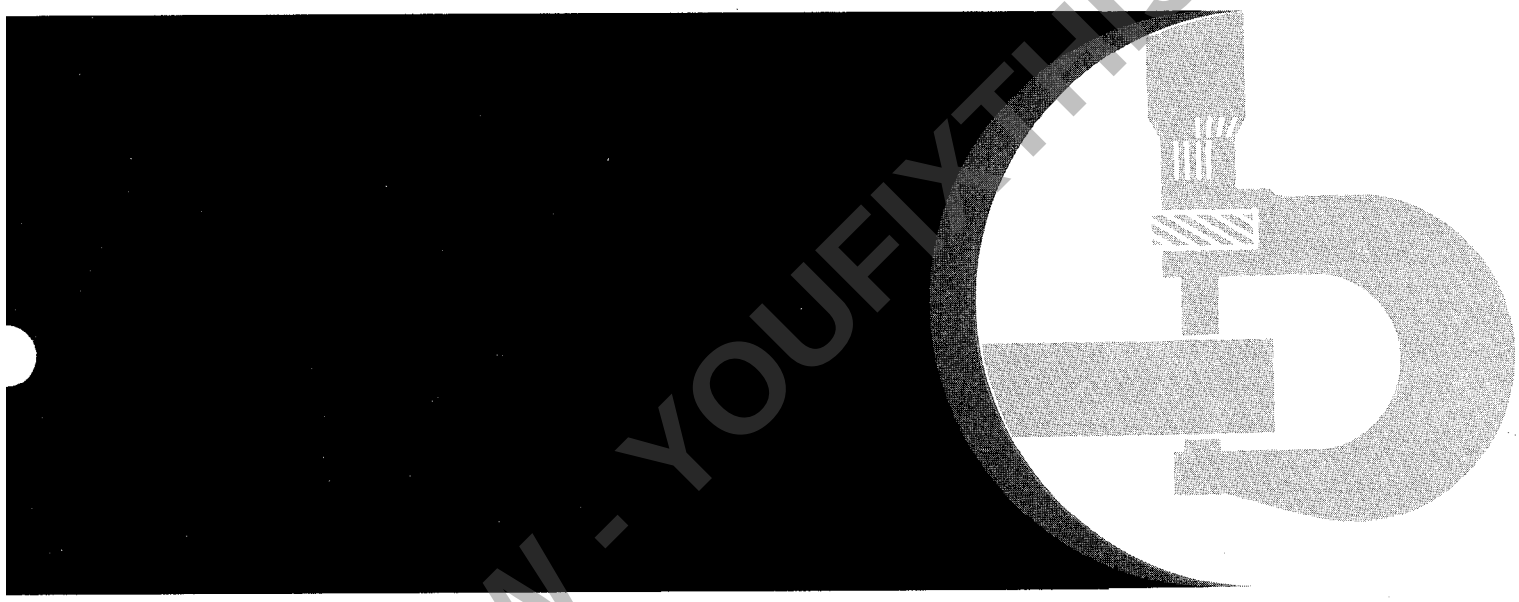
John Deere
JD510
Loader Backhoe



TECHNICAL MANUAL

John Deere Dubuque Works
TM-1039
Litho in U.S.A.

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JD510 Loader Backhoe Technical Manual TM-1039 (Oct-79)

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

OOA

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POWER TRAIN

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Starting Circuit

Before testing the circuit, check if the solenoid is engaging. If the solenoid makes a "clicking" noise and the battery has a high charge, place a heavy jumper cable from the solenoid to the starter. If the starter cranks, the solenoid is probably defective.

If the solenoid does not engage and the starter cannot be turned over by jumping the circuit, check for current through the circuit.

NOTE: If the lights operate, you can assume there is current at test point 2 and up to the terminal of the ignition switch, leaving only that portion of the circuit between test point 3 and test point 6 to check.

If the circuit and solenoid are not defective, refer to Group 15 and test the starting motor.

Accessory Circuits

Before testing, try to determine at what point the circuit is either shorted or open.

NOTE: If, for example, both the fuel gauge and the cigar lighter work, but the horn does not function, you can assume the circuit breaker is all right and that an open exists between the horn switch and the circuit breaker.

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.

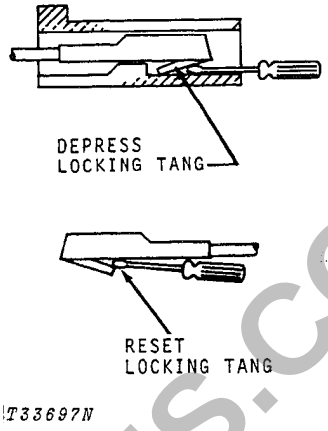


Fig. 1-Removing Female Connector

Insert a small screw driver or paper clip into the body connector and press the locking tang down as shown in Fig. 1. Remove wire from connector.

Be sure to bend the locking tang back up when installing new body connector.

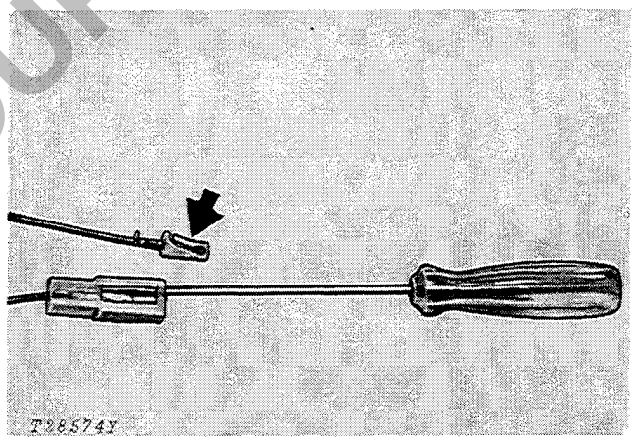


Fig. 2-Removing Male Connector

Using a knife or a screw driver, bend the locking tang in as shown in Fig. 2. Remove wire from connector.

Be sure to bend the locking tang out when assembling new body connector.

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1—Battery
2—Starting Motor
3—Solenoid
4—Circuit Breaker
5—Starting Circuit Relay
6—Neutral Start Switch (2 used) (later units)
Neutral Start Switch (1 used) (early units)
7—Start Switch
8—Key Switch
9—Fuel Injection Pump
10—Air Filter Relay
11—Air Filter Vacuum Switch
12—Transmission Oil Pressure Indicator
13—Oil Pressure Switch
14—Oil Filter Bypass Switch
15—Tachometer Lamp
16—Oil Pressure Switch
15—Tachometer Lamp
16—Oil Pressure Switch
17—Fuse (25 amp)
18—Circuit Breaker
19—Circuit Breaker
20—Circuit Breaker
21—Light Switch
22—L.H. Combination Lamps
23—Flasher
24—Warning Lamps
25—Head Lamps
26—Alternator
27—Starting Aid Switch (280627-)
28—Starting Aid Solenoid (280627-)
29—Horn Switch
30—Fuel Gauge Sender
31—Parking Brake Switch (280627-)
32—Parking Brake Lamp (280627-)
33—Parking Brake Relay (280627-)
34—Rear Tail Lamps
35—R.H. Combination Lamps
36—Pressurizer Motor and Switch
37—Heater Motor Switch and Fuse
38—Windshield Wiper Motor
39—Dome Light
40—Circuit Breaker
41—Cab Accessory Relay
42—Cigar Lighter
43—Backup Switch
44—Backup Alarm
45—Defroster Fan and Switch

Legend for Fig. 4-Electrical Schematic

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The fuel tank is located at the front of the unit. An electric fuel gauge sending unit is located on the right rear side of the tank. On early units a fuel shut-off valve is located between the fuel supply line and the tank. A drain cock is located under the tank.

REPAIR

CAUTION: Cleaning or repairing a fuel tank can be dangerous. Sparks, smoking, and open flame are hazardous in the area where the tank is cleaned or repaired.

Refer to FOS Manual - ENGINES for repair of fuel tank.

Removal

1 - Disconnect battery ground strap and remove hood and side grilles.

2 - On early units, shut off fuel at shut-off valve and disconnect fuel lines. On later units, drain fuel into clean containers and disconnect fuel lines.

3 - Disconnect fuel gauge sender wire.

4 - Remove air cleaner from tank.

5 - Remove attaching cap screws and lift tank from unit with a chain hoist.

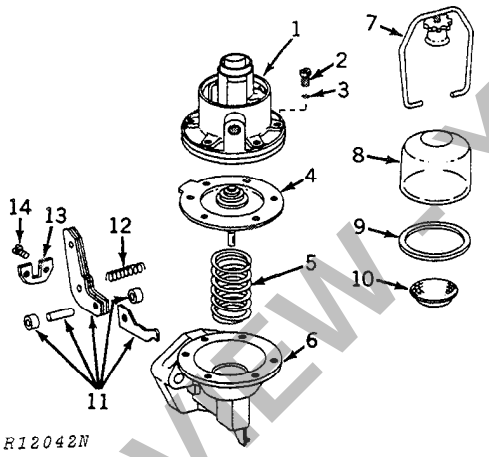
Refer to Fig. 1 during disassembly and assembly of fuel tank parts.

Installation

Follow the removal procedure in the reverse order.

FUEL TRANSFER PUMP

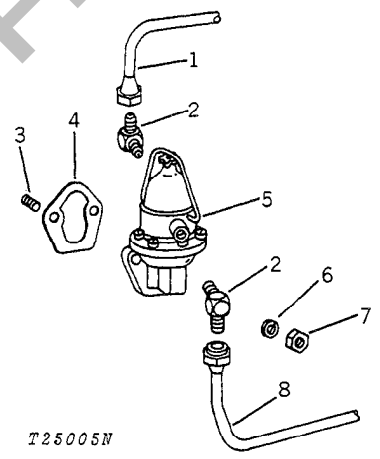
GENERAL INFORMATION



1—Cover*
2—Screw
3—Lock Washer
4—Diaphragm* +
5—Diaphragm Spring+
6—Body*
7—Bail Assembly
8—Bowl
9—Gasket
10—Screen
11—Rocker Arm Kit
12—Rocker Arm Spring+
13—Bearing Retainer*
14—Screw

* *Not available for service.*
+Pump overhaul kit.

Fig. 2-Fuel Pump Parts (early units)



1—Fuel Line
2—Elbow (2 used)
3—Stud (2 used)
4—Gasket
5—Fuel Pump (later units)
6—Lock Washer (2 used)
7—Nut (2 used)
8—Fuel Line

Fig. 3-Fuel Pump (later units)

Early fuel pumps (Fig. 2) were used on units up to engine serial number 202394. Later pumps were used after this number and also as replacement pumps for early units. To discover which pump is on a particular unit, notice the bowl. A glass bowl is used on pumps shown in Fig. 2 and an aluminum bowl is used on pumps shown in Fig. 3.

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Group 5
SPECIFICATIONS

JD510 BACKHOE LOADER 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 1-1/8 cu. yd. (0.86 m³) loader bucket, 24 in. (610 mm) backhoe bucket and standard equipment.)

Power (@ 2500 engine rpm):	**SAE**	**DIN**
Gross	83 hp (61.9 kW*)	
Net	80 hp (59.7 kW)	85.0 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. altitude and 85°F. temperature and DIN 70 020 standard conditions of 760 mm Hg barometer (sea level) and 20°C temperature. *In the International System of Units (SI), power is expressed in kilowatts (kW).

Engine: John Deere diesel, 4-cylinder, 4-stroke cycle
Bore and stroke ..... 4.25x4.75 in. (108x121 mm)
Piston displacement ..... 270 cu. in. (4425 cm³)
Compression ratio ..... 17.3 to 1
Maximum torque
@ 1300 rpm ..... 202 lb-ft (274 Nm) (27.9 kg-m)
NACC or AMA (U.S. Tax) horsepower 28.9
Main bearings 5
Lubrication ..... Pressure system w/full-flow filter
Cooling ..... Pressurized w/thermostat and fixed bypass
Fan ..... Suction
Air cleaner w/restriction indicator ..... Dry
Electrical system ..... 12 volt w/alternator
Batteries (two volt) ..... Reserve capacity: 340 minutes each

Transmission

Full Power Shift. 8 speeds forward, 4 reverse: Power shift from forward to reverse in first 4 gears.

Gear:	**Travel Speeds: mph**	**km/h**
Forward 1	1.7	2.7
2	2.4	3.9
3	3.8	6.1
4	4.9	7.9
5	6.3	10.1
6	8.1	13.0
7	10.8	17.4
8	18.0	29.0
Reverse 1	2.0	3.2
2	2.8	4.5
3	4.4	7.1
4	5.7	9.2

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) .. 11 ft. 2 in. (3.40 m)
Loader clearance (brake applied) .... 31 ft. (9.45 m)
Number of turns, far left to far right 3.3

Hydraulic System: Closed-center
Max. Pressure ..... 2350 psi 16 203 kPa (162 bar)
Load control ..... Single-lever
Backhoe control ..... Two-lever
Pump ... Piston, constant pressure, variable-displacement, 60 gpm (227 L/min) @ 2500 engine rpm
Filter ..... 25 micron steel-enclosed paper cartridge in return

Hydraulic Cylinders:	**Bore**	**Stroke**
Loader boom	3.75 in. (95 mm)	28.7 in. (729 mm)
Loader bucket	3.5 in. (89 mm)	27.3 in. (693 mm)
Backhoe boom	3.5 in. (140 mm)	41.75 in. (1060 mm)
Backhoe crowd	5.5 in. (140 mm)	37.5 in. (953 mm)
Backhoe bucket	4 in. (102 mm)	37.5 in. (953 mm)
Backhoe swing	4.5 in. (114 mm)	9.9 in. (251 mm)
Stabilizer	4.5 in. (114 mm)	21.5 in. (546 mm)

Cylinder rods .. Ground, heat-treated, chrome-plated, polished
Loader cylinder rods ..... 2 in. (51 mm) dia.
Backhoe boom, crowd, bucket and stabilizer cylinder rods ..... 2.5 in. (64 mm) dia.
Backhoe cylinder rods ..... 2 in. (51 mm) dia.

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11. Steering

Check power steering. Steering wheel should turn freely in both directions without jerking and excessive play.

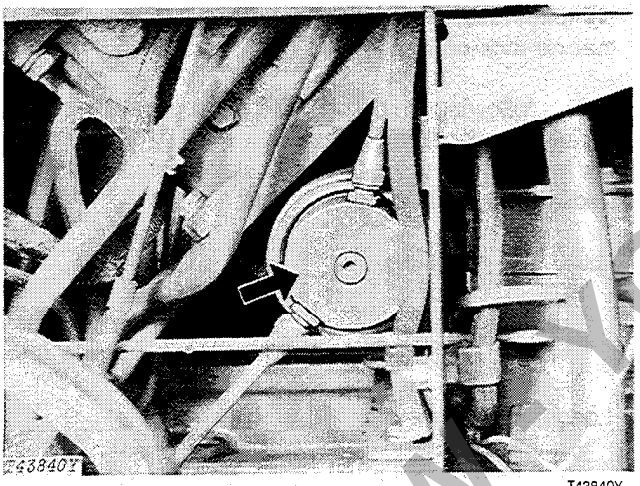
If repair is needed, see Section 60.

Steering checked *Yes* *No*

12. Accumulator

Check the brake accumulator and hydraulic accumulator circuits.

CAUTION: Do not attempt to disconnect or remove the accumulator unless you release the hydraulic pressure. To do so, stop engine, loosen the right-hand brake bleed screw and hold the right-hand brake pedal down for a few minutes.

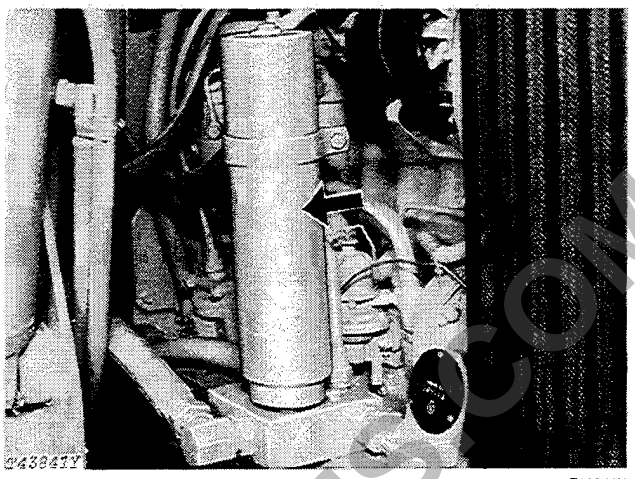


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Fig. 27-Brake Accumulator

Check the accumulator brake circuit.

1. Run engine one minute minimum, or until transmission-hydraulic oil is at normal operating temperature.
2. Stop engine.
3. Wait 10 to 15 minutes.
4. Apply brakes five times at five second intervals.
5. If brakes stop working in five applications or fewer, the brake circuit needs service.



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Fig. 28-Hydraulic System Accumulator

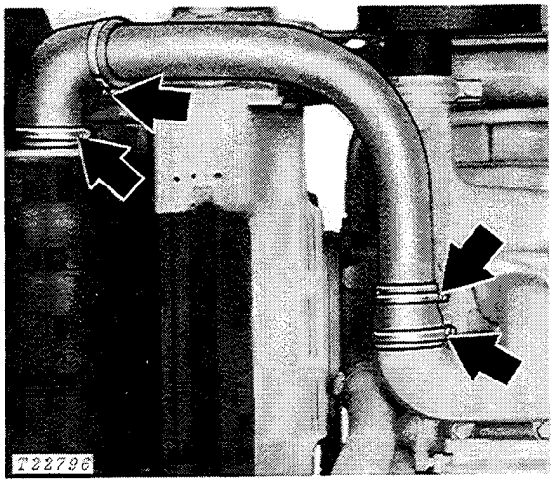
Check hydraulic system accumulator circuit as follows:

Start engine and run for one minute. Stop engine.

Turn steering wheel to left as far as far as possible. Power steering should be available for 1/2 to 3/4 steering wheel revolution. If not, the accumulator circuit may need service.

Accumulators checked *Yes* *No*

13. Air Intake Hoses



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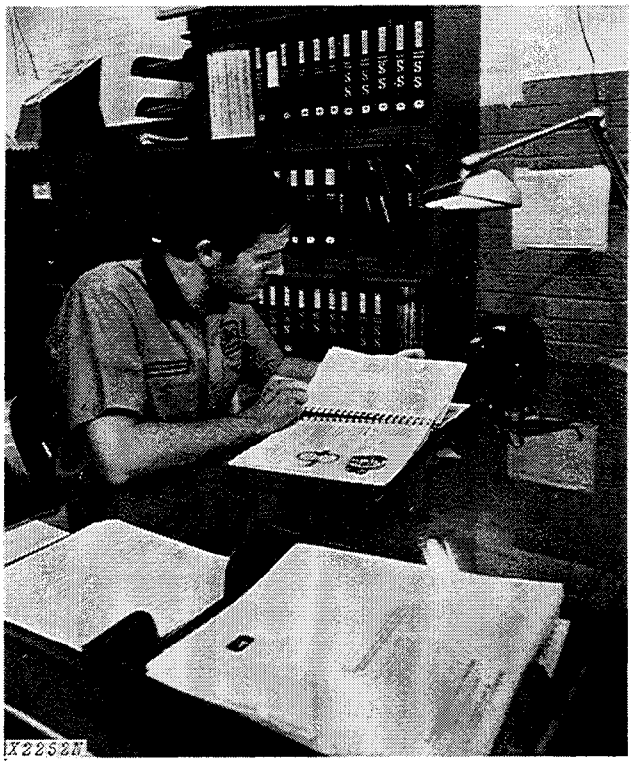
Fig. 29-Air Intake Hose Clamps

Check air hose clamps. Tighten clamps if necessary. Inspect hoses for damage.

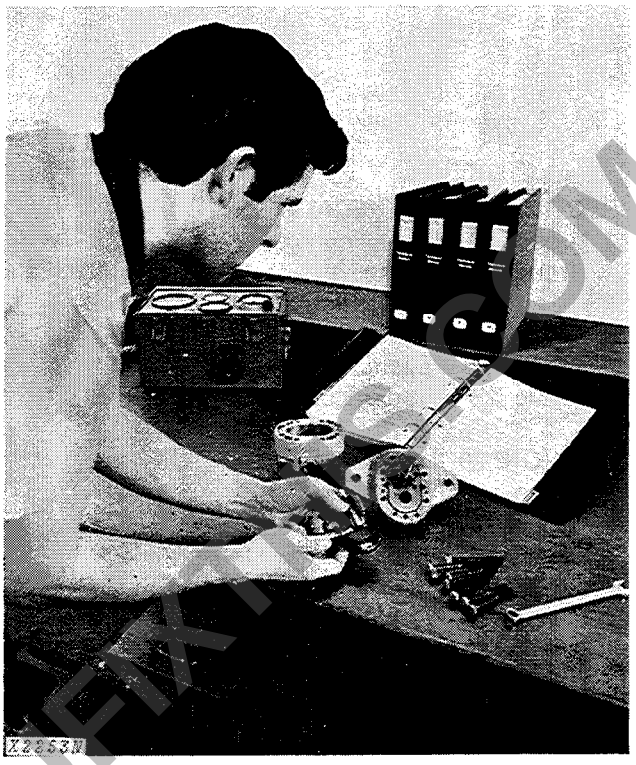
Air intake hoses checked *Yes* *No*

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INTRODUCTION



Use FOS Manuals for Reference



Use Technical Manuals for Actual Service

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

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

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

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

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

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

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

Some features of this technical manual:

- *Table of contents at front of manual*
- *Exploded views showing parts relationship*
- *Photos showing service techniques*
- *Specifications grouped for easy reference*

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

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ENGINE TUNE-UP—Continued

Operation	Specification	Section-Group Reference
Starting System		40
Check neutral start switch operation	. . . . .	40-15
Check battery voltage when starting	Min. 9 volts (cranking)	40-15
Check operation of alternator, oil pressure, and Power Shift transmission filter restriction indicator lights	. . . . .	40-20

FINAL ENGINE TEST

Operation	Specification	Section-Group Reference
Dynamometer	Compare with previous recorded output record for future use.	FOS 30 Manual, Chapter 12

UNIT TUNE-UP

Operation	Specification	Section-Group Reference
Adjust Collar-Shift transmission clutch free travel	1-1/2 in.	50-10
Check Power Shift transmission disconnect lever operation	6 in. travel	50-30
Transmission		
Check shifting	. . . . .	50-5
Check for proper operation without excessive noise	. . . . .	50-15 & 30
Power Shift transmission pump pressure	180 ± 5 psi	50-30
Power Shift engaged element pressure	Max. of 15 psi less than pump	50-30
Check differential lock operation	420 - 525 psi	50-40
Check brake pedal travel and even position	3 in. max. for one emergency application immediately after stopping engine	70-25
Check front wheel bearing adjustment and lubrication	. . . . .	Operator's manual
Check front wheel toe-in	1/8 - 3/8 in.	Operator's manual

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Group 30
SPECIFICATIONS AND SPECIAL TOOLS

Basic Engine

SPECIFICATIONS

NOTE: All specifications are in inches unless otherwise noted.

Item	New Part	Wear Tolerance
CYLINDER HEAD, VALVES, AND ROCKER ARMS		
O.D. of valve stem	0.3715 to 0.3725	
I.D. of valve guide	0.3745 to 0.3755	
Clearance between guide and stem	0.0020 to 0.0040	0.0060 Max.
Maximum guide wear (knurling old guide)	0.0080 to 0.0100	
Valve guide distance from bottom of head	1.8750	
Angle of valve face	44.5°	
Angle of valve seat	45°	
Concentricity of valve seat with guide		0.0020 runout
Width of valve seat	0.0830 to 0.0930	
Valve recess in valve seat (max.)		
Intake	0.0360 to 0.0500	
Exhaust	0.0540 to 0.0680	
O.D. of valve head		
Intake	1.8970 to 1.9070	
Exhaust	1.7100 to 1.7200	
Valve clearance (cold)		
Intake	0.018	
Exhaust	0.028	
Valve lift (clearance adjusted)	0.4500	
O.D. of rocker arm shaft	0.7490 to 0.7500	0.0020
I.D. of rocker arm bore	0.7505 to 0.7525	
Valve springs		
Free length (approx.)	2.1200	
Compressed at 54 to 62 lbs. - valve closed	1.8100	
Compressed at 133 to 153 lbs. - valve open	1.3600	
Cylinder head out-of-flat		0.0050
Maximum material that can be removed from head		0.0300
PISTON		
Piston ring side clearance in groove (keystone ring)		0.0100
Piston ring side clearance (No. 2 compression ring)		0.0080
Piston-to-cylinder clearance at bottom of skirt		0.0060 Max.

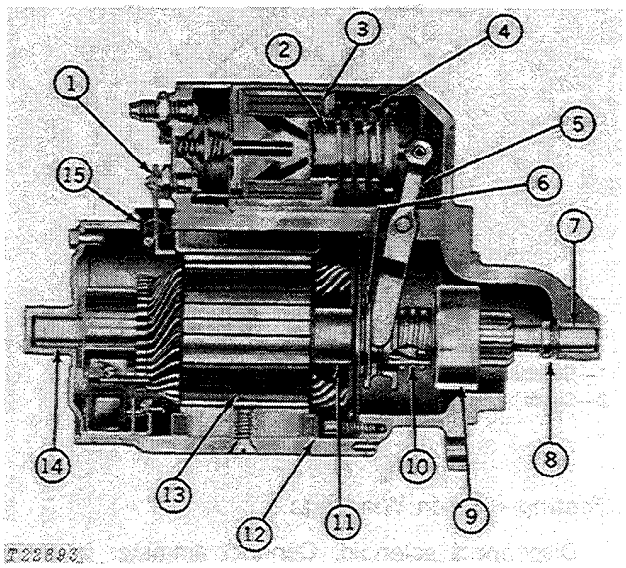
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Group 15
STARTING CIRCUIT

DELCO-REMY STARTING MOTOR

GENERAL INFORMATION



1—Field Connectors
2—Plunger
3—Solenoid
4—Return Spring
5—Shift Lever
6—Brake Washer
7—Bushing
8—Pinion Stop
9—Overrunning Clutch
10—Spiral Splines
11—Center Bearing
12—Field Coil
13—Armature
14—Bushing
15—Grommet

Fig. 1-Sectional View of Starter

The starting circuit consists of the battery, starter with solenoid switch, starter circuit relay, key switch, neutral start switch, and connecting wires or cables.

NOTE: Later units have two neutral start switches in series.

The starter has a totally enclosed shift lever and an overrunning clutch.

When the transmission shift lever is in "PARK" or neutral, the neutral start switch is closed so the starter can be operated.

When making tests the battery voltage should not drop below 9 volts. 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.

TEST AND DIAGNOSIS

Place the shift lever in "PARK." Turn the key switch on. Oil pressure indicator lamp should light. If indicator lamp lights, turn switch to start position.

Sluggish Starter Operation

Low battery
High resistance in circuit
Excessive engine drag
Defective starter

If starter does not operate, connect a voltmeter to the solenoid "S" terminal and a good ground.

Voltmeter Indicates Battery Voltage

Defective starter
Defective starter solenoid switch

Voltmeter Does Not Indicate Battery Voltage

Defective key switch
Defective neutral start switch
Maladjusted neutral start switch
Defective starter circuit relay
Defective wiring between key switch and solenoid "S" terminal
Defective wiring between battery and starter circuit relay

Indicator Lamp Fails to Light

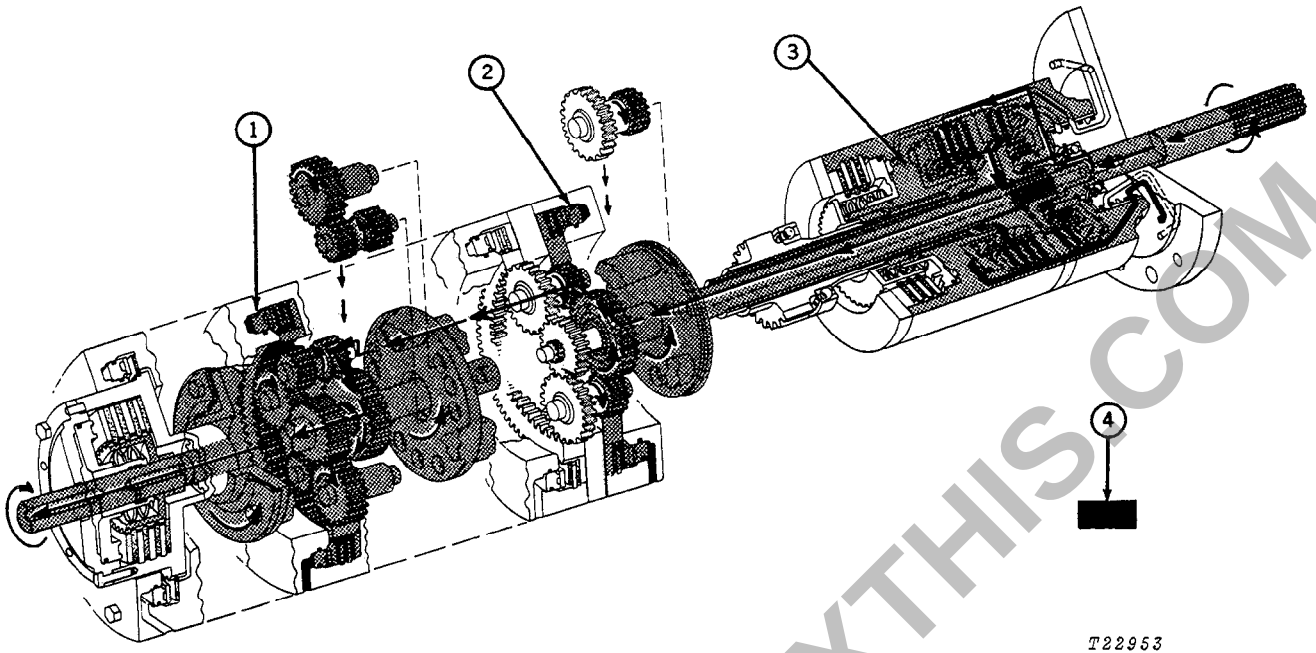
Defective main circuit breaker
Burned out fuse
Defective key switch
Defective wiring from battery to key switch

Solenoid Switch Chatters

Low battery
Poor connection
Open in solenoid hold-in circuit

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1—B-3
2—B-1
3—C-2
4—Pressure Oil

Fig. 5-Flow of Engine Power in Third Speed Reverse

When the transmission control lever is placed in the third speed reverse position, the hydraulic transmission control system engages C2 in the clutch pack and B1 and B3 in the planetary pack (Fig. 5).

	Clutch Pack			Planetary Pack			
	C1	C2	B1	B2	B3	B4	C3
3rd Reverse		X	X		X		

Fig. 6-Clutches and Brakes Engaged for 3rd Speed Reverse

The flow of engine power is from the engine disconnect clutch to C2 in the clutch pack. The C2 clutch shaft transmits power at engine speed from C2 to the C2 sun pinion in the planetary pack.

Since B1 restrains one ring gear from turning, the planet pinions "walk around" the ring gear, forcing the planet pinion carrier to rotate in the same direction as the sun pinion, but at a slower rate of speed. The planet pinion carrier transmits power to the overdrive and reverse planetary set.

When B3 is engaged, one ring gear is restrained from turning. As the planet pinion carrier rotates, the planet pinions in mesh with the ring gear are forced to rotate on their axis, driving the inner planet pinions, which in turn force the sun pinion to rotate in the opposite direction from the planet pinion carrier. The sun pinion which is driven by the planet pinions drives the transmission reduction gears.

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PARKING BRAKE (251393 -)

GENERAL INFORMATION

The parking brake is a dry disk type, mounted on the transmission rear cover. The brake contains a pinion shaft connecting the brake disk to the differential ring gear.

When the brake is applied, pressure from the brake caliper against the brake disk locks the shaft, which in turn locks the differential ring gear. When the brake is released, the shaft and disk are free to rotate with the differential.

NOTE: Frequently apply parking brake to check for proper adjustment and working order of components.

IMPORTANT: After using park brake for an emergency stop, check adjustment of brake.

REMOVAL

Remove the seat and seat support base from unit.

Disconnect and remove necessary brake lever linkage from parking brake cover and caliper lever.

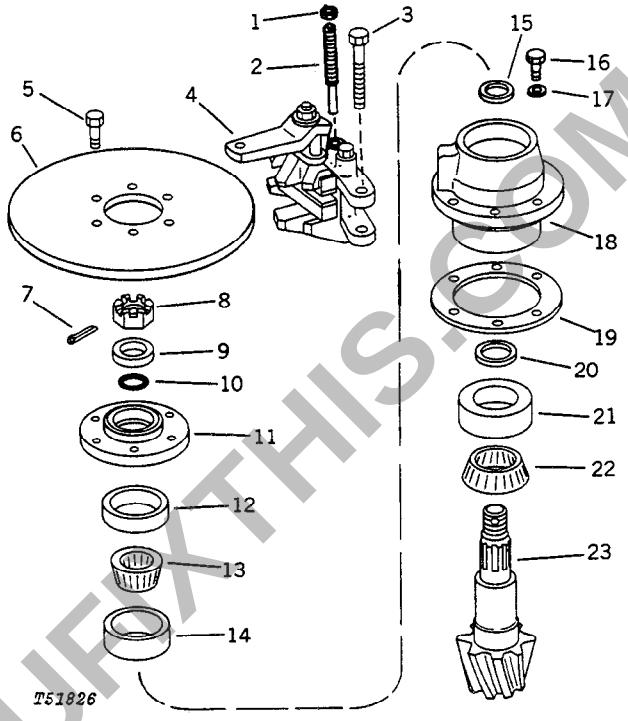
Remove parking brake cover from rear transmission cover.

Remove cap screws (3, Fig. 6) securing brake caliper (4) to transmission case top cover and remove brake caliper.

Remove cap screws (5) securing brake disk (6) to brake support (11). Remove brake disk.

Disconnect hydraulic lube line from brake housing (18).

Remove cap screws (16) securing brake housing to transmission case cover. Remove parking brake shaft assembly.



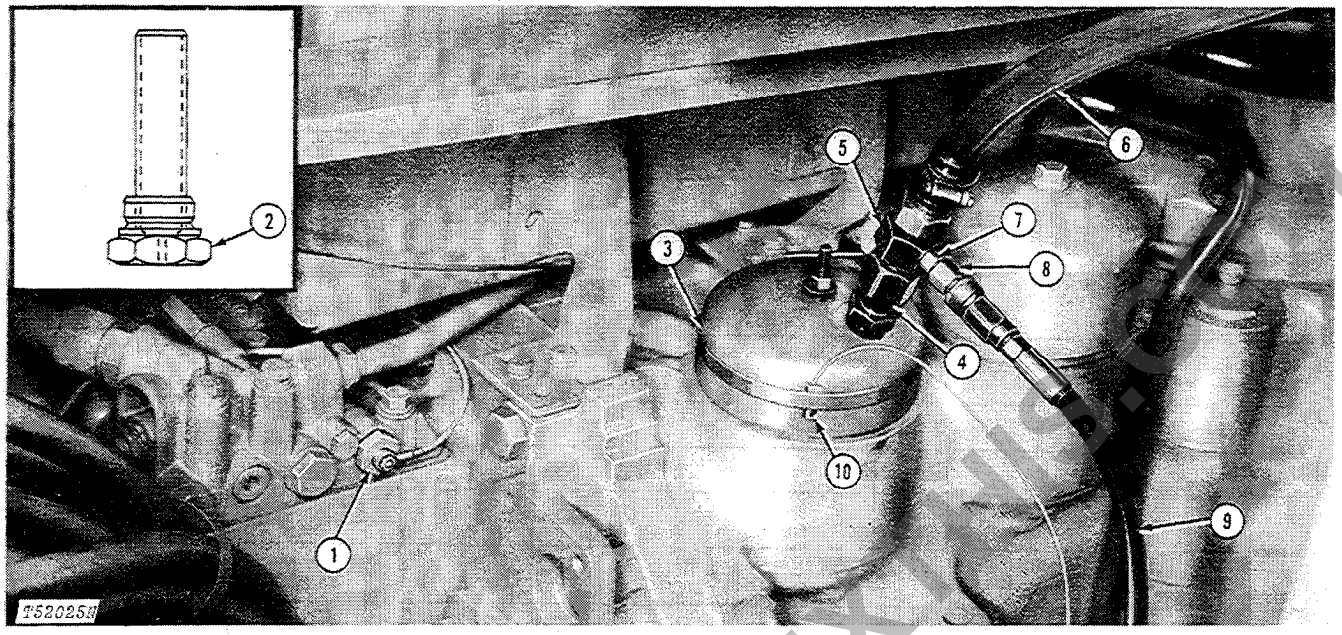
1—Jam Nut
2—Special Screw
3—Cap Screw (2 used)
4—Brake Caliper Assembly
5—Cap Screw (6 used)
6—Brake Disk
7—Cotter Pin
8—Slotted Hex Nut
9—Special Washer
10—O-Ring
11—Brake Disk Support
12—Oil Seal
13—Bearing Cone
14—Bearing
15—Shim (use as required)
16—Cap Screw (6 used)
17—Washer (6 used)
18—Parking Brake Housing
19—Shim (use as required)
20—Scraper
21—Bearing Cup
22—Bearing Cone
23—Parking Brake Shaft

Fig. 6-Parking Brake Elements

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Transmission Pump Test



1—Transmission Filter Relief Valve Plug
2—JD-293-5 Relief Valve Plug Assembly
3—JD-293-1 Filter Housing Cover Assembly
4—17502 Connector
5—203660 0.218 in. (5.54 mm) Orifice
6—203658 Plastic Hose Assembly
7—202853 Straight Connector
8—202850 Quick Coupler Adapter
9—36952 144 in. (3 658 mm) Hose Assembly
10—Temperature Sensor

Fig. 16-Transmission Pump Test Hookup

1. Connect Tachometer Temperature Reader as described in System Test, page 70-6-7.

2. Install manual destroke valve in stroke control valve if not equipped. Do not destroke pump at this time.

3. Start engine and cycle Loader Backhoe functions to warm hydraulic oil to 122° to 140°F (50° to 60°C). *NOTE: If orifice is installed from System Test, use orifice flow to warm hydraulic oil.*

4. Stop engine and relieve hydraulic pressure.

5. Destroke main hydraulic pump. *NOTE: Main hydraulic pump does not receive any charge oil during transmission pump test so keep it as short as possible.*

6. Remove transmission filter cover and filter.

7. Install filter kit (Fig. 17), fittings, 0.218 in. (5.54 mm) orifice, Part No. 203660 and hose assemblies to transmission housing (Fig. 16). Connect hose assembly from orifice to No. 3 test port on Hydraulic Analyzer (3, Fig. 8). Route plastic hose assembly to transmission filler neck. *NOTE: Install orifice with arrow pointing away from filter housing.*

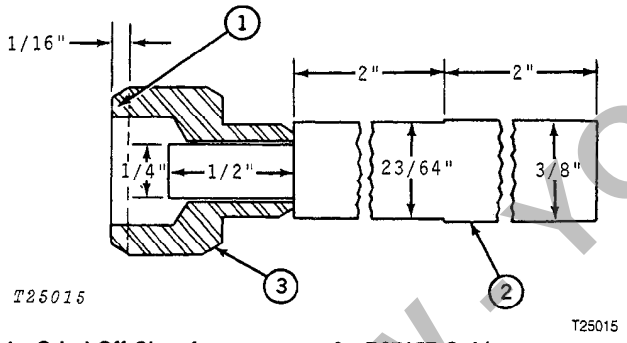
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SPECIAL TOOLS

No.	Name	Use
Essential Tools		
	Hydraulic test unit	Adjust pump standby pressure
JDH-18	Driver	To install oil seal
JDH-19	Crankcase outlet valve adjusting tool	Adjust crankcase outlet valve
JDH-39A	Seat Driver	To install discharge valve seats
JDH-40	Puller	Remove discharge valve seat
AR52495	Test plug	To replace shut-off solenoid
Fig. 16*	Removal tool	Remove inlet valve assembly
Convenience Tool		
JDH-21	Parts tray	To hold parts
JD288	Crow foot wrench	Remove and install hydraulic pump solenoid stroke control valve

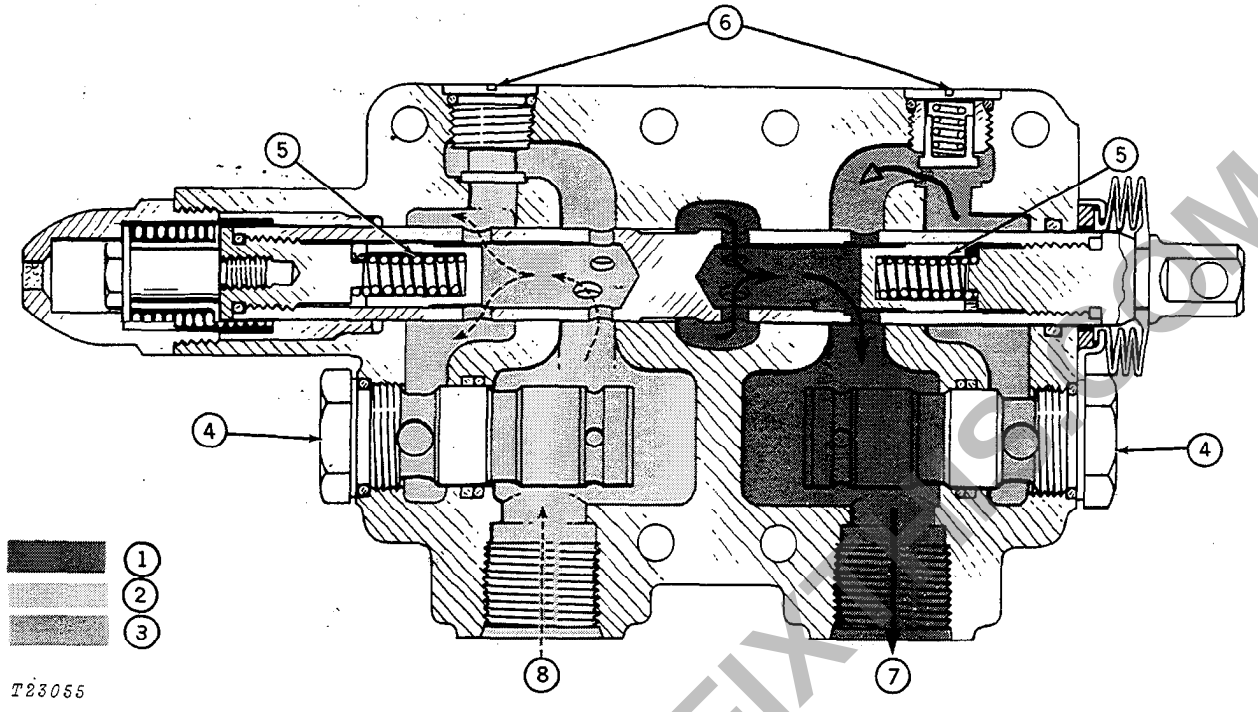


1—Grind Off Chamfer **3—R27157 Guide**
2—Driver Rod

Fig. 16-Inlet Valve Removal Tool

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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. 4-Swing Section (Left Swing Circuit Shown)

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 cylinders.

Displaced oil from the cylinders 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 to flow to the swing cylinders.

TESTING CONTROL VALVE

For additional test and diagnosis of the backhoe hydraulic system refer to Group 5.

The control valve spools may be worn allowing oil to leak past them. Check the control valves for leaks as follows:

1. Place backhoe control valve in neutral and disconnect the return line between control valve and reservoir.

2. With the control valve in neutral, start unit and check for oil leakage past the valve spools. Oil will leak out the return line if there is spool leakage.

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