and push the button. Push the lever down and release the button.



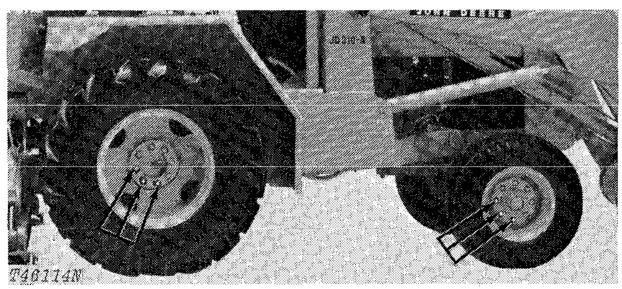
T45731

Fig. 42-Parking Brake

NOTE: The parking brake warning light will glow when the key switch is on and the parking brake is engaged. The horn will blow also if the transmission is shifted from neutral when the parking brake is engaged.

Parking brake checked *Yes* *No*

27. Wheel Retainers



T46114N

Fig. 43-Wheel Retainers

Check wheel retainer cap screw torque.

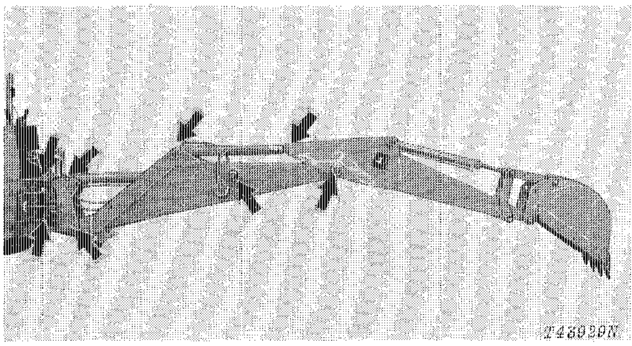
Tighten front wheel retainers to 100 lb-ft (136 N·m) (14 kg-m).

Tighten rear wheel retainers to 425 lb-ft (576 N·m) (60 kg-m).

Wheel retainer torque checked *Yes* *No*

28. Backhoe Tapered Pins

Check the torque on the backhoe tapered pins.



T43929N

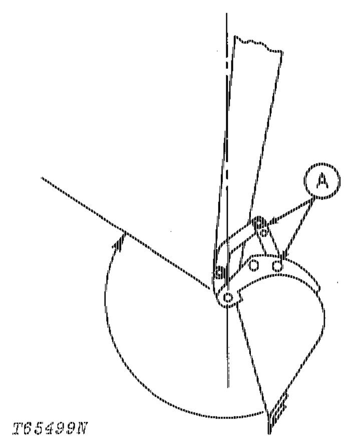
Fig. 44-Backhoe Tapered Pins

Use the torque chart on page I-II-1. If pins need to be tightened, follow the procedure on page I-IV-34.

Tapered pins checked *Yes* *No*

29. Bucket Position

Be sure the backhoe bucket is in the power dig position.



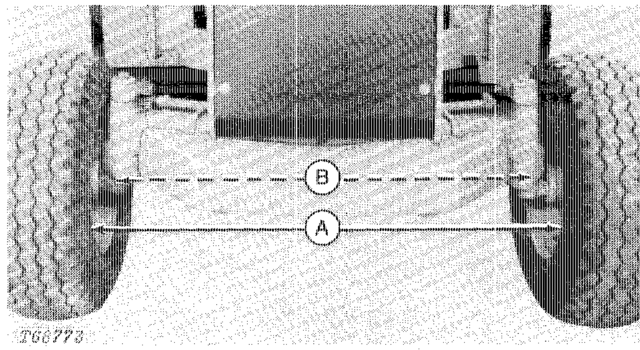
T65499N

A—Install Pins

Fig. 45-Power Dig Position

30. Tow-In

Check the front wheel toe-in.



T68773

A—Distance Between Rims At Front **B—Distance Between Rims At Rear**

Fig. 46-Checking Toe-In

1. Use down pressure of loader bucket to raise front wheels. Turn wheels so each valve stem is at bottom of the wheel.
2. Lower wheels to ground.
3. Measure from ground to hub.
4. Mark this distance on inside of each rim at the head of tire front and rear.
5. Measure distance between rims at front and rear marks.
6. Distance between front of rims must be 1/8 to 3/8 in. (3 to 9.5 mm) less than distance between rear of rims.

If adjustment is needed, see page I-IV-34.

Toe-in checked *Yes* *No*

31. Accessible Hardware Torque

Check all accessible bolts and nuts for the correct tightness. If hardware is loose, tighten it to the correct torque. See the torque chart on page I-II-1.

Accessible hardware checked *Yes* *No*

32. Fluid Leakage

Check the following systems for leakage due to poor or faulty connections and broken hoses or lines.

A. Cooling system checked	*Yes*	*No*
B. Hydraulic system checked	*Yes*	*No*
C. Transmission system checked	*Yes*	*No*
D. Fuel system checked	*Yes*	*No*

33. Final Check

Clean the whole unit. Make the unit LOOK like a new machine. Touch up any chipped paint. Wash the machine thoroughly. Deliver to the customer a machine anyone would be proud to own.

DELIVERY SERVICE

A thorough discussion of the operation and service of this new backhoe loader at the time of delivery helps to assure complete customer satisfaction. Proper delivery should be an important phase of a dealer's program. A portion of the John Deere Delivery Receipt emphasizes the importance of proper delivery service.

Many complaints arise because the owner was not shown how to operate and service the new backhoe loader properly. Devote enough time at the customer's convenience, to introduce the owner to the new backhoe loader. Explain how to operate and service it.

The following procedure is recommended before the service technician and owner complete the delivery acknowledgments portion of the Delivery Receipt.

Using the operator's manual as a guide, be sure the owner understands these points thoroughly:

1. The importance of safety.
2. The importance of lubrication and periodic services.
3. The importance of the break-in period.
4. Controls and instruments.
5. How to start and stop the engine.
6. All functions of the hydraulic system.

After explaining and demonstrating the above features, have the owner sign the Delivery Receipt and give the owner the operator's manual.

AFTER-SALE INSPECTION

The purchaser of a new John Deere backhoe loader is entitled to a free inspection at some mutually agreeable time within the warranty period after the equipment has been "run in," usually after 50 to 100 hours of backhoe loader operation. The terms of this after-sale inspection are outlined on the customer's John Deere Delivery Receipt.

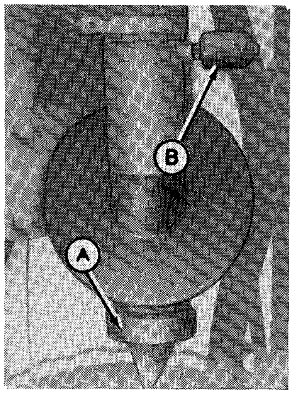
This inspection is to make sure that the customer is receiving satisfactory performance from the backhoe loader. At the same time, the inspection should reveal whether or not the backhoe loader is being operated, lubricated, and serviced properly.

If the recommended after-sale service inspection is followed, the dealer can eliminate a needless volume of service work by preventing minor irregularities from developing into serious problems later on. This will promote strong dealer-customer relations and present the dealer an opportunity to answer questions that may have arisen during the first few days of operation.

During this inspection service, the dealer has the opportunity to promote the possible sale of other new equipment.

Check operation of all controls and instruments for freedom of movement and correct operation.

1. Air Cleaner



T85044

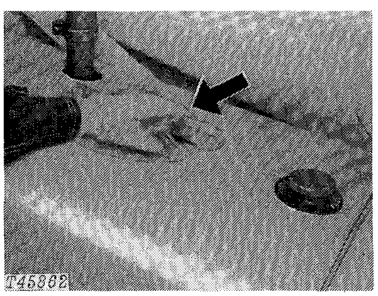
A—Dust Unloader Valve **B—Restriction Indicator**

Fig. 47-Air Cleaner

Check the restriction indicator (B). If the red signal can be fully seen, check the air intake system for a restriction.

Air cleaner checked *Yes* *No*

2. Radiator



T45862

Fig. 48-Radiator Filler Cap

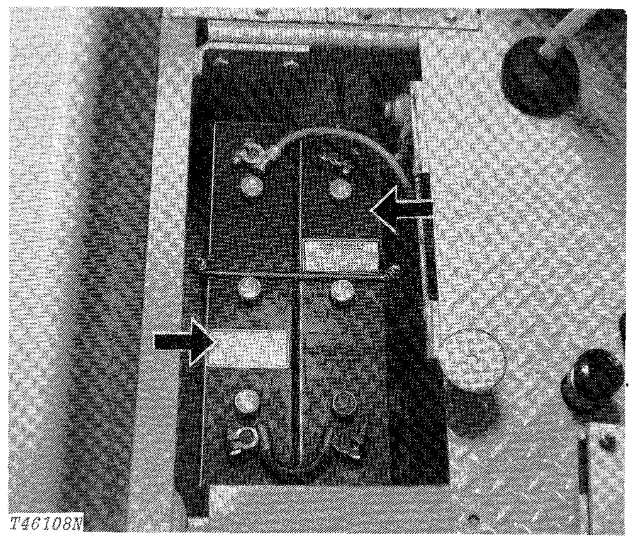
CAUTION: Do not remove the radiator filler cap unless the engine is cool. Then loosen the cap slowly to the stop. Release all pressure before you remove the cap.

Check the level of the coolant in the radiator. Coolant must be halfway between the radiator core and fille neck. Use clean, soft water for warm weather. Use a solution of 50% clean, soft water and 50% permanent antifreeze (ethylene glycol with approved rust inhibitor) for cold weather.

Check the cooling system for loose connections and leaks. Remove trash from the radiator.

Coolant level checked *Yes* *No*

3. Batteries



T46108N

Fig. 49-Batteries

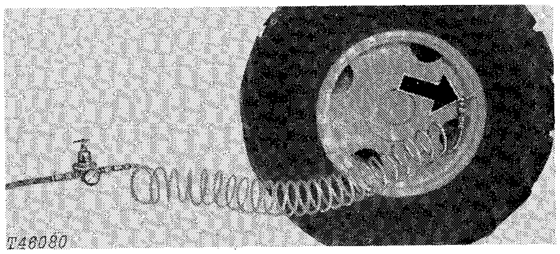
Check the electrolyte level of the batteries. Add distilled water, if necessary. Do not use hard water. Remove dirt from the top of the batteries with a damp cloth. Put petroleum jelly on terminals.

IMPORTANT: Do not add water to the batteries in freezing weather unless you run the engine 2 or 3 hours or charge the batteries.

Check battery connections.

Batteries checked *Yes* *No*

4. Tires



T46080

Fig. 50-Correct Tire Filling Procedure

Check air pressure in the tires with an accurate gauge having 1 psi (0.07 bar) (0.07 kg/cm²) graduations.

Front Tires

Tire Size	Type	Ply Rating	Inflation Pressure
7.50-16	F-3	10	50 psi (4.2 bar) (4.2 kg/cm²)
11L-15	F-3	8	44 psi (3.1 bar) (3.1 kg/cm²)

Rear Tires

Tire Size	Type	Ply Rating	Inflation Pressure
16.9-24	R-4	8	28 psi (2.0 bar) (2.0 kg/cm²)
19.5L-24	R-4	8	34 psi (2.4 bar) (2.4 kg/cm²)
19.5L-24	R-4	12	34 psi (2.4 bar) (2.4 kg/cm²)

CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim can produce an explosion which may result in serious bodily injury. DO NOT attempt to mount a tire unless you have the proper equipment and experience to perform the job safely.

Detailed tire mounting instructions, including necessary safety precautions, are contained in John Deere Fundamentals of Service (FOS) Manual 55, Tires and Tracks.

Tire pressure checked *Yes* *No*

5. Engine Oil and Filter

NOTE: Check with the customer if oil and filter have been changed before performing this service.

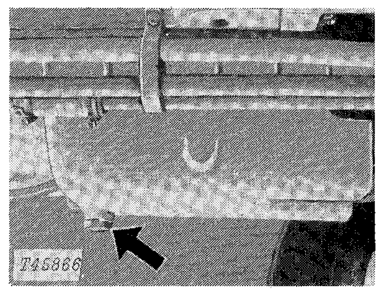
Normal sequence of service is as follows:

Oil and Filter Change - after first 100 hours
- every 200 hours thereafter

If changed, record information below:

Approximate hours at change

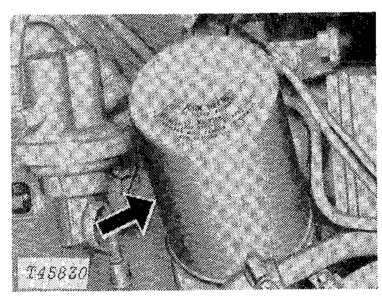
If not, change as follows:



T45866

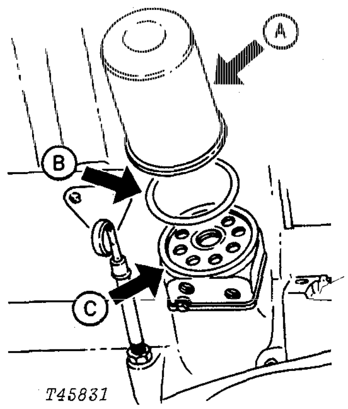
Fig. 51-Engine Drain Plug

1 - Run engine to heat oil.
2 - Drain oil from engine.
3 - While oil is draining, install new filter as instructed on page I-IV-18:



T45830

Fig. 52-Engine Oil Filter



T45831

A—Oil Filter
B—Sealing Ring
C—Mounting Surface

Fig. 53-Engine Oil Filter Components

- A - Remove filter. (Turn counterclockwise.)
- B - Clean mounting surface.
- C - Apply film of oil to sealing ring.
- D - Tighten filter until sealing ring touches mounting surface.
- E - Turn an additional 1/2 to 3/4 turn.
- F - Do not overtighten.

4 - Install drain plug.
5 - Fill crankcase with new oil specified on page I-V-2. Capacity is 8 quarts (7.5 L) without filter, 9 quarts (8.5 L) with filter.
6 - Run engine a short time. Check for leaks around filter base and drain plug. Tighten filter if needed.
7 - Stop engine.
8 - Check oil level. Level must be between marks on dipstick.

Engine oil changed	*Yes*	*No*
Oil filter changed	*Yes*	*No*

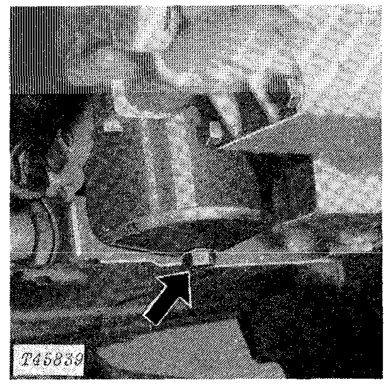
6. Transmission-Hydraulic System Oil Level and Filter Element

NOTE: Before checking oil level find out if customer has changed filter element (first 50 hours service.).

If changed at an earlier date, record information below:

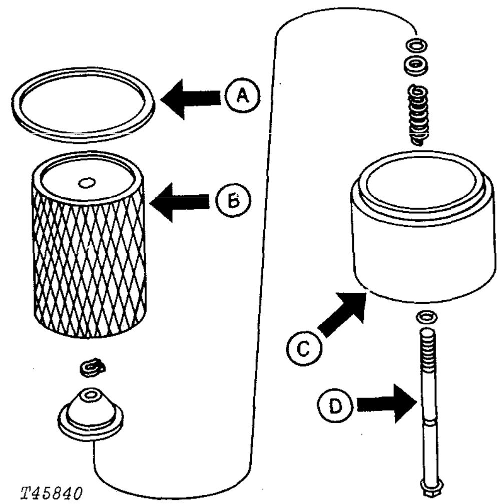
Approximate hours at change ________

If not, change as follows:



T45839

Fig. 54-Transmission-Hydraulic Filter



T45840

A—Packing
B—Element
C—Filter Cover
D—Special Screw

Fig. 55-Transmission-Hydraulic Filter Components

1 - Remove filter cover.
2 - Remove packing and element.
3 - Install new packing. Be sure it fits correctly in the cover.
4 - Install new element and filter cover.
5 - Tighten special screw to 55 lb-ft (75 N·m) (7.6 kg-m).
6 - Check oil level. See item 7.

Filter changed	*Yes*	*No*

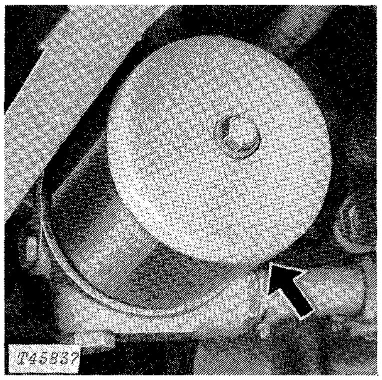
7. Backhoe Loader Return Oil Filter

NOTE: Check with the customer if filter element has been changed (first 50 hour service).

If changed at an earlier date, record information below:

Approximate hours at change ______

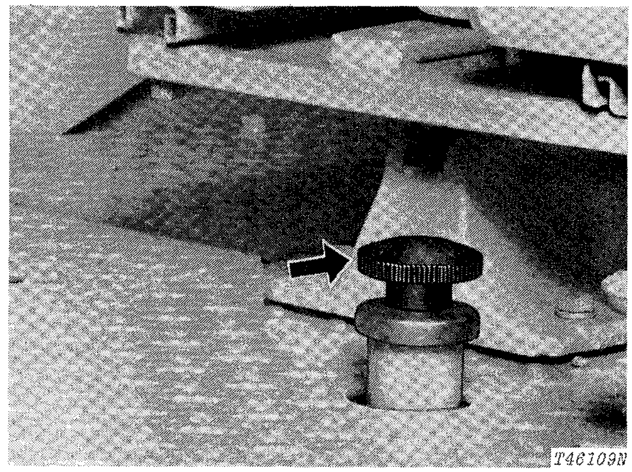
If not, change as follows:



T45837
Fig. 56-Backhoe Loader Return Oil Filter

1 - Remove filter cover.
2 - Remove packing and element.
3 - Install new packing. Be sure it fits correctly in the filter housing.
4 - Install new element and filter cover.
5 - Tighten special screw to 55 lb-ft (75 N·m) (7.6 kg-m).
6 - Check the transmission-hydraulic system oil level.

Filter element changed *Yes* *No*



T46109N
Fig. 57-Transmission Oil Level Dipstick and Filler Cap

7 - Run engine two to three minutes.

8 - Check oil level with:

A - Unit on level ground.
B - Engine at slow idle (800 rpm).
C - Loader bucket on ground.
D - Backhoe in transport position.
E - Range shift lever in (P) park or parking brake applied (if equipped).
F - Gear shift lever in neutral.
G - Clutch engaged.

Oil level must be to top mark on dipstick. If not, add oil specified on page I-V-2.

Oil level checked *Yes* *No*
Oil added *______qts. (L)*

8. Fuel Tank

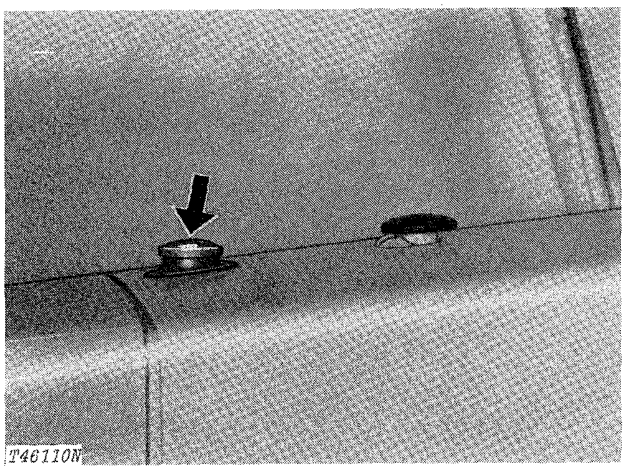
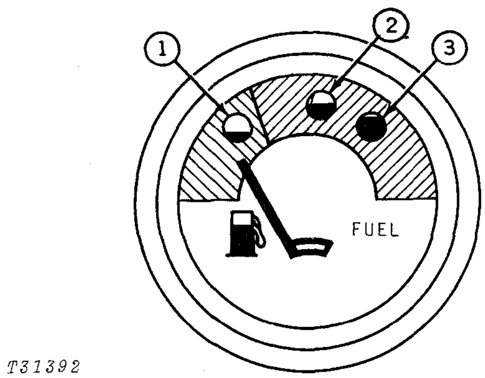


Fig. 58-Fuel Tank Filler Cap

Add a small amount of fuel to the fuel tank. Check the action of the fuel gauge.



1—Empty Tank **3—Full Tank**
2—Half Full Tank

Fig. 59-Fuel Gauge

Fuel gauge checked *Yes* *No*

9. Grease Fittings

Check each lubrication point shown on the following pages. Lubricate with several strokes of John Deere Multi-Purpose Grease or equivalent, if necessary.

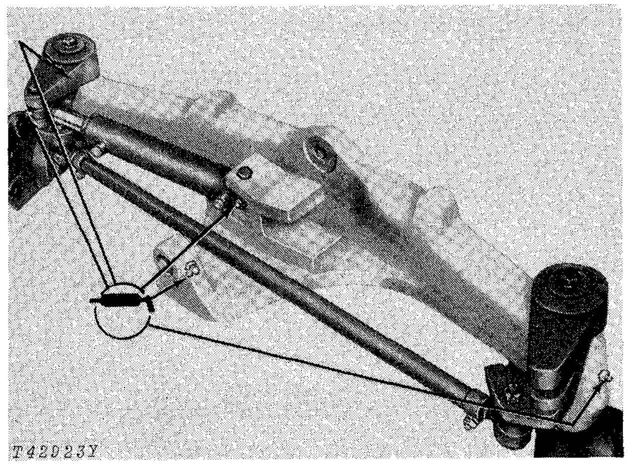


Fig. 60-Front Axle (5 points)

Lubrication required *Yes* *No*

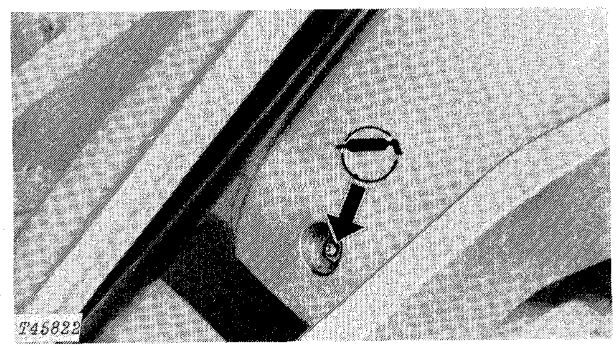
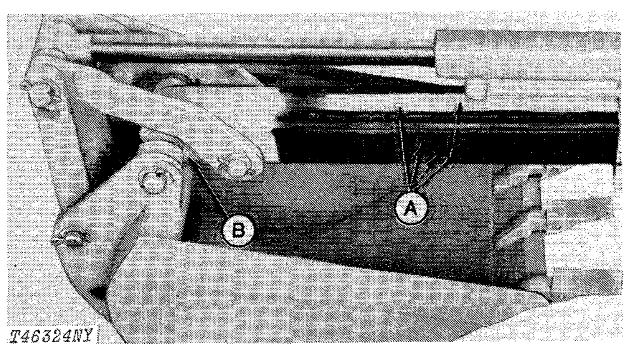


Fig. 61-Extendible Dipperstick (1 point)

Lubrication required *Yes* *No*



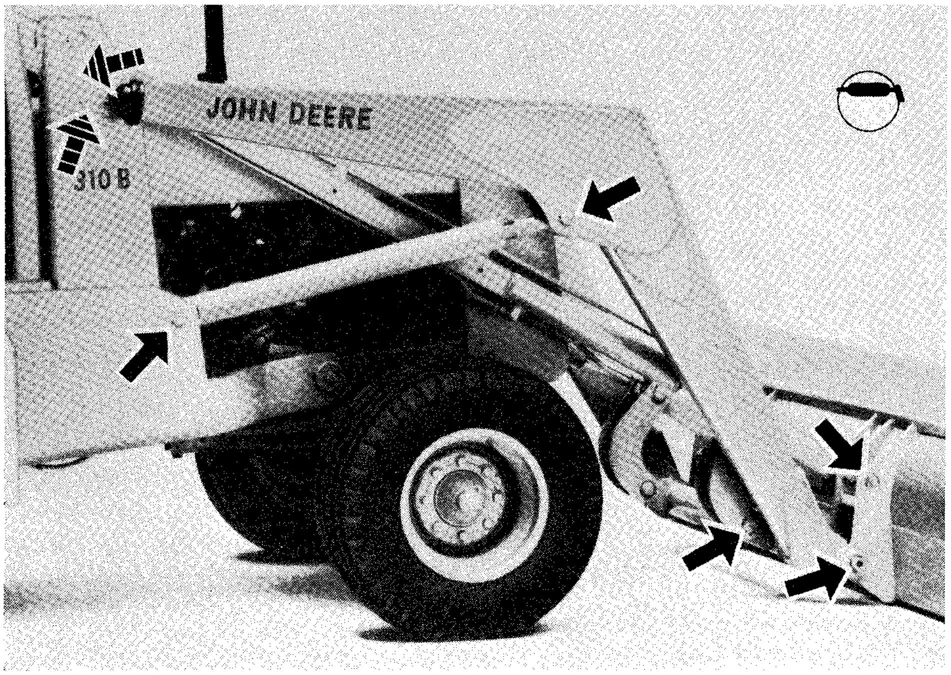
A—Bearing Strips **B—Drain Port**

Fig. 62-Bearing Strips and Drain Port (Extendible Dipperstick)

Clean bearing strips. Tighten and stake screws (-368874). Lubricate strips with Digmor Special Lube (dry film).

Be sure drain port is clean.

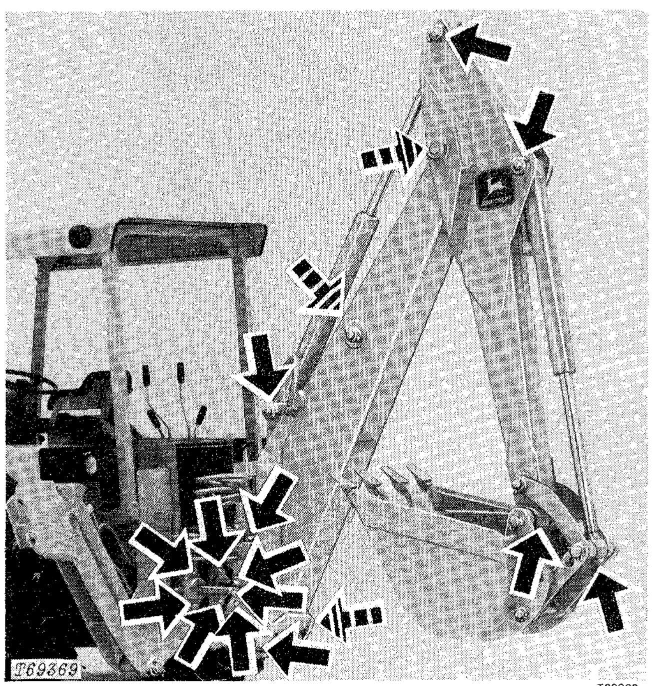
Lubrication required *Yes* *No*



T84884

Fig. 63-Loader (14 points)

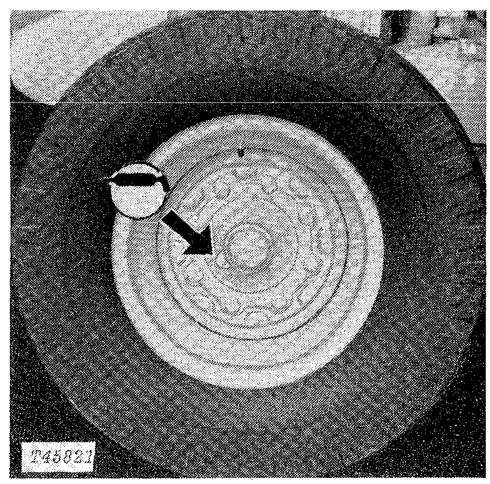
Lubrication required Yes No



T69369

Fig. 64-Backhoe (23 points)

Lubrication required Yes No



T45821

Fig. 65-Front Wheel Bearing (2 points)

If lubrication is needed, remove pipe plug from each front wheel. Install grease fittings.

Lubrication required Yes No

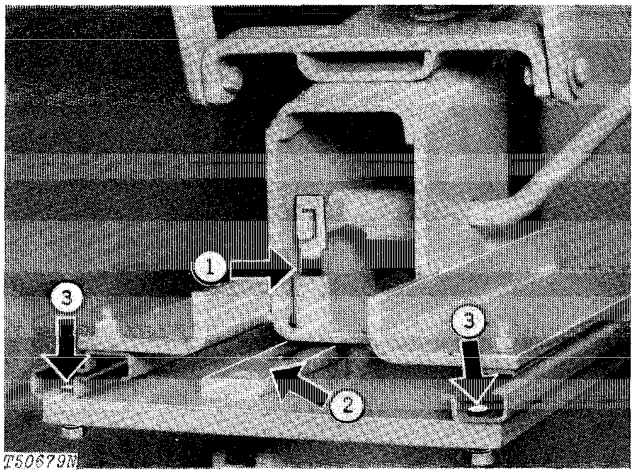


Fig. 66-Seat Lubrication

1 - Lubricate swivel locking pin with engine oil.

2 - Lubricate locking pin slide plate with John Deere Multi-Purpose Grease or equivalent.

3 - Lubricate bearing contact areas—both ends of adjuster. Use John Deere Multi-Purpose Grease or equivalent.

Lubrication required *Yes* *No*

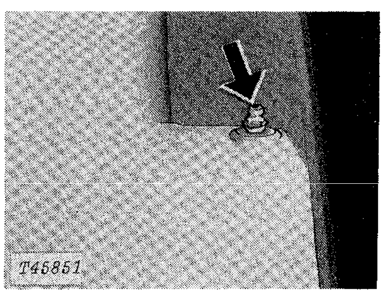


Fig. 67-Rear Axle Bearing (2 points)

Lubrication required *Yes* *No*

10. Air Intake Hose

Check clamps on hoses connecting air cleaner and engine. Tighten four hose clamps. Inspect hoses for cracks.

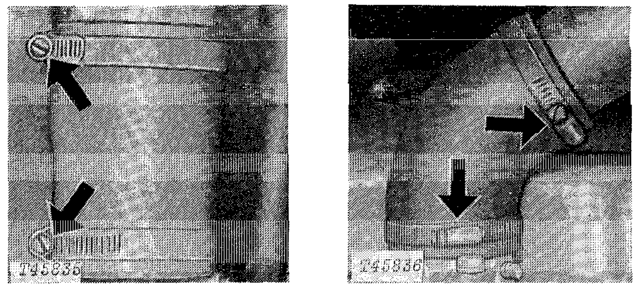


Fig. 68-Air Intake Hose Connections

Air intake hose checked *Yes* *No*

11. Belt Tension

Check the tension of the alternator-fan belt.

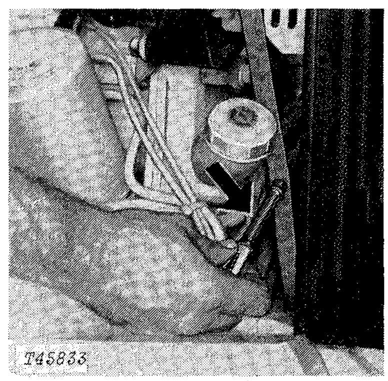


Fig. 69-Checking Tension With Tension Tester

Tension Tester

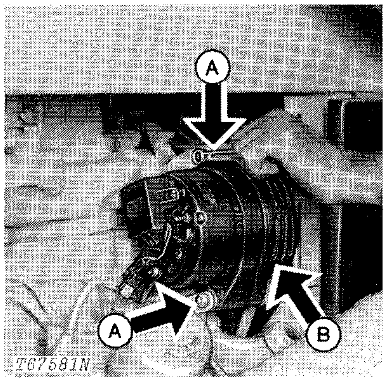
A 20 lb. (89 N) force halfway between pulleys must move the belt 3/4 in. (19 mm).

Strand Tension Gauge

Tighten a new fan belt to 135 lb. (601 N) and a used belt to 90 lb. (391 N).

Immediately after stopping the engine (run the engine 5 minutes or more), check the belt tension. If tension is less than 50 lb. (223 N), wait ten minutes. Then change tension to 90 lb. (391 N).

If adjustment is needed, loosen cap screws (A, Fig. 70).



T67581N

A—Cap Screws
B—Front Alternator Housing

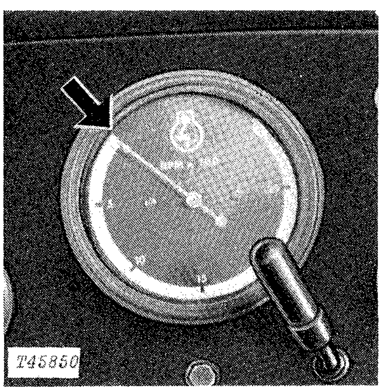
Fig. 70-Changing Belt Tension

IMPORTANT: To tighten the alternator-fan belt, apply outward force to the FRONT alternator housing (B) ONLY.

Tighten the cap screws.

Belt tension checked *Yes* *No*

12. Engine Speeds

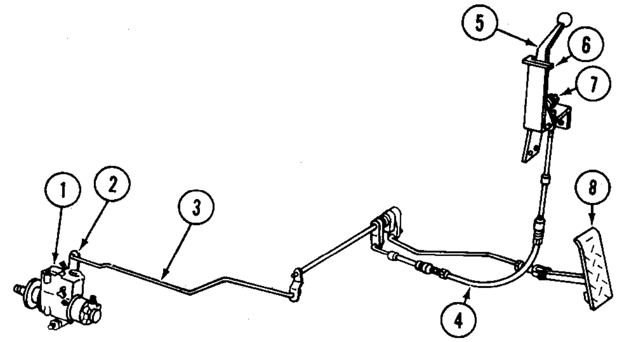


T45850

Fig. 71-Tachometer

Warm up the engine. Use the tachometer to check speeds.

If engine speeds need adjustment, follow the procedure below.



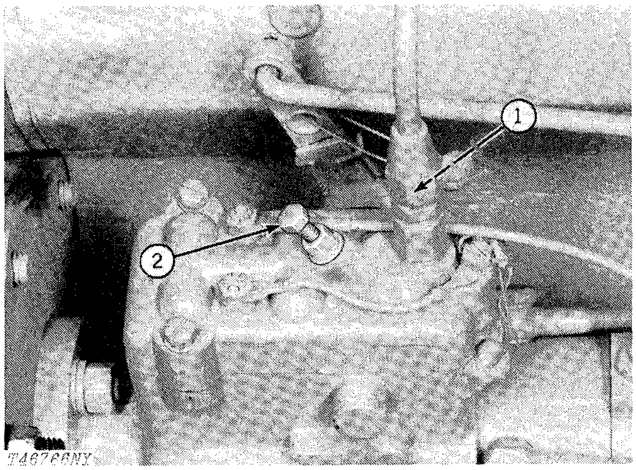
T67582N

1—Injection Pump
2—Throttle Lever
3—Speed Control Rod
4—Push-Pull Cable
5—Throttle Lever
6—Throttle Stop
7—Stop Nut
8—Accelerator Pedal

Fig. 72-Speed Control Adjustments

Disconnect the speed control rod (3) from the throttle lever (2). Run the engine. Move the throttle lever to the rear until it is against the stop. Fast idle must be 2650 ± 25 rpm.

ENGINE RPM			
Throttle Position	**Throttle**	**Load RPM**	**No Load Idle RPM**
Rearward to stop	Hand	....	800 rpm
Forward past intermediate stop	Hand	2500 rpm	2650 rpm
Pedal down	Foot	....	2800 rpm



T46766NY

1—Fast Idle Stop Screw **2—Slow Idle Stop Screw**

Fig. 73-Idle Adjustments

If not, turn the fast idle stop screw (1, Fig. 73) to make the correct adjustment.

Move the throttle lever forward to the slow idle position. Slow idle must be 800 rpm. If not, turn the slow idle stop screw (2, Fig. 73) to make the correct adjustment.

Connect the speed control rod (3, Fig. 72). Move the throttle lever (5, Fig. 72) completely forward. Fast idle must be 2650 rpm. If not, turn the swivel on the push-pull cable (4, Fig. 72) to make the correct adjustment.

Move the throttle lever (5, Fig. 72) completely to the rear. Slow idle must be 800 rpm with a small preload.

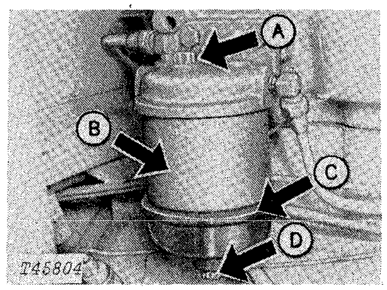
Move the throttle lever (5, Fig. 72) against the throttle stop (6, Fig. 72). Engine rpm must be 2200. If not, loosen the two cap screws on the stop. Slide the stop to the desired position. Tighten the cap screws.

Adjust the accelerator pedal (8, Fig. 72) so that the fast idle override on the pump lever is preloaded to 1/8 to 1/4 inch (3 to 6 mm) when the pedal is against the platform.

Fasten a spring scale to the throttle lever (5, Fig. 72) under the knob. Approximately 10 lb. (45 N) force must move the lever. Turn the stop nut (7, Fig. 72) to change the adjustment.

Engine speeds checked *Yes* *No*

13. Fuel Filter



T45804

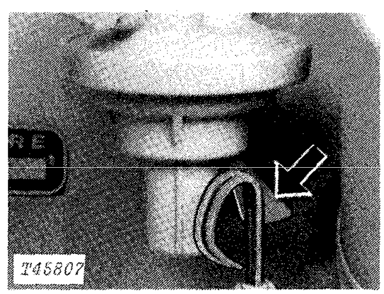
A—Bleed Plug **C—Sediment Bowl**
B—Filter Element **D—Drain Plug**

Fig. 74-Fuel Filter (-382507)

Check the fuel filter for sediment. Drain if necessary. Loosen the drain plug (D) (-382507). Drain liquid for several seconds. Tighten the plug.

Units with S.N. (382508-) are equipped with a glass enclosed fuel filter with drain plug located in lower left corner of filter housing.

NOTE: If the sediment bowl and filter are completely drained, remove air from the fuel system. Follow the procedure below.



T45807

Fig. 75-Primer Lever

Loosen the bleed plug (A, Fig. 74) (-382507). Bleed plug (382508-) is located in upper right corner of filter housing. Work the primer lever (Fig. 75) until fuel free from bubbles comes from the plug. Tighten the plug.

Sediment bowl checked *Yes* *No*
Air removed from fuel system *Yes* *No*

14. Indicator Lights and Gauges

Check operation of indicator light.

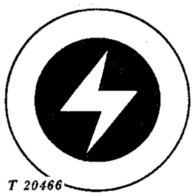


Fig. 76-Alternator Indicator Light

This light glows when the alternator is not charging. If the light goes on when the engine is running, stop the engine. Find the cause. The light will go on when key is in start position and engine off.

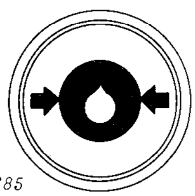


Fig. 77-Engine Oil Pressure Indicator Light

This light will go on when the crankcase oil level is low or when the oil pressure is low. When the light goes on, stop the engine. Check the engine oil level. If oil level is not low, check for restrictions or incorrect type of oil.

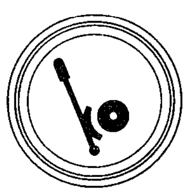
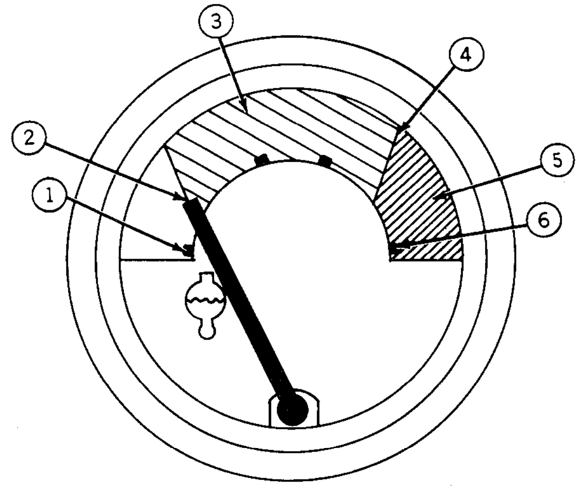


Fig. 78-Parking Brake Indicator Light

This light will go on when the parking brake is engaged and the key switch is on.

Check the operation of the gauges.



1—100°F (38°C)
2—135°F (57°C)
3—Light Green
4—224°F (107°C)
5—Red - Orange
6—240°F (116°C)

Fig. 79-Engine Coolant Temperature Gauge

The light green zone (3) shows the normal operating temperatures.

IMPORTANT: If the indicator hand goes into the RED-ORANGE ZONE (5), stop the engine. Find the cause.

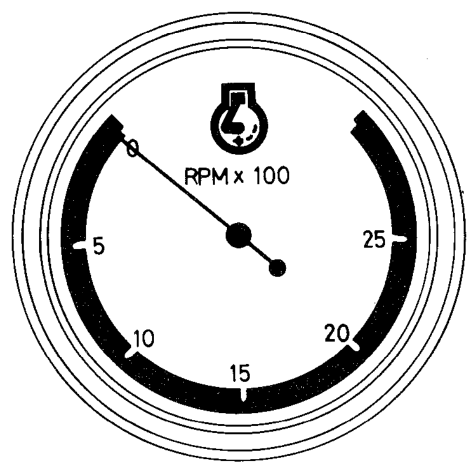
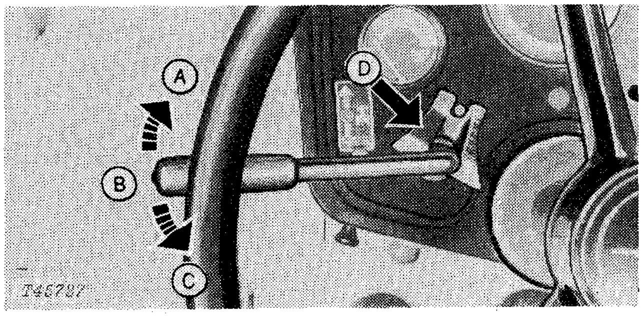


Fig. 80-Tachometer

The tachometer shows engine rpm.

Indicator lights and gauges checked *Yes* *No*

15. Reverser



T45727

A—Forward
B—Neutral
C—Reverse
D—Neutral Lock

Fig. 81-Reverser Lever

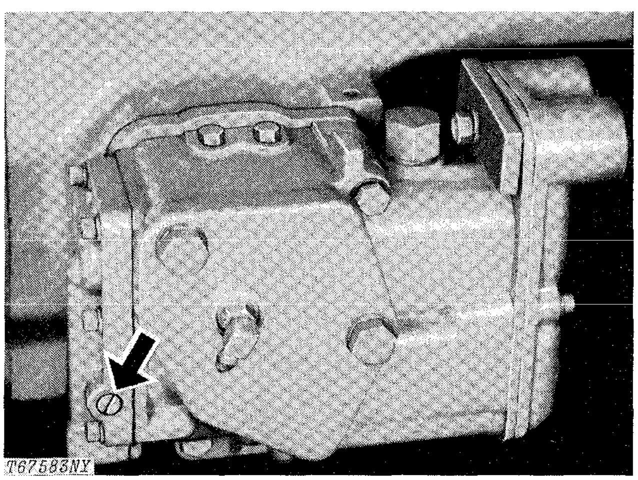
Move the reverser lever to change the direction of travel in any gear while moving without using the clutch or shift levers.

IMPORTANT: DO NOT change direction at high speeds.

DO NOT operate the backhoe with the reverser lever in reverse position.

To change the shifting speed of the reverser, follow the procedure below.

Make the shifting speed as rapid as possible without a jerky motion.



T67583NY

Fig. 82-Adjusting Screw

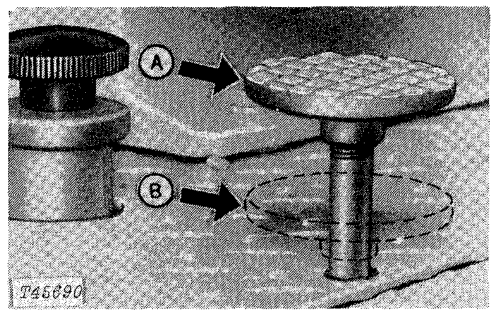
The reverser speed-of-shift adjusting screw is on the rear of the reverser control housing under the right foot-rest.

Turn the adjusting screw clockwise to slow down the shift. Turn the screw counterclockwise to speed up the shift. Turn the screw one-fourth turn at a time until the desired speed-of-shift is obtained.

NOTE: When the reverser speed-of-shift screw is adjusted correctly, the total time for the shift must be 3/4 to 1-1/4 seconds.

Reverser checked	*Yes*	*No*
Adjustment changed	*Yes*	*No*

16. Differential Lock



T45690

A—Disengaged
B—Engaged

Fig. 83-Differential Lock Pedal

Check differential lock operation.

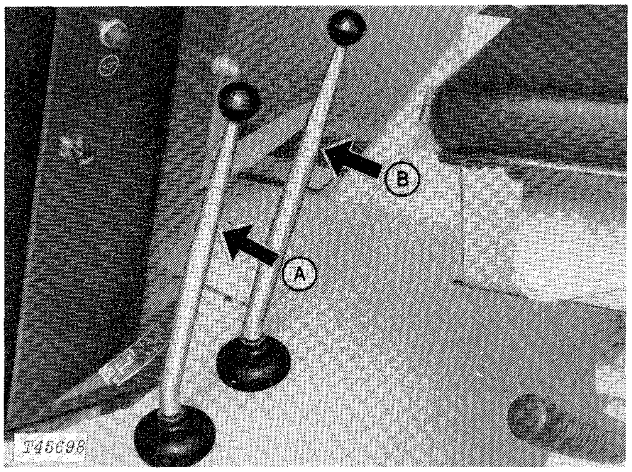
1. Extend one stabilizer to lift one rear wheel off the ground.

2. Stop the engine. Engage the differential lock (push the pedal down).

3. Attempt to turn the raised wheel manually. If the differential lock is working correctly, the raised wheel will lock in place.

Differential lock checked	*Yes*	*No*

17. Transmission Shifting



T45698

1—Range Shift Lever **2—Gear Shift Lever**

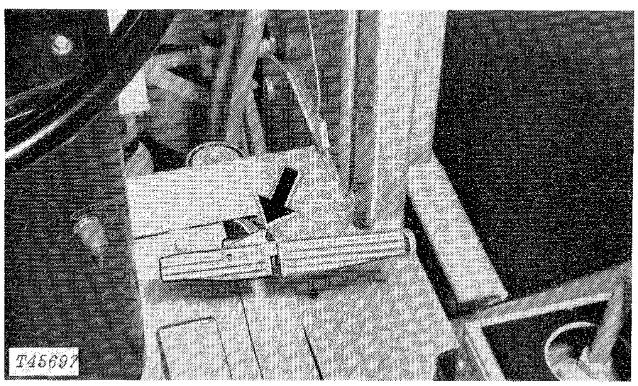
Fig. 84-Transmission Shift Levers

Check operation of the transmission in all ranges and gears.

Transmission checked *Yes* *No*

18. Brakes

Check the operation of the hydraulic brakes.



T45697

Fig. 85-Brake Pedals Connected

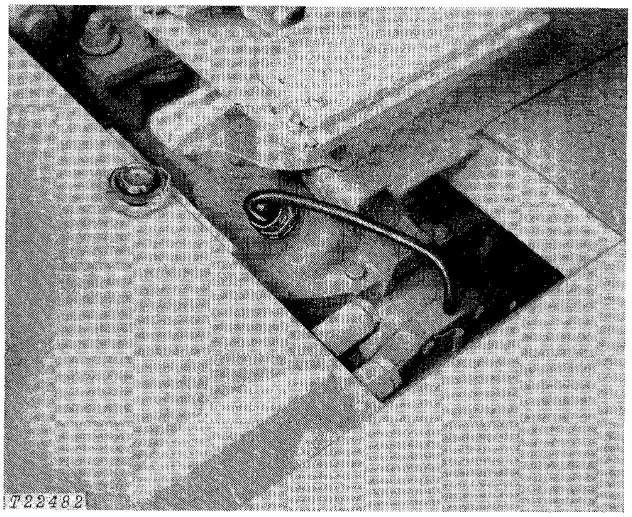
Put the backhoe loader in gear. Push down the brake pedal. Moderate pedal force must hold the machine in place.

Remove air from the brake system:

1. If moderate pedal force does not hold the machine in place.
2. If the pedal feels spongy.
3. If the pedal has too much travel.

Removing Air from the Brake System

Run the engine for approximately two minutes to allow the transmission lubricating system to fill brake valve reservoir (clutch engaged and engine at fast idle).



T22482

Fig. 86-Removing Air from Brake System

Attach a clear plastic bleeder tube to a brake bleed screw (located on top of axle shaft housing) and insert the tube in the transmission filler hole on rear of rock-shaft housing.

Open bleed screw.

Press brake pedal on brake being bled. Close screw before returning pedal.

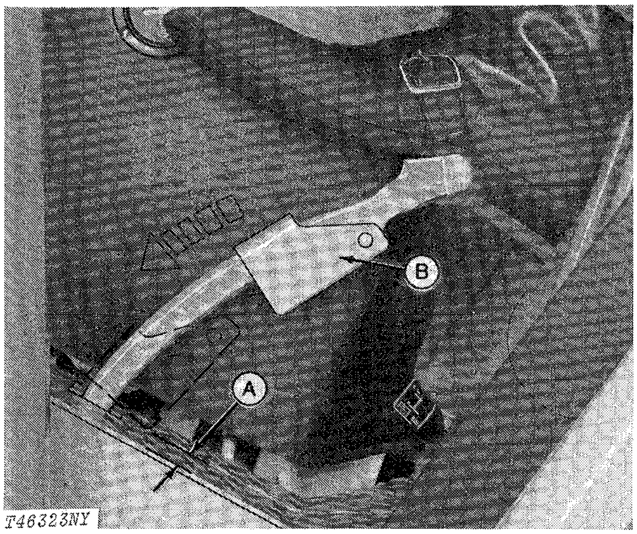
Continue this operation until oil in tube is free of air bubbles.

Never allow brake pedal to return sharply, permitting brake valve piston to release quickly, as damage to valve parts may occur before brakes are completely adjusted.

With brake pedal depressed, close bleed screw. Remove bleeder tube and repeat bleeding operation on other brake.

Brakes checked *Yes* *No*
Air removed from brake system *Yes* *No*

19. Clutch



A—0.75 in. (19 mm) Maximum Clearance

B—Clutch Pedal Stop

Fig. 87-Clutch Pedal Adjustment

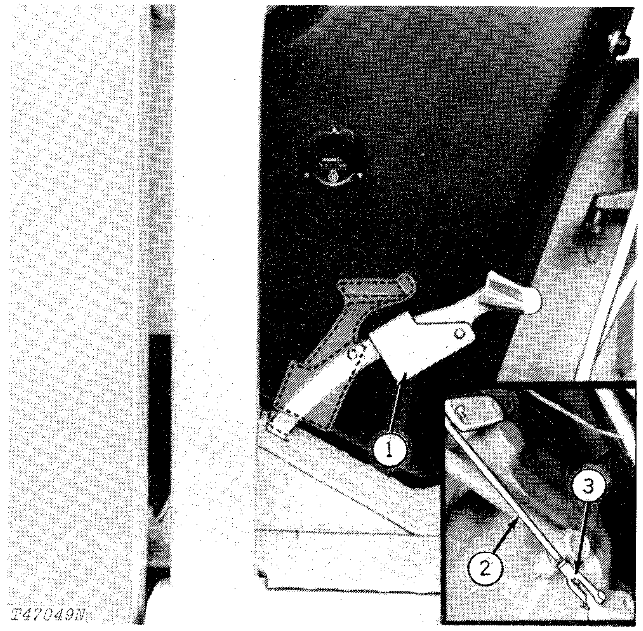
Check the clutch pedal adjustment.

Put the clutch pedal stop down. Push down the clutch pedal until the throwout bearing contacts the clutch fingers.

Clearance between the platform and the stop must not be greater than 0.75 in. (19 mm).

If adjustment is needed, follow the procedure below.

Push the clutch pedal down until the pedal stop (1, Fig. 88) hits the platform. Turn the yoke (3) on the clutch fork shaft rod (2) until the throw-out bearing contacts the clutch fingers. Then make the clutch fork shaft rod shorter by turning the yoke 2-1/2 turns.



1—Clutch Pedal Stop

2—Clutch Fork Shaft Rod

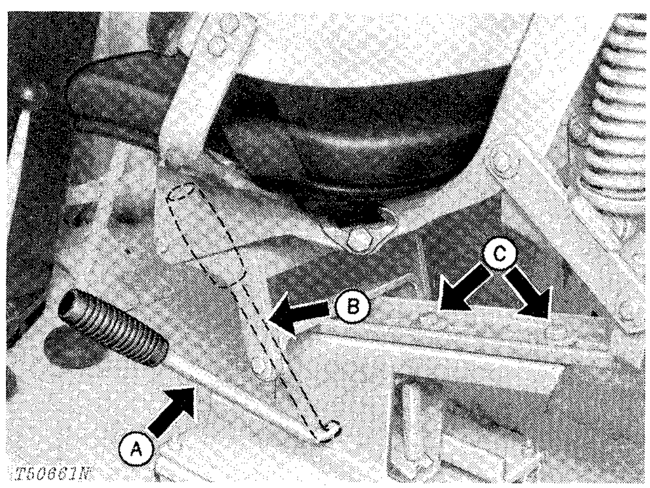
3—Yoke

Fig. 88-Adjusting Clutch Pedal Free Play

Clutch checked	*Yes*	*No*
Adjustment changed	*Yes*	*No*

20. Seat

Check the operation of the seat.



A—Seat Control Handle Locked

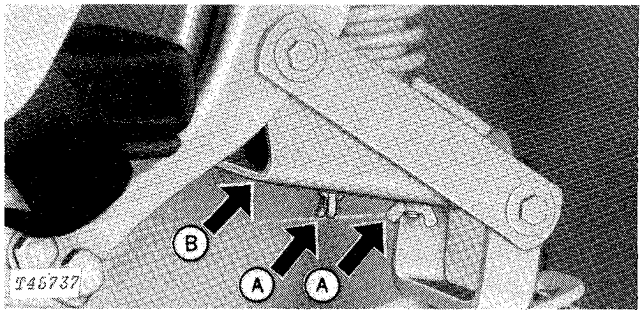
B—Seat Control Handle Unlocked

C—Height Adjustment

Fig. 89-Seat Control and Adjustment

To move the seat for loader or backhoe operation:
1. Lift the seat control handle (B, Fig. 89).
2. Slide the seat forward or to the rear.
3. Turn the seat 180°.
4. Release the handle (A). Seat must lock in place.

To change the height of the seat:
1. Loosen cap screws (C, Fig. 89).
2. Slide the seat to the desired position.
3. Tighten the cap screws.

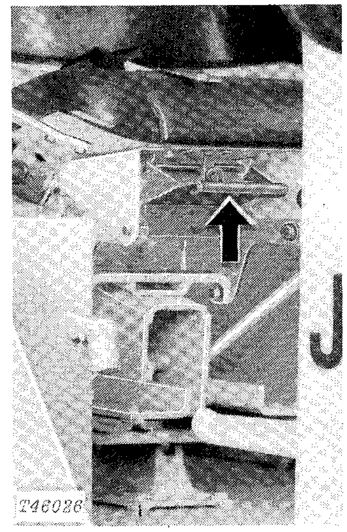


T45737

A—Wing Nuts **B—Slide**

Fig. 90-Ride Adjustment

To change the ride adjustment.
1. Move seat to the upper rear position. See step 1 under Fig. 91.
2. Loosen wing nuts (A).
3. Move the slide to the desired position.
4. Tighten wing nuts.
5. Move seat to normal position. Seat must lock in position when you sit on it.



T46026

Fig. 91-Seat Release Latch

To move the seat to the upper rear position:
1. While seated, lift the latch.
2. Move the seat to the upper rear position.
3. When moving seat forward to normal position, stay in one seat.

Seat checked *Yes* *No*

21. Accumulator

Check the accumulator action.

Run the engine five to ten minutes. Stop the engine. The steering wheel must turn easily until all hydraulic pressure is released.

If the steering wheel cannot be turned immediately after stopping the engine, the accumulator needs repair.

CAUTION: The accumulator is charged with nitrogen gas under high pressure. When servicing accumulator, see Group 2160.

Accumulator checked *Yes* *No*

22. Power Steering

Check the operation of the power steering. Start the engine. The steering wheel must turn easily in both directions.

Number of turns:
Far left to far right 3
Far right to far left 2-3/4

Check lines and cylinders for leakage.

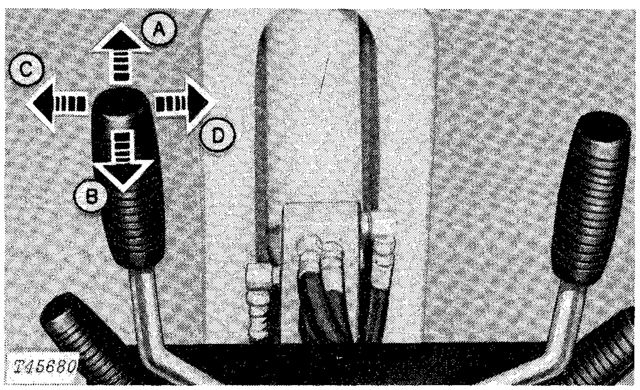
Power steering checked *Yes* *No*

23. Backhoe Controls

Check the operation of the backhoe controls.

CAUTION: Do not operate backhoe controls unless you are in the operator's seat facing the backhoe.

IMPORTANT: Do not operate the backhoe with the reverser lever in the reverse position.

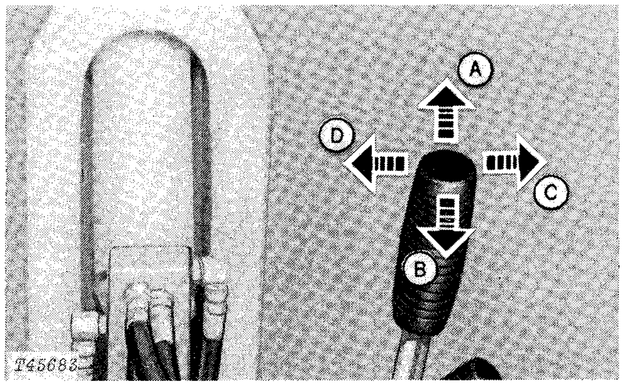


A—Lower Boom **C—Boom Left**
B—Raise Boom **D—Boom Right**

Fig. 92-Boom Control Lever

Move the lever to one of the intermediate positions to swing the boom left or right at the same time it is being raised or lowered.

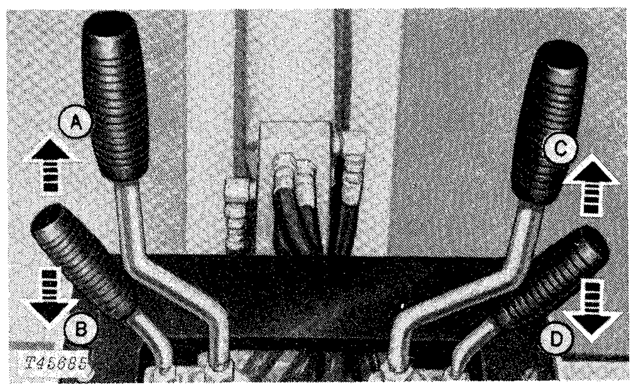
A swing brake automatically slows the boom before it hits the stops on the main frame.



A—Dipperstick Out **C—Dump Bucket**
B—Dipperstick In **D—Retract Bucket**

Fig. 93-Bucket and Dipperstick Control Lever

Move the lever to one of the intermediate positions to extend or retract the dipperstick at the same time the bucket is being loaded or dumped.



A—Left Stabilizer Down **C—Right Stabilizer Down**
B—Left Stabilizer Up **D—Right Stabilizer Up**

Fig. 94-Stabilizer Control Levers

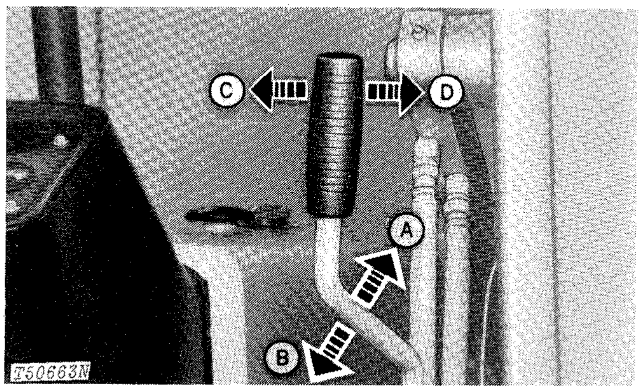
The stabilizers can be raised or lowered one at a time or together.

Backhoe controls checked *Yes* *No*

24. Loader Control Lever

Check the operation of the loader control lever.

CAUTION: Do not operate the loader control lever unless you are in the operator's seat facing forward.



T50663N

A—Lower Boom
B—Raise Boom
C—Retract Bucket
D—Dump Bucket

Fig. 95-Boom and Bucket Control

For faster cycle times, move the lever to intermediate position.

Move the lever farther to dump or retract the bucket faster.

After dumping the bucket, return the control lever immediately to neutral position.

If the lever is released during normal loader operation, it will return to neutral and the boom will be held in position.

Push the control lever all the way forward for float position. The lever will stay in this position until it is manually returned to neutral.

Loader control checked *Yes* *No*

25. Cycle Times

Check backhoe and loader hydraulic function cycle times.

NOTE: Operate each hydraulic control function until all air has been removed from the hydraulic system. Check for freedom of movement of all controls and proper direction of travel before checking cycle times.

Use the following times as a guide. If cycle times vary greatly from those listed, trouble shoot the hydraulic system. Check cycle times when oil is warm.

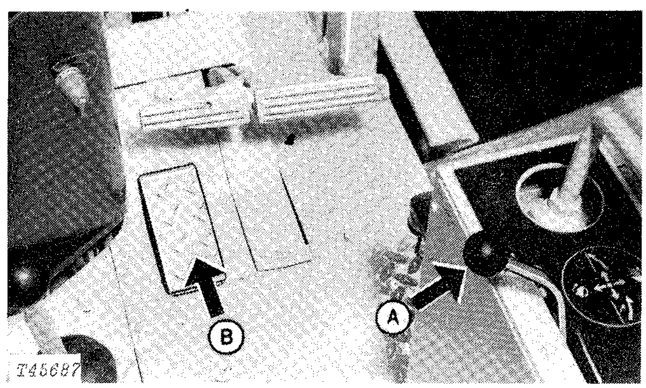
Loader (engine at full throttle)	**Seconds**
Boom lower	2.9 max.
Boom lower (control lever in float position	3.5 max.
Boom raise	4.3 max.
Bucket dump (boom at full height)	1.8 max.

9405 Backhoe (engine at 2500 rpm)	
Bucket cylinder retract	2.5 max.
Bucket cylinder extend	3.5 max.
Swing left (180°)	3.0 - 5.0
Swing right (180°)	3.0 - 5.0

Cycle times checked *Yes* *No*

26. Speed Controls

Check the operation of the accelerator pedal and the hand throttle.



T45687

A—Hand Throttle
B—Accelerator Pedal

Fig. 96-Speed Controls

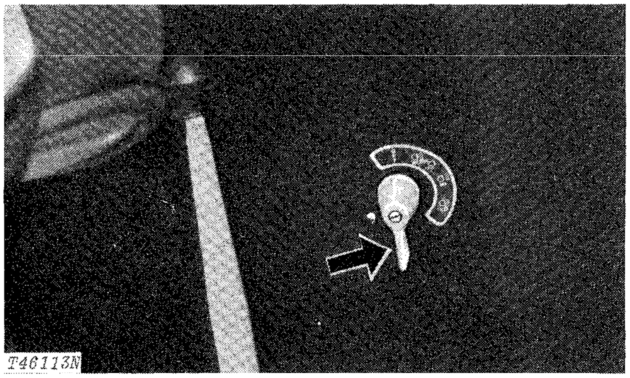
Check hand throttle lever for freedom of movement.

Use the accelerator pedal to speed up the engine quickly. When the pedal is released, the engine speed will go back to the hand throttle setting.

Speed controls checked *Yes* *No*

27. Lights

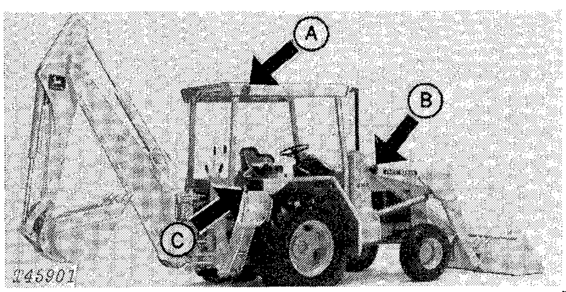
Check the operation of the lights and light switch.



T46113N

Fig. 97-Light Switch

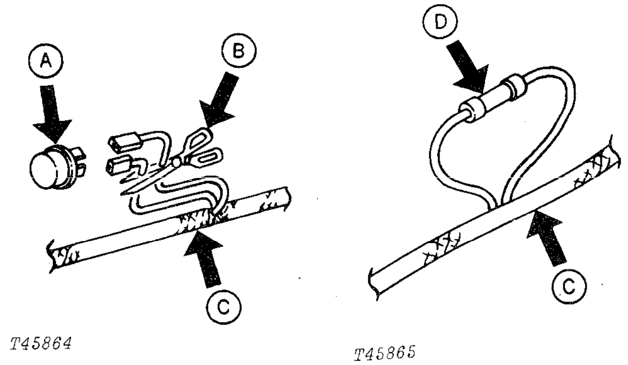
Switch Position	Lights On
Off	All lights off
Work	B (bright) and C (white)
Hi	A, B (bright) and C (red)
Lo	A, B (dim) and C (red)



T45901

A—Warning Lamps
B—Head Lights
C—Rear Combination Lights

Fig. 98-Backhoe Loader Lights



T45864 T45865

Fig. 99-Disconnecting Flashing Unit

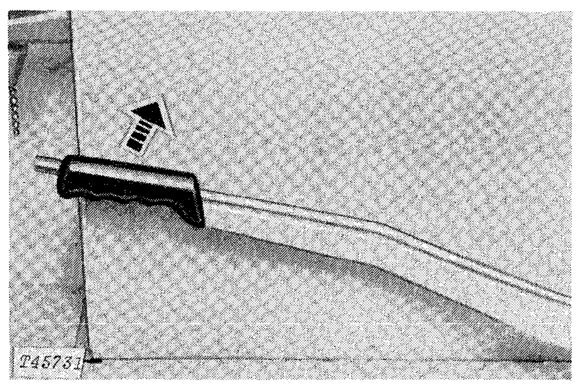
NOTE: If flashing lights are prohibited by local regulations:

A - Disconnect flasher unit.
B - Cut off both female connectors on wiring lead from lamp circuit.
C - Connect using R32028R Splice Terminal (D) (for 10-12 gauge wire) or equivalent.

Lights and light switch checked Yes No

28. Parking Brake

Check the operation of the parking brake.



T45731

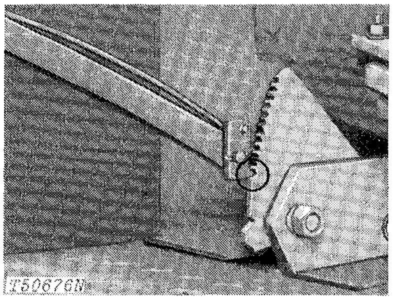
Fig. 100-Parking Brake

1. To engage, pull up the lever until firm resistance is felt. The brake latch must be approximately in the center notch. If not, see page I-IV-33 for adjustment.

2. To disengage, lift the lever slightly and push the button. Push the lever down and release the button.

NOTE: The parking brake warning light will glow when the key switch is on and the parking brake is engaged. The horn will blow also if the transmission is shifted from neutral when the parking brake is engaged.

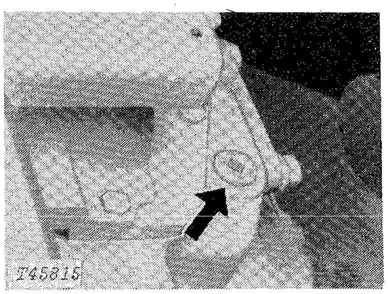
If parking brake needs adjustment, follow the procedure below.



T50676N

Fig. 101-Lever in First Notch

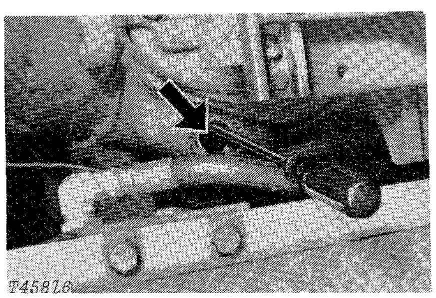
Before adjusting parking brake, set brake lever so pawl is in first notch above long tooth (Fig. 101).



T45815

Fig. 102-Brake Band Plug

1 - Remove plug (Fig. 102) from top left side of transmission case.

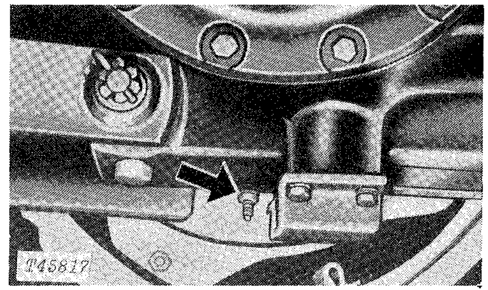


T45816

Fig. 103-Tightening Set Screw

2 - Using a screwdriver, tighten the brake band set screw (slotted screw) (Fig. 103) by hand until it is not possible to turn screw another complete half turn. Final position of screw must have concave surface of screw head mating with surface of pivot pin.

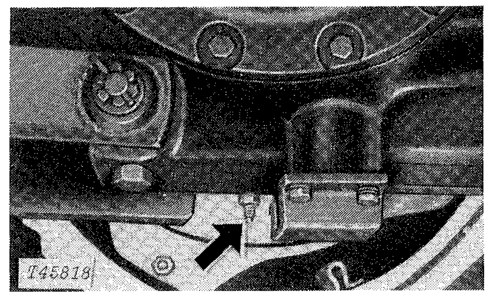
3 - Install and tighten plug.



T45817

Fig. 104-Lock Nut

4 - Loosen lock nut (located on bottom left side of transmission case) (Fig. 104).



T45818

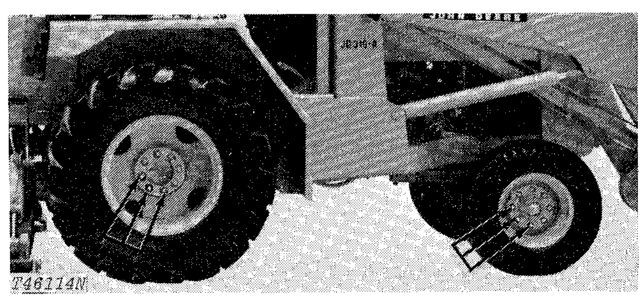
Fig. 105-Set Screw

5 - Tighten brake band set screw (Fig. 105). Back it off two turns.

6 - Tighten lock nut.

Parking brake checked	*Yes*	*No*
Adjustment changed	*Yes*	*No*

29. Wheel Retainers



T46114N

Fig. 106-Wheel Retainers

Check wheel retainer cap screw torque.

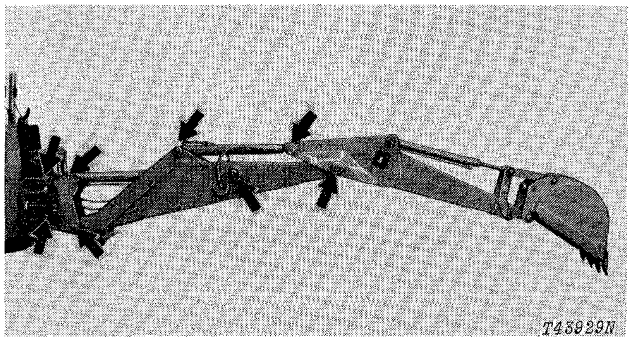
Tighten front wheel retainers to 100 lb-ft (136 N·m) (14 kg-m).

Tighten rear wheel retainers to 425 lb-ft (576 N·m) (60 kg-m).

Wheel retainer torque checked	*Yes*	*No*

30. Backhoe Tapered Pins

Check the torque on the backhoe tapered pins.



T43929N

Fig. 107-Backhoe Tapered Pins

Use the torque chart on page I-II-1. If pins need to be tightened, follow the procedure below.

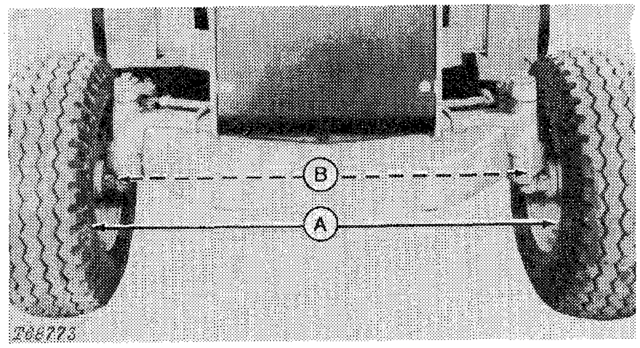
A. Tighten to one-half the specified torque.
B. Shock both wedge bushings with a brass, lead, or aluminum hammer.
   1. If the washers are accessible and large enough, hit both washers three places.
   2. If the washers are not accessible or are too small to hit directly, place a spacer over the bolt head or bolt nut and hit the spacer three times. Do not hit the bolt or nut.
C. Tighten bolt(s) to full torque shown on the torque chart.
D. Repeat Step B.
E. Check torque.
F. Repeat Steps C and B alternately until shocking the assembly does not reduce the torque reading on the bolts.
G. Recheck for centered position.

Tapered pins checked *Yes* *No*

31. Toe-In

Check the front wheel toe-in.

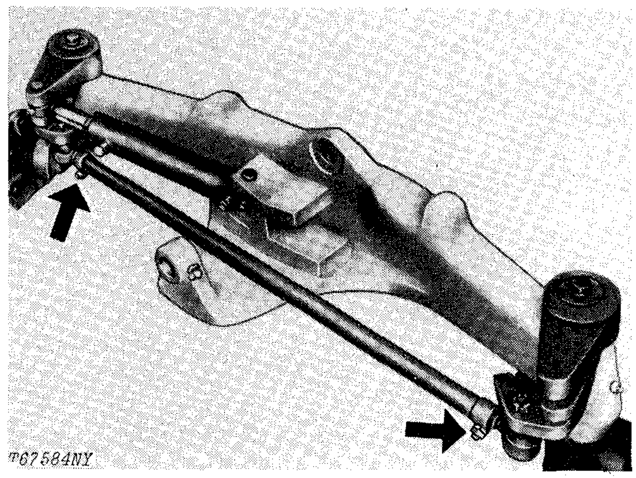
1. Use down pressure of loader bucket to raise front wheels. Turn wheels so each valve stem is at bottom of the wheel.
2. Lower wheels to ground.
3. Measure from the ground to hub.
4. Mark this distance on inside of each rim at the head of tire front and rear.
5. Measure distance between rims at front and rear marks.
6. Distance between front of rims must be 1/8 to 3/8 in. (3 to 9.5 mm) less than distance between rear of rims.



T68773

A—Distance Between Rims at Front **B—Distance Between Rims at Rear**

Fig. 108-Checking Toe-In



T67584NY

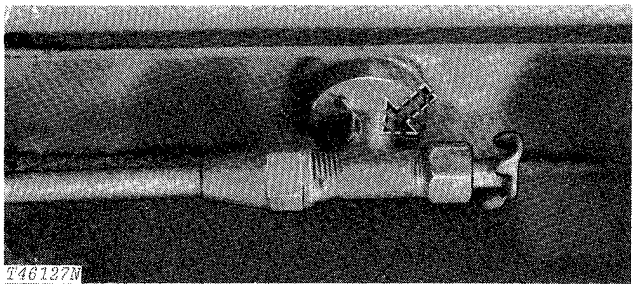
Fig. 109-Tie Rod Clamps

If adjustment is needed, loosen the clamps on each end of the tie rod. Turn the tie rod tube to make the correct adjustment. Turn the slots on the tube to the rear. Tighten the clamps to 40 lb-ft (54 N·m) (6 kg-m).

Toe-in checked *Yes* *No*

32. Fuel Tank Filter

Clean the fuel tank filter.



T46127N

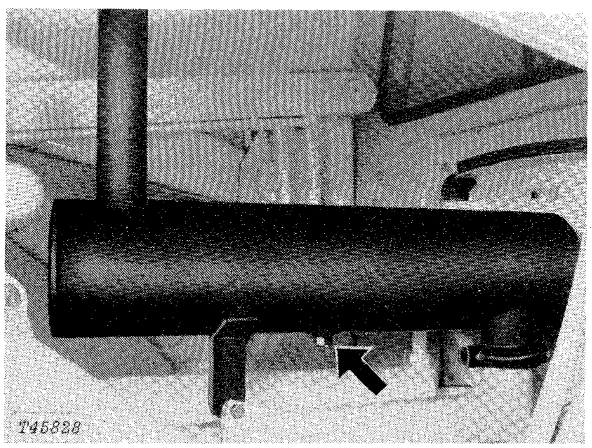
Fig. 110-Fuel Tank Filter

Drain the fuel tank. Close the valve and disconnect fuel line. Remove valve fitting and filter. Clean the filter in diesel fuel. Install the filter, valve, and connect fuel line. Open the valve.

Filter cleaned Yes No

33. Spark-Arresting Muffler

Clean debris from the muffler.



T45828

Fig. 111-Pipe Plug

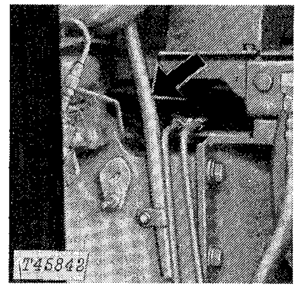
CAUTION: DO NOT remove pipe plug until engine is cool.

Remove pipe plug (Fig. 111) from muffler. Run the engine until dirt is cleaned out. Install the plug when engine is cool.

Muffler cleaned Yes No

34. Engine Crankcase Vent Tube

Clean the vent tube.



T45842

Fig. 112-Engine Crankcase Vent Tube

Remove the vent tube. Clean it with diesel fuel. Install the tube. Be sure the packing fits correctly in the tappet cover.

Crankcase vent tube cleaned Yes No

35. Accessible Hardware Torque

Check all accessible bolts and nuts for correct tightness. If hardware is loose, tighten it to the correct torque.

The table on page I-II-1 gives correct torque values for various bolts and cap screws. Tighten all hardware to standard torque unless a different torque is specified.

Most hardware used is high-strength (note dashes on nex. heads). The types of bolts and cap screws are identified by head markings as follows:

Plain Head: regular machine bolts and cap screws.

3-Dash Head: tempered steel high-strength bolts and cap screws.

6-Dash Head: tempered steel extra high-strength bolts and cap screws.

Machine bolts and cap screws 7/8-inch (22 mm) and larger are sometimes formed hot rather than cold, which accounts for lower torque.

All accessible hardware torqued	*Yes*	*No*

36. Fluid Leakage

Check the following systems for leakage due to poor or faulty connections and broken hoses or lines.

A. Cooling system checked	*Yes*	*No*
B. Hydraulic system checked	*Yes*	*No*
C. Transmission system checked	*Yes*	*No*
D. Fuel system checked	*Yes*	*No*

Group V
LUBRICATION

GENERAL INFORMATION

Below is a copy of the periodic service chart which is on the left side of the cowl. More detailed information needed for working on the backhoe loader is in the current 310A or 310B operator's manual.

Use the operator's manual and the periodic service chart as references when working on the backhoe loader. Tell your customer to thoroughly read the operator's manual before operating or working on the backhoe loader.

PERIODIC SERVICE CHART

REFER TO OPERATOR'S MANUAL FOR MORE DETAILED INFORMATION

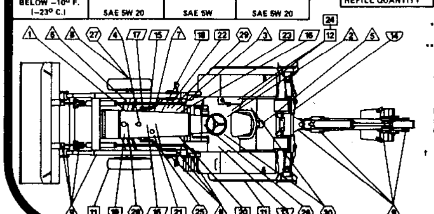
INTERVAL HOURS	ITEM NO.	COMPONENTS	SERVICE POINTS	DESCRIPTION OF SERVICE	CAPACITY OR MEASUREMENT	APPROVED SERVICE MATERIAL
10 OR DAILY	1	AIR CLEANER *	1	CHECK UNLOADER VALVE, RESTRICTION INDICATOR AND CLEAN ELEMENT AS REQUIRED	OPERATOR'S MANUAL	
	2	TRANSMISSION SYSTEM	1	CHECK OIL LEVEL	TO TOP MARK WITH DIPSTICK RESTING ON TOP OF FILLER TUBE	HY-GARD OR EQUIVALENT
	3	RADIATOR	1	CHECK COOLANT LEVEL, DRAIN AND REFILL - SPRING AND FALL	MIDWAY BETWEEN CORE AND FILLER NECK	OPERATOR'S MANUAL
	4	FUEL FILTER	1	REPLACE AS REQUIRED	OPERATOR'S MANUAL	
	5	SEAT	1	LUBRICATE SWIVEL LOCKING PIN, SLIDE PLATE AND ADJUSTERS	OPERATOR'S MANUAL	ENGINE OIL AND SAE-MPG
	6	FRONT AXLE AND STEERING CYLINDERS	6-JD310-A 8-JD410	LUBRICATE	SEVERAL SHOTS	SAE-MPG
	7	ENGINE CRANKCASE	1	CHECK OIL LEVEL	BETWEEN MARKS ON DIPSTICK	SEE OIL CHART
	8	FRONT WHEELS	2	SERVICE ONLY WHEN UNIT IS BEING OPERATED IN EXTREME WET AND MUDDY CONDITIONS	OPERATOR'S MANUAL	
	9	LOADER BACKHOE PIVOT POINTS **	†	LUBRICATE FITTINGS	2 SHOTS	SAE-MPG
	10	CAPSCREWS AND BOLTS		CHECK FOR TIGHTNESS	OPERATOR'S MANUAL	
50	11	TIRES	4	CHECK AIR PRESSURE	OPERATOR'S MANUAL	
	12	TRANSMISSION AND HYDRAULIC SYSTEM	2	REPLACE 2 FILTER ELEMENTS (BREAK-IN ONLY)	OPERATOR'S MANUAL	
100	13	BATTERY	1	CHECK ELECTROLYTE LEVEL AND TERMINALS	TO BOTTOM OF FILLER NECK. REMOVE ANY CORROSION	DISTILLED WATER
	14	LOCKING CYLINDER (9500)	2	LUBRICATE FITTINGS	1 SHOT OF GREASE	SAE-MPG
200	15	ENGINE CRANKCASE	2	DRAIN, REFILL AND REPLACE FILTER ELEMENT	SEE CHART BELOW	SEE OIL CHART JD FILTER
	16	ACCUMULATOR	1	CHECK ACTION	OPERATOR'S MANUAL	
	17	ALTERNATOR FAN BELT	1	CHECK TENSION	3/4 INCH (19 mm) FLEX WITH 20 LB. (89 N) FORCE	
500	18	SPARK PLUGS	4	CLEAN AND SET GAPS	OPERATOR'S MANUAL	
	19	AIR INTAKE HOSES	2	CHECK CONNECTIONS		
	20	CRANKCASE VENT TUBE	1	REMOVE AND CLEAN		DIESEL FUEL
	21	CARBURETOR STRAINER	1	CLEAN INLET STRAINER SCREEN		
	22	DISTRIBUTOR CAM POINTS TIMING	1	LUBRICATE CAM SET GAP CHECK TIMING	TRACE OPERATOR'S MANUAL OPERATOR'S MANUAL	CAM LUBRICANT OR HIGH TEMPERATURE GREASE
	23	REAR AXLE BEARINGS	2	LUBRICATE BEARINGS	8 SHOTS	SAE-MPG
	24	TRANSMISSION AND HYDRAULIC SYSTEM	2	REPLACE ELEMENTS	OPERATOR'S MANUAL	
1000	25	ENGINE VALVE TAPPETS	1	ADJUST CLEARANCE	OPERATOR'S MANUAL	OPERATOR'S MANUAL
	26	ENGINE SPEEDS	1	CHECK SPEEDS		
	27	FRONT WHEEL BEARINGS	2	CLEAN REPACK AND ADJUST	OPERATOR'S MANUAL	SAE-MPG
	28	MAIN HYDRAULIC PUMP	1	CLEAN STROKE CONTROL VALVE FILTER	SEE YOUR JOHN DEERE DEALER FOR THIS SERVICE	
	29	STARTER (DIESEL)	1	LUBRICATE WICKS	SATURATE WICKS	10W 20 OIL
	30	TRANSMISSION SYSTEM	2	DRAIN AND REFILL CLEAN INTAKE SCREEN	10 GAL. (38 l)	HY-GARD OR EQUIVALENT

ENGINE OIL

AIR TEMP.	JOHN DEERE TORQ GARD OIL	SINGLE VISCOSITY OIL API SERVICE CD/SD	MULTI VISCOSITY OIL API SERVICE CC/SD
ABOVE 32° F. (0° C.)	SAE 30	SAE 30	NOT RECOMMENDED
32° F. to −10° F. (0° C. to −23° C.)	SAE 10W 20	SAE 10W	SAE 10W 20 SAE 10W 30
BELOW −10° F. (−23° C.)	SAE 5W 20	SAE 5W	SAE 5W 20

CAPACITIES

ITEM	JD310-A U.S. MEASURE	JD310-A METRIC	JD410 U.S. MEASURE	JD410 METRIC
FUEL TANK	19.5 GAL.	74 l	19.5 GAL.	74 l
COOLING SYSTEM	12 QT.	11.5 l	13 QT.	12.5 l
ENGINE CRANKCASE	9 QT.	8.5 l	9 QT.	8.5 l
TRANSMISSION REFILL QUANTITY	10 GAL.	38 l	10 GAL.	38 l



*REPLACE ELEMENT ANNUALLY OR AS REQUIRED WITH JD FILTER
**LUBRICATE BUCKET PIVOT POINTS EVERY 5 HOURS UNDER ADVERSE CONDITIONS

WHEN BACKHOE LOADER IS USED DURING PREVAILING AIR TEMPERATURES BELOW −10° F. (−23° C.), CHANGE OIL AFTER EVERY 100 HOURS OF OPERATION OR EVERY 6 WEEKS OF INTERMITTENT OPERATION, WHICHEVER OCCURS FIRST.

† 14–LOADER
21–9405 BACKHOE
23–9410 BACKHOE
13–9500 BACKHOE

T46115N

T46115N

Fig. 1-310A Periodic Service Chart

PERIODIC SERVICE CHART

REFER TO OPERATOR'S MANUAL FOR MORE DETAILED INFORMATION

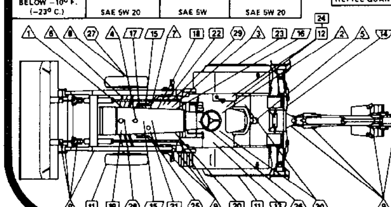
INTERVAL HOURS	ITEM NO.	COMPONENTS	SERVICE POINTS	DESCRIPTION OF SERVICE	CAPACITY OR MEASUREMENT	APPROVED SERVICE MATERIAL
10 OR DAILY	1	AIR CLEANER *	1	CHECK UNLOADER VALVE, RESTRICTION INDICATOR AND CLEAN ELEMENT AS REQUIRED	OPERATOR'S MANUAL	
	2	TRANSMISSION SYSTEM	1	CHECK OIL LEVEL	TO TOP MARK WITH DIPSTICK RESTING ON TOP OF FILLER TUBE	HY-GARD OR EQUIVALENT
	3	RADIATOR	1	CHECK COOLANT LEVEL, DRAIN AND REFILL - SPRING AND FALL	MIDWAY BETWEEN CORE AND FILLER NECK	OPERATOR'S MANUAL
	4	FUEL FILTER	1	REPLACE AS REQUIRED	OPERATOR'S MANUAL	
	5	SEAT	1	LUBRICATE SWIVEL LOCKING PIN, SLIDE PLATE AND ADJUSTERS	OPERATOR'S MANUAL	ENGINE OIL AND SAE-MPG
	6	FRONT AXLE AND STEERING CYLINDERS	6- 310B 8- 410	LUBRICATE	SEVERAL SHOTS	SAE-MPG
	7	ENGINE CRANKCASE	1	CHECK OIL LEVEL	BETWEEN MARKS ON DIPSTICK	SEE OIL CHART
	8	FRONT WHEELS	2	SERVICE ONLY WHEN UNIT IS BEING OPERATED IN EXTREME WET AND MUDDY CONDITIONS	OPERATOR'S MANUAL	
	9	LOADER BACKHOE PIVOT POINTS **	†	LUBRICATE FITTINGS	2 SHOTS	SAE-MPG
	10	CAPSCREWS AND BOLTS		CHECK FOR TIGHTNESS	OPERATOR'S MANUAL	
50	11	TIRES	4	CHECK AIR PRESSURE	OPERATOR'S MANUAL	
	12	TRANSMISSION AND HYDRAULIC SYSTEM	2	REPLACE 2 FILTER ELEMENTS (BREAK-IN ONLY)	OPERATOR'S MANUAL	
100	13	BATTERY	1	CHECK ELECTROLYTE LEVEL AND TERMINALS	TO BOTTOM OF FILLER NECK. REMOVE ANY CORROSION	DISTILLED WATER
	14	LOCKING CYLINDER (9500)	2	LUBRICATE FITTINGS	1 SHOT OF GREASE	SAE-MPG
200	15	ENGINE CRANKCASE	2	DRAIN, REFILL AND REPLACE FILTER ELEMENT	SEE CHART BELOW	SEE OIL CHART JD FILTER
	16	ACCUMULATOR	1	CHECK ACTION	OPERATOR'S MANUAL	
	17	ALTERNATOR FAN BELT	1	CHECK TENSION	3/4 INCH (19 mm) FLEX WITH 20 LB. (89 N) FORCE	
500	18	SPARK PLUGS	4	CLEAN AND SET GAPS	OPERATOR'S MANUAL	
	19	AIR INTAKE HOSES	2	CHECK CONNECTIONS		
	20	CRANKCASE VENT TUBE	1	REMOVE AND CLEAN		DIESEL FUEL
	21	CARBURETOR STRAINER	1	CLEAN INLET STRAINER SCREEN		
	22	DISTRIBUTOR CAM POINTS TIMING	1	LUBRICATE CAM SET GAP CHECK TIMING	TRACE OPERATOR'S MANUAL OPERATOR'S MANUAL	CAM LUBRICANT OR HIGH TEMPERATURE GREASE
	23	REAR AXLE BEARINGS	2	LUBRICATE BEARINGS	8 SHOTS	SAE-MPG
	24	TRANSMISSION AND HYDRAULIC SYSTEM	2	REPLACE ELEMENTS	OPERATOR'S MANUAL	
1000	25	ENGINE VALVE TAPPETS	1	ADJUST CLEARANCE	OPERATOR'S MANUAL	OPERATOR'S MANUAL
	26	ENGINE SPEEDS	1	CHECK SPEEDS		
	27	FRONT WHEEL BEARINGS	2	CLEAN REPACK AND ADJUST	OPERATOR'S MANUAL	SAE-MPG
	28	MAIN HYDRAULIC PUMP	1	CLEAN STROKE CONTROL VALVE FILTER	SEE YOUR JOHN DEERE DEALER FOR THIS SERVICE	
	29	STARTER (DIESEL)	1	LUBRICATE WICKS	SATURATE WICKS	10W 20 OIL
	30	TRANSMISSION SYSTEM	2	DRAIN AND REFILL CLEAN INTAKE SCREEN	10 GAL. (38 l)	HY-GARD OR EQUIVALENT

ENGINE OIL

AIR TEMP.	JOHN DEERE TORQ GARD OIL	SINGLE VISCOSITY OIL API SERVICE CD/SD	MULTI VISCOSITY OIL API SERVICE CC/SD
ABOVE 32° F. (0° C.)	SAE 30	SAE 30	NOT RECOMMENDED
32° F. to −10° F. (0° C. to −23° C.)	SAE 10W 20	SAE 10W	SAE 10W 20 SAE 10W 30
BELOW −10° F. (−23° C.)	SAE 5W 20	SAE 5W	SAE 5W 20

CAPACITIES

ITEM	310B U.S. MEASURE	310B METRIC	410 U.S. MEASURE	410 METRIC
FUEL TANK	19.5 GAL.	74 l	19.5 GAL.	74 l
COOLING SYSTEM	12 QT.	11.5 l	13 QT.	12.5 l
ENGINE CRANKCASE	9 QT.	8.5 l	9 QT.	8.5 l
TRANSMISSION REFILL QUANTITY	10 GAL.	38 l	10 GAL.	38 l



*REPLACE ELEMENT ANNUALLY OR AS REQUIRED WITH JD FILTER
**LUBRICATE BUCKET PIVOT POINTS EVERY 5 HOURS UNDER ADVERSE CONDITIONS

WHEN BACKHOE LOADER IS USED DURING PREVAILING AIR TEMPERATURES BELOW −10° F. (−23° C.), CHANGE OIL AFTER EVERY 100 HOURS OF OPERATION OR EVERY 6 WEEKS OF INTERMITTENT OPERATION, WHICHEVER OCCURS FIRST.

† 14–LOADER
21–9405 BACKHOE
23–9410 BACKHOE
13–9500 BACKHOE

T88012

Fig. 2-310B Periodic Service Chart

LUBRICANTS

Engine Oils

Use John Deere TORQ-GARD SUPREME® engine oil.

Use John Deere TORQ-GARD SUPREME SAE 10W-20 oil during the first 100 hours of operation for break-in.

Oils other than John Deere TORQ-GARD SUPREME must have the following specifications:

Single Viscosity Oils	Multi-Viscosity Oils
API Service CD/SD	API Service CC/SE
MIL-L-2104C	MIL-L-46152

OILS AND AIR TEMPERATURE

SAE ENGINE OILS			
Air Temperature	John Deere TORQ-GARD SUPREME Oil	Other Oils	
		Single Viscosity Oil	Multi-Viscosity Oil
Above 32°F (0°C)	30	30	Not recommended.
32° to -10°F (0° to -23°C)	10W-20	10W	10W-30
Below -10°F (-23°C)	5W-20	5W	5W-20

T80330

If you use SAE 5W-20 or SAE 5W oil, your engine may use more oil. Check the oil level often.

Storing and Handling Lubricants

Store lubricants in clean containers in an area protected from dust, moisture, and other contamination.

When you handle lubricants, use clean containers.

Transmission-Hydraulic Oils

Use John Deere Hy-GARD® Transmission and Hydraulic Oil (J20A) or an equivalent.

Greases

Use John Deere Multi-Purpose Grease or an equivalent for all grease fittings and wheel bearings.

Extendable Dipperstick

Use Digmor Special Lube (dry film) or equivalent.

Section 1
WHEELS

CONTENTS OF THIS SECTION

Group 0110
POWERED WHEELS AND FASTENINGS

GENERAL INFORMATION

Air in the tires should be kept at the following pressures:

16.9-24 8PR R-4 - 28 psi (1.9 bar) (193 kPa)
19.5-24 8PR R-4 - 24 psi (1.7 bar) (165 kPa)
19.5-24 12PR R-4 - 34 psi (2.3 bar) (234 kPa)

Check air pressure every day for the first few days and make sure valve cores and valve stem caps are tight.

Be careful when moving around, installing or taking apart the wheels to make sure the valve stems are not damaged. DO NOT attempt to drive, push, or pull the tractor with a tire on any of the wheels that is flat or does not have enough air.

REMOVAL

CAUTION: Use correct equipment when removing wheels to prevent injury.

Loosen cap screw (5, Fig. 2) before lifting wheels off the ground.

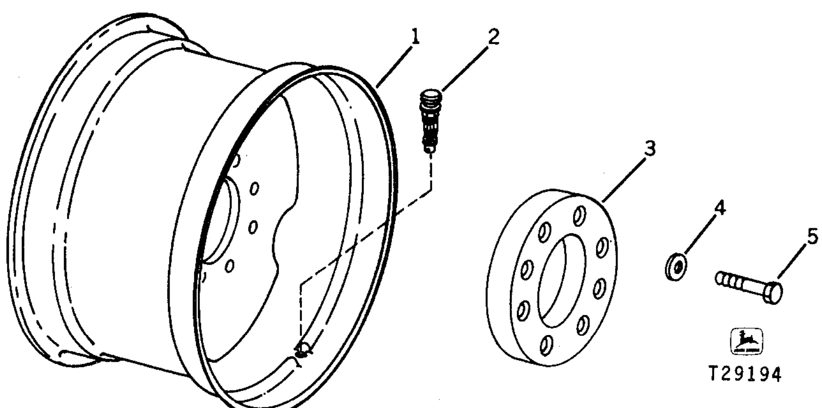
Lift unit and put support stands under axle.

T45486N

Fig. 1-Rear Wheel
(-284900)

Remove cap screws, washers and reinforcing ring.

Remove wheel from axle, being careful not to damage axle flange during removal. A D-05019ST Wheel Lift can be used as an aid to remove wheels.



T29194

1—Wheel
2—Valve Stem
3—Reinforcing Ring (-284900)
4—Special Washer (8 used)
5—Cap Screw (8 used)

Fig. 2-Steel Disk Rear Wheel

REPAIR

CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim, can produce an explosion which may result in serious bodily injury. DO NOT attempt to mount a tire unless you have the proper equipment and experience to perform the job safely. Have it done by your John Deere dealer or a qualified tire repair service.

NOTE: Refer to John Deere Off-The-Road Tire Maintenance Manual for dismounting and mounting tires.

Always completely deflate the tire by removing the valve core from valve (2, Fig. 2) before attempting any demounting operation. Check the valve stem by running a probe through it to make sure the valve stem is not plugged.

Inspect all parts for damage; replace parts as necessary.

INSTALLATION

Tire

Make sure all parts are clean and free from rust or grease before assembly.

To prevent slipping of the wheel under load, the inside and outside of wheel (1, Fig. 2) must be free of paint, rust, oil, grease, dirt or other foreign material before installation.

Install valve stem (2) in rim base and tighten valve core housing finger tight.

CAUTION: Serious bodily injury can occur from explosion when mounting and inflating tires if safe procedures are not followed.

Before mounting tire on rim, add soap lubricant to beads of the tire.

Clear the area of all persons.

Use a pressure regulating valve with clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of the tire while inflating.

Use only recommended air pressure. Pressure over this limit can cause an explosion.

Add air until side flange of tire slides out against the rim. (See page 0110-3 for tire pressures.)

Check air pressure in both drive tires with an accurate gauge having 1 psi (0.01 bar) (10 kPa) graduations. Be sure that tire pressures are equal for both drive tires.

Wheel

Thoroughly clean the cap screws, washers, and the tapped holes in the flanged axle. Use compressed air to dry all parts and tapped holes.

Install the wheel using a D-05019ST Wheel Lift.

Install and hand tighten cap screws (5, Fig. 2).

Lower the unit to the ground.

IMPORTANT: If a power wrench is used, be sure that the cap screws are engaged to prevent stripping. Operate the wrench slowly to prevent thread damage.

(For Serial No. (-284900), cross tighten cap screws to 175 + 25 or − 35 lb-ft (237 + 34 or − 47 N·m).

For Serial No. (284901-), cross tighten cap screws to 425 lb-ft (576 N·m).

Group 0120
NON-POWERED WHEELS AND FASTENINGS

GENERAL INFORMATION

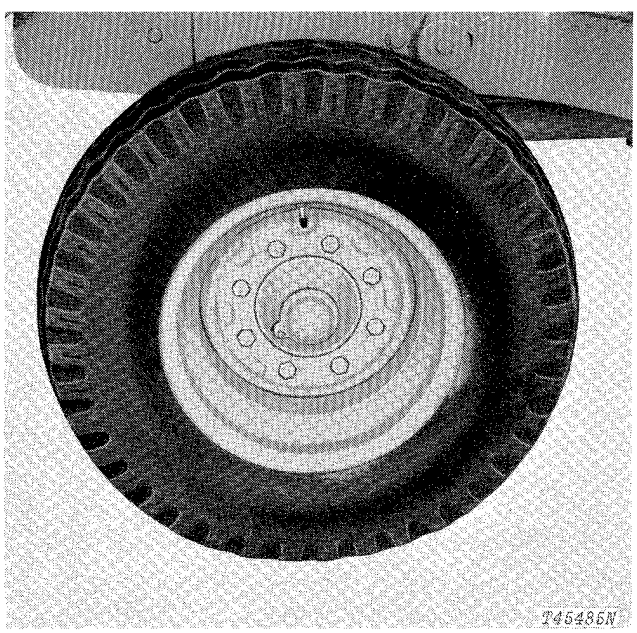
Air in the tires should be kept at the following pressures:

7.50/8.00-16 16PR F3	- 40 psi (2.8 bar) (276 kPa)
11L-15 8PR F3	- 44 psi (3 bar) (303 kPa)
11L-15 8PR F3 (with calcium chloride)	- 44 psi (3 bar) (303 kPa)

Check air pressure every day for the first few days and make sure valve cores and valve stem caps are tight.

The extended backhoe dipperstick requires calcium chloride to be used in the front tires. The amount of calcium chloride solution used per wheel is 14 gal. (53 L). The weight of the solution is 140 lbs. (63 kg).

Be careful when moving, installing, or repairing the wheels to make sure the valve stems are not damaged. DO NOT attempt to drive, push, or pull the tractor with a tire on any of the wheels that is flat or does not have enough air.



T45485N

Fig. 1-Front Wheel

REMOVAL

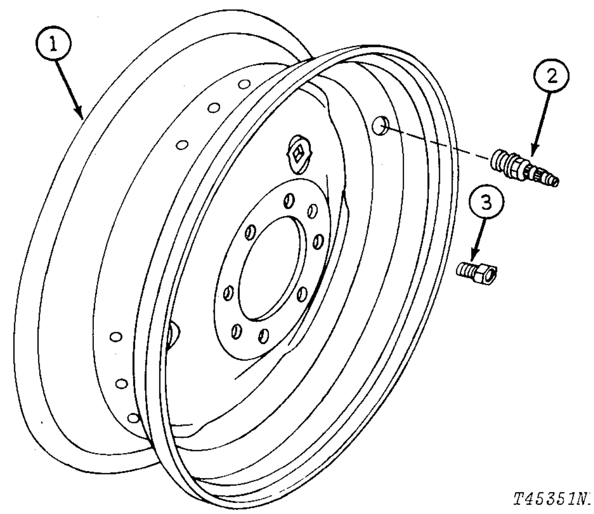
CAUTION: Use correct equipment when removing the wheels to prevent injury.

Loosen cap screws before lifting wheel off the ground.

Lift unit and put support stands under front axle.

Remove wheel bolts (3, Fig. 2).

Remove wheel from axle, being careful not to damage axle flange during removal.



T45351N

1—Front Wheel
2—Tubeless Tire Valve
3—Wheel Bolt

Fig. 2-Front Wheel Assembly

REPAIR

CAUTION: Failure to follow proper procedures when mounting a tire on a wheel or rim, can produce an explosion which may result in serious bodily injury. DO NOT attempt to mount a tire unless you have the proper equipment and experience to perform the job safely. Have it done by your John Deere dealer or a qualified tire repair service.

Always completely deflate the tire by removing the valve core from valve (2, Fig. 2) before attempting any demounting operation. Check the valve stem by running a probe through it to make sure the valve stem is not plugged.

Inspect all parts for damage; replace parts as necessary.

INSTALLATION

Tire

Make sure all parts are clean and free from rust or grease before assembly.

To prevent slipping of the wheel under load, the inside and outside of wheel (1, Fig. 2) must be free of paint, rust, oil, grease, dirt or other foreign material before installation.

Install valve (2) in rim base and tighten valve core housing finger tight.

CAUTION: Serious bodily injury can occur from explosion when mounting and inflating tires if safe procedures are not followed.

Before mounting tire on rim, add soap lubricant to beads of the tire.

Clear the area of all persons.

Use a pressure regulating valve with clip-on chuck and extension hose long enough to allow you to stand to one side and NOT in front of the tire while inflating.

Use only recommended air pressure. Pressure over this limit can cause an explosion.

Add air until side flange of tire slides out against the rim. (See page 0120-1 for tire pressures.)

Check air pressure in both drive tires with an accurate gauge having 1 psi (0.01 bar) (10 kPa) graduations. Be sure that tire pressures are equal for both drive tires.

Wheel

Thoroughly clean the cap screws, washers, and the tapped holes in the flanged axle. Use compressed air to dry all parts and tapped holes.

Install the wheel.

Install and hand tighten wheel bolt (3, Fig. 2).

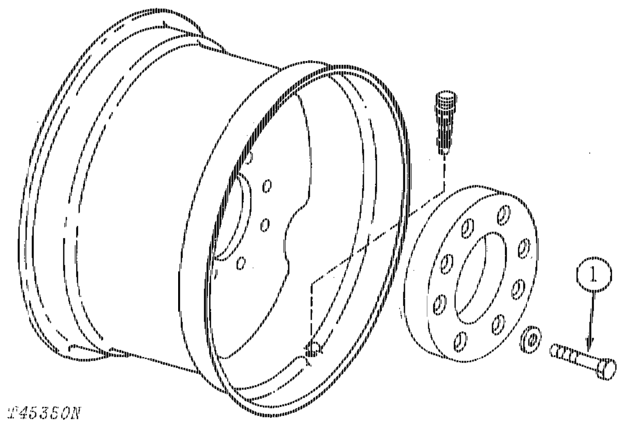
Lower the unit to the ground.

IMPORTANT: If a power wrench is used, be sure that the cap screws are engaged to prevent stripping. Operate the wrench slowly to prevent thread damage.

Cross tighten cap screws to 100 ± 10 lb-ft (136 ± 14 N·m).

With the extendible backhoe dipperstick option, calcium chloride must be used in the front tires. Add 48 lbs. (22 kg) of calcium chloride to make a 14 gal. (53 L) solution per wheel. The weight of solution is 140 lbs. (63 kg) per wheel.

Group 0199
SPECIFICATIONS AND SPECIAL TOOLS
POWERED WHEELS AND FASTENINGS
SPECIFICATIONS AND TORQUE VALUES



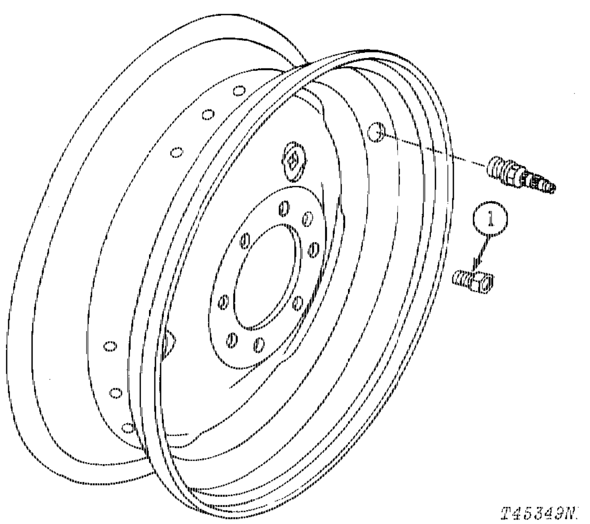
T45350N

Fig. 1-Wheel Attaching Cap Screw for Rear Tire

1 - Wheel attaching cap screw
torque (-284900) . 175 + 25 or − 35 lb-ft
(237 + 34 or − 47 N·m)

Wheel attaching cap screw
torque (284901-) . . . . 425 lb-ft
(576 N·m)

NON-POWERED WHEELS AND FASTENINGS
SPECIFICATIONS AND TORQUE VALUES



T45349N

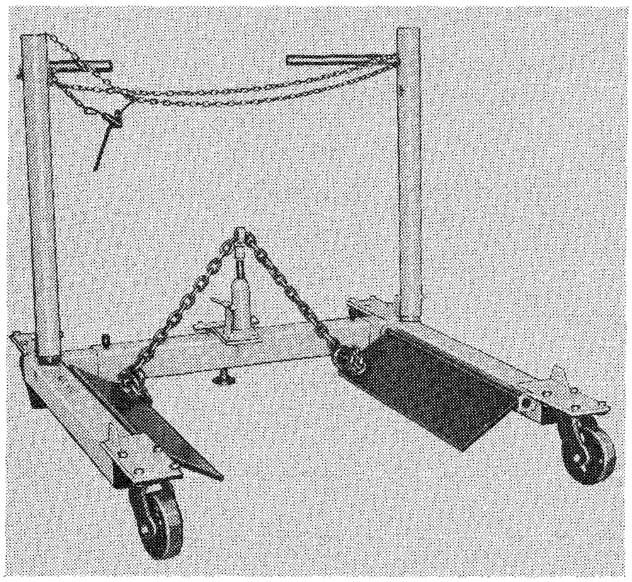
Fig. 2-Wheel Attaching Hub Bolt for Front Tire

1 - Wheel attaching hub bolt
torque . . . . 100 ± 10 lb-ft
(136 ± 14 N·m)

POWERED WHEELS AND FASTENINGS

SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
 T49656 *Fig. 3-Heavy-Duty Wheel Lift*	D-05019ST	To aid in removal and installation of wheels.

Section 2
AXLES AND SUSPENSION SYSTEM

CONTENTS OF THIS SECTION

Litho in U.S.A.

Group 0201
DRIVE AXLE HOUSING AND SUPPORT

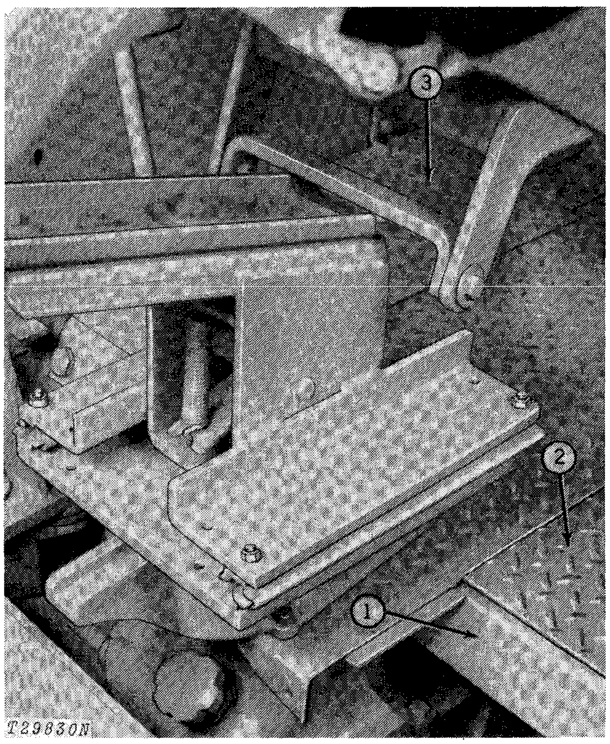
GENERAL INFORMATION

Each rear axle assembly is mounted on two tapered roller bearings with oil seals and a planetary gear system which provides the final 5-to-1 speed reduction.

REMOVAL

Removal of Right Axle Assembly

1. Remove backhoe.



1—Rear Cross Member **3—Battery Cover**
2—Right Platform

Fig. 1-Seat and Platform

2. Remove operator's seat.

3. Remove rear platform (which is shown removed in Fig. 1), right platform (2) and battery cover (3).

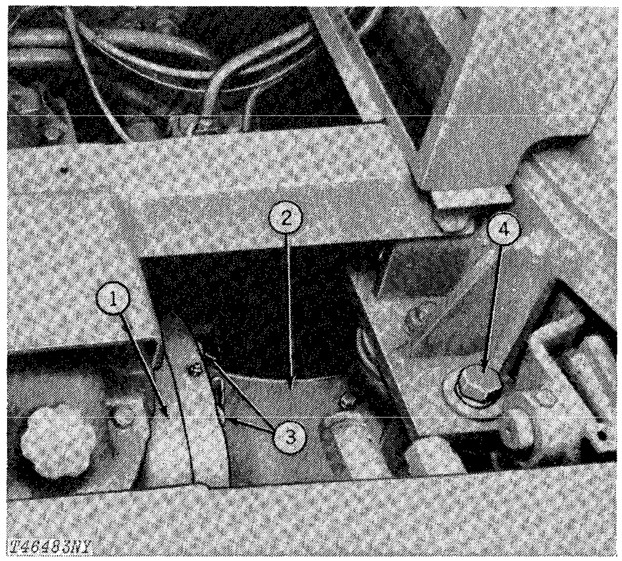
4. Disconnect battery ground strap.

5. Remove rear cross member (1) attaching cap screws. DO NOT remove rear cross member.

6. Block up rear of loader side frame. Also block transmission for additional support.

7. Drain transmission.

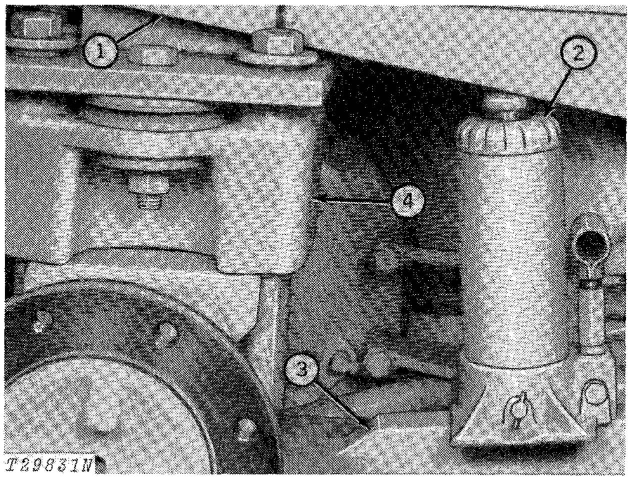
8. Remove rear wheel from the axle.



1—Transmission Case **4—Loader Side Frame-to-Axle Housing Bolts**
2—Axle Housing
3—Axle Attaching Points

Fig. 2-Axle Assembly Attaching Points

9. Remove loader side frame-to-axle housing bolts (4, Fig. 2).



T29831N

1—Backhoe Tie Bar
2—Jack
3—Loader Side Frame
4—Rear Canopy Support

Fig. 3-Canopy Frame Lifting Point

10. Install backhoe tie bars (1, Fig. 3) on unit.

11. Loosen right brake line clamp and loosen brake line from axle housing and brake valve. DO NOT remove brake line.

12. Remove the two cap screws holding loader control valve to axle housing.

13. Disconnect loader control valve levers from valve.

14. Remove loader control valve pressure line from the valve.

15. Remove loader control valve return line from hydraulic oil filter relief valve.

16. Push loader control valve forward so axle housing will clear it when removing housing.

17. Raise canopy frame to lift rear canopy support (4, Fig. 3) off axle housing.

18. Support axle housing and remove cap screws securing axle housing to transmission case.

19. Remove axle assembly from transmission case.

Removal of Left Axle Assembly

1. Follow steps 1 through 10 for removing right axle assembly.

2. Remove batteries.

3. Remove battery box attaching cap screws and position battery box so axle housing will clear it when being removed.

4. Remove brake line from axle housing. Loosen the two brake line clamps on top of the transmission and pivot them so brake line is free to move.

5. Raise canopy frame to lift rear canopy support (4, Fig. 3) off axle housing.

6. Support axle housing and remove cap screws (9, Fig. 4) securing rear axle housing (11, Fig. 4) to transmission case.

7. Remove axle assembly from transmission case.

Because the brake disk and final drive shaft (7, Fig. 5) are free fitting, be careful when removing rear axles so that these parts do not drop out and hit the floor. These parts may become damaged if dropped.

If the above parts did not become loosened when the rear axle was removed, then removal of these parts is necessary.

REPAIR

See Group 0250 for disassembly and assembly of axle housing.

Clean axle housing, axle mounting surfaces on unit from grease, paint, weld spatter, and weld. Make sure all parts are dry. Inspect for wear, cracks or other damage. Replace parts as needed.

If final drive gear is worn or damaged, the final drive gear and axle housing must be replaced as a unit.

Replace old axle housing gasket with new gasket.

INSTALLATION

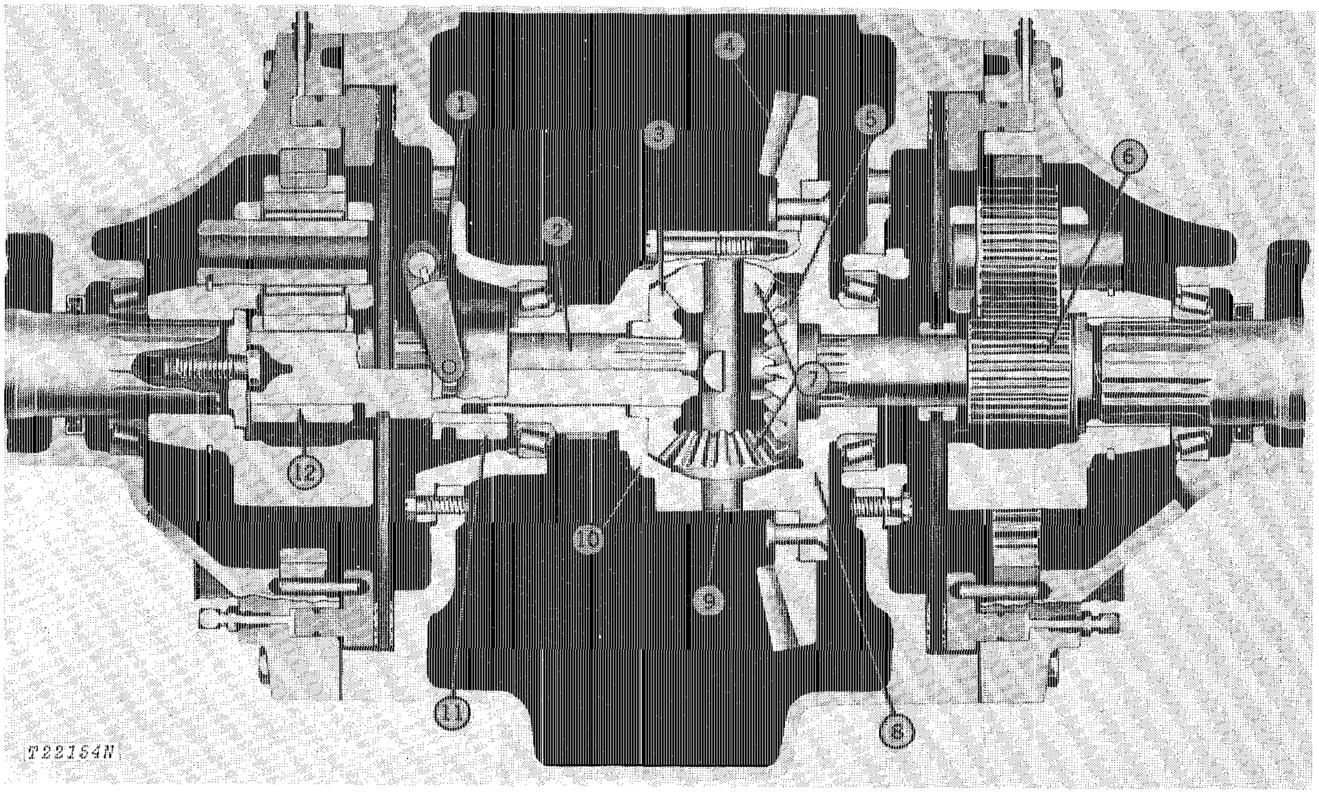
Coat pressure plate with grease and install into annular groove in axle assembly.

Install final drive shaft.

Position axle assembly against transmission. Engage sun pinion with planet pinions and align dowel pins. Fasten with attaching cap screws and tighten to 85 lb-ft (115 N·m).

Install and connect all parts removed.

Group 0210
DIFFERENTIAL OR BEVEL DRIVE



1—Differential Lock Lever
2—Final Drive Shaft
3—Left Bevel Gear
4—Ring Gear
5—Right Bevel Gear
6—Sun Pinion
7—Bevel Pinion
8—Differential Hub
9—Bevel Pinion Shaft
10—Differential Hub Quill
11—Differential Lock Collar
12—Sun Pinion

Fig. 1-Differential Assembly with Differential Lock (Unit without parking brake shown)

GENERAL INFORMATION

The differential is a spiral bevel gear assembly.

It is located in the rear compartment of the one-piece transmission and differential case.

The assembly may be equipped with pedal-operated differential lock which consists of a collar to connect the final drive shaft to the differential housing. This locks the gears and pinions within the housing, giving the effect o' a solid rear axle.

The parking brake drum, if equipped, is located within the differential case and is splined to the left-hand differential housing.

REMOVAL

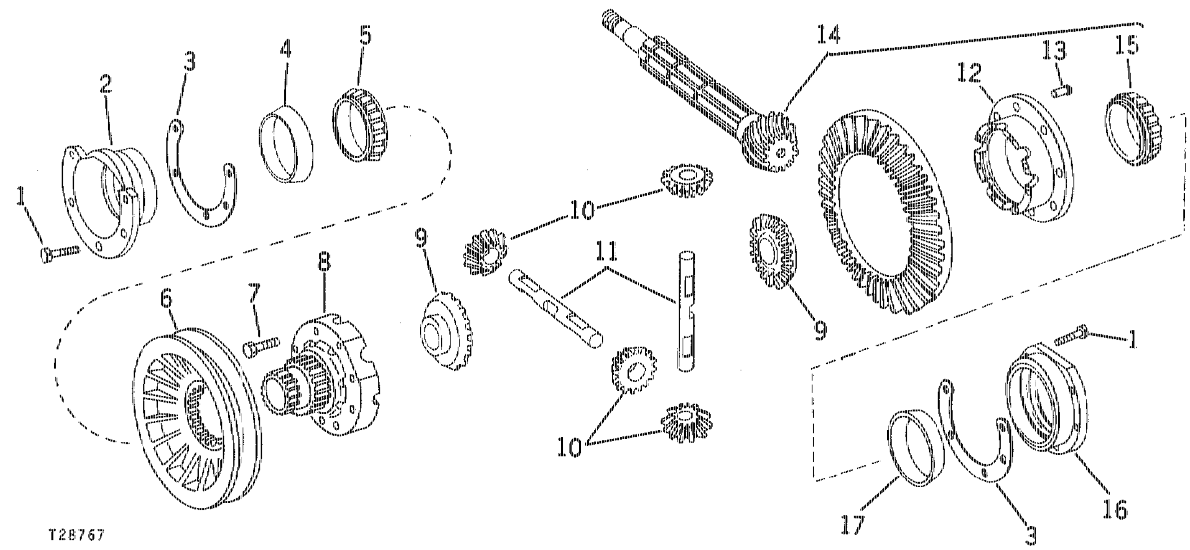
Remove seat support base and both axle assemblies from machine (Group 0201).

Remove transmission oil cup and rear oil line.

If machine is equipped with a differential lock, lock assembly must be removed to service differential.

Differential Lock

Remove cap screw securing differential lock arm to shaft on left side of transmission case. Remove pin from differential lock arm. Drive arm off forward end of shaft. Remove key from shaft (refer to Fig. 3).



1—Place Bolt (10 used)
2—Quill (L.H.)
3—Shim (as required)
4—Bearing Cup (L.H.)
5—Bearing Cone (L.H.)
6—Parking Brake Drum (with parking brake)
7—Place Bolt (8 used)
8—Differential Housing (L.H.)
9—Differential Bevel Gear (2 used)
10—Differential Bevel Pinion
11—Bevel Pinion Shaft (2 used)
12—Differential Housing
13—Special Rivet (8 used)
14—Differential Housing (R.H.)
15—Bearing Cone (R.H.)
16—Quill (R.H.)
17—Bearing Cup (R.H.)

Fig. 2-Differential Assembly

Hold differential lock yoke (11, Fig. 3) in place and drive shaft out towards rear of machine. Remove plug from rear of transmission and Woodruff key (12, Fig. 3) from under yoke as shaft is driven out.

Note outer spring (7) position in Fig. 3.

Note O-ring packing on shaft. Replace if damaged.

REPAIR

Differential Assembly

Refer to Fig. 2 during disassembly.

Lift up on differential assembly to relieve weight on bearing quills.

Remove bearing quills with shims from transmission case, keeping shims with their respective quills for correct assembly.

If the differential ring gear is no longer serviceable and must be replaced, also replace the differential drive shaft. These parts are furnished as matched sets and are not available individually for replacement.

Inspect all parts for worn or bent condition. Replace parts as necessary.

FOS

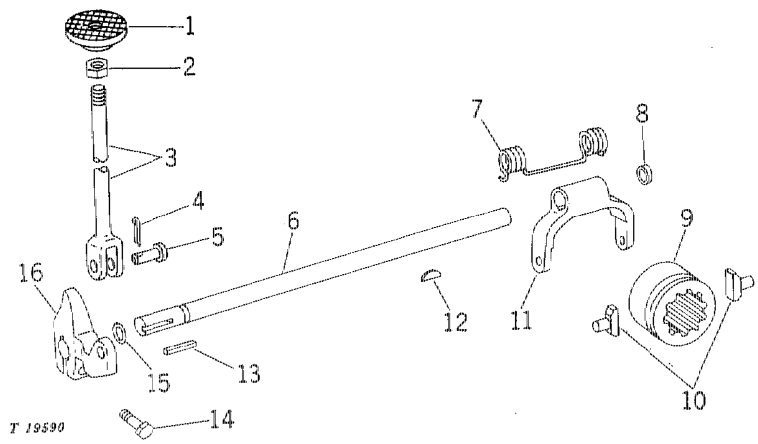
Refer to "Gear Wear" in FOS Manual - Power Train for additional description and theory of operation.

INSTALLATION

Coat face of differential bevel gear with transmission oil and install gear and shafts in differential housing.

Install differential housing (8, Fig. 2) and tighten attaching place bolts (7) to 35 lb-ft (47 Nm) (5 kg-m).

Coat differential bearing cones with transmission oil and lower differential assembly into correct position in transmission case.



1—Lock Pedal
2—Nut
3—Lock Rod
4—Cotter Pin
5—Pin
6—Shaft
7—Outer Spring
8—Plug
9—Collar
10—Shoe (2 used)
11—Yoke
12—Woodruff Key
13—Key
14—Cap Screw
15—O-Ring
16—Lock Arm

Fig. 3-Differential Lock Mechanism

Cone Point Adjustment

Cone point adjustment is obtained by controlling the shim pack between the differential drive shaft rear bearing cup and the transmission case.

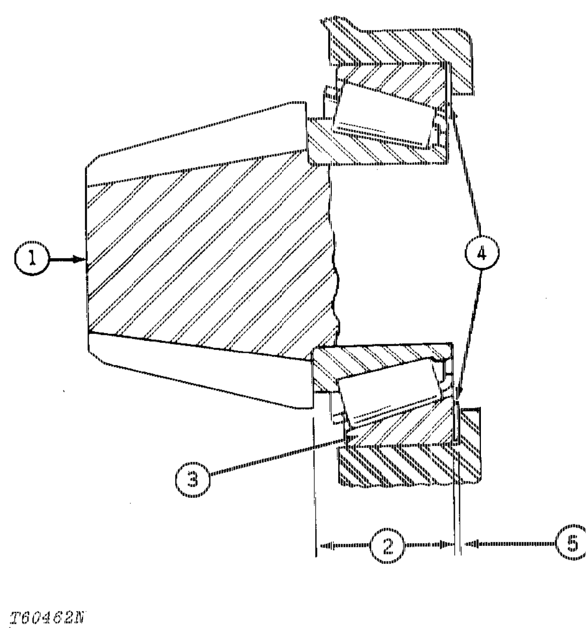
The following dimensions are required for correct cone point adjustment.

A. Nominal measurement of the differential drive shaft bearing cone and cup (1.446 in. [36.73 mm]) (2, Fig. 4).

B. Dimension etched on the face of the bevel pinion (1).

C. Dimension stamped on the top rear of the transmission case. If dimension is not stamped on transmission case, use the case mean bore depth given in the example to calculate the shim pack.

To determine shim pack, add the measurement found in Steps A and B and subtract from measurement observed in Step C. The total (C − [A + B]) is the shim pack required between rear differential drive shaft bearing cup and transmission case.



1—Dimension on Face of Spiral Bevel Pinion
2—Bearing Mean Overall Width
3—Bearing Cup
4—Shim Pack
5—Amount of Shims Required

Fig. 4-Cone Point Adjustment

Example:

6.352	in.	(161.34	mm)-dimension on bevel pinion shaft
+1.446	in.	(36.73	mm)-bearing mean overall width
=7.798	in.	(198.07	mm)-total from steps A and B.
7.8125	in.	(198.438	mm)-case mean bore depth
−7.798	in.	(198.07	mm)
=0.015	in.	(0.37	mm)-amount of shim pack between bearing cup and backing shoulder in the case.

Differential Drive Shaft Rolling Torque

Install differential drive shaft assembly as shown in Group 0351.

Tighten differential drive shaft hex. nut to 160 lb-ft (217 Nm) (22 kg-m).

Adjust front shim pack to provide 10 to 20 lb-in. (1.4 to 2.3 Nm) (0.12 to 0.23 kg-m) rolling torque.

Differential Preload Adjustment

With clearance between the differential drive shaft and the ring gear, check the end play of the differential assembly.

Install shims (3, Fig. 2) between differential bearing quill and transmission case to give 0.002 to 0.005 in. (0.05 to 0.13 mm) preload.

Differential Backlash Adjustment

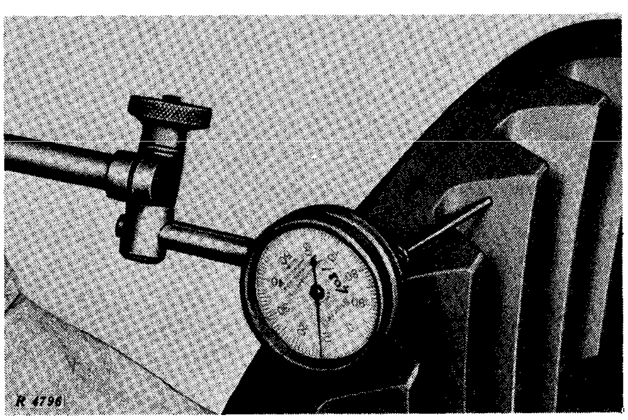


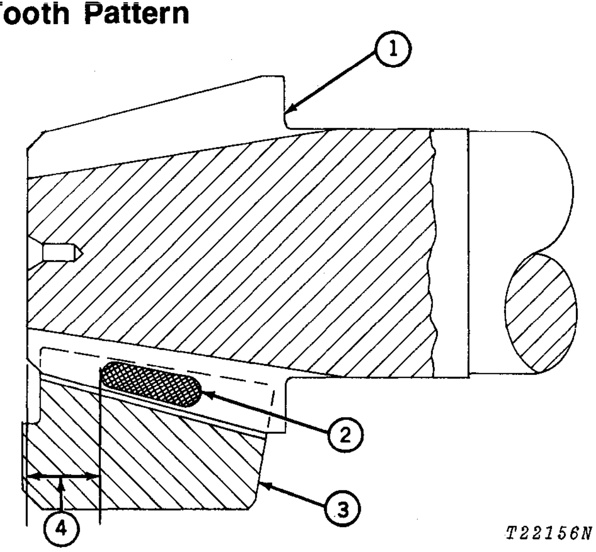
Fig. 5-Checking Backlash on Gear

With bearing preload established, check backlash between the differential spiral bevel gear and differential spiral bevel shaft in mesh.

The dial indicator (Fig. 5) is mounted so that it registers the full rotary movement of the ring gear shown.

Check and adjust differential bearing shims (3, Fig. 2) to provide 0.006 to 0.008 in. (0.15 to 0.20 mm) backlash at point of least backlash between output shaft spiral bevel pinion and spiral bevel ring gear. Backlash not to exceed 0.012 in. (0.30 mm) at point of greatest backlash. Check backlash at outer end of spiral bevel ring.

Differential Spiral Bevel Gear And Pinion Tooth Pattern



1—Bevel Pinion
2—Tooth Bearing Pattern
3—Spiral Bevel Gear
4—0.120 to 0.360 inch (3.05 to 9.14 mm)

Fig. 6-Tooth Pattern

Check the tooth bearing pattern of the bevel gear and pinion (Fig. 6). End of pattern (2) should be 0.120 to 0.360 in. (3.05 to 9.14 mm) from the end of the pinion. If tooth bearing pattern is not properly located, readjust shim pack (4, Fig. 4) as required. If shim pack (4) is readjusted, differential drive shaft rolling torque and differential backlash must also be readjusted.

Install differential lock assembly.

Install both axle assemblies and transmission housing (Group 0201).

Group 0230
NON-POWERED WHEEL AXLES

GENERAL INFORMATION

The heavy-duty swept-back front axle mounts on the front end support.

REMOVAL

Place transmission in park position and attach hoist to tractor front end support.

Disconnect, cap and mark hoses from steering cylinder.

CAUTION: Place a floor jack under the axle assembly during removal.

Remove cotter pin, slotted hex. nut, washers, shim pack, and special cap screw from axle assembly. Slide axle assembly toward the rear until clear of support pivot pins.

REPAIR

Refer to Fig. 2 during disassembly and assembly of the front axle.

Inspect all parts for wear or damage and repair or replace as necessary.

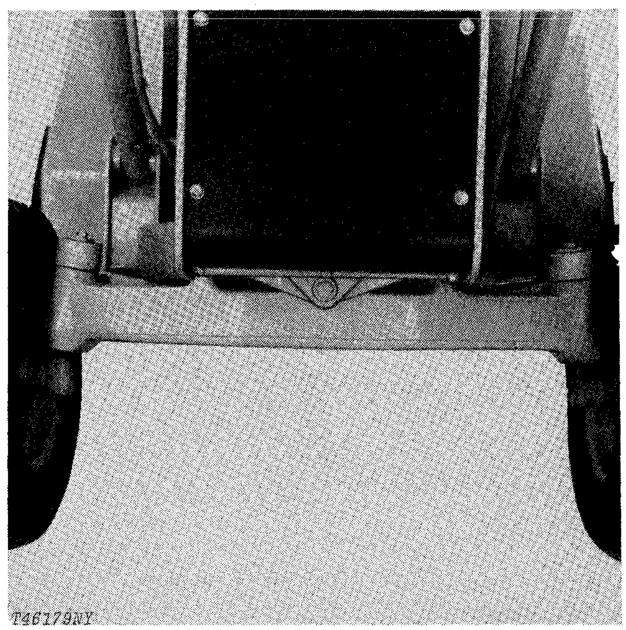
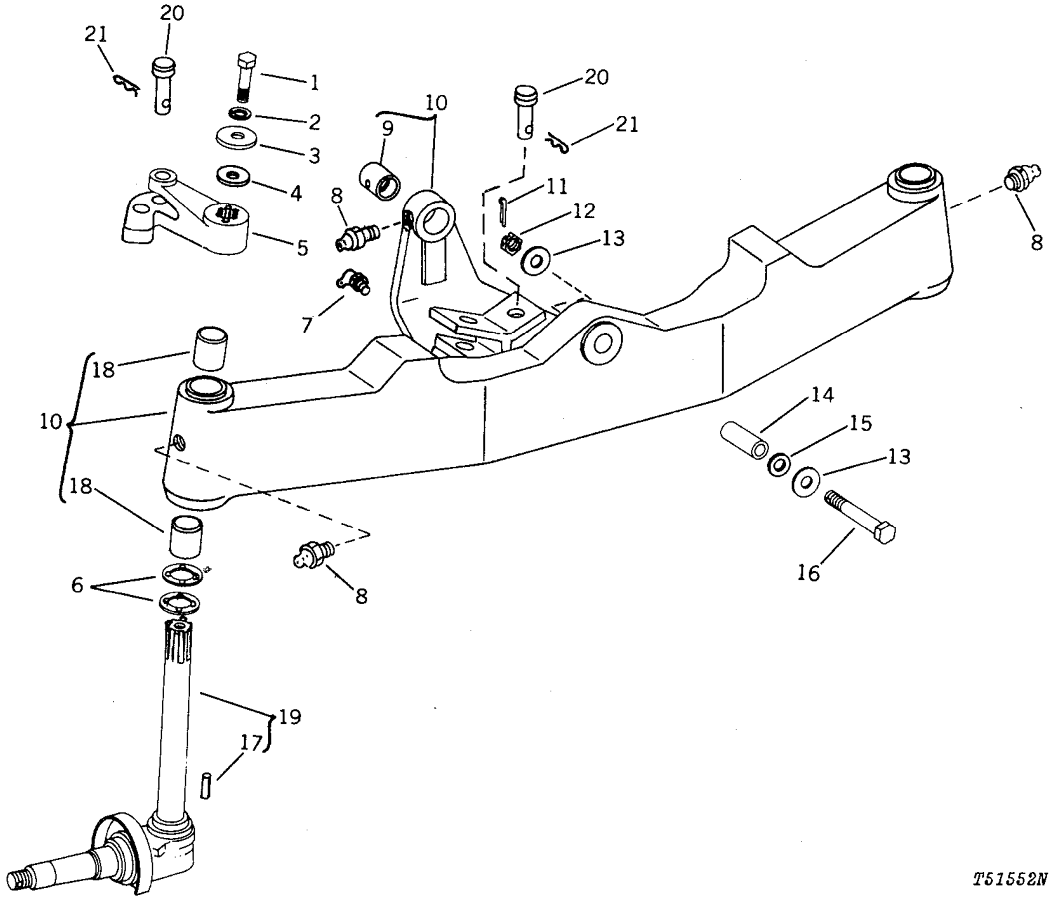


Fig. 1-Front Axle



1—Cap Screw (2 used)
2—Lock Washer (2 used)
3—Special Washer (2 used)
4—Special Washer (4 used)
5—R.H. Steering Arm
6—Special Washer (4 used)
7—90° Grease Fitting
8—Straight Grease Fitting (2 used)
9—Pivot Bushing
10—Axle Assembly
11—Cotter Pin
12—Slotted Nut
13—Special Washer (2 used)
14—Pivot Pin
15—Shim (as required)
16—Special Cap Screw
17—Spring Pin (2 used)
18—Knuckle Bushing (4 used)
19—Spindle and Knuckle (2 used)
20—Pin (2 used)
21—Cotter Pin (2 used)

Fig. 2-Front Axle, Spindle and Knuckle Assembly

Adjust vertical spindle end play by adding or removing washers under steering arms. Arms must turn freely, but end play must not exceed 0.005 to 0.045 in. (0.13 to 1.14 mm).

Align punch mark on top of each spindle and knuckle (19, Fig. 2) with punch mark on top of each steering arm (5).

Install bushing (9) into front axle bore so that at least one third of the grease hole in the bushing lines up with the drilled hole in the axle (10).

When assembling new parts, an interference fit must exist between the serrations of the spindle and the serrations of the steering arm through approximately one half of the engagement. When assembling used parts, it is acceptable if an interference fit exists through any part of the engagement.

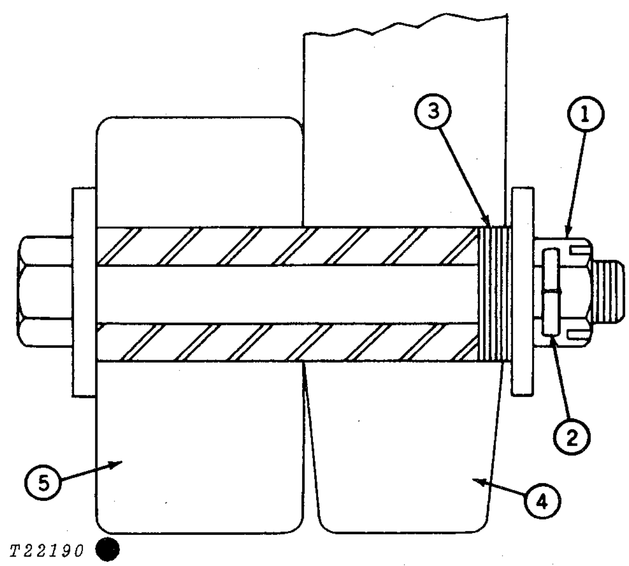
Tighten steering arm attaching cap screw to 170 lb-ft (230 Nm) (24 kg-m).

INSTALLATION

Install axle to front support. Secure axle with special cap screw, shim pack, washers, and slotted nut (Fig. 3).

Add or subtract shims from shim pack to give specified end play 0.000 to 0.015 in. (0.00 to 0.38 mm).

Tighten hex. nut to 220 lb-ft (298 Nm) (30 kg/m) and advance to the next slot and insert cotter pin.



1—Hex. Nut
2—Cotter Pin
3—Shim Pack
4—Front Axle
5—Front Support

Fig. 3-Front Axle Installed

Install tie rod on axle assembly (10, Fig. 2) and steering arms (5) and tighten.

Press front wheel oil seal (1, Fig. 4) on knuckle with supplier's marking facing oil seal driver.

Fill lips of oil seal with John Deere Multi-Purpose Grease or an equivalent.

Press inner and outer cups (4 and 6, Fig. 4) tight against shoulders in front wheel hub.

Assemble wheel hub and bearing cones on the knuckle and pull into position with the slotted nut.

Adjust the front wheel bearings by tightening the slotted nut to 35 lb-ft (47 Nm) (5 kg/m). Rotate hub several times to align bearings. Retighten slotted nut to specified torque. Back nut off to the nearest slot. If hole in knuckle is aligned with slot in nut when nut is tightened to specified torque, then back nut off one slot and insert cotter pin.

Lubricate front wheel spindle and knuckle bushings (18, Fig. 2) and pivot bushing (9) with John Deere Multi-Purpose Grease or an equivalent.

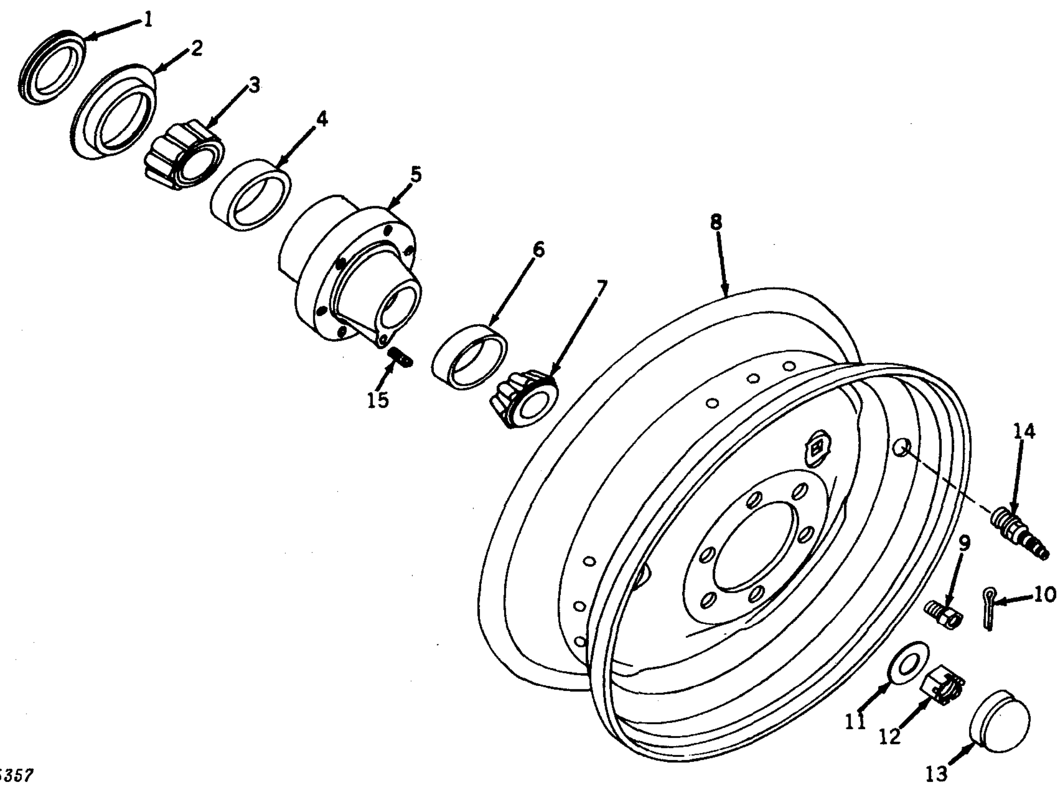
Position front wheels in the straight ahead position. Adjust wheel toe-in to 0.125 to 0.375 in. (3.18 to 9.53 mm).

Advance hex. nut (1, Fig. 3) to the nearest slot and insert cotter pin.

Reinstall cylinder making sure it and its hoses are connected to the same ends from which they were removed. The rod end of the steering cylinder goes to the steering arm. The barrel end of the steering cylinder goes to the axle.

When finished, be sure slots in tie rod tube faces to the rear. Tighten tie rod clamp screws to 55 lb-ft (75 Nm) (8 kg/m).

Locate clamp opening down with cap screw in a horizontal position.



1—Oil Seal
2—Seal Cup
3—Inner Bearing
4—Inner Cup
5—Hub
6—Outer Cup
7—Outer Bearing
8—Wheel
9—Hub Bolt (8 used)
10—Cotter Pin
11—Special Washer
12—Slotted Nut
13—Hub Cap
14—Tubeless Tire Valve
15—Pipe Plug

Fig. 4-Front Wheel Assembly

Group 0250
AXLE SHAFT, BEARINGS, REDUCTION GEARS

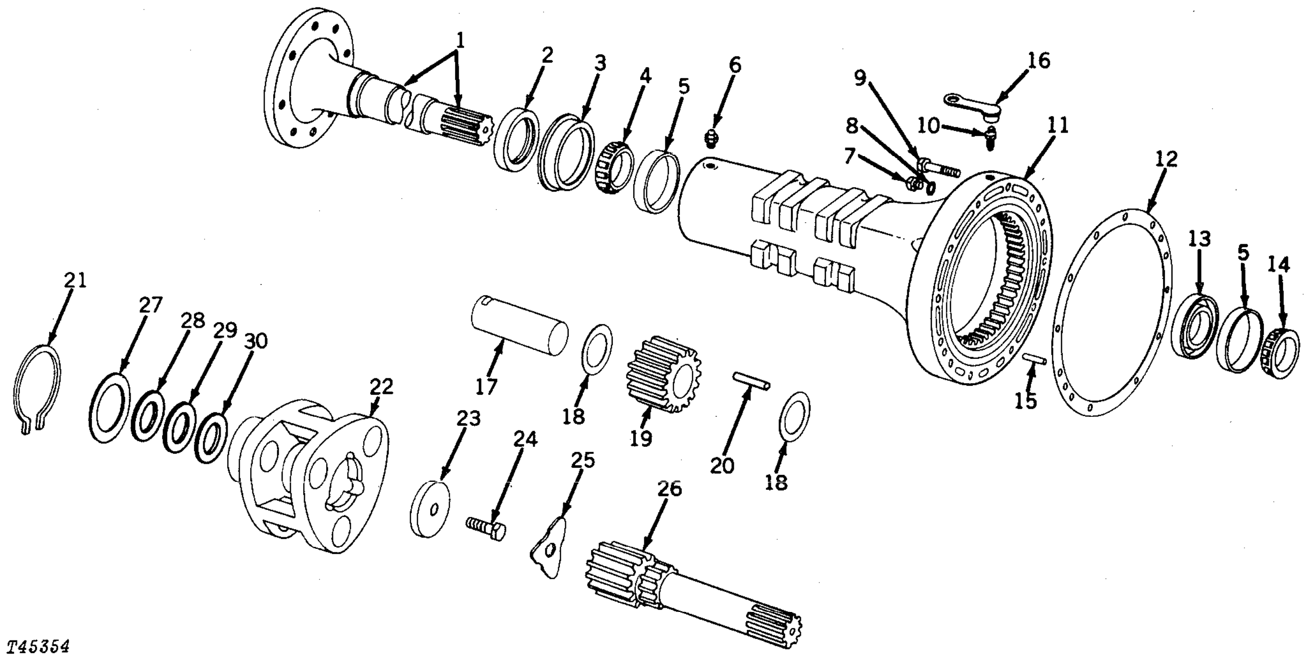
GENERAL INFORMATION

Each axle (final drive) is mounted on two tapered roller bearings, and is equipped with a planetary gear system providing a final speed reduction of 5 to 1.

REMOVAL

See Group 0201 and remove drive axle housing assembly to be serviced.

REPAIR



T45354

1—Flanged Rear Axle Shaft
2—Outer Oil Seal
3—Oil Seal Cup
4—Outer Bearing Cone
5—Bearing Cup (2 used)
6—Straight Grease Fitting
7—Brake Oil Lead Plug
8—O-Ring
9—Cap Screw (12 without Parking Brake) (10 with Parking Brake)
10—Special Screw
11—Rear Axle Housing with Gear
12—Gasket
13—Inner Oil Seal
14—Inner Bearing Cone
15—Dowel Pin
16—Cap
17—Planet Pinion Shaft (3 used)
18—Thrust Washer (6 used)
19—Planet Pinion (18 teeth) (3 used)
20—Bearing Roller (69 used)
21—Snap Ring
22—Planet Pinion Carrier
23—Special Washer
24—Special Screw
25—Lock Plate
26—Final Drive Shaft
27—Thrust Washer
28—Spacer (used as required)
29—Shim (used as required)
30—Shim (used as required)

Fig. 1-Axle Assembly

Remove lock plate (25, Fig. 1), and special cap screw (24).

To remove lock plate, it may be necessary to first turn special cap screw and align edges with inside of lock plate.

Remove lock plate before continuing to remove special cap screw.

Remove planet pinion carrier assembly.

Remove snap ring (21, Fig. 1) from planet pinion shaft (17) and planet pinion carrier.

Remove planet pinions (19) and thrust washer (18), taking care not to lose any of the bearing rollers (20).

NOTE: If any bearing rollers are lost or damaged, replace as a complete set.

Remove special washer (23).

Press axle out of axle housing.

If final drive gear is worn or damaged, the final drive gear and axle housing must be replaced as a unit.

Press outer axle bearing cone (4) off the axle shaft in order to replace outer axle bearing seal (2).

Assemble

Install bearing rollers (20, Fig. 1) in planet pinion. Use petroleum jelly or an oil soluble grease on bearing rollers for an aid of installation.

Install special washer in planet pinion carrier with step side toward spline. This must be installed before the last planet pinion is installed.

Install planet pinions (19) and thrust washers (18) in planet pinion carrier (22).

Install planet pinion shafts (17) in planet pinion carrier, making sure notches on shafts can be viewed from the back side of planet pinion carrier.

Install snap ring (21) in notches of planet pinion shafts and in groove of planet pinion carrier.

Assemble outer seal (2) on axle shaft flush with the bearing shoulder and with metal flange facing away from driver.

Heat bearing cone (4) not to exceed 300°F (149°C).

Assemble heated bearing cone on axle shaft (1).

Press the bearing cups (5) into the axle housing (11) tight against the shoulder.

Install axle outer bearing oil seal cup (3) before axle is installed.

Install axle inner oil seal (13) with spring side of seal facing driver.

Heat bearing cone (14, Fig. 1) not to exceed 300°F (149°C).

Coat lip of axle inner oil seal (13) with oil before installing axle.

The procedure for establishing preload on the rear axle shaft bearings is as follows:

IMPORTANT: To prevent possible damage to bearings or special retaining washer, DO NOT tighten special screw to more than 55 lb-ft (75 N·m) until the correct shim pack has been established and installed.

1. Install shaft (1, Fig. 2), heated bearing cone, and planet pinion carrier assembly in axle housing (2). Seat the bearing cone by tightening special screw (8) before cone cools. Turn carrier (3) a minimum of three times while tightening screw to 55 lb-ft (75 N·m).

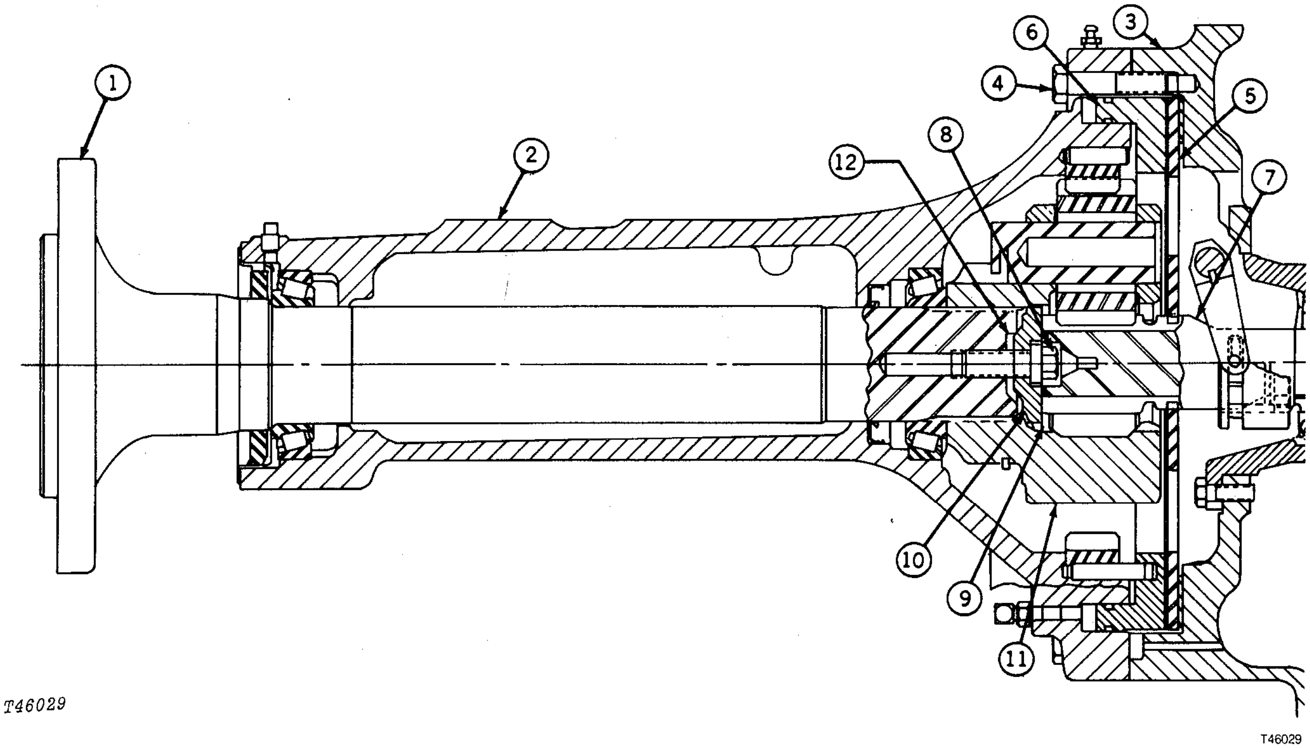
2. Remove planet pinion carrier and put three small pieces of approximately 1/8 inch diameter solder or lead wire on end of axle shaft equally spaced. Use a small amount of grease to hold the wires in place. Install final drive carrier without shims and tighten special screw to 55 lb-ft (75 N·m).

Lay rear axle housing down on blocks and roll flanged rear axle shaft (1, Fig. 2) while making this adjustment to make sure bearings are seated.

NOTE: Do not check drag torque on the final drive shaft (7).

3. Remove final drive carrier assembly and measure compresssed thickness of solder or lead wire. Subtract 0.005 inch (0.13 mm) from this measurement to determine thickness of required shim pack. Use specified shims to approximate the calculated value as closely as possible.

4. Install shim pack and final drive carrier assembly and tighten special screw to 180 to 240 lb-ft (244 to 325 N·m) torque.



1—Flanged Rear Axle Shaft
2—Rear Axle Housing
3—Transmission Case
4—Cap Screws (12 used)
5—Brake Disk
6—Brake Piston
7—Final Drive Shaft
8—Special Screw
9—Lock Plate
10—Special Washer
11—Planet Pinion Carrier
12—Shim and Spacer Location

Fig. 2-Axle Assembly

IMPORTANT: If too many shims or spacers were removed, the bearings can be damaged. Roll axle shaft while tightening.

5. Turn axle shaft three full revolutions and measure rolling torque. Rolling torque must be 8 to 12 lb-ft (11 to 16 N·m). If rolling torque is too high, add shims. If too low, remove shims.

6. Repeat steps 4 and 5 until proper rolling torque is obtained.

Apply an axial force in both directions to the carrier to check for end play. No end play is allowed.

Apply multi-purpose grease to lock plate (9, Fig. 2) and install, turning it over if necessary. If special cap screws adjustment is necessary for alignment, tighten a maximum of 8°.

IMPORTANT: DO NOT tighten special cap screw to retain lock plate in position.

Fill axle outer bearing compartment and bearing with multi-purpose grease after axle is asembled in housing. Grease must flow past outer seal in axle housing.

If repair of brake piston is necessary, see Group 1011.

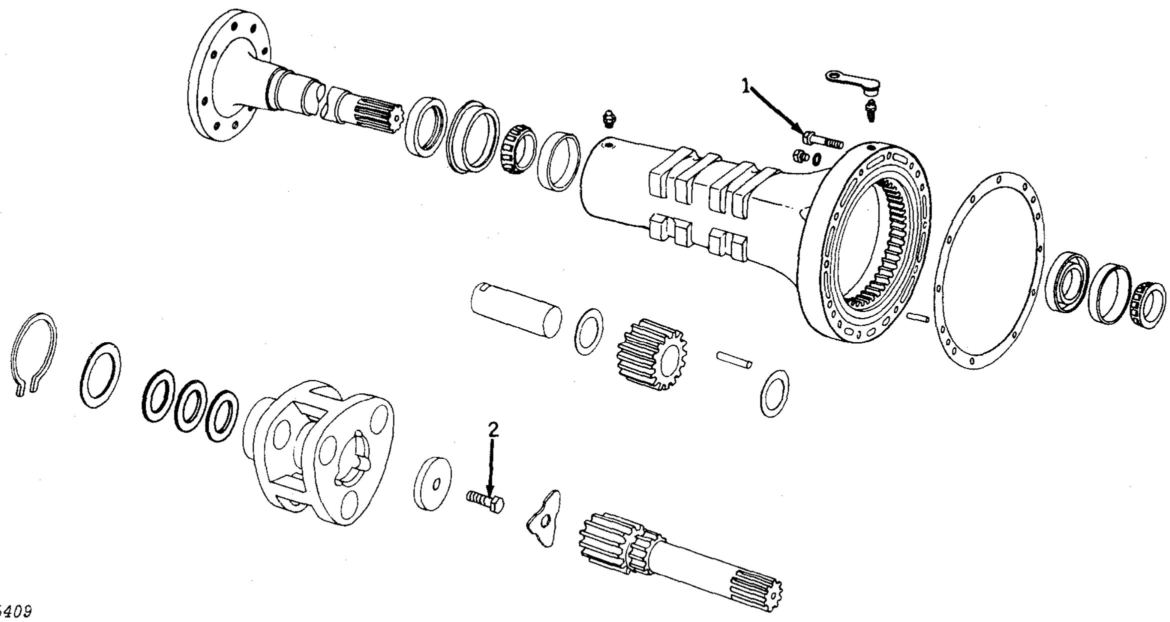
INSTALLATION

See Group 0201 and install repaired drive axle housing assembly.

Group 0299
SPECIFICATIONS AND SPECIAL TOOLS

DRIVE AXLE HOUSING AND SUPPORT

SPECIFICATIONS AND TORQUE VALUES



T45409

T45409

1 - Rear axle housing to transmission case cap screws torque . . . . 85 lb-ft (115 N·m)

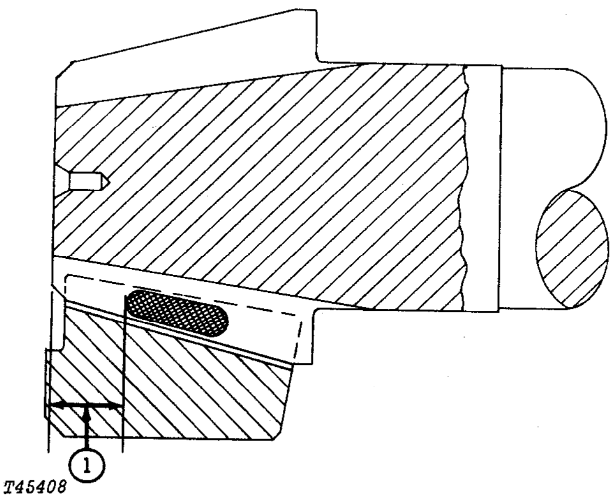
2 - Rear axle retaining cap screw torque . . . . 180 to 240 lb-ft (244 to 325 N·m)

Maximum drag torque on rear axle assembly taken at retaining cap screw . . . . 8 to 12 lb-ft (11 to 16 N·m)

Fig. 1-Axle Assembly

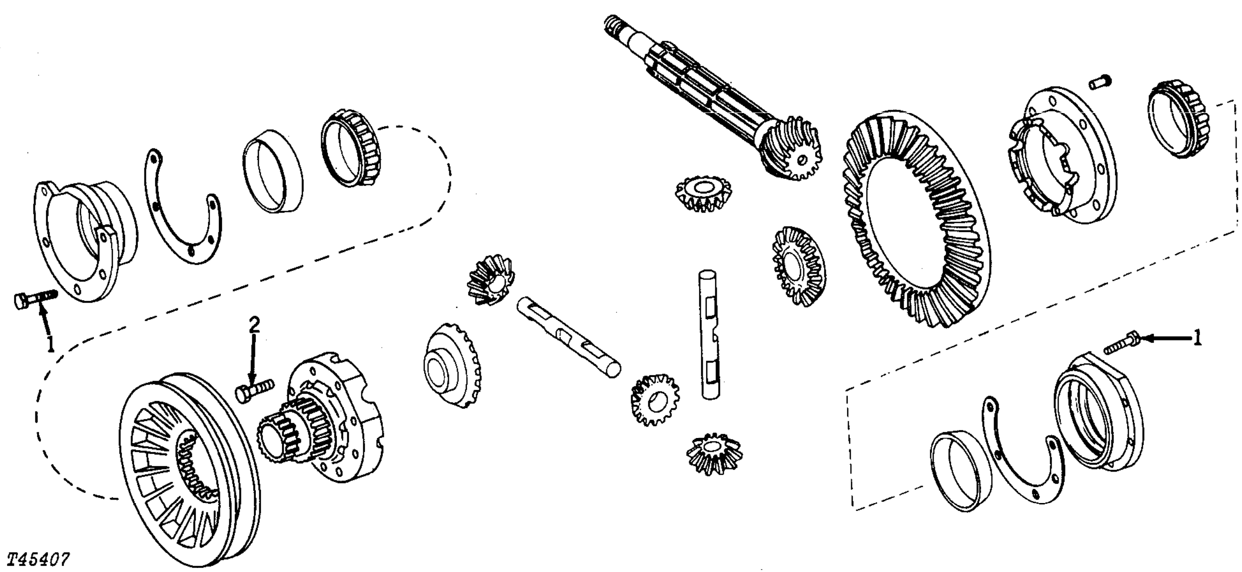
DIFFERENTIAL OR BEVEL DRIVE

SPECIFICATIONS AND TORQUE VALUES



1 - Location of tooth pattern from end of pinion teeth .... (0.120 to 0.360 in.) (3.05 to 9.14 mm)

Fig. 2-Tooth Pattern



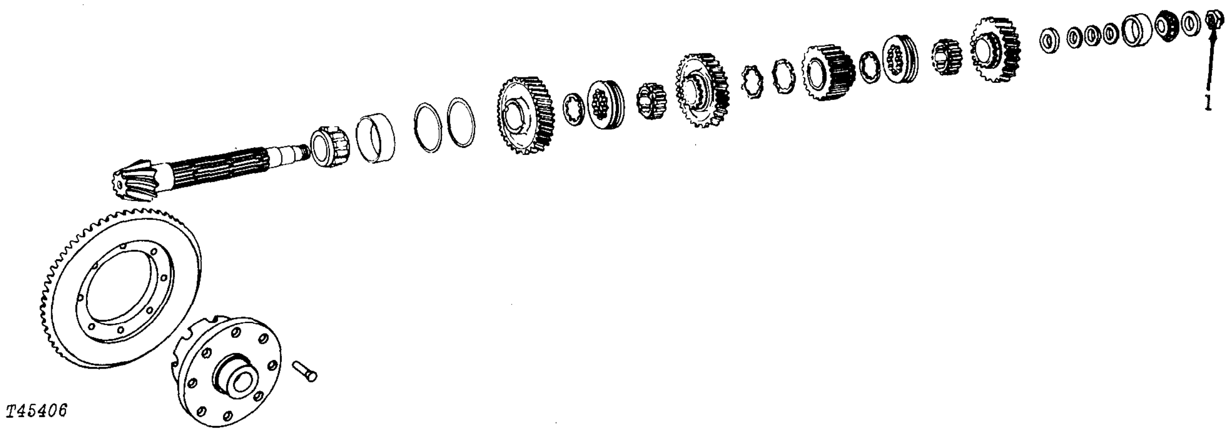
1 - Differential bearing quill-to-transmission case cap screw torque .... 35 lb-ft (47 Nm) (5 kg/m)

2 - Differential housing cover-to-differential housing cap screw torque .... 35 lb-ft (47 Nm) (5 kg/m)

Fig. 3-Differential Assembly

DIFFERENTIAL OR BEVEL DRIVE

SPECIFICATIONS AND TORQUE VALUES—Continued



1 - Differential drive shaft hex. nut torque . . . . 160 lb-ft (217 Nm) (22 kg/m)

Differential drive and bevel pinion shaft bearing rolling drag torque . . . . . . 10 - 20 lb-in (1.1 Nm - 2.3 Nm) (0.12 - 0.23 kg/m)

Fig. 4-Differential Drive Shaft Hex. Nut

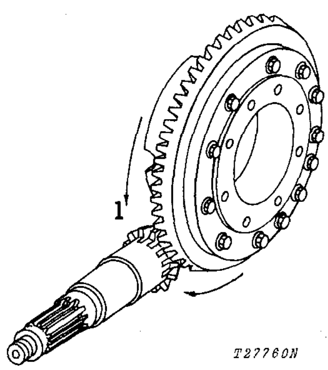


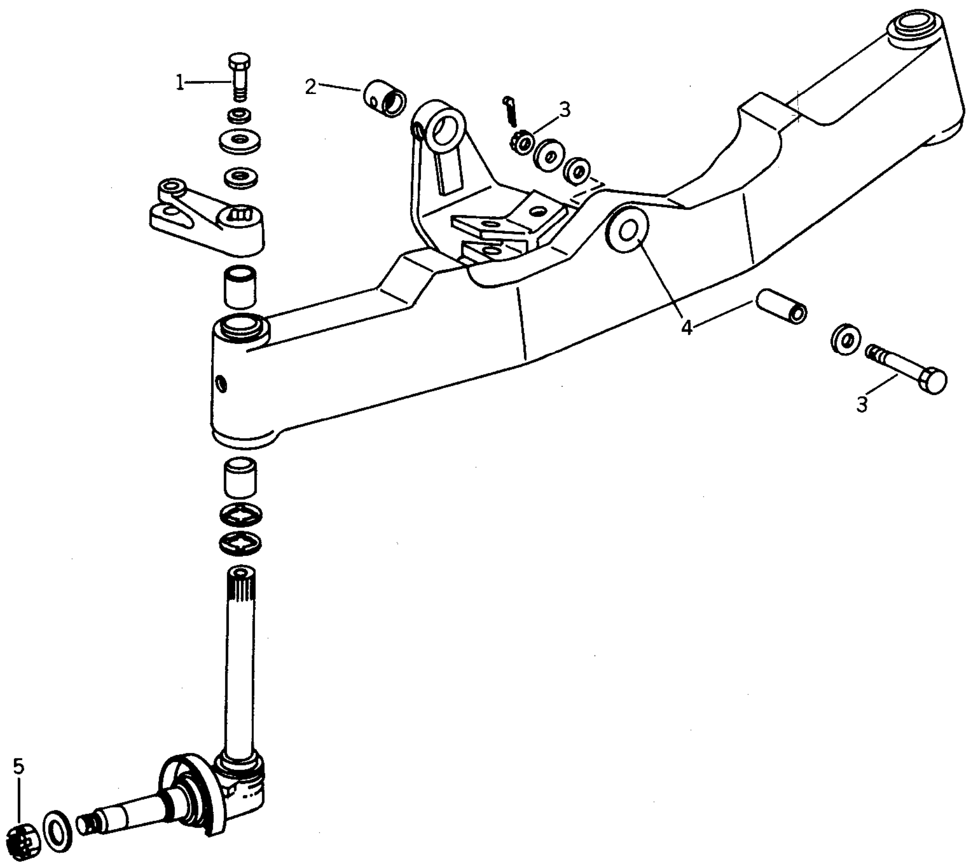
Fig. 5-Pinion Shaft and Ring Gear

1 - Backlash between ring gear and pinion shaft . . . . 0.006 to 0.008 in. (0.15 to 0.20 mm)

Preload between differential quill and transmission case . . 0.002 to 0.005 in. (0.05 to 0.13 mm)

NON-POWERED WHEEL AXLES

SPECIFICATIONS AND TORQUE VALUES



1 - Steering arm-to-spindle and knuckle cap screw torque .... 170 lb-ft (230 Nm) (24 kg/m)

2 - Axle rear pivot pin bushing - press into axle flush with bottom of chamfer with grease holes lined up.

3 - Axle-to-front support torque .... 220 lb-ft (298 Nm) (30 kg/m)

4 - Axle front pivot pin - press into front axle flush with rear face of front pivot.

5 - Front wheel slotted nut torque .... 35 lb-ft (47 Nm) (5 kg/m)

Fig. 6-Front Axle, Spindle and Knuckle Assembly

NON-POWERED WHEEL AXLES

SPECIFICATIONS AND TORQUE VALUES—Continued

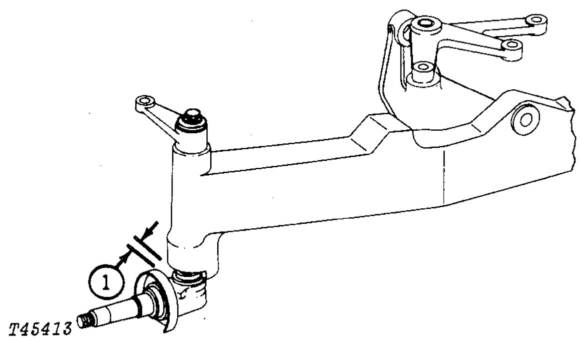


Fig. 7-Vertical Spindle End Play

1 - Vertical spindle end play .... 0.005 to 0.045 in. (0.13 to 1.14 mm)

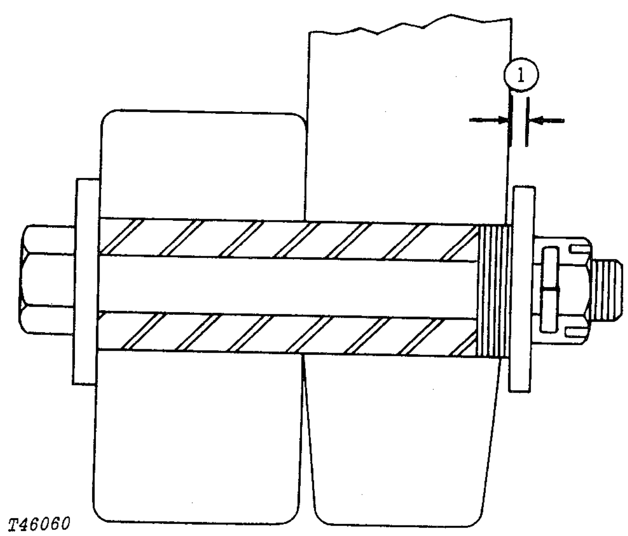


Fig. 8-Front Axle End Play

1 - Axle pivot end play .... 0.000 to 0.015 in. (0.00 to 0.38 mm)

Section 3
TRANSMISSION

CONTENTS OF THIS SECTION

Group 0315
CONTROLS

GENERAL INFORMATION

Transmission Control Levers

Transmission gears are selected manually by two shift levers mounted on top of the clutch housing.

The range shift lever (left-hand) is used to select low or high range or the park position.

The gear shift lever (right-hand) can be used to select first, second, third or fourth gears when the range shift lever is in low range position; it can be used to select fifth, sixth, seventh, or eighth gears when the range shift lever is in high range position.

Neutral Start Switch

A neutral start switch is provided. The range shift lever must be in neutral or in park (P) position before the engine can be started.

Refer to Section 16, Group 1674 for adjustment procedure.

Linkage must be kept clean, adjusted, and well lubricated. Bent or damaged linkage must be repaired or replaced.

Park Position

Place the right-hand shift lever in any gear and the left-hand lever in park position. The machine cannot be put into park until a gear is selected. This locks the differential drive shaft to the transmission drive shaft and the transmission drive shaft to the drive shaft front quill which is secured to the transmission case.

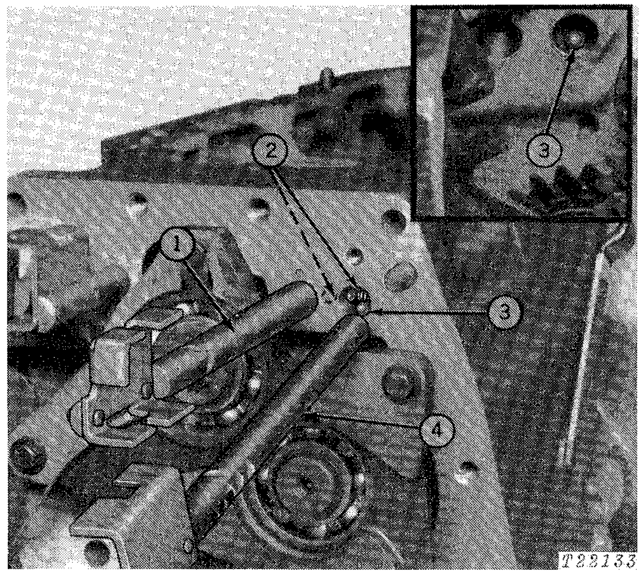
Tow Position

Place both gear shift levers in neutral position. (Never tow the unit at speeds greater than 15 mph [24.2 km/h]).

IMPORTANT: Never attempt to start the unit by towing or pushing as reverser clutches may be damaged.

Refer to the Operator's Manual for ground speeds of unit.

REMOVAL



T22133

1—High Range Shifter Shaft
2—Two 5/16″ Balls Between Shafts
3—One 5/16″ Ball and Spring
4—Low and Reverse Range Shifter Shaft

Fig. 1-Removing Range Change Shafts

Separate machine between clutch housing and transmission as instructed in Group 0341.

Shifter Mechanism

Remove top cover from top of transmission.

Remove clutch housing cover with levers.

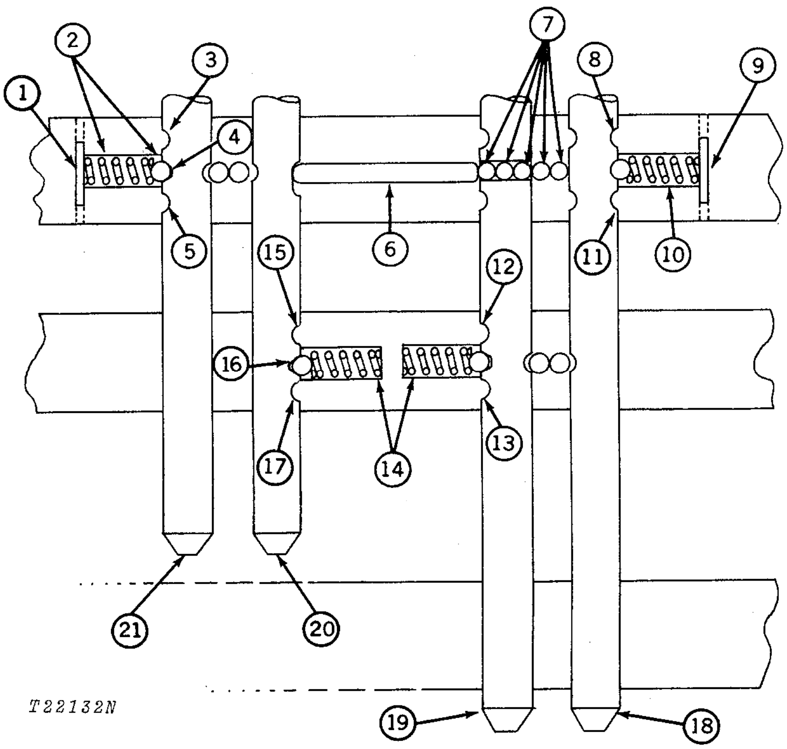
Remove neutral start switch pin from low range shifter fork.

Remove set screws securing shifters to shifter shafts.

Do not turn shifter shafts during removal as spring-loaded detent balls can become lodged in the shifter fork set screw holes in the shafts. See Fig. 2 for ball location.

Shift left side shafts into neutral position and pull low and reverse range shifter shaft from transmission case.

Be careful not to lose three balls (5/16 inch) in shifter shaft front detent hole (Fig. 1).



1—Spring Pin
2—Detent Ball and Spring
3—Low Position
4—Neutral Position
5—Reverse Position
6—Interlock Pin
7—Interlock Balls
8—1st-5th Speed Position
9—Spring Pin
10—Spring
11—2nd-6th Speed Position
12—4th-8th Speed Position
13—3rd-7th Speed Position
14—Detent Ball and Spring
15—Park Position
16—Neutral Position
17—High Position
18—Speed Shifter Shaft 1st-5th, 2nd-6th
19—Speed Shifter Shaft 3rd-7th, 4th-8th
20—Shifter Shaft Park and High Range
21—Shifter Shaft Low and Reverse Range

Fig. 2-Shifter Mechanism

Shift inside speed shaft into gear (to release interlock pin) and pull the high range shifter shaft from transmission case, being careful not to lose one ball (5/16 inch) and spring in shifter shaft rear bottom detent hole (see inset in Fig. 1, page 0315-3).

Pull inside speed shifter shaft out of transmission case until three balls (1/4 inch) can be removed from shaft as shown in Fig. 3. Then pull shaft out of transmission case, being careful not to lose three balls (5/16 inch) in shifter shaft rear detent hole (see inset in Fig. 3). One ball on one side is spring loaded and there are two balls on the opposite side.

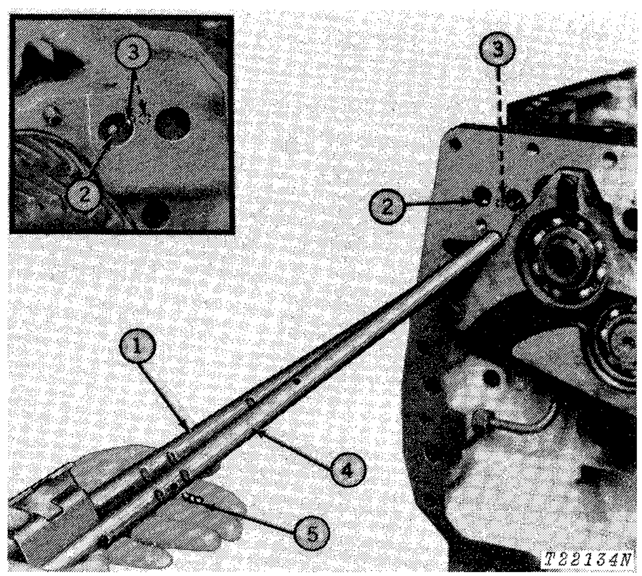
CAUTION: Be sure and return all interlock balls to their correct location when assembling. Not to do so can cause the transmission to jump out of gear.

Remove two balls (1/4 inch between speed shifter shafts at front detent hole) (Fig. 3).

Pull outside speed shifter shaft out of transmission case, being careful not to lose one ball (5/16 inch) and spring in front detent hole.

Remove shifter forks from the appropriate shifter collars.

Remove shifters from low and reverse sliding gear and high and park range pinion inside transmission case.

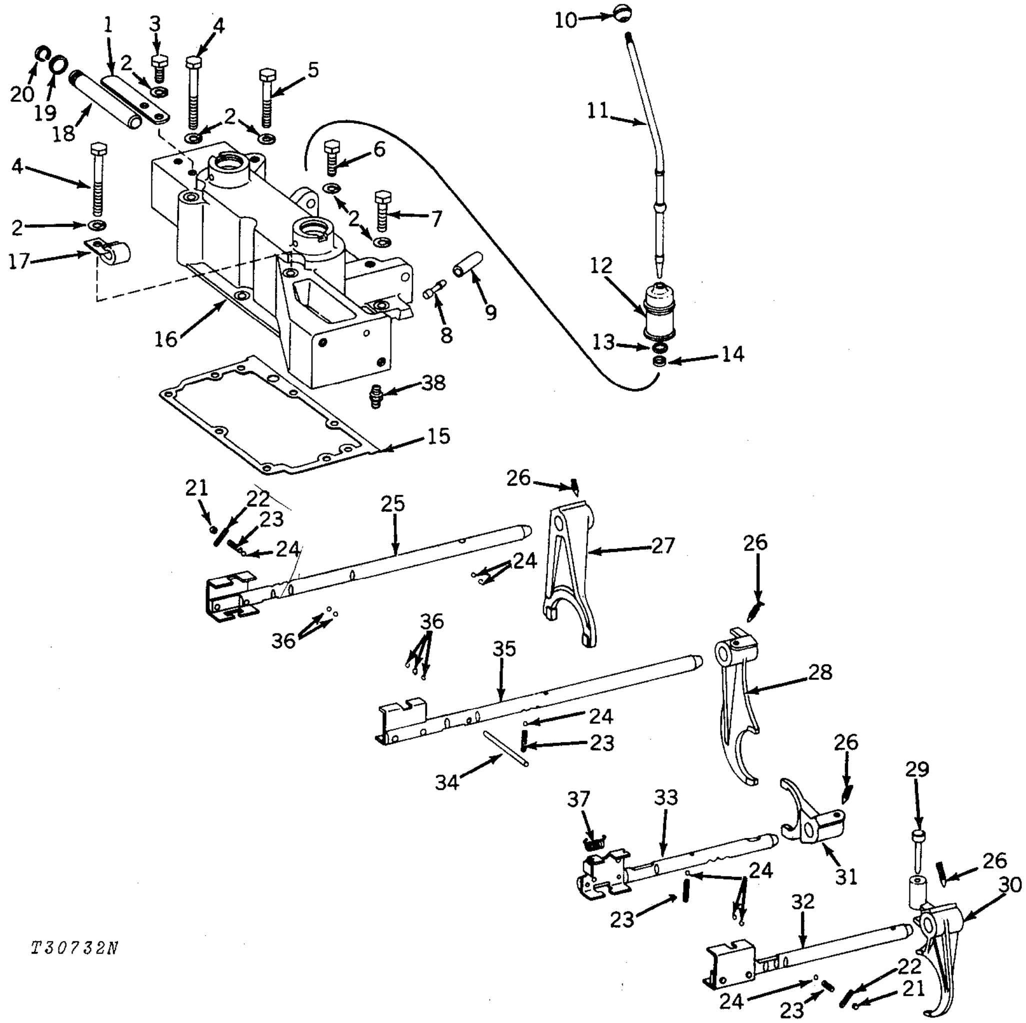


1—Outside Shifter Shaft
2—One 5/16″ Ball and Spring
3—Two 1/4″ Balls Between Shafts
4—Inside Shifter Shaft
5—Three 1/4″ Balls

Fig. 3-Removing Speed Change Shifter Shafts

To remove high and park range pinion, first remove transmission front bearing support.

REPAIR



1—Pedal Stop
2—Lock Washer (11 used)
3—Cap Screw (2 used)
4—Cap Screw (2 used)
5—Cap Screw
6—Cap Screw (4 used)
7—Cap Screw (2 used)
8—Special Tube (-134822)
9—Cap (-134822)
10—Ball (2 used)
11—Gear Shift Lever (2 used)
12—Boot (2 used)
13—Snap Ring (2 used)
14—Retainer (2 used)
15—Gasket
16—Clutch Housing Cover
17—Clamp
18—Clutch Pedal Pivot Shaft
19—Washer
20—Snap Ring
21—Detent Plug (3 used)
22—Spring Pin (2 used)
23—Spring (4 used)
24—Ball, 5/16" (8 used)
25—Speed Shifter Shaft 1st-5th, 2nd-6th
26—Special Set Screw (4 used)
27—Shifter, 1st-5th, 2nd-6th
28—Shifter, 3rd-7th, 4th-8th
29—Pin
30—Low-Reverse Range Shifter
31—High Range Shifter
32—Low-Reverse Range Shifter-Shaft
33—High Range Shifter Shaft
34—Pin
35—Speed Shifter Shaft 3rd-7th, 4th-8th
36—Ball, 1/4" (5 used)
37—Spring
38—Connector

Fig. 4-Shifter Mechanism

Refer to Fig. 4 for identification and relative location of parts. Inspect the following items:

Shifters

Check shifters for excessive wear or bent condition and replace if necessary.

Shifter Shaft Parts

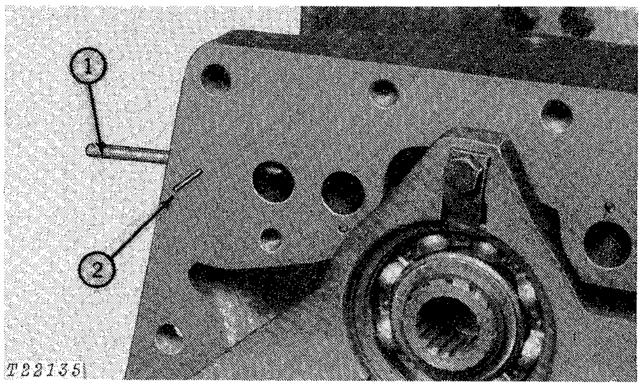
Make sure shafts are straight. Examine the area around the interlock notches and holes for wear and replace if necessary. Inspect shift guides on end of shafts for damage.

Inspect shifter shaft bores in transmission case for burrs or other damage.

Interlock Pin, Balls, and Springs

Check springs free length (0.960 inch [24.38 mm]) and test length (0.0640 inch at 30 ± 3.5 lb. [1.626 mm at 134 ± 16 N] [1.626 mm at 14± 2 kg]). Replace if necessary.

Inspect all balls for any flat surfaces.



T22135

1—Interlock Pin **2—Spring Pin**

Fig. 5-Removing Interlock Pin

NOTE: For units with park brake, the interlock pin (34, Fig. 4) and balls (36) are not used.

Inspect interlock pin in transmission case for damage. If pin is to be replaced, drive spring pin through front wall of transmission case and push interlock pin out right side of transmission case (Fig. 5).

INSTALLATION

Insert new pin in from right side of transmission case and replace plug and spring pin.

Refer to Figs. 2 through 7 for proper relationship of parts when assembling shifter mechanism.

CAUTION: Be sure and return all interlock balls to their correct location when assembling. Not doing so can cause the transmission to jump out of gear.

A tool for removal and installation of interlock balls may be produced locally or purchased. See "Special Tools," page 3-0399-5.

Install spring and insert special tool (end with indentation) to just past hole for the ball. Slide ball in indentation to hole and push tool into bore of case approximately 2 inches (51 mm). Rotate tool 1/4 turn.

Insert tapered end of shifter shaft in outer open end of tool. Push the tool on through the shifter shaft bore with the shifter shaft.

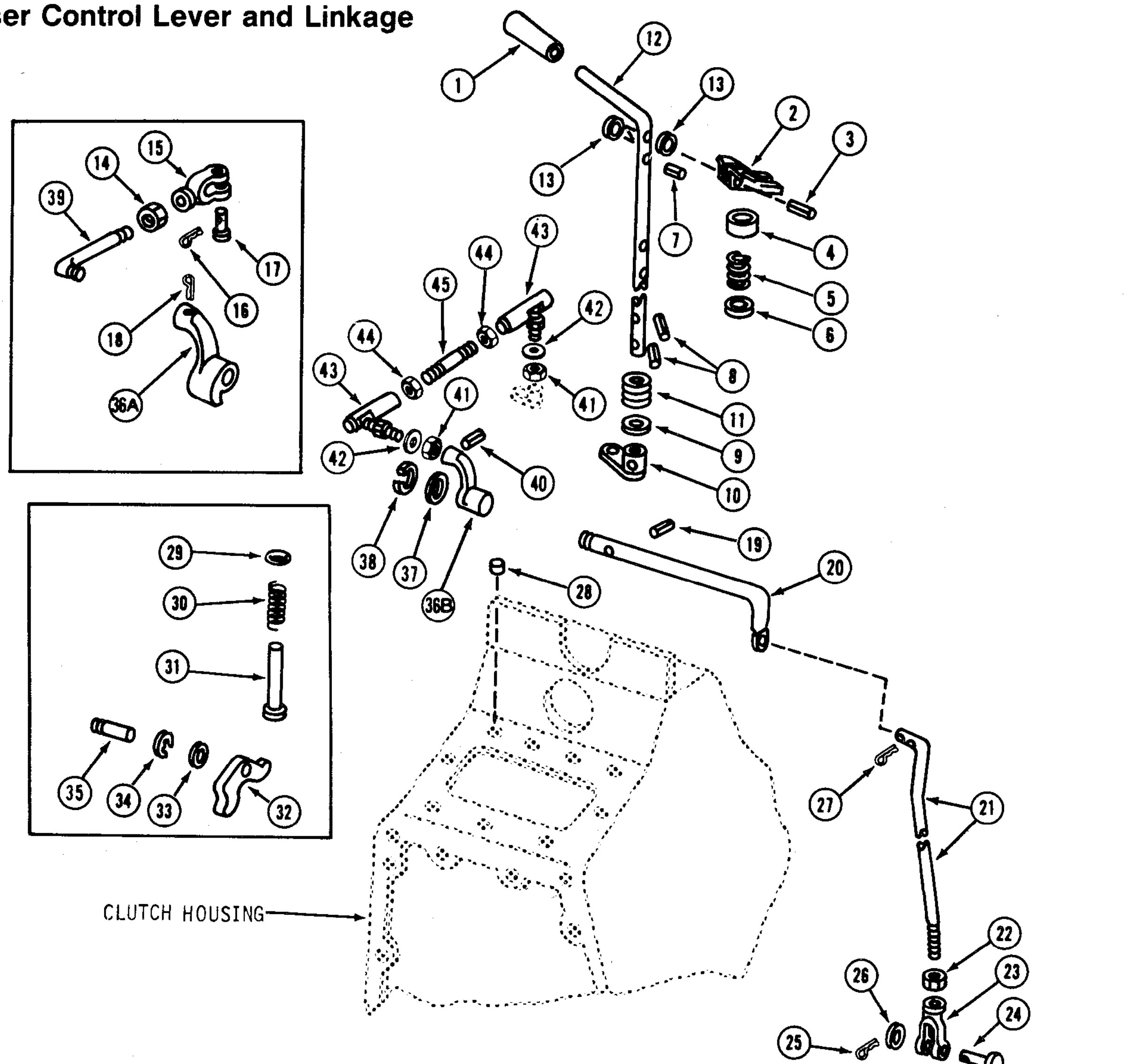
Shifter shafts may be removed from case without removing the balls and springs. This is accomplished by placing the open end of the tool to tapered end of shifter shaft to be removed. Push shaft from its bore with the tool. Leave tool in bore until ready to reposition shifter shaft and push tool out of bore with shifter shaft. Oil shaft and push in with one smooth motion.

Replace gasket and install top cover on transmission.

Join unit between clutch housing and transmission.

Shift levers through all ranges and gears to check for proper operation of shifters.

.everser Control Lever and Linkage



1—Knob
2—Neutral Latch
3—Spring Pin
4—Special Washer
5—Spring
6—Washer
7—Spring Pin
8—Spring Pin (2 used)
9—Washer
10—Control Arm
11—Bushing
12—Transmission Control Lever
13—Washer (use as required) (-268782)
14—Nut (-372850)
5—Adjustable Yoke (-372850)
16—Cotter Pin (-372850)
17—Pin (-372850)
18—Cotter Pin (-372850)
19—Spring Pin
20—Shaft
21—Control Lever Rod
22—Nut
23—Yoke
24—Headed Pin
25—Cotter Pin
26—Washer
27—Cotter Pin (2 used)
28—Plug
29—O-Ring (-276764)
30—Spring (-276764)
31 —Headed Pin (-276764)
32 —High Speed Lockout Arm (-276764)
33 —Washer (-276764)
34 —Snap Ring (-276764)
35 —Pin (-276764)
36A—Control Shaft Arm (-372850)
36B—Control Shaft Arm (372851-)
37 —Washer
38 —Retaining Ring
39 —Link (-372850)
40 —Spring Pin (372851-)
41 —Nut (372851-)
42 —Lock Washer (372851-)
43 —Ball Joint (372851-)
44 —Nut (372851-)
45 —Stud (372851-)

Fig. 6-Reverser Control Lever and Linkage

Inspect control linkage parts for damaged or worn condition. Refer to Fig. 6.

Check transmission control shaft (28) for twisted, broken or otherwise damaged condition.

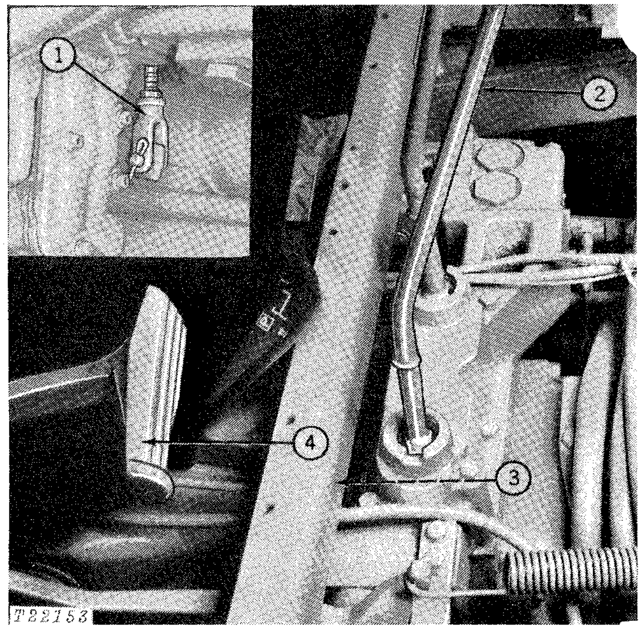
Examine bushings (11) in tractor cowl assembly for wear or damage. Install new bushing in cowl with larger diameter side facing upward.

Place one washer (-268782) on each side of transmission control lever between lever (12, Fig. 6) and neutral latch (2). Add washers as required to provide minimum clearance without binding.

Insert control lever through top bushing in dash until it bottoms. Install control lever arm to shaft with spring pin. Spring pin may be easily installed if control lever is rotated until it points to rear of dash.

Reposition control lever and connect control lever arm to control shaft arm.

Move reverser control lever backward and forward to locate the neutral detent position. Adjust link (39) or stud (45) to a position where the neutral latch (2) will fit over pin on dash. Tighten nut (14) or nuts (44) and recheck adjustment.



1—Adjusting Yoke **3—Lockout Pin Location**
2—High Position **4—Clutch Pedal**

Fig. 7-High Speed Lockout Pin Location

ADJUSTMENTS

Adjusting High Speed Lockout Pin Clearance (-276764)

Place the transmission range shifter lever in the high range position (2, Fig. 7).

Move the reverser control lever to the neutral position. With a feeler gauge, check the clearance between the control shaft arm and the side of the high speed lockout pin (Fig. 7). Lengthen or shorten the reverser control lever rod adjusting yoke (1) to provide the desired specification (0.040 inch [1.02 mm]).

It may be necessary to readjust the control lever neutral latch adjustment after adjusting lockout pin clearance.

Group 0341
HOUSINGS AND COVERS

GENERAL INFORMATION

The transmission housing is the main structural member of the transmission assembly. It supports and encloses the output transfer gears and output shaft. It includes various oil passages within the casting for oil circuits.

The transmission housing is located below the operator's seat in the unit and consists of two compartments. The forward compartment contains the transmission gear train and the rearward compartment contains the differential assembly.

The transmission housing provides a sump for the oil necessary for operation, lubrication, cooling and control functions for transmission and hydraulic system.

The transmission is part of the main frame and supports the final drive system. The transmission clutch housing bolts directly to the front of the transmission case.

The transmission gear train is contained in a single compartment of the transmission case. The case also serves as the main oil reservoir for the hydraulic system. A gear-type oil pump at the clutch housing end of the case forces oil through the transmission shafts to lubricate the gear train. It also charges the main hydraulic pump. The transmission also contains an oil cup reservoir which feeds oil (at gravity pressure) to the transmission parts when the unit is towed.

REMOVAL

Remove backhoe.

Place solid blocking under the rear of right and left loader side frames. Also place blocking under the center of the clutch housing.

Remove operator's seat and floor panels.

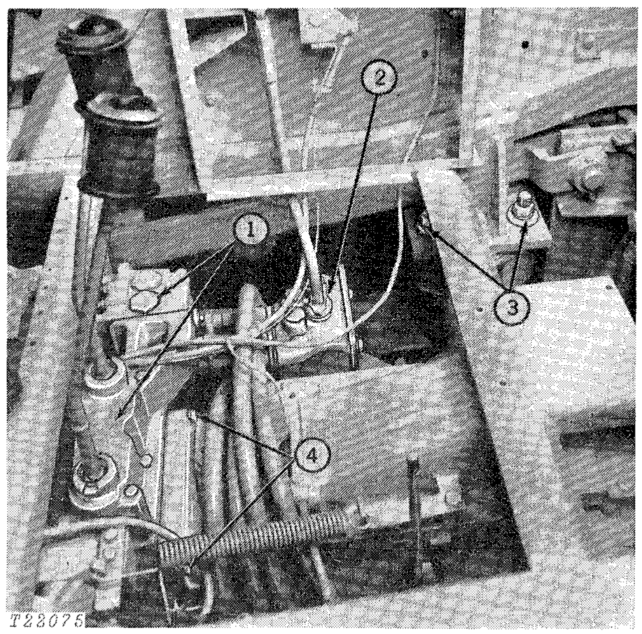
Remove batteries and disconnect battery box from transmission.

Drain oil from transmission.

Disconnect the loader control valve from the axle housing.

Disconnect all the necessary wiring, linkage and hydraulic lines between clutch housing and transmission case.

Remove cap screws securing loader side frames to axle housing.



1—Brake Valve and Clutch Housing Cover
2—Loader Control Valve
3—Loader Frame Attaching Points
4—Transmission Case Attaching Points

Fig. 1-Transmission Attaching Points

Disconnect and remove the brake valve and transmission and hydraulic oil filter.

Remove clutch housing cover.

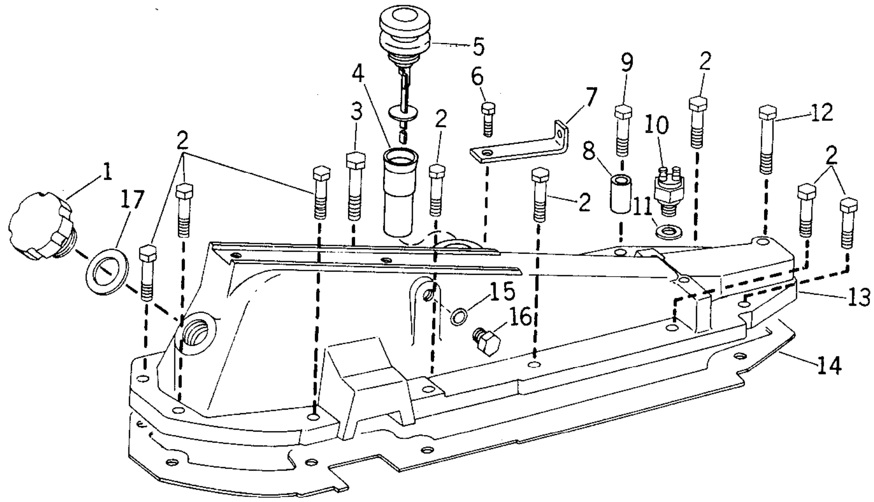
Support front of transmission with floor jack.

Support rear of canopy with chain hoist.

Remove cap screws securing transmission case to clutch housing. Roll transmission case away from clutch housing.

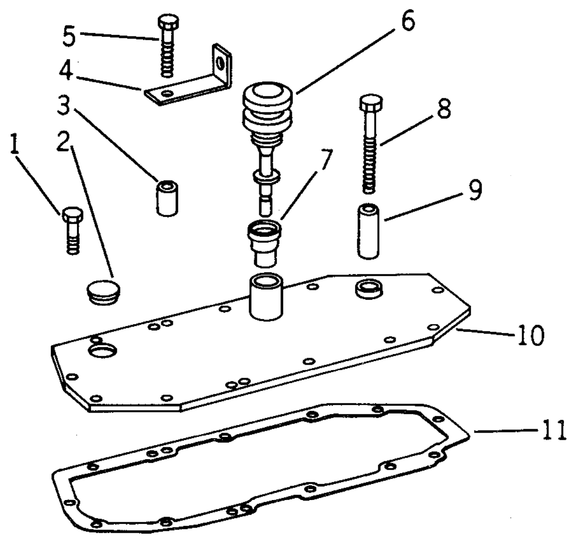
Support transmission case with a hoist.

Remove rear wheels and axle housings.



1—Oil Filler Cup
2—Cap Screw (10 used)
3—Cap Screw
4—Tube
5—Transmission Dipstick
6—Cap Screw
7—Clutch Spring Strap
8—Spacer
9—Cap Screw
10—Neutral Start Switch
11—Aluminum Washer
12—Cap Screw
13—Cover
14—Gasket
15—O-Ring
16—Plug
17—Packing

Fig. 2-Transmission Top Cover (-300420)

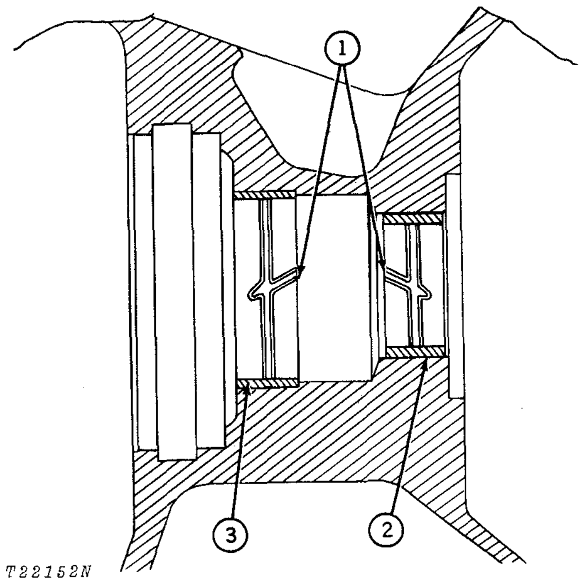


1—Cap Screw (11 used)
2—Cap
3—Pipe Spacer
4—Clutch Spring Strap
5—Cap Screw
6—Dipstick
7—Tube
8—Cap Screw
9—Pipe Spacer
10—Cover
11—Gasket

Fig. 3-Transmission Top Cover (300421-)

REPAIR

Check clutch housing for cracks or other damage.



1—Oil Groves
2—Reverse Brake Bushing
3—Forward Clutch Bearing

Fig. 4-Forward Clutch and Reverse Brake Bushings

Inspect bushings in center bore of clutch housing. Press in new bushings with open ends of oil grooves toward center of clutch housing (Fig. 4).

Remove top cover from top of transmission.

Remove shifter mechanism from front of transmission.

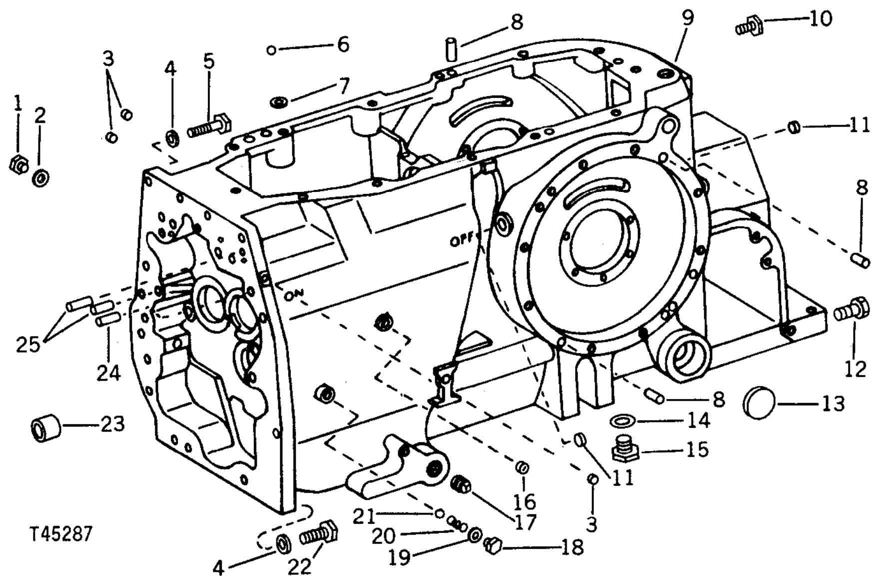
Remove transmission lubricating oil cup with oil lines.

Remove countershaft and transmission drive shaft.

Remove differential assembly.

Remove differential drive shaft.

Remove oil sump cover at bottom of transmission case.



1—Plug
2—O-Ring
3—Plug (3 used)
4—Special Washer (8 used)
5—Cap Screw (2 used)
6—Steel Ball
7—O-Ring
8—Dowel Pin (6 used)
9—Transmission Case
10—Cap Screw (-335257)
11—Differential Lock Shifter Shaft Holes Plug (2 used)
12—Cap Screw
13—Transmission Load Control Blower Shaft Plug (2 used)
14—Special Washer (2 used)
15—Drain Plug (2 used)
16—Plug
17—Reducer Bushing
18—Cap Screw
19—Special Washer
20—Spring
21—Ball
22—Cap Screw (6 used)
23—Bushing
24—Hollow Dowel (2 used)
25—Dowel Pin (2 used)

Fig. 5-Transmission Case

Remove and clean suction screen.

Suction screen is removed by taking out a plug on the right side of the transmission. The cover goes over cavity in which screen is located.

Clean reservoir at bottom of case and replace cover.

Clean transmission case thoroughly and inspect for cracks or other damage.

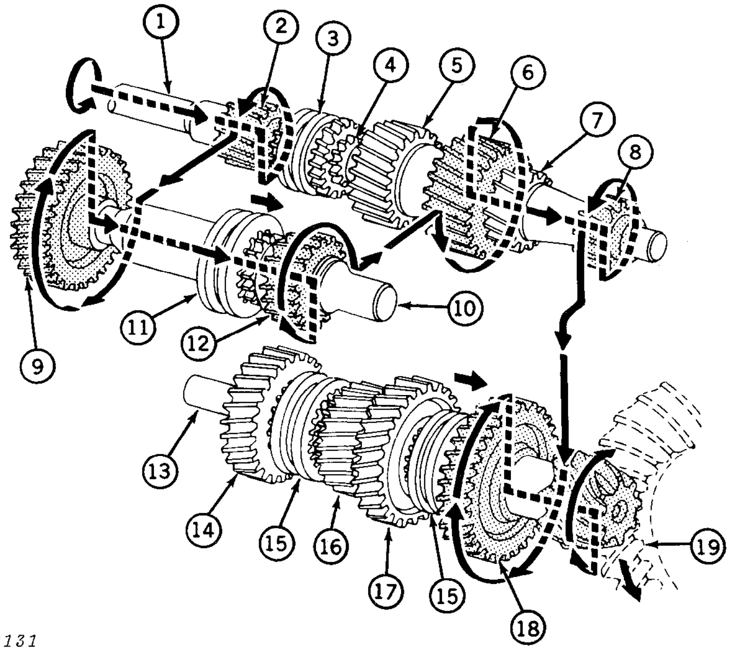
Inspect oil level rod and tube for damage and replace if necessary. If tube is damaged, remove old tube and press in new tube until it bottoms out.

INSTALLATION

Install transmission case by reversing the removal procedure.

NOTE: Refer to page 0741-3 for correct sequence of cap screws torquing, connecting transmission case to clutch housing.

Group 0351
GEARS, SHAFTS AND BEARINGS



1—Clutch Shaft
2—Drive Gear
3—High Range Shifter Collar
4—Transmission Drive Shaft
5—Third and Seventh Speed Drive Gear
6—Fourth and Eighth Speed Drive Gear
7—Second and Sixth Speed Drive Gear
8—First and Fifth Speed Drive Gear
9—Countershaft Drive Gear
10—Countershaft
11—Shifter Collar
12—Low Range Pinion
13—Differential Drive Shaft
14—Third and Seventh Speed Driven Gear
15—Shifter Collar (2 used)
16—Fourth and Eighth Speed Driven Gear
17—Second and Sixth Speed Driven Gear
18—First and Fifth Speed Driven Gear
19—Differential

Fig. 1-Collar Shift Transmission
(Power Flow in First Forward Speed Illustrated)

GENERAL INFORMATION

The transmission is a collar shift type using helical gears. Two shift levers manually select four gears in each of two forward ranges. This provides eight forward speeds. A hydraulic reverser unit changes input shaft rotation to provide four reverse speeds.

The transmission gears are carried on three shafts—the transmission drive shaft, the differential drive shaft, and the countershaft (Fig. 1).

Transmission Drive Shaft

The transmission drive shaft is located at the top of the transmission. It is a solid shaft with four gears which transmit power to the differential drive shaft from the countershaft (low range) or directly from the reverser (high range).

Differential Drive Shaft

The differential drive shaft is located below and to the right of the transmission drive shaft. Four gears in constant mesh with the transmission drive shaft are located on the differential drive shaft. Two shift collars connect the four gears to the differential drive to complete the power flow path. Power is transmitted to the differential assembly by the bevel pinion at the rear of the differential drive shaft.

Countershaft

The countershaft is located to the left and slightly below the transmission drive shaft. It carries a low range pinion to provide low range shifting between the countershaft and the transmission drive shaft.

Input power is transmitted from the clutch shaft to the countershaft by a transmission drive gear which is located on the clutch shaft.

Fig. 1 illustrates the collar shift transmission parts. Gear combinations to obtain first gear (forward) are also shown.

Use the following chart and Fig. 1 to trace power flow through the transmission when diagnosing problems in a particular operating gear. The drive gears and driven gears are listed by component numbers (see key to Fig. 1) in the sequence of power flow.

Gear	Power Flow (Fig. 1)
Forward	
1	1, 2, 9, 12, 6, 8, 18, 13, 19
2	1, 2, 9, 12, 6, 7, 17, 13, 19
3	1, 2, 9, 12, 6, 5, 14, 13, 19
4	1, 2, 9, 12, 6, 16, 13, 19
5	1, 2, 8, 18, 13, 19
6	1, 2, 7, 17, 13, 19
7	1, 2, 5, 14, 13, 19
8	1, 2, 6, 16, 13, 19

Reverse speeds use the same gears as 1 through 4 forward speeds except that power flow into the transmission is reversed by the reverser clutch assembly.

REMOVAL

Remove as described in Group 0341.

Countershaft

Remove cap screws securing bearing support to front of transmission.

Remove snap ring from groove at rear of countershaft.

Rotate the locking washer until the splines on the washer index with the countershaft splines.

Pry the bearing support off the dowels on the front of the transmission case. As the bearing support, countershaft, and transmission drive gear are pulled forward, the gears and shifter collar will slide off the rear of the countershaft. Keep these parts in order to aid in assembly.

Transmission Drive Shaft

Remove transmission drive shaft front bearing quill, shims, and rear lubricating oil line.

Tap transmission drive shaft forward to free front bearing cup from case and rear bearing cone from cup.

Move transmission drive shaft forward and work rear end of shaft through top of transmission case.

Differential Drive Shaft

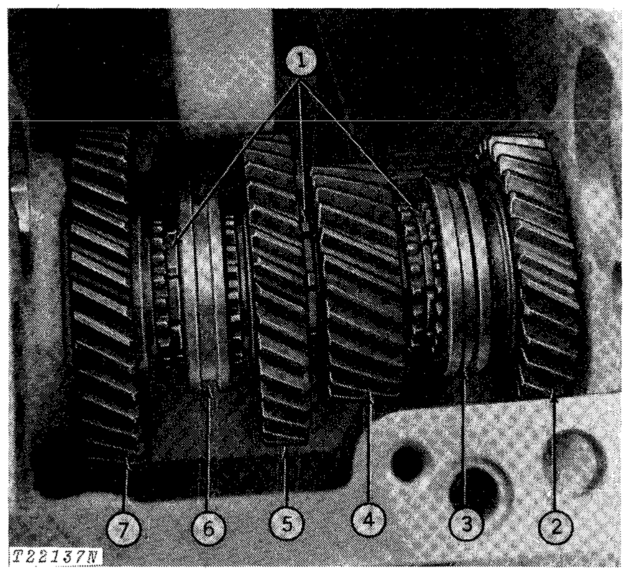
To service differential drive shaft, block up transmission case and remove final drive housings from unit.

Lift differential assembly to relieve weight on bearing quills.

Remove bearing quills with shims from transmission case, keeping shims with their respective quills for correct assembly.

If the differential ring gear is no longer serviceable and must be replaced, also replace the differential drive shaft.

These parts are furnished as matched sets and are not available individually for replacement.



1—Locking Thrust Washer
2—3rd-7th Speed Gear
3—Collar
4—4th-8th Speed Gear
5—2nd-6th Speed Gear
6—Collar
7—1st-5th Speed Gear

Fig. 3-Removing Differential Drive Shaft

Remove hex, nut, washer, bearing, shim pack, and spacer from the front of the differential drive shaft.

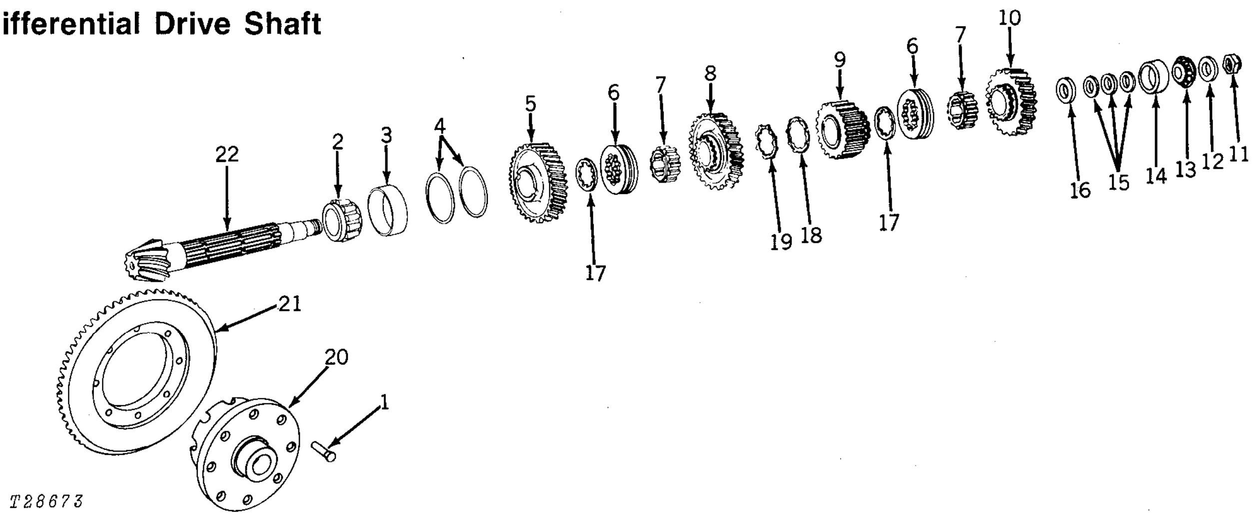
Tap front of shaft with rubber hammer or brass drift to obtain end play in shaft. This will loosen front bearing.

Locate the three locking thrust washers on the drive shaft (Fig. 3). Rotate the thrust washers in their grooves until the splines on the shaft and washers index.

Pull drive shaft to the rear until it can be lifted from the differential compartment. Keep these parts in order to aid in assembly.

REPAIR

Differential Drive Shaft



1—Rivet (8 used)
2—Bearing Cone
3—Bearing Cup
4—Shims (approx. 2 used)
5—1st-5th Speed Gear
6—Collar (2 used)
7—Shifter Collar Sleeve (2 used)
8—2nd-6th Speed Gear
9—4th-8th Speed Gear
10—3rd-7th Speed Gear
11—Special Nut
12—Special Washer
13—Bearing Cone
14—Bearing Cup
15—Shim (as required)
16—Spacer
17—Thrust Washer (2 used)
18—Retaining Washer
19—Thrust Washer
20—Differential Housing
21—Ring Gear
22—Bevel Pinion

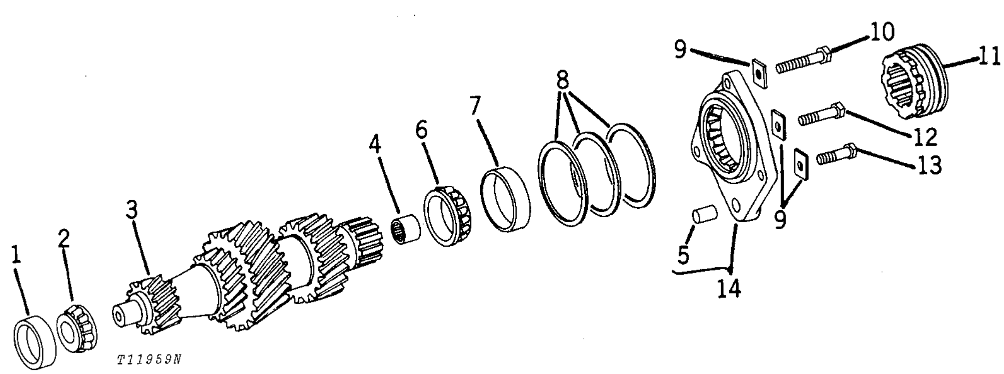
Fig. 4-Differential Drive Shaft

If the differential drive shaft is no longer serviceable and must be replaced, also replace the ring gear. These parts are furnished as matched sets and are not available individually for replacement.

NOTE: When installing shifter collar sleeves (7, Fig. 4), install with protruding teeth toward ring gear. Teeth must engage with thrust washers (17).

If either a new transmission case, differential assembly, or differential drive gear with bearing cups and cones is to be installed, it will be necessary to (1) check and adjust differential drive shaft preload and cone point and (2) set proper backlash between drive shaft and differential assembly as described in Group 0210.

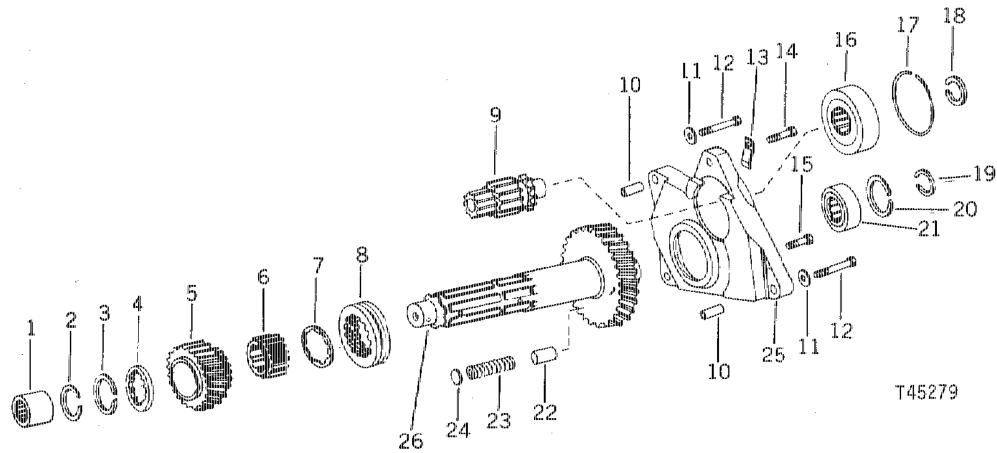
Transmission Drive Shaft



1—Bearing Cup
2—Bearing Cone
3—Transmission Drive Shaft
4—Needle Bearing
5—Dowel Pin
6—Bearing Cone
7—Bearing Cup
8—Shim [0.003″, 0.005″, 0.010″ (0.08, 0.13, 0.25 mm)]
9—Lock Plate (3 used)
10—Cap Screw
11—High Range Shifter Collar
12—Cap Screw
13—Cap Screw
14—Quill

Fig. 5-Transmission Drive Shaft

Countershaft and Bearing Support



1—Needle Bearing
2—Snap Ring
3—Snap Ring
4—Thrust Washer
5—Low Range Pinion (22 teeth)
6—Sleeve
7—Thrust Washer
8—Collar
9—Transmission Drive Gear (12 teeth)
10—Hollow Dowel (2 used)
11—Special Washer (2 used)
12—Cap Screw, 3/8" x 2" (2 used)
13—Clamp
14—Cap Screw, 3/8" x 1-1/4"
15—Cap Screw, 3/8" x 1"
16—Ball Bearing
17—Snap Ring
18—Snap Ring
19—Snap Ring
20—Snap Ring
21—Ball Bearing
22—Friction Plug (2 used)
23—Spring (2 used)
24—Spacer (2 used) (with reverser)
25—Countershaft Support Bearing
26—Countershaft with Gear (37 teeth)

Fig. 6-Countershaft and Bearing Support

If bearing support, countershaft, transmission drive gear, or bearings which support these parts need to be replaced, remove snap rings securing bearings to support and shafts and press shafts out of bearing support.

The transmission drive gear must be removed before the countershaft can be removed.

Press new shafts or bearings in support until all snap rings fit in their proper grooves.

Ball bearing (16, Fig. 6) must be assembled with the end opposite the snap ring groove entering first.

Inspect friction plugs (22) for wear and replace if necessary. Replace plugs when the grooves in the friction material are completely worn smooth.

Check springs (23). Free length is 1-7/8 inch (47.6 mm), test length 1-1/2 inch (38.1 mm) at 63 to 77 lb force (280 to 343 N).

INSTALLATION

Differential Drive Shaft

(1) Cone Point Adjustment

Cone point adjustment is obtained by controlling the shim pack between the differential drive shaft rear bearing cup and the transmission case.

See Group 0210 for the cone point adjustment procedure.

Insert differential drive shaft with rear bearing cone into differential compartment and slide shaft forward about one-half the distance of the shaft into transmission compartment.

Refer to Fig. 4 for identification and sequence of parts installed on differential drive shaft.

Shift collar spacers should be installed with tangs toward rear.

(2) Preload Adjustment

Measure end play to obtain 0.006 inch (0.15 mm) preload and 10 to 20 lb-in. (1.1 to 2.3 N·m) (0.1 to 0.2 kg-m) of rolling drag torque.

Install the proper shim pack, bearing cone, washer, and hex. nut. Be sure bent tang on washer faces out toward threaded end of shaft. Tighten nut to 160 lb-ft (217 N·m) (22 kg-m) and stake it.

NOTE: If differential drive shaft is removed to aid in checking or adjusting differential assembly preload, be careful that the differential drive shaft preload shim pack is not damaged or lost.

Be sure front oil line is in place.

Transmission Drive Shaft

Install transmission drive shaft into case and slip it to the rear so that the bearing cone seats in rear bearing cup.

End Play Adjustment

Adjust transmission drive shaft to 0.004 to 0.006 inch (0.10 to 0.15 mm) end play. Tighten quill attaching cap screws to 35 lb-ft (47 N·m) (5 kg-m). Fold lock tags over cap screws.

Countershaft

Be sure high range collar and high and park range shifter are installed on front of transmission drive shaft before installing countershaft assembly.

Install shifter collar sleeve (6, Fig. 6) with protruding teeth toward countershaft support bearing. Teeth must engage with thrust washer (7).

Install countershaft assembly and secure bearing support assembly to transmission case.

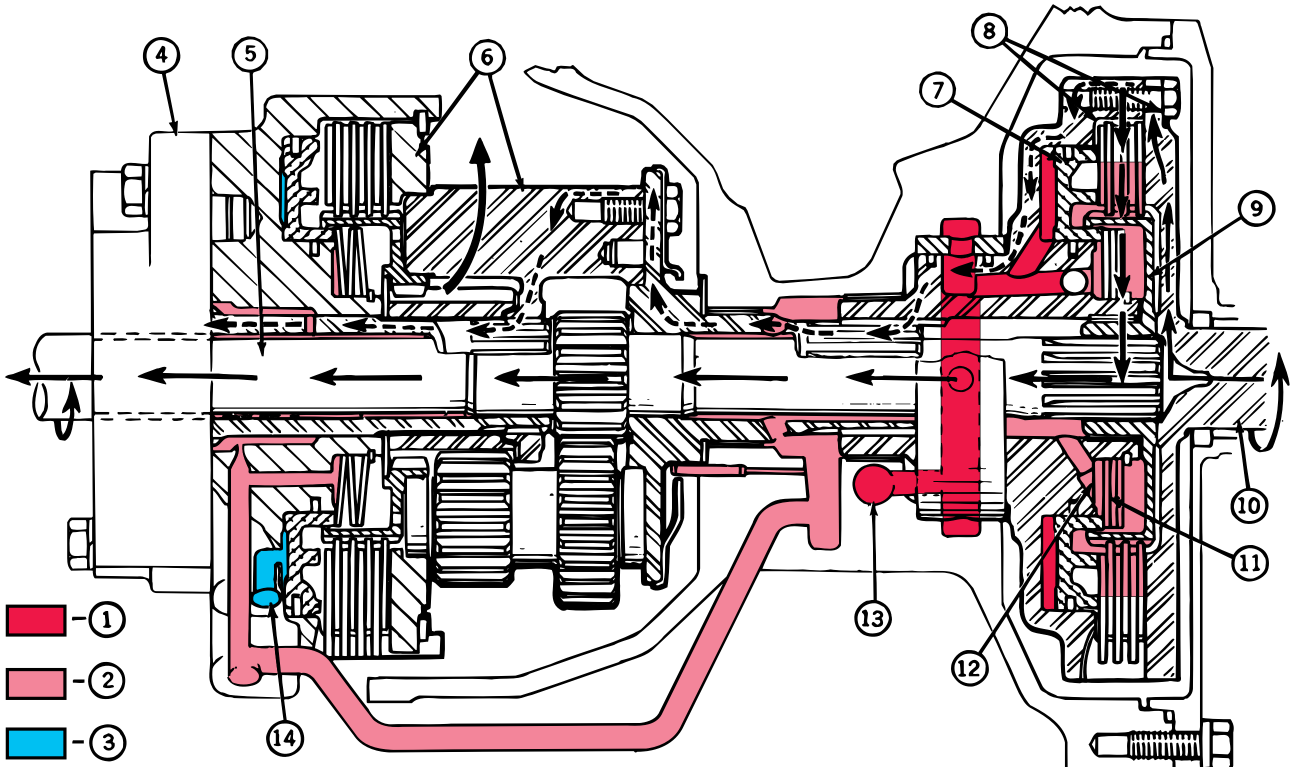
Install transmission oil cup and rear oil line. Tighten oil cup-to-transmission case cap screw to 20 lb-ft (27 N·m) (3 kg-m).

To be sure of axle assembly lubrication, ends of oil tubes must extend into or be flush with inner edge of axle assembly compartment so that oil is directed into each axle assembly compartment. Hand bend tubes if necessary.

Check for interference of oil lines with shafts. Also check for proper engagement of oil line adapters into ends of shafts.

Install shifter mechanism in transmission case.

Reverser Clutch Assembly



1—Pressure Oil
2—Lube Oil
3—Return Oil
4—Transmission Oil Pump
5—Clutch Shaft
6—Reverse Brake Assembly
7—Forward Clutch Piston
8—Forward Clutch Assembly
9—Clutch Hub
10—Clutch Drive Shaft
11—Spring Washer Pack
12—Lube Oil Opening to Clutch Pack
13—Pressure Oil Inlet From Shift Valve
14—Return Oil to Sump

Fig. 7-Reverser Unit in Forward Drive

General Information

The reverser clutch contains two main functional units:

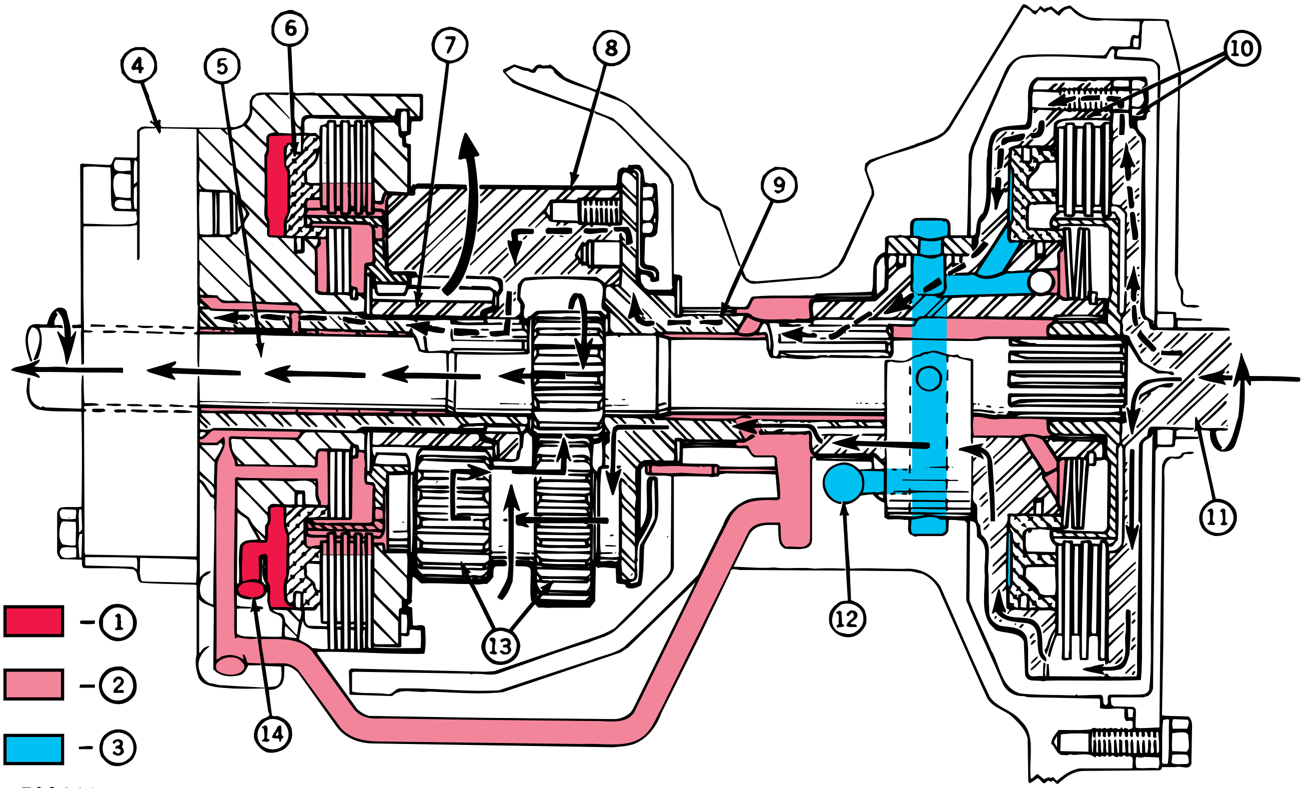
(1) Forward Clutch Assembly
(2) Reverse Brake Assembly

Forward Clutch Assembly (Fig. 9)

The forward clutch assembly consists of three sintered bronze clutch friction disks alternated with three steel separator plates. The disks and plates are "stacked" on a clutch hub. Internal teeth on the disks mesh with teeth on the hub. The separator plates have external tangs fitting into slots on the clutch drum. To aid in clutch release, the clutch separator plates have a "wavy" configuration.

The clutch pack is engaged by movement of a circular hydraulic piston. A spring washer pack returns the piston when the clutch pack is disengaged.

The forward clutch hub, drum, and separator plates are driven by the clutch drive shaft splined to the dry-type disconnect clutch. The clutch hub is splined to the rear clutch shaft and rotates only when the forward clutch is engaged.



1—Pressure Oil
2—Lube Oil
3—Return Oil
4—Transmission Oil Pump
5—Clutch Shaft
6—Reverse Brake Pinion
7—Planet Sun Pinion (braked)
8—Planet Pinion Carrier
9—Planet Pinion Carrier Shaft
10—Forward Clutch Assembly
11—Clutch Drive Shaft
12—Return Oil to Sump
13—Planet Pinion
14—Pressure Oil Inlet from Shift Valve

Fig. 8-Reverser Unit in Reverse Drive

Reverse Brake Assembly (Fig. 10)

The reverse brake assembly is a hydraulic and mechanical device to reverse the flow of engine power to the transmission, without shifting gears. A hydraulic disk-type brake and a single compound planetary set act together to provide this type of tractor reversing.

The reverse brake unit consists of four sintered bronze friction disks alternated with four separator plates. The disks have internal splines in mesh with external teeth on the brake hub. The hub is splined to the planet sun pinion in the planetary set. The separator plates have external tangs fitting in slots around the outside of the reverse brake housing. To aid in brake release, the separator plates have a "wavy" configuration.

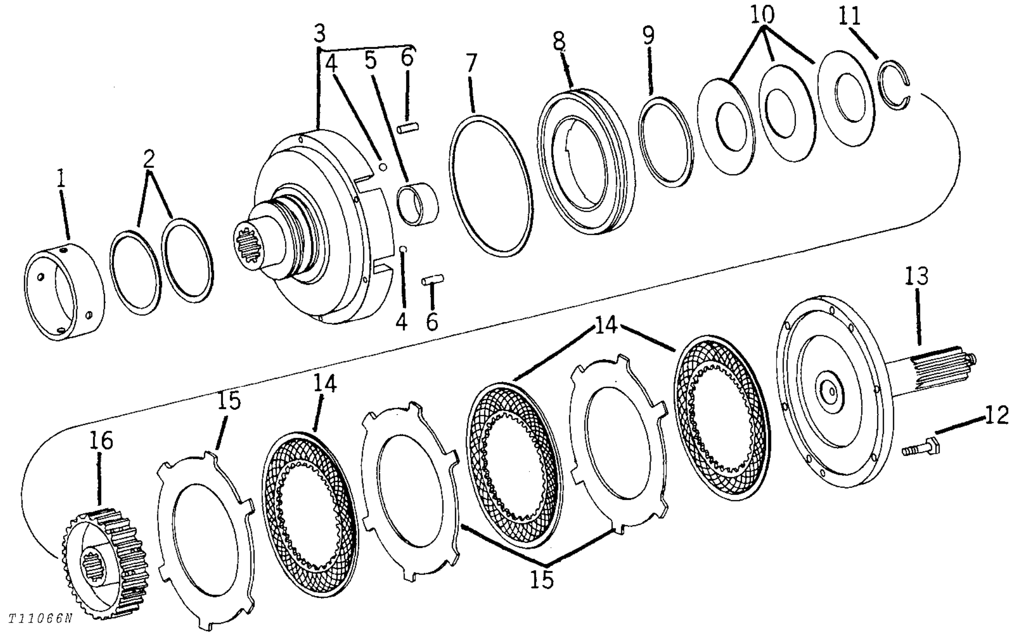
The reverse brake is applied by means of a circular hydraulic piston. When the brake is disengaged, spring washers return the piston.

The reverser planetary system consists of a planet pinion carrier with three planet pinions, a planet sun pinion, and a driven gear integral with the clutch shaft (Fig. 10). The planet pinions are made up of two gears on a single forging supported in the carrier by shafts and needle bearings. The largest gear (25 teeth) on the planet pinion is in mesh with the clutch shaft driven gear (17 teeth), while the smaller planet pinion gear (17 teeth) is in mesh with the planet sun pinion (25 teeth).

REPAIR

Refer to Group 0360 and remove the reverser components from the clutch housing.

Clutch Pack



T11066N

1—Sleeve
2—Sealing Ring (2 used)
3—Drum Assembly
4—Ball (2 used)
5—Bushing
6—Dowel Pin (2 used)
7—Sealing Ring
8—Clutch Piston
9—Sealing Ring
10—Spring (3 used)
11—Snap Ring
12—Cap Screw (6 used)
13—Clutch Drive Shaft
14—Clutch Drive Disk (3 used)
15—Separator Plate (3 used)
16—Clutch Hub

Fig. 9-Forward Clutch Assembly

Disassembly

Refer to Figure 9 for parts identification and disassembly of forward clutch assembly.

Release spring washer pack and remove piston with a press and an AM236T Oil Filter Cover as described under "Reverse Brake Assembly", page 0351-11.

Examine bushing in hub for wear. Drive in new bushing until top is flush with bottom of chamfer in bushing bore. Open end of bushing oil groove must face inward.

Inspect steel separator plates and bronze clutch disks for wear. Examine grooved pattern on facings of disk to see that it has not been worn or chipped off.

The separator plates should have a slight "wavy" configuration. Do not attempt to flatten these plates.

Assembly

Liberally grease all sealing rings to facilitate installation. Be sure sealing rings do not become twisted or damaged when installing pistons.

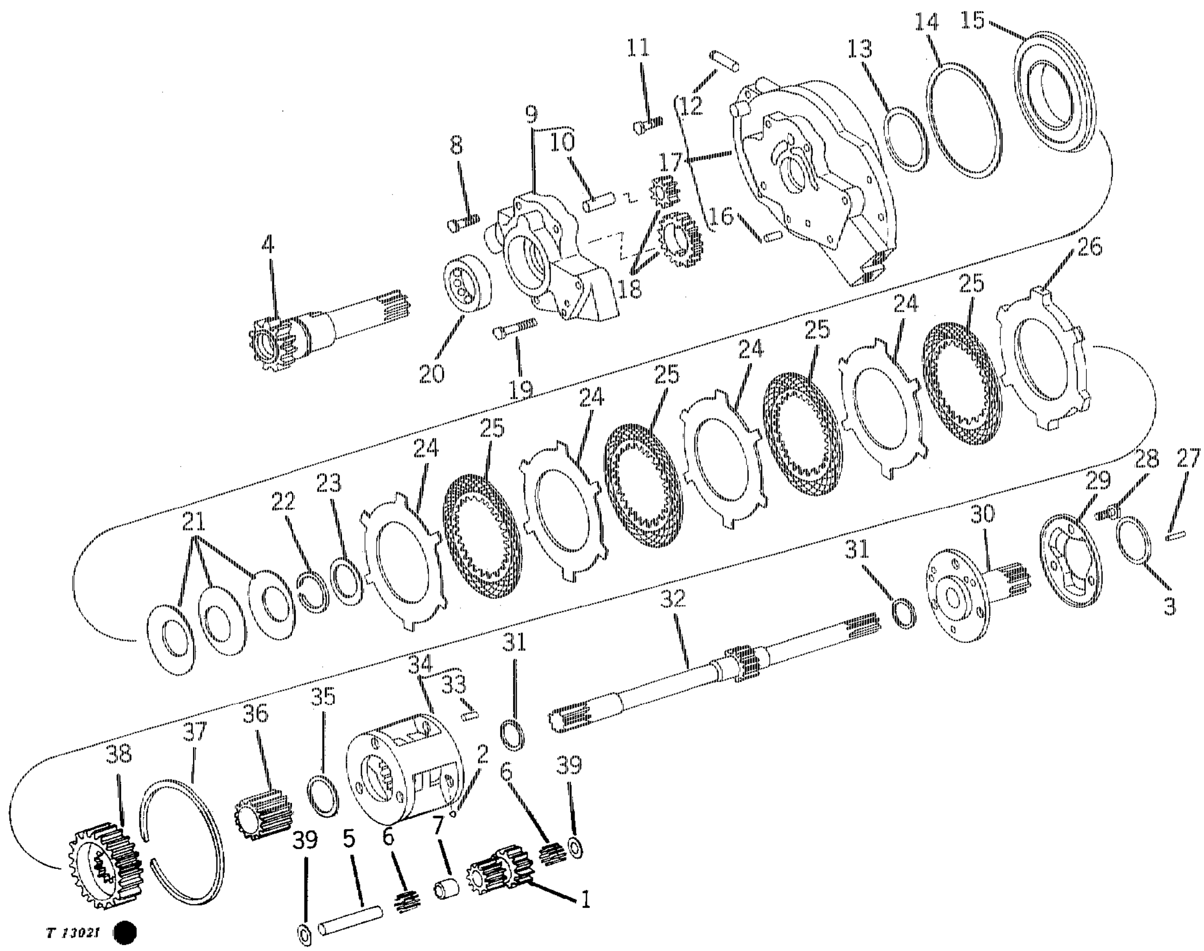
Install one spring washer (concave side down) against piston. Place other two spring washers, concave side to concave side, against the first washer.

Using a press and AM236T Oil Filter Cover, depress spring washer pack until snap ring can be seated.

Place clutch hub over spring pack and starting with a tanged separator disk and alternating with a clutch facing, asssemble the clutch pack (consisting of three separator plates and three clutch disks).

Install clutch drive shaft to drum. Tighten cap screws to 20 lb-ft (27 N·m) (3 kg-m).

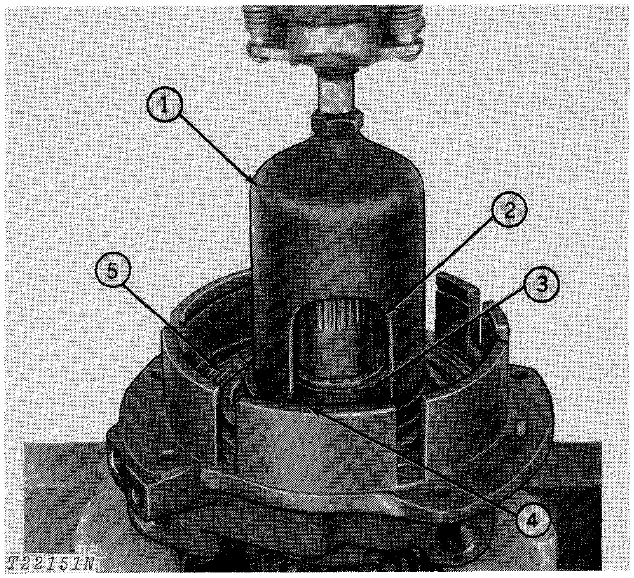
Reverser Brake Assembly



1—Planet Pinion (set of 3)
2—Steel Ball (3 used)
3—Thrust Washer
4—Powershaft Drive Shaft
5—Planet Pinion Shaft
6—Roller Bearing (132 used)
7—Spacer (3 used)
8—Cap Screw
9—Oil Pump Body
10—Pin
11—Cap Screw (7 used)
12—Pivot Pin
13—Sealing Ring
14—Sealing Ring
15—Brake Piston
16—Dowel Pin (3 used)
17—Reverser Brake Housing
18—Oil Pump Gears
19—Screw (5 used)
20—Roller Bearing
21—Spring (3 used)
22—Snap Ring
23—Thrust Washer
24—Separator Plate (4 used)
25—Brake Disk (4 used)
26—Backing Plate
27—Spring Pin
28—Cap Screw (3 used)
29—Baffle
30—Pinion Carrier Shaft
31—Thrust Washer (2 used)
32—Clutch Shaft
33—Dowel Pin
34—Planet Pinion Carrier
35—Thrust Washer
36—Pinion
37—Snap Ring
38—Clutch Hub
39—Thrust Washer (6 used)

Fig. 10-Reverse Brake Assembly with Transmission Oil Pump

Refer to Figure 10 for parts identification and disassemble reverse brake assembly.



1—Oil Filter Cover
2—Revised Portion
3—Snap Ring
4—Spring Washer Pack
5—Piston

Fig. 11-Removing Reverse Brake Piston

The snap ring holding the spring washer pack in reverse brake housing must be removed in order to free piston from reverse brake housing. Place an AM236T Oil Filter Cover with one side cut out over washer pack and press down on washers until snap ring can be removed (Fig. 11). Then release pressure slowly. BE CAREFUL.

Disassembling Planetary Gear Set

The planet pinions rotate in planet pinion carrier on shafts supported by roller bearings located radially around inner circumference on each end of pinions. To remove pinions, push planet pinion shafts a slight distance from carrier and remove small locking balls at end of each shaft. Be careful, do not lose these balls.

Pull shafts completely from carrier and remove planet pinions, roller bearings, and spacers.

Use care not to lose roller bearings located radially on each end of planet pinions. There are 44 rollers used in each planet pinion assembly or a total of 132 rollers for the pinion set.

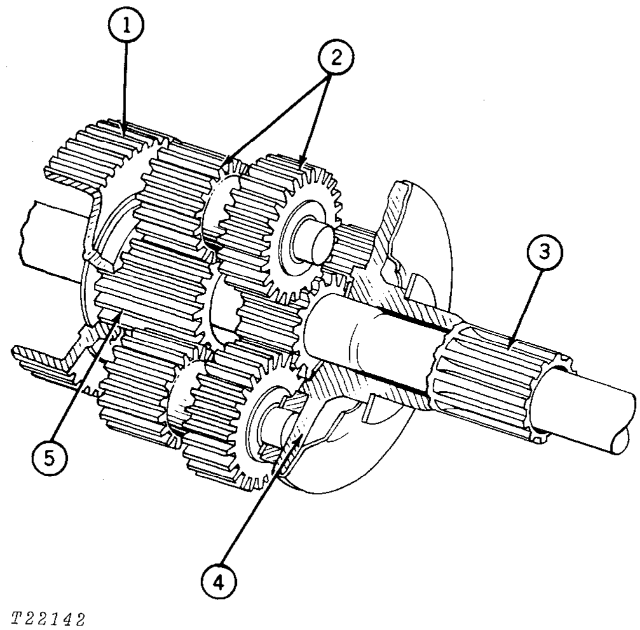
Check three spring washers for damage or flattened condition. With concave side of washer face down on a flat surface, approximate free height should be to specifications.

Inspect bronze clutch disks and steel separator plates for wear. Examine facings on disks to see that grooved pattern has not been worn or chipped off. Also check internal teeth for breakage.

The separator plates should have a slight "wavy" configuration. Do not attempt to flatten these plates.

If replacement of planet pinion is necessary, replace with a set of 3 pinions as planet pinions are matched.

Assembly



1—Reverse Brake Clutch Hub
2—Planet Pinion (3 used)
3—Carrier Drive Shaft
4—Planet Pinion Carrier
5—Planet Sun Pinion

Fig. 12-Reverser Planetary Set

Assemble reverse brake assembly using Figure 10 for parts identification.

Install pivot pin (12, Fig. 10) to extend 0.73 in. (18.5 mm) from surface of reverser brake housing (17).

Be sure sealing rings on piston are not cut during piston installation. Apply a generous coat of oil to sealing rings before installation.

To depress washer pack, use AM236T Oil Filter Cover (with one side cut out) and install snap ring. See Figure 11. BE CAREFUL.

To install the 44 rollers used in each planet pinion, apply a generous coating of grease to rollers to keep them in place during assembly.

Place planet pinion with roller bearing in carrier (large gear to front of carrier as installed in machine). Note number etched on large gear of pinion and numbers on clutch shaft gear. Match number on pinion with number on clutch shaft gear to be sure of proper timing.

Position a special washer on each end of planet pinion and install planet pinion shaft (end with hole to front). Push shaft in far enough so that locking ball hole is just exposed. Insert ball in hole and push shaft flush with outside of planet pinion carrier. Repeat the process on the other two planet pinions.

Install planet pinion carrier shaft on carrier. Install baffle. Tighten cap screws to specifications.

Place planet sun pinion in reverse brake hub and assemble planetary gear set to reverse brake housing.

Installation

Assemble reverser components in clutch housing as described under "Reverser Installation" in Group 0360.

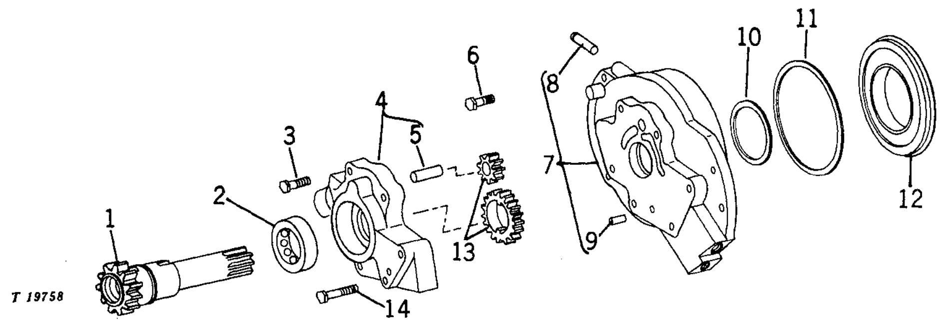
Install clutch housing with reverse unit in machine as described in Group 0741.

Attach top cover to top of transmission.

Join unit between clutch housing and transmission.

Group 0360
TRANSMISSION HYDRAULICS

TRANSMISSION OIL PUMP



1—Powershaft Drive Shaft
2—Roller Bearing
3—Special Screw
4—Oil Pump Body
5—Pin
6—Cap Screw (7 used)
7—Reverser Brake Housing
8—High Speed Lockout Arm Pivot Pin
9—Dowel Pin (3 used)
10—Sealing Ring
11—Sealing Ring
12—Reverse Brake Piston
13—Oil Pump Gear Assembly
14—Special Screw (5 used)

Fig. 1-Reverser Brake Housing, Piston and Oil Pump Body

GENERAL INFORMATION

The transmission oil pump is a constant displacement, gear-type pump, located on the rear wall of the reverser brake housing and driven at engine speed by the powershaft.

REPAIR

Separate transmission from clutch housing.

Remove pump inlet and outlet tubes.

Pull powershaft from pump drive gear.

Remove pump from rear of reverser brake housing.

Remove pump gears.

Check pump body for damage. Burrs can be removed with a file. Replace housing if cracked or badly scored.

Examine ball bearing in pump drive shaft bore for wear or damage. Install new bearing to bottom of bearing bore.

Inspect pump adapter for damage or wear.

Inspect pump gears for damage. Examine idler gear bushing for wear. Replace gears if unfit for service. Both gears must be replaced as a matched set.

INSTALLATION

Place the transmission oil pump drive gear into the transmission oil pump body cavity with the side of the gear which has flat ends on the drive tangs facing outward. Coat gears with oil before installation.

Install transmission oil pump body to reverse brake housing tightening screws to 23 lb-ft (31 Nm) (3 kg-m) torque.

If reverser brake housing has been removed, it should be reinstalled on clutch housing tightening screws to 35 lb-ft (47 Nm) (5 kg-m) torque.

Join clutch housing and transmission.

REVERSER

GENERAL INFORMATION

The reverser is a hydraulic and mechanical device which changes the direction of tractor travel under full load without shifting the transmission gears. A single compound planetary set of gears, a reverse brake, and one clutch are utilized to accomplish this type of directional shifting.

A "high-speed" lockout is provided in the reverser and transmission control mechanisms to allow reverse shifting only when the transmission is in low range.

NOTE: Units starting with S.N. (276765) will not have the high range reverse lockout.

Thus, four reverse speeds are provided, each approximately 35% faster than their respective forward low range speeds.

A single stage dry clutch is provided on the engine flywheel ahead of the reverser unit to disconnect the reverser during cold weather. The pedal control linkage is designed so that the reverser clutches are neutralized before the disconnect clutch is disengaged.

Oil Supply

Oil for reverser operation, lubrication, and cooling is drawn from the transmission case (main transmission-hydraulic oil reservoir) by the transmission oil pump located at the rear of the reverser. The oil is pumped through a micronic type oil filter before entering the reverser clutch control valve. An oil cooler, located at the front of the tractor and attached to the radiator, cools the transmission-hydraulic oil.

Control Valve Assembly

The reverser control valve housing, located on the right side of the tractor and bolted onto the clutch housing, receives pressure oil from the transmission oil pump. The components of the valve assembly are shown in Fig. 2.

Clutch Control Valve

The clutch control valve is controlled by the clutch pedal. Engaging the clutch pedal moves the clutch control valve, opening the pressure oil passage to the shift valve. Disengaging the clutch pedal moves the valve to close off pressure oil flowing to the shift valve and allows oil from the engaged clutch pack to return to sump. The accumulator remains charged when the clutch pedal is depressed, as the clutch control valve blocks the accumulator discharge port.

To obtain a close control of pressure oil (for inching into loads) a spring and movable stop are placed in the clutch control valve. This spring and stop allows the operator to closely regulate clutch pressure oil with the clutch pedal.

Shift Valve (Directional Valve)

The spool-type shift valve is operated by the reverser control lever and has three detented positions, forward or reverse, for direction control of the tractor and neutral position. This valve directs oil to engage the selected clutch pack during a shift. It also allows oil to return from the other clutch.

Accumulator Charging Orifices

A fixed accumulator charging orifice is provided to give a minimum accumulator charging rate. An adjustable charging orifice is also provided to vary the accumulator charging rate, controlling shift time. Closing the orifice decreases the rate of pressure rise and provides a smoother or softer shift. Opening the orifice increases the rate of pressure rise and reduces the tendency to drop torque under load, but makes shifts sharper under no load.

Accumulator

The accumulator is a spring-loaded piston located in the center of the reverser control valve housing. It controls pressure build-up during a shift and provides the following distinct functions:

(1) Maintains oil in reserve to provide a "surge" of oil to assist in moving the forward clutch or reverse brake pistons rapidly toward engagement during a directional shift.
(2) Provides a low system pressure at the time of initial clutch or brake engagement. This provides smoother shifting.
(3) Gives a gradual pressure build-up as the shift is accomplished and provides for a rapid pressure build-up to full engagement when the shift is completed.

Pressure Regulating Valve

A shim-adjusted regulating valve is provided to maintain full engagement pressure for reverse brake and forward clutch operation. In operation, this valve opens a passage to the cooler and allows oil not utilized by the reverser clutch packs to be sent via the main pump charging line to the oil cooler.

Cooler Bypass and Relief Valve

This valve protects the oil cooler from excessively high oil pressures, such as during cold weather when oil is stiff. The spring loaded valve bypasses cooler supply oil to the clutch lubrication circuit or, if pressures are excessively high, relieves oil to sump.

Lubrication Oil Pressure Reduction Valve

Pressure of oil returning from the cooler to the clutches depends upon line restriction, oil temperature, and engine rpm. This oil pressure could cause clutch drag and tractor creeping when the clutch pedal is depressed. The lubrication oil pressure reduction valve acts to reduce oil pressure when the clutch pedal is depressed (clutch control valve moved forward). Full engagement pressure behind this valve is dropped to zero when the clutch pedal is depressed, causing cooler return oil (lubrication oil) to move the valve against spring pressure and open the lubrication circuit to sump. This eliminates the possibility of reverser clutch drag.

Operation of Control Valve

Pressure oil from the transmission oil pump is filtered and routed to the reverser control valve housing. The pressure regulating valve maintains pressure of oil going to the clutch control valve and clutch packs. Since the volume of oil required by the clutch packs and accumulator is small, the valve will be opened by the incoming oil and will divert excess oil to the oil cooler.

Oil in the lubrication circuit remains at a pressure dependent on line restriction and oil temperature, unless the clutch pedal is depressed. At this time lubrication pressure will drop.

For purposes of explanation, let us discuss the function of the reverser control valve assembly during a shift from reverse to forward drive. Before the shift, assume that the accumulator is fully charged and the reverse brake pack is also fully pressurized.

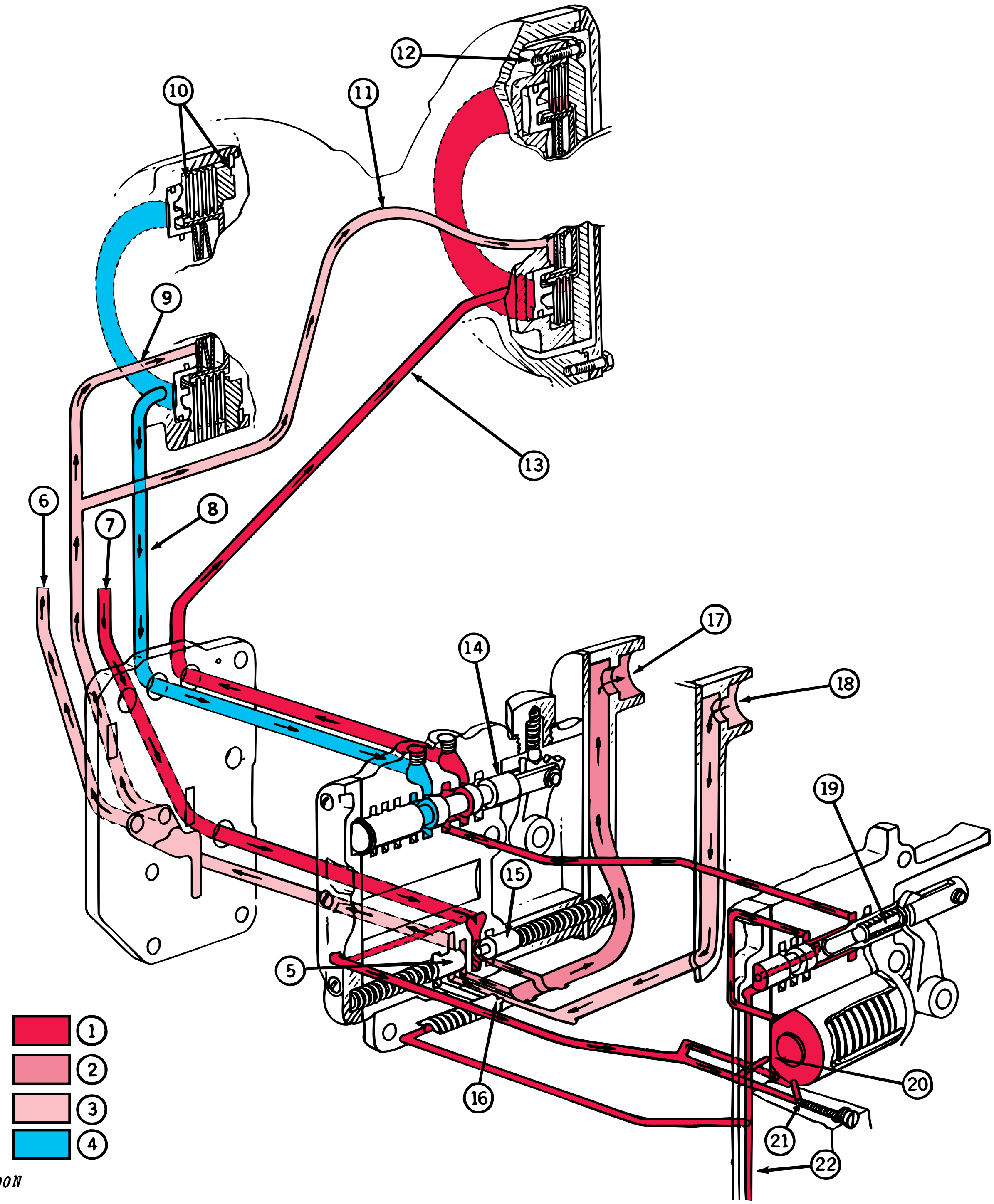
Shift Valve

As the reverser control lever is moved forward, the shift valve is moved forward and stopped in the rear detent position. The lands on the shift valve now uncover the groove in the valve housing leading to sump and connect sump with the reverse brake. The reverse brake now dumps oil. At the same time the shift valve lands open the pressure oil passage in the control valve housing to the forward clutch pack and clutch pressurization is started.

During the shift, accumulator pressure is dropped as the spring moves the accumulator piston rearward, and pressure oil is sent to the forward clutch. Approximately 1/10 of a second after the start of the shift the oil pressure starts to increase in the accumulator and clutch packs. Before full clutch engagement pressure in the clutch pack can be obtained, the accumulator must be charged to full pressure.

Initial accumulator charging is accomplished by means of two orifices, one fixed and the other adjustable. The fixed orifice provides for a minimum charging rate; the adjustable orifice is provided to increase the charging rate. Therefore, the tractor rate of shifting can be varied by this adjustable orifice.

When accumulator pressures reach 100 psi (7 bar) (7 kg/cm^2) (this should require 3/4 to 1-1/4 seconds), another charging orifice is uncovered by the accumulator piston. With the added pressure oil entry, the accumulator and clutch pack pressures rise instantly to full engagement pressure for the clutch pack.



1—Pressure Oil
2—Inlet Oil To Main Hydraulic Pump
3—Lube Oil From Cooler
4—Return Oil To Sump
5—Cooler Bypass And Relief Valve
6—Lube Oil To Transmission
7—Oil From Transmission Oil Pump
8—Oil Line To Reverse Brake
9—Reverse Brake Lube Oil Line
10—Reverse Brake Assembly
11—Forward Clutch Lube Oil Line
12—Forward Clutch Assembly (Engaged)
13—Oil Line To Forward Clutch
14—Shift Valve
15—Pressure Regulating Valve
16—Lube Oil Reduction Valve
17—To Cooler
18—From Cooler
19—Clutch Control Valve
20—Fixed Charging Orifice
21—Adjustable Charging Orifice
22—Test Port

Fig. 2-Reverser Clutch Control Valve

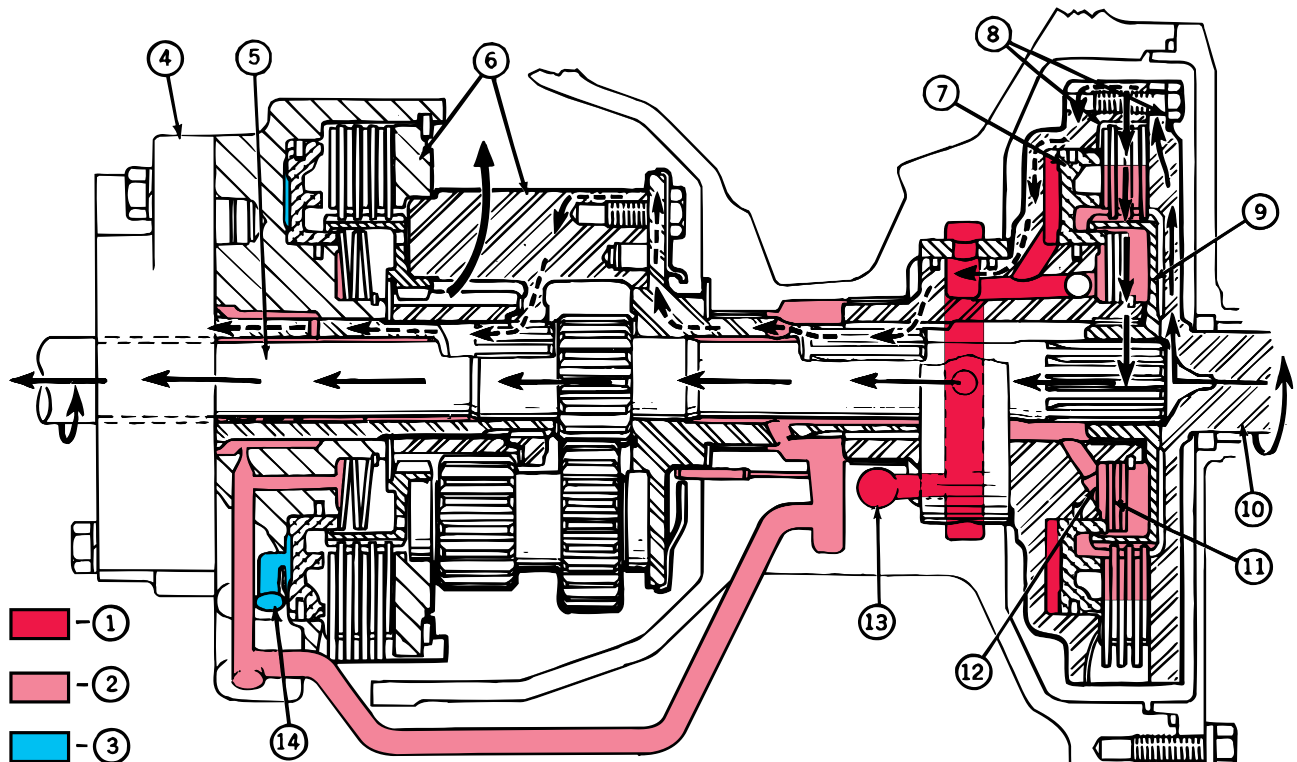
Clutch Control Valve

Operating the clutch pedal to stop tractor motion moves the clutch control valve forward, closing off pressure oil from the clutch packs and opens the engaged clutch pack pressure line to sump, neutralizing this clutch. The accumulator remains charged as the accumulator discharge port is closed by the clutch control valve.

As the clutch pedal is released, the clutch control valve is moved, uncovering the pressure oil port and connecting it with the proper clutch pack. A spring within the valve provides a controlled clutch engagement as described earlier under "Clutch Control Valve."

Hydraulic Operation of Reverser Drive Units

Forward Drive



1—Pressure Oil
2—Lube Oil
3—Return Oil
4—Transmission Oil Pump
5—Clutch Shaft
6—Reverse Brake Assembly
7—Forward Clutch Piston
8—Forward Clutch Assembly
9—Clutch Hub
10—Clutch Drive Shaft
11—Spring Washer Pack
12—Lube Oil Opening to Clutch Pack
13—Pressure Oil Inlet From Shift Valve
14—Return Oil to Sump

Fig. 3-Reverser Unit in Forward Drive

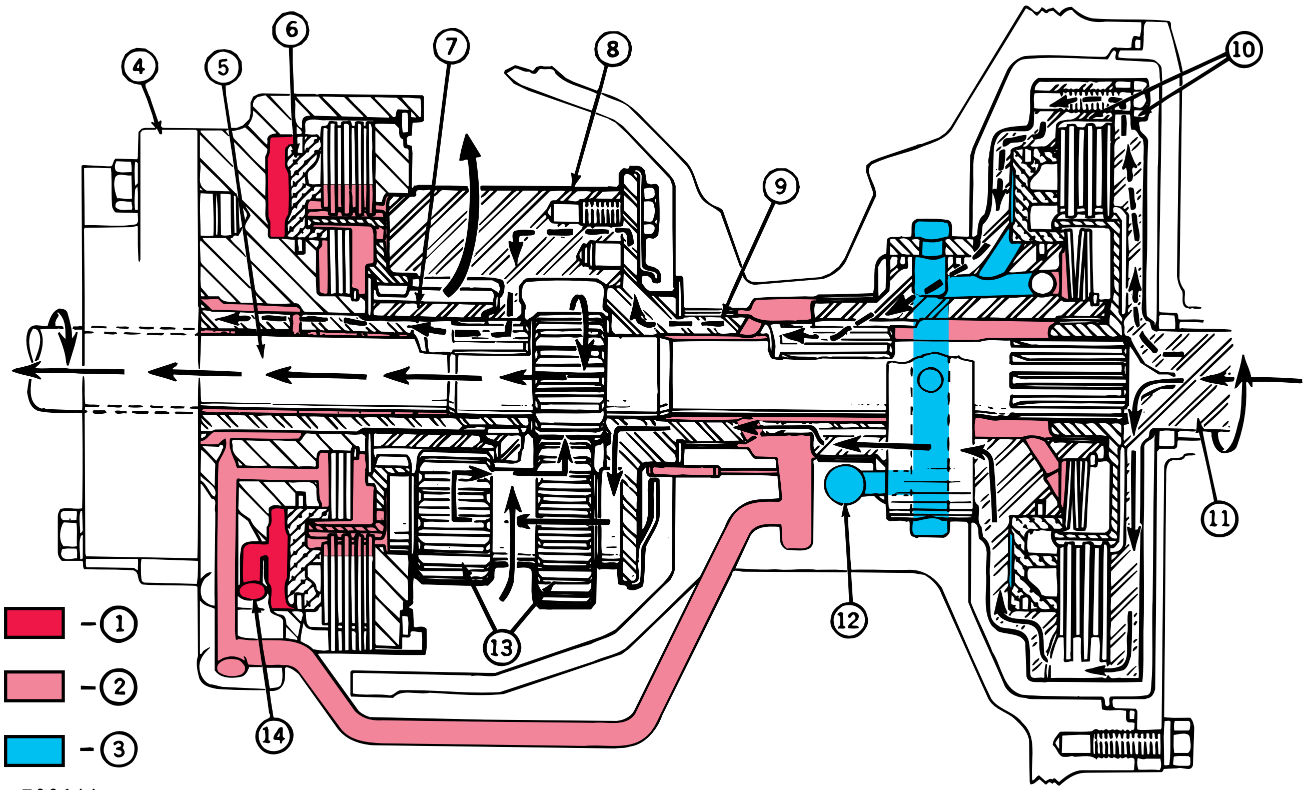
Engine flywheel rotation returns the clutch drive shaft and drum assembly as shown by arrows. Separator plates locked to the clutch drum rotate within the clutch disks splined to the clutch hub. The clutch hub is splined to the clutch shaft (transmission input shaft).

When the reverser control lever is moved to forward drive, pressure oil is sent to pressurize the forward clutch, moving the separator plates and disks together and forming a solid unit. The clutch hub is now rotating the clutch shaft. At the same time, oil in the reverse brake is "dumped" back to the clutch control valve, releasing the reverse brake.

The engaged clutch moves the clutch release springs away from a drilled passage in the clutch drum to admit lube oil to the clutch pack for cooling and lubrication. Thus, only an engaged clutch receives lube oil.

Depressing the clutch pedal blocks the flow of pressure oil to the forward (engaged) clutch and allows oil in the forward clutch piston to "dump" to sump, disengaging the clutch. The clutch piston spring washer pack blocks lubrication oil from the forward clutch as the clutch piston is disengaged. At the same time the lubrication oil reduction valve reduces lubrication oil pressure to prevent clutch drag.

Reverse Drive



1—Pressure Oil
2—Lube Oil
3—Return Oil
4—Transmission Oil Pump
5—Clutch Shaft
6—Reverse Brake Pinion
7—Planet Sun Pinion (braked)
8—Planet Pinion Carrier
9—Planet Pinion Carrier Shaft
10—Forward Clutch Assembly
11—Clutch Drive Shaft
12—Return Oil to Sump
13—Planet Pinion
14—Pressure Oil Inlet from Shift Valve

Fig. 4-Reverser Unit in Reverse Drive

When the reverse brake is in the disengaged position engine power is transmitted to the reverse brake assembly by the forward clutch drum as shown by arrows. The planet pinion carrier shaft is splined to the forward clutch drum and rotates the planet pinion carrier and planet pinions. The planet pinion (meshed to the clutch shaft gear) and the planet sun pinion rotate with the carrier without turning on their own axes.

Moving the reverser control lever rearward to the reverse drive position sends pressure oil to pressurize the reverse brake. The brake plates are locked to the reverse brake housing and the brake disks and hub are as one unit. With the brake applied, the brake disks are stopped, restraining the clutch hub and planet sun pinion. At the same time the forward clutch piston is released.

With the planet sun pinion restrained, the planet pinions are forced to rotate at a specific speed and turn the clutch shaft in a reverse direction from that of the engine. The transmission is now driven in a reverse direction.

The engaged piston moves a spring washer away from the lubrication oil entry opening to the reverse brake pack, providing oil for lubrication and cooling.

Depressing the clutch pedal blocks the flow of pressure oil to the reverse brake (engaged clutch) and allows oil pressurizing the brake piston to "dump" to sump, disengaging the brake. The brake spring washer pack blocks lubrication oil from the reverse brake as the brake piston is disengaged. At the same time the lubrication oil reduction valve reduces lubrication oil pressure to prevent brake drag.

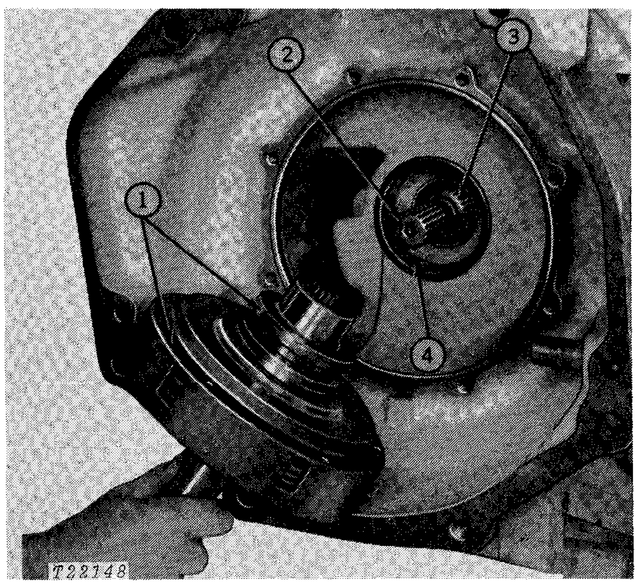
REMOVAL

Remove clutch housing assembly from tractor per Group 0741.

Disconnect linkage from clutch control valve and remove valve.

Remove clutch control valve plate and remove oil lines from clutch housing.

Forward Clutch Assembly



1—Forward Clutch Pack **3—Powershaft Drive Shaft**
2—Clutch Shaft **4—Oil Sleeve**

Fig. 5-Forward Clutch Pack

Remove throwout bearing support and slide clutch pack from clutch housing (Fig. 5).

Transmission Oil Pump

If transmission oil pump requires servicing it may be removed from reverse brake assembly or it may be removed with brake assembly.

Reverse Brake Assembly

Remove drive assembly and slide reverse brake assembly from clutch housing.

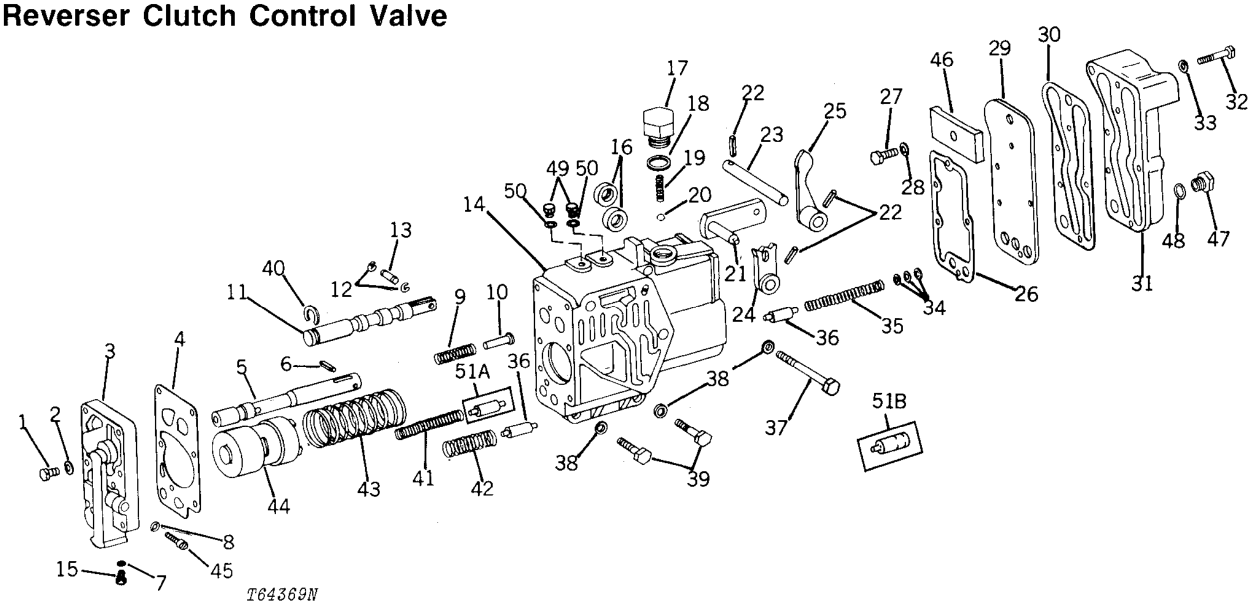
Reverser Control Lever and Linkage

With link disconnected from control lever arm, rotate control lever until it points to the rear of the machine. Locate spring pin fastening lower end of control lever shaft to control arm. Drive pin from shaft and arm.

Pull shaft with control lever straight up from mounting.

REPAIR

Reverser Clutch Control Valve



1—Cap Screw (6 used)	**14—Housing**	**28—Lock Washer**	**41 —Cooler Bypass Spring**
2—Lock Washer (6 used)	**15—Plug**	**29—Plate**	**42 —Lube Reduction Spring**
3—Cover	**16—Oil Seal (2 used)**	**30—Gasket**	**43 —Accumulator Spring**
4—Gasket	**17—Plug**	**31—Cover**	**44 —Accumulator Piston**
5—Control Valve	**18—O-Ring**	**32—Cap Screw (5 used)**	**45 —Charging Orifice Screw**
6—Spring Pin	**19—Detent Spring**	**33—Lock Washer (5 used)**	**46 —Block**
7—O-Ring	**20—Ball**	**34—Shim (6 used)**	**47 —Plug**
8—O-Ring	**21—Shift Shaft**	**35—Pressure Regulating Spring**	**48 —O-Ring**
9—Reverser Clutch Control Valve Spring	**22—Spring Pin (3 used)**	**36—Valve (2 used)**	**49 —Plug (2 used)**
10—Stop	**23—Shaft**	**37—Cap Screw**	**50 —O-Ring (2 used)**
11—Shift Valve	**24—Inner Arm**	**38—Washer (3 used)**	**51A—Cooler Relief Valve (early 310A units)**
12—Retaining Ring (2 used)	**25—Arm**	**39—Cap Screw (2 used)**	**51B—Cooler Relief Valve (later or replaced 310A units)**
13—Pin	**26—Gasket**	**40—Retaining Ring**	
	27—Cap Screw		

Fig. 6-Reverser Clutch Control Valve

Disassembly

Refer to Fig. 6 for parts identification and disassemble control valve.

Because control valve rear cover is spring loaded by accumulator spring, loosen cover screws evenly. Identify valves and springs for assembly purposes.

Clean all valve housing passages and openings.

Install new seals (16, Fig. 6) in control shaft bores until outer edge of seal is flush with bottom of bore chamfer.

Check all springs against specifications.

Accumulator piston spring (43, Fig. 6)
Free length .... 3.62 in. (91.9 mm)
Test length .... 2.62 in. (66.5 mm)
when compressed with 282 to 344 lb. (1 255 to 1 531 N) (128 to 156 kg)

Oil cooler bypass valve spring (41, Fig. 6)
Free length .... 2.80 in. (71.1 mm)
Test length .... 2.05 in. (52.1 mm)
when compressed with 18 to 22 lb. (80 to 98 N) (8 to 10 kg)

Lubrication reduction valve spring (42, Fig. 6)
Free length .... 2.06 in. (52.3 mm)
Test length .... 0.75 in. (19.1 mm)
when compressed with 3.9 to 4.7 lb. (17 to 21 N) (1.8 to 2.1 kg)

Reverser clutch pressure regulating valve spring (35, Fig. 6)
Free length . . . . 3.27 in. (83.1 mm)
Test length . . . . 2.56 in. (65.0 mm)
when compressed with 26.5 to 32.3 lb. (118 to 144 N) (12 to 15 kg)

Detent spring (19, Fig. 6)
Free length . . . . 1.16 in. (29.5 mm)
Test length . . . . 0.83 in. (21.1 mm)
when compressed with 5.85 to 7.15 lb. (26 to 32 N) (2.6 to 3.2 kg)

Reverser clutch control valve spring (9, Fig. 6)
Free length . . . . 1.63 in. (41.4 mm)
Test length . . . . 1.12 in. (28.4 mm)
when compressed with 29.7 to 36.3 lb. (132 to 162 N) (13 to 16 kg)

Assembly

Dip all parts in clean hydraulic oil before assembly.

Assemble control valve using (Fig. 6 for parts identification. Be sure valves and springs are installed in their respective bores.

Bottom charging orifice screw and back out five complete turns for preliminary setting.

Install cover on valve housing, compressing accumulator spring. Be sure piston is not cocked in bore.

Tighten cover to 10 lb-ft (14 N·m) (1 kg-m).

Tighten the screw (39, Fig. 6) from the reverser clutch control valve housing to the clutch housing to 35 lb-ft (47 N·m) (5 kg-m).

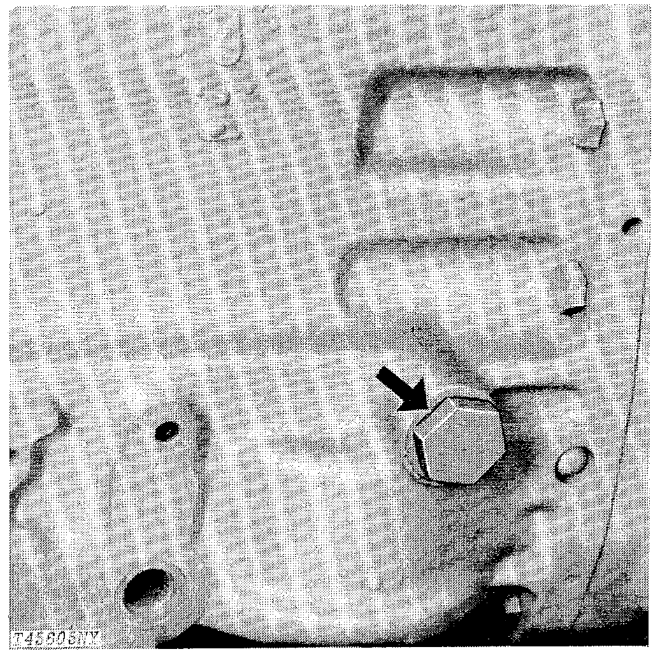
INSTALLATION

Assemble the reverser components in clutch housing in reverse order of "REMOVAL."

Install clutch housing with reverser unit in machine as described in Group 0741.

TRANSMISSION OIL FILTER RELIEF VALVE

The differential pressure operated oil filter relief valve is incorporated into the filter system to protect the oil filter from excessive pressure. Should the filter become clogged or the oil heavy during warm-up period, the relief valve will open and route oil past the filter directly to the transmission case.



T45605NY

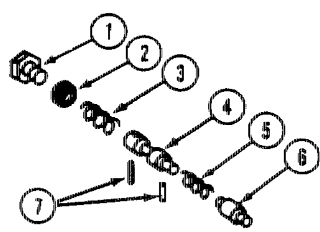
Fig. 7-Oil Filter Relief Valve Location

REPAIR

Remove oil filter relief valve plug and slide sleeve with spring and valve from bore in transmission case.

Remove valve from sleeve by driving out spring pin. Slide spring from sleeve.

Check valve spring tension against specifications.



T87894

1—Relief Valve Plug
2—O-Ring
3—Spring (xxxxxx-)
4—Sleeve
5—Spring
6—Relief Valve
7—Spring Pin (2 used)

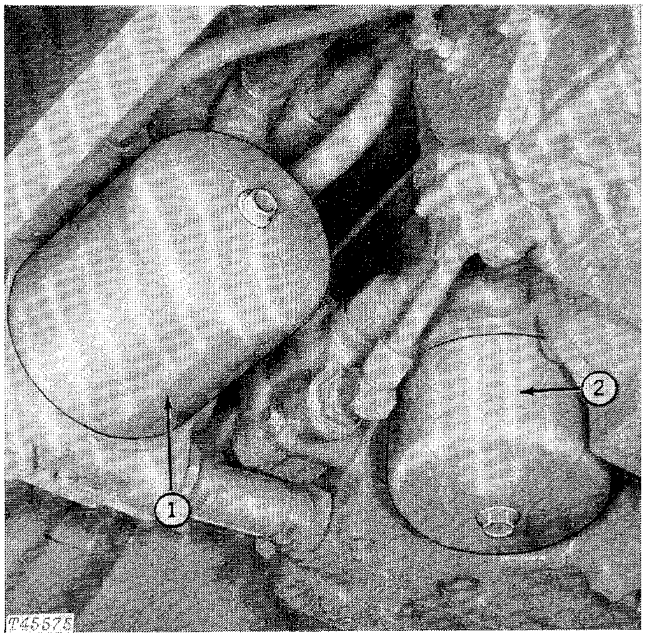
Fig. 8-Transmission Oil Filter Relief Valve

INSTALLATION

Using Figs. 7 and 8, install sleeve in transmission case and use a new O-ring on plug.

TRANSMISSION OIL FILTER ASSEMBLY

GENERAL INFORMATION



1—Function Return Filter 2—Transmission Filter

Fig. 9-Transmission Filter Location

The transmission filter is located on the right side of the transmission housing (Fig. 9).

The transmission-hydraulic system has a full-flow filter which contains a disposable micronic paper element.

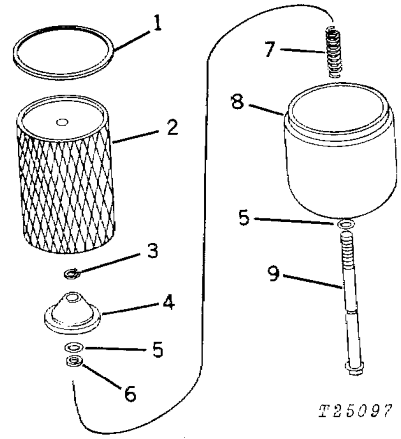
REMOVAL

Loosen and remove cap screw (9, Fig. 10).

Remove filter assembly.

Check packings, O-rings, and backup rings for wear or failure. Replace parts as necessary.

REPAIR



1—Packing
2—Element
3—Retaining Ring
4—Retainer
5—O-Ring (2 used)
6—Washer
7—Spring
8—Cover
9—Cap Screw

Fig. 10-Transmission-Hydraulic Filter

Change filter element (2, Fig. 10) at regular time intervals or whenever clogged.

Assembly

Place O-ring (5, Fig. 10) on special cap screw (9).

Insert special cap screw through transmission oil filter cap.

Put packing (1), spring (7), washer (6), retainer (4), retaining ring (3) and oil filter element (2) on as shown in Fig. 10.

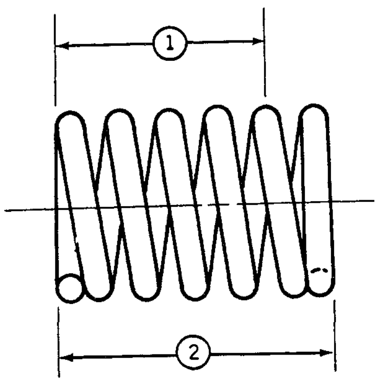
Install new packing in groove in transmission case. Be sure packing is fully seated.

INSTALLATION

Install filter assembly on unit using cap screw (9, Fig. 10) to align parts.

Install new element and filter cover. Tighten securely, but do not overtighten.

Group 0399
SPECIFICATIONS AND SPECIAL TOOLS
CONTROLS
SPECIFICATIONS AND TORQUE VALUES

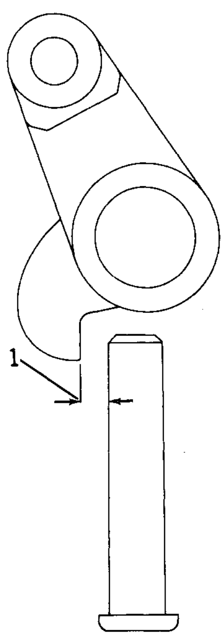


T38675N

Fig. 1-Shifter Mechanism Spring (4 used)

1 - Shifter mechanism spring
Test length ....0.0640 in. (1.63 mm)
when compressed with 26.5 to 33.5 lb. (118 to 149 N) (12 to 15 kg)

2 - Shifter mechanism spring
Free length ....0.83 in. (21.1 mm)

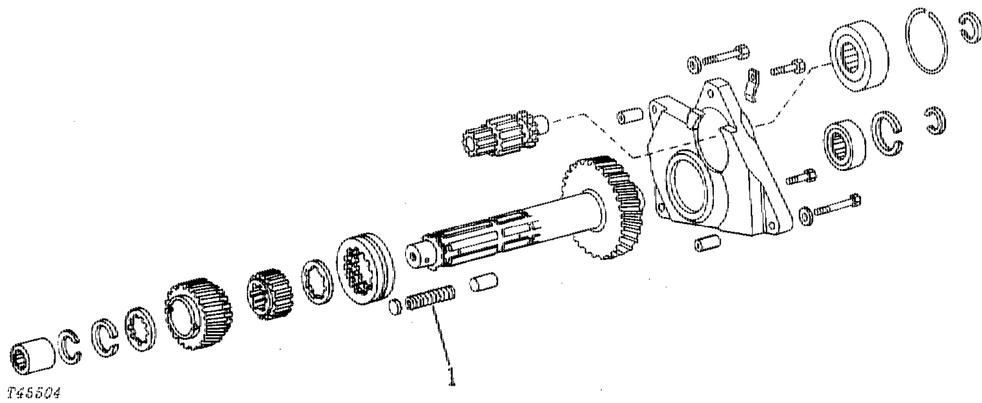


T45522

Fig. 2-Control Shaft Arm and the Side of the High Speed Lockout Pin

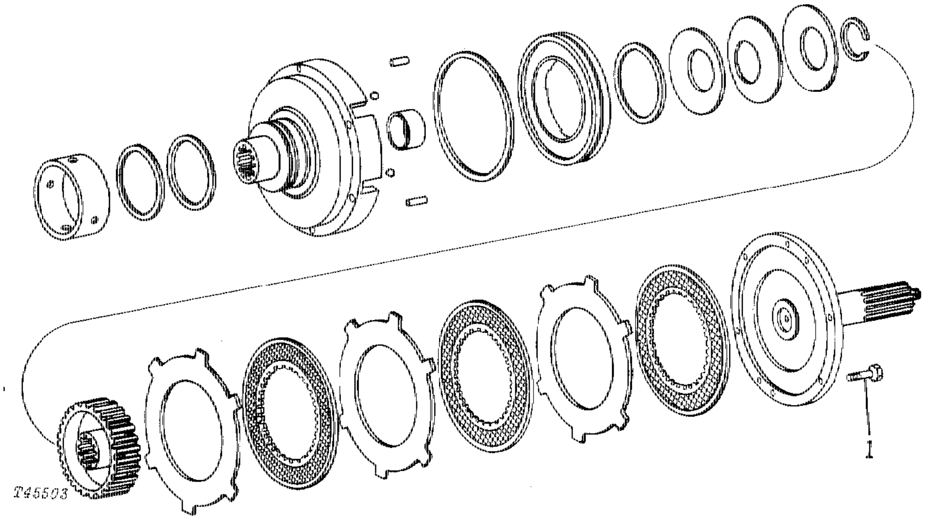
1 - Clearance between the control shaft arm and the side of the high speed lock out pin (-276764) ..0.040 in. (1.02 mm)

GEARS, SHAFTS AND BEARINGS
SPECIFICATIONS AND TORQUE VALUES



1 - Spring
Free length .... 1.78 in. (45.2 mm)
Test length .... 1.50 in. (38.1 mm)
when compressed with 63 to 77 lb. (280 to 343 N) (29 to 35 kg)

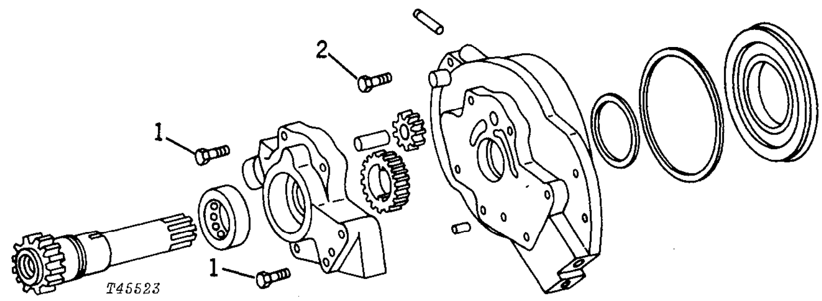
Fig. 3-Countershaft and Springs



1 - Clutch drive shaft to drum cap screw torque .... 20 lb-ft (27 Nm) (3 kg/m)

Fig. 4-Forward Clutch Assembly

TRANSMISSION HYDRAULICS
SPECIFICATIONS AND TORQUE VALUES



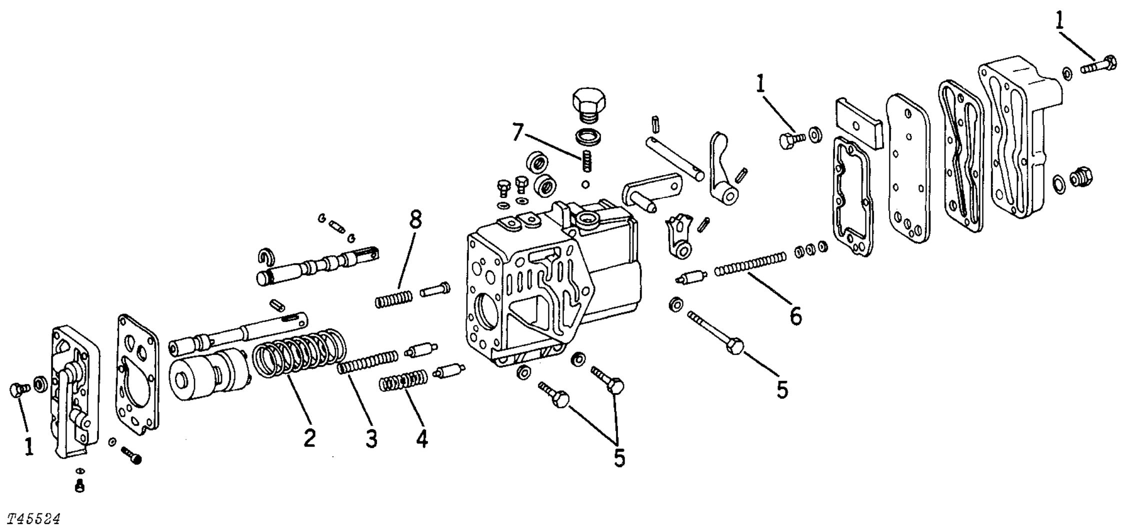
1 - Transmission oil pump body to reverse brake housing screw torque .... 23 lb-ft (31 Nm) (3 kg/m)

2 - Reverser brake housing to clutch housing torque .... 35 lb-ft (47 Nm) (5 kg/m)

Fig. 5-Reverser Brake Housing and Piston

TRANSMISSION HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES - Continued



1 - Reverser clutch control valve housing cover and accumulator cover screw torque . . . 10 lb-ft (14 Nm) (1 kg/m)

2 - Accumulator piston spring
Free length . . . . 3.62 in. (91.9 mm)
Test length . . . . 2.62 in. (66.5 mm)
when compressed with 282 to 344 lb. (1 255 to 1 531 N) (128 to 156 kg)

3 - Oil cooler bypass valve spring
Free length . . . . 2.80 in. (71.1 mm)
Test length . . . . 2.05 in. (52.1 mm)
when compressed with 18 to 22 lb. (80 to 98 N) (8 to 10 kg)

4 - Lubrication reduction valve spring
Free length . . . . 2.06 in. (52.3 mm)
Test length . . . . 0.75 in. (19.1 mm)
when compressed with 3.9 to 4.7 lb. (17 to 21 N) (1.8 to 2.1 kg)

5 - Reverser clutch control valve housing to clutch housing screw torque . . . . 35 lb-ft (47 Nm) (5 kg/m)

6 - Reverser clutch pressure regulating valve spring
Free length . . . . 3.27 in. (83.1 mm)
Test length . . . . 2.56 in. (65.0 mm)
when compressed with 26.5 to 32.3 lb. (118 to 144 N) (12 to 15 kg)

7 - Detent spring
Free length . . . . 1.16 in. (29.5 mm)
Test length . . . . 0.83 in. (21.1 mm)
when compressed with 5.85 to 7.15 lb. (26 to 32 N) (2.6 to 3.2 kg)

8 - Reverser clutch control valve spring
Free length . . . . 1.63 in. (41.4 mm)
Test length . . . . 1.12 in. (28.4 mm)
when compressed with 29.7 to 36.3 lb. (132 to 162 N) (13 to 16 kg)

Fig. 6-Clutch Control Valve

CONTROLS

SPECIAL TOOLS

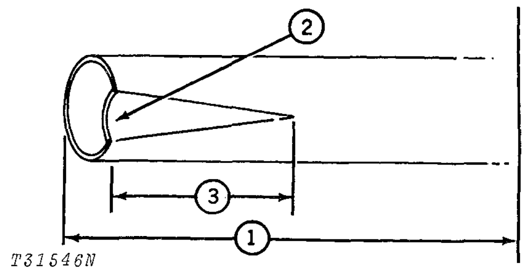


Fig. 7-Tool for Transmission Shifter Interlock Balls

The procedure to make the tool is as follows:

1. Cut a 6 to 7 in. (152 to 178 mm) length of 1/2 in. (13 mm) electrical conduit.
2. Make an indentation 1/4 in. (6 mm) deep on one end.
3. Taper the indentation out 1 in. (25 mm) along tube.

Section 4
ENGINE

CONTENTS OF THIS SECTION

CONTENTS OF THIS SECTION—Continued

Group 0400
ENGINE REMOVAL AND INSTALLATION

REMOVAL

Most service procedures on the engine can be performed with the engine in the machine. If the crankshaft is to be removed or in the event of a general overhaul, remove the engine.

Wash the unit before opening up lines and hoses to remove the engine.

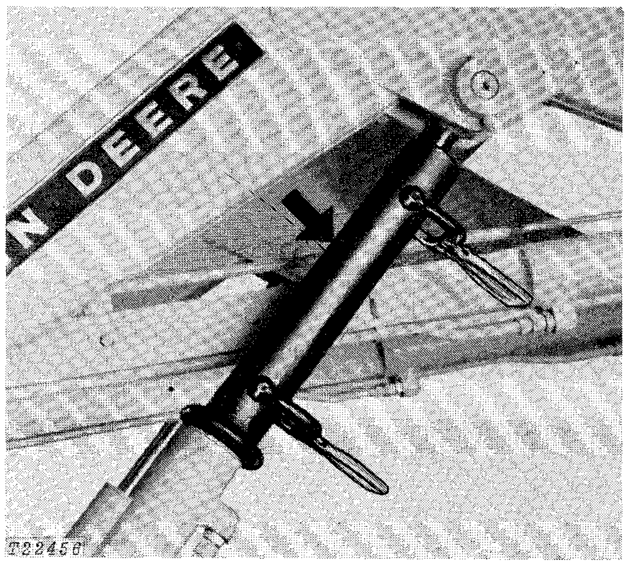


Fig. 1-Supporting Loader

Raise loader to full height and support boom by one of the following methods.

1. Attach a piece of angle iron to the boom cylinder piston rod between the rod end and the cylinder barrel, being careful to avoid damaging the piston rod. Be sure the angle iron is large enough to rest against the cylinder barrel and not against the head casting.

2. Use prop under cross member to support boom.

3. Chain bucket to hoist or overhead beam.

Disconnect battery ground straps and remove grille screen and hood. Bleed down accumulator by operating steering valve.

Drain radiator and disconnect inlet and outlet hoses. Disconnect cooler lines and air cleaner hose.

Remove radiator top support rod and disconnect fan shroud and slip it back over fan. Remove cap screws securing radiator to front end support and slide radiator out left side of tractor.

Close fuel shut-off valve at bottom of fuel tank and disconnect fuel lines. Disconnect fuel gauge sender wire.

Remove clamps securing hydraulic oil lines to engine on right side of tractor. Disconnect pressure and return lines at connector at right front side of engine.

Disconnect steering cylinder.

Support machine under clutch housing and under loader side frames.

Insert wooden blocks between front axle and front end support to keep assembly from pivoting side to side.

Remove screws in pump drive shaft and pull hydraulic pump shaft from pump drive shaft.

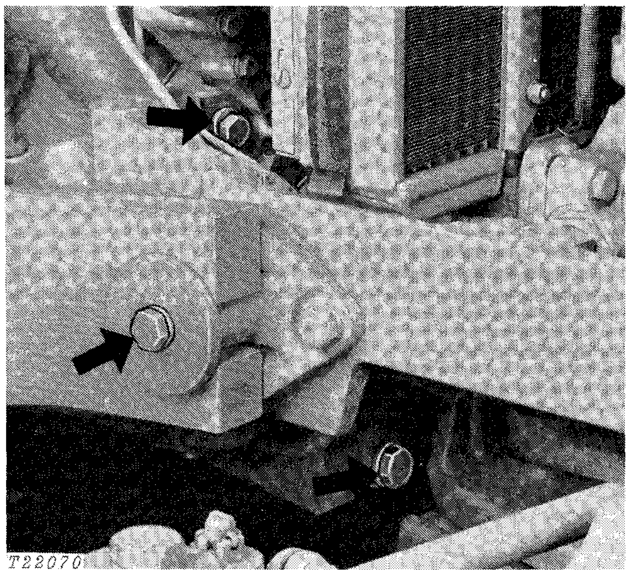


Fig. 2-Attaching Points

Position floor jack under rear portion of assembly and support with chain hoist. Remove attaching cap screws from front end support and roll away from engine.

Use caution to prevent assembly from tipping forward. Drain fuel tank if necessary.

Most service procedures on the engine can be performed with the engine in the machine. If the crankshaft is to be removed or in the event of a general overhaul, remove the engine.

Remove battery cable and wiring harness from starter solenoid. Disconnect wiring harness at oil pressure sending unit. Disconnect front wiring harness from alternator lead.

Disconnect and remove tachometer cable. Remove rubber gasket from the tachometer cable (gasket may remain in clutch housing). Disconnect starting fluid line (if equipped) from air intake manifold.

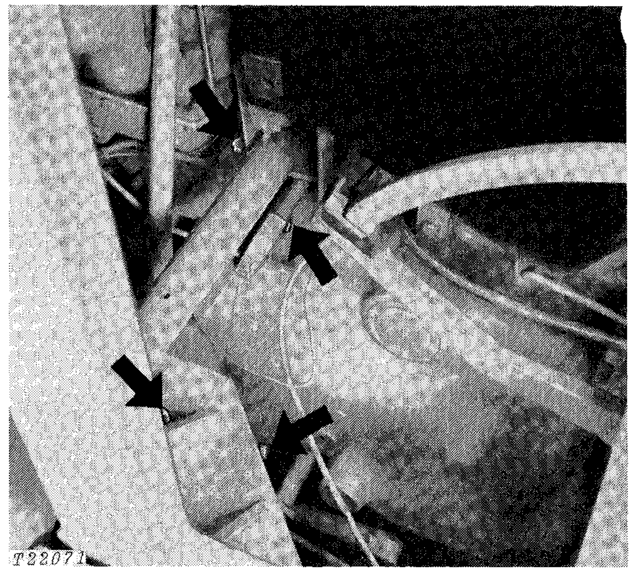


Fig. 3-Engine Attaching Points

Disconnect pressure line from connection on power steering valve.

Disconnect throttle rod. Remove water temperature sending unit.

Add additional support under loader frame and remove cap screws securing canopy brackets to flywheel housing.

Remove cap screws securing upper cowl to flywheel housing.

Install two JD-244 Lifting Eyes on cylinder head. Remove cap screws securing flywheel housing to reverser housing and, using JDG-23 Lifting Sling on D-01043AA Load Positioning Sling with hoist, pull engine forward off reverser housing.

INSTALLATION

To install engine correctly, line up cap screw holes of the engine with those of the clutch housing. Bar engine over, and holding in a horizontal position, move engine toward the clutch housing.

Be sure engine flywheel housing is tight against clutch housing before drawing up cap screws. Tighten cap screws to 250 lb-ft (339 N·m) (35 kg-m).

Coat tachometer cable gasket with Lubriplate or equivalent and install on cable. Index slot in cable to coupler and tighten so that no oil leaks from around cable. Do not tighten too tight or gasket will be damaged and oil leaks will develop.

Install and connect all parts removed.

Reverse the removal procedure to install front end assembly. Be sure to use all shims removed between front end support and engine oil pan.

Apply T43515 John Deere LOCTITE® Retaining Compound or equivalent to tractor front support to cylinder block and oil pan and spacers to tractor front support.

NOTE: Before applying retaining compound, wipe all surfaces with chlorothene. Holes must be free of retaining compound.

IMPORTANT: Install front end of side grille retaining spring with open end of hook facing front of tractor.

Group 0401
CRANKSHAFT AND MAIN BEARINGS

GENERAL INFORMATION

The crankshaft is a one-piece steel forging, and is supported on main bearings. The bearings are replaceable, steel-backed, tin-plated, aluminum-lined inserts. The rear main bearing has a thrust surface.

The crankshaft is drilled for pressure lubrication from the main bearings to connecting rod bearings.

REMOVAL

To service crankshaft and main bearings, it is necessary to remove engine from the unit (see Group 0400).

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

Before removing flywheel, check crankshaft end play.

Remove crankshaft and main bearing caps.

Checking Crankshaft End Play

Checking crankshaft end play can give an indication of thrust bearing wear.

To check end play, position a dial indicator against the flywheel (Fig. 1). Push crankshaft as far into block as possible. Set dial indicator at zero. Using a bar between the gear and the block gently force the crnkshaft out.

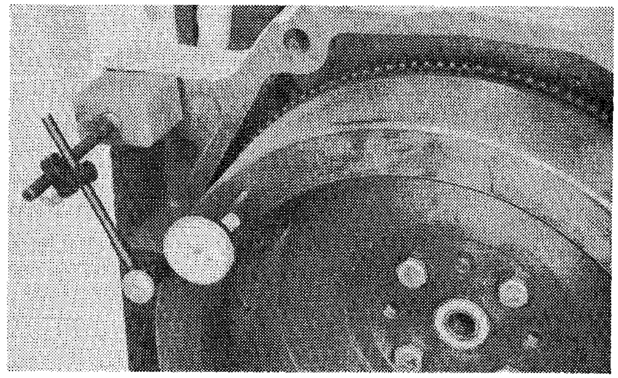

T81179

Fig. 1-Checking Crankshaft End Play

IMPORTANT: Do not apply too much pressure with bar as this could damage bearings.

New part end play will be 0.0020 to 0.0080 inch (0.051 to 0.203 mm). The maximum allowable end play is 0.0150 inch (0.381 mm).

New rear main thrust bearings will restore proper end play.

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

REPAIR

Crankshaft Gear

CAUTION: Oil fumes or oil can ignite above 380°F (193°C). Use a thermometer and do not exceed 360°F (182°C). Do not allow a flame or heating element to be in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

Check crankshaft gear for wear or damage. If necessary, remove old gear with knife edge puller. Heat new gear to 360°F (182°C) (don't overheat). Place Woodruff key in keyway and support crankshaft under first throw while pressing on gear.

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

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

Check each journal with a micrometer at several points to determine if journal is out-of-round by more than 0.002 inch (0.05 mm) or if tapered more than 0.0010 inch (0.025 mm) per inch (25.4 mm) of journal length.

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

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

Main Bearings

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

Check thrust bearing thrust surfaces to confirm th· thrust bearing wear was the cause for excessiv crankshaft end play.

Remove piston cooling orifices from main bearing webs and check for damage or clogging. Repair or replace as necessary. Install orifices and tighten to 85 to 110 lb-in (9.6 to 12.4 Nm) (0.18 to 1.27 kg-m).

Main Bearing Clearance

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

O.D. of main bearing
journal .... 3.1230 to 3.1240 in.
(79.324 to 79.350 mm)

I.D. of main bearing
(assembled) .... 3.1256 to 3.1276 in.
(79.390 to 79.441 mm)

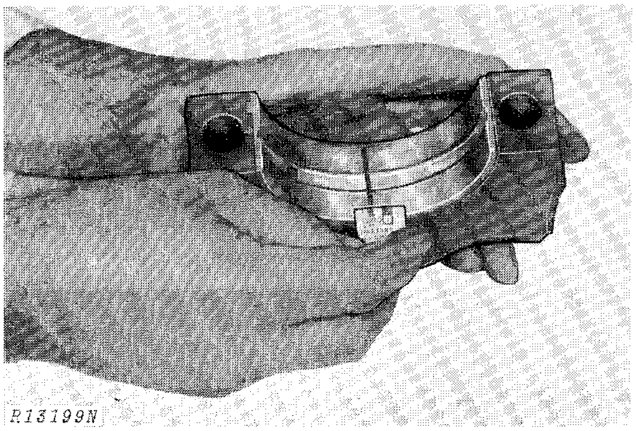
Bearing to journal
clearance .... 0.0016 to 0.0046 in.
(0.041 to 0.117 mm)

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

Main bearing bore I.D. is 3.3250 to 3.3260 in. (84.455 to 84.480 mm).

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

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

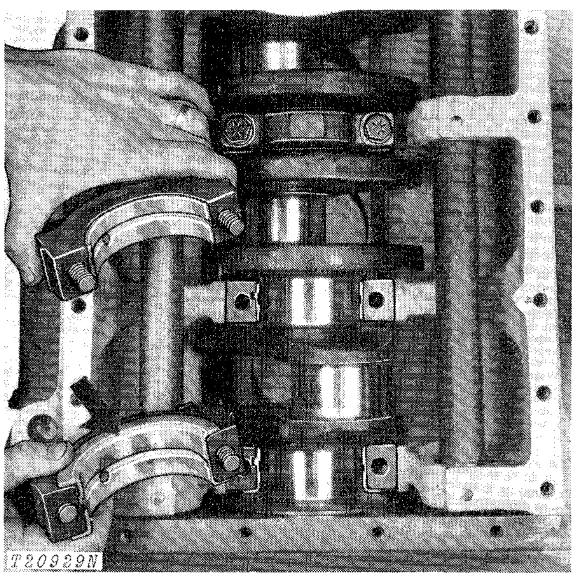


R13199N

Fig. 2-Determining Main Bearing Clearance

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

INSTALLATION



T20929N

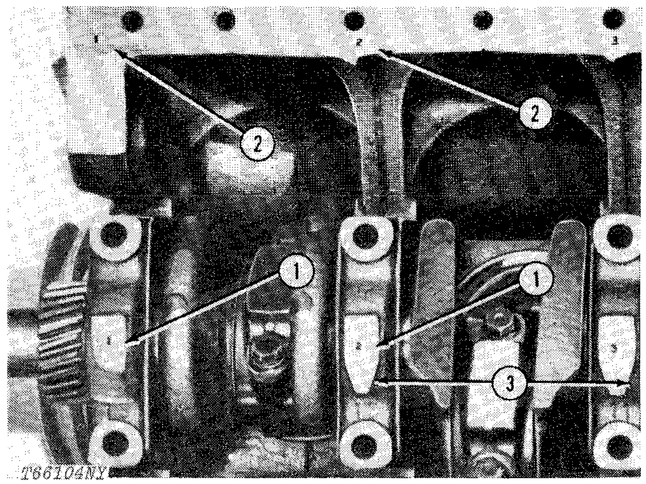
Fig. 5-Installing Main Bearing Caps

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

Install each bearing cap with the recesses and tabs toward the same side of the engine as those on the respective upper bearings in the block.

Make sure bearing caps are installed on the mains from which they were removed by referring to identification marks made at the time of removal.

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



T66104NY

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

Fig. 6-Main Bearing Cap Positions

If numbers were stamped in main bearing caps (1, Fig. 6) at factory, install main bearing caps with numbers corresponding to numbers in oil pan rail (2). The "arrow" (3) machined on the main bearing cap number pad must point toward the cam shaft side of the cylinder block.

NOTE: Dip cap screws in engine oil before installing.

Loosely install cap screws in main bearing caps until finger tight.

Align upper and lower thrust flanges on rear main bearing as follows: Tap the crankshaft to the rear to line up the front flanges. Then tap the crankshaft to the front to line up the rear flanges. Tighten main bearing cap screws to 85 lb-ft (115 N·m) (12 kg-m).

If crankshaft end play has not been checked with all repair parts installed, check it by method given on page 4-0401-1. End play is 0.0020 to 0.0080 inch (0.051 to 0.203 mm). End play up to 0.015 inch (0.38 mm) is acceptable.

IMPORTANT: Install new flywheel cap screws.

To facilitate installation of flywheel, screw two pilot studs into flywheel mounting screw holes in crankshaft. Tighten cap screws to 120 lb-ft (163 N·m) (17 kg-m).

Place crankshaft oil slinger over front end of crankshaft with inside of slinger against front gear on crankshaft. Install flywheel housing on rear of engine. Be careful not to invert oil seal lip in flywheel housing.

Install all other parts removed.

Install engine (Group 0400 of this section).

Group 0402
CAMSHAFT AND VALVE ACTUATING MEANS

GENERAL INFORMATION

The camshaft is iron alloy with all cams integral. The camshaft has a lobe to actuate the fuel transfer pump.

The camshaft is driven at one-half engine speed by the top idler gear and is supported by three pressure-lubricated bores integral with the cylinder block. Camshaft thrust is taken by a thrust plate fastened to the front of the cylinder block.

Valve Lift Check

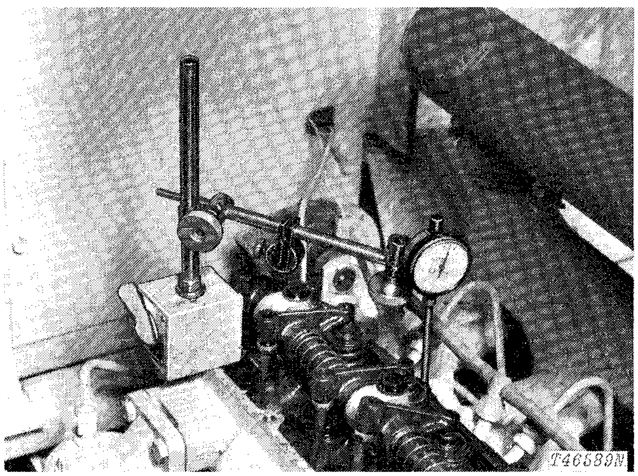


Fig. 1-Checking Valve Lift

Measuring valve lift can give an indication of wear on cam lobes.

Set exhaust valve clearance of 0.018 inch (0.46 mm) and intake valve clearance of 0.014 inch (0.36 mm).

Place dial indicator on valve spring cap. (Be sure that valve is fully closed and the rocker arm moves freely.) Zero dial indicator.

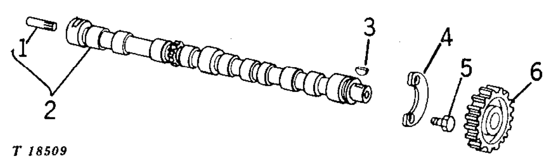
Manually turn engine in running direction. When rocker arm contacts valve, check indicator travel as the rocker arm moves valve to full open.

Exhaust valve lift should be 0.456 to 0.482 inch (11.58 to 12.24 mm) and intake valve lift should be 0.460 to 0.490 inch (11.68 to 12.45 mm).

REMOVAL

To service camshaft and related parts, engine normally need not be removed from unit. If engine has to be removed, see Group 0400.

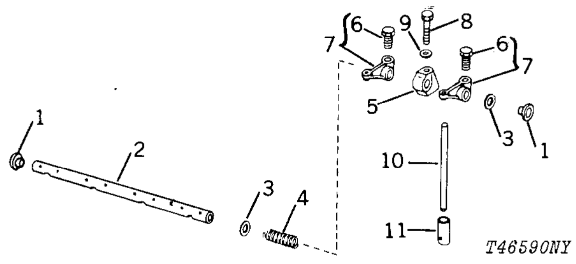
Remove fuel transfer pump.



1—Tachometer Drive Shaft
2—Camshaft
3—Key
4—Thrust Plate
5—Cap Screw (2 used)
6—Gear

Fig. 2-Camshaft

Cam followers must be moved off of camshaft lobes. Use one of the following options: (a) remove cam followers, (b) use D-15001NU Magnetic Follower Holder Kit to move the followers up, or (c) turn engine bottom side up so followers fall away from camshaft.



1—Plug (2 used)
2—Rocker Arm Shaft
3—Special Washer (2 used)
4—Spring (3 used)
5—Support (4 used)
6—Adjusting Screw (8 used)
7—Rocker Arm (8 used)
8—Cap Screw (4 used)
9—Special Washer (4 used)
10—Push Rod (8 used)
11—Tappet (8 used)

Fig. 3-Rocker Arm Assembly

Remove top idler gear from engine front plate. This will allow camshaft to rotate when lining up camshaft attaching cap screws.

NOTE: If cylinder block is removed from machine and secured on an engine stand upside down, tappets need not be wired up.

Timing Gear Train

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

1. Remove oil pressure regulating valve. Remove timing gear cover.

2. Remove hex. nuts from the oil pump, drive gears and cap screws from upper and lower idler gears.

3. Remove upper and lower idler gears from engine front plate. Attach a puller to oil pump gear and pull gear from shaft. NEVER PRY GEAR FROM SHAFT.

4. Remove oil pump (Group 0407).

5. Remove fuel injection pump and drive gear (Group 0413).

6. Remove camshaft and balancer shafts.

REPAIR

Camshaft

1. New camshaft journals are 2.1997 to 2.2007 inches (55.872 to 55.898 mm); new camshaft bore is 2.2042 to 2.2052 in. (55.987 mm to 56.012 mm).

Maximum allowable clearance between journal and bore is 0.009 in. (0.23 mm).

2. Thrust plate must be within 0.1560 to 0.1580 inch (3.962 to 4.013 mm) as the thrust plate determines camshaft end play.

3. Replace camshaft drive gear if necessary by pressing shaft from gear. Press on gear until it is tight against flange on camshaft. Timing mark must face away from camshaft.

Support camshaft under its first bearing while pressing on gear.

4. Whenever a new camshaft is installed, replace the tappets with new parts.

5. If replacing tachometer drive, support camshaft and press in new drive with slot facing opposite direction from keyway in opposite end of camshaft.

Rocker Arm Assembly

Make sure that rocker arm oil holes are not plugged.

If ends of arms are excessively worn, replace or resurface them.

Thoroughly clean holes in rocker arm mounting brackets. This is especially important for the rear bracket, because oil is fed to the rocker arm shaft through this hole.

If a failed valve has been replaced, also replace the rocker arm and push rod for that valve.

Timing Gear Train

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

Checking Gear Train Backlash

If gear train noise is noted at the time of disassembly, it usually indicates excessive gear lash or damaged gear teeth.

During disassembly, measure crankshaft to upper idler (0.0027 to 0.0116 inch [0.069 to 0.295 mm]), upper idler to camshaft (0.0028 to 0.0135 inch [0.071 to 0.343 mm]), upper idler to injection pump (0.0028 to 0.0135 inch [0.071 to 0.343 mm]) crankshaft to lower idler (0.0027 to 0.0137 inch [0.069 to 0.348 mm]), lower idler to oil pump (0.0016 to 0.0147 inch [0.041 to 0.373 mm]), lower idler to balancer (0.0018 to 0.0156 inch [0.046 to 0.396 mm]), and oil pump to balancer (0.0020 to 0.0140 inch [0.051 to 0.356 mm]) for gear train backlash.

Idler Gears

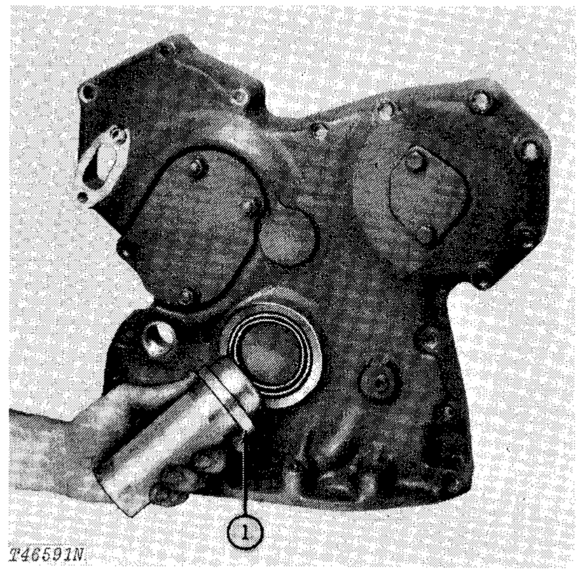
Be sure that the oil hole in the upper shaft is open. Measure inside diameter of bushing (1.7520 to 1.7530 inches [44.500 to 44.526 mm]) and outside diameter of shaft (1.7495 to 1.7505 inches [44.437 to 44.463 mm]) to determine oil clearance. If bushing replacement is required, press in new bushing to flush with either side of gear using JD252 Driver.

The upper idler gear is pressure lubricated. If there are signs of oil starvation, make certain that the oil delivery hole in cylinder block is open.

If idler gear shaft replacement is necessary, press in new spring pins to 0.2000 to 0.2800 inch (5.080 to 7.112 mm) above shaft.

Front Plate and Timing Gear Cover

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

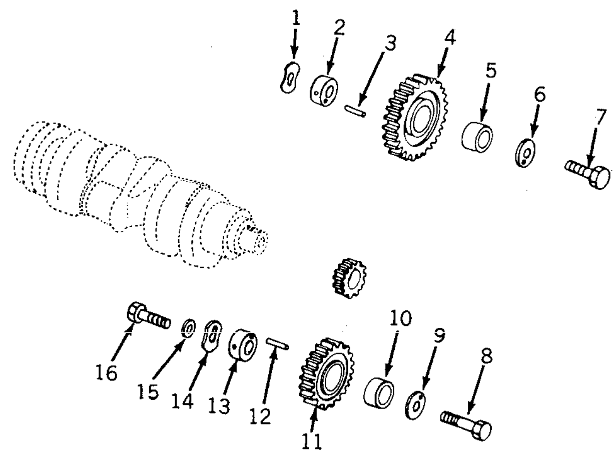


1—JD-250 Driver

Fig. 4-Installing Oil Seal in Timing Gear Cover

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

Coat outer surface of seal with joint sealing compound. Support the oil seal bore area of timing gear cover. Press in oil seal to bottom of bore with spring-loaded lip facing inward using special JD250 driver.



T 17128

1—Inner Thrust Washer	**5—Bushing**	**9—Outer Thrust Washer**	**13—Idler Gear Shaft**
2—Idler Gear Shaft	**6—Outer Thrust Washer**	**10—Bushing**	**14—Inner Thrust Washer**
3—Spring Pin	**7—Cap Screw**	**11—Lower Idler Gear**	**15—Special Washer**
4—Upper Idler Gear	**8—Cap Screw**	**12—Spring Pin**	**16—Special Cap Screw**

Fig. 5-Idler Gears

INSTALLATION

Camshaft

Install the camshaft, noting the following:

1. Coat entire camshaft with a light film of oil.

2. When installing camshaft, do not permit cam lobes to drag on camshaft bores.

3. Turn the camshaft gear until the cap screws and locks which secure the thrust plate can be installed and tightened to 35 lb-ft (47 Nm) (5 kg/m).

4. Check camshaft for 0.0025 to 0.0085 inch (0.064 to 0.216 mm) end play (new camshaft and thrust plates should restore this).

5. Before installing idler gear, set flywheel at "TDC" with No. 1 (front) piston on the compression stroke and align the timing mark on the camshaft drive gear with the center of the crankshaft, using timing tool JD-254.

6. With timing marks aligned, install top idler gear and secure to front plate with flat washers and cap screw. Tighten cap screw to 65 lb-ft (88 Nm) (9 kg/m).

Install all parts removed.

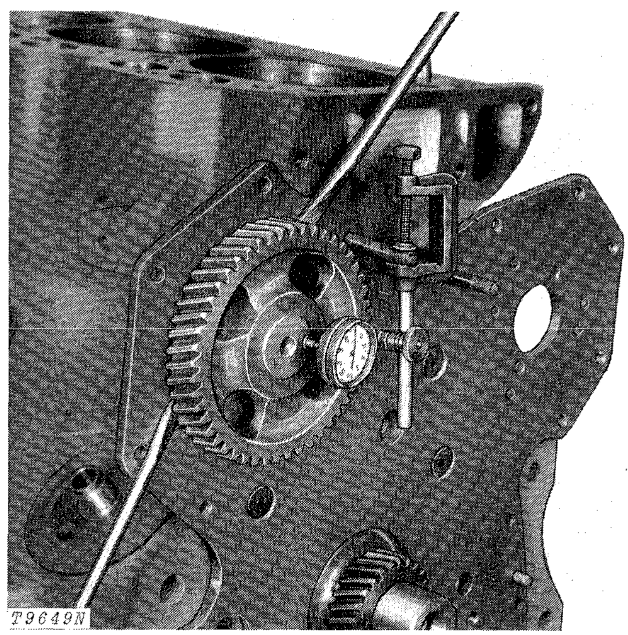


Fig. 6-Checking Camshaft End Play

Rocker Arm Assembly

Assemble parts to rocker arm shaft in sequence that they were removed (Fig. 3).

Oil hole in rocker arm shaft to shaft support must face downward when assembly is installed on cylinder head.

Apply John Deere Valve Stem Lubricant AR44402 to valve stems and install valves in valve guides, working them back and forth to make sure they slip through the guides easily and seat properly.

Note also the following:

1. Use new valve keepers.

2. After assembly, "pop" each spring and valve assembly three or four times by tapping the end of each valve stem with a soft mallet.

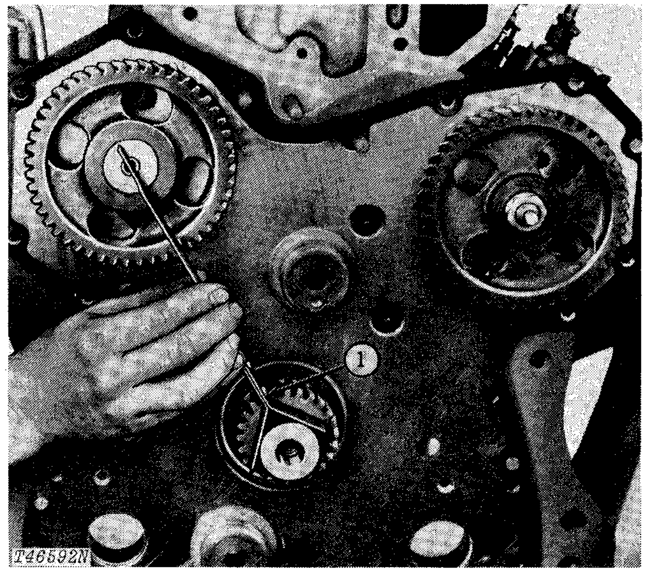
Timing Gear Train

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

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

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

2. Install camshaft.



1—JD-254 Timing Tool

Fig. 7-Timing the Camshaft Gear

With engine at "TDC," use special tool JD-254 to align the timing mark on the camshaft gear between centers of the crankshaft and camshaft (Fig. 7).

3. Install fuel injection pump and drive gear (Group 0413).

With engine at "TDC," use special tool JD-254 to align the timing mark on the injection pump gear between centers of crankshaft and injection pump shaft (Fig. 8).

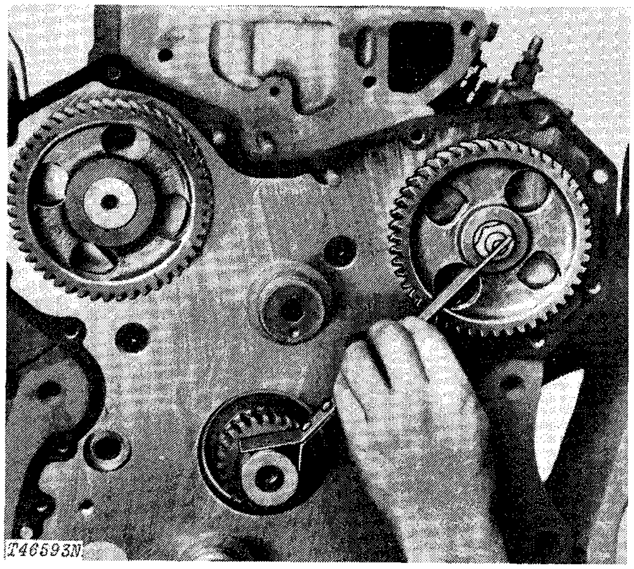


Fig. 8-Timing the Injection Pump Gear

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

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

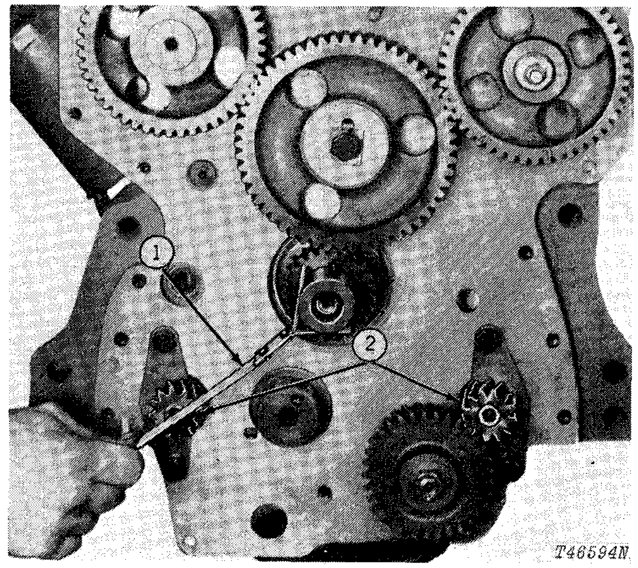
Install outer thrust washers (Fig. 5), making sure holes in inner and outer thrust washers fit over spring pins of idler gear shafts. Install special washer (15) and cap screw (16) and tighten to 65 lb-ft (88 Nm) (9 kg/m).

5. Install balancer shafts.

With engine at "TDC," use tool JD-254 to align the timing marks on the balancer shaft drive gears between center of the crankshaft and balancer shaft (Fig. 9).

6. Install oil pump and drive gear (Group 0407).

Tighten oil pump gear hex. nut 35 to 45 lb-ft (47 to 61 Nm) (5 to 6 kg/m) after gears have been timed and lower idler gear installed so that gears may be restrained with a screwdriver. Then stake threads on shaft.



1—JD-254 Timing Tool **2—Timing Marks**

Fig. 9-Timing the Balancer Shaft Gears

7. With balancer shaft and oil pump gear installed, install lower idler gear into position, using care not to rotate any gears. Be sure special bolt, washer, inner thrust washer, and idler gear shaft are in place on rear of idler gear shaft. Over front of gear, install outer thrust washer and cap screw. Tighten cap screw to 95 lb-ft (129 Nm) (13 kg/m).

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

On later units, install oil bypass valve (Group 0407).

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

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

Group 0403
CONNECTING RODS AND PISTONS

GENERAL INFORMATION

Pistons are aluminum-alloy, cam ground and weight controlled, with two compression rings and one oil control ring.

Connecting rods have a replaceable bronze bushing for the piston pin and a replaceable, steel-backed, aluminum-lined bearing insert.

REMOVAL

Remove the pistons and connecting rods noting the following:

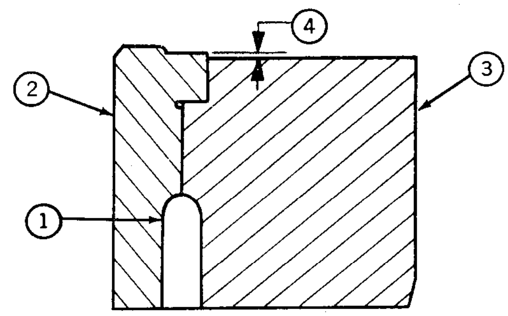
Engine normally need not be removed from unit to service pistons and connecting rods. If engine has to be removed, see Group 0400.

Do not rotate crankshaft with cylinder head removed unless all cylinder liners are bolted down. Bolt down cylinder liners before removing pistons.

Keep rod bearing inserts with their respective rods and caps to assure correct reassembly.

Each connecting rod and piston must be reinstalled in the cylinder bore from which it was removed. Observe the word "FRONT" stamped on the head of all pistons and in the rib of the connecting rods. These identification marks must face toward the fan end of the engine at the time of reassembly.

Measure height of bolted down liners before removal from block. Height is 0.001 to 0.004 inch (0.03 to 0.10 mm) above block. See Fig. 1.

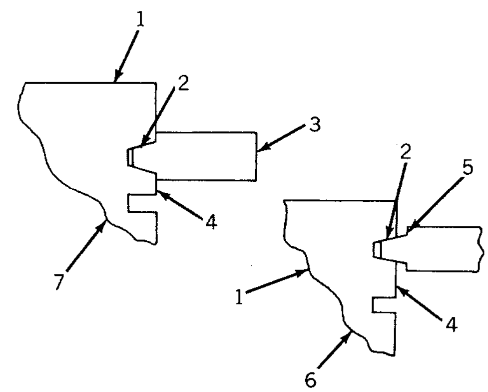


T30270N

1—Water Passage
2—Liner
3—Block
4—0.001 to 0.004 inch (0.03 to 0.10 mm)

Fig. 1-Location of Liner in Cylinder Block

REPAIR



T27564

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

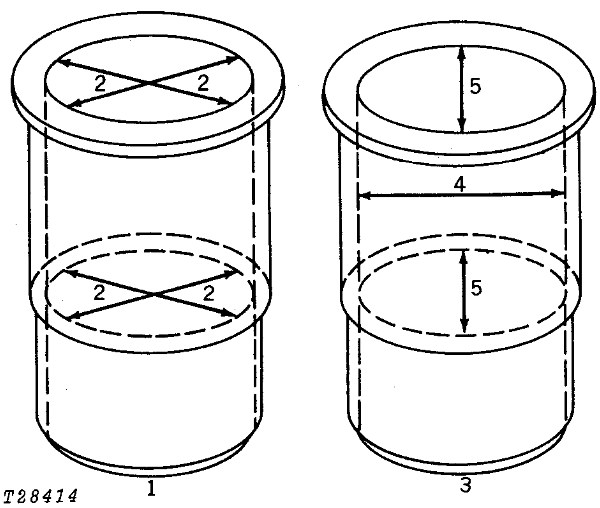
Fig. 2-Using Ring Groove Wear Gauge

Check top ring groove for excessive wear (Fig. 2) by inserting a JDE-62 Ring Groove Wear Gauge in the groove. If gauge shoulders contact the ring land the groove is excessively worn.

Check the other two grooves for wear by inserting a new ring in the proper groove at several points around the piston. Measure clearance with a feeler gauge. If the clearance exceeds 0.008 inch (0.203 mm), replace the piston.

Check clearance between piston and cylinder liner bore to determine if replacement is necessary. Measure clearance with a feeler gauge at the bottom of the piston skirt 90° to pin bore. To establish taper and out-of-round, check liner 1 inch (25 mm) from bottom and 1 inch (25 mm) from top, lengthwise and crosswise. Wear limits are as follows:

Specifications	Measurement
Liner taper (maximum)	0.0020 in. (0.051 mm)
Liner out-of-round (maximum)	0.0020 in. (0.051 mm)
Clearance between liner and piston at bottom of skirt (maximum)	0.008 in. (0.20 mm)



1—Liner Roundness
2—Measurements Within 0.0020 in. (0.051 mm)
3—Liner Taper
4—Direction of Piston Pin
5—Measurements Within 0.0020 in. (0.051 mm)

Fig. 3-Measuring Cylinder Liner

Replace piston pins if they are damaged or show signs of excessive wear. Replace snap rings when pins are replaced.

Replace connecting rod bearing inserts at every major overhaul. Inserts are available in standard size or undersizes of 0.002 inch, 0.010 inch, 0.020 inch or 0.030 inch (0.05, 0.25, 0.51 or 0.76 mm).

Rod bore I.D. is 2.9000 to 2.9010 in. (73.660 to 73.685 mm).

Piston pin bushings should be replaced if they show signs of damage or excessive wear. Replacement bushings must be reamed after being pressed into position to provide a thumb press fit for the pin.

INSTALLATION

IMPORTANT: When installing new pistons, be sure they are all of the same part number due to weight differences.

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

Each connecting rod and piston must be reinstalled in the cylinder liner from which it was removed. Observe the word "FRONT" stamped on the head of all pistons and in the rib of the connecting rods. All identification marks must face toward the front of engine.

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

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

NOTE: Use of incorrect size ring expander will damage rings.

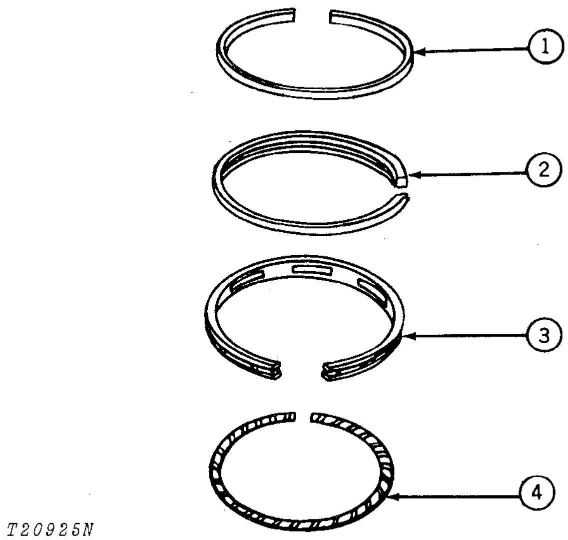
Install the expander in the oil ring groove. Install the oil ring with dots (or "Top") facing up towards the top of the piston and position oil ring gap opposite expander gap (Fig. 4).

Install second compression ring (2, Fig. 4) with dots (or "Tops") facing up towards the top of the piston.

Install the first compression ring (1, Fig. 4) with dots (or "Top") facing up towards the top of the piston.

Be sure rings move freely in their grooves.

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

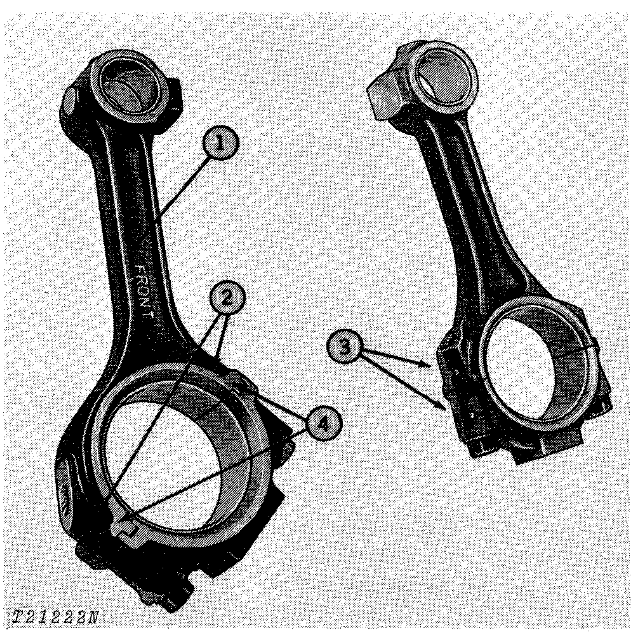


1—1st Compression Ring **3—Oil Ring**
2—2nd Compression Ring **4—Oil Ring Expander**

Fig. 4-Ring Installation

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

Install top piston ring with gap above one end of piston pin and stagger ring gaps (Fig. 4) before installing them in cylinder liners.



1—"FRONT" **3—"PIP"**
2—Tangs **4—Slots**

Fig. 5-Connecting Rods

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

The tangs for locating the bearing inserts are on the lower side of the connecting rod and cap. The cylinder location number is also located on the lower side. The lower side is installed toward the camshaft side of the engine.

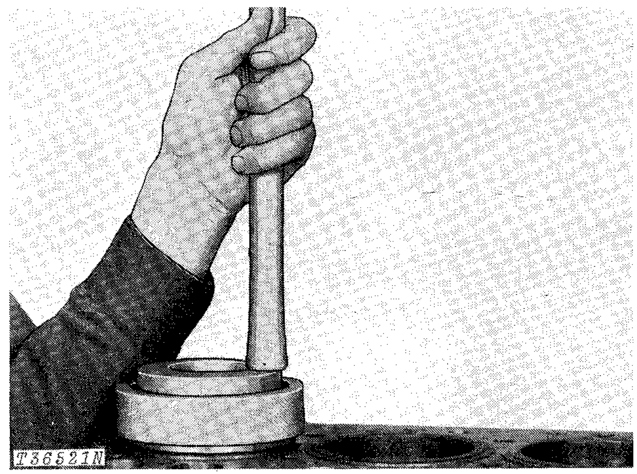


Fig. 6-Installing Pistons

Use compressor tool JD-271 to install pistons (Fig. 5).

Apply a light-weight oil to the bearing inserts and crankshaft rod journals. Dip connecting rod cap screws in engine oil.

Tighten connecting rod cap screws to 52 lb-ft (71 N·m) (7 kg/m).

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

Installing Oil Pan

Apply PT 502 John Deere Gasket Maker or equivalent to oil pan gasket and cylinder block pan surface. Tighten oil pan-to-cylinder block and timing gear cover.

Engine Break-In

Perform the break-in steps (Group 0499) to insure proper run-in of new parts.

Group 0404
CYLINDER BLOCK

GENERAL INFORMATION

Cylinder block and crankcase are cast in one piece.

Cylinder liners are of the replaceable wet-sleeve type, made of hardened alloy cast iron and are a slip fit in the cylinder block. The flange of each liner rests on a shoulder within the block and is sealed by a square rubber packing. The top edge of the liner is sealed flush with the cylinder block by the compression of the cylinder head and gasket. Two O-rings in the block provide additional sealing.

REMOVAL

Engine must be removed from unit to service cylinder block. (See Group 0400).

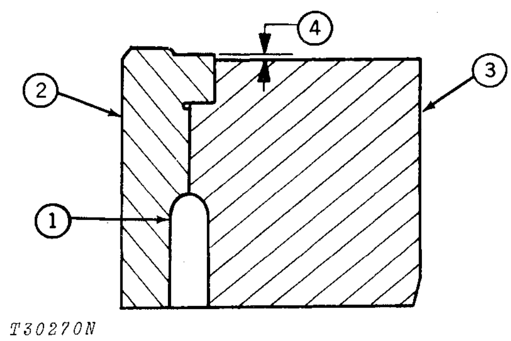
Drain the crankcase and remove oil pan and cylinder head.

Do not rotate crankshaft with cylinder head removed unless liners are bolted down. Bolt liners down before removing pistons.

Remove carbon or ridge from liner bore with a ridge reamer before removing pistons.

Remove pistons keeping bearing inserts with their respective rods and caps. Mark rods, pistons, and caps to assure correct assembly. Each connecting rod and piston must be reinstalled in the cylinder bore from which it was removed.

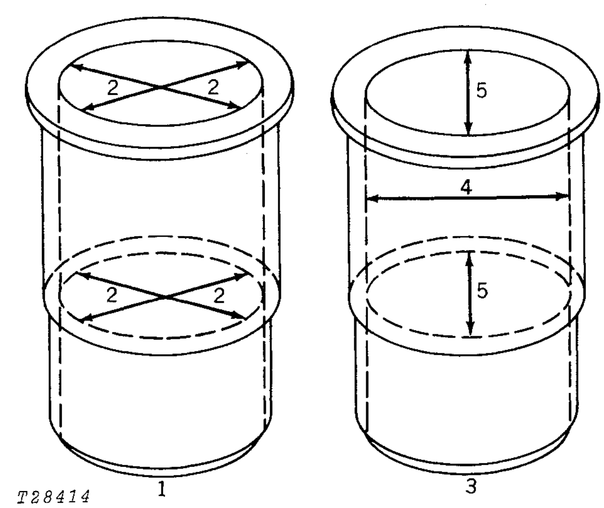
Measure height of bolted down liners before removal from block. Height is 0.001 to 0.004 inch (0.03 to 0.10 mm) above block. See Fig. 1.



1—Water Passage
2—Liner
3—Block
4—0.001 to 0.004 Inch (0.03 to 0.10 mm)

Fig. 1-Location of Liner in Cylinder Block

REPAIR



1—Liner Roundness
2—Measurements Within 0.0020 Inch (0.051 mm)
3—Liner Taper
4—Direction of Piston Pin
5—Measurements Within 0.0020 Inch (0.051 mm)

Fig. 2-Measuring Cylinder Liner

Check clearance between piston and cylinder liner bore to determine if replacement is necessary. Measure clearance with a feeler gauge at the bottom of the piston skirt 90° to pin bore. To establish taper and out-of-round, check liner 1 inch (25.4 mm) from bottom and 1 inch (25.4 mm) from top, lengthwise and crosswise (Fig. 2). Wear limits are as follows:

Specifications	Measurement
Liner Taper (maximum)	0.0020 in. (0.051 mm)
Liner out-of-round (Maximum)	0.0020 in. (0.051 mm)
Clearance between liner and piston at bottom of skirt (maximum)	0.008 in. (0.20 mm)

NOTE: Service blocks are furnished with piston cooling orifices to be installed in the tapped holes in the main bearing webs. Tighten orifices with 85 to 110 lb-in. (9.6 to 12.4 N·m) (0.98 to 1.27 kg-m).

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

Check oil gallery steel ball plugs in cylinder block for leaks. If gallery hole is leaking oil, steel ball plugs must be removed and holes in cylinder block tapped and plugged with pipe plugs.

Inspect oil pressure regulating valve bushing in fan end of cylinder block. If valve seating area is worn or damaged, remove bushing from block and install a new bushing (Group 0407).

If dipstick nipple has been removed, coat threads of nipple with joint sealing compound and install in cylinder block. Measure from block rail vertically to center of nipple end. Measurement should be 8.25 inches (210 mm).

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

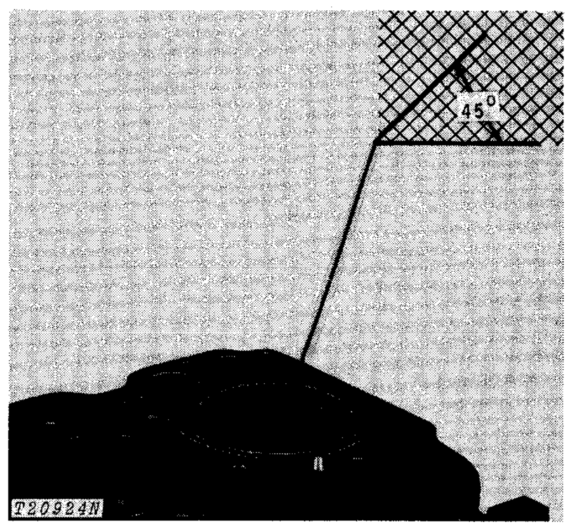
When installing new cylinder liners in block, use a depth gauge to check the height of the flange on the liner in relation to the cylinder block (Fig. 1). The top of the flange should be no more than 0.004 inch (0.10 mm) above the cylinder block with packings removed from the bottom of the liner. Check this several places around the liner to make sure the liner is seated squarely in the bore of the cylinder block.

IMPORTANT: Remove cylinder liner and install all packings before final assembly.

Deglazing Cylinder Liners

The cylinder lines may be deglazed with a D-17005BR Deglazing Brush, but not rebored. When the liner exceeds a 0.0020 inch (0.051 mm) maximum taper or exceeds 0.0020 inch (0.051 mm) out-of-roundness, the liner and piston must be replaced.

Use a deglazing brush and light pressure to produce the desired 15 to 35 micro-inch R.M.S. cylinder wall finish (Fig. 3).



T20924N

Fig. 3-Deglazing Cylinder Line

If broken piston rings were present and deglazing does not clean up scratches, the cylinder liner should be replaced.

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

IMPORTANT: Solvents will not remove deglazing residue.

INSTALLATION

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

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

Install cylinder bore O-rings into the grooves in the cylinder block. Check that the O-rings do not protrude outside the grooves and are not twisted.

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

IMPORTANT: Do not soak the packing or O-rings in oil prior to assembly. Soaking will cause the packings to swell.

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

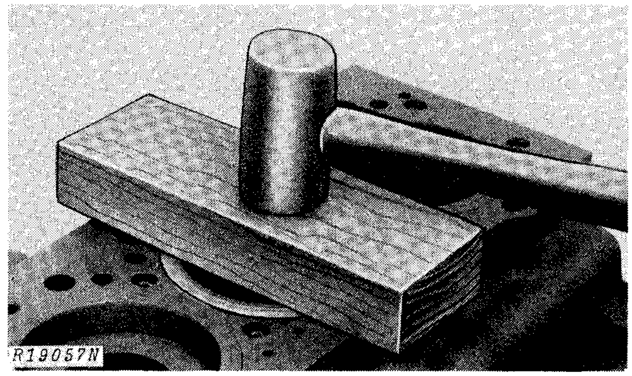


Fig. 4-Installing Cylinder Liner

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

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

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

Group 0407
OILING SYSTEM

GENERAL INFORMATION

The engine oiling system consists of an engine oil pump, oil cooler, oil filter and oil pressure regulating valve.

The oil pump is located in the oil pan and is driven by a gear located in the engine gear train. The pump is a gear-type pump.

The engine oil filter is located on the right side of the engine.

OIL PUMP

REMOVAL

NOTE: Before removing oil pump, check engine oil pressure (Section 90, Group 9010).

Drain oil from engine.

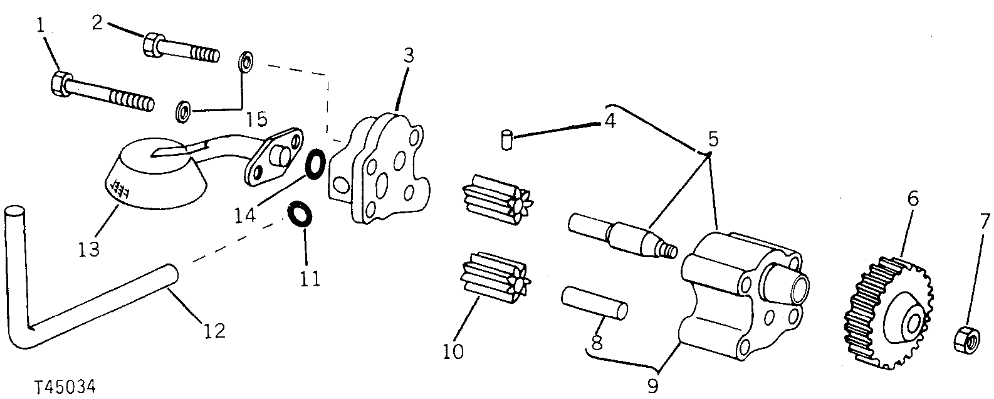
Remove engine oil pan.

NOTE: Before removing oil pump assembly, set engine at TDC and secure left-hand balancer shaft to prevent turning during oil pump removal.

Remove oil pump assembly.

REPAIR

To remove idler shaft (8, Fig. 1) from oil pump housing, slide idler gear (10) off shaft; then support pump housing (9) and press out shaft.



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

Fig. 1-Engine Oil Pump

Pump Housing and Idler Shaft

If surface to which cover attaches is rough, burred, or warped, upper body must be replaced.

Pump Cover

Examine pump cover (3, Fig. 1) mounting surface. A damaged cover must be replaced. The seal between cover and pump housing is dependent upon these two surfaces being perfectly flat and smooth.

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

Inspect inlet and outlet tubes for clogging.

Pump Drive Shaft

Carefully inspect drive shaft assembly (5) for wear, especially at points of contact. Check diameter of drive shaft 0.6308 to 0.6312 inch (16.0222 to 16.0225 mm) at point where it rides in bore of housing and replace if necessary. (The drive shaft is not available separate from the pump gear and groove pin.)

Pump Gears

Install gears in housing in running position and measure radial clearance 0.003 to 0.007 (0.08 to 0.18 mm) between gear teeth and body. Excessive clearance can be corrected only by replacement of worn parts.

Place a straightedge across top of housing (to represent cover) and measure clearance 0.001 ot 0.006 inch (0.03 to 0.15 mm) between gears and straightedge.

ASSEMBLY AND INSTALLATION

Press idler shaft (8) into pump housing until flush with outer surface of housing.

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

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

On later units, install O-ring in outlet tube bore in cylinder block.

Install new O-ring (11) in oil outlet opening in oil pump cover.

Place pump housing with gears and drive shaft in position in engine. Install drive gear on shaft. Tighten hex. nut to 35 to 45 lb-ft (47 to 61 N·m) (5 to 6 kg-m) and then stake nut to shaft.

NOTE: If let-hand balancer shaft has moved, retime balancer shaft to engine gear train (see Group 0402).

Position oil pump cover and screen up against pump housing. Install pump outlet oil tube in cover. Fasten cover in place with four cap screws and lock washers. Tighten to 35 lb-ft (47 N·m) (5 kg-m).

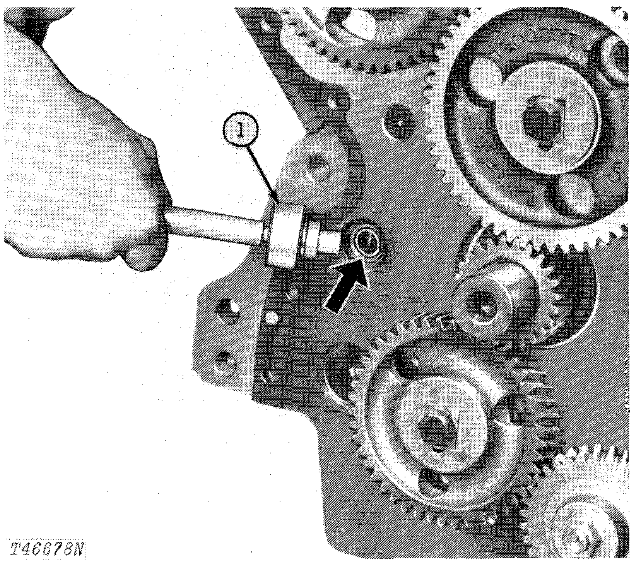
OIL PRESSURE REGULATING VALVE

REMOVAL

Remove oil pressure regulating plug, shims, spring, and valve. Save all shims for correct reassembly.

REPAIR

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



1—JD248-A—Oil Pressure Relief Valve Bushing Driver

Fig. 2-Installing Pressure Regulating Valve Bushing

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

Check oil pressure regulating spring. Test length is 1.68 inches (42.7 mm) at 15 ± 1.5 lb. (67 ± 7 N) (7 ± 0.7 kg) pressure.

Check pressure regulating valve plug thread for damage.

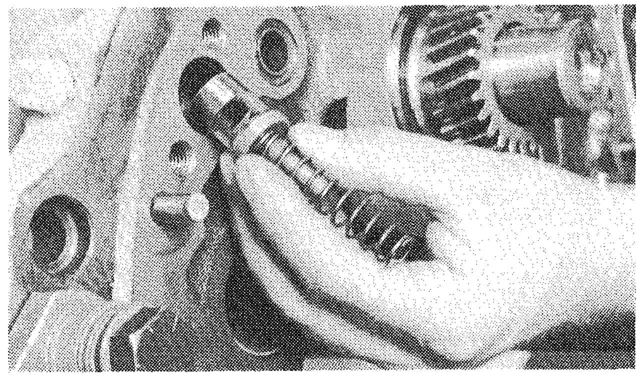
INSTALLATION

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

OIL BYPASS VALVE (Later Units)

REMOVAL

Remove timing gear cover (Group 0402).



T87436

Fig. 3-Oil Bypass Valve

Remove oil bypass valve and spring (Fig. 3).

REPAIR

Inspect oil bypass valve for damage. Install a new valve if there is damage.

Use D-01168AA Spring Compression Tester to check oil bypass valve spring. Spring length must be 1.34 in. (34 mm) when compressed with 23 ± 2.3 lb. force (101 ± 10 N). If length is not correct, install a new spring.

INSTALLATION

Install bypass valve and spring (Fig. 3).

Install timing gear cover (Group 0402).

OIL FILTER

REMOVAL

Unscrew filter element from engine and discard it.

REPAIR

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

INSTALLATION

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

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

IMPORTANT: The filter element has a special by-pass valve to protect the engine in case of filter clogging. Advise the operator to replace only with a John Deere filter element supplied by his dealer.

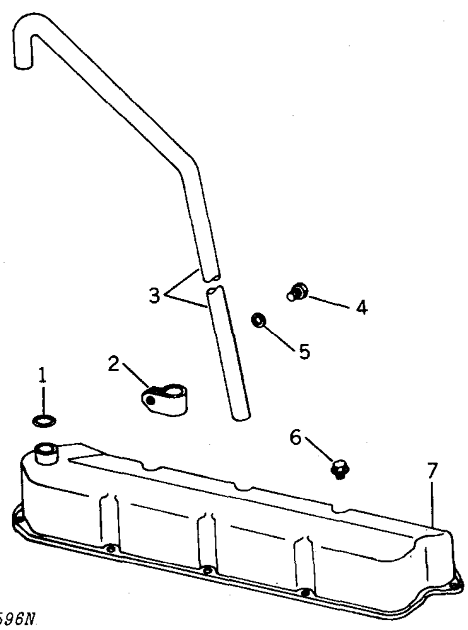
Group 0408
VENTILATING SYSTEM

GENERAL INFORMATION

The ventilator outlet tube prevents pressure buildup in the engine crankcase. This allows the engine to breathe freely, which is necessary for proper lubrication.

REMOVAL

Refer to Fig. 1 for removal of the ventilator outlet tube.



1—O-Ring
2—Clamp
3—Ventilator Outlet Tube
4—Cap Screw
5—Washer
6—Special Cap Screw with Washer (8 used)
7—Rocker Arm Cover

Fig. 1-Ventilator Outlet Tube

REPAIR

Check the ventilator outlet tube for damage or restrictions. Clean or replace as necessary.

INSTALLATION

Use a new O-ring (1, Fig. 1) when installing the ventilator outlet tube. Be sure O-ring is properly seated.

Group 0409
CYLINDER HEAD AND VALVES

GENERAL INFORMATION

The cylinder head holds the rocker arm assembly, valve springs, and valves.

Valve guides and seats are integral with the cylinder head.

Intake and exhaust valves have replacement wear caps.

REMOVAL

The engine need not be removed to service cylinder head, valves, and related parts.

Plug all open injection lines. Remove injection nozzles from head. (Nozzle tips extend below face of cylinder head and may be accidentally damaged.)

REPAIR

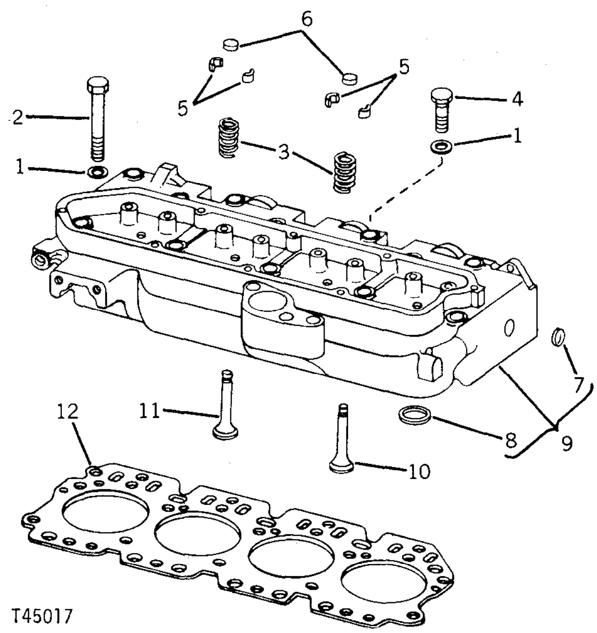
Do not rotate crankshaft with cylinder head removed unless all cylinder liners are bolted down.

Measure inside diameter of valve guides. Valves are available with standard size or oversize stems.

Valve guides must be precision reamed to match oversized valves. Make sure valves fit freely in guides.

Badly worn valve guides should be sized by knurling. Use D-20002WI Knurling Tool exactly as recommended by the manufacturer.

Badly worn valve inserts should be replaced. Use JDE-41296 Valve Seat Puller to remove valve inserts.



1—Special Washer (18 used)
2—Special Cap Screw (18 used)
3—Spring (8 used)
4—Special Cap Screw (4 used)
5—Retainer (16 used)
6—Cap (8 used)
7—Special Plug (2 used)
8—Exhaust Valve Insert (4 used)
9—Cylinder Head
10—Exhaust Valve (4 used)
11—Intake Valve (4 used)
12—Gasket

Fig. 1-Cylinder Head and Valves

Check to determine if cylinder head is flat and smooth. If it is necessary to resurface the bottom deck of the head, remove no more material than absolutely necessary (not to exceed 0.030 inch [0.76 mm]).

Check distance from the bottom deck of the cylinder head to the valves when seated. The distance for intake valves must be 0.037 ± 0.007 inch (0.93 ± 0.18 mm); the distance for exhaust valves must be 0.057 ± 0.007 inch (1.45 ± 0.18 mm).

Valve Stem Caps

Replace valve stem caps if worn or damaged.

Inspecting Valve Springs

Check compression strength of springs. The free length should be 2.12 inches (53.8 mm). Test lengths are 1.81 inches (46.0 mm) at 58 ± 4 lb. (258 ± 18 N) (26 ± 2 kg) (valve closed) and 1.36 inches (34.5 mm) at 143 ± 10 lb. (636 ± 45 N) (65 ± 5 kg).

Inspecting Rocker Arm Assembly

Make sure that rocker arm oil holes are not plugged.

If ends of arms are worn, replace or resurface them.

Thoroughly clean holes in rocker arm mounting brackets. This is especially important for the rear bracket, because oil is fed to the rocker arm shaft through this hole.

If a failed valve has been replaced, also replace the rocker arm and push rod for that valve.

ASSEMBLY

Rocker Arm Assembly

Assemble parts to rocker arm shaft in sequence that they were removed.

Oil hole in rocker arm shaft to shaft support must face downward when assembly is installed on cylinder.

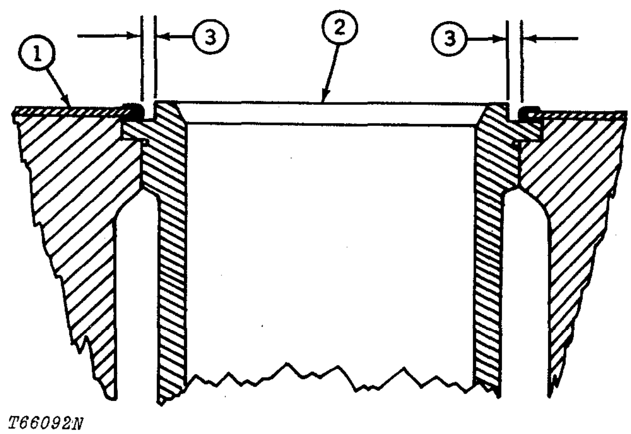
Note also the following:

Use new valve keepers.

After assembly, "pop" each spring and valve assembly three or four times by tapping the end of each valve stem with a soft mallet.

INSTALLATION

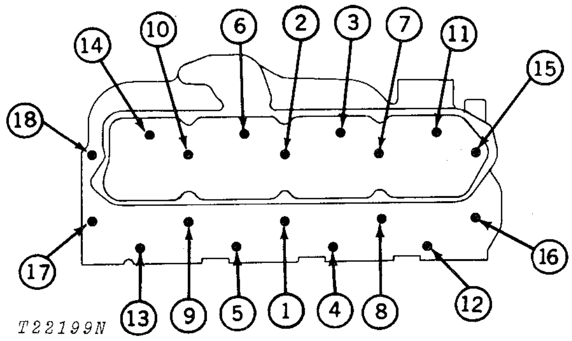
Install the head gasket dry.



1—Cylinder Head Gasket
2—Cylinder Liner
3—Equal Distance Within 0.040 in. (1 mm)

Fig. 2-Cylinder Head Gasket

Position cylinder head gasket (1, Fig. 2) over dowels on cylinder block. Check distance between cylinder head gasket and cylinder liner (2). Distances should be equal within 0.040 in. (1 mm) around each cylinder liner. If distance is not equal, make dowel holes in cylinder head gasket larger.



T22199N

Fig. 3-Proper Sequence for Tightening Cylinder Head Cap Screws

Use specified flat washers under all cap screws. Dip cap screws in oil prior to installation. Start cylinder head to cylinder block cap screws by hand and tighten evenly to 95 lb-ft (129 N·m) (13 kg-m), following sequence in Fig. 3.

Install push rods in location from which they were removed.
Position valve stem caps over ends of valve stems. Make certain the caps rotate freely on the stems.

Install rocker arm and shaft assembly on cylinder head. Tighten cap screws to 35 lb-ft (47 N·m) (5 kg-m).

Run engine to bring it up to normal operating temperature.

Loosen each cylinder head cap screw 45 degrees and retighten it to 95 lb-ft (129 N·m) (13 kg-m), in the sequence shown in Fig. 3.

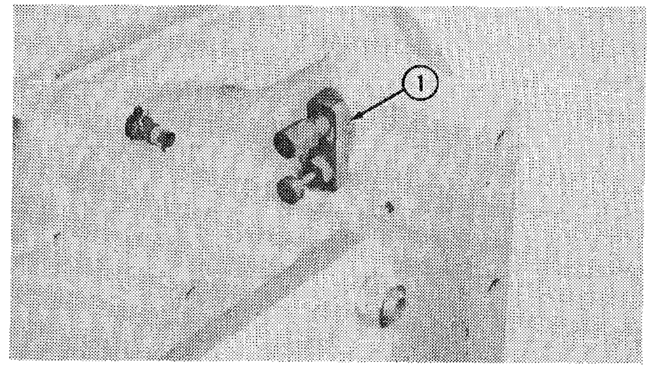
Check and reset valve clearance.

Adjusting Valve Tappet Clearance

The engine may be either hot or cold during valve adjustment.

Use JD-281 Engine Timing Tool (1, Fig. 4) to position No. 1 piston (located at fan end) on TDC. Timing pin will enter its hole in flywheel.

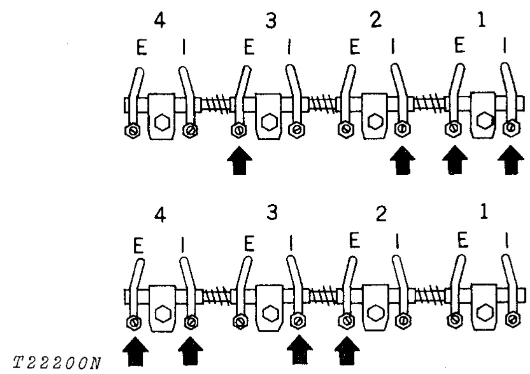
NOTE: The timing line on the injection pump rotor will be visible with No. 1 piston on TDC. If the timing line is not visible, No. 4 piston is on TDC.



T81223

1—JD-281 Engine Timing Tool

Fig. 4-Setting No. 1 Piston at Top Dead Center



T22200N

Fig. 5-Adjusting Valve Tappet Clearance

Adjust valve clearance on No. 1 and 3 exhaust valves to 0.018 inch (0.46 mm) and on No. 1 and 2 intake valves to clearance of 0.014 inch (0.36 mm). Using a feeler gauge to measure clearance, turn valve adjusting screw up or down until clearance is correct.

Remove timing pin from flywheel. Rotate engine flywheel 360 degrees and reinsert timing pin into hole on flywheel rim.

Adjust valve clearance on No. 2 and 4 exhaust and No. 3 and 4 intake valves to clearances specified.

Remove timing tool from flywheel and reinstall timing cover.

Install Rocker Arm Cover

Fasten cork gasket to rocker arm cover with John Deere Gasket Maker or an equivalent sealant. Install rubber and metal gasket without sealant.

Install rocker arm cover on cylinder head. If using a cork gasket, tighten cap screw to 25 lb-in. (2.8 N·m). If using a rubber and metal gasket, tighten cap screws to 96 lb-in (10.8 N·m).

Group 0410
EXHAUST MANIFOLD

GENERAL INFORMATION

The exhaust manifold attached to the left side of the engine routes burned gasses from the cylinders.

REMOVAL

Let the engine cool down before removing the exhaust manifold.

REPAIR

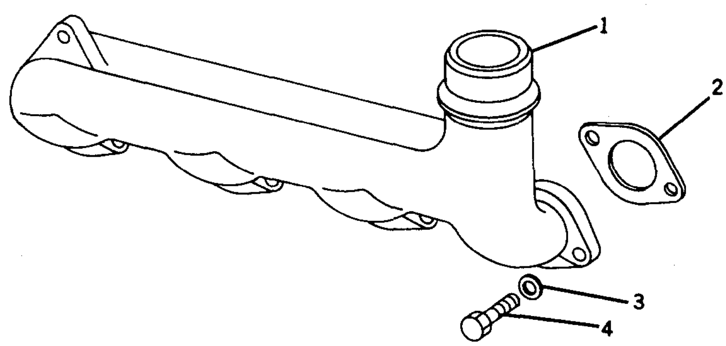
Discard the gaskets.

Check the manifold for cracks or other damage. Clean the manifold ports.

If the manifold is cracked, it should be replaced rather than repaired.

INSTALLATION

Install the manifold using new gaskets.



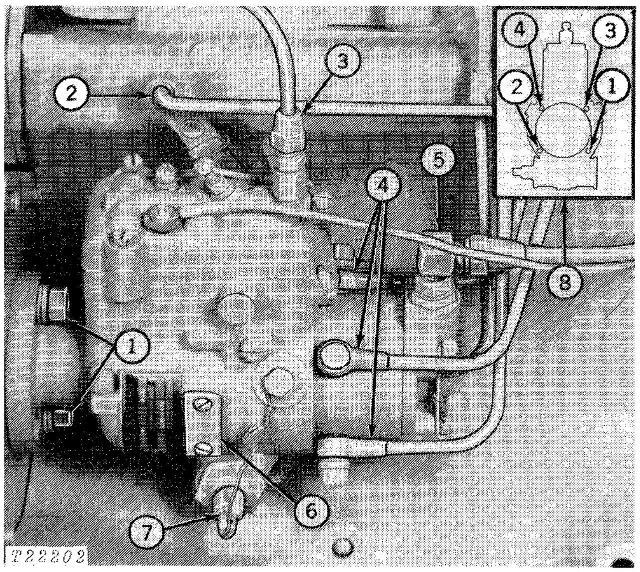
1—Manifold
2—Gasket (4 used)
3—Washer (8 used)
4—Cap Screw (8 used)

Fig. 1-Exhaust Manifold

Group 0413
FUEL INJECTION SYSTEM

FUEL INJECTION PUMP

GENERAL INFORMATION



1—Attaching Points
2—Throttle Linkage
3—Fuel Return
4—Injection Lines
5—Fuel Inlet
6—Timing Hole Cover
7—Cam Advance Mechanism
8—Injection Delivery Sequence (View from end plate)

Fig. 1-Fuel Injection Pump

The fuel injection pump is mounted horizontally on the left side of the engine front plate (Fig. 1). The pump model and characteristics are shown in code form on the pump name plate.

The pump is a speed advance, single cylinder, opposed plunger, inlet metering, distributor type.

IMPORTANT: Modification or alteration of the fuel injection pump, the injection pump timing, or the fuel injection nozzles in ways not recommended by the manufacturer will terminate the warranty obligation to the purchaser.

REMOVAL

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

To relieve pressure in the fuel system, slightly crack high pressure supply lines at injection nozzles.

Before removing fuel injection pump, thoroughly clean the pump, fittings, and all connections to be disconnected.

IMPORTANT: Never spray cold water on or steam clean a warm injection pump.

The fuel injection pump and engine should be static timed before injection pump is removed (see "Installation").

Removing Injection Pump, Drive Shaft, and Gear

NOTE: The injection pump drive shaft can be removed without removing the timing gear cover. Remove fuel injection pump. Remove injection pump gear cover. Remove thrust spring and pin from gear end of shaft. Remove pump drive shaft nut and washer from end of shaft.

IMPORTANT: DO NOT overtighten center screw.

Fasten JD303 Injection Pump Shaft Removal Tool to timing gear cover. Tighten center screw against shaft. Make a tubular type driver to tap gear lightly. If shaft does not come out of gear after several taps, hold a larger hammer against removal tool centerscrew and hit gear harder. If shaft does not come out of gear, remove timing gear cover (Group 0402), remove gear and shaft, and push shaft out of gear. Care should be taken to avoid dropping Woodruff key when removing shaft. Install by placing the shaft in the gear and tightening the attaching nut, drawing the shaft through the gear. Tighten nut to 45 lb-ft (61.0 N·m) (6.2 kg-m).

If it is desired to remove the pump drive gear and shaft from the engine with the pump, the timing gear cover must be removed (see Group 0402).

Clean the injection pump and lines. Align the timing marks on the pump and insert the timing screw in flywheel.

With timing gear cover removed, check to see that the injection pump gear is properly timed to the crankshaft (see Group 0402).

Remove the upper idler gear.

Remove injection pump drive gear and shaft.

Remove pump mounting hex. nuts and remove pump from engine.

REPAIR

Refer to Group 0499 for fuel injection pump specifications in this manual.

For testing and repair of the injection pump, refer to John Deere Service Manual SM-2045, "Testing and Servicing Fuel Injection Pumps and Nozzles."

Drive Shaft and Gear

Remove thrust spring and pin from gear end of shaft.
Loosen nut until flush with end of shaft.
Remove nut and gear from shaft.
Inspect gear for wear or chipped teeth.
Inspect tang on drive shaft (tang thickness of 0.305 inch [7.75 mm] minimum).
Inspect wear surfaces on drive shaft.

Check seals on drive shaft for hardness or cracked condition. Examine seal grooves on shaft for smooth finish. Any roughness at these points will cause seal failure.

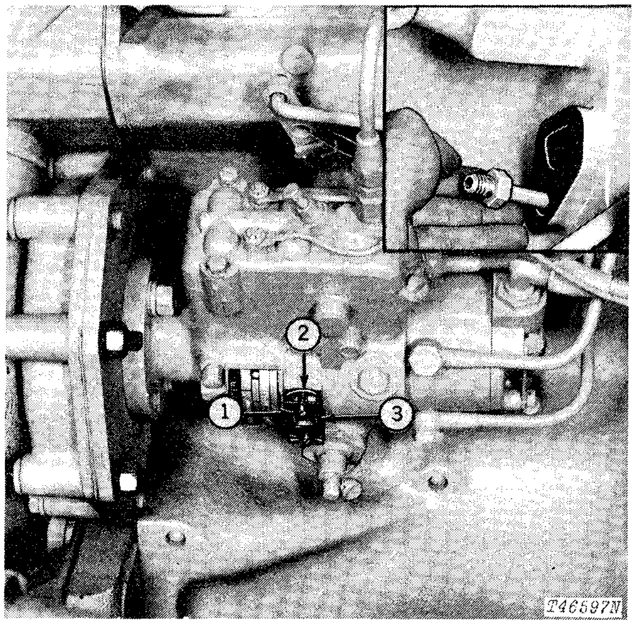
Apply a generous coat of Lubriplate to the drive shaft seals and slide seals into grooves. The seals must face in opposite directions. Apply Lubriplate liberally around the shaft between the seals.

Install gear on drive shaft using key and keyway to locate gear on shaft. Tighten hex. nut to 45 lb-ft (61.0 Nm) (6.2 kg-m).

INSTALLATION AND TIMING

If removed, install injection pump gear and shaft on engine front plate. See Group 0402 for timing injection pump gear.

Install engine timing gear cover if removed.



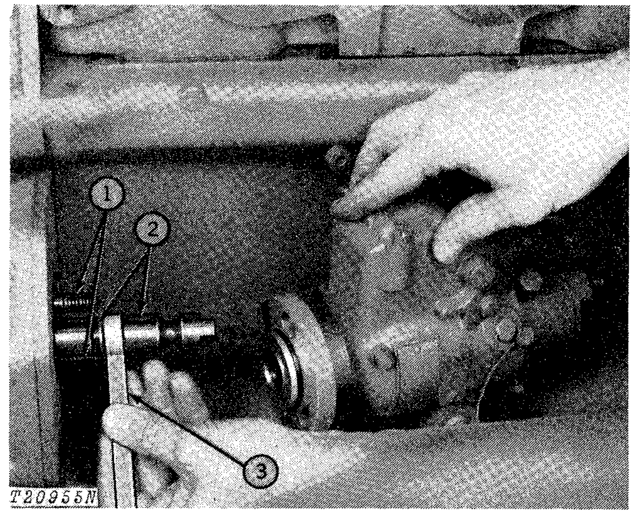
1—Governor Weight Retainer Timing Line **2—Timing Window** **3—Cam Timing Line**

Fig. 2-Timing Lines

With timing window (JD259) in place, check to be sure that timing line on governor weight retainer hub registers with the line on the cam (Fig. 2).

If engine has not been set on "top dead center" (No. 1 cylinder on compression stroke), use JD-281 Engine Timing Tool to rotate engine in direction of rotation (counterclockwise as viewed from flywheel end) until No. 1 cylinder is on compression stroke. Insert timing pin in flywheel as the flywheel is rotated and comes in registry. Engine is now set at "top dead center."

Modificaiton or alteration of the injection pump timing, or the fuel injeciton nozzles in ways not recommended by the manufacturer will terminate the warranty obligation to the purchaser.



1—Mounting Studs **2—Seals** **3—Seal Compression Tool**

Fig. 3-Compressing Drive Shaft Seal

Using Drive Shaft Seal Compressing Tool (JD256), compress seal on shaft and slide pump in place (Fig. 3).

IMPORTANT: Do not turn drive shaft seal over while installing. If resistance is felt, stop and check position of seal. If seal has been forced back, replace seal.

Install hex. nuts and tighten finger tight. Rotate pump first in the direction of rotation (counterclockwise as viewed from the flywheel end) and then in the opposite direction and again register timing lines to take up all backlash. Tighten mounting nuts securely.

Recheck pump timing.

Connect injection lines using new washers. Tighten connections to 420 lb-in. (47.5 Nm) (4.8 kg/m).

Connect fuel supply and return lines. Tighten fitting screws to 240 lb-in. (27.1 Nm) (2.8 kg/m).

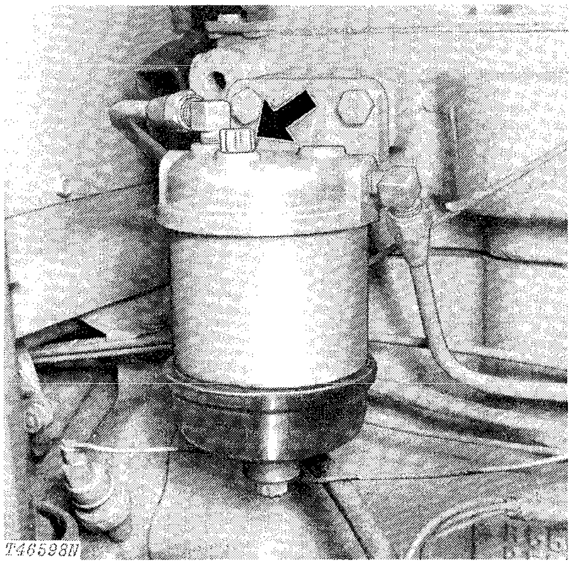
Connect throttle linkage.

Remove timing window and install timing window cover.

Bleeding the Fuel System

Fill tank with proper fuel.

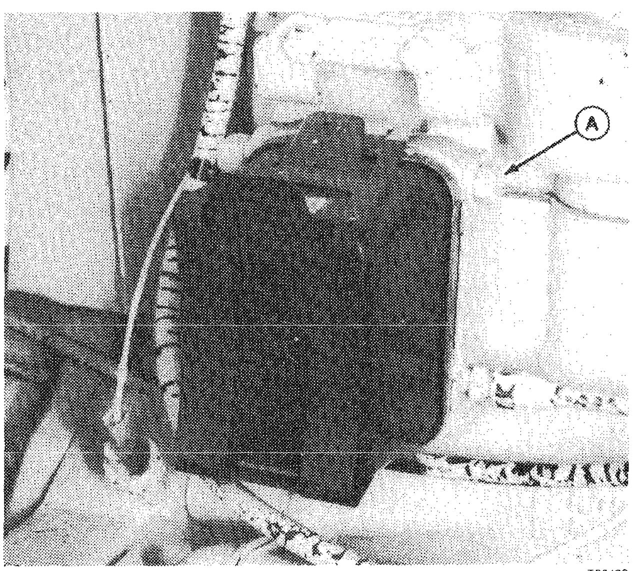
Open shut-off valve at tank outlet.



T46598N

Fig. 4-Bleed Plug (-382507)

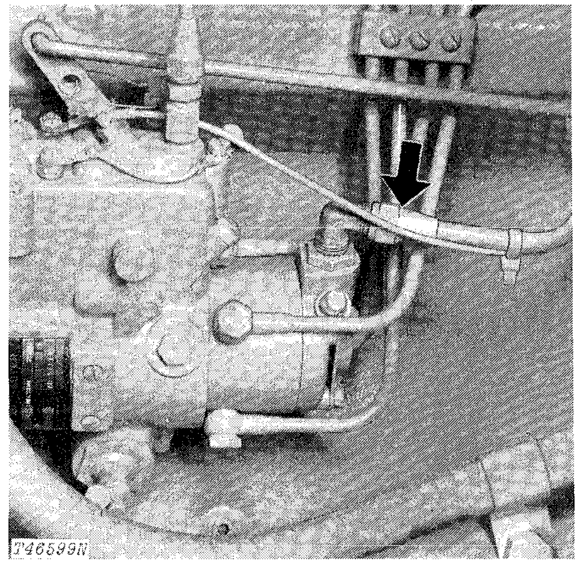
Loosen bleed plug (Fig. 4 or A, Fig. 5) fuel filter. Pump primer lever until a solid stream of fuel (free of air bubbles) flows from the opening. Tighten plug.



T86499

A-Bleed Plug

Fig. 5-Bleed Plug (382508-)



T46599N

Fig. 6-Pump Inlet Line

Loosen pump inlet line (Fig. 6). Pump primer lever until a solid stream of fuel (free of air bubbles) flows from line.

Be sure to leave primer lever at lowest point of stroke.

ADJUSTMENT

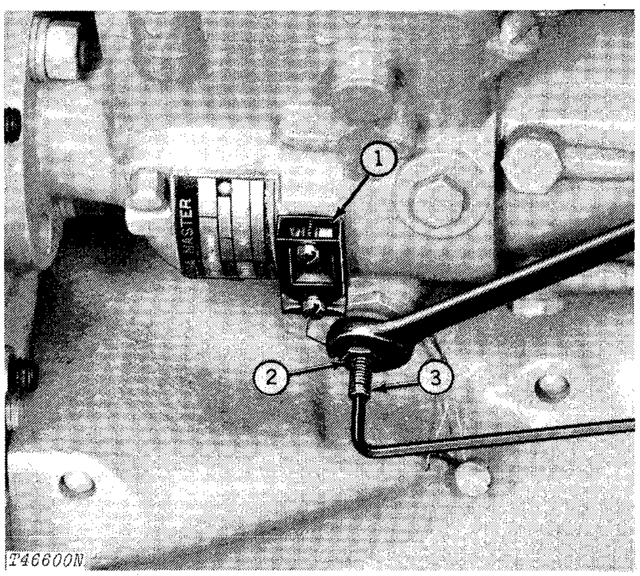
Speed Control Linkage

See Group 9010.

Cam Advance

Be sure that injection pump is static timed to engine.

Install timing window.



1—Timing Window **3—Advance Trimmer Screw**
2—Lock Nut

Fig. 7-Adjusting Cam Advance

Note the location of the cam timing line. Due to slight variations in windows and hole locations, cam line may not be exactly behind window line. Adjust timing window to get best possible line-up.

Bring engine to operating temperature.

NOTE: Marks on the timing window are two pump degrees apart.

Adjust cam advance by loosening lock nut and turning advance trimmer screw (3, Fig. 7)

Turn screw in to retard timing; turn screw out to advance timing.

Total advance movement .... 8 + 1 − 0°
Advance (1100 rpm - no load)................ 4°

Secure trimmer screw with lock nut and install seal cap.

FUEL INJECTION NOZZLES

GENERAL INFORMATION

The fuel injection nozzles (one for each cylinder) spray fuel into the combustion chamber.

REMOVAL

Clean the cylinder head area around the nozzles and blow off with compressed air. Use hose clamp pliers to loosen clamp on leakoff boot and slip off boot. Remove and return leakoff line with the boots.

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

To relieve pressure in the fuel system slightly crack high pressure supply lines at injection nozzles.

Use a wrench to hold nut on injector and unscrew the nut on fuel supply line. Cap openings as soon as lines are disconnected.

Remove nozzle clamp cap screws and spacer. Withdraw nozzle from cylinder head. If nozzles cannot be easily removed from cylinder head, use a JDE38 Nozzle Puller to remove them. Use care when attaching the puller to the nozzle. Operate puller so as to pull nozzles straight out of the bores.

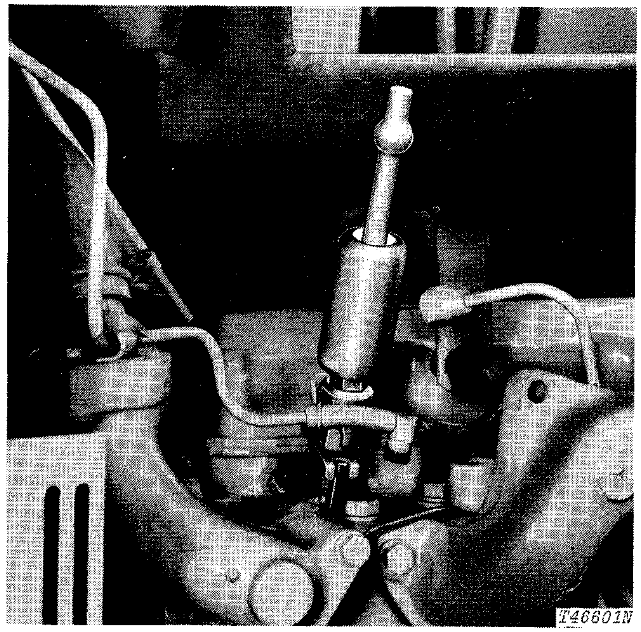


Fig. 8-Using Nozzle Puller to Remove Nozzles

IMPORTANT: Do not use a screwdriver or similar tool to pry injector nozzles from cylinder head as distortion and permanent damage to nozzles may occur. Injectors are easily removed by hand unless lower carbon seal has failed, allowing nozzle to become "set." In this case, the nozzle puller must be used.

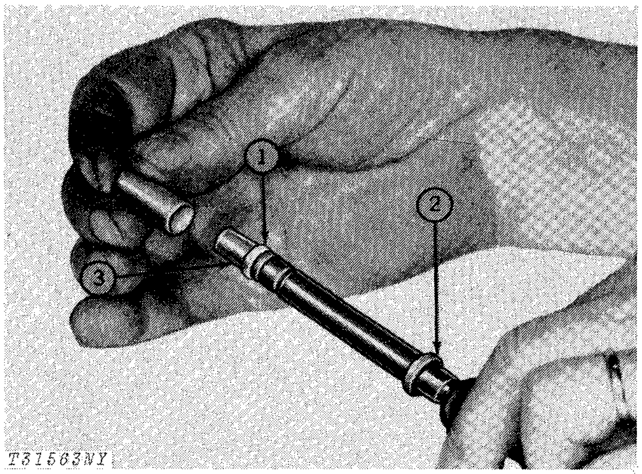
REPAIR

Refer to Group 0499 for nozzle specifications in this manual.

IMPORTANT: Do not attempt to test or disassemble nozzles unless the proper service tools are available. Service Manual SM-2045 "Testing and Servicing Fuel Injection Pumps and Nozzles" contains special service tools and testing procedures necessary to service the Roosa-Master injection nozzles.

INSTALLATION

Install a new sealing washer onto the nozzle body. Use JD-258 pilot tool to install a new carbon stop seal (Fig. 9). Place the pilot on the spray tip of the nozzle and work the seal down over the pilot onto the nozzle body, then into its groove.



T31563NY

1—Carabon Seal
2—Seal Washer
3—Pilot

Fig. 9-Installing Sealing Washer and Carbon Stop Seal

Using a JDE-39 Nozzle Bore Cleaning Tool, clean out the nozzle bores in the cylinder head. When using the tool, gradually turn it into the bore.

NOTE: Always turn the tool clockwise as turning it counterclockwise will dull the tool.

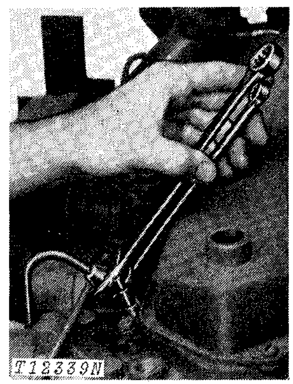
After the bores are clean, blow out with compressed air. Be sure nozzle gasket mounting surface on cylinder head is free from burrs or dirt. Foreign material in this area could cause the nozzle body to distort when clamped down, resulting in a sticking valve.

Unplug holes in cylinder head and insert the nozzle into the cylinder head bore using a twisting motion.

NOTE: Be sure nozzle body is free from oil or grease when installing.

Turn injector locating clamp until forks fit down over inlet line. Install cap screw and leaf spring around head of injector and position round spacer on end of cap screw under leaf spring. Hand tighten cap screw. Connect inlet line and hand tighten.

Tighten nozzle hold-down cap screws to 20 lb-ft (27 N·m) (3 kg/m) and install leak-off line.



T12339N

Fig. 10-Tightening Injector Lines

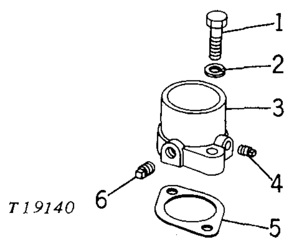
Crank engine with starter until fuel flows around loose injector lines. **Using one hand and two wrenches,** tighten injector lines as shown in Fig. 10. Using only enough force to keep lines from leaking. Start engine and check for leaks around nozzle connections. Retighten if necessary and install hood.

Group 0414
INTAKE MANIFOLD

GENERAL INFORMATION

An air inlet is used to carry air through the intake valves into the combustion chamber.

REMOVAL



1—Cap Screw (2 used)
2—Lock Washer (2 used)
3—Air Inlet
4—Pipe Plug
5—Gasket
6—Pipe Plug

Fig. 1-Air Inlet

Let engine cool down before removing the air inlet.

REPAIR

Discard the gasket.

Check the air inlet for cracks or other damage. Clean the inlet port.

If the air inlet is cracked, it should be replaced rather than repaired.

INSTALLATION

Install the air inlet using a new gasket. Apply John Deere Gasket Maker or an equivalent to air inlet cap screws. Tighten air inlet cap screws to 35 lb-ft (45 N·m) (5 kg-m).

Group 0415
ENGINE BALANCER

GENERAL INFORMATION

Two balancer shafts are mounted in the lower half of the cylinder block and each rotates in three pressure-lubricated replaceable bushings.

The balancer shafts rotate in opposite directions to reduce engine vibration. Thrust of the balancer shafts is absorbed by thrust plates fastened to the front of the cylinder block.

REMOVAL

To service balancer shafts and related parts, engine normally need not be removed from unit. If engine has to be removed, see Group 0400. Then proceed as follows:

Remove oil pressure regulating valve and timing gear cover.

Remove oil pump gear.

Remove lower idler gear.

Remove balancer shafts and identify shafts and thrust plates as "right" and "left."

REPAIR

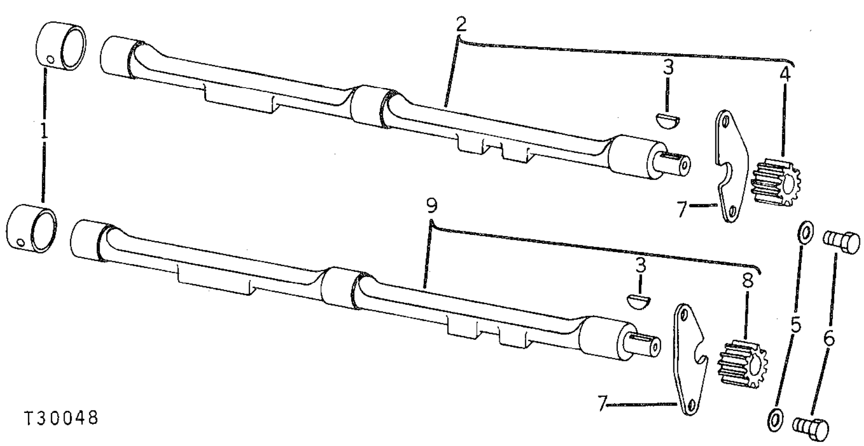
Check balancer shaft journal to bushing clearance. If clearance is greater than 0.0058 in. (0.147 mm), replace the bushings. If clearance is still greater than 0.0058 in. (0.147 mm) the balancer shaft must be replaced.

The first two bushings can be replaced with the engine in the unit using special tool JD-249. To remove the third (rear) bushing, separate the engine from the clutch housing (Group 0400). Press all bushings in from front of engine until flush with bushing bore chamfer in block. (JD-249 tool can also be used to drive out old bushings.)

Be sure that oil hole in each bushing lines up with upper oil lead hole in cylinder block.

Check thickness of thrust plate. These must be within 0.1170 to 0.1190 inch (2.972 to 3.023 mm) as the thrust plate determines balancer shaft end play.

Inspect balancer shaft drives for worn, cracked and broken teeth.



1—Bushing (6 used)
2—L.H. Balancer Shaft
3—Woodruff Key (2 used)
4—L.H. Gear
5—Lock Washer (4 used)
6—Cap Screw (4 used)
7—Thrust Plate (2 used)
8—R.H. Gear
9—R.H. Balancer Shaft

Fig. 1-Engine Balancer Shaft

Installing Drive Gear

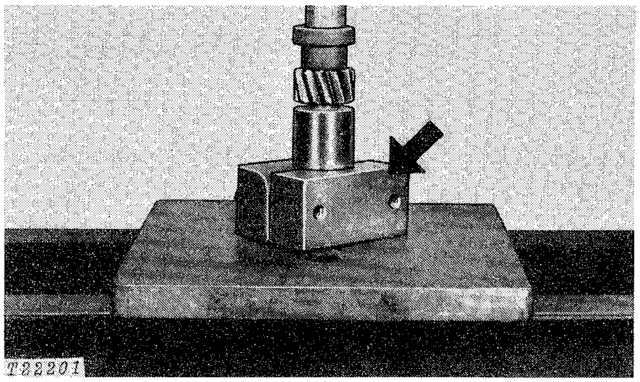


Fig. 2-Replacing Balancer Shaft Gear

Position balancer shaft drive gear on front of balancer shaft so that slot in gear lines up with Woodruff key, and timing mark on front of gear faces away from balancer shaft. Press on gear to flush with end of shaft using JD-247 Holding Tool to support shaft as shown in Fig. 2. Be sure gear is flush with end of shaft (within 0.0010 inch [0.025 mm]) as this sets balancer shaft end play.

INSTALLATION

Apply a light film of oil to balancer journals and bushings.

Secure thrust plates to front plate with hardware and tighten to 35 lb-ft (47 Nm) (5 kg-m).

Check balancer shaft for end play of no more than 0.0080 inch (0.203 mm) or less than 0.0020 inch (0.051 mm).

Install oil pump.

Before installing lower idler gear, set flywheel at "TDC" with No. 1 piston on compression stroke and align timing mark on balancer shaft drive gears with center of crankshaft using timing tool JD-254.

Install all parts removed.

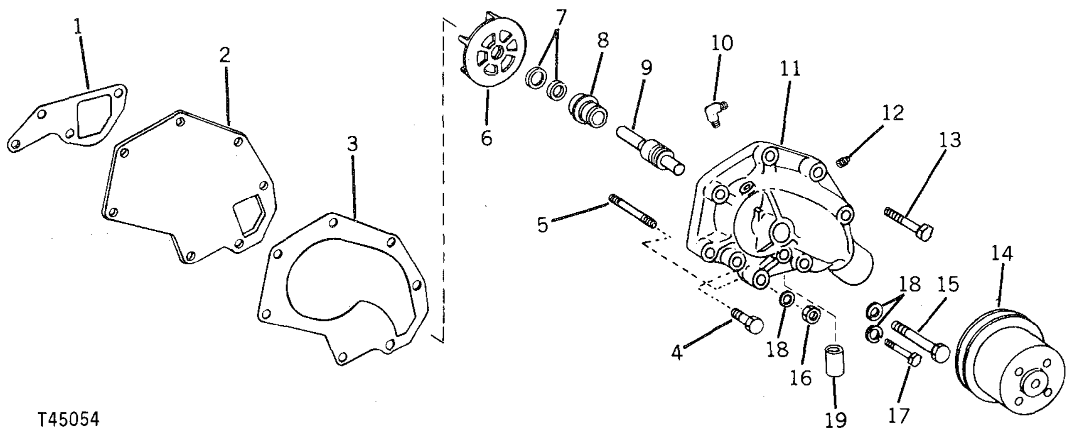
Group 0417
WATER PUMP

GENERAL INFORMATION

The centrifugal-type water pump attaches directly to the cylinder block and is driven by the fan belt. A bellows-type seal assembly is pressed into the pump housing between the pre-lubricated ball bearing and the impeller. If the seal becomes worn or damaged, water will escape through a drain hole near the bottom of the pump housing.

REMOVAL

Drain coolant from radiator and engine block and remove radiator and water pump from engine.



1—Gasket
2—Cover
3—Gasket
4—Cap Screw
5—Stud
6—Impeller
7—Cup and Insert Seal
8—Seal
9—Bearing
10—Elbow
11—Housing
12—Pipe Plug
13—Cap Screw (4 used)
14—Fan Pulley
15—Cap Screw (2 used)
16—Nut
17—Cap Screw
18—Lock Washer (4 used)
19—Tube (2 used)

Fig. 1-Water Pump Assembly

REPAIR

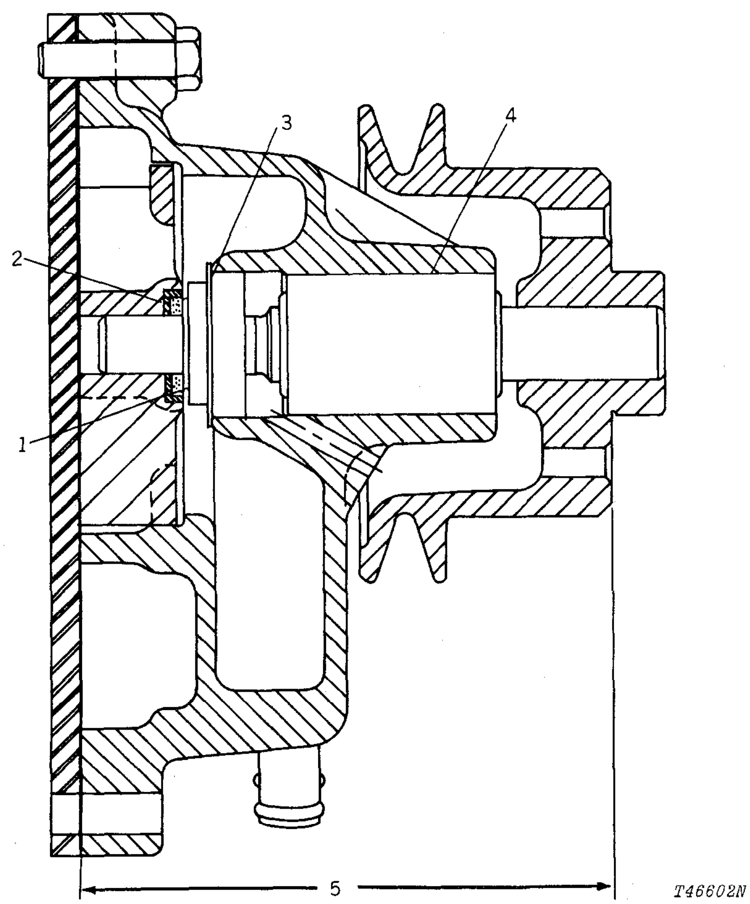
Any leakage at the drain hole in bottom of housing generally indicates a leaking seal.

Remove the rear cover plate (2, Fig. 1) and gasket from the pump housing (11).

Select a drift which is slightly smaller than the bearing shaft and, supporting fan hub, press hub from water pump.

Support water pump housing and allow sufficien clearance for impeller at center of support. Use a JD262-A water pump bearing driver or any tubular type driver that contacts only the outer race of bearing and press bearing assembly from housing.

Support impeller and press out bearing shaft using a drift which is slightly smaller than the bearing shaft. Remove seal from bearing shaft. Note location of cup and insert in impeller.



1—Insert
2—Cup
3—Seal
4—Bearing
5—5.50 in. (140 mm)

Fig. 2-Cutaway View of Water Pump Assembly

Install a new seal in the pump housing. Coat outside of pump seal metal retainer with joint sealing compound and wipe off any excess (spring-loaded type seal only). Apply a thin coat of light oil to sealing lip of seal before installing.

If seal is a two-piece type, install by hand. Rubber sealing surface that contacts housing should be clean and dry.

If seal is a spring-loaded type, use a tubular type driver that contacts only the outer metal portion of the seal and press new seal (metal side first) into pump housing. Press in until metal flange bottoms on housing.

Using a JD-262-A water pump bearing driver or any tubular type driver that contacts only the outer race of bearing, press shaft and bearing assembly into housing until outer metal case is flush with pump housing.

Install impeller insert and cup in impeller. Place insert in cup with "V" groove on insert toward cup. Be sure parts are dry and clean. Dip cup and insert in oil and install in impeller (cup to bottom of counterbore in impeller). Insert should be flat and edge of cup uniform around insert when installed in impeller.

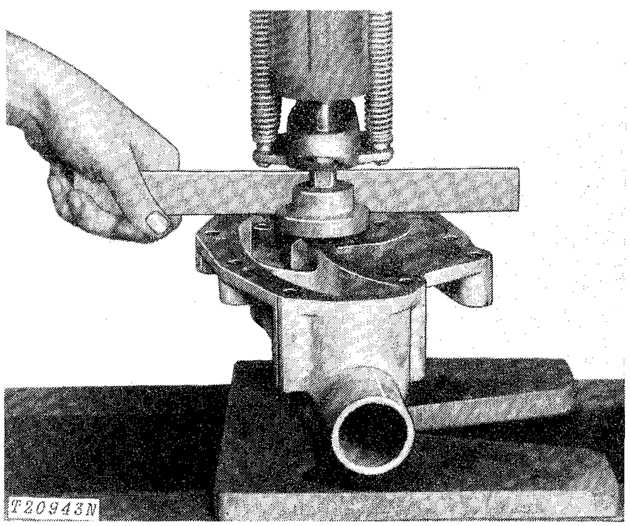


Fig. 3-Installing Impeller

Support pump assembly on end of bearing shaft and press impeller (fins toward housing) into position. Impeller should be pressed in until fins are flush with 0.010 inch (0.25 mm) with metal rim of pump housing. Check with a straightedge and feeler gauge as shown in Fig. 3.

Support impeller end of pump bearing shaft and press fan hub into position on opposite end of shaft.

Fan hub should be pressed onto shaft according to specifications. The distance from the fan surface on pulley-to-rear surface of water pump housing (without rear plate or gasket) should be 5-1/2 inches (140 mm).

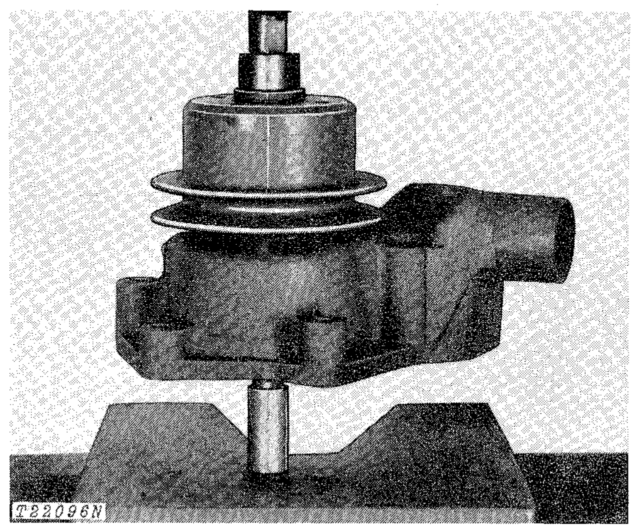


Fig. 4-Installing Fan Hub

INSTALLATION

Using a new gasket, install pump rear cover on pump assembly. Tighten attaching cap screws to 35 lb-ft (47 Nm) (5 kg/m).

Install water pump and radiator on engine.

Group 0418
THERMOSTAT, HOUSING AND PIPING

GENERAL INFORMATION

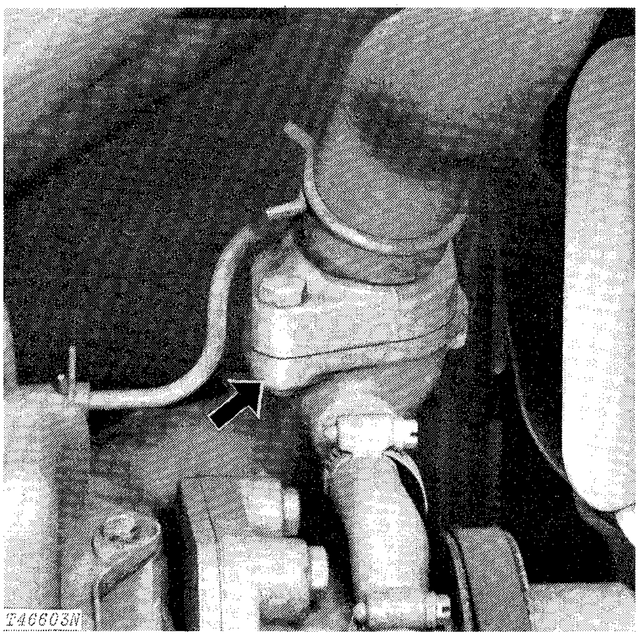


Fig. 1-Thermostat Housing

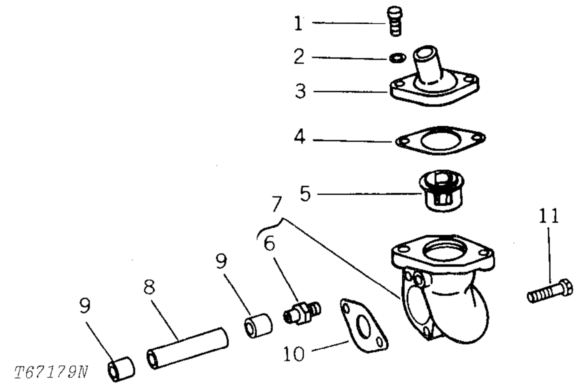
Coolant temperature is controlled by a thermostat. A bypass line from the thermostat housing to the water pump allows fast engine warm-up and a uniform cooling temperature throughout the cylinder block.

REMOVAL

Drain radiator.

Remove thermostat housing cover.

REPAIR



1—Cap Screw (2 used)
2—Washer (2 used)
3—Cover
4—Gasket
5—Thermostat
6—Nipple
7—Housing
8—Hose
9—Clamp (2 used)
10—Gasket
11—Cap Screw (2 used)

Fig. 2-Thermostat and Housing

If the engine has been running too cool or too hot, carefully inspect the thermostat for defects. If visual inspection fails to disclose any defects, test the thermostat in hot water to check for proper closing.

INSTALLATION

Use a new gasket (4, Fig. 2) during assembly.

Fill radiator with soft clean water and proper additive.

Group 0419
OIL COOLER

GENERAL INFORMATION

The engine oil cooler is connected directly to the water pump by two external lines.

Coolant is pumped from the water pump through a line connected to the cooler. Heat generated in the engine oil is conducted through the cooler tubes. The coolant then absorbs this heat and is circulated through the radiator for final heat dissipation.

A bypass valve is located in the bottom of the oil cooler. It allows oil flow past the oil cooler if it should become plugged and pressure rises to 12 to 15 psi (0.8 to 1.0 bar) (0.8 to 1.0 kg/cm²).

REMOVAL

CAUTION: Do not drain engine coolant until the coolant temperature is below its boililng point. Then loosen drain cock slowly to relieve any excess pressure.

Drain engine cooling system. Engine cooling system capacity is 8 gal. (30 L) of coolant.

Remove engine oil filter by rotating it counterclockwise (Group 0407).

Disconnect coolant line hoses (5, Fig. 1) at the oil cooler.

Remove oil cooler nipple (6) by unscrewing it.

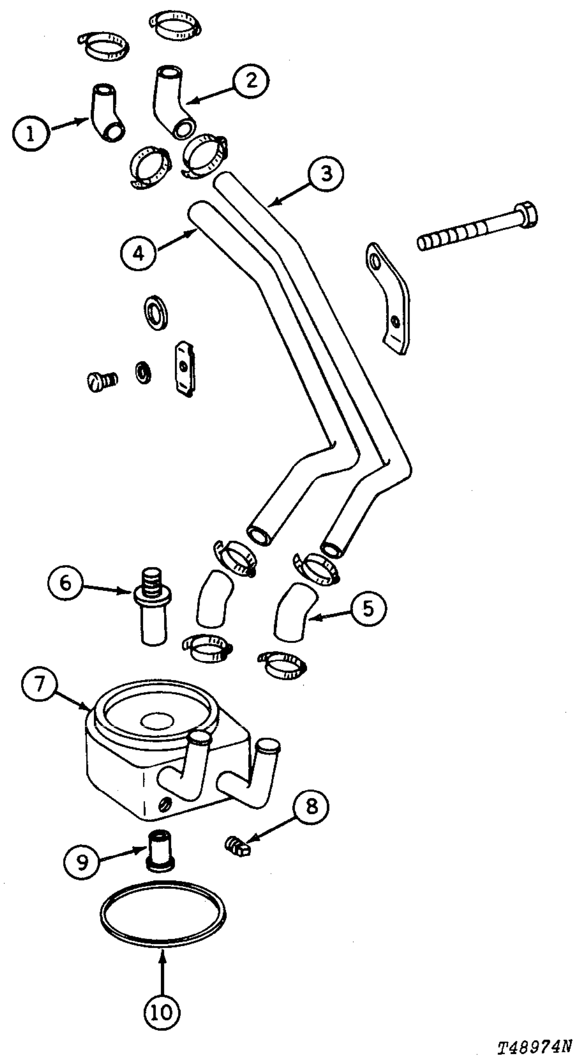
Lift the oil cooler from the cylinder block.

REPAIR

Check water passages for lime deposits.

Inspect internal passages for any evidence of water or oil leakage.

Pressure check the oil cooler by pressurizing the water side to 15 psi (1 bar) (1 kg/cm²). Submerge the cooler in water and check for air bubbles. This test can show a possible cause for engine oil in coolant or coolant in the oil.



1—Hose
2—Hose
3—Lower Tube
4—Upper Tube
5—Hose (2 used)
6—Oil Cooler Nipple
7—Oil Cooler
8—Special Plug
9—Bypass Valve
10—Four-Sided Packing

Fig. 1-Engine Oil Cooler

INSTALLATION

Position four-sided packing (10, Fig. 1) on bottom of oil cooler.

Place oil cooler on cylinder block and install oil cooler nipple (6). Tighten oil cooler nipple with 20 to 25 lb-ft (27 to 34 Nm) (2.8 to 3.5 kg/m) torque.

Connect coolant hoses to oil cooler.

Install new oil filter (Group 0407).

Fill cooling system with proper coolant to proper level.

Group 0420
FUEL FILTER

GENERAL INFORMATION

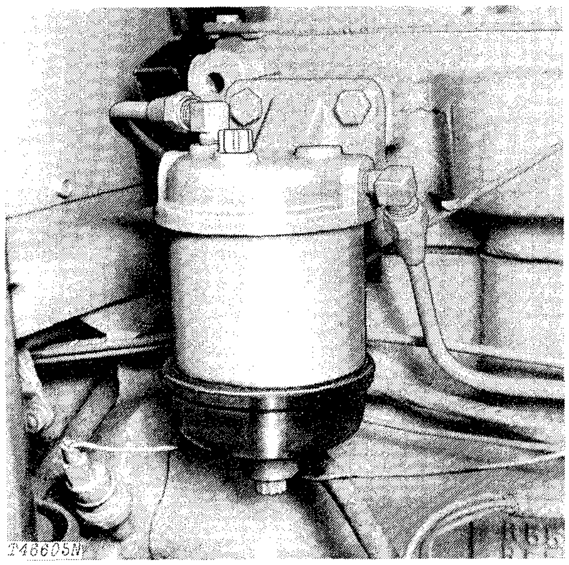
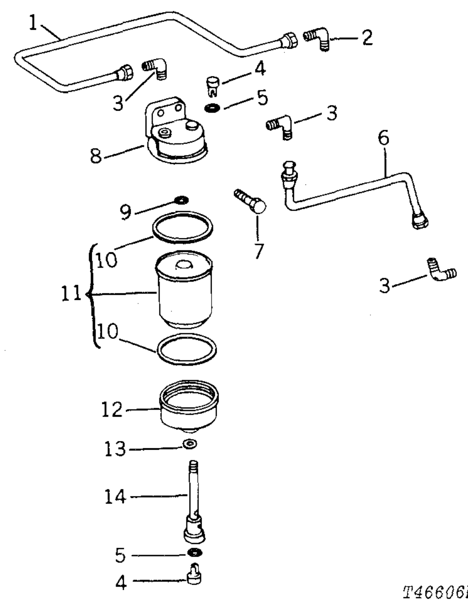


Fig. 1-Fuel Filter (-382507)

The backhoe loader has a single stage fuel filter with sediment bowl. The filter is located on the right side of the engine.

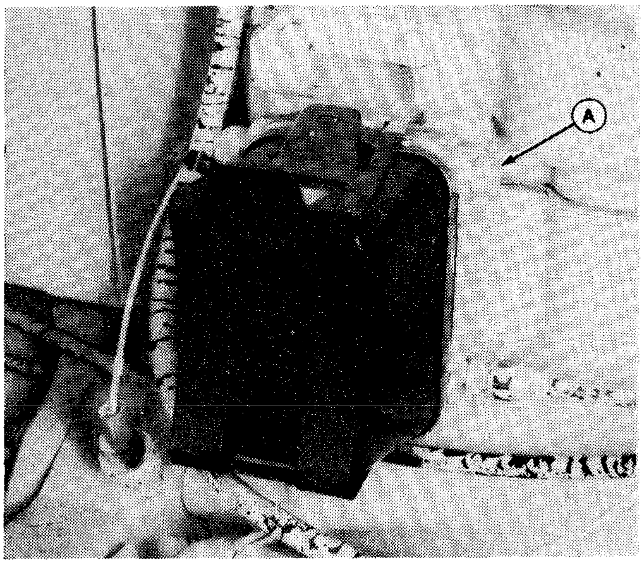
REPAIR



1—Line
2—Special Elbow
3—Special Elbow (3 used)
4—Plug (2 used)
5—O-Ring (2 used)
6—Line
7—Cap Screw
8—Filter Head
9—O-Ring
10—Gasket (2 used)
11—Element
12—Sediment Bowl
13—Gasket
14—Special Screw

Fig. 2-Fuel Filter and Lines (-382507)

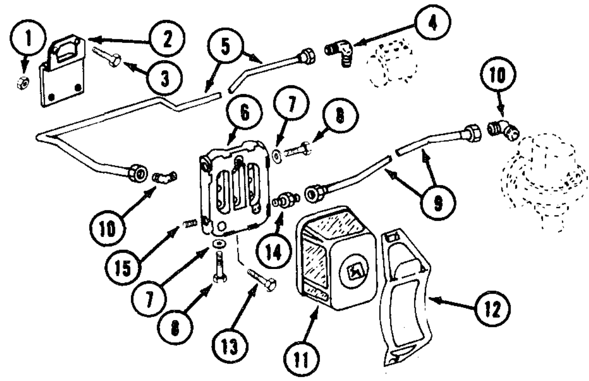
Refer to (Fig. 2) during disassembly and assembly of the fuel filter.



T86499

A—Bleed Plug

Fig. 3-Fuel Filter
(382508-   )



T87672

1—14H812, Nut (2 used)
2—R53214, Bracket
3—19H1134, Cap Screw (2 used)
4—R48008, Elbow
5—AR63646, Fuel Line
6—AR50040, Housing
7—R34447, Washer (2 used)
8—R48071, Drain Plug (2 used)
9—R48071, Fuel Line
10—T30738, Elbow (2 used)
11—AR50041, Filter Element
12—R66821, Clamp
13—19H2284, Cap Screw (2 used)
14—R27346, Fitting
15—15H558, Pipe Plug

Fig. 4-Fuel Filter and Lines
(382508-   )

Refer to (Fig. 4) during disassembly and assembly of the fuel filter.

Group 0421
FUEL TRANSFER PUMP

GENERAL INFORMATION

The fuel transfer pump is of the diaphragm type actuated by an eccentric lobe on the engine camshaft.

A hand primer lever is used as an aid in bleeding the fuel system.

REMOVAL

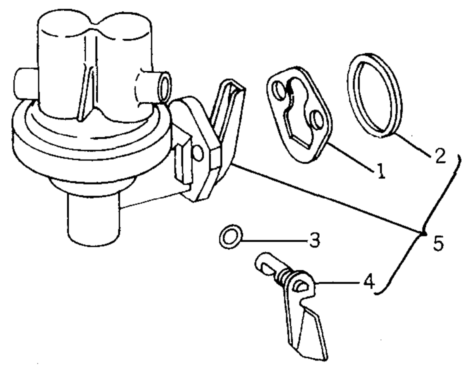
Remove and plug fuel lines from the transfer pump and remove the pump from the engine.

REPAIR

Refer to Fig. 1 when disassembling and assembling the fuel pump.

To remove or install primer lever, compress rocker arm lever.

Further breakdown of the pump is not possible. If a diagnosis of the system indicates a faulty transfer pump, a new pump (5, Fig. 1) must be installed.



T23206N

1—Gasket
2—Packing
3—O-Ring
4—Primer Lever
5—Fuel Pump

Fig. 1-Fuel Pump

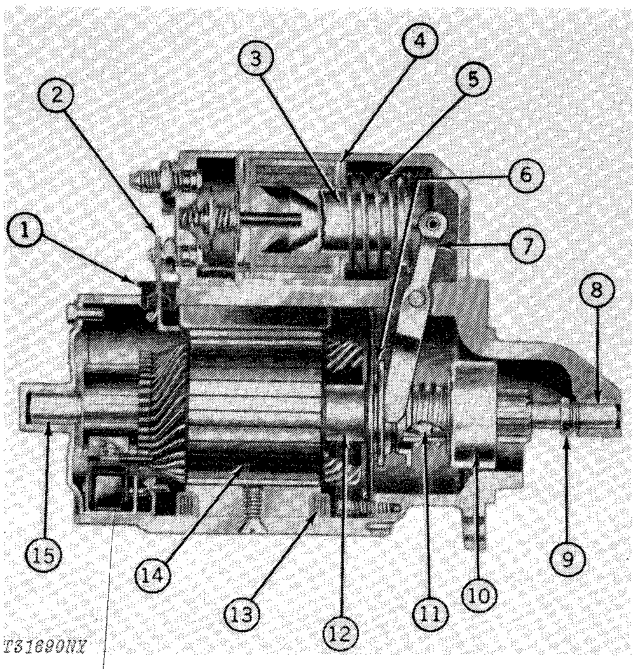
INSTALLATION

Install the fuel transfer pump on the engine and connect fuel lines.

Group 0422
STARTING MOTOR AND FASTENINGS

STARTING MOTOR

GENERAL INFORMATION



1—Grommet
2—Field Connectors
3—Plunger
4—Solenoid
5—Return Spring
6—Brake Washer
7—Shift Lever
8—Bushing
9—Pinion Stop
10—Overrunning Clutch
11—Spiral Splines
12—Center Bearing
13—Field Coil
14—Armature
15—Bushing

Fig. 1-Sectional View of Starting Motor

The starting motor consists of a drive housing, overrunning clutch and pinion, shift lever, field frame, solenoid, armature, field coil assembly, brushes and commutator end frame.

The shift lever mechanism and the solenoid plunger are enclosed in the drive housing to protect them from exposure to dirt, icing conditions and splash.

Armature

The armature is supported on three bushings in the drive housing, center bearing and commutator end frame. The armature assembly consists of a stack of iron lamination located over a steel shaft, a commutator assembly and the armature windings. The windings are heavy copper ribbon that are assembled into slots in the iron laminations. The winding ends are soldered or welded to the commutator bars which are electrically insulated from each other and from the iron shaft.

Field Windings

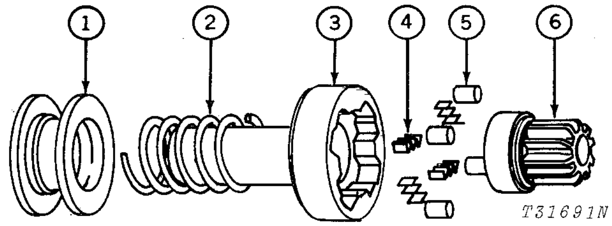
The frame and field assembly consists of field windings assembled over iron pole pieces which are attached to the inside of a heavy iron frame. The iron frame and pole shoes not only provide a place onto which the field coils can be assembled, but also provide a low reluctance, or low resistance path for the magnetic flux produced by the field coil windings.

Solenoid Switch

The solenoid switch consists basically of two windings mounted around a hollow cylinder containing a movable core or plunger. A shift lever is connected to the plunger, and a push rod and contact disk are assembled in line with the plunger.

The two windings in the solenoid are called the hold-in winding and the pull-in winding. The hold-in winding contains many turns of fine wire, and the pull-in winding the same number of turns of larger wire.

Overrunning Clutch Drive



1—Collar
2—Spring
3—Shell
4—Spring
5—Roll
6—Pinion

Fig. 2-Overrunning Clutch

The overrunning clutch drive has a shell and sleeve assembly which is splined internally to match splines on the armature shaft. The pinion is located inside the shell along with the spring-loaded rollers that are wedged against the pinion and taper cut inside the shell. The springs may be either the helical or accordian type, and four rolls are used. A collar and spring located over the sleeve are the other major components.

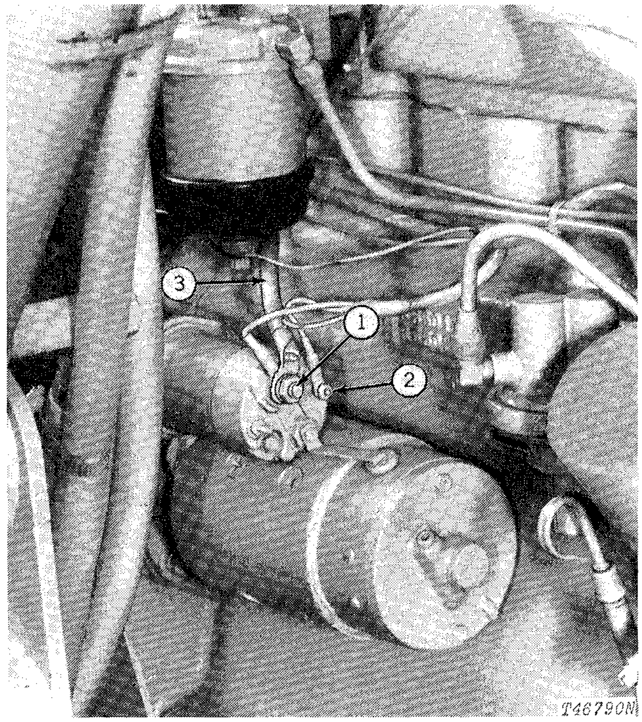
The overrunning clutch drive is designed to be serviced as a complete unit, therefore, do not disassemble. Replace if necessary.

An important service check on roll clutches involves the clearance in the crank position between the pinion and pinion stop with the pinion pushed back toward the shift lever. Proper clearance is needed to prevent rubbing of the collar against the shift lever during motor operation and to insure proper engagement before cranking begins.

Never run the starting motor more than twenty seconds at a time or overheating will result. Allow motor to cool at least two minutes before running it again.

FOS For additional information on starting motors, refer to "Starting Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

REMOVAL



1—"BAT" Terminal
2—"S" Terminal
3—Battery Positive Cable

Fig. 3-Starting Motor Wiring

Disconnect battery ground strap.

Disconnect battery positive cable (3, Fig. 3) and wires from solenoid.

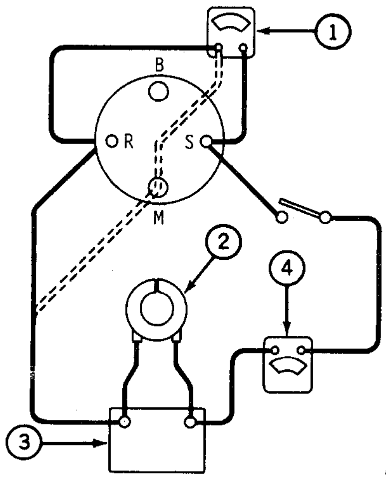
Remove the mounting cap screw and stud nut. Remove starting motor from engine.

TESTING AND DIAGNOSIS

Solenoid Tests (Starting Motor Removed)

Testing Pull-In Windings

Disconnect field connector from solenoid motor terminal. Connect ammeter in series with a carbon pile resistor to terminal "S" and to battery. Connect voltmeter to terminal "S" and to solenoid motor terminal (Fig. 4). With carbon pile in the off position, connect other battery post to solenoid motor terminal. Quickly adjust the carbon pile to obtain 5 volts. The ammeter reading should be 13 to 15.5 amps.



1—Voltmeter
2—Carbon Pile
3—Battery
4—Ammeter

Fig. 4-Solenoid Test Points

Testing Hold-In Windings

Disconnect solenoid. Connect ammeter in series with a switch to terminal "S" and to battery. Connect voltmeter to terminal "S" and to solenoid ground. Connect carbon pile resistor across the battery. Connect other battery post to solenoid ground. Close the switch and adjust carbon pile to obtain 10 volts. The ammeter reading should be 14.5 to 16.5 amps.

High Ammeter Reading

Windings are grounded or short circuited

Low Ammeter Reading

Excessive resistance is present (usually in a connection)

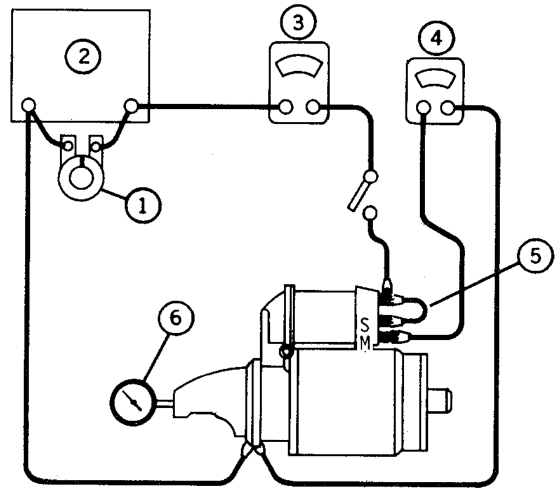
No Ammeter Reading

Windings are open circuited

To prevent overheating, do not energize the pull-in winding longer than 15 seconds. Current draw will decrease as the winding temperature increases.

If the fault cannot be repaired and the solenoid performance is questionable, replace the windings.

Starter No-Load Test



T21259N

1—Carbon Pile
2—Battery
3—Ammeter
4—Voltmeter
5—Jumper Lead
6—Tachometer

Fig. 5-No-Load Test Hook-Up

Make connections shown in Fig. 5. Close switch to operate starting motor and adjust carbon pile to obtain specified voltage. Current draw and rpm should be as follows:

Motor No.	Test Volts	Min. Amps	Max. Amps	Min. RPM	Max. RPM
1107871	9.0	40*	140*	8000	13000

**Includes solenoid.*

Interpret the test results as follows:

1. Rated current draw and no load speed indicates normal condition of the starting motor.

2. Low free speed and high current draw indicates:

   a. Too much friction - tight, dirty, or worn bearings, bent armature shaft or loose pole shoes allowing armature to drag.

b. Shorted armature. This can be further checked on a growler after disassembly.

c. Grounded armature or fields. Check further after disassembly.

3. Failure to operate with high current draw indicates:

a. A direct ground in the terminal or fields.

b. Frozen bearings (this should have been determined by turning the armature by hand).

4. Failure to operate with no current draw indicates:

a. Open field circuit. This can be checked after disassembly, by inspecting internal conditions and tracing circuit with a test lamp.

b. Open armature coils. Inspect the commutator for badly burned bars after disassembly.

c. Broken brush springs, worn brushes, high insulation between the commutator bars or other causes which would prevent good contact between the brushes and commutator.

5. Low no-load speed and low current draw indicates:

a. High internal resistance due to poor connections, defective leads, dirty commutator and causes listed under no. 4.

6. High free speed and high current draw indicates shorted fields. If shorted fields are suspected, replace the field coil assembly and check for improved performance.

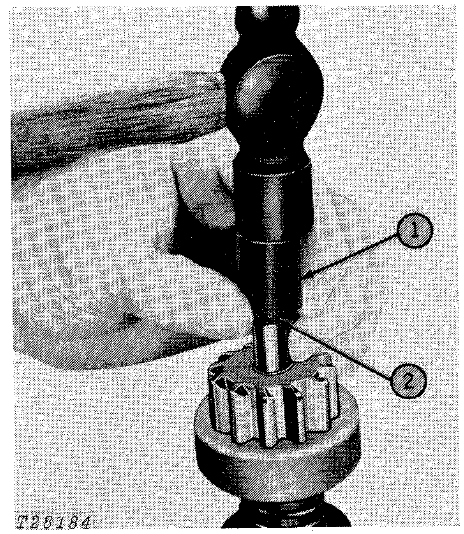
REPAIR

Disassemble motor only as far as necessary to make repairs (Fig. 7).

Mark position of commutator end frame with regard to main frame to aid in alignment during reassembly.

Disconnect field coil connector from solenoid motc terminal and remove solenoid mounting screws.

Remove commutator end frame. Remove field frame and solenoid from drive housing. Separate armature and clutch assembly from drive housing.



1—Pipe Coupling **2—Pinion Stop**

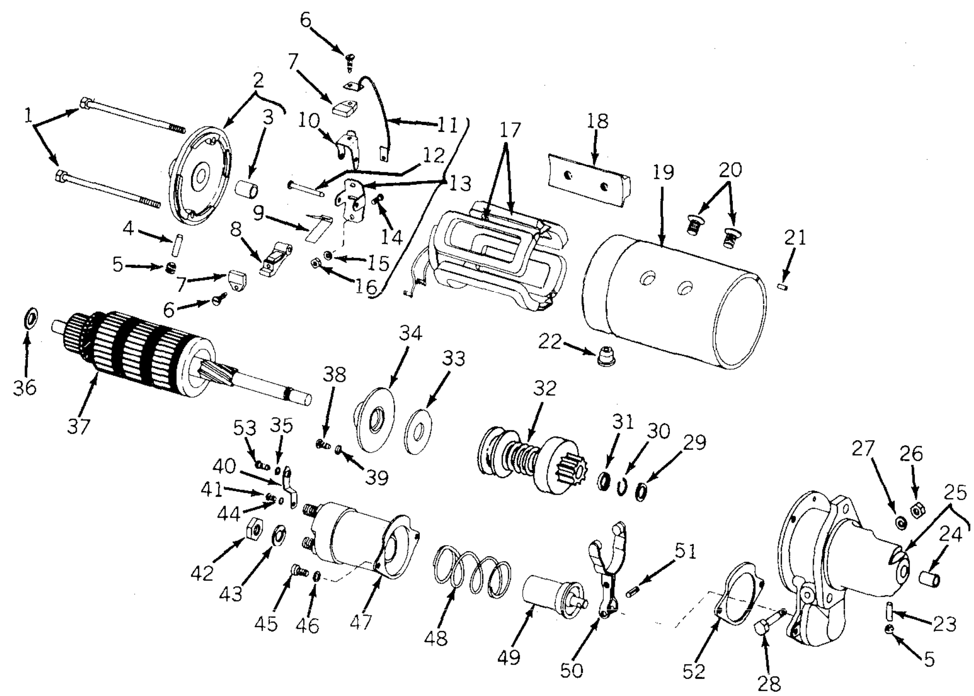
Fig. 6-Removing Retainer

Slide a standard half-inch pipe coupling onto the shaft so it butts against the pinion stop. Tap coupling, driving stop toward the armature end, off the retaining ring (Fig. 6).

Remove retaining ring. If it is badly distorted, use a new retaining ring when reassembling the clutch.

Remove armature and clutch from lever housing and separate solenoid from the housing.

Do not clean any parts in grease dissolving solvents. Wipe the drive with a clean cloth.



1—Through Bolt (2 used)
2—Commutator End Frame
3—Commutator Bushing
4—Commutator End Wick
5—Pipe Plug (2 used)
6—Drive Screw (4 used)
7—Brush (4 used)
8—Insulated Brush Holder (2 used)
9—Brush Spring (4 used)
10—Ground Brush Holder (2 used)
11—Lead Assembly (2 used)
12—Brush Pin (2 used)
13—Brush Support Package
14—Machine Screw (4 used)
15—Lock Washer (4 used)
16—Nut (4 used)
17—Field Coil Assembly
18—Pole Shoe (4 used)
19—Frame
20—Pole Shoe Screw (8 used)
21—Dowel Pin
22—Grommet
23—Drive End Wick
24—Drive End Bushing
25—Drive Housing
26—Jam Nut
27—Lock Washer
28—Shift Lever Screw
29—Drive End Thrust Collar
30—Retaining Ring
31—Piston Stop
32—Motor Drive
33—Brake Washer
34—Center Bearing Plate
35—Lock Washer
36—Commutator End Spacer Washer
37—Armature
38—Center Bearing Screw
39—Lock Washer
40—Connector
41—Machine Screw
42—Nut
43—Lock Washer
44—Internal Tooth Lock Washer
45—Machine Screw (2 used)
46—Lock Washer (2 used)
47—Solenoid Switch Assembly
48—Plunger Return Spring
49—Solenoid Switch Plunger
50—Shift Lever
51—Spring Pin
52—Solenoid Gasket
53—Machine Screw

Fig. 7-Starting Motor

Checking Brushes

Inspect brushes. If they are oil soaked or are worn to approximately 0.3125 inch (7.94 mm), replace them.

Make sure the brush holders are clean and the brushes are not binding in the holders. The full brush surface should ride on the commutator to give proper performance. Check by hand to insure that the brush springs are giving firm contact between the brushes and commutator. If the springs are distorted or discolored, they should be replaced.

To remove brush holders, slide pivot pins out.

Tighten brushes after assembling starting motor.

Armature

If the commutator is excessively worn, dirty, out of round, or if it has high insulation, it should be turned down on a lathe and the insulation undercut 1/32 inch (0.794 mm) and 1/32 inch (0.794 mm) deep.

The commutator may be cleaned with No. 00 sand paper. Do not use emery cloth.

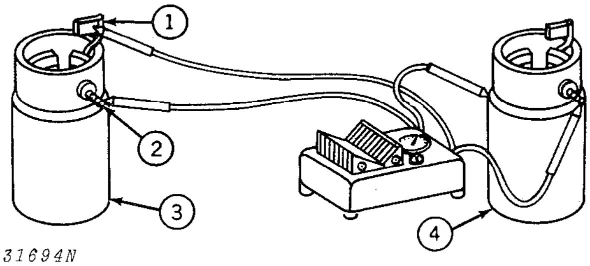
The armature should be checked for short circuits, opens and grounds.

1. Short circuits are located by rotating the armature in a growler with a steel strip such as a hacksaw blade held on the armature. The steel strip will vibrate on the area of the short circuit. Shorts between bars are sometimes produced by brush dust or copper between bars. Undercutting the insulation will eliminate these shorts.

2. Opens may be located by inspecting the points where the conductors are joined to the commutator for loose connections. Poor connections cause arcing and burning of the commutator. If the bars are not badly burned, leads originally soldered to the riser bars can be resoldered.

3. Grounds in the armature can be detected by thr use of a test lamp. If the lamp lights when onι test prod is placed on the commutator and the other test prod on the armature core or shaft, the armature is grounded. If the commutator is worn, dirty, out of round, or has high insulation, the commutator should be turned down.

Field Coils



T31694N

1—Brush
2—Field Connector Terminal
3—Open Circuit Test
4—Grounded Winding Test

Fig. 8-Field Winding Test

The field coils should be checked for grounds and opens using a test lamp.

1. Grounds - Disconnect field coil ground connections. Connect one test prod to the field frame and the other to the field connector. If the lamp lights, the field coils are grounded and must be repaired or replaced.

2. Opens - Connect test lamp prods to ends of field coils. If lamp does not light field coils are open.

If the field coils need to be removed for repair or replacement, a pole shoe spreader and pole shoe screwdriver should be used. Care should be taken in replacing the field coils to prevent grounding or shorting them as they are tightened into place. Where the pole shoe has a long lip on the side, it should be assembled in the direction of armature rotation.

Overrunning Clutch Assembly

The pinion should turn smoothly with a slight drag in the overrunning direction and lock up in the opposite direction. If not, the entire clutch and pinion assembly must be replaced as the assembly cannot be repaired.

Bushings

Pre-Lubricated Bushings

When installing pre-lubricated bushings, use an arbor to prevent bearing collapse. After installation, check bushing size. Burnish bushing to size if necessary.

Wick-Lubricated Bushings

Remove pipe plugs, expansion plugs and oil wicks from housings. Press out old bushing. Press new bushing in to same depth as old bushing. Carefully drill bushing through oil wick hole using same size drill as oil wick hole.

After drilling, ream bushing to maintain proper oil clearance between shaft and bushing.

Soak new wicks in SAE 10 engine oil. Install wicks, expansion plugs and pipe plugs.

Bushing, Overrunning Clutch

I.D. .... 0.5620 - 0.5630 in. (14.275 - 14.300 mm)
Wear tolerance .... 0.5740 in. (14.580 mm)

Bushing, Drive Housing

I.D. .... 0.4490 - 0.5010 in. (11.405 - 12.725 mm)
Wear tolerance .... 0.5110 in. (12.979 mm)
Oil clearance .... 0.0020 - 0.0050 in. (0.051 - 0.127 mm)
Wear tolerance .... 0.0170 in. (0.432 mm)

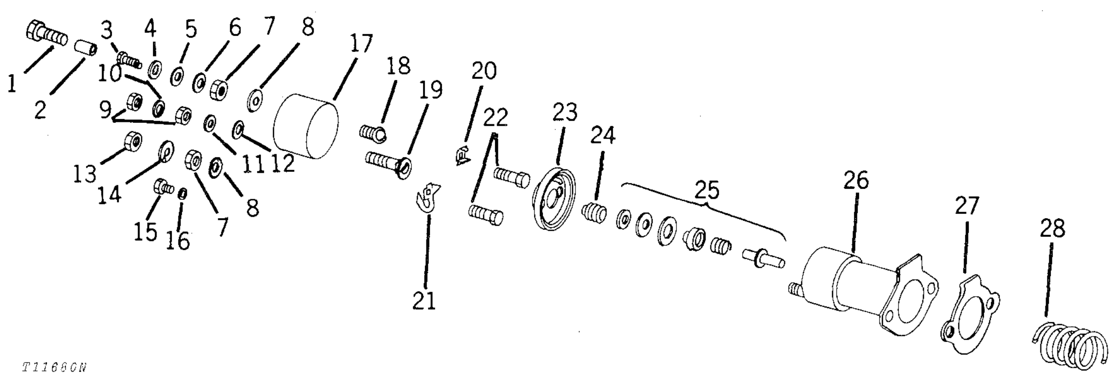
Bushing, Commutator End Frame

I.D. .... 0.5625 - 0.5635 in. (14.288 - 14.313 mm)
Wear tolerance .... 0.5730 in. (14.554 mm)
Oil clearance .... 0.0020 - 0.0050 in. (0.051 - 0.127 mm)
Wear tolerance .... 0.0160 in. (0.406 mm)

Bushing, Center Bearing

I.D. .... 0.7600 - 0.7620 in. (19.304 - 19.355 mm)
Wear tolerance .... 0.7720 in. (19.609 mm)
Oil clearance .... 0.0100 - 0.0150 in. (0.254 - 0.381 mm)
Wear tolerance .... 0.0250 in. (0.635 mm)

Solenoid Switch



T11660N

1—Terminal Screw
2—Connector
3—Machine Screw
4—Lock Washer
5—Washer
6—Washer
7—Jam Nut (2 used)
8—Sealing Washer (2 used)
9—Nut (4 used)
10—Lock Washer (2 used)
11—Washer
12—Washer
13—Jam Nut
14—Lock Washer
15—Machine Screw (2 used)
16—Washer
17—Cover
18—Motor Terminal Stud
19—Battery Terminal Stud
20—Switch Terminal Clip
21—Contact
22—Switch and Resistor Terminal Stud (2 used)
23—Gasket
24—Return Spring
25—Contact Assembly
26—Case and Coil
27—Gasket
28—Return Spring

Fig. 9-Solenoid Switch

Remove nuts and sealing washers from solenoid motor and "S" terminals when removing switch cover.

Replacement "S" terminal clips and motor terminal studs are soldered to winding leads. Use new sealing washers when assembling the solenoid.

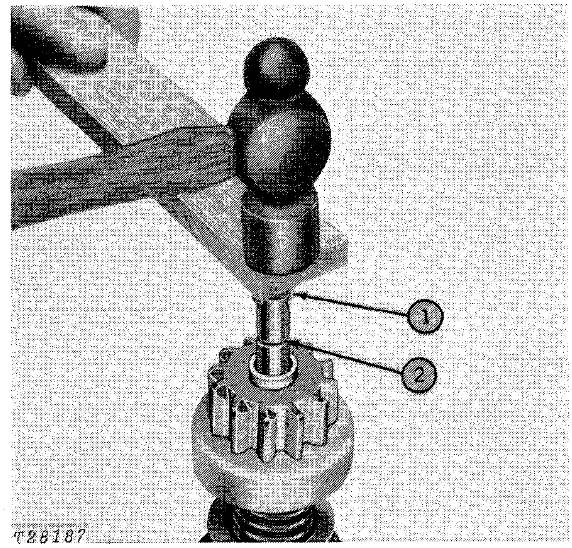
ASSEMBLY

To assemble starting motor, reverse the disassembly procedures.

Lubricate splines and drive end of armature shaft with SAE 10 engine oil. Heavier oil may cause failure to mesh at low temperature. Lubricate the bearing surfaces of the center bearing, drive end frame, and commutator end frame with Delco-Remy lubricant No. 1960954.

With overrunning clutch in place, install pinion stop with cupped side out and retaining ring.

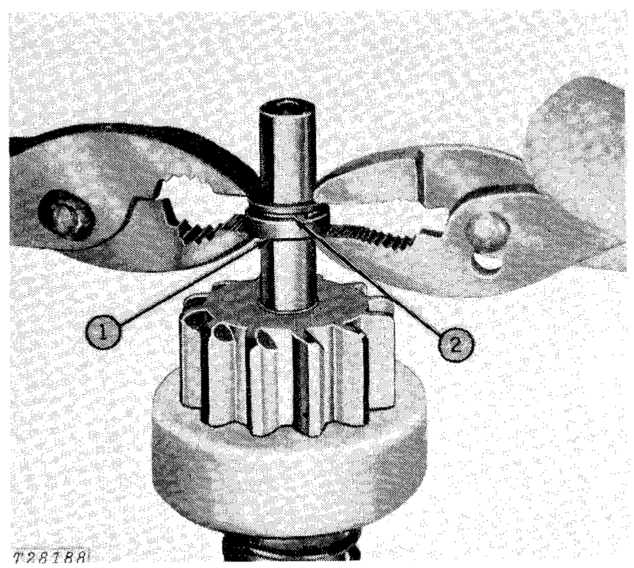
Proceed as follows when assembling retaining ring and pinion stop on shaft.



1—Retaining Ring **2—Groove**

Fig. 10-Forcing Retaining Ring Over Shaft

1. With the pinion stop placed over the shaft (cupped surface facing the end of the shaft), force the retaining ring over the shaft with a light hammer blow and slide ring into the groove (Fig. 10).



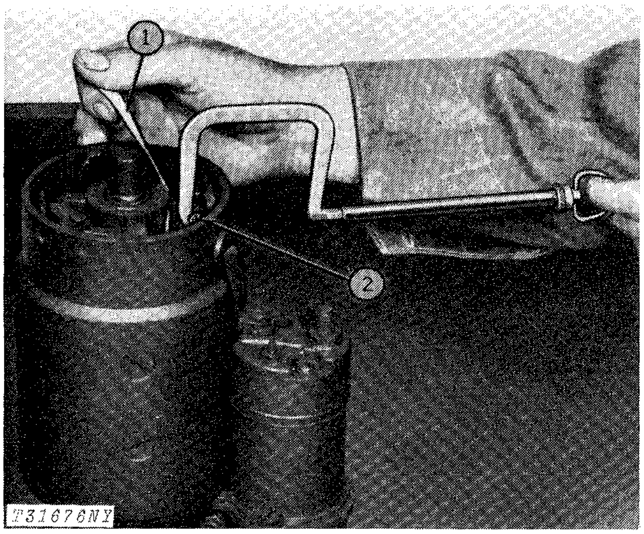
1—Pinion Stop **2—Retaining Ring**

Fig. 11-Forcing Pinion Stop Over Retaining Ring

2. To force the pinion stop over the ring, place a uitable washer over the shaft and squeeze with pliers (Fig. 11). Remove the washer.

Carefully install field frame so that brush holders are not broken. Align brushes with commutator and tighten brushes.

If it is necessary to seat brushes, use No. 00 sandpaper. Clean all dust from starting motor.



1—Piece of Paper **2—Brush Attaching Screw**

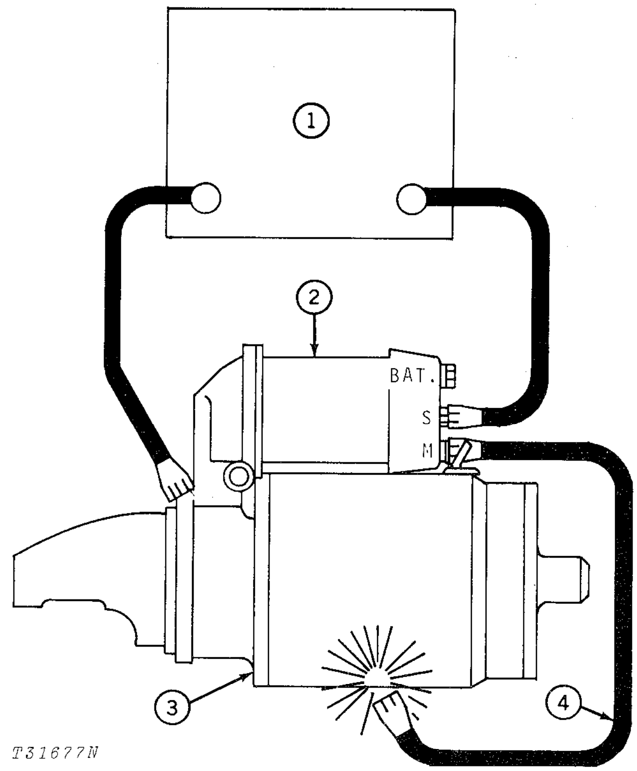
Fig. 12-Testing Brush Spring Tension

Place a piece of paper under the brush (Fig. 12). Hook a spring tension scale on the head of the brush attaching screw. Pull the scale on a line parallel to the brush and note the reading when the paper is released. Minimum brush spring tension is 35 ounces (10 N) (1.0 kg). Bend springs, if it is necessary, to adjust the tension.

Pinion Clearance

The pinion clearance cannot be adjusted but should be checked after reassembly of the starting motor to insure proper clearance. Improper clearance is an indication of worn parts.

To check pinion clearance use the following steps:



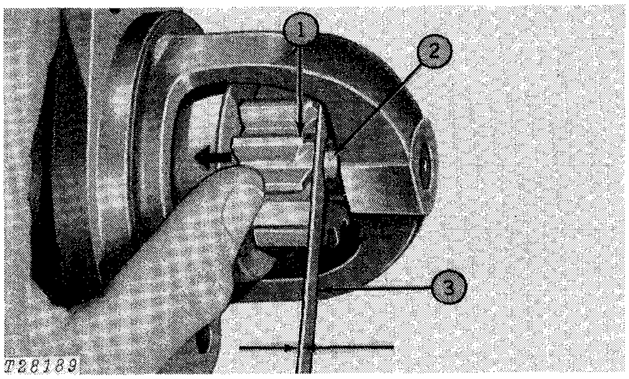
1—Battery
2—Solenoid
3—Starting Motor
4—Jumper Wire

Fig. 13-Circuit for Checking Pinion Clearance

1. Disconnect the motor field coil connector from the solenoid motor terminal and insulate it carefully.

2. Connect a battery, of the same voltage as the solenoid (12 volt), from the solenoid switch terminal to the solenoid frame (Fig. 13).

3. Momentarily flash a jumper lead from the solenoid motor terminal to solenoid frame. This will shift the pinion into cranking position and it will remain so until the battery is disconnected.



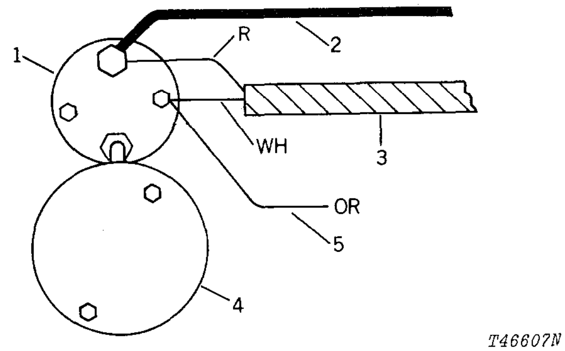
1—Pinion
2—Pinion Stop
3—Feeler Gauge

Fig. 14-Checking Pinion Clearance

4. Push the pinion back toward the commutator end as indicated by the arrow in Fig. 14 to eliminate slack movement.

5. Measure the distance between pinion and pinion stop. The clearance should be between 0.010 to 0.140 inch (0.25 to 3.56 mm).

INSTALLATION



1—Solenoid
2—Positive Battery Cable
3—Wiring Harness
4—Starting Motor
5—To Hydraulic Pump Destroke Solenoid

R—Red
OR—Orange
WH—White

Fig. 15-Solenoid Connections

Install starting motor. Connect wiring harness (3, Fig. 15) and positive battery cable (2).

Connect battery ground cable.

Group 0433
FLYWHEEL, HOUSING AND FASTENERS

GENERAL INFORMATION

The ring gear for the starting motor is shrunk in place on the front outer rim of the flywheel. On the front outer rim of the flywheel is a "TDC" (top dead center) bore that is used when timing injection pump and adjusting valve tappets.

REMOVAL

To service the flywheel and flywheel housing, it is necessary to remove the engine (Group 0400).

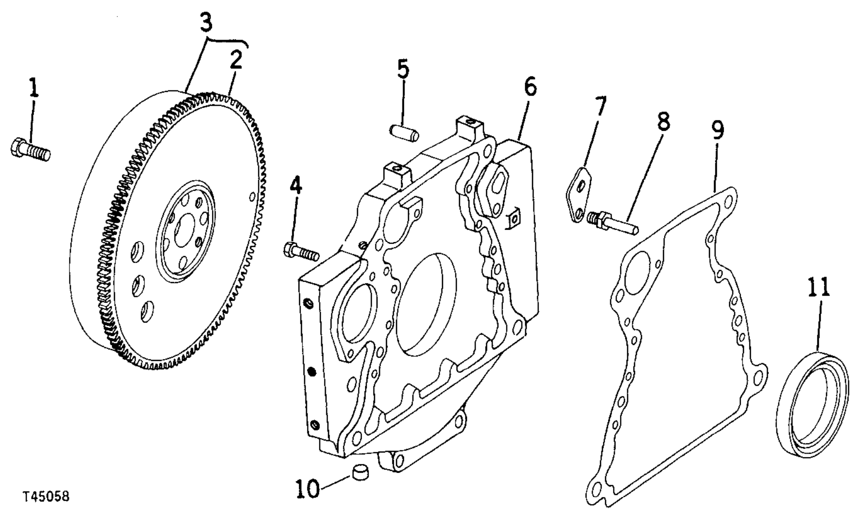
REPAIR

Flywheel

Examine flywheel ring gear for wear or damage. If new gear is needed, heat gear evenly to approximately 360°F (182°C). (Do not overheat.) Install hot with chamfered edge of teeth toward front of flywheel.

CAUTION: Oil fumes or oil can ignite above 380°F (193°C). Use a thermometer and do not exceed 360°F (182°C). Do not allow a flame or heating element to be in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

To install new pilot bearing, pack with AT30408 John Deere High-Temperature Grease (or equivalent) and drive in (shielded side out) to bottom of bore.

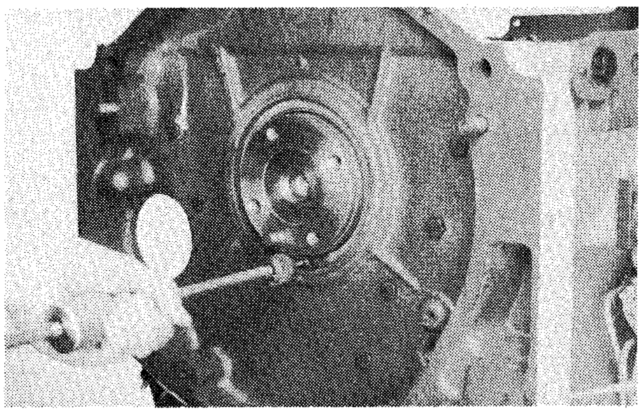


1—Special Cap Screw (4 used)
2—Ring Gear
3—Flywheel
4—Cap Screw (8 used)
5—Dowel Pin (2 used)
6—Flywheel Housing
7—Timing Hole Cover
8—Special Screw
9—Gasket
10—Cork
11—Rear Oil Seal

Fig. 1-Engine Flywheel and Housing

Crankshaft Rear Oil Seal

Remove seal with JDG-22 Seal Remover (Fig. 2).

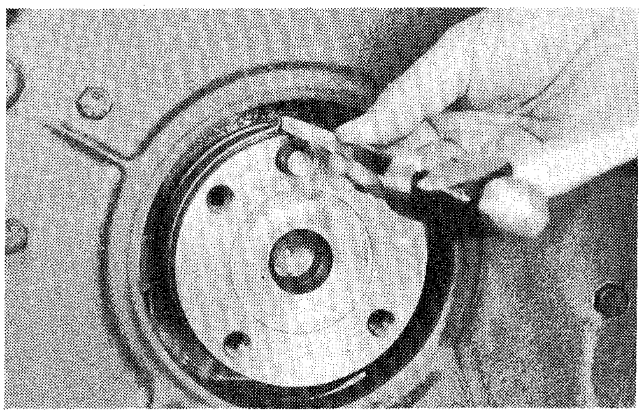


T81200

Fig. 2-Seal Removal

IMPORTANT: DO NOT scratch crankshaft surface.

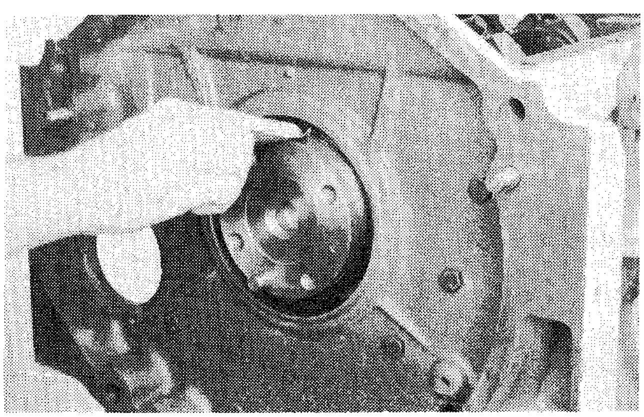
Cut wear ring off crankshaft (Fig. 3).



T81201

Fig. 3-Wear Ring Removal

Look for nicks or burrs on wear ring surface. If there is a nick or burr, use FINE emery cloth to remove it (Fig. 4).



T81202

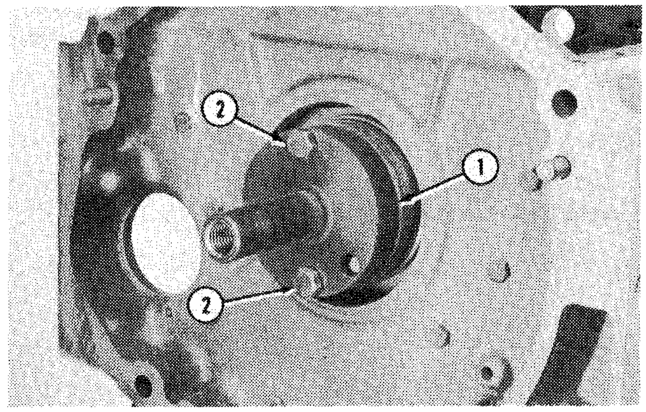
Fig. 4-Clean Wear Ring Surface

LOCTITE is a trademark of the Loctite Crop.

Attach JDE-140-1 Guide Plate (1, Fig. 5) with cap screw (2).

IMPORTANT: Use only enough sealant to fill nicked or scratched area.

Put a very thin flim of T43513 John Deere LOCTITE® Thread Lock and Sealer (high strength), PT502 John Deere Gasket Maker or an equivalent sealant on the wear ring surface of the crankshaft.



T81203

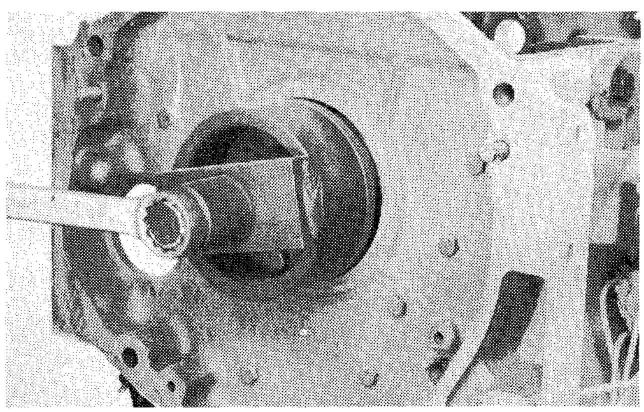
Fig. 5-Install JDE-140-1 Guide Plate

Install seal and wer ring on guide plate with open side of seal toward engine.

Check to be sure chamfer on wear ring inside diameter and open side of the seal are toward the same side.

Attach JDE-140-2 Driver and 12189 Thrust Washer to the guide palte with 10497 cap screw. Tighten the cap screw until driver stops moving (Fig. 6).

Remove the cap screw, thrust washer, driver, two cap screws and the guide plate.



T81205

Fig. 6-Install Seal

INSTALLATION

Install flywheel housing and tighten cap screws to 35 lb-ft (47 N·m) (5 kg-m).

IMPORTANT: Install new flywheel cap screws.

Install flywheel and tighten cap screw to 120 lb-ft (163 N·m) (17 kg-m).

Group 0499
SPECIFICATIONS AND SPECIAL TOOLS

ENGINE BREAK-IN

SPECIFICATIONS AND TORQUE VALUES

NOTE: Whenever possible, use a dynamometer to provide a more accurate break-in, assuring proper initial seating of new piston rings.

Time	Load*	Engine Speed	Remarks
5 Minutes	No Load	800 rpm (Slow Idle)	Check oil
5 Minutes	No Load	1500 to 2000 rpm (1/2 Throttle)	pressure,
5 Minutes	1/4 Load	1900 to 2200 rpm	coolant
10 Minutes	1/2 Load	(3/4 Throttle)	temperature,
10 Minutes	1/2 to 3/4 Load		and leakage.
10 Minutes**	3/4 to Full Load		
100 Hours+	All Loads		Field Only

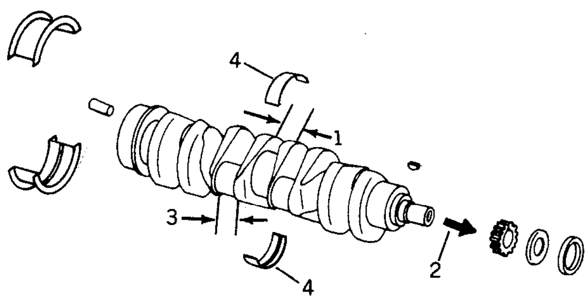
**Loads can be simulated in the field by controlled machine operation.*

***After this run, loosen cylinder head bolts 45 degrees; then retighten bolts one at a time, in sequence (Group 0409), with 95 lb-ft (129 N·m) (13 kg-m) torque. Loosen rocker arm support cap screws; then retighten with 35 lb-ft (47 N·m) (5 kg-m) torque. Check and reset valve clearance. Loosen intake and exhaust manifold cap screws and nuts; then retighten to 35 lb-ft (47 N·m) (5 kg-m).*

+After break-in, drain crankcase oil, and remove filter. Install new filter and fill crankcase with oil of proper viscosity and service classification.

CRANKSHAFT AND MAIN BEARINGS

SPECIFICATIONS AND TORQUE VALUES



T46610N

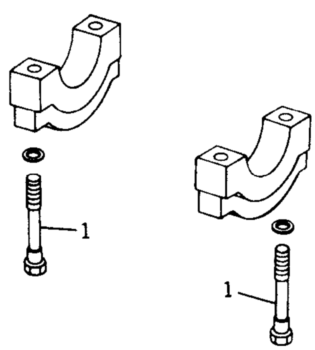
Fig. 1-Crankshaft Assembly

1 - O.D. main bearing journal . . . 3.123 to 3.124 in. (79.32 to 79.35 mm)
Round within . . . . 0.002 in. (0.05 mm)

2 - Crankshaft end play . . . . . . 0.0020 to 0.0080 in. (0.051 to 0.203 mm)
Maximum end play . . . . 0.150 in. (3.810 mm)

3 - O.D. of connecting rod journal . . . . 2.7480 to 2.7490 in. (69.800 to 69.825 mm)
Round within . . . . 0.002 in. (0.05 mm)

4 - Main bearing I.D. (assembled) . . . . 3.1256 to 3.1276 in. (79.390 to 79.441 mm)
Main bearing to journal clearance . . . . 0.0011 to 0.0041 in. (0.0279 to 0.1041 mm)
Maximum clearance . . . . 0.0060 in. (0.152 mm)
Journal taper per inch (25 mm) of journal length . . . . 0.001 in. (0.02 mm)
Journal out-of-round . . . . 0.002 in. (0.05 mm)
Main bearing undersize inserts available . . . . . 0.002, 0.010, 0.020 and 0.030 in. (0.05, 0.25, 0.51 and 0.76 mm)
Main bearing bore I.D. . . . 3.3250 to 3.3260 in. (84.455 to 84.480 in.)



T46611N.

Fig. 2-Main Bearing Caps

1 - Main bearing caps to block cap screw torque . . . . 85 lb-ft (115 Nm) (12 kg/m)

CRANKSHAFT AND MAIN BEARINGS

SPECIFICATIONS AND TORQUE VALUES—Continued

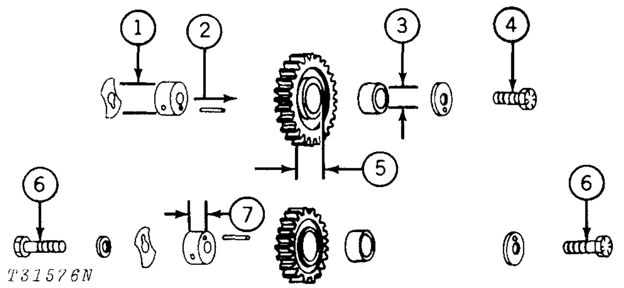


Fig. 3-Upper and Lower Idler Gears

1 - O.D. of idler shaft .... 1.7495 to 1.7505 in. (44.437 to 44.463 mm)
2 - Idler gear end play .... 0.0010 to 0.0070 in. (0.025 to 0.178 mm)
3 - I.D. idler bushing .... 1.7520 to 1.7530 in. (44.501 to 44.526 mm)
Oil clearance between shaft and bushing .... 0.0015 to 0.0035 in. (0.038 to 0.089 mm)
Maximum oil clearance..............0.0060 in. (0.152 mm)
4 - Crankshaft upper idler gear cap screw torque .... 65 lb-ft (88 Nm) (9 kg-m)
5 - Width of idler gears at hub .... 0.8650 to 0.8670 in. (21.971 to 22.022 mm)
6 - Crankshaft lower idler gear cap screw torque .... 95 lb-ft (129 Nm) (13 kg-m)
7 - Width of idler gear shaft .... 0.8680 to 0.8720 in. (22.047 to 22.149 mm)

CAMSHAFT AND VALVE ACTUATING MEANS

SPECIFICATIONS AND TORQUE VALUES

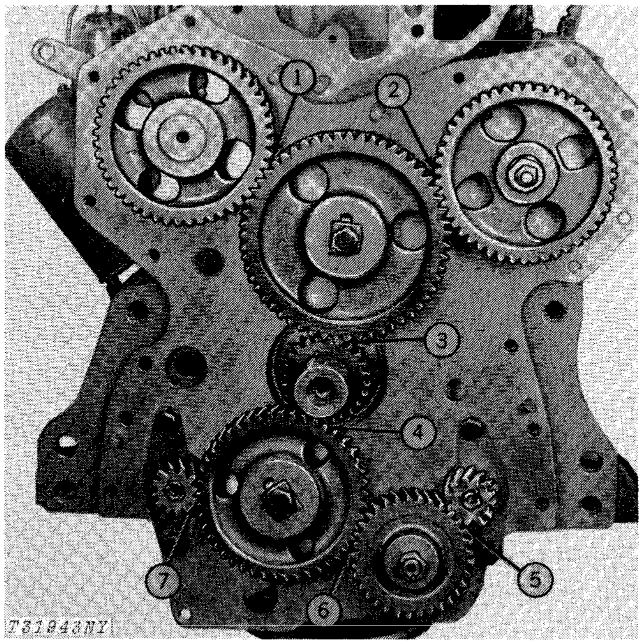


Fig. 4-Gear Train Backlash

1 - Camshaft gear to upper idler .... 0.0028 to 0.0135 in. (0.071 to 0.343 mm)

2 - Injection pump gear to upper idler .... 0.0028 to 0.0135 in. (0.071 to 0.343 mm)

3 - Crankshaft gear to upper idler .... 0.0027 to 0.0116 in. (0.069 to 0.295 mm)

4 - Crankshaft gear to lower idler .... 0.0027 to 0.0137 in. (0.069 to 0.348 mm)

5 - Oil pump gear to left balancer gear .... 0.0020 to 0.0140 in. (0.051 to 0.356 mm)

6 - Oil pump gear to lower idler .... 0.0016 to 0.0147 in. (0.041 to 0.373 mm)

7 - Lower idler to right balancer gear .... 0.0018 to 0.0156 in. (0.046 to 0.396 mm)

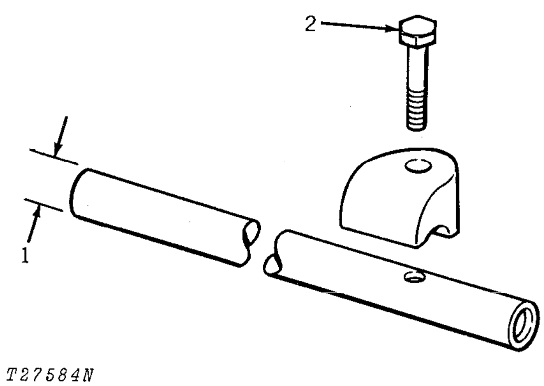


Fig. 5-Rocker Arm Shaft and Clamp

1 - O.D. of rocker arm shaft .... 0.7869 to 0.7879 in. (19.987 to 20.013 mm)
Additional wear tolerance .... 0.0020 in. (0.051 mm)

2 - Rocker arm shaft clamp to head cap screw torque .... 35 lb-ft (47 Nm) (5 kg/m)

CAMSHAFT AND VALVE ACTUATING MEANS

SPECIFICATIONS AND TORQUE VALUES—Continued

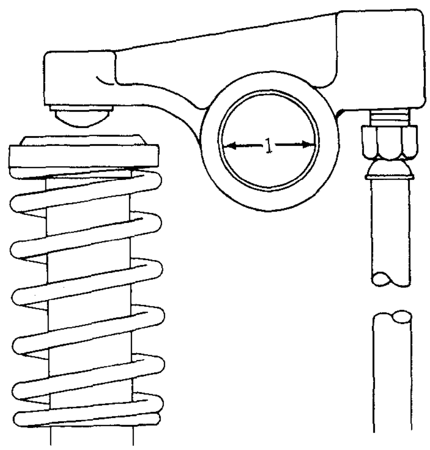


Fig. 6-Rocker Arm

1 - I.D. of rocker arm bore.... 0.7900 to 0.7920 in. (20.066 to 20.117 mm)
Additional wear tolerance............0.0020 in. (0.051 mm)

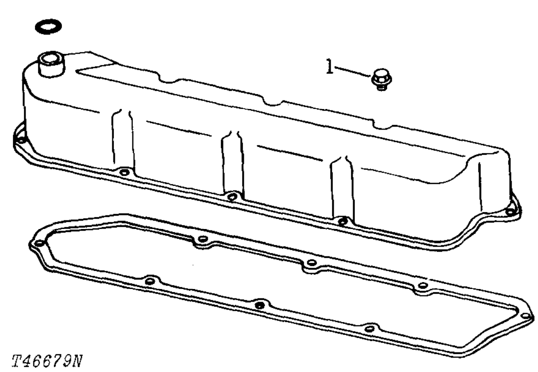
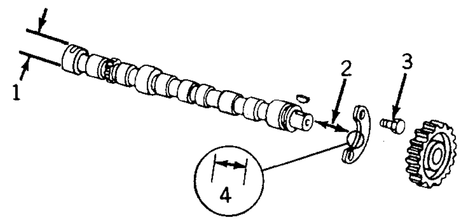


Fig. 7-Rocker Arm Cover

1 - Rocker arm cover cap screw torque
(with cork gasket).................. 25 lb-in (2.6 N·m) (0.3 kg-m)
(with rubber and metal gasket) .... 96 lb-in (10.8 N·m)

CAMSHAFT AND VALVE ACTUATING MEANS

SPECIFICATIONS AND TORQUE VALUES—Continued



T35759N

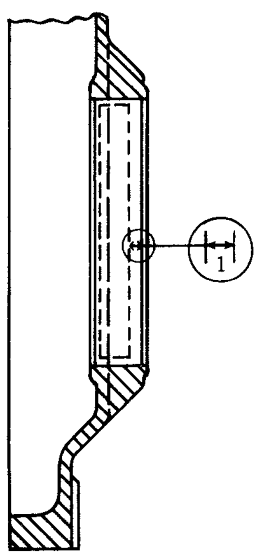
Fig. 8-Camshaft and Gear

1 - O.D. of camshaft journal .. 2.1997 to 2.2007 in. (55.872 to 55.898 mm)
Camshaft journal clearance .... 0.0035 to 0.0055 in. (0.089 to 0.140 mm)
Maximum allowable clearance ....0.0090 in. (0.229 mm)

2 - Camshaft end play .... 0.0025 to 0.0085 in. (0.064 to 0.216 mm)
Maximum end play ....0.0150 in. (0.381 mm)

3 - Camshaft thrust plate to block cap screw torque .... 35 lb-ft (47 Nm) (5 kg/m)

4 - Thrust plate thickness..... 0.1560 to 0.1580 in. (3.962 to 4.013 mm)
Minimum thickness ....0.1510 in. (3.835 mm)



T27591N

Fig. 9-Front Oil Seal Installed in Timing Gear Cover

1 - Distance of front oil seal from front of timing gear cover ....0.33 in. (8.4 mm)

CAMSHAFT AND VALVE ACTUATING MEANS

SPECIFICATIONS AND TORQUE VALUES—Continued

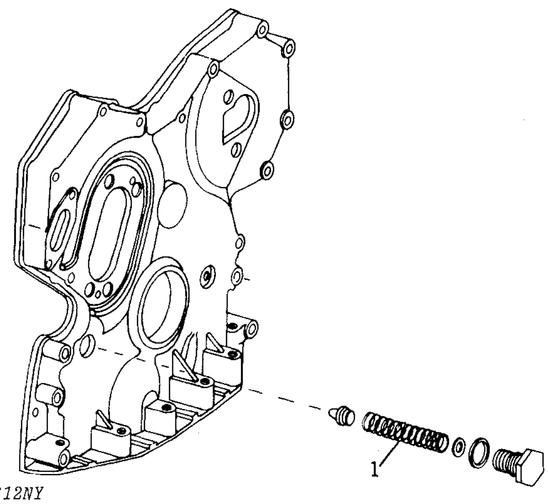


Fig. 10-Oil Pressure Regulating Spring

1 - Oil pressure regulating spring
free length . . . . 4.68 in. (118.9 mm)
Compressed at 13.5 to 16.5 lb. (60 to 73 N) (6 to 7 kg) . . . . 1.68 in. (42.7 mm)

CONNECTING RODS AND PISTONS

SPECIFICATIONS AND TORQUE VALUES

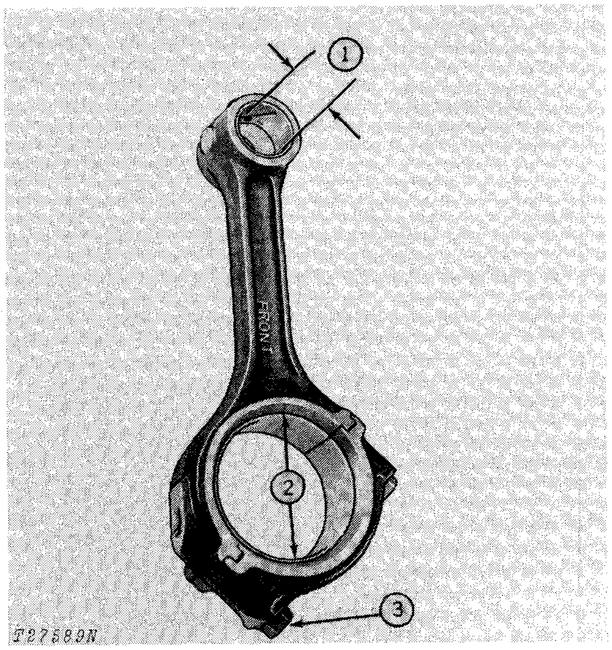


Fig. 11-Connecting Rod

1 - I.D. of piston pin bushing in rod .... 1.3760 to 1.3780 in. (34.950 to 35.001 mm)

Piston pin to connecting rod bushing clearance .... 0.0008 to 0.0022 in. (0.020 to 0.056 mm)

2 - I.D. connecting rod bearing (assembled) .... 2.7502 to 2.7522 in. (69.855 to 69.906 mm)

Connecting rod bearing to journal clearance .... 0.0016 to 0.0046 in. (0.041 to 0.117 mm)

Maximum wear limit .... 0.006 in. (0.15 mm)

Connecting rod undersize bearing inserts available..... 0.002, 0.010, 0.020 and 0.030 in. (0.05, 0.25, 0.51 and 0.76 mm)

3 - Connecting rod cap to rod cap screw torque (dip cap screws in oil) .... 52 lb-ft (71 N·m) (7 kg/m)

O.D. of piston pin .... 1.3750 ± 0.0002 in. (34.925 ± 0.005 mm)

CYLINDER BLOCK

SPECIFICATIONS AND TORQUE VALUES

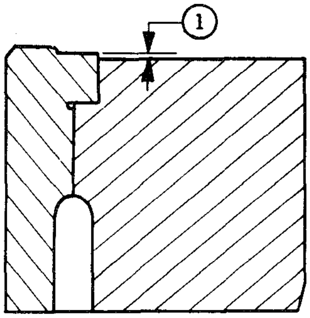


Fig. 12-Liner and Block

1 - Liner height above block .... 0.001 to 0.004 in. (0.03 to 0.10 mm)

Piston to cylinder liner clearance at bottom of skirt (max.) .... 0.008 in. (0.20 mm)

Liner out-of-roundness (max.) .... 0.0020 in. (0.05 mm)

Liner taper (max.) .... 0.0020 in. (0.05 mm)

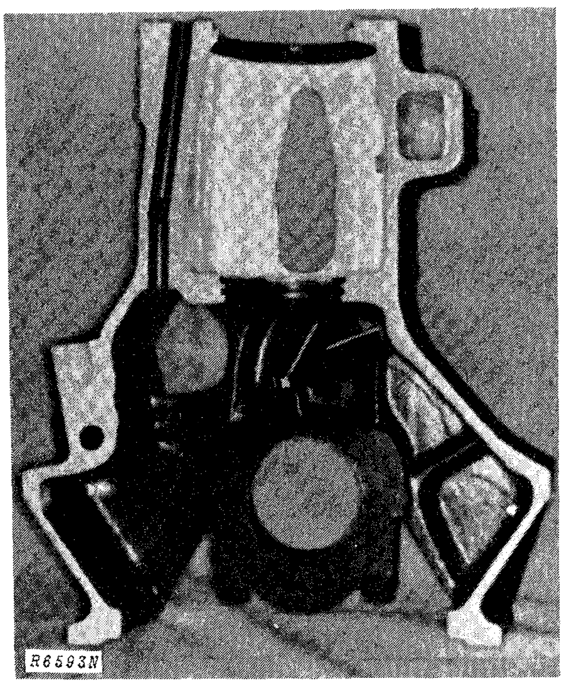


Fig. 13-Piston Cooling Orifice

Piston cooling orifices in main bearing web torque .... 85 to 110 lb-in (9.6 to 12.4 Nm) (0.98 to 1.3 kg-m)

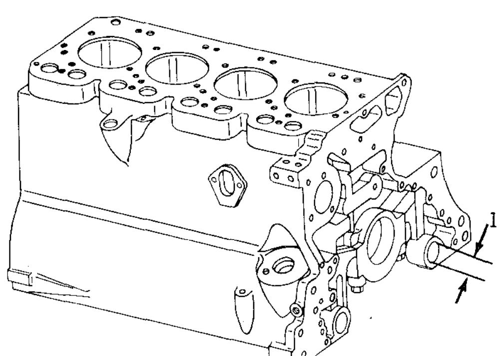


Fig. 14-Balancer Shaft Bearing Bore

1 - Balancer shaft bearing bore (without bearing) .... 1.6245 to 1.6255 in. (41.262 to 41.288 mm)

Dipstick tube height above pan rail .... 8.25 in. (210 mm)

OILING SYSTEM

SPECIFICATIONS AND TORQUE VALUES

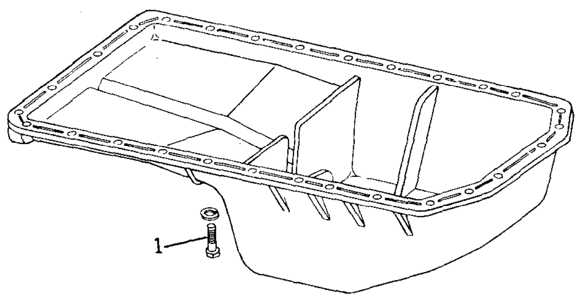


Fig. 15-Oil Pan

1 - Oil pan to block cap screw torque...... 35 lb-ft (47 Nm) (5 kg-m)
Dipstick tube height above block pan rail ....8 in. (203 mm)

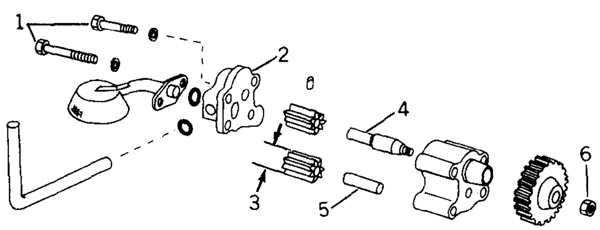


Fig. 16-Engine Oil Pump

1 - Assembly cap screws .... 35 lb-ft (47 Nm) (5 kg-m)
2 - Gears to cover clearance . 0.0012 to 0.0062 in. (0.030 to 0.157 mm)
3 - Pump gears width .... 1.6203 to 1.6223 in. (41.156 to 41.206 mm)
4 - Drive shaft O.D........... 0.6308 to 0.6312 in. (16.022 to 16.032 mm)
5 - Idler shaft O.D............ 0.4850 to 0.4856 in. (12.319 to 12.334 mm)
6 - Oil pump gear-to-drive shaft nut........................35 to 45 lb-ft (47 to 61 Nm) (5 to 6 kg-m)
Pump gear-to-housing radial clearance (not illustrated) .... 0.0030 to 0.0060 in. (0.076 to 0.152 mm)

CYLINDER HEAD AND VALVES

SPECIFICATIONS AND TORQUE VALUES

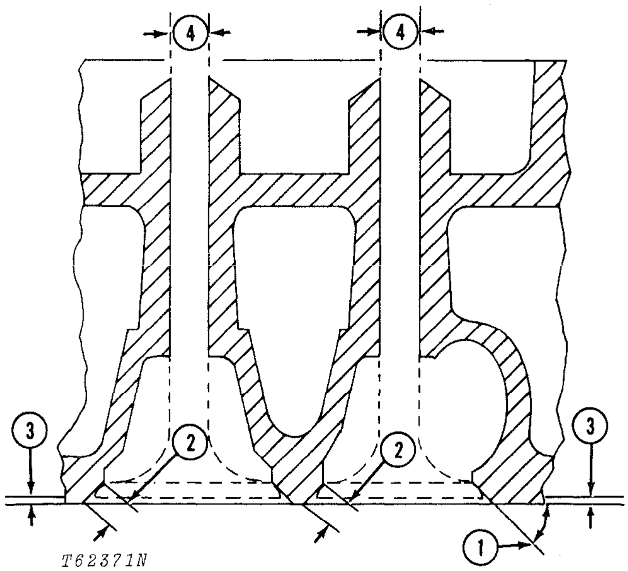


Fig. 17-Head, Seat and Guide

1 - Angle of valve seat .... 45°
2 - Width of valve seat .... 0.0625 to 0.0781 in. (1.588 to 1.984 mm)
3 - Distance closed valve to head deck
  (a) intake .... 0.037 ± 0.007 in. (0.94 ± 0.18 mm)
  (b) exhaust .... 0.057 ± 0.007 in. (1.45 ± 0.18 mm)
4 - I.D. of valve guide .... 0.3745 to 0.3755 in. (9.512 to 9.538 mm)
  Valve stem to guide clearance .... 0.0020 to 0.0040 in. (0.051 to 0.102 mm)
  Wear tolerance .... 0.0060 in. (0.152 mm)

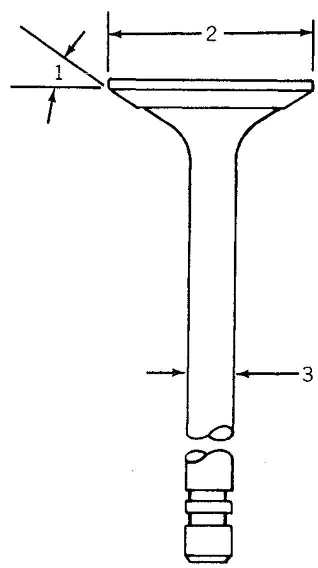


Fig. 18-Valve

1 - Angle of valve face
  (a) intake .... 44.5°
  (b) exhaust .... 44.5°
2 - O.D. of valve head
  (a) intake .... 1.7670 to 1.7770 in. (44.882 to 45.136 mm)
  (b) exhaust .... 1.5700 to 1.5800 in. (39.878 to 40.132 mm)
3 - O.D. of valve stem .... 0.3715 to 0.3725 in. (9.436 to 9.462 mm)
  Oversize valves available .... 0.003, 0.015 and 0.030 in. (0.08, 0.38 and 0.76 mm)

CYLINDER HEAD AND VALVES

SPECIFICATIONS AND TORQUE VALUES—Continued

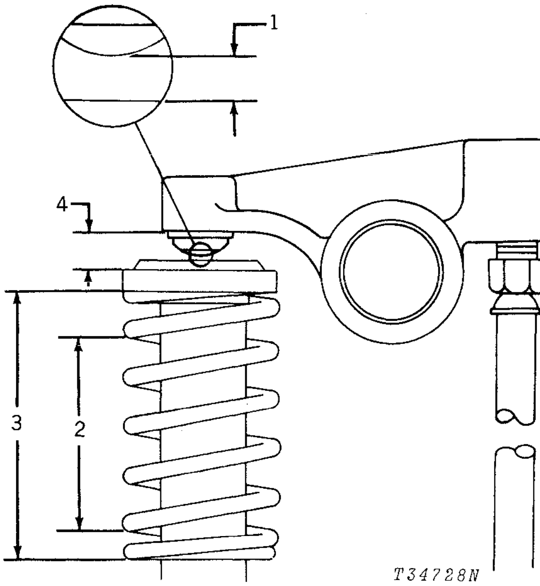


Fig. 19-Valve Spring and Rocker Arm

1 - Valve clearance
(a) exhaust .... 0.023 in. (0.56 mm)
(b) intake .... 0.018 in. (0.46 mm)

2 - Valve spring length (valve open) at 131 to 152 lb. (583 to 676 N) (59 to 69 kg) .... 1.36 in. (34.5 mm)

3 - Valve spring length (valve closed) at 54 to 62 lb. (240 to 276 N) (24 to 28 kg) .... 1.81 in. (46.0 mm)
Valve spring free length .... 2.12 in. (53.8 mm)

4 - Valve lift
(a) exhaust .... 0.456 to 0.482 in. (11.58 to 12.24 mm)
(b) intake .... 0.460 to 0.490 in. (11.68 to 12.45 mm)

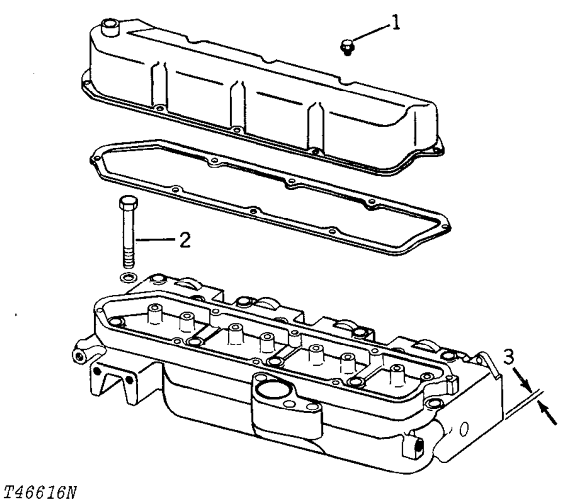


Fig. 20-Cylinder Head

1 - Rocker arm cover cap screw torque
(with cork gasket) .... 25 lb-in (2.8 N·m)
(with rubber and metal gasket) .... 96 lb-in (10.8 N·m)

2 - Cylinder head to block cap screw torque (dip cap screws in oil) .... 95 lb-ft (129 Nm) (13 kg-m)

3 - Maximum amount of material to be removed from bottom of head .... 0.030 in. (0.76 mm)

FUEL INJECTION SYSTEM

SPECIFICATIONS AND TORQUE VALUES

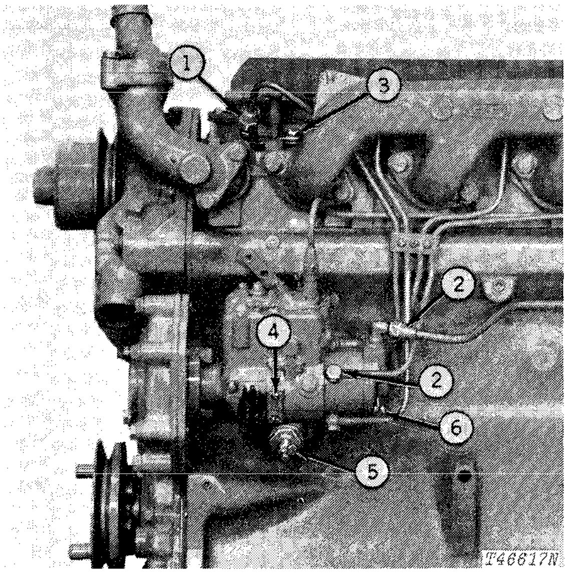


Fig. 21-Injection Pump and Nozzles

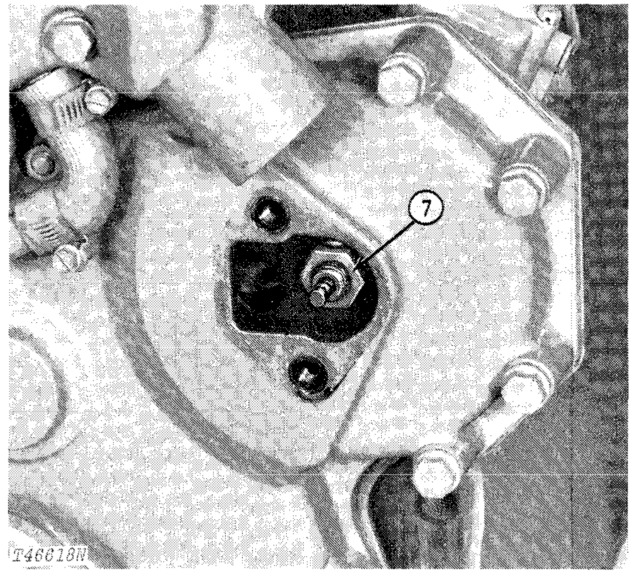


Fig. 22-Drive Hub Nut

1 - (Fig. 21) Nozzle inlet torque .... 35 lb-ft (47.5 N·m) (4.8 kg-m)

2 - (Fig. 21) Fuel inlet and outlet fitting screws .... 20 lb-ft (27 N·m) (2.8 kg-m)

3 - (Fig. 21) Injection nozzle hold down cap screw torque .... 20 lb-ft (27 N·m) (3 kg-m)

4 - (Fig. 21) Timing hole cover screw torque .... 15 to 20 lb-in (1.7 to 2.3 N·m) (0.17 to 0.23 kg-m)

5 - (Fig. 21) Advance screw hole plug .... 40 to 50 lb-in (4.5 to 5.6 Nm) (0.46 to 0.58 kg-m)

6 - (Fig. 21) End plate screws ...... 25 to 30 lb-in (2.8 to 3.4 Nm) (0.29 to 0.35 kg-m)

7 - (Fig. 22) Drive shaft hex. nut .... 45 lb-ft (61.0 Nm) (6.2 kg-m)

FUEL INJECTION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

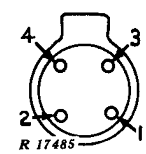
MODEL NO. **JDB431MD3027**
PART NO. **AR79346**

Roller-to-roller dimensions .... 1.971 ± 0.0005 in. (50.06 ± 0.013 mm)
Weight retainer timing mark .... 136.5°

ON TEST STAND:
Automatic advance movement . 1° at 300-500 rpm
5° at 700-800 rpm
7-1/2° Min. by 1200 rpm

Total advance movement .... 8 + 1 − 0°

Engine delivery sequence (from end plate)



Return oil at 1250 rpm ....200-500 cc/min.

Check point .... 1250 rpm
Volume per 1000 strokes (cc) 50-53
Transfer pump pressure (psi) 85-95
(6 to 7 bar) (6 to 7 kg/cm²)
Check point .... 750 rpm
Volume per 1000 strokes (cc) 51-55

High idle (WOT) .... 1340 rpm
Volume per 1000 strokes (cc) 10-12
Max. variation between cylinders (cc) 4

Governor cutoff (1/2 high idle delivery) . 1365 rpm
Volume per 1000 strokes (cc) .... 5 Max.

Low idle .... 400 rpm
Volume per 1000 strokes (cc) 10-12
Max. variation between cylinders (cc) 4

Check shut-off at .... 200 rpm
Volume per 1000 strokes (cc) .... 2 Max.
Adjust shut-off .... Notch A

Min. cranking speed delivery at .... 75 rpm
Volume per 1000 strokes (cc) 31
Transfer pump pressure (psi) .... 12 Min.
(0.8 bar Min.) (0.8 kg/cm² Min.)
Time end of injection (pump timing mark) 10° after
(engine) 2° ATDC

FUEL INJECTION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

ROOSA MASTER 9.5 MILLIMETER INJECTION NOZZLE SPECIFICATIONS

Return oil leakage on all nozzles: 3 to 10 drops/30 sec. at 1500 psi (103 bar) (105 kg/cm²) after first drop (service only)

Serial No.	Roosa Master Number	Part Number
(-441335)	19762	AR56290
(-441335)	20500	AR56290
(-467466)	20631	AR73673
(467467-)	22042	AR88239

GENERAL INFORMATION

Number of Orifices 4
Orifice Diameter ....0.011 in. (0.28 mm)
Sac Hole Diameter ....0.042 in. (1.07 mm)

NOZZLE SETTINGS

Nozzle Opening
Pressure (New) ....3150 to 3250 psi
(217 to 224 bar)
(222 to 228 kg/cm²)

Nozzle Opening
Pressure (Used) ....2990 to 3050 psi
(206 to 210 bar)
(210 to 214 kg/cm²)
Nozzle Valve Lift ....1/2 turn from bottom
(0.009 in. [0.23 mm] nominal)

Lock Nut Torque:
Lift Adjusting ....35 - 45 lb-in.
(4 - 5.1 Nm)
(0.40 - 0.52 kg/m)
Pressure Adjusting
Screw-to-Nozzle Body ....70 - 75 lb-in.
(7.9 to 8.5 Nm)
(0.81 to 0.86 kg/m)

ENGINE BALANCER

SPECIFICATIONS AND TORQUE VALUES

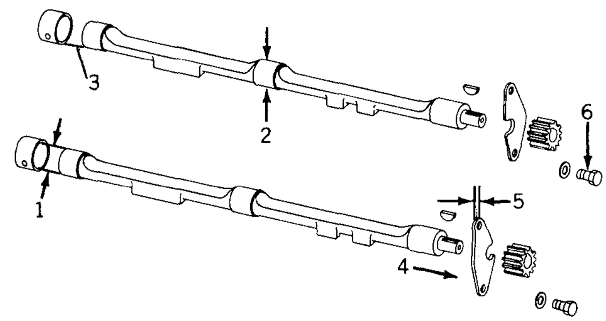


Fig. 23-Engine Balancer

1 - New Bearing I.D. .... 1.5032 to 1.5052 in. (38.181 to 38.232 mm)
Round within .... 0.0030 in. (0.076 mm)

2 - New bearing journal O.D. . 1.5014 to 1.5024 in. (38.136 to 38.161 mm)

3 - Bearing-to-journal clearance (new parts) ..... 0.0008 to 0.0038 in. (0.020 to 0.097 mm)
Maximum allowable clearance for worn parts .... 0.0058 in. (0.147 mm)

4 - End play .... 0.0020 to 0.0080 in. (0.051 to 0.203 mm)

5 - Thrust plate thickness ..... 0.1170 to 0.1190 in. (2.972 to 3.023 mm)

6 - Thrust plate-to-front plate cap screw torque .... 35 lb-ft (47 Nm) (5 kg-m)

WATER PUMP

SPECIFICATIONS AND TORQUE VALUES

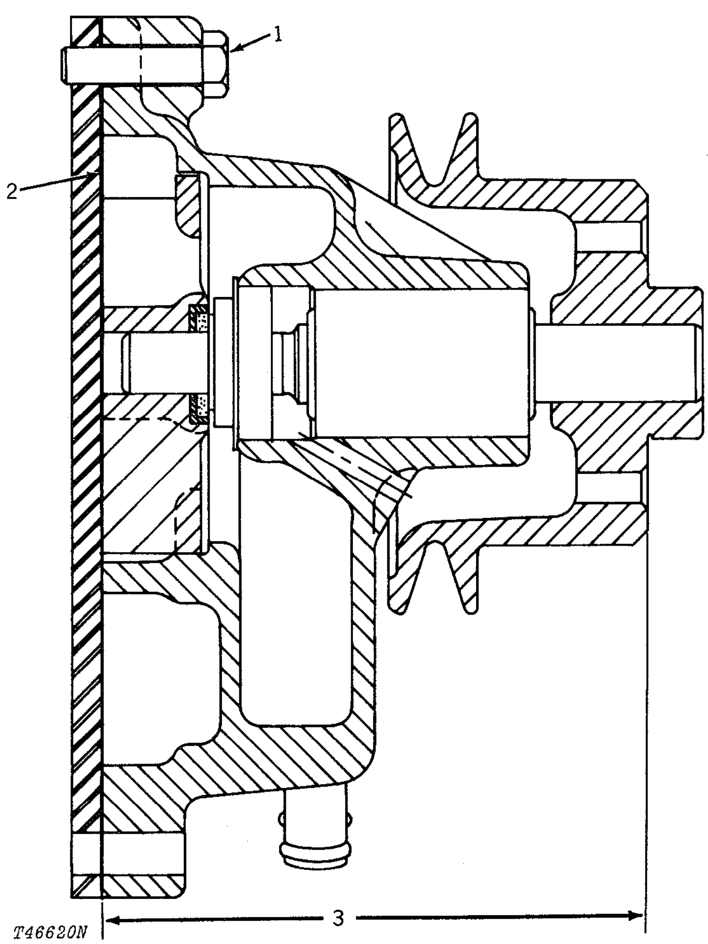


Fig. 24-Water Pump

1 - Water pump rear cover cap screw torque .... 35 lb-ft (47 Nm) (5 kg/m)

2 - Water pump impeller clearance to housing .... Flush to within 0.010 in. (0.25 mm)

3 - Fan surface on pulley to rear of water pump housing .... 5.5 in. (140 mm)

THERMOSTAT, HOUSING AND PIPING

SPECIFICATIONS AND TORQUE VALUES

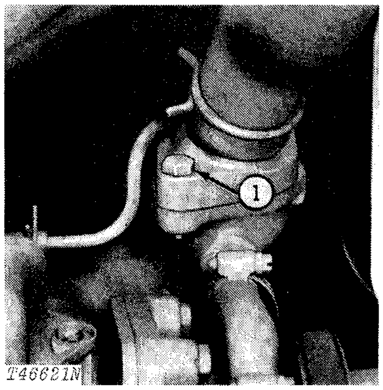
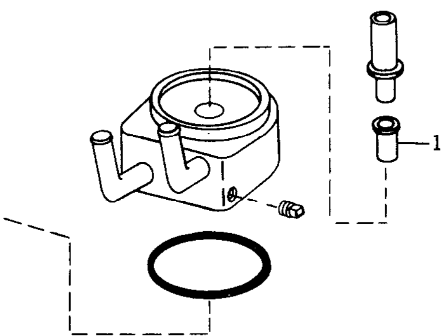


Fig. 25-Thermostat Housing and Cover

1 - Thermostat housing-to-cover cap screw torque .... 20 lb-ft (27 Nm) (3 kg/m)
Thermostat opening temperature .... 205°F (96°C)

OIL COOLER

SPECIFICATIONS AND TORQUE VALUES



T46622N

Fig. 26-Oil Cooler Relief Valve

1 - Oil cooler relief valve setting....... 12 to 15 psi (0.8 to 1.0 bar) (0.8 to 1.1 kg/cm²)

STARTING MOTOR AND FASTENINGS

SPECIFICATIONS AND TORQUE VALUES

No Load Test

Motor No.	Test Volts	Min. Amps	Max. Amps	Min. RPM	Max. RPM
1107871	9.0	40*	140*	8000	13000

*Includes solenoid.

Solenoid Test

Pull-In (current draw at 5 volts) .... 13 to 15.5 amps
Hold-In (current draw at 10.0 volts) .... 14.5 to 16.5 amps

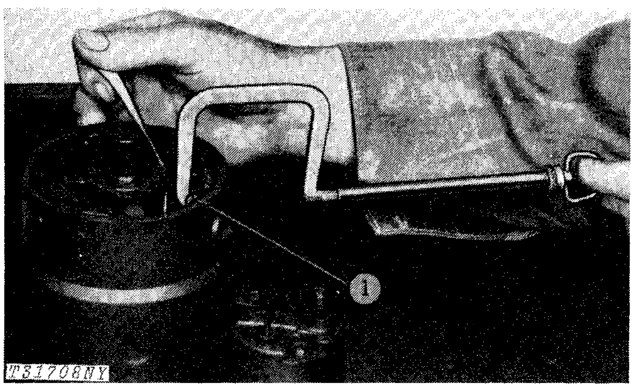


Fig. 27-Brush Spring Tension

Starting Motor - Model No. 1107871

1 - Brush spring minimum tension .... 35 oz. (10 N) (1.0 kg)

STARTING MOTOR AND FASTENINGS

SPECIFICATIONS AND TORQUE VALUES—Continued

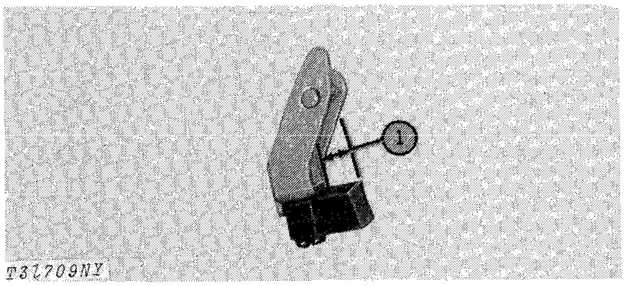


Fig. 28-Brush Length

1 - Brush minimum length beyond holder . 5/16 in. (7.938 mm)

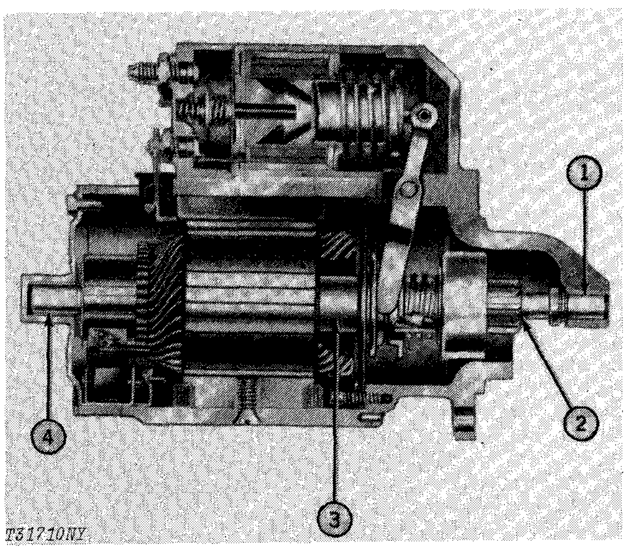


Fig. 29-Starting Motor

1 - Drive housing bushing
- I.D. .... 0.4990 to 0.5010 in. (12.675 to 12.725 mm)
- Wear tolerance .... 0.511 in. (12.98 mm)
- Oil clearance .... 0.0020 to 0.0050 in. (0.051 to 0.127 mm)
- Wear tolerance .... 0.0170 in. (0.432 mm)

2 - Overrunning clutch housing
- I.D. .... 0.5620 to 0.5630 in. (14.275 to 14.300 mm
- Wear tolerance .... 0.5740 in. (14.580 mm)

3 - Center bearing bushing
- I.D. .... 0.7600 to 0.7620 in. (19.304 to 19.355 mm)
- Wear tolerance .... 0.7720 in. (19.609 mm)
- Oil clearance .... 0.0100 to 0.0150 in. (0.254 to 0.381 mm)
- Wear tolerance .... 0.0250 in. (0.635 mm)

4 - Commutator end frame bushing
- I.D. .... 0.5625 to 0.5635 in. (14.288 to 14.313 mm)
- Wear tolerance .... 0.5730 in. (14.554 mm)
- Oil clearance .... 0.0020 to 0.0050 in. (0.051 to 0.127 mm)
- Wear tolerance .... 0.0160 in. (0.406 mm)

STARTING MOTOR AND FASTENINGS

SPECIFICATIONS AND TORQUE VALUES—Continued

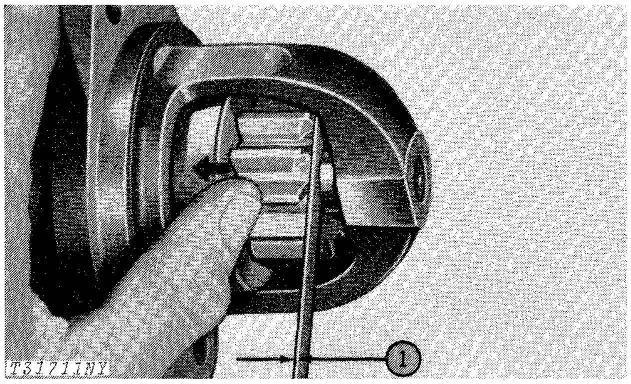


Fig. 30-Pinion Clearance

1 - Pinion clearance .... 0.010 to 0.140 in. (0.25 to 3.56 mm)

FLYWHEEL, HOUSING AND FASTENERS

SPECIFICATIONS AND TORQUE VALUES

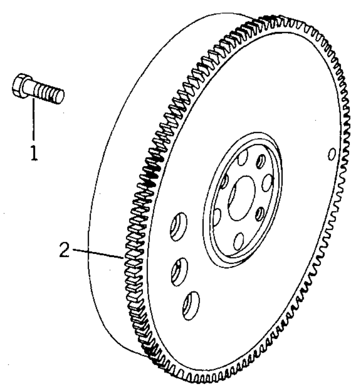


Fig. 31-Flywheel

1 - Flywheel-to-crankshaft cap screw torque (D-grade) .... 85 lb-ft (115 Nm) (12 kg-m)
(F-grade) .... 120 lb-ft (163 Nm) (17 kg-m)

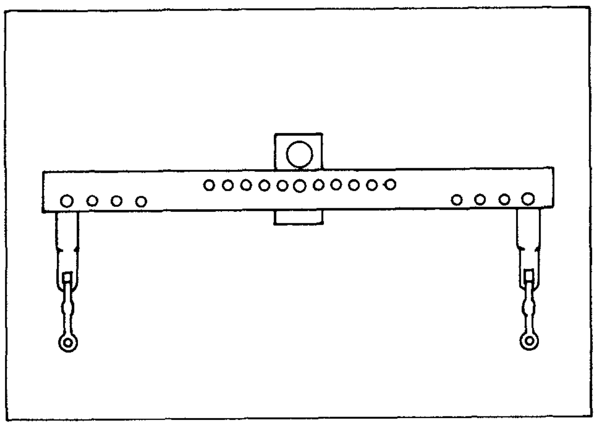
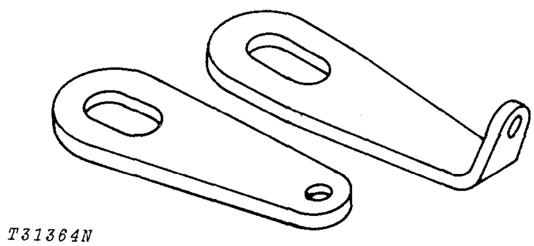
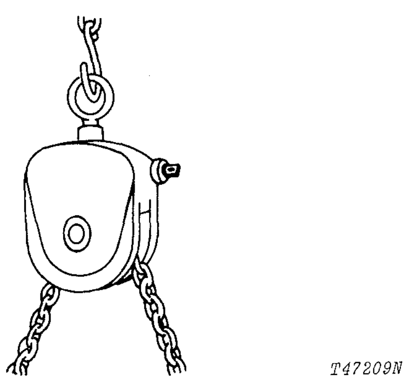
2 - Number of teeth on flywheel ring gear 142

Flywheel housing to cylinder block cap screw torque .... 35 lb-ft (47 Nm) (5 kg-m)

ENGINE REMOVAL AND INSTALLATION

SPECIAL TOOLS

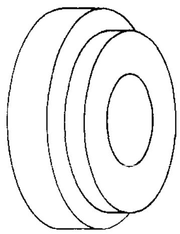
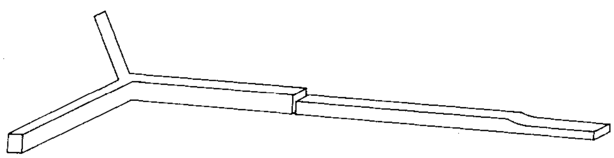
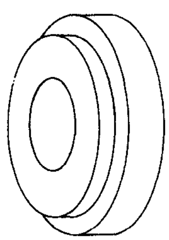
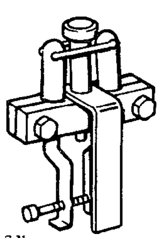
Convenience Tools—Continued

Tool	Tool Number	Use
 T69843 Fig. 32-Lifting Device	JDG-23	Lifting Device - To remove engine.
 T31364N Fig. 33-Lifting Eyes	JD-244	Lifting Eyes - Used with JDG-23 or D01043AA for removing engine.
 T47209N Fig. 34-Load Positioning Sling	D01043AA	Load Positioning Sling - To remove and install engine in unit.

CAMSHAFT AND VALVE ACTUATING MEANS

SPECIAL TOOLS

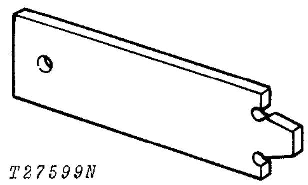
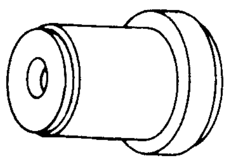
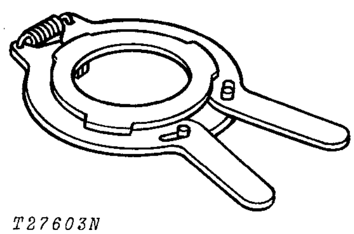
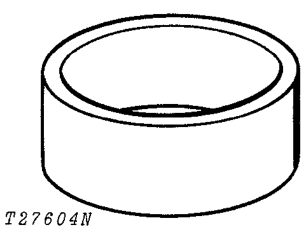
Essential Tools

Tool	Tool Number	Use
 T31584N T31584N *Fig. 35-Driver*	JD-252	Idler Gear Bushing Driver - To install idler gear bushing.
 T31585N T31585N *Fig. 36-Gear Timing Tool*	JD-254	Gear Timing Tool - To time gear train.
 T31581N T31581N *Fig. 37-Driver*	JD-250	Front Crankshaft Oil Seal Driver - To install front crankshaft oil seal in timing gear cover.
 T27593N T27593 *Fig. 38-JDE-41296 Puller*	JDE-41296	Valve Seat Puller - Used to pull intake and exhaust valve seats

CONNECTING RODS AND PISTONS

SPECIAL TOOLS

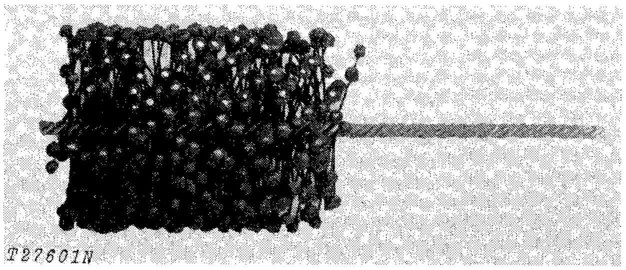
Essential Tools

Tool	Tool Number	Use
 T27599N *Fig. 39-Keystone Ring Groove Wear Gauge*	JDE-62	Ring Groove Wear Gauge - To measure keystone ring groove wear.
 T32805 *Fig. 40-Bushing Installation and Removal Tool*	JDE-88	Bushing Installation and Removal Tool—Used for removing and installing the piston pin bushings in the connecting rods.
 T27603N *Fig. 41-Piston Ring Expander*	JDE-45 or JDE-135	Limiting Piston Ring Expander - To install piston rings. Universal Piston Ring Expander.
 T27604N *Fig. 42-Piston Ring Compressor*	JD-271	Piston Ring Compressor - To install pistons.

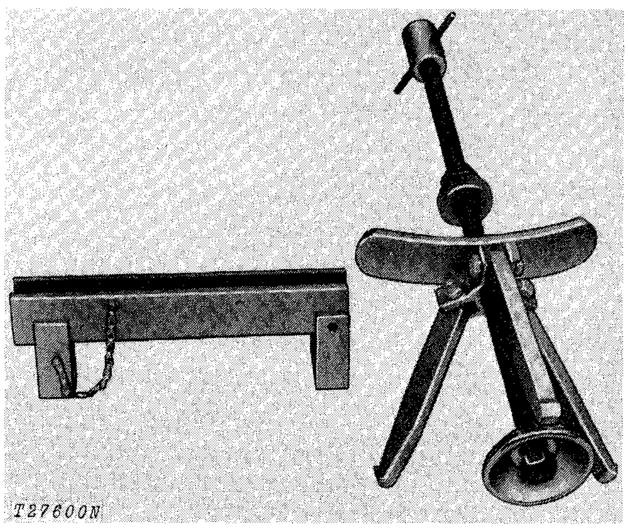
CYLINDER BLOCK

SPECIAL TOOLS

Essential Tools

Tool	Tool Number	Use
 T27601N Fig. 43-Deglazing Brush	D-17004BR	Cylinder Brush - Deglaze cylinder liners.

Convenience Tools

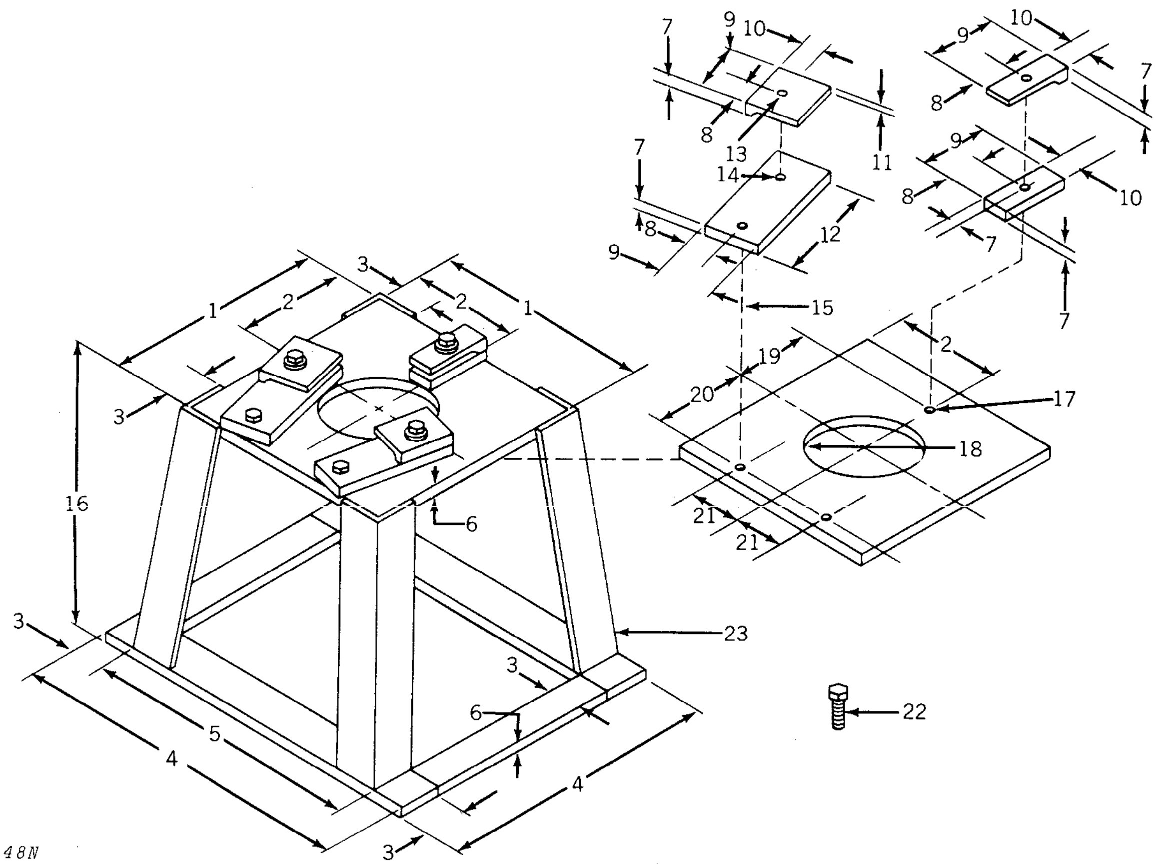
Tool	Tool Number	Use
 T27600N Fig. 44-Cylinder Liner Puller	D-01062AA or D-01073AA	Cylinder Liner Puller - To remove cylinder liners.

CYLINDER BLOCK

SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use



1—10" (254.0 mm)
2—5" (127.0 mm)
3—1.5" (38.1 mm)
4—16" (406.4 mm)
5—13" (330.2 mm)
6—0.375" (9.53 mm)
7—0.5" (12.7 mm)
8—1.25" (31.8 mm)
9—2.5" (63.5 mm)
10—1" (25.4 mm)
11—0.25" (6.35 mm)
12—6" (152.4 mm)
13—0.328" Drill Through
14—5/16"—18 Tap
15—2 used
16—12" (304.8)
17—5/16"—18 Tap
18—2.75" (69.85 mm) Radius
19—4" (101.6 mm)
20—4.38" (111.25 mm)
21—2.38" (60.45 mm)
22—5/16" x 1" Cap Screw
23—2.5" (63.5 mm) Angle Iron

Fig. 45-Cylinder Liner Holding Fixture

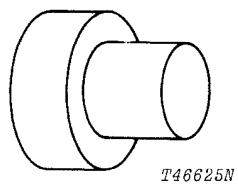
	. . . . *	*Liner Holding Fixture - Hold liner for deglazing.*

**Make in dealer's shop*

OILING SYSTEM

SPECIAL TOOLS

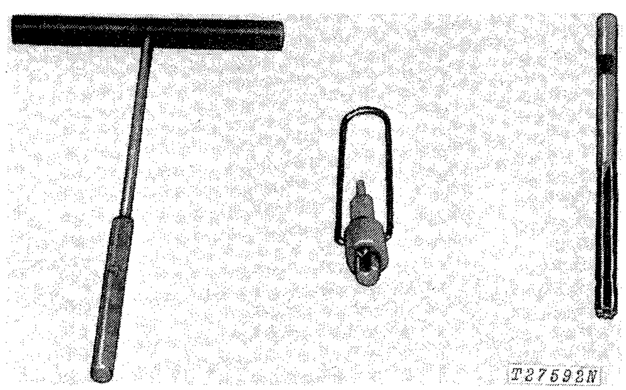
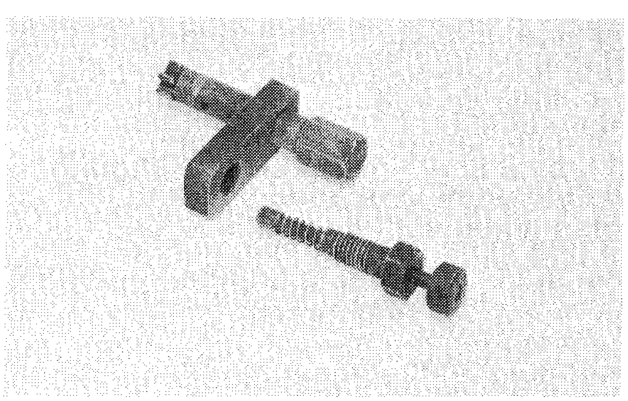
Essential Tools

Tool	Tool Number	Use
 T46625N Fig. 46-Driver	JD-248-A	Oil Pressure Relief Valve Bushing Driver - To install oil pressure relief valve bushing in engine.

CYLINDER HEAD AND VALVES

SPECIAL TOOLS

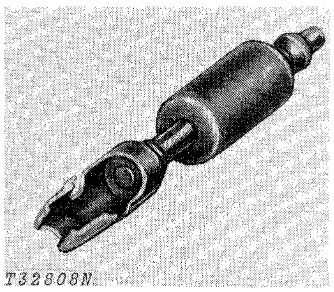
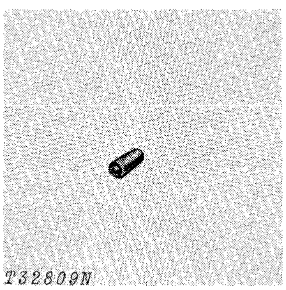
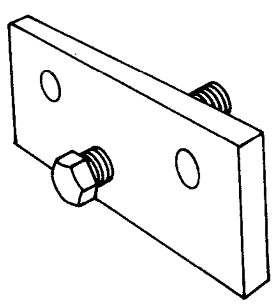
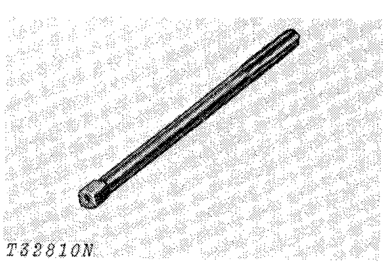
Essential Tools

Tool	Tool Number	Use
 T27592N Fig. 47-Knurling Tool	D-20002WI	Knurling Tool - To knurl engine valve guides.
 T82397 Fig. 48-Engine Timing Tool	JD-281	Engine Timing Tool - To rotate fly-wheel and locate TDC.

FUEL INJECTION SYSTEM

SPECIAL TOOLS

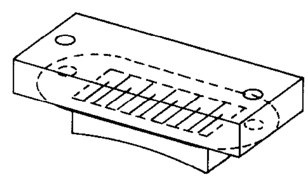
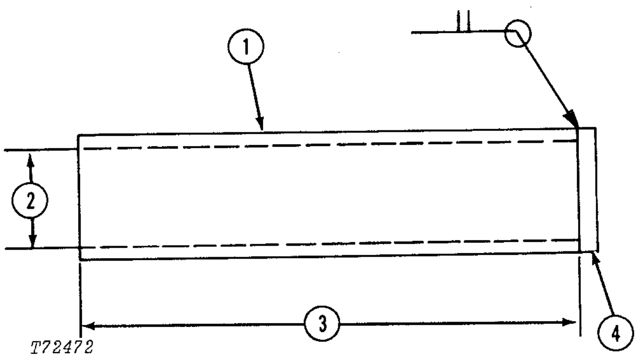
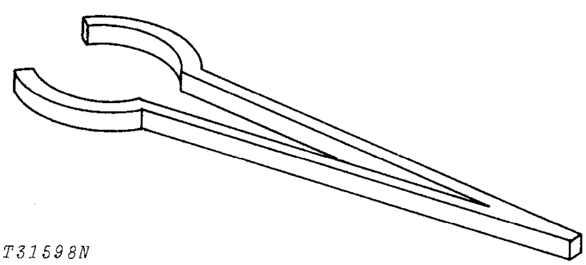
Essential Tools

Tool	Tool Number	Use
 T32808N *Fig. 49-Nozzle Puller*	JDE-38	Nozzle Puller - To remove fuel injection nozzles.
 T32809N *Fig. 50-Seal Installation Tool*	JD-258	Carbon Stop Seal Installation Tool - To install carbon stop seal on nozzles.
 T71629 *Fig. 51-Injection Pump Shaft Removal Tool*	JD-303	Injection Pump Shaft Removal Tool—To remove shaft from injection pump drive gear.
 T32810N *Fig. 52-Cleaning Tool*	JD-39	Nozzle Bore Cleaning Tool - To clean nozzle bore in cylinder head.

FUEL INJECTION SYSTEM

SPECIAL TOOLS—Continued

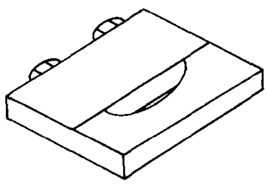
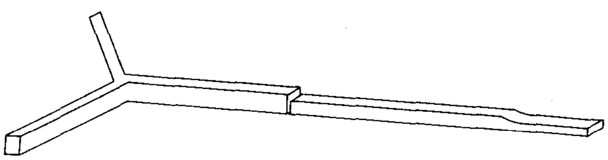
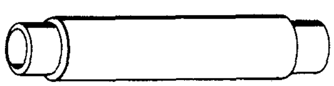
Essential Tools—Continued

Tool	Tool Number	Use
 T31920N T431920N *Fig. 53-Injection Pump Timing Window*	JD-259	Timing Window - To adjust injection pump cam advance.
 T72472 *Fig. 54-Driver*	---	Driver - To remove injection pump shaft from drive gear. 1 - Heavy Wall Pipe 2 - 1.0 in. (25.5 mm) 3 - 5.0 in. (127 mm) 4 - Plate
 T31598N T31598N *Fig. 55-Drive Shaft Seal Installation Tool*	JD-256	Injection Pump Drive Shaft Seal Installation Tool - To install drive shaft seal.

ENGINE BALANCER

SPECIAL TOOLS

Essential Tools

Tool	Tool Number	Use
 T31946N Fig. 56-Holding Tool	JD-247	Balancer Shaft Holding Tool - To hold balancer shaft when installing drive gear.
 T31585N Fig. 57-Gear Timing Tool	JD-254	Gear Timing Tool - To time gear train.
 T31944N Fig. 58-Driver	JD-249	Balancer Shaft Bushing Driver - To install balancer shaft bushings.

WATER PUMP

SPECIAL TOOLS

Convenience Tool

Tool	Tool Number	Use
	JD-262-A	Water Pump Bearing Installation Tool - To install water pump bearing.

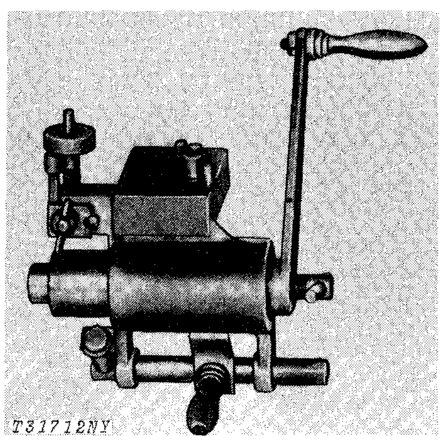
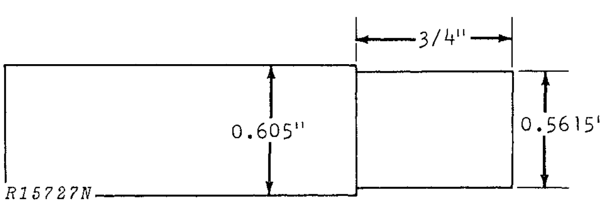
T31591N

Fig. 59-Bearing Installation Tool

STARTING MOTOR AND FASTENINGS

SPECIAL TOOLS

Convenience Tools

	....	To undercut armature and commutator.
	....	To install pre-lubricated bushings.

T31712NY

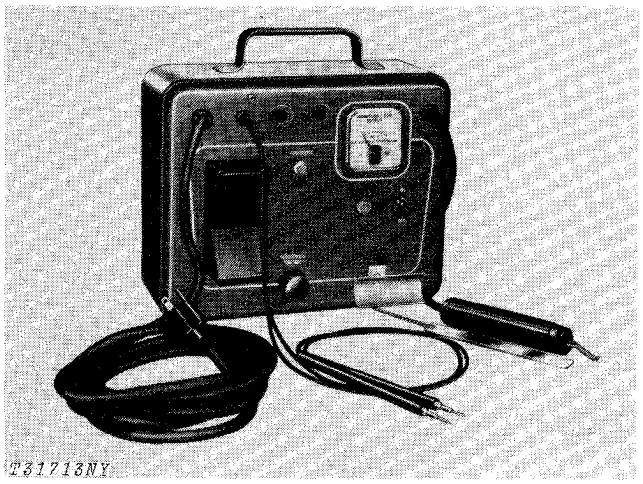
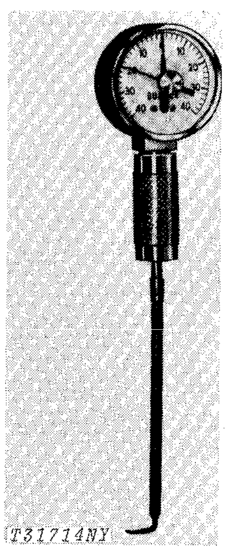
Fig. 60-Armature Commutator Turning and Undercutting Tool

Fig. 61-Pre-Lubricated Bushing Arbor

STARTING MOTOR AND FASTENINGS

SPECIAL TOOLS—Continued

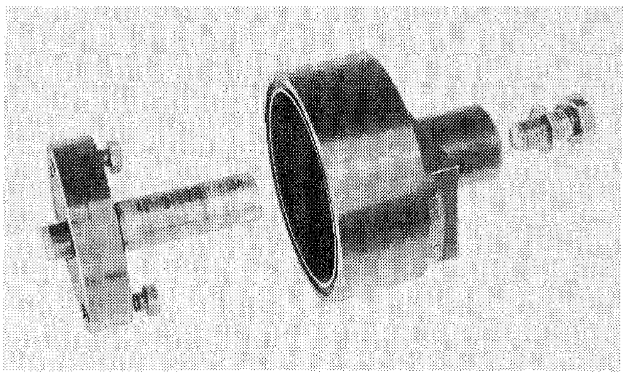
Convenience Tools—Continued

Tool	Tool Number	Use
 *Fig. 62-Armature Tester*	. . . .	To test armature for shorts, opens and grounds.
 *Fig. 63-Spring Tension Gauge*	. . . .	To check brush spring tension.

FLYWHEEL, HOUSING AND FASTENERS

SPECIAL TOOLS

Essential Tools

Tool	Tool Number	Use
 T79556 Fig. 64-Seal and Wear Ring Installer	JDE-140	Seal and Wear Ring Installer - To install crankshaft wear ring.

Section 5
ENGINE AUXILIARY SYSTEMS

CONTENTS OF THIS SECTION

Group 0505
COLD WEATHER STARTING AIDS

FLUID STARTING AID

GENERAL INFORMATION

The tractor is equipped with a starting fluid adapter. It is used to inject atomized starting fluid into the engine during cold weather starts.

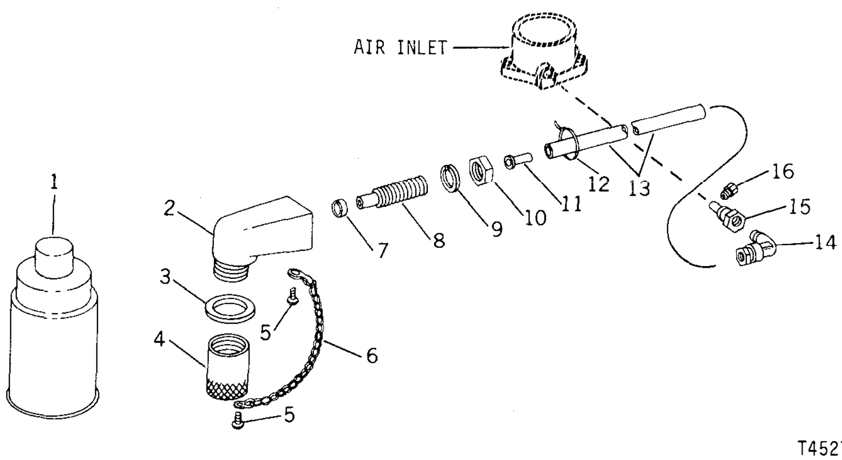
Fig. 1-Nozzle Holder

IMPORTANT: To avoid damage, turn engine one or two revolutions before injecting starting fluid. Inject starting fluid only while engine is turning. Inject fluid intermittently, not continuously.

CAUTION: Do not puncture or incinerate starting fluid containers.

Use starting fluid at air temperatures below 20° F (−7° C).

IMPORTANT: Keep starting fluid adapter capped to prevent dirt from entering system.



1—Starting Fluid
2—Adapter
3—Packing
4—Cap
5—Drive Screw (2 used)
6—Chain
7—Packing
8—Packing Gland
9—Lock Washer
10—Nut
11—Sleeve
12—Band (2 used)
13—Tube
14—Elbow
15—Spray Nozzle Holder
16—Spray Nozzle

Fig. 2-Fluid Starting Aid (No Cab Only)

REMOVAL

If elbow and spray nozzle holder (14 and 15, Fig. 2) are removed, plug opening to prevent dirt from entering the engine.

REPAIR

Check for damaged or clogged parts. Clean, repair or replace as necessary.

INSTALLATION

When installing tube (13, Fig. 2), torque nut (10) and nut on elbow (14) to 60 lb-in. (6.8 Nm) (0.69 kg/m).

FLUID STARTING AID WITH CAB UNITS (277569-)

GENERAL INFORMATION

IMPORTANT: To avoid engine damage, crank engine one or two revolutions before depressing starting aid switch. Depress starting fluid switch only when the engine is cold and cranking.

IMPORTANT: To prevent dirt from entering the engine, a container of starting fluid should be in place on the solenoid at all times.

STARTING AID SOLENOID

Removal

Open left engine side shield, disconnect wires and tube from solenoid, remove attaching hardware and remove solenoid.

Repair

The solenoid is not repairable. If the solenoid is defective, it should be replaced.

Test solenoid as described in Group 9015.

Installation

Mount solenoid and can on cab and connect wires and tube.

Assemble starting fluid spray holder with arrow on hex head pointing up.

STARTING AID SWITCH

Removal

Remove four screws from instrument panel and pull panel out just far enough to gain access to the switch.

Remove switch cap, disconnect wires, remove retaining hardware and remove switch.

Repair

The switch is not repairable. If the switch is defective, it must be replaced.

Test the switch as described in Group 9015.

Installation

Install switch, connect wires and install instrument panel.

STARTING AID ADAPTER, LINE AND NOZZLE

Removal

Remove line by disconnecting at starting aid solenoid and at nozzle holder.

Unscrew nozzle holder from air intake manifold and remove nozzle and holder.

Repair

Be sure hose and openings in nozzle are open. Clean or replace as necessary.

Installation

Install nozzle and holder with arrow on nozzle pointing toward center of engine.

Connect line to solenoid and nozzle holder.

ENGINE COOLANT HEATER

GENERAL INFORMATION

The tractor may be equipped with an engine coolant heater to aid in cold weather starting.

The heater is a 1000 watt, 115 volt operated unit.

REMOVAL

Remove and plug hoses from the heater. Remove U-bolts and remove heater from the bracket.

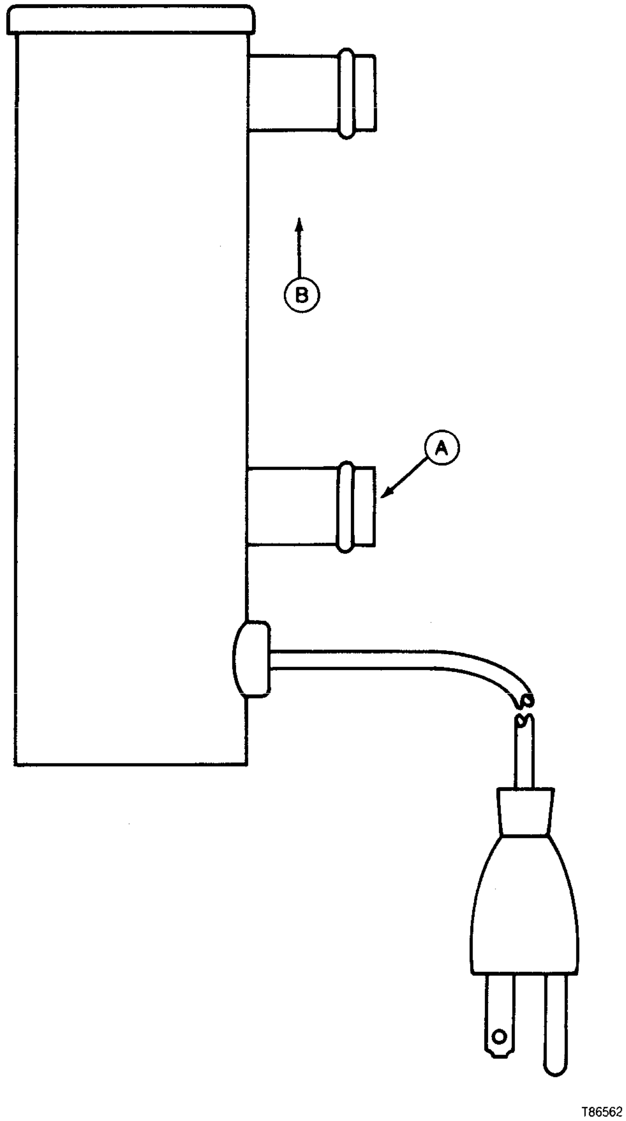
REPAIR

The heater cannot be repaired; it must be replaced.

Check condition of the hoses. Replace as needed.

INSTALLATION

Be sure the heater is correctly installed. Note that the correct (up) position is with the electrical cord attached at the bottom of the heater.



A—Inlet **B—Up Position**

Fig. 3-Engine Coolant Heater

Group 0510
COOLING SYSTEM

GENERAL INFORMATION

The engine cooling system consists of the radiator, fan and fan shroud.

The radiator is located in front of the engine and behind the fuel tank. The radiator is of the tube and fin type construction. The pressure type radiator cap is located on the top of the radiator to maintain pressure in the cooling system.

RADIATOR

REMOVAL

Drain the radiator.

Remove exhaust extension, side screens and hood.

Remove the radiator.

REPAIR

FOS

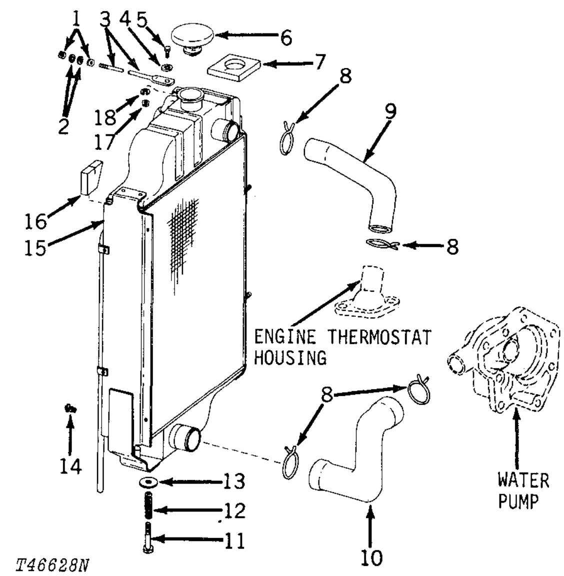
Refer to Cooling Systems in FOS Manual - ENGINES - for radiator inspection and repair.

INSTALLATION

Follow removal procedure in reverse order.

Fill radiator with clean soft water and proper additive.

IMPORTANT: Install front support end of side grille retaining spring with open end of hook facing front of tractor.

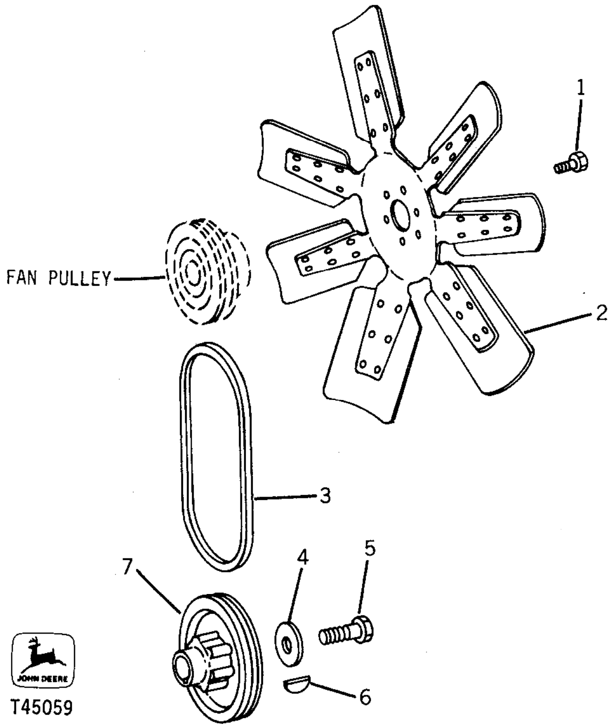


1—Special Nut (2 used)	10—Lower Hose
2—Washer (2 used)	11—Cap Screw (2 used)
3—Tie Rod	12—Spring (2 used)
4—Washer	13—Rubber Washer (2 used)
5—Cap Screw	14—Drain Cock
6—Radiator Cap	15—Radiator
7—Packing Strip	16—Baffle
8—Hose Clamp (4 used)	17—Nut
9—Upper Hose	18—Lock Washer

Fig. 1-Radiator

FAN AND FAN DRIVE

REMOVAL



1—Cap Screw (4 used)
2—Fan Blade
3—Fan Belt
4—Special Washer
5—Cap Screw
6—Key
7—Pulley

Fig. 2-Fan and Pulley

Remove engine side screens.

Remove cap screws attaching fan to pulley. Remove fan.

REPAIR

IMPORTANT: Do not attempt to repair a damaged fan. The fan should always be replaced if damaged.

INSTALLATION

Install fan.

Tighten fan to fan pulley cap screws (1, Fig. 2) to 35 ± 3 lb-ft (47.4 ± 4.1 Nm) (4.8 ± 0.4 kg-m).

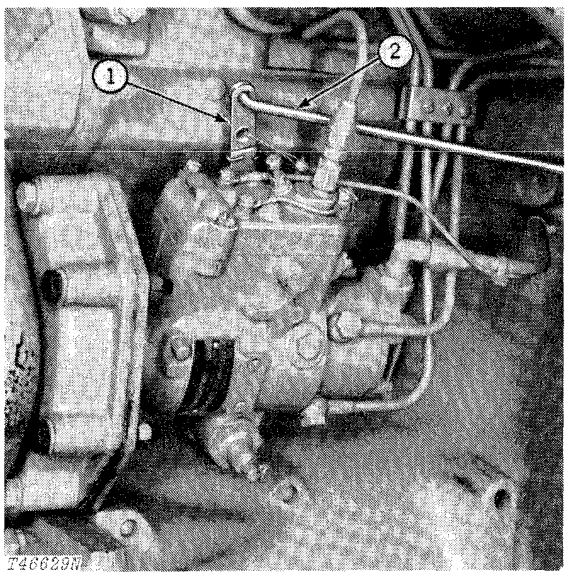
Install engine side screens.

Group 0515
SPEED CONTROLS

GENERAL INFORMATION

The speed control linkage consists of the hand throttle, accelerator pedal and various linkages connected to the injection pump. Through common movement of the throttle and linkage, speed control is maintained.

REMOVAL



1—Throttle Lever **2—Speed Control Rod**

Fig. 1-Removing Speed Control Rod

Remove the speed control rod from the injection pump throttle lever (Fig. 1).

Refer to Figs. 2 and 3 for complete removal of the speed control linkage.

REPAIR

Carefully inspect all parts for wear, bends or breaks.

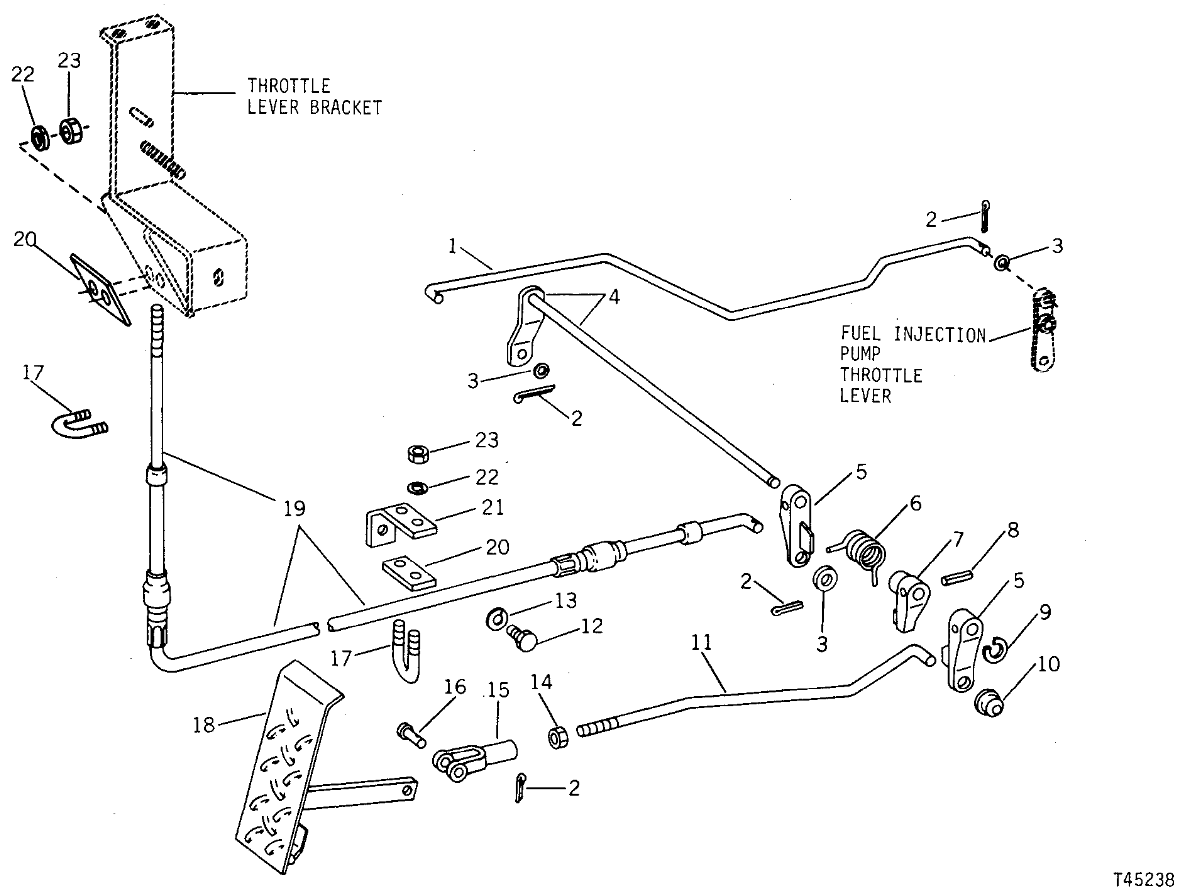
For smooth and accurate speeds and control, all excessively worn or damaged parts should be replaced.

INSTALLATION

Refer to Figs. 2 and 3 during installation of the speed control linkage.

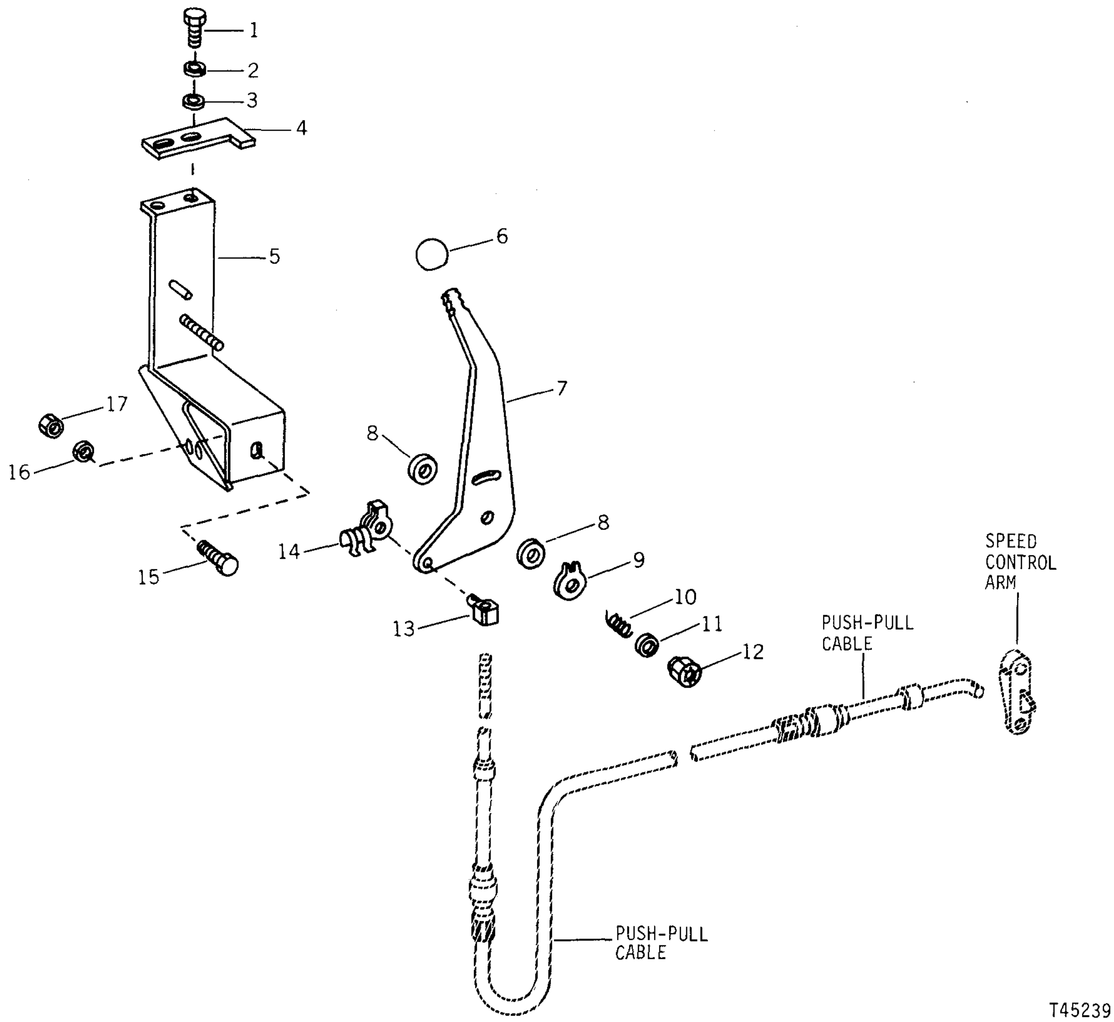
When installing speed control arm (7, Fig. 2), check that spring pin (8) protrudes approximately 1/16 inch (1.59 mm) on each side.

Refer to Group 9010 for speed control adjustments.



1—Speed Control Rod
2—Cotter Pin (4 used)
3—Washer (3 used)
4—Speed Control Shaft with Arm
5—Speed Control Arm (2 used)
6—Spring
7—Speed Control Arm
8—Spring Pin
9—Retaining Ring
10—Capped Locking Plate
11—Foot Accelerator Rod
12—Cap Screw
13—Lock Washer
14—Jam Nut
15—Yoke
16—Pin
17—U-Bolt (2 used)
18—Accelerator Pedal
19—Push-Pull Cable
20—Spacer
21—Bracket
22—Lock Washer (2 used)
23—Nut (2 used)

Fig. 2-Speed Control Linkage



1—Cap Screw (2 used)
2—Lock Washer (2 used)
3—Washer (2 used)
4—Throttle Stop
5—Bracket
6—Knob
7—Throttle Lever
8—Facing (2 used)
9—Plate
10—Spring
11—Washer
12—Special Nut
13—Swivel
14—Clevis Clip
15—Bolt
16—Lock Washer
17—Nut

Fig. 3-Speed Control Lever

Group 0520
INTAKE SYSTEM

GENERAL INFORMATION

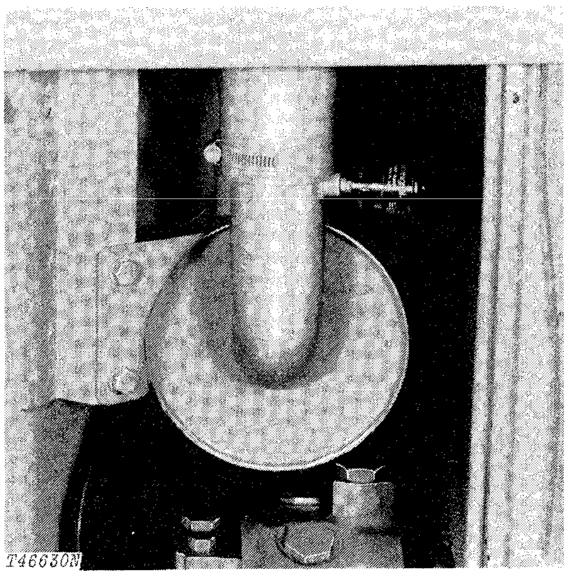


Fig. 1-Air Cleaner with Restriction Indicator

The backhoe loader is equipped with a dry type air cleaner located behind the fuel tank.

Dirty air entering the air cleaner flows first past the filter fins which separate dirt from the air and deposit the dirt in the dust unloading valve. The air is then further filtered when it passes through the filter element before flowing out to the engine.

IMPORTANT: Never operate engine without filter element or dust unloader valve.

An air restriction indicator is located on the filter assembly (Fig. 1) and warns the operator whenever restriction is present in the air cleaner.

REMOVAL

Refer to Fig. 2 for parts identification.

Disconnect intake pipe (6) from air cleaner.

Remove cap screws (1 and 14). Remove air cleaner assembly.

REPAIR

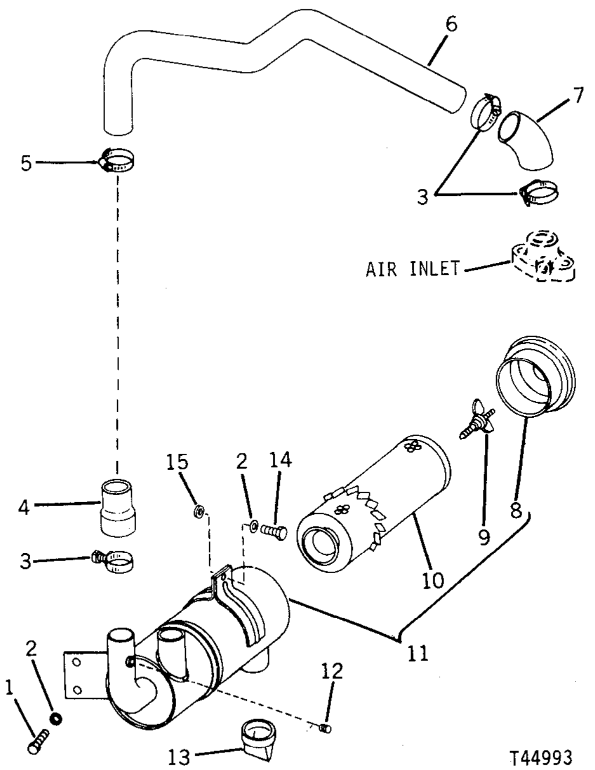
Refer to Fig. 2 during disassembly and assembly of the air cleaner.

Inspect dust unloading valve for clogging, damage, or fatigue, and replace if necessary.

Replace filter element (1) if damaged, (2) after one year of service, or (3) when filter is not responding to cleaning (indicated by excessive smoke, loss of power, or restriction indicator in red).

See Group 9010 to test the air intake system. This test will determine if the restriction indicator is functioning properly.

See Operator's Manual for more information on cleaning and replacing air cleaner unloading valve and element.



1—Cap Screw (2 used)
2—Lock Washer (3 used)
3—Clamp (3 used)
4—Front Hose
5—Clamp
6—Intake Pipe
7—Rear Hose
8—Cover
9—Special Screw
10—Element
11—Air Cleaner
12—Pipe Plug (without restriction indicator)
13—Unloader Valve
14—Cap Screw
15—Spacer

Fig. 2-Air Cleaner

INSTALLATION

Install the air cleaner using attaching hardware (1, 2, 14 and 15, Fig. 2).

Attach hoses to air cleaner. Be sure connections are tight to prevent unfiltered air from entering the engine.

Group 0530
EXTERNAL EXHAUST SYSTEM

GENERAL INFORMATION

The backhoe loader is equipped with a muffler and muffler extension.

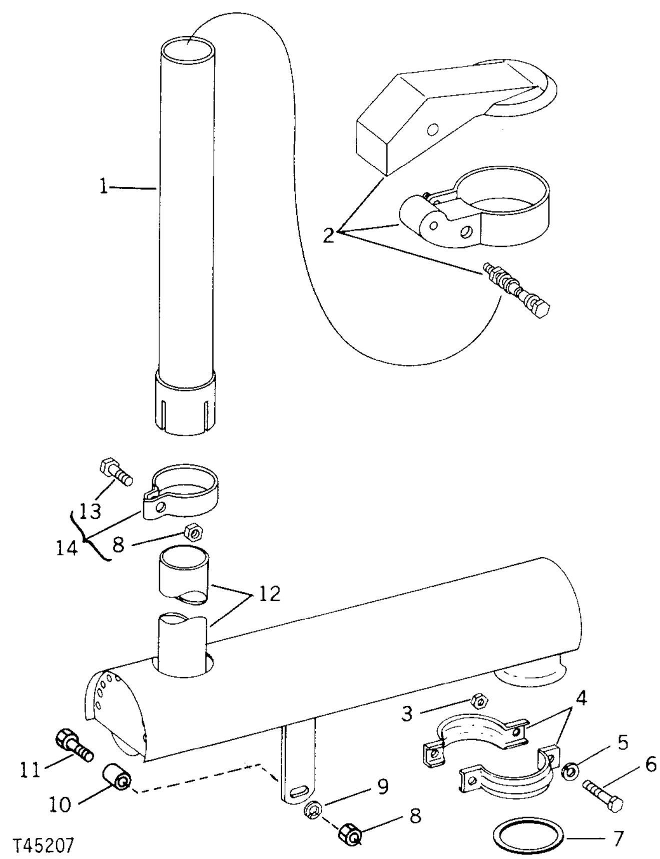
A muffler cover is also used to prevent the entrance of dirt and water into the engine.

REMOVAL

Remove exhaust extension.

Remove side screens and hood.

Remove muffler.



1—Extension
2—Muffler Cover
3—Nut (2 used)
4—Half Clamp (2 used)
5—Lock Washer (2 used)
6—Cap Screw (2 used)
7—Gasket
8—Nut (2 used)
9—Lock Washer
10—Pipe Spacer
11—Cap Screw
12—Muffler
13—Cap Screw
14—Clamp

Fig. 1-Muffler

REPAIR

Do not repair a defective muffler. A defective muffler must be replaced.

INSTALLATION

Install the muffler. Be sure the half clamps (4, Fig. 1) are correctly installed to prevent leakage of exhaust gasses at that connection.

Install hood, side screens and muffler extension. Note that the muffler cover opens toward the rear of the backhoe loader.

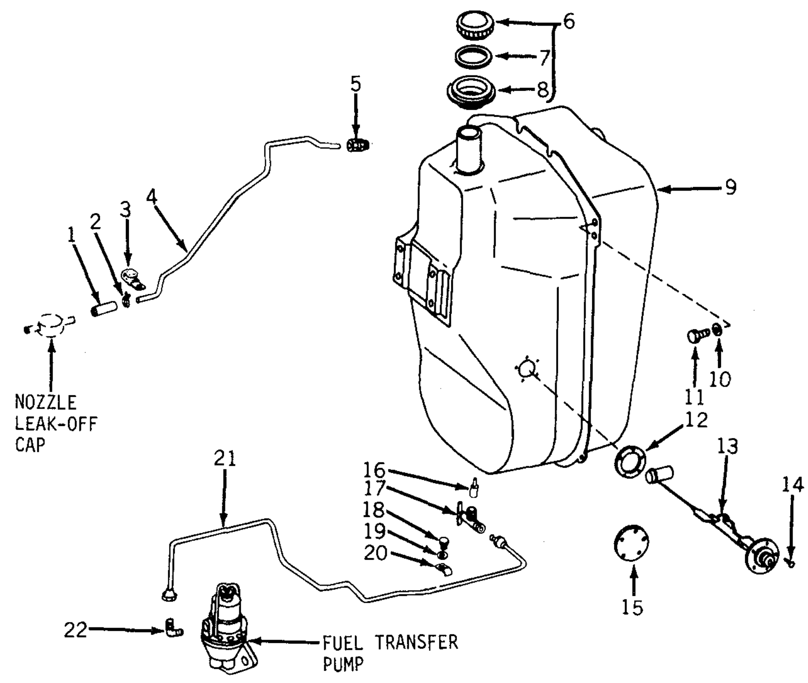
Group 0560
EXTERNAL FUEL SUPPLY SYSTEM

GENERAL INFORMATION

The fuel tank is located in front of the radiator, inside the grille housing. An electric fuel gauge sending unit is located on the right side of the tank. A fuel shut-off is located on the bottom of the tank.

REMOVAL

Remove front plate, side grilles, and hood. Separate air cleaner from the fuel tank. Close fuel shut-off valve. Disconnect fuel line(s) and fuel gauge sending wire.



1—Hose
2—Clamp
3—Clamp
4—Leak-off Tube
5—Connector
6—Fuel Cap
7—Gasket
8—Grommet
9—Fuel Tank
10—Washer (4 used)
11—Cap Screw (4 used)
12—Gasket
13—Sender
14—Drive Screw (5 used)
15—Cover
16—Tank Outlet Filter
17—Fuel Shut-Off Valve
18—Cap Screw
19—Lock Washer
20—Clip
21—Fuel Line
22—Elbow

Fig. 1-Fuel Tank and Lines

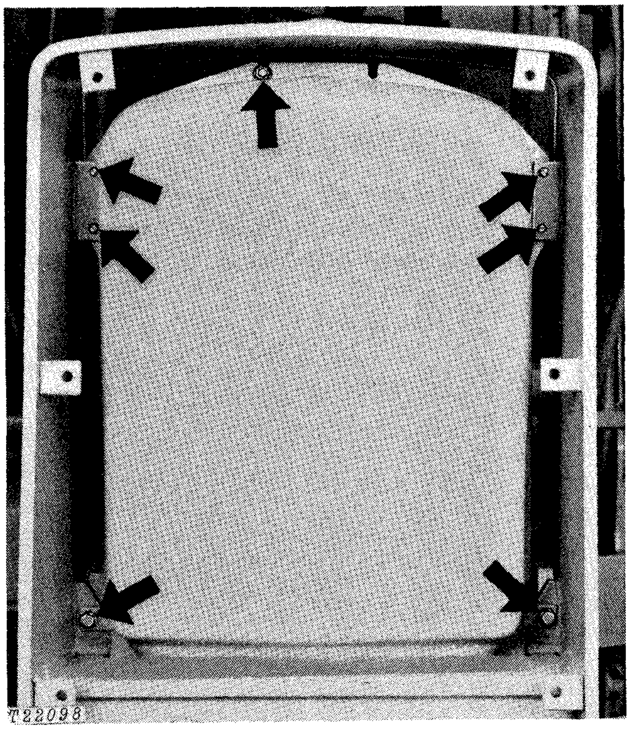


Fig. 2-Fuel Tank Attaching Points

Disconnect fuel tank at its attaching points (Fig. 2) and remove fuel tank and grille housing from the tractor.

REPAIR

Refer to Fig. 1 during disassembly and assembly. The nylon tank outlet filter (16) seldom needs cleaning because the sloshing of the fuel tends to wash dirt particles from the filter.

CAUTION: Cleaning and repairing a fuel tank is very dangerous. Live sparks, smoking, or fire of any nature should never be permitted in the vicinity of the cleaning or repairing operation.

FOS Refer to FOS-30, ENGINES for detailed information.

INSTALLATION

Follow removal in the reverse order when installing the fuel tank in the backhoe loader.

IMPORTANT: Install front support end of side grille retaining spring with open end of hook facing front of tractor.

Group 0599
SPECIFICATIONS AND SPECIAL TOOLS
COLD WEATHER STARTING AIDS
SPECIFICATIONS AND TORQUE VALUES

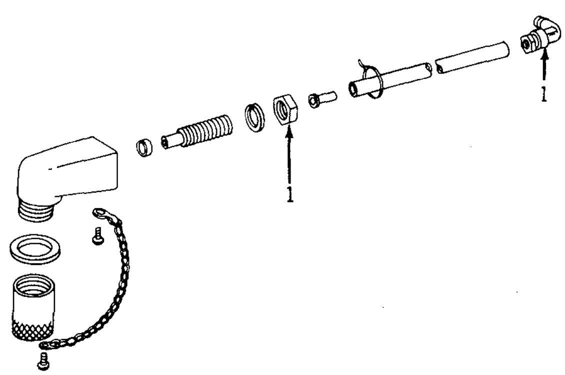


Fig. 1-Starting Aid Line Hex. Nuts

1 - Starting aid line hex. nuts torque . . . . 60 lb-in (6.8 Nm) (0.69 kg-m)

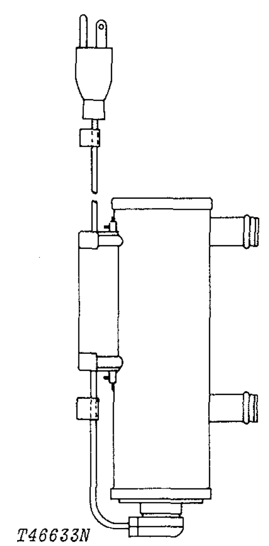


Fig. 2-Engine Coolant Heater

Engine coolant heater rating . . . . 1000 watts
115 volts

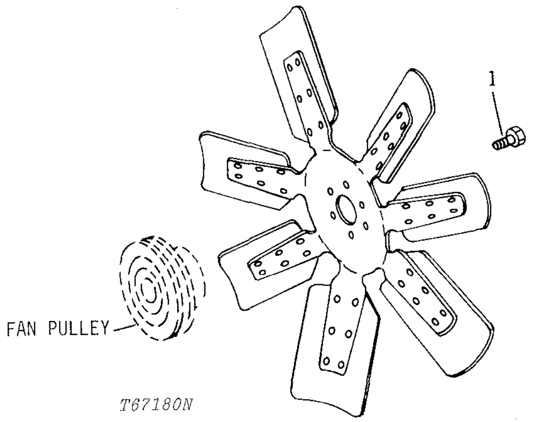
COOLING SYSTEM

SPECIFICATIONS AND TORQUE VALUES

Cooling system capacity .... 3 gal. (11.4 L)

Radiator cap test pressure .... 6.25 to 7.50 psi (0.4 to 0.5 bar) (0.4 to 0.5 kg/cm²)

1 - Fan to fan pulley cap screw torque .... 35 ± 3 lb-ft (47 ± 4 N·m) (4.8 ± 0.4 kg-m)



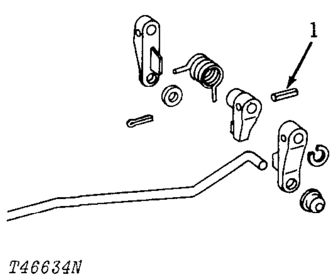
T67180N

Fig. 3-Fan to Fan Pulley

SPEED CONTROLS

SPECIFICATIONS AND TORQUE VALUES

1 - Speed control arm spring pin to protrude each side .... 1/16 inch (1.59 mm)



T46634N

Fig. 4-Speed Control Arm

EXTERNAL FUEL SUPPLY SYSTEM

SPECIFICATIONS AND TORQUE VALUES

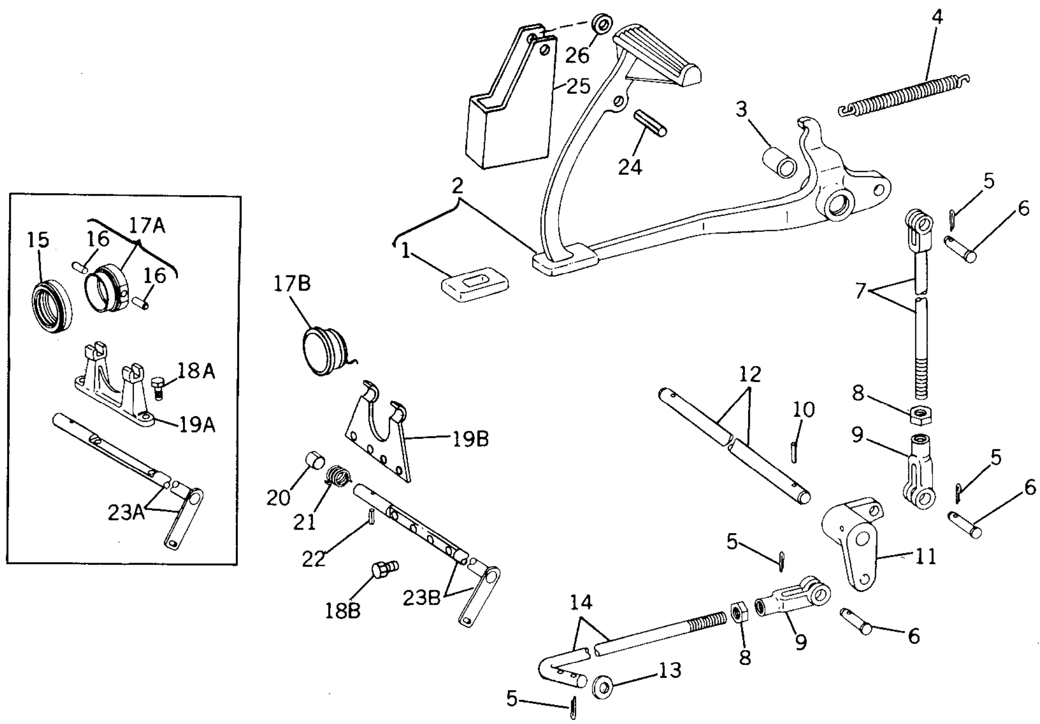
Fuel tank capacity .... 19.5 gal. (74 L)

Section 7
CLUTCH

CONTENTS OF THIS SECTION

Group 0715
CONTROLS

REPAIR



1—Pad
2—Clutch Pedal
3—Bushing
4—Pedal Return Spring
5—Cotter Pin (5 used)
6—Headed Pin (3 used)
7—Upper Clutch Control Rod
8—Nut (2 used)
9—Yoke (2 used)
10—Spring Pin
11—Clutch Control Bell Crank
12 —Clutch Control Shaft
13 —Washer (2 used)
14 —Clutch Fork Shaft Rod
15 —Throw-Out Bearing (-316080)
16 —Pin (2 used) (-316080)
17A—Throw-Out Bearing Carrier (-316080)
17B—Throw-Out Bearing Carrier (316081-)
18A—Cap Screw (2 used) (-316080)
18B—Cap Screw (4 used) (316081-)
19A—Fork (-316080)
19B—Fork (316081-)
20 —Bushing
21 —Fork Shaft Return Spring
22 —Spring Pin
23A—Clutch Fork Shaft (-316080)
23B—Clutch Fork Shaft (316081-)
24 —Spring Pin
25 —Pedal Stop
26 —Bowed Washers (2 used)

Fig. 1-Clutch Controls

Using directions given in Group 0741, separate engine from clutch housing.

Clutch Throw-Out Bearing and Bearing Carrier

Check throw-out bearing for evidence of overheating. If bearing appears to have been overheated or does not run smoothly, replace it.

Throw-out bearing should not be soaked in solvent as it is pre-packed with grease. Wipe clean with cloth dampened in solvent. NEVER attempt to oil the bearing.

If throw-out bearing requires replacing, press new bearing onto carrier with the highly polished surface toward the engine clutch assembly.

Prevent damage to bearing balls by inserting a block of wood between bearing and arbor or similar means to rotate bearing while installing. Do not use excessive pressure.

Check Pedal and Clutch Control Shaft

Inspect all parts of clutch pedal control linkage for wear or damage.

Clutch Fork Shaft

Inspect clutch fork shaft for evidence of binding or distortion.

Check for cracks in fork, wear in attaching holes, or wear along surface of fork which comes in contact with clutch throw-out bearing carrier.

NOTE: If unit has a one piece clutch fork shaft, it can be cut in two and replaced with the two piece clutch fork shaft.

Clutch Throw-Out Bearing Carrier Sleeve

Inspect clutch throw-out bearing carrier sleeve for wear or damage. If sleeve is damaged, replace clutch throw-out bearing carrier support.

Inspect clutch shaft bushing in clutch housing for wear or damage. If necessary, press in new bushing flush with outer edge of bore.

Inspect clutch shaft pivot and oil seal in center of clutch throw-out bearing carrier support for damage or oil leakage in clutch compartment. To replace oil seal, cover must be removed. Drive new seal in cover with sealing lips facing driver.

Clutch Shaft

Inspect shaft for wear or damage. Replace if necessary.

Clutch Pedal Return Spring

Pedal return spring (4, Fig. 1) has a free length of 10.46 in. (266 mm). The test length is 12.13 in. (308 mm) at 78 to 94 lb. (347 to 418 N) (35 to 43 kg) and 14.08 in. (358 mm) at 130 to 158 lb. (579 to 703 N) (59 to 72 kg).

INSTALLATION

Assemble all parts removed using Fig. 1

Join engine to clutch housing by reversing removal procedure as instructed in Group 0741.

Hold clutch control bellcrank (11, Fig. 1) so that the clutch control valve is completely bottomed in the engaged position. With the engine running at 2500 rpm and the clutch pedal against the clutch pedal stop (25) adjust upper clutch control rod (7) to obtain 155 ± 10 psi (1070 ± 17 kPa) (11 ± 0.7 bar) at clutch pressure tap. Then turn yoke one full turn to shorten control rod, install pin, and tighten nut in place.

With clutch pedal stop (25) down, depress the pedal (2) until the stop contacts the platform. At this position, adjust the clutch fork shaft rod (14) to obtain throwout bearing to clutch finger contact. Then shorten the clutch fork shaft rod (14) by 2-1/2 turns of the yoke (9).

It is necessary to make this adjustment after each time the clutch control rod is adjusted.

Group 0741
HOUSING AND COVERS

GENERAL INFORMATION

The transmission clutch housing attached to the rear of the engine flywheel contains the transmission oil pump, forward clutch assembly and reverse brake pack.

If the clutch housing, clutch shafts, or the bearings and seals which support these parts in the clutch housing are worn or damaged, it will be necessary to remove clutch housing from the tractor.

REMOVAL

Raise loader boom and support.

Disconnect battery ground strap. Drain oil from transmission. Bleed down accumulator by operating steering valve.

Disconnect all connections between clutch housing and engine except clutch housing-to-engine cap screws.

Remove operator's seat and floor panels.

Disconnect, mark and cap main pump pressure line at pressure control valve on right side of transmission.

Insert wooden blocks between front axle and front end support to keep tractor from tipping.

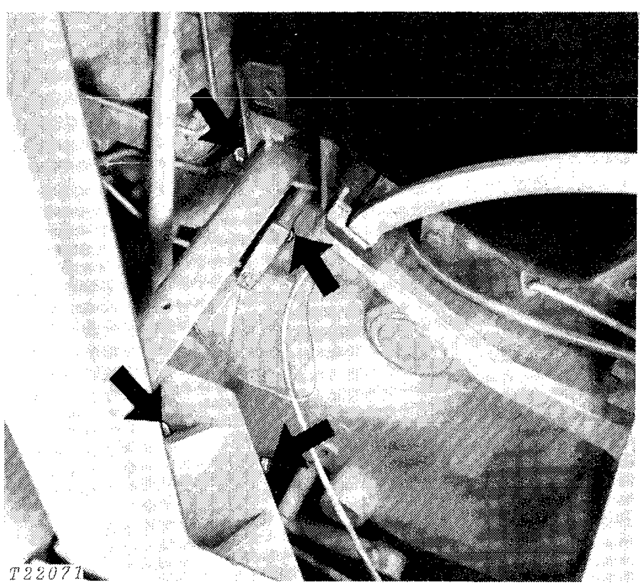


Fig. 1-Engine Attaching Points

Place solid blocking under loader frame and remove cap screws securing loader to front end support and canopy brackets to flywheel housing.

Support rear of machine and front of transmission case with solid blocking.

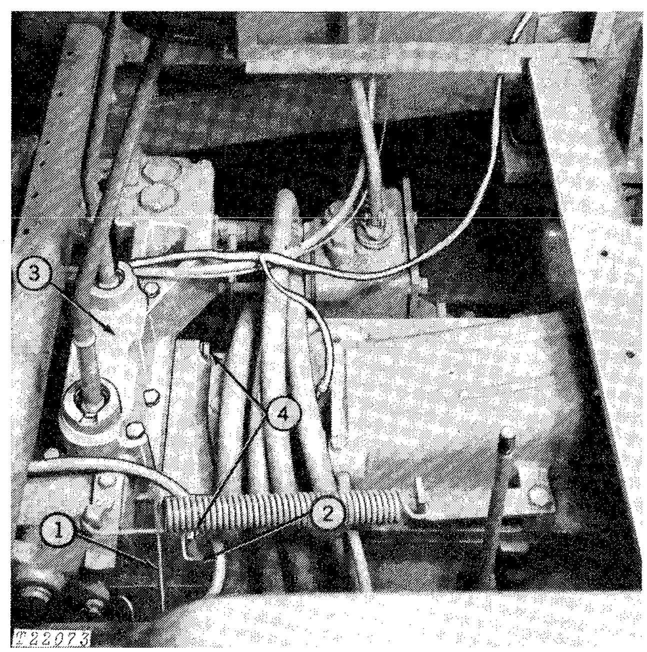
Install two JD-244 engine lifting adapters in engine cylinder head. Attach sling to adapters and to A-frame hoist.

Remove clutch housing-to-engine cap screws.

With the aid of a hoist, roll engine with front end assembly away from reverser housing.

Disconnect all the necessary wiring, linkage and hydraulic lines between upper cowl and clutch housing. Disassemble upper cowl from top of clutch housing.

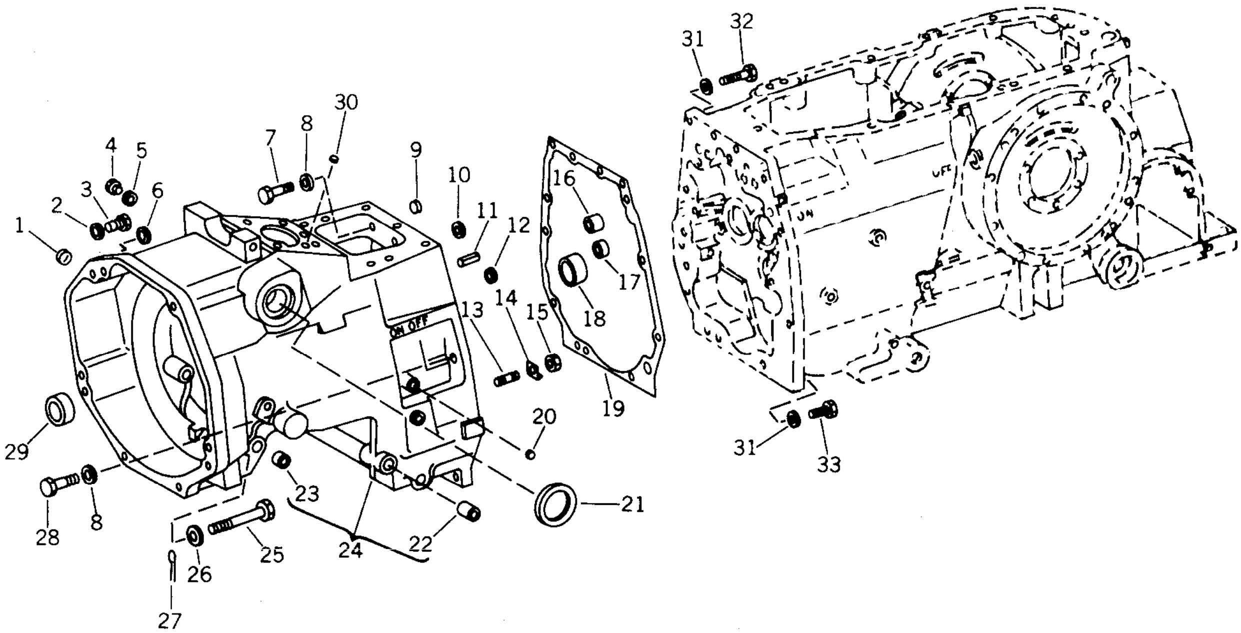
Disconnect and remove the brake valve and clutch housing cover.



1—Reverser Housing
2—Transmission Case
3—Clutch Housing Cover
4—Attaching Points

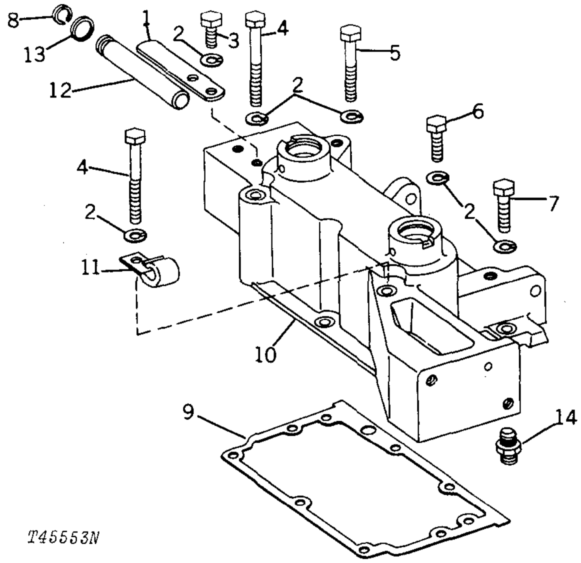
Fig. 2-Reverser Housing Attaching Points

Position a chain hoist around clutch housing. Remove cap screws securing housing to transmission case and remove housing from transmission.



1—Expansion Plug
2—Gasket (without tachometer)
3—Plug (without tachometer)
4—Steering Shaft Oil Drain Plug
5—O-Ring
6—O-Ring
7—High Strength Cap Screw (2 used)
8—Special Washer (3 used)
9—Plug
10—O-Ring
11—Spring Pin
12—O-Ring
13—Stud (4 used)
14—Lock Plate (4 used)
15—Nut (4 used)
16—Lubrication Tube Bushing
17—Pressure Tube Bushing
18—Pinion Carrier Shaft Planet Bushing
19—Gasket
20—Plug
21—Button Plug (2 used)
22—Bushing
23—Bushing
24—Clutch Housing
25—High Strength Cap Screw (4 used)
26—Special Washer (4 used)
27—Cotter Pin
28—High Strength Cap Screw
29—Forward Clutch Drum Bushing
30—Plug
31—Special Washer (8 used)
32—Cap Screw (2 used)
33—Cap Screw (6 used)

Fig. 3-Clutch Housing and Transmission Case



1—Pedal Stop
2—Lock Washer (11 used)
3—Cap Screw (2 used)
4—Cap Screw
5—Cap Screw (2 used)
6—Cap Screw (5 used)
7—Cap Screw
8—Snap Ring
9—Gasket
10—Clutch Housing Cover
11—Clamp
12—Clutch Pedal Pivot Shaft
13—Washer
14—Connector

Fig. 4-Clutch Housing Cover

INSTALLATION

Install clutch housing by reversing the removal procedure.

When joining clutch housing to transmission case, first tighten two of the cap screws (33, Fig. 3), one on each side of transmission pump inlet tube (Fig. 5), to 130 lb-ft (176 Nm) (18 kg/m) before tightening the other cap screws.

Tighten the remaining cap screws (28 and 33, Fig. 3) to 130 lb-ft (176 Nm) (18 kg/m), alternating from one side to the other with the top cap screws (7 and 32) torqued last.

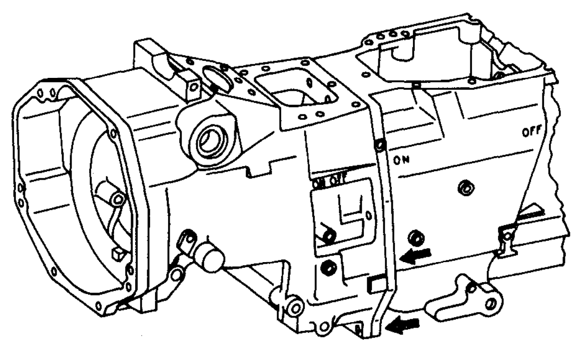
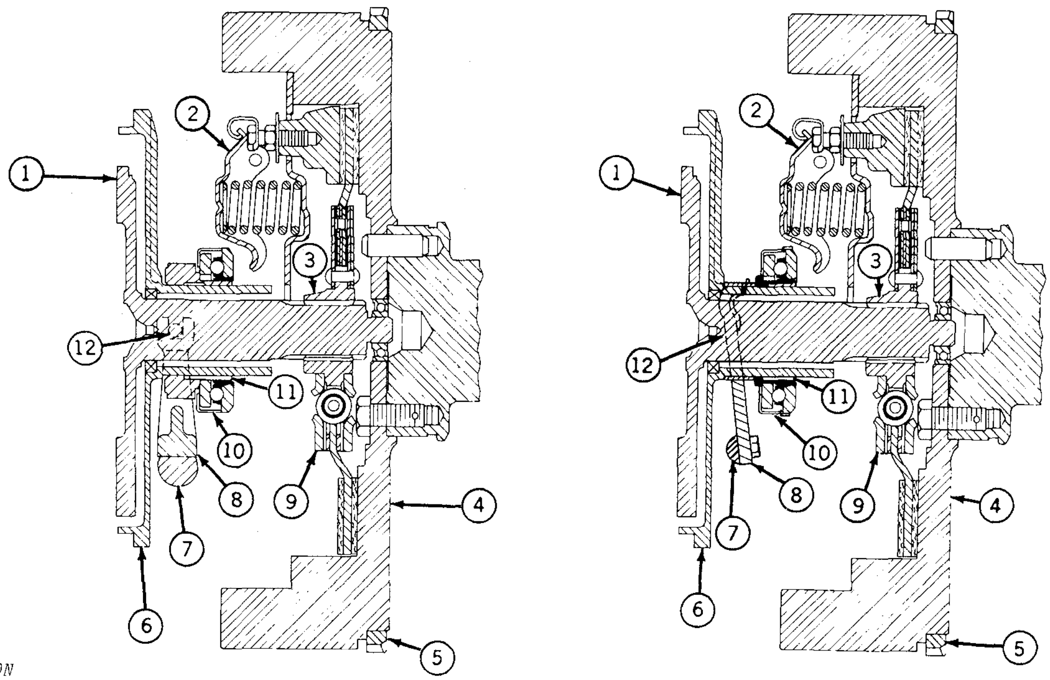


Fig. 5-Cap Screws Location on Each Sides of Transmission Pump Inlet Tube

Group 0752
ELEMENTS

GENERAL INFORMATION



T67330N

(-316080) (316081-)

1—Clutch Drive Shaft
2—Clutch Assembly
3—Clutch Disk Hub
4—Flywheel
5—Flywheel Ring Gear
6—Throwout Bearing Carrier
7—Clutch Shaft Fork
8—Clutch Fork
9—Clutch Disk
10—Clutch Release Bearing
11—Clutch Release Bearing Carrier
12—Pin

Fig. 1-Single Stage Clutch Assembly

A single stage engine clutch assembly is used on all units. The assembly is attached to the rear of the engine flywheel and consists of a single spring-loaded, dry disk type clutch with friction facings bonded to either side of the driven disk. When in the engaged position, these facings contact the rear surface of the engine flywheel and the pressure plate.

When the clutch pedal is depressed, the clamping action of the pressure plate is released, disengaging the clutch driven disk from the pressure plate and flywheel. This is the disengaged position.

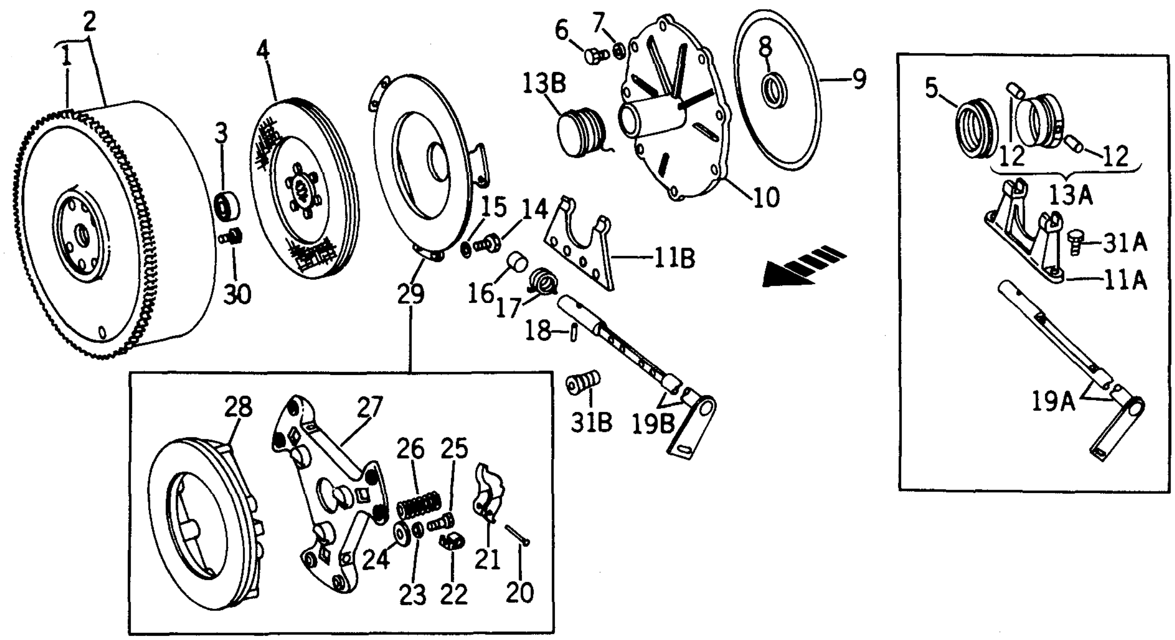
When the clutch pedal is released, coil springs within the pressure plate mechanism act against the pressure plate disk and clamp the friction surfaces of the driven disk between the pressure plate and the clutch surface of the flywheel. This causes the clutch driven disk to rotate with the pressure plate assembly and the flywheel, thereby transmitting engine power to the transmission. This is the engaged position.

The clutch and clutch control linkages are designed so that minor adjustment of the clutch is made externally, thereby eliminating disassembly of the clutch except at time of major overhauls.

NOTE: The clutch pedal has two operating positions. The first position (pedal stop down) operates the clutch pressure modulating valve which disengages the reverser by neutralizing the reverser clutch. The second position (completely depressed) disengages the clutch as explained above and interrupts the flow of power.

PRESSURE PLATE

REPAIR



T65272F

1 —Ring Gear
2 —Flywheel
3 —Ball Bearing
4 —Clutch Disk
5 —Throw-Out Bearing (-316080)
6 —Cap Screw (8 used)
7 —Lock Washer (8 used)
8 —Oil Seal
9 —Packing
10 —Bearing Carrier Support
11A—Fork (-316080)
11B—Fork (316081-)
12 —Pin (2 used) (-316080)
13A—Clutch Throw-Out Bearing Carrier (-316080)
13B—Clutch Throw-Out Bearing Carrier (316081-)
14 —Special Cap Screw (6 used)
15 —Lock Washer (6 used)
16 —Bushing
17 —Fork Shaft Return Spring
18 —Spring Pin
19A—Clutch Fork Shaft (-316080)
19B—Clutch Fork Shaft (316081-)
20 —Pivot Pin (3 used)
21 —Clutch Lever (3 used)
22 —Return Clip (3 used)
23 —Jam Nut (3 used)
24 —Special Washer (3 used)
25 —Special Screw (3 used)
26 —Spring (3 used)
27 —Clutch Bracket
28 —Pressure Plate
29 —Pressure Plate
30 —Cap Screw (4 used)
31A—Cap Screw (2 used) (-316080)
31B—Cap Screw (4 used) (316081-)

Fig. 2-Single Stage Clutch and Flywheel

Using directions given in Group 0741, separate engine from clutch housing.

Remove pressure plate attaching cap screws and lift pressure plate and driven disk from flywheel.

Do not immerse clutch disks in any type of cleaning solution as it will tend to glaze them.

Refer to Fig. 2 for identification of parts and proceed as follows:

Place flywheel on a bench and install pressure plate. Depress the inner ends of the release levers as far as possible without forcing against bracket. Do this by placing the flywheel on a hydraulic press and applying the load to the levers through a steel plate.

Loosen adjusting screw lock nuts. Back out the three cap screws from pressure plate and remove return clips.

Release assembly by gradually releasing load on press. The clutch may then be disassembled for inspection.

To separate release levers from bracket, first grind off peened ends of pivot pins.

Spring (26, Fig. 2) free length is 2.518 in. (63.96 mm). The test length is 1.812 in. (46.02 mm) with a test load of 294 lb. (1 308 N) (133 kg).

Flywheel and Clutch Pilot Bearing

Check ball bearing (3, Fig. 2) for excessive wear or tight spots by rotating inner bearing race with finger.

Replace bearing if defective. Pack new pilot bearing with high-temperature grease. Drive in new bearing (shielded side out) to bottom of counterbore with a driver which will contact only the outer bearing race.

Using a straightedge and feeler gauges, check the clutch plate driving surface to make sure it is flat within 0.006 in. (0.15 mm).

Using a straightedge and feeler gauges, check the flywheel driving surface to make sure it is flat within 0.006 in. (0.15 mm).

ASSEMBLY

Refer to Fig. 2.

Assemble release levers and bracket with new pivot pins.

Peen over ends of pins to secure assembly. Position spring cups in clutch bracket and place pressure springs in the cups.

Assemble bracket, spring, and lever over pressure plate. Be sure slots in bracket align with pressure plate drive lugs. Apply Lubriplate to sides of drive lugs to assure free operation of clutch assembly.

Place this assembly on a hydraulic press and apply pressure on lever directly above the pressure spring while forcing the spring into position in bracket.

Assemble return clips under adjusting screws in pressure plate. Be sure return clips are in proper position, and then tighten lock nuts.

INSTALLATION

Using either a JDE-52-1 Clutch Aligning Tool from the JDE-52A Universal Clutch Aligning Set or a clutch shaft, position clutch pressure plate assembly over end of shaft and into place on rear of flywheel.

NOTE: The long hub of driven disk must face away from flywheel.

ADJUSTMENT

Using a new clutch driven disk, bolt the clutch pressure plate and disk to a flywheel or fixture and adjust the clutch release levers using a JD-7 Clutch Finger Set Gauge.

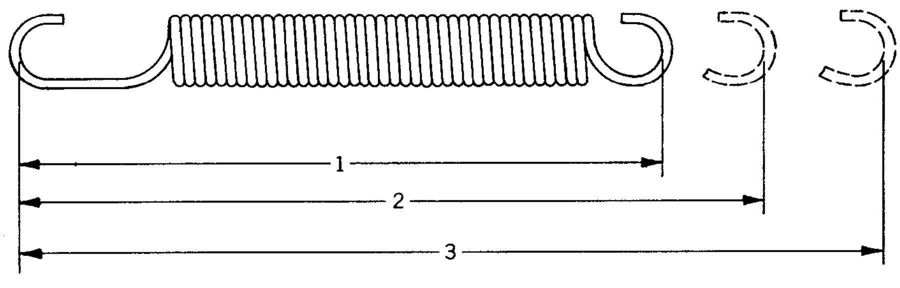
Place the gauge over the pressure plate with the gauge legs resting on the flywheel (not on any portion of the pressure plate rim) and with the step of the gauge (stamped "engine") over a release lever. Move the adjusting screw in or out to place release levers at the proper level. Repeat the above procedure on the remaining release levers.

After the release levers are adjusted and lock nuts tightened, depress the clutch levers several times. Recheck adjustment. If the levers dropped excessively, this process should be repeated until the setting is permanent.

To insure proper clutch functioning, the variation in the adjusted height of the release levers should not exceed 0.020 in. (0.51 mm).

Join engine to clutch housing by reversing removal procedure as instructed in Group 0741.

Group 0799
SPECIFICATIONS AND SPECIAL TOOLS
CONTROLS
SPECIFICATIONS AND TORQUE VALUES

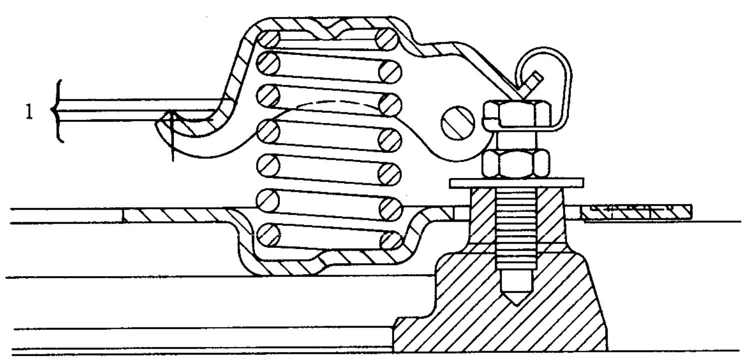


1 - Free length .... 10.46 in. (266 mm)

2 - Test length .... 12.13 in. (308 mm) at 78 to 94 lb. (347 to 418 N) (35 to 43 kg)

3 - Test length .... 14.08 in. (358 mm) at 130 to 158 lb. (579 to 703 N) (59 to 72 kg)

Fig. 1-Clutch Pedal Return Spring

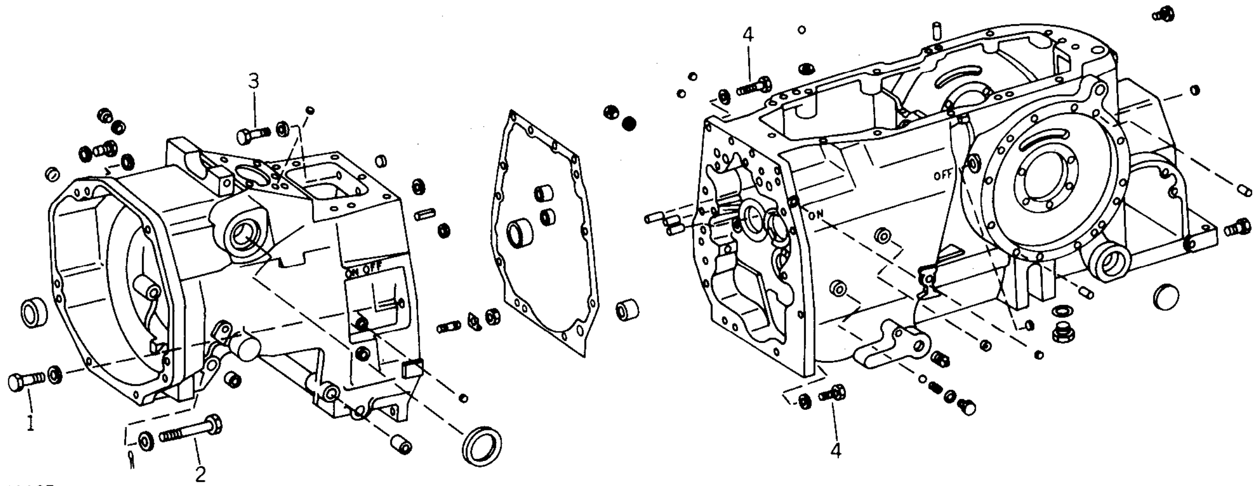


1 - The variation in adjusted height of the three release levers is not to exceed 0.020 in. (0.51 mm) when pressure plate is bolted in place.

Fig. 2-Clutch Release Levers

HOUSING AND COVERS

SPECIFICATIONS AND TORQUE VALUES



1 - Clutch housing-to-transmission case cap screw torque .... 130 lb-ft (176 Nm) (18 kg/m)

2 - Clutch housing to flywheel housing cap screw torque .... 250 lb-ft (339 Nm) (35 kg/m)

3 - Clutch housing-to-transmission case upper cap screw torque .... 130 lb-ft (176 Nm) (18 kg/m)

4 - Transmission case-to-clutch housing cap screw torque .... 130 lb-ft (176 Nm) (18 kg/m)

Fig. 3-Clutch Housing and Transmission Case

ELEMENTS

SPECIFICATIONS AND TORQUE VALUES

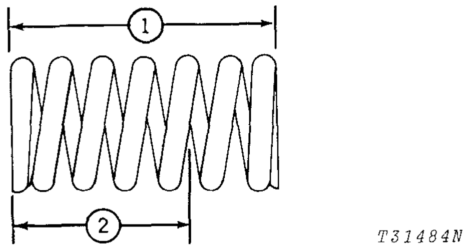


Fig. 4-Pressure Plate Spring

1 - Free length .... 2.518 in. (63.96 mm)
2 - Test length .... 1.812 in. (46.02 mm) at 294 lb. (1 308 N) (133 kg)

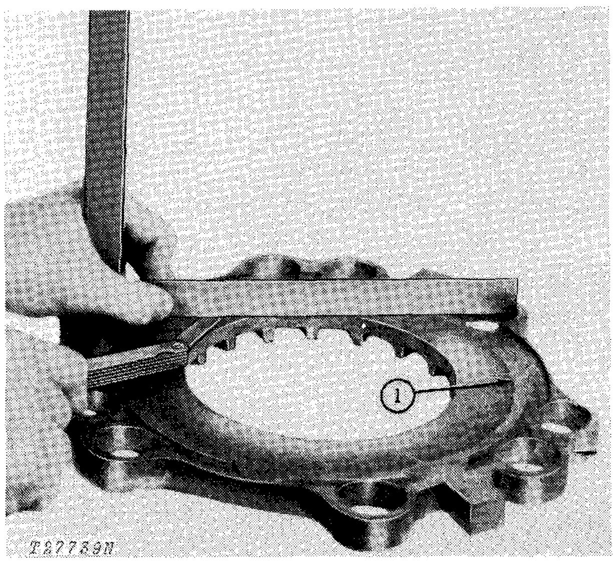


Fig. 5-Clutch Plate Drive Surface

1 - Clutch plate driving surface flat within .... 0.006 in. (0.15 mm)

ELEMENTS

SPECIFICATIONS AND TORQUE VALUES—Continued

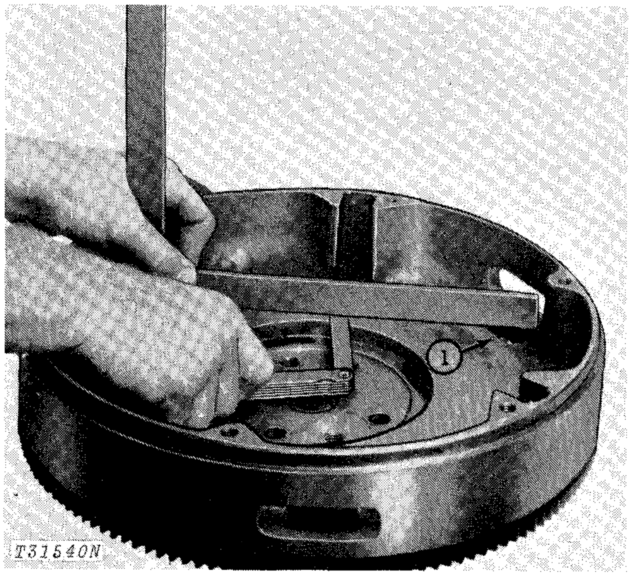


Fig. 6-Checking Flywheel Surface

1 - Flywheel driving surface
flat within .... 0.006 in.
(0.15 mm)

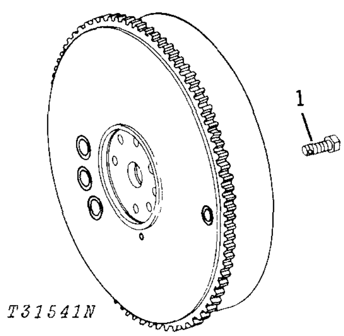


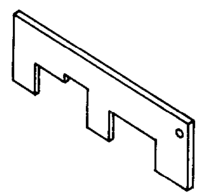
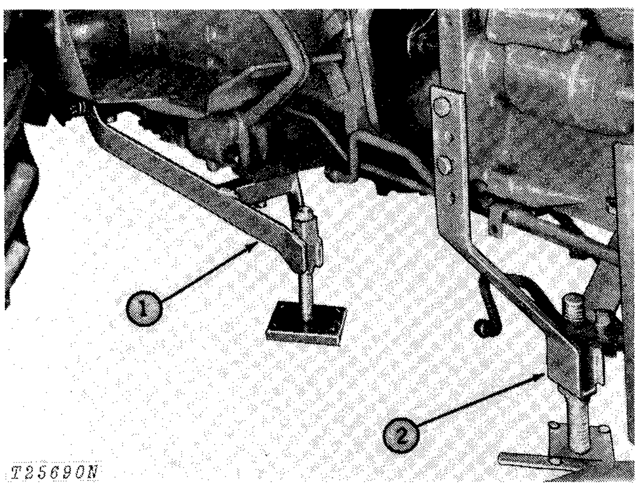
Fig. 7-Flywheel Retaining Cap Screws

1 - Flywheel-to-engine crankshaft
flange (D-grade) .... 85 lb-ft
(115 Nm) (12 kg-m)
(F-grade) .... 120 lb-ft
(163 Nm) (17 kg-m)

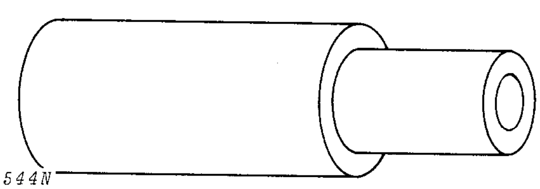
ELEMENTS

SPECIAL TOOLS

Essential Tools

Tool	Tool No.	Use
 T31543N *Fig. 8-Clutch Adjusting Gauge*	JD-7	Adjusting engine clutch pressure plate finger height (without continuous running PTO) (with reverser).
 *Fig. 9-Support Stands*	1 - JDG-2A or D-05007ST	Support rear half of tractor.
	2 - JDG-2C or D-05006ST	Support front half of tractor.

Convenience Tools

Tool	Tool No.	Use
 T31544N *Fig. 10-Dual Stage Adapter*	JDE-52-1	To properly line up clutch disk.

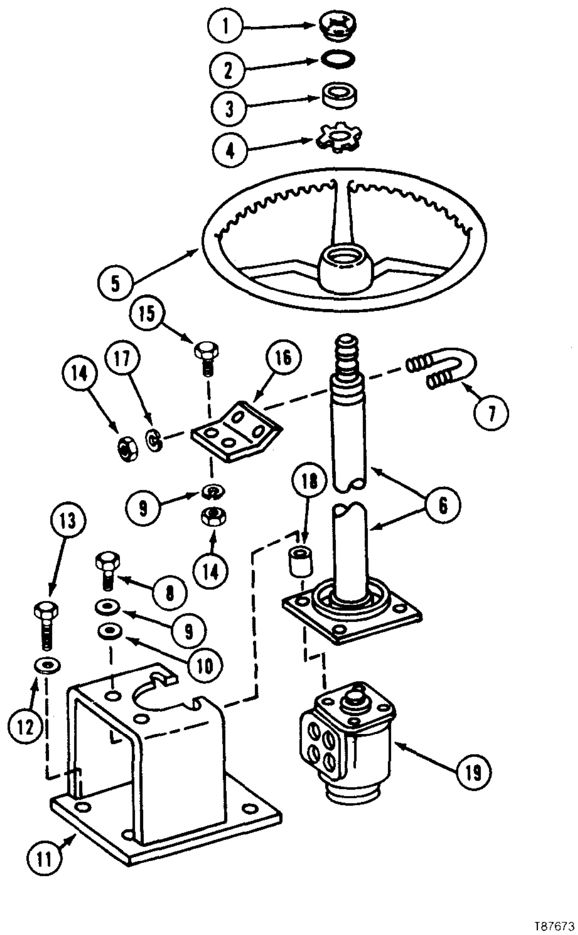
Section 9
STEERING SYSTEM

CONTENTS OF THIS SECTION

Group 0960
HYDRAULIC SYSTEM

STEERING WHEEL COLUMN AND VALVE SUPPORT

REMOVAL



1—Steering Wheel Emblem
2—O-Ring
3—Special Nut
4—Special Washer
5—Steering Wheel
6—Steering Column
7—U-Bolt
8—Cap Screw (4 used)
9—Lock Washer (6 used)
10—Washer (8 used)
11—Steering Valve Support
12—Lock Washer (4 used)
13—Cap Screw (4 used)
14—Nut (4 used)
15—Cap Screw (2 used)
16—Steering Shaft Support Bracket
17—Washer (2 used)
18—Spacer (4 used)
19—Steering Valve

Fig. 1-Steering Wheel Column and Valve Support

Lower all equipment to the ground.

Stop the engine. Disconnect battery ground strap.

Operate all manual control valves to release pressure in the hydraulic system.

Remove the hood.

Remove front cowl panel, and four cap screws fastening cowl to support.

Remove steering wheel emblem (1, Fig. 1), special nut (3), and special washer (4) to remove steering wheel (5).

Remove spring pin to remove reverser lever latch. Remove reverser level knob.

Remove cap screws from instrument panel. Slide instrument panel off reverser lever and lower panel into cowl.

Remove light switch from cowl. Disconnect wiring from horn button, cigar lighter, and hour meter.

For 310B units with cab, remove front foam panel.

Remove and slide cowl over steering shaft.

Remove U-bolt (7, Fig. 1) from steering column.

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

Disconnect the hydraulic lines from steering valve. Close all openings with caps and plugs to keep dirt out of the hydraulic system.

Remove cap screws (13, Fig. 1) to remove steering valve support (11), steering valve (19), and steering column as an assembly.

REPAIR

Remove cap screws (8, Fig. 1) to remove steering column (6) and steering valve (19) from steering valve support (11).

Inspect all parts for wear or damage; replace parts as necessary.

For repair of steering valve, see page 0960-8.

Put base of steering column on steering valve and install spacers (18, Fig. 1). Slide the assembly into steering valve support and fasten with cap screws (8), lock washers (9), and washers (10). Tighten cap screws.

INSTALLATION

Install the steering valve assembly and fasten with cap screws (13, Fig. 1) and lock washers (12). Tighten cap screws.

Connect the hydraulic lines to steering valve.

Fasten steering column with U-bolt (7).

Install cowl.

For 310B units with cab, install front foam panel.

Install light switch in cowl. Connect wiring to horn button, cigar lighter, and hour meter.

Install instrument panel and fasten with cap screws.

Install reverser lever latch and fasten with spring pin. Install reverser lever knob.

Install steering wheel and fasten special washer (4) and special nut (3). Tighten nut to 50 lb-ft (68 N·m). Install emblem (1).

Fasten cowl with four cap screws and install front cowl panel.

Install hood.

STEERING VALVE

GENERAL INFORMATION

The steering valve consists of a rotary spool and sleeve assembly located inside the valve housing with a gerotor at the end of the assembly.

Refer to Figs. 2 and 3 and study the following before attempting to diagnose steering difficulties.

Neutral Position

Whenever the steering wheel is not moving, the steering valve assumes the neutral position. In this position the spool and sleeve are lined up in such a way that oil flow through the valve is blocked. Oil can neither flow from the pump through the valve nor can it flow from the steering cylinder through the valve.

Left-Hand Turn (Fig. 2)

As the steering wheel is turned to the left, the spool is turned by means of its direct connection to the steering shaft. This movement aligns the spool passages with the sleeve ports and pressure oil begins to flow in the valve.

The oil flows through the sleeve, into spool passages, and back out of the sleeve into the valve housing. The passages in the housing direct oil to one side of the gerotor moving the gerotor gear. As the gear is rotated it performs the following functions:

1. It forces oil out of the gerotor into outlet passages in the housing, back through the sleeve and spool, and out the left outlet port (marked "L").

This oil is directed to the rod end of the steering cylinder. Return oil from the cylinder is forced back through the valve and out to the sump.

2. The rotation of the gerotor gear also turns the gerotor drive which is connected to and turns the valve sleeve.

When rotation of the steering wheel stops, the gerotor gear continues to move, turning the valve sleeve until the sleeve is in the correct relationship with the spool to stop the flow of oil to the gerotor. At this point the valve is in the neutral position and will remain there until the steering wheel is again moved.

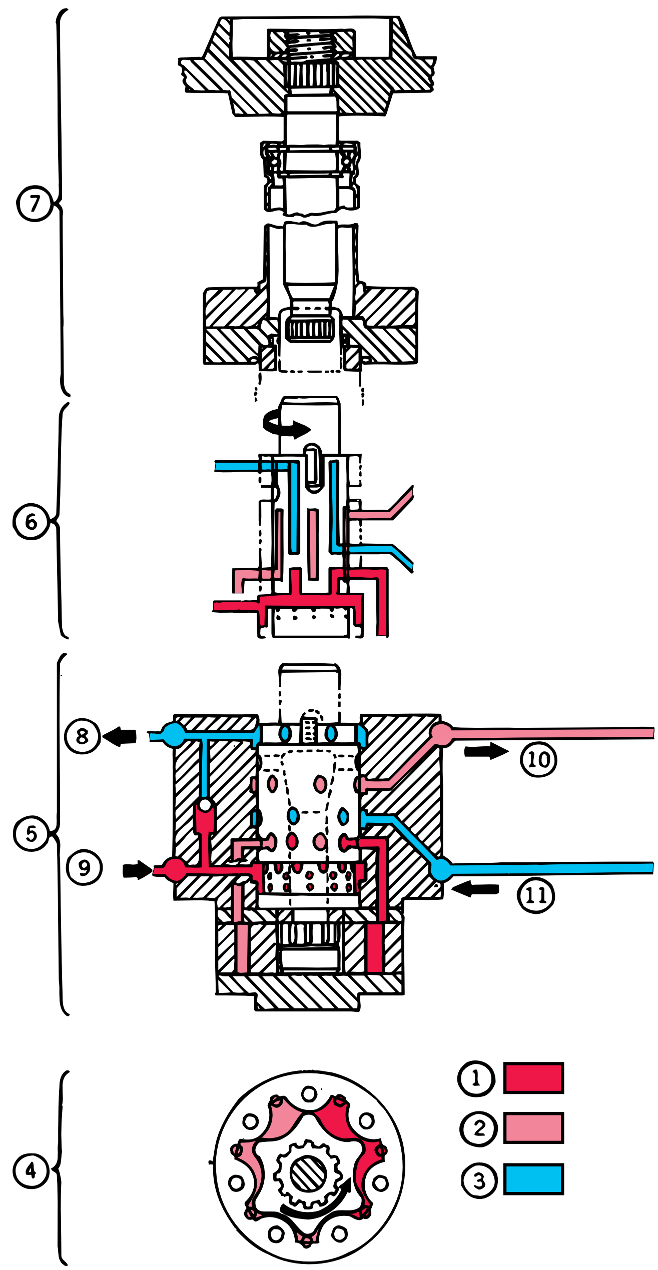
Right-Hand Turn (Fig. 3)

When the steering wheel is turned to the right, movement takes place in the valve which is similar to the movement occuring during a left-hand turn.

The movement of the spool, however, is in the opposite direction to a left turn and oil is routed through different ports and passages in the sleeve and spool, directing oil out the right outlet port (marked "R").

Manual Steering

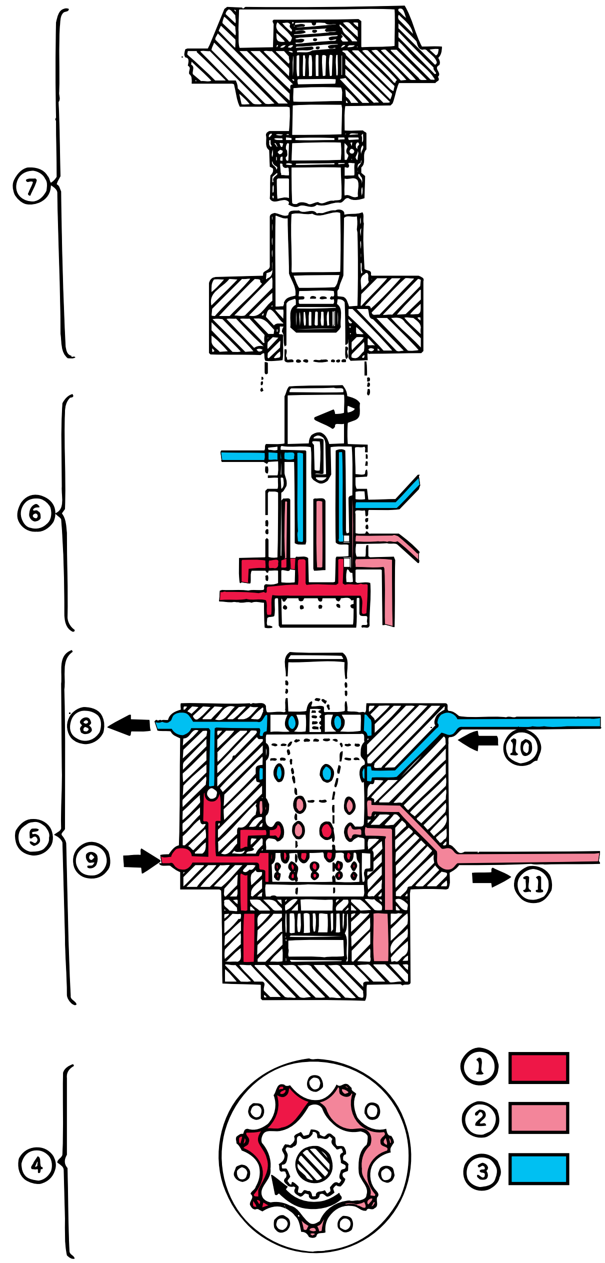
If there is no power to supply pressure oil to the valve, the unit can be steered manually. When the steering wheel is turned, the spool directs oil as described above. If no pressure oil is available, the spool will come into contact with the cross pin. The pin then provides a direct mechanical connection to the gerotor gear. As the gerotor is turned it pumps oil to the steering cylinder. Return oil from the cylinder is drawn through a check valve between the inlet and outlet ports to provide oil for manual steering operation. Thus the unit can be steered manually until the unit is brought to a stop.



T28611

1—Pump Pressure Oil
2—Steering Pressure Oil
3—Return Oil
4—Gerotor Assembly
5—Sleeve and Housing
6—Spool
7—Steering Column
8—Return to Transmission Sump
9—From Hydraulic Pump
10—To Cylinders
11—From Cylinders

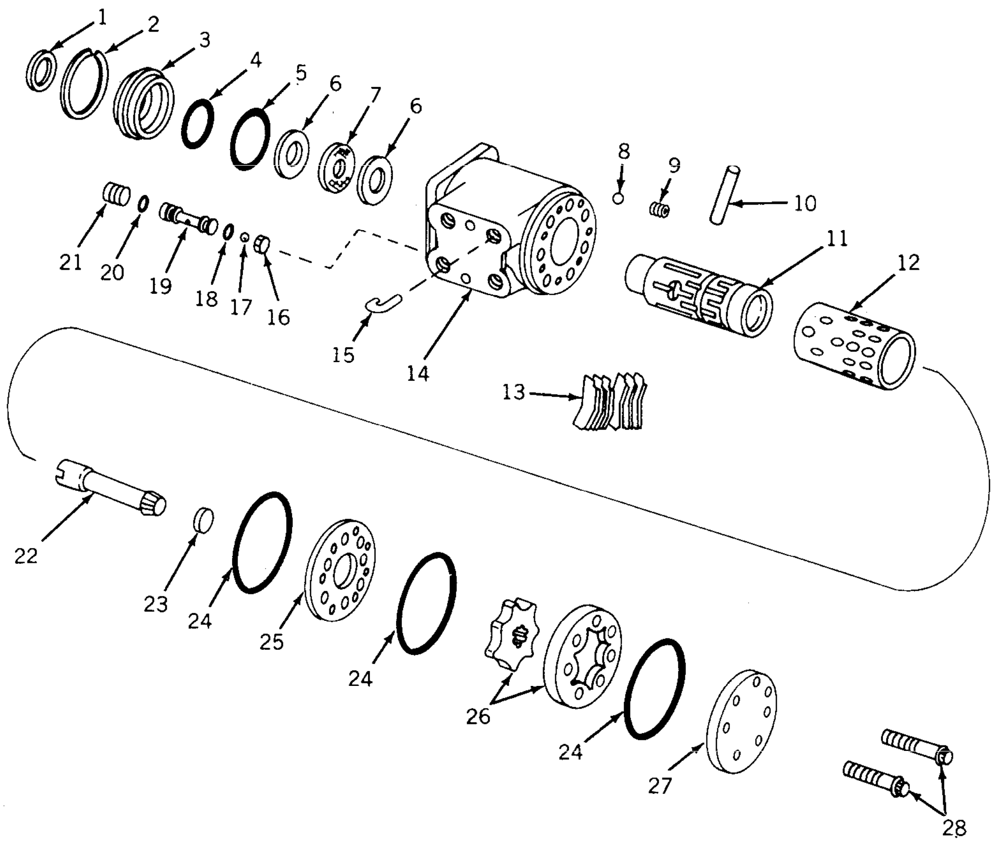
Fig. 2-Power Steering - Left Turn



T28612

1—Pump Pressure Oil
2—Steering Pressure Oil
3—Return Oil
4—Gerotor Assembly
5—Sleeve and Housing
6—Spool
7—Steering Column
8—Return to Transmission Sump
9—From Hydraulic Pump
10—From Cylinders
11—To Cylinders

Fig. 3-Power Steering - Right Turn



T65079N

1—Oil Seal
2—Snap Ring
3—Seal Gland Bushing
4—Quad Ring Seal
5—O-Ring
6—Bearing Race (2 used)
7—Needle Thrust Bearing
8—Ball (-292510)
9—Threaded Insert (-292510)
10—Pin
11—Control Spool
12—Control Sleeve
13—Centering Spring (6 used)
14—Housing
15—Clip Retainer (-292510)
16—Check Ball Retainer (292511-)
17—Check Ball (292511-)
18—O-Ring (292511-)
19—Check Ball Seat (292511-)
20—O-Ring (292511-)
21—Set Screw (292511-)
22—Drive Shaft
23—Spacer
24—O-Ring (3 used) (292511-)
25—Spacer Plate
26—Geroter Assembly
27—End Cap
28—Cap Screw (7 used)

Fig. 4-Steering Valve Assembly

REMOVAL

See page 0960-3 to remove steering valve.

REPAIR

Disassembly

IMPORTANT: Before starting to disassemble the steering valve be sure that the working area and tools are clean.

The steering valve itself should be free of dirt and grease. Use a solvent to clean oil and grease from valve. Also clean all paint from metering end of valve so that no paint flakes will enter these closely fitted parts during assembly.

Do not use a shop cloth to clean parts. Lint deposits can disrupt a function or cause leaks. The parts should be rinsed clean in solvent and blown dry with an air hose. Then place all parts on a clean paper towel.

Remove the seven special screws (28, Fig. 4) and remove end cap (27).

Carefully lift geroter and drive shaft from valve assembly.

NOTE: Remove spool and sleeve assembly only when necessary. Tolerance in this area is very close and when replacement is necessary, the housing, spool and sleeve must be ordered as a matched set.

If it is necessary to disassemble the housing, spool, and sleeve assembly, be careful to prevent these parts from binding. They are very closely fitted and must be rotated slightly as they are withdrawn.

IMPORTANT: Always remove spool and sleeve assembly from the 14-hole end of the housing.

Remove centering pin (10, Fig. 4).

Push the spool (11) so that it moves toward the splined end and remove it carefully from sleeve. Rotate the spool slightly as you remove it. Push the centering spring set out of the spring slots in the spool.

If it is necessary (-292510) to remove ball (8), reach through port opening and remove clip retainer (15). Remove threaded insert (9) and remove ball.

If necessary (292511-), remove set screw (21) to remove check ball seat (19), check ball (17), and check ball retainer (16).

Remove snap ring (2, Fig. 4) and remove gland bushing seal (3), bearing races and needle thrust bearings (6 and 7).

Assembly

NOTE: Replace all seals when assembling valve.

Insert ball (8, Fig. 4), clip retainer (15) and threaded insert (9) (-292510).

Install check ball retainer (16), check ball (17), check ball seat (19), and set screw (21) (292511-).

Install O-ring (5) into housing.

Install gland bushing (3) with quad ring seal (4) and oil seal (1). Install snap ring (2).

Install bearing races and needle bearings in housing.

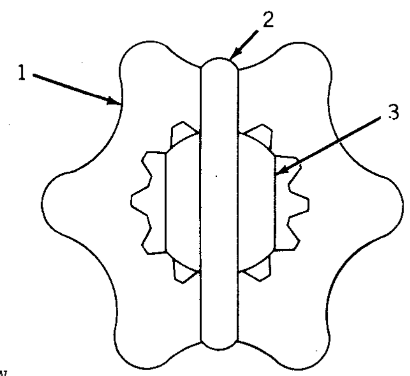
If spool and sleeve assembly were disassembled, install spool (11) in sleeve (12) carefully so that the spring slots of both parts are at the same end. Coat both parts with a film of oil and rotate while sliding parts together. Check spool and sleeve for free rotation. The spool should rotate smoothly in sleeve when fingertip force is applied at the splined end.

Insert spring installation tool (600057) through both spool and sleeve spring slots. Enter one end of spring set into tool. Compress the other end of spring set and draw into place through the spool and sleeve.

Install cross pin until it is flush or slightly below diameter of sleeve.

Install spool and sleeve assembly so the splined end of the spool enters the fourteen hole end of the housing first. Rotate spool and sleeve assembly gently during assembly.

Place the spacer plate on the steering motor housing so that the bolt holes in the plate align with the tapped holes in the housing. Place the metering section outer gear on the spacer plate so that the bolt holes align.



T42949N

T42949N

1—Metering Star Gear
2—Centering Pin
3—Control End Drive Slot End

Fig. 5-Timing Metering Star Gear And Control End Drive

Place the splined end of the control end drive within the metering star gear so that the slot at the control end of the drive is in alignment with the valleys between the metering star gear teeth. See Fig. 5.

Push the splined end of the control end drive partially through the metering star gear so that the spline extends about one-half its length beyond the metering star gear and hold it in this position while installing it into the housing. Chamfer on gear teeth must be toward the housing.

Note the position of the spool sleeve centering pin. Install the metering star gear with drive into the metering gear ring. Wiggle the parts slowly into position so the control end drive does not become disengaged from the metering star gear. Hold the spacer plate and metering gear ring in position on the housing while the gear is being installed. Rotate the metering star gear slightly to bring the cross slot of the drive into engagement with the centering pin.

NOTE: Alignment of the cross slot in the control end drive with the valleys between the teeth of the metering star gear determines the proper valve timing of the unit. There are twelve teeth on the spline and six pump lobes on the star. This means there are six possible correct timing positions. If the parts slip during assembly repeat timing procedure.

Place the spacer in the end of the metering star gear. If the spacer does not drop flush with the gear surface, the drive has not properly engaged centering pin.

Place the metering section end cap over the assembly. Install two cap screws finger tight to maintain alignment of the parts. Install the remaining cap screws and tighten them evenly to 250 lb-in (28.2 N·m) (2.9 kg-m).

INSTALLATION

See page 0960-4 to install steering valve, steering column, and steering valve support as an assembly.

STEERING CYLINDER

GENERAL INFORMATION

The double acting steering cylinders have a 1.998 inch (50.75 mm) bore and a 7.99 inch (203 mm) stroke.

Piston rods are chrome plated and are wiped clean on each stroke by polyurethane rod wipers.

FOS See "Hydraulic Cylinders" in FOS Manual "HYDRAULICS" for additional information on cylinders.

REMOVAL

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

Retract cylinder.

Disconnect and cap hoses from rod and barrel ends of cylinder.

Remove pins from both ends of cylinder and remove cylinder.

Disconnect and cap hoses from both ends of cylinder.

Remove pins from both ends of cylinder and remove cylinder.

REPAIR

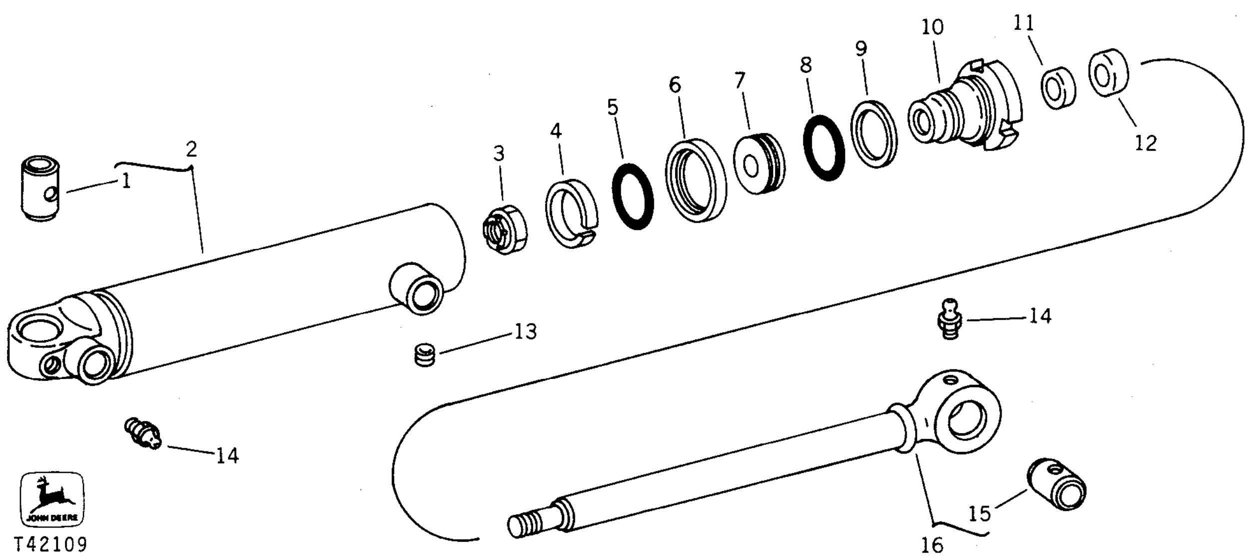
If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Remove plumbing from control valve to cylinder and flush hoses. Change transmission and hydraulic return filters.

Clamp the cylinder in a vise to prevent it from turning. Remove set screw and rod guide. Use a spanner wrench to loosen rod guide. Take care not to damage barrel.

Remove piston rod, rod guide and piston from barrel.

Clamp the rod end in a vise taking care to prevent damage to the piston rod. Remove nut from end of rod. Slide parts from end of rod.

Wash all parts thoroughly and inspect all parts.



1—Bushing
2—Barrel and Head Assembly with Bushing
3—Special Nut
4—Wear Ring
5—O-Ring
6—Piston Seal
7—Piston
8—O-Ring
9—Backup Ring
10—Rod Guide
11—Rod Seal
12—Wiper Seal
13—Set Screw
14—Straight Grease Fitting (2 used)
15—Bushing
16—Rod with Bushing

Fig. 6-Steering Cylinder

Assembly

Assemble parts on rod guide (10, Fig. 6) and slip rod guide on piston rod. Sealing lips of wiper seal (12) should face outward.

NOTE: Soak teflon piston seal (6) in 130°F (54°C) oil for five to ten minutes prior to assembling on piston.

Install O-ring (5) and piston seal (6) on piston (7).

Install wear ring (4) on piston. Carefully tap open end of wear ring to seat it in the piston groove.

Install a band-type hose clamp over wear ring (4) on piston and tighten securely.

Leave clamp over seal ring for a few minutes and then remove clamp just prior to inserting rod assembly in barrel. Seal ring will remain compressed long enough to allow piston installation in barrel.

Install piston assembly on rod. Tighten special nut (3) to 65 - 80 lb-ft (88 to 108 Nm) (9 to 11 kg-m) torque.

Coat cylinder bore with oil and insert rod assembly.

Tighten rod guide (10) to 250 - 300 lb-ft (339 to 407 Nm) (35 to 41 kg-m) torque.

Tighten set screw (13) to 40 lb-in (4.5 Nm) (0.5 kg-m) torque.

INSTALLATION

Place the cylinder in position on the machine and align the attaching holes. Insert pivot pins and secure with cotter keys. Connect the hydraulic lines, making sure they are connected to the same ends of the cylinder from which they were removed.

After replacing the cylinder, operate the cylinder several times to remove air from the system.

Group 0999
SPECIFICATIONS AND SPECIAL TOOLS
HYDRAULIC SYSTEM
SPECIFICATIONS AND TORQUE VALUES

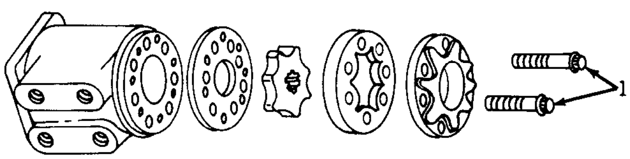


Fig. 1-Steering Valve End Cap

1 - End cap screw torque ....250 lb-in (28.2 Nm) (2.9 kg/m)

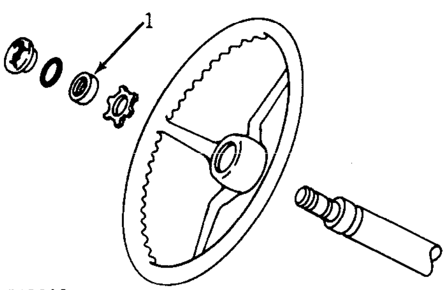
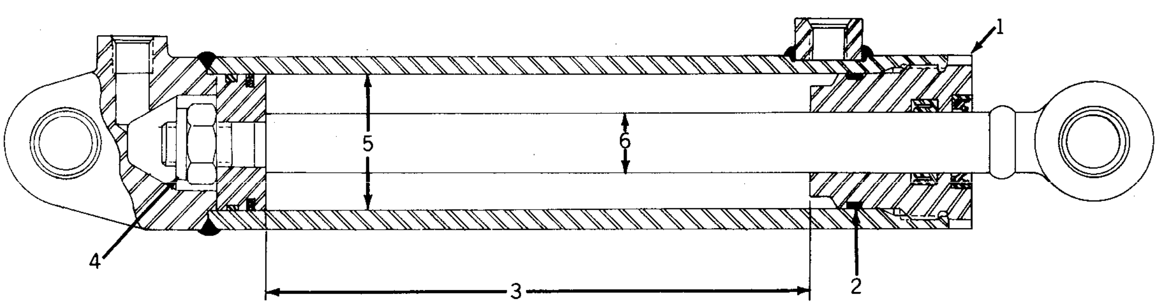


Fig. 2-Steering Wheel

1 - Steering wheel nut torque.............. 50 lb-ft (68 Nm) (7 kg/m)



1 - Rod guide torque .... 250 to 300 lb-ft (339 to 407 Nm) (35 to 41 kg/m)
2 - Set screw torque......................40 lb-in (4.5 Nm) (0.5 kg/m)
3 - Cylinder stroke.................7.87 to 8.11 in. (199.9 to 206.0 mm)
4 - Stop nut torque ....65 to 80 lb-ft (88 to 108 Nm) (9 to 11 kg/m)
5 - Cylinder bore .... 1.996 to 2.000 in. (50.70 to 50.80 mm)
6 - Rod diameter .... 0.8735 to 0.8765 in. (22.187 to 22.263 mm)

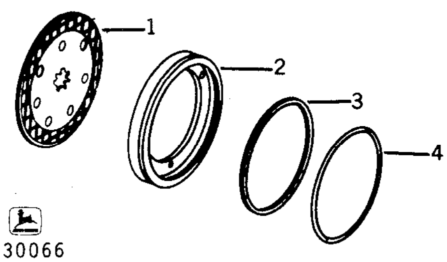
Fig. 3-Steer Cylinder

Section 10
SERVICE BRAKES

CONTENTS OF THIS SECTION

Group 1011
ACTIVE ELEMENTS

GENERAL INFORMATION



1—Brake Disk with Facings
2—Pressure Plate
3—O-Ring (Outside)
4—O-Ring (Inside)

Fig. 1-Brake Disk Assembly

The brakes are hydraulically-actuated, wet-disk type. Braking action is achieved when the pressure plate (2, Fig. 1) forces the brake disk with facings (1) against the stationary transmission housing. This action stops the rear axle from turning.

The pressure plate has three holes drilled radially in the piston area to allow oil to flow to the back of the disk, keeping the facing lubricated.

When repairing the brake system, both sides of the unit should be done at the same time.

Check for freedom of the brake pedal on the pedal shaft to assure that the brakes are releasing properly.

REMOVAL

Refer to Group 0201 and remove rear axle housing. Remove final drive shaft and brake disk as one piece.

Remove pressure plate by applying force at several points equally distributed around the circumference of the pressure plate.

NOTE: If brake pressure plate is not easily removed from housing, remove bleed screw on top of housing and attach a small hydraulic hand pump. Pump oil behind pressure plate to force it from cylinder.

Lift brake pressure plate from dowels on rear axle housing.

Remove and discard O-rings from the brake pressure plate.

INSTALLATION

Replace sun pinion in differential assembly.

Position new gasket on face of final drive housing.

Install brake disk against transmission case.

Coat O-rings (3 and 4, Fig. 1) and inner and outer piston surface area of pressure plate (2) with John Deere Multi-Purpose Grease or an equivalent and install in pressure plate grooves.

Coat pressure plate with grease and install into annular cylinder in axle shaft housing. Be sure O-rings are not cut. Make sure dowels in final drive housing are in line with holes in pressure plate.

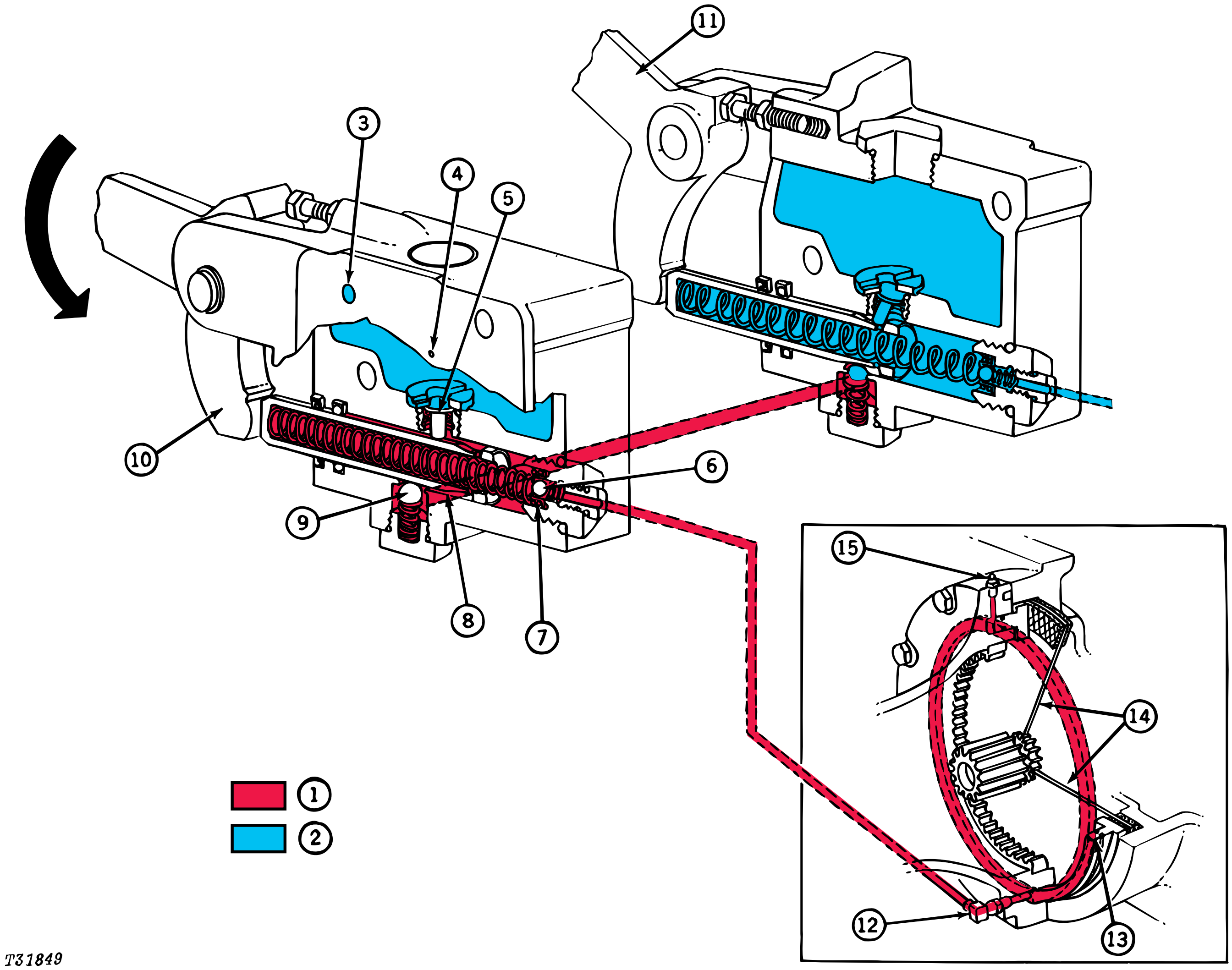
IMPORTANT: Line the holes in the pressure plate with the dowels.

Install assembled final drive unit on tractor and tighten cap screws.

Group 1060
HYDRAULIC SYSTEM

BRAKE VALVE

GENERAL INFORMATION



1—Pressure Oil
2—Low Pressure Oil
3—Brake Valve Reservoir Bleed Hole
4—Brake Valve Reservoir Inlet Hole
5—Reservoir Check Valve
6—Brake Line Check Ball
7—Retainer
8—Brake Valve Piston
9—Equalizing Valve
10—L.H. Brake Pedal
11—R.H. Brake Pedal
12—Hydraulic Brake Oil Inlet Fitting
13—Brake Pressure Plate
14—Brake Disk
15—Brake Bleed Screw

Fig. 1-Individual Hydraulic Brake Operation

FOS For additional basic hydraulic brake information refer to FOS Manual - HYDRAULICS.

The hydraulic brake assembly is activated by two brake pedals, allowing individual or simultaneous operation of the hydraulic brake pressure plates located in each final drive housing.

Braking is fully hydraulic with no mechanical connection between the valve and pressure plate.

The brake valve reservoir is filled with oil by the transmission oil pump via the transmission lubrication circuit.

As long as there is oil in the brake valve reservoir, hydraulic braking is possible with the engine either running or stopped.

Individual Braking

The brake valve reservoir is filled with oil from the transmission oil pump lube circuit through inlet hole (4, Fig. 1). Because the flow of oil is continuous, excess oil is dumped through bleed hole (3) to the main hydraulic oil reservoir. When both brake pedals are released, reservoir check valves (5) are unseated and the brake valve cylinders are filled with oil from the brake valve reservoir.

As a brake pedal is depressed, its respective brake valve piston (8) is moved rearward against spring pressure and against oil in the cylinder. As the piston continues to move rearward it closes the reservoir check valve (5) sealing off the cylinder from the reservoir. Oil is then pushed out of the valve cylinder, unseating brake line check ball (6). The oil moves through a brake line to the rear axle housing and applies a force against the pressure plate (13). This compresses the revolving brake disk (14) between the pressure plate (13) and the transmission case, causing a braking action.

When the brake pedal is released, the force against the pressure ring is relieved. The oil returning from the rear axle housing is metered by the brake line check ball (6, Fig. 1) assuring a governed rate of pedal return.

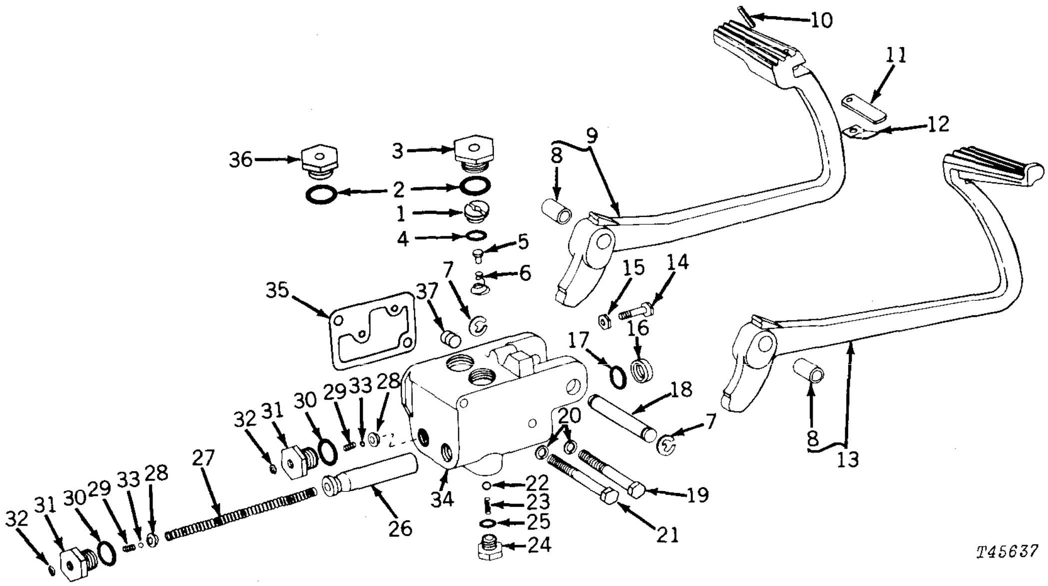
Equalized Braking

As either brake pedal is depressed, movement of the brake valve piston (8) unseats equalizing valve (9) on the bottom of the brake housing, opening a passage to the other brake cylinder, where oil flow is stopped by the opposite closed equalizing valve.

When both pedals are depressed simultaneously, the equalizing valves (9) on both brake cylinders are opened and connected by a drilled passage in the valve housing. Pressure oil in the two brake cylinders is thus equalized by oil in this passage and even braking pressure is accomplished.

Braking With Engine Stopped

Hydraulic braking with the engine stopped (transmission lubricating system not in operation) is possible if there is an adequate quantity of oil in the brake reservoir. The operation of the brake valve is the same as that previously described.



1—Reservoir Check Valve Seat (2 used)
2—O-Ring Packing (2 used)
3—Filler Plug
4—O-Ring Packing (2 used)
5—Reservoir Check Valve (2 used)
6—Spring (2 used)
7—Retaining Ring (2 used)
8—Bushing (2 used)
9—L.H. Brake Pedal
10—Spring Pin
11—Brake Pedal Lock Bar
12—Leaf Spring
13—R.H. Brake Pedal
14—Cap Screw (2 used)
15—Hex. Jam Nut (2 used)
16—Oil Seal (2 used)
17—O-Ring Packing (2 used)
18—Brake Pedal Shaft
19—Cap Screw
20—Lock Washer (2 used)
21—Cap Screw
22—Ball (2 used)
23—Spring (2 used)
24—Plug (2 used)
25—O-Ring Packing (2 used)
26—Brake Piston (2 used)
27—Piston Spring (2 used)
28—Retainer (2 used)
29—Spring (2 used)
30—O-Ring Packing (2 used)
31—Brake Line Check Valve Seat (2 used)
32—O-Ring Packing (2 used)
33—Ball (2 used)
34—Brake Valve and Cylinder Housing
35—Gasket
36—Plug
37—Pipe Plug

Fig. 2-Brake Valve and Cylinder Housing

REPAIR

Disconnect hydraulic brake lines from valve and remove valve from tractor.

Refer to Figure 2 and do the following:

1. Remove brake pedals.

2. Remove brake line connectors and allow brake line check balls and springs to fall free of valve. Remove brake line check valve seats and check ball retainers.

3. Push brake pistons (protruding from front of valve) and piston return springs out the rear ports of valve.

4. Remove reservoir filler plug(s) (3, Fig. 2) from top of valve to gain entry to reservoir check valves.

5. Using a screwdriver with a bit that fits milled slot in check valve seal, remove both reservoir check valves.

6. Remove equalizing springs and balls (23 and 22) from bottom of valve.

Inspecting Brake Valve Assembly

Check brake valve housing for cracks or damage, especially at the two brake cylinder bores. Carefully inspect equalizing ball seats for foreign matter or damage. Replace housing if necessary.

Replace O-ring packings located in each cylinder bore. Dip new packings in oil before installation.

Examine oil seals on outer end of each brake cylinder. If seals require replacement, coat lips of seals with oil. Install oil seals with sealing lips facing outward.

Inspect brake pistons for wear or damage. Wash pistons in solvent and replace if necessary.

Check piston spring (27, Fig. 2) for wear or broken coils and test spring to specifications.

Piston Spring (27, Fig. 2)
Free length .... 7.50 in. (190.5 mm)
Test length .... 5.75 in. (146.1 mm)
when compressed w th 18 to 22 lb.
(80 to 98 N) (8 to 10 kg)

Brake Line Check Valve Spring (29, Fig. 2)
Free length .... 0.42 in. (10.7 mm)
Test length .... 0.24 in. (6.10 mm)
when compressed with 2.7 to 3.3 oz.
(0.8 to 0.9 N) (0.08 to 0.09 kg)

Reservoir Check Valve Spring (6, Fig. 2)
Free length .... 0.89 in. (22.6 mm)
Test length .... 0.33 in. (8.4 mm)
when compressed with 0.09 to 0.13 lb.
(0.4 to 0.6 N) (0.04 to 0.06 kg)

Equalizing Valve Spring (23, Fig. 2)
Free length .... 0.79 in (20.1 m)
Test length .... 0.28 in. (7.1 m)
when compressed with 0.13 to 0.17 lb.
(0.6 to 0.8 N) (0.06 to 0.08 kg)

Examine reservoir check valve (5, Fig. 2) for damage or wear, especially in the area where the piston contacts the valve. Replace valve if necessary.

Check reservoir check valve spring for damaged or worn coils. Replace if necessary.

Check brake pedal bushings for wear or scoring. Remove old bushings and install new bushings flush with outside edges of brake pedals.

ASSEMBLY

Use Fig. 2 as a guide in assembly.

Dip all O-rings, valves, and pistons in oil before assembly.

INSTALLATION

Using a new gasket, install brake valve. Connect all hydraulic brake lines.

When assembling brake pedal (9, Fig. 2) install leaf spring (12) in front of the brake pedal lock bar (11).

ADJUSTMENT AND BLEEDING

The following adjustment and bleeding procedures are to be made in the sequence shown any time the brake valve is removed and disassembled.

1. Bleeding Air From The Brake System

Run the engine for approximately two minutes to allow the transmission lubricating system to fill brake valve reservoir (clutch engaged and engine at fast idle).

NOTE: If it is not desirable to run engine at this time, the brake valve reservoir may be filled by removing the filler plug on top of the valve.

Attach a clear plastic bleeder tube to a brake bleed screw (located on top of axle shaft housing) and insert the tube in the transmission filler hole on rear of rockshaft housing.

Open bleed screw.

Press brake pedal on brake being bled. Close screw before returning pedal.

Continue this operation until oil in tube is free of air bubbles.

Never allow brake pedal to return sharply, permitting brake valve piston to release quickly, as damage to valve parts may occur before brakes are completely adjusted.

NOTE: Brake valve reservoir must be refilled after each 15 strokes of brake pedal.

With brake pedal depressed, close bleed screw securely. Remove bleeder tube and repeat bleeding operation on other brake.

2. Brake Pedal and Equalizing Valve Adjustment

This adjustment must be made any time the brake valve is disassembled. Failure to adjust pedal stop screws will allow a mechanical interference between the brake pistons and reservoir check valves, causing undue wear on valve parts.

Make this adjustment after the brake system is free of air (see above).

Right-Hand Pedal Adjustment

Adjust the right-hand brake pedal adjusting screw so that the right-hand brake piston is fully extended from the housing and the brake pedal arm is tight against the piston (not so tight as to move piston) with no piston free travel.

Apply a slight force to the left-hand brake pedal (approximately 10 pounds [45 N] [5 kg]). The left-hand pedal may start to settle. Turn the pedal adjusting screw on the right-hand pedal counterclockwise (out) 1/3 turn. Pedal should stop settling. If it does not, a leak in the brake system is indicated.

Left-Hand Pedal Adjustment

Adjust the left-hand brake pedal adjusting screw so that the left-hand brake piston is fully extended from the housing and the brake pedal is tight against the piston (not so tight as to move piston) with no piston free travel.

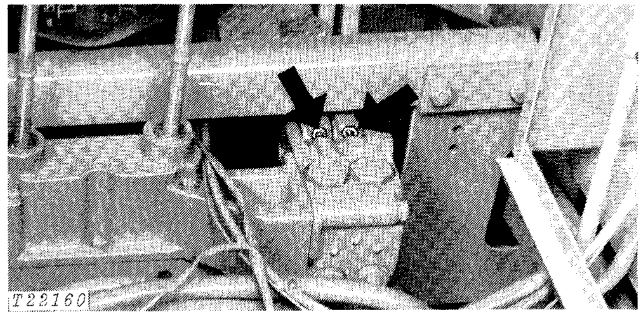


Fig. 3-Brake Pedal Adjusting Screws

Apply a slight force to the right-hand brake pedal (approximately 10 pounds [45 N] [5 kg]). The right-hand pedal may start to settle. Turn the pedal adjusting screw on the left-hand pedal counterclockwise (out) 1/3 turn. Pedal should stop settling. If it does not, a leak in the brake system is indicated.

After both pedals have been adjusted, align the pedals by turning the screw on the highest pedal counterclockwise no more than 1/3 turn.

After making adjustments, check each pedal separately and simultaneously to make sure the pedal returns to the stop screw, the piston is tight against brake pedal, and the check valve opens (brakes do not drag) when the brakes are released.

Checking Brake Pedal Settling

Apply a 60 pound (267 N) (27 kg) continuous force to each brake pedal and hold for one minute. Pedal should not settle more than one inch (25 mm) during this period.

IMPORTANT: Check each pedal separately, not both simultaneously.

CLEAN-UP PROCEDURE

A brake or hydraulic component failure may produce particles in the hydraulic system which are too fine to be filtered by the system return filter. Use the following method to clean the system.

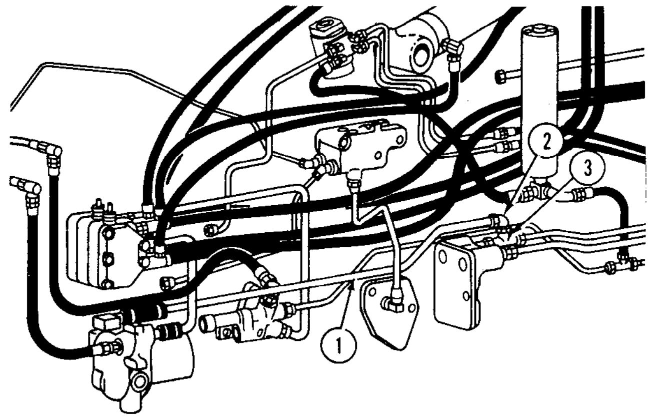
Parts required are:
A—One Filter Assembly
B—Two Filter Elements (10 Micron)
C—One Hose
D—Two 90° Fittings with O-Ring

Install the element (2, Fig. 5) in the filter assembly (3).

Connect one 90° fitting (4) to the inlet port of the filter assembly.

Connect one 90° fitting (4) with hose (5) to the outlet port of the filter assembly.

Disconnect the return oil filter to adapter line (1, Fig. 4) from the adapter (3).



T64363N

T64363N

1—Return Oil Filter to Adapter Line
2—Elbow (1, Fig. 5)
3—Adapter (6, Fig. 5)

Fig. 4-Return Oil Filter to Adapter Line and Adapter Location

Connect the elbow (2, Fig. 4) (1, Fig. 5) to the filter inlet and the hose (5, Fig. 5) to the adapter (3, Fig. 4).

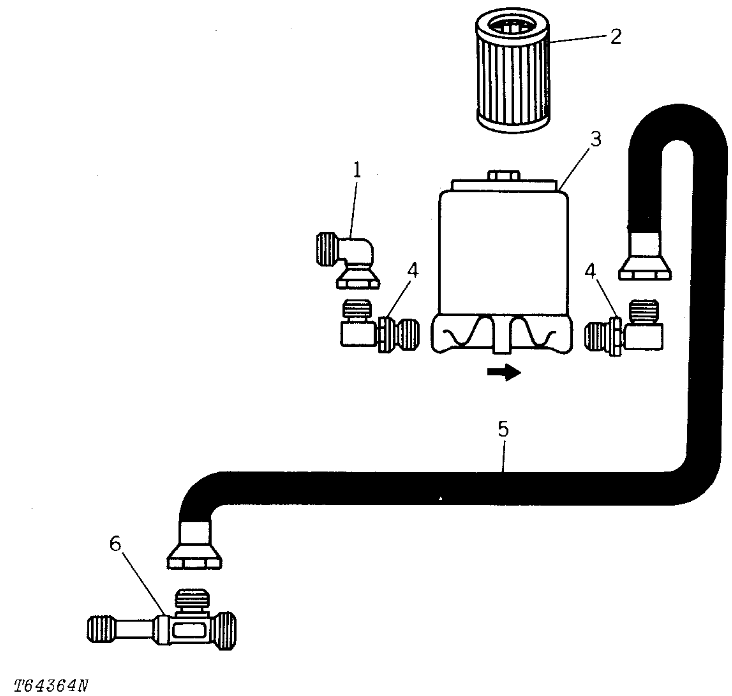
Operate the backhoe at approximately 3/4 throttle for 1-1/2 hours and the loader for 1/2 hour.

Replace the filter element (2, Fig. 5).

Leave the filter assembly in line for an additional 10 to 20 hours of normal operation.

Remove the filter assembly.

Connect elbow (2, Fig. 4) to adapter (3).



T64364N

1—Elbow, 90 Deg. Swivel (2, Fig. 4)
2—Filter Element (10 micron) (2 used)
3—Filter Assembly
4—Elbow, 90 Deg. with O-Ring (2 used)
5—Hose
6—Adapter (3, Fig. 4)

Fig. 5-Oil Filtering Assembly

Group 1099
SPECIFICATIONS AND SPECIAL TOOLS
HYDRAULIC SYSTEM
SPECIFICATIONS AND TORQUE VALUES

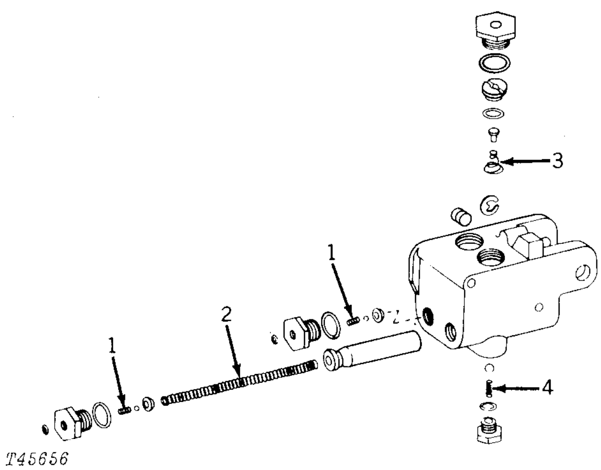


Fig. 1-Brake Valve

1 - Brake line check valve spring
Free length . . . . 0.42 in. (10.7 mm)
Test length . . . . 0.24 in. (6.10 mm)
when compressed with 2.7 to 3.3 oz. (0.8 to 0.9 N) (0.08 to 0.09 kg)

2 - Piston spring
Free length . . . . 7.50 in. (190.5 mm)
Test length . . . . 5.75 in. (146.1 mm)
when compressed with 18 to 22 lb. (80 to 98 N) (8 to 10 kg)

3 - Reservoir check valve spring
Free length . . . . 0.89 in. (22.6 mm)
Test length . . . . 0.33 in. (8.4 mm)
when compressed with 0.09 to 0.13 lb. (0.4 to 0.6 N) (0.04 to 0.06 kg)

4 - Equalizing valve spring
Free length . . . . 0.79 in. (20.1 mm)
Test length . . . . 0.28 in. (7.1 mm)
when compressed with 0.13 to 0.17 lb. (0.6 to 0.8 N) (0.06 to 0.08 kg)

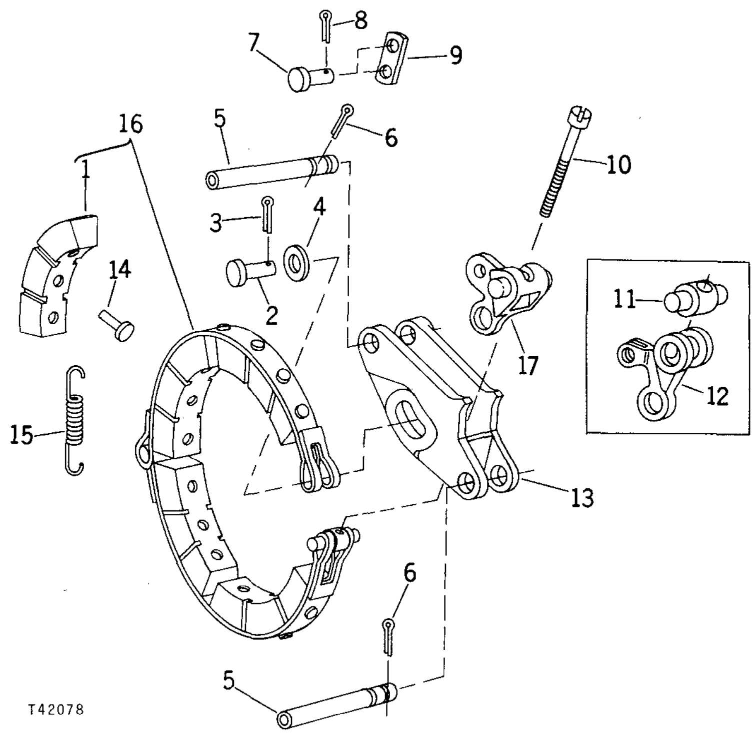
Section 11
PARKING - EMERGENCY BRAKES

CONTENTS OF THIS SECTION

Litho in U.S.A.

Group 1111
ACTIVE ELEMENTS

GENERAL INFORMATION



1—Brake Band Lining (4 used)
2—Pin
3—Cotter Pin
4—Washer
5—Special Pin (2 used)
6—Cotter Pin (2 used)
7—Pin (2 used)
8—Cotter Pin (2 used)
9—Bell Crank Link (-285117)
Link (2 used) (285118-)
10—Set Screw
11—Pivot Pin (-285117)
12—Brake Bell Crank (-285117)
13—Toggle Lever
14—Rivet (12 used)
15—Return Spring
16—Brake Band Assembly
17—Brake Band Arm (285118-)

Fig. 1 Parking Brake Band, Lining and Linkage

The 310A and 310B can be ordered with an optional parking brake. If so equipped, the brake consists of a hand operated lever, a two-piece brake band and a brake drum. The brake drum is splined to the left-hand differential housing. When the lever is pulled to the "ON" position, the brake band tightens around the drum to hold the tractor stationary.

REMOVAL

If the parking brake drum (6, Fig. 2) is to be worked on, remove both axles.

If only the parking brake band with lining or linkage is being worked on, it will only be necessary to remove seat support base.

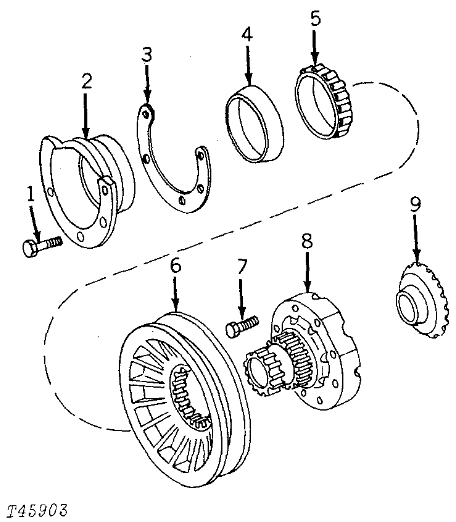
Remove seat support base.

Referring to Figs. 1 and 2, remove parking brake.

REPAIR

Check all parts for worn or bent condition.

Replace as necessary.



1—Place Bolt (5 used)
2—Quill (L.H.)
3—Shim (As Required)
4—Bearing Cup (L.H.)
5—Bearing Cone (L.H.)
6—Parking Brake Drum (With Parking Brake)
7—Place Bolt (8 used)
8—Differential Housing (L.H.)
9—Differential Bevel Gear (2 used)

Fig. 2-Left Half Differential with Parking Brake Drum

INSTALLATION

Referring to Figs. 1 and 2, reinstall parking brake.

Tighten rear axle housing to transmission case cap screw to 85 lb-ft (115 Nm) (12 kg-m).

Apply parking brake five times to seat linkage.

Burnish brake band as follows:
1. Apply parking brake firmly
2. Place transmission in fourth gear forward
3. Set engine speed at 1500 rpm
4. Engage clutch and burnish brake band for 20 to 25 seconds

ADJUSTMENT

Set brake lever so that brake latch (11, Fig. 1, page 1115-1) is in first notch above long tooth.

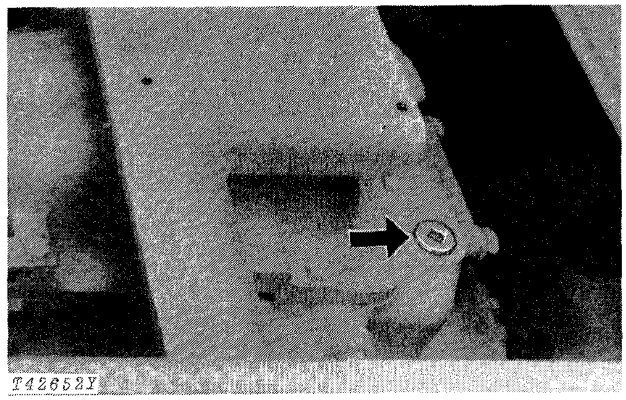
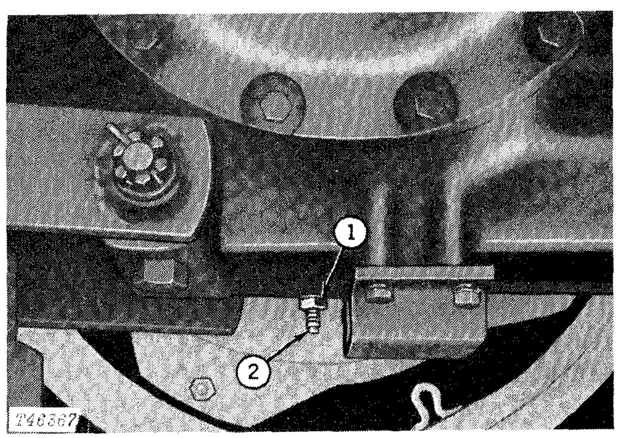


Fig. 3-Brake Band Plug

Remove brake band plug from top left side of the transmission case. Tighten the brake band adjustment set screw (slotted screw) (10, Fig. 1) with a wide blade screwdriver by hand, until it is not possible to turn screw another complete half turn. Final position of screw should have concave surface of screw head mating with surface of pivot pin. Install and tighten plug.



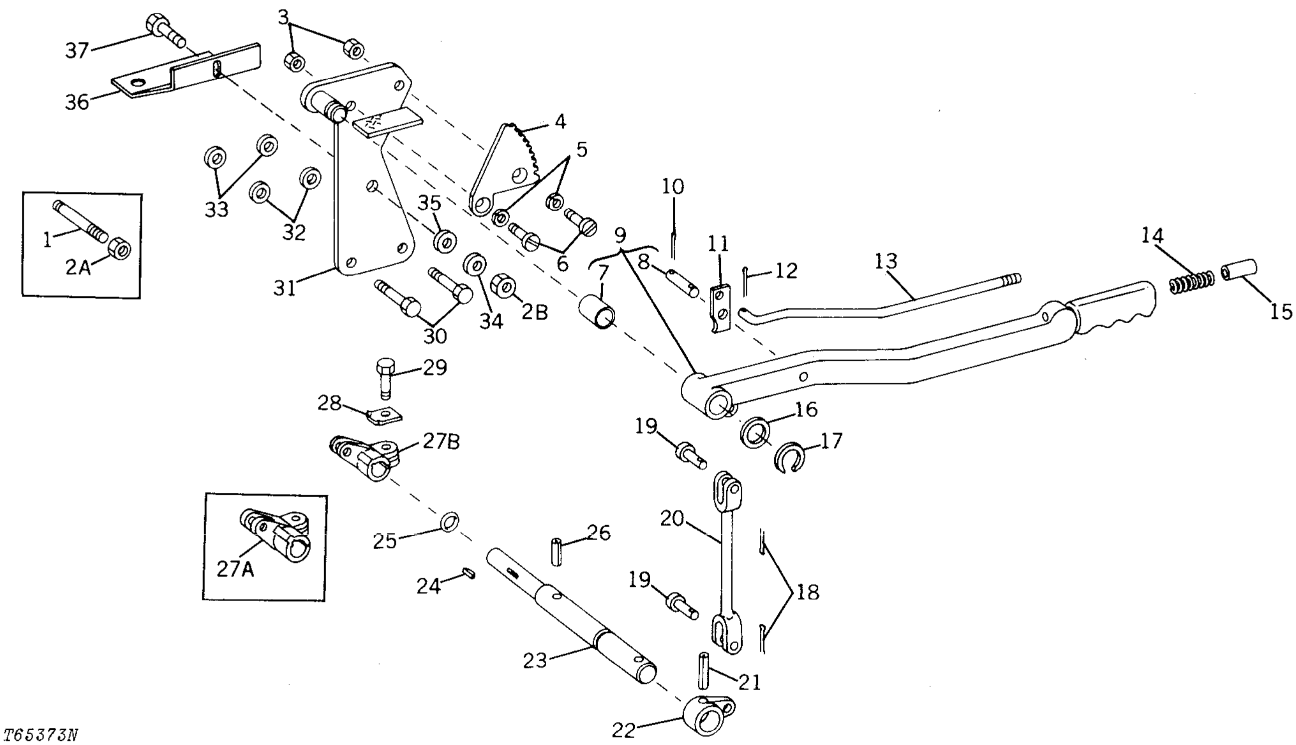
1—Jam Nut **2—Brake Band Stop Screw**

Fig. 4-Brake Band Stop

Loosen jam nut (1, Fig. 4) (located on bottom left side of the transmission case). Tighten the brake band stop screw (2) and back off two turns. Tighten jam nut with the stop screw held in adjusted position.

Group 1115
CONTROLS LINKAGE

REPAIR



T65373N

1 —Stud (-300420)
2A—Lock Nut (2 used) (-300420)
2B—Lock Nut (300421-)
3 —Nut (2 used)
4 —Brake Latch Plate
5 —Lock Washer (2 used)
6 —Screw (2 used)
7 —Bushing
8 —Pin
9 —Brake Lever
10 —Cotter Pin
11 —Brake Latch
12 —Cotter Pin
13—Brake Latch Rod
14—Spring
15—Button
16—Washer
17—Snap Ring
18—Cotter Pin (2 used)
19—Pin (2 used)
20—Brake Rod
21—Spring Pin
22—Parking Brake Outer Arm
23—Brake Shaft
24—Woodruff Key
25—O-Ring
26 —Spring Pin
27A—Brake Shaft Arm (-285117)
27B—Brake Shaft Arm (285118-)
28 —Lock Plate
29 —Cap Screw
30 —Cap Screw (2 used)
31 —Brake Lever Support
32 —Washer (2 used)
33 —Washer (2 used)
34 —Lock Washer (300421-)
35 —Washer (300421-)
36 —Support (300421-)
37 —Cap Screw (300421-)

Fig. 1-Parking Brake Lever and Linkage

The parking brake lever (9, Fig. 1) is located on the right-hand side of the driver's seat, between the seat and control box.

The parking brake is actuated by pulling up on the lever.

The parking brake is released by depressing the button (15) and pushing back down.

Refer to Fig. 1 during disassembly and assembly of the control linkage.

Inspect control linkage for worn or damaged parts.

Coat shafts and movable linkage parts with grease before assembly.

Install pin (26) into brake shaft so top of pin is below top surface of transmission case.

The brake band release spring should have 4.80 in. (121.9 mm) with tension at 16.2 to 19.8 lb. (72 to 88 N) (7 to 9 kg). The test length should be 5.16 in. (131.1 mm) with tension at 46 to 56 lb. (205 to 249 N) (21 to 25 kg).

The brake latch rod springs free length is 1.77 in. (45.0 mm). The test length is 1.26 in. (32.0 mm) when compressed with 5.55 to 6.95 lb. (25 to 31 N) (2.5 to 3.2 kg).

Group 1199
SPECIFICATIONS AND SPECIAL TOOLS
ACTIVE ELEMENTS
SPECIFICATIONS AND TORQUE VALUES

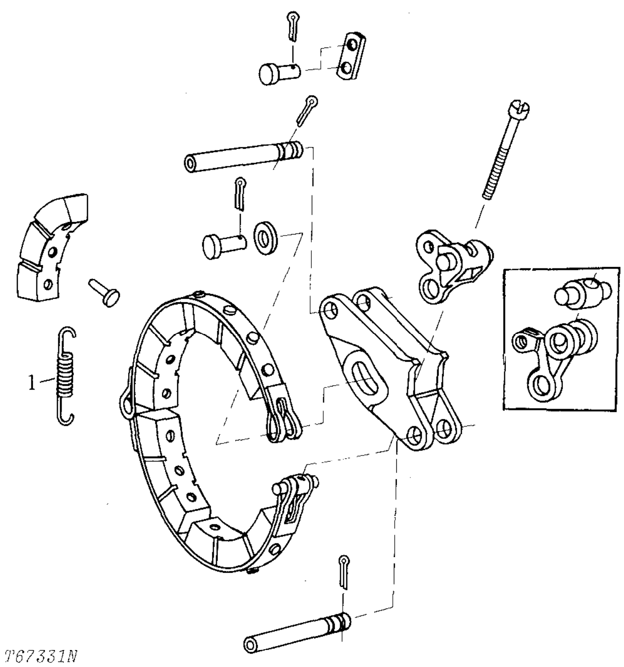


Fig. 1-Brake Band and Release Spring

1 - Brake band release spring
Free length . . . . 4.80 in. (121.9 mm)
with initial tension at 16.2 to 19.8 lb. (72 to 88 N) (7 to 9 kg)
Test length . . . . 5.16 in. (131.1 mm)
with tension at 46 to 56 lb. (205 to 249 N) (21 to 25 kg)

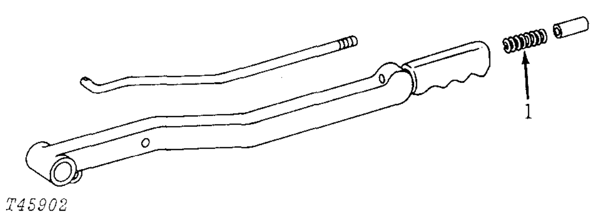


Fig. 2-Brake Latch Rod Spring

1 - Brake latch rod spring
Free length . . . . 1.77 in. (45.0 mm)
Test length . . . . 1.26 in. (32.0 mm)
when compressed with 5.55 to 6.95 lb. (25 to 31 N) (2.5 to 3.2 kg)

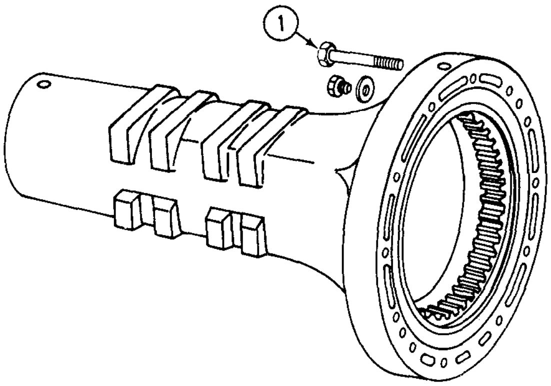


Fig. 3-Rear Axle Housing to Transmission Case Cap Screw

1 - Rear axle housing to transmission case cap screw .... 85 lb-ft (115 Nm) (12 kg-m)

Section 16
ELECTRICAL SYSTEMS

CONTENTS OF THIS SECTION

Group 1671
BATTERIES, SUPPORTS AND CABLES

GENERAL INFORMATION

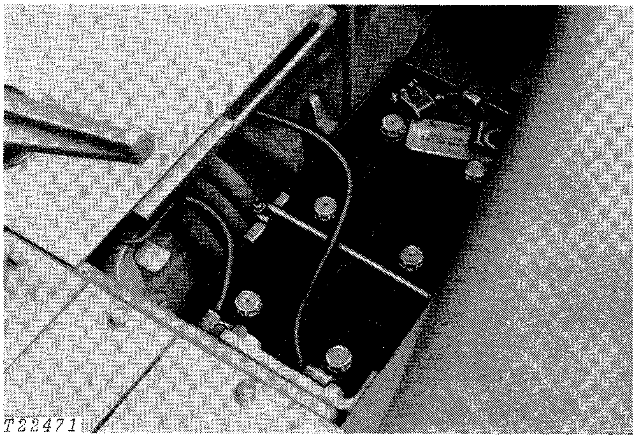


Fig. 1-Batteries

The batteries are below the left floor panel.

When replacing a battery, use the John Deere battery or its equivalent shown in the following chart:

(2 used)

Volts	6
John Deere Part Number	AR45450
BCI Group	3EH
Cold Cranking Amps (0°F) (−18°C)	830
(−20°F) (−29°C)	675
Reserve Capacity (minutes at 25 amps)	340

There are two important things that must be done periodically in order to obtain long life from a battery.

First, the electrolyte must at all times be kept above the plates and separators. The electrolyte level should be checked once a week or after fifty hours of operation. See "Checking Electrolyte Level" in this group.

Second, be sure the battery is kept nearly charged at all times. The state of charge should be checked at frequent intervals by making specific gravity readings with a battery hydrometer. See "Specific Gravity Cell Comparison Test" in this group.

FOS For additional information on batteries, refer to "Storage Batteries" in FOS Manual-ELECTRICAL SYSTEM.

Precautions

CAUTION: All exposed metal surfaces on batteries are "alive." Never lay a metal object on top of a battery as a short circuit may result. Sparks or an open flame must be kept away from batteries due to the presence of explosive gas in and around the batteries while they are being charged or in use.

BATTERY ACID IS HARMFUL ON CONTACT with the skin or materials. If acid spills, here are some first aid tips to minimize the damage:

1. Remove immediately any clothing on which acid spills.

2. If acid contacts the skin, rinse the affected area with running water for 10 to 15 minutes.

3. If acid ever splashes into the eyes, force the lids open and flood the eyes with running water for 10 to 15 minutes. Then see a doctor at once. Don't use any medication or eye drops unless prescribed by the doctor.

4. To neutralize acid spilled on the floor, use one of the following mixtures:

a. One pound (454 g) of baking soda in a gallon (4 L) of water.

b. One pint (474 mL) of household ammonia in a gallon (4 L) of water.

5. Acid from the batteries can also damage the paint and metal surfaces of the machine. Avoid overfilling the battery cells and protect the battery when necessary.

REMOVAL

Remove batteries as follows:

1. Remove cap screws from left floor panel and lift up panel.

2. Note carefully the location of the positive terminals so that the batteries are installed in the same way.

3. Disconnect the ground cable first. Use only a box end wrench to loosen clamps on terminals. Remove clamps, using a screw-type puller. DO NOT hit the battery posts.

4. Remove the connecting cable and the positive cable.

5. Remove the battery clamps and the batteries.

6. Check cables for worn insulation. Replace cable clamps or bolts if there is corrosion.

INSPECTION

Cleaning Batteries

Wipe batteries with a damp cloth. If terminals are corroded, use a stiff brush and wash with an ammonia solution or a solution of baking soda (1/4 pound [113 g] added to a quart [1 L] of water). Keep vent plugs tight while washing. After washing, flush battery and compartment with clear water.

Checking Electrolyte Level

Check electrolyte level in each cell. Proper level is to bottom of filler neck. Always add distilled water if available. If not, use clean soft water. Avoid hard water.

NEVER ADD ACID TO THE BATTERY unless electrolyte is lost by spilling.

Always wait until after checking specific gravity before you add water to the battery. This will assure a true reading. If level is too low to check specific gravity, add water, operate engine for a few minutes to let water and electrolyte mix, then check.

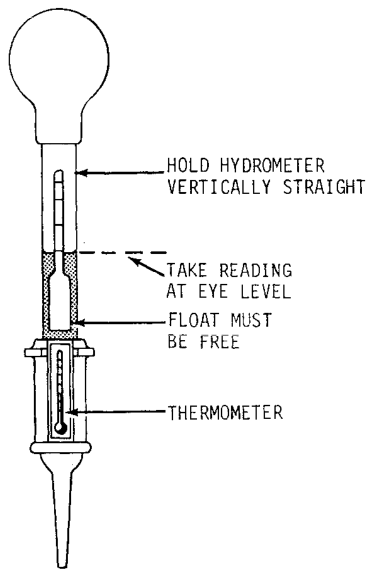
In freezing weather, never add water to the battery unless it will be operated immediately to allow proper mixing of water with electrolyte.

TESTING

Testing the battery will tell you whether the battery is usable, requires recharging or should be replaced. Regular periodic testing provides a means of anticipating battery failure.

Specific Gravity Cell Comparison Test

Check the specific gravity of each cell with an accurate hydrometer equipped with a thermometer. Hold the hydrometer vertically and take the reading at eye level.



T31402N

Fig. 2-Checking Specific Gravity

True readings are taken at 80°F (27°C) only. To correct a reading, add four gravity points (0.004) for every 10°F (6°C) that the electrolyte temperature is above 80°F (27°C). Subtract four gravity points (0.004) for every 10°F (6°C) that the electrolyte is below 80°F (27°C). A hydrometer reading of 1.260 at 0°F (−18°C) is corrected to 1.228.

TEMPERATURE OF ELECTROLYTE °F	(°C)	GRAVITY POINTS TO ADD OR SUBTRACT FROM READING
0	(-18)	-32
10	(-12)	-28
20	(- 7)	-24
30	(- 1)	-20
40	(4)	-16
50	(10)	-12
60	(16)	- 8
70	(21)	- 4
80	(27)	0
90	(32)	+ 4
100	(38)	+ 8
110	(43)	+12
120	(49)	+16
130	(54)	+20
140	(60)	+24
150	(66)	+28
160	(71)	+32

T38420N

Fig. 3-Correcting Specific Gravity Readings to Allow for Temperatures

Specific gravity should read from 1.215 to 1.270 (corrected for 80°F [27°C] electrolyte temperature).

The variation in readings between cells should be no more than 50 specific gravity points (0.050).

If specific gravity readings show a difference between the highest and lowest cell of more than 50 specific gravity points (0.050) or more, the battery is defective and must be replaced.

If the maximum difference between all readings is less than 50 specific gravity points (0.050) and the lowest cell reading is 1.200 or above, the battery is in good condition and may be returned to service.

If the maximum difference between all readings is less than 50 specific gravity points (0.050) but the lowest cell reading is below 1.200, the battery is good but needs to be charged by the slow method.

Specific Gravity Reading (Adjusted)	State of Charge
1.260	100%
1.230	75%
1.200	50%
1.170	25%
1.140	Minimal
1.110	Completely Discharged

The table above shows the state of charge of a typical battery at various specific gravity readings.

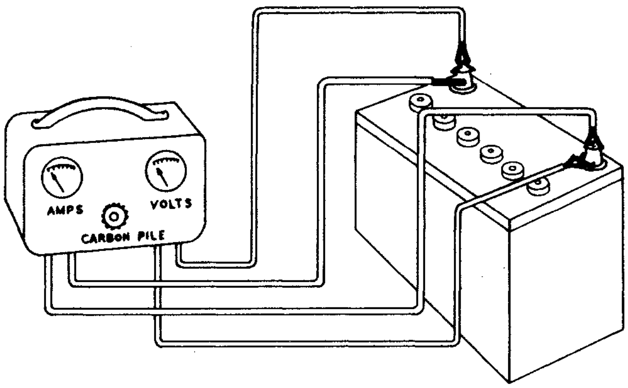
High-Rate Discharge Test

To be sure of a battery's ability to deliver current under load, give it a high-rate discharge test. This test shows the internal conditions that might not otherwise be detected.

The following conditions must exist before this test is made:

1. Battery specific gravity must not be less than 1.215 at 80°F (27°C). Otherwise, erratic or unreliable readings will result.

2. Battery electrolyte temperature must be between 70°F (21°C) and 90°F (32°C).



T33000N

Fig. 4-High-Rate Discharge Battery Tester Connected to Battery

Connect the high-rate discharge tester to the battery and be sure to follow the manufacturer's instructions (Fig. 4).

The terminal voltage reading should remain above 4.5 volts.

If the terminal voltage falls below 4.5 volts, the battery is defective or it is not as fully charged as the specific gravity reading indicates in the specific gravity test.

To be sure of the battery condition, carefully charge it and repeat the test.

Remember these key facts when testing batteries.

1. In general, if all cells of a battery test the same, the battery is good. If all are low, the battery usually only needs recharging.

2. If there is a real difference between cells, the battery generally must be replaced.

For additional information on "Battery Testing" refer to "Storage Batteries" in FOS Manual - ELECTRICAL SYSTEMS.

CHARGING THE BATTERY

Batteries can be recharged in two ways:

1. Fast charging.

2. Slow charging.

A battery that is in satisfactory condition but requires recharging will accept a large amount of charging current without undesirable effect. This type of battery may be charged quickly at a high rate with a battery fast charger.

A battery that becomes sulfated, however, will not accept a high rate of charging current without possible damage. Its sulfated condition provides increased resistance to current flow within the battery. Flow of a high rate of charging current creates heat, which can result in warping of the plates, boiling of electrolyte, and eventual damage to the separators. Cell caps and covers and the battery case may be damaged or distorted.

A battery in this condition must be charged over a long period at a low rate. In this manner, sulfate formation on the plates will be gradually broken down and the battery returned to its normal charged state.

NOTE: When charging batteries be sure to follow the manufacturer's instructions for using the charger.

John Deere battery chargers can be used as a booster to start the engine.

IMPORTANT: Before hooking up battery charger to batteries in the unit, observe precautions listed in Group 9015.

IMPORTANT: A battery charger should not be used as a booster if a battery has a very low charge (1.150 specific gravity reading or lower). A low-charged battery greatly increases the possibility of mistakenly connecting the charger to the battery in reverse, and it is possible to reverse the charge on a battery. If this is done the alternator diodes or the wire harness may be damaged.

If the battery has a specific gravity reading of 1.150 or lower, disconnect battery cables and charge it until the specific gravity reading is 1.150 or above before using a battery charger as a booster.

INSTALLATION

Install batteries as follows:

1. Be sure the batteries are fully charged.

2. Set batteries in tray making sure batteries are resting level.

3. Tighten the battery hold-down nuts evenly until batteries are secure. Do not overtighten as this will distort or crack the battery case.

4. Clean the battery terminals and cable clamps with a wire brush before attaching the clamps. This will assure a good contact.

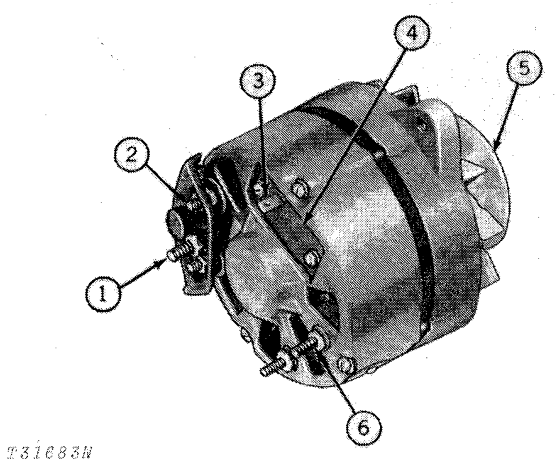
5. Check for correct polarity of the battery. Connect the positive cable first. Before connecting the ground cable, momentarily touch it against the battery post. With all switches and accessories off, no spark should occur. If spark does occur, do not connect the ground cable. Check for reversed battery polarity, improper alternator connection, defective electrical wire connection, or defective electrical equipment.

6. Tighten the clamps on the battery terminals. Use a box-end wrench carefully to avoid twisting the battery terminal posts.

7. Coat the terminals with petroleum jelly to prevent corrosion. Never paint the terminal posts.

Group 1672
ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING

GENERAL INFORMATION



1—Output Terminal
2—Regulator Terminal
3—Field Terminal
4—Brush and Holder Cover
5—Pulley
6—Ground Terminal

Fig. 1-Alternator

The alternator is an open type alternator with an isolation diode.

It is not necessary to disassemble the alternator to replace brushes. The brushes can be replaced with the alternator left intact on the engine.

The alternator is cooled by an externally mounted fan. Correct air circulation requires air to be pulled into the rear of the alternator and expelled through the front housing.

Alternator can be divided into three main assemblies:

1. Rotor - magnetic field which rotates.

2. Stator Assembly - conductors which are stationary.

3. Rectifier Assembly - diodes which change a.c. to d.c. current.

The rotor assembly consists of a wire coil wrapped around an iron core and mounted on a rotating shaft. The coil is enclosed between two interlocking soft iron sections. The ends of the coil are connected to two slip rings mounted on one end of the shaft.

Small brushes ride on the slip rings. One of the brushes is connected to ground. The other is insulated and connects to the alternator field terminal. This terminal is connected through the regulator and the key switch to the battery.

The rotor turns on sealed ball bearings that contain lubrication for the life of the bearing.

The stator assembly is a laminated soft iron ring with three groups of coils or windings in the slots. Each group is made up of from eight to sixteen coils, depending on the design.

One end of each stator winding is connected to a positive and negative diode. The other ends of the stator windings are wye connected.

To convert the a.c. to d.c. current, diodes are used. Six diodes are mounted at the slip ring end of the alternator housing. Three negative diodes are mounted in a heat sink bolted to the end frame. Three positive diodes are mounted in the heat sink which is insulated from the end frame.

The isolation diode primary function is to act as an automatic switch between the battery and alternator. It will block any current flow from the battery back to the alternator and regulator when the alternator is not operating.

FOS

For additional information on alternators, refer to "Charging Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

REMOVAL

IMPORTANT: Disconnect the battery ground cables first to prevent damage that might occur if wire leads removed from alternator should be grounded to tractor.

Disconnect wires from alternator. Slip fan belt off and remove the alternator.

REPAIR

Disassembly

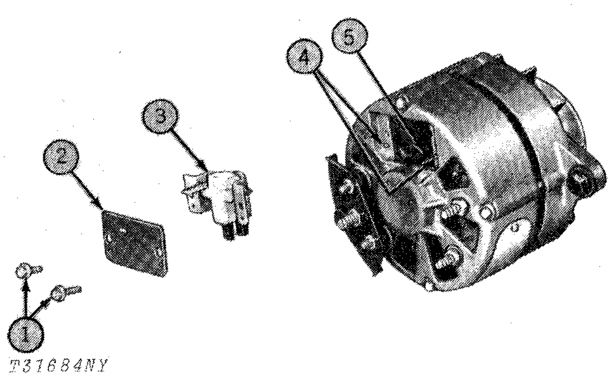
Never immerse an alternator in cleaning solution. When necessary, scrape off most of the dirt and grease, then use a stiff brush and solvent. Dry with compressed air.

IMPORTANT: Never hammer or jar an alternator or diodes. To do so may ruin the diodes.

Disassemble alternator only as far as necessary to correct the difficulty.

Removing and Cleaning Brushes

Clean alternator brushes will assure full charging of the alternator at all times.



1—Screws
2—Cover
3—Brush Assembly
4—Locating Pins
5—Slip Ring

Fig. 2-Alternator Brush Assembly

Remove the two self-tapping screws and cover. Grasp the field terminal, exert slight downward pressure and pull brush assembly back until it clears the two locking pins. Then tilt the assembly back at approximately a 45° angle and pull it straight out.

Replace the brush assembly if the brushes are excessively worn. The entire assembly is replaced rather than just the brushes.

If the brushes become clogged with dust or dirt, remove the dirt with compressed air. It is well to refrain from cleaning brushes with any type of liquid, since this would increase the possibility of any dust or dirt hardening within the brush cavity and hindering the movement of the brush.

It may become necessary to use a non-petroleum base cleaning solvent to clean the slip rings, should they become contaminated. If this is not sufficient, then it is necessary to use crocus cloth to clean the slip rings.

Pulley Removal

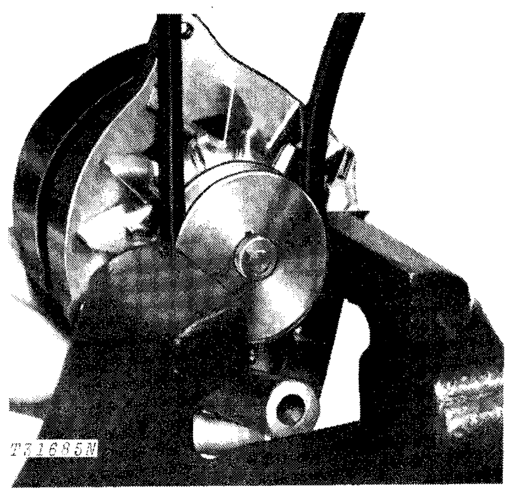
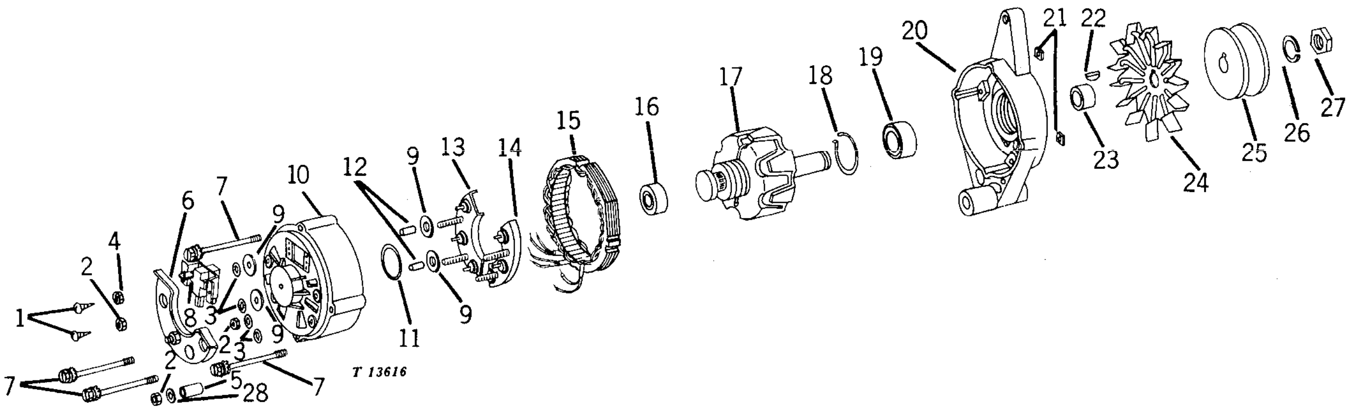


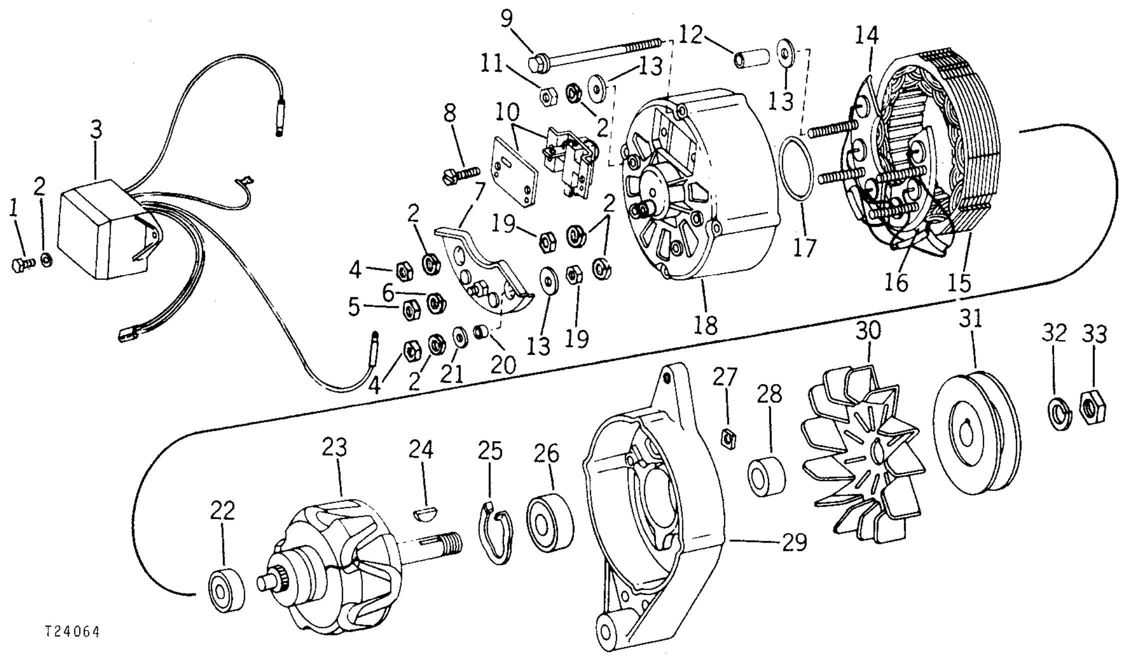
Fig. 3-Pulley Removal

The pulley is a slip fit on shaft with a Woodruff key. To remove the nut and lock washer, clamp pulley in vise as shown in Fig. 3. Belt protects pulley from damage. While supporting alternator, strike end of shaft with a wooden mallet or plastic hammer.



1—Drive Screw (2 used)
2—Nut (6 used)
3—Lock Washer (6 used)
4—Nut
5—Insulator Sleeve
6—Isolation Diode Assembly
7—Through Bolt (4 used)
8—Brush and Cover
9—Insulator Washer (5 used)
10—Rear Housing
11—Rear Bearing Retainer
12—Insulator Sleeve (2 used)
13—Positive Rectifier Diode Assembly
14—Negative Rectifier Diode Assembly
15—Stator
16—Rear Bearing
17—Rotor
18—Front Bearing Retainer
19—Front Bearing
20—Front Housing
21—Nut (4 used)
22—Woodruff Key
23—Spacer
24—Fan
25—Alternator Pulley
26—Lock Washer
27—Jam Nut
28—Insulator Washer (2 used)

Fig. 4-35 Amp Alternator Assembly



1—Self Tapping Screw (3 used)
2—Lock Washer (9 used)
3—Regulator
4—Nut (2 used)
5—Nut
6—Lock Washer
7—Dual Diode Insulator
8—Drive Screw (2 used)
9—Through Bolt (4 used)
10—Brush and Cover
11—Nut (2 used)
12—Insulator Sleeve (2 used)
13—Insulator Washer (5 used)
14—Positive Rectifying Diode
15—Stator
16—Negative Rectifying Diode
17—Rear Bearing Retainer
18—Rear Housing
19—Nut (2 used)
20—Insulator Sleeve
21—Insulator Washer
22—Rear Bearing
23—Rotor
24—Woodruff Key
25—Front Bearing Retainer
26—Front Ball Bearing
27—Square Nut (4 used)
28—Fan and Pulley Spacer
29—Front Housing
30—Fan
31—Pulley
32—Lock Washer
33—Jam Nut

Fig. 5-55 Amp Alternator Assembly

Removing Rear Housing

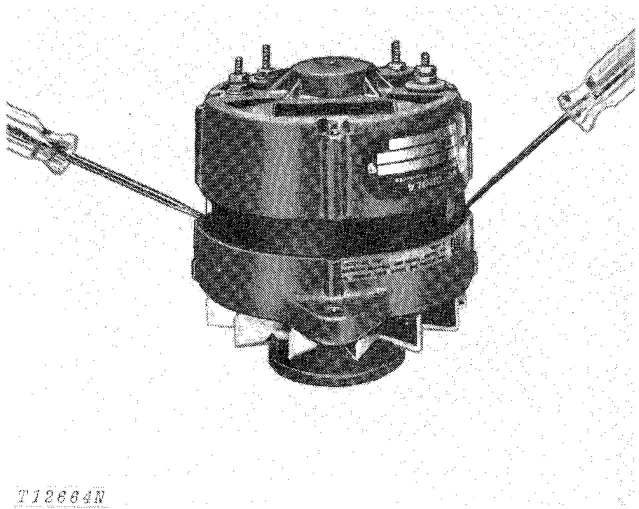


Fig. 6-Removing Rear Housing

Remove brush assembly, then remove isolation diode assembly (see Fig. 6). Remove the four through bolts and nuts. Insert a small-bladed screwdriver in the stator slots between stator and front housing.

IMPORTANT: Do not insert screwdriver blade deeper than 1/16 inch (1.6 mm) to avoid damaging stator winding.

Apply prying pressure at several points around the stator to extract rotor and front housing as an assembly. Do not burr the stator core which would make reassembly difficult.

Rear Bearing

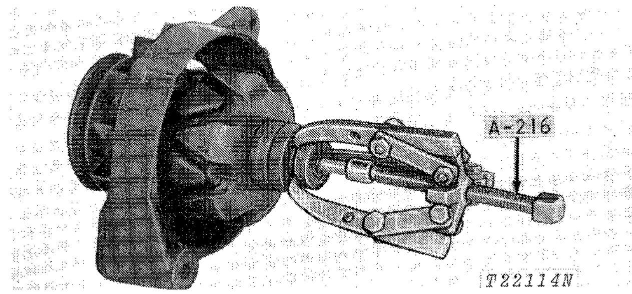


Fig. 7-Removing Rear Bearing

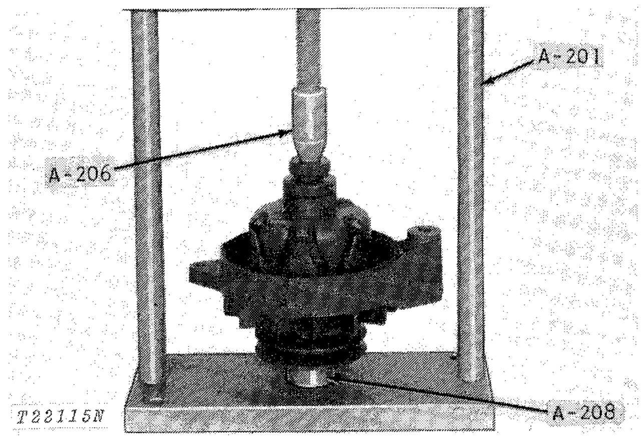
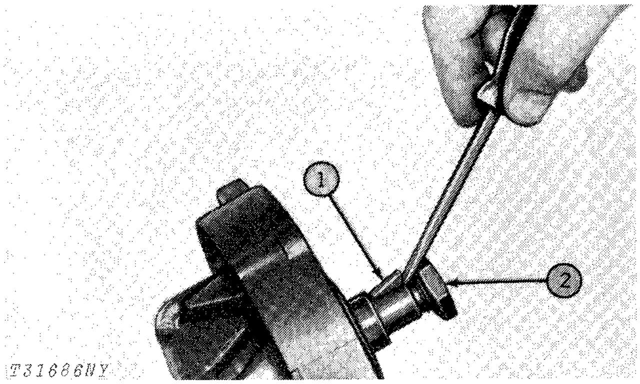


Fig. 8-Installing Rear Bearing

Figs. 7 and 8 show rear bearing replacement. Also replace O-ring bearing retainer in rear housing.

Front Bearing

Figs. 9 through 13 illustrate front bearing replacement. Remove front housing by tapping rotor shaft against the wood block or use A-216 puller. Remove bearing with A-216 puller. Compress the waves of the bearing retainer (Fig. 12) to seat it in its groove. Do not use a screwdriver or other small object that might slip off and damage the bearing seal. A-209 presses against the inside of the bearing (Fig. 13).



1—Woodruff Key 2—Pulley Nut

Fig. 9-Removing Woodruff Key

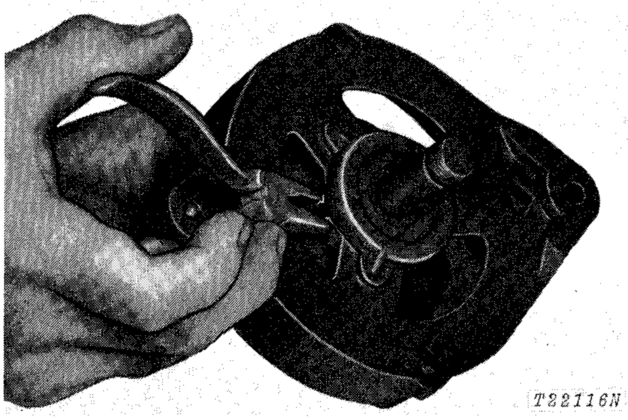


Fig. 10-Compressing Bearing Retainer

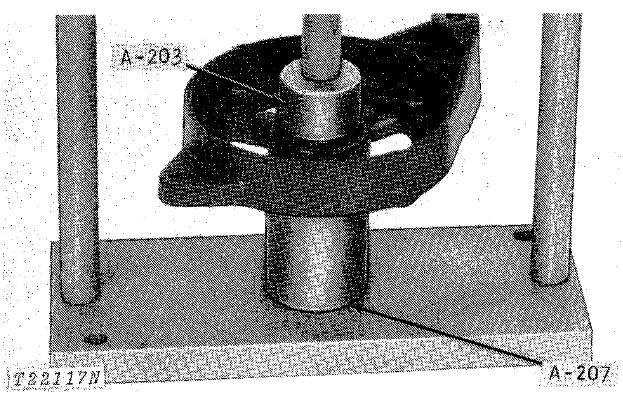


Fig. 11-Installing Front End Bearing

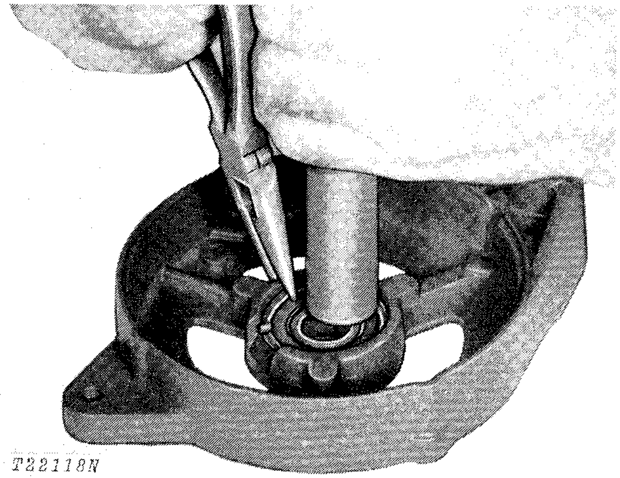


Fig. 12-Installing Bearing Retainer

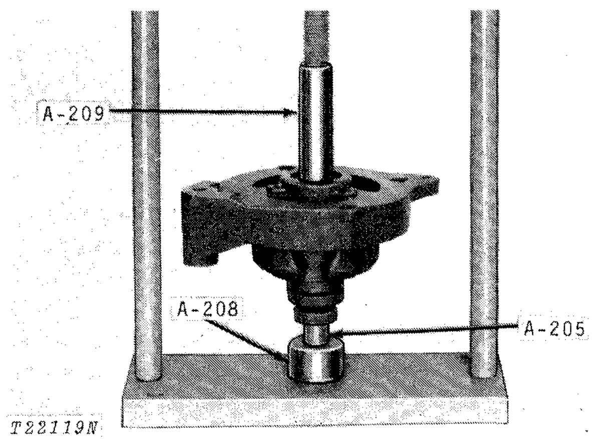


Fig. 13-Installing Front Housing

Removing Stator and Diodes

Remove stator and diode assembly from the rear housing. Carefully note locations of insulators and washers for proper reassembly. Do not unsolder stator-to-diode wire junctions. Avoid bending stator wires at junction.

When soldering and unsoldering leads from diodes, grasp the diode lead with pliers between the diode and the stator lead to be removed (Fig. 14). This gives better heat dissipation and protects the diode. Do not exert excessive stress on diode lead.

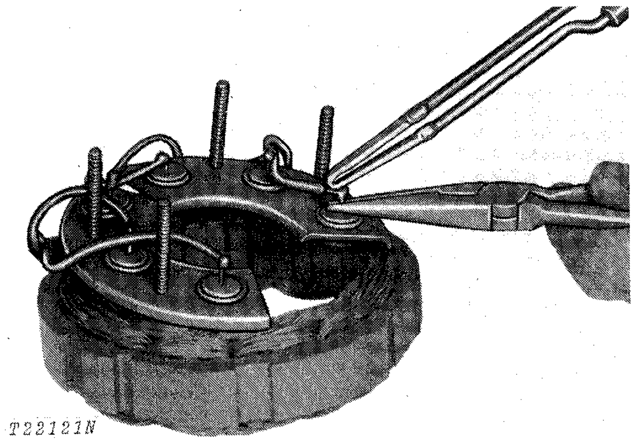


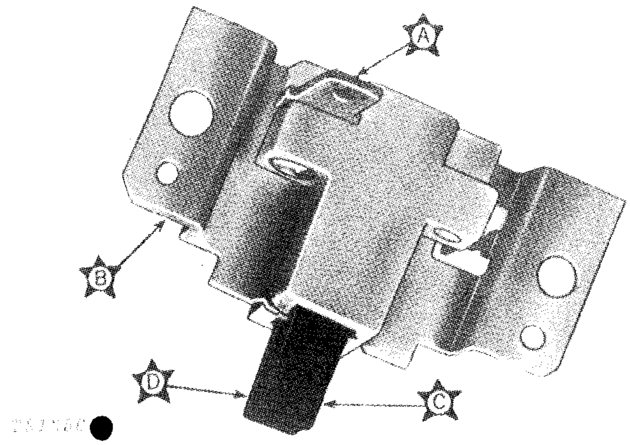
Fig. 14-Pliers Used as a Heat Sink

Note diode assembly to stator connections. Be sure replacement diode assembly connections are the same. The positive diode assembly has red printing and the negative has black printing—DO NOT INTERCHANGE.

Do not use an acid-core solder when soldering diode leads. Use rosin-core solder.

ALTERNATOR COMPONENT TESTS

Brush Assembly Insulation and Continuity Tests



A—Field Terminal
B—Bracket
C—Insulated Brush
D—Grounded Brush

Fig. 15-Brush Installation and Continuity Test Points

Insulation Test

Connect ohmmeter or a test lamp (12 to 120-volt) to field terminal and bracket (test points A and B) as shown in Figure 15.

Resistance should be high (infinite) or test lamp should not light. If resistance is low or test lamp lights, brush assembly is shorted and must be replaced.

Continuity Test

Connect an ohmmeter to field terminal and brush (test points A and C). Use an alligator clip to assure good contact to brush. Resistance reading should be zero. Move brush and brush lead wire to make certain that the brush lead wire connections are not intermittent. Resistance reading should not vary when brush and lead wire is being moved around.

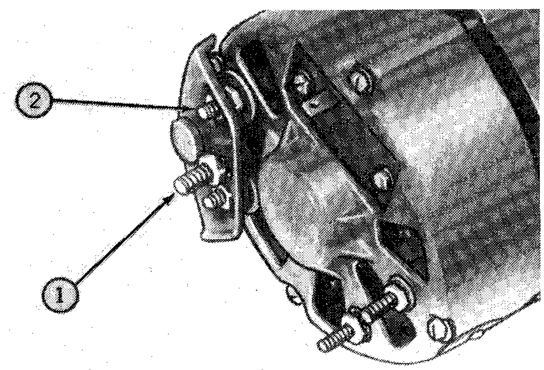
Connect ohmmeter to bracket and grounded brush (test points B and D). Resistance reading should be zero. Repeat same test on brush lead wire as described in above paragraph.

Replace brush assembly if brush exposed length is 1/4 inch (6.4 mm) or less.

Isolation Diode Test

If a commercial diode tester is used, follow tester manufacturer's testing instructions. If a commercial tester is not available, use a DC test lamp.

DO NOT USE A 120-VOLT TEST LAMP. USE A 12-VOLT DC TEST LAMP ONLY, OTHERWISE DIODES WILL BE DAMAGED.



1—Output Terminal **2—Regulator Terminal**

Fig. 16-Isolation Diode Test Points

Connect the test lamp to output terminal and regulator terminal (test points 1 and 2) as shown in Figure 16.

Then reverse test probes. The test lamp should light in one direction, but should not light in the other direction. If the test lamp lights in both directions, the isolation diode is shorted. If the test lamp does not light in either direction, isolation diode is open.

Repeat test after isolation diode has been removed to ascertain findings.

In-Circuit Rectifier Diode Test

Any commercial in-circuit diode tester will be adequate to make this check. Follow tester manufacturer's recommended testing procedure.

If the in-circuit tester indicates that diodes are faulty, recheck diodes individually after the diode assemblies have been disconnected from stator assembly (Fig. 20).

Shorted stator coil or shorted insulating washers o sleeves on positive diode assembly would mak diodes appear to be shorted.

To check the negative diode assembly, connect tester to test points 1 and 2 as shown in Fig. 17. Then successively check the two remaining diodes in the same manner (to ground terminal and diode lead).

To check the positive diode assembly, connect tester to the output terminal and one of the positive diode terminals. Repeat operation for remaining two positive diodes.

Rectifier Diode Test Using a Test Lamp

Test lamp will not indicate an open condition unless ALL THREE DIODES of either assembly are open. However, a shorted diode can be detected. This test is not completely reliable, but can be used when an in-circuit diode tester is not available.

DO NOT USE A 120-VOLT TEST LAMP. USE A 12-VOLT DC TEST LAMP ONLY; OTHERWISE DIODES WILL BE DAMAGED.

A. Negative Diodes - Connect test lamp probes to test points 1 and 2 (Fig. 17), then reverse test probes. The test lamp should light in one direction but not in the other direction. If the test lamp lights in both directions, one or more of the rectifier diodes of the assembly being tested is shorted. If the test lamp does not light in either direction, ALL THREE DIODES IN THE ASSEMBLY ARE OPEN. Recheck diodes individually after disassembly to ascertain findings (Fig. 20).

A shorted stator coil to core would appear as a shorted negative rectifier diode assembly. Also check stator for shorts after disassembly. (See next page.)

B. Positive Diodes - Connect test probes to regulator terminal and to terminal of top position diode. Then reverse test probes. The same procedure and results apply as in paragraph "A" above.

Rotor Leakage (Shorts) Test

This test checks the field coil for leakage or shorts to rotor poles. An ohmmeter or test lamp (12-volt or 120-volt) may be used.

A. Remove the brush assembly.

B. Connect ohmmeter or test lamp test probes to one of the slip rings and ground terminal.

Ohmmeter resistance should be infinite (test lamp should not light). If resistance is not infinite (test lamp lights), leakage or a short exists between field coil and rotor.

Repeat test after rotor has been removed from alternator to ascertain findings. Connect test probes to one of the slip rings and to rotor shaft.

In-Circuit Stator Leakage (Shorts) Test

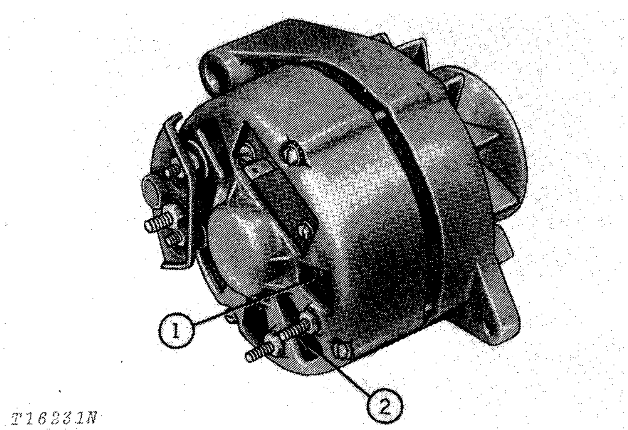


Fig. 17-In-Circuit Stator Leakage (Shorts) Test

When making the "in-circuit" stator leakage test, some consideration must be given to the rectifier diodes that are connected to the stator winding. The negative rectifier diode assembly will conduct in one direction when properly connected. A shorted diode in the negative rectifier diode assembly would make stator appear to be shorted. For this reason, the rectifier diode plate assembly and stator must be checked individually after alternator has been disassembled if the problem is localized to the stator.

DO NOT USE A 120-VOLT TEST LAMP. USE A 12-VOLT DC TEST LAMP ONLY, OTHERWISE DIODES WILL BE DAMAGED.

A. Connect the test lamp to a diode terminal of the negative diode assembly and ground terminal (Test points 1 and 2) as shown in Fig. 17.

B. Reverse test probes. The test lamp should light in one direction but not in the other.

If the test lamp does not light in either direction, this indicates that all three rectifiers in the negative diode assembly are open.

If the test lamp lights in both directions, the stator winding is shorted to stator or one of the negative rectifier diodes is shorted. Recheck stator and rectifier diode assembly after disassembly to ascertain findings.

Out-of-Circuit Stator Leakage (Shorts) Test

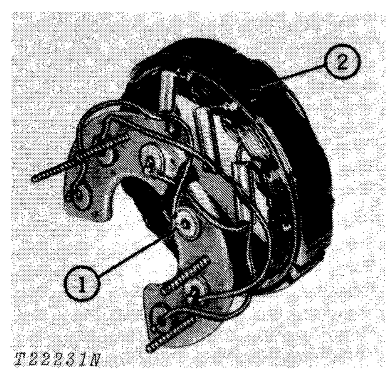


Fig. 18-Stator Leakage Test Points

Disassemble alternator and remove the rectifier diode plates and stator as an assembly as shown in Fig. 18.

An ohmmeter or test lamp (12-volt) may be used.

Connect ohmmeter or test lamp probes to one of the rectifier diode terminals and to stator (test points 1 and 2) as shown in Fig. 18.

Resistance reading should be infinite or test lamp should not light. If resistance reading is not infinite or test lamp lights, high leakage or a short exists between stator winding and stator. In either case, stator should be replaced.

Stator

Examine stator for insulation failure or defects. Shorted stator windings are usually discolored and have a burnt odor. Replace stator only after each electrical component has been proven to be satisfactory.

If a sensitive ohmmeter is available, use the following procedure.

1. Disconnect the stator leads from the diode assemblies.

2. Check for a grounded winding by connecting an ohmmeter to one stator lead and to the stator frame. The ohmmeter reading should be infinite.

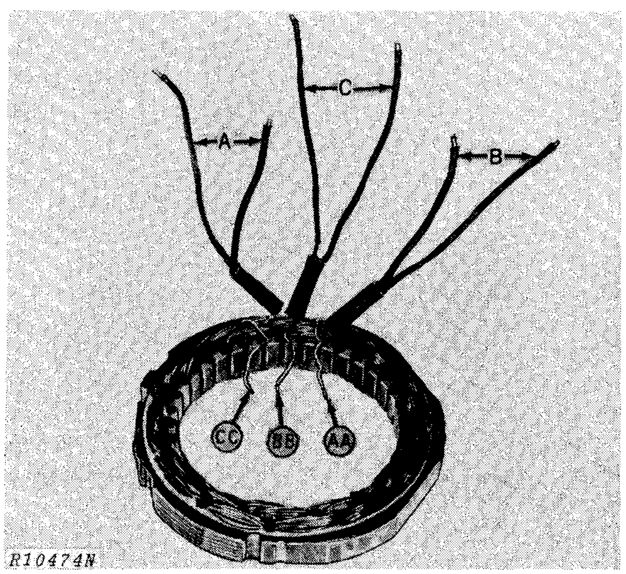


Fig. 19-Stator Leads

3. To check for an open-circuited or a short-circuited winding, carefully zero the ohmmeter and connec the ohmmeter leads to A and B (Fig. 19). The meter reading should be approximately 0.4 ohm. An infinite or high reading indicates an open-circuited winding. Now touch the remaining A and B leads together several times. The meter pointer should deflect slightly to zero. If there is no pointer movement, the windings are shorted.

4. Check for an open circuit or a short circuit between A and C and between B and C.

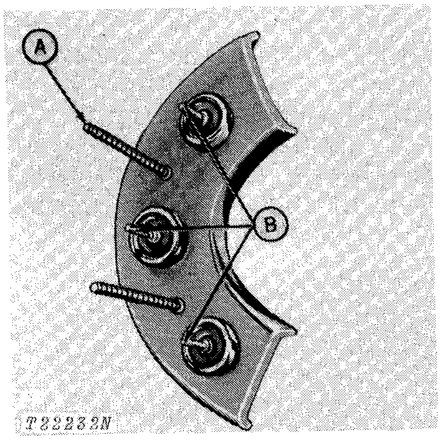
If a sensitive ohmmeter is not available for the above procedures, carefully disconnect the stator leads AA, BB, and CC from each other. (Stator leads may be brittle if they have been overheated of if they are old.) Test the stator as instructed in FOS Manual 20—ELECTRICAL SYSTEMS.

Out-of-Circuit Rectifier Diode Test

If a commercial "Alternator Rectifier Diode Tester" is used, follow the tester manufacturer's recommended testing procedure.

If a commercial tester or ohmmeter is not readily available, check diodes with a test lamp. DO NOT USE A 120-VOLT TEST LAMP. USE A 12-VOLT DC TEST LAMP ONLY, otherwise diodes will be damaged.

When unsoldering the stator wires from the rectifier diode assembly, provide a heat sink to the diode terminal with long-nosed pliers (Fig. 14).



A—Diode Plate Stud **B—Diode Terminals**

Fig. 20-Rectifier Diode Test Points

Connect the test lamp probes to diode terminal and diode plate stud (see Fig. 20) then reverse test lamp probes. The test lamp should light in one direction but not in the other.

If the test lamp lights in both directions, the diode is shorted. If the test lamp does not light in either direction, the diode is open.

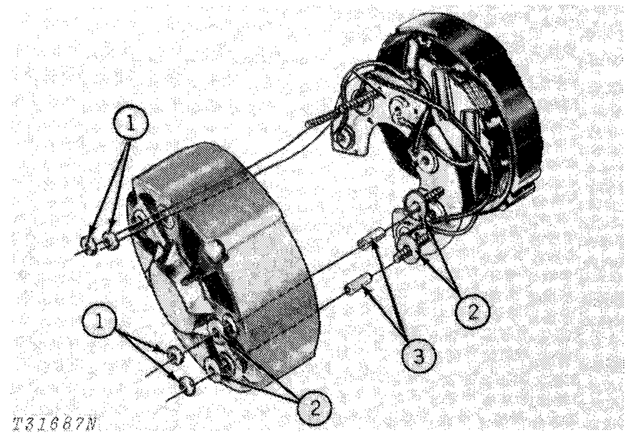
Test the remaining diodes of the assembly in the same manner. Replace entire assembly if one of the diodes is found to be faulty.

When testing with an ohmmeter, if a needle deflection is observed with the positive lead to the diode stem and negative lead to the case, the diode is positive. The reverse is true for a negative diode.

Positive diodes have red printing and negative diodes have black printing. DO NOT INTERCHANGE THEM.

ASSEMBLY

Assembling Stator and Rear Housing



1—Nut **3—Insulating Sleeves**
2—Insulating Washers

Fig. 21-Stator and Rear Housing Assembly

Assemble stator to rear housing making sure insulating washers and sleeves are positioned as shown in Fig. 21.

Assembling Rear Housing to Front Housing

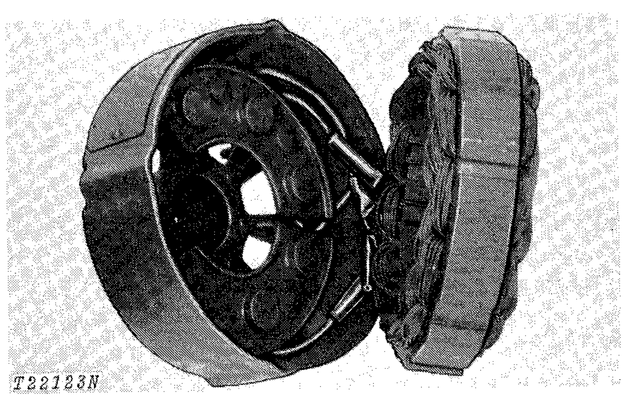


Fig. 22-Stator and Slip Ring End Frame

Position stator leads to prevent interference with rotor (Fig. 22). Assemble stator and rear housing to the rotor and front housing. Tighten through bolts to 50 to 60 lb-in (5.6 to 6.8 Nm) (0.58 to 0.69 kg/m) torque. Install brush assembly and tighten screws to 20 to 30 lb-in (2.3 to 3.4 Nm) (0.23 to 0.35 kg/m).

Seal small hole at center of bearing boss in rear housing.

Assembly of Isolation Diode

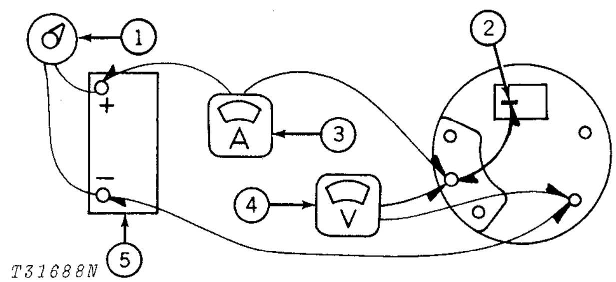
Before mounting isolation diode, make certain that the positive rectifier diode plate has been properly insulated from housing (Fig. 21).

The isolation diode is mounted to the positive rectifier diode studs. Mount isolation diode as shown in Fig. 16.

Pulley Installation

To facilitate tightening pulley retainer lock washer and nut, position Woodruff key, fan and pulley on shaft and grasp in vise with a belt protecting the pulley as shown in Fig. 3. Tighten pulley nut to 40 to 50 lb-ft (54 to 68 Nm) (6 to 7 kg/m) torque.

TESTS AFTER ASSEMBLY



1—Carbon Pile Resistor
2—Field Terminal
3—Ammeter
4—Voltmeter
5—12-Volt Battery

Fig. 23-Alternator Test Connections

Mount alternator on electrical servicer. If servicer instructions are not available, connect alternator as shown in Fig. 23. Run alternator at 3000 rpm. Adjust resistor to obtain 14 volts.

35 Amp Alternator

The ammeter reading should be 24 amps or more.

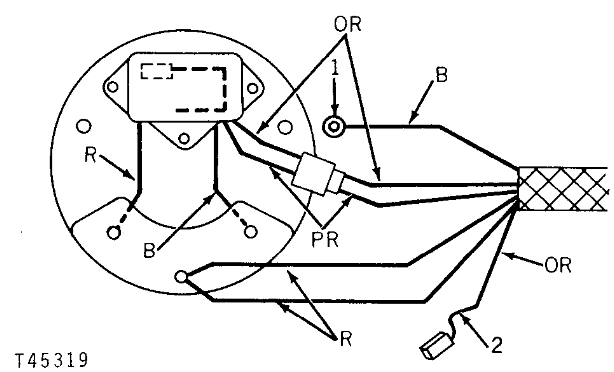
55 Amp Alternator

The ammeter reading should be 43 amps or more.

INSTALLATION

Install alternator. Apply force only to the front alternator frame when adjusting belt tension Group 9010, for adjusting belt tension)

Connect alternator wires (Fig. 24) making sure all connections are clean and tight. Connect battery ground. Do not polarize.



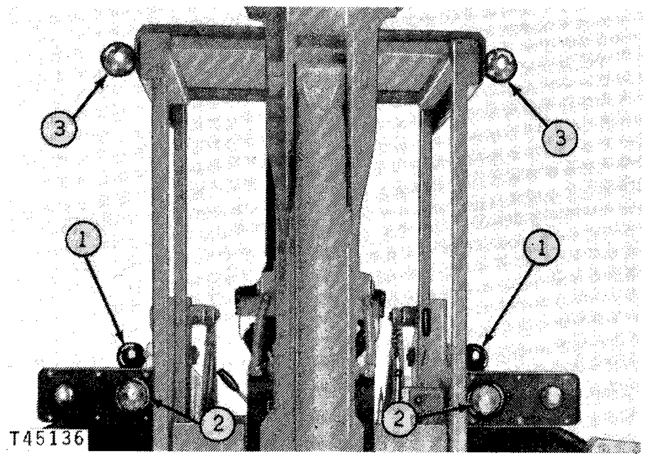
1—To Fuel Gauge Sender
2—To Solenoid Valve on Hydraulic Pump
B —Black
OR—Orange
PR—Purple
R —Red

Fig. 24-Alternator Connections

Group 1673
VEHICLE LIGHTING SYSTEM

LIGHTS

GENERAL INFORMATION



1—Headlights
2—Rear Combination Lights
3—Warning Lamps

Fig. 1-Lights

REMOVAL

All the lights can be removed by disconnecting the wiring lead to the light and removing attaching hardware.

REPAIR

If a light fails to work, either the sealed beam is burned out or the wiring is shorted, or if no lights work, the light switch may have a defect.

Each light can be disassembled for replacement of parts. To remove the sealed beam from the headlights or combination lights, pull the sealed beam out of the light.

There are two suppliers of the AR38456 Warning Lamp-Hobbs and Guide Lamp.

When a light bulb needs to be changed, BOTH warning lamps will take the AD2062 (General Electric No. 1156) bulb.

Access to the bulb on the Guide Lamp warning lamp is made by removing the three screws on the lens face.

On the Hobbs warning lamp, remove the lock screw and then remove the lens housing assembly by turning in direction shown on the base of the lamp.

INSTALLATION

Install lights following removal procedure in reverse order.

LIGHT SWITCH

GENERAL INFORMATION

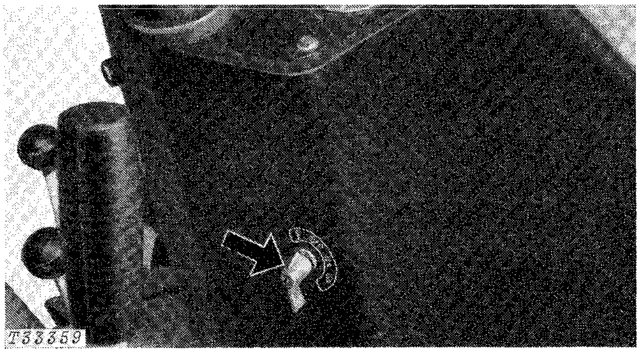


Fig. 2-Light Switch

When the key switch is turned clockwise to the "on" position, the light switch will turn on all lights. The light switch has four positions:

Vertical Position—To turn off all lights.

1st Clockwise Position—To turn on bright front lights and white rear combination lights.

2nd Clockwise Position—To turn on bright front lights, red rear combination lights, and amber warning lamps.

3rd Clockwise Position—To turn on dim front lights, red rear combination lights, and amber warning lamps.

REMOVAL

Remove knob from switch.

Remove cap screws from instrument panel and pull up panel.

Remove nut from front of switch and pull switch out of cowl.

Disconnect wiring.

REPAIR

The switch cannot be repaired. Test according to instructions in Group 9015. Replace if necessary.

INSTALLATION

Install light switch in cowl, connect wires and install instrument panel.

Group 1674
WIRING HARNESS AND SWITCHES
WIRING HARNESSES

GENERAL INFORMATION

There are one main wiring harness and five secondary harnesses.

The main wiring harness connects the key switch and starting motor, alternator and other main components.

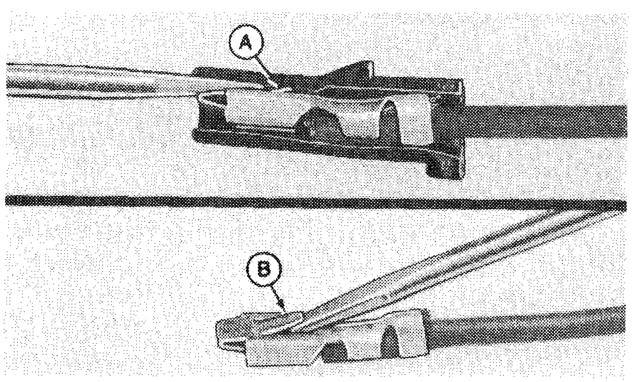
The secondary harnesses are the cowl wiring harness, the wiring harness connecting the horn button to horn, two wiring harnesses to the combination lights and the main lighting wiring harness.

For detailed information on the harness wiring schematics, see Group 9015.

REPAIR

Removing Body Connectors From Wires

To remove the body connectors is a very simple job. DO NOT attempt to jerk the wires out of the body connector. Use the following procedure.



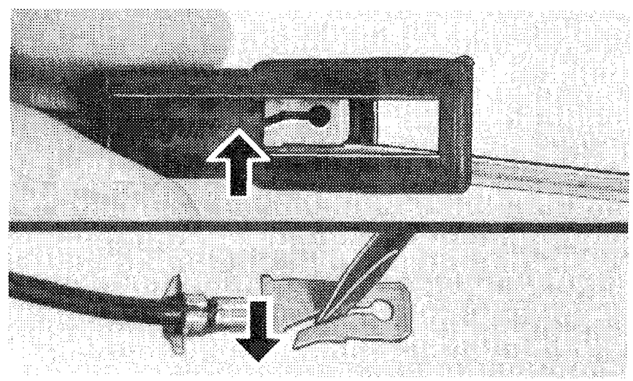
T86496

A—Depress the Locking Tang
B—Reset the Locking Tang

Fig. 1-Removing Female Connector

To remove female body connectors, insert a small screwdriver or paper clip into the body connector and press the locking tang (A, Fig. 1) down. Remove wire from connector.

Be sure to bend the locking tang (B) back when installing new body connector.



T86497

Fig. 2-Removing Male Connector

To remove a male body connector, use a knife or a screwdriver to bend the locking tank in as shown in Fig. 2. Remove wire from connector.

Be sure to bend the locking tang out when assembling new body connector.

CIRCUIT PROTECTORS

GENERAL INFORMATION

Five-amp in-line fuses protect the wiper circuits.

A 5-amp in-line fuse protects the heater circuit.

A 30-amp fuse protects the pressurizer circuit.

Two circuit breakers are located behind the cowl. A 40-amp circuit breaker protects the main wiring. A 20-amp circuit breaker protects the accessories.

A 40-amp circuit breaker located in the lower right hand corner of the cab protects the cab wiring and components.

REMOVAL

To remove any circuit breaker, remove the wiring and attaching hardware.

REPAIR

The circuit breakers will reset themselves. If a circuit breaker trips, turn off power. The circuit breaker should reset in one minute.

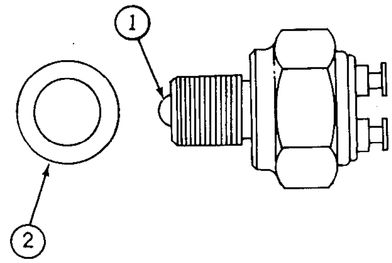
INSTALLATION

Follow removal procedure in reverse order.

NEUTRAL START SWITCH

These units are equipped with a neutral start switch. This switch prevents unit from starting with shift lever in any gear.

The switch is mounted on the transmission case near the transmission oil filler cap.



T51452

T51452

1—Nipple **2—Aluminum Washer**

Fig. 3-Neutral Start Switch

The switch is normally open. The switch loses when nipple is depressed, thus completing the current path to starter when starting unit.

Adjustment

Put shift lever in neutral.

Insure shift lever linkage is adjusted correctly.

Adjust the switch by adding washers (2, Fig. 3), one at a time, until switch continuity is lost.

NOTE: Tighten neutral start switch to 20 to 25 lb-ft (27 to 34 N·m) (3 to 4 kg-m) each time a washer is added or removed during the adjustment procedure.

Remove one washer.

Tighten neutral start switch to 20 to 25 lb-ft (27 to 34 N·m) (3 to 4 kg-m).

Move the shift lever in and out of gear several times to insure the neutral start switch is closed only in the neutral or park position.

Connect wire leads to switch.

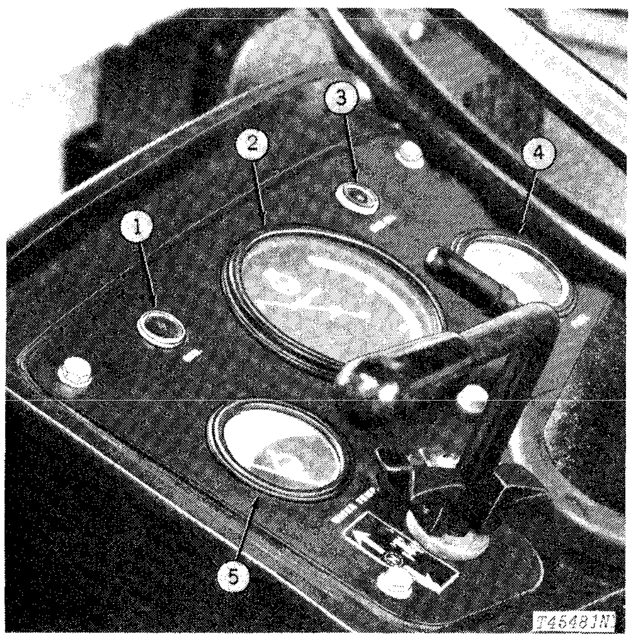
Group 1676
INSTRUMENTS AND INDICATORS

GENERAL INFORMATION

There are both mechanical and electrical instruments and indicators used on the Backhoe Loaders.

The air restriction indicator, engine coolant temperature gauge, and tachometer are mechanical.

The hourmeter, engine oil pressure indicator light, alternator indicator light, and fuel gauge are electrical.



1—Alternator Indicator Light
2—Tachometer
3—Engine Oil Pressure Indicator Light
4—Fuel Gauge
5—Engine Coolant Temperature Gauge

Fig. 1-Instrument Panel

MECHANICAL INSTRUMENTS AND INDICATORS

General Information

Air Restriction Indicator

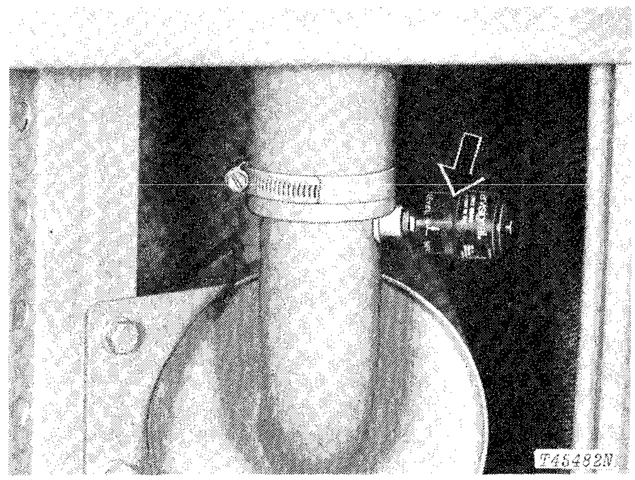
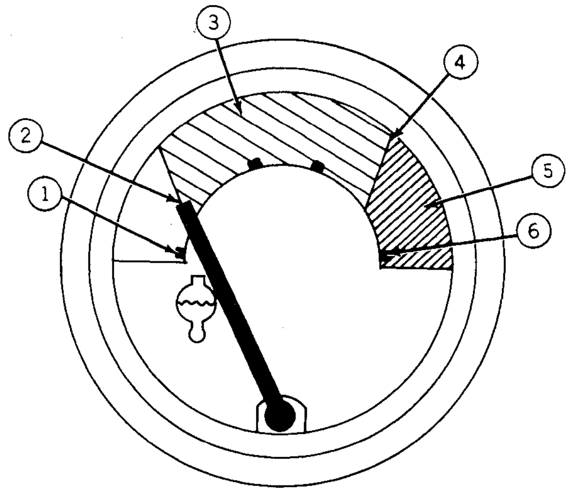


Fig. 2-Air Restriction Indicator

The air restriction indicator (Fig. 2) will show red when the air intake system is excessively restricted.

Engine Coolant Temperature Gauge



1—100°F (38°C)
2—135°F (57°C)
3—Light Green
4—224°F (107°C)
5—Red - Orange
6—240°F (116°C)

Fig. 3-Engine Coolant Temperature Gauge

The engine coolant temperature gauge indicates the engine coolant temperature.

The gauge indicates temperature from 100°F (38°C) to 240°F (116°C). The normal operating range is indicated by the light green area on the gauge face (135°F to 224°F [57°C to 107°C]).

Tachometer

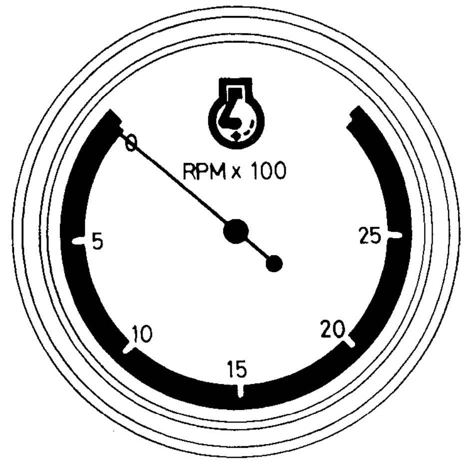


Fig. 4-Tachometer

The tachometer is driven by a cable and indicates engine rpm.

Removal

Unscrew the air restriction indicator to remove it.

To remove the engine coolant temperature gauge or tachometer, remove the instrument panel mounting screws and pull up panel. Remove the gauge mounting hardware and remove the temperature gauge and capillary tube or the cable from the back of tachometer.

Installation

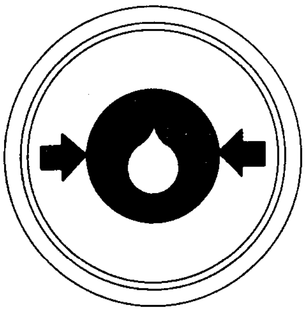
Follow removal procedure in reverse order.

Before installing a new engine coolant temperature gauge, apply PT504 John Deere Gasket Maker or equivalent on gauge threads. DO NOT overtighten gauge mounting hardware.

ELECTRICAL INSTRUMENTS AND INDICATORS

General Information

Engine Oil Pressure Indicator Light

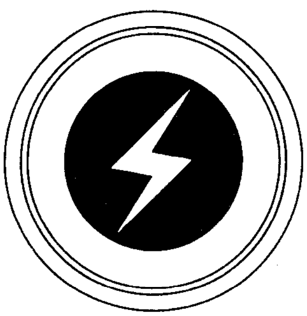


T11763N

Fig. 5-Engine Oil Pressure Indicator

The engine oil pressure indicator light will come on when engine oil pressure drops to approximately 8 psi (0.6 bar) (0.6 kg/cm²).

Alternator Indicator Light

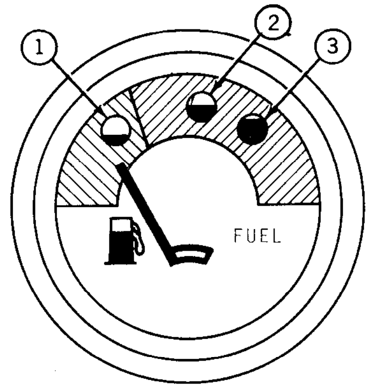


T11762N

Fig. 6-Alternator Indicator Light

The alternator indicator light will come on when the alternator is not charging.

Fuel Gauge



T31392

1—Empty Tank
2—Half Full Tank
3—Full Tank

Fig. 7-Fuel Gauge

The fuel gauge indicates the amount of fuel in the fuel tank.

Hour Meter

T22441

Fig. 8-Electric Hour Meter

The hour meter is electrically connected to the "IGN" terminal of the key switch. It will record the amount of time the engine has run in hours and tenths of hours.

Removal

To remove a gauge or indicator light, remove instrument panel mounting screws and pull up panel. Remove the mounting hardware and electrical wiring from gauge. Twist the indicator light socket and pull from rear of panel. The lens will come out the top.

The replacement bulb for the indicator lights is trade no. 1895R.

Installation

Follow removal procedure in reverse order.

Group 1699
SPECIFICATIONS AND SPECIAL TOOLS

SPECIFICATIONS AND TORQUE VALUES

BATTERIES, SUPPORTS AND CABLES

Battery ground .... Negative
Full charge specific gravity (corrected for 80°F [27°C] electrode temperature) .... 1.215 to 1.270
Maximum variation between cells during specific gravity test (specific gravity points) 0.050
High-rate discharge test (minimum reading per cell) .... 4.5 volts

When replacing the battery (s) use the John Deere battery or its equivalent shown in the following chart:

Volts	John Deere Part Number	BCI Group	Cold Cranking AMPS 0°F (−18°C)	Cold Cranking AMPS −20°F (−29°C)	Reserve Capacity (Minutes at 25 amps)
6	AR45450 (2 used)	3EH	830	675	340

ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING

35 Amp Alternator

Item	Measurement	Specification
Brushes	Minimum Exposed Length	1/4 in (6.4 mm)
Output	Without Regulator (3000 rpm, 77°F [25°C])	26 amps at 14.0 volts
	With Regulator (77°F [25°])	
	Minimum at 1180 rpm (800 engine rpm)	5 amps at 13 to 15 volts
	Minimum at 3000 rpm (2040 engine rpm)	26 amps at 13 to 15 volts
Speed Ratio	Alternator to Engine	1.475:1

Alternator Through Bolts .... 50 to 60 lb-in (5.6 to 6.8 Nm)
(0.58 to 0.69 kg/m)

Brush Assembly Screws .... 20 to 30 lb-in (2.3 to 3.4 Nm)
(0.23 to 0.35 kg/m)

Alternator Pulley Nut .... 40 to 50 lb-ft (54 to 68 Nm)
(6 to 7 kg/m)

SPECIFICATIONS AND TORQUE VALUES (Continued)

ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING (Continued)

55 Amp Alternator

Item	Measurement	Specification
Brushes	Minimum Exposed Length	1/4 in (6.4 mm)
Output	Minimum at 1660 rpm (75°F (25°C)	23 amps at 13 to 15 volts
	Minimum at 3000 rpm (75°F (25°C)	45 amps at 13 to 15 volts
Speed Ratio	Alternator to Engine	2.08:1
Alternator Through Bolts		50 to 60 lb-in (5.6 to 6.8 Nm) (0.58 to 0.69 kg/m)
Brush Assembly Screws		20 to 30 lb-in (2.3 to 3.4 Nm) (0.23 to 0.35 kg/m)
Alternator Pulley Nut		40 to 50 lb-ft (54 to 68 Nm) (6 to 7 kg/m)

VEHICLE LIGHTING SYSTEM

Light	Trade No.
Headlight (two)	4411
Warning Light (two)	1156
Combination Light Sealed Beam	4409
Dash Lamp	1893

WIRING HARNESS AND SWITCHES CIRCUIT PROTECTORS

Front Wiper Fuse	5 amp
Rear Wiper Fuse	5 amp
Heater Fuse	5 amp
Pressurizer Fuse	30 amp
Main Circuit Breaker	40 amp
Cab Circuit Breaker	40 amp
Accessory Circuit Breaker	20 amp

SPECIFICATIONS AND TORQUE VALUES (Continued)

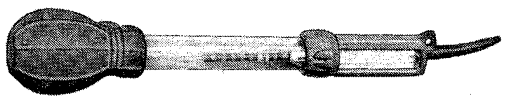
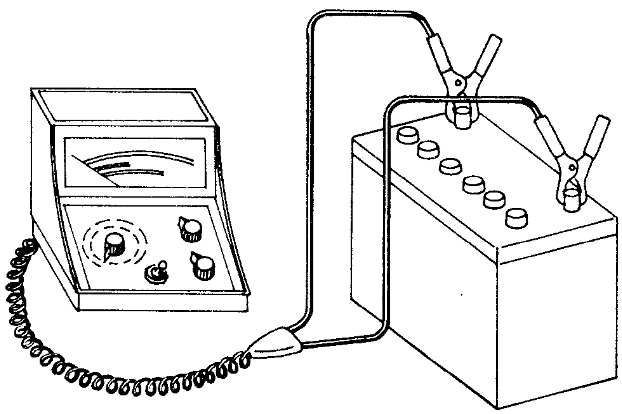
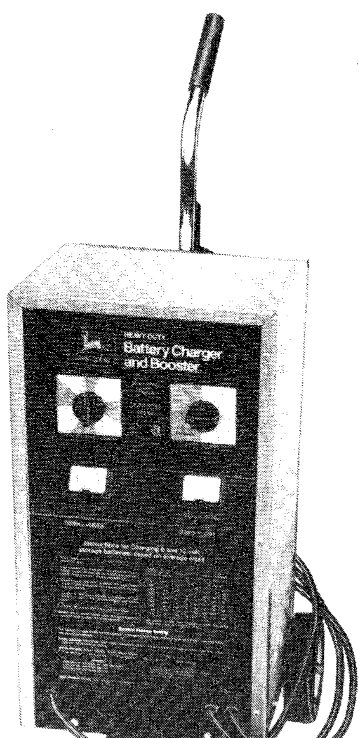
INSTRUMENTS AND INDICATORS

Mechanical Instruments and Indicators	Engine Coolant Temperature Gauge Gauge range ....100 to 240°F (38 to 116°C) Normal operating range . . 135 to 224°F (57 to 107°C)
	Tachometer Gauge range .... 0 to 2500 rpm
Electrical Instruments and Indicators	Indicator Lamp Replacement Bulb 1895R

SPECIAL TOOLS

BATTERIES, SUPPORTS AND CABLES

Convenience Tools

Tool	Tool No.	Use
 R458N *Fig. 1-Hydrometer*	....	Hydrometer - to check specific gravity
 T57280N *Fig. 2-Battery Tester*	D-24001 MO	Check battery internal condition
 T31858N *Fig. 3-Battery Charger*	TY-1337 (10 amp) TY-5104 (15 amp) TY-5105 (30 amp) TY-5106 (100 amp)	Battery Charger - To charge battery and to use as a booster to start engine

SPECIAL TOOLS

ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING

Essential Tools

Tool	Tool No.	Use

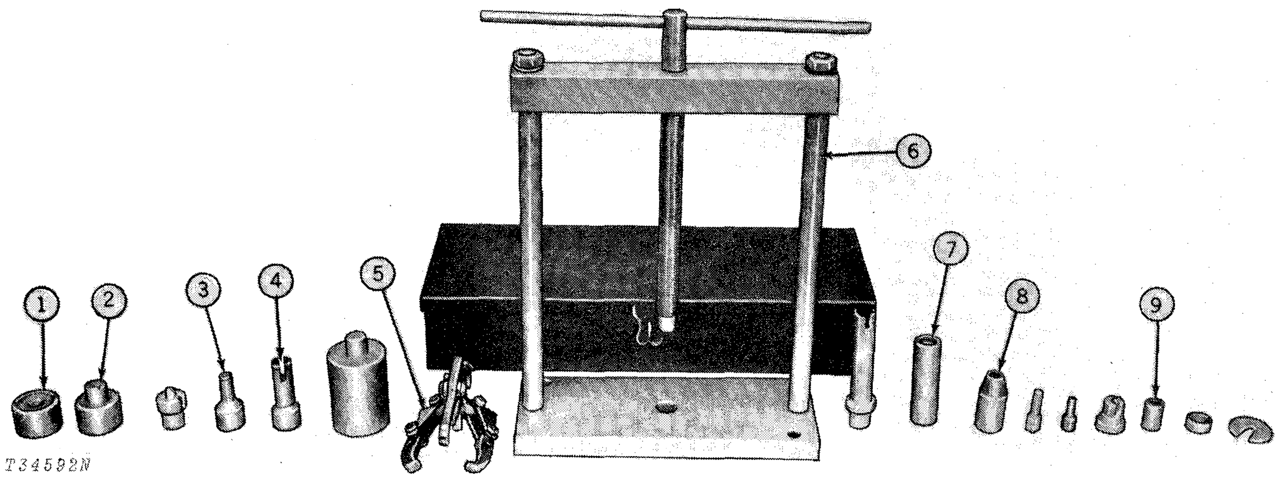


Fig. 4-A200JD Alternator Service Tool Set

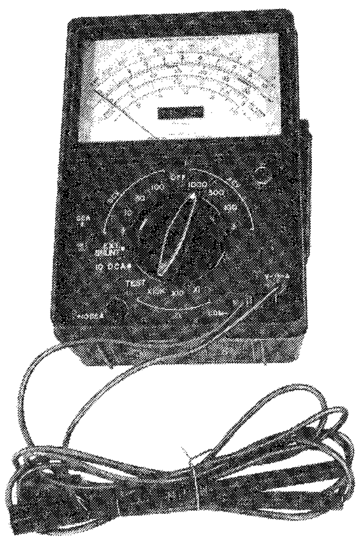
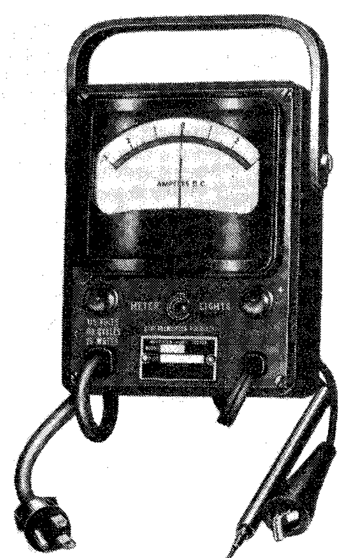
1 - A-203*	To install front bearings
2 - A-208*	To install rotor
3 - A-213*	To remove negative diodes
4 - A-214*	To install negative diodes
5 - A-216*	To remove bearings
6 - A-201*	Used with other tools in set
7 - A-209*	To install front housing
8 - A-206*	To remove positive diodes
9 - A-205*	To install positive diodes

**Tools are part of A200JD Alternator Service Tool Set and cannot be purchased individually.*

SPECIAL TOOLS—Continued

ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING

Essential Tools—Continued

Tool	Tool No.	Use
 T51677N *Fig. 5-Voltmeter, Ammeter, Ohmmeter*	D-19001 TT	Check winding resistance and continuity
 T31704NY *Fig. 6-Alternator Diode Tester*	....	Alternator Diode Tester - To test diodes.

Section 17
FRAME, CHASSIS OR SUPPORTING STRUCTURE

CONTENTS OF THIS SECTION

Group 1740
FRAME INSTALLATION

GENERAL INFORMATION

The front support mounts on the oil pan, engine block, and loader frame. The radiator, hydraulic pump, and the fuel tank are all mounted on the front support. The front axle is mounted on the underside of the support.

REMOVAL

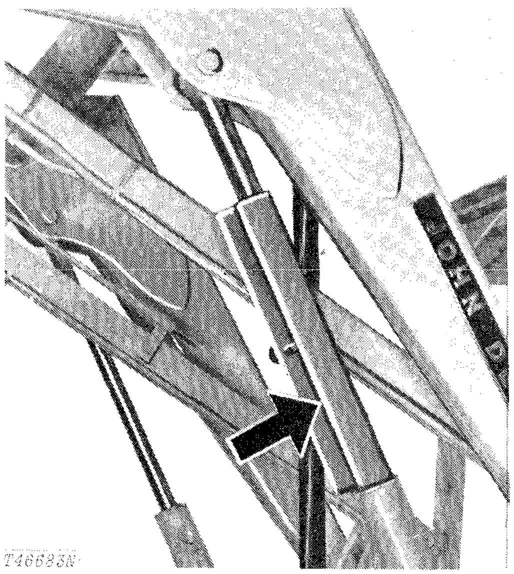


Fig. 1-Supporting Loader

Raise loader to full height and support boom by one of the following methods.

1. Attach a piece of angle iron to the boom cylinder piston rod between the rod end and the cylinder barrel, being careful to avoid damaging the piston rod. Be sure the angle iron is large enough to rest against the cylinder barrel and not against the head casting.

2. Use prop under cross member to support boom.

3. Chain bucket to hoist or overhead beam.

Disconnect battery ground straps and remove grille screen and hood. Bleed down accumulator by operating steering valve.

Drain radiator and disconnect inlet and outlet hoses. Disconnect cooler lines and air cleaner hose.

Remove radiator top support rod and disconnect fan shroud and slip it back over fan. Remove cap screws securing radiator to front end support and slide radiator out left side of tractor.

Close fuel shut-off valve at bottom of fuel tank and disconnect fuel lines. Disconnect fuel gauge sender wire.

Remove clamps securing hydraulic oil lines to engine on right side of tractor. Disconnect pressure and return lines at connector at right front side of engine.

Disconnect steering drag link rod from front steering arm.

Support machine under clutch housing and under loader side frames.

Insert wooden blocks between front axle and front end support to keep assembly from pivoting side to side.

Remove screws in pump drive shaft and pull hydraulic pump shaft from pump drive shaft.

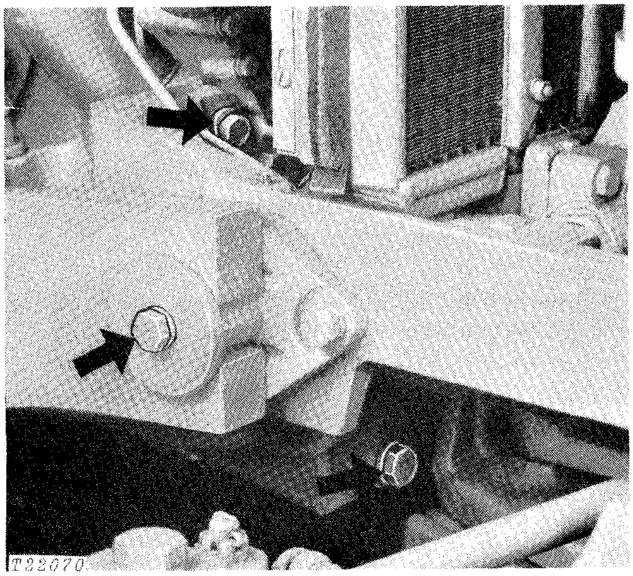


Fig. 2-Attaching Points

Position floor jack under rear portion of assembly and support with chain hoist. Remove attaching cap screws from front end support and roll away from engine.

Use caution to prevent assembly from tipping forward. Drain fuel tank if necessary.

REPAIR

Refer to Fig. 3 during disassembly.

Check all parts for excessive wear or damage and replace as necessary.

Refer to Fig. 3 during assembly and note the following:

Press bushing (12) into support so hole in bushing is in line with hole in bore.

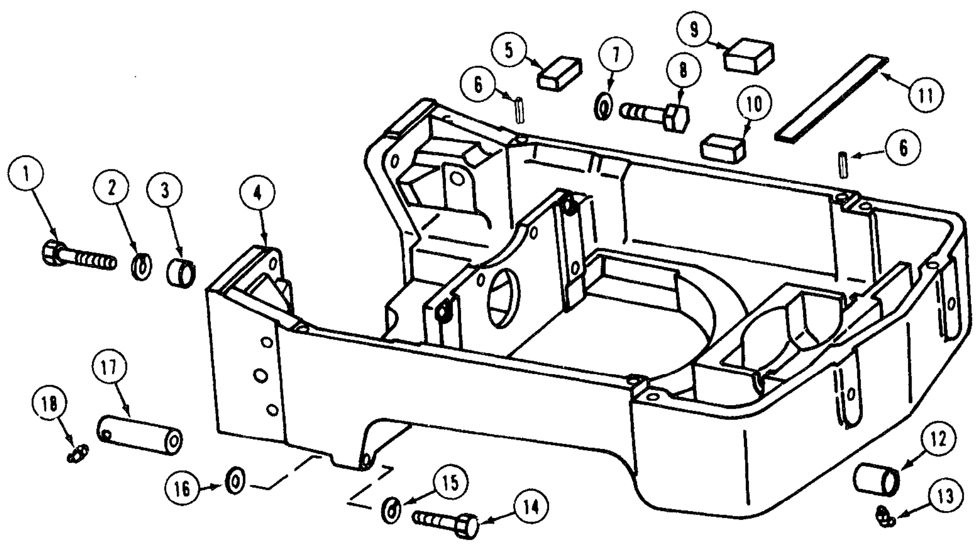
If it is necessary to replace baffle and packing strips (5 and 11) attach to the support using a suitable adhesive.

Apply T43515 John Deere LOCTITE® Retaining Compound or an equivalent between tractor front support and cylinder block.

Apply T43515 John Deere LOCTITE® Retaining Compound or an equivalent between oil pan and spacers to tractor front support.

Select spacer (16) between oil pan and front support to provide 0.000 to 0.010 in. (0.00 to 0.25 mm) clearance prior to tightening cap screws (14).

LOCTITE is a trademark of the Loctite Corp.



1—Cap Screw (2 used)
2—Lock Washer (2 used)
3—Dowel (2 used)
4—Front Support
5—Baffle
6—Spring Pin (4 used)
7—Lock Washer (4 used)
8—Cap Screw (4 used)
9—Baffle (2 used)
10—Baffle
11—Packing Strip (2 used)
12—Bushing
13—Grease Fitting
14—Cap Screw (2 used)
15—Lock Washer (2 used)
16—Spacer
17—Rear Pivot Pin
18—Grease Fitting

Fig. 3-Front Support

INSTALLATION

Reverse the removal procedure to install front end assembly. Be sure to use all shims removed between front end support and engine oil pan.

Apply T43515 John Deere LOCTITE Retaining Compound or an equivalent to front support to cylinder block and oil pan and spacers to front support.

NOTE: Before applying retaining compound, wipe all surfaces with chlorothene. Holes must be free of retaining compound.

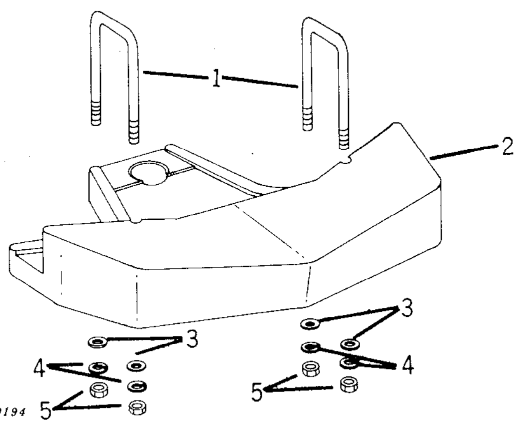
Group 1749
CHASSIS WEIGHTS

GENERAL INFORMATION

Two counterweights can be used to stabilize the backhoe loader for backhoe operation.

The first counterweight weighs 574 lb. (260 kg). The additional counterweight weighs 271 lb. (123 kg).

REMOVAL



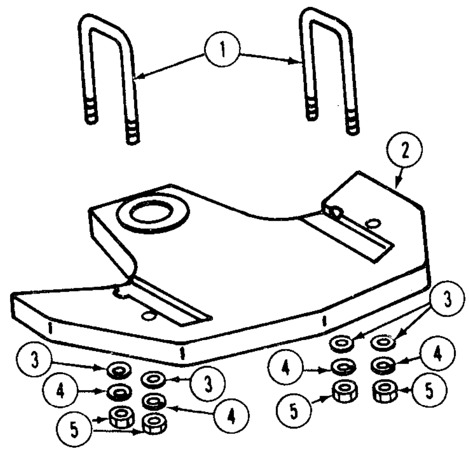
T 10194

1—U-Bolt (2 used)
2—Counterweight
3—Washer (4 used)
4—Lock Washer (4 used)
5—Nut (4 used)

Fig. 1-Counterweight

Use a floor jack for removal of the counterweights.

CAUTION: The counterweights are heavy. Be careful to avoid personal injury.



1—U-Bolt (2 used)
2—Counterweight
3—Washer (4 used)
4—Lock Washer (4 used)
5—Nut (4 used)

Fig. 2-Additional Counterweight

INSTALLATION

When installing counterweights, be sure nuts on U-bolts are tight so counterweights will not move.

Group 1799
SPECIFICATIONS AND SPECIAL TOOLS
FRAME INSTALLATION
SPECIFICATIONS AND TORQUE VALUES

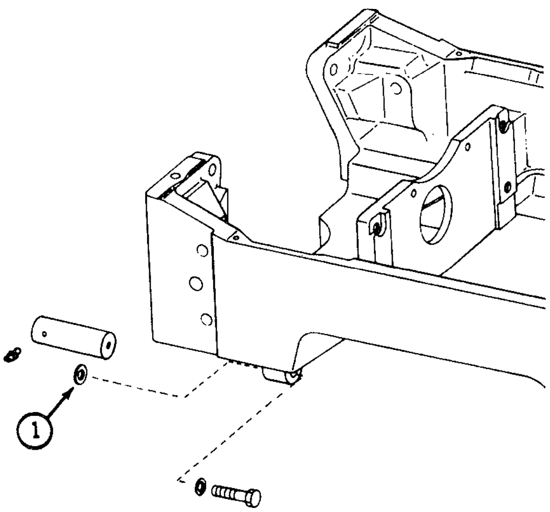


Fig. 1-Oil Pan and Front Support Clearance

1 - Clearance between oil pan and support................ 0.000 to 0.010 in. (0.00 to 0.25 mm)

Section 18
OPERATOR'S STATION

CONTENTS OF THIS SECTION

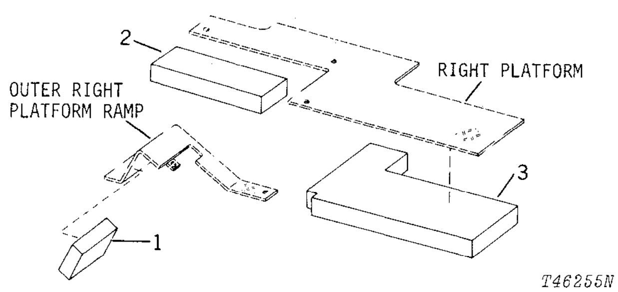
Group 1807
SPECIAL NOISE CONTROL ITEMS

GENERAL INFORMATION

Noise reduction pads are available on several areas of the unit. See Figs. 1 through 10 for location of padding.

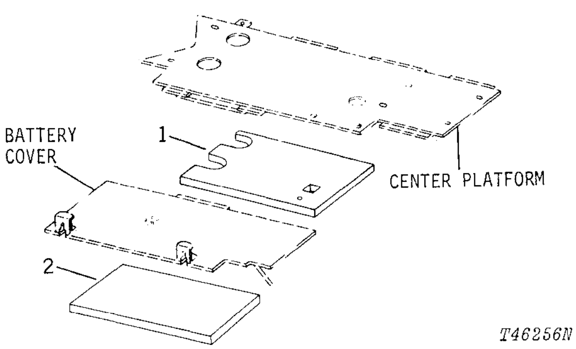
REPAIR

When removing a padded panel or cover, inspect padding for oily condition or deterioration. Replace as necessary using SCOTCH-GRIP® Plastic Adhesive or an equivalent.



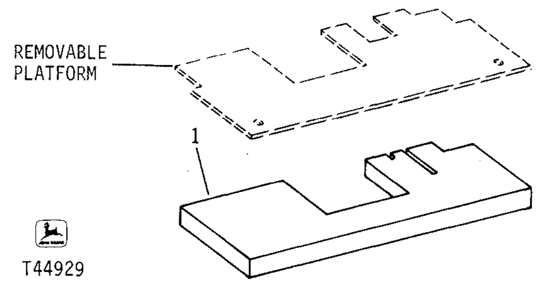
1—Outer Right Ramp Pad **3—Right Platform Pad**
2—Right Front Platform Pad

Fig. 1-Right Platform



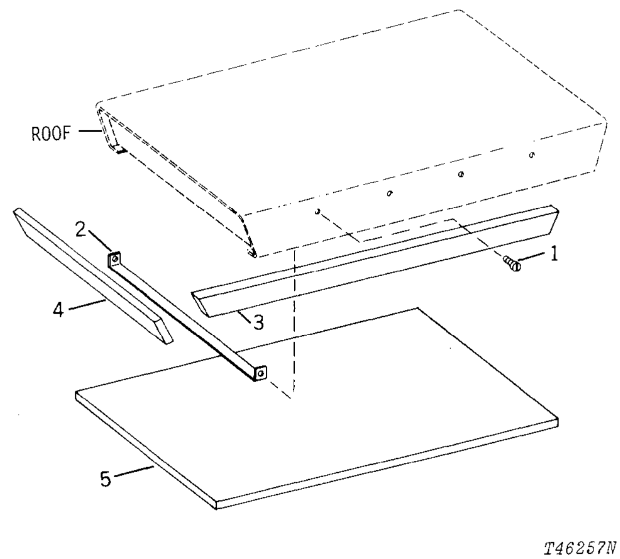
1—Center Platform Pad **2—Battery Cover Pad**

Fig. 2-Center Platform and Battery Cover



1—Removable Platform Pad

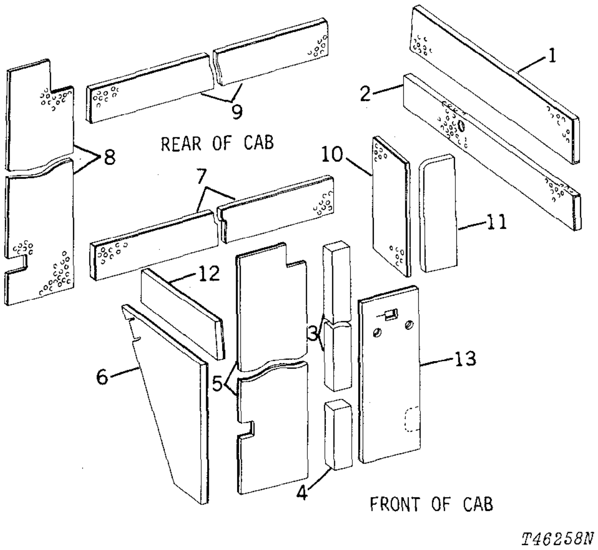
Fig. 3-Removable Platform



1—Machine Screw **4—Roof End Cover (2 used)**
2—Strap (4 used) **5—Headliner**
3—Roof Side Cover (2 used)

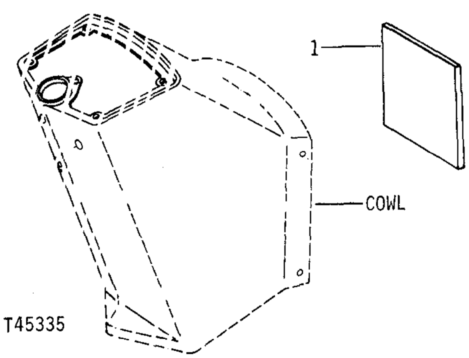
Fig. 4-Cab Roof

SCOTCH-GRIP is a trademark of the 3M Company



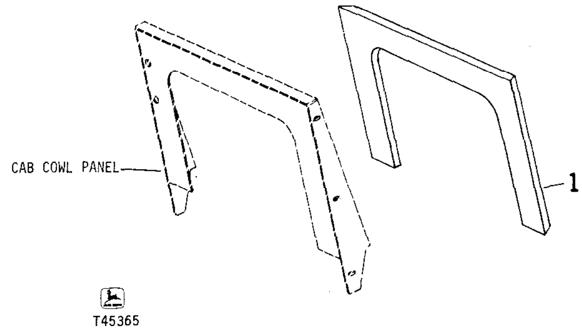
1—Upper Window Panel Cover
2—Lower Window Panel Cover
3—Upper Front Post to Cab Filler
4—Lower Front Post to Cab Filler
5—Front Canopy Post Cover
6—Lower Door Cover
7—Rear Side Filler (2 used)
8—Rear Canopy Post Cover
9—Upper Rear Cover
10—Side Rear Panel Cover
11—Fender Panel Cover
12—Upper Front Door Panel Cover
13—Lower Front Cover

Fig. 5-Cab Foam Covers and Fillers



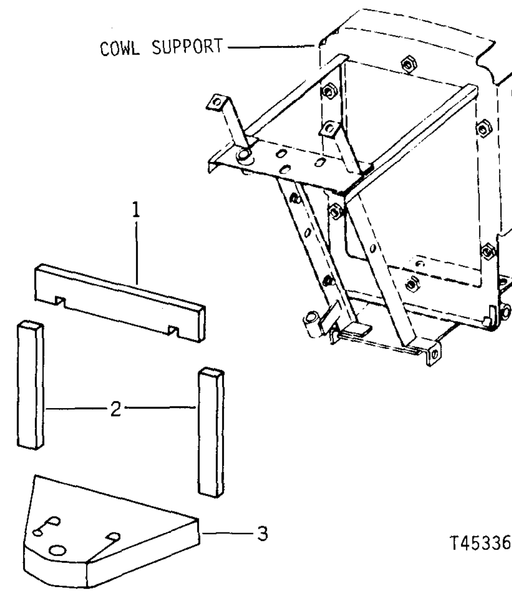
1—Cowl Cover Barrier

Fig. 6-Cowl Cover Barrier



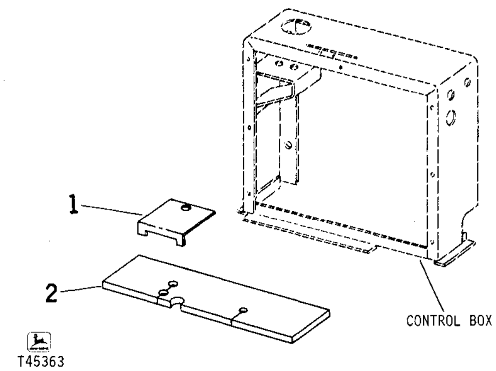
1—Cowl Panel Cover

Fig. 7-Cab Cowl Panel Cover



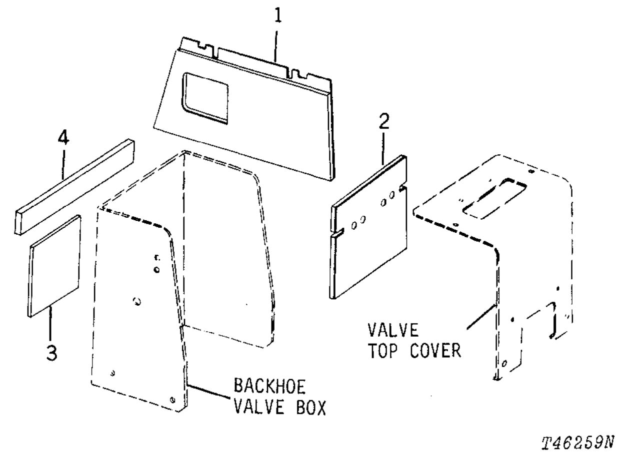
1—Cowl Support Barrier
2—Cowl Support Side Barrier (2 used)
3—Cowl Barrier

Fig. 8-Cowl Support Barriers



1—Support (2 used)
2—Control Box Barrier

Fig. 9-Control Box Barrier and Support



1—Backhoe Control Cover
2—Backhoe Control Valve Filler Cover
3—Lower Rear Cover (2 used)
4—Rear Cross Channel Cover

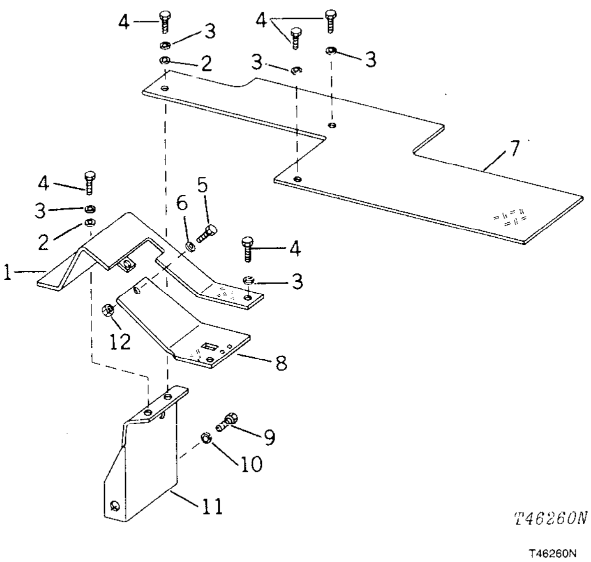
Fig. 10-Backhoe Control Valve Cover and Filler

Group 1810
OPERATOR ENCLOSURE

PLATFORM

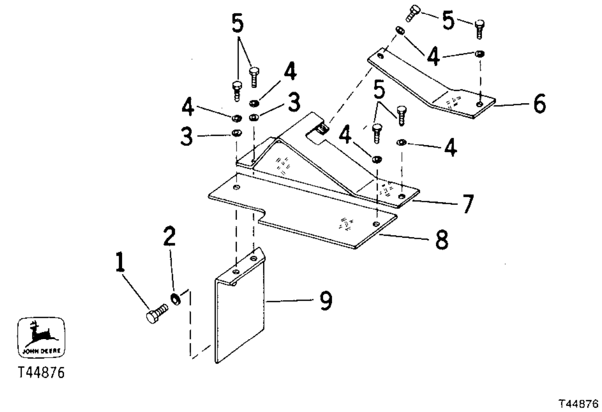
REMOVAL

Refer to Figs. 1 through 3 to remove or disassemble platform covers.



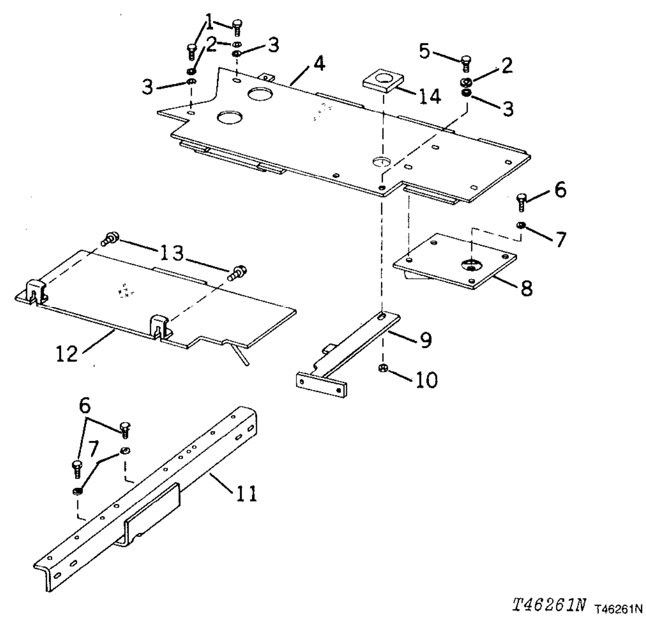
1—Outer Right Platform Ramp
2—Washer (2 used)
3—Lock Washer (5 used)
4—Cap Screw (5 used)
5—Cap Screw (2 used)
6—Lock Washer (2 used)
7—Right Platform
8—Inner Right Platform Ramp
9—Cap Screw
10—Lock Washer
11—Right Front Support
12—Nut (2 used)

Fig. 1-Right Platform and Support



1—Cap Screw
2—Lock Washer
3—Washer (2 used)
4—Lock Washer (6 used)
5—Cap Screw (6 used)
6—Inner Left Platform Ramp
7—Outer Left Platform Ramp
8—Left Platform
9—Left Front Support

Fig. 2-Left Platform and Support



1—Cap Screw (4 used)
2—Lock Washer (3 used)
3—Washer (3 used)
4—Center Platform
5—Cap Screw
6—Cap Screw (4 used)
7—Lock Washer (4 used)
8—Platform Support
9—Battery Brace
10—Nut
11—Platform Center Support
12—Battery Cover
13—Special Screw (2 used)
14—Transmission Filler Seal

Fig. 3-Center Platform and Battery Cover

ROLLOVER PROTECTIVE STRUCTURE

GENERAL INFORMATION

The 310A and 310B Backhoe Loaders may be equipped with a cab, or a cushion mounted ROPS.

REMOVAL

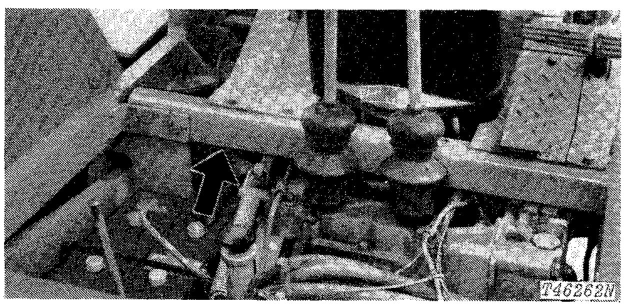
Remove backhoe and tie bars as instructed in Group 3340. On units equipped with a 9500 Backhoe, the backhoe main frame must also be removed.

Remove seat as instructed in Group 1821.

Remove all platform covers (Fig. 1-3).

Remove batteries.

Remove control box door and disconnect linkage and wiring from control box. Remove platform center support (Fig. 4).



T46262N

Fig. 4-Platform Center Support

Remove fenders as instructed in Group 1927.

Disconnect wiring to lights and remove roof. Attach chain hoist to ROPS.

Remove horn and horn bracket.

Remove front cross member (11, Fig. 5).

Remove cap screw securing ROPS front upper mounts to bracket (Fig. 6).

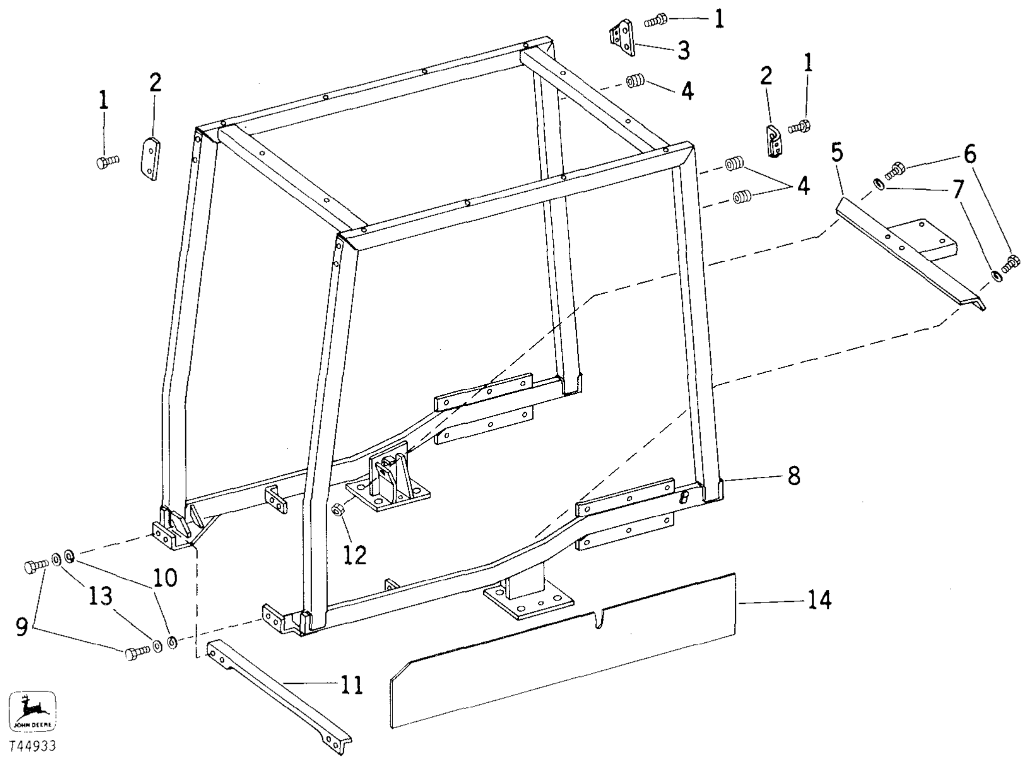
Place blocking under rear of loader side frames by axle housing to keep them in position when removing rear attaching bolts.

Remove hardware attaching canopy to rear support (Fig. 7).

Remove ROPS.

REPAIR

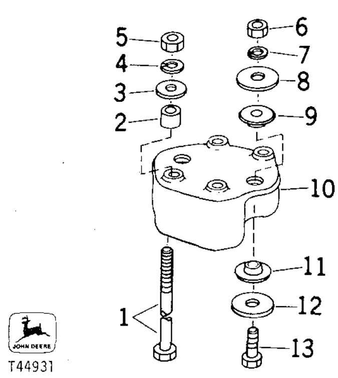
Refer to Figs. 5-7 to disassemble ROPS or supports.



T44933

1—Drive Screw (8 used)
2—Corner Bracket (2 used)
3—Corner Bracket (2 used)
4—Grommet (4 used)
5—Rear Cross Member
6—Cap Screw (2 used)
7—Lock Washer (2 used)
8—ROPS
9—Cap Screw (4 used)
10—Lock Washer (4 used)
11—Front Cross Member
12—Nut (2 used)
13—Washer (4 used)
14—Sealing Strip

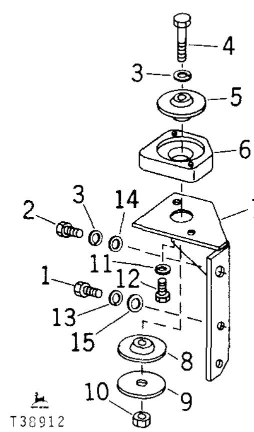
Fig. 5-ROPS



T44931

1—Bolt (4 used)
2—Spacer (4 used)
3—Washer (4 used)
4—Lock Washer (4 used)
5—Nut (4 used)
6—Nut (4 used)
7—Lock Washer (2 used)
8—Washer (6 used)
9—ROPS Upper Mount (2 used)
10—Rear Support
11—ROPS Lower Mount (2 used)
12—Washer (2 used)
13—Cap Screw (2 used)

Fig. 6-ROPS Rear Cushion Mount Support



T38912

1—Cap Screw (2 used)
2—Cap Screw
3—Lock Washer (2 used)
4—Cap Screw
5—Upper ROPS Front Mount
6—Socket Mount
7—Right Front Bracket
8—Lower ROPS Front Mount
9—Washer
10—Nut
11—Lock Washer (2 used)
12—Cap Screw (2 used)
13—Lock Washer (2 used)
14—Washer (2 used)
15—Washer (2 used)

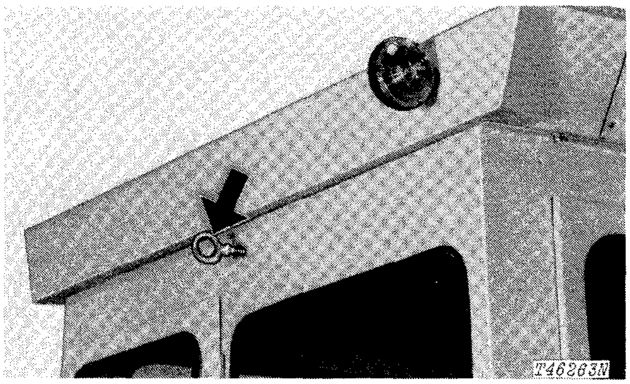
Fig. 7-ROPS Front Cushion Mount Socket and Bracket

CAB (310A)

REMOVAL

Install eyebolts into each side of cab (Fib. 8).

Make sure shoulder on eyebolt is tight against cab wall.



T46263N

Fig. 8-Eyebolt

Attach chain hoist to eyebolts.

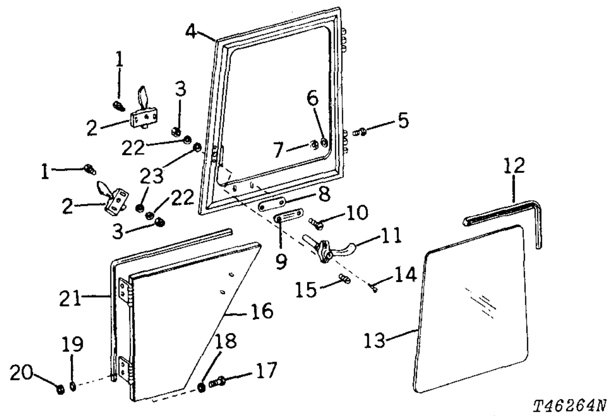
Disconnect wiring and remove heater hoses to cab.

Remove filler panels (20, Fig. 11).

Remove hardware attaching cab to ROPS (3, 4, 5, 6, 7 and 8, Fig. 11) and pull cab carefully away from unit.

REPAIR

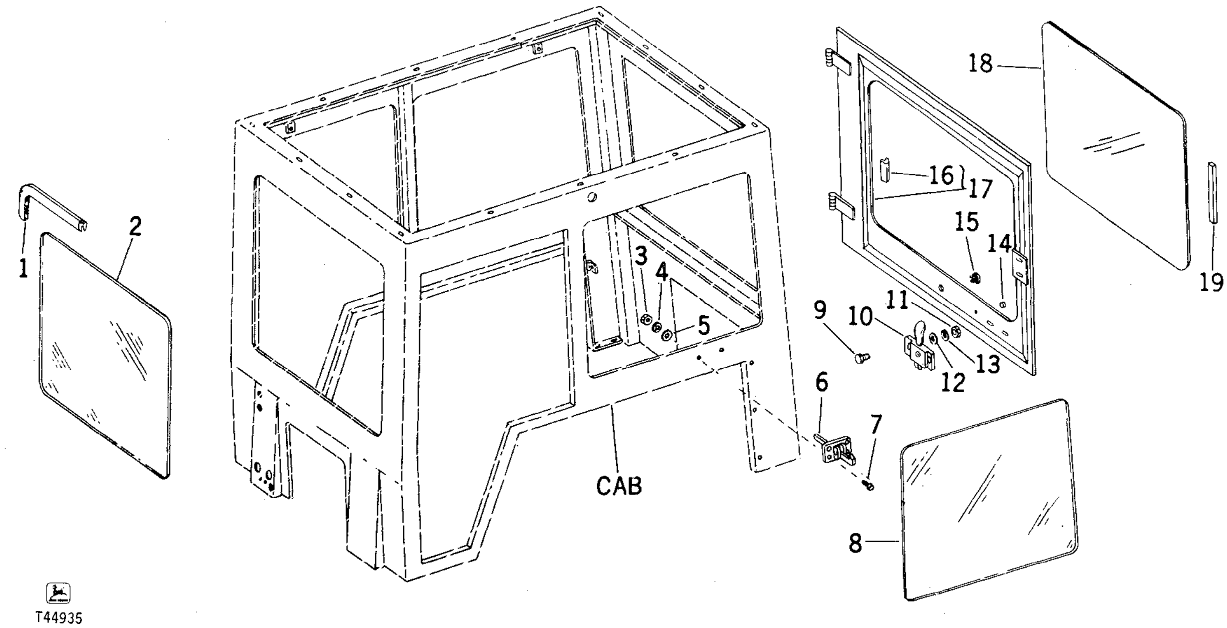
Refer to Figs. 9, 10 and 11 to disassemble and assemble cab components.



T46264N

1—Pan Head Screw (10 used)
2—Latch (2 used)
3—Nut (8 used)
4—Upper Front Door
5—Cap Screw (4 used)
6—Lock Washer (4 used)
7—Nut (4 used)
8—Pad (2 used)
9—Latch (2 used)
10—Flat Head Screw (4 used)
11—Locking Handle (2 used)
12—Glass Weatherstrip (2 used)
13—Door Glass
14—Locking Door Handle Key
15—Flat Head Screw (4 used)
16—Lower Front Door
17—Cap Screw (4 used)
18—Washer (8 used)
19—Lock Washer (8 used)
20—Nut (8 used)
21—Door Weatherstrip
22—Lock Washer (8 used)
23—Washer (8 used)

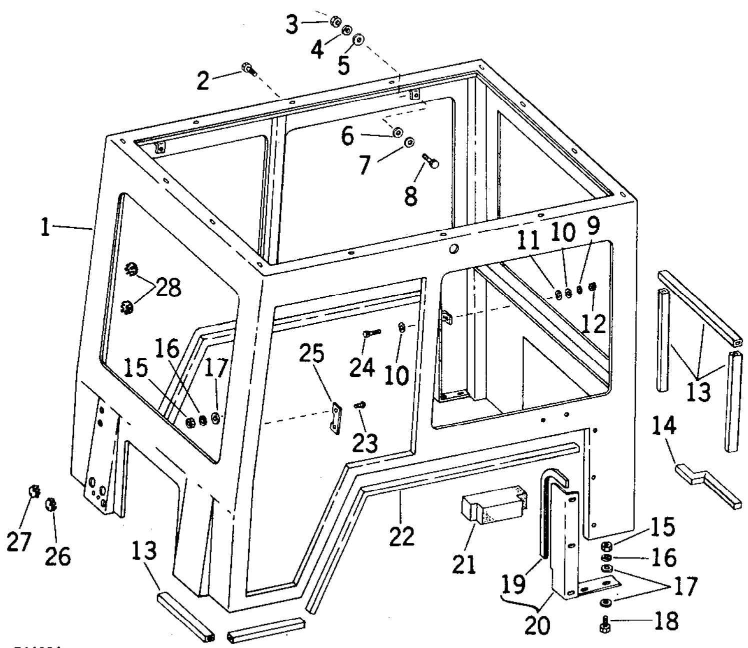
Fig. 9-Cab Door



T44935

1—Glass Weatherstrip (4 used)
2—Windshield
3—Nut (4 used)
4—Lock Washer (4 used)
5—Washer (4 used)
6—Locking Plunger (2 used)
7—Flat Head Screw (4 used)
8—Glass
9—Pan Head Screw (2 used)
10—Latch
11—Nut (2 used)
12—Washer (2 used)
13—Lock Washer (2 used)
14—Button Plug (without rear wiper)
15—Button Plug (without rear wiper)
16—Rear Window Seal
17—Rear Window Frame
18—Rear Window Glass
19—Rear Window Weatherstrip

Fig. 10-Cab Window Glass



T44934

1—Cab Frame
2—Cap Screw (2 used)
3—Nut (4 used)
4—Lock Washer (4 used)
5—Washer (4 used)
6—Washer (16 used)
7—Washer (4 used)
8—Cap Screw (4 used)
9—Lock Washer (4 used)
10—Washer (8 used)
11—Washer (8 used)
12—Nut (4 used)
13—Seal (8 used)
14—Seal (2 used)
15—Nut (10 used)
16—Lock Washer (10 used)
17—Washer (16 used)
18—Cap Screw (10 used)
19—Weatherstrip
20—Panel
21—Filler (2 used)
22—Seal (2 used)
23—Pan Head Screw (2 used)
24—Cap Screw (4 used)
25—Striker Plate
26—Button Plug (2 used)
27—Button Plug (2 used)
28—Button Plug (2 used)

Fig. 11-Cab

INSTALLATION

Follow removal procedure in reverse order.

CAB (310B)

REMOVAL

Disconnect battery ground cable from the battery.

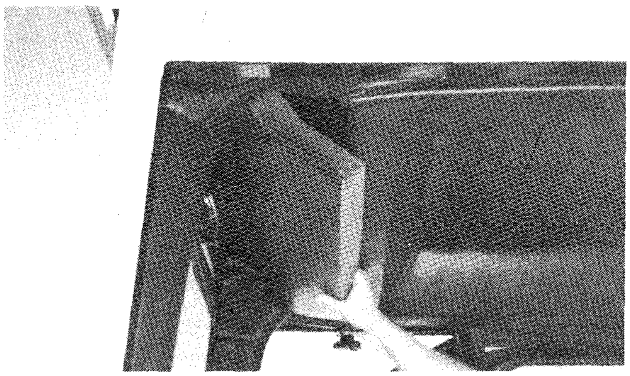

T85007

Fig. 12-Removing Front Headliner

Remove front headliner.

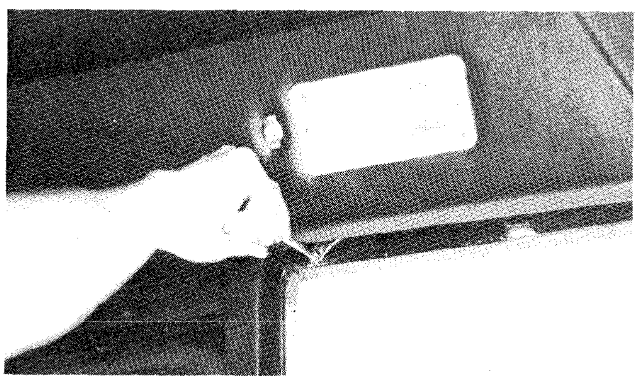
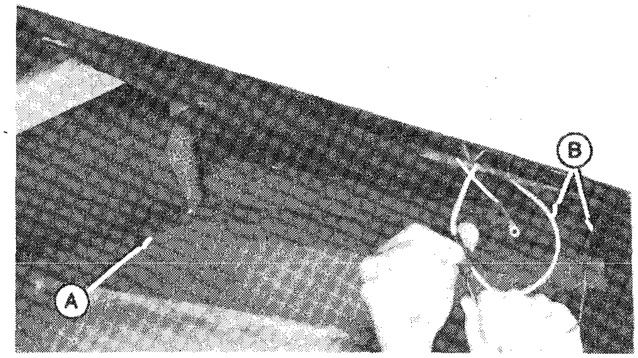

T85008

Fig. 13-Dome Light Ground Wire

Disconnect dome light ground wire.



T85009

A—Center Headliner **B—Dome Light Wires**

Fig. 14-Center Headliner and Dome Light Wires

Pull left front corner of center headliner (A, Fig. 14) down.

Disconnect wires (B).

Remove center headliner (A).

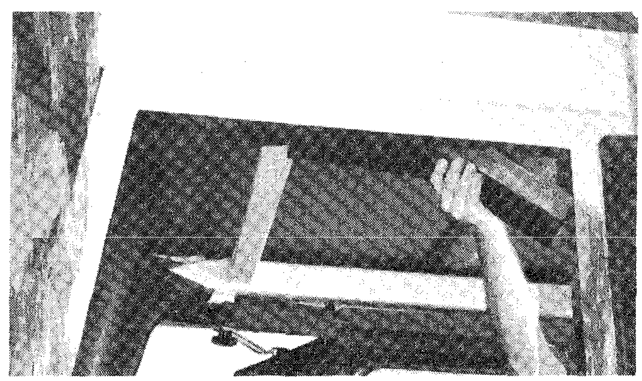
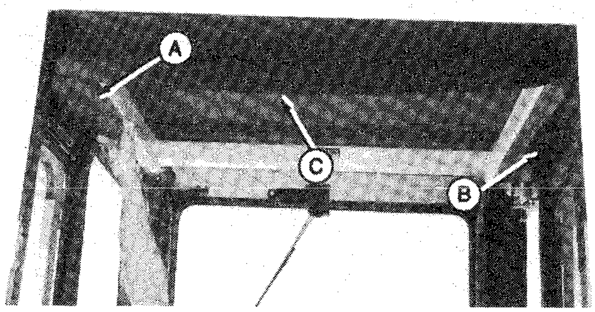

T85010

Fig. 15-Left Front Side Headliner

Remove left and right front side headliners.



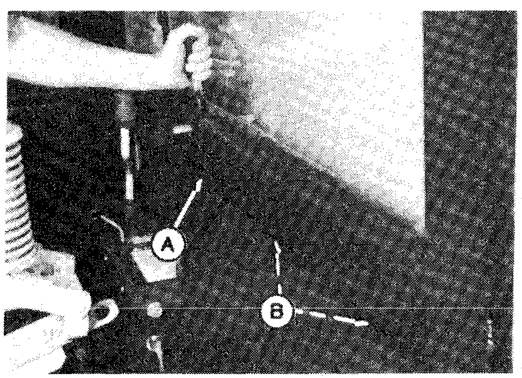
A—Left Rear Side Headliner
B—Right Rear Side Headliner
C—Rear Headliner

Fig. 16-Rear Headliners

Remove left and right rear side headliners (A and B, Fig. 16).

Remove rear headliner (C).

Remove floor mats.

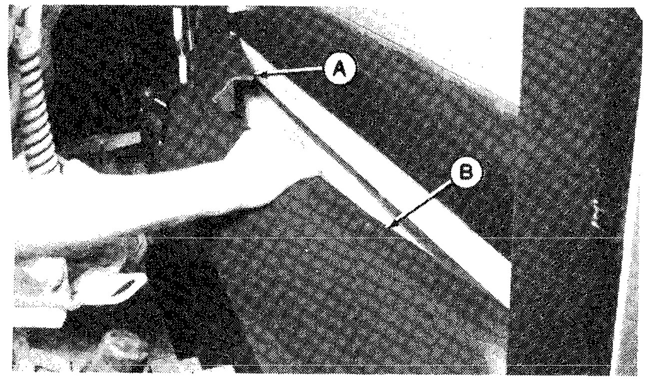


A—Screw
B—Screw (2 used)

Fig. 17-Right Side Cover Fastening Screws

Remove screw (A, Fig. 17) from right front side cover.

Remove screws (B) from right and left rear side covers.



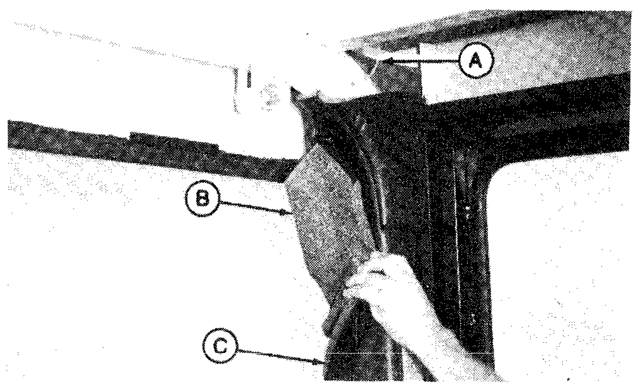
A—Right Front Side Cover
B—Right Rear Side Cover

Fig. 18-Removing Side Covers

Remove right rear side cover (B, Fig. 18).

Remove right front side cover (A).

Remove left side cover.



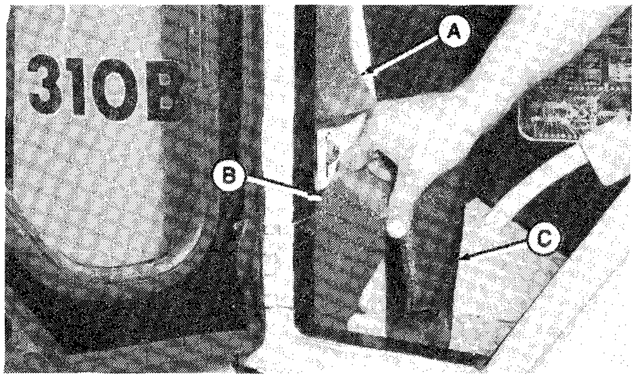
A—Warning Light Lead
B—Filler
C—Canopy Post Cover

Fig. 19-Right Rear Canopy Post

Pull back canopy post rear cover (C, Fig. 19) with filler (B).

Disconnect wire lead (A).

Repeat same procedure for left canopy post.



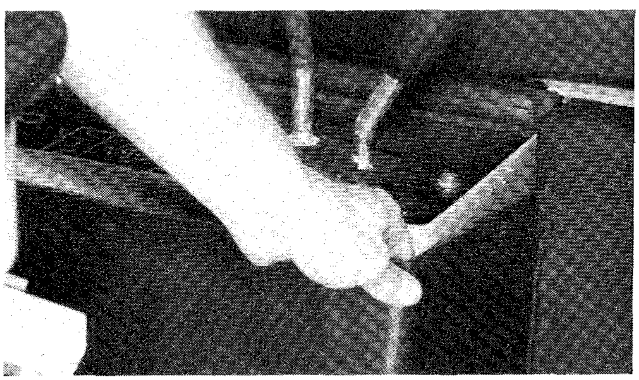
T85015

A—Upper Filler
B—Lower Filler
C—Canopy Post Cover

Fig. 20-Left Front Canopy Post

Pull canopy post cover (C, Fig. 20) back and remove fillers (A and B).

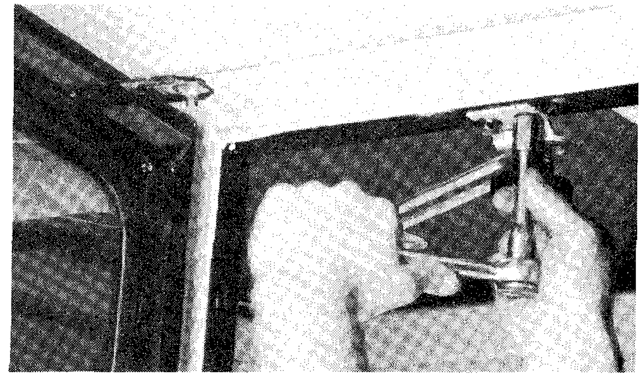
Repeat same procedure for right front canopy post.



T85016

Fig. 21-Backhoe Valve Box Cover

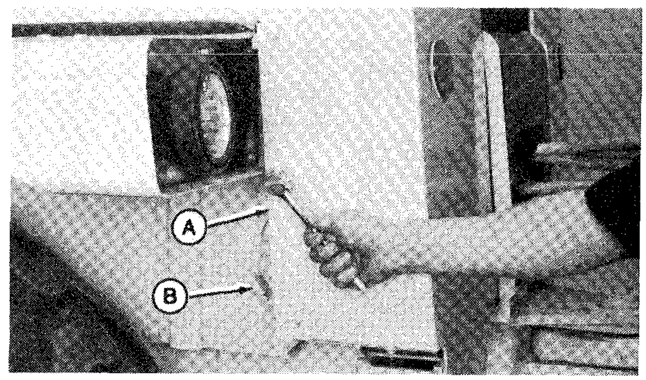
Remove three screws to remove backhoe valve box cover.



T85017

Fig. 22-Door Adjuster Bracket

Remove door adjuster bracket.



T85018

A—Panel
B—Wire Lead

Fig. 23-Panel

Remove panel (A, Fig. 23) from both sides of cab.

Disconnect wire (B) from both sides of cab.

Fig. 24-Rear Cab Filler

Remove rear cab filler from both sides of cab.

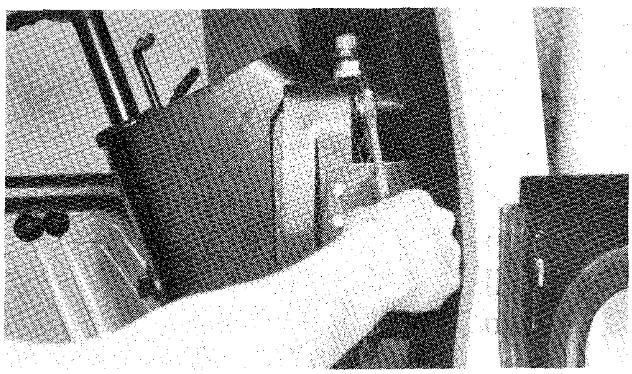
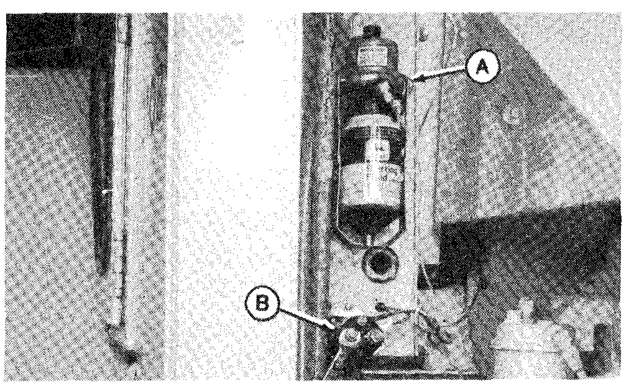


Fig. 25-Cab Heater Hoses

Remove hoses from heater and pull hoses out of cab.



A—Fluid Starting Aid **B—Cab Relay**

Fig. 26-Fluid Starting Aid and Cab Relay

Disconnect wires from cab relay (B, Fig. 26) and remove relay.

Disconnect wires and tube from fluid starting aid (A).

Remove fluid starting aid.

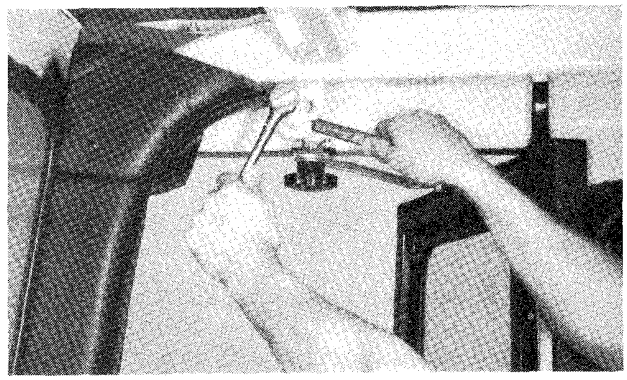


Fig. 27-Cab-To-ROPS Upper Cap Screws

Remove cap screws (Fig. 27) in four locations.

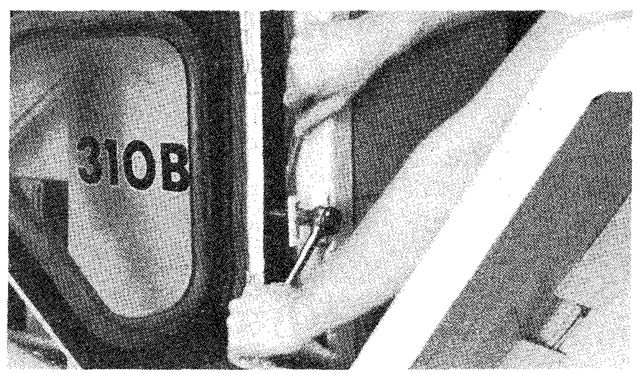
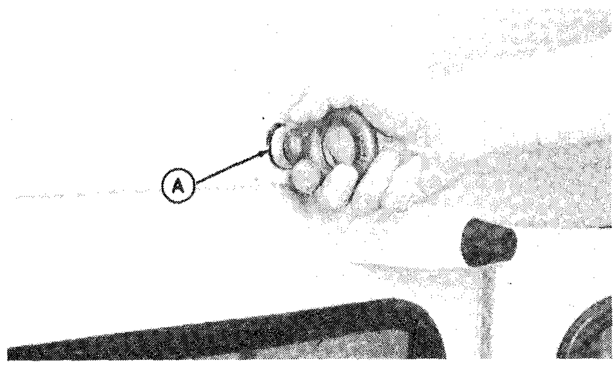


Fig. 28-Cab-To-ROPS Lower Cap Screws

Remove cap screws (Fig. 28) in four locations.



A—Washers

Fig. 29-Installing Eyebolts

Remove plug from both sides of cab roof.

IMPORTANT: Install enough washers so that when eyebolt is tightened, eyebolt shoulder is tight against the washers.

Install washers (A, Fig. 29) and eyebolts into both sides of cab.

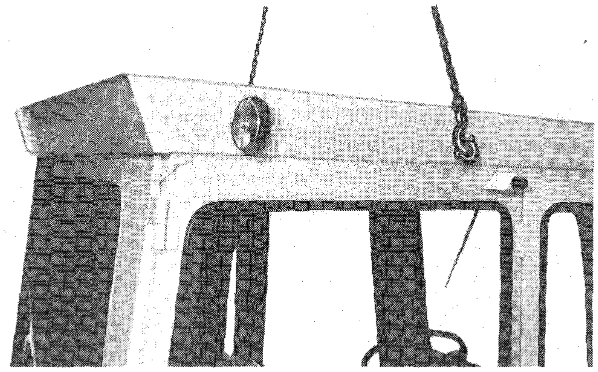


Fig. 30-Removing Cab

Attach chain hoist to eyebolts.

Slowly lift cab off of unit.

INSTALLATION

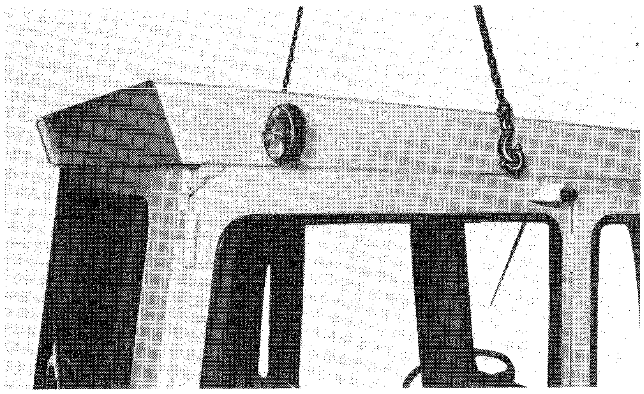
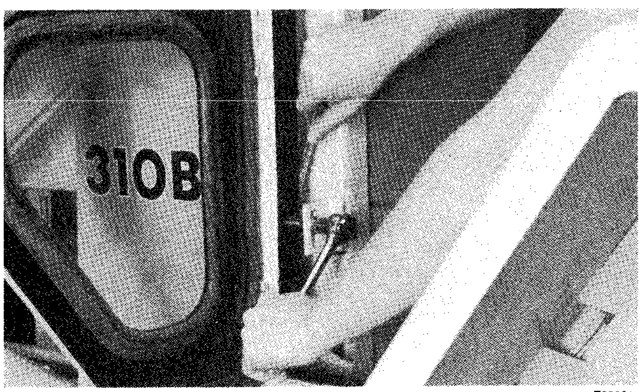

T82025

Fig. 31-Installing Cab

Attach chain hoist to eyebolts.

Slowly lower cab on unit.



T85021

Fig. 32-Lower Fastening Cap Screws

Install lower fastening cap screws in four locations. Use enough washers to fill gap between mounting brackets.

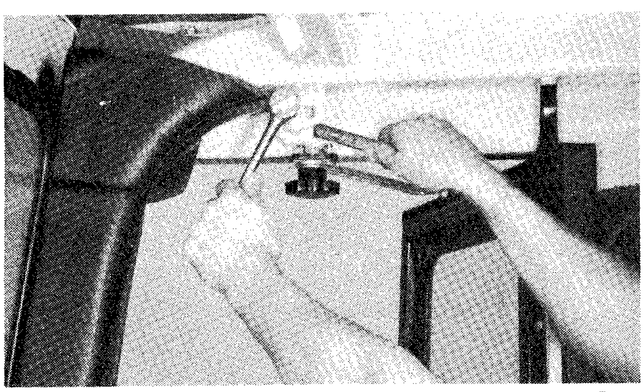

T85020

Fig. 33-Upper Fastening Cap Screws

Install upper fastening cap screws in four locations (Fig. 33). Use enough washers to fill gap between mounting brackets.

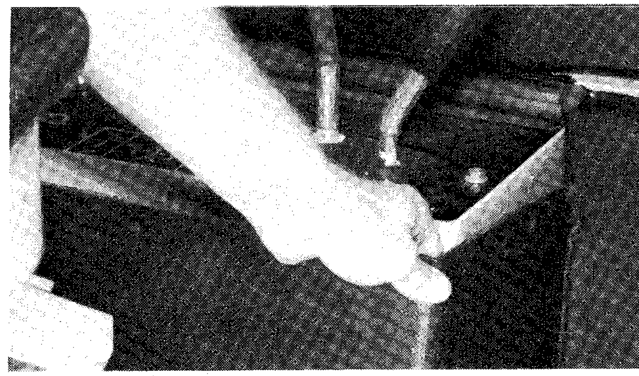
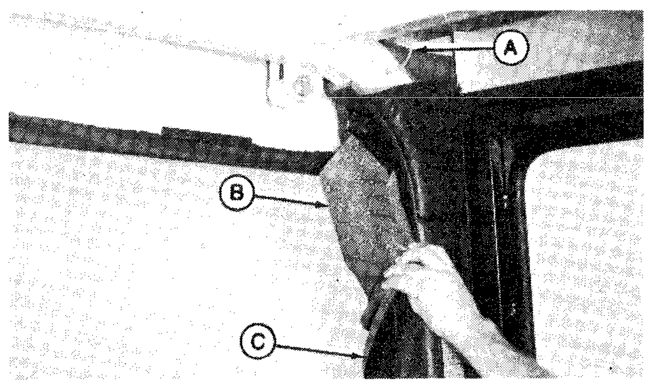

T85016

Fig. 34-Installing Backhoe Valve Box Cover

Install backhoe valve box cover.



T85014

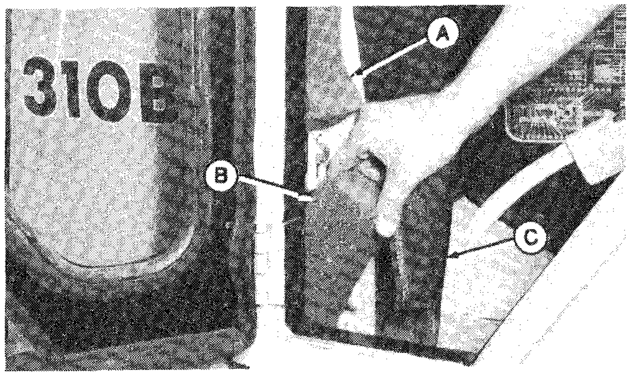
A—Wire Lead
B—Filler
C—ROPS Post Cover

Fig. 35-Installing Rear ROPS Post Cover

Install ROPS post cover (C, Fig. 35) with filler (B) between post and cab.

Connect wire lead (A) to warning light lead.

Repeat same procedure for other rear ROPS post.



T85015

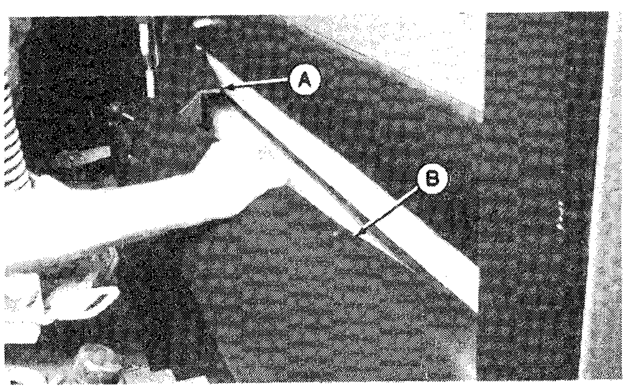
A—Upper Filler
B—Lower Filler
C—Front ROPS Post Cover

Fig. 36-Installing Front ROPS Post Covers and Fillers

Install fillers (A and B, Fig. 36).

Install post cover (C).

Repeat same procedure for the other front ROPS post.



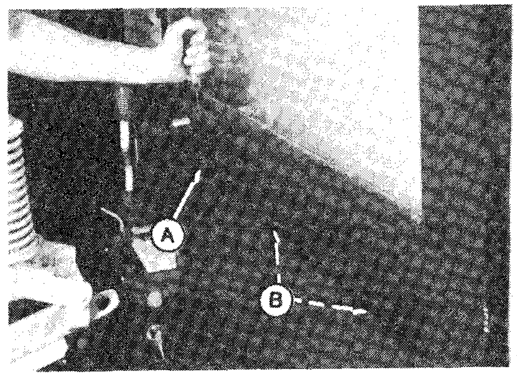
T85013

A—Right Front Side Cover
B—Right Rear Side Cover

Fig. 37-Installing Side Covers

Install right front and right rear side covers (A and B, Fig. 37).

Install left side cover.



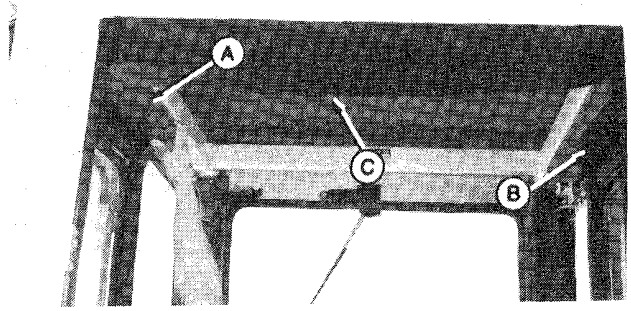
T85012

A—Screw
B—Screw (2 used)

Fig. 38-Right Side Cover Screws

Install screw (A, Fig. 38) into right front side cover.

Install screws (B) into right and left rear side covers.



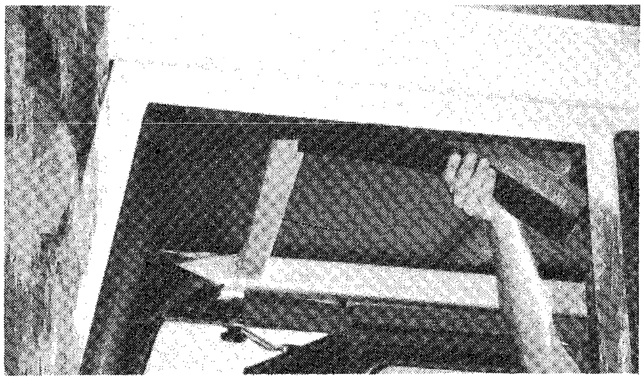
T85011

A—Left Rear Side Headliner
B—Right Rear Side Headliner
C—Rear Headliner

Fig. 39-Rear Headliners

Install left and right rear side headliners (A and B, Fig. 39).

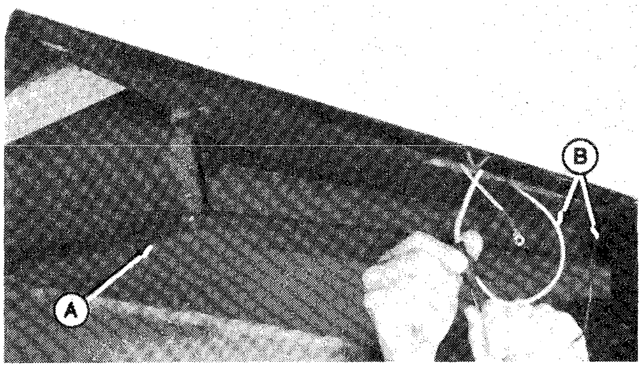
Install rear headliner (C).



T85010

Fig. 40-Installing Front Side Headliners

Install right and left front side headliners.



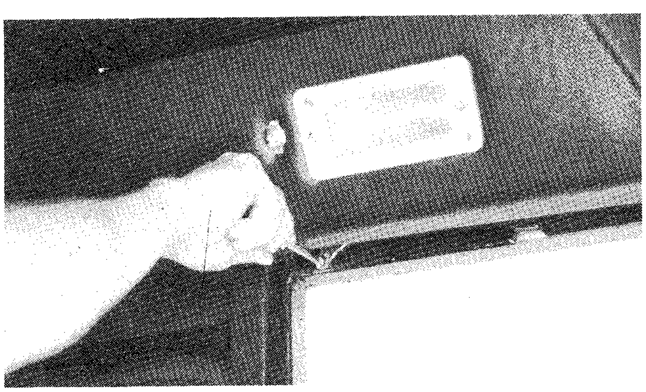
T85009

A—Center Headliner **B—Dome Light Wires**

Fig. 41-Center Headliner and Dome Light Wires

Connect dome light wires (B, Fig. 41).

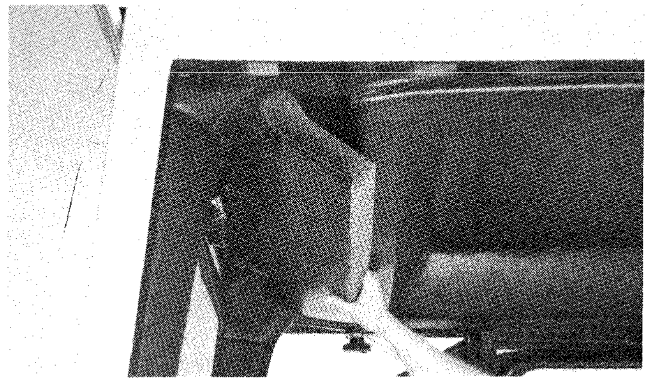
Install center headliner (A).



T85008

Fig. 42-Connect Ground Wire

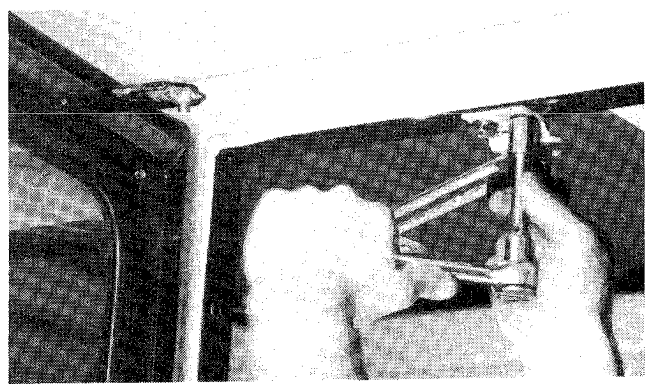
Connect dome light ground wire to cab (Fig. 42).



T85007

Fig. 43-Installing Front Headliner

Install front headliner.



T85017

Fig. 44-Installing Door Adjuster Bracket

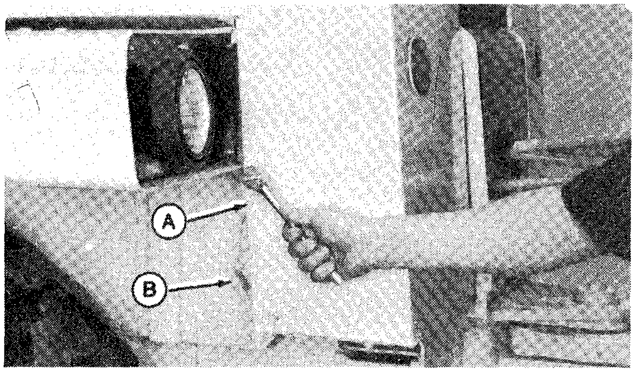
Install door adjuster bracket to cab.

Connect adjuster to door.

T85019

Fig. 45-Rear Cab Filler

Install rear cab fillers on both sides of cab.

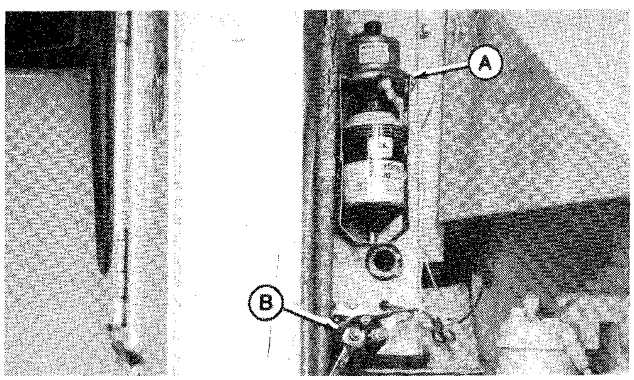


A—Filler Panel **B—Rear Light Wire Lead**

Fig. 46-Installing Filler Panels

Install rear filler panel (A, Fig. 46) on both sides of cab.

Connect rear light wire lead (B) on both sides of cab.



A—Fluid Starting Aid **B—Cab Relay**

Fig. 47-Fluid Starting Aid and Cab Relay

Install fluid starting aid (A, Fig. 47) and connect wires.

Install cab relay (B) and connect wires.

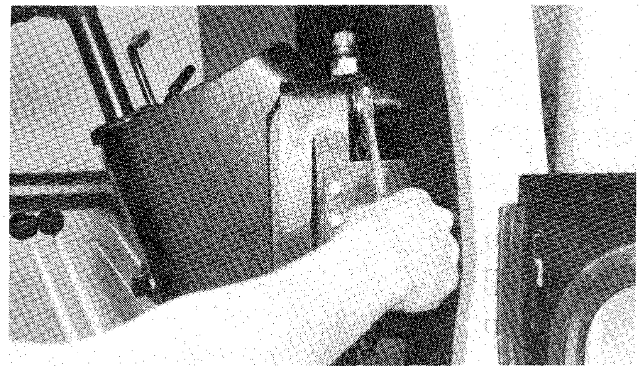


Fig. 48-Cab Heater Hoses

Install heater hoses through holes in cab and connect hoses to heater.

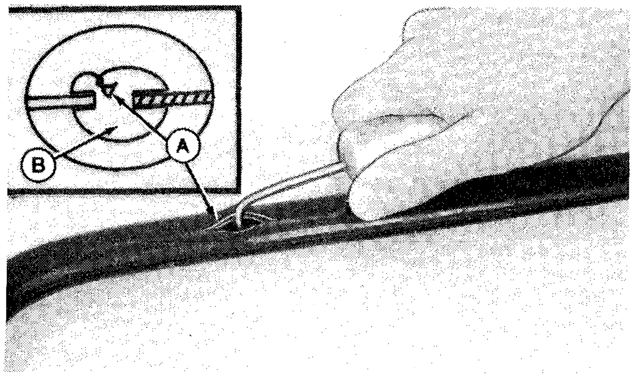
Connect battery ground strap.

Install floor mats.

WINDOWPANES

REMOVAL

NOTE: All windowpanes from the cab are removed using the following procedure.

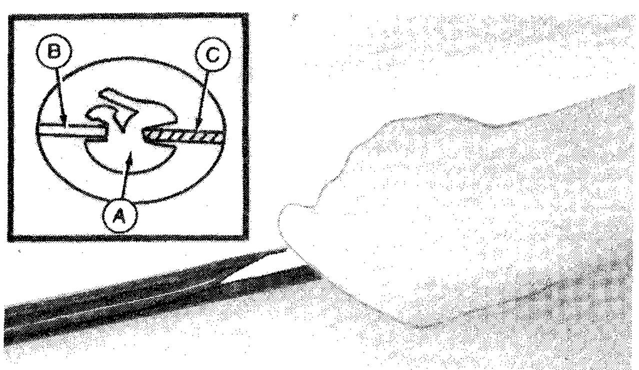


T85103

A—Locking Tab **B—Molding**

Fig. 49-Loosening Locking Tab

Use JDG-128-1 Tool Assembly from JDG-128 Glass Service Set and loosen locking tab (A, Fig. 49) from molding (B).

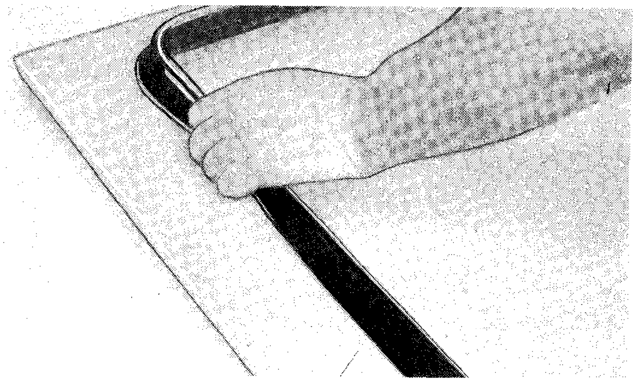


T85104

A—Molding **C—Frame**
B—Window Pane

Fig. 50-Loosening Molding

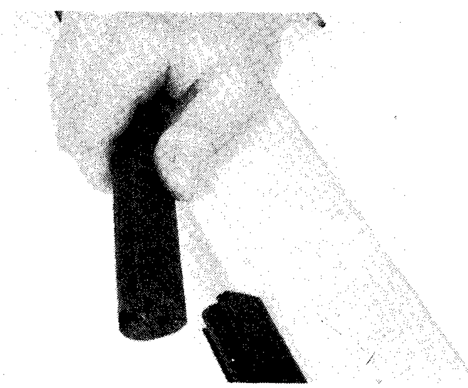
Use JDG-128-2 Insert Tool from JDG-128 Glass Service Set to loosen molding (A, Fig. 50) between window (B) and window frame (C).



T85105

Fig. 51-Removing Windowpane

Push with your hands to remove windowpane. Use extreme care when removing the windowpane or damage can occur.

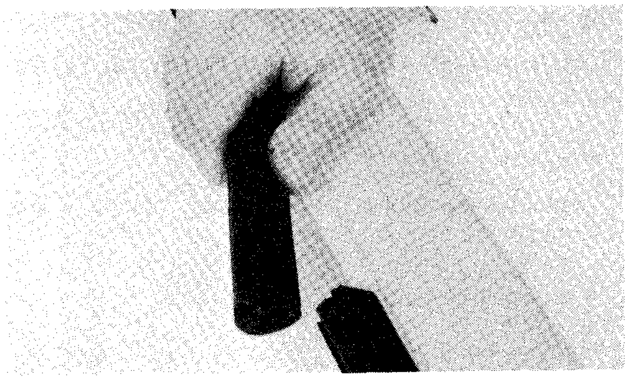


T85329

Fig. 52-Window Molding

Remove and inspect molding for damage; replace if necessary.

INSTALLATION



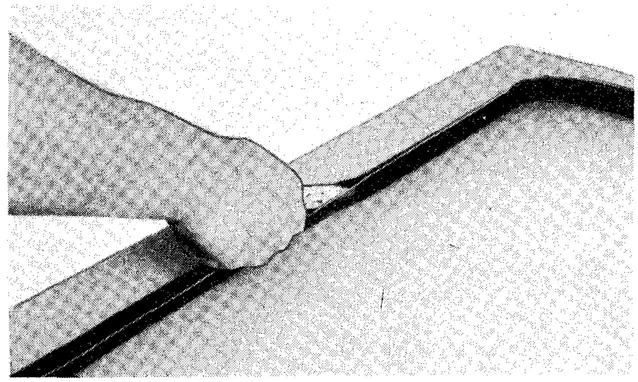
T85329

Fig. 53-Installing Molding

Install molding on cab panel edge. Start molding so that the joint is on side of window. If joint is at top or bottom of window, water can enter into inside of cab.

Put TY15147 John Deere LOCTITE® Super Bonder or an equivalent in joint of window molding.

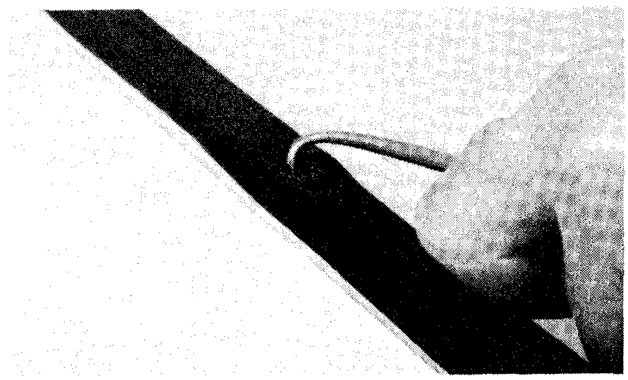
Put AR54749 Soap Lubricant or an equivalent in windowpane groove and on locking tab.



T85106

Fig. 54-Installing Windowpane

Use JDG-128-2 Insert Tool to install windowpane.



T85107

Fig. 55-Installing Locking Tab

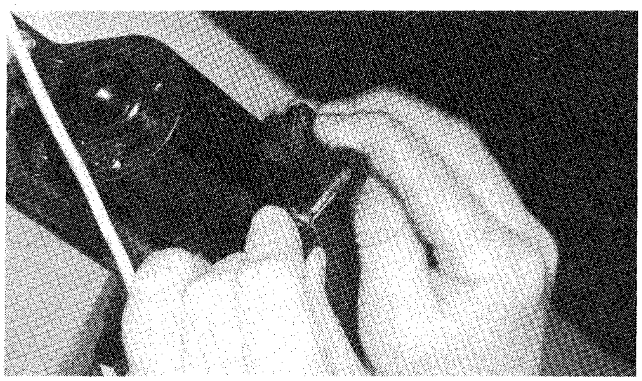
Use JDG-128-1 Tool Assembly to push locking tab into groove.

LOCTITE is a trademark of the Loctite Corp.

WINDSHIELD WIPERS

FRONT WINDSHIELD WIPER (310B Shown)

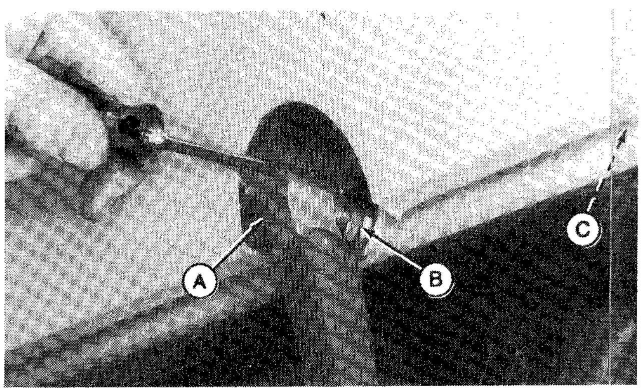
Removal



T85330

Fig. 56-Wiper Motor Lead

Disconnect wiper motor lead at the fuse.



T85331

A—Wiper Arm
B—Nut
C—Screw

Fig. 57-Front Windshield Wiper

Use a screwdriver to pry wiper arm (A) off motor shaft.

Remove nut (B) and screw (C) to remove motor from cab.

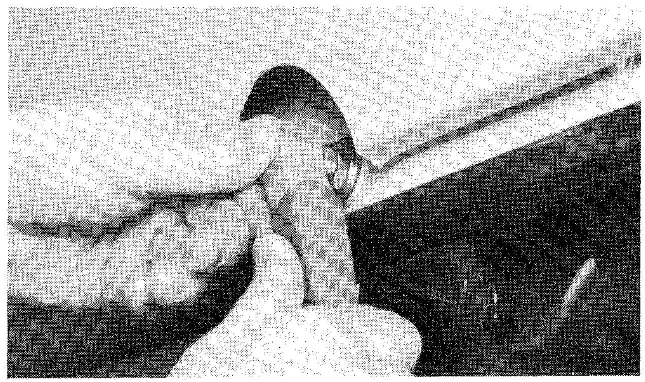
Repair

The windshield wiper motor is not repairable. Replace if defective.

Installation

Install wiper motor in cab and fasten with nut (B, Fig. 57) and screw (C).

Connect wire lead (Fig. 56).



T85332

Fig. 58-Install Wiper Arm

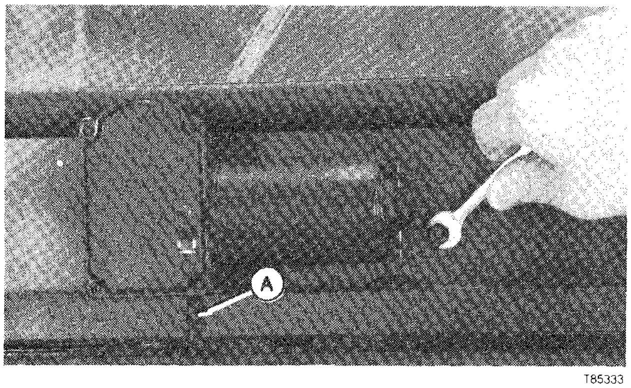
Install wiper arm on motor shaft just enough to hold arm in place.

Adjustment

Run front wiper motor until wiper blade is to the extreme left position. Blade bottom tip must be approximately 1.00 in. (25.5 mm). When adjustment is made, push arm onto motor shaft until retainer is behind the hub.

REAR WINDSHIELD WIPER

Removal

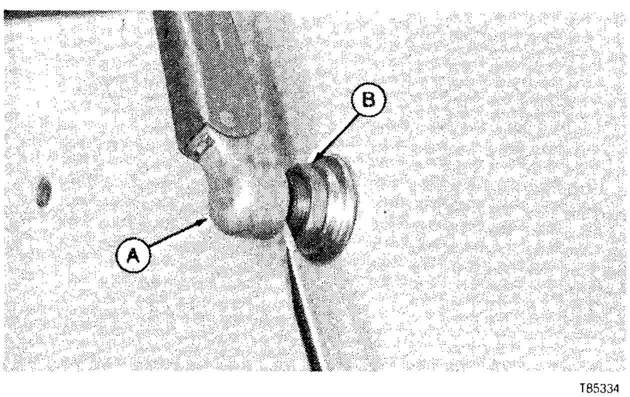


A—Wire Lead

Fig. 59-Rear Wiper Motor

Remove nut.

Disconnect wire lead (A, Fig. 59) from motor.



A—Wiper Arm
B—Nut

Fig. 60-Remove Wiper Arm

Use a screwdriver to pry the wiper arm (A, Fig. 60) off motor shaft.

Remove nut (B) to remove wiper motor.

Repair

The wiper motor is not repairable. Replace if defective.

Installation

Install wiper motor and fasten with nut (B, Fig. 60) and nut (Fig. 59).

Connect wire lead (A).

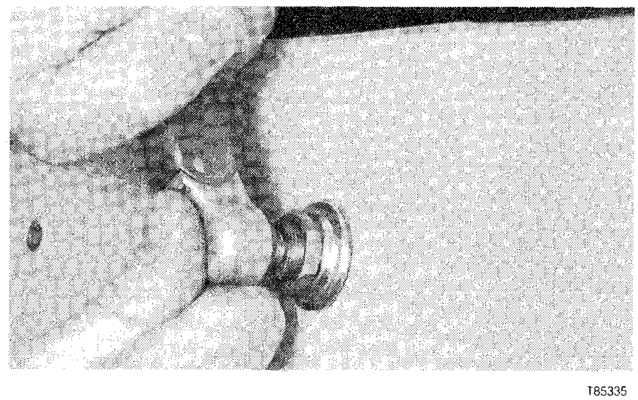


Fig. 61-Install Wiper Arm

Install wiper arm on motor shaft just enough to hold arm in place.

Adjustment

Run rear wiper motor. Wiper blade must be equal distance from both sides of window. When adjustment is made, push arm onto motor shaft until retainer is behind the hub.

With motor shut off, make sure the wiper blade stops to the right as you face the rear window.

Group 1821
SEAT

GENERAL INFORMATION

A foam padded adjustable seat is used on the 310A and 310B Backhoe Loaders. The machine operator manual describes all seat adjustments.

REMOVAL

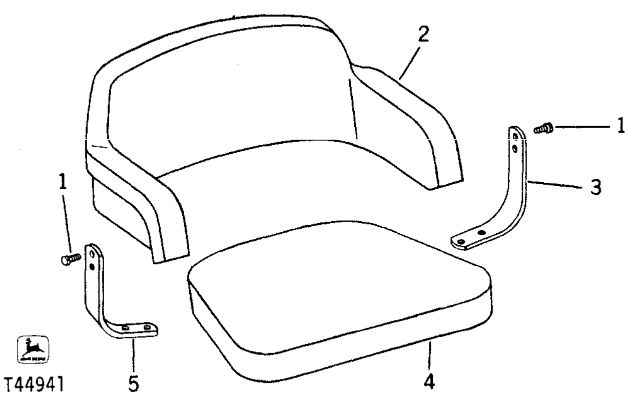
Remove cap screws and washers (15 and 14, Fig. 2) and pull seat out of operator's station.

REPAIR

Refer to Figs. 1-3 to disassemble and assemble seat components.

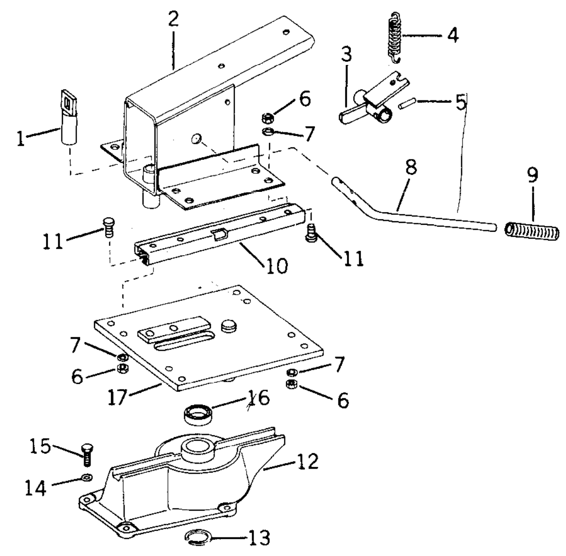
Lubricate pin (1, Fig. 2) with oil after assembly. Lubricate seat adjuster (10) and contact area of pivot plate (17) with grease.

When installing seat belt kit, install seat belt bracket onto shoulder bolt, then one flat washer. Install this assembly through seat frame and fasten with one flat washer, one lock washer, and nut.



1—Cap Screw (12 used)
2—Seat Back Cushion
3—L.H. Support
4—Seat Cushion
5—R.H. Support

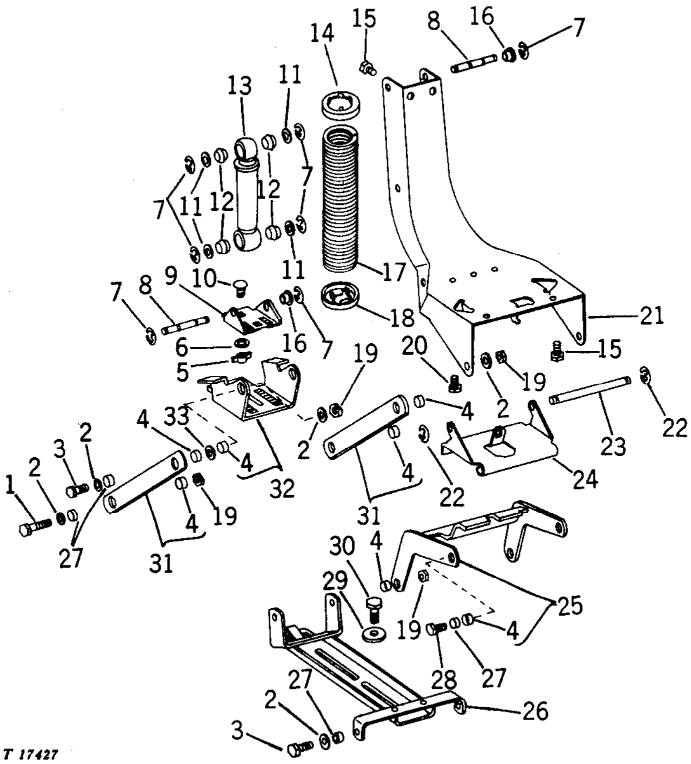
Fig. 1-Seat Cushions and Seat Supports



T46265N

1—Pin
2—Seat Lower Support
3—Pivot Control Lever
4—Spring
5—Spring Pin
6—Nut (8 used)
7—Lock Washer (8 used)
8—Seat Control Handle
9—Grip
10—Seat Adjuster (2 used)
11—Special Screw (8 used)
12—Seat Base
13—Snap Ring
14—Lock Washer (4 used)
15—Cap Screw (4 used)
16—Thrust Roller Bearing
17—Pivot Plate

Fig. 2-Seat Lower Support and Swivel



T 17427

1—Cap Screw (2 used)
2—Special Washer (10 used)
3—Cap Screw (4 used)
4—Bushing (10 used)
5—Special Wing Nut (2 used)
6—Washer (4 used)
7—Retaining Ring (8 used)
8—Seat Shock Absorber Shaft (2 used)
9—Seat Shock Absorber Support
10—Bolt (2 used)
11—Special Washer (4 used)
12—Rubber Bushing (4 used)
13—Shock Absorber
14—Upper Spring Cap
15—Cap Screw (4 used)
16—Bushing (2 used)
17—Spring
18—Lower Spring Cap
19—Nut (8 used)
20—Cap Screw
21—Seat Frame
22—Retaining Ring (2 used)
23—Shaft
24—Seat Release Latch
25—Seat Suspension Link
26—Seat Support
27—Bearing (10 used)
28—Cap Screw (2 used)
29—Special Washer (2 used)
30—Cap Screw (2 used)
31—Upper Seat Suspension Link (2 used)
32—Seat Shock Absorber Link
33—Washer (2 used)

Fig. 3-Deluxe Seat Supports

Group 1830
HEATING AND AIR CONDITIONING

HEATER

GENERAL INFORMATION

A cab heater is available to increase operator comfort during cold weather operation.

The heater is mounted on the right front of the cab.

REMOVAL

Disconnect battery ground strap.

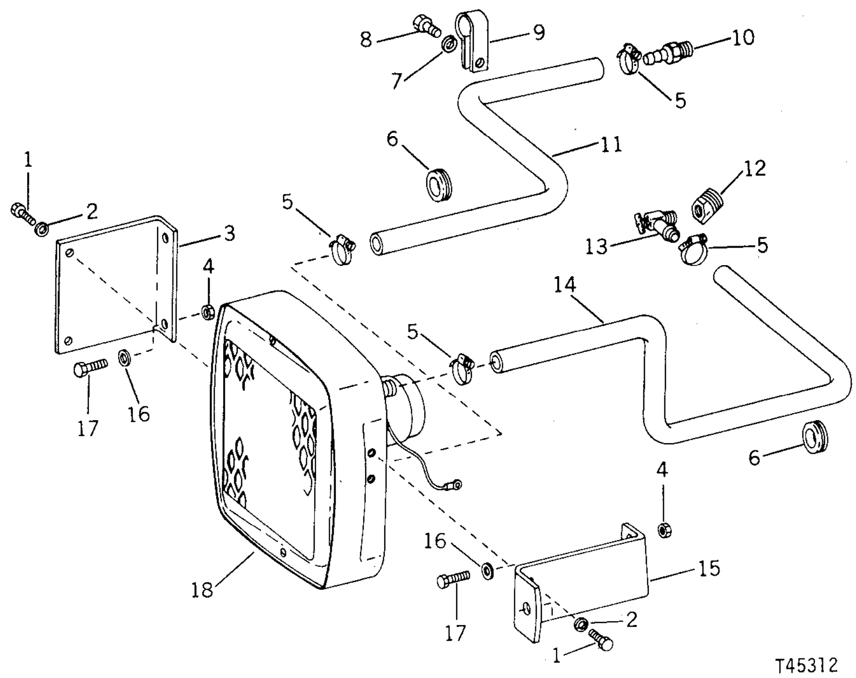
Disconnect heater lead from switch.

Remove heater to bracket mounting cap screws (17, Fig. 1). To remove hoses, loosen hose clamp and twist hose from connector.

REPAIR

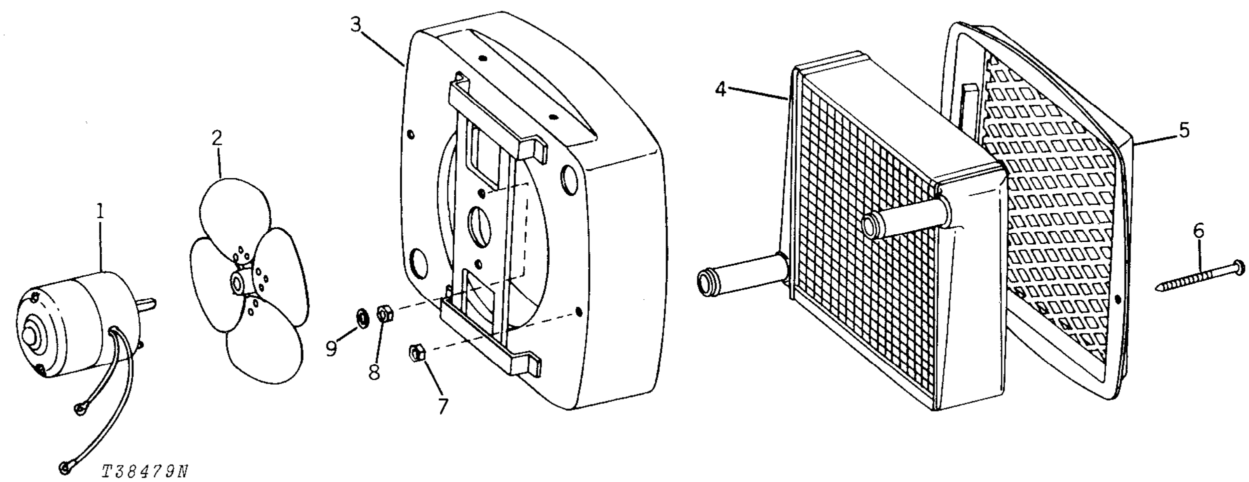
Refer to Figs. 1 and 2 for dissassembly and assembly of heater.

Check hoses for blockage, holes or cracks. Replace parts as necessary.



1—Cap Screw (4 used)
2—Lock Washer (4 used)
3—Heater Bracket
4—Nut (4 used)
5—Hose Clamp (4 used)
6—Grommet (2 used)
7—Lock Washer
8—Cap Screw
9—Hose to Cylinder Block Clamp
10—Connector
11—Hose
12—Special Elbow
13—Valve
14—Hose
15—Heater Bracket
16—Washer (4 used)
17—Cap Screw (4 used)
18—Heater

Fig. 1-Cab Heater and Hoses



1—Heater Motor
2—Fan Blade
3—Back Casing
4—Heater Core
5—Core Baffle
6—Special Screw (2 used)
7—Nut (2 used)
8—Nut (2 used)
9—Washer

Fig. 2-Heater Assembly

INSTALLATION

Install heater using reverse order of removal. Check engine coolant level. Fill if necessary.

PRESSURIZER (310A ONLY)

GENERAL INFORMATION

A pressurizer mounted to the top rear of the cab is available to circulate filtered outside air into the cab.

REMOVAL

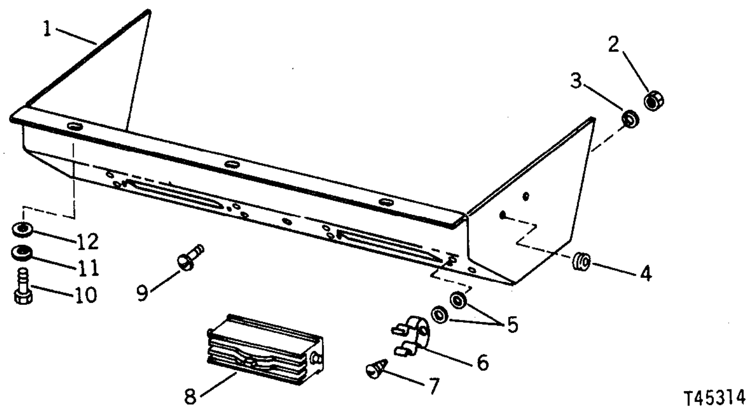
Disconnect wiring lead to fuse and remove mounting cap screws (10, Fig. 3).

REPAIR

Refer to Figs. 3 and 4 to disassemble and assemble pressurizer assembly.

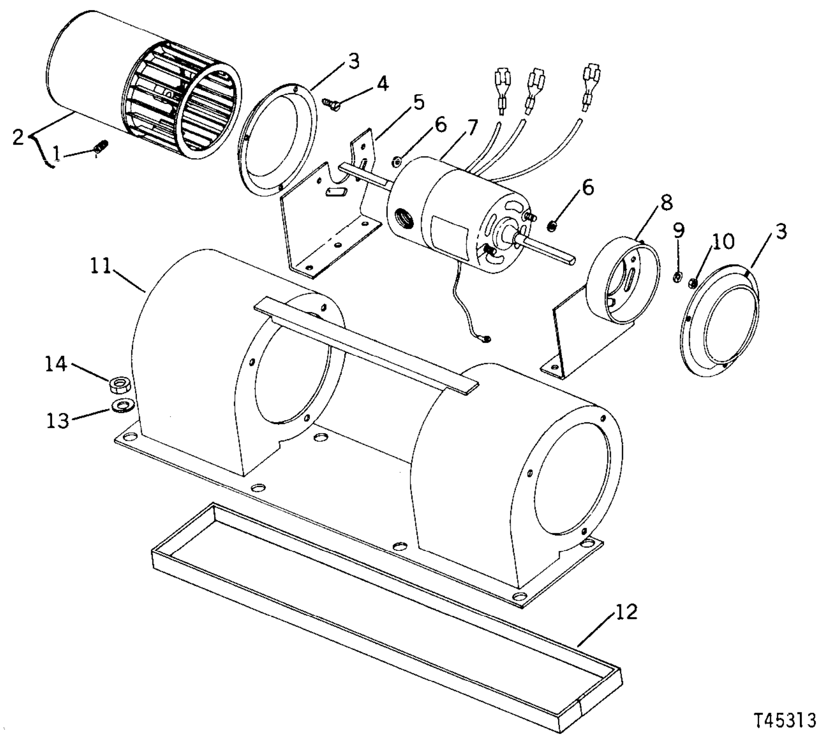
The motor or switch are not repairable. Test as described in Group 9015.

If the pressurizer does not work properly, the filter may be plugged. Remove and clean the filter by tapping on floor or blowing it out with low pressure air.



1—Pressurizer Cover
2—Nut (4 used)
3—Lock Washer (4 used)
4—Grommet
5—Special Washer (32 used)
6—Clip (4 used)
7—Drive Screw (4 used)
8—Louver (2 used)
9—Drive Screw (8 used)
10—Cap Screw (3 used)
11—Lock Washer (3 used)
12—Washer (3 used)

Fig. 3-Cab Pressurizer Cover



1—Set Screw (2 used)
2—Blower Wheel
3—Inlet Ring (4 used)
4—Drive Screw (12 used)
5—L.H. Bracket
6—Washer (4 used)
7—12-Volt Motor
8—R.H. Bracket
9—Lock Washer (8 used)
10—Nut (8 used)
11—Housing
12—Weatherstrip
13—Lock Washer (8 used)
14—Nut (8 used)

Fig. 4-Cab Blower Motor and Housing

INSTALLATION

Follow removal procedure in reverse order. Replace weatherstripping if old or cracked.

Section 19
SHEET METAL AND STYLING

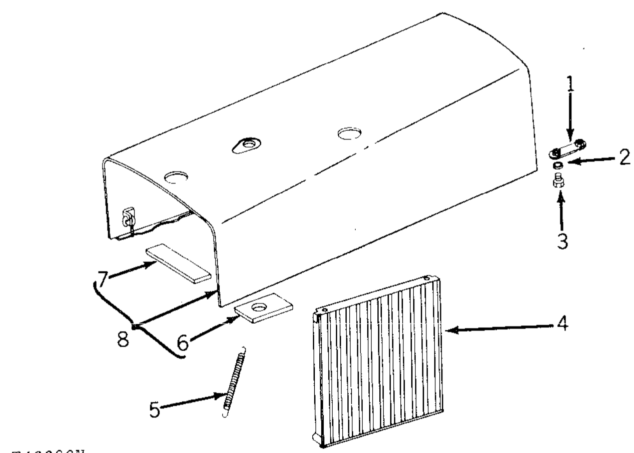
CONTENTS OF THIS SECTION

Group 1910
HOOD OR ENGINE ENCLOSURE

GENERAL INFORMATION

The hood and engine enclosure consists of the hood, side grilles, cowl, cowl support and cab cowl panel.

REMOVAL

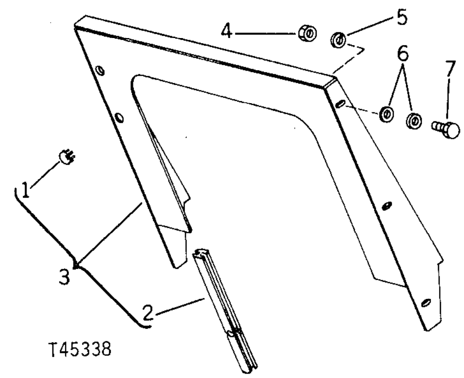


1—Plate (2 used)
2—Lock Washer (2 used)
3—Cap Screw (2 used)
4—Side Grille (2 used)
5—Spring (2 used)
6—Packing Strip
7—Packing Strip (2 used)
8—Hood

Fig. 1-Hood

Remove exhaust extension and side grilles.

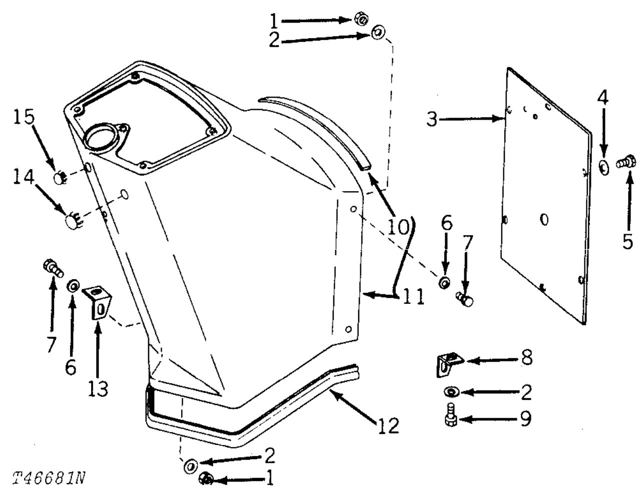
Remove hood.



1—Button Plug (2 used)
2—Seal
3—Cowl Panel
4—Nut (8 used)
5—Lock Washer (8 used)
6—Washer (16 used)
7—Cap Screw (8 used)

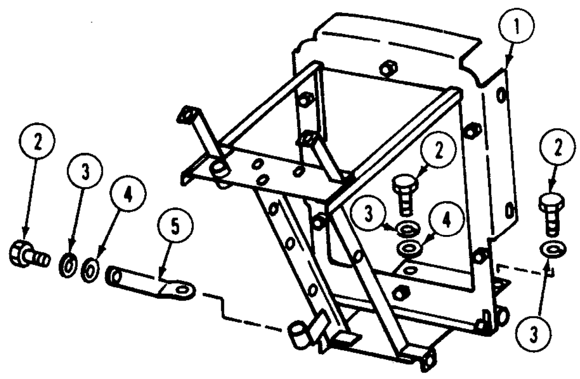
Fig. 2-Cab Cowl Panel

Remove cab cowl panel by removing attaching hardware (4, 5, 6 and 7, Fig. 2).



1—Nut (6 used)
2—Lock Washer (6 used)
3—Front Cover
4—Lock Washer (6 used)
5—Cap Screw (6 used)
6—Washer (4 used)
7—Cap Screw (4 used)
8—Right Rear Hood Retainer
9—Cap Screw (2 used)
10—Upper Bumper
11—Cowl
12—Cowl Bumper
13—Left Rear Hood Retainer
14—Plug (without horn)
15—Plug (without cigar lighter)

Fig. 3-Cowl



1—Cowl Support
2—Cap Screw (3 used)
3—Lock Washer (3 used)
4—Washer (2 used)
5—Bracket

Fig. 4-Cowl Support

See Group 0960 to remove cowl. Steering valve support and steering valve must be removed to remove cowl support (Fig. 4).

REPAIR

Check for any damaged conditions, especially conditions that could cause binding of linkages.

Repair or replace as necessary.

INSTALLATION

See Group 0960 to install cowl, steering valve support, and steering valve.

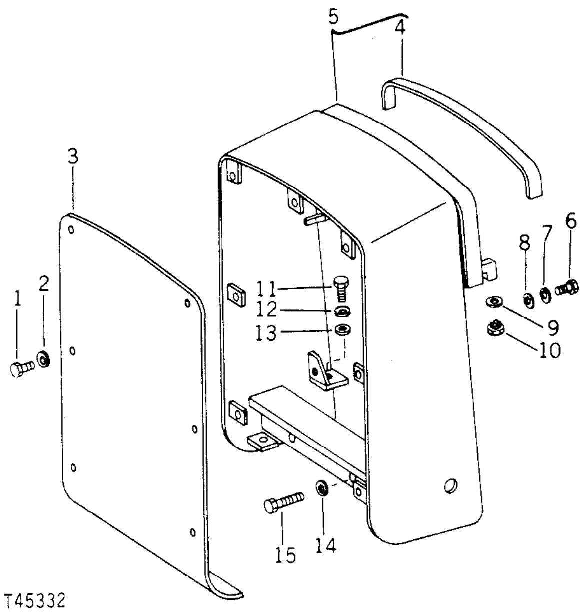
IMPORTANT: Install front support end of side grille retaining spring with open end of hook facing front of tractor.

Group 1921
GRILLE AND GRILLE HOUSING

GENERAL INFORMATION

The grille and grille housing is used to protect tractor components such as the fuel tank, radiator, fan and engine.

REMOVAL



1—Cap Screw (8 used)
2—Washer (8 used)
3—Front Plate
4—Cushion
5—Grille Housing
6—Cap Screw (2 used)
7—Lock Washer (2 used)
8—Washer (2 used)
9—Washer (2 used)
10—Stop Nut (2 used)
11—Cap Screw (2 used)
12—Washer (2 used)
13—Washer
14—Lock Washer (2 used)
15—Cap Screw (2 used)

Fig. 1-Grille and Grille Housing

Remove muffler extension, side grilles and hood.

Remove front plate (3, Fig. 1). Use a hoist when removing the grille housing, as it is heavy.

REPAIR

Repair or replace damaged front plate or grille housing.

INSTALLATION

Install grille housing and front plate.

Group 1927
FENDERS

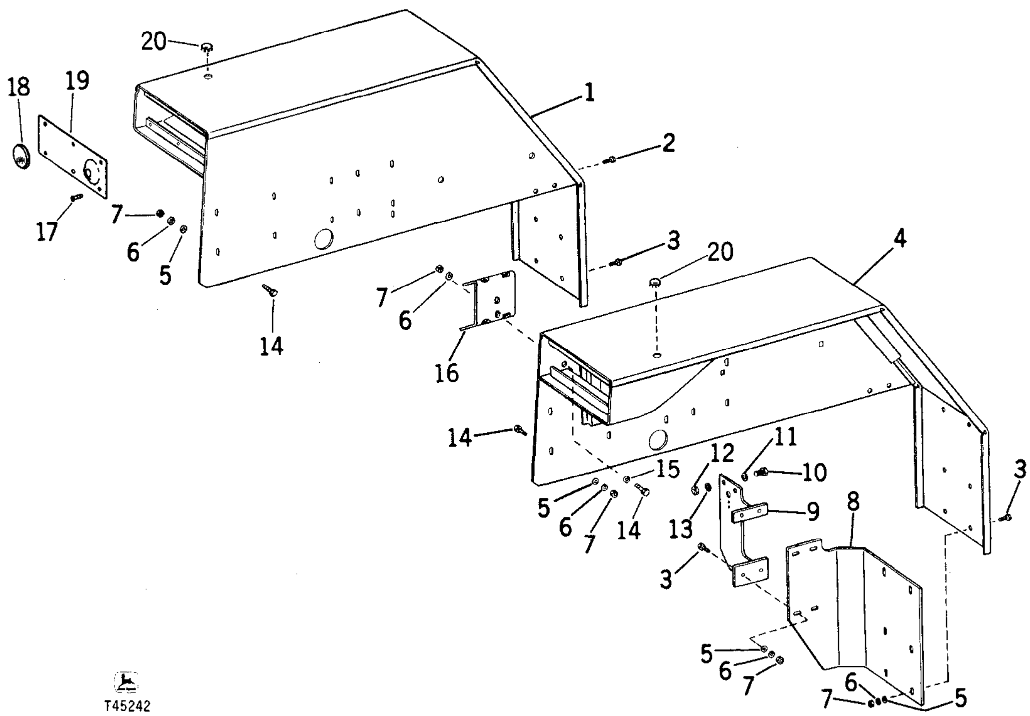
GENERAL INFORMATION

Fenders are provided on the backhoe loader for personal and components protection. A fender support and stiffener are also provided when equipped with rigid mount platform.

REMOVAL

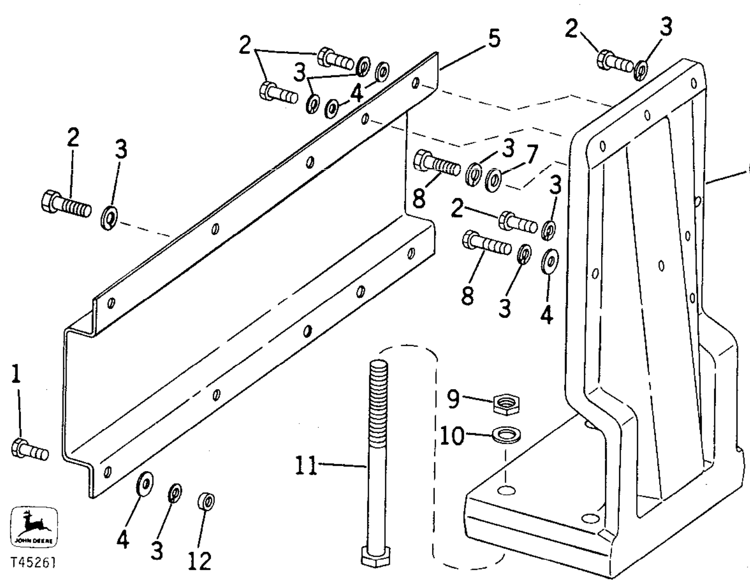
Disconnect wiring to rear lamp.

Remove hardware attaching fenders (Fig. 1) and fender support and stiffener if equipped.



1—Left Fender
2—Cap Screw (4 used)
3—Cap Screw (8 used)
4—Right Fender
5—Washer (32 used)
6—Lock Washer (34 used)
7—Nut (34 used)
8—Fender Supports
9—Fender Brace (2 used)
10—Cap Screw (4 used)
11—Washer (4 used)
12—Nut (4 used)
13—Lock Washer (4 used)
14—Cap Screw (14 used)
(12 used with rigid platform)
15—Washer (2 used)
16—Transport Pin Bracket
17—Machine Screw (12 used)
18—Red Reflector (2 used)
19—Rear Lamp Plate
20—Button Plug (2 used)

Fig. 1-Fenders



1—Cap Screw (6 used)
2—Cap Screw
(7 used - right fender)
(15 used - left fender)
3—Lock Washer
(15 used - right fender)
(12 used - left fender)
4—Washer (11 used)
5—Fender Rear Stiffener
6—Fender Support
7—Washer (left fender)
8—Cap Screw
(2 used - left fender)
9—Nut (4 used)
10—Lock Washer
(4 used)
11—Hex. Hd. Bolt
(4 used)
12—Nut (6 used)

Fig. 2-Fender Support and Stiffener
(Equipped with rigid mount platform)

REPAIR

As the fenders, supports and stiffeners are used for the protection of the operator and equipment, carefully check for damaged conditions.

Repair or replace parts as needed.

INSTALLATION

Refer to Figs. 1 and 2 for installation of the fenders, supports and stiffener.

Section 20
SAFETY, CONVENIENCE AND MISCELLANEOUS

CONTENTS OF THIS SECTION

Group 2004
HORN

HORN

GENERAL INFORMATION

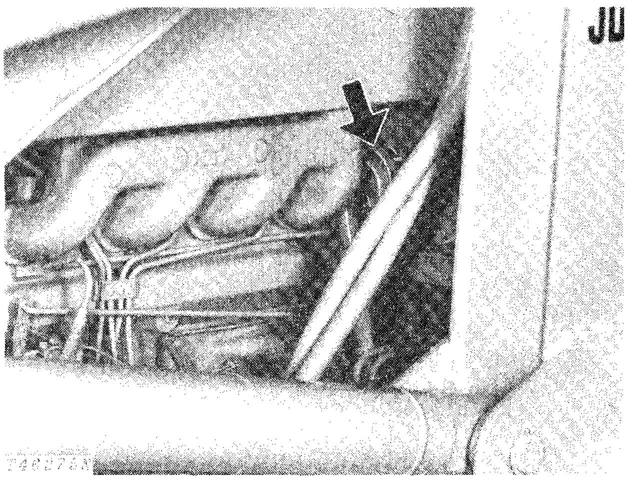


Fig. 1-Horn

The horn is located on a bracket at the rear of the engine.

REMOVAL

To remove the horn, disconnect wiring lead and remove nut securing horn to bracket.

REPAIR

The horn is not repairable. Test as part of the electrical system (Group 9015).

INSTALLATION

Attach horn to bracket and connect wiring lead.

HORN SWITCH

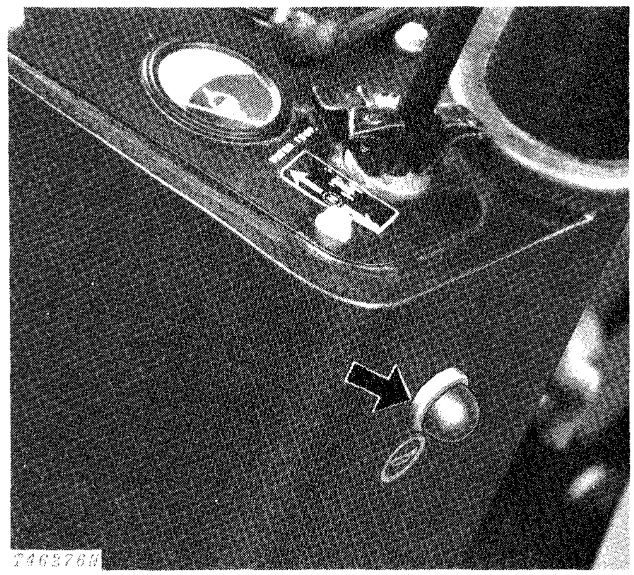


Fig. 2-Horn Switch

REMOVAL

Pull up the instrument panel. Disconnect wiring to switch. Remove rubber cap and nut from outside of cowl. Pull switch from rear of cowl.

REPAIR

The switch cannot be repaired.

INSTALLATION

Follow removal procedure in reverse order.

Group 2006
CIGAR LIGHTER

GENERAL INFORMATION

The cigar lighter is located in the cowl.

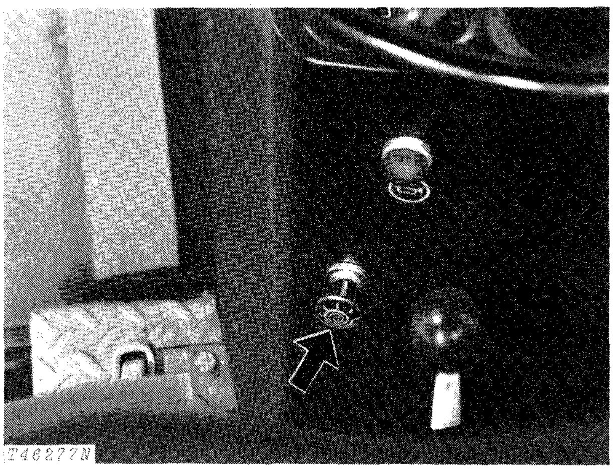


Fig. 1-Cigar Lighter

REMOVAL

Pull up instrument panel.

Remove element.

Disconnect wire lead and remove lighter housing.

REPAIR

The element or housing cannot be repaired. Replace if defective.

INSTALLATION

Follow removal procedure in reverse order.

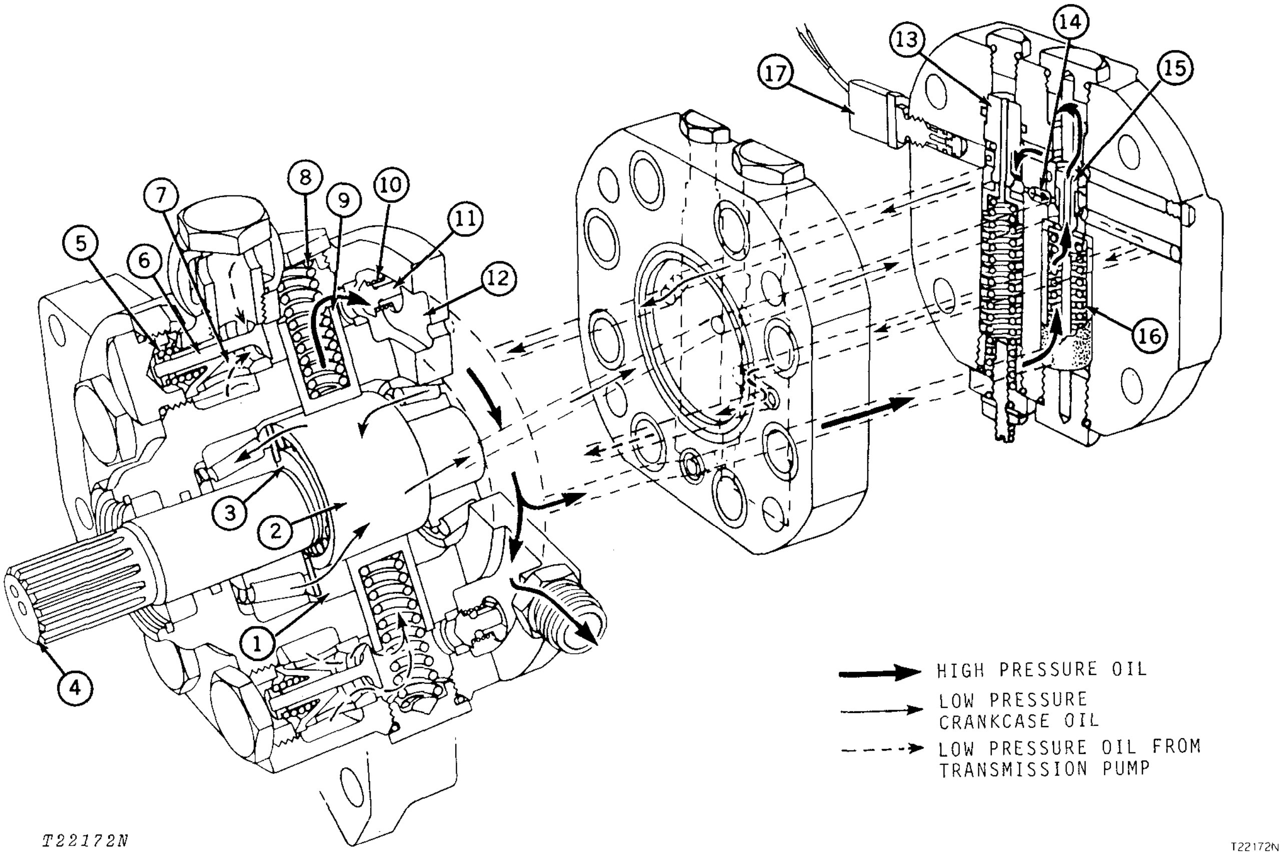
Section 21
MAIN HYDRAULIC SYSTEM

CONTENTS OF THIS SECTION

Section 2160
HYDRAULIC SYSTEM

3 in.³ (49 cm³) HYDRAULIC PUMP AND STROKE CONTROL VALVE (WITHOUT PUMP SERIAL NUMBER PLATE)

GENERAL INFORMATION



1—Pump Crankcase
2—Race
3—Cam
4—Pump Shaft
5—Inlet Valve Spring
6—Inlet Valve
7—Inlet Gallery
8—Piston Spring
9—Piston
10—Discharge Valve Spring
11—Discharge Valve
12—Outlet Gallery
13—Stroke Control Valve
14—Crankcase Orifice
15—Crankcase Outlet Valve
16—Crankcase Outlet Valve Spring
17—Destroke Solenoid Valve

Fig. 1-Oil Flow Through Main Hydraulic Pump

The main hydraulic pump is an eight-piston, variable displacement, pressure compensated, radial piston type. The pump is located in front of the engine coolant radiator and is driven directly by the engine crankshaft.

The pump can be equipped with a pilot-operated poppet-type destroke solenoid valve located in the hydraulic pump stroke control valve housing. The valve is normally closed and is electrically opened during engine cranking to bypass discharge oil directly to the pump crankcase.

The valve is replaced as a cartridge and is not field adjustable. Any attempt to adjust the valve will damage it.

To determine if the valve is affecting pump test flows, the valve may be replaced with a special plug. To test the solenoid, refer to the Electrical System Section (Group 9015).

REMOVAL

Lower all equipment to the ground.

Stop the engine.

Operate all hydraulic control valves to release hydraulic pressure in the system.

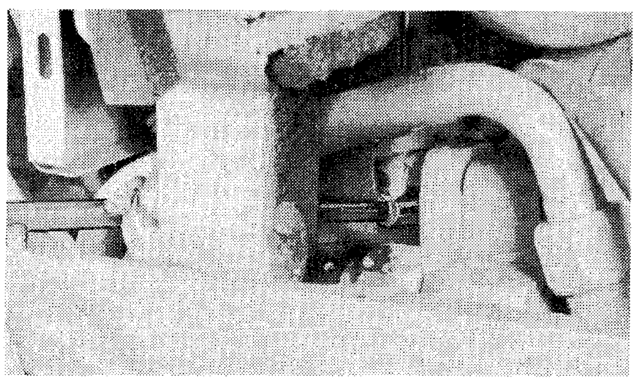
Remove the left and right grille screens.

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. DO NOT use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

Disconnect the hydraulic lines and wiring lead.

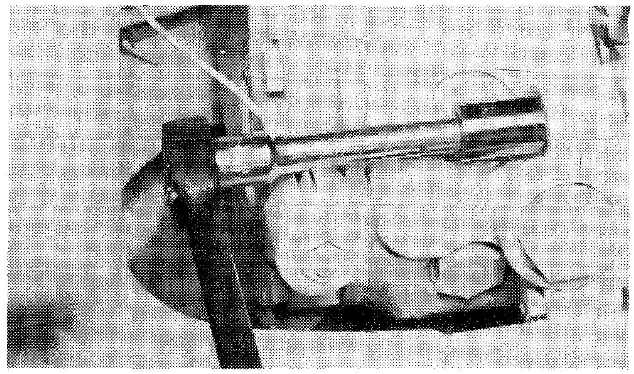
Close all openings with caps and plugs to keep dirt out of hydraulic system.



T85240

Fig. 2-Loosen Cap Screws

Loosen the cap screws (Fig. 2) in pump drive shaft.



T85243

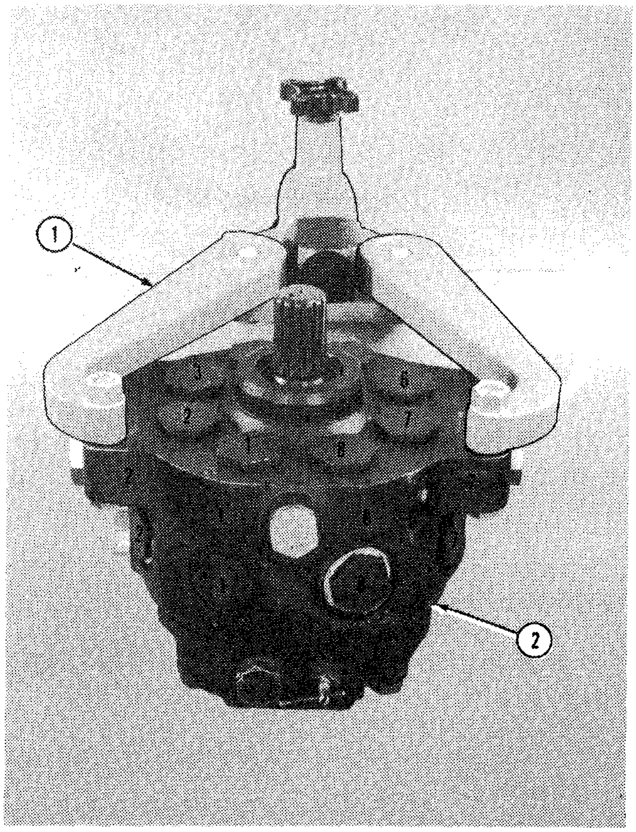
Fig. 3-Remove Pump

CAUTION: Approximate weight of pump is 66 lb. (30 kg).

Remove the four cap screws to remove pump (Fig. 4). Use JDH-26 Hydraulic Pump Lifting Device and a hoist to aid in removal of pump.

REPAIR

Disassemble and Inspect Pump Housing



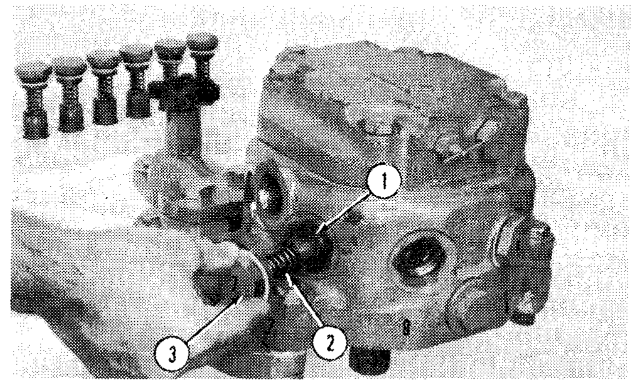
1—D-01006AA Bench Fixture **2—Pump**

Fig. 4-Install Pump On Bench Fixture

1. Thorough clean the outside surface of the pump (2, Fig. 4).

2. Install pump on the D-01006AA Bench Fixture (1).

3. Write numbers on pump housing, piston plugs, and inlet valve plugs for identification.

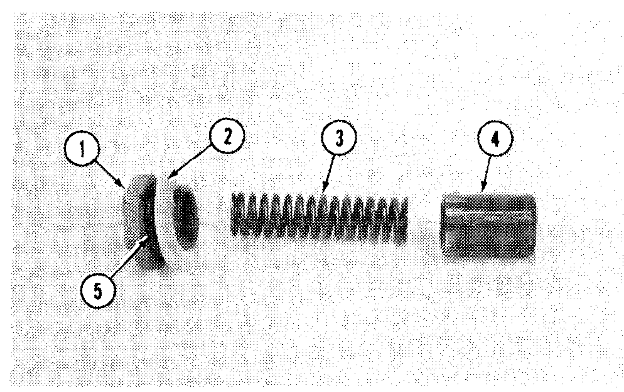


1—Piston (8 used)
2—Spring (8 used)
3—Piston Plug (8 used)

Fig. 5-Remove Piston Assemblies

IMPORTANT: If original pistons are used again, install them into the same bores from which they were removed.

4. Remove piston plugs (3, Fig. 5), springs (2) and pistons (1). Put assemblies in the JDH-21A Parts Tray so they can be installed into same bores from which they were removed.



1—Piston Plug
2—Sheath
3—Spring
4—Piston
5—O-Ring

Fig. 6-Inspect Piston Assemblies

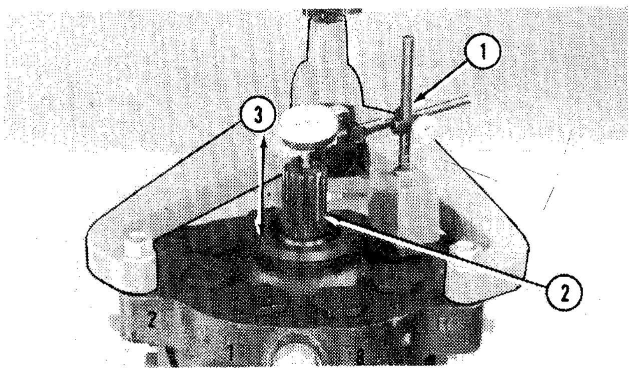
5. Remove and discard sheaths (2, Fig. 6) and O-rings (5). Inspect threads of piston plug and pump housing (1) for damage.

6. Inspect springs (3, Fig. 6) for wear or broken coils. Check compression rate of springs using the D-01168AA Spring Compression Tester.

SPRING SPECIFICATIONS

Free Length (approximate) . . . . 2.44 in.
Test Length at 34 to 40 lb. force . . . . 1.62 in.
(151 to 178 N . . . . 41 mm)
with a maximum difference
of force permissible of . . . . 1.5 lb. force
(6.7 N)

If difference of force is more than the specification, install new springs as a set. The eight springs in a set must be of the same color code.



T78735

1—Dial Indicator
2—Pump Shaft
3—End Play

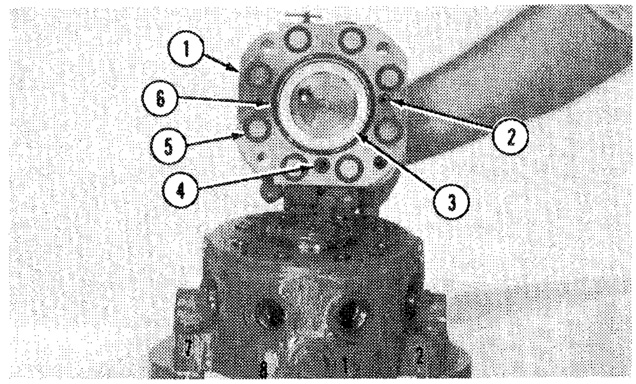
Fig. 7-Check End Play

7. Check end play (3, Fig. 7) of pump shaft (2) using a dial indicator (1).

END PLAY SPECIFICATION

End Play . . . . 0.001 to 0.005 in.
(0.03 to 0.13 mm)

End play more than specification can be an indication of worn bearings.



T75236

1—Stroke Control Valve Housing
2—O-Ring
3—Shims
4—Packing
5—Packing (8 used)
6—O-Ring

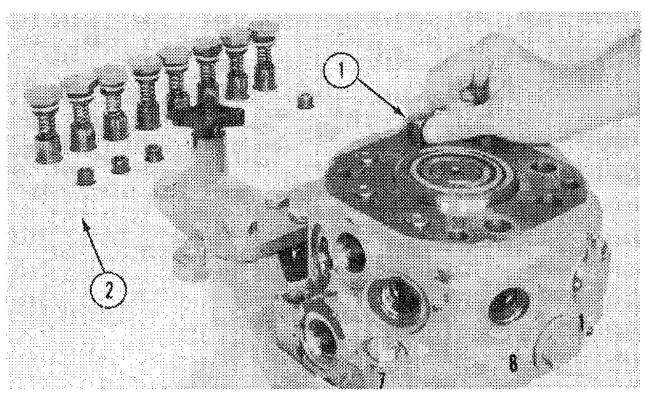
Fig. 8-Remove Stroke Control Valve Assembly

NOTE: If stroke control valve assembly is to be disassembled, loosen all plugs before removing cap screws to make disassembly easier.

8. Remove the four cap screws to remove stroke control valve assembly (1, Fig. 8).

9. Remove and discard O-rings (2 and 6) and packings (4 and 5).

10. Keep the shims (3) with valve housing (1) for use at assembly.

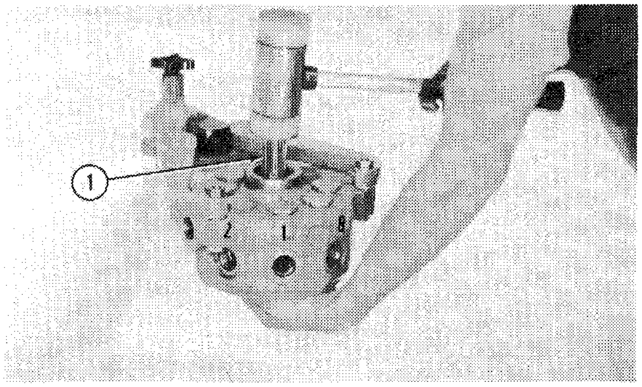


T75237

1—Outlet Valve Assembly (8 used)
2—JDH-21A Parts Tray

Fig. 9-Remove Outlet Valve Assemblies

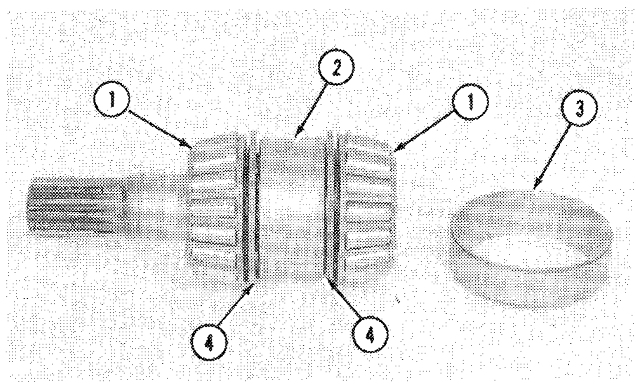
11. Remove the outlet valve assemblies (1, Fig. 9). Put assemblies into parts tray (2) so they can be returned to their original bores.



1—Pump Shaft Assembly

Fig. 10-Remove Pump Shaft Assembly

12. To remove pump shaft assembly (1, Fig. 10), lightly tap on the spline end using a soft-faced hammer.



1—Bearing Cone
2—Race
3—Bearing Cup (2 used)
4—Spacer

Fig. 11-Inspect Pump Shaft Assembly

NOTE: If replacement of parts is necessary, disassemble pump shaft assembly.

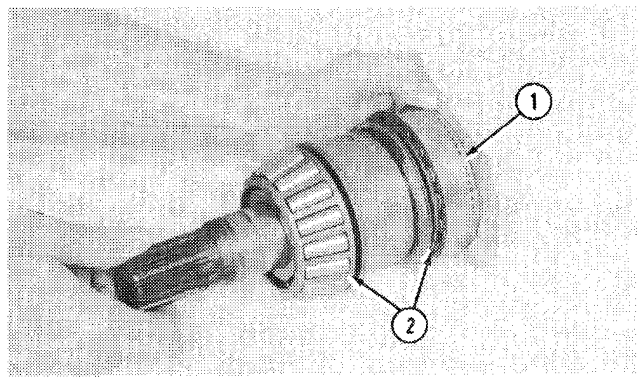
13. Inspect race (2, Fig. 11) for wear or damage. If replacement is necessary, replace the race and all pistons.

14. If there is no external damage, hold the pump shaft and slowly turn the race. It must turn smoothly. Replace all rollers, pistons, and race if assembly was sticking or noisy.

15. Visually compare thickness of the spacers (4) against new parts.

16. Visually inspect the exterior of the tapered roller bearing cones (1) for a damaged cage or pitted, scratched, or flaked rollers.

17. Inspect bearing cup (3) and bearing cup in pump housing for pitting or scratches.

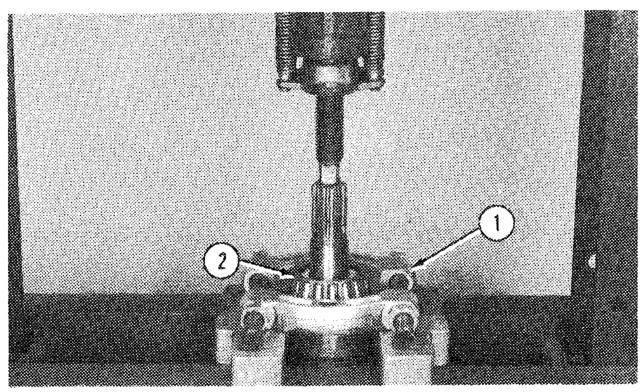


1—Bearing Cup
2—Bearing Cone

Fig. 12-Inspect Bearings

18. If there is no visible damage, put pump shaft with bearing cone (2, Fig. 12) into bearing cup (1) and slowly turn shaft. To check other cone, put shaft with cone into cup in pump housing.

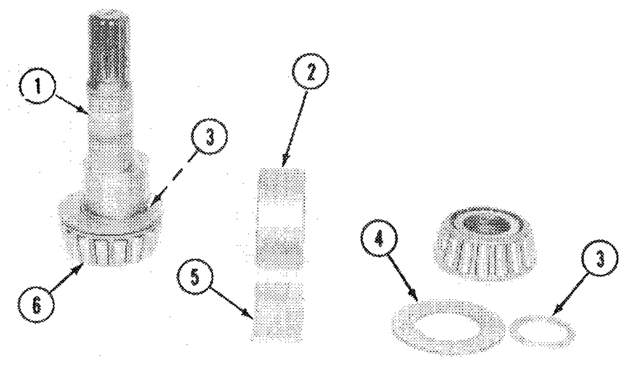
If there is any clicking noise or sticking of bearing, clean the cone and cup; then apply clean oil to cone and check again. If bearing still clicks or sticks, replace cone and cup.



1—Knife Edge Puller
2—Bearing Cone

Fig. 13-Remove Bearing Cone

19. Remove bearing cone (2, Fig. 13) using a knife edge puller (1) from D-01048AA Puller Set.



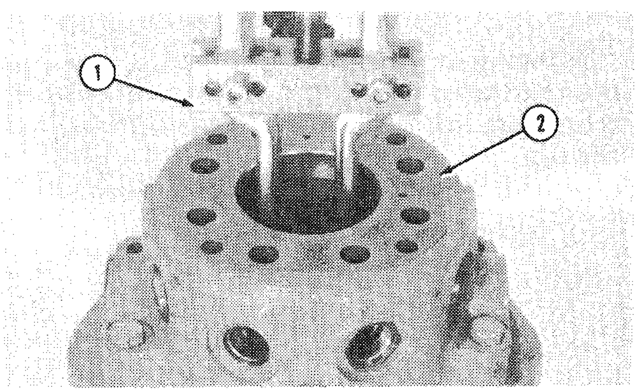
T87840

1—Pump Shaft
2—Race
3—Spacer (2 used)
4—Thrust Washer (2 used)
5—Roller Bearing (36 used)
6—Bearing Cone

Fig. 14-Disassemble Pump Shaft Assembly

20. Remove thrust washers (4, Fig. 14), spacers (3), race (2), and roller bearings (5) from pump shaft (1).

21. Remove bearing cone (6) from shaft if necessary.

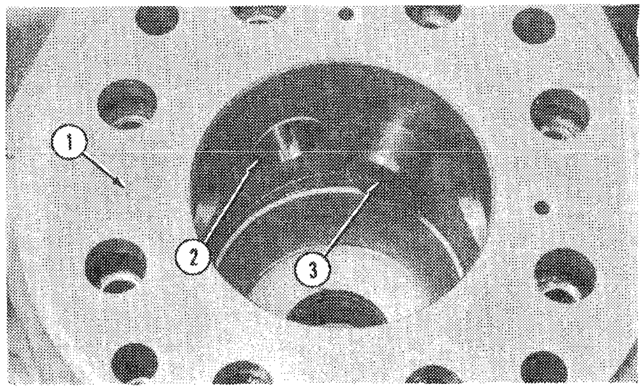


T75243

1—Slide Hammer And Puller
2—Pump Housing

Fig. 15-Remove Bearing Cup

22. To remove bearing cup from pump housing (2, Fig. 15) use a slide hammer and puller (1) from 0-01048AA Puller Set.



T75244

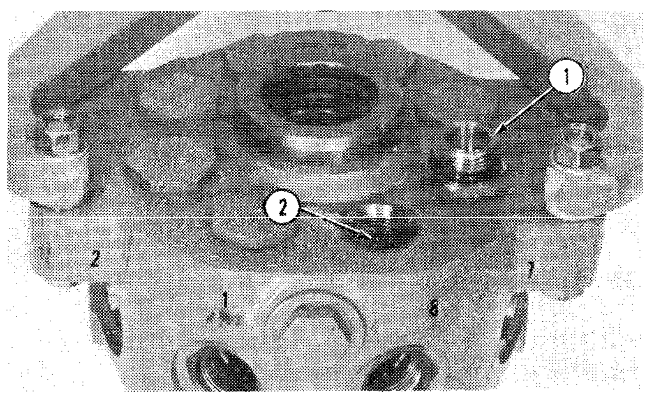
1—Pump Housing
2—Piston Bore (8 used)
3—Piston (8 used)

Fig. 16-Inspect Piston Bores

23. Inspect piston bores (2, Fig. 16) in the pump housing (1) for scoring. If scoring can be felt, the pump housing and pistons will have to be replaced.

24. After visually inspecting piston bores, install each piston (3) into its bore so it extends approximately 0.50 in. (12.7 mm) into the crankcase.

Pistons must slide in smoothly and have no side play. If any slide play is evident, replace pump housing and pistons.



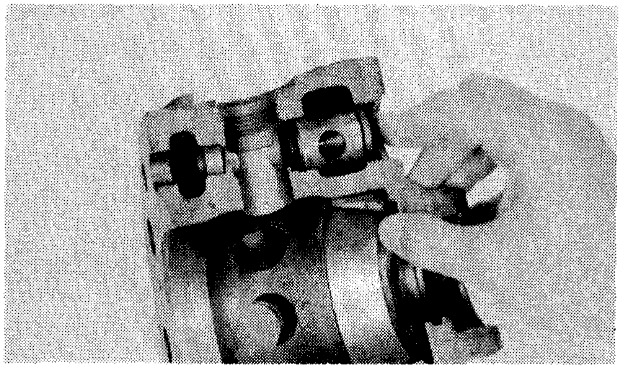
T75245

1—Inlet Valve Plug (8 used)
2—Inlet Valve (8 used)

Fig. 17-Remove Inlet Valve Plugs

25. Remove the inlet valve plugs (1) to inspect the inlet valves (2).

26. Inspect inlet valves for broken parts and that they move freely when pushed.

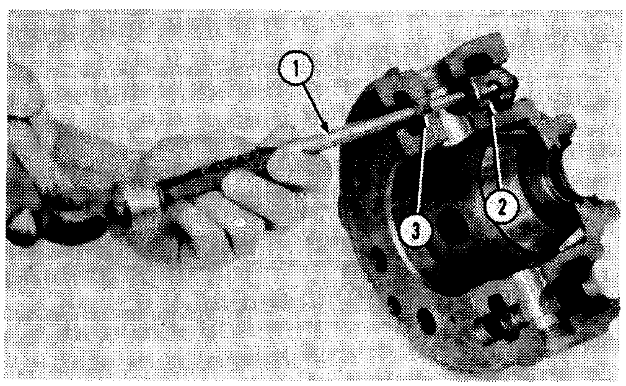


T77508

Fig. 18-Inspect Inlet Valves

NOTE: Cutaway section of a pump housing is shown.

27. Visually check inlet valve for approximately 0.125 in. (3 mm) of valve lift and that the valve moves freely.



T75247

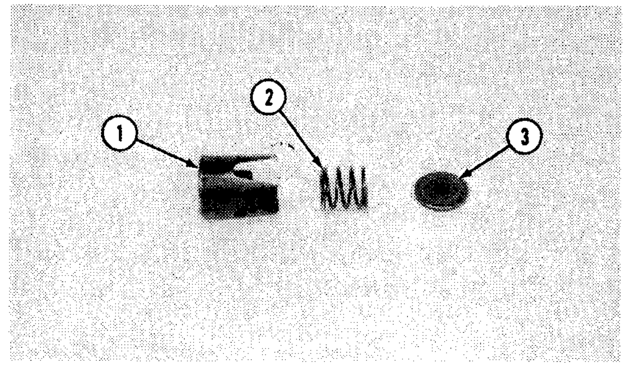
1—Punch
2—Inlet Valve
3—Outlet Valve Seat

Fig. 19-Remove Inlet Valves

NOTE: Cutaway section of a pump housing is shown.

IMPORTANT: If inlet valves are removed new valve must be installed because the press fit is critical for sealing.

28. To remove the inlet valves (2, Fig. 19), put a punch (1) through the outlet valve seat (3) and put end of punch on center of valve face. Hit punch to drive out inlet valve.



T75248

1—Outlet Valve Guide
2—Spring
3—Outlet Valve

Fig. 20-Inspect Outlet Valve Assemblies

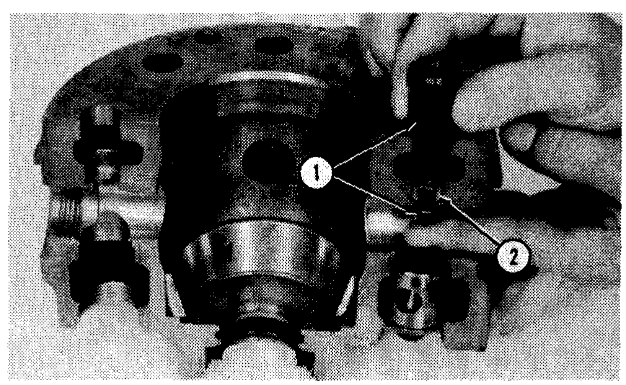
29. Inspect the outlet valve guide (1, Fig. 20) for wear or damage.

30. Inspect the outlet valve (3) for scratched or broken wear pattern. If these patterns exist, replace outlet valve and seat.

31. Inspect springs (2) for wear or broken coils. Check compression rate of springs using the spring compression tester.

SPRING SPECIFICATIONS

Free Length (approximate)	0.480 in. (12.19 mm)
Test Length at 2.84 ± 0.30 lb. force	0.30 in.
(12.6 ± 0.1 N	7.6 mm)



T75249

1—JDH-39B-1 Installer And Removal Tool
2—Outlet Valve Seat (8 used)

Fig. 21-Install Installer And Removal Tool

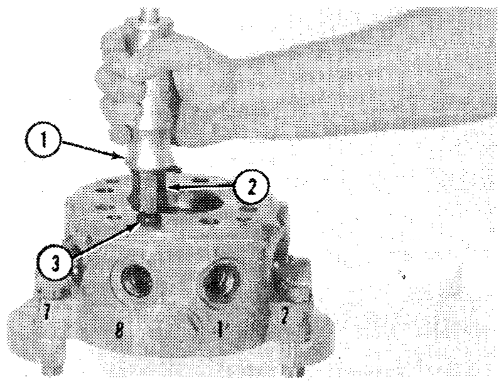
NOTE: Cutaway section of a pump housing is shown.

32. Visually inspect outlet valve seats (2, Fig. 21) for peening and breakage.

IMPORTANT: If outlet valve seats are removed, new seats must be installed because the press fit is critical for sealing.

33. Remove seats (2, Fig. 21) using the JDH-39B-1 Installer and Removal Tool (1) from the JDH-39B Hydraulic Pump Seat Installing Tool Set.

Put the special cap screw through piston bore opening and install into tool.



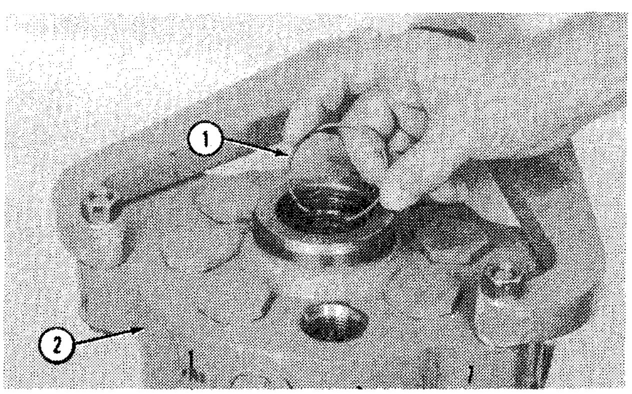
T75250

1—Slide Hammer
2—Adapter
3—JDH-39B-1 Installer And Removal Tool

Fig. 22-Remove Outlet Valve Seats

34. Install a slide hammer (1, Fig. 22) and adapter (2) from D-01048AA Puller Set into tool (3).

35. Remove outlet valve seats from pump housing.

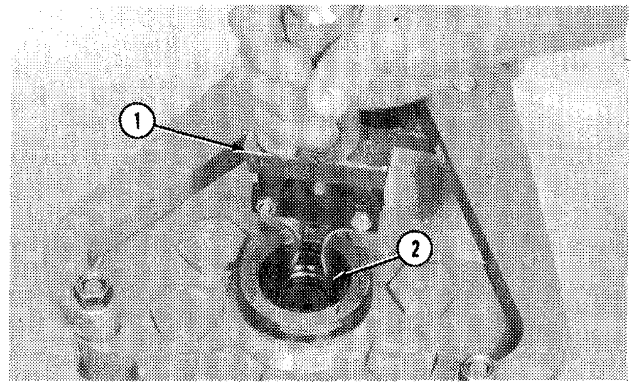


T75251

1—Snap Ring **2—Pump Housing**

Fig. 23-Remove Snap Ring

36. Remove snap ring (1, Fig. 23) from groove in pump housing (2).

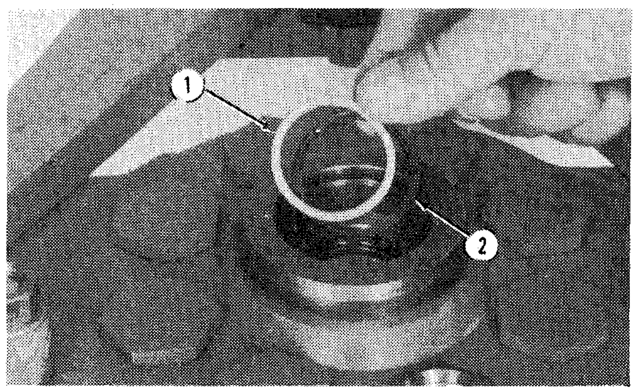


T75252

1—Puller **2—Oil Seal**

Fig. 24-Remove Oil Seal

37. Remove oil seal (2, Fig. 24) using puller (1) from D-01048AA Puller Set.



T75253

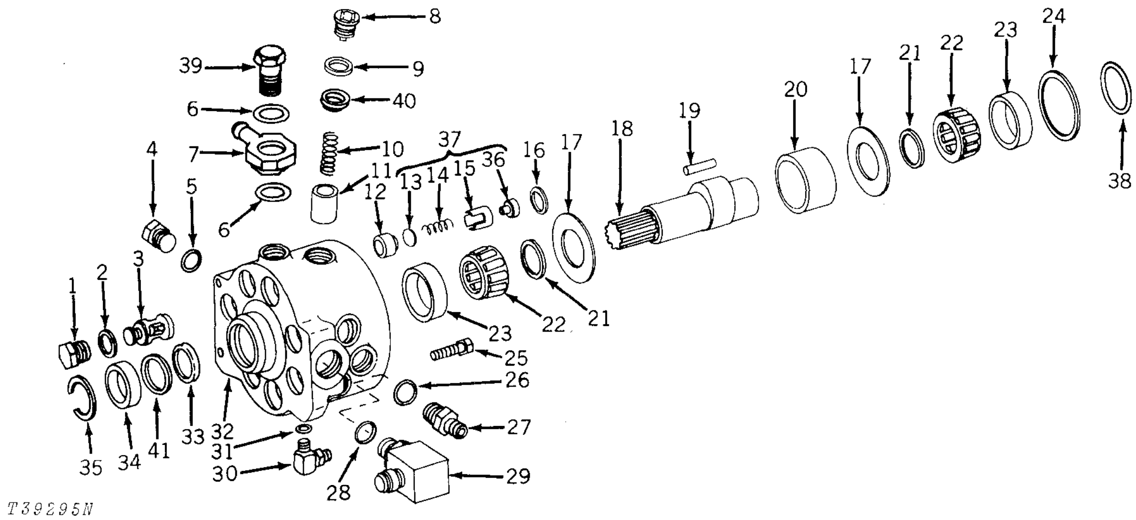
1—Backup Ring **2—Quad-Ring Seal**

Fig. 25-Remove Backup Ring And Quad Ring Seal

41. Remove backup ring (1, Fig. 25) and quad-ring seal (2).

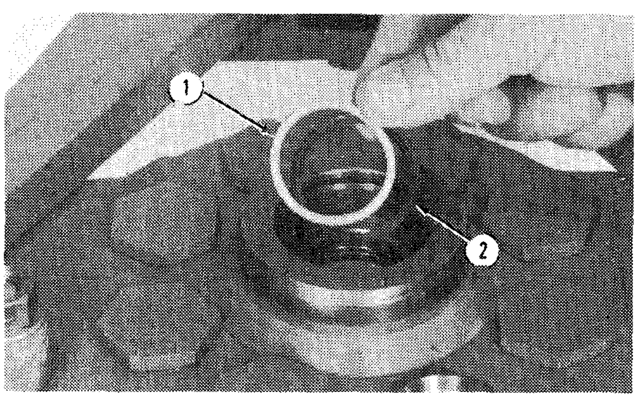
42. Inspect the quad-ring seal (2), backup ring (1) and contact surface of pump shaft for wear or damage.

Assemble Pump Housing



1—Plug (8 used)
2—O-Ring (8 used)
3—Inlet Valve (8 used)
4—Plug
5—O-Ring
6—O-Ring (2 used)
7—Connector
8—Plug (8 used)
9—O-Ring (8 used)
10—Spring (8 used)
11—Piston (8 used)
12—Seat (8 used)
13—Discharge Valve (8 used)
14—Spring (8 used)
15—Valve Guide (8 used)
16—Packing (8 used)
17—Thrust Washer (2 used)
18—Shaft
19—Roller Bearing (36 used)
20—Race
21—Spacer (2 used)
22—Cone (2 used)
23—Bearing Cup (2 used)
24—Shim (0.006" and 0.060")
25—Cap Screw (4 used)
26—O-Ring
27—Connector
28—O-Ring
29—Elbow
30—Elbow
31—O-Ring
32—Housing
33—Quad Ring Packing
34—Oil Seal
35—Snap Ring
36—Valve Stop
37—Valve Assembly
38—Spacer
39—Special Screw
40—Sheath (8 used)
41—Backup Ring

Fig. 26-Hydraulic Pump Housing



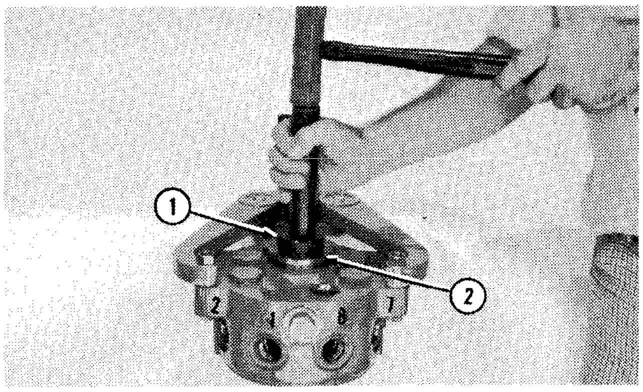
1—Backup Ring
2—Quad-Ring Seal

Fig. 27-Install Backup Ring and Quad-Ring Seal

1. Use an overhaul kit to assemble a rebuildable pump.

2. Before assembling, put clean hydraulic oil on all parts except O-rings and sheaths for piston plugs.

3. Install the backup ring (1, Fig. 27) and quad-ring seal (2) into groove inside the pump housing. Install the quad-ring seal and backup ring at the same time for easier assembly.



T75260

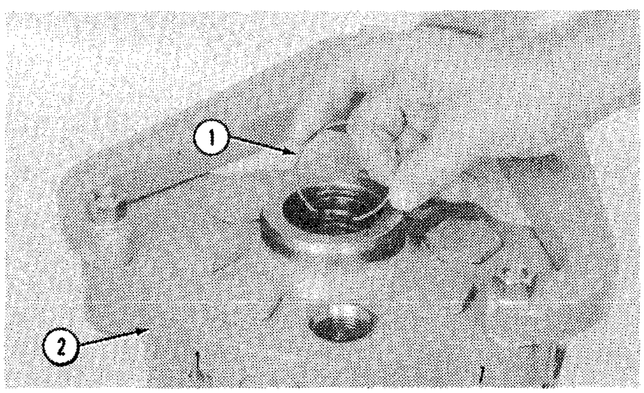
1—JDH-18 Driver **2—Oil Seal**

Fig. 28-Install Oil Seal

IMPORTANT: DO NOT push oil seal beyond inner edge of snap ring groove. Doing so can close the drain passage and cause an oil seal failure.

4. Install oil seal (2, Fig. 28) with lip (spring side) toward inside of pump housing using JDH-18 Driver (1).

5. Apply petroleum jelly to lips of oil seal for lubrication when pump shaft is installed.

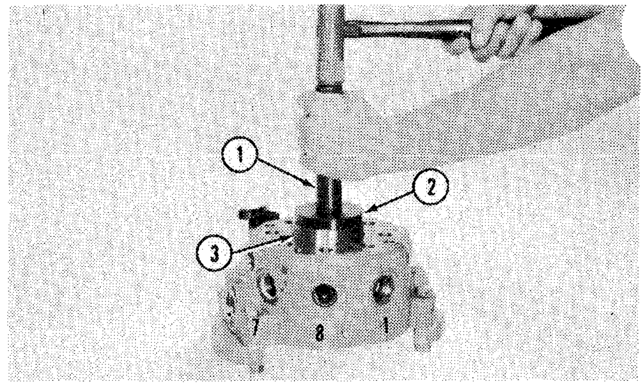


T75251

1—Snap Ring **2—Pump Housing**

Fig. 29-Install Snap Ring

6. Install snap ring (1, Fig. 29) into the groove in pump housing (2).

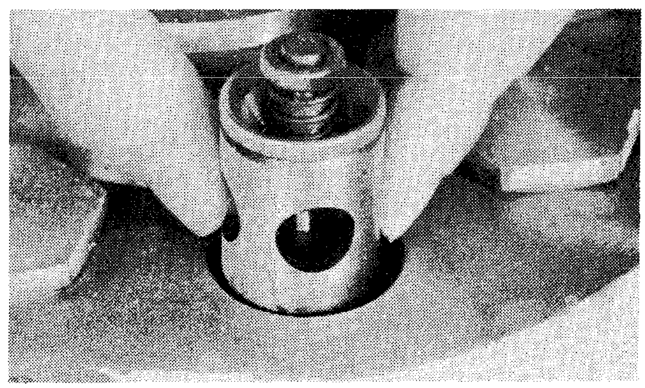


T75261

1—Handle **3—Bearing Cup**
2—27536 Disk

Fig. 30-Install Bearing Cup

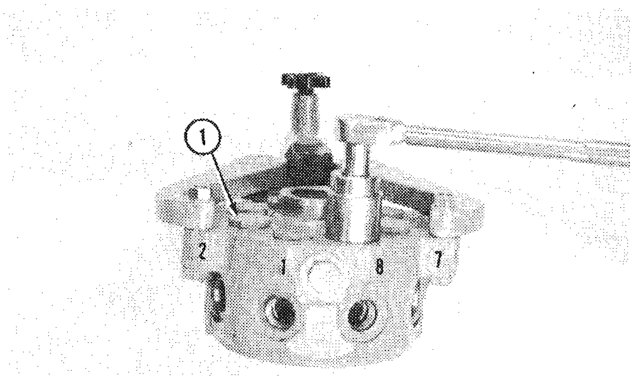
7. Install bearing cup (3, Fig. 30) into pump housing using handle and 27536 disk (2) from D-01045AA Bushing, Bearing, and Seal Driver Set.



T85282

Fig. 31-Install Inlet Valve Assemblies

8. Install the inlet valve assemblies (Fig. 31). Push valve assemblies into bores using inlet valve plugs.

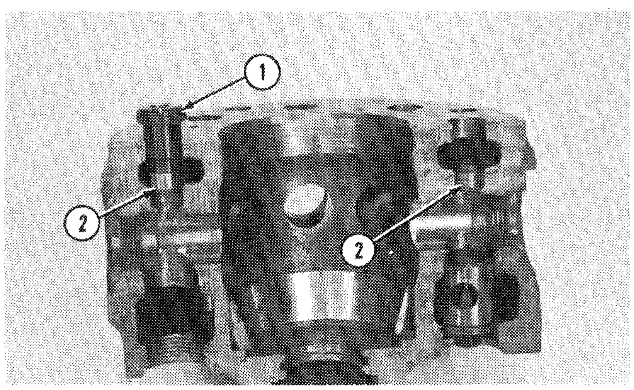


T75263

1—Inlet Valve Plug (8 used)

Fig. 32-Install Inlet Valve Plugs

9. Install inlet valve plugs (1, Fig. 32) and new O-rings. Tighten plugs to 100 lb-ft (136 N·m). Then loosen plugs and retighten to 100 lb-ft (136 N·m) to seat valve assemblies in their bores.



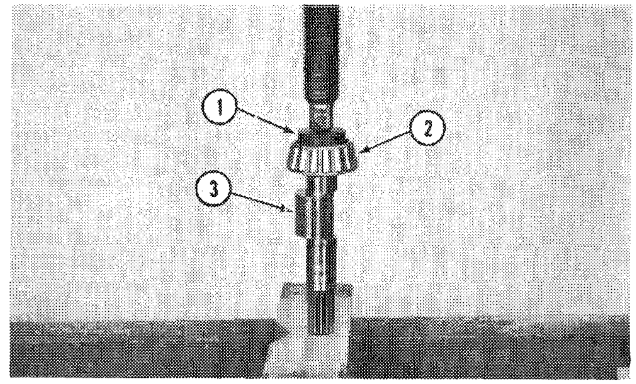
T75264

1—JDH-39B-1 Installer And Removal Tool **2—Outlet Valve Seat (8 used)**

Fig. 33-Install Outlet Valve Seats

NOTE: Cutaway section of a pump housing is shown.

10. Install outlet valve seats (2, Fig. 33) using JDH-39B-1 Installer and Removal Tool. Push seat into housing until flange of tool is against face of housing.

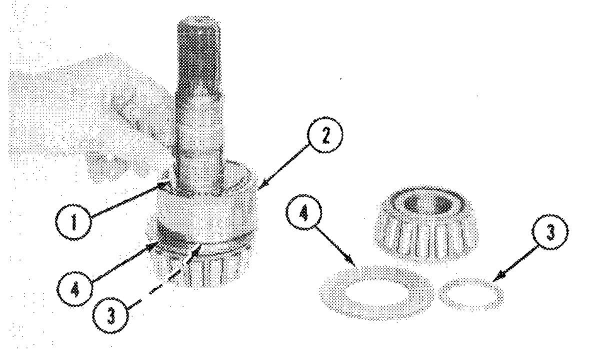


T75265

1—27516 Disk **3—Pump Shaft**
2—Bearing Cone

Fig. 34-Install Bearing Cone

11. Install bearing cone (2, Fig. 34) using 27516 disk (1) from D-01045AA driver set. Push on inner race of cone until it is against shoulder of shaft (3).



T87841

1—Roller Bearing (36 used) **3—Spacer (2 used)**
2—Race **4—Thrust Washer (2 used)**

Fig. 35-Install Race

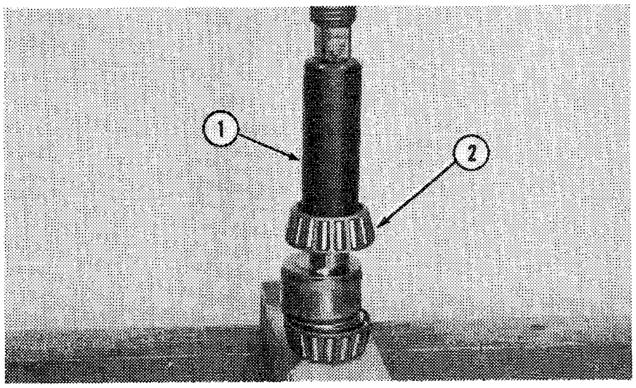
12. Install one thrust washer (4, Fig. 35) and spacer (3).

13. Install the race (2). Spacer must fit inside race.

14. Install the roller bearings (1). Apply clean oil to bearings.

15. Insall spacer. Spacer must fit inside race against bearings.

16. Install the thrust washer.

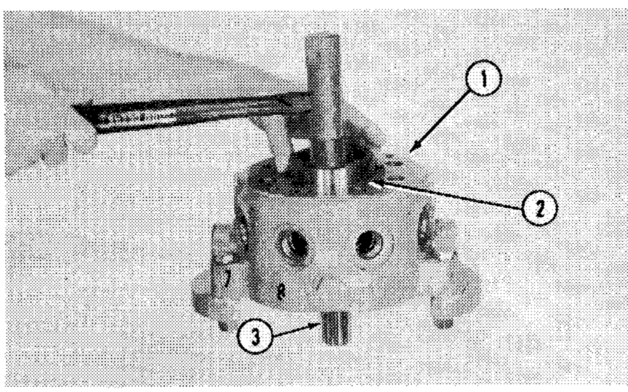


T75267

1—JD-318 Driver 2—Bearing Cone

Fig. 36-Install Bearing Cone

17. Install bearing cone (2, Fig. 36) using JD-318 Driver (1). Push on inner race of cone until it is against shoulder of shaft.



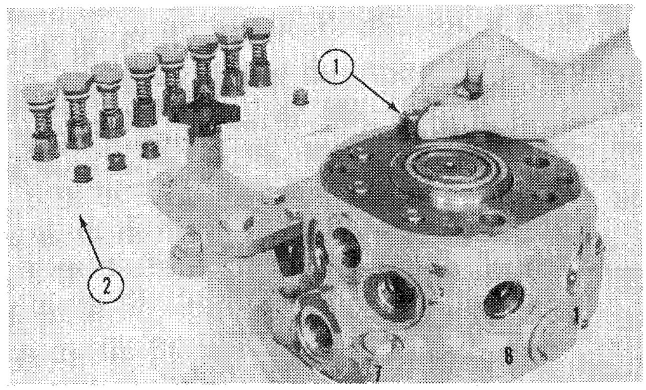
T75268

1—Pump Housing
2—Bearing Cup
3—Pump Shaft Assembly

Fig. 37-Install Pump Shaft Assembly

18. Carefully install pump shaft assembly (3, Fig. 37).

19. Install bearing cup (2) into pump housing (1) against bearing cone.



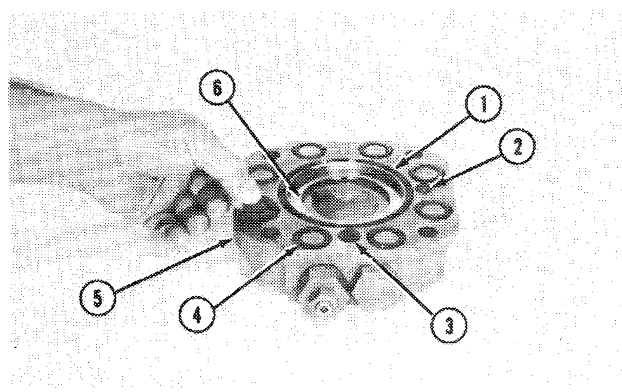
T75237

1—Outlet Valve (8 used) 2—JDH-21A Parts Tray

Fig. 38-Install Outlet Valves

NOTE: If new parts have been installed (housings, shaft, or bearings) install outlet valves, O-rings and packings after checking end play of pump shaft.

20. Install the outlet valves (1, Fig. 38).



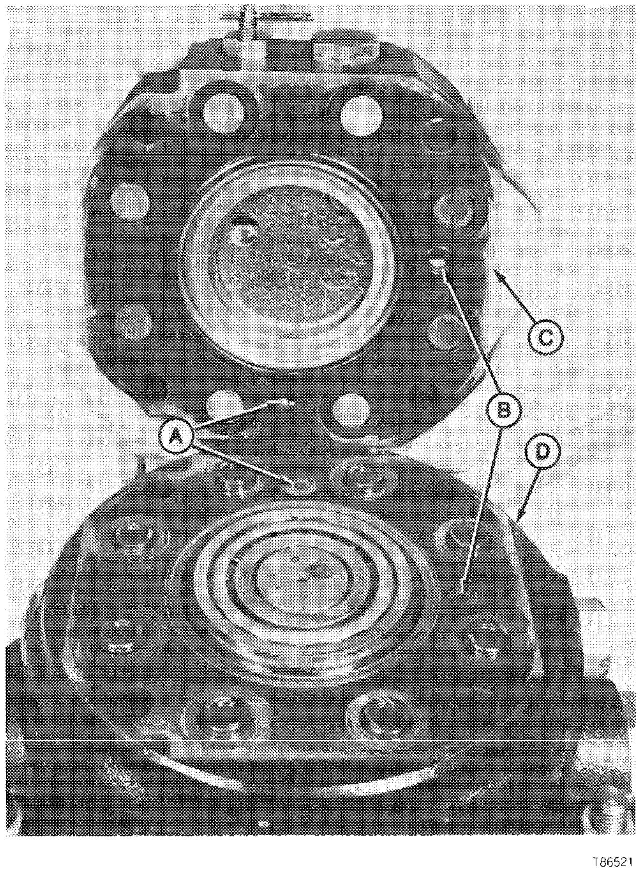
T87842

1—O-Ring
2—O-Ring
3—Packing
4—Packing (8 used)
5—Stroke Control Valve Housing
6—Shim (as needed)

Fig. 39-Install Packings, O-Rings And Shims

IMPORTANT: The machined surface of valve and pump housing must be clean and free of oil and petroleum jelly to get a good tight joint for sealing when cap screws are tightened.

21. Install the O-rings (1 and 2, Fig. 39), packings (3 and 4), and shims. A small amount of petroleum jelly can be used on each part to hold them in place.



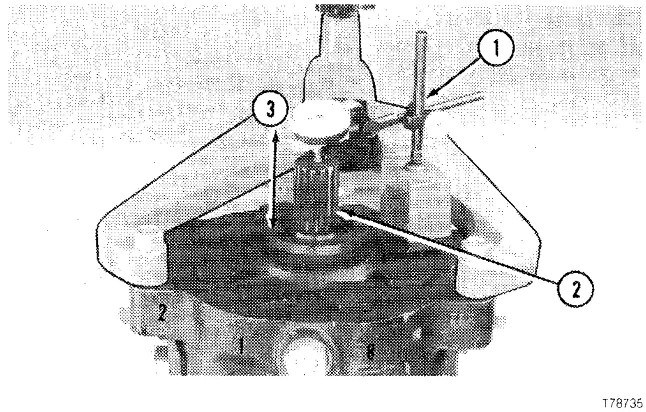
A—High Pressure Passage
B—Charge Pressure Passage
C—Stroke Control Valve Housing
D—Pump Housing

Fig. 40-Install Stroke Control Valve Assembly

CAUTION: Stroke control valve assembly must be installed so passages in valve housing and pump housing are in alignment. If passages are not in alignment, system pressure is not sensed at stroke control valve to destroke pump at the standby pressure setting; causing pressure to increase until there is a component failure and possible personal injury.

22. Install stroke control valve assembly so high pressure passage (A, Fig. 40) and charge pressure passage (B) in stroke control valve housing (C) and pump housing (D) are in alignment.

23. Install and tighten the four cap screws, in even steps, to 85 lb-ft (115 N·m).



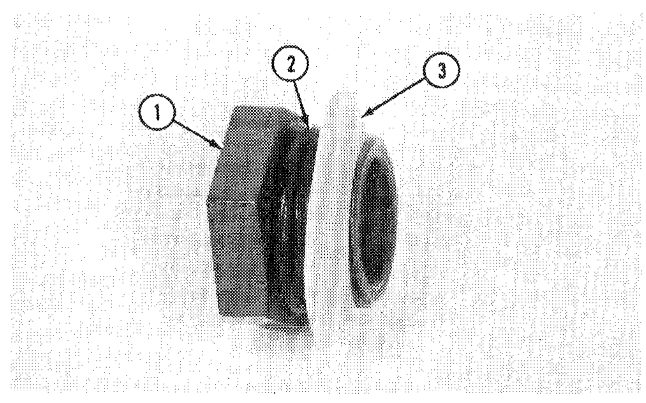
1—Dial Indicator
2—Pump Shaft
3—End Play

Fig. 41-Check End Play

24. Check the end play (3, Fig. 41) of pump shaft (2) using a dial indicator (1). Add or remove shims in stroke control valve housing to get the correct end play.

END PLAY SPECIFICATIONS

End Play .... 0.001 to 0.005 in.
(0.03 to 0.13 mm)

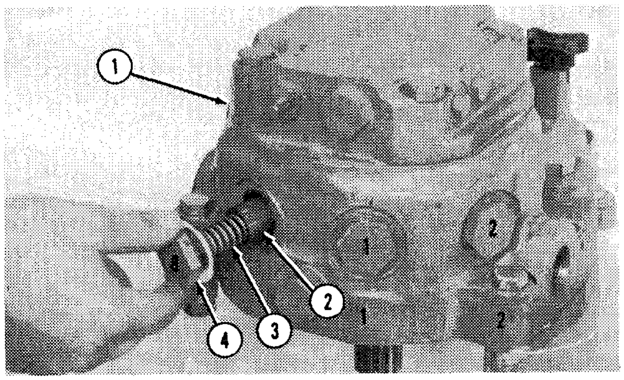


1—Piston Plug
2—O-Ring
3—Sheath

Fig. 42-Install O-ring And Sheath

IMPORTANT: DO NOT apply hydraulic oil to plugs, O-rings, and sheaths.

25. Install O-rings (2, Fig. 42) and sheath (flange first) (3) on piston plugs (1).

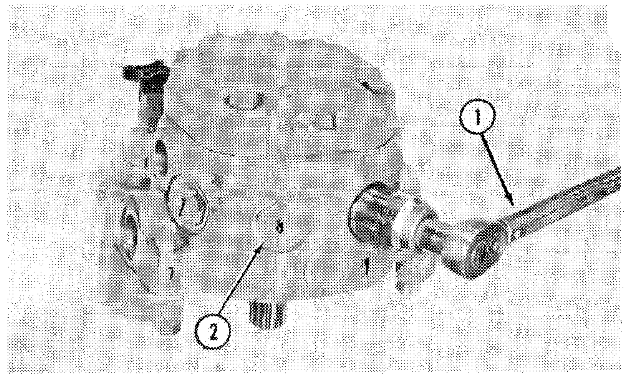


1—Pump Housing
2—Piston (8 used)
3—Spring (8 used)
4—Piston Plug (8 used)

Fig. 43-Install Piston Assemblies

IMPORTANT: Install original pistons into their original bores. All eight springs must be of the same color code.

26. Install pistons (2, Fig. 43), spring (3) and plugs (4) into pump housing (1). For easier assembly, turn pump shaft until the piston assembly being installed is on the low side of cam.



1—Torque Wrench
2—Piston Plug

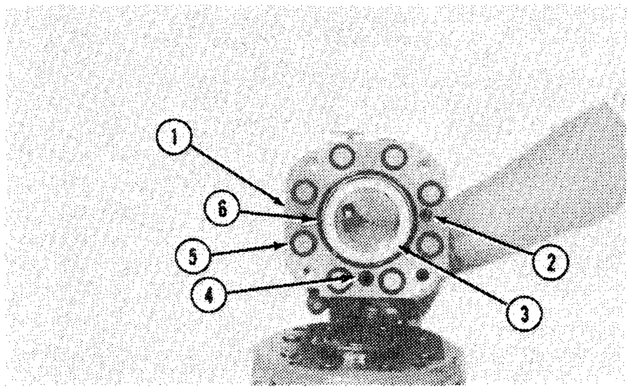
Fig. 44-Tighten Piston Plug

IMPORTANT: To prevent damage to sheaths, use a hand wrench to tighten the piston plug, not an air-operated wrench.

27. Tighten piston plugs (2, Fig. 44) to 100 lb-ft (136 N·m).

28. Install the pump on unit (See Installation).

Disassemble And Inspect Stroke Control Valve Assembly



1—Stroke Control Valve Housing
2—O-Ring
3—Shim (as needed)
4—Packing
5—Packing (8 used)
6—O-Ring

Fig. 45-Remove Stroke Control Valve Assembly

1. Thoroughly clean the outside surface of pump.

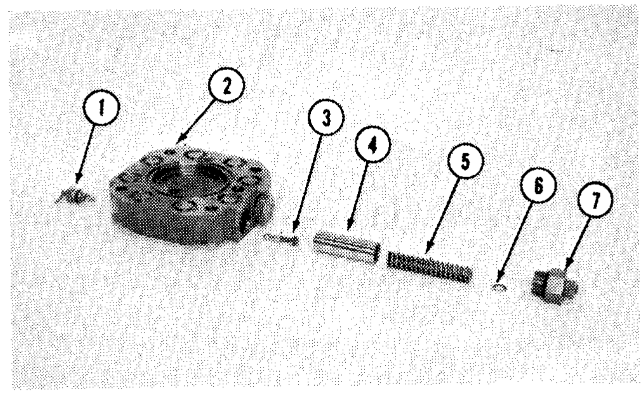
2. Install the pump on the D-01006AA Bench Fixture.

3. Loosen the plugs, manual destroke valve, and destroke solenoid valve or special plug in stroke control valve housing (1, Fig. 45).

4. Remove the four cap screws to remove stroke control valve assembly.

5. Remove and discard O-rings (2 and 6) and packings (4 and 5).

6. Keep the shims (3) with valve housing for use at assembly.



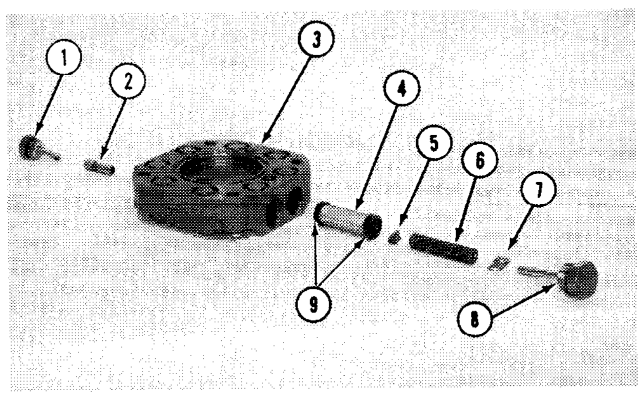
1—Manual Destroke Screw
2—Stroke Control Valve Housing
3—Stroke Control Valve
4—Spring Guide
5—Spring
6—Special Washer
7—Adjusting Plug

Fig. 46-Remove Stroke Control Valve

7. Remove the adjusting plug (7, Fig. 46).

8. Remove the special washer (6), spring (5), spring guide (4), and stroke control valve (3).

9. Remove the manual destroke screw (1).



1—Plug With Pin (-351941) Plug (351942-383155)
2—Crankcase Outlet Valve (-351941)
3—Stroke Control Valve Housing
4—Filter Screen
5—Spring Guide (-351941)
6—Spring (-351941)
7—Shim (as needed) (-351941)
8—Plug With Pin (-351941) Plug (351942-383155)
9—Packing (2 used)

Fig. 47-Remove Crankcase Outlet Valve

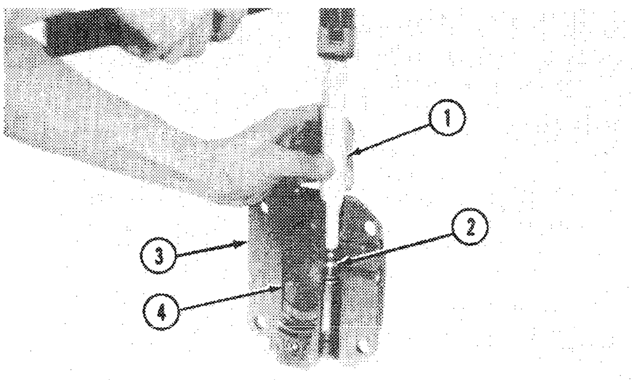
10. Remove plug with pin or plug (8, Fig. 47).

11. For units through Serial Number (-351941) remove shims (7), spring (6), and spring guide (5).

12. Remove the filter screen (4) and packings (9).

13. Remove plug with pin or plug (1).

14. For units through Serial Number (-351941), remove the crankcase outlet valve (2).



T87843

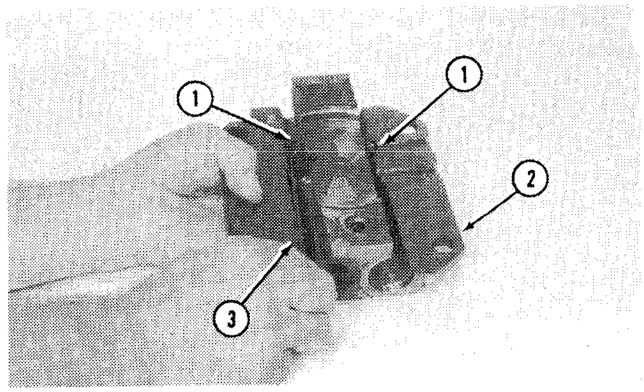
1—Wooden Dowel
2—Crankcase Outlet Valve Sleeve (-351941) Secondary Orifice Sleeve (351942-383155)
3—Stroke Control Valve Housing
4—Stroke Control Valve Sleeve

Fig. 48-Remove Sleeves

NOTE: Cutaway of a stroke control valve housing shown.

IMPORTANT: Do not use a punch for removal that can damage inner bore of sleeves causing valve to stick or bind.

15. Carefully remove the crankcase outlet valve or secondary orifice sleeve (2, Fig. 48) and stroke control valve sleeve (4) using a wooden dowel (1).

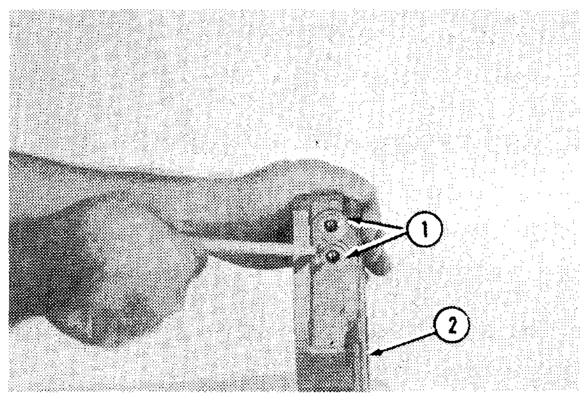


T75257

1—O-Ring (2 used)
2—Stroke Control Valve Housing
3—JDG-127 O-Ring Seal Tool Set

Fig. 49-Remove O-Rings

16. Remove O-rings (1, Fig. 49) from housing (2) and sleeves using the JDG-127 O-Ring Seal Tool Set (3).



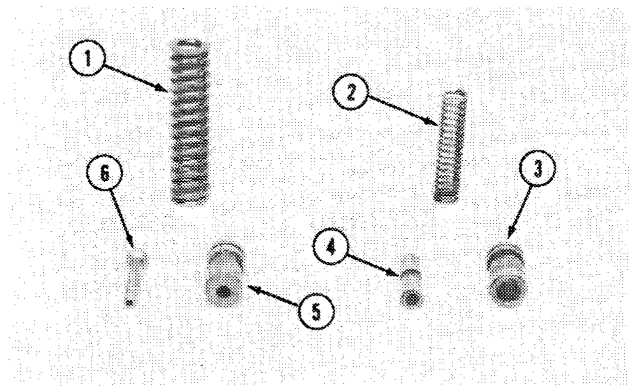
T75258

1—Openings **2—Stroke Control Valve Housing**

Fig. 50-Check Crankcase Orifice

17. Remove plugs from openings (1, Fig. 50).

18. Check that crankcase orifice (bottom opening) from crankcase outlet valve bore to stroke control valve bore is open.



1—Stroke Control Valve Spring
2—Crankcase Outlet Valve Spring (-351941)
3—Crankcase Outlet Valve Sleeve (-351941) Secondary Orifice Sleeve (351941-383155)
4—Crankcase Outlet Valve (-351941)
5—Stroke Control Valve Sleeve
6—Stroke Control Valve

Fig. 51-Inspect Valves And Springs

19. Check that the valves (4 and 6, Fig. 51) slide freely in their sleeve (3 and 5). If a valve is sticking or binding, install a new valve and sleeve.

Inspect the seating surface of stroke control valve and sleeve. If a broken wear pattern is seen, install a new valve and sleeve.

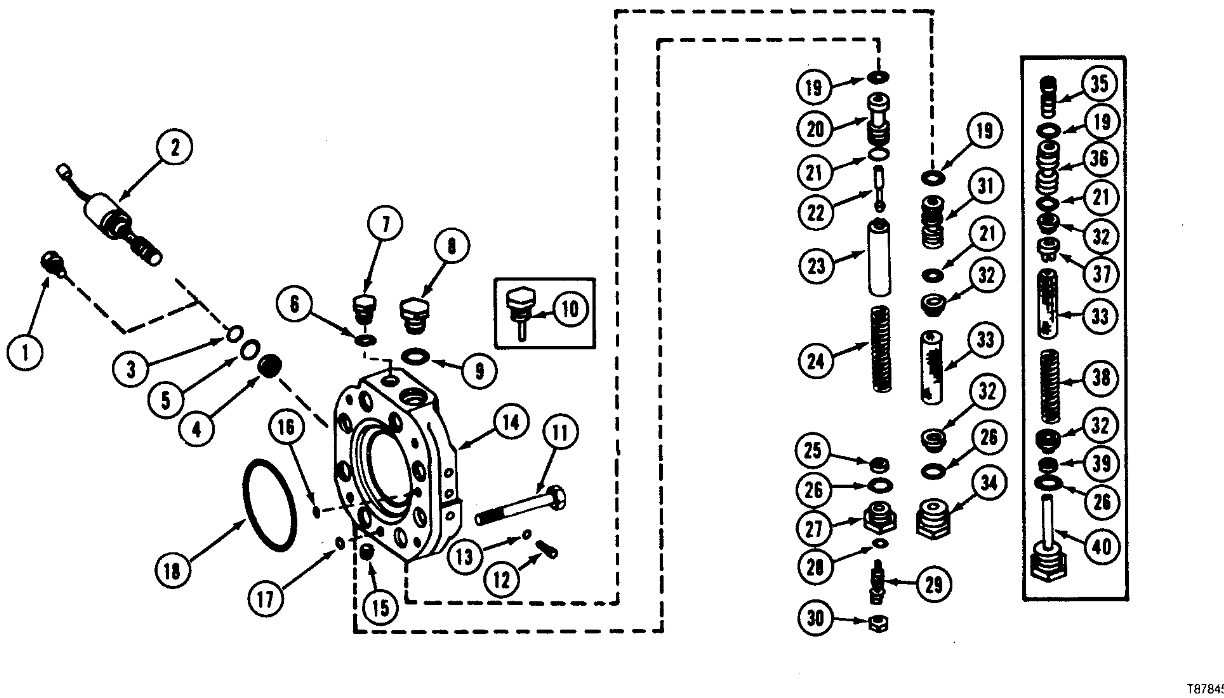
20. Inspect the springs (1 and 2) for wear or broken coils.

Check the compression rate of springs using the D-01168AA Spring Compession Tester.

SPRING SPECIFICATIONS

Stroke Control Valve Spring (1):
Free Length (approximate) .... 3.62 in. (92 mm)
Test Length at 140 ± 15 lb. force .... 3.310 in.
(623 ± 66.75 N .... 84.07 mm)
Crankcase Outlet Valve Spring (2):
Free Length (approximate) .... 2.89 in. (73.5 mm)
Test Length at 50 ± 5 lb. force .... 2.20 in.
(222.5 ± 22.3 N .... 56 mm)

Assemble Stroke Control Valve Assembly



1—Special Plug
2—Solenoid Valve
3—O-Ring
4—O-Ring
5—Backup Ring (use on special plug with groove in center section)
6—O-Ring
7—Plug
8—Plug (351942-)
9—O-Ring
10—Plug With Pin (-351941)
11—Cap Screw (4 used)
12—Plug (2 used)
13—O-Ring (2 used)
14—Stroke Control Valve Housing
15—Pipe Plug
16—O-Ring
17—Packing
18—O-Ring
19—O-Ring (2 used)
20—Sleeve
21—O-Ring (2 used)
22—Stroke Control Valve
23—Spring Guide
24—Spring
25—Washer
26—O-Ring (2 used)
27—Fitting
28—O-Ring
29—Adjusting Screw
30—Nut
31—Sleeve (351942-)
32—Packing (2 used)
33—Filter Screen
34—Plug (351942-)
35—Crankcase Outlet Valve (-351941)
36—Sleeve (-351941)
37—Spring Guide (-351941)
38—Spring (-351941)
39—Washer (as needed) (-351941)
40—Plug With Pin (-351941)

Fig. 52-Stroke Control Valve Assembly (Pump Without Pump Serial Number Plate)

1. Use an overhaul kit to assemble a rebuildable stroke control valve assembly.

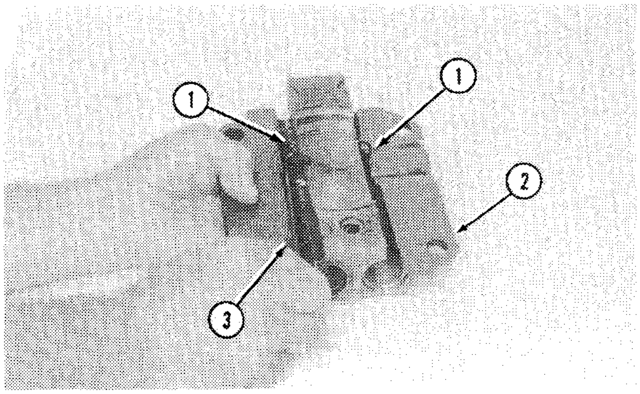
2. Apply clean hydraulic oil to all parts.

3. Install plugs (12, Fig. 52) and O-rings (13) into stroke control valve housing (14).

NOTE: When special plug is installed, backup ring is only used on the plug with groove in center section.

4. Install O-rings (3 and 4) and backup ring (5) on special plug (1) or solenoid valve (2).

5. Install plug or valve into housing.



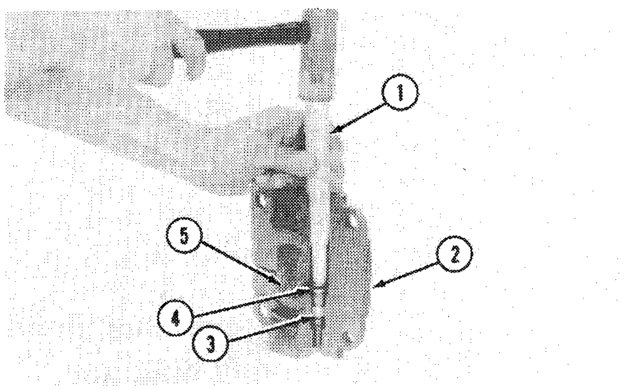
T75257

1—O-Ring (2 used)
2—Stroke Control Valve Housing
3—JDG-127 O-Ring Seal Tool Set

Fig. 53-Install O-Rings

NOTE: Cutaway of a stroke control valve housing shown.

5. Install O-rings (1, Fig. 53) into stroke control valve housing (2) using JDG-127 O-ring seat tool set (3).



T87846

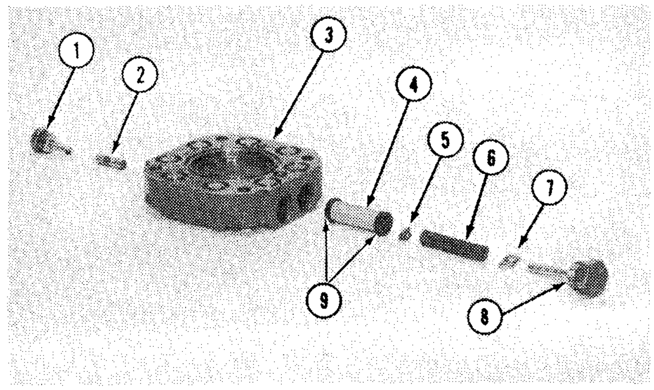
1—Wooden Dowel
2—Stroke Control Valve Housing
3—Stroke Control Valve Sleeve
4—O-Ring (2 used)
5—Crankcase Outlet Valve Sleeve (-351941) Secondary Orifice Sleeve (351941-)

Fig. 54-Install Sleeves

NOTE: Cutaway of a stroke control valve housing shown.

IMPORTANT: Do not use a driver that can damage the inner bore of sleeves.

6. Install new O-rings (4, Fig. 54) into grooves of sleeves (3 and 5). Carefully install sleeves into housing using a wooden dowel (1).



T75255

1—Plug With Pin (-351941) Plug (351942-)
2—Crankcase Outlet Valve (-351941)
3—Stroke Control Valve Housing
4—Filter Screen
5—Spring Guide (-351941)
6—Spring (-351941)
7—Shim (as needed) (-351941)
8—Plug With Pin (-351941) Plug (351942-)
9—Packing (2 used)

Fig. 55-Install Filter Screen And Crankcase Outlet Valve

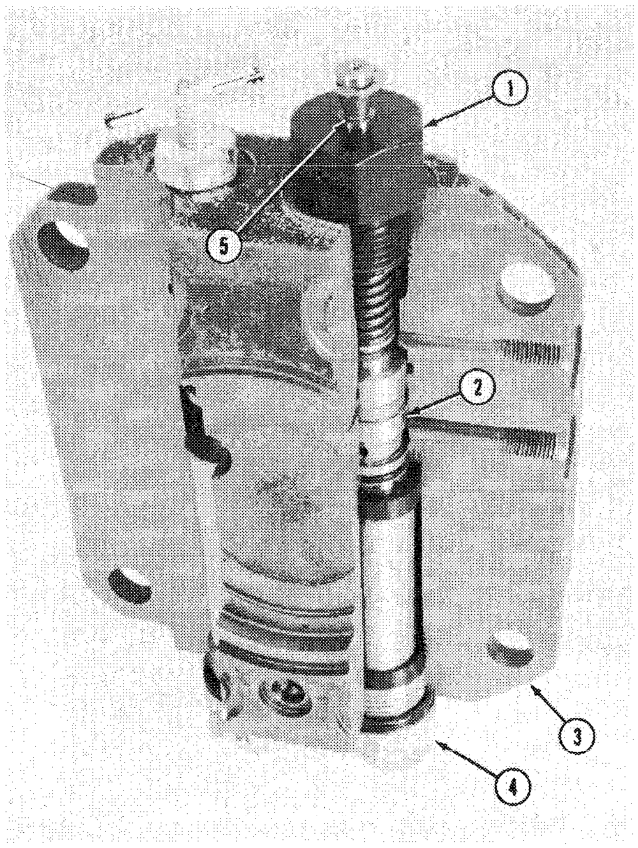
7. Install packings (9, Fig. 55) on filter screen (4), then install assembly into housing.

8. For units through Serial Number (-351941) with crankcase outlet valve, install shims (7) (same amount as removed), spring (6), and spring guide (5) on plug with pin (8). Install assembly into housing.

For units from Serial Number (351942-), install plug (34, Fig. 52).

9. For units through Serial Number (-351941) with crankcase outlet valve (2, Fig. 55), install valve (small end first) into sleeve in housing. After checking valve adjustment, install plug with pin (1).

For units from Serial Number (751942-) install the plug (8, Fig. 52).



T86528

1—JDH-19 Outlet Valve Adjusting Tool
2—Crankcase Outlet Valve
3—Stroke Control Valve Housing
4—Plug With Pin
5—Bottom of Notch

Fig. 56-Check Adjustment Of Crankcase Outlet Valve

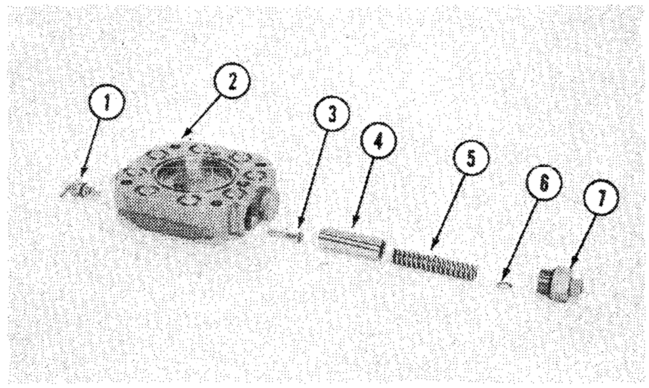
10. Check adjustment of crankcase outlet valve (2, Fig. 56) using JDH-19C Outlet Valve Adjusting Tool (1).

Add or remove shims on plug with pin (4) until bottom of notch (5) is even with the top of nut.

11. Remove the tool.

12. Push on valve to be sure that it moves freely in sleeve.

13. Install plug with pin (1, Fig. 55).



T75254

1—Manual Destroke Screw
2—Stroke Control Valve Housing
3—Stroke Control Valve
4—Spring Guide
5—Spring
6—Special Washer
7—Adjusting Plug

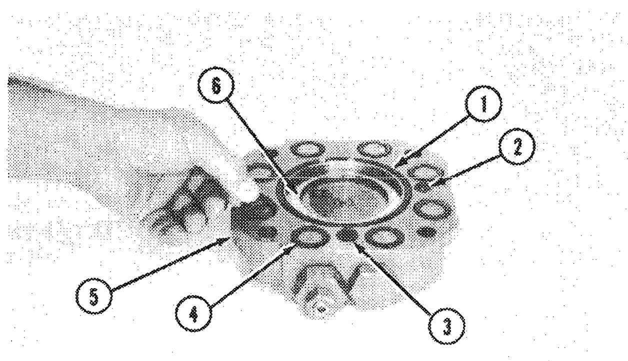
Fig. 57-Install Stroke Control Valve

14. Install stroke control valve (3, Fig. 57) into sleeve in stroke control valve housing (2).

15. Install spring guide (4) and spring (5).

16. Install special washer (6) in adjusting plug (7). Install plug.

17. Install manual destroke screw (1).

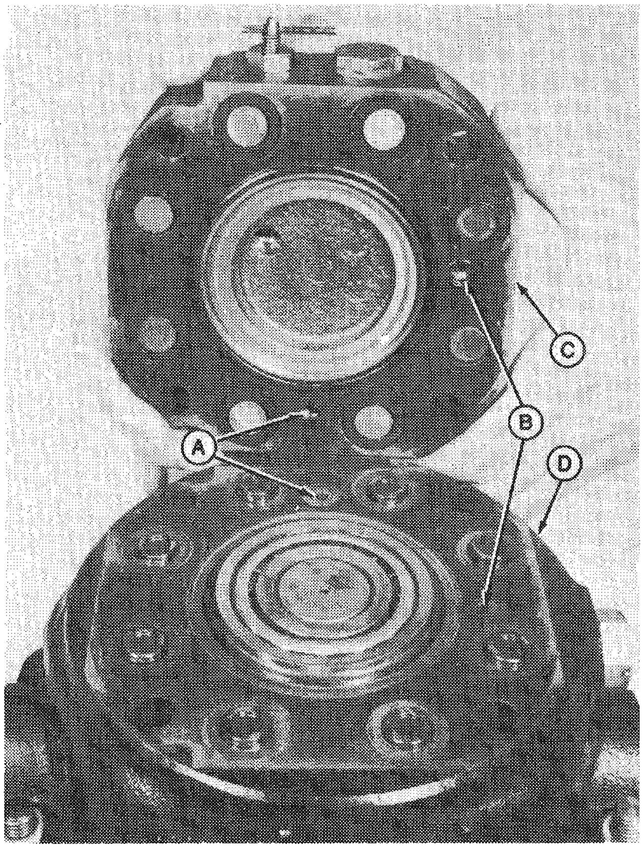


T87842

1—O-Ring
2—O-Ring
3—Packing
4—Packing (8 used)
5—Stroke Control Valve Housing
6—Shim (as needed)

Fig. 58-Install O-Rings And Packings

18. Install the O-rings (1 and 2, Fig. 58), packings (3 and 4), and shims (6) (same amount as removed) into stroke control valve housing (5). Apply a small amount of petroleum jelly to O-rings and packings to hold them in place.



A—High Pressure Passage
B—Charge Pressure Passage
C—Stroke Control Valve Housing
D—Pump Housing

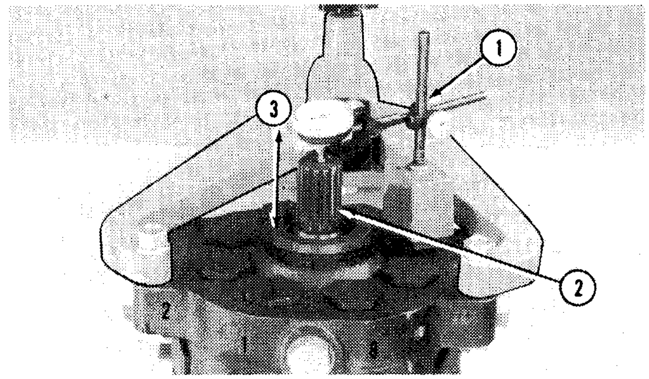
Fig. 59-Install Stroke Control Valve Assembly

CAUTION: Stroke control valve assembly must be installed so passages in valve housing and pump housing are in alignment. If passages are not in alignment, system pressure is not sensed at stroke control valve to destroke pump at the standby pressure setting; causing pressure to increase until there is a component failure and possible personal injury.

IMPORTANT: The machined surface of valve and pump housing must be clean and free of oil and petroleum jelly to get a good tight joint for sealing when cap screws are tighten.

19. Install stroke control valve assembly so high pressure passage (A, Fig. 59) and charge pressure passage (B) in stroke control valve housing (C) and pump housing (D) are in alignment.

20. Install and tighten the four cap screws in even steps to 85 lb-ft (115 N·m).



1—Dial Indicator
2—Pump Shaft
3—0.001 to 0.005 in. (0.03 to 0.13 mm) End Play

Fig. 60-Check End Play

21. If a new housing was installed, check the end play (3, Fig. 60) of pump shaft (2) using a dial indicator (1). Add or remove shims in stroke control valve housing to get the correct end play.

22. Install the pump on unit (See Installation).

(3 in.^{3}) 50 cm^3 AND (4 in.^{3}) 65 cm^3 HYDRAULIC PUMP AND STROKE CONTROL VALVE (WITH PUMP SERIAL NUMBER PLATE)

REMOVAL

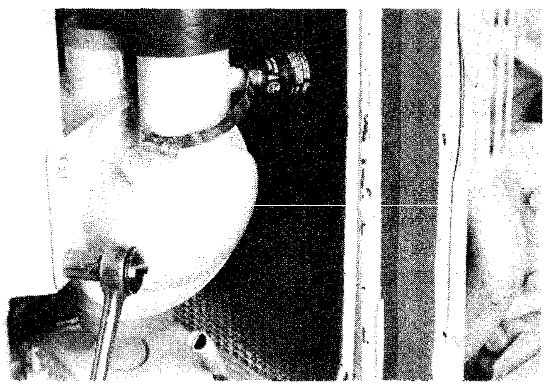
1. Lower all equipment to the ground.

2. Stop the engine.

3. Operate all hydraulic control valve to release hydraulic pressure in the system.

4. Disconnect the battery ground strap.

5. Remove the left and right-hand grille screens.

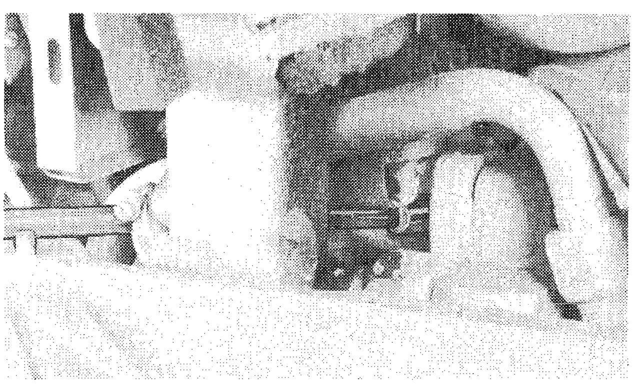


T85237

Fig. 61-Remove Air Cleaner

6. Disconnect hose from air cleaner.

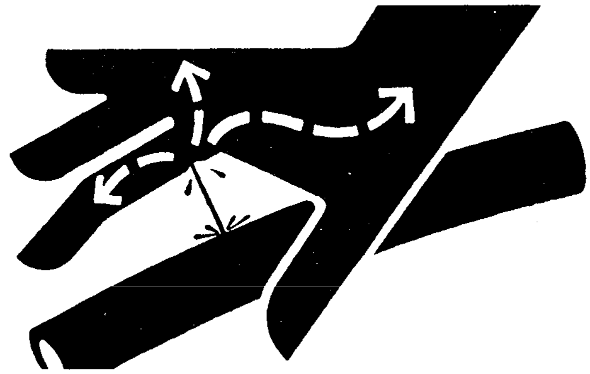
7. Remove cap screws to remove air cleaner (Fig. 61).



T85240

Fig. 62-Loosen Cap Screws

8. Turn pump drive shaft until two cap screws (Fig. 62) are accessible. Loosen the two cap screws, then turn pump drive shaft 180° and loosen the other two cap screws.

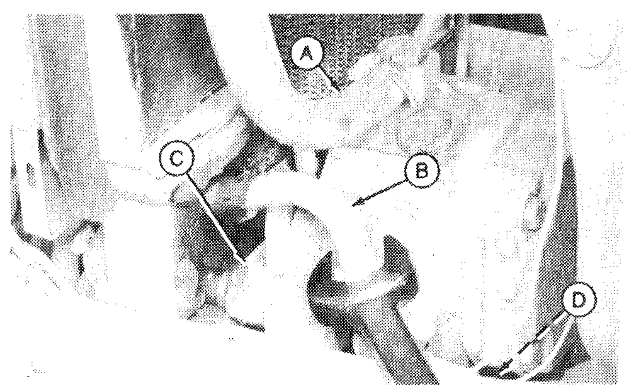


X9811

Fig. 63-Avoid High-Pressure Fluids

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. DO NOT use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.



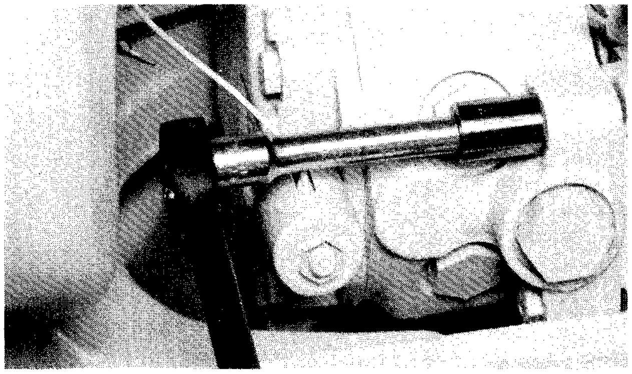
T85241

A—Excess Charge Pressure Line **B—Inlet Line**
B—Outlet Line **D—Seal Drain Line**

Fig. 64-Disconnect Lines

9. Slowly loosen connections at the hydraulic pump to release any residual pressure. Disconnect hydraulic lines (Fig. 64).

10. Close all openings with cap and plugs to keep dirt out of hydraulic system.



T85243

Fig. 65-Remove Pump

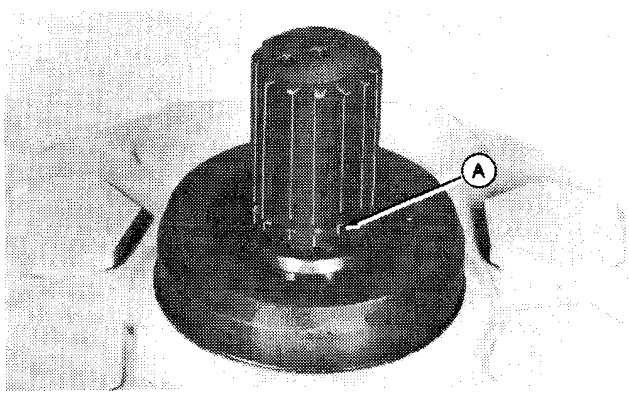
11. Disconnect the solenoid wiring lead.

CAUTION: Approximate weight of pump is 66 lb. (30 kg).

12. Remove four cap screws to remove pump (Fig. 65).

REPAIR

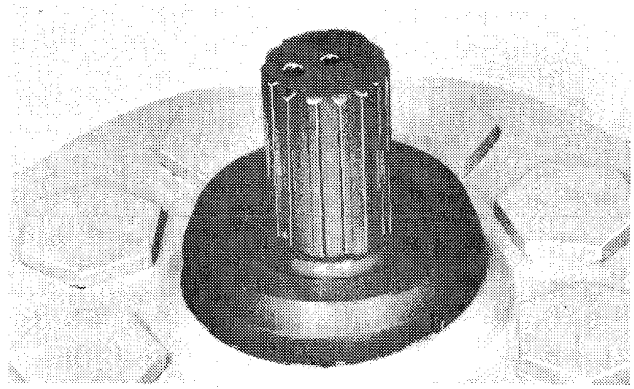
Disassemble and Inspect Pump Housing



T87847

A—Identification Groove

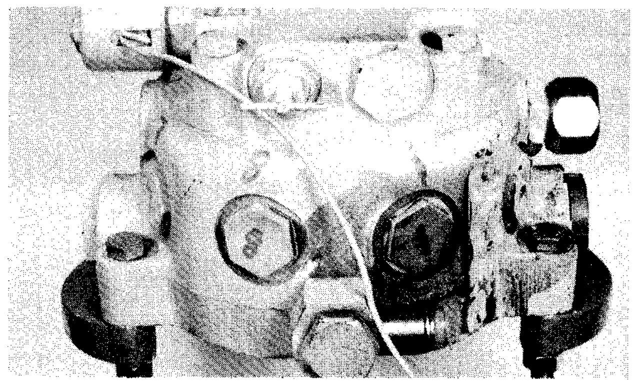
Fig. 66-(3 in.^{3}) 50 cm^3 Pump Identification



T87848

Fig. 67-(4 in.^{3}) 65 cm^3 Pump Identification

1. The repair of (3 in.^{3}) 50 cm^3 or (4 in.^{3}) 65 cm^3 pump is similar except for some specifications. Check the pump shaft (Figs. 66 and 67) or serial number plate for identification of pump size.



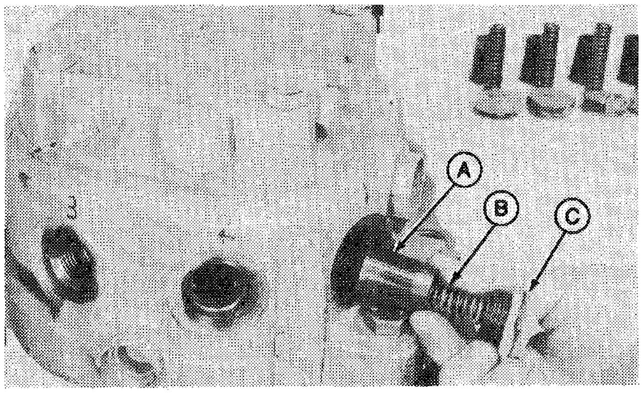
T85244

Fig. 68-Install Pump On Bench Fixture

2. Thoroughly clean the outside surface of the pump housing.

3. Install pump on the D-01006AA bench fixture (Fig. 68).

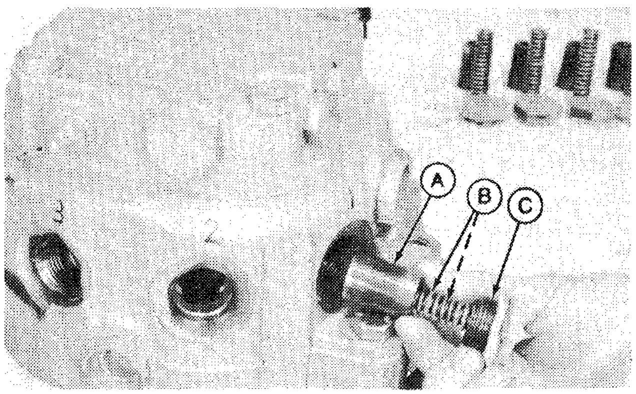
4. Write numbers on pump housing, piston plugs, and inlet valve plugs for identification.



T86222

A—Piston (8 used)
B—Spring (8 used)
C—Piston Plug (8 used)

Fig. 69-Remove Piston Assemblies (3 in.^{3}) 50 cm^3 Pump



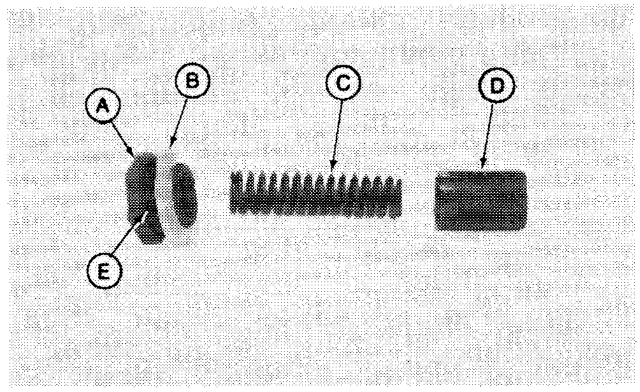
T85458

A—Piston (8 used)
B—Inner and Outer Spring (8 used)
C—Piston Plug (8 used)

Fig. 70-Remove Piston Assemblies (4 in.^{3}) 65 cm^3 Pump

IMPORTANT: Piston assemblies for the (3 in.^{3}) 50 cm^3 and (4 in.^{3}) 65 cm^3 pumps are not interchangable. If original pistons are used again, install them into the same bores from which they were removed.

5. Remove the piston assemblies (Fig. 69 or 70). Put assemblies into JDH-21A Parts Tray so they can be installed into the same bores from which they were removed.



T86223

A—Piston Plug
B—Sheath
C—Spring
D—Piston
E—O-Ring

Fig. 71-Inspect Piston Assemblies (3 in.^{3}) 50 cm^3 Pump

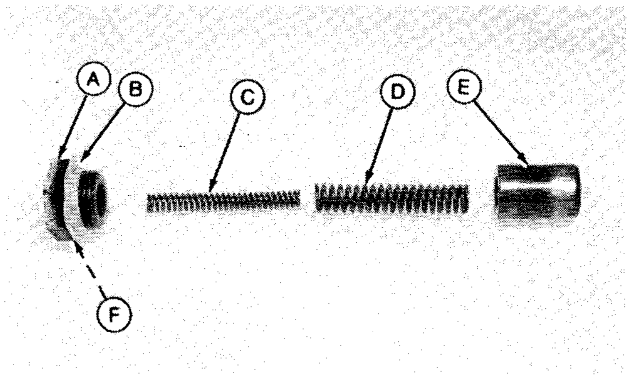
6. Remove and discard sheaths (B, Fig. 71) and O-rings (E). Inspect threaded area of piston plugs (A) and pump housing for damage.

7. Inspect the springs (C) for wear or broken coils. Check the compression rate of spring using the D-01168AA Spring Compression Tester.

PISTON SPRING SPECIFICATIONS
(3 in.^{3}) 50 cm^3 PUMP

Free Length (approximate) .... 2.44 in. (62 mm)
Test Length at 34 to 40 lb. force .... 1.62 in. (151 to 178 N .... 41 mm)
with a maximum difference of force permissible of .... 1.5 lb. force (6.7 N)

If the difference of force is more than the specification, install new springs as a set. The eight springs in a set must be of the same color code.



A—Piston Plug
B—Sheath
C—Inner Spring
D—Outer Spring
E—Piston
F—O-Ring

Fig. 72-Inspect Piston Assemblies (4 in.^{3}) 65 cm^3 Pump

8. Remove and discard sheaths (B, Fig. 72) and O-rings (F). Inspect threaded area of piston plugs (A) and pump housing for damage.

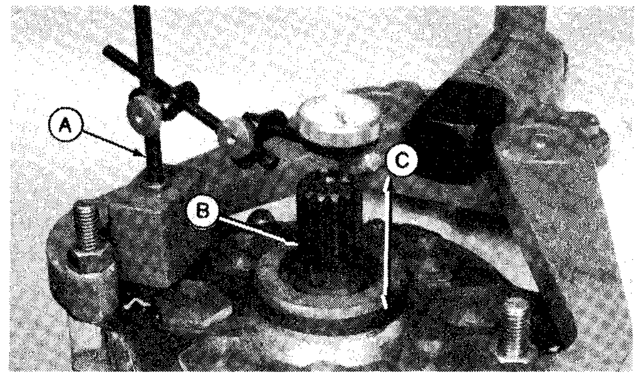
9. Inspect the springs (C and D) for wear or broken coils. Check the compression rate of springs using D-01168AA Spring Compression Tester.

PISTON SPRING SPECIFICATIONS
(4 in.^{3}) 65 cm^3 PUMP

Inner Spring (C):
Free Length (approximate) .... 2.74 in. (69.5 mm)
Test Length at 17 to 21 lb. force .... 1.78 in. (75.6 to 93.4 N .... 45.2 mm)
with a maximum difference of force permissible of .... 1.0 lb. force (4.45 N)

Outer Spring (D):
Free Length (approximate) .... 2.8 in. (70 mm)
Test Length at 30 to 35 lb. force .... 1.78 in. (129 to 155.7 N .... 45.2 mm)
with a maximum difference of force permissible of .... 1.5 lb. force (6.7 N)

If the difference of force is more than the specification, install new springs as a set. The eight springs in a set must be of the same color code.



A—Dial Indicator
B—Pump Shaft
C—End Play

Fig. 73-Check End Play

10. Before further disassembly, check the end play (C, Fig. 73) of pump shaft (B) using a dial indicator (A).

END PLAY SPECIFICATION

End play .... 0.001 to 0.005 in. (0.03 to 0.13 mm)

End play more than the specification can be an indication of worn bearings.

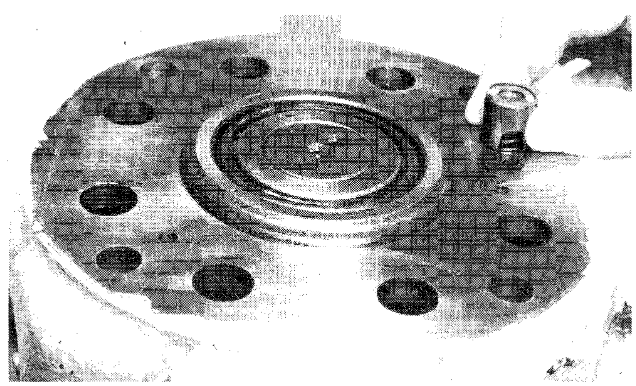


Fig. 74-Remove Outlet Valves

NOTE: If stroke control valve assembly is to be disassembled, loosen all plugs before removing cap screw to make disassembly easier.

11. Remove the four cap screws to remove stroke control valve assembly. Remove and discard O-rings and packings. Keep shims with valve assembly for use at assembly.

12. Remove the outlet valve assemblies (Fig. 74). Put assemblies into parts tray so they can be installed into their original bores.

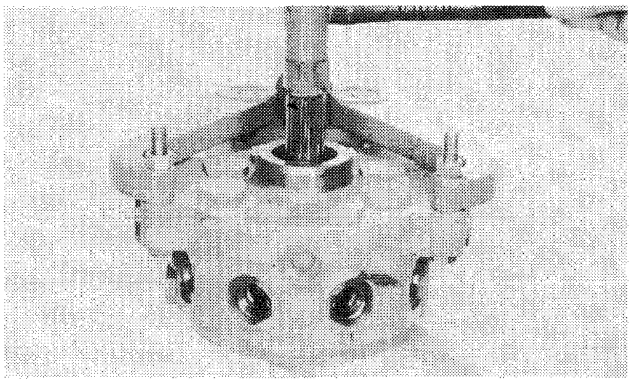
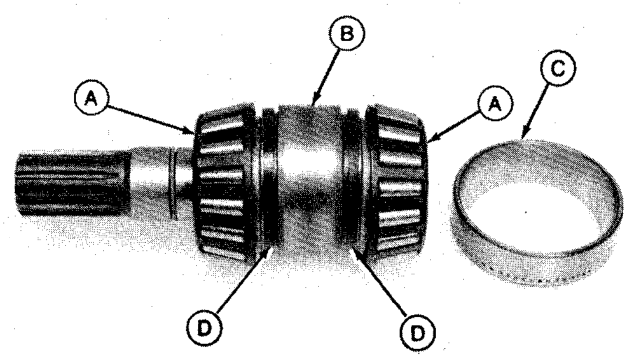


Fig. 75-Remove Pump Shaft Assembly

13. To remove pump shaft assembly (Fig. 75), lightly tap on splined end shaft using a soft-face hammer.



A—Bearing Cone (2 used)
B—Race
C—Bearing Cup (2 used)
D—Thrust Washer (2 used)

Fig. 76-Inspect Pump Shaft Assembly

IMPORTANT: Pump shaft for the (3 in.^{3}) 50 cm^3 and (4 in.^{3}) 65 cm^3 pumps are not interchangable.

14. Inspect race (B, Fig. 76) for nicks, scratches or pitting. If any external damage is seen, replace the race and all pistons.

15. If there is no external damage, hold pump shaft and slowly turn the race. Race must turn smoothly. Replace race and all rollers if assembly is sticking or noisy.

16. Inspect thrust washers (D, Fig. 74) for wear or looseness on race.

17. Inspect bearing cones (A) for a worn race, damaged cage or pitted, scratched or flaked rollers.

18. Inspect bearing cup (C) and bearing cup in pump housing for pitting, scratches or flaking.

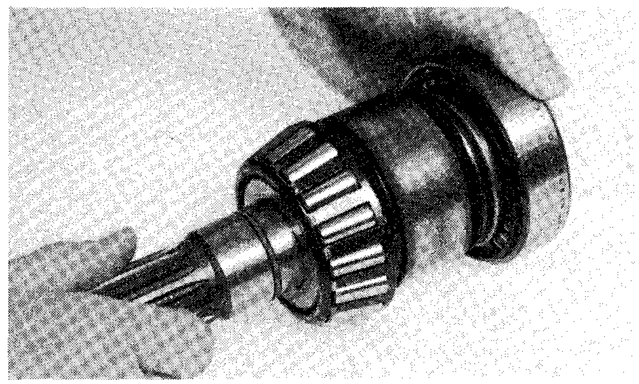


Fig. 77-Inspect Bearings

19. If there is no visible damage, put pump shaft with bearing cone into bearing cup and slowly turn shaft (Fig. 77). To check other cone, put shaft with cone into cup in pump housing.

If there is any clicking noise or sticking, clean the bearing cones and cups, then apply clean hydraulic oil to cones and check again. If bearing still clicks or sticks, replace cone and cup.

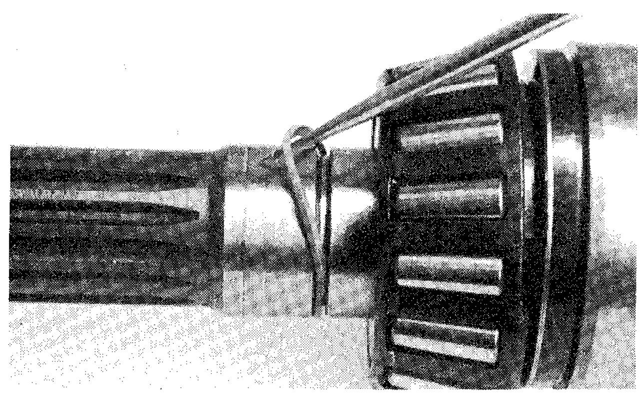


Fig. 78-Remove Sealing Ring

20. Remove sealing ring (Fig. 78) using JDG-127 O-Ring Seal Tool Set.

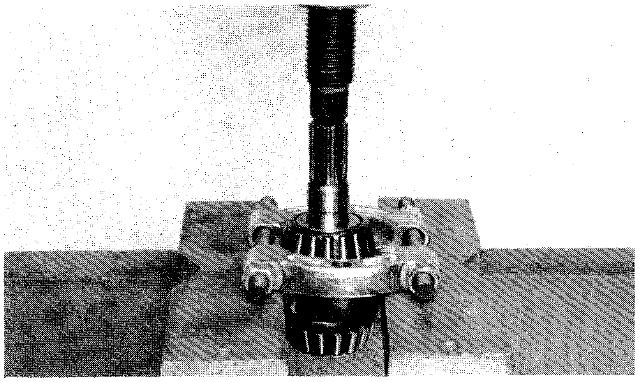
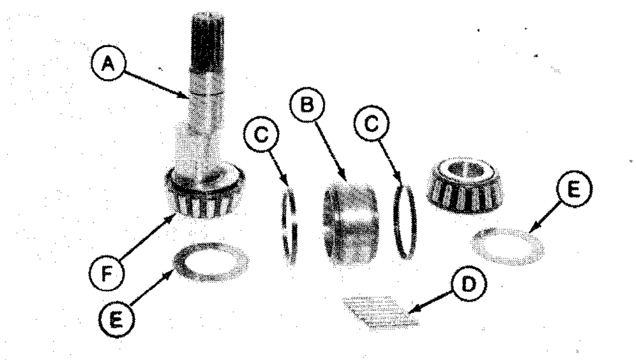


Fig. 79-Remove Bearing Cone

21. Remove bearing cone (Fig. 79) using a knife edge puller from D-01048AA Puller Set.



A—Pump Shaft
B—Race
C—Thrust Washer (2 used)
D—Roller Bearing (25 used)
E—Spacer (2 used)
F—Bearing Cone (2 used)

Fig. 80-Disassemble Pump Shaft Assembly

22. Remove spacers (E, Fig. 80), race (B) and roller bearings (D). Inspect parts for wear or damage.

23. Remove thrust washers (C) fom race.

24. If replacement is necessary, remove remaining bearing cone (F).

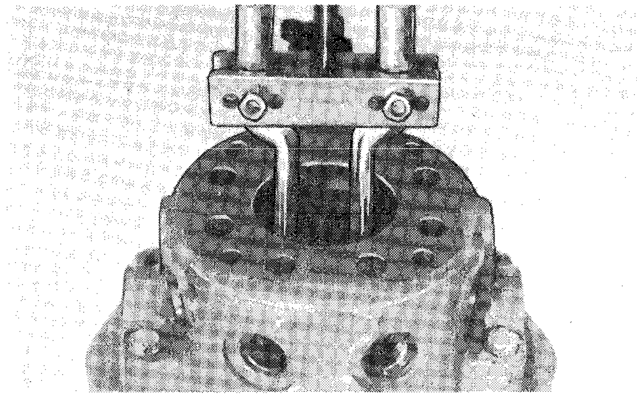
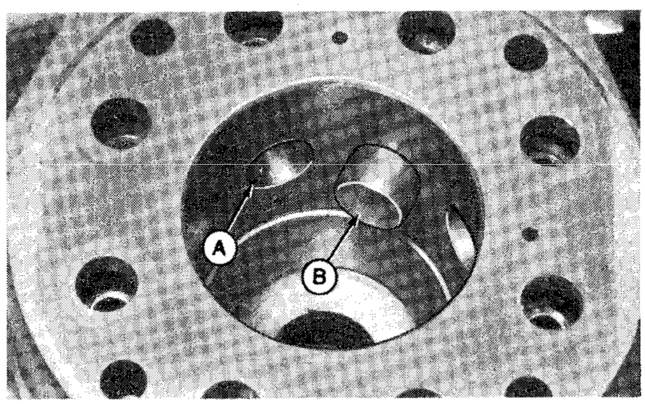


Fig. 81-Remove Bearing Cup

25. If necessary, remove bearing cup (Fig. 81) from pump housing using a slide hammer and puller from D-01048AA Puller Set.



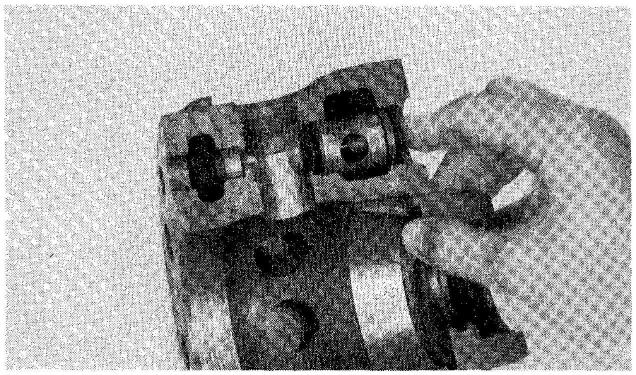
A—Piston Bore **B—Piston**

Fig. 82-Inspect Pump Housing

26. Inspect piston bores (A, Fig. 82) for scoring. If scoring can be felt, replace pump housing and all pistons (B).

27. After visually inspecting piston bores, install each piston into its bore so it extends approximately 0.50 in. (13 mm) into crankcase.

Piston must slide in smoothly and have no side play. If there is side play, replace the pump housing and pistons.



T77508

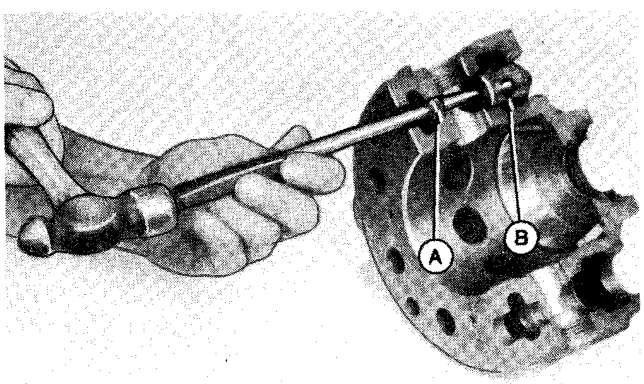
Fig. 83-Inspect Inlet Valves

NOTE: Cutaway section of a pump housing is shown.

28. Remove the inlet valve plugs.

29. Inspect inlet valves (Fig. 83) for a loose retainer or broken parts.

30. Visually check inlet valves for approximately 0.125 in. (3 mm) of valve lift and that it moves freely.



T85260

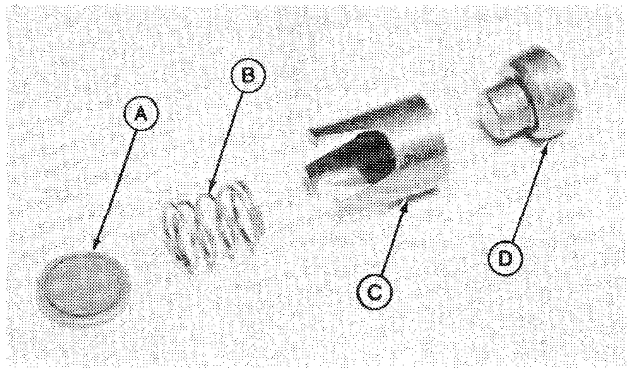
A—Outlet Valve Seat **B—Inlet Valve**

Fig. 84-Remove Inlet Valve

NOTE: Cutaway section of a pump housing is shown.

IMPORTANT: If inlet valves are removed, new valves must be installed because the press fit is critical for sealing.

31. To remove inlet valves (B, Fig. 84), put a punch through outlet valve seat (A) against center of valve face. Hit punch to drive out inlet valve.



T85461

A—Outlet Valve **C—Guide**
B—Spring **D—Stop**

Fig. 85-Inspect Outlet Valve Assemblies

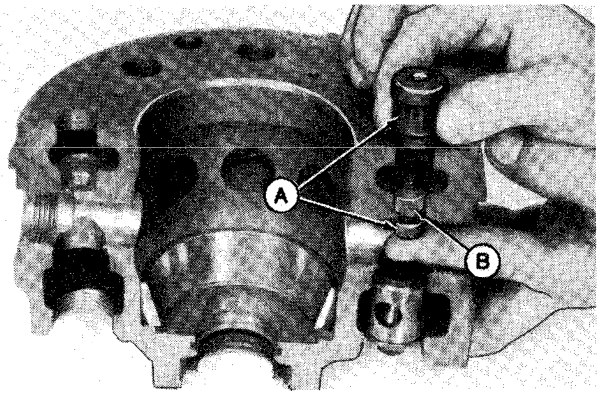
32. Inspect guides (C, Fig. 85) and stops (D) for wear or damage.

33. Inspect outlet valve (A) for scratched or broken wear patterns. If these patterns are found, replace valve and seat in pump housing.

34. Inspect springs (B) for wear or broken coils. Check the compression rate of springs using spring compression tester.

SPRING SPECIFICATIONS

Free Length (approximate) .... 0.48 in. (12.19 mm)
Test Length at 2.84 ± 0.30 lb. force ...... 0.30 in. (12.6 ± 0.1 N............ 7.6 mm)



1—JDH-39B-1 Installer and Removal Tool
2—Outlet Valve Seat

Fig. 86-Install Tool

NOTE: Cutaway section of a pump housing is shown.

35. Visually inspect outlet valve seats (B, Fig. 86) for peening and breakage.

IMPORTANT: If outlet valve seats are removed, new seats must be installed because the press fit is critical for sealing.

36. Remove outlet valve seats using the JDH-39B-1 Installer and Removal Tool (A) from the JDH-39B Hydraulic Pump Seat Installing Tool Set. Put the special cap screw through piston bore opening and install it into tool.

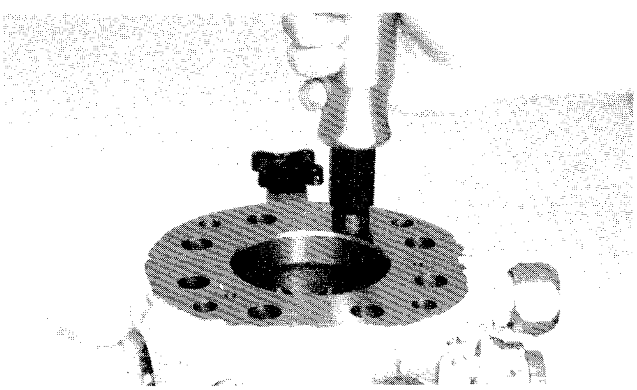


Fig. 87-Remove Outlet Valve Seat

37. Install a slide hammer and adapter (Fig. 87) from D-01048AA Puller Set into tool.

38. Remove the seat.

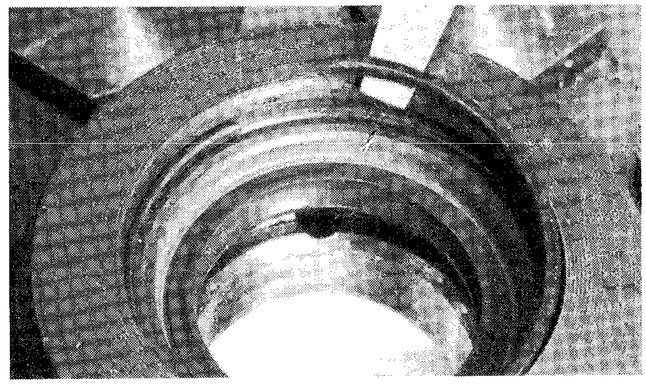


Fig. 88-Remove Snap Ring

39. Remove the snap ring (Fig. 88).

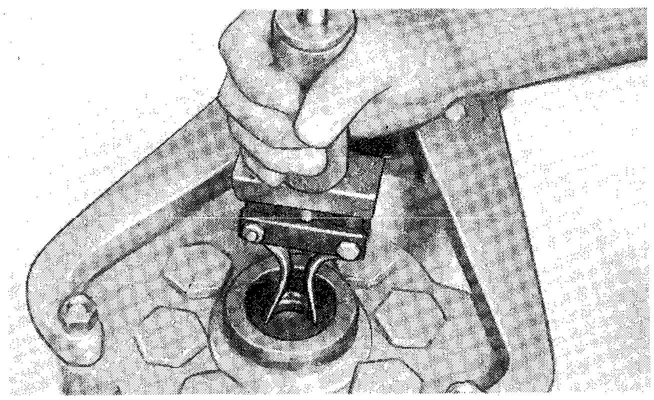
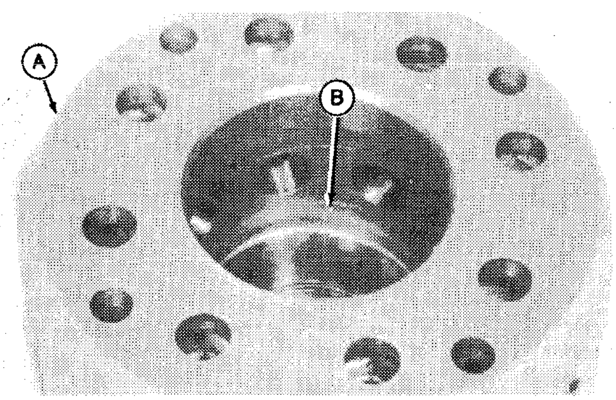


Fig. 89-Remove Oil Seal

40. Remove oil seal (Fig. 89) using puller from D-01048AA Puller Set.

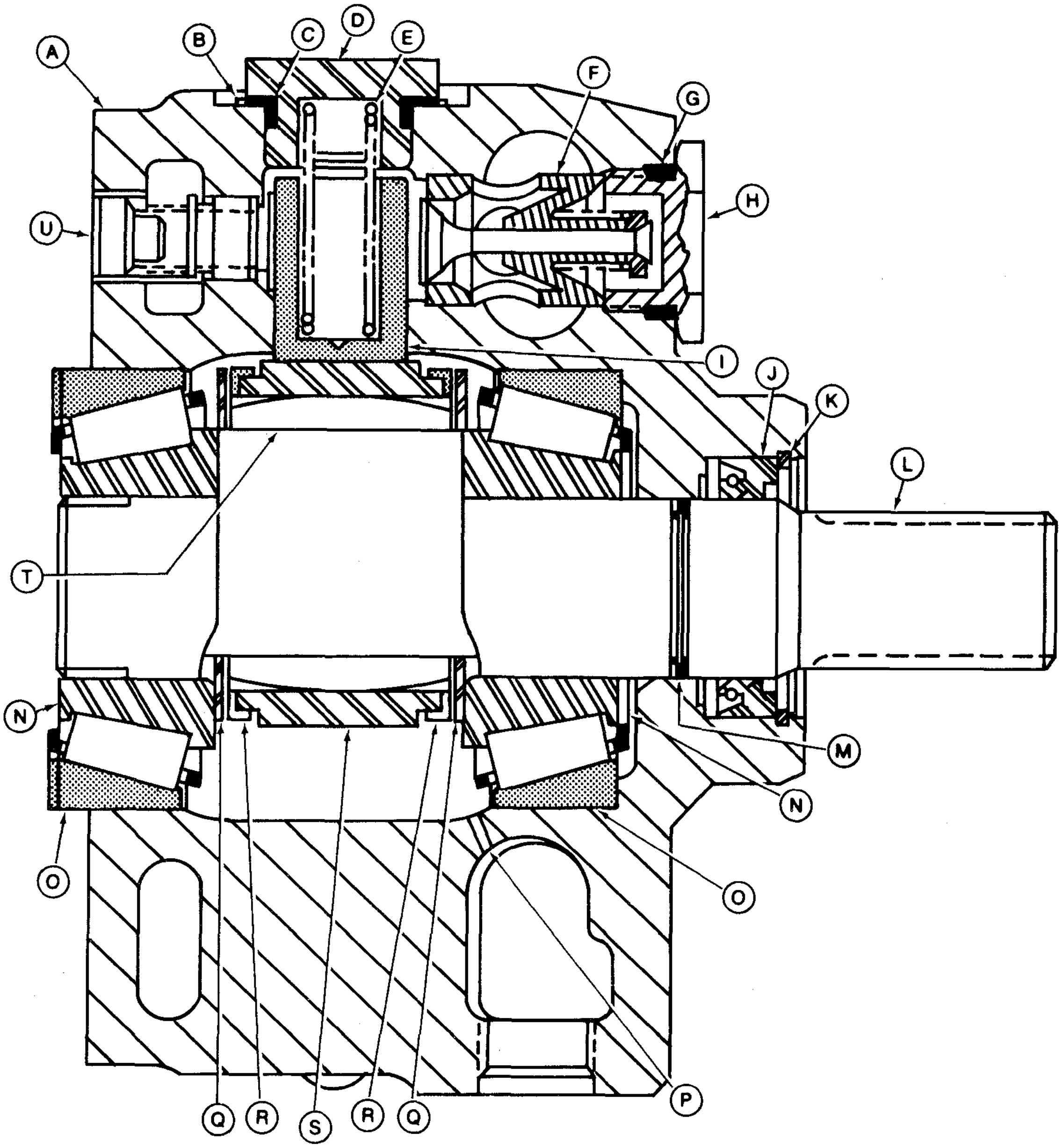


A—Pump Housing
B—Crankcase Orifice

Fig. 90-Check Crankcase Orifice

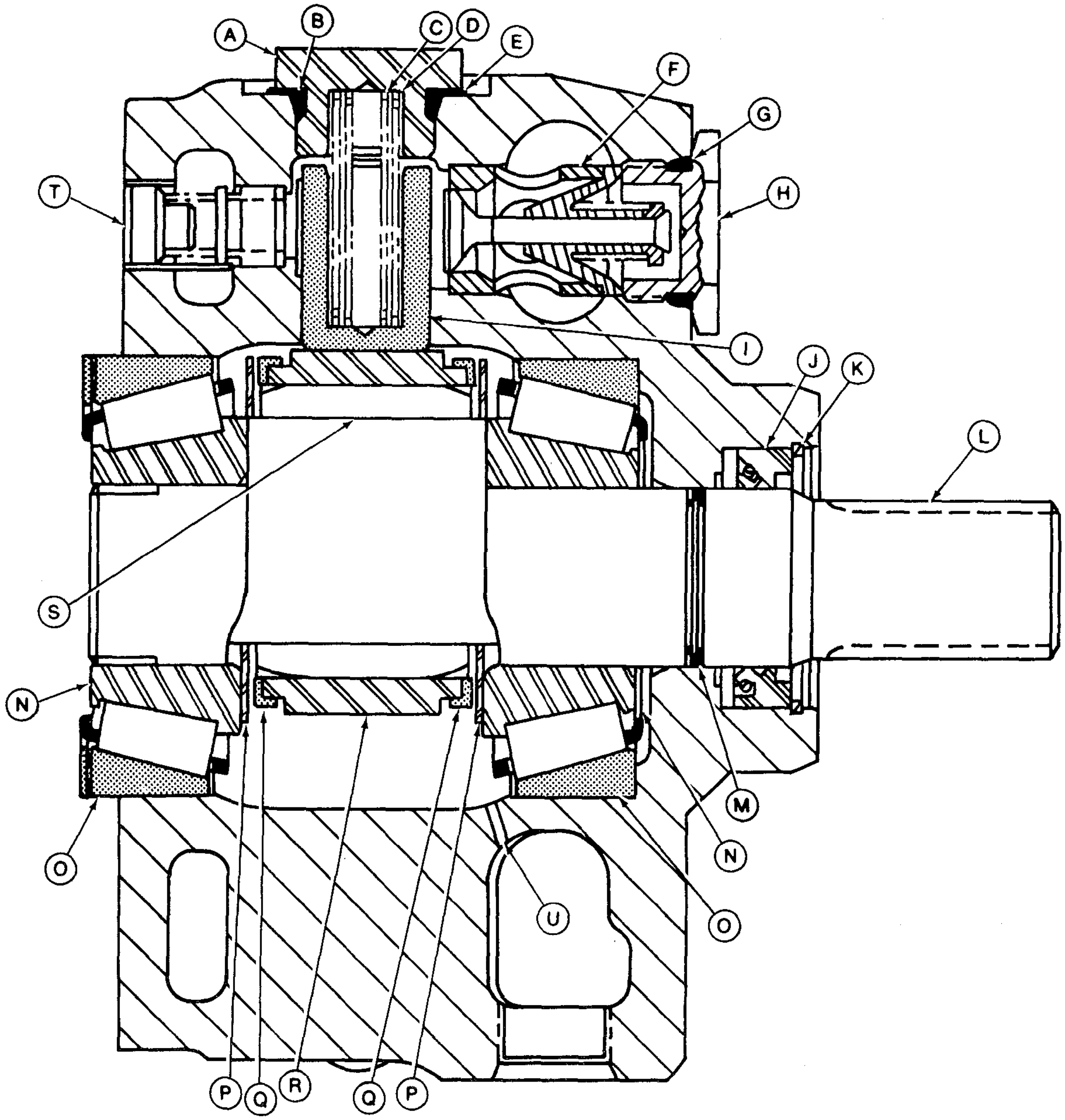
41. Check that crankcase orifice (B, Fig. 90) is open.

Assemble Pump Housing



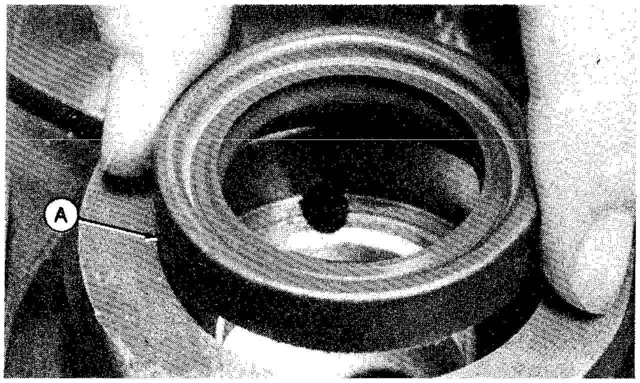
A—Pump Housing	G—O-Ring (8 used)	L—Pump Shaft	Q—Washer (2 used)
B—Sheath (8 used)	H—Plug (8 used)	M—Sealing Ring	R—Thrust Washer (2 used)
C—O-ring (8 used)	I —Piston (8 used)	N—Bearing Cone (2 used)	S—Race
D—Plug (8 used)	J—Oil Seal	O—Bearing Cup (2 used)	T—Roller Bearing (25 used)
E—Spring (8 used)	K—Snap Ring	P—Crankcase Orifice	U—Outlet Valve (8 used)
F—Inlet Valve (8 used)			

Fig. 91-Cross Section of Pump Housing For (3 in.^{3}) 50 cm^3 Pump

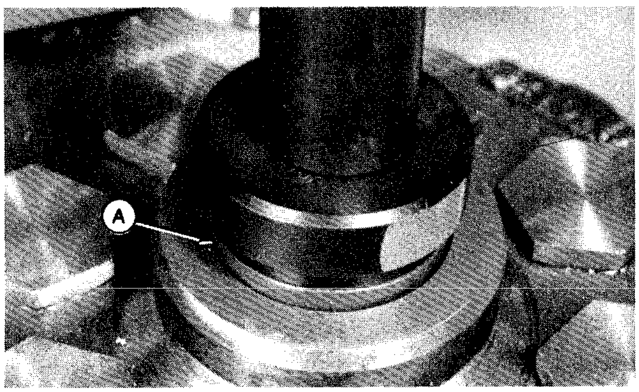


A—Plug (8 used)
B—O-Ring (8 used)
C—Inner Spring (8 used)
D—Outer Spring (8 used)
E—Sheath (8 used)
F—Inlet Valve (8 used)
G—O-Ring (8 used)
H—Plug (8 used)
I—Piston (8 used)
J—Oil Seal
K—Snap Ring
L—Pump Shaft
M—Sealing Ring
N—Bearing Cone (2 used)
O—Bearing Cup (2 used)
P—Washer (2 used)
Q—Thrust Washer (2 used)
R—Race
S—Roller Bearing (25 used)
T—Outlet Valve (8 used)
U—Crankcase Orifice

Fig. 92-Cross Section of Pump Housing for (4 in.^{3}) 65 cm^3 Pump



T85279



T85280

A—Oil Seal

Fig. 93-Install Oil Seal

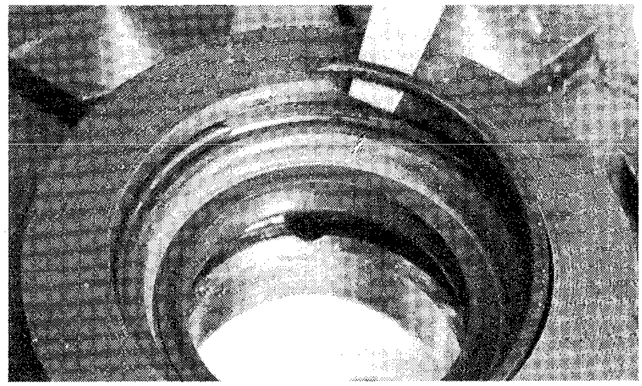
Use a hydraulic pump overhaul kit when assembling the hydraulic pump or stroke control valve assembly.

1. Before assembling, put clean hydraulic oil on all parts except O-rings and sheaths for piston plugs.

IMPORTANT: DO NOT push oil seal beyond inner edge of snap ring groove. Doing so can close the drain passage and cause an oil seal failure.

2. Install oil seal (A, Fig. 93) with lip of seal (spring side) toward the inside of pump housing using JDH-18 Driver.

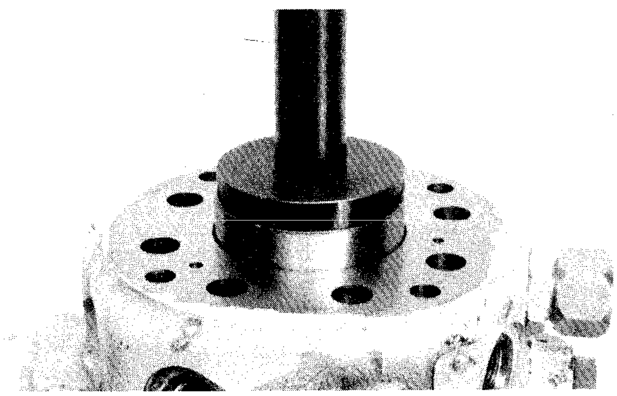
3. Apply petroleum jelly to lips of oil seal for lubrication when pump shaft is installed.



T85264

Fig. 94-Install Snap Ring

4. Install the snap ring (Fig. 94).



T85281

Fig. 95-Install Bearing Cup

5. Install bearing cup (Fig. 95) into the bottom of pump housing using 27488 handle and 27536 disk from the D-01045AA Bushing, Bearing and Seal Driver Set.

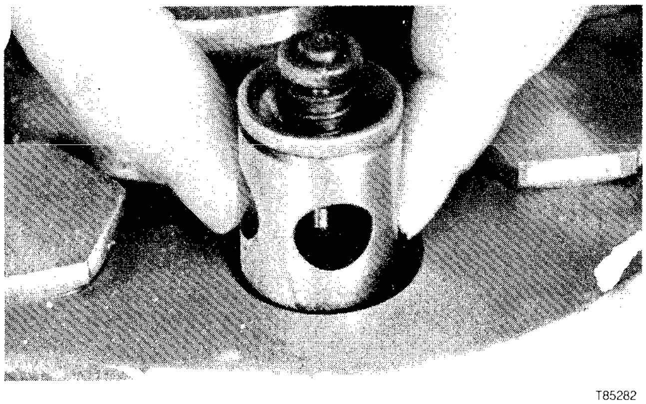
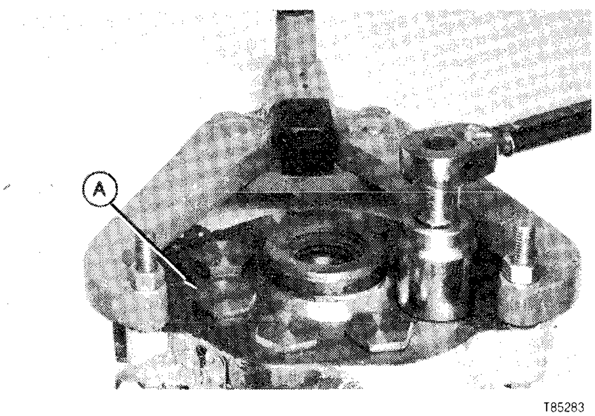


Fig. 96-Install Inlet Valve

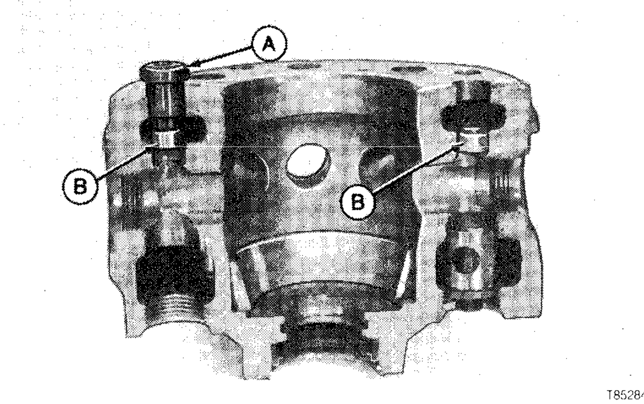
6. Install the new inlet valves (Fig. 96). Push valves in bores using the inlet valve plugs.



A—Plug (8 used)

Fig. 97-Install Plugs

7. Install inlet valve plugs (A, Fig. 97) and O-rings. Tighten plugs to 100 lb-ft (136 N·m). Then loosen plugs and retighten 100 lb-ft (136 N·m) to seat inlet valves in their bore.

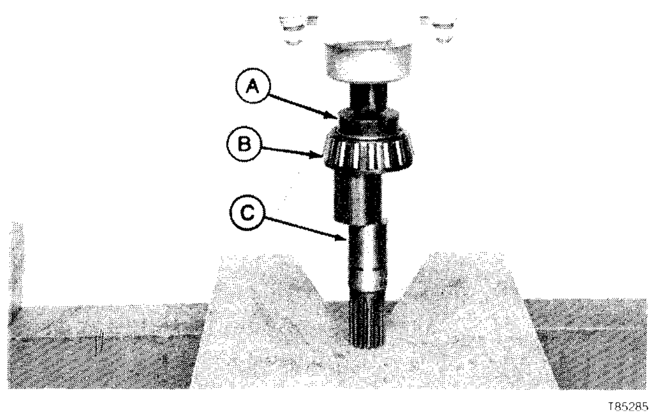


A—JDH-39B Seat Driver **B—Outlet Valve Seat (8 used)**

Fig. 98-Install Outlet Valve Seats

NOTE: Cutaway section of pump body is shown.

8. Install outlet valve seats (B, Fig. 98) using JDH-39B-1 Installer and Removal Tool (A). Push seat into housing until flange of tool is against face of housing.

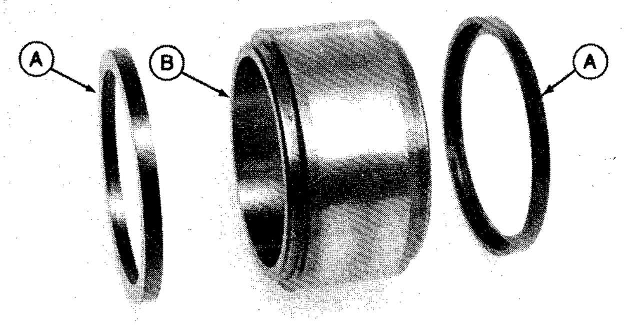


A—27516 Disk
B—Bearing Cone
C—Pump Shaft

Fig. 99-Install Bearing Cone

IMPORTANT: Pump shaft for the (3 in.^{3}) 50 cm^3 and (4 in.^{3}) 65 cm^3 pumps are not interchangeable.

9. Install bearing cone (B, Fig. 99) using 27516 disk (A) from D-01045AA Driver Set. Push on inner race of cone until it is against shoulder of shaft.

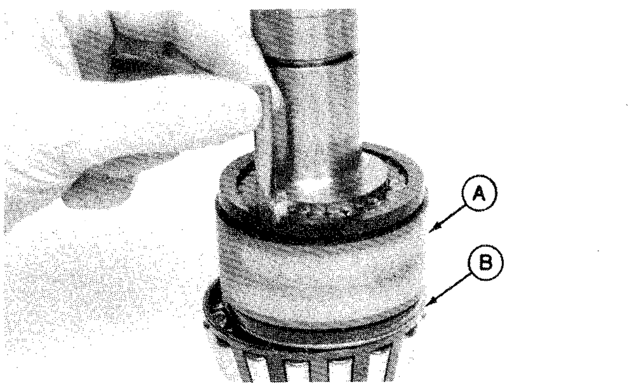


T85286

A—Thrust Washer (2 used) **B—Race**

Fig. 100-Install Thrust Washers

10. Install thrust washers (A, Fig. 100) on race (B).



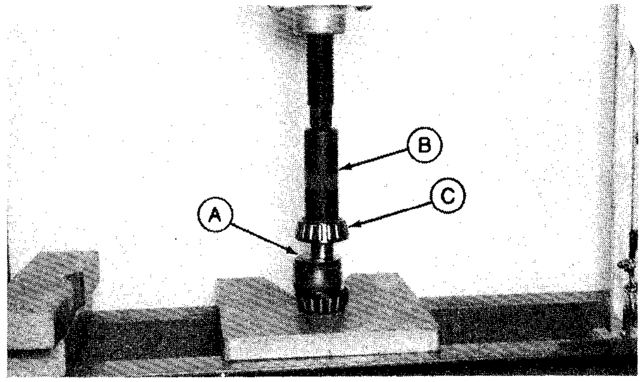
T85287

A—Race Assembly **B—Washer**

Fig. 101-Assemble Pump Shaft

11. Install washer (B, Fig. 101) and race assembly (A).

12. Install the 25 roller bearings. Apply clean hydraulic oil to bearings.



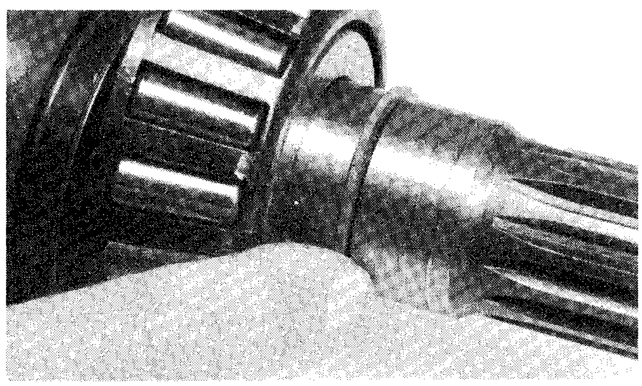
T85288

A—Washer **C—Bearing Cone**
B—JD-318 Driver

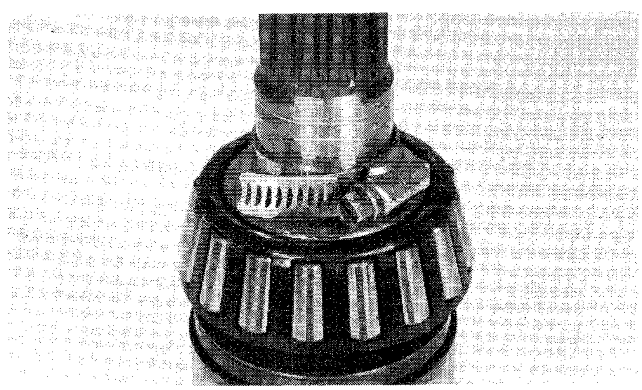
Fig. 102-Assemble Pump Shaft

13. Install the washer (A, Fig. 102).

14. Install bearing cone (C) using JD-318 Driver (B). Push inner race of cone against shoulder of shaft.



T85289

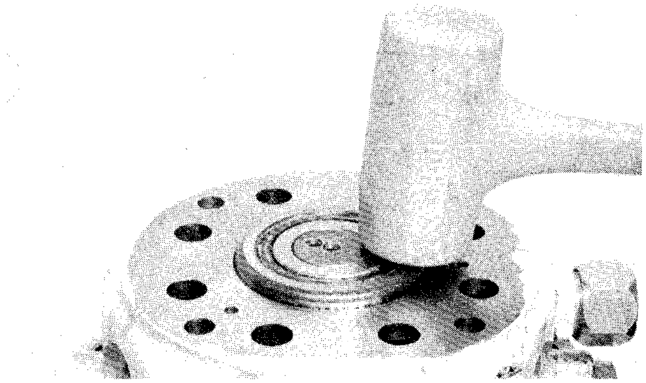


T85290

Fig. 103-Install Sealing Ring

15. Apply petroleum jelly to sealing ring. Install sealing ring (Fig. 103) on the pump shaft.

16. Shrink sealing ring to its original size using a hose clamp with a piece of shim stock between clamp and ring to protect ring from clamp.

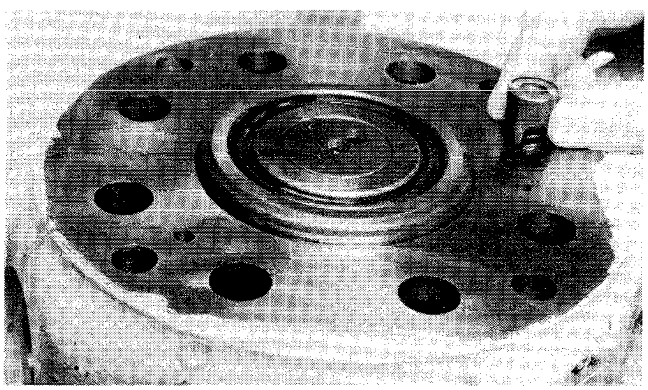


T85291

Fig. 104-Install Pump Shaft and Bearing Cup

17. Carefully install pump shaft assembly into the pump housing (Fig. 104).

18. Install the bearing cup into pump housing and against the bearing cone.

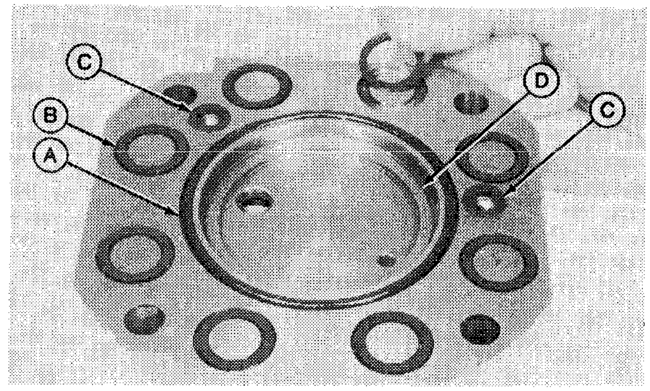


T85250

Fig. 105-Install Outlet Valves

IMPORTANT: The original outlet valve assemblies must be installed in their original boxes.

19. Install the eight outlet valves (Fig. 105).

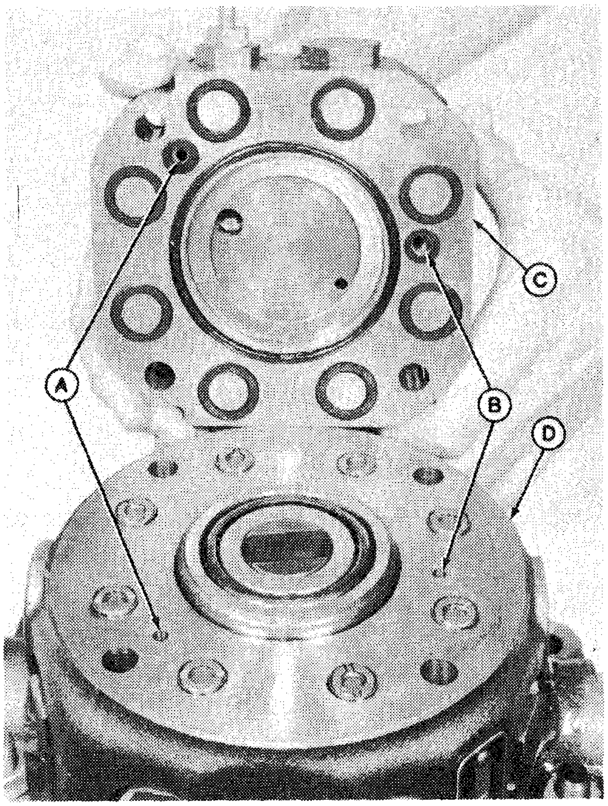


T85462

A—O-Ring
B—Packing (8 used)
C—Packing (2 used)
D—Shim (as needed)

Fig. 106-Install Shims, O-Ring and Packings

20. Install the O-ring (A, Fig. 106) packings (B and C), and shims (D). Apply a small amount of petroleum jelly to O-ring and packings to hold them in placing during assembly.



T86280

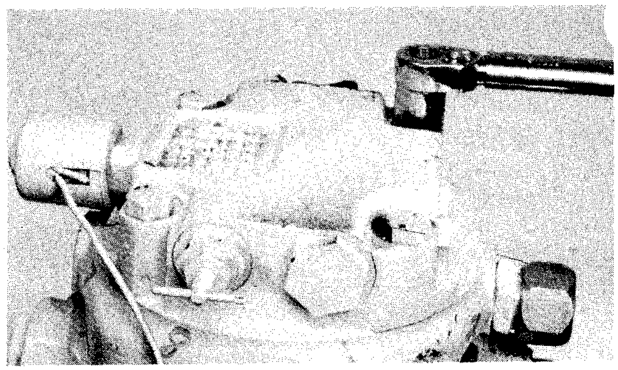
A—High Pressure Passage
B—Change Pressure Passage
C—Stroke Control Valve Housing
D—Pump Housing

Fig. 107-Install Stroke Control Valve Assembly

CAUTION: Stroke control valve assembly must be installed so passages in valve housing and pump housing are in alignment. If passages are not in alignment, system pressure is not sensed at stroke control valve to destroke pump at the standby pressure setting; causing pressure to increase until there is a component failure and possible personal injury.

IMPORTANT: The machined surface of valve and pump housings must be clean and free of oil and petroleum jelly to get a good tight joint for sealing when cap screws are tighten.

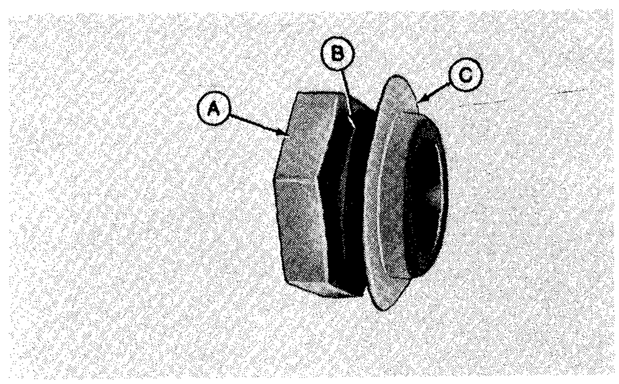
21. Install stroke control valve assembly so high pressure passage (A, Fig. 107) and charge pressure passage (B) in stroke control valve housing (C) and pump housing (D) are in alignment.



T85294

Fig. 108-Install and Tighten Cap Screws

22. Install and tighten the cap screws in even steps to 85 lb-ft (115 N·m).



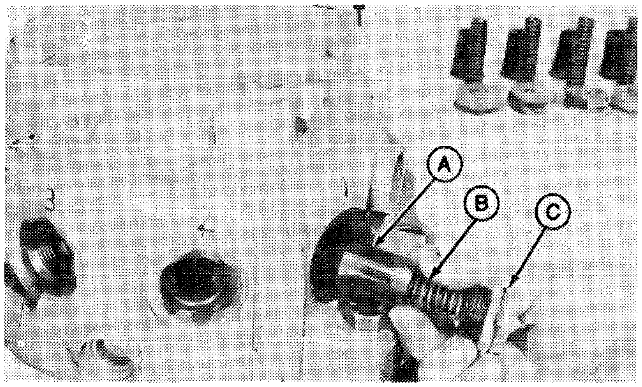
T85295

A—Piston Plug (8 used)
B—O-Ring (8 used)
C—Sheath (8 used)

Fig. 109-Install O-Ring and Sheath

IMPORTANT: DO NOT apply hydraulic oil to piston plugs, O-rings and sheaths.

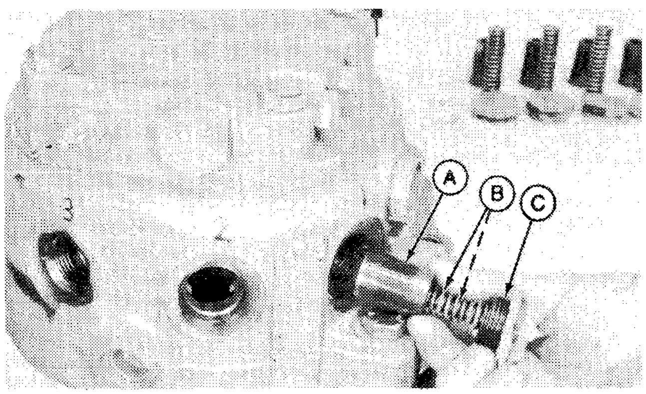
23. Install O-rings (B, Fig. 109) and sheaths (flange first) (C) on piston plugs (A).



T86222

A—Piston (8 used)
B—Spring (8 used)
C—Piston Plug (8 used)

Fig. 110-Install Piston Assemblies (3 in.³) 50 cm³ Pump



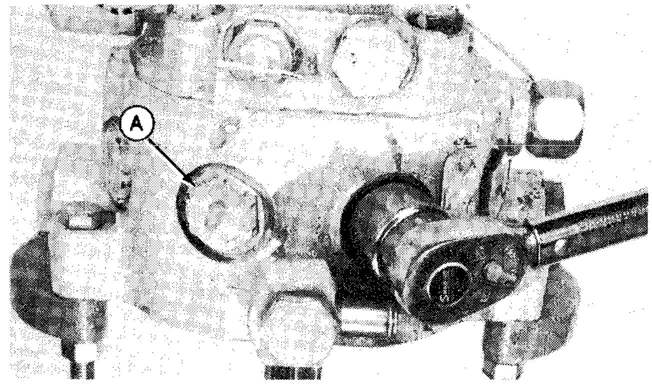
T85458

A—Piston (8 used)
B—Inner and Outer Spring (8 used)
C—Piston Plug (8 used)

Fig. 111-Install Piston Assemblies (4 in.³) 65 cm³ Pump

IMPORTANT: Piston assemblies for (3 in.³) 50 cm³ and (4 in.³) 65 cm³ pumps are not interchangable. If original pistons are used, install them into the same bores from which they were removed. The eight springs in a set must be of the same color code.

24. Install the piston assemblies (Fig. 110 or 111) into pump housing. For easier assembly, turn pump shaft so assembly being installed is on the low side of cam.



T85296

A—Plug (8 used)

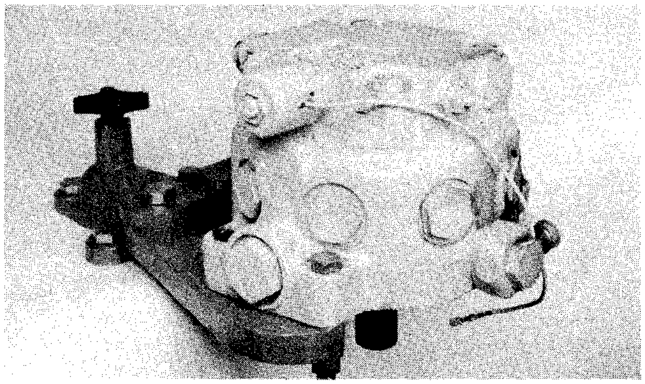
Fig. 112-Tighten Piston Plugs

IMPORTANT: To prevent damage to sheaths, do not use an air operated wrench to tighten piston plugs, use a hand wrench.

25. Tighten piston plugs (A, Fig. 112) to 100 lb-ft (136 N·m) using a hand wrench.

26. After installation of pump check pump standby pressure setting.

Disassemble and Inspect Stroke Control Valve Assembly



T85297

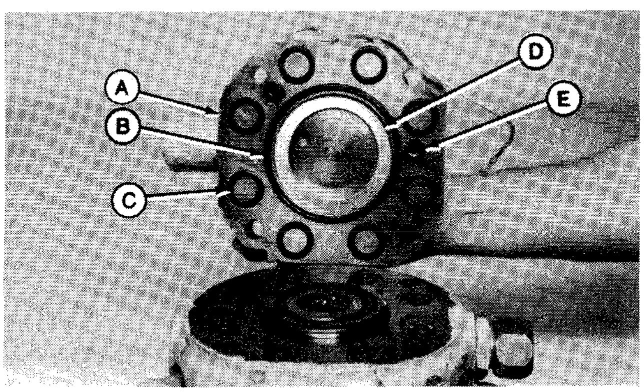
Fig. 113-Install Pump on Bench Fixture

NOTE: The repair of stroke control valve assembly (3 in.^{3}) 50 cm^3 and (4 in.^{3}) 65 cm^3 pump is the same.

1. Thoroughly clean the outside surface of pump housing.

2. Install pump on the D-01006AA Bench Fixture (Fig. 113).

3. Loosen the plugs, manual destroke screw, and destroke solenoid valve.



T85249

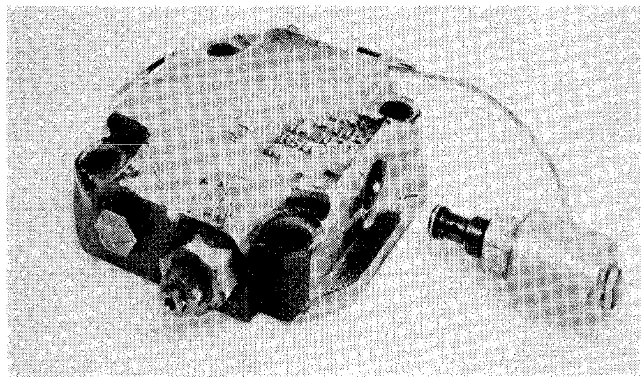
A—Stroke Control Valve Housing
B—O-Ring
C—Packing (8 used)
D—Shims
E—Packing (2 used)

Fig. 114-Remove Stroke Control Valve Assembly

4. Remove four cap screws to remove the stroke control valve assembly (Fig. 114).

5. Remove and discard the O-ring (B) and packings (C and E).

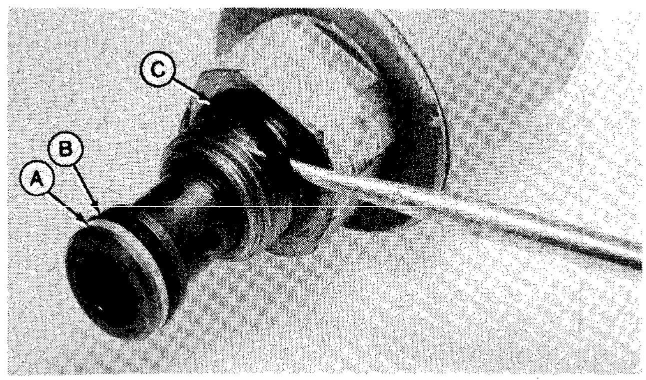
6. Keep shims (D) with stroke control valve housing for use at assembly.



T85299

Fig. 115-Remove Destroke Solenoid Valve

7. Remove the destroke solenoid valve (Fig. 115).

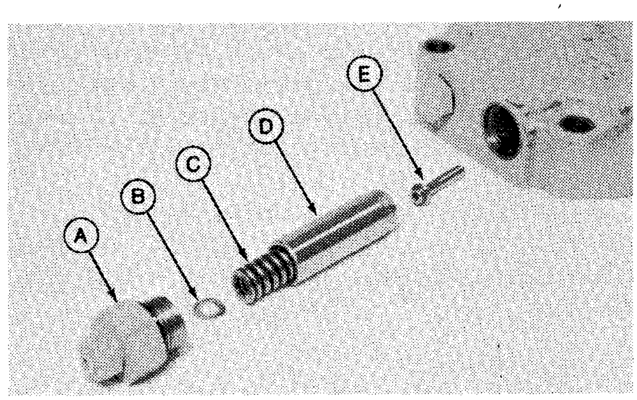


T85300

A—Backup Ring
B—O-Ring
C—O-Ring

Fig. 116-Remove O-Rings and Backup Ring

8. Remove O-rings (B and C, Fig. 116) and backup ring (A).



T85468

A—Adjusting Plug
B—Special Washer
C—Spring
D—Spring Guide
E—Stroke Control Valve

Fig. 117-Remove Stroke Control Valve

9. Remove adjustment plug (A, Fig. 117) and special washer (B).

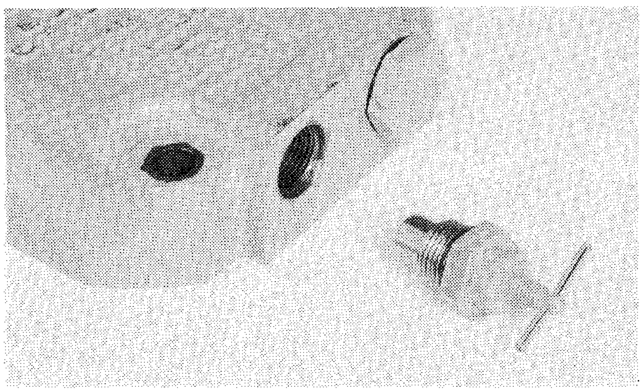
10. Remove spring (C) and spring guide (D).

11. Remove stroke control valve (E).

12. Inspect spring (C) for wear or broken coils. Check compression rate of spring using D-01168AA Spring Compression Tester.

SPRING SPECIFICATIONS

Free Length (approximate)	3.62 in. (92 mm)
Test Length at 140 ± 15 lb. force (623 ± 67 N	3.31 in. 84 mm)

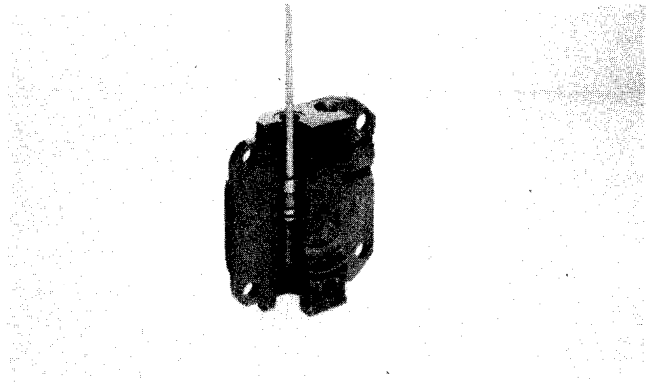


T85469

Fig. 118-Remove Manual Destroke Screw And Special Plug

IMPORTANT: The special plug is the stop for stroke control valve sleeve. To prevent spring from pushing sleeve up and damaging the O-rings and backup rings, remove adjustment plug to release spring force before removing special plug.

13. Remove the manual destroke screw and special plug (Fig. 118).



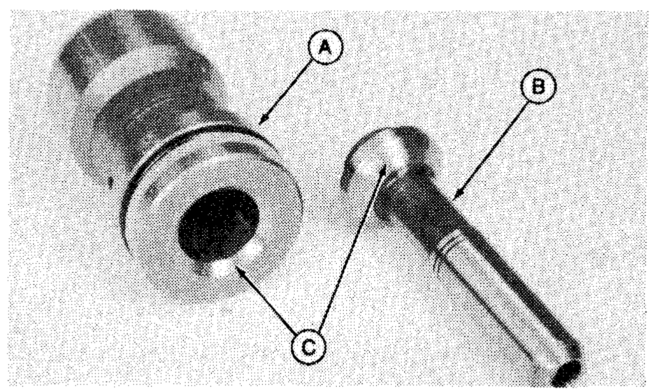
T85303

Fig. 119-Remove Stroke Control Valve Sleeve

NOTE: Cutaway section of a stroke control valve housing is shown.

IMPORTANT: DO NOT use a punch to remove stroke control valve sleeve that can damage the sleeve.

14. Carefully drive out stroke control valve sleeve (Fig. 119) using a wooden dowel.



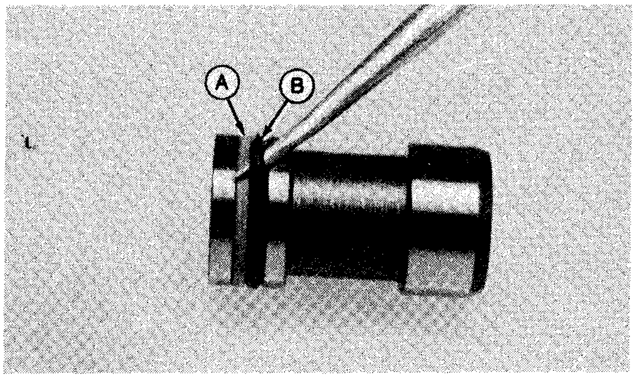
T85475

A—Stroke Control Valve Sleeve
B—Stroke Control Valve
C—Sealing Surfaces

Fig. 120-Inspect Sealing Surfaces

15. Inspect sealing surfaces (C, Fig. 120) of stroke control valve sleeve (A) and stroke control valve (B). Replace sleeve and valve if a broken wear pattern is seen on sealing surfaces.

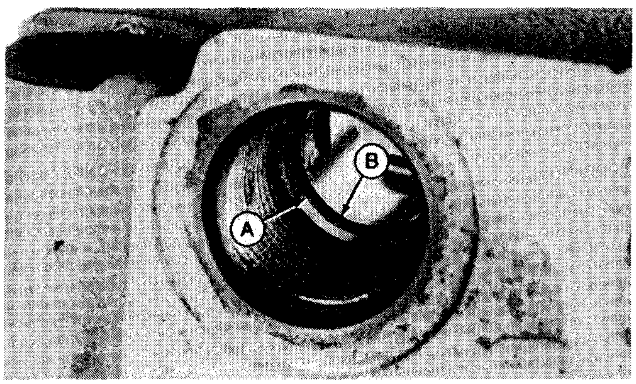
16. Install valve into sleeve. The valve must move freely in sleeve with no sticking or binding. Replace sleeve and valve if any drag is felt.



A—Backup Ring **B—O-Ring**

Fig. 121-Remove O-Ring and Backup Ring

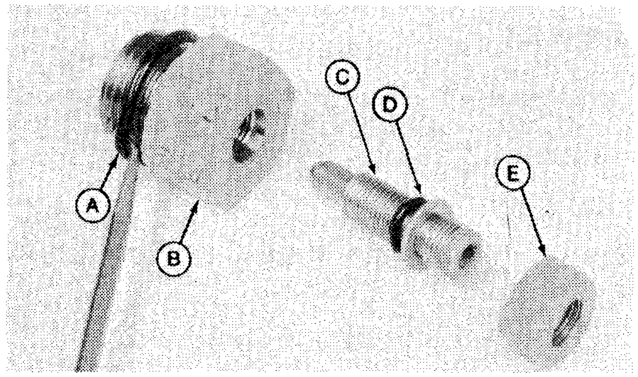
17. Remove O-ring (B, Fig. 121) and backup ring (A) from sleeve.



A—Backup Ring **B—O-Ring**

Fig. 122-Remove O-Ring and Backup Ring

18. Remove backup ring (A, Fig. 122) and O-ring (B) from stroke control valve housing.

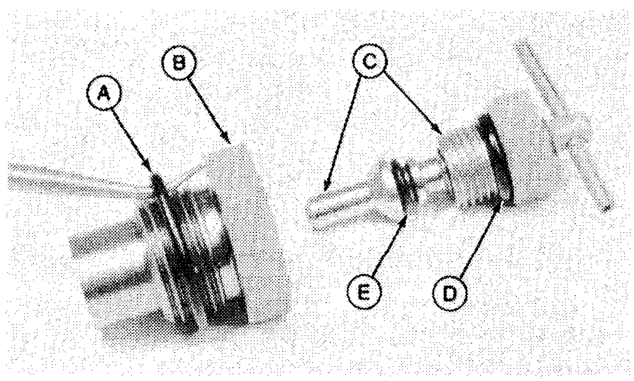


A—O-Ring
B—Fitting
C—Screw
D—O-Ring
E—Nut

Fig. 123-Disassemble Adjustment Screw

19. Remove nut (C, Fig. 123) and screw (C) from fitting (B).

20. Remove O-rings (A and D).

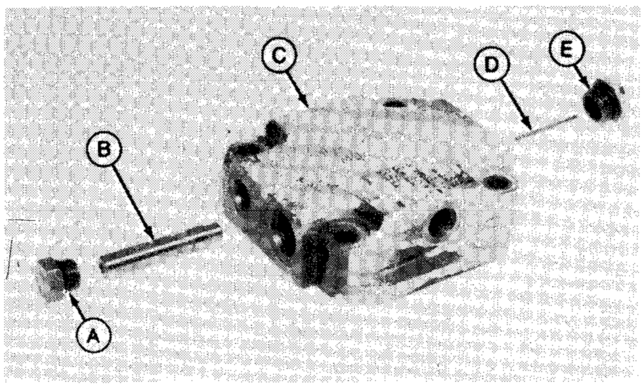


A—O-Ring
B—Special Plug
C—Screw Assembly
D—O-Ring
E—O-Ring

Fig. 124-Disassemble Manual Destroke Screw

21. Remove screw assembly (C, Fig. 124) from special plug (B).

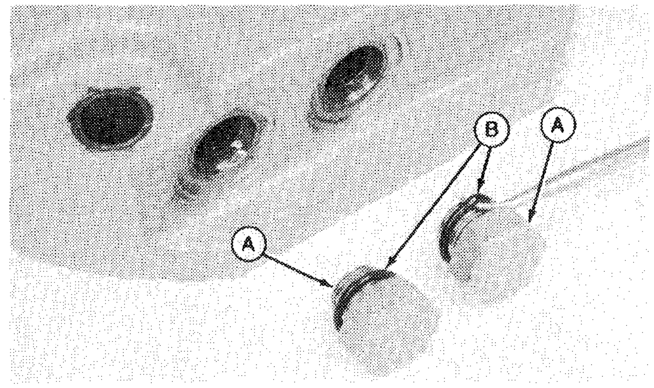
Remove O-rings (A, D and E).



A—Special Plug
B—Secondary Orifice Sleeve
C—Stroke Control Valve Housing
D—Pin
E—Special Plug

Fig. 125-Disassemble Secondary Orifice

22. Remove special plugs (A and E, Fig. 125). Remove pin (D) and secondary orifice sleeve (B).

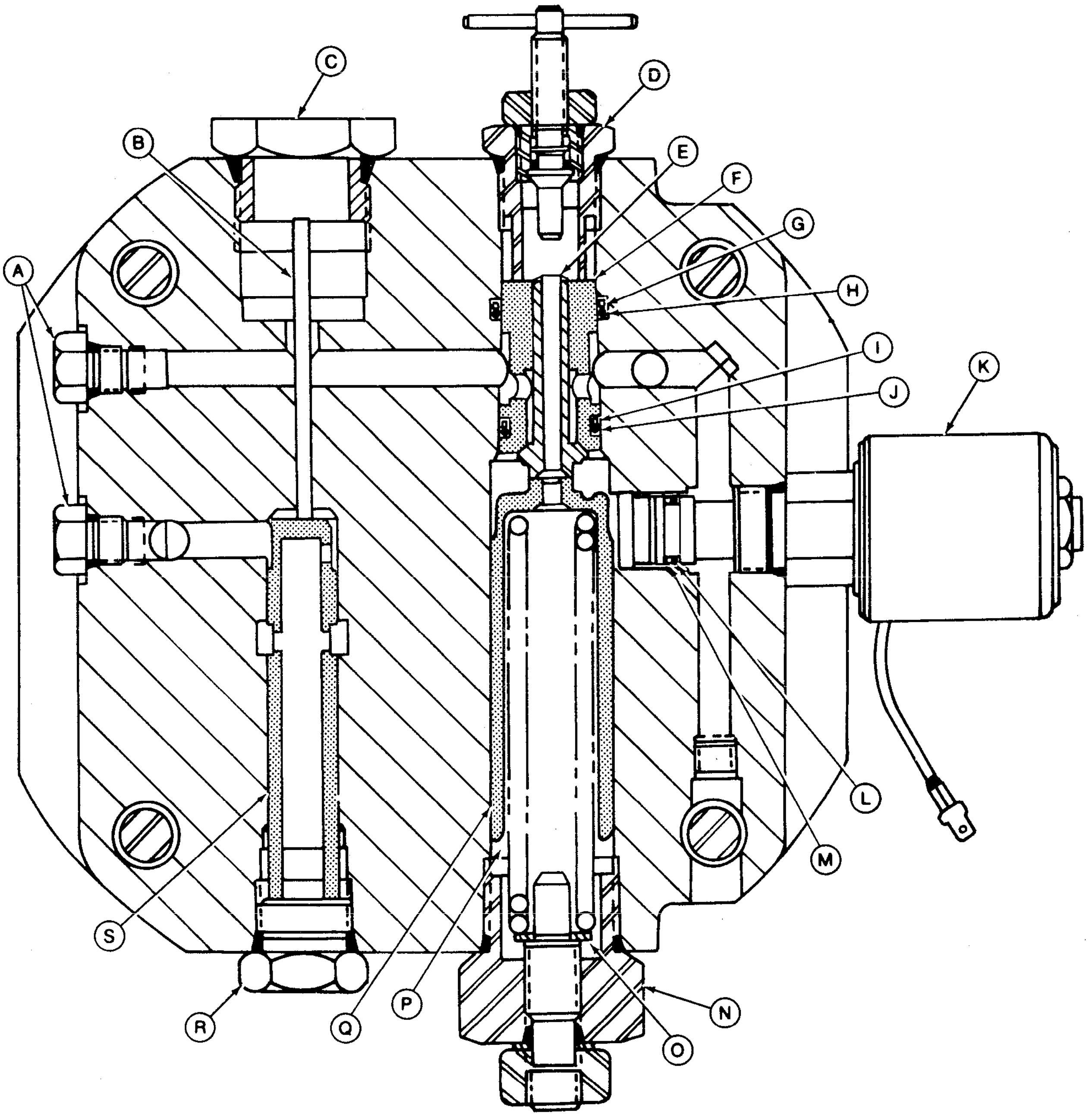


A—Plug (2 used) **B—O-Ring (2 used)**

Fig. 126-Remove Plugs

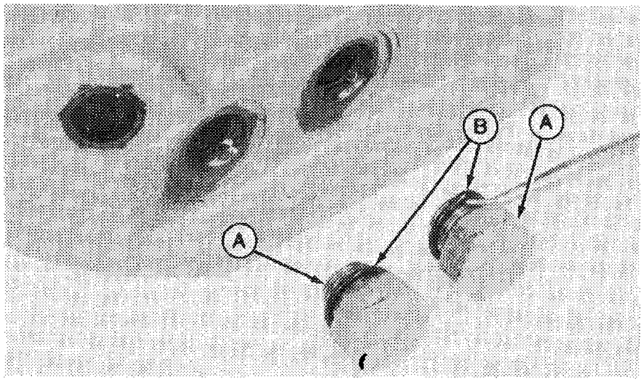
23. Remove plugs (A, Fig. 126) and O-rings (B).

Assemble Stroke Control Valve Assembly



A —Plug (2 used)
B —Pin
C —Special Plug
D —Manual Destroke Screw Assembly
E —Stroke Control Valve
F —Stroke Control Valve Sleeve
G —Backup Ring
H —O-Ring
I —O-Ring
J —Backup Ring
K —Destroke Solenoid Assembly
L —O-Ring
M —Backup Ring
N —Adjusting Plug Assembly
O —Special Washer
P —Spring
Q —Spring Guide
R —Special Plug
S —Secondary Orifice Sleeve

Fig. 127-Cross Section of Stroke Control Valve For (3 in.³) 50 cm³ and (4 in.³) 65 cm³ Pump



A—Plug (2 used) **B—O-Ring (2 used)**

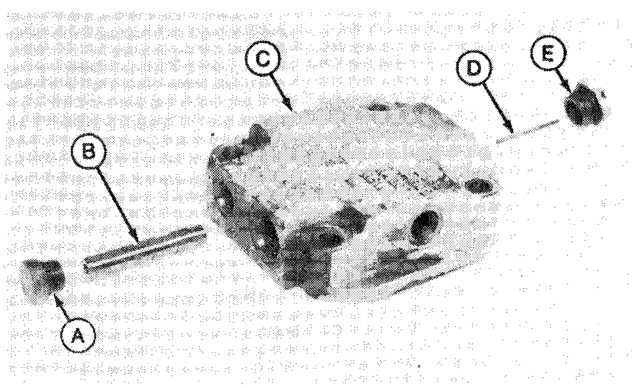
Fig. 128-Install Plugs

When assembling stroke control valve assembly and hydraulic pump, use a hydraulic pump overhaul kit.

Apply clean hydraulic oil to all internal parts during assembly.

IMPORTANT: Tapped holes in housing for plugs are metric threads. Only use plugs with metric threads for replacement.

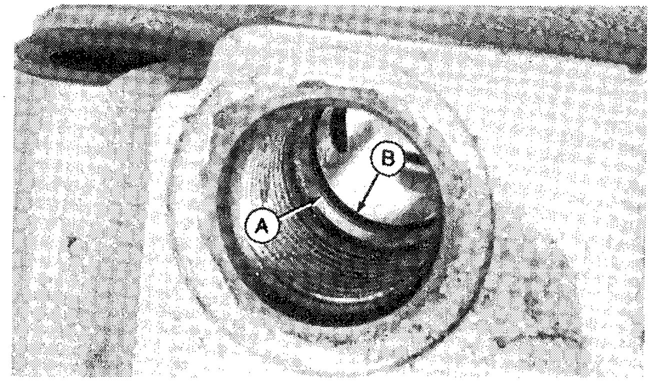
1. Install plugs (A, Fig. 128) and new O-rings (B). Tighten plugs to 25 lb-ft (34 N·m).



A—Special Plug
B—Secondary Orifice Sleeve
C—Stroke Control Valve Housing
D—Pin
E—Special Plug

Fig. 129-Assemble Secondary Orifice

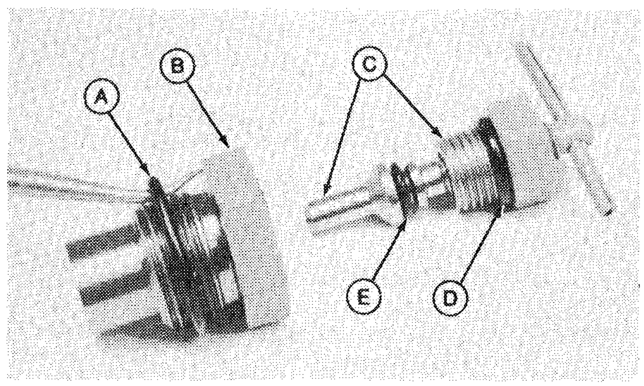
2. Install secondary orifice sleeve (B, Fig. 129) and pin (D). Install new O-ring on special plugs (A and E). Install and tighten plug (A) to 45 lb-ft (61 N·m) and plug (E) to 100 lb-ft (136 N·m).



A—Backup Ring **B—O-Ring**

Fig. 130-Install Seals

3. Install backup ring (A, Fig. 130) and O-ring (B) into stroke control valve housing.

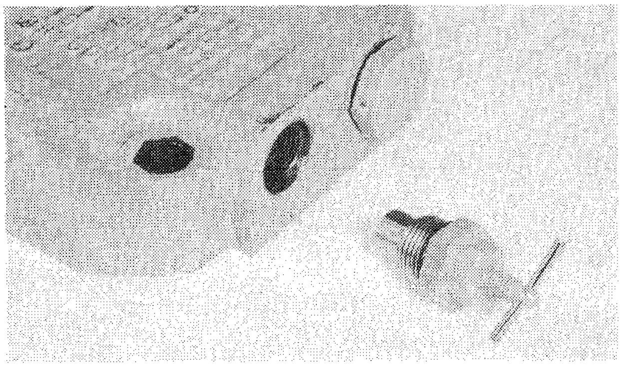


A—O-Ring
B—Special Plug
C—Manual Destroke Screw
D—O-Ring
E—O-Ring

Fig. 131-Assemble Manual Destroke Screw and Special Plug

4. Install new O-rings (A, D and E, Fig. 131).

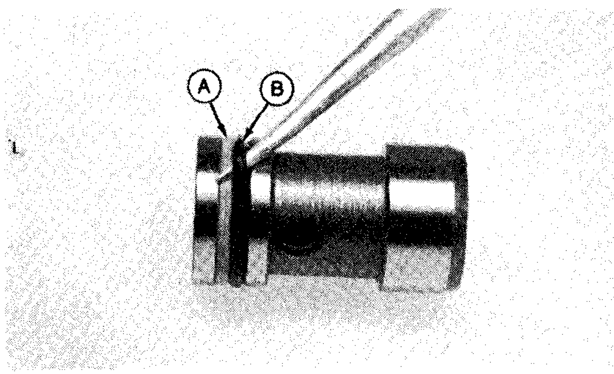
5. Install manual destroke screw (C) into special plug (B).



T85469

Fig. 132-Install Manual Destroke Screw and Special Plug

6. Install and tighten special plug to 80 lb-ft (108 N·m).

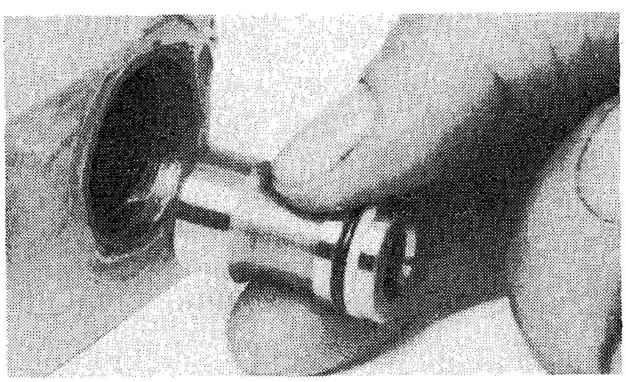


T85304

A—Backup Ring **B—O-Ring**

Fig. 133-Install O-Ring and Backup Ring

7. Install new O-ring (B, Fig. 133) and backup ring (A).

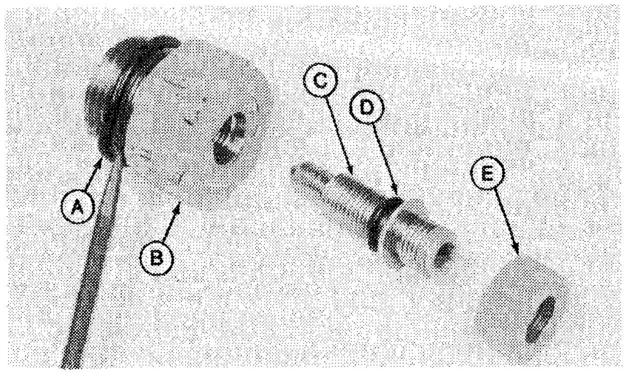


T85474

Fig. 134-Install Stroke Control Valve Sleeve

IMPORTANT: The special plug must be installed before installing stroke control valve sleeve because plug is the stop for sleeve. Do not use a punch to install stroke control valve sleeve that can damage the seat surface.

8. Install stroke control valve sleeve (Fig. 134). Push sleeve against special plug using a wooden dowel. Be careful, do not damage seating surfce of sleeve.



T85470

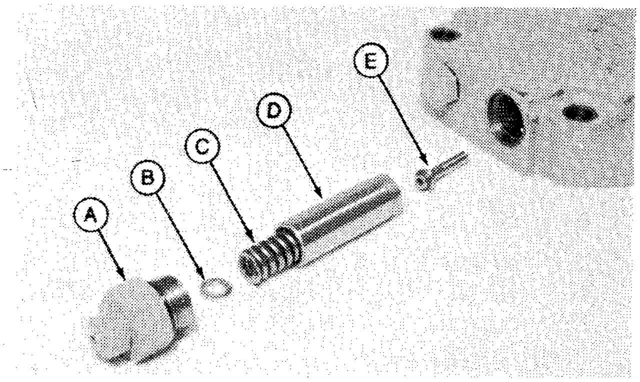
A—O-Ring
B—Fitting
C—Screw
D—O-Ring
E—Nut

Fig. 135-Assemble Adjustment Screw

9. Install new O-rings (A and D, Fig. 135).

10. Install screw (C) into fitting.

11. Install nut (E) on screw.



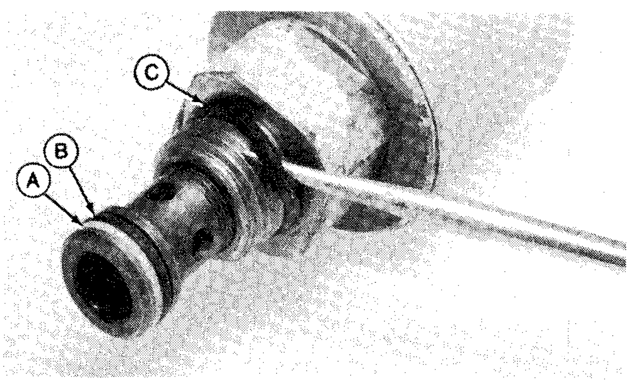
A—Adjustment Screw Assembly
B—Special Washer
C—Spring
D—Spring Guide
E—Stroke Control Valve

Fig. 136-Install Stroke Control Valve

12. Carefully install stroke control valve (E, Fig. 136). Be careful, do not damage seating surface of valve or sleeve.

13. Install spring guide (D) and spring (C).

14. Install special washer (B) on screw then install adjustment screw assembly (A). Tighten fitting of adjustment screw assembly to 110 lb-ft (150 N·m).



A—Backup Ring
B—O-Ring
C—O-Ring

Fig. 137-Install Seals

15. Install O-rings (B and C, Fig. 137) and backup ring (A).

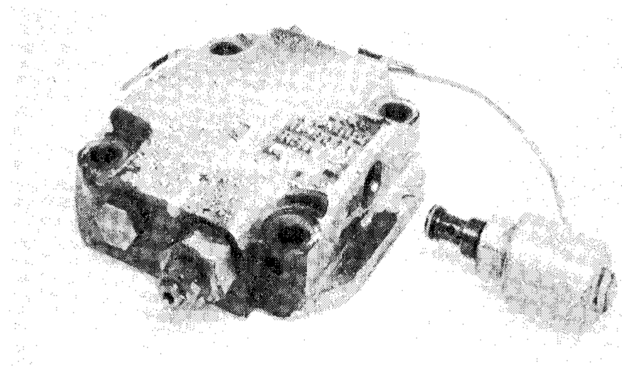
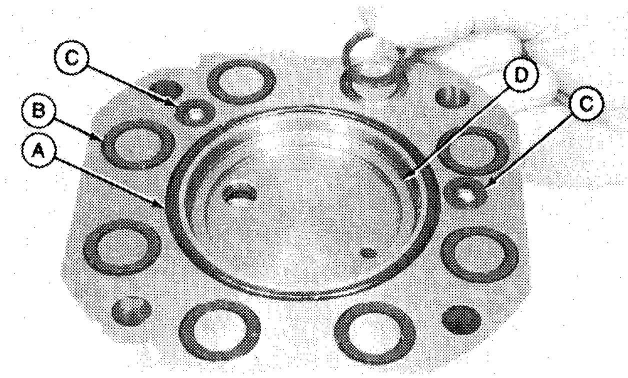


Fig. 138-Install Destroke Solenoid Valve

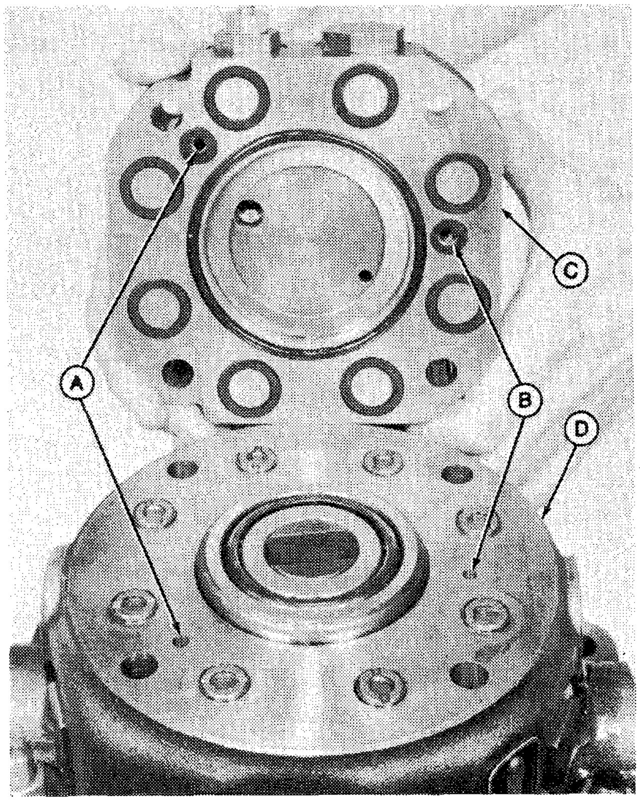
16. Install and tighten the destroke solenoid valve (Fig. 138) to 30 ± 10 lb-ft (41 ± 14 N·m).



A—O-Ring
B—Packing (8 used)
C—Packing (2 used)
D—Shim (as needed)

Fig. 139-Install O-Ring, Packings, and Shims

17. Install the O-ring (A, Fig. 139), packings (B and C) and shims. Apply a small amount of petroleum jelly to O-ring and packings to hold them in place.



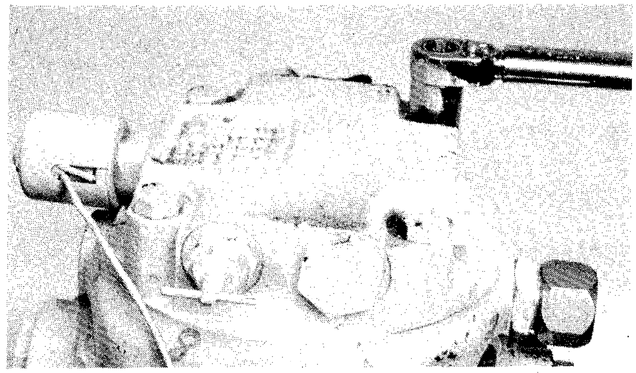
A—High Pressure Passage
B—Change Pressure Passage
C—Stroke Control Valve Housing
D—Pump Housing

Fig. 140-Install Stroke Control Valve Assembly

CAUTION: Stroke control valve assembly must be installed so passages in valve housing and pump housing are in alignment. If passages are not in alignment, system pressure is not sensed at stroke control valve to destroke pump at the standby pressure setting; causing pressure to increase until there is a component failure and possible personal injury.

IMPORTANT: The machined surface of valve and pump housings must be clean and free of oil and petroleum jelly to get a good tight joint for sealing when cap screws are tighten.

18. Install stroke control valve assembly so high pressure passage (A, Fig. 140) and charge pressure passage (B) in stroke control valve housing (C) and pump housing (D) are in alignment.



A—Stroke Control Valve Housing
B—O-Ring
C—Packing (8 used)
D—Shims
E—Packing (2 used)

Fig. 141-Install and Tighten Cap Screws

19. Install and tighten the four cap screws (Fig. 141) in even steps to 85 lb-ft (115 N·m).

20. If a new stroke control valve housing was installed, check pump shaft end play. Add or remove shim to get the correct end play.

END PLAY SPECIFICATIONS

End Play	0.001 to 0.005 in. (0.03 to 0.13 mm)

INSTALLATION

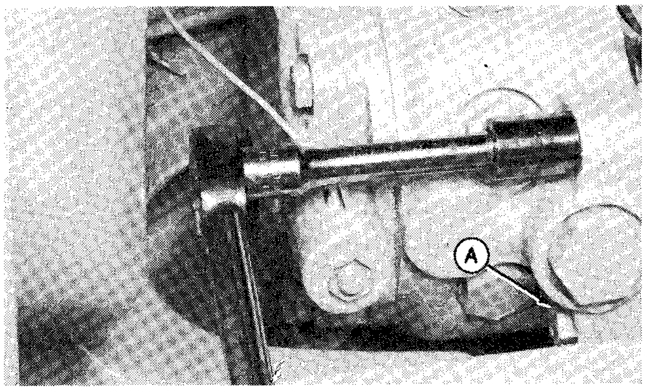


Fig. 142-Install Pump

1. Install pump on pump support so splines of pump shaft engage splines in pump drive shaft.

2. Install and tighten the cap screws (A, Fig. 142) to 85 ± 8 lb-ft (115 ± N·m).

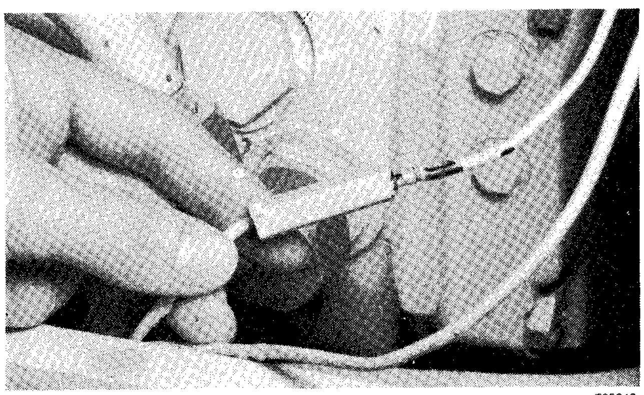
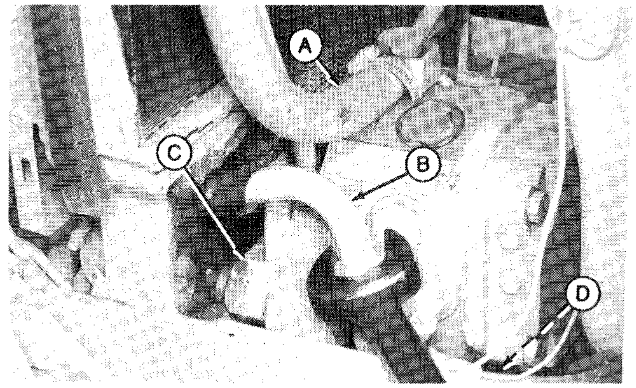


Fig. 143-Connect Wiring Lead

3. Connect the solenoid wiring lead (Fig. 143).



A—Excess Change Line
B—Outlet Line
C—Change Inlet Line
D—Seal Drain Line

Fig. 144-Connect Lines

4. Connect the lines (A through D, Fig. 144).

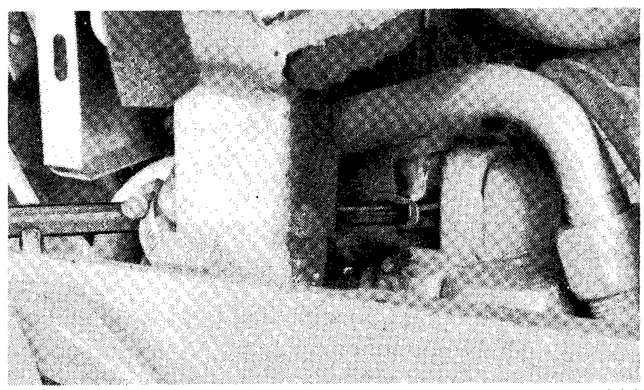


Fig. 145-Connect Pump Drive Shaft

5. Install coupling cushion between the front and rear couplings. Push the front half coupling against coupling cushion and rear coupling so there is a tight fit between coupling cushion and couplers. The coupling cushion must engage the front and rear coupling.

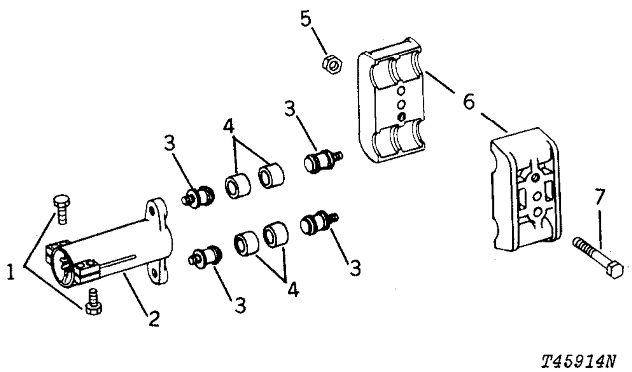
IMPORTANT: Do not put an axial force against the crankshaft.

6. While holding couplings together, tighten the cap screws to 35 ± 3 lb-ft (47 ± 4 N·m) in the following sequence: rear cap screw, front cap screw, turn pump drive shaft 180°, front cap screw, rear cap screw and front cap screw.

7. Install air cleaner and fasten with three cap screws.

PUMP DRIVE ASSEMBLY
(-267582)
(268351-   )

REPAIR



T45914N

1—Cap Screw (4 used)
2—Drive Shaft
3—Special Screw (4 used)
4—Bushing (4 used)
5—Lock Nut (2 used)
6—Half Coupler (2 used)
7—Cap Screw (2 used)

Fig. 146-Pump Drive

Locate pump on unit and tighten support to pump cap screws to 85 lb-ft (15 N·m) (2 kg/m).

Apply 2 or 3 drops of T43513 John Deere LOCTITE Thread Lock and Sealer (high strength) to special pump drive screws (3, Fig. 85) and tighten to shaft (2) and crankshaft pulley to 35 ± 3 lb-ft (45 ± 4 N·m) (5 ± 0.4 kg/m).

Position pump drive shaft assembly in the couplers so that the couplers do not contact drive screws, crankshaft pulley, or the drive shaft and to relieve any axial strain on the bushings.

Tighten drive shaft retaining cap screws to 32 ± 4 lb-ft (43 ± 5 N·m) (4 ± 0.6 kg/m).

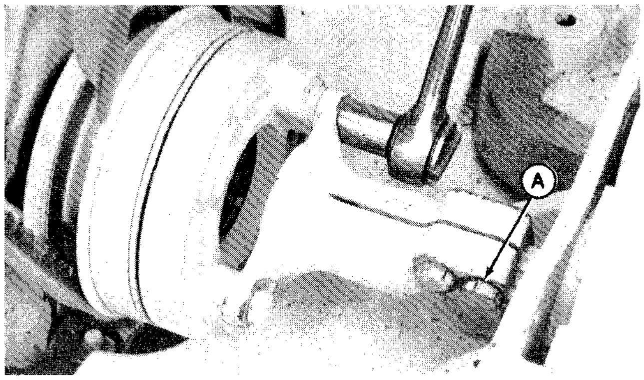
Tighten one coupler half cap screw to 25 ± 2 lb-ft (34 ± 3 N·m) (3 ± 0.3 kg/m). Tighten second coupler half cap screw to 25 ± 2 lb-ft (34 ± 3 N·m) (3 ± 0.3 kg/m). Using the same sequence, again tighten coupler half cap screws to 25 ± 2 lb-ft (34 ± 3 N·m) (3 ± 0.3 kg/m).

Install and tighten coupler lock nuts to 25 ± 2 lb-ft (34 ± 3 N·m) (3 ± 0.3 kg/m).

Install destroke solenoid valve in hydraulic pump and tighten to 30 ± 10 lb-ft (41 ± 14 N·m) (4 ± 1 kg/m).

PUMP DRIVE ASSEMBLY (267583-268350) (270055-)

REMOVAL



A—Cap Screw (4 used)

Fig. 147-Disconnect Pump Drive Shaft

1. Remove side shields.

2. Remove hood.

3. Remove radiator (Group 0510).

4. Loosen the cap screws (A, Fig 147).

5. Remove two cap screws to disconnect the pump drive shaft from the front half coupling.

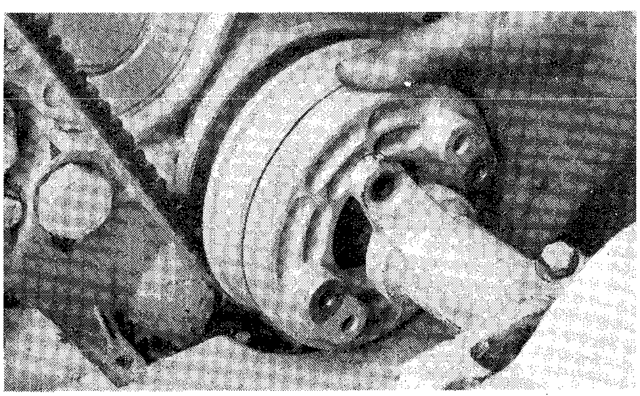


Fig. 148-Remove Front Half Coupling

6. Turn the pump drive shaft 90° to remove the front half coupling.

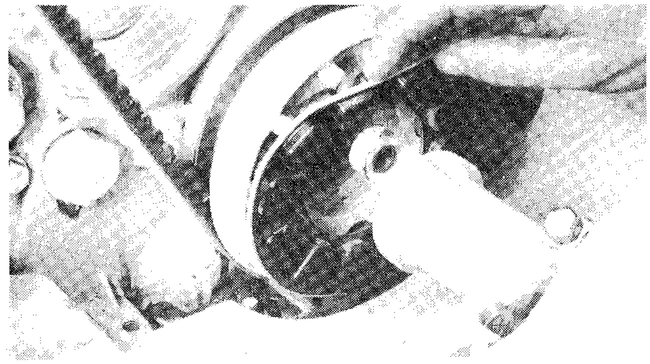
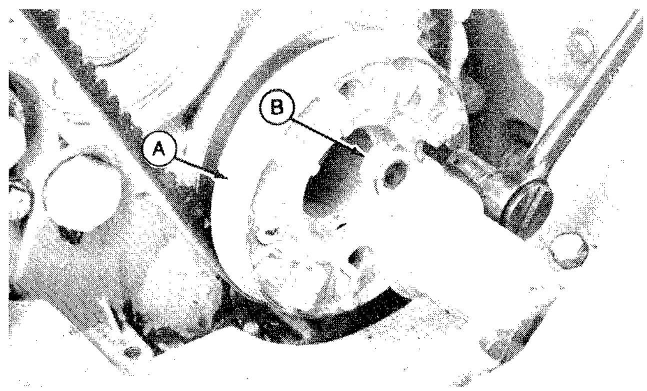


Fig. 149-Remove Coupling Cushion

7. Remove the coupling cushion.



A—Rear Coupling **B—Pump Drive Shaft**

Fig. 150-Remove Rear Coupling

8. Remove two special cap screws to remove the rear coupling (A, Fig. 150).

9. Remove the pump drive shaft (B).

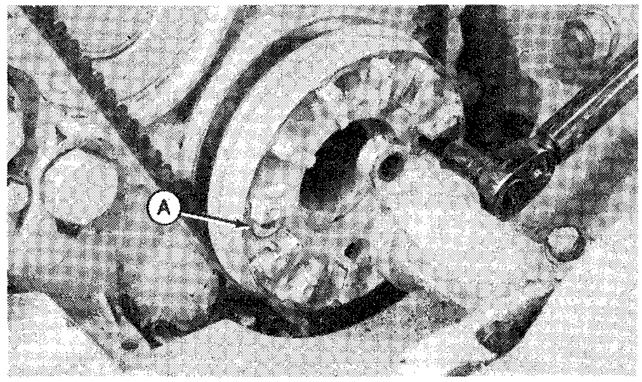
REPAIR

Disassembly and Inspection

1. Inspect components for wear or damage. If necessary, install new parts.

2. Check that contact surfaces of pump drive coupling, crankshaft pulley, tapped holes in pulley and the cap screws are clean and free of paint.

INSTALLATION



A—Special Cap Screw (2 used)

Fig. 151-Install Rear Coupling

1. Install drive shaft on the pump shaft.

2. Install rear coupling on the crankshaft pulley and fasten with two special cap screws (A, Fig. 151). Tighten special cap screws to 35 ± 3 lb-ft (47 ± 4 N·m).

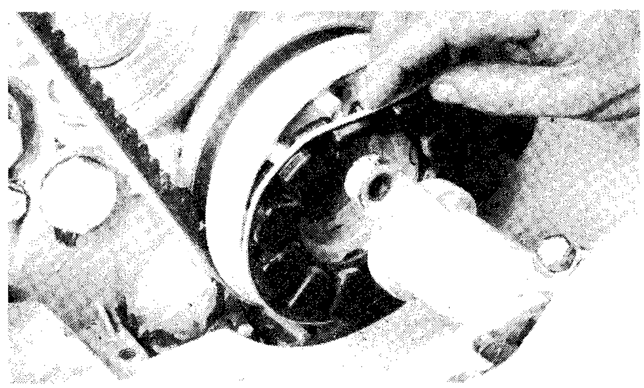
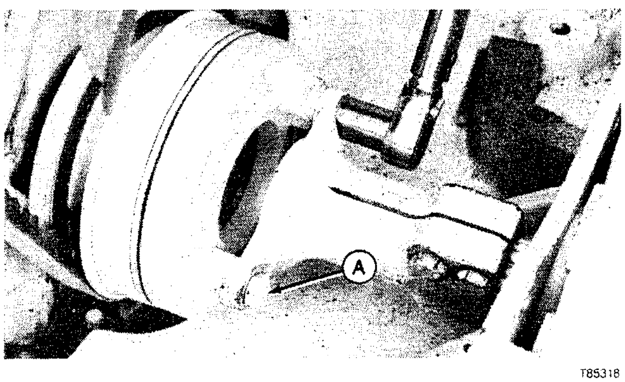


Fig. 152-Install Coupling Cushion

3. Install the coupling cushion.

Fig. 153-Install Front Half Coupling

4. Install the front half coupling.



A—Cap Screw (2 used)

Fig. 154-Connect Pump Drive Shaft

5. Align the pump drive shaft with the front half coupling.

6. Install the cap screws (A, Fig. 154) and tighten to 35 ± 3 lb-ft. (47 ± 4 N·m).

Fig. 155-Connect Pump Drive Shaft

7. Push the front half coupling against coupling cushion and rear coupling so there is a tight fit between coupling cushion and couplers. The coupling cushion must engage the front and rear coupling.

IMPORTANT: Do not put an axial force against the crankshaft.

8. While holding couplings together, tighten cap screws to 35 ± 3 lb-ft (47 ± 4 N·m) in the following sequence: rear cap screw, front cap screw, turn pump shaft 180°, front cap screw, rear cap screw, and front cap screw.

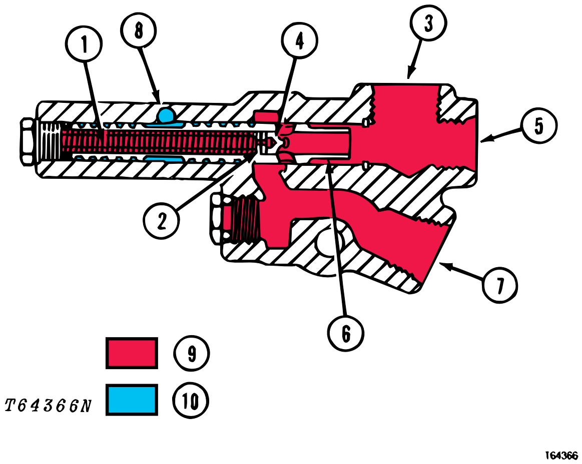
9. Install radiator (Group 0510).

10. Install hood.

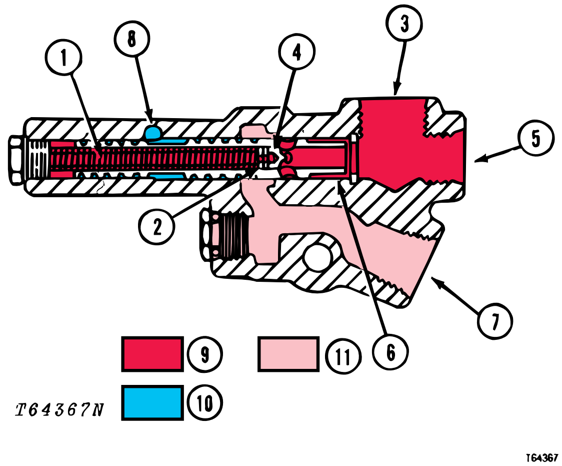
11. Install side shields.

PRESSURE CONTROL VALVE

GENERAL INFORMATION



(ABOVE 1300 psi)
(ABOVE 90 bar)
(ABOVE 91 kg/cm²)



(BELOW 1300 psi)
(BELOW 90 bar)
(BELOW 91 kg/cm²)

1—Pressure Control Valve Spring
2—Shims
3—Outlet to Backhoe Valve
4—Orifice
5—Pressure Oil Inlet
6—Pressure Control Valve
7—Outlet to Loader Valve
8—Bleed Passage to Transmission Reservoir
9—Pressure Oil
10—Return Oil
11—Low Pressure Oil

Fig. 156-Positions of Pressure Control Valves

The pressure control valve acts as a flow divider and maintains pressure for the hydraulic system. It gives priority to the steering system and backhoe system while limiting pressure oil flow to the loader system until pressure is above 1300 psi (90 bar) (91 kg/cm²).

A movable orifice acts as a pressure sensing device connecting pressure oil to the front and rear of the pressure control valve (6, Fig. 156).

The rear portion of the pressure control valve has a smaller diameter than the front, providing the necessary differential for dividing oil flow properly.

When pressure is equal at both ends of the pressure control valve (6), pressure at the larger end will cause the pressure control valve to move left against the pressure control valve spring (1) connecting pressure oil to the loader circuit.

A low pressure leak-off cavity at the middle of the valve housing prevents a hydraulic lock in case of oil leakage past the valve.

Refer to "Hydraulic Valves" in FOS Manual, "HYDRAULICS" for additional description and theory of operation.

REMOVAL

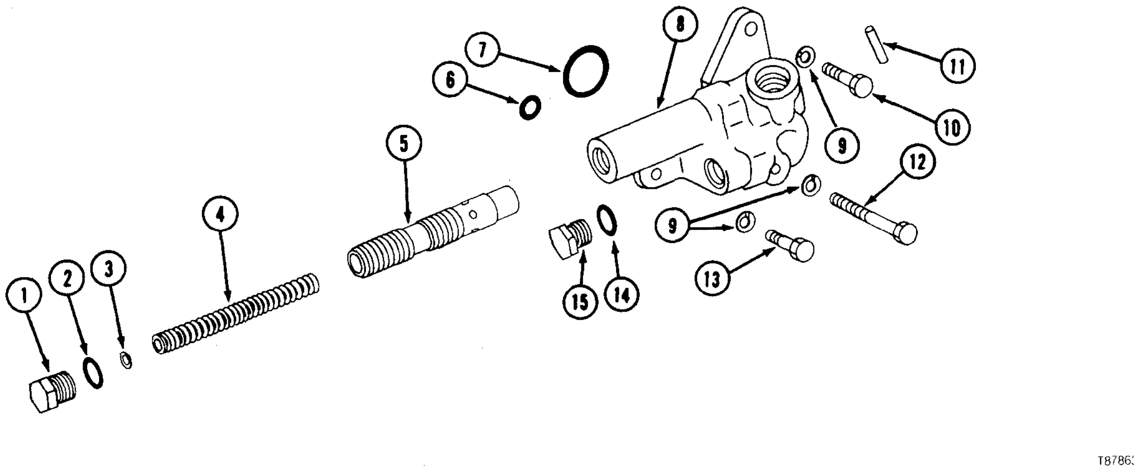
The pressure control valve is located on the righthand side of the backhoe loader. It is located beneath the loader control valve and is mounted on the transmission housing.

Relieve hydraulic system pressure by actuating the steering valve and brakes with the engine stopped.

Disconnect and tag all lines for easier installation. Cap all lines to prevent dust from entering hydraulic system.

Remove valve from unit.

REPAIR



1—Plug
2—O-Ring (2 used)
3—Washer (as needed)
4—Spring
5—Pressure Control Valve (With Orifice and Washer)
6—O-Ring
7—O-Ring
8—Pressure Control Valve Housing
9—Lock Washer (3 used)
10—Cap Screw
11—Pin
12—Cap Screw
13—Cap Screw
14—O-Ring
15—Plug

Fig. 157-Pressure Control Valve

Refer to Fig. 157 for identification of parts and sequence of assembly. Also note the following specific instructions.

Inspection

Check the inside diameter of the pressure control valve housing bore. The front of the housing bore should be 0.7508 to 0.7518 in. (19.070 to 19.096 mm). The rear should be 0.7268 to 0.7278 in. (18.461 to 18.486 mm).

Check the outside diameter of the pressure control valve. The front of the valve should be 0.7497 to 0.7503 in. (19.042 to 19.058 mm). The rear should be 0.7257 to 0.7263 in. (18.433 to 18.448 mm).

The valve spring (4, Fig. 157) should have a free length of 4.61 in. (117.1 mm) and its test length should be 3.50 in. (88.9 mm) when compressed with 45 to 55 lbs. (200 to 245 N) (20 to 25 kg).

Assembly

Assemble spring (4) into valve (5) before valve is installed into housing (8).

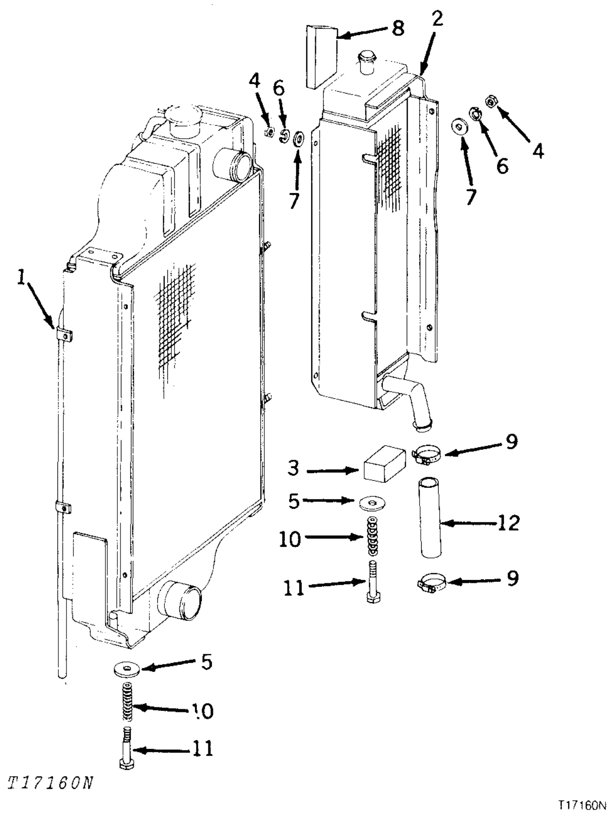
INSTALLATION

Install valve on unit and connect lines.

The pressure setting should be 1250 to 1350 psi (86 to 93 bar) (88 to 95 kg/cm²).

OIL COOLER ASSEMBLY

GENERAL INFORMATION



1—Radiator
2—Oil Cooler
3—Baffle (2 used)
4—Nut (4 used)
5—Rubber Washer (2 used)
6—Lock Washer (4 used)
7—Washer (4 used)
8—Baffle
9—Clamp (2 used)
10—Spring (2 used)
11—Cap Screw (2 used)
12—Hose

Fig. 158-Oil Cooler

The oil cooler is of the air-to-oil type, controlling transmission lubrication oil temperature, and is located at the right side of the radiator.

In addition, the cooler provides cooled oil for the hydraulic system through the main hydraulic pump.

REMOVAL

Remove grille housing.

Disconnect all oil lines to the oil cooler and cap so dirt will not enter system.

Remove all cap screws connecting oil cooler to radiator and remove from unit.

REPAIR

FOS Clean oil cooler thoroughly as described for radiators in FOS Manual, "Engines."

NOTE: Cooler should be cleaned and repaired only by an experienced radiator technician.

Repair of Aluminum Coolers

As the procedures require removal of the cooler for repair, it is recommended that the cooler be pressure tested at 100 to 110 psi (7 to 8 bar) (7 to 8 kg/cm²) after it is repaired and before it is reinstalled.

Four general methods of repairing aluminum heat exchangers are welding, brazing, soldering, and the use of epoxy adhesives. Brazing and soldering are generally too complex for field use. Only welding and epoxy adhesives are recommended for field repair.

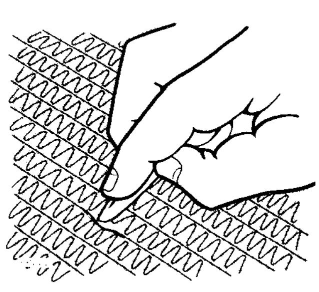


Fig. 159-Removing Contaminants

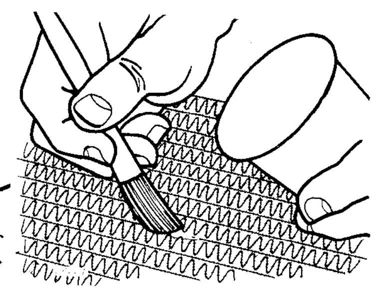


Fig. 160-Forcing Fluid Through From Outside

The first step in making any repair is to properly clean the damaged area. Remove all paint, oil, grease and dirt from the area. Use a pen-knife (Fig. 159), file, emery paper, or wire wheel, and solvent to remove the contaminants to bare the aluminum surface. Flush internally with a hydrocarbon solvent such as trichlorethyene or chlorothene nu to degrease the internal surfaces (Fig. 160). For this limited work, naptha paint thinner or chlorothene nu are acceptable solvents.

Caustics attack aluminum and if not properly controlled, cause irreparable damage to the all-aluminum cooler.

Welding represents an easy and effective method for repairing damage to the relatively heavy tank, connection, or bracket areas. Use the tungsten inert gas (heli-Arc) welding process. With a little practice, even the leading edges of the tube can be repaired by this welding process. All parts of the cooler are weldable using 4043 welding rod.

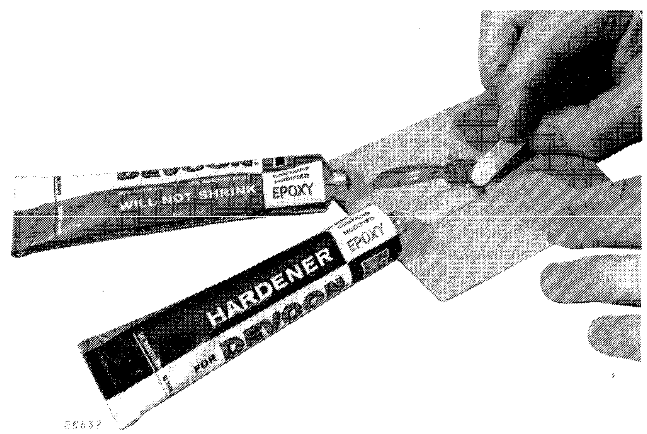
R6535

Fig. 161-Special-F Repair Kit

R6536

Fig. 162-EK-40 KIT

Epoxy adhesive is the best way of repairing leaks in the core section of an oil cooler. Modine suggests epoxies manufactured by the Devcon Corporation of Danvers, Massachusetts, and available at industrial supply houses. The Devcon Special-F Repair Kit, aluminum filled, (Fig. 161), has an 8 hour cure time. The EK-40 Kit, unfilled, (Fig. 162), will set in 15 minutes and can be cured to near maximum strength with a 20 minute heat application from a 100 watt light bulb. Both are two-part adhesives supplied in collapsible tubes for ease of measurement and storage. The 8 hour cure material has a pot life of 20 to 30 minutes and is useful for large repair areas. The 15 minute cure material has a pot life of approximately 5 to 6 minutes and is useful for small, quick repairs.



R6537

Fig. 163-Equal Lengths of Epoxy and Hardener

Squeeze equal lengths of epoxy and hardener on a discardable surface (Fig. 163). Mix the two ribbons thoroughly with a putty knife or spatula and immediately apply to the damaged area.

Repair a small puncture, such as created by a nail, by patching the hole with the adhesive. If the puncture is larger, use a combination of adhesive and sheet metal screw. When the simple patch method is used, force the adhesive into the hole (Fig. 164), allowing it to spread internally so that it forms a plug or adhesive rivet. Then cover the area above and around the hole with a generous coating of epoxy. Where a screw is to be used, first apply adhesive to the hole, drive in a short sheet metal screw, and then completely cover the repair and the screw head with adhesive (Fig. 165).

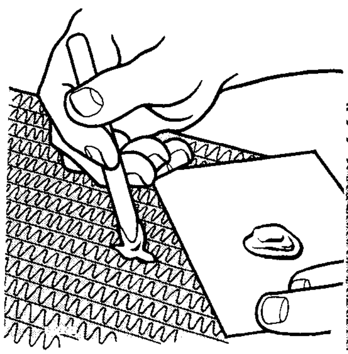

T6538

Fig. 164-Forcing Adhesive Into Hole

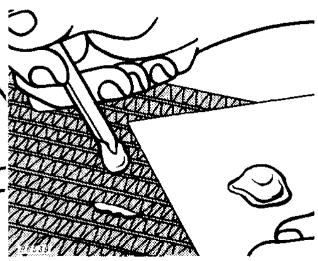
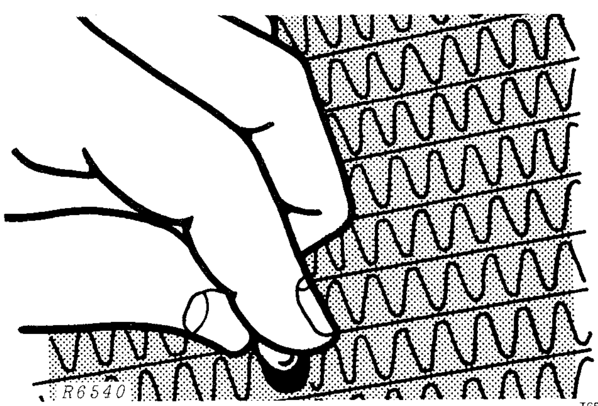

T6539

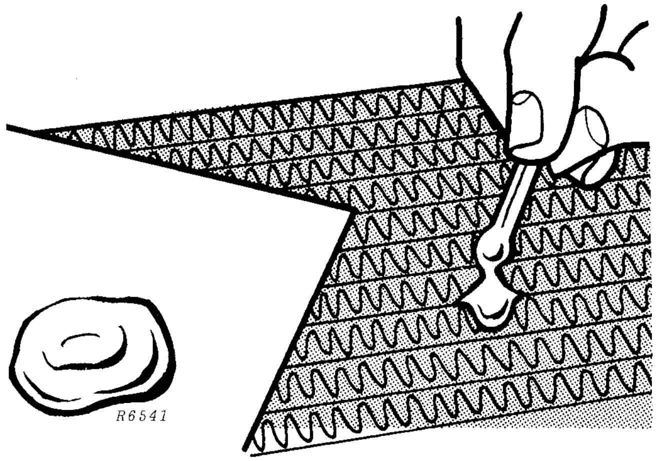
Fig. 165-Covering Area Around Hole

Should the damage occur to the sidewall of the tube, a plug technique can be used. First clean the area; then plug the back of the air fin convolution with paper, gum or modeling clay. To complete the repair, fill the entire air fin convolution with adhesive and allow to harden (Fig. 165). Be sure to pack the adhesive into the area to avoid bubbles and potential leaks caused by air entrapments (Fig. 167).



T6540

Fig. 166-Filling Air Fin Convolution



R6541

Fig. 167-Packing Adhesive to Avoid Bubbles

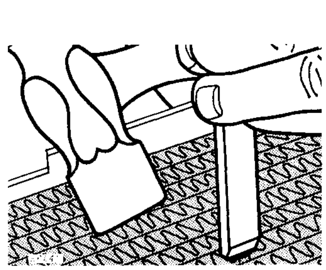

R6542

Fig. 168-Removing Air Fins

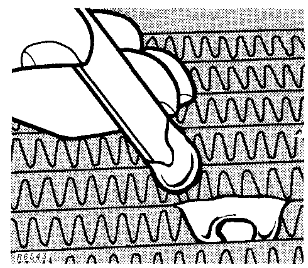
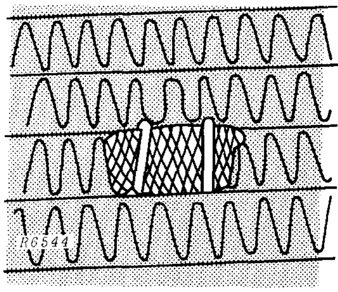

R6543

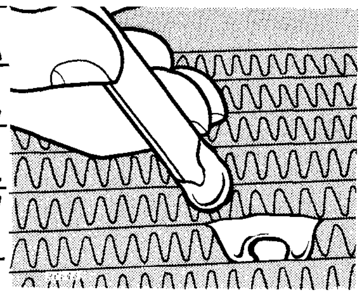
Fig. 169-Applying Prime Coat of Epoxy

For repair of large areas, use the bandage technique. First, remove the air fins adjacent to the damaged area by driving a sharp wood chisel (Fig. 168) down the side wall of the tube. Prepare a bandage which will cover the entire area to be repaired, using expanded aluminum, aluminum screening, or heavy-duty aluminum foil with some perforations. This bandage will act as a bridge for the epoxy and add to the strength of the repair.

After cleaning the repair area, apply a prime coat of epoxy (Fig. 169), then lay the prepared bandage over the area (Fig. 170). To hold this bandage in place, wrap string, wire, or hairpin clips twisted on the back around the tube. Using several strands of wire or several hairpins in a row will add to the structural strength of the repair. Then, completely cover bandage with adhesive (Fig. 171).

To improve appearance, straighten any bent fins with a duck bill pliers and spray the repaired area with a paint that matches the remainder of the core. To replace a removed fin for appearance purposes, form the fin from a strap of light gauge aluminum folded between wooden strips of the right size. Bond in place with a fresh batch of adhesive.


R6544
Fig. 170-Laying Bandage Over Area


R6543
Fig. 171-Covering Bandage with Adhesive

Remember, adhesives have a limited pot life. Do not mix the materials until you are ready to use and only mix enough for one repair. Also, always allow sufficient time for the adhesive to cure. Curing times are slower when the temperature is under 65°F (18°C). Warming the repair area with a 100 watt light bulb can speed up the cure time.

IMPORTANT: Do not let the materials harden on tools which you intend to reuse. Once the adhesive has set, it is practically impossible to remove. Clean your tools immediately after a repair.

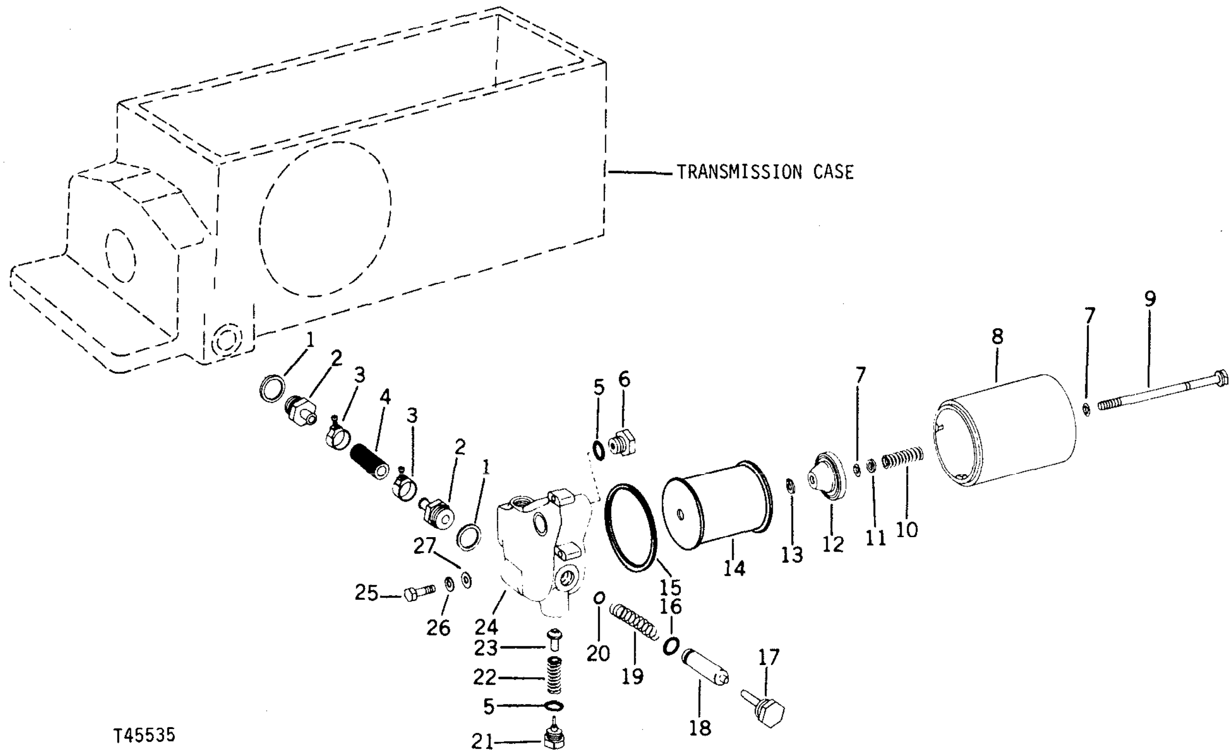
INSTALLATION

Install oil cooler and secure in place.

Connect all lines to cooler and hydraulic pump.

Install grille screen.

HYRAULIC OIL FILTER AND RELIEF VALVE



T45535

1—Special Washer (2 used)
2—Special Connector (2 used)
3—Hose Clamp (2 used)
4—Hose
5—O-Ring (3 used)
6—Relief Valve Inlet Port Plug (2 used)
7—Packing (2 used)
8—Oil Filter Cover
9—Special Cap Screw
10—Spring
11—Washer
12—Oil Filter Element Retainer
13—Retainer Ring
14—Element
15—Filter Cover Packing
16—O-Ring
17—Plug with Pin
18—Valve
19—Spring
20—O-Ring
21—Plug with Guide
22—Relief Valve Spring
23—Valve
24—Relief Valve Housing with Balls
25—Cap Screw (2 used)
26—Lock Washer (2 used)
27—Washer (2 used)

Fig. 172-Hydraulic Oil Filter and Relief Valve

GENERAL INFORMATION

The hydraulic return filter is located on the righthand side of the transmission housing.

The hydraulic oil filter is incorporated into the loader and backhoe return oil circuits to filter the return oil and to route this oil directly to the inlet side of the main hydraulic pump so that the pump will not cavitate.

A surge relief valve is incorporated into the filter housing to protect the system from excessively high return oil pressure. High pressure oil opening this valve will return directly to the transmission case.

An oil filter relief valve (actuated with a 50 psi [3 bar] [4 kg/cm^2] pressure differential) returns oil to sump when oil is heavy during warm-up or if the filter becomes clogged.

REMOVAL

Remove the special cap screw (9, Fig. 172) and drain the filter assembly.

Remove filter from transmission housing.

REPAIR

Disassemble using Fig. 172 as a reference.

Visually inspect hydraulic return relief valve for damage. Replace filter element and any other parts as needed.

Spring (10, Fig. 172) free length is 1-13/16 in. (46.04 mm) and test length is 1-1/8 in. (28.58 mm) when compressed with 64 to 71 lbs. (285 to 316 N) (29 to 32 kg) of force.

Spring (19, Fig. 172) free length is 3.24 in. (82.3 mm) and test length is 2.50 in. (63.5 mm) when compressed with 16.5 to 20.5 lbs. (73 to 91 N) (7 to 9 kg) and test length is 1.75 in. (44.5 mm) when compressed with 33 to 41 lbs. (147 to 182 N) (15 to 19 kg) of force.

Spring (22, Fig. 172) free length is 2.06 in. (52.3 mm) and test length is 1.31 in. (33.3 mm) when compressed with 30.6 to 37.4 lbs. (136 to 166 N) (14 to 17 kg) of force.

Assembly

Assemble parts into valve housing (24, Fig. 172).

Install valve housing into the transmission housing.

Slip special cap screw (9) through packing (7) and oil filter cover (8) and assemble parts 10 through 15, Fig. 172.

INSTALLATION

Dip filter cover packing (15, Fig. 172) in oil and install packing on hydraulic oil filter cover (8).

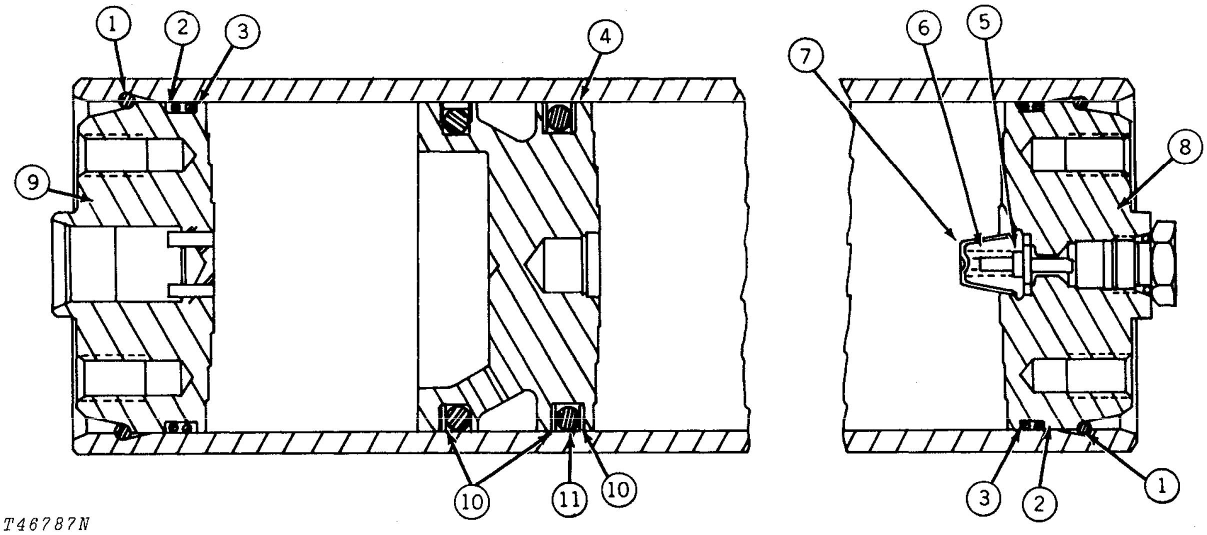
When installing new element, be sure filter cover packing is seated properly in oil filter relief valve housing.

Install filter assembly to unit making sure filter is square with unit.

Start engine and check for leaks.

ACCUMULATOR

GENERAL INFORMATION



T46787N

1—Retainer Ring
2—Backup Ring
3—O-Ring
4—Piston
5—Gas Valve
6—Spring
7—Spring Guide
8—Cylinder End
9—Cap
10—Backup Ring
11—O-Ring

Fig. 173-Hydraulic Oil Accumulator

The hydraulic oil accumulator is located on the right-hand side of the tractor inside of the loader mast frame.

The top part of the accumulator is precharged with dry nitrogen to a specified pressure and the bottom part is filled with hydraulic oil from the main pump. A floating piston in the accumulator keeps the nitrogen and hydraulic oil from mixing.

Hydraulic oil is admitted to the accumulator at a pressure exceeding that of the precharged gas, causing the piston to move back until main pump standby pressure is reached on both sides of the piston.

The accumulator acts as a buffer to greatly reduce surge pressures developed in the system when the cylinders of either a loader or backhoe reach the end of their stroke, or when the control lever is moved to neutral.

Another purpose of the accumulator during loader or backhoe operation, is to supply the system with oil and pressure as the pump starts into stroke. There is approximately a 0.2 second delay as the pump goes into stroke, due to the large instantaneous quantity of oil required by the loader or backhoe. The accumulator discharges and fills in this delay to smooth out the operation.

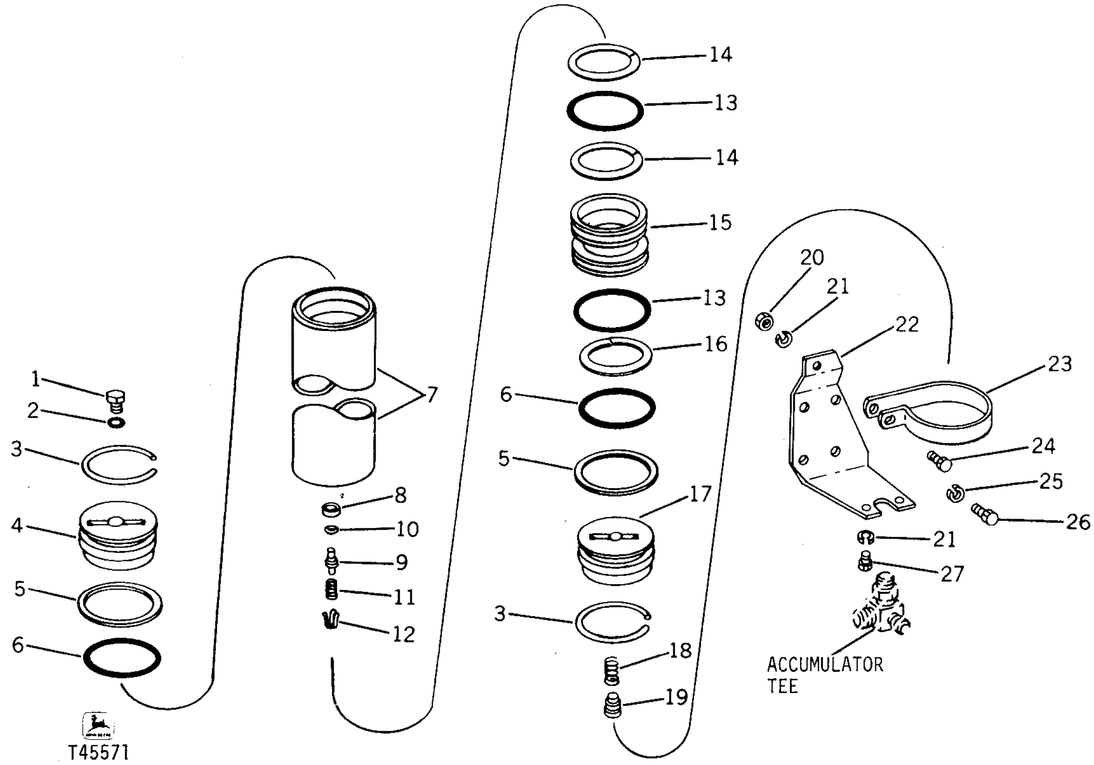
REMOVAL

CAUTION: Relieve hydraulic oil accumulator pressure from the hydraulic system by actuating the loader or backhoe valve operating lever or steering valve with engine stopped.

Open accumulator pressure lines slowly because accumulator may be slightly charged.

Remove cap screws from clamps.

Remove fastening cap screws and lock washers from bracket and remove accumulator from unit.



T45571

1—Plug
2—O-Ring
3—Retaining Ring (2 used)
4—Accumulator End
5—Backup Ring
6—O-Ring (2 used)
7—Accumulator Cylinder
8—Packing
9—Valve
10—Special Washer
11—Spring
12—Spring Guide
13—O-Ring (2 used)
14—Backup Ring (2 used)
15—Accumulator Piston
16—Backup Ring
17—Cap
18—Spring
19—Orifice
20—Nut
21—Lock Washer (3 used)
22—Accumulator Bracket
23—Accumulator Clamp
24—Cap Screw
25—Lock Washer (2 used)
26—Cap Screw (2 used)
27—Cap Screw (2 used)

Fig. 174-Hydraulic Oil Accumulator and Bracket

REPAIR

Disassembly

CAUTION: Bleed nitrogen gas from accumulator before disassembly. Remove small plug in cylinder end and insert a steel rod through hole to unseat gas valve.

Push accumulator cylinder cap (17, Fig. 174) into the accumulator cylinder (7) and remove retaining ring (3). Pull cap with O-ring and backup ring from the cylinder.

Remove accumulator piston (15, Fig. 174).

Push accumulator end (4) into cylinder (7) and remove retaining ring (3). Pull end with O-ring and backup ring from the cylinder.

Disassemble gas valve from accumulator end. Check and replace all parts if necessary.

Spring (11, Fig. 174) free length is 1.10 in. (27.9 mm) and test length is 0.59 in. (15.0 mm) when compressed with 1.3 to 1.7 lbs. (6 to 8 N) (0.6 to 0.8 kg) of force.

Spring (18, Fig. 174) free length is 0.78 in. (19.8 mm) and test length is 0.61 in. (15.5 mm) when compressed with 15 to 18.4 lbs. (67 to 82 N) (7 to 8 kg) of force.

Check accumulator cylinder for pitting or scoring. If scored or pitted, replace it.

Inspect accumulator piston for scoring or other damage. If it is excessively worn or otherwise damaged, replace piston.

Inspect accumulator cap for cracks or other damage. Replace as necessary.

Assembly

Install gas valve assembly into accumulator end.

Dip all O-rings and backring rings in oil before assembly.

Install O-ring and backup ring on end. Install accumulator end in cylinder. Push in far enough to install retaining ring.

Install backup rings and O-rings on piston. Install piston with small counterbore end toward gas end of cylinder.

Install backup ring and O-ring on cap. Install cap in cylinder. Push in far enough to install retaining ring.

Pre-Charging Accumulator

IMPORTANT: Use dry nitrogen only to precharge the accumulator. Dry nitrogen does not mix with oil. It is non-combustible. It will not cause oxidation or condensation within the accumulator and is not harmful to the piston seal. Do NOT use air or any combustible gas as these may cause oxidation and condensation. Oxidation and condension are harmful to the oil piston seal and the accumulator.

If D-15012-NU Accumulator Charging Kit is used to charge the accumulator, convert it to this application and charge the accumulator as follows:

1. Remove gas cock and union.

2. Install the hose to the tee fitting.

3. Remove the accumulator plug and install the connector in its place.

4. Attach the high pressure hose to the connector on the accumulator. Attach the charging kit hose to the dry nitrogen charging tank.

5. Open the charging tank control valve until 500 ± 25 psi (34 ± 2 bar) (35 ± 2 kg/cm²) is registered on the pressure gauge. Shut control valve.

6. Remove high pressure hose from the accumulator and reinstall the plug.

NOTE: If the accumulator is overcharged, remove the connector from the accumulator. Depress the valve in the accumulator to allow excess gas to escape.

INSTALLATION

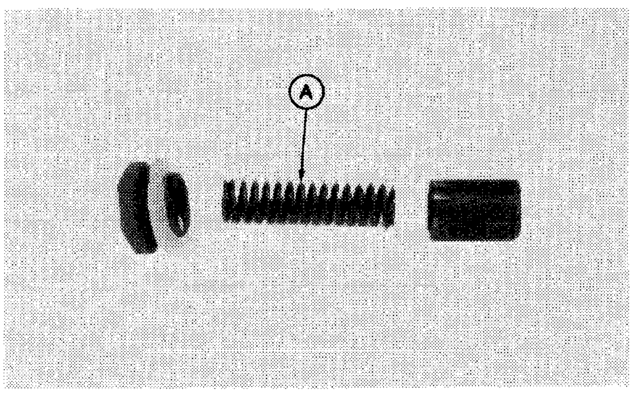
Position accumulator on unit.

Install cap screws through clamps and tighten.

Connect lines to accumulator.

Section 2199
SPECIFICATIONS AND SPECIAL TOOLS
HYDRAULIC SYSTEM
SPECIFICATIONS AND TORQUE VALVES

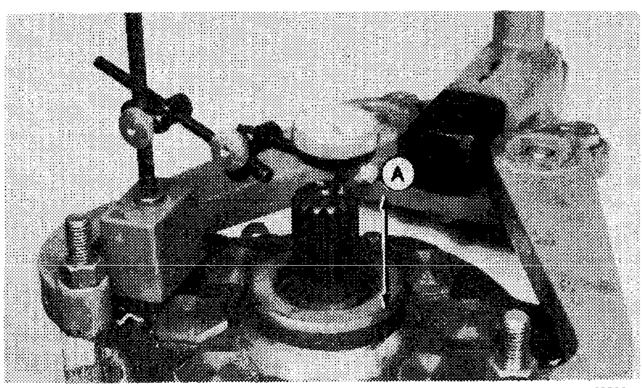
3 in.^{3} (49 cm^3) Hydraulic Pump and Stroke Control Valve (Without Pump Serial Number Plate)



T86224

Fig. 1-Piston Springs

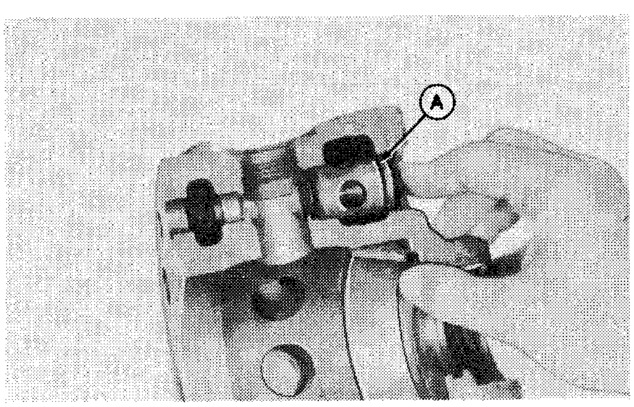
A - Piston Spring:
Free length (approximate) .... 2.44 in. (62 mm)
Test length at 34 to 40 lb. force ...... 1.62 in. (151 to 178 N .... 41 mm)
with a maximum difference of force permissible of .... 1.5 lb. force (6.7 N)
The eight springs in a set must be of the same color code.



T85321

Fig. 2-Pump Shaft End Play

A - Pump Shaft End Play .... 0.001 to 0.005 in. (0.03 to 0.13 mm)



T85322

Fig. 3-Valve Lift Of Inlet Valves

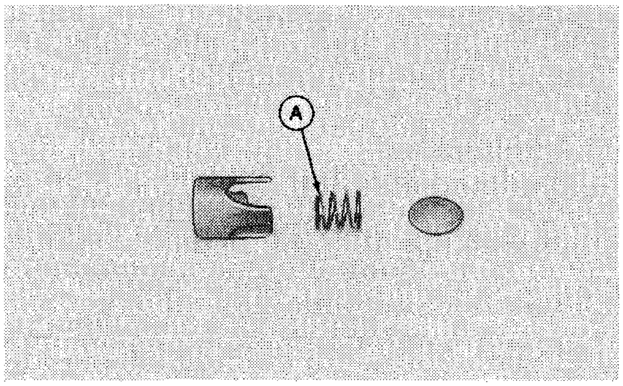
NOTE: Cutaway section of a pump housing shown.

A - Valve Lift (approximate) of Inlet Valves .... 0.125 in. (3 mm)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALVES—Continued

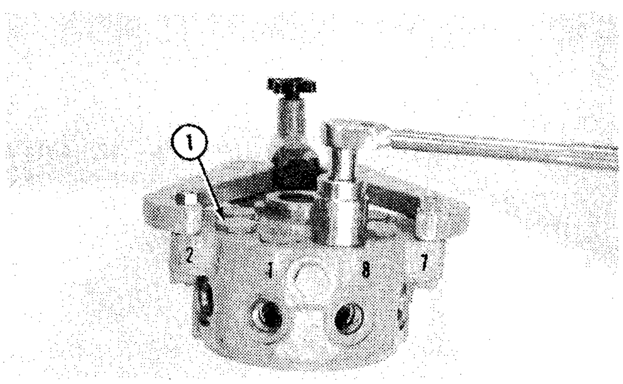
3 in.^{3} (49 cm^3) Hydraulic Pump and Stroke Control Valve (Without Pump Serial Number Plate)—Continued



T85323

Fig. 4-Outlet Valve Springs

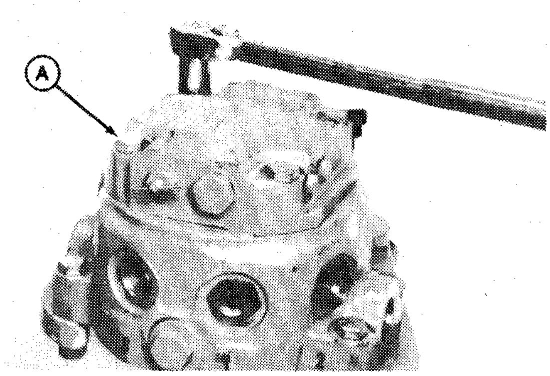
A - Outlet Valve Spring:
Free length (approximate) .... 0.480 in. (12.19 mm)
Test length at 2.84 ± 0.3 lb. force .... 0.30 in.
(12.6 ± 0.1 N .... 7.6 mm)



T75263

Fig. 5-Inlet Valve Plugs

1 - Inlet Valve Plug Torque .... 100 lb-ft (136 N·m)



T87889

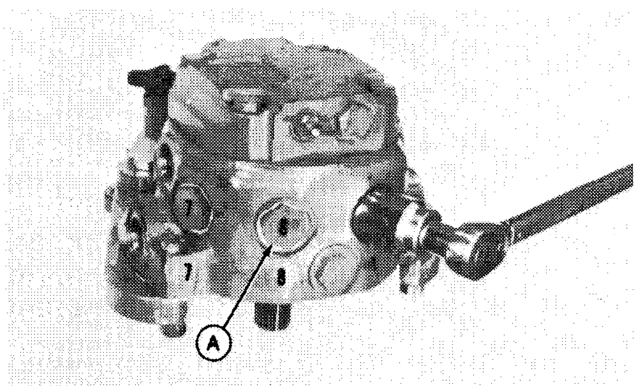
Fig. 6-Stroke Control Valve Housing Cap Screws

A - Cap Screw Torque .... 85 lb-ft (115 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALVES—Continued

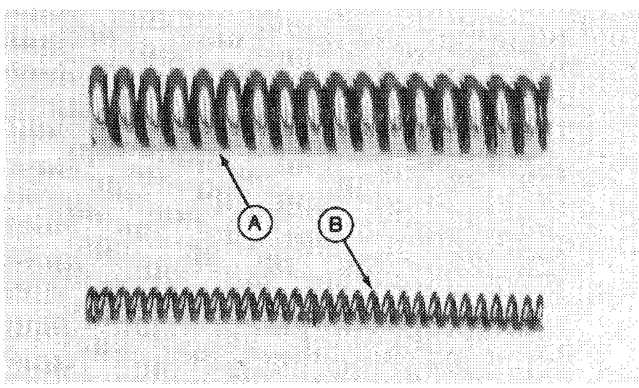
3 in.³ (49 cm³) Hydraulic Pump and Stroke Control Valve (Without Pump Serial Number Plate)—Continued



T87890

Fig. 7-Piston Plugs

A - Piston Plug Torque . . . . 100 lb-ft (136 N·m)

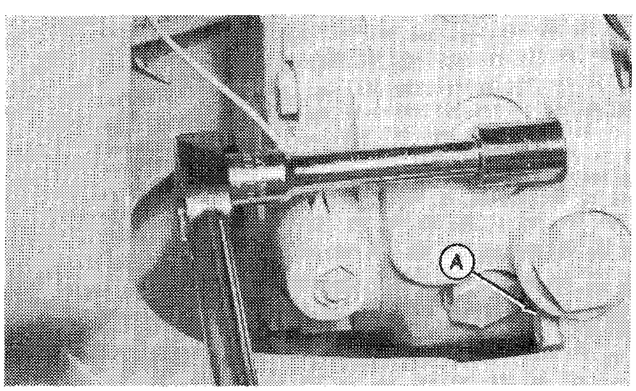


T85477

Fig. 8-Stroke Control Valve Assembly Springs

A - Stroke Control Valve Spring:
Free length (approximate) . . . . 3.62 in. (92 mm)
Test length at 140 ± 15 lb. force . . . . . 3.31 in. (623 ± 67 N . . . . 84 mm)

B - Crankcase Outlet Valve Spring (-351941):
Free length (approximate) . . . . 2.89 in. (73.5 mm)
Test length at 50 ± 5 lb. force . . . . 2.20 in. (222.5 ± 22 N . . . . 56 mm)



T85310

Fig. 9-Pump to Pump Support Cap Screws

A - Cap Screw Torque . . . . 85 lb-ft (115 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALVES—Continued

(3 in.^{3}) 50 cm^3 and (4 in.^{3}) 65 cm^3 Hydraulic Pump and Stroke Control Valve (With Pump Serial Number Plate)

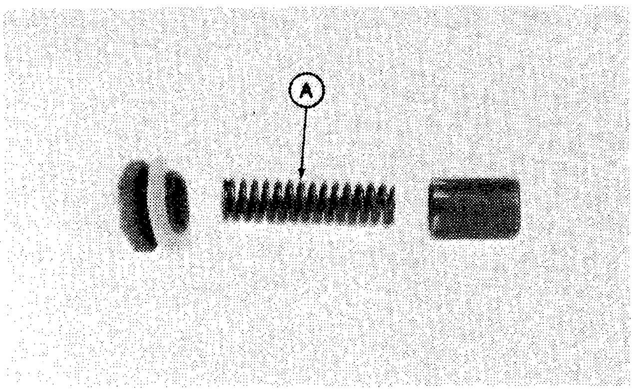


Fig. 10-Piston Springs For (3 in.^{3}) 50 cm^3 Pump

A - Piston Spring For (3 in.^{3}) 50 cm^3 Pump:
Free length (approximate) . . . . 2.44 in. (62 mm)
Test length at 34 to 40 lb. force . . . . . . 1.62 in. (151 to 178 N . . . . 41 mm)
with a maximum difference of force permissible of . . . . 1.5 lb. force (6.7 N)
The eight springs in a set must be of the same color code.

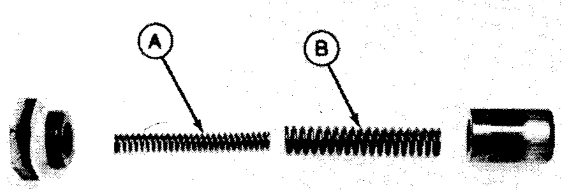


Fig. 11-Piston Springs For (4 in.^{3}) 65 cm^3 Pump

A - Inner Piston Spring For (4 in.^{3}) 65 cm^3 Pump:
Free length (approximate) . . . . 2.74 in. (69.5 mm)
Test length at 17 to 21 lb. force . . . . . . 1.78 in. (75.6 to 93.4 N . . . . 45.2 mm)
with a maximum difference of force permissible of . . . . 1.0 lb. force

B - Outer Piston Spring For (4 in.^{3}) 65 cm^3 Pump:
Free length (approximate) . . . . 2.8 in. (70 mm)
Test length at 30 to 35 lb. force . . . . . . 1.78 in. (129 to 155.7 N . . . . . . 45.2 mm)
with a maximum difference of force permissible of . . . . 1.5 lb. force (6.7 N)
The eight springs in a set must be of the same color code.

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALVES—Continued

(3 in.^{3}) 50 cm^3 and (4 in.^{3}) 65 cm^3 Hydraulic Pump and Stroke Control Valve (With Pump Serial Number Plate)—Continued

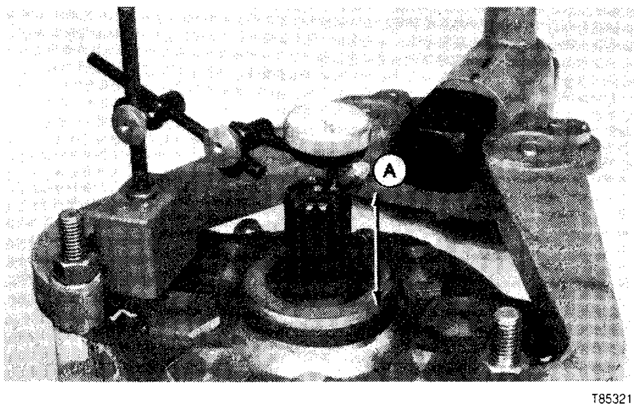


Fig. 12-Pump Shaft End Play

A - Pump Shaft End Play....... 0.001 to 0.005 in. (0.03 to 0.13 mm)

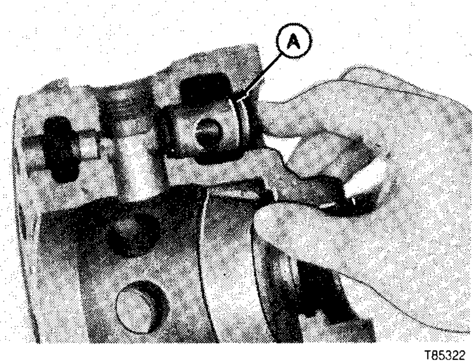


Fig. 13-Valve Lift Of Inlet Valves

Cutaway section of a pump housing shown.

A - Valve Lift (approximate) Of Inlet Valves...................... 0.125 in. (3 mm)

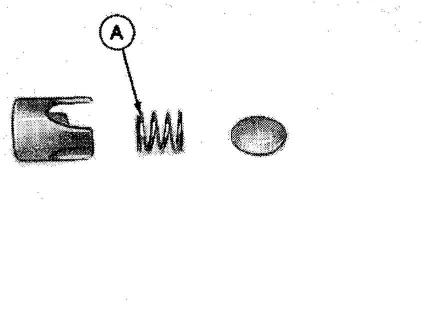


Fig. 14-Outlet Valve Springs

A - Outlet Valve Spring:
Free length (approximate) .... 0.48 in. (12.19 mm)
Test length at 2.84 ± 0.30 lb. force ... 0.30 in. (12.6 ± 0.1 N......... 7.6 mm)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALVES—Continued

(3 in.^{3}) 50 cm^3 and (4 in.^{3}) 65 cm^3 Hydraulic Pump and Stroke Control Valve (With Pump Serial Number Plate)—Continued

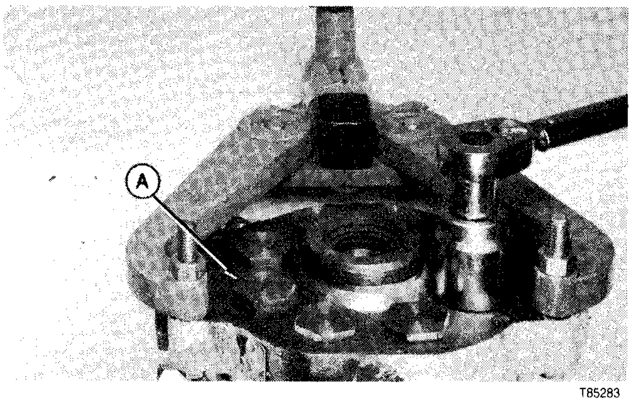


Fig. 15-Inlet Valve Plugs

A - Inlet Valve Plug Torque . . . . 100 lb-ft (136 N·m)

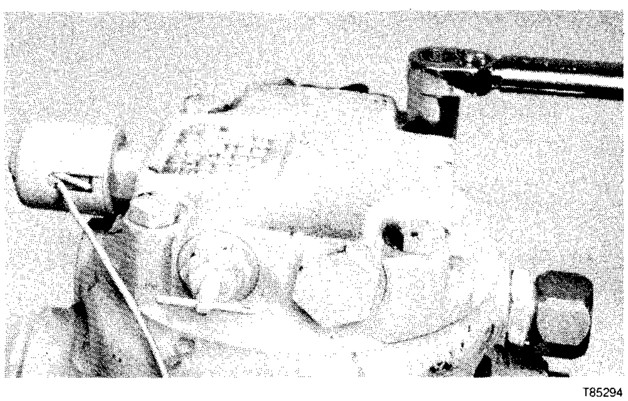


Fig. 16-Stroke Control Valve Housing Cap Screws

Cap Screw Torque . . . . 85 lb-ft (115 N·m)

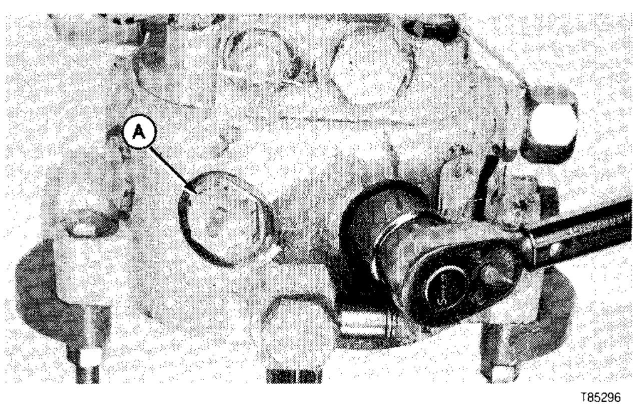


Fig. 17-Piston Plugs

A - Piston Plug Torque . . . . 100 lb-ft (136 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALVES—Continued

(3 in.³) 50 cm³ and (4 in.³) 65 cm³ Hydraulic Pump and Stroke Control Valve (With Pump Serial Number Plate)—Continued

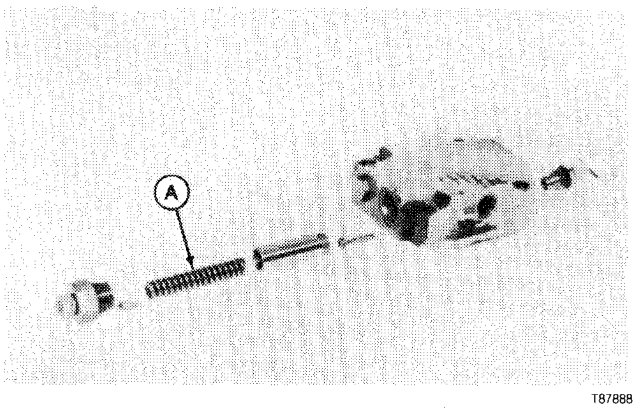


Fig. 18-Stroke Control Valve Spring

A - Stroke Control Valve Spring:
Free length (approximate) . . . . 3.62 in. (92 mm)
Test length at 140 ± 15 lb. force . . . . . 3.31 in. (623 ± 67 N . . . . 84 mm)

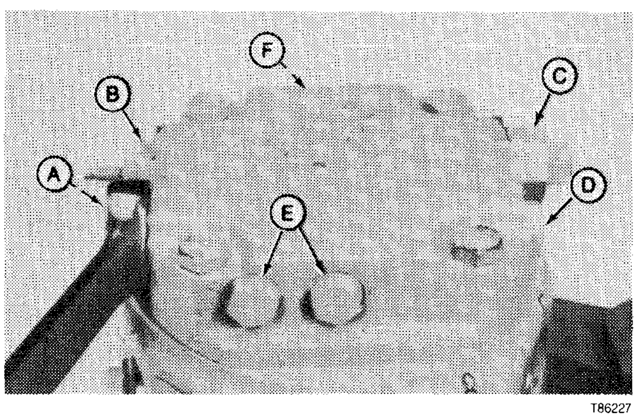


Fig. 19-Plugs For Stroke Control Valve Assembly

A - Plug Torque . . . . 100 lb-ft (136 N·m)
B - Special Plug Torque . . . . 80 lb-ft (108 N·m)
C - Fitting Torque . . . . 110 lb-ft (150 N·m)
D - Plug Torque . . . . 45 lb-ft (61 N·m)
E - Plug Torque . . . . 25 lb-ft (34 N·m)
F - Destroke Solenoid Valve Torque . . . . 30 ± 10 lb-ft (41 ± 14 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALVES—Continued

3.in.^{3} (50 cm^3) and (4 in.^{3}) 65 cm^3 Hydraulic Pump and Stroke Control Valve (With Pump Serial Number Plate)—Continued

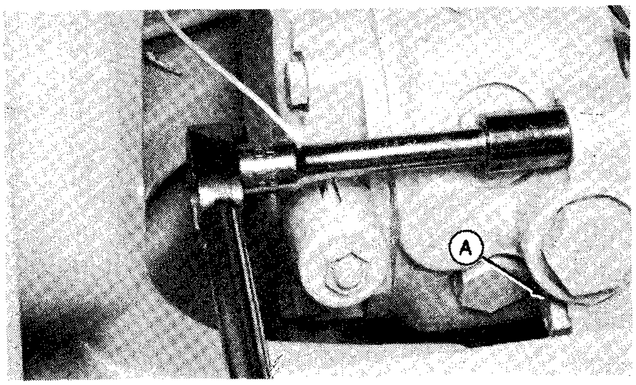


Fig. 20-Pump To Pump Support

A - Cap screw torque . . . . 85 ± 8 lb-ft (115 ± 10 N·m)

Pump Drive Assembly (-267582) (268351-270054)

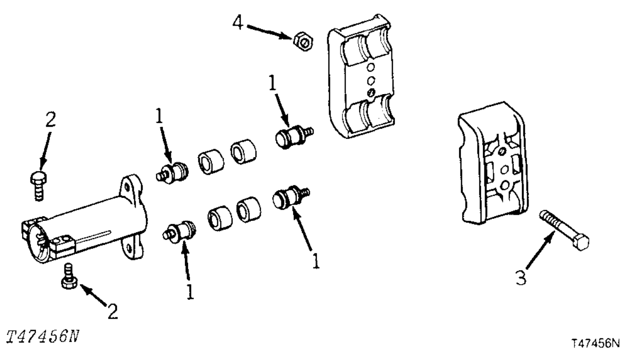


Fig. 21-Pump Drive

1 - Pump drive special screw torque . . . . 32 to 38 lb-ft (43 to 52 N·m) (4 to 5 kg/m)
2 - Drive shaft retaining cap screw torque . . . . 28 to 36 lb-ft (38 to 49 N·m) (4 to 5 kg/m)
3 - Half coupler cap screw torque . . . . 23 to 27 lb-ft (31 to 37 N·m) (3 to 4 kg/m)
4 - Half coupler lock nut torque . . . . 23 to 27 lb-ft (31 to 37 N·m) (3 to 4 kg/m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALVES—Continued

Pump Drive Assembly (267583-268350) (270054-)

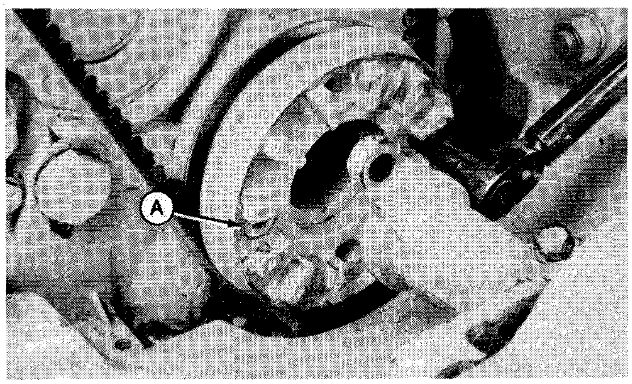


Fig. 22-Rear Coupling

A - Cap screw torque .... 35 ± 3 lb-ft (47 ± 4 N·m)

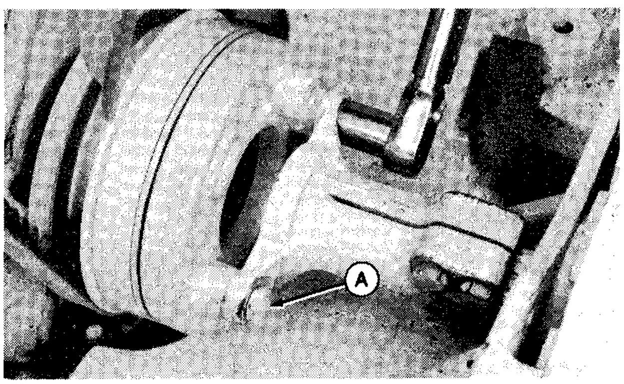


Fig. 23-Drive Shaft

A - Cap screw torque .... 35 ± 3 lb-ft (47 ± 4 N·m)

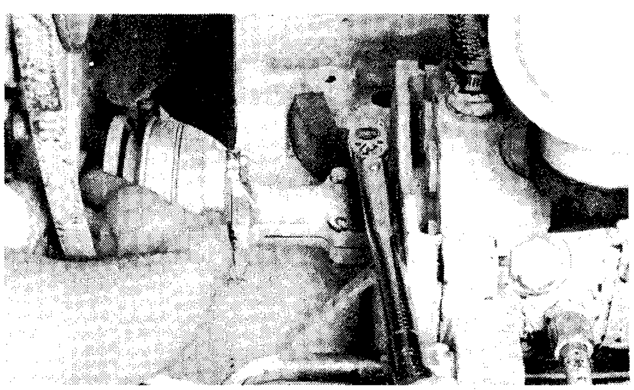


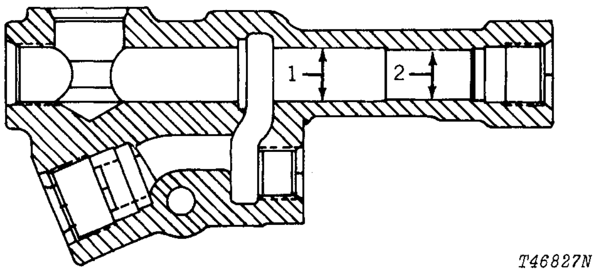
Fig. 24-Drive Shaft

A - Cap screw torque .... 35 ± 3 lb-ft (47 ± 4 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

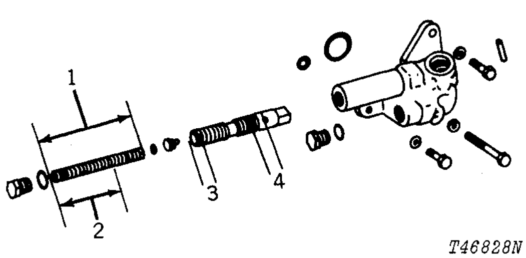
Pressure Control Valve



T46827

Fig. 25-Pressure Control Valve Housing

1 - I.D. of housing bore (front) .... 0.7508 to 0.7518 in. (19.070 to 19.096 mm)
2 - I.D. of housing bore (rear) .... 0.7268 to 0.7278 in. (18.461 to 18.486 mm)



T46828

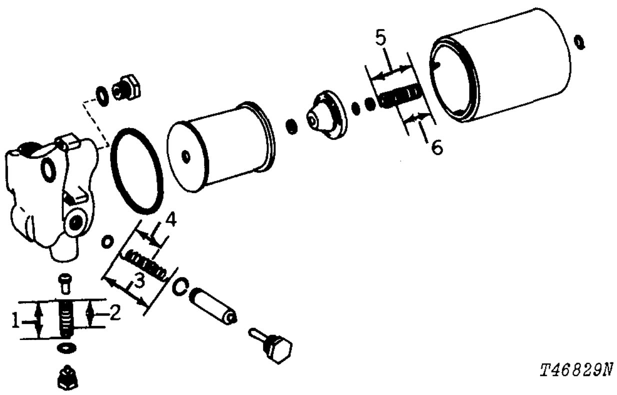
Fig. 26-Pressure Control Valve Spring and Valve

1 - Pressure control valve spring free length .... 4.61 in. (117.1 mm)
2 - Pressure control valve spring test length........................ 3.50 in. (88.9 mm) when compressed with 45 to 55 lb. force (200 to 245 N)
3 - O.D. of valve (rear) .... 0.7257 to 0.7263 in. (18.433 to 18.448 mm)
4 - O.D. of valve (front) ...... 0.7497 to 0.7503 in. (19.042 to 19.058 mm)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

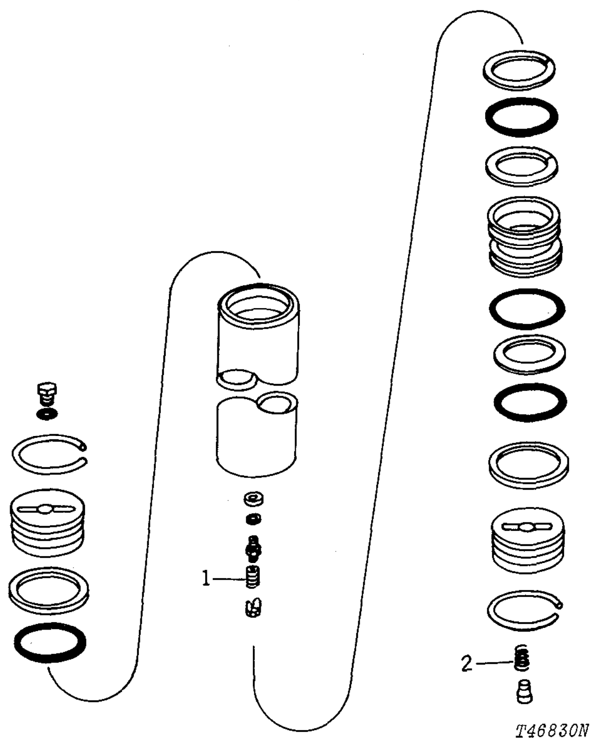
Hydraulic Oil Filter and Relief Valve



T46829N

Fig. 27-Hydraulic Oil Filter and Relief Valve Springs

1 - Spring
Free length . . . . 2.06 in. (52.3 mm)
2 - Test length . . . . 1.31 in. (33.3 mm)
when compressed with 30.6 to 37.4 lbs. (136 to 166 N) (14 to 17 kg)
3 - Spring
Free length . . . . 3.24 in. (82.3 mm)
4 - Test length . . . . 2.50 in. (63.5 mm)
when compressed with 16.5 to 20.5 lbs. (73 to 91 N) (7 to 9 kg)
5 - Spring
Free length . . . . 1-13/16 in. (46.04 mm)
6 - Test length . . . . 1-1/8 in. (28.6 mm)
when compressed with 64 to 71 lbs. (285 to 316 N) (29 to 32 kg)



T46830N

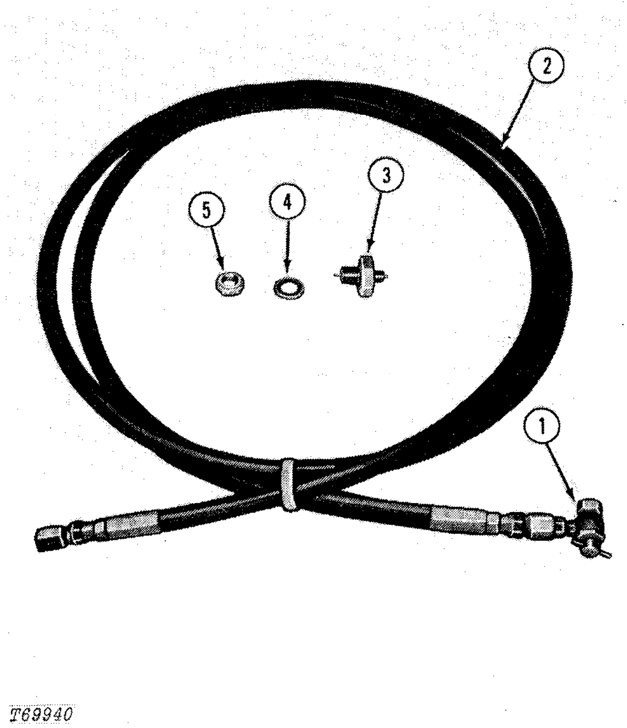
Fig. 28-Hydraulic Oil Accumulator Springs

1 - Spring
Free length . . . . 1.10 in. (28.0 mm)
Test length . . . . 0.59 in. (15.0 mm)
when compressed with 1.3 to 1.7 lbs. (6 to 8 N) (0.6 to 0.8 kg)
2 - Spring
Free length . . . . 0.78 in. (19.8 mm)
Test length . . . . 0.61 in. (15.5 mm)
when compressed with 15 to 18.4 lbs. (67 to 82 N) (7 to 8 kg)

HYDRAULIC SYSTEM

SPECIAL TOOLS

Essential Tools

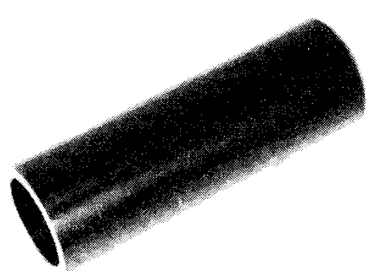
Tool	Tool Number	Use
	D-15041NU	To charge the accumulator

CAUTION: For safety reasons, pressure regulator valve and gauge must be ordered from your local nitrogen gas supplier.

T69940

1—Gas Cock
2—High Pressure Hose Assembly
3—Adapter Assembly
4—O-Ring Washer
5—Tru-Seal Nut

Fig. 29-Nitrogen Accumulator Charging Kit

Tool	Tool Number	Use
	JD-318	To assemble pump shaft

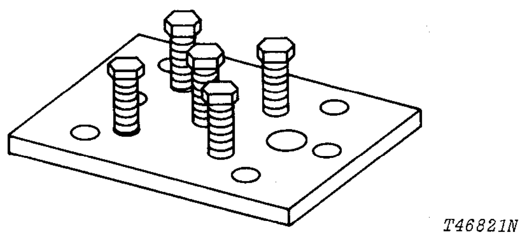
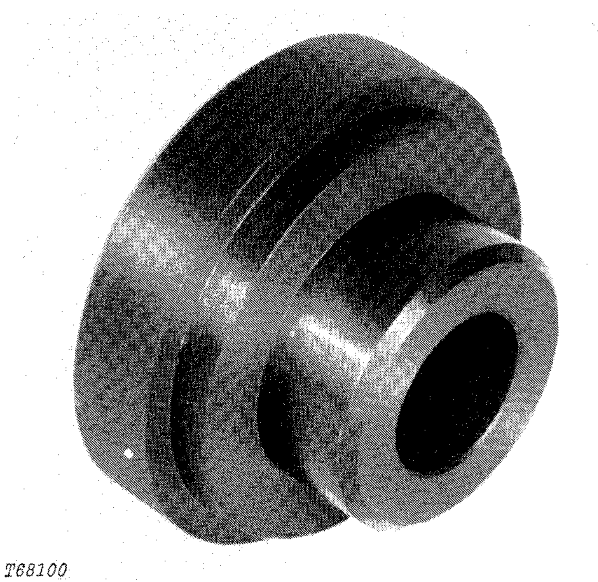
T80276

Fig. 30-Driver

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

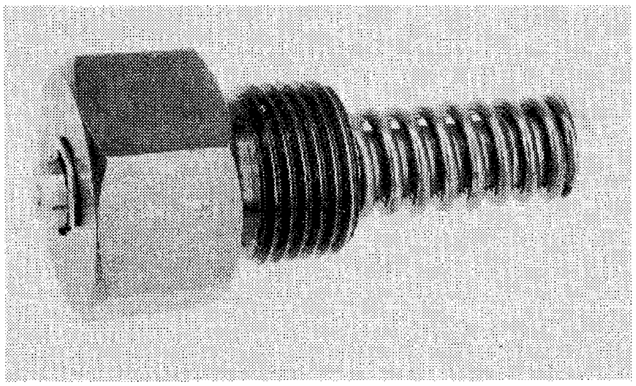
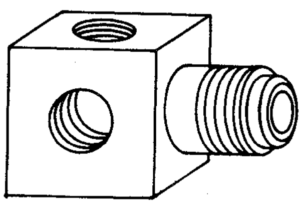
Essential Tools—Continued

Tool	Tool Number	Use
 T46821 *Fig. 31-JDH-15C Selective Control Valve Adjusting Plate*	JDH-15C	Used to hold control valve in closed position while adjusting valve clearance.
 T68100 *Fig. 32-JDH-18 Seal Driver*	JDH-18	To install oil seal to the correct depth in pump housing.

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

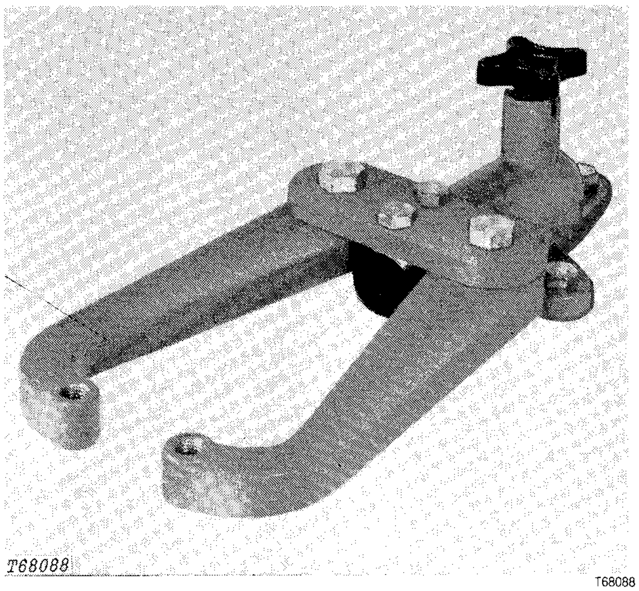
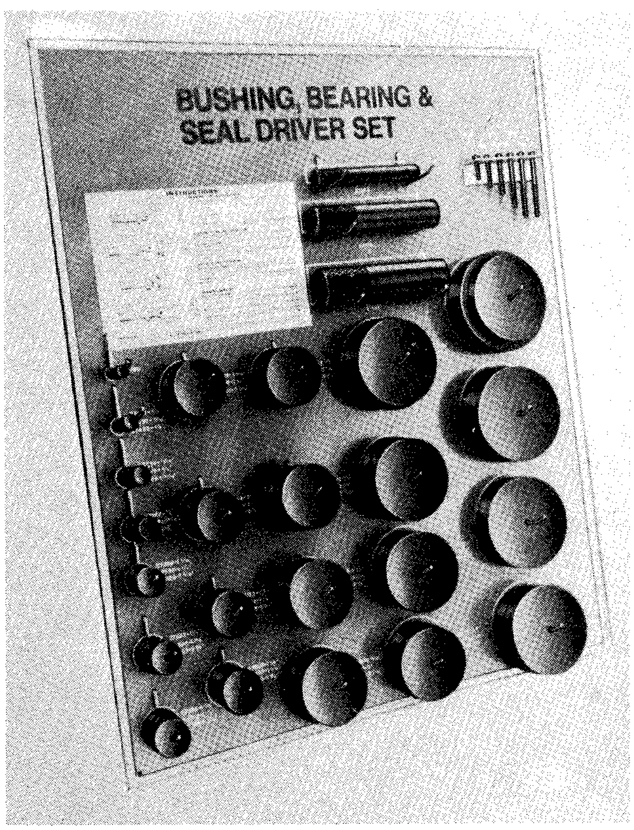
Essential Tools—Continued

Tool	Tool Number	Use
 T86282 *Fig. 33-Crankcase Outlet Valve Adjusting Tool*	JDH-19C	For the adjustment of crankcase outlet valve in the stroke control valve assembly (-351941)
 T46820N T46820 *Fig. 34-Flow Return Fitting*	JDH-37	Severe space limitations necessitate the use of this special fitting in order to direct return oil through the hydraulic system filter when system checks are being made with a hydraulic tester.
 T75754 *Fig. 35-Installer and Removal Tool*	JDH-39B-1	Used to remove and install the outlet valve seats in the hydraulic pump.

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

Convenience Tools

Tool	Tool Number	Use
	D-01006AA	To hold the hydraulic pump during disassembly and assembly.
	D-01045AA	To remove and install bushings, bearings and seals.

T68088

Fig. 36-Bench Fixture

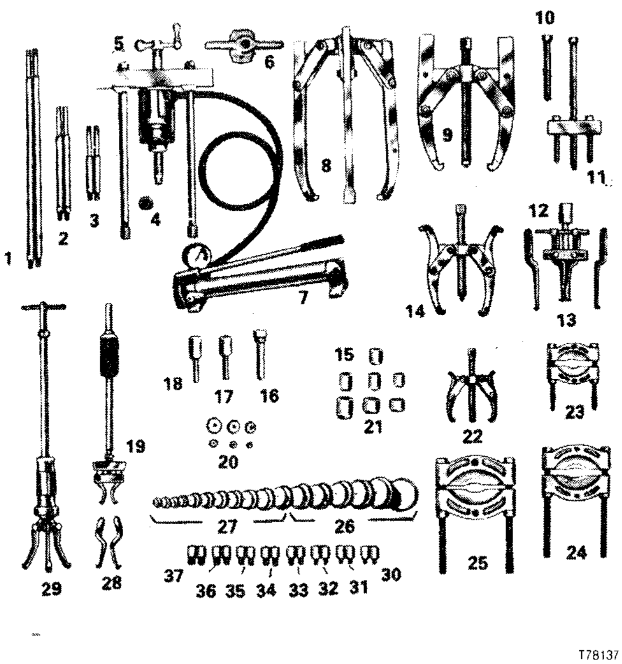
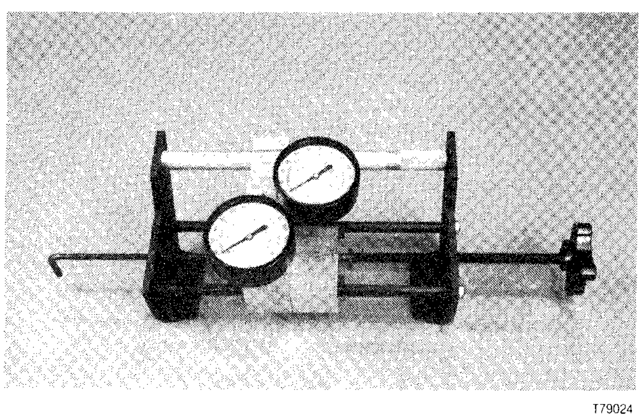
T78009

Fig. 37-Bushing, Bearing and Seal Driver Set

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

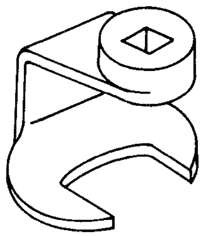
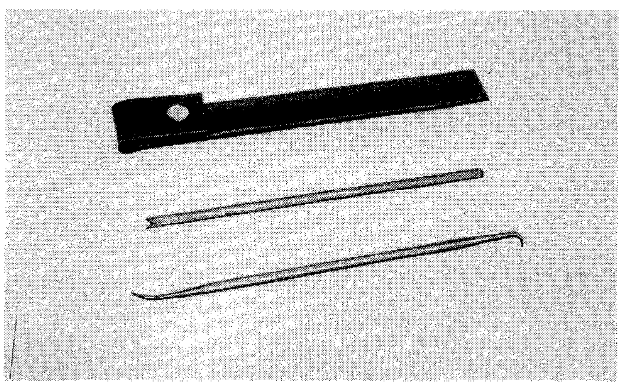
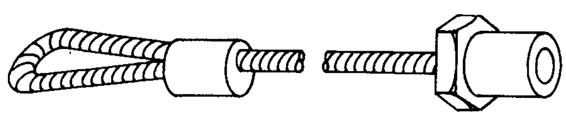
Convenience Tools—Continued

Tool	Tool Number	Use
 Fig. 38-17-1/2-Ton Puller Set	D-01048AA	To remove and install gears, bearings and bushings.
 Fig. 39-Spring Compression Tester	D-01168AA	To check spring free length and fatigue rate.

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

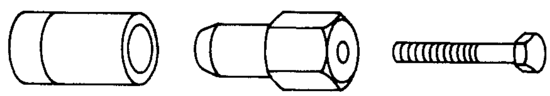
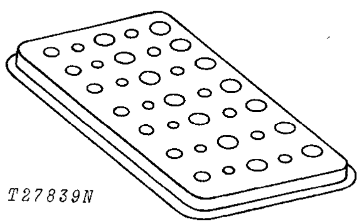
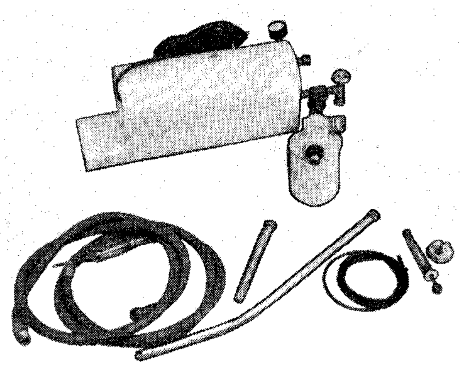
Convenience Tools—Continued

Tool	Tool Number	Use
 T46818N T46818 Fig. 40-Crow Foot Wrench	JD-288	Has 1-1/4 in. (31.75 mm) opening. For removing and installing the hydraulic pump solenoid stroke control valve used on loader backhoes.
 T79815 Fig. 41-O-Ring Seal Tool Set	JDG-127	Use to remove and install O-ring seals.
 T46817N T46817 Fig. 42-Hydraulic Pump Lifting Device	JDH-26	When attached to a hoist, permits lifting radial-piston (closed-center) hydraulic pump from tractor frame, and reinstalling it as well.

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
 T46822N T46822 *Fig. 43-Hydraulic Pump Seal Replacement Kit*	JDH-32	Includes JDH-31 Driver and JDH-35 Puller. Permits removal and installation of oil seal in radial piston (closed-center) hydraulic pump of John Deere tractors without disassembling the pump.
 T27839 *Fig. 44-Pump Parts Tray*	JDH-21A	Parts tray for pump pistons, inlet valves, discharge valves and plugs.
 T79027 *Fig. 45-Oil Transfer Unit with Vacuum Pump*	D-05155ST	To remove oil from a reservoir or hold a vacuum in a reservoir so repairs can be made on other parts of the hydraulic system without removing oil from reservoir.

Section 31
LOADER

CONTENTS OF THIS SECTION

Group 3102
BUCKETS

GENERAL INFORMATION

There are two buckets available on the 310A and 310B Backhoe Loaders: a 3/4 cubic yard (0.6 m^3) and a 1 cubic yard (0.8 m^3) bucket. The bucket cutting edge is made of high carbon steel.

Two utility rings are welded to the top of the buckets to aid in attaching or removing the buckets.

REMOVAL

Lower boom and bucket until bucket is level on the floor.

Relieve hydraulic pressure on the cylinders.

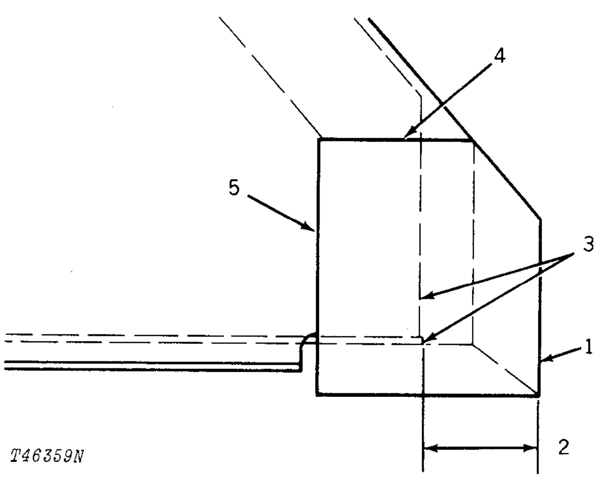
Remove snap rings and pivot pins.

Buckets can be moved by using a chain hoist on the utility rings on top of the bucket or the unit can be carefully backed away from the bucket.

REPAIR

Inspect bucket pins and cutting edge for damage. Repair or replace if necessary.

IMPORTANT: Because bucket cutting edges are made of high carbon steel, special welding techniques are required (See "Special Welding Instructions," at right).



1—Cutting Edge
2—2.0±0.12 in (51±3 mm)
3—0.19x0.38 in (4.8x9.5 mm) Fillet Weld
4—0.38 in. (9.5 mm) Fillet Weld
5—0.19 in (4.8 mm) Fillet Weld

Fig. 1-Cutting Edge Replacement

Special Welding Instructions

A low hydrogen (with iron powder) electrode (American Welding Society, Series E7018) is recommended for this type of work. The sizes most easily handled in horizontal or out of flat positions are 5/32 inch (3.97 mm) and 3/16 inch (4.76 mm) diameters.

To obtain maximum strength, it is imperative that all craters at the termination of each weld be filled. Because of the cupping action of heavy electrode coating, it is necessary to drag the electrode lightly or hold a very short arc.

As a second choice, an E7010 Series Electrode can be used in DC reverse polarity after preheating the cutting edge to approximately 300°F (149°C). Allow the edge to cool slowly.

IMPORTANT: When repairing a small section of the cutting edge, it is necessary to preheat around damaged area regardless of the electrode used. This will prevent rapid cooling of the edge around the weld which could cause the cutting edge to become brittle.

When cutting edge is cracked, cut completely through cutting edge. Extend cut 1/2 inch (12.7 mm) beyond each end of crack.

Weld crack from both sides.

When welding cracks between cutting edge and bucket, extend weld at least 1/2 inch (12.7 mm) beyond each end of the crack.

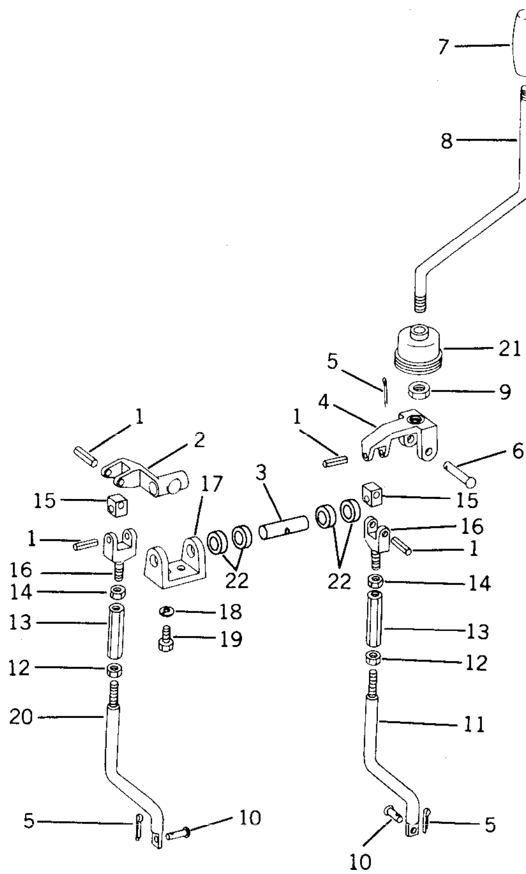
INSTALLATION

Follow removal procedure in reverse order.

Group 3115
CONTROLS LINKAGE

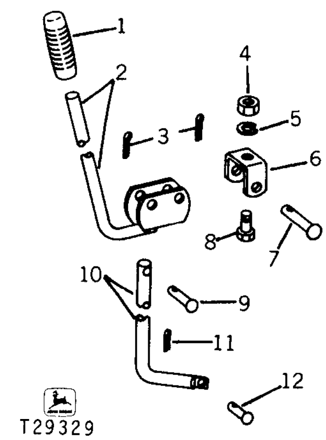
REPAIR

Inspect control valve linkage for worn or damaged parts and replace as necessary.



1—Spring Pin (4 used)
2—Pivot Block
3—Pivot Shaft
4—Handle Mount
5—Cotter Pin (3 used)
6—Pivot Pin
7—Handle Grip
8—Handle
9—Nut
10—Connector Pin (2 used)
11—Boom Control Valve Rod
12—Nut (2 used)
13—Turnbuckle (2 used)
14—Nut (2 used)
15—Universal Block (2 used)
16—Connector Link (2 used)
17—Control Pivot
18—Lock Washer (2 used)
19—Cap Screw (2 used)
20—Bucket Control Valve Rod
21—Boot (With Cab)
22—Washer (as required)

Fig. 1-Control Valve Linkage



1—Grip
2—Control Valve Lever
3—Cotter Pin (2 used)
4—Nut
5—Lock Washer
6—Bracket
7—Pin
8—Cap Screw
9—Pin
10—Rod
11—Cotter Pin
12—Pin

Fig. 2-Multi-Purpose Bucket Control Valve Lever and Linkage

Coat shafts and movable linkage parts with grease before assembly.

Add washers (22, Fig. 1) so that end play of pivot block (2) does not exceed 0.04 in. (1 mm).

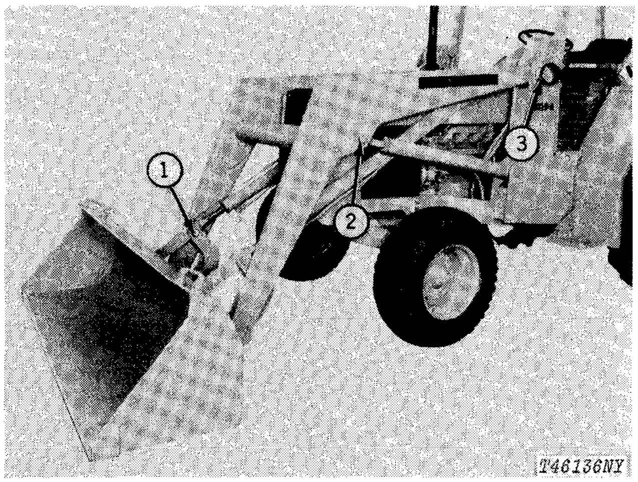
Adjust control valve lever so that offset is directly to the front and the handle is vertical.

Group 3140
LOADER FRAMES

LOADER BOOM

GENERAL INFORMATION

The boom is of welded construction and attaches to the frame with pivot pins.



1—Bucket Cylinder to Bucket Linkage Pin
2—Boom Cylinder to Boom Pin
3—Boom to Frame Pin

Fig. 1-Boom Attaching Pins

REMOVAL

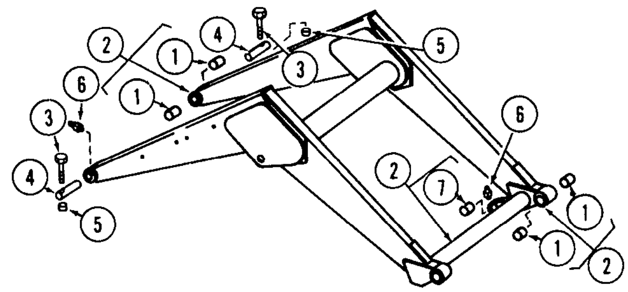
Lower boom and bucket, and relieve hydraulic pressure.

Attach chain hoist to boom.

Remove snap rings and remove pivot pins.

REPAIR

Refer to Fig. 2 when disassembling boom. Inspect all parts for excessive wear and damage and repair or replace as necessary.



T46137

1—Bushing (8 used)
2—Boom
3—Cap Screw (2 used)
4—Boom to Frame Pin (2 used)
5—Special Nut (2 used)
6—Grease Fitting (4 used)
7—Bushing (2 used)

Fig. 2-Loader Boom

INSTALLATION

Install boom with pivot pins and snap rings. Grease all fittings after assembly.

LOADER SIDE FRAMES

REMOVAL

Remove loader boom as described in Group 3140.

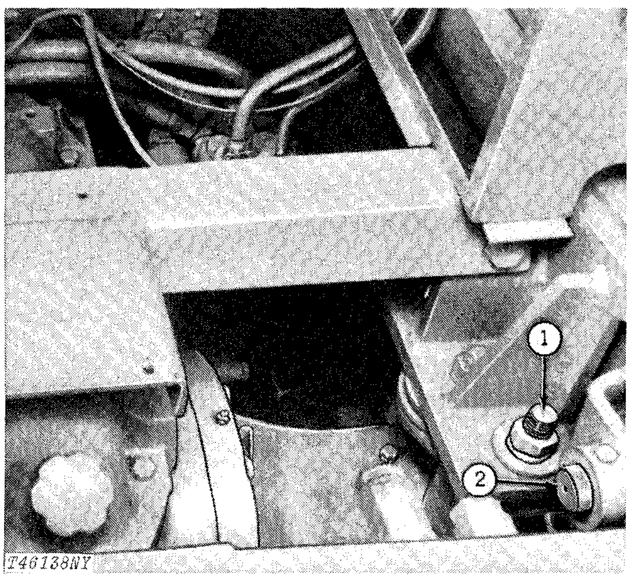
Remove cab as described in Group 1810.

Remove backhoe as described in Group 3340.

Remove boom and bucket cylinders.

The right or left side frame may be removed separately.

Remove floor panels necessary to gain access to the side frame attaching points.



1—Loader Frame Rear Attaching Points **2—Tie Bar Rear Mounting Pin**

Fig. 3-Loader Frame Rear Attaching Points

Remove left or right backhoe tie bar (2, Fig. 3 and Fig. 4).

NOTE: If 9405 Backhoe was removed prior to removing side frame, the tie bars will be off.

NOTE: When removing right side frame, it is necessary to remove cap screws holding return oil filter housing to side frame.

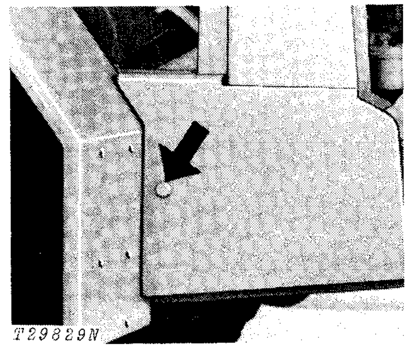


Fig. 4-Tie Bar Pin

Disconnect all the necessary linkage and wiring from right or left fender.

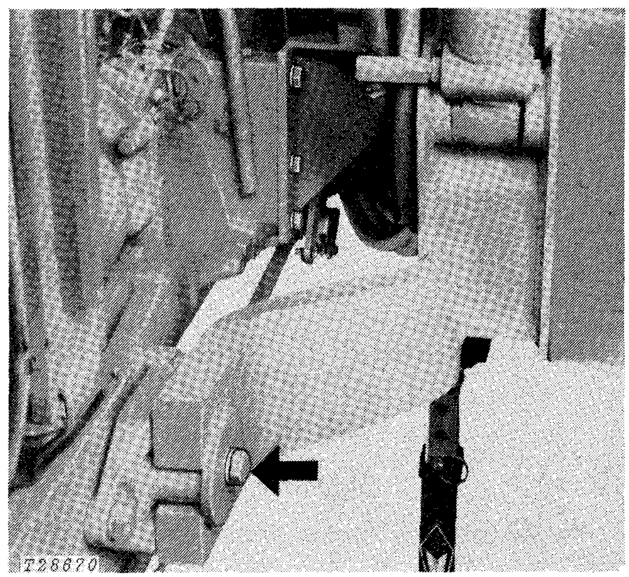


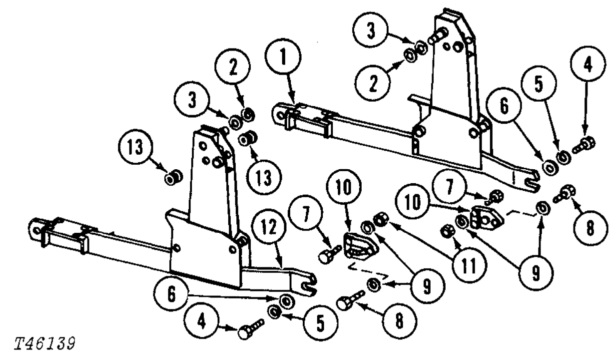
Fig. 5-Loader Frame Front Attaching Point

Attach chain hoist to loader side frame to be removed. Remove cap screws securing side frame to machine (Fig. 3 and 5) and swing frame away from unit.

REPAIR

Refer to Fig. 6 when disassembling loader side frames.

Inspect all parts for excessive wear or damage and repair or replace as necessary.



1—L.H. Side Frame
2—Snap Ring (2 used)
3—Washer (2 used)
4—Cap Screw (2 used)
5—Lock Washer (2 used)
6—Front Mount Retainer (2 used)
7—Cap Screw (4 used)
8—Cap Screw (2 used)
9—Special Washer (6 used)
10—Side Rail Mounting (2 used)
11—Nut (4 used)
12—R.H. Side Frame
13—Wiring Grommet (4 used)

Fig. 6-Loader Side Frames

INSTALLATION

Install loader by reversing the removal procedure. Note the following torques during assembly.

Torque loader frame rear attaching nuts (1, Fig. 3) to 445 lb-ft (603 Nm) (62 kg/m).

Torque side rail mounting cap screws (7 and 8, Fig. 6) to 250 lb-ft (339 Nm) (35 kg/m).

Torque loader side frame to side rail cap screws (4, Fig. 6) to 250 lb-ft (339 Nm) (35 kg/m).

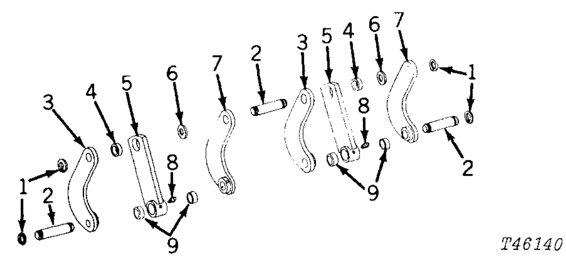
LOADER BUCKET LINKAGE

REPAIR

CAUTION: To avoid possible injury, always stop machine and lower or block up boom and bucket before servicing loader components.

Refer to Fig. 7 during disassembly and assembly of bucket links.

Inspect inner and outer links, bucket links and bushings for damage. Replace as necessary.



1—Snap Ring (8 used)
2—Pin (4 used)
3—Guide Link (2 used)
4—Bucket Link Bushing (2 used)
5—Bucket Link (2 used)
6—Washer (1 used with bucket level indicator, 2 used without bucket level indicator)
7—Guide Link (2 used)
8—Grease Fitting
9—Bucket Link Bushing (2 used)

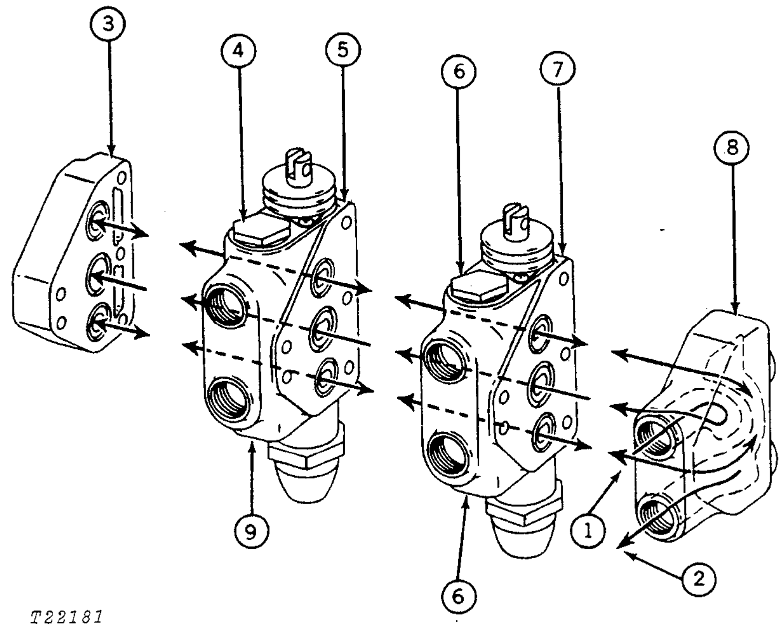
Fig. 7-Loader Bucket Linkage

Grease all fittings after disassembly and assembly.

Group 3160
LOADER HYDRAULICS

LOADER CONTROL VALVE

GENERAL INFORMATION



1—Pressure Oil
2—Return Oil
3—End Plate
4—Plug
5—Boom Valve
6—Relief Valve
7—Bucket Valve
8—Port Plate
9—Check Valve

Fig. 1-Oil Flow Through Control Valve Stack

The loader control valve is a closed-center, two spool, stack-type hydraulic valve.

Valve Construction

The boom and bucket valve sections are separate bodies containing single spools. Both spools contain lift checks (two in boom spool—one in bucket spool) which serve as one-way valves to prevent draft or pressure oil leakage from entering the port passages and causing cylinder rod movement.

A detent in the boom valve end cap retains the spool in the boom float position. The boom section also contains a check valve and anti-cavitation check valve.

An anti-cavitation check valve is contained in the bucket valve section. The bucket valve section also contains two relief valves to protect its circuits from excessive pressure.

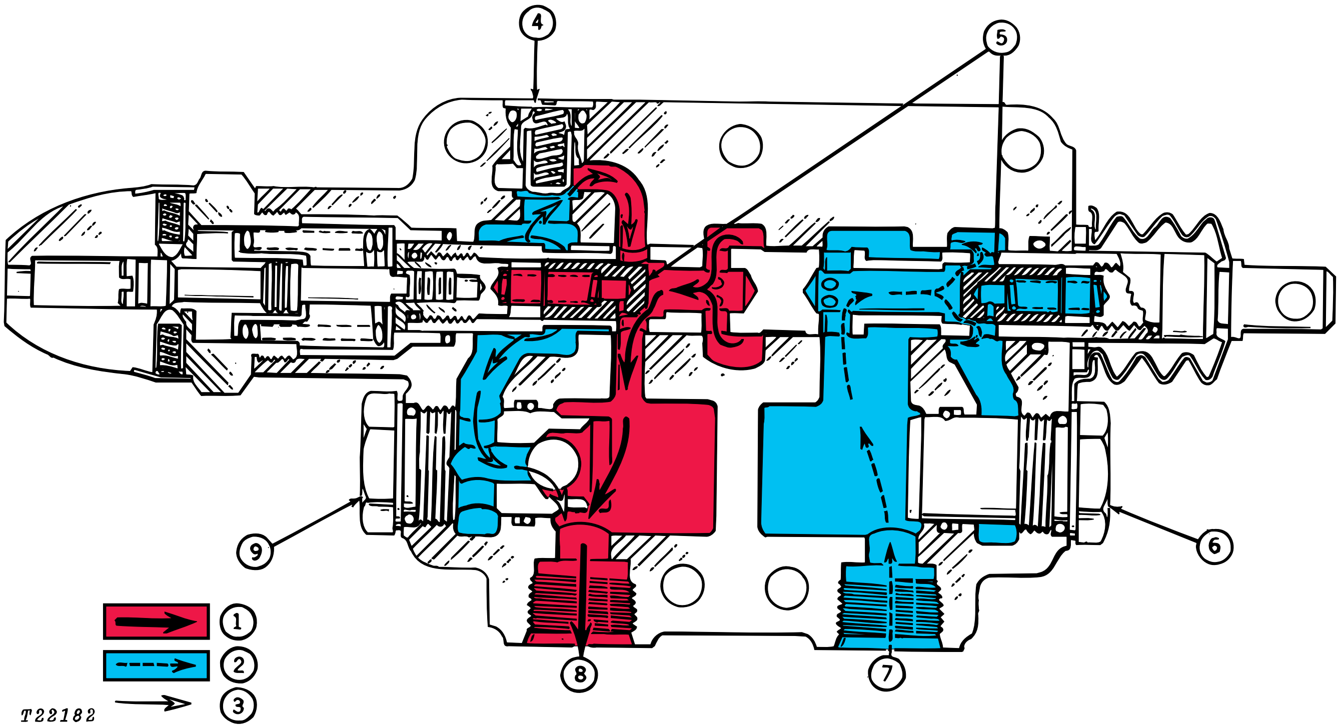
The pressure and return ports are both located in the port plate. The end plate on the control valve assembly is completely blocked.

Valve Oil Flows

The closed-center control valve has no continuous flow of oil when the valve is in neutral. Because the variable displacement pump delivers oil only on demand, oil flows through the control valve only when the control lever is operated.

Fig. 1 shows the flow of oil through the loader control valve. Note that the oil is blocked when it reaches the end plate.

Valve Oil Flows—Continued



1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Oil Flow
4—Anti-Cavitation Check Valve
5—Lift Checks
6—Plug
7—From Cylinder
8—To Cylinder
9—Check Valve

Fig. 2-Boom Section (Lowering Circuit Shown)

Boom Power Circuit

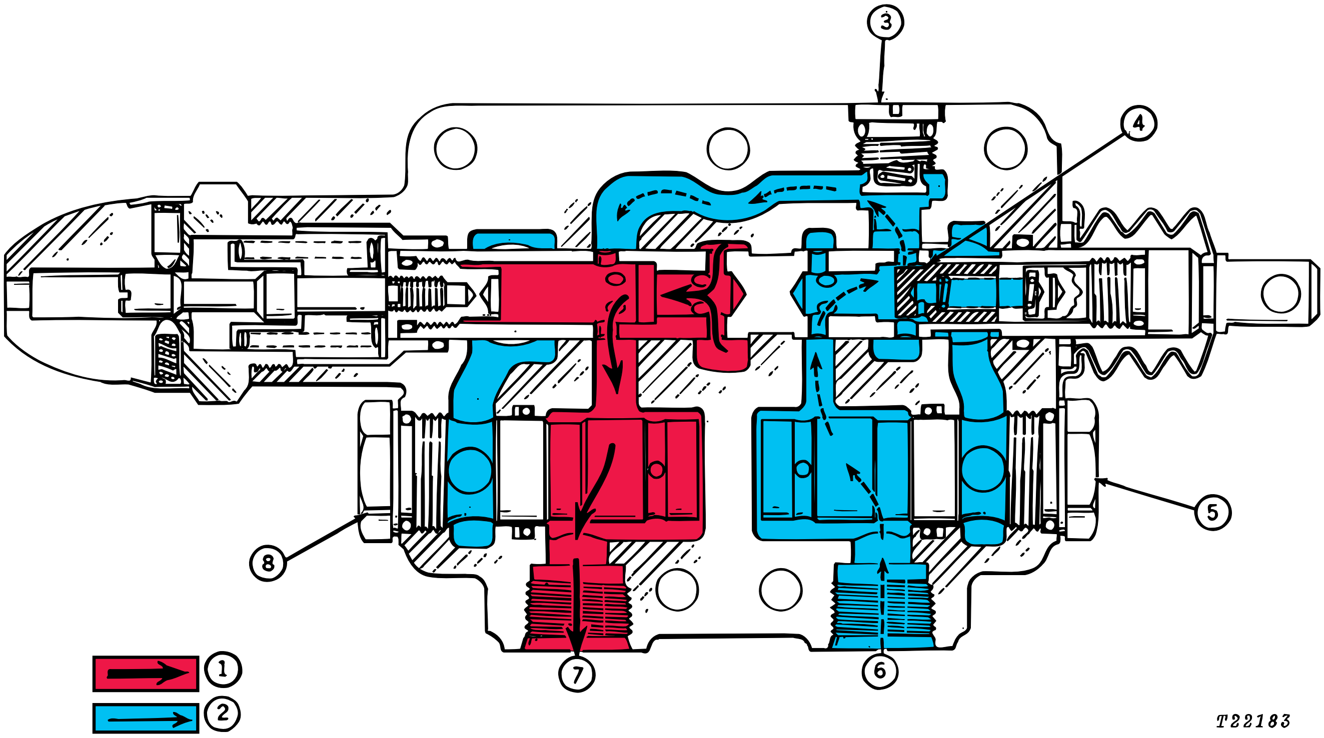
When the boom spool is extended or retracted to lower or raise the boom, the pump moves oil to the control valve. Oil is then directed through the lift check to the boom cylinders.

Displaced oil from the cylinders is forced back through the control valve to the reservoir. Note that if cavitation occurs, return oil flow through anti-cavitation check valves is directed to applied end of the boom cylinder.

Boom Float Circuit

When the boom valve spool is in the float position, the detent in the spool cap engages the valve spool. The spool will be held in this position until manually released.

With the boom spool in the float position, both cylinder ports are open to the outlet in the valve port plate. Thus, the boom floats up and down, following the ground contour. The cylinder pistons freely move back and forth, with the displaced oil returning to the reservoir.



1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Check Valve
4—Lift Check
5—Relief Valve
6—From Cylinder
7—To Cylinder
8—Relief Valve

Fig. 3-Bucket Section (Fast Dump Regenerative Circuit Shown)

Bucket Fast Dump (Regenerative) Circuit

When the bucket spool is moved, the hydraulic pump moves oil to the control valve. Pressure oil then flows to the bucket cylinders.

With the bucket spool in full dump position, the return oil to reservoir is blocked. Oil that is displaced from the cylinder is directed through the valve spool lift check and anti-cavitation check valve into the regenerative channel.

This "one-way" circuit between the two cylinders creates an increased volume of oil for a fast dump.

Bucket Power Circuit

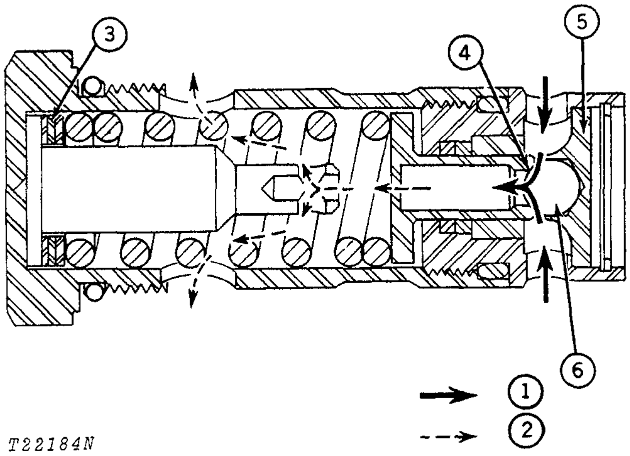
When the bucket spool is moved, the pump moves oil to the control valve. Pressure oil then flows to the bucket cylinders.

Displaced oil from the cylinders is forced back to the control valve and reservoir.

Third Function Valve

The third function valve is similar to Fig. 3 except it does not have the anti-cavitation check valve (3) or regenerative circuit, and has only one relief valve (8).

Relief Valves



1—Pressure Oil
2—Return Oil
3—Shims
4—Seat
5—Retainer
6—Steel Bolt

Fig. 4-Direct Acting Relief Valve

FOS

The bucket valve circuits use direct-acting relief valves (Fig. 4). Refer to "Hydraulic Valves" in FOS Manual - HYDRAULICS for basic information on the operation of direct acting relief valves.

The circuit relief valves in the bucket section provide relief when high pressure is created by some force other than the pump. This force could be caused by the weight of the bucket when a partially rolled-back bucket is used as a bulldozer.

REMOVAL

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

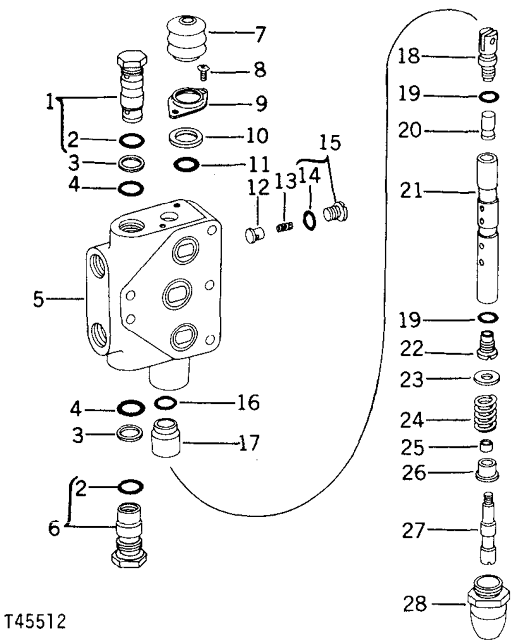
If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

Operate control valve lever until all hydraulic pressure is relieved.

Disconnect lines from valve. Mark lines and fittings on valve for assembly.

Remove valve from unit.

REPAIR



T45512

1—Relief Valve Assembly
2—O-Ring (2 used)
3—Backup Washer (2 used)
4—O-Ring (2 used)
5—Valve Body
6—Relief Valve Assembly
7—Dust Seal
8—Machine Screw (2 used)
9—Dust Seal Retainer
10—Breather Washer
11—O-Ring
12—Anti-Cavitation Valve
13—Spring
14—O-Ring
15—Plug
16—O-Ring
17—Bushing
18—Plug
19—O-Ring (2 used)
20—Lift Check
21—Valve Spool
22—Spool Plug
23—Washer
24—Spring
25—Spool Sleeve
26—Washer
27—Spool Screw
28—Cap

Fig. 5-Bucket Section

Refer to Figs. 5 and 6 and proceed as follows:

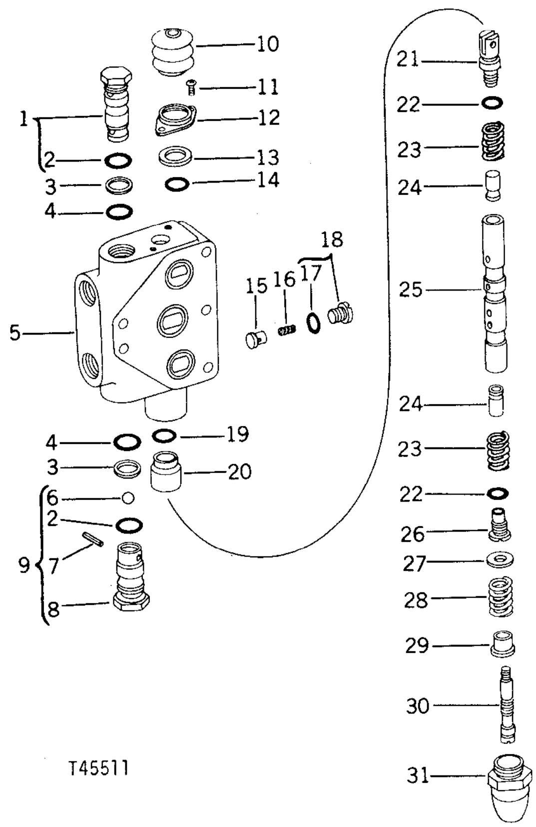
If loader control valve is removed for servicing and it is believed that fragments of failed valve parts may have entered the loader hydraulic system, completely drain the system and replace the hydraulic filters.

Separating Valve Bodies

Remove tie bolts and separate valve sections.

Remove end caps and spools from valve bodies.

Clean and dry all parts thoroughly.



1—Plug
2—O-Ring (2 used)
3—Backup Washer (2 used)
4—O-Ring (2 used)
5—Valve Body
6—Ball
7—Spring Pin
8—Plug
9—Check Valve Assembly
10—Dust Seal
11—Machine Screw (2 used)
12—Dust Seal Retainer
13—Breather Washer
14—O-Ring
15—Anti-Cavitation Valve
16—Spring
17—O-Ring
18—Plug
19—O-Ring
20—Bushing
21—Clevis Plug
22—O-Ring (2 used)
23—Lift Check Spring (2 used)
24—Lift Check (2 used)
25—Spool
26—Spool Plug
27—Special Washer
28—Spring
29—Special Washer
30—Boom Spool Spring Screw
31—Cap

Fig. 6-Boom Section

Inspection

Discard old O-rings and use new O-rings and seal kit when reassembling.

Valve Housing

Check valve housings for damage or evidence of leakage. Replace housing and spool as a matched assembly.

Anti-Cavitation Check Valve

Remove check valves from valve sections and inspect for damage. Check the springs for fatigue.

Spool

Remove burrs from spool assembly ports with fine emery cloth. If spools are worn or damaged, replace spool and valve housing as a matched assembly.

Lift Checks

Remove spool ends and inspect lift checks for damage. Be sure holes in sides of lift checks are not plugged.

Check springs for fatigue.

ASSEMBLY

Thoroughly clean and dry all parts. Oil all parts lightly prior to assembly.

Replace all O-rings and backup washers with new parts.

Instll spools in proper valve section.

Coat threads of spool detent screws with AT52853 John Deere LOCTITE® Thread Lock and Sealer or equivalent, and tighten to 5 to 8 lb-ft (7 to 11 N·m) (0.7 to 1 kg/m).

Stack port plate, valve sections, and end plate in proper sequence.

Install tie bolts and tighten evenly to 20 to 25 lb-ft (27 to 34 Nm) (3 to 4 kg/m).

Install the loader control valve with bracket toward the rear of axle housing. *NOTE: Do not tighten screws at this time.*

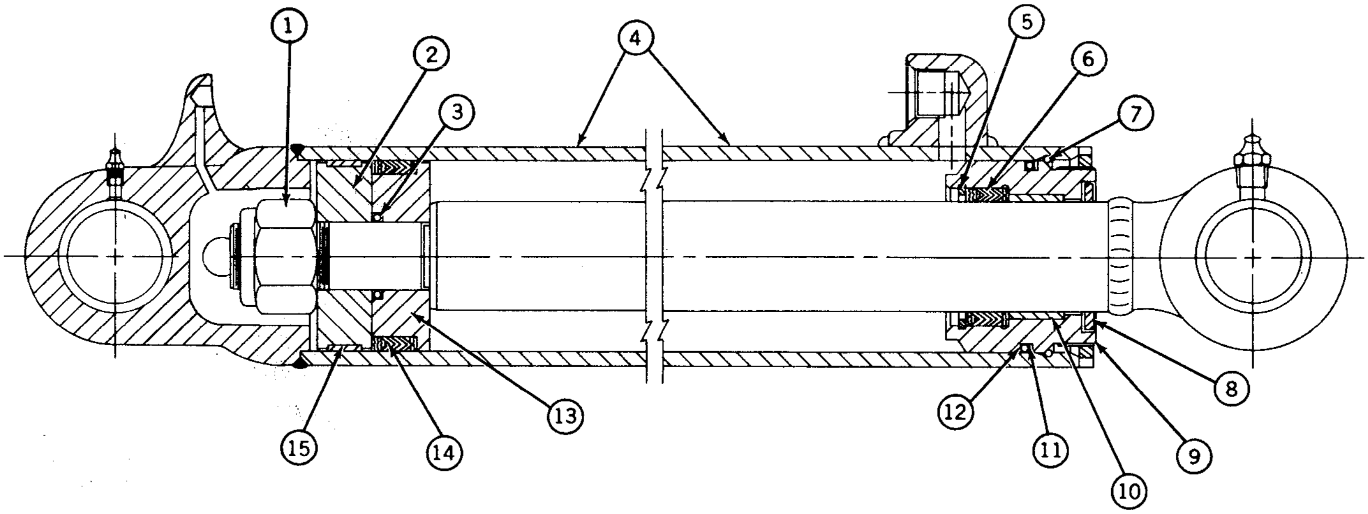
Connect oil lines to loader control valve and pressure control valve. Tighten all fittings.

Tighten cap screws securing control valve to axle housing.

Run loader to check for proper operation and leaks.

LOCTITE is a trademark of the Loctite Corp.

HYDRAULIC CYLINDERS



1—Stop Nut
2—Piston Retainer
3—O-Ring
4—Barrel
5—Snap Ring
6—V-Packing
7—Snap Ring
8—Wiper Seal
9—Rod Guide
10—Wear Ring
11—Backup Washer
12—O-Ring
13—Piston
14—V-Packing
15—Wear Ring

Fig. 7-Cutaway View of Assembled Loader Boom Cylinder

GENERAL INFORMATION

The hydraulic cylinders are double acting with V-packings. Piston pins are heat treated, chrome plated and polished. Replaceable non-metallic wear rings are used on the piston retainers to prevent scoring of the cylinder barrels.

FOS

See "Hydraulic Cylinders" in FOS Manual "HYDRAULICS" for additional information on cylinders.

REMOVAL

CAUTION: Be sure the engine is stopped and the bucket is resting on the ground before attempting to remove cylinders.

Operate the control valve levers until all hydraulic pressure is relieved.

Remove the hoses and cap them to prevent dirt from entering the system. Remove the pins from each end of the cylinder and move the cylinder to a clean disassembly area.

REPAIR

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filters.

Clamp the cylinder in a vise to prevent it from turning. Use a spanner wrench to loosen rod guide or spanner nut.

Clamp the cylinder rod end in a vise, taking care to prevent damage to the piston rod. Remove nut from end of rod. Slide parts from rod.

Wash all parts thoroughly with diesel fuel and inspect the following:

1. Check barrel, rod guide, and rod for scoring and O-rings for surface damage.

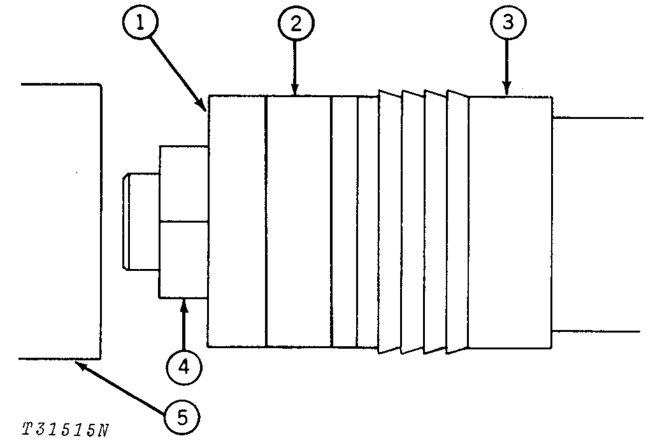
2. Check V-packings and wear rings for breaks, cuts, or foreign material.

3. Check piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.

ASSEMBLY

Repair kits are available for overhauling all cylinders. Discard used parts and use all new parts provided in kits when assembling cylinders.

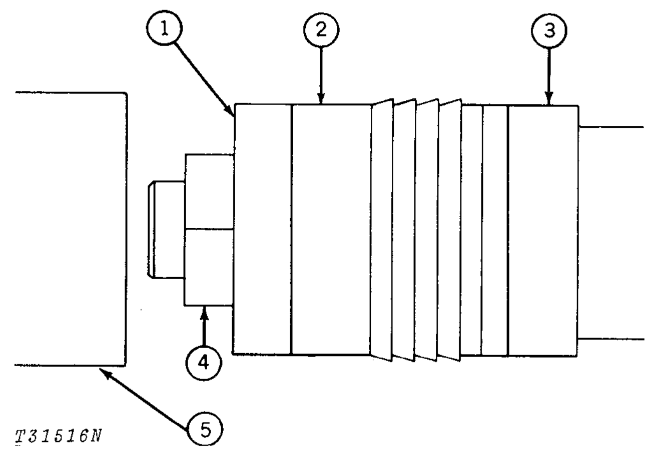
Lubricate all O-rings, seals, and packings before assembly.



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 8-Original Installation of V-Packing

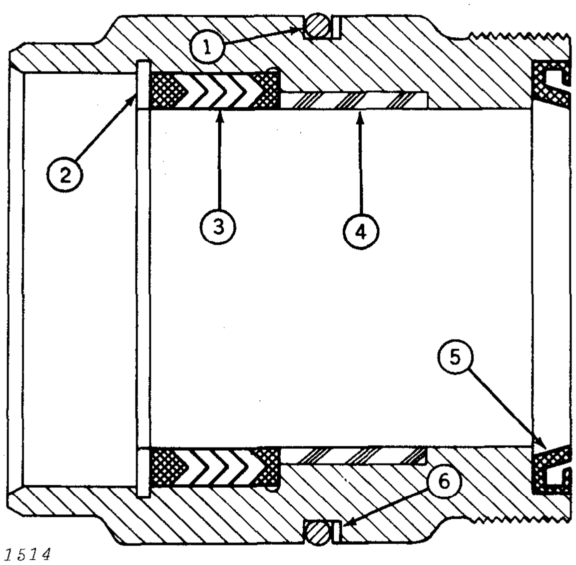
V-packings are originally installed on the piston with the apex of the V pointing away from the barrel (Fig. 8). When replacing V-packings in the field this procedure can be used if a suitable ring compressor is available to compress packings during installation.



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 9-Installation of V-Packing Without Compressor

If a suitable compressor is not available, assemble the packings with the apex of the V pointing toward the barrel (Fig. 9). This eliminates scuffing that may occur in assembly; however, the V-packing may become torn if the cylinder has to be disassembled in the future.



1—O-Ring
2—Snap Ring
3—V-Packing
4—Wear Ring
5—Wiper Seal
6—Backup Washer

Fig. 10-Rod Guide Components

Install new wiper seal in rod guide.

Install new wear ring in rod guide. Position backup washer and O-ring on rod guide.

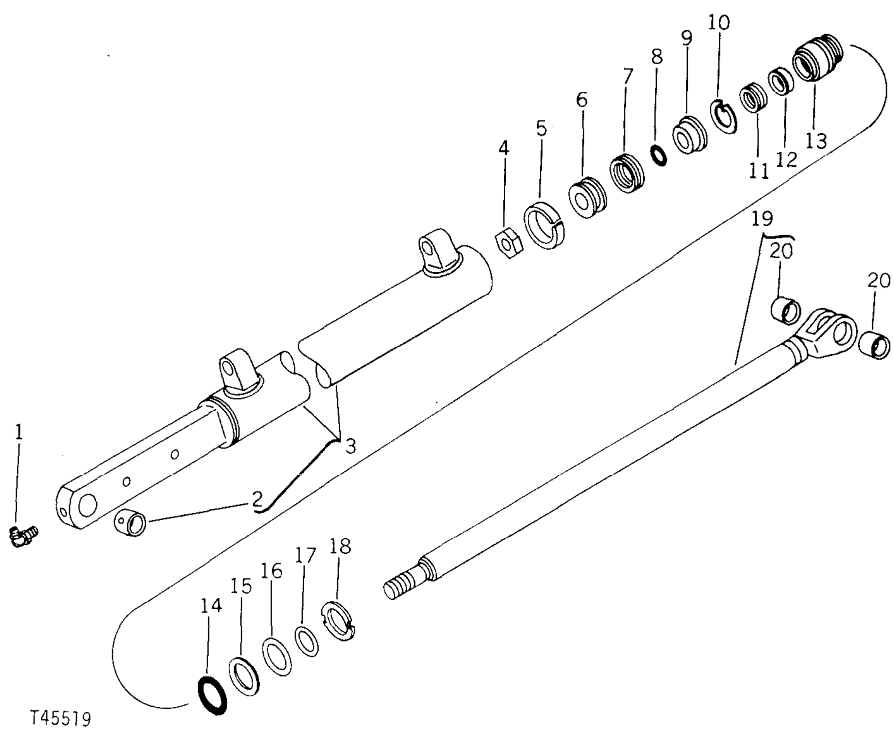
Install V-packing in rod guide with the apex of the V toward the wear ring and secure with snap ring.

Slip rod guide assembly on piston rod being careful not to damage packing.

Position piston on piston rod. Install wear ring on piston retainer. Position retainer on piston rod and secure with stop nut. Tighten to 475 to 575 lb-ft (644 to 780 Nm) (66 to 79 kg/m).

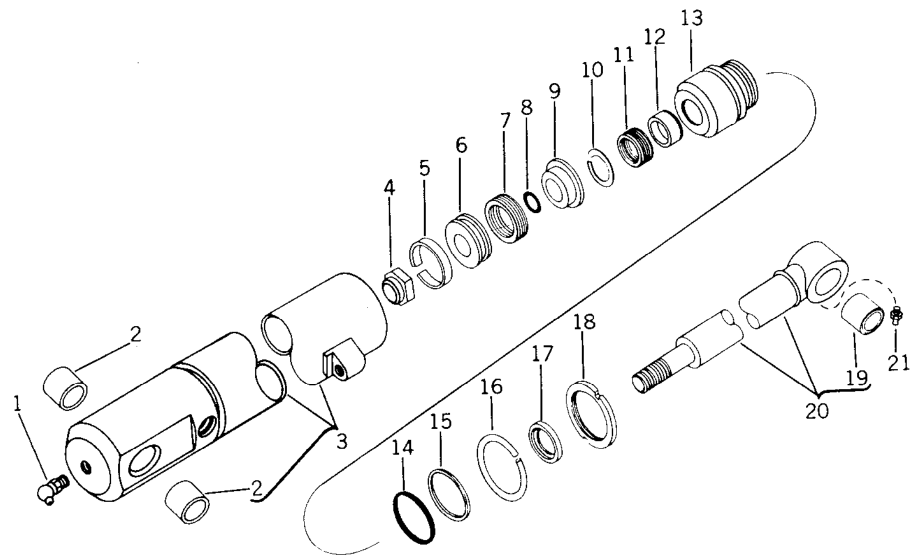
Install piston rod assembly into barrel.

Secure piston rod assembly in barrel with snap ring (if used) and spanner nut or with rod guide. Tighten nut to 150 lb-ft (203 Nm) (21 kg/m).



1—Grease Fitting
2—Bushing
3—Barrel
4—Stop Nut
5—Wear Ring
6—Piston Retainer
7—V-Packing
8—O-Ring
9—Piston
10—Snap Ring
11—V-Packing
12—Wear Ring
13—Rod Guide
14—O-Ring
15—Backup Washer
16—Snap Ring
17—Wiper Seal
18—Spanner Nut
19—Rod Assembly
20—Bushing (2 used)

Fig. 11-Loader Bucket Cylinder Assembly



1—Grease Fitting	**6—Piston**	**11—V-Packing**	**16—Snap Ring**
2—Bushing (2 used)	**7—V-Packing**	**12—Wear Ring**	**17—Wiper Seal**
3—Barrel and Head	**8—O-Ring**	**13—Rod Guide**	**18—Spanner Nut**
4—Lock Nut	**9—Piston**	**14—O-Ring**	**19—Bushing (2 used)**
5—Bearing Ring	**10—Snap Ring**	**15—Leather Backup Washer**	**20—Piston Rod**
			21—Grease Fitting

Fig. 12-Loader Boom Cylinder Assembly

INSTALLATION

Place the cylinder in position on the machine and align the attaching holes. Insert pivot pins and secure with cap screws. Connect the hydraulic lines, making sure they are connected to the same ends of the cylinder from which they were removed.

After installing the cylinder, operate the cylinder several times to remove air from the system. Add oil to the reservoir to bring it up to the proper level.

Group 3199
SPECIFICATIONS AND SPECIAL TOOLS

CONTROL VALVE LINKAGE

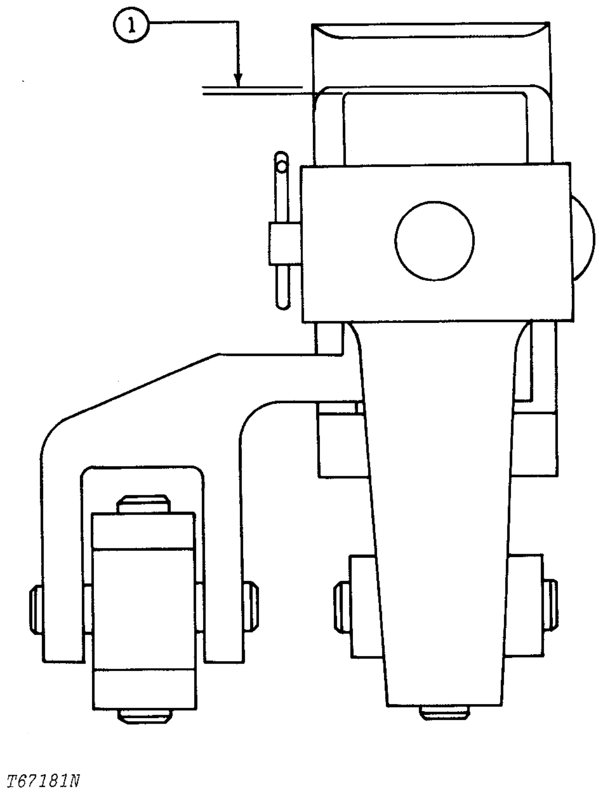


Fig. 1-Pivot Block Endplay

1 - Maximum end play of pivot block .... 0.04 in. (1 mm)

LOADER FRAMES

SPECIFICATIONS AND TORQUE VALUES

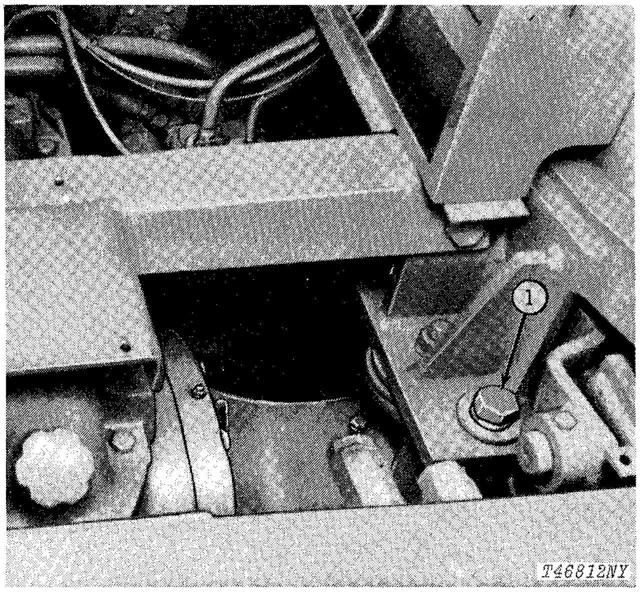


Fig. 2-Loader Frame Rear Attaching Point

1 - Loader frame rear attaching points .... 445 lb-ft (603 Nm) (62 kg-m)

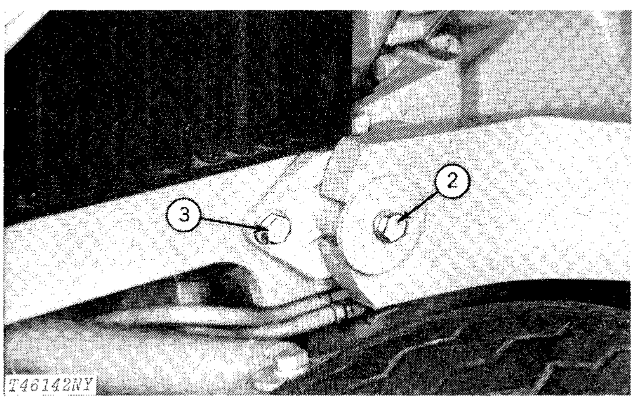


Fig. 3-Loader Frame Front Attaching Points

2 - Loader side frame to side rail cap screws .... 250 lb-ft (339 Nm) (35 kg-m)

3 - Side rail mounting cap screws .... 250 lb-ft (339 Nm) (35 kg-m)

LOADER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES

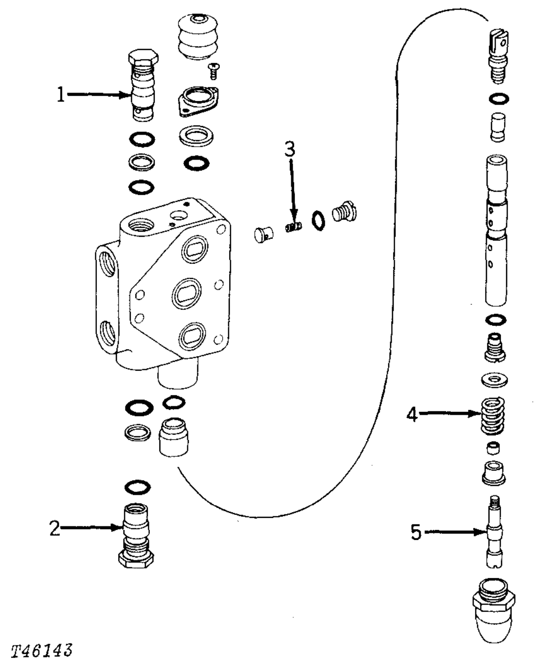


Fig. 4-Bucket Section of Loader Control Valve

Bucket Section

1 - Relief valve pressure .... 2750 psi (190 bar) (193 kg/cm²)

2 - Relief valve pressure .... 1500 psi (103 bar) (105 kg/cm²)

3 - Lift check spring
- Free length .... 0.692 in. (17.58 mm)
- Test length .... 0.625 in. (15.88 mm) with 0.75 lb. (3 N) (0.3 kg)

4 - Spool spring
- Free length .... 1.594 in. (40.49 mm)
- Test length .... 1.187 in. (30.15 mm) with 19.2 lb. (85 N) (9 kg)

5 - Spool screw torque (coat threads with Loctite) .... 5 to 8 lb-ft (7 to 11 Nm) (0.7 to 1 kg/m)

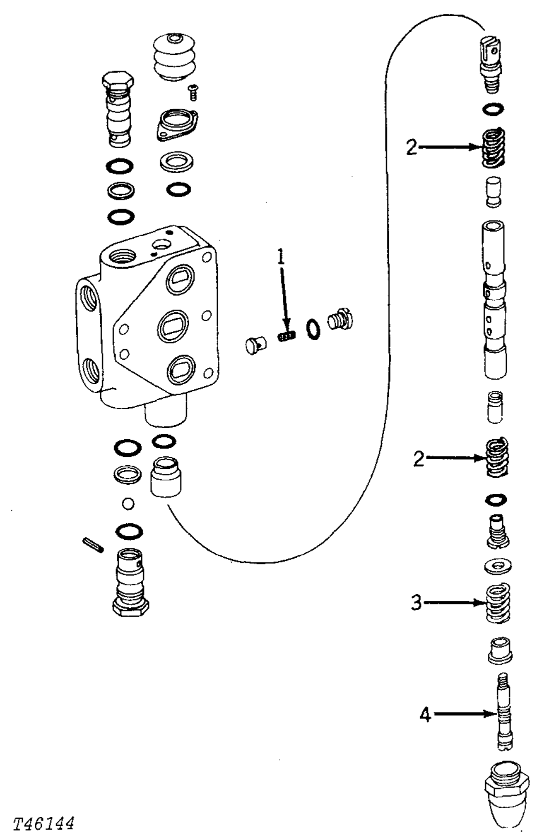


Fig. 5-Boom Section of Loader Control Valve

Boom Section

1 - Lift check spring
- Free length .... 0.692 in. (17.58 mm)
- Test length .... 0.625 in. (15.88 mm) with 0.75 lb. (3 N) (0.3 kg)

2 - Lift check springs
- Free length .... 1.094 in. (27.79 mm)
- Test length .... 0.843 in. (21.41 mm) with 0.5 lb. (2 N) (0.2 kg)

3 - Spool spring
- Free length .... 1.594 in. (40.49 mm)
- Test length .... 1.187 in. (30.15 mm) with 19.2 lb. (85 N) (9 kg)

4 - Spool screw torque (coat threads with Loctite) .... 5 to 8 lb-ft (7 to 11 Nm) (0.7 to 1 kg/m)

LOADER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES—Continued

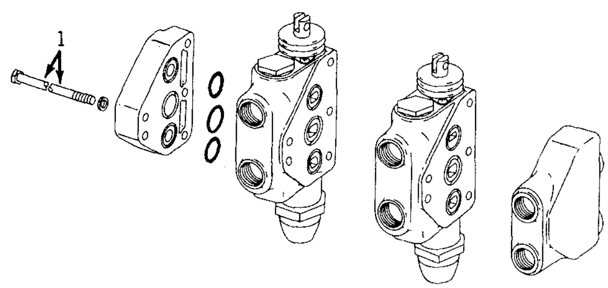


Fig. 6-Control Valve Tie Bolt

1 - Tie bolt torque .... 20 to 25 lb-ft (27 to 34 Nm) (3 to 4 kg/m)

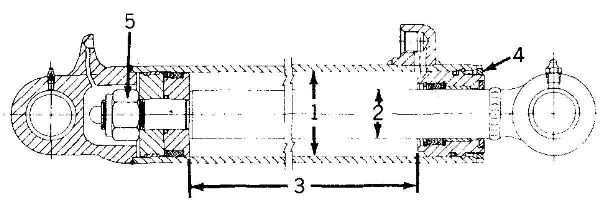


Fig. 7-Cylinder (Boom Cylinder Illustrated)

Boom Cylinder

1 - Cylinder bore (-291985) .... 3.0 in. (76 mm)
(291986-) .... 3.25 in. (82.5 mm)

2 - Rod diameter .... 1.75 in. (44.5 mm)

3 - Cylinder stroke .... 28.68 in. (728.5 mm)

4 - Spanner nut torque .... 150 lb-ft (203 Nm) (21 kg/m)

5 - Stop nut torque .... 475 to 575 lb-ft (644 to 780 Nm) (66 to 79 kg/m)

Bucket Cylinder

1 - Cylinder bore (-291985) .... 3.0 in. (76 mm)
(291986-) .... 3.25 in. (82.5 mm)

2 - Rod diameter .... 1.75 in. (44.5 mm)

3 - Cylinder stroke .... 16.14 in. (410 mm)

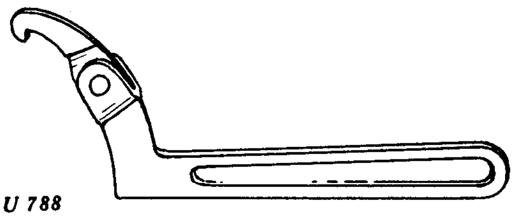
4 - Spanner nut torque .... 150 lb-ft (203 Nm) (21 kg/m)

5 - Stop nut torque .... 475 to 575 lb-ft (644 to 780 Nm) (66 to 79 kg/m)

LOADER HYDRAULICS

SPECIAL TOOLS

Convenience Tools

Tool	Tool No.	Use
 U 788 Fig. 8-Spanner Wrench	D-01053AA	Remove and install cylinder spanner nuts

Section 33
*9405 BACKHOE

CONTENTS OF THIS SECTION

**Early 310A units having backhoe serial number plates are equipped with the 9500 Backhoe. (See Section 33A for repair of this backhoe.)*

Later 310A units not having backhoe serial number plates are equipped with the 9405 Backhoe.

All 310B units are equipped with the 9405 Backhoe.

Group 3302
BUCKETS

GENERAL INFORMATION

There are standard, heavy duty or ejector buckets available on the 9405 Backhoe.

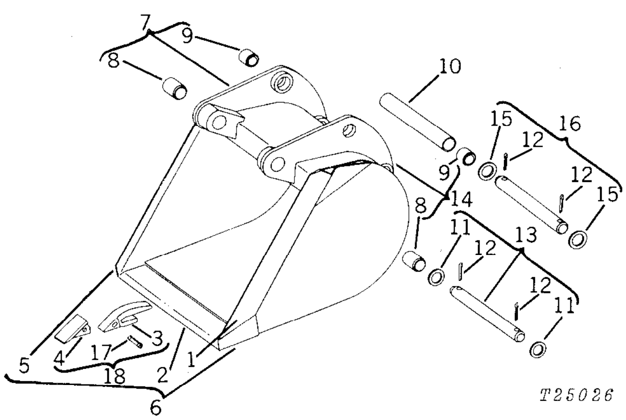
REMOVAL

Lower boom and dipperstick to position bucket on the ground.

CAUTION: Relieve hydraulic pressure on the bucket before removing the retaining pins.

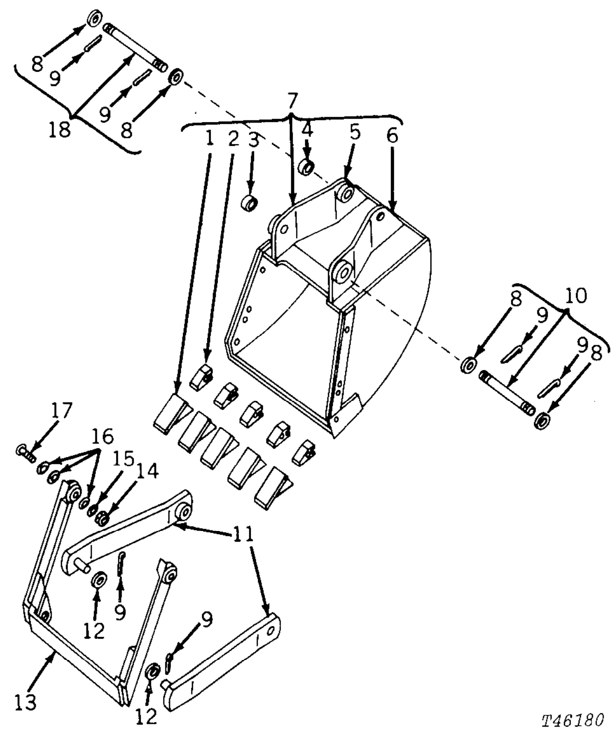
REPAIR

Refer to Fig. 1 or 2 during disassembly and assembly. Inspect all parts for excessive wear or damage and replace as necessary.



1—R.H. Side Cutting Edge
2—Front Cutting Edge
3—Tooth Shank
4—Tooth Tip
5—L.H. Side Cutting Edge
6—Bucket
7—L.H. Pivot Plate
8—Bushing (2 used)
9—Bushing (4 used)
10—Spacer
11—Backup Washer (2 used)
12—Cotter Pin (4 used)
13—Pin
14—R.H. Pivot Plate
15—Backup Washer (2 used)
16—Pin
17—Flex Pin
18—Tooth Assembly

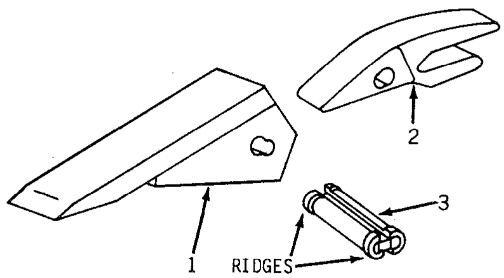
Fig. 1-Standard Bucket (with curved pivot plates)



1—Tooth Tip (Welded) (5 used)
2—Tooth Shank (5 used)
3—Bushing (2 used)
4—Bushing (2 used)
5—L.H. Pivot Plate
6—R.H. Pivot Plate
7—Ejector Bucket
8—Special Washer (4 used)
9—Cotter Pin (6 used)
10—Link Pin (To Dipperstick)
11—Ejector Blade Link (2 used)
12—Special Washer (2 used)
13—Ejector Blade
14—Nut (2 used)
15—Lock Washer (2 used)
16—Washer (6 used)
17—Bolt (2 used)
18—Control Link to Bucket Pin

Fig. 2-Ejector Bucket

Backhoe Bucket Tooth Assembly - Heavy-Duty Buckets



T44120N

1—Tooth Tip
2—Tooth Shank
3—Flex Pin

Fig. 3-Tooth Assembly

To fasten the tooth tip to shank, drive the flex pin in, making sure that the ridges face toward the tooth tip as shown in Fig. 3. The ridges are the locking mechanism.

NOTE: If "back" is stamped on the pin, it should face toward the shank.

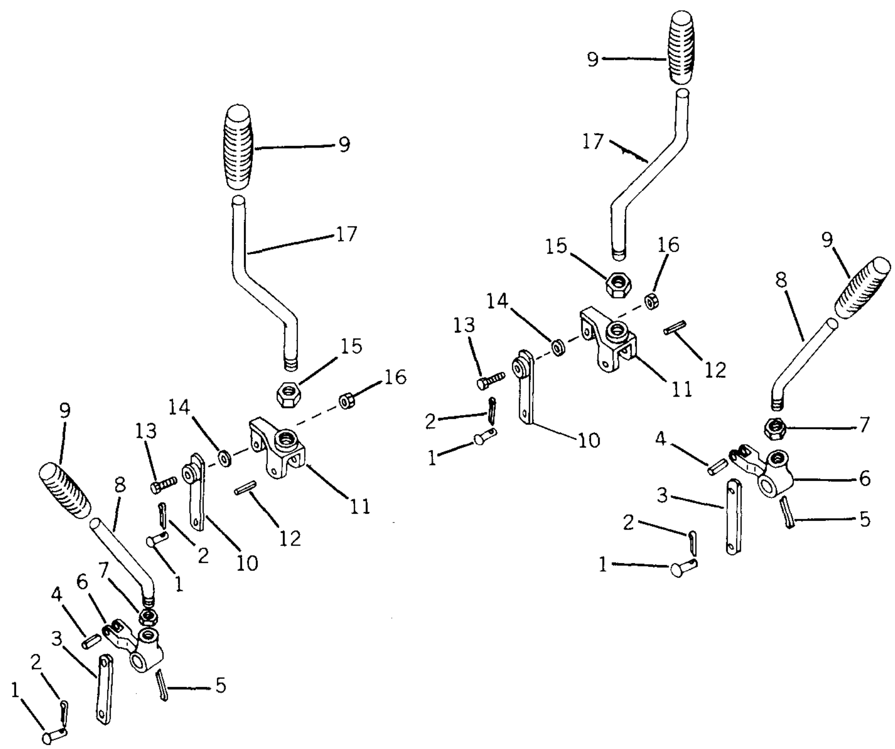
INSTALLATION

Align dipperstick to bucket and insert retaining pins.

Grease all fittings before operation.

Group 3315
CONTROLS LINKAGE

REPAIR



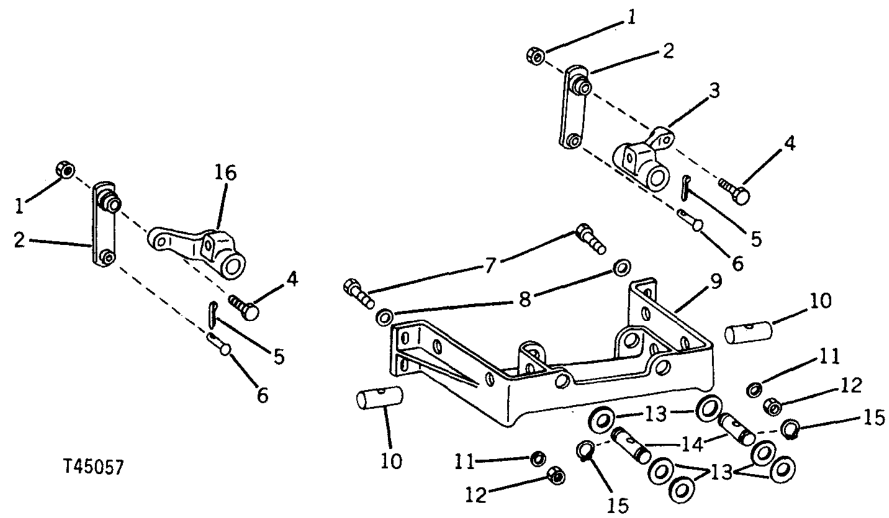
1—Connector Pin (4 used)
2—Cotter Pin (4 used)
3—Stabilizer Lever Connector Link (2 used)
4—Spring Pin (2 used)
5—Cotter Pin (2 used)
6—Stablizer Lever Handle Mount (2 used)
7—Jam Nut (2 used)
8—Stabilizer Control Lever (2 used)
9—Lever Hand Grip (4 used)
10—Four-Way Lever Control Link (2 used)
11—Four-Way Lever Handle Mount (2 used)
12—Groove Pin (2 used)
13—Cap Screw (2 used)
14—Spacer Washer (2 used)
15—Nut (2 used)
16—Nut (2 used)
17—Four-Way Lever (2 used)

Fig. 1 - Control Levers and Linkage

Refer to Figs. 1 and 2 during disassembly and assembly of control linkage.

Inspect control valve linkage for worn or damaged parts.

Coat shafts and movable linkage parts with grease before assembly.



1—Nut (2 used)
2—Four-Way Lever Connector Link (2 used)
3—R.H. Pivot Link
4—Cap Screw (2 used)
5—Cotter Pin (2 used)
6—Connector Pin (2 used)
7—Cap Screw (4 used)
8—Washer (4 used)
9—Lever Mounting Frame
10—Stabilizer Lever Pivot Shaft (2 used)
11—Lock Washer (4 used)
12—Nut (4 used)
13—Washer (6 used)
14—Four-Way Lever Pivot Shaft (2 used)
15—Snap Ring (4 used)
16—L.H. Pivot Link

Fig. 2-Lever Mounting Frame

Group 3340
FRAMES

MAIN FRAME

GENERAL INFORMATION

Follow all precautions concerning safety, cleanliness, and general mechanical procedures.

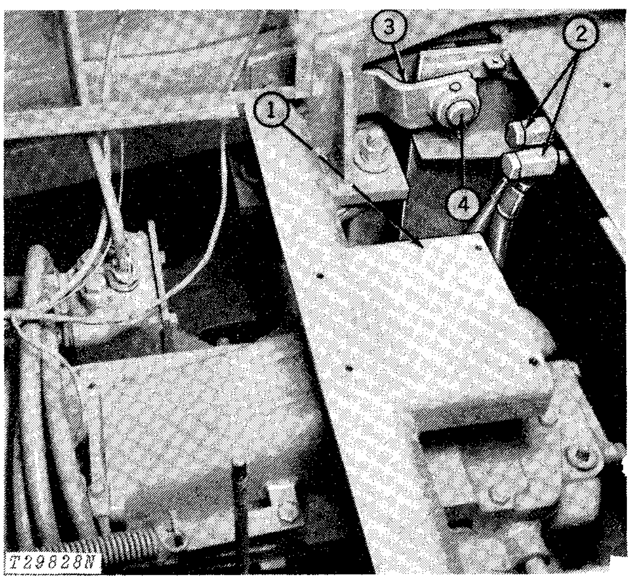
Have several metal support stands and adequate supply of blocking available for supporting the heavy components of this machine.

To speed up separation, first take time to remove grease, dirt, or debris from the machine.

REMOVAL

1. Drive machine to an area where the backhoe can be safely supported and blocked.

2. Extend dipperstick and boom to maximum extended position with bucket resting on floor.



1—Lower Mounting Pins
2—Hydraulic Hoses
3—Tie Bar
4—Tie Bar Mounting Pins

Fig. 1-Backhoe Mounting
(Seat and platform removed to illustrate mounting points)

3. Lower stabilizers to the floor and apply just enough hydraulic pressure to take the weight off the mounting pins for easy removal.

4. Place heavy blocking under backhoe main frame to support unit.

5. Remove cab as described in Group 1810.

6. Remove the two lower rear pins on each side connecting the backhoe frame to loader frame (Fig. 1). To facilitate removal of the pins, align the cutout of the rear wheels with the pins.

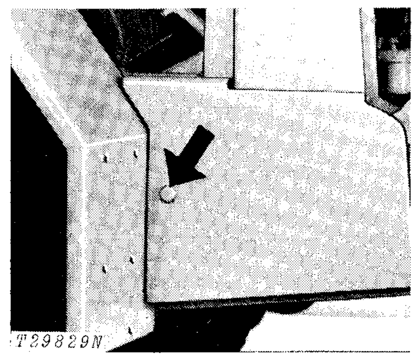


Fig. 2-Tie Bar Pin

7. Remove the two tie bar pins from the loader frame, Fig. 2.

NOTE: Tie bars will come off with backhoe.

8. Carefully move the tractor away from the backhoe unit (with hoses attached) until the backhoe is clear of the loader frame. Do not separate far enough to stretch the hoses.

9. Operate stabilizer controls to permit backhoe to rest solidly on the blocking.

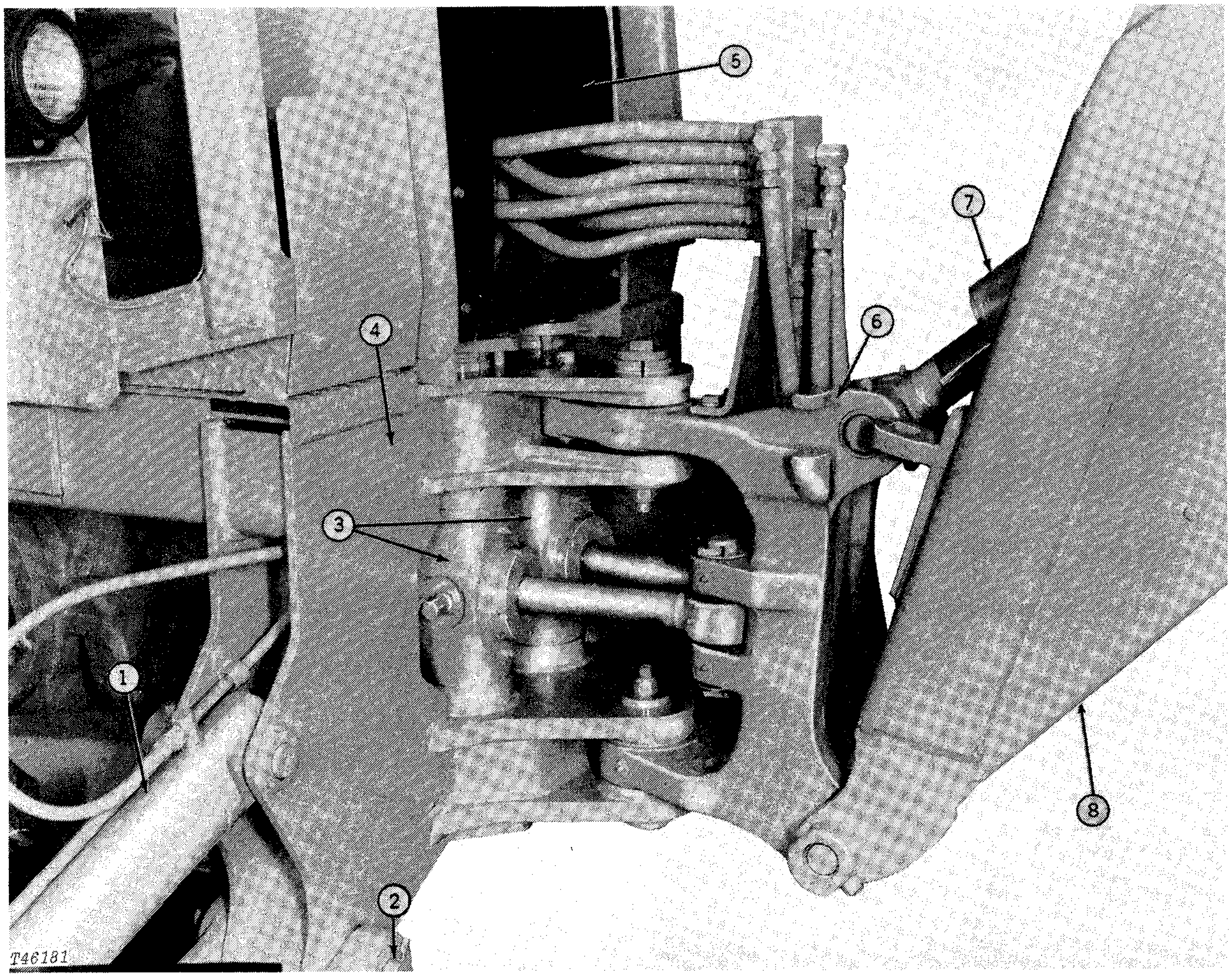
CAUTION: Be sure to discharge hydraulic function accumulator before disconnecting hoses. This can be done by operating stabilizer control until control response ceases.

10. Disconnect backhoe pressure and return lines at junction shown in Fig. 1.

11. Plug backhoe hydraulic lines to prevent dirt from entering the system.

12. Plug pressure and return lines on machine so that machine may be moved.

DISASSEMBLY



1—Stabilizer Cylinder
2—Stabilizer Pin
3—Swing Cylinders
4—Main Frame
5—Valve Assembly
6—Boom Pivot
7—Boom Cylinder
8—Boom

Fig. 3 - Backhoe

Support boom and dipperstick with a hoist or blocks. Support main frame with blocks.

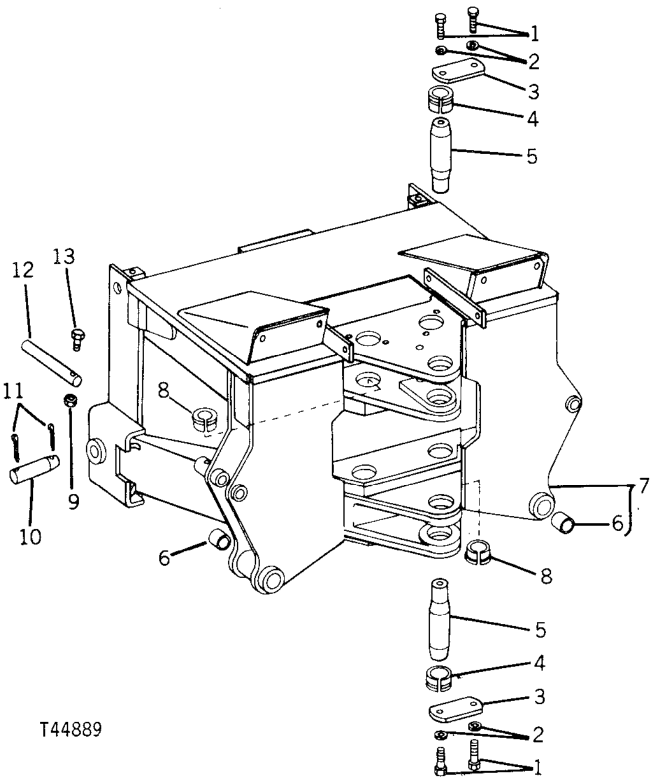
Drive out pins connecting boom pivot to main frame and remove boom and boom pivot as a unit.

Remove valve assembly.

Remove stabilizer and stabilizer cylinders.

REPAIR

Refer to Fig. 4 during disassembly and assembly of main frame.



1—Cap Screw (8 used)
2—Lock Washer (8 used)
3—Wedge Retainer (4 used)
4—Outer Tapered Sleeve (4 used)
5—Swing Cylinder Pin (4 used)
6—Bushing (4 used)
7—Main Frame
8—Inner Tapered Sleeve (4 used)
9—Lock Nut (2 used)
10—Frame to Tractor Pin (2 used)
11—Cotter Pin (4 used)
12—Stabilizer Cylinder Pin (2 used)
13—Cap Screw (2 used)

Fig. 4-Main Frame

MOVABLE FRAME

BOOM PIVOT

Removal

Remove boom and dipperstick.

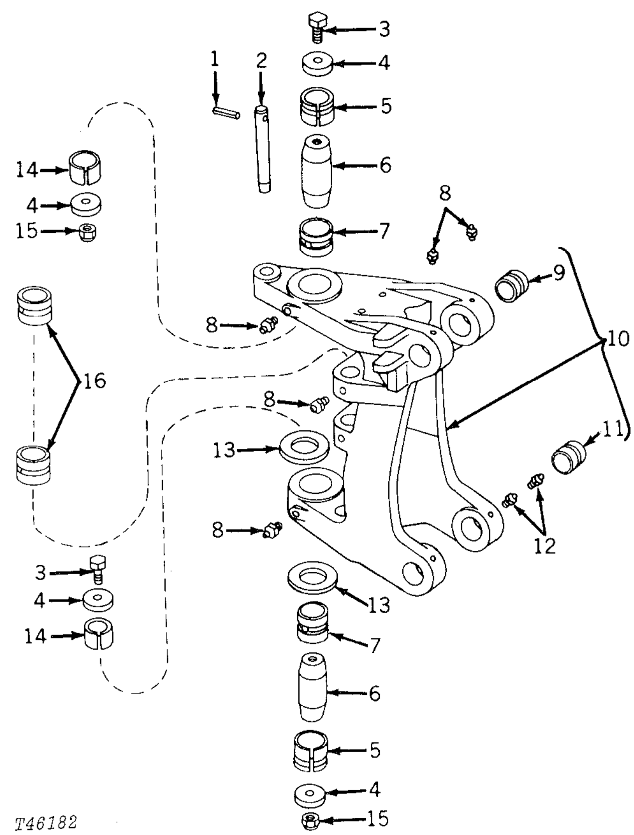
Disconnect hydraulic hoses.

Remove swing cylinder pins.

Attach hoist to boom pivots and remove pins.

Repair

Refer to Fig. 5 for disassembly and assembly of boom pivot.



1—Spring Pin
2—Swing Lock Pin
3—Hex. Bolt (2 used)
4—Special Washer (4 used)
5—Outer Tapered Sleeve (2 used)
6—Swing Frame Pin (2 used)
7—Bushing (2 used)
8—Grease Fitting (8 used)
9—Bushing (2 used)
10—Swing Frame
11—Bushing (2 used)
12—Grease Fitting (2 used)
13—Thrust Washer (2 used)
14—Inner Tapered Sleeve (2 used)
15—Special Nut (2 used)
16—Bushing (4 used)

Fig. 5-Boom Pivot

Removing And Installing Tapered Pins And Bushings

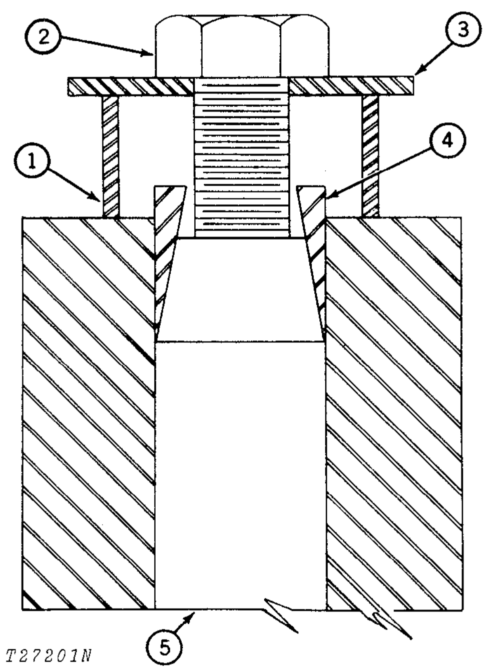
The procedures for removing tapered pins and bushings are as follows:

Remove cap screw (2, Fig. 6) from tapered pin (5).

Place a short piece of pipe (1) around the tapered bushing (4). Lay a piece of steel plate (3) with a hole in the center over the pipe (1). Insert a long cap screw (2) through the hole in the steel plate (3).

IMPORTANT: To avoid damaging the threads in the tapered pin, be sure several threads of the cap screw are engaged sufficiently before applying force.

Screw cap screw (2) into tapered pin (5) until the pin and bushing are pulled from the bore.



1—Pipe
2—Cap Screw
3—Steel Plate
4—Tapered Bushing
5—Tapered Pin

Fig. 6-Pulling Tapered Pins and Bushings

Whenever it is not possible to remove tapered pins and bushings by the first method, use the second procedure outlined as follows:

Place a pipe spacer or washer (1, Fig. 7) between the cap screw (2) and tapered pin (4). This will transfer the force applied at the cap screw to the tapered pin and not the bushing.

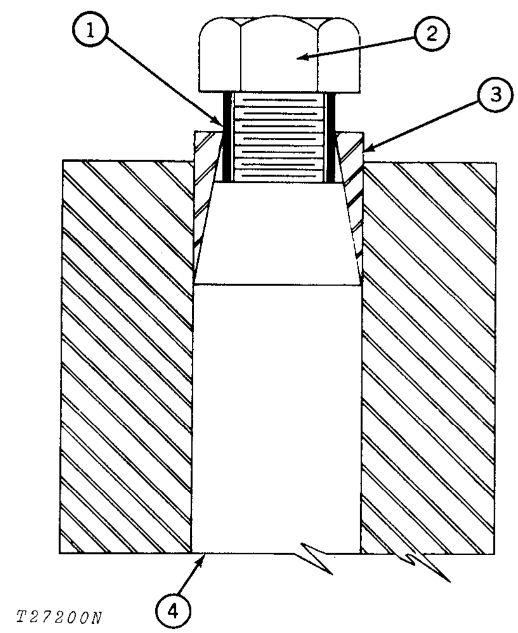
Tighten cap screw to standard torque.

Strike head of cap screw to drive tapered pin and bushing from bore.

If neither of the two procedures will remove tapered pin and bushings, use both procedures simultaneously.

When installing tapered pins use the following procedure:

1. Before inserting pins and bushings, be sure bushing bores are clean, dry and unpainted.



1—Pipe Spacer or Washers
2—Cap Screw
3—Tapered Bushing
4—Tapered Pin

Fig. 7-Removing Tapered Pins and Bushings

2. Assemble parts loosely. Center pin assembly in pin joint within 0.12 inch (3.05 mm).

3. Tighten bolts as follows:

   a. Tighten all bolts associated with the tapered pin assembly to a minimum of one-half the standard torque.

   b. Shock both wedge bushings with a brass, lead, or aluminum hammer.

      (1) If the washers are accessible and large enough, strike both washers in three places.

      (2) If the washers are not accessible or are too small to strike directly, place a spacer over the bolt head or bolt nut and strike the spacer three times.

   NOTE: Do not pound on bolt head or nut.

   c. Tighten bolts to full torque.

   d. Repeat step b.

   e. Check torque.

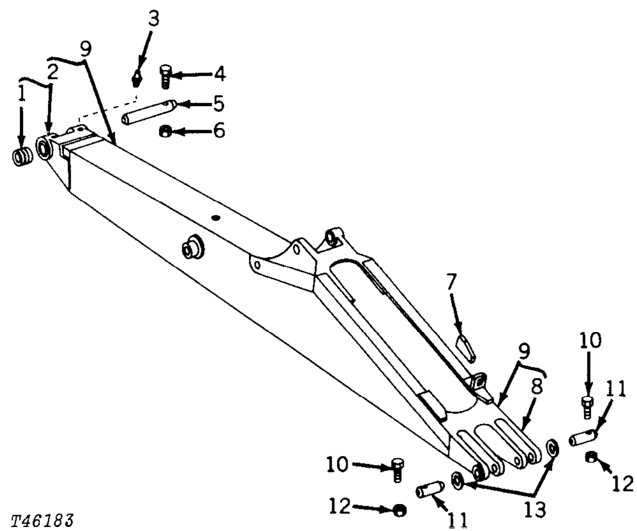
   f. Repeat steps b and c alternately until shocking the assembly does not reduce the torque reading on bolts.

   g. Recheck for centered position.

BOOM

Repair

Refer to Fig. 8 during disassembly and assembly of the boom.



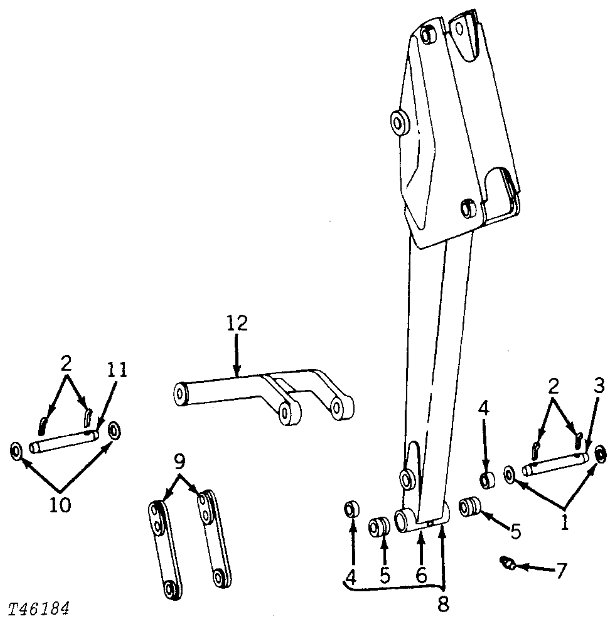
1—Bushing (2 used)
2—Boom Upper Pivot
3—Grease Fitting (2 used)
4—Cap Screw
5—Pivot Pin
6—Special Nut
7—Boom Wedge
8—Boom Lower Pivot
9—Boom Assembly
10—Cap Screw (2 used)
11—Boom Pivot Pin (2 used)
12—Stop Nut (2 used)
13—Backup Washer (use as required)

Fig. 8-Boom

DIPPERSTICK

Repair

Refer to Fig. 9 during disassembly and assembly of the dipperstick.



1—Special Washer (2 used)
2—Cotter Pin (4 used)
3—Pin
4—Bushing (2 used)
5—Bushing (2 used)
6—Pivot End
7—Grease Fitting
8—Dipperstick
9—Coupler Links (2 used)
10—Special Washer (2 used)
11—Pin
12—Guide Link

Fig. 9-Dipperstick

EXTENDIBLE DIPPERSTICK

General Information

The extendible dipperstick assembly increases the backhoe digging depth by four feet (1.2 m). In addition, it permits digging of square holes, provides higher truck-loading clearance, and more reach for placement of spoil. The John Deere backhoe functions remain the same and a separate foot-operated valve is used to extend and retract the dipperstick. The extendible dipperstick can be operated simultaneously with other backhoe functions.

Visual Inspection

With the extendible assembly extended all the way out, inspect the complete dipperstick for cracks. It may be necessary to steam-clean the telescoping portion of the extension to detect cracks or unusual wear.

Check all bearing plates (-368874), making sure they are tight and that they are at least 3/32-inch (2.4 mm) thick. To determine if they are loose, run the extension in and out a few inches in rapid succession (two people required for this job). If there is movement of the bearing plates, they must be tightened.

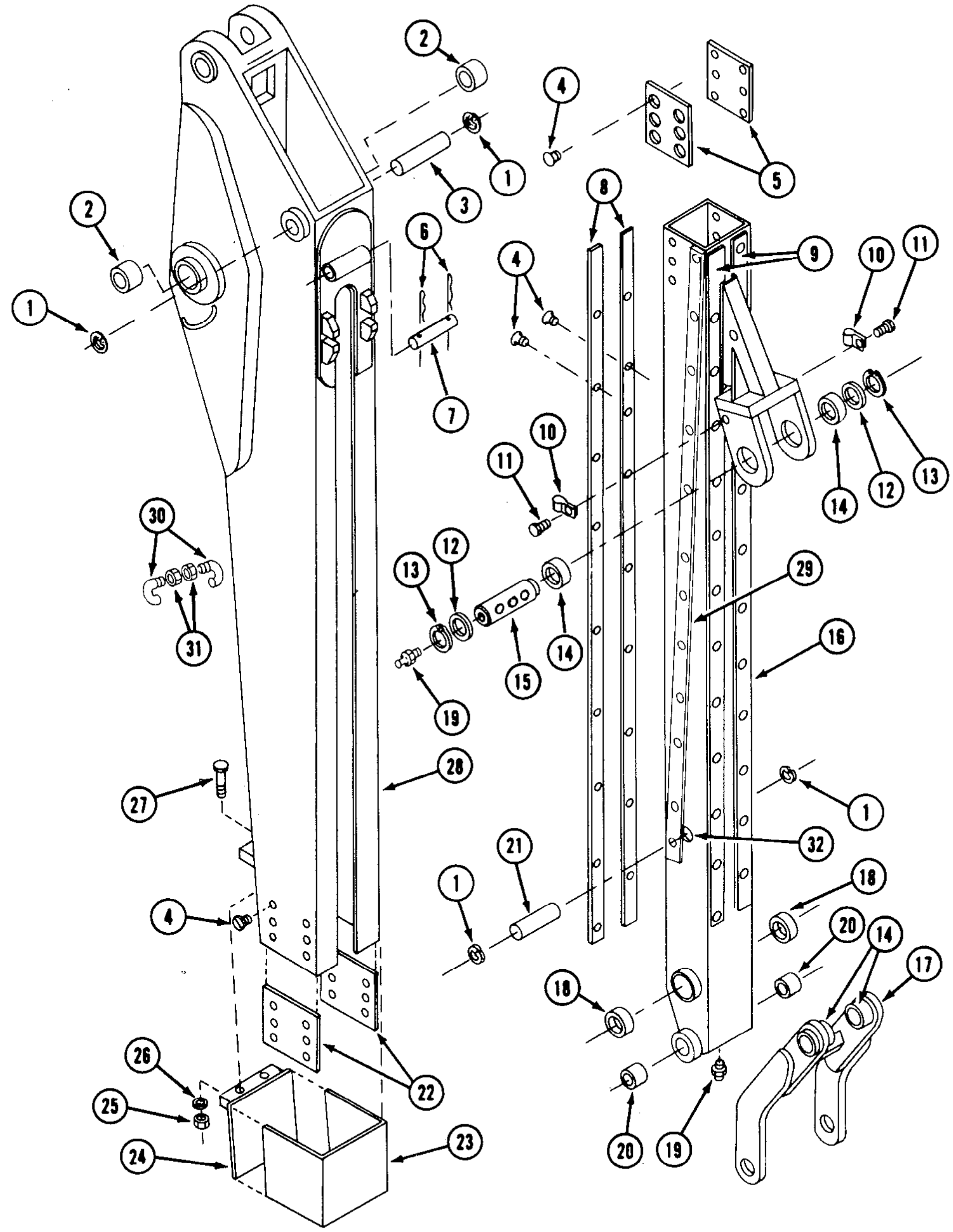
To tighten bearing plates, it is necessary to remove the collar (23, Fig. 10) from the end of housing. Cut the weld with a cutting torch or grind through it with a small abrasive disk and remove collar assembly.

After tightening the screws, stake with a center punch to prevent them from working loose. Replace all missing screws. Reinstall the collar assembly and reweld to housing area as necessary.

Newer units use bearing strips that are welded to telescoping extension assembly.

Check all strips for wear or weld separation. Replace or repair as necessary.

NOTE: If the telescoping extension assembly is to be removed, do not reinstall the collar assembly at this time.



1—Snap Ring (4 used)
2—Bushing (2 used)
3—Cylinder Pin
4—Machine Screw (60 used) (-368874)
5—Bearing Plate (2 used) (-368874)
6—Pin Clip (2 used)
7—Locking Pin
8—Lower Bearing Strip (2 used)
9—Upper Bearing Strip (2 used)
10—Hose Clamp (2 used)
11—Bolt (2 used)
12—Flat Washer (2 used)
13—Snap Ring (2 used)
14—Bushing (4 used)
15—Bucket Cylinder Pin
16—Telescoping Extension Assembly
17—Guide Link Assembly
18—Bushing (2 used)
19—Grease Fitting (2 used)
20—Bushing (2 used)
21—Cylinder Pin
22—Bearing Plate (2 used) (-368874)
23—Housing Collar
24—Collar Bottom Plate
25—Nut (2 used)
26—Washer (2 used)
27—Bolt (2 used)
28—Dipperstick Housing Assembly
29—Side Bearing Strip (2 used)
30—Hose Guide (2 used)
31—Nut (2 used)
32—Retaining Hole

Fig. 10-Extendible Dipperstick

Removal

Telescoping Extension Assembly

Extend telescoping extension assembly out far enough to gain access to pin (21, Fig. 10) securing extension cylinder to telescoping extension assembly.

Remove bucket from telescoping extension assembly.

Remove bucket cylinder from telescoping extension assembly.

Remove pin (21) securing extension cylinder to telescoping extension assembly.

Remove the collar assembly from the end of dipperstick housing. Cut the weld with a cutting torch or grind through it with a small abrasive disk and remove collar assembly.

Remove telescoping extension assembly from dipperstick housing assembly.

Dipperstick Housing Assembly

Remove pin (3) and lift extension cylinder from dipperstick housing assembly.

Remove pin securing crowd cylinder to dipperstick housing assembly.

Remove boom-to-housing pin and lift dipperstick housing assembly from boom.

Repair

Refer to Group 3360 to repair extension cylinder.

If bearing strips are fastened with cap screws, remove and discard the old bearing strips, special screws (4, Fig. 10), and bearing plates (5 and 22) from the telescoping extension and the dipperstick housing.

If bearing strips are welded, remove old bearing strips using a chisel. Grind all welds even with surface of extension.

Clean all surfaces of extension with solvent to remove oil and grease.

The welding equipment should be capable of D.C. polarity using a setting of 115-130 amps. Heat range may vary with the brand of welder used. The electrode specifications are as follows: For wire; 0.045 diameter #10 silicon - bronze (AWS A5-6). For rod; 1/8″ diameter #70 phosphor - bronze. AWS A5-6-69, A5-13-70, A5-15-69. Use reversed polarity, maintaining a close arc that is concentrated toward the brass as much as possible.

Install two bearing strips on the top and two on the bottom (8 and 9, Fig. 10). Install one strip on each side diagonally. Be sure that retaining hole (32) is not covered.

IMPORTANT: DO NOT weld both ends of each bearing strip. This will cause bowing and distortion. Weld one end first and then work to the other end with the bearing strips clamped in position every 12 in. (305 mm).

Weld ends of strips with a 0.187-in. (4.76 mm) fillet weld.

Use plug welds in all holes of each bearing strip. Fill each hole with weld.

Grind the top of each plug weld even with surface of bearing strips.

IMPORTANT: DO NOT use a conventional lubricant on bearing strips. A dry lubricant must be used to prevent abrasive wear caused by contamination collected by a conventional lubricant.

Use AT56125 Digmor Dry Lube or an equivalent on bearing strips.

Inspect pivot pins and bushings for bent or worn condition.

Inspect telescoping extension assembly and dipperstick housing assembly for cracks or other damage.

Make sure drain port on the lower end of the telescoping extension assembly is open and free from debris.

Replace parts as necessary.

Installation

Assemble telescoping extension into dipperstick.

Extend telescoping cylinder until it is aligned with the pin bosses. Install pin and snap ring.

Assemble collar housing and complete the installation of extendible dipperstick.

STABILIZERS

REMOVAL

Operate control lever to fully extend stabilizers.

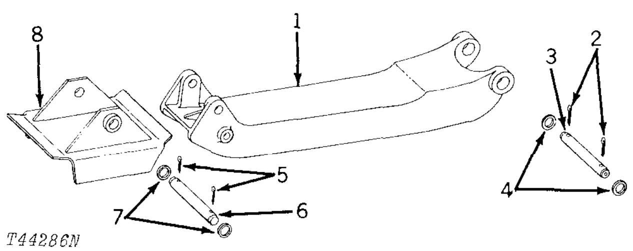
CAUTION: Stop engine and operate the stabilizer control lever to release hydraulic pressure.

Remove stabilizer pivot pin and stabilizer cylinder pin.

Lower stabilizer to ground.

REPAIR

Refer to Fig. 11 during disassembly and assembly of the stabilizers.



1—Stabilizer
2—Cotter Pin (2 used)
3—Stabilizer to Main Frame Pin
4—Washer (2 used)
5—Cotter Pin (2 used)
6—Stabilizer Foot Pivot Pin
7—Washer (2 used)
8—Stabilizer Foot

Fig. 11-Stabilizer

STABILIZER FEET

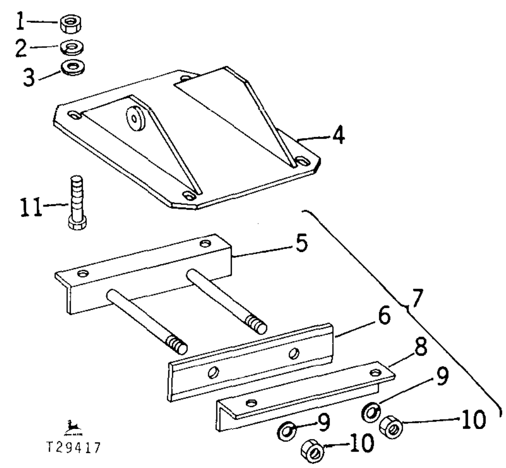
GENERAL INFORMATION

Street pads or reversible stabilizer feet are available on the 9405 Backhoe.

REPAIR

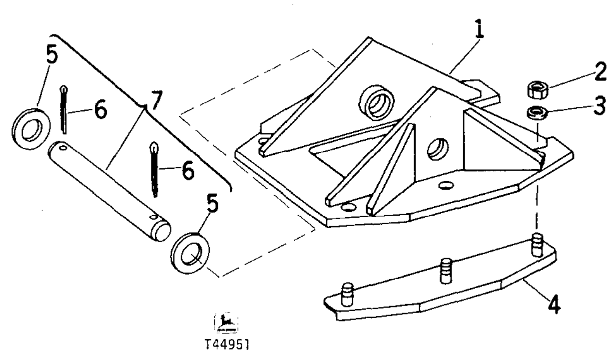
Refer to Figs. 12 or 13 during disassembly and assembly of stabilizer feet.

Install washers as necessary to provide tension between each stabilizer and reversible stabilizer foot so rotation does not occur during raising and lowering of stabilizer. (See PC-1930 for washer part number.)



1—Nut (4 used)
2—Lock Washer (4 used)
3—Washer (4 used)
4—Stabilizer Foot
5—Street Pad Angle Rod
6—Rubber Pad (14 used)
7—Street Pad Assembly
8—Street Pad Angle
9—Lock Washer (2 used)
10—Nut (2 used)
11—Cap Screw (4 used)

Fig. 12-Street Pads



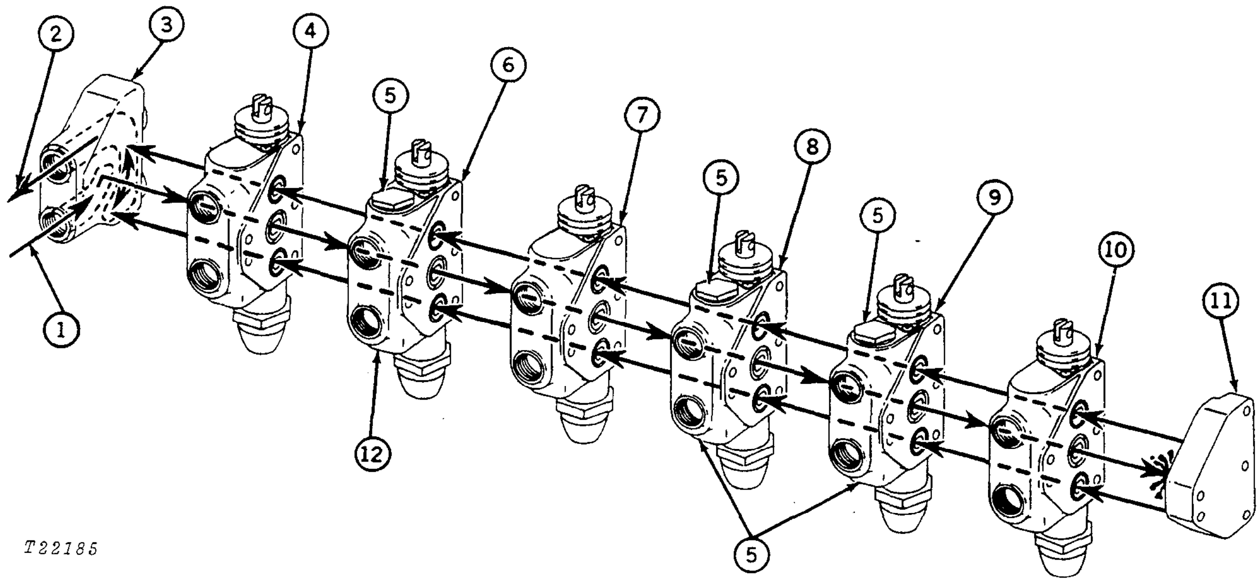
1—Stabilizer Foot
2—Nut (6 used)
3—Washer (6 used)
4—Street Pad (2 used)
5—Special Washer (2 used)
6—Cotter Pin (2 used)
7—Pin Assembly

Fig. 13-Reversible Stabilizer Feet

Group 3360
HYDRAULIC SYSTEM

CONTROL VALVE

GENERAL INFORMATION



1—Pressure Oil	**5—Relief Valve**	**9—Boom Valve**
2—Return Oil	**6—Crowd Valve**	**10—Stabilizer Valve**
3—Port Plate	**7—Bucket Valve**	**11—End Plate**
4—Stabilizer Valve	**8—Swing Valve**	**12—Plug**

Fig. 1-Oil Flow Through Backhoe Control Valve Stack

The backhoe hydraulic functions control valve is a closed-center, six spool, stack-type valve.

There is no continuous flow of oil through the closed-center control valve when the valve is in neutral. Because the main hydraulic pump delivers oil only on demand, oil flows through the control valve only when the control lever is moved.

Fig. 1 shows the flow of oil through the backhoe control valve with all valve sections in neutral. Note that the oil is blocked when it reaches the end plate.

Valve Construction

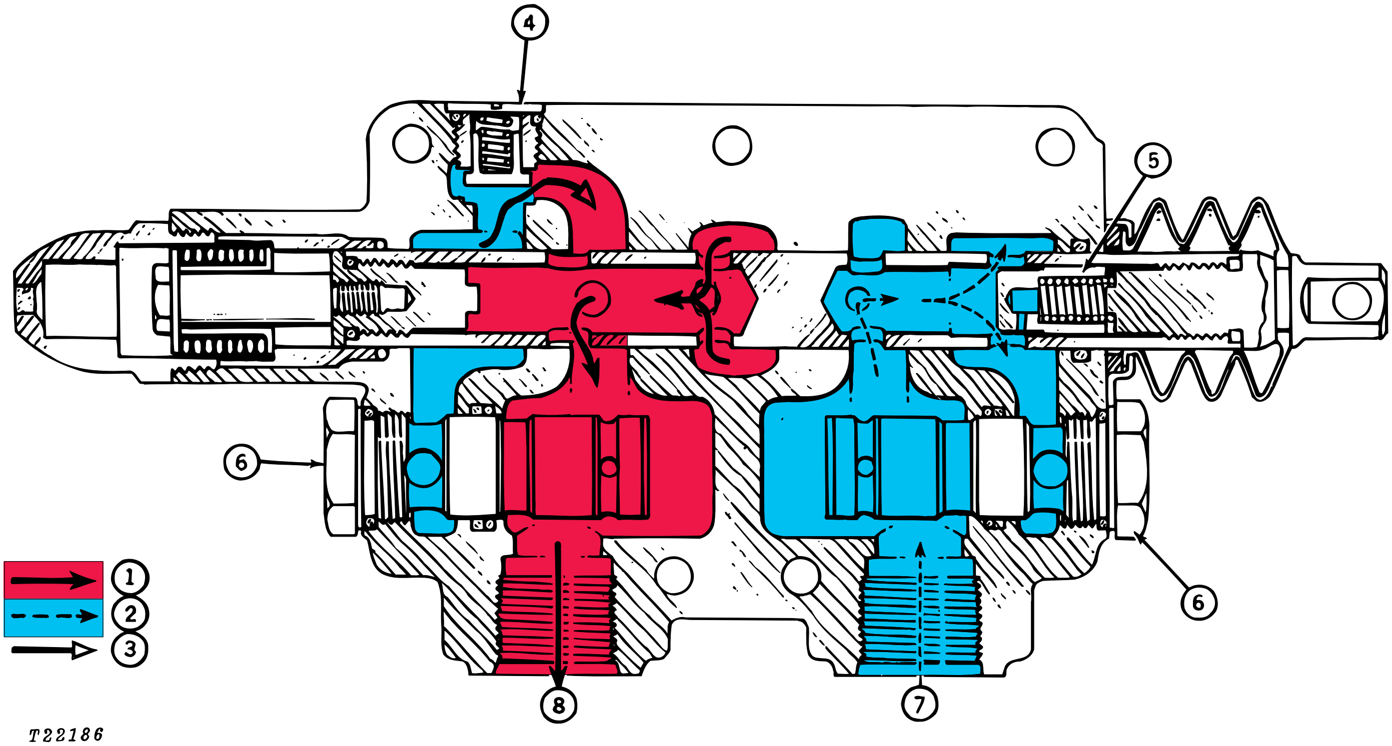
All valve sections are separate bodies containing single spools. All spools contain lift checks which serve as one-way valves to prevent drift or leakage of pressure oil to the port passages.

The crowd, boom, and swing sections each contain relief valves to protect their circuits from excessive pressures.

The stabilizer, and boom valve sections contain orifice plates to slow the action of the cylinders.

The boom and swing valve sections contain anti-cavitation check valves.

The pressure and return ports are both located in the port plate. The end plate on the control valve assembly is completely blocked.



1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Oil
4—Anti-Cavitation Check Valve
5—Lift Check
6—Relief Valve
7—From Cylinder
8—To Cylinder

Fig. 2-Boom Section (Lowering Circuit Shown)

Figs. 2 and 3 illustrate the boom and swing valve. Although there are slight mechanical variations, oil flow through the other valve sections is similar.

Boom Section

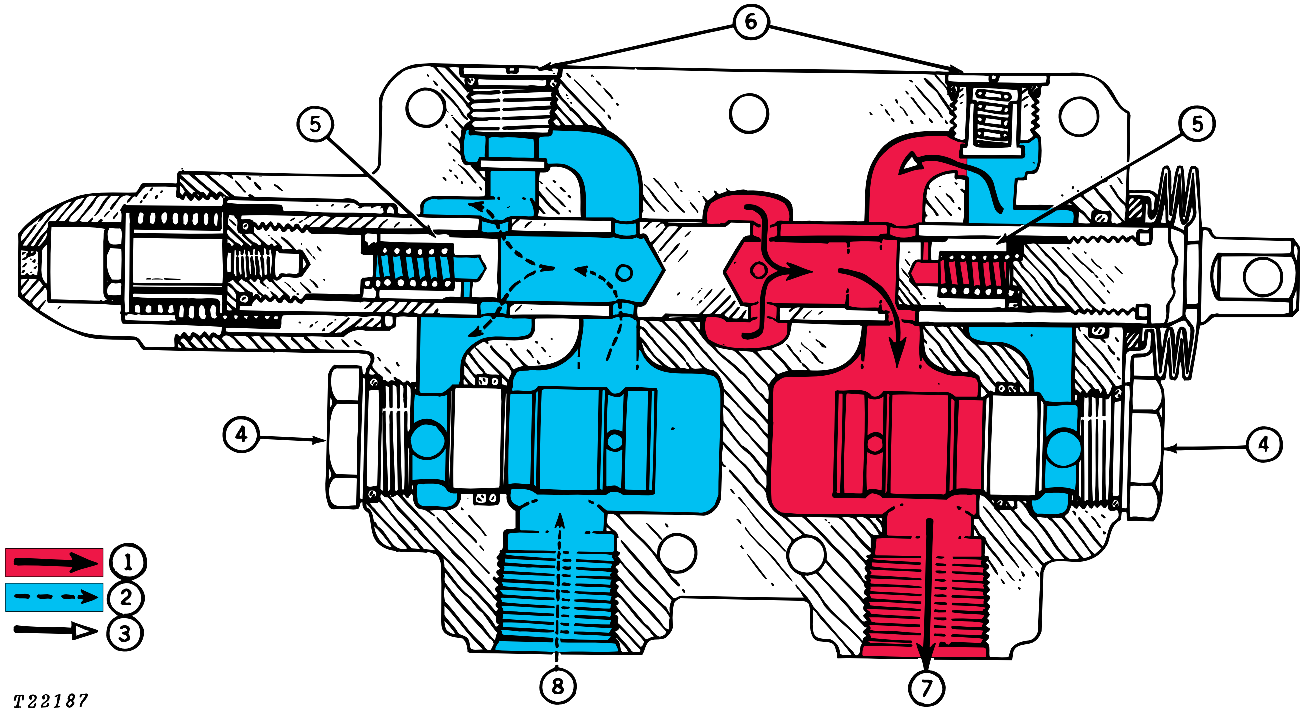
When the boom spool is extended or retracted to lower or raise the boom, the pump moves oil to the control valve. Oil is then directed through the lift check to the boom cylinder.

Displaced oil from the cylinder is forced back through the control valve to the reservoir. Note that if cavitation occurs, return oil flow through the anti-cavitation check valve is directed to the applied side of the boom valve.

When the swing spool is moved, the hydraulic pump moves oil to the control valve. Pressure oil then flows through the lift check to the swing cylinder.

Displaced oil from the cylinder is forced back through the control valve to the reservoir.

To prevent cavitation, a portion of the return oil may unseat the anti-cavitation check valve in the valve housing and supplement the flow to the swing cylinder.



1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Oil
4—Relief Valve
5—Lift Check
6—Anti-Cavitation Check Valve
7—To Cylinder
8—From Cylinder

Fig. 3-Swing Section (Left Swing Circuit Shown)

REMOVAL

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

Operate backhoe control valve levers until all hydraulic pressure is relieved.

Discharge the accumulator by turning the machine steering wheel back and forth until it no longer operates freely.

Label control valve ports and lines to aid assembly.

If control valve stack is to be removed for servicing and it is believed that fragments of failed valve parts may have entered the hydraulic system, completely drain the system and replace the hydraulic filters.

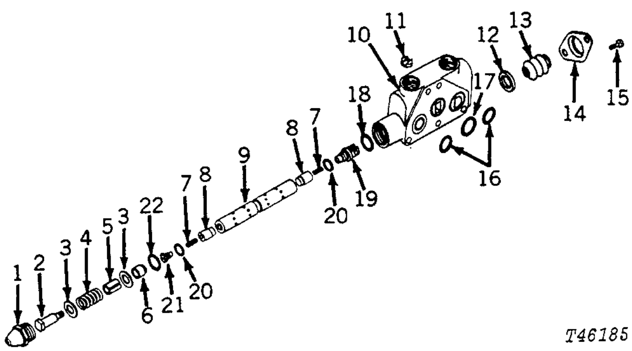
REPAIR

Service individual valves separately. Be sure valve bodies and their spools are kept together because these parts are matched assemblies.

Remove tie bolts and separate valve sections.

Remove end caps and remove spools from valve housings.

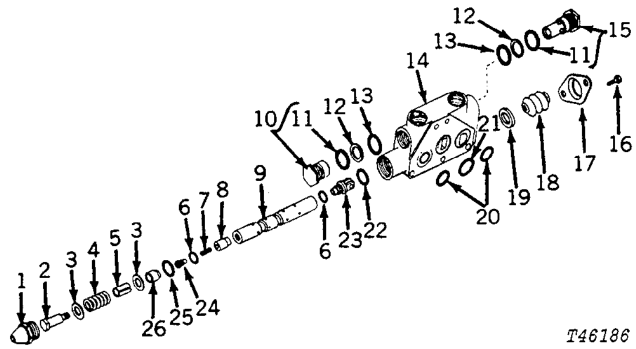
Clean and dry all parts thoroughly and inspect for wear or damage.



T46185

1—Spool Cap
2—Valve Spool Screw
3—Spool Washer (2 used)
4—Spool Spring
5—Spool Spacer
6—Bushing
7—Lift Check Spring (2 used)
8—Lift Check (2 used)
9—Stabilizer Valve Spool
10—Stabilizer Valve Housing
11—Orifice
12—Breather Washer
13—Spool Dust Seal
14—Dust Seal Retainer
15—Machine Screw (2 used)
16—O-Ring (2 used)
17—O-Ring
18—O-Ring
19—Spool Clevis
20—O-Ring (2 used)
21—Spool Plug
22—O-Ring

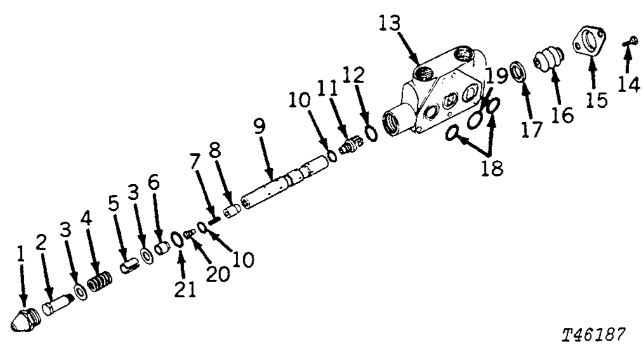
Fig. 4-Stabilizer Valve



T46186

1—Spool Cap
2—Valve Spool Screw
3—Spool Washer (2 used)
4—Spool Spring
5—Spool Spacer
6—O-Ring (2 used)
7—Lift Check Spring
8—Lift Check
9—Crowd Valve Spool
10—Plug
11—O-Ring (2 used)
12—Back-up Washer (2 used)
13—O-Ring (2 used)
14—Crowd Valve Housing
15—Relief Valve Cartridge
16—Machine Screw (2 used)
17—Dust Seal Retainer
18—Spool Dust Seal
19—Breather Washer
20—O-Ring (2 used)
21—O-Ring
22—O-Ring
23—Spool Clevis
24—Spool Plug
25—O-Ring
26—Bushing

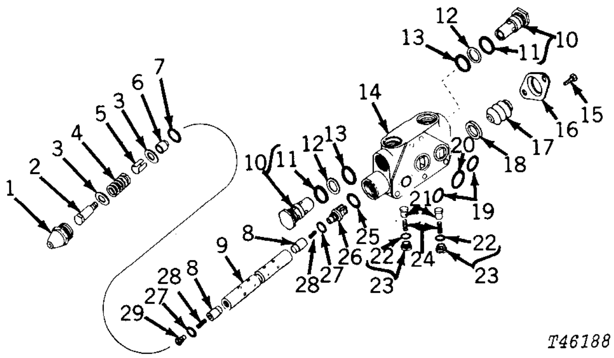
Fig. 5-Crowd Valve



T46187

1—Spool Cap
2—Valve Spool Screw
3—Spool Washer (2 used)
4—Spool Spring
5—Spool Spacer
6—Bushing
7—Lift Check Spring
8—Lift Check
9—Bucket Valve Spool
10—O-Ring (2 used)
11—Spool Clevis
12—O-Ring
13—Bucket Valve Housing
14—Machine Screw
15—Dust Seal Retainer
16—Spool Dust Seal
17—Breather Washer
18—O-Ring (2 used)
19—O-Ring
20—Spool Plug
21—O-Ring

Fig. 6-Bucket Valve



1—Spool Cap
2—Valve Spool Screw
3—Spool Washer (2 used)
4—Spool Spring
5—Spool Spacer
6—Bushing
7—O-Ring
8—Lift Check (2 used)
9—Swing Valve Spool
10—Relief Valve Cartridge (2 used)
11—O-Ring (2 used)
12—Backup Washer (2 used)
13—O-Ring (2 used)
14—Swing Valve Housing
15—Machine Screw (2 used)
16—Dust Seal Retainer
17—Spool Dust Seal
18—Breather Washer
19—O-Ring (2 used)
20—O-Ring
21—Anti-Cavitation Plunger (2 used)
22—O-Ring (2 used)
23—Plug Assembly (2 used)
24—Plunger Spring (2 used)
25—O-Ring
26—Spool Clevis
27—O-Ring (2 used)
28—Lift Check Spring (2 used)
29—Spool Plug

Fig. 7-Swing Valve

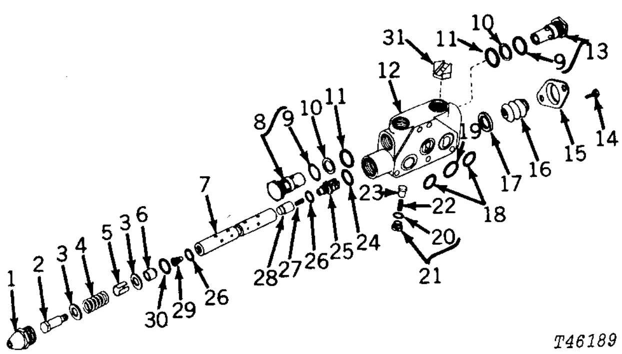


Fig. 8-Boom Valve

Check valve housing for damage or evidence of leakage. Replace housing and spool as a matched assembly. Check the spool spring for a length of 1.187 in. (30.15 mm) with 27 lb. (120 N) (12 kg).

Remove anti-cavitation check valves (if applicable) from valve section and inspect for damage. Check the springs for a length of 0.625 in. (16 mm) with 0.75 lb. (3 N) (0.3 kg).

Remove spool ends and inspect lift checks for damage. Be sure hole in lift check is not plugged. Check the lift check spring for a length of 0.845 in. (21 mm) with 0.5 lb. (2 N) (0.2 kg).

Inspect hole in orifice plates (if applicable) for plugged condition. Install plates with the smooth side toward the valve housing.

ASSEMBLY

Thoroughly clean and dry all parts. Oil all parts lightly prior to assembly.

Replace all O-ring and backup washers with new parts.

Install spools in proper valve section. Apply AT52853 John Deere LOCTITE® Thread Lock and Sealer (Low Strength) or equivalent on threads of spool screws. Tighten spool screws to 5 to 8 lb-ft (7 to 11 N·m) (0.7 to 1.1 kg/m).

Stack port plate, valve sections and end plate in proper sequence.

Install tie bolts and tighten evenly with 20 to 25 lb-ft (27 to 34 N·m) (2.8 to 3.5 kg/m).

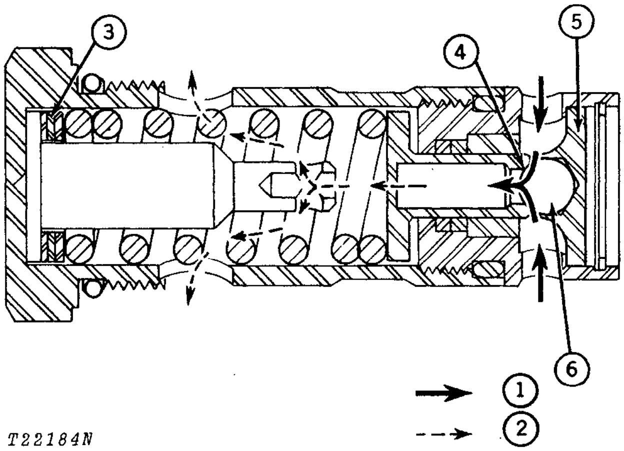
1—Spool Cap
2—Valve Spool Screw
3—Spool Washer (2 used)
4—Spool Spring
5—Spool Spacer
6—Bushing
7—Boom Valve Spool
8—Relief Valve Cartridge
9—O-Ring (2 used)
10—Backup Washer (2 used)
11—O-Ring (2 used)
12—Boom Valve Housing
13—Relief Valve Cartridge
14—Machine Screw (2 used)
15—Dust Shield Retainer
16—Spool Dust Seal
17—Breather Washer
18—O-Ring (2 used)
19—O-Ring
20—O-Ring
21—Plug Assembly
22—Plunger Spring
23—Anti-Cavitation Plunger
24—O-Ring
25—Spool Clevis
26—O-Ring (2 used)
27—Lift Check Spring
28—Lift Check
29—Spool Plug
30—O-Ring
31—Orifice

Legend for Fig. 8

LOCTITE is a trademark of the Loctite Corp.

RELIEF VALVES

GENERAL INFORMATION

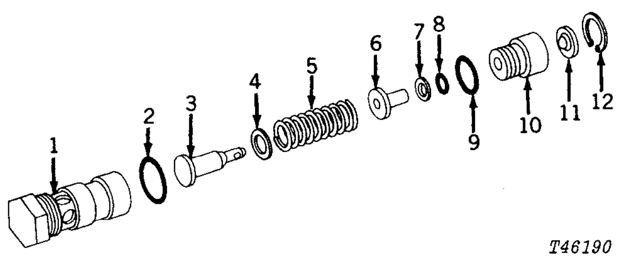


1—Pressure Oil
2—Return Oil
3—Shims
4—Seat
5—Retainer
6—Steel Ball

Fig. 9-Direct-Acting Relief Valves

The crowd, boom and swing sections of the valve stack use direct-acting relief valves.

REPAIR



1—Relief Valve Cage
2—O-Ring
3—Spring Guide
4—Washer (use as required)
5—Spring
6—Seat
7—Backup Washer
8—O-Ring
9—O-Ring
10—Plug
11—Retainer
12—Snap Ring

Fig. 10-Relief Valve

Remove relief valve from valve housing.

Disassemble relief valve using Fig. 10 as a guide.

Position the hex. head of the relief valve cartridges in a vise and remove snap ring and retainer.

Remove parts from valve cage.

Thoroughly clean and dry all parts. Inspect parts and replace as necessary.

Check spring for a length of 1.5 in. (38 mm) with 122.5 lb. (545 N) (56 kg).

When assembling the relief valve, be sure to use all the shims removed.

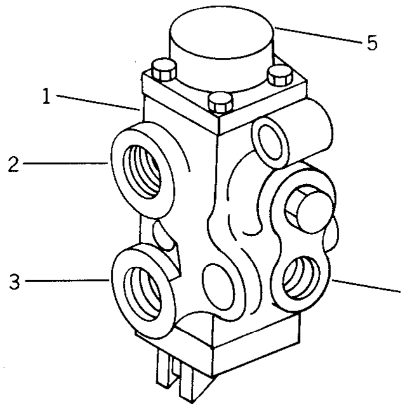
Assemble parts in cage and install retainer and snap ring.

INSTALLATION

Install control valve and connect linkage and oil lines.

Run machine and check backhoe circuit for proper operation and leaks.

EXTENDIBLE DIPPERSTICK VALVE AND LINKAGE



1—Valve Inlet Port
2—Valve Outlet Port (To head end of extendible dipper-stick cylinder)
3—Valve Outlet Port (To rod end of extendible dipper-stick cylinder)
4—Valve Outlet Port to Tank
5—Extendible Dipper-stick Control Valve

Fig. 11-Extendible Dipperstick Control Valve

GENERAL INFORMATION

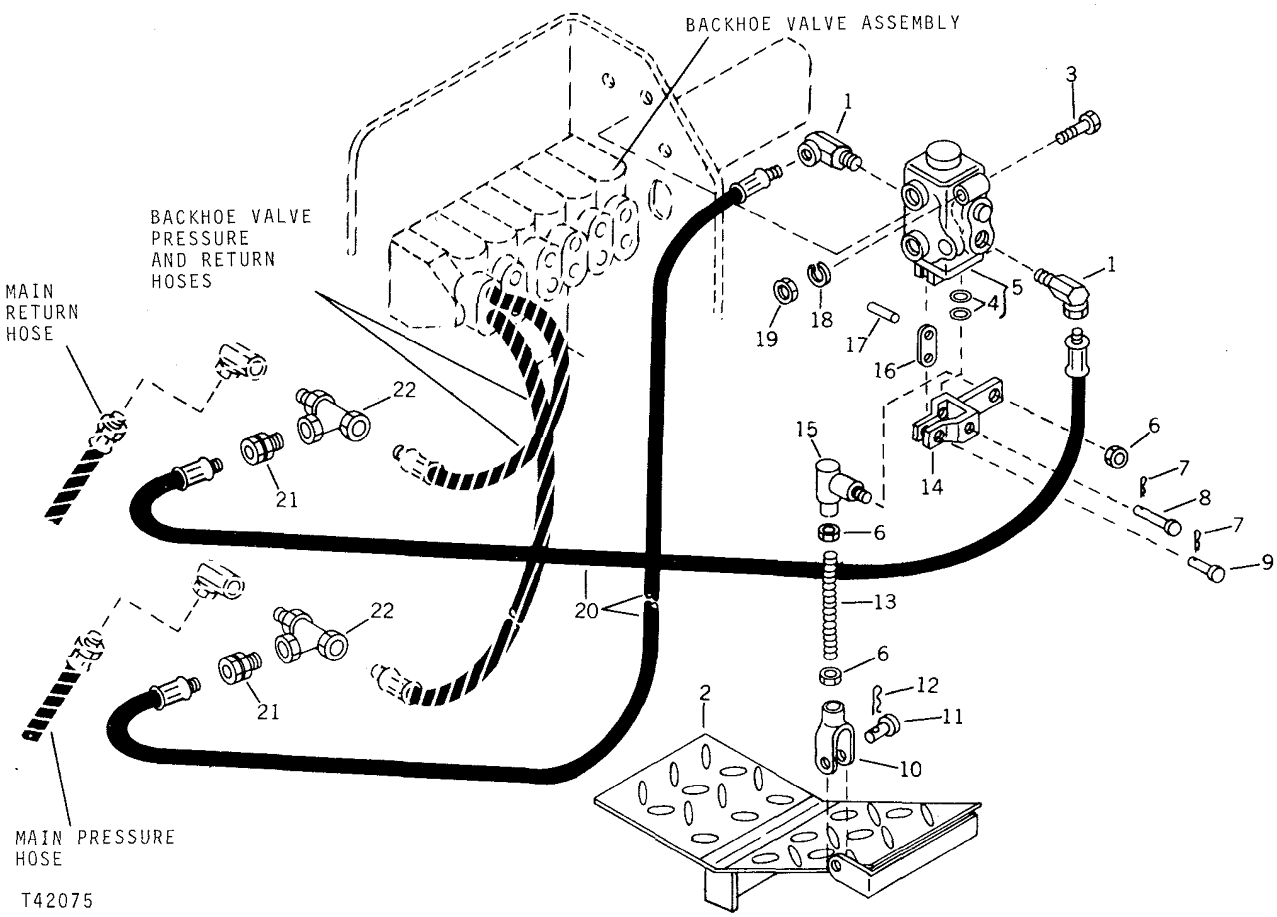
The extendible dipperstick control valve is a double-acting valve. It uses a spring centered spool and is closed center in design. When the pedal assembly is pushed forward, pressure fluid is directed to the head end of the extendible dipperstick cylinder, causing it to extend. To retract extendible dipperstick cylinder, push pedal backward. This causes pressure fluid to be directed to the rod end of the extendible dipperstick cylinder.

REMOVAL

To remove extendible dipperstick control valve, first disconnect all hydraulic lines to it. Then disconnect cotter pin and clevis pin. Remove three cap screws (3, Fig. 12) and lift out of circuit.

REPAIR

If extendible dipperstick control valve is leaking, repair is not recommended. Instead replace with new valve.



1—Elbow, 90° Swivel (2 used)
2—Pedal Assembly
3—Cap Screw (3 used)
4—Valve Spool Seal (2 used)
5—Dipperstick Control Valve
6—Nut (3 used)
7—Cotter Pin (2 used)
8—Clevis Pin
9—Clevis Pin
10—Yoke
11—Clevis Pin
12—Cotter Pin
13—Linkage Rod
14—Control Valve Lever
15—Ball Joint Link
16—Valve Link
17—Spring Pin
18—Lock Washer (3 used)
19—Nut (3 used)
20—Pressure and Return Hose (2 used)
21—Straight Adapter (2 used)
22—Service Tee (2 used)

Fig. 12-Extendible Dipperstick Control Valve Circuit

INSTALLATION

To install new extendible dipperstick control valve use reverse of removal procedure.

CYLINDERS

GENERAL INFORMATION

The hydraulic cylinders are double acting with V-packings. Piston pins are heat treated, chrome plated and polished. Replaceable non-metallic wear rings are used on the piston retainers to prevent scoring of the cylinder barrels.

The backhoe crowd, boom, and swing cylinders are hydraulically cushioned. This prevents harsh stops when the cylinder reaches the end of its stroke.

FOS

See "Hydraulic Cylinders" in FOS Manual "HYDRAULICS" for additional information on cylinders and an explanation of the hydraulic cushion design.

REMOVAL

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

CAUTION: Be sure the engine is stopped and the bucket is resting on the ground before attempting to remove cylinders.

Operate the control valve levers until all hydraulic pressure is relieved.

Remove the hoses and cap them to prevent dirt from entering the system. Remove the pins from each end of the cylinder and move the cylinder to a clean disassembly area.

NOTE: 9405 Backhoe swing cylinders may be serviced on unit by disconnecting rod end and swinging cylinder out until rod guide can be removed.

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filters.

REPAIR

Clamp the cylinder in a vise to prevent it from turning. Use a spanner wrench to loosen rod guide or spanner nut.

IMPORTANT: Medium strength thread lock and sealer on stop nut threads on crowd cylinder rod greatly increases loosening torque. Heating of nut is necessary to avoid damage to rod during disassembly.

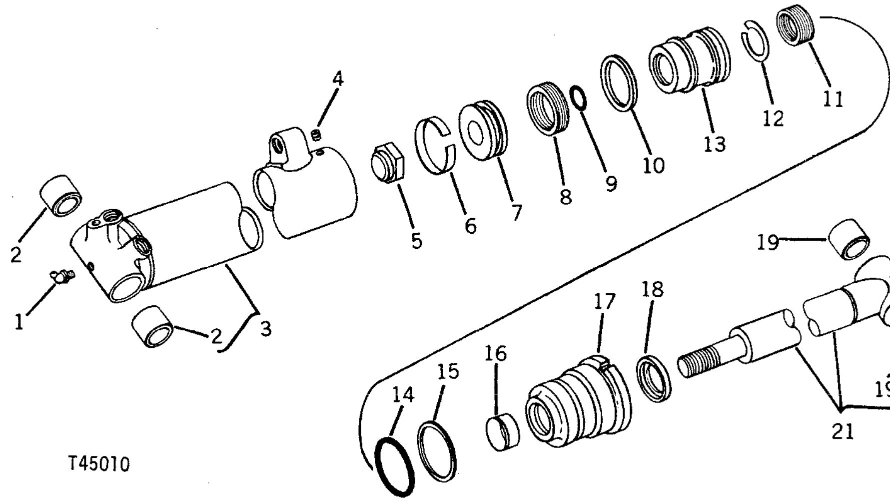
Clamp the cylinder rod end in a vise, taking care to prevent damage to the piston rod. Remove nut from end of rod. Slide parts from rod. For crowd cylinder, prior to removal, apply a small amount of heat to the nut to oxidize the medium strength thread lock and sealer. Do not apply excessive heat as nut or nylon insert may be damaged.

Wash all parts thoroughly with diesel fuel and inspect the following:

1. Check barrel, rod guide, and rod for scoring and O-rings for surface damage.

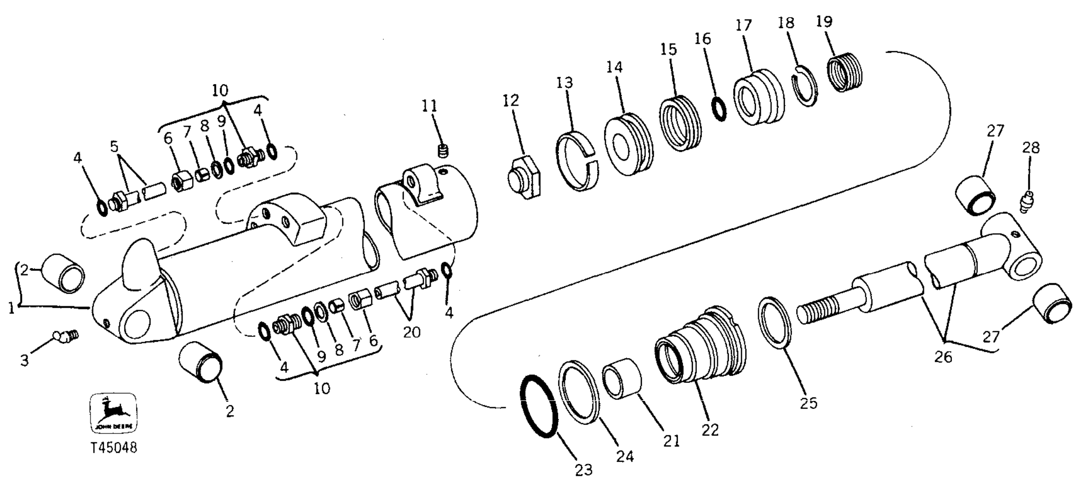
2. Check V-packings and wear rings for breaks, cuts, or foreign material.

3. Check piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.



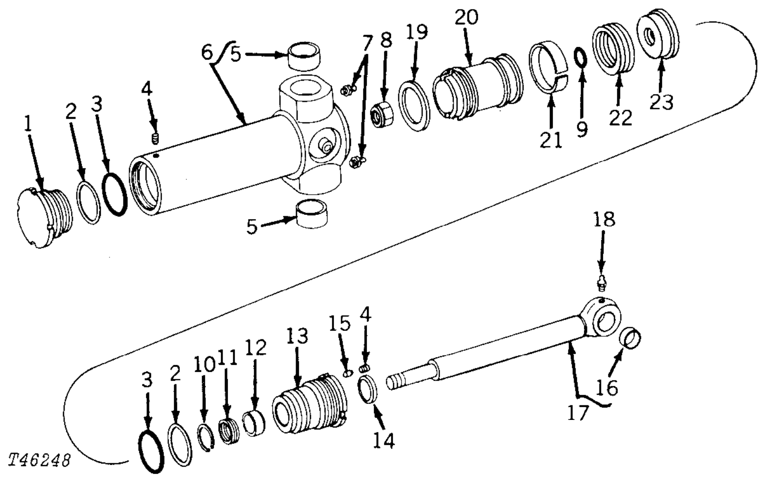
1—Grease Fitting
2—Bushing (2 used)
3—Barrel
4—Set Screw
5—Lock Nut
6—Wear Ring
7—Piston
8—V-Packing
9—O-Ring
10—Brake Seal
11—V-Packing
12—Snap Ring
13—Piston
14—O-Ring
15—Backup Washer
16—Rod Guide Wear Ring
17—Rod Guide
18—Wiper Seal
19—Bushing (2 used)
20—Grease Fitting
21—Rod Assembly

Fig. 13-Crowd Cylinder



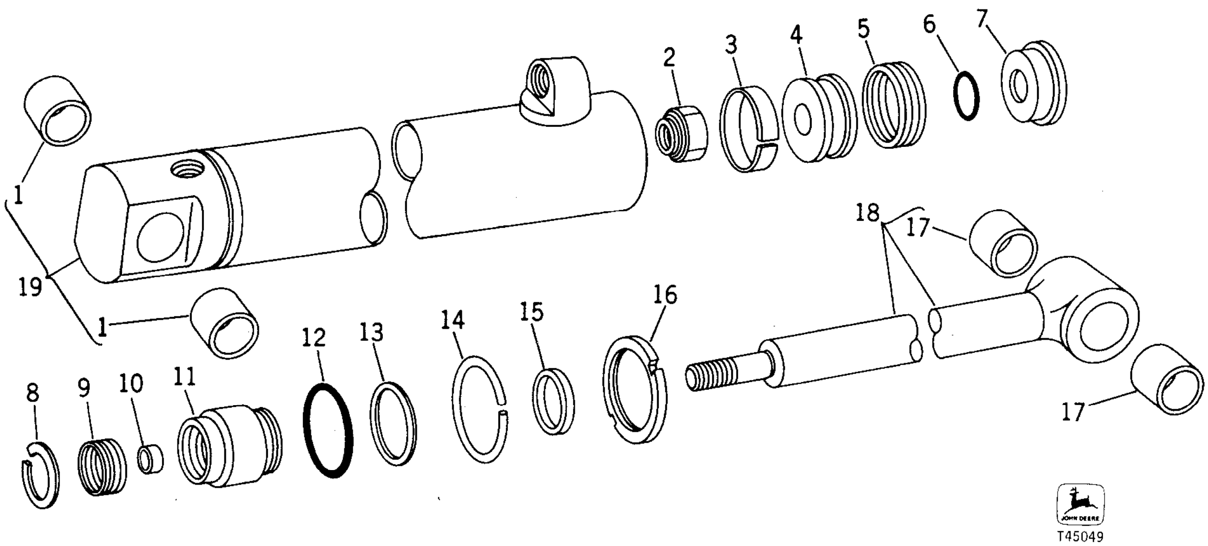
1—Barrel
2—Bushing (2 used)
3—Grease Fitting
4—O-Ring (4 used)
5—Return Tube
6—Connector
7—Ferrule (2 used)
8—Backup Washer (2 used)
9—O-Ring (2 used)
10—Union Adapter (2 used)
11—Set Screw
12—Lock Nut
13—Wear Ring
14—Piston Retainer
15—V-Packing
16—O-Ring
17—Piston
18—Snap Ring
19—V-Packing
20—Return Tube
21—Rod Guide Wear Ring
22—Rod Guide
23—O-Ring
24—Backup Washer
25—Wiper Seal
26—Piston Rod
27—Bushing (2 used)
28—Grease Fitting

Fig. 14-Bucket Cylinder



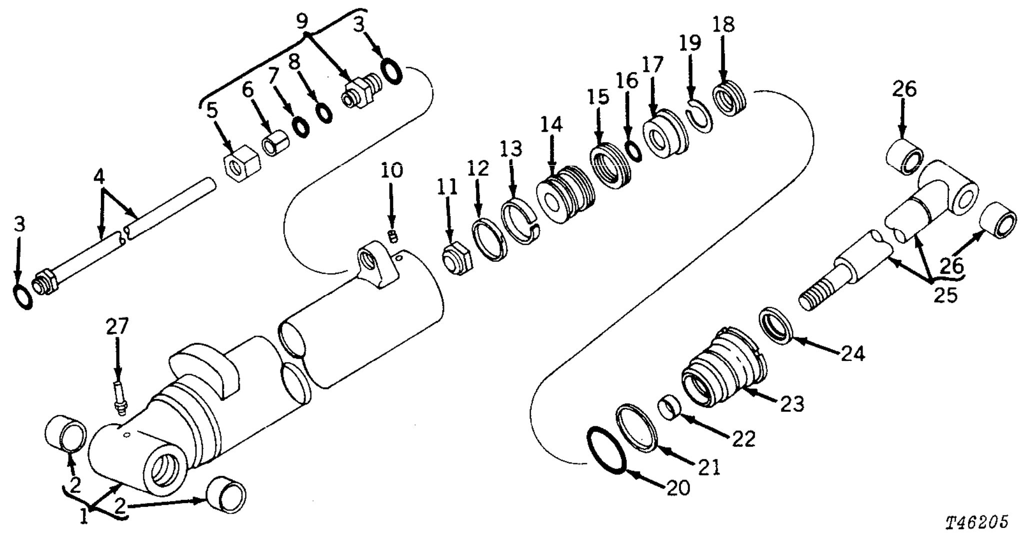
1—Cylinder End
2—Backup Washer (2 used)
3—O-Ring (2 used)
4—Set Screw (2 used)
5—Trunnion Bushing (2 used)
6—Barrel and Trunnion
7—Grease Fitting
8—Elastic Stop Nut
9—O-Ring
10—Rod Guide Snap Ring
11—Rod Guide V-Packing
12—Rod Guide Wear Ring
13—Rod Guide
14—Wiper Seal
15—Nylon Insert
16—Bushing
17—Piston Rod
18—Grease Fitting
19—Brake Seal
20—Piston
21—Wear Ring
22—V-Packing
23—V-Packing End Piston

Fig. 15-Swing Cylinder



1—Barrel Bushing (2 used)
2—Lock Nut
3—Piston Wear Ring
4—Piston Retainer
5—Piston V-Packing
6—O-Ring
7—Piston
8—Snap Ring
9—Rod Guide V-Packing
10—Rod Guide Wear Ring
11—Rod Guide
12—Rod Guide O-Ring
13—Rod Guide Backup Washer
14—Snap Ring
15—Wiper Seal
16—Spanner Nut
17—Piston Rod Bushing (2 used)
18—Piston Rod
19—Barrel

Fig. 16-Stabilizer Cylinder



1—Barrel
2—Bushing (2 used)
3—O-Ring (2 used)
4—Return Tube
5—Special Nut
6—Backup Washer
7—O-Ring
8—O-Ring
9—Tube Connector
10—Set Screw
11—Lock Nut
12—Brake Seal
13—Piston Retainer Wear Ring
14—Piston
15—V-Packing
16—O-Ring
17—Piston
18—V-Packing
19—Snap Ring
20—O-Ring
21—Backup Washer
22—Wear Ring
23—Rod Guide
24—Wiper Seal
25—Rod Assembly
26—Bushing (2 used)
27—Grease Fitting

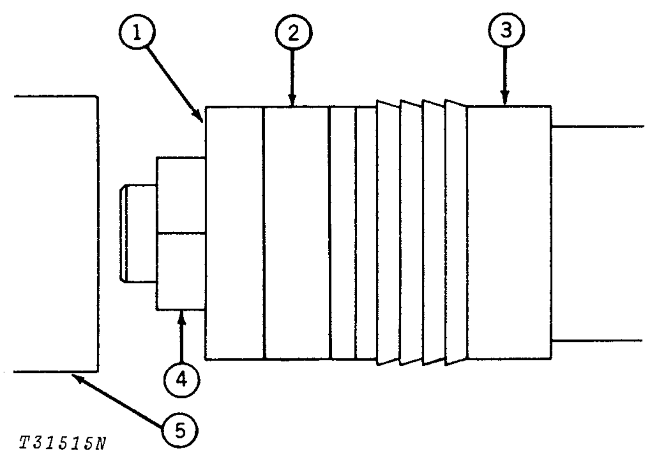
Fig. 17-Boom Cylinder

ASSEMBLY

Repair kits are available for overhauling all cylinders. Discard used parts and use all new parts provided in kits when assembling cylinders.

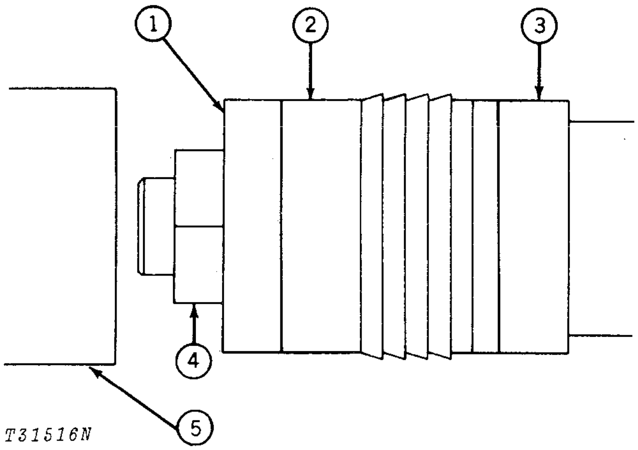
Lubricate all O-rings, seals, and packings before assembly.

V-packings are originally installed on the piston with the apex of the V pointing away from the barrel (Fig. 18). When replacing V-packings in the field this procedure can be used if a suitable ring compressor is available to compress packings during installation.



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

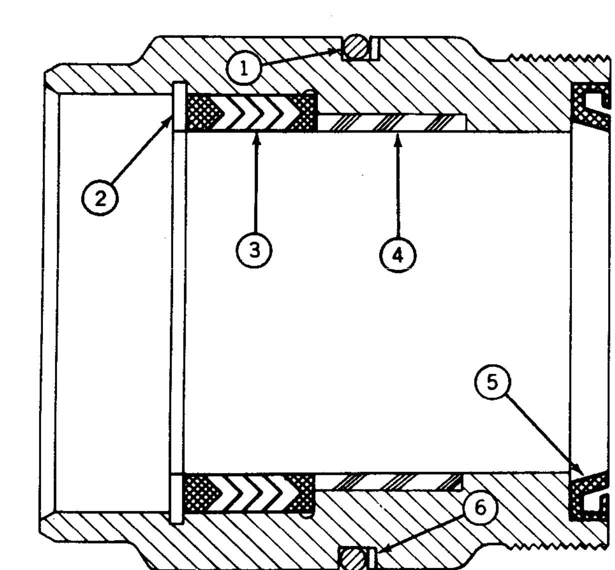
Fig. 18-Original Installation of V-Packing



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 19-Installation of V-Packing Without Compressor

If a suitable compressor is not available, assemble the packings with the apex of the V pointing toward the barrel (Fig. 19). This eliminates scuffing that may occur in assembly; however, the V-packing may become torn if the cylinder has to be disassembled in the future.



1—O-Ring
2—Snap Ring
3—V-Packing
4—Wear Ring
5—Wiper Seal
6—Backup Washer

Fig. 20-Rod Guide Components

Install new wiper seal in rod guide.

Install new wear ring in rod guide. Position backup washer and O-ring on rod guide.

Install V-packing in rod guide with the apex of the V toward the wear ring and secure with snap ring.

Slip rod guide assembly on piston rod being careful not to damage packing.

Position piston on piston rod. Install wear ring on piston retainer. Position retainer on piston rod and secure with stop nut. For crowd cylinder, apply medium strength thread lock and sealer to threads before installing nut.

Tighten stabilizer cylinder stop nut to 475 to 575 lb-ft (644 to 780 Nm) (66 to 79 kg/m).

Tighten crowd, boom or bucket cylinder stop nut to 600 to 700 lb-ft (813 to 949 Nm) (83 to 97 kg/m).

Install piston rod assembly into barrel.

Secure piston rod assembly in barrel with snap ring (if used) and spanner nut or with rod guide.

Tighten stabilizer cylinder nut to 150 lb-ft (203 Nm) (21 kg/m).

Tighten crowd, boom or bucket nut to 250 to 300 lb-ft (339 to 407 Nm) (35 to 42 kg/m).

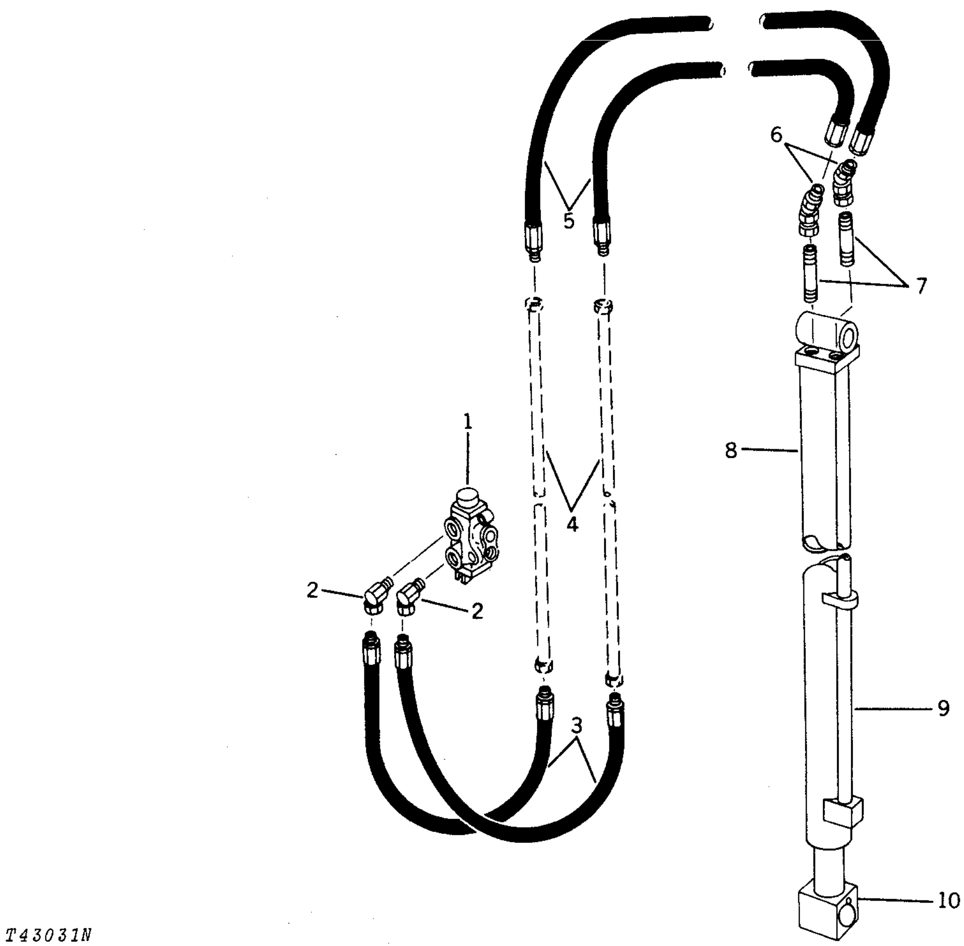
INSTALLATION

Place the cylinder in position on the machine and align the attaching holes. Insert pivot pins and secure with cap screws. Connect the hydraulic lines, making sure they are connected to the same ends of the cylinder from which they were removed.

After installing the cylinder, operate the cylinder several times to remove air from the system. Add oil to the reservoir to bring it up to the proper level.

EXTENDIBLE DIPPERSTICK CYLINDER

GENERAL INFORMATION



1—Dipperstick Valve Assembly
2—Elbow, 90° Swivel (2 used)
3—Valve to Extendible Dipperstick Cylinder Tube Hose (2 used)
4—Boom Dipperstick Cylinder Tube (2 used)
5—Dipperstick Cylinder Hose (2 used)
6—Elbow, 45° Swivel (2 used)
7—Nipple (2 used)
8—Extendible Dipperstick Cylinder
9—Hydraulic Tube
10—Rod Clevis

Fig. 21-Extendible Dipperstick Cylinder Hydraulic Circuit

The extendible dipperstick cylinder is a double acting 2.500 inch (63.5 mm) bore by 48 inch (1.2 m) stroke cylinder. It has a 1.250 inch (31.75 mm) rod and uses a hydraulic cushion on rod end of the cylinder.

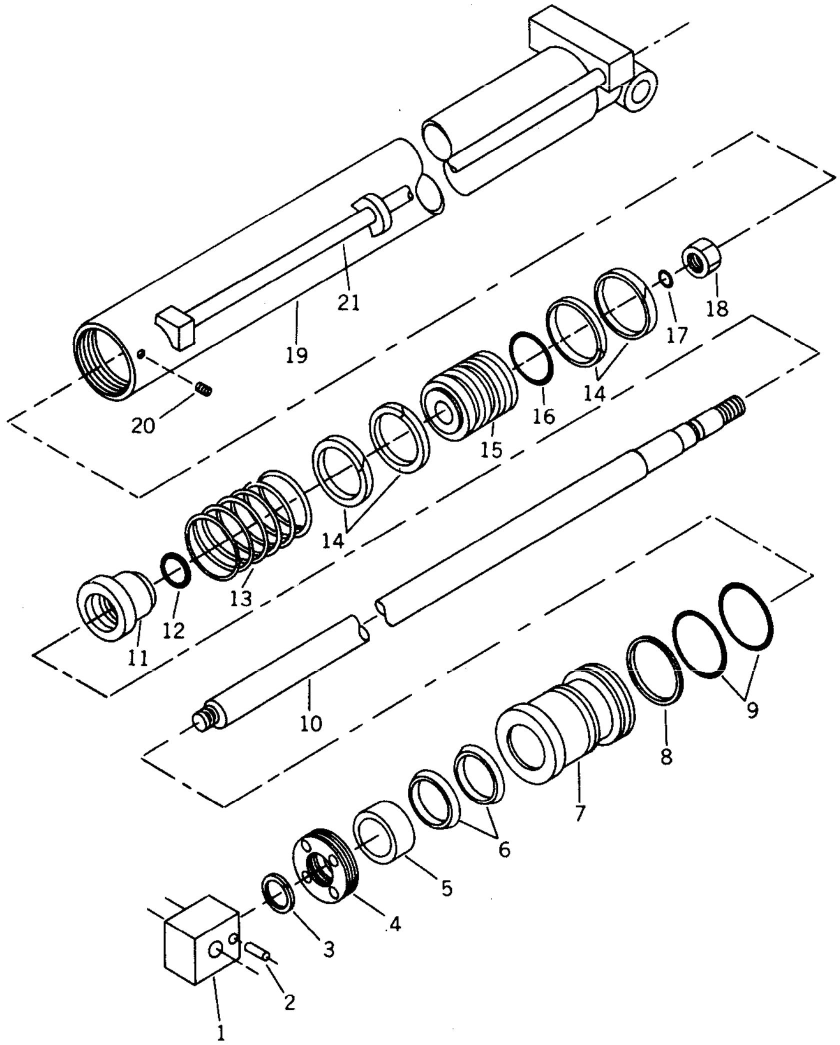
FOS

See "Hydraulic Cylinders" in FOS Manual "Hydraulics" for additional information on cylinders.

REMOVAL

To remove extendible dipperstick cylinder, extend the cylinder to its fully extended position. Remove rod end cylinder pin and base end cylinder pin. Lift cylinder up through top of extendible dipperstick.

REPAIR



1—Rod Clevis
2—Roll Pin
3—Bronze Wiper
4—Gland Lock Ring
5—Bronze Bearing
6—Rod Seal (2 used)
7—Gland
8—Back-up Ring
9—Gland O-Ring
10—Cylinder Rod
11—Aluminum Cushion
12—Cushion O-Ring
13—Cushion Return Spring
14—Cast Iron Rings (4 used)
15—Piston
16—Piston O-Ring
17—Piston O-Ring
18—Lock Nut
19—Body and Base Assembly
20—Nylon Set Screw
21—Hydraulic Tube

Fig. 22-Extendible Dipperstick Cylinder Assembly

Drain hydraulic oil from extendible dipperstick cylinder by first extending rod to its furthest extent under power. Release pressure and remove power supply from extendible dipperstick cylinder. Apply air pressure to open end of hydraulic return tube until cylinder rod has retracted to the closed position. This will remove oil that would prove a nuisance in disassembly.

Mount extendible dipperstick cylinder in vise with clevis end approximately 8 - 12 inches (203 to 305 mm) from vise jaws. Use brass or aluminum for protection from vise jaws. Secure cylinder with hydraulic tube on top.

Remove roll pin from rod clevis and remove rod clevis from cylinder rod. If this proves difficult, pull rod out several inches, wrap a piece of fine grain sandpaper around rod, and hold with a strap wrench while removing clevis. Do not use a pipe wrench on cylinder rod under any circumstances, as this will cause permanent damage to rod and will mutilate bearings and chevron packing when the cylinder is activated.

Remove nylon set screw that secures lock ring. Use a spanner wrench (Tool P/N T00112) to remove gland lock ring. If gland lock ring is extremely tight, use hammer and tap lightly on barrel around lock ring. This will loosen Loctite sealer that has been applied to gland lock ring threads.

Pull rod out slowly from barrel. As this is done, gland will come out when piston contacts it. A slight tug may be necessary at this point since gland has an O-ring pressure seal. Bearings and packing may stay intact inside of gland during removal from rod.

Inspect component parts before removing the individual parts of rod.

Check cast-iron rings for scores or cracks.

Check bronze bearings on rod for excessive play. The bearing inside diameter should not exceed 0.008 in. (0.2 mm) larger than the outside diameter of the rod.

If only the seals need to be replaced, use a soft seal kit. If either the bearings or piston rings need to be replaced, use a major repair kit.

Check outside of piston. If it has been worn, replace it.

Mount cylinder rod in vise with piston end approximately 6 to 8 inches (152 to 203 mm) from vise. Be certain that rod is protected from vise jaws when securing rod in vise.

In removing lock nut, it may be necessary to heat same for removal. If this is necessary, do not re-use same lock nut.

Remove piston, cushion spring and cushion. Remove O-ring from rod and O-ring from cushion. Also remove O-ring from piston as well as cast-iron rings if required. Clean piston and cushion thoroughly in cleaning solvent.

If it is necessary to replace the hydraulic tube (21, Fig. 22) do the following. Remove the tube threaded into the boss which the tube is aligned. Cut a section of the tube (21) out. Heat the tube weld at each end of the tube until the two pieces of tube can be removed.

To install new tube (21), slide tube through boss on cylinder head end until it bottoms in boss on rod end. Braze weld the tube ends to the end bosses.

ASSEMBLY

Install O-ring on piston first, in center groove. To install new cast-iron rings, carefully start them, one end at a time, and work them into the grooves with your thumbs.

IMPORTANT: If you try to spread a cast-iron ring apart and slip it over the piston, you may break the ring. Chipped or broken rings must be replaced.

Install new O-ring on rod and new O-ring on aluminum cushion and lubricate them. Install aluminum cushion onto rod, flanged end first, so that spring will slip over aluminum cushion. Install cushion return spring onto rod.

Install piston assembly onto rod with grooved end of piston in position to seat spring. Be sure spring seats in piston.

Install and tighten nut to 150 to 250 lb-ft. Then remove rod assembly from vise.

Mount barrel in vise as previously described. Be sure inside of barrel is clean and has been flushed out.

Install Digmor ring compressor (Tool P/N TOO122) into end of barrel for easiest installation. If you do not have a Digmor ring compressor, use an auto-type ring compressor around piston assembly after assembly has been thoroughly lubricated. When using an auto-type compressor, it must be used in reverse position so that the longest portion of the ring compressor will fit past the threads in the cylinder.

Push rod assembly approximately 3/4 of the way into barrel and remove ring compressor.

Clean gland thoroughly and install back-up ring first, then O-rings. Lubricate O-rings.

Install gland carefully, making certain that O-rings do not get pinched while passing under the port in the extendible dipperstick cylinder.

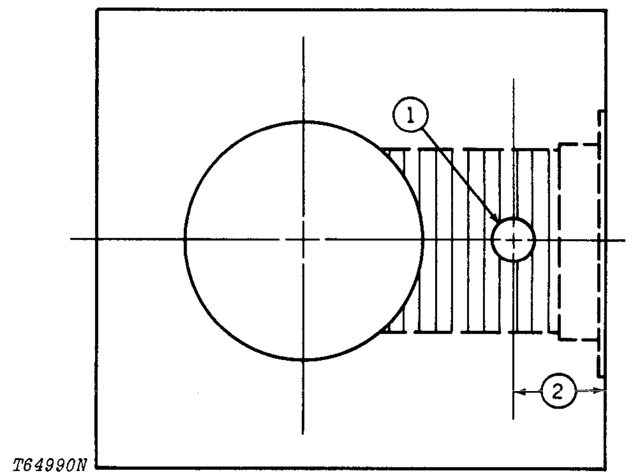
Install rod seals with the O-ring side in first.

Install bearing.

LOCTITE is a trademark of the Loctite Corp.

Install new bronze wiper inside gland lock ring. When installing gland lock ring, apply AT52853 John Deere LOCTITE® Threadlock and Sealer (low strength) or equivalent to threads, making sure spanner holes are facing outside of assembly.

Tighten gland lock ring to 125 to 175 lb-ft with spanner wrench. Install new nylon set screw and tighten same. Install rod clevis onto rod and insert roll pin through rod clevis.



T64990N

1—0.187 in. (4.75 mm) **2—0.5 in. (12.7 mm)**

Fig. 23-Rod Clevis Drilling Instruction

NOTE: When installing a new rod clevis (1, Fig. 22), it will be necessary to drill the hole (1, Fig. 23) through the rod clevis and the cylinder rod. This allows for installation of the roll pin (2, Fig. 22).

Test cylinder assembly for oil leaks under power source before re-installing into Digmor dipperstick. aw)thAlso verify that the aluminum cushion is functioning properly.

IMPORTANT: When installing the cylinder assembly into the extension, be sure that the return line tube is on the bottom, i.e., toward the ground. If the cylinder is installed upside down, it will be damaged during operation.

Group 3399
SPECIFICATIONS AND SPECIAL TOOLS
HYDRAULIC SYSTEM
SPECIFICATIONS AND TORQUE VALUES

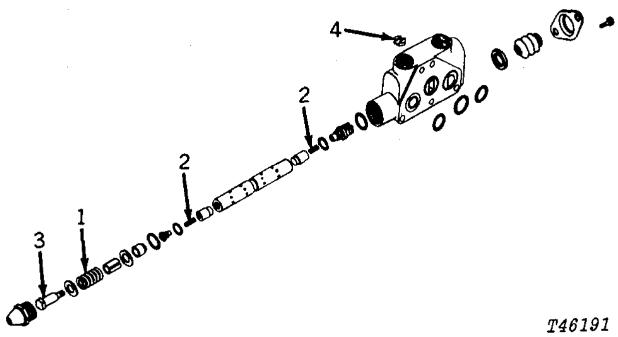


Fig. 1-Stabilizer Valve

Stabilizer Valve

1 - Spool spring
  Free length .... 1.78 in (45.2 mm)
  Test length .... 1.187 in (30.15 mm)
  with 27 lbs (120 N) (12 kg)

2 - Lift check spring
  Free length .... 1.093 in (27.76 mm)
  Test length .... 0.843 in (21.41 mm)
  with 0.5 lb (2 N) (0.2 kg)

3 - Spool screw torque (coat threads with LOCTITE) .... 5 to 8 lb-ft (7 to 11 N·m) (0.7 to 1 kg/m)

4 - Orifice size .... 0.1405 in. (3.569 mm)

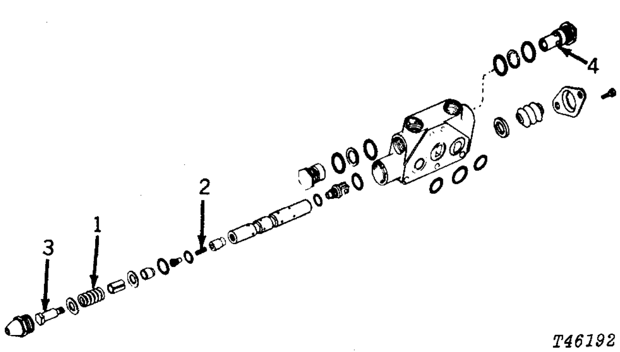


Fig. 2-Crowd Valve

Crowd Valve

1 - Spool spring
  Free length .... 1.78 in (45.2 mm)
  Test length .... 1.187 in (30.15 mm)
  with 27 lbs (120 N) (12 kg)

2 - Lift check spring
  Free length .... 1.093 in (27.76 mm)
  Test length .... 0.843 in (21.41 mm)
  with 0.5 lb (2 N) (0.2 kg)

3 - Spool screw torque (coat threads with LOCTITE) .... 5 to 8 lb-ft (7 to 11 N·m) (0.7 to 1 kg/m)

4 - Relief valve pressure .... 2375 psi (164 bar) (167 kg/cm²)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

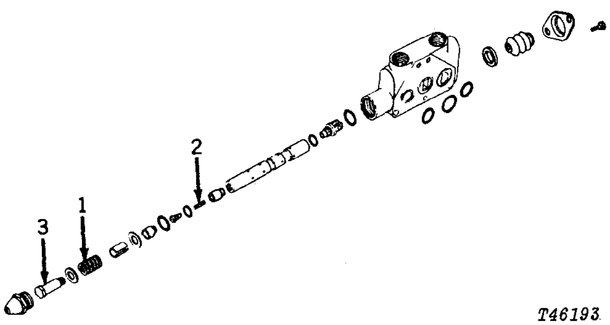


Fig. 3-Bucket Valve

Bucket Valve

1 - Spool spring
Free length .... 1.78 in (45.2 mm)
Test length .... 1.187 in (30.15 mm)
with 27 lbs (120 N) (12 kg)

2 - Lift check spring
Free length .... 1.093 in (27.76 mm)
Test length .... 0.843 in (21.41 mm)
with 0.5 lb (2 N) (0.2 kg)

3 - Spool screw torque (coat threads with LOCTITE) .... 5 to 8 lb-ft
(7 to 11 N·m) (0.7 to 1 kg/m)

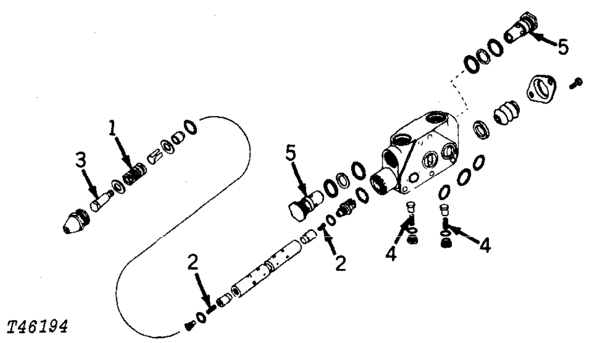


Fig. 4-Swing Valve

Swing Valve

1 - Spool spring
Free length .... 1.78 in (45.2 mm)
Test length .... 1.187 in (30.15 mm)
with 27 lbs (120 N) (12 kg)

2 - Lift check spring
Free length .... 1.093 in (27.76 mm)
Test length .... 0.843 in (21.41 mm)
with 0.5 lb (2 N) (0.2 kg)

3 - Spool screw torque (coat threads with LOCTITE) .... 5 to 8 lb-ft
(7 to 11 N·m) (0.7 to 1 kg/m)

4 - Anti-cavitation spring
Free length .... 0.692 in (17.58 mm)
Test length .... 0.625 in (15.88 mm)
with 0.75 lbs (3.3 N) (0.3 kg)

5 - Relief valve pressure .... 2375 psi
(164 bar) (167 kg/cm²)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

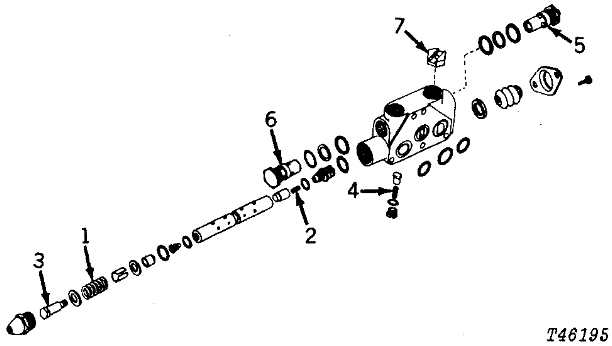


Fig. 5-Boom Valve

Boom Valve

1 - Spool spring
Free length .... 1.78 in (45.2 mm)
Test length .... 1.187 in (30.15 mm)
with 27 lbs (120 N) (12 kg)

2 - Lift check spring
Free length .... 1.093 in (27.76 mm)
Test length .... 0.843 in (21.41 mm)
with 0.5 lb (2 N) (0.2 kg)

3 - Spool screw torque (coat threads with LOCTITE) .... 5 to 8 lb-ft
(7 to 11 N·m) (0.7 to 1 kg/m)

4 - Anti-cavitation spring
Free length .... 0.692 in (17.58 mm)
Test length .... 0.625 in (15.88 mm)
with 0.75 lbs (3 N) (0.3 kg)

5 - Relief valve pressure .... 3500 psi
(241 bar) (246 kg/cm²)

6 - Relief valve pressure .... 2375 psi
(164 bar) (167 kg/cm²)

7 - Orifice size .... 0.234 in (5.944 mm)

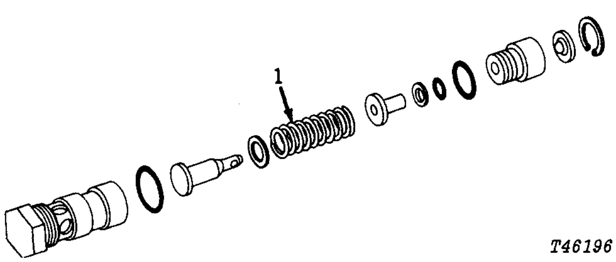


Fig. 6-Relief Valve

Relief Valve

1 - Relief valve spring
Free length .... 1.715 in (43.56 mm)
Test length .... 1.5 in (38 mm)
with 122 lbs (543 N) (55 kg)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

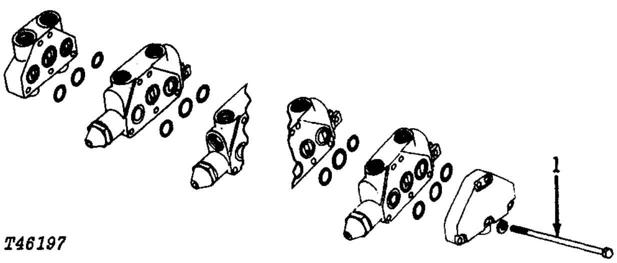


Fig. 7-Control Valve

Control Valve

1 - Tie bolt torque .... 20 to 25 lb-ft
(27 to 34 Nm) (2.8 to 0.6 kg/m)

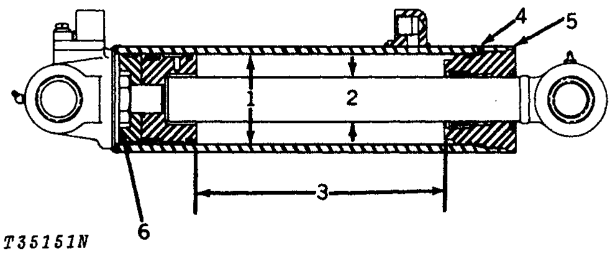


Fig. 8-Crowd Cylinder

Crowd Cylinder

1 - Cylinder bore .... 4.0 in
(102 mm)

2 - Rod diameter .... 2.0 in
(51 mm)

3 - Cylinder stroke .... 33.00 in
(838 mm)

4 - Set screw torque .... 40 lb-in
(4.5 Nm) (0.46 kg/m)

5 - Rod guide torque............. 250 to 300 lb-ft
(339 to 407 Nm) (35 to 42 kg/m)

6 - Stop nut torque .... 600 to 700 lb-ft
(813 to 949 Nm) (83 to 97 kg/m)

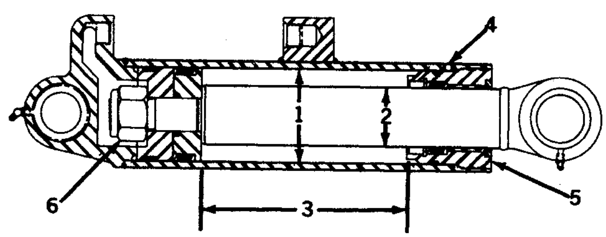


Fig. 9-Bucket Cylinder

Bucket Cylinder

1 - Cylinder bore .... 3.50 in
(88.9 mm)

2 - Rod diameter .... 2.25 in
(57.2 mm)

3 - Cylinder stroke .... 27.37 in
(695.2 mm)

4 - Set screw torque .... 40 lb-in
(4.5 Nm) (0.46 kg/m)

5 - Rod guide torque............. 250 to 300 lb-ft
(339 to 407 Nm) (35 to 42 kg/m

6 - Stop nut torque .... 600 to 700 lb-ft
(813 to 949 Nm) (83 to 97 kg/m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

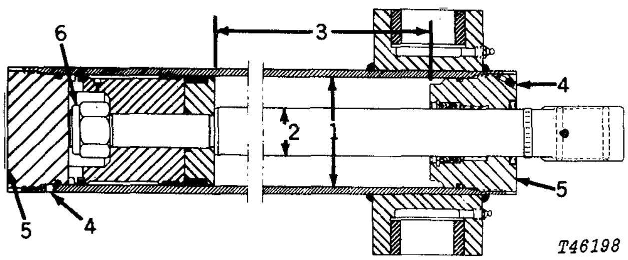


Fig. 10-Swing Cylinder

Swing Cylinder

1 - Cylinder bore .... 4.0 in. (102 mm)

2 - Rod diameter (-346261) .... 1.75 in. (44.5 mm)
(346262-   ) .... 2.00 in. (50.8 mm)

3 - Cylinder stroke .... 9.35 in. (237.5 mm)

4 - Set screw torque .... 40 lb-in (4.5 Nm) (0.46 kg/m)

5 - Rod guide and cylinder head torque .... 250 to 300 lb-ft (339 to 407 Nm) (35 to 41 kg/m)

6 - Stop nut torque .... 600 to 700 lb-ft (813 to 949 Nm) (83 to 97 kg/m)

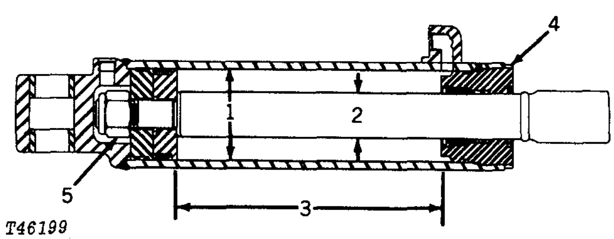


Fig. 11-Stabilizer Cylinder

Stabilizer Cylinder

1 - Cylinder bore .... 3.50 in (88.9 mm)

2 - Rod diameter .... 1.75 in (44.5 mm)

3 - Cylinder stroke .... 16.94 in (430.3 mm)

4 - Rod guide torque .... 125 to 175 lb-ft (169 to 237 Nm) (17 to 24 kg/m)

5 - Stop nut torque .... 475 to 575 lb-ft (644 to 780 Nm) (66 to 79 kg/m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

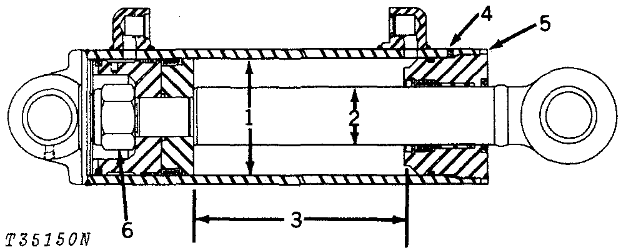


Fig. 12-Boom Cylinder

Boom Cylinder

1 - Cylinder bore .... 4.50 in (114.30 mm)

2 - Rod diameter .... 2.25 in (57.2 mm)

3 - Cylinder stroke .... 34.00 in (863.6 mm)

4 - Set screw torque ....40 lb-in (4.5 Nm) (0.46 kg/m)

5 - Rod guide torque............. 250 to 300 lb-ft (339 to 407 Nm) (35 to 41 kg/m)

6 - Stop nut torque........... 1000 to 1100 lb-ft (1 356 to 1 491 Nm) (138 to 152 kg/m)

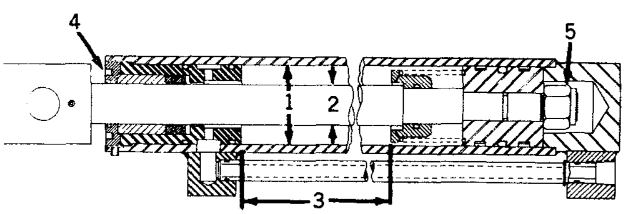


Fig. 13-Extendible Dipperstick Cylinder

Extendible Dipperstick Cylinder

1 - Cylinder bore .... 2.50 in (63.5 mm)

2 - Rod diameter .... 1.250 in (31.75 mm)

3 - Cylinder stroke .... 48 in (1.2 m)

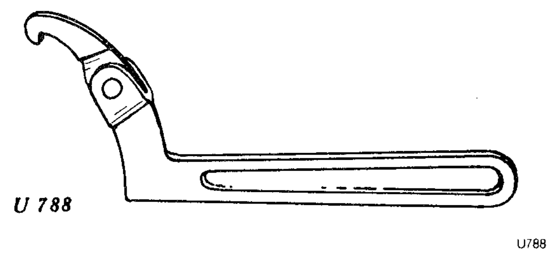
4 - Gland nut torque .... 125 to 175 lb-ft (169 to 237 Nm) (17 to 24 kg/m)

5 - Lock nut torque .... 150 to 250 lb-ft (203 to 339 Nm) (21 to 35 kg/m)

HYDRAULIC SYSTEM

SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
 Fig. 14-Spanner Wrench	D-01053AA	Remove and install cylinder rod guides and spanner nuts
Ring Compressor	T00122*	To Install Piston Rings
Ring Compressor (Larger Cylinders)	T00115*	To Install Piston Rings
Adjustable Spanner Wrench	T00112*	To Install Gland Lock Ring

* Order From:
Digmor Equipment and Engineering Co.
P.O. Box 1187
Redlands, CA. 92373
(714)-794-1131

Section 33A
*9500 BACKHOE

CONTENTS OF THIS SECTION

**Early 310A units having backhoe serial number plates are equipped with the 9500 Backhoe.*

Later 310A units not having backhoe serial number plates are equipped with the 9405 Backhoe. (See Section 33 for repair of this backhoe.)

All 310B units are equipped with the 9405 Backhoe.

Group 3302
BUCKETS

GENERAL INFORMATION

There are standard, heavy duty or ejector buckets available on the 9500 Backhoe.

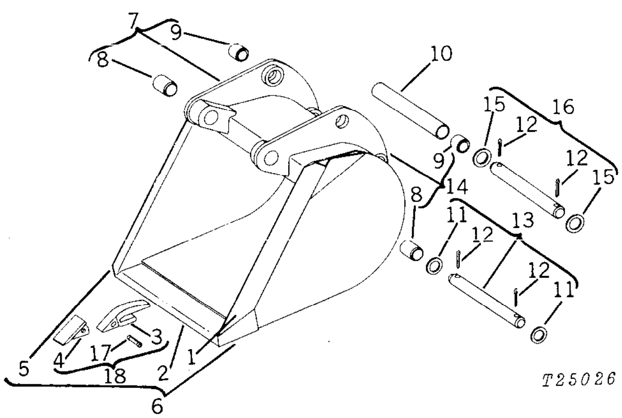
REMOVAL

Lower boom and dipperstick to position bucket on the ground.

CAUTION: Relieve hydraulic pressure on the bucket before removing the retaining pins.

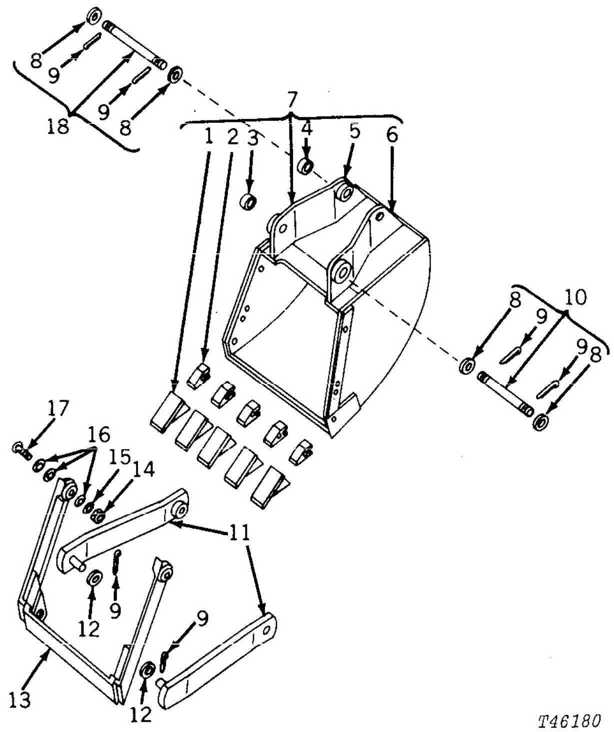
REPAIR

Refer to Fig. 1 or 2 during disassembly and assembly. Inspect all parts for excessive wear or damage and replace as necessary.



1—R.H. Side Cutting Edge
2—Front Cutting Edge
3—Tooth Shank
4—Tooth Tip
5—L.H. Side Cutting Edge
6—Bucket
7—L.H. Pivot Plate
8—Bushing (2 used)
9—Bushing (4 used)
10—Spacer
11—Backup Washer (2 used)
12—Cotter Pin (4 used)
13—Pin
14—R.H. Pivot Plate
15—Backup Washer (2 used)
16—Pin
17—Flex Pin
18—Tooth Assembly

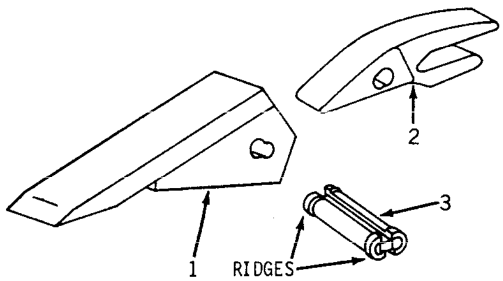
Fig. 1-Standard Bucket (with curved pivot plates)



1—Tooth Tip (Welded) (5 used)
2—Tooth Shank (5 used)
3—Bushing (2 used)
4—Bushing (2 used)
5—L.H. Pivot Plate
6—R.H. Pivot Plate
7—Ejector Bucket
8—Special Washer (4 used)
9—Cotter Pin (6 used)
10—Link Pin (To Dipper-stick)
11—Ejector Blade Link (2 used)
12—Special Washer (2 used)
13—Ejector Blade
14—Nut (2 used)
15—Lock Washer (2 used)
16—Washer (6 used)
17—Bolt (2 used)
18—Control Link to Bucket Pin

Fig. 2-Ejector Bucket

Backhoe Bucket Tooth Assembly - Heavy-Duty Buckets



T44120N

1—Tooth Tip **3—Flex Pin**
2—Tooth Shank

Fig. 3-Tooth Assembly

To fasten the tooth tip to shank, drive the flex pin in, making sure that the ridges face toward the tooth tip as shown in Fig. 3. The ridges are the locking mechanism.

NOTE: If "back" is stamped on the pin, it should face toward the shank.

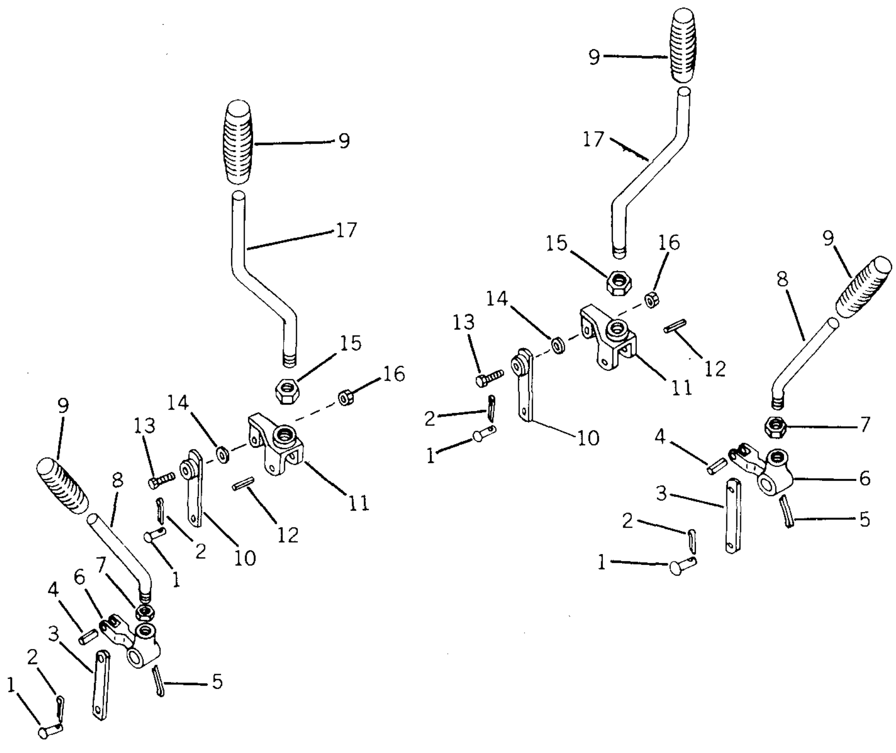
INSTALLATION

Align dipperstick to bucket and insert retaining pins.

Grease all fittings before operation.

Group 3315
CONTROLS LINKAGE

REPAIR



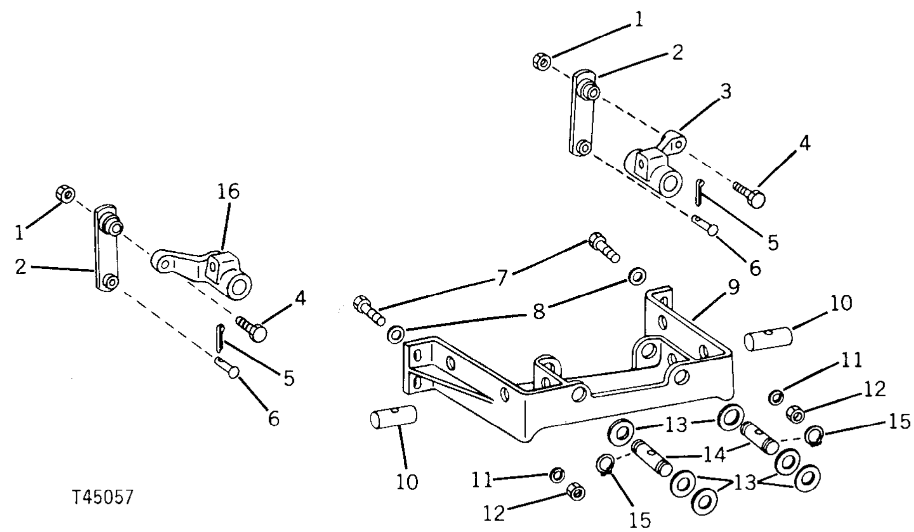
1—Connector Pin (4 used)
2—Cotter Pin (4 used)
3—Stabilizer Lever Connector Link (2 used)
4—Spring Pin (2 used)
5—Cotter Pin (2 used)
6—Stablizer Lever Handle Mount (2 used)
7—Jam Nut (2 used)
8—Stabilizer Control Lever (2 used)
9—Lever Hand Grip (4 used)
10—Four-Way Lever Control Link (2 used)
11—Four-Way Lever Handle Mount (2 used)
12—Groove Pin (2 used)
13—Cap Screw (2 used)
14—Spacer Washer (2 used)
15—Nut (2 used)
16—Nut (2 used)
17—Four-Way Lever (2 used)

Fig. 1-Control Levers and Linkage

Refer to Figs. 1 and 2 during disassembly and assembly of control linkage.

Inspect control valve linkage for worn or damaged parts.

Coat shafts and movable linkage parts with grease before assembly.



1—Nut (2 used)
2—Four-Way Lever Connector Link (2 used)
3—R.H. Pivot Link
4—Cap Screw (2 used)
5—Cotter Pin (2 used)
6—Connector Pin (2 used)
7—Cap Screw (4 used)
8—Washer (4 used)
9—Lever Mounting Frame
10—Stabilizer Lever Pivot Shaft (2 used)
11—Lock Washer (4 used)
12—Nut (4 used)
13—Washer (6 used)
14—Four-Way Lever Pivot Shaft (2 used)
15—Snap Ring (4 used)
16—L.H. Pivot Link

Fig. 2-Lever Mounting Frame

Group 3340
FRAMES

MAIN FRAME

REMOVAL

Have several metal support stands and adequate supply of blocking available for supporting the heavy components of this machine.

1. Drive machine to an area where the backhoe can be safely supported and blocked.

2. Extend dipperstick and boom to maximum extended position with bucket resting on floor.

3. Lower stabilizers to the floor and apply just enough hydraulic pressure to take the weight off the mounting pins for easy removal.

4. Remove the rear pins (one pin on each side connecting the backhoe frame to loader frame, Fig. 1).

5. Use stabilizers to raise backhoe frame off the bottom mounting bracket hooks.

6. Carefully move the tractor away from the backhoe unit (with hoses attached) until the backhoe is clear of the loader frame. Do not separate far enough to stretch the hoses.

7. Place heavy blocking under backhoe main frame to support unit.

8. Carefully retract the stabilizer until the main frame is resting on blocking under main frame.

9. Operate stabilizer controls to permit backhoe to rest solidly on the blocking.

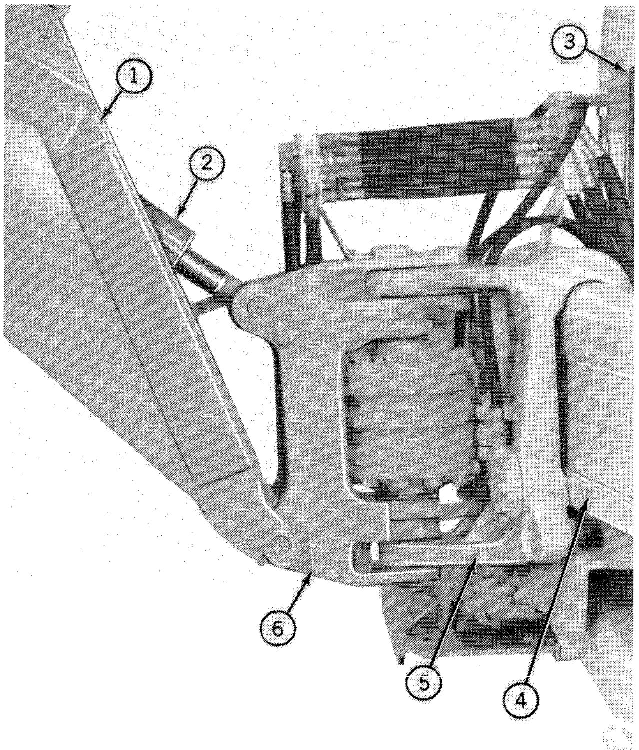
CAUTION: Be sure to discharge hydraulic function accumulator before disconnecting hoses. This can be done by operating stabilizer control until control response ceases.

10. Disconnect the pressure and return lines at the quick disconnect couplers.

11. Plug backhoe hydraulic lines to prevent dirt from entering the system.

Fig. 1-Backhoe Attaching Points

DISASSEMBLY



T46212NY

1—Boom
2—Boom Cylinder
3—Valve Assembly
4—Main Frame
5—Sliding Boom Pivot
6—Boom Pivot

Fig. 2-Backhoe

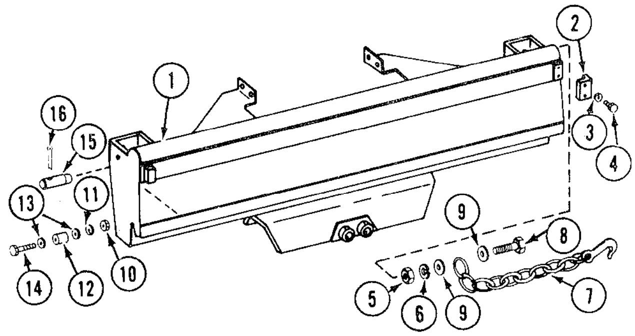
Support boom and dipperstick with a hoist or blocks. Support main frame with blocks.

Remove boom cylinder pin and hydraulic hoses to boom and dipperstick. Remove boom to boom pivot pin and remove boom and dipperstick as one assembly.

Remove valve assembly.

Remove stop plate on right side of main frame.

Attach hoist to swing assembly (sliding boom pivot and boom pivot) and slide assembly off right side of main frame.



T46213

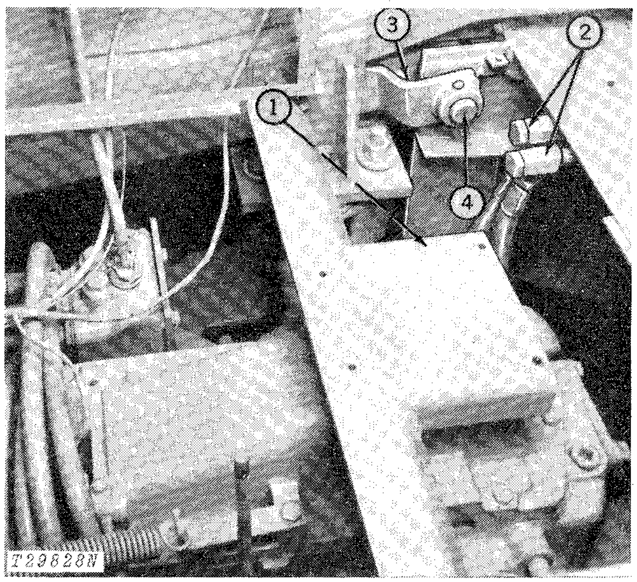
1—Frame
2—Stop Plate
3—Lock Washer (2 used)
4—Cap Screw (2 used)
5—Nut
6—Lock Washer
7—Swing Lock Chain
8—Cap Screw
9—Washer (5 used)
10—Nut (2 used)
11—Lock Washer (2 used)
12—Ferrule (2 used)
13—Washer (4 used)
14—Cap Screw (2 used)
15—Main Frame to Sub Frame Pin (2 used)
16—Cotter Pin (2 used)

Fig. 3-Main Frame

SUBFRAME

REMOVAL

Attach chain hoist to subframe.



1—Lower Mounting Pins **3—Tie Bar**
2—Hydraulic Hoses **4—Tie Bar Mounting Pins**

Fig. 4-Backhoe Mounting (Seat and platform removed to illustrate mounting points)

Remove the two lower rear pins on each side connecting the backhoe frame to loader frame (Fig. 4). To facilitate removal of the pins, align the cutout of the rear wheels with the pins.

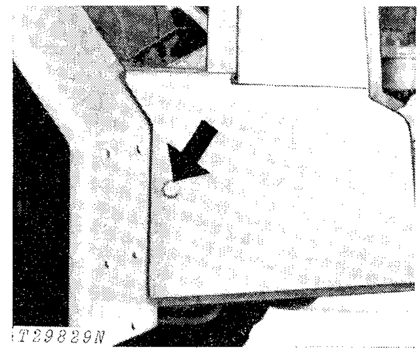


Fig. 5-Tie Bar Pins

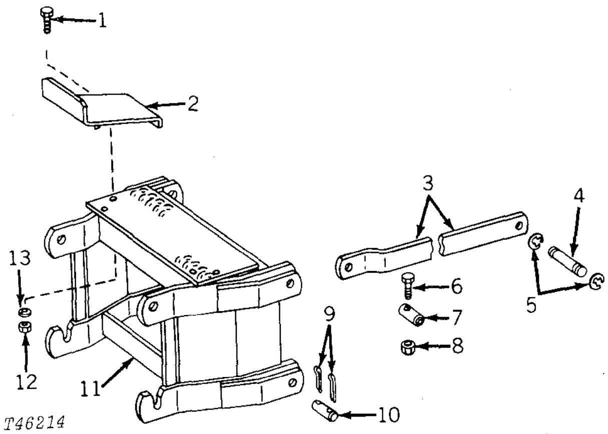
Remove the two tie bar pins from the loader frame (Fig. 5).

NOTE: Tie bars will come off with backhoe.

Disconnect backhoe pressure and return lines at junction shown in Fig. 4.

Plug backhoe hydraulic lines to prevent dirt from entering the system.

Plug pressure and return lines on machine so that machine can be moved.

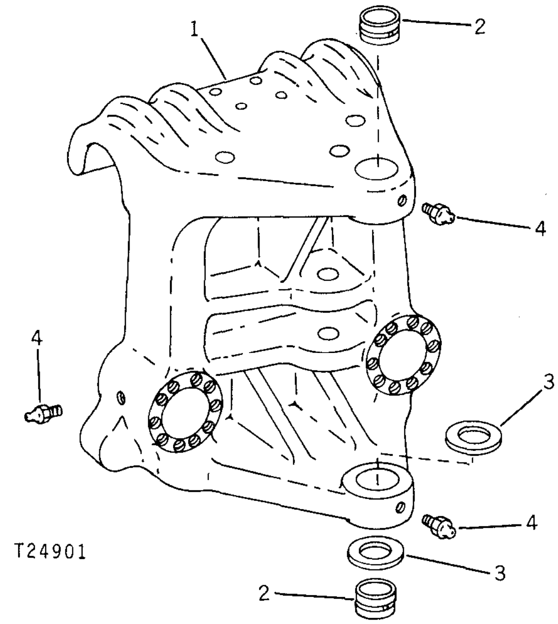


1—Cap Screw (4 used)
2—Footrest
3—Tie Bar (2 used)
4—Tie Bar to Loader Pin (2 used)
5—Snap Ring (4 used)
6—Cap Screw (2 used)
7—Subframe to Tie Bar Pin (2 used)
8—Lock Nut (2 used)
9—Cotter Pin (4 used)
10—Subframe to Loader Pin (2 used)
11—Subframe
12—Nut (4 used)
13—Lock Washer (4 used)

Fig. 6-Subframe

SLIDING BOOM PIVOT

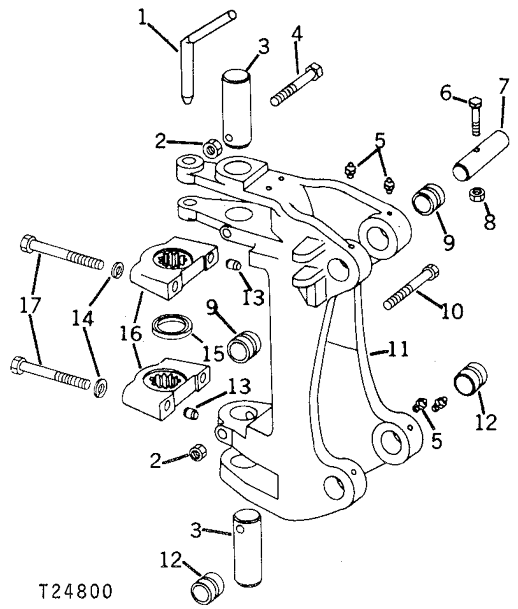
Refer to Fig. 7 for disassembly and assembly of sliding boom pivot. Refer to Group 3360 for information on the swing cylinder and locking cylinders.



1—Sliding Boom Pivot
2—Bushing (2 used)
3—Washer (2 used)
4—Grease Fitting (4 used)

Fig. 7-Sliding Boom Pivot

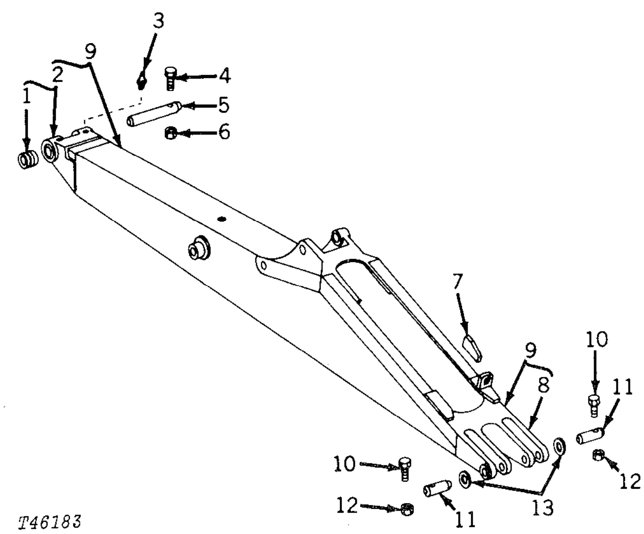
BOOM PIVOT



1—Pin
2—Lock Nut (2 used)
3—Pin (2 used)
4—Cap Screw (2 used)
5—Grease Fitting (4 used)
6—Cap Screw
7—Pin
8—Lock Nut
9—Bushing (2 used)
10—Cap Screw
11—Boom Pivot
12—Bushing (2 used)
13—Dowel (2 used)
14—Lock Washer (4 used)
15—Spacer Ring
16—Shaft Coupling (2 used)
17—Cap Screw (4 used)

Fig. 8-Boom Pivot

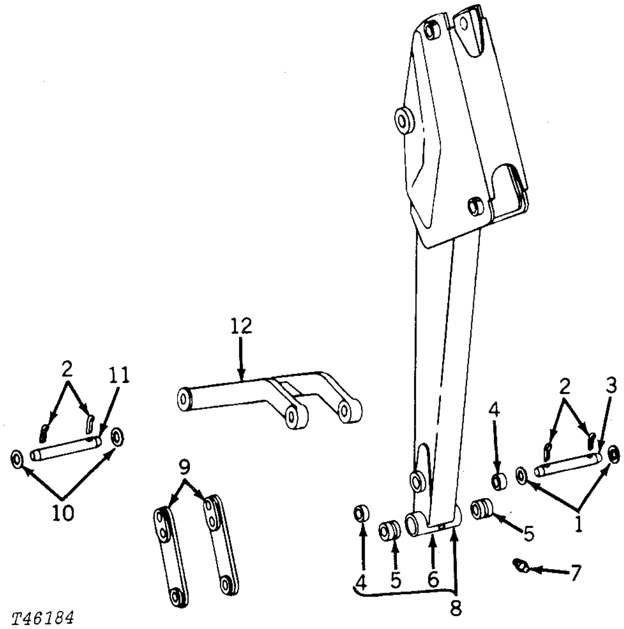
BOOM



1—Bushing (2 used)
2—Boom Upper Pivot
3—Grease Fitting (2 used)
4—Cap Screw
5—Pivot Pin
6—Special Nut
7—Boom Wedge
8—Boom Lower Pivot
9—Boom Assembly
10—Cap Screw (2 used)
11—Boom Pivot Pin (2 used)
12—Stop Nut (2 used)
13—Backup Washer (use as required)

Fig. 9-Boom

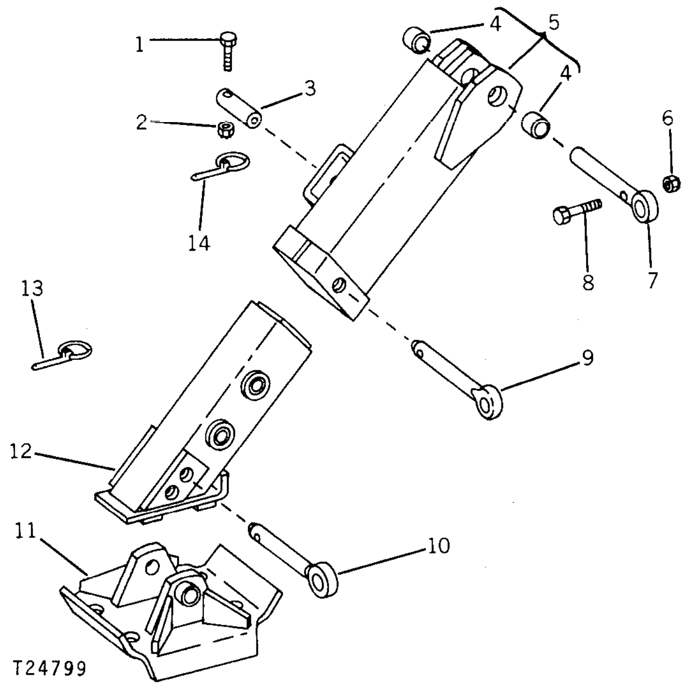
DIPPERSTICK



1—Special Washer (2 used)
2—Cotter Pin (4 used)
3—Pin
4—Bushing (2 used)
5—Bushing (2 used)
6—Pivot End
7—Grease Fitting
8—Dipperstick
9—Coupler Links (2 used)
10—Special Washer (2 used)
11—Pin
12—Guide Link

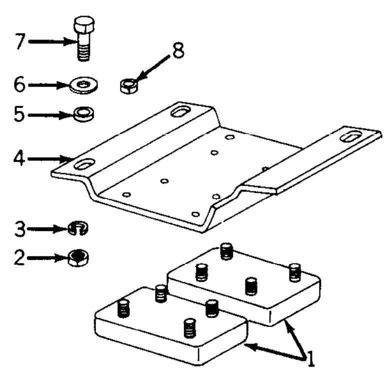
Fig. 10-Dipperstick

STABILIZER



1—Cap Screw
2—Nut
3—Pin
4—Bushing (2 used)
5—Stabilizer
6—Nut
7—Pin
8—Cap Screw
9—Pin
10—Pin
11—Stabilizer Foot
12—Stabilizer Inner Box
13—Pin
14—Pin

Fig. 11-Stabilizer

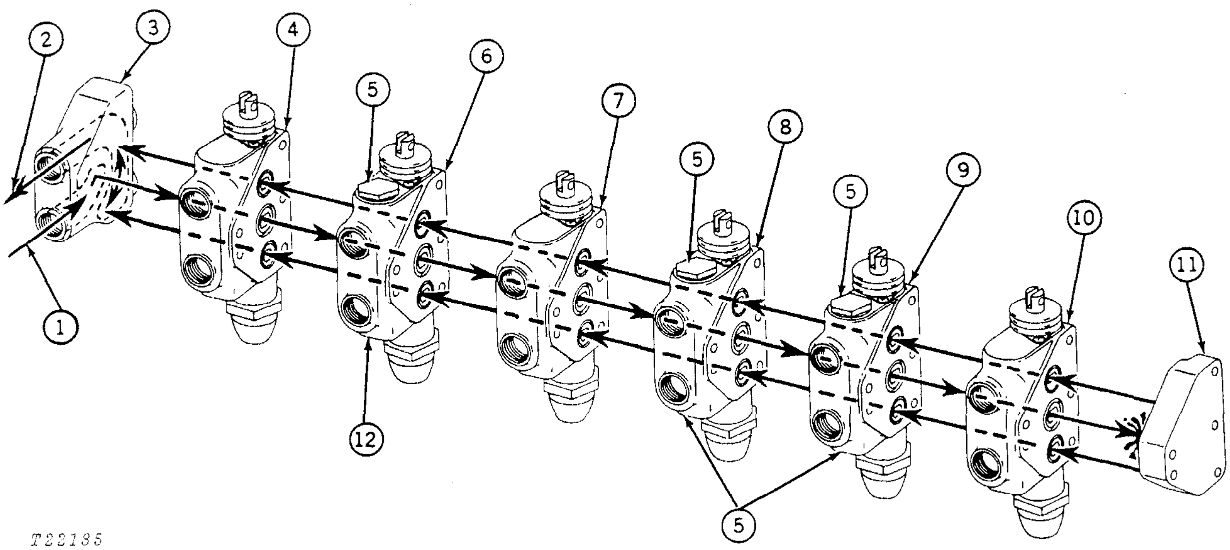


1—Rubber Track Shoe (4 used)
2—Nut (6 used)
3—Lock Washer (6 used)
4—R.H. Pad Plate
5—Spacer (6 used)
6—Washer (6 used)
7—Cap Screw (6 used)
8—Nut (16 used)

Fig. 12-Street Pads

Group 3360
HYDRAULIC SYSTEM

CONTROL VALVE
GENERAL INFORMATION



1—Pressure Oil
2—Return Oil
3—Port Plate
4—Stabilizer Valve
5—Relief Valve
6—Crowd Valve
7—Bucket Valve
8—Swing Valve
9—Boom Valve
10—Stabilizer Valve
11—End Plate
12—Plug

Fig. 1-Oil Flow Through Backhoe Control Valve Stack

The backhoe hydraulic functions control valve is a closed-center, six spool, stack-type valve.

There is no continuous flow of oil through the closed-center control valve when the valve is in neutral. Because the main hydraulic pump delivers oil only on demand, oil flows through the control valve only when the control lever is moved.

Fig. 1 shows the flow of oil through the backhoe control valve with all valve sections in neutral. Note that the oil is blocked when it reaches the end plate.

Valve Construction

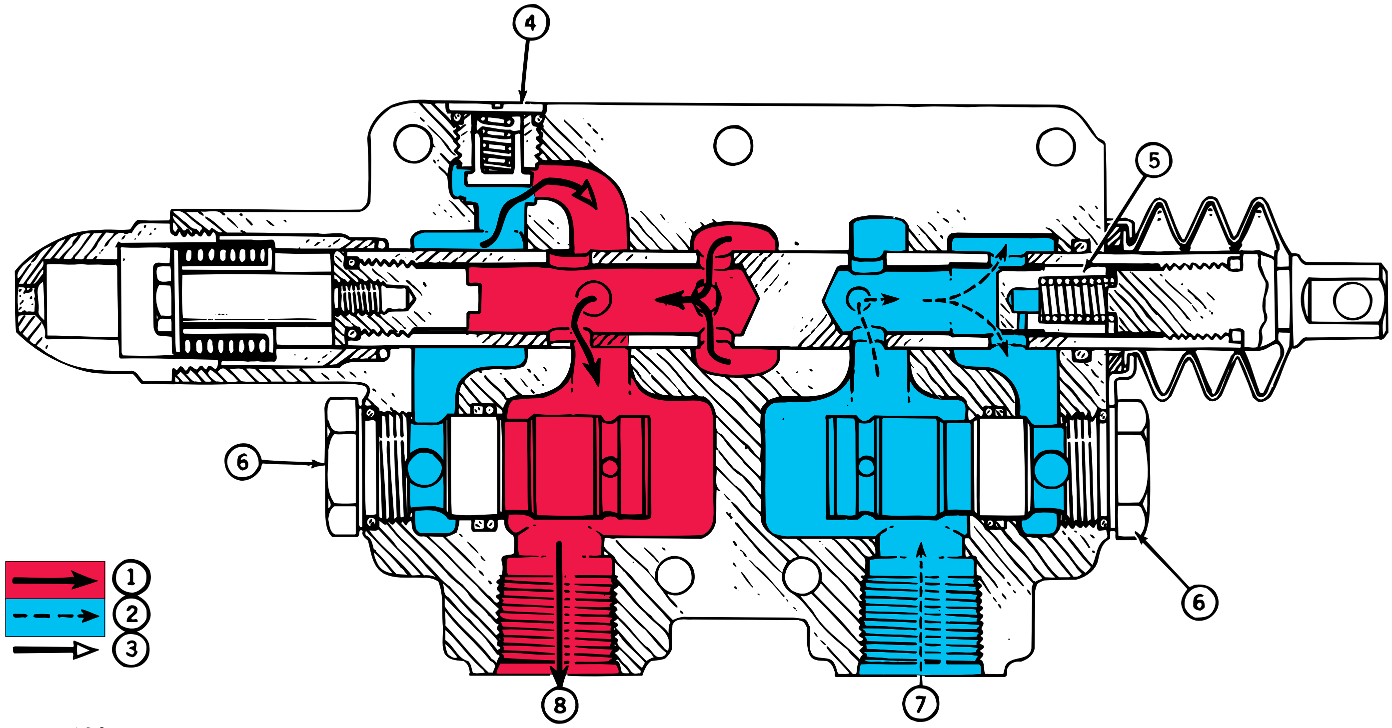
All valve sections are separate bodies containing single spools. All spools contain lift checks which serve as one-way valves to prevent drift or leakage of pressure oil to the port passages.

The crowd, boom, and swing sections each contain relief valves to protect their circuits from excessive pressures.

The stabilizer, swing and boom valve sections contain orifice plates to slow the action of the cylinders.

The boom and swing valve sections contain anti-cavitation check valves.

The pressure and return ports are both located in the port plate. The end plate on the control valve assembly is completely blocked.



T22186

1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Oil
4—Anti-Cavitation Check Valve
5—Lift Check
6—Relief Valve
7—From Cylinder
8—To Cylinder

Fig. 2-Boom Section (Lowering Circuit Shown)

Figs. 2 and 3 illustrate the boom and swing valve. Although there are slight mechanical variations, oil flow through the other valve sections is similar.

Boom Section

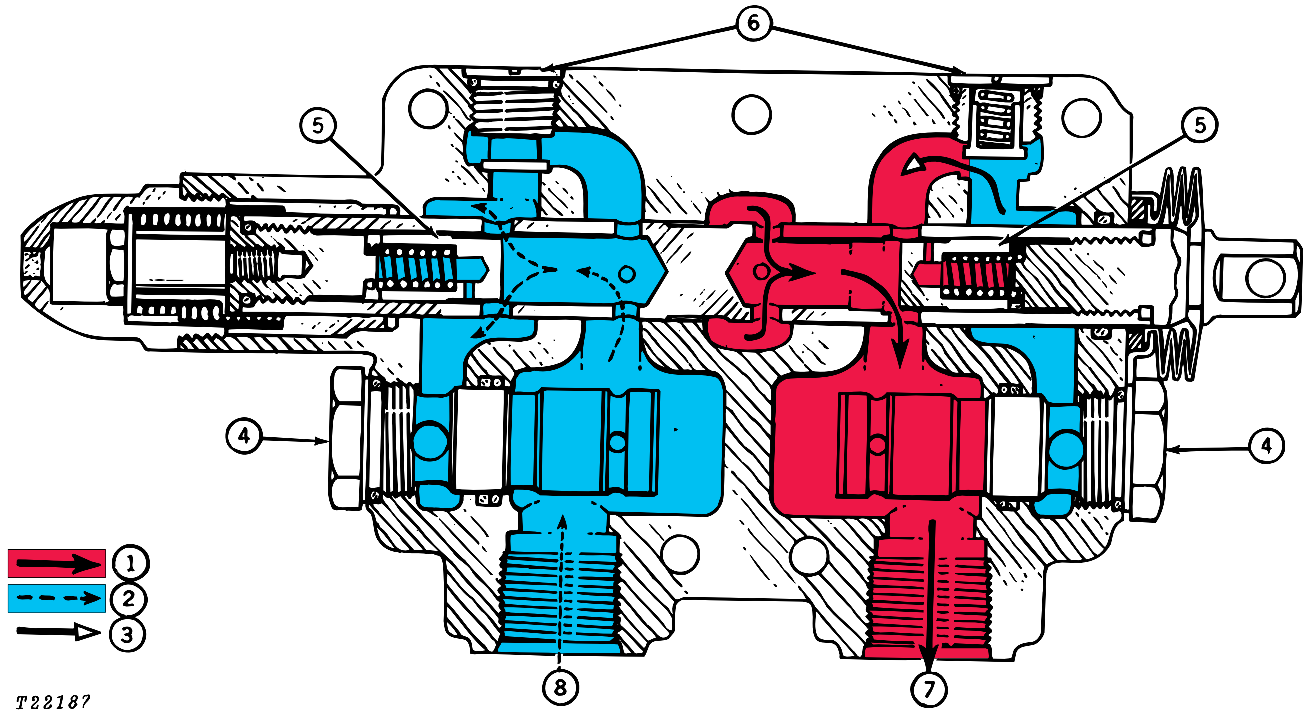
When the boom spool is extended or retracted to lower or raise the boom, the pump moves oil to the control valve. Oil is then directed through the lift check to the boom cylinder.

Displaced oil from the cylinder is forced back through the control valve to the reservoir. Note that if cavitation occurs, return oil flow through the anti-cavitation check valve is directed to the applied side of the boom valve.

When the swing spool is moved, the hydraulic pump moves oil to the control valve. Pressure oil then flows through the lift check to the swing cylinder.

Displaced oil from the cylinder is forced back through the control valve to the reservoir.

To prevent cavitation, a portion of the return oil may unseat the anti-cavitation check valve in the valve housing and supplement the flow to the swing cylinder.



1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Oil
4—Relief Valve
5—Lift Check
6—Anti-Cavitation Check Valve
7—To Cylinder
8—From Cylinder

Fig. 3-Swing Section (Left Swing Circuit Shown)

REMOVAL

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

Operate backhoe control valve levers until all hydraulic pressure is relieved.

Discharge the accumulator by turning the machine steering wheel back and forth until it no longer operates freely.

Label control valve ports and lines to aid assembly.

If control valve stack is to be removed for servicing and it is believed that fragments of failed valve parts may have entered the hydraulic system, completely drain the system and replace the hydraulic filters.

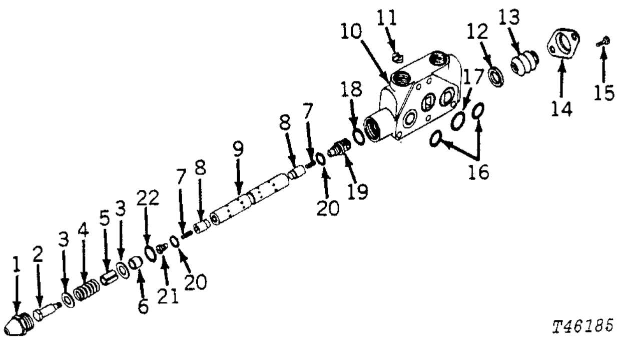
REPAIR

Service individual valves separately. Be sure valve bodies and their spools are kept together because these parts are matched assemblies.

Remove tie bolts and separate valve sections.

Remove end caps and remove spools from valve housings.

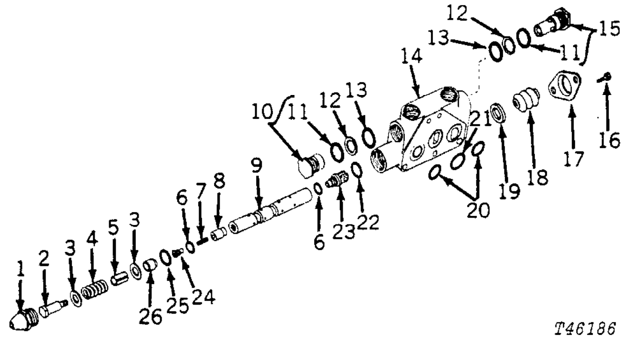
Clean and dry all parts thoroughly and inspect for wear or damage.



T46185

1—Spool Cap
2—Valve Spool Screw
3—Spool Washer (2 used)
4—Spool Spring
5—Spool Spacer
6—Bushing
7—Lift Check Spring (2 used)
8—Lift Check (2 used)
9—Stabilizer Valve Spool
10—Stabilizer Valve Housing
11—Orifice
12—Breather Washer
13—Spool Dust Seal
14—Dust Seal Retainer
15—Machine Screw (2 used)
16—O-Ring (2 used)
17—O-Ring
18—O-Ring
19—Spool Clevis
20—O-Ring (2 used)
21—Spool Plug
22—O-Ring

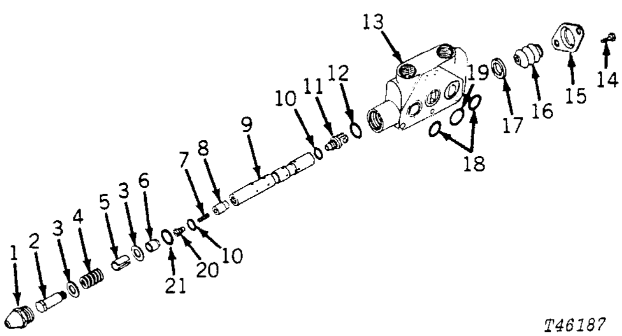
Fig. 4-Stabilizer Valve



T46186

1—Spool Cap
2—Valve Spool Screw
3—Spool Washer (2 used)
4—Spool Spring
5—Spool Spacer
6—O-Ring (2 used)
7—Lift Check Spring
8—Lift Check
9—Crowd Valve Spool
10—Plug
11—O-Ring (2 used)
12—Back-up Washer (2 used)
13—O-Ring (2 used)
14—Crowd Valve Housing
15—Relief Valve Cartridge
16—Machine Screw (2 used)
17—Dust Seal Retainer
18—Spool Dust Seal
19—Breather Washer
20—O-Ring (2 used)
21—O-Ring
22—O-Ring
23—Spool Clevis
24—Spool Plug
25—O-Ring
26—Bushing

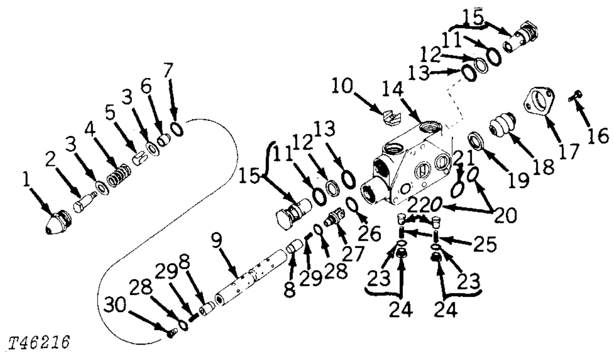
Fig. 5-Crowd Valve



T46187

1—Spool Cap
2—Valve Spool Screw
3—Spool Washer (2 used)
4—Spool Spring
5—Spool Spacer
6—Bushing
7—Lift Check Spring
8—Lift Check
9—Bucket Valve Spool
10—O-Ring (2 used)
11—Spool Clevis
12—O-Ring
13—Bucket Valve Housing
14—Machine Screw
15—Dust Seal Retainer
16—Spool Dust Seal
17—Breather Washer
18—O-Ring (2 used)
19—O-Ring
20—Spool Plug
21—O-Ring

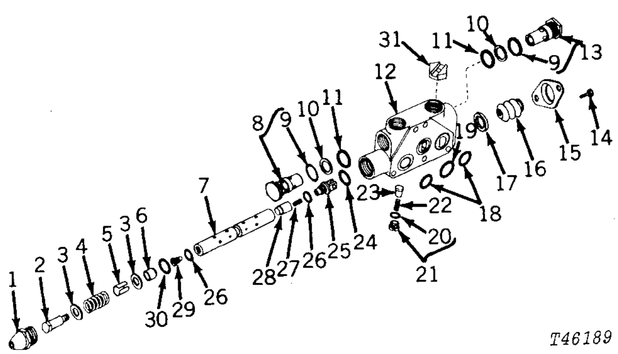
Fig. 6-Bucket Valve



T46216

1—Spool Cap
2—Valve Spool Screw
3—Spool Washer (2 used)
4—Spool Spring
5—Spool Spacer
6—Bushing
7—O-Ring
8—Lift Check (2 used)
9—Swing Valve Spool
10—Orifice Plate
11—O-Ring (2 used)
12—Backup Washer (2 used)
13—O-Ring (2 used)
14—Swing Valve Housing
15—Relief Valve Cartridge
16—Machine Screw (2 used)
17—Dust Seal Retainer
18—Spool Dust Seal
19—Breather Washer
20—O-Ring (2 used)
21—O-Ring
22—Anti-Cavitation Plunger (2 used)
23—O-Ring (2 used)
24—Plug Assembly (2 used)
25—Plunger Spring (2 used)
26—O-Ring
27—Spool Clevis
28—O-Ring (2 used)
29—Lift Check Spring (2 used)
30—Spool Plug

Fig. 7-Swing Valve



T46189

Fig. 8-Boom Valve

Check valve housing for damage or evidence of leakage. Replace housing and spool as a matched assembly. Check the spool spring for a length of 1.187 in. (30.15 mm) with 27 lb. (120 N) (12 kg).

Remove anti-cavitation check valves (if applicable) from valve section and inspect for damage. Check the springs for a length of 0.625 in. (15.88 mm) with 0.75 lb. (3 N) (0.3 kg).

Remove spool ends and inspect lift checks for damage. Be sure hole in lift check is not plugged. Check the lift check spring for a length of 0.845 in. (21.46 mm) with 0.5 lb. (2 N) (0.2 kg).

Inspect hole in orifice plates (if applicable) for plugged condition. Install plates with the smooth side toward the valve housing.

ASSEMBLY

Thoroughly clean and dry all parts. Oil all parts lightly prior to assembly.

Replace all O-ring and backup washers with new parts.

Install spools in proper valve section. Apply AT52853 John Deere LOCTITE® Thread Lock and Sealer (low strength) or equivalent on threads of spool screws.

Stack port plate, valve sections and end plate in proper sequence.

Install tie bolts and tighten evenly with 20 to 25 lb-ft (27 to 34 Nm) (2.8 to 3.5 kg/m).

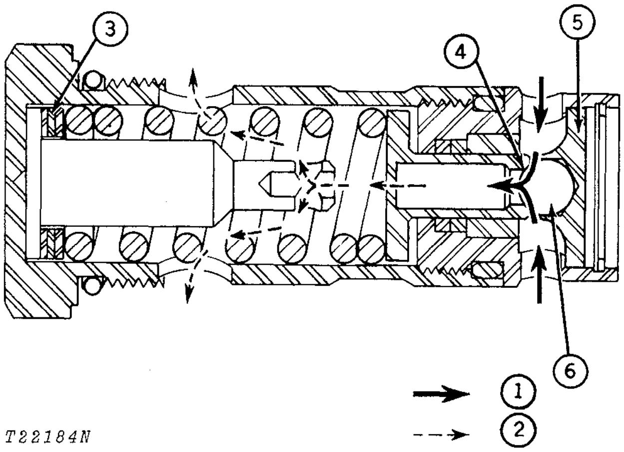
1—Spool Cap
2—Valve Spool Screw
3—Spool Washer (2 used)
4—Spool Spring
5—Spool Spacer
6—Bushing
7—Boom Valve Spool
8—Relief Valve Cartridge
9—O-Ring (2 used)
10—Backup Washer (2 used)
11—O-Ring (2 used)
12—Boom Valve Housing
13—Relief Valve Cartridge
14—Machine Screw (2 used)
15—Dust Shield Retainer
16—Spool Dust Seal
17—Breather Washer
18—O-Ring (2 used)
19—O-Ring
20—O-Ring
21—Plug Assembly
22—Plunger Spring
23—Anti-Cavitation Plunger
24—O-Ring
25—Spool Clevis
26—O-Ring (2 used)
27—Lift Check Spring
28—Lift Check
29—Spool Plug
30—O-Ring
31—Orifice

Legend for Fig. 8

LOCTITE a trademark of the Loctite Corp.

RELIEF VALVES

GENERAL INFORMATION

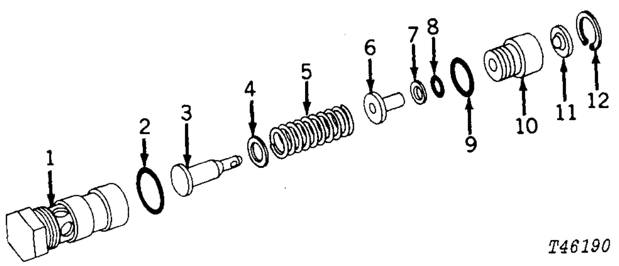


1—Pressure Oil
2—Return Oil
3—Shims
4—Seat
5—Retainer
6—Steel Ball

Fig. 9-Direct-Acting Relief Valves

The crowd, boom and swing sections of the valve stack use direct-acting relief valves.

REPAIR



1—Relief Valve Cage
2—O-Ring
3—Spring Guide
4—Washer (use as required)
5—Spring
6—Seat
7—Backup Washer
8—O-Ring
9—O-Ring
10—Plug
11—Retainer
12—Snap Ring

Fig. 10-Relief Valve

Remove relief valve from valve housing.

Disassemble relief valve using Fig. 10 as a guide.

Position the hex. head of the relief valve cartridges in a vise and remove snap ring and retainer.

Remove parts from valve cage.

Thoroughly clean and dry all parts. Inspect parts and replace as necessary.

Check spring for a length of 1.5 in. (38 mm) with 122.5 lb. (545 N) (56 kg).

When assembling the relief valve, be sure to use all the shims removed.

Assemble parts in cage and install retainer and snap ring.

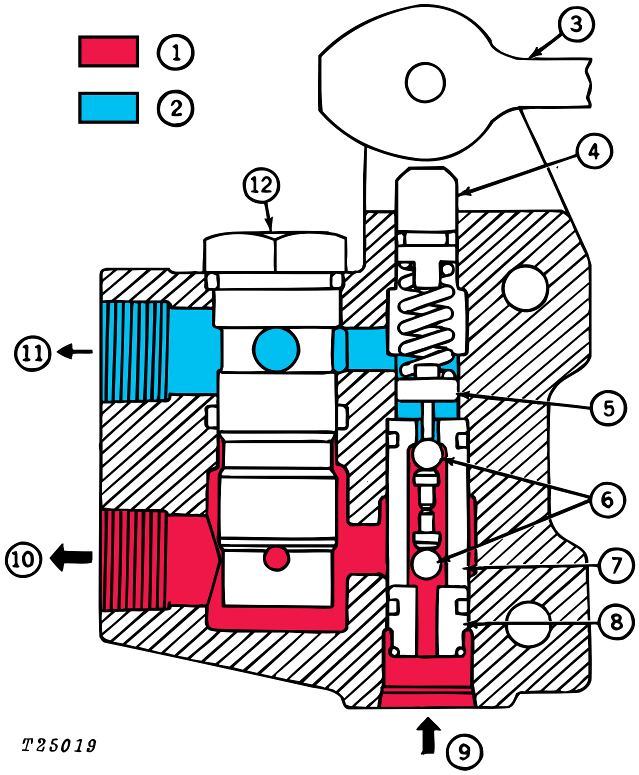
INSTALLATION

Install control valve and connect linkage and oil lines.

Run machine and check backhoe circuit for proper operation and leaks.

LOCKING CONTROL VALVE

GENERAL INFORMATION



1—Pressure
2—Return Oil
3—Control Lever
4—Main Piston
5—Intermediate Piston
6—Balls
7—Valve Liner
8—Base
9—Pressure Line
10—To Piston
11—To Sump
12—Relief Valve

Fig. 11-Locking Control Valve (engaged)

The 9500 Backhoe is equipped with a locking control valve (Fig. 11). This valve activates locking pistons which lock the backhoe in position while in operation or in transport.

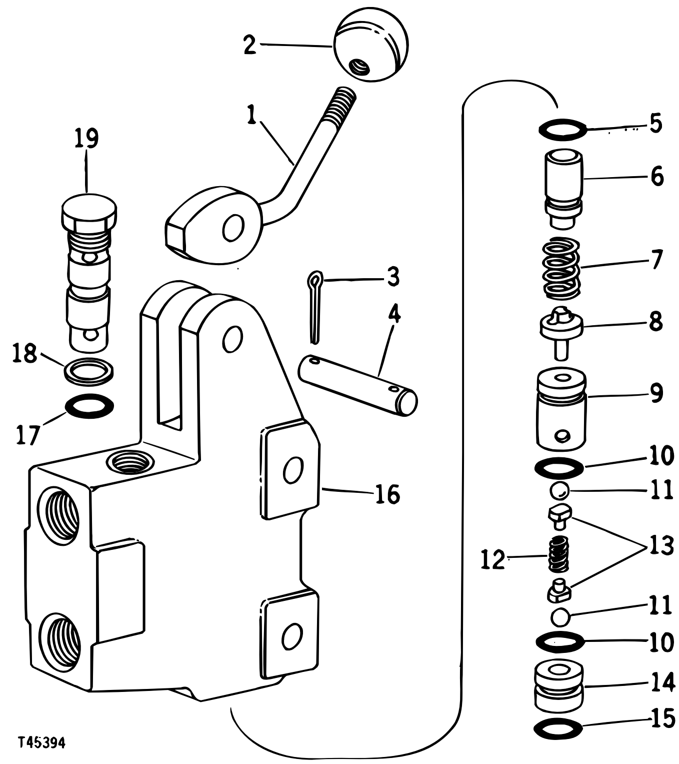
Engaged Position (Fig. 11)

Pressure oil lifts the lower ball off its seat on the base (8, Fig. 11). Pressure oil is then routed to the locking pistons forcing them against the backhoe main frame.

Disengaged Position (not illustrated)

When the control lever is placed in the vertical position the main piston (4) is pushed down, compressing the spring located directly beneath it. The compressed spring forces the intermediate piston (5) down, unseating the upper ball. Pressure oil is then routed to the sump relieving the pressure built up behind the locking pistons.

REPAIR



1—Lock Control Lever
2—Knob
3—Cotter Pin (2 used)
4—Special Pin
5—O-Ring
6—Main Piston
7—Spring
8—Intermediate Piston
9—Valve Liner
10—O-Ring
11—Ball (2 used)
12—Spring
13—Intermediate Piston (2 used)
14—Base
15—O-Ring
16—Body
17—O-Ring
18—Backup Washer
19—Relief Valve

Fig. 12-Locking Control Valve

Refer to Fig. 12 during disassembly and assembly of the locking control valve.

Remove any burrs or rough spots from main piston with fine emery cloth.

Thoroughly clean and dry all parts. Oil all parts lightly prior to assembly.

Replace all O-rings and backup washers with new parts.

STABILIZER, BOOM, CROWD, BUCKET AND LOCKING CYLINDERS

GENERAL INFORMATION

NOTE: For information on the swing cylinder, see page 33A-3360-13.

The hydraulic cylinders are double acting with V-packings. Piston pins are heat treated, chrome plated and polished. Replaceable non-metallic wear rings are used on the piston retainers to prevent scoring of the cylinder barrels.

The backhoe crowd and boom cylinders are hydraulically cushioned. This prevents harsh stops when the cylinder reaches the end of its stroke.

FOS See "Hydraulic Cylinders" in FOS Manual "HYDRAULICS" for additional information on cylinders and an explanation of the hydraulic cushion design.

REMOVAL

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

CAUTION: Be sure the engine is stopped and the bucket is resting on the ground before attempting to remove cylinders.

Operate the control valve levers until all hydraulic pressure is relieved.

Remove the hoses and cap them to prevent dirt from entering the system. Remove the pins from each end of the cylinder and move the cylinder to a clean disassembly area.

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filters.

REPAIR

Clamp the cylinder in a vise to prevent it from turning. Use a spanner wrench to loosen rod guide or spanner nut.

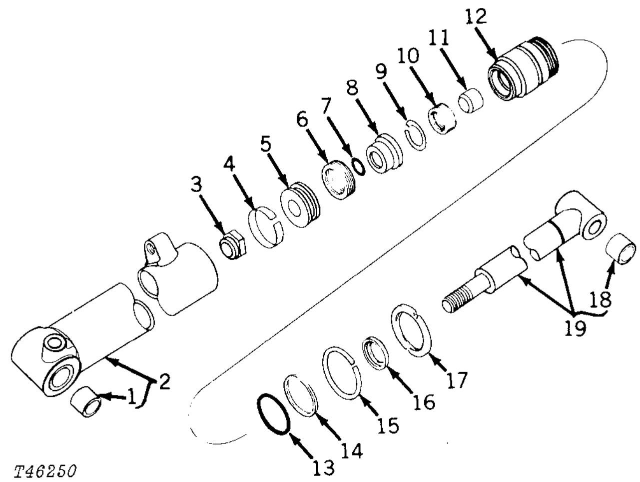
Clamp the cylinder rod end in a vise, taking care to prevent damage to the piston rod. Remove nut from end of rod. Slide parts from rod.

Wash all parts thoroughly with diesel fuel and inspect the following:

1. Check barrel, rod guide, and rod for scoring and O-rings for surface damage.

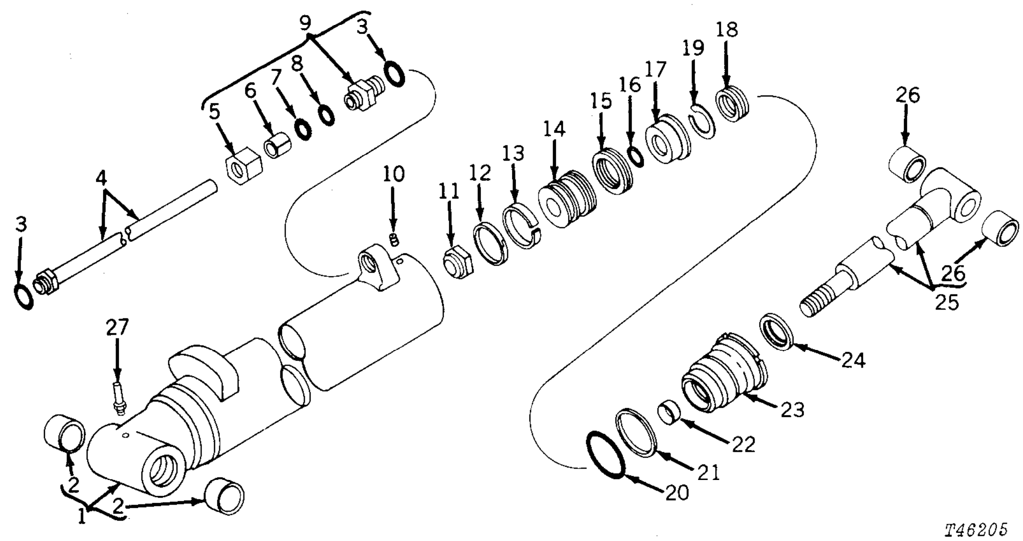
2. Check V-packings and wear rings for breaks, cuts, or foreign material.

3. Check piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.



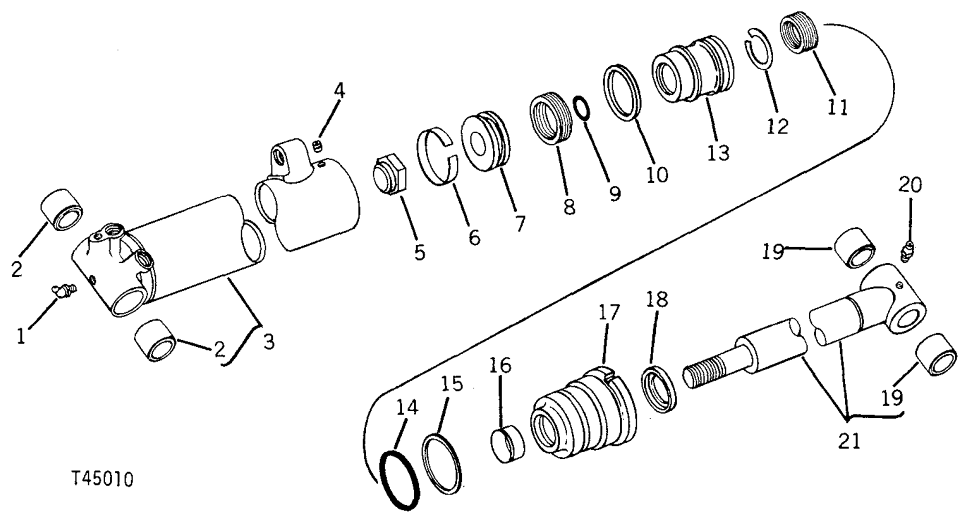
1—Bushing (2 used)
2—Barrel
3—Lock Nut
4—Wear Ring
5—Piston Retainer
6—V-Packing
7—O-Ring
8—Piston
9—Snap Ring
10—V-Packing
11—Rod Guide Wear Ring
12—Rod Guide
13—O-Ring
14—Backup Washer
15—Snap Ring
16—Wiper Seal
17—Spanner Nut
18—Bushing (2 used)
19—Piston Rod

Fig. 13-Stabilizer Cylinder



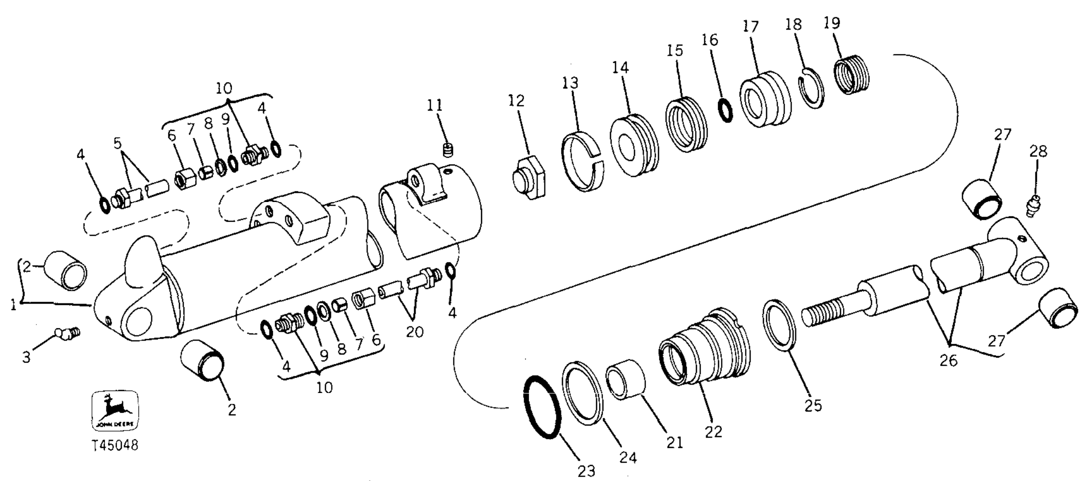
1—Barrel
2—Bushing (2 used)
3—O-Ring (2 used)
4—Return Tube
5—Special Nut
6—Backup Washer
7—O-Ring
8—O-Ring
9—Tube Connector
10—Set Screw
11—Lock Nut
12—Brake Seal
13—Piston Retainer Wear Ring
14—Piston
15—V-Packing
16—O-Ring
17—Piston
18—V-Packing
19—Snap Ring
20—O-Ring
21—Backup Washer
22—Wear Ring
23—Rod Guide
24—Wiper Seal
25—Rod Assembly
26—Bushing (2 used)
27—Grease Fitting

Fig. 14-Boom Cylinder



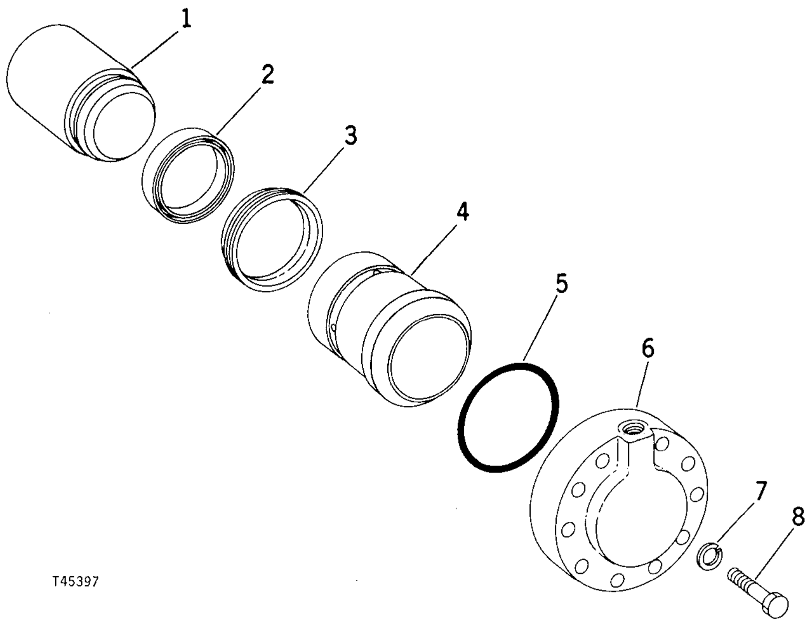
1—Grease Fitting
2—Bushing (2 used)
3—Barrel
4—Set Screw
5—Lock Nut
6—Wear Ring
7—Piston
8—V-Packing
9—O-Ring
10—Brake Seal
11—V-Packing
12—Snap Ring
13—Piston
14—O-Ring
15—Backup Washer
16—Rod Guide Wear Ring
17—Rod Guide
18—Wiper Seal
19—Bushing (2 used)
20—Grease Fitting
21—Rod Assembly

Fig. 15-Crowd Cylinder



1—Barrel
2—Bushing (2 used)
3—Grease Fitting
4—O-Ring (4 used)
5—Return Tube
6—Connector
7—Ferrule (2 used)
8—Backup Washer (2 used)
9—O-Ring (2 used)
10—Union Adapter (2 used)
11—Set Screw
12—Lock Nut
13—Wear Ring
14—Piston Retainer
15—V-Packing
16—O-Ring
17—Piston
18—Snap Ring
19—V-Packing
20—Return Tube
21—Rod Guide Wear Ring
22—Rod Guide
23—O-Ring
24—Wiper Seal
25—Wiper Seal
26—Piston Rod
27—Bushing (2 used)
28—Grease Fitting

Fig. 16-Bucket Cylinder



1—Piston (2 used)
2—Seal (2 used)
3—Seal (2 used)
4—Barrel (2 used)
5—O-Ring (2 used)
6—Cap (2 used)
7—Lock Washer (20 used)
8—Cap Screw (20 used)

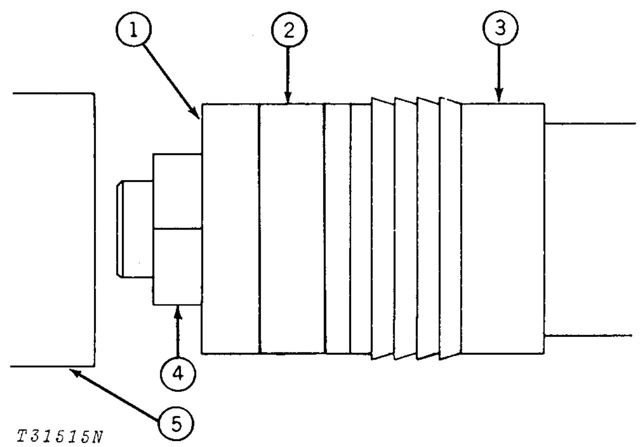
Fig. 17-Locking Cylinder

ASSEMBLY

Repair kits are available for overhauling all cylinders. Discard used parts and use all new parts provided in kits when assembling cylinders.

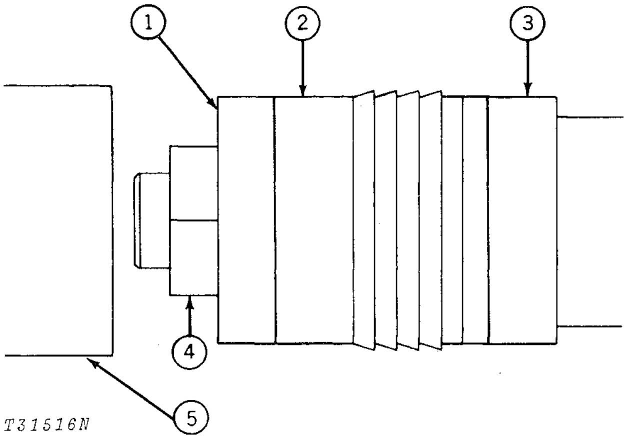
Lubricate all O-rings, seals, and packings before assembly.

V-packings are originally installed on the piston with the apex of the V pointing away from the barrel (Fig. 18). When replacing V-packings in the field this procedure can be used if a suitable ring compressor is available to compress packings during installation.



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

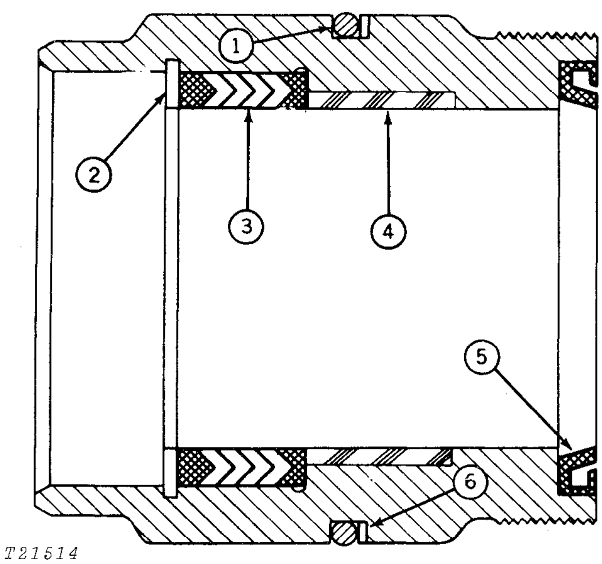
Fig. 18-Original Installation of V-Packing



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 19-Installation of V-Packing Without Compressor

If a suitable compressor is not available, assemble the packings with the apex of the V pointing toward the barrel (Fig. 19). This eliminates scuffing that may occur in assembly; however, the V-packing may become torn if the cylinder has to be disassembled in the future.



1—O-Ring
2—Snap Ring
3—V-Packing
4—Wear Ring
5—Wiper Seal
6—Backup Washer

Fig. 20-Rod Guide Components

Install new wiper seal in rod guide.

Install new wear ring in rod guide. Position backup washer and O-ring on rod guide.

Install V-packing in rod guide with the apex of the V toward the wear ring and secure with snap ring.

Slip rod guide assembly on piston rod being careful not to damage packing.

Position piston on piston rod. Install wear ring on piston retainer. Position retainer on piston rod and secure with stop nut.

Tighten stabilizer cylinder stop nut to 150 to 250 lb-ft (203 to 339 Nm) (21 to 35 kg/m).

Tighten crowd, boom or bucket cylinder stop nut to 600 to 700 lb-ft (813 to 949 Nm) (83 to 97 kg/m).

Install piston rod assembly into barrel.

Secure piston rod assembly in barrel with snap ring (if used) and spanner nut or with rod guide.

Tighten stabilizer cylinder nut to 150 lb-ft (203 Nm) (21 kg/m).

Tighten crowd, boom or bucket nut to 250 to 300 lb-ft (339 to 407 Nm) (35 to 41 kg/m).

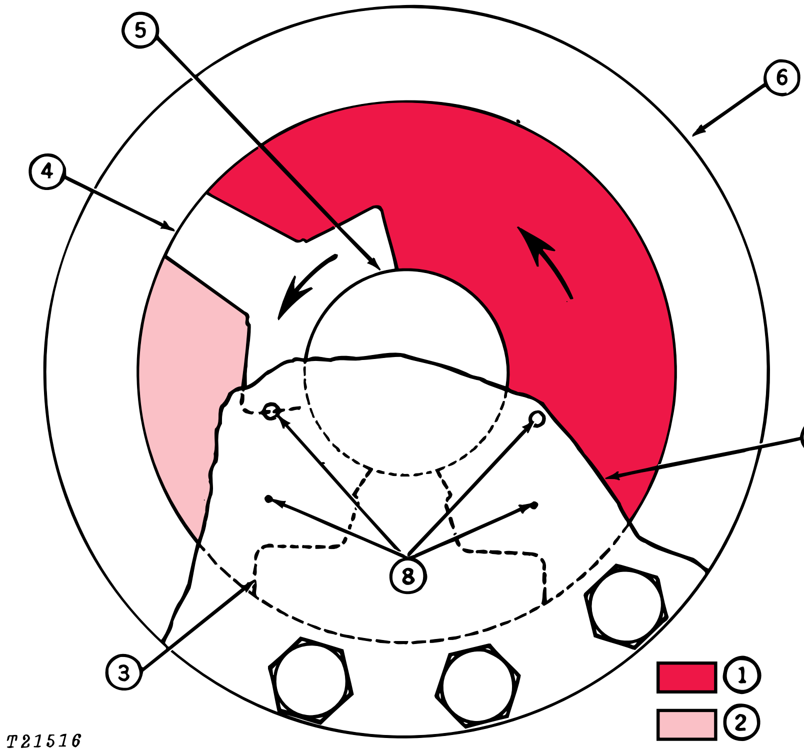
INSTALLATION

Place the cylinder in position on the machine and align the attaching holes. Insert pivot pins and secure with cap screws. Connect the hydraulic lines, making sure they are connected to the same ends of the cylinder from which they were removed.

After installing the cylinder, operate the cylinder several times to remove air from the system. Add oil to the reservoir to bring it up to the proper level.

SWING CYLINDER

GENERAL INFORMATION



1—Pressure Oil
2—Oil Under Slight Pressure
3—Barrel Vane
4—Shaft Vane
5—Splined Shaft
6—Barrel
7—Top Plate
8—Brake Holes

Fig. 21-Swing Cylinder Hydraulic Brake Operation

A rotary, vane-type, double-acting swing cylinder with incorporated brake swings the boom. The cylinder is composed of a barrel and vane assembly, top and bottom plates, splined shaft, and a vane assembly.

During operation, the cylinder barrel is held in a stationary position by the swing cylinder link assembly, while the splined shaft and vane assembly rotate within the barrel. The top plate, which is stationary with the barrel, has two brake holes drilled on each side of the barrel vane.

As the shaft and vane assembly rotates, the shaft vane gradually closes the larger brake hole. (The small brake hole is never closed.) This gradual closing causes a reduction in the flow or return oil from the swing cylinder to the reservoir. The reduction in the flow of return oil slows down the rotation of the swing cylinder, providing a hydraulic braking action.

The braking action is the same in either direction.

REMOVAL

Extend the boom and dipperstick along the ground so they are resting on the bucket.

Remove hoses from back of swing cylinder.

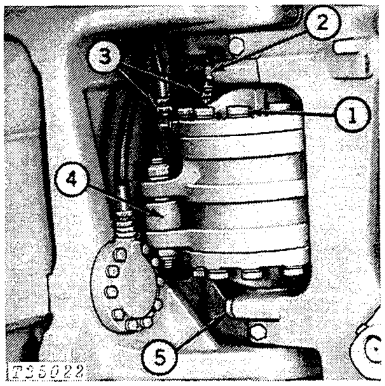
Remove cap screw (1, Fig. 22) from top of swing cylinder and replace it with removal bars (see Special Tools).

Remove tapered pin and tapered bushings (4).

Remove cap screws holding the top coupling (2) and bottom shaft couplings (5) to the pivot casting.

Break shaft coupling dowels loose by prying rearward on swing cylinder barrel.

Carefully slide the cylinder out and up.



1—Cap Screw
2—Top Coupling
3—Hoses
4—Bushing
5—Bottom Coupling

Fig. 22-Removing Swing Cylinder

DISASSEMBLY

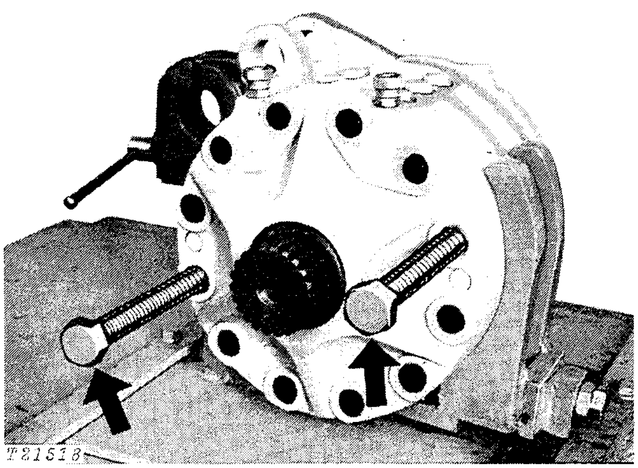


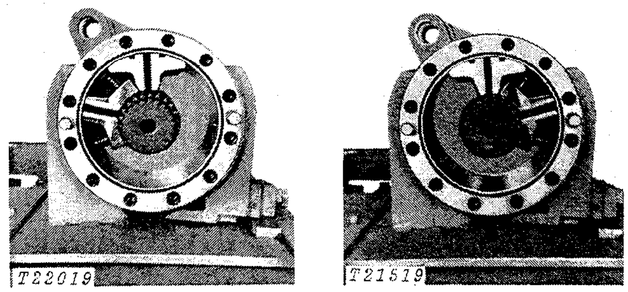
Fig. 23-Removing Top Plate

Clamp swing cylinder in special fixture (Fig. 23). Drawings of this fixture are shown in "Special Tools."

Use two 7/8-inch cap screws as jack screws (Fig. 23) and force the top plate from the cylinder barrel.

Turn jack screws alternately and evenly so that top and bottom plates are always square.

Slide top plate from splined shaft being careful not to damage O-ring and backup washer.



Vane Right **Vane Left**

Fig. 24-Removing Shaft Vane

The shaft vane must contact either the right or left side of the barrel vane (Fig. 24) before it can be removed. Rotate it either to the right or left position.

Remove the shaft vane being careful not to scratch the barrel surface.

Support the barrel vane so it cannot drop inside the barrel, and remove the barrel vane.

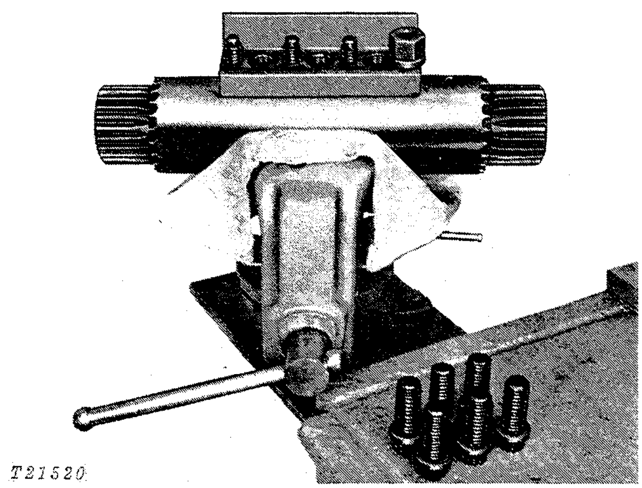
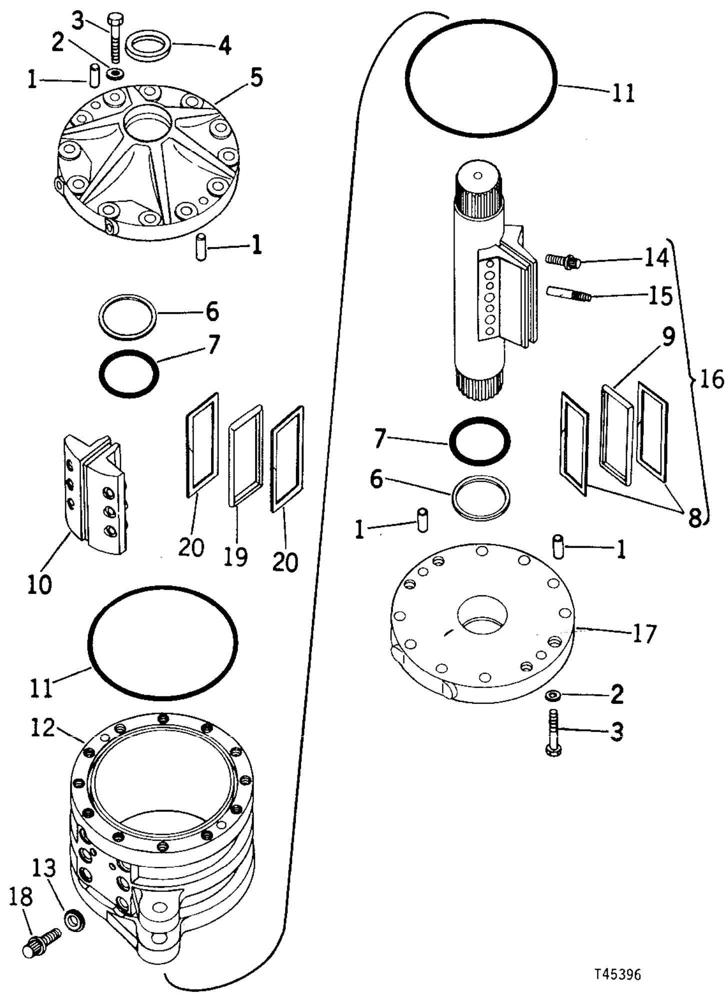


Fig. 25-Removing Shaft Vane

Place splined shaft in vise being careful not to scratch the shaft. Mark the shaft and vane before disassembly so the vane can be installed in exactly the original position.

To remove dowel pins, place a spacer and nut on a pin (Fig. 25) and tighten to end of threads. Remove the nut, add a second spacer, install the nut and tighten until pin is removed.



1—Dowel (4 used)
2—Special Washer (24 used)
3—Cap Screw (24 used)
4—Dust Seal
5—Top Plate
6—Backup Washer (2 used)
7—O-Ring (2 used)
8—Backup Seal (2 used)
9—Vane Seal
10—Cylinder Vane
11—O-Ring (2 used)
12—Barrel
13—Seal Washer (6 used)
14—Cap Screw (6 used)
15—Dowel (8 used)
16—Vane and Shaft Assembly
17—Bottom Plate
18—Special Cap Screw (6 used)
19—Vane Seal
20—Backup Seal (2 used)

Fig. 26-Swing Cylinder

Wash all parts thoroughly with a solvent and inspect for scoring of cylinder and surface damage to O-rings, backup washers, and packings.

If brass choke plates on the vane of the splined shaft (16, Fig. 26) are damaged, replace the shaft and vane assembly. Damaged choke plates will stop brake action of the swing cylinder.

ASSEMBLY

Soak backup washers in oil and install them. Attach rubber packing to the vanes.

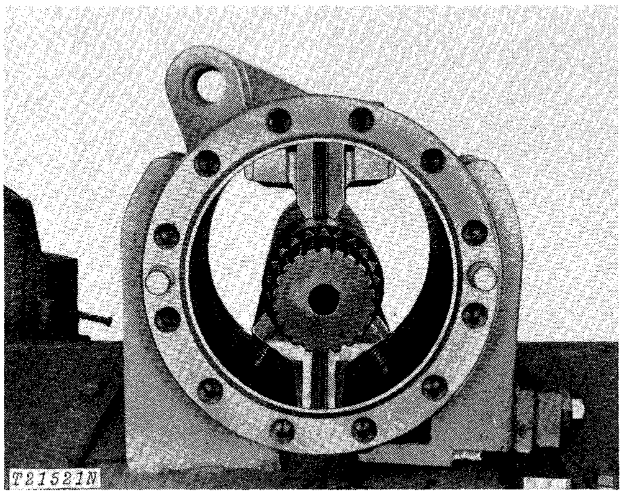


Fig. 27-Installing Shaft and Vane

Place the barrel vane (Fig. 27) in the barrel with oil grooves facing the bottom of the cylinder.

IMPORTANT: Always use new sealing washers under heads of cap screws when installing vane.

Attach the vane to the barrel with cap screws. Tighten to 370 to 380 lb-ft (502 to 515 Nm) (51 to 53 kg/m).

Place the vane on the shaft in the exact position from which it was removed (as indicated by markings made before removal). Drive in dowels and secure vane with cap screws.

Install splined shaft in cylinder barrel with the large brass choke plates toward the top of the barrel. Position the shaft so that the vane contacts either the right or left side of the barrel vane (Fig. 24).

Rotate the splined shaft until the barrel vane and shaft vane are exactly opposite each other (Fig. 27).

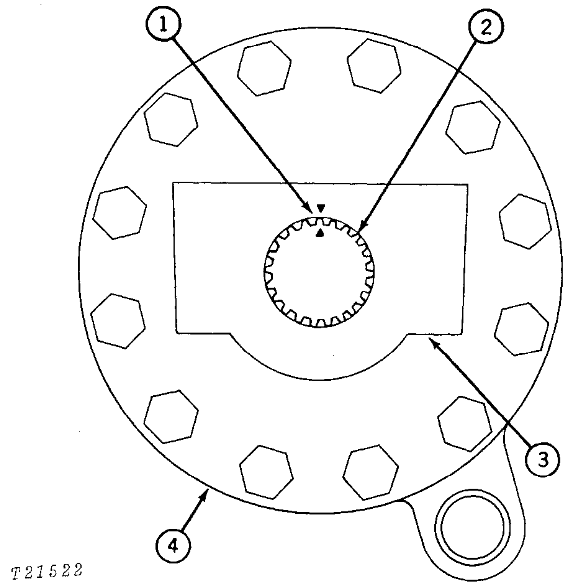
NOTE: Do not attempt to force the shaft and vane assembly into position. When properly assembled, parts should rotate smoothly.

Insert backup washer and O-rings in bore of the top and bottom plate.

Replace O-rings in top and bottom of cylinder barrel. Attach top and bottom plates to the barrel.

Lightly grease the shaft splines to make future removal easier.

Insert the swing cylinder removal bar into swing cylinder and raise the cylinder with a chain hoist.



1—Timing Arrows **3—Coupling**
2—Splined Shaft **4—Swing Cylinder**

Fig. 28-Timing Coupling and Shaft

Place the ring spacer over the splined shaft at the bottom. Align stamped arrows on each end of shaft with mark on each coupling (Fig. 28), and place couplings on splined shaft.

Push cylinder in place until the dowels in the couplings align with dowel holes in the pivot casting.

Install cap screws holding shaft couplings to pivot casting. Tighten to 300 lb-ft (407 Nm) (41 kg/m).

Align the torque link with the upper bracket on the cylinder barrel and insert tapered pin. Place the tapered bushing in the upper bracket.

Install a lock nut on each end of the tapered pin. Tighten bottom lock nut to 175 to 195 lb-ft (237 to 264 Nm) (24 to 27 kg/m) to draw tapered pin through lower bracket. Then tighten top lock nut to 175 to 195 lb-ft (237 to 264 Nm) (24 to 27 kg/m). **It is important that the bottom lock nut be tightened first.**

Group 3399
SPECIFICATIONS AND SPECIAL TOOL

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES

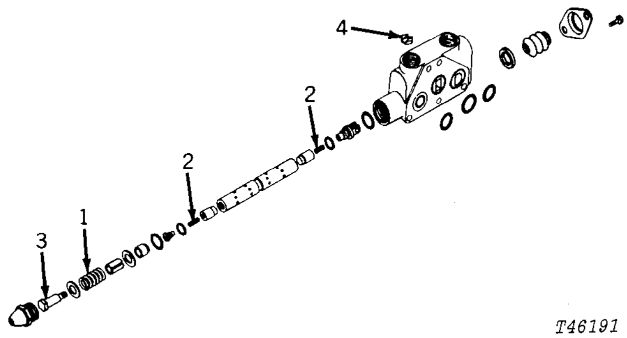


Fig. 1-Stabilizer Valve

Stabilizer Valve

1 - Spool spring
Free length .... 1.78 in. (45.21 mm)
Test length .... 1.187 in. (30.15 mm)
with 27 lbs (120 N) (12 kg)

2 - Lift check spring
Free length .... 1.093 in (27.76 mm)
Test length .... 0.843 in (21.41 mm)
with 0.5 lb (2 N) (0.2 kg)

3 - Spool screw torque
(coat threads with
(LOCTITE)....................... 5 to 8 lb-ft
(7 to 11 N·m) (0.7 to 1 kg/m)

4 - Orifice size.............. 0.1405 in (3.569 mm)

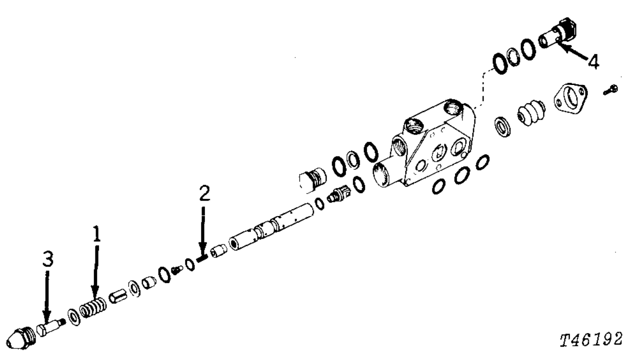


Fig. 2-Crowd Valve

Crowd Valve

1 - Spool spring
Free length .... 1.78 in (45.21 mm)
Test length .... 1.187 in (30.15 mm)
with 27 lbs (120 N) (12 kg)

2 - Lift check spring
Free length .... 1.093 in (27.76 mm)
Test length .... 0.843 in (21.41 mm)
with 0.5 lb (2 N) (0.2 kg)

3 - Spool screw torque
(coat threads with
(LOCTITE)....................... 5 to 8 lb-ft
(7 to 11 N·m) (0.7 to 1 kg/m)

4 - Relief valve pressure .... 2375 psi
(164 bar) (167 kg/cm^2)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

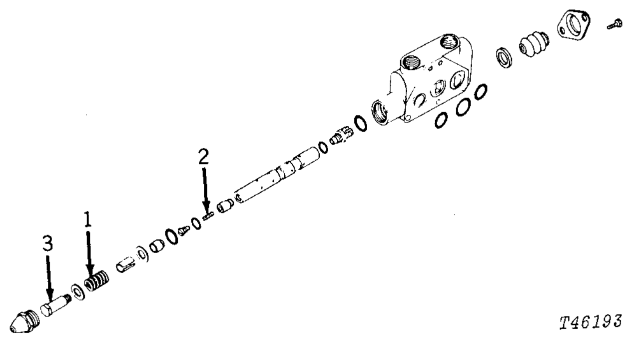


Fig. 3-Bucket Valve

Bucket Valve

1 - Spool spring
Free length .... 1.78 in (45.21 mm)
Test length .... 1.187 in (30.15 mm)
with 27 lbs (120 N) (12 kg)

2 - Lift check spring
Free length .... 1.093 in (27.76 mm)
Test length .... 0.843 in (21.41 mm)
with 0.5 lb (2 N) (0.2 kg)

3 - Spool screw torque
(coat threads with
(LOCTITE)...................... 5 to 8 lb-ft
(7 to 11 N·m) (0.7 to 1 kg/m)

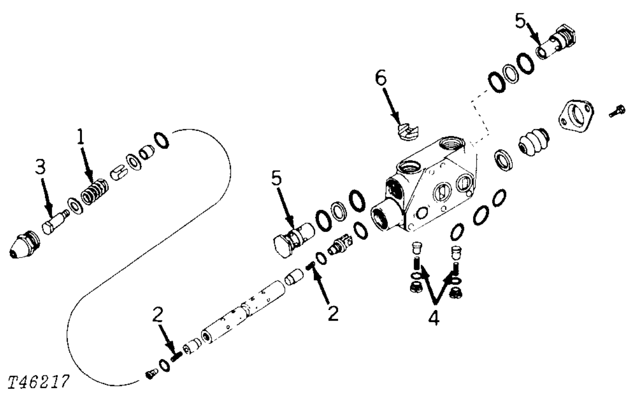


Fig. 4-Swing Valve

Swing Valve

1 - Spool spring
Free length .... 1.78 in (45.21 mm)
Test length .... 1.187 in (30.15 mm)
with 27 lbs (120 N) (12 kg)

2 - Lift check spring
Free length .... 1.093 in (27.76 mm)
Test length .... 0.843 in (21.41 mm)
with 0.5 lb (2 N) (0.2 kg)

3 - Spool screw torque
(coat threads with
(LOCTITE)...................... 5 to 8 lb-ft
(7 to 11 N·m) (0.7 to 1 kg/m)

4 - Anti-cavitation spring
Free length .... 0.692 in (17.58 mm)
Test length .... 0.625 in (15.88 mm)
with 0.75 lbs (3 N) (0.3 kg)

5 - Relief valve pressure .... 1625 psi
(112 bar) (114 kg/cm²)

6 - Orifice size .... 0.1405 in (3.569 mm)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

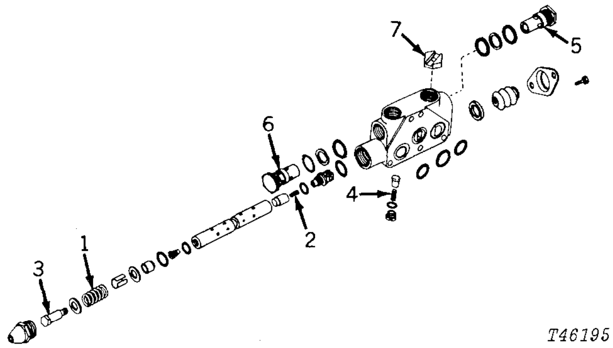


Fig. 5-Boom Valve

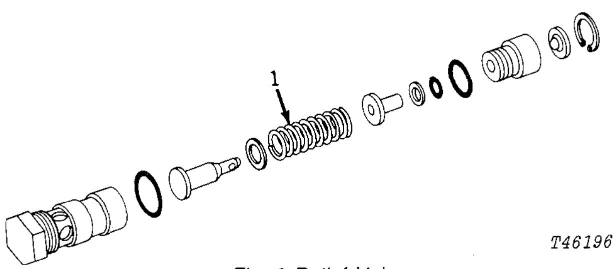


Fig. 6-Relief Valve

Boom Valve

1 - Spool spring
Free length .... 1.78 in (45.21 mm)
Test length .... 1.187 in (30.15 mm)
with 27 lbs (120 N) (12 kg)

2 - Lift check spring
Free length .... 1.093 in (27.76 mm)
Test length .... 0.843 in (21.41 mm)
with 0.5 lb (2 N) (0.2 kg)

3 - Spool screw torque
(coat threads with
(LOCTITE) .... 5 to 8 lb-ft
(7 to 11 N·m) (0.7 to 1 kg/m)

4 - Anti-cavitation spring
Free length .... 0.692 in (17.58 mm)
Test length .... 0.625 in (15.88 mm)
with 0.75 lbs (3 N) (0.3 kg)

5 - Relief valve pressure .... 3000 psi
(207 bar) (211 kg/cm²)

6 - Relief valve pressure .... 2375 psi
(164 bar) (167 kg/cm²)

7 - Orifice size .... 0.234 in (5.944 mm)

Relief Valve

1 - Relief valve spring
Free length .... 1.715 in (43.56 mm)
Test length .... 1.5 in (38 mm)
with 122 lbs (543 N) (55 kg)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

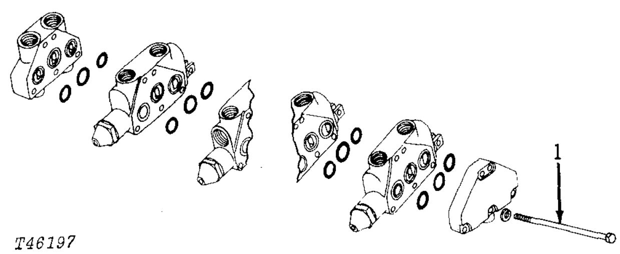


Fig. 7-Control Valve

Control Valve

1 - Tie bolt torque ....20 to 25 lb-ft
(27 to 34 Nm) (2.8 to 3.5 kg/m)

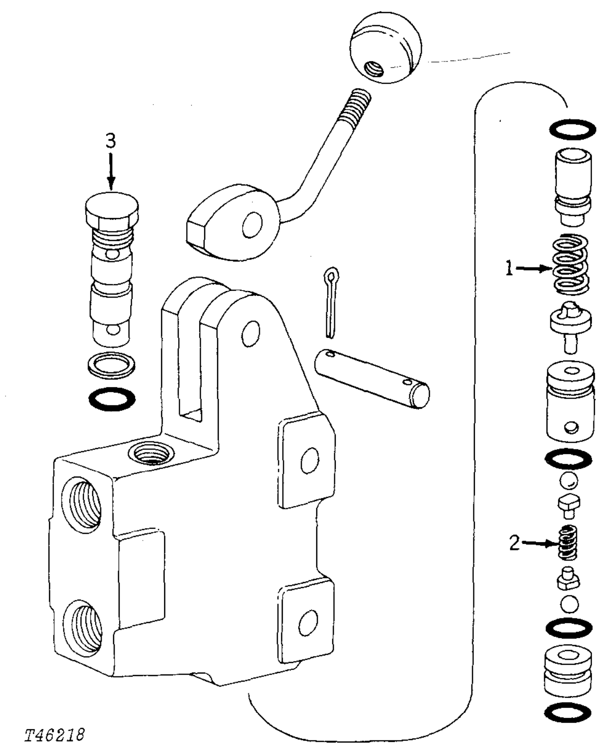


Fig. 8-Locking Control Valve

Locking Control Valve

1 - Upper spring
Free length .... 0.925 in (23.5 mm)
Test length .... 0.79 in (20 mm)
with 140 lbs (623 N) (64 kg)

2 - Lower spring
Free length .... 0.591 in (15 mm)
Test length ......2 lbs (9 N) (0.9 kg) tension
to compress solid

3 - Relief valve pressure ....4000 psi
(276 bar) (281 kg/cm²)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

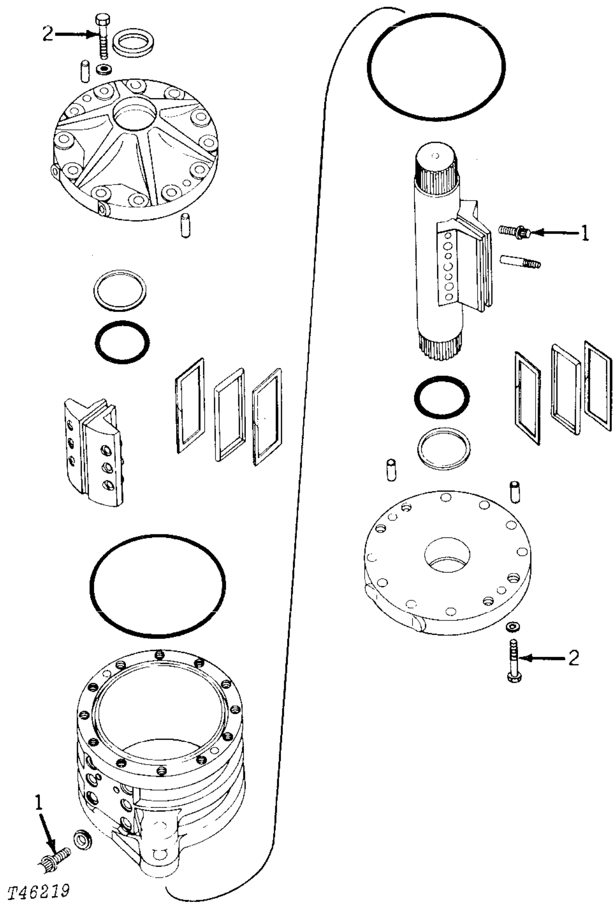


Fig. 9-Swing Cylinder

Swing Cylinder

1 - Vane-to-barrel cap screw torque .... 370 to 380 lb-ft (502 to 515 Nm) (51 to 53 kg-m)

2 - Top and bottom plate-to-barrel cap screw torque .... 375 lb-ft (508 Nm) (52 kg-m)

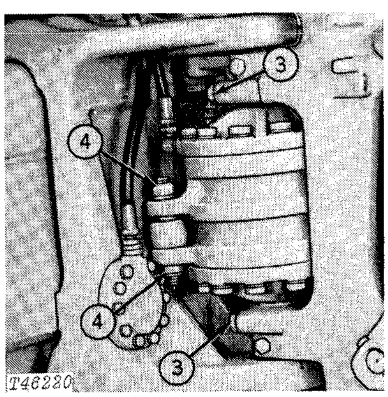


Fig. 10-Swing Cylinder Mounting

3 - Shaft couplings-to-pivot casting cap screw torque .... 300 lb-ft (407 Nm) (41 kg-m)

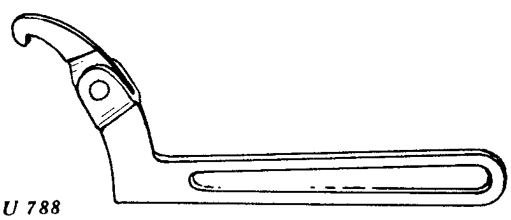
4 - Tapered pin lock nut torque .... 175 to 195 lb-ft (237 to 264 Nm) (24 to 27 kg-m)

HYDRAULIC SYSTEM

SPECIAL TOOLS

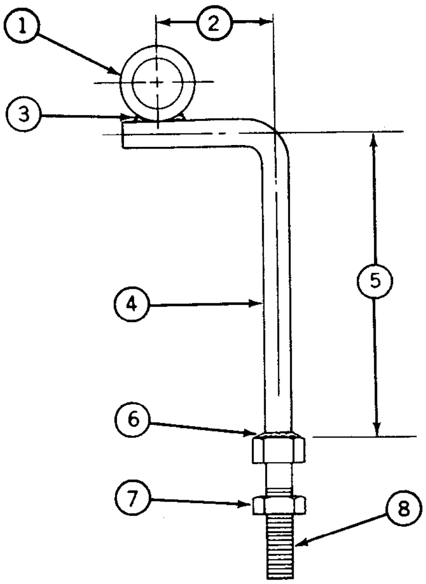
Convenience Tools

Tool	Tool Number	Use
Fig 11-Spanner Wrench (Adjustable form 2 to 4-3/4 in. [50.8 to 120.65 mm])	D-01053AA	Remove and install cylinder rod guides and spanner nuts
Fig. 12-Removal Bar	———*	To remove swing cylinder



U 788

Fig 11-Spanner Wrench
(Adjustable form 2 to 4-3/4 in. [50.8 to 120.65 mm])



T21523

1—2 in. (50.8 mm) I.D. Pipe Ring
2—4.75 in. (120.65 mm)
3—Weld
4—1 in. (25.4 mm) Dia. Round Bar
5—16.50 in. (419.10 mm)
6—Weld
7—Jam Nut
8—3/4" x 6-1/2" Bolt (3/4-10 UNC Thread)

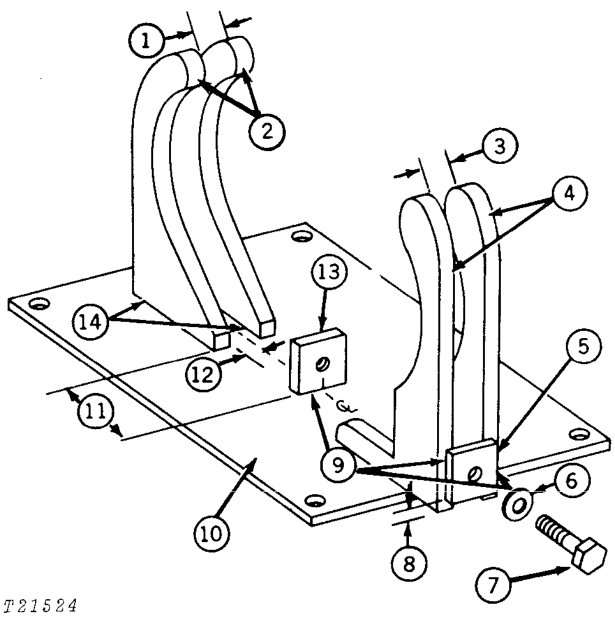
Fig. 12-Removal Bar

**Make in dealer shop*

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
	———————*	To hold swing cylinder during repair

1—1.75 in. (44.45 mm)	8—0.50 in. (12.70 mm)
2—Part "B"	9—Weld
3—1.75 in. (44.45 mm)	10—Part "E"
4—Part "A"	11—6.50 in. (165.10 mm)
5—Part "D"	12—0.875 in. (22.23 mm)
6—Flat Washer	13—Part "C"
7—0.875 x 3.75 in. Cap Screw	14—Weld

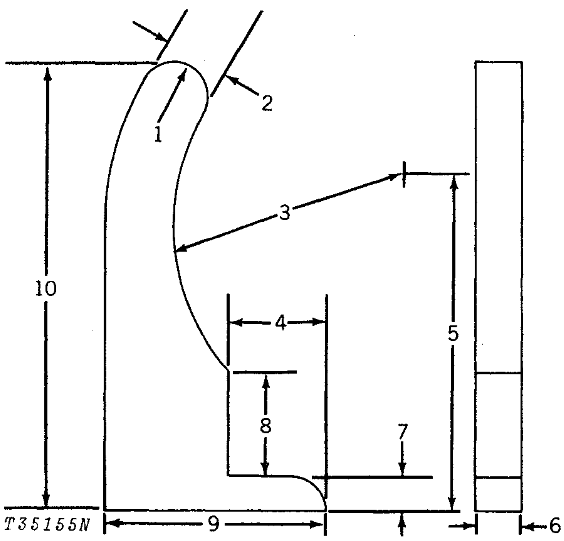
Fig. 13-Cylinder Holder

**Make in dealer shop. See Figs. 17, 18, 19, 20, 21, and 22 for measurements to make tool.*

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
	Fig. 17	To hold swing cylinder during repair

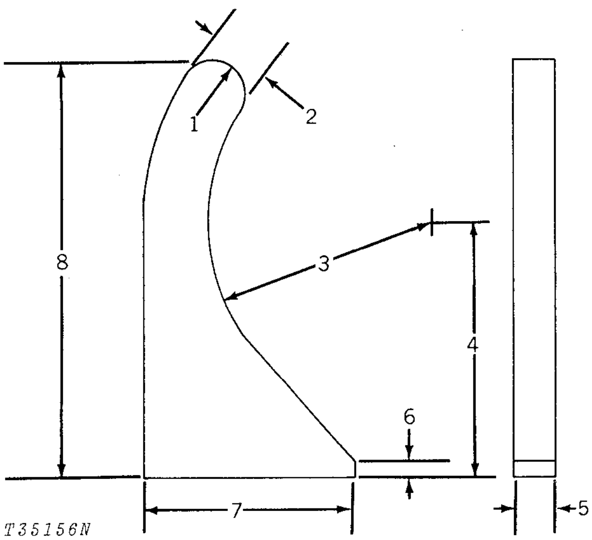
1—0.75 in. (19.05 mm) radius
2—1.50 in. (38.10 mm)
3—4.75 in. (120.65 mm) radius
4—2.25 in. (57.15 mm)
5—6.25 in. (158.75 mm)
6—1.0 in. (25.4 mm)
7—0.75 in. (19.05 mm)
8—2.25 in. (57.15 mm)
9—5.0 in. (127.00 mm)
10—9.75 in. (247.65 mm)

Fig. 14-Part "A" Fixture Print

HYDRAULIC SYSTEM

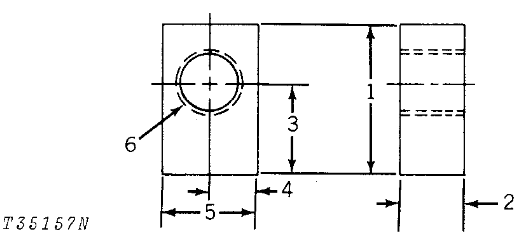
SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
	Fig. 17	To hold swing cylinder during repair

1—0.75 in. (19.05 mm) radius
2—1.50 in. (38.10 mm)
3—4.75 in. (120.65 mm) radius
4—6.25 in. (158.75 mm)
5—1.0 in. (25.4 mm)
6—0.3750 in. (9.53 mm)
7—5.0 in. (127.00 mm)
8—9.75 in. (247.65 mm)

Fig. 15-Part "B" Fixture Print

Tool	Tool Number	Use
	Fig. 17	To hold swing cylinder during repair

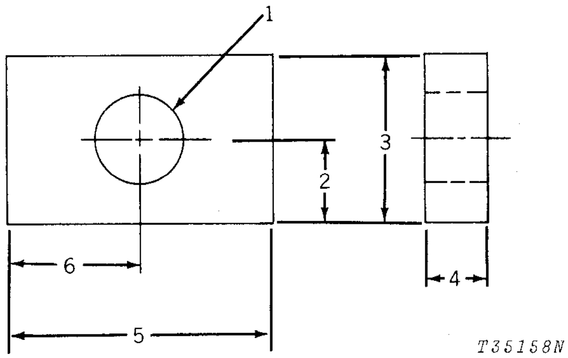
1—2.50 in. (63.50 mm)
2—1.0 in. (25.4 mm)
3—1.50 in. (38.10 mm)
4—0.8125 in. (20.64 mm)
5—1.6250 in. (41.28 mm)
6—7/8 in.-9 UNC

Fig. 16-Part "C" Fixture Print

HYDRAULIC SYSTEM

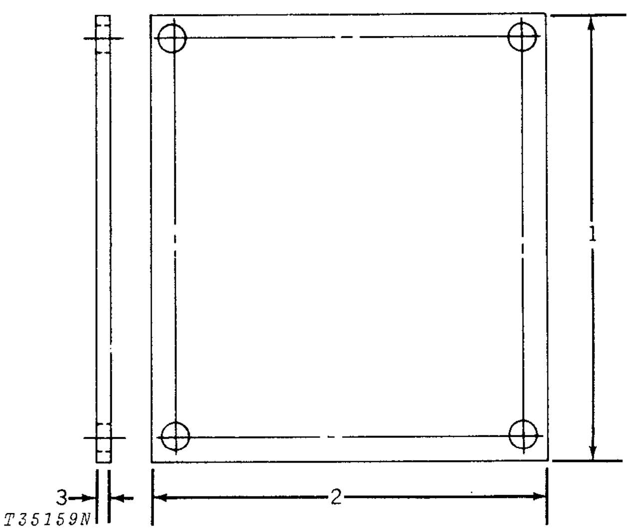
SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
	Fig. 17	To hold swing cylinder during repair

1—0.9375 in. (23.81 mm)
2—1.0 in. (25.4 mm)
3—2.0 in. (50.8 mm)
4—0.75 in. (19.05 mm)
5—3.25 in. (82.55 mm)
6—1.6250 in. (41.28 mm)

Fig. 17-Part "D" Fixture Print

Tool	Tool Number	Use
	Fig. 17	To hold swing cylinder during repair

1—18 in. (457.20 mm)
2—16 in. (406.40 mm)
3—0.50 in. (12.70 mm)

Fig. 18-Part "E" Fixture Print

Section 90
SYSTEM TESTING

CONTENTS OF THIS SECTION

CONTENTS OF THIS SECTION (Continued)

Group 9005
GENERAL INFORMATION

SEVEN BASIC STEPS OF DIAGNOSIS AND TESTING

To prevent the unnecessary loss of time and money, use the following seven steps for a quick and accurate method of locating troubles:

1. Know The Backhoe Loader

In other words, "Do your Homework." Study this manual to know how the individual components work and what their function is in the over-all system.

Keep up with the latest service information. Read and then file in a handy place. Information received today may have the cause and remedy of a problem being encountered.

2. Ask The Operator

Question the operator as to how the backhoe loader acted when it started to fail. Find out what was unusual about it.

Also find out if any do-it-yourself service was performed. (You may find out later that the trouble is somewhere else, but you should know if any components were improperly serviced or repaired.)

Ask how the backhoe loader is used and when it is serviced. Many problems can be traced to poor maintenance or abuse.

3. Operate The Backhoe Loader

Get on the backhoe loader and operate it. Warm it up and put it through its paces. Don't completely rely on the operator's story - check it yourself.

Are the gauges reading normal? (If not, it may be that the component being monitored is not functioning correctly or it may mean that the gauge is faulty.)

How's the performance? Is the action slow, erratic, or nil?

Do the controls feel solid or "spongy"? Do they seem to be "sticking"?

Smell anything? Any signs of smoke?

Hear any funny sounds? Where? At what speeds or during what cycles?

4. Inspect The Backhoe Loader

Get off the backhoe loader and make a visual check. Use your eyes, ears, and nose to spot any signs of trouble.

Look closely at the components. Inspect for cracked welds, loose tie bolts, damaged linkages, worn or broken lines, etc.

During the inspection, make a note of all the trouble signs.

5. List The Possible Causes

With the information obtained during steps 1 through 4, make a list of the possible causes.

What were the signs you found while inspecting the backhoe loader? What is the most likely cause?

6. Reach A Conclusion

Look over the list of possible causes and decide which are most likely and which are easiest to verify.

"Diagnosing Malfunctions" given in the following groups will be a helpful guide.

Reach your decision on the leading causes and plan to check them first.

7. Test Your Conclusion

Before repairing components in the system, test your conclusions to make sure they are correct.

Some of the possible causes can be verified without further testing. Check these possibilities first.

Tests will soon narrow the remaining list of possible causes and soon the actual source of trouble will be pinpointed.

With the trouble accurately located, it is now a simple matter to remove and repair the component at fault.

Group 9010 ENGINE

GENERAL INFORMATION

The Backhoe Loader has a four-cylinder 219 cu. in. (3 589 cm^3) diesel engine.

The engine is a valve-in-head vertical in-line four stroke cycle engine. The engine consists of a lubrication system, cooling system, fuel system and air intake system.

Engine Lubrication System

The components of the lubrication system are the oil pump, oil cooler, oil filter, oil bypass valve (later units), and oil pressure regulating valve.

The oil pump draws lubricant from the oil pan through a system of gears and sends it through an internal passage through the oil filter and then through the oil cooler.

As the oil moves through the cooler, heat is transferred to the engine coolant flowing through the cooler. The oil goes to the oil filter after passing through the oil cooler past the pressure regulating valve.

The oil filter is a spin-on replaceable element which mounts on the oil cooler. The filter removes contaminants from the engine oil.

The oil pressure regulating valve is used to maintain and regulate oil pressure. From the regulating valve the oil goes to the oil gallery.

The oil bypass valve allows cold oil to bypass the filter to prevent a rapid pressure rise at the filter. This improves engine lubrication when starting the engine in cold weather.

Engine Cooling System

The components of the cooling system are the radiator, water pump, fan and thermostat and housing.

The radiator is equipped with a pressure cap which acts as a relief valve to keep pressure at a specified level in the system.

The water pump draws coolant from the radiator and sends it into the coolant gallery and engine oil cooler. Coolant from the gallery circulates through the engine to cool the block, cylinder liners, and head, and then flows into the thermostat housing. The coolant going to the engine oil cooler flows through the cooler, then back to the intake area of the water pump.

If the thermostat is closed (as during engine warm-up) the coolant is sent directly to the water pump for recirculation and bypasses the radiator. This allows a faster and more uniform warm up.

Fuel System

The components of the fuel system are the fuel tank, fuel supply pump, the fuel filter, the fuel injection pump and the fuel injection nozzles.

The fuel tank has a small filter in the bottom of the tank and a fuel shut-off valve located below the fuel tank.

The fuel supply pump operates off a cam lobe of the camshaft. It draws fuel from the tank and delivers it to the fuel injection pump through the fuel filter.

The filter removes impurities from the fuel before it enters the injection pump.

The injection pump pressurizes the fuel and sends it through high pressure lines to the injection nozzles.

The injection nozzles open when the fuel reaches a specified level and inject the fuel into the combustion chambers.

Air Intake System

The components of the air intake system are the air cleaner and intake manifold.

The air enters the air cleaner. The air cleaner element removes impurities from the ambient air. The air cleaner has a restriction indicator switch which warns the operator of excessive restriction in the system.

The intake manifold receives air from the air cleaner and delivers it through passages to the combustion chambers.

Speed Control Linkage

The speed control linkage consists of various linkages which are connected to the injection pump. Through common movement of the linkages speed control is maintained.

1—Engine Speed Control Lever
2—Muffler Extension
3—Muffler
4—Air Intake Pipe
5—Thermostat Housing
6—Radiator Upper Hose
7—Radiator
8—Fuel Tank
9—Fuel Gauge Sending Unit
10—Air Cleaner
11—Front Support
12—Engine Oil Filler
13—Water Pump
14—Engine Oil Filter
15—Alternator
16—Engine Oil Cooler
17—Engine Oil Dipstick
18—Fuel Transfer Pump
19—Air Inlet
20—Cylinder Head
21—Engine Oil Pan
22—Starting Motor
23—Fuel Filter (early unit shown)
24—Flywheel Housing
25—Engine Flywheel
26—Pressure Plate
27—Clutch Bracket
28—Engine Speed Control Shaft
29—Engine Speed Control Cable

Legend for Fig. 1-Engine and Fuel System-Right-Hand Side

1—Fuel Tank
2—Fuel Tank Filler Cap
3—Radiator Tie Rod
4—Radiator
5—Radiator Pressure Cap
6—Fuel Injection Leak-Off Line
7—Air Intake Pipe
8—Air Intake Hose
9—Fuel Injection Nozzle
10—Muffler Extension
11—Muffler
12—Rocker Arm Cover
13—Exhaust Manifold
14—Engine Ventilator Tube
15—Engine Speed Control Lever
16—Engine Speed Control Cable
17—Engine Speed Control Shaft
18—Engine Flywheel
19—Engine Flywheel
20—Engine Oil Pan
21—Fuel Injection Pump
22—Engine Timing Gear Cover
23—Radiator Lower Hose
24—Air Cleaner Restriction Indicator
25—Crankshaft Pulley
26—Air Cleaner
27—Front Support
28—Fan Blade

Legend for Fig. 1A-Engine and Fuel System - Left-Hand Side

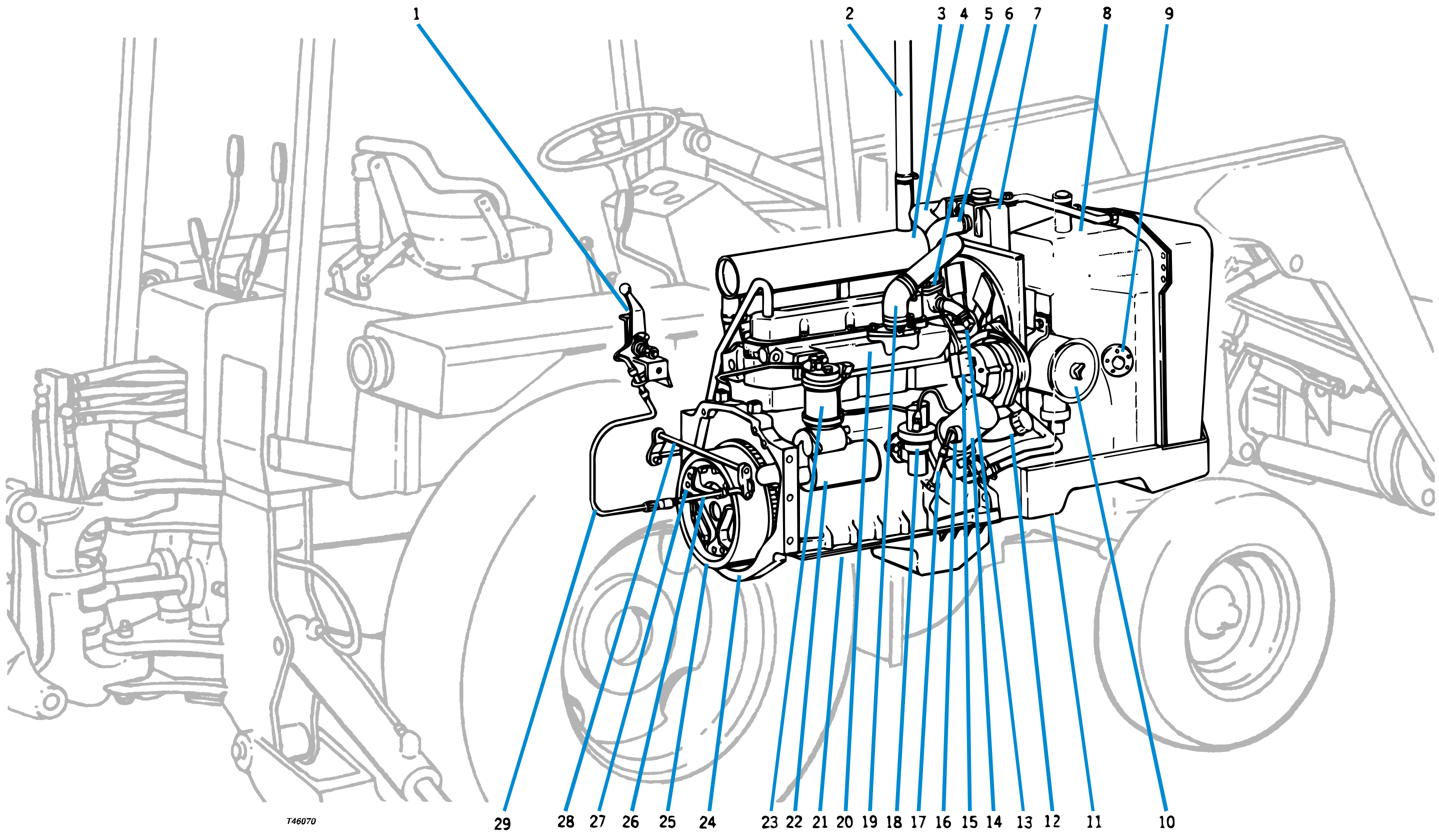


Fig 1-Engine and Fuel System - Right-Hand Side

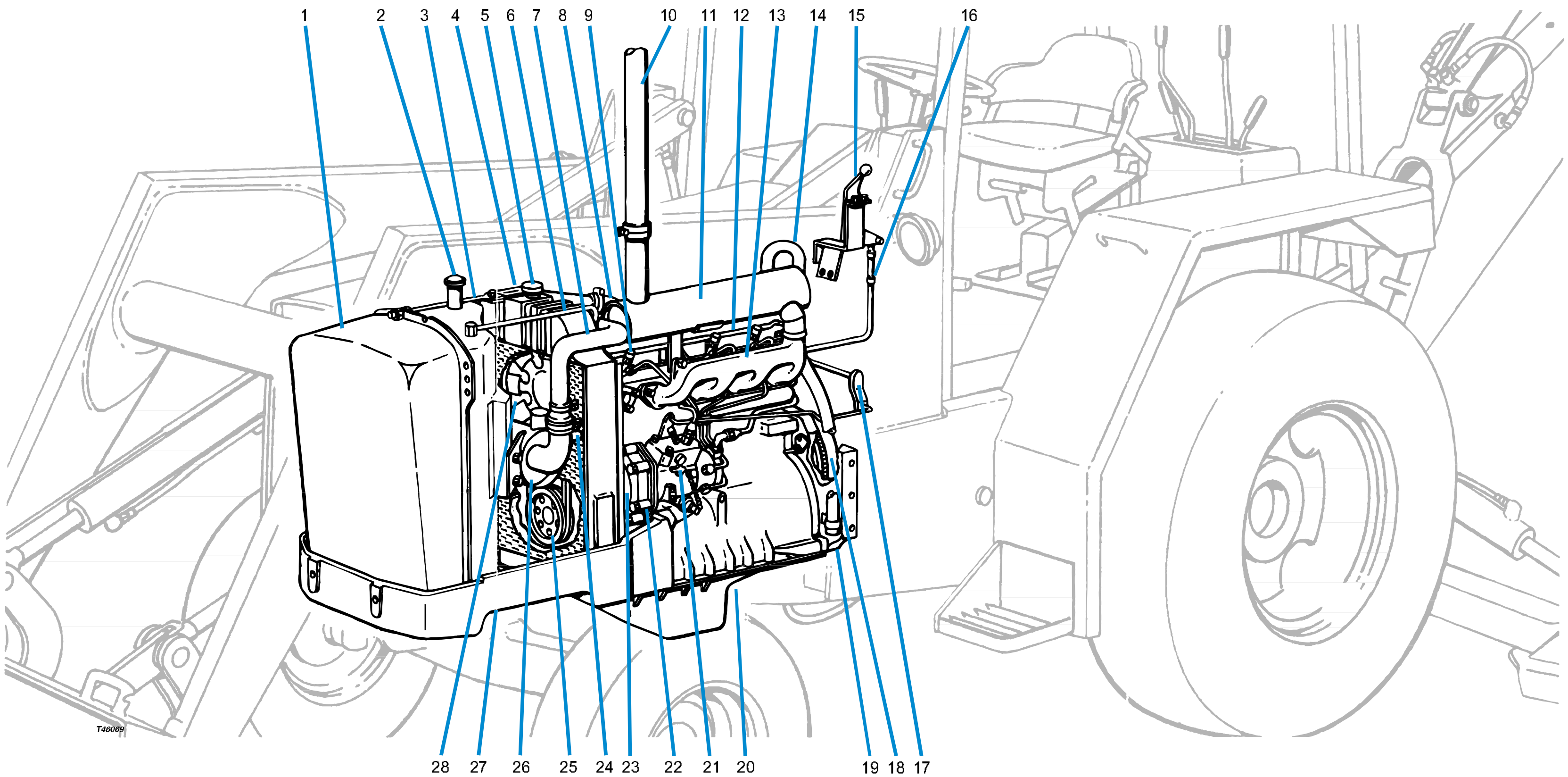


Fig 1-Engine and Fuel System - Left-Hand Side

DIAGNOSING MALFUNCTIONS

Engine Will Not Start or Starting Hard

- Fuel System Malfunction
- Fuel tank empty
  - Improper type of fuel
  - Foreign material in fuel
  - Fuel lines clogged or restricted
  - Air leak on suction side of fuel system
  - Fuel transfer pump malfunction
  - Fuel filter restricted
  - Restricted air intake system
  - Faulty injection pump
  - Faulty injection nozzles
  - Water, dirt, or air in fuel system
- Electrical System Malfunction
  - Corrorded or loose battery cables
  - Weak or dead battery
  - Cranking speed too slow

Uneven Running or Frequent Stalling

- Basic Engine Malfunction
  - Improper valve clearance
  - Valves sticking or burned
  - Worn or broken compression rings
  - Low compression
  - Incorrect timing
  - Dirty air intake system
  - Exhaust system restricted
  - Engine overheating
- Fuel System Malfunction
  - Improper type of fuel
  - Air leak on suction side of fuel system
  - Fuel line clogged or restricted
  - Fuel transfer pump malfunction
  - Fuel filter restricted
  - Faulty injection pump
  - Faulty injection nozzles
  - Water, dirt, or air in fuel system
  - Injection nozzle leak-off lines clogged
  - Injection pump out of time
  - Exhaust system restricted

Engine Misses

- Basic Engine Malfunction
  - Weak valve springs
  - Incorrect valve clearance
  - Burned, warped, pitted or sticking valves
  - Low compression
  - Worn camshaft lobes
  - Engine overheating
- Fuel System Malfunction
  - Water, air or dirt in fuel
  - Faulty injection nozzles
  - Faulty injection pump
  - Faulty transfer pump
  - Detonation
  - Mixture of gasoline and diesel fuels

Lack of Power

- Basic Engine Malfunction
  - Blown cylinder head gasket
  - Worn camshaft lobes
  - Incorrect valve clearance
  - Incorrect valve timing
  - Burned, warped, pitted, or sticking valves
  - Weak valve springs
  - Low compression
  - Dirty air intake system
  - Incorrect timing
  - Engine overheating
- Fuel System Malfunction
  - Improper type of fuel
  - Air leak on suction side of fuel system
  - Fuel line clogged or restricted
  - Fuel transfer pump malfunction
  - Speed control linkage not adjusted properly
  - Fuel filter restricted
  - Fuel injection pump malfunction
  - Fuel injection nozzle faulty
  - Water, dirt or air in fuel system
  - Injection nozzle leak-off line clogged
  - Injection pump out of time
  - Clogged manifold system

Black or Gray Exhaust Smoke

Basic Engine Malfunction
- Incorrect engine timing
- Engine overloaded
- Restricted air cleaner
- Defective muffler
- Dirty air intake system

Fuel System Malfunction
- Improper grade of fuel
- Excessive fuel delivery
- Faulty injection nozzles
- Injection nozzle leak-off line clogged
- Injection pump out of time

White Exhaust Smoke

Basic Engine Malfunction
- Low compression

Fuel System Malfunction
- Faulty injection nozzle
- Improper fuel
- Injection pump out of time

Slow Acceleration

Fuel System Malfunction
- Faulty injection nozzle
- Improper fuel

Detonation

Fuel System Malfunction
- Injection pump out of time
- Faulty injection nozzles

Abnormal Engine Noise

Basic Engine Malfunction
- Excessive valve clearance
- Worn cam followers
- Bent push rods
- Worn rocker arm shafts
- Worn main or connecting rod bearings
- Foreign material in combustion chamber
- Worn piston pin bushings and pins
- Scored piston
- Incorrect engine timing
- Excessive crankshaft endplay
- Loose main bearing caps
- Worn timing gears
- Worn oil pump gears
- Broken oil pump shaft
- Low engine oil level
- Camshaft oil pump gear worn or broken
- Gears worn or broken

Excessive Oil Consumption

Basic Engine Malfunction
- Restricted crankcase breather
- Worn valve guides or valve stems
- Piston rings worn or broken
- Scored lines or pistons
- Excessive ring groove wear in piston
- Rings sticking in grooves of piston
- Oil return slots in piston clogged
- Insufficient piston ring tension
- Piston ring gaps not staggered
- Excessive main or connecting rod bearing clearance
- Worn crankshaft thrust bearing (misaligned piston and rod)
- Front or rear crankshaft seal faulty
- Crankcase oil too thin (wrong viscosity)
- Oil level too high
- Restricted air intake system

Low Oil Pressure

Basic Engine Problem
- Excessive main and connecting rod bearing clearance
- Low oil level
- Leakage at internal oil passages
- Faulty oil pump
- Improper regulating valve operation
- Improper oil (wrong viscosity)

High Oil Pressure

Basic Engine Problem
- Stuck regulating valve
- Regulating valve spring worn or broken
- Worn valve or valve seat

Engine Overheats

Basic Engine Malfunction
- Defective head gasket
- Incorrect engine timing
- Low coolant level
- Radiator dirty or plugged
- Loose or broken fan belt
- Faulty thermostat
- Cooling system limed up
- Defective radiator pressure cap
- Faulty water pump
- Scored piston
- Air in coolant
- Engine overloaded
- Crankcase oil level low

Fuel System Malfunction
- Improper fuel
- Excessive fuel delivery
- Improper injection pump timing

Water Pump Leaks

Basic Engine Malfunction
- Worn seal and/or shaft in water pump
- Worn or broken water pump gasket
- Water pump damaged
- Water pump impeller broken

Engine Runs Cold

Basic Engine Problem
- Faulty thermostat
- Defective temperature gauge

Water Pump Making Noise

Basic Engine Malfunction
- Worn water pump shaft
- Water pump impeller broken
- Bent or broken fan blade
- Loose fan belt
- Fan hitting

Oil in Coolant or Coolant in Crankcase

Basic Engine Malfunction
- Leaking head gasket
- Cylinder liner packings leaking
- Cylinder block water jacket cracked
- Cylinder liner cracked

VISUAL INSPECTION

By visually inspecting the engine before you tune it, you can learn a lot about its general condition.

For example, if the engine has been using too much oil, this often means an external oil leak. If the engine overheats, look for leaks in the cooling system.

Oil and Water Leakage

Look for water leaks at the radiator, water pump, and hoses around the cylinder head gasket and water manifold.

Check coolant for proper level and examine visible portion inside top of radiator for evidence of rust or scale.

Check crankcase oil level and for coolant in oil.

Look for oil leaks at the oil pan, drain plugs and gaskets.

Hoses

Inspect upper and lower radiator hoses and bypass hose for hardening or cracking, and softening and swelling. Examine hoses at least twice a year for possible replacement and tightening.

Oil Cooler

Check around base of cooler for oil leakage. Check water inlet and outlet for leakage.

Radiator

Inspect the radiator for bent fins, kinks, dents, fractured seams, and tubes for cracks.

Fan

The only service on the fan is to be certain the fan blades are straight and are far enough from the radiator so they do not strike the core.

Bent blades reduce the efficiency of the cooling system and throw the fan out of balance.

Fan Belt

The fan belt should be neither too tight nor too loose.

A belt which is too tight puts extra load on the fan bearings and shortens the life of the bearings as well as the belt.

A belt which is too loose allows slippage and lowers the fan speed, causes excessive belt wear and leads to overheating of the cooling system.

The condition of the belts and their tension should be checked periodically. Adjust fan belt tension as shown in "Testing and Adjustments" in this group.

Fuel Tank

Check all seams and connections for fuel leakage.

Fuel Supply Pump

Check fuel inlet and outlet connections for leaking fuel. Be sure primer lever is in its farthest downward position.

Fuel Injection Pump

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

Check fuel inlet and outlet connections and high pressure fuel supply connections. If any of the lines are twisted, kinked or broken, repair or replace as necessary.

Fuel Filter

Check fuel inlet and outlet connections. Check element frequently for deposits. Clean if necessary. Replace filter element as required.

Fuel Injection Nozzles

CAUTION: Escaping fluid under pressure can penetrate the skin causing serious injury. Relieve pressure before disconnecting hydraulic or other lines. Tighten all connections before applying pressure. Keep hands and body away from pinholes and nozzles which eject fluids under high pressure. Use a piece of cardboard or paper to search for leaks. Do not use your hand.

If ANY fluid is injected into the skin, it must be surgically removed within a few hours by a doctor familiar with this type injury or gangrene may result.

Check each delivery and leak-off line. Repair or replace lines if necessary.

Air Cleaner

Check all air intake and outlet connections to be sure they are tight. Check dust unloader valve. Check air restriction indicator daily. Clean element when indicator shows red with engine shut off, or when excessive smoke or loss of power is noted.

Replace air cleaner element every 1000 hours or as required.

TESTING AND ADJUSTMENT

Basic Engine

Compression Pressure Test

1 - Clean the engine thoroughly, preferably by steam cleaning.

2 - Warm the engine to operating temperature.

3 - When engine has reached operating temperature, turn key switch off.

Disconnect the electrical solenoid shut-off wire from the injection pump. This will keep the injection pump from pumping fuel under high pressure to the nozzles during the test.

CAUTION: The above step is important because fuel under high pressure from the injection pump will have sufficient force to penetrate skin. Do not, at any time, while the engine is cranking, place hands or arms in front of the injection nozzles.

Remove all four injection nozzles and seal gaskets from the head (see Section 4).

Clean the injection bores. Blow loose carbon out with compressed air.

Install a D-14550 BA Compression Gauge Adapter in bore to be tested. A new seal gasket should be inserted before the adapter is installed.

Connect a D-14547 BA Compression Gauge to the adapter.

Crank engine at approximately 200 rpm with the starting motor.

Observe the pressure reading on the compression gauge. The reading must be 350 psi (2400 kPa) (24 bar) minimum. All cylinders must be within 50 psi (345 kPa) (3.5 bar).

Engine Lubrication System

Checking Engine Oil Pressure

Engine oil pressure should be checked before and aaaci*hafter a major overhaul or anytime it is necessary to remove the oil pump.

T46761N

Fig. 2-Oil Pressure Test Connection Point

To check oil pressure, remove oil pressure indicator switch from engine. Connect an oil pressure gauge (Fig. 2).

With engine at normal operating temperature and running at high idle (2650 ± 25 rpm), oil pressure reading should be 50 ± 15 psi (3.5 ± 1.0 bar) (3.5 ± 1.0 kg/cm^2).

If engine oil pressure is not 50 ± 15 psi (3.5 ± 1.0 bar) (3.5 ± 1.0 kg/cm^2), the pressure regulating valve should be checked.

Remove valve and check as described in Group 0407.

Install valve and recheck oil pressure. If pressure is still not within 50 ± 15 psi (3.5 ± 1.0 bar) (3.5 ± 1.0 kg/cm^2), other problems in the lubrication system are indicated (see "Diagnosing Malfunctions" in this group).

Engine Cooling System

Since efficient operation of pressure cooling depends on a system that is free from leaks, the entire cooling system should be tested prior to servicing.

Checking Radiator for Leaks

Install a pressure tester on the radiator according to the manufacturer's instructions.

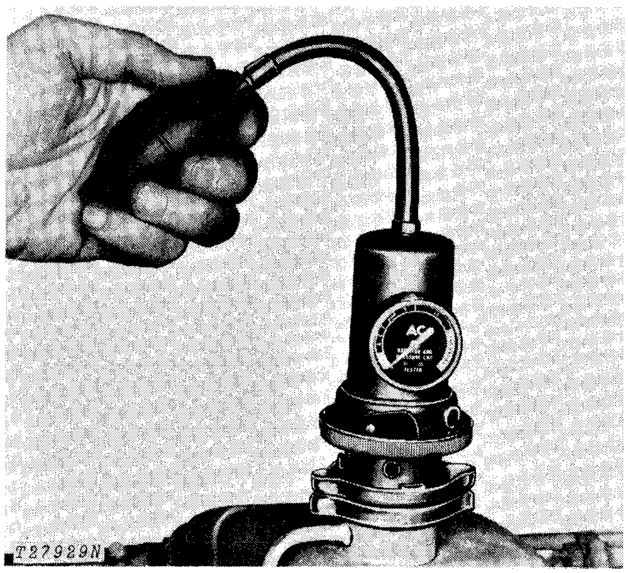


Fig. 3-Testing Radiator

With the tester installed, carefully inspect the radiator, water pump, hoses, drain cocks and cylinder block for leakage.

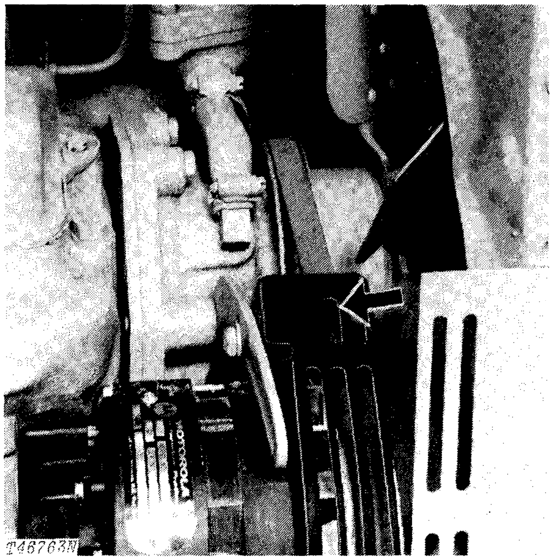
Mark all leaks plainly to help locate them when repairing.

If you cannot find any leaks but leaking persists, remove the radiator and test as described in Group 0510.

FOS

For additional information on testing and maintaining the cooling system refer to "Cooling System" in FOS Manual - Engines.

Fan Belt Tension Adjustment



T46763N

Fig. 4-Testing Fan Belt Tension

Adjust fan belt tension by loosening the alternator bracket and adjusting cap screws and applying outward pressure to the front alternator frame to determine if the fan belts are adjusted properly. Apply approximately 20 pounds (89 N) of force on the belt with the thumb about midway between the pulleys. The belt deflection should be 0.75 inch (19.1 mm).

More consistent belt tension will result and the belts will last longer if the tension is set with the belt tension gauge. When a belt tension gauge is used, the initial reading should be 130 to 140 lb (579 to 623 N) strand tension for a new belt. After three minutes of operation recheck the belt tension. Gauge should read a minimum of 85 to 95 lb (378 to 423 N) strand tension. If the belt is not new adjust the belt tension to 85 to 95 lb (378 to 423 N) strand tension.

Fuel System

CAUTION: Live sparks, smoking or fire of any nature should not be permitted when testing the fuel system.

Fuel Supply Pump Pressure Test

Tee a low-pressure gauge (0 to 30 psi [0 to 2 bar] [0 to 2 kg/cm^2]) between the filter inlet line and the fuel filter (Fig. 5).

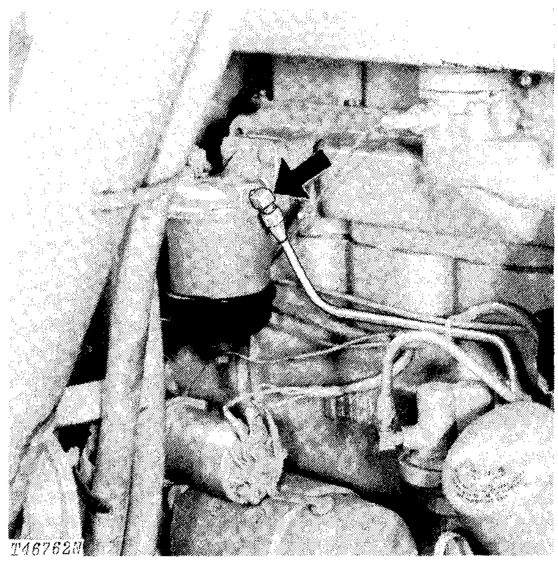


Fig. 5-Fuel Transfer Pump Pressure Test Connection Point

Start the engine. Let it run at low idle and observe the low pressure gauge. Reading on the gauge should be 2 to 2.5 psi (0.1 to 0.2 bar) (0.1 to 0.2 kg/cm^2).

Remove pressure gauge and connect fuel line to filter after test has been completed.

Adjusting Injection Pump Cam Advance

1 - Be sure injection pump is static timed to engine (see Group 0413).

2 - Remove timing hole cover and install timing window (JD-259).

Note the location of the cam timing line. Due to slight variations in windows and hole locations, cam line may not be exactly behind window line. Adjust timing window to get best possible line-up.

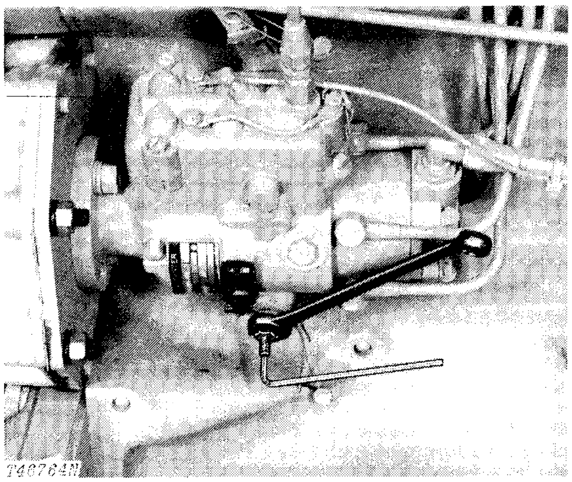


Fig. 6-Setting Cam Advance

3 - Bring engine to operating temperature.

4 - Check cam advance according to following specifications:

JDB431MD3027

Total advance movement................ 8 ± 1/2°
Advance at 800 to 1000 rpm (no load) .... 1°

NOTE: Marks on timing window are two pump degrees apart.

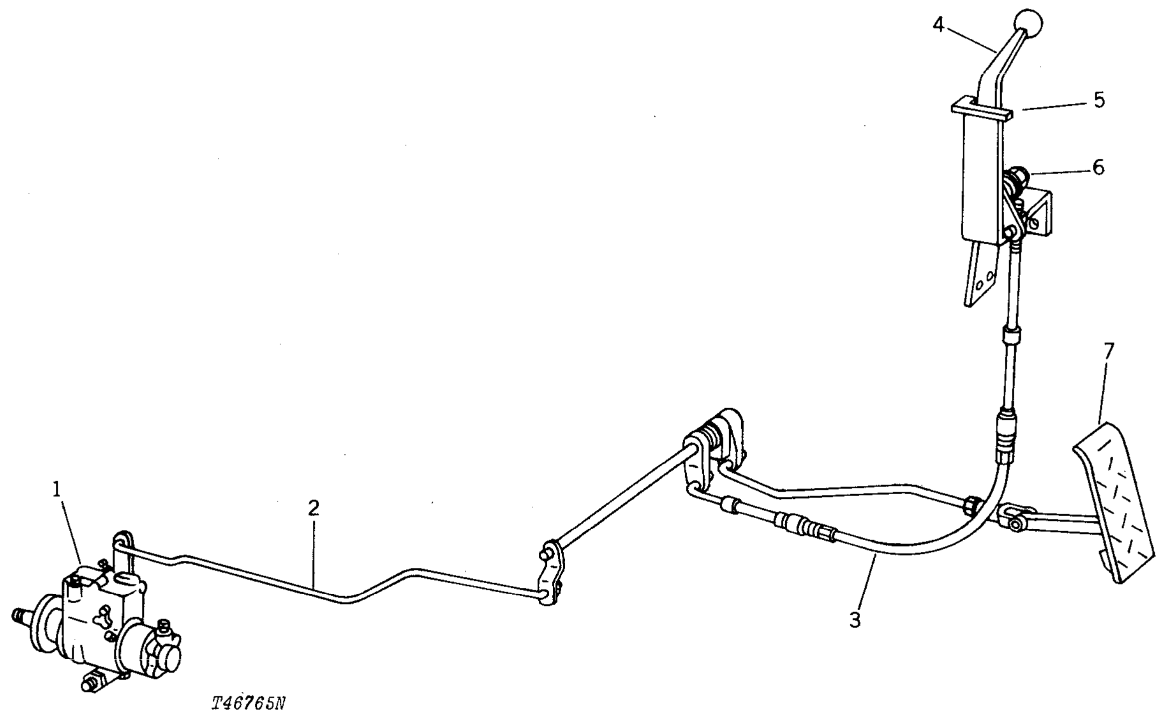
5 - If cam advance must be adjusted, loosen lock nut and turn advance trimmer screw.

Turn screw in (clockwise) to retard timing; turn screw out (counterclockwise) to advance timing.

6 - Secure trimmer screw with lock nut and install seal cap.

7 - Remove timing window and install timing hole cover.

Speed Control Linkage



1—Injection Pump
2—Speed Control Rod
3—Push-Pull Cable
4—Throttle Lever
5—Throttle Stop
6—Stop Nut
7—Accelerator Pedal

Fig. 7-Speed Control Linkage

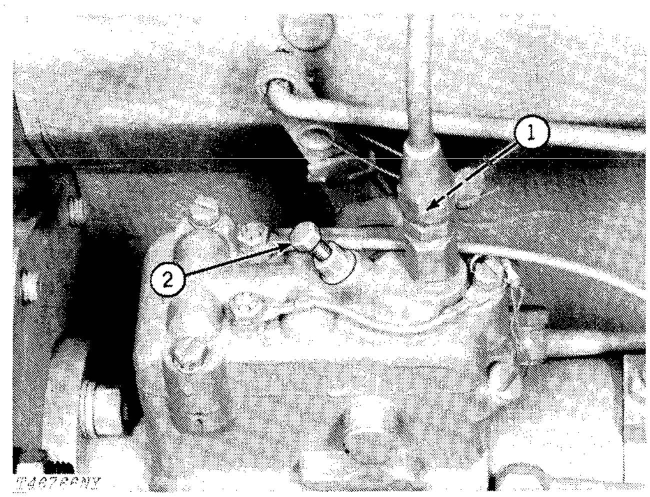
Speed Control Adjustments

Engine and tractor should be at normal operating temperature during these checks.

With speed control rod (2, Fig. 7) disconnected from the injection pump throttle lever, run engine and rotate pump throttle lever to rear until it touches stop. Engine speed should be at 2650 ± 25 rpm fast idle. If not, adjust pump fast idle stop screw to correct.

Lightly rotate pump throttle lever forward to slow idle position. Engine speed should be at 800 + 25 − 0 rpm slow idle. If not, adjust at slow idle stop screw.

Connect speed control lever to push-pull cable. Push throttle lever (4, Fig. 7) completely forward. Adjust length of push-pull cable (3) at swivel as necessary until the fast idle is at 2650 ± 25 rpm.



1—Fast Idle Stop Screw **2—Slow Idle Stop Screw**

Fig. 8-Pump Idle Adjustments

Pull speed control lever completely rearward. Engine speed should be at 800 rpm slow idle. (A slight preload will exist).

Adjust the throttle stop for 2200 rpm with clearance between stop and control box sufficient to permit speed control lever to pass stop.

Adjust the foot throttle at the pedal so that the fast-idle override on the pump lever is preloaded to 1/8 to 11/32 inch (3.2 to 8.7 mm) when the pedal is against the platform.

Adjust stop nut (6, Fig. 7) for 10 lbs. (45 N) (4.5 kg) drag friction on throttle lever.

Air Intake System

Testing Air Restriction Indicator

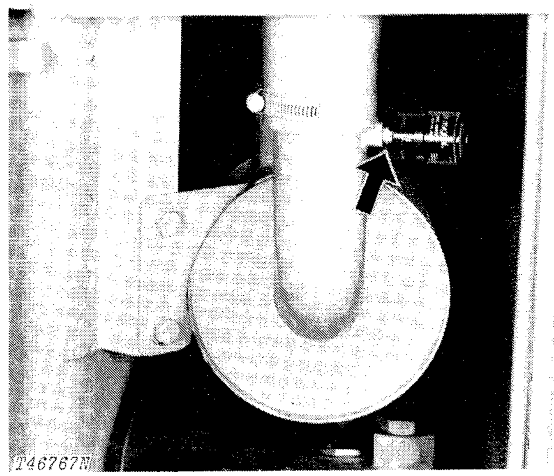


Fig. 9-Air Restriction Indicator

Remove air restriction indicator (Fig. 9).

Install a restriction indicator tee fitting into opening. Install restriction indicator on one end of tee and add D-05022ST water vacuum gauge on other end.

Start the engine and slowly cover air intake pipe.

Observe reading on water vacuum gauge. Restriction indicator should show red when water vacuum gauge reads 22.5 to 27.5 in. (56.0 to 68.5 mbar) of water.

Remove water vacuum gauge, restriction indicator and tee fitting. Put TY9375 John Deere LOCTITE® Pipe Sealant with TEFLON® or equivalent on threads on connector. Install indicator.

LOCTITE is a trademark of the Loctite Corp.

TEFLON is a trademark of the DuPont Co.

Group 9015
ELECTRICAL SYSTEM

GENERAL INFORMATION

This group contains troubleshooting tips, wiring diagrams and test specifications necessary to locate trouble in the system. By following the tests as given, the faulty component may be located and removed for further testing, repair, or replacement.

Tests and service instructions for any system component, when removed from the unit, are provided in the section covering that specific component.

Component Location

The component location contains a legend and illustration of the electrical components showing where they are found on the unit.

Key	Description
1	Warning Light Lead
2	Pressurizer Fuel 310A Only
3	Pressurizer Motor 310A Only
4	Pressurizer Switch 310A Only
5	Rear Wiper Lead
6	Fuel Holder 310A Only
7	Warning Light
8	Dome Light
9	Dome Light Switch
10	Start Switch
11	Key Switch
12	Horn Switch
13	Front Wiper Fuse
14	Engine Coolant Temperature Gauge
15	Dash Lamp
16	Alternator Indicator Light
17	Front Wiper Motor
18	Tachometer
19	Parking Brake Indicator Light
20	Fuel Gauge
21	Cab Wiring Lead
22	Engine Oil Pressure Indicator Light
23	Front Light
24	Flasher
25	Parking Brake Relay
26	Dowl Wiring Harness
27	Heater and Switch
28	Starting Aid Solenoid
29	Fuel Sending Unit
30	Hydraulic Pump Solenoid
31	Alternator and Regulator
32	Fuel Injection Pump
33	Starting Motor
34	Heater Fuse
35	Engine Oil Pressure Switch
36	Horn
37	Cab Relay
38	Circuit Breaker
39	Circuit Breaker
40	Hourmeter
41	Horn Wiring Harness
42	Light Switch
43	Engine Wiring Harness
44	Reverse Warning Switch
45	Cigar Lighter
46	Starting Aid Switch
47	Neutral Start Switch
48	Battery to Starting Motor Cable
49	Battery Ground Cable
50	Battery
51	Parking Brake Switch
52	Battery to Battery Cable
53	Main Wiring Harness
54	Rear Light
55	Rear Light Harness
56	Rear Wiper Motor
57	Reverse Warning Alarm

Legend for Fig. 1-Component Location - Electrical System

Litho in U.S.A.

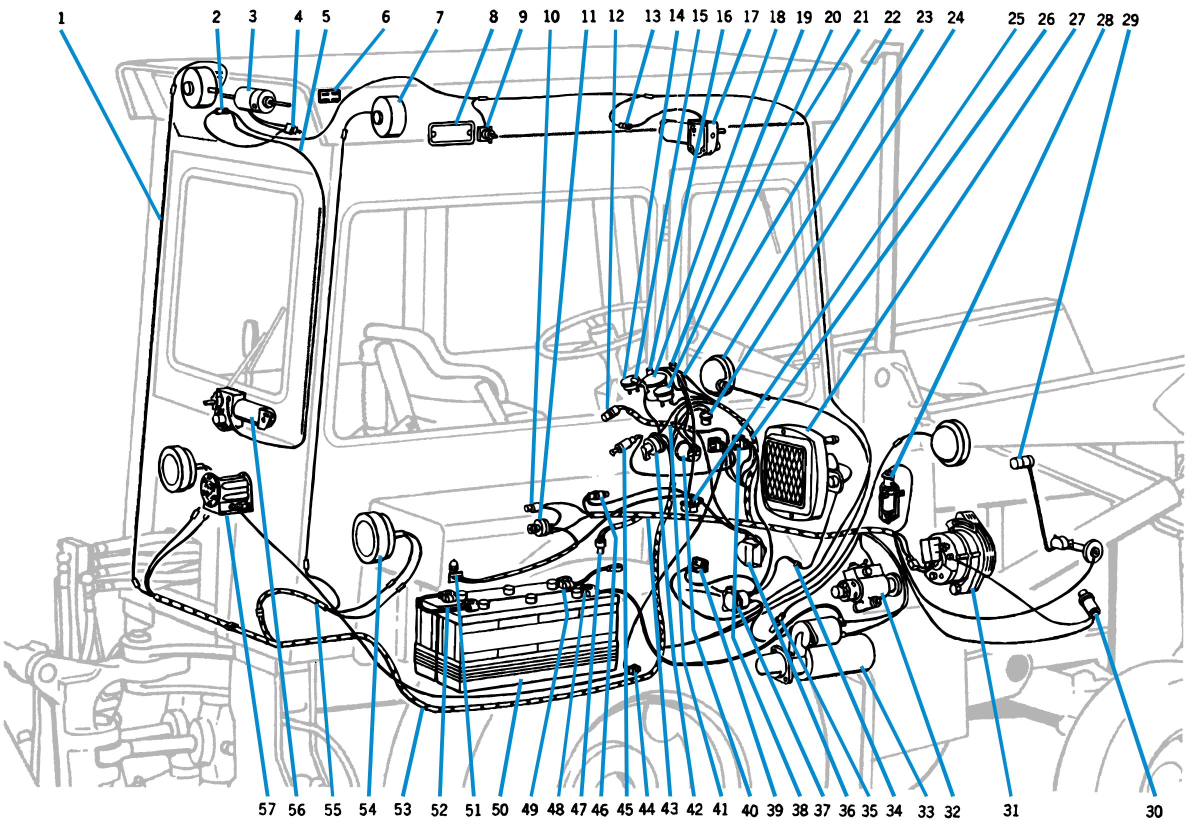


Fig. 1-Component Location - Electrical System

T87439

Block Diagram (Figs. 2 and 3)

The block diagram traces the power flow in the electrical system.

A block diagram will seldom isolate a problem to a specific component, but it will aid in isolating a problem to a particular circuit.

Schematic Diagram (Figs. 4 and 5)

The schematic diagram is a detailed "How It Works" picture of the electrical system. It provides the theory of operation in a simple, easy-to-understand manner. The schematic is especially helpful in trouble shooting to isolate a problem to a given component.

Component Wire Routing (Figs. 6, 7, 8, 9, and 10)

The component wire routings show the electrical components and wiring harnesses and which wires connect to each component or harness.

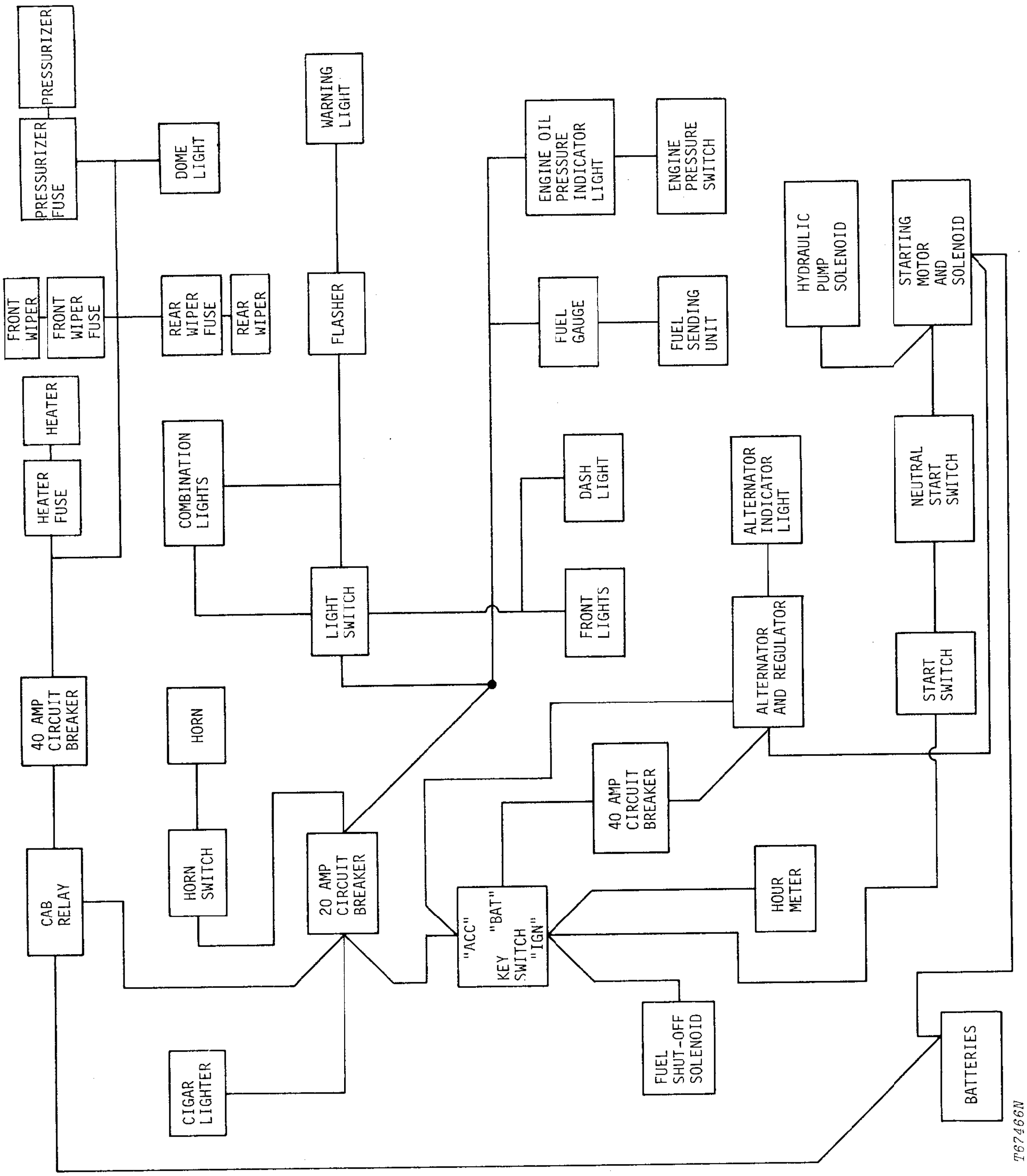


Fig. 2-Electrical System Block Diagram (-25718)

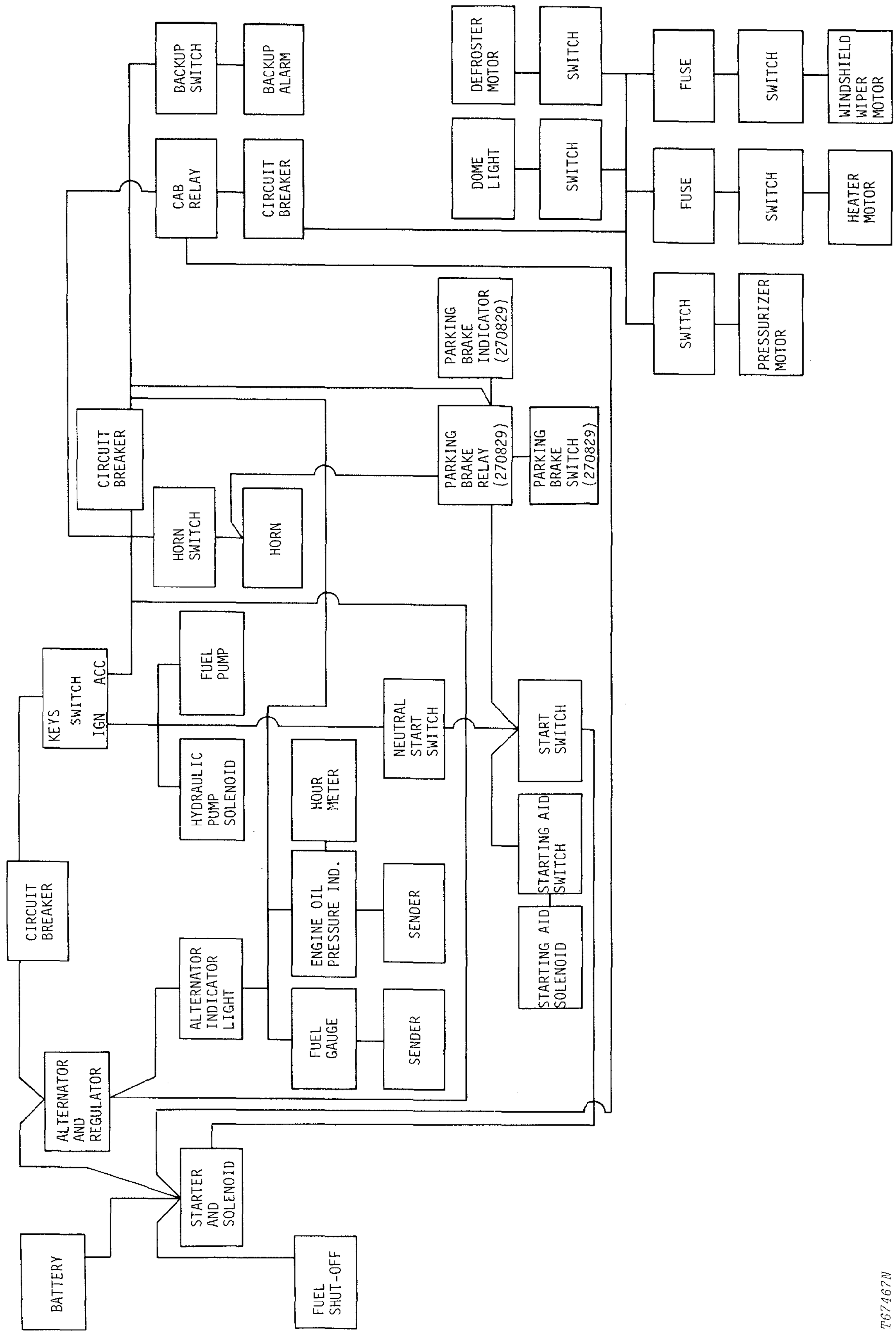
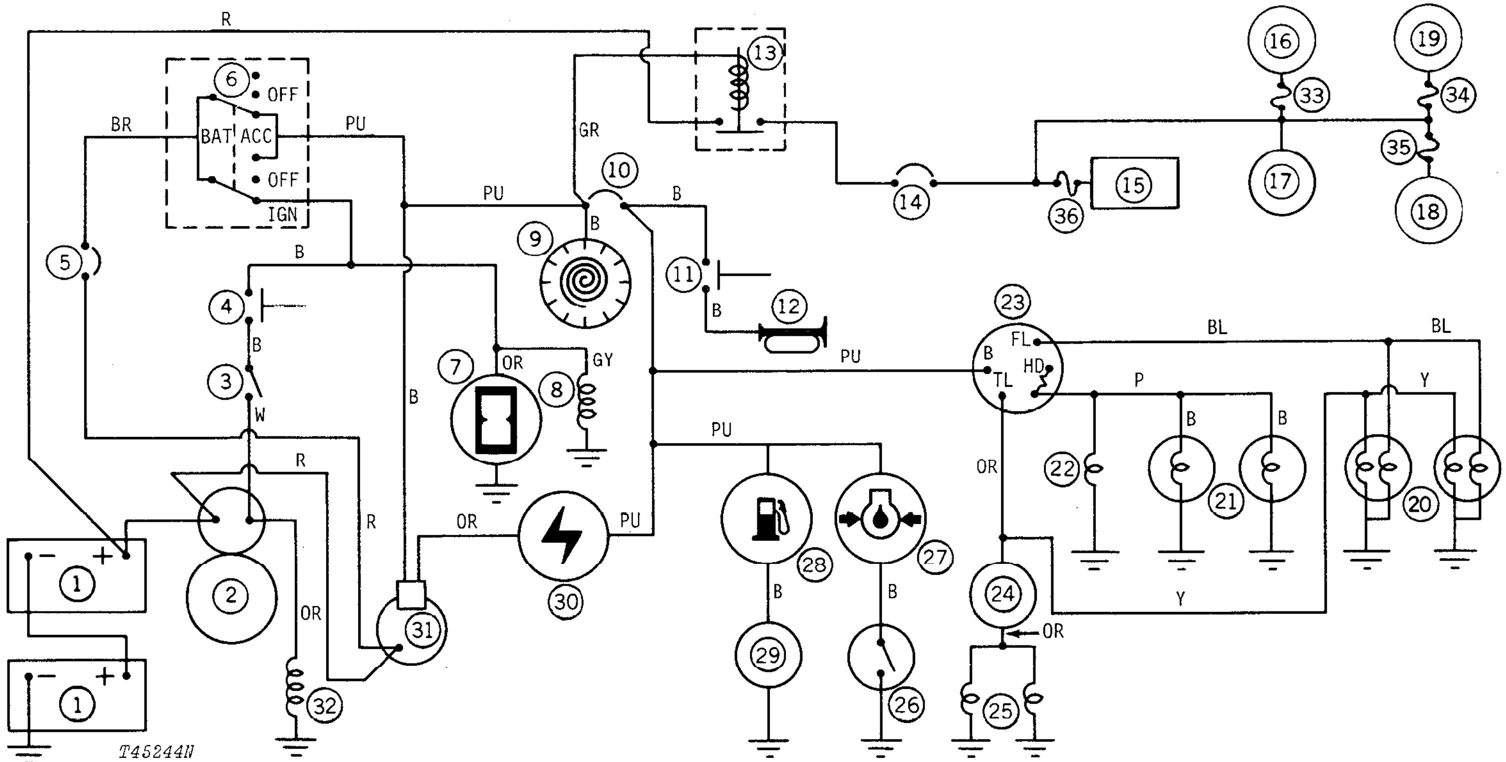


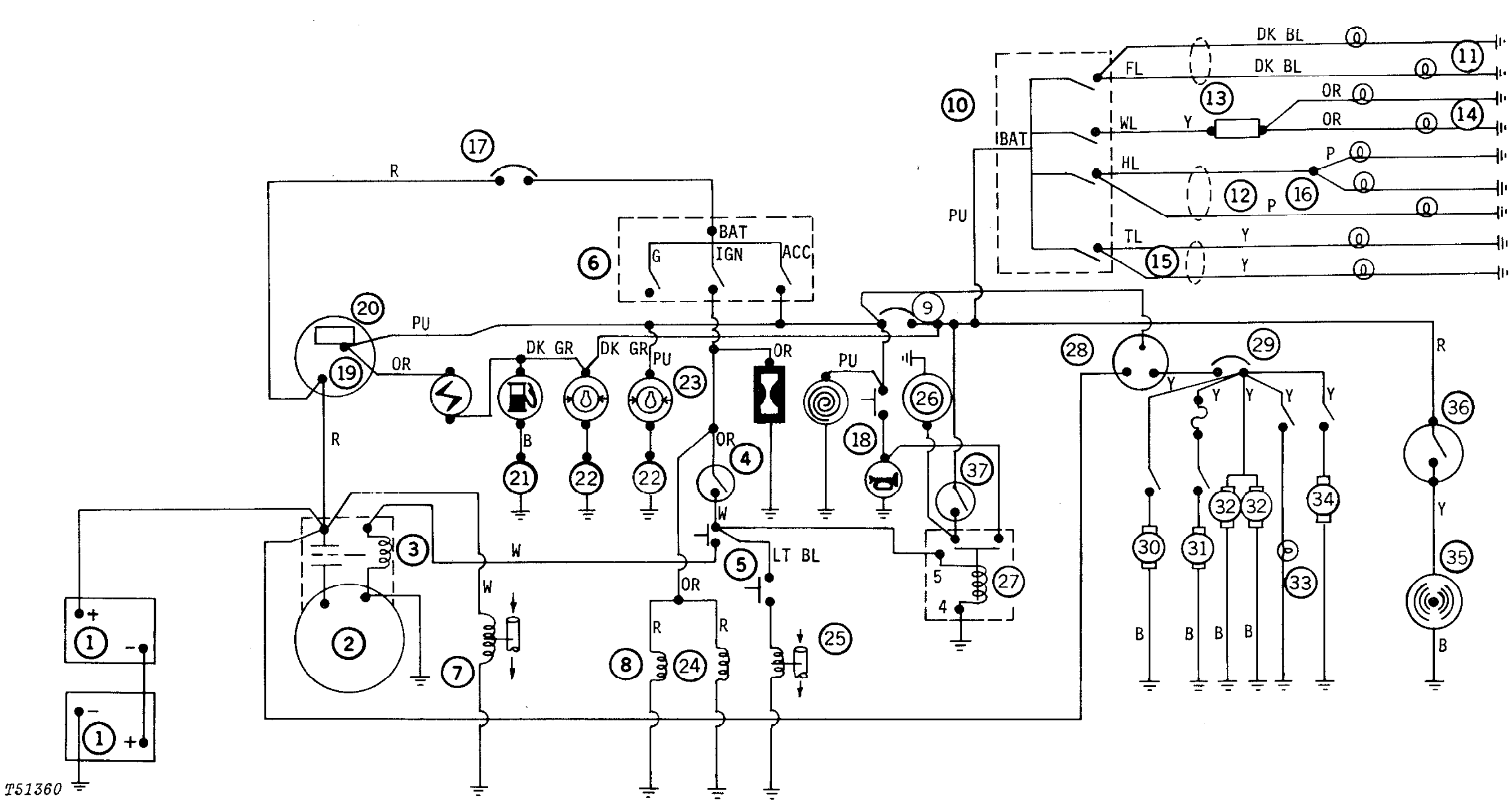
Fig. 3-Electrical System Block Diagram (255719-)



1—Batteries
2—Starting Motor and Solenoid
3—Neutral Start Switch
4—Start Switch
5—40 Amp Circuit Breaker
6—Key Switch
7—Hour Meter
8—Fuel Shut-Off Solenoid
9—Cigar Lighter
10—20 Amp Circuit Breaker
11—Horn Switch
12—Horn
13—Cab Relay
14—40 Amp Circuit Breaker
15—Heater
16—Front Wiper Motor
17—Dome Light
18—Rear Wiper Motor
19—Pressurizer Motor
20—Combination Lights
21—Front Lights
22—Dash Lamp
23—Light Switch
24—Flasher
25—Warning Lights
26—Engine Oil Pressure Switch
27—Engine Oil Pressure Indicator Light
28—Fuel Gauge
29—Fuel Sending Unit
30—Alternator Indicator Light
31—Alternator and Regulator
32—Hydraulic Pump Solenoid
33—Front Wiper Fuse
34—Pressurizer Fuse
35—Rear Wiper Fuse
36—Heater Fuse

B—Black
BL—Blue
OR—Orange
GY—Gray
BR—Brown
GR—Green
P—Pink
PU—Purple
R—Red
W—White
Y—Yellow

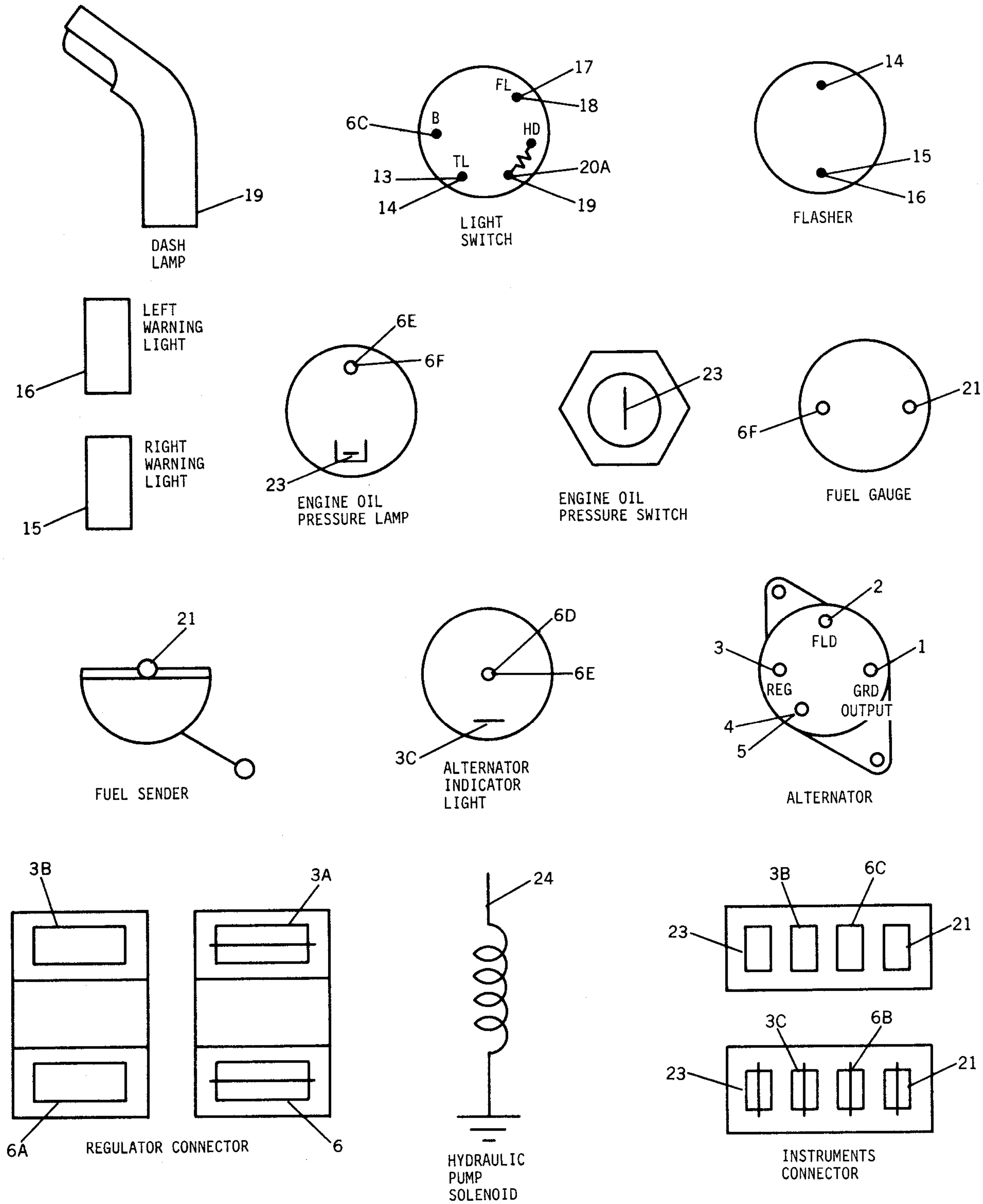
Fig. 4-Electrical System Schematic Diagram (-255718)



1—Battery (6 volt)
2—Starter
3—Solenoid
4—Neutral Start Switch
5—Start Switch
6—Key Switch
7—Hydraulic Pump Solenoid
8—Fuel Shut-Off Solenoid
9—Circuit Breaker
10—Light Switch
11—Front Lamps
12—Dash Lamp
13—Flasher
14—Warning Lamps
15—Tail Lamps
16—Head Lamps
17—Circuit Breaker
18—Horn Switch
19—Alternator
20—Regulator
21—Sending Unit
22—Pressure Switch
23—Rear Engine Oil Pressure Indicator
24—Fuel Injection Pump
25—Starting Aid Solenoid
26—Parking Brake Indicator* (270829-)
27—Parking Brake Relay* (270829-)
28—Cab Relay*
29—Accessories Circuit Breakers*
30—Pressurizer Motor*
31—Heater Motor*
32—Windshield Wiper Motor*
33—Dome Light*
34—Defroster Motor*
35—Backup Alarm
36—Backup Alarm Switch
37—Parking Brake Switch (270829-)

*Cab Units Only

Fig. 5-Electrical Schematic (255719-)



T45245N

Fig. 6-Component Wire Routing - Part 1 (-255718)

The following is an explanation of Fig. 6 - Component Wire Routing - Part I.

No.	Color	Routing
1	Black	Alternator "GND" terminal to regulator.
2	Green	Alternator "FLD" terminal to regulator.
3	Red	Alternator "REG" terminal to regulator.
3A	Orange	Regulator to regulator connector.
3B	Orange	Regulator connector to instruments connector.
3C	Orange	Alternator indicator light to instruments connector.
4	Red	Alternator "OUTPUT" terminal to starting motor solenoid "B" terminal.
5	Red	Alternator "OUTPUT" terminal to circuit breaker.
6	Purple	Regulator to regulator connector.
6A	Purple	Regulator connector to circuit breaker and key switch "ACC" terminal.
6B	Purple	Circuit breaker to instrument connector.
6C	Purple	Instrument connector to light switch "BAT" terminal.
6D	Purple	Light switch "BAT" terminal to alternator indicator light connector.
6E	Purple	Alternator indicator light connector to engine oil pressure indicator light connector.
6F	Purple	Engine oil pressure indicator light connector to fuel gauge.
13	Yellow	Light switch to light harness connector.
14	Orange	Light switch to flasher.
15	Orange	Flasher to right warning light.
16	Orange	Flasher to left warning light.
17	Blue	Light switch to left combination light harness connector.
18	Blue	Light switch to right combination light harness connector.
19	Pink	Light switch to dash lamp.
20A	Pink	Light switch to light connector.
21	Black	Fuel gauge to fuel sending unit.
23	Black	Engine oil pressure indicator light to engine oil pressure switch.
24	Orange	Starting motor solenoid "S" terminal to hydraulic pump solenoid.

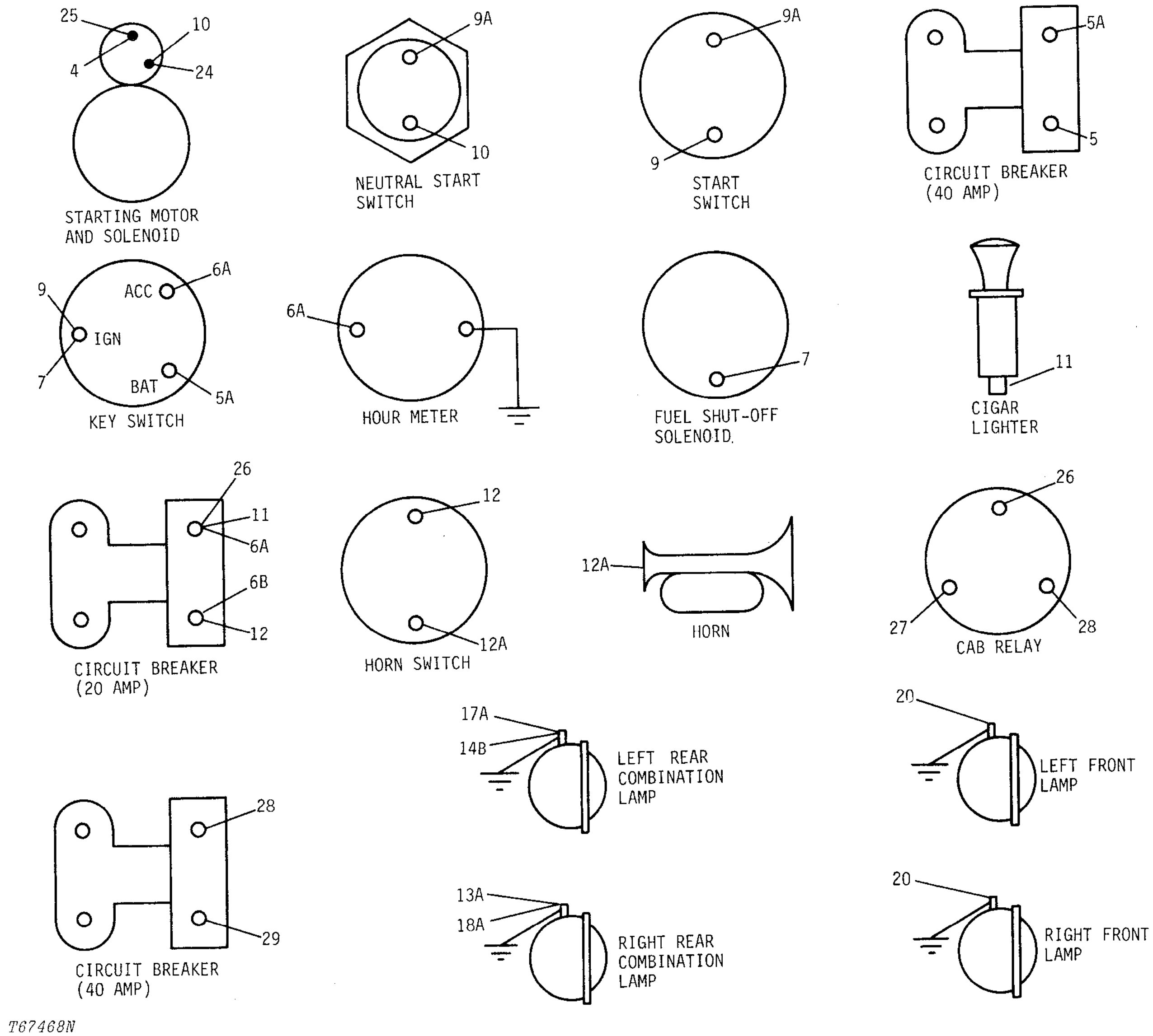


Fig. 7-Component Wire Routing - Part II (-255718)

The following is an explanation of Fig. 7 - Component Wire Routing - Part II.

No.	Color	Routing
4	Red	Alternator "OUTPUT" terminal to starting motor solenoid "B" terminal.
5	Red	Alternator "OUTPUT" terminal to circuit breaker.
5A	Brown	Circuit breaker to key switch "BAT" terminal.
6A	Purple	Regulator connector to circuit breaker and key switch "ACC" terminal.
6B	Purple	Circuit breaker to instrument connector.
6G	Orange	Key switch "IGN" terminal to hour meter.
7	Gray	Key switch "IGN" terminal to fuel shutoff solenoid.
9	Black	Start switch to key switch "IGN" terminal.
9A	Black	Neutral start switch to start switch.
10	White	Neutral start switch to starting motor "S" terminal.
11	Black	Cigar lighter to circuit breaker.
12	Black	Circuit breaker to horn switch.
12A	Black	Horn switch to horn.
13A	Yellow	Right light harness connector to right combination light.
14B	Yellow	Left light harness connector to left combination light.
17A	Blue	Left light harness connector to left combination light.
18A	Blue	Right light harness connector to right combination light.
20	Black	Front lights to light connector.
25		Starting motor "B" terminal to battery.
26	Gray	Circuit breaker to cab relay.
27	Red	Cab relay to battery.
28		Cab relay to cab circuit breaker.
29		Cab circuit breaker to cab wiring connector.

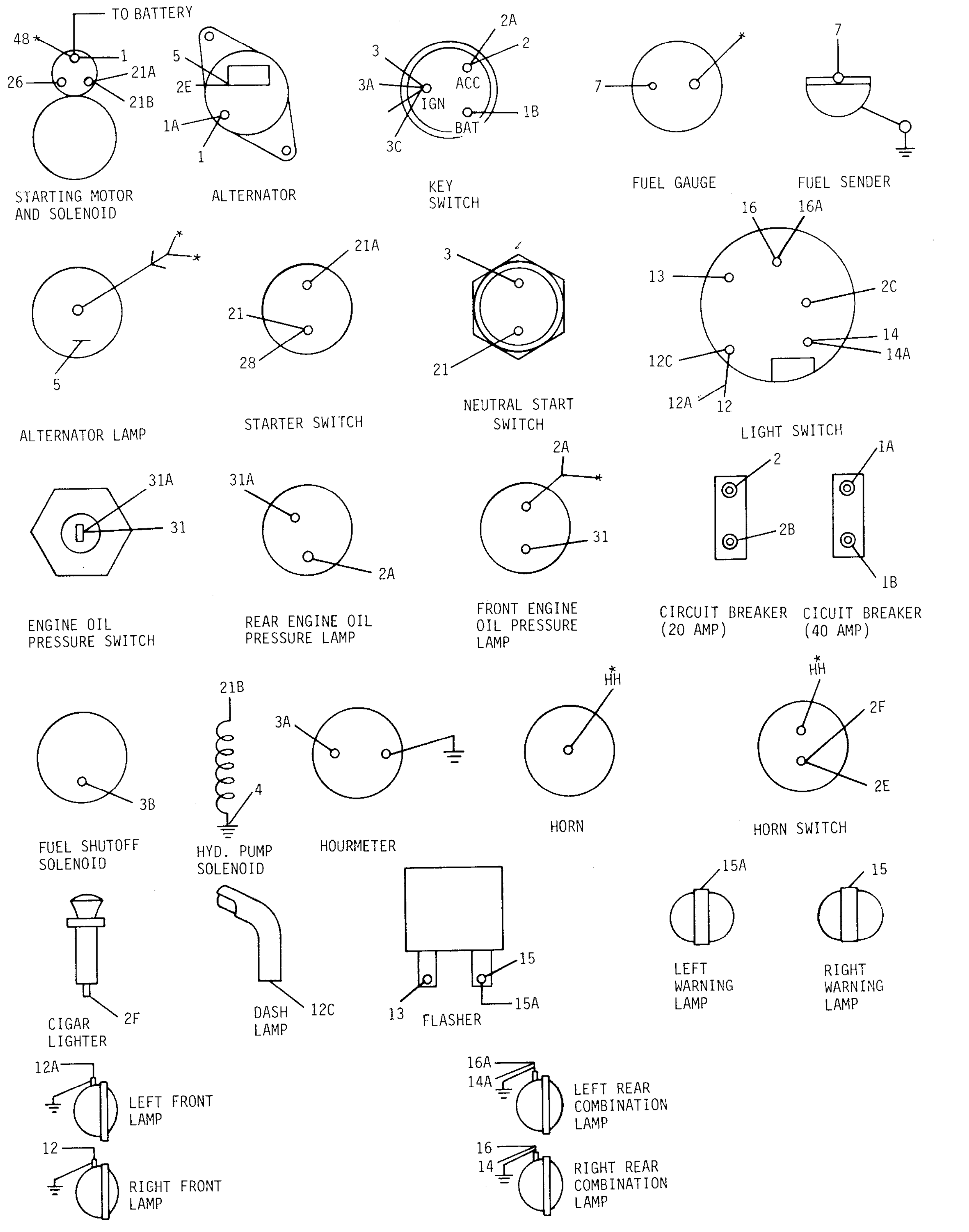


Fig. 8-Wire Routing (255719-   )

KEY TO COMPONENT WIRE ROUTING

No.	Color	Routing
1	Red	Starter solenoid to alternator output
1A	Red	Alternator output to main circuit breaker
1B	Red	Main circuit breaker to key switch
2	Purple	Key switch ACC to 20 amp circuit breaker
2A	Purple	Rear engine oil pressure indicator lamp to key switch ACC
2B	Purple	20 amp circuit breaker to instrument panel harness terminal connector
2C	Purple	Instrument panel harness terminal connector to light switch BAT
2D	Purple	Horn switch to 2 and 2E within harness, key switch ACC
2E	Purple	Regulator to starter solenoid
2F	Purple	Horn switch to cigar lighter
3	Orange	Key switch IGN to neutral start switch
3A	Orange	Key switch IGN to hour meter
3B	Orange	Fuel shut off solenoid to 3A within harness
4	Black	(385490-) Hydraulic pump solenoid to alternator ground terminal
5	Orange	Alternator indicator lamp to regulator
7	Black	Fuel gauge to fuel gauge sender
12	Pink	Light switch to right front lamp
12A	Pink	Light switch to left front lamp
12C	Pink	Light switch to dash lamp
13	Yellow	Light switch to lamp flasher
14	Yellow	Light switch to right rear combination lamp
14A	Yellow	Light switch to left rear combination lamp
15	Orange	Lamp flasher to right warning lamp
15A	Orange	Lamp flasher to left warning lamp
16	Dk. Blue	Light switch to right rear combination lamp
16A	Dk. Blue	Light switch to left rear combination lamp
21	White	Neutral start switch to starter switch
21A	White	Starter switch to starting motor solenoid
21B	White	Starting motor solenoid to hydraulic pump solenoid
28	Lt. Blue	Starter switch connector to starting aid switch
31	Dk. Green	Front engine oil pressure indicator to engine oil pressure switch
31A	Dk. Green	Rear engine oil pressure indicator to engine oil pressure switch
48*	Red	Accessory relay to cab accessories circuit breaker
64	Black	Horn switch to horn

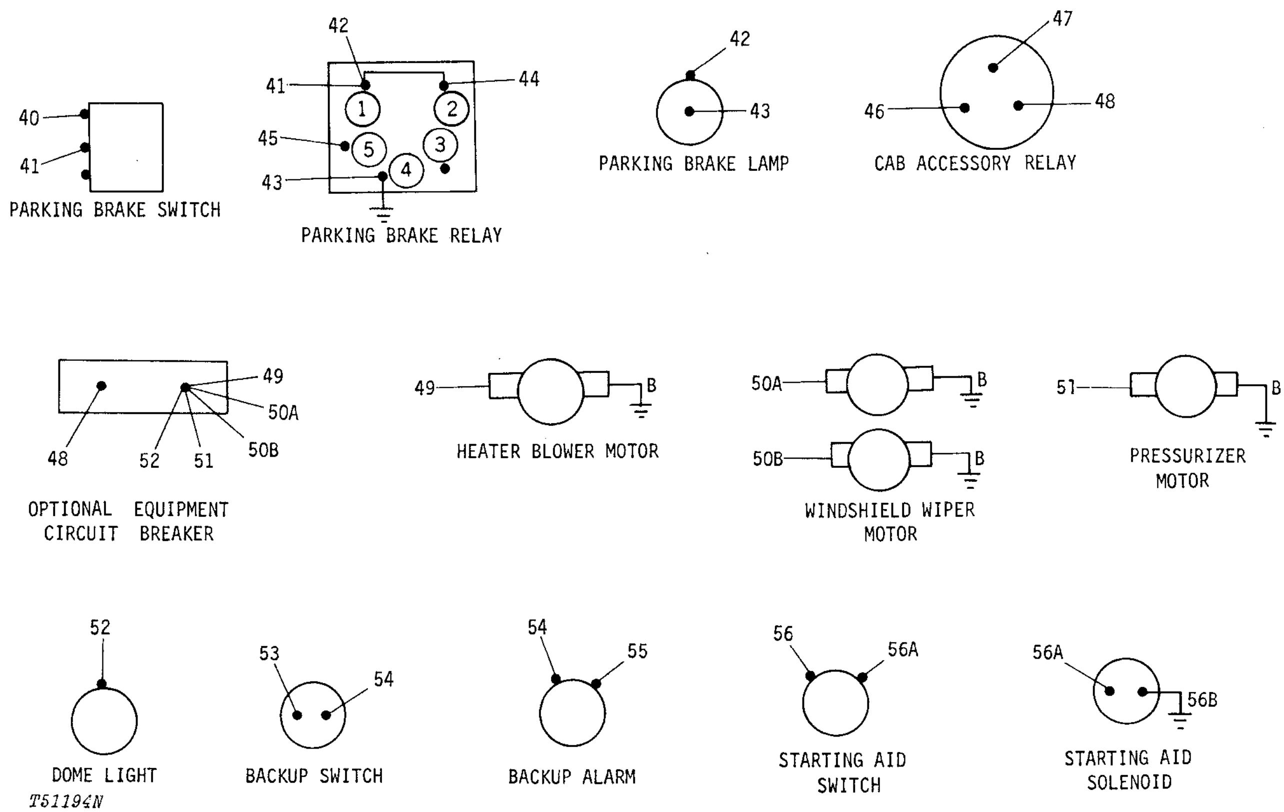


Fig. 9-Miscellaneous Equipment Diagram

No.	Color	From	To
40	Orange	Accessory circuit breaker	Parking brake switch
41	Orange	Parking brake switch	Parking brake relay
42	Orange	Parking brake relay	Parking brake lamp
43	Orange	Parking brake lamp	Parking brake relay
44	Purple	Parking brake relay	Horn
45	Green	Parking brake relay	Neutral start switch
46	Red	Starting circuit relay	Cab relay
47	Red	Accessory circuit breaker	Cab relay
48	Red	Optional equipment circuit breaker	Cab relay
49	Yellow	Optional equipment circuit breaker	Heater blower motor
50A, 50B	Yellow	Optional equipment circuit breaker	Windshield wiper motors
51	Yellow	Optional equipment circuit breaker	Pressurizer motor
52	Yellow	Optional equipment circuit breaker	Dome light
53	Yellow	Accessory circuit breaker	Backup switch
54	Red	Backup switch	Backup alarm
55	Black	Backup alarm	Backup alarm ground
56	Green	Neutral start switch	Starting aid switch
56A	Green	Starting aid switch	Starting aid solenoid
56B	Black	Starting aid solenoid	Starting aid solenoid ground

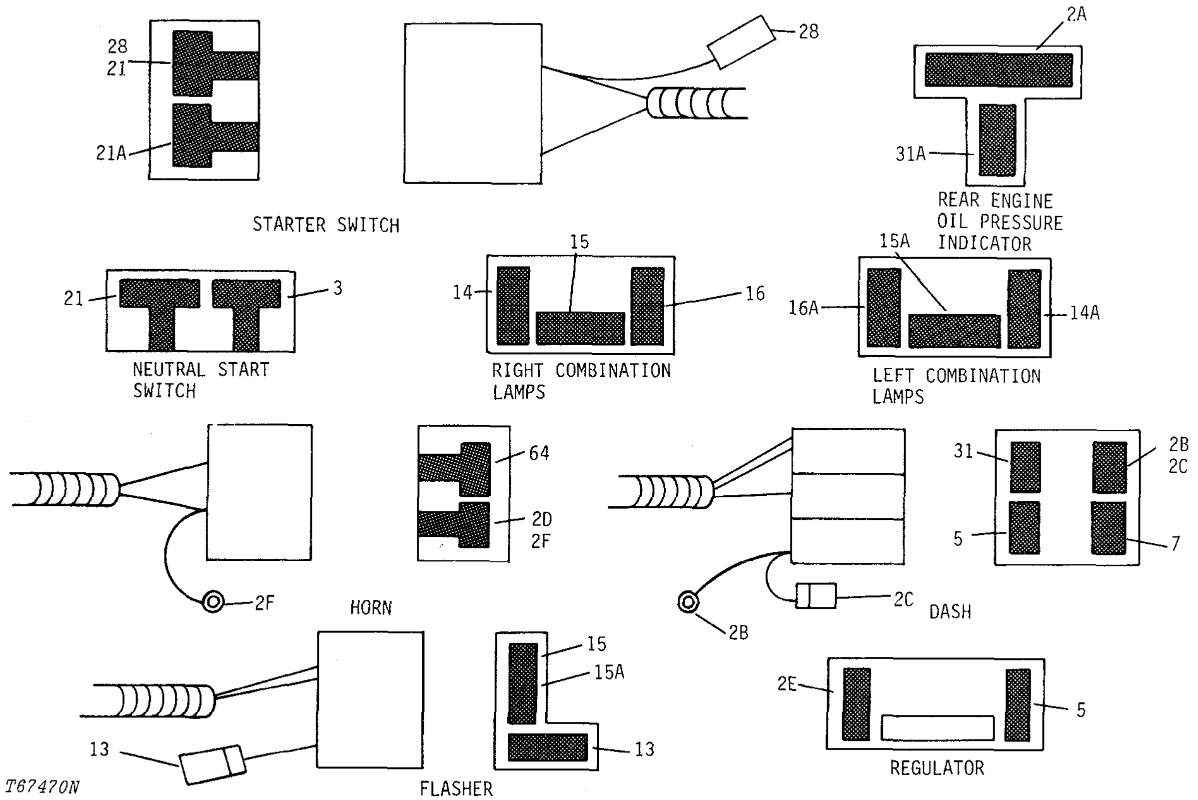


Fig. 10-Harness Terminal Routing (255719-   )

DIAGNOSING MALFUNCTIONS

Batteries

Undercharged Battery

Excessive loads from added accessories.
Excessive engine idling.
Accessories left on.
Low charging system voltage.
Low charging system output.
Continuous drain on battery.

Low Battery Output

High resistance in circuit.
Low electrolyte level.
Low specific gravity.
Defective battery cell.
Cracked or broken battery case.
Low battery capacity.

Battery Uses Too Much Water

Cracked battery case.
Battery being overcharged.
Defective battery.

Starting Circuit

Solenoid Switch Chatters

Low battery.
Poor connection.
Open in solenoid hold-in circuit.

Starting Motor Spins But Will not Crank Engine

Damaged overrunning clutch pinion.
Broken drive lever.
Broken drive lever pivot bolt.
Broken solenoid switch plunger hook.
Defective overrunning clutch.

Engine Cranks Slowly

Burnt or poor solenoid switch contacts.
Poor contact of brush or worn-out brushes.
Burnt commutator.
Commutator mica too high.
Shorted or grounded armature coil.
Poor tension on brush spring.
Armature rubbing pole core.
Low battery charge.
High resistance in battery cables.

Starting Motor Keeps Running

Defective starting motor solenoid.
Short in wiring.

Noise Produced At Engine Cranking

Armature interfering with stationary components.
Starting motor drive gear worn.

Starting Motor Will Not Spin, Engine Will Not Crank

Burnt or poor solenoid switch contacts.
Open, shorted, or grounded solenoid switch pull-in windings.
Open, shorted, or grounded solenoid switch hold-in winding.
Poor contact of brush or worn-out brushes.
Burnt commutator.
Commutator mica too high.
Open or grounded field winding.
Open, shorted, or grounded armature coil.
Poor tension on brush spring.
Grounded positive side brush holder.

If starting motor does not operate connect a voltmeter to the solenoid "S" terminal and a good ground. Turn key switch to "IGN" position and push start switch.

Voltmeter Indicates Battery Voltage

Defective starting motor.
Defective solenoid switch.

Voltmeter Does Not Indicate Battery Voltage

Unit not in neutral.
Defective key switch.
Defective wiring between key switch and neutral start switch.
Defective wiring between battery and solenoid "S" terminal.
Defective start switch.
Defective neutral start switch.

Charging Circuit

Low Charging System Voltage

High resistance in circuit connections.
Defective wiring.
Low amperage output of alternator.
Defective regulator.
Defective batteries.

Low Charging System Output

Slipping drive belts.
Excessively worn or sticking brushes.
Dirty or out-of-round slip rings.
Grounded, shorted, or open field circuit.
Defective diodes and alternator.
Defective regulator.

High Charging System Voltage

High resistance at regulator connections.
Defective regulator.

Noisy Alternator

Defective drive belt.
Worn or defective bearings.
Loose mounting or drive belt.
Pulley not aligned.
Diodes shorted or open.

Gauges

If A Gauge Does Not Register

Lack of voltage to the gauge.
Poor ground connection.
Connecting wire grounded to unit.
A defective sending unit or gauge.

If A Gauge Consistently Registers Too High

Poor Connection between gauge and connecting wire.
Broken connecting wire.
Poor ground at sending unit.
Failure of gauge or sender, usually the sender.

Fuel Gauge Shows Empty

Poor ground of gauge.
Lack of voltage to gauge.
Grounded wire between gauge and sender.
Hole in sender float.

Fuel Gauge Shows Full

Poor ground of sender.
High resistance or open circuit in wire between gauge and sender.
Defective sender or gauge.

Horn

Horn Operates After Tapping

Points open because of wear or maladjustment.
Foreign particle between points (horn will operate normally the next time).

Horn Has No Current Draw

Broken Lead.
Open contact (turn screw counterclockwise).
Open-circuited winding.

Excessive Horn Current Draw

Closed points (turn screw clockwise).

Indicator Lights

Alternator Indicator Light Out With Key Switch On

Loose or broken connector wire.
Open alternator field circuit.
Indicator lamp burned out.

Oil Pressure Indicator Light Will Not Light

Burnt-out bulb.
Open circuit or excessive resistance in wiring.
Defective lamp body.
Faulty oil pressure switch.

Oil Pressure Light Remains On With Key Switch Off

Defective lamp body.
Grounded wire to oil pressure switch.
Faulty oil pressure switch.

Cigar Lighter

Cigar Lighter Does Not Function

Circuit breaker in lighter tripped.
Faulty lighter element or lighter shell.
Defective wiring.

Injection Pump Solenoid

High Current Draw

Shorted windings.

Low or No Current Draw

High resistance at internal connection.
High resistance in connector or wire.
Open circuited windings.

Lights

Dim Lights

High resistance in circuit or poor ground on lights.
Low battery charge.
Defective key switch or light switch.

Precautions

Certain precautions should be followed when testing or servicing the electrical system.

CAUTION: To avoid injury from a spark or short circuit, DISCONNECT THE BATTERY GROUND STRAP when working on any part of the electrical system. This will also prevent accidental starting.

When removing the batteries, disconnect the battery ground strap first. When installing the battery, connect the ground strap last.

NEVER REVERSE THE POLARITY OF THE BATTERY CONNECTIONS. Reversing the polarity may damage some components and wiring in the system.

DO NOT ATTEMPT TO POLARIZE THE ALTERNATOR after connecting the battery. No polarization is needed. Any attempt to do so may damage the alternator, regulator, or circuits.

CAUTION: Wear eye protection and remove metal watch bands, rings and other metal jewelry.

If booster batteries are used to help start the engine, be sure to connect them properly. Connect the negative (−) terminal of the booster battery to the negative (−) terminal of the machine battery, and connect the positive (+) terminals to each other.

When using booster batteries, prevent fire hazards as follows:

1. When possible, use equipment with a switch in the line connecting the booster battery to the machine battery.

2. Always "rock" the connector clips to make sure they are secure.

3. If only jumper cables are available, always connect the machine battery first; then when connecting the booster battery, be very careful in handling the cable clips. When disconnecting always break the connection at the booster battery first.

When connecting a fast charger to a battery in a machine, be very careful. If charging the battery, first remove the battery ground strap to prevent fire hazards and damage to the alternator.

Do not lay metal tools or other objects across the battery as they may create a short circuit.

CAUTION: GAS FROM BATTERY ELECTROLYTE IS FLAMMABLE. Keep all sparks and fires away from the battery. When charging the battery, gas is created more rapidly. Be sure the room where the battery is charged is well ventilated.

CAUTION: BATTERY ACID IS HARMFUL ON CONTACT with the skin or most materials. See Section 16, Group 1671 for first aid tips when acid comes in contact with skin.

Never operate the alternator in an open circuit.

Never short or ground the alternator terminals.

Do not disconnect the voltage regulator while the alternator is running.

VISUAL INSPECTION

Carefully inspect the electrical system for tips on the malfunction. Check to see if the unit can be operated without further damaging the system.

Always check these items before turning on switches or running the unit.

1. Look for bare wires that could cause grounds or shorts and dangerous sparks. Shorted wires can damage the charging system.

2. Look for loose or broken wires. They can damage the regulator.

3. Inspect all connections, especially battery connecting points. Acid film and dirt on the battery may cause current flow between the battery terminals, resulting in current leakage. Check the battery ground strap for proper operation.

4. Check the battery electrolyte level. Continued loss of electrolyte indicates overcharging. Check for acid film and dirt on top of battery.

5. Check the alternator drive belt tension.

6. Inspect for overheated parts after the unit has been stopped for a while. They will often smell like burnt insulation. Put your hand on the alternator or regulator. Heat in these parts when the unit has not been operated for some time is a sure tip-off to charging circuit problems.

If your visual inspection does not indicate the possible malfunction, but your inspection does indicate that the machine can be run, first turn the key switch to the "accessory" position. Try out the accessory circuits - alternator indicator light, gauges and lights. How do these components work? Look for sparks or smoke which might indicate shorts.

Turn the key switch to the "start" position. Now start the machine. Check all gauges for good operation, and check to see if the system is charging or discharging.

In general, look for anything unusual.

Many electrical failures cannot be detected even if the machine is started. Therefore, a systematic and complete inspection of the electrical system is necessary. See "System Testing" in this section.

TESTING AND ADJUSTMENT

Tests of the charging and starting circuits, the lights, accessories, and miscellaneous components are covered in this group.

Failure of the engine to crank may be due to one of a number of causes. Any one of several components in the starting circuit may be at fault, or the cause of failure may be a weak battery. Another reason for failure could be broken, disconnected or loose leads or corroded connections.

Therefore, both a visual and an electrical check should be made to isolate trouble before removing any component from the unit; otherwise a component may be removed only to find it is not the cause of cranking failure.

Always use accurate electrical test equipment when making electrical tests. Faulty equipment will prevent the service technician from doing thorough work and may damage the electrical system.

Before you start the circuit tests, quickly review the precautions on page 9015-22 of this group and make the following checks:

1. Check battery electrolyte level.

2. Look for corroded terminals.

3. Check for acid film and dirt on top of battery.

4. Check battery polarity.

5. Test the charge of the batteries (nine volts minimum for testing system).

System Short Test

Following is a simple method to locate an electrical system short quickly:

1. Be sure battery is fully charged.

2. Disconnect the negative cable from the battery.

3. Connect a 12-volt test lamp between the negative battery post and the disconnected cable. If there is a short, the test lamp will glow with all accessories turned off.

4. By disconnecting and reconnecting each electrical circuit, one at a time, the shorted circuit can be located.

5. When a disconnected circuit causes the test lamp to go out, you've found the problem. Now all that remains is to trace that circuit, then locate and correct the cause of the short.

Testing Batteries

Battery condition should be determined first. It is vital to the testing of starting circuit problems to have the battery fully charged and free of shorted or dead cells. Use the following test to determine voltage available at battery.

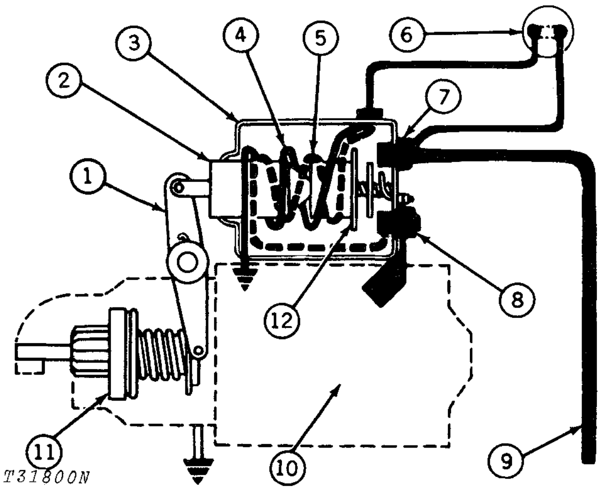
1. Attach positive (+) voltmeter lead to positive (+) battery lead. Attach negative (−) voltmeter lead to negative (−) battery terminal.

2. Crank engine.

3. Voltmeter should read at least 9 volts. If above the minimum, continue testing. If below minimum, replace or recharge battery.

Starting Circuit

The starting circuit consists of the batteries, starting motor with solenoid switch, neutral start switch, key switch and connecting wires.



1—Shift Lever
2—Plunger
3—Solenoid
4—Hold-In Winding
5—Pull-In Winding
6—Start Switch
7—Battery Terminal
8—Motor Terminal
9—Battery Positive Cable
10—Starting Motor
11—Overrunning Clutch
12—Contact Disk

Fig. 11-Basic Starting Circuit

With the key switch ON, and the unit in neutral when the start switch is depressed, the battery current flows into the hold-in winding and also to the armature coils through the pull-in and field windings and brushes.

Then the solenoid plunger is pulled in by means of magnetism produced by pull-in and hold-in windings, and the overrunning clutch is pushed out on the armature shaft by the drive lever, to engage the pinion with the flywheel ring gear. At this time, the pinion is partially engaged with the ring gear before the contact plate closes between the contacts.

When the contacts are fully closed, battery current flows directly into field windings and to the armature coils through the contact plate, and energizes the armature to spin, creating torque. This pushes the clutch pinion further to engage completely with the ring gear. As the armature rotates, the overrunning clutch also rotates, and the rollers between the clutch shell and pinion collar are moved into the narrower portion of the notches in the shell. This action locks the pinion to the armature shaft and permits the transfer of torque to the pinion for engine cranking.

Once the solenoid switch plunger is pulled in, less magnetism is needed to hold it in; so the pull-in winding is shorted with the contact plate, and only the hold-in winding operates to hold the plunger in place as long as the start switch remains closed.

When the engine has started, the flywheel gear will tend to drive the armature through the pinion faster than the armature is running. The pinion, rotating faster than the clutch shell, turns the rollers back into the larger portion of the notches against spring tension. This permits the rollers to unlock and turn freely so that the pinion will overrun the clutch shell but not drive the armature.

With the start switch released after engine starting, the current flows from the contact plate to both the pull-in and hold-in windings in the same direction. These windings are wound to have their magnetic fields act in opposite directions. They cancel each other. The plunger returns to the rest position by means of the return spring, demeshing the pinion from the flywheel.

FOS

For additional information on starting circuits, refer to "Starting Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

Testing the Starting Circuit

When the start switch is depressed, you can expect one of five things to occur if the starting circuit is defective:

1. Nothing happens - there is no "click," indicating that the solenoid contacts did not close.

2. An audible "click" in the solenoid is heard, but the starting motor does not operate.

3. The starting motor is running, but the engine does not turn over.

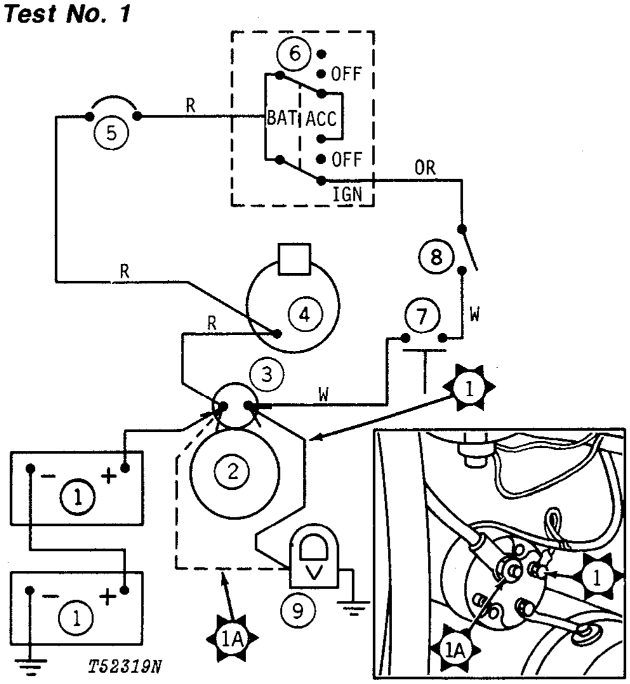
4. The starting motor turns over the engine slowly or erratically.

5. The engine starts but the starting motor drive does not disengage from the flywheel.

You can check out these five problems as follows:

1. Nothing Happens.

Test No. 1



1—Batteries
2—Starting Motor
3—Starting Motor Solenoid
4—Alternator
5—Circuit Breaker
6—Key Switch
7—Start Switch
8—Neutral Start Switch
9—Voltmeter
R—Red
B—Black
OR—Orange
W—White

Fig. 12-Starting Circuit Test No. 1 (255719-)

Connect voltmeter to solenoid "S" terminal and to ground (Test Point 1, Fig. 12). With shift lever in neutral position, turn key switch on and depress start switch. Voltmeter should read 9 to 12 volts.

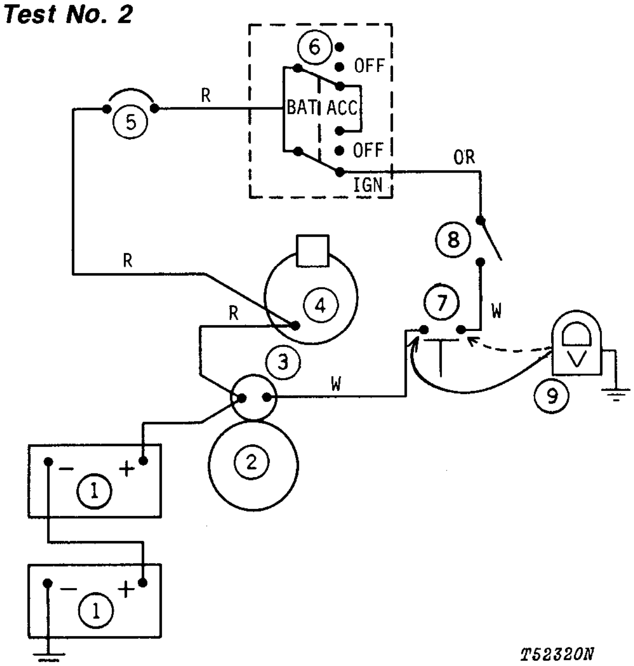
If there is a voltage reading of 9 to 12 volts, the problem is in the solenoid. See Group 0422 for "Solenoid Tests."

If there is no voltage reading connect voltmeter to solenoid "BAT" terminal (Test Point 1A). Voltmeter should read 9 to 12 volts.

If there is a reading of 9 to 12 volts proceed to Test No. 2.

If there is no voltage reading, check for a defective battery cable or poor and corroded connections.

Test No. 2



1—Batteries
2—Starting Motor
3—Starting Motor Solenoid
4—Alternator
5—Circuit Breaker
6—Key Switch
7—Start Switch
8—Neutral Start Switch
9—Voltmeter
R—Red
B—Black
OR—Orange
W—White

Fig. 13-Starting Circuit Test No. 2 (255719-)

NOTE: Prior to Serial No. 255718, the neutral start switch was wired between the key switch and start switch.

Connect voltmeter to each terminal of start switch. Depress switch.

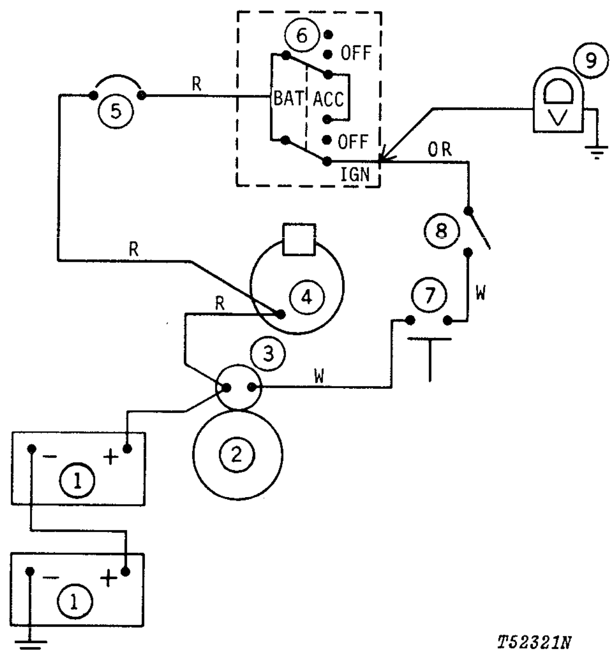
Voltage on only one terminal indicates a defective start switch.

No voltage on either terminal indicates a defective key switch or wiring from key switch to start switch. Go to Test No. 3.

Voltage on both terminals indicates a defective or maladjusted neutral start switch or wiring from start switch to neutral start switch. Go to Test No. 4.

If neutral start switch requires adjustment, see Group 1674.

Test No. 3



1—Batteries	**6—Key Switch**
2—Starting Motor	**7—Start Switch**
3—Starting Motor Solenoid	**8—Neutral Start Switch**
	9—Voltmeter
4—Alternator	**R—Red** **B—Black**
5—Circuit Breaker	**BR—Brown** **W—White**

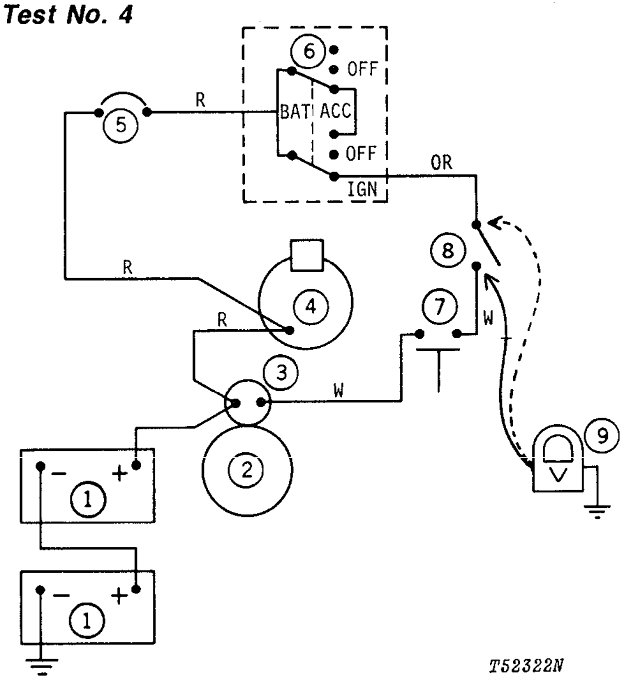
Fig. 14-Starting Circuit Test No. 3

Connect voltmeter to key switch "IGN" terminal. Turn key switch to "IGN."

If voltage is obtained, the problem is in the wiring between the key switch and start switch.

No voltage obtained indicates a defective key switch.

Test No. 4



1—Batteries	**6—Key Switch**
2—Starting Motor	**7—Start Switch**
3—Starting Motor Solenoid	**8—Neutral Start Switch**
	9—Voltmeter
4—Alternator	**R—Red** **B—Black**
5—Circuit Breaker	**OR—Orange** **W—White**

Fig. 15-Starting Circuit Test No. 4

Connect voltmeter to each terminal of neutral start switch. With key switch on and unit in neutral, depress start switch.

Voltage on both terminals indicates defective wiring between switch and solenoid.

Voltage on one terminal indicates defective or maladjusted switch.

No voltage on either terminal indicates defective wiring between switch and start switch.

2. Solenoid Contacts "Clicked" but the Starting Motor Did Not Operate.

This indicates that the circuit problems lie within the solenoid. If the solenoid switch contacts close, and the switch begins to "chatter," an open circuit exists in the hold-in winding of the solenoid. In any case, the starting motor should be removed and tested as covered in Section 4, Group 0422.

3. Starting Motor Ran but Did Not Turn the Engine Over.

We know that the starting motor is getting enough current to operate. The problem, then is either in the shifting of the drive assembly into mesh, a broken armature shaft, or a dirty or faulty drive assembly. These causes require disassembly of the starting motor for proper service or repair. See Section 4, Group 0422.

4. Starting Motor Turned the Engine Over Slowly or Erratically.

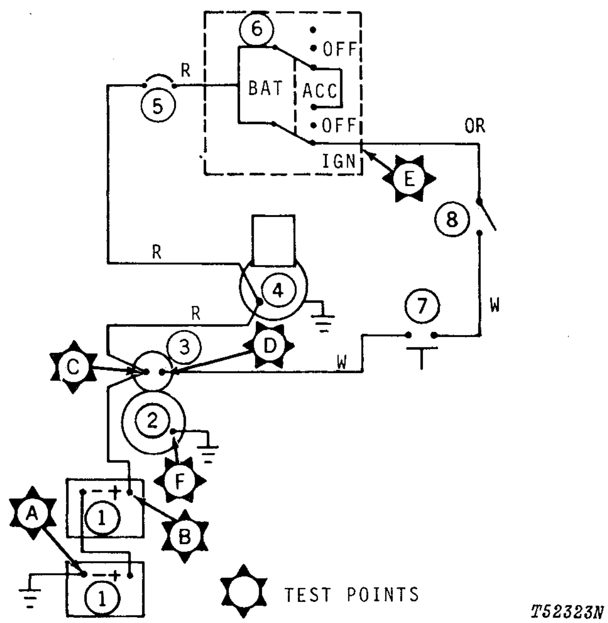
With sluggish starting motor operation, connect a voltmeter across the battery terminals and operate starting motor. With a slow-running starting motor the voltage should be less than 9 volts. If more than 9 volts, check for high resistance between the batteries and the starting motor. See "High Resistance Test."

If voltage reading is less than 9 volts, the cause is either the batteries or the starting motor. Check battery condition first.

High Resistance Test

Disconnect wire from injection pump solenoid shut-off terminal.

Connect voltmeter to ground and to solenoid "BAT" terminal. Operate starting motor and compare voltage with a similar reading at battery. Always use a pin connector at battery post. If the difference is more than 0.8 volt, make the tests indicated in Fig. 16. Check for defective wires or faulty connections.



1—Batteries
2—Starting Motor
3—Starting Motor Solenoid
4—Alternator
5—Circuit Breaker
6—Key Switch
7—Start Switch
8—Neutral Start Switch
R—Red
B—Black
OR—Orange
W—White

Fig. 16-Starting Circuit High Resistance Test

RESISTANCE TEST

Test Points	Maximum Voltmeter Reading
A - F	0.2
B - C	0.2
C - D	1.0
C - E	0.2

5. Engine Starts But the Starting Motor Drive Does Not Disengage From the Flywheel.

This indicates a defect in the drive mechanism, solenoid pull-in windings, solenoid contact, or solenoid control circuit, which will not allow the drive to disengage.

The starting motor or solenoid should be repaired or the start switch replaced.

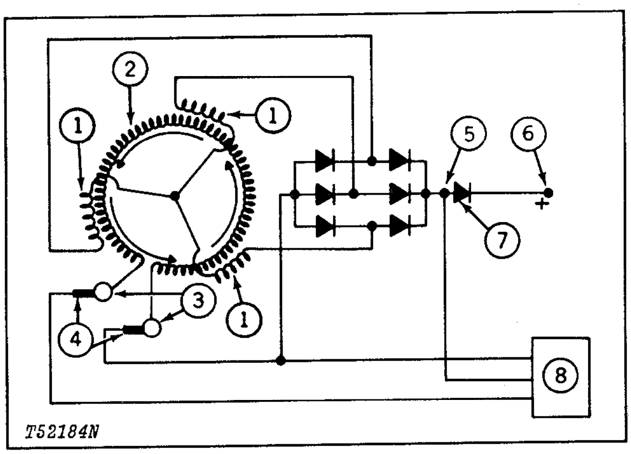
Charging Circuit

FOS For information on fundamentals of an alternator charging circuit, refer to "Charging Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

The alternator is an electric generator that produces alternating current. An alternator has a high current output at low speeds.

In an alternator, the magnetic field of the rotor is moved across stationary conductors in the stator. This permits permanent connection between the stator windings and the output terminal. Slip rings are used to transmit the field current to the rotor field winding.

The alternator produces power in the form of three phase alternating current and voltage. The alternating current is rectified to direct current by a three-phase full-wave rectifier circuit using six silicon rectifier diodes. Since the diode will pass current in only one direction (from alternator to battery or load), the alternator does not require the use of a cutout relay.



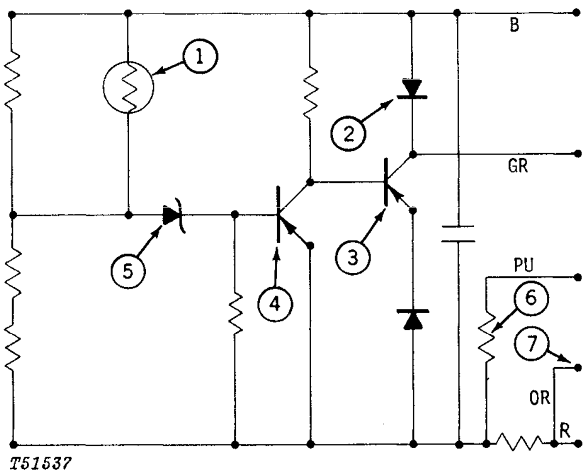
1—Stator
2—Rotor Winding (Field)
3—Rotor Slip Rings
4—Brushes
5—Regulator Terminal
6—Output Terminal
7—Isolation Diode
8—Regulator

Fig. 17-Alternator Circuit

The entire DC output of the system passes through the isolation diode. This provides the system with several distinct advantages. It prevents the battery from discharging through the regulator and alternator field without the use of relays or switches. Electrically, the indicator lamp is connected across the isolation diode. When the system is operating properly, the alternator output voltage is very nearly the same as the battery voltage. This means that the voltage potential across the isolation diode is low and the indicator lamp shows that the alternator is charging.

The alternator output current is controlled by the current flow through the field coil (rotor). The amount of current required is determined and controlled by the regulator. Since there is very little residual magnetism in the alternator, it is necessary to supply a small amount of excitation current to the field (rotor) to start the process of current generation. The excitation resistor supplies this starting current when the key switch is turned on. This resistor is enclosed in the sealed regulator case. Once the alternator is excited, a voltage is developed at the regulator terminal and the voltage regulator takes over control of the system voltage.

The transistor regulator is an electronic switching device composed principally of transistors, resistors, and diodes to form a completely static unit containing no moving parts.



1—Thermistor (RT)
2—Field Discharge Diode
3—Transistor (T-2)
4—Transistor (T-1)
5—Zener Diode
6—Excitation Resistor
7—To Alternator Indicator Light

Fig. 18-Voltage Regulator Complete Circuit

The transistors are used to switch the alternator field current on and off and are controlled by the resistors and the Zener diode.

A Zener diode is a special diode that will break down and permit a reverse flow of current when the voltage reaches a certain value, without damaging the semiconductor material. This diode is the trigger which senses the maximum desired voltage and turns the transistor on or off to limit charging system voltage.

The field discharge diode provides an alternato' current path to protect the transistors from inducec high voltage from the alternator field windings. The sudden stopping of field current by the transistor and subsequent collapsing of the magnetic field causes an induced voltage in the rotor windings.

The thermistor (RT) is a temperature compensating resistor. Its resistance varies with temperature and controls the operating point of the Zener diode so that a higher system voltage is produced in cold weather when needed, and a lower system voltage in warm weather.

The diagram in Fig. 18 is a complete voltage regulator circuit. Its operation is as follows:

When the voltage appearing at the output terminal of the alternator rises to a predetermined value (14.4 volts), the voltage which appears across the Zener diode is the critical Zener voltage and the Zener diode conducts. This conduction of the Zener diode permits current to flow in the base of transistor T-1. This causes transistor T-1 to turn on and reverse bias transistor T-2, thus turning off the current applied to the alternator field.

When the system voltage drops below the predetermined value, the Zener diode stops conducting, T-1 turns off and T-2 turns on. When transistor T-2 is switched on, field current again is supplied to the alternator.

The operation of transistor T-2 is in effect like a switch, turning the alternator field current on and off as the electrical supply varies due to the varying electrical load. This action occurs many times a second, so fast it cannot be detected in the alternator output.

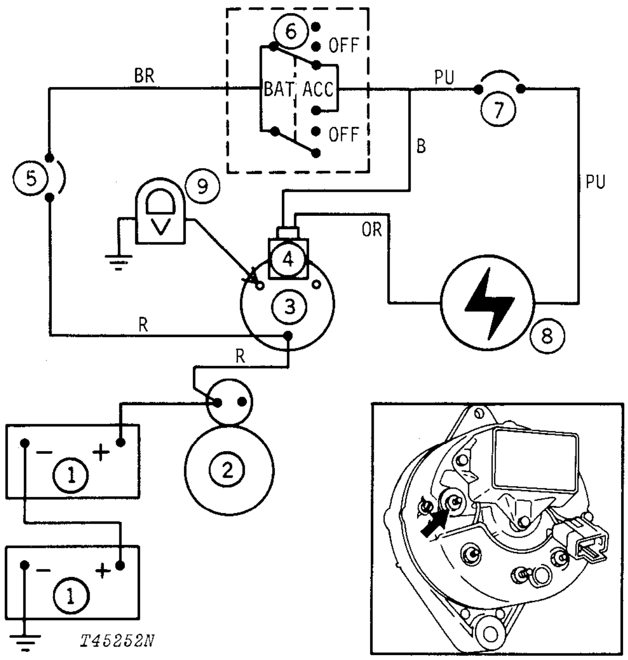
FOS

For additional information on transistor regulator, see Charging Circuits in FOS Manual - ELECTRICAL SYSTEMS.

Testing the Charging Circuit

Before you start the circuit tests, quickly review the precautions listed on page 90-9015-22.

Make the following tests to isolate a faulty component in the charging circuit.



1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Regulator
5—Circuit Breaker
6—Key Switch
7—Circuit Breaker
8—Alternator Indicator Light
9—Voltmeter
R—Red BR—Brown
PU—Purple B—Black
OR—Orange

Fig. 19-Voltmeter Connected to Auxiliary Terminal

Test No. 1 - Isolation Diode Check (Key Switch Off)

Connect voltmeter negative lead to alternator ground terminal. Connect positive lead to alternator auxiliary terminal (Fig. 19). Voltmeter should indicate zero voltage.

If voltage reading is same as voltage at output terminal, the isolation diode is shorted. Replace it.

Test No. 2 - Field Circuit Check (Key Switch On - Engine Not Running)

Connect voltmeter negative lead to alternator ground terminal and positive lead to auxiliary terminal (Fig. 19). Voltmeter should read 1.5 to 2.5 volts.

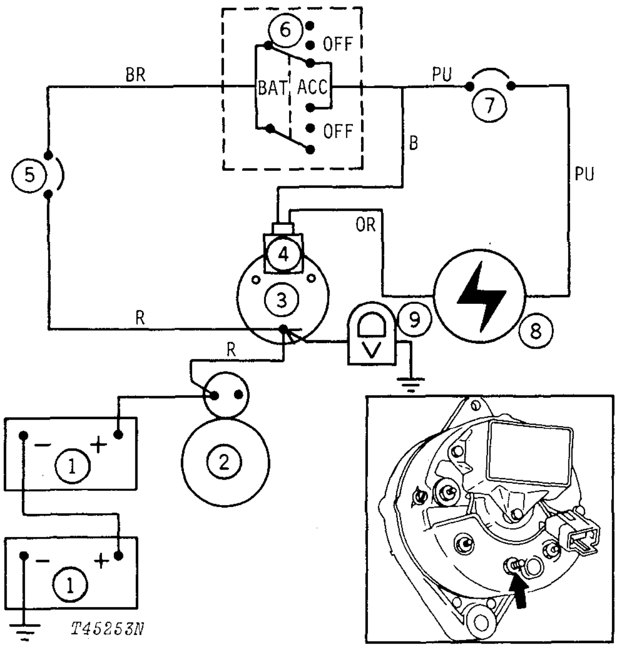
If voltage is greater than 3 volts, field circuit is defective; check brushes.

If no voltage is read, check purple wire at regulator connector to see that it is connected to 12-volt source.

If voltage was not correct in above test, make test No. 4. If field draw test indicates field circuit is good and voltmeter still reads high at auxiliary terminal with key switch on, voltage regulator is open and should be replaced.

Test No. 3 - Isolation Diode Check (Key Switch on - Engine Running)

Start engine and run at approximately 1500 rpm. Connect voltmeter negative lead to alternator ground terminal and connect positive lead to alternator auxiliary terminal (Fig. 19). Voltmeter should read 15.4 volts. Now move voltmeter positive lead to alternator output terminal (Fig. 20). Voltage reading should be 14.4 volts.

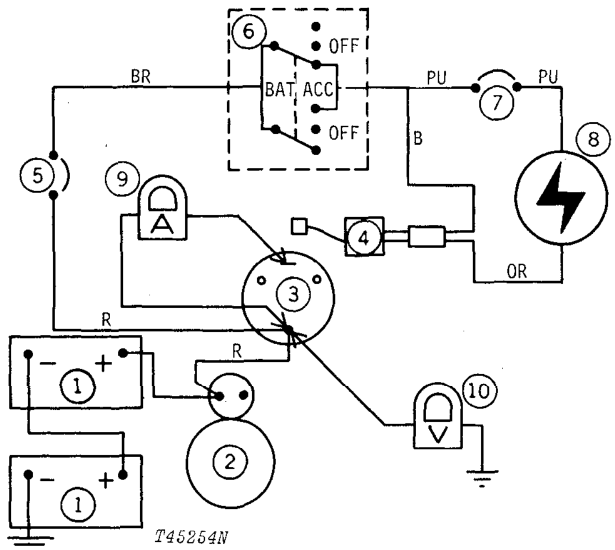


1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Regulator
5—Circuit Breaker
6—Key Switch
7—Circuit Breaker
8—Alternator Indicator Light
9—Voltmeter
R—Red BR—Brown
PU—Purple B—Black
OR—Orange

Fig. 20-Voltmeter Connected to Output Terminal

If voltage at auxiliary terminal is 15.4 volts, while a the output terminal it is 12 volts or battery voltage, the isolation diode is open. Replace it.

Test No. 4 - Field Draw Test (Key Switch Off)



1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Regulator
5—Circuit Breaker
6—Key Switch
7—Circuit Breaker
8—Alternator Indicator Light
9—Ammeter
10—Voltmeter
R—Red BR—Brown
PU—Purple B—Black
OR—Orange

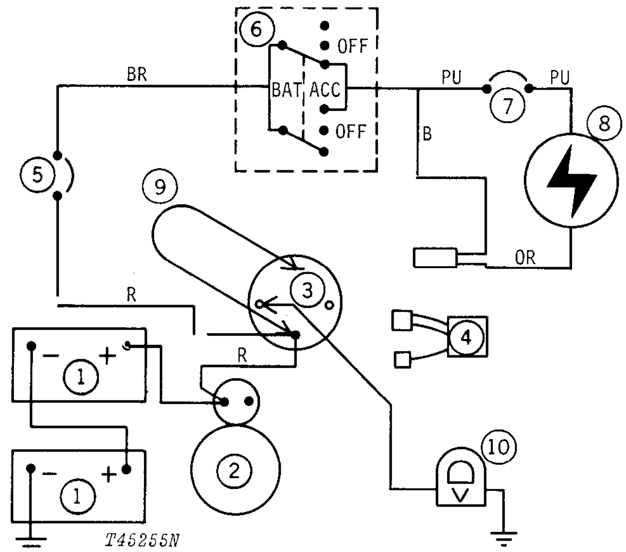
Fig. 21-Ammeter Connected to Field and Output Terminals

Detach regulator and let hang by red and black wires. DO NOT allow regulator to touch the output terminal.

NOTE: If test ammeter is not equipped with a 1/4-ohm resistor, a 1/4-ohm resistor should be connected in series with the ammeter to protect the meter.

Disconnect green field wire from field terminal. Connect ammeter from output terminal to field terminal (Fig. 21). Current reading should be 2 to 2.5 amps. If less than this, check brushes and slip rings.

Test No. 5 - Checking Alternator and Regulator With Regulator Disconnected (Key Switch on - Engine Running)



1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Regulator
5—Circuit Breaker
6—Key Switch
7—Circuit Breaker
8—Alternator Indicator Light
9—Jumper Wire
10—Voltmeter
R—Red BR—Brown
PU—Purple B—Black
OR—Orange

Fig. 22-Jumper Wire Connected to Field and Output Terminals and Voltmeter Connected to Auxiliary Terminal

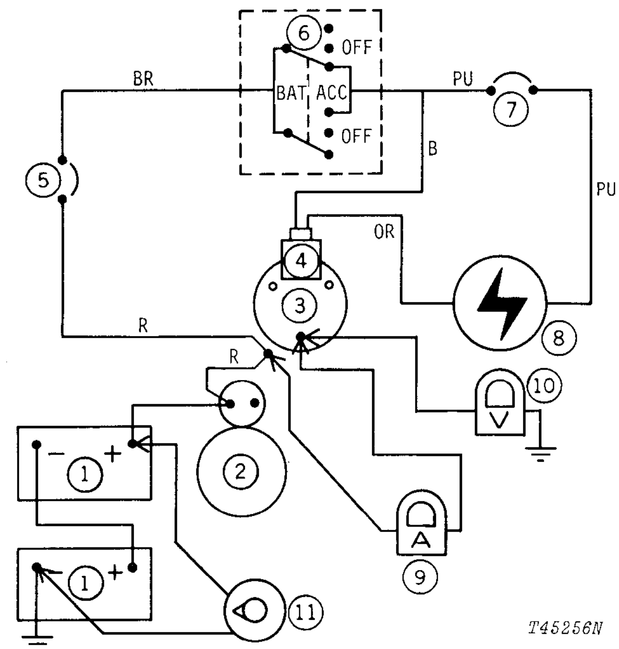
Disconnect the regulator from the connector. Disconnect the green wire from the field terminal. Connect a jumper wire from the output terminal to the field terminal. Connect voltmeter negative lead to ground terminal and connect voltmeter positive lead to regulator terminal (Fig. 22).

Start engine and run at slow idle. This test isolates the defect to either the alternator or regulator.

If voltage at regulator terminal rises to 15-16 volts now, when it did not with regulator connected in Test No. 3, then the regulator is defective and should be replaced.

If voltage does not rise at regulator terminal and the field circuit was okay in Test No. 4, then the stator or rectifier diodes are defective. See Section 16, Group 1672 for testing diodes and stator.

Test No. 6 - Alternator Output



1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Regulator
5—Circuit Breaker
6—Key Switch
7—Circuit Breaker
8—Alternator Indicator Light
9—Ammeter
10—Voltmeter
11—Carbon Pile
R—Red BR—Brown
PU—Purple B—Black
OR—Orange

Fig. 23-Ammeter and Voltmeter Connected to Output Terminal

If not using JDST-23 tong-type ammeter, disconnect wire from alternator output terminal and connect ammeter (Fig. 23). Connect voltmeter negative lead to ground and connect positive lead to output terminal. Connect a carbon pile resistor (turned off) to the battery.

Run engine at approximately 1400 rpm. Use a master tachometer to measure rpm. Adjust carbon pile to obtain maximum alternator output at 13 to 15 volts. Ammeter should read 25 amps or more for the 35 amp alternator and 43 amps for the 55 amp alternator.

Test No. 7 - Testing Regulator

The regulator must be checked with an alternator that is in good condition. If the alternator is questionable, check it as previously instructed.

Connect voltmeter with ± 0.1 volt accuracy to the alternator output terminal and ground terminal (Fig. 20). With charged batteries and the regulator brought to operating temperature (fifteen nimutes operation), the voltage should be as specified for the surrounding air temperature. See chart below. If battery is partially discharged, it may be necessary to connect a 1/4-ohm resistor in series with the ammeter.

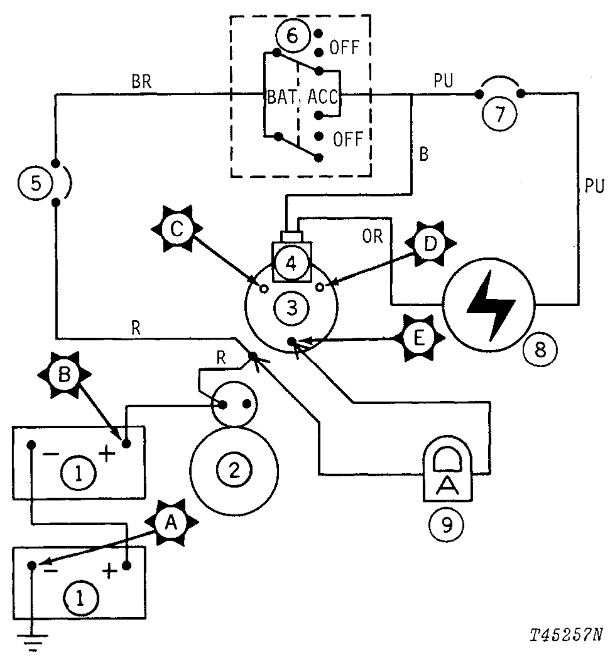
Regulator Voltage (After Fifteen Minutes Operation and at 1500 rpm)

Temperature*	Voltage
40° F (4°C)	14.4 - 14.9 volts
60° F (16°C)	14.3 - 14.7 volts
80° F (27° C)	14.2 - 14.6 volts
100° F (38° C)	14.0 - 14.4 volts
120° F (49° C)	13.8 - 14.3 volts
140° F (60° C)	13.6 - 14.1 volts

**Measured one inch (25 mm) from regulator.*

If voltage is not within the limits in the above chart, stop engine and with key switch off, replace the regulator. If voltage with new regulator is not correct, the difficulty must be in the system wiring or the isolation diode.

High Resistance Test



1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Regulator
5—Circuit Breaker
6—Key Switch
7—Circuit Breaker
8—Alternator Indicator Light
9—Ammeter
R—Red BR—Brown
PU—Purple B—Black
OR—Orange

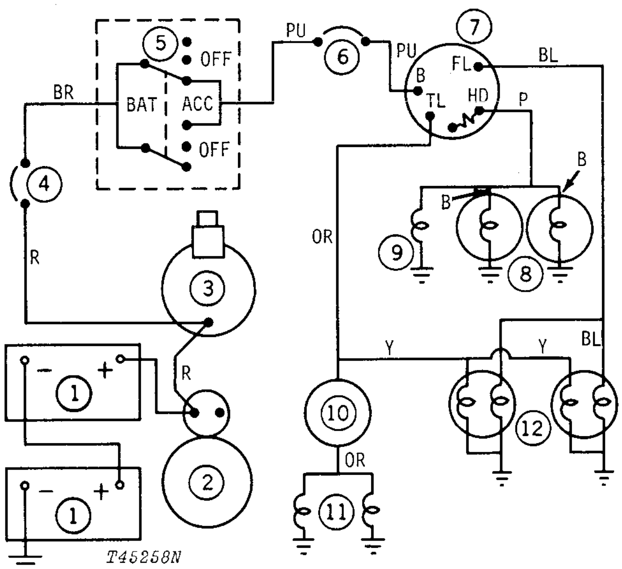
Fig. 24-High Resistance Test Points

With battery ground disconnected, connect the ammeter (Fig. 24). Obtain 10 amp charge rate. Check the voltage between the indicated points. Use a pin connector at the battery post. High resistances are usually caused by a poor connection.

Test Points	Maximum Voltmeter Reading*
A - D	0.3 volt
B - E	0.3 volt
B - C	1.3 volts

10-amp charging rate.

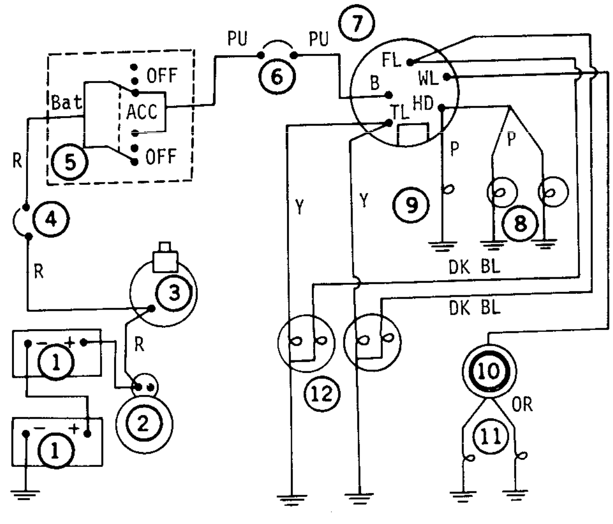
Testing the Lighting Circuit



1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Circuit Breaker
5—Key Switch
6—Circuit Breaker
7—Light Switch
8—Front Lights
9—Dash Lamp

10—Flasher
11—Warning Lights
12—Combination Lights
R—Red BR—Brown
PU—Purple BL—Blue
P—Pink B—Black
Y—Yellow OR—Orange

Fig. 25-Lighting Circuit (-255718)



T51361

1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Circuit Breaker
5—Key Switch
6—Circuit Breaker
7—Light Switch
8—Front Lights
9—Dash Lamp

10—Flasher
11—Warning Lights
12—Combination Lights
R—Red BL—Blue
PU—Purple OR—Orange
P—Pink
Y—Yellow

Fig. 26-Lighting Circuit (255719-)

If no lights will work, check for voltage at light switch (7, Fig. 25 or 26) and at circuit breaker (6). If either switch or circuit breaker is defective, it should be replaced.

If individual lights will not light, use the following procedure.

Connect voltmeter to lamp terminal and lamp frame.

Voltmeter Reads Battery Voltage

Defective bulb.
High resistance at an internal connection.

If voltmeter reading is 0.5 volt or more below battery voltage, connect voltmeter between lamp frame and a good ground.

Voltmeter Reading Exceeds 0.1 Volt

Defective lamp ground.

If voltmeter reading to ground is lower than 0.1 volt, connect voltmeter between lamp terminal and battery positive post that is connected to the starting motor.

Voltmeter Reading Exceeds 0.5 Volt

Defective light switch or key switch.
Defective or disconnected wiring.

If voltage is excessive, use voltmeter across various points between the lamp terminal and the battery post to locate the point of excessive resistance. Individual unit readings should not exceed 0.1 volt.

If voltmeter reading is under 0.5 volt between lamp terminal and the battery post, connect voltmeter to lamp frame and the grounded battery post. A voltage reading above 0.5 volt indicates there is a high resistance somewhere is the ground circuit. Connect the voltmeter across various places where a high resistance might be present such as a fender mounting to the tractor frame.

Front Lamp Adjustment

Position the tractor so the lamp is 25 feet (7.62 m) from a wall. With the light switch in the "H" or "H^2" position, the high intensity light beams should shine straight forward from the lamps and be equal distances from the tractor center line. The upper edge of each high intensity beam should be at least 5 inches (127 mm) below the center of the light from which it comes.

Adjust the lamps so they never cause glare to the driver of an approaching vehicle.

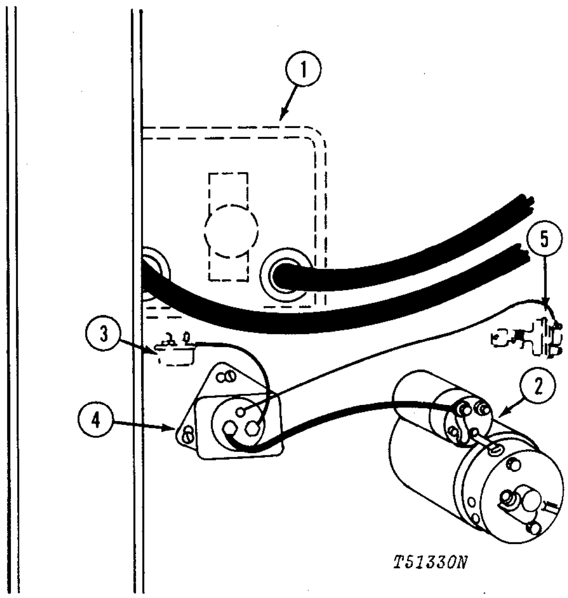
TESTING THE ACCESSORY CIRCUIT

CAB RELAY (257229-)

General Information

The cab relay is located on the cab frame near starting motor.

The cab relay supplies battery voltage to the main fuse block bus terminal when the key switch is in the IGN position. The use of the cab relay reduces the amount of current through the key switch and prevents usage of cab accessories without ignition key.



1—Heater
2—Starter and Solenoid
3—Circuit Breaker
4—Cab Relay
5—Key Switch

Fig. 27-Cab Relay

Test

If none of the cab accessories work, check for voltage at the three terminals of the cab relay (4, Fig. 27).

With the key switch in the OFF position, no voltage should be measured at the small terminal. Voltage on only the small terminal indicates defective wiring between the relay and the battery. See Fig. 27.

With the key switch in the run position, voltage measured on the small terminal and only one large terminal indicates a defective relay.

If any one cab accessory will not work, check for voltage at the accessory. If voltage is obtained, the accessory is effective. If voltage is not obtained, check the fuse, switch and wiring.

Repair

The cab relay is not repairable.

Replace if found defective.

Removal

Remove battery ground strap.

Disconnect wires from relay.

Remove relay from unit.

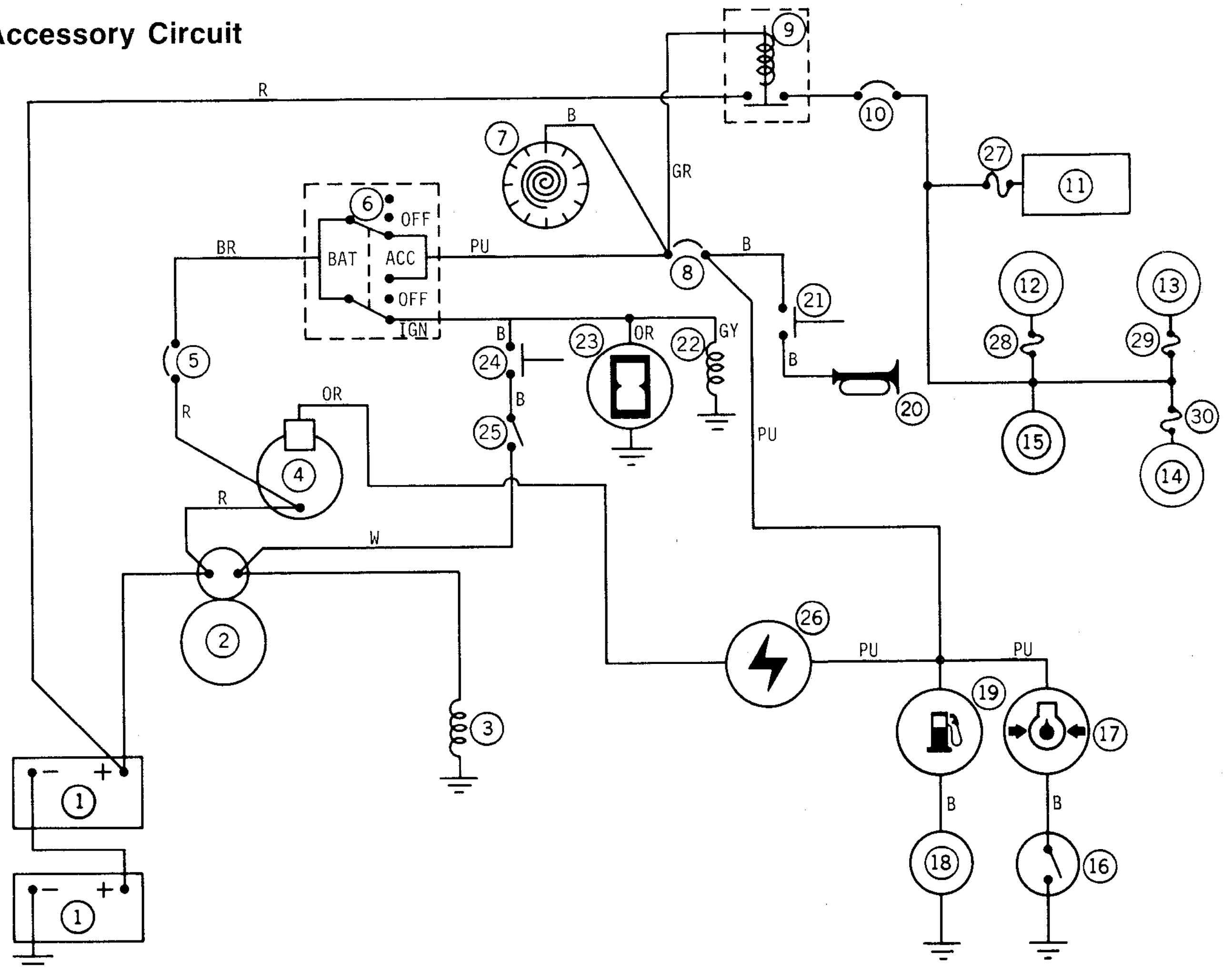
Installation

Mount relay on unit.

Reconnect wires as indicated in Fig. 27.

Replace battery ground strap.

Accessory Circuit

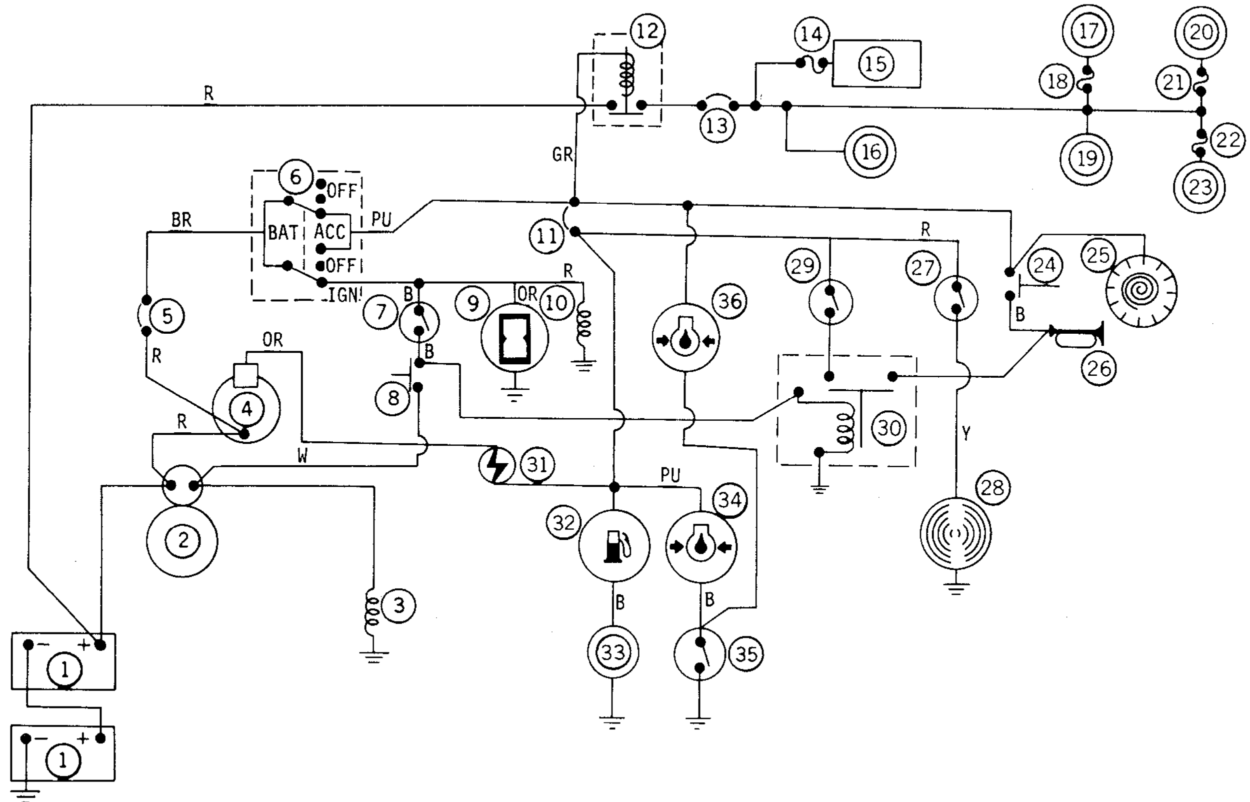


T45259N

1—Batteries
2—Starting Motor and Solenoid
3—Hydraulic Pump Solenoid
4—Alternator and Regulator
5—Circuit Breaker
6—Key Switch
7—Cigar Lighter
8—Circuit Breaker
9—Cab Relay
10—Cab Circuit Breaker
11—Heater
12—Front Wiper Motor
13—Pressurizer Motor
14—Rear Wiper Motor
15—Dome Light
16—Engine Oil Pressure Switch
17—Engine Oil Pressure Indicator Light
18—Fuel Sending Unit
19—Fuel Gauge
20—Horn
21—Horn Switch
22—Fuel Shut-Off Solenoid
23—Hour Meter
24—Start Switch
25—Neutral Start Switch
26—Alternator Indicator Light
27—Heater Fuse
28—Front Wiper Fuse
29—Pressurizer Fuse
30—Rear Wiper Fuse

B—Black
BL—Blue
OR—Orange
GY—Gray
BR—Brown
GR—Green
P—Pink
PU—Purple
R—Red
W—White
Y—Yellow

Fig. 28-Accessories Circuit (-257228)



T51362

1—Battery
2—Starting Motor and Solenoid
3—Hydraulic Pump Solenoid
4—Alternator and Regulator
5—Circuit Breaker
6—Key Switch
7—Neutral Start Switch
8—Start Switch
9—Hour Meter
10—Fuel Shut-Off Solenoid
11—Circuit Breaker
12—Cab Relay
13—Cab Accessories Circuit Breaker
14—Heater Fuse
15—Heater Motor
16—Defroster Motor
17—Front Wiper Motor
18—Front Wiper Fuse
19—Dome Light
20—Pressurizer Motor
21—Pressurizer Fuse
22—Rear Wiper Fuse
23—Rear Wiper Motor
24—Horn Switch
25—Cigar Lighter
26—Horn
27—Backup Switch
28—Backup Alarm
29—Parking Brake Switch
30—Parking Brake Relay
31—Alternator Indicator Light
32—Fuel Gauge
33—Fuel Sending Unit
34—Engine Oil Pressure Indicator (instrument panel)
35—Engine Oil Pressure Switch
36—Engine Oil Pressure Indicator (backhoe controls)

B—Black
BL—Blue
OR—Orange
GY—Gray
BR—Brown
GR—Green
P—Pink
PU—Purple
R—Red
W—White
Y—Yellow

Fig. 29-Accessories Circuit (257229-)

Fuel Gauge

The fuel gauge receiver is of the balancing-coil type and the fuel gauge sender has 30 ohms resistance with 0 ohms at EMPTY. The receiver may be checked with an ohmmeter, commercial tester, or another 30-ohm sender. Connect sender at the tank first, then if necessary, at the receiver. Check receiver and sender for adequate ground with a voltmeter.

FOS Additional information is in FOS Manual 20 - ELECTRICAL SYSTEMS.

Injection Pump Solenoid

The injection pump solenoid windings may be checked for resistance or current consumption. The solenoid terminal connection should be clean and tight.

Injection Pump Solenoid Winding

Winding current draw .... Approx. 2.5 amp
Winding resistance .... Approx. 5 ohms
Voltage required to energize .... Approx. 8 volts

Horn

Current draw at 12 volts is 4.5 to 5.5 amps. Ammeter reading of 20 amps indicates points not opening. Turn adjusting screw to adjust current draw and frequency.

Engine Oil Pressure Indicator

Indicator light should come on with key switch on "ACC." If it doesn't, remove wire from sending unit and touch it to a good ground.

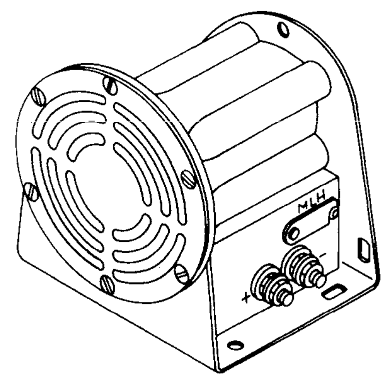
If light now comes on, sending unit is defective. If light doesn't work, check for voltage at the light with the purple lead.

The bulb may be burnt out or the wiring defective.

Backup Alarm

The backup alarm is located in the wheel well of the left-hand fender facing rear of unit. The actuating switch is located on the reverse lever with face towards middle of unit.

The alarm sounds whenever the machine is operated in reverse.



T51198N

Fig. 30-Backup Alarm

The alarm has an adjustable switch for low, medium, and high volume. The volume switch is protected by an access hatch. To adjust, remove two screws in access hatch, remove hatch and adjust switch for desired volume. The horn has a self-contained flasher.

The backup alarm and switch are not repairable. Replace if defective.

PARKING BRAKE WARNING SYSTEM (270829-)

A warning system is provided to prevent operator from driving unit with parking brake applied. Warning lamp will light and vehicle horn will sound if the parking brake is applied and transmission is in any gear. See page 9015-39 for schematic.

If horn will not sound with above conditions, then check vehicle horn for proper operation.

If horn still does not operate under above conditions, remove dash cowl and check voltages at terminals 1 and 2 of parking brake switch with transmission in and out of gear.

Parking brake switch and relay are not repairable. Replace if found defective.

NOTE: It is a normal condition that the parking brake light will light when the horn button is pushed with the unit in gear.

COLD WEATHER STARTING AIDS

There are two types of cold weather starting aids. Starting fluid is manually injected in early units. Those newer units with cab have an electrical solenoid activated by a switch on the instrument panel.

IMPORTANT: To avoid engine damage, crank engine before injecting starting fluid. Use only when the engine is cold and cranking.

IMPORTANT: Keep a canister of starting fluid in place on the solenoid at all times to prevent dirt from entering the engine.

For units with manual injection of starting fluid, remove starting fluid container from the spray nozzle holder and replace cap on spray nozzle holder after each use.

DIAGNOSIS

Solenoid Starting Aid

Solenoid Will not "Click"

Blown fuse.
Defective solenoid.
Defective wiring.

Solenoid "Clicks", Fluid Will Not Spray

Empty fluid container.
Starting aid line or nozzle clogged.
Fluid container too cold.

Test

If the starting aid does not work and no "click' is heard from the solenoid when the start aid switch button is pushed, then it is necessary to test the starting aid electrical circuit.

Check the start aid fuse in the main fuse block.

If fuse is not blown, connect one lead of voltmeter to starting aid solenoid and other lead to ground. Turn on key switch and press start aid switch. If no reading is obtained the problem is in the start aid switch or wiring to the switch. Check for 10-12 volts at the starting aid switch with the above conditions. If no voltage is obtained, the problem is the switch or wiring between the start aid switch and fuse. If voltage can be obtained at the start aid switch, the problem is the switch. If not the problem is wiring.

If voltage was obtained at the starting aid solenoid in the first test, place a jumper wire between the starting aid solenoid and ground. Press start aid switch. If solenoid now works, the problem is wiring between the solenoid and ground. If solenoid doesn't work, the solenoid is defective.

Solenoid Removal

Disconnect wires and tube from solenoid, remove attaching hardware and remove solenoid.

Repair

The solenoid is not repairable. If the solenoid is defective, it should be replaced.

Installation

Mount solenoid and can on engine and connect wires and tube.

Group 9020
POWER TRAIN

GENERAL INFORMATION

Clutch Assembly

Single Stage Clutch

Engine power is transmitted to the transmission through a clutch. The purpose of the clutch is to allow the operator to interrupt the power flow between the engine and the transmission.

The assembly is bolted to the engine flywheel and consists of a single driven disk sandwiched between the flywheel and the pressure plate.

When the clutch pedal is depressed, the throwout bearing presses against clutch operation levers and the clamping action of the pressure plate is released, thereby disengaging the driven disk from the pressure plate and the flywheel.

When the clutch pedal is released, coil springs within the pressure plate mechanism press against the pressure plate and the operating levers and clamp the clutch driven disk between the pressure plate and the flywheel.

The driven disk has friction facings riveted or bonded to each side of the disk.

The center hub is riveted to the disk and is splined internally to accept the transmission drive shaft.

The driven disk center hub is longer on one side. When installing the disk, the long hub side of the driven disk is placed away from the flywheel.

The transmission reverser is covered in Group 9025.

Transmission

The transmission is a collar shift-type with reverser using helical gears. The reverser is hydraulically activated and is explained in Group 9025, Hydraulic System Testing.

Using the two shift levers located on top of the clutch housing, the operator can select four (4) gears in each of two (2) ranges to provide eight (8) speeds forward, the lower four (4) can be reversed by the hydraulic reverser giving four speeds (4) in reverse (- 276764), or eight speeds (8) in reverse (276765-).

The gears are carried on three shafts located in a single compartment. The shafts are:

1. Transmission Drive Shaft
2. Countershaft
3. Differential Drive Shaft

Transmission Drive Shaft

The transmission drive shaft is located at the top of the transmission case. It is in direct line with the clutch shaft and provides the high range drive for the transmission. The shaft itself is one piece and is in constant mesh with the low range pinion on the countershaft and all four gears on the differential drive shaft.

A shift collar located at the front of the transmission drive shaft is used to connect the shaft to the transmission drive gear for high range or to the front bearing quill for park position if equipped with parking brake. The position of this shift collar is selected by the left-hand shift lever and corresponds to the "P" and "II" on the shift pattern decal.

The four gears cut on the transmission drive shaft are called "drive" gears. From the front of the shaft the gears are identified as the 3rd - 7th speed drive gear, the 4th - 8th speed drive gear, the 2nd - 6th speed drive gear and, on the end, the 1st - 5th speed drive gear.

Countershaft

The countershaft is located below and to the left of the transmission drive shaft. The countershaft drive gear is in constant mesh with the transmission drive gear. The countershaft has the low range pinion (the gear on the left).

A shifter collar is located ahead of the low range gear and rides on a spacer. The spacer is splined to the countershaft and to the shift collar.

1	**Left Hand Rear Flanged Axle Shaft**
2	**Left Hand Rear Axle Housing**
3	**Transmission Oil Filler Cap**
4	**Transmission Case Top Cover**
5	**Differential Lock Pedal**
6	**Transmission Dipstick**
7	**Gear Shifter Levers**
8	**Clutch Pedal**
9	**Clutch Housing**
10	**Clutch Housing Cover**
11	**Transmission Case**
12	**Right Hand Rear Flanged Axle Shaft**
13	**Right Hand Rear Axle Housing**
14	**Transmission Case Rear Cover**

Legend for Fig. 1-Component Location - Power Train

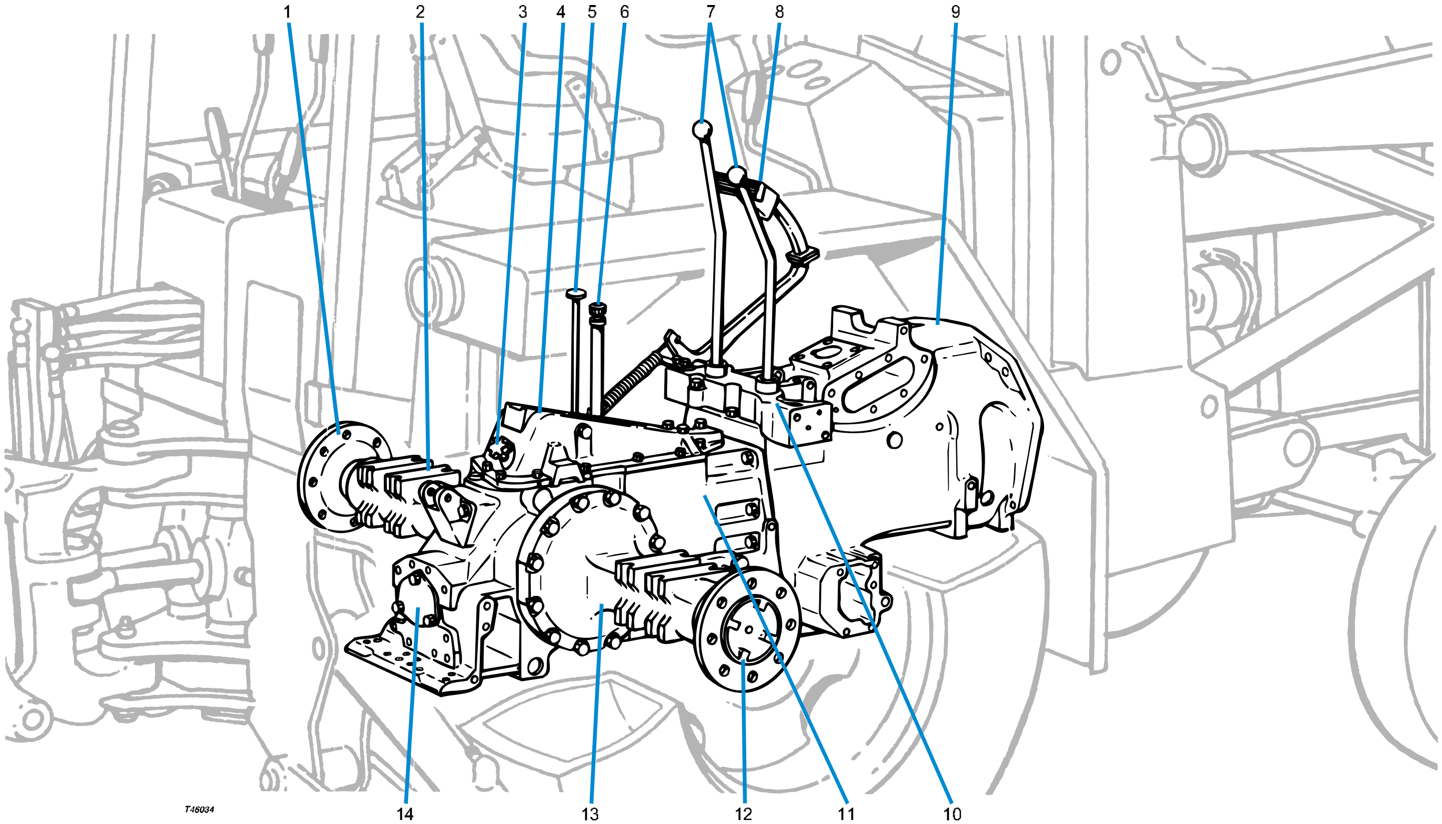
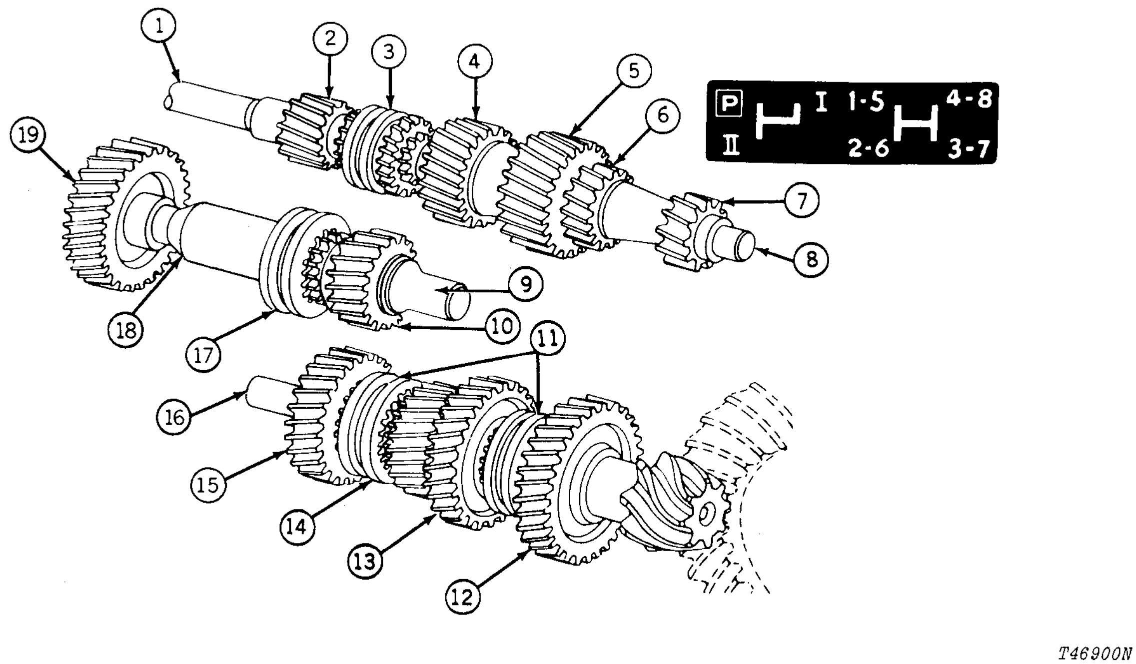


Fig 1-Component Location — Power Train



1—Clutch Shaft
2—Transmission Drive Gear
3—Park and High Range Shifter Collar
4—Third and Seventh Speed Drive Gear
5—Fourth and Eighth Speed Drive Gear
6—Second and Sixth Speed Drive Gear
7—First and Fifth Speed Drive Gear
8—Transmission Drive Shaft
9—Countershaft
10—Low Range Pinion
11—Speed Change Shift Collars
12—First and Fifth Speed Driven Gear
13—Second and Sixth Speed Driven Gear
14—Fourth and Eighth Speed Driven Gear
15—Third and Seventh Speed Driven Gear
16—Differential Drive Shaft
17—Reverse Shift Collar Low Range
18—Countershaft
19—Countershaft Drive Gear

Fig. 2-Collar Shift Transmission Components

The low range pinion is not splined to the shaft but has teeth cut on it that mate with the shifter collar.

The low range pinion is in constant mesh with the 4th - 8th speed drive gear on the transmission drive shaft.

The countershaft shifter collar is moved by the left-hand shift lever and corresponds to the "I" on the shift pattern decal.

Differential Drive Shaft

The differential drive shaft is located in the lower right-hand side of the transmission case.

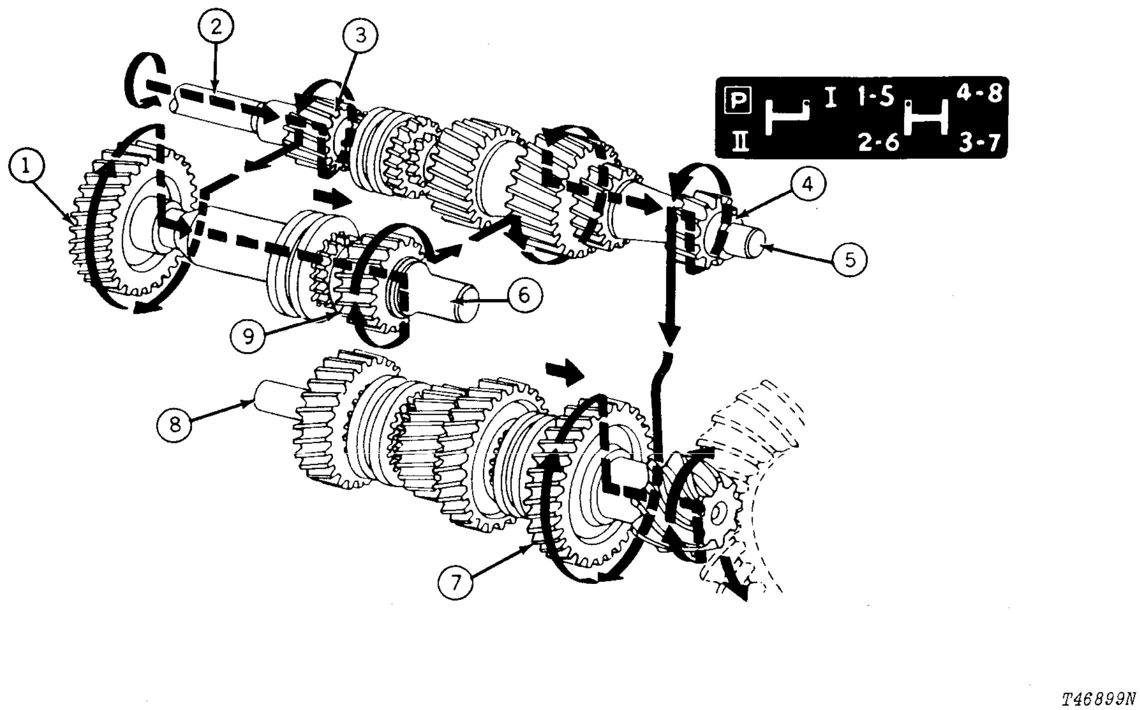
The shaft transmits power to the differential through the bevel pinion. Four driven gears are located on this shaft. Starting at the front, they are the 3rd - 7th speed driven gear, the 4th - 8th speed driven gear, the 2nd - 6th speed driven gear and the 1st - 5th speed driven gear.

Shifter collars are located between the 3rd - 7th and 4th - 8th speed driven gears, and the 2nd - 6th and the 1st - 5th speed driven gears. The shift collars ride on sleeves which are splined to the differential drive shaft. The gears are driven freely by the transmission drive shaft until connected to the differential drive shaft by a shift collar.

All of the speed driven gears are in constant mesh with the corresponding transmission drive shaft drive gears. The 3rd - 7th speed driven gear is also in constant mesh with the reverse range pinion on the countershaft.

Transmission Power Flows

Now that we have seen what components make up the transmission, we should be able to follow the flow of power through the transmission. We will look at four selected speeds that illustrate all of the different power paths that can exist with the John Deere collar shift transmission.



1—Countershaft Drive Gear
2—Clutch Shaft
3—Transmission Drive Gear
4—First and Fifth Speed Drive Gear
5—Transmission Drive Shaft
6—Countershaft
7—First and Fifth Speed Driven Gear
8—Differential Drive Shaft
9—Low Range Pinion

Fig. 3-First Speed Forward

First Speed Forward

To obtain first speed forward, the shift levers are placed in the "I" slot and the "I-5" slot as depicted by the (.) dot on the shift decal in the above Figure.

Moving the left-hand shift lever to the "I" slot moves the shift collar on the countershaft to connect the low range pinion to the countershaft.

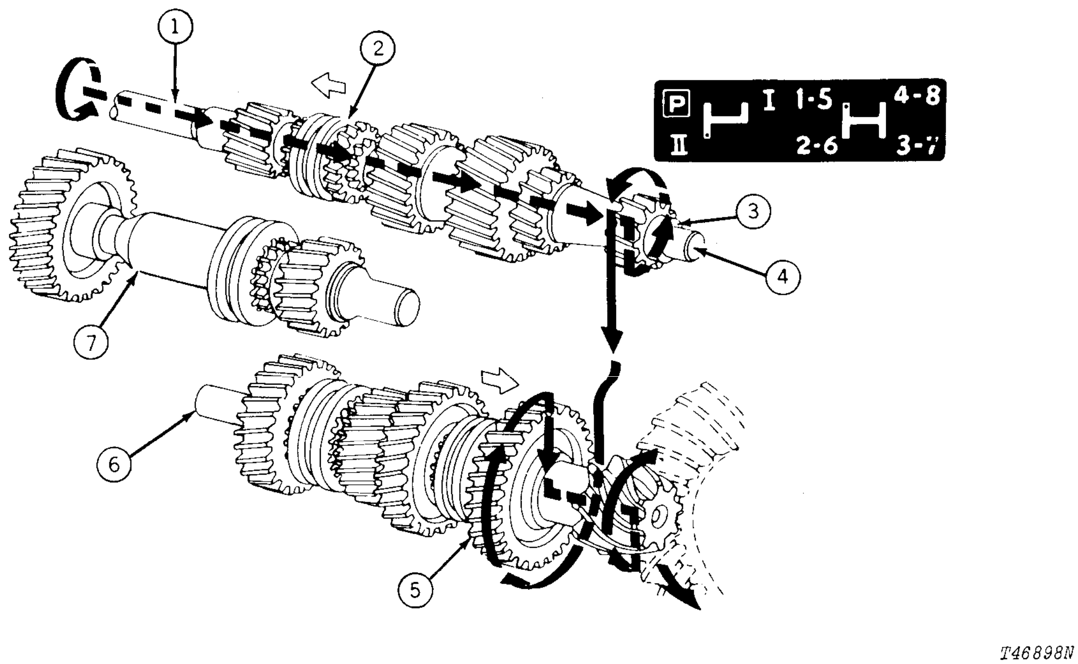
Moving the right-hand shift lever to the "1-5" slot moves the 1st - 5th speed driven gear shaft collar rearward to connect the 1st - 5th driven gear to the differential drive shaft.

When the reverser is engaged, power is transmitted through the clutch shaft to the transmission drive gear.

From the transmission drive gear, the power is directed through the countershaft drive gear to the countershaft. From the countershaft, power is transferred through the shifter collar to the low range pinion gear. The low range pinion is in constant mesh with the 4th - 8th speed drive on the transmission drive shaft so power is transmitted from the low range pinion to the transmission drive shaft.

The power flow in the transmission drive shaft is from the 4th - 8th speed drive gear to the 1st - 5th speed drive gear and from the 1st - 5th speed drive gear to the 1st - 5th speed driven gear on the differential drive shaft. The 1st - 5th speed driven gear shifter collar transfers the power from the 1st - 5th speed driven gear to the differential drive shaft and through the shaft to the bevel pinion. The bevel pinion drives the differential.

Another way to describe the power flow would be to say that engine power travels from the transmission drive gear to the countershaft to the transmission drive shaft to the differential drive shaft and to the differential.



1—Clutch Shaft
2—Park and High Range Shifter Collar
3—First and Fifth Speed
4—Transmission Drive Shaft
5—First and Fifth Speed Driven Gear
6—Differential Drive Shaft
7—Countershaft

Fig. 4-Fifth Speed Forward

Fifth Speed Forward

To get fifth speed forward, the left-hand shift lever is put in the "II" slot and the right lever is again put in the "1-5" slot.

With the left-hand lever in the "II" slot, the countershaft shift collar is put in neutral position. The park and high range collar is moved forward to connect the transmission drive shaft to the transmission drive gear.

With the right-hand shift lever in the "1-5" slot, the 1st - 5th speed driven gear shift collar is moved rearward. This connects the differential drive shaft to the 1st - 5th speed driven gear.

When the reverser is engaged, engine power is transmitted through the clutch shaft to the transmission drive gear. From the drive gear, power flow goes through the park - high range shift collar directly to the transmission drive shaft.

Engine power flows through the transmission drive shaft to the 1st - 5th speed drive gear and to the 1st - 5th speed driven gear on the differential drive shaft. Engine power is, therefore, transferred from the 1st - 5th speed driven gear through the shift collar to the differential drive shaft. Power is transmitted by the differential drive shaft to the bevel pinion, driving the differential.

By looking at first and fifth speed forward, we have seen two of three speed ranges in use, those being Low range (I) and High range (II).

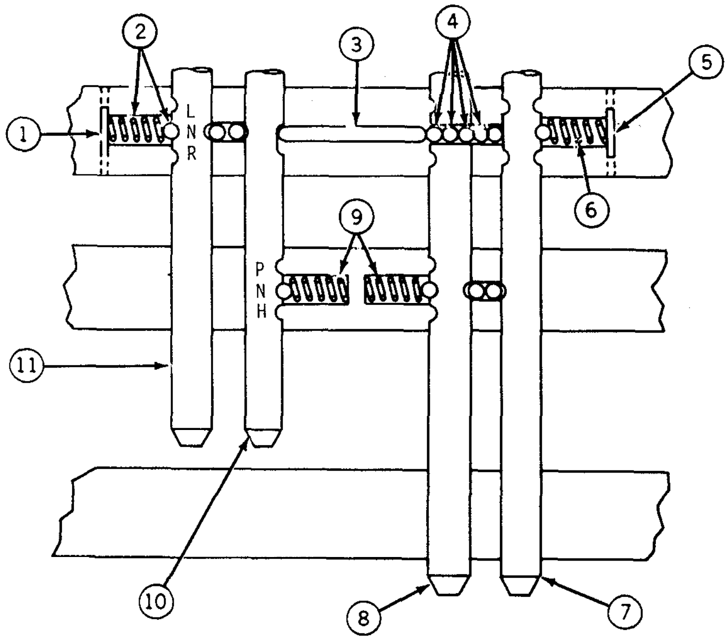
Low range utilizes the countershaft to transmit engine power to the transmission and high range utilizes a direct connection between the engine and the transmission.

Park Position (for units not equipped with a parking brake)

The John Deere collar shift transmission has a mechanical park mechanism. The "P" on the shift decal indicates the slot in which to put the range shift lever to park. Because of a built-in interlock system, the speed selection lever must be put into a gear slot in order to put the left-hand lever into the park slot.

When in park, the transmission drive shaft is locked by the park - high range shifter collar to the transmission drive shaft front bearing quill. With one of the gears engaged to the differential drive shaft and the transmission drive shaft locked to the bearing quill, the tractor can not move.

On those tractors that have the optional parking brake in the differential, the park - high range shift collar and front bearing quill (right-hand pair of parts) for the transmission drive shaft do not have a mating spline.



1—Spring Pin
2—Detent Ball and Spring
3—Interlock Pin
4—Interlock Balls
5—Spring Pin
6—Spring
7—Speed Shifter Shaft First and Fifth, Second and Sixth
8—Speed Shifter Shaft Third and Seventh, Fourth and Eighth
9—Detent Ball and Spring
10—Park and High Range Shifter Shaft
11—Low and Reverse Range Shifter Shaft

Fig. 5-Shifter Shafts in Neutral Position

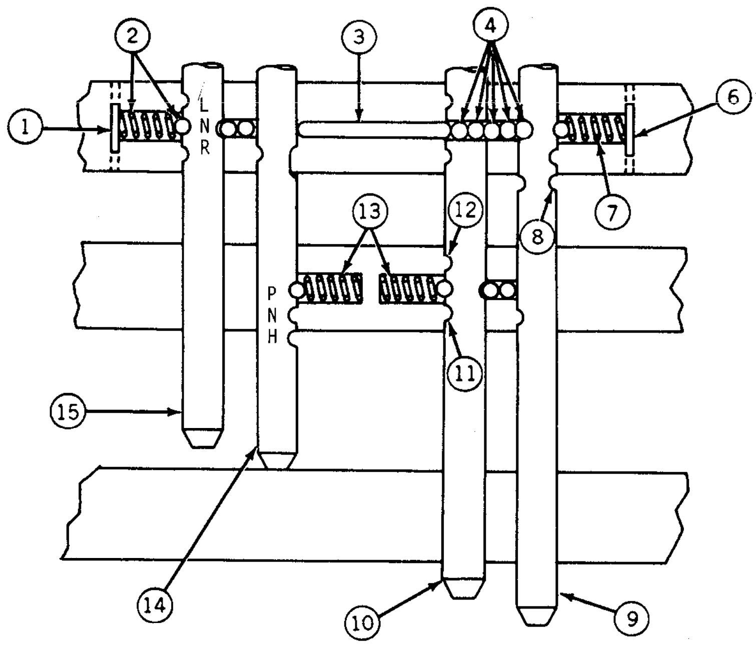
Shift Lever Operation

There are two shift levers located on top of the clutch housing. The left-hand lever selects the speed range from either "I" - low range or "II" - high range. The third position for the left-hand lever is the "P" - park position.

The right-hand shift lever selects the speed gear from four positions.

Each shift lever operates two of the four shifter shafts located in the transmission case above the three transmission shafts. Each shifter shaft has a shifter fork attached to it that controls the movement of one of the shifter collars on the transmission shafts.

The left-hand lever moves the shift collar on the countershaft and transmission drive gear. The right-hand lever moves the two shift collars located on the differential drive shaft.



1—Spring Pin
2—Detent Ball and Spring
3—Interlock Pin
4—Interlock Balls
5—First and Fifth
6—Spring Pin
7—Spring
8—Second and Sixth
9—Speed Shifter Shaft, First and Fifth - Second and Sixth
10—Speed Shifter Shaft - Third and Seventh, Fourth and Eighth
11—Third and Seventh
12—Fourth and Eighth
13—Detent Ball and Spring
14—Park and High Range Shifter Shaft
15—Low and Reverse Range Shifter Shaft

Fig. 6-Shifter Shafts in Park Position

Shifter Shafts

Each shifter shaft has a special end to accept the shifter lever. When in the neutral position, the shift lever can be moved freely from side to side in the slot formed by the shifter shaft ends.

The shift lever can only move one shifter shaft at a time and must move the engaged shifter shaft to neutral before crossing over to pick up and move the adjoining shifter shaft.

Detent balls fit into notches cut in the shaft to hold them in neutral or in the selected gear or range position. The detent balls are backed by springs to press the balls against the shaft at all times.

Neutral Position

The relationship of the shifter shafts and the detent balls and springs is shown in Fig. 5. The shifter shafts appear as they would in the transmission. From this you can see that the outside slots on the shift pattern decal correspond to the inside shifter shafts and inside slots on the decal to the outside shifter shafts. Also note that when the shift lever is pushed forward the corresponding shifter shaft will move rearward.

The interlock pin and balls are used to lock all the right-hand shifter shafts to the transmission case when the left lever is put into the park position.

Park Position

Fig. 6 shows the shifter shafts in the park position. The park and high range shifter shaft has moved rearward, pushing the interlock pins and balls into position to lock the 1st - 5th speed shifter shaft to the transmission case. Also moved are the neutral detent balls for the low - reverse range, and the 3rd - 7th and 4th - 8th speed shifter shafts to lock these shafts in neutral.

Before the park - high range shifter shaft can be moved to the park position, one of the speed selector shafts must be moved into a gear. This allows the interlock pin to move right to let the park - high range shaft move rearward. In Fig. 6, the speed selector shaft was placed in the 1st - 5th speed position.

Transmission Gear Locking

The gears on the countershaft and the differential drive shaft are held in place by locking thrust washers.

The thrust washers ride in grooves on the shafts and prevent the gears from sliding on the shaft.

There is one locking washer on the countershaft. It is located in front of the shifter collar sleeve.

There are three locking washers on the differential drive shaft. The center washer is prevented from spinning by a retaining washer. The retaining washer rides in the shaft splines and has "ears" which fit into notches on the locking washer.

Differential

The differential receives power from the transmission and distributes it to the drive axles.

The differential is a spiral bevel gear assembly. Four bevel pinions carried on two shafts drive two bevel gears.

The bevel gears are connected to the final drive shafts which drive the planetaries located in the inboard end of the axle housings.

A pedal-operated differential lock is provided.

A sliding collar connects the left-hand final drive shaft to the left-hand differential housing. The left-hand bevel gear now turns with the differential housing. The bevel pinions can not spin on their shafts. Therefore, the right-hand bevel gear must turn at the same speed as the differential housing and the left-hand bevel gear. In effect, the differential is locked up as a solid assembly.

IMPORTANT: Turning with the differential lock engaged can damage the bevel pinions and gears.

Parking Brake

The parking brake, if equipped, consists of a hand operated lever, a two piece brake band, and a brake drum.

The brake drum is splined to the left-hand differential housing.

When the lever is pulled to the "ON" position, the brake band tightens around the drum to hold the differential housing stationary.

DIAGNOSING SYSTEM MALFUNCTIONS

UNIT FAILS TO MOVE

Clutches

Clutch linkage improperly adjusted.
Clutch slips.
Clutch release levers out of adjustment.
Throw-out bearing shaft or fork damaged.
Throw-out bearing fork sheared from shaft.

Transmission

Clutch shaft worn or broken.
Shifter forks or shafts broken.
Transmission shaft or gear failure.
Transmission shifter collars broken.

Reverser

Loss of pressure.
Mechanical failure within reverser unit.

Differential

Ring gear teeth sheared.
Pinion shaft jammed against ring gear.

Final Drive

Broken axle shaft.
Improper planetary system assembly.
Final drive shaft and sun pinion broken.

UNIT MAKES EXCESSIVE NOISE WHEN MOVING

Clutches

Clutch disk loose at hub rivets.
Flywheel loose on crankshaft.

Transmission

Transmission parts worn or damaged.
Transmission oil level low.
Shifter forks and shafts worn.
Transmission oil pump worn.

Reverser

Low oil supply.
Worn or damaged parts.

Differential

Loss of lubricant.
Damaged or worn gears.
Ring gear loose.
Worn bearings.
Cone point out of adjustment.
Axle shaft improperly adjusted.
Incorrect backlash adjustment.

Final Drive

Planetary pinions or bearings damaged.
Sun pinion damaged.
Improper alignment of drive.

EXCESSIVE UNIT VIBRATION

Clutches

Incorrect assembly.
Flywheel loose in crankshaft.

Transmission

Bent or damaged shafts.
Improper bearing adjustment.

Differential

Ring gear loose.
Cone point improperly adjusted.
Incorrect backlash adjustment.

Final Drive

Axle shaft bent or damaged.

DIAGNOSING CLUTCH MALFUNCTIONS

Clutch Slips

Worn or burned clutch disk facings.
Replace clutch disk. Check pressure plate.

Oil or grease on clutch disk facings.
Clean or replace disk.

Insufficient clutch pedal free travel.
Adjust pedal linkage.

Release levers out of adjustment.

Clutch Grabs or Chatters

Broken damper clutch spring (diesel).
Replace spring.

Loose clutch disk facings.
Replace clutch disk.

Disk facings dirty or gummed.
Clean or replace disk.

Clutch disk loose at hub.
Repair disk and shaft.

Clutch disk hub tight on shaft.
Repair disk and shaft.

Tight or binding clutch fork shaft.

Cracked or broken pressure plate.

Pressure plate sticking.

Weak clutch springs.
Check springs to specifications.

Excessive transmission backlash.
Repair transmission.

Worn clutch throw-out bearing.
Replace and lubricate periodically.

Clutch Makes Noise (While Engaged)

Broken damper clutch spring (diesel).
Replace spring.

Clutch shaft or disk splines worn.
Replace shaft and disk.

Clutch disk loose at hub rivets.
Replace disk.

Flywheel loose on crankshaft.

Clutch Drags

Distorted or rough clutch shaft splines.
Repair or replace shaft and disk.

Disk hub tight on clutch shaft.
Repair or replace shaft and disk.

Disk facings broken.

Clutch disk warped or bent.

High spots on disk.

Excessive pedal free travel.
Adjust pedal linkage.

Excessive clutch face run-out (flywheel not seated properly).

Clutch disk frozen to flywheel.
Clean or replace disk.

Clutch Pedal Pulsates

Broken or missing clutch pedal spring.
Replace spring.

Release levers out of adjustment.
Adjust levers.

Flywheel not seated correctly.
Remove and seat correctly.

Bent crankshaft flywheel flange.
Replace crankshaft.

Bent clutch shaft.
Replace shaft and disk.

DIAGNOSING TRANSMISSION MALFUNCTIONS

Excessive Gear Clash When Shifting

Attempting to shift too fast.
  See Operator's Manual for instructions.
Shifters worn or broken.
  Replace shifters.
Gears rotate with clutch pedal depressed.
  Repair failed friction plug or spring.
  Check reverser assembly.

Excessive Transmission Noise

Parts worn or damaged.
  Repair transmission.
Transmission low on oil.
  Fill to specified level.
Transmission oil pump not functioning.
  Inspect and repair pump.

DIAGNOSING DIFFERENTIAL MALFUNCTIONS

Excessive Noise

(Continuous)
Worn bearings.
Damaged or worn gears.
Loss of lubricant.

(Under Load)
Worn bearings.
Bearing preload out of adjustment.
Ring gear backlash out of adjustment.

Differential Will Not Lock

Lock pedal turning on shaft.
Lock collar splines worn or damaged.
Differential lock shaft frozen in housing.

DIAGNOSING FINAL DRIVE MALFUNCTIONS

Excessive Noise

Worn final drive shaft and sun pinion.
Damaged final drive gear.
Worn planet pinion bearing rollers.
Axle bearings damaged.
Insufficient amount of lubricant.

Axles Won't Turn

Broken rear axle.
Broken planetary gears or shafts.

Loss Of Lubricant

Worn or broken oil seal.
Housing gasket broken.

VISUAL INSPECTION

Much can be learned about the general condition of the power train by visual inspection.

For example, if the power train is losing too much fluid, this can mean an external leak.

Check for the following conditions:

1. Improper cap screw torques.
2. Cracked or broken housing.
3. Failed gasket.
4. Worn or improperly installed oil seals and/or O-rings.

ADJUSTMENTS

Parking Brake Adjustment

The parking brake band may be adjusted for wear without removing the transmission cover.

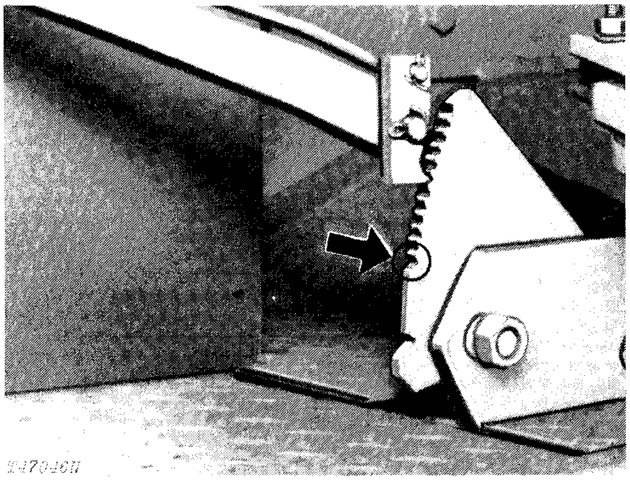


Fig. 7-Setting Brake Lever

Before adjusting the parking brake, set the brake lever so the pawl is in the first notch above the long tooth (Fig. 7).

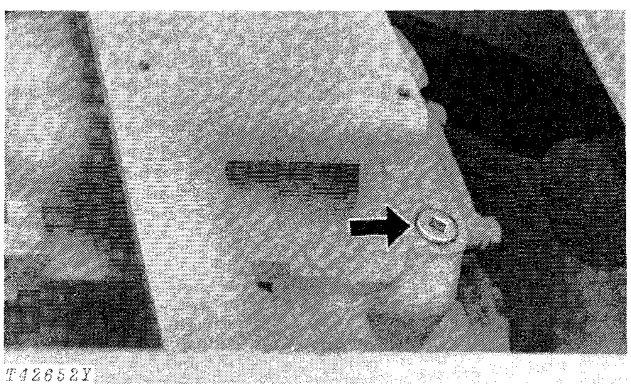


Fig. 8-Brake Band Plug

Remove brake band plug (Fig. 8) from top left side of transmission case.

Using a screwdriver (Fig. 9), tighten the brake band set screw (slotted screw) by hand, until it is not possible to turn screw another complete half turn. Final position of screw should have concave surface of screw head mating with surface of pivot pin.

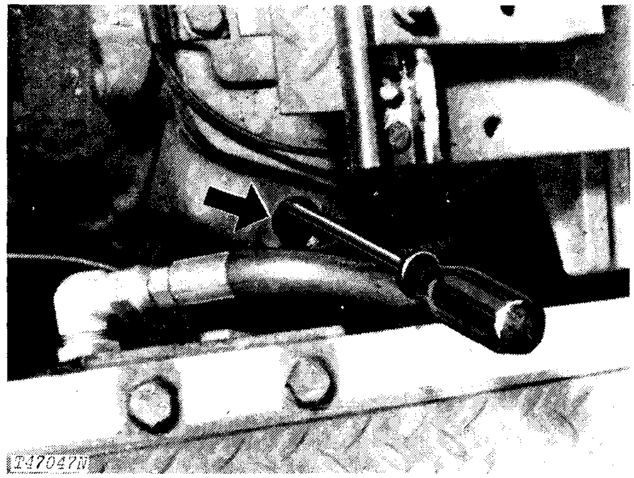
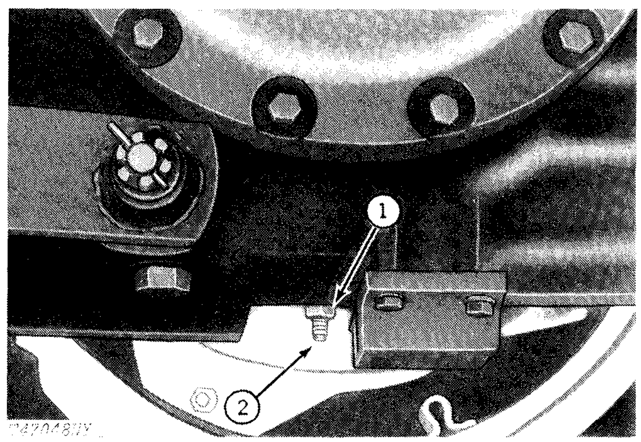


Fig. 9-Brake Band Slotted Screw

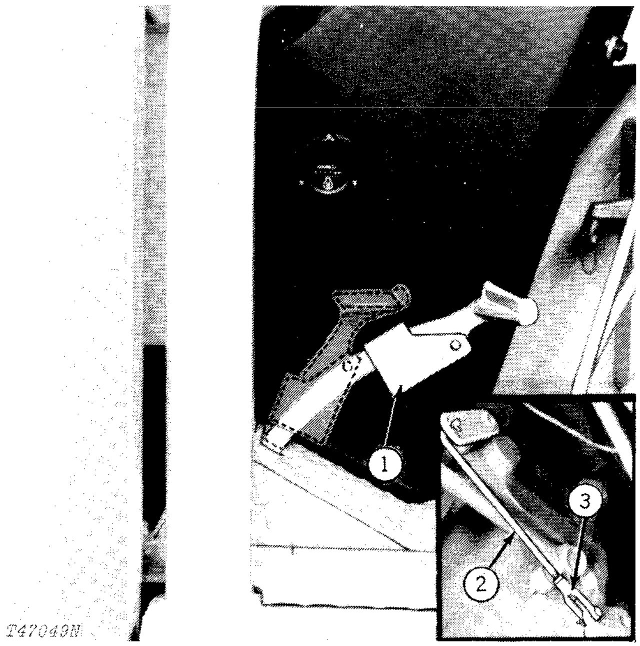


1—Jam Nut **2—Brake Band Set Screw**

Fig. 10-Brake Band Set Screw and Jam Nut

Loosen jam nut (Fig. 10) located on the bottom left side of the transmission case. Tighten the brake band set screw and back it off two turns. Then tighten the jam nut with the set screw in this position.

Clutch Adjustment



1—Clutch Pedal Stop
2—Clutch Fork Shaft Rod
3—Yoke

Fig. 11-Adjusting Clutch for Wear

With the clutch pedal stop (1, Fig. 11) down, depress the pedal until the stop contacts the platform. At this position, adjust the clutch fork shaft rod (2) to obtain throwout bearing to clutch finger contact. Then shorten the clutch fork shaft rod by 2-1/2 turns of the yoke.

It is necessary to make this adjustment after each time the clutch control rod is adjusted as outlined in Groups 9025 or 9025A.

Group 9025
HYDRAULIC SYSTEM (FLOW METER)

1—Left Brake Oil Line
2—Loader Control Valve
3—Loader Left-Hand Bucket Cylinder Head End Circuit
4—Loader Left-Hand Boom Cylinder Rod End Circuit
5—Loader Left-Hand Boom Cylinder Head End Circuit
6—Loader Left-Hand Bucket Cylinder Rod End Circuit
7—Pressure Control Valve Line to Loader Valve Pressure Port
8—Loader Right-Hand Boom Cylinder Rod End Circuit
9—Steering Return Line
10—Steering Valve
11—Steering Pressure Hose
12—Brake Valve
13—Left-Hand Steering Cylinder Line Rod End
14—Right-Hand Steering Cylinder Line Head End
15—Loader Left-Hand Boom Cylinder
16—Hydraulic Accumulator
17—Loader Left-Hand Bucket Cylinder
18—Hydraulic Pump Drain Line to Clutch Housing Cover
19—Loader Right-Hand Bucket Cylinder
20—Loader Right-Hand Boom Cylinder
21—Hydraulic Pump Line to Hydraulic Oil Accumulator
22—Hydraulic Pump
23—Hydraulic Pump to Pressure Control Valve Line
24—Hydraulic Pump Stroke Control Valve
25—Hydraulic Oil Cooler
26—Hydraulic Pump Inlet Line
27—Steering Cylinder
28—Hydraulic Oil Cooler Line to Clutch Control Valve Cover
29—Right-Hand Steering Cylinder Line Head End
30—Left-Hand Steering Cylinder Line Rod End
31—Loader Right-Hand Bucket Cylinder Rod End Circuit
32—Loader Right-Hand Bucket Cylinder Head End Circuit
33—Accumulator Circuit to Pump Pressure Circuit
34—Steering Pressure Circuit
35—Clutch Control Valve Cover
36—Hydraulic Filter Return Circuit to Hydraulic Pump Inlet Circuit
37—Oil Supply Cover
38—Brake Feed Line
39—Loader Right-Hand Boom Cylinder Head End Circuit
40—Right Brake Oil Line
41—Pressure Control Valve
42—Loader Valve Return Line to Filter Relief Valve
43—Hydraulic Oil Filter Relief Valve Assembly

Legend for Fig. 1-Component Location - Main Hydraulic System

44—Backhoe Bucket Cylinder
45—Backhoe Bucket Cylinder Rod End Circuit
46—Backhoe Bucket Cylinder Head End Circuit
47—Backhoe Crowd Cylinder
48—Backhoe Crowd Cylinder Head End Circuit
49—Backhoe Crowd Cylinder Rod End Circuit
50—Backhoe Boom Cylinder
51—Backhoe Boom Cylinder Rod End Circuit
52—Backhoe Boom Cylinder Head End Circuit
53—Backhoe Manifold Block
54—Left Stabilizer Cylinder Rod End Hose
55—Left Stabilizer Head End Hose
56—Backhoe Control Valve Crowd Cylinder Head End Hose to Manifold
57—Backhoe Control Valve Crowd Cylinder Rod End Hose to Manifold
58—Backhoe Control Valve Stack
59—Right Stabilizer Cylinder Rod End Hose
60—Right Stabilizer Cylinder Head End Hose
61—Pressure Control Valve Pressure Hose to Backhoe Control Valve
62—Backhoe Control Valve Return Hose to Filter Relief Valve
63—Backhoe Right Stabilizer Cylinder
64—Backhoe Right Swing Cylinder Rod End Hose and Backhoe Left Swing Cylinder Head End Hose
65—Backhoe Left Swing Cylinder Rod End Hose and Backhoe Right Swing Cylinder Head End Hose
66—Backhoe Right Swing Cylinder
67—Backhoe Left Swing Cylinder
68—Backhoe Control Valve Boom Cylinder Rod End Hose to Manifold
69—Backhoe Control Valve Boom Cylinder Head End Hose to Manifold
70—Backhoe Control Valve Bucket Cylinder Head End Hose to Manifold
71—Backhoe Control Valve Bucket Cylinder Rod End Hose to Manifold
72—Backhoe Left Stabilizer Cylinder

Legend for Fig. 1A-Component Location - Backhoe Hydraulic System

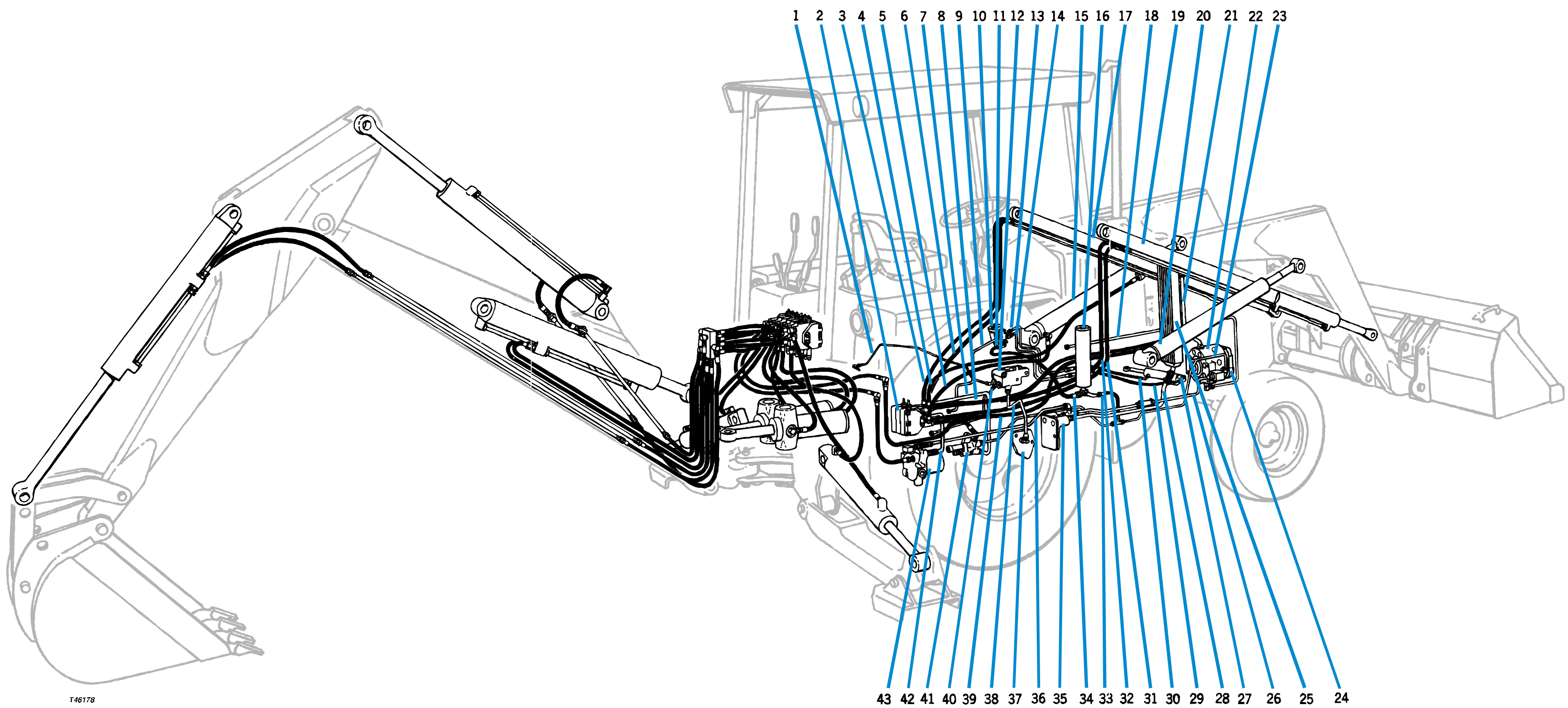


Fig. 1-Component Location - Main Hydraulic System

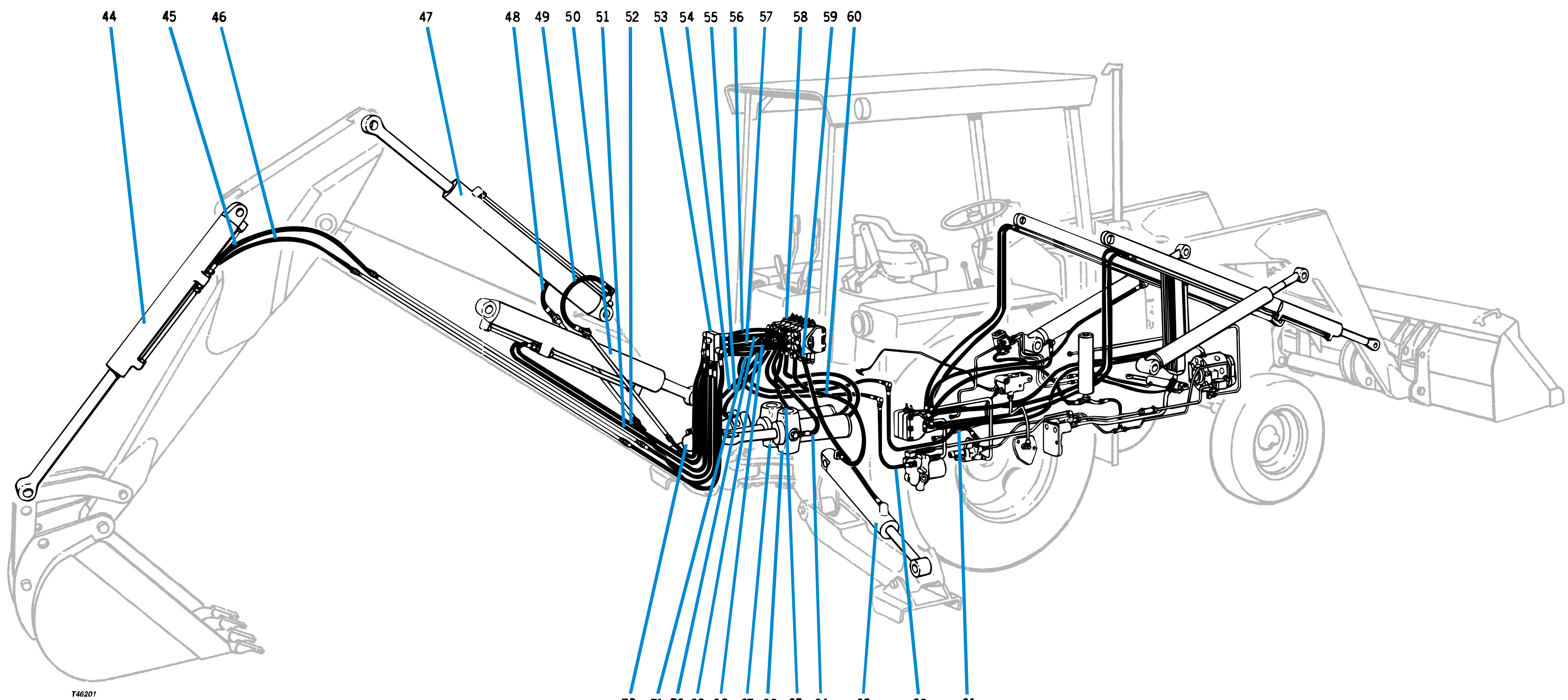


Fig. 1A-Component Location - Backhoe Hydraulic System

TRANSMISSION HYDRAULIC SYSTEM

GENERAL INFORMATION

The JD310-A planetary reverser transmission is a collar shift type using helical gears. Two shift levers manually select four gears in each of two forward ranges. This provides eight forward speeds. A hydraulic reverser unit changes input shaft rotation to provide four reverse speeds.

The reverser is a hydraulic and mechanical device which changes the direction of tractor travel under full load without shifting the transmission gears. A single compound planetary set of gears, a reverse brake, and one clutch are utilized to accomplish this type of directional shifting.

A "high-speed" lockout is provided in the reverser and transmission control mechanisms to allow reverse shifting only when the transmission is in low range.

NOTE: Units starting with S.N. (276765) will not have the high range reverse lockout.

Thus, four reverse speeds are provided, each approximately 35% faster than their respective forward low range speeds.

A single stage dry clutch is provided on the engine flywheel ahead of the reverser unit to disconnect the reverser during cold weather. The pedal control linkage is designed so that the reverser clutches are neutralized before the disconnect clutch is disengaged.

The transmission hydraulic system performs four important functions.

1. It supplies and controls pressure oil for clutch and brake engagement.

2. It cools the transmission oil.

3. It supplies pressure oil for shaft and bearing lubrication.

4. It provides pressure oil to charge the main hydraulic pump.

Oil Supply

Oil for reverser operation, lubrication, and cooling is drawn from the transmission case (main transmission-hydraulic oil reservoir) by the transmission oil pump located at the rear of the reverser. The oil is pumped through a micronic type oil filter before entering the reverser clutch control valve. An oil cooler, located at the front of the tractor and attached to the radiator, cools the transmission-hydraulic oil.

Control Valve Assembly

The reverser control valve housing, located on the right side of the tractor between the clutch housing and brake valve, receives pressure oil from the transmission oil pump.

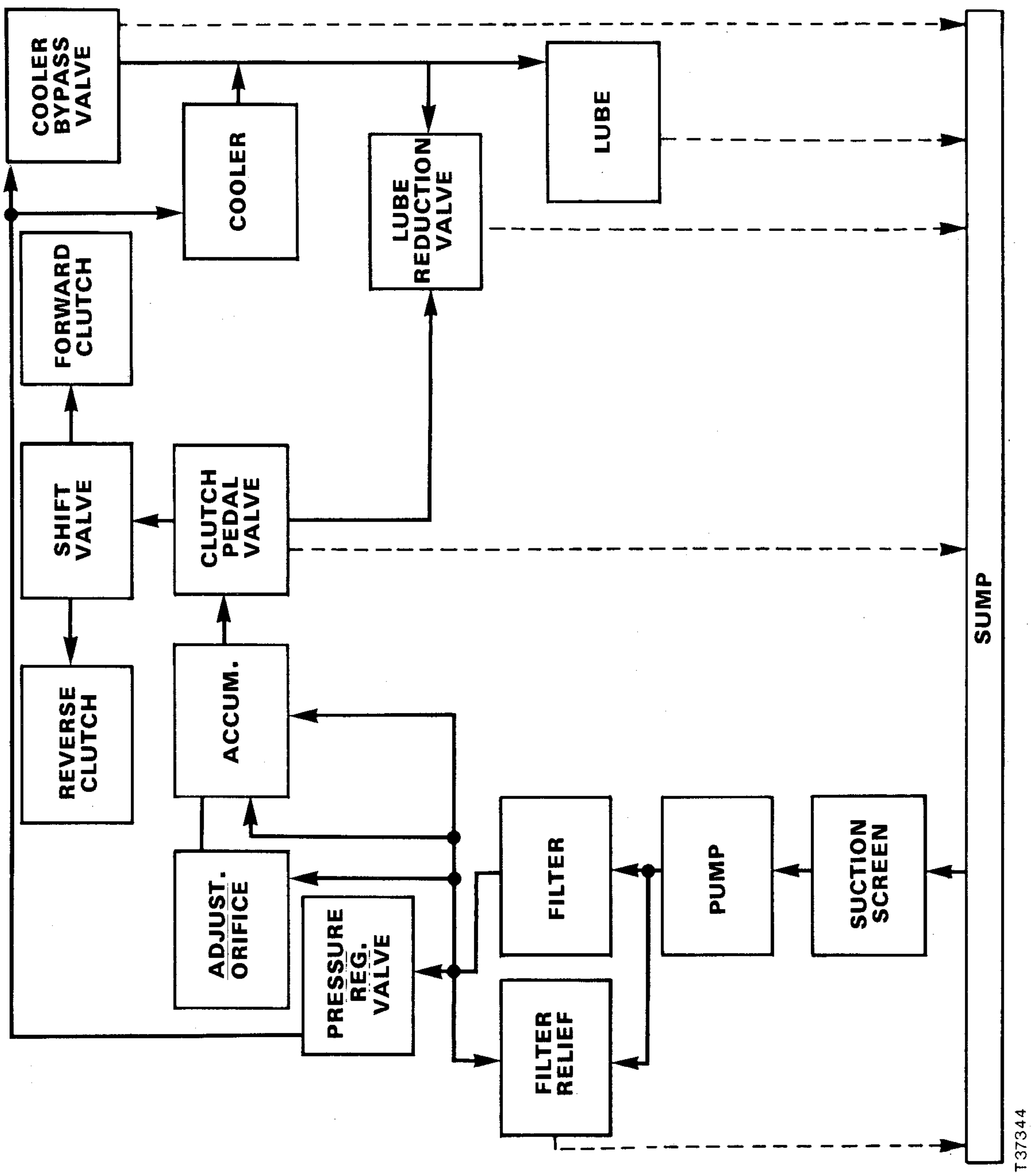


Fig. 3-Block Diagram of the Transmission Hydraulic System

Clutch Control Valve

The clutch control valve is controlled by the clutch pedal. Engaging the clutch pedal moves the clutch control valve, opening the pressure oil passage to the shift valve. Disengaging the clutch pedal moves the valve to close off pressure oil flowing to the shift valve and allows oil from the engaged clutch pack to return to sump. The accumulator remains charged when the clutch pedal is depressed, as the clutch control valve blocks the accumulator discharge port.

To obtain a close control of pressure oil (for inching into loads) a spring and movable stop are placed in the clutch control valve. This spring and stop allows the operator to closely regulate clutch pressure oil with the clutch pedal.

Shift Valve (Directional Valve

The spool-type shift valve is operated by the reverser control lever and has two detented positions, forward and reverse, for direction control of the tractor. A neutral position is not provided. This valve directs oil to engage the selected clutch pack during a shift. It also allows oil to return from the other clutch.

Accumulator Charging Orifices

A fixed accumulator charging orifice is provided to give a minimum accumulator charging rate. An adjustable charging orifice is also provided to vary the accumulator charging rate, controlling shift time. Closing the orifice decreases the rate of pressure rise and provides a smoother or softer shift. Opening the orifice increases the rate of pressure rise and reduces the tendency to drop torque under load, but makes shifts sharper under no load.

Accumulator

The accumulator is a spring-loaded piston located in the center of the reverser control valve housing. It controls pressure build-up during a shift and provides the following distinct functions:

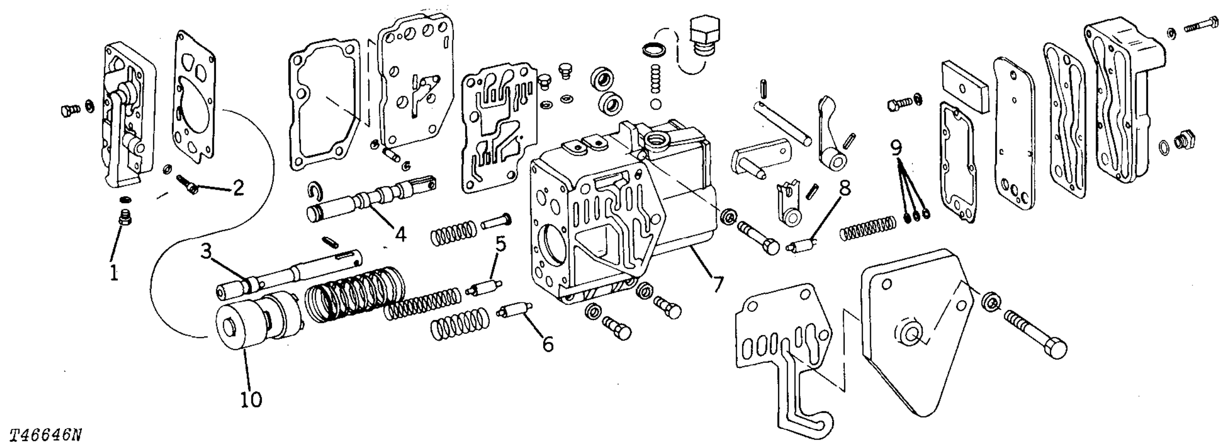
(1) Maintains oil in reserve to provide a "surge" of oil to assist in moving the forward clutch or reverse brake pistons rapidly toward engagement during a directional shift.
(2) Provides a low system pressure at the time of initial clutch or brake engagement. This provides smoother shifting.
(3) Gives a gradual pressure build-up as the shift is accomplished and provides for a rapid pressure build-up to full engagement when the shift is completed.

Pressure Regulating Valve

A shim-adjusted regulating valve is provided to maintain full engagement pressure for reverse brake and forward clutch operation. In operation, this valve opens a passage to the cooler and allows oil not utilized by the reverser clutch packs to be sent via the main pump charging line to the oil cooler.

Cooler Bypass and Relief Valve

This valve protects the oil cooler from excessively high oil pressures, such as during cold weather when oil is stiff. The spring loaded valve bypasses cooler supply oil to the clutch lubrication circuit or, if pressures are excessively high, relieves oil to sump.



1—Reverser System Pressure Plug
2—Rate of Shift Adjusting Screw
3—Clutch Control Valve Spool
4—Shift Valve Spool
5—Cooler Bypass and Charge Relief Valve
6—Lube Oil Pressure Reduction Valve
7—Reverser Control Valve Housing
8—Pressure Regulating Valve
9—Shims
10—Accumulator

Fig. 4-Reverser Control Valve Assembly

Lubrication Oil Pressure Reduction Valve

Pressure of oil returning from the cooler to the clutches depends upon line restriction, oil temperature, and engine rpm. This oil pressure could cause clutch drag and tractor creeping when the clutch pedal is depressed. The lubrication oil pressure reduction valve acts to reduce oil pressure when the clutch pedal is depressed (clutch control valve moved forward). Full engagement pressure behind this valve is dropped to zero when the clutch pedal is depressed, causing cooler return oil (lubrication oil) to move the valve against spring pressure and open the lubrication circuit to sump. This eliminates the possibility of reverser clutch drag.

Oil Cooler

The oil cooler is mounted next to the engine radiator. The oil cooler cools the excess oil not needed by the reverser control circuit, lube circuit or the main hydraulic pump. The oil cooler is protected by the cooler bypass and charge relief valve located in the clutch control valve housing.

Operation of Control Valve

Pressure oil from the transmission oil pump and oil filter is routed to the reverser control valve housing. The pressure regulating valve maintains the pressure of the oil going to the clutch control valve and clutch packs. Since the volume of oil required by the clutch packs and accumulator is small, the valve will be opened by the incoming oil and will divert excess oil to the oil cooler.

Oil in the lubrication circuit remains at a pressure dependent on line restriction and oil temperature, unless the clutch pedal is depressed. At this time lubrication pressure will drop.

For purposes of explanation, let us discuss the function of the reverser control valve assembly during a shift from reverse to forward drive. Before the shift, assume that the accumulator is fully charged and the reverse brake pack is also fully pressurized.

Shift Valve

As the reverser control lever is moved forward, the shift valve is moved forward and stopped in the rear detent position. The lands on the shift valve now uncover the groove in the valve housing leading to sump and connect sump with the reverse brake. The reverse brake now dumps oil. At the same time the shift valve lands open the pressure oil passage in the control valve housing to the forward clutch pack and clutch pressurization is started.

During the shift, accumulator pressure is dropped as the spring moves the accumulator piston rearward, and pressure oil is sent to the forward clutch. Approximately 1/10 of a second after the start of the shift the oil pressure starts to increase in the accumulator and clutch packs. Before full clutch engagement pressure in the clutch pack can be obtained, the accumulator must be charged to full pressure.

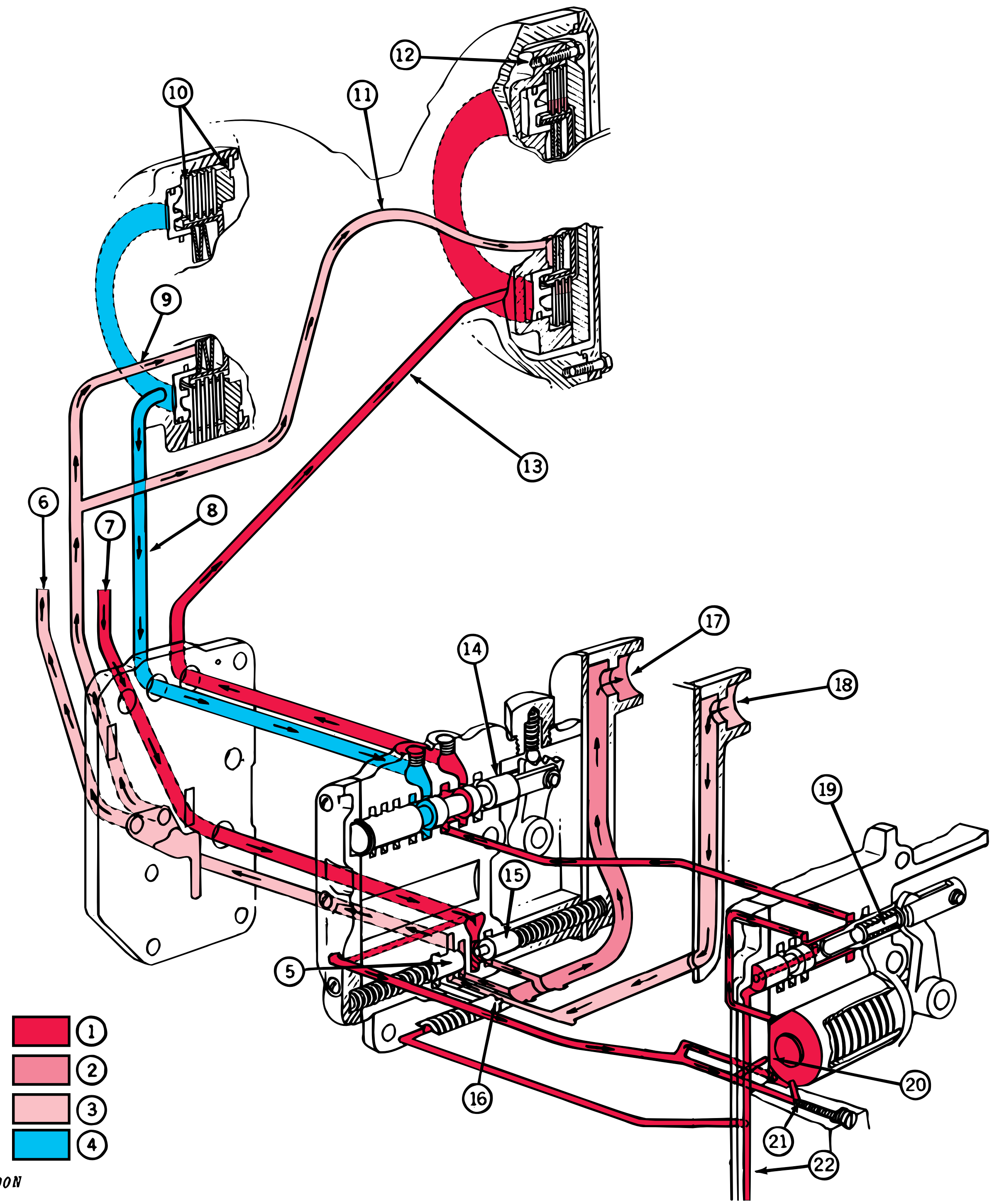
Initial accumulator charging is accomplished by means of two orifices, one fixed and the other adjustable. The fixed orifice provides for a minimum charging rate; the adjustable orifice is provided to increase the charging rate. Therefore, the tractor rate of shifting can be varied by this adjustable orifice.

When accumulator pressures reach 100 psi (7 bar) (7 kg/cm^2) (this should require 3/4 to 1-1/4 seconds), another charging orifice is uncovered by the accumulator piston. With the added pressure oil entry, the accumulator and clutch pack pressures rise instantly to full engagement pressure for the clutch pack.

Clutch Control Valve

Operating the clutch pedal to stop tractor motion moves the clutch control valve forward, closing off pressure oil to the clutch packs and opening the engaged clutch pack pressure line to sump, neutralizing the clutch. The accumulator remains charged as the accumulator discharge port is closed by the clutch control valve.

As the clutch pedal is released, the clutch control valve is moved, uncovering the pressure oil port and connecting it with the proper clutch pack. A spring within the valve provides a controlled clutch engagement as described earlier under "Clutch Control Valve."



1—Pressure Oil
2—Inlet Oil To Main Hydraulic Pump
3—Lube Oil From Cooler
4—Return Oil To Sump
5—Cooler Bypass And Relief Valve
6—Lube Oil To Transmission
7—Oil From Transmission Oil Pump
8—Oil Line To Reverse Brake
9—Reverse Brake Lube Oil Line
10—Reverse Brake Assembly
11—Forward Clutch Lube Oil Line
12—Forward Clutch Assembly (Engaged)
13—Oil Line To Foward Clutch
14—Shift Valve
15—Pressure Regulating Valve
16—Lube Oil Reduction Valve
17—To Cooler
18—From Cooler
19—Clutch Control Valve
20—Fixed Charging Orifice
21—Adjustable Charging Orifice
22—Test Port

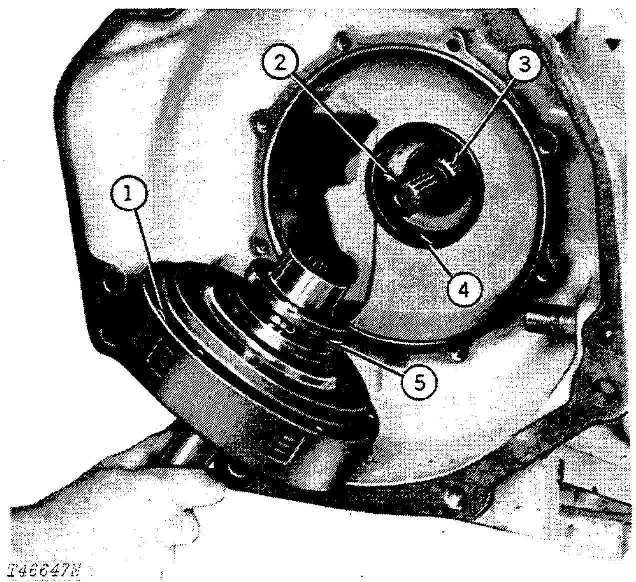
Fig. 5-Reverser Clutch Control Valve

Reverser Housing Assembly

The reverser clutch housing contains three main functional units:

(1) Forward Clutch Assembly
(2) Reverse Brake Assembly
(3) Compound Planetary Gear Set

Forward Clutch Assembly



1—Forward Clutch Pack
2—Clutch Shaft
3—Powershaft Drive Shaft
4—Oil Sleeve
5—Pressure Port for Engaging Clutch

Fig. 6-Forward Clutch Pack

The forward clutch is located in the front part of the clutch housing. Access to the clutch is obtained by removing the cover plate. With the cover plate removed, the forward clutch assembly is removed by pulling it out of the clutch housing.

The clutch drive shaft is bolted to the clutch drum. Two dowel pins help locate the drive shaft on the drum.

The forward clutch pack is comprised of three clutch disks and three separator plates. The plates and disks are installed alternately with each other. A plate is always placed next to the aluminum piston to prevent damage to the piston from the grooved clutch disks. The plates and piston turn with the clutch drum.

The separator plates are tanged on the outside edge to engage with the clutch drum. The separator plates are "wavy" to help separate the plates and disks when the clutch is disengaged. The notch in the end of one tang indicates the plate is a wavy plate.

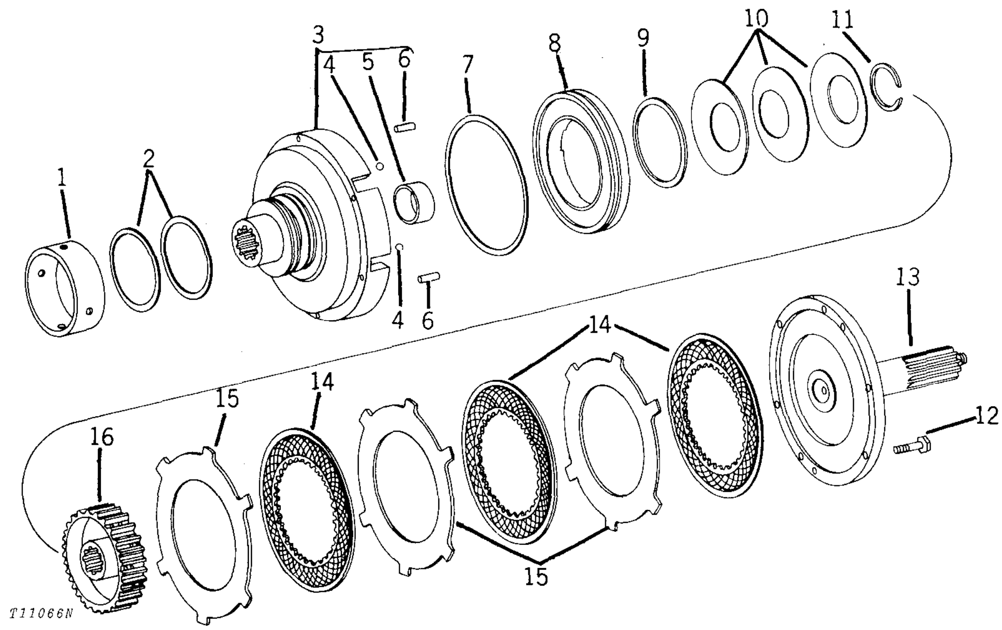
The clutch disks are splined internally and ride on the clutch hub. When the clutch is engaged, the plates and disks are pressed together to drive the clutch hub. The clutch hub is splined to the transmission input shaft.

The clutch hub has oil holes in it to permit oil to flow through the clutch pack in order to cool it.

The clutch disks are grooved to allow the oil to flow through a clutch pack.

The forward clutch is engaged by an annular piston made of aluminum. The piston is engaged by hydraulic oil and disengaged by three spring washers. A snap ring holds the spring washers in the clutch drum.

When the clutch is disengaged, the spring washers next to the piston block lube oil from entering the clutch pack. When the forward clutch is engaged, the piston moves forward and lets lube oil flow through notches in the piston to lubricate and cool the clutch pack.



1—Sleeve
2—Sealing Ring (2 used)
3—Drum Assembly
4—Ball (2 used)
5—Bushing
6—Dowel Pin (2 used)
7—Sealing Ring
8—Clutch Piston
9—Sealing Ring
10—Spring (3 used)
11—Snap Ring
12—Cap Screw (6 used)
13—Clutch Drive Shaft
14—Clutch Drive Disk (3 used)
15—Separator Plate (3 used)
16—Clutch Hub

Fig. 7-Forward Clutch Assembly

Pressure oil from the control valve enters the forward clutch drum through a hole (5, Fig. 6) in the area between the two sealing rings.

The sealing rings ride in a sleeve that is pressed into the clutch housing. The holes in the sleeve match up with an oil groove in the clutch housings (4, Fig. 6).

The internal splines at the rear of the clutch drum mate with the planet pinion carrier drive shaft of the planetary set.

Forward Clutch Operation

To engage the forward clutch, pressure oil is directed to the forward clutch. The oil enters the clutch pack through the hole located between the sealing rings to compress the piston against the clutch plates and disks.

When this happens, the clutch hub and the clutch drum turn as a unit to drive the transmission clutch shaft.

Lube oil flows through the notch in the piston and the holes in the hub to lubricate and cool the clutch pack.

The power flow is from the clutch drive shaft to the clutch drum through the clutch pack (separator plates and disks) to the clutch hub splined to the transmission drive shaft.

Clutch Disengaged

When the forward clutch is disengaged (reverse or neutral), pressure oil is released from the forward clutch. The spring washers push the piston away from the separator plates and disks. The clutch hub no longer turns with the clutch drum, or simply, the forward clutch is disengaged.

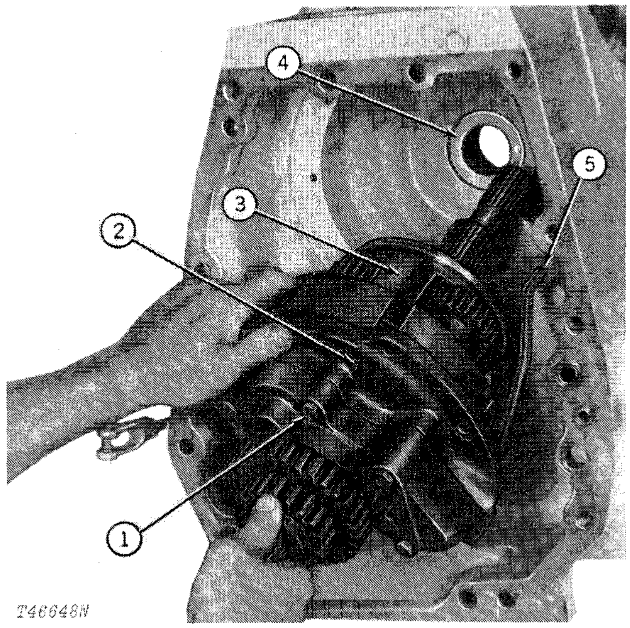
The spring washer stops lube oil flow from entering the clutch pack. The notch in the piston is covered by the clutch drum inner hub. Power from the engine is to the planet pinion carrier shaft.

Before leaving the forward clutch, note that when the reverser control lever is in reverse, the forward clutch separator plates and disks are turning in opposite directions to each other. Any contact or drag between these two parts will cause the forward clutch to burn up as there is no lubrication of the forward clutch pack during reverser operation.

Therefore, whenever the engine is running and the transmission is in park or neutral, place the reverser control lever in the forward or neutral slot. Doing so will prevent damage to the forward clutch pack should it be dragging slightly.

A backhoe operation is an example of the above condition.

Reverse Brake Assembly



1—Transmission Oil Pump
2—Reverse Brake
3—Planetary Gear Set
4—Thrust Washer
5—Forward Clutch Lube Tube

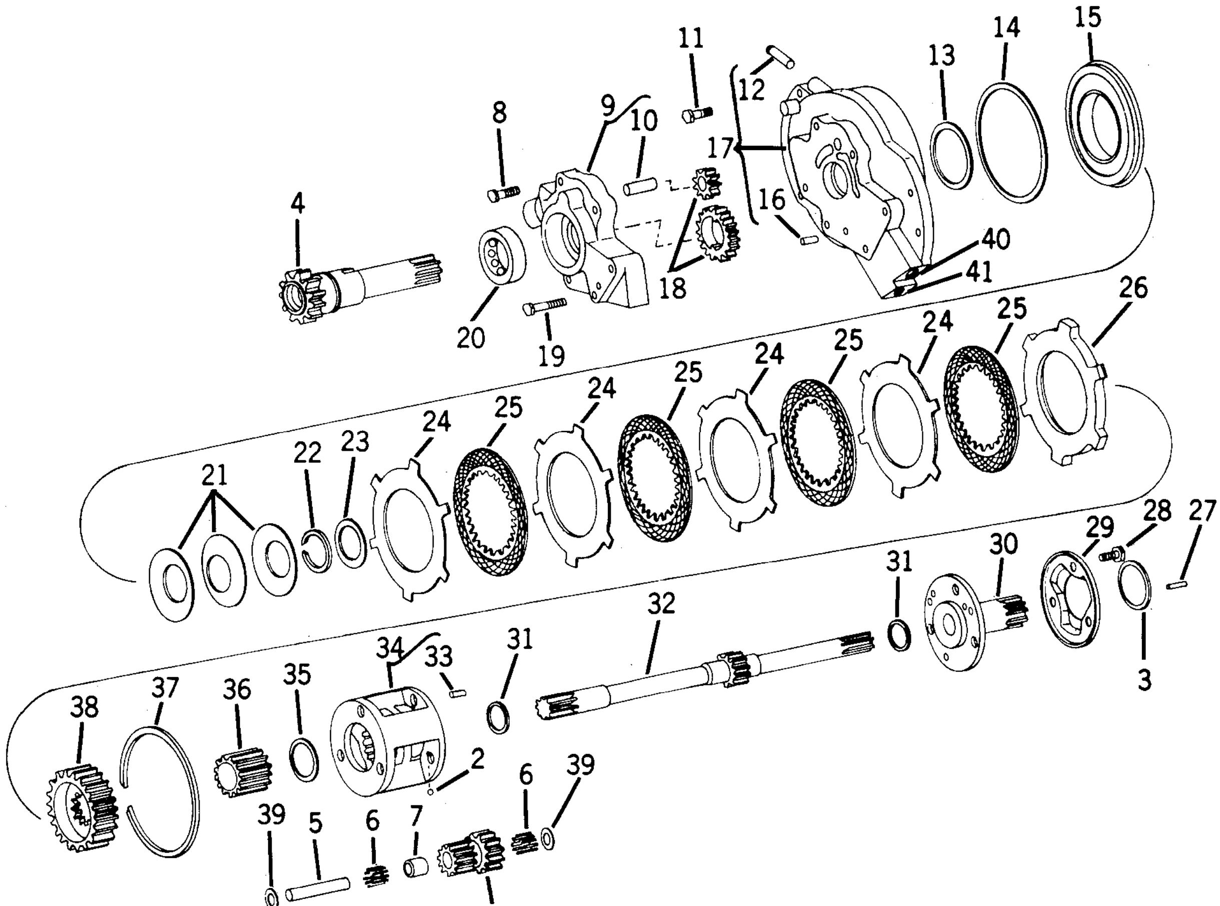
Fig. 8-Reverse Brake Assembly

The reverse brake assembly is a hydraulic and mechanical device to reverse the flow of engine power to the transmission, without shifting gears. A hydraulic disk-type brake and a single compound planetary set act together to provide this type of tractor reversing.

The reverse brake drum is bolted to the clutch housing. When engaged, the reverse brake hub is prevented from turning. When disengaged, the brake hub turns at engine speed.

The reverse brake contains four separator plates and four clutch disks. The separator plates are "wavy" similar to the forward clutch plates and are identified by a notch in the end of one of the tangs. The brake disks are grooved to let lube oil flow through the brake assembly. The separator plates are tanged to the reverse brake drum and the brake disks are splined to the brake hub.

Reverser Brake Assembly



1—Planet Pinion (set of 3)
2—Steel Ball (3 used)
3—Thrust Washer
4—Powershaft Drive Shaft
5—Planet Pinion Shaft
6—Roller Bearing (132 used)
7—Spacer (3 used)
8—Cap Screw
9—Oil Pump Body
10—Pin
11—Cap Screw (7 used)
12—Pivot Pin
13—Sealing Ring
14—Sealing Ring
15—Brake Piston
16—Dowel Pin (3 used)
17—Reverser Brake Drum
18—Oil Pump Gears
19—Screw (5 used)
20—Roller Bearing
21—Spring (3 used)
22—Snap Ring
23—Thrust Washer
24—Separator Plate (4 used)
25—Brake Disk (4 used)
26—Backing Plate
27—Spring Pin
28—Cap Screw (3 used)
29—Baffle
30—Pinion Carrier Shaft
31—Thrust Washer (2 used)
32—Clutch Shaft
33—Dowel Pin
34—Planet Pinion Carrier
35—Thrust Washer
36—Pinion
37—Snap Ring
38—Reverse Brake
39—Thrust Washer (6 used)
40—Pressure Port
41—Lube Port

Fig. 9-Reverser Brake Assembly with Transmission Oil Pump

The separator plates and brake disks are retained in the reverse brake drum by a steel backing plate and a snap ring. Should the snap ring break, the backing plate would come out of the brake drum during engagement making the reverse brake inoperative.

The reverse brake contains an annular brake piston made of aluminum. The piston is sealed on the outside by a cast iron sealing ring and on the inside by a rubber packing. The piston has notches on the inside to let lube oil into the brake pack during engagement of the reverse brake. Three spring washers are used to return the piston to the disengaged position. The washer next to the piston seals off lubrication oil to the reverse brake when the brake is disengaged. When the reverse brake is engaged, the piston compresses the spring washer into a flat surface to allow lube oil to flow through the notches in the piston to lubricate and cool the brake.

The two holes on the right side of the brake drum are for the pressure oil (40, Fig. 9) and lube oil (41).

Reverse Brake Operation

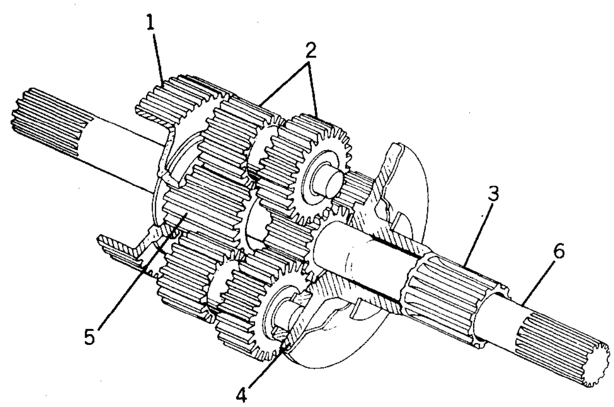
Reverse brake operation is similar to the forward clutch operation. Pressure oil pushes the piston out to compress the separator plates and brake disks which stops the brake hub from turning. When the reverser brake is engaged, lube oil flows through the notches in the piston and the holes in the drum to lubricate and cool the reverse brake assembly. Power flow with the reverse brake engaged is through the compound planetary. The reverse brake stops and holds the planetary gear from turning. This forces the compound pinions to "walk around" the sun gear as the planet pinion carrier turns.

NOTE: The planet pinion carrier is powered by the forward clutch drum which is connected directly to the engine clutch.

Reverse Brake - Disengaged

When disengaged, the spring washers push the piston away from the plates and disks. The brake hub will rotate with the planetary carrier. Lube oil is stopped by the spring washers. Unlike the forward clutch, the reverse brake separator plates never turn and the brake disks turn (with brake disengaged) only in the direction of the engine at engine speed. With the brake disengaged, the brake hub turns with the planet pinion carrier and pinion gears as a single unit.

Compound Planetary



T46650N

1—Reverse Brake Clutch Hub
2—Planet Pinion (3 used)
3—Carrier Drive Shaft
4—Planet Pinion Carrier
5—Planet Sun Pinion
6—Clutch Shaft

Fig. 10-Reverser Planetary Set

The compound planetary contains three compound gears on three shafts. Working with the reverse brake, the compound planetary assembly results in reversing the direction of the tractor.

The planet pinion carrier drive shaft is splined to the forward clutch drum. The planet pinion carrier always turns at engine speed whenever the single stage clutch is engaged.

The hole in the shaft allows the lube oil to enter the shaft and flow forward to the forward clutch.

Bolted to the front of the planet carrier is a baffle. The baffle has two purposes. One purpose is to hold the planet pinion shafts in the carrier. The second purpose is to trap oil needed to lubricate the planet pinion bearings. Oil comes through the small opening in the clutch housing shown earlier in this section. As the carrier spins, the oil is thrown to the outside and trapped in the baffle cups. The oil then flows through the holes in the pinion shafts to lubricate the pinion gear needle bearings.

The compound pinion gears ride on needle bearings on the pinion shaft. Thrust washers are located between the gears and the carrier. A spacer separates the needle bearings.

The pinion shaft does not turn in the carrier. A small ball fits partially in a hole near the front end of the shaft and partially in a notch in the carrier to prevent the shaft from turning.

The smaller of the two gears is in mesh with the reverse brake sun pinion and the larger gear is in mesh with the gear on clutch shaft. The sun pinion is splined to reverse brake hub.

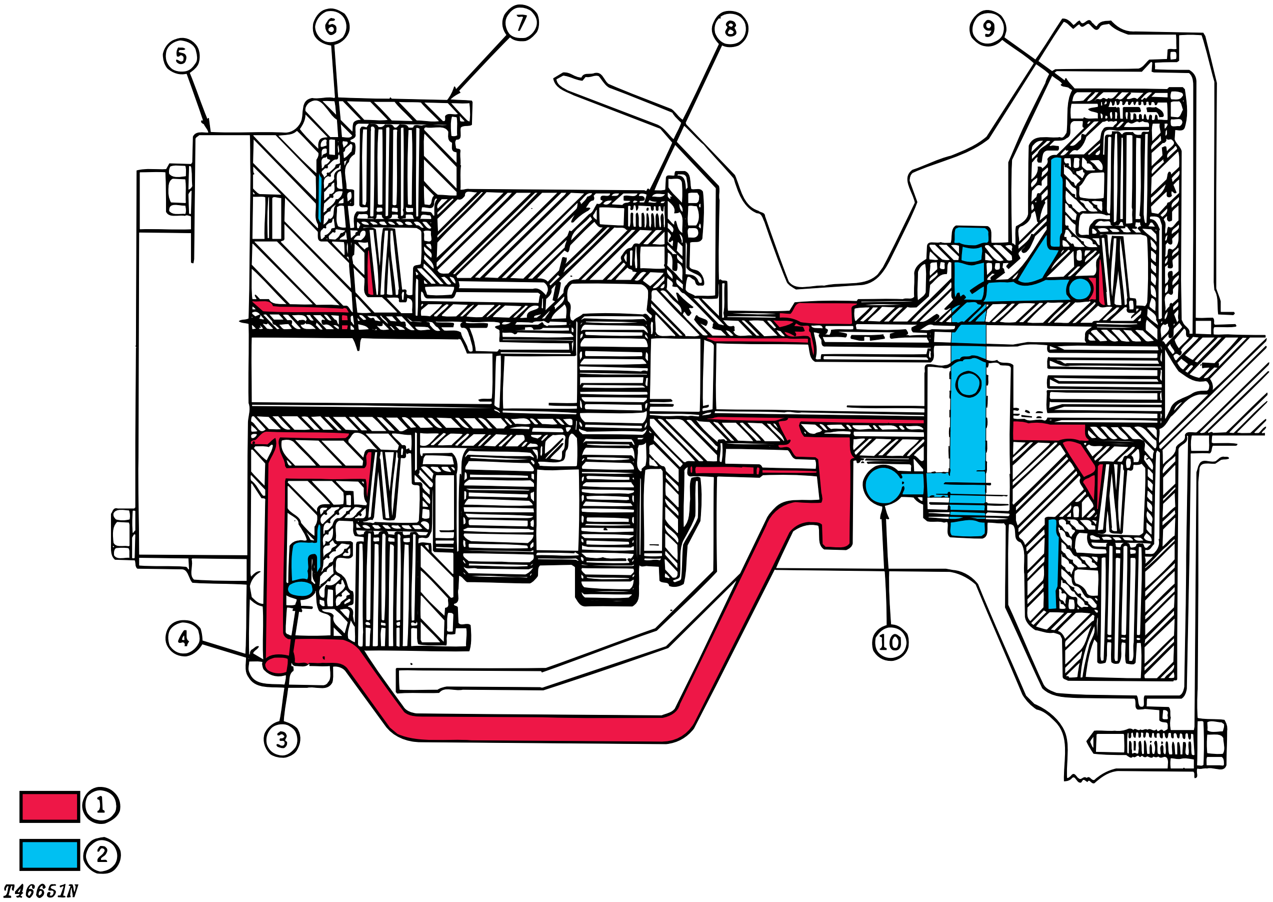
The planet pinion carrier has splines cut in the center rib. The oil pump drive shaft mates with these splines and therefore is turning whenever the engine is running and the engine clutch is engaged.

Planetary Operation - Forward

When the forward clutch is engaged, the planetary assembly is turning as one single unit. The transmission clutch shaft is turned by the forward clutch in the direction of the engine. The planet pinion carrier is turned by the carrier drive shaft connected to the forward brake drum also in the direction of the engine. With the reverse brake disengaged, the brake hub is free to turn. Since the transmission clutch shaft and the planetary carrier drive shaft are both turning in the same direction, the planet pinions are locked up and do not turn. The planet sun pinion is in mesh with the planet pinions and turns with the planetary assembly. The reverse brake hub and disks also turn with the planetary assembly (brake hub is splined to the sun pinion).

Planetary Operation - Reverse

The brake and planetary combine to reverse the clutch shaft when the reverse brake is engaged. First, note that the reverse brake stops the brake hub. The planet pinion carrier continues to turn in the direction of the engine (splined to forward clutch drum). With the carrier turning and the planet sun pinion stopped, the planet pinions are forced to turn or "walk" around the sun pinion. As the planet pinions walk around the sun pinions the transmission clutch shaft is driven in the opposite or reverse direction.

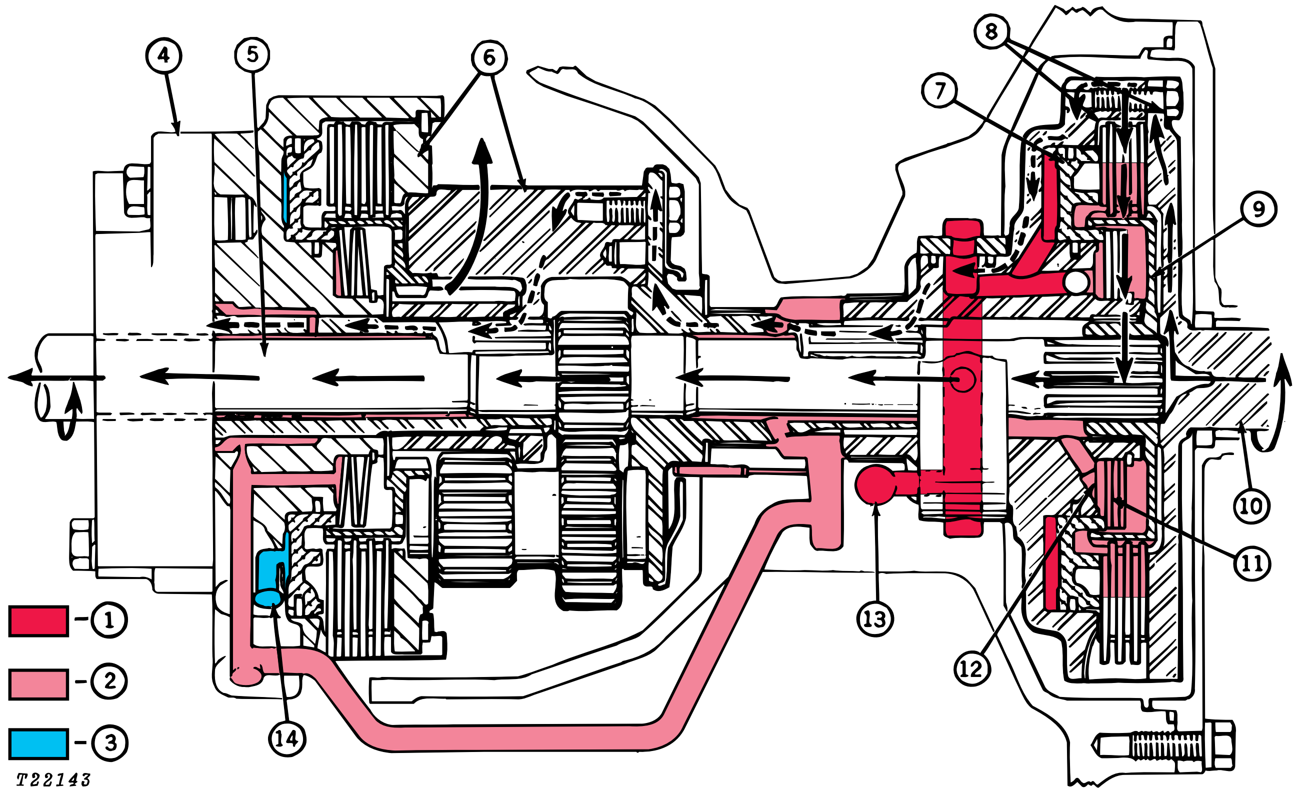


1—Low Pressure Lube Oil
2—Return Oil
3—Reverse Brake Oil Return
4—Lube Oil Inlet
5—Transmission Oil Pump
6—Transmission Clutch Shaft
7—Reverse Brake
8—Planetary Assembly
9—Forward Clutch
10—Forward Clutch Return Oil

Fig. 11-Reverser Unit in Neutral

Hydraulic Operation of Reverser Drive Units

Forward Drive



1—Pressure Oil
2—Lube Oil
3—Return Oil
4—Transmission Oil Pump
5—Clutch Shaft
6—Reverse Brake Assembly
7—Forward Clutch Piston
8—Forward Clutch Assembly
9—Clutch Hub
10—Clutch Drive Shaft
11—Spring Washer Pack
12—Lube Oil Opening to Clutch Pack
13—Pressure Oil Inlet From Shift Valve
14—Return Oil to Sump

Fig. 12-Reverser Unit in Forward Drive

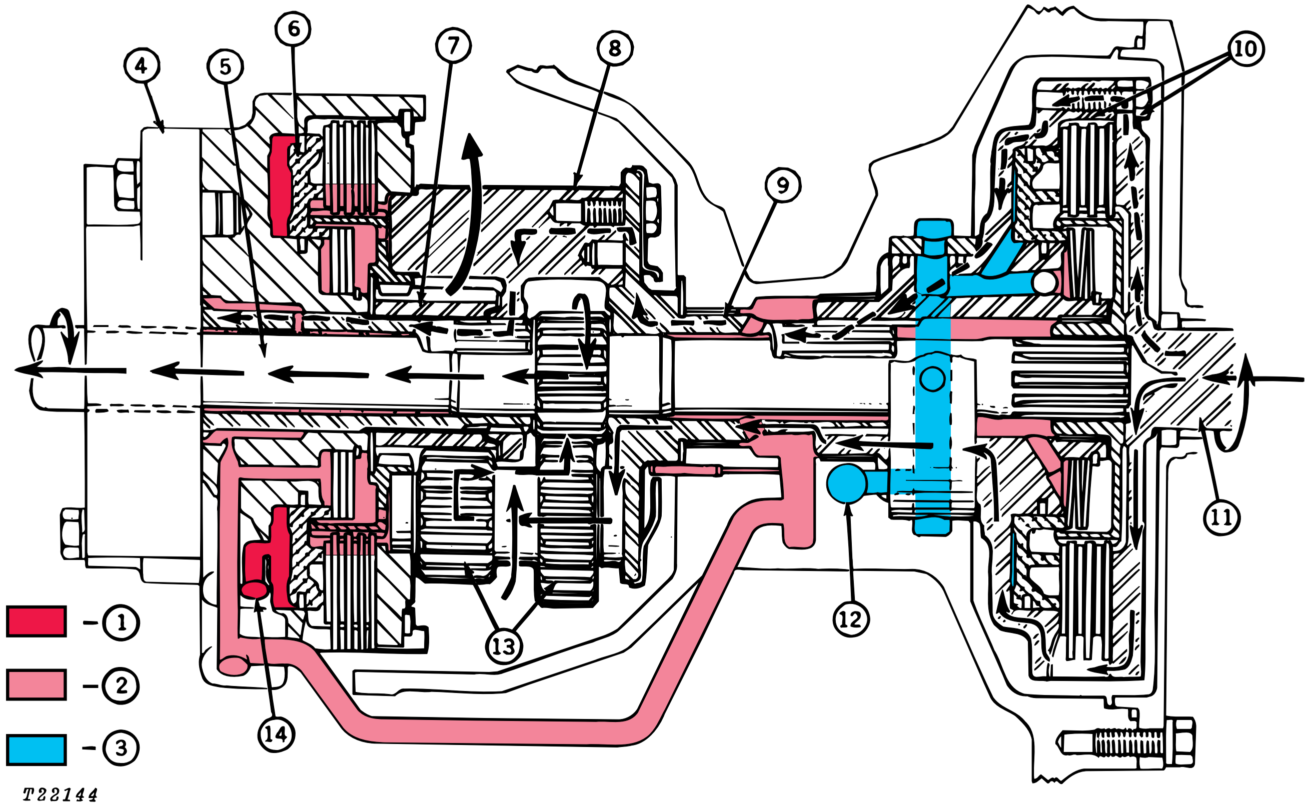
Engine flywheel rotation turns the clutch drive shaft and drum assembly as shown by arrows. Separator plates locked to the clutch drum rotate within the clutch disks splined to the clutch hub. The clutch hub is splined to the clutch shaft (transmission input shaft).

When the reverser control lever is moved to forward drive, pressure oil is sent to pressurize the forward clutch, moving the separator plates and disks together and forming a solid unit. The clutch hub is now rotating the clutch shaft. At the same time, oil in the reverse brake is "dumped" back to the clutch control valve, releasing the reverse brake.

The engaged clutch moves the clutch release springs away from a drilled passage in the clutch drum to admit lube oil to the clutch pack for cooling and lubrication. Thus, only an engaged clutch receives lube oil.

Depressing the clutch pedal blocks the flow of pressure oil to the forward (engaged) clutch and allows oil in the forward clutch piston to "dump" to sump, disengaging the clutch. The clutch piston spring washer pack blocks lubrication oil from the forward clutch as the clutch piston is disengaged. At the same time the lubrication oil reduction valve reduces lubrication oil pressure to prevent clutch drag.

Reverse Drive



1—Pressure Oil
2—Lube Oil
3—Return Oil
4—Transmission Oil Pump
5—Clutch Shaft
6—Reverse Brake Pinion
7—Planet Sun Pinion (braked)
8—Planet Pinion Carrier
9—Planet Pinion Carrier Shaft
10—Forward Clutch Assembly
11—Clutch Drive Shaft
12—Return Oil to Sump
13—Planet Pinion
14—Pressure Oil Inlet from Shift Valve

Fig. 13-Reverser Unit in Reverse Drive

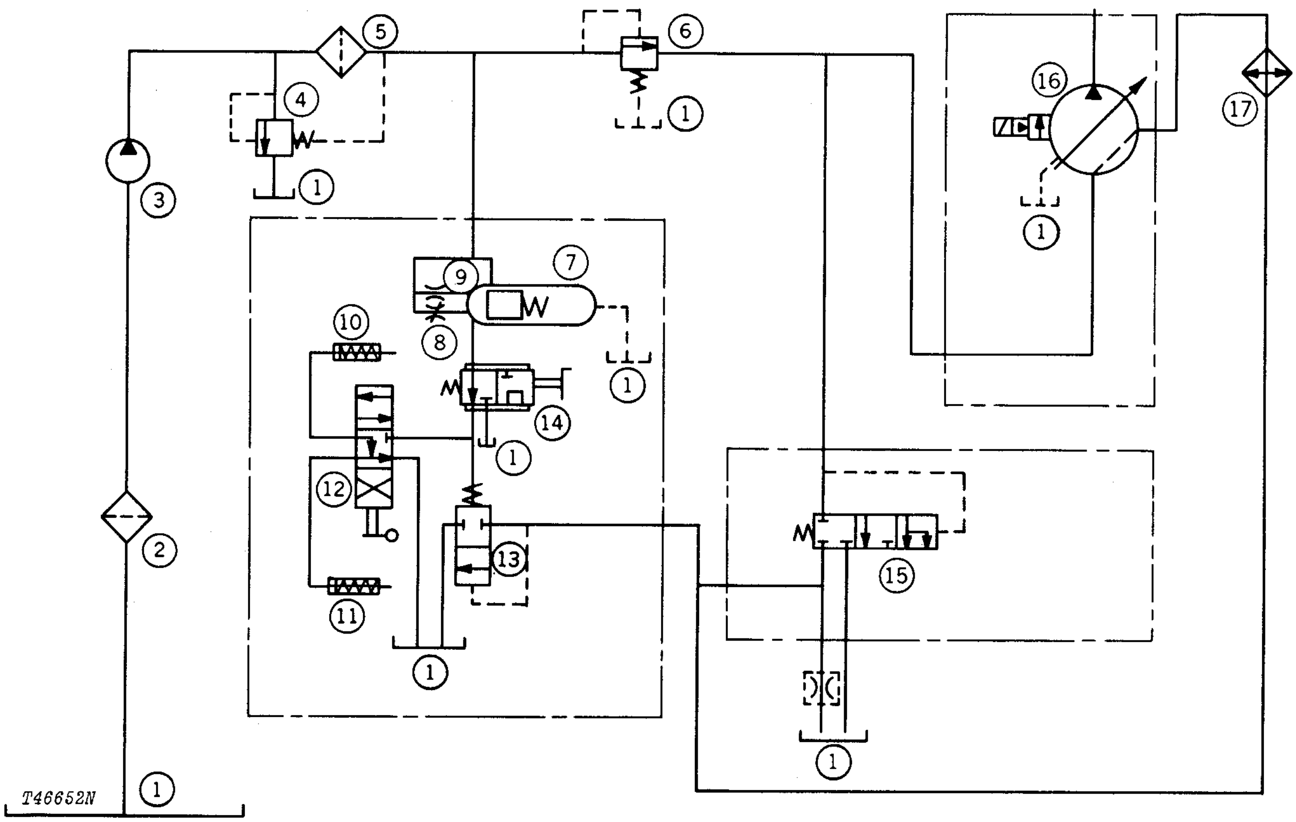
When the reverse brake is in the disengaged position engine power is transmitted to the reverse brake assembly by the forward clutch drum as shown by arrows. The planet pinion carrier shaft is splined to the forward clutch drum and rotates the planet pinion carrier and planet pinions. The planet pinion (meshed to the clutch shaft gear) and the planet sun pinion rotate with the carrier without turning on their own axes.

Moving the reverser control lever rearward to the reverse drive position sends pressure oil to pressurize the reverse brake. The brake plates are locked to the reverse brake housing and the brake disks and hub are as one unit. With the brake applied, the brake disks are stopped, restraining the clutch hub and planet sun pinion. At the same time the forward clutch piston is released.

With the planet sun pinion restrained, the planet pinions are forced to rotate at a specific speed and turn the clutch shaft in a reverse direction from that of the engine. The transmission is now driven in a reverse direction.

The engaged piston moves a spring washer away from the lubrication oil entry opening to the reverse brake pack, providing oil for lubrication and cooling.

Depressing the clutch pedal blocks the flow of pressure oil to the reverse brake (engaged clutch) and allows oil pressurizing the brake piston to "dump" to sump, disengaging the brake. The brake spring washer pack blocks lubrication oil from the reverse brake as the brake piston is disengaged. At the same time the lubrication oil reduction valve reduces lubrication oil pressure to prevent brake drag.



1—Transmission Reservoir
2—20 Mesh Strainer
3—Transmission Oil Pump
4—Filter Relief Valve
5—Transmission Filter
6—Pressure Regulating Valve
7—Accumulator
8—Adjustable Charging Orifice
9—Fixed Charging Orifice
10—Clutch Pack
11—Brake Pack
12—Shift Valve
13—Lube Relief Valve
14—Clutch Control Valve
15—Oil Cooler Bypass and Charge Relief Valve
16—Main Hydraulic Pump with Stroke Control Valve
17—Oil Cooler

Fig. 14-Transmission Hydraulic Schematic

DIAGNOSING MALFUNCTIONS

Shifts Too Slowly

1. Accumulator charging orifice screw in too far. Adjust charging orifice. See page 9025-27.

2. Low system pressure due to a stuck or damaged pressure regulating valve or weakened pressure regulating valve spring. Adjust pressure by adding shims behind pressure regulating valve spring as described under "Pressure Regulating Valve Adjustment."

If low pressure occurs on the forward or reverser shift but not on both, the difficulty could be caused by excessive leakage in the circuit to the respective clutch or brake.

3. Broken accumulator spring. This would be indicated by a delay and then a jerky engagement.

Shifts Too Fast

1. Accumulator charging orifice out too far. Adjust charging orifice. See page 9025-27.

2. Stuck accumulator piston. Remove and replace piston. Use caution when removing piston.

Jumpy Clutch Engagement When Inching Unit

When this type of clutch engagement is observed the first check should be a pressure check. Connect a pressure gauge to either the forward or reverse pressure tap as described under "Clutch Control Valve Test" and observe pressure readings as clutch pedal is released. Clutch or brake pressure should rise smoothly in an increasing rate.

Deviations from the specified pressure may be caused by the following:

1. Sticking clutch control valve.
2. Broken clutch control valve spring.

DIAGNOSING MALFUNCTIONS—Continued

Clutch or Brake Slips Under Load

Check clutch pressure as described under "Clutch Control Valve Test".

Perform "Engine Stall Test" as follows:

1. With engine running, engage the clutch pedal with the reverser lever in the forward position until the unit moves.

2. Depress the clutch pedal, lock the brakes, place the transmission in 8th gear, run the engine at fast idle and engage the clutch. The engine must stall in a maximum of 5 seconds after the clutch pedal is released.

3. Repeat the stall with the reverser lever in the reverse position and the transmission in the 4th gear.

If the 5-second maximum stall test cannot be achieved, the reverser system pressure should be raised to specifications until the test can be satisfied. A requirement for pressures higher than specified indicates a malfunction in the reverser clutches.

Also perform the ENGINE STALL TEST after servicing any components in the reverser assembly.

Transmission Gears Fail to Stop When Clutch Pedal Is Depressed

1. Incorrect clutch pedal adjustment. Adjust as described under CLUTCH CONTROL VALVE TEST. Be sure clutch pressure goes to zero when pedal is depressed.

2. Check for warped clutch disks or broken clutch piston return spring washers if this occurs in only forward or reverse and not in both.

3. If this condition occurs in both forward and reverse, and clutch pressure returns to zero when clutch pedal is depressed, check the transmission snubber brake.

If transmission snubber brake is not the cause of difficulty, "tee" a pressure gauge into the cooler return line and check operation of lubrication oil pressure reduction valve with engine at fast idle. When clutch pedal is depressed, pressure gauge should reflect specified lubrication oil pressure.

VISUAL INSPECTION

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

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

Check all oil lines, hoses, and connections for leaks. Oil leaks in the pressure side of the system can be located by carefully inspecting the external area of the connections and fittings.

Check the suction side of the system for leaks by examining the oil in the transmission reservoir. If air is being drawn into the system, the oil will contain air bubbles and appear foamy.

Inspect all tubing. Defective tubing can cause oil foaming, heat, and transmission pump failure. Replace damaged tubing immediately.

Check the type of oil being used in the transmission.

Low oil level or wrong type of oil can cause overheating, slow shifting and failure of clutches, gears and bearings due to improper lubrication.

Check to see when the transmission filter was last changed.

Also check the intervals at which the filters must be changed. If the filter continually becomes clogged or obstructed at intervals which are much less than those specified, chances are that a failure is in progress. By inspecting the deposits within the filter, the area from which the metal filings are coming can be determined.

Inspect transmission lines for leaks or kinks which can reduce the volume of oil available to engage the various clutches.

Check for a leak in any of the cast housings.

Check all hydraulic lines. Pinched or kinked lines will restrict flow through the hydraulic system.

Inspect all pressurized hydraulic lines and connections for leaks. Tighten fittings or replace as necessary.

Operate the machine and see for yourself how the machine operates. There could be some condition that might aid you in isolating the problem.

TEST AND ADJUSTMENT

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

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

Reverser System Pressure Test

Remove the reverser system pressure test plug (2, Fig. 16).

Install D-15 3/8" - 24 JIC x 7/16 20 JIC fitting into test port.

Connect D-19 hose and a 0 - 600 psi (0 - 41 bar) (0 - 42 kg/cm²) pressure gauge to the D-15 fitting.

With the clutch pedal in the engaged position, the reverser system pressure should be 155 to 165 psi (11 to 12 bar) (11 to 12 kg/cm²) at engine high idle with 100°F (38°C) oil.

If the system pressure is too high or low, remove the plug in the front cover (1, Fig. 16). Add or deduct shims to adjust system pressure.

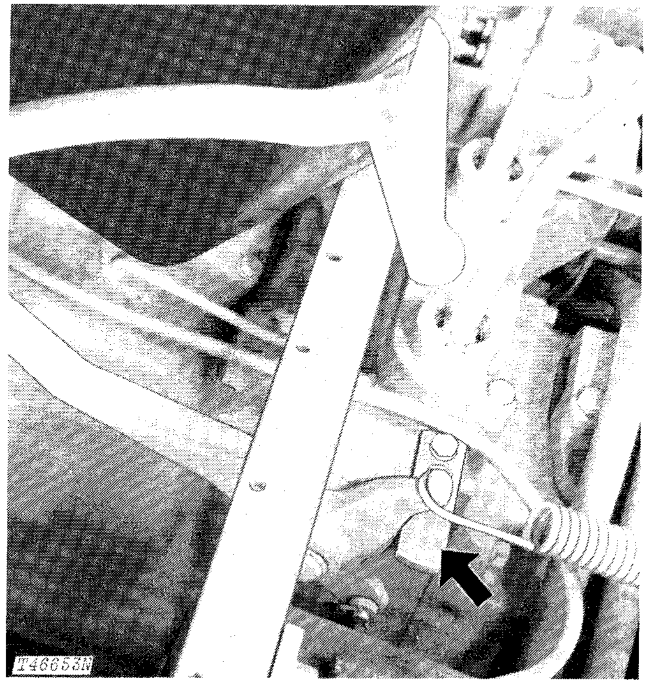
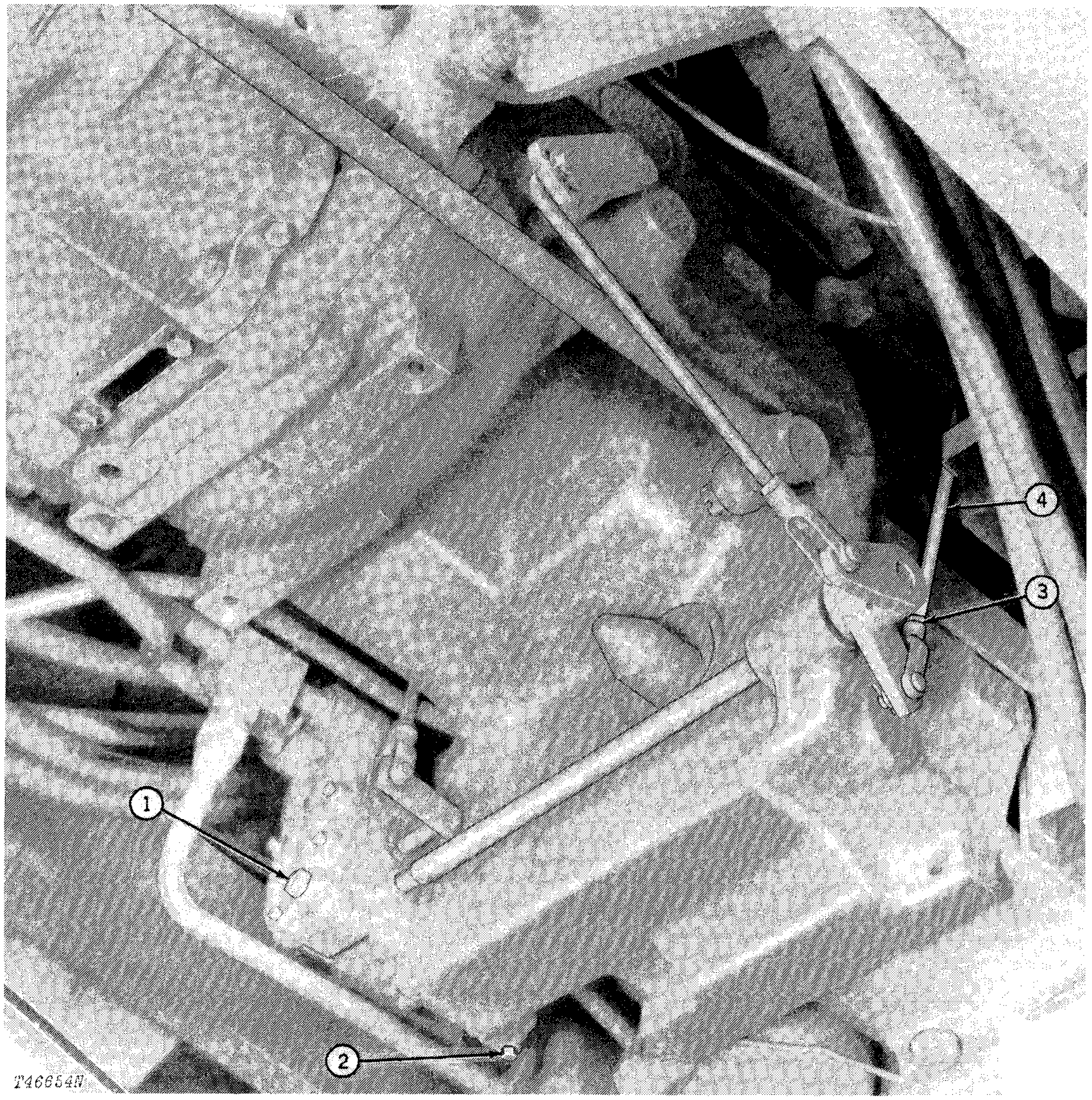


Fig. 15-Clutch Pedal Stop

Clutch Valve Test

The clutch control valve test follows the system pressure test. (Be sure the reverser system pressure is correct and the engine disconnect clutch is correctly adjusted for wear before checking the clutch control valve.) With the clutch pedal against the platform ramp (engaged position), adjust the clutch pedal stop (Fig. 15) to contact the pedal.

With the engine running at high idle, check the pressure reading in the neutral position. The reading should be equal to the reverser system pressure. Then check and record the pressure in the forward and reverse position. These pressure readings should be equal to each other and to the system pressure. If they are not equal to each other, it indicates leaking clutch packs or internal lines to the clutch.



1—Pressure Regulating Plug
2—Reverser System Pressure Test Plug
3—Jam Nut
4—Upper Clutch Control Rod

Fig. 16-Reverser Control Linkage

Clutch Control Valve Adjustment

Operate the engine rpm override.

With the engine running at 2500 rpm, and the clutch pedal against the platform stop, adjust the upper clutch control rod to obtain 130 psi (9 bar) (9 kg/cm²) at the clutch pressure test plug (3, Fig. 17). Then lengthen the upper control rod by three full turns of the yoke and retighten the jam nut.

Recheck the pressure in the forward (3, Fig. 17) and reverse (2) position. It should be equal to the system pressure or be in the specified pressure range of 155 to 165 psi (10.7 to 11.4 bar) (11 to 12 kg/cm²) with 100°F (38°C) oil.

If the pressure readings still are not equal in forward or reverse, then check for excessive oil leakage in the oil circuit. When the clutch pedal is depressed, the pressure reading should fall to zero.

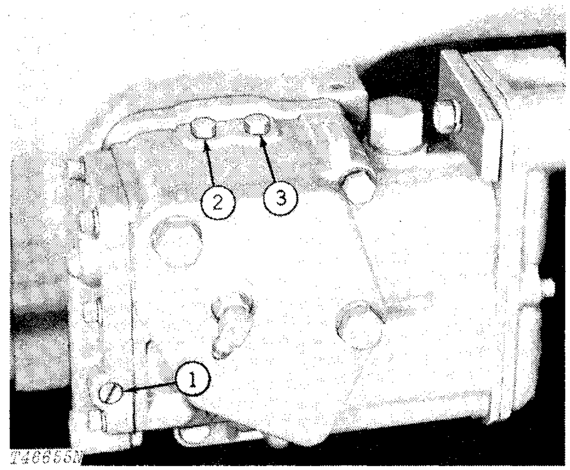
As the pedal is released, the pressure should increase smoothly to 130 psi (9 bar) (9 kg/cm²), then rapidly to full system pressure.

If the clutch control valve pressure does not respond this way, then the clutch valve is sticking or the spring is broken.

Rate-of-Shift Adjustment

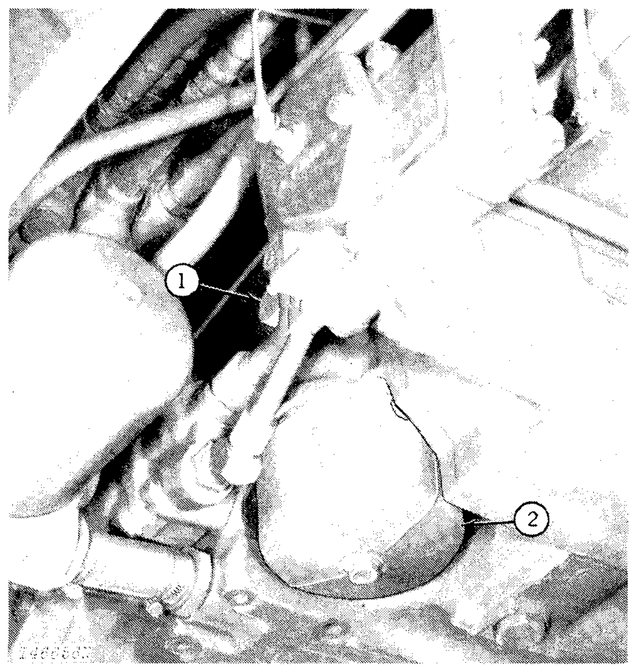
The rate-of-shift may be changed to accommodate the working conditions. The reverser should shift as fast as possible without being jerky. The rate-of-shift is adjusted by turning the adjustable orifice screw in to slow down the shift time or out to speed up the shift time.

The recommended shift time is 3/4 to 1-1/4 seconds. Generally speaking, those tractors operating under heavier loads need a faster rate-of-shift time than those operating under light loads. When making an adjustment only turn the screw 1/4 of a turn at a time until the desired rate (speed) of shift is obtained.



1—Rate of Shift Adjusting Screw
2—Brake Pressure Test Plug
3—Clutch Pressure Test Plug

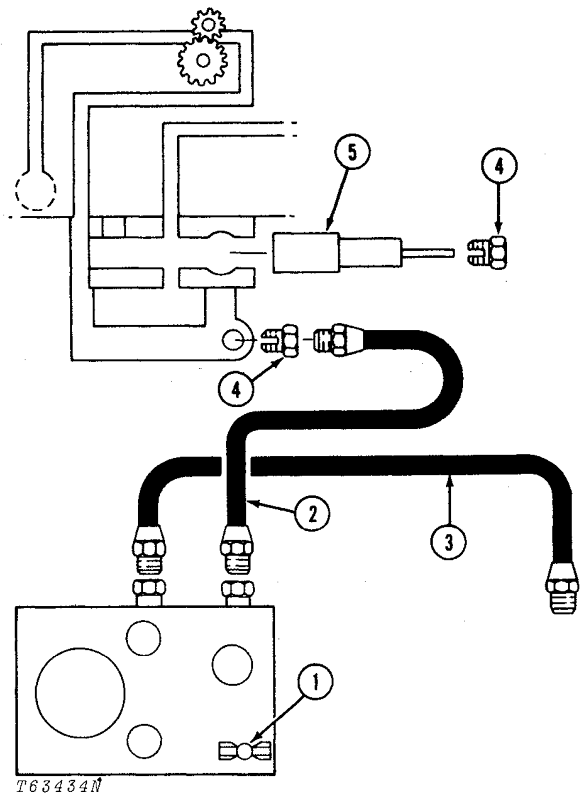
Fig. 17-Rate of Shift Adjusting Screw



1—Transmission Oil Filter Relief Valve Plug
2—Transmission Oil Filter

Fig. 18-Transmission Oil Filter Location

Transmission Oil Pump Flow Test



1—Pressure Loading Valve Handle
2—Tester Inlet Hose
3—Tester Outlet Hose (to trans. filler neck)
4—D-89 Fitting
5—Dummy Filter Relief Valve Spool

Fig. 19-Transmission Oil Pump Test Using OTC Hydraulic Tester

Remove transmission oil filter (2, Fig. 18).

Remove transmission oil filter relief valve plug (1, Fig. 18).

Remove oil filter relief valve cartridge.

Install dummy filter relief valve plug (5, Fig. 19) (6, Fig. 20).

Connect hydraulic tester as shown in Figs. 19 and 20.

NOTE: If transmission dummy filter leaks you will have to grind a step back on dummy filter cover to allow it to seat better. See page 9025A-18 for more information.

Open hydraulic tester pressure loading valve, start engine and adjust to 2200 rpm.

Close pressure loading handle (1, Fig. 19) (1, Fig. 20) until you reach 150 psi (10 bar) (11 kg/cm²).

Minimum acceptable pump flow is 10.5 gpm (40 l/min).

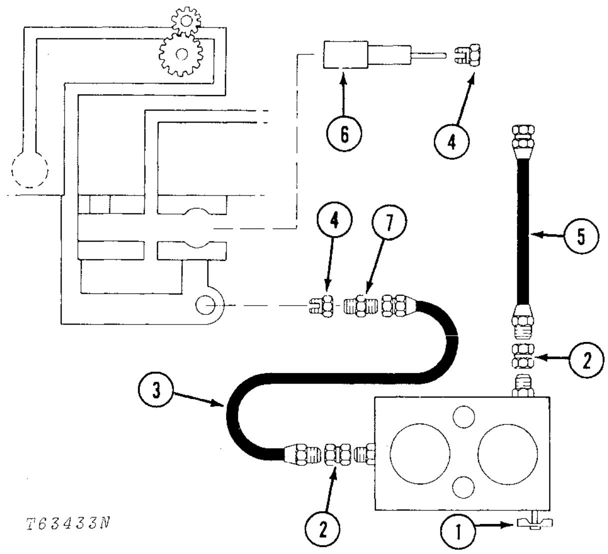
NOTE: JD293 transmission kit contains all the parts required to install the dummy filter and the dummy filter relief valve plug.

Test Diagnosis

If pump flow is to specifications, but pressure is low, check the pressure regulating valve for malfunction.

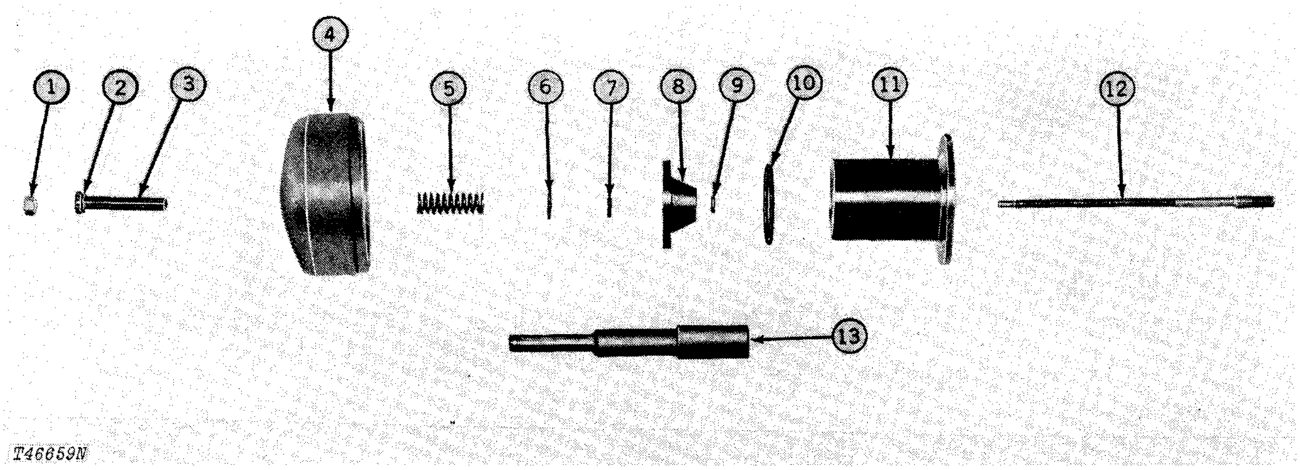
If the pressure is to specifications but the pump flow is low, check for (1) plugged transmission pump inlet screen (2) faulty transmission filter relief valve (3) worn transmission pump.

To check the filter relief valve install dummy filter but not relief valve plug. Establish pump flow and pressure. Raise the pressure with the tester loading valve until flow drops off. The filter relief valve should open at 50 psi (3 bar) (4 kg/cm²).



1—Pressure Loading Valve Handle
2—D-96
3—D-91 Tester Inlet Hose
4—D-89
5—D-91 Tester Outlet Hose (to trans filler neck)
6—Dummy Filter Relief Valve Spool
7—D-88

Fig. 20-Transmission Oil Pump Test Using Nuday Hydraulic Tester



1—Nut
2—O-Ring
3—Spring Retainer Sleeve
4—Cover
5—Spring
6—Washer
7—O-Ring
8—Retainer
9—Retaining Ring
10—O-Ring
11—Dummy Filter
12—Special Bolt
13—Oil Filter Relief Valve Plug

Fig. 21-Parts for Installing Dummy Filter

MAIN HYDRAULIC SYSTEM

MAIN HYDRAULIC PUMP

General Information

The pump is of the variable-displacement, pressure compensated, piston type. The pump is located below the engine coolant radiator and is driven directly by the engine crankshaft.

The main pump works together with the stroke control valve to supply oil as required to the components in the hydraulic system.

The pump is equipped with a pilot-operated poppet-type solenoid valve located in the hydraulic pump stroke control valve housing. The solenoid is normally closed and is electrically opened during engine cranking to bypass discharge oil directly to the pump crankcase.

The solenoid is replaced as a cartridge and is not field adjustable. Any attempt to adjust the solenoid will damage it.

To determine if the solenoid is affecting pump test flows, the solenoid may be replaced with a special plug. To test the solenoid refer to the Electrical Section, Group 9015.

When pumping at full stroke, pump will put out the full volume of oil, except leakage used for lubrication, each drive shaft revolution; but as the pump is of the "variable displacement" type it can change its output from full output to zero or to any value in between. The pump has a stroke control valve assembly which is the "pressure compensator." This stroke control valve senses system pressure and hydraulically changes the pump displacement (output).

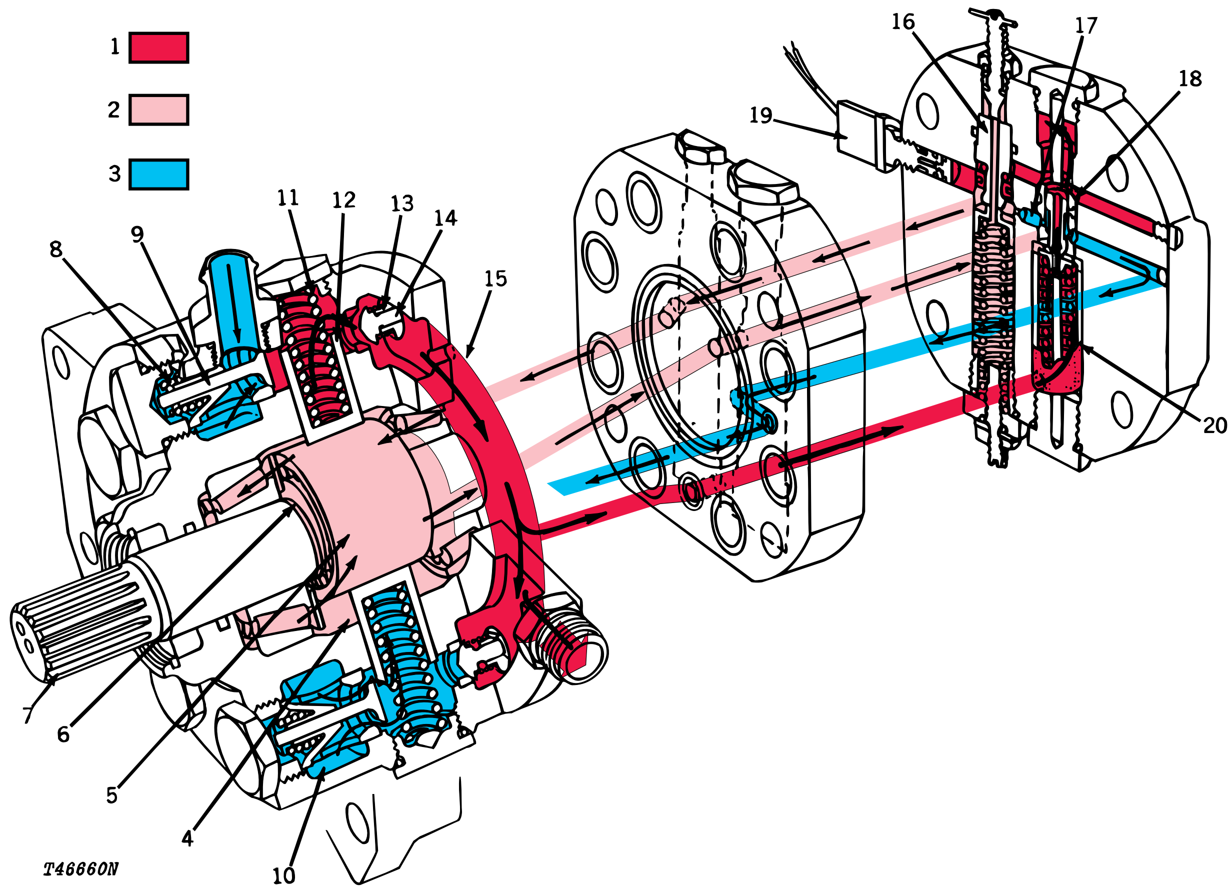
The pump contains eight pistons located radially around the center of the housings. The pistons are precision machine parts and must be returned to the respective bores upon reassembly. They are loaded against the cam with closely matched coil springs and retained with a plug. An O-ring on each plug seals the piston bores.

The inlet valves are located around the pump - one for each piston. The valve assemblies are a press fit into the valve bores. This press fit seals the outside of the valve assembly and stops leakage.

The valve assembly consists of a valve, valve body, valve guide, spring and spring retainer. Valve assemblies cannot be disassembled. The end of the valve is swaged for spring retension.

The rear of the pump is sealed with the stroke control valve housing. Square packings seal the discharge valves and stroke control valve oil passages. A shim pack located in the counterbore of the stroke control valve housing provides proper bearing adjustment. An O-ring in the counterbore seals the crankcase area.

The outlet valves (or discharge valves) are "slip fit" into their bores around the housing. Each outlet valve assembly consists of a valve disk, spring, valve guide, and an outlet valve stop. The center portion of the valve disk contacts the valve seat. The valve seat has an edge which allows the valve disk to contact it, but not the valve guide tangs. The valve seat is a press fit into the bottom of outlet valve bores of the pump housing.



1—Pressure Oil
2—Low Pressure Oil
3—Return Oil
4—Pump Crankcase
5—Race
6—Cam
7—Pump Shaft
8—Inlet Valve Spring
9—Inlet Valve
10—Inlet Gallery
11—Piston Spring
12—Piston
13—Discharge Valve Spring
14—Discharge Valve
15—Outlet Gallery
16—Stroke Control Valve
17—Bleed Hole
18—Crankcase Outlet Valve
19—Stroke Control Valve Solenoid
20—Crankcase Outlet Valve Spring

Fig. 22-Oil Flow Through Pump (3.0 cubic inch [49 cm³] illustrated)

Tapered roller bearings at each end of the pump shaft support the shaft assembly. Bearing cups pressed into the pump crankcase support the tapered bearings.

Roller bearings under the cam race support the race on the cam. Bronze thrust washers on each end of the cam race carry any side loads and center the cam race.

The stroke control valve housing has two sections. The stroke control valve section allows oil into the crankcase which destrokes the pump. The crankcase outlet valve (located in the stroke control valve housing) opens and dumps the pump crankcase to allow the pump to go quickly back into full stroke.

Operation

Return oil from the hydraulic system enters the hydraulic reservoir. The transmission pump pumps oil to the inlet gallery of the main hydraulic pump. The inlet gallery is a cored passage around the front of the pump. The inlet valves pass through the gallery and receive oil through the drilled holes in the valve bodies.

The pump crankcase (area around bearings on drive shaft) is full of oil at all times. A sealing ring on the pump shaft seals against the moderate oil pressure in the crankcase. A lip seal on the pump shaft stops oil leakage past the seal ring from going to the outside of the pump. Any oil leaking by the seal ring is routed back to the sump through a bleed passage drilled between the two seals.

As the drive shaft rotates, the springs force the pistons to follow the cam giving a pumping action. A piston on an inward stroke creates a partial vacuum. This vacuum plus charge pressure opens the inlet valve and the piston fills with oil. When the piston is full of oil and the partial vacuum is eliminated inlet valve oil, which is forced out of the pistons by the cam, opens the outlet valves. This oil enters the outlet gallery, travels around the rear of the pump, and enters the hydraulic system.

We make this pump a variable displacement type by adding a stroke control valve and a crankcase outlet valve. These parts are in the stroke control valve assembly and have four connections to the pump. High pressure oil from the discharge gallery is connected to the stroke control valve. Oil in the crankcase is connected to the outlet valve. When the pump is in full stroke, crankcase oil is also connected to the inlet gallery through the outlet sleeve. The fourth connection is between the crankcase and the crankcase bleed orifice which is also connected to the inlet gallery. When the pump is in full stroke, the crankcase pressure and charge pressure are the same.

When the pump is at standby (destroke) the pump has quit pumping except for the oil needed to maintain system and crankcase pressure. The stroke control valve destrokes the pump by admitting oil to the pump crankcase. Enough oil goes into the crankcase to raise the crankcase oil pressure and hold the pistons away from the cam.

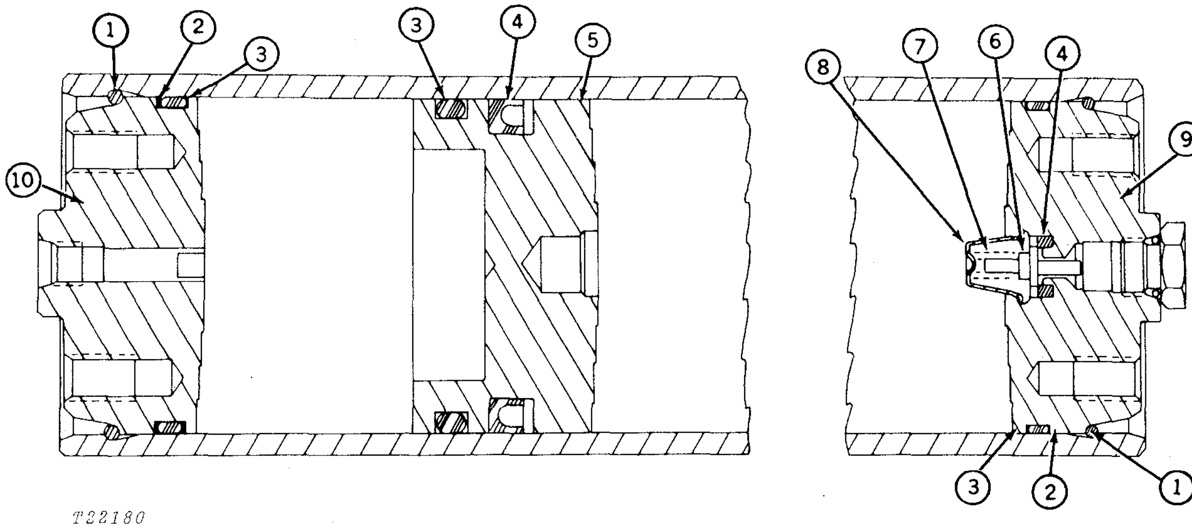
Pressure in the crankcase goes only high enough to overcome the piston spring force. Since oil cannot be compressed, the pressure of the oil in the piston drops to charge pressure as soon as the cam leaves the piston. We can say that charge pressure has no effect on the pressure needed to hold the pistons away from the cam since the pressure is the same on both sides of the piston.

The stroke control valve senses the system pressure and regulates the pressure in the crankcase. This pressure overcomes the pump piston spring force. Since the piston spring rate increases as they are compressed, the crankcase pressure determines how far the pistons are held away from the cam. The lower the crankcase pressure, the longer the piston stroke; and the higher the crankcase pressure, the shorter the piston stroke.

FOS

See "Radial Piston Pumps" in FOS Manual—"HYDRAULICS" for additional description and theory of operation.

ACCUMULATOR



1—Retainer Ring
2—Backup Ring
3—O-Ring
4—Packing
5—Piston
6—Gas Valve
7—Spring
8—Spring Guide
9—Cylinder End
10—Cap

Fig. 23-Hydraulic Oil Accumulator

GENERAL INFORMATION

The rear part of the accumulator is precharged with dry nitrogen to a specified pressure and the front part is filled with hydraulic oil from the main pump. A floating piston in the accumulator keeps the nitrogen and hydraulic oil from mixing.

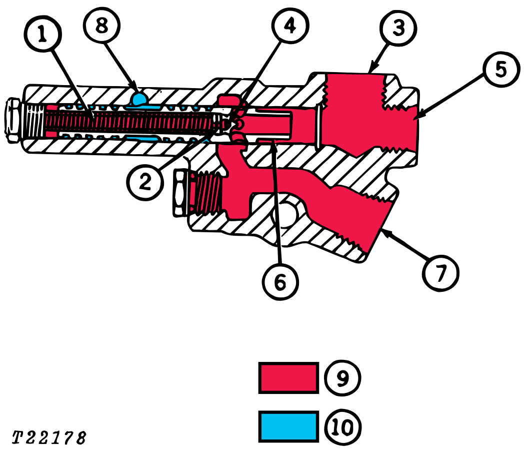
Hydraulic oil is admitted to the accumulator at a pressure exceeding that of the precharged gas, causing the piston to move back until main pump standby pressure is reached on both sides of the piston.

The accumulator acts as a buffer to greatly reduce surge pressures developed in the system when the cylinders of either a loader or backhoe reach the end of their stroke, or when the control lever is moved to neutral.

PRESSURE CONTROL VALVE

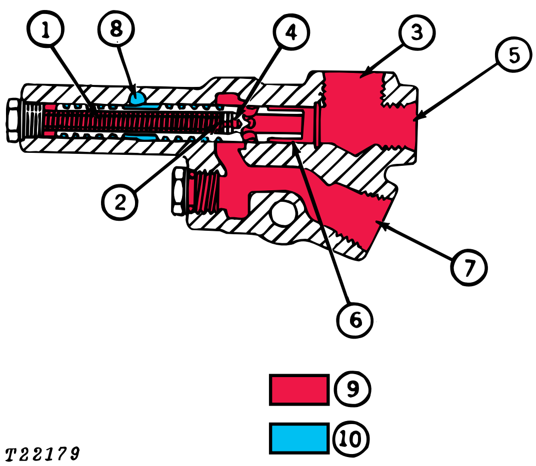
GENERAL INFORMATION

Above 1250 to 1350 psi (86 to 93 bar) (88 to 95 kg/cm²)



T22178

Below 1250 to 1350 psi (86 to 93 bar) (88 to 95 kg/cm²)



T22179

1—Pressure Control Valve Spring
2—Shims
3—Outlet to Backhoe Valve
4—Orifice
5—Pressure Oil Inlet
6—Pressure Control Valve
7—Outlet to Loader Valve
8—Bleed Passage to Transmission Reservoir
9—Pressure Oil
10—Return Oil

Fig. 24-Positions of Pressure Control Valves

The pressure control valve maintains pressure oil to steering and brakes regardless of demands made by the loader function (see Fig. 24).

When the hydraulic system is in "standby," oil flows through the pressure control orifice, equalizing pressure on both sides of the valve. The oil leakage past the valve is returned to the low pressure side of the system via the bleed port. The bleed port is incorporated to prevent hydraulic lock in the valve.

When the loader is used, a pressure differential allows the valve spring to move the valve forward. Pressure oil is then directed to the steering valve port and restricted at the hydraulic function port. When the main pump rebuilds to operating pressure, the valve moves rearward and all functions are equally pressurized.

FOS — Refer to "Hydraulic Valves" in FOS Manual, "HYDRAULICS" for additional description and theory of operation.

HYDRAULIC CYLINDERS

GENERAL INFORMATION

The hydraulic cylinders used for loader and backhoe functions are double acting with V-packings. Piston pins are heat treated, chrome plated and polished. Replaceable non-metallic wear rings are used on the piston retainers to prevent scoring of the cylinder barrels.

The backhoe crowd, boom, and swing cylinders are hydraulically cushioned. This prevents harsh stops when the cylinder reaches the end of its stroke.

FOS — See "Hydraulic Cylinders" in FOS Manual "HYDRAULICS" for additional information on cylinders and an explanation of the hydraulic cushion design.

POWER STEERING

GENERAL INFORMATION

The steering valve consists of a rotary spool and sleeve assembly located inside the valve housing with a gerotor at the end of the assembly.

Refer to Figs. 25 and 26 and study the following before attempting to diagnose steering difficulties.

Neutral Position

Whenever the steering wheel is not moving, the steering valve assumes the neutral position. In this position the spool and sleeve are lined up in such a way that oil flow through the valve is blocked. Oil can neither flow from the pump through the valve nor can it flow from the steering cylinder through the valve.

Left-Hand Turn (Fig. 25)

As the steering wheel is turned to the left, the spool is turned by means of its direct connection to the steering shaft. This movement aligns the spool passages with the sleeve ports and pressure oil begins to flow in the valve.

The oil flows through the sleeve, into spool passages, and back out of the sleeve into the valve housing. The passages in the housing direct oil to one side of the gerotor moving the gerotor gear. As the gear is rotated it performs the following functions:

1. It forces oil out of the gerotor into outlet passages in the housing, back through the sleeve and spool, and out the left outlet port (marked "L").

This oil is directed to the rod end of the steering cylinder. Return oil from the cylinder is forced back through the valve and out to the sump.

2. The rotation of the gerotor gear also turns the gerotor drive which is connected to and turns the valve sleeve.

When rotation of the steering wheel stops, the gerotor gear continues to move turning the valve sleeve until the sleeve is in the correct relationship with the spool to stop the flow of oil to the gerotor. At this point the valve is in the neutral position and will remain there until the steering wheel is again moved.

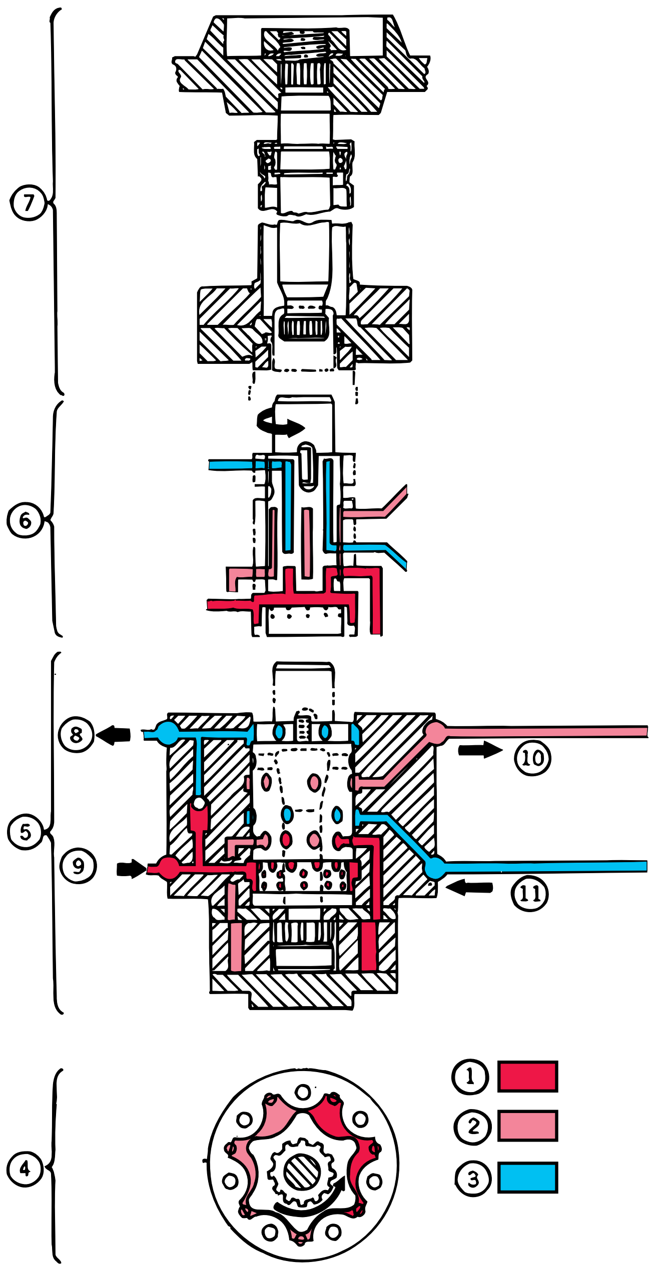
Right-Hand Turn (Fig. 26)

When the steering wheel is turned to the right, movement takes place in the valve which is similar to the movement occuring during a left-hand turn.

The movement of the spool, however, is in the opposite direction to a left turn and oil is routed through different ports and passages in the sleeve and spool, directing oil out the right outlet port (marked "R").

Manual Steering

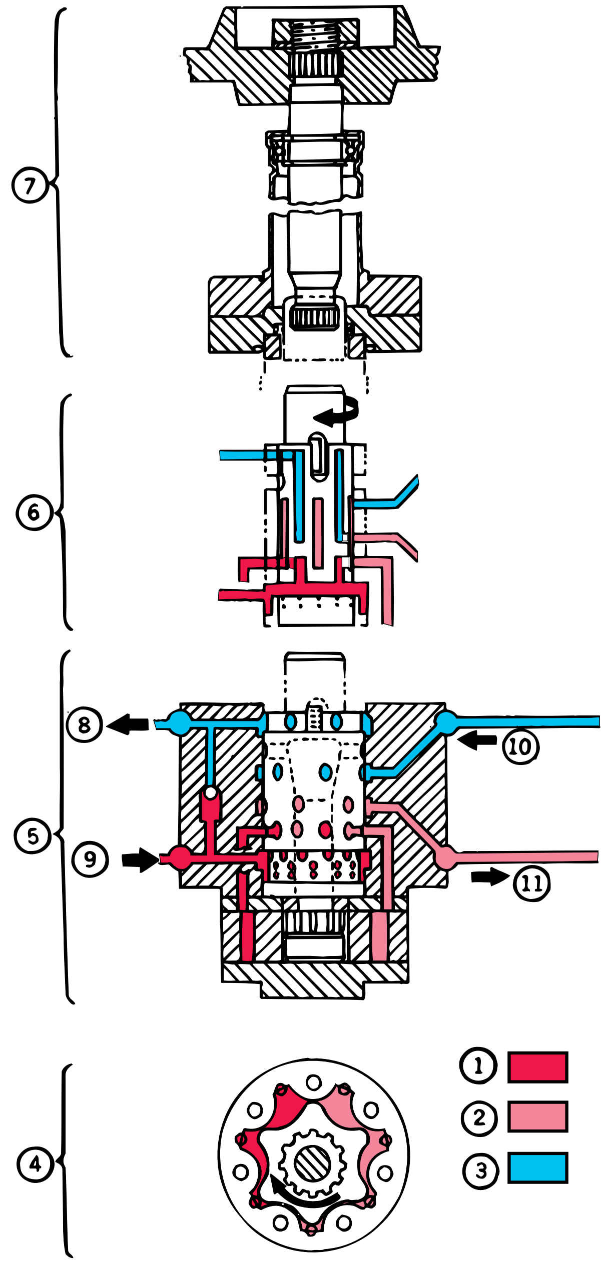
If there is no power to supply pressure oil to the valve, the unit can be steered manually. When the steering wheel is turned, the spool directs oil as described above. If no pressure oil is available, the spool will come into contact with the cross pin. The pin then provides a direct mechanical connection to the gerotor gear. As the gerotor is turned it pumps oil to the steering cylinder. Return oil from the cylinder is drawn through a check valve between the inlet and outlet ports to provide oil for manual steering operation. Thus the unit can be steered manually until the unit is brought to a stop.



T28611

1—Pump Pressure Oil
2—Steering Pressure Oil
3—Return Oil
4—Gerotor Assembly
5—Sleeve and Housing
6—Spool
7—Steering Column
8—Return to Transmission Sump
9—From Hydraulic Pump
10—To Cylinder
11—From Cylinder

Fig. 25-Power Steering - Left Turn

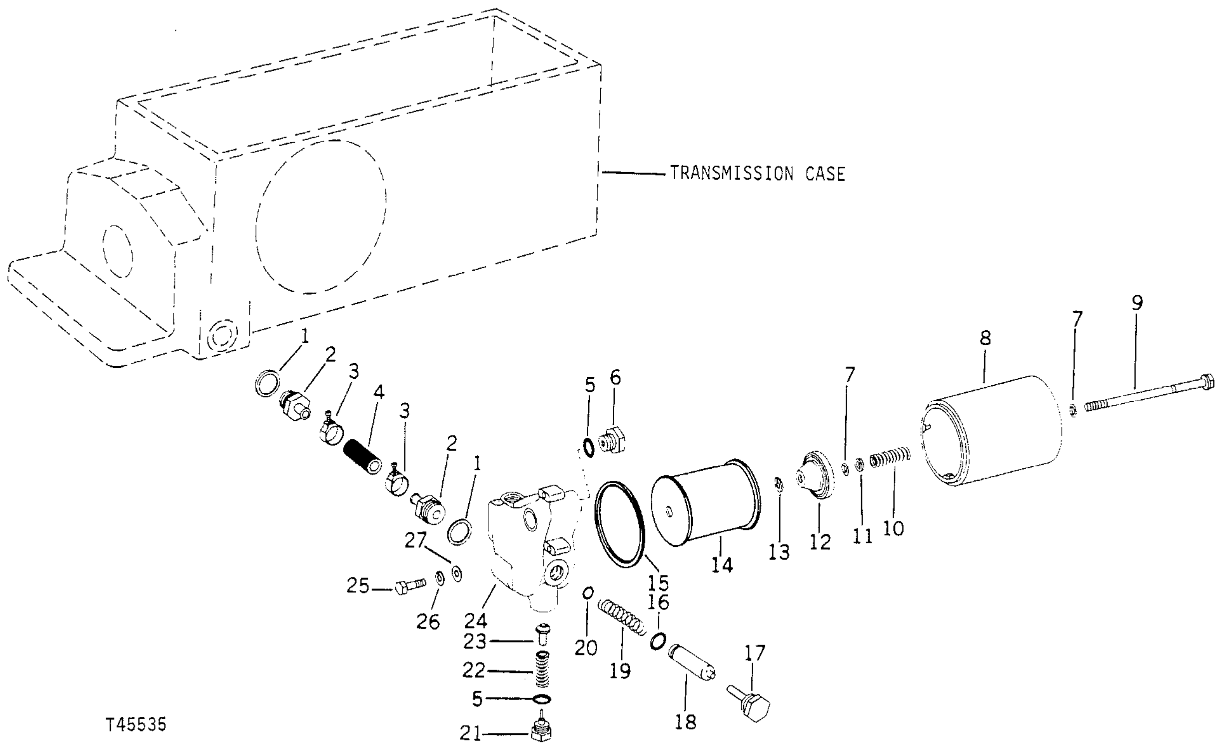


T28612

1—Pump Pressure Oil
2—Steering Pressure Oil
3—Return Oil
4—Gerotor Assembly
5—Sleeve and Housing
6—Spool
7—Steering Column
8—Return to Transmission Sump
9—From Hydraulic Pump
10—From Cylinder
11—To Cylinder

Fig. 26-Power Steering - Right Turn

HYDRAULIC OIL FILTER AND RELIEF VALVE



1—Special Washer (2 used)
2—Special Connector (2 used)
3—Hose Clamp (2 used)
4—Hose
5—O-Ring (3 used)
6—Relief Valve Inlet Port Plug (2 used)
7—Packing (2 used)
8—Oil Filter Cover
9—Special Screw
10—Spring
11—Washer
12—Oil Filter Element Retainer
13—Retainer Ring
14—Element
15—Filter Cover Packing
16—O-Ring
17—Pin with Plug
18—Filter Relief Valve
19—Spring
20—O-Ring
21—Guide with Plug
22—Relief Valve Spring
23—Surge Relief Valve
24—Relief Valve Housing
25—Cap Screw (2 used)
26—Lock Washer (2 used)
27—Washer (2 used)

Fig. 27-Hydraulic Oil Filter and Surge Relief Valves

GENERAL INFORMATION

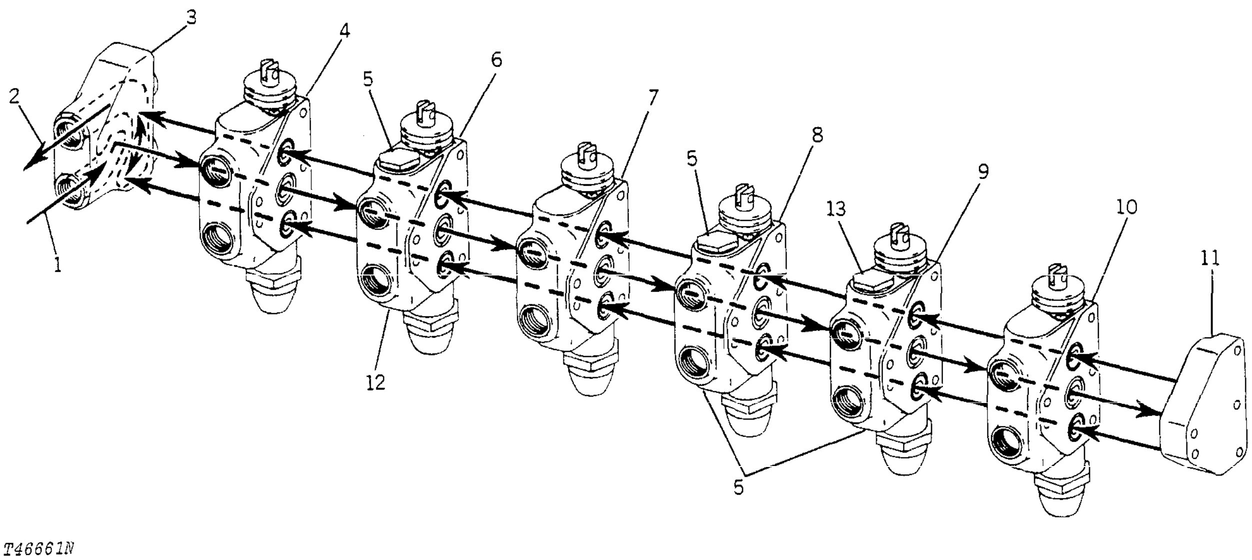
The hydraulic oil filter is incorporated into the loader and backhoe return oil circuits to filter the return oil and to route this oil directly to the inlet side of the main hydraulic pump so that the pump will not cavitate.

A surge relief valve is incorporated into the filter housing to protect the system from excessively high oil pressure. High pressure oil opening this valve will return directly to the transmission case.

An oil filter relief valve (actuated with a 50 psi [3 bar] [4 kg/cm^2] pressure differential) returns oil to sump when oil is heavy during warm-up or if the filter becomes clogged.

BACKHOE CONTROL VALVE (9405)

GENERAL INFORMATION



1—Pressure Oil
2—Return Oil
3—Port Plate
4—Stabilizer Valve
5—Relief Valve
6—Crowd Valve
7—Bucket Valve
8—Swing Valve
9—Boom Valve
10—Stabilizer Valve
11—End Plate
12—Plug
13—Relief Valve

Fig. 28-Oil Flow Through Backhoe Control Valve Stack

The backhoe hydraulic functions control valve is a closed-center, six spool, stack-type valve.

There is no continuous flow of oil through the closed-center control valve when the valve is in neutral. Because the main hydraulic pump delivers oil only on demand, oil flows through the control valve only when the control lever is moved.

Fig. 28 shows the flow of oil through the backhoe control valve with all valve sections in neutral. Note that the oil is blocked when it reaches the end plate.

Valve Construction

All valve sections are separate bodies containing single spools. All spools contain lift checks which serve as one-way valves to prevent drift or leakage of pressure oil to the port passages.

The crowd, boom, and swing sections each contain relief valves to protect their circuits from excessive pressures.

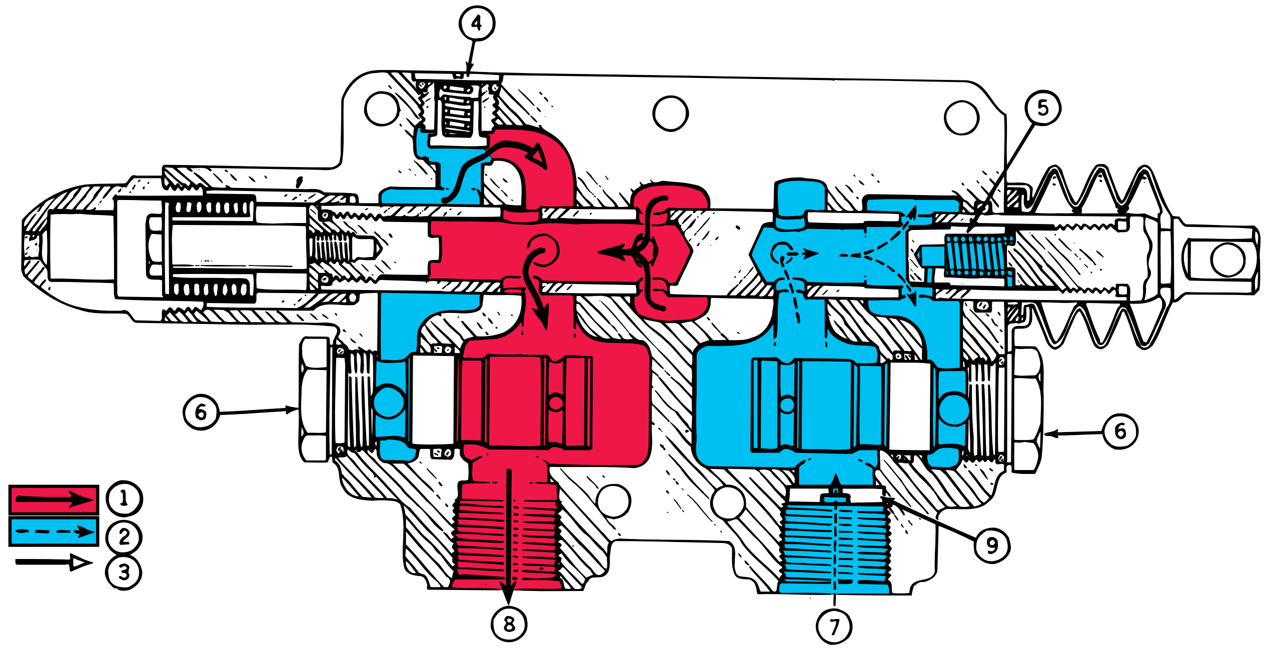
The crowd section contains one 2375 psi (164 bar) (167 kg/cm²) relief valve (5, Fig. 28).

The swing section contains two 2375 psi (164 bar) (167 kg/cm²) relief valves (5, Fig. 28).

The boom section contains one 2375 psi (164 bar) (167 kg/cm²) relief valve (5, Fig. 28).

The boom section also contains one 3500 psi (241 bar) (246 kg/cm²) relief valve (13, Fig. 28).

NOTE: The two bottom ports of the stabilizer and the top port of the boom control valves contain orifice plates. The orifice plates are installed with the slots out.



1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Oil
4—Anti-Cavitation Check Valve
5—Lift Check
6—Relief Valve
7—From Cylinder
8—To Cylinder
9—Orifice Plate

Fig. 29-Boom Section (Lowering Circuit Shown)

Figs. 29 and 30 illustrate the boom and swing valve. Although there are slight mechanical variations, oil flow through the other valve sections is similar.

Boom Section

When the boom spool is extended or retracted to lower or raise the boom, the pump moves oil to the control valve. Oil is then directed through the lift check to the boom cylinder.

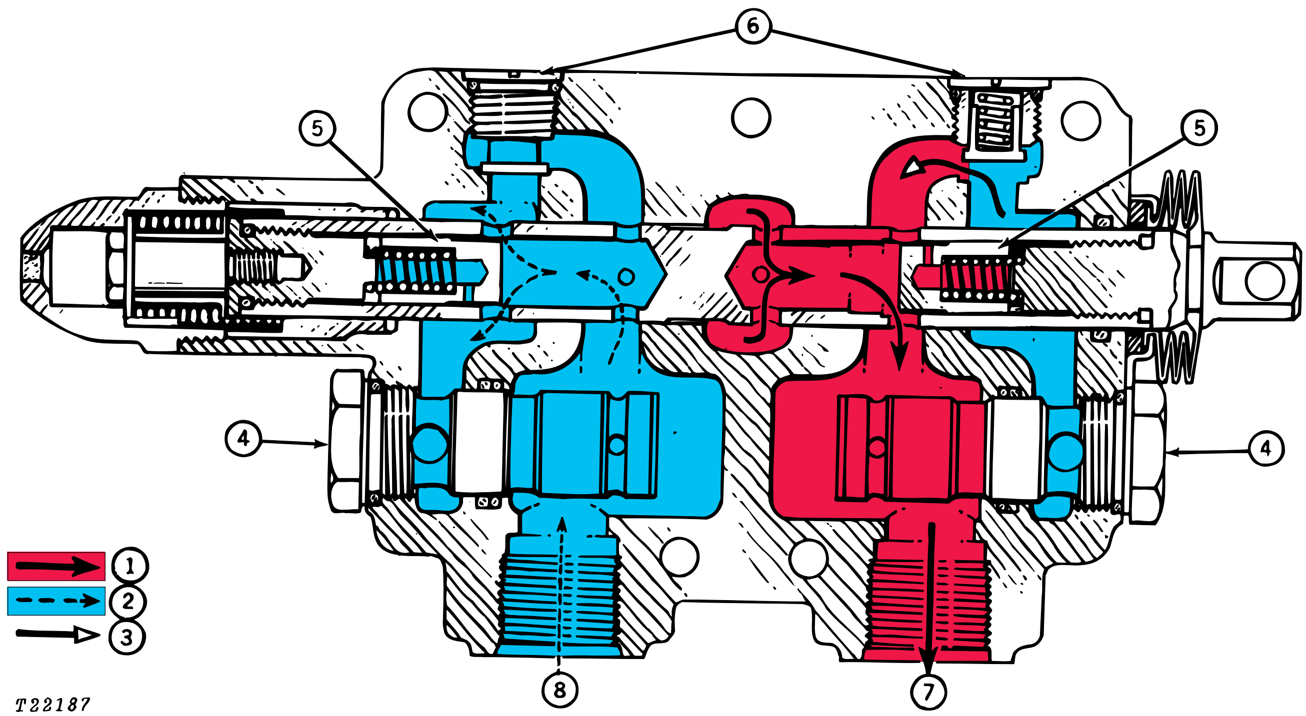
Displaced oil from the cylinder is forced back through the control valve to the reservoir. Note that if cavitation occurs, return oil flow through the anti-cavitation check valve is directed to the applied side of the boom valve.

Swing Section

When the swing spool is moved, the hydraulic pump moves oil to the control valve. Pressure oil then flows through the lift check to the swing cylinder.

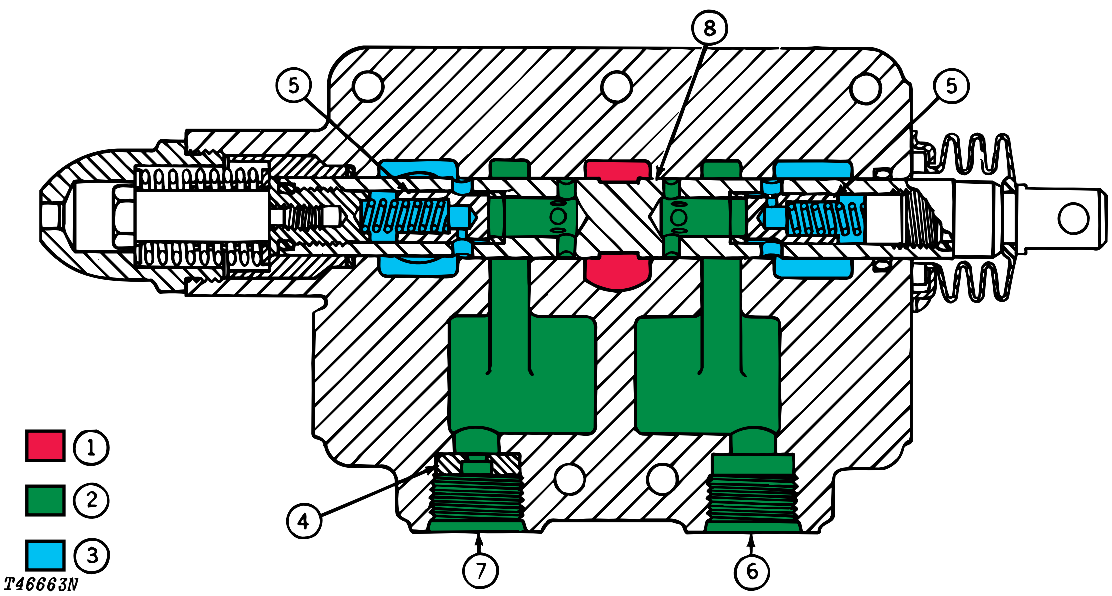
Displaced oil from the cylinder is forced back through the control valve to the reservoir.

To prevent cavitation, a portion of the return oil may unseat the anti-cavitation check valve in the valve housing and supplement the flow to the swing cylinder.



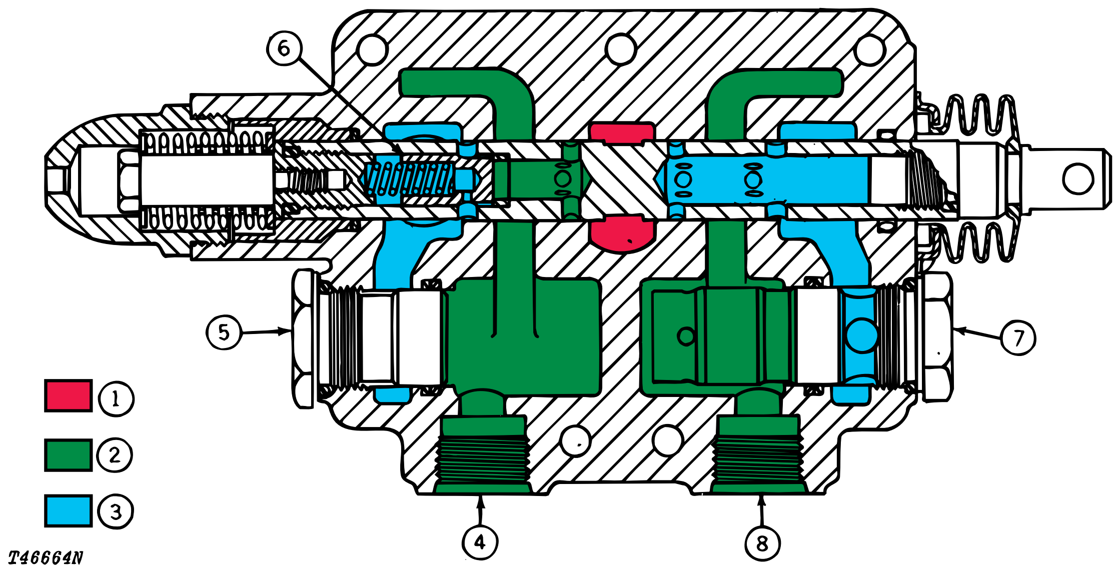
1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Oil
4—Relief Valve
5—Lift Check
6—Anti-Cavitation Check Valve
7—To Cylinder
8—From Cylinder

Fig. 30-Swing Section (Left Swing Circuit Shown)



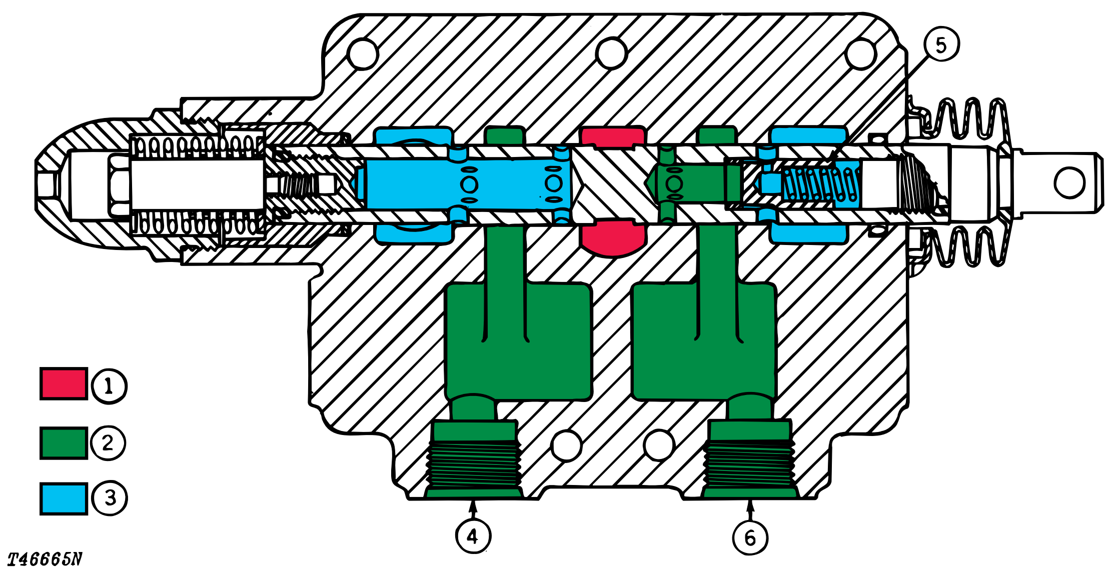
1—Pressure Oil
2—Trapped Oil
3—Return Oil
4—Orifice Plate
5—Lift Check (2 used)
6—To Rod End of Cylinder
7—To Head End of Cylinder
8—Spool

Fig. 31-Stabilizer Section (Neutral Shown)



1—Pressure Oil
2—Trapped Oil
3—Return Oil
4—To Rod End of Cylinder
5—Plug
6—Lift Check
7—Relief Valve
8—To Head End of Cylinder

Fig. 32-Crowd Section (Neutral Shown)

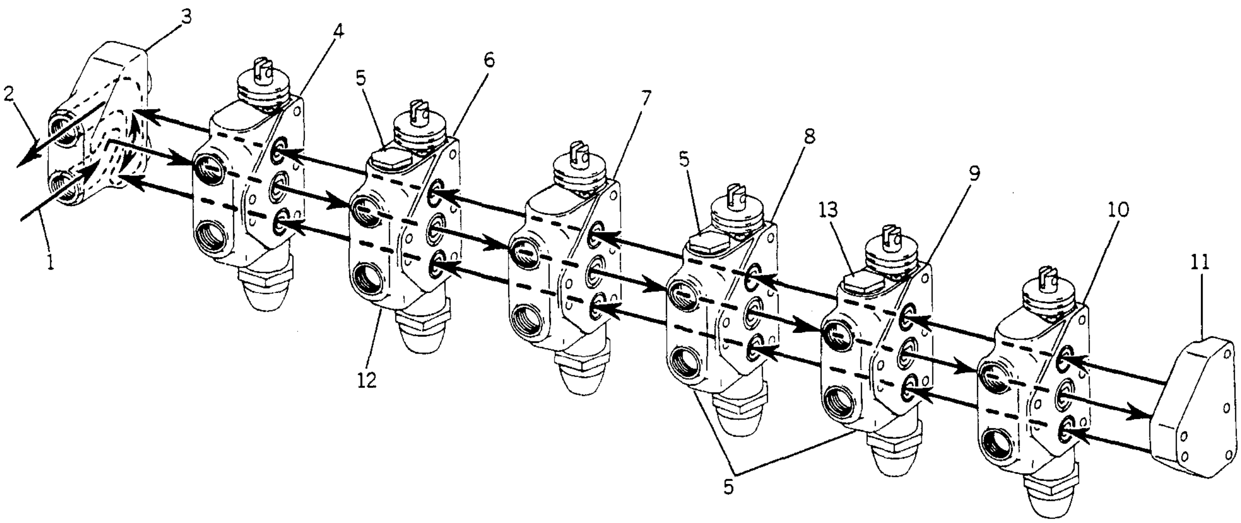


1—Pressure Oil
2—Trapped Oil
3—Return Oil
4—To Rod End of Cylinder
5—Lift Check
6—To Head End of Cylinder

Fig. 33-Bucket Section (Neutral Shown)

BACKHOE CONTROL VALVE (9500)

GENERAL INFORMATION



T46661N

1—Pressure Oil
2—Return Oil
3—Port Plate
4—Stabilizer Valve
5—Relief Valve
6—Crowd Valve
7—Bucket Valve
8—Swing Valve
9—Boom Valve
10—Stabilizer Valve
11—End Plate
12—Plug
13—Relief Valve

Fig. 34-Oil Flow Through Backhoe Control Valve Stack

The backhoe hydraulic functions control valve is a closed-center, six spool, stack-type valve.

There is no continuous flow of oil through the closed-center control valve when the valve is in neutral. Because the main hydraulic pump delivers oil only on demand, oil flows through the control valve only when the control lever is moved.

Fig. 34 shows the flow of oil through the backhoe control valve with all valve sections in neutral. Note that the oil is blocked when it reaches the end plate.

Valve Construction

All valve sections are separate bodies containing single spools. All spools contain lift checks which serve as one-way valves to prevent drift or leakage of pressure oil to the port passages.

The crowd, boom, and swing sections each contain relief valves to protect their circuits from excessive pressures.

The crowd section contains one 2375 psi (164 bar) (167 kg/cm²) relief valve (5, Fig. 34).

The swing section contains two 1625 psi (112 bar) (114 kg/cm²) relief valve (5, Fig. 34).

The boom section contains one 2375 psi (164 bar) (167 kg/cm²) relief valve (5, Fig. 34).

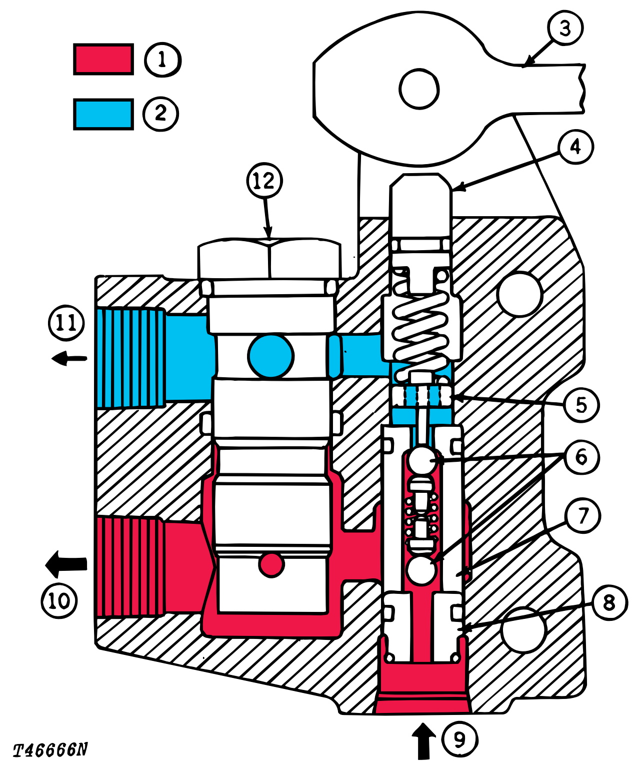
The boom section also contains one 3000 psi (207 bar) (211 kg/cm²) relief valve (13, Fig. 34).

NOTE: The 9500 backhoe control valve is the same as the 9405 backhoe control valve except for the relief valves. See page 9025-37 for operation.

NOTE: The bottom ports of the stabilizer and the top port of the boom control valves contain orifice plates. The orifice plates are installed with the slots facing out.

LOCKING CONTROL VALVE (9500)

GENERAL INFORMATION



1—Pressure
2—Return Oil
3—Control Lever
4—Main Piston
5—Intermediate Piston
6—Balls
7—Valve Liner
8—Base
9—Pressure Line
10—To Piston
11—To Sump
12—Relief Valve

Fig. 35-Locking Control Valve (engaged)

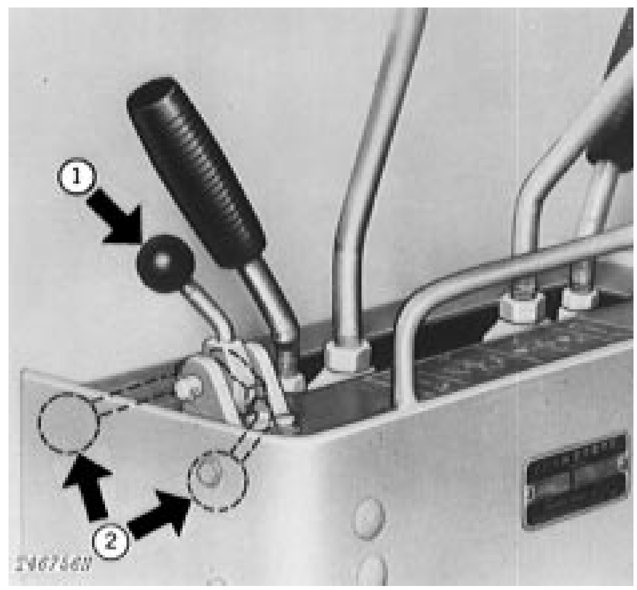
The 9500 Backhoe is equipped with a locking control valve (Fig. 35). This valve activates locking pistons which lock the backhoe in position while in operation or in transport.

Engaged Position (Fig. 35)

Pressure oil lifts the lower ball off its seat on the base (8, Fig. 35). Pressure oil is then routed to the locking pistons forcing them against the backhoe main frame.

Disengaged Position (not illustrated)

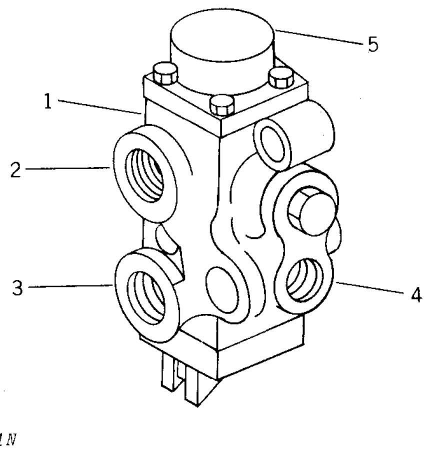
When the control lever is placed in the vertical position the main piston (4) is pushed down, compressing the spring located directly beneath it. The compressed spring forces the intermediate piston (5) down unseating the upper ball. Pressure oil is then routed to the sump, relieving the pressure built up behind the locking pistons.



1—Sliding Frame Unlocked
2—Sliding Frame Locked

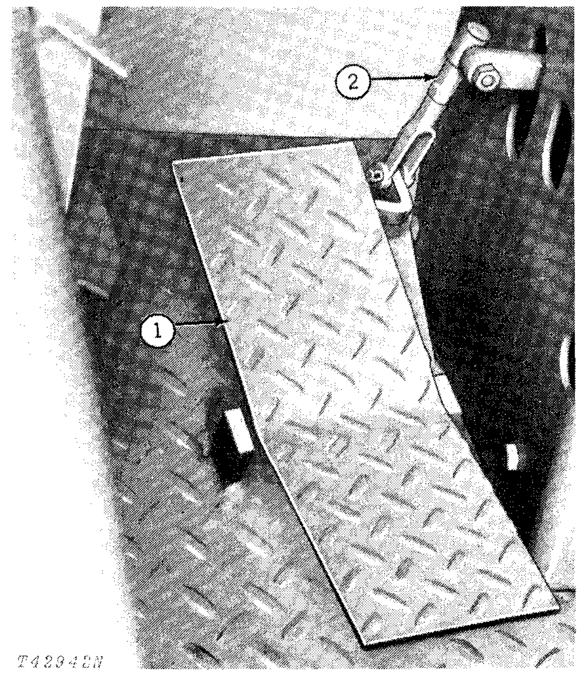
Fig. 36-Locking Control Valve Operation

EXTENDIBLE DIPPERSTICK CONTROL VALVE AND LINKAGE



1—Valve Inlet Port
2—Valve Outlet Port (To head end of extendible dipperstick cylinder)
3—Valve Outlet Port (To rod end of extendible dipperstick cylinder)
4—Valve Outlet Port to Tank
5—Extendible Dipperstick Control Valve

Fig. 37-Extendible Dipperstick Control Valve



1—Pedal Assembly
2—Linkage

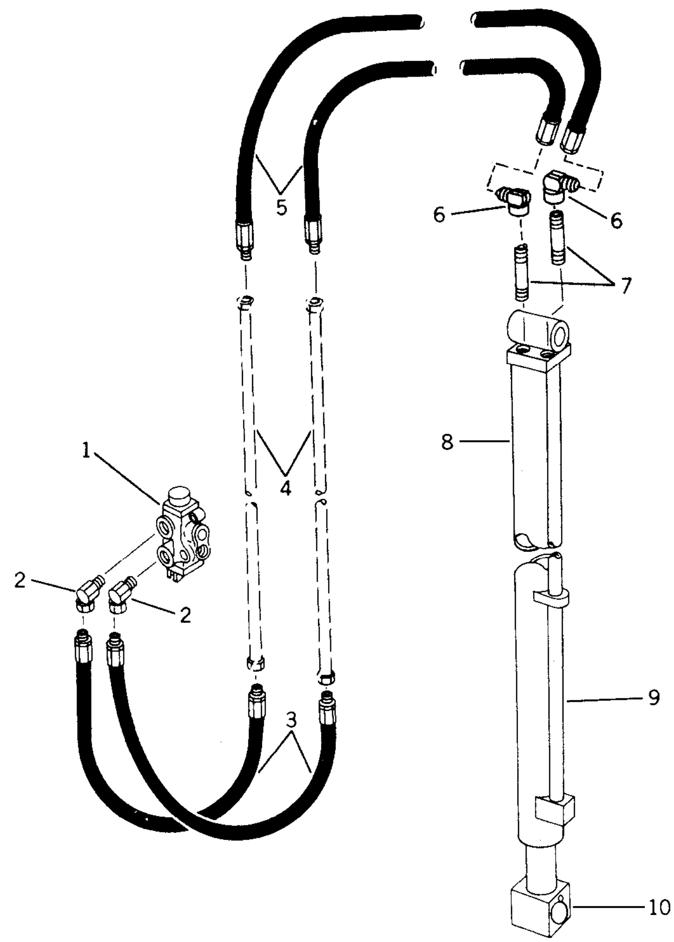
Fig. 38-Extendible Dipperstick Control Pedal and Linkage

GENERAL INFORMATION

The extendible dipperstick control valve is a double-acting valve. It uses a spring centered spool and is closed center in design. When the pedal assembly is pushed forward, pressure fluid is directed to the head end of the extendible dipperstick cylinder, causing it to extend. To retract extendible dipperstick cylinder, push pedal backward. This causes pressure fluid to be directed to the rod end of the extendible dipperstick cylinder.

EXTENDIBLE DIPPERSTICK CYLINDER

GENERAL INFORMATION



1—Extendible Dipperstick Valve Assembly
2—Elbow, 90° Swivel (2 used)
3—Valve to Extendible Dipperstick Cylinder Tube Hose (2 used)
4—Boom Dipperstick Cylinder Tube (2 used)
5—Dipperstick Cylinder Hose (2 used)
6—Elbow, 90° Swivel (2 used)
7—Nipple (2 used)
8—Extendible Dipperstick Cylinder
9—Hydraulic Tube
10—Rod Clevis

Fig. 39-Extendible Dipperstick Cylinder Hydraulic Circuit

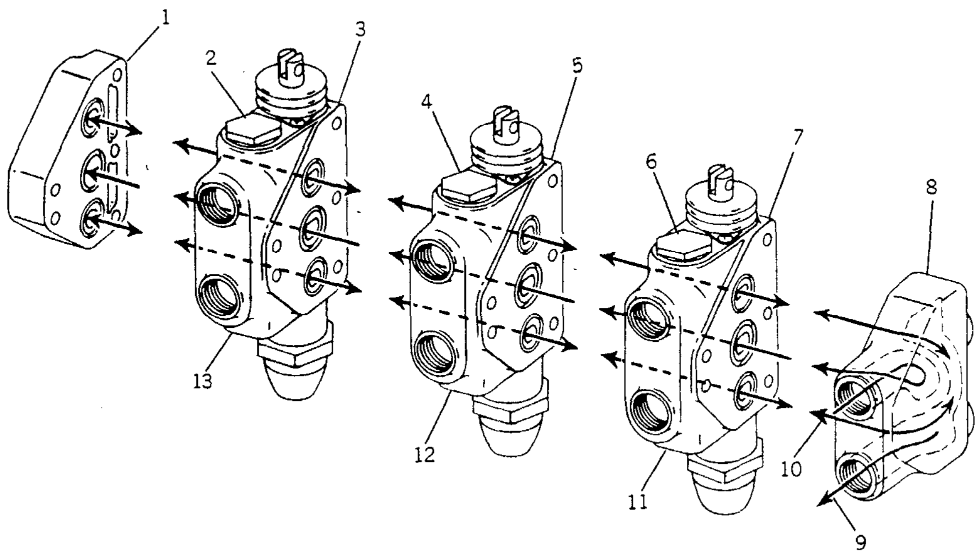
The extendible dipperstick cylinder is a double acting 2.500 inch (63.50 mm) bore by 48 inch (1.2 m) stroke cylinder. It has a 1.250 inch (31.75 mm) rod and uses a hydraulic cushion on rod end of the cylinder.

FOS

See "Hydraulic Cylinders" in FOS Manual "Hydraulics" for additional information on cylinders.

LOADER CONTROL VALVE

GENERAL INFORMATION



T46667N

1—End Plate
2—Plug
3—Boom Valve
4—Relief Valve
5—Bucket Valve
6—Relief Valve
7—Auxiliary Valve
8—Port Plate
9—Return Oil
10—Pressure Oil
11—Plug
12—Relief Valve
13—Check Valve

Fig. 40-Oil Flow Through Control Valve Stack

The loader control valve is a closed-center, two spool, stack -type hydraulic valve.

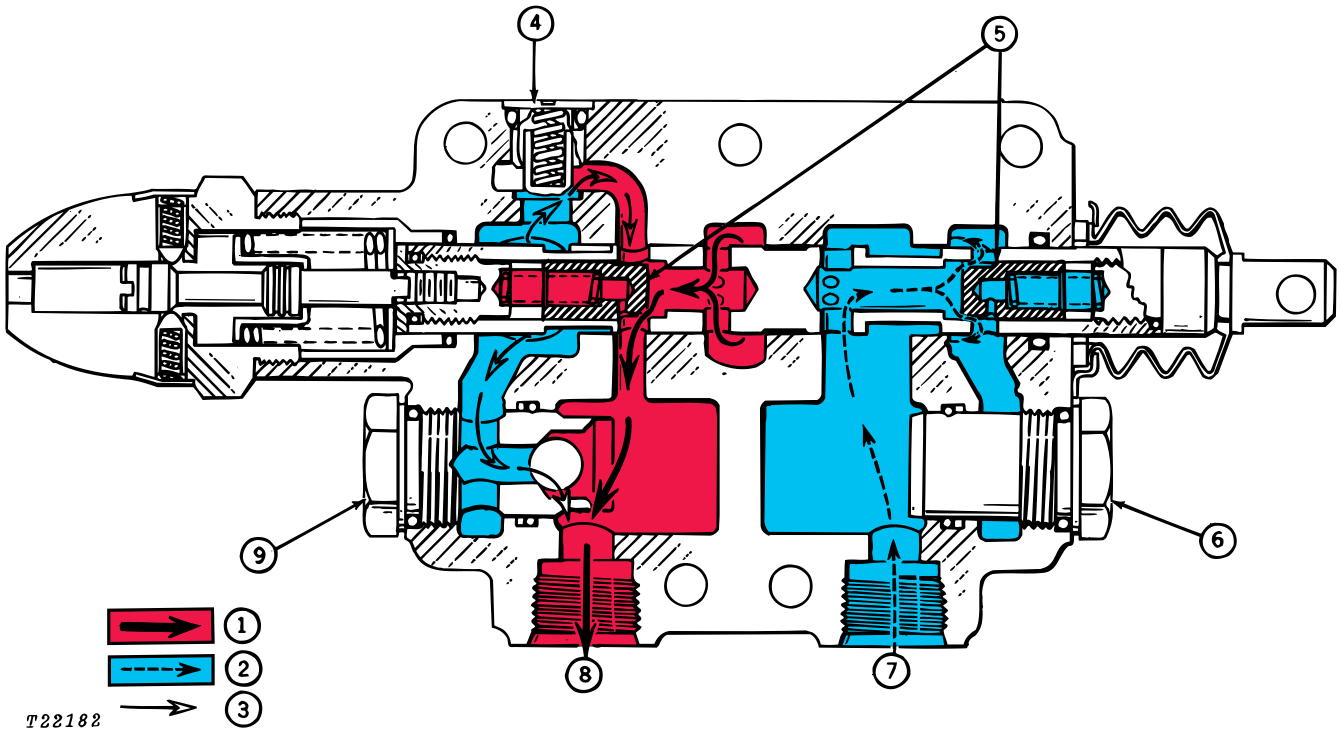
Valve Construction

The boom and bucket valve sections are separate bodies containing single spools. Both spools contain lift checks (two in boom spool - one in bucket spool).

Lift checks serve as one-way valves to prevent oil on the applied side of the cylinders from flowing back through the valves while the pump is going into stroke.

A detent in the boom valve end cap retains the spool in the boom float position. The boom section also contains a check valve and anti-cavitation check valve.

An anti-cavitation check valve is also contained in the bucket valve section. The bucket valve section contains two relief valves to protect its circuits from excessive pressure.



1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Oil Flow
4—Anti-Cavitation Check Valve
5—Lift Checks
6—Plug
7—From Cylinder
8—To Cylinder
9—Check Valve

Fig. 41-Boom Section (Lowering Circuit Shown)

The top relief valve (4, Fig. 40) is set at 2750 psi (190 bar) (193 kg/cm²).

The bottom relief valve (12, Fig. 40) is set at 1500 psi (103 bar) (105 kg/cm²).

The pressure and return ports are both located in the port plate. The end plate on the control valve assembly is completely blocked.

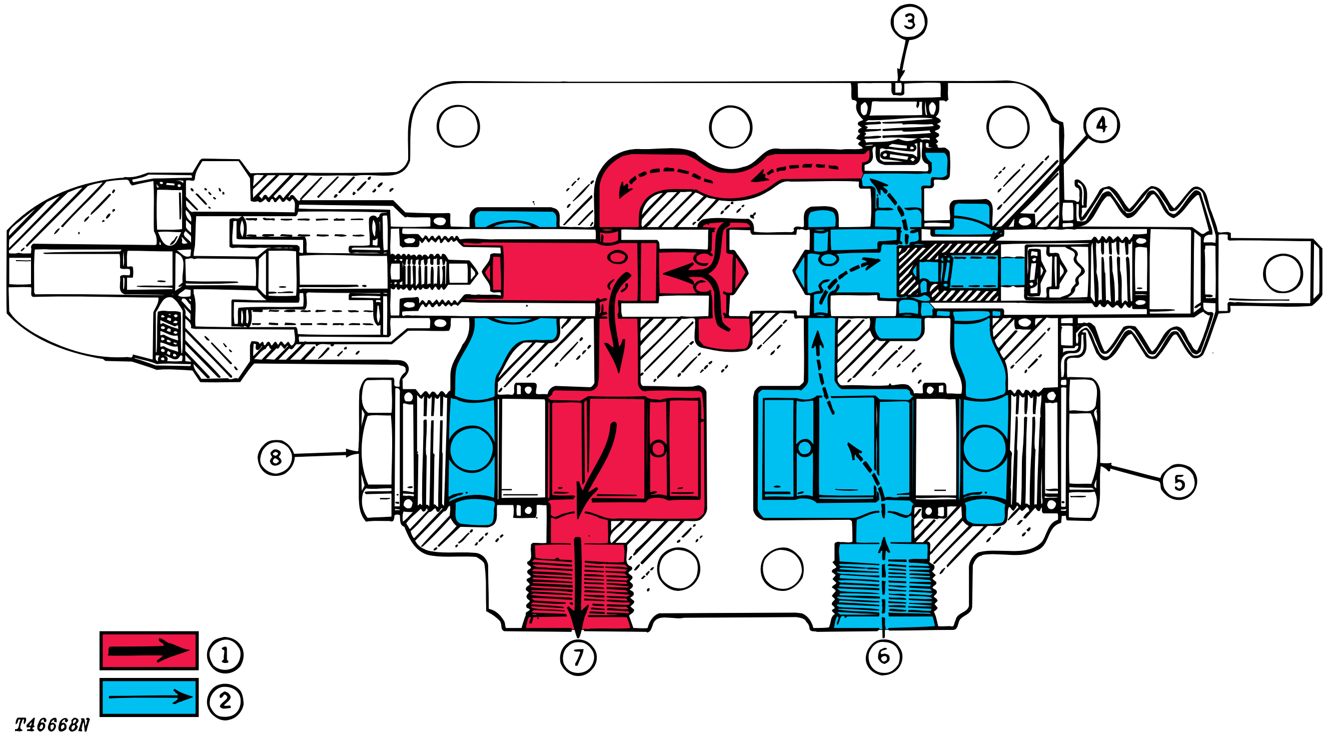
Valve Oil Flows

The closed-center control valve has no continuous flow of oil when the valve is in neutral. Because the variable displacement pump delivers oil only on demand, oil flows through the control valve only when the control lever is operated.

Fig. 40 shows the flow of oil through the loader control valve. Note that the oil is blocked when it reaches the end plate.

Boom Power Circuit

When the boom spool is extended or retracted to lower or raise the boom, the pump moves oil to the control valve. Oil is then directed through the lift check to the boom cylinders.



1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Check Valve
4—Lift Check
5—Relief Valve
6—From Cylinder
7—To Cylinder
8—Relief Valve

Fig. 42-Bucket Section (Fast Dump Regenerative Circuit Shown)

Displaced oil from the cylinders is forced back through the control valve to the reservoir. Note that if cavitation occurs, return oil flow through anti-cavitation check valves is directed to applied end of the boom cylinder.

Boom Float Circuit

When the boom valve spool is in the float position, the detent in the spool cap engages the valve spool. The spool will be held in this position until manually released.

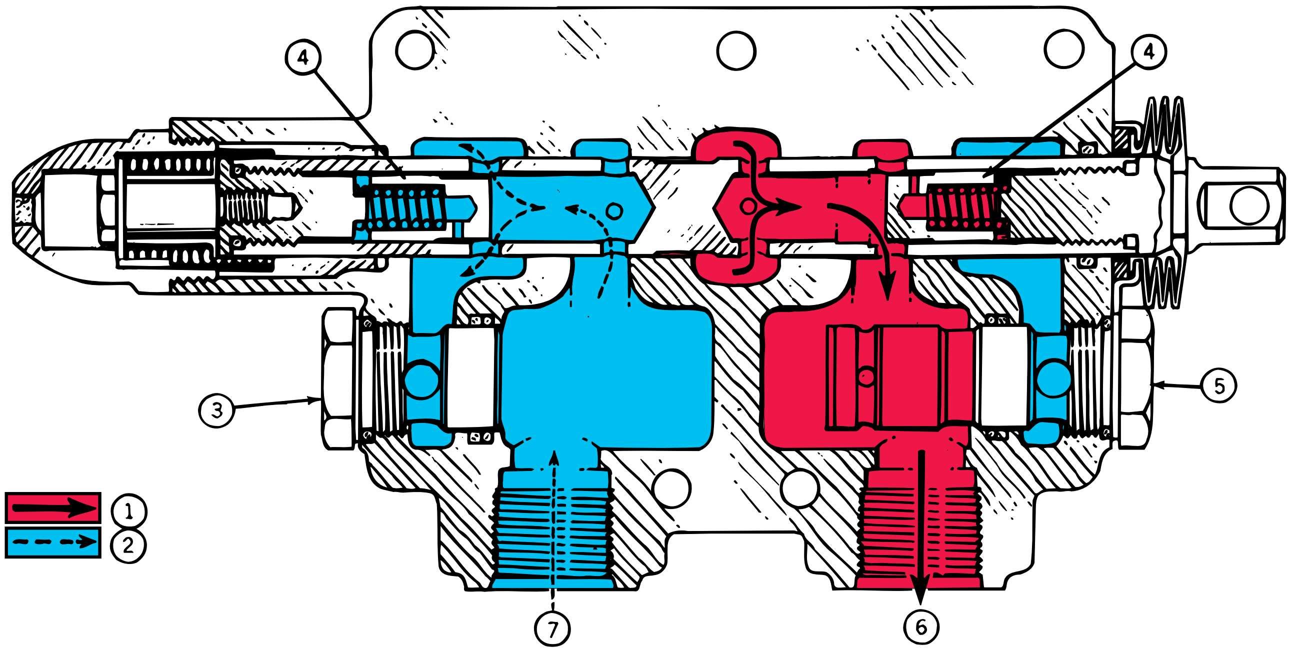
With the boom spool in the float position, both cylinder ports are open to the outlet in the valve port plate. Thus, the boom floats up and down, following the ground contour. The cylinder pistons freely move back and forth, with the displaced oil returning to the reservoir.

Bucket Fast Dump (Regenerative) Circuit

When the bucket spool is moved, the hydraulic pump moves oil to the control valve. Pressure oil then flows the bucket cylinders.

With the bucket spool in full dump position, the return oil to reservoir is blocked. Oil that is displaced from the cylinder is directed through the valve spool lift check and anti-cavitation check valve into the regenerative channel.

This "one-way" circuit between the two cylinders creates an increased volume of oil for a fast dump.



T46669N

1—Pressure Oil
2—Return Oil
3—Plug
4—Lift Check (2 used)
5—Circuit Relief Valve
6—To Cylinder
7—From Cylinder

Fig. 43-Auxiliary Section (Opening the Multi-purpose Bucket Shown)

Bucket Power Circuit

When the bucket spool is moved, the pump moves oil to the control valve. Pressure oil then flows to the bucket cylinders.

Displaced oil from the cylinders is forced back to the control valve and reservoir.

Third Function Valve

The third function valve is similar to Fig. 42 except it does not have the anti-cavitation check valve (3) and has only one relief valve (8).

SYSTEM OPERATION

Oil from the reservoir flows through the mesh strainer to the transmission oil pump. From the transmission oil pump, pressure oil flows to the transmission oil filter, the pressure regulating valve and then on the main hydraulic pump.

Excess oil not needed by the main hydraulic pump flows to the oil cooler lube circuit and then to the reservoir.

Pressure oil from the main hydraulic pump flows to the hydraulic oil accumulator, power steering valve, backhoe control valve, extendible dipperstick control valve and locking control valve, if so equipped.

Pressure oil also flows to the pressure control valve.

When the pressure is below 1250 to 1350 psi (86 to 93 bar) (88 to 95 kg/cm²), non-priority loader functions boom and bucket receive no oil.

When the pressure is above 1250 to 1350 psi (86 to 93 bar) (88 to 95 kg/cm²), pressure oil is available to the loader boom and bucket control valves.

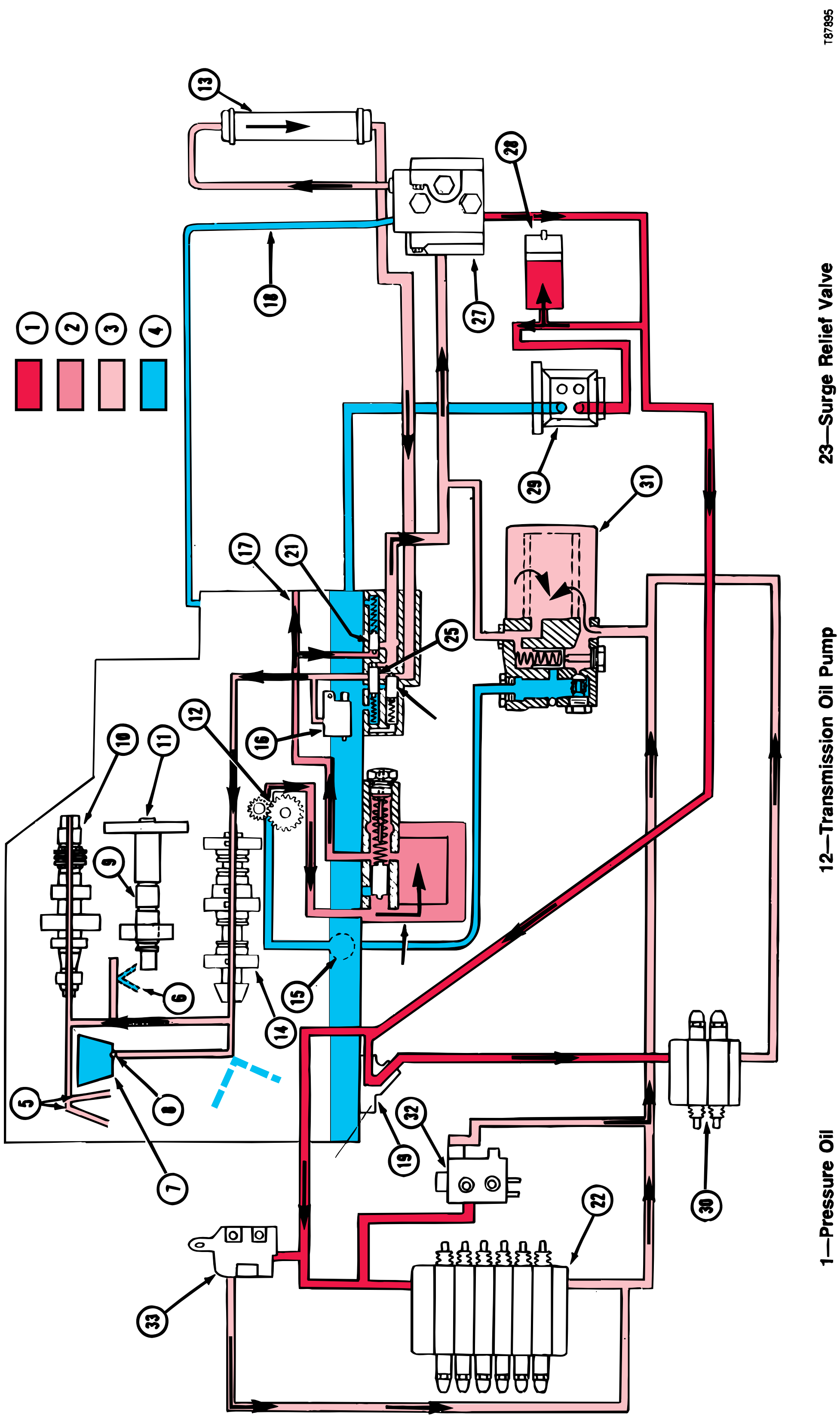
All control valves are closed center, allowing oil to flow only when activated.

Circuit relief valves located in the control valves limit high pressures from developing in the cylinder. The circuit relief valves dump pressure oil directly to the main return line.

Return oil from the functions flows to the surge relief valve. Should a high pressure develop in the return line, the high pressure would be directed to sump.

Return oil also flows to the hydraulic oil filter. If the hydraulic oil filter becomes plugged, return oil will be directed to sump by the hydraulic oil filter relief valve.

Return oil from the hydraulic oil filter flows back to the main hydraulic pump charge circuit.



T87895

1—Pressure Oil
2—Intermediate Pressure Oil
3—Low Pressure Oil
4—Return Oil
5—Lube to Axle
6—Transmission Spray
7—Transmission Oil Cup
8—Check Valve
9—Countershaft Pin
10—Transmission Drive Shaft
11—Countershaft
12—Transmission Oil Pump
13—Oil Cooler
14—Differential Drive Shaft
15—Transmission Intake Screen
16—Brake Valve
17—To Reverser Control Valve
18—Pump Bleed Line
19—Pressure Control Valve
20—Transmission Filter
21—Pressure Regulating Valve
22—Backhoe Control Valve
23—Surge Relief Valve
24—Lube Reduction Valve
25—Cooler Bypass Relief Valve
26—Filter Relief Valve
27—Main Hydraulic Pump
28—Accumulator
29—Power Steering Valve
30—Loader Control Valve
31—Hydraulic Oil Filter
32—Extendible Dipperstick Control Valve (9405)
33—Locking Control Valve (9500)

Fig. 44-Hydraulic System

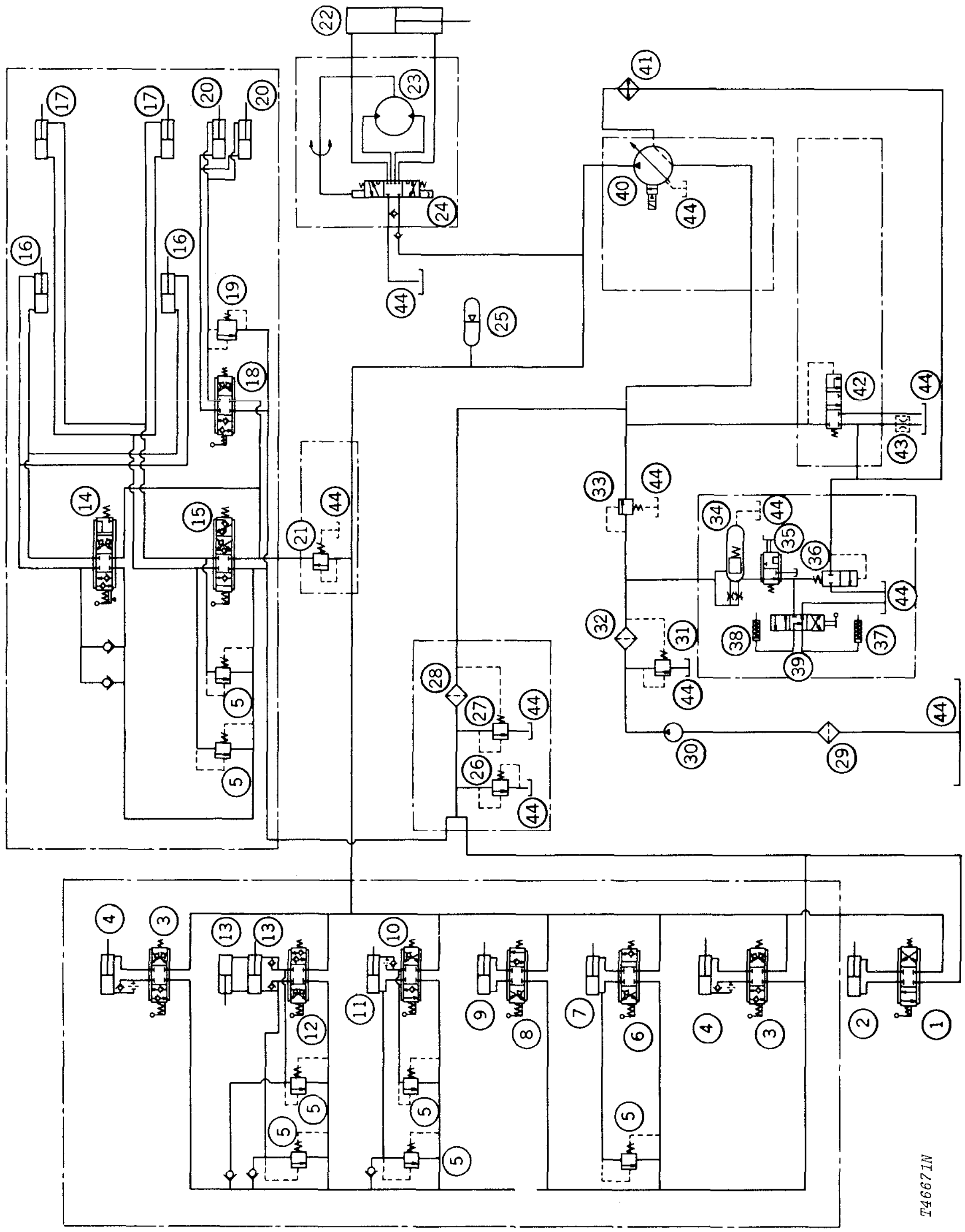


Fig. 45-Hydraulic Schematic with Control Valves in Neutral (9405 Backhoe Shown)

1—Extendible Dipperstick Control Valve
2—Extendible Dipperstick Cylinder
3—Stabilizer Control Valve
4—Stabilizer Cylinder
5—Circuit Relief Valve (7 used)
6—Crowd Control Valve
7—Crowd Cylinder
8—Bucket Control Valve
9—Bucket Cylinder
10—Boom Control Valve
11—Boom Cylinder
12—Swing Control Valve
13—Swing Cylinder (2 used)
14—Loader Boom Control Valve
15—Bucket Control Valve
16—Loader Boom Cylinder (2 used)
17—Loader Bucket Cylinder (2 used)
18—Loader Auxiliary Control Valve
19—Circuit Relief Valve
20—Multi-Purpose Bucket Cylinder (2 used)
21—Pressure Control Valve
22—Steering Cylinder
23—Power Steering Gerotor
24—Power Steering Valve
25—Hydraulic Oil Accumulator
26—Surge Relief Valve
27—Filter Relief Valve
28—Hydraulic Oil Filter
29—Mesh Strainer
30—Transmission Oil Pump
31—Filter Relief Valve
32—Transmission Oil Filter
33—Pressure Regulating Valve
34—Accumulator
35—Clutch Control Valve
36—Lube Relief Valve
37—Brake Pack
38—Clutch Pack
39—Shift Valve
40—Main Hydraulic Pump with Stroke Control Valve
41—Oil Cooler
42—Oil Cooler Bypass and Charge Relief Valve
43—Lube Circuit
44—Reservoir

Legend for Fig. 45-Hydraulic Schematic (9405 Backhoe)

1—Locking Control Valve
2—Locking Cylinder (2 used)
3—Stabilizer Control Valve
4—Stabilizer Cylinder
5—Circuit Relief Valve (7 used)
6—Crowd Control Valve
7—Crowd Cylinder
8—Bucket Control Valve
9—Bucket Cylinder
10—Boom Control Valve
11—Boom Cylinder
12—Swing Control Valve
13—Swing Cylinder (2 used)
14—Loader Boom Control Valve
15—Bucket Control Valve
16—Loader Boom Cylinder (2 used)
17—Loader Bucket Cylinder (2 used)
18—Loader Auxiliary Control Valve
19—Circuit Relief Valve
20—Multi-Purpose Bucket Cylinder (2 used)
21—Pressure Control Valve
22—Steering Cylinder
23—Power Steering Gerotor
24—Power Steering Valve
25—Hydraulic Oil Accumulator
26—Surge Relief Valve
27—Filter Relief Valve
28—Hydraulic Oil Filter
29—Mesh Strainer
30—Transmission Oil Pump
31—Filter Relief Valve
32—Transmission Oil Filter
33—Pressure Regulating Valve
34—Accumulator
35—Clutch Control Valve
36—Lube Relief Valve
37—Brake Pack
38—Clutch Pack
39—Shift Valve
40—Main Hydraulic Pump with Stroke Control Valve
41—Oil Cooler
42—Oil Cooler Bypass and Charge Relief Valve
43—Lube Circuit
44—Reservoir

Legend for Fig. 46-Hydraulic Schematic (9500 Backhoe)

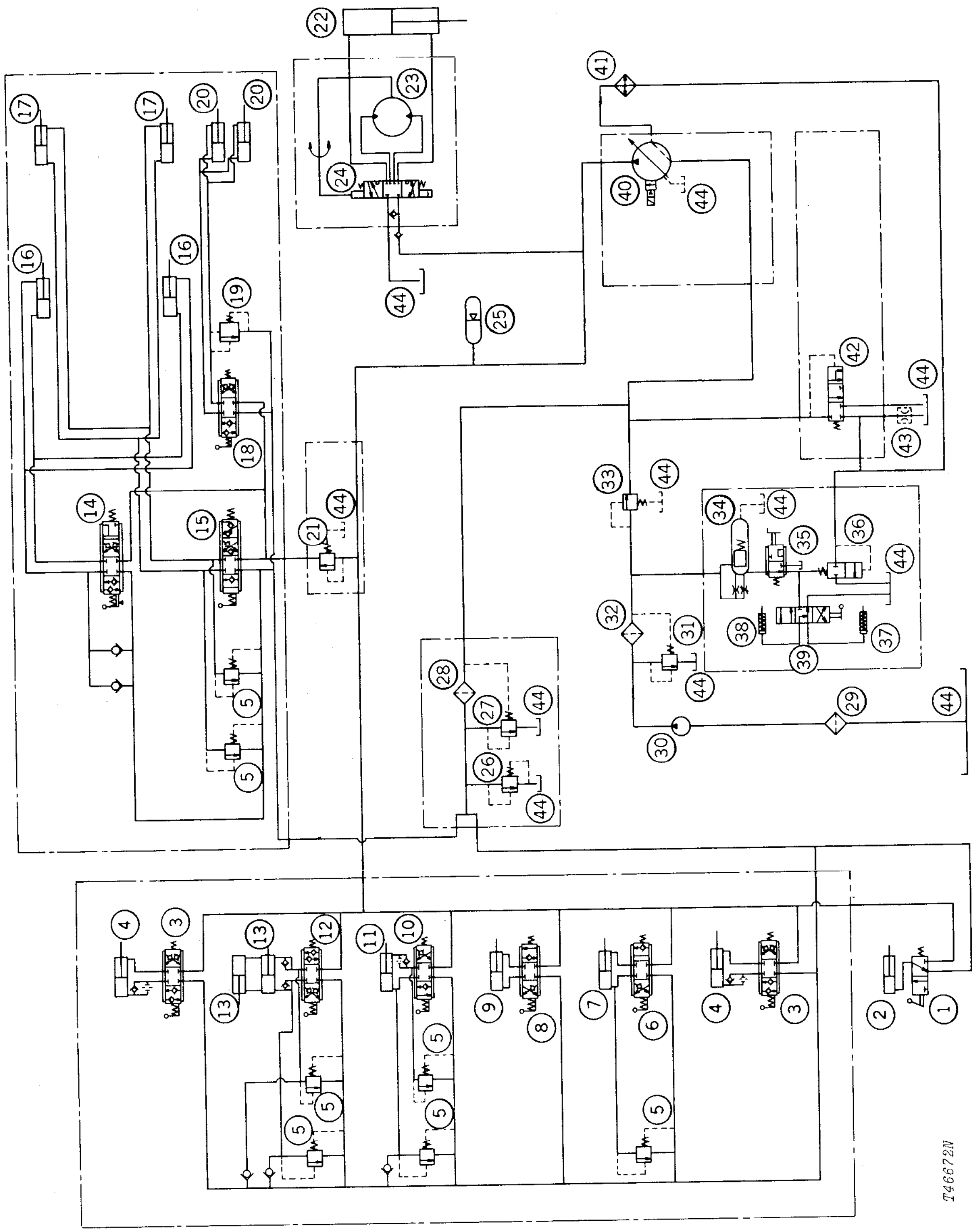


Fig. 46-Hydraulic Schematic with Control Valves in Neutral (9500 Backhoe Shown)

DIAGNOSING MALFUNCTIONS

HYDRAULIC SYSTEM

General System Problems

Improper operation.
Improper oil.
Low or no oil in system.
Dirty filters.
External oil leaks.
Kinks in oil lines.
Dirt or water in system.
Air in system.

Hydraulic Functions Slow

Low engine speed.
Improper oil.
Internal system leaks.
Pressure control valve sticking.
Main hydraulic pump malfunction.
Stroke control valve out of adjustment.
Inadequate charge flow.
Main hydraulic charge pump malfunction.

No Hydraulic Oil Pressure

Low oil in system.
Main hydraulic charge pump failure.
Main hydraulic pump failure.
Internal oil leaks.
Plugged hydraulic oil filter.
Stroke control valve out of adjustment or defective.
Main hydraulic pump shaft broken.

Hydraulic Oil Heats

Contaminated oil.
  Drain and refill with new oil; replace filter.
Tractor engine running too fast.
  Reset fast idle stop.
Kink or dent in oil lines.
  Replace oil lines.
Wrong viscosity of oil.
Internal oil leaks.
Low oil supply.
Main pump crankcase outlet valve open.
Inadequate charge flow.

Hydraulic Oil Foams

Kink or dent in oil lines.
  Replace oil lines.
Incorrect hydraulic oil.
  Drain and refill with specified oil.

Water in Hydraulic System

  Drain and refill with specified oil.

No Pump Output.

Pump out of stroke.
  Reset pump stroke control valve.
  Stroke control valve stuck open.
  Pump shaft broken.
  Stripped drive shaft splines.
  Defective destroke solenoid.

Erratic Pump Operation

Stroke control valve not seating properly.
  Check for foreign material or damaged seat.

Leaking inlet or discharge valve, defective O-rings.
  Replace inlet and discharge valve; replace O-rings in stroke control valve housing.

Piston springs not balanced.
  Check for broken springs or springs at unequal tension.

Pump piston sticking in bore.
  Clean pump and check for damaged piston.

DIAGNOSING SYSTEM MALFUNCTIONS—Continued

Pump Noise or Squeal

Stroke control valve spring guide binding.
Dress down sharp bottom edge. Reset system pressure.

Loose drive coupling cap screws.
Tighten coupling cap screws.

Steering Wheel Does Not Center

Binding in valve linkage.
Re-align valve.
Broken centering springs.
Replace springs.

No Response When Steering Wheel Is Turned Slowly

Low pump pressure.
Dirt in system.
Drain, flush, and refill with clean oil.
Wear on sleeve and spool.
Replace.
Oil level low.
Fill to proper level.
Trouble in pump.
Trouble in gerotor.
Check and correct.
Trouble in lines or filter.
Check and correct.

No Response

Sleeve and spool locked.
Disassemble, repair or replace.
Pump failure.
Hose or filter clogged.
Check and correct.
Steering column shaft broken.
Replace shaft.
Shaft splines not engaged in spool splines.
External leakage.
Oil level low.
Fill to proper level.
Steering cylinder leakage.
Repair cylinder.
Wear in metering valve.
Repair.

Steering Wheel Kickback

Check valve in pressure line leaking.
Repair check valve.

Unit Steers When Steering Wheel Is Not Moved

Excessive internal leakage.
Disassemble and replace worn parts.

Steering Wheel Continues To Turn At a Rapid Rate When Steering Linkage Is Against Stops

Sleeve, spool, or gerotor set worn or broken.
Disassemble and repair.
Excessive internal leakage.
Disassemble and replace worn parts.

DIAGNOSING SYSTEM MALFUNCTIONS—Continued

Wrong Response To Steering

Lines hooked up to wrong ports.
  Reconnect.
Gerotor gear misaligned.
  Realign.

Continuous Steering Wheel Rotation

Dirty fluid.
  Drain, flush, and refill.
Broken centering springs.
  Replace.
Input linkage binding.
  Realign.
Burr on sleeve or spool.
  Repair.

Boom Lifts or Swings Too Slowly

Cold oil.
  Allow oil to warm up with slow engine speed.
Oil viscosity too heavy.
  Use oil as specified in operator's manual.
Insufficient engine speed.
  Open engine throttle.
Oil leak in suction line.
  Check and tighten.
Badly worn pump.
  Replace or repair pump.
Oil leaking past cylinder packings or O-rings.
  Replace worn parts.
Oil leaking past control valve.
  Replace or repair valve.
Restriction in suction line.
  Check and replace suction line.
Clogged oil filters (transmission and hydraulic).
  Replace oil filters.
Circuit relief valve dirty or leaking.
  Clean or replace relief valve cartridge.

Boom Fails To Lift Or Swing

Insufficient oil in reservoir.
  Add specified oil.
Circuit relief valve malfunctioning.
  Clean or replace relief valve.
Pump badly worn or damaged.
  Replace or repair pump.
Broken oil line.
  Check for leaks and repair oil line.
Obstruction in oil lines or valve.
  Check flow through system and clean.
Worn control valve.
  Replace valve.
Hoses attached improperly.
  Remove and install correctly.
Oil leaking past cylinder packings or O-rings.
  Replace worn parts.

DIAGNOSING SYSTEM MALFUNCTIONS—Continued

Load Drops with Spool in Power Position

Leaking or broken oil lines from manifold block to cylinders.
  Check for leaks; tighten oil lines.
Contaminated oil.
  Drain and refill with new oil; replace filter.
Oil leaking past cylinder V-packing or O-rings.
  Replace worn parts.
Oil leaking past control valve.
  Replace or repair valve.
Faulty circuit relief valve.
  Clean or replace.

Load Drops with Spool In Neutral Position

Leaking or broken oil lines from control valve to cylinder.
  Check for leaks; tighten or replace lines.
Oil leaking past cylinder piston or seals.
  Replace worn parts.
Oil leaking past control valve.
  Replace or repair valve.
Circuit relief valve leaking.
  Clean or replace valve.
Anticavitation valve leaking.
  Clean or replace valve.

Control Valve Sticks or Works Hard

Return spring binding or broken.
  Replace spring.
Dirty valve.
  Clean valve.
Scored bore or bent spool.
  Replace valve.
Misalignment of control linkage.
  Correct misalignment.
Tie bolts too tight.
  Tighten to specifications.
Foreign material in spool bore.
  Clean valve.

VISUAL INSPECTION

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

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

Since the hydraulic system is tied in with the transmission, the complete machine should be checked. This is especially true when it comes to a complaint of the transmission "overheating."

The transmission oil level is an important factor. Be sure to check oil level.

Check the type of oil being used in the transmission.

Check the oil cooler and radiator for a plugged core.

Check to see when the transmission filter was last changed.

A plugged or clogged filter causes the filter relief valve to open and return pressure oil from the transmission pump to the transmission reservoir.

Slow function operation may be an indication that the hydraulic system is leaking. Check all oil lines and connections for leaks.

Leaks in the pressure side of the system can be located by carefully inspecting the external area of the components, fittings and hoses.

Check for a leak in any of the cast housings.

Check the suction side of the system for leaks by examining the oil in the transmission reservoir. If air is being drawn into the system, the oil will contain air bubbles and will appear to foam.

Check all hydraulic lines. Pinched or bent lines will restrict flow through the hydraulic system.

Dented tubing can cause oil foaming, heat, faulty function operation or pump failure. Replace damaged tubing immediately.

Inspect all pressurized hydraulic lines and connections for leaks. Tighten fittings or replace as necessary.

Wash inside and outside of oil lines and fittings with cleaning solvent to remove dirt before installing them on the machine.

When tightening connections, always use two wrenches to prevent damage to hoses, tubing and fittings.

IMPORTANT: Tighten fittings only tight enough to eliminate leaks. Do not overtighten connections.

Check the type of oil being used in the transmission reservoir.

Also check the intervals at which the hydraulic oil filter must be changed. If the filter continually becomes clogged or obstructed at intervals which are much less than those specified, chances are that a failure is in progress. By inspecting the deposits within the filter, the area from which the metal particles or hydraulic packings are coming can be determined.

Operate the machine and see for yourself how the machine operates. There could be some condition that might aid you in isolating the problem.

TESTING AND ADJUSTMENT

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

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

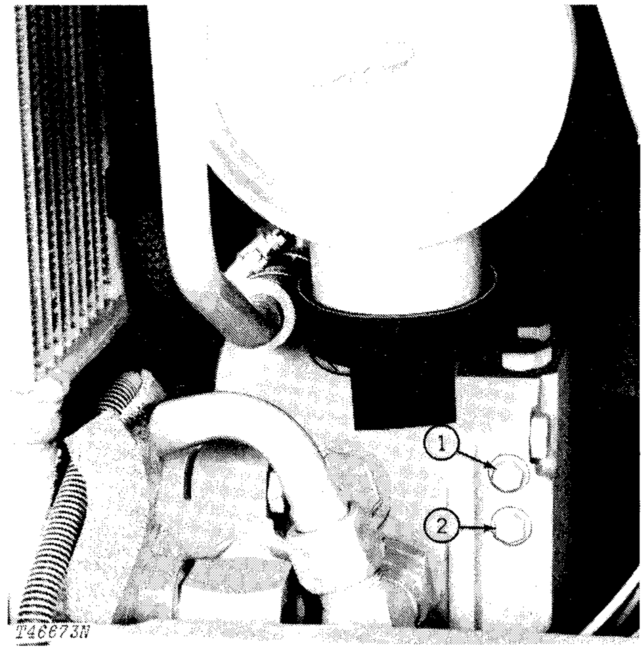
A closed center hydraulic system is used to operate all the hydraulic functions.

When a failure occurs, it is important to isolate the problem and repair it as quickly as possible. This will hold troubleshooting time to a minimum and aid in maintaining customer satisfaction. To troubleshoot a problem, read the General Information section, refer to the hydraulic schematics, and the section on Diagnosing Malfunctions.

Main Hydraulic Pump Inlet Pressure Test

Remove charge pressure test plug (2, Fig. 47) from stroke control valve housing.

Install a 0 to 300 psi (0 to 2070 kPa) (0 to 21 bar) pressure gauge into the pressure test port of the stroke control valve to monitor charge pressure.



T46673N

1—System Standby Pressure Test Port Plug **2—Charge Pressure Test Port Plug**

Fig. 47-Main Hydraulic System Inlet and Outlet Test Plugs

Install a 0 to 5000 psi (0 to 34 480 kPa) (0 to 345 bar) pressure gauge in the upper test port of the stroke control valve to monitor system standby pressure (1).

Start engine and run at 1000 rpm. Operate loader to bring oil temperature up to 100°F (38°C).

With main hydraulic pump in standby 2300 to 2400 psi (15 860 to 16 550 kPa), charge pressure should be 35 to 130 psi (240 to 900 kPa) (2 to 9 bar).

Increase engine speed to 2200 rpm with main hydraulic pump in standby. Pressure should be 55 to 130 psi (380 to 900 kPa) (4 to 9 bar).

If main hydraulic pump inlet pressure is low it could be an indication of four things:

1. A high pressure leak in the return circuit.
2. A high pressure leak in the reverser hydraulic control circuit.
3. Low transmission charge pump flow.
4. Malfunctioning oil cooler relief valve.

Perform the transmission pump flow test page 9025-28. See page 9025-68 to aid in analyzing the Transmission and Main Hydraulic Pump Flow Tests.

Main Hydraulic Pump Flow Test

Install a 0 to 300 psi (0 to 2070 kPa) (0 to 21 bar) pressure gauge into the pressure test port (2, Fig. 47) of the stroke control valve to mônitor charge pressure.

Install a 0 to 5000 psi (0 to 34 480 kPa) (0 to 345 bar) pressure gauge in the upper test port (1) of the stroke control valve to monitor system standby pressure.

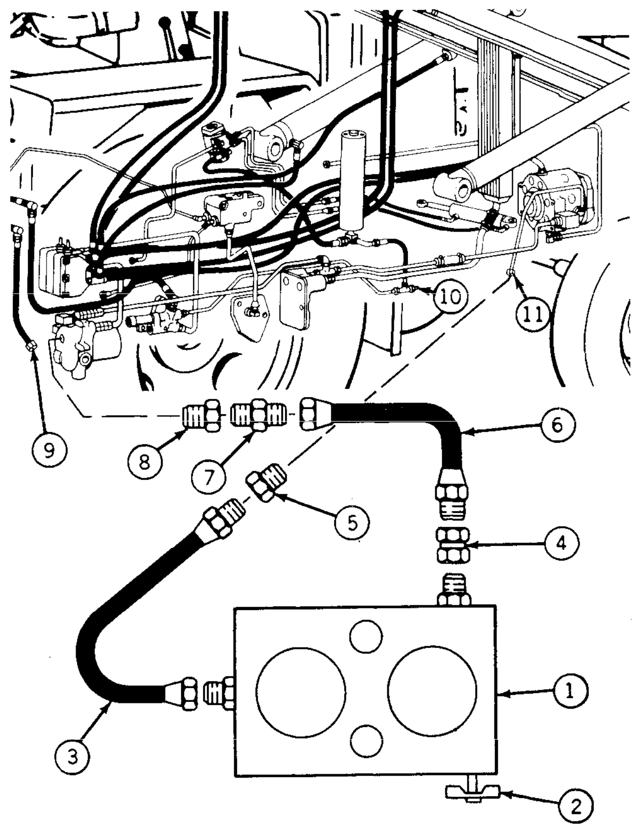
Connect hydraulic test unit as shown in Figs. 48 and 49. Operate steering or backhoe to bleed down accumulator before disconnecting lines.

Open hydraulic test unit loading handle (2, Fig. 48 or 1, Fig. 49). Start engine and adjust engine speed to 2200 rpm. Run unit until temperature of 100°F (38°C) is reached.

Close test unit loading handle slowly to increase pressure until the test unit loading handle is completely closed. The reading on the hydraulic test unit pressure gauge should be 2300 to 2400 psi (15 860 to 16 550 kPa) (159 to 165 bar).

If standby pressure is not to specifications, adjust the pump stroke control valve adjusting screw to give the correct standby pressure.

Adjust test unit loading handle so pressure reads 2000 psi (13 790 kPa) (138 bar). Minimum pump flow must be:
(3 in.^{3}) 49 cm^3 pump (without pump serial number plate) or
(3 in.^{3}) 50 cm^3 pump (with pump serial number plate)
(310A) . . . . 23 gpm (87 L/min)
(4 in.^{3}) 65 cm^3 pump (with pump serial number plate)
(310B) . . . . 30.5 gpm (115 L/min)



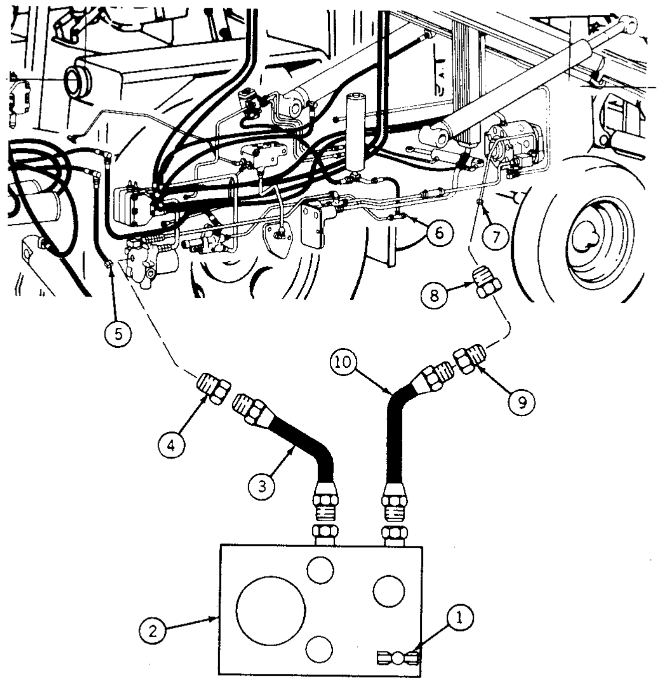
T46674N

1—Nuday Hydraulic Tester
2—Pressure Loading Valve Handle
3—D-91 Tester Inlet Hose
4—D-96
5—D-107
6—D-91 Tester Outlet Hose
7—D-103
8—D-102
9—Backhoe Return Hose
10—Special Tee
11—Main Hydraulic Pump Pressure Tube

Fig. 48-Main Hydraulic Pump Flow Setup

If minimum pump flow cannot be reached, measure pump inlet pressure (30 psi [210 kPa] [2 bar] minimum). If inlet pressure specification is met and flow cannot be met, repair or replace the main hydraulic pump. See Group 2160.

See page 9025-68 to aid in analyzing Transmission and Main Hydraulic Pump Flow Tests.



T46675N

T46675N

1—Loading Handle
2—OTC Hydraulic Tester
3—Y-21-10 Tester Outlet Hose
4—Y-3021
5—Backhoe Return Line
6—Special Tee
7—Main Hydraulic Pump Pressure Tube
8—D-107
9—Y-3021
10—Y-21-10 Tester Inlet Hose

Fig. 49-Main Hydraulic Pump Flow Setup

Stroke Control Valve Pressure Test

Install a 0 to 5000 psi (0 to 34 480 kPa) (0 to 345 bar) pressure gauge into the system standby pressure test port (1, Fig. 47) of the stroke control valve.

Start engine and run at 2300 rpm.

With oil at 100°F (38°C), the pressure gauge should read 2300 to 2400 psi (15 860 to 16 550 kPa) (158 to 165 bar).

If the pressure is incorrect, adjust the stroke control valve adjusting screw. The adjusting screw is located in the bottom of the stroke control valve.

Checking Control Valve for Leaks

After long use, the valve spools may become worn, allowing oil to leak past them. Check the control valve for leaks as follows:

1. Place control valve in neutral.

2. Disconnect return line between valve and reservoir. Install a plug in return line.

3. Start engine and observe control valve return line.

4. If a steady stream of oil is coming out of return port, spool is worn and should be replaced.

Checking Cylinder for Leaks

NOTE: Test the cylinders for leaks before checking the control valves.

If the control valve is not leaking and the function continues to settle with the control valve in neutral, oil is probably leaking past the packings in the cylinders. Check each cylinder individually to determine which one is leaking.

With the cylinder to be checked either fully extended or retracted, remove a hydraulic hose from one end of the cylinder. (If the cylinder is extended, remove hose from rod end; if the cylinder is retracted, remove hose from the head end). Cap end of hose removed and operate the cylinder.

IMPORTANT: To prevent oil discharge from teh disconnected hose, be sure to operate cylinder in the same direction as chosen above. For example, if hose is disconnected from the rod end, operate the valve lever to extend the cylinder.

Examine the open port on the cylinder. If any oil is leaking from the port, cylinder packings are defective and should be replaced.

Be sure to replace any oil lost during each test.

Checking Cylinder Cycle Tiems

Operate cylidner full stroke several time to bring cylinder oil up to temperature.

Run the engine at fast idle. With a stop watch, measure the time required to fully extend or retract the cylinder.

Measure the cylinder cycle time from 5 to 10 times and figure the average.

NOTE: Cycle times given are to be used only as guidelines. Therefore when a unit does not perform according to the cycle times given, the service technician must decide if the difference is great enough to indicate a malfunction of some component in the system.

310A CYCLE TIME SPECIFICATIONS

LOADER FUNCTION	SECONDS
Boom raise	4.1
Boom down (power)	2.9
Boom down (float)	3.5
Bucket dump (boom at full height)	1.8
Bucket rollback (from maximum dump position and boom at full height)	1.5
Bucket rollback (flat on ground)	0.8

BACKHOE FUNCTION	SECONDS
Boom raise (maximum depth to full height)	4.5
Boom raise (ground to full height)	2.1
Boom lower (full height to maximum depth)	4.1
Boom lower (full height to ground)	1.9
Dipperstick in	3.6
Dipperstick out	3.3
Bucket curl	2.3
Bucket dump	1.9
Swing (180°)	3 to 5

310B CYCLE TIME SPECIFICATIONS

LOADER FUNCTION	SECONDS
Boom raise	3.4
Boom down (power)	2.5
Boom down (float)	3.5
Bucket dump (boom at full height)	1.4
Bucket rollback (from maximum dump position and boom at full height)	1.2
Bucket rollback (flat on ground)	0.6

BACKHOE FUNCTION	SECONDS
Boom raise (maximum depth to full height)	4.0
Boom raise (ground to full height)	1.9
Boom lower (full height to maximum depth)	3.4
Boom lower (full height to ground)	1.6
Dipperstick in	2.8
Dipperstick out	2.7
Bucket curl	2.3
Bucket dump	1.8
Swing (180°)	3 to 5

Checking Loader and Backhoe Functions

The loader and backhoe functions are relatively easy to troubleshoot. The customer complaint will usually lead to the cause.

As an example, a complaint of loader boom settles could be caused by three things: (1) defective boom control valve circuit relief valve (2) leaking boom control valve spool or (3) leakage past the cylinder packings.

To correct problem, first replace the circuit relief valve. If the function is still bad, check the hydraulic cylinders for leakage, then check the boom control valve.

Pressure Control Valve Test

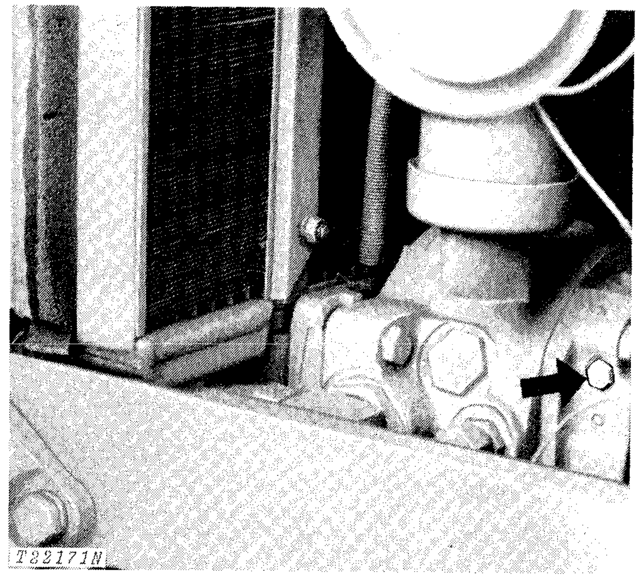


Fig. 50-Main Hydraulic Pump System Pressure Port

Install a 0 to 5000 psi (0 to 345 bar) (0 to 352 kg/cm²) pressure gauge in top port of the stroke control valve (Fig. 50).

Run the unit at 1000 rpm.

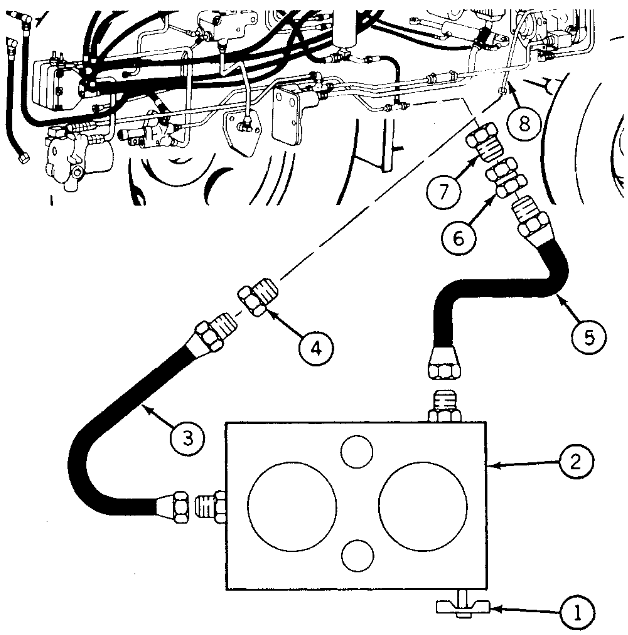
Operate the loader control valve or some other non-priority function.

The pressure gauge will indicate the pressure control valve setting. The pressure control valve setting should be 1250 to 1350 psi (86 to 93 bar) (88 to 95 kg/cm²).

If setting is high or low remove rear plug and add or deduct shims.

See Group 2160 for repair of the pressure control valve.

Circuit Leakage Test



T46676N

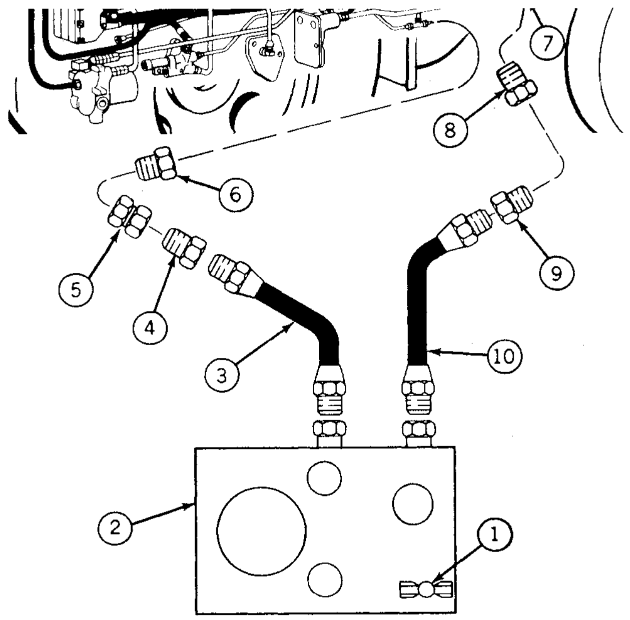
1—Pressure Loading Valve Handle
2—Nuday Hydraulic Tester
3—D-91 Tester Inlet Hose
4—D-107
5—D-91 Tester Outlet Hose
6—D-96
7—D-106
8—Main Hydraulic Pump Pressure Hose

Fig. 51-Circuit Leakage Test Set-Up Using Nuday

With engine shut off, operate loader on backhoe functions to bleed down accumulator before disconnecting lines.

Connect hydraulic tester (in-line type only) as shown in Figs. 51 and 52.

Open hydraulic tester pressure loading valve handle (1, Figs. 51 and 52). Start engine, adjust to high idle and run until normal operating temperature is reached.



T46677N

1—Pressure Loading Valve Handle
2—OTC Hydraulic Tester
3—Y21-10 Tester Outlet Hose
4—Y3005
5—Y3001
6—D-106
7—Main Hydraulic Pump Pressure Hose
8—D-107
9—Y3021
10—Y21-10 Tester Inlet Hose

Fig. 52-Circuit Leakge Test Set-Up Using OTC

With all components in neutral, tester should show no flow. If flow is present, check the cylinders and control valves for leakage.

Steering Leakage

Perform the following service checks on the steering system if steering functions become erratic or if it is suspected that the unit has been operating with highly contaminated hydraulic oil.

Gerotor Leakage Test

1. Operate the machine to obtain a transmission oil temperature of approximately 100° F (38° C).

2. Cycle steering valve from lock to lock approximately 15 times to bring oil temperature in the valve to approximate temperature in the transmission sump.

3. With engine at idle speed, turn steering wheel to extreme left (steering arm stop against axle). Apply 60 lb-in. (7 Nm) (0.7 kgm) of torque to steering wheel forcing it to the left.

Record the time required to make one full left turn of the steering wheel.

4. Check extreme right turn under same procedure as specified for left turn.

5. If the time for one full turn in either direction is less than 4 seconds the valve or cylinders are defective.

6. To determine if the leakage is in the steering valve or in the steering cylinder use the following procedure. Shut off engine and relieve hydraulic pressure.

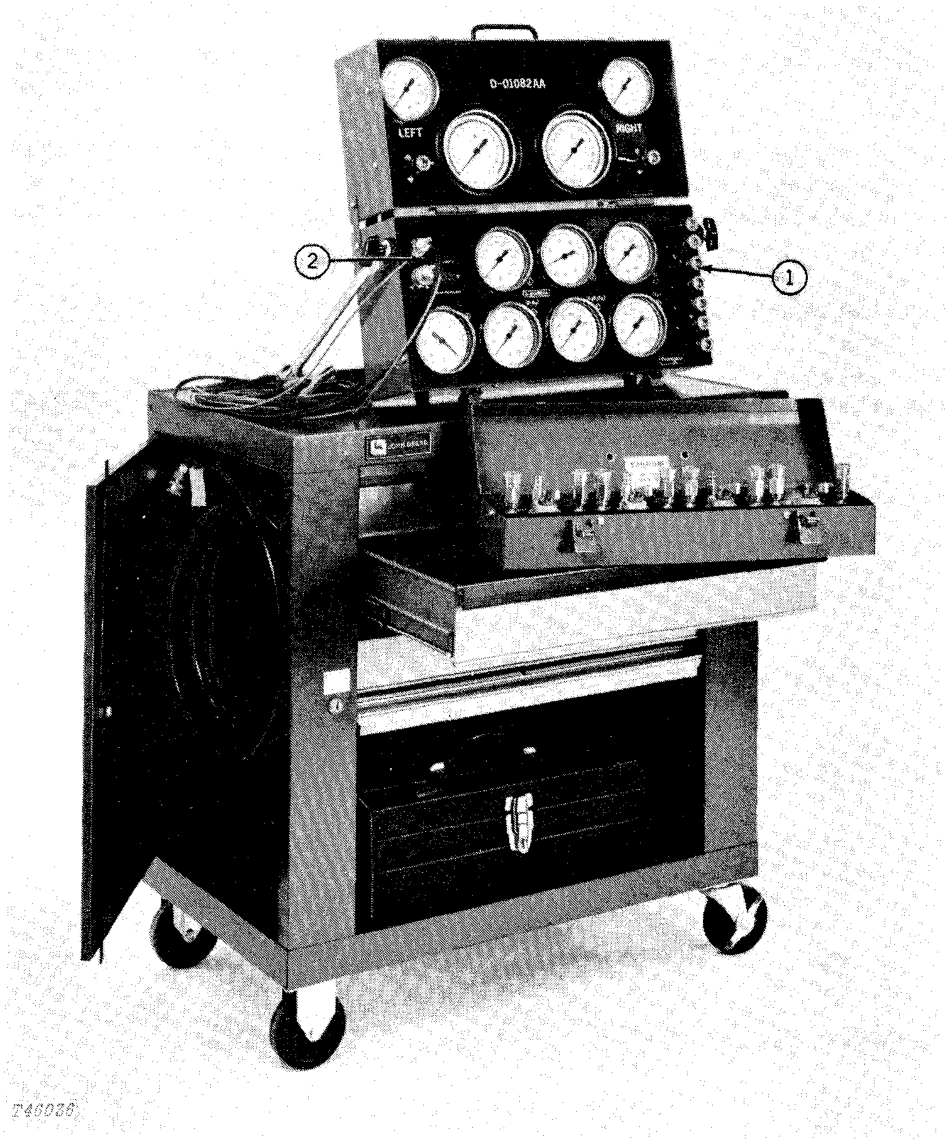
a. Disconnect steering cylinder hoses from the hydraulic steering lines.
b. Plug hydraulic steering lines to stop passage of oil.
c. Conduct leakage test on the steering valve in both turns under the same procedure as indicated in steps 3 and 4.
d. If the slippage of the steering valve has not changed, the steering valve is defective and must be replaced.
e. If the slippage of the steering valve has reduced considerably the leakage is in the steering cylinder and must be repaired.

ANALYZING TRANSMISSION AND MAIN HYDRAULIC PUMP TESTS

Transmission Pump Flow	Main Hydraulic Pump Inlet Pressure	Main Hydraulic Pump Flow	Defective Part(s)
Normal	Normal	Low	Bad Main Hydraulic Pump
Normal	Normal	Low	Bad Hydraulic Oil Filter High Pressure Leak in Reservoir Hydraulic Circuit Bad Surge Relief Valve Bad Transmission Filter High Pressure Leak in Circuit Returning Oil to the Transmission Sump Bad Cooler Bypass Relief Valve
Low	Low	Normal	Bad Transmission Pump

HYDRAULIC SYSTEM ANALYZER

Group 9025A
HYDRAULIC SYSTEM (ANALYZER)



T46036

1—Master Hydraulic System Analyzer
2—Tachometer/ Temperature Unit

Fig. 1-Hydraulic System Analyzer

GENERAL INFORMATION

The hydraulic system analyzer consists of a master hydraulic system analyzer, a tachometer/temperature sending unit and a utility equipment accessory kit.

The master hydraulic system analyzer contains a 0 - 5000 psi (0 - 34 480 kPa) (0 - 345 bar) gauge, a dual purpose 0 - 30 in. (0 - 1 016 mbar) Hg vacuum or a 0 - 150 psi (0 - 1030 kPa) (0 - 10 bar) pressure gauge, a 0 - 30 in. (0 - 1 016 mbar) Hg vacuum gauge and four 0 - 400 psi (0 - 2760 kPa) (0 - 28 bar) pressure gauges. Each gauge uses quick coupling connectors. The quick coupling connectors are numbered the same as the gauges.

The tachometer/temperature reader is used to record engine rpm and hydraulic system oil temperature. It is powered by the backhoe loader electrical system.

The utility equipment accessory kit contains the necessary quick connectors and adapters to instrument the hydraulic circuits for easy hook-up of the analyzer.

The hydraulic system analyzer is designed to test hydraulic systems.

The hydraulic system analyzer measures pump and circuit conditions by recording pressures at specified engine rpm's. An orifice is installed into the circuit so all the hydraulic pump flow is directed through it.

To check the hydraulic system, remove the backhoe boom circuit relief valve. Install the specified orifice, then install the pressure gauge into the top test port of the hydraulic pump stroke control valve.

Connect the tachometer/temperature sending unit and start the engine. Bottom the backhoe boom raise function and hold. Watch the oil temperature. When the oil reaches the specified temperature, adjust engine rpm to obtain the specified test pressure. If it takes more engine rpm than specified to obtain the test pressure, the circuit has a leak or the hydraulic pump is defective.

The hydraulic system pretest check sheet provides a general listing of problems in the hydraulic system.

The symptom index is a table that lists the symptoms that the operator may report. From the symptoms, it points out the probable faulty component and a test to verify it.

The procedure for testing the hydraulic system follows:

1. Fill out the hydraulic system pretest check sheet (Fig. 2).

2. Locate symptoms from the pretest check sheet on the symptom index, pages 9025A-5 and 9025A-6.

3. Perform verification tests.

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

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

PRETEST INSPECTION

1. Record machine identification information on Hydraulic Systems Pretest Check Sheet (Form M-5107).
2. Record customer description of problem.
3. Clean machine as required for visual inspection.
4. Inspect following items: (Record findings on Check Sheet)

   Hydraulic oil
   Transmission filter
   Function return filter
   Transmission oil cooling system
   Hydraulic lines and fittings
   Cylinders

5. Correct problems noted.
6. Perform operational checks.

OPERATIONAL CHECKS

1. Record following information on the Hydraulic System Test Record.

   Machine description
   Test specifications
   Circuit relief settings

2. Start engine.
3. Cycle a function until hydraulic oil is warm.
4. With engine at fast idle, cycle functions. Record cycle times on Test Record. Observe operation of functions.
5. Compare recorded cycle times with specification cycle times.
6. Check applicable symptoms on Check Sheet.
7. Inspect hydraulic oil for bubbles.
8. Inspect filters for plugging and particles.
9. Go to Symptom Index, Pages 9025A-5 and 9025A-6. Select probable faulty component(s). Select component test.

HYDRAULIC SYSTEM PRETEST CHECK SHEET

Machine Identification

Customer Comments: ______________________

PRETEST INSPECTION

1. Clean machine as required.
2. Perform all inspections.
3. Correct any problems.
4. Perform Operational Check.

Hydraulic Oil	Yes	No
Correct type	☐	☐
Correct level	☐	☐
Bubbles in oil	☐	☐
Other ________	☐	☐

Oil Cooler	Yes	No
Clear of dirt, debris	☐	☐
Fan or shroud damaged	☐	☐
Belt tension and condition	☐	☐
Leaking cooler or lines	☐	☐

Control Valve(s)	Yes	No
Bent linkage	☐	☐
Properly adjusted linkage	☐	☐

Hydraulic System	Yes	No
Bent or damaged lines	☐	☐
External oil leaks	☐	☐
Cylinder Rod(s) Bent	☐	☐
Frequently blown seals and fittings	☐	☐

Filters:	Transmission		Return		Hydraulic	
	Yes	No	Yes	No	Yes	No
Ruptured Filter	☐	☐	☐	☐	☐	☐
Plugged Filter	☐	☐	☐	☐	☐	☐
Metal Particles	☐	☐	☐	☐	☐	☐
Packing Particles	☐	☐	☐	☐	☐	☐
New Filter Installed	☐	☐				

OPERATIONAL CHECK

1. Start engine. Warm the hydraulic oil as described in the machine Technical Manual.
2. With engine at specified fast idle, cycle each circuit.
3. Record cycle times. Check applicable symptoms.
4. Reinspect hydraulic oil for bubbles.
5. Go to Symptom Index in machine Technical Manual to select and verify faulty component.

No hydraulics	☐	
No power in hydraulics	☐	
Slow hydraulics, general	☐	
Slow hydraulics in circuit	☐	________ (Name of circuit)
Slow circuit in one direction	☐	________ (Name of circuit)
Chattering hydraulics, general	☐	
Chattering hydraulics in circuit	☐	________ (Name of circuit)
Circuit initially moves in opposite direction	☐	________ (Name of circuit)
Wrong circuit operates	☐	________ (Name of circuit)
Drift or leakdown in circuit	☐	________ (Name of circuit)
Sticky operation of control valves	☐	
Noisy pump	☐	
Filter warning indicator on	☐	
Slipping transmission	☐	

COMMENTS: ______________________

M-5107-STOCK-5-76

T49052N

T49052N

Fig. 2-Hydraulic System Pretest Check Sheet

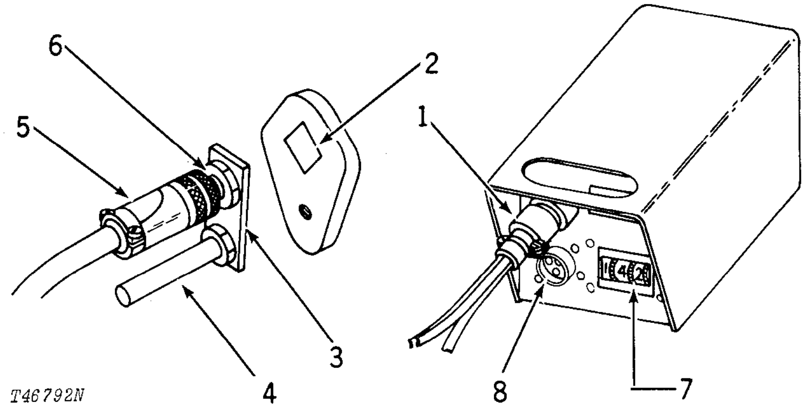
SYMPTOM INDEX

SYMPTOMS	PROBABLE FAULTY COMPONENTS	VERIFICATION
Function drifts or leaks down from loaded position Possible: Lack of power in function	Loader control valve or loader cylinder Backhoe control valve or backhoe cylinder	Perform Cylinder Leakage Test on applicable cylinder, page 9025A-18. If no problem is found, perform the Backhoe and Loader Function Circuit Test, pages 9025A-16 and 9025A-17.
Lack of power in loader or backhoe bucket	Control valve	Perform Backhoe and Loader Function Circuit Test on control valve, pages 9025A-16 and 9025A-17.
Sluggish or no loader operation Loss of steering power during loader operations	Pressure control valve	Perform Pressure Control Valve Test, page 9025A-20.
Function initially moves in opposite direction	Loader control valve Backhoe control valve	Replace lift check valve in function.
Slipping direction reverser clutches	Reverser clutch control Pressure regulating valve Direction reverser clutches	Perform Transmission Pump Test, page 9025A-18.
Ruptured oil cooler or connecting hoses	Surge relief valve Cooler bypass and relief valve	Remove and inspect surge relief valve, plug and spring. Repair and replace if necessary. See Group 2160. Remove and inspect cooler bypass and relief valve and spring. Repair or replace as necessary. See Group 0360.
Slow hydraulics, general Chattering hydraulics, general Overheating hydraulic oil general	These general complaints have many possible causes.	Perform System Test, page 9025A-7.

SYMPTOM INDEX (Continued)

SYMPTOMS	PROBABLE FAULTY COMPONENTS	VERIFICATION
Chattering loader only Possible: Lack of steering power	Power steering valve or Pressure control valve	Check power steering valve for indications of overheating. Perform Pressure Control Valve Test, page 9025A-20.
Chattering when extending cylinders	Charge or return circuits	Perform System Test, page 9025A-7.

TESTING AND ADJUSTMENT



T46792N

1—Power/RPM Cable
2—Access Hole
3—Mounting Plate
4—Special Screw
5—Power/RPM Cable
6—Magnetic Pickup
7—Thumb Dials
8—Lower Junction

Fig. 3-Tachometer Setup

System Test

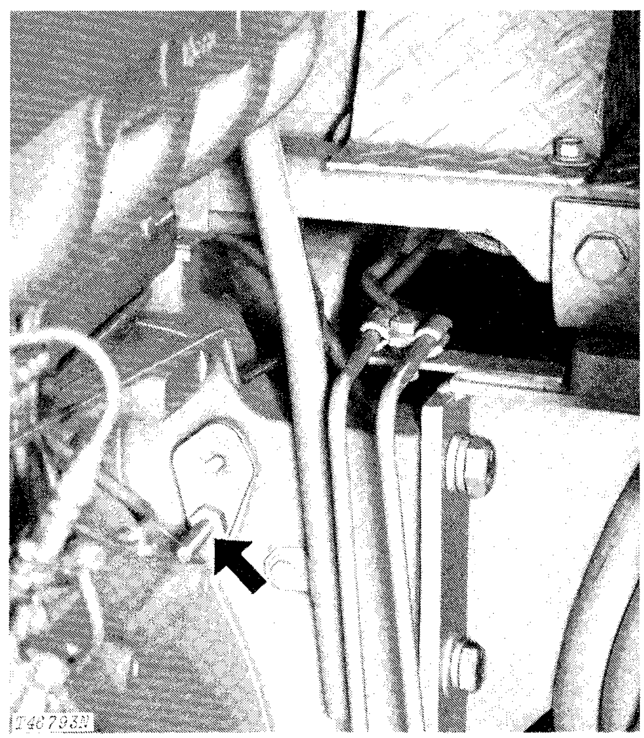
1. Connect Hydraulic Diagnostic Unit.

   a. Tachometer, Temperature and Power Hookup

   (1) Remove access hole cover from front surface of flywheel housing by removing special screw (Fig. 4).

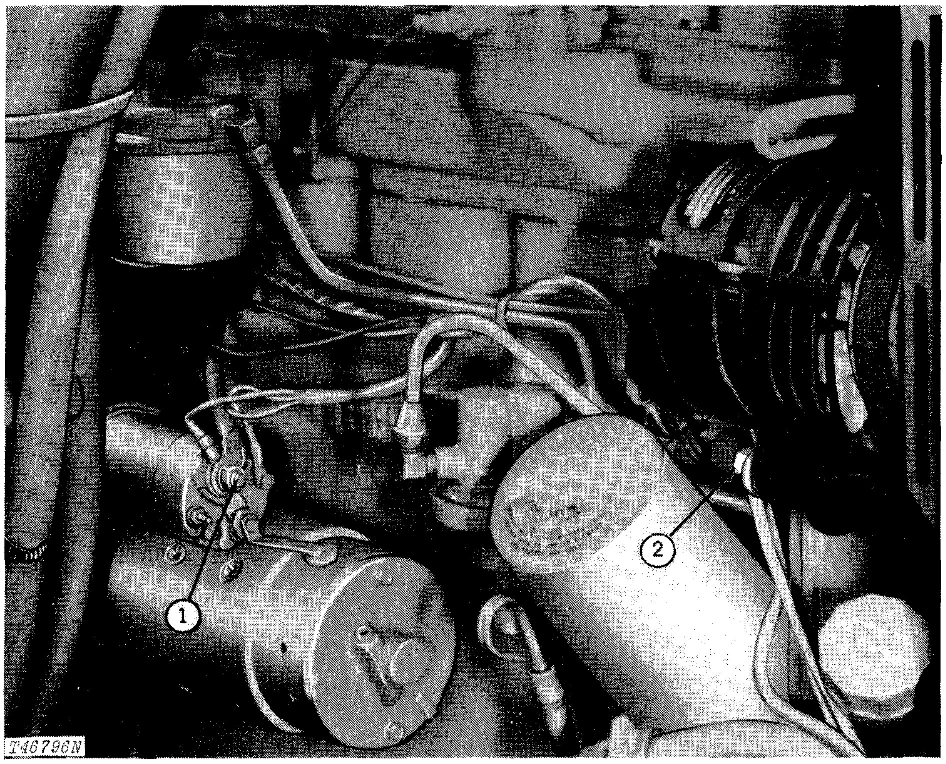
   (2) Thread magnetic pickup (6, Fig. 3) into mounting plate (3, Fig. 3). Attach to flywheel housing at location shown in Fig. 4 using special screw (4, Fig. 3). NOTE: With engine stopped, turn magnetic pickup in until it contacts flywheel. Back out 1/4 to 1/2 turn and lock in place.

   (3) Place master hydraulic system analyzer box on machine fender, facing operator. Install power/rpm cable (1 and 5, Fig. 3) between tachometer/temperature reader and magnetic pickup (6).



T46793N

Fig. 4-Flywheel Access Hole Cover Cap Screw



T46796N

1—Starting Motor Battery Terminal

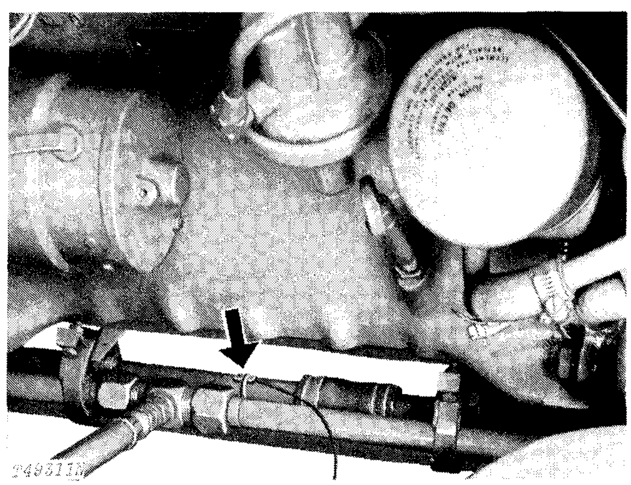
2—Alternator Mounting Screw

Fig. 5-Tachometer Temperature Reader Electrical Hookup

(4) Adjust thumb dials (7, Fig. 3) on tachometer/temperature unit to a setting of 142 teeth pulses per revolution.

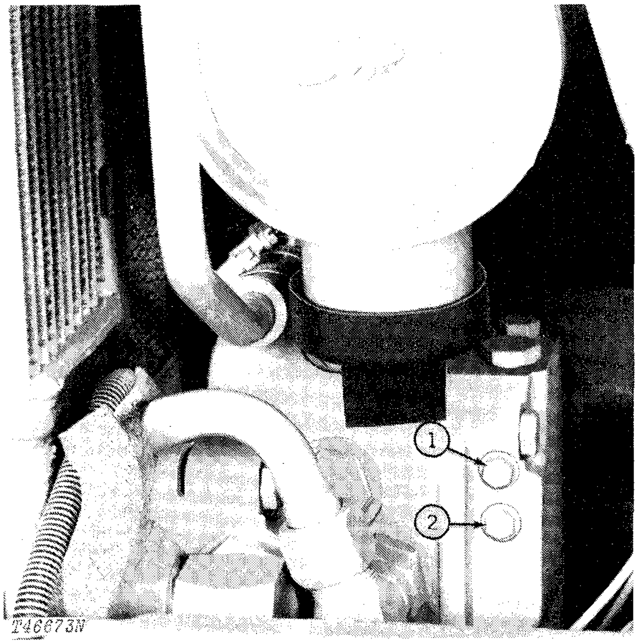
(5) Route electrical leads on power/rpm cable to right side of engine. Attach red clip to battery terminal (1, Fig. 5) on starter motor solenoid. Attach black clip to lower mounting cap screw (2, Fig. 5) on alternator.

(6) Using plastic strap, attach temperature sensor to main hydraulic pump charge line (Fig. 6). Attach other end of temperature sensor cable to lower junction (8, Fig. 3). To assure good contact, apply a layer of grease between temperature sensor and charge line.



T49311N

Fig. 6-Temperature Sensor Location



T46673N

1— System Pressure (Pump Outlet Pressure) 2— Charge Pressure (Pump Inlet Pressure)

Fig. 7-Charge and System Pressure Test Ports

b. Main Pump Pressure Hookup

(1) Remove two plugs from pressure ports (1 and 2, Fig. 7) in right side of main hydraulic pump.

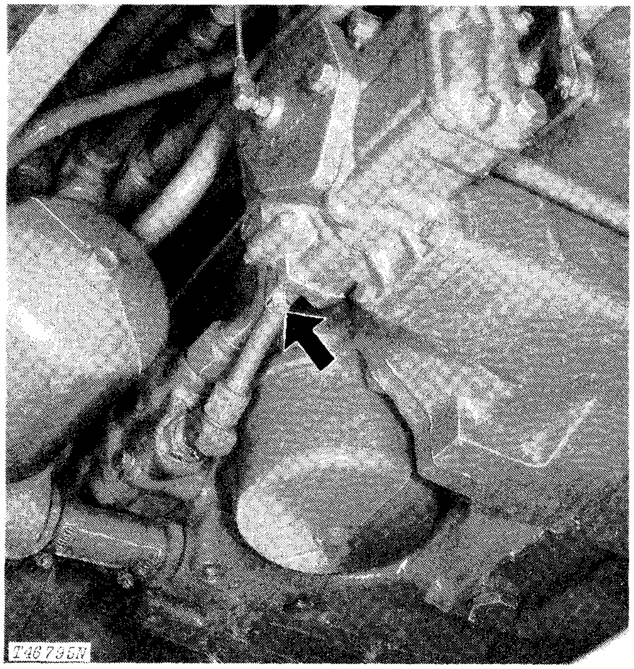
(2) Install straight connector, Part No. 202853 (customary) or JT05491 (metric) in each port.

(3) Attach quick coupler adapter, Part No. 202850, to top straight connector.

(4) Attach 45° swivel elbow, Part No. 202852 and quick coupler adapter, Part No. 202850 to bottom straight connector.

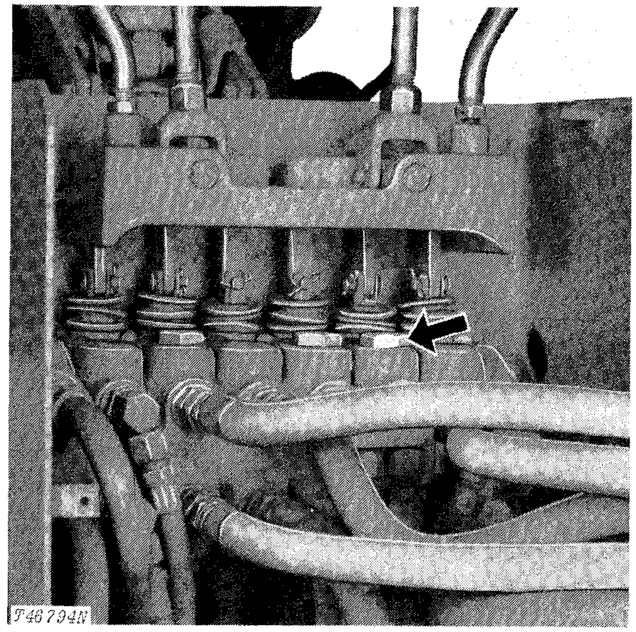
(5) Attach quick coupler adapter on 144 in. (3 658 mm) hose assembly, Part No. 36952, to No. 2 test port on Master Hydraulic System Analyzer box. Attach other end of hose to lower (2, Fig. 7) quick coupler adapter on pump.

(6) Attach quick coupler adapter on 144 in. (3 658 mm) hose assembly with valve, Part No. 36953, to No. 1 test port on Master Hydraulic System Analyzer box. Attach other end of hose to quick coupler adapter in system pressure port (1, Fig. 7) on pump.



T46795N

Fig. 8-Transmission System Pressure Test Plug



T46794N

Fig. 9-Boom Raise Relief Valve Cartridge

c. Transmission Pump Pressure Hookup

(1) Remove plug (Fig. 8) from bottom side of reverse control valve cover.

(2) Install straight connector, Part No. 202853.

(3) Attach quick coupler adapter, Part No. 202850, to straight connector.

(4) Attach quick coupler adapter on 144 in. (3 658 mm) hose assembly, Part No. 36952, to No. 3 test port on Master Hydraulic System Analyzer box. Attach other end of hose to quick coupler adapter on reverse control valve.

d. Orifice Installation

(1) Lock backhoe boom in transport position.

(2) Check boom raise circuit for leakage before installing orifice.

(a) Let engine speed stabilize at idle. Record engine rpm.

(b) Operate backhoe boom raise circuit. Record engine rpm. There should be no decrease in engine rpm.

(c) If engine rpm decreases there is leakage in boom circuit. Disconnect boom lower hose at manifold on backhoe. Plug hose and rerun step (a) and (b). If cylinder is leaking plug connector on manifold and repair after test. If leak is in valve, repair as necessary before proceeding.

(3) If boom raise circuit does not have leakage, remove relief valve cartridge from boom raise circuit (Fig. 9) of backhoe control valve.

(4) Install 0.125 in. (3.18 mm) orifice, Part No. 202836 for units (310A) equipped with (3 in.^{3}) 49 cm^3 or (3 in.^{3}) 50 cm^3 pump. Install 0.177 in. (4.50 mm) orifice, Part No. 202837 for units (310B) equipped with (4 in.^{3}) 65 cm^3 pump.

Test

1. Record test specifications (Figs. 10 and 11) on Close Center Hydraulic System Test Record (Form M-5112) (Figs. 12 and 13).

2. Run engine to warm hydraulic oil, 100° to 110°F (38° to 43°C). Maintain this temperature for all test readings.

NOTE: To warm oil the perform the in stroke test, operate the backhoe boom raise circuit with the orifice installed.

3. Hold engine speed at 100 rpm and obtain the following readings:

a. With main pump in stroke, record main pump outlet pressure.

b. With main pump in standby, record main pump outlet pressure.

c. With main pump in stroke, record main pump inlet pressure.

d. With main pump in standby, record main pump inlet pressure.

e. With main pump in standby, record transmission pump outlet pressure.

4. Hold engine speed at 2200 rpm and obtain the following readings:

a. With main pump in standby, record main pump outlet pressure.

b. With main pump in stroke, record main pump inlet pressure.

c. With main pump in standby, record main pump inlet pressure.

d. With main pump in standby, record transmission pump outlet pressure.

5. Put main pump in stroke. Start at low idle and increase engine rpm until main pump outlet pressure is at 2000 psi (13 790 kPa) (138 bar). Record engine rpm in high pressure circuit test slot on test record (Figs. 12 and 13). Stop engine.

NOTE: Before going to the next step the hydraulic oil accumulator can be checked at this point. The results of this check will not affect the system test and is performed at this point to utilize the instrumentation of the unit for the system test. Perform Hydraulic Oil Accumulator Check per following procedure.

a. Observe pressure gauge and slowly bleed pressure from hydraulic system. The backhoe stabilizer or steering is used to slowly bleed pressure from hydraulic system.

b. The point at which needle on pressure gauge quickly drops to 0 indicates accumulator precharge pressure.

c. If pressure is less than 500 psi (3 450 kPa) (34 bar), recharge, repair, or replace accumulator as necessary. See Group 2160.

HYDRAULIC OIL TEMPERATURE: 100° to 110°F (38 to 43°C) sensor on main pump inlet line.
ORIFICE USED: 202836, 0.125 in. (3.18 mm), remove the circuit relief valve for boom raise and install orifice.

SETTING OF THUMB DIALS: 142

ENGINE RPM	MAIN PUMP OUTLET PRESSURE		MAIN PUMP INLET PRESSURE		TRANSMISSION PUMP OUTLET
	IN STROKE	STANDBY	IN STROKE	STANDBY	STANDBY
1000	1100 psi min. (7580 kPa min.) (75.8 bar min.)	2250 to 2400 psi (15510 to 16550 kPa) (155.1 to 165.5 bar)	30 to 130 psi (210 to 900 kPa) (2.1 to 9.0 bar)	35 to 130 psi (240 to 900 kPa) (2.4 to 9.0 bar)	155 to 165 psi (1070 to 1140 kPa) (10.7 to 11.4 bar)
2200		2300 to 2400 psi (15860 to 16550 kPa) (158.6 to 165.5 bar)	50 to 130 psi (340 to 900 kPa) (3.4 to 9.0 bar)	50 to 130 psi (340 to 900 kPa) (3.4 to 9.0 bar)	155 to 165 psi (1070 to 1140 kPa) (10.7 to 11.4 bar)
1510 MAX.	2000 psi (13 790 kPa) (137.9 bar)	HIGH PRESSURE CIRCUIT TEST			

T87919

Fig. 10-Test Specifications for Units (310A) Equipped with (3 in.³) 49 cm³ or (3 in.³) 50 cm³ Hydraulic Pump

HYDRAULIC OIL TEMPERATURE: 100 to 110°F (38 to 43°C) sensor on main pump inlet line.
ORIFICE USED: 202837, 0.177 in. (4.50 mm), remove the circuit relief valve for boom raise and install orifice.

SETTING OF THUMB DIALS: 142

ENGINE RPM	MAIN PUMP OUTLET PRESSURE		MAIN PUMP INLET PRESSURE		TRANSMISSION PUMP OUTLET
	IN STROKE	STANDBY	IN STROKE	STANDBY	STANDBY
1000	560 psi min. (3860 kPa min.) (38.6 bar min.)	2250 to 2400 psi (15510 to 16550 kPa) (155.1 to 165.5 bar)	30 to 130 psi (210 to 900 kPa) (2.1 to 9.0 bar)	35 to 130 psi (240 to 900 kPa) (2.4 to 9.0 bar)	155 to 165 psi (1070 to 1140 kPa) (10.7 to 11.4 bar)
2200		2300 to 2400 psi (15860 to 16550 kPa) (158.6 to 165.5 bar)	50 to 130 psi (340 to 900 kPa) (3.4 to 9.0 bar)	50 to 130 psi (340 to 900 kPa) (3.4 to 9.0 bar)	155 to 165 psi (1070 to 1140 kPa) (10.7 to 11.4 bar)
2025 MAX.	2000 psi (13 790 kPa) (137.9 bar)	HIGH PRESSURE CIRCUIT TEST			

T87920

Fig. 11-Test Specifications for Units (310B) Equipped with (4 in.³) 65 cm³ Hydraulic Pump

CLOSED-CENTER HYDRAULIC SYSTEM TEST RECORD

Date ____________

Work Order No. ____________

[Attach to Hydraulic System Pretest Check Sheet]

TEST SPECIFICATIONS: (A)

Hydraulic Oil Temperature: 100 to 110 F (38 to 43 C)

High Pressure Circuit Test: While main pump outlet pressure is at 2000 psi, engine speed must not be greater than 1510 rpm. using 0.125 in. (3.18 mm) orifice, part No. 202836

Transmission Pump Test: ______ Use ______ orifice, Part No. ______. With transmission pump pressure at ______ PSI (Bar) engine speed must not exceed ______ RPM.

ENGINE RPM	MAIN PUMP OUTLET PRESSURE		MAIN PUMP INLET PRESSURE		TRANS. PUMP OUTLET
	In Stroke	Standby	In Stroke	Standby	Standby
1000	1100 psi min.	2250 to 2400 psi	30 to 130 psi	35 to 130 psi	155 to 165 psi
2200		2300 to 2400 psi	50 to 130 psi	50 to 130 psi	155 to 165 psi
1510 max.	2000 psi	HIGH PRESSURE CIRCUIT TEST			
		TRANSMISSION PUMP TEST			

TEST RECORD (B)

	ENGINE RPM	MAIN PUMP OUTLET PRESSURE		MAIN PUMP INLET PRESSURE		TRANS. PUMP OUTLET
		In Stroke	Standby	In Stroke	Standby	Standby
TEST 1	1000	1500 psi N	2300 psi N	55 psi N	45 psi N	157 psi N
	2200		2350 psi N	25 psi L	35 psi L	162 psi N
	1280 N	2000 psi	HIGH PRESSURE CIRCUIT TEST			
			TRANSMISSION PUMP TEST			

T85455

A—Test Specifications **B—Test Readings**

Fig. 12-Sample of Hydraulic System Test Record for Units (310A) Equipped with (3 in.³) 49 cm³ or (3 in.³) 50 cm³ Hydraulic Pump (Sample Does Not Reflect Actual Test Data)

6. Compare test readings (B, Figs. 12 and 13) to test specification (A). Mark classification next to each reading. Use following classifications:

- H = High Pressure and high rpm
- N = Normal pressure and normal rpm
- L = Low pressure
- P = Pulsing pressure - Pulsing is combined with other classifications. For example, NP means pressure is normal but unsteady.

7. Determine probable cause by comparing test pattern with test pattern(s) on Test Pattern Analysis Chart pages 9025A-15 and 9025A-16.

Sample test pattern in Figs. 12 and 13 compares with the second test pattern from the Test Pattern Analysis Chart and indicates a cooler bypass relief valve stuck open or weak or broken spring.

CLOSED-CENTER HYDRAULIC SYSTEM TEST RECORD

Date ____________________

Work Order No. ____________________

[Attach to Hydraulic System Pretest Check Sheet]

TEST SPECIFICATIONS: (A)

Hydraulic Oil Temperature: 100 to 110 F (38 to 43 C)

High Pressure Circuit Test: While main pump outlet pressure is at 2000 psi, engine speed must not be greater than 2025 rpm. using 0.177 in. (4.50 mm) orifice part No. 202837

Transmission Pump Test: __________ Use ______ orifice, Part No. __________. With transmission pump pressure at ______ PSI (Bar) engine speed must not exceed ______ RPM.

ENGINE RPM	MAIN PUMP OUTLET PRESSURE		MAIN PUMP INLET PRESSURE		TRANS. PUMP OUTLET
	In Stroke	Standby	In Stroke	Standby	Standby
1000	560 psi min.	2250 to 2400 psi	30 to 130 psi	35 to 130 psi	155 to 165 psi
2200		2300 to 2400 psi	50 to 130 psi	50 to 130 psi	155 to 165 psi
2025	2000 psi	HIGH PRESSURE CIRCUIT TEST			
		TRANSMISSION PUMP TEST			

TEST RECORD (B)

	ENGINE RPM	MAIN PUMP OUTLET PRESSURE		MAIN PUMP INLET PRESSURE		TRANS. PUMP OUTLET
		In Stroke	Standby	In Stroke	Standby	Standby
TEST 1	1000	740 psi N	2300 psi N	55 psi N	45 psi N	157 psi N
	2200		2350 psi N	25 psi L	35 psi L	162 psi N
	1960 N	2000 psi	HIGH PRESSURE CIRCUIT TEST			
			TRANSMISSION PUMP TEST			

T85456

A—Test Specifications **B—Test Readings**

Fig. 13-Sample of Hydraulic System Test Record for Units (310B) Equipped with (4 in.³) 65 cm³ Hydraulic Pump (Sample Does Not Reflect Actual Test Data)

TEST PATTERN ANALYSIS CHART

PATTERN	PROBABLE CAUSE	VERIFICATION AND/OR CORRECTION
N N N N N N H H N N	Cooler bypass - relief valve not opening or set too high	Inspect valve, spring and bore. Repair or replace. See Group 0360.
N N N N N N L L N N	Cooler bypass - relief valve stuck open or weak or broken spring	Inspect valve, spring and bore. Repair or replace. See Group 0360. Retest.
N N N N N N L L N/L N	Transmission filter restricted	Change filter. Retest.
N N N/L N N N L N N N	Function return filter restricted	Change filter. Retest.
N N H H N N N N N N	Cooler oil flow restricted	Inspect cooler and lines. Remove restriction.
P N P P P N P P P H	Air entering suction side of transmission pump	Remove suction screen, inspect and clean. Retest. If problem was not corrected, split tractor between clutch housing and transmission case. Inspect and replace seals and gaskets as required. See Group 0341.
N N L L N N L L N H	Leak in charge or return circuit	Replace hydraulic oil filter with the JD-293-2 filter assembly and JD-293-3 tube extension. Return the standby tests only. If readings are normal, problem is in the hydraulic oil filter assembly. Inspect valves, springs, valve seats and bores. Replace or repair as necessary. If readings are unchanged, perform the Transmission Pump Test, page 9025A-18 and replace as indicated. Rerun test.
N L N N N L N N N H	Standby pressure adjustment low	Adjust standby pressure. Retest.

TEST PATTERN ANALYSIS CHART—Continued

PATTERN	PROBABLE CAUSE	VERIFICATION AND/OR CORRECTION
N N N N N N N N N H	Electric destroke solenoid leaking. Stroke control valve assembly leaking.	Replace solenoid with solenoid test plug. Retest. If problem is not corrected, inspect stroke control valve assembly. Repair or replace as necessary (Group 2160).
L N N N N N N N N H	High pressure leak in a function returning oil to pump or inefficient hydraulic pump.	Replace hydraulic oil filter with the JD-293-2 filter assembly and JD-293-3 tube extension. Rerun test at standby only. If main pump inlet pressure drops, problem is a leak in a function (backhoe or loader) returning oil to to pump. Use Backhoe and Loader Function Circuit Test to locate the problem, page 9025A-16. If problem is not corrected, problem is in the main hydraulic pump. Repair or replace main hydraulic pump (Group 2160).
L L/N L L N N L L N H	High pressure leak in power steering valve, pressure control valve or transmission top cover O-ring.	Check power steering valve, pressure control valve or transmission top cover for excessive heat. Excessive heat is an indication of a high pressure leak.

Backhoe and Loader Function Circuit Test

1. Oil leakage in each of the functions can be checked by using the following general procedure. Check each function in each direction.

2. Connect Hydraulic Analyzer to machine as described in System Test 1a, 1b, and 1d.

3. Bottom function to be checked in one direction.

4. Return function control lever to neutral.

5. Operate backhoe boom raise circuit to keep pump in stroke. Make all readings with oil temperature at 100° to 110°F (38° to 43°C).

6. Adjust engine speed to maintain 2000 psi (13 790 kPa) (138 bar). Immediately bottom function being checked and watch pressure. A pressure drop indicates leakage in that function. Note for later test.

7. Bottom function in opposite direction and repeat steps 4, 5, and 6.

8. Test all functions as described above. Note all functions indicating leakage.

9. Using Hydraulic System Test Record (Fig. 14), run the boom raise function at 2000 psi (13 790 kPa) (138 bar) to 1000 psi (6900 kPa) (69 bar)at 250 psi (1720 kPa) (17 bar) increments. Record engine rpm for each pressure setting. This will be the standard circuit.

HYDRAULIC SYSTEM TEST RECORD

HYDRAULIC TEST SPECIFICATIONS: USE (________) ORIFICE, PART NO. ____________
WHILE PRESSURE IS AT ________ PSI (________ BAR)
MAXIMUM ENGINE SPEED MUST BE LESS THAN ________ RPM.
HYDRAULIC OIL TEMPERATURE MUST BE ________ °F (________ °C)

SYSTEM RELIEF VALVE SETTING: SPEC ________ PSI (________ BAR)
ACTUAL ________ PSI (________ BAR)

CIRCUIT	CIRCUIT RELIEF SETTING SPEC	CYCLE TIME SPEC	CYCLE TIME ACTUAL	Rpm at 17 bar 250 PSI	Rpm 34 bar 500 PSI	Rpm at 52 bar 750 PSI	Rpm at 69 bar 1000 PSI	Rpm at 86 bar 1250 PSI	Rpm at 103 bar 1500 PSI	Rpm at 120 bar 1750 PSI	Rpm at 138 bar 2000 PSI	Rpm at 155 bar 2250 PSI	Rmp at 172 bar 2500 PSI
Boom Lift		3.5		2			870	950	1030	1110	1200		
Crowd Out				3			920	1110	1185	1275	1375		
Crowd In	2375			4			870	950	1275	1875	2200		
											1		

T65581N

T65581N

1—Pressure at Which Circuit Condition is Check
2—Backhoe Boom Lift, Standard Circuit
3—Crowd Out, Indicating a Leak
4—Crowd In, Indicating a Bad Circuit Relief Valve

Fig. 14-Hydraulic System Test Record Sample (Sample Does Not Reflect Actual Test Data)

10. Using test in step 9 run function(s) noted before as leaking. Record engine rpm for each pressure setting.

11. Compare readings from step 10 to standard circuit from step 9.

12. All engine rpm in a circuit are greater than rpm's in standard circuit. Variation becomes greater at an increasing but steady rate. Possible causes are cylinder leaking, (perform Cylinder Leakage Test, page 9025A-18), circuit relief valve seat, O-ring, anti-cavitation valves or spool leakage. Repair or replace as necessary (Group 3360).

13. If engine rpm in a circuit shows a sudden jump above the rpm's in standard circuit; this indicates relief valve set too low. Repair, or replace as necessary (Group 3360).

NOTE: 9500 Backhoe swing circuit relief valves are set below 2000 psi (13 790 kPa) (138 bar). Therefore, this test is not valid for leakage, but will indicate relief valve operation. Loader bucket dump is a non-priority circuit and relief valve is set too close to pressure control valve setting. Therefore, this test is not valid for leakage or relief valve operation.

Cylinder Leakage Test

1. Bottom a cylinder.

2. Disconnect hydraulic oil line from cylinder at end where cylinder is bottom.

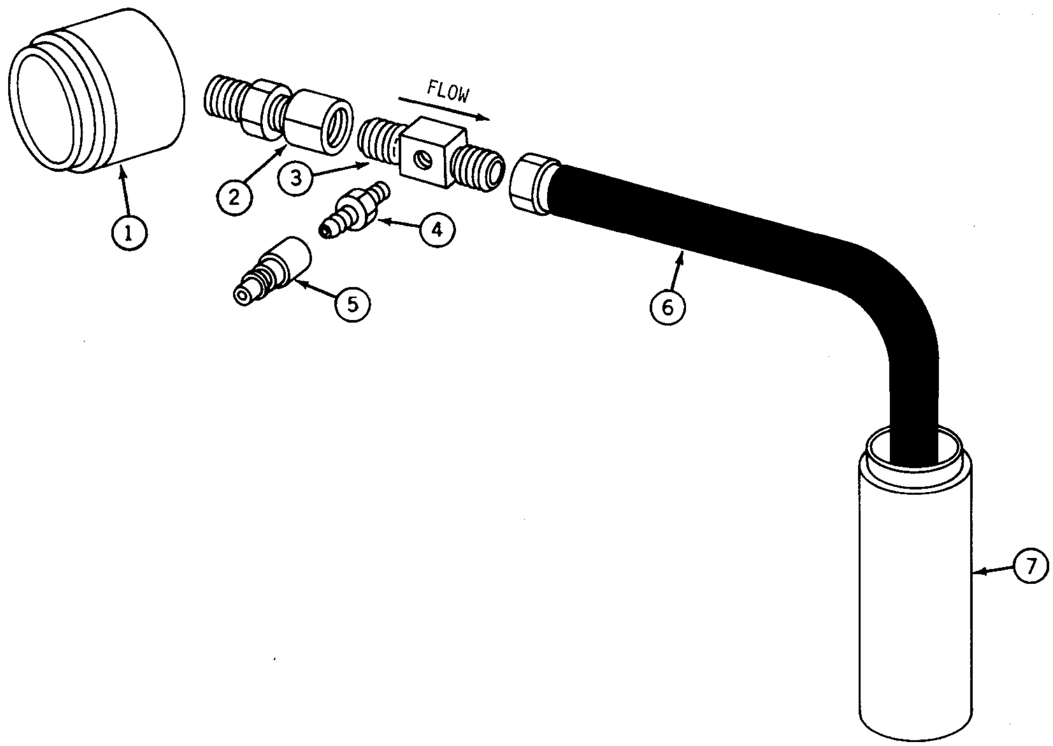
3. Cap line.

4. While observing open cylinder port for a flow of oil, reactivate circuit in the same direction that cylinder is bottomed.

5. If oil flows from open port in a continuous stream, remove and repair cylinder (Group 3360).

6. If oil does not flow in a continuous stream, check applicable section of control valve (Group 3360).

Transmission Pump Test



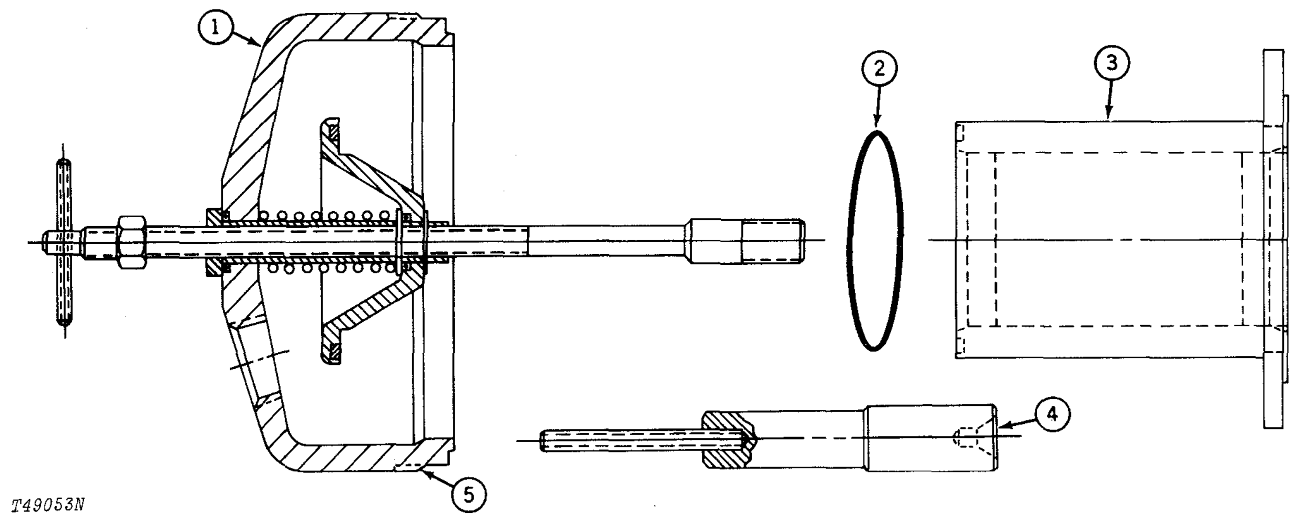
1—JD-293-1 Cover
2—17502 Connector
3—203665 0.187 (4.75 mm) orifice
4—202853 Straight Connector
5—202850 Quick Coupler Adapter
6—203658 Plastic Hose Assembly
7—Transmission Filler Neck

Fig. 15-Transmission Pump Test Setup

1. Start engine and operate boom and bucket to heat the oil to 100° to 110°F (38° to 43°C).

2. Stop engine and relieve hydraulic pressure.

3. Remove plug from the top of the stroke control valve and replace with a manual destroke valve and lever. Turn destroke valve in to destroke main pump. Keep test short with main pump destroked.



T49053N

1—Filter Housing Cover Assembly (JD-293-1)
2—O-Ring
3—Filter Assembly (JD-293-2)
4—Spool Assembly (JD-293-4)
5—Distance to Grind Step Back

Fig. 16-Parts for Installing JD-293 Transmission Pump Tool Kit

4. Remove transmission filter cover and filter.

5. Install transmission pump tool kit in order shown in Fig. 16.

NOTE: If oil leaks around the cover, remove it, grind back step (5, Fig. 16).

6. Remove transmission filter relief valve. The transmission filter relief valve is located in the transmission case right above the transmission filter.

7. Replace filter relief valve with spool assembly JD-293-4 (4, Fig. 16). Install 202807 fitting to hold spool assembly JD-293-4 in place.

NOTE: If oil leaks from 202807 fitting during test, stop test and check dummy filter for proper installation of components and/or leaking O-rings.

8. Install fittings, hoses, and 0.187 in. (4.75 mm) orifice, Part No. 203665, as shown in Fig. 15.

9. Install straight connector, part number 202853 into orifice (3, Fig. 15).

10. Attach quick coupler adapter, part number 202850, to straight connector.

11. Attach quick coupler adapter on 144 in. (3 658 mm) hose assembly, part number 36952 to No. 3 test port on Master Hydraulic System Analyzer. Attach other end of hose to quick coupler adapter on the orifice (3, Fig. 15).

12. Start engine and check for leaks.

13. Increase engine rpm until the pressure gauge reads 175 psi (1210 kPa) (12 bar).

14. 175 psi (1210 kPa) (12 bar) should be obtained at no more than 2400 rpm. If not, the transmission pump or pressure line is defective. See Group 0360 for repair or replacement.

Pressure Control Valve Test

1. Install Hydraulic Diagnostic Unit as follows:

   a. Remove right-hand side grille.

   b. Remove plug from system pressure test port (1, Fig. 7) in right side of main hydraulic pump.

   c. Install straight connector, Part No. 202853 (customary) or JT05491 (metric).

   d. Attach quick coupler adapter, Part No. 202850, to straight connector.

   e. Attach quick coupler adapter on 144 in. (3 658 mm) hose with valve assembly, Part No. 36953, to No. 1 test port on Master Hydraulic System Analyzer. Attach other end of hose to quick coupler adapter on pump.

2. Run engine at 1000 rpm and raise loader. Record pressure.

NOTE: Pressure reading while operating the loader with no load indicates the pressure control valve setting.

3. Pressure should be 1250 to 1350 psi (8620 to 9310 kPa) (86 to 93 bar).

4. If pressure reading is not within specifications, remove plug from the neck of the pressure control valve and add shims to increase pressure or deduct shims to decrease pressure.

5. If problem not corrected, perform System Test, pages 9025A-7 to 9025A-14.

CYCLE TIME CHART

310A CYCLE TIME SPECIFICATIONS

LOADER FUNCTION	SECONDS
Boom raise	4.1
Boom down (power)	2.9
Boom down (float)	3.5
Bucket dump (boom at full height)	1.8
Bucket rollback (from maximum dump position and boom at full height)	1.5
Bucket rollback (flat on ground)	0.8

BACKHOE FUNCTION	SECONDS
Boom raise (maximum depth to full height)	4.5
Boom raise (ground to full height)	2.1
Boom lower (full height to maximum depth)	4.1
Boom lower (full height to ground)	1.9
Dipperstick in	3.6
Dipperstick out	3.3
Bucket curl	2.3
Bucket dump	1.9
Swing (180°)	3 to 5

310B CYCLE TIME SPECIFICATIONS

LOADER FUNCTION	SECONDS
Boom raise	3.4
Boom down (power)	2.5
Boom down (float)	3.5
Bucket dump (boom at full height)	1.4
Bucket rollback (from maximum dump position and boom at full height)	1.2
Bucket rollback (flat on ground)	0.6

BACKHOE FUNCTION	SECONDS
Boom raise (maximum depth to full height	4.0
Boom raise (ground to full height)	1.9
Boom lower (full height to maximum depth)	3.4
Boom lower (full height to ground)	1.6
Dipperstick in	2.8
Dipperstick out	2.7
Bucket curl	2.3
Bucket dump	1.8
Swing (180°)	3 to 5

NOTE: Cycle times given are to be used only as guidelines. Therefore when a unit does not perform according to the cycle times given, the service technician must decide if the difference is great enough to indicate a malfunction of some component in the system.

BACKHOE LOADER FUNCTION

BACKHOE FUNCTIONS	CIRCUIT RELIEF SETTING 9405	9500	LIFT CHECK	ANTI CAVITATION
Right Stabilizer Up	NONE	NONE	YES	NONE
Right Stabilizer Down	NONE	NONE	YES	NONE
Left Stabilizer Up	NONE	NONE	YES	NONE
Left Stabilizer Down	NONE	NONE	YES	NONE
Crowd In	2375	2375	NONE	NONE
Crowd Out	NONE	NONE	YES	NONE
Bucket Load	NONE	NONE	YES	NONE
Swing Right	2375	1625	YES	YES
Swing Left	2375	1625	YES	YES
Boom Up	3500	3000	YES	NONE
Boom Down	2375	2375	NONE	YES
Extendible Dipperstick In	NONE	NONE	NONE	NONE
Extendible Dipperstick Out	NONE	NONE	NONE	NONE
Locking Control Valve Engaged		4000	NONE	NONE
Locking Control Valve Disengaged		NONE	NONE	NONE
LOADER FUNCTIONS				
Boom Up	NONE	NONE	YES	NONE
Boom Down (Power)	NONE	NONE	YES	YES
(Float)	NONE	NONE	YES	YES
Bucket Dump (Boom at full height)	1500	1500	NONE	YES
Bucket Rollback	2750	2750	YES	NONE
Third Function (Clam Open)	2500	2500	YES	NONE
(Clam Close)	NONE	NONE	YES	NONE

LIST OF PARTS FOR TESTS

System Test

1. 202836 0.125 in. (3.18 mm) orifice for units (310A) equipped with (3 in.^{3}) 49 cm^3 or (3 in.^{3}) 50 cm^3 hydraulic pump.

   202837 0.177 in. (4.50 mm) orifice for units (310B) equipped with (4 in.^{3}) 65 cm^3 hydraulic pump.
2. 202853 (customary) (3 used) or JT05491 (metric) (2 used) Straight connector
3. 202850 Quick Coupler Adapter (3 used)
4. 202852 45° Swivel Elbow
5. 202854 Straight connector
6. 202851 90° Swivel elbow
7. 36952 144 in. (3 658 mm) hose assembly
8. 36953 144 in. (3 658 mm) hose assembly with needle valve
9. Magnetic pickup
10. Mounting plate
11. D-01080AA Master hydraulic system analyzer
12. D-01084AA Tachometer temperature reader

Backhoe and Loader Function Circuit Test

1. 202853 (customary) or JT05491 (metric) Straight connector (2 used)
2. 202850 Quick coupler adapter (2 used)
3. 202852 45° Swivel elbow
4. 202836 0.125 in. (3.18 mm) orifice for units (310A) equipped with (3 in.^{3}) 49 cm^3 or (3 in.^{3}) 50 cm^3 hydraulic pump.

   202837 0.177 in. (4.50 mm) orifice for units (310B) equipped with (4 in.^{3}) 65 cm^3 hydraulic pump.
5. 36952 144 in. (3 658 mm) hose assembly
6. 36953 144 in. (3 658 mm) hose assembly with needle valve
7. Magnetic pickup
8. Mounting plate
9. D-01080AA Master hydraulic system analyzer
10. D-01084AA Tachometer temperature reader

Transmission Pump Test

1. JD-293 Transmission pump tool kit
2. 17502 Connector
3. 202850 Quick coupler adapter
4. 202853 Straight connector
5. 203665 0.187 in. (4.75 mm) orifice
6. 202807 Fitting
7. 203658 Plastic hose assembly
8. 36952 144 in. (3 658 mm) hose assembly
9. Magnetic pickup
10. Mounting plate
11. Manual destroke valve and lever
12. D-01080AA Master hydraulic system analyzer
13. D-01084AA Tachometer temperature reader

Pressure Control Valve Test

1. 202853 (customary) or JT05491 (metric) Straight connector
2. 202850 Quick coupler adapter
3. 36953 144 in. (3 658 mm) hose assembly with needle valve
4. D-01080AA Master hydraulic system analyzer
5. D-01084AA Tachometer temperature reader

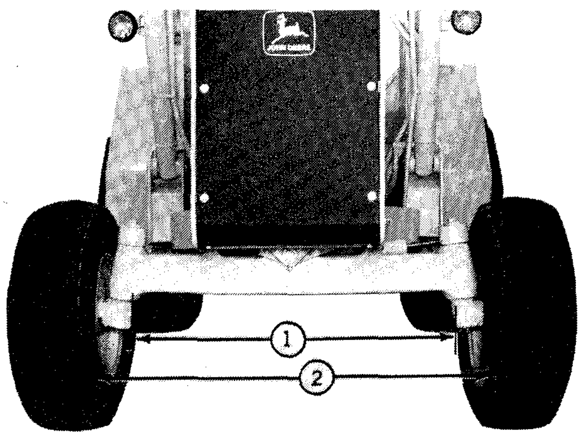
Group 9030
MISCELLANEOUS COMPONENTS

ADJUSTMENT

Front Axle Toe-In

The solid front axle has a fixed tread of 58 inches (147 cm). Check the toe-in of the front wheels periodically as follows:

With wheels in the straight ahead position, measure distance between rims at front and rear of wheels at hub height. Proper toe-in is 0.13 to 0.37 inch (3.3 to 9.4 mm) less in front than in the rear.



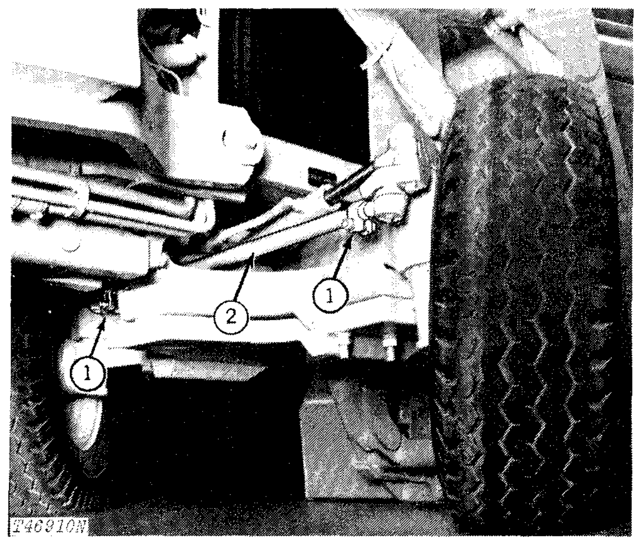
T46909N

1—Distance Between Rims at Rear
2—Distance Between Rims at Front

Fig. 1-Front Axle Toe-In

To adjust toe-in, loosen clamps on outer end of tie rod. Turn tie rod tube until proper toe-in is obtained.

When adjustments are completed, position cap screws in clamps so they do not interfere with the steering cylinder rod during turns.



1—Clamps
2—Tie Rod

Fig. 2-Toe-In Adjustment

Group 9035
SPECIFICATIONS AND SPECIAL TOOLS
ENGINE
SPECIFICATIONS AND TORQUE VALUES

Basic Engine

Minimum compression reading . . . . 350 psi
(24 bar) (25 kg/cm²)

The most important factor in compression readings is the difference between cylinders. This difference should be no more than 50 psi (3 bar) (4 kg/cm²).

Engine Lubrication System

Oil pressure at 2650 rpm with engine oil at normal operating temperature . . . . .50 ± 15 psi
(3.5 ± 1.0 bar) (3.5 ± 1.0 kg/cm²)

Engine Cooling System

Fan Belt Adjustment

With gauge
(initial . . . . 130 to 140 lb. force
(579 to 623 N)

(after 3 minutes of operation) . . . . 85 to 95 lb. force
(378 to 423 N)

Without gauge . . . . 3/4 inch (19.0 mm) flex at 25 lb. force
(111 N)

Fuel System

Fuel supply pump at low idle pressure . . . . 2 to 2.5 psi
(0.1 to 0.2 bar) (0.1 to 0.2 kg/cm²)

Injection pump cam advance
JDB431MD3027
Total advance movement . . . . 8 ± 1/2°
Advance at 800 to 1000 rpm (no load) . . . . 1°

ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

Speed Control Linkage

Fast idle .... 2650 ± 25 rpm
Slow idle ....800 + 25-0 rpm

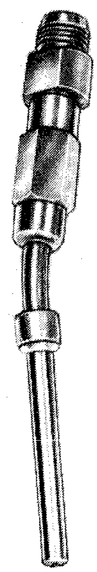
Air Intake System

Air restriction indicator shows red when water vacuum gauge reads .... 22.5 to 27.5 inches of water (56 to 68 mbar)

ENGINE
SPECIAL TOOLS

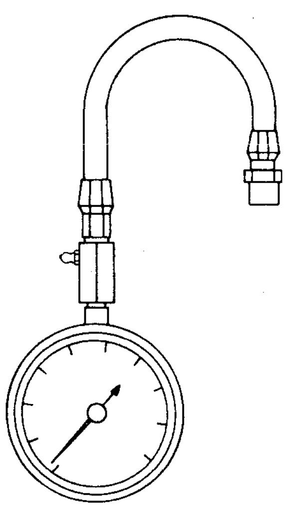
Essential Tools

Tool	Tool Number	Use
Basic Engine	D-14550 BA (Formerly 70-314)	Compression Gauge Adapter - To check engine compression.
	D-14547 BA (Formerly 70-7003)	Compression Gauge - To check engine compression.



T31826NY

Fig. 1-Compression Gauge Adapter



T27985N

Fig. 2-Compression Gauge

ENGINE

SPECIAL TOOLS—Continued

Essential Tools—Cont.

Tool	Tool Number	Use
Engine Lubrication System	-----	Pressure Gauge - To check oil and fuel pressures.

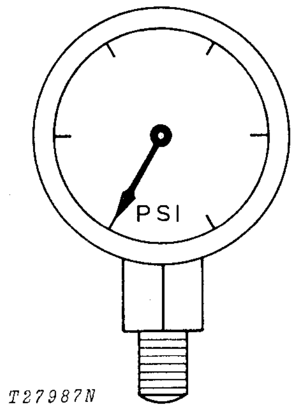


Fig. 3-Pressure Gauge

Tool	Tool Number	Use
Fuel System	JD259	Timing Window - To adjust injection pump cam advance.

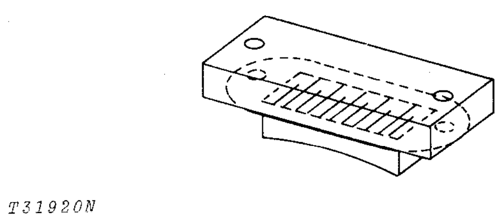


Fig. 4-Injection Pump Timing Window

ENGINE

SPECIAL TOOLS—Continued

Essential Tools—Cont.

Tool	Tool Number	Use
Speed Control Linkage	(Not Illustrated)	Tachometer - To check engine speeds while adjusting speed control linkage.

Convenience Tools

Tool	Tool Number	Use
Air Intake System	D-05022 ST (Formerly JDST-11)	Water Vacuum Gauge - To check air vacuum.

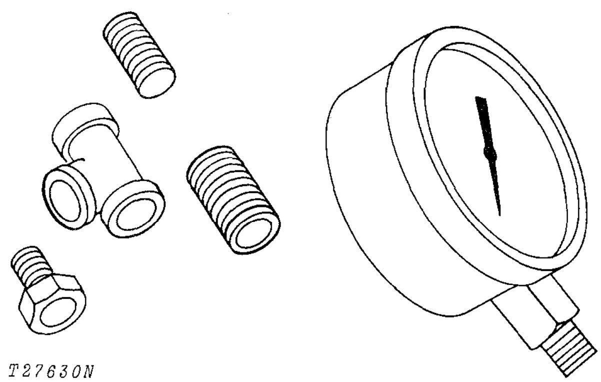
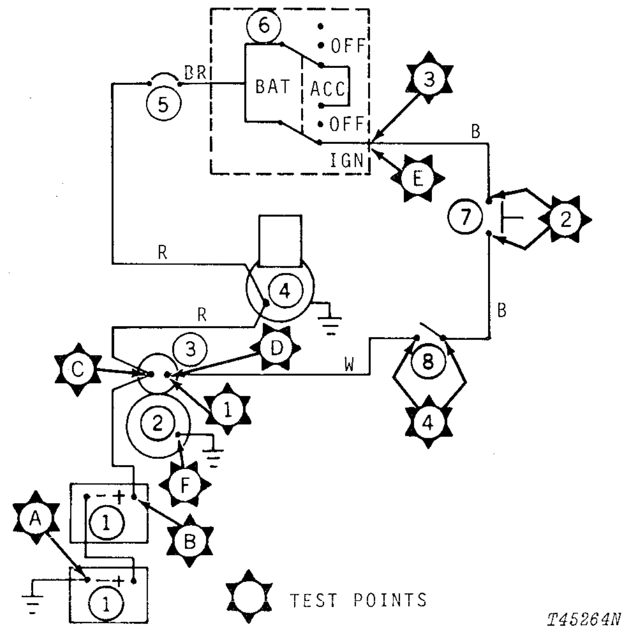


Fig. 5-Water Vacuum Gauge and Fittings

ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES



1—Batteries
2—Starting Motor
3—Starting Motor Solenoid
4—Alternator
5—Circuit Breaker
6—Key Switch
7—Start Switch
8—Neutral Start Switch
R—Red BR—Brown
B—Black W—White

Fig. 6-Starting Circuit Test Points

Starting Circuit Test Valves

Test No. 1 .... 9.0 to 12.0 volts
Test No. 2 .... 9.0 to 12.0 volts
Test No. 3 .... 9.0 to 12.0 volts
Test No. 4 .... 9.0 to 12.0 volts

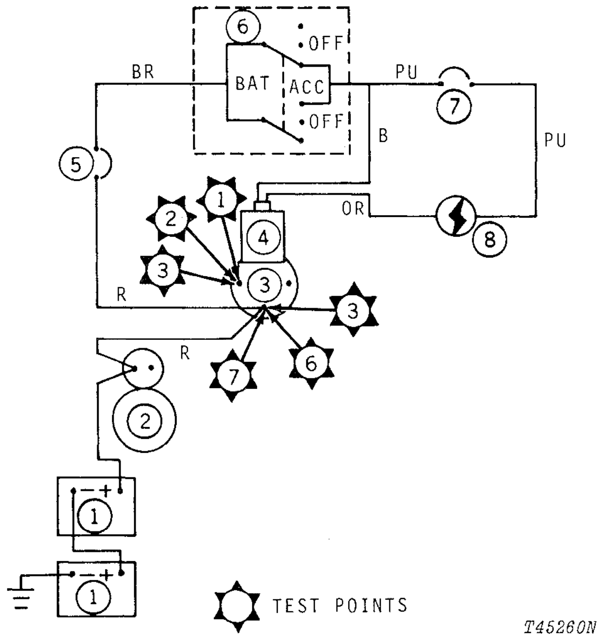
High Resistance Test

Test Points	Maximum Voltage Reading
A - F	0.2 volt
B - C	0.2 volt
C - D	1.0 volt
C - E	0.2 volt

Neutral Start Switch .... Tighten to 20 to 25 lb-ft each time a washer is added or removed during the adjustment procedure.

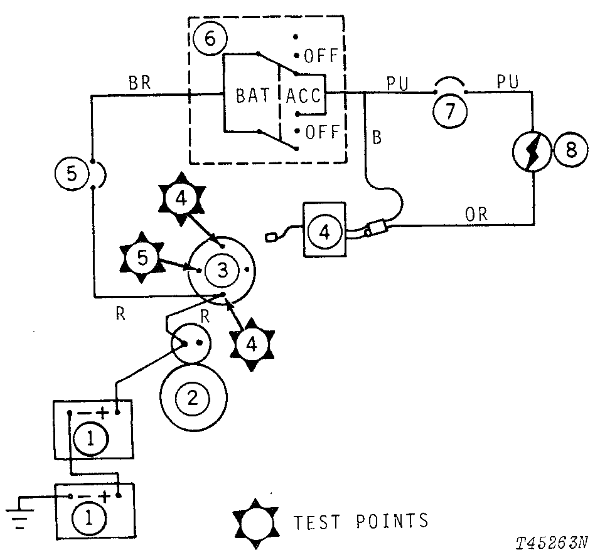
ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Regulator
5—Circuit Breaker
6—Key Switch
7—Circuit Breaker
8—Alternator Indicator Light
R—Red BR—Brown
PU—Purple B—Black
OR—Orange

Fig. 7-Charging Circuit Test Points



1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Regulator
5—Circuit Breaker
6—Key Switch
7—Circuit Breaker
8—Alternator Indicator Light

Fig. 8-Charging Circuit Test Points

Charging Circuit Test Values

Test No. 1 - Isolation Diode Check (Key Switch Off) .... 0 volts

Test No. 2 - Field Circuit Check (Key Switch On, Engine Not Running) .... 1.5 - 2.5 volts

Test No. 3 - Isolation Diode Check (Key Switch On, Engine Running)
Regulator terminal .... 15.4 volts
Output terminal .... 14.4 volts

Test No. 4 - Field Draw Test (Key Switch Off) .... 2 to 2.5 amps

Test No. 5 - Checking Alternator and Regulator With Regulator Disconnected (Key Switch On, Engine Running) .... 15 to 16 volts

Test No. 6 - 35 Amp Alternator Output
25 Amps .... 13 to 15 volts

55 Amp Alternator Output
43 Amps .... 13 to 15 volts

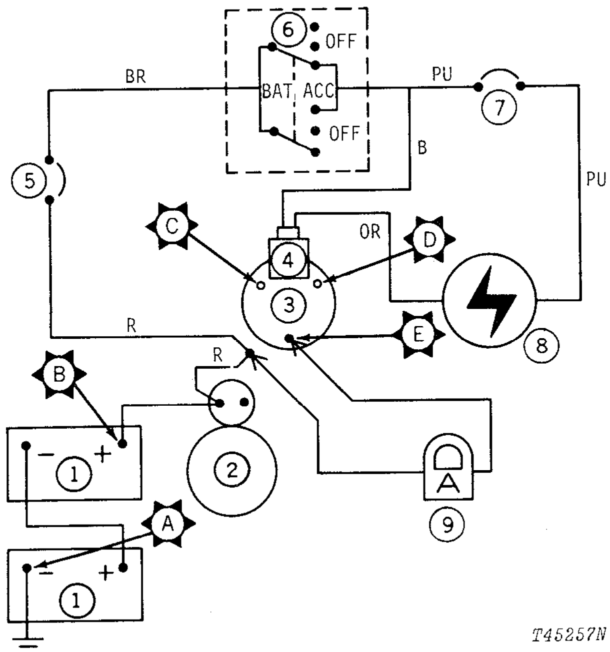
Test No. 7 - Testing Regulator (after fifteen minutes of operation at 1500 rpm) .... See Chart

Temperature*	Voltage
40° F (4° C)	14.4 - 14.9 volts
60° F (16° C)	14.3 - 14.7 volts
80° F (27° C)	14.2 - 14.6 volts
100° F (38° C)	14.0 - 14.4 volts
120° F (49° C)	13.8 - 14.3 volts
140° F (60° C)	13.6 - 14.1 volts

Measured one inch (25 mm) from regulator.

ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



1—Batteries
2—Starting Motor and Solenoid
3—Alternator
4—Regulator
5—Circuit Breaker
6—Key Switch
7—Circuit Breaker
8—Alternator Indicator Light
9—Ammeter
R—Red BR—Brown
PU—Purple B—Black
OR—Orange

Fig. 9-Charging Circuit High Resistance Test

High Resistance Test

Test Points	Maximum Voltage Reading*
A - D	0.3 volt
B - E	0.3 volt
B - C	1.3 volts

**10-amp charging rate.*

Light Circuit Test Values

Voltage reading at lamp terminal .... Battery voltage
Maximum voltage drop between battery and lamp .... 0.5 volts
Maximum voltage drop between lamp frame and ground; across switch or connection .... 0.1 volt

Light Adjustment

Distance of upper edge from lamp center at 25 ft (7.62 m) ... Top edge - 5 in. (127.0 mm) below centerline

Accessory Circuit

Fuel Gauge Resistance

Full .... 30 ohms
Half Full .... 15 ohms
Empty .... 0 ohms

Horn

Current draw .... 4.5 to 5.5 amps

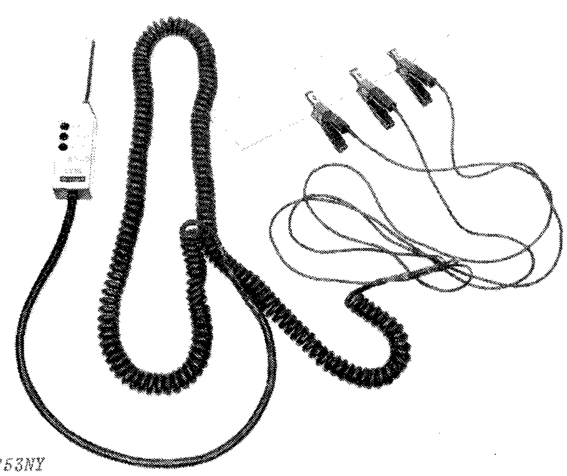
Injection Pump Solenoid Winding

Winding current draw .... Approx. 2.5 amps
Winding resistance .... Approx. 5 ohms
Voltage required to energize .... Approx. 8.0 volts

ELECTRICAL SYSTEM

SPECIAL TOOLS

Convenience Tools



T55753NY

Fig. 10-Voltage Detector

T61677N

Fig. 11-Voltmeter, Ohmmeter and Ammeter

Tool No.	Use
D-05136ST	Voltage Detector....to test starting, charging and accessory circuits to determine grounded or shorted circuit components.
D-19001TT	Voltmeter .... to test starting charging and accessory circuits.
	Ohmmeter ... to check continuity.
	Ammeter... to measure alternator output current.
D-19005TT	100 Amp DC Current shunt...to extend the ammeter's current range.

POWER TRAIN

SPECIFICATIONS AND TORQUE VALUES

NOTE: Power train operation is hydraulically controlled; therefore, "Hydraulic System - Specifications and Special Tools" contains the necessary information to test the power train with reverser system.

HYDRAULIC SYSTEM (FLOW METER)

SPECIFICATIONS AND TORQUE VALUES

Transmission Hydraulic System

Reverser system pressure at high idle with 100°F (38°C) oil . . . . 155 to 165 psi (1070 to 1140 kPa) (10.7 to 11.4 bar)

Clutch pressure . . . . 130 psi (900 kPa) (9 bar)

Transmission pump flow at 2200 rpm with 100°F (38°C) oil and 150 psi (1030 kPa) (10 bar) . . . . 10.5 gpm (40 L/min)

Transmission filter relief valve differential pressure setting . . . . 50 psi (340 kPa) (3 bar)

Main Hydraulic System

Pressure control valve setting . . . . 1250 to 1350 psi (8620 to 9310 kPa) (86 to 93 bar)

Hydraulic return oil filter relief valve differential pressure setting . . . . 50 psi (340 kPa) (3 bar)

Charge pressure at low idle with main hydraulic pump in standby (oil at 100°F [38°C]) . . . . . . 35 to 130 psi (240 to 900 kPa) (2 to 9 bar)

Charge pressure at high idle with main hydraulic pump in standby (oil at 100°F [38°C]) . . . . 55 to 130 psi (380 to 900 kPa) (4 to 9 bar)

Standby system pressure. . . . . 2300 to 2400 psi (15 860 to 16 550 kPa) (159 to 165 bar)

HYDRAULIC SYSTEM (FLOW METER)

SPECIFICATIONS AND TORQUE VALUES—Continued

Main Hydraulic System—Continued

Main hydraulic pump flow at 2200 rpm with 100°F (38°C) oil and a minimum of 5 psi (30 kPa) (0.3 bar) charge pressure and 2000 psi (13 790 kPa) (138 bar) system pressure
3.00 in.^{3} (49 cm^3) or (3 in.^{3})
50 cm^3 pump (310A) . . . . 23 gpm (87 L/min)
(4 in.^{3}) 65 cm^3 pump (310B) . . . . 30.5 gpm (115 L/min)

310A Cycle Time Specifications:

Loader Function	Seconds
Boom raise	4.1
Boom down (power)	2.9
Boom down (float)	3.5
Bucket dump (boom at full height)	1.8
Bucket rollback (from maximum dump position and boom at full height)	1.5
Bucket rollback (flat on ground)	0.8

Backhoe Function	Seconds
Boom raise (maximum depth to full height)	4.5
Boom raise (ground to full height)	2.1
Boom lower (full height to maximum depth)	4.1
Boom lower (full height to ground)	1.9
Dipperstick in	3.6
Dipperstick out	3.3
Bucket curl	2.3
Bucket dump	1.9
Swing (180°)	3 to 5

NOTE: Cycle times given are to be used only as guidelines. Therefore when a unit does not perform according to the cycle times given, the service technician must decide if the difference is great enough to indicate a malfunction of some component in the system.

HYDRAULIC SYSTEM (FLOW METER)

SPECIFICATIONS AND TORQUE VALUES—Continued

Main Hydraulic System—Continued

310B Cycle Time Specifications:

Loader Function	Seconds
Boom raise	3.4
Boom down (power)	2.5
Boom down (float)	3.5
Bucket dump (boom at full height)	1.4
Bucket rollback (from maximum dump position and boom at full height)	1.2
Bucket rollback (flat on ground)	0.6

Backhoe Function	Seconds
Boom raise (maximum depth to full height)	4.0
Boom raise (ground to full height)	1.9
Boom lower (full height to maximum depth)	3.4
Boom lower (full height to ground)	1.6
Dipperstick in	2.8
Dipperstick out	2.7
Bucket curl	2.3
Bucket dump	1.8
Swing (180°)	3 to 5

NOTE: Cycle times given are to be used only as guidelines. Therefore when a unit does not perform according to the cycle times given, the service technician must decide if the difference is great enough to indicate a malfunction of some component in the system.

Surge relief valve setting .... 150 psi (1030 kPa) (10 bar)

Accumulator precharge .... 500 psi (3450 kPa) (34 bar)

Oil cooler bypass and charge relief valve (early units)

Relieves to lubrication at .... 70 psi (480 kPa) (4 bar)

Relieves to sump at .... 100 psi (690 kPa) (7 bar)

HYDRAULIC SYSTEM (FLOW METER)

SPECIFICATIONS AND TORQUE VALUES—Continued

Main Hydraulic System—Continued

Oil cooler bypass and
charge relief valve (later or replaced units)

Relieves to lubrication at . . . . 120 psi
(830 kPa)
(8 bar)

Relieves to sump at . . . . 130 psi
(900 kPa)
(9 bar)

Loader Circuit

Bucket rollback circuit
relief valve setting . . . . 2750 psi
(18 960 kPa)
(190 bar)

Bucket dump circuit
relief valve setting . . . . 1500 psi
(10 340 kPa)
(103 bar)

Multi-purpose bucket opening
circuit relief valve setting . . . . 2500 psi
(17 240 kPa)
(172 bar)

Backhoe Control Valve (9405)

Crowd section circuit
relief valve setting (head end) . . . . 2375 psi
(16 380 kPa)
(164 bar)

Swing section circuit
relief valve setting . . . . 2375 psi
(16 380 kPa)
(164 bar)

HYDRAULIC SYSTEM (FLOW METER)

SPECIFICATIONS AND TORQUE VALUES—Continued

Main Hydraulic System—Continued

Backhoe Control Valve (9405)—Continued

Boom lower (head end) circuit relief valve setting .... 2375 psi (164 bar) (167 kg/cm^2)

Boom raise (rod end) circuit relief valve setting .... 3000 psi (207 bar) (211 kg/cm^2)

Stabilizer orifice plate (bottom port) .... 0.1405 in. (3.569 mm)

Boom orifice plate (top port) .... 0.234 in. (5.94 mm)

HYDRAULIC SYSTEM (FLOW METER)

SPECIFICATIONS AND TORQUE VALUES—Continued

Main Hydraulic System—Continued

Backhoe Control Valve (9500)

Crowd section circuit
relief valve setting (head end) .... 2375 psi
(164 bar)
(167 kg/cm²)

Swing section circuit
relief valve setting .... 1625 psi
(112 bar)
(114 kg/cm²)

Boom lower (head end)
circuit relief valve setting .... 2375 psi
(164 bar)
(167 kg/cm²)

Boom raise (rod end) circuit
relief valve setting .... 3000 psi
(207 bar)
(211 kg/cm²)

Stabilizer orifice
plate (bottom port) .... 0.1405 in.
(3.569 mm)

Boom orifice plate
(top port) .... 0.234 in.
(5.94 mm)

HYDRAULIC SYSTEM (ANALYZER)

SPECIFICATIONS AND TORQUE VALUES

Hydraulic oil temperature
for tests . . . . 100 to 110°F
(38 to 43°C)

Hydraulic oil
accumulator precharge . . . . 500 psi
(3450 kPa)
(34 bar)

Pressure control
valve setting . . . . 1250 to 1350 psi
(8620 to 9310 kPa)
(86 to 93 bar)

Flywheel teeth
per revolution 142

Transmission pump test
with 0.187 in. (4.75 mm)
orifice installed, 100 to 110°F
(38 to 43°C) oil. 175 psi (1210 kPa)
(12 bar) should be maintained
at no more than . . . . 2400 rpm

HYDRAULIC SYSTEM (ANALYZER)

SPECIFICATIONS AND TORQUE VALUES—Continued

HYDRAULIC OIL TEMPERATURE: 100 to 110°F (38 to 43°C) sensor on main pump inlet line.
ORIFICE USED: 202836, 0.125 in. (3.18 mm), remove the circuit relief valve for boom raise and install orifice.

SETTING OF THUMB DIALS: 142

ENGINE RPM	MAIN PUMP OUTLET PRESSURE		MAIN PUMP INLET PRESSURE		TRANSMISSION PUMP OUTLET
	IN STROKE	STANDBY	IN STROKE	STANDBY	STANDBY
1000	1100 psi min. (7580 kPa min.) (75.8 bar min.)	2250 to 2400 psi (15510 to 16550 kPa) (155.1 to 165.5 bar)	30 to 130 psi (210 to 900 kPa) (2.1 to 9.0 bar)	35 to 130 psi (240 to 900 kPa) (2.4 to 9.0 bar)	155 to 165 psi (1070 to 1140 kPa) (10.7 to 11.4 bar)
2200		2300 to 2400 psi (15860 to 16550 kPa) (158.6 to 165.5 bar)	50 to 130 psi (340 to 900 kPa) (3.4 to 9.0 bar)	50 to 130 psi (340 to 900 kPa) (3.4 to 9.0 bar)	155 to 165 psi (1070 to 1140 kPa) (10.7 to 11.4 bar)
1510 MAX.	2000 psi (13 790 kPa) (137.9 bar)	HIGH PRESSURE CIRCUIT TEST			

T87919

Fig. 12-Specifications for Units (310A) Equipped with (3.00 in.³) 49 cm³ or (3 in.³) 50 cm³ Hydraulic pump

HYDRAULIC OIL TEMPERATURE: 100 to 110°F (38 to 43°C) sensor on main pump inlet line.
ORIFICE USED: 202837, 0.177 in. (4.50 mm), remove the circuit relief valve for boom raise and install orifice.

SETTING OF THUMB DIALS: 142

ENGINE RPM	MAIN PUMP OUTLET PRESSURE		MAIN PUMP INLET PRESSURE		TRANSMISSION PUMP OUTLET
	IN STROKE	STANDBY	IN STROKE	STANDBY	STANDBY
1000	560 psi min. (3860 kPa min.) (38.6 bar min.)	2250 to 2400 psi (15510 to 16550 kPa) (155.1 to 165.5 bar)	30 to 130 psi (210 to 900 kPa) (2.1 to 9.0 bar)	35 to 130 psi (240 to 900 kPa) (2.4 to 9.0 bar)	155 to 165 psi (1070 to 1140 kPa) (10.7 to 11.4 bar)
2200		2300 to 2400 psi (15860 to 16550 kPa) (158.6 to 165.5 bar)	50 to 130 psi (340 to 900 kPa) (3.4 to 9.0 bar)	50 to 130 psi (340 to 900 kPa) (3.4 to 9.0 bar)	155 to 165 psi (1070 to 1140 kPa) (10.7 to 11.4 bar)
2025 MAX.	2000 psi (13 790 kPa) (137.9 bar)	HIGH PRESSURE CIRCUIT TEST			

T87920

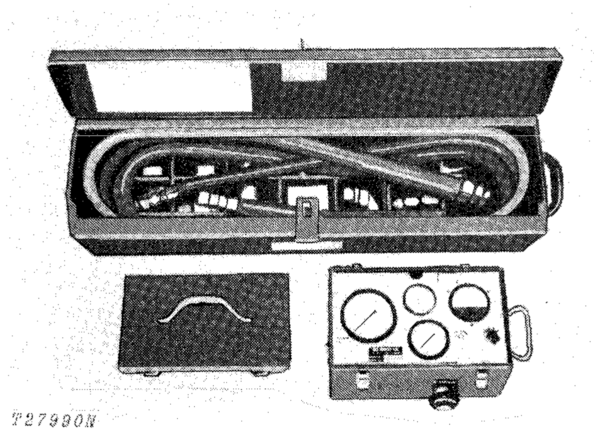
Fig. 13-Specifications for Units (310B) Equipped with (4 in.³) 65 cm³ Hydraulic pump

HYDRAULIC SYSTEM (FLOW METER)

SPECIAL TOOLS

Essential Tools

Tool



T27990N

Fig. 14-Pump Flow Meter

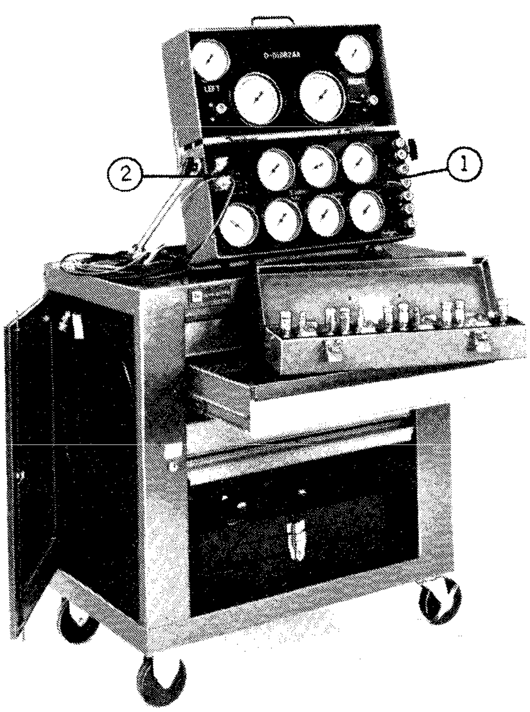
Tool Number	Use
D-15028NU	Universal pressure test kit used to check pressure readings at specific locations.
D-15051NU	Flow meter used to check system flow, pressure and temperature.
D-15037NU	Industrial flow test kit use to make hydraulic connections.

HYDRAULIC SYSTEM (ANALYZER)

SPECIAL TOOLS

Convenience Tools

Tool



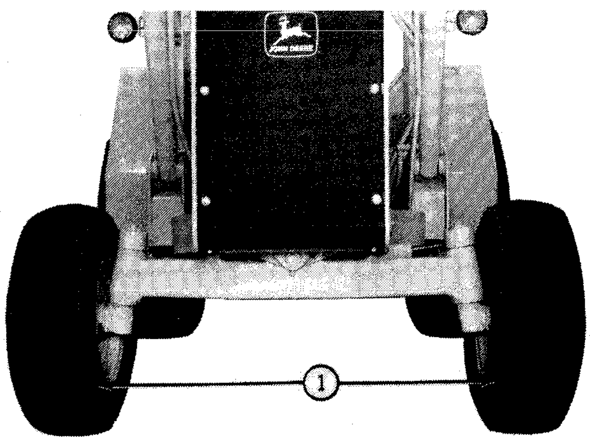
T46913N

1—Master Hydraulic System Analyzer
2—Tachometer/Temperature Reader

Fig. 15-Hydraulic System Analyzer

Tool Number	Use
D-01080AA	Master hydraulic system analyzer used when testing hydraulic system.
D-01084AA	Tachometer temperature reader used to measure engine rpm and oil temperature.
D-01085AA	Utility equipment accessory kit fittings used to make hydraulic connections.

MISCELLANEOUS COMPONENTS
SPECIFICATIONS AND TORQUE VALUES



T46911N

T46911N

Fig. 16-Toe-In Adjustment

1 - Amount front measurement less than rear measurement .... 0.13 to 0.37 in. (3.3 to 9.4 mm)

ALPHABETICAL INDEX

R

S

SAFETY

live with it