350C, 350D Crawler Bulldozer 350C, 355D Crawler Loader

JOHN DEERE

TECHNICAL MANUAL

350C, 350D Crawler Bulldozer 350C, 355D Crawler Loader

TM1115 (01NOV86) English

John Deere Dubuque Works
TM1115 (01NOV86)

LITHO IN U.S.A.
ENGLISH

DCG

TM1115 01NOV86

350C AND 350D CRAWLER BULLDOZERS
350C AND 355D CRAWLER LOADERS
TECHNICAL MANUAL
TM-1115 (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. Whenever applicable, specifications and design information are in accordance with SAE and ICED standards.

T64;1115 K13 131086

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SECTION AND GROUP CONTENTS—CONTINUED

T64;1115 K14 100986

INTRODUCTION

This manual is part of a total service support program.

FOS Manuals—reference

Technical Manuals—machine service

Component Manuals—component 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.

Component Technical Manuals are concise service guides for specific components. Component technical manuals are written as stand alone manuals covering multiple machine applications.

AB6;RW5559 053;INTRO2 030785

FEATURES OF THIS TECHNICAL MANUAL

John Deere ILLUSTRUCTION format emphasizing illustrations and concise instructions in easy-to-use modules.

Emphasis on diagnosis, analysis, and testing so you can understand the problem and correct it.

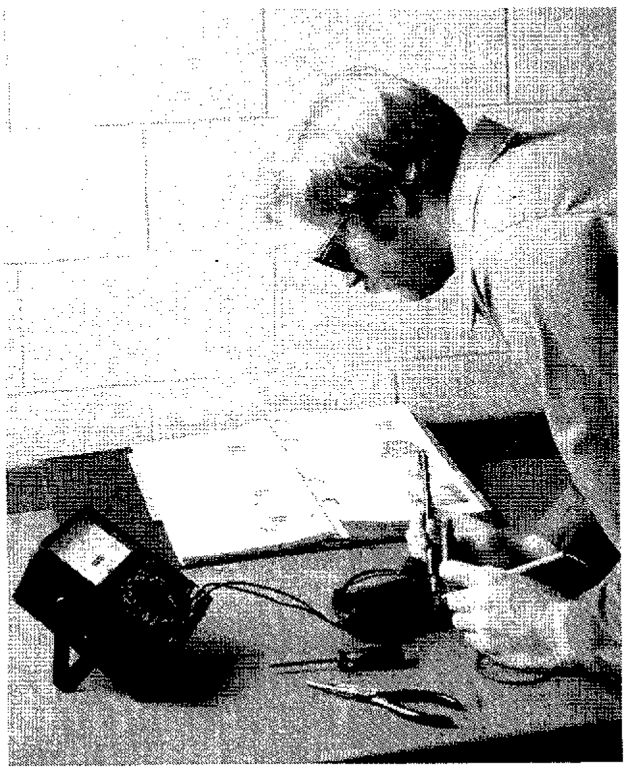
Diagnostic information presented with the most logical and easiest to isolate problems first to help you identify the majority of routine failures quickly.

Step-by-step instructions for teardown and assembly.

Summary listing at the beginning of each group of all applicable specifications, wear tolerances, torque values, essential tools, and materials needed to do the job.

An emphasis throughout on safety—so you do the job right without getting hurt.

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. Refer to it when you need to know correct service procedures or specifications.



AB6;RW5560 053;INTRO3 071085

RECOGNIZE SAFETY INFORMATION

This is the safety-alert symbol. When you see this symbol on your machine or in this manual, be alert to the potential for personal injury.

AB6;T81389 053;ALERT 071085

UNDERSTAND SIGNAL WORDS

A signal word—DANGER, WARNING, or CAUTION—is used with the safety-alert symbol. DANGER identifies the most serious hazards.

Safety signs with signal word DANGER or WARNING are typically near specific hazards.

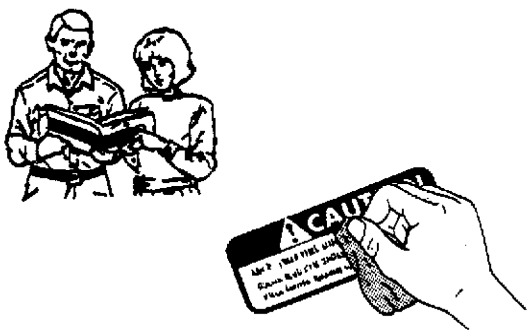
General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

AB6;TS187 053;SIGNAL 071085

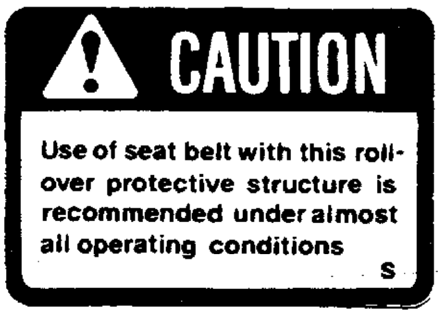
FOLLOW SAFETY INSTRUCTIONS

Carefully read all safety messages in this manual and on your machine safety signs. Follow recommended precautions and safe operating practices.

Keep safety signs in good condition. Replace missing or damaged safety signs.

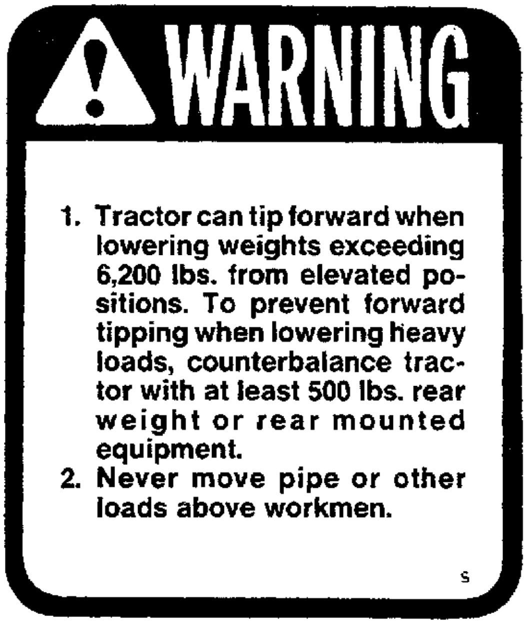


AB6;TS188 053;SIGNS 071085



On right front ROPS post near the top, facing the operator.

018;T6001BE T82;05 M1 120186



355D—On support casting at right of instrument panel.

018;T6192AJ T82;05 M2 191285

350D—On slope of battery box cover, between latch and lock slot.

355D—On support casting at right of instrument panel.

018;T6192AK T82;05 M3 191285

⚠ WARNING

AVOID POSSIBLE INJURY OR DEATH FROM A MACHINE RUNAWAY.

1. Do not start engine by shorting across starter terminals. Machine will start in gear and move if normal starting circuitry is bypassed.
2. Start engine only from operator's seat with transmission in neutral or park. NEVER start engine while standing on ground.

S

350D—On right side of cowl support next to left edge of engine side shield.

355D—In right side of engine compartment on front of loader frame plate.

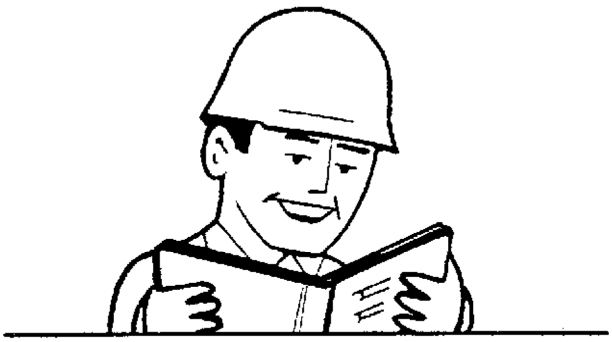
018;T6084AZ T82;05 M4 140186

LEARN MACHINE SAFETY

Carefully read this manual. Learn how to operate the machine and how to use the controls properly.

Do not let anyone operate this machine without proper instruction.

Unauthorized modifications to the machine may impair the function and/or safety and affect machine life.



AB6;M35220 053;READ1 080785

USE HANDHOLDS AND STEPS

When you get on and off the machine, use handholds and steps.

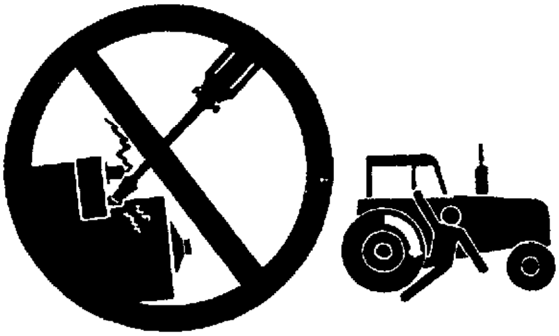
018;T6192AH T82;BHSA CM 010686

PREVENT MACHINE RUNAWAY

Avoid possible injury or death from machinery runaway.

Do not start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

Never start engine while standing on ground. Start engine only from operator's seat. Move shift lever to neutral. Move direction selector lever to neutral and engage neutral lock. Depress brake pedal and engage lock.



AB6;TS177 T82;05 M5 120186

STAY CLEAR OF PTO

Stop the engine and be sure the PTO drive line has stopped before:

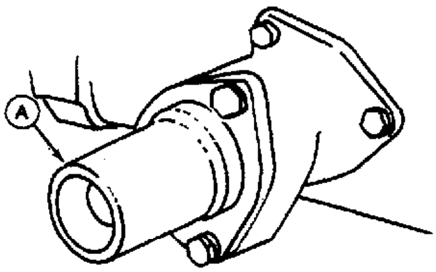
— Connecting or disconnecting implement drive line.
— Making adjustments on the implement.
— Cleaning out PTO driven equipment.

Remove PTO shift guard ONLY to repair PTO or to connect equipment to power shaft.

Remove the master shield only when necessary. Be sure shield is in place any time the PTO shaft guard is removed.

Operate PTO at recommended speed.

Avoid loose-fitting or dangling clothing.



018;T6244AH T82;05 M7 201285

KEEP RIDERS OFF MACHINE

Only allow the operator on the machine. Keep riders off.

Riders on machine are subject to injury such as being struck by foreign objects and being thrown off of the machine. Riders also obstruct the operator's view resulting in the machine being operated in an unsafe manner.

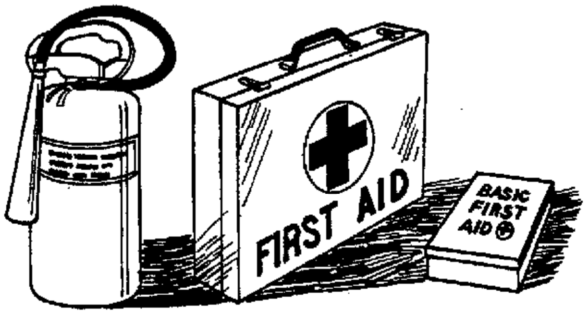
AB6;TS173 053;RIDER 261184

PREPARE FOR EMERGENCIES

Be prepared if a fire starts.

Keep a first aid kit and fire extinguishers handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.



AB6;TS186 053;FIRE2 080785

HANDLE FUEL SAFELY—AVOID FIRES

Handle fuel with care: it is highly flammable. Do not refuel the machine while smoking or when near open flame or sparks.

Always stop engine before refueling machine. Fill fuel tank outdoors.

Prevent fires by keeping machine clean of accumulated trash, grease, and debris. Always clean up spilled fuel.

AB6;TS185 053;FIRE1 240785

HANDLE STARTING FLUID SAFELY

Starting fluid is highly flammable.

Keep all sparks and flame away when using it. To prevent accidental discharge when storing the pressurized can, keep the cap on the container, and store in a cool, protected location.

Do not incinerate or puncture a starting fluid container.

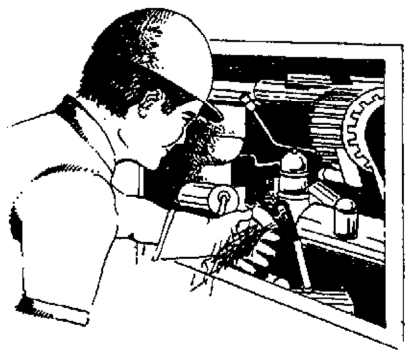
AB6;T6089A U 053;FIRE3 080785

CLEAN TRASH FROM MACHINE

Wait until engine has cooled before removing trash from areas such as engine, radiator, batteries, hydraulic lines, fuel tank, and operator's station.

Temperature in engine compartment may go up immediately after engine is stopped. BE ON GUARD FOR FIRES DURING THIS PERIOD.

Open side shields to cool the engine faster.



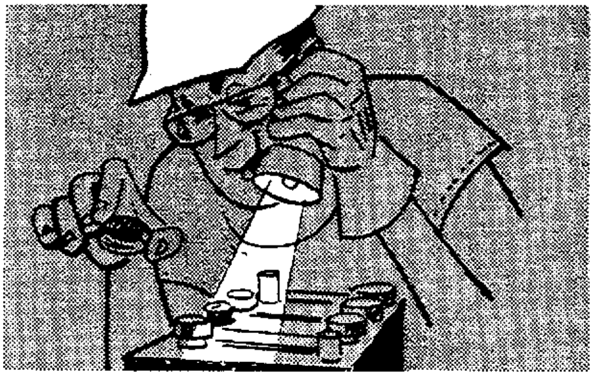
018;T86512 T82;FLSA D 010485

PREVENT BATTERY EXPLOSIONS

Battery gas can explode. Keep sparks and flames away from batteries. Use a flashlight to check battery electrolyte level.

Never check battery charge by placing a metal object across the posts. Use a voltmeter or hydrometer.

Always remove grounded (-) battery clamp first and replace it last.



AB6;TS181 053;EXPLO 180485

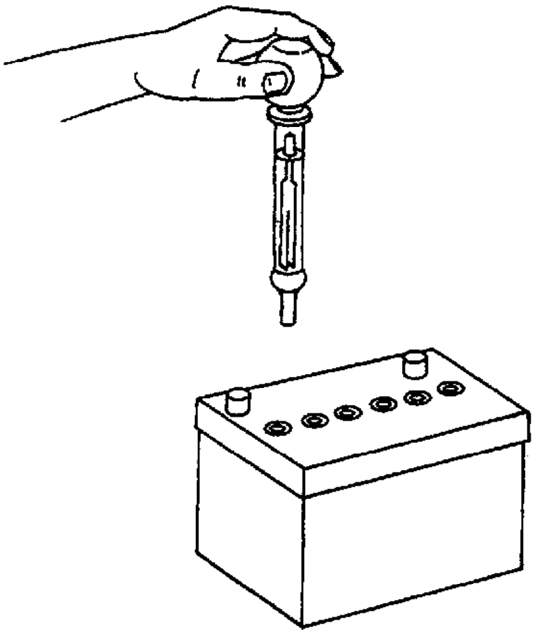
AVOID ACID BURNS

Sulfuric acid in battery electrolyte is poisonous. It is strong enough to burn skin, eat holes in clothing, and cause blindness if splashed into eyes.

Avoid the hazard by:
1. Filling batteries in a well-ventilated area.
2. Wearing eye protection and rubber gloves.
3. Avoiding breathing fumes when electrolyte is added.
4. Avoiding spilling or dripping electrolyte.

If you spill acid on yourself:
1. Flush your skin with water.
2. Apply baking soda or lime to help neutralize the acid.
3. Flush your eyes with water for 10-15 minutes. Get medical attention immediately.

If acid is swallowed:
1. Drink large amounts of water or milk.
2. Then drink milk of magnesia, beaten eggs, or vegetable oil.
3. Get medical attention immediately.

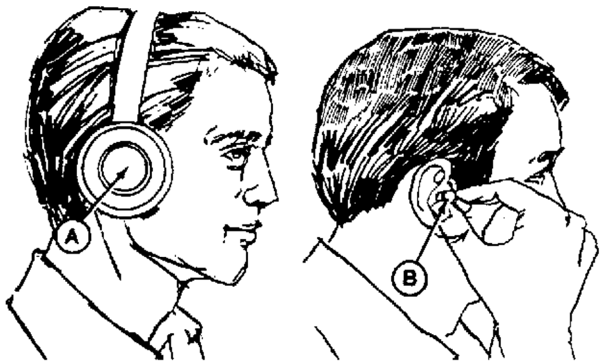


AB6;TS182 053;ACID 180485

PROTECT AGAINST NOISE

Prolonged exposure to loud noise can cause impairment or loss of hearing.

Wear a suitable hearing protective device such as earmuffs (A) or earplugs (B) to protect against objectionable or uncomfortable loud noises.

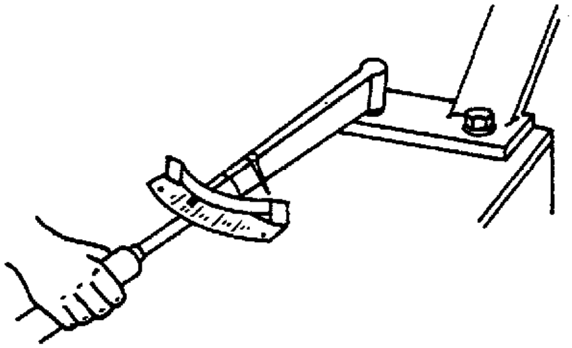


AB6;X7662 053;NOISE 270886

KEEP ROPS INSTALLED PROPERLY

Make certain all parts are reinstalled correctly if the roll-over protective structure (ROPS) is loosened or removed for any reason. Tighten mounting bolts to proper torque.

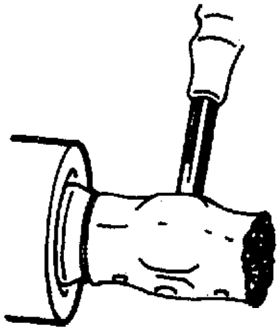
The protection offered by ROPS will be impaired if ROPS is subjected to structural damage, is involved in an overturn incident, or is in any way altered by welding, bending, drilling, or cutting. A damaged ROPS should be replaced, not reused.



AB6;TS176 053;ROPS3 280186

PROTECT AGAINST FLYING DEBRIS

When you drive connecting pins in or out, guard against injury from flying pieces of metal or debris; wear goggles or safety glasses.

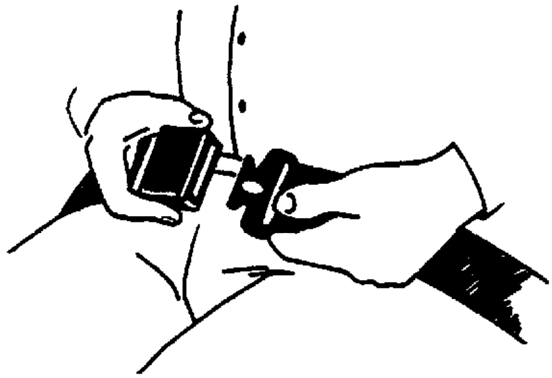


018;T6073AP T82;FLSA AB 130685

USE SEAT BELT PROPERLY

Use a seat belt when you operate with a roll-over protective structure (ROPS) to minimize chance of injury from an accident such as an overturn.

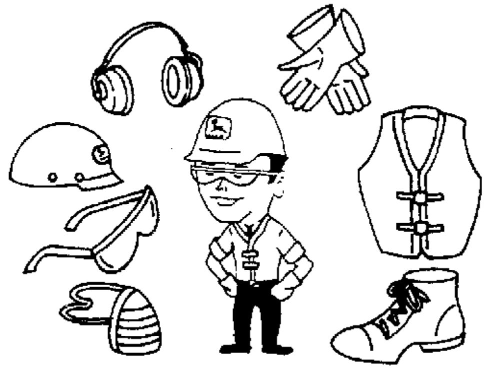
Do not use a seat belt if operating without a ROPS.



AB6;TS175 053;ROPS1 261184

WEAR PROTECTIVE CLOTHING

Wear fairly tight clothing. . . . . . and safety equipment.



AB6;T85056 053;WEAR1 080785

SERVICE CRAWLER SAFELY

Never operate the machine if an unsafe condition exists. Place a "DO NOT OPERATE" tag on the machine.

Be sure you understand a service procedure before working on the machine.

Never lubricate or work on the machine while it is moving.

ALWAYS USE TWO PEOPLE when making checks with the engine running-the operator at the controls, able to see the person doing the checking.

Keep hands away from moving parts.

Install boom lock bar before working under the crawler loader.

Disconnect battery ground cable (-) or turn battery disconnect switch (if equipped) off before welding on the machine or making adjustments on the engine or electrical system.

When you work near the track recoil spring, use extreme care. Do not disassemble parts unless you know the correct procedure and have correct tools.

T82;05 M8 201285

AVOID HIGH-PRESSURE FLUIDS

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 to search for leaks.

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.

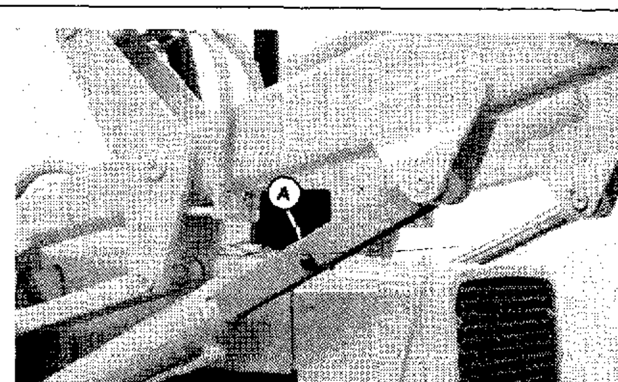
AB6;X9811 053;FLUID 010586

SUPPORT RAISED EQUIPMENT

Do not work under raised equipment unless it has a support under it.

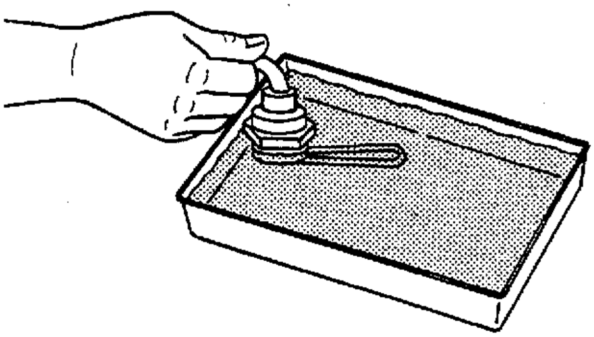
On crawler loaders, use the boom safety lock bar (A) stored in the battery compartment.

If a support is not available, lower equipment to the ground.



000;T91444 T82;05 M9 201285

TEST COOLANT HEATER IN LIQUID ONLY

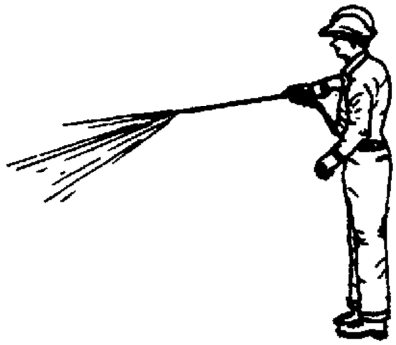


Do not plug coolant heater into electrical power unless heating element is immersed in coolant. Sheath could burst and result in personal injury.

Use a heavy-duty grounded cord to connect coolant heater to electrical power.

AB6;TS174 053;HEAT 110584

CLEAN THE MACHINE REGULARLY



Remove any grease, oil or debris build-up to avoid possible injury or machine damage.

018;TS813AM TB2;FLSA AC 130685

(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 [3/4 cu yd (0.57 m³) digging bucket with teeth (loader)], diesel engine, roll-over protective structure, full fuel tank, 175 lb (79 kg) operator, and standard equipment.)

Engine:
John Deere 3-cylinder diesel, valve-in-head, 4-stroke cycle ..... SAE net 48 hp (36 kw)
Bore and stroke ..... 4.19 x 5 in. (106.5 x 127 mm)
Piston displacement ..... 179 cu. in. (2.9 L)
Lubrication ..... Pressure system with full-flow filter
Cooling ..... Pressurized with thermostat and fixed bypass
Fan ..... Blower
Air cleaner with restriction indicator ..... Dry
Electrical system ..... 12-volt with alternator
Battery ..... 180 minutes reserve capacity

Transmission ..... Selective sliding gear

Hydraulic Direction Reverser ..... Multiple-disk oil clutches

Travel Speeds (Forward or Reverse)	mph	km/h
1	1.4	2.3
2	1.9	3.1
3	3.3	5.3
4	6.5	10.4

Steering:
Clutches ..... Oil cooled, hydraulically-activated, multiple-disk 9 in. (228 m) disk; 16 friction surfaces per clutch.
Brakes ..... Self-adjusting, self-energizing, oil-cooled contracting band with bonded lining.

Hydraulic System (Dozer):
Pump ..... Gear, 15 or 23 gpm (57 or 87 L/min)
Pressure (6305) ..... 2250 psi (15514 kPa)
Pressure (6310) ..... 1750 psi (12066 kPa)

Hydraulic System (Loader):
Pump ..... Gear, 23 gpm (87 L/min)
Pressure ..... 2250 psi (15514 kPa)

Tracks (5 roller track frame with rock guards):
Grousers:
- Loader ..... 12 in. (305 mm)
- Dozer ..... 14 in. (356 mm)
- Wide-Track ..... 33 in. (838 mm)

Track shoes, each side 36
Ground contact area:
- Loader ..... 1662 sq. in. (10 723 cm²)
- Dozer ..... 1939 sq. in. (12 510 cm²)
- Wide-Track ..... 4574 sq. in. (29 510 cm²)

Ground pressure:
- Dozer ..... 5.5 psi (37.9 kPa)
- Loader ..... 7.2 psi (49.6 kPa)
- Wide-Track ..... 2.7 psi (18.6 kPa)

T82;115 M1 020186

Tracks (5 roller track frame with rock guards—Continued:
Track Gauge:
Dozer and Loader .... 48 in. (1.22 mm)
Wide Track .... 68 in. (1.73 mm)

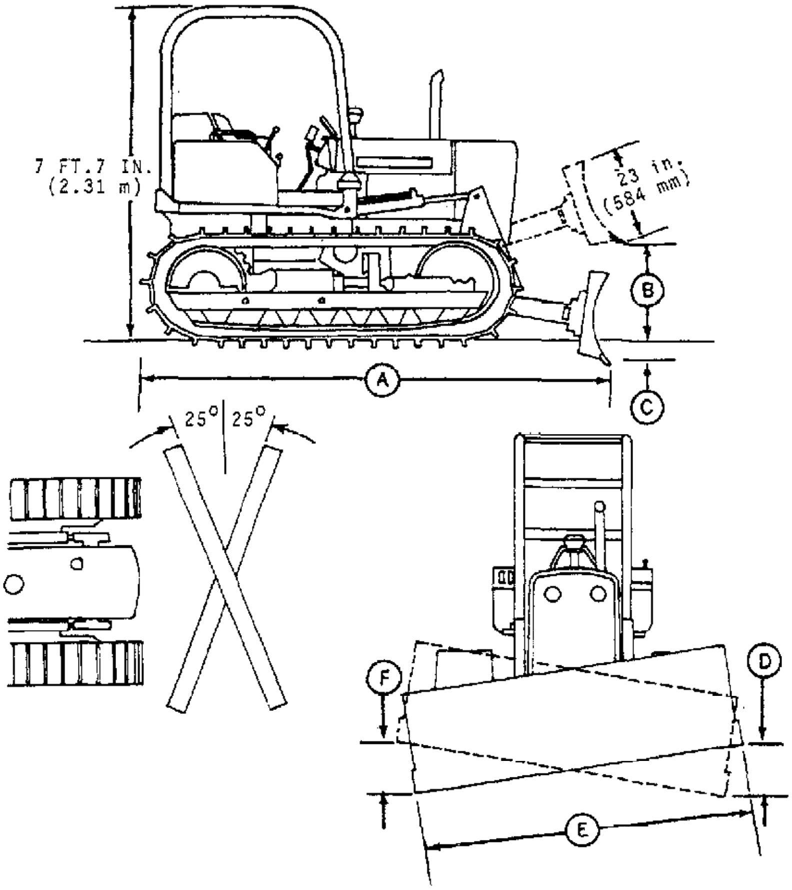
Operating Information:
Breakout force .... 12,100 lb (5488 kg)
Lifting capacity, full height .... 7150 lb (3423 kg)
Maximum dumping angle .... 50 degrees
Raising time .... 6.5 seconds
Dumping time .... 1.5 seconds
Lowering time .... 4.0 seconds

SAE Operating Weight with ROPS:
6305 Dozer .... 10,600 lb (4808 kg)
6310 Dozer .... 10,400 lb (4717 kg)
Wide Track Dozer .... 12,050 lb (5465 kg)
Loader .... 12,400 lb (5625 kg)

Winch:
Drum diameter .... 6 in. (152 mm)
Drum capacity (no allowance for looseness or uneven spooling):
1/2 in. (12.7 mm) cable .... 159 ft (48.5 m)
5/8 in. (15.9 mm) cable .... 105 ft (31.9 m)
3/4 in. (19 mm) cable .... 74 ft. (22.5 m)
Cable speed (at 2500 rpm engine speed wing 5/8 in. (15.9 mm) cable:
With bore drum .... 119 fpm (36.3 mpm)
With full drum .... 186 fpm (56.7 mpm)
Cable pull (at 1300 rpm engine speed):
With bore drum .... 15,700 lb (7120 kg)
With full drum .... 10,020 lb (4544 kg)
Shipping weight:
Winch (without cable) .... 815 lb (370 kg)
Fairlead .... 110 lb (50 kg)
Drawbar .... 44 lb (20 kg)

Drain and refill capacities:	U.S.	Metric
Cooling system	3.25 gal	12.3 L
Fuel tank	22 gal	83 L
Engine crankcase and filter	9 qt	8.5 L
Transmission and steering clutch housing and final drive	10 gal	38 L
Direction reverser	12 qt.	11.3 L
Hydraulic reservoir	6.4 gal	24.5 L
Winch reservoir	9 qt.	8.5 L

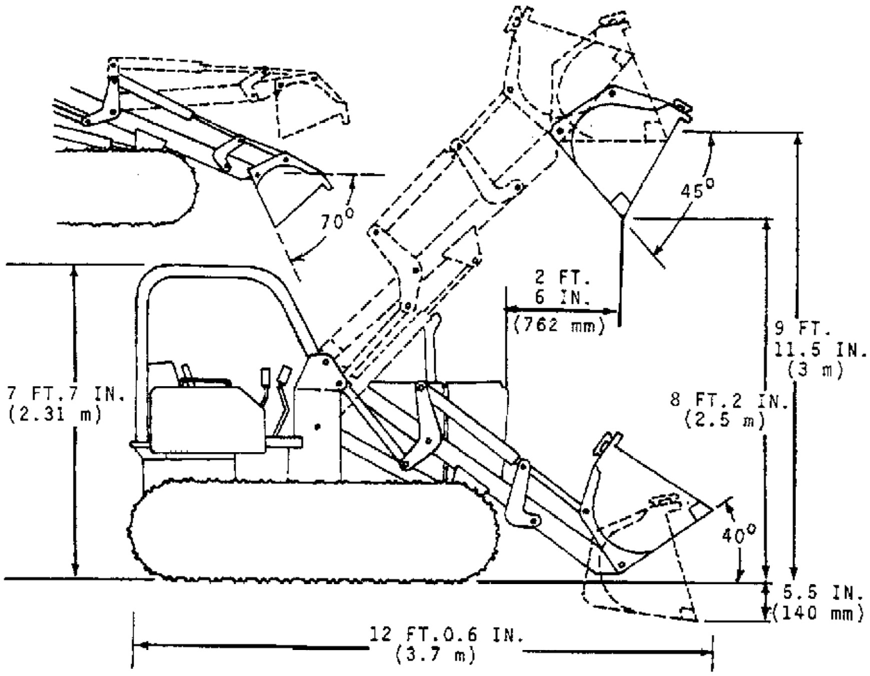
T82,115 M2 020186



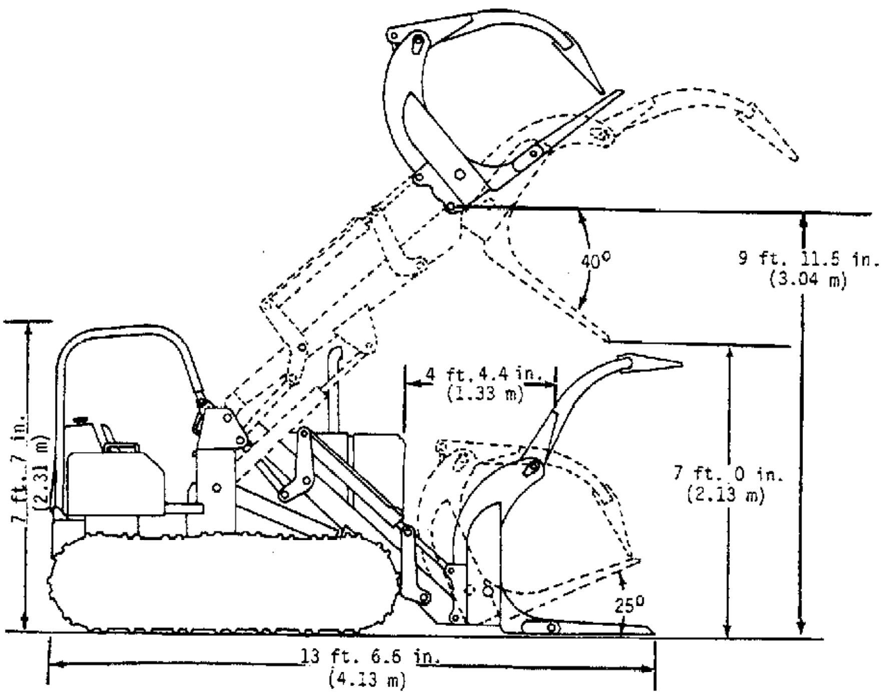
350D Crawler Dozer

A—6305 and Wide Track	11 ft. 3 in. (343 m)
6310 and Wide Track	11 ft. 1.5 in. (349 m)
B—6305 and Wide Track	3 ft. 2 in. (965 mm)
6310 and Wide Track	4 ft. (1.22 in.)
C—6305, 6310, and Wide-Track	1 ft. 1 in. (330 mm)
D—6305	8.5 in. (216 mm)
6310	8 in. (203 mm)
Wide Track	12.2 in. (310 mm)
E—6305	80 in. (2.03 m)
6310	93 in. (2.36 m)
Wide Track	104 in. (2.64 m)
F—6305	7 in. (178 mm)
6310 and Wide Track	8 in. (203 mm)

000;T6237A G T82;115 M3 140186



355D Crawler Loader



7702 Log Loader

000;T6237AI, T6237AH T82;115 M4 120186

HARDWARE TORQUE SPECIFICATIONS

Check cap screws and nuts to be sure they are tight. If hardware is loose, tighten to torque shown on the following charts unless a special torque is specified.

T82;SKMA AT 270286

NOTE: Torques shown are for dry (no lubrication on threads) hardware.

NOTE: Torque wrench tolerance is ± 10 per cent of specified torque.

Customary Hardware

Cap Screw Size-Inches	Grade B lb-ft.	Grade B (N-m)	Grade D lb-ft.	Grade D (N-m)	Grade F lb-ft.	Grade F (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)

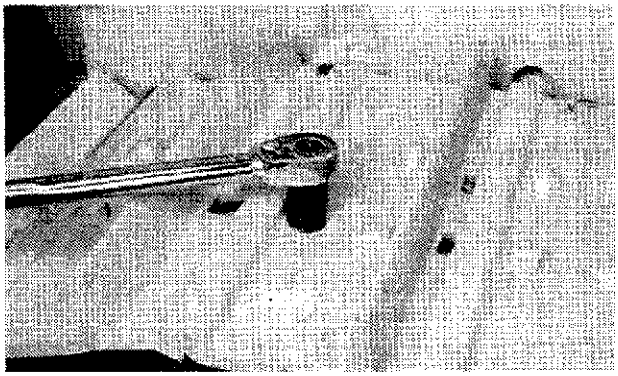
018;T88884 T82;FLMA AJ 140685

CHECK TRACK SHOE TORQUE

Track shoe cap screws should be checked periodically for tightness.

Tighten cap screws to 110 lb-ft (149 N·m) torque.

NOTE: Replacement hardware should be lubricated and tightened to above specification.



000;T6009AN T82;90 M17 161285

METRIC HARDWARE TORQUE CHART

NOTE: Torques shown are for hardware with SAE30W oil on threads.

NOTE: Torque wrench tolerance is ± 10 percent of specified torque.

Metric Standard Thread

Thread	8.8 N·m	8.8 (lb-ft)	10.9 N·m	10.9 (lb-ft)	12.9 N·m	12.9 (lb-ft)
M5	6	(5)	8	(6)	10	(7)
M6	10	(7)	14	(10)	17	(13)
M8	25	(18)	34	(25)	40	(29)
M10	48	(35)	68	(50)	82	(60)
M12	84	(62)	118	(87)	142	(105)
M14	133	(98)	187	(138)	226	(167)
M16	206	(152)	290	(214)	348	(257)
M18	285	(210)	398	(294)	478	(351)
M20	402	(296)	570	(420)	677	(499)
M22	540	(398)	765	(564)	914	(674)
M24	697	(514)	980	(723)	1180	(870)

Metric Fine Thread

Thread	8.8 N·m	8.8 (lb-ft)	10.9 N·m	10.9 (lb-ft)	12.9 N·m	12.9 (lb-ft)
M8 x 1	26	(19)	37	(27)	44	(32)
M10 x 1	47	(35)	69	(51)	82	(60)
M12 x 1.5	88	(66)	123	(91)	147	(106)
M14 x 1.5	147	(108)	206	(152)	246	(181)
M16 x 1.5	221	(163)	309	(228)	373	(275)
M18 x 1.5	319	(235)	451	(333)	540	(398)
M20 x 1.5	451	(333)	628	(463)	755	(557)
M22 x 1.5	599	(442)	845	(623)	1030	(760)
M24 x 2	765	(564)	1080	(796)	1275	(940)
M26 x 2	1130	(833)	1570	(1158)	1915	(1412)

T82;EXMA T 290586

O-RING BOSS FITTING SERVICE RECOMMENDATIONS

1. Inspect boss O-ring seat. It must be free of dirt and defects. If repeated leaks occur, inspect for defects with a magnifying glass. Some raised defects can be removed with a slip stone.

Occasionally a lower durometer O-ring will seal against a rough seat. If neither of these solutions work, the component must be replaced.

2. Lubricate O-ring using petroleum jelly. Put a thimble over the threads to protect O-ring from nicks. Slide O-ring over the thimble and into the turned down section of fitting.

For angle fittings, loosen special nut and push special washer against threads so O-ring can be installed into the turned down section of fitting.

3. Turn fitting into the boss by hand until special washer or washer face (straight fitting) contacts boss face and O-ring is squeezed into its seat.

4. To position angle fittings, turn the fitting counterclockwise a maximum of one turn.

5. Tighten straight fittings to the torque valve shown in chart. For angle fittings, tighten the special nut to valve shown in the chart while holding body of fitting with a wrench.

STRAIGHT FITTING OR SPECIAL NUT TORQUE (1)

Thread Size	Torque[1] N·m	(lb-ft	Number Of Flats[2]
3/8-24 UNF	8	(6)	2
7/16-20 UNF	12	(9)	2
1/2-20 UNF	16	(12)	2
9/16-18 UNF	24	(18)	2
3/4-16 UNF	46	(34)	2
7/8-14 UNF	62	(46)	1-1/2
1-1/16-12 UN	102	(75)	1
1-3/16-12 UN	122	(90)	1
1-5/16-12 UN	142	(105)	3/4
1-5/8-12 UN	190	(140)	3/4
1-7/8-12 UN	217	(160)	1/2

1. Tolerance ± 10%.

2. To be used if a torque wrench cannot be used. After tightening fitting by hand, put a mark on nut and boss; then tighten special nut or straight fitting the number of flats shown.

T82:TLPD AA 040285

TUBE AND HOSE FITTING, 37° FLARE AND 30° CONE SEAT CONNECTOR SERVICE RECOMMENDATIONS

1. Inspect the flare and the flare seat. They must be free of dirt and defects. If repeated leaks occur, inspect for defects with a magnifying glass. If burrs and raised nicks on the connector body cannot be removed with a slip stone, replace the connector.

2. Defects in the tube flare cannot be repaired. Replace the tube. Overtightening a defective flared fitting will not stop leaks.

3. As a field repair, a ductile truncated cone shaped washer can be used between the tube flare and connector body. These washers are soft enough to fill defects in the seat and flare. They will also seal the connection. Ductile washers are available from industrial supply houses.

4. Align the tube with the fitting before attempting to start the nut. Failure to do so can cause a deformed flare and subsequent leaks. Install hoses without twists. A twisted hose attempts to straighten out when pressure is applied. This exerts a torque on the connection, eventually causing failure.

5. Lubricate the connection with hydraulic fluid, petroleum jelly or soap. Tighten the swivel nut by hand until it is snug.

6. Mark a line across the nut and connector body. This line will serve as a visual indicator as to whether the nut has been tightened and by how much.

7. Using two wrenches, one on the connector body and a torque wrench on the nut, tighten the nut to the torque value as shown in the chart. In the case of a hose, it may be necessary to use three wrenches to prevent twisting.

TUBE AND HOSE FITTING, 37° FLARE AND 30° CONE SEAT CONNECTOR TORQUE

Thread Size	Torque[1] N·m	Torque[1] (lb-ft)	New[2] Number of Flats	Used[3] Number of Flats
3/8-24 UNF	8	(6)	2-1/2	1
7/16-20 UNF	12	(9)	2-1/2	1
1/2-20 UNF	16	(12)	2-1/2	1
9/16-18 UNF	24	(18)	2	1
3/4-16 UNF	46	(34)	2	1
7/8-14 UNF	62	(46)	1-1/2	1
1-1/16-12 UN	102	(75)	1	3/4
1-3/16-12 UN	122	(90)	1	3/4
1-5/16-12 UN	142	(105)	3/4	3/4
1-5/8-12 UN	190	(140)	3/4	3/4
1-7/8-12 UN	217	(160)	1/2	1/2

1. Tolerance of $\pm$ 10%.

2. To be used if a torque wrench cannot be used. After tightening fitting by hand, put a mark across the fittings, then tighten fitting the number of flats shown.

3. Flare connection seal by deforming or squeezing the tube between the nut and the connector. More deformation is possible with new parts than with old. Therefore, if a torque wrench is not used for re-assembly, the values in this column must be used to prevent damage.

T82:TLPD AS 150383

FUEL SPECIFICATIONS

Use ONLY clean, high-quality fuel.

Use Grade No. 2-D fuel above 4°C (40°F).

Use Grade No. 1-D fuel below 4°C (40°F).

Use Grade No. 1-D fuel for all air temperatures at altitudes above 1 500 m (5000 ft).

IMPORTANT: If fuel sulfur content exceeds 0.5 per cent, the engine oil drain interval must be reduced by 50 per cent (to 125 hours).

Use fuel with less than 1.0 per cent sulfur. If possible, use fuel with less than 0.5 per cent sulfur.

For maximum filter life, sediment and water should not be more than 0.10 per cent.

The cetane number should be 40 minimum. If you operate your machine where air temperatures are normally low or where altitudes are high, you may need fuel with a higher cetane number.

Cloud Point—For cold weather operation, cloud point should be 6°C (10°F) below lowest normal air temperature.

T82;BHFL F 261285

FUEL STORAGE

NOTE: Diesel fuels stored for a long time may form gum or bacteria and plug filters.

Keep fuel in a clean container in a protected area. Water and sediment must be removed before fuel gets to the engine. Do not use de-icers to remove water from fuel. Do not depend on fuel filters to remove water.

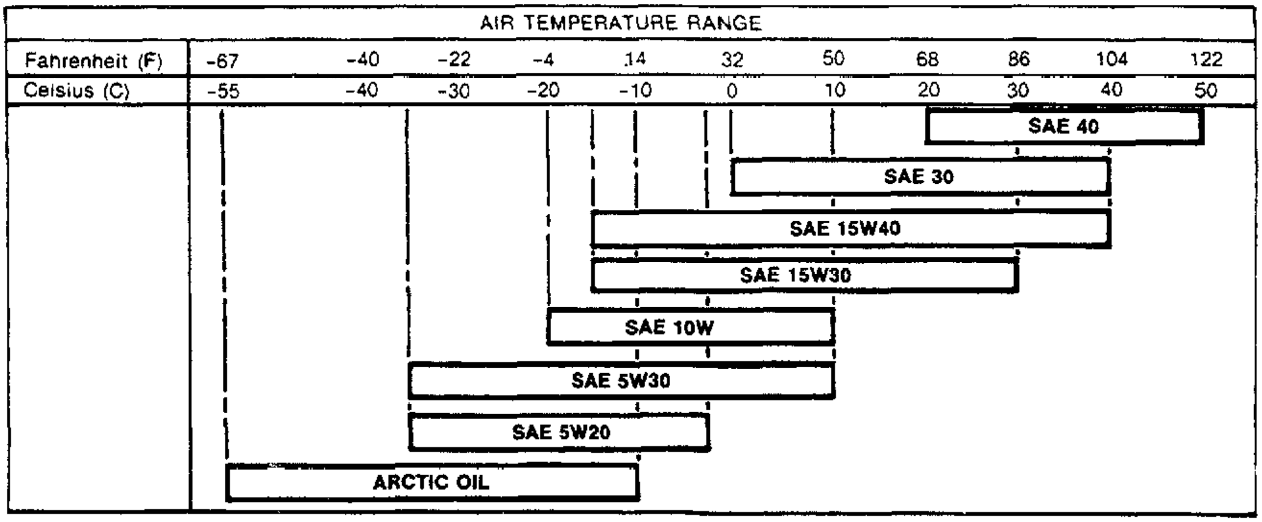
If possible, install a water separator at the storage tank outlet. (See your John Deere dealer).

IMPORTANT: Keep all dirt, scale, water or other foreign material out of fuel.

Store fuel drums on their sides with plug up.

T82;BHFL G 290186

ENGINE OIL



Depending upon the expected air temperature range between oil changes, use oil viscosity shown on the temperature chart above.

Additives are not required nor recommended.

John Deere TORQ-GARD SUPREME® engine oil is recommended. If other oils are used, they must have one of the following specifications:

Oil Specification	Use
API Service: CD/SF, CD/SE, CD/SD, CD/SC, or MIL-L-2104C, MIL-L-2104D	Recommended
*API Service CC/SF, CC/SE, CC/SD, CC/SC or *MIL-L-46152, *MIL-L-46152B	For SAE 5W20, SAE 5W30 and arctic oil only, use if recommended oil is not available.
*MIL-L-46167A	For arctic oil only

**Change oil at one-half the normal drain interval.*

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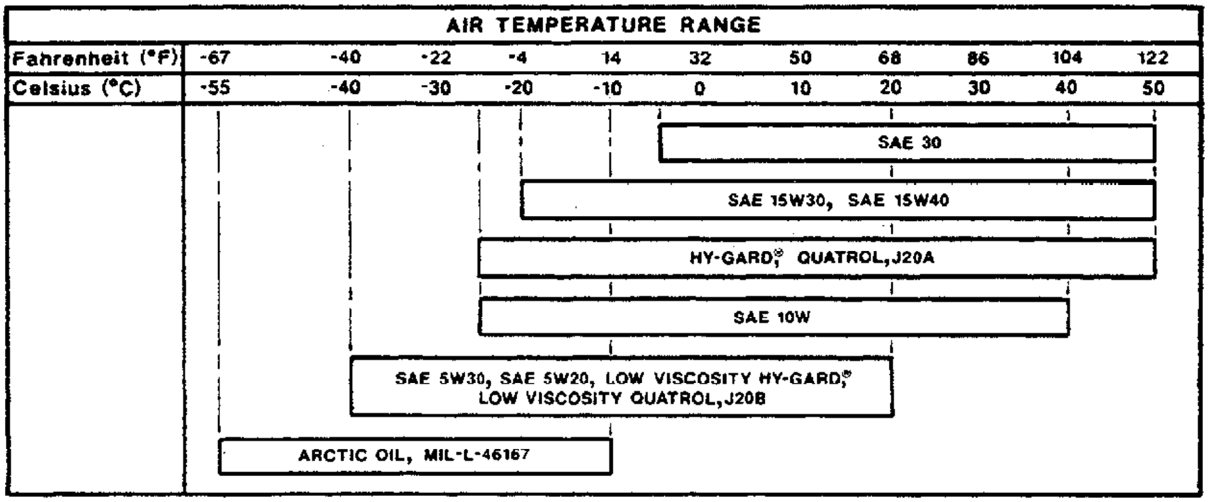
TRANSMISSION—STEERING CLUTCHES—FINAL DRIVES; DIRECTION REVERSER; HYDRAULIC OIL



Depending upon the expected air temperature range between oil changes, use oil viscosity shown on the temperature chart above.

The following oils are recommended:

John Deere HY-GARD® Transmission and Hydraulic Oils.

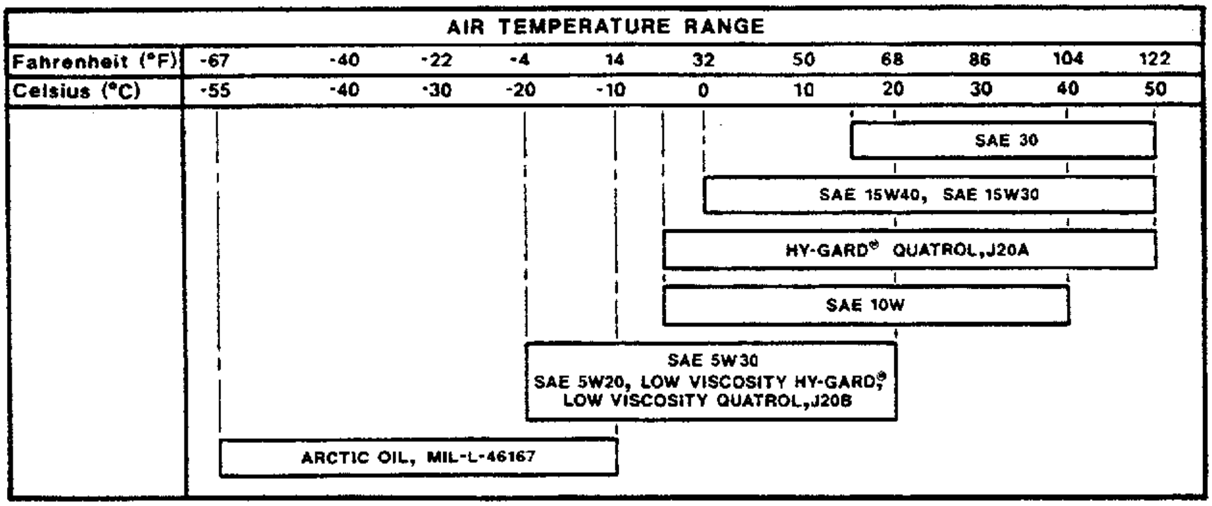
Engine oil meeting API Service CD/SC (MIL-L-2104C), CC/SC, or MIL-L-46152 and T02 oil test.

You may also use QUATROL® oils, which are oils that meet John Deere standards, or other oils meeting John Deere Standard J20A or J20B.

Oil meeting MIL-L-46167 may be used as an arctic oil.

018:T6249AP T82:45 M2 120186

WINCH OIL



Depending upon the expected air temperature range between oil changes, use oil viscosity shown on the temperature chart above.

The following oils are recommended:

John Deere HY-GARD® Transmission and Hydraulic Oils.

Engine oil meeting API Service CD/SC (MIL-L-2104C), CC/SC, or MIL-L-46152 and T02 oil test.

You may also use QUATROL® oils, which are oils that meet John Deere standards, or other oils meeting John Deere Standard J20A or J20B.

Oil meeting MIL-H-5606A may be used as an arctic oil.

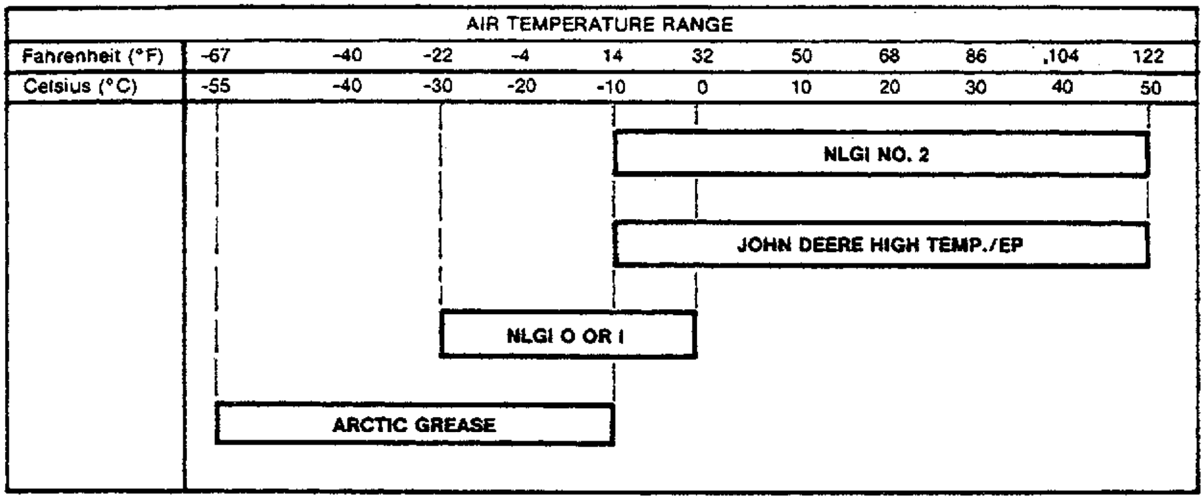
018;T6249AO T82;45 M4 011486

TRACK ROLLER, FRONT IDLER, AND CARRIER ROLLER OIL

Use SAE 80W90 gear oil meeting API Service GL-5 (MIL-L-2105B or MIL-L-2105C).

T82;CRFL D 080483

GREASE



Depending on the expected air temperature range during use, use grease shown on chart above.

Greases recommended are:

SAE Multipurpose Grease with Extreme Pressure (EP) performance and containing 3 to 5 per cent molybdenum disulfide (preferred).

John Deere High Temperature/EP Grease.

SAE multi-purpose EP grease.

Grease meeting MIL-G-10924C specifications may be used as arctic grease.

018;T91371 T82;EXFL AC 260984

COLD WEATHER OPERATION

Additional information on cold weather operation is available from your John Deere Industrial Region office.

T82;TLPD U 270183

ALTERNATIVE LUBRICANTS

Conditions in certain geographical areas may require special lubricants and lubrication practices which do not appear in this manual. If you have any questions, consult your John Deere Industrial Region office to obtain the latest information and recommendations.

T82;TLPD Y 270183

LUBRICANT STORAGE

Your machine can operate at top efficiency only if clean lubricants are used. Use clean containers to handle all lubricants. Store them in an area protected from dust, moisture, and other contamination. Store drums on their sides.

T82;BHFL J 080483

PREDELIVERY INSPECTION (PDI)

Do the predelivery services shown on the inspection checklist before you deliver the machine to the customer. The checklist is in the back of the Operator's Manual

06T;PIM C1 090586

AFTER-SALE INSPECTION (ASI)

Do the after-sale services shown on the inspection checklist during the warranty period after 50—100 hours of machine operation. The after-sale checks are also found on the inspection checklist in the back of the Operator's Manual

Terms of this inspection are outlined on the customers John Deere Delivery Receipt.

06T;PIM C2 090586

PLANNED INSPECTION PROGRAM I (PIP I)

When you deliver the machine, explain to the customer the advantages of the Planned Inspection Program I (PIP I):

Top production from the machine
Minimum downtime
Lower long-term operating costs
Overall greater satisfaction

Prepare a contract with the customer specifying the number of field inspections by your service technician and the cost.

Use the PIP I Inspection Checklists in this group as a guide in preparing the contract.

06T;PIM C3 140486

PLANNED INSPECTION PROGRAM II (PIP II)

PIP II is a continuation of PIP I.

This program tests critical machine systems and will enable the customer to keep the machine in the best possible condition.

Prepare a contract with the customer specifying the number of field inspections by your service technician and the cost. Use the PIP II Inspection Checklist in this group as a guide in preparing the contract.

06T;PIM C4 090586

USING THE CHECKLISTS

Do an inspection procedure only if there is a "box" behind the procedure in the service column which you are following. Mark the box with an "x" when the procedure is done.

For specific instructions on how to do each procedure, refer to the operator's manual or the technical manual.

If a box is not marked, write an explanation in the comments column. For example:

If engine oil level is low, note amount of oil needed to fill crankcase.

If the machine is not lubricated according to the Periodic Maintenance Chart, note this.

When the inspection is done, put the checklist in the customer's file. Use the same checklist for additional inspections.

06T;PIM C5 120586

DELIVERY SERVICE

Use the operator's manual as a guide. Discuss the following points thoroughly with the customer:

The importance of safety.

Controls and instruments.

All functions of the hydraulic system.

How to start and stop the engine.

The importance of the break-in period.

The importance of lubrication and periodic maintenance.

Have the owner sign the Delivery Receipt.

Give the owner the operator's manual.

T82;TLPD P 290284

JOHN DEERE 350D AND 355D CRAWLERS

PRE-DELIVERY INSPECTION (PDI), AFTER-SALE INSPECTION (ASI)

MACHINE NUMBERS

Product Identification Number ____________________ Winch Serial Number ____________________

Engine Serial Number ____________________

PRE-DELIVERY INSPECTION
(Required Before Delivery of Machine to Owner)

Delivered by ____________________ Owner's Name ____________________

Dealer ____________________ Owner's Address ____________________

Date ____________________ City ______________ State ________ Zip ________

AFTER-SALE INSPECTION
(Required During 50 to 100 Hours of Operation)

Machine Hours ____________________ Owner's Name ____________________

Inspected By ____________________ Owner's Address ____________________

Inspector's Signature ____________________ City ______________ State ________ Zip ________

Dealership ____________________ Owner's Signature ____________________

05T;CL M3 090986

Item	INSPECTION COMPLETED PDI OK	ASI OK	Comments
1. Coolant level	☐	☐	
2. Belt tension	☐	☐	
3. Engine oil level	☐	☐	
4. Starting aid—if equipped	☐	☐	
5. Fuel filter sediment	☐	☐	
6. Fuel tank sump	☐	☐	
7. Fuel filler screen	☐	☐	
8. Air restriction indicator	☐	☐	
9. Air intake hose	☐	☐	
10. Battery electrolyte level/terminals	☐	☐	
11. Seat	☐	☐	
12. Operating lights—if equipped	☐	☐	
13. Trans.—steering clutch oil level	☐	☐	
14. Direction reverser oil level	☐	☐	
15. Hydraulic oil level	☐	☐	
16. Hydraulic oil filter		☐	
17. Rollers and idlers	☐	☐	
18. Track shoe bolt torque	☐	☐	
19. Loader boom alignment	☐		
20. Instruments after starting	☐	☐	
21. Steering levers	☐	☐	
22. Brake	☐	☐	

05T;CL M1 040886

Item	INSPECTION COMPLETED PDI OK	ASI OK	Comments
23. Brake lock	☐	☐	
24. Control levers	☐	☐	
25. Neutral start switch	☐	☐	
26. Transmission operation	☐	☐	
27. Return-to-dig	☐	☐	
28. Engine speeds	☐	☐	
29. PTO operation	☐	☐	
30. Radiator/oil cooler air flow	☐		
31. Engine oil and filter		☐	
32. Lubrication points	☐	☐	
33. Track sag	☐	☐	
34. Accessible hardware	☐	☐	
35. Fluid leakage	☐	☐	
36. Locks and latches	☐	☐	
37. Overall appearance	☐		

05T;CL M2 040886

PLANNED INSPECTION PROGRAM

JOHN DEERE

CHECK LIST FOR PLANNED INSPECTION PROGRAM I (PIP I) — Field inspections contracted with the owner.

NOTE: Check off each item as it is completed. Refer to the Operator's Manual or Technical Manual for detailed information.

	Inspection 1	**Inspection 2**	**Inspection 3**	**Inspection 4**
Crawler Hours				
Performed by				
Mechanic Signature				
Date				
Owner's Name				
Address				
Signature				
Dealership				

OK	Item
☐	1. Coolant level.
☐	2. Coolant freeze-protection level.
☐	3. Radiator area-core, foam baffling, fan and shroud, water pump leaks.
☐	4. Belt condition and tension.
☐	5. Engine oil level and condition.
☐	6. Clean engine compartment.
☐	7. Measure engine valve clearance.
☐	8. Starting aid (if equipped)-solenoid must click, inspect tube.
☐	9. Exhaust system-muffler and stack.
☐	10. Drain fuel filter sediment.

Comments: ____

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OK	Item	OK	Item
☐	11. Change fuel filter.	☐	29. Front idler oil level and condition.
☐	12. Drain fuel tank sump.	☐	30. Track roller and carrier roller oil level and condition.
☐	13. Clean fuel filler screen.	☐	31. Track shoe bolt torque.
☐	14. Injection pump lines-free of leaks, clamps tight.	☐	32. Equipment and welds-damaged covers or shields, weld cracks.
☐	15. Air intake hose-free of cracks, clamps tight.	☐	33. Blade/bucket-excessive wear.
☐	16. Air filter elements-clean or replace.	☐	34. Return-to-dig operational.
☐	17. Battery electrolyte level and terminals-JT05460.	☐	35. Levers-operational.
☐	18. Battery specific gravity JT05460.	☐	36. Brake and brake lock-operational.
☐	19. Wiring-abrasions, loose connections, corroded terminals, missing clamps.	☐	37. Neutral start system-operational.
☐	20. Seat-check adjustments.	☐	38. Transmission-operate in N-L-R and 1st through 4th gears.
☐	21. Lights-operational.	☐	39. Gauges and indicators-operational.
☐	22. Transmission-steering clutch-final drive oil level and condition.	☐	40. Engine speeds.
☐	23. Direction reverser oil level and condition.	☐	41. PTO-operational.
☐	24. Hydraulic oil level and condition.	☐	42. Radiator/oil cooler air flow-JT05529 Air Flow Meter.
☐	25. Change hydraulic oil filter.	☐	43. Change engine oil and filter.
☐	26. Hydraulic hoses, lines, cylinders-damage, leaks.	☐	44. Lubricate pivot points.
☐	27. Pivot pins and bushings-damage, leaks.	☐	45. Track sag.
☐	28. Rollers and idlers-leaks.	☐	46. Accessible hardware-tighten.
		☐	47. Leaks-check overall machine.
		☐	48. Locks and latches-operational.
		☐	49. Replace missing safety decals.

Comments: ____

____

____

05T;CL L2 040886

PLANNED INSPECTION PROGRAM

CHECK LIST FOR PLANNED INSPECTION PROGRAM II (PIP II) — Field inspections contracted with the owner.

NOTE: Check off each item as it is completed. Refer to the Technical Manual for detailed information.

	Inspection 1	**Inspection 2**	**Inspection 3**	**Inspection 4**
Crawler Hours				
Performed by				
Mechanic Signature				
Date				
Owner's Name				
Address				
Signature				
Dealership				

Item	**OK**	**Comments**
1. Engine speeds (Group 9035), Linkage Adjustment (Group 9010)		
Slow idle	☐	
Fast idle	☐	
2. Steering brakes and clutches (Group 9020)	☐	
3. System Pressure Tests (Group 9025)		
Clutch Oil Regulator Valve	☐	
Cooler Inlet Regulator Valve	☐	
Lube Regulating Valve	☐	
4. Hydraulic Pump Efficiency (Cycle Times)(Group 9025)	☐	
5. Hydraulic System Relief Valve (Group 9025)	☐	
6. Hydraulic Circuit Relief Valves (Group 9025)	☐	

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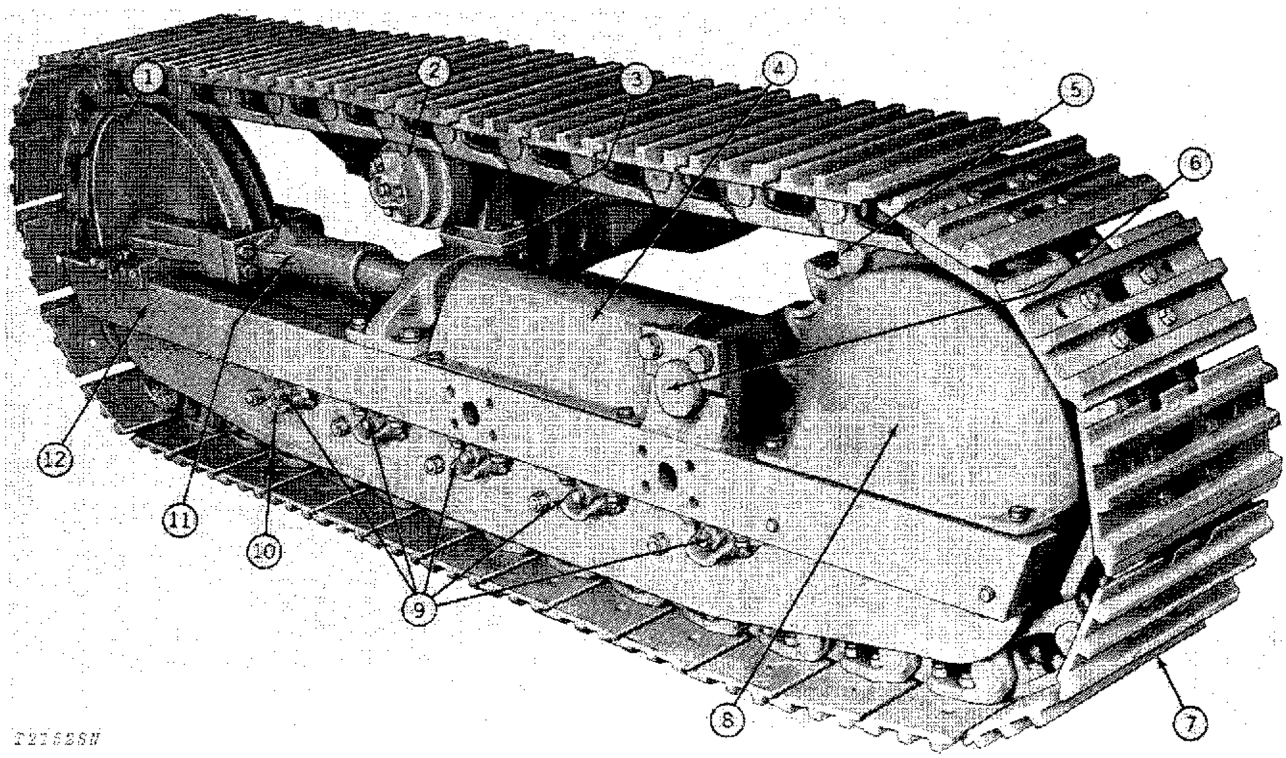
Section 1
TRACKS

CONTENTS OF THIS SECTION

Group 0130
TRACK SYSTEMS

GENERAL INFORMATION



1—Track Idler
2—Track Carrier Roller
3—Front Crossbar
4—Track Idler Spring
5—Track Drive Sprocket
6—Rear Crossbar
7—Track
8—Sprocket Shield
9—Track Rollers
10—Rock Guard
11—Track Adjuster
12—Track Frame

Fig. 1-Track System

The track system for the JD350-C Crawler consists of two tracks mounted on track frame assemblies, piloted by and connected to two fixed crossbars (Fig. 1). The track frame assemblies are fastened to the crossbars to give a fixed gauge setting of 48 inches (1.2 m). The track frame has five track roller assemblies.

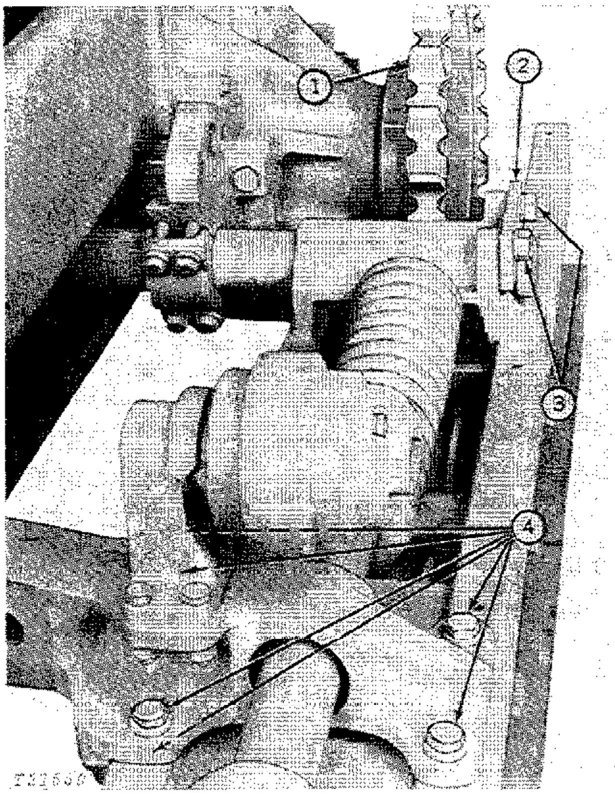
A special wide tread track is available for snow operation on crawlers without loaders. Track gauge is fixed at 68 inches (1.7 m).

Each track frame assembly consists of a fixed single unit of welded steel frame which supports the roller assemblies and the front idler wheel with its adjusting mechanism. The assembly is clamped to the fixed crossbars which support the weight of the tractor.

TRACK FRAMES AND UNDERCARRIAGES

TRACK FRAME ASSEMBLY

Removal



1—Drive Sprocket
2—Retainer
3—Rear Attaching Points Cap Screws
4—Front Attaching Points Cap Screws

Fig. 2-Removing Track Frame

Remove track as directed on page 0130-15.

Slip entire idler assembly off front end of track carrier frame.

Remove sprocket shield or sprocket weight.

Remove sprocket (1, Fig. 2) from flanged axle shaft (or axle extension on units with wide tread option).

Remove cap screws attaching inner rock guard to final drive housing.

IMPORTANT: Do not permanently remove rock guards or cut out portions of rock guards on the track roller frames to aid in clearing dirt out of the roller area. The rock guards add much strength to the track roller frame construction and should not be "cut out" or left off the machine.

Remove cap screws (4) attaching front crossbar to track frame (Fig. 2).

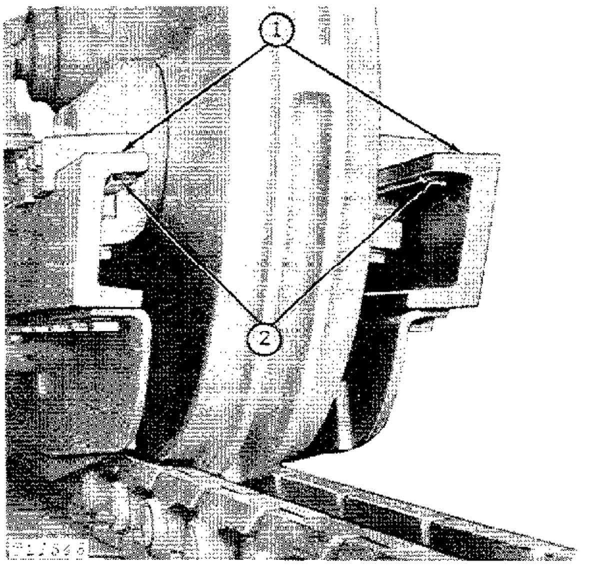
Remove cap screws (3) and retainer attaching track frame to rear crossbar (Fig. 2).

Raise crawler with jack or hoist under both crossbars until roller flanges clear track. Pull track carrier assembly from rear crossbar.

Due to the welded construction of the track frame no further disassembly of the frame should be attempted unless wear strips are worn and require replacing.

Repair

Inspect for bent channel frames, excessive wear on track frame channel wear strips, and cracks or broken welds. If wear strips (Fig. 3) are excessively worn, they must be removed and replaced.



1—Track Frames
2—Track Frame Channel Wear Strips

Fig. 3-Track Frame Channel Wear Strips

Replacing Track Frame Channel Wear Strips

IMPORTANT: Disconnect battery ground strap or turn master battery disconnect switch to the "off" position if so equipped before doing any welding on the crawler. Failure to do so may damage the electrical system.

Release track cylinder pressure to loosen track. Remove master track pin and split track.

Remove and replace worn track wear strips as follows:
Grind off the old wear strip inside the track frame channel (Fig. 3) so that none of the strips or welds remain.

Clamp new wear strips evenly but not tightly to track frame channel. A secure clamping which still allows a slight wear strip shift will prevent cracking of weld fillet during cooling.

Using a low hydrogen electrode (0.125 inch [3.18 mm] dia. rec.) and a fairly low melting current (100-115 amp), melt as little as possible of the wear strip by starting and maintaining the arc primarily on the track frame channel. The wear strip is a high carbon steel, so best results are obtained by washing the weld metal toward the wear strip. This will produce a slightly convex weld fillet.

None of the other integral parts of the frame are furnished as repair parts. It will be necessary to replace the entire carrier if damage is such that it cannot be repaired by straightening or welding the damaged parts.

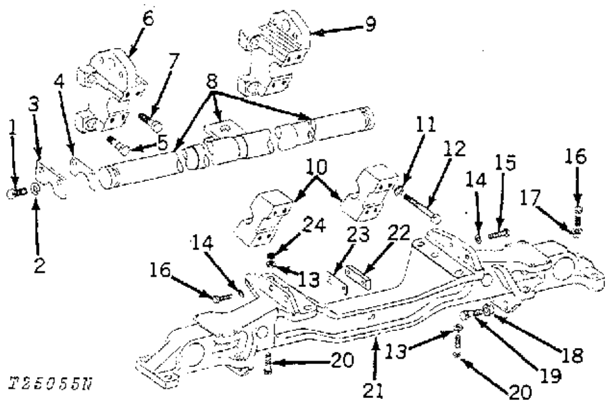
Join track and install master pin and snap ring.

NOTE: To adjust track tension and to check track alignment, refer to Section 90, Group 9030.

Connect negative battery ground strap.

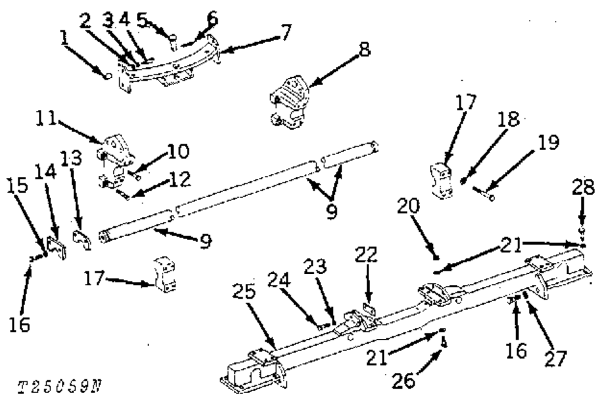
Disassembly and Assembly

Refer to Fig. 4 or 5 for position of parts during disassembly and assembly.



1—Cap Screw (4 used)
2—Lock Washer (4 used)
3—Rear Bar Retainer (2 used)
4—Shim (approx. 6 used)
5—Special Cap Screw (4 used)
6—Rear Bar Right Bracket
7—Cap Screw (4 used)
8—Rear Crossbar
9—Rear Bar Left Bracket
10—Rear Bar Cap (2 used)
11—Special Washer (8 used)
12—Cap Screw (8 used)
13—Special Washer (8 used)
14—Special Washer (4 used)
15—Cap Screw (2 used)
16—Cap Screw (10 used)
17—Flanged Spacer (8 used)
18—Flanged Spacer (4 used)
19—Cap Screw (4 used)
20—Cap Screw (6 used)
21—Front Crossbar
22—Tapping Bar
23—Shim (approx. 2 used) (early units)
24—Nut (2 used)

Fig. 4-Crossbar Assembly



1—Hollow Dowel (4 used)
2—Special Washer (4 used)
3—Lock Washer (4 used)
4—Cap Screw (4 used)
5—Pin
6—Pin
7—Bracket
8—Rear Bar Left Bracket
9—Rear Crossbar
10—Cap Screw (4 used)
11—Rear Bar Right Bracket
12—Cap Screw (4 used)
13—Shim (approx. 6 used)
14—Retainer (2 used)
15—Lock Washer (4 used)
16—Cap Screw (8 used)
17—Rear Bar Cap (2 used)
18—Special Washer (8 used)
19—Cap Screw (8 used)
20—Lock Nut (2 used)
21—Special Washer (16 used)
22—Shim (approx. 2 used)
23—Special Washer (4 used)
24—Cap Screw (4 used)
25—Front Crossbar
26—Cap Screw (6 used)
27—Special Washer (4 used)
28—Cap Screw (8 used)

Fig. 5-Wide Tread Crossbar Assembly

Installation

Before installing track frame, be sure that front and rear crossbar are secure. Make sure that rear crossbar extends an equal distance from rear bar brackets on both sides. Tighten front crossbar-to-side frame horizontal cap screws and vertical cap screws. Evenly tighten the rear crossbar cap-to-bracket cap screws (12, Fig. 4) to 250 lb-ft (339 Nm).

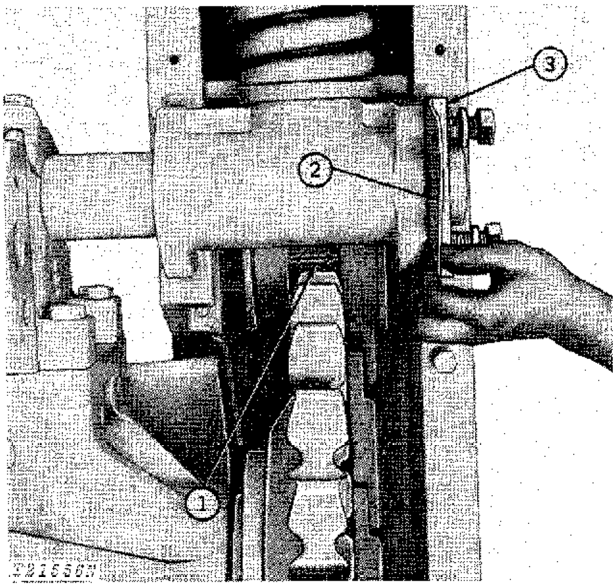
With the tractor supported under both crossbars, start the track frame on the rear crossbar and slide in place. Position the rear crossbar retainer (3) and shims (4) and loosely install the cap screws. Note that spacers are used at front attaching points.

Install the drive sprocket on hub dowels and tighten cap screws.

Shift track frame in or out until drive sprocket is centered between flanges of rear track roller (Fig. 6). Then install just enough shims (2) to fill space between retainer (3) and retainer seating surface.

Tighten the retainer cap screws (1, Fig. 4) to 170 lb-ft (230 Nm) and the front crossbar horizontal cap screws and the vertical cap screws.

Recheck centering of sprocket between rear track flanges.



1—Centered Sprocket **3—Retainer**
2—Adjusting Shims

Fig. 6-Centering Track Frame

DRIVE SPROCKETS

GENERAL INFORMATION

Each track is driven from the rear by a hardened cast steel sprocket receiving power through the final drive and clutch-brake mechanism.

The sprocket is bolted to the axle shaft.

The sprocket is of the hunting tooth design.

MEASURING SPROCKET WEAR

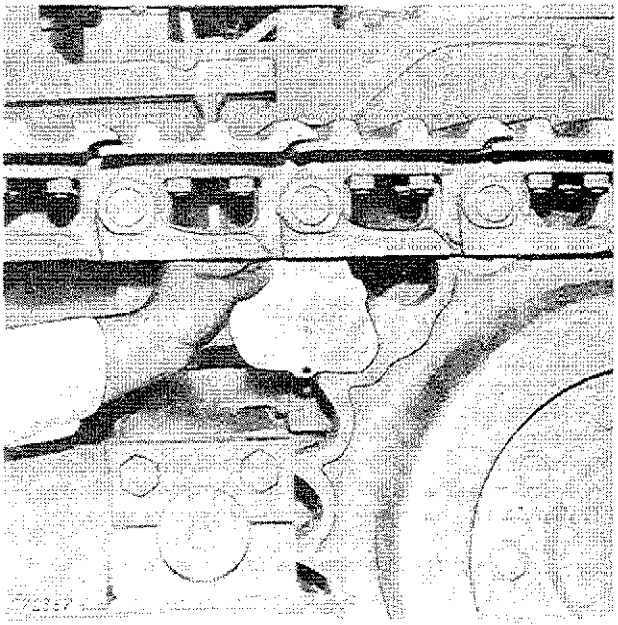


Fig. 7-Measuring Sprocket Wear

Use JDG-43 Sprocket Wear Gauge (part of D-05227ST Undercarriage Inspection Service Tool Kit) to measure sprocket wear.

Place the gauge on the sprocket as shown in Fig. 7, with the gauge against one sprocket tooth.

Measure the gap between the other side of the gauge and the sprocket tooth. Allowable wear is indicated on the gauge.

NOTE: For additional information on measuring sprockets refer to UNDERCARRIAGE APPRAISAL MANUAL SP-326.

NOTE: It is recommended to use the above procedure for more accurate measurements when replacing the track components. A track wear gauge (JD266) is available, enabling the service technician to quickly check the condition of a track assembly.

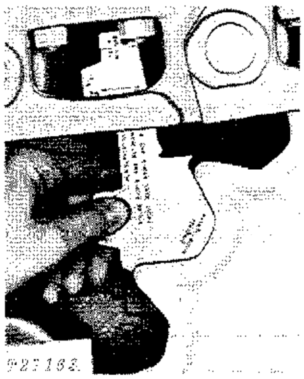


Fig. 8-Measuring Sprocket Wear

Use JD266 Track Wear Gauge to measure sprocket wear.

Place the gauge on the sprocket as shown in Fig. 8, with the gauge against one sprocket tooth.

Measure the gap between the other side of the gauge and the sprocket tooth. Allowable wear is indicated on the gauge.

REMOVAL

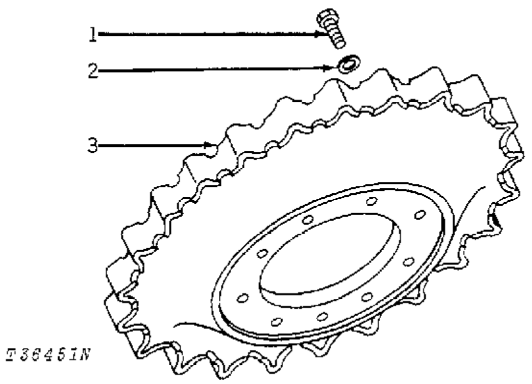
Raise one side of tractor by placing floor jack securely under front cross member. Start engine and shift transmission into first gear. Pull back on steering lever that controls track not raised off floor (this disengages steering clutch and applies brake to that side). Engage engine clutch, permitting raised track to rotate until master pin has moved around drive sprocket and is approximately 6 inches (152 mm) from floor.

CAUTION: Be sure that track to be rotated is clear of floor and that opposite track is locked in position so that tractor does not move.

NOTE: When crawler is equipped with a loader and bottom counterweight, the counterweight must be removed.

Release track tension, remove track master pin, page 1-0130-15 and move track assembly clear of drive sprocket.

Remove sprocket shield or sprocket weight from machine. See Group 1749 for removal of sprocket weight.



1—Cap Screw (9 used)
2—Special Washer (9 used)
3—Sprocket

Fig. 9-Regular Sprocket

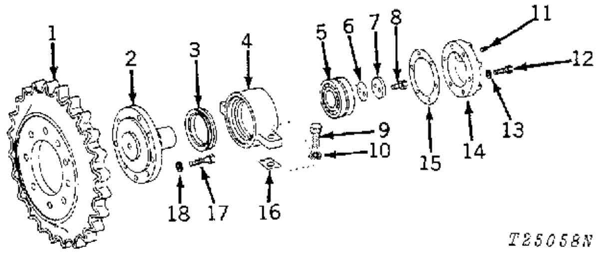
Remove cap screws (1, Fig. 9) and washers (2) and pull sprocket (3) from the axle shaft.

REPAIR

The drive sprocket is not repairable. It must be replaced when excessively worn or damaged.

NOTE: If the unit is driven in one direction the majority of the time, most of the wear will occur on one side of the teeth. To extend the service life, the sprockets can be switched from one side of the machine to the other. This will cause the chain to wear on the opposite face of the tooth.

Wide Tread Installation

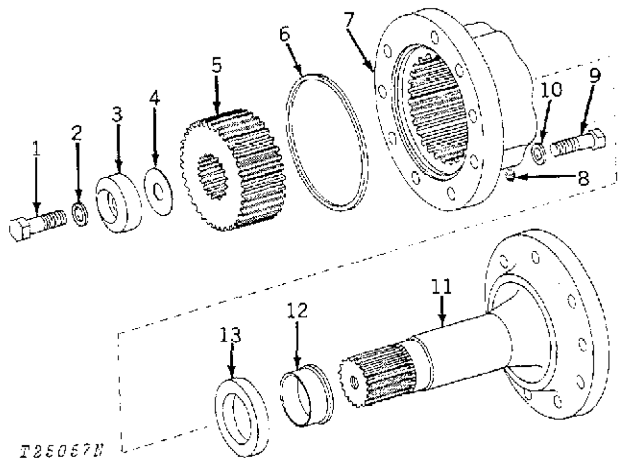


1—Sprocket
2—Shaft
3—Oil Seal
4—Housing
5—Bearing
6—Shim
7—Retainer
8—Cap Screw (2 used)
9—Cap Screw (2 used)
10—Washer (2 used)
11—Pipe Plug
12—Cap Screw (6 used)
13—Lock Washer (6 used)
14—Cover
15—Gasket
16—Shim (as required)
17—Cap Screw (9 used)
18—Washer (9 used)

Fig. 10-Outer Sprocket Shaft and Cover

Disassembly

Remove cover (14, Fig. 10) from housing (4). Remove retaining cap screws (8) and retainer (7). Press shaft (2) out of housing. Remove bearing (5) and oil seal (3) from housing. Check the condition of bearing and oil seal.



1—Cap Screw
2—Lock Washer
3—Gear Retainer
4—Shim
5—Coupling Gear
6—Packing
7—Housing
8—Pipe Plug
9—Cap Screw (9 used)
10—Washer (9 used)
11—Sprocket Shaft
12—Spacer
13—Seal

Fig. 11-Inner Sprocket Shaft and Gear

Remove gear (5, Fig. 11) from housing (7) and sprocket shaft (11) by removing cap screw (1) and gear retainer (3). Press sprocket shaft out of housing while holding seal (13) and spacer (12) in housing. Press seal (13) out and check for wear.

Assembly

Press seal (13, Fig. 11) into spacer (12) and then press seal into housing (7). With the large end of sprocket shaft (11) down, place housing on sprocket shaft and then place gear (5) on sprocket shaft and into housing as far as it will go. Now lay a flat piece of iron on the gear and press it and the housing onto the sprocket shaft until gear is flush with end of sprocket shaft. Fasten retainer and shim to end of shaft with cap screw (1).

NOTE: Do not let the housing assembly sit on the large end of sprocket shaft. This will tend to damage the seal (13, Fig. 11).

Pack the gear cavity area in housing (7) with multi-purpose lubricant. Put packing (6) in place on the flange axle of the final drive and attach inner sprocket housing assembly to the flange axle on the final drive.

NOTE: Remove pipe plug (8) from housing before attaching the flange axle so any excess grease or air can escape.

Press bearing (5, Fig. 10) into housing (4). With large end of shaft (2) down, place oil seal (3) on the shaft and press housing on the shaft. Attach shims (6) and retainer (7) on end of shaft with cap screws (8). Replace cover (14). Fill housing with 1-1/2 to 2 cups (355 to 474 mL) of the recommended oil. (See Section I, Group V).

After wide-track outboard bearings have been installed, refer to Group 9030 for alignment of track.

Add shims (16, Fig. 10) between track and housing (4) as required.

INSTALLATION

The flanged axle shaft, sprocket weight (if used), and the drive sprocket mounting surfaces must be clean, free of grease, oil, paint and rust prior to installation.

See Group 1749 and install sprocket and sprocket weight (if used) on flanged axle shaft. Tighten cap screws as follows:

D-grade - 170 lb-ft (230 N·m)
F-grade - 240 lb-ft (325 N·m)

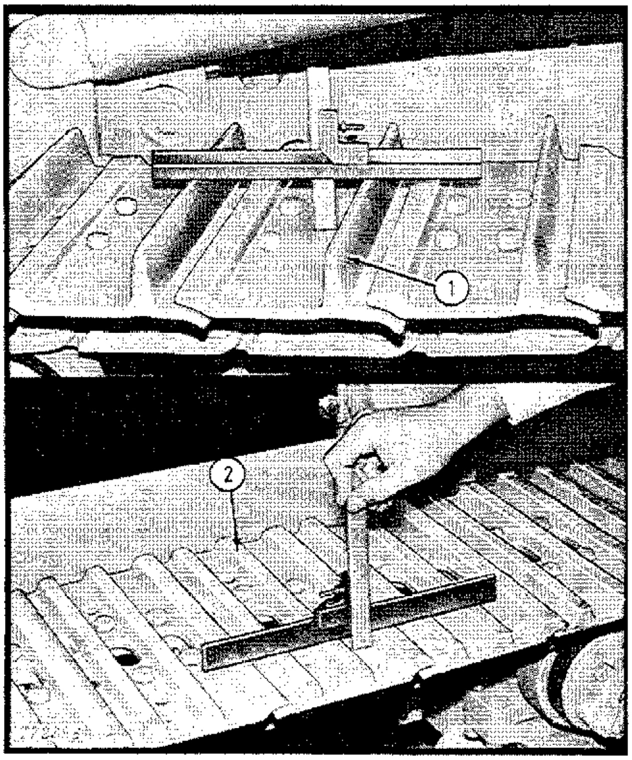
Connect track and remove floor jack from cross member.

TRACK SHOES

GENERAL INFORMATION

The five track roller assembly has 36 track shoes and 36 links. Track shoes are available in a variety of widths and types to accommodate various ground and working conditions.

MEASURING GROUSER BAR HEIGHT



1—Standard Grouser **2—Triple Semi Grouser**

Fig. 12-Grouser Bar Measurement

Use a depth gauge consisting of D-05231ST 300 mm Metric Ruler, D-05265ST 150 mm Metric Ruler and D-05266ST Right Angle Attachment (part of D-05227ST Undercarriage Inspection Service Tool Kit) to measure grouser bar height.

Place a depth gauge over grouser bar as shown in Fig. 12. Repeat the measurement for several grousers and record the average depth.

Standard grouser height on a new shoe is 1.58 in. (40.2 mm). Minimum recommended standard grouser height is 0.75 in. (19.0 mm).

Standard Grouser Height

Dimension (allowable wear-0.83 in. [21.2 mm])	Percent Worn
1.58 in. (40.2 mm)	0
1.50 in. (38.1 mm)	10
1.42 in. (36.0 mm)	20
1.33 in. (33.8 mm)	30
1.25 in. (31.7 mm)	40
1.17 in. (29.6 mm)	50
1.08 in. (27.5 mm)	60
1.00 in. (25.4 mm)	70
0.91 in. (23.2 mm)	80
0.83 in. (21.1 mm)	90
0.75 in. (19.0 mm)	100
0.67 in. (16.9 mm)	110
0.58 in. (14.8 mm)	120
0.50 in. (12.6 mm)	130

Triple semi-grouser height on a new shoe is 0.61 in. (15.5 mm). Minimum recommended triple semi-grouser height is 0.35 in. (9.0 mm).

Triple Semi-Grouser Height

Dimension (allowable wear-0.26 in. [6.5 mm])	Percent Worn
0.61 in. (15.5 mm)	0
0.58 in. (14.9 mm)	10
0.56 in. (14.2 mm)	20
0.53 in. (13.6 mm)	30
0.51 in. (12.9 mm)	40
0.48 in. (12.3 mm)	50
0.45 in. (11.6 mm)	60
0.43 in. (11.0 mm)	70
0.40 in. (10.3 mm)	80
0.38 in. (9.6 mm)	90
0.35 in. (9.0 mm)	100
0.33 in. (8.4 mm)	110
0.30 in. (7.7 mm)	120
0.28 in. (7.0 mm)	130

NOTE: For additional information on measuring grouser bar height, refer to UNDERCARRIAGE APPRAISAL MANUAL SP-326.

NOTE: It is recommended to use the previous procedure for more accurate measurements when replacing the track components. A track wear gauge (JD266) is available, enabling the service technician to quickly check the condition of a track assembly.

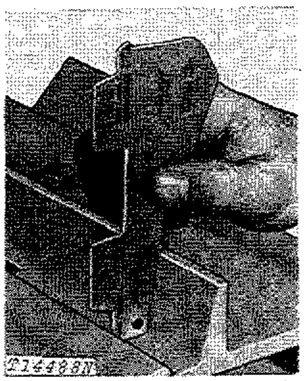


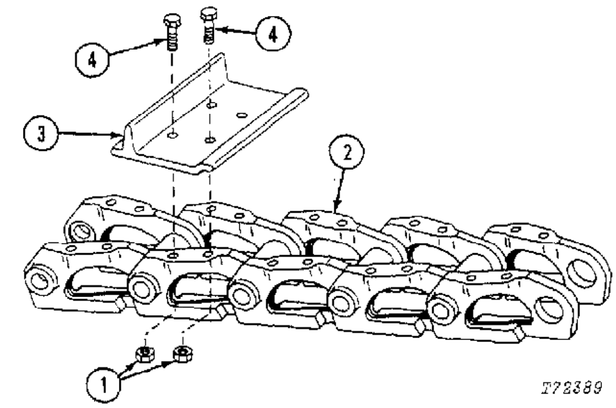
Fig. 13-Grouser Bar Wear

Use JD266 Track Wear Gauge to measure grouser bar wear.

Place gauge upright and against grouser bar as shown in Fig. 13.

Amount of wear is indicated on the gauge.

REMOVAL



1—Special Nut (144 used)
2—Track Assembly
3—Track Shoe (36 used)
4—Cap Screw (144 used)

Fig. 14-Track Shoe

Remove cap screws (4, Fig. 14) and nuts (1) fastening track shoe (3) to track (2).

Remove track shoe.

REPAIR

Inspect shoes for excessive grouser wear, cracks or broken shoes.

Replace or rebuild shoes as necessary.

INSTALLATION

Track shoe mounting surfaces of links and shoes must be clean and free of paint.

Lubricate cap screw threads and the bearing surface of the head.

Install track shoes and cap screws.

Install nuts with the rounded corners toward the track shoes.

Tighten track shoe cap screws to 120 lb-ft (163 N·m).

Tighten rubber track shoe nuts to 89 lb-ft (121 N·m).

TRACK CHAIN ASSEMBLY

GENERAL INFORMATION

The track links are joined together by press-fit, replaceable-type hardened pins and bushings. Since the pins and bushings normally wear on one side only, they can be rotated when half-worn and reinstalled for further service.

The ends of the track are joined by a master pin.

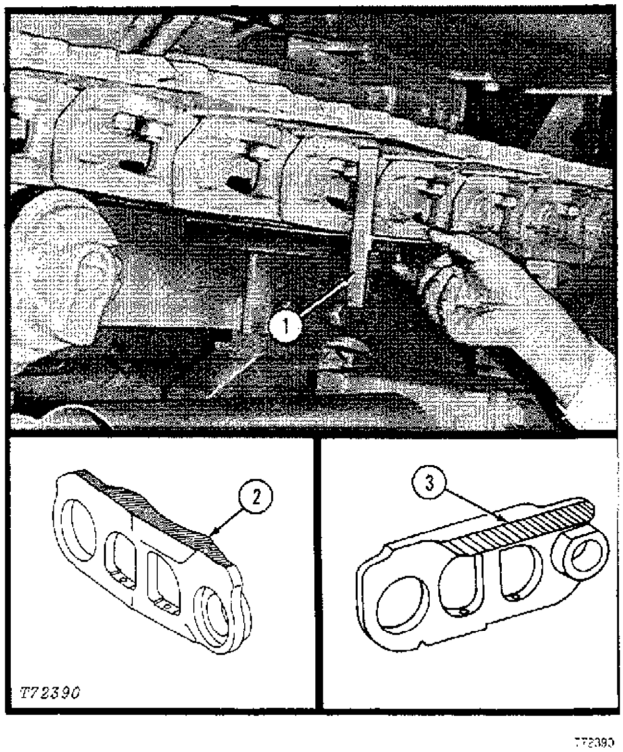
The master pin can be identified by the drill point in the end of the pin.

MEASURING CHAIN WEAR

Measure the track chain components in as many positions as possible on both sides of the undercarriage.

This procedure will give a more accurate condition of the track.

Link Height



1—Link Height Measurement
2—Link Rail Surface Wear
3—Rail Side Wear

Fig. 15-Link Height Measurement

Use a depth gauge consisting of D-05231ST 300 mm Metric Ruler, D-05265ST 150 mm Metric Ruler and D-05266ST Right Angle Attachment (part of D-05227ST Undercarriage Inspection Service Tool Kit) to measure link height.

Position a depth gauge over a track link as shown in Fig. 15. Record the measurement. Repeat the measurement for several links.

Link height of a new chain is 3.19 in. (81.0 mm). Minimum recommended link height is 3.02 in. (76.7 mm) for rebuilding link.

Link Height

Dimension (allowable wear - 0.17 in. [4.3 mm])	Percent Worn
3.19 in. (81.0 mm)	0
3.17 in. (80.6 mm)	10
3.16 in. (80.3 mm)	20
3.15 in. (79.9 mm)	30
3.13 in. (79.5 mm)	40
3.12 in. (79.2 mm)	50
3.10 in. (78.8 mm)	60
3.09 in. (78.4 mm)	70
3.07 in. (78.0 mm)	80
3.05 in. (77.4 mm)	90
3.02 in. (76.7 mm)	100
2.99 in. (76.0 mm)	110
2.96 in. (75.3 mm)	120
2.94 in. (74.6 mm)	130

NOTE: For additional information on measuring link height, refer to UNDERCARRIAGE APPRAISAL MANUAL SP-326.

NOTE: It is recommended to use the above procedure for more accurate measurements when replacing the track components. A track wear gauge (JD266) is available, enabling the service technician to quickly check the condition of a track assembly.

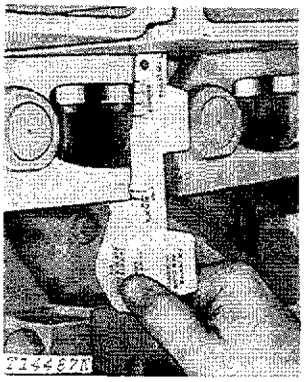
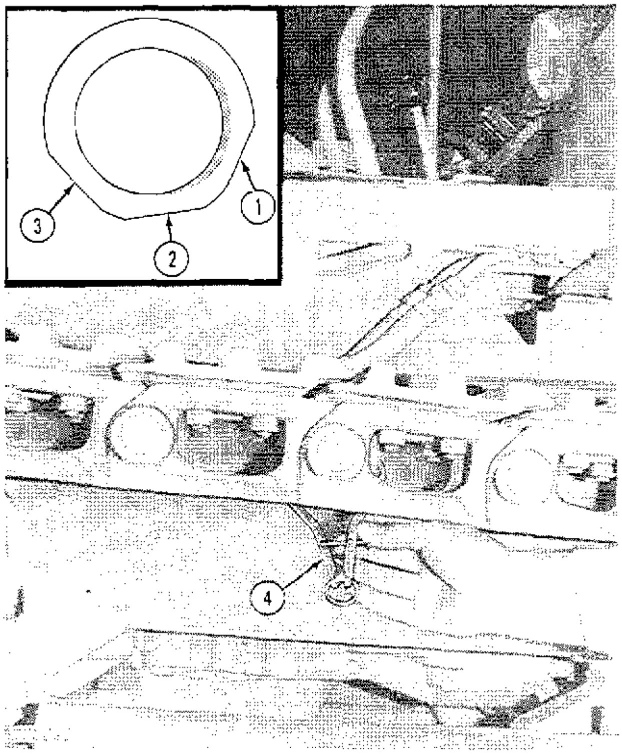


Fig. 16-Link Wear

Use JD266 Track Wear Gauge to measure link wear.

Position gauge on track link as shown in Fig. 16. With top of gauge (end with hole) against track shoe, check position of two arrows on gauge in relation to bottom of link. Link is worn if arrow marked "Replace" is at bottom edge of link.

Bushing Outer Diameter



1—Reverse Drive Wear
2—Radial Wear
3—Forward Drive Side Wear
4—Bushing Outer Diameter Measurement

Fig. 17-Bushing Outer Diameter Measurement

Use a D-17524C1 4 in. Spring Caliper (part of D-05227ST Undercarriage Inspection Service Tool Kit) to measure bushing outer diameter.

Position a caliper around the bushing as shown in Fig. 17. A bushing wears in three positions, so measure wear by positioning the caliper accordingly. Record the smallest measurement. Repeat the measurement for several bushings.

Outside diameter of a new bushing is 1.75 in. (44.5 mm). Minimum recommended bushing outside diameter is 1.63 in. (41.4 mm) for rotating bushing.

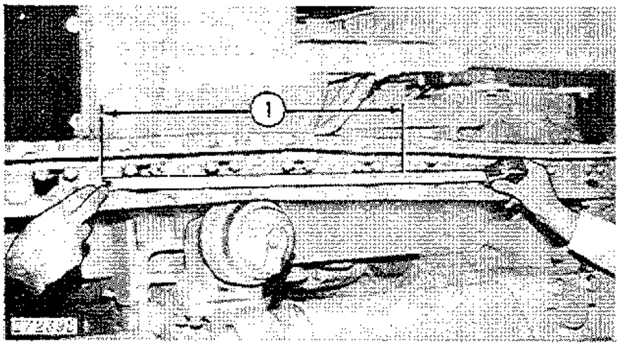
Bushing Outer Diameter

Dimension (allowable wear-0.12 in. [3.1 mm])	Percent Worn
1.75 in. (44.5 mm)	0
1.74 in. (44.2 mm)	10
1.73 in. (43.9 mm)	20
1.72 in. (43.6 mm)	30
1.70 in. (43.3 mm)	40
1.69 in. (43.0 mm)	50
1.68 in. (42.7 mm)	60
1.67 in. (42.4 mm)	70
1.66 in. (42.1 mm)	80
1.65 in. (41.8 mm)	90
1.63 in. (41.4 mm)	100
1.59 in. (40.5 mm)	110
1.56 in. (39.6 mm)	120

NOTE: For additional information on measuring bushing outer diameter, refer to UNDERCARRIAGE APPRAISAL MANUAL SP-326.

Track Pitch

To measure track pitch the track tension must be tight. Place a pin or block in the sprocket and reverse the unit until the track tension is tight.



1—Length Measurement

Fig. 18-Track Pitch Measurement

Use D-05230ST 3 Meter Steel Tape (part of D-05227ST Undercarriage Inspection Service Tool Kit) to measure track pitch.

Position a tape measure between a four link section (5 pins) of the track links as shown in Fig. 18. Record the measurement. Repeat the measurement for several sections, avoiding four sections either side of the master pin.

Distance across a four link section (5 pins) on a new chain is 23.03 in. (584.9 mm). Maximum recommended distance across four links (5 pins) is 23.51 in. (597.1 mm) for rotating pins and bushings.

Track Pitch

Dimension (allowable wear-0.48 in. [12.2 mm]).	Percent Worn
23.03 in. (584.9 mm)	0
23.08 in. (586.1 mm)	10
23.13 in. (587.3 mm)	20
23.17 in. (588.6 mm)	30
23.22 in. (589.8 mm)	40
23.27 in. (591.0 mm)	50
23.32 in. (592.2 mm)	60
23.37 in. (593.4 mm)	70
23.41 in. (594.7 mm)	80
23.46 in. (595.9 mm)	90
23.51 in. (597.1 mm)	100
23.60 in. (599.5 mm)	110
23.69 in. (601.8 mm)	120
23.79 in. (604.2 mm)	130
23.88 in. (606.5 mm)	140
23.97 in. (608.9 mm)	150

NOTE: For additional information on measuring track pitch, refer to UNDERCARRIAGE APPRAISAL MANUAL SP-326.

NOTE: It is recommended to use the above procedure for more accurate measurements when replacing the track components. A track wear gauge (JD266) is available, enabling the service technician to quickly check the condition of a track assembly.

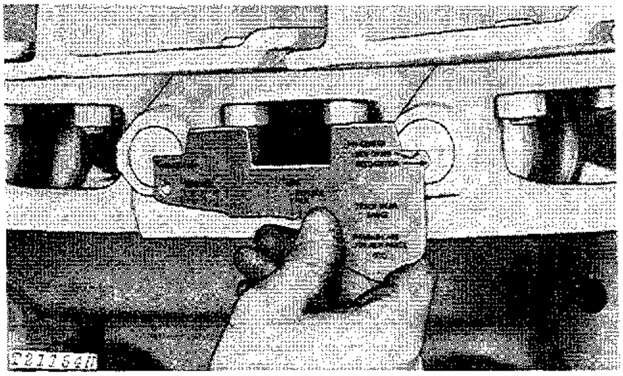


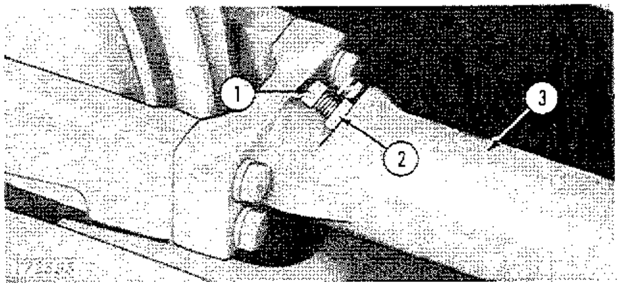
Fig. 19-Pin and Bushing Wear

Use JD266 Track Wear Gauge to measure pin and bushing wear.

Position gauge on track link as shown in Fig. 19. Place corner of gauge marked "Pin Center" at center of one pin and other end of gauge at center of next pin. If point of gauge marked "New Chain" falls at center of pin, track chain does not require servicing. If point marked "Recondition" falls on pin center, track pins and bushings are probably worn.

REMOVAL

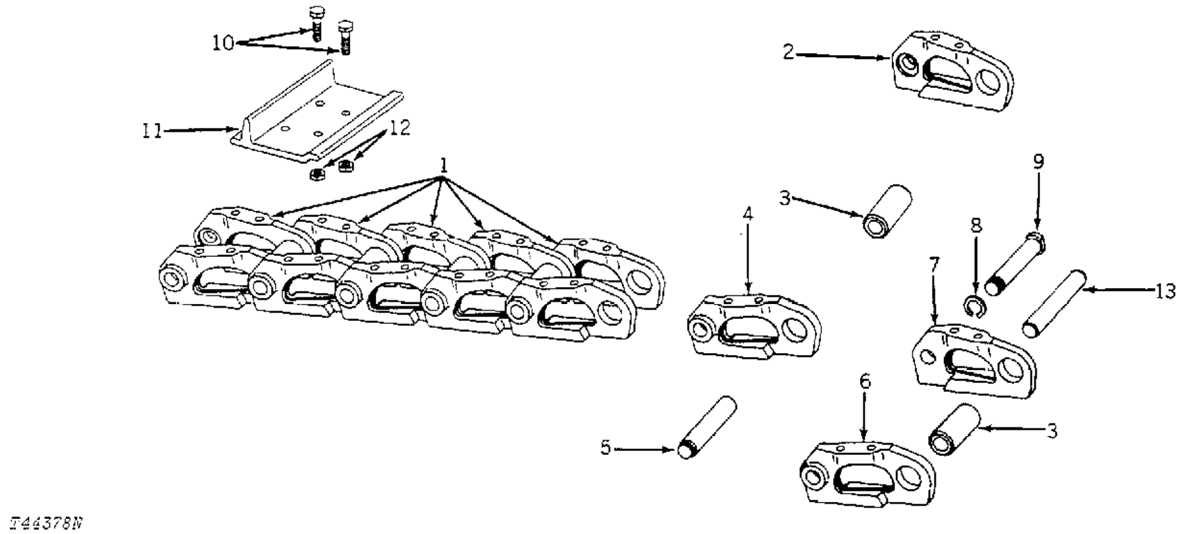
Rotate track chain until the master pin is on the front of the front idler.



1—Set Screw
2—Jam Nut
3—Track Adjusting Cylinder

Fig. 20-Track Adjusting Cylinder

Release track tension by loosening nut (2, Fig. 20) and turn the set screw (1) out of the track adjusting cylinder (3) three turns. Put a piece of pipe between the sprocket and track chain and rotate the chain to retract the adjusting cylinder if required.



1—Track Assembly
2—Right Track Link (35 used)
3—Bushing (36 used)
4—Left Track Link (35 used)
5—Track Pin (35 used)
6—Left Master Track Link
7—Right Master Track Link
8—Snap Ring (-261194)
9—Track Master Pin (-261194)
10—Cap Screw (144 used)
11—Track Shoe (36 used)
12—Special Hex. Nut (144 used)
13—Headless Master Pin (261195-)

Fig. 21-Track Assembly and Shoes

CAUTION: High pressure may be present in track adjuster cylinder. Do not visually inspect grease vent hole.

Remove snap ring (8, Fig. 21) and track master pin (9). Move track assembly clear of drive sprocket. On units with a headless master pin (13), use a D-01030AA 50-Ton Master Pin Pusher to remove headless master pin (Fig. 23).

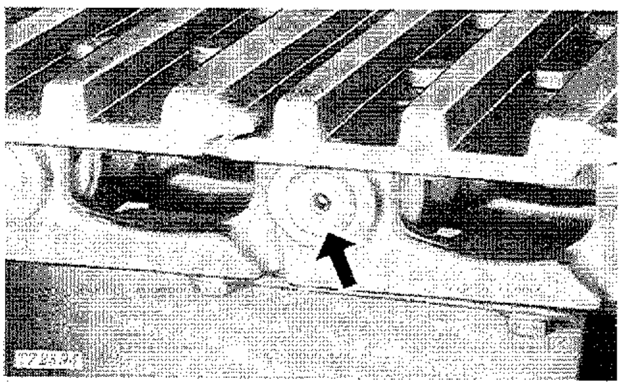
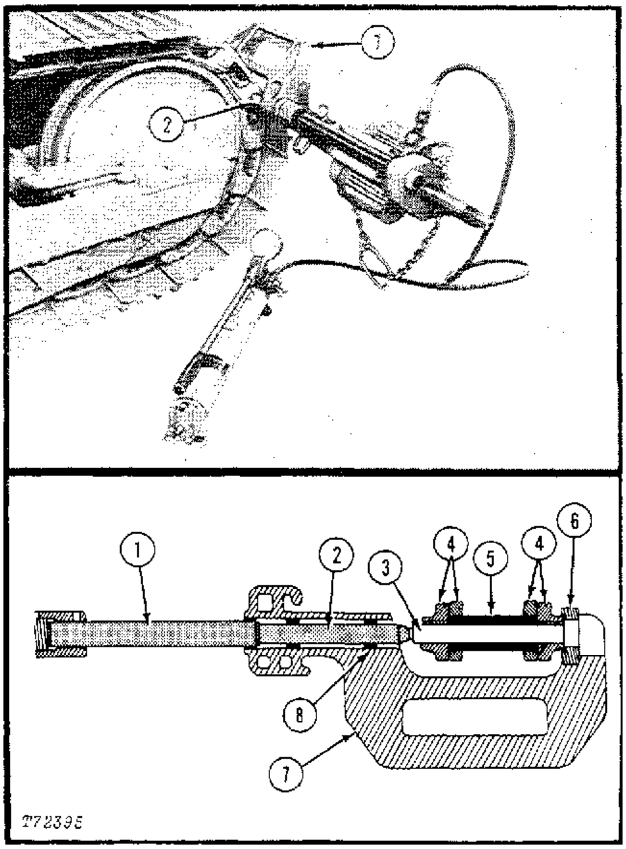


Fig. 22-Master Track Pin

The master pin can be identified by the drill point in the end of the pin (Fig. 22).

Remove the track shoe on each side of the master pin.



1—Forcing Pin
2—Forcing Pin
3—Master Pin
4—Side Links
5—Bushing
6—Aligning Adapter
7—"C" Frame
8—Aligning Bushing

Fig. 23-Pressing Master Pin

Install aligning adapter (6, Fig. 23) into C-frame and secure with holding screw.

Place forcing pin (2) into C-frame assembly.

Position master pin pusher over master pin, using a hoist with load positioning sling.

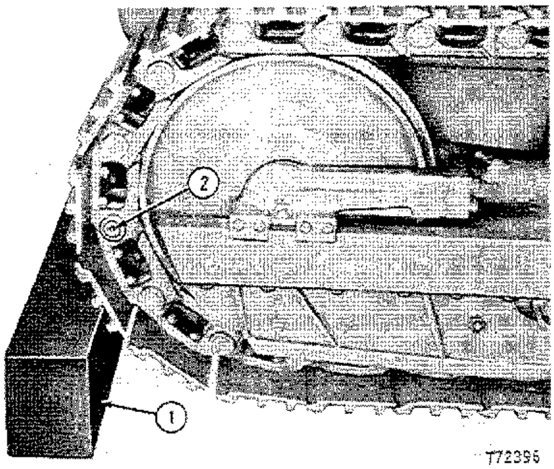
Advance ram adjusting screw with crank until forcing pin contacts track master pin.

Attach hydraulic hand pump and activate ram to remove the master pin. Advance ram manually with crank and recycle as necessary. *NOTE: Forcing pin (2) replaces master pin in track.*

Remove forcing pin from track links.

If a master pin pusher is not available, the master pin may be driven out using the following procedure.

CAUTION: Striking hardened steel pins may cause them to chip or break. Always wear safety glasses when striking hardened pins.

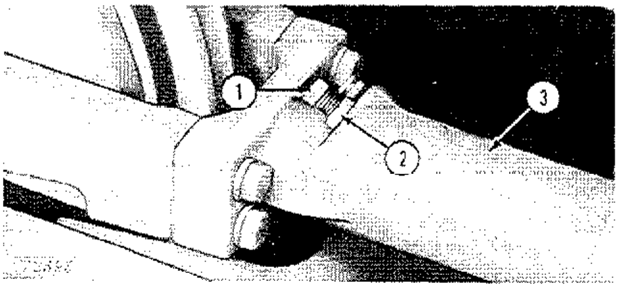


1—Wood Block
2—Master Pin

Fig. 24-Supporting Track Pad

Place the crawler on a hard level surface. Support the track shoe next to the master pin (2, Fig. 24) with a 4 x 4 inch (102 x 102 mm) wood block (1).

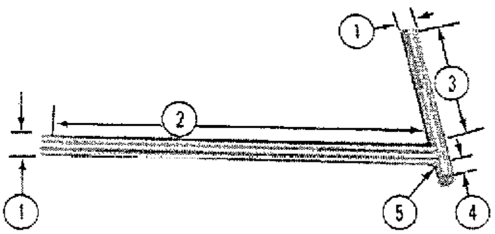
Do not remove the track shoes as they will provide support for the links during master pin removal.



1—Set Screw
2—Jam Nut
3—Track Adjusting Cylinder

Fig. 25-Track Adjusting Cylinder

Release track tension by loosening jam nut (2, Fig. 25) and turn the set screw (1) out of the track adjusting cylinder (3) three turns.



1—7/8 In. Round Bar
2—48 In. (1.2 m)
3—14 In. (356 mm)
4—5-1/8 In. (130 mm)
5—Weld

Fig. 26-Pin Driver

NOTE: Refer to Fig. 26 during fabrication of the pin driver.

Make pin driver from 7/8 inch round bar stock (should not be heat treated steel). Approximately 68 inches (1.7 m) will be needed. Cut to length and weld as shown in Fig. 26.

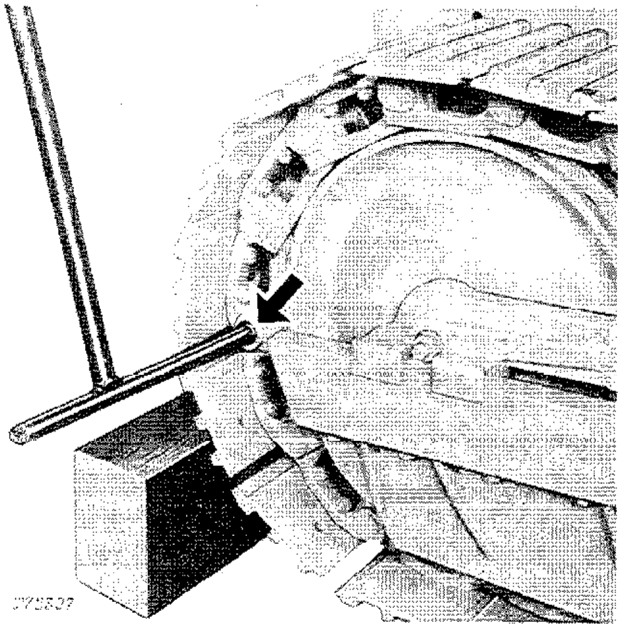


Fig. 27-Using Pin Driver

Using the pin driver (Fig. 27), drive the master pin out.

Lift side of machine and rotate track in the reverse direction. Slowly unwrap track off drive sprocket.

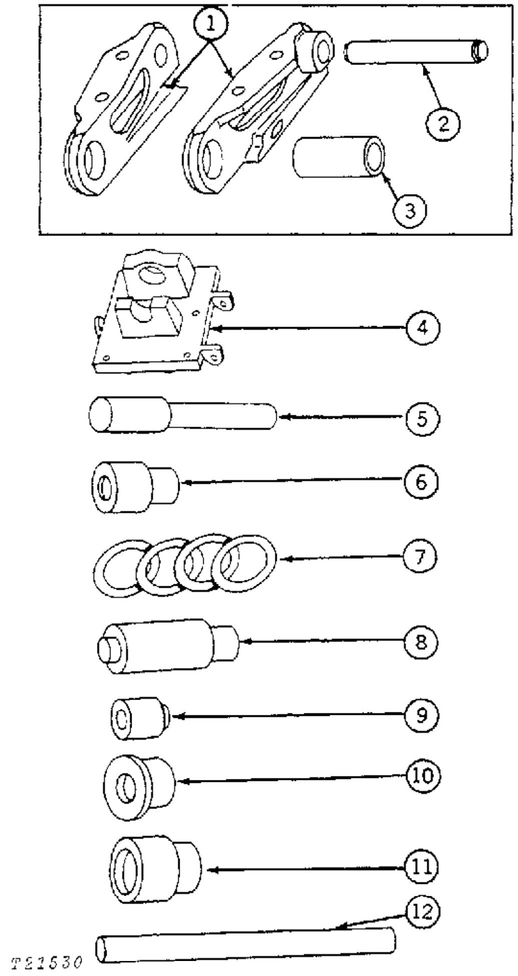
REPAIR

Disassembly

The pins and bushings in the track assembly are made of extremely hard material. They are manufactured to press-fit tolerances. Accordingly, the track cannot be disassembled without track-pressing equipment equivalent to that described and illustrated in the following instruction.

Using 35-Ton (Approximately 311 500 N) Press

A 35-ton (approximately 311 500 N) press, a 60-ton (approximately 534 000 N) press and a 200-ton (approximately 780 000 N) press each with different adapting tools can be used for track service.



1—Link
2—Pin
3—Bushing
4—Saddle Adapter
5—Long Forcing Pin
6—Track Pin Forcing Adapter
7—Spacing Washer
8—Bushing Forcing Pin
9—Bushing Forcing Adapter
10—Pin Adapter
11—Bushing Adapter
12—Aligning Pin

Fig. 28-Track Press Adapting Tools for 35-Ton Press

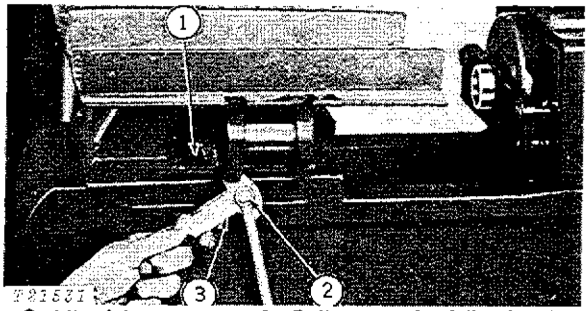
NOTE: To identify the various fixtures and tools referred to in the following paragraphs, see Figure 28.

It will not be necessary to remove track shoes when replacing or rotating pins and bushings unless individual side link replacement is necessary.

Removing Pins

Install proper saddle adapter.

Lay track on roller bed with master pin link assembly away from press and with track shoes up.



1—Saddle Adapter 2—Bolt 3—Adjusting Lever

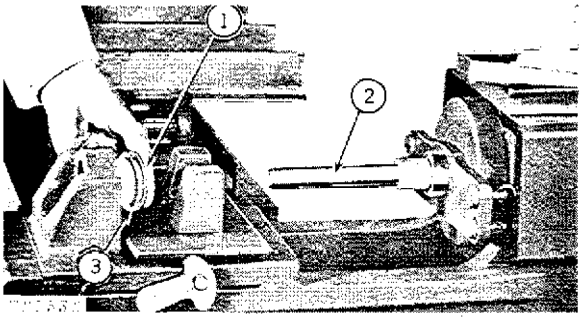
Fig. 29-Aligning Position of Saddle Adapter

To compensate for track wear and to assure perfect alignment of adapters, pins, and bushings, during operations, raise or lower the saddle adapter (1, Fig. 29). Pull first track link assembly over saddle adapter so that bushing rests in cradle. Turn adjusting lever to raise saddle adapter until all parts are in alignment. Tighten bolt to hold adjusting lever and saddle adapter in position. This adjustment need only be made once for the entire length of track.

Insert long forcing pin into ram piston head (Fig. 30).

Insert pin adapter with adequate number of spacing washers into head of saddle adapter (Fig. 30).

NOTE: Due to friction wear on the side links, the number of shims required will vary. Experimentation will show correct number to use. Allow as little space as possible between side link and pin adapter, to eliminate any bending stress on the side links as pressure is applied to push out track pins. Be sure pins will be positioned properly when installed to allow ample clearance for free track link action.



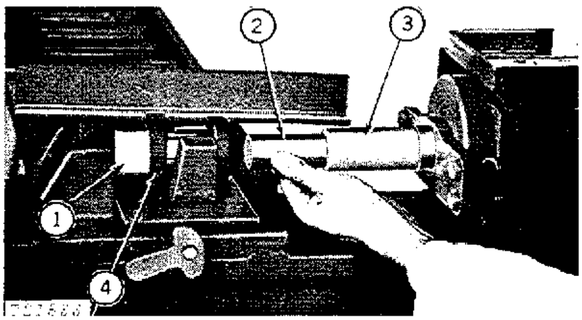
1—Pin Adapter 2—Forcing Pin 3—Spacer Washer

Fig. 30-Inserting Forcing Pin, Pin Adapter and Spacer Washer

... pressure and force pin out of bushing. Continue process of removing pins and remove all pins before starting process of servicing bushings.

Removing or Rotating and Reinstalling Bushings

NOTE: Normally, the greatest wear to bushings is on the side where they contact the sprocket teeth. If bushings are otherwise in good condition, they may be rotated 180 degrees and reused to obtain additional service. Refer to Fig. 44 for correct position when installing used bushings.



1—Bushing Adapter
2—New Bushing
3—Bushing Forcing Adapter
4—Link Assembly

Fig. 31-Forcing Old Bushing Out With New Bushing

Insert bushing forcing adapter into ram cylinder head (Fig. 31).

Insert bushing adapter with adequate number of spacing washers into saddle adapter.

NOTE: Before continuing, check bushing installation to determine whether or not proper number of spacers on bushing adapter are being used. Ends of bushing must be flush with sides of side links to allow ample clearance for free track link action.

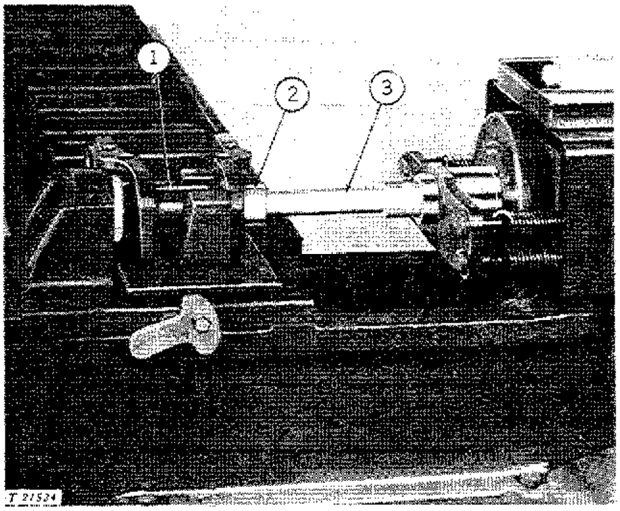
Place a link assembly into saddle adapter so that bushing is seated in bottom of adapter (Fig. 31).

Position new bushing on end of bushing forcing adapter (Fig. 31). Hold new bushing and guide it while applying pressure until it butts squarely against old bushing.

NOTE: As each bushing is removed, inspect it as outlined on page 0130-26. If press-fit of bushing in links is very slight, bushing or links should be replaced.

Removing Side Links

NOTE: To remove individual links, track shoes must be removed from link assemblies. To remove links proceed as follows:



1—Bushing
2—Bushing Forcing Adapter
3—Long Forcing Pin

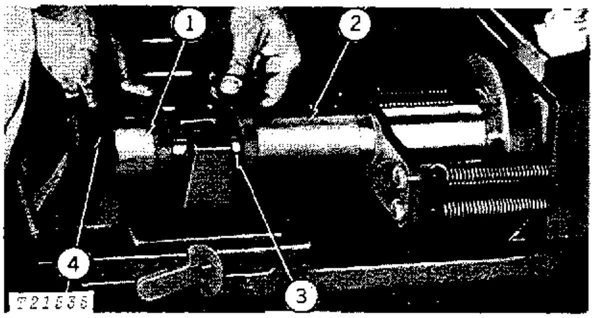
Fig. 32-Removing Links From Bushing

Insert long forcing pin into ram cylinder head (Fig. 32). Place bushing forcing adapter on end of long forcing pin. Place link assembly, with track shoe removed and track shoe bolt holes up, in bottom of saddle adapter with bushing in place. Apply pressure and force bushing from side link closest to ram.

To remove bushing from remaining link, rotate link and bushing so that bushing rests in bottom of adapter and link is on side of adapter closest to ram. Apply pressure and force bushing from side link.

Assembling Side Links and Bushings

Insert bushing forcing pin into ram piston head (Fig. 33).



T21535

1—Bushing Adapter
2—Bushing Forcing Pin
3—Bushing
4—Adjusting Shims

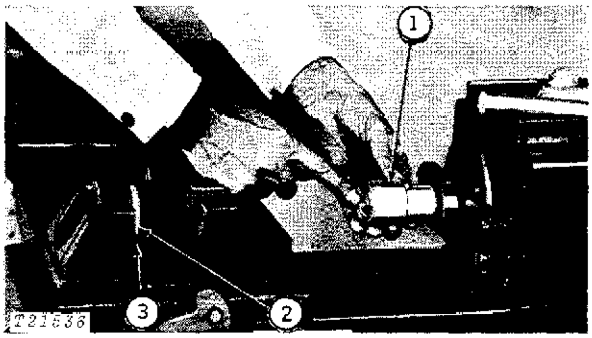
Fig. 33-Installing Bushing in Links

Insert bushing adapter with adequate number of spacing washers into saddle adapter.

NOTE: Before continuing, check bushing installation to determine whether or not proper number of spacers on bushing adapter are being used. Ends of bushing must be flush with sides of side links to allow ample clearance for free track link action.

Place a right and left side link in position on each side of saddle adapter. Position bushing in bottom of saddle adapter between side links (Fig. 33).

Apply pressure, being sure that all parts are held in alignment until pressed together.



T21536

1—Track Pin Forcing Adapter
2—Pin Adapter
3—Adjusting Shims

Fig. 34-Preparing Press for Installation of Track Pins

Assembling Track

Insert track pin forcing adapter having 0.0625 inch (1.58 mm) recess, into ram piston head (Fig. 34).

Insert pin adapter with adequate number of spacers into saddle adapter (Fig. 34).

NOTE: Due to friction wear on the side links, the number of shims required will vary. Experimentation will show correct number to use. Allow as little space as possible between side link and pin adapter, to be sure pins will be positioned properly when installed. This will allow ample clearance for free track link action.

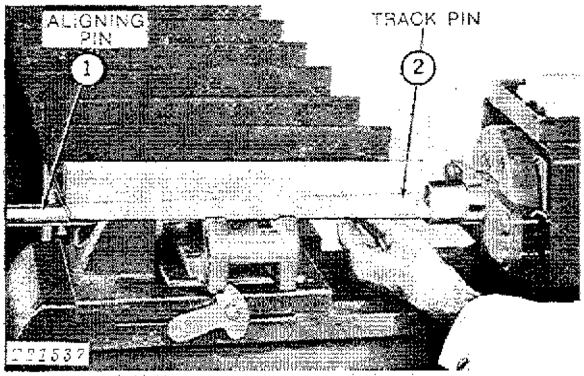
Place master link assembly in position in saddle adapter so that bushing rests in bottom of adapter.

Place second link assembly in position so that side links straddle bushing end of master link assembly (Fig. 35). Leave aligning pin in position.

Coat track pins with 80W-90 gear oil before assembly.

Hold new track pin in position. Apply pressure and guide pin into hole in side link and into recess of track pin forcing adapter. The new pin will push aligning pin out as it is inserted. Stop pressure when track pin forcing adapter butts against side link.

Continue these steps with each link assembly until the track is completely assembled.



1—Aligning Pin 2—Track Pin

Fig. 35-Installing Track Pins

Using 60-Ton (Approximately 534 000 N) Press

Two different service methods, each with a set of adapting tools, are available to accommodate the 60 ton (approximately 534 000 N) press.

The interlock service method is used when it is not desirable to push the pin and bushing completely through the link assembly. The adapting tools for the interlock type method will accommodate flush type tracks (bushing flush with links) and interlocking type tracks (bushings interlocked with links).

The flush type servicing method is used to press the pin and bushing completely through the link assembly. The adapting tools for the flush type method will accommodate flush-type tracks only.

Interlock-Type Service Method

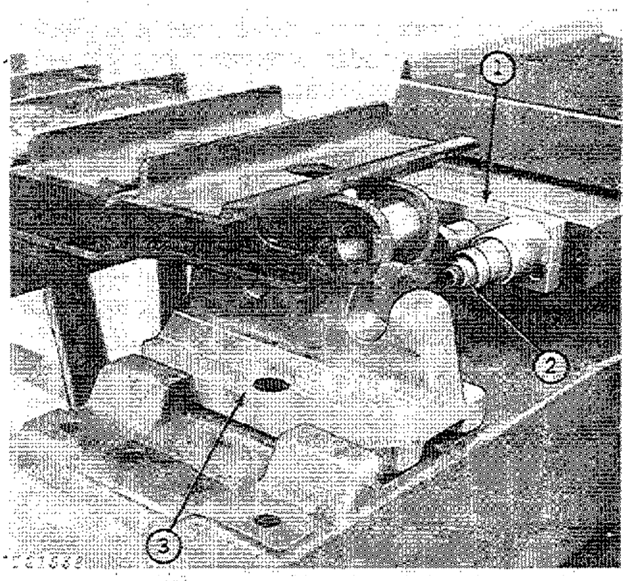
NOTE: A 60 ton (approximately 534 000 N) track press and tool set is illustrated in the following instructions.

Track Disassembly

Install proper saddle and secure to track press frame with socket head cap screws.

Adjust conveyor extension to desired conveyor working height.

Remove outside row of cap screws (row away from head of press) securing track shoes to link assemblies.



1—Ram End Disassembly Adapter **2—Bushing Side Cap** **3—Saddle**

Fig. 36-Installing Ram End Disassembly Adapter

Install ram end disassembly adapter to work head of press and secure with attaching nut (Fig. 36). Install bushing side cap to disassembly adapter and secure with socket head cap screws.

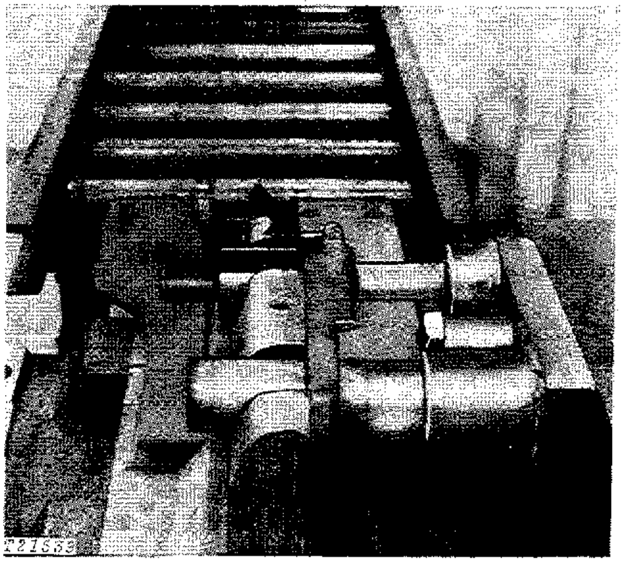
Raise the elevating conveyor and manually pull the track chain assembly toward the press operator until the link assembly bushing male end is directly over the top of the saddle.

Lower conveyor so that chain link assembly is indexed into saddle.

IMPORTANT: When rebuilding track with same components, the pins and bushings MUST be reinserted into the same links from which they were removed. Numbering the links, pins, and bushings before disassembly is a good procedure.

Advance work head of track press until the ram end disassembly adapter comes in contact with bushing and pin. Press bushing and pin from right-hand link. Remove right-hand link with shoe as an assembly.

Remove left-hand link with bushing and pin intact from saddle.

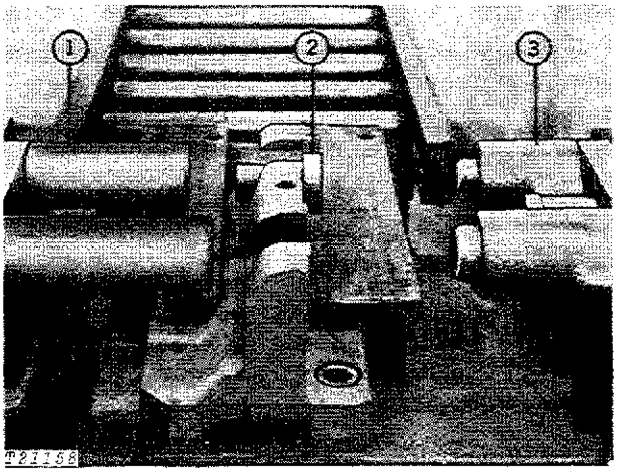


T21539

Fig. 37-Removing Bushing and Pin From Left-Hand Link

Install saddle spacer into saddle as shown in Fig. 37. Advance work head of track press and remove bushing and pin from left-hand link.

Track Assembly

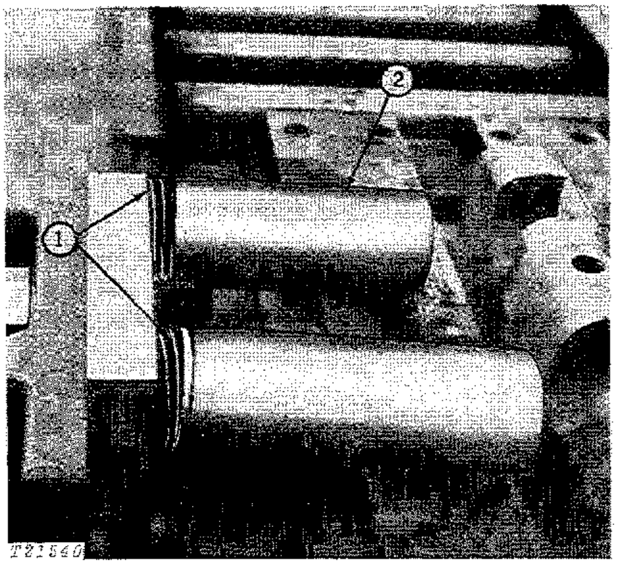


T21158

1—Rear Abutment Assembly Adapter
2—Saddle Spacer
3—Ram End Assembly Adapter

Fig. 38-Preparing Press for Track Pin and Bushing Installation

Remove ram end disassembly adapter from press head and install ram end assembly adapter. Install rear abutment assembly adapter on press as shown in Fig. 38. Do not remove saddle adapter.

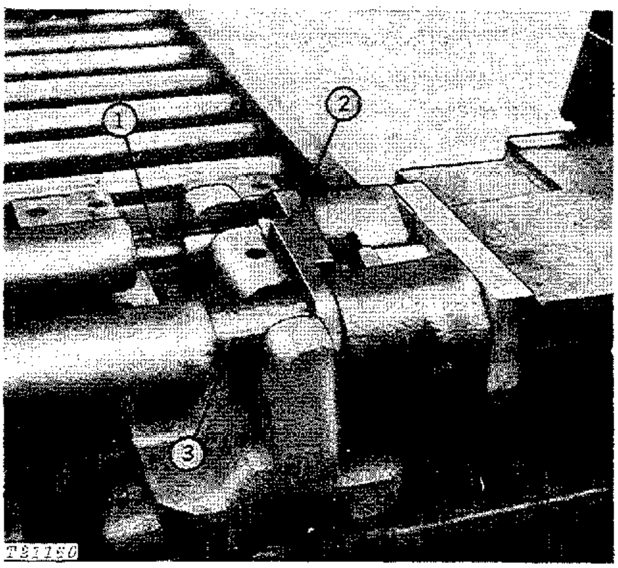


T21540

1—Shims **2—Rear Abutment Assembly Adapters**

Fig. 39-Installing Shims Behind Abutment Adapter Blocks

Position shims behind rear abutment assembly adapter blocks to align abutment blocks so that link assemblies remain loose during assembly.



T21160

1—Pin **3—Bushing**
2—Left Link (Track Shoes Mounting Holes Down)

Fig. 40-Installing Left Link to Pin and Bushing

Coat track pins with 80W-90 gear oil before assembly.

With pin and bushing in saddle, position left link with track shoe mounting holes down between saddle and work head of press as shown in Fig. 40. Advance work head of press and press link onto pin and bushing.

NOTE: The track shoe mounting holes are in the down position. After the link is pressed onto the pin and bushing, it becomes the left-hand link assembly.

With the conveyor in the raised position, install the left-hand link assembly into the male end of the track chain. Lower the conveyor positioning the left-hand link assembly into the saddle.

Install right-hand link, with track shoes attached, into position. Advance track press work head and press right-hand link onto left-hand link. Continue to advance work head until right-hand link assembly is properly positioned so that bolt holes in track shoes align with bolt holes in left link.

If a new right link is to be installed, it will be necessary to remove the track bolts securing the track shoes to the right-hand link.

IMPORTANT: One link assembly should be completely assembled prior to assembling various components. This is recommended because it may be necessary, depending upon link wear, to vary the number of adjusting shims behind the rear abutment assembly adapter blocks.

NOTE: When the right-hand link is pressed onto the pin and bushing, use care to properly align the track shoe bolt holes with the left-hand link.

Continue these steps with each link assembly until the track is completely assembled.

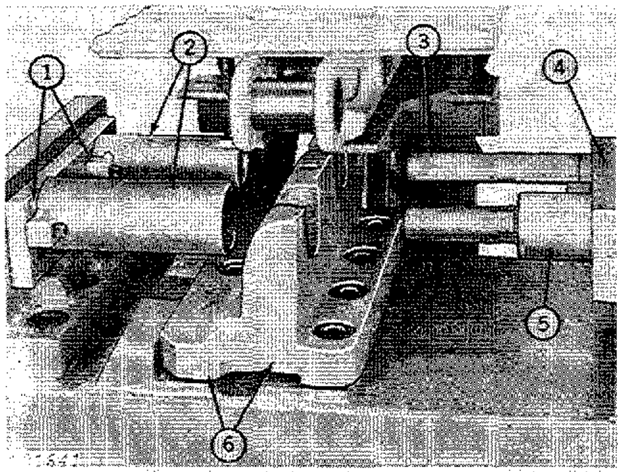
Flush Type Service Method

NOTE: A 60-ton (approximately 534 000 N) track press with tool set is illustrated in the following instructions.

Track Disassembly

NOTE: It will not be necessary to remove track shoes when replacing pins or bushings unless individual side link replacement is necessary.

Install rear abutment adapter with proper shims (Fig. 41).



1—Shims
2—Rear Abutment Adapters
3—Pin Forcing Adapter
4—Ram End
5—Bushing Adapter
6—Saddle

Fig. 41-Installing Ram End for Disassembly

NOTE: Due to the friction wear on the side links, the number of shims required will vary. Leave as little space as possible between side link and rear abutment adapter to eliminate any bending stress on the side links when pins and bushings are removed and installed.

Install proper saddle and secure to track press frame with socket head cap screws.

Adjust conveyor extension to desired conveyor working height.

Install pin forcing adapter and bushing adapter on ram end. Position ram end on work head of press and secure with attaching nut (Fig. 41).

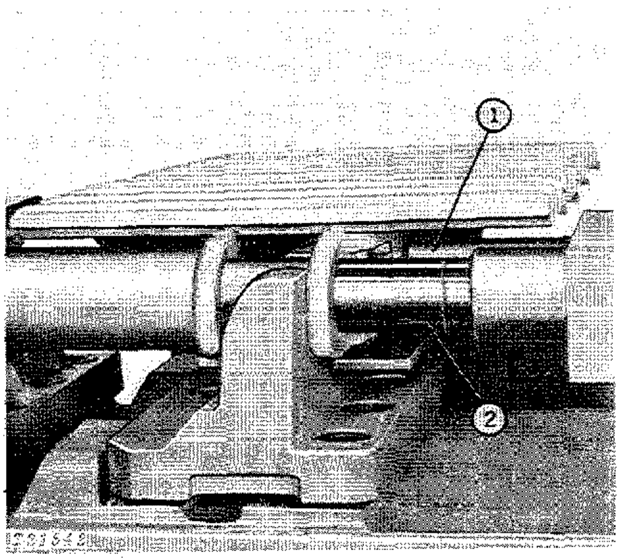
Raise the elevating conveyor and manually pull the track chain assembly toward the operator until the bushing of the link assembly male end is directly over the top of the saddle.

Position new bushing over bushing adapter or ram end (Fig. 42).

Lower conveyor so that chain link assembly is indexed into saddle.

Advance work head of track press until the pin forcing adapter and bushing adapter with new bushing push pin and old bushing out of link assembly.

Retract work head of track press and raise elevating conveyor. Manually, remove link assembly with new bushing from track chain assembly. Advance track chain assembly and install new bushing on bushing adapter. Lower conveyor so that chain link assembly is again indexed into saddle.



1—Pin Forcing Adapter 2—New Bushing

Fig. 42-Removing Pins and Bushings

Continue this process of removing pins and forcing out old bushing with new bushing until each link assembly is removed from the track chain assembly.

Track Assembly

Remove ram end from the working head of the press. Remove pin forcing adapter and bushing adapter from ram head.

Secure pin assembly adapter to ram end. Position ram end on work head of press and secure with attaching nut (Fig. 43).

Place one link assembly in position in saddle so that bushing rests in slot of saddle nearest conveyor.

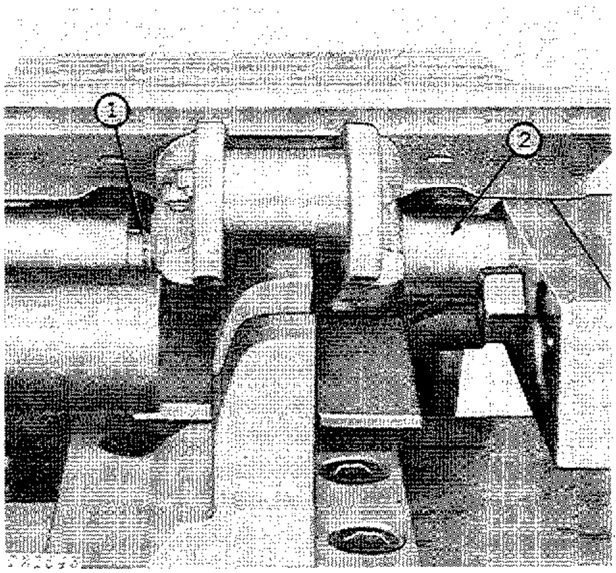
Place second link assembly in position so that side links straddle bushing end of first link assembly. Place second link bushing in saddle slot nearest track press operator.

NOTE: Link assembly is shown raised in Figure 42 for illustration purposes only.

Coat pins with 80W-90 gear oil before assembly.

Align link assemblies with aligning pin. Hold new track pin in position and advance work head of press. The new pin will push aligning pin out as it is inserted.

Retract work head of track press and raise elevating conveyor to free link assembly from saddle. Lower conveyor and install another link assembly.



1—Aligning Pin 2—Pin Assembly Adapter

Fig. 43-Connecting Track Chain Assembly

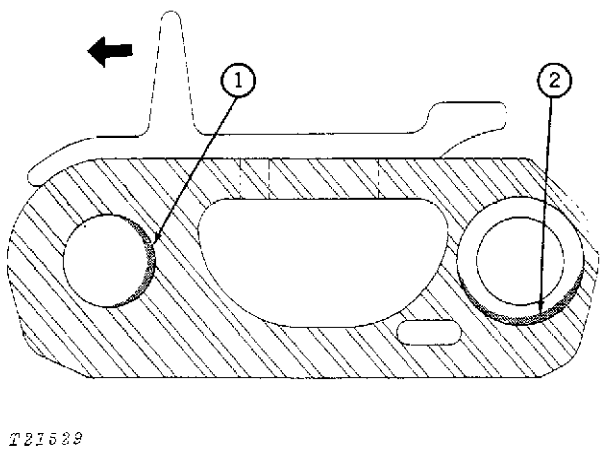
Continue these steps with each link assembly until the track chain is completely assembled.

Tighten track shoe bolts with 110 lb-ft (149 N·m).

Lubricate and tighten rubber track shoe nuts to 89 lb-ft (121 N·m).

Rotating Pins and Bushings

The wear on pins and bushings does not extend over the entire surface of these parts; the life of worn pins and bushings can often be restored by rotating them 180 degrees with respect to the track link (Fig. 44).



1—Worn Side of Pin 2—Worn Side of Bushing

Fig. 44-Rotating Track Pins and Bushings

IMPORTANT: When forward edge of track front bracket is approximately 1-inch (25 mm) from the end of the track frame, track bushings and pins should be inspected for excessive wear. Replace excessively worn bushings and pins as needed. When the forward edge of the front idler and forward end of the track frame are in line, track assemblies are in need of reconditioning.

INSTALLATION

Headed Pins

Install track chains on the unit with the part of the track chain on the ground having the pin boss on any link towards the rear of the unit.

Place a steel bar through the end link and hold it against the sprocket. Slowly, rotate the sprocket and guide the chain over the carrier rollers and to the front idler.

Drive in master pin and secure with snap ring.

Align track and adjust tension (see Group 9030).

Headless Master Track Pin

Install track chains on the unit with the part of the track chain on the ground having the pin boss on any link towards the rear of the unit.

Place a steel bar through the end link and hold it against the sprocket. Slowly, rotate the sprocket and guide the chain over the carrier rollers and to the front idler.

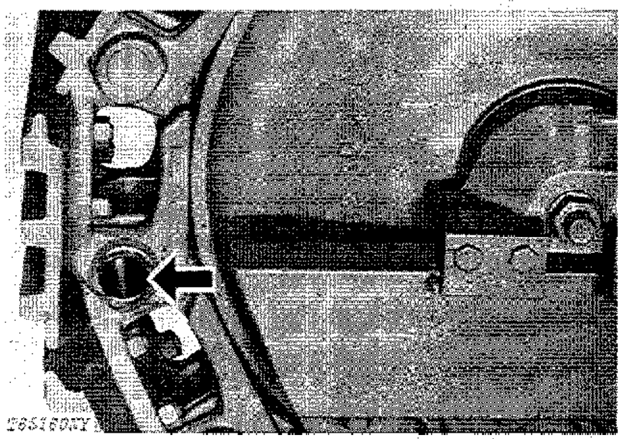
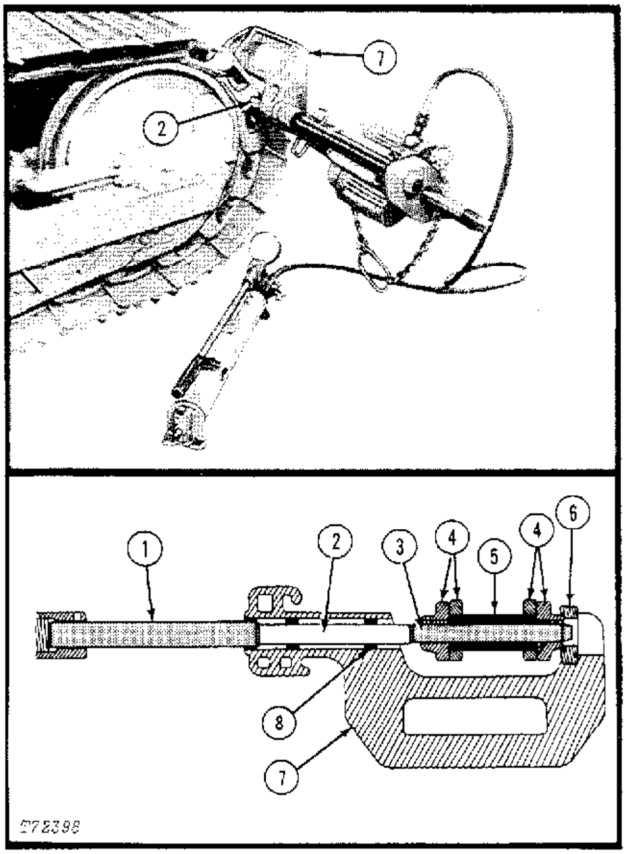


Fig. 45-Track in Alignment

Align links with track bushings (Fig. 45).



1—Forcing Pin - 2-1/4 in. dia.
2—Master Pin
3—Forcing Pin
4—Side Links
5—Bushing
6—Aligning Adapter
7—"C" Frame
8—Aligning Bushing

Fig. 46-Installing Master Pin

Use D-01030A Master Pin Pusher to push master pin (2, Fig. 46) into master pin side links (4).

With the same two track shoes removed as before, use a hoist to raise master pin pusher near master pin hole.

Use same aligning adapter (6, Fig. 46) when used in removing.

Place the flattened forcing pin (3) into master pin hole, and insert master pin (2) through aligning bushings (8) and into the hollowed-out portion in the "C" frame (7).

Place "C" frame securely around forcing pin (3) and tighten forcing screw. This will apply just enough pressure to hold master pin pusher in place.

Use the hydraulic hand pump and pump until pressure forces out forcing pin (3) and replaces it with the master pin.

If a master pin pusher is not available the master pin may be driven in using the pin driver and the following procedure.

CAUTION: Striking hardened steel pins may cause them to chip or break. Always wear safety glasses when striking hardened pins.

Thoroughly clean master pin and links.

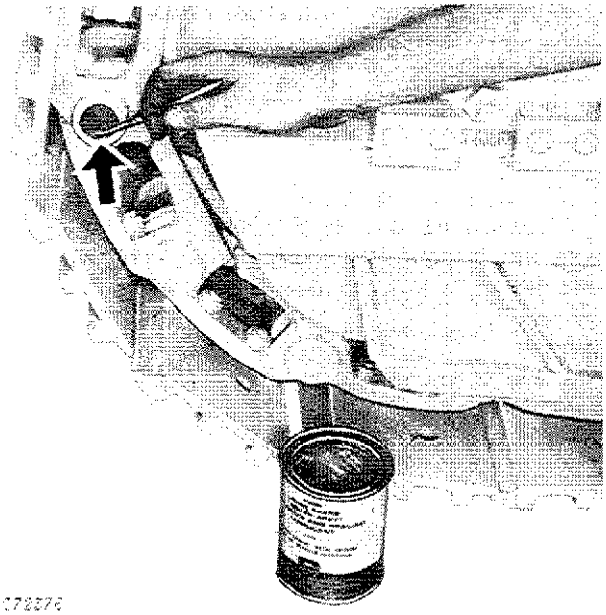


Fig. 47-Coating Pin Bore

Coat the pin bore (Fig. 47) approximately 1 inch (25.4 mm) in the left and right hand side of the track link with John Deere Never-Seez or an equivalent.

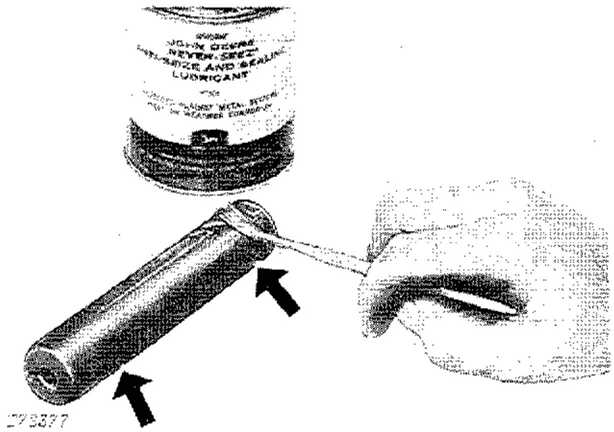


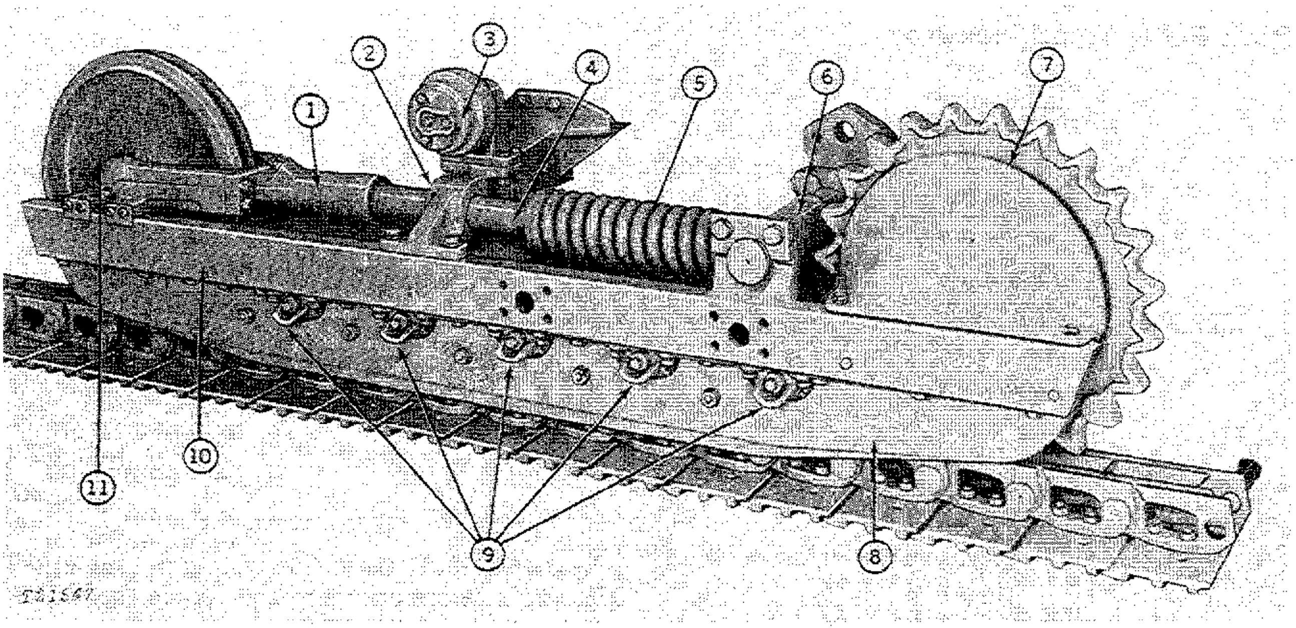
Fig. 48-Coating Master Pin

Coat the master pin (Fig. 48) approximately 1 inch (25.4 mm) from both ends with John Deere Never-Seez or an equivalent.

Drive the master pin through the track chain until it extends equally from the left and right-hand track links.

Align track and adjust tension (see Group 9030).

TRACK ROLLERS



1—Track Adjusting Cylinder
2—Front Crossbar
3—Track Carrier Roller
4—Piston
5—Idler Spring
6—Rear Crossbar
7—Drive Sprocket
8—Rock Guard
9—Track Rollers
10—Track Frame
11—Front Idler

Fig. 49-Track Frame Assembly

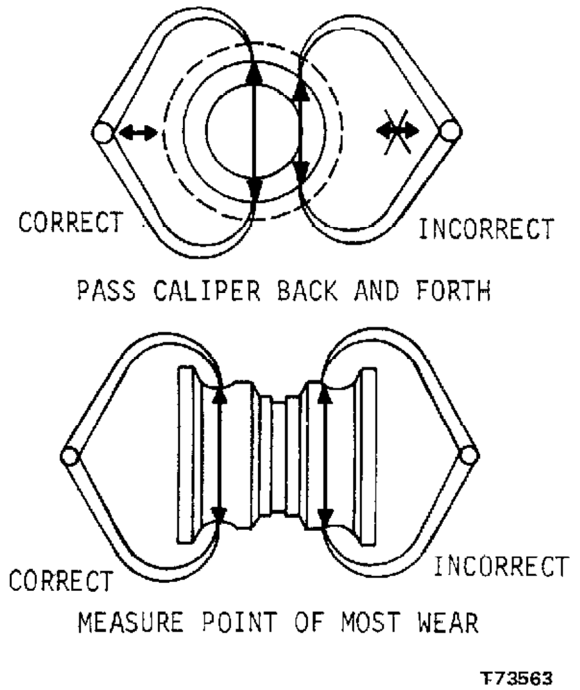
GENERAL INFORMATION

The individual roller assemblies (9, Fig. 49) fastens directly to the lower edges of the track frame (10). Each roller assembly consists of a forged-steel roller with two replaceable bronze bearings which rotate on a hardened steel shaft. Face-type seals are used to retain the lubricant and exclude foreign material from the bearing cavity.

The track rollers are lubricated at button head fittings on the shafts. Drilled passages in the shaft carry the grease from the fitting to the reservoir in the hubs.

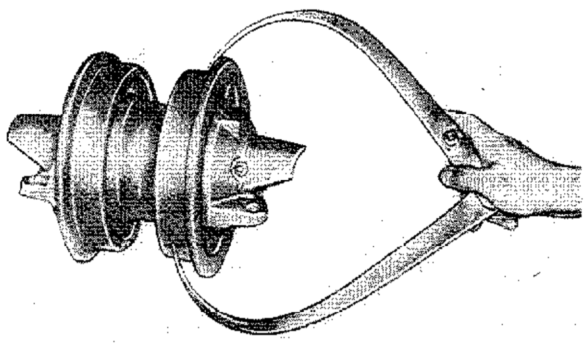
CHECKING ROLLER WEAR

Track Roller Tread Diameter



T73563

Fig. 50-Tread Measurement Technique



T72490

Fig. 51-Track Roller Diameter Measurement

Use D-05229ST 12 in. Spring Caliper (part of D-05227ST Undercarriage Inspection Service Tool Kit) to measure track roller diameter.

Position a caliper around a track roller as shown in Fig. 51. Record the measurement. Repeat the procedure for each roller.

Track roller diameter of a new roller is 7.19 in. (182.6 mm). Minimum recommended roller diameter is 6.85 in. (174.0 mm) for rebuilding track roller.

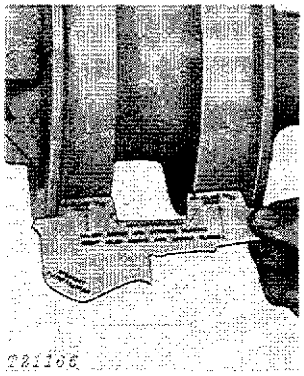
Track Roller Tread Diameter

Allowable Wear - 0.34 in. (8.6 mm) Dimension	Percent Worn
7.19 in. (182.6 mm)	0
7.17 in. (182.2 mm)	10
7.15 in. (181.8 mm)	20
7.14 in. (181.4 mm)	30
7.13 in. (181.0 mm)	40
7.11 in. (180.6 mm)	50
7.06 in. (179.3 mm)	60
7.01 in. (178.0 mm)	70
6.95 in. (176.6 mm)	80
6.90 in. (175.3 mm)	90
6.85 in. (174.0 mm)	100
6.80 in. (172.7 mm)	110
6.75 in. (171.4 mm)	120
6.69 in. (170.0 mm)	130

NOTE: For additional information on measuring track roller diameter, refer to UNDERCARRIAGE APPRAISAL MANUAL SP-326.

NOTE: It is recommended to use the two previous procedures for more accurate measurements when replacing the track components. A track wear gauge (JD266) is available, enabling the service technician to quickly check the condition of a track assembly.

Use JD266 Track Wear Gauge to check wear on track roller.



T21156

Fig. 52-Track Roller Wear

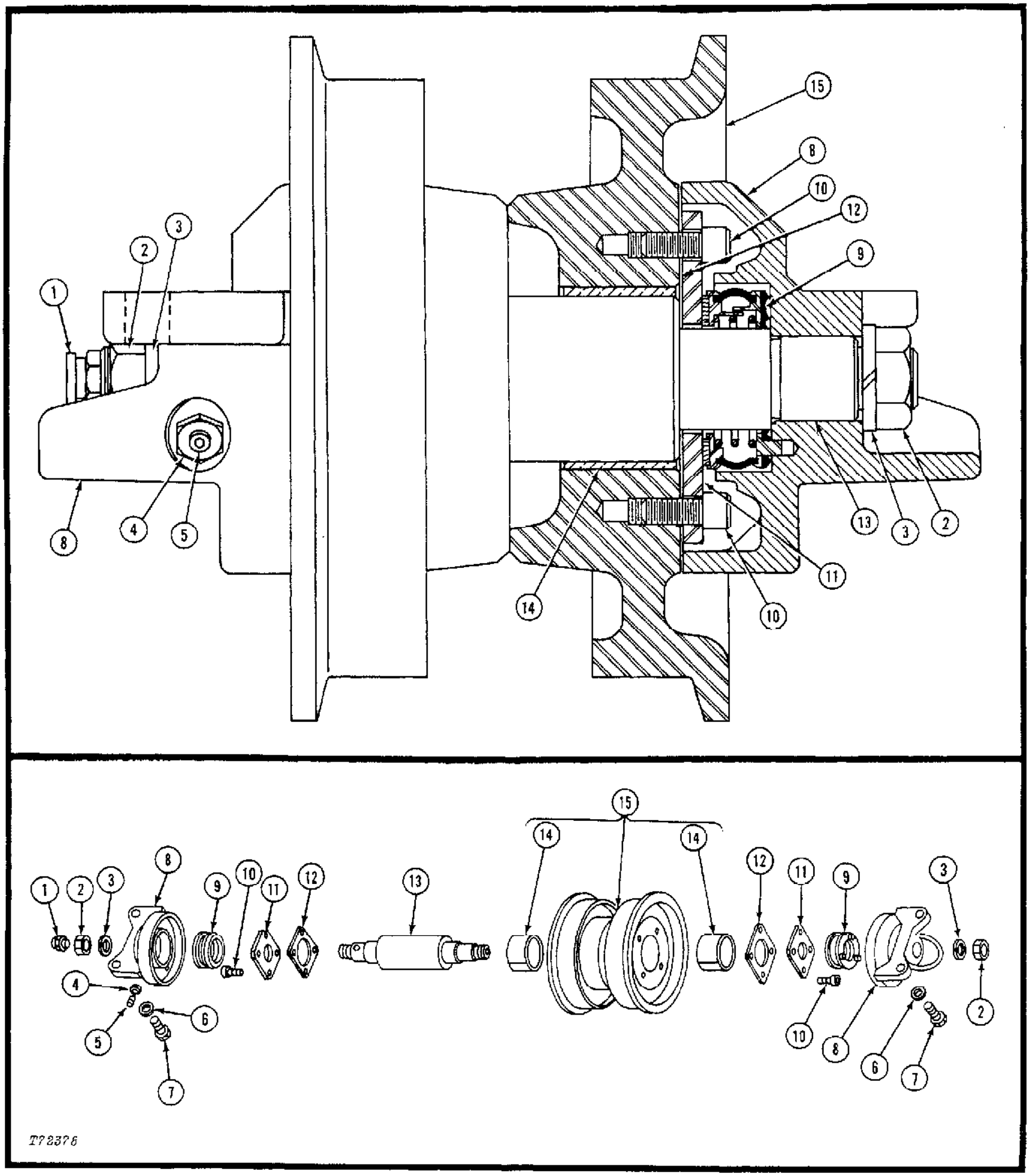
The track rollers will wear on the roller running surface and the inner surface of the flanges. Place gauge between the roller flanges tight against one flange as shown in Fig. 52. Measure gap between gauge and roller running surface and gap between gauge and flange. Allowable wear is indicated on gauge with an arrow pointing to surface where gap is to be measured.

REMOVAL

NOTE: Due to the design of the track frame assembly, it is possible to remove the track rollers individually.

To remove roller, remove outer rock guard, loosen inner rock guard, and release all tension from track. Place jack or hoist under front crossbar and raise unit high enough to allow removal of roller.

Remove roller attaching cap screws and remove rollers.



T72376

1—Grease Fitting
2—Jam Nut (2 used)
3—Lock Washer (2 used)
4—Nut
5—Set Screw
6—Lock Washer (4 used)
7—Cap Screw (4 used)
8—Roller Bracket (2 used)
9—Oil Seal (2 used)
10—Socket Hd. Cap Screw (8 used)
11—Thrust Plate (2 used)
12—Shim (2 used)
13—Shaft
14—Bushing (2 used)
15—Roller Assembly

Fig. 53-Track Roller Assembly (350C)

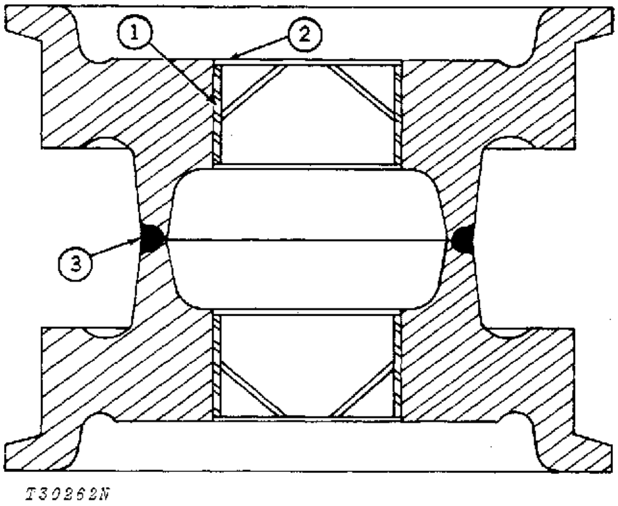
Disassembly (350C)

Remove grease fitting (1, Fig. 53) from end of roller shaft (15) and remove the two jam nuts (2) and lock washers (3) which attach the roller brackets (8) to the roller shaft (13).

Slide inner bracket and oil seal (9) free from roller assembly (15).

NOTE: Keep metal face of seals lubricated and together at all times while disassembled.

Loosen jam nut (2) and back out screw (5) until outer bracket and seal can be removed from roller shaft. Remove the four socket head cap screws (10) and slip off the thrust plate (11) and shims (12). Roller shaft can now be pulled free from roller. Remove thrust plate and shims from side of roller.



1—Bushing
2—Locate Bushing Below Face
3—Track Roller

Fig. 54-Correct Location of Bushing in Track Rollers

Bushing Wear (350C)

Inspect bushings in rollers for scoring and excessive wear. The I.D. of the roller bushings is 1.984 inches to 1.985 inches (50.39 to 50.42 mm). If it is necessary to replace the bushings, use a suitable driver to press old bushings out and to install new bushings in rollers and idlers. Install bushings with open ends of oil grooves to the inside and 1/32 inch (0.79 mm) below face of roller (Fig. 54).

NOTE: Replacement roller bushings are pre-zised and therefore require no reaming after installation.

Assembly (350C)

Position shaft (13, Fig. 53) in roller and install a thrust plate (11) on each side, using one shim (12) under each thrust plate. Tighten the socket head cap screws (10) with 30 ± 3 lb-ft (41 ± 4 N·m).

Lubricate bushings in track rollers with multi-purpose grease before installing roller shaft in roller.

Place oil seal (9) into counterbore in roller bracket (8); make sure the three small dowels, on the oil seal, seat in the drilled holes in the bracket. Slip outer bracket over end of shaft with grease fitting hole in it and slide onto shaft until set screw hole in bracket lines up with detent in shaft. Install and tighten set screw (5) and jam nut (4) securely.

Slide inner bracket into position and install bracket attaching jam nut (2) and lock washers (3) on each end of shaft. Tighten to 150 ± 8 lb-ft (203 ± 11 N·m).

NOTE: To facilitate tightening the bracket-to-roller shaft attaching nuts, install the roller assembly on the track carrier first (tighten to 85 lb-ft [115 N·m]) and then tighten the attaching nuts on both ends of the shaft to 85 lb-ft (115 N·m).

Install grease fitting (1) in outer end of roller shaft.

INSTALLATION

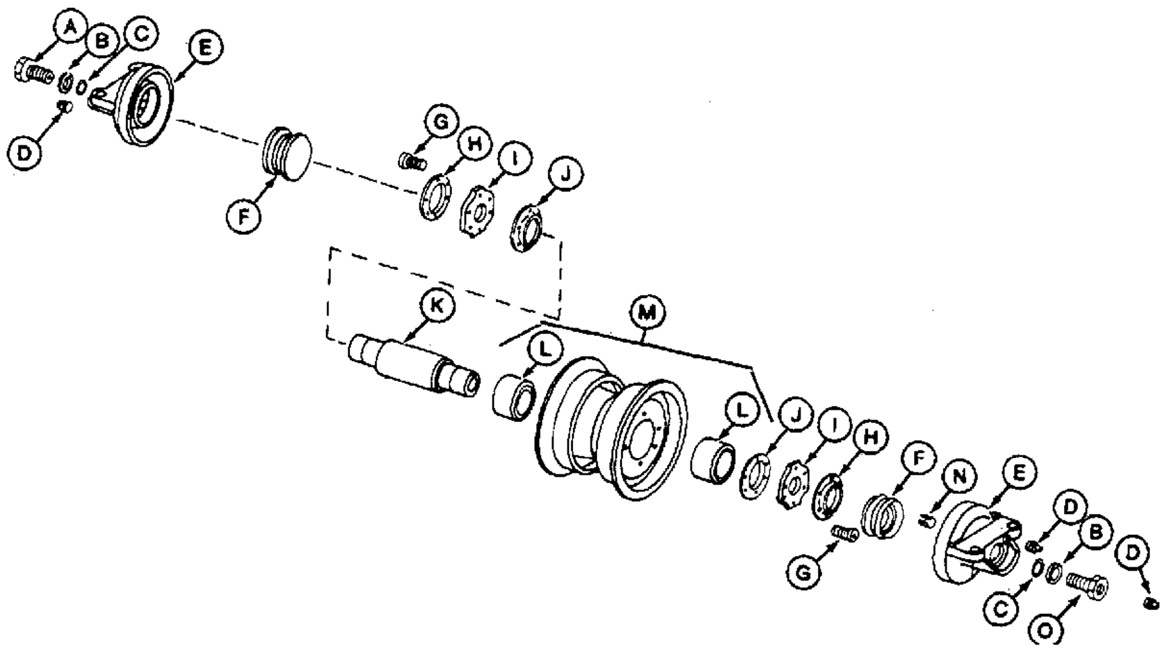
NOTE: If track has been disconnected, install rollers before connecting track. However, roller assemblies can be installed by loosening track and raising tractor.

Using a track roller installation tool (see Special Tools), position rollers under track carrier frame. Make sure that grease fittings are facing outward. Install the four attaching cap screws and lock washers and tighten.

NOTE: The front and rear track rollers usually wear at a faster rate than the center rollers. Move some of the center rollers to the front and rear to distribute wear evenly to all of the rollers and extend track service life.

Install rock guards; tighten attaching cap screws and nuts on rock guard spacer bolts to 120 lb-ft (163 N·m).

DISASSEMBLE TRACK ROLLER (350D, 355D)

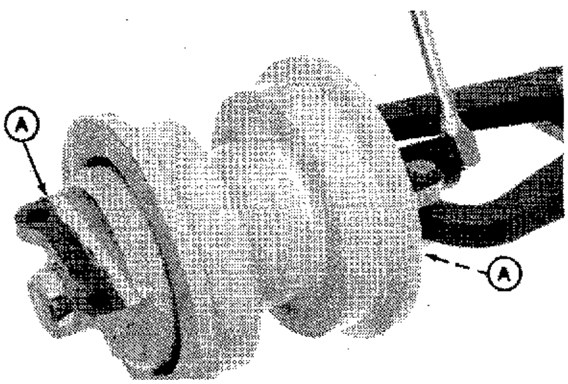


A—Cap Screw
B—Washer (2 used)
C—O-Ring (2 used)
D—Pipe Plug (3 used)
E—Bracket (2 used)
F—Seal (2 used)
G—Screw (12 used)
H—Ring (2 used)
I—Plate (2 used)
J—Gasket (2 used)
K—Shaft
L—Bushing (2 used)
M—Roller
N—Spring Pin
O—Cap Screw

Track Roller (350D, 355D)

2AG;T6403AB T47;0130 K1 040986

1. Remove two cap screws, washers, and O-rings to remove roller brackets (A).



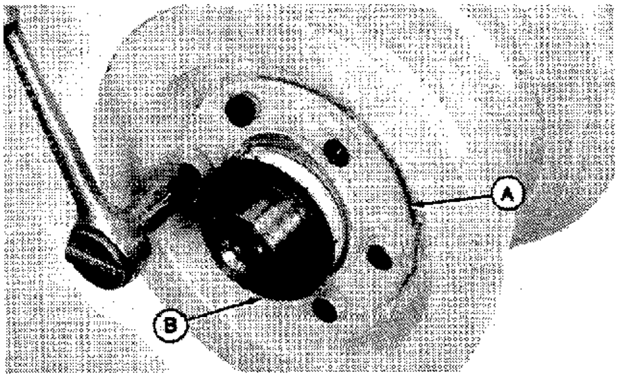
2AG;T93589 T47;0130 K2 220886

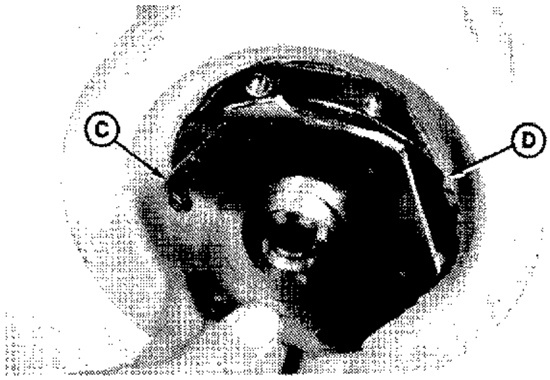
2. Remove six socket head cap screws to remove seal ring (A) and oil seal (B) on each side.

NOTE: Keep metal face of seals lubricated and together at all times while disassembled.

3. Remove thrust plate (C) gasket (D) and shaft.

4. Examine all parts for wear or damage. Replace all parts as required.





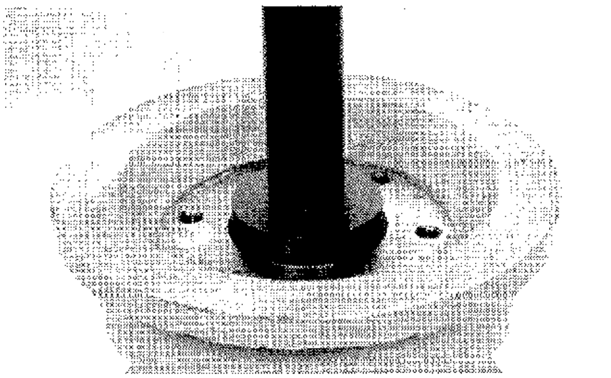
A—Seal Ring
B—Oil Seal
C—Thrust Plate
D—Gasket

2AG;T93590,T93591 T47;0130 69 220783

ASSEMBLE TRACK ROLLERS (350D, 355D)

NOTE: Replacement roller bushings are pre-sized and therefore do not need to be sized after installation.

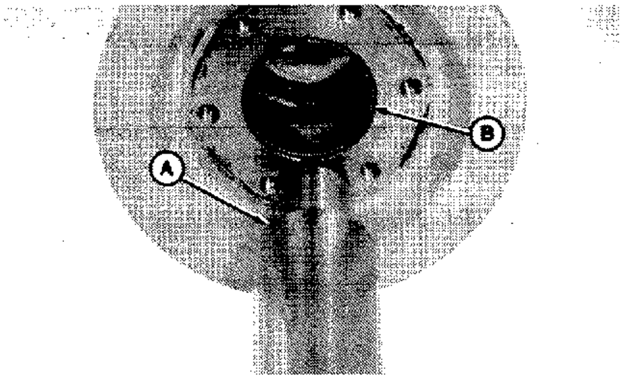
1. I.D. of the roller bushing is 60.41—60.44 mm (2.3785—2.3795 in.) If necessary to replace bushings, use 60 mm and 63 mm disks from driver set. Install new bushings 0.79 mm (0.031 in) below face of roller with open ends of oil grooves to the inside.

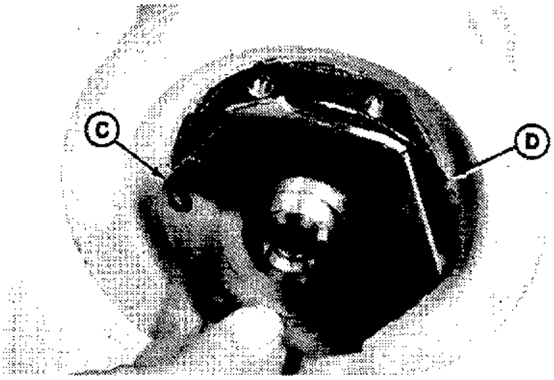


2AG;T93592 T47;0130 J1 260886

2. Lubricate bushings (B) with oil and install shaft (A).

3. Install gasket (D) and thrust plate (C), chamfered edge facing toward outside of track rollers.





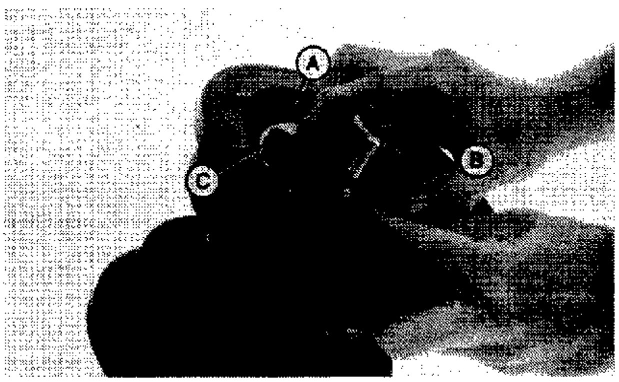
A—Shaft
B—Bushing (2 used)
C—Thrust Plate
D—Gasket

2AG;T93593,T93591 T47;0130 71 040285

4. Install seal ring (A).

5. Install three socket head cap screws (C) alternately spaced and finger tighten to position thrust plates, gasket, and seal ring.

6. Center seal ring on shaft using a JT30019 Seal Centering Fixture (B).



2AG;T6044AH T47;0130 6044JC 020485

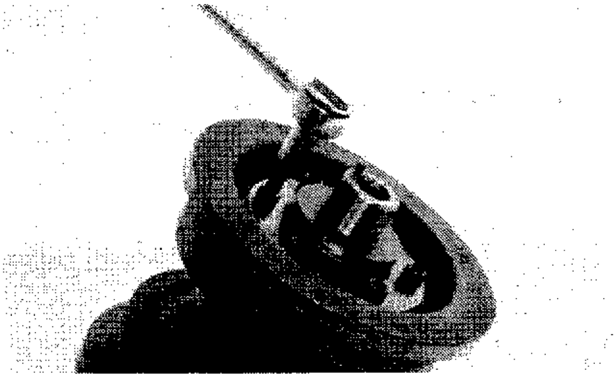
7. Install the other three cap screws and tighten them all.

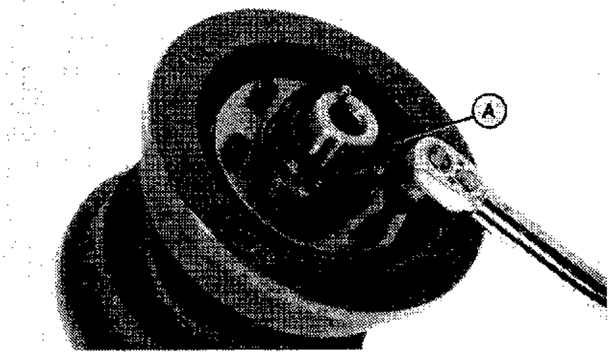
8. Remove seal centering fixture.

NOTE: DO NOT remove plastic retaining ring from new seal.

9. It is recommended that a new oil seal kit be installed. Install new oil seal (A). Side with retainer ring goes into seal ring. Seal must be straight in bore.

10. Tighten six cap screws to 68 ± 7 N·m (50 ± 5 lb-ft). Repeat steps 4—10 on the other side.





2AG;T6044AA, T6044AC T47;0130 6044JD 040285

11. Degrease sealing surface of roller bracket.

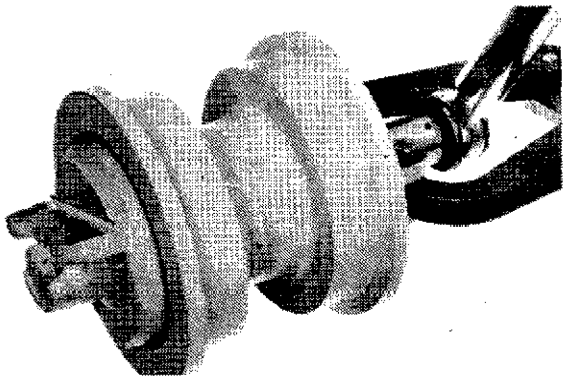
12. Install roller bracket, that does not have plugs, on the shaft end not having the pin. Install O-ring, washer, and cap screw. Tighten finger tight.

13. Install roller bracket, having the plugs, on shaft end having the pin. Install O-ring, washer and special cap screw. Tighten finger tight.

14. Tighten inside bracket cap screw to 407 ± 41 N·m (300 ± 30 lb-ft).

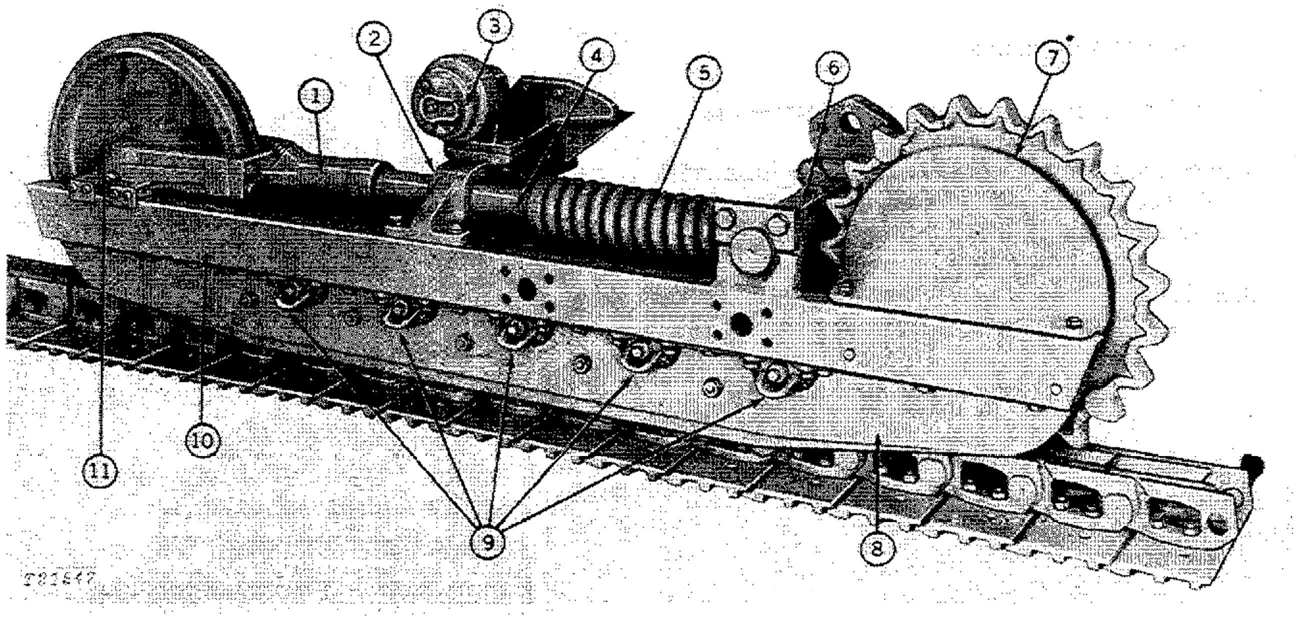
15. Tighten outer bracket special cap screw with Part No. on head to 407 ± N·m (300 ± 30 lb-ft) or the special cap screw with No. marking on head to 285 N·m (210 ± 21 lb-ft).

16. Fill assembly with approximately 178 ml (3/8 pt) of the recommended oil. (See Lubrication in Section I).



2AG;T93595 T47;0130 6044JE 040285

CARRIER ROLLERS



1—Track Adjusting Cylinder
2—Front Crossbar
3—Track Carrier Roller
4—Piston
5—Idler Spring
6—Rear Crossbar
7—Drive Sprocket
8—Rock Guard
9—Track Rollers
10—Track Frame
11—Front Idler

Fig. 55-Track Frame Assembly

GENERAL INFORMATION

The track carrier roller is located approximately in the middle of the carrier frame assembly. Its cast-iron roller has two replaceable bronze bushings which rotate on a hardened steel shaft pressed into the mounting bracket.

The carrier roller (3, Fig. 55) provides support and guides the track chain between the drive sprocket (7) and the front idler (11).

MEASURING CARRIER ROLLER WEAR

Use a D-05229ST 12 in. Spring Caliper (part of D-05227ST Undercarriage Inspection Service Tool Kit) to measure carrier roller diameter.

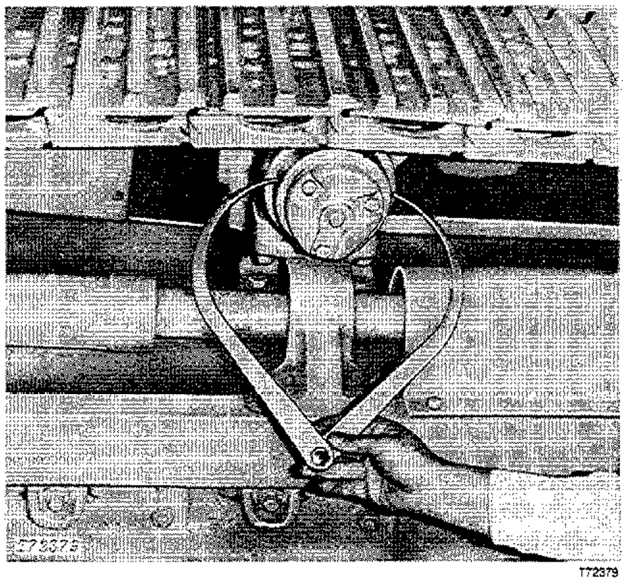


Fig. 56-Carrier Roller Diameter Measurement

Position a caliper around the carrier roller as shown in Fig. 56. Measure the diameter of the carrier roller running surface. Record the measurement.

The outside diameter of a new carrier roller is 4.88 in. (124.0 mm). Minimum recommended outside diameter of a carrier roller is 4.36 in. (110.7 mm) for rebuilding carrier roller.

Carrier Roller Tread Diameter

Dimension (allowable wear - 0.52 in. [13.3])	Percent Worn
4.88 in. (124.0 mm)	0
4.83 in. (122.7 mm)	10
4.78 in. (121.4 mm)	20
4.73 in. (120.1 mm)	30
4.68 in. (118.8 mm)	40
4.63 in. (117.5 mm)	50
4.57 in. (116.2 mm)	60
4.52 in. (114.9 mm)	70
4.47 in. (113.6 mm)	80
4.42 in. (112.3 mm)	90
4.36 in. (110.7 mm)	100
4.30 in. (109.1 mm)	110
4.23 in. (107.5 mm)	120
4.17 in. (105.9 mm)	130

NOTE: For additional information on measuring carrier roller diameter, refer to UNDERCARRIAGE APPRAISAL MANUAL SP-326.

NOTE: It is recommended to use the above procedure for more accurate measurements when replacing the track components. A track wear gauge (JD266) is available, enabling the service technician to quickly check the condition of a track assembly.

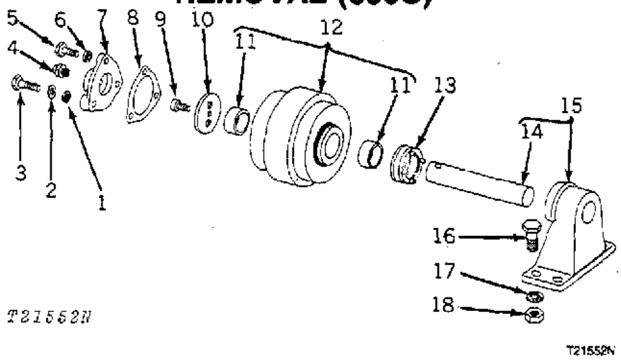
Use JD266 Track Wear Gauge to measure carrier roller wear as follows:

T21165

Fig. 57-Track Carrier Roller Wear

Place gauge over track carrier roller so that large cutout is over raised portion of roller as shown in Fig. 57. The lines on gauge will match outer edge of center flange on a new roller. Wear is reflected by the distance the center flange passes the lines on gauge.

REMOVAL (350C)



1—Gasket
2—Washer
3—Cap Screw
4—Grease Fitting
5—Cap Screw (2 used)
6—Lock Washer (2 used)
7—Cover
8—Shim
9—Socket Hd. Cap Screw (2 used)
10—Thrust Plate
11—Bushing (2 used)
12—Roller
13—Oil Seal
14—Shaft
15—Support
16—Cap Screw (4 used)
17—Lock Washer (4 used)
18—Nut (4 used)

Fig. 58-Track Carrier Roller Assembly

Refer to Fig. 58. Remove the hex. nuts, lock washers and cap screws which attach cover to roller and lift cover and shims free from roller. Take out the two socket head cap screws and remove the thrust plate. The carrier roller can now be pulled from its mounting shaft. Remove track carrier roller bracket from front crossbar.

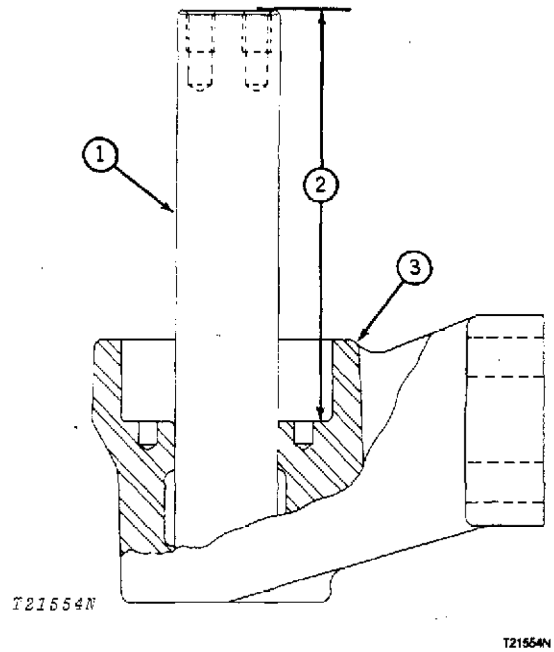
REPAIR (350C)

Disassembly and Assembly

Examine bushings (11, Fig. 58) in track carrier rollers for scoring or excessive wear. The I.D. of new track carrier roller bushings is 1.377 inches to 1.379 inches (34.98 to 35.03 mm). Using a suitable driver, install bushings in roller so that ends of bushings are flush with bottom of chamfers in roller. Be sure open ends of bushing oil grooves face center of roller.

Inspect oil seal (13) in carrier support. Keep seals in pairs as removed. It is recommended the new seal kit be installed.

Inspect track carrier roller shaft (14) for damage or excessive wear (O.D. 1.374 to 1.375 inch [34.89 to 34.93 mm]). This shaft can be replaced by pressing old shaft out of bracket and pressing new one into bracket (Fig. 59).



1—Shaft
2—5.42 ± 0.01 in. (138 ± 0.25 mm)
3—Track Carrier Roller Support

Fig. 59-Installing New Shaft in Track Carrier Roller Support

INSTALLATION (350C)

For identification and correct location of parts refer to Fig. 58.

Install track carrier roller support (15). Tighten mounting cap screws (16).

Position oil seal in roller support with steps on seal in corresponding holes in support. Slide carrier roller into position on mounting shaft (14) making sure oil seal (13) is not damaged.

NOTE: Before installing carrier roller on shaft, lubricate roller bushings with multi-purpose grease.

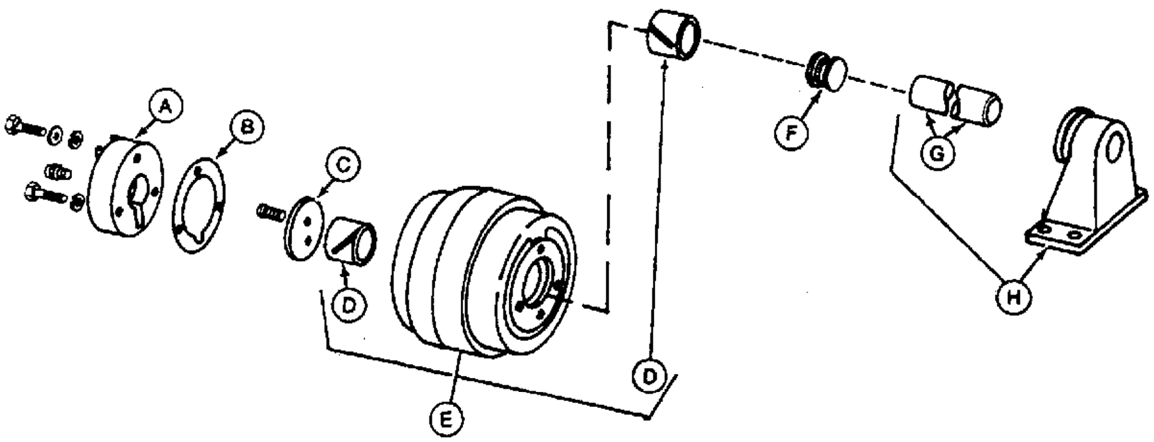
Position track adjusting cylinder and same number of shims as removed on the idler brackets and fasten with cap screws. Tighten screws.

Install thrust plate (10) and tighten the socket head cap screws (9) to 37 to 43 lb-ft (50 to 58 N·m).

Place a shim (8) between the track carrier roller and cover to act as a gasket. Insert the cover attaching cap screws and tighten.

Refer to Group 9030 to adjust track tension.

DISASSEMBLE AND INSPECT UPPER CARRIER ROLLER ASSEMBLY (350D, 355D)



A—Cover	**C—Plate**	**E—Roller**	**G—Shaft**
B—Gasket	**D—Bushing (2 used)**	**F—Seal**	**H—Support**

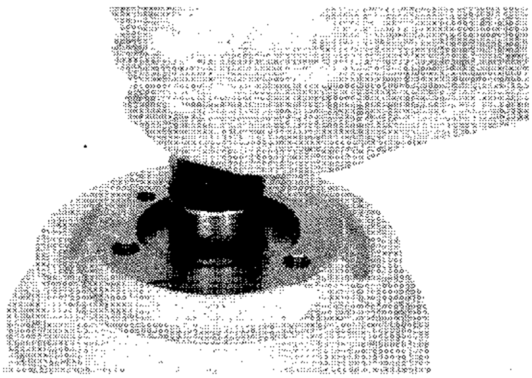
IMPORTANT: Keep metal face seals lubricated and together at all times while disassembled.

Remove parts (A—H) to disassemble roller assembly.

2AG;T6403AC T47;0130 J2 220886

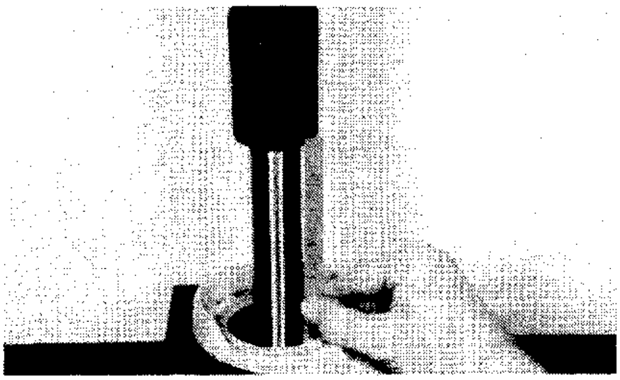
ASSEMBLE UPPER CARRIER ROLLER (350D, 355D)

1. If replacement of the two bushings in roller is necessary, use 35 mm and 39 mm disks from driver set.



2AG;T93569 T47;0130 J3 220886

2. Install new shaft using a press. Press in shaft to 145.03 to 145.54 mm (5.710 to 5.730 in.) above the face of seal bore.

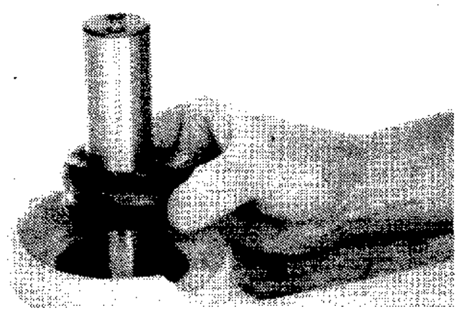


2AG;T6404AD T47;0130 K3 260886

IMPORTANT: The metal face seal bore in support and roller must be degreased with clean solvent and dried before installing seal.

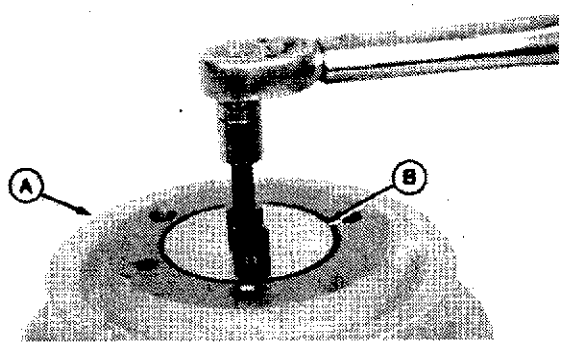
3. Install oil seal into support. Side with the retainer ring goes into support. It is recommended that a new oil seal kit be installed.

IMPORTANT: DO NOT remove plastic retaining ring from new seal.



2AG;T93567 T47;0130 46 040285

4. Install roller assembly (A), plate (B) and two socket head screws. Tighten screws to 54 ± 3 N·m (40 ± 3 lb-ft).

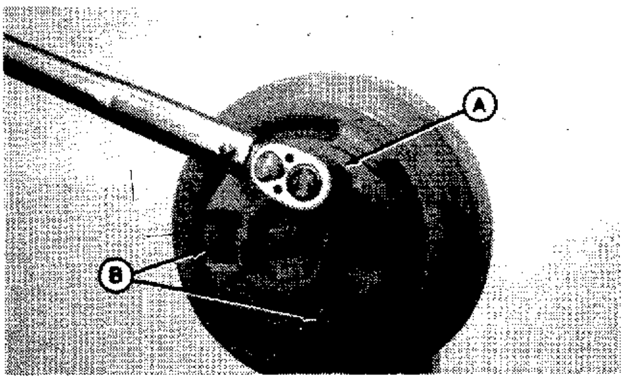


2AG;T93571 T47;0130 6034DC 040285

5. Install washer and gasket on the longer cap screw (A).

6. Install cover with three cap screws. Tighten cap screw (A) to 41 ± 4 N·m (30 ± 3 lb-ft) and cap screws (B) to 47 N·m (35 lb-ft).

7. Fill roller assembly with approximately 296 mL (10 oz) of the recommended oil. (See Lubrication in Section I.)



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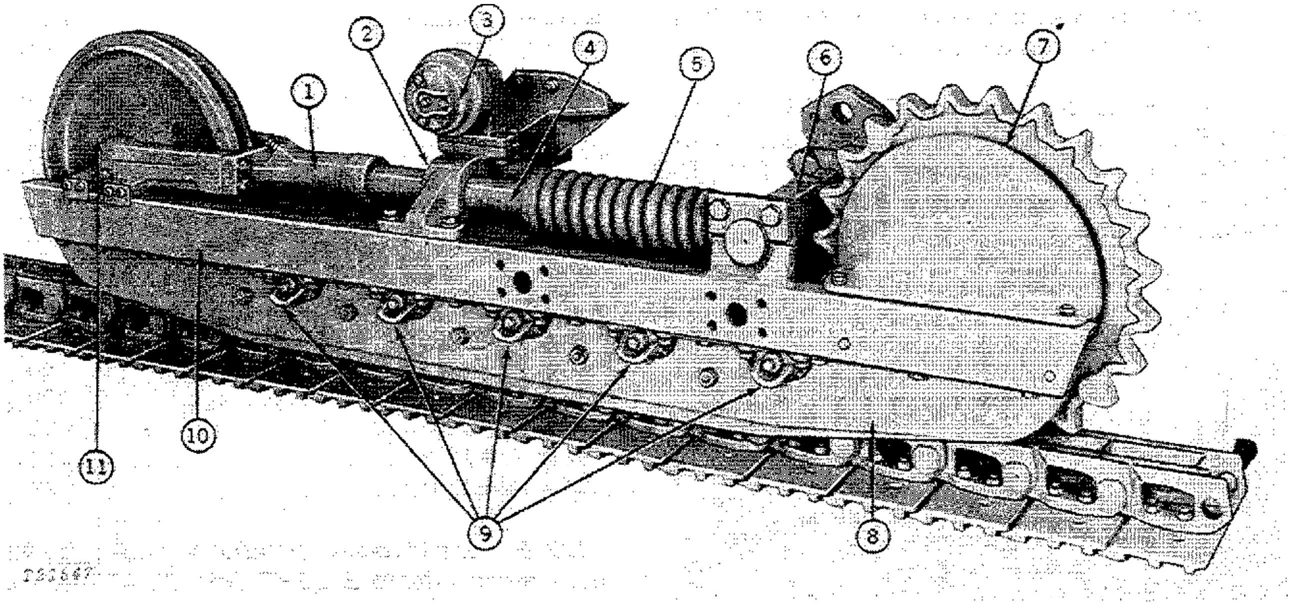
FRONT IDLER



1—Track Adjusting Cylinder
2—Front Crossbar
3—Track Carrier Roller
4—Piston
5—Idler Spring
6—Rear Crossbar
7—Drive Sprocket
8—Rock Guard
9—Track Rollers
10—Track Frame
11—Front Idler

Fig. 60-Track Frame Assembly

GENERAL INFORMATION

The tracks are guided at the front by idlers (11, Fig. 60) which are hydraulically shifted forward or rearward by adjusting track tension.

The front idler assemblies are held in place on the track frame by idler brackets which are shim adjusted to slide freely on the track frame.

The front idlers are lubricated at button head fittings on the shafts. Drilled passages in the shaft carry the grease from the fitting to the reservoir in the hubs.

MEASURING FRONT IDLER WEAR

The front idler wear occurs on the sides of the idler flange and the idler running surface.

Use a depth gauge consisting of D-05231ST 300 mm Metric Ruler, D-05265ST 150 mm Metric Ruler and D-05266ST Right Angle Attachment (parts from D-05227ST Undercarriage Inspection Service Tool Kit) to measure front idler flange height.

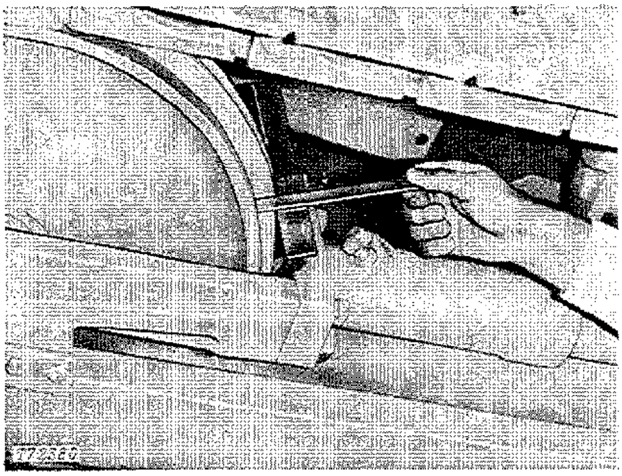


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Fig. 61-Front Idler Flange Height Measurement

Place a depth gauge over the front idler flange as shown in Fig. 61. Record the measurement.

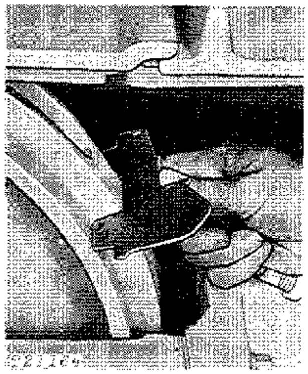
Flange height on a new front idler is 0.75 in. (19.0 mm). Maximum recommended flange height is 0.91 in. (23.0 mm) for rebuilding front idler.

Front Idler Flange Height

Dimension (allowable wear - 0.16 in. [4.0 mm])	Percent Worn
0.75 in. (19.0 mm)	0
0.76 in. (19.4 mm)	10
0.78 in. (19.8 mm)	20
0.80 in. (20.2 mm)	30
0.81 in. (20.6 mm)	40
0.83 in. (21.0 mm)	50
0.84 in. (21.4 mm)	60
0.86 in. (21.8 mm)	70
0.87 in. (22.2 mm)	80
0.89 in. (22.6 mm)	90
0.91 in. (23.0 mm)	100
0.92 in. (23.4 mm)	110
0.94 in. (23.8 mm)	120
0.94 in. (24.2 mm)	130

NOTE: For additional information on measuring idler flange height, refer to UNDERCARRIAGE APPRAISAL MANUAL SP-326.

NOTE: It is recommended to use the above procedure for more accurate measurements when replacing the track components. A track wear gauge (JD266) is available, enabling the service technician to quickly check the condition of a track assembly.



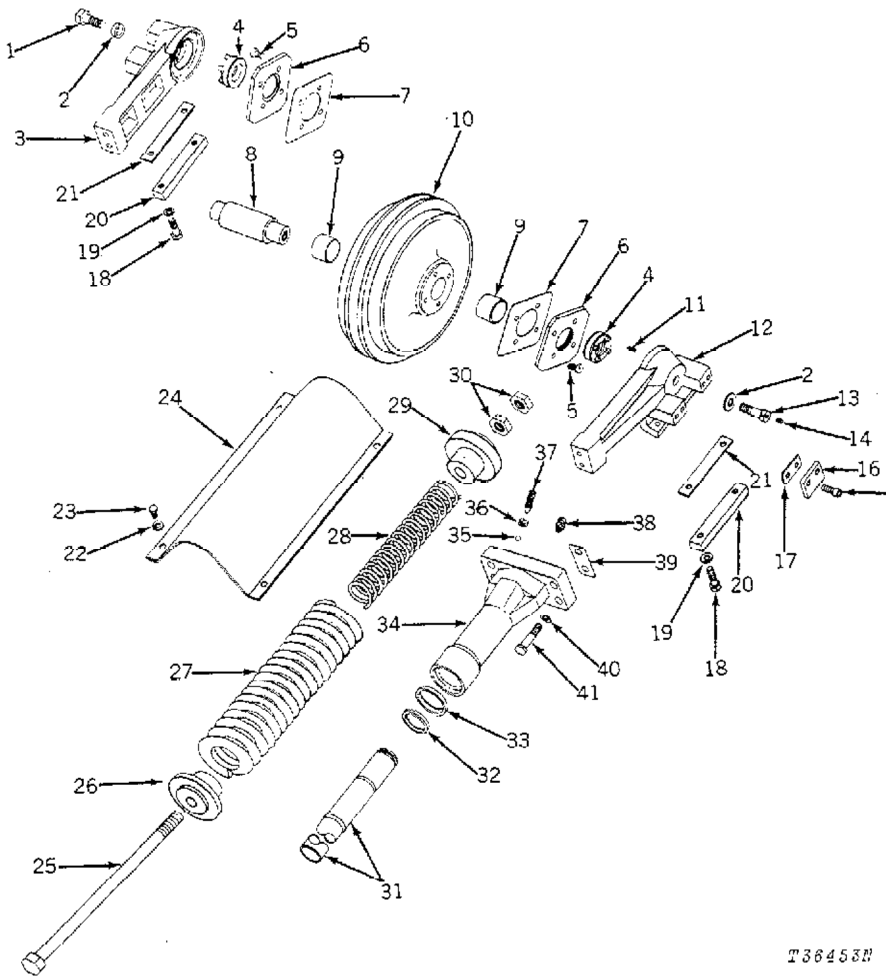
T21164

Fig. 62-Front Idler Wear

Use the JD266 Track Wear Gauge to measure front idler wear.

Place the gauge on the front idler, with the gauge tight against one side of the idler flange. The allowable wear is indicated on the gauge with arrows pointing to where the gap between the gauge and idler is measured.

REMOVAL



T36453N

1—Cap Screw
2—Special Washer (2 used)
3—Left Idler Bracket
4—Oil Seal (2 used)
5—Socket Hd. Cap Screw (8 used)
6—Thrust Plate (2 used)
7—Special Shim (2 used)
8—Front Idler Shaft
9—Bushing (2 used)
10—Idler
11—Spring Pin
12—Right Idler Bracket
13—Special Cap Screw
14—Grease Fitting
15—Cap Screw (8 used)
16—Idler Guide (4 used)
17—Shim (approx. 14 used)
18—Cap Screw (4 used)
19—Lock Washer (4 used)
20—Wear Plate (2 used)
21—Shim (6 used)
22—Lock Washer (4 used)
23—Cap Screw (4 used)
24—Cover
25—Hex. Hd. Bolt
26—Rear Cap
27—Spring
28—Inner Auxiliary Spring
29—Front Cap
30—Nut (2 used)
31—Piston
32—Piston Seal
33—Scraper Seal
34—Cylinder
35—Ball
36—Nut
37—Set Screw
38—Grease Fitting
39—Shim (10 used)
40—Lock Washer (4 used)
41—Cap Screw (4 used)

Fig. 63-Front Idler Assembly (350C Shown)

Refer to page 0130-15 to remove the track.

Remove cap screws (41, Fig. 63) fastening track adjusting cylinder (34) to idler brackets (3 and 12).

Attach a hoist to the front idler.

Slide front idler forward off track frame.

REPAIR (350C)

Remove the grease fitting (14, Fig. 63) from end of idler shaft (8) and remove the two cap screws (1 and 13) which attach the idler bracket (3 and 12) to the idler shaft. Slip idler brackets and oil seals (4) from shaft. Remove wear plates (20) from brackets.

Remove the four socket head cap screws (5) and slip the thrust plate (6) and shims (7) from the idler shaft. The idler shaft can now be pulled free from the idler wheel (10). Remove thrust plate and shims from other side of idler wheel.

Inspect bushings in idlers for scoring and excessive wear. The I.D. of idler bushings is 2.3725 inches to 2.3745 inches (60.26 to 60.31 mm). If it is necessary to replace the bushings, use a suitable driver to press old bushings out and to install new bushings in idlers. Install bushings with open ends of oil grooves to the inside.

NOTE: Replacement idler bushings are pre-sized and therefore require no reaming after installation.

Check idler and idler shaft for damage or excessive wear. Make sure grease passages in idler shaft are clean and open.

Inspect oil seals for damage.

Inspect wear plates (20) for damage or excessive wear.

Replace parts as needed.

NOTE: Lubricate bushings in front idler with multipurpose grease before installing idler shaft in idler.

Install idler shaft (8, Fig. 63) in front idler (10). Install shim (7) and thrust plate (6) on each side of idler shaft. Install cap screws (5) fastening thrust plate to idler. Tighten cap screws to 26 ± 2 lb-ft (35 ± 3 N·m).

Place oil seal (4) into counterbore in idler brackets (3 and 12). BE SURE the small dowels on the oil seal seat in the drilled holes in the idler brackets.

Install idler brackets on idler shaft.

Apply AT52853 John Deere Loctite Threadlock and Sealer (low strength) or an equivalent to threads of bracket-to-idler shaft cap screws.

Install cap screws (1 and 13) fastening idler brackets to idler shaft. Tighten cap screw (1) to 300 ± 20 lb-ft (407 ± 27 N·m). Tighten cap screw (13) to 210 ± 20 lb-ft (285 ± 27 N·m).

Install grease fitting (14) on end of front idler shaft attaching cap screw.

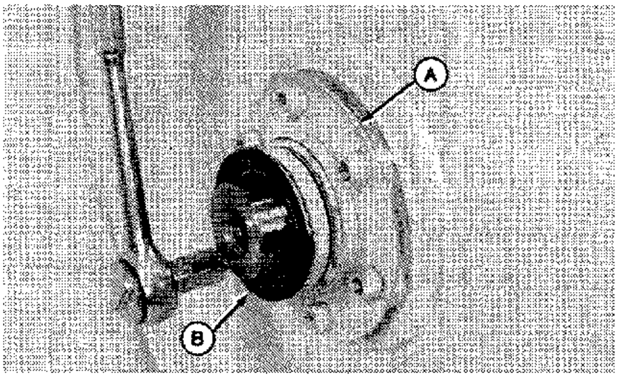
If wear plates (20) have been removed, reassemble them to the idler bracket using the same number of shims as removed. Refer to paragraph on "Front Idler" in "Installation" for procedure on checking and adjusting front idler bracket wear.

Be sure that shims (21) are properly positioned between idler brackets and crosshead.

DISASSEMBLE AND INSPECT FRONT IDLER ASSEMBLY (350D, 355D)

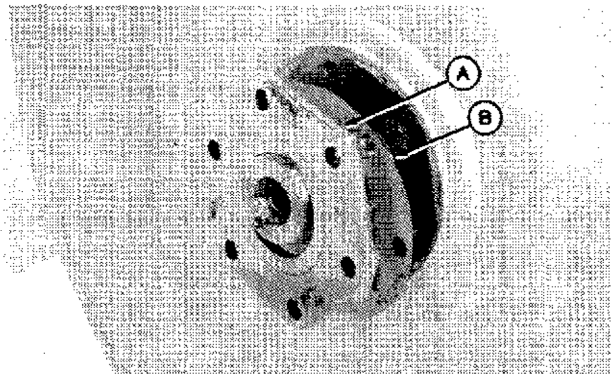
IMPORTANT: Keep metal face of seals lubricated and together at all times while disassembled.

1. Remove six socket head screw to remove seal ring (A) and seals (B) on each side.



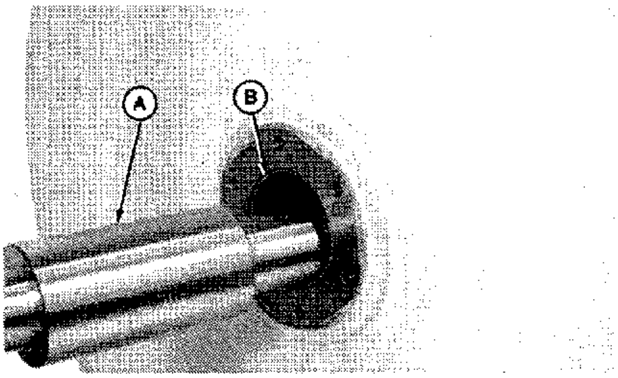
2AG;T93575 T47;0130 K5 080986

2. Remove plate (A) and gasket (B) on each side.



2AG;T93576 T47;0130 K6 270886

3. Remove shaft (A) and inspect bushings (B) for wear or damage; replace if necessary.



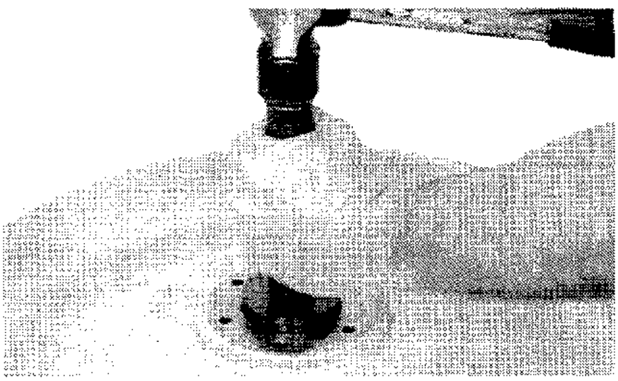
2AG;T93577 T47;0130 K7 030986

ASSEMBLE FRONT IDLER ASSEMBLY (350D, 355D)

1. Clean all parts thoroughly.

2. Install new bushing using 66 mm and 71 mm disks from driver set. Install bushing 0.79 mm (0.031 in.) below face of roller.

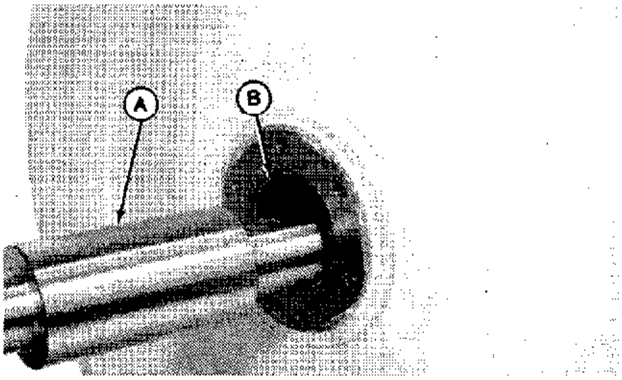
NOTE: Replacement idler bushings are pre-sized and, therefore, do not need to be sized after installation.



2AG;T93578 T47;0130 K8 030986

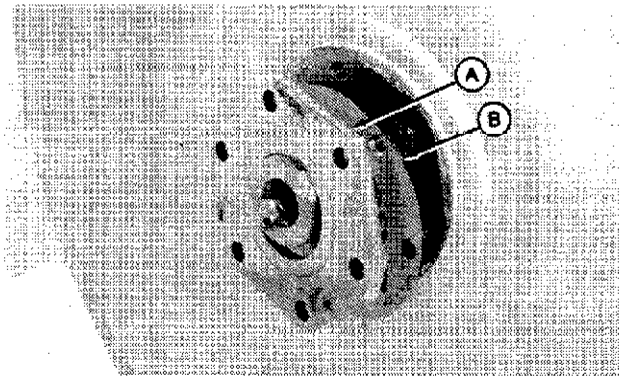
IMPORTANT: Lubricate idler bushing (B) with oil before installing shaft.

3. Install shaft (A).



2AG;T93577 T47;0130 K9 270886

4. Install new gasket (B) and thrust plate (A), chamfered edge of plate facing toward inside of front idler.

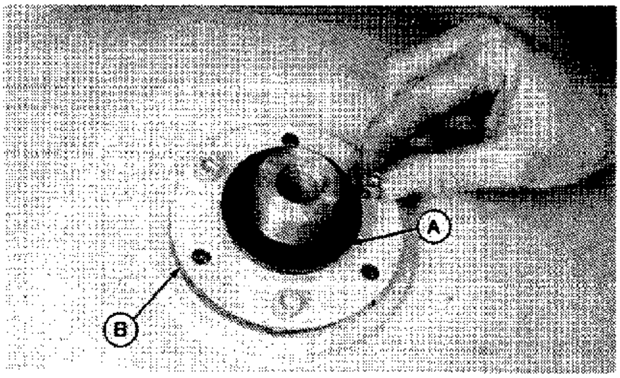


2AG;T93576 T47;0130 K10 270886

5. Install seal ring (B).

6. Install three socket head cap screws and finger tighten to position thrust plate, gasket, and seal ring.

7. Center seal ring on shaft using a JT30018 Seal Centering Fixture (A).



2AG;T6044AK T47;0130 K11 270886

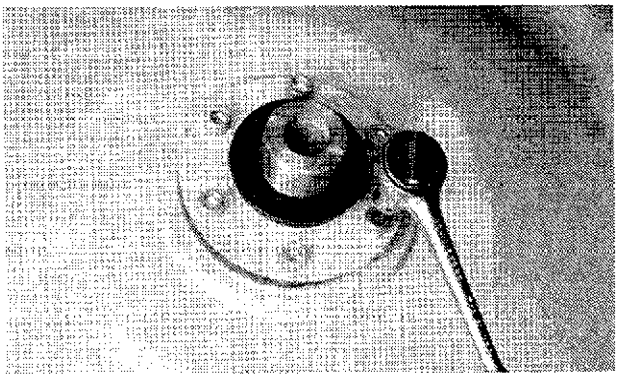
8. Install the other three cap screws and tighten them all.

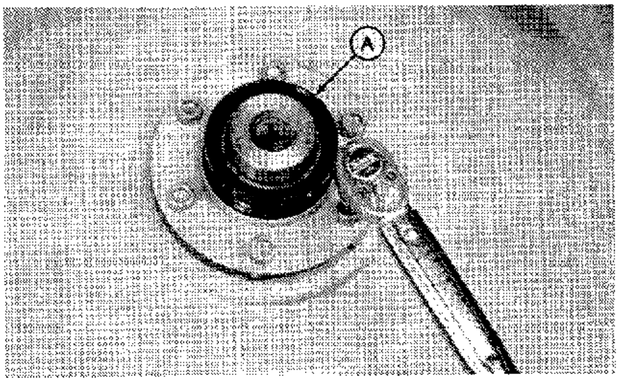
9. Remove seal centering fixture.

NOTE: DO NOT remove plastic retaining ring from new seal.

10. Install new oil seal (A). Side with retainer goes into seal ring. Seal must be straight in bore. It is recommended that a new oil seal kit be installed.

11. Tighten six cap screws to 68 ± 7 N·m (50 ± 5 lb-ft). Repeat steps 4—10 on other side.

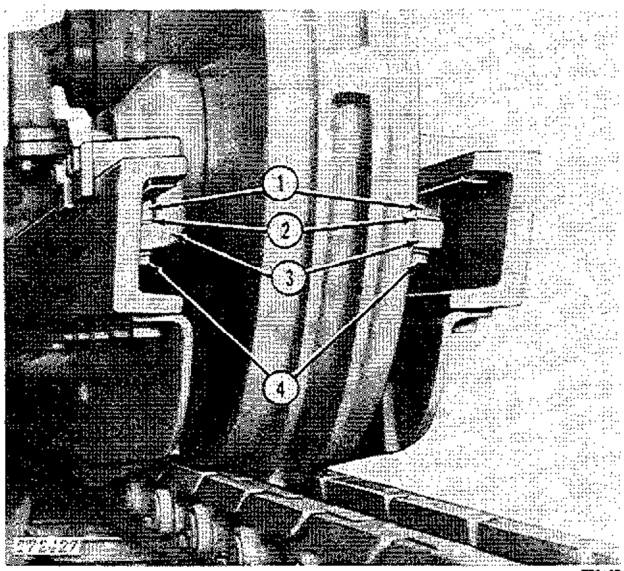




2AG;T6044AI, T6044AJ T47;0130 K12 270886

INSTALLATION

IMPORTANT: Front idler must slide freely along its entire movable range on the track frame rails, but cannot be excessively loose. Adjust using shims on idler guide and on idler wear plates inside track frame as explained below.

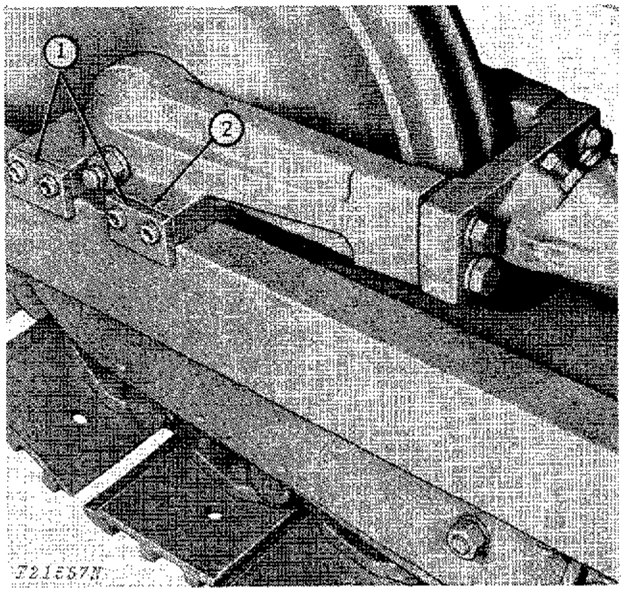


1—Wear Plate (2 used)
2—Shim (as required)
3—R.H. or L.H. Idler Bracket
4—Cap Screw (4 used)

Fig. 64-Installing and Adjusting Track Front Idler

Slide front idler assembly into position on track carrier frame assembly. Check for excessive play between idler bracket and track channels. If clearance is excessive, add shims under wear plates (Fig. 64). Tighten cap screws. The front idler must slide freely on track frames but not be loose.

Install idler guides (1, Fig. 65) and shims (2) on idler brackets.



1—Idler Guides
2—Adjusting Shims

Fig. 65-Front Idler Guides

Adjust the front idler with shims so that the edge of the idler rim is parallel to the track frame. There can be no more than 0.19 (5 mm) gap between a straight edge that is parallel to the outer channel member of the track frame and the front and rear edge of the front idler rim.

Tighten socket head cap screws. Check for excessive looseness or binding and add or subtract shims as necessary.

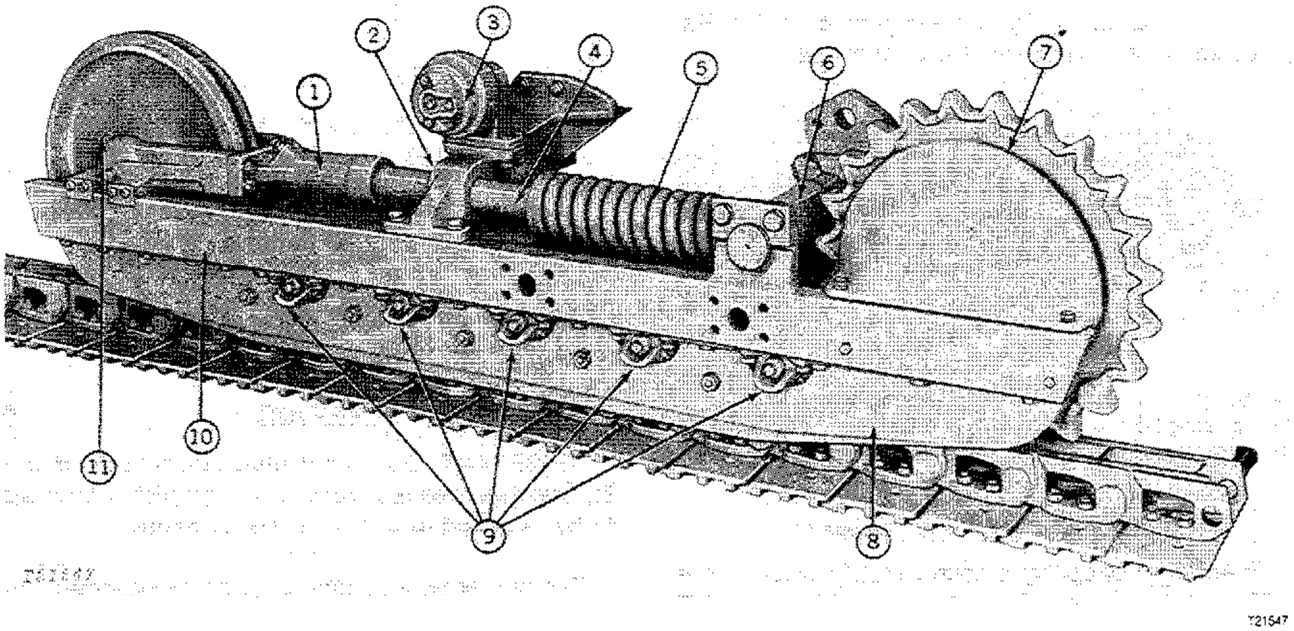
Move the front idler assembly back and forth through its entire movable range on the track frame channel, checking to see that the brackets do not bind on the rails. Remove shims if necessary to correct binding.

Install cap screws (41, Fig. 63) fastening track adjusting cylinder (34) to idler brackets (3 and 12).

Refer to page 0130-26 to connect the track chain.

Refer to Group 9030 to adjust track tension.

TRACK IDLER RECOIL SPRING



1—Track Adjusting Cylinder
2—Front Crossbar
3—Track Carrier Roller
4—Piston
5—Idler Spring
6—Rear Crossbar
7—Drive Sprocket
8—Rock Guard
9—Track Rollers
10—Track Frame
11—Front Idler

Fig. 66-Track Frame Assembly

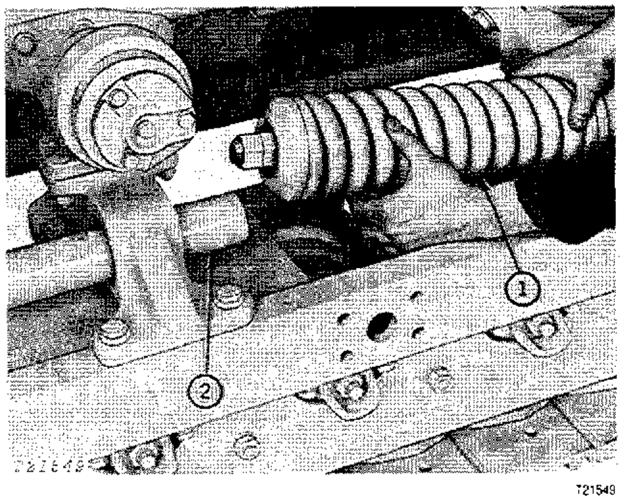
GENERAL INFORMATION

The idler spring assemblies (5, Fig. 66) are preloaded at the factory and locked in place. Track tension adjustments are made by shifting the entire idler assemblies forward or backward on the frame assemblies.

A recoil spring is used to absorb shock loads on the track system.

REMOVAL

To remove idler spring, first disconnect tracks (page 0130-15). Then push front idler forward, and remove spring (Fig. 67).

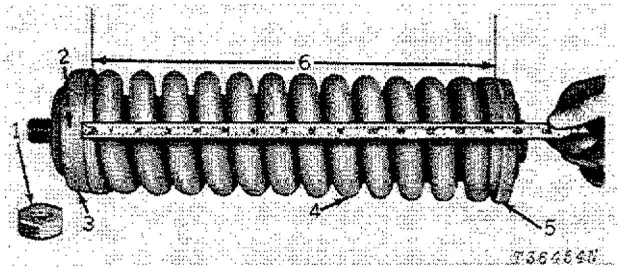


1—Spring
2—Piston

Fig. 67-Removing Track Spring

REPAIR

See that spring (4, Fig. 68) is in good condition. Replace spring if it has taken a permanent set.



T36454N

1—Jam Nut
2—Adjusting Nut
3—Front Cap
4—Spring
5—Rear Cap
6—14.875 Inches (378 mm)

Fig. 68-Track Spring Preload Adjustment

Free length of spring is approximately 18.00 inches (457 mm). Testing length of spring is 14.88 inches (378 mm) with a testing force of 6000 lbs (26 700 N).

If spring preload setting is disturbed, it must be reset by adjusting the spring to 14.875 inches (378 mm); measure between the front and rear caps (Fig. 68). Lock the adjusting nut in this position.

CAUTION: Be careful Accidental release of spring tension can cause serious injury.

INSTALLATION

Position idler spring on track frame assembly with the front end of spring assembly against adjusting tube or piston and rear part of the spring against rear crossbar attaching bracket of the track frame. Slide front idler assembly to the rear until the spring is held in position. Install cover.

Install and connect track. Adjust tension and check track alignment.

HYDRAULIC TRACK TENSION ADJUSTER

GENERAL INFORMATION

The track adjuster cylinder hydraulically moves the front idler to adjust track tension.

REMOVAL

Remove idler recoil spring (page 0130-42).

Remove cap screws (41, Fig. 63) and lift adjuster assembly from track assembly.

REPAIR

IMPORTANT: Do not pull piston from track adjusting cylinder unless scraper seal and piston seal are to be replaced or seals will be damaged.

Pull track adjusting piston (31) from cylinder (34). Remove scraper-type oil seal (33) and discard. Inspect cylinder for damage. Replace if necessary.

Remove piston seal (32) from piston. Examine piston for evidence of bending or other damage.

If piston is to be reused, clean the surface of piston.

NOTE: If grease has been removed from track adjusting cylinder or if a new cylinder is installed, bleed cylinder as follows: (a) With cylinder release screw loosened, place a small amount of grease in bottom of cylinder. (b) Move piston to bottom of bore without seating oil seal. A small amount of grease should be forced out of bleed hole. If necessary, add grease and repeat procedure until grease is observed at bleed hole. Seat oil seal as described above and tighten release screw.

Use a JD284 Track Adjuster Tool Set to install piston seal, oil seal and piston in cylinder. Make sure all parts are clean before starting the following steps:

Insert the oil seal (1, Fig. 69), metal side up, on the piston (2). Set the conical seal installation tool (3) on end of piston and lubricate tool.

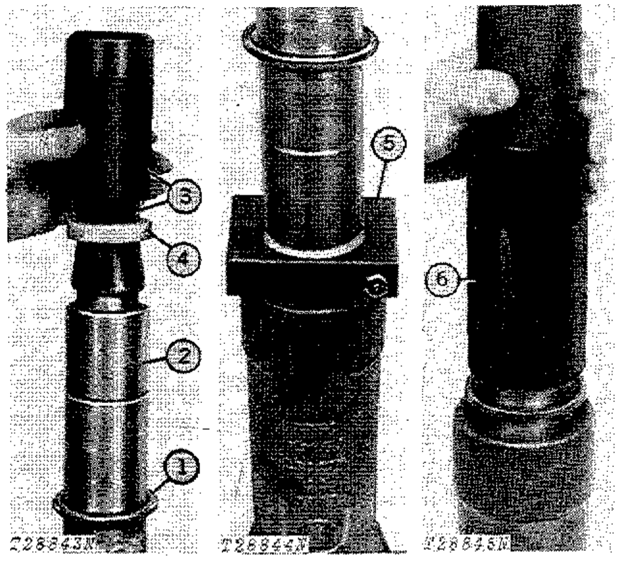
Insert the piston seal (4) onto conical tool, groove side up. Using the seal installation driver (3), drive the piston seal onto recessed area of piston.

Insert approximately two tablespoons of grease in cylinder and lubricate top two inches (51 mm) of cylinder wall.

Install piston guide (5) on cylinder, with square flange to the top. Tighten bolts and lubricate inside diameter of flange.

Place piston with seal end into flange. Force downward by hand until piston seal clears the flange. Remove piston guide.

Using a dust seal driver (6), drive the oil seal into the recess of the cylinder.



1—Oil Seal
2—Piston
3—JDH284-1
4—Piston Seal
5—JDH284-3
6—JDH284-2

Fig. 69-Using Track Adjuster Tool Set

Installation

Position piston and cylinder on track frame. Tighten cap screws (41, Fig. 63).

Install front idler recoil spring (page 0130-43).

Group 0199
SPECIFICATIONS AND SPECIAL TOOLS
TRACK SYSTEMS
SPECIFICATIONS AND TORQUE VALUES

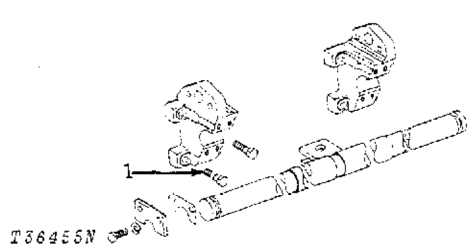


Fig. 1-Front Crossbar

1 - Rear crossbar outer attaching cap screws .... 250 lb-ft. (339 N·m)

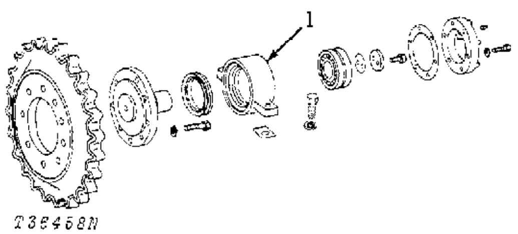


Fig. 2-Outer Sprocket Housing

1 - Wide Tread outer sprocket housing oil capacity........... 1-1/2 to 2 cups (0.4 to 0.6 L)

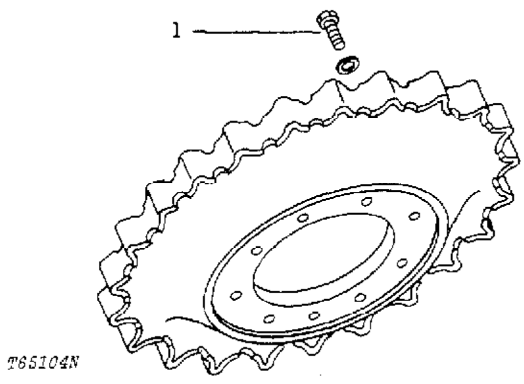


Fig. 3-Sprocket

1 - Sprocket cap screws
(D grade) .... 170 lb-ft (230 N·m)
(F grade)................ 240 lb-ft (325 N·m)

TRACK SYSTEMS

SPECIFICATIONS AND TORQUE VALUES—Continued

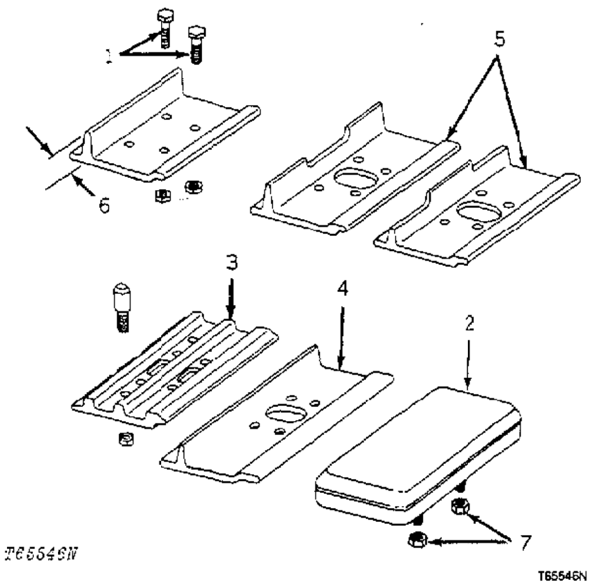
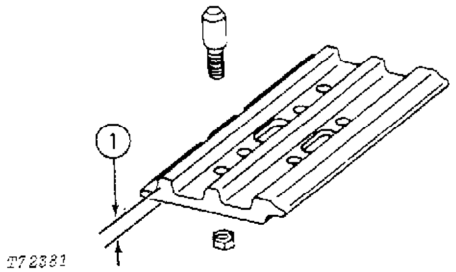


Fig. 4-Track Shoes

1 - Track shoe cap screws .... 110 lb-ft torque (149 N·m)
2 - Rubber shoe .... 10 in. (254 mm)
3 - All-purpose semi-grouser .... 12 in. (304.8 mm)
4 - Grouser .... 12 or 14 in. (304.8 or 355.6 mm)
5 - Notched grouser, open center ..... 12 or 14 in. (304.8 or 355.6 mm)
6 - Full Grouser Height
    New Shoe .... 1.58 in. (40.2 mm)
    100% Worn .... 0.75 in. (19.0 mm)
    Track shoes per track 36
7 - Rubber track shoe nuts (lubricated) .... 89 lb-ft (121 N·m)

TRACK SYSTEMS

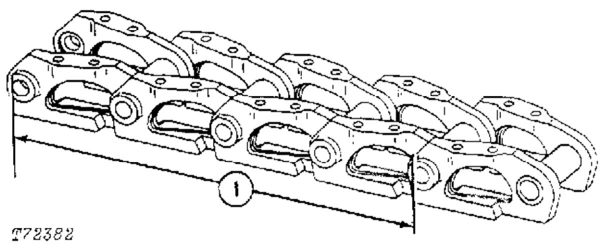
SPECIFICATIONS AND TORQUE VALUES—Continued



T72381

Fig. 5-Semi Grouser Height

1 - Semi Grouser Height
New Shoe . . . . 0.61 in. (15.5 mm)
100% Worn . . . . 0.35 in. (9.0 mm)



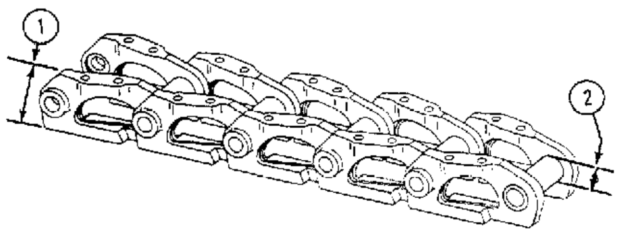
T72382

Fig. 6-Track Chain Pitch

1 - Pitch
New Chain . . . . 23.03 in. (584.9 mm)
100% Worn . . . . 23.51 in. (597.1 mm)

TRACK SYSTEMS

SPECIFICATIONS AND TORQUE VALUES—Continued



T72383

Fig. 7-Track Chain

1 - Link Height
- New link .... 3.19 in. (81.0 mm)
- 100% Worn .... 3.02 in. (76.7 mm)

2 - Bushing Outer Diameter
- New Bushing .... 1.75 in. (44.5 mm)
- 100% Worn .... 1.63 in. (41.4 mm)

TRACK SYSTEMS

SPECIFICATIONS AND TORQUE VALUES—Continued

350C

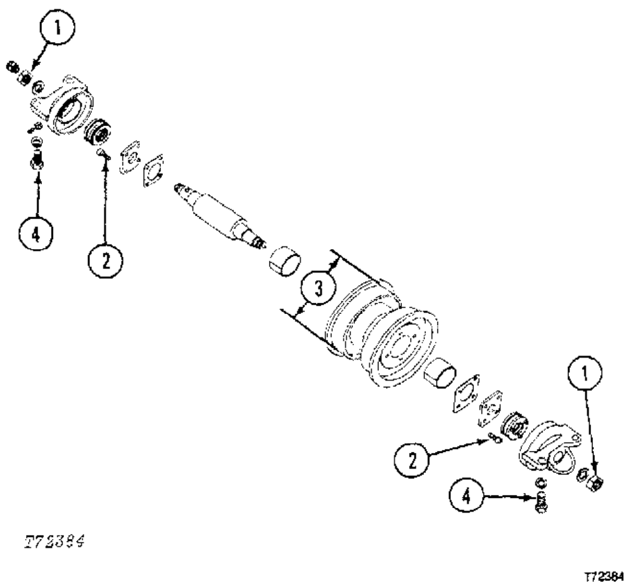


Fig. 8-Track Roller Assembly

1 - Roller shaft hex nut torque ...... 150 ± 8 lb-ft (203 ± 11 N·m)

2 - Roller thrust plate cap screw torque .... 30 ± 3 lb-ft (41 ± 4 N·m)

3 - Track Roller Tread Diameter
New Roller .... 7.19 in. (182.6 mm)
100% Worn .... 6.85 in. (174.0 mm)

4 - Roller assembly-to-track frame bolt .... 85 lb-ft (115 N·m)

350D, 355D

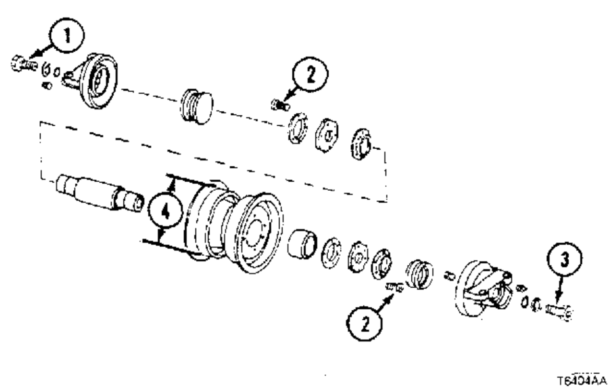


Fig. 8A-Track Roller Assembly

1 - Inner roller bracket and idler bracket to shaft cap screw .... 300 lb-ft (407 N·m)

2 - Seal plate screws .... 50 lb-ft (68 N·m)

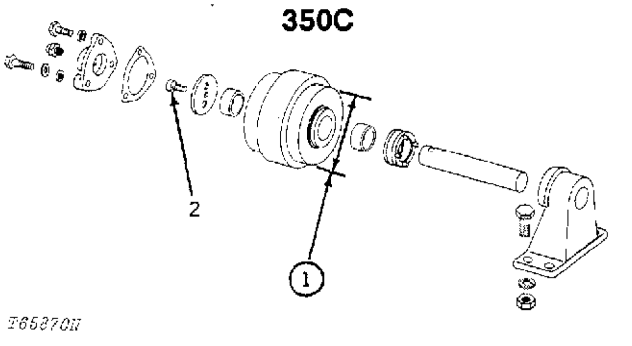
3 - Outer roller and idler bracket to shaft
Part no. on head .... 300 lb-ft (407 N·m)
No marking on head .... 210 lb-ft (285 N·m)

4 - Track Roller Tread Diameter
New roller .... 7.19 in. (182.6 mm)
100% worn .... 6.85 in. (174.0 mm)

TRACK SYSTEMS

SPECIFICATIONS AND TORQUE VALUES—Continued

350C



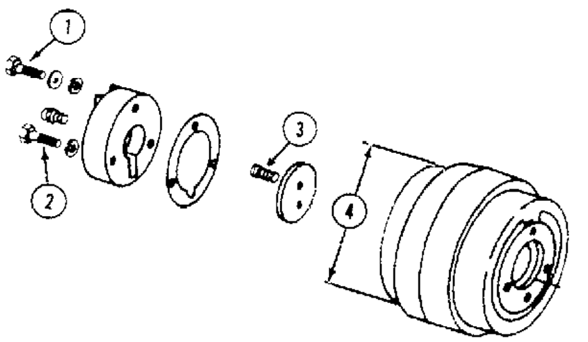
T65870N

Fig. 9-Track Carrier Roller

1 - Carrier Roller Tread Diameter
New roller . . . . 4.88 in. (124.0 mm)
100% worn . . . . 4.36 in. (110.7 mm)

2 - Track frame roller thrust plate
attaching cap screws . . . . 37 to 43 lb-ft
(50 to 58 N·m)

350D, 355D



T6404AC

Fig. 9A-Track Carrier Roller

1 - Carrier roller oil level
check cap screw . . . . 30 lb-ft
(41 N·m)

2 - Carrier roller cover
cap screws . . . . 35 lb-ft
(47 N·m)

3 - Carrier roller plate
socket head screws . . . . 40 lb-ft
(54 N·m)

4 - Carrier Roller Tread Diameter
New roller . . . . 4.88 in. (124.0 mm)
100% worn . . . . 4.36 in. (110.7 mm)

TRACK SYSTEMS

SPECIFICATIONS AND TORQUE VALUES—Continued

350C

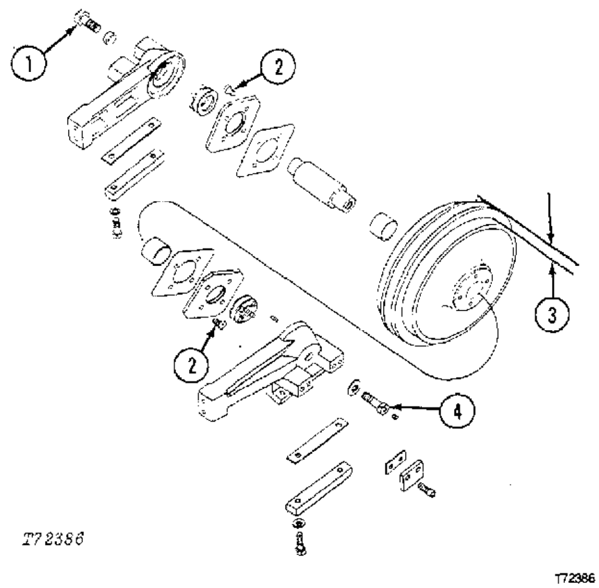


Fig. 10-Front Idler

1 - Inner idler bracket to front idler shaft cap screw .... 300 ± 20 lb-ft (407 ± 27 N·m)

2 - Thrust plate to front idler cap screws .... 26 ± 2 lb-ft (35 ± 3 N·m)

3 - Front Idler Flange Height
New idler .... 0.75 in. (19.0 mm)
100% worn .... 0.91 in. (23.0 mm)

4 - Outer idler bracket to front idler shaft cap screw .... 210 ± 20 lb-ft (285 ± 27 N·m)

350D, 355D

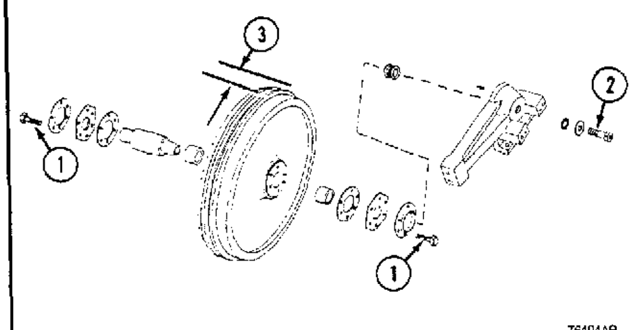


Fig. 10A-Front Idler

1 - Front idler seal ring socket head cap screws .... 50 lb-ft (68 N·m)

2 - Outer idler bracket to front idler shaft cap screw .... 210 lb-ft (285 N·m)

3 - Front Idler Flange Height
New idler .... 0.75 in. (19.0 mm)
100% worn .... 0.91 in. (23.0 mm)

TRACK SYSTEMS

SPECIFICATIONS AND TORQUE VALUES—Continued

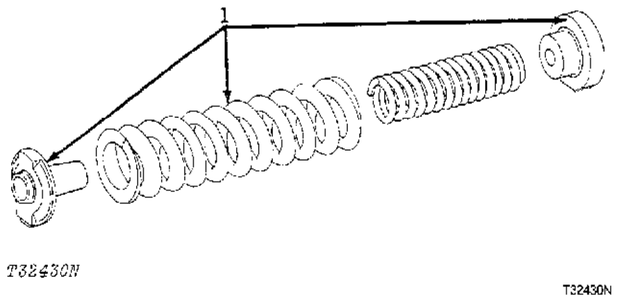


Fig. 11-Recoil Spring

1 - Track idler recoil srring compression for assembly (cap to cap) .... 14.875 in. (378 mm)
Free length .... 18.00 in. (457 mm)
Testing length .... 14.88 in. (378 mm)
with a testing force of 6000 lbs. (26 700 N).

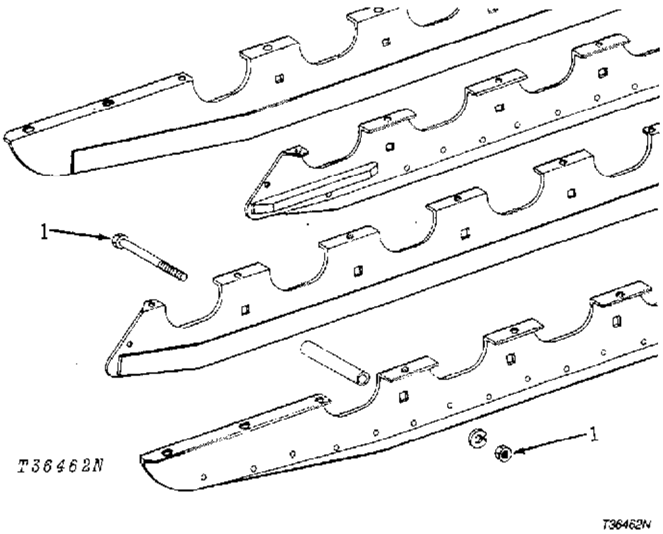


Fig. 12-Rock Guard Spacer

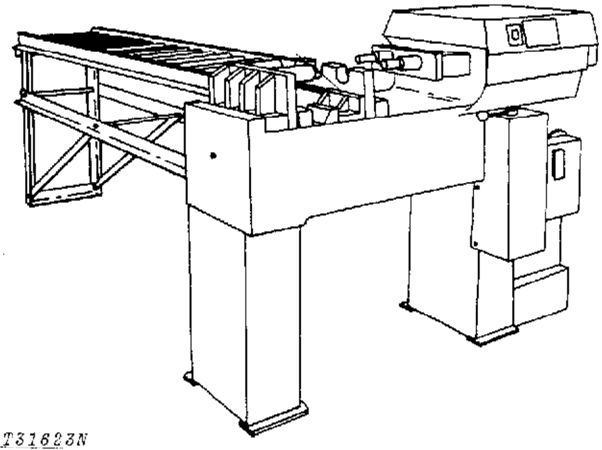
1 - Rock guard spacer bolts and nuts .... 120 lb-ft (163 N·m)

TRACK SYSTEMS

SPECIAL TOOLS

Essential Tools

Tool



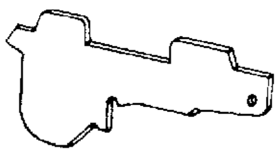
T31623N

T31623N

Fig. 13-D-01094AA Track Press

Tool No.	Use
D-01094AA (Formerly Y760)	60-Ton Owatonna Track Press - Track diassembly and assembly
D-01095AA	Master Tooling Set - used with 60-ton track press for removing track pins and bushings
D-01031AA	200-Ton Track Press - Track disassembly and assembly
D-01033AA	Master Tooling Set - used with 200-ton track press for removing track pins and bushings
Y360*	35-Ton Owatonna Track Press - Track disassembly and assembly

**No longer available*



T32407N

T32407N

Fig. 14-JD266

Tool No.	Use
JD266	Track Wear Gauge - Check track system component parts for wear.

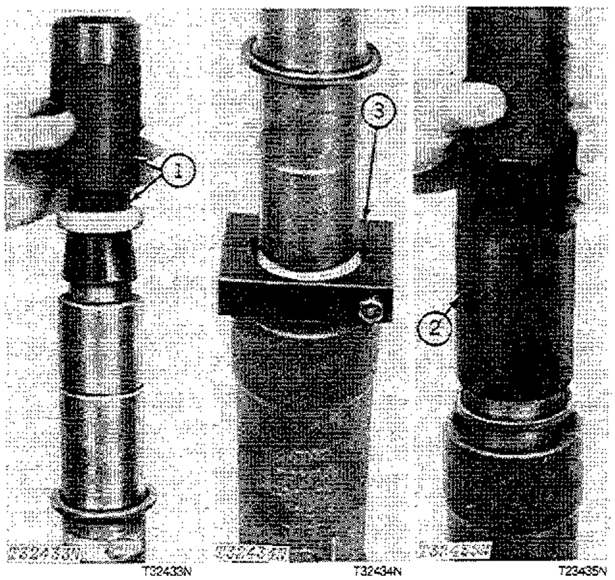


Fig. 15-JD284

Tool No.	Use
JD284	Track Adjuster Tool Set - to install piston seals, oil seals and piston in track tension adjuster cylinder.
1 - JD284-1	Seal Installation Tool - To install piston seal.
2 - JD284-2	Dust Seal Driver - To install oil seal.
3 - JD284-3	Piston Guide - To install piston in cylinder.

TRACK SYSTEMS

SPECIAL TOOLS—Continued

Essential Tools—Continued

Tool

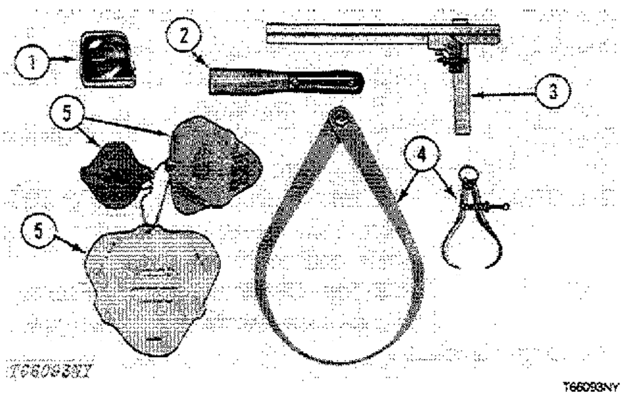
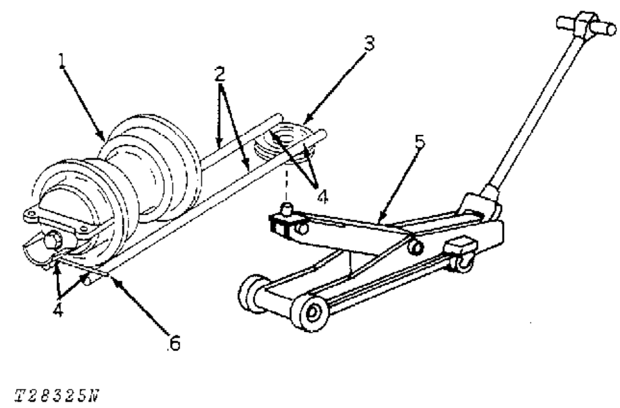


Fig. 16-Undercarriage Measuring Tools

Tool Number	Use
D-05227ST	Undercarriage Inspection Service Tool Kit—To check track system components for wear.
1—D-05230ST	3 Meter Steel Tape
2—D-05264ST	Scraper
3—D-05231ST	300 mm Metric Ruler
D-05265ST	150 mm Metric Ruler
D-05266ST	Right Angle Attachment
4—D-05229ST	12 in. Spring Caliper
D-17524CI	4 in. Spring Caliper
5—JDG-43	Sprocket Wear Gauge Kit



1—Track Roller
2—Rods
3—Pulley
4—Weld
5—Modified Floor Jack
6—Rod

Fig. 17-Track Roller Installation Tool

Track Roller Installation Tool - To install roller in track carrier

This tool is used with a large floor jack with lift pad removed. To make the tool, weld two quarter-inch rods or angle irons (2, Fig. 18), approximately 24 inches (610 mm) long, to a pulley (3) that has a flange that will fit on the jack. A 2010 Crawler crankshaft pulley is suggested as sufficient size.

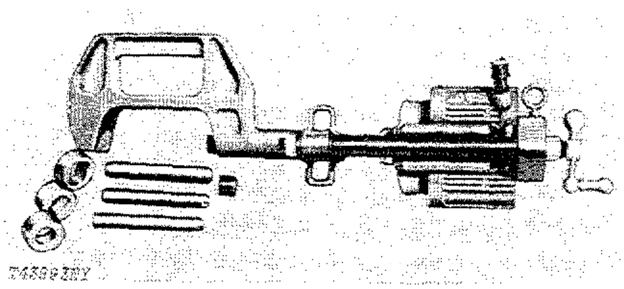
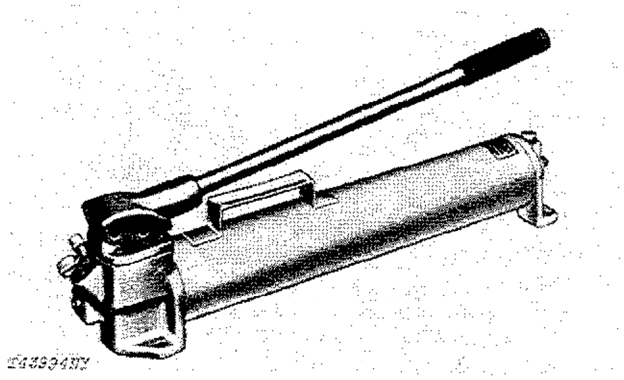
Weld a rod (6) across the top of the quarter inch rods or angle irons (opposite end of pulley) to prevent roller from sliding off. Rods or angle irons should be placed close enough together to prevent roller from falling through.

JT30018	Seal Centering Tool—To center seal ring on front idler shaft.

TRACK SYSTEMS

SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
 T43993NY *Fig. 18-50-Ton Master Pin Pusher*	D-01030AA	50-Ton Master Pin Pusher - to remove or install track master pin. Requires hydraulic pump for operation.
 T43994NY *Fig. 19-Hydraulic Hand Pump*	D-01019AA D-01020AA D-01021AA D-01027AA D-01022AA D-01023AA	Hydraulic Hand Pump - to operate 50-ton master pin pusher.

Section 2
AXLES AND SUSPENSION SYSTEM

CONTENTS OF THIS SECTION

Group 0201
DRIVE AXLE HOUSING

GENERAL INFORMATION

The drive axle housing is attached to the outboard side of the steering clutch housing.

REMOVAL

Raise one side of tractor by placing floor jack securely under front cross member. Start engine and shift transmission into first gear. Pull back on steering lever that controls track not raised off floor (this disengages steering clutch and applies brake to that side). Engage engine clutch, permitting raised track to rotate until master pin has moved around drive sprocket and is approximately 6 inches (152 mm) from floor.

CAUTION: Be sure that track to be rotated is clear of floor and that opposite track is locked in position so that tractor does not move.

Remove sprocket shield or sprocket weight from machine.

A special tool used in the removal and installation of crawler sprocket weights may be produced locally.

See "Special Tools", Section 1 Group 0199.

Position special tool as shown in Fig. 1 to remove or install sprocket weights, if so equipped.

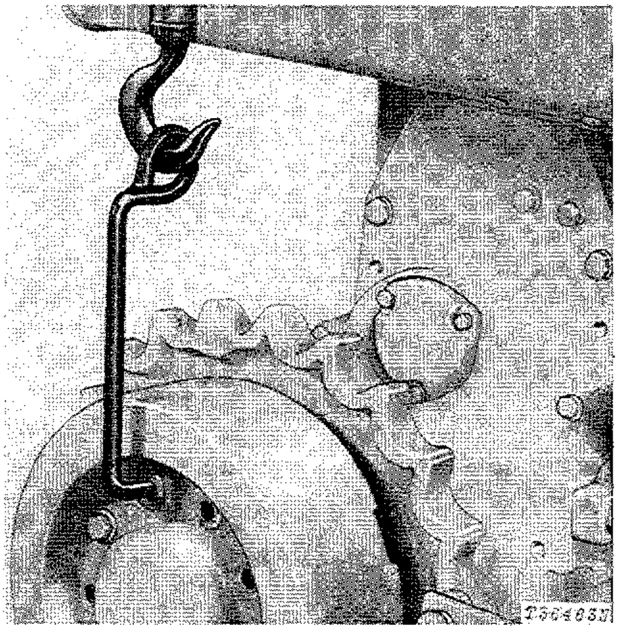


Fig. 1-Removing Sprocket Weight

Release track tension, remove track master pin and move track assembly clear of drive sprocket.

Drain oil from final drive housing, steering clutch housing, and transmission. Remove track drive sprocket from unit.

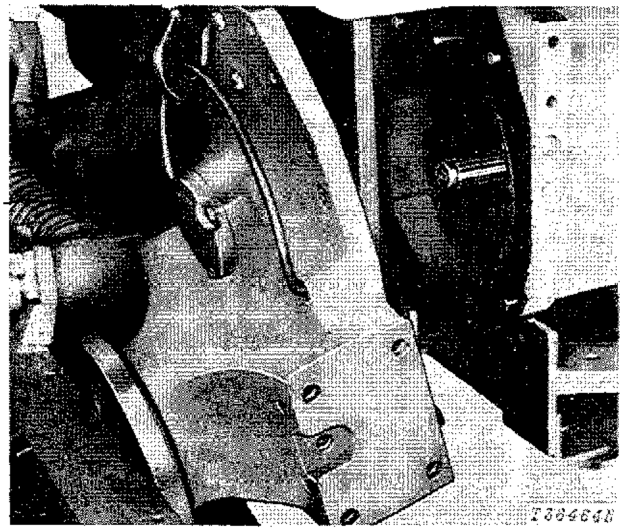


Fig. 2-Removing Final Drive

Under tractor, remove six inner cap screws attaching steering clutch housing to drive axle housing.

Remove three cap screws from drive axle housing securing brake anchor to drive axle housing.

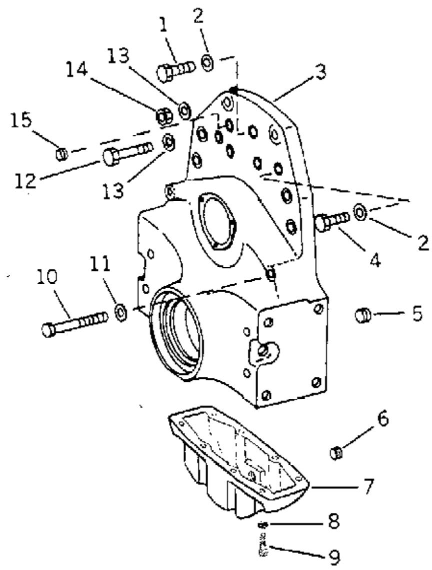
Remove hex. nuts and cap screws which hold drive axle housing to steering clutch housing.

Using a hoist, lift the drive axle housing assembly away from steering clutch housing. The special yoke shown in Fig. 2 can be constructed from 1/2-inch round stock and will facilitate removal of the drive axle housing.

Remove final drive bearing quill, being careful not to damage the shim pack. Remove final drive shaft.

REPAIR

Clean drive axle housing thoroughly and inspect for excessive wear, cracks, or other damage.



T65105N

1—Cap Screw (4 used)
2—Washer (6 used)
3—Housing
4—Cap Screw (2 used)
5—Pipe Plug (4 used)
6—Special Plug (2 used)
7—Pan
8—Lock Washer (20 used)
9—Cap Screw (20 used)
10—Cap Screw (4 used)
11—Washer (4 used)
12—Cap Screw (8 used)
13—Special Washer (12 used)
14—Nut (4 used)
15—Expansion Plug (3 used)

Fig. 3-Right and Left Drive Axle Housing

Apply John Deere Loctite Sealer or an equivalent to internal pipe thread tapped holes in drive axle housing (3, Fig. 3) and final drive pan (7) just prior to installing pipe plugs (5 and 6).

INSTALLATION

To install axle shaft, bearings and reduction gear refer to Group 0250.

Before installing drive axle housing on crawler, install pinion drive shaft in housing and determine the number of shims necessary behind quill to obtain 0.000 to 0.003-inch (0.00 to 0.08 mm) preload. Refer to Group 0225 for details.

Refer to Group 0225 and install the pinion shaft.

Apply John Deere Loctite Plastic Gasket or an equivalent to the machine surface of the steering clutch housing.

Position drive axle housing and secure.

Group 0210
BEVEL DRIVE

GENERAL INFORMATION

The transmission case contains a ring gear and spiral bevel pinion.

The second and reverse speed sliding gear, the first and fourth speed sliding gear, and the third speed sliding gear are splined to the spiral bevel pinion.

The case also contains a first and second speed gear cluster, third speed gear and fourth speed gear.

The powershaft is also contained in this case.

REMOVAL

Remove winch assembly (if so equipped). Refer to Section 30, Group 3041.

Remove backhoe (if so equipped). Refer to Section 33, Group 3340.

Remove ground conditioning tool (if so equipped). Refer to Section 42, Group 4240.

Remove rollover protective structure as instructed in Section 18, Group 1810.

Disconnect batteries and free battery cable clamp from tank unit.

Remove seat cushion and disconnect fuel lines. Disconnect hydraulic tank lines. Cap all hoses and lines.

Remove cap screws attaching front seat support to the side tank. Free support from shift levers. Remove cap screws securing fuel tank support and bottom seat support to steering clutch housing.

Attach a chain hoist to lift bars and lift rear tank unit from tractor. When lifting assembly, check to make certain all lines, hoses, and wiring are free.

Disconnect steering control rods from steering controls and controls on steering clutch housing.

Refer to Group 0201 and split track.

Drain oil from final drive housing, steering clutch housing and transmission.

Remove track drive sprocket. Remove cap screws which attach drawbar and bottom plate to final drive housing.

Remove cap screws attaching oil pan rock guard to final drive and roller frame.

Remove four cap screws which attach final drive housing to rear crossbar bracket.

Remove or block up rear bottom plate. Center floor jack under front of grille housing.

Remove rear cap screws securing front crossbar to side frames. Remove rear cap screws under side frame securing front crossbar to center frame support. Also loosen front cap screws, but do not remove.

Place a chain sling around final drives and attach to hoist. Also use a floor jack on the transmission case to avoid tipping.

Lower floor jack at front of tractor until transmission case clears rear crossbar.

Remove cap screws securing transmission and with the aid of a hoist remove transmission case, steering clutch housing and drive axle housing back from machine as an assembly. Care must be taken so assembly will not tip.

REPAIR

Remove shift cover assembly.

Remove transmission rear cover.

If so equipped, remove PTO shifter detent spring and ball.

To service input shaft, remove coupling from front of input shaft.

Remove the input shaft front bearing quill.

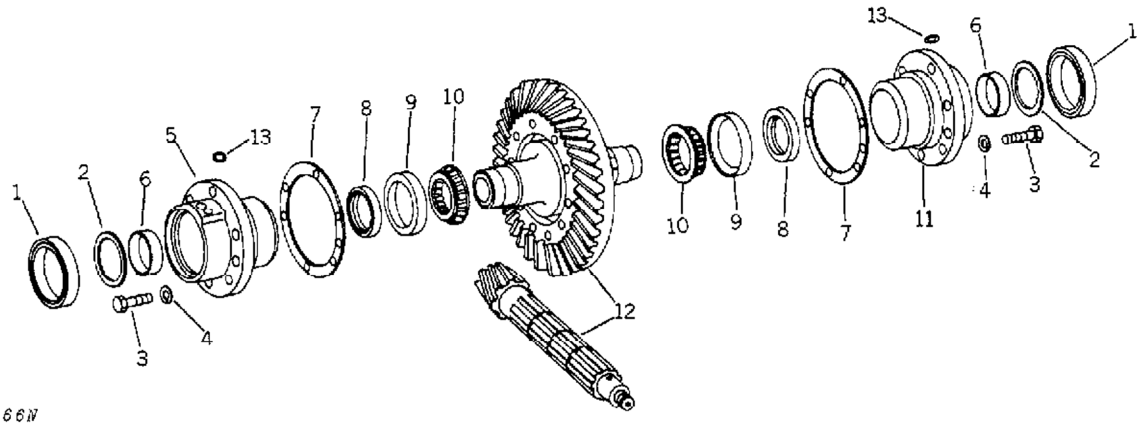
Move the PTO lever to the left (if used).

Slip input shaft forward and work rear end of shaft up through top of transmission case.

When servicing ring gear (12, Fig. 1) and spiral bevel pinion, refer to Section 2, Group 0201 and remove drive axle housing. Next remove the steering clutch assemblies. Refer to Section 2, Group 0250.

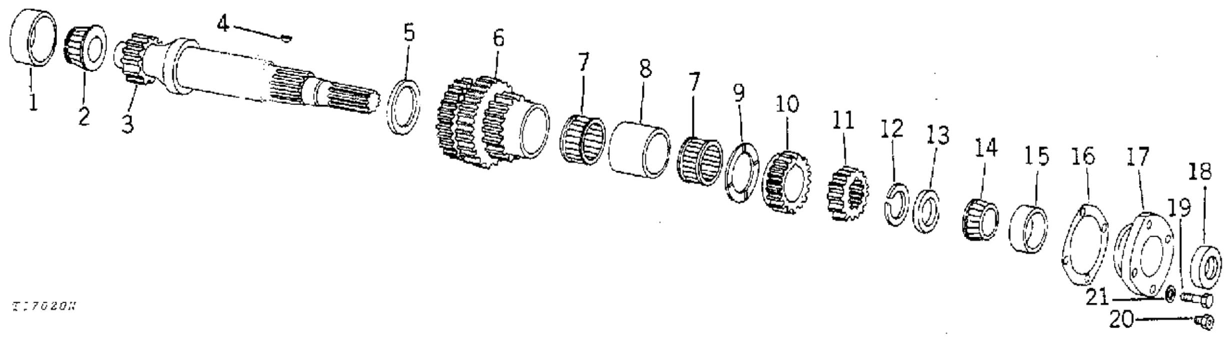
Remove right and left hand bearing quills (5 and 11). Remove ring gear assembly out of housing.

Remove pinion shaft front bearing cover, pull cotter pin from end of shaft and remove nut retainer. Lock transmission gears and remove bearing retainer nut and special washer. Support pinion shaft with one hand and tap front end of shaft to free front bearing cone. Slide shaft rearward. Continue to slide shaft rearward removing the three sliding gears as they slip off the end of the shaft. Pull shaft and rear bearing from rear end of case.



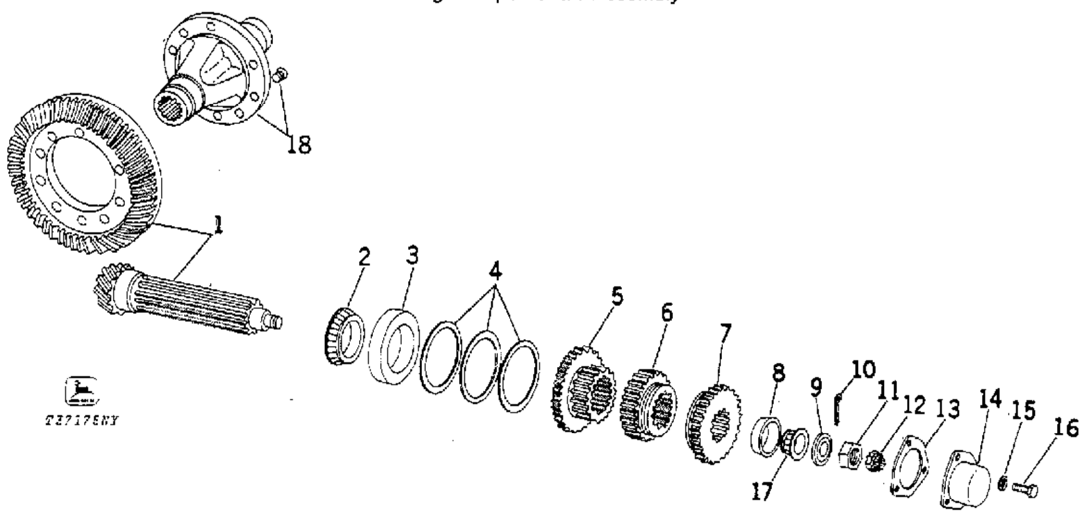
1—Oil Seal (2 used)
2—Thrust Washer
3—Cap Screw (12 used)
4—Lock Washer (12 used)
5—Bearing Quill, R.H.
6—Bushing
7—Shim (as required)
8—Oil Seal (2 used)
9—Bearing Cup
10—Bearing Cone
11—Bearing Quill, L.H.
12—Pinion Shaft with Ring Gear
13—O-Rings (4 used)

Fig. 1-Ring Gear and Hub



1—Bearing Cup
2—Bearing Cone
3—Input Shaft
4—Woodruff Key
5—Rear Washer
6—First- and Second-Speed Cluster Gear
7—Bearing (2 used)
8—Spacer
9—Thrust Washer
10—Fourth-Speed Gear
11—Third-Speed Gear
12—Snap Ring
13—Input Shaft Bearing Spacer
14—Bearing Cone
15—Bearing Cup
16—Shim (as required)
17—Quill
18—Oil Seal
19—Cap Screw (3 used)
20—Special Cap Screw
21—Special Washer (4 used)

Fig. 2-Input Shaft Assembly



1—Pinion Shaft and Ring Gear (Matched Set)
2—Bearing Cone
3—Bearing Cup
4—Shims (as required)
5—Sliding Gear (Second- and Reverse-Speed)
6—Sliding Gear (First- and Fourth-Speed)
7—Sliding Gear (Third-Speed)
8—Bearing Cup
9—Special Washer
10—Cotter Pin
11—Bearing Retainer Nut
12—Bearing Nut Retainer
13—Gasket
14—Cover
15—Special Washer (3 used)
16—Cap Screw (3 used)
17—Bearing Cone
18—Ring Gear Hub and Rivets

Fig. 3-Pinion Shaft and Ring Gear Assembly

All parts must be clean to permit effective inspection. During assembly, it is very important that no dirt or foreign matter enters the transmission. Even minute particles can cause the malfunction of close-fitting parts.

All metallic parts of the transmission (except bearings) should be cleaned thoroughly with volatile mineral spirits, or by the steam-cleaning method. Do not use a caustic soda solution for steam cleaning. Gum and varnish deposits should be removed by allowing the parts to soak in varnish remover.

Parts should be dried with compressed air. Steam-cleaned parts should be oiled immediately after drying.

After cleaning, examine the parts and especially the oil passages to make certain they are entirely clean. Reclean them, if necessary.

Bearings that have been in service should be thoroughly washed in volatile mineral spirits.

If the bearings are particularly dirty or filled with hardened grease, soak them in the spirits before trying to clean them.

Before inspection, oil the bearings with the same type of oil that will be used in the transmission.

NOTE: Never spin dry bearings with compressed air. Do not rotate bearings while they are not lubricated.

Inspect bearings for roughness of rotation. Replace a bearing if its rotation is still rough after cleaning and oiling.

Inspect bearings for scored, pitted, scratched, cracked or chipped races, and for indication of excessive wear of rollers or balls. If one of these defects is found, replace the bearing.

Inspect the defective bearing's housing and shaft for grooved, burred, or galled conditions that indicate the bearing has been turning in its housing or on its shaft. If the damage cannot be repaired with crocus cloth, replace the defective part.

Inspect gears for scuffed, nicked, burred, or broken teeth. If the defect cannot be removed with a soft honing stone, replace the gear.

Inspect gear teeth for wear that may have destroyed the original tooth shape. If this condition is found, replace the gear.

Inspect the thrust faces of gears for scores, scratches, and burrs. Remove such defects with a soft honing stone.

IMPORTANT: If the spiral bevel pinion is no longer serviceable and must be replaced, it will be necessary to replace the ring gear also as these parts are furnished only as matched sets.

To rivet ring gear to ring gear hub, heat ring gear to 200°F (93°C). Press heated ring gear on ring gear hub to seat squarely on hub.

Start rivets in all locations around ring gear hub prior to the seating of any rivets.

Seat rivets in ring gear until holes in gear are filled evenly with rivets.

When installing oil seals (1 and 8, Fig. 1) into quills (5 and 11), coat lips of oil seals with Lubriplate or an equivalent.

Press oil seal (1) until it bottoms in bore of quill.

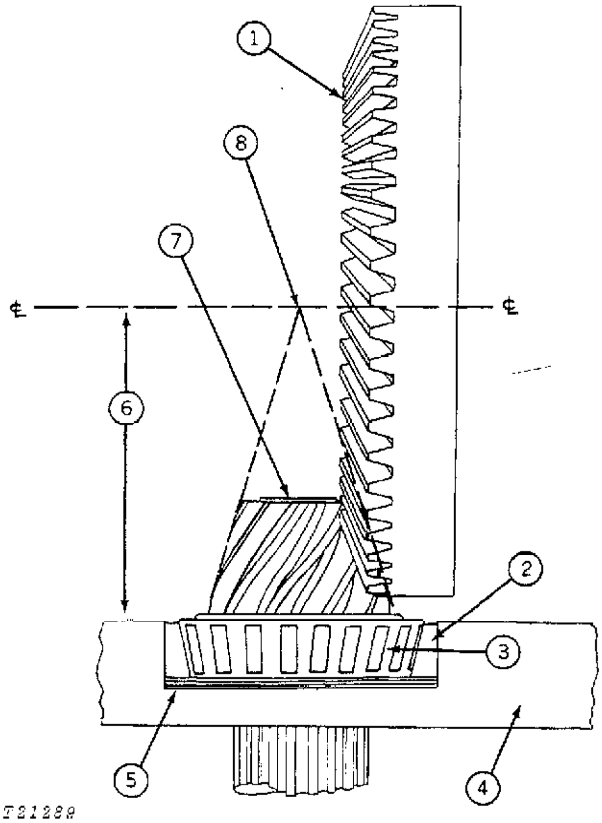
Press oil seal (8) with spring on seal lip facing inward toward steering clutch housing until it bottoms in bore of quill.

Press bushing (6) flush with outside surface of quill. Lubriplate inside of bushing.

When installing a new transmission case, ring gear and pinion set, or the bearing quills, cones, or cups which support these parts, it will be necessary to make certain adjustments to be sure of proper tooth contact, quiet operation, and longer service life. These adjustments are as follows:

Cone Point Adjustment

The pinion is actually a part of a cone; that is, if the pitch lines of the pinion teeth were extended they would come together at a cone point (Fig. 4). The dimension which is etched on the end of each pinion is the actual distance from the base of the pinion gear to the cone point.



1—Ring Gear
2—Cup
3—Bearing Cone
4—Differential Compartment Front Wall
5—Shims
6—Dimension of Pinion
7—Etched Dimension on Pinion
8—Cone Point

Fig. 4-Ring Gear and Pinion Cone Point Adjustment

It is essential that the cone point of pinion be exactly on centerline of ring gear as shown.

This relationship is obtained by controlling the number of shims between the spiral bevel pinion shaft rear bearing cup and transmission case.

To determine number of shims required proceed as follows:

A. Press the bearing cone on the spiral bevel pinion. With the bearing cup held tightly against the cone, measure the width of the bearing cone and cup from the mounting shoulder on the cone to the mounting shoulder on the cup. Add 0.003 in. (0.076 mm) which is the standard allowance for the increased length of the bearing cone and cup when the cup is pressed into the transmission case.

B. Observe the actual dimension that is stamped on the top rear of the transmission case. This dimension is the distance from the center line of the ring gear cross-bores to the spiral bevel pinion shaft bearing cup backing shoulder in the transmission case. If the dimension is not on the top rear of the transmission case, use the dimension given in the example to determine the shim pack.

C. Observe the dimension etched on the ground face of the bevel pinion.

D. To determine shim pack, subtract the sum of the measurements from Step A and C from measurement observed in Step B.

Example: 5.188-inch (131.78 mm), the number etched on the pinion, plus 1.196-inch (30.38 mm), the nominal bearing cone and cup measurement, equals 6.384-inch (162.15 mm). Subtracting this from 6.406-inch (162.71 mm), the number etched on the transmission case, equals 0.022-inch (0.56 mm), the total thickness of shims that must be added.

After correct shim pack has been installed behind bearing cup, proceed with "Ring Gear Bearing Preload Adjustment."

Ring Gear Bearing Preload Adjustment

Two adjustments of the ring gear and hub assembly are necessary for quiet and proper operation. They are:

a. Preload on bearings of 0.002 to 0.005-in (0.05 to 0.13 mm).
b. Backlash between ring gear and output shaft pinion of 0.006 to 0.008-in. (0.15 to 0.20 mm).

These adjustments are made by use of shims located between the transmission case and ring gear hub bearing quill (Fig. 5). The total thickness of shims on both sides determines the preload. Backlash is established by shifting shims from one side to the other. Preload must be adjusted before checking backlash.

To determine thickness of shim packs required to preload ring gear bearings as specified, proceed as follows:

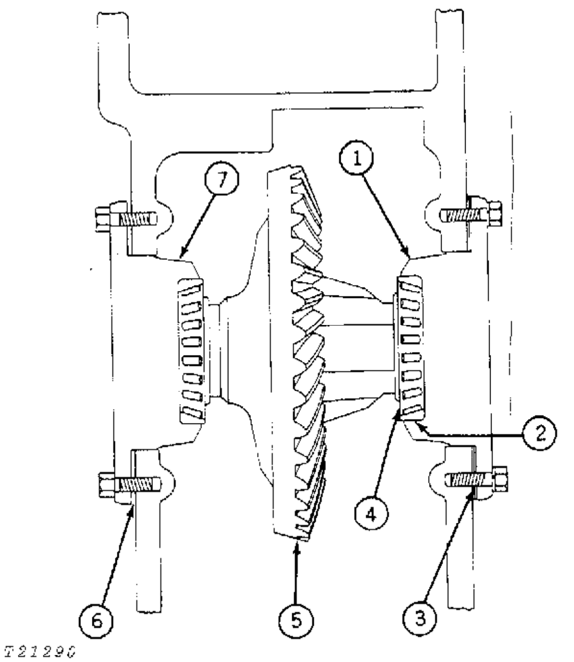
1. Place the ring gear and hub assembly in transmission case (refer to Figs. 2 and 5 for identification of parts).

2. As a starting point, use no shims between the transmission case and the right-hand ring gear hub bearing quill.

3. Install right-hand quill so that the right-hand bearing cone fits into the right-hand bearing cup. Secure with cap screws.

4. Install the left bearing quill with three cap screws but without lock washers. Tighten these cap screws as evenly as possible until the ring gear hub has neither end play nor preload.

5. Use a feeler gauge to measure the distance between the quill and the transmission at three places evenly spaced around the quill to arrive at an average measurement.



1—Right-Hand Quill
2—Bearing Cup
3—Shims
4—Bearing Cone
5—Ring Gear and Hub
6—Space
7—Left-Hand Quill

Fig. 5-Ring Gear and Hub Bearing Preload Adjustment

6. This measurement, less amount required for preload of 0.002 to 0.005-in. (0.05 to 0.13 mm), is the correct shim pack for the left-hand quill in order to provide proper preload.

7. Once ring gear bearing preload has been set, remove ring gear from transmission case being sure that right-hand quill (and its shims) and left-hand quill (and its shims) are tagged and kept together so that they may be correctly reinstalled.

Install pinion shaft. (Refer to Fig. 3 for identification of parts and their sequence of installation).

Slide pinion shaft with rear bearing cone into transmission case. Install sliding gears on the pinion shaft. Position bearing cup (8), bearing cone (17), washer (9) and bearing retainer nut (11).

To establish preload and rolling torque in pinion shaft, proceed as follows:

Tighten bearing retainer nut to obtain a specified rolling torque (6 to 12 lb-in [0.07 to 0.14 kg-m]). Tighten nut until there is no end play, then advance nut 1/12 turn. Check rolling torque.

If rolling torque is low (below 6 lbs-in [0.07 kg-m]) advance the bearing retainer nut until the specified rolling torque is obtained. If rolling torque is over specified torque (12 in-lbs [0.14 kg-m]), back-off bearing retainer nut and bearing until end play is felt, then advance nut to obtain correct rolling torque.

After correct preload (0.002 to 0.005-in [0.05 to 0.13 mm]) is obtained install bearing nut retainer (12) and cotter pin. Tighten bearing retainer nut if necessary to install cotter pin.

Spiral Bevel Pinion and Ring Gear Backlash

Reinstall the ring gear and hub assembly and quills with their proper number of shims.

To determine amount of shims required in the left and right shim pack to provide 0.006 to 0.008-in (0.15 to 0.20 mm) backlash between ring gear and pinion, proceed as follows:

1. Set up a dial indicator as shown in Fig. 6, (indicator at outer end of ring gear tooth face) and measure backlash at several different points around the entire circumference of ring gear. Reading should be 0.006 to 0.008-in (0.15 to 0.20 mm) at point of least backlash between pinion shaft and ring gear. Backlash should not exceed 0.012-in. (0.30 mm) at point of greatest backlash.

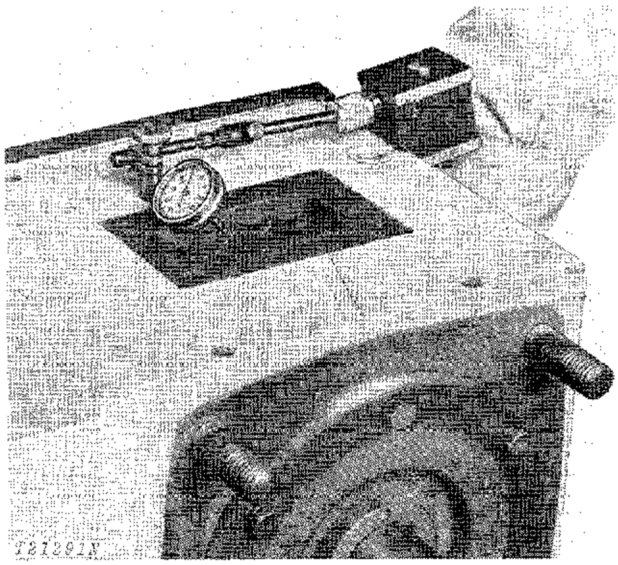


Fig. 6-Measuring Pinion and Ring Gear Backlash

2. Transferring shims from left quill to right quill decreases the backlash. To increase backlash, shims must be transferred from right to left side.

NOTE: Backlash is reduced or increased an amount less than the shim thickness.

Backlash movement compared to shim thickness is as follows:

Shim Thickness	Approximate Backlash Movement
0.010-inch	0.008-inch (0.20 mm)
0.005-inch	0.004-inch (0.10 mm)
0.002-inch	0.0016-inch (0.04 mm)

IMPORTANT: If shims are removed from one bearing quill, same shims must be added to the other bearing quill to maintain proper pre-load adjustment on ring gear bearings.

Install Input Shaft

It is very important that all parts be installed on the input shaft in the correct order and proper position. Refer to Fig. 2, for guidance.

1. Install rear bearing cone (2) with large diameter against integral gear. Use an arbor press and sleeve to install bearing cone.

2. Install flat side of rear washer (5) next to cluster gear.

3. Install cluster gear (6) with bearing, spacer and bearing on shaft with small gear toward front of shaft.

NOTE: Lubricate bearings (7) before assembly.

4. Place thrust (9) washer on shaft.

5. Place Woodruff key on shaft. Press fourth-speed drive gear (10) on shaft with rounded teeth toward rear of transmission.

6. Slide third-speed drive gear (11) onto shaft with rounded teeth toward front of tractor. Secure snap ring against gear. Slide spacer onto shaft.

7. Install front bearing cone (14) with large diameter toward rear of shaft.

Slip splined end of assembled input shaft through transmission cover hole and into front bearing quill bore of transmission case. Lower input shaft into case and slip it to the rear so that rear bearing cone seats in rear bearing cup. Hold shaft level and install front bearing quill with shims under quill. Draw cap screws down tightly. Make sure that shaft does not begin to bind. Rotate shaft to be sure bearings are seating properly.

Proper end play (0.002 to 0.004-in. [0.05 to 0.10 mm]) of the input shaft is established by shims under the front bearing quill.

INSTALLATION

Refer to "Removal" and reverse procedure to install assembly in crawler.

Apply John Deere Loctite plastic gasket or an equivalent between steering clutch housing and transmission case and between final drive housing and steering clutch housing.

Group 0225
PINION DRIVE SHAFT

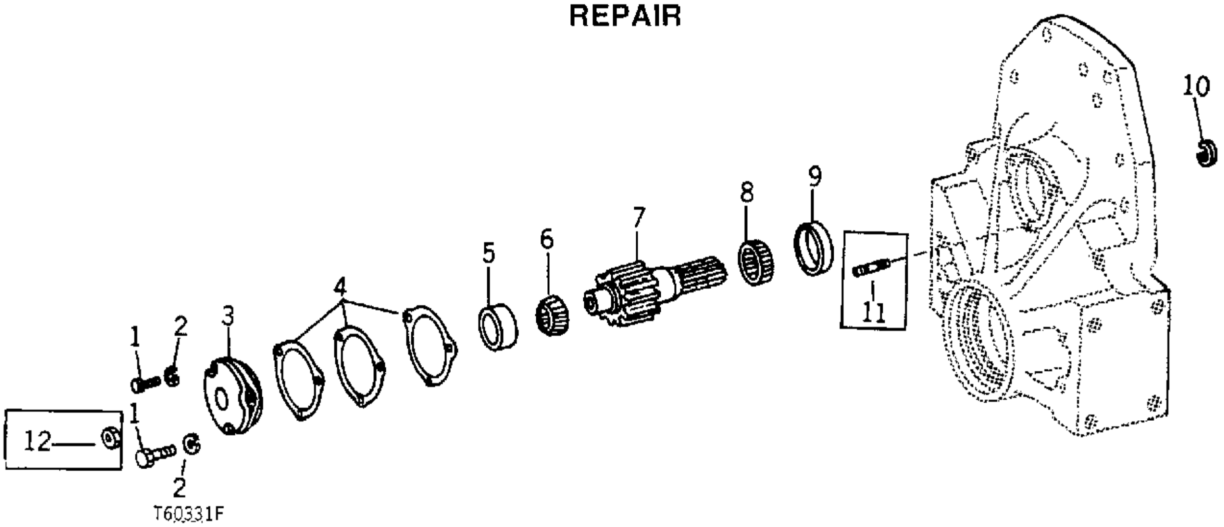
GENERAL INFORMATION

The pinion drive shaft is splined to the steering brake drums and drives a large bull gear which in turn drives the flanged axle.

REMOVAL

For removal refer to Group 0201.

REPAIR



1—Cap Screw (4 used) (-278429)
(6 used) (278430-)
2—Lock Washers (6 used)
3—Quill (2 used)
4—Shim (as required)
5—Bearing Cup
6—Bearing Cone
7—Pinion Shaft
8—Bearing Cone
9—Bearing Cup
10—Snap Ring
11—Stud (2 used) (-278429)
12—Hex. Nut (2 used) (-278429)

Fig. 1-Pinion Shaft Components

Examine pinion shaft (7, Fig. 1) for excessive spline wear and damage to the bearing contact areas. The bearing contact areas must be free of nicks, burrs, and roughness. Check pinion shaft for damage or excessively worn gear teeth. Replace pinion shaft if necessary.

Inspect bearing quill (3) for damage or excessive wear and replace if necessary.

Bearings that have been in service should be thoroughly washed in volatile mineral spirits.

If the bearings are particularly dirty or filled with hardened grease, soak them in the spirits before trying to clean them.

NOTE: Never spin dry bearings with compressed air. Do not rotate bearings while they are not lubricated.

Inspect bearings for roughness of rotation. Replace a bearing if its rotation is still rough after cleaning and oiling.

Inspect bearings for scored, pitted, scratched, cracked or chipped races, and for indication of excessive wear of rollers or balls. If one of these defects is found, replace the bearing.

INSTALLATION

Fill input shaft outer bearing quill (3, Fig. 1) with AT30408 High Temperature Grease or an equivalent prior to installation.

Pack input shaft inner bearing cone (8) and outer bearing cone (6) with AT30408 High Temperature Grease or an equivalent prior to installing shaft in housing. Be sure grease does not damage seal in drive axle housing.

Install pinion shaft (7) in drive axle housing with enough shims to obtain a measurable amount of end play. Install bearing quill and tighten cap screws.

Using a dial indicator, record the end play. Take from the shim pack the thickness of shims equal to the end play reading plus an additional 0.002-inch (0.05 mm) to give the desired preload setting. Remove pinion shaft.

Apply a thin even coat of Permatex Form-A-Gasket No. 3 or an equivalent to the machine surface of the final drive housing and outer bearing quill before installing the predetermined shim pack.

Coat threads of final drive shaft outer bearing quill stud (11, Fig. 1) or cap screw (1) with John Deere Loctite Sealer or an equivalent just prior to installing in final drive housing.

Install pinion shaft and bearing quill and secure.

Apply John Deere Loctite Plastic Gasket or an equivalent to the machine surface of the steering clutch housing.

Position drive axle housing and secure.

NOTE: Do not force the pinion shaft into position as forcing the shaft will misalign the bearings and damage the inner splines on the steering clutch.

Group 0250
AXLE SHAFT BEARINGS AND REDUCTION GEARS

GENERAL INFORMATION

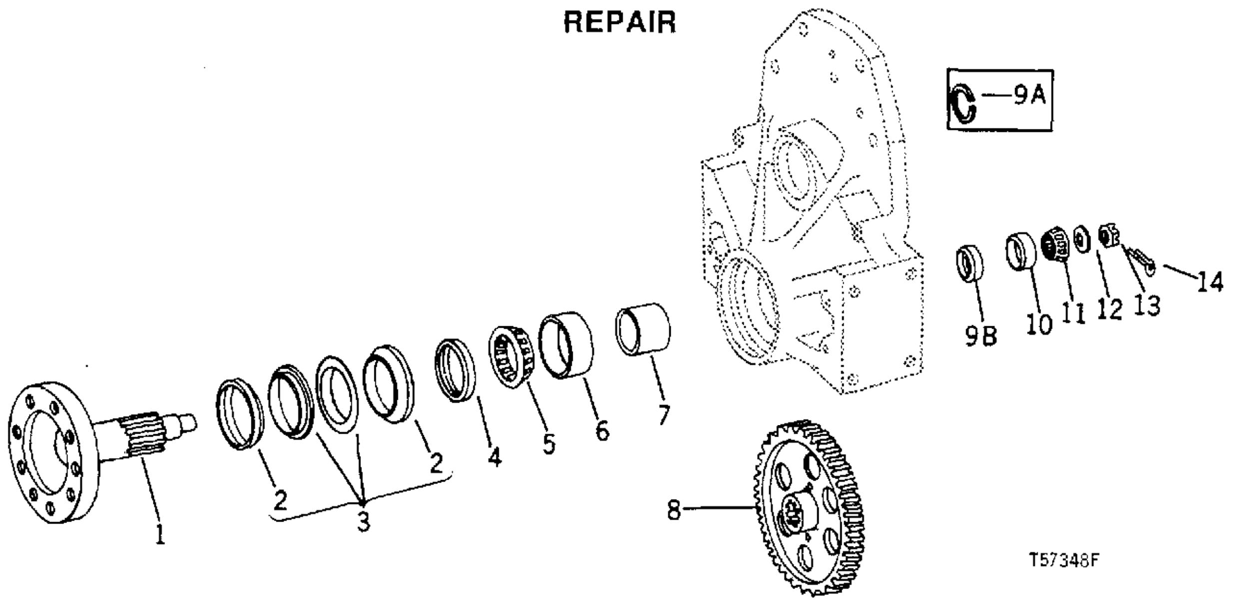
Power is transmitted from the steering clutches to the rear track drive of the crawler.

Each track drive unit contains one flanged axle mounted on two tapered roller bearings and is driven off the pinion drive shaft by a large bull gear.

REMOVAL

For removal refer to Group 0201.

REPAIR



1—Flanged Axle
2—Belleville Washers
3—Oil Seal Kit
4—Spacer
5—Bearing Cone
6 —Bearing Cup
7 —Spacer
8 —Gear
9A—Snap Ring (-276370)
9B—Spacer (276371-)
10—Bearing Cup
11—Bearing Cone
12—Washer
13—Slotted Nut
14—Cotter Pin

Fig. 1-Flanged Axle Components

Remove oil pan from bottom of housing. Remove cotter pin, hex nut, and washer from flanged axle shaft.

Reverse slotted nut (13, Fig. 1) and tighten on flanged axle. Make a plate as shown in Specifications and Special Tools to match bolt pattern in final drive housing.

Position plate over reversed slotted nut and tighten cap screws evenly to push flanged axle from its seat.

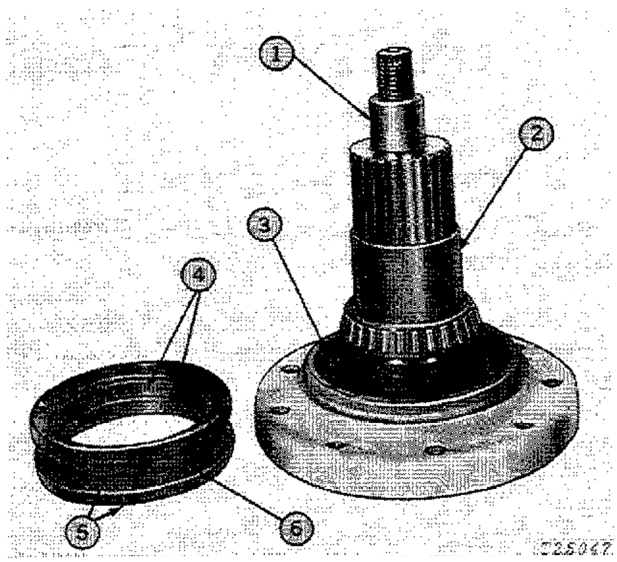
Remove washer (12), bearing cone (11), bearing cup (10) and snap ring (9A) or spacer (9B) from flanged axle. Then slide flanged axle and remaining parts from final drive housing.

Remove bearing cone (5, Fig. 1) from flanged axle by attaching a knife-edge puller under bearing.

Examine splines on axle shaft for galling or excessive spline wear. Remove all metal deposits from splines caused by galling. Inspect final drive gear (8) for wear or damage to gear teeth or splines.

Carefully inspect bearings for wear which may have been caused by foreign material entering the housing through a damaged seal. Inspect the drive axle housing for any damage which would make it unserviceable.

IMPORTANT: Belleville washers on the flanged axle oil seal must be replaced every time axle shaft is removed from drive axle housing.



1—Flanged Axle
2—Axle Bearing Spacer
3—Oil Seal Bearing Area
4—Metal Sealing Rings
5—Rubber Sealing Rings
6—Plastic Retainer Band

Fig. 2-Replacing Flanged Axle Oil Seal

Examine sealing faces for wear to determine whether seal rings can be reused or must be replaced. If highly polished sealing band is in the middle or toward the outside of the seal face, sealing rings can be reused. If highly polished sealing band is not uniform or is toward the inside of the seal face, sealing rings must be replaced.

1. Clean the bores and shoulders where oil seal fits with a cleaning solvent and wipe dry. Surfaces that contact rubber sealing rings must be free of grease, oil, dirt, and scale.

2. Remove and discard retainer band from seal. Check rubber sealing rings to be sure they are flush against the inside shoulder of the metal sealing rings.

3. All seal parts must be free of grease, oil, dirt, and scale.

4. Sealing rings must be handled with care. The lapped sealing faces of the metal sealing rings must not be damaged, scratched, or contaminated with dirt or grease.

5. Install one seal half (metal ring and rubber ring) into the final drive housing. Install second seal half (metal ring and rubber ring) into the flanged axle. Check each seal half to be sure that seal is not cocked and that rubber rings are seated evenly at the bottom of the bore.

6. Wipe both metal sealing faces clean with a lint free wiper and apply a thin film of clean SAE 30 oil.

IMPORTANT: Oil must not wet areas other than the lapped surface of the metal sealing rings.

Slip outer spacer onto axle with chamfer side of spacer to radius of shaft.

Press the outer bearing cone against spacer.

Place inner spacer on shaft next to bearing.

Roll final drive gear into housing.

IMPORTANT: Make certain gear is inserted with long hub end toward sprocket side of housing.

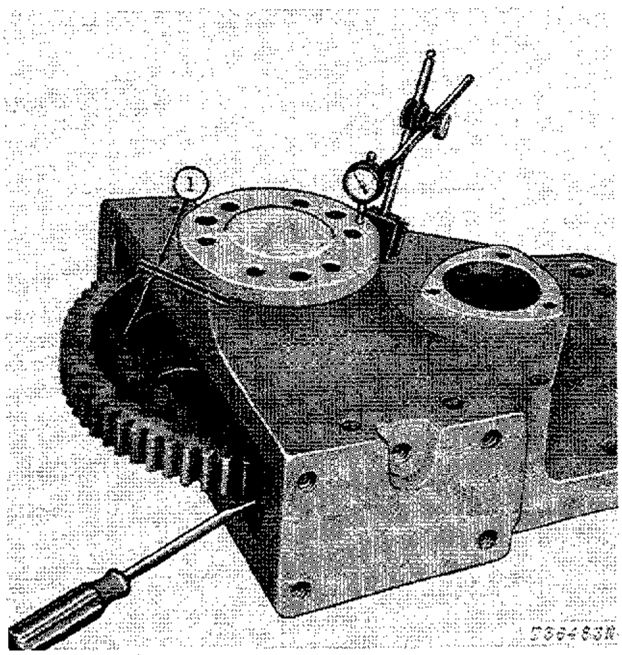
When installing flanged axle shaft, avoid getting any dirt, oil, or other foreign material on oil seal.

Install snap ring (9A, Fig. 1) or spacer (9B) after flanged axle passes bull gear. Start inner bearing cone on shaft. Place washer on end of shaft and start slotted hex. nut on shaft.

With all parts assembled on the flanged axle shaft, tighten nut to get 0.001 to 0.005 inch (0.3 to 0.13 mm) end play (Fig. 3).

Rotate axle shaft six times in each direction to seat roller bearings.

Advance nut (if necessary) to nearest alignment of slot in nut with hole in shaft.



1—End Play

Fig. 3-Measuring Axle Shaft Induced End Play

Tighten nut one additional slot and insert cotter pin.

NOTE: Rolling torque with new bearings is 90 to 115 lb-in (1.0 to 1.3 kg-m). Rolling torque with used bearings is 70 to 85 lb-in (0.8 to 1.0 kg-m).

Install drive axle housing oil pan to drive axle housing. Use Loctite Plastic Gasket between oil pan and housing. Tighten all cap screws.

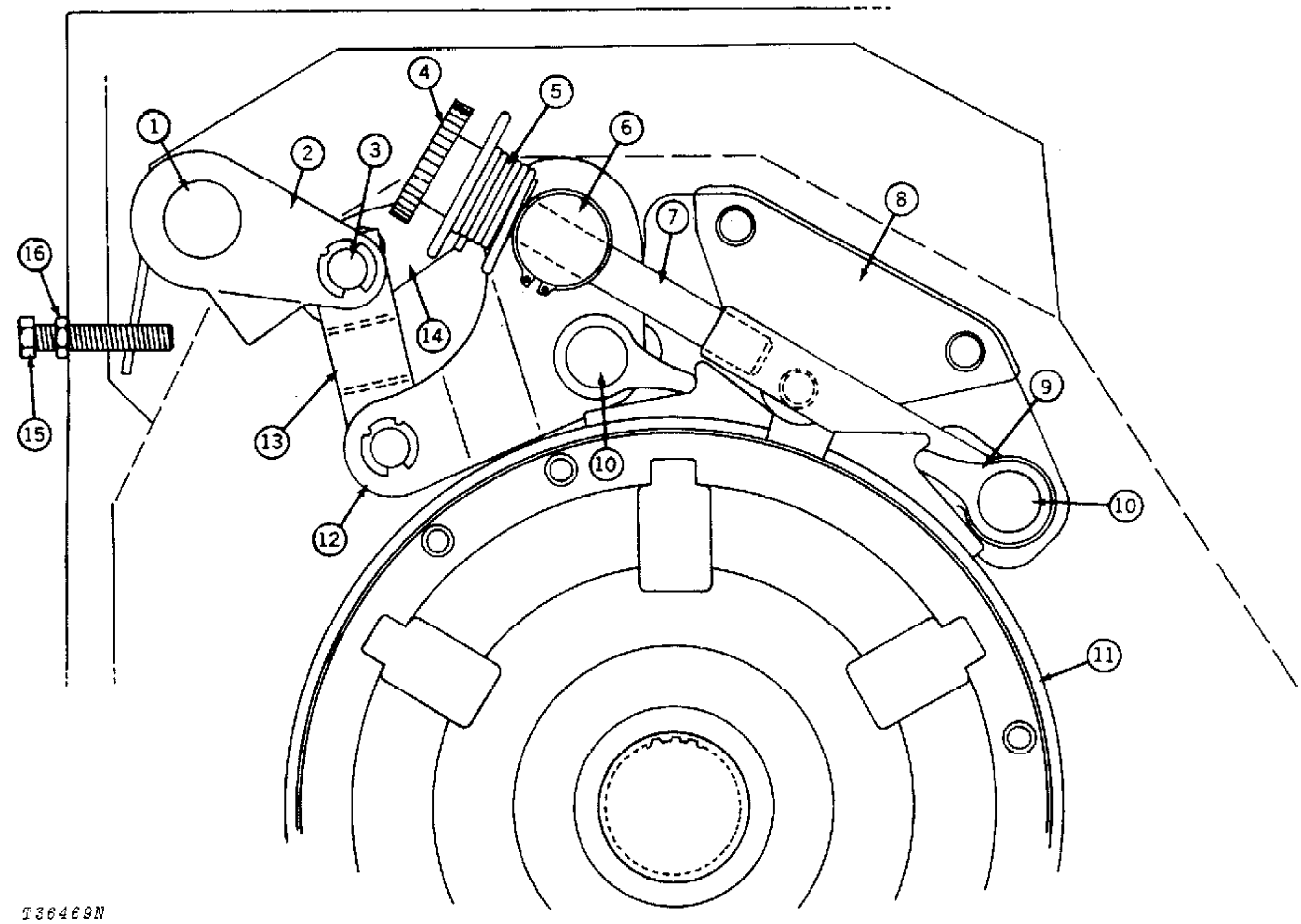
INSTALLATION

Before installing drive axle housing on crawler, install pinion shaft in housing. Install a preliminary shim pack to record a measurable amount of end play. Refer to Group 0225 for instructions.

Refer to Group 0201 and install drive axle housing assembly.

STEERING CLUTCHES AND BRAKES

GENERAL INFORMATION



1—Brake Lever Shaft
2—Brake Lever
3—Pin
4—Adjusting Nut
5—Spring
6—Pin
7—Stud
8—Brake Anchor
9—Brake Strut
10—Pin
11—Brake Band
12—Brake Band Yoke
13—Link
14—Adjusting Link
15—Brake Lever Adjusting Screw
16—Jam Nut

Fig. 4-Steering-Brake Assembly

The combination clutch and brake mechanism on each rear axle engages or disengages the flow of power to each rear axle by means of individual steering levers.

In addition, a brake pedal is used to stop tractor motion on both axles by means of a contracting brake band device. The relationship of steering clutch and brake linkage is shown in Fig. 4.

REMOVAL

Disconnect track assembly and remove track drive sprocket.

Disconnect all the necessary wiring, linkage and lines from rear tank unit (hydraulic reservoir, battery box and fuel tank). Remove cap screws securing rear tank unit support to steering clutch housing and lift rear tank unit from machine.

Remove cap screws from drive axle housing securing brake anchor to drive axle housing.

Remove steering clutch housing cover.

NOTE: On new brake anchors, the part has been revised so the anchor can be removed and installed through the top of the steering clutch housing.

Refer to Group 0201 and remove drive axle housing.

Disconnect spring from pin (3, Fig. 4). Remove pin.

Remove adjusting nut (4).

Remove retaining rings (10, Fig. 5) from forward pin (9) and remove forward brake strut (11).

Remove brake band (14, Fig. 5) out side of steering clutch housing.

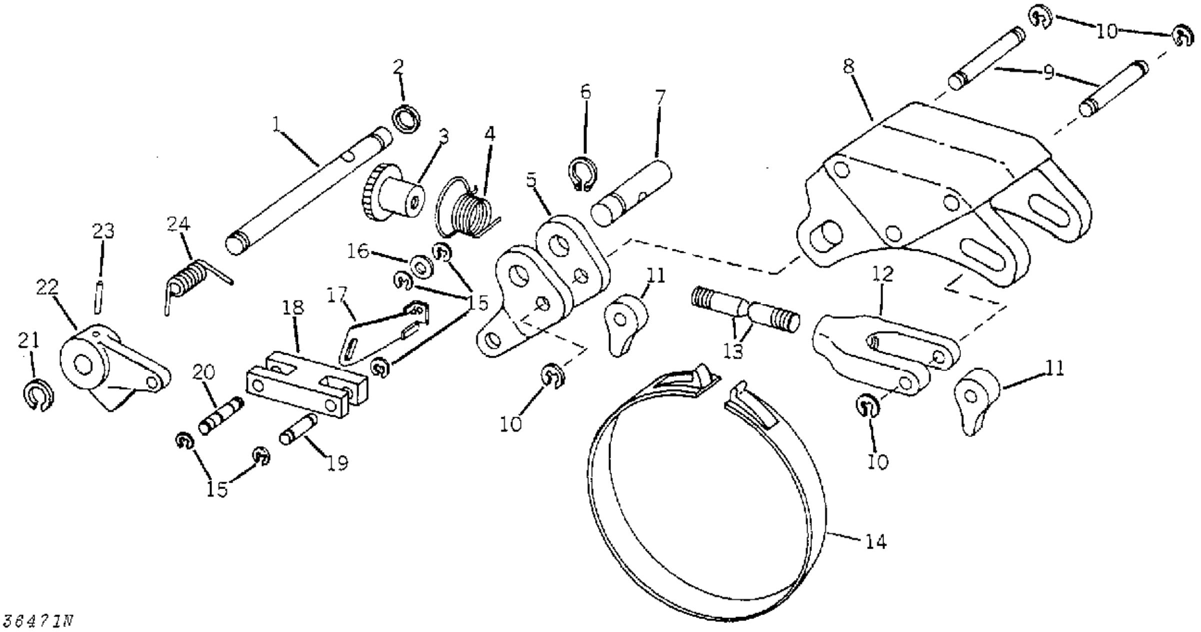
Slide steering clutch assembly off steering clutch drive shaft.

Remove steering clutch drive shaft.

To service steering clutch housing, remove ring gear hub bearing quill and pressure and bleed tubes. Be careful not to damage shim pack.

Remove cap screws attaching steering clutch housing to transmission case and remove steering clutch housing with the aid of a hoist.

REPAIR



1—Brake Lever Shaft
2—Oil Seal
3—Adjusting Nut
4—Spring
5—Brake Band Yoke
6—Snap Ring
7—Pin
8—Brake Anchor
9—Pin (2 used)
10—Retaining Ring (4 used)
11—Brake Strut (2 used)
12—Brake Yoke
13—Stud
14—Brake Band
15—Snap Ring (5 used)
16—Special Washer
17—Adjusting Link
18—Link
19—Pin
20—Pin
21—Snap Ring
22—Brake Lever
23—Groove Pin
24—Spring

Fig. 5-Brake Anchor and Band

Check brake band (14, Fig. 5) for worn condition. Replace if cross hatch pattern of lining has worn thin.

Check pins (9) for bent or worn condition. Replace as needed.

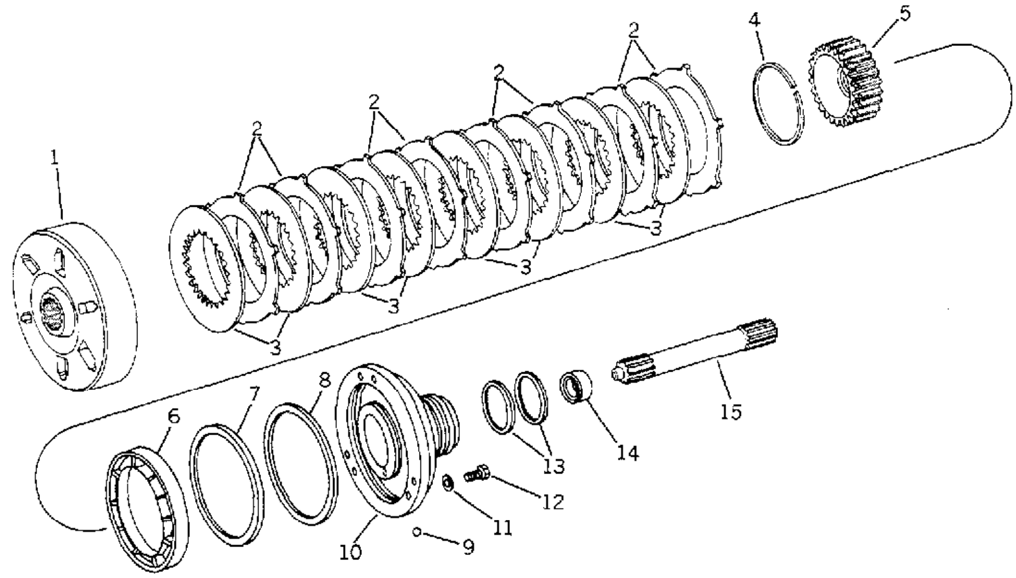
Replace any parts which may show damage or excessive wear.

When installing pin (7) the snap ring groove must be to the left as seen from the operator's seat.

Check springs (24) and (4) for broken coils.

IMPORTANT: When assembling brake anchor assembly in steering housing, make certain brake struts (11) are engaged properly with the brake band.

NOTE: Apply John Deere Loctite Hydraulic Sealant or an equivalent to threads of brake anchor cap screws before installation.



1—Steering Brake Drum	**6—Clutch Piston**	**11—Washer (6 used)**
2—Drive Plate (8 used)	**7—Sealing Ring**	**12—Cap Screw (6 used)**
3—Steering Clutch Facing (8 used)	**8—Sealing Ring**	**13—Sealing Ring (2 used)**
4—Snap Ring	**9—Ball**	**14—Pilot Ball Bearing**
5—Steering Clutch Hub	**10—Clutch Piston Housing**	**15—Clutch Drive Shaft**

Fig. 6-Steering Clutch Assembly

Remove pressure plate and inspect steel plates and composition facings for burrs, warpage, or excessive wear.

All plates and facings should be flat and free from defects of any kind. Examine brake drum for galls or scores. Remove any defects which may cause the brake to drag or operate improperly.

Install steel driving plates and composition facings in hub as follows:

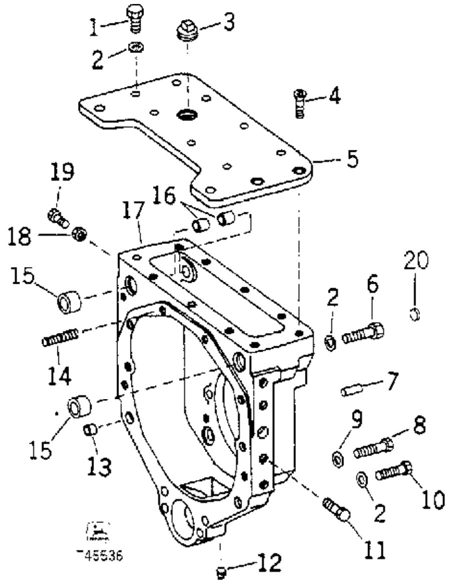
1. Install one composition facing against the brake drum.

2. With snap ring in place on hub, alternately install eight steel plates and seven composition facings on hub.

3. Install clutch housing and tighten cap screws.

Examine splines on shaft for damage or abnormal wear. Clutch hub is not intended to be a tight fit on clutch drive shaft. Do not be concerned if it is slightly loose.

Inspect pilot bearing (14, Fig. 6). If replacement is necessary, install a new bearing with open side in.



1—Cap Screw (10 used)
2—Washer (10 used)
3—Drum Plug
4—Flat Head Cap Screw (2 used)
5—Steering Clutch Housing Cover
6—Cap Screw (2 used)
7—Dowel Pin (2 used)
8—Cap Screw (2 used)
9—Washer (2 used)
10—Cap Screw (2 used)
11—Cap Screw (2 used)
12—Pipe Plug
13—Hollow Dowel (2 used)
14—Studs (2 used)
15—Expansion Plugs (2 used)
16—Bushings (2 used)
17—Steering Clutch Housing
18—Jam Nut
19—Cap Screw
20—Expansion Plug

Fig. 7-Right and Left Steering Clutch Housing

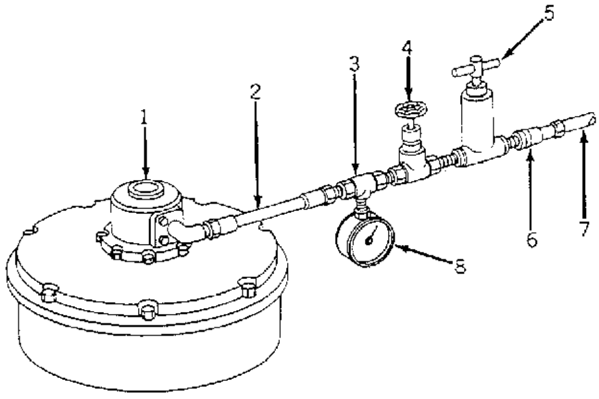
Clean steering clutch housing (17, Fig. 7) thoroughly and inspect for excessive wear, cracks, or other damage.

Press bushings (16) flush with seal shoulder and inside of steering clutch housing.

Drive studs (14) to 1.68 ± 0.06 inches (42.7 ± 1.5 mm) from machine surface of steering clutch housing.

Coat all steering clutch housing studs and pipe plugs with Permatex Form-A-Gasket No. 3 or an equivalent just prior to installation.

Leakage past the steering clutch piston or the oil seals between the clutch pressure manifold and the clutch piston housing, is extremely critical. A bench test and complete system test using air pressure has been developed to check for leakage. For this test you will need an air pressure supply, needle valve, air regulator, and appropriate fittings.



1—Steering Clutch Assembly
2—Pressure Hose
3—Tee
4—Needle Valve
5—Air Regulator
6—Disconnect Coupler
7—Air Supply Line
8—Pressure Gauge

Fig. 8-Clutch Leakage Test

Plug the bleed port on the clutch pressure manifold. Connect the air regulator, needle valve port, and air supply as shown (Fig. 8) to the pressure of the clutch pressure manifold. With the needle valve open, regulate pressure to 10 psi (1 kg/cm^2) of air pressure into the clutch system.

NOTE: Do not exceed 10 psi (1 kg/cm^2) as the oil seals may be blown from their seats causing a leak.

Tightly close the needle valve.

Remove air supply and watch for any drop in air pressure. The clutch should hold the 10 psi (1 kg/cm^2) pressure for 30 seconds. No (zero) leakage is allowed. If leakage occurs, rerun the test making sure that the bleed port is tightly plugged, and the needle valve is securely shut. If leakage persists, the cause is due to leakage past the oil seals, or piston seals. Replace the defective seals.

To test the complete steering system after assembly, rerun the test by plugging the pressure port of the steering valve housing and connecting the air supply to the leak-off port. The same procedure must be followed with the same results obtained.

INSTALLATION

If removed, coat steering clutch housing-to-transmission case with John Deere Loctite Plastic Gasket or an equivalent.

Position steering clutch housing and secure.

Tighten side frame-to-steering clutch cap screws before tightening side frame-to-engine clutch housing cap screws.

Attach ring gear hub bearing quill and pressure and bleed tubes.

Install steering clutch drive shaft and slide steering clutch assembly onto drive shaft.

Install brake band on brake drum.

Position brake anchor in steering clutch housing, install forward brake strut and secure with pin and retaining rings. Install adjusting nut.

Install pin (3, Fig. 4) and attach spring.

Refer to Group 0201 and install drive axle housing.

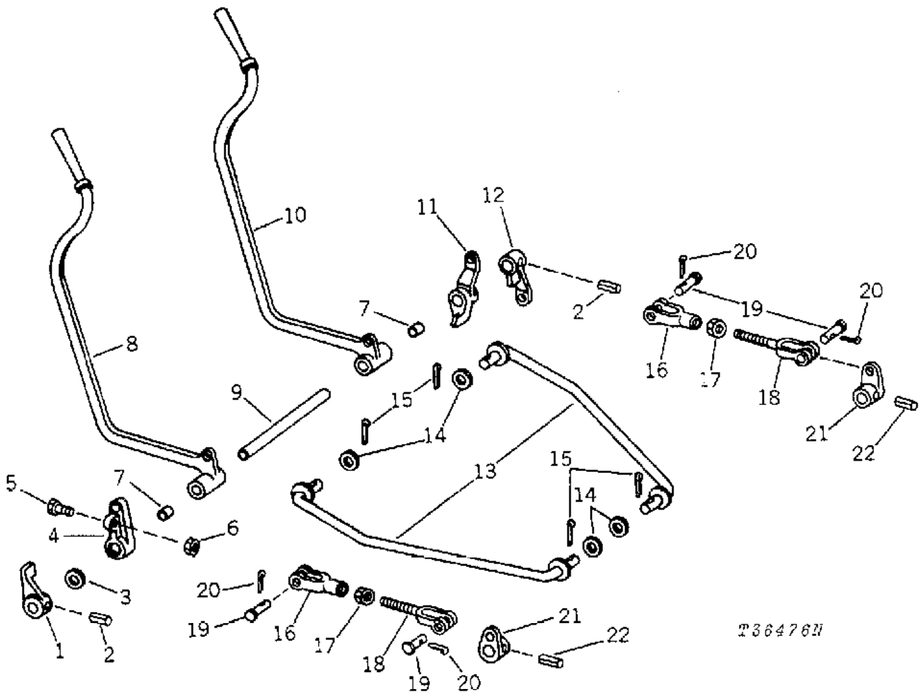
Install cap screws through drive axle housing securing brake anchor to steering clutch housing.

Refer to Section 9020 for the brake adjustment.

Apply John Deere Loctite Plastic Gasket or an equivalent to the steering clutch housing-to-steering clutch housing cover mating surfaces. Position and secure cover.

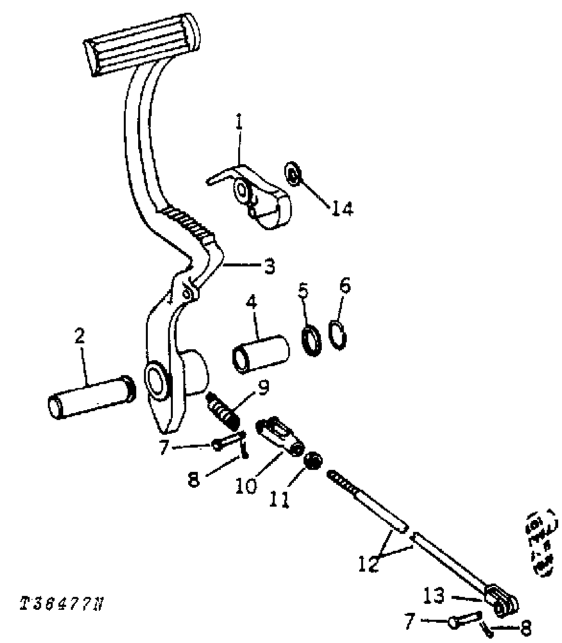
CONTROL LINKAGE

REPAIR



1—Brake Pickup Lever, L.H.
2—Grooved Pin (2 used)
3—Washer (as required)
4—Brake Control Lever, L.H.
5—Cap Screw
6—Jam Nut
7—Bushing (6 used)
8—Steering Lever, L.H.
9—Steering Lever Shaft
10—Steering Lever, R.H.
11—Brake Control Lever, R.H.
12—Brake Pickup Lever, R.H.
13—Steering Valve Rod (2 used)
14—Washers (4 used)
15—Cotter Pin (4 used)
16—Adjustable Yoke (2 used)
17—Jam Nut (2 used)
18—Adjustable Yoke End (2 used)
19—Pin (4 used)
20—Cotter Pin (4 used)
21—Brake Control Lever (2 used)
22—Grooved Pin (2 used)

Fig. 9-Lever Steering Control Linkage



1—Brake Lock
2—Brake Pedal Shaft
3—Brake Pedal
4—Bushing
5—Special Washer
6—Snap Ring
7—Headed Pin
8—Cotter Pin
9—Return Spring
10—Adjustable Yoke End
11—Jam Nut
12—Brake Rod
13—End Yoke
14—Washer

Fig. 10-Brake Pedal Linkage

Remove seat cushion, seat support from side tanks. and floor plate.

Disconnect linkage.

Examine bushing (7, Fig. 9) for worn condition. Replace as needed.

Check steering lever shaft (9) for bent or worn conditions.

Inspect brake rods (18) and steering valve rods (13) for bent condition. Replace as needed.

Check brake rod (12, Fig. 10) for bent condition. Replace if needed.

Examine brake shaft (2) and replace if excessively worn or damaged.

INSTALLATION

Install parts on support shafts using Figs. 9 and 10 as guides.

Press bushing (7, Fig. 9) into steering levers (8 and 10) and brake control levers (4 and 11) flush with chamfer. Lubricate bearings with John Deere Multi-Purpose Grease or an equivalent.

Install maximum number of washers (3) possible between control lever (4) and pick-up lever (1) to eliminate end play.

Connect steering lever linkage.

Install pins (7, Fig. 10) from inside.

Add additional washers (14) as required (not to exceed a total of four) on brake lock pivot shaft behind brake lock (1) to provide 0.125 in. (3.18 mm) contact between the platform and brake lock.

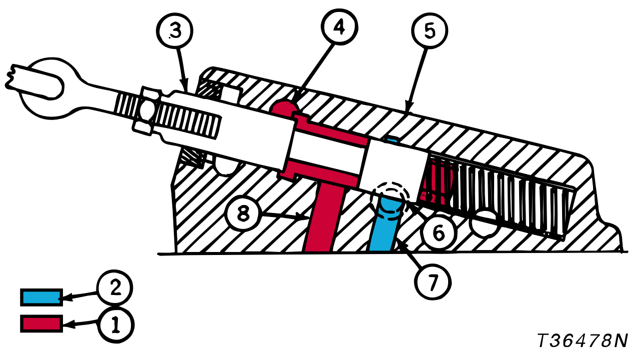
Connect brake rods.

See Section 90, Group 9020 for brake rod adjustment.

See Section 90, Group 9020 for steering valve rod adjustment.

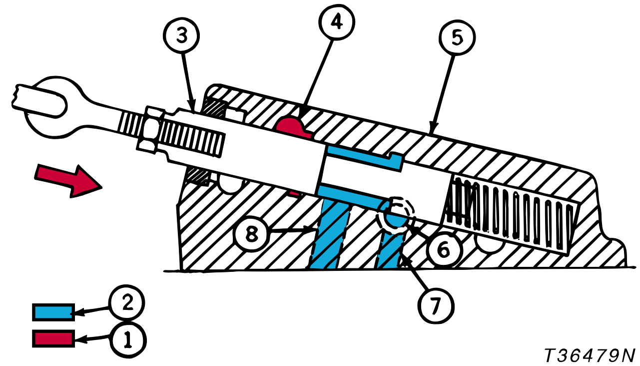
STEERING VALVE

GENERAL INFORMATION



1—Pressure Oil
2—Return Oil
3—Spool
4—Pressure Port
5—Housing
6—Return Port
7—Return Passage For Steering Clutch
8—Pressure Passage To Steering Clutch

Fig. 11-Steering Lever Released



1—Pressure Oil
2—Return Oil
3—Spool
4—Pressure Port
5—Housing
6—Return Port
7—Return Passage From Steering Clutches
8—Pressure Passage To Steering Clutch

Fig. 12-Steering Lever Moved Rearward

The steering valve housing (Fig. 13) contains two spools, one for the right steering clutch and one for the left steering clutch.

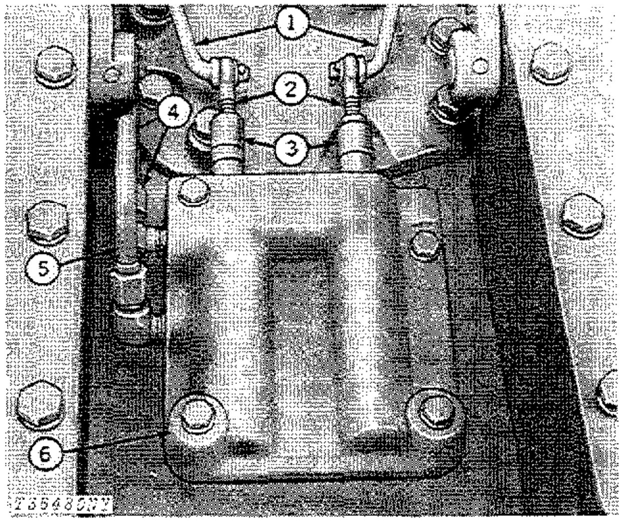
The pressure oil is supplied to the steering valve by the reverser pump through the reverser control valve.

When a steering lever is released (Fig. 13), the valve spool allows pressure oil to push against a piston in the clutch pack engaging the steering clutch.

When a steering lever is moved rearward (Fig. 12), it moves the valve spool rearward to block off the pressure passage and releases a small amount of oil from the clutch pack releasing the clutch pack.

The small amount of oil released from the clutch pack is returned back to the reverser housing sump by an exterior line.

REMOVAL



1—Steering Valve Rods
2—Eyebolts
3—Spools
4—Pressure Line
5—Return Line
6—Housing

Fig. 13-Steering Valve Spools and Housing

Remove seat.

Disconnect steering valve rods (1) from eyebolts (2).

Disconnect pressure and return lines (4 and 5).

Remove valve housing (6) from transmission.

NOTE: Valve spools can be removed for inspection or for replacing seals without removing housing from transmission.

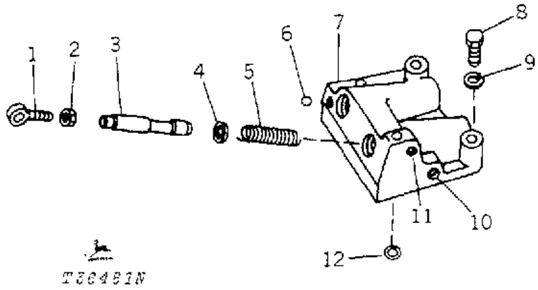
REPAIR

Disassembly

Slide valve spools (3, Fig. 14) out of housing.

Remove oil seals (4, Fig. 14).

Inspect valve spool bores and spools for scoring and pitting. Replace as necessary.



1—Eyebolt (2 used)
2—Nut (2 used)
3—Spool (2 used)
4—Oil Seal (2 used)
5—Spring (2 used)
6—Ball (3 used)
7—Housing
8—Cap Screw (4 used)
9—Lock Washer (4 used)
10—Return Port
11—Pressure Port
12—O-Ring (4 used)

Fig. 14-Steering Valve Assembly

Inspect springs for broken coils. Check spring length.

Spring free length is 3.47 in. (88.1 mm) and test length is 1.62 in. (41.5 mm) when compressed with 17.6 ± 2.5 lbs. (8 ± 1 kg).

Assembly

Install new oil seals with lip toward inside of valve bore.

Slide valve spools into housing.

INSTALLATION

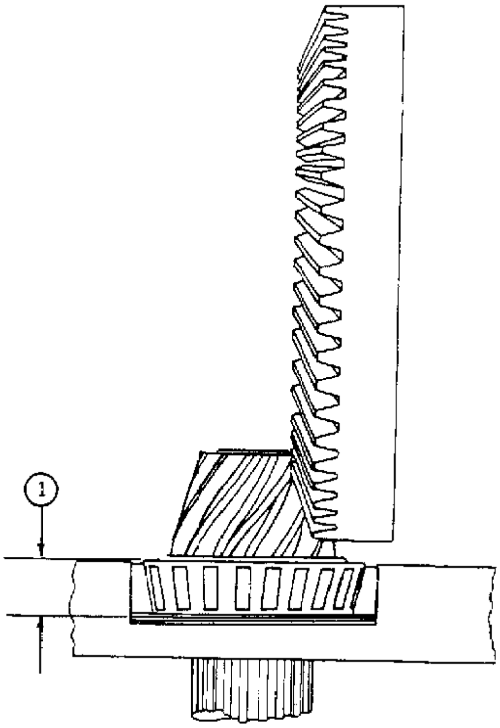
Position steering valve assembly on transmission case and tighten cap screws.

Connect oil lines and steering valve rods.

ADJUSTMENT

See Section 90, Group 9020.

Group 0299
SPECIFICATIONS AND SPECIAL TOOLS
BEVEL DRIVE
SPECIFICATIONS AND TORQUE VALUES



T32055N

Fig. 1-Pinion Shaft Bearing Cone

1. Nominal measurement of the height of the pinion shaft bearing cone and cup . . . . 1.196-in. (30.38 mm)

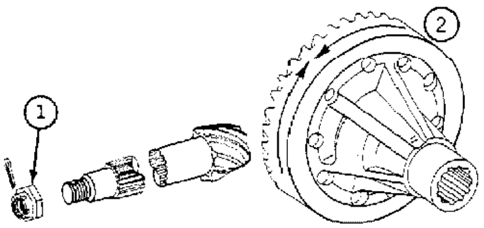


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Fig. 2-Pinion Shaft and Ring Gear

1. Pinion shaft rolling torque . . . . 6 to 12 lb-in (0.07 to 0.14 kg-m)
2. Ring gear-to-pinion shaft backlash . . . . 0.006 to 0.008-in. (0.15 to 0.20 mm)

BEVEL DRIVE

SPECIFICATIONS AND TORQUE VALUES—Continued

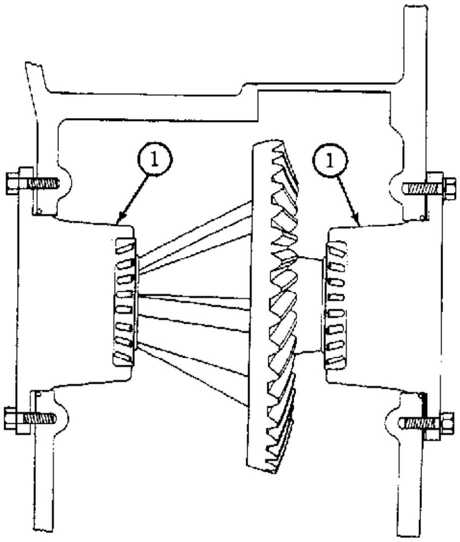


Fig. 3-Ring Gear and Hub Bearing

1. Ring gear bearing preload .... 0.002 to 0.005-in. (0.05 to 0.13 mm)

PINION DRIVE SHAFT

SPECIFICATIONS AND TORQUE VALUES

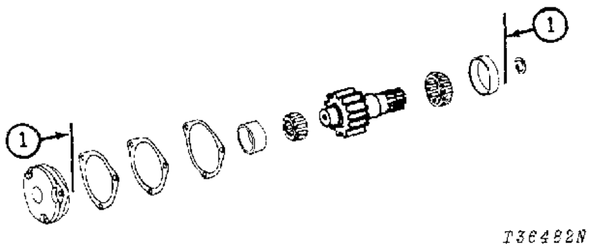


Fig. 4-Pinion Drive Shaft and Bearings

1. Pinion drive shaft bearing preload .... 0.000 to 0.003 in. (0.00 to 0.08 mm)

AXLE SHAFTS, BEARINGS AND REDUCTION GEARS

SPECIFICATIONS AND TORQUE VALUES

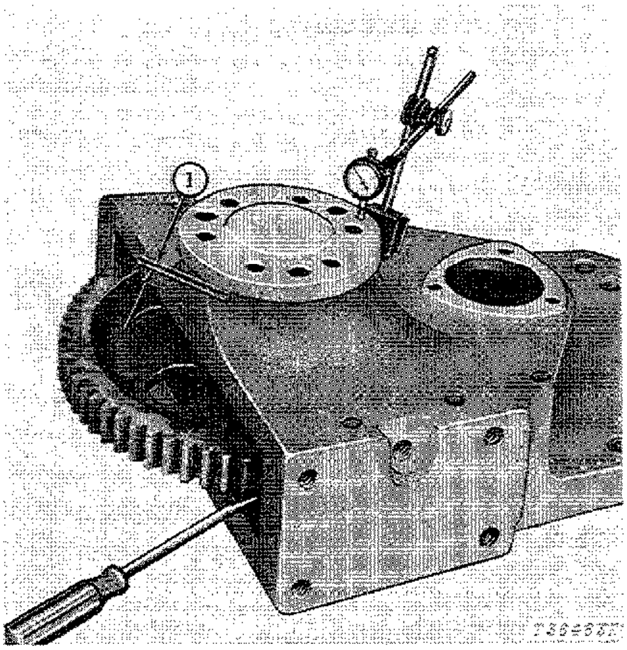


Fig. 5-Axle Shaft Induced End Play

1. Flange axle shaft introduced end play .... 0.001 to 0.005 inch (0.03 to 0.13 mm)

After axle has been rotated six turns to seat bearing rollers, advance nut if necessary, to align slot in nut with nearest cotter pin hole. Then tighten nut one additional slot and lock with cotter pin.

Rolling torque with new bearings .... 90 to 115 lb-in. (1.0 to 1.3 kg-m)

Rolling torque with used bearings .... 70 to 85 lb-in. (0.8 to 1.0 kg-m)

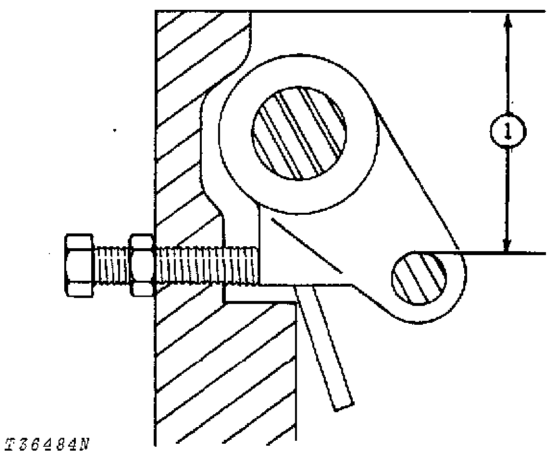


Fig. 6-Brake Lever Nominal Setting

1 - Brake lever linkage pin-to-top of steering clutch housing nominal setting ...... 2.57-inch (65.3 mm)

NOTE: During initial setting, turn in adjusting screw far enough to prevent linkage from going over center.

STEERING VALVE

SPECIFICATIONS AND TORQUE VALUES

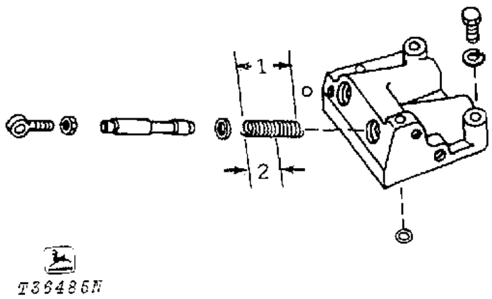


Fig. 7-Steering Valve Spool Spring

Steering Valve Spool Spring
1 - Free length .... 3.47 in. (88.1 mm)
2 - Test length .... 1.62 in. (41.5 mm) at 17.6 ± 2.5 lbs (8 ± 1 kg)

DRIVE AXLE HOUSING

SPECIAL TOOLS

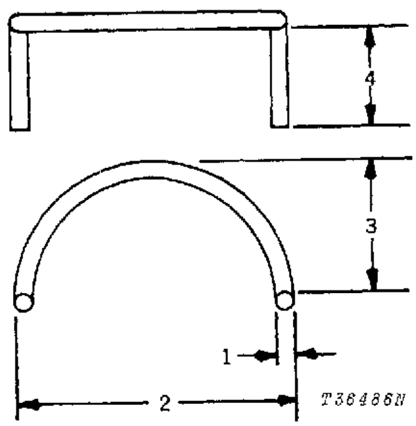


Fig. 8-Drive Axle Housing Lifting Tool

1. Round Stock .... 1/2 in.
2. Outside width between legs .... 13.500 in. (342.90 mm)
3. Length from bend to top .... 8.000 in. (203.20 mm)
4. Length of legs .... 5.0000 in. (127.00 mm)

AXLE SHAFT, BEARINGS AND REDUCTION GEARS

SPECIAL TOOLS

Convenience Tools

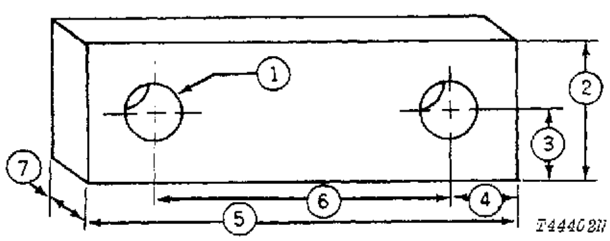


Fig. 9-Flanged Axle Shaft Removing Tool

1. Hole diameter ....0.50 in. (13 mm)
2. Width of flat stock......................1.50 in. (38 mm)
3. Edge to centerline......................0.75 in. (19.1 mm)
4. Edge to centerline......................0.75 in. (19.1 mm)
5. Length of flat stock.....................5.62 in. (143 mm)
6. Centerline distance of holes...............................4.12 in. (104.6 mm)
7. Flat stock thickness (min.) ....1.00 in. (25 mm)

Section 3
TRANSMISSION

CONTENTS OF THIS SECTION

Group 0315
CONTROLS

TRANSMISSION SHIFTER MECHANISM

GENERAL INFORMATION

A selective sliding-gear type transmission is used on JD350-C Crawler. The transmission is shifted manually by the shift lever while declutching. Shifter forks engage sliding gears on the output shaft with driving gears on the input shaft.

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 of neutral start switch.

REMOVAL

Remove seat cushion.

Remove seat support from side tanks.

Remove rear floor plate.

Disconnect steering control rods from steering controls, and controls on steering clutch housing.

Move shift lever to neutral position to aid in sliding shifter forks from gears.

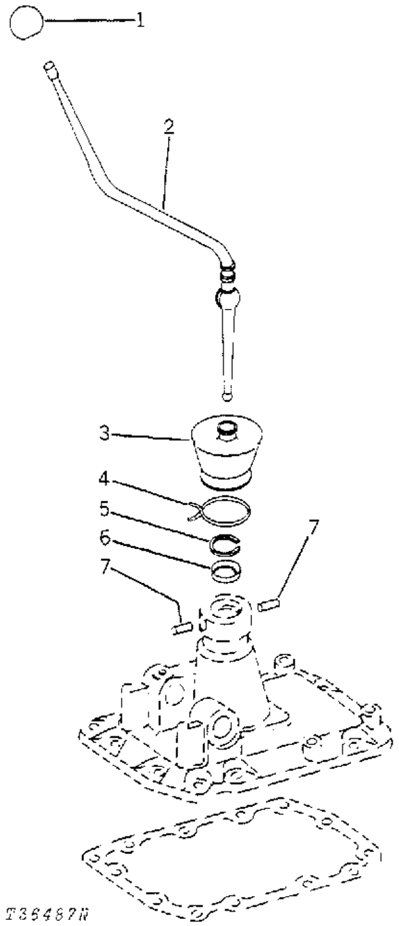
Remove cap screws attaching cover to transmission case and lift cover and shifter mechanism from transmission.

NOTE: Do not force top cover if it becomes wedged in position, as shifter mechanism may be damaged.

Remove shift lever knob (1, Fig. 1).

Remove clamp (4) and slide boot from lever.

Place shift lever in neutral and remove snap ring (5). Remove bearing (6) and lift shift lever away from cover.



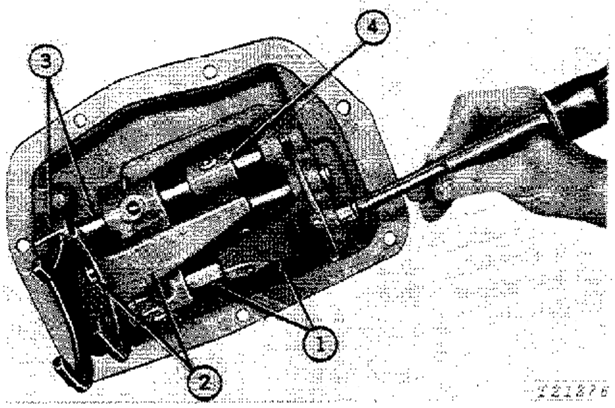
1—Knob
2—Shift Lever
3—Boot
4—Clamp
5—Snap Ring
6—Bearing
7—Lock Pin

Fig. 1-Transmission Shifter Cover

NOTE: When any one shift shaft is removed, the other two shafts must be in neutral position. An interlock prevents movement of the other shafts when one is in the engaged position.

Remove the shafts and forks in the following order: (1) second- and reverse-speed: (2) first-and fourth-speed; (3) third-speed.

Before removing a shaft and fork, make sure the others are in neutral. Then shift the fork to be removed against boss in cover to support shaft when groove pin is removed. Drive out groove pin which holds fork to shaft. Using a brass drift, drive shaft from fork and cover (Fig. 2).

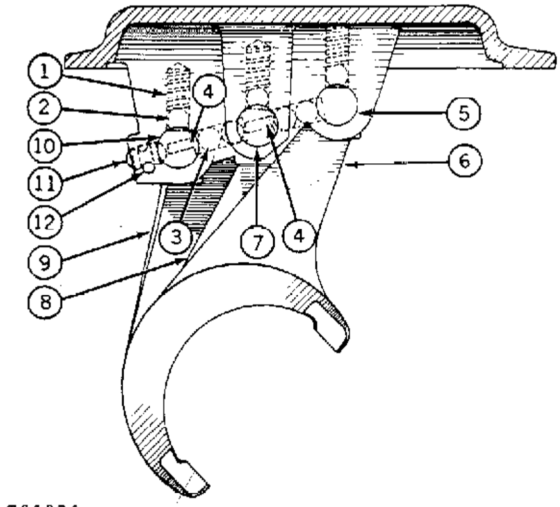


1—Second- and Reverse-Speed Fork and Shaft
2—First- and Fourth-Speed Fork and Shaft
3—Third-Speed Fork and Shaft
4—Third-Speed Shifter

Fig. 2-Removing Second- and Reverse-Speed Shift Shaft

Remove spring pin (12, Fig. 3) and remove interlock plug (11).

Remove balls, springs and interlock pins from cover.



1—Poppet Spring
2—Poppet Ball
3—Interlock Ball
4—Interlock Pin
5—Third-Speed Shift Shaft
6—Third-Speed Fork
7—First- and Fourth-Speed Shift Shaft
8—First-and Fourth-Speed Fork
9—Second-Speed and Reverse Fork
10—Second-Speed and Reverse Shift Shaft
11—Interlock Plug
12—Spring Pin

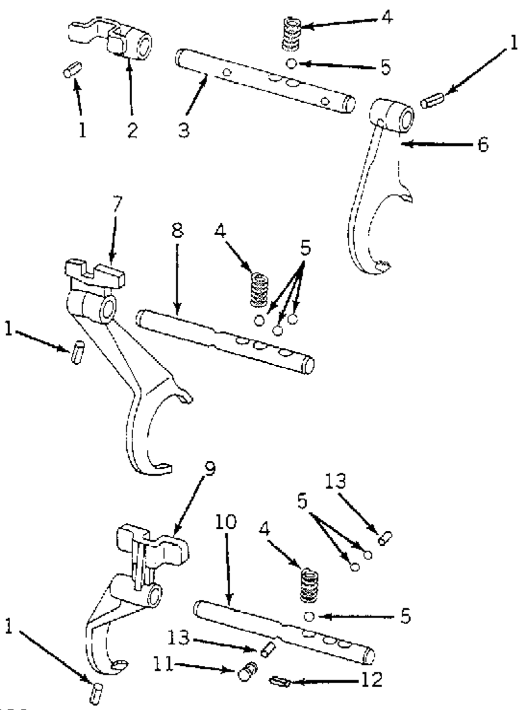
Fig. 3-Shifter Mechanism

REPAIR

Note condition of lock pins (7, Fig. 1) in upper bore of cover. These pins keep the shift lever from rotating. If pins are worn or damaged, drive them out and replace with new pins.

Check shift lever lock pin groove for excessive wear or rough edges. Remove all burrs.

Make sure shafts are straight. Examine the area around the interlock and detent notches and holes for wear.



1—Groove Pin (4 used)
2—Third-Speed Shifter
3—Third-Speed Shift Shaft
4—Spring (3 used)
5—Ball (7 used)
6—Third-Speed Shift Fork
7—First- and Fourth-Speed Shift Fork
8—First- and Fourth-Speed Shift Shaft
9—Second- and Reverse-Speed Shift Fork
10—Second- and Reverse-Speed Shift Shaft
11—Interlock Plug
12—Spring Pin
13—Interlock Pin (2 used)

Fig. 4-Transmission Shifter Mechanism

Check interlock plug (11) for damage or wear on ends (0.685 to 0.690-in. long [17.40 to 17.53 mm]). Examine interlock pin (13) for damage or wear (0.527 to 0.532-in. long [13.39 to 13.51 mm]). If pin is damaged or worn excessively, it will not actuate interlock balls and shifter will not operate correctly. Inspect all balls for any flat surfaces that might prevent them from rolling freely.

Inspect transmission shifter cover for cracks or other damage. Replace if necessary.

Check shifter boot to be sure breather hole is open.

INSTALLATION

NOTE: Use Figs. 1 and 4 as a guide for correct installation of parts.

Be sure to install each fork and shaft in the proper position. All balls are identical and interchangeable. Shafts can be identified as follows:

Second and Reverse (10, Fig. 4): Shortest shaft.

First and Fourth (8): Intermediate size shaft.

Third (3): Longest shaft.

Assemble fork to third-speed shaft so that when shaft is installed in cover, open end of fork faces rounded edge of cover and notch for interlock ball will face toward center shaft. Line up holes in shaft and fork. Drive in groove pin.

Slip shaft into cover. Insert shifter on shaft with shifter arms opposite rounded edge of cover. Before sliding shaft into position, insert detent spring and ball. Hold detent ball down to start shaft through the bore. Line up holes in shaft and shifter. Drive in groove pin. Install interlock balls.

NOTE: Be sure previously installed shaft is in neutral position.

Slip first- and fourth-speed shaft, with detent ball notches facing top of cover, through center boss. Slip fork into position on shaft with open end facing rounded edge of cover. Drop detent spring and ball into hole. Hold ball down and slide shaft on through bore. Line up holes in shaft and fork. Drive in groove pin. Slip interlock pin into shaft and install two remaining interlock balls.

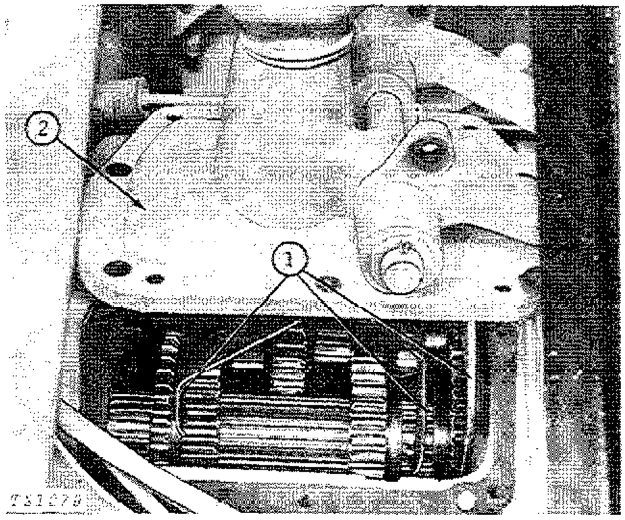
NOTE: Be sure two previously installed shafts are in neutral position.

Slide second- and reverse-speed shaft into cover with notches for detent ball facing top of cover. Start shaft into boss. Slip second- and reverse-speed fork onto shaft so that open end of fork faces rounded edge of cover.

Drop detent spring and ball into hole. Hold ball down and slide shaft on through poppet boss. Line up hole in shaft with hole in fork, with open end of fork facing rounded edge of cover, and with notch for interlock ball on shaft facing toward first- and fourth-speed shaft. Drive in groove-pin. Install remaining interlock pin. Position interlock plug (11, Fig. 4) and lock in place with roll pin.

With shafts in neutral position, slip shift lever in to place. Install upper bearing and replace snap ring. Coat inside of small hole in rubber boot with Lubriplate. Slip boot down into position and fasten with clamp.

Apply John Deere Loctite Sealant or an equivalent to threads of shifter knob so that when tightened the shift pattern remains in proper relation to the operator.



1—Shifter Forks **2—Shifter Cover**

Fig. 5-Installing Shift Cover

Shift transmission into neutral by moving sliding gears on output shaft. Fig. 2, page 0350-2 shows positions of sliding gears when transmission is in neutral.

With shift lever in neutral position, slip cover with new gasket, into place. Be sure forks fit into grooves in sliding gears. Insert two cap screws on opposite corners of cover and tighten. Test shift lever to be sure it will shift into each gear.

REVERSER PEDAL MECHANISM

GENERAL INFORMATION

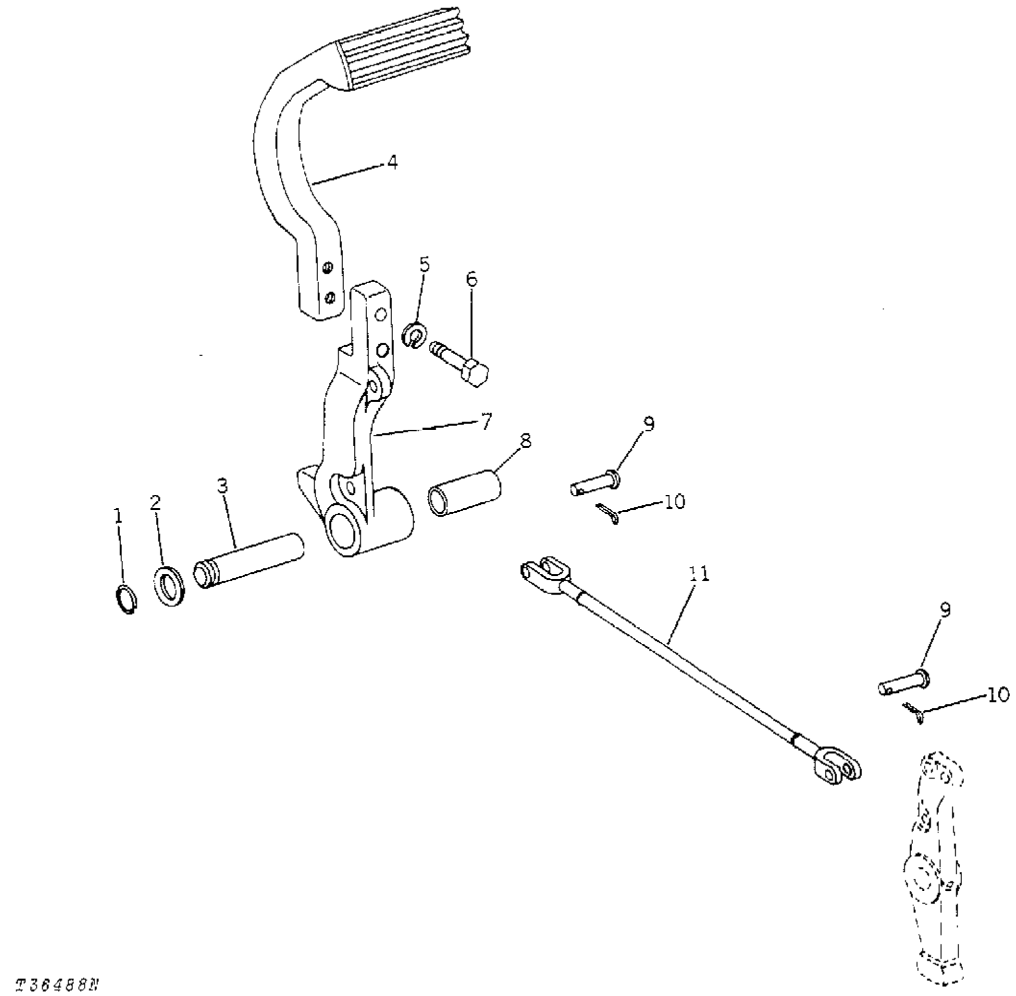
The foot clutch disengages the flow of power through the reverser gear train by neutralizing the reverser clutches. The clutches are disengaged by depressing the pedal. Releasing the pedal engages the reverser power train. The foot clutch is used for shifting transmission gears or for "inching" the tractor into a load.

REMOVAL

Remove pedal return spring.

Remove pins and cotter pins and separate link from clutch pedal and clutch control lever.

Remove snap ring and washer and slide clutch pedal from shaft.



1—Snap Ring
2—Special Washer
3—Clutch Pedal Shaft
4—Clutch Pedal
5—Lock Washer (2 used)
6—Cap Screw (2 used)
7—Clutch Pedal Hub
8—Bushing
9—Pin (2 used)
10—Cotter Pin (2 used)
11—Clutch Control Rod

Fig. 6-Reverser Pedal Mechanism

REPAIR

Inspect clutch pedal and shaft for evidence of wear, especially at points of contact. If worn excessively, replace both parts. Remove any burrs or rough spots. If bushing in pedal is worn, remove and replace with new bushing.

Inspect all remaining parts of clutch pedal control linkage for wear or damage and replace as necessary.

INSTALLATION

Install clutch pedal (4) on pedal shaft and secure with washers and snap ring.

Connect clutch link (11) to clutch pedal and to arm of control lever using pins (9) and cotter pins.

NOTE: Install pins (9) from inside.

Install pedal return spring on anchor and connect to clutch pedal.

REVERSER CONTROL LEVER

GENERAL INFORMATION

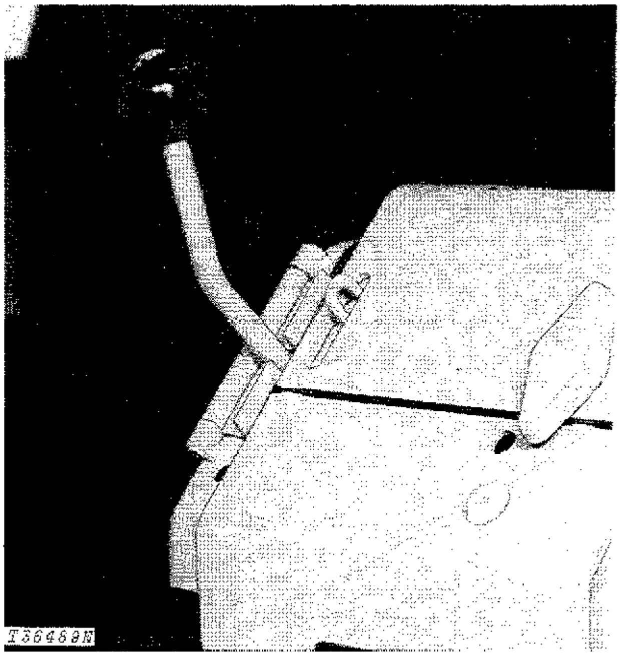


Fig. 7-Reverser Control Lever

The reverser control lever has three operating positions: forward, neutral, and reverse. When the lever is in forward position, the unit is in forward drive. When lever is pulled to the rear, the unit is in reverse drive. When the lever is at the center of its slot, the unit is in neutral. It is not necessary to declutch or to shift gears when operating the reverser control lever. A neutral lock at the lever allows the unit to be kept in neutral during stationary work.

REMOVAL

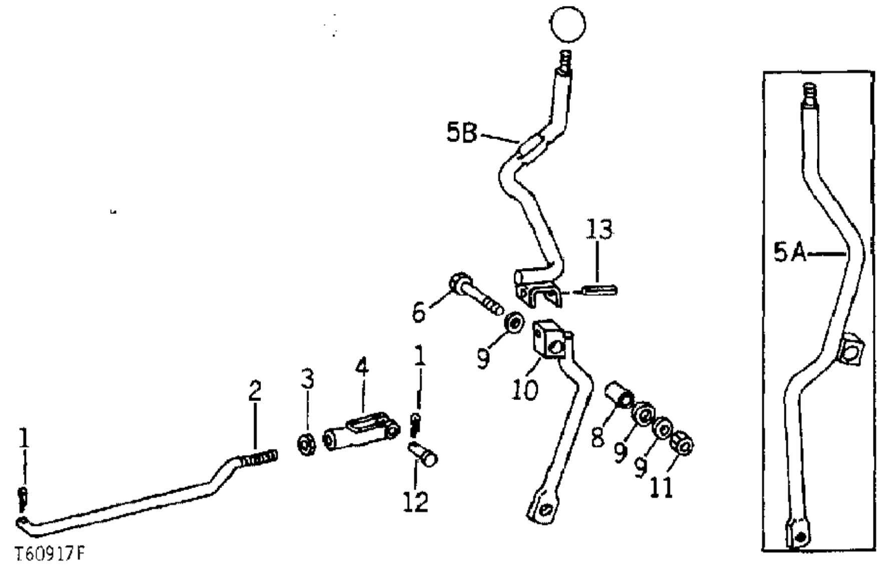
Remove seat.

Remove rear platform.

Disconnect rod (2, Fig. 8) from reverse-forward control arm and reverser lever (5A or 5B).

Remove cap screw (6, Fig. 8) and remove lever (5A or 5B).

REPAIR



1 —Cotter Pin (2 used)
2 —Reverser Lever Rod
3 —Nut
4 —Adjustable Yoke
5A—Reverser Lever (-264841)
5B—Reverser Lever (264842-)
6 —Cap Screw
7 —Reverser Lever Knob
8 —Bushing
9 —Washer (3 used)
10—Reverser Lower Lever (264842-)
11—Nut
12—Pin
13—Spring Pin (264842-)

Fig. 8-Hydraulic Reverser Control Lever

Inspect reverser lever rod (2, Fig. 8) and reverser lever (5A or 5B) for bent conditions. Replace as necessary.

Inspect bushing (8). Replace as necessary.

INSTALLATION

Install reverser lever (5A or 5B, Fig. 8).

Tighten cap screws (6) to 45 lb-ft.

Connect rod (2) to reverse-forward control arm and lever (5A or 5B).

Install rear platform and seat.

Group 0341
HOUSINGS AND COVERS

TRANSMISSION

GENERAL INFORMATION

The transmission case is located directly behind the hydraulic direction reverser unit. The left and right-hand steering clutch housings attach directly to the transmission case on their respective sides.

The transmission case consists of two compartments. The forward compartment contains the input shaft, the powershaft, and the output shaft. The rearward compartment contains the ring gear and spiral bevel pinion. The spiral bevel pinion is the input to the ring gear and output from the transmission.

REMOVAL

Drain oil from transmission.

Refer to Section 2, Group 0201 and remove drive axle housing.

Refer to Section 2, Group 0250 and remove steering clutch housing.

Remove or block up rear bottom plate. Center floor jack under front of grille housing.

Remove rear cap screws securing front cross bar to side frames. Remove rear cap screws under side frame securing front cross bar to center frame support. Also loosen front cap screws, but do not remove.

Attach JD-244 adapter tools to transmission case. Place JDG-1 sling on a hoist and attach sling to adapter tools.

Lower floor jack at front of tractor until transmission case clears rear cross bar.

CAUTION: Keep clear of tractor while pivoting on front axle.

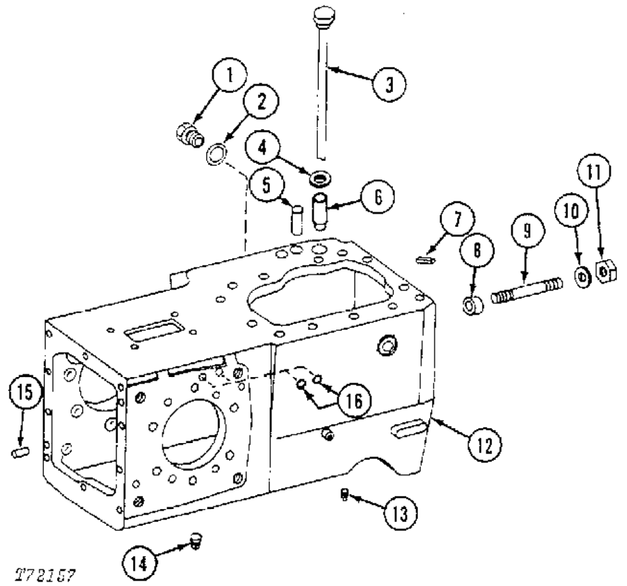
Remove cap screws securing transmission and with the aid of a hoist remove transmission case from machine.

Place transmission on bench or stand to facilitate further disassembly.

Refer to Section 3, Group 0315 and remove shifter mechanism.

Refer to Section 3, Group 0350 and remove gears, shafts, and bearings.

REPAIR



1—Poppet Holder
2—Gasket
3—Bayonet Oil Gauge
4—Gasket or Special Washer
5—Shifter Shaft Bushing (with PTO) Dowel Pin (without PTO)
6—Oil Gauge Bushing
7—Input Shaft and Bearing Wick
8—Hollow Dowel (2 used)
9—Stud (2 used)
10—Special Washer (2 used)
11—Nut (2 used)
12—Transmission Case
13—Pipe Plug
14—Pipe Plug
15—Dowel Pin (2 used)
16—O-Ring (2 used)

Fig. 1-Transmission Case

Clean transmission case (12, Fig. 1) thoroughly and inspect for cracks or other damage.

Inspect oil trough at input shaft bore and remove all foreign material. Remove felt wick in case and replace it as all oil lubricating the input shaft front bearing is filtered by this wick.

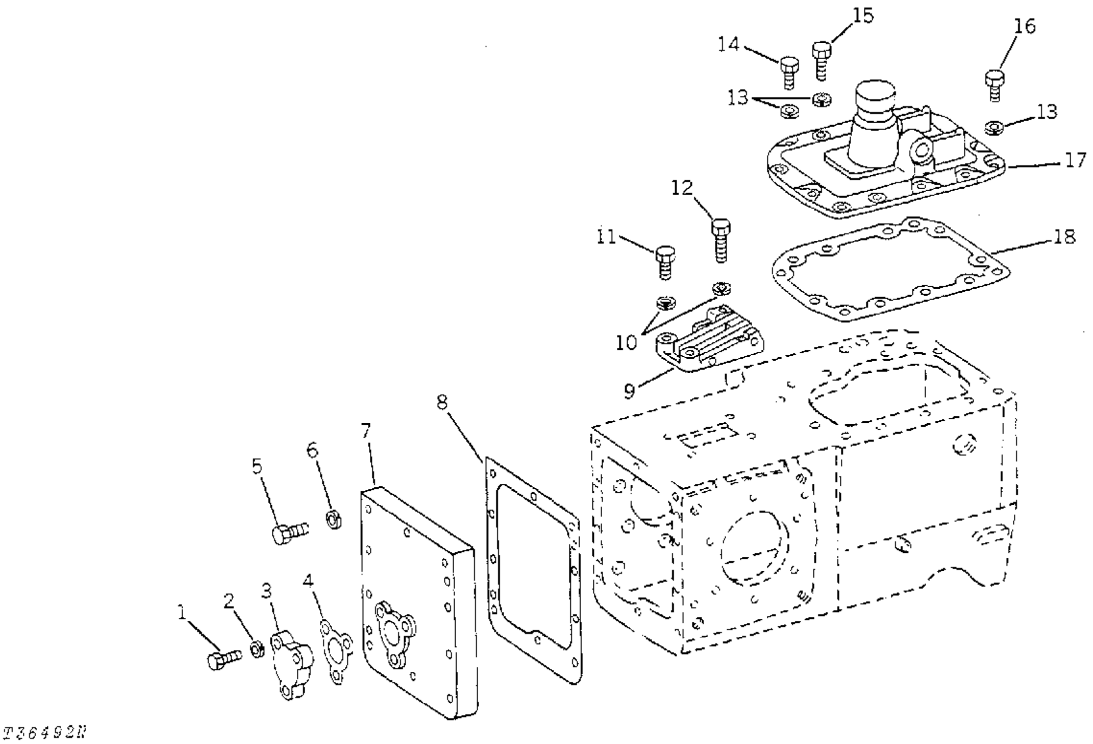
Inspect transmission rear cover (7, Fig. 2), steering valve housing (9), and transmission shifter cover (17) for cracks or other damage. Replace if necessary.

Clean oil inlet bores and check for damage. Replace all O-rings (16, Fig. 1).

INSTALLATION

If installing a new transmission case, a ring and pinion set, or the bearing quills, cones or cups which support these parts, it will be necessary to make certain adjustments before complete assembly of transmission.

Refer to Section 2, Group 0210 for Cone Point Adjustment, Ring Gear Bearing Preload Adjustment, and Spiral Bevel Pinion and Ring Gear Adjustment.



1—Cap Screw (3 used)
2—Lock Washer (3 used)
3—Power Shaft Cover
4—Gasket
5—Cap Screw (10 used)
6—Lock Washer (10 used)
7—Transmission Rear Cover
8—Gasket
9—Steering Valve Housing
10—Lock Washer (4 used)
11—Cap Screw (3 used)
12—Cap Screw (1 used)
13—Lock Washer (13 used)
14—Special Cap Screw (3 used)
15—Cap Screw (6 used)
16—Cap Screw (4 used)
17—Transmission Shift Cover
18—Gasket

Fig. 2-Transmission Case Covers

Refer to "Removal" and reverse procedure.

Apply John Deere Loctite Sealant or an equivalent to all stud holes just prior to driving studs.

Apply John Deere Loctite Plastic Gasket or an equivalent between transmission case and steering valve housing.

Apply Lubri-Plate or an equivalent to threads of hex nuts to transmission housing studs and tighten to 300 ± 30 lb-ft (41 ± 4 kg-m).

Apply Lubri-Plate or an equivalent in lower front tapped holes in transmission case and tighten cap screws to 300± 30 lb-ft (41 ± 4 kg-m).

HYDRAULIC DIRECTION REVERSER

GENERAL INFORMATION

The direction reverser case is a separate compartment containing the necessary gears, shafts, and clutches for receiving engine flywheel rotation and transmitting it in either forward or reverse direction to the input shaft of the transmission. All gears are in constant mesh. The only shifting is in the two clutch assemblies. By hydraulic engagement and disengagement, they change the power flow and control the rotation of the transmission input shaft.

The front cover bolts onto the inner shoulder of the reverser case. The cover supports the rear of the front spider shaft in a roller bearing cone. The reverser hydraulic pump mounts over and is driven by the front spider shaft. The idler shaft is pressed into the reverser case front cover and supports the idler gear on a roller bearing.

REMOVAL

NOTE: On crawler-loader units, leave loader and cowl support intact. Remove engine. Disconnect brake pedal, remove stop and roll pedal back. Disconnect all wiring and control linkage from reverser housing. Remove cap screws securing reverser housing to cowl supports, side frames, front crossbar and transmission. With the aid of a hoist, remove reverser housing by sliding forward off transmission studs and out under loader and cowl support.

Refer to Section 4, Group 0401 and remove engine.

Disconnect all the necessary wiring, linkage and lines from cowl. Remove cap screws securing cowl to reverser housing. With the aid of a chain hoist, lift cowl from crawler.

Disconnect linkages and lines from both sides of reverser housing.

With the aid of a hoist, remove reverser housing by sliding it forward off transmission studs and input shaft.

NOTE: If coupler remained on transmission input shaft when reverser housing was removed, pull coupler off and place it on end of drive shaft for easier installation.

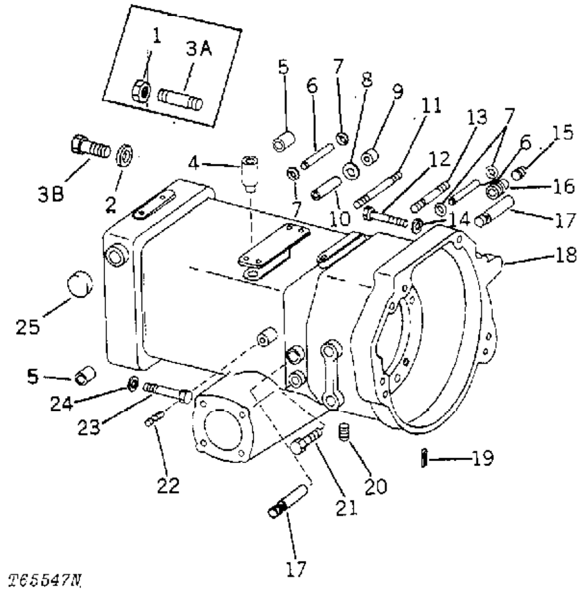
Place reverser housing unit on a stand for easier servicing.

Refer to Section 3, Group 0360 and remove control valve unit, oil filter, and hydraulic pump.

Remove eight mounting cap screws and lift front cover off dowels and spider shaft. Remove and discard gasket. If necessary, screw cap screws into tapped holes to brake gasket loose.

Refer to Section 3, Group 0350 and remove reverser clutches and countershaft.

REPAIR



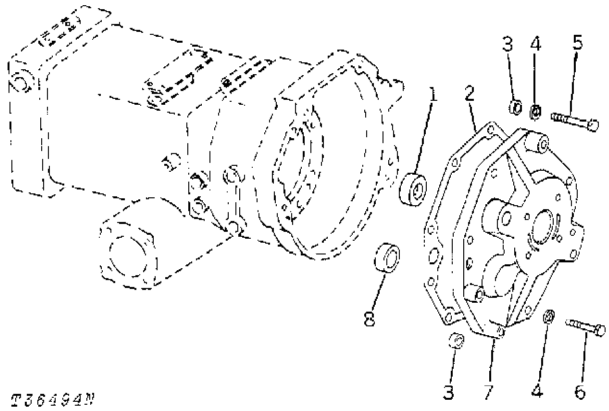
1 —Nut (7 used)
(-278429)
2 —Washer (7 used)
3A—Stud (7 used)
(-278429)
3B—Cap Screw (7 used)
(278430-)
4 —Oil Gauge Bushing
5 —Bushing (2 used)
6 —Tube (2 used)
7 —O-Ring (4 used)
8 —O-Ring
9 —Retainer
10 —Tube
11 —Stud (2 used)
12—Cap Screw (2 used)
13—Stud (2 used)
14—Lock Washer (2 used)
15—Pipe Plug
16—Reducer Bushing
17—Reverser and Brake Pedal Shaft
18—Reverser Housing
19—Cotter Pin
20—Pipe Plug
21—Cap Screw
22—Groove Pin
23—Cap Screw (2 used)
24—Special Washer (2 used)
25—Cap Plug

Fig. 3-Reverser Case

Check reverser case for cracks, chips, or other damage. Check for evidence of leakage around quill openings, and mounting surfaces of control valve and front cover. Clean these surfaces thoroughly. Replace all gaskets.

Clean oil inlet tubes and check for damage. Replace all O-rings.

Replace gasket on bayonet oil gauge.



1—Bearing Cup
2—Gasket
3—Hollow Dowel (2 used)
4—Lock Washer (8 used)
5—Cap Screw (3 used)
6—Cap Screw (5 used)
7—Front Cover
8—Bearing Cup

Fig. 4-Reverser Case Cover

Inspect front cover for cracks or breakage.

Examine bearing cups (1 and 8, Fig. 4) for wear. If cups must be replaced, remove old cups (use a gear puller on countershaft bearing cup). Then install new cups as follows:

On spider shaft bearing cup (1), press in using any flat-faced tool, larger than cup diameter as guide.

On countershaft bearing cup (8) use a guide and press cup in until it bottoms on shoulder of bore.

INSTALLATION

Refer to removal and reverse procedure.

Apply John Deere Loctite Sealant or an equivalent to all stud holes just prior to driving studs.

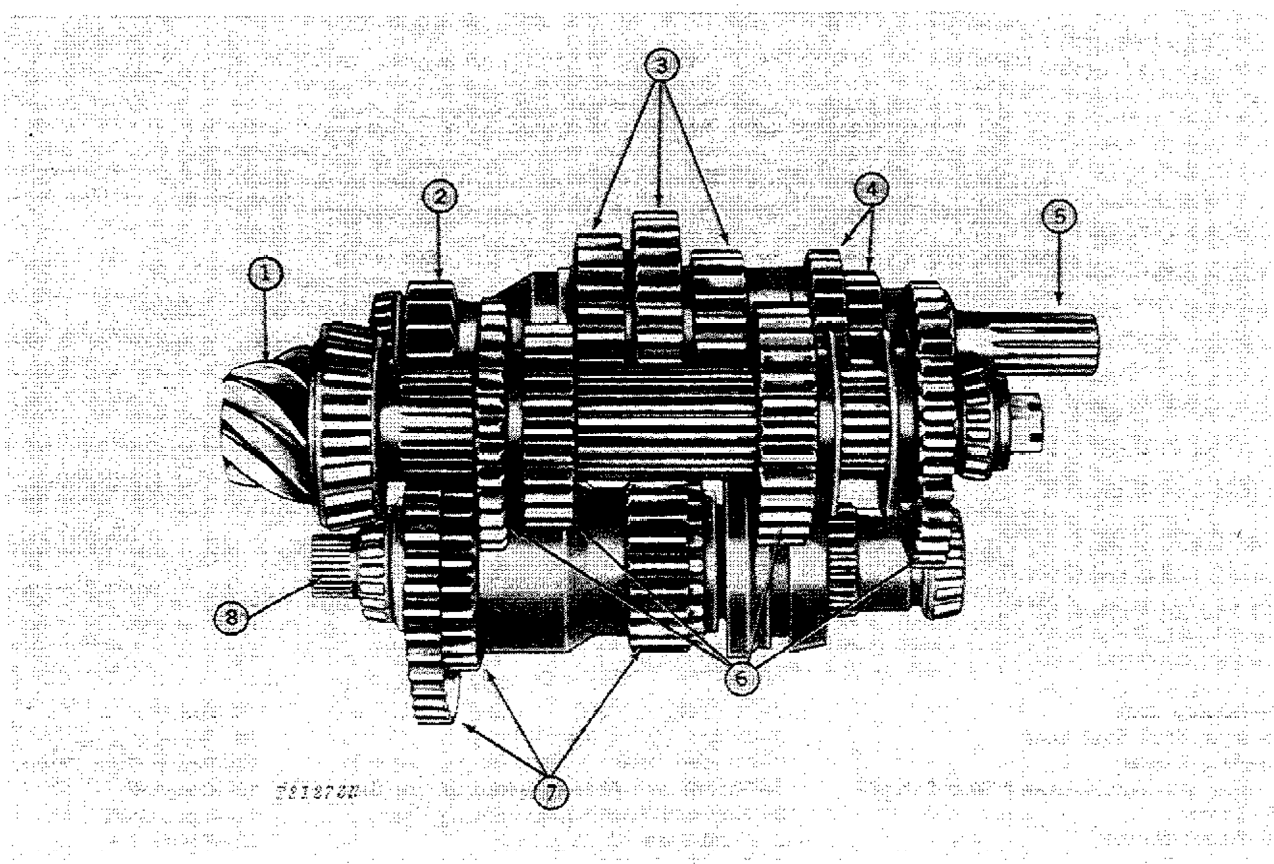
Tighten side frame-to-steering clutch cap screws before tightening side frame-to-engine clutch housing cap screws.

Apply Lubri-Plate or an equivalent to threads of hex nuts to transmission housing studs and tighten to 300 ± 30 lb-ft (41 ± 4 kg-m).

Apply Lubri-Plate or an equivalent in lower front tapped holes in transmission case and tighten cap screws to 425 lb-ft (59 kg-m).

Group 0350
GEARS, SHAFTS, BEARINGS AND POWER SHIFT CLUTCH

GENERAL INFORMATION



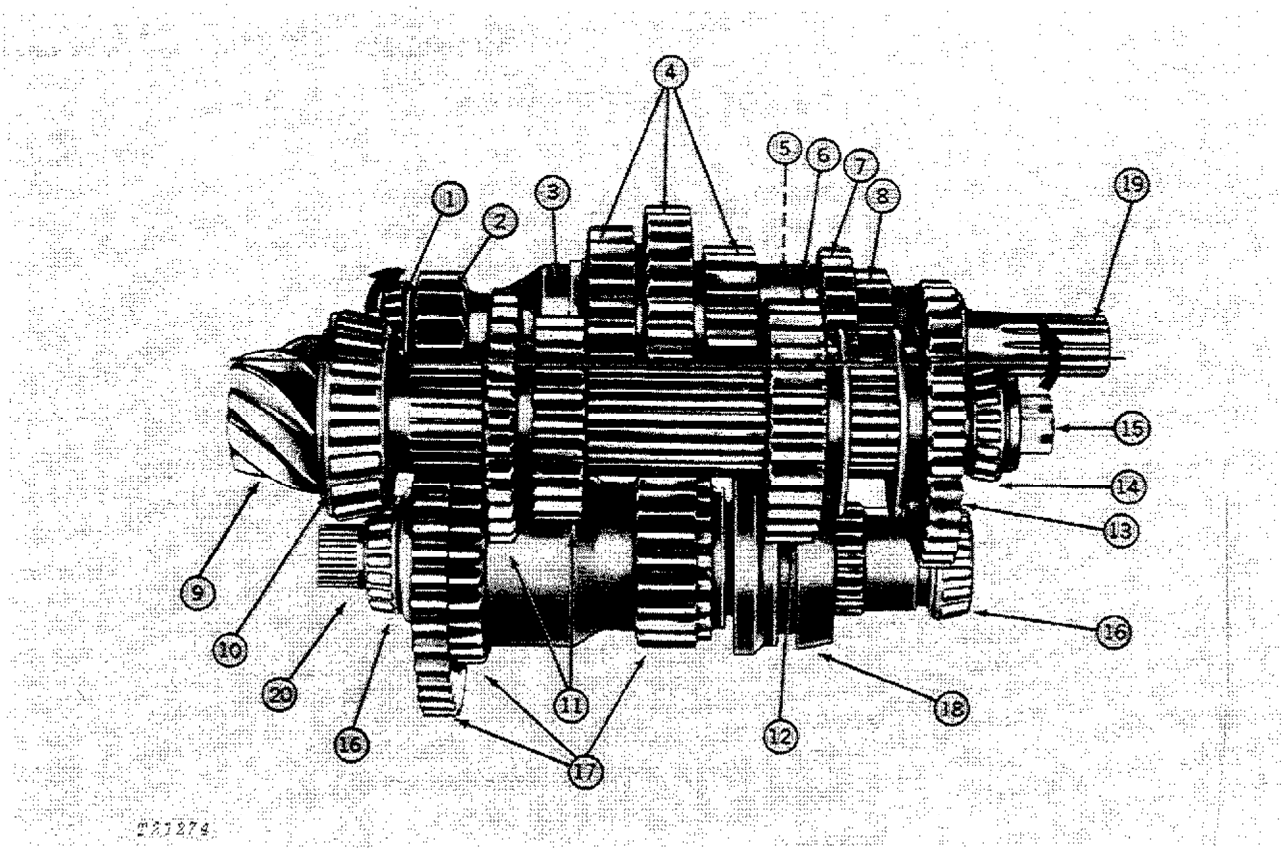
1—Output Pinion Shaft
2—Spur Gear
3—Cluster Gear
4—Drive Gears
5—Input Shaft
6—Sliding Gears
7—Power Shaft Cluster Gears
8—Power Shaft

Fig. 1-Transmission Shafts and Gears

A selective sliding-gear type transmission is used on JD350-C Crawler. The transmission is shifted manually by the shift lever while declutching. Shifter forks engage sliding gears on the output shaft with driving gears on the input shaft (Fig. 1). Four speeds forward and four speeds in reverse are available. Power is transmitted by the output shaft, through the ring gear and hub, to the steering clutches.

The transmission gears are carried on three shafts—the input shaft, the powershaft, and the output shaft.

The flow of power in the transmission is explained below. Study the diagram carefully to understand the operation of the transmission during the various speed shifts.



1—Bearing Cone
2—Input Shaft Spur Gear
3—Rear Washer
4—First and Second-Speed Gear Cluster
5—Spacer
6—Thrust Washer
7—Fourth-Speed Gear
8—Third-Speed Gear
9—Output Pinion Shaft
10—Bearing Cone
11—Second and Reverse-Speed Sliding Gear
12—First and Fourth-Speed Sliding Gear
13—Third-Speed Sliding Gear
14—Bearing Cone
15—Hex. Nut
16—Bearing Cone
17—Power Shaft Cluster
18—Coupling
19—Input Shaft
20—Power Shaft

Fig. 2-Transmission Gears in Neutral Position

Gear	Power Flow (Fig. 2)
Forward or Reverse	
1	19 - 2 - 17 - 4 - 12 - 9
2	19 - 2 - 17 - 4 - 11 - 9
3	19 - 8 - 13 - 9
4	19 - 7 - 12 - 9

The figure above illustrates a sliding-gear type transmission in the neutral position.

Use the chart at left and Fig. 2 to trace power flow through the transmission when diagnosing problems in a particular operating gear.

REMOVAL

Drain Transmission.

Refer to Section 2, Group 0201 and remove drive axle housing.

Refer to Section 2, Group 0250 and remove steering clutch housing.

Refer to Section 3, Group 0341 and remove transmission from crawler.

Place transmission on bench or on stand to facilitate further disassembly.

Remove shift cover assembly.

Remove transmission rear cover.

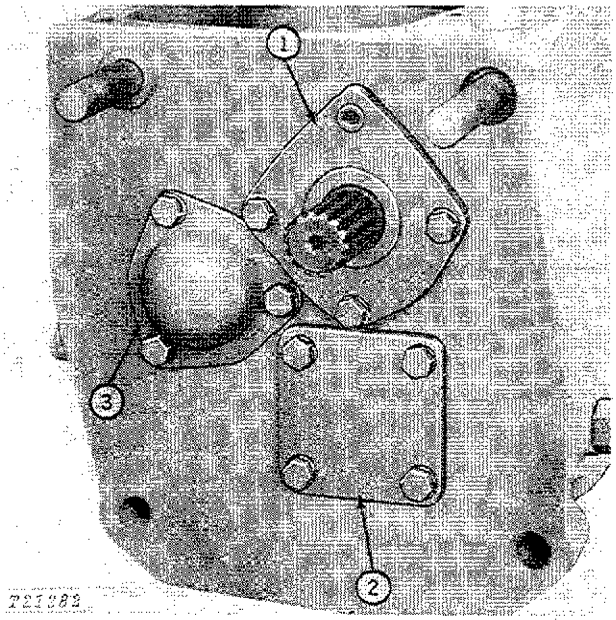
If so equipped, remove PTO shifter detent spring and ball.

Remove coupling from front of input shaft.

Remove the input shaft front bearing quill (1, Fig. 3).

Move the PTO lever to the left (if used).

Slip input shaft forward and work rear end of shaft up through top of transmission case.



1—Input Shaft Front Bearing Quill
2—Powershaft Bearing Cover
3—Output Shaft Front Bearing Cover

Fig. 3-Output Shaft Front Bearing Cover

Refer to Section 2, Group 0210 and remove ring gear assembly.

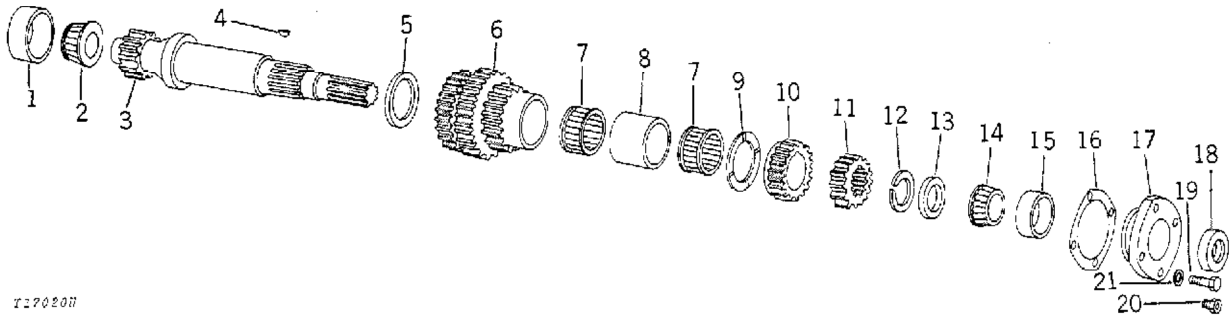
Remove output shaft front bearing cover (3, Fig. 3), pull cotter pin from end of shaft and remove nut retainer. Lock transmission gears and remove bearing retainer nut and special washer. Support output shaft with one hand and tap front end of shaft to free front bearing cone. Slide shaft rearward. Continue to slide shaft rearward removing the three sliding gears as they slip off the end of the shaft. Pull shaft and rear bearing from rear end of case.

Remove powershaft bearing cover (2, Fig. 3).

Place a spacer, such as a wooden block, between shifter fork and inside front of transmission case. Tap powershaft forward to free front bearing cup from case and rear bearing cone from shaft. Pull powershaft forward out of transmission case.

After powershaft is withdrawn, the cluster gear with bearings, spacers, and drive coupling will be left in the transmission case. Lift cluster gear with bearing cup out of case. Remove bearing cone, front and rear spacer washers.

REPAIR



1—Bearing Cup
2—Bearing Cone
3—Input Shaft
4—Woodruff Key
5—Rear Washer
6—First- and Second-Speed Cluster Gear
7—Bearing (2 used)
8—Spacer
9—Thrust Washer
10—Fourth-Speed Gear
11—Third-Speed Gear
12—Snap Ring
13—Input Shaft Bearing Spacer
14—Bearing Cone
15—Bearing Cup
16—Shim (as required)
17—Quill
18—Oil Seal
19—Cap Screw (3 used)
20—Special Cap Screw
21—Special Washer (4 used)

Fig. 4-Input Shaft Assembly

Inspect input shaft as a unit for damage or excessive wear. Check bearings for damaged or worn rollers. See that the cluster gear (6) rotates freely but without excessive looseness. If inspection shows that the input shaft must be disassembled for parts replacement, proceed as follows:

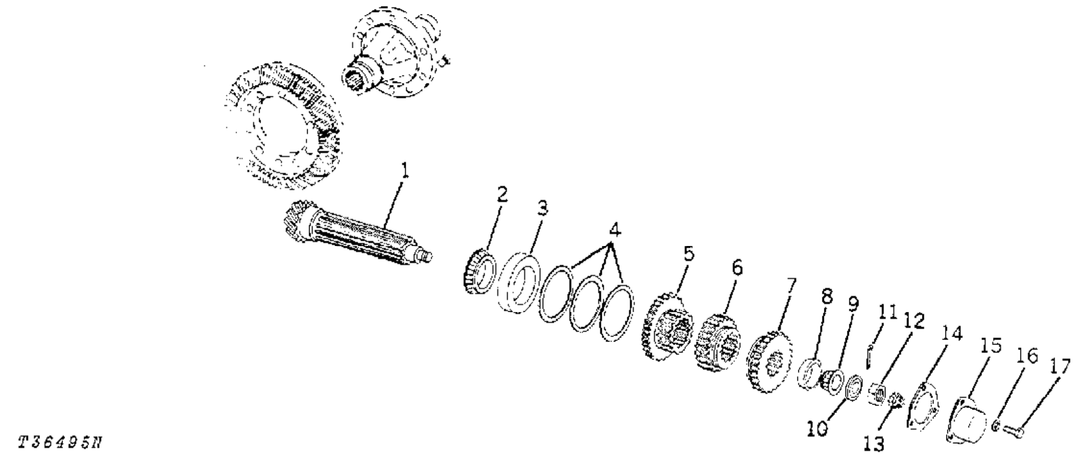
Use a knife-edge puller to remove bearing cones (2) and (14).

NOTE: If rear bearing cone (2) is in satisfactory condition, it need not be removed to disassemble the remainder of the input shaft.

Remove snap ring (12) in front of third-speed drive gear (11) and slide off gear. Press fourth-speed drive gear from shaft. Slide off thrust washer.

Slip cluster gear with bearings (7), spacer (8) and rear washer from shaft.

Check spacers and washers for excessive wear.



1—Output Shaft
2—Bearing Cone
3—Bearing Cup
4—Shims (as required)
5—Sliding Gear (Second- and Reverse-Speed)
6—Sliding Gear (First- and Fourth-Speed)
7—Sliding Gear (Third-Speed)
8—Bearing Cup
9—Bearing Cone
10—Special Washer
11—Cotter Pin
12—Bearing Retainer Nut
13—Bearing Nut Retainer
14—Gasket
15—Cover
16—Special Washer (3 used)
17—Cap Screw (3 used)

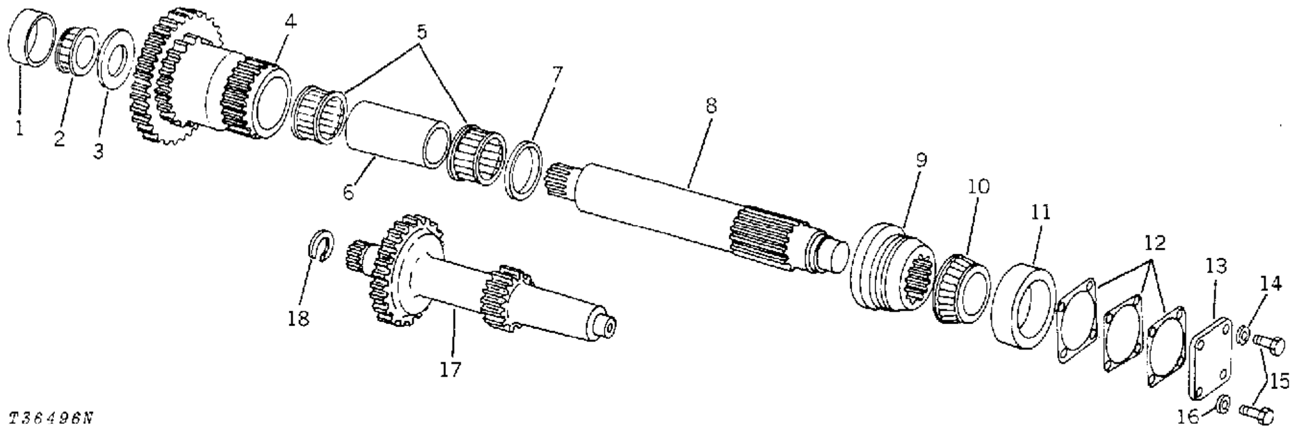
Fig. 5-Output Shaft Assembly

Inspect gears for excessive tooth wear or broken teeth. Make sure splines are in good condition.

Examine output shaft bearing cones (2 and 9, Fig. 5) for excessive wear or damaged rollers.

NOTE: If output shaft is no longer serviceable and must be replaced, it will be necessary to replace the ring gear as these parts are furnished only as matched sets.

Inspect output shaft front and rear bearing cups (3 and 8) for excessive wear or damage. If it is necessary to replace the rear bearing cup (3) be careful not to damage shims (4) behind the bearing cup during removal. Install new cup with large inside diameter facing toward ring gear end of case.



1—Bearing Cup
2—Bearing Cone
3—Spacer Washer (with PTO)
4—Powershaft Cluster Gear (with PTO)
5—Bearing (2 used with PTO)
6—Spacer (with PTO)
7—Front Washer (with PTO)
8—Powershaft (with PTO)
9—Coupling (with PTO)
10—Bearing Cone
11—Bearing Cup
12—Shim (as required)
13—Cover
14—Special Washer (2 used)
15—Cap Screw (4 used)
16—Lock Washer (2 used)
17—Reduction Shaft
18—Snap Ring

Fig. 6-Powershaft Assembly

Examine all parts for excessive wear or damage. Replace unserviceable parts. If bearing cone on front end of powershaft (or powershaft itself) must be replaced, press off old bearing and press new bearing on shaft with large diameter toward spline.

INSTALLATION

If installing a new transmission case, a ring and pinion set, or the bearing quills, cones or cups which support these parts, it will be necessary to make certain adjustments before complete assembly of transmission.

Refer to Section 2, Group 0210 for Cone Point Adjustment, Ring Gear Bearing Preload Adjustment, and Spiral Bevel Pinion and Ring Gear Adjustment.

Refer to Figs. 4, 5, and 6 for identification of parts and their sequence of installation.

Install powershaft as described in the following paragraphs.

1. Place rear bearing cone (2, Fig. 6) in position in its cup.

2. Set rear spacer washer (3) against rear bearing cone with beveled edge away from cone. Support cone and washer in this position.

3. Install roller bearings (5) with long spacer (6) between them into bore of cluster gear. Install front washer (7) on coupling.

NOTE: Lubricate bearings (5) before assembling.

4. Start splined end of powershaft through front end of transmission case.

5. While supporting drive coupling (9) between arms of shifter fork with large diameter of coupling toward rear, slide powershaft through coupling, front washer (7), cluster gear assembly, rear spacer washer, and bearing cone.

IMPORTANT: Make sure spacer washer (3) does not slip out of position. Tap front end of shaft to make sure rear bearing cone is properly seated.

6. Install front bearing cup with large diameter toward rear.

NOTE: To obtain a true measurement of powershaft end play, the indicator reading must be taken directly on the rear end of the powershaft.

Powershaft must be set to provide 0.001 to 0.005-in. (0.03 to 0.13 mm) end play. End play is established by shims under the front bearing cover and measured by a dial indicator. Add or subtract shims until proper end play reading is obtained. Before installing shims apply a thin even coat of John Deere Loctite Sealer or an equivalent to machined surface of transmission case power shaft cover that contacts shims.

Install poppet ball, spring, gasket, and poppet holder in left side of transmission case.

Refer to Section 2, Group 0210 and install output shaft and ring gear and hub.

It is very important that all parts be installed on the input shaft in the correct order and proper position.

1. Install rear bearing cone (2, Fig. 4) with large diameter against integral gear. Use an arbor press and sleeve to install bearing cone.

2. Install flat side of rear washer (5) next to cluster gear.

3. Install cluster gear (6) with bearing, spacer and bearing on shaft with small gear toward front of shaft.

NOTE: Lubricate bearings (7) before assembly.

4. Place thrust (9) washer on shaft.

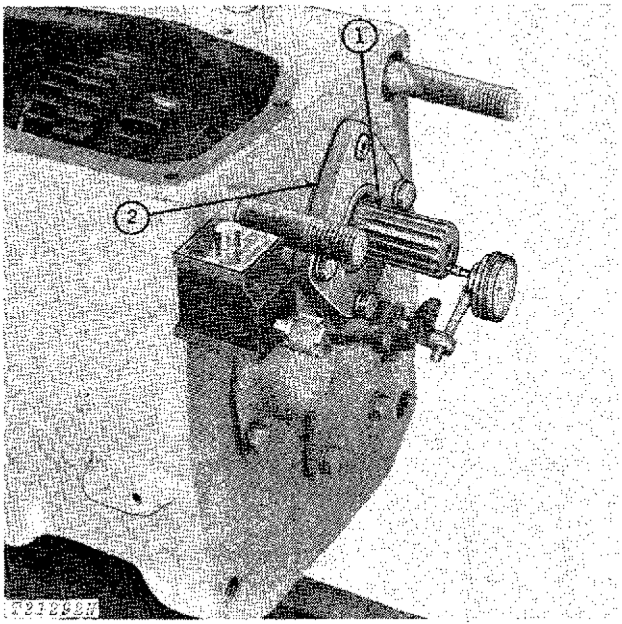
5. Place Woodruff key on shaft. Press fourth-speed drive gear (10) on shaft with rounded teeth toward rear of transmission.

6. Slide third-speed drive gear (11) onto shaft with rounded teeth toward front of tractor. Secure snap ring against gear. Slide spacer onto shaft.

7. Install front bearing cone (14) with large diameter toward rear of shaft.

Slip splined end of assembled input shaft through transmission cover hole and into front bearing quill bore of transmission case. Lower input shaft into case and slip it to the rear so that rear bearing cone seats in rear bearing cup. Hold shaft level and install front bearing quill with shims under quill. Draw cap screws down tightly. Make sure that shaft does not begin to bind. Rotate shaft to be sure bearings are seating properly.

Proper end play of 0.001 to 0.004-in. (0.03 to 0.10 mm) of the input shaft is established by shims under the front bearing quill.



1—Input Shaft 2—Quill

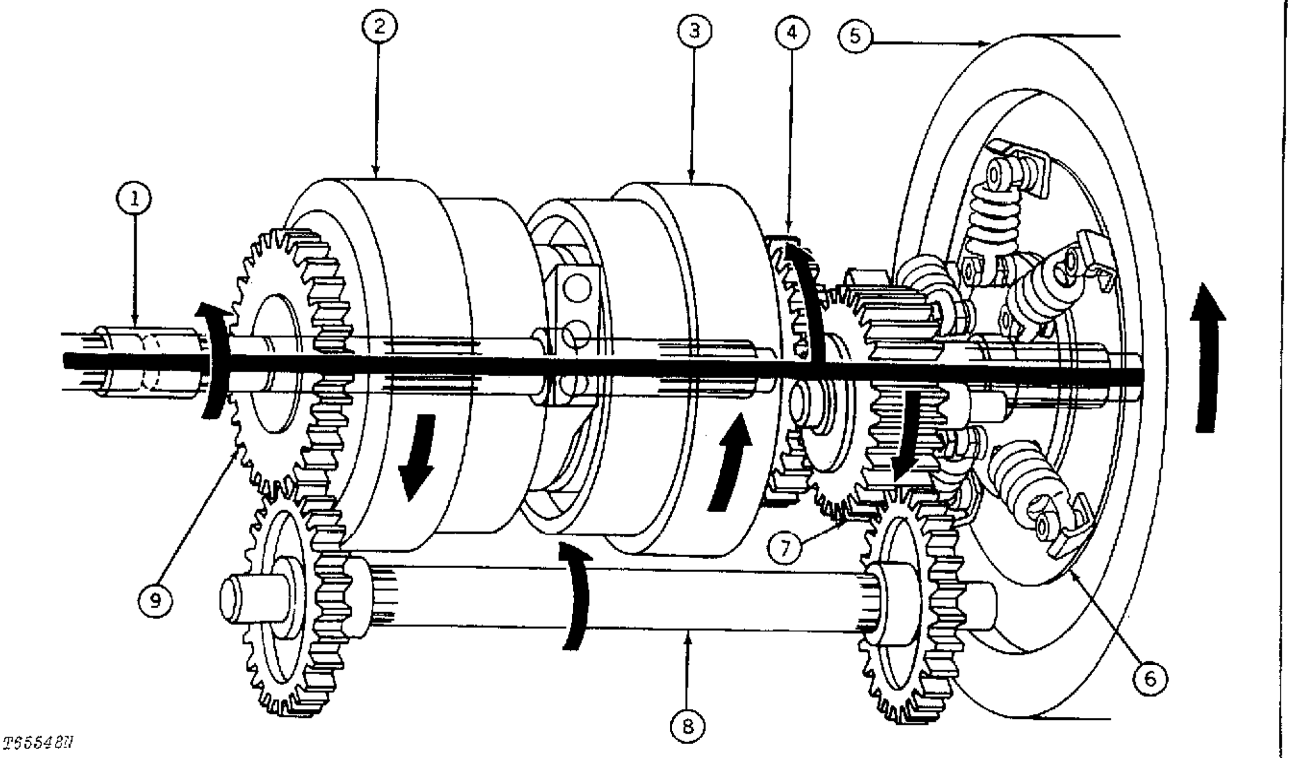
Fig. 7-Checking Input Shaft End Play

Install a dial indicator as shown in Fig. 7 and measure end play of shaft. Remove quill and add or deduct shims as necessary to obtain proper end play. Before reinstalling shims, apply a thin even coat of John Deere Loctite Sealer or an equivalent to machined surface of transmission case input shaft quill that contacts shims. Position shim pack and install quill.

Refer to "Removal" and reverse procedure.

HYDRAULIC DIRECTION REVERSER

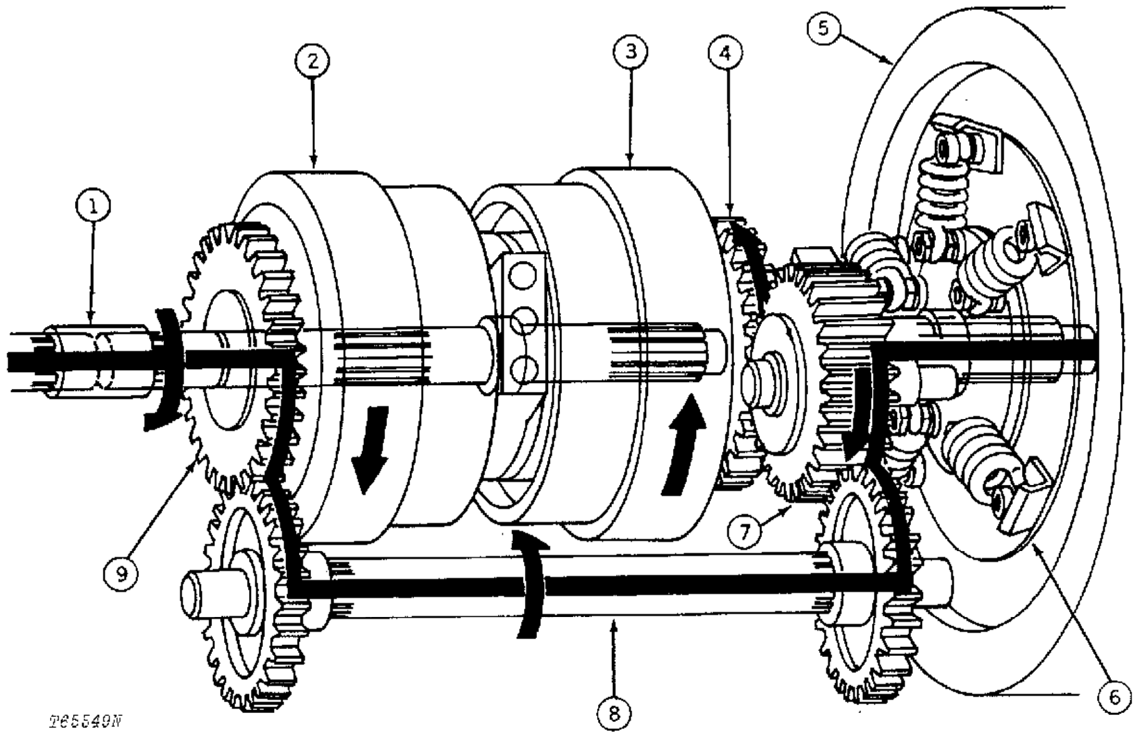
GENERAL INFORMATION



1—Coupling
2—Rear Clutch Assembly (Disengaged)
3—Front Clutch Assembly (Engaged)
4—Front Spider Gear
5—Flywheel
6—Isolator
7—Idler Gear
8—Countershaft
9—Rear Spider Gear (Idling)

Fig. 8-Power Flow in Forward Operation

The front spider shaft, being splined to the isolator, always follows engine rotation. In the forward position, since the forward clutch is engaged, the front spider drives the clutch shaft and engine power flows directly through the clutch shaft to the transmission input shaft. The idler gear is in constant mesh with the front spider gear and the countershaft, and so drives the countershaft in the direction of the flywheel rotation. The rear gear of the countershaft is in constant mesh with the rear spider gear and turns it in the opposite direction. However, since the reverse clutch is disengaged, the rear spider "idles" on the clutch shaft, and engine power is allowed to flow directly from the forward clutch to the transmission input.



1—Coupling
2—Rear Clutch Assembly (Engaged)
3—Front Clutch Assembly (Disengaged)
4—Front Spider Gear
5—Flywheel
6—Isolator
7—Idler Gear
8—Countershaft
9—Rear Spider Gear

Fig. 9-Power Flow in Reverse Operation

The front spider shaft is splined to the isolator. In reverse position, since the forward clutch is disengaged, the front end of the clutch shaft "idles" in the front spider. Thus power flows from the front spider gear through the idler gear and drives the front countershaft gear. Power flows to the rear countershaft gear, which drives the rear spider gear. Since the reverse clutch is engaged, the clutch shaft is driven by the rear spider gear and power is fed into the transmission input in a reverse rotation from that of the engine.

REMOVAL

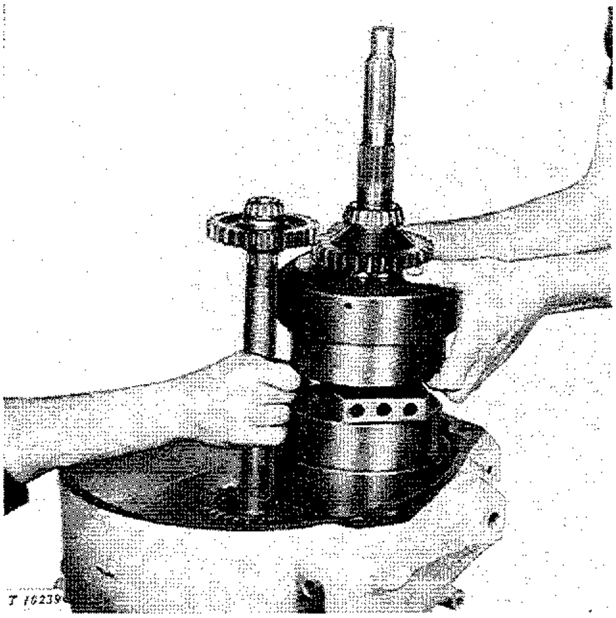


Fig. 10-Removing Reverser Clutches

Refer to Section 3, Group 0341 and remove hydraulic direction reverser from crawler and disassemble.

Remove cap screws securing idler shaft from reverser front cover. Remove idler shaft, gear, and bearings.

Remove bayonet oil gauge from case to give clearance for removing clutches.

Set reverser case on end. Reach down in case and grasp reverser clutch unit under shoulder of front clutch. Lift reverser unit and countershaft out of case together (Fig. 10). If necessary, reach through filter hole to guide parts.

REPAIR

Inspect reverser clutches, countershaft, and idler shaft as units for damage or excessive wear.

Refer to Fig. 11 for parts identification.

Remove forward clutch spider (36, Fig. 11) by setting reverser assembly on end. While lifting on shaft, jiggle spider to free disks.

Remove rear clutch spider (13) using gear puller. Be sure puller mounts under spider gear. Do not pull under large shoulder of spider as this will damage sintered plates (19). Bearing cone, washer, and thrust washer will be pressed from shaft as spider is removed.

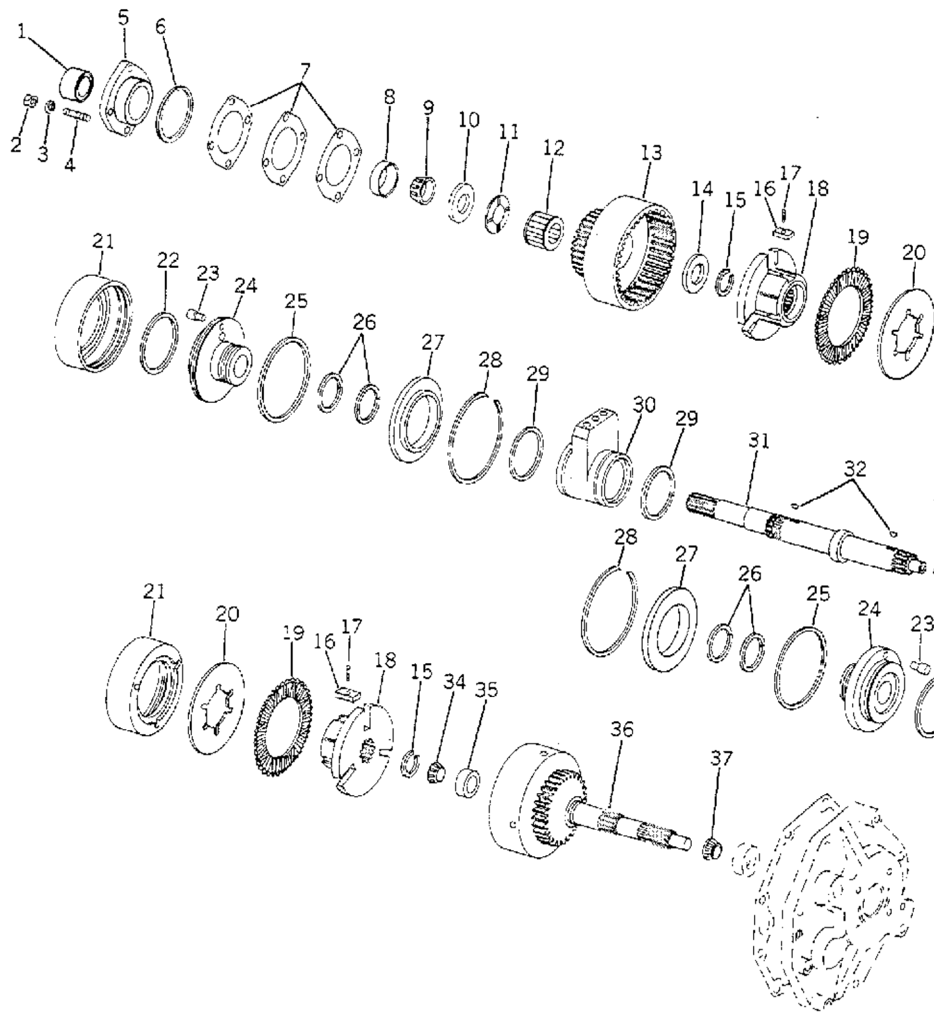
Remove special washer (10) from clutch shaft. If washer will not remove easily, use a gear puller. This is a soft washer, so be careful not to bend or burr it.

Remove front bearing cone from clutch shaft using a gear puller. Bearing can be removed more easily if flow regulating plug (33) is removed from end of shaft. Then place a protector tool over shaft and attach puller.

Remove snap rings securing front and rear hubs and slide hub and disk packs from shaft.

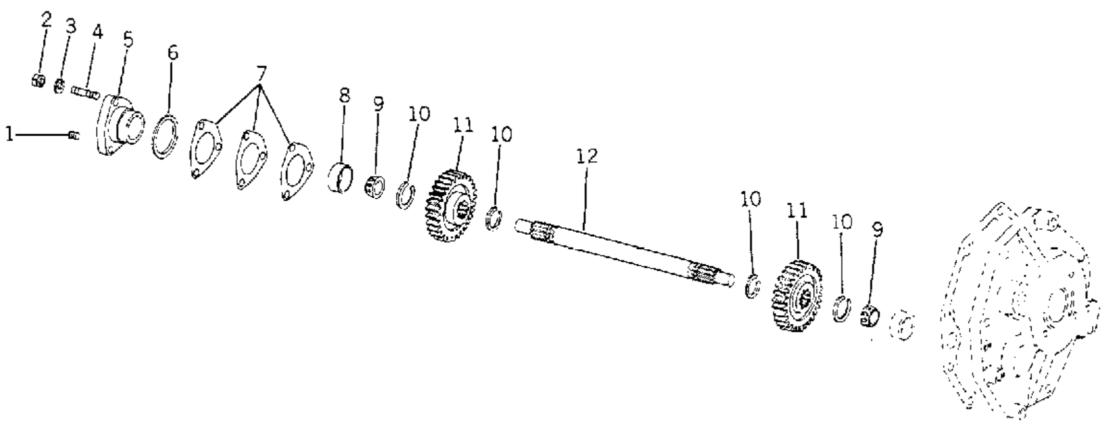
Remove large snap rings securing pistons to carriers (24) and remove pistons (21).

Remove piston carrier by placing assembly in press and pressing clutch shaft through carrier (carrier is keyed to clutch shaft). When pressing off front piston carrier, be sure to use a protector on end of clutch shaft (31) to protect flow regulating plug.



1—Oil Seal
2—Nut (4 used) (-278429)
3—Lock Washer (4 used)
4—Stud (4 used) (-278429)
Cap Screw (278430-)
5—Quill
6—Sealing Ring
7—Shim (as required)
8—Bearing Cup
9—Bearing Cone
10—Special Washer
11—Thrust Washer
12—Roller Bearing
13—Rear Clutch Spider
14—Special Washer
15—Snap Ring (2 used)
16—Drive Key (6 used)
17—Special Screw (6 used)
18—Hub and Back Plate (2 used)
19—Sintered Plate (12 used)
20—Driving Plate (12 used)
21—Piston (2 used)
22—Piston Ring (2 used)
23—Pin (2 used)
24—Carrier (2 used)
25—Piston Ring (2 used)
26—Piston Ring (4 used)
27—Piston Plate (2 used)
28—Snap Ring (2 used)
29—Piston Ring (2 used)
30—Collector
31—Clutch Shaft
32—Woodruff Key (2 used)
33—Flow Regulating Plug
34—Bearing Cone
35—Bearing Cup
36—Forward Clutch Spider
37—Bearing Cone

Fig. 11-Reverser Clutch Assembly



T36498N

1—Pipe Plug
2—Nut (3 used) (-278429)
3—Lock Washer (3 used)
4—Stud (3 used) (-278429)
Cap Screw (3 used) (278430-)
5—Quill
6—Sealing Ring
7—Shim (as required)
8—Bearing Cup
9—Bearing Cone (2 used)
10—Snap Ring (4 used)
11—Countershaft Gear (2 used)
12—Countershaft

Fig. 12-Countershaft Assembly

Remove four piston rings from piston carrier. The rings are self locking and can be easily removed by pressing on side opposite joint, then pushing in one locking tab, causing tabs to snap free.

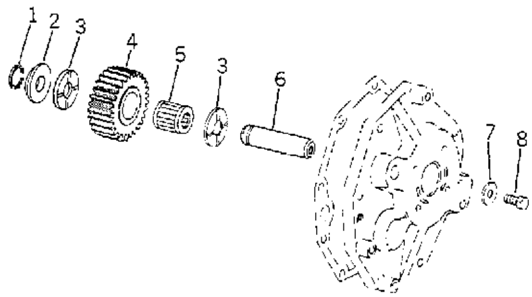
Slide piston plates (27, Fig. 11) and collector (30) from clutch shaft. Remove two piston rings (29) from collector.

Wash all clutch parts in clean solvent and dry thoroughly before inspection.

Inspect all parts thoroughly for excessive wear or damage. Replace worn or damaged parts.

Check bearings for damaged or worn rollers.

Inspect gears for excessive tooth wear or broken teeth. Make sure splines are in good condition.



T36499N

1—Snap Ring
2—Special Washer
3—Thrust Washer (2 used)
4—Idler Gear
5—Roller Bearing
6—Idler Shaft
7—Washer
8—Cap Screw

Fig. 13-Idler Shaft Assembly

INSTALLATION

Refer to Fig. 11, page 0350-12 as an assembly guide.

Install four piston rings on carrier (24).

Assemble piston parts. Slide piston over rear of carrier so that carrier pin (23) matches hole in piston. Install piston plate (27) inside front shoulder of piston and secure with snap ring.

Press piston assemblies onto clutch shaft. First slide collector (30) onto clutch shaft. Then place one piston assembly, face up, on platform of press. Insert flow regulator end of clutch shaft into carrier bore, insert key, and carefully press in clutch shaft. Piston is pressed all the way on shaft to allow for end play of shaft.

Turn assembly over and press on other piston. Do this by placing other piston on platform, face up, keying clutch shaft, and pressing in shaft using a shaft protector over flow regulator plug.

Assemble clutch packs on hubs. Place sintered plate on hub first. Install all sintered plates and driving plates so that when pack is installed, a driving plate is on the working face towards the piston.

Install packs over splines of clutch shaft and secure with snap rings.

Install special washer on spline shoulder at rear of clutch shaft.

Press front bearing cone on clutch shaft. Use an old bearing or any suitable tool to press on bearing.

Install rear spider.

Install thrust washer (11) over end of clutch shaft. If parts are installed correctly, this washer will just fit down over large shoulder of clutch shaft. Then install heavy steel washer, which should fit flat on top of shaft shoulder. If necessary, press on this washer using a suitable tool.

Press bearing cone onto clutch shaft over washers. Install front spider.

Assemble countershaft using Fig. 12 as an assembly guide.

Assemble idler shaft using Fig. 13 as a guide and secure to front cover.

Install reverser clutches and countershaft in housing.

Refer to Section 3, Group 0341 and assemble reverser through hydraulic pump in front cover installation.

Next adjust end play on reverser clutches and countershaft as follows:

Turn reverser case over with rear end upward on stand and attach a dial indicator to end of clutch shaft (Fig. 14). Pry on opposite end of front spider shaft and check endplay of shaft (0.002 to 0.004 inch [0.05 to 0.10 mm]).

If necessary, remove rear quill and add or subtract shims until proper endplay is obtained.

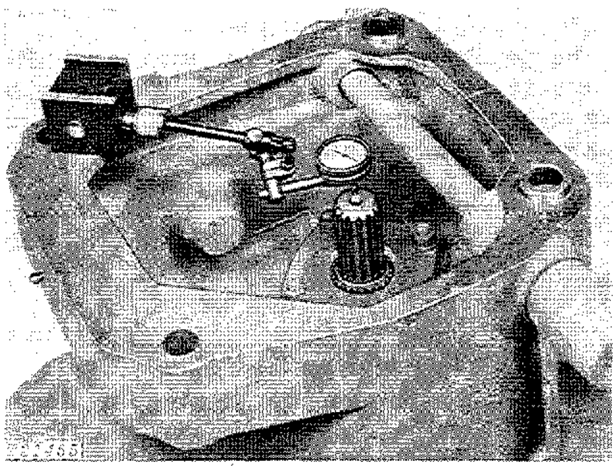


Fig. 14-Checking for Proper Endplay on Clutch Shaft

Secure the rear quill with studs (4, Fig. 11), lock washers (3), and nuts (2). Thoroughly clean the studs and apply John Deere Threadlock and Sealer (medium strength) or an equivalent prior to installation of lock washers and nuts.

NOTE: Ser. No. (278430-) use cap screws and lock washers instead of studs, lock washers, and nuts. Use Threadlock and Sealer on cap screws also.

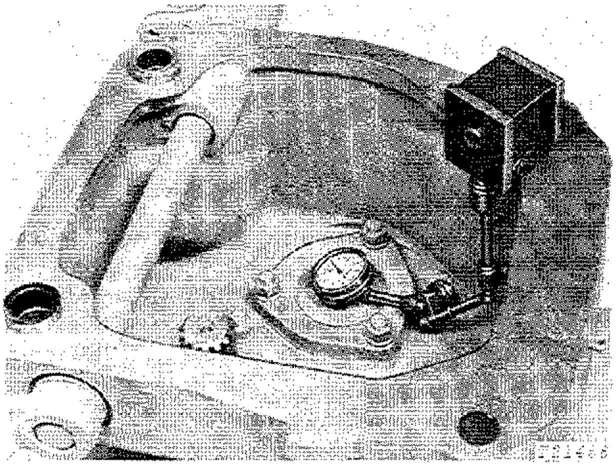


Fig. 15-Checking for Proper Endplay on Countershaft

To check countershaft endplay (Fig. 15) attach dial indicator to end of shaft through hole in quill. Reach through filter hole and move the shaft to check for proper endplay reading (0.002 to 0.004 inch [0.05 to 0.10 mm]). If necessary, remove quill and add or subtract shims until proper endplay is obtained.

Secure the quill with studs (4, Fig. 12), lock washers (3), and nuts (2). Thoroughly clean the studs and apply John Deere Threadlock and Sealer (medium strength) or an equivalent prior to installation of the nuts and lock washers.

NOTE: Ser. No. (278430-) use cap screws and lock washers instead of studs, lock washers, and nuts. Use Threadlock and Sealer to cap screws also.

Install clutch shaft oil seal in quill. Coat lips of seal with Lubriplate and install over shaft (with lips inward) flush with face of quill.

Refer to Section 3, Group 0341 and finish assembling reverser and install in crawler.

Group 0360
TRANSMISSION HYDRAULICS
HYDRAULIC REVERSER PUMP

GENERAL INFORMATION

The constant-running, rotor-type hydraulic pump mounts over and is driven by the front spider shaft. The pump housing or cover bolts to the front cover of the reverser case (Fig. 1). Pump rotation is counter-clockwise (when viewed from the rear).

As the inner rotor revolves, it drives the outer rotor. The bore in the pump body, in which the outer rotor revolves, is eccentric to the spider shaft and inner rotor. Since the outer rotor has nine cavities and the inner rotor has eight lobes, the outer rotor revolves at eight-ninths spider shaft speed. Only one lobe of the inner rotor is in full engagement with the outer rotor at any given time, so the inner rotor revolves inside the latter without interference.

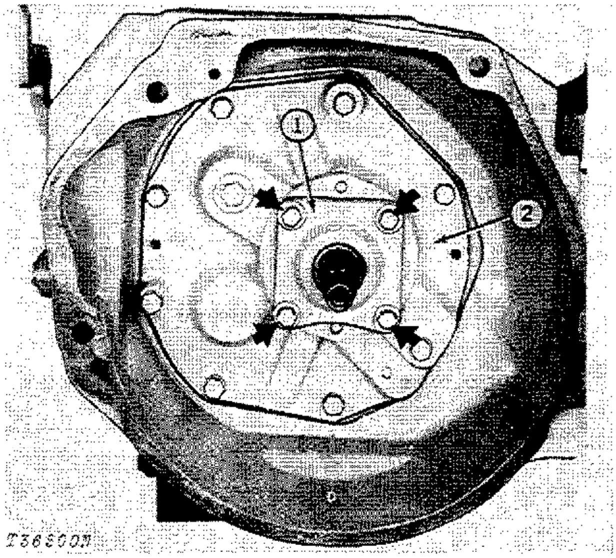
As the pump rotors revolve, a low pressure is formed on the inlet side of the pump and oil is drawn from the reservoir in the reverser case. Oil then passes through the filter and upward through an internal, drilled passage in the front cover to the integral pump in the front cover. Pressure oil is then discharged to the control valve.

Oil used for flushing, releasing, and cooling the clutch packs is first pumped through the reverser oil cooler, which is located in the bottom tank of the crawler radiator.

REMOVAL

Separate unit between rear of engine and front of reverser. Remove reverser unit from crawler as outlined in Group 0341 of this section.

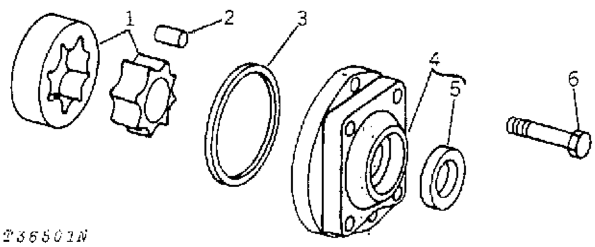
Remove four cap screws attaching pump cover (1, Fig. 1) to reverser case front cover (2). Pull cover and remove inner and outer pump gears from the shaft.



1—Pump Cover 2—Reverser Front Cover

Fig. 1-Hydraulic Pump and Front Cover

REPAIR



1—Pump Gears
2—Dowels (2 used)
3—Sealing Ring
4—Pump Cover
5—Oil Seal
6—Cap Screw (4 used)

Fig. 2-Hydraulic Reverser Oil Pump

Wash all parts in clean fuel oil and dry with compressed air, and inspect.

The greatest amount of wear on the pump is imposed on the lobes of the inner and outer gear. Clean hydraulic oil reduces this wear to a minimum. Inspect the lobes and faces for scratches or burrs. Score marks here and on pump pocket and cover facings may be removed with an emery cloth. Normally, if the lobes of one gear are excessively worn, those of the other will be damaged also, and both gears should be replaced as a set.

Inspect the splines of the inner gear for excessive wear (check also drive splines on front spider). If splines are excessively worn, replace with new parts.

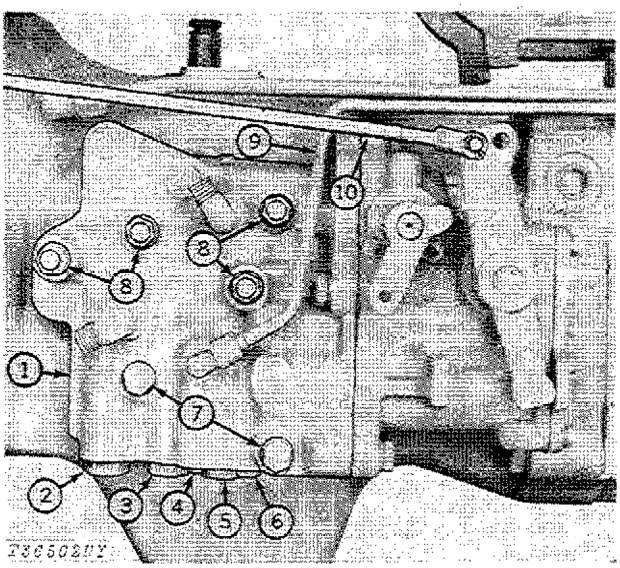
INSTALLATION

Coat inner and outer gears with oil and place them in pump cover. Place new sealing ring in groove on rear of pump cover. Coat lips of cover oil seal with Lubriplate. Tape splines on front spider shaft to protect seal. Slide pump cover over shaft with an easy rotary motion. Align pump cover on dowels and secure with four cap screws and lock washers. Tighten cap screw to 35 lb-ft (5 kg-m).

Install reverse unit into crawler as outlined in Group 0341 of this section.

REVERSER CONTROL VALVE

GENERAL INFORMATION



1—Control Valve Assembly
2—Cooler Pressure Regulating Valve
3—Clutch Pressure Regulating Valve
4—Restricting Orifice
5—Lube Regulating Valve
6—Bypass Valve
7—Cap Screw (2 used)
8—Nut (4 used)
9—Line
10—Rod

Fig. 3-Reverser Control Valve

The control valve housing assembly (Fig 3) mounts on the left side of the reverser case; the rear of the assembly is formed by the accumulator housing and cover.

The complete assembly contains all the valves and oil passages necessary to hydraulically control the engagement and disengagement of the reverser clutches.

The valves located in the control valve housing are: three pressure regulating valves; bypass valve; adjustable orifice; clutch valve (operated by foot clutch); and rotary valve (operated by control lever).

An accumulator piston regulates the "surges" of engaging oil sent by the rotary valve to the reverser clutches.

Three oil inlet tubes in the reverser case wall direct oil from the control valve into the oil collector ring, between the reverser clutches.

REMOVAL

Separate unit between rear of engine and front of reverser. Remove reverser unit from crawler as outlined in Group 0341 of this section.

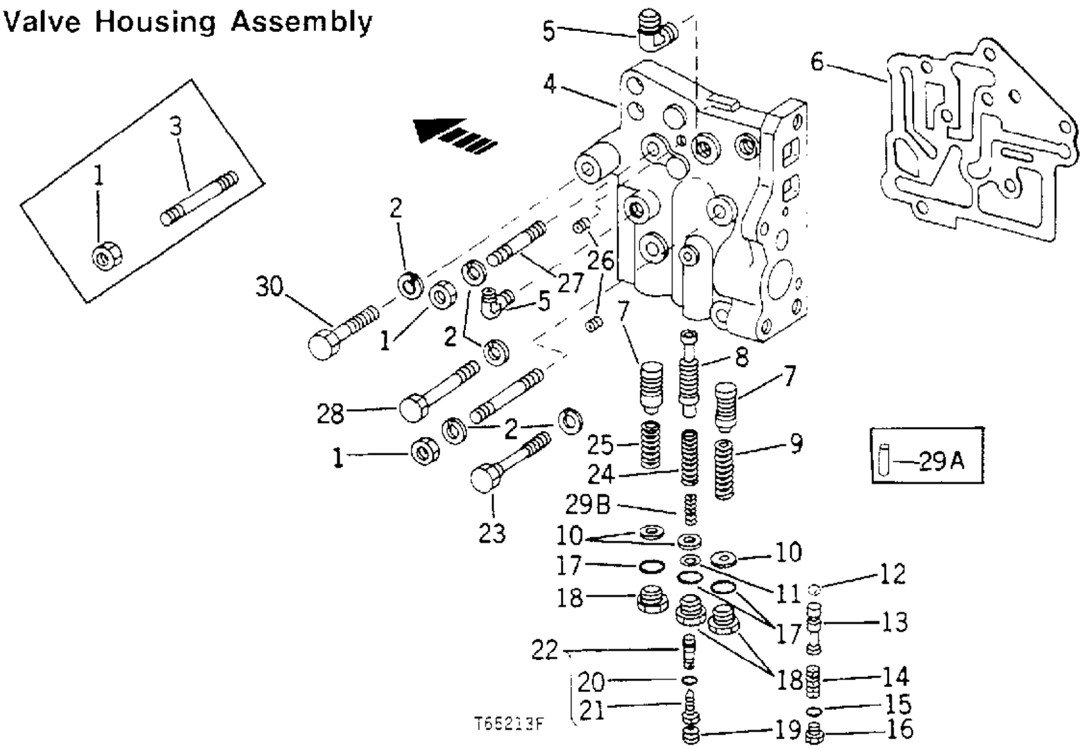
Remove two cap screws (7, Fig. 3) and four nuts (8) from control valve housing. Disconnect line (9, Fig. 3) from control valve.

Detach rod (10, Fig. 3) from rear clutch arm.

Slide valve housing and gasket from studs.

REPAIR

Relief Valve Housing Assembly



1—Nut (4 used)
(-278429)
2—Lock Washer (6 used)
3—Stud (2 used)
(-278429)
4—Relief Valve Housing
5—Elbow (2 used)
6—Gasket
7—Piston (2 used)
8—Relief Valve
9—Spring
10—Shim (as required)
11—Shim (as required)
12—Bypass Valve Ball
13—Bypass Valve
14—Spring
15—O-Ring
16—Plug
17—Aluminum Washer
(3 used)
18—Plug (3 used)
19—Hex. Pipe Plug
20—O-Ring
21—Regulating Screw
22—Orifice
23—Special Cap Screw
24—Spring
25—Spring
26 —Hex. Pipe Plug
(2 used)
27 —Stud (2 used)
28 —Cap Screw
29A—Dowel Pin (-278391)
29B—Spring (278392-)
30 —Cap Screw
(278430-)

Fig. 4-Hydraulic Reverser Relief Valve Housing Assembly

Refer to Fig. 4 for parts identification and disassemble relief valve.

Remove three regulating valves by removing large hex. plugs and washers from three lower bores of housing and sliding out shims, springs, and valves. Note number of shims behind each spring for proper reassembly.

Remove small hex. plug from bottom of valve housing and pull spring and bypass valve. Be careful not to lose small steel ball which is loose in bore above bypass valve.

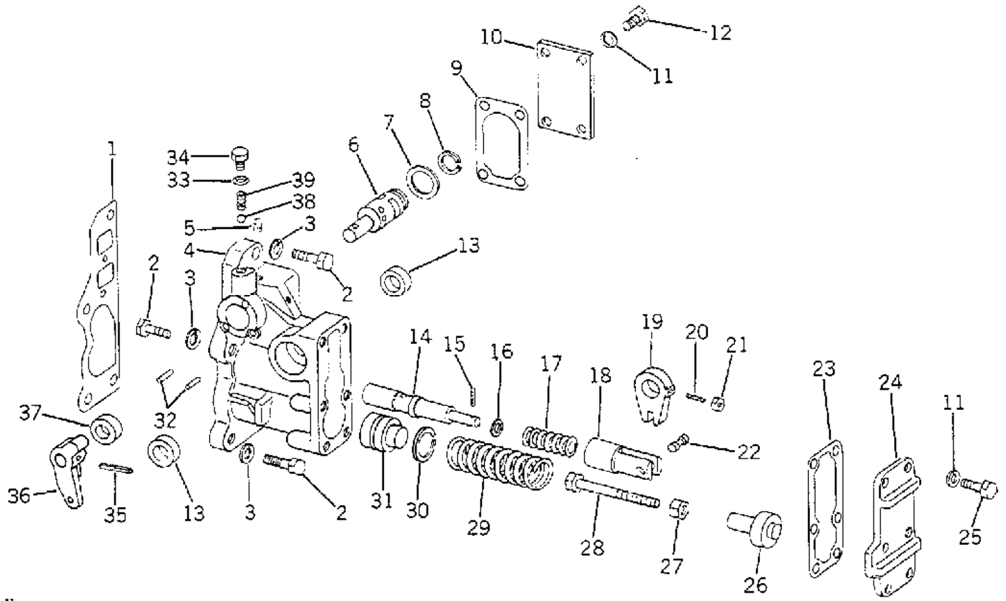
Remove small pipe plug next to lube regulating valve bore. Reach into bore with small-blade screwdriver and remove adjusting screw from orifice. Then use screwdriver to remove orifice.

NOTE: Original orifice (22, Fig. 4) has one hole. Service replacement orifice (22) has two holes.

Inspect the relief valve housing for damage or cracks. Remove plugs and flush out all passages with cleaning solvent; then dry with compressed air. See that all passages are open and clean. Check valve bores and accumulator cylinder for scoring. Install plugs removed for cleaning. Discard and replace old housing gasket.

Wash all parts in solvent and dry. Clean any dirt from oil grooves in valves. Inspect ground surfaces of these valves for any nicks or burrs. Check valve springs for worn or broken coils. Replace any damaged parts. Discard and replace old washers on plugs.

Reverser Accumulator Housing



T36504N

1—Gasket
2—Cap Screw (4 used)
3—Lock Washer (4 used)
4—Accumulator Housing
5—Pipe Plug
6—Forward-Reverse Clutch Valve
7—Washer
8—Snap Ring
9—Gasket
10—Cover
11—Lock Washer (10 used)
12—Cap Screw (4 used)
13—Oil Seal (2 used)
14—Clutch Valve
15—Spring Pin
16—Washer
17—Spring
18—Clutch Valve Piston
19—Clutch Valve Lever
20—Set Screw
21—Jam Nut
22—Pin
23—Gasket
24—Cover
25—Cap Screw (6 used)
26—Spring Cap
27—Jam Nut
28—Cap Screw
29—Spring
30—Sealing Ring
31—Accumulator Piston
32—Spring Pin (2 used)
33—O-Ring
34—Plug
35—Spring Pin
36—Forward-Reverse Control Arm
37—Oil Seal
38—Ball
39—Spring

Fig. 5-Hydraulic Reverser Accumulator Housing Assembly

Refer to Fig. 5 for parts identification and disassemble accumulator housing.

Drive out spring pin and remove clutch control lever from clutch lever shaft.

Remove accumulator housing (4) and gasket by removing four cap screws and lock washers.

Remove spring pin (35) and pull forward-reverse control arm (36) from shaft.

Remove plug (41), spring (39) and ball (38).

Remove cover (10) and gasket and slide out forward-reverse clutch valve (6).

Remove cover (24) and gasket from accumulator housing and slide out spring cap (26) and spring (29, Fig. 5). Slide accumulator piston (31) from its bore.

Loosen jam nut (21) on clutch valve lever set screw (20). Use socket head wrench to remove set screw. Slide out clutch lever shaft. Remove clutch valve lever (19).

Remove clutch valve assembly from its bore.

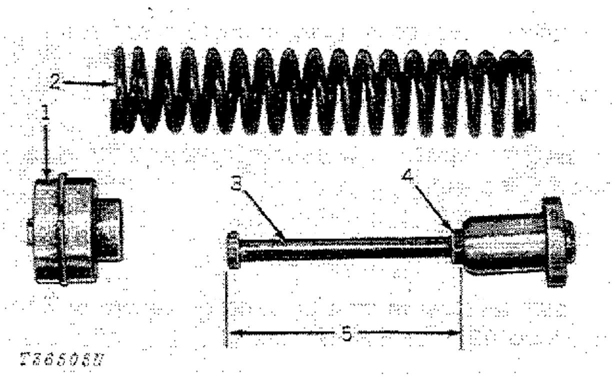
To disassemble the clutch valve assembly, drive pin (22) from fork of clutch valve piston. Hold piston down against spring and drive spring pin from end of clutch valve (14) to separate parts.

Wash all parts in solvent and dry. Clean any dirt from passages in housing. Inspect housing bores and cover mounting surfaces for damage. Discard and replace old gaskets.

Inspect oil seals, O-ring, accumulator piston, piston spring, clutch valve and springs. Replace as needed.

Assembly

Use Figs. 4 and 5 as a guide when assembling control valve.



1—Accumulator Piston
2—Spring
3—Stop Bolt
4—Lock Nut
5—Length of Accumulator Stop Bolt

Fig. 6-Accumulator

Measure length (5, Fig. 6) of accumulator stop bolt from top of head to rear of lock nut (6). This distance should be 4 in. (102 mm).

Adjust if necessary by loosening lock nut and turning stop bolt in or out of cap. Then secure with lock nut. Tighten lock nut to 20 lb-ft (3 kg-m). Slide spring over stop bolt and end of cap.

To assemble clutch valve, place washer (16, Fig. 5) and spring (17) on clutch valve (14) and, holding piston (18) down against spring, insert roll pin (15) in end of clutch valve to secure parts. Install larger pin (22) in forks of piston.

Slide accumulator piston (31, Fig. 5) with sealing ring into its bore in valve housing (4, Fig. 4) and assemble accumulator housing to valve housing.

Install clutch valve assembly in its bore in accumulator housing.

Coat clutch lever shaft with Lubriplate and insert into bore. Position notch end of lever (19, Fig. 5) over pin (22) between forks of clutch valve piston (18). Slide clutch lever shaft on through hole in lever (19) and into other side of housing. Line up hole in lever and shaft and install set screw (20). Tighten jam nut.

Install accumulator assembly in lower bore of accumulator housing. Install end cover and gasket.

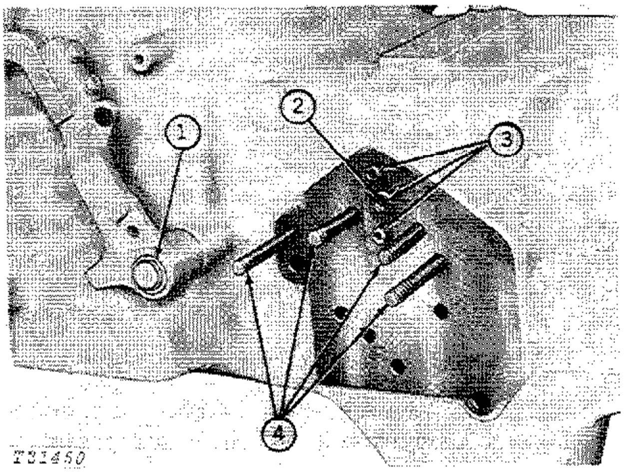
Insert steel ball (12, Fig. 4) into bypass valve. Then install bypass valve in its bore, double spool end first. Install spring in plug. Install orifice (22, Fig. 4) in its bore. Screw in until snug. Turn adjusting screw (21) into orifice until it covers the largest opening in orifice. Install pipe plug (17).

Install relief valves in relief valve housing.

Coat shaft of forward-reverse clutch valve (6, Fig. 5) with Lubriplate and insert valve in bore in accumulator housing. Make sure washer and snap ring are installed on valve. Install cover (10).

Install forward-reverse arm on clutch valve and secure with roll pin.

Installation



1—Pedal Snap Ring
2—Retainer
3—Oil Inlet Tubes
4—Studs

Fig. 7-Oil Inlet Tubes

Install oil inlet tubes (3, Fig. 7) if removed. Install new O-rings in grooves at each end of outer tubes. In center bore, insert tube, place new O-ring in counter bore, and insert retainer (2) in counter bore.

Position new gasket over mounting studs and inlet tubes, checking to be sure that gasket holes match cavities in case.

Install control valve assembly and tighten cap screws and nuts.

Connect rod to clutch arm.

Install reverser in crawler using procedure outlines in Group 0341 of this section.

REVERSER OIL FILTER

GENERAL INFORMATION

Reverser sump oil circulates through a full flow oil filter before passing out an internal. drilled passageway on its way to the reverser pump.

Should the element become clogged by residue or by sluggish oil (in extreme cold weather), a low pressure pocket is created by pump suction and reservoir oil at atmospheric pressure opens a spring loaded bypass in the head of the filter. The oil then flows through the hollow center of the filter to the pump, bypassing the element.

REMOVAL

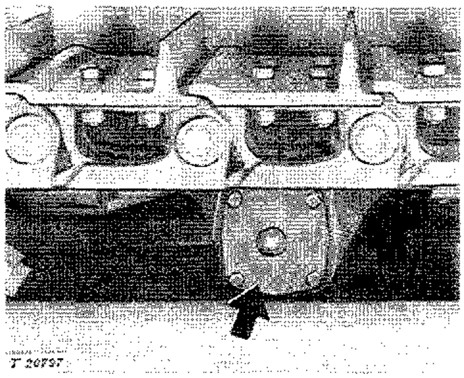


Fig. 8-Reverser Oil Filter

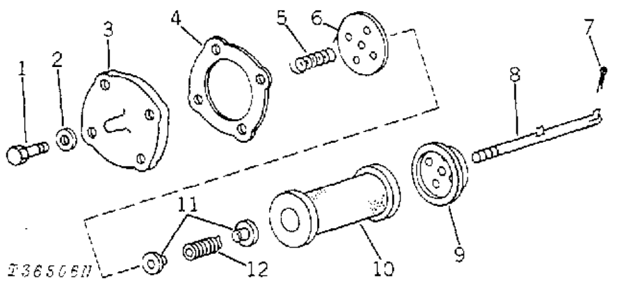
Remove four cap screws from cover on case and pull cover and filter element. Remove and discard filter element.

REPAIR

Remove filter by rotating cap (9, Fig. 9) until slots in cap match tabs on stud (8). Remove and discard old filter element.

Unscrew stud (10, Fig. 9) from cap (3).

Inspect springs (5 and 12, Fig. 9) for wear or broken coils.



1—Cap Screw (4 used)
2—Lock Washer (4 used)
3—Oil Filter Cover
4—Gasket
5—Outer Spring
6—Cap
7—Cotter Pin
8—Oil Filter Stud
9—Inner Filter Cap
10—Oil Filter Element
11—Retainer (2 used)
12—Spring

Fig. 9-Reverser Oil Filter

Assemble parts on threaded end of filter stud (10) against pin as follows: Large spring (12) with retainer (11) in each end, cap (6) and small spring (5). Tighten stud securely into filter cover.

Install new filter element on stud. Place metal cap (9) on stud, align slots with tabs and press cap down. Then rotate cap 1/4 turn to secure with tabs.

INSTALLATION

Insert filter assembly in reverser case. Be sure cover gasket is in place. Attach cover using four cap screws and lock washers.

OIL COOLER

GENERAL INFORMATION

The reverser oil cooler is part of the radiator assembly.

There is no repair to the oil cooler.

For "removal and installation" of radiator, see Section 5, Group 0510.

Group 0399
SPECIFICATIONS AND SPECIAL TOOLS
CONTROLS
SPECIFICATIONS AND TORQUE VALUES

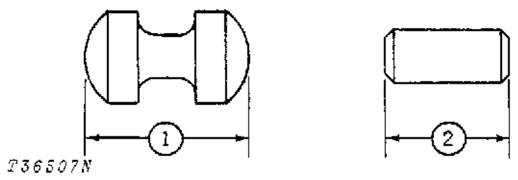


Fig. 1-Interlock Plug and Pin

1. Length of interlock plug .... 0.685 to 0.690-inch (17.40 to 17.53 mm)

2. Length of interlock pin ..... 0.527 to 0.532-inch (13.39 to 13.51 mm)

HOUSINGS AND COVERS

SPECIFICATIONS AND TORQUE VALUES

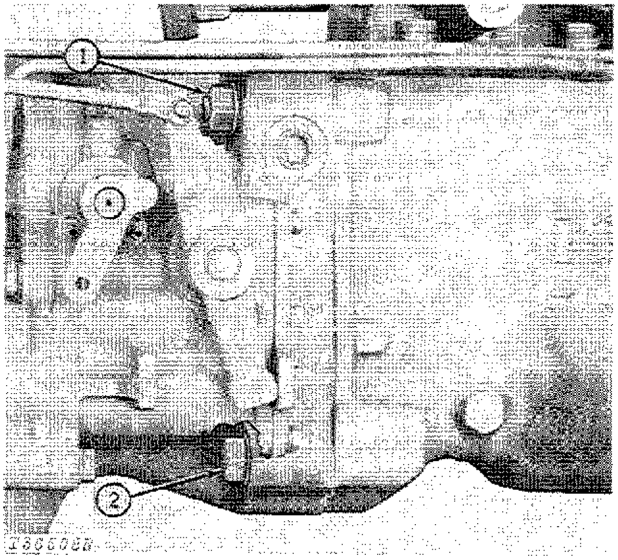


Fig. 2-Transmission to Reverser Attaching Torques

1. Hex. nut to transmission case studs .... 300 ± 30 lb-ft (41 ± 4 kg-m)

2. Reverser housing to transmission case cap screw .... 425 ± 42 lb-ft (59 ± 6 kg-m)

GEARS, SHAFTS, BEARINGS AND POWER SHIFT CLUTCH

SPECIFICATIONS AND TORQUE VALUES

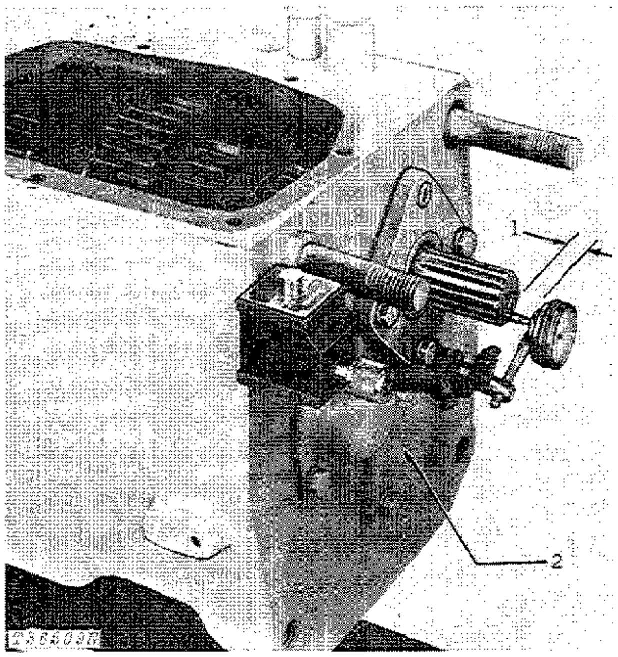


Fig. 3-Checking Shaft End Play

1. Input shaft end play . . . . 0.001 to 0.004 inch (0.03 to 0.10 mm)
2. Power shaft end play . . . . 0.001 to 0.005 inch (0.03 to 0.13 mm)

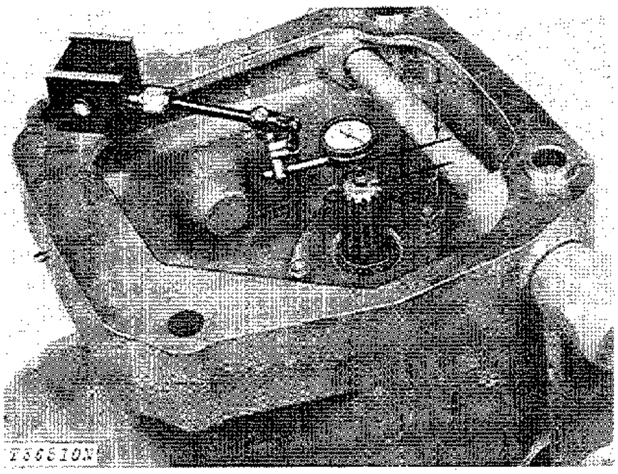


Fig. 4-Checking Clutch Shaft End Play

1. Clutch shaft end play . . . . . . 0.002 to 0.004-inch (0.05 to 0.10 mm)

GEARS, SHAFTS, BEARINGS AND POWER SHIFT CLUTCH

SPECIFICATIONS AND TORQUE VALUES—Continued

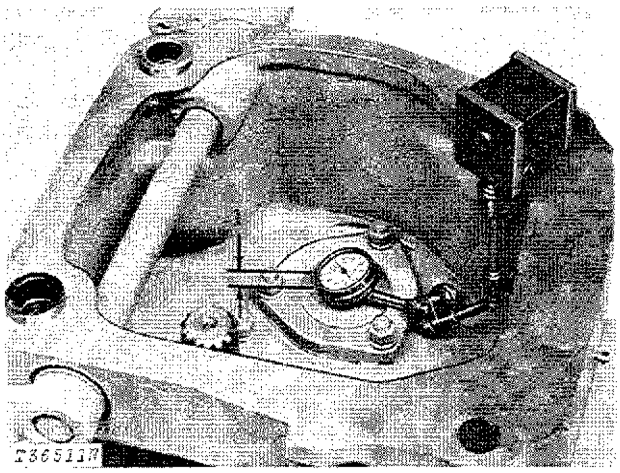


Fig. 5-Checking Counter Shaft End Play

1. Counter shaft end play .... 0.002 to 0.004-inch (0.05 to 0.10 mm)

TRANSMISSION HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES

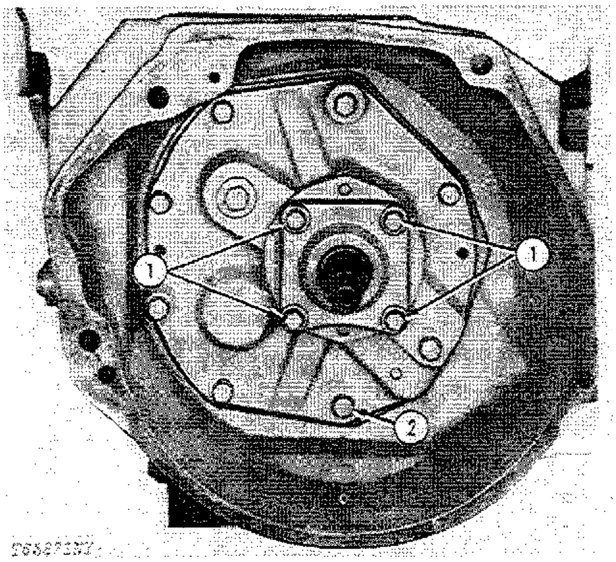


Fig. 6-Reverser Pump Attaching Cap Screws

1 - Reverser pump attaching cap screw torque .... 35 lb-ft (5 kg-m)

2 - Reverser housing front cover attaching cap screw torque .... 55 lb-ft (7.6 kg-m)

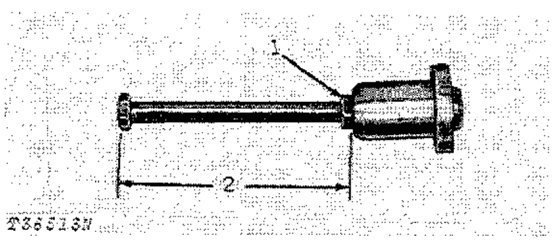
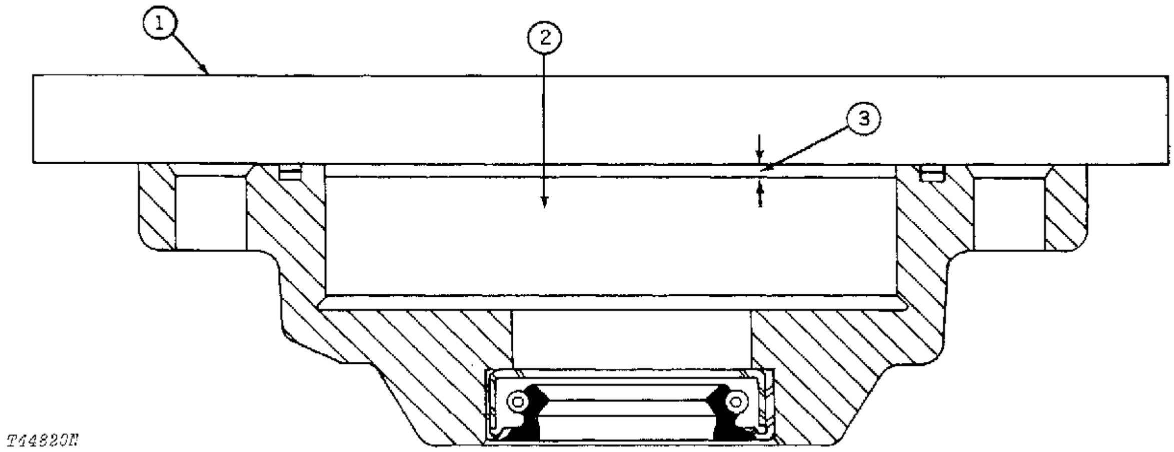


Fig. 7-Accumulator

1 - Accumulator cap lock nut torque .... 20 lb-ft (3 kg-m)

2 - Accumulator stop bolt length.............. 4 in. (102 mm)



1—Straight Edge
2—Inner Gear

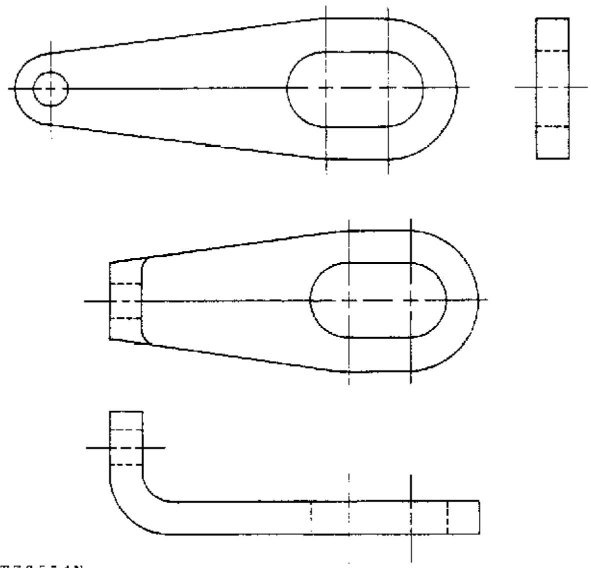
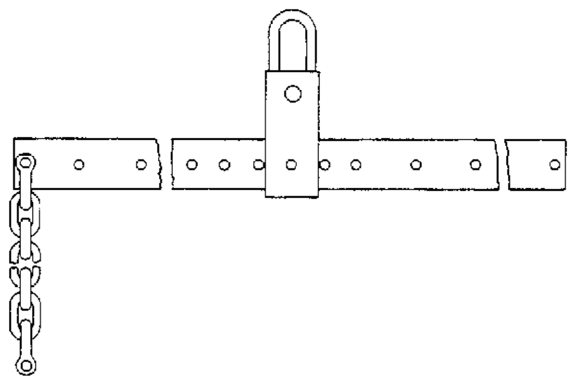
3—Maximum Side Clearance of Pump Gears with Housing Should be 0.004 in. (0.10 mm) and Can Be Measured with Straight Edge and Feeler Gauges.

Fig. 8-Reverser Pump Inner Gear Side Clearance

HOUSINGS AND COVERS

SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
 T36514N Fig. 9-Lifting Eyes	JD-244	Lifting Eyes - To remove transmission.
 T36515N Fig. 10-Sling	JDG-1	Sling - To remove transmission

Section 4
ENGINE

CONTENTS OF THIS SECTION

REPAIR INFORMATION

For complete repair information on the 3179 John Deere engine, component technical manual CTM-4 is also required.

Use the component manual in conjunction with this machine manual.

See the component manual for instructions on the engine and fuel system:

Diagnostic and testing procedures
Disassembly
Inspection
Repair
Assembly
Engine accessory items

See this machine manual for instructions on removal and installation.

CONTENTS—Continued

CONTENTS—Continued

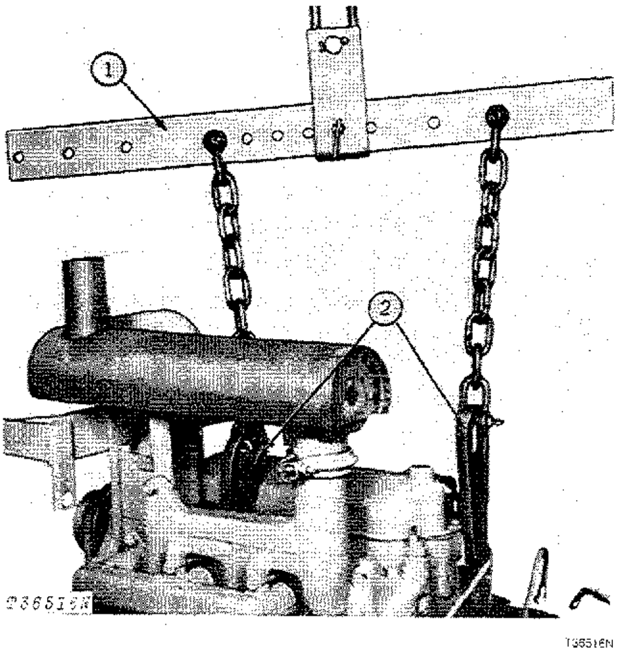
Group 0400
REMOVAL AND INSTALLATION

REMOVAL

Remove hood and grille housing.

Disconnect all the necessary wiring, linkage and lines from both sides of the engine.

Disconnect radiator hoses and remove radiator and pump with support as a unit.



1—JDG-23 Engine Lifting Sling or D01043AA Load Positioning Sling **2—JD-244 Lifting Eyes**

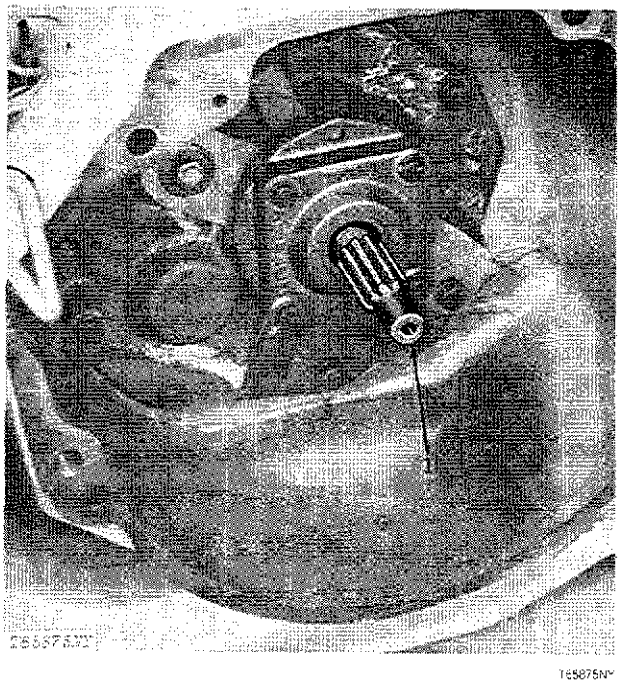
Fig. 1-Removing Engine

Install two JD-244 Lifting Eyes (Fig. 1) on cylinder head.

Attach JDG-23 Engine Lifting Sling or D01043AA Load Positioning Sling to lifting adapters. Remove cap screws securing engine flywheel housing to reverser housing and with a hoist remove engine from unit.

NOTE: Alternate method would be to remove the engine, radiator, and pump with support as one unit.

INSTALLATION



1—Reverser Input Shaft

Fig. 2-Engine Indexing Points

IMPORTANT: Tighten side frame-to-steering clutch cap screws before tightening side frame-to-engine clutch housing cap screws.

To install engine correctly, line up cap screw holes of engine with those of reverser housing. Bar engine over, holding it in a horizontal position and exerting a steady pressure on the engine toward the clutch housing until the engine clutch indexes with reverser input shaft (Fig. 2).

Tighten flywheel housing to reverser housing hardware to 250 lb-ft (339 N·m) (35 kg-m) (upper) and 170 lb-ft (230 N·m) (24 kg-m) (lower).

Install radiator and hoses.

Connect all the necessary wiring, linkage and lines to both sides of engine.

Start engine and check for oil or water leaks.

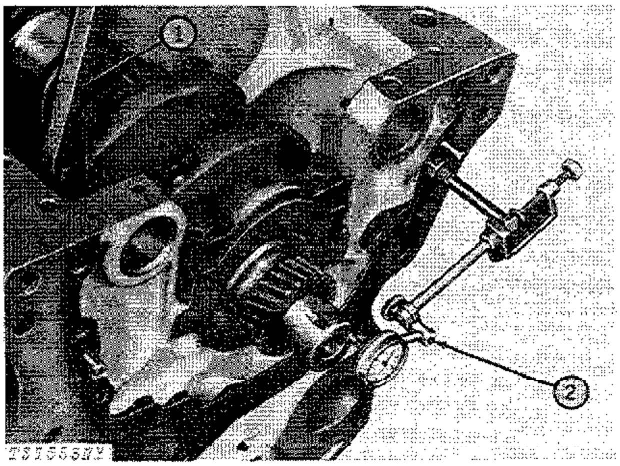
Group 0401
CRANKSHAFT AND MAIN BEARINGS

REMOVAL

To service crankshaft, main bearings and flywheel it is necessary to remove engine from unit (Group 0400).

Remove oil pan (Group 0407), timing gear train and front plate (Group 0402), flywheel, and flywheel housing (Group 0433).

Measure crankshaft end play and determine if it is within 0.0020 to 0.0080 inch (0.0508 to 0.2032 mm). End play exceeding this specification indicates a worn thrust bearing. However, a maximum end play of 0.0150 inch (0.381 mm) is acceptable.



T31553NY

1—Pry Bar **2—Dial Indicator**

Fig. 1-Checking Crankshaft 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.

Remove main bearing and connecting rod caps.

REPAIR

Crankshaft

Check crankshaft gear for wear or damage. To replace, remove gear with knife edge puller. To install, heat gear to approximately 360°F (182.2°C) (do not overheat), place Woodruff key in keyway and support crankshaft under first throw while pressing on gear.

Inspect crankshaft journals for damage.

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 0.0030 inch (0.0762 mm) or if tapered more than 0.0010 inch (0.0254 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 that thrust bearing wear was the cause for excessive 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 with 85 to 110 lb-in (9.6 to 12.4 N·m) (0.98 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:

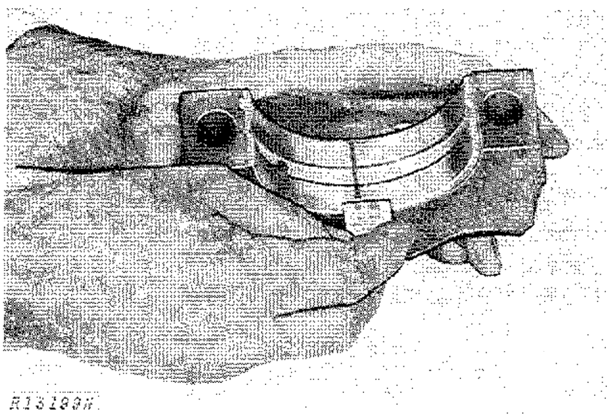
O.D. of main bearing
journal .... 3.1230 to 3.1240 in.
(79.324 to 79.350 mm)
I.D. of main bearing
(assembled) .... 3.1256 to 3.1276 in.
(79.390 to 79.441 mm)
Bearing to Journal Clearance .. 0.0016 to 0.0046 in.
(0.041 to 0.0117 mm)
Crankshaft main bearing
bore I.D. .... 3.3250 to 3.3260 inch
(84.455 to 84.480 mm)

A maximum clearance of 0.0060 inch (0.152 mm) is acceptable.

Clearance can be determined with the use of "Plastigage" while the main bearings are assembled on the crankshaft. Follow the instructions supplied by the manufacturer.

NOTE: If the engine is still in the tractor, use a light jack to raise the crankshaft against the upper half of the bearing. Keep all caps tight except the bearing being checked. Do not turn crankshaft.

The use of "Plastigage" will give bearing clearance, but will not reveal whether wear is on the crankshaft journal or on the bearing.

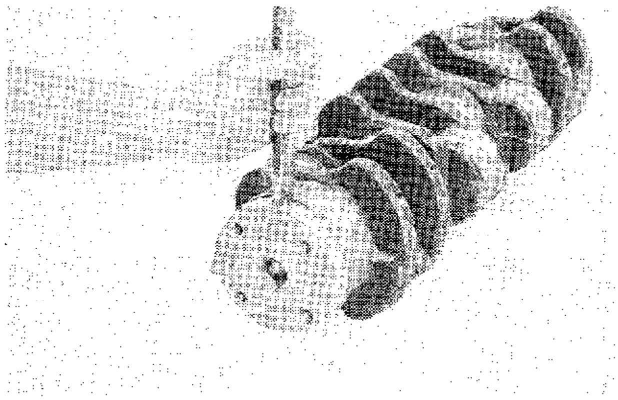


R13193N

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 (0.0508, 0.254, 0.508, and 0.762 mm) undersize bearings are available.

To remove old seal wear ring from crankshaft (Fig. 3), scribe lines across wear ring with the aid of a dull chisel until ring can be removed. **IMPORTANT: Do not scribe lines too deep in wear ring, as crankshaft wear ring surface may be damaged.**

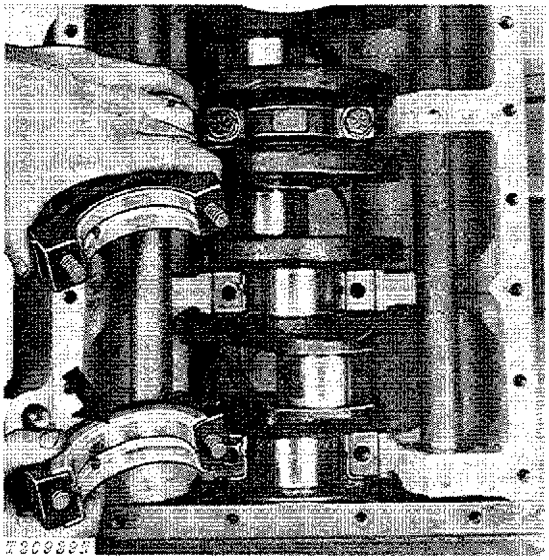


R81193

Fig. 3-Remove Wear Ring

The wear ring must be installed after the crankshaft and flywheel housing are installed (see "Crankshaft Rear Oil Seal and Wear Ring" in this group).

INSTALLATION

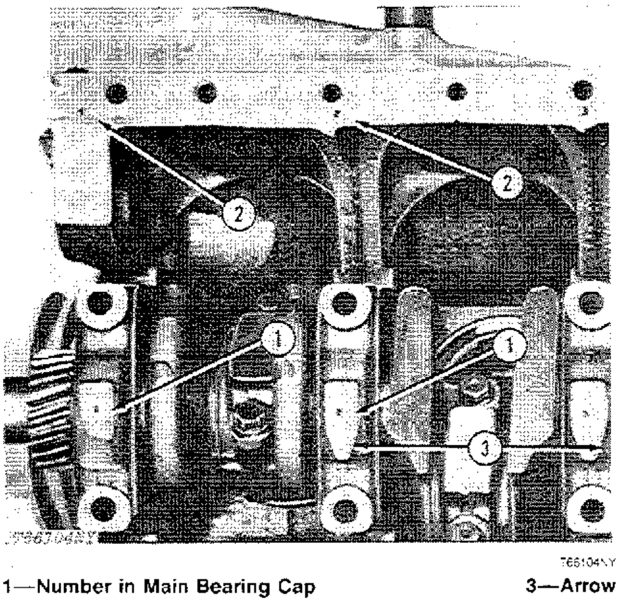


T20939N

Fig. 4-Installing Main Bearing Caps

Install inserts with thrust faces (Fig. 4) 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.

Put clean engine oil on main bearings.



T66104NY

1—Number in Main Bearing Cap
2—Number in Oil Pan Rail
3—Arrow

Fig. 5-Main Bearing Cap Positions

Install main bearing caps with numbers (1, Fig. 5) corresponding to numbers in oil pan rail (2). If there is no arrow (3) machined on main bearing cap, install cap with number to same side as numbers in oil pan rail. If there is an arrow machined on main bearing cap, arrow must point toward camshaft side.

Inspect cap screws for thread and under head damage. Replace as necessary.

Coat main bearing cap screws and washers with oil. 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 (11.75 kg-m).

Turn crankshaft by hand. Crankshaft should turn with little effort.

Check crankshaft end play. End play is 0.002 to 0.008 inch (0.05 to 0.20 mm) with new parts. Maximum end play is 0.015 inch (0.38 mm).

Install connecting rod caps (Group 0403).

Install flywheel housing (Group 0433).

Install crankshaft rear oil seal and wear ring (Group 0401).

Install flywheel (Group 0433).

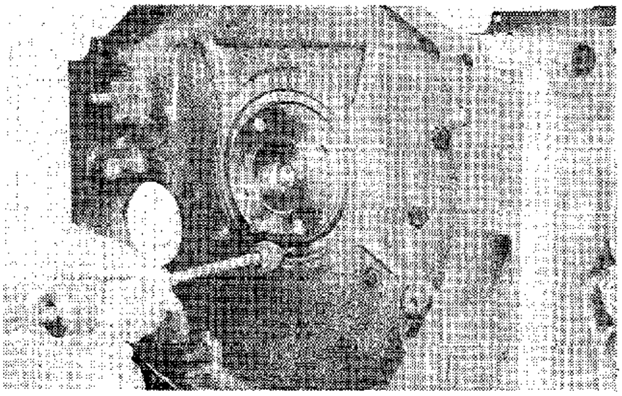
Install front plate, timing gear train, and timing gear cover (Group 0402).

Install oil pan (Group 0407).

CRANKSHAFT REAR OIL SEAL AND WEAR RING

Removal

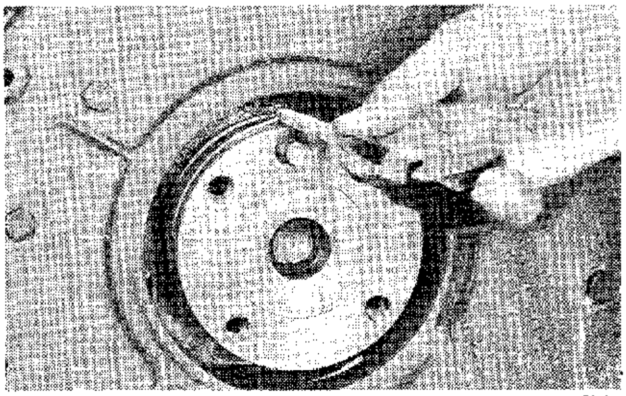
Remove flywheel (Group 0433).



T81200

Fig. 6-Remove Oil Seal

Remove seal with JDG-22 Seal Remover.

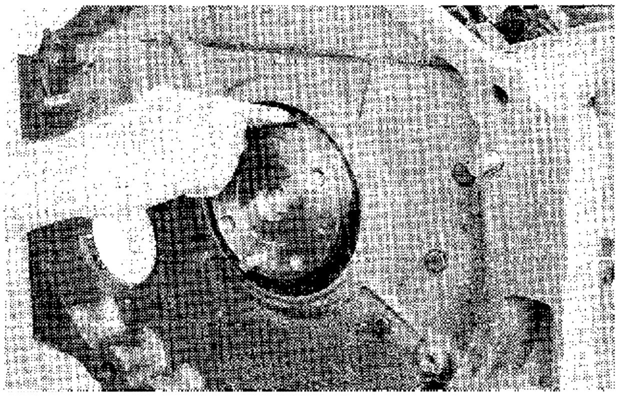


T81201

Fig. 7-Remove Wear Ring

IMPORTANT: DO NOT scratch crankshaft surface.

Cut wear ring off crankshaft.

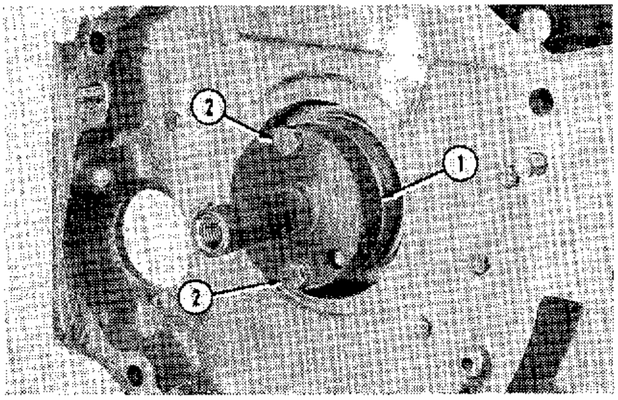


T81202

Fig. 8-Remove Scratches

Remove any scratches, nicks, or burrs with fine emery cloth.

Installation



T81203

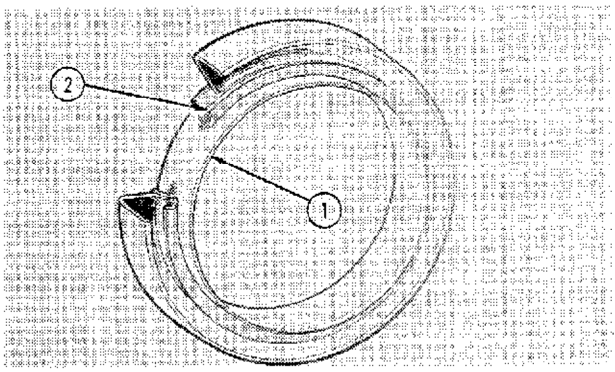
1—JDE-140-1 Guide Plate **2—Cap Screw**

Fig. 9-Install JDE-140-1 Guide Plate

Attach JDE-140-1 Guide Plate (1) with cap screws (2).

IMPORTANT: Use only enough sealant to fill nicked or scratched area.

Put a very thin film of T43513 John Deere LOCKTITE Thread Lock and Sealer (high strength), PT502 John Deere Gasket Maker or an equivalent sealant on the wear ring surface of the crankshaft.

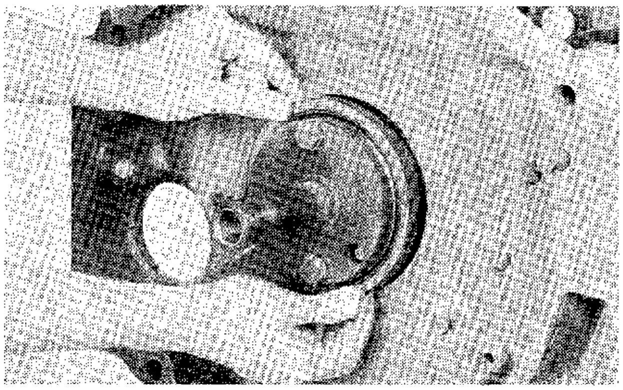


T73391

1—Chamfer **2—Open Side of Seal**

Fig. 10-Rear Oil Seal

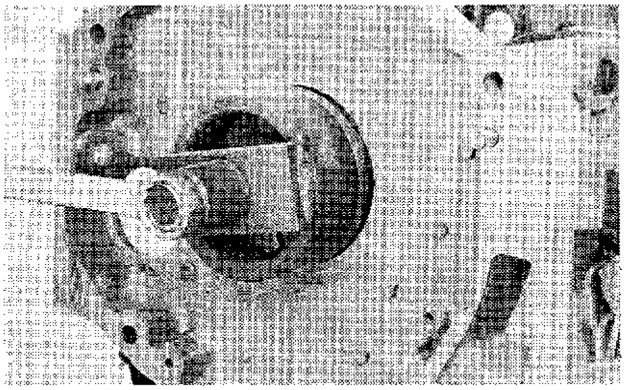
Check to be sure chamfer on wear ring inside diameter (1) and open side of the seal (2) are toward the same side.



T81204

Fig. 11-Install Seal and Wear Ring

Install seal and wear ring on guide plate with open side of seal toward engine.



T81205

Fig. 12-Push Seal Into Position

Attach JDE-140-2 Driver and 12189 Thrust Washer to the guide plate with 10497 cap screw. Tighten the cap screw until driver stops moving.

Remove the cap screw, thrust washer, driver, two cap screws and the guide plate.

Install flywheel and all parts removed with it (Group 0433).

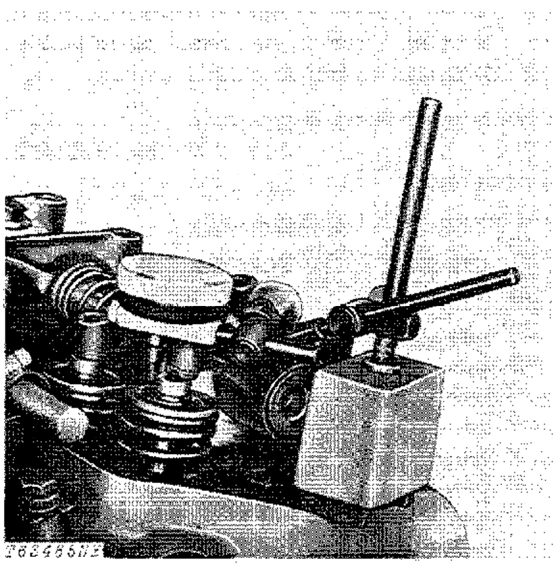
Group 0402
CAMSHAFT AND VALVE ACTUATING MEANS

GENERAL INFORMATION

The camshaft is alloy-iron with all cams integral. The gasoline engine camshaft is cast with an integral distributor drive gear. Both the gasoline and diesel engine camshafts have 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



T63485NY

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 (0.457 mm) for diesel and 0.022 inch (0.559 mm) for gasoline and intake valve clearance of 0.014 inch (0.356 mm) for both diesel and gasoline.

Place dial indicator on valve rotator or 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.

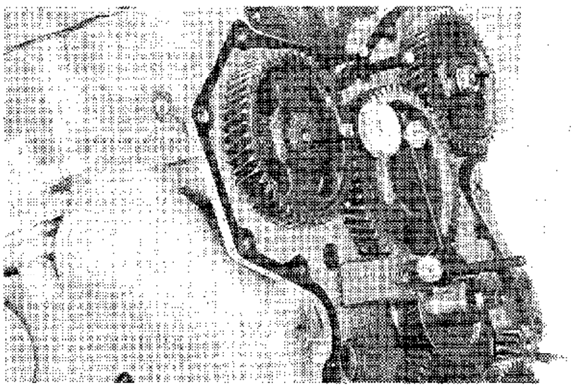
Exhaust valve lift should be 0.456 to 0.482 inch (11.58 to 12.24 mm) for diesel and 0.452 to 0.482 inch (11.48 to 12.24 mm) for gasoline and intake valve lift should be 0.460 to 0.490 inch (11.68 to 12.45 mm) for both diesel and gasoline.

REMOVAL

Camshaft

To service camshaft and related parts, engine normally need not be removed from unit. If engine has to be removed, refer to Group 0400.

Remove push rods. Use D-15001NU Magnetic Holding Tool Set to hold cam followers away from camshaft if the cylinder head has not been removed, or remove followers if the head has been removed. If followers are removed, mark them for identification on reassembly.



T81250

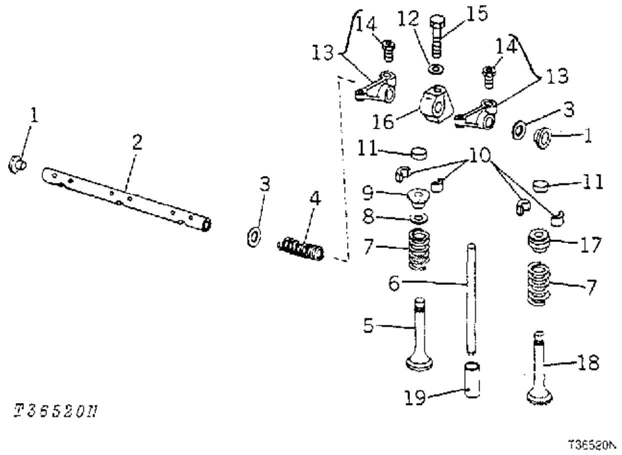
Fig. 2-Checking Camshaft End Play

Check camshaft end play. End play is governed by the thrust plate thickness. End play is 0.0025 to 0.0085 inch (0.0635 to 0.2159 mm). End play up to 0.015 inch (0.381 mm) is acceptable.

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, cam followers need not be wired up.

Rocker Arm Assembly



- 1—Plug (2 used)
- 2—Shaft
- 3—Bowed Washer (2 used)
- 4—Spring (2 used)
- 5—Intake Valve (3 used)
- 6—Push Rod (6 used)
- 7—Spring (6 used)
- 8—O-Ring (3 used)
- 9—Cap (3 used)
- 10—Retainer Lock (12 used)
- 11—Valve Stem Cap (6 used) (diesel)
- 12—Washer (3 used)
- 13—Rocker Arm (6 used)
- 14—Adjusting Screw (6 used)
- 15—Cap Screw (3 used)
- 16—Support (3 used)
- 17—Exhaust Valve Cap (3 used) (diesel) Exhaust Valve Rotator (3 used) (gasoline)
- 18—Exhaust Valve (3 used)
- 19—Tappet (6 used)

Fig. 3-Rocker Arm Assembly

Remove the supports (16, Fig. 3) and remove rocker arm assembly from the cylinder head. Remove the push rods (6) and tappets (19).

Timing Gear Train

To service gear train and related parts, with the exception of the crankshaft, engine normally need not be removed. If engine must be removed, see Group 0400.

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:

Remove timing gear cover.

Remove hex. nuts from the oil pump, drive gears and cap screws from upper and lower idler gears.

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.

Remove oil pump (Group 0407).

Remove fuel injection pump and drive gear (Group 0413) or governor (Group 0406).

Remove camshaft.

REPAIR

Camshaft

Inspect camshaft journals and bores in block for damage.

O.D. of journal is 2.200 to 2.201 in. (55.87 to 55.90 mm). Minimum journal diameter is 2.199 in. (55.85 mm). I.D. of camshaft bore in block is 2.204 to 2.205 in. (55.99 to 56.01 mm). Maximum oil clearance is 0.006 in. (0.15 mm).

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.

Measure each camshaft lobe at highest point and at narrowest point. Subtract narrowest dimension from highest dimension to find camshaft lobe height (Fig. 4).

New camshaft lobe height is (6.76 to 7.26 mm) 0.266 to 0.286 in. If height is not correct on any lobe, install a new camshaft.

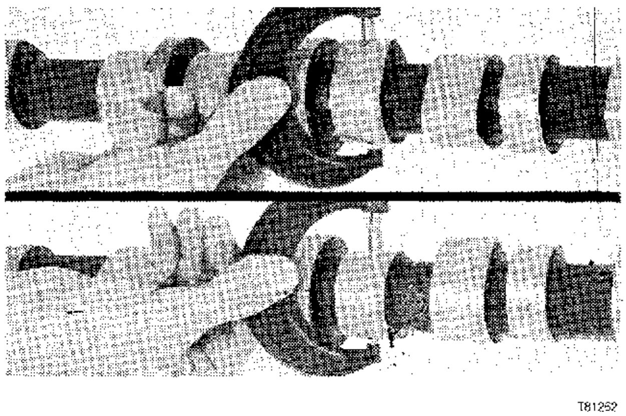


Fig. 4-Measure Camshaft Lobe Height

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.

Whenever a new camshaft is installed, replace the tappets with new parts.

If replacing tachometer drive, support camshaft and press in new drive gear in end of camshaft.

Rocker Arm Assembly

Remove plugs (1, Fig. 3) from rocker arm shaft. Slide parts from shaft and identify for reassembly.

Remove valve spring retainer locks (10), valve spring caps (9 and 17), valve springs (7), rotators (17, gasoline exhaust only) and valves (5 and 18). Identify each valve for reassembly into the guide from which it was removed.

Clean holes in rocker arms, rocker arm shaft and rocker arm mounting brackets to insure proper lubrication of the rocker assembly.

Check rocker arms and rocker arm shaft for wear. Rocker arm shaft O.D. is 0.7869 to 0.7879 inch (19.99 to 20.00 mm). Shaft may be 0.7849 inch (19.936 mm) and still be acceptable. I.D. of rocker arm bore is 0.7900 to 0.7920 inch (20.07 to 20.12 mm). Bore can also be worn an additional 0.0020 inch (0.050 mm).

If a failed valve has been replaced, also inspect the rocker arm and push rod for that valve.

Timing Gear Train

The camshaft and crankshaft must be removed 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 in. [0.0686 to 0.2946 mm]), upper idler to camshaft (0.0028 to 0.0135 in. [0.0711 to 0.3429 mm]), upper idler to injection pump (diesel) (0.028 to 0.0135 in. [0.0711 to 0.3429 mm]) crankshaft to lower idler (0.0027 to 0.0137 in. [0.0686 to 0.3480 mm]), lower idler to oil pump (0.0016 to 0.0147 in. [0.0406 to 0.3734 mm]), upper idler to governor (gasoline) (0.0023 to 0.0127 in. [0.0828 to 0.3226 mm]), camshaft to distributor (gasoline) for gear train backlash.

Replace gears as necessary.

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 [44.50 to 44.53 mm]) and outside diameter of shaft (1.7495 to 1.7505 inches [44.43 to 44.46 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.

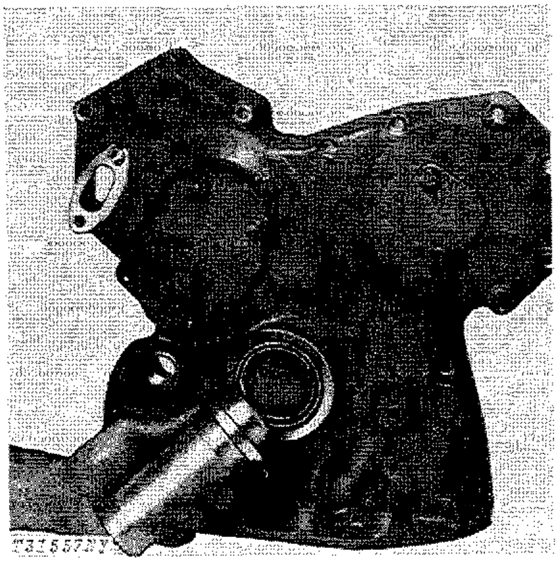


Fig. 5-Installing Oil Seal in Timing Gear Cover Using JD250 Driver

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 and inside surface with multi-purpose grease. 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 (Fig. 5).

INSTALLATION

Camshaft and Rocker Arm Assembly

Install the camshaft, noting the following:

Coat entire camshaft with a light film of oil.

When installing camshaft, do not permit cam lobes to drag on camshaft bores.

Turn the camshaft gear until the cap screws and locks which secure the thrust plate can be installed and tightened to 35 lb-ft (4.8 kg-m).

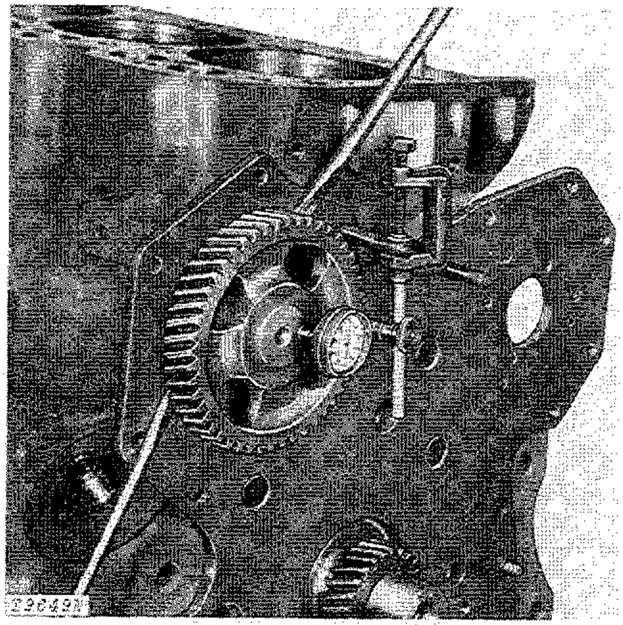


Fig. 6-Checking Camshaft End Play

Check camshaft for 0.0020 to 0.0080 in. (0.0508 to 0.2032 mm) end play. (New camshaft and thrust plate should restore this.)

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 JD254.

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 (9.0 kg-m).

If cylinder head was removed, refer to Group 0409 for installation.

Install tappets in their respective bores.

Install push rods in holes from which they were removed.

Install rocker arm assembly. Tighten the support cap screws to 35 lb-ft (4.8 kg-m).

Adjust valve clearance (Group 0409).

If using a cork rocker arm cover gasket, apply John Deere Gasket Maker or equivalent to gasket.

Install rocker arm cover and gasket. If using a cork gasket, tighten cap screws to 25 lb-in (2.8 N·m). If using a rubber and metal gasket, tighten cap screws to 96 lb-in. (108 N·m).

Check injection pump timing. See Group 0413.

Install engine (see Group 0400), fill radiator with proper coolant and engine crankcase with proper oil. Bleed diesel fuel system (see Group 0413).

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:

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 its 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.

Install camshaft.

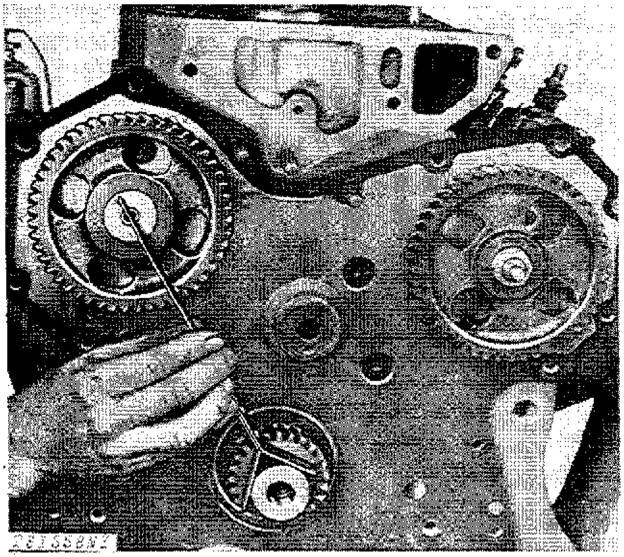


Fig. 5-Timing the Camshaft Gear with JD254 Tool

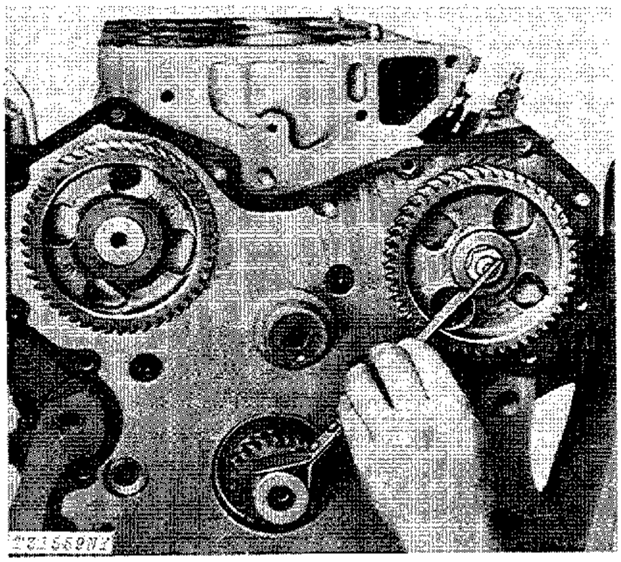


Fig. 6-Timing the Injection Pump Gear With JD254 Tool

With engine at "TDC," use special tool JD254 to align the timing mark on the camshaft gear between centers of the crankshaft and camshaft (Fig. 5).

Install fuel injection pump and drive gear or governor.

On diesel engines, with engine at "TDC," use special tool JD254 to align the timing mark on the injection pump gear between centers of crankshaft and injection pump shaft (Fig. 6).

Use the timing mark on the injection pump drive gear which indicates the number of cylinders in the engine.

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 washer, making sure holes in inner and outer thrust washers fit over spring pin or idler gear shaft. Install special washer and cap screw and tighten to 65 lb-ft (8.9 kg-m).

Install oil pump and drive gear, gears do not require timing.

Tighten oil pump gear hex. nut 35 to 45 lb-ft (4.8 to 6.2 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.

With oil pump gear installed, install lower idler gear into position, using care not to rotate any gears. Be sure inner thrust washer is in place on rear of idler gear shaft.

Install outer thrust washer, making sure holes in inner and outer thrust washers fit over spring pin in idler gear shaft. Install inner and outer special washers and cap screws and tighten to 95 lb-ft (13.1 kg-m).

After all gears are locked in place, recheck all timing marks with special tool JD254, making sure that marks still align between the center 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.

Final Installation

Install oil slinger on crankshaft.

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.

Install oil pressure control valve (Group 0407).

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. The crown of each diesel piston has a cut-out swirl cup.

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.

IMPORTANT: Installing or removing connecting rod and main bearing cap screws using pneumatic wrenches may cause thread damage.

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 diesel connecting rods. These must face toward the fan end of the engine at the time of reassembly. *Observe the "pip" marks on both the connecting rod and cap of a gasoline engine. These "pip" marks must both face towards the camshaft side of the engine at the time of reassembly.*

REPAIR

NOTE: If cylinder liners need repair or replacement, refer to Group 0404.

Inspect all parts and compare with "Specifications."

FOS Refer to "Basic Engine" in FOS Manual - ENGINES for additional repair information.

Piston

Fig. 1-Measuring Ring Clearance

Check piston ring grooves (Fig. 1) for excessive wear by inserting a new ring in the proper groove at several points around the piston. Measure clearance between ring and groove with a feeler gauge. If the clearance exceeds 0.008 inch (0.203 mm) in the grooves, 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 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. Wear limits are as follows:

Specifications	Measurement
Liner Taper (max.)	0.002 in. (0.05 mm)
Liner Out-of-Round (max.)	0.002 in. (0.05 mm)
Clearance Between Liner and Piston at Bottom of Skirt (max. for new parts)	
Gasoline	0.004 in. (0.10 mm)
Diesel (3-152)	0.006 in. (0.15 mm)
Diesel (3-164)	0.008 in. (0.20 mm)

Always replace piston rings whenever they are removed from a piston.

Piston Pin Bore

Piston pins must fit piston pin bore with a thumb press fit.

Replace piston if piston pin bore is worn.

Piston Pin

Measure piston pin outside diameter at six places; two measurements 90° apart at each end, and two measurements 90° apart at center.

New piston pin O.D.;
- gasoline .... 1.1875 to 1.1879 in. (30.163 to 30.173 mm)
- diesel (3-152) .... 1.1875 to 1.1879 in. (30.163 to 30.173 mm)
- diesel (3-164) .... 1.3750 ± 0.0002 in. (34.925 ± 0.005 mm)

If piston pin size is not within specifications, install a new one.

Piston Pin Bushing

Measure piston pin bushing inside diameter with bushing in connecting rod.

Piston pin bushing I.D.
- gasoline .... 1.1883 to 1.1886 in. (30.183 to 30.190 mm)
- diesel (3-152) .... 1.1886 to 1.1896 in. (30.190 to 30.216 mm)
- diesel (3-164) .... 1.376 to 1.377 in. (34.95 to 34.98 mm)

Check piston pin size (Group 0403).

Find the difference, piston pin/bushing clearance, between the piston pin size and the bushing size. The clearance must be 0.0008 to 0.0022 in. (0.02 to 0.06 mm).

If bushing size is not within specifications, install a new one.

Push bushing out of connecting rod. On a 3-164 engine, using JDE-88 Piston Pin Bushing Remover and Installer to replace bushing.

IMPORTANT: Be sure oil hole in connecting rod and oil hole in bushing are aligned.

Push bushing into connecting rod until one side is flush with connecting rod.

Hone bushing to size shown above.

Connecting Rod Bearing

Measure connecting rod bearings and crankshaft rod journals. The specifications are as follows:

Specification	Measurement
Connecting rod bearing inside diameter (assembled)	
diesel	2.7502 to 2.7522 in. (69.855 to 69.901 mm)
gasoline)	2.4365 to 2.4375 in. (61.887 to 61.913 mm)
Connecting rod bearing to crankshaft journal clearance (diesel and gasoline)	0.0012 to 0.0040 in. (0.030 to 0.102 mm)
Connecting rod bearing to journal clearance (maximum)	0.006 inch (0.15 mm)
Connecting rod undersize bearing inserts available (diesel and gasoline)	0.002, 0.010, 0.020, and 0.030 in. (0.05, 0.25, 0.51, and 0.76 mm)
Connecting rod bore I.D.	2.9000 to 2.9010 in. (73.660 to 73.685 mm)

ASSEMBLY

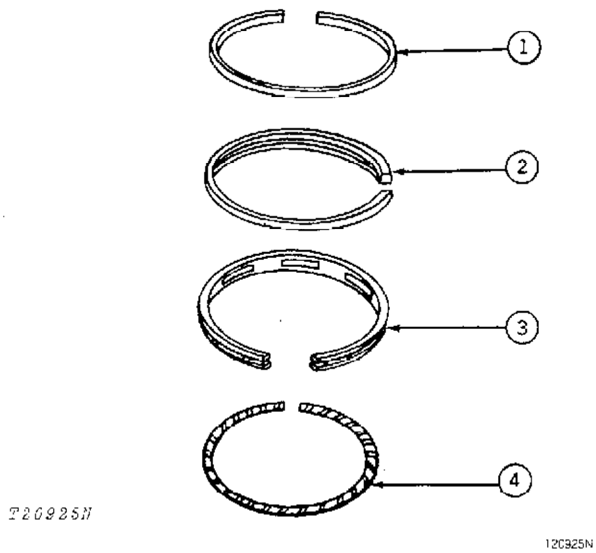
Assemble pistons and connecting rods making sure that identification marks on piston and rod are in same relative position as they were at time of disassembly.

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 diesel connecting rods. Observe the "pip" marked on both the connecting rod and cap of a gasoline engine. On diesel engine all identification marks must face toward the front of engine. On gasoline engine, "pip" mark must face toward camshaft side.

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. Use JD-45 Limiting Piston Ring Expander or JDE-135 Universal Piston Ring Expander to install rings in their respective grooves.

IMPORTANT: Use of incorrect size ring expander will damage rings.



1—1st Comp. Ring
2—2nd Comp. Ring
3—Oil Ring
4—Oil Ring Expander

Fig. 2-Ring Installation

Install the expander in the oil ring groove. Install the oil ring with "pip" marks (or "Top") facing up towards the top of the piston and position oil ring gap opposite expander gap (Fig. 2).

Install second compression ring (Fig. 2) with "pip" marks (or "Top") facing up towards the top of the piston.

Install the first compression ring with "pip" marks (or "Top") facing up towards the top of the piston.

NOTE: If rings are not marked, install with either side up.

Piston rings should move freely in their grooves.

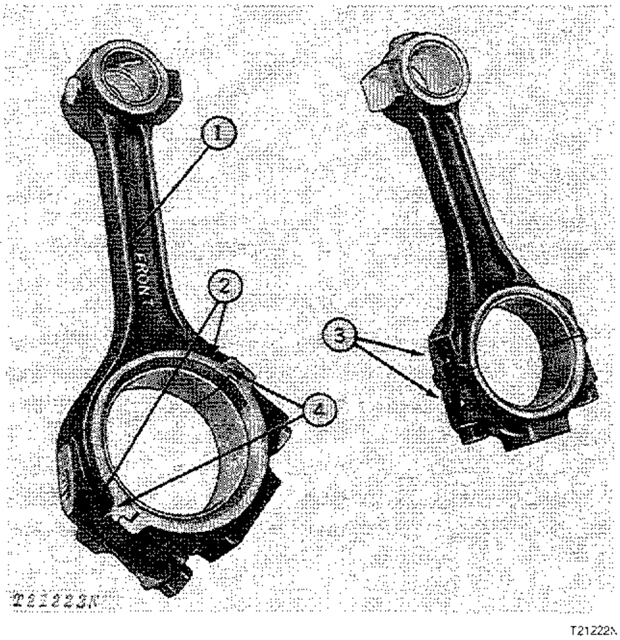
Gasoline and diesel engines use same ring sets for service replacement.

INSTALLATION

If cylinder liners were removed, refer to Group 0404 for proper installation.

Use short cap screws and large flat washers to retain liners in position while pistons are installed.

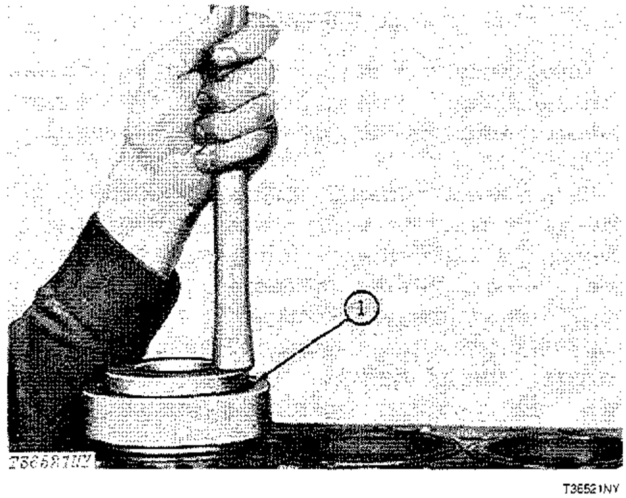
Install top piston ring with gap above one end of piston pin and stagger ring gaps (Fig. 2) before installing them in cylinder liners.



1—"FRONT"
2—Tangs
3—"PIP"
4—Slots

Fig. 3-Connecting Rods

Be sure the word "FRONT" stamped on the head of the pistons faces towards the fan end of the engine before installing them in liners. On diesel connecting rods, be sure the word "FRONT" faces toward the fan end of engine. On gasoline connecting rods, be sure the "pip" mark faces toward the camshaft side of engine.



1—JD239 Compressor Tool

Fig. 4-Installing Pistons

Use Compressor Tool JD239 to install pistons (Fig. 4).

Apply engine oil to the bearing inserts and crankshaft rod journals.

Use new connecting rod cap screws. DO NOT reuse cap screws.

NOTE: Dip connecting rod cap screws in oil before installing.

IMPORTANT: Using pneumatic wrenches to install cap screws may damage the threads.

On gasoline engines, tighten connecting rod cap screws to 40 to 46 lb-ft (54 to 62 N·m).

On diesel engines, tighten each connecting rod cap screw to 52 lb-ft (71 N·m).

Apply Permatex No. 3 Sealing Compound to oil pan gasket and cylinder block pan surface. Tighten oil pan-to-cylinder block and timing gear cover cap screws at 35 lb-ft (47 N·m).

Refer to Group 0499 and perform the break-in steps 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 sets on a shoulder within the block and is sealed by a rubber compound 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.

An engine oil pressure sending unit is located on the right rear side of the cylinder block.

REMOVAL

The engine must be removed from the crawler to service cylinder block and liners (see Group 0401).

Drain the crankcase and remove oil pan and cylinder head.

Do not rotate crankshaft with cylinder head removed unless all cylinder liners are bolted down. Bolt down cylinder liners before removing pistons.

Refer to Group 0403 for connecting rod and piston removal.

REPAIR

Cylinder Block

NOTE: Diesel service blocks are furnished with piston cooling orifices to be installed in the tapped holes of the main bearing webs. Tighten orifices to 85 to 110 lb-in. (0.98 to 1.27 kg-m).

Clean block thoroughly with cleaning solvent or by pressure steam cleaning.

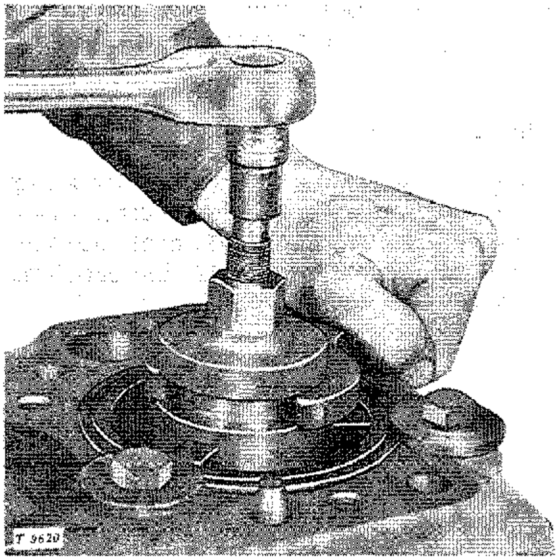


Fig. 1-Removing Ridges from Cylinder Liner Bore

Remove any ridges from top of cylinder liner bore with a ridge reamer (Fig. 1).

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 using the procedure shown in Group 0407.

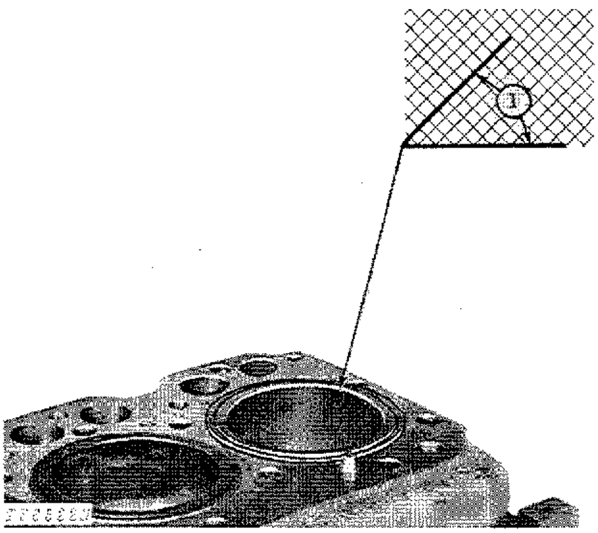
If dipstick nipple has been removed, coat threads of nipple with joint sealing compound and install in cylinder block. Measure from block rail vertically to center of nipple end. Measurement must be 10.33 inches (262.4 mm).

NOTE: Be sure integral O-ring is not twisted, sheared or damaged when installing nipple.

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.

Cylinder Liners

The cylinder liners may be deglazed with a deglazing tool or honing stone, but not rebored. When the liner exceeds a 0.002 inch (0.051 mm) maximum taper or exceeds 0.002 inch (0.051 mm) out-of-roundness, the liner must be replaced.



1—45° Angle

Fig. 2-Deglazing Cylinder Liner

Use a 180-grit honing stone with light pressure to produce the desired 15 to 35 micro-inch r.m.s. cylinder wall finish and hone pattern (Fig. 2).

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 liners dry with clean towels. Wipe bores with clean engine oil.

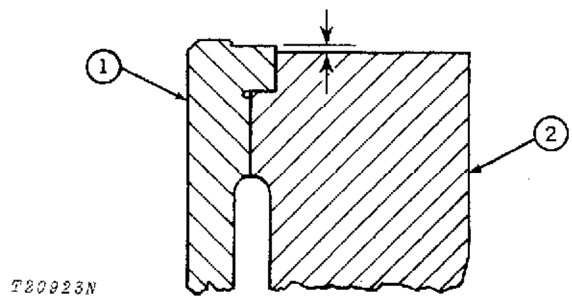
IMPORTANT: Solvents will not remove honing residue.

Oil Pressure Sending Unit

Test oil pressure sending units as part of the electrical system (Section 90, Group 9015).

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.



1—Liner 2—Block

Fig. 3-Location of Liner in Cylinder Block

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. 3). The top of the flange should be 0.0010 to 0.0040 inch (0.025 to 0.102 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.

Be sure to pull cylinder liner and reinstall packing and O-rings before final assembly. Check O-ring grooves in block and remove any burrs or sharp edges.

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. The black O-ring goes in the bottom groove of the cylinder block and the red O-ring goes in the top groove. 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 John Deere Soap Lubricant (AR54749).

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.

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.

See Group 0403 to install connecting rods and pistons.

Apply Permatex No. 3 Sealing Compound to oil pan gasket and cylinder block pan surface. Tighten oil pan-to-cylinder block and timing gear cover cap screws at 35 lb-ft (4.8 kg-m).

Refer to Group 0401 for engine installation.

Group 0405
CARBURETOR

GENERAL INFORMATION

Gasoline tractors are equipped with Marvel-Schebler, single throat, up-draft carburetors. A solenoid shut-off is incorporated into the carburetor load control needle to provide positive tractor shut-off.

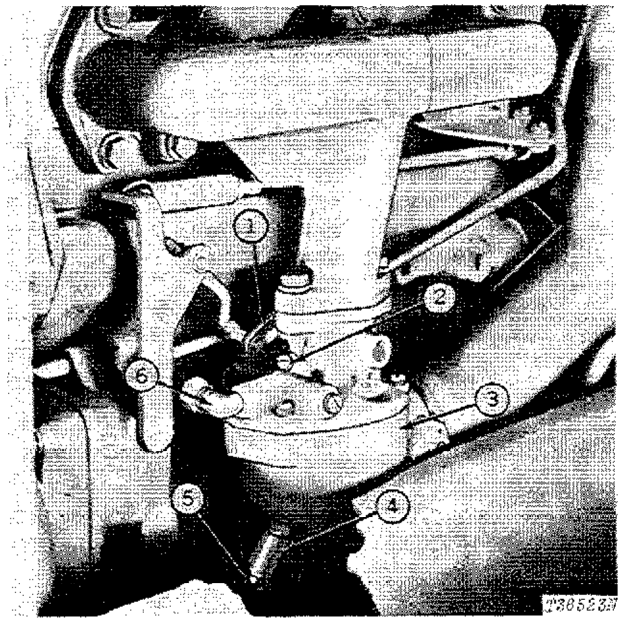
FOS Refer to FOS Manual—ENGINES, for a detailed description of the functions of a carburetor.

TEST

Solenoid Assembly

Test solenoid action by turning key switch to the "ON" position and listening for solenoid opening. If no sound from solenoid is heard, remove solenoid and test using 12-volt battery.

REMOVAL



1—Slow Idle Stop
2—Idle Adjusting Needle
3—Carburetor
4—Shut-off Solenoid
5—Load Adjusting Needle
6—Inlet Elbow and Strainer

Fig. 1-Carburetor

Clean area around the carburetor to prevent dirt from entering the fuel system.

Disconnect solenoid lead from wiring harness before removing the carburetor.

REPAIR

Carburetor servicing should be performed after engine valve grinding or major overhaul, as well as any time the carburetor fails to operate properly. Clean carburetor, replace shafts, and check bearings at the beginning of each season.

Disassembly

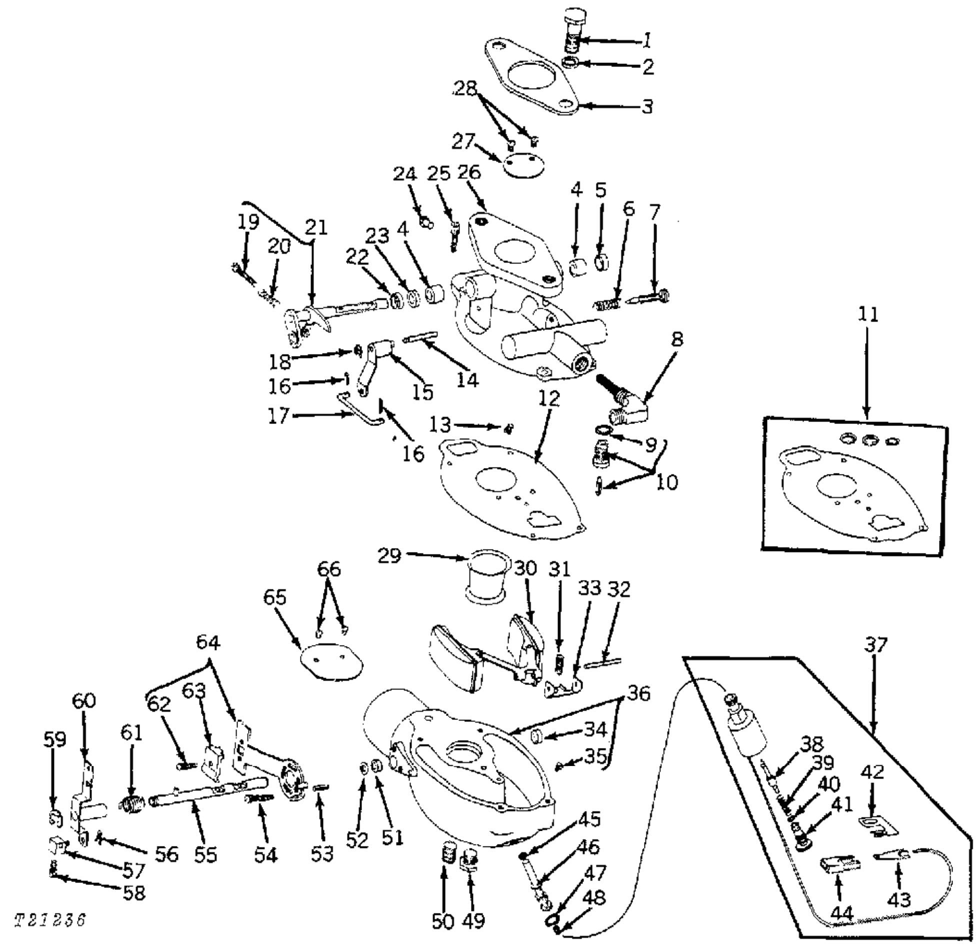
Before disassembling carburetor study Fig. 2.

Strainer screen is part of elbow (8, Fig. 2). Be careful when removing elbow.

When removing solenoid, apply torque to hex. portion only.

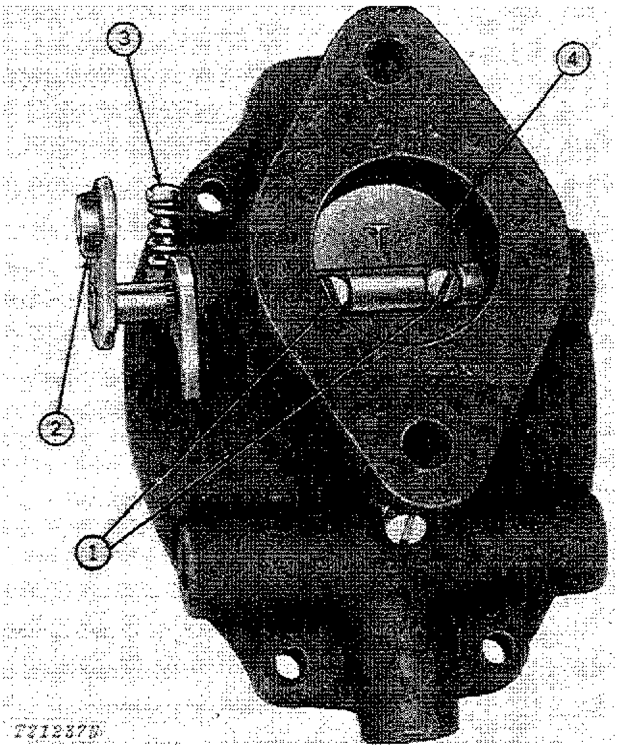
Inspection and Cleaning

Place throttle fly in closed position (Fig. 3) and check for wear on valve and throttle bores. If fly is burred or distorted, replace with new fly.



1—Cap Screw (2 used)
2—Lock Washer (2 used)
3—Gasket
4—Throttle Shaft Bearing (2 used)
5—Throttle Shaft Cup
6—Spring
7—Idle Adjusting Needle
8—Strainer and Elbow
9—Gasket
10—Valve Assembly
11—Gasket Set
12—Gasket
13—Idle Jet
14—Fast Idle Cam Pin
15—Fast Idle Cam Lever
16—Cotter Pin (2 used)
17—Fast Idle Link
18—Snap Ring
19—Screw
20—Spring
21—Throttle Shaft Assembly
22—Retainer
23—Throttle Shaft Packing
24—Plug
25—Screw
26—Throttle Body Assembly
27—Fly Throttle
28—Screw
29—Venturi
30—Float and Lever Assembly
31—Float Support Spring
32—Float Shaft
33—Float Support Bracket
34—Choke Shaft Plug
35—Plug
36—Carburetor Bowl Assembly
37—Solenoid Assembly
38—Shut-off Needle
39—Spring
40—O-ring
41—Adjusting Screw
42—Clip
43—Male Terminal
44—Terminal Connector
45—Nozzle Gasket
46—Main Nozzle
47—Gasket
48—Power Jet
49—Drain Plug
50—Headless Plug
51—Choke Shaft Packing
52—Special Washer
53—Spring Pin
54—Choke Bracket Screw
55—Choke Shaft Assembly
56—Snap Ring
57—Choke Swivel
58—Screw
59—Choke Shaft Lever Retainer
60—Choke Lever Assembly
61—Spring
62—Choke Bracket Clip Screw
63—Choke Bracket Clip
64—Choke Bracket Assembly
65—Choke Fly
66—Special Screw

Fig. 2-Carburetor Throttle Body and Bowl



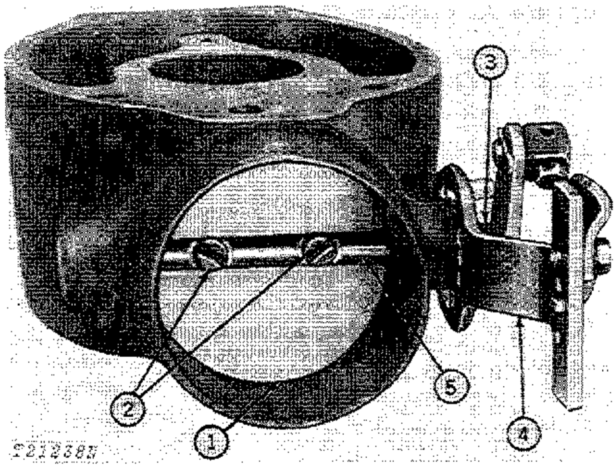
1—Throttle Fly Screws
2—Throttle Shaft and Lever
3—Throttle Stop Screw
4—Throttle Fly

Fig. 3-Throttle Assembly

Place the choke fly in closed position (Fig. 4). If fly is burned or distorted, replace fly.

Check tension of choke relief spring. The spring should be sufficiently taut to open choke with a snap.

Dispose of all parts that are replaced by new parts in the carburetor repair kit.



1—Choke Fly
2—Choke Fly Screws
3—Choke Relief Spring
4—Choke Bracket
5—Choke Shaft

Fig. 4-Choke Assembly

Check all parts. Replace if worn or damaged.

All other parts should be soaked in a carburetor cleaner until all foreign material has been removed.

IMPORTANT: Never clean holes or passageways with small drills or wire, as a slight enlargement or burring of these holes will change the performance of the carburetor. No method of cleaning other than solvent should be used.

Dry all parts with compressed air, making sure all holes are open and free of carbon and dirt.

IMPORTANT: Never use compressed air to clean a completely assembled carburetor. To do so will cause the float to collapse.

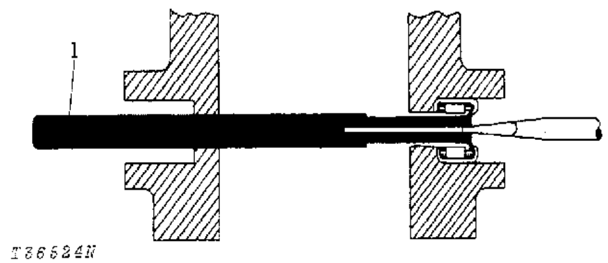
Replacing Needle Bearings

1. Remove throttle shaft (21, Fig. 2), packings (22), and retainer (23).

2. Insert the bearing-removing tool, (Fig. 5).

3. Spread the lips of the tool apart with a small screwdriver so the tool will seat firmly inside the rolled edge of the bearing. Press out bearing.

4. Press in new bearings flush with shoulder of driving tool.



1—M-504 Bearing Removing Tool

Fig. 5-Bearing Removal Tool in Position

Assembly

Refer to Fig. 2 when assembling the carburetor.

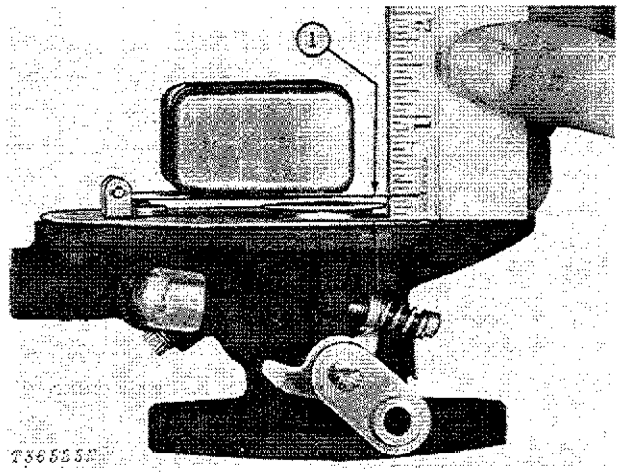
When assembling carburetor, note the following:

When installing solenoid, apply to hex. portion only.

Be sure that the throttle fly screws are tight. If they are not secure, suction from the engine will draw them into the combustion chamber.

Do not force idle adjusting needle too firmly against seat, as it will groove the idle seat and prevent proper adjustment.

Invert throttle body assembly and measure the distance between both halves of the float and the bowl gasket (Fig. 6). If float is not 0.25 in. (6.35 mm) from throttle body use float bending tool and adjust to correct height.



1—0.25 in. (6.35 mm) Float Height from Throttle Body

Fig. 6-Correct Float Position

ADJUSTMENT

The shut off needle adjusting screw and the idle needle should be adjusted prior to the installation of the carburetor so that the engine will start and run.

Turn the shut-off needle adjusting screw until it seats, then back out two turns. Turn idle needle in until it seats, then back out one turn.

FOS To adjust the carburetor once the engine has been started refer to FOS Manual-ENGINES, "Gasoline Fuel Systems." (See Specifications for correct idle speeds.)

INSTALLATION

Secure carburetor to manifold.

Connect solenoid lead to wiring harness and fuel line to carburetor.

To attach governor-to-carburetor rod refer to Group 0406.

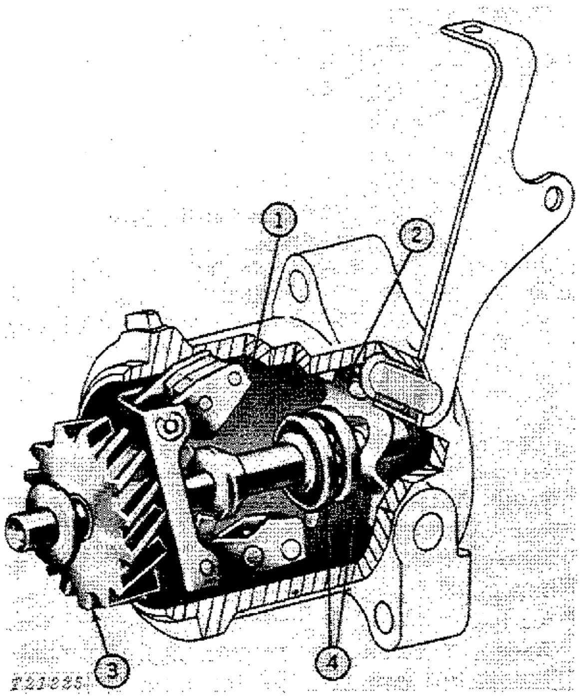
Connect air cleaner hose to carburetor making sure there are no leaks between carburetor and air cleaner.

Push choke control button in and attach choke wire and cable. Be sure the choke fly is in full open position before tightening screws on choke cable.

Group 0406
GOVERNOR

GENERAL INFORMATION

The following group covers the governor for gasoline models only. On diesel models, the governor is integral with the fuel injection pump. For information on diesel models, see Group 0413.



1—Weight
2—Yoke
3—Drive Gear and Shaft
4—Sleeve and Thrust Bearing

Fig. 1-Governor Assembly

As the governor shaft rotates, the weights are thrown outward by centrifugal force, pushing a thrust bearing against the governor yoke that in turn actuates the throttle lever and, through governor-to-carburetor linkage, controls the amount of fuel and air supplied to the engine.

The governor is lubricated through a passage in the weight carrier assembly by oil from the engine lubrication system.

REMOVAL

Close fuel shut-off valve at tank and disconnect fuel line from carburetor to provide clearance when removing governor.

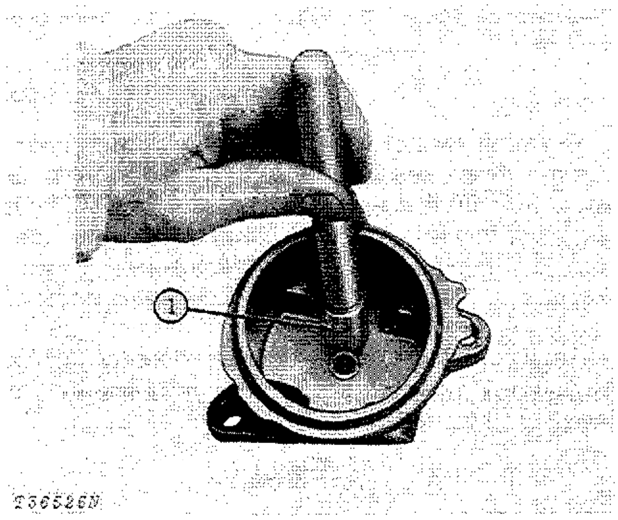
Remove governor housing, drive shaft with weight carrier, and gear from engine.

REPAIR

Disassemble governor assembly. Refer to Fig. 3.

To remove shaft bearings (16) and (12), drive from outside governor boss to inside governor case. Use JD241 driver to remove open end bearing (16) and JD245 driver to remove sealed bearing (12).

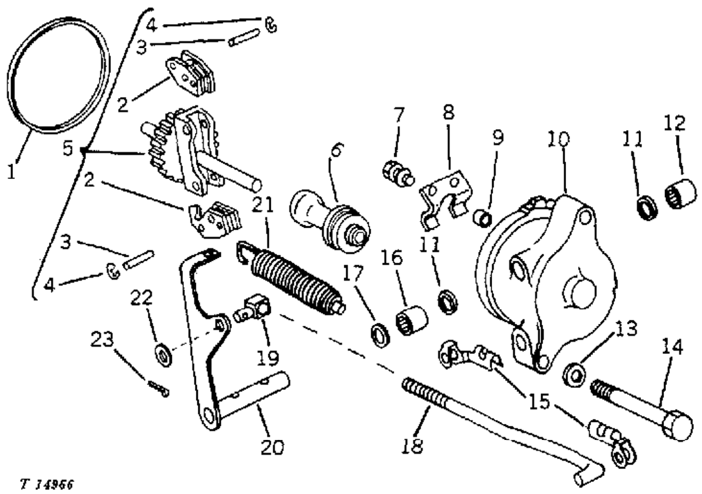
Inspecting Governor Parts



1—JD240 Driver

Fig. 2-Governor Bushing Installation

Inspect bushing (9, Fig. 3) in governor body. Bushing is located properly when seated against back of bore in governor case. Install new bushing using JD240 driver.



1—Packing
2—Weight (2 used)
3—Special Pin (2 used)
4—Retainer (2 used)
5—Weight Carrier Assembly
6—Thrust Bearing
7—Screw and Washer (2 used)
8—Yoke
9—Bushing
10—Housing
11—Thrust Washer (2 used)
12—Needle Bearing (Closed)
13—Washer (2 used)
14—Cap Screw (2 used)
15—Clevis Clip
16—Needle Bearing (Open)
17—Oil Seal
18—Throttle Rod
19—Trunnion
20—Lever with Shaft
21—Spring Assembly
22—Washer
23—Cotter Pin

Fig. 3-Governor Assembly

Examine feet of weights (portion which bears against thrust bearing). If curved surface has flat spots worn on it, weights should be replaced. This is the most frequent cause of governor failing to open throttle at rated speeds or failing to operate properly. Replace all worn or damaged parts as necessary.

Check all other parts. Contact surface of moving parts must be smooth. If there are indications of wear, replace parts.

ASSEMBLY

Install needle bearing (16, Fig. 3) in governor housing with numbered end of bearing toward JD241 driver. Press bearing in flush with inside of housing.

Coat sealing lip of new oil seal (17) with Lubriplate and install with lips inward to flush with housing.

Before installing needle bearing (12), coat outside surface with sealing compound. Drive on closed side of bearing using JD245 driver until flush with inside of housing.

Weights must be free on pins, but pins must be tight in weight carrier.

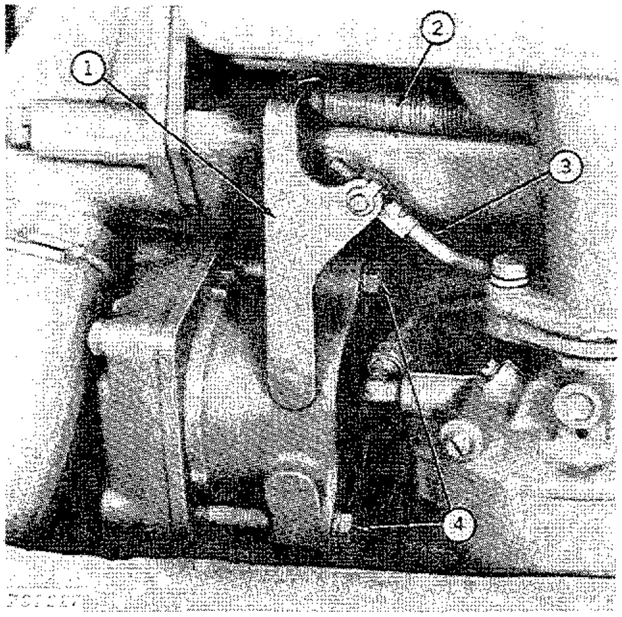
After weights are assembled to weight carrier, hold assembly horizontally and rotate shaft slowly to be sure governor weights are free on pins. As shaft is rotated, weights should fall away from shaft under their own weight.

Position new packing (1) on flange of governor body.

INSTALLATION

Install governor assembly into position on engine (Fig. 4). Be sure housing is seated properly before tightening attaching hardware.

Adjusting Governor Linkage



1—Governor Control Lever
2—Speed Control Spring
3—Throttle Rod
4—Governor Attaching Points

Fig. 4-Governor Linkage

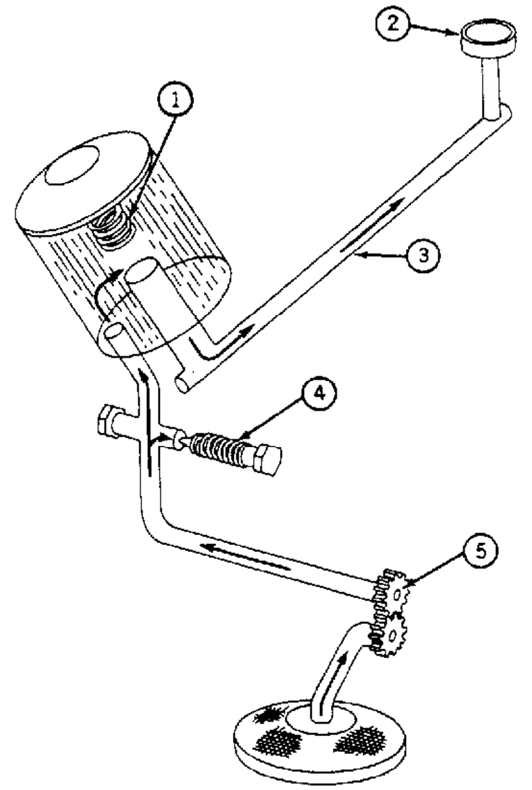
Move the governor control lever and shaft assembly rearward as far as possible. Move the carburetor throttle lever to the wide-open position.

Install the throttle rod on the governor lever and adjust according to specifications (Section 90 Group 9010).

Install speed control spring in hole on top flange of governor lever.

Group 0407
ENGINE OILING SYSTEM

GENERAL INFORMATION



1—Bypass Valve **2—Sending Unit** **3—Oil Gallery** **4—Regulating Valve** **5—Oil Pump**

Fig. 1-Engine Lubrication System

The engine is pressure-lubricated by a positive-displacement gear pump with an externally adjustable pressure regulating valve and a full-flow oil filter.

Oil Pump

Oil enters the pump through the pump intake tube and is discharged at the oil outlet hole into an oil tube leading to the oil filter and engine oil gallery.

Regulating Valve

An externally adjustable pressure regulating valve is located at fan end of cylinder block in the oil gallery.

The valve assembly consists of a valve body held against a seat by a spring and plug. Pressure may be adjusted by changing the number of shims behind the valve plug. When oil pressure is greater than the valve setting, oil is bypassed to the crankcase and desired pressure is maintained.

Oil Filter

The oil filter is mounted on the cylinder block. It is a full-flow type with a spin-on, replaceable element. If the filter clogs, a bypass valve in the element opens to keep a full flow of oil to vital engine parts.

ENGINE OIL PUMP

Removal

Remove engine oil pan and remove oil pump assembly.

Repair

To remove idler shaft (10, Fig. 2) from oil pump housing, slide idler gear (11) off shaft; then support housing (9) and press out shaft.

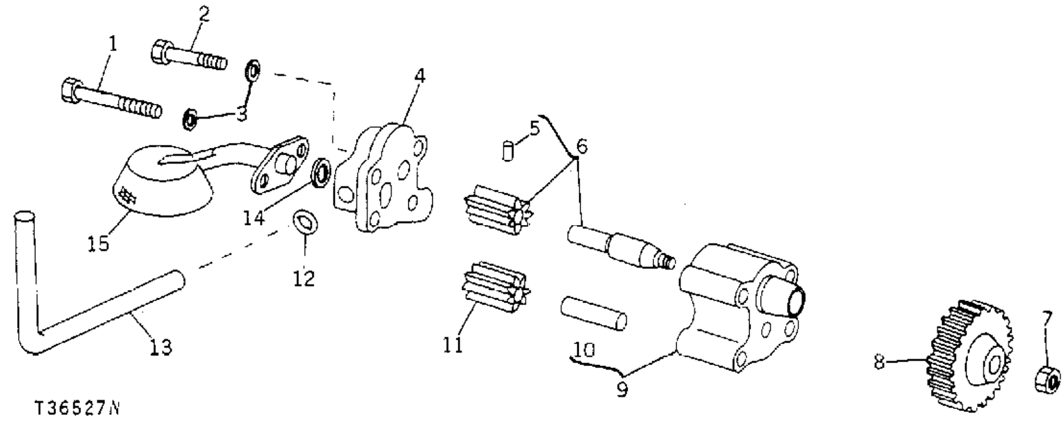
If surface to which cover attaches is rough, burred, or warped, pump body must be replaced.

Examine pump cover (4) 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.

Carefully inspect shaft (6) for wear, especially at points of contact. Check diameter of drive shaft (0.6308 to 0.6312 inch [16.02 to 16.03 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.)



1—Cap Screw (2 used)
2—Cap Screw (2 used)
3—Lock Washer (4 used)
4—Cover
5—Groove Pin
6—Drive Shaft with Gear and Pin
7—Jam Nut
8—Drive Gear
9—Pump Housing
10—Idler Shaft
11—Idler Gear
12—O-Ring
13—Outlet Tube
14—O-Ring
15—Intake

Fig. 2-Engine Oil Pump

Install gears in housing in running position and measure radial clearance (0.0030 to 0.0060 inch [0.076 to 0.152 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 (0.0012 to 0.0062 inch [0.030 to 0.157 mm]) between gears and straightedge.

Press idler shaft (10, Fig. 2) into pump housing until flush with outer surface of housing.

IMPORTANT: Put engine oil on gears before assembling oil pump.

Place gear and shaft in housing. Install pump idler gears on idler shaft in housing. Check to see that both gears rotate freely in housing.

Installation

Install new O-ring (12) in oil outlet opening in oil pump cover and a new O-ring in the outlet tube bore in the block (later units).

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. (4.8 to 6.2 kg-m) and then stake nut to shaft.

Position oil pump cover and screen up against pump housing. Install pump outlet oil tube in cover. Fasten cover in place. Tighten to 35 lb-ft. (4.8 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).

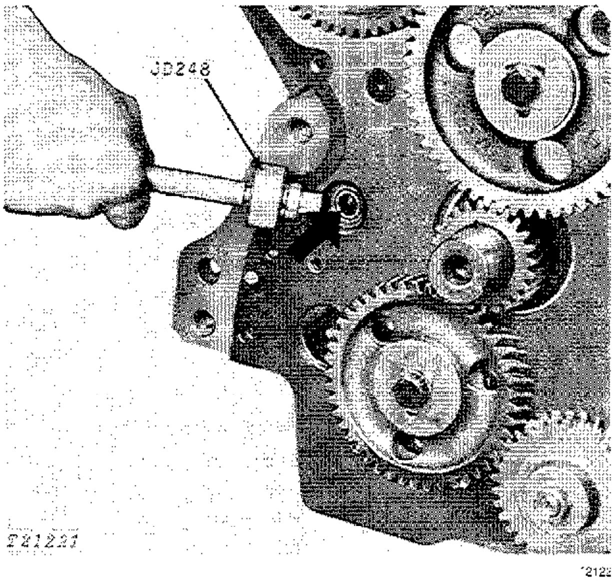


Fig. 3-Installing Pressure Regulating Valve Bushing

Press new bushing into block using JD248 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 at 15 ± 1.5 lbs. (42.7 mm at 6.8 ± 0.7 kg) pressure.

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 (if used) in plug counterbore as removed, install plug in timing gear cover. Tighten plug to 70 lb-ft (9.7 kg-m).

OIL BYPASS VALVE (Later Units)

Removal

Remove timing gear cover and front plate (Group 0402).

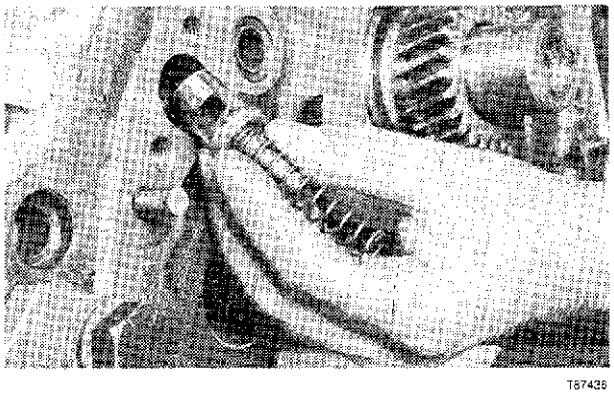


Fig. 4-Oil Bypass Valve

Remove oil bypass valve and spring (Fig. 4).

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

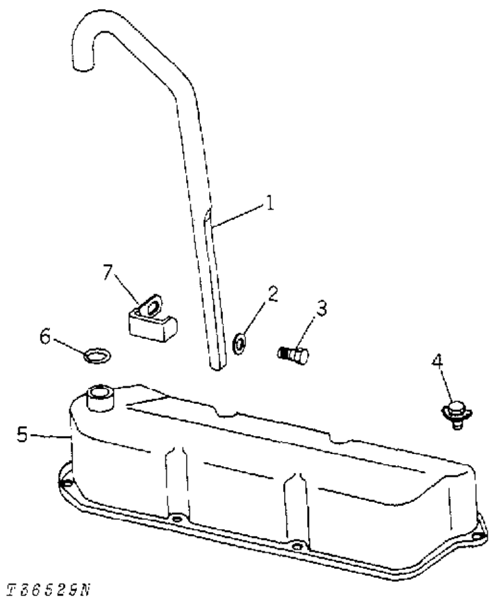
Install bypass valve and spring (Fig. 4).

Install front plate, timing gear train, and timing gear cover (Group 0402).

Group 0408
VENTILATING SYSTEM

GENERAL INFORMATION

The ventilator outlet tube prevents pressure build-up in the engine crankcase. This allows the engine to breathe freely which is necessary for proper lubrication.



1—Ventilator Outlet Tube
2—Washer
3—Cap Screw
4—Special Cap Screw
5—Rocker Arm Cover
6—O-Ring
7—Clamp

Fig. 1-Ventilator Outlet Tube

Remove ventilator outlet tube (1, Fig. 1) by removing clamp (7).

REPAIR

Check the tube for damage or restriction and clean or replace as necessary.

INSTALLATION

Replace the O-ring (6). When installing the tube, be careful not to damage the O-ring.

Install the tube and secure with the clamp.

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 in diesel engines have replaceable wear caps. Gasoline exhaust valves have valve rotators.

An engine coolant temperature sending unit is located on the cylinder head.

REMOVAL

The engine need not be removed from unit 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.

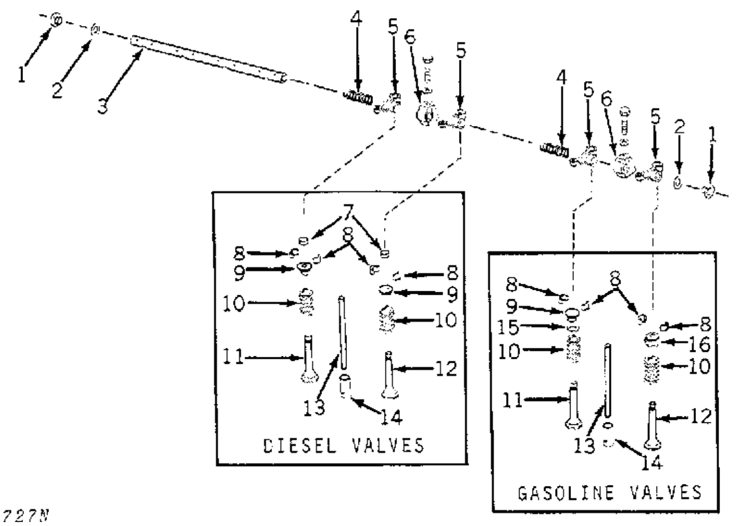
Cylinder Head

Check valve stem to guide clearance. 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.

Worn valve guides should be reconditioned by knurling. Use knurling tool no. D-20002WI exactly as recommended by the manufacturer.

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]).



1—Plug (2 used)
2—Washer (2 used)
3—Rocker Arm Shaft
4—Spring (2 used)
5—Rocker Arm with Adjusting Screw (6 used)
6—Bracket (3 used)
7—Valve Stem Caps (Diesel) (6 used)
8—Keepers (12 used)
9—Valve Spring Cap (3 used Diesel) (3 used Gasoline)
10—Spring (6 used)
11—Intake Valve (3 used)
12—Exhaust Valve (3 used)
13—Push Rod (6 used)
14—Cam Follower (6 used)
15—Intake Valve O-Ring (Gasoline) (3 used)
16—Exhaust Valve Spring Cap Rotator (Gasoline) (3 used)

Fig. 1-Rocker Arm Assembly

On diesel engines 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 (0.94 ± 0.18 mm); the distance for exhaust valves must be 0.057 ± 0.007 inch (1.45 ± 0.18 mm).

On gasoline engines, replace the intake valve stem O-ring.

If a failed valve has been replaced, also inspect the rocker arm and push rod for that valve for possible damage.

Valve Rotators (Gasoline)

On gasoline engines, inspect valve rotators (exhaust only). If rotator will not turn freely in both direction, replace with a new part.

Engine Coolant Temperature Sending Unit

Test the engine coolant temperature sending unit as part of the electrical system (Section 90, Group 9015).

ASSEMBLY

Refer to Group 0402 for rocker arm assembly procedure.

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 ports easily and seat properly.

Refacing Valves

If end of valve stem on gasoline engine is excessively pitted or worn by rocker arm, grind down end of valve until squared. On diesel engines, replace valve stem caps if worn or damaged. Check rocker arm and push rod for possible damage.

Inspecting Valve Springs

Check compression strength of springs.

On gasoline engines, place oil deflectors (O-rings) on intake valve stems and place rotators on exhaust valves.

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 head gasket dry on cylinder head.

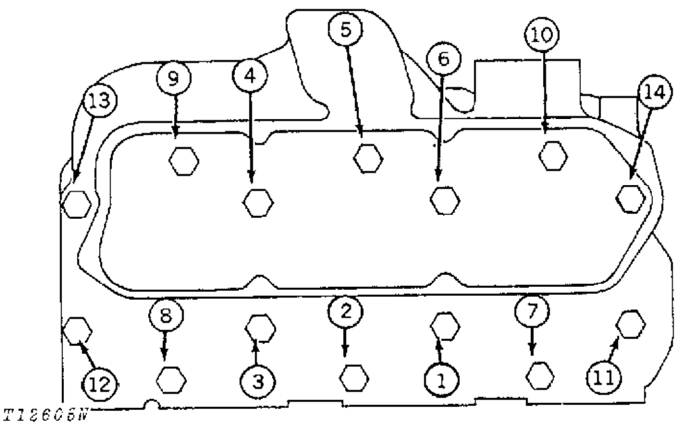


Fig. 2-Sequence for Tightening Cylinder Head Cap Screws

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 (13 kg-m), following sequence in Fig. 2.

Install push rods in location from which they were removed.

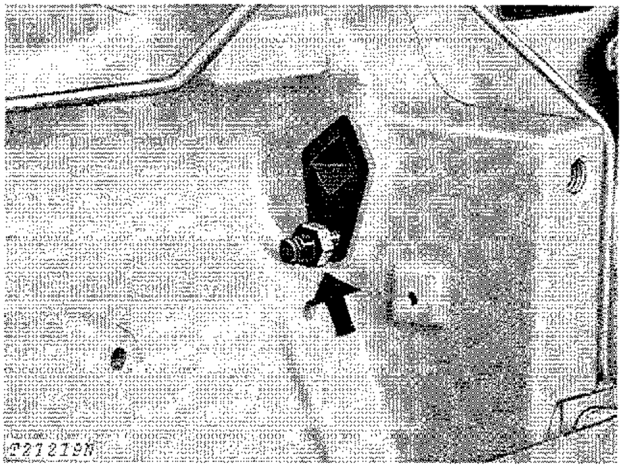
On diesel engines, position valve stem caps over ends of valve stems. Make certain the caps rotate freely on the stems.

Install rocker arm and shaft assembly on cylinder head. Tighten cap screws to 35 lb-ft (5 kg-m).

Adjusting Valve Tappet Clearance

The engine may be either hot or cold during valve adjustment.

Use JD-281 Engine Timing Tool to position No. 1 cylinder (located at fan end) on TDC Timing cover so screw will enter its hole in flywheel (Fig. 3).



T21219N

Timing Screw

Fig. 3-Setting No. 1 Cylinder at Top Dead Center

The timing line (A, Fig. 3A) on the injection pump governor weight retainer will be visible if the No. 1 piston is on TDC compression stroke.

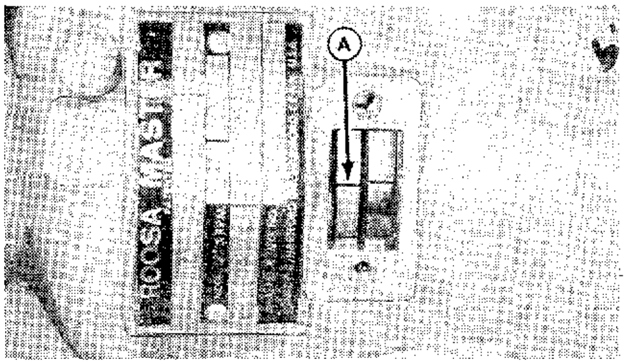


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Fig. 3A-Timing Line

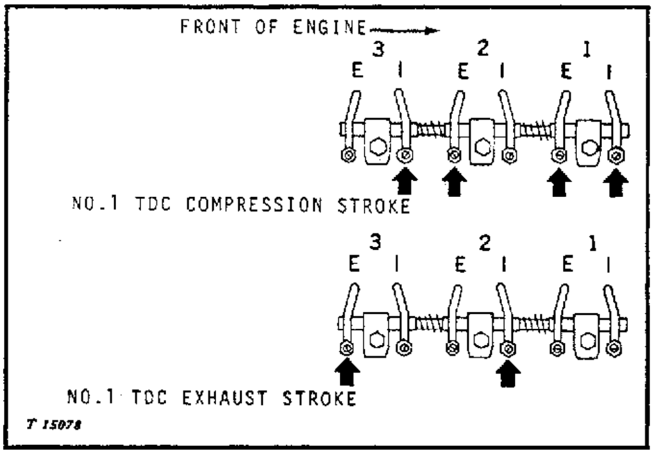


Fig. 4-Adjusting Valve Tappet Clearance

Adjust valve clearance on No. 1 and 2 exhaust valves to 0.018-inch (0.457 mm) for diesel and 0.022 inch (0.558 mm) for gasoline, and on No. 1 and 3 intake valves to clearance of 0.014 inch (0.356 mm) for both gasoline and diesel. Using a feeler gauge to measure clearance, turn valve adjusting screw up or down until clearance is correct (Fig. 4).

Remove timing screw from flywheel. Rotate engine flywheel 360 degrees and reinsert timing screw into hole on flywheel rim.

Adjust valve clearance on No. 2 intake and No. 3 exhaust valves to clearances specified.

Remove timing screw from flywheel and reinstall timing cover.

Retighten cylinder head cap screws and recheck valve clearances after thirty minutes run-in with engine at 1900 to 2200 rpm with 3/4 to full load. See "Engine Break-In Procedure", Group 0499.

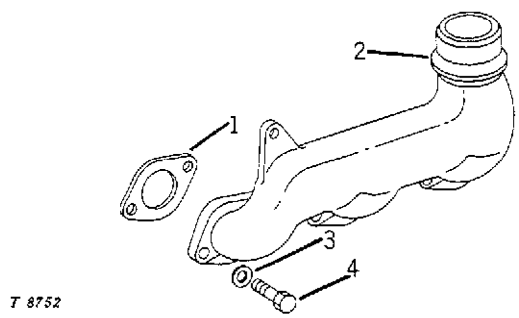
Litho in U.S.A.

Group 0410
EXHAUST MANIFOLD

GENERAL INFORMATION

The exhaust manifold routes burned gases from the cylinders and away from the engine. On the gasoline engine, some heat from the exhaust manifold is used to maintain the intake manifold at the proper temperature.

REMOVAL

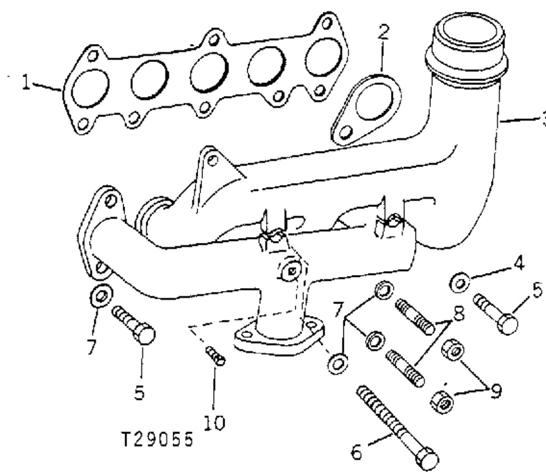


1—Gasket (3 used)
2—Manifold
3—Washer (6 used)
4—Cap Screw (6 used)

Fig. 1-Diesel Exhaust Manifold

Let engine cool down before removing the exhaust manifold.

On gasoline engines remove the carburetor before removing the manifold.



1—Gasket
2—Gasket
3—Manifold
4—Washer (5 used)
5—Cap Screw (4 used)
6—Cap Screw (2 used)
7—Washer
8—Stud (2 used)
9—Nut (2 used)
10—Pipe Plug

Fig. 2-Gasoline Intake and 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. Tighten cap screws to 35 lb-ft (47 N·m).

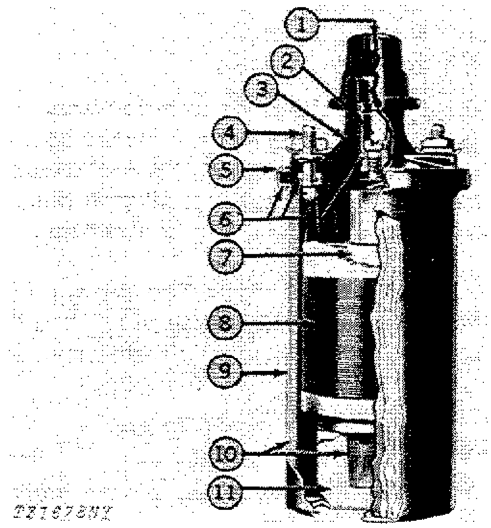
Run engine to bring it up to normal operating temperature. Retighten exhaust manifold cap screws to 35 lb-ft (47 N·m).

Group 0411
IGNITION SYSTEM

GENERAL INFORMATION

The ignition system consists of the coil, distributor, resistance wire and spark plugs and spark plug wires.

Coil

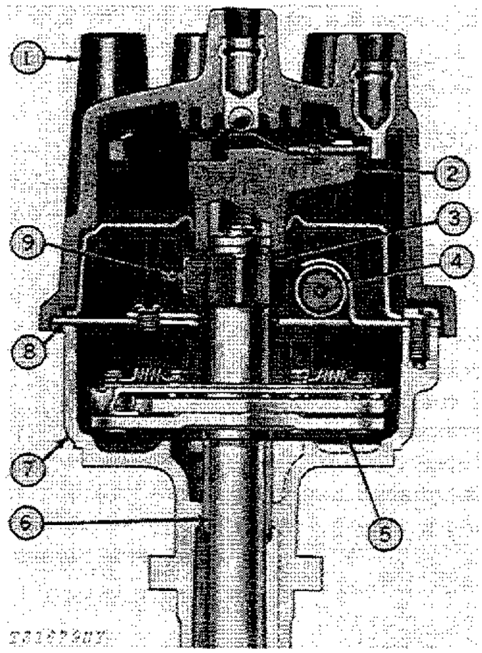


1—Sealing Nipple
2—High Tension Terminal
3—Coil Cap
4—Primary Terminal
5—Spring Washer
6—Sealing Gaskets
7—Secondary Winding
8—Primary Winding
9—Coil Case
10—Lamination
11—Porcelain Insulator

Fig. 1-Ignition Coil

The ignition coil (Fig. 1) is a pulse transformer that steps low primary circuit voltage up to a high secondary voltage of approximately 4,000 to 10,000 volts. The coil may produce up to 25,000 volts.

The primary windings, a few hundred turns of heavy wire, and the secondary windings, many thousand turns of fine wire, surround a soft iron core. A soft iron shell encloses the windings and core. This assembly is inserted into a one-piece steel case, which is filled with oil and hermetically sealed by a coil cap of moulded insulating material. The cap contains the primary and secondary terminals.



1—Cap
2—Rotor
3—Cam
4—Condenser
5—Advance Mechanism
6—Drive Shaft
7—Housing
8—Breaker Plate
9—Breaker Lever

Fig. 2-Distributor

The distributor is mounted on the right-hand side of the engine and is driven by the camshaft at one-half engine speed. The distributor consists of a housing, breaker plate assembly, dust cover, rotor, distributor cap, and a drive shaft to which is attached the centrifugal advance mechanism and breaker cam.

The distributor has three functions. First the breaker cam and contact points close and open the primary circuit, thus causing the ignition coil to produce high-voltage surges. Second, the distributor, geared to engine rotation, times these surges by means of a centrifugal advance mechanism. Third, the distributor directs each high-voltage surge to the proper spark plug.

The breaker plate carries the breaker lever, contact support, and condenser. When the cam is rotated, each cam lobe separates the contact points to produce a high-voltage surge. The condenser, connected across the contact points, functions to produce a quick stop of the primary current and to prevent arcing across the contact points.

Resistance Wire

The ignition resistor is a special resistance wire in the engine wiring harness between the coil and the key switch. The resistance wire has a braided insulation covering and a resistance of 2.2 ohms.

When the engine is running, the resistance wire is connected in series with the coil and reduces voltage at the coil. To provide a better spark when starting, the resistance wire is bypassed and battery voltage of approximately 10 volts is applied to the coil. This is accomplished when the starting motor is operating by current flowing from the "R" solenoid terminal of the starting motor through the resistor bypass wire to the coil.

Spark Plugs

Spark plugs ignite the fuel mixture within the cylinders. The spark plugs are one-piece, 14 mm plugs.

Premature spark plug failure is usually caused by using a plug that is too hot or too cold. A spark plug that is too hot will have severe erosion of the electrodes and blisters at the insulator tip. A spark plug that is too cold will usually have carbon and oil fouling. This is indicated by black carbon accumulation on the insulator. Lead fouling, a tan powdery deposit on the insulator, results from fuel with a high lead content or low engine speed with a light load. The next hotter plug may correct lead fouling.

Spark plugs in their proper heat range will have a grayish tan powdery deposit on the insulator and electrode erosion confined to the spark gap. Spark plugs listed in the tractor parts catalog satisfy normal heat range requirements under average field conditions.

COIL

Removal

Disconnect battery ground straps from batteries or turn battery disconnect switch (if equipped) to "OFF" position.

Disconnect wires from coil.

Remove cap screws from coil mounting bracket and remove coil.

Repair

NOTE: Coil should not be disassembled for repair. If coil is damaged or defective, it should be replaced.

Check top of coil for carbon tracks or cracks which can cause current leakage, resulting in poor performance. Check for clean, tight connections.

Test the coil in a coil tester. Test the coil when it is hot and also when cold (coil usually takes 15 minutes to heat up). Coil primary current draw, is 4.2 to 4.8 amps at 6.0 volts.

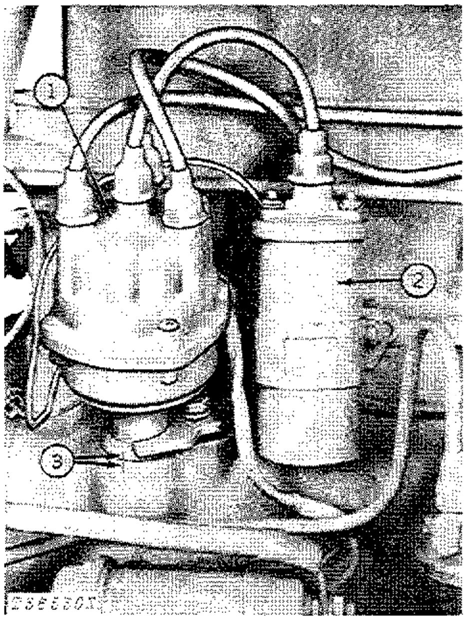
Installation

Follow removal procedure in reverse order.

When installing the coil, connect the distributor primary lead to the negative (−) coil primary terminal.

DISTRIBUTOR

Removal



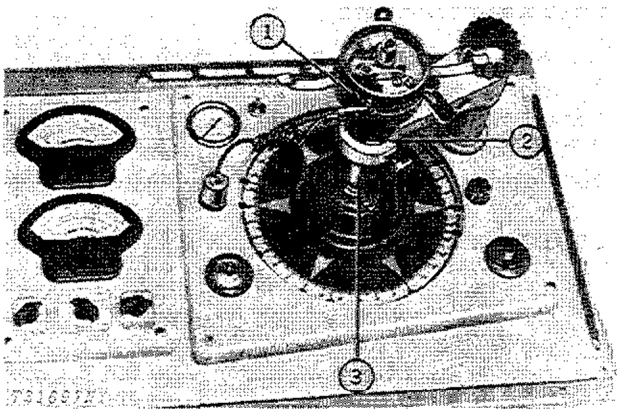
1—Distributor
2—Coil
3—Reference Marks

Fig. 3-Distributor and Coil

Place a reference mark on distributor and cylinder block. Remove distributor cap. Turn engine until rotor points to No. 1 cylinder and "TDC" mark on crankshaft pulley is aligned. Remove distributor.

Testing

If a syncrograph-type distributor tester is available, mount the distributor on it and follow the manufacturer's instructions to make the following tests.



1—Primary Insulated Terminal
2—Split Bushing
3—Flexible Drive Coupling

Fig. 4-Distributor Mounted in Syncrograph for Testing

Contact Point Test

Set syncrograph controls according to manufacturer's instructions. Rotate chuck until contact points are closed. If reading on cam angle meter is not near the "SET" line, clean or replace the point assembly.

Poor Insulation or Leakage Test

Revolve chuck by hand until contact points are open. The cam angle meter reading should be zero. If not, a leak or partial ground exists. Common causes are poor primary terminal insulation, shorted condenser, poor insulation on breaker arm, or short between breaker arm and breaker plate.

Breaker Spring Tension Test

Set syncrograph controls, according to manufacturer's instructions, to show the distributor firing pattern and to drive the distributor shaft clockwise (when viewed from drive end). Operate distributor at 1200 rpm.

If a faint flash of light precedes the regular flash, the breaker spring tension is weak or the breaker arm is binding.

Checking Cam Lobes

With syncrograph set in same manner as for testing breaker spring tension, operate distributor at 950 rpm. All firing positions should be 120 degrees apart. If firing position spacing is 118 degrees or less, the cam is excessively worn and should be replaced.

Checking Centrifugal Advance

Set syncrograph to show firing positions. Operate distributor at 100 rpm and set dial so that one firing position is at 0. Then check distributor advance at the speeds given in chart below.

Rpm	200	400	1200
Advance	0°	4°	15°

Mount distributor so that it is driven directly by syncrograph drive (remove flexible drive). Connect syncrograph lead and operate distributor at 950 rpm. Grasp distributor and shake distributor case. Any variations in firing position will indicate worn bushings or shaft.

Condenser Test

Use a condenser tester to check condenser for each of the following:

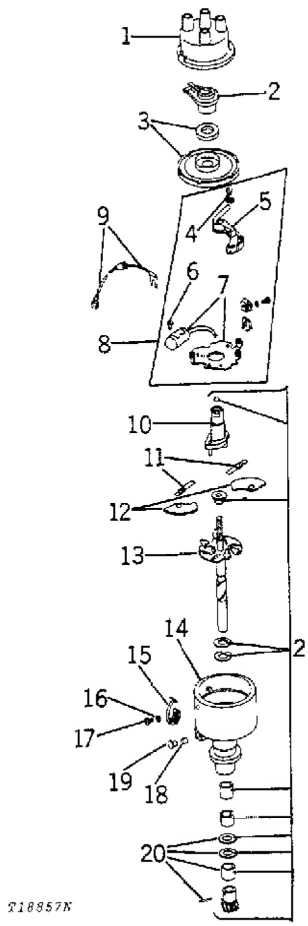
1. Breakdown or leakage of insulation.

2. High series resistance of condenser lead and its connections.

3. Capacity of condenser plates, which should be 0.18 to 0.21 microfarads.

Repair

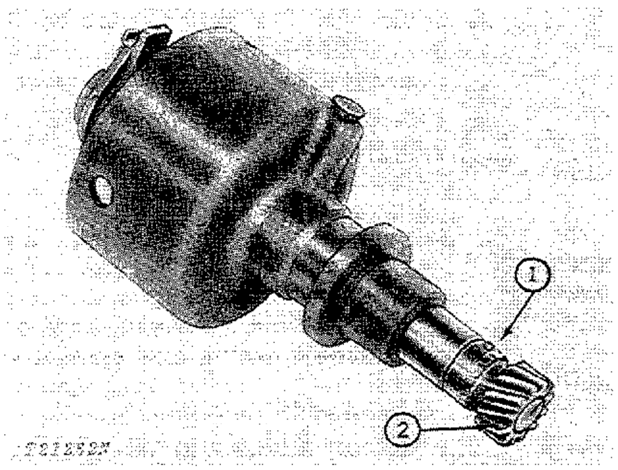
Disassemble distributor only as far as necessary to repair or replace defective parts (Fig. 5).



1—Cap
2—Rotor
3—Dust Cover, with Felt Seal
4—Machine Screw
5—Breaker Point
6—Machine Screw
7—Condenser
8—Breaker Plate Assembly
9—Primary Lead
10—Cam and Stop Plate
11—Governor Weight Spring
12—Weight (2 used)
13—Drive Shaft
14—Housing
15—Cap Clamp (2 used)
16—Lock Washer (2 used)
17—Machine Screw (2 used)
18—Felt Wick
19—Oiler Plug
20—Gear Replacement Kit
21—Shaft Bearings, Washers, and Spacers Kit

Fig. 5-Distributor Assembly

Remove breaker plate assembly with points and condenser. Detach point assembly and condenser. Push grommet from outside to inside of housing and remove distributor wire.



1—Spring Pin **2—Drive Gear**

Fig. 6-Rotor Position Marked on Shaft and Drive Gear

Mark rotor position on both the shaft and drive gear (Fig. 6). Drive spring pin from drive gear. Remove gear, thrust washers, shaft with cam, and advance mechanism.

Disassemble advance mechanism by removing cam retaining ring, weight springs, cam, cam spacer, and advance weights.

Clean and inspect distributor cap, rotor, and dust cover. NEVER clean with any type of degreasing compound. Check rotor tip and terminals inside of cap for excessive burning away of material. Too great a clearance will place a greater strain on the coil.

Bushing Replacement

Remove breaker plate assembly. Push grommet from outside to inside and remove distributor wire. Mark rotor position on the shaft and the gear (Fig. 6). Drive spring pin from gear. Remove gear, thrust washers, and shaft with cam and advance mechanism.

Remove old bushings and carefully install new ones 0.094 inch (2.39 mm) below the housing surface. Use an arbor with a pilot that is 0.5001 to 0.5003 inch (12.703 to 12.708 mm) in diameter and 1 inch (25.4 mm) long.

Remove grease hole plug and drill lubrication hole in top bushing. Clean and deburr bushing. Pack new wick with cam lubricant or similar high temperature lubricant. Install plug.

Check advance mechanism for wear. A worn camshaft gear can cause excessive wear on advance mechanism. If cam was removed, lubricate shaft and bearing surface of cam with cam lubricant or high temperature lubricant.

Drive Gear Replacement

When installing a new drive gear, place gear on shaft and finish drilling spring pin hole with a 1/8-inch (3.175 mm) drill.

Contact Points

Replace breaker plate assembly if the pivot post is loose or worn.

FOS D

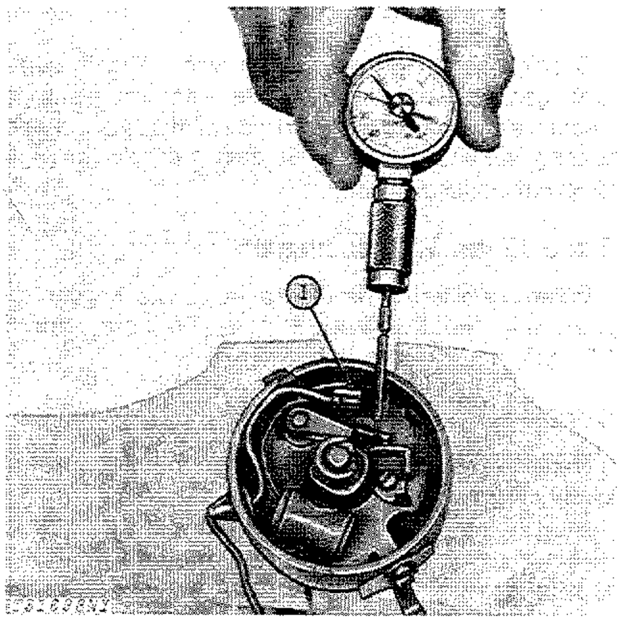
Check contact point condition. See Chapter 6 of FOS Manual 20—ELECTRICAL SYSTEMS for point servicing information. For emergency reconditioning of points, hone contact surfaces and clean the contacts.

Align the points and set point gap to 0.018 to 0.022 inch (0.46 to 0.56 mm) (96° to 102° cam dwell).

Assembly

Install cam spacer on shaft and weight plate assembly. Fill upper housing bearing lubrication hole and lubricate bearing bore of cam and the advance weights with a cam lubricant or other suitable high-temperature grease. Install advance springs, weights, cam and cam retaining ring.

Lubricate the drive shaft with SAE 20W oil and place the outer and inner thrust washers on drive shaft. Install drive shaft in distributor housing. Place inner and outer thrust washers, spacer, and drive gear on distributor shaft. Install spring pin with one end of spring pin exposed (0.060 inch [1.52 mm] max.) to indicate position of rotor. Distributor shaft end play is 0.002 to 0.010 inch (0.05 to 0.25 mm).



1—Spring Attaching Screw

Fig. 7-Checking Breaker Spring Tension

Install breaker plate, distributor wire, condenser, and point assembly. Check point alignment. Bend only the stationary contact to align contacts. Set the contact gap to 0.020 inch (0.51 mm). Check breaker spring tension with a scale and pull on a line perpendicular to the contact face. The tension should be 17 to 22 ounces (0.48 to 0.62 kg) at the center of contact or 19 to 24 ounces (0.54 to 0.69 kg) when measured beside the contact (Fig. 7). Spring may be adjusted by sliding spring in or out on the attaching screw or by bending the spring.

The contacts should be cleaned with a few drops of lighter fluid on a strip of lint-free cloth. Then pull a dry strip through points to remove residue. Observe caution when using lighter fluid. If present, oxide on the points can be removed with a cloth soaked in water.

Apply a trace of cam lubricant to the cam. DO NOT OVERLUBRICATE.

TEST AFTER ASSEMBLY

Mount distributor in syncrograph, using flexible drive connection. Connect lead to distributor terminal. Turn switch to "CAM ANGLE." With contact points closed, adjust "SET" knob until pointer is at "SET" on meter dial.

Operate distributor at 950 rpm. Cam angle should be 96 to 102 degrees. Do not set contact gap outside of limits of 0.018 to 0.022 inch (0.46 to 0.56 mm) to obtain specified cam dwell. Replace cam if difficulty is encountered.

Correct point opening can be set with a feeler gauge only when points are new or in good condition, because of the irregularity of worn points.

If centrifugal-advance mechanism was disassembled, recheck the advance on the syncrograph as previously discussed.

If after weights are clean and free of binds, it is necessary to adjust the distributor advance, bend the outer spring support. The light spring controls distributor advance below 400 rpm. The heavy spring controls most of the distributor advance between 400 and 1200 rpm.

Installation

To provide a good electrical ground, the distributor mounting must be clean. With rotor and housing in same position as when removed, install distributor. Line up reference marks scribed during removal (Fig. 3). To prevent seizing of bearing, make sure that distributor is all the way down and that the drive gear is properly meshed with the camshaft.

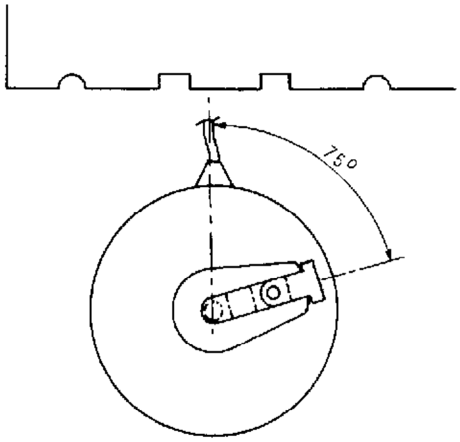


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Fig. 8-Indexing Distributor

If in doubt about proper distributor position, use the following procedure. With No. 1 cylinder at top center on compression stroke, position rotor arm 75 degrees clockwise (view from rotor end of distributor) from primary lead (Fig. 8). Install distributor so that primary lead points toward the engine and is perpendicular to center line of engine. When correctly engaged, the rotor arm will be approximately 50 degrees from the primary lead.

Install and tighten distributor clamp so that engine may be run. Connect coil-to-distributor primary lead. Install dust cover, rotor, and distributor cap. Spark plug cables are installed in distributor cap in engine firing order (1-2-3).

Time the distributor (refer to Section 90, Group 9015).

SPARK PLUGS

Removal

Blow dirt and trash away from spark plugs. Be sure to protect your eyes from flying particles.

Pull spark plug cables from spark plugs. Grip cable at terminal not on the cable. Use a suitable spark plug socket (deep-well type) to remove the spark plugs and gaskets.

Repair

Discard plugs that have cracked insulators, badly eroded electrodes or are otherwise defective.

If inspection shows cables have deteriorated insulation or broken strands, replace with new cables.

Cleaning

If spark plugs are suitable for further use, clean them. If spark plug condition is questionable, replace plugs. Excessive fuel consumption in an engine with old, dirty plugs, will soon exceed the cost of new plugs.

After cleaning spark plugs, brush threads with a wire brush or a wire brush buffing wheel.

To remove insulating deposits and erosion from the electrodes, file them with a small fine-cut contact file. The electrodes should have flat, parallel surfaces.

Setting Spark Plug Gap

Using a wire-type gauge, set spark plug gap by bending the outer or grounded electrode only (Fig. 9). The spark plug gap should measure 0.025 inch (0.64 mm). Test plug in a spark plug tester to compare its efficiency with a new plug.

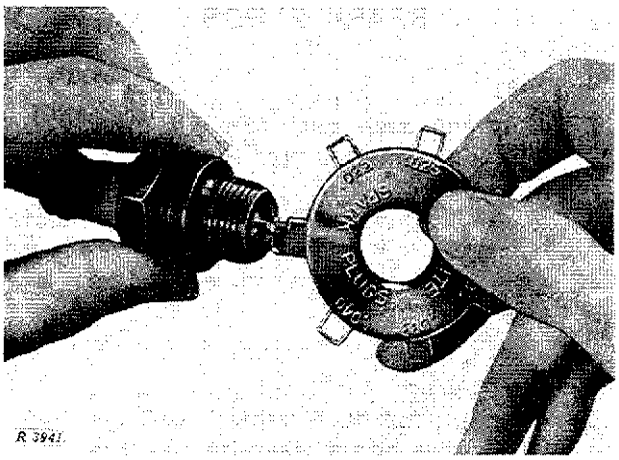


Fig. 9-Setting Gap Clearance

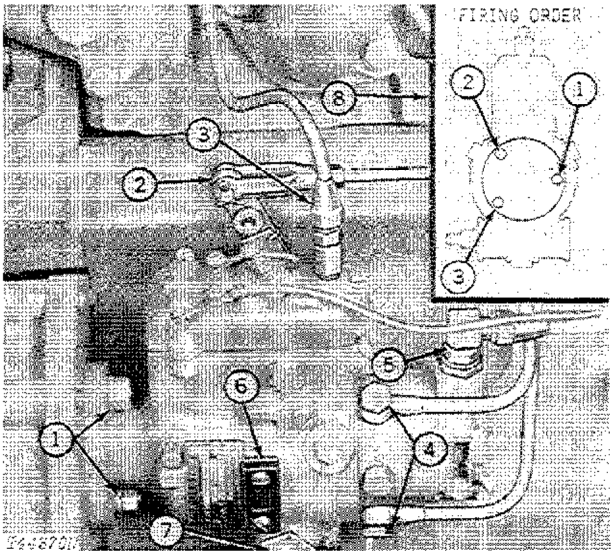
Installation

Thoroughly clean the spark plug mounting surface. Any foreign material on this surface retards flow of spark plug heat, makes a poor electrical ground and compression seal.

Install and tighten plugs to 35 lb-ft (4.8 kg-m). Push spark plug cable boots all the way on spark plugs.

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.

REMOVAL

CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury. Before disconnecting lines be sure to relieve all pressure.

Fuel escaping from a very small opening can be almost invisible. Use a piece of cardboard or wood, rather than hands to check for escaping fuel.

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

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 the injection pump is removed (see "Installation").

Removing Injection Pump From Drive Shaft

Disconnect fuel supply, fuel return, and the injection lines from the pump. Plug all openings.

Disconnect the throttle linkage and wire throttle lever in wide open position before removal of pump to prevent loosening of internal parts.

Remove the pump mounting nuts and slide the pump in a straight line away from the engine.

The pump drive gear and shaft will remain on the engine front plate.

Removing Injection Pump, Drive Shaft and Gear

NOTE: The injection pump drive shaft can be removed without removing the timing gear cover. Remove injection pump gear cover. Remove thrust spring and pin from gear end of shaft. Loosen pump drive shaft nut until it is flush with end of shaft. Drive shaft from the front using a brass drift. Completely remove nut from end of shaft and remove shaft from 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 (6 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.

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.

Install pump over shaft, making sure that reference mark on drive shaft tang aligns with mark on the slot end of the distributor rotor in the pump.

Incorrect assembly of shaft into pump will result in timing error of 180 degrees.

REPAIR

For detailed information and specifications refer to John Deere Service Manual SM-2045, "Testing and Servicing Fuel Injection Pumps and Nozzles." See Group 0499 for specifications.

Remove thrust spring and pin from gear end of shaft.

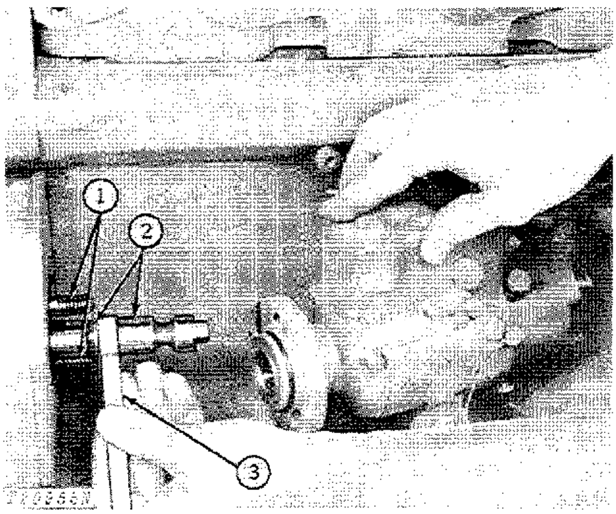
Loosen nut until flush with end of shaft.

Remove nut and gear from shaft.

Inspect gear for wear or chipped teeth.

Inspect tang on drive shaft for a minimum width of 0.305 inch (7.747 mm).

Examine seal grooves on shaft for smooth finish. Any roughness at these points will cause seal failure. Install new seals on drive shaft.



1—Mounting Studs **3—Seal Compressing Tool**
2—Seals

Fig. 2-Compressing Drive Shaft Seal

Apply a generous coat of Lubriplate to the drive shaft seals and slide seals into grooves using drive shaft seal installation (13369 or JD-256). The seals must face in opposite directions. Apply Lubriplate liberally around the shaft between seals.

Install gear on drive shaft using key and keyway to locate gear on shaft. Tighten hex. nut to 45 lb-ft (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.

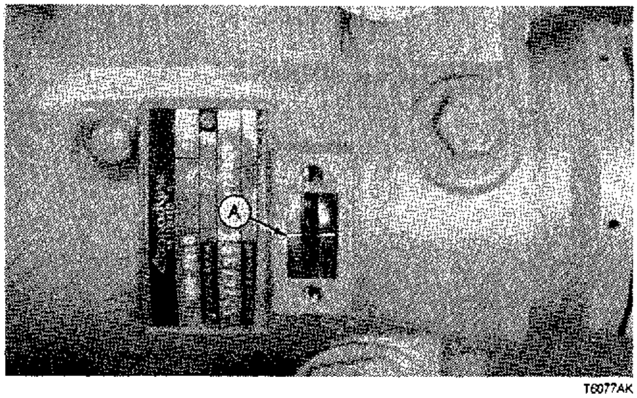


Fig. 3-Timing Lines

Line up line on weight retainer hub with line on cam (A, Fig. 3).

If engine has not been set on "top dead center" (No. 1 cylinder on compression stroke) 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".

Using drive shaft seal compressing tool (JD256-13371), compress seal on shaft and slide pump in place (Fig. 2).

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 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 banjo connectors to 35 lb-ft (4.8 kg-m). Tighten flare fittings to 20 lb-ft (2.8 kg-m).

IMPORTANT: Do not use washers other than those specified in the parts catalogs since other washers may allow injection screws to bottom on hydraulic head and cause pump seizure.

Connect fuel supply and return lines. Tighten connections to 20 lb-ft (2.8 kg-m).

Connect throttle linkage.

Install timing hole cover.

Bleed fuel system.

Refer to Group 9010 Section 90 for speed control adjustment and injection pump advance adjustment.

Bleeding

Any time the engine has been idle for a long period or the fuel system has been cleaned, bleed the fuel system before operation to remove trapped air.

Fill tank with proper fuel.

Open shut off valve at tank outlet.

Loosen bleed plug on the fuel filter. Pump primer lever until a solid stream of fuel (free of air bubbles) flows from the opening. Tighten plug.

Loosen pump inlet line. Pump primer lever until a solid stream of fuel (free of air bubbles) flows from line. Retighten line.

Be sure to leave primer lever at lowest point of stroke.

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. Remove leak-off lines from nozzles. Remove the return with the boots.

CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury. Before disconnecting lines be sure to relieve all pressure.

Fuel escaping from a very small opening can be almost invisible. Use a piece of cardboard or wood, rather than hands to check for escaping fuel.

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

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.

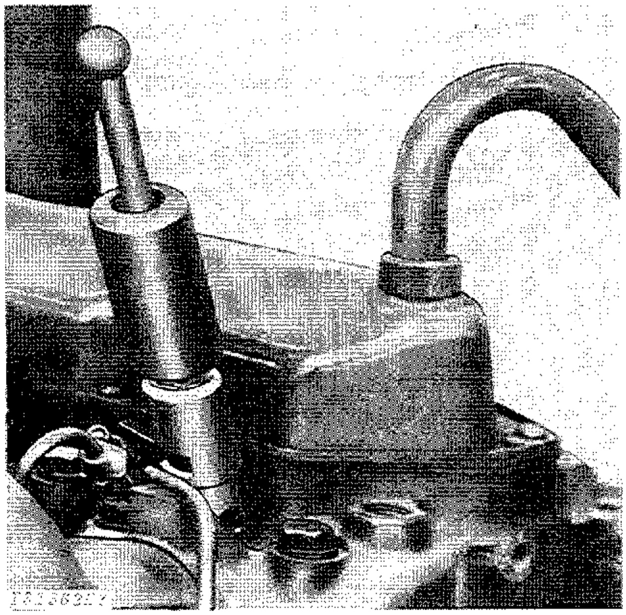


Fig. 4-Using Nozzle Puller to Remove Nozzles

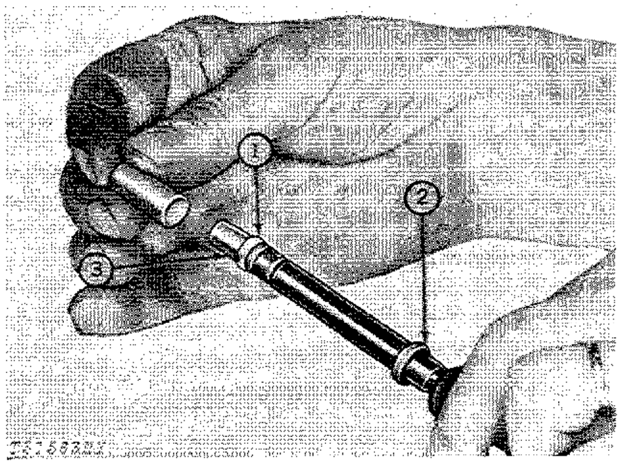
IMPORTANT: Do not use a screwdriver or similar tool to pry injector nozzles from cylinder head as distortion and permanent damage to nozzles may occur. Injectors are easily removed by hand unless lower carbon seal has failed, allowing nozzle to become "set." In this case, the nozzle puller must be used.

REPAIR

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 specifications, special service tools, and testing procedures necessary to service the Roosa-Master injection nozzles. See Group 0499 for specifications.

INSTALLATION

Install a new sealing washer onto the nozzle body. Use No. 16477 or JD-258 Seal Installation Tool to install a new carbon stop seal (Fig. 5). 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.



1—Carbon Seal
2—Seal Washer
3—Pilot

Fig. 5-Installing Sealing Washer and Carbon Stop Seal

Using a JDE39 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 (2.8 kg-m) and install leak-off boots and line.

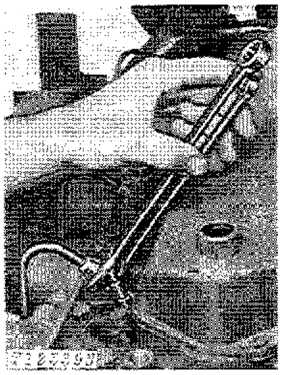


Fig. 6-Tightening Injector Lines

Crank engine with starter until fuel flows around loose injector lines. **Using one hand and two wrenches**, tighten injector lines as shown in Fig. 6. Use only enough force to keep lines from leaking. Start engine and check for leaks around nozzle connections. Retighten if necessary and install hood.

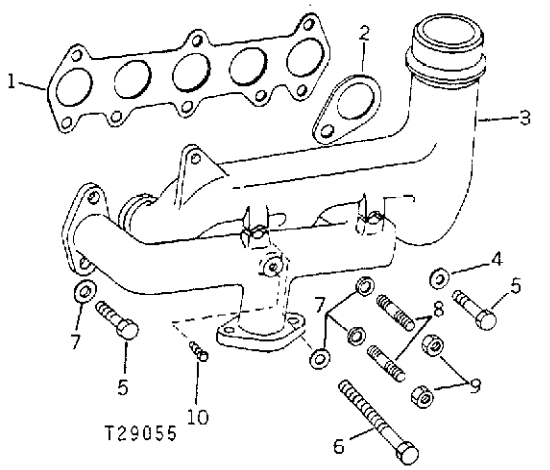
Group 0414
INTAKE MANIFOLD

GENERAL INFORMATION

On the gasoline engine, the fuel-air mixture is carried from the carburetor to the engine intake valves by the intake manifold.

The diesel engine uses an air inlet to carry air through the intake valves into the combustion chamber.

REMOVAL

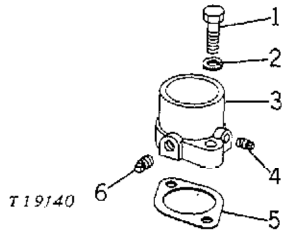


1—Gasket
2—Gasket
3—Manifold
4—Washer (5 used)
5—Cap Screw (4 used)
6—Cap Screw (2 used)
7—Washer
8—Stud (2 used)
9—Nut (2 used)
10—Pipe Plug

Fig. 1-Gasoline Intake and Exhaust Manifold

Let engine cool down before removing the intake manifold.

On gasoline engines remove the carburetor before removing the manifold.



1—Cap Screw (2 used)
2—Lock Washer (2 used)
3—Air Inlet
4—Pipe Plug
5—Gasket
6—Pipe Plug

Fig. 2-Diesel Air Inlet

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. Put John Deere Gasket Maker, or equivalent, on cap screws before installing them. Tighten cap screws to 35 lb-ft (47 N·m).

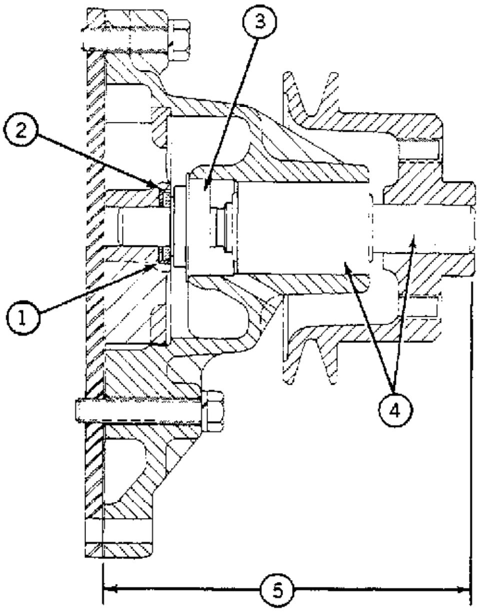
Group 0417
WATER PUMP

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.

REMOVAL

Drain coolant from radiator and engine block and remove radiator and water pump from engine.



T36531N

1—Insert
2—Cup
3—Seal
4—Bearing and Shaft
5—5.47 inches (139 mm)

Fig. 2-Water Pump Assembly

REPAIR

Remove the rear cover plate and gasket from the pump housing (Fig. 1).

Use D-01200AA Puller to remove pulley from water pump shaft.

Support water pump housing and allow sufficient 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.

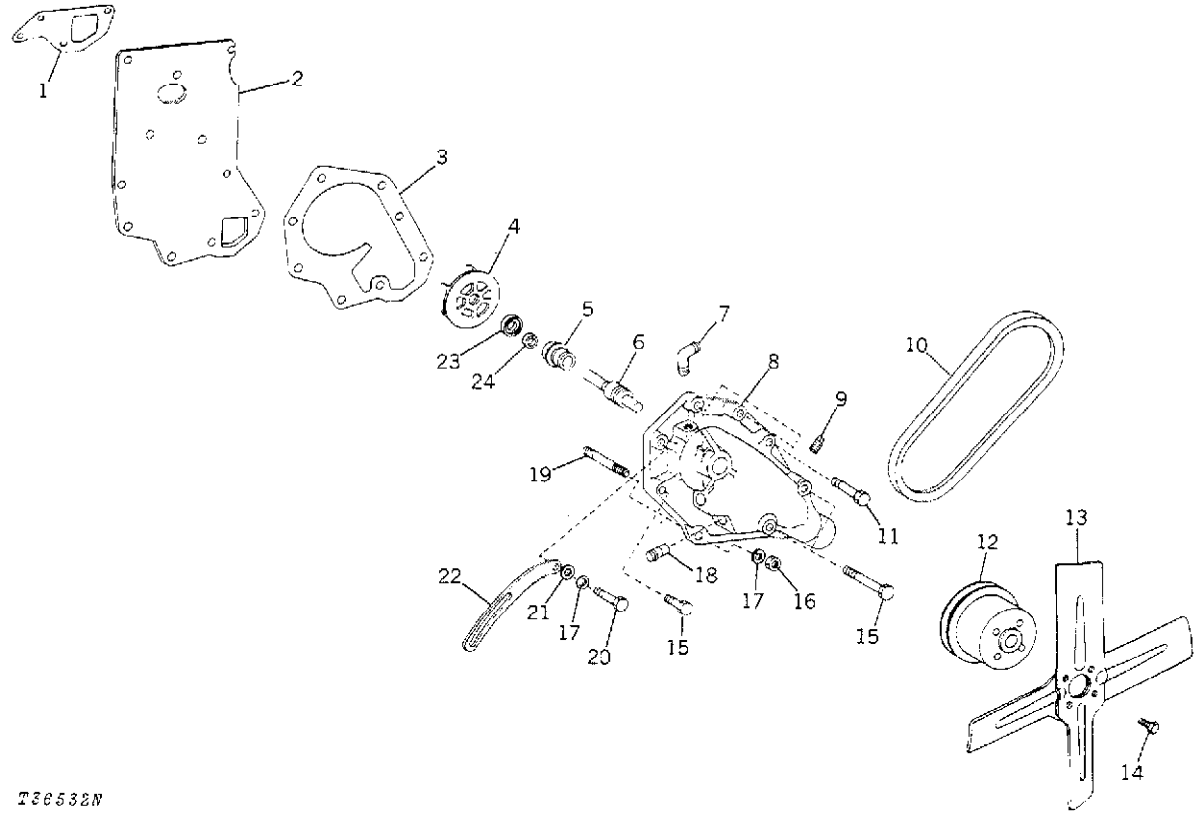
Support impeller and press out bearing shaft using a drift that is slightly smaller than the bearing shaft. Remove seal from bearing shaft. Note location of cup and insert in impeller on later model pumps.

Any leakage at the drain hole in bottom of housing generally indicates a leaking seal.

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.



1—Gasket
2—Cover
3—Gasket
4—Impeller
5—Seal
6—Bearing
7—Bypass Elbow
8—Housing
9—Pipe Plug
10—Fan Belt
11—Cap Screw (4 used)
12—Fan Pulley
13—Fan
14—Cap Screw (4 used)
15—Cap Screw (2 used)
16—Nut
17—Lock Washer (4 used)
18—Tube (2 used)
19—Stud
20—Cap Screw
21—Washer
22—Adjusting Strap
23—Cup
24—Insert

Fig. 2-Water Pump and Related Parts

Using a JD262-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 vee 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.

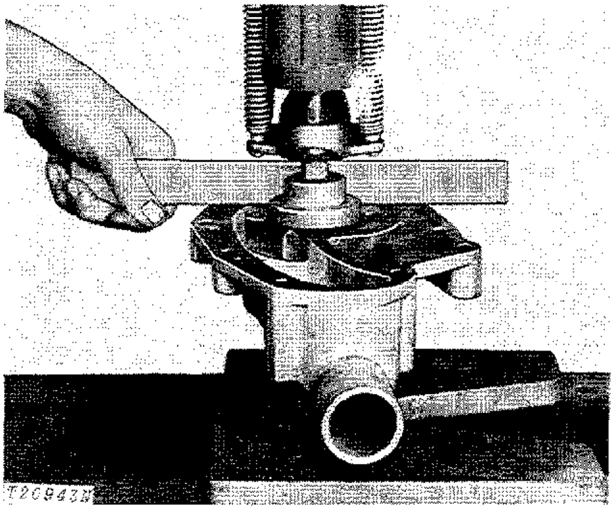


Fig. 3-Installing Impeller

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 (within 0.010 inch [0.254 mm]) with metal rim of pump housing. Check with a straight-edge 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 5.5 inches (139.7 mm).

Using a new gasket, install pump rear cover on pump assembly. Tighten attaching cap screws to 35 lb-ft (4.8 kg-m).

INSTALLATION

Install radiator and water pump on engine.

Fill cooling system with proper coolant.

Group 0418
THERMOSTATS, HOUSINGS AND WATER PIPING

GENERAL INFORMATION

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 coolant temperature throughout the engine.

REMOVAL

Drain the cooling system.

Remove thermostat housing cover and lift out thermostat.

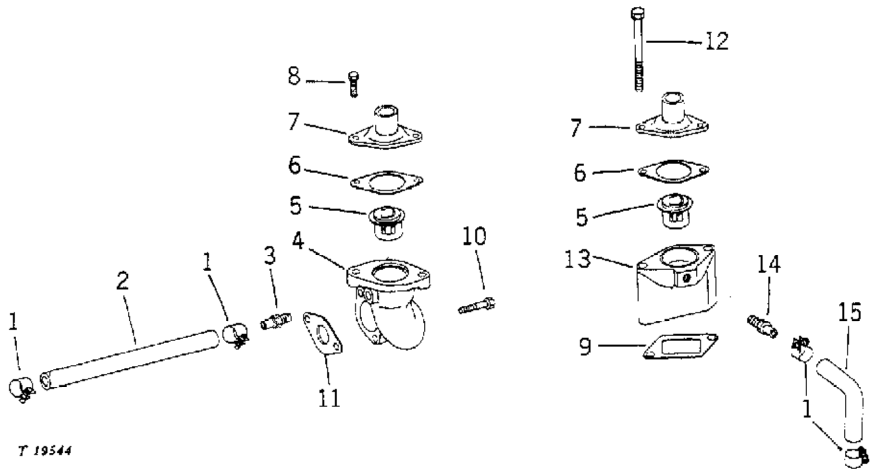
REPAIR

If engine has been running too hot or cold, carefully inspect the thermostat for defects. Test in hot water to check for proper opening and closing.

Replace damaged or spongy hoses.

INSTALLATION

Install the thermostat using a new gasket.



1—Clamp (2 used)
2—Hose (diesel)
3—Nipple (diesel)
4—Housing (diesel)
5—Thermostat
6—Gasket
7—Cover
8—Cap Screw (2 used) (diesel)
9—Gasket (gasoline)
10—Cap Screw (2 used) (diesel)
11—Gasket (diesel)
12—Cap Screw (2 used) (gasoline)
13—Housing (gasoline)
14—Nipple (gasoline)
15—Hose (gasoline)

Fig. 1-Thermostat Housing Assembly

Group 0419
ENGINE OIL COOLER

GENERAL INFORMATION

The diesel engine has an oil cooler located on the cylinder block. The cooler uses engine coolant to lower the temperature of the crankcase oil.

REMOVAL

Drain oil from engine crankcase and coolant from radiator and oil cooler.

Disconnect coolant lines and remove cooler from the cylinder block.

REPAIR

Pressure check the oil cooler by pressurizing the water side to 15 psi (1.0 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.

Check water passages for lime deposits.

Inspect internal passages for any evidence of water or oil leakage.

Refer to Fig. 1 for relationship of parts.

INSTALLATION

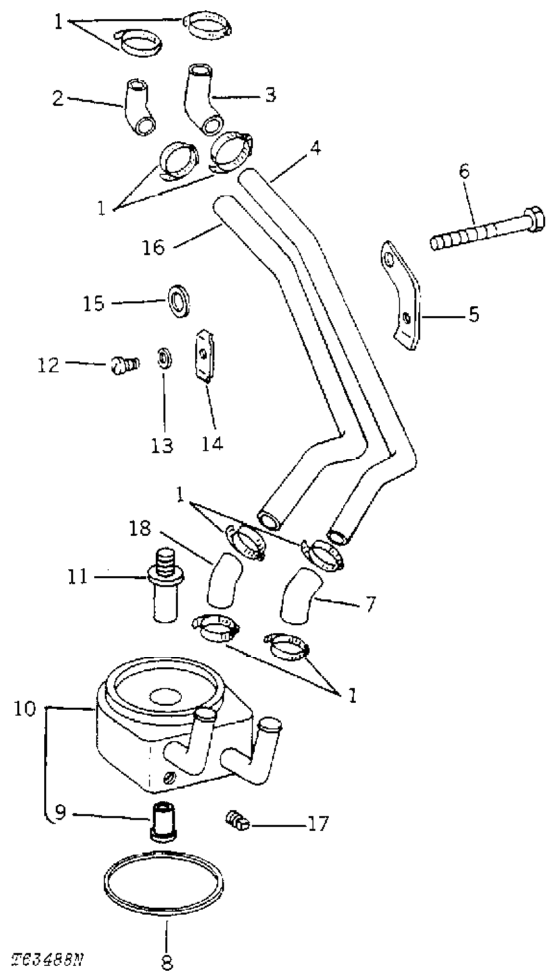
Position O-ring (8, Fig. 1) on bottom of oil cooler.

Place oil cooler on cylinder block and install oil cooler nipple (11). Tighten oil cooler nipple with 20 to 25 lb-ft (27 to 34 Nm) (2.8 to 3.5 kg-m) torque.

Connect lines. Be sure all connections are tight.

Fill lubrication system with proper oil.

Fill cooling system with proper coolant.



1—Clamp (8 used)
2—Hose
3—Hose
4—Lower Tube
5—Half Clamp
6—Cap Screw
7—Hose
8—O-Ring
9—Relief Valve
10—Oil Cooler
11—Nipple
12—Screw
13—Lock Washer
14—Half Clamp
15—Washer
16—Upper Tube
17—Special Plug
18—Hose

Fig. 1-Oil Cooler

Group 0420
FUEL FILTER

GENERAL INFORMATION

Gasoline engines are equipped with a fuel line strainer located on the right side of the engine (Fig. 1).

A strainer is used to filter fuel before it reaches the transfer pump. The strainer is located in the fuel tank.

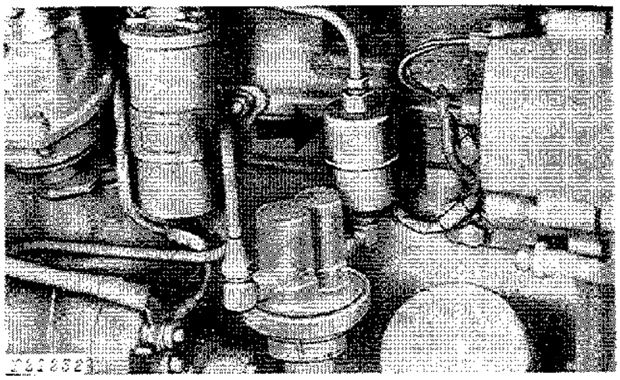
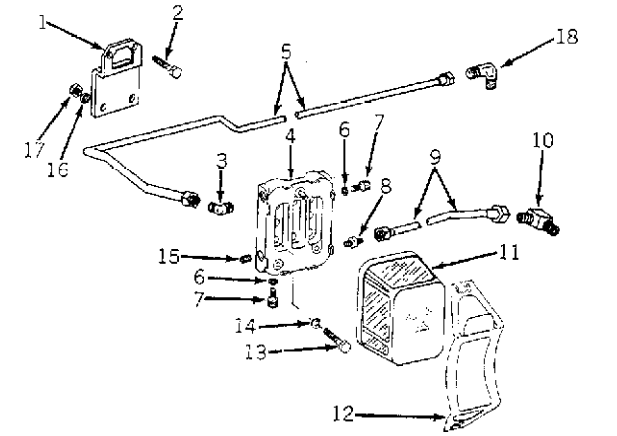


Fig. 1-Fuel Line Filter (Gasoline)

The dual stage diesel fuel filter is located on the right side of the tractor engine. Fuel from the transfer pump enters the bottom of the fuel filter body and leaves at the top of the fuel filter body.

REPAIR

The fuel strainer in the fuel tank seldom needs cleaning because the sloshing of the fuel tends to wash dirt particles from the filter screen.



1—Bracket
2—Cap Screw (2 used)
3—Elbow
4—Body
5—Line (to injection pump)
6—Packing (2 used)
7—Bleed Screw (2 used)
8—Connector
9—Line (to transfer pump)
10—Elbow
11—Element
12—Retaining Spring
13—Cap Screw (2 used)
14—Washer (2 used)
15—Pipe Plug
16—Lock Washer (2 used)
17—Nut (2 used)
18—Elbow

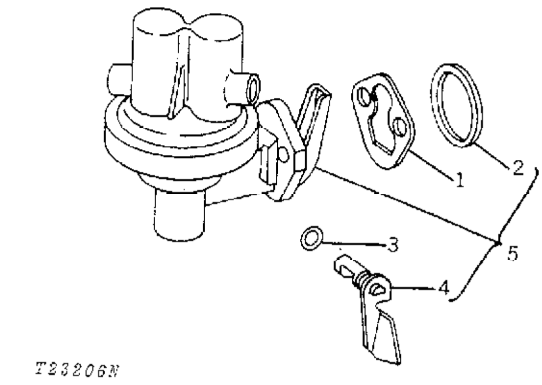
Fig. 2-Fuel Filters

Refer to Fig. 2 during disassembly and assembly of fuel filter.

Group 0421
FUEL TRANSFER PUMP

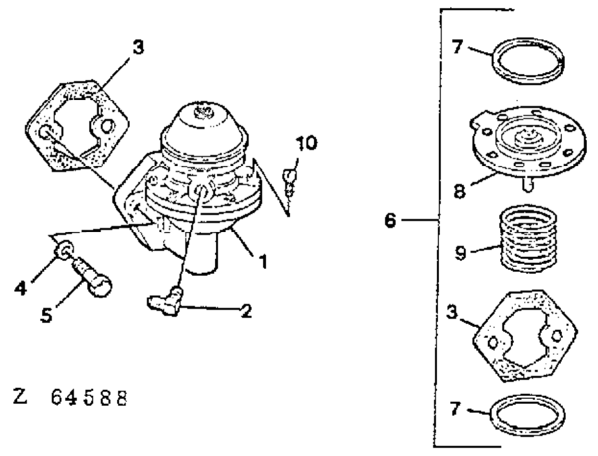
GENERAL INFORMATION

Two fuel transfer pumps are available (Figs. 1 and 2).



1—Gasket
2—Packing
3—O-Ring (diesel only)
4—Primer Lever (diesel only)
5—Fuel Pump

Fig. 1-Fuel Transfer Pump



1—Pump Body
2—Pipe Fitting
3—Packing
4—Washer
5—Cap Screw
6—Repair Kit
7—O-Ring
8—Diaphragm
9—Spring
10—Screw

Fig. 2-Fuel Transfer Pump

REMOVAL

Disconnect fuel lines at pump.

Remove cap screws and remove pump.

REPAIR

Refer to Figs. 1 and 2 when disassembling and assembling the pump.

To remove or install primer lever (4, Fig. 1), compress rocker arm lever. Further disassembly of this pump is not possible.

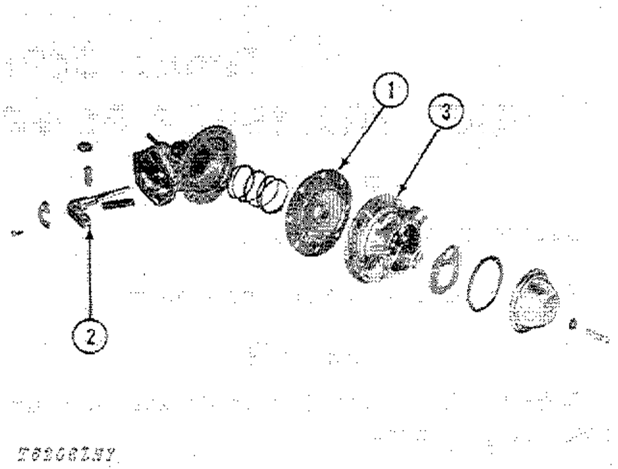
When disassembling pump in (Fig. 2) mark pump cover and pump body for easier reassembly.

Remove screws (10, Fig. 2).

Separate pump body (1, Fig. 2) from pump cover.

Disassemble pump as necessary.

Install repair kit (6, Fig. 2) if necessary.



1—Diaphragm
2—Rocker Arm
3—Pump Cover

Fig. 3-Fuel Transfer Pump

When assembling the fuel pump, observe the following:

1. Make sure diaphragm (1, Fig. 3) is engaged in rocker arm (2).

2. Before installing the pump cover (3), position diaphragm so that it is level by moving rocker arm. Hold lever in this position.

3. Install pump cover and cover screws. Turn screws in until they just contact the washers. Operate rocker arm several times, then release with a snap to make sure that diaphragm will not be overstretched when in use. Tighten cover screws in a crosswise pattern.

INSTALLATION

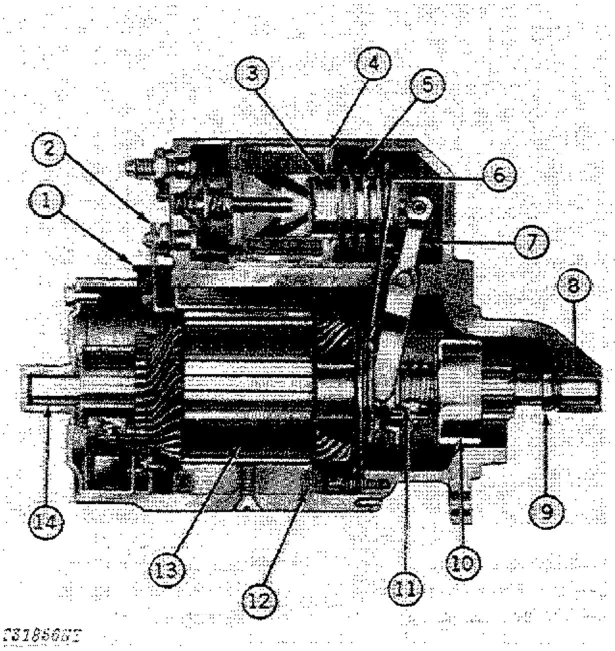
Using a new gasket, attach transfer pump to cylinder block.

Connect fuel lines.

Bleed fuel system.

Group 0422
STARTING SYSTEM

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—Field Coil
13—Armature
14—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

On gasoline crawlers, the armature is supported on two bushings in the drive housing and commutator end frame. On diesel crawlers, 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 windings 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.

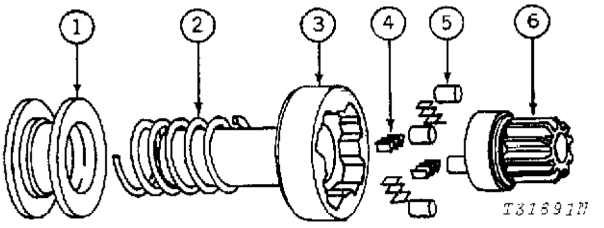
Solenoid Switch

The solenoid switch consists basically of two windings mounted around a hollow cylinder containing a moveable 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.

On gasoline crawlers the solenoid terminal "R" is connected to the ignition coil to bypass the ignition resistor when starting.

Overrunning Clutch Drive



1—Collar
2—Spring
3—Shell
4—Spring
5—Rollers
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.

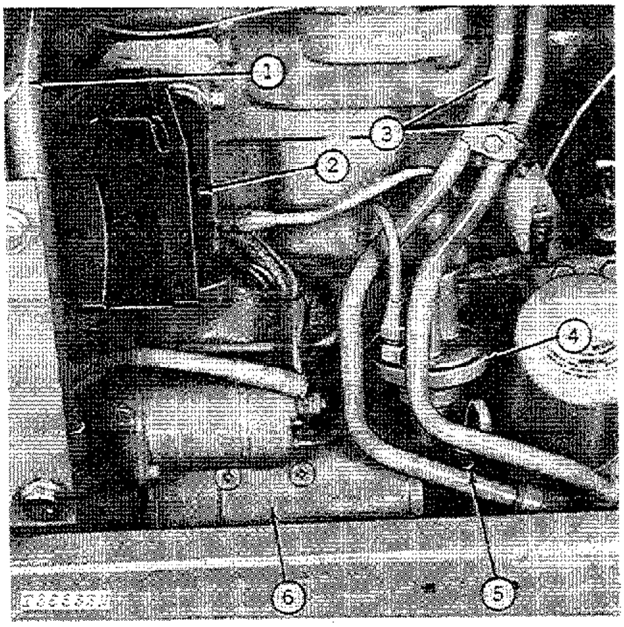
The overrunning clutch drive is designed to be serviced as a complete unit, therefore, do not disassemble. Replace if necessary.

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—Crankcase Vent Tube
2—Fuel Filter Element
3—Coolant Lines
4—Fuel Transfer Pump
5—Dipstick and Nipple
6—Starting Motor

Fig. 3-Starting Motor Removal (diesel shown)

On crawler-loaders, raise loader boom as far as possible and secure safely.

On crawler-dozers, remove spring pin in pin from front of mounting point of right dozer cylinder. Raise cylinder as far as possible and secure safely.

Disconnect battery ground straps from batteries or turn battery disconnect (if equipped) to "OFF" position.

Shut off fuel at fuel tank.

Remove right engine side shield and hood.

On diesel units remove coolant lines from radiator to engine oil cooler.

On diesel units, remove fuel filter element (see Section 4, Group 0420) and fuel transfer pump (see Section 4, Group 0421).

On gasoline units, remove in-line fuel filter (see Section 4, Group 0420), fuel transfer pump (see Section 4, Group 0421) and distributor and coil (see Section 4, Group 0411).

Remove engine crankcase vent tube and clamp.

Remove crankcase oil dipstick and dipstick nipple.

Disconnect wiring from starting motor solenoid.

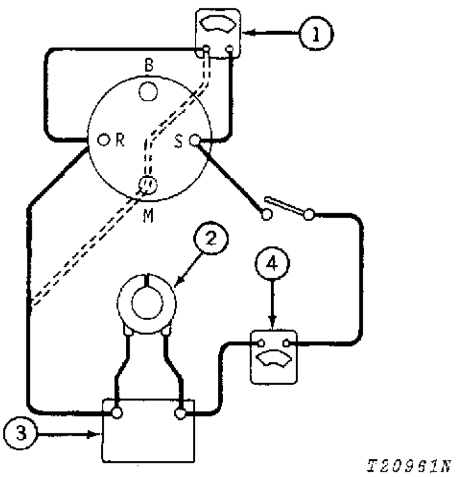
Remove mounting cap screw and hex nut from mounting stud and remove starting motor.

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 shortcircuited

Low Ammeter Reading

Excessive resistance is present (usually in a connection)

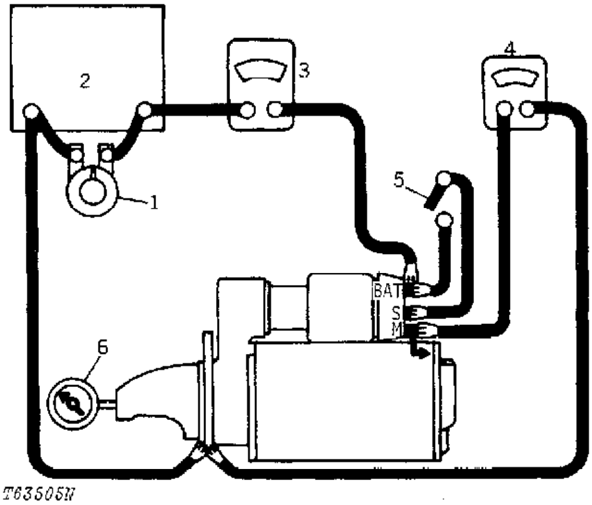
No Ammeter Reading

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.

Starting Motor No-Load Test



1—Carbon Pile
2—Battery
3—Ammeter
4—Voltmeter
5—Switch with Wire 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
(Gasoline)					
1108319	9.0	55*	80*	3500	6000
(Diesel)					
1109251	9.0	20*	120*	9000	14000

**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.

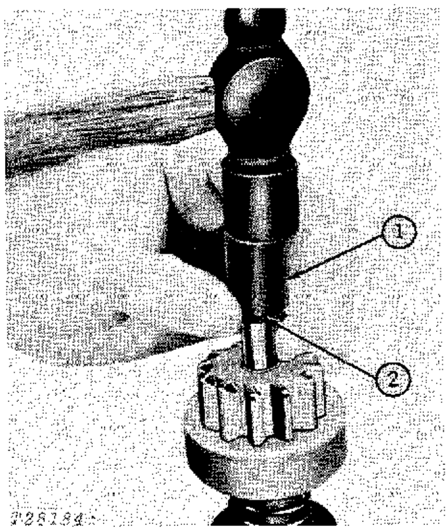
REPAIR

Disassemble motor only as far as necessary to make repairs (Fig. 7 or 8).

Mark position of commutator end frame with regard to main frame to aid in alignment during reassembly.

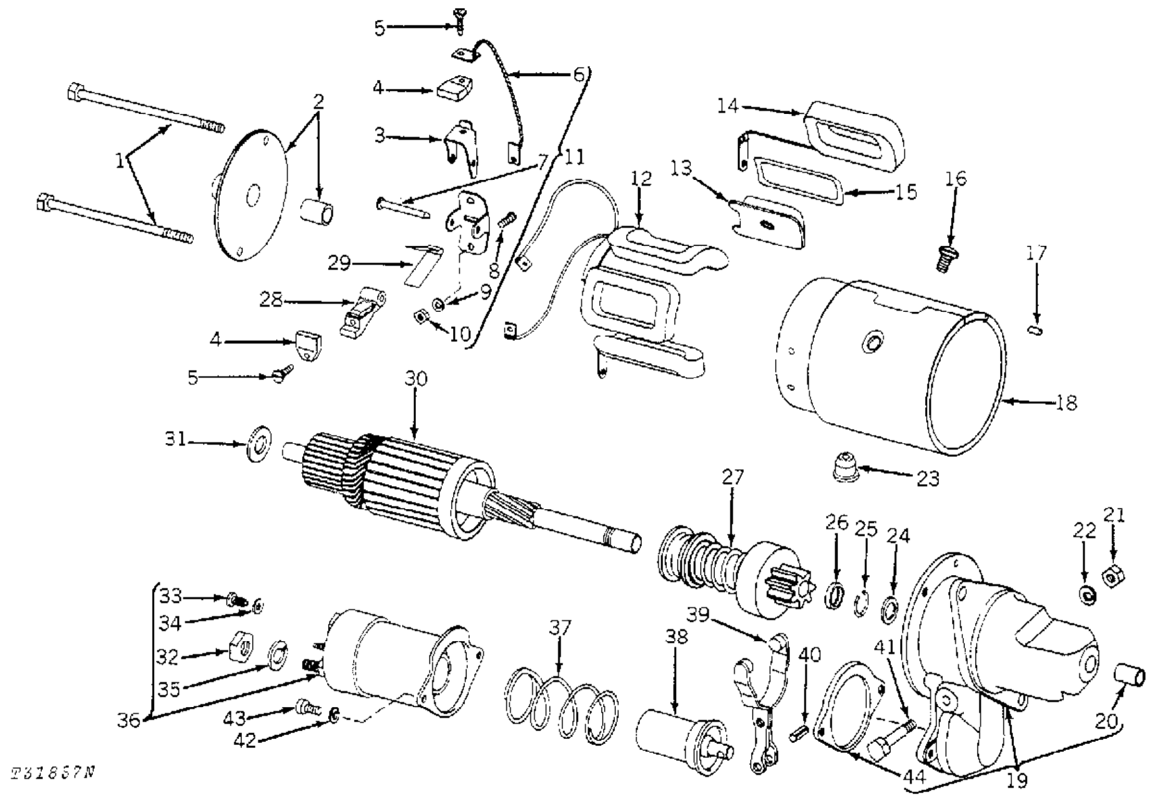
Disconnect field coil connector from solenoid motor terminal and remove solenoid mounting screws.

Remove commutator end frame. Remove field frame and solenoid from drive housing. Separate armature and clutch assembly from drive housing.



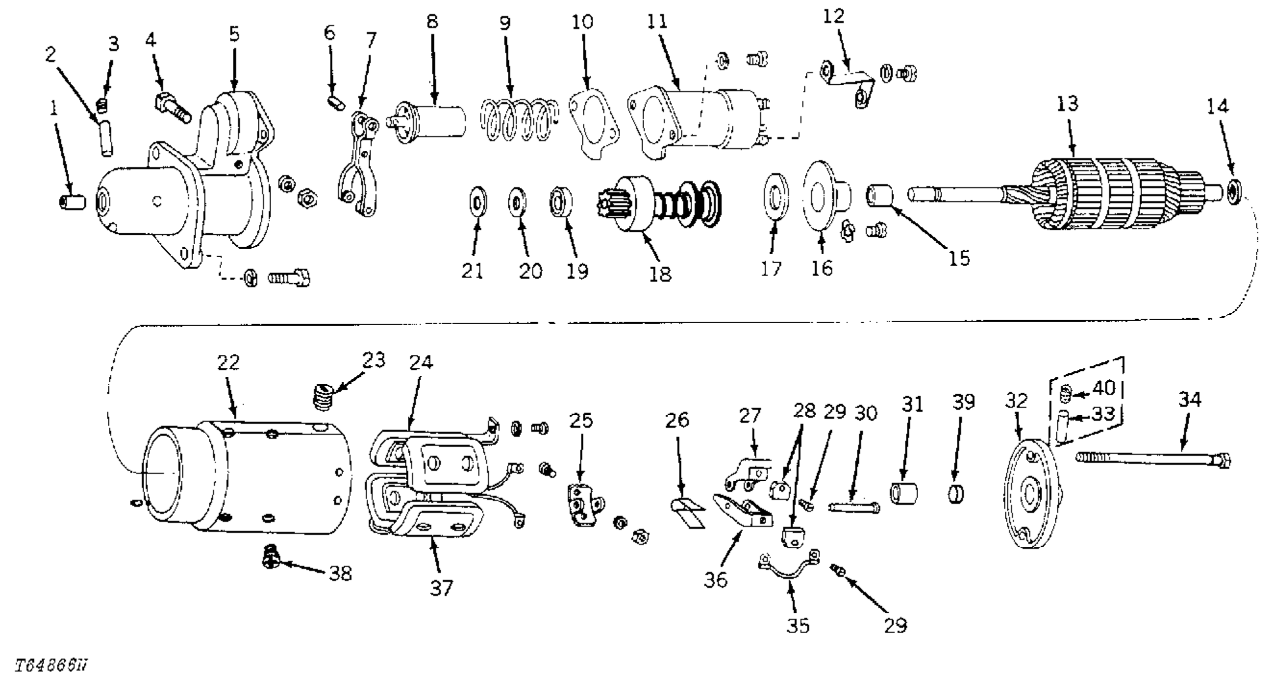
1—Pipe Coupling **2—Pinion Stop**

Fig. 6-Removing Retainer



1—Through Bolt (2 used)
2—Commutator End Assembly
3—Grounded Brush Holder (2 used)
4—Brush (4 used)
5—No. 8 x 5/8" Drive Screw (4 used)
6—Lead Assembly (2 used)
7—Brush Pin (2 used)
8—No. 10 x 1/2" Machine Screw (4 used)
9—No. 10 Lock Washer (4 used)
10—No. 10 Nut (4 used)
11—Brush Support Package
12—Field Coil Assembly
13—Pole Shoe (4 used)
14—Field Coil Shunt
15—Insulator (4 used)
16—Special Screw (4 used)
17—Dowel Pin
18—Field Frame
19—Motor Drive Housing
20—Bushing
21—5/16" Jam Nut
22—5/16" Lock Washer
23—Grommet
24—Thrust Washer
25—Retaining Ring
26—Pinion Stop
27—Motor Drive
28—Insulated Brush Holder (2 used)
29—Brush Spring (2 used)
30—Armature
31—Brake Washer
32—3/8" Jam Nut
33—No. 10 x 7/16" Special Machine Screw
34—No. 10 Internal Tooth Lock Washer
35—3/8" Lock Washer
36—Solenoid Switch
37—Plunger Spring
38—Plunger
39—Shift Lever
40—3/16" x 13/16" Spring Pin
41—Special Cap Screw
42—1/4" Lock Washer (2 used)
43—1/4" x 1/2" Machine Screw (2 used)
44—Solenoid Gasket

Fig. 7-Gasoline Starting Motor



1—Bushing
2—Lubricating Wick
3—Plug
4—Shift Lever Pivot Screw
5—Drive End Housing
6—Spring Pin
7—Shift Lever
8—Solenoid Plunger
9—Solenoid Return Spring
10—Gasket
11—Solenoid Assembly
12—Field Coil Connector
13—Armature
14—Thrust Washer
15—Bushing
16—Center Bearing
17—Brake Washer
18—Overrunning Clutch
19—Pinion Stop
20—Retaining Ring
21—Thrust Collar
22—Field Frame
23—Insulating Bushing
24—Field Coil Assembly
25—Brush Support
26—Brush Spring
27—Insulated Brush Holder
28—Brushes
29—Brush Mounting Screws (2 used)
30—Brush Pivot Pin (2 used)
31—Bushing
32—Commutator End Frame
33—Lubricating Wick (Early Starting Motors)
34—Through Bolts (2 used)
35—Brush Ground Lead (2 used)
36—Grounded Brush Holder
37—Field Pole Shoe (4 used)
38—Pole Shoe Screw (8 used)
39—Commutator End Wick (Later Starting Motors)
40—Plug (Early Starting Motors)

Fig. 8-Diesel Starting Motor

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.

Checking Brushes

Inspect brushes. If they are oil soaked or are worn to approximately 5/16 inch (8 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 on gasoline units 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 0.0312 inch (0.792 mm) and 0.0312 inch (0.792 mm) deep.

If the commutator on diesel units is excessively worn, dirty, out of round, or if it has high insulation, it should be turned down on a lathe. Do not under cut the insulation.

The commutator may be cleaned with No. 00 sand paper. Do not use emery cloth.

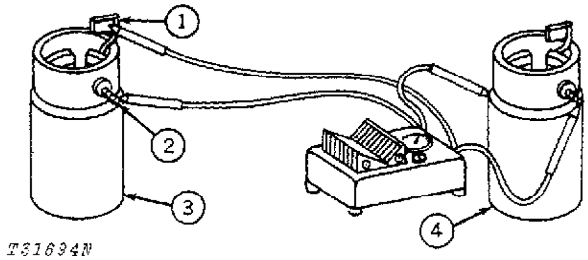
The armature should be checked for short circuits, opens and grounds.

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 the use of a test lamp. If the lamp lights when one 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



1—Brush
2—Field Connector Terminal
3—Open Circuit Test
4—Grounded Winding Test

Fig. 9-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 except for the spring and collar.

Bushings

Pre-Lubricated Bushings

When installing pre-lubricated bushings, use an arbor (see Group 0499) 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. (14.274 - 14.300 mm)
Wear tolerance.......................... 0.5740 in. (14.579 mm)

Bushing, Drive Housing

I.D. .... 0.4990 - 0.5010 in. (12.674 - 12.725 mm)
Wear tolerance.......................... 0.5110 in. (12.979 mm)
Oil clearance .... 0.0020 - 0.0050 in. (0.050 - 0.127 mm)
Wear tolerance.......................... 0.0170 in. (0.431 mm)

Bushing, Commutator End Frame

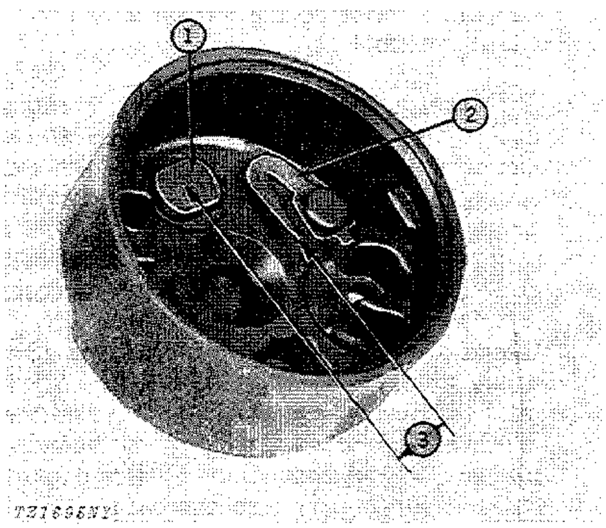
I.D. .... 0.5625 - 0.5635 in. (14.288 - 14.312 mm)
Wear tolerance.......................... 0.5730 in. (14.554 mm)
Oil clearance .... 0.0020 - 0.0050 in. (0.050 - 0.127 mm)
Wear tolerance.......................... 0.0160 in. (0.406 mm)

Bushing, Center Bearing (Diesel)

I.D. .... 0.7570 - 0.7620 in. (18.228 - 19.354 mm)
Wear tolerance.......................... 0.7220 in. (19.608 mm)
Oil clearance .... 0.0070 - 0.0150 in. (0.178 - 0.381 mm)
Wear tolerance.......................... 0.0250 in. (0.635 mm)

Solenoid Switch

Remove nuts and sealing washers from solenoid motor and "S" terminals when removing switch cover.

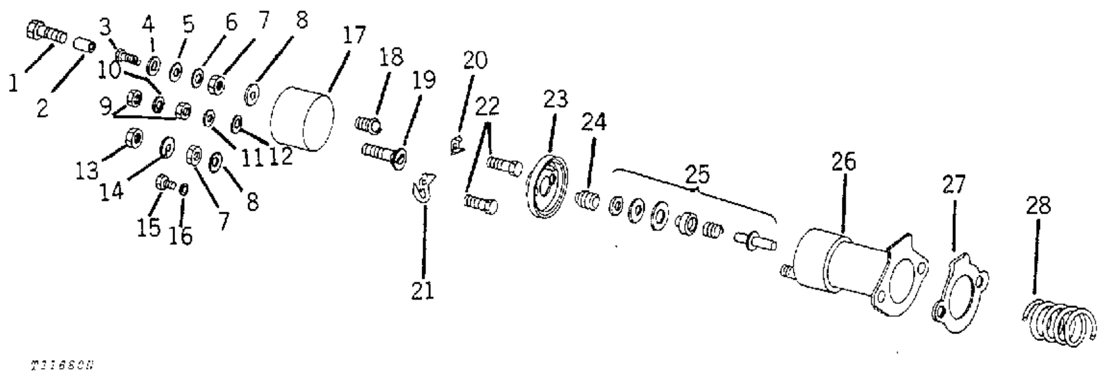


1—Main Contact
2—Contact Finger
3—Contact Finger Height Above Main Contact

Fig. 10-"R" Terminal Contact Finger on Gasoline Units

The "R" terminal (for ignition bypass on gasoline units) contact finger height above the surface of the main contact (Fig. 10) should be 0.0625 to 0.0938 inch (0.792 to 2.383 mm). Bend the finger to adjust contact height.

Replacement "S" terminal clips and motor terminal studs are soldered to winding leads. Use new sealing washers when assembling the solenoid.



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
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. 11-Solenoid Switch

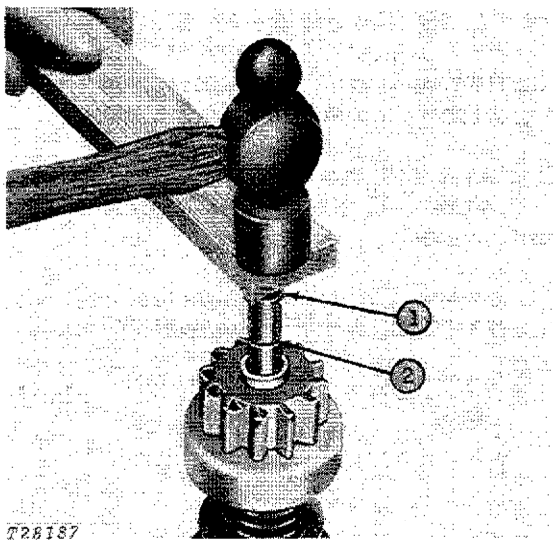
ASSEMBLY

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.

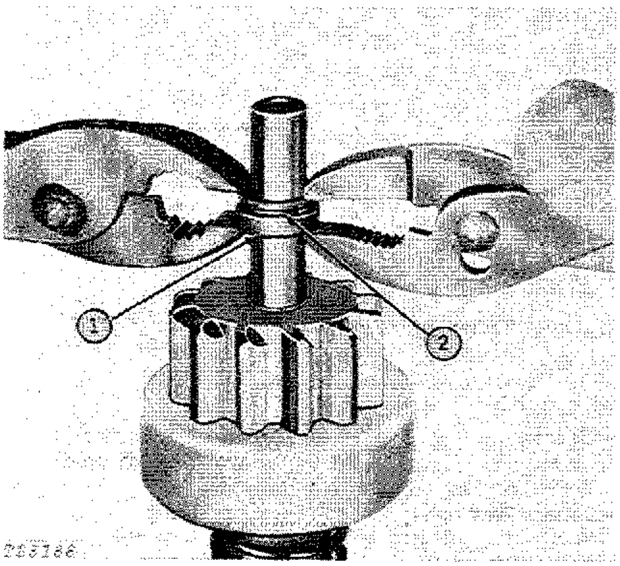
Proceed as follows when assembling retaining ring and pinion stop on shaft.



1—Retaining Ring 2—Groove

Fig. 12-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. 12).



1—Pinion Stop 2—Retaining Ring

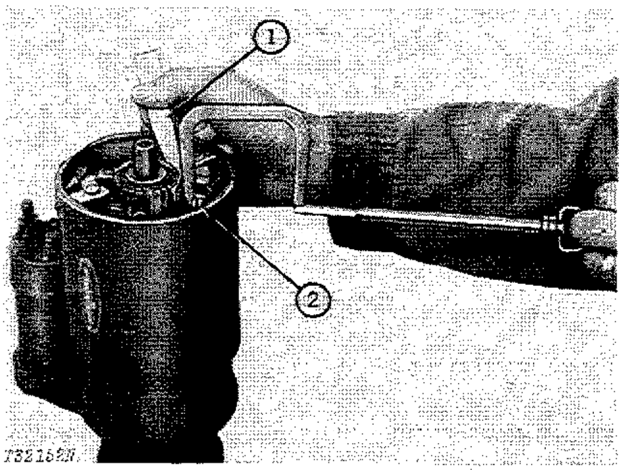
Fig. 13-Forcing Pinion Stop Over Retaining Ring

2. To force the pinion stop over the ring, place a suitable washer over the shaft and squeeze with pliers (Fig. 13). Remove the washer.

Use Permatex No. 2 sealing compound between solenoid flange and starting motor field frame.

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. 14-Testing Brush Spring Tension

Place a piece of paper under the brush (Fig. 14). 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 (1.0 kg) on gasoline units or 80 ounces (2.3 kg) on diesel units. Bend springs, if it is necessary, to adjust the tension.

Pinion Clearance

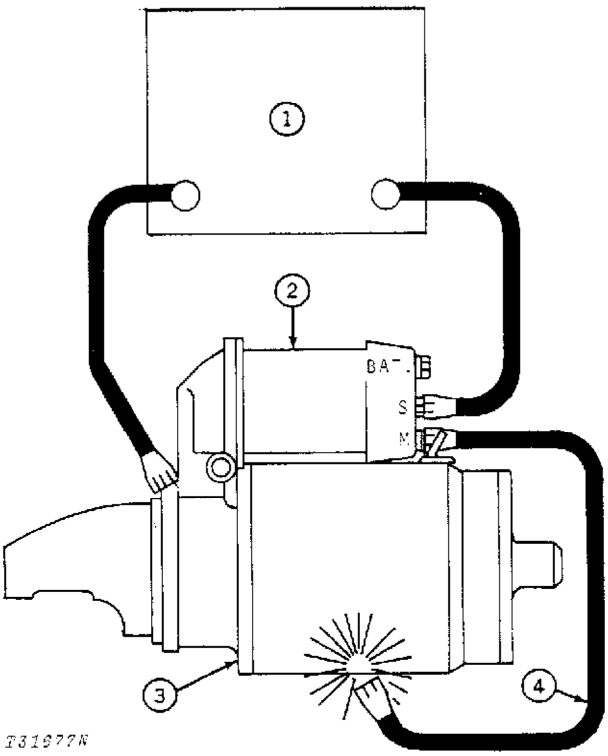
The pinion clearance cannot be adjusted but should be checked after reassembly of the starting motor to insure proper clearance. Improper clearance is an indication of worn parts.

To check pinion clearance use the following steps:

1. 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. 15).

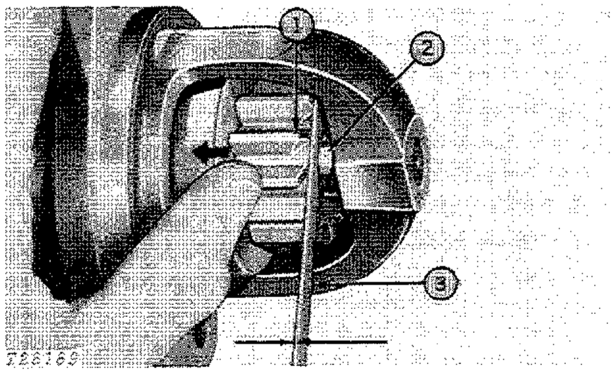
3. Momentarily flash a jumper lead from the solenoid motor terminal to solenoid frame. This will shift the pinion into cranking position and it will remain so until the battery is disconnected.



1—Battery
2—Solenoid
3—Starting Motor
4—Jumper Wire

Fig. 15-Circuit for Checking Pinion Clearance

4. Push the pinion back toward the commutator end as indicated by the larger arrow in Fig. 16 to eliminate slack movement.



1—Pinion
2—Pinion Stop
3—Feeler Gauge

Fig. 16-Checking Pinion Clearance

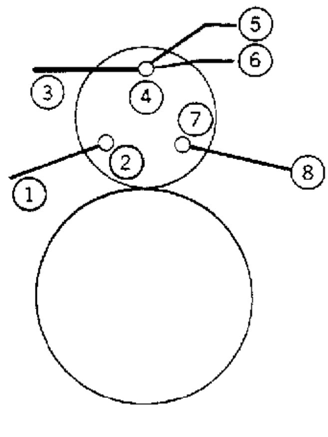
5. Measure the distance between pinion and pinion stop. The clearance should be 0.010 inch (0.25 mm) to 0.140 inch (3.56 mm).

INSTALLATION

Follow removal procedure in the reverse order.

Bleed the air from the fuel system (see Section 4, Group 0413).

Connect battery positive cable (3, Fig. 17) and red and black wires to "BAT" terminal (4). Connect neutral wire to "S" terminal and light blue wire (gas only) to "R" terminal.



1—Light Blue Wire (Gas)
2—"R" Terminal
3—Battery Positive Cable
4—"BAT" Terminal
5—Red Wire
6—Black Wire
7—"S" Terminal
8—Neutral

Fig. 17-Starting Motor Wire Connections

Group 0433
FLYWHEEL, HOUSING AND FASTENINGS

GENERAL INFORMATION

The 142 tooth 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.

A flywheel isolator is attached by springs and spring anchors to the flywheel.

The springs cushion the force upon the reverser parts caused by sudden acceleration or deceleration of the engine or reversal of the tractor direction.

REMOVAL

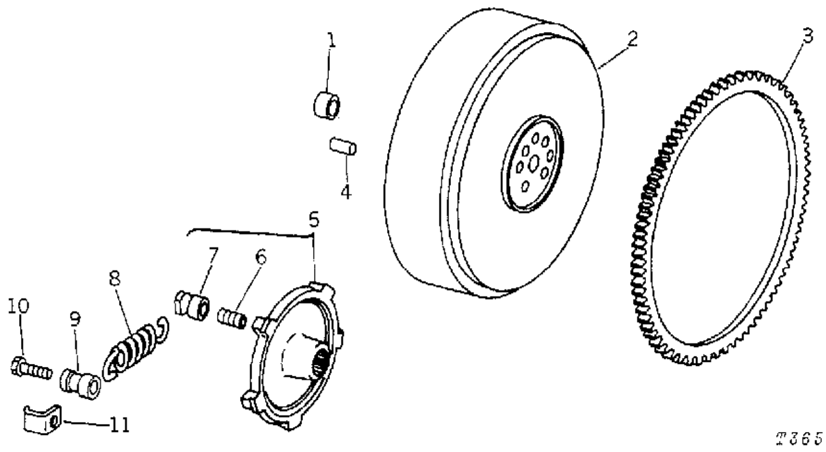
To service the flywheel and flywheel isolator, it is necessary to remove the engine from the crawler (see Group 0400).

REPAIR

To install new ring gear, heat gear evenly all the way around and while ring is hot, slip it on flywheel. Install 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.

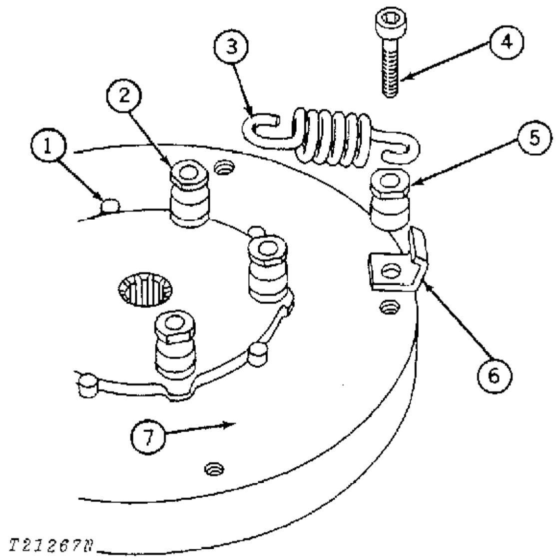
Check isolator parts for damages. Be sure anchors are not loose in isolator plate. If anchors are loose or in need of replacement remove parts and clean threads in anchors and on stud.



T36535N

1—Bearing
2—Flywheel
3—Ring Gear
4—Groove Pin
5—Flywheel Isolator
6—Stud (5 used)
7—Anchor (5 used)
8—Spring
9—Anchor (5 used)
10—Cap Screw (5 used)
11—Retainer (5 used)

Fig. 1-Flywheel



1—Pin
2—Isolator Plate Anchor
3—Spring
4—Socket Head Cap Screw
5—Flywheel Anchor
6—Retainer
7—Flywheel

Fig. 4-Positioning Isolator Springs and Retainers

If isolator plate anchors (2, Fig. 4) or studs (6, Fig. 1) on the isolator plate are damaged or loose, remove the parts and thoroughly clean the threads and threaded bore of component parts prior to assembly. Use a cleaning solvent which does not leave an oil film. The T43511 John Deere Loctite Clean and Cure Primer is excellent for cleaning areas where Loctite is to be applied and will speed cure time.

The studs should be assembled to project 1.06 ± .04 inch (26.9 ± 1.0 mm) from the isolator plate.

Apply T43513 John Deere Loctite Thread Lock and Sealer High-Strength or an equivalent to studs (6, Fig. 1) and to bottom of isolator plate anchor (2, Fig. 4). Assemble isolator plate anchor onto stud tightening to 85 lb-ft (115 N·m) (12 kg-m).

If spline wear is evident on the reverser input shaft and in the isolator plate, both items should be replaced.

Check the condition of the flywheel. If support areas for the flywheel anchors (5, Fig. 4) are severely damaged, the flywheel will require replacement or resurfacing.

A maximum of 0.060 inch (1.5 mm) can be removed from the flywheel face. The specified surface finish is 125 RMS and the surface parallel to crankshaft mount surface within 0.0005 inch (0.013 mm) per inch (25.4 mm). The surface should be flat within 0.005 inch (0.13 mm). The socket head cap screw (4) bore threads must be 0.83 inch (21 mm) minimum deep. The pin (1) bores must be 0.56 inch (14 mm) minimum deep. Damaged pins should be replaced. Install with T43515 John Deere Loctite Retaining Compound or an equivalent. Pins should be bottomed in the bore.

Check pilot bearing and replace if required. When engine is pulled and isolator disc is not removed, the pilot bearing may come out of its bore and fall behind the disc.

To install new pilot bearing, pack with high temperature grease (AT 30408) and drive in (shielded side out) to bottom of bore.

Clean socket head cap screw (4) threads and threaded bores in flywheel with T43511 John Deere Loctite Clean and Cure Primer. Apply T43513 John Deere Loctite Thread Lock and Sealer - High Strength to the socket head cap screw (4) threads and assemble retainers (6) and flywheel anchors to flywheel.

When tightening the socket head cap screws to 130 lb-ft (175 N·m) (18 kg/m) torque, hold the retainer with an adjustable wrench so that the inside edge of the retainer is perpendicular to an imaginary line from center of the flywheel across the center of the socket head cap screw head. This is important to provide maximum clearance in the reverser housing. Cocked retainers can cause a repeat failure.

INSTALLATION

Flywheel Housing

NOTE: See Group 0401 for the installation of a new crankshaft rear oil seal and wear ring.

When installing the flywheel housing, be careful not to invert or damage the lips of the crankshaft rear oil seal.

Tighten 3/8 in. cap screws to 35 lb-ft (47 N·m).

Tighten 5/8 in. cap screws to 170 lb-ft (230 N·m).

Flywheel

To aid in installation of flywheel, install two pilot studs into cap screw holes in crankshaft.

IMPORTANT: Install new flywheel attaching cap screws.

Tighten flywheel attaching cap screws to 120 lb-ft (163 N·m).

Before installing the engine in the crawler, check for 7-3/8 inches (187.33 mm) clearance in the reverser flywheel housing measured from the reverser input shaft. If 7-3/8 inches (187.33 mm) clearance is not available, grind areas of inadequate clearance to the dimension. This is only necessary at areas directly about the isolator spring retainers when engine has been installed.

Assemble flywheel isolator to flywheel. Install springs to anchors.

Install engine in unit (Group 0400).

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

T49644N

**Loads can be simulated in the field by controlled 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 Nm) (13 kg-m) torque. Loosen rocker arm support cap screws; then retighten with 35 lb-ft (47 Nm) (5 kg-m) torque. Check and reset valve clearance. Retighten exhaust manifold cap screws to standard torque.*

+After break-in, drain crankcase oil, and remove filter. Install new filter and fill crankcase with oil to proper level. Remove turbocharger oil inlet screen.

REMOVAL AND INSTALLATION

SPECIFICATIONS AND TORQUE VALUES

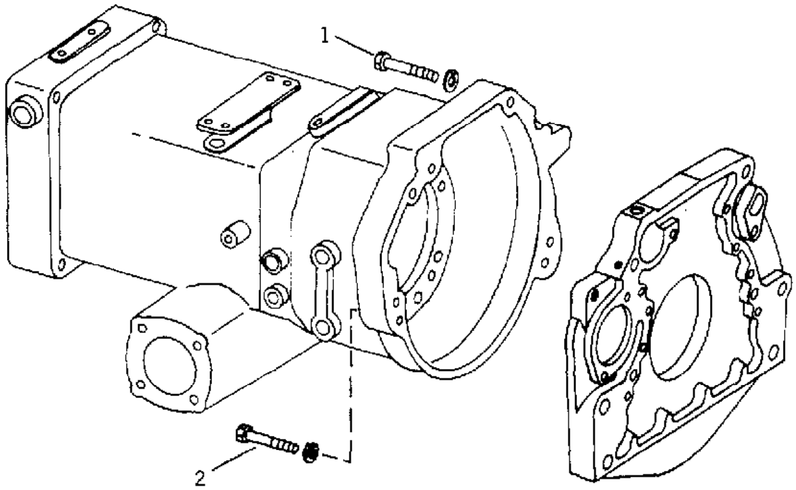


Fig. 1-Transmission Case, Clutch and Flywheel Housings Cap Screws

1 - Reverser housing through flywheel housing to engine block upper cap screws torque . . . . 250 lb-ft (339 Nm) (35 kg-m)

2 - Reverser housing through flywheel housing to engine block lower cap screws torque . . . . 170 lb-ft (230 Nm) (24 kg-m)

CRANKSHAFT AND MAIN BEARINGS

SPECIFICATIONS AND TORQUE VALUES

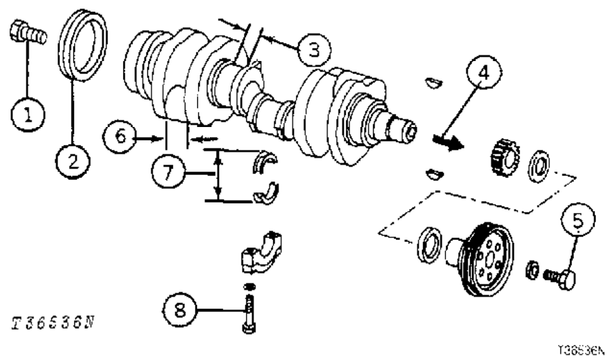


Fig. 2-Crankshaft Assembly

1 - Flywheel to crankshaft cap screw
torque . . . . (163 N·m) (17 kg-m)

2 - Crankshaft rear oil seal to housing
runout . . . . 0.0060 in.
(0.152 mm)

3 - O.D. main bearing journal . . 3.1235 to 3.1245 in.
(79.34 to 79.38 mm)
Round within . . . . 0.0030 in.
(0.0762 mm)

4 - Crankshaft end play . . . . . . 0.0020 to 0.0080 in.
(0.051 to 0.203)
Maximum end play . . . . 0.015 in.
(0.38 mm)

5 - Crankshaft pulley to crankshaft cap screw
torque . . . . 85 lb-ft
(115 N·m) (11.8 kg-m)

6 - O.D. of connecting rod
journal . . . (diesel) . . . . 2.7480 to 2.7490 in.
(69.799 to 69.825 mm)
(gasoline) . . . . . . 2.3085 to 2.3095 in.
(58.636 to 58.661 mm)
Round within . . . . 0.0030 in.
(0.0762 mm)

7 - Main bearing I.D.
(assembled) . . . . 3.1256 to 3.1276 in.
(79.390 to 79.441 mm)
Main bearing to journal
clearance . . . . 0.0018 to 0.0048 in.
(0.041 to 0.117 mm)
Maximum clearance . . . . 0.0060 in.
(0.152 mm)
Journal taper per inch of journal
length . . . . 0.0010 in.
(0.0254 mm)
Journal out-of-round . . . . 0.0030 in.
(0.0762 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)
Crankshaft main bearing
bore I.D. . . . . 3.3250 to 3.3260 inch
(84.455 to 84.480 mm)

8 - Main bearing caps to block
cap screw torque . . . . 85 lb-ft
(115 N·m) (11.8 kg-m)

CRANKSHAFT AND MAIN BEARINGS

SPECIFICATIONS AND TORQUE VALUES—Continued

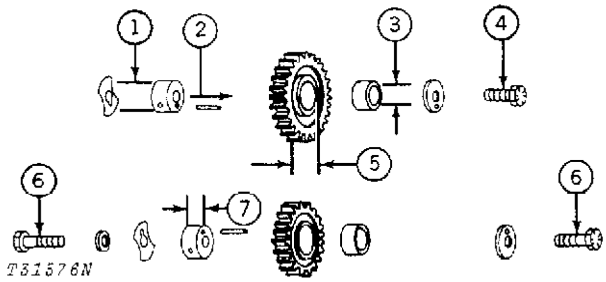


Fig. 3-Upper and Lower Idler Gears

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. (0.0254 to 0.118 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. (0.0381 to 0.0891 mm)
Maximum oil clearance..............0.0060 in. (0.1524 mm)

4 - Crankshaft upper idler gear cap screw torque .... 65 lb-ft (88 Nm) (9.0 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) (13.1 kg-m)

7 - Width of idler gear shaft .... 0.8680 to 0.8720 in. (22.047 to 22.149 mm)

CRANKSHAFT AND MAIN BEARINGS
SPECIFICATIONS AND TORQUE VALUES—Continued

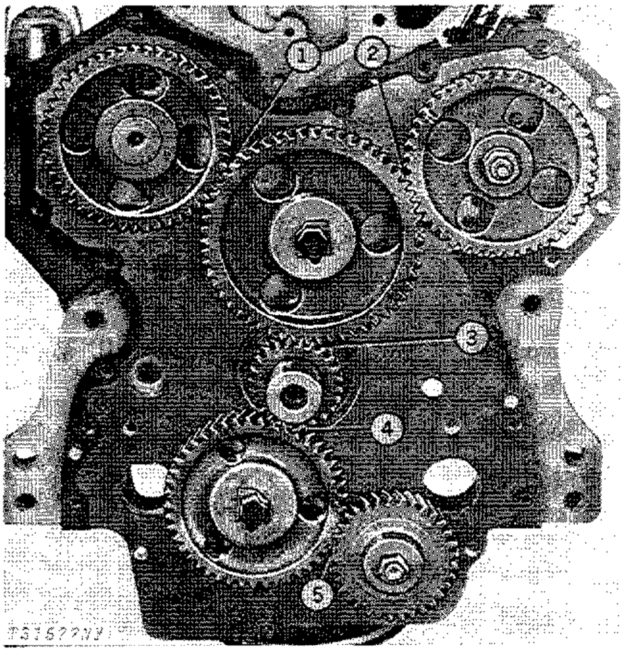


Fig. 4-Diesel Gear Grain Backlash

1 - Camshaft gear to upper idler gear backlash.................0.0028 to 0.0135 in. (0.0711 to 0.3429 mm)

2 - Injection pump gear to upper idler gear ....0.0028 to 0.0135 in. (0.0711 to 0.3429 mm)

3 - Crankshaft gear to upper idler gear ....0.0027 to 0.0116 in. (0.0686 to 0.2946 mm)

4 - Crankshaft gear to lower idler gear ....0.0027 to 0.0137 in. (0.0686 to 0.3480 mm)

5 - Oil pump gear to lower idler gear ....0.0016 to 0.0147 in. (0.0406 to 0.3734 mm)

Gasoline Gear Train Backlash (Not Illustrated)

Camshaft gear to upper idler gear........................0.0028 to 0.0135 in. (0.0711 to 0.3429 mm)

Governor gear to upper idler gear........................0.0023 to 0.0127 in. (0.0828 to 0.3226 mm)

Crankshaft gear to upper idler gear........................0.0027 to 0.0116 in. (0.0686 to 0.2972 mm)

Crankshaft gear to lower idler gear........................0.0027 to 0.0137 in. (0.0686 to 0.3480 mm)

Oil pump gear to lower idler gear........................0.0016 to 0.0147 in. (0.0406 to 0.3734 mm)

Camshaft gear to distributor gear........................0.0005 to 0.0075 in. (0.0127 to 0.1905 mm)

CAMSHAFT AND VALVE ACTUATING MEANS

SPECIFICATIONS AND TORQUE VALUES

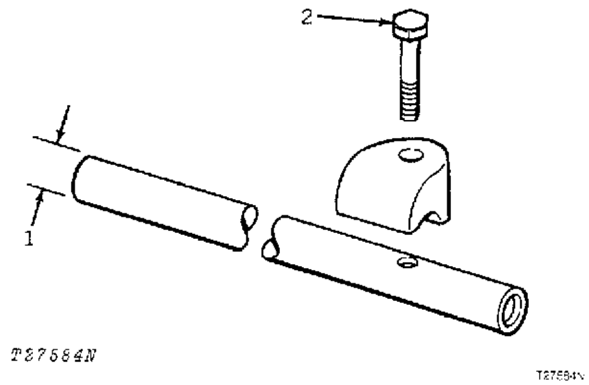


Fig. 5-Rocker Arm Shaft and Clamp

1 - Outside diameter of rocker arm shaft (diesel and gasoline) . . . . 0.7869 to 0.7879 in. (19.987 to 20.013 mm)
Additional wear tolerance . . . . 0.0020 in. (0.0508 mm)

2 - Rocker arm shaft clamp to head cap screw torque . . . . 35 lb-ft (47 N·m) (5 kg-m)

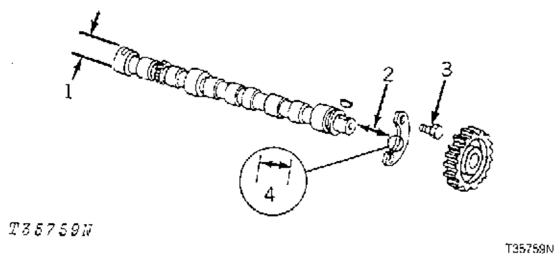


Fig. 6-Camshaft, Bushing and Gear

1 - Outside diameter of camshaft journal (diesel and gasoline) . . . . 2.1997 to 2.2207 in. (55.773 to 55.899 mm)
Camshaft journal to bushing clearance (diesel and gasoline) . . . . 0.0035 to 0.0055 in. (0.0889 to 0.1397 mm)
Maximum allowable clearance (diesel and gasoline) . . . . 0.0090 in. (0.2286 mm)

2 - Camshaft end play (diesel and gasoline) . . . . 0.0025 to 0.0085 in. (0.064 to 0.216 mm)
Maximum allowable end play (diesel and gasoline) . . . . 0.0150 in. (0.381 mm)

3 - Camshaft thrust plate to block cap screw torque (diesel and gasoline) . . 35 lb-ft (47 N·m) (5 kg-m)

4 - Thrust plate thickness (diesel and gasoline) . . . . 0.1560 to 0.1580 in. (3.988 to 4.013 mm)
Minimum allowable thickness (diesel and gasoline) . . . . 0.1510 in. (2.82 mm)

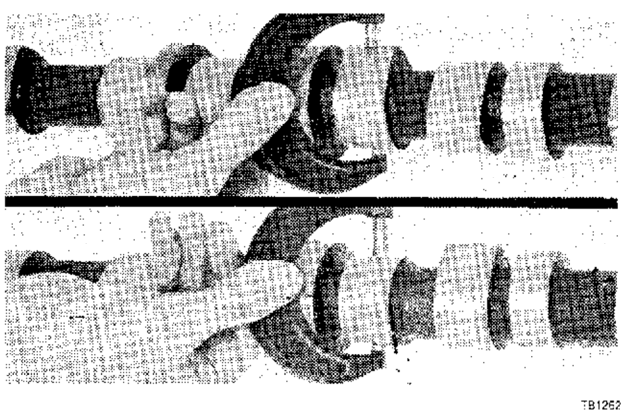


Fig. 6A-Camshaft Lobe Height

1 - Camshaft lobe height (diesel and gasoline) . . . . 0.266 to 0.286 in. (6.76 to 7.26 mm)

CAMSHAFT AND VALVE ACTUATING MEANS

SPECIFICATIONS AND TORQUE VALUES—Continued

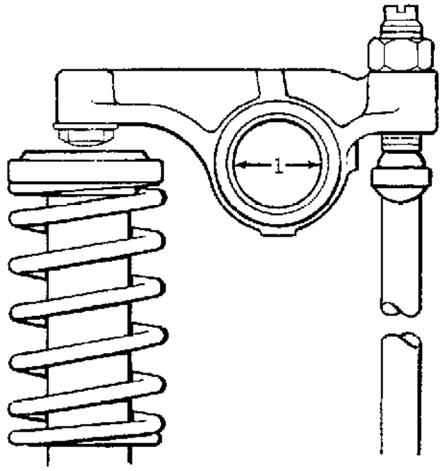


Fig. 7-Rocker Arm

1 - Inside diameter of rocker arm bore (diesel and gasoline) . . . . 0.7900 to 0.7920 in. (20.066 to 20.117 mm)
Wear tolerance . . . . 0.0020 in. (0.051 mm)

CONNECTING RODS AND PISTONS

SPECIFICATIONS AND TORQUE VALUES

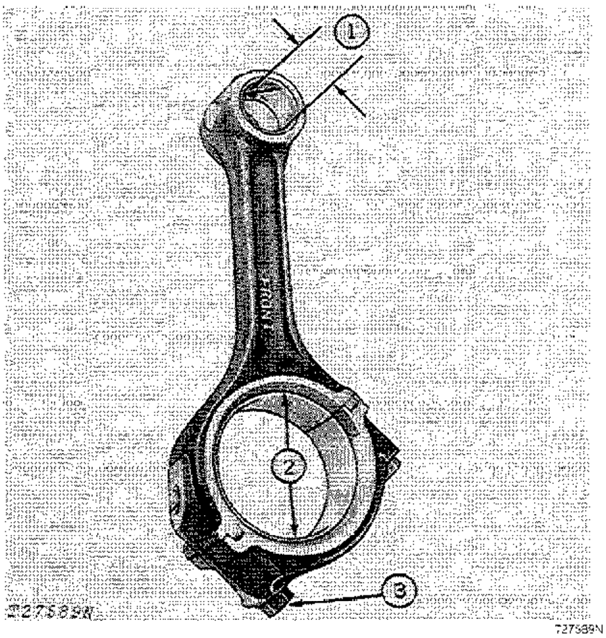


Fig. 8-Connecting Rod

1 - Inside diameter of piston pin bushing in rod
gasoline . . . . 1.1883 to 1.1886 in. (30.183 to 30.190 mm)
diesel (3-152) . . . . 1.1886 to 1.1896 in. (30.190 to 30.216 mm)
diesel (3-164) . . . . 1.376 to 1.377 in. (34.95 to 34.98 mm)

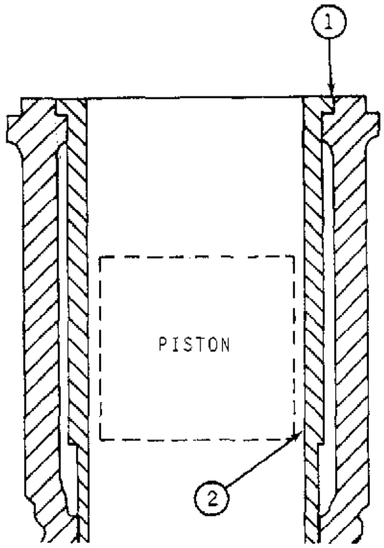
Piston pin O.D. diesel (3-152) and gasoline . . . . . . 1.1875 to 1.1879 in. (30.163 to 30.173 mm)
diesel (3-164) . . . . 1.3750 ± 0.0002 in. (34.925 ± 0.005 mm)
Piston pin to connecting rod bushing clearance (diesel and gasoline) . . . . . . 0.0008 to 0.0002 in. (0.02 to 0.06 mm)

2 - Connecting rod bearing inside diameter (assembled)
(a) diesel . . . . 2.7502 to 2.7522 in. (69.855 to 69.901 mm)
(b) gasoline . . . . 2.4365 to 2.4375 in. (61.887 to 61.913 mm)
Connecting rod bearing to crankshaft journal clearance (diesel and gasoline) . . . . 0.0012 to 0.0040 in. (0.030 to 0.102 mm)
Connecting rod bearing to journal clearance (maximum) . . . . 0.006 inch (0.15 mm)
Connecting rod bore I.D. . . 2.9000 to 2.9010 in. (73.660 to 73.685 mm)

3 - Connecting rod cap to rod cap screw torque
(a) diesel . . . . 52 lb-ft (71 N·m)
(b) gasoline . . . . 40 to 46 lb-ft (54 to 62 N·m)

CYLINDER BLOCK

SPECIFICATIONS AND TORQUE VALUES



T36540N

Fig. 9-Liner, Piston and Block

1 - Liner height above block (diesel and gasoline) .... 0.0010 to 0.0040 in. (0.025 to 0.102 mm)

2 - Piston to cylinder liner clearance at bottom of skirt (maximum)
- gasoline .... 0.004 in. (0.10 mm)
- diesel (3-152) .... 0.006 in. (0.15 mm)
- diesel (3-164) .... 0.008 in. (0.02 mm)

Liner out-of-roundness (maximum) (diesel and gasoline) .... 0.0020 in. (0.05 mm)

Liner taper (maximum) (diesel and gasoline) .... 0.0020 in. (0.05 mm)

CARBURETOR

SPECIFICATIONS AND TORQUE VALUES

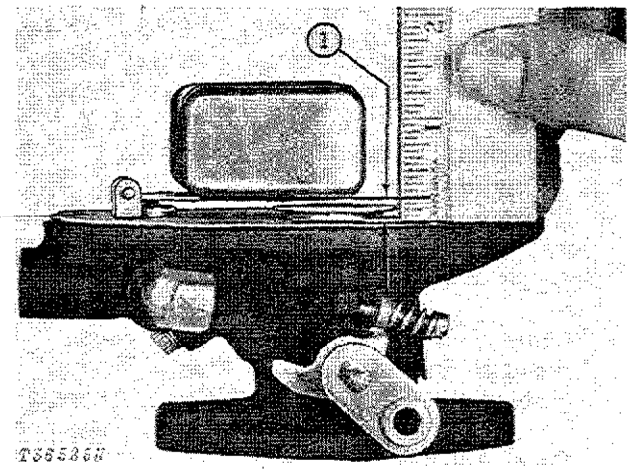


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Fig. 10-Correct Float Position

1 - Distance between both float halves and bowl gasket ....0.25 in. (6.35 mm)

CARBURETOR

SPECIFICATIONS AND TORQUE VALUES—Continued

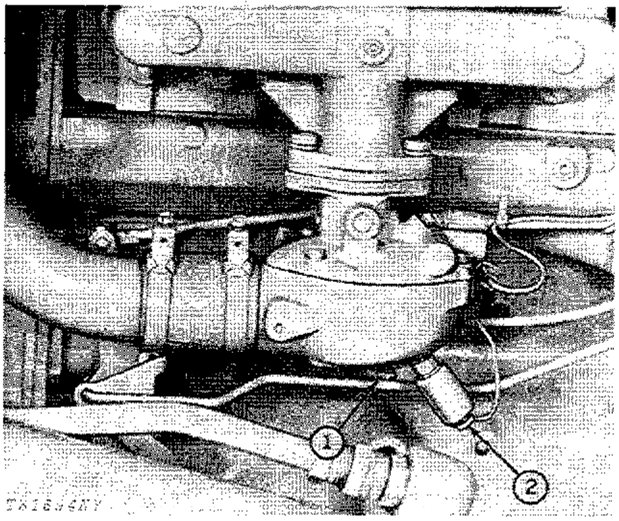

Fig. 11-Initial Carburetor Adjustments

1 - Idle needle - turn in to seat and back out one turn.

2 - Load adjusting screw - turn in to seat and back out approximately 2 turns.

GOVERNOR

SPECIFICATIONS AND TORQUE VALUES

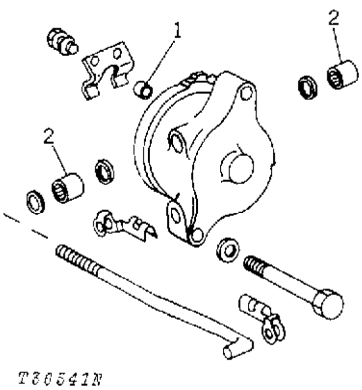

Fig. 12-Governor

1 - Bushing location .... Seated against back of bore in governor case.

2 - Bearing location.................. Flush with inside of housing.

ENGINE OILING SYSTEM

SPECIFICATIONS AND TORQUE VALUES

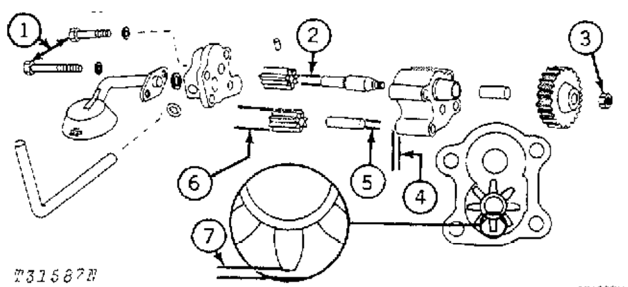

Fig. 13-Engine Oil Pump Assembly

1 - Oil pump to block cap screw torque (diesel and gasoline) . . . . 35 lb-ft (4.8 kg-m)
2 - Outside diameter of drive gear shaft (diesel and gasoline) . . . . 0.6308 to 0.6312 in. (16.022 to 16.032 mm)
3 - Oil pump gear to drive shaft nut torque (diesel and gasoline) . . . . 35 to 45 lb-ft (4.8 to 6.2 kg-m)
4 - Pump gears to cover clearance (diesel and gasoline) . . . . 0.0012 to 0.0062 in. (0.0305 to 0.1575 mm)
5 - Outside diameter of idler shaft (diesel and gasoline) . . . . 0.4850 to 0.4856 in. (12.319 to 12.334 mm)
6 - Oil pump gear width (diesel and gasoline) . . . . 1.6203 to 1.6223 in. (41.1556 to 41.2064 mm)
7 - Pump gears-to-housing radial clearance (diesel and gasoline) . . . . 0.003 to 0.006 in. (0.076 to 0.152 mm)

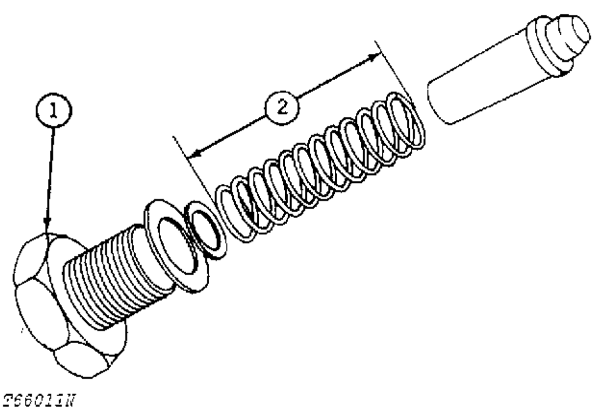

Fig. 14-Oil Pressure Regulating Valve

1 - Oil pressure regulating valve plug torque (diesel and gasoline) . . . . 70 lb-ft (9.7 kg-m)
2 - Oil pressure regulating valve spring compressed at 15 ± 1 lb. (6.8 ± 0.45 kg) . . . . 1.68 (42.67 mm)

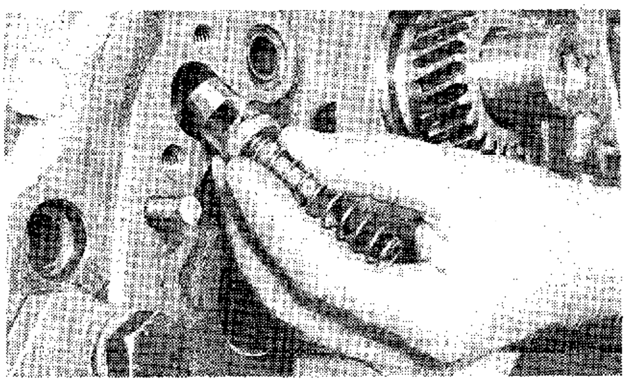

Fig. 14A-Oil Bypass Valve

1 - Oil bypass valve spring length when compressed with 23 ± 2.3 lb. (101 ± 10 N) . . . . 1.34 in. (34 mm)

ENGINE OILING SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

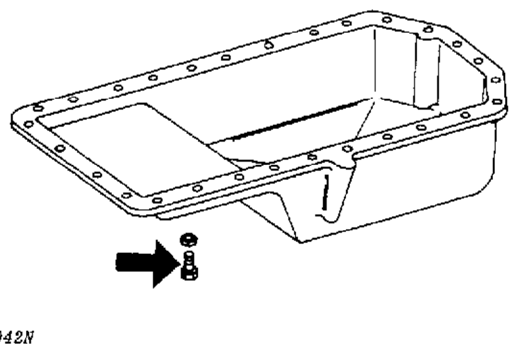

Fig. 15-Oil Pan

Oil pan to block 3/8 inch (9.5 mm) cap screw torque (diesel and gasoline) .... 35 lb-ft (47 N·m) (4.8 kg-m)

CYLINDER HEAD AND VALVES

SPECIFICATIONS AND TORQUE VALUES

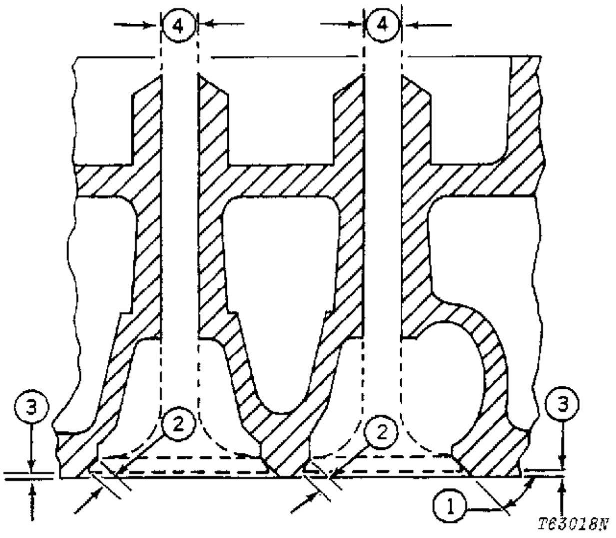

Fig. 16-Cylinder Head

1 - Angle of valve seat (diesel and gasoline)
(a) intake .... 45°
(b) exhaust .... 45°

2 - Width of valve seat
(a) diesel .... 0.06 in. (0.15 mm)
(b) gasoline .... 0.0625 to 0.0781 in. (1.588 to 1.984 mm)

3 - Distance closed valve to head deck (diesel)
(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 - Inside diameter of valve guide (diesel and gasoline) .... 0.3745 to 0.3755 in. (9.512 to 9.538 mm)
Valve stem to guide clearance (diesel and gasoline) .... 0.0020 to 0.0040 in. (0.051 to 0.102 mm)
Wear tolerance (diesel and gasoline) .... 0.002 in. (0.05 mm)

CYLINDER HEAD AND VALVES

SPECIFICATIONS AND TORQUE VALUES—Continued

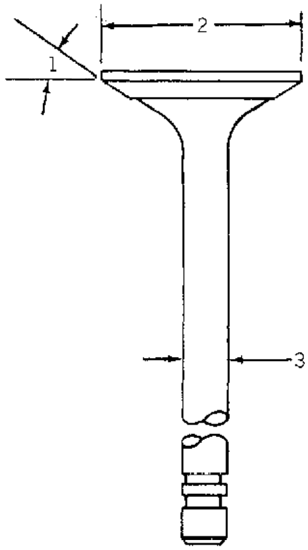

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Fig. 17-Valve

1 - Angle of valve face (diesel and gasoline)
(a) Intake .... 43.5°
(b) Exhaust.......................... 43.5°

2 - Outside diameter of valve head
-diesel-
(a) intake.................. 1.767 to 1.777 in. (44.882 to 45.136 mm)
(b) exhaust ....1.57 to 1.58 in. (39.878 to 40.132 mm)
-gasoline-
(a) intake.................. 1.767 to 1.777 in. (44.882 to 45.136 mm)
(b) exhaust .... 1.452 to 1.462 in. (36.881 to 37.135 mm)

3 - Outside diameter of valve stem (diesel and gasoline) .... 0.3715 to 0.3725 in. (9.436 to 9.462 mm)
Oversize valves available (diesel and gasoline) .... 0.003, 0.015 and 0.030 in. (0.007, 0.38 and 0.76 mm)

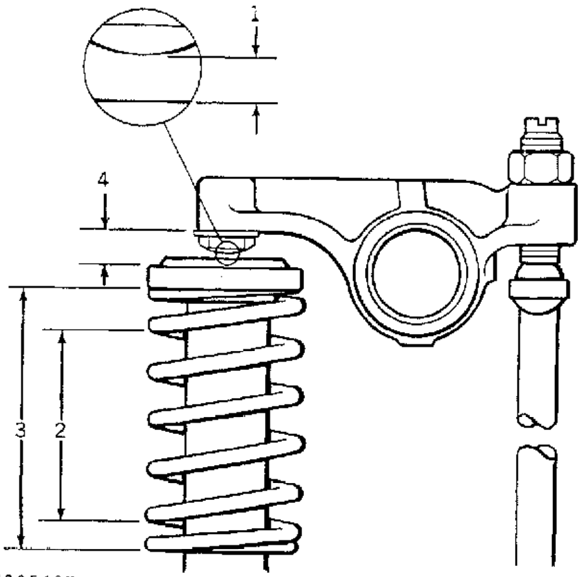

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Fig. 18-Valve Spring and Rocker Arm

1 - Valve clearance
-diesel-
(a) exhaust ....0.018 in. (0.46 mm)
(b) intake..........................0.014 in. (0.35 mm)
-gasoline-
(a) exhaust ....0.022 in. (0.56 mm)
(b) intake..........................0.014 in. (0.35 mm)

2 - Valve spring length, valve open (diesel and gasoline) .... 1.36 in. (34.54 mm) at 131-152 lb. (583 to 676 N) (59.4 to 68.9 kg)

3 - Valve spring length, valve closed (diesel and gasoline .... 1.81 in. (45.97 mm) at 54-62 lb. (240 to 276 N) (24.5 to 28.1 kg)

Valve spring free length (diesel and gasoline) ....2.12 in. (53.8 mm)

4 - Valve lift (diesel and gasoline) ....0.4500 in. (11.430 mm)

CYLINDER HEAD AND VALVES

SPECIFICATIONS AND TORQUE VALUES—Continued

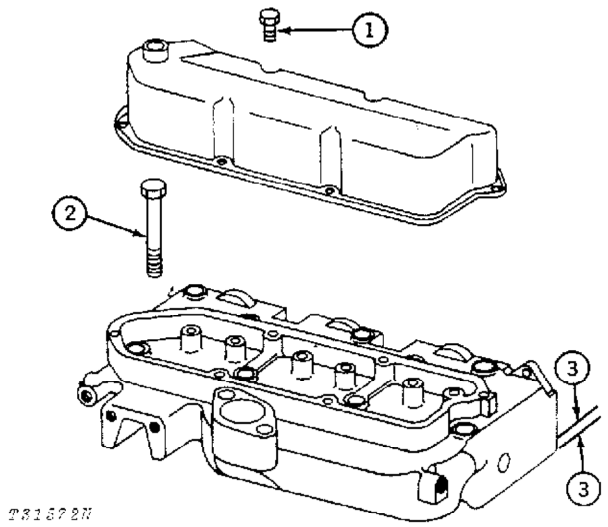

Fig. 19-Rocker Arm Cover and Cylinder Head

1 - Rocker arm cover to cylinder head cap screw torque (with cork gasket) . . . . . 25 lb-in (0.29 kg-m)
(with rubber and metal gasket) . . . . . 96 lb-in (108 N·m)

2 - Cylinder head to block cap screw torque (diesel and gasoline). . . 95 lb-ft (13 kg-m) after 30 minutes run at 3/4 to full load loosen bolts 5 to 10 degrees, retighten one at a time to 95 lb-ft (13 kg-m).

3 - Maximum amount of material to be removed from bottom of head (diesel and gasoline) . . . . . 0.030 in. (0.762 mm)
Cylinder head thickness (new) . . . . . 4.129 to 4.139 in. (104.87 to 105.13 mm)

IGNITION SYSTEM

SPECIFICATIONS AND TORQUE VALUES

Coil

Primary winding current draw . . . . . 4.2 to 4.8 amps at 6 volts

Distributor

Firing position
Spacing . . . . . 118.2° to 120°
Wear limit . . . . . 118°
Cam angle . . . . . 96° to 102°
Centrifugal advance
200 rpm . . . . . 0°
400 rpm . . . . . 4°
1200 rpm . . . . . 15°
Condenser capacity . . . . . 0.18 to 0.21 Microfarads

IGNITION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

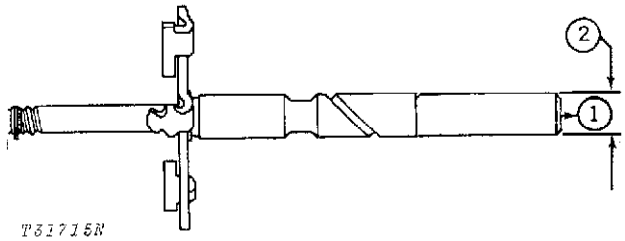

Fig. 20-Distributor Shaft

1 - Distributor shaft end play . . . 0.002 to 0.010 in. (0.05 to 0.25 mm)
2 - Distributor shaft O.D. . . . . . 0.4985 to 0.4990 in. (11.662 to 12.675 mm)

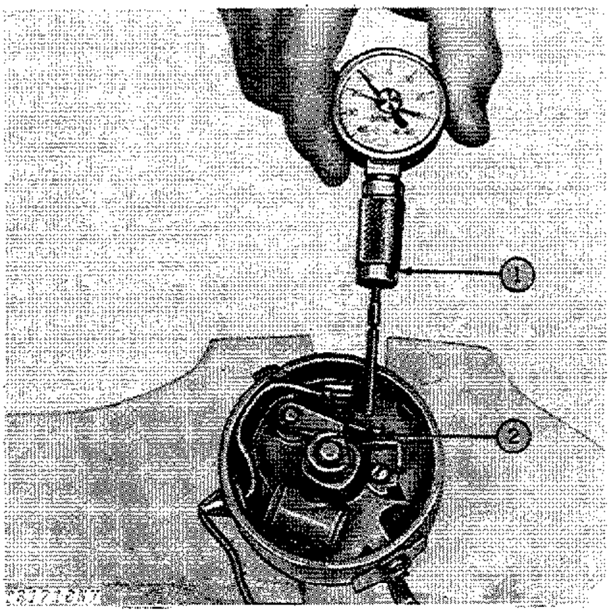

Fig. 21-Breaker Spring Tension and Point Gap

1 - Breaker spring tension
   Beside contact . . . . 19 to 24 oz. (539 to 680 g)
   Center of contact . . . . 17 to 22 oz. (482 to 624 g)

2 - Distributor point
   Gap . . . . 0.018 to 0.022 in. (0.46 to 0.56 mm)
   Pitting maximum depth . . . . 0.020 in. (0.51 mm)

IGNITION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

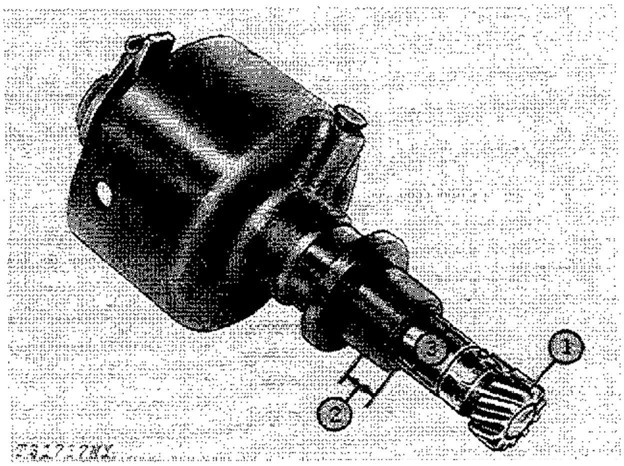

Fig. 22-Spring Pin and Bushing

1 - Distance spring pin protrudes from drive gear .... 0.060 in. max. (1.52 mm)

2 - Depth to press bushings into housing .... 0.0940 in. (2.388 mm)

3 - I.D. ....0.5003 to 0.5008 in. (12.708 to 12.720 mm)
Wear tolerance .... 0.5030 in. (12.775 mm)

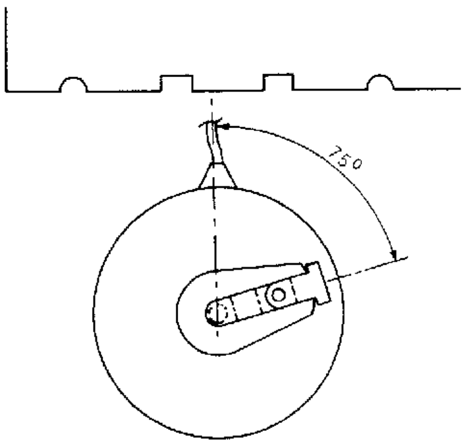

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Fig. 23-Rotor and Primary Lead Position Before Installation

1 - Rotor and primary lead position before installation ....75°

IGNITION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

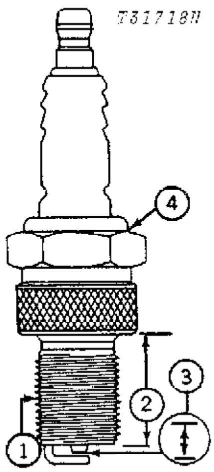


Fig. 24-Spark Plug

Spark Plugs

1 - Thread .... 14 mm
2 - Reach.............................. 0.750 in. (19.05 mm)
3 - Gap.............................. 0.025 in. (0.64 mm)
4 - Torque .... 35 lb-ft. (4.8 kg-m)

FUEL INJECTION SYSTEM

SPECIFICATIONS AND TORQUE VALUES

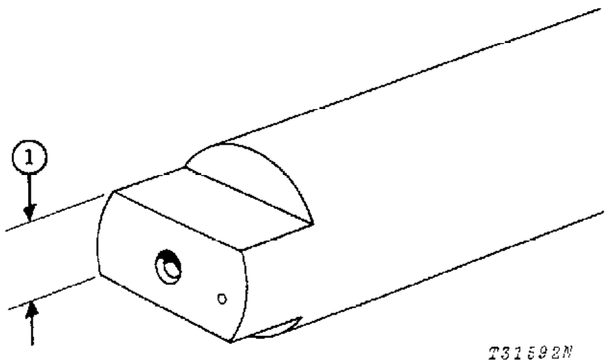


Fig. 25-Pump Drive Shaft Tang Thickness

1 - Fuel injection pump drive shaft tang thickness (minimum)..... 0.305 in. (7.747 mm)

FUEL INJECTION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

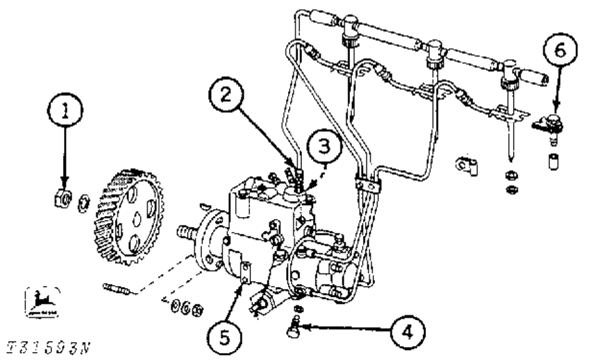


Fig. 25-Injection Pump and Nozzles

1 - Drive shaft hex. nut torque .... 45 lb-ft. (6.2 kg-m)

2 - Fuel inlet screw torque .... 20 lb-ft. (2.8 kg-m)

3 - Throttle control lock screw torque .... 35 to 40 lb-in. (0.40 to 0.46 kg-m)

4 - Injection line connector screw torque .... 35 lb-ft. (4.8 kg-m)

5 - Timing hole cover screw torque ... 15-20 lb-in. (0.17 to 0.23 kg-m)

6 - Injection nozzle hold down cap screw torque.............20 lb-ft. (2.8 kg-m)

WATER PUMP

SPECIFICATIONS AND TORQUE VALUES

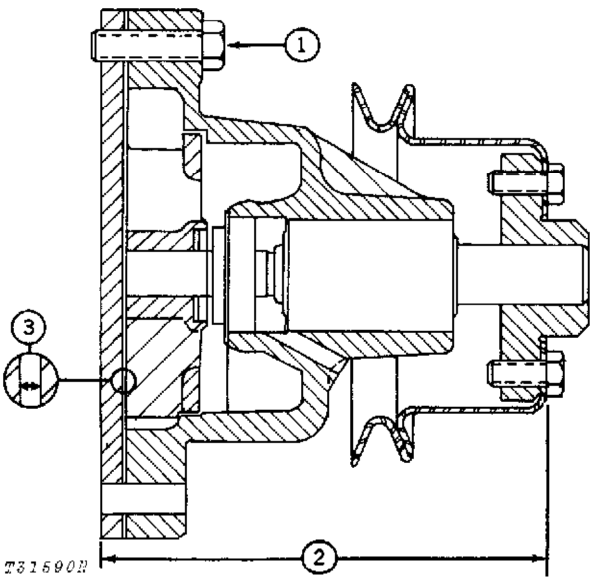


Fig. 26-Water Pump

1 - Water pump rear cover cap screw torque (diesel and gasoline) .... 35 lb-ft. (4.8 kg-m)

2 - Fan surface on pulley-to-rear of water pump housing (diesel and gasoline) ....5.71 in. (145.03 mm)

3 - Water pump impeller flush to housing within ....0.10 in. (0.25 mm)

WATER PUMP

SPECIFICATIONS AND TORQUE VALUES—Continued

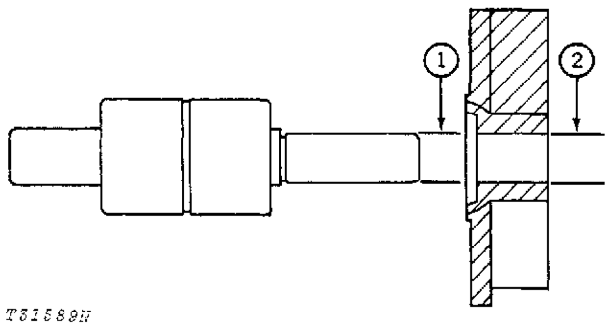


Fig. 27-Water Pump Shaft and Impeller

1 - Outside diameter of water pump shaft - end pressed into impeller (diesel and gasoline) ....0.6262 to 0.6267 in. (15.905 to 15.918 mm)

2 - Inside diameter of water pump impeller bore (diesel and gasoline) ....0.6242 to 0.6252 in. (15.854 to 15.880 mm)

THERMOSTATS, HOUSINGS AND PIPING

SPECIFICATIONS AND TORQUE VALUES

Thermostats range
- Gasoline ....180° F. (82.2° C.)
- Diesel ....205° F. (96.1° C.)

ENGINE OIL COOLER

SPECIFICATIONS AND TORQUE VALUES

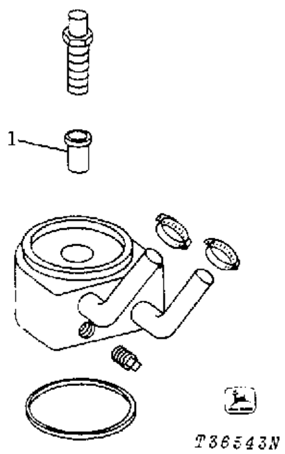


Fig. 28-Engine Oil Cooler

1 - Relief Valve Setting ....12 to 15 psi (0.84 to 1.1 kg/cm²)

FUEL INJECTION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

Fuel Injection Nozzles

General Information

Part Number	Model Number
AR56290	19762 or 20500
AR73673	20631
AR88239	22042
AR89564	23698

Number of orifices 4
Orifice diameter . . . . 0.011 in.
(0.28 mm)

Sac hole diameter (AR56290,
AR73673, and AR88239) . . . . 0.042 in.
(1.07 mm)
(AR89564) . . . . 0.039 in.
(1.00 mm)

Nozzle Settings

Nozzle opening pressure
(new) . . . . 3150 to 3250 psi
(217 to 224 bar) (221 to 228 kg/cm²)

Nozzle opening pressure
(used) . . . . 2950 to 3050 psi
(203 to 210 bar) (207 to 214 kg/cm²)

Maximum opening pressure
difference between
cylinders . . . . 1000 psi
(7 bar) (7 kg/cm²)

Nozzle valve lift . . . . 1/2 ± 1/8 turn from bottom
(0.009 in. [0.23 mm] nominal)

Pressure adjusting
screw-to-nozzle body
torque . . . . 70 to 80 lb-in
(7.9 to 9.0 N·m) (0.8 to 0.9 kg/m)

Lift adjusting lock
nut torque . . . . 35 to 45 lb-in
(4.0 to 5.1 N·m) (0.40 to 0.52 kg/m)

Return oil leakage
(used) . . . . 3 to 10 drops per 30
seconds at 1500 psi
(103 bar) (105 kg/cm²)
after first drop

FUEL INJECTION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

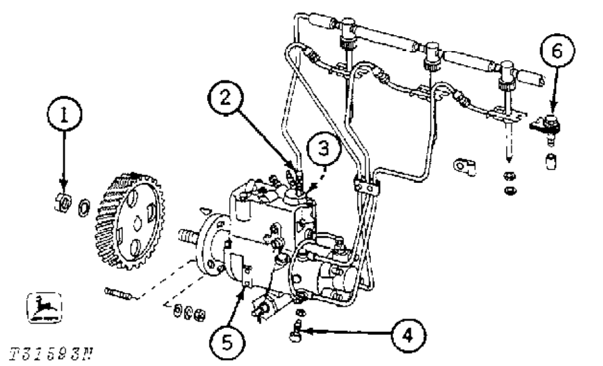


Fig. 27-Injection Pump and Nozzles

1 - Drive shaft hex. nut torque .... 45 lb-ft (6.2 kg-m)

2 - Fuel return fitting torque............... 20 lb-ft (2.8 kg-m)

3 - Throttle control lock screw torque .... 35 to 40 lb-in (0.40 to 0.46 kg-m)

4 - Injection line connector screw torque .... 35 lb-ft (4.8 kg-m)

5 - Timing hole cover screw torque..... 15-20 lb-in (0.17 to 0.23 kg-m)

6 - Injection nozzle hold down cap screw torque .... 20 lb-ft (2.8 kg-m)

WATER PUMP

SPECIFICATIONS AND TORQUE VALUES

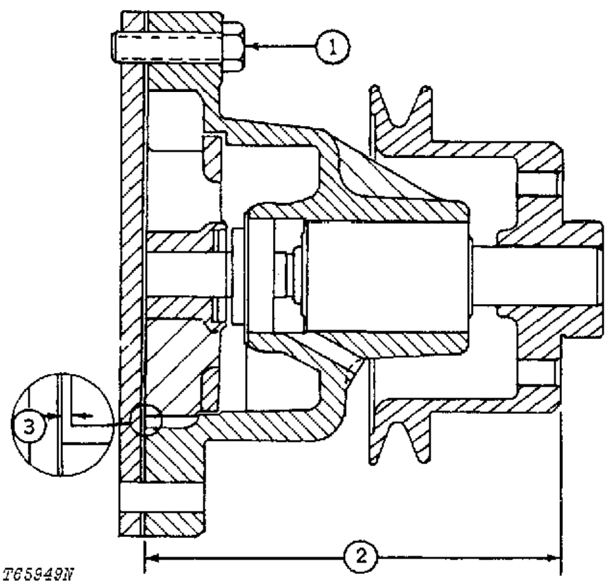


Fig. 28-Water Pump

1 - Water pump rear cover cap screw torque (diesel and gasoline) .... 35 lb-ft (4.8 kg-m)

2 - Fan surface on pulley-to-rear of water pump housing (diesel and gasoline) .... 5.47 in. (139 mm)

3 - Water pump impeller flush to housing within........................ 0.10 in. (0.25 mm)

THERMOSTATS, HOUSINGS AND PIPING

SPECIFICATIONS AND TORQUE VALUES

Thermostats range
Gasoline . . . . 180°F (82.2°C)
Diesel . . . . 205°F (96.1°C)

ENGINE OIL COOLER

SPECIFICATIONS AND TORQUE VALUES

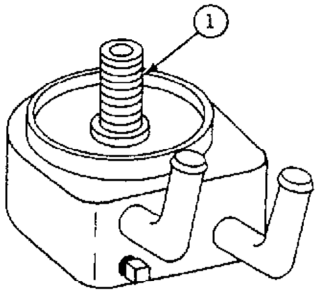


Fig. 29-Engine Oil Cooler

1 - Oil cooler nippel
torque . . . . .20 to 25 lb-ft
(27 to 34 Nm) (2.8 to 3.5 kg-m)

Relief Valve Setting. . . . . .12 to 15 psi
(1 bar) (0.84 to 1.1 kg/cm²)

STARTING SYSTEM

SPECIFICATIONS AND TORQUE VALUES

NO LOAD TEST

Motor No.	Test Volts	Min. Amps	Max. Amps	Min. RPM	Max. RPM
1108319 (Gasoline)	9.0	55*	80*	3500	6000
1109251 (Diesel	9.0	20*	120*	9000	14000

**Includes solenoid.*

SOLENOID TEST

Pull-In (current draw to 4 volts) .... 13 to 15.5 amps
Hold-In (current draw at 10.0 volts) .... 14.5 to 16.5 amps

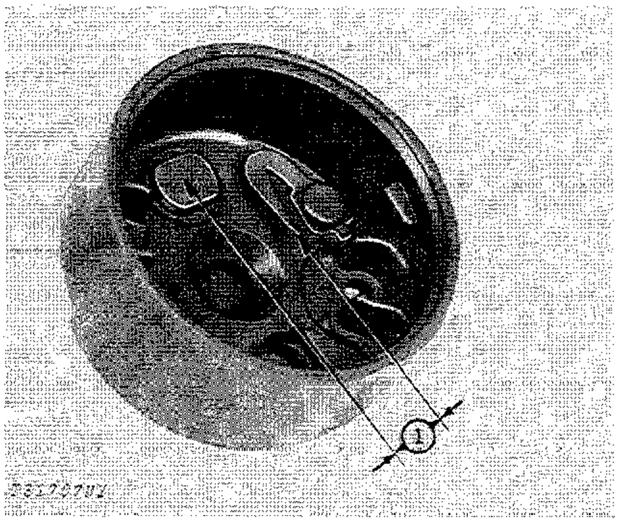


Fig. 30-Solenoid "R" Terminal Contact Height

Solenoid

1 - "R" terminal contact height (starting motor 1108319 - gasoline) .... 0.0625 to 0.0938 inch (0.79 to 2.38 mm)

STARTING SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

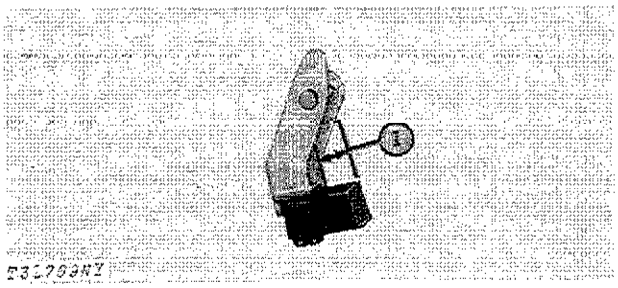


Fig. 31-Brush Length

Starting Motor
Model No. 1108319
Model No. 1109251

1 - Brush minimum length beyond holder .... 3/16 in. (8 mm)

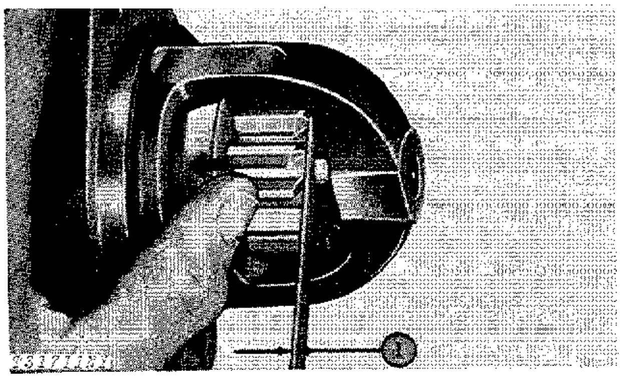


Fig. 32-Pinion Clearance

1 - Pinion clearance .... 0.010 to 0.140 in. (0.25 to 3.56 mm)

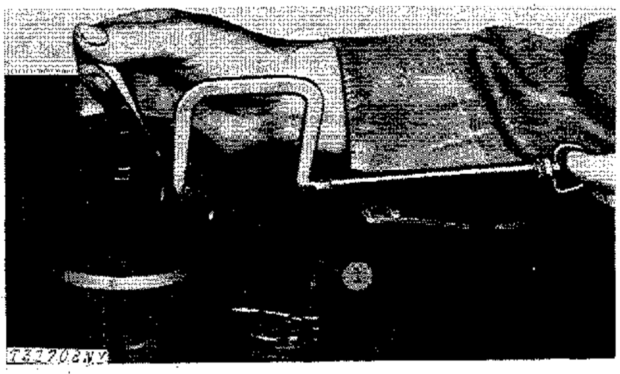


Fig. 33-Brush Spring Tension

1 - Brush spring minimum tension
1108319 (Gasoline) ... 35 ounces (0.99 kg)
1109251 (Diesel) .... 80 ounces (2.3 kg)

STARTING SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

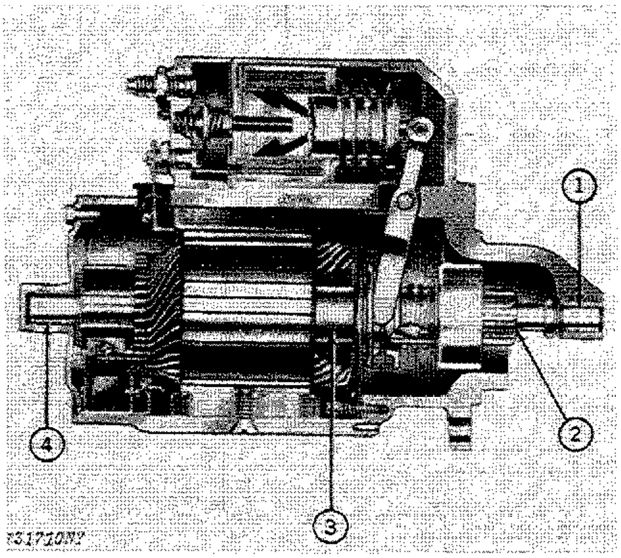


Fig. 34-Starting Motor

1 - Drive housing bushing
- I.D. ....0.4990 to 0.5010 in. (12.674 to 12.725 mm)
- Wear tolerance ....0.511 (12.979 mm)
- Oil clearance ....0.0020 to 0.0050 in. (0.050 to 0.127 mm)
- Wear tolerance .... 0.0170 in. (0.431 mm)

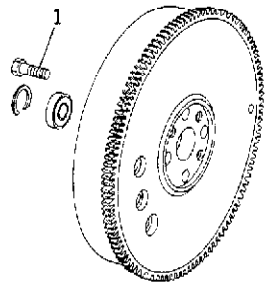
2 - Overrunning clutch bushing
- I.D. ....0.5620 to 0.5630 in. (14.274 to 14.300 mm)
- Wear tolerance .... 0.5740 in. (14.579 mm)

3 - Center bearing bushing (diesel only)
- I.D. ....0.7570 to 0.7620 in. (18.228 to 19.354 mm)
- Wear tolerance .... 0.7720 in. (19.608 mm)
- Oil clearance ....0.0070 to 0.0150 in. (0.178 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 14.312 mm)
- Wear tolerance .... 0.5730 in. (14.554 mm)
- Oil clearance ....0.0020 to 0.0050 in. (0.050 to 0.127 mm)
- Wear tolerance .... 0.0160 in. (0.406 mm)

FLYWHEEL, HOUSING AND FASTENINGS

SPECIFICATIONS AND TORQUE VALUES

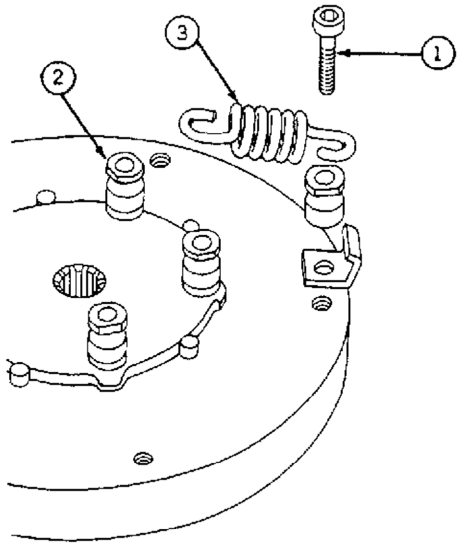


T36544N

Fig. 35-Flywheel Fastenings

1 - Flywheel to crankshaft cap screw .... 120 lb-ft (163 N·m) (17 kg-m)

Number of teeth on flywheel ring gear 142



T63947N

Fig. 36-Torsional Isolator

1 - Flywheel anchor to flywheel socket head cap screw .... 130 lb-ft (18 kg-m)

2 - Isolator plate anchor studs .... 85 lb-ft (12 kg-m)

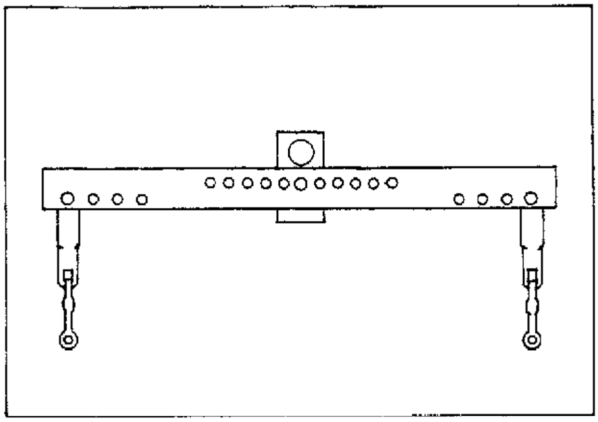
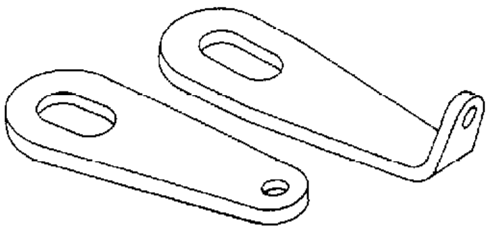
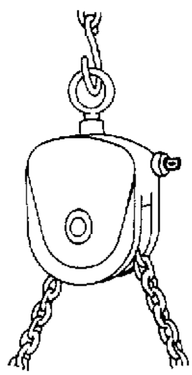
3 - Isolator springs free length .... 3.95 inches (100.3 mm)

NOTE: Apply John Deere Loctite Threadlock and Sealer High-Strength or a thread locking compound with the same specifications to cap screws (1 and 2, Fig. 36).

REMOVAL AND INSTALLATION

SPECIAL TOOLS

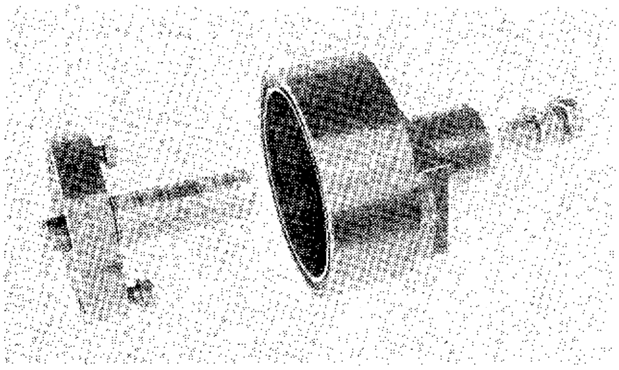
Convenience Tools

Tool	Tool Number	Use
 T69843 T69843 Fig. 37-Engine Lifting Sling	JDG-23	Engine Lifting Sling - To remove engine.
 T31364N T31364N Fig. 38-Lifting Eyes	JD244	Lifting Eyes - Used for removing engine.
 T47209N T47209N Fig. 39-Load Positioning Sling	D01043AA	Load positioning sling - To remove and install engine in unit.

CRANKSHAFT AND MAIN BEARINGS

SPECIAL TOOLS

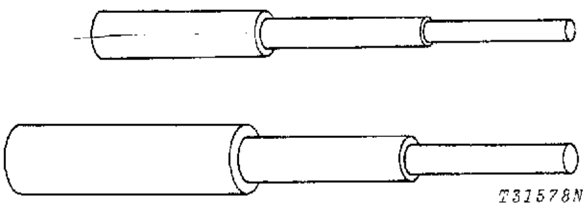
Essential Tools

Tool	Tool Number	Use
 T79556 Fig. 40-Seal and Wear Ring Installer	JDE-140	Seal and Wear Ring Installer - To install crankshaft rear oil seal and wear ring.

CAMSHAFT AND VALVE ACTUATING MEANS

SPECIAL TOOLS

Essential Tools

Tool	Tool Number	Use
	813 and 815	Mandrels - Used with bushing and seal drivers.

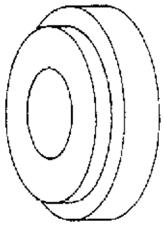
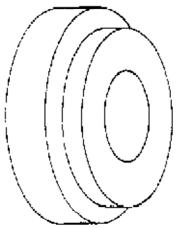
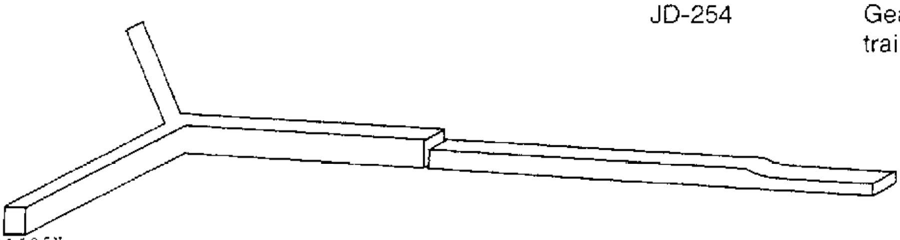
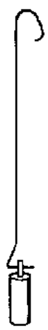
T31578N

Fig. 41-Mandrels

CAMSHAFT AND VALVE ACTUATING MEANS

SPECIAL TOOLS—Continued

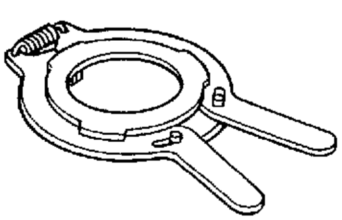
Essential Tools—Continued

Tool	Tool Number	Use
 T31681N Fig. 46-Driver	JD-250	Front Crankshaft Oil Seal Driver - To install front crankshaft oil seal.
 T31684N Fig. 47-Drivor	JD252	Idler Gear Bushing Driver - To install idler gear bushing.
 T31685N Fig. 48-Timing Tool	JD-254	Gear Timing Tool - To time gear train.
 T27597N Fig. 49-Magnetic Tool	D15001NU	Magnetic Tool - To hold cam followers.

CONNECTING RODS AND PISTONS

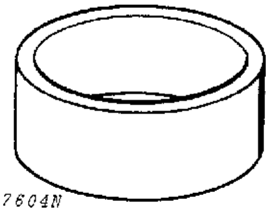
SPECIAL TOOLS

Essential Tools



T27603N

Fig. 50-Piston Ring Expander (JD237 shown)



T27604N

Fig. 51-Ring Compressor

Tool	Tool Number	Use
Fig. 50	JD237 or JDE-135	Limiting Piston Ring Expander - To install piston rings. Universal Piston Ring Expander - To install piston rings.
Fig. 51	JD239	Piston Ring Compressor - To compress piston rings when installing piston.

CYLINDER BLOCK

SPECIAL TOOLS

Essential Tools

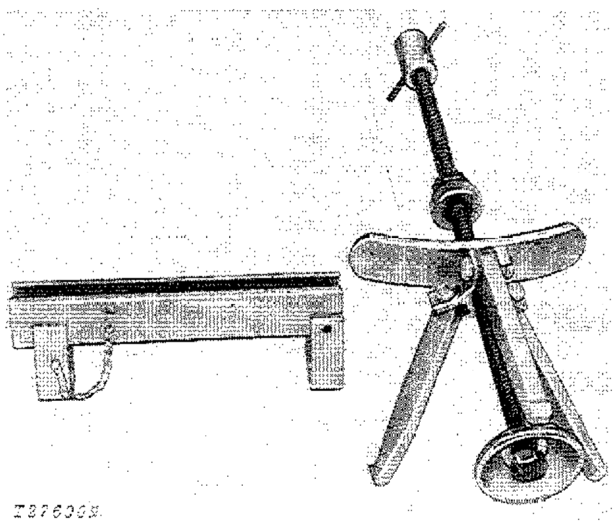
Tool	Tool Number	Use
	D01062AA or D01073AA	Cylinder Liner Puller - To remove cylinder liners.

Fig. 52-Cylinder Liner Puller

CARBURETOR

SPECIAL TOOLS

Essential Tools

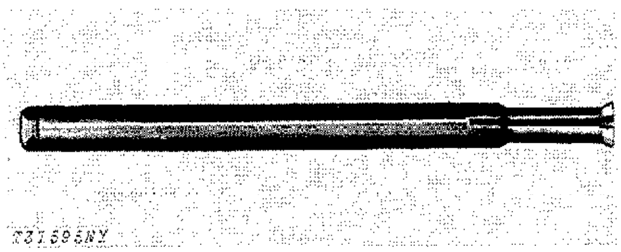
Tool	Tool Number	Use
	M-8* (Not illustrated)	Float Bending Tool - To bend carburetor float to correct height.

*Available from: Marvel-Schebler
2195 South Elwin Road
Decatur, Illinois 62525

CARBURETOR

SPECIAL TOOLS—Continued

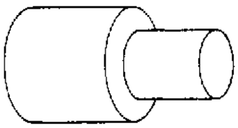
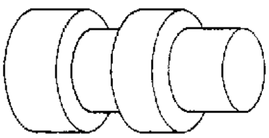
Essential Tools—Continued

Tool	Tool Number	Use
 T31595NY Fig. 53-Bearing Removal Tool	M-504*	Bearing Removal Tool - To remove throttle shaft bearing on carburetor.

GOVERNOR

SPECIAL TOOLS

Essential Tools

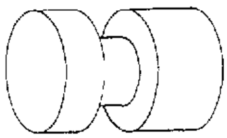
Tool	Tool Number	Use
 T31596N Fig. 54-Driver	JD240	Governor Bushing Driver - To install gasoline governor bushing.
 T31597N Fig. 55-Driver	JD241	Governor Bushing Driver - To install gasoline governor bushing.

*Available from: Marvel-Schebler
2195 South Elwin Road
Decatur, Illinois 62525

GOVERNOR

SPECIAL TOOLS—Continued

Essential Tools—Continued

Tool	Tool Number	Use
	JD-245	Governor Bushing Driver - To install gasoline bushing.

T31599N

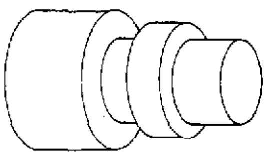
T31599N

Fig. 56-Driver

ENGINE OILING SYSTEM

SPECIAL TOOLS

Essential Tools

Tool	Tool Number	Use
	JD-248	Oil Pressure Regulating Valve Bushing Driver - To install oil pressure regulating valve bushing.

T31580N

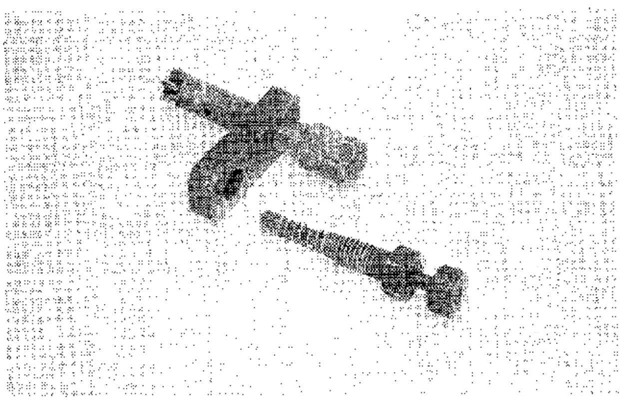
T31580N

Fig. 57-Driver

CYLINDER HEAD AND VALVES

SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
	JD-281	Engine Timing Tool - To turn crankshaft and locate No. 1 piston at top dead center.

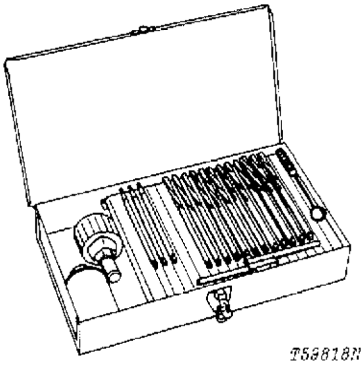
T62397

Fig. 57A-Engine Timing Tool

CYLINDER HEAD AND VALVES

SPECIAL TOOLS—Continued

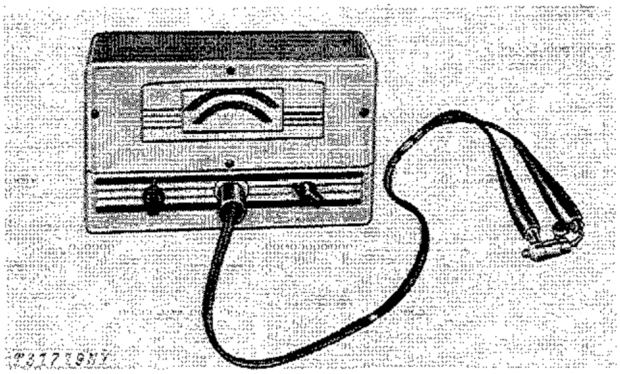
Essential Tools

Tool	Tool Number	Use
 T58818N Fig. 58-Knurling Tool	D-20002WI	Knurling Tool - To knurl engine valve guide.

IGNITION SYSTEM

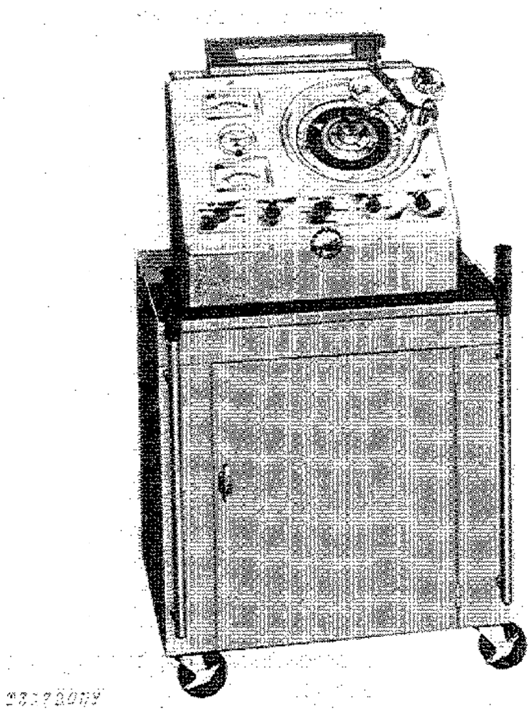
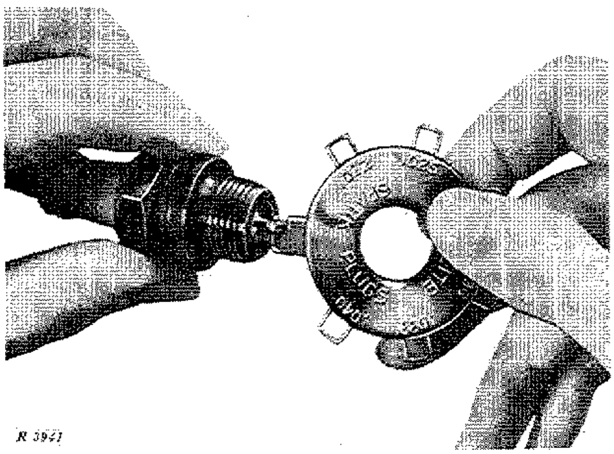
SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
 T27799N Fig. 59-Ignition Coil and Condenser Tester	-------	To test coil current draw and condenser capacity.

IGNITION SYSTEM
SPECIAL TOOLS—Continued

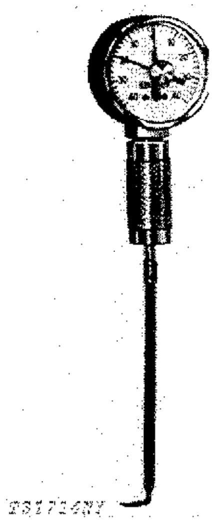
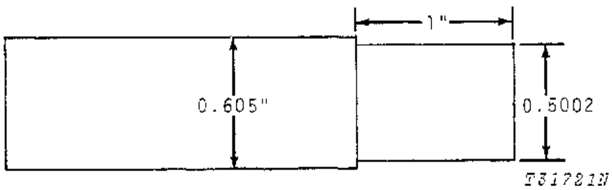
Convenience Tools

Tool	Tool Number	Use
 Fig. 60-Distributor Tester	-------	To test distributor cam dwell angle and centrifugal advance.
 Fig. 61-Spark Plug Gap Gauge	-------	To check spark plug gap.

IGNITION SYSTEM

SPECIAL TOOLS—Continued

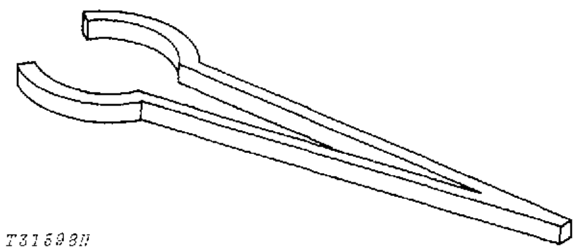
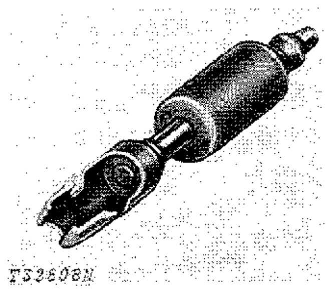
Convenience Tools—Continued

Tool	Tool Number	Use
 Fig. 62-Spring Tension Gauge	-------	To check breaker spring tension.
 Fig. 63-Driver	-------	To press distributor bushings into housing.

FUEL INJECTION SYSTEM

SPECIAL TOOLS

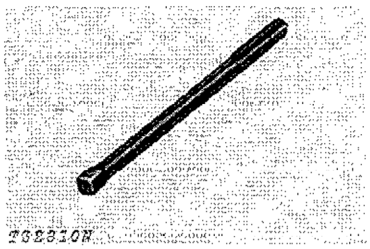
Essential Tools

Tool	Tool Number	Use
 T31598N *Fig. 64-Drive Shaft Installation Tool*	JD-256	Injection Pump Drive Shaft Seal Installation Tool - To install drive shaft seal.
 T32608N *Fig. 65-Nozzle Puller*	JDE-38	Nozzle Puller - To remove fuel injection nozzles.

FUEL INJECTION SYSTEM

SPECIAL TOOLS—Continued

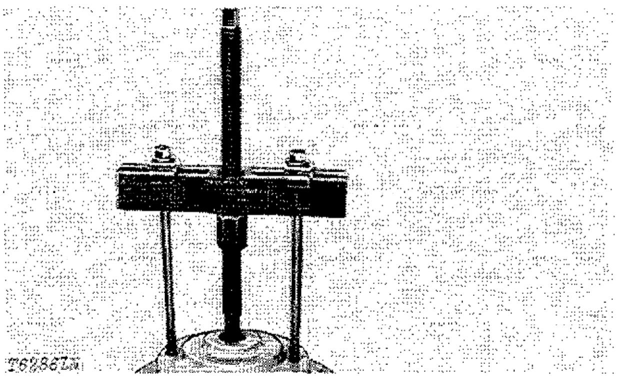
Essential Tools—Continued

Tool	Tool Number	Use
 T32810N Fig. 66-Cleaning Tool	JDE-39	Nozzle Bore Cleaning Tool - To clean nozzle bore in cylinder head.
	JD-258 (Not illustrated)	Carbon Stop Seal Installing Tool - To install carbon Stop Seal.

WATER PUMP

SPECIAL TOOLS

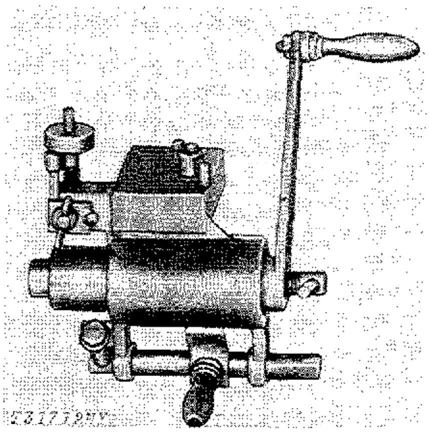
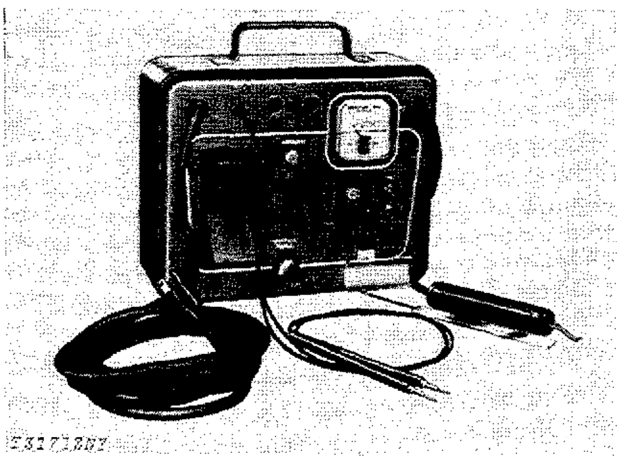
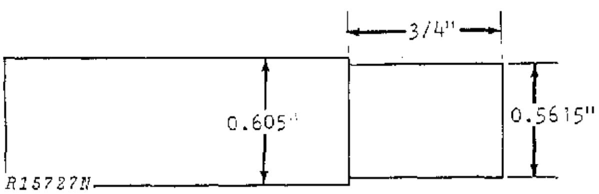
Essential Tools

Tool	Tool Number	Use
 T31591N Fig. 67-Bearing Installation Tool	JD-262A	Water Pump Bearing Installation Tool - To install water pump bearing.
 T62861N Fig. 68-Puller	D-01200AA	Puller - To remove fan pulley from water pump shaft.

STARTING SYSTEM

SPECIAL TOOLS

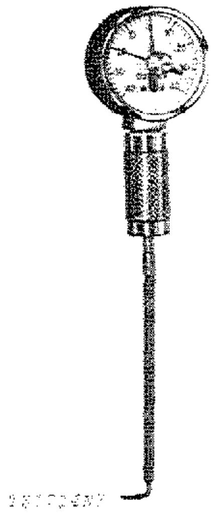
Convenience Tools

Tool	Tool Number	Use
 Fig. 70-Armature Commutator Turning and Undercutting Tool	-------	To undercut armature and commutator on gasoline starting motors.
 Fig. 71-Armature Tester	-------	To test armature for shorts, opens and grounds.
 Fig. 72-Pre-Lubricated Bushing Arbor	-------	To install overrunning clutch bushings.

STARTING SYSTEM

SPECIAL TOOLS - Continued

Convenience Tools - Continued

Tool	Tool Number	Use
 Fig. 73-Spring Tension Gauge	-------	To check brush spring tension.

Section 5
ENGINE AUXILIARY SYSTEMS

CONTENTS OF THIS SECTION

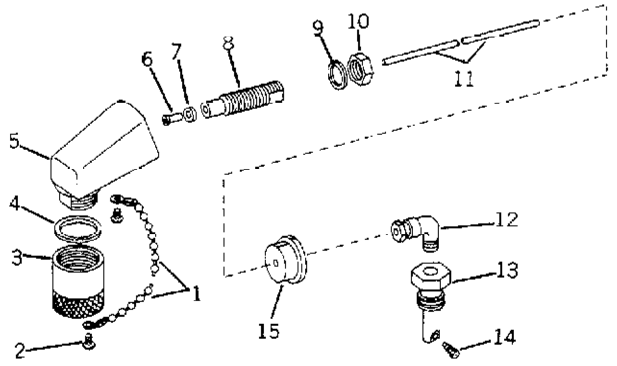
Group 0505
COLD WEATHER STARTING AID

GENERAL INFORMATION

Crawlers with diesel engines may be equipped with a starting fluid adapter located by the air cleaner in the operator's compartment.

The injected starting fluid is carried by a tube to the air intake to aid in cold weather starting.

REPAIR



1—Chain
2—Drive Screw (2 used)
3—Cap
4—Packing
5—Adapter
6—Sleeve
7—Packing
8—Packing Gland
9—Lock Washer
10—Nut
11—Tube
12—Elbow
13—Spray Nozzle Holder
14—Spray Nozzle
15—Grommet

Fig. 1-Starting Fluid Adapter

CAUTION: Starting fluid is highly flammable.

Refer to Fig. 1 during repair of the starting fluid adapter.

Check all parts for damage and replace as necessary. Be sure packings (4 and 7) are serviceable to prevent the entrance of unfiltered air into the intake system.

INSTALLATION

When installing the spray nozzle holder (13) be sure direction of arrow on the hex. head of the spray nozzle holder points upward.

Group 0510
ENGINE COOLING SYSTEM
RADIATOR AND FAN

GENERAL INFORMATION

The radiator has heated engine coolant circulated through it where it is cooled by the passage of air. The fan shroud is used to confine and direct air flow for efficient engine cooling.

RADIATOR

Removal

Remove hood and grille housing.

NOTE: The grille housing can be tipped forward rather than removed if desired.

Drain radiator.

Disconnect radiator hoses and remove radiator.

Repair

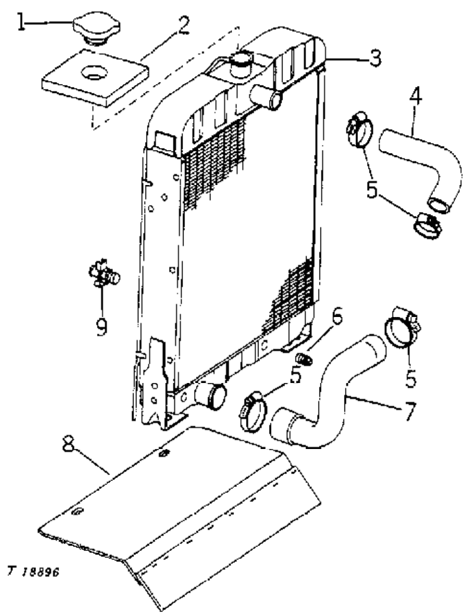
FOS

For information on testing and repairing the radiator, refer to "Cooling System" in FOS Manual - ENGINES.

Visually check the radiator for leaks or damage.

If no leaks can be seen but leaking persists, perform the following tests:

Install radiator cap and plug the overflow tube and outlet tube.



1—Radiator Cap
2—Baffle
3—Radiator
4—Hose
5—Clamp (4 used)
6—Pipe Plug
7—Hose
8—Baffle
9—Drain Cock

Fig. 1-Radiator

Attach an air hose to the inlet connection.

Apply a maximum of 10 psi (0.7 kg/cm²) air pressure and submerge in tank of water.

Look for bubbles which tell the location of leak.

NOTE: Repairs should be done only by experienced radiator repairmen.

Check radiator cap for defects. Cap should maintain 6.25 to 7.50 psi (0.4 to 0.5 kg/cm²) pressure.

Installation

Install radiator being sure all hose connections are tight.

Fill radiator with clean soft water and John Deere Summer Engine Coolant Conditioner or antifreeze solution.

FAN

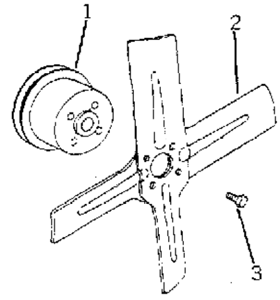
Removal

Tip the grille housing forward. Loosen radiator top bracket and tip radiator forward.

Remove fan from fan pulley.

Repair

If the fan is damaged, replace it rather than attempting to repair it.



T36546N

1—Fan Pulley
2—Fan
3—Cap Screw (4 used)

Fig. 2-Fan

Installation

Install fan on fan pulley torquing cap screws to 20 lb-ft. (3 kg-m).

Group 0515
SPEED CONTROLS

GENERAL INFORMATION

The speed control linkage is used by the operator to control the speed of the engine.

The speed control linkage consists of a cable and linkages to control the action of the carburetor and governor or the fuel injection pump.

REMOVAL

Refer to Figs. 1, 2, 3 and 4 during removal of speed control linkage.

Remove parts only as needed to make repairs.

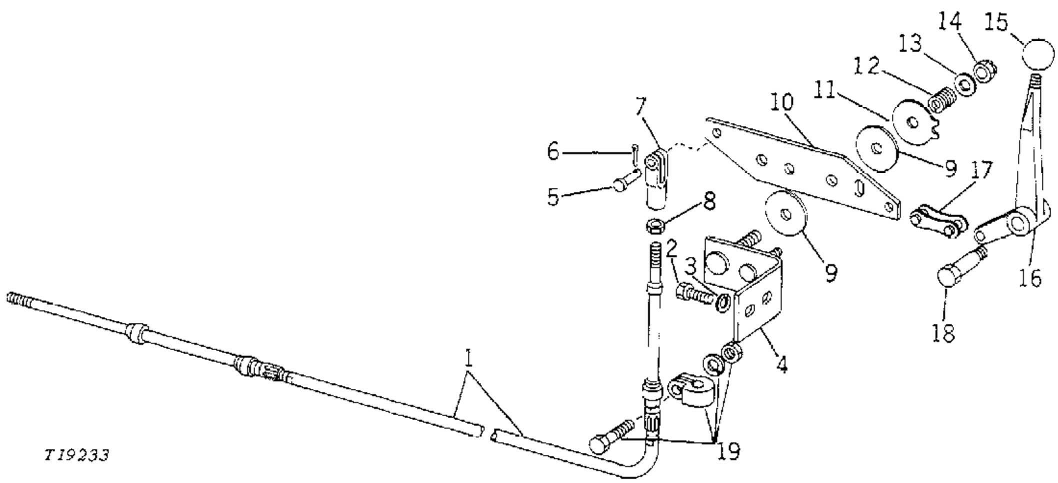
REPAIR

Check all parts for bent or worn condition. Check control cable for smooth non-binding operation.

INSTALLATION

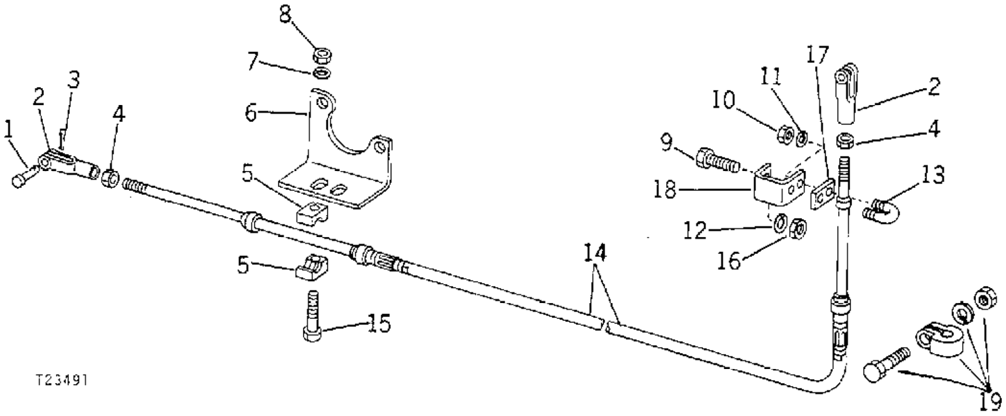
Refer to Figs. 1, 2, 3 and 4 when installing the speed control linkage.

Adjust speed control linkage (Group 9010).



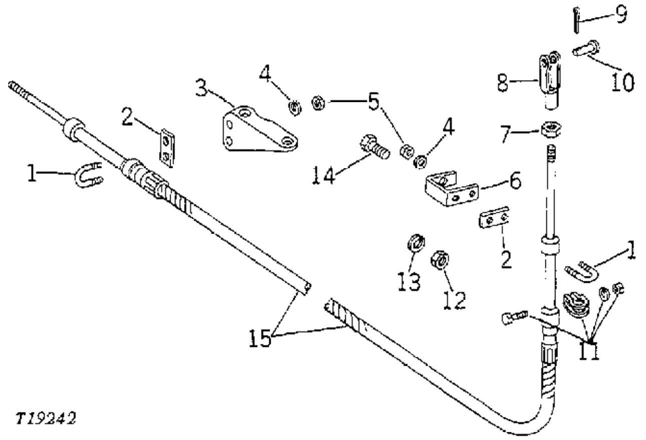
1—Cable
2—Cap Screw (2 used)
3—Lock Washer (2 used)
4—Bracket
5—Pin (2 used)
6—Cotter Pin (2 used)
7—Yoke (2 used)
8—Nut (2 used)
9—Facing (2 used)
10—Bell Crank
11—Plate
12—Spring
13—Washer
14—Special Nut
15—Knob
16—Hand Lever
17—Link
18—Special Screw
19—Clamp with Hardware

Fig. 1-Speed Control Lever (Diesel)



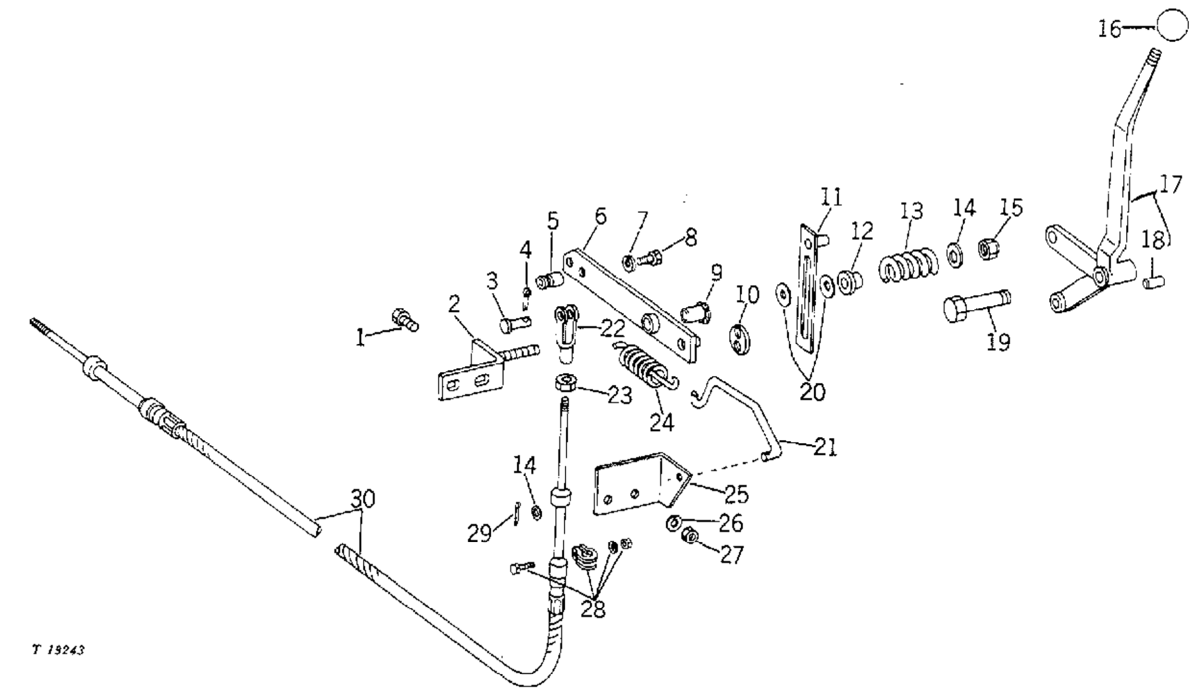
1—Pin (2 used)
2—Yoke (2 used)
3—Cotter Pin (2 used)
4—Nut (2 used)
5—Clamp (2 used)
6—Bracket
7—Lock Washer
8—Nut
9—Cap Screw
10—Nut (2 used)
11—Lock Washer (2 used)
12—Lock Washer
13—U-Bolt
14—Cable
15—Cap Screw
16—Nut
17—Spacer
18—Anchor Bracket
19—Clamp with Hardware

Fig. 2-Speed Control Cable and Bracket (Diesel)



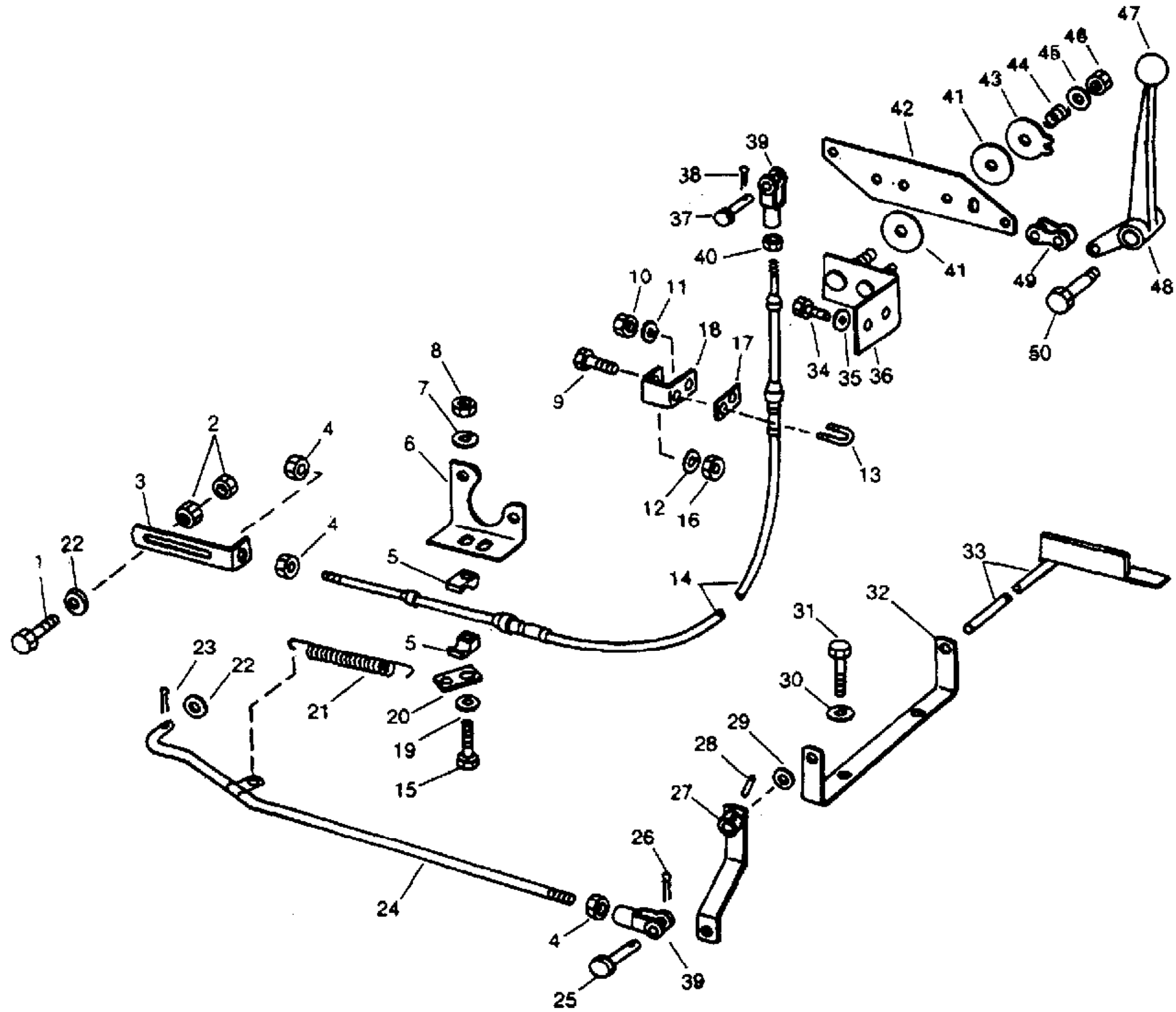
1—U-Bolt (2 used)
2—Spacer (2 used)
3—Anchor Bracket
4—Lock Washer (4 used)
5—Nut (4 used)
6—Anchor Bracket
7—Nut
8—Yoke
9—Cotter Pin
10—Pin
11—Clamp with Hardware
12—Nut
13—Lock Washer
14—Cap Screw
15—Cable

Fig. 3-Speed Control Cable and Bracket (Gasoline)



1—Cap Screw (2 used)
2—Pivot Bracket
3—Pin
4—Cotter Pin
5—Anchor
6—Lever
7—Lock Washer
8—Cap Screw
9—Bushing
10—Link
11—Friction Link
12—Friction Disk
13—Spring
14—Washer (2 used)
15—Stop Nut
16—Knob
17—Lever
18—Pin
19—Special Cap Screw
20—Special Washer (2 used)
21—Rod
22—Yoke
23—Nut
24—Spring
25—Anchor Bracket
26—Lock Washer (2 used)
27—Nut (4 used)
28—Clamp with Hardware
29—Cotter Pin
30—Cable

Fig. 4-Speed Control Lever (Gasoline)



1—Cap Screw
2—Yoke (2 used)
3—Angle
4—Nut (3 used)
5—Clamp (2 used)
6—Bracket
7—Lock Washer
8—Nut
9—Cap Screw
10—Nut (2 used)
11—Lock Washer (2 used)
12—Lock Washer
13—U-Bolt
14—Cable
15—Cap Screw
16—Nut
17—Strap
18—Bracket
19—Washer
20—Strap
21—Spring
22—Washer
23—Cotter Pin
24—Rod
25—Pin
26—Cotter Pin
27—Lever
28—Spring Pin
29—Washer
30—Lock Washer
31—Cap Screw (2 used)
32—Channel
33—Pedal
34—Cap Screw (2 used)
35—Lock Washer (2 used)
36—Bracket
37—Pin
38—Cotter Pin
39—Yoke
40—Nut
41—Washer (2 used)
42—Bellcrank
43—Plate
44—Spring
45—Washer
46—Lock Nut
47—Knob
48—Lever
49—Chain Link
50—Cap Screw

Fig. 5—Speed Control Linkage (350D, 355D)

7AJ;T6405AA 08T;0515 K1 030986

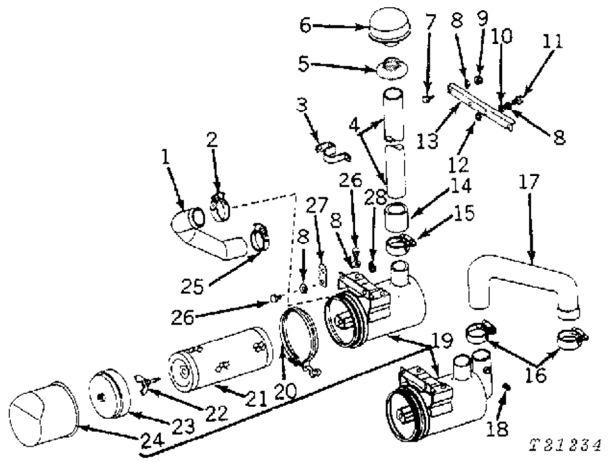
Group 0520
INTAKE SYSTEM

AIR CLEANER AND PIPING

GENERAL INFORMATION

Air enters through the inlet on the top of the air cleaner assembly. Dirt is removed from the air as it passes through the cleaner element. Clean air then flows out the end of the filter assembly to the engine.

REPAIR



1—Hose (gasoline)
2—Hose Clamp (gasoline)
3—Clamp
4—Extension
5—Seal (with loader) Grommet (without loader)
6—Cap
7—Cap Screw (2 used) (without loader)
8—Lock Washer
9—Nut (without loader)
10—Washer (2 used)
11—Cap Screw
12—Washer (approx. 6 used)
13—Extension Bracket (without loader)
14—Hose (with loader)
15—Hose Clamp (2 used) (with loader)
16—Hose Clamp (2 used) (diesel)
17—Hose (diesel)
18—Pipe Plug (without restriction indicator)
19—Air Cleaner Assembly
20—Clamp
21—Element
22—Wing Bolt
23—Baffle Skirt
24—Cap
25—Hose Clamp (gasoline)
26—Cap Screw (4 used)
27—Bracket
28—Pipe Plug (without restriction indicator)

Fig. 1-Air Cleaner

FOS

Refer to FOS Manual - ENGINES - for cleaning of air cleaner element.

Replace the filter elements, (1) if damaged, (2) after one year of service, or (3) if element is not responding to cleaning as indicated by excessive smoke or loss of power.

Check all air passages, check restriction indicator for proper operation.

PRE-CLEANER

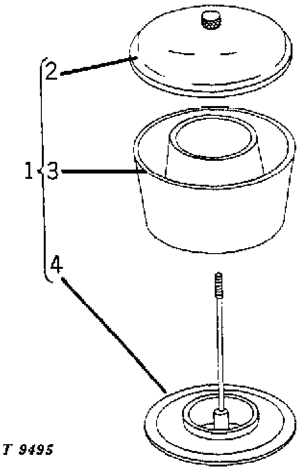
GENERAL INFORMATION

The pre-cleaner collects large particles of dirt before the air enters the cleaner element. This reduces the number of times the cleaner element must be cleaned.

REPAIR

Remove and thoroughly clean the bowl and base (3 and 4, Fig. 2).

If too much dirt is allowed to collect in the bowl, the pre-cleaner becomes clogged and a greater load is placed on the air cleaner.



1—Pre-Cleaner
2—Cover
3—Bowl
4—Sleeve Assembly

Fig 2-Pre-Cleaner

Group 0560
EXTERNAL FUEL SUPPLY SYSTEM

GENERAL INFORMATION

The fuel tank is of welded sheet steel construction and mounts directly behind the operator's seat.

A fuel shut-off valve is provided at the tank outlet under the seat. Also a drain valve under the seat enables the operator to easily drain condensation from the tank.

REMOVAL

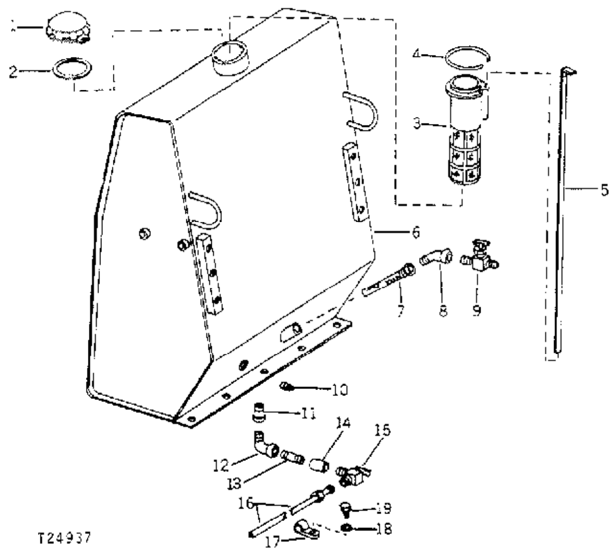
Fig. 1-Fuel Tank Lifting Hooks

Remove operator's seat from tractor. Drain fuel from the tank. Close fuel shut-off valve and detach fuel outlet line and fuel return line (diesel). Disconnect drain tube from drain valve.

Attach a chain to tank lifting hooks (Fig. 1). Remove cap screws from lower tank flange and from tank side brackets. Lift tank from unit.

REPAIR

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.



1—Cap
2—Gasket
3—Fuel Strainer
4—Snap Ring
5—Fuel Gauge
6—Fuel Tank
7—Filter
8—Elbow
9—Shut-Off Valve
10—Pipe Plug (gasoline)
11—Bushing
12—Elbow
13—Pipe Nipple
14—Pipe Coupler
15—Drain Valve
16—Drain Tube
17—Clamp
18—Lock Washer
19—Cap Screw

Fig. 2-Fuel Tank

FOS

Refer to FOS-30 ENGINES for detailed information on repair of fuel tanks.

INSTALLATION

Use a chain hoist to lower fuel tank into place on unit. Attach fuel outlet line, fuel return line (diesel) and drain tube loosely to tank fittings.

Secure tank to lower bar and side flanges with cap screws. Tighten tank line(s) and tube securely. Open fuel shut-off valve. Install seat.

Group 0599
SPECIFICATIONS AND SPECIAL TOOLS
COLD WEATHER STARTING AID
SPECIFICATIONS AND TORQUE VALUES

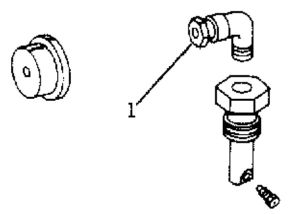


Fig. 1-Starting Aid Line Hex. Nut

1 - Starting aid line hex. nut torque .... 50 to 70 lb-in. (0.6 to 0.8 kg-m)

ENGINE COOLING SYSTEM
SPECIFICATIONS AND TORQUE VALUES

Cooling system capacity .... 13 qts. (12.3 l)

Radiator test pressure .... 10 psi (1 kg/cm²)

Radiator cap test pressure .... 6.25 to 7.50 psi (0.4 to 0.5 kg/cm²)

1 - Fan cap screw torque .... 20 lb-ft. (3 kg-m)

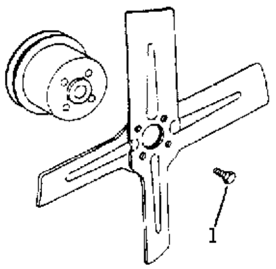


Fig. 2-Fan

EXTERNAL FUEL SUPPLY SYSTEM

SPECIFICATIONS AND TORQUE VALUES

Fuel tank capacity .... 22 gal.
(83 l)

Section 15
EQUIPMENT ATTACHING

CONTENTS OF THIS SECTION

Group 1511
DRAWBAR

DRAWBARS

GENERAL INFORMATION

Five drawbar options are available on the JD350-C. The swinging drawbar is available on the bulldozer only. A different drawbar is used with PTO and without PTO.

A straight drawbar is available with bottom counterweight. The unit may be equipped with a winch drawbar or 3-point hitch drawbar.

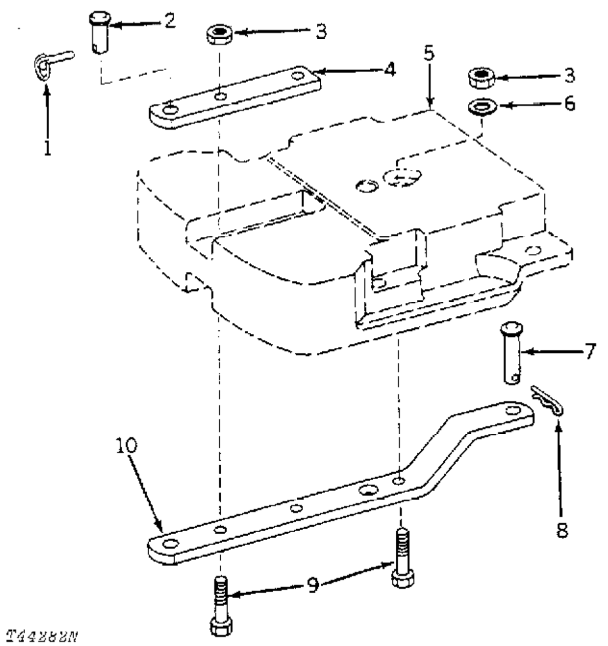
REMOVAL

Remove cap screws attaching drawbar to the crawler. Lower drawbar from the unit.

When removing 3-point hitch drawbar, remove draft links and sway chains before removing drawbar.

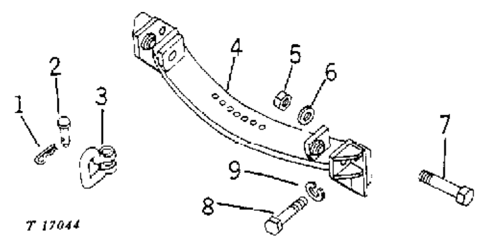
REPAIR

Refer to Figs. 1-5 during disassembly and assembly of the drawbar.



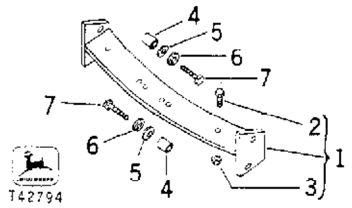
1—Quik-Lock Pin
2—Drawbar Pin
3—Hex. Nut (3 used)
4—Drawbar Top Extension
5—Bottom Guard Counterweight
6—Special Washer
7—Pin
8—Spring Locking Pin
9—Cap Screw (3 used)
10—Drawbar

Fig. 1-Straight Drawbar



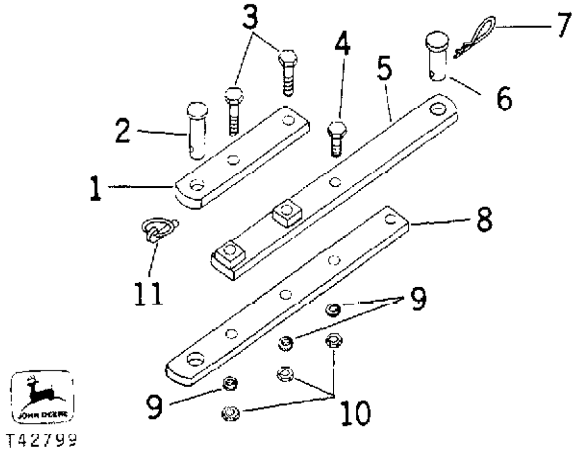
1—Spring Lock Pin (2 used)
2—Pin (2 used)
3—Sway Chain Anchor (2 used)
4—Drawbar Segment
5—Jam Nut (4 used)
6—Special Washer (2 used)
7—Cap Screw (2 used)
8—Cap Screw (4 used)
9—Lock Washer (4 used)

Fig. 2-3-Point Hitch Drawbar



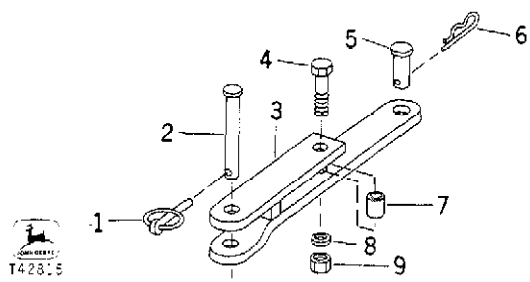
1—Quadrant With Cap Screws and Nuts
2—Cap Screw (2 used)
3—Nut (2 used)
4—Dowel (2 used)
5—Special Washer (2 used)
6—Lock Washer (2 used)
7—Cap Screw (2 used)

Fig. 3-Drawbar Segment (with or without PTO)



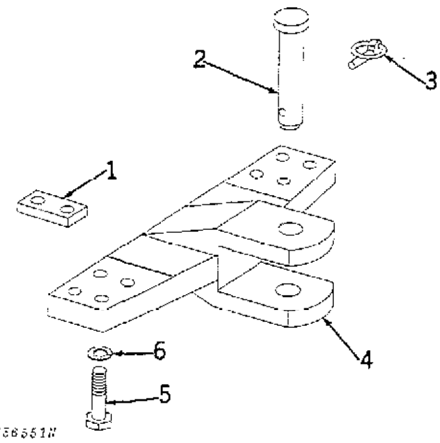
1—Top Extension
2—Pin
3—Cap Screw (2 used)
4—Cap Screw (2 used)
5—Drawbar Assembly
6—Drawbar Pin
7—Spring Locking Pin
8—Bottom Extension
9—Lock Washer (3 used)
10—Nut (3 used)
11—Quik-Lock Pin

Fig. 4-Drawbar Assembly with PTO (when equipped with bulldozer)



1—Quik-Lock Pin
2—Drawbar Pin
3—Drawbar Assembly
4—Cap Screw
5—Pin
6—Spring Locking Pin
7—Spacer
8—Lock Washer
9—Nut

Fig. 5-Drawbar Assembly Without PTO (when equipped with bulldozer)



1—Support Spacer (2 used with fairlead assembly)
2—Drawbar Pin
3—Quik-Lock Pin
4—Winch Drawbar
5—Cap Screw (8 used)
6—Lock Washer (8 used)

Fig. 6-Winch Drawbar

INSTALLATION

Install drawbar in reverse order of removal procedure.

When installing straight drawbar (Fig. 1) apply Loctite to cap screws (9) and tighten nuts (3) to 170 lb-ft (24 kg/m).

FAIRLEAD

GENERAL INFORMATION

The fairlead assembly, mounted under the winch, aids the operator when winching loads from the side. The assembly provides proper winding of the cable.

REMOVAL

Attach strap or chain hoist to fairlead assembly.

Remove mounting cap screws (8 and 14, Fig. 7). Pull assembly away from unit.

REPAIR

Examine the top roller and each side roller for excessively worn or damaged condition and replace if necessary.

Inspect the roller bushing in each end of the top roller and in each side roller. Replace any excessively worn or damaged bushing.

Using a JD630-13 tool, press in the new bushing to the bottom of the counterbore in the top roller and in each side roller.

Inspect each roller shaft for worn or damaged condition and replace if necessary.

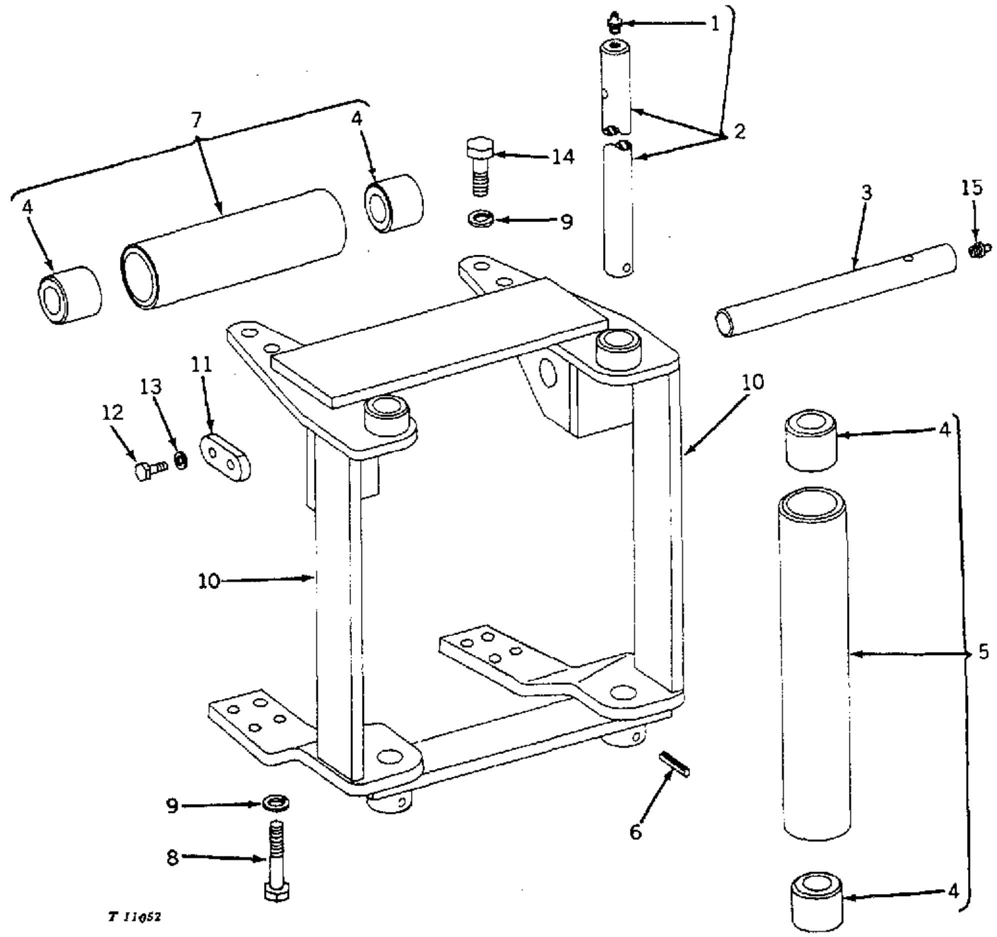
Examine the lubricating hole in each shaft for a plugged condition.

Inspect and replace all defective grease fittings.

INSTALLATION

Reverse removal procedure for installation of the fairlead assembly.

Tighten cap screws (8) to 150 lb-ft (20.74 kg-m).

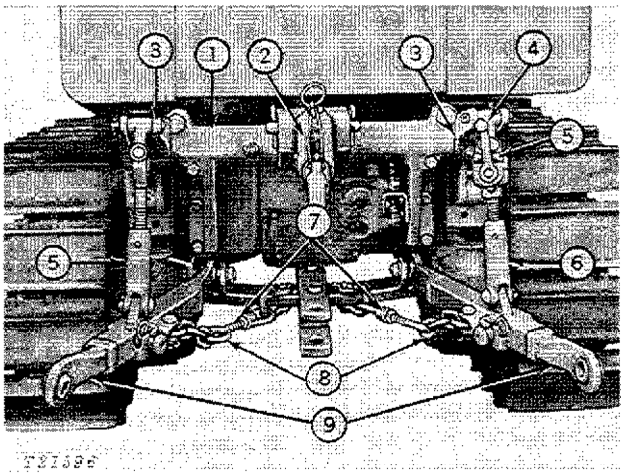


1—Grease Fitting (2 used)
2—Side Roller Shaft (2 used)
3—Top Roller Shaft (2 used)
4—Roller Bushing (6 used)
5—Side Roller (2 used)
6—Spring Pin (2 used)
7—Top Roller
8—Cap Screw (8 used)
9—Lock Washer (12 used)
10—Fairlead Frame
11—Shaft Retainer
12—Cap Screw (2 used)
13—Lock Washer (2 used)
14—Cap Screw (4 used)
15—Grease Fitting

Fig. 7-Winch Fairlead Assembly

Group 1520
HITCHES AND HITCH PINS

GENERAL INFORMATION



1—Rockshaft
2—Center Link
3—Lift Arms
4—Leveling Crank
5—Leveling Crank Lock
6—Lift Links
7—Eye Nuts
8—Sway Chains
9—Draft Links

Fig. 1-3-Point Hitch

Tractors equipped with a rockshaft can accommodate a 3-point hitch (Fig. 1).

The hitch consists of a center link, draft links, and lift links.

The hitch lift links attach to rockshaft lift arms. These arms are actuated by two hydraulic cylinders.

Hitch draft links will telescope for easier hook-up to tools. Sway chains provide tool stability in raised position.

The 3-point hitch is a category 2 type, but can be adopted for Category 1 tool operation.

REMOVAL

Remove sway chains and draft links from drawbar.

Attach strap or chain hoist to rockshaft housing.

CAUTION: Operate control lever to relieve hydraulic pressure on the rockshaft cylinders.

Disconnect lift arms from the cylinders.

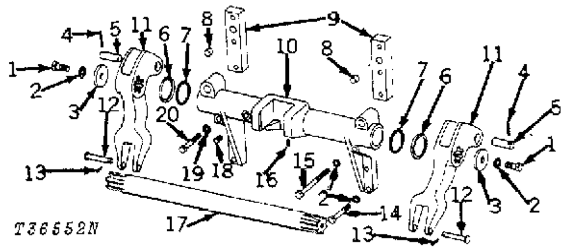
Remove cap screws attaching rockshaft housing to steering clutch housing.

Pull assembly straight out and away from crawler.

REPAIR

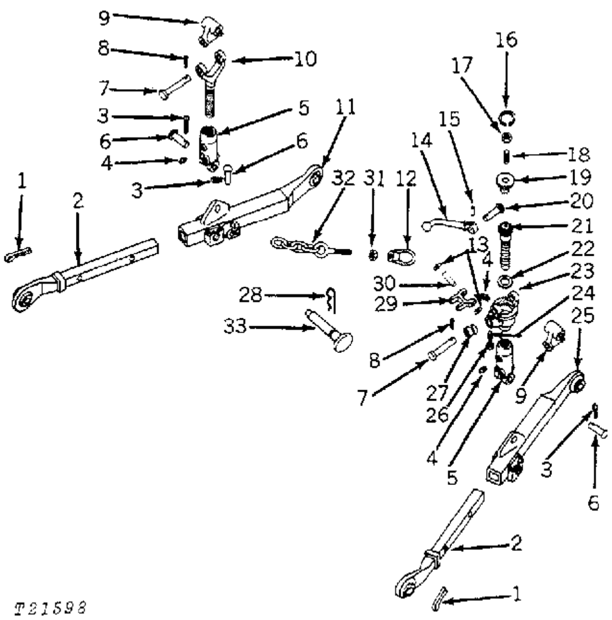
Use Figs. 2, 3, and 4 as a reference during disassembly and assembly.

When assembling right lift link, tighten thrust plate set screw (18, Fig. 3) until pinion and gear (20 and 21) turn freely but without excessive backlash.



1—Special Bolt (2 used)
2—Lock Washer (8 used)
3—Washer (2 used)
4—Spring Pin (2 used)
5—Pin (2 used)
6—Retainer (2 used)
7—O-Ring
8—Dowel (2 used)
9—Spacer (2 used)
10—Rockshaft Housing
11—Lift Arm (2 used)
12—Clevis Pin (2 used)
13—Cotter Pin (2 used)
14—Cap Screw (4 used)
15—Cap Screw (2 used)
16—Pipe Plug
17—Rockshaft
18—Pipe Plug
19—Lock Washer (2 used)
20—Cap Screw (2 used)

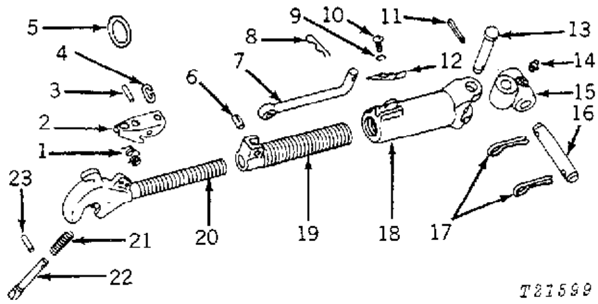
Fig. 2-Rockshaft Housing Assembly



T21598

1—Pin (2 used)
2—Draft Link Bar (2 used)
3—Cotter Pin (4 used)
4—Grease Fitting (3 used)
5—Fork (2 used)
6—Pin (4 used)
7—Pin (2 used)
8—Cotter Pin (2 used)
9—Tee Joint (2 used)
10—Lift Link
11—Draft Link
12—Eye Nut (2 used)
13—Spring Washer (2 used)
14—Leveling Crank
15—Spring Pin
16—Snap Ring
17—Jam Nut
18—Set Screw
19—Thrust Plate
20—Pinion
21—Gear With Shaft
22—Thrust Washer
23—Housing
24—Set Screw
25—Draft Link
26—Jam Nut
27—Bushing
28—Locking Pin (2 used)
29—Crank Lock
30—Spring Pin
31—Jam Nut (2 used)
32—Sway Chain (2 used)
33—Pin (2 used)

Fig. 3-Three-Point Hitch Lift and Draft Links



T21599

1—Spring
2—Handle
3—Spring Pin (2 used)
4—Link
5—Ring
6—Groove Pin
7—Handle
8—Locking Pin
9—Lock Washer
10—Screw
11—Cotter Pin
12—Spring
13—Pin
14—Grease Fitting
15—Tee Joint
16—Pin
17—Pin (2 used)
18—Link End
19—Link Center
20—Link Hook
21—Spring
22—Link Latch
23—Spring Pin

Fig. 4-3-Point Hitch Center Link

INSTALLATION

Install 3-point hitch and rockshaft in reverse order of removal procedure.

Grease all fittings before resuming operation.

To adjust 3-point hitch, see Section 90, Group 9030.

Group 1599
SPECIFICATIONS AND SPECIAL TOOLS
DRAWBAR
SPECIFICATIONS AND TORQUE VALUES

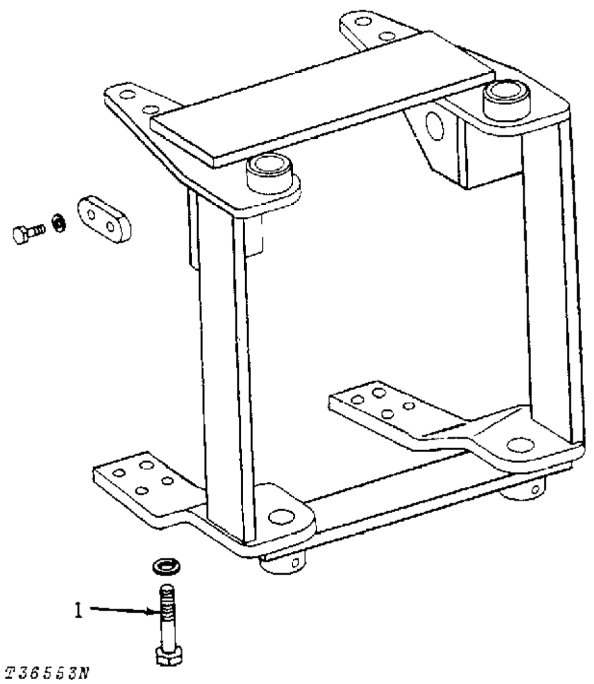


Fig. 1-Fairlead

1 - Fairlead-to-steering clutch housing cap screws torque . . . . 150 lb-ft (20.74 kg-m)

SPECIAL TOOLS

Convenience Tools

Tool No.	Use
630-13*	Driver - To press bushings in fairlead rollers

Order from: *Service Tools*
Division of Owatonna Tool Company
P.O. Box 314
Owatonna, Minnesota 55060

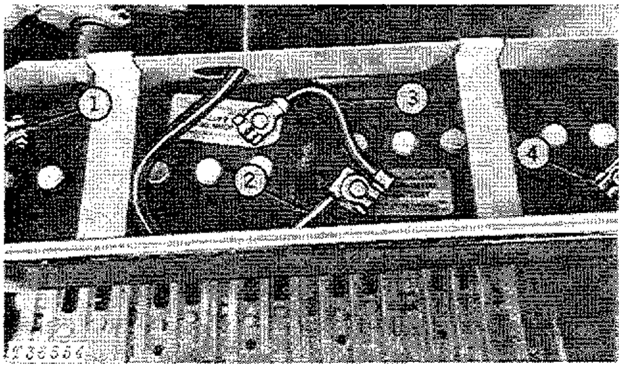
Section 16
ELECTRICAL SYSTEM

CONTENTS OF THIS SECTION

CONTENTS—Continued

Group 1671
BATTERIES, SUPPORTS AND BATTERY CABLES

GENERAL INFORMATION



1—Ground Cable
2—Positive Cable
3—Connecting Cable
4—Ground Cable

Fig. 1-Battery Connections

Batteries are located under the left-hand arm rest. To gain access to the batteries, lift up the battery box door and remove tool box and tool box tray.

When replacing a battery, use the John Deere battery or its equivalent shown in the following chart:

Volts	12
John Deere Part Number	AT29160
BCI Group	30H
Cold Cranking Amps (0°F.) (−18°C.)	570
(−20°F.) (−29°C.)	450
Reserve Capacity (minutes at 25 amps)	180

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 (0.5 kg) of baking soda in a gallon (4 L) of water.

b. One pint (0.4 L) 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. Lift up battery box door and remove tool box and tool box tray.

2. Note carefully the location of the positive (+) terminals so that the batteries are installed in the same way.

3. Disconnect the ground cables (1 and 4) first. Use only a box end wrench to loosen clamps on terminals. Remove clamps, using a screw-type puller. DO NOT hammer on the battery posts.

4. Remove the connecting cable (3) and positive cable (2).

5. Remove the battery clamps and the batteries.

6. Check cables for worn or frayed insulation. Replace cable clamps or bolts if corroded.

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 [approximately 100 g] added to a quart [approximately 1 l] of water). Keep vent plugs tight while washing. After washing, flush battery and compartment with clear water. Then coat terminals with petroleum jelly to protect against corrosion. Be sure vent holes in vent plugs are open.

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.

NOTE: If D-24001MO battery tester is used, follow the manufacturer's instructions on the battery tester.

Specific Gravity Cell Comparison Test

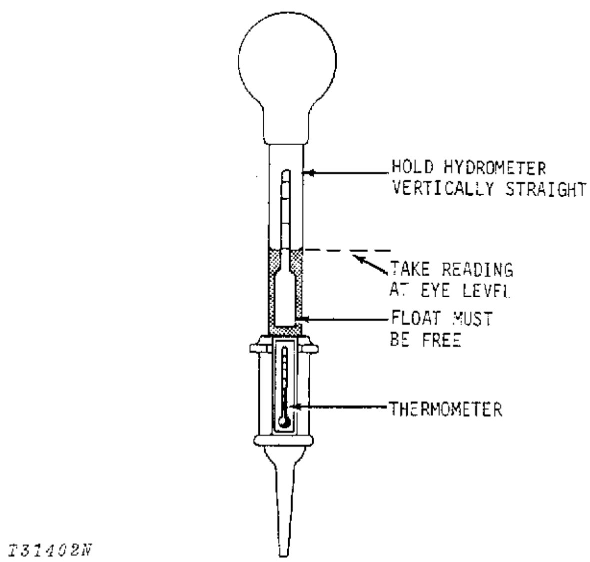


Fig. 2-Checking Specific Gravity

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.

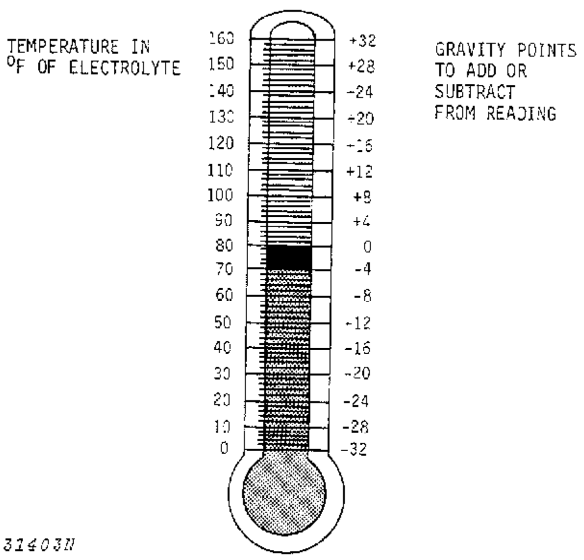


Fig. 3-Electrolyte Temperature Correction Table

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.

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	Very Little Useful Capacity
1.110	Discharged

The table above shows the state of charge of a typical battery at various specific gravity readings.

The table above shows the state of charge of a typical battery at various specific gravity readings.

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.

Checking Battery Condition

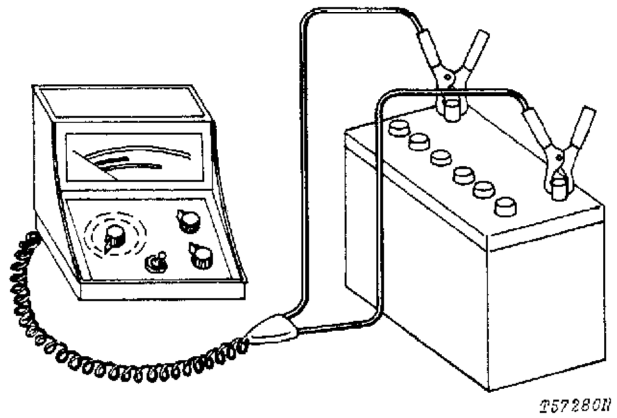


Fig. 4-D-24001MO Electronic Battery Tester

Turn off the engine and all electrical loads before testing. Connect D-24001MO Electronic Battery Tester to battery as follows. Attach red clip to the positive (+) terminal and the black clip to the negative (−) terminal. Set the voltage selector switch for 12 volt operation.

Battery Power—Turn switch to "kW" position and read battery power in kilowatts. This is the maximum starting power of your battery.

Battery Condition—Set battery rating switch to applicable battery rating and set temperature switch to estimated battery temperature. (If battery rating is unknown, substitute engine cubic inch displacement in cubic inches for cold crank amp rating.) Turn switch to "BAT. COND." and read red-green scale.

Voltage Test—If battery condition is in red area, turn switch to volts. If voltage is in recharge area, battery is not fully charged. Recharge and retest.

When tester is in transit, or not in use, keep switch in off position.

FOS 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 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.

FOS For additional information on charging batteries, refer to "Storage Batteries" in FOS Manual - ELECTRICAL SYSTEM.

John Deere battery chargers can be used as a booster to start the engine.

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 clamp 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. Coat the terminals with petroleum jelly to prevent corrosion. Never paint the terminal posts.

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.

BATTERY BOX

GENERAL INFORMATION

The battery box is located in the left side of the operator's station under the left arm rest.

REMOVAL

Relieve pressure in hydraulic system.

Remove seat cushion and back rest.

Remove tool box tray, tool box tray supports, disconnect and remove batteries. Pull positive battery cable out of battery box.

Disconnect four hydraulic lines which run through battery box.

Disconnect shifter lever linkage.

Disconnect light from battery box lid (if used).

Remove five cap screws from underneath battery box.

Remove three cap screws from battery box (on front of fuel tank).

Remove two cap screws which fasten battery box to side of fuel tank from inside the battery box.

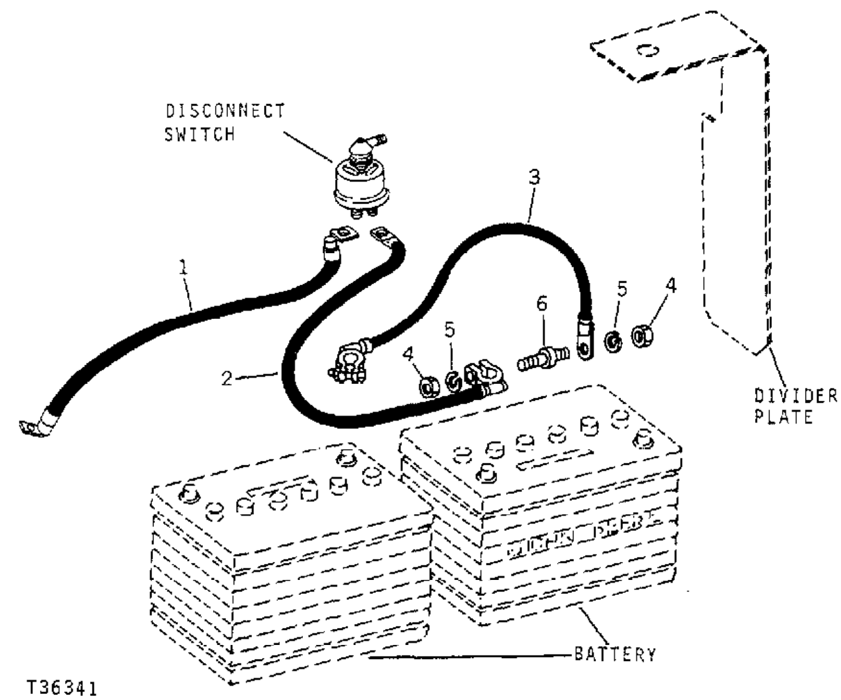
Place chains or straps securely around battery box. Using a chain hoist lift the battery box.

INSTALLATION

Follow removal procedure in the reverse order.

Refer to Section 90, Group 9025 for possible adjustment of shifter lever linkage.

BATTERY DISCONNECT SWITCH



1—Disconnect Switch to Starting Motor Cable
2—Disconnect Switch to Battery Cable
3—Battery to Battery Cable
4—Nut
5—Lock Washer
6—Special Stud

Fig. 5-Battery Disconnect Switch

GENERAL INFORMATION

A battery disconnect switch (if equipped) is wired between the batteries and the starting motor.

With the switch in the "OFF" position, all battery power is disconnected from the unit.

REMOVAL

Remove the screw from the switch handle. Remove nut from top of switch. Disconnect cables from switch and pull out switch.

REPAIR

The switch is not repairable. Replace if defective.

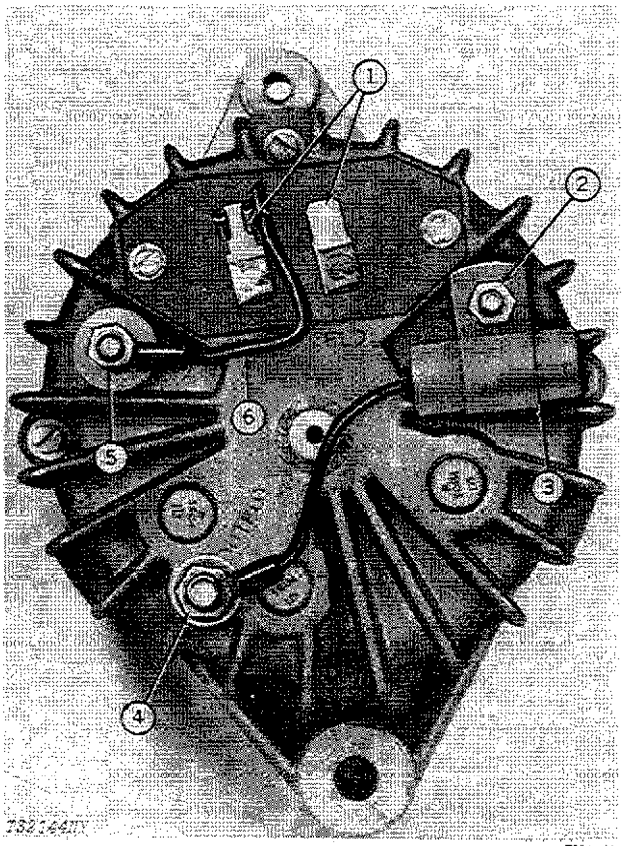
INSTALLATION

Follow removal procedure in reverse order.

Group 1672
ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING

ALTERNATOR

GENERAL INFORMATION



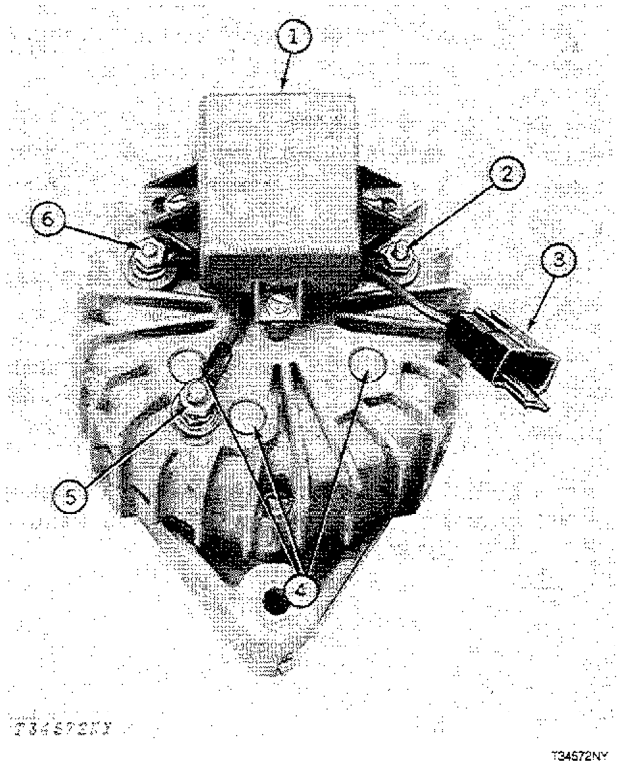
1—Field Terminals
2—Ground Terminal
3—Capacitor
4—Output Terminal
5—Stator Terminal
6—Wire Lead

Fig. 1-Alternator (-343540)

This alternator is a totally enclosed-type, designed for dusty or hazardous environments. The alternator is not waterproof and should not be submerged.

Alternators can be divided into three main assemblies:

1. Rotor Assembly - magnetic field which rotates.
2. Stator Assembly - conductors which are stationary.
3. Rectifier Assembly - diodes which change a.c. to d.c.



1—Voltage Regulator
2—Ground Terminal
3—Wire Lead
4—Negative Diodes
5—Output Terminal
6—Stator Terminal

Fig. 2-Alternator (343541-719786)

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.

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 the rear housing. Three positive diodes are mounted in the heat sink which is insulated from the rear housing.

To understand the diodes, first remember these two points.

1. Alternating current flow is produced by the rotor-stator combination. That is, during half the rotor revolution, current flow in the stator phases is in one direction. In the other half, flow is in opposite direction.

2. Current flow from the alternator output terminal is always the same direction.

This means that during each phase of a revolution, two diodes are used to convert a.c. to d.c. current - one positive and one negative diode.

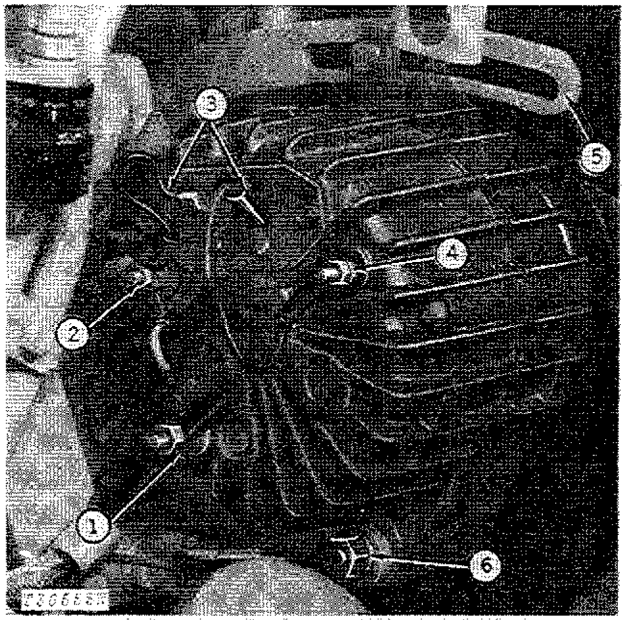
FOS

For additional information on alternators, refer to "Charging Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

REMOVAL

CAUTION: Disconnect battery ground straps or turn battery disconnect switch (if equipped) to "OFF" position first to prevent damage if leads removed from alternator should be accidentally grounded.

Alternators (-343540)



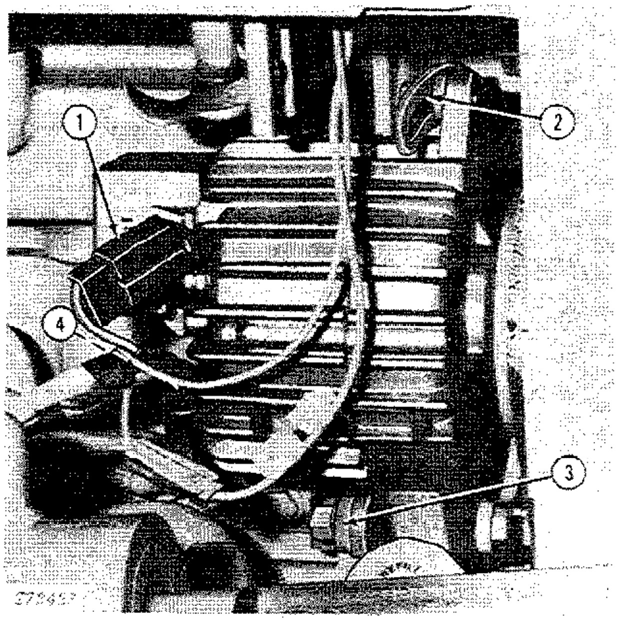
1—Output Terminal
2—Stator Terminal
3—Field Terminal
4—Ground Terminal
5—Adjusting Strap
6—Mounting Bracket

Fig. 3-Alternator Wiring and Mounting Bracket (-343540)

Remove wires from output (1, Fig. 3), stator (2), field (3) and ground terminals (4).

Loosen screw from adjusting strap (5) and remove belt. Remove alternator attaching screw from mounting bracket (6) and remove alternator.

Alternators (343541-719786)



1—Wiring Lead
2—Adjusting Cap Screw
3—Mounting Bracket
4—Output Terminal

Fig. 4-Alternator Wire Leads and Mounting Bracket (343541-719786)

Remove wires from output terminal (4, Fig. 4) and disconnect wiring lead (1).

Remove adjusting cap screw (2). Remove cap screw, nut, washers and shim holding alternator to mounting bracket (3).

Remove alternator.

REPAIR

Disassembly

Refer to Fig. (6 or 8) during disassembly and assembly.

Never immerse the alternator in cleaning solution. Scrape off dirt and grease, then use a stiff brush and solvent. Dry with compressed air.

Never hammer or jar the alternator as this may ruin the diodes.

Disassemble alternator only as far as necessary to correct the difficulty.

Brushes and Slip Rings

NOTE: It is not necessary to remove the alternator from the unit to check the brushes.

Remove the brush cover with the black leads attached to it from the brushes.

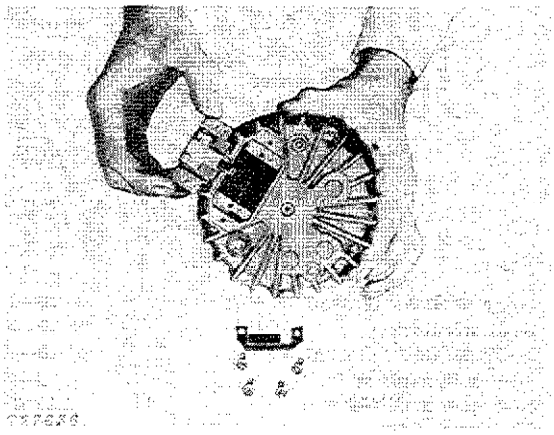


Fig. 5-Removing Brush Assembly

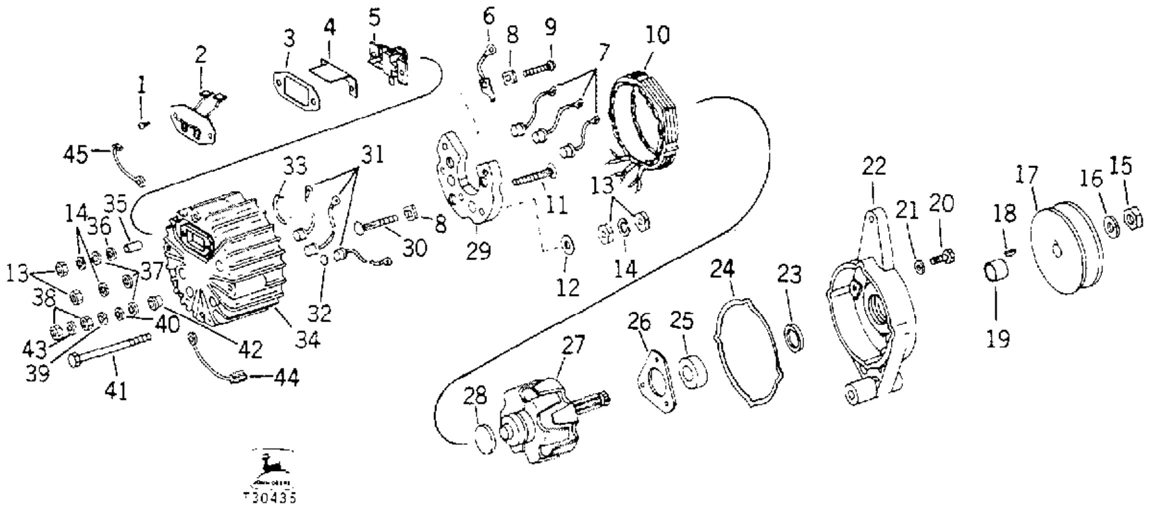
Remove the two screws holding brush assembly and carefully remove assembly and insulator (Fig. 5).

Replace brush assembly if brushes extend less than 1/4-inch (6 mm) beyond the holder.

IMPORTANT: If in the process of brush removal the brush cover gasket (3, Fig. 6) should become damaged or torn, it must be replaced and positioned properly.

If the insulator which prevents the brush leads from shorting on the rear housing and grounding the field, should become damaged or torn, it must be replaced.

If the brushes are clogged with dust or dirt, clean them with compressed air. Avoid using any type of liquid as this increases the possibility of dust or dirt hardening in the brush cavity and hindering the movement of the brush.



1—Drive Screw (2 used)
2—Brush Cover
3—Brush Cover Gasket
4—Brush Insulator
5—Brush and Holder
6—Jumper Cable
7—Rectifying Positive Diode (3 used)
8—Insulator (5 used)
9—Bolt (2 used)
10—Stator
11—Bolt
12—Washer (3 used)
13—Nut
14—Lock Washer (9 used)
15—Nut
16—Lock Washer
17—Pulley
18—Key
19—Spacer
20—Screw (3 used)
21—Lock Washer (3 used)
22—Front Housing
23—Special Washer
24—Gasket
25—Ball Bearing
26—Bearing Retainer
27—Rotor
28—Ball Bearing
29—Positive Diode Plate
30—Special Bolt (3 used)
31—Negative Rectifying Diode (3 used)
32—Insulator (3 used)
33—Bearing Retainer
34—Rear Housing
35—Sleeve
36—Washer (2 used)
37—Washer
38—Nut
39—Lock Washer
40—Washer
41—Bolt (4 used)
42—Insulator
43—Lock Washer
44—Capacitor
45—Lead Wire

Fig. 6-Alternator (-343540)

If slip rings are contaminated, clean with a nonpetroleum base cleaning solvent. If solvent does not clean the slip rings, use crocus cloth.

Rear Housing Removal

Remove the four through bolts retaining the front and rear housings. Using two screwdrivers (Fig. 7), apply equal pressure to release the rear housing from the front. Care should be taken that the stator stays with the rear housing.

IMPORTANT: If housing gasket is damaged, replace it at time of assembly.

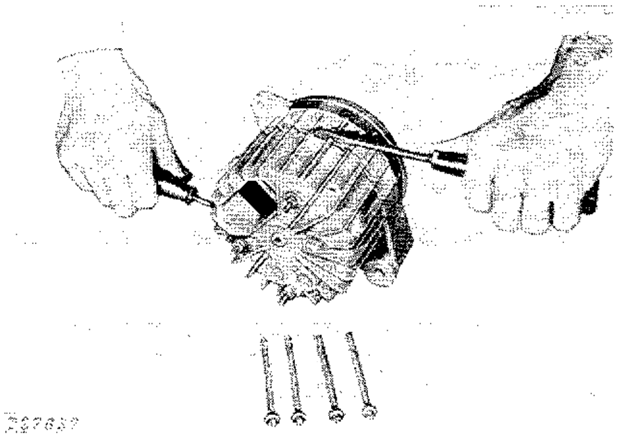
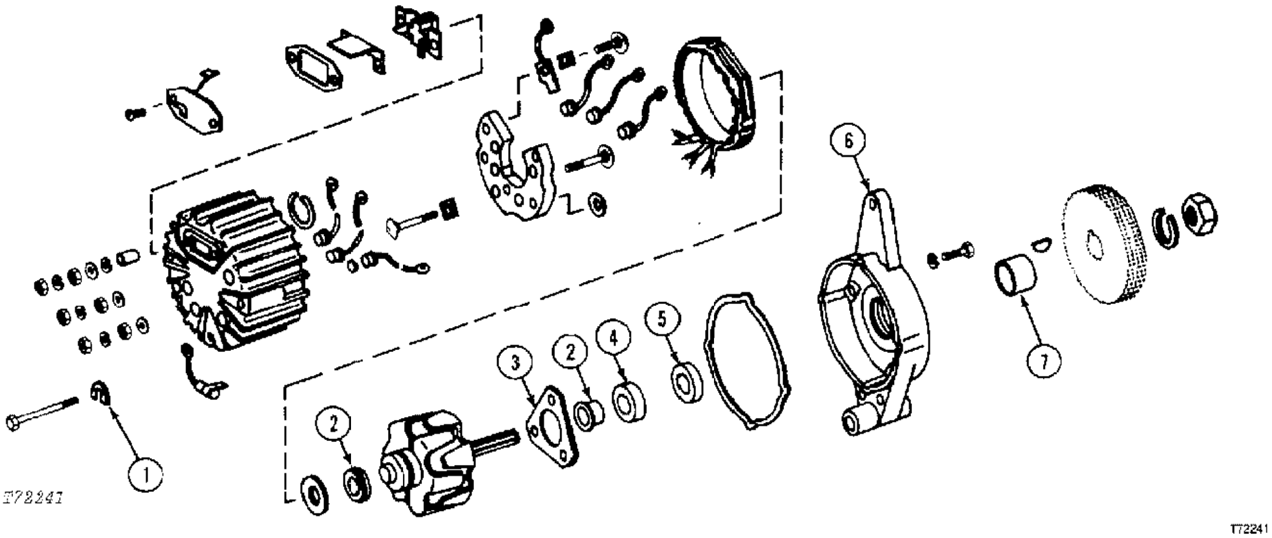


Fig. 7-Separating Front and Rear Housings



1—Drain Clip
2—V-Ring Seal
3—Front Bearing Retainer
4—Front Bearing
5—Double Lip Oil Seal
6—Front Housing
7—Pulley Spacer

Fig. 8-Alternator (343541-719786)

NOTE: New parts only keyed in Fig. 8.

Stator

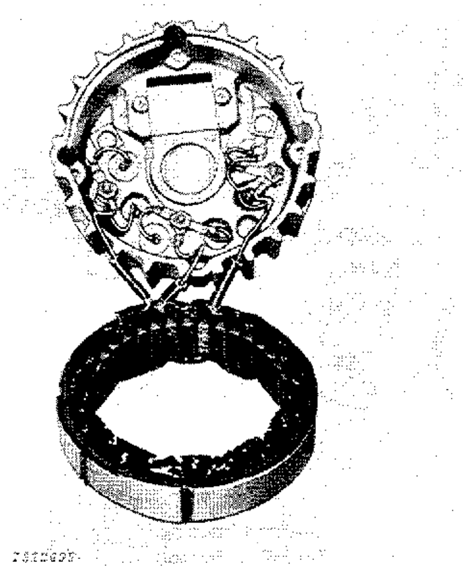


Fig. 9-Removing Stator from Rear Housing

Grasping the stator, apply pressure and separate stator from housing (Fig. 9).

Remove the stator wires from the terminals in the rear housing. Note wire connections for assembly.

Diodes

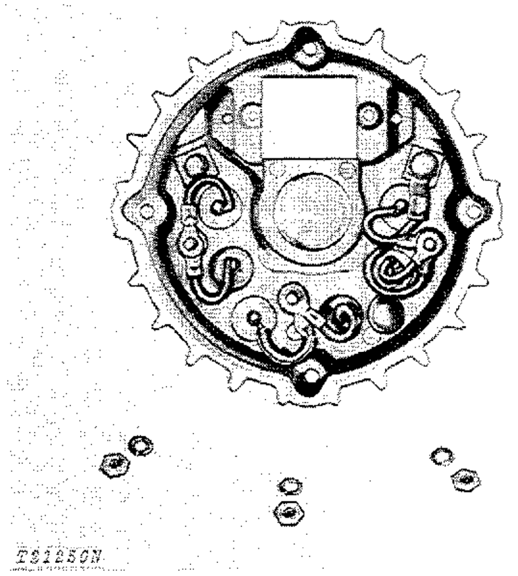


Fig. 10-Removing Positive Diode Heat Sink

Remove the three black leads from the heat sink screws and push heat sink out of housing.

NOTE: Three mica insulators are set against the inside of the rear housing and insulate the positive heat sink from the housing. DO NOT lose them.

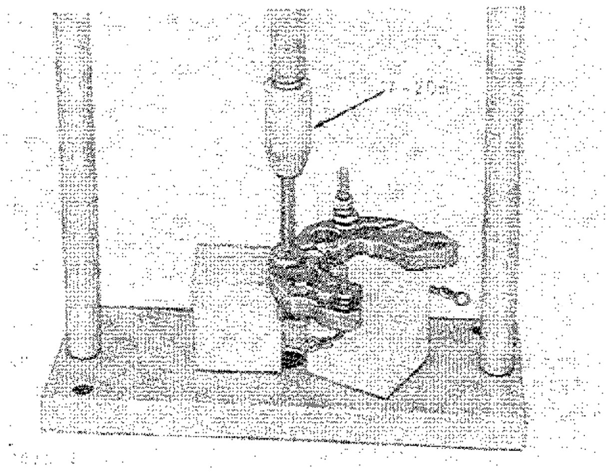


Fig. 11-Removing Defective Positive Diodes

Using a small punch and A-206 tool (Fig. 11), press defective positive diodes out of heat sink.

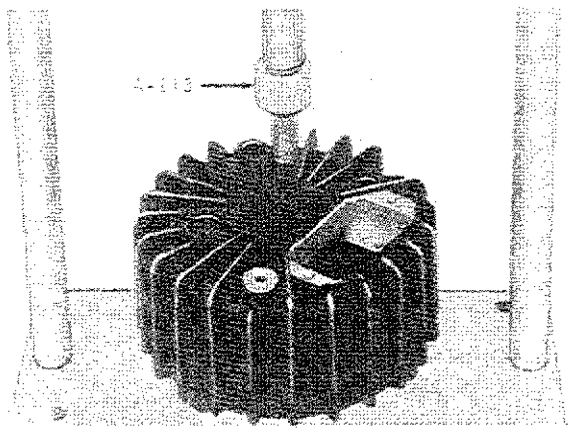


Fig. 12-Removing Defective Negative Diode

Using A-213 tool (Fig. 12) press defective negative diodes out of the rear housing.

IMPORTANT: The rectifying diodes used in this application have welded rather than soldered leads. Do not attempt to use replacement diodes with soldered leads.

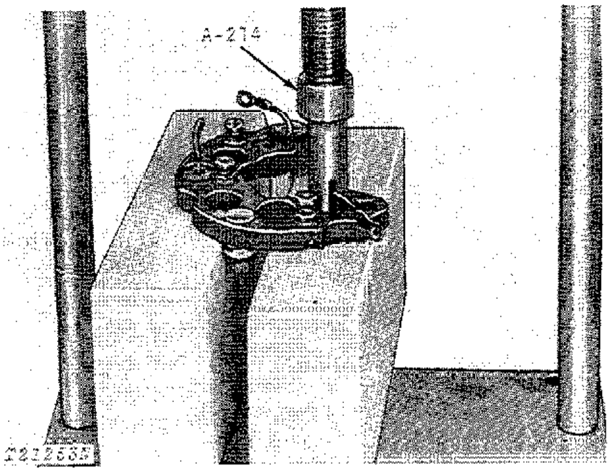


Fig. 13-Installing Positive Diodes

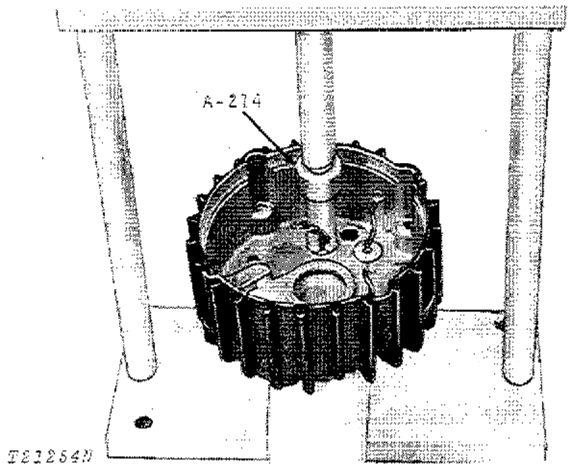


Fig. 14-Installing Negative Diodes

Place a new diode in diode hole. Rotate diode so serrations on new diode do not line up with the serrations made by original diode; this provides a more efficient transfer of heat from the diode. Press diode fully into hole using A-214 tool (Figs. 11 and 12).

Pulley Removal

The pulley is a slip fit on shaft with a Woodruff key. To remove the nut and lock washer, clamp pulley in a vise, using an old oversized belt to protect the pulley from damage by the vise jaws (Fig. 15). Alternator should slide out of pulley. If not, a slight rocking of the alternator body will loosen a tight pulley.

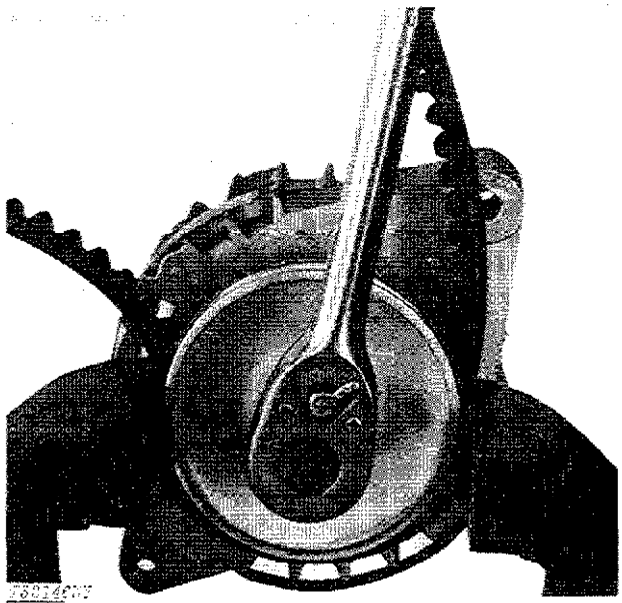


Fig. 15-Pulley Removal

Rotor

Remove the three screws and lock washers from the front housing (Fig. 16). If not already removed, remove Woodruff key from rotor shaft.

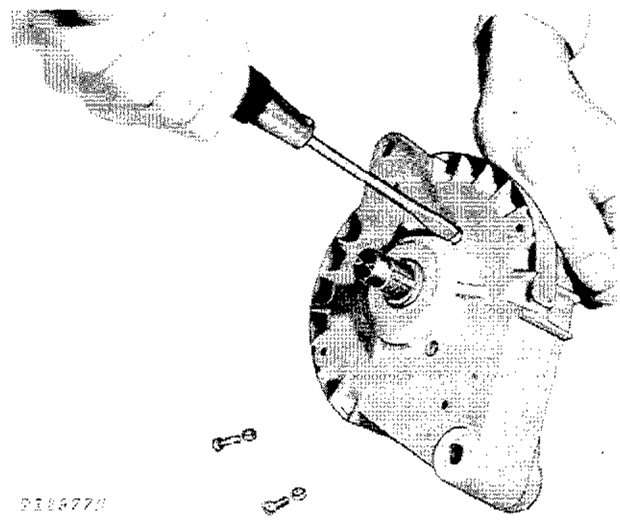


Fig. 16-Removing Rotor Retaining Hardware

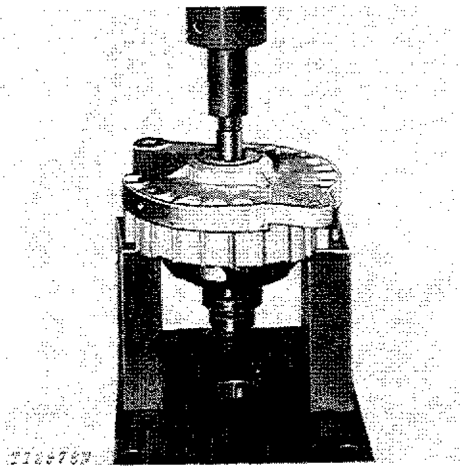


Fig. 17-Pressing Rotor Out of Housing

Using a press (Fig. 17), press rotor out of front housing.

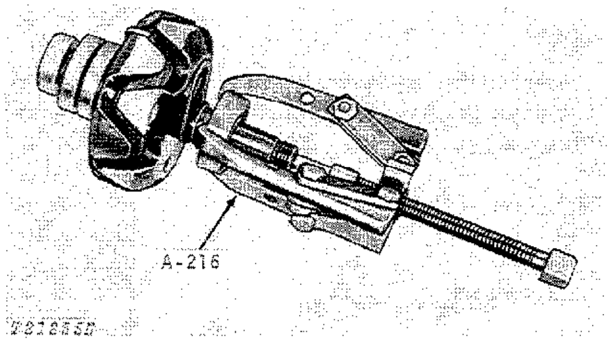


Fig. 18-Removing Rotor Bearings

Bearings are sealed and cannot be lubricated. Remove the bearings using A-216 Puller and Adapter (Fig. 18).

ALTERNATOR COMPONENT TESTS

Make the following tests to locate faulty components prior to assembly.

Brush Assembly Insulation Test

1. Insulation Test: Connect ohmmeter or a test lamp (12 volts) to field terminals and bracket (test points E to A and E to C, Fig. 19).

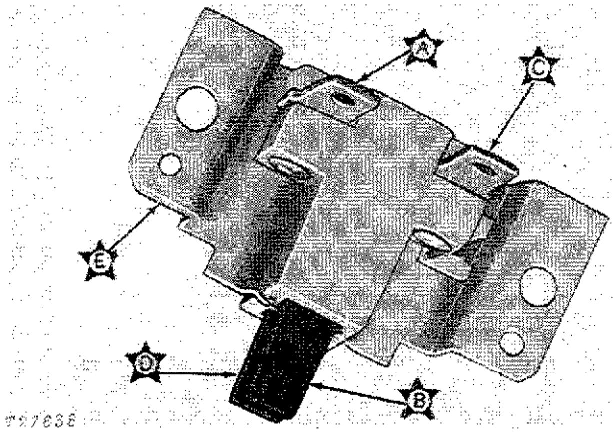


Fig. 19-Brush Assembly Test Points

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.

2. Continuity Test: Connect an ohmmeter or a test lamp to field terminal and brush (test points A to B and C to D). Use an alligator clip to assure good contact to brush. **IMPORTANT: Do not chip brush.** Resistance reading should be zero or test light should light. 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 are being moved around.

Rectifier Diode Test

If a commercial alternator rectifier diode tester is available, follow manufacturers instructions to test all diodes. Do not use 120-volt AC test lamp.

A 12-volt battery-operated test lamp may be used if a commercial tester is not available. Connect one test lead to diode heat sink (2, Fig. 20), and the other to each diode wire terminal (1). Then repeat test with test leads reversed. Lamp should light with leads in one position, but should not light with test leads reversed. All diodes in heat sink or rear housing should show the same results.

1—Terminal Screws **2—Heat Sink**

Fig. 20-Rectifier Diode Test Points

If lamp lights, regardless of how test leads are switched, the diode is shorted. If lamp fails to light in either test, the diode is open. Replace defective diodes. Observe correct polarity by color of lead wire. Negative diode has a black lead wire and positive diode has a red lead wire.

Stator Tests

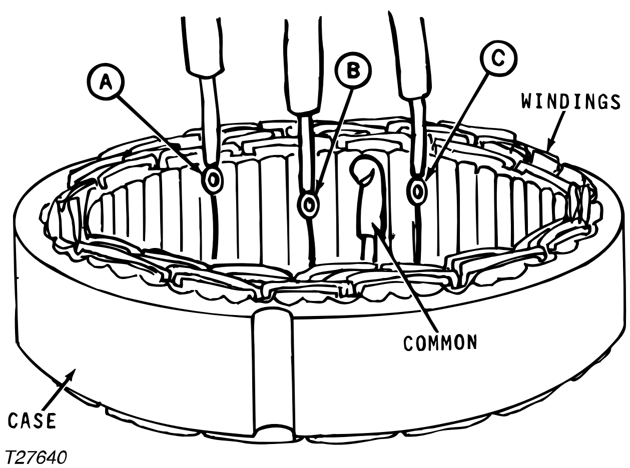


Fig. 21-Stator Test Points

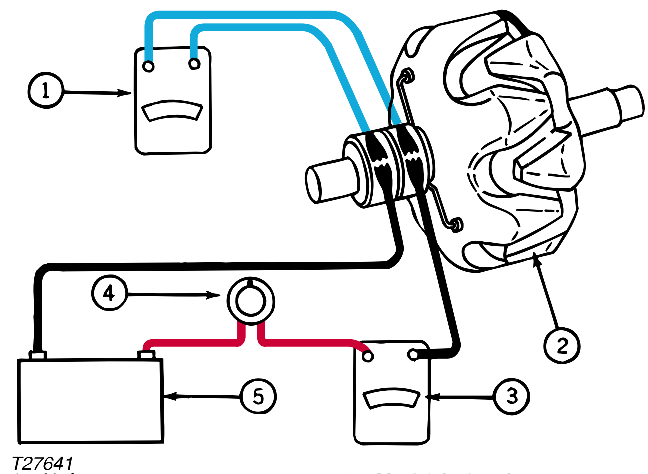
An ohmmeter or test lamp may be used to test for opens.

1. Connect ohmmeter or test lamp probe to one of the stator leads (A, B, or C) and connect the other test probe to each remaining lead.

Resistance reading should not be indicated or test lamp should not light. If resistance reading is indicated or test lamp lights, there is an open in the stator windings. Replace stator.

2. To test for shorts, connect one ohmmeter or test lamp probe to the stator windings and the other test probe to the stator case. Resistance reading should be infinite or test lamp should not light. If test lamp lights or there is a resistance reading, a short exists in the stator. Replace stator.

Rotor Test



1—Voltmeter
2—Rotor Assembly
3—Ammeter
4—Variable Resistor
5—Battery

Fig. 22-Rotor Current Draw Test Hook-Up

Test A: Continuity and Current Draw

This test checks the rotor for shorted or open windings. Connect voltmeter to the slip rings. Then connect an ammeter in series with a variable resistor to the slip ring and 12-volt battery. Set the variable resistor to maximum resistance. Connect the other slip ring to the battery and adjust the resistor to obtain full battery voltage.

IMPORTANT: Do not remove the wire from the slip ring at this time as it will cause an arc, damaging the slip ring surface and requiring cleanup.

Rotor field current draw should equal 0.55 to 1.5 ampere at 10.0 volts (70 to 80°F [21 to 27°C]). Shorted windings are indicated by excessive current draw; open windings by no current draw at all.

Test B - Checking Field Coil for Leakage or Shorts

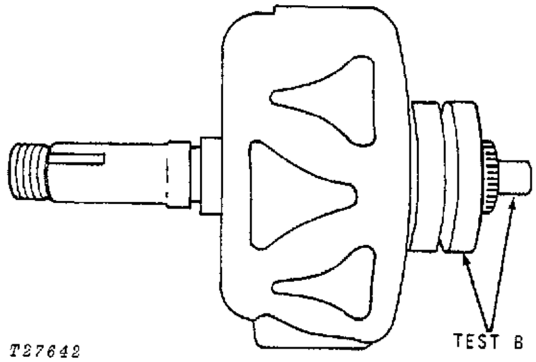


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Fig. 23-Test B Test Points

Connect ohmmeter or test lamp probes to one of the slip rings, and to rotor shaft. Ohmmeter resistance should be infinite and test lamp should not light. If resistance is not infinite or test lamp lights, leakage or a short exists between the field coil and rotor.

ASSEMBLY

Installing Front Bearing (-343540)

Check that bearing cavity in front housing is clean and that felt dust seal is installed in recess. Press bearing into housing using A-203 tool (Fig. 24). Apply even pressure only to the outside race of the bearing. Install bearing retainer and secure with screws and lock washers.

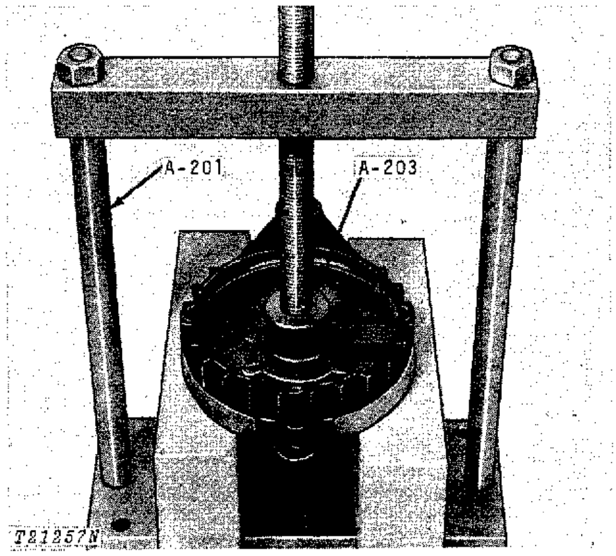

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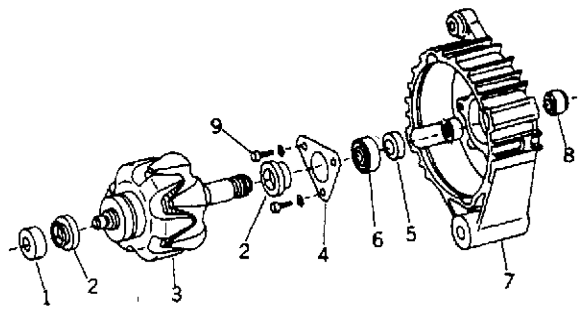
Fig. 24-Installing Bearing in Front Housing

Bearings and Seals (343541-719786)



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1—Rear Bearing
2—V-Ring Seal
3—Rotor Assembly
4—Front Bearing Retainer
5—Double Lip Seal
6—Front Bearing
7—Front Housing
8—Pulley Spacer
9—Cap Screws (3 used)

Fig. 25-Bearing and Seal Placement

Wipe off old grease. Apply new grease to areas as directed below.

Apply AT30408 High Temperature Grease or equivalent to double lip seal (5, Fig. 25).

Insert double lip seal in front housing.

Install front bearing. Press bearing into front housing. Apply an even pressure to the outside race of the bearing.

Coat bearing retainer's forward side with John Deere Loctite Thread Lock and Sealer (low strength) or equivalent.

Install bearing retainer and secure with cap screws and lock washers.

Coat V-Ring Seal (2, Fig. 25) with high temperature silicon base grease.

Install V-Ring seal with rubber lip toward bearing.

Installing Rotor

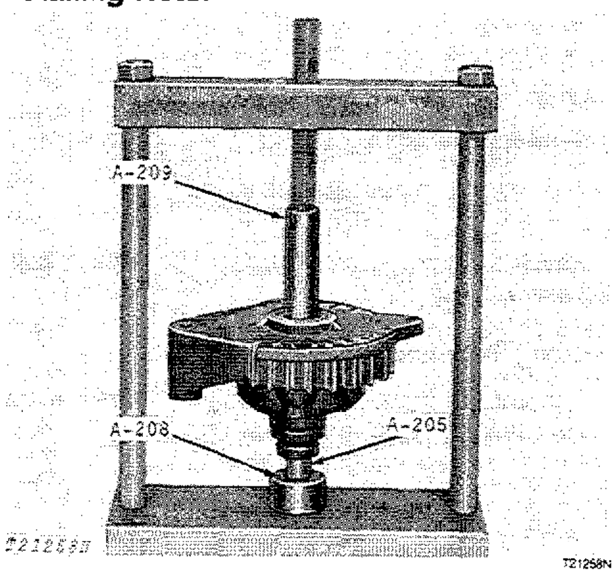


Fig. 26-Installing Rotor

Press assembled front housing onto rotor assembly using A-209 tool (Fig. 26). Support end of rotor shaft with A-205 tool inside of A-208 tool as illustrated (Fig. 26).

Installing Rear Bearing (-343540)

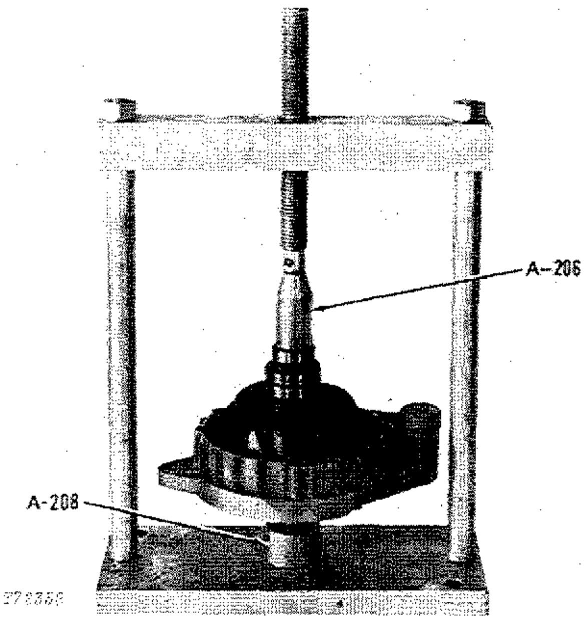


Fig. 27-Installing Rear Bearing

Support front housing in press using A-208 tool. Using A-206 Bearing Driver, press bearing on rotor shaft up to shoulder.

Install new rear bearing retainer (33, Fig. 6) in rear housing.

Installing Rear Bearing Seal and Bearing (343541-719786)

Apply AT30408 High Temperature Grease or equivalent to V-ring seal.

Install V-ring seal (2, Fig. 25) on rotor shaft with rubber lip towards bearing.

Support front housing in press (Fig. 27) using A-208 Tool. Using A-206 Bearing Driver, press bearing on rotor shaft up to shoulder.

Install new rear bearing retainer (33, Fig. 6) in rear housing.

Installing Diode Heat Sink

Coat the three mica insulators with a thin coat of silicon grease or petroleum. Make certain that all insulating washers are properly positioned. Secure heat sink to housing with terminal bolts.

Attach diode leads and stator leads to heat sink.

Assembling Stator To Rear Housing

Check that rear bearing retainer is properly seated in rear housing. Place stator in rear housing, with leads extended toward heat sink. Assemble leads to diode terminal screws. Each screw should hold a black negative diode lead, a red positive diode lead, and a lead from the stator. The terminal screw nearest the stator terminal will also hold the stator top lead wire. See Fig. 9.

Arrange all leads to prevent accidental contact with surfaces, through bolts, or the rotor. Align stator slots with through bolt holes.

Assembling Front and Rear Housing

Place front housing with rotor assembly in a vise, with the drive end down. Place sealing gasket over top edge of front housing. Place rear housing and heat sink assembly over top end of rotor, align bearing cavity, and press housings together.

Position gasket to align with through bolts and tighten bolts to 50 to 60 lb-in (68 to 81 N·m). Spin rotor by hand to check that diode wires are not rubbing against rotor.

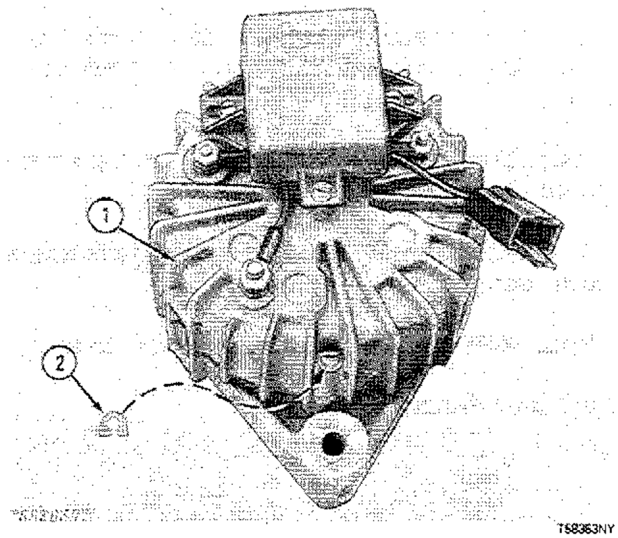
Installing Brush Assembly

Place insulator over brush assembly. Slide assembly into brush cavity and position with alignment pins. Secure insulator and brush assembly to rear housing and tighten screws to 16 to 20 lb-in (22 to 27 N·m).

Position brush cover gasket on alternator and install the brush cover and connect the two black leads.

Installing Pulley

Place pulley spacer over rotor shaft and install Woodruff Key in slot. Place pulley on shaft and tighten nut to 35 to 50 lb-ft (47 to 68 N·m).



1—Rearing Housing 2—Drain Clip

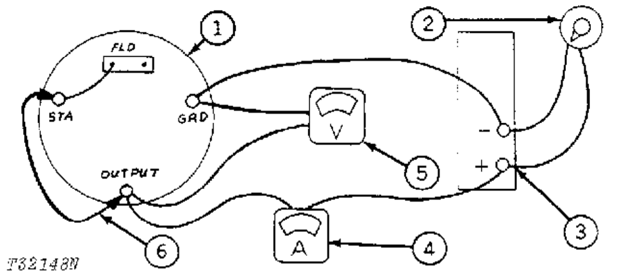
Fig. 28-Installing Drain Clip (343541-719786)

Attach drain clip to rear housing with through bolt. Tighten securely.

Installing Regulator

Connect the regulator blue and green wires to the brush cover (2, Fig. 6) and install regulator.

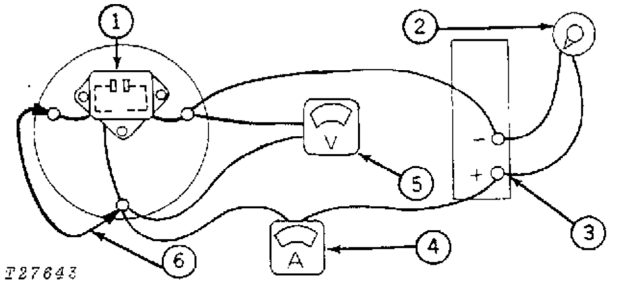
TEST AFTER ASSEMBLY



T32148N

1—Alternator
2—Carbon Pile Resistor
3—12-Volt Battery
4—Ammeter
5—Voltmeter
6—Jumper Wire

Fig. 29-Alternator Test Connections (-343540)



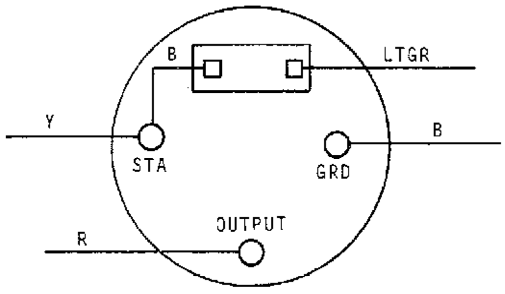
T27643

1—Brush Terminal
2—Carbon Pile Resistor
3—12-Volt Battery
4—Ammeter
5—Voltmeter
6—Jumper Wire

Fig. 30-Alternator Test Connections (343541-719786)

Mount alternator on alternator test stand. If instructions are not available, connect alternator as shown in Fig. 29 or 30.

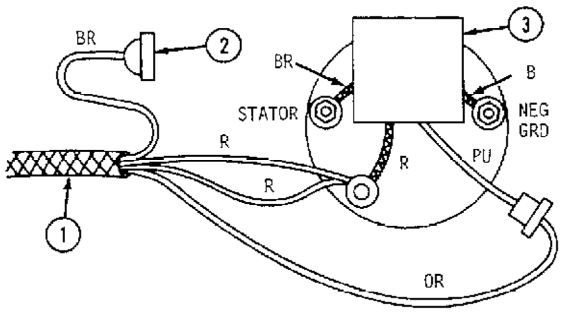
Run alternator at 3000 to 4000 rpm. Momentarily connect jumper wire between alternator output terminal and stator terminal to excite alternator field. Adjust resistor to obtain maximum output (15 volts). The ammeter reading should be 18 amps or more.



T36556N

T36556N

Fig. 31-Alternator Connections
(-343540)



T72446

T72446

1—Engine Wiring Harness
2—Front Headlight (if equipped)
3—Regulator

Fig. 32-Alternator Connections
(343541-719786)

Install alternator. Connect alternator wires (Fig. 31 or 32) making sure all connections are clean and tight. Connect battery ground strap.

Check belt tension. See Section 90, Group 9010.

VOLTAGE REGULATOR

GENERAL INFORMATION

The regulator controls the voltage the alternator produces.

FOS For more information on regulators, refer to "Charging Circuits" in FOS Manual - Electrical Systems.

REMOVAL

Disconnect battery ground straps or turn battery disconnect switch (if equipped) to "OFF" position.

Regulators (-343540)

Disconnect wire harness regulator connector.

Remove attaching hardware and remove regulator from unit.

Regulators (343541-719786)

Remove attaching hardware and remove regulator from the alternator.

Disconnect the three wire leads from the back of the alternator (Fig. 32) and the wire leads from the brush cover (2, Fig. 6).

Disconnect wiring harness lead from regulator lead.

REPAIR

Test the regulator as part of the charging system (See Section 90, Group 9015).

The regulator cannot be repaired. If it is found to be defective, the regulator should be replaced.

INSTALLATION

Use attaching hardware and mount regulator.

Connect wire harness regulator connector (-343540).

Connect battery ground straps.

Connect wire leads (Fig. 32) to back of alternator and connect regulator field wire to orange lead from harness (343541-719786).

SERVICE EQUIPMENT AND TOOLS

NOTE: Order tools from your SERVICE-GARD™ Catalog. Some tools may be available from a local supplier.

Name	Use
17½-Ton Puller Set	Remove bearings.
Digital Volt-Ohm-Amp Meter	Check resistance and continuity.
Hollow Bearing Driver	Drive bearing on shaft.
O-Ring Seal Tool Set	Remove O-rings.
Belt Tension Gauge	Measure belt tension.
Slide Hammer Puller	Remove bearings.
Bearing Pulling Attachment	Remove bearings.
38 mm Driver	Install bearings.

T52;1672 601508 040185

SPECIFICATIONS

Item	Measurement	Specification
ALTERNATOR AND REGULATOR (719789-) and 350D, 355D:		
Brush	Minimum Length	6.4 mm (0.25 in.)
Brush Holder Screw	Torque	2.8—3.4 N·m (20—30 lb-in.)
Alternator Housing Cap Screw	Torque	2.8—3.4 N·m (25—30 lb-in.)
Pulley Nut	Torque	54—68 N·m (40—50 lb-ft)
Alternator Belt	Tension	19 mm (0.75 in.) deflection with 89 N (20 lb) force applied halfway between pulleys.

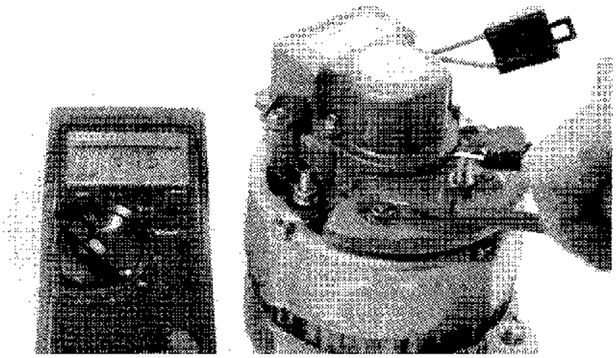
T52;1672 K1 080986

DISASSEMBLE AND TEST ALTERNATOR

NOTE: Never immerse alternator in cleaning solution. Scrape off dirt and grease before using a stiff brush and solvent.

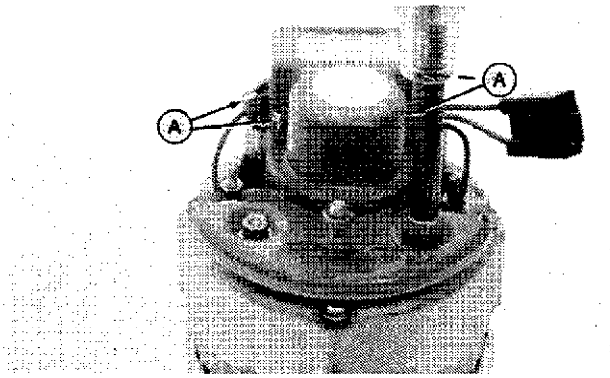
1. Check isolation diode using digital volt-ohm-amp meter with selector indicator in diode test position.

The meter must register OL in one direction and approximately 0.5 volts in the other. If it does not, replace diode.



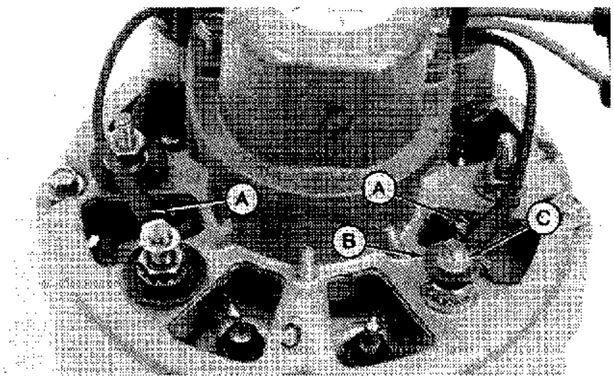
7AL;T6015BJ T52;1672 6015GG 160185

2. Loosen regulator cap screws (A). Remove two nuts to remove isolation diode plate.



7AL;T6015AZ T52;1672 6015GH 040185

3. Remove sleeve (C), insulator washer (B) and regulator wires (A) from alternator terminals.

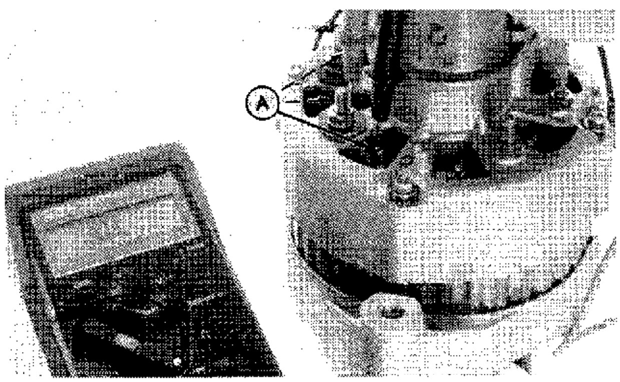


7AL;T6015AT T52;1672 6015GI 040185

4. Test the three negative diodes (A) with selector in diode test position.

Touch one probe to a diode (A) and the other probe to the ground terminal. Take reading. Reverse probes and take another reading.

The meter must register OL in one direction and approximately 0.50 volts in the other on all three diodes. If it does not, replace the negative diode plate.

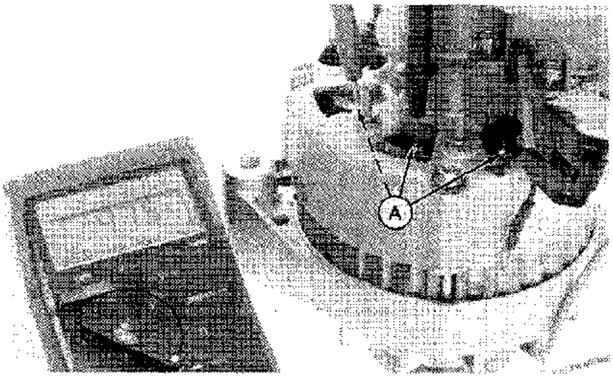


7AL;T6015AL T52;1672 6015GJ 040185

5. Test the three positive diodes (A) with selector in diode test position.

Touch one probe to a diode (A) and the other probe to diode plate post. Take reading. Reverse probes and take another reading.

The meter must register OL in one direction and approximately 0.50 volt in the other on all three diodes. If it does not, replace the positive diode plate.

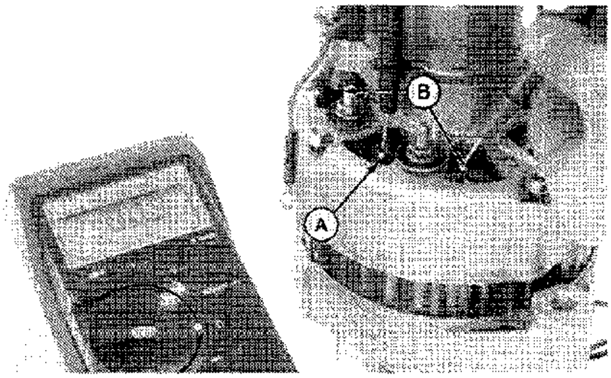


7AL;T6015AM T52;1672 6015GK 040185

6. Check the stator windings for continuity.

Touch one probe to a diode (A) and the other probe to each of the other two diodes (B) attached to the same diode plate. Repeat step for other diode plate.

If there is no continuity in any of the connections, there is an open circuit in the stator windings and the stator must be replaced.

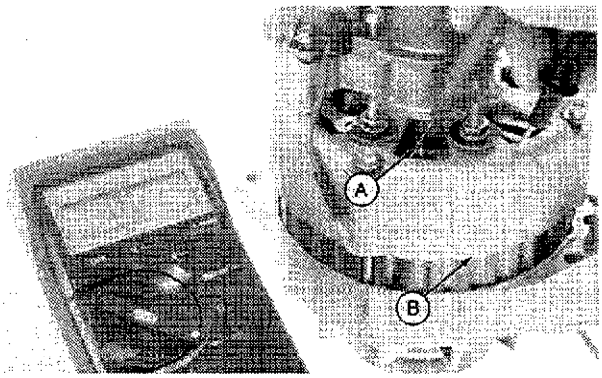


7AL;T6015AD T52;1672 6015GL 040185

7. Check stator for a grounded winding.

Touch one probe to diode lead (A) and the other probe to the rear alternator housing (B). Take reading. Reverse the probes and take another reading.

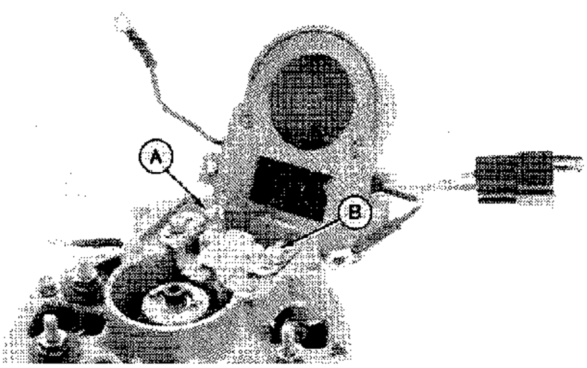
The meter must register continuity in one direction only. If continuity is registered in both directions, a stator winding is grounded and the stator must be replaced.



7AL;T6015BA T52;1672 6015GM 040185

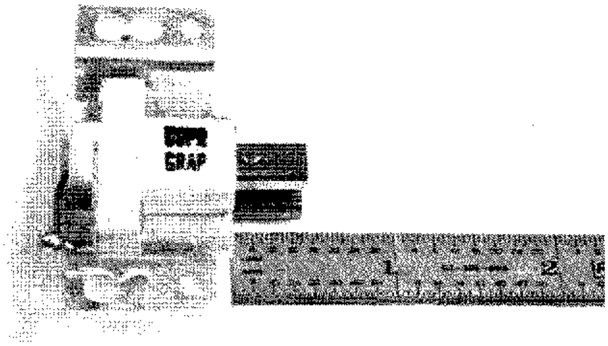
8. Remove screws and disconnect wire (A) to remove regulator.

9. Remove cap screws (B) to remove brushes.



7AL;T6015AY T52;1672 6015GN 080185

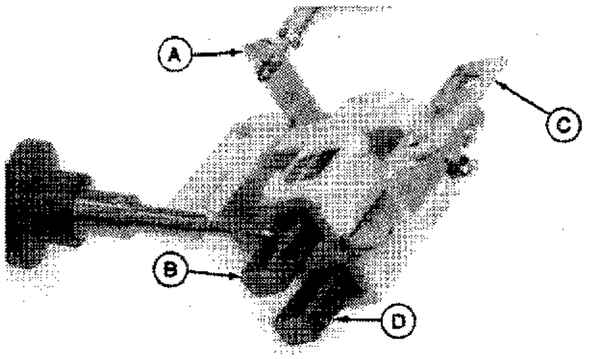
10. Check the condition of the springs, connections, and for free movement of the brushes. If either brush is worn to an exposed length of 6.4 mm (1/4 in.) or less, cracked or oil soaked, replace the brush assembly.



7AL;T84656 T52;1672 95 120583

11. Check for continuity between terminal (A) and brush (B) and bracket (C) and brush (D). If there is no continuity at either brush, replace the brush assembly.

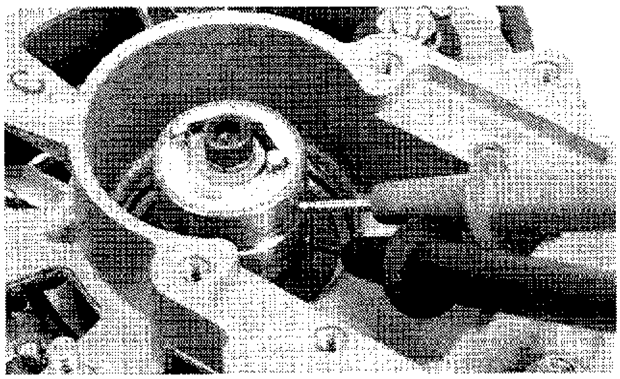
12. Check for continuity between terminal (A) and bracket (C). If there is continuity, replace the brush assembly.



A—Terminal
B—Brush
C—Bracket
D—Brush

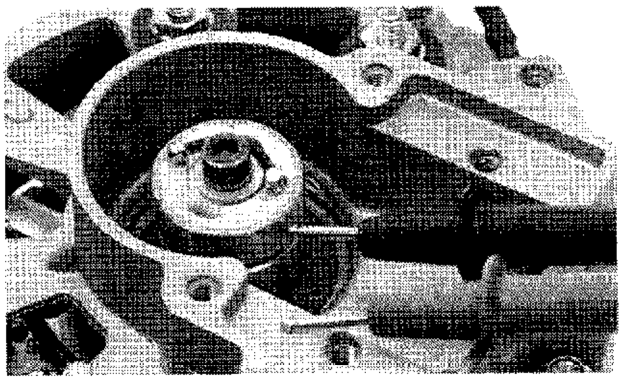
7AL;T87568 T52;1672 96 120583

13. Check rotor winding continuity. If there is no continuity, replace rotor.



7AL;T6015AF T52;1672 6015GO 080185

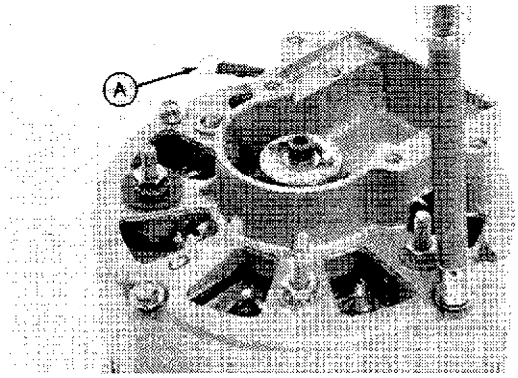
14. Check for grounded rotor windings. If there is continuity, replace rotor.



7AL;T6015AE T52;1672 6015GP 080185

15. Remove nut and isolation washer. Disconnect wiring lead (A).

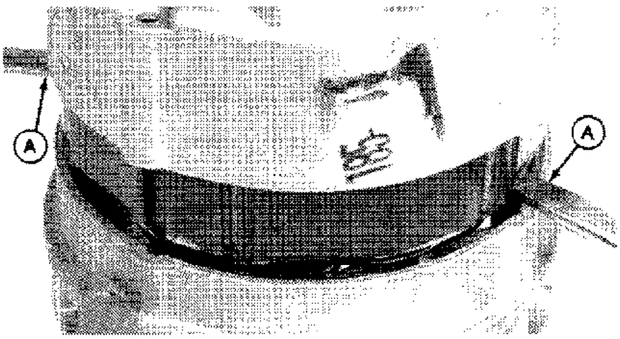
16. Remove four cap screws to remove rear housing cover.



7AL;T6015AP T52;1672 6015GQ 080185

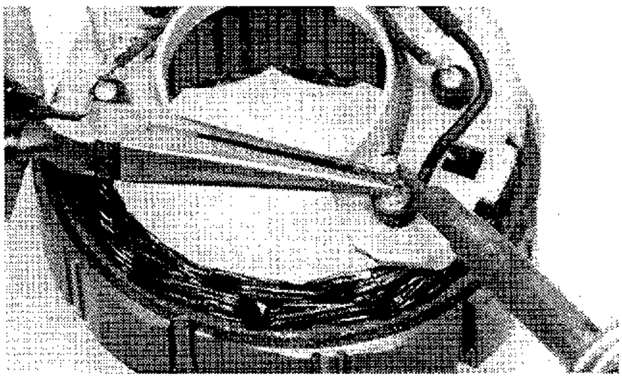
IMPORTANT: Inserting screwdriver blades farther than 1.6 mm (1/16 in.) may damage stator windings.

17. Carefully insert two screwdriver blades (A) in opposite openings between the stator and front housing and separate the front housing from the rear.



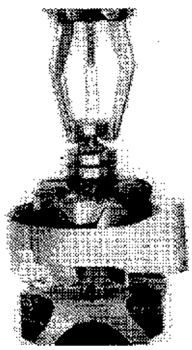
7AL;T87572 T52;1672 6015GR 080185

18. Use needle nose pliers as a heat sink when soldering leads to diodes. Use rosin core solder only.



7AL;T89073 T52;1672 6015GS 080185

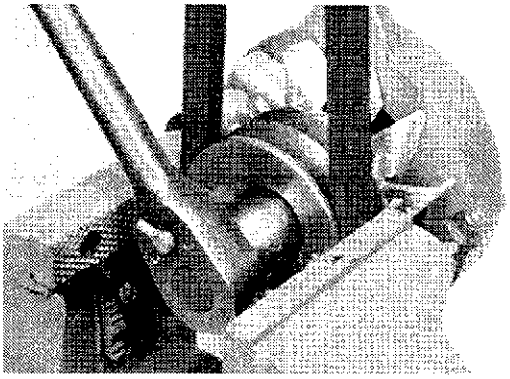
19. Use slide hammer puller to remove slip ring end bearing.



7AL;T87602 T52;1672 6015GT 090185

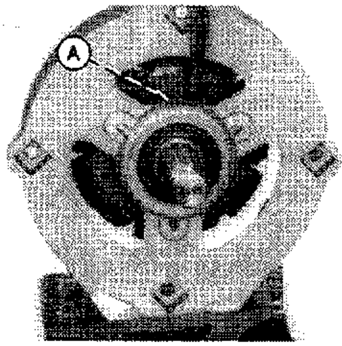
20. Remove nut to remove pulley and fan.

Inspect parts for wear or damage.



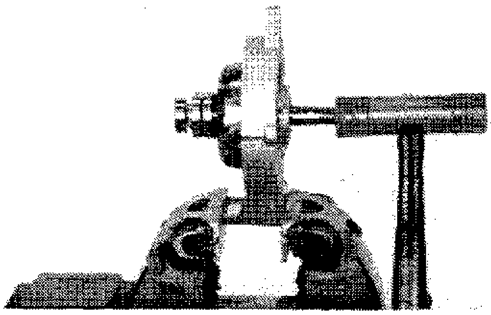
7AL;T89074 T52;1672 6015GU 090185

21. Remove the front bearing retainer (A) by prying it out of its groove with an awl.



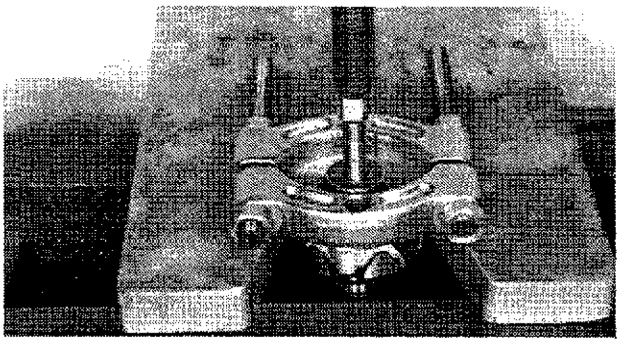
7AL;T87605 T52;1672 6015GV 090185

22. Use a plastic hammer to remove rotor and bearing from front housing.



7AL;T87606 T52;1672 6015GW 080986

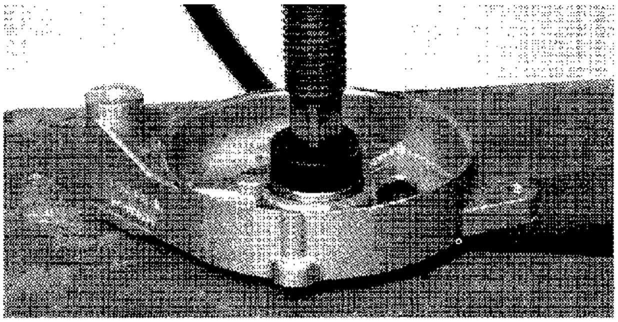
23. Use bearing pulling attachment to remove front bearing.



7AL;T87607 T52;1672 6016GI 090185

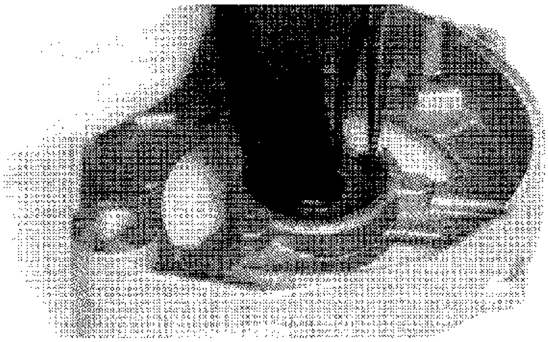
ASSEMBLE ALTERNATOR

1. Use 38 mm driver to install bearing in front housing.



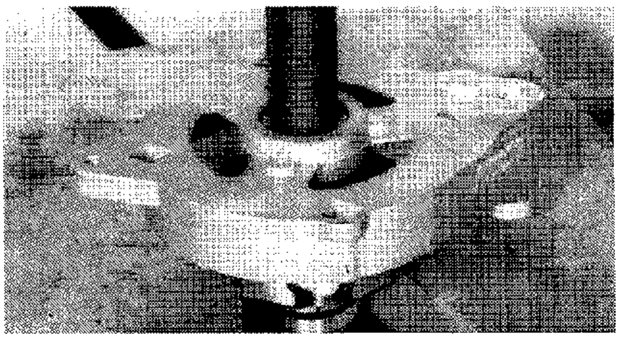
7AL;T87608 T52;1672 6015GX 090185

2. Install bearing retainer.



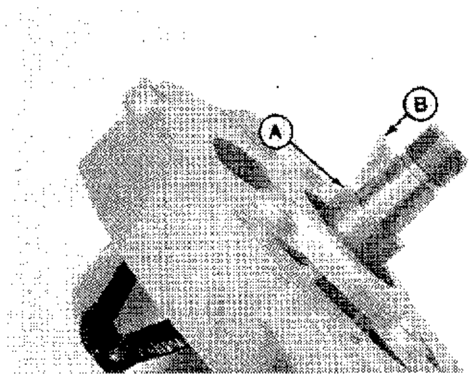
7AL;T87609 T52;1672 112 120583

3. Use hollow driver to install front housing on rotor.



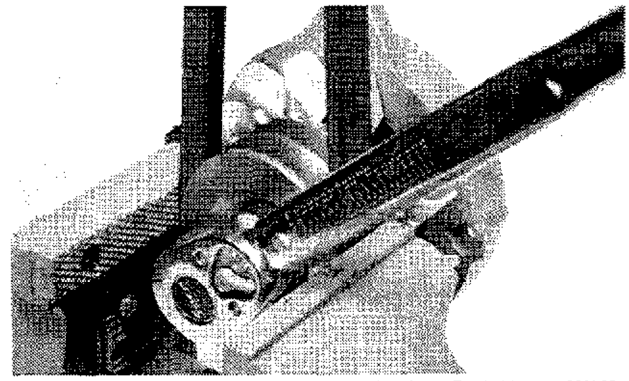
7AL;T87610 T52;1672 6015GY 090185

4. Install spacer (A) and woodruff key (B).



7A_;T89075 T52;1672 114 120583

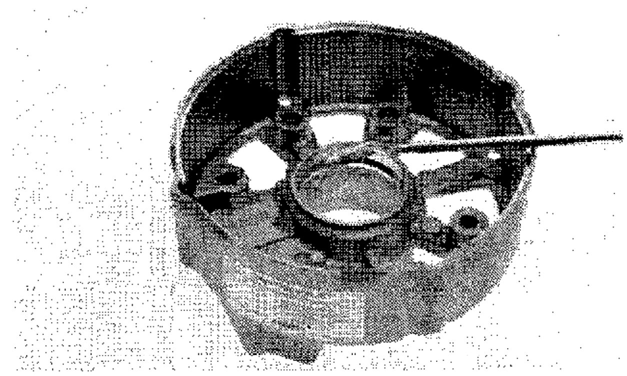
5. Install fan, pulley, lock washer, and hex nut. Tighten nut to 54.2—67.8 N·m (40—50 lb-ft).



7AL;T89076 T52;1672 115 090185

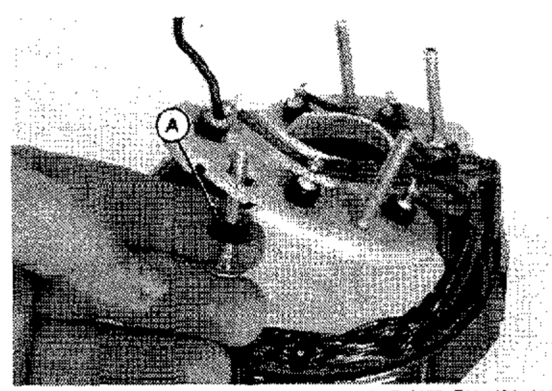
6. Install O-ring. Lubricate the exposed area of the O-ring with hydraulic brake fluid only.

DO NOT use oil.



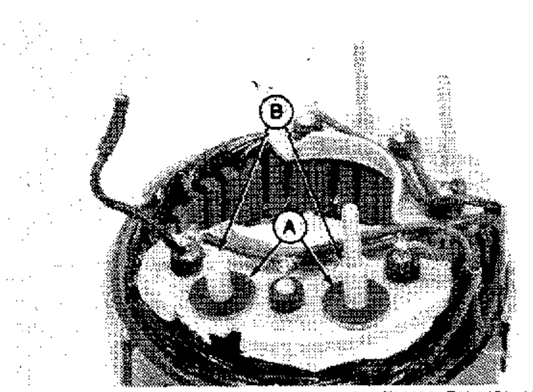
7AL;T6015AJ T52;1672 6016GA 090185

7. Install insulator washer (A) and cap screw.



7AL;T89077 T52;1672 117 120583

8. Install insulator washers (A) and sleeves (B).



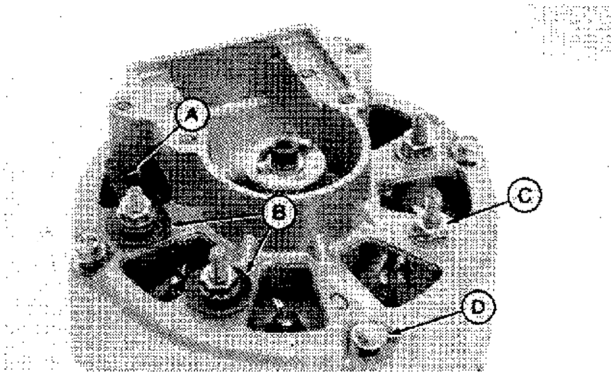
7AL;T89089 T52;1672 118 120583

9. Install rear housing on stator.

10. Install insulating washers (B), wire lead (A) and four nuts (C).

11. Install rear housing and stator on the front housing. Line up screw holes.

12. Install and tighten four screws (D) to 2.8—3.4 N·m (25—30 lb-in.)

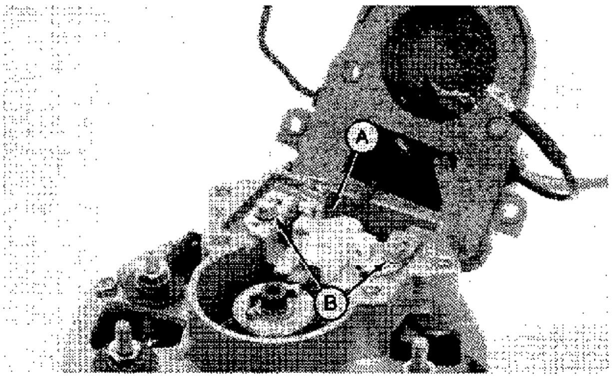


7AL;T6015AR T52;1672 6016GB 090185

13. Install brush assembly.

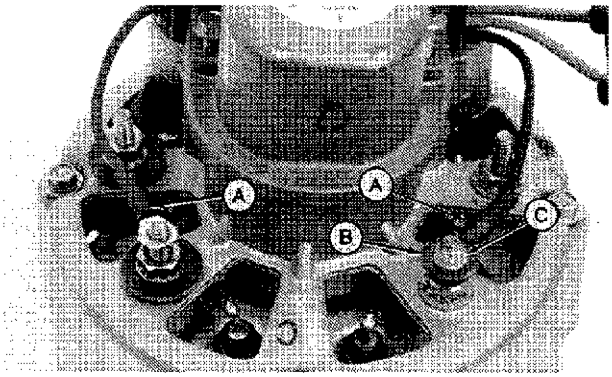
14. Install and tighten screws (B) to 2.3—3.4 N·m (20—30 lb-in.).

15. Connect regulator wire (A) to bush terminal.



7AL;T6015AC T52;1672 6016GC 090185

16. Install regulator wires (A). Install insulator washer (B) and sleeve (C).

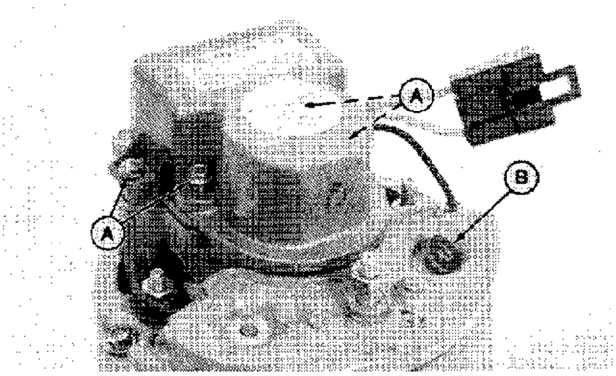


7AL;T6015AT T52;1672 6016GD 090185

17. Install isolation diode plate and insulation washer (B) at negative terminal.

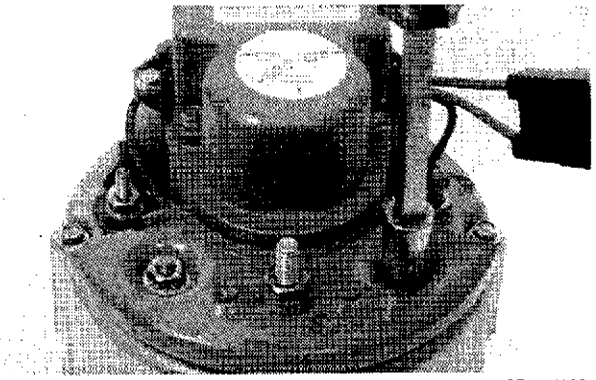
IMPORTANT: The negative terminal post must be isolated from diode plate.

18. Install and tighten alternator cap screws (A).



7AL;TT6015AK T52;1672 6016GE 090185

19. Install and tighten two nuts.



7AL;T6015BI T52;1672 6016GF 090185

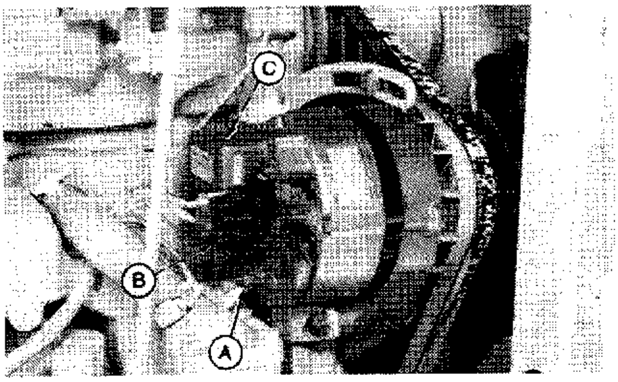
ALTERNATOR OPERATIONAL CHECK

1. If test stand is available, follow the manufacture instructions. If not, install alternator on unit (Group 1672) and test as described in step 2. If readings are not to specification, test alternator in Group 9015-25.

IMPORTANT: When checking for field voltage, grounding voltmeter positive probe to regulator or alternator housing can cause regulator failure.

2. Position the key switch in the following test modes and check voltage at alternator test points.

Test Mode	Test Points		
	Output (A)	Regulator (B)	Field (C)
Key Switch OFF	12	0	0
Key Switch ON	12	2 to 4	1 to 3
Key Switch ON With Engine Running	14.4	15.4	4 to 12



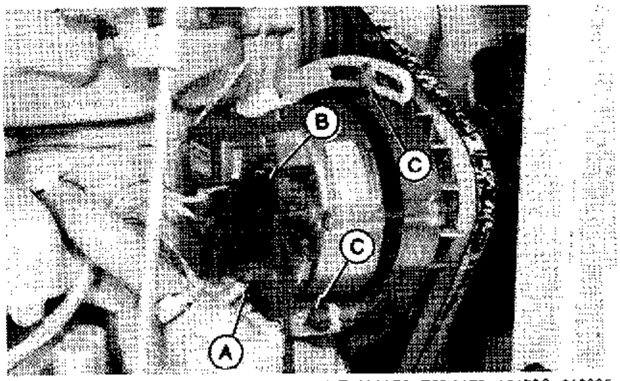
7AL;T6008AP2 T52;1672 6047DB 060285

INSTALL ALTERNATOR

1. Install alternator and screws (C).

2. Install belt on alternator pulley.

3. Connect voltage regulator connector (B) and wire lead (A).

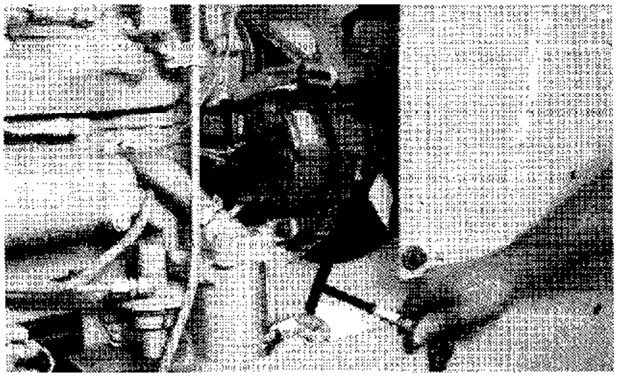


7AL;T6008AP3 T52;1672 6047DC 060285

IMPORTANT: When adjusting belt tension, apply force ONLY on front housing to prevent alternator damage.

4. Adjust belt tension to 19 mm (0.75 in.) deflection with 89N (20 lb force) applied midway between pulleys using belt tension gauge.

5. Tighten mounting cap screws.



7AL;T6010AK1 T52;1672 60490A 060285

Group 1673
LIGHTING SYSTEM

GENERAL INFORMATION

The JD350-C Crawler can be equipped with three lights: two front lights in the grille housing and one rear light on the battery box lid or the canopy rear support.

The crawler is equipped with a series of lights in the gauges on the instrument panel.

The lights are controlled with a light switch on the instrument panel.

The light switch is a push-pull switch. When the switch is pushed in the lights are off and when the switch is pulled out the lights are on.

LIGHTS

Removal

The front lights are removed by removing the front grille screen, disconnecting the wire leads, and removing attaching hardware. The rear light is removed by disconnecting wire leads and removing attaching hardware.

To remove the gauge lights, remove four screws from instrument panel, pull panel from cowl and pull light and socket from rear of gauge.

Repair

The front and rear lights may be disassembled for repair.

The lamp replacement trade number for the front and rear and lights is 4406.

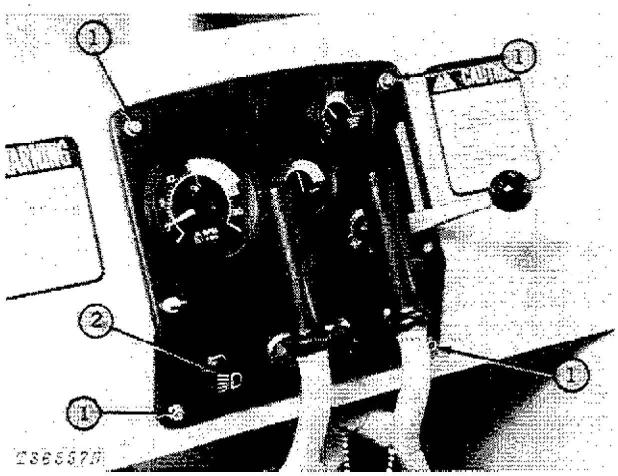
The gauge light replacement trade number is 57X.

Installation

Follow removal procedure in reverse order.

LIGHT SWITCH

Removal



1—Mounting Screws **2—Light Switch**

Fig. 1-Light Switch

Remove four screws from instrument panel. Pull panel from cowl.

Remove wiring from switch.

Remove set screw on switch knob. Remove two special nuts on front of switch. Pull switch out from back of panel.

Repair

The light switch cannot be repaired; it must be replaced if defective.

Test light switch as part of lighting system as described in Section 90, Group 9015.

Installation

Follow removal procedure in reverse order.

Group 1674
WIRING HARNESS AND SWITCHES

GENERAL INFORMATION

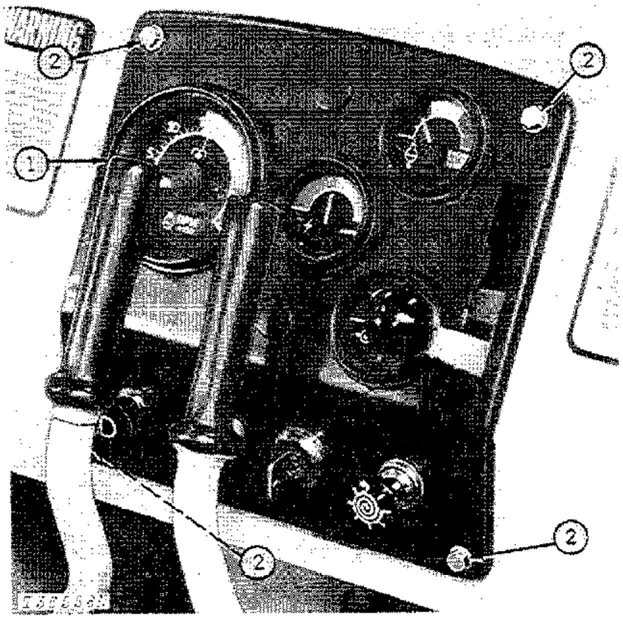
See Section 90, Group 9015 for schematics and complete information on the wiring harnesses.

There is a 20 amp circuit breaker on the rear of the instrument panel used to protect the light circuit. The circuit breaker will trip within one minute with 40 amps.

A battery disconnect switch may be located in the battery box.

LIGHT CIRCUIT BREAKER

Removal



1—Instrument Panel 2—Mounting Screws

Fig. 1-Instrument Panel Removal

Remove four screws from instrument panel. Pull panel from cowl. Disconnect wiring, remove attaching hex nuts and remove circuit breaker.

Repair

The circuit breaker cannot be repaired.

If the circuit breaker trips, turn off power and wait 35 seconds. The circuit breaker should reset itself.

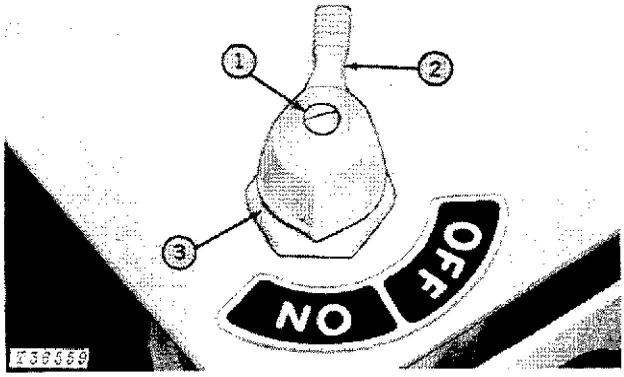
Installation

Follow removal procedure in the reverse order.

BATTERY DISCONNECT

Removal

Remove tool box, tool box tray and tool box tray supports.



1—Screw
2—Lever
3—Hex. Nut

Fig. 2-Battery Disconnect Removal

Disconnect battery ground straps and battery positive cables.

Disconnect two cables from under disconnect switch.

Remove screw from indicator handle and remove handle. Remove hex. nut. Remove operator's seat and remove switch through bottom of battery box.

REPAIR

Test the switch as described in Section 90, Group 9015. Replace the switch if it is found to be defective.

INSTALLATION

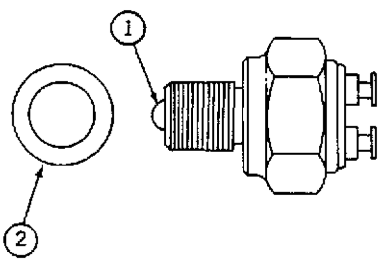
Follow removal procedure in reverse order.

Tighten cable to switch nuts to 96 lb-in (11 N·m).

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 closes when nipple is depressed, thus completing the current path to starter when starting unit.

ADJUSTMENT

To adjust the switch, put the shift lever in neutral.

Install the switch with a minimum of one washer. Add the aluminum washers one at a time until switch continuity is lost.

IMPORTANT: To insure correct adjustment of the switch, tighten the switch to 22 ± 2 lb-ft (30 ± 3 N·m) EACH TIME a washer is added or removed during the adjustment procedure.

Continuity is lost when a test light will not light or an ohmmeter indicates an open circuit, (no ohmmeter needle movement).

When continuity is lost, remove one washer and tighten switch to 22 ± 2 lb-ft (30 ± 3 N·m).

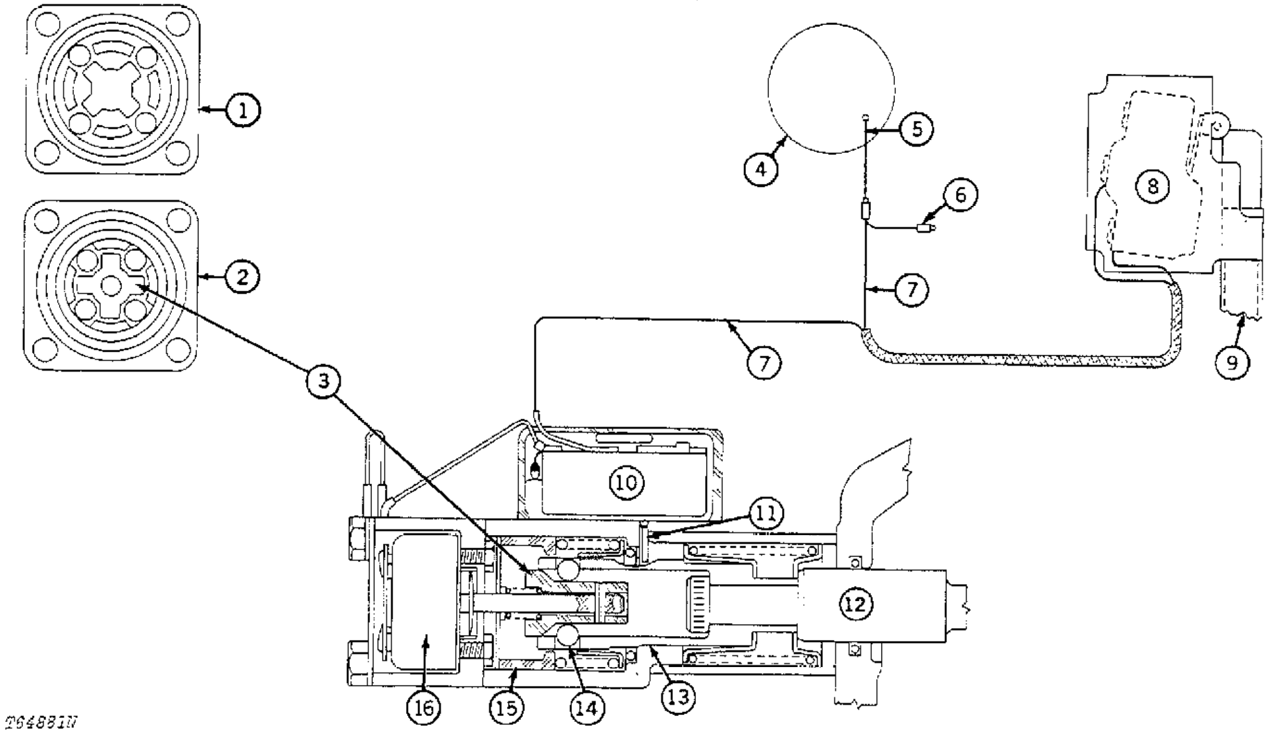
Move the shift lever in and out of gear several times to insure the neutral start switch is closed only in the neutral position.

Connect wire leads to switch.

Group 1675
SYSTEM CONTROLS

RETURN-TO-DIG (-294007)

General Information



1—Detent Position
2—Release Position (Solenoid Energized)
3—Detent Ramp
4—Key Switch
5—Acc. Terminal
6—To Light Switch
7—White Lead
8—Bucket Switch
9—Indicator Rod
10—Spool Switch
11—Activator Pin
12—Bucket Spool
13—Ball Guide
14—Detent Balls
15—Detent Seat
16—Solenoid

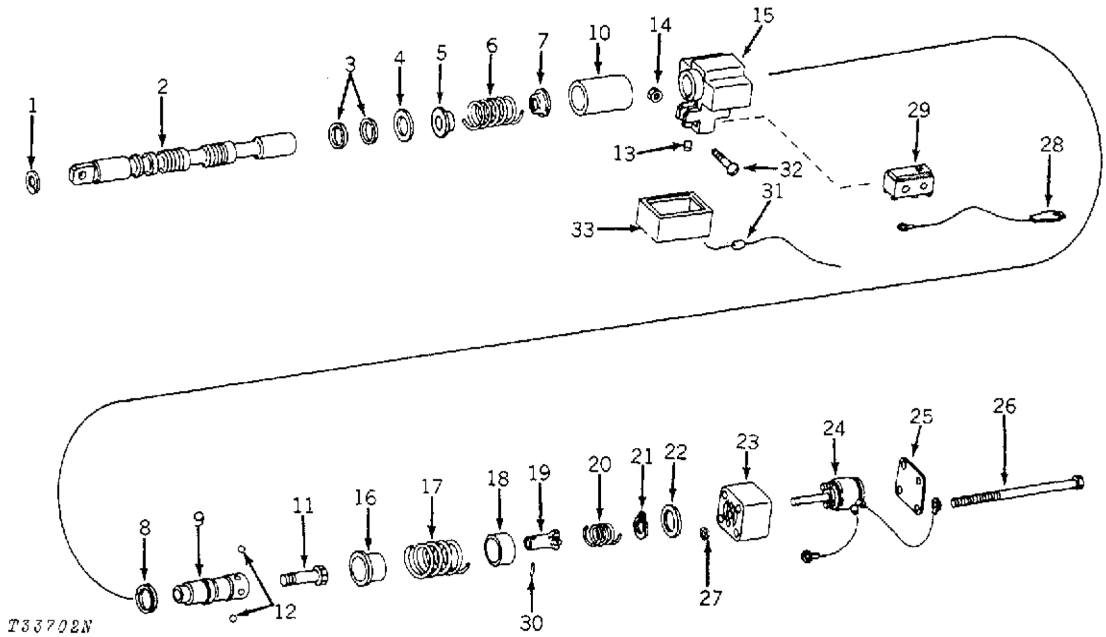
Fig. 1-Return-To-Dig Mechanism (-294007)

When the bucket spool is moved rearward, the ball guide that carries the balls up the detent ramp is also forced rearward allowing the balls to roll between the detent ramp and the detent seat lip. After the balls have passed the detent seat lip, the detent ramp moves forward, locking the balls behind the detent seat.

During the rearward movement of the ball guide, the activator pin moves up and closes the spool switch (detent position). The bucket switch is normally open until closed by the indicator rod.

As the bucket rolls back, the indicator rod hits the bucket switch. This closes the circuit and energizes the solenoid which turns the ball ramp releasing the detent balls. The spool centering spring now returns the spool to the neutral position stopping the bucket at return-to-dig position. With the ball guide in the neutral position, the activator pin moves down and opens the spool switch de-energizing the solenoid.

The spool may be mechanically released from the detent position by manually moving the spool lever forward. As the ball guide moves forward the detent seat is forced forward against spring tension allowing the balls to roll down the detent ramp to a released position.



1—Lock Washer	**9—Ball Guide**	**17—Spring**	**25—Solenoid Cover**
2—Spool	**10—Body Sleeve**	**18—Detent Seat**	**26—Cap Screw (4 used)**
3—Vee-Type Seal (2 used)	**11—Shoulder Screw**	**19—Ball Ramp**	**27—Lock Washer (2 used)**
4—Pilot Ring	**12—Ball (4 used)**	**20—Spring**	**28—Lead Wire**
5—Spring Guide	**13—Needle Roller (2 used)**	**21—Retaining Ring**	**29—Switch**
6—Centering Spring	**14—Nut (2 used)**	**22—Shim**	**30—Groove Pin**
7—Spring Guide	**15—Detent Body**	**23—Solenoid Body**	**31—Semi-conductor**
8—Snap Ring	**16—Spring Retainer**	**24—Rotary Solenoid**	**32—Machine Screw**
			33—Switch Enclosure

Fig. 2-Detent Assembly (-294007)

Removal

The return-to-dig mechanism can be removed from the bucket section of the control valve without removing the control valve.

Completely loosen the cap screws (26, Fig. 2). Rotate the mechanism so the cap screw is on the top to clear the reservoir. Remove the cap screw. Do the same for the remaining cap screws.

Disconnect wiring and remove solenoid assembly. The four steel balls (12) will usually fall from their seat in the ball guide (9) so be careful not to lose them.

The detent body is held loosely in place by the snap ring (8) pushed on to the ball guide. Do not pull the detent body off the ball guide.

Disconnect the bucket control valve linkage at the spool to avoid bending the linkage when removing the remainder of the mechanism.

Use a 1/4 inch hex. wrench to remove the shoulder screw (11). It will be necessary to use a wrench at the front of the valve spool (2) to keep it from turning.

There is a needle roller (13) in the detent body underneath the switch (29). Be careful not to lose the roller.

Remove remainder of mechanism. The pilot ring (4) need not be removed. If it is removed reinstall with chamfered edge toward the solenoid.

Repair

Refer to Section 90, Group 9015 to service the electrical components of the return-to-dig mechanism.

Clean and dry all parts thoroughly and inspect for wear or damage. Check springs for fatigue.

Installation

Refer to Fig. 2 during installation of the mechanism.

Be sure snap ring (8) is on the ball guide (9). Insert the ball guide through the back end of the detent body (15). Set the body sleeve (10) on the detent body. Insert the spring guide (7), spring (6), and spring guide (5) into the body sleeve. Attach this portion of the mechanism to the valve spool (2) with the shoulder screw (11). Tighten securely.

Grease the four balls (12) with heavy grease so they will remain in place when installed. It is helpful to insert the balls in the ball guide by turning the valve spool so the holes in the ball guide are on the bottom when inserting the balls.

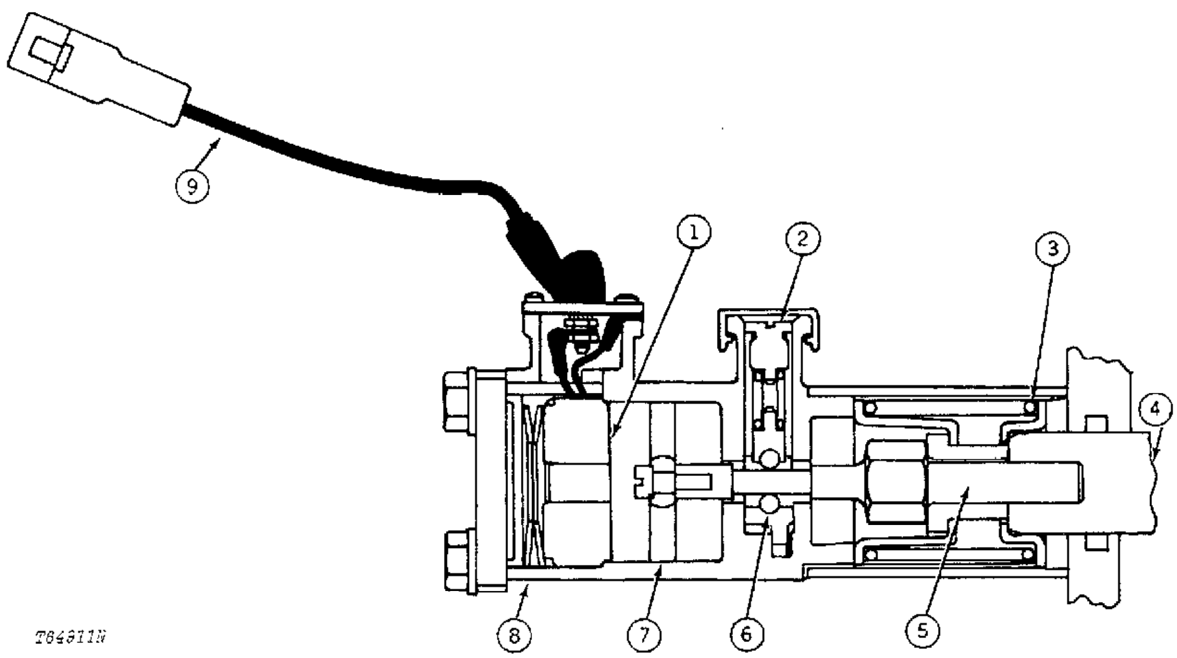
NOTE: When making the electrical connections be sure to connect the black end of the semi-conductor (31) to the terminal side of the switch (29).

The shim (22) fits in the bore of the detent body. Be sure it is properly installed or the assembly will not go together correctly. It is helpful to use grease to hold it in place against the detent seat a bit on the high side of dead center. Snug up the cap screws and push the shim down so it will fit in the detent cap when the cap screws are tightened.

When installing the remainder of the mechanism be sure the flat surface of the detent seat (18) rests against the spring (17). Be careful not to unseat the balls from the ball guide during installation. To get the retaining cap screws in place rotate the mechanism the same as for removal.

RETURN-TO-DIG (294008-)

General Information



1—Electro-Magnet
2—Feel Screw
3—Centering Spring
4—Spool
5—Stud
6—Steel Ball (2 used)
7—Electro-Magnetic Armature
8—Bonnet
9—Wire Lead (Neutral color)

Fig. 3-Return-to-Dig Mechanism (294008-)

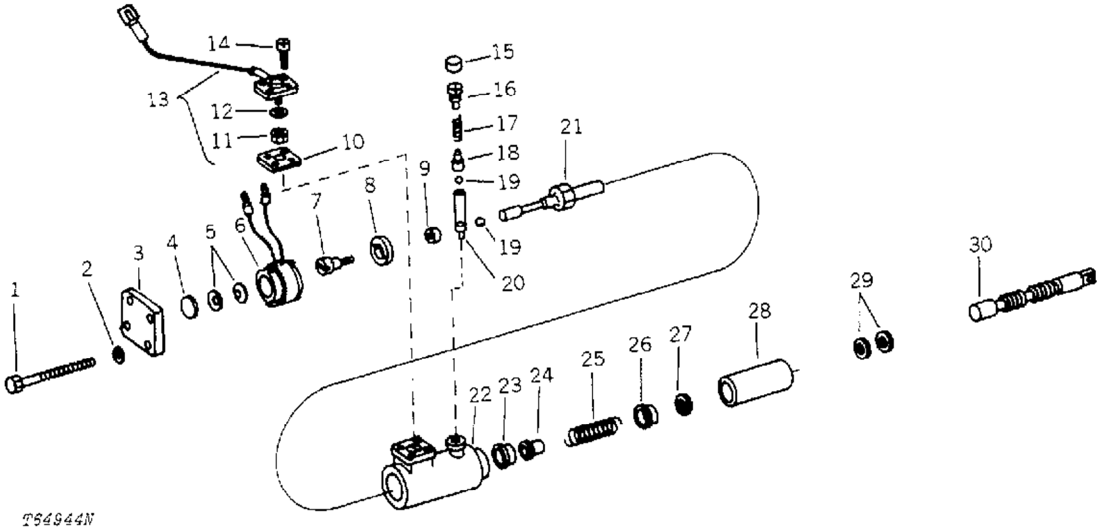
When the spool (4, Fig. 3) is moved rearward, the electro-magnetic armature (7), through the stud (5), is moved rearward also.

As long as the indicator rod is not contacting the return-to-dig switch, the electro-magnet (1) is energized through the normally closed return-to-dig switch. The energized electro-magnet holds the electro-magnetic armature which, through the stud, holds the spool in the bucket roll back position.

As the bucket rolls back, the indicator rod hits the return-to-dig switch roller. This opens the electro-magnet circuit de-energizing the electro-magnet. The valve spool is then returned to the neutral position by the centering spring (3).

The valve spool can manually be returned to the neutral position by overcoming the magnetic force of the electro-magnet.

Removal



1—Cap Screw (4 used)
2—Washer (4 used)
3—Bonnet Cap
4—Cap Guide
5—Spring (2 used)
6—Electro-Magnet
7—Shoulder Screw
8—Electro-Magnetic Armature
9—Alignment Washer
10—Flange Gasket
11—Nut (4 used)
12—Special Washer (4 used)
13—Connector Assembly
14—Screw (4 used)
15—Adjustment Cap
16—Feel Screw
17—Compression Spring
18—Ball Follower
19—Steel Ball (2 used)
20—Ball Holder Sleeve
21—Stud
22—Bonnet
23—Spring Guide
24—Stud Guide
25—Centering Spring
26—Spring Guide
27—Pilot Ring
28—Body Sleeve
29—V-Type Seal (2 used)
30—Regenerative Valve Spool

Fig. 4-Detent Assembly (294008-)

The return-to-dig mechanism can be removed from the bucket section (regenerative) of the control valve without removing the control valve.

Refer to Group 3160 to remove the control valve.

Disconnect wire lead (9, Fig. 3) from harness.

Remove four screws (14, Fig. 4) from connector assembly (13) and disconnect lead from terminal in connector assembly.

Remove four cap screws (1) holding detent assembly to the valve.

Remove bonnet cap (3) cap guide (4) springs (5) and electro-magnet (6).

Remove shoulder screw (7) and electro-magnetic armature (8).

Pull remaining detent assembly off valve.

Two steel balls (19) can fall out as the assembly is removed. Be careful not to lose them.

NOTE: Remove stud (21) to service the stud guide (24), spring guides (23 and 26), pilot ring (27) and centering spring (25).

Repair

Refer to Group 9015 to test the electro-magnet.

Examine all other parts for damage and replace as necessary.

Note the following during reassembly.

Centering spring free length must be 2.75 inches (70 mm).

Apply medium strength John Deere Loctite, or an equivalent, to the stud (21, Fig. 4) and tighten to 6 to 8 lb-ft (8 to 11 Nm) (0.8 to 1.1 kg-m).

NOTE: Hold front of valve spool (30, Fig. 4) (where linkage is connected) with a wrench while tightening stud (21) to prevent spool from turning.

Apply John Deere Multipurpose Grease, or an equivalent, to the ball holder sleeve (20, Fig. 4) outside diameter and to the ball follower (18) and steel balls (19).

Apply medium strength John Deere Loctite, or an equivalent, to the shoulder screw and tighten to 18 to 22 lb-in (2 to 4 Nm) (0.21 to 0.25 kg-m).

Installation

Reverse removal procedure to install detent assembly.

Tighten cap screws (1, Fig. 4) to 6 to 8 lb-ft (8 to 11 Nm) (0.8 to 1.1 kg-m).

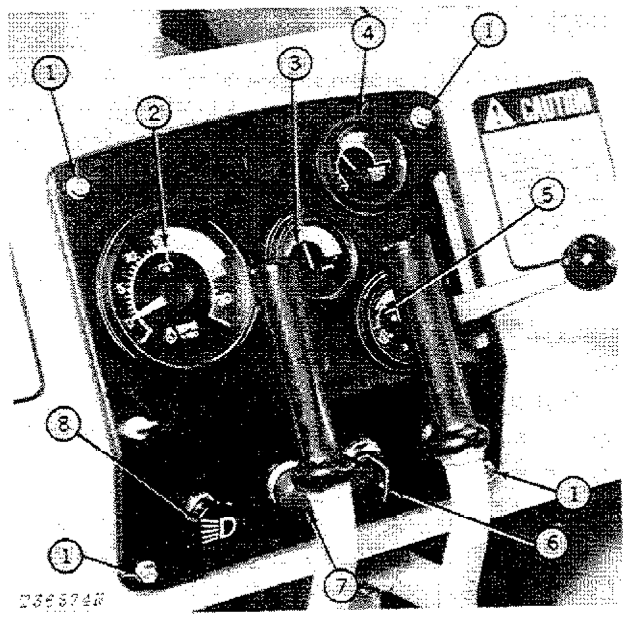
Group 1676
INSTRUMENTS AND INDICATORS

GENERAL INFORMATION

There are both mechanical and electrical instruments and indicators used on the JD350-C Crawler.

The tachometer and the air restriction indicator are mechanical instruments.

The engine oil pressure gauge and sender, engine water temperature gauge and sender, ammeter, hour-meter, and hydraulic filter restriction indicator are electrical instruments and indicators.



1—Mounting Screws
2—Tachometer
3—Ammeter
4—Engine Water Temperature Gauge
5—Engine Oil Pressure Gauge
6—Key Switch
7—Start Switch
8—Light Switch

Fig. 1-Instrument Panel

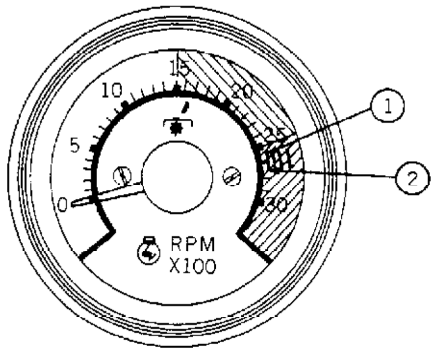
The engine oil pressure sender is located in the engine block, the engine water temperature sender is located in the cylinder head, the hydraulic filter restriction switch is located in the filter base and the hour-meter is located on a panel under the seat. The remaining instruments and indicators are located in the instrument panel.

MECHANICAL INSTRUMENTS AND INDICATORS

General Information

Tachometer

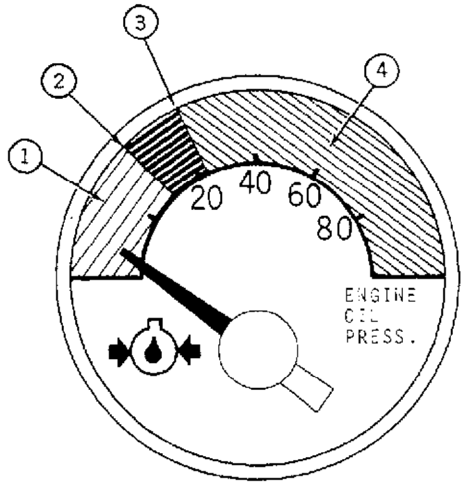
The tachometer indicates engine rpm (0-3000 rpm) by means of a cable attached to the tachometer and to the engine flywheel housing and is driven by a gear on the camshaft.



1—2500 rpm
2—2700 rpm

Fig. 2-Tachometer

Engine Oil Pressure Gauge (343541-)



T34792N

1—Red-Orange
2—10 PSI (69 kPa) (0.7 bar)
3—25 PSI (172 kPa) (1.7 bar)
4—Light Green

Fig. 3-Engine Oil Pressure Gauge

An oil filled tube leads from the engine oil pressure gauge to the engine block. The oil pressure in this tube will be sensed by the gauge and indicated on the gauge face.

The gauge indicates pressure from 0 psi to 80 psi (0 to 552 kPa) (0 to 5.5 bar). The normal operating range is indicated by the green area on the gauge face (25 psi to 80 psi [172 to 552 kPa] [1.7 to 5.5 bar]).

Air Restriction Indicator

The air restriction indicator is located on the cowl under the instrument panel. The indicator is connected to the air cleaner by a hose.

If the air cleaner is restricted the indicator will show red.

Removal

To remove the tachometer, remove four screws from instrument panel. Pull panel from cowl. Remove cable from back of tachometer, remove gauge light and hex nuts and pull tachometer from front of instrument panel.

To remove the air restriction indicator, unscrew from adapter.

To remove the engine oil pressure gauge, remove four screws from instrument panel. Pull panel from cowl. Remove gauge light and hex nuts, disconnect sending tube and pull gauge from front of instrument panel.

Repair

The tachometer, engine oil pressure gauge and the air restriction indicator are not repairable.

Test the tachometer by using the master tachometer to check engine speeds as described in Section 90, Group 9010.

To check the engine oil pressure gauge, disconnect the sending tube from the engine block. Connect a calibrated oil pressure gauge to the engine block.

If the calibrated gauge reads a different pressure from the gauge on the unit, remove the gauge from the panel and replace it.

Test the air restriction indicator as described in Section 90, Group 9010.

Installation

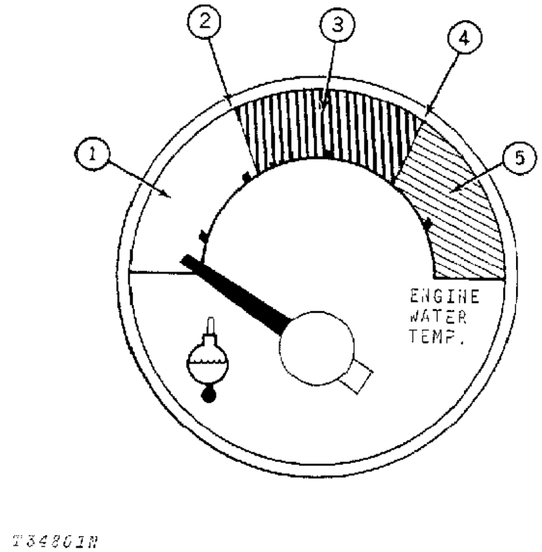
Follow removal procedure in the reverse order.

To connect tube to the engine oil pressure gauge, insert tube in fitting until it bottoms and tighten nut one full turn past finger tight.

ELECTRICAL INSTRUMENTS AND INDICATORS

General Information

Engine Water Temperature Gauge



1—Black
2—160°F (71.1°C)
3—Light Green
4—224°F (106.7°C)
5—Red-Orange

Fig. 4-Engine Water Temperature Gauge

The engine water temperature gauge measures engine coolant temperature.

The gauge indicates temperatures from 100 to 280°F (38 to 138°C). The normal operating range is indicated by the light green area on the gauge face (160 to 224°F [71 to 107°C]).

Hourmeter

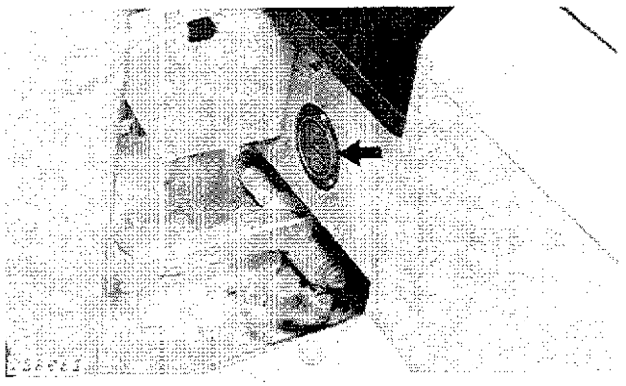
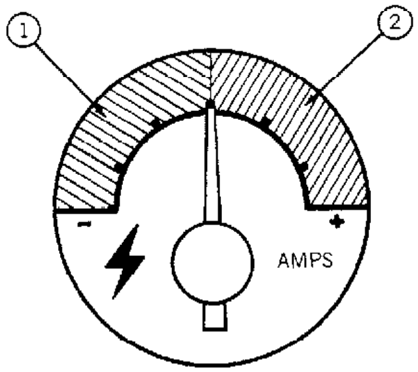


Fig. 5-Hourmeter

The hourmeter is an electrically energized clock which records the number of hours the engine is operated. Starting and stopping of the clock is controlled by the key switch ignition terminal.

The negative terminal of the hourmeter is connected to the hourmeter case and the case is grounded to the machine and therefore a separate ground wire is not needed.

Ammeter (-343540)



T36576N

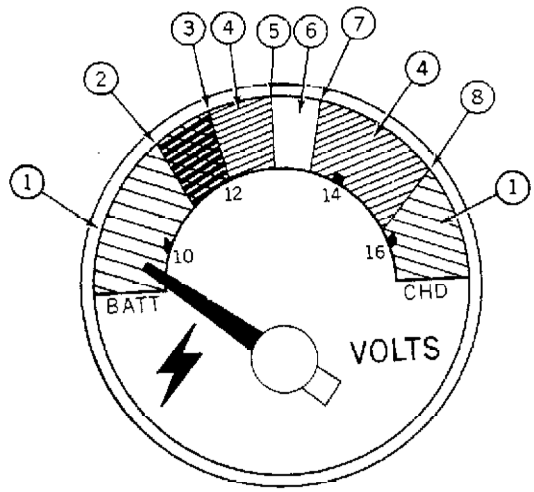
1—Orange 2—Light Green

Fig. 6-Ammeter

When the engine is started, the ammeter should show a high charging rate, then gradually fall back to the middle of the ammeter as the batteries become charged.

If the ammeter shows consistently high charging rates or is discharging while the engine runs, it indicates either a faulty battery, alternator, regulator or improper wiring. If the machine has just been repaired, check the wiring with the wiring schematic in Section 90, Group 9015. To test the alternator and regulator, see Section 90, Group 9015.

Voltmeter (343541-)



T34800N

1—Orange
2—11.2 Volts
3—12.0 Volts
4—Light Green
5—12.8 Volts
6—Black
7—13.4 Volts
8—15.5 Volts

Fig. 7-Voltmeter

The voltmeter is connected in parallel between the engine water temperature gauge "I" terminal and the transmission oil temperature gauge "I" terminal.

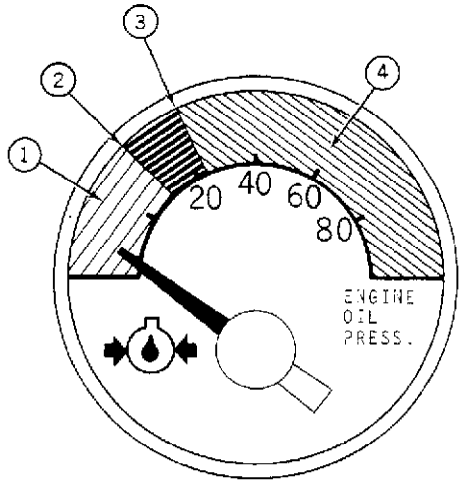
The voltmeter will measure the voltage of the electrical system when the key switch is in the "IGN" or "ACC" position.

With the key switch in the "IGN" or "ACC" position and the engine not running, the pointer should be between 12.0 and 12.8 volts (light green zone). If the pointer is below 12.0 volts (red-orange zone) low battery voltage or electrical system malfunction is indicated.

With the engine cranking, the indicator will register the lowest point on the gauge.

When the engine is running, the pointer should be between 13.4 to 15.5 volts (light green zone). If the pointer is consistently above 15.5 volts (black zone) an electrical system malfunction is indicated.

Engine Oil Pressure Gauge (-343540)



T34793N

1—Red-Orange
2—10 PSI (69 kPa) (0.7 bar)
3—25 PSI (172 kPa) (1.7 bar)
4—Light Green

Fig. 8-Engine Oil Pressure Gauge

The gauge indicates engine oil pressure from 0 psi to 80 psi (0 to 6 kg/cm²). The normal operating range is indicated by the green area on the gauge face (25 psi to 80 psi [2 to 6 kg/cm²]).

The gauge sending wire is connected to a sending unit located at the rear of the engine on the right hand side.

Removal

To remove the gauges, remove four screws from instrument panel and pull panel from cowl.

Disconnect wires from gauge. Remove hex nuts and pull gauge from front of panel.

To remove the hydraulic filter restriction indicator, disconnect the wire lead and remove the bulb from the rear of the socket.

Repair

The gauges and switches cannot be repaired. Test any switch suspected of being defective following instructions in Section 90, Group 9015.

The lamp replacement trade number for the hydraulic filter restriction indicator is 1895R.

Installation

Follow removal procedure in the reverse order.

Group 1699
SPECIFICATIONS AND SPECIAL TOOLS
BATTERIES, SUPPORTS AND CABLES
SPECIFICATIONS AND TORQUE VALUES

Battery ground .... Negative
Full charge specific gravity (corrected for 80°F [27°C] electrode temperature) 1.260
Maximum variation between cells during specific gravity test (specific gravity points) 0.050
High-rate discharge test (minimum reading) .... 9.0 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)
12	AT29160	30H	570	450	180

ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING
SPECIFICATIONS AND TORQUE VALUES

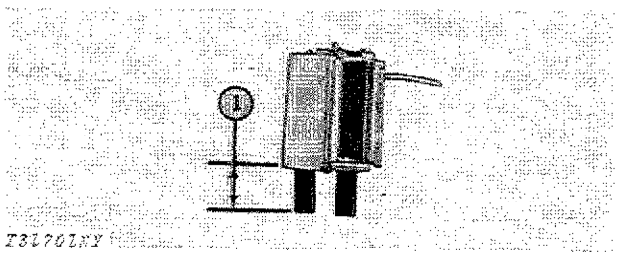


Fig. 1-Brush Length

Rating .... 12 volts, 22 amps
Ground .... Negative
Stator Winding .... Wye

1 - Brush minimum length beyond holder .... 1/4-inch (6 mm)

ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING

SPECIFICATIONS AND TORQUE VALUES—Continued

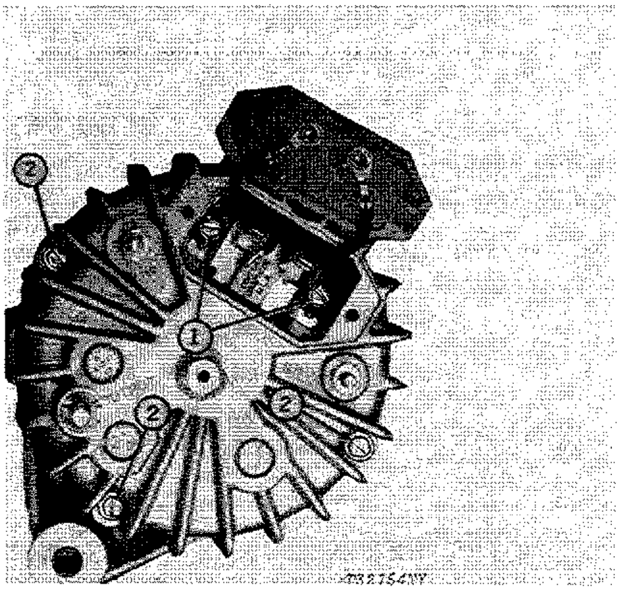


Fig. 2-Brush Screws and Through Bolts

(-719786)

1 - Brush screws .... 16 to 20 lb-in (0.18 to 0.22 kg-m)

2 - Through bolts .... 50 to 60 lb-in (0.6 to 0.7 kg-m)

(719787-) and 350D, 355D

Brush holder screws .... 20-30 lb-in (2.8-3.4 N·m)

Housing cap screws .... 25-30 lb-in (2.8-3.4 N·m)

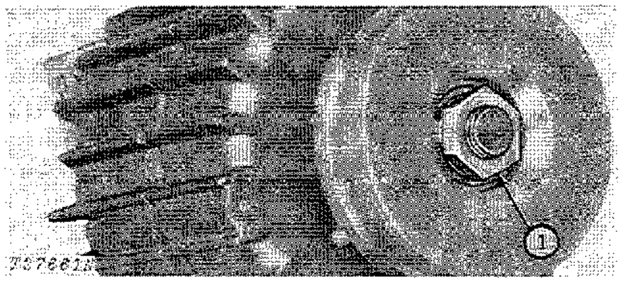


Fig. 3-Pulley Nut

(-719786)

1 - Pulley nut .... 35 to 50 lb-ft (5 to 7 kg-m)

(719787-) and 350D, 355D

Pulley nut .... 40-50 lb-ft (54-68 N·m)

LIGHTING SYSTEM

SPECIFICATIONS AND TORQUE VALUES

Front and rear lights lamp replacement trade number 4406

Gauge lights lamp replacement trade number 57X

WIRING HARNESS AND SWITCHES

SPECIFICATIONS AND TORQUE VALUES

Circuit breaker 20 amps
Amps to trip circuit breaker . . . . 40 amps for one minute
Reset time . . . . 35 seconds
Neutral Start Switch
Torque . . . . 22 ± 2 lb-ft (30 ± 3 N·m)

SYSTEM CONTROLS

SPECIFICATIONS AND TORQUE VALUES

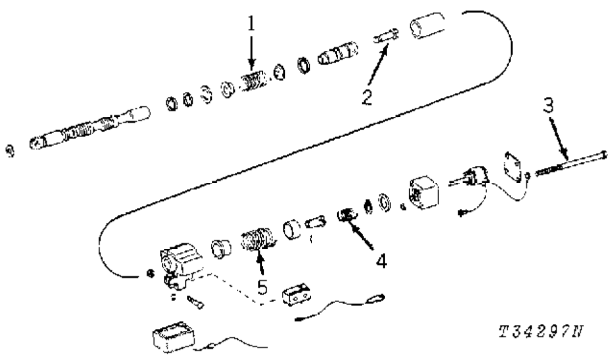


Fig. 4-Return-To-Dig Assembly (-294007)

Return-to-Dig Assembly (-294007)

1 - Spool spring test length . . . . . 1.37 in. (34.8 mm) with 52 lbs. (23.6 kg)

2 - Spool screw torque . . . . 30 lb-ft (4.1 kg-m)

3 - Solenoid screw torque . . . . 15 lb-ft (2.1 kg-m)

4 - Detent seat spring test length . . . . 0.69 in. (1.75 mm) with 84 lbs. (38.1 kg)

5 - Detent ramp spring . . . . 0.56 in. (1.42 mm) with 35 lbs. (15.9 kg)

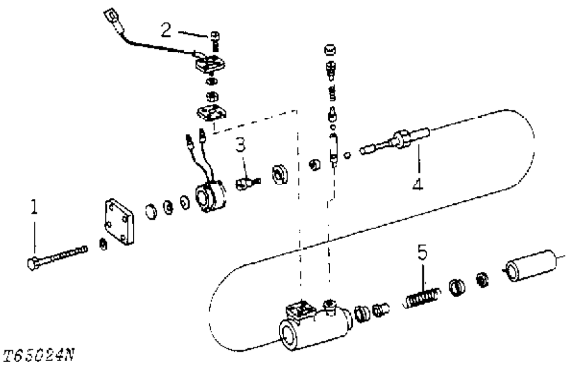


Fig. 5-Return-To-Dig Assembly (294008-)

Return-to-Dig Assembly (294008-)

1 - Mounting cap screw torque . . . . 6 to 8 lb-ft (0.8 to 1.1 kg-m)

2 - Connector assy. screw . . . . 4 to 5 lb-in (0.05 to 0.06 kg-m)

3 - Shoulder screw torque . Apply Medium Strength John Deere Locktite, or an equivalent. . . . 18 to 22 lb-in (0.21 to 0.25 kg-m)

4 - Stud screw torque . . . . . Apply Medium Strength John Deere Locktite or an equivalent. . . . 6 to 8 lb-ft (0.8 to 1.1 kg-m)

5 - Centering spring free length . . . . 2.75 in. (70 mm)

INSTRUMENTS AND INDICATORS

SPECIFICATIONS AND TORQUE VALUES

Tachometer
Range .... 0 to 3000 rpm

Engine Water Temperature Gauge
Gauge Range.................. 100°F to 280°F (38°C to 138°C)
Normal Operating Range .... 160°F to 224°F (71°C to 107°C)

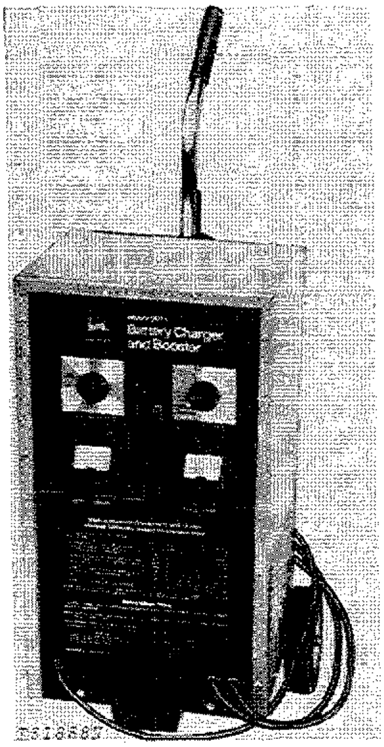
Engine Oil Pressure Gauge
Gauge Range........................ 0 to 80 psi (0 to $6\ kg/cm^2$)
Normal Operating Range .... 25 to 80 psi (2 to $6\ kg/cm^2$)

Cable to battery switch
disconnect nuts .... 96 lb-in (11 N·m)

BATTERIES, SUPPORTS AND CABLES

SPECIAL TOOLS

Convenience Tools

Tool	Tool No.	Use
	TY-1337 (10 amp) TY-5104 (15 amp) TY-5105 (30 amp) TY-5106 (100 amp)	To charge battery and to use as a booster to start engine.

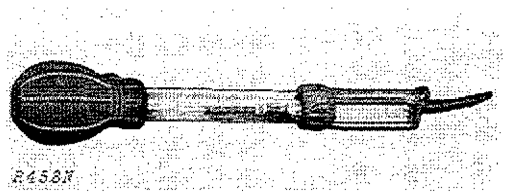
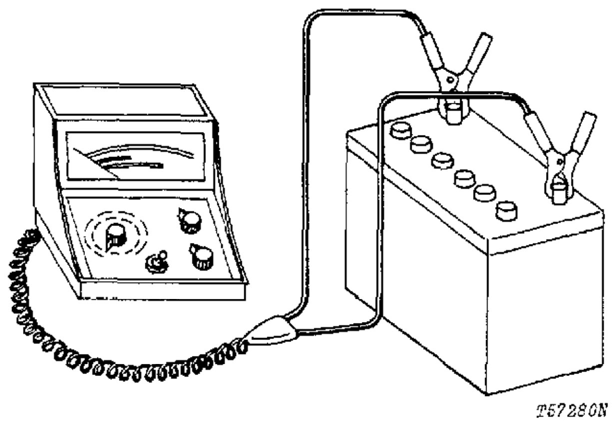
T31858N

Fig. 6-Battery Charger

BATTERIES, SUPPORTS AND CABLES

SPECIAL TOOLS—Continued

Convenience Tools

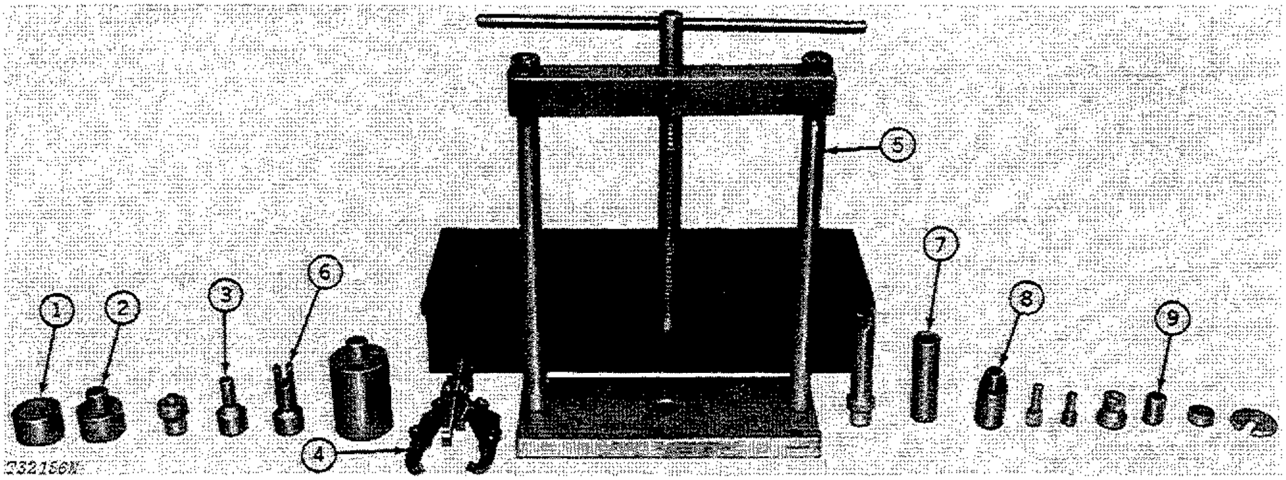
Tool	Tool Number	Use
 Fig. 7-Hydrometer	------	Check specific gravity
 Fig. 8-Battery Tester	D-24001 MO	To check battery internal condition

ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING

SPECIAL TOOLS

Essential Tools
(-719786)

Tool **Tool Number** **Use**



T32156N

Fig. 9-A200JD Alternator Service Tool Set

1 - A-203*....To install front bearing
2 - A-208*....To install rotor and rear bearing
3 - A-213*....To remove negative diodes
4 - A-216*....Remove front and rear bearings
5 - A-201*....To install front bearing
6 - A-214*....To install diodes
7 - A-209* To install rotor
8 - A-206*....To remove positive diodes and install rear bearing
9 - A-205*....To install rotor

**Tools are part of A200JD Alternator Service Tool Set and cannot be purchased individually.*

SERVICE EQUIPMENT AND TOOLS (719787—)

NOTE: Order tools from your SERVICE-GARD™ Catalog. Some tools may be available from a local supplier.

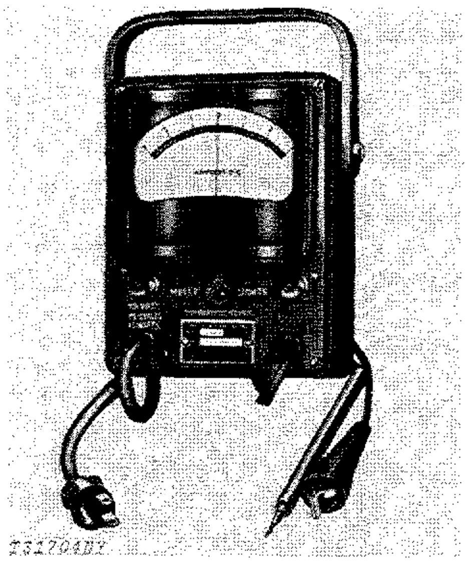
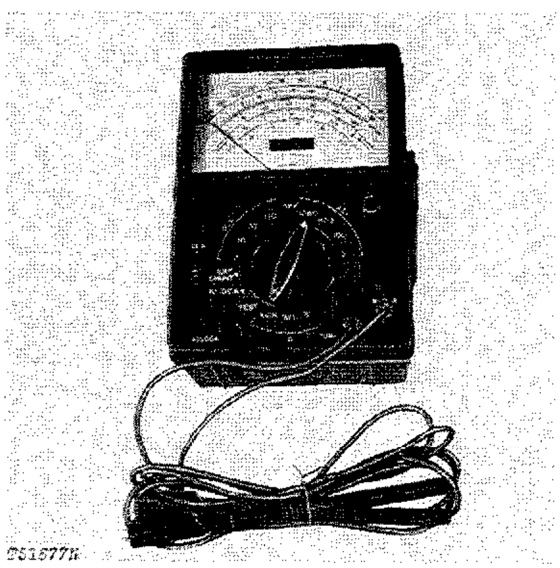
Name	Use
17½-Ton Puller Set	Remove bearings.
Digital Volt-Ohm-Amp Meter	Check resistance and continuity.
Hollow Bearing Driver	Drive bearing on shaft.
O-Ring Seal Tool Set	Remove O-rings.
Belt Tension Gauge	Measure belt tension.
Slide Hammer Puller	Remove bearings.
Bearing Pulling Attachment	Remove bearings.
38 mm Driver	Install bearings.

T52;1672 K2 100986

ALTERNATOR, REGULATOR AND CHARGING SYSTEM WIRING

SPECIAL TOOLS—Continued

Convenience Tools

Tool	Tool Number	Use
 T31704NY *Fig. 10-Alternator Diode Tester*	-----	To test diodes
 T51877N *Fig. 11-Voltmeter, Ohmmeter, Ammeter*	D-19001 TT	To test brushes, rotor, stator and diodes.

Section 17
FRAME, CHASSIS, OR SUPPORTING STRUCTURE

CONTENTS OF THIS SECTION

Group 1741
ENGINE OR MAIN FRAME

REMOVAL

Use the following steps to remove side frames:

1. Remove loader as directed in Section 31, Group 3140 or remove inside dozer mounting frames as directed in Section 32, Group 3241.

2. Remove bottom guards as directed on Page 1746-1.

3. Remove grille housing as directed in Section 19, Group 1921.

4. Place jack under engine and transmission to take weight off side frame and front crossbar before removing side frame-to-clutch housing cap screws.

5. Remove cap screws attaching side frame to steering clutch housing, front crossbar and transmission case.

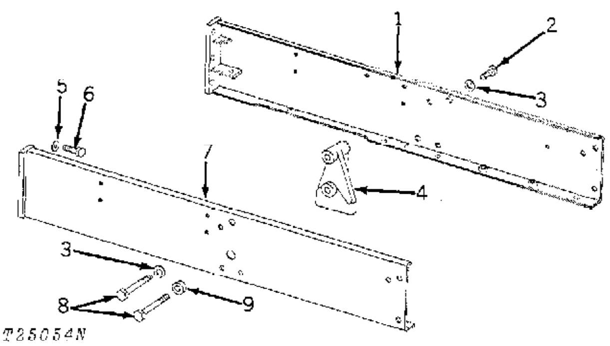
6. Remove canopy as directed in Section 18, Group 1810 or support canopy with hoist while removing side frames.

7. Remove side frame by shifting it forward and raising the side frame when the notch in the lower flange of the side frame is in line with the attaching boss on the transmission case.

NOTE: If you have difficulty removing the right side frame, check for interference with hydraulic lines. Move or disconnect these lines if necessary.

REPAIR

Refer to Fig. 1 during disassembly and assembly.



1—L.H. Side Frame
2—Cap Screw
3—Special Washer (2 used)
4—R.H. Side Frame Spacer
5—Special Washer (6 used)
6—Cap Screw (6 used)
7—R.H. Side Frame
8—Cap Screw (2 used)
9—Spacer

INSTALLATION

Reverse removal procedure to install side frames.

Note the following during installation: Tighten side frame-to-steering clutch housing cap screws (6) to 250 lb-ft (35 kg-m) prior to tightening side frame-to-engine clutch housing cap screws (8).

Group 1746
FRAME BOTTOM GUARDS

GENERAL INFORMATION

Front and rear bottom guards protect unit components from damage, dirt and contamination during operation. Short or regular length rear bottom guards are available.

REMOVAL

Place jack under bottom guards.

Remove drawbar (if necessary) as directed in Section 15, Group 1511.

Remove attaching cap screws (Fig. 1). Lower jack and slide bottom guards out the back of the unit.

REPAIR

Inspect parts for damage and replace if necessary.

Refer to Fig. 1 for disassembly and assembly of the bottom guards.

INSTALLATION

Raise loader and block up boom and bucket.

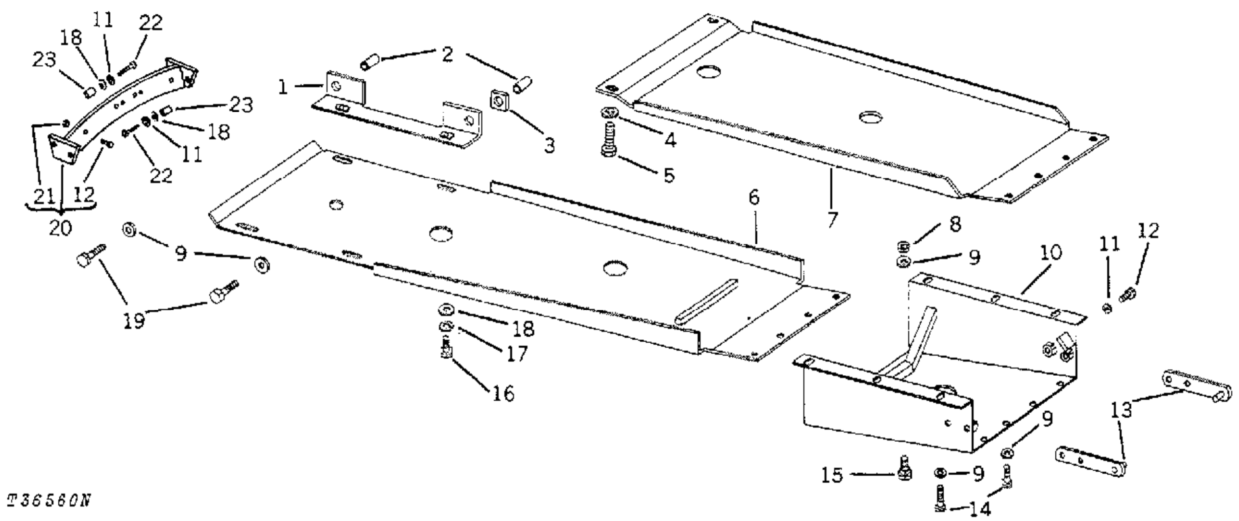
Place jack under bottom guards and slide under unit from the front.

Position bottom guards to align cap screws with attaching holes.

Install front cap screws, then install rear cap screws. Tighten to standard torque.

Install drawbar if removed.

Remove jack.



1—Rear Bracket
2—Hollow Dowel (4 used)
3—Spacer (2 used)
4—Special Washer (2 used)
5—Cap Screw (2 used)
6—Regular Rear Bottom Guard
7—Short Rear Bottom Guard
8—Nut (4 used)
9—Special Washer (8 used)
10—Front Bottom Guard
11—Lock Washer (8 used)
12—Cap Screw (6 used)
13—Pivot Strap (2 used)
14—Cap Screw (9 used)
15—Carriage Bolt (4 used)
16—Cap Screw (4 used)
17—Lock Washer (4 used)
18—Special Washer (4 used)
19—Cap Screw (4 used)
20—Drawbar Segment
21—Nut (2 used)
22—Cap Screw (4 used)
23—Hollow Dowel (4 used)

Fig. 1-Bottom Guards

Group 1749
CHASSIS WEIGHTS

GENERAL INFORMATION

Sprocket, rear and bottom counterweights are used to balance weight distribution on the unit. Rear and bottom counterweights are used when no rear equipment is attached.

The stationary drawbar is attached to the bottom counterweight.

The sprocket weight is used on the loader only. The bulldozer is equipped with a sprocket shield.

SPROCKET COUNTERWEIGHT

Removal

Use a lifting tool as shown in Fig. 1 to remove sprocket counterweight. See Group 1799 for directions on making the tool.

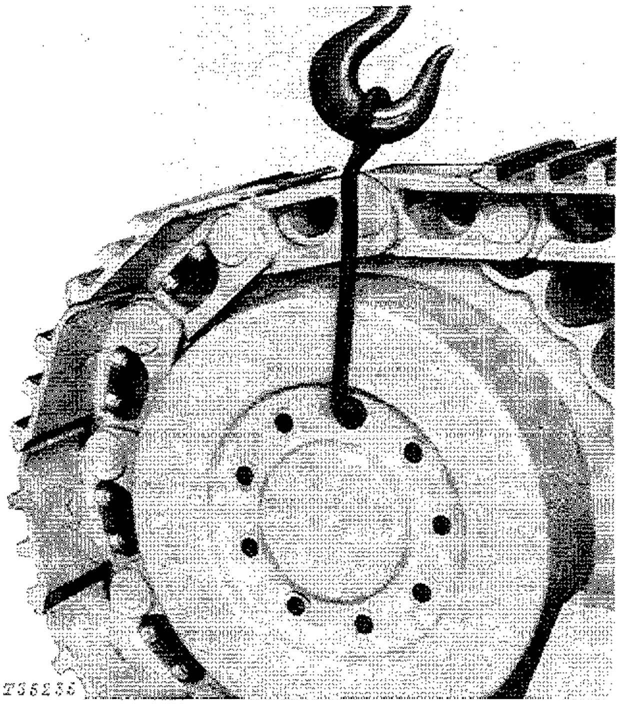
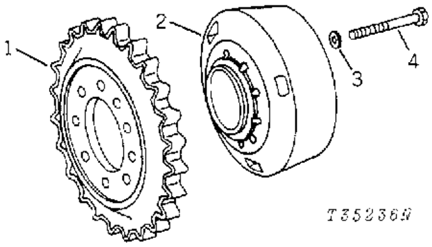


Fig. 1-Sprocket Counterweight Removal

Repair

Examine parts for damage and replace if necessary.

Refer to Fig. 2 during disassembly and assembly.



1—Sprocket (2 used)
2—Sprocket Counterweight (2 used)
3—Special Washer (18 used)
4—Cap Screw (18 used)

Fig. 2-Sprocket Counterweight

Installation

Use lifting tool as shown in Fig. 1 for installation. Tighten cap screws to standard torque.

REAR COUNTERWEIGHT

Removal

Remove top two cap screws from counterweight and replace with eyebolts.

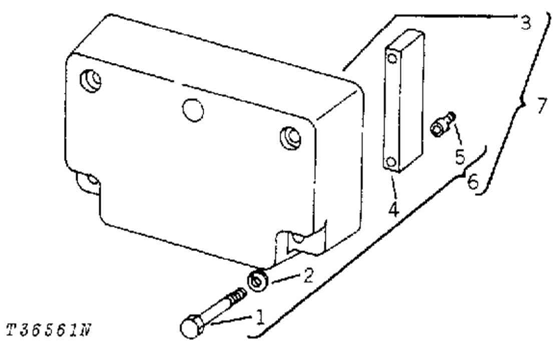
Attach chain hoist to eyebolts.

Remove bottom cap screws and lower counterweight to the ground.

Repair

Examine parts for damage and replace if necessary.

Refer to Fig. 3 during disassembly and assembly.



1—Bolt (4 used)
2—Special Washer (4 used)
3—Counterweight
4—Spacer (2 used)
5—Set Screw (2 used)
6—Counterweight Hardware
7—Counterweight (with multi-purpose bucket or log fork)

Fig. 3-Rear Counterweight

Installation

Use reverse of removal procedure for installation.

BOTTOM COUNTERWEIGHT

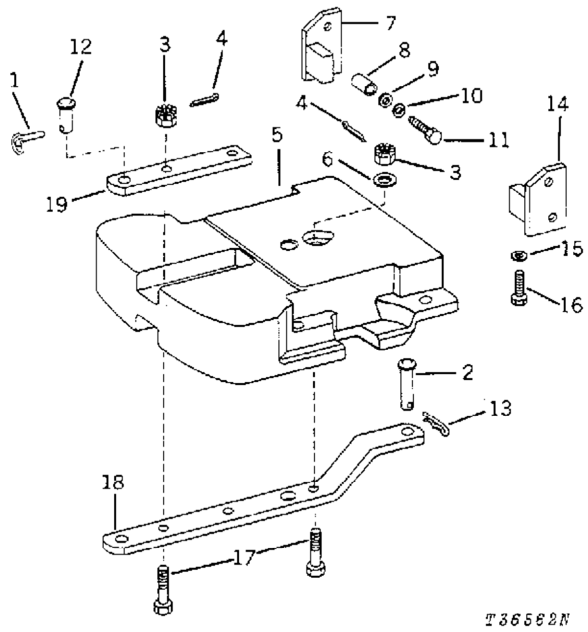
Removal

Place jack under weight. Remove drawbar pin and cap screws securing weight to steering clutch housing. Lower jack with weight to floor.

Repair

Examine parts for damage and replace if necessary.

Refer to Fig. 4 during disassembly and assembly.



1—Quik-Lock Pin
2—Drawbar Pin
3—Nut (3 used)
4—Cotter Pin (3 used) (early units)
5—Bottom Guard Counterweight
6—Special Washer
7—Bracket (2 used)
8—Hollow Dowel (8 used)
9—Special Washer (8 used)
10—Lock Washer (8 used)
11—Cap Screw (8 used)
12—Pin
13—Spring Locking Pin
14—Bracket (2 used)
15—Special Washer (4 used)
16—Cap Screw (2 used)
17—Cap Screw (3 used)
18—Drawbar
19—Drawbar Top Extension

Fig. 4-Bottom Counterweight

Installation

Use reverse of removal procedure for installation.

Clean the threads of nuts (3, Fig. 4) and cap screws (17) with T43511 John Deere Loctite Clean and Cure Primer or an equivalent. Put T43515 John Deere Loctite Retaining Compound or an equivalent on nut and cap screw threads. Tighten nuts to 170 lb-ft (24 kg-m).

Group 1799
SPECIFICATIONS AND SPECIAL TOOLS

ENGINE OR MAIN FRAME

SPECIFICATIONS AND TORQUE VALUES

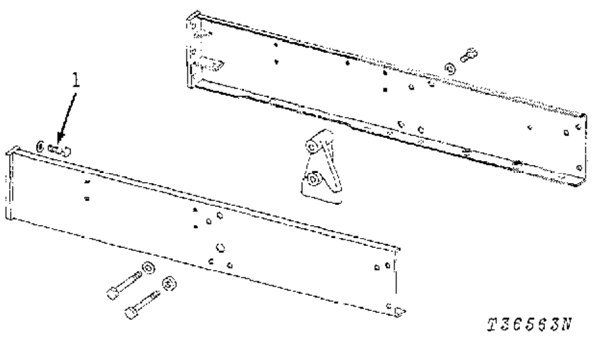


Fig. 1-Side Frames

1 - Side frame-to-steering clutch housing cap screw torque .... 250 lb-ft (35 kg-m)

CHASSIS WEIGHTS

SPECIFICATIONS AND TORQUE VALUES

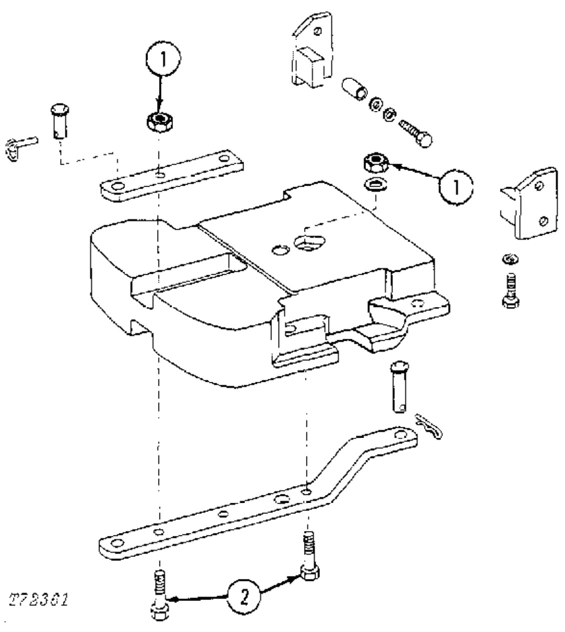


Fig. 2-Bottom Weight and Drawbar Assembly

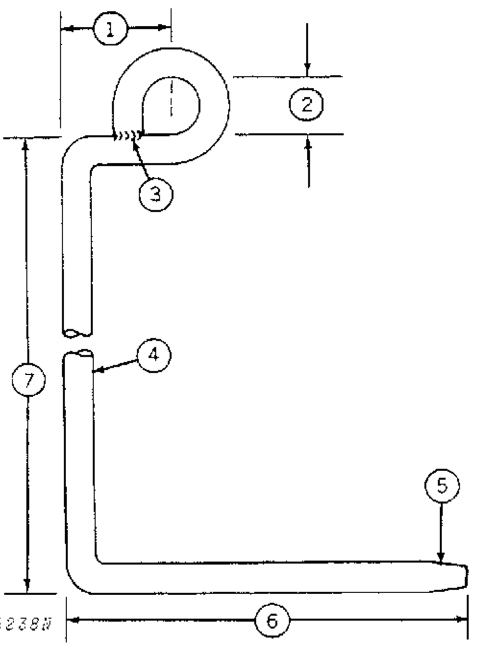
Put T43515 John Deere Loctite Retaining Compound on threads of nuts (1) and cap screws (2) (3 used).

Tighten nuts (1) to .... 170 lb-ft (24 kg-m)

CHASSIS WEIGHTS

SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
	--*	Sprocket Weight Lifting Tool - To remove and install sprocket weights.

T33238N

1—2-3/4" (69.9 mm)
2—1-1/2" (38.1 mm)
3—Weld
4—5/8" (approximately 15.9 mm)
5—Taper End
6—7-1/4" (174.2 mm)
7—12" (308.4 mm)

Fig. 3-Sprocket Weight Lifting Tool

*Make in dealer's shop.

Section 18
OPERATOR'S STATION

CONTENTS OF THIS SECTION

Litho in U.S.A.

Group 1806
SAFETY EQUIPMENT

HORN

GENERAL INFORMATION

After Serial No. 249090, a horn is supplied on the JD350-C Crawler.

The horn is located on the grille housing. The horn switch is located on the instrument panel to the left of the engine water temperature gauge.

The horn will be actuated when the horn switch is depressed.

REMOVAL

Remove the attaching hardware and wiring lead to remove horn.

To remove horn switch, remove instrument panel mounting screws and remove instrument panel. Remove cap from switch and remove wiring leads at rear of switch. Remove mounting nut and pull switch from rear of panel.

REPAIR

The horn and horn switch are not repairable. Test as described in Section 90, Group 9015 and replace as necessary.

INSTALLATION

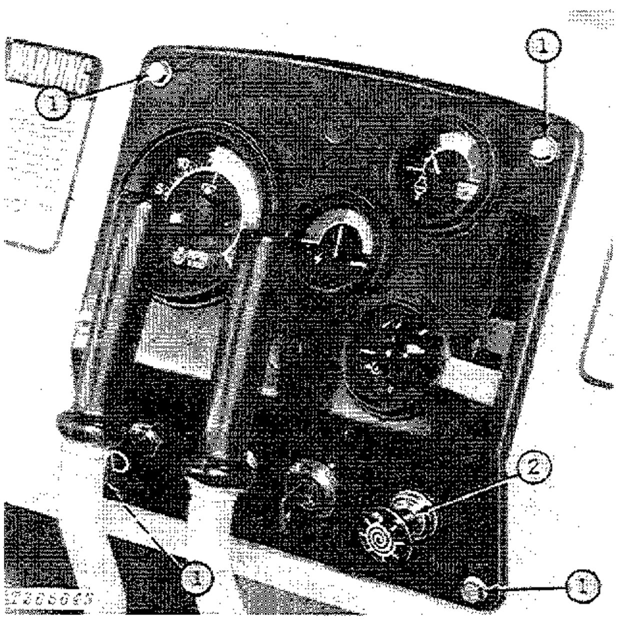
Follow removal procedure in reverse order.

Group 1808
COMFORT AND CONVENIENCE ITEMS
CIGAR LIGHTER

GENERAL INFORMATION

The cigar lighter is located in the crawler instrument panel (Fig. 1). Lighter is equipped with a self-contained circuit breaker.

REMOVAL



1—Mounting Screws **2—Cigar Lighter**

Fig. 1-Cigar Lighter

Remove instrument panel mounting screws and remove instrument panel.

Remove element portion of lighter.

Disconnect wiring from lighter housing terminal.

Unscrew large hex nut from lighter housing and remove from instrument panel.

REPAIR

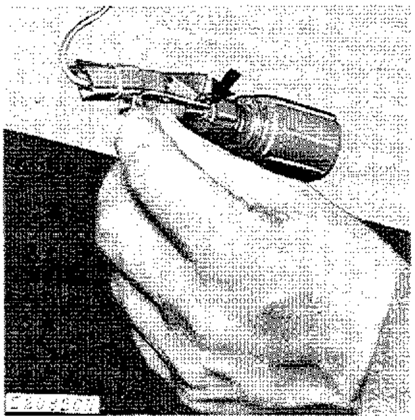


Fig. 2-Resetting Cigar Lighter Circuit Breaker

If the cigar lighter fails to operate, its circuit breaker may be open and must be reset.

To reset the lighter, remove the instrument panel, disconnect wiring lead and insert a wire in the small hole at the rear of the lighter.

INSTALLATION

Install lighter housing in instrument panel, connect wires to lighter terminals, install element in instrument panel.

Group 1810
OPERATOR ENCLOSURE

GENERAL INFORMATION

The crawler may be equipped with rollover protective structure (ROPS) or cab. The cab features a front windshield wiper.

The backhoe ROPS is mounted with rubber isolators. Limb risers are optional with the ROPS.

ROPS

Removal

Disconnect light wires.

Remove limb risers (if equipped).

Attach chain hoist to hooks on top of ROPS (if equipped) or sling a chain around roof.

Remove attaching cap screws and lift ROPS from the unit.

Repair

Examine ROPS for damaged parts and replace if necessary.

Refer to Figs. 1, 2 and 3 during disassembly and assembly. Note the following during assembly.

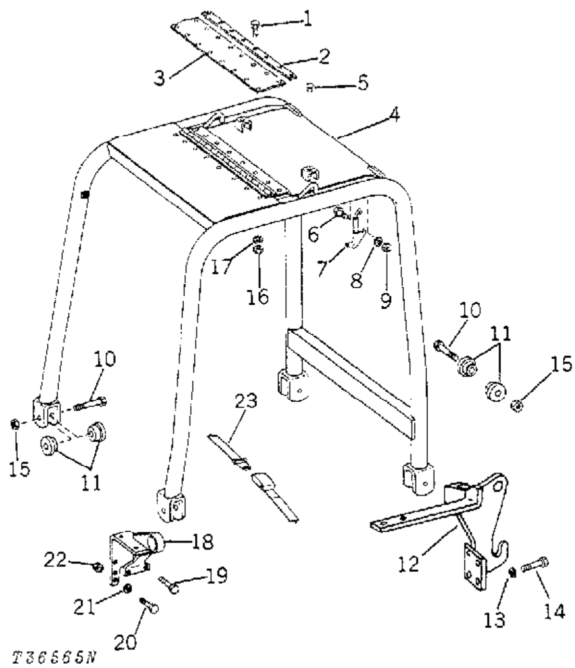
Secure seat belt to center front plate holes in battery box and hydraulic reservoir.

Weld canopy screen to rear of ROPS (Figs. 2 and 3) using 0.31 inch (7.9 mm) bevel groove weld.

Installation

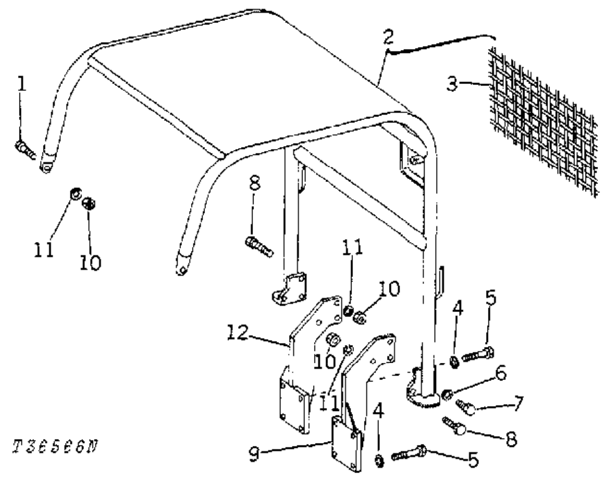
Reverse removal procedure to install ROPS.

Tighten cap screws (10) with 125 lb-ft (17 kg-m), taking care not to distort shape of isolators (11) when tightening cap screws.



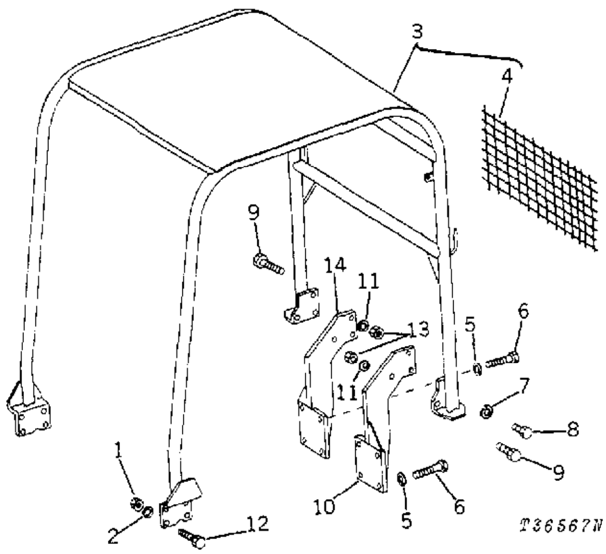
1—Bolt (16 used)
2—Clamp
3—Seal
4—ROPS
5—Plug (2 used)
6—Cap Screw (2 used)
7—Roof Latch
8—Lock Washer (2 used)
9—Nut (2 used)
10—Cap Screw (4 used)
11—Isolator (8 used)
12—Canopy Rear Support (2 used)
13—Lock Washer (8 used)
14—Cap Screw (8 used)
15—Lock Nut (4 used)
16—Nut (16 used)
17—Lock Washer (16 used)
18—Front Support (2 used)
19—Cap Screw (2 used)
20—Cap Screw (4 used)
21—Lock Washer (4 used)
22—Hex Nut (4 used)
23—Seat Belt

Fig. 1-Backhoe ROPS



1—Cap Screw (2 used)
2—Canopy
3—Canopy Screen
4—Lock Washer (8 used)
5—Cap Screw (8 used)
6—Lock Washer
7—Cap Screw
8—Cap Screw (5 used)
9—Left Rear Support
10—Nut (5 used)
11—Lock Washer (5 used)
12—Right Rear Support

Fig. 2-Loader Canopy (Without Ripper)



1—Nut (8 used)
2—Lock Washer (8 used)
3—Canopy
4—Canopy Screen
5—Lock Washer (8 used)
6—Cap Screw (8 used)
7—Lock Washer
8—Cap Screw
9—Cap Screw (5 used)
10—Left Rear Support
11—Lock Washer (5 used)
12—Cap Screw (8 used)
13—Nut (5 used)
14—Right Rear Support

Fig. 3-Dozer Canopy (Without Ripper)

CAB

Removal

Disconnect rear lamp and windshield wiper wiring.

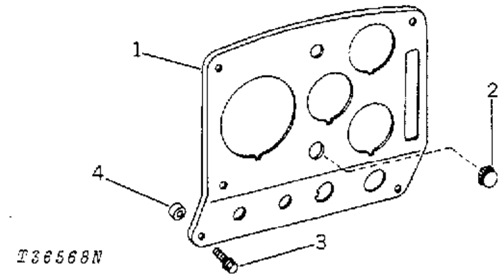
Attach strap or chain hoist to cab.

Remove cap screws attaching cab to cab supports and fenders.

Repair

Refer to Figs. 4-6 during disassembly and assembly of the cab. Replace parts as necessary.

Cut rubber strips (1 and 17, Fig. 5 and 3, 10 and 17, Fig. 6) to required length.

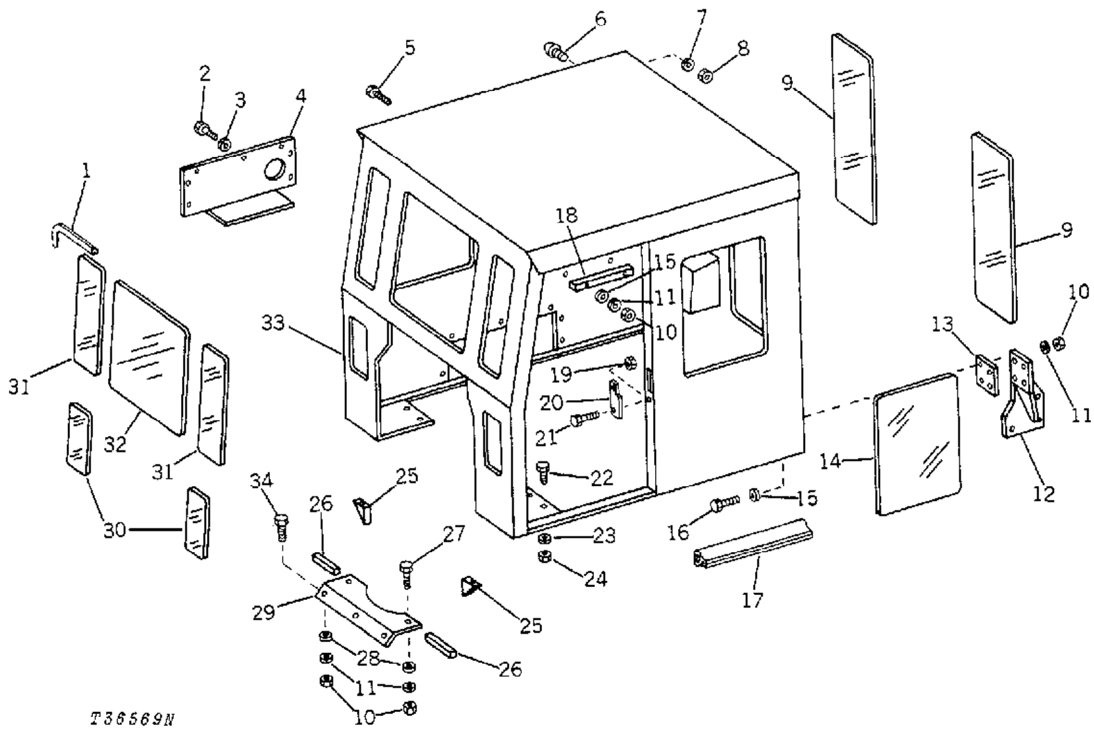


1—Instrument Panel
2—Button Plug (2 used)
3—Special Screw (4 used)
4—Spacer (4 used with loader)

Fig. 4-Instrument Panel

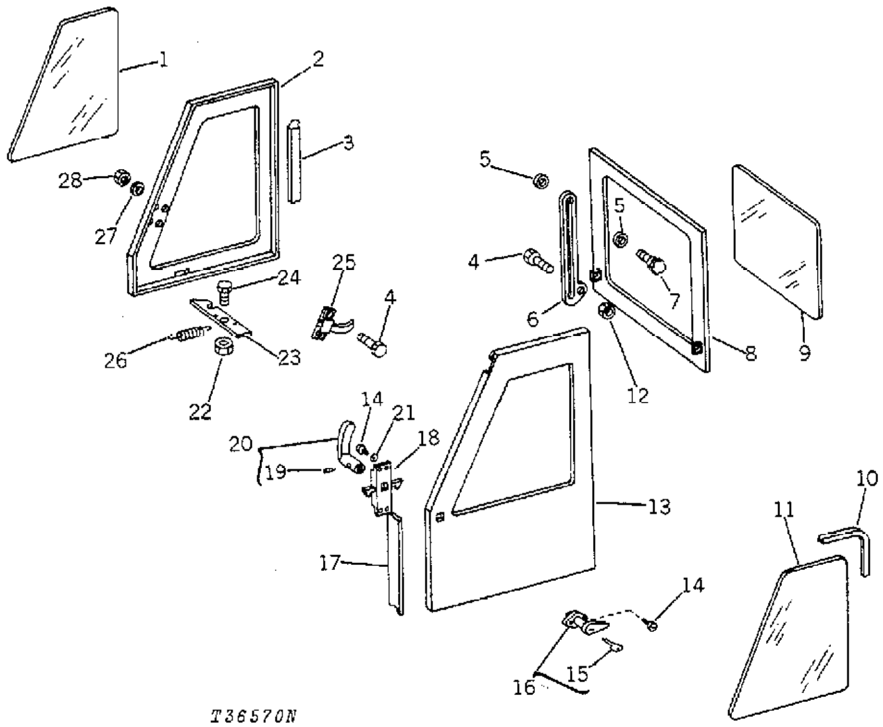
Installation

Use reverse of removal procedure to install cab.



1—Window Gasket
2—Drive Screw (7 used)
3—Lock Washer (7 used)
4—Valve Box Cover
5—Cap Screw (4 used)
6—Window Bumper
7—Lock Washer
8—Nut
9—Rear Side Window Glass (2 used)
10—Nut (18 used)
11—Lock Washer (18 used)
12—Rear Mounting Bracket (2 used)
13—Spacer (2 used)
14—Side Panel Glass (2 used)
15—Washer (8 used)
16—Cap Screw (11 used)
17—Rubber Extrusion
18—Spacer (2 used)
19—Nut (2 used)
20—Door Hold Back Bracket
21—Cap Screw (2 used)
22—Cap Screw (4 used)
23—Lock Washer (4 used)
24—Nut (4 used)
25—Front Support Bracket (2 used)
26—Seal (2 used)
27—Cap Screw (3 used)
28—Washer (6 used)
29—Cowl Mounting Plate
30—Cowl Glass
31—Side Windshield Glass
32—Windshield Glass
33—Cab
34—Cap Screw (3 used)

Fig. 5-Cab (loader illustrated)



1—R.H. Side Window Glass
2—Swing Out Window
3—Door Weather Strip
4—Cap Screw (6 used)
5—Washer (4 used)
6—Window Hold Out Rim (2 used)
7—Window Hold Out Knob (2 used)
8—Rear Swing Out Window
9—Rear Window Glass
10—Window Gasket
11—L.H. Side Window Glass
12—Special Nut (2 used)
13—Sliding Door
14—Machine Screw (6 used)
15—Key
16—Outside Locking Handle
17—Weather Strip
18—Latch
19—Set Screw
20—Inside Door Handle
21—Lock Washer (4 used)
22—Special Nut
23—Window Hold Back Latch
24—Cap Screw
25—Latch
26—Spring
27—Lock Washer (4 used)
28—Nut (4 used)

Fig. 6-Cab Door

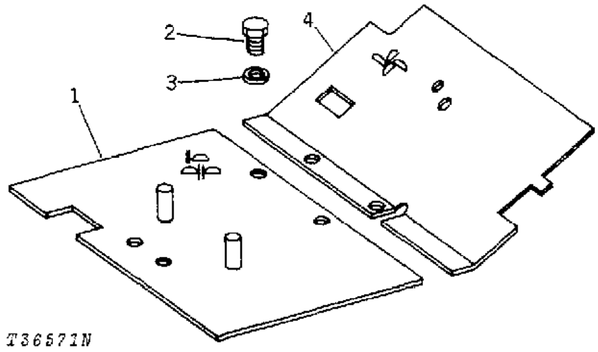
PLATFORMS

Removal

Remove cap screws (2, Fig. 7) and lift platforms from the crawler.

Repair

Refer to Fig. 7 during disassembly and assembly. Replace parts as necessary.



1—Rear Platform
2—Cap Screw (7 used)
3—Lock Washer (7 used)
4—Front Platform

Fig. 7-Platform

Installation

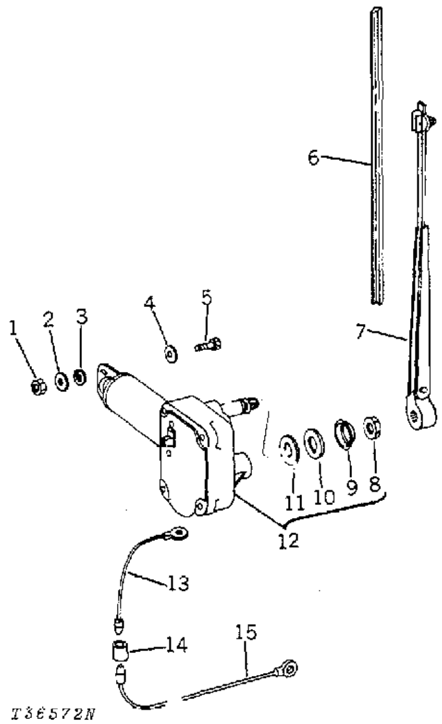
Reverse removal procedure to install platforms.

WINDSHIELD WIPERS

Repair

Refer to Fig. 8 for disassembly and assembly of the front windshield wiper. Replace parts as necessary.

Refer to Section 90, Group 9015, for testing of the windshield wiper motors.



1—Nut
2—Lock Washer
3—Washer (4 used)
4—Washer
5—Machine Screw
6—Wiper Blade
7—Wiper Arm
8—Special Nut
9—Outer Spacer
10—Gasket
11—Washer
12—Windshield Wiper Motor
13—Lead
14—Lead Connector
15—Lead

Fig. 8-Windshield Wiper

Group 1821
SEAT

GENERAL INFORMATION

Crawler Seat

The crawler seat is positioned for maximum operator vision and access to the controls while performing loader or dozer functions.

The crawler seat may be adjusted forward or rearward. See Section 90, Group 9030, for adjustment.

Backhoe Seat

For backhoe operation, the backhoe seat is lowered into position by releasing the spring pin from the seat support.

The spring pin locks the seat in a rearward position while the backhoe is not in use. See Section 90, Group 9030 for seat adjustment.

REMOVAL

Crawler Seat

Remove seat cushion (4, Fig. 1) and remove four seat support-to-seat support rail cap screws (8). Lift seat frame (7) from the operator's station.

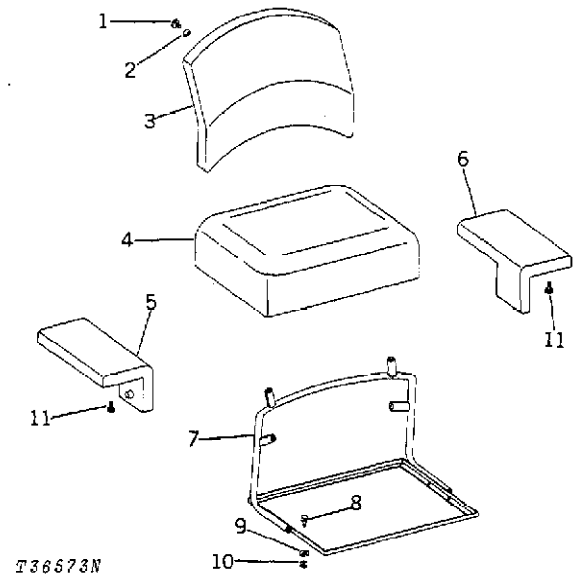
Backhoe Seat

Remove cap screws attaching seat support to the valve bracket. Lift seat assembly from the backhoe.

REPAIR

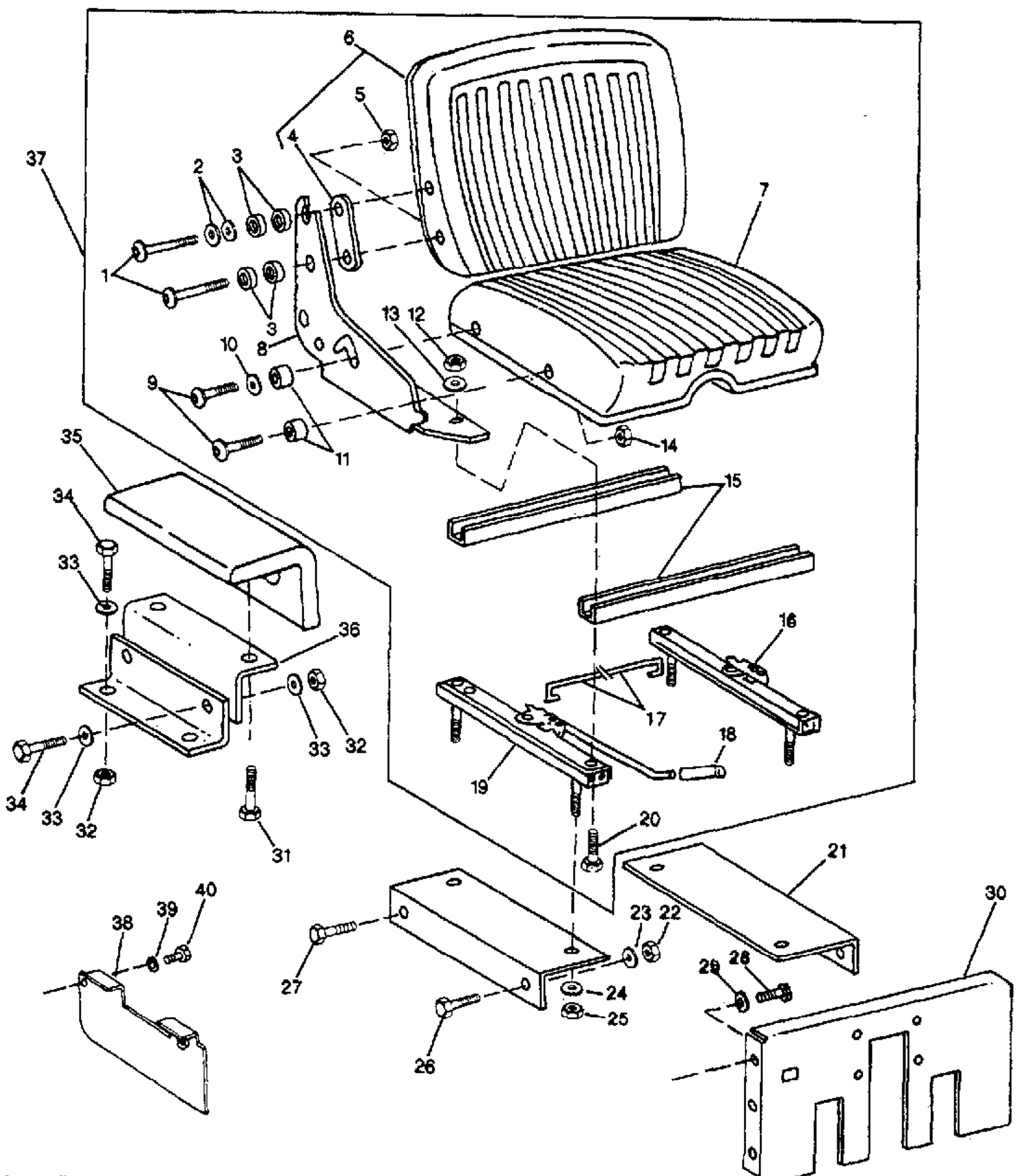
Crawler Seat

Refer to Fig. 1 during disassembly and assembly of the crawler seat. Replace parts as necessary.



1—Cap Screw (4 used)
2—Washer (4 used)
3—Back Cushion
4—Seat Cushion
5—Right Arm Cushion
6—Left Arm Cushion
7—Seat Frame
8—Cap Screw (4 used)
9—Lock Washer (4 used)
10—Nut (4 used)
11—Cap Screw (8 used)

Fig. 1-Crawler Seat (350C)



1—Belt (4 used)	11—Bushing (4 used)	21—Bracket (2 used)	31—Cap Screw (4 used)
2—Washer (4 used)	12—Lock Nut (4 used)	22—Nut (4 used)	32—Nut (8 used)
3—Spacer (8 used)	13—Washer (4 used)	23—Washer (4 used)	33—Washer (8 used)
4—Strap (2 used)	14—Lock Nut (2 used)	24—Washer (4 used)	34—Cap Screw (2 used)
5—Lock Nut (2 used)	15—Channel (2 used)	25—Nut (4 used)	35—Bracket (2 used)
6—Cushion	16—Adjuster	26—Cap Screw (2 used)	36—Bracket (4 used)
7—Cushion	17—Rod	27—Cap Screw (2 used)	37—Seat
8—Support (2 used)	18—Grip	28—Cap Screw (4 used)	38—Shield
9—Belt (4 used)	19—Handle	29—Lock Washer (4 used)	39—Washer (4 used)
10—Washer (2 used)	20—Cap Screw (4 used)	30—Panel	40—Cap Screw (4 used)

Fig. 1A—Crawler Seat (350D, 355D)

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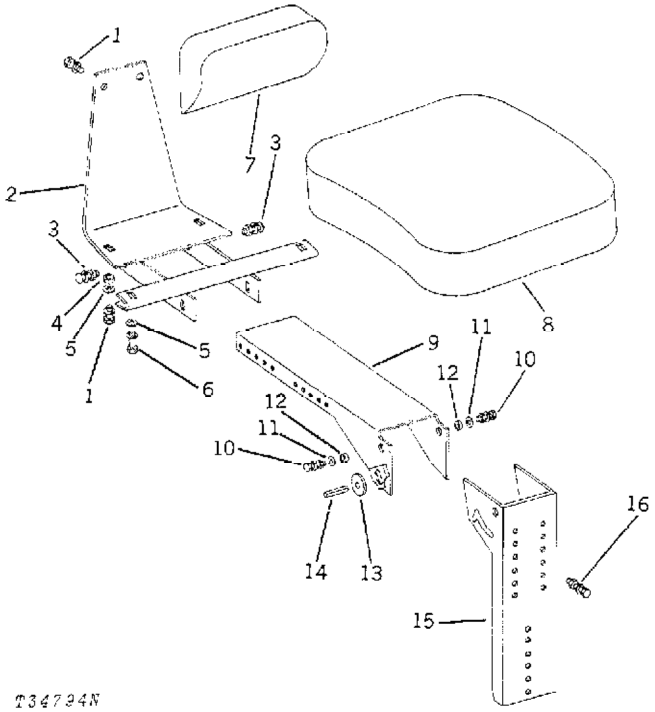
Backhoe Seat

NOTE: Drive spring pin (14, Fig. 2) in so that it extends a minimum of 0.25 inch (6.4 mm) through the seat support (15).



1—Cap Screw (4 used)
   Lock Washer (4 used)
2—Seat Mount
3—Carriage Bolt (4 used)
   Lock Washer (4 used)
   Nut (4 used)
4—Seat Spacer (2 used)
5—Washer (4 used)
6—Cap Screw (2 used)
   Lock Washer (2 used)
7—Back Cushion
8—Seat Cushion
9—Seat Bracket
10—Cap Screw (2 used)
   Lock Washer (2 used)
   Nut (2 used)
11—Washer (2 used)
12—Bushing (2 used)
13—Latch Weight
14—Spring Pin
15—Seat Support
16—Cap Screw (3 used)
   Lock Washer (3 used)
   Nut (3 used)

Fig. 2-Backhoe Seat

INSTALLATION

Reverse removal procedure to install crawler and backhoe seats.

Group 1899
SPECIFICATIONS AND SPECIAL TOOLS
ROLLOVER PROTECTIVE STRUCTURE (ROPS)
SPECIFICATIONS AND TORQUE VALUES

1. ROPS mounting cap screws .... 125 lb-ft. (17 kg-m)

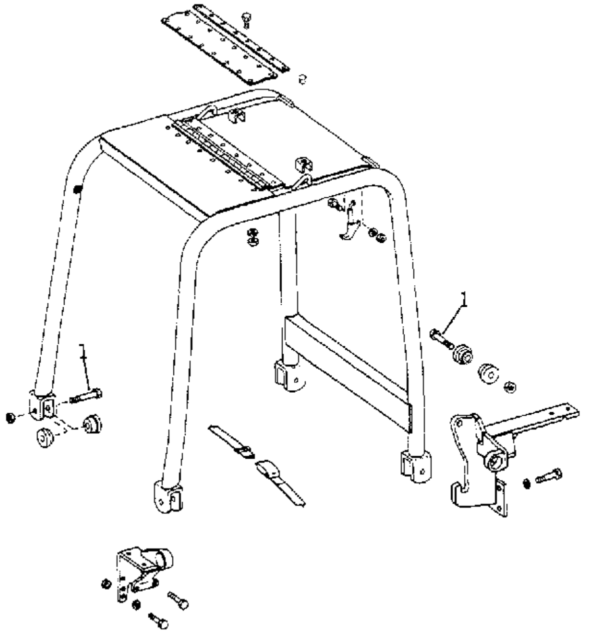


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Fig. 1-ROPS

SEAT
SPECIFICATIONS AND TORQUE VALUES

1. Distance spring pin extends through seat support................. minimum of 0.25 inch (6.4 mm)

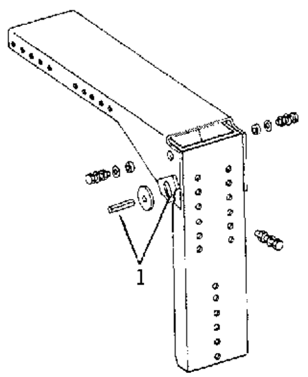

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Fig. 2-Backhoe Seat

Section 19
SHEET METAL

CONTENTS OF THIS SECTION

Group 1910
HOOD OR ENGINE ENCLOSURE

ENGINE SIDE SHIELDS

Removal

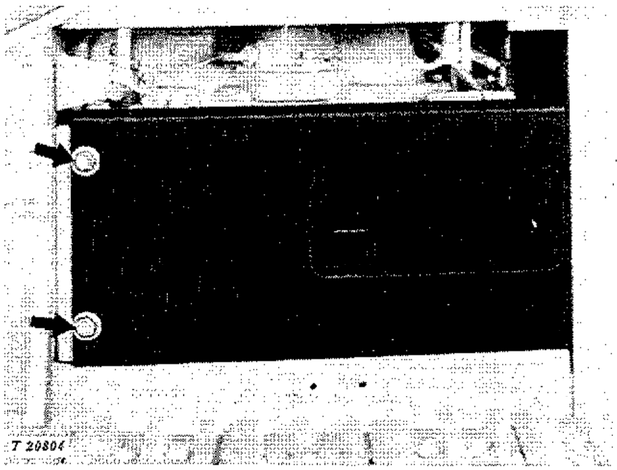


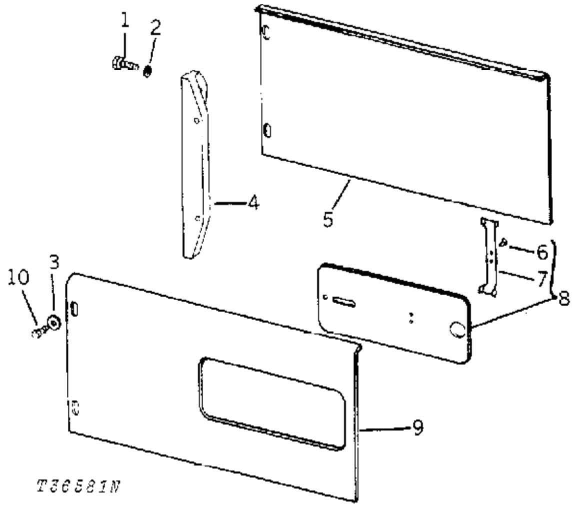
Fig. 1-Removing Side Shields

Remove the side shield by taking out the two cap screws on the rear of the side shield. Pull shield out of slots in grille housing.

Repair

Refer to Fig. 2 during disassembly and assembly.

Clean side shields to prevent dirt and other contaminants from entering the engine.



1—Cap Screw (4 used)
2—Lock Washer (4 used)
3—Washer (4 used)
4—Bracket (2 used)
5—Left Shield
6—Rivet (2 used)
7—Spring
8—Shield Door
9—Right Shield
10—Cap Screw (4 used)

Fig. 2-Side Shields

Installation

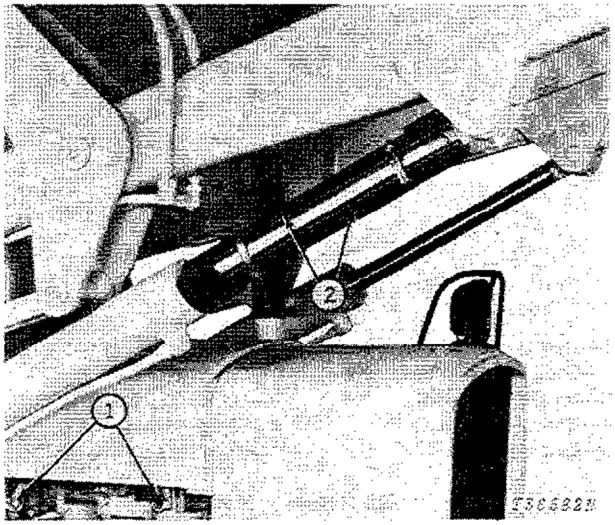
Reverse removal procedure to install side shields.

HOOD AND COWL

Removal

Raise boom to full height.

CAUTION: Support boom before working underneath it.



1—Hood Latches **2—Loader Support**

Fig. 3—Removing Hood

Remove engine side shields.

Remove limb risers (if equipped).

Remove the muffler exhaust stack and the air cleaner, pre-cleaner.

Pull down on the two spring-loaded latches on each side of the hood. Release latches and lift off hood.

Remove hood-to-cowl cap screws, release hood latches and lift hood from unit.

Remove cowl-to-cowl support cap screws (9, Fig. 5) to remove cowl from support.

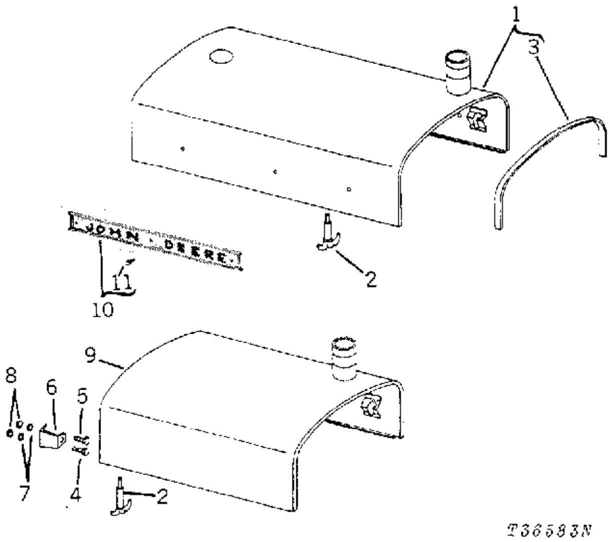
If necessary, disconnect instrument panel instruments and the indicators as described in Group 1823.

Remove cap screws (7) to remove cowl support from the clutch housing.

Repair

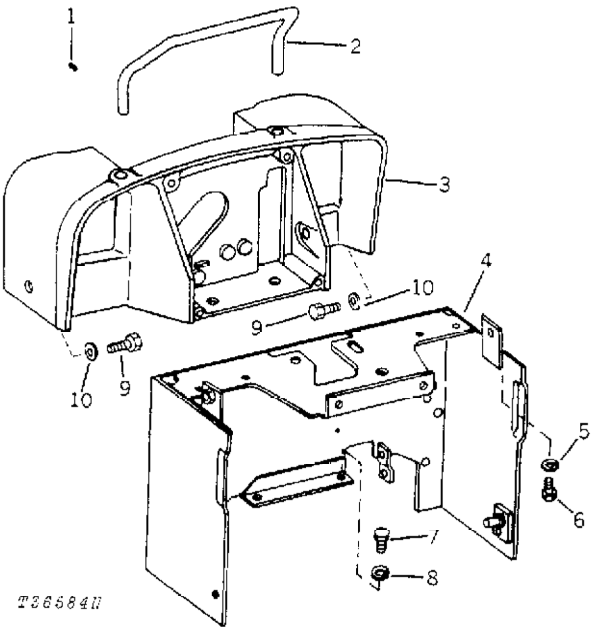
Examine parts for damage and replace if necessary.

Refer to Figs. 3 and 4 during disassembly and assembly.



1—Hood (with or without dozer)
2—Hood Latch (4 used)
3—Rubber Bumper (2 used)
4—Cap Screw (2 used with loader)
5—Cap Screw (2 used with loader)
6—Rear Hood Latch Retainer (2 used) with loader)
7—Lock Washer (4 used) with loader)
8—Nut (2 used with loader)
9—Hood (loader)
10—Name Plate with Attaching Screws (2 used)
11—Special Screw (6 used)

Fig. 4-Hood



1—Set Screw (2 used)
2—Grab Bar
3—Cowl
4—Cowl Support
5—Lock Washer (4 used)
6—Cap Screw (4 used)
7—Cap Screw (2 used)
8—Lock Washer (2 used)
9—Cap Screw (2 used)
10—Washer (2 used)

Fig. 5-Cowl (with or without dozer)

Installation

Reverse removal procedure to install hood and cowl.

Group 1921
GRILLE AND GRILLE HOUSING

REMOVAL

To remove the grille, unscrew the knob on the top center of screen and lift out screen.

Attach a chain hoist to grille housing.

Remove bottom guards as described in Section 17, Group 1746.

Remove hood and engine side shields as described in Section 19, 1910.

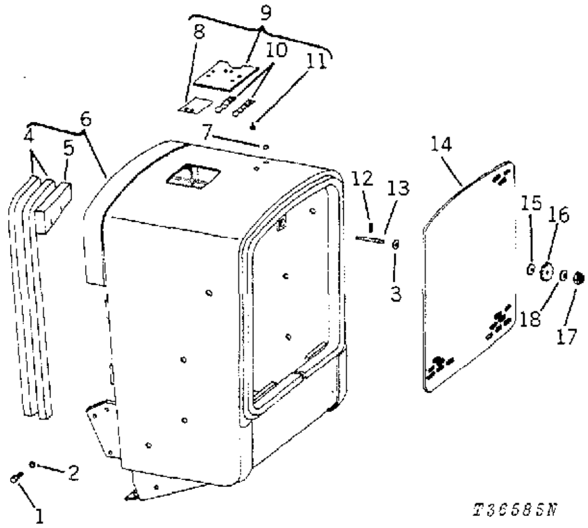
Remove cap screws (21, Fig. 1) attaching grille housing to side frames and lift housing from the unit.

REPAIR

Examine parts for damage and replace if necessary.

Refer to Fig. 1 during disassembly and assembly.

Apply baffles (4 and 5) to grille housing using a suitable adhesive.



1—Cap Screw (6 used)
2—Lock Washer (6 used)
3—Washer
4—Radiator Baffle (2 used)
5—Baffle
6—Grille Housing With Baffles
7—Plug (2 used)
8—Closure Spring
9—Radiator Cap Cover With Clips and Rivet
10—Clip (2 used)
11—Rivet (6 used)
12—Cotter Pin
13—Special Screw
14—Grille
15—Special Washer
16—Handle
17—Stop Nut
18—Washer

Fig. 1-Grille and Grille Housing

INSTALLATION

Reverse removal procedure for installation of grille and grille housing.

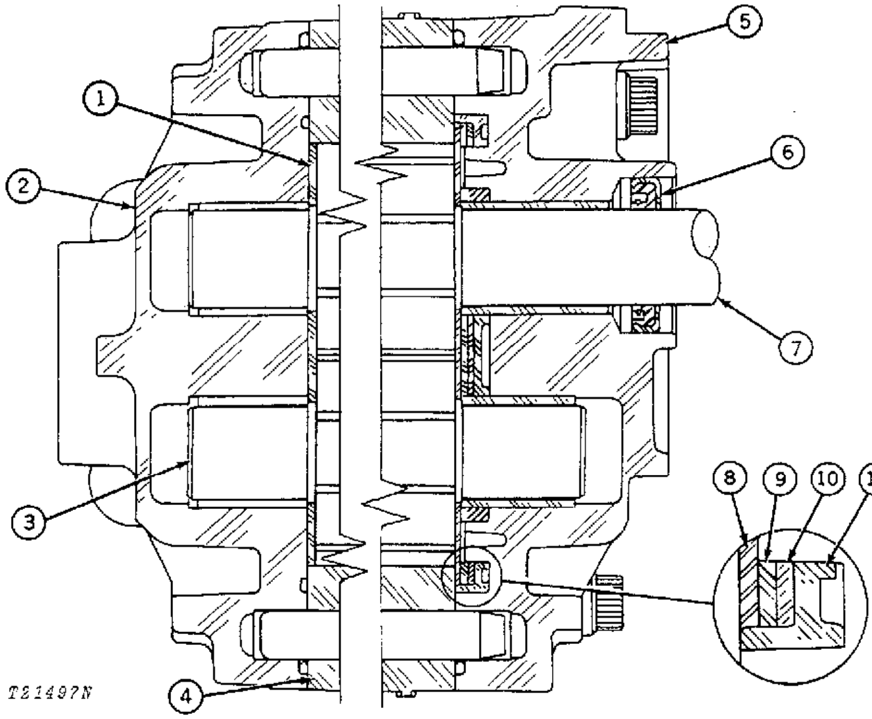
Section 21
MAIN HYDRAULIC SYSTEM

CONTENTS OF THIS SECTION

Group 2160
HYDRAULIC SYSTEM

PUMPS

GENERAL INFORMATION



1—Thrust Plate
2—Back Plate
3—Idler Gear Assembly
4—Pump Body
5—Front Plate
6—Shaft Seal
7—Drive Gear Assembly
8—Diaphragm
9—Backup Gasket
10—Protective Gasket
11—Diaphragm Seal

Fig. 1-Hydraulic Pump

The hydraulic pump is a positive-displacement, gear-type pump mounted at the front of the engine block.

The pump is driven by the crankshaft and operates whenever the engine is running.

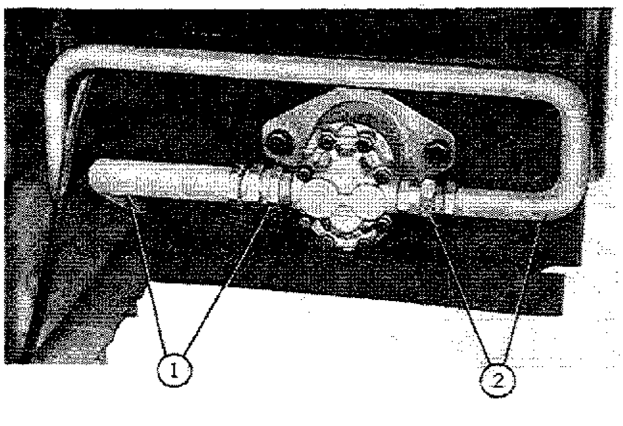
The drive and idler gears are mounted on shafts which rotate in four bushings pressed into the front and back plates of the pump. The pump housing is composed of the two plates and the body, which are aligned by two dowels.

IMPORTANT: Never operate the crawler without oil in the reservoir as serious damage to pump will result.

FOS

Refer to "Gear-Type Pumps" in FOS Manual-HYDRAULICS for additional description and theory of operation.

REMOVAL



1—Inlet Line 2—Outlet Line

Fig. 2-Main Hydraulic Pump

NOTE: When servicing any hydraulic system, always use care and cleanliness. A very small amount of dirt in the mechanism and lines, or the smallest nick or burr in the internal working parts may result in serious damage.

Remove the drain plug under the hydraulic reservoir and drain.

Open grille.

Remove inlet line (1) and outlet line (2) from pump and plug ends of oil lines to prevent contamination.

Remove the two mounting cap screws and pull pump forward to disengage it from drive coupling.

REPAIR

Clean outside of pump thoroughly.

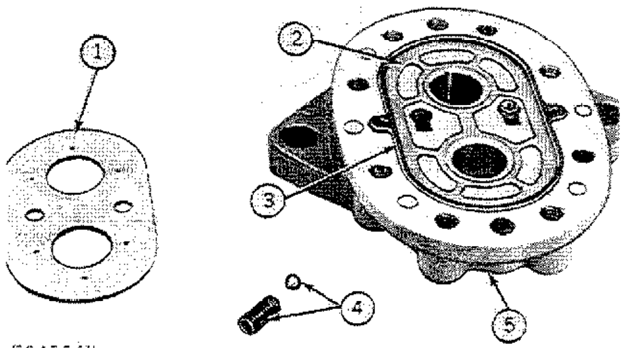
Clamp pump in vise.

Remove the eight assembly cap screws from pump.

Use scribe to mark across front plate, body, and back plate. This will assure proper reassembly.

Remove pump from vise and, holding securely in hands, bump shaft against a wooden block to separate front plate from back plate. Pump body will remain doweled to either front plate or back plate.

To separate pump body from either plate, place drive gear in bushing and tap protruding end with plastic hammer. Be very careful to avoid damaging finely machined surfaces.

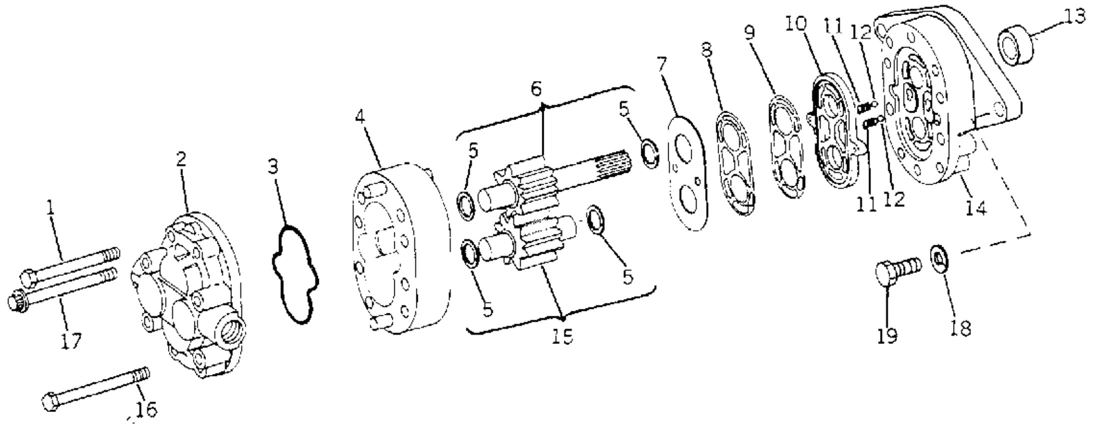


1—Diaphragm
2—Gaskets
3—Diaphragm Seal
4—Ball and Spring Assembly
5—Front Plate

Fig. 3-Parts in Pump Front Plate

Remove diaphragm (Fig. 3) from front plate by prying with sharp tool.

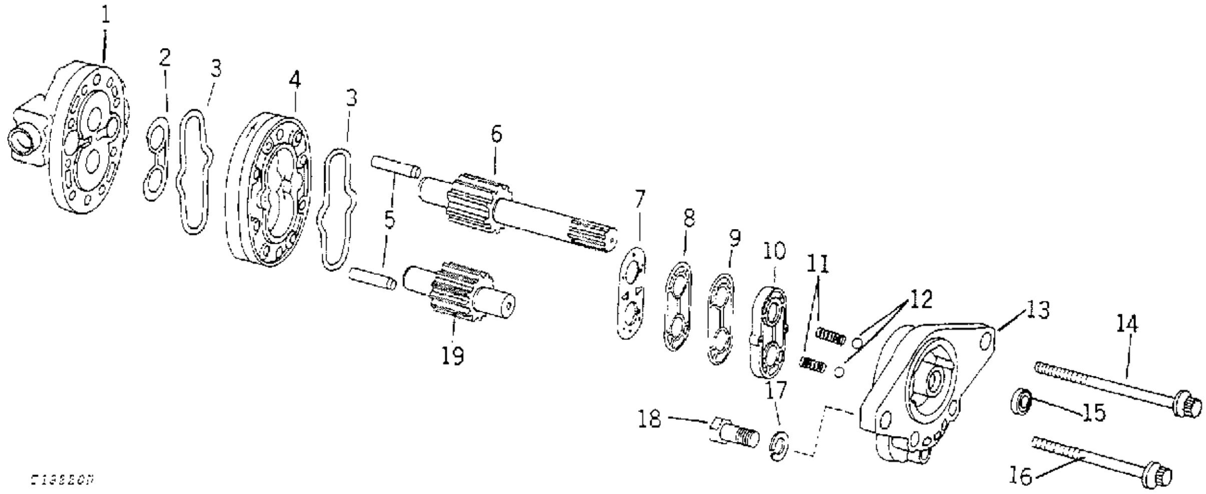
Remove springs and steel balls from bores in front plate (Fig. 3).



1—Special Cap Screw (4 used)
2—Back Plate
3—O-Ring*
4—Pump Body
5—Snap Ring (4 used)
6—Drive Gear
7—Diaphragm*
8—Backup Gasket*
9—Protector Gasket*
10—Diaphragm Seal*
11—Spring (2 used)*
12—Ball (2 used)*
13—Shaft Seal*
14—Front Plate
15—Idler Gear
16—Cap Screw (2 used)
17—Special Cap Screw (2 used)
18—Lock Washer (2 used)
19—Cap Screw (2 used)

*Seal Kit

Fig. 4-15 GPM (56.8 L/min) Hydraulic Pump



1—Back Plate
2—Thrust Plate
3—O-Ring (2 used)
4—Pump Body
5—Dowel (2 used)
6—Drive Gear
7—Diaphragm
8—Backup Gasket
9—Protector Gasket
10—Diaphragm Seal
11—Spring (2 used)
12—Ball (2 used)
13—Front Plate
14—Cap Screw (4 used)
15—Shaft Seal
16—Cap Screw (4 used)
17—Lock Washer (2 used)
18—Cap Screw (2 used)
19—Idler Gear

Fig. 5-23 GPM (87.1 L/min) Hydraulic Pump

Lift back-up and protector gaskets from front plate.

Remove rubber diaphragm seal from groove in front plate.

Remove shaft oil seal from front plate.

Clean all parts in solvent and dry with compressed air.

Remove nicks or burrs from all parts with emery cloth.

Gear Assemblies

Inspect drive gear shaft for worn or broken splines.

Inspect both the drive gear and idler gear shafts at bushing points and seal area for rough surfaces and excessive wear.

Inspect gear faces for scoring or excessive wear. If edges of gear teeth are sharp, break edges with an emery cloth. Snap rings should be in shaft grooves on each side of gears.

Front and Back Plates

Oil grooves in bushings in both front and back plates should be in line with dowel pin holes, and at outer sides of their respective bores. This positions the oil grooves closest to the respective dowel pin holes.

Check bushings inside front and back plates for excessive wear or scoring. Bushings are not available as separate service parts.

Pump Body

Check inside gear pockets in the pump body for excessive wear or scoring.

Assembly

Assemble pump as follows using Fig. 4 or 5 as a guide.

When reassembling parts into pump front plate after an overhaul, the diaphragm, back-up gasket, protector gasket, diaphragm seal, and shaft seal should be replaced as new parts.

Tuck rubber diaphragm seal into groove in front plate with open part of "V" groove down. Use a dull tool to avoid tearing seal.

Press protector gasket and back-up gasket into rubber seal.

Drop steel balls into bores in front plate and place springs over balls.

Place diaphragm on gasket with bronze face of diaphragm facing up. Entire diaphragm must fit inside the raised rim of the rubber seal.

Dip gear assemblies in oil and slip them into front plate bushings.

Pumps Without O-Rings

Milled surfaces of pump must be clean and dry. If John Deere Loctite Plastic Gasket or equivalent has been used previously to seal pump, the old application should be removed to prevent excessive gear end clearance.

Spread a thin even coating (not more than 0.003-inch [0.008 mm] thickness) of John Deere Loctite Plastic Gasket or equivalent on one surface of mating parts. Be sure excess plastic gasket does not fill grooves or come in contact with internal parts.

Pumps With O-Rings

Assemble pump with O-rings between pump bodies. Be sure O-rings are fitted into grooves in pump sections to eliminate damaging O-rings during assembly.

NOTE: Make sure the open side of thrust plate (2, Fig. 5) is toward the pump inlet.

Assemble pump making sure that scribe marks made during disassembly match on plates and body.

Arrow on pump body must point in the direction of drive gear rotation.

Tighten cap screws for 15 gpm (56.8 L/min) pump to 25 to 28 lb-ft (34 to 38 N·m) and allow 12 hours drying time before installing pump.

Tighten cap screws for 23 gpm (87.1 L/min) pump to 40 to 50 lb-ft (54 to 68 N·m).

Put petroleum jelly on a new drive shaft oil seal. Install the oil seal and tap it with a plastic hammer to seat it.

Rotate pump drive shaft by hand or with pliers. Pump will have small amount of drag, but must turn freely after short period of use.

INSTALLATION

NOTE: Flush entire hydraulic system and replace the filter if it is believed that fragments of failed pump have entered the hydraulic system.

Slide pump in place so spline shaft engages coupling on the crawler. Line up holes in the pump with holes in the pump mounting plate and fasten pump in place with two cap screws and lock washers.

Connect oil lines to pump. Install spacer and clamp between pressure and suction line.

Install grille.

Install drain plug in bottom of hydraulic reservoir and fill system with the proper oil.

Check pump for proper operation as follows:

(a) Start engine and operate at one-half speed for a minute without working hydraulic control lever.
(b) At same speed, operate control lever back and forth several times to cycle system.
(c) Increase engine speed to full throttle and operate lever several times to cycle system.
(d) Idle engine and check pump and fittings for leaks. If leakage occurs, tighten connection very slowly until leaks stop.

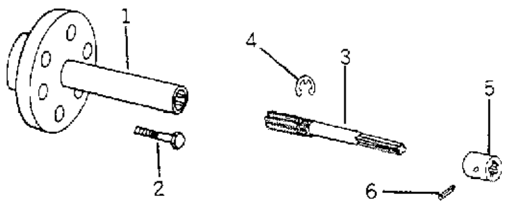
Check oil level in reservoir, add oil if necessary.

PUMP DRIVE

REMOVAL

Open grille.
Remove hydraulic pump.
Slide drive shaft (3, Figs. 6 or 7) with coupling (5) out of pump drive (1).
Remove pump drive from crankshaft pulley.

REPAIR



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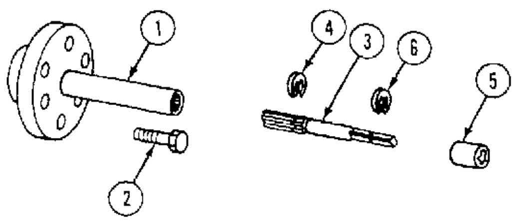
1—Pump Drive
2—Cap Screw (4 used)
3—Drive Shaft
4—Retaining Ring
5—Coupling
6—Spring Pin

Fig. 6-Pump Drive Assembly (-xxxxx)



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1—Pump Drive
2—Cap Screw (4 used)
3—Drive Shaft
4—Retaining Ring
5—Coupling
6—Retaining Ring

Fig. 7-Pump Drive Assembly (xxxxx-)

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

INSTALLATION

Assemble pump drive to crankshaft pulley and tighten cap screws to 33 lb-ft (45 N·m).
Before assembling put John Deere Never-Seez Lubricant or an equivalent on splines of drive shaft (3).
Assemble coupling on drive shaft and slide drive shaft assembly into pump drive.
Install hydraulic pump and grille.

RESERVOIR

GENERAL INFORMATION

The hydraulic reservoir is the sump area for the hydraulic functions and is pressurized to keep out dirt and to hold pressure for positive flow to the pump.

REMOVAL

Remove drain plug at bottom rear of reservoir and drain oil from reservoir.

Remove right fender, seat and seat frame.

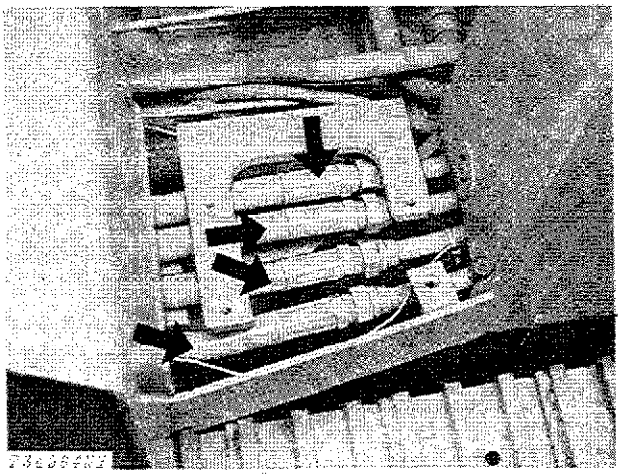


Fig. 8-Cylinder Hoses and Lines (Loader Shown)

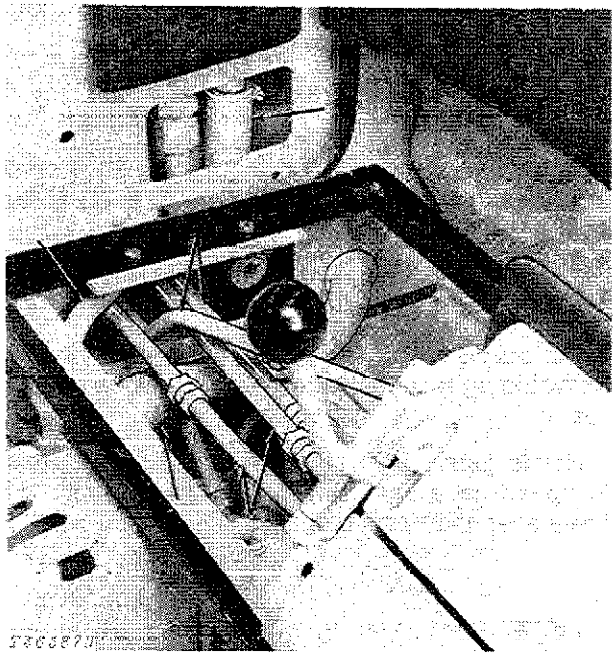


Fig. 9-Hydraulic Lines (Loader Shown)

Disconnect and cap hydraulic lines and hoses indicated by the arrows in Fig. 8 and 9.

Disconnect winch control cable from control lever and clamp on reservoir.

Remove cap screws fastening reservoir to rear cover and right hand fender shield.

Remove cap screws and nuts fastening the reservoir to steering clutch housing and remove reservoir.

INSTALLATION

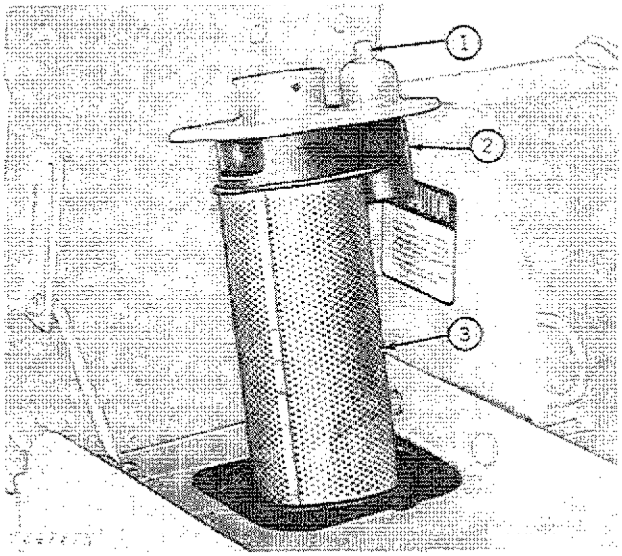
Put reservoir on unit and connect lines and hoses.

Install right fender, seat, and seat frame.

Fill reservoir with the recommended type of oil.

FILTER (-354079) Bulldozers
(-354129) Loaders

GENERAL INFORMATION



1—Indicator
2—Bypass Valve
3—Return Line Filter

Fig. 10-Filter Assembly
(-354079) Bulldozers, (-354129) Loaders

The hydraulic filtering unit consists of a return line filter element that filters the oil as it returns to the reservoir.

Should the return line filter become plugged, a valve at the top of the reservoir allows oil to bypass the filter and enter the reservoir. As the valve rises to allow oil to bypass the filter, an indicator rises through the reservoir cover to show the operator that the filter element is plugged and should be replaced.

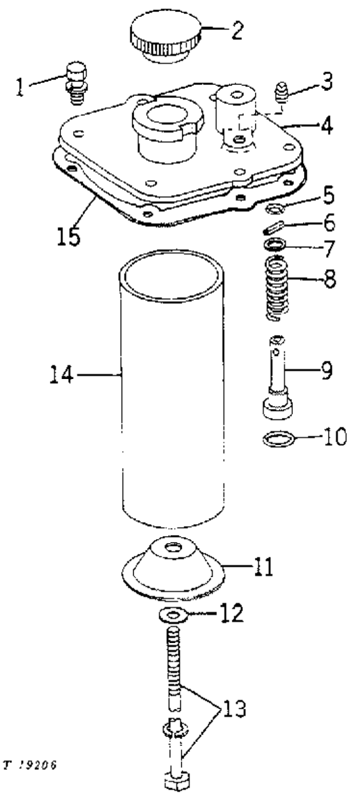
To prevent damage to the hydraulic system, it is extremely important that the filtering system be serviced as soon as the indicator rises through the reservoir cover and stays up.

NOTE: If the oil is extremely cold, increased viscosity may cause the indicator to rise. As soon as oil reaches operating temperature, the indicator should drop back to its normal position.

REMOVAL

Remove six cap screws holding the return line filter and indicator to the reservoir. Lift the filter assembly from the reservoir. Remove the filter from the filter cap by unscrewing the bolt inside the filter.

REPAIR



1—Cap Screw (6 used)
2—Pressure Cap
3—Pipe Plug
4—Filter Cap
5—O-Ring
6—Spring Pin
7—Washer
8—Spring
9—Indicator Piston
10—O-Ring
11—Filter Cap
12—Washer
13—Machine Bolt
14—Filter
15—Gasket

Fig. 11-Return Line Filter
(-354079) Bulldozers, (-354129) Loaders

Remove the spring pin (6, Fig. 11) and washer (7) from the indicator piston (9) and remove piston and spring (8) from the filter cap.

Make sure the indicator piston moves freely in the piston cap. Remove any burrs that may hinder its operation.

Replace O-ring packings (5) and (10) in filter cap. Be sure the two small holes in filter cap neck are open to assure proper reservoir breathing.

Check indicator spring (8).

Free length .... 2.90 in. (73.7 mm)
Test length at 23.5 lb. force .... 1.52 in.
(104.5 N....... 38.5 mm)

Inspect reservoir pressure cap for wear or damage. Using a pressure cap tester, determine the ability of the pressure cap to build and hold pressure.

The reservoir pressure cap valve opens between 12 and 15 psi (83 and 103 kPa) (0.8 and 1.0 bar). The cap vacuum valve (smaller) opens at 0.6 psi (4.1 kPa) (0.04 bar).

Install spring on the indicator piston. Install the assembly into the filter cap and fasten with a washer and spring pin.

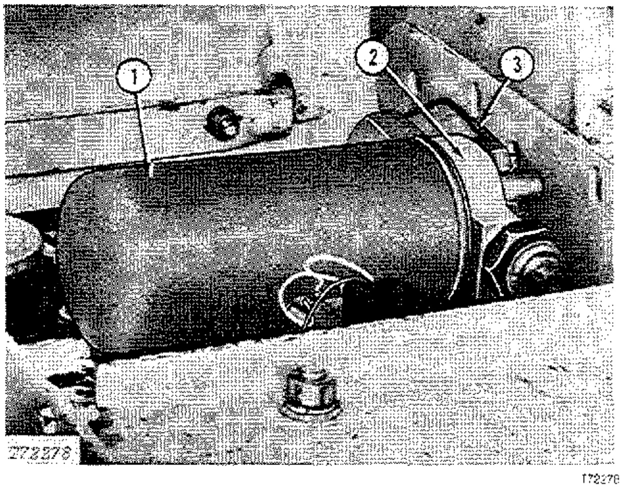
Replace filter.

INSTALLATION

Install the filter assembly being careful not to damage the gasket (15).

FILTER (354080-) Bulldozers (354130-) Loaders

GENERAL INFORMATION



1—Filter
2—Filter Base
3—Filter Restriction Indicator Lead

Fig. 12-Hydraulic Filter Assembly (354080-) Bulldozers, (354130-) Loaders

A spin-on hydraulic oil return filter is used on later units. A filter bypass valve is incorporated into the filter base (2, Fig. 12) and will bypass unfiltered return oil to the reservoir if the filter becomes plugged. When the filter is plugged, an electrical filter restriction indicator will activate a light on the dash.

REPAIR

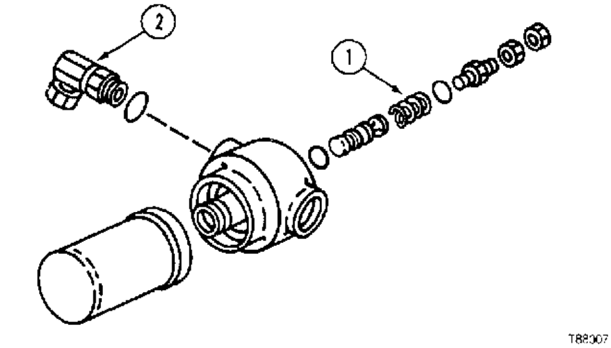
Disconnect the filter restriction indicator lead (3, Fig. 12). Remove the plug assembly, spring and piston.

Check the restriction indicator spring (1, Fig. 12A) for a free length of 0.57 in. (14.5 mm).

Inspect all parts for wear or damage and replace if necessary.

Install piston with O-ring and spring, and plug assembly with O-ring.

Connect the filter restriction indicator lead.



1—Spring
2—90° Union Adapter

Fig. 12A-Spin-On Filter

Tighten 90° union adapter (2, Fig. 12A) to 65 ± 7 lb-ft (88 ± 9.5 N·m) or 1.5 flats after seat contact.

REMOTE CYLINDERS

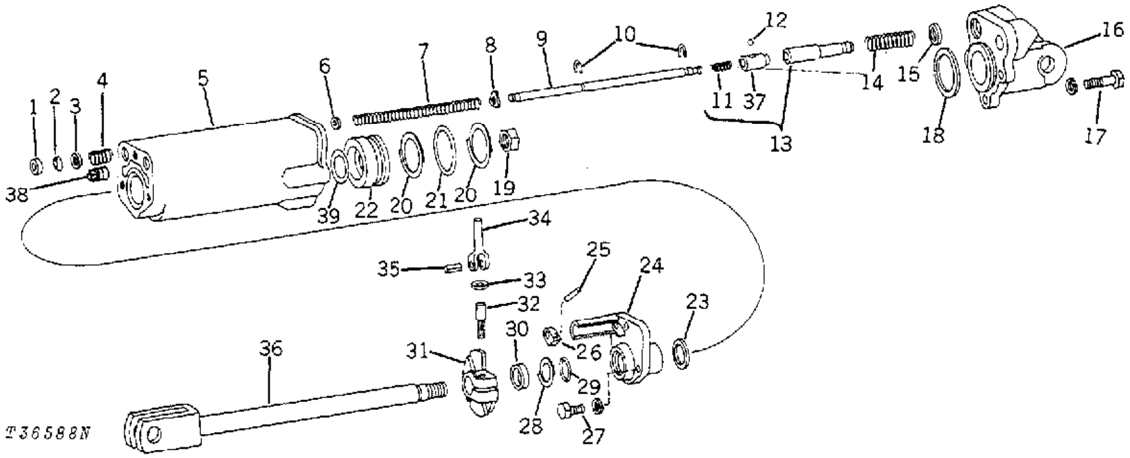
GENERAL INFORMATION

The remote cylinders are double-acting cylinders and are provided with a hydraulic adjustable stop to vary the working stroke from 0 to 8 inches.

FOS

See "Hydraulic Cylinders" in FOS Manual - HYDRAULICS for cylinder theory of operation. Refer to machine operator's manual for information on connecting cylinders.

REPAIR



1—Stop Rod Packing Adapter
2—V-Packing (3 used)
3—Stop Rod Packing Adapter
4—Stop Rod Packing Spring
5—Remote Cylinder
6—Washer
7—Stop Rod Spring
8—Stop Rod Washer
9—Stop Rod
10—Snap Ring (2 used)
11—Bleed Valve Spring
12—Bleed Valve Ball
13—Stop and Bleed Valves
14—Stop Valve Spring
15—Oil Pressure Gasket (2 used)
16—Remote Cylinder End Cap
17—Cap Screw and Lock Washer (4 used)
18—Gasket
19—Nut
20—Backup Ring (2 used)
21—O-Ring
22—Piston
23—Piston Rod Guide Gasket
24—Piston Rod Guide
25—Groove Pin
26—Stop Rod Arm
27—Cap Screw and Lock Washer (3 used)
28—Backup Ring
29—O-Ring
30—Oil Seal
31—Piston Rod Stop
32—Stop Screw
33—Washer
34—Adjusting Lever
35—Spring Pin
36—Piston Rod with Yoke
37—Bleed Valve
38—Pipe Plug
39—O-Ring

Fig. 13-Hydraulic Stop Remote Cylinder

Disassembly

Refer to Fig. 13 for reference to disassemble the remote cylinder.

Remove cylinder end cap (16, Fig. 13). Stop and bleed valves (13) can be removed by pushing stop rod assembly into cylinder to its limit. Pull stop valve from bleed valve. After removing ball from recess, bleed valve can be removed from the stop rod.

Remove piston (22), and piston rod (36).

Push stop rod (9) all the way into cylinder to prevent distortion of stop rod while driving groove pin (25) from stop rod arm (26). Push V-packing assembly (2) from housing.

Assembly

Refer to Fig. 13 and assemble remote cylinder. Do the following:

1. Press in a new piston rod oil seal (30, Fig. 13) with sealing lip toward outer end of bore.

2. Install stop rod V-packing assembly (2) with sealing lip toward outer end of bore.

3. Install piston rod guide (24) and gasket (23) but do not tighten attaching hardware.

Install stop rod assembly. Use stop and bleed valve assembly to push stop rod (9) through stop rod V-packing. Tighten piston rod guide hardware to 35 lb-ft (47 N·m).

4. Install stop rod arm (26) and groove pin (25). When installing groove pin, push stop rod (9) all the way into the cylinder to avoid bending the stop rod.

5. Install bleed and stop valves (13) making certain retaining ball is in the recess. Push valve assembly into the cylinder. Install piston rod (36) in cylinder.

6. Install O-ring packing (21) and backup rings (20) on piston.

Install piston (22) on piston rod (36). Before nut (19) is tightened, push piston well into the cylinder. Tighten nut to 300 lb-ft (407 N·m).

7. Install the piston rod stop (31) on the piston rod with adjusting lever (34) opposite the stop rod arm (26).

8. Install gasket (18) on end cap (16). Install two oil passage gaskets (15). Put spring (14) over end of stop valve (13) and install end cap. Tighten cap screws (17) to 85 lb-ft (115 N·m).

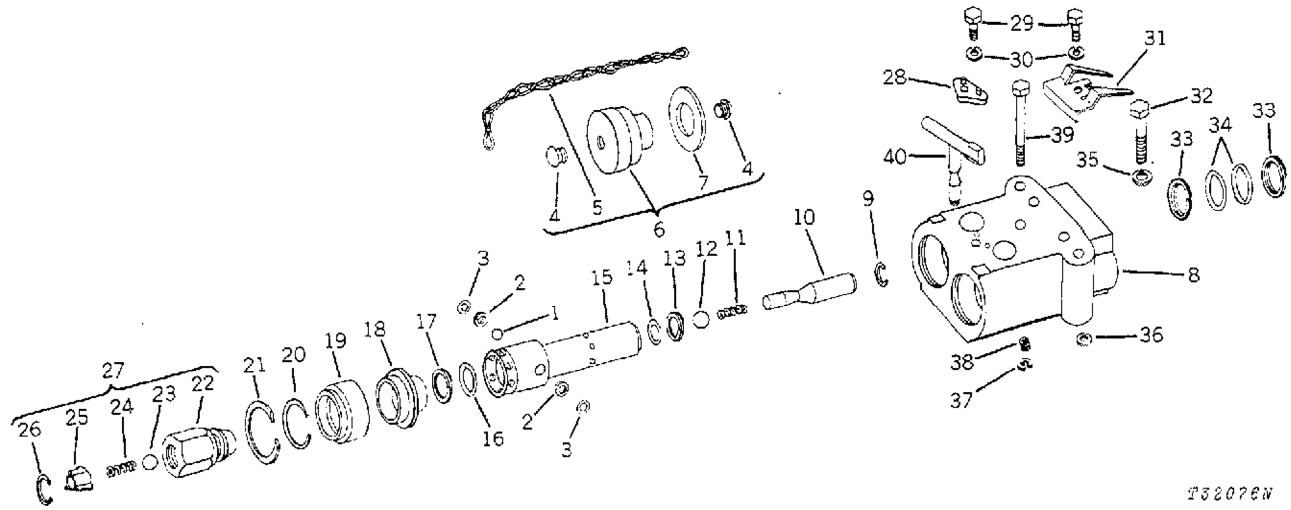
Bleeding

After the cylinder is assembled, attach the hoses to breakaway coupler.

Start the engine and move the control valve to extend and retract the piston rod seven or eight times to remove any air trapped in the remote cylinder.

BREAKAWAY COUPLERS

GENERAL INFORMATION



1—Ball (12 used)
2—O-Ring (4 used)
3—Backup Ring (4 used)
4—Drive Screw (4 used)
5—Chain (2 used)
6—Dust Plug (2 used)
7—Gasket (2 used)
8—Body
9—Snap Ring (2 used)
10—Plug (2 used)
11—Spring (2 used)
12—Ball (2 used)
13—Backup Ring (2 used)
14—O-Ring (2 used)
15—Receptacle (2 used)
16—O-Ring (2 used)
17—Backup Ring (2 used)
18—Dust Cover (2 used)
19—Sleeve (2 used)
20—Snap Ring (2 used)
21—Snap Ring (2 used)
22—Plug (2 used)
23—Ball (2 used)
24—Spring (2 used)
25—Guide (2 used)
26—Snap Ring (2 used)
27—Plug (2 used)
28—Cam
29—Cap Screw (2 used)
30—Lock Washer (2 used)
31—Spring
32—Cap Screw (2 used)
33—Backup Ring (4 used)
34—O-Ring (4 used)
35—Lock Washer (8 used)
36—Gasket (2 used)
37—Retaining Ring (2 us
38—Spring (2 used)
39—Cap Screw
40—Lever

Fig. 14-Breakaway Coupler

Refer to "Quick Disconnect Couplers" in FOS Manual—HYDRAULICS for theory of operation.

REMOVAL

Disconnect oil lines from couplers and remove couplers from unit.

REPAIR

Refer to Fig. 14 and disassemble couplers.

Remove retaining rings (37, Fig. 14) and springs (38) from operating levers and remove levers from receptacles and coupler body.

Remove receptacle assembly from coupler body. Remove steel balls (1) and snap ring (20) from receptacle.

Invert and install receptacle in coupler body and place coupler body in vise. Press down on receptacle plug (10) and remove snap ring (9). Use a brass drift to drive receptacle plug, spring (11), and ball (12) from receptacle.

Inspect all parts of the assembly for wear or damage.

INSTALLATION

Install couplers on unit and connect oil lines.

Group 2199
SPECIFICATIONS AND SPECIAL TOOLS

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES

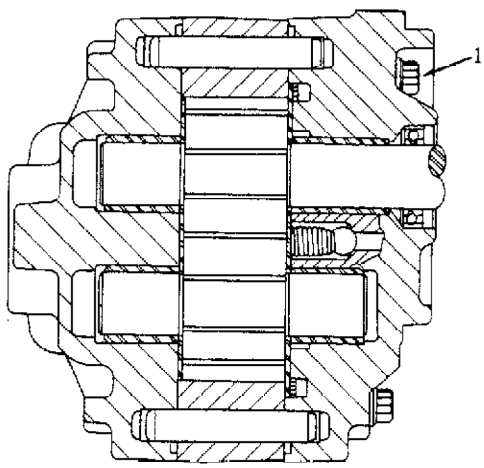


Fig. 1-Hydraulic Pump Assembly Cap Screw

1 - Pump Assembly Cap Screw Torque
15 GPM (56.8 L/min) .... 25 to 28 lb-ft (34 to 38 N·m)
23 GPM (87.1 L/min) .... 40 to 50 lb-ft (54 to 68 N·m)

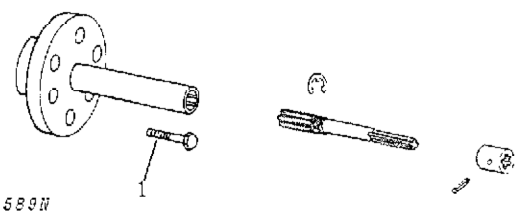
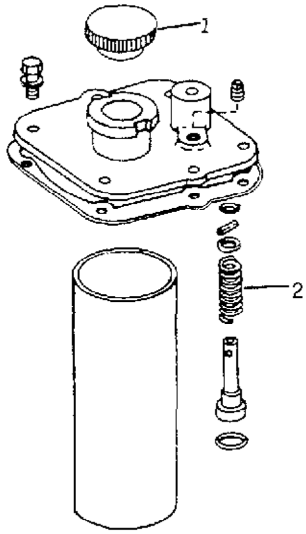


Fig. 2-Hydraulic Pump Drive (early units shown)

1 - Pump drive to crankshaft pulley cap screw torque (all units) .... 33 lb-ft (45 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



T36590N

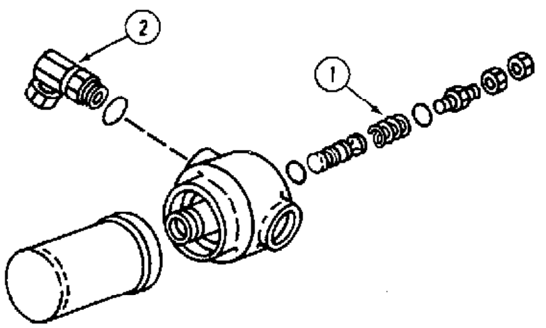
T36590N

Fig. 3-Return Line Filter
(-354079) Bulldozers, (-354129) Loaders

1 - Pressure cap
valve opening pressure . . . . 12 to 15 psi
(83 to 103 kPa) (0.8 to 1.0 bar)

Pressure cap vacuum
valve opening pressure . . . . 0.6 psi
(4.1 kPa) (0.04 bar)

2 - Indicator spring
Free length . . . . 2.90 in. (73.7 mm)
Test length at 23.5 lb. force . . . . 1.52 in.
(104.5 N . . . . 38.5 mm)

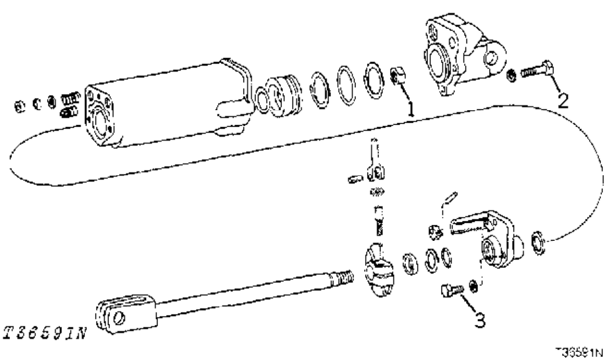


T98007

Fig. 4-Return Line Filter
(354090-) Bulldozers, (354130-) Loaders

1 - Indicator Spring
Free length . . . . 0.57 in. (14.5 mm)
Test length at 7.7 lb. force . . . . 0.21 in.
(34.3 N . . . . 5.3 mm)

2 - 90° Union Adapter
torque . . . . 65 ± 7 lb-ft (88 ± 9.5 N·m)
or 1.5 flats after
seat contact



T36591N

T36591N

Fig. 5-Remote Cylinder

1 - Piston nut torque . . . . 300 lb-ft
(407 N·m)

2 - End cap screw torque . . . . 85 lb-ft
(115 N·m)

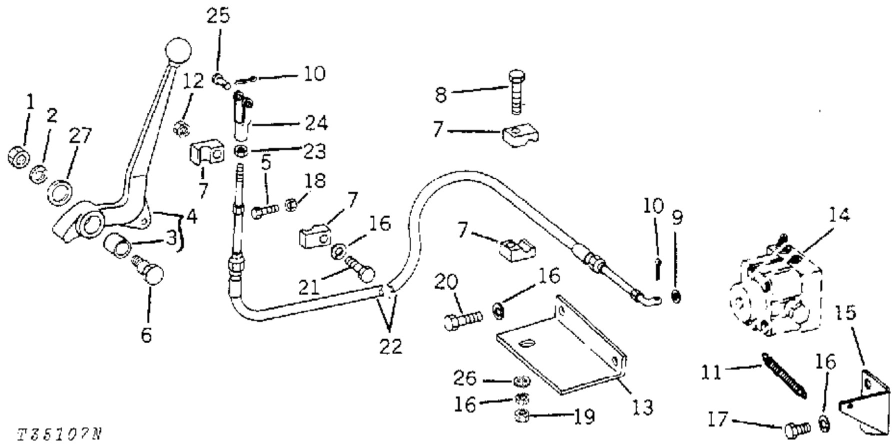
3 - Piston rod guide cap screw torque . . . . . 35 lb-ft
(47 N·m)

Section 30
WINCH

CONTENTS OF THIS SECTION

Litho in U.S.A.

Group 3015
CONTROLS LINKAGE



1—Nut
2—Lock Washer
3—Bearing
4—Control Lever
5—Cap Screw (lever stop)
6—Special bolt
7—Clamp (4 used)
8—Cap Screw
9—Washer
10—Cotter Pin (2 used)
11—Spring
12—Nut
13—Control Bracket
14—Control Valve
15—Spring
16—Lock Washer (6 used)
17—Cap Screw
18—Nut (lever stop)
19—Nut
20—Cap Screw (3 used)
21—Cap Screw
22—Control Cable
23—Nut
24—Yoke
25—Pin
26—Washer
27—Washer

Fig. 1-Winch Control Lever

REMOVAL

Remove control cable clamps (7) from winch control bracket (13) and reservoir.

Disconnect control cable (22) from control lever (4) and control valve (14). Remove cable.

INSTALLATION

Route control cable (control valve end) over the top of right-hand winch adapter and behind cable guard on final drive housing.

Route control cable (control lever end) inside of reservoir in front of front pressure line and clamp to bottom hole in reservoir. Make sure there are no kinks or sharp bends in the cable. Do not tighten clamp.

Clamp cable to control bracket (13).

Connect cable to control lever and control valve.

Tighten clamp cap screws.

Control Lever Adjustment

See Section 90, Group 9025.

Group 3041
WINCH HOUSING AND MOUNTING STRUCTURE

REMOVAL

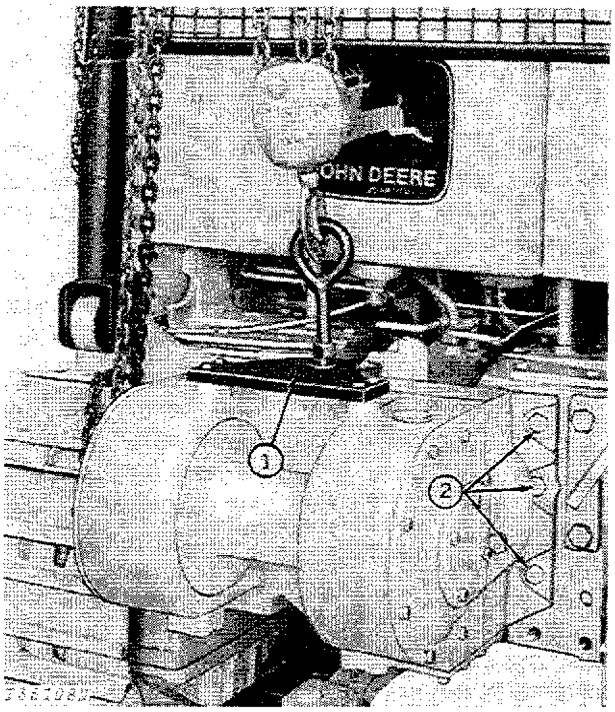
Detach control cable from winch control lever.

Remove winch fairlead assembly (Section 15, Group 1511).

Position and secure winch lifting tool (see "Special Tools").

Attach a chain hoist to lifting tool (1, Fig. 1). Remove winch housing-to-steering clutch housing cap screws (2).

Pull winch away from rear of crawler, clearing stubs and dowels.



1—Winch Lifting Tool **2—Winch Housing Cap Screws**

Fig. 1-Winch Removal

CAUTION: If unit is to be operated without winch, install winch drive shaft guard and shield.

REPAIR

Disassembly

Place winch on a stand or bench for disassembly. Drain oil from winch housing.

Remove brake band and clutch cover as directed in Group 3050.

Remove clutch disk, main drive shaft, and clutch and brake drum as directed in Group 3050.

Removing Winch Drum

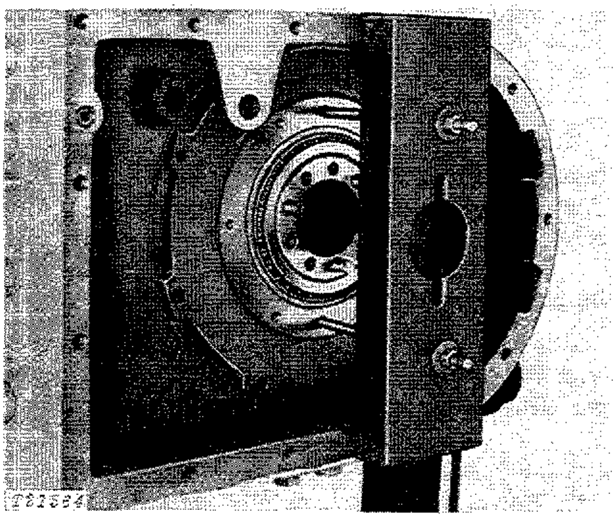


Fig. 2-Removing Left Bearing Quill

Remove inner grease retainer secured to left bearing quill. Remove bearing quill cap screws. Attach a puller to the bearing quill and force the bearing cone off the end of the winch drum (Fig. 2). Remove the bearing quill and gasket from the winch housing.

Remove end plate and shim pack (from right side of winch).

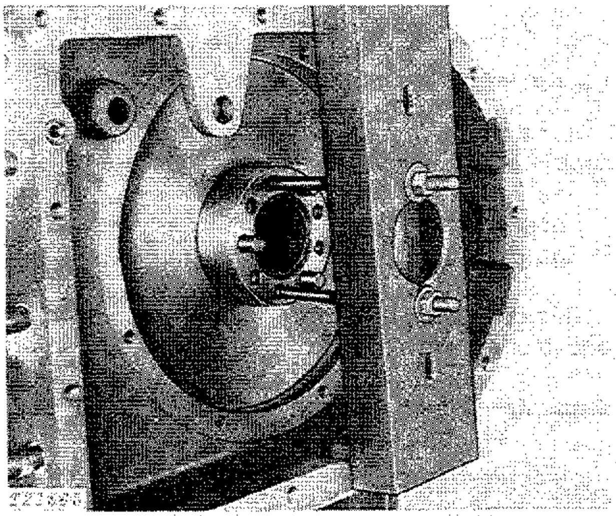


Fig. 3-Removing Winch Drum

Attach a puller to the winch drum and force the bearing cone off the right-hand end of the winch drum. Slide the winch drum out the left side of the winch housing.

Inspecting Winch Drum Bearing Quills

Inspect the oil seal in the bearing quills for damage. Press in new oil seals to flush with bore (lips of the seals facing driver).

Inspect bearing cup in the bearing quills. Drive new bearing cup into quill, large end facing driver, until it bottoms.

Inspect the quill bearing cones for wear or damage. Pack cones with John Deere Winch Bearing Grease.

Inspecting Winch Drum

If winch drum needle bearing is damaged, press new bearing to 0.25 in. (6.35 mm) from end of winch drum counterbore surface. Pack with John Deere Winch Bearing Grease.

Install new vee packing with lip facing needle bearing.

Assembly

Installing Winch Drum

Install the right bearing quill and gasket at the inner bore in right-hand side of the winch housing.

Install two guides in the cap screw holes to facilitate quill installation.

Remove the guides and tighten the attaching cap screws to standard torque.

Install the winch drum in the left-hand side of the winch housing. End of drum with six holes and three dowels should face out to left side.

Install gasket and left bearing quill in inner bore on left hand side of winch housing.

Install two guides in the cap screw bores to facilitate quill installation.

Remove the guides and tighten the attaching cap screws.

Pack the left and right bearing cones with John Deere Winch Bearing Grease and drive cones on winch drum, leaving the bearing cones protruding to specifications over end of winch drum.

Position the inner grease retainer on the left bearing quill and secure with attaching cap screws.

Winch Drum Adjustment

1. Place shims under the end plate to induce end play and attach the end plate to the right-hand end of winch drum. Tighten attaching cap screws to standard torque.

2. Check the end play on the drum. Remove or add the correct quantity of shims to give the desired bearing adjustment of 0.002-inch (0.05 mm) end play to 0.002-inch (0.05 mm) preload.

3. Install the winch hydraulic pump (see Group 3060).

INSTALLATION

Secure winch lifting tool on winch (see Fig. 1).

Attach chain hoist to lifting tool and lift it into position on studs and dowels at rear of crawler.

Tighten winch housing-to-steering clutch housing cap screws to 150 lb-ft. (20.74 kg-m).

Attach control cable to winch control lever.

Refill winch housing with proper oil.

Attaching Cable to Winch Drum

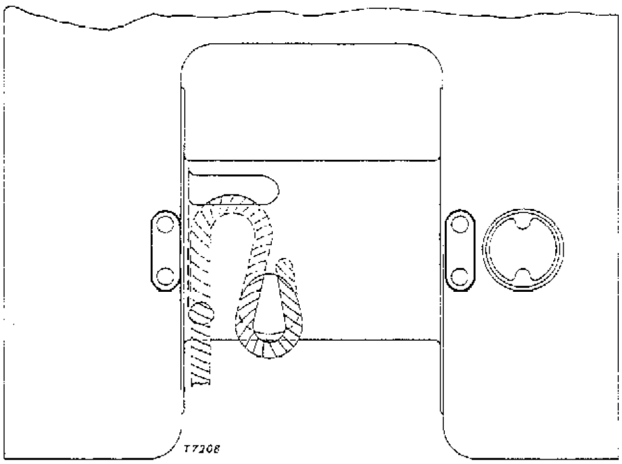


Fig. 4-Attaching Cable to Drum

Thread cable through winch drum, fold end of cable back into drum and pound it in (Fig. 4).

To conform to certain state laws, the winch cable must be attached to the winch drum so that it can come loose if the cable is unwound.

Thread the cable through the winch drum as shown in Fig. 5 and wind the cable onto the drum.

IMPORTANT: When the cable is attached to the winch in this manner, unwinding the cable below five turns on the drum will allow the cable to disconnect from the drum.

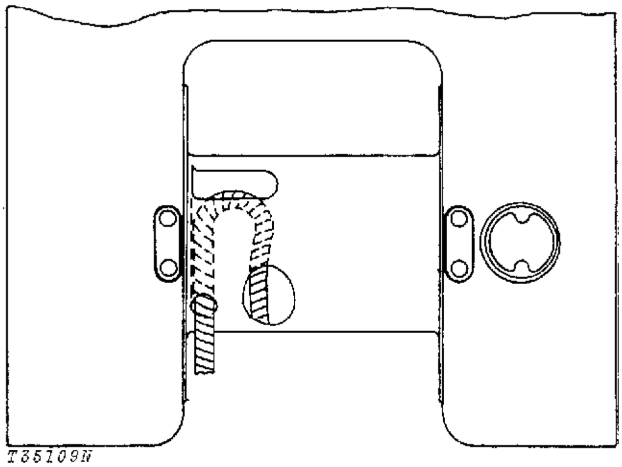


Fig. 5-Attaching Cable to Winch Drum

Group 3050
WINCH DRIVE AND CLUTCHES

GENERAL INFORMATION

The winch clutch (disk type) is located inside the clutch and brake drum. A pressure plate hydraulically engages the clutch. A release spring disengages the clutch pack after pressure oil is released.

The winch brake is of the contracting band type mounted around the winch drum and operated by a hydraulic piston and cylinder mechanism. The brake band is released by oil pressure and engaged by spring pressure.

REMOVAL

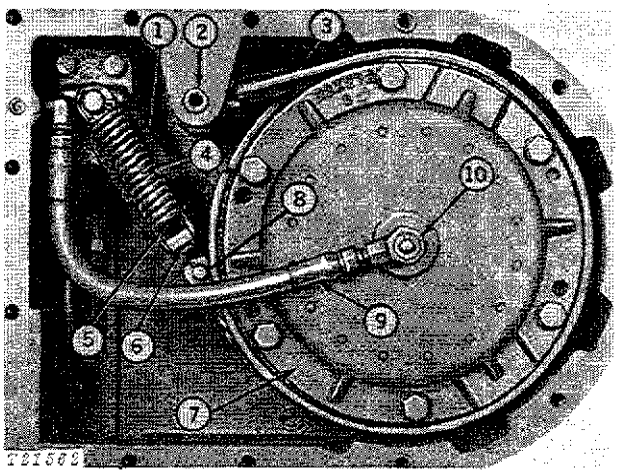
Remove winch housing as directed in Group 3041.

REPAIR

Disassembly

Place winch on a stand or bench for disassembly. Drain oil from winch housing.

Removing Brake Band and Clutch Cover



1—Brake Cylinder
2—Anchor Pin
3—Brake Band Assembly
4—Springs
5—Brake Adjusting Nut
6—Lock Nut
7—Clutch Cover
8—Adjusting Screw Pin
9—Oil Line
10—Swivel Fitting

Fig. 1-Removing Brake Band

Remove left quill from winch housing.

Release brake spring pressure.

Remove brake springs and adjusting screw.

Remove anchor pin and brake cylinder from winch housing. Slide brake band assembly off the clutch and brake drum.

Removing Clutch Disks and Piston

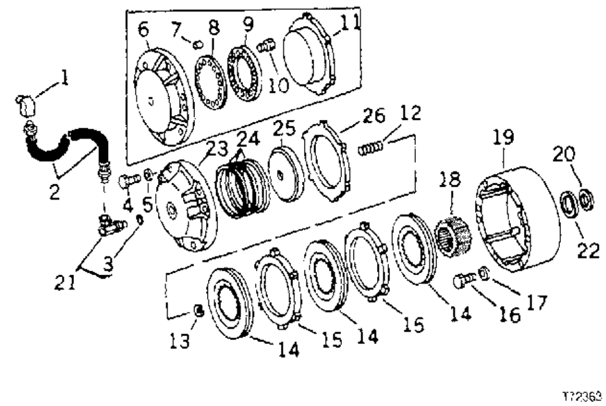
Remove two clutch cover attaching cap screws (4, Fig. 2) and install two 1/2 x 2-inch cap screws to facilitate the removal of the springloaded clutch screws.

For units with winch serial number (-029519), remove diaphragm ring (9, Fig. 2) and diaphragm (8).

For units with winch serial number (029520-XXXXXX), remove clutch plate (26, Fig. 2), clutch piston (25), and seal rings (24).

For units with winch serial number (XXXXXX-), remove hose (2, Fig. 2A) from spool (8). Push spool from clutch cover (4) to remove clutch piston (9).

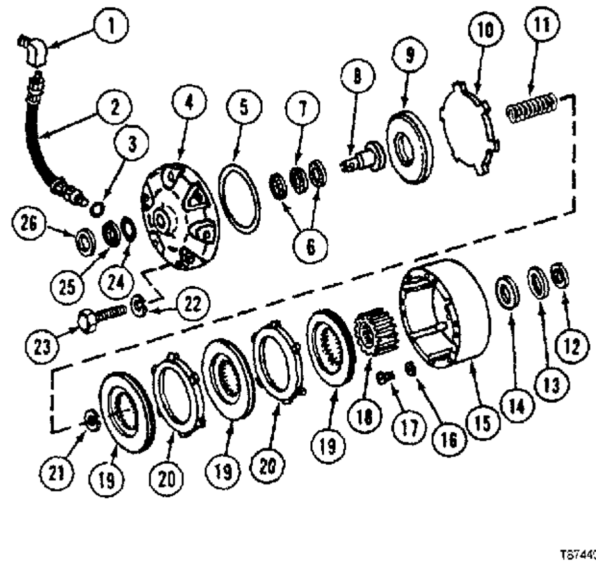
Remove middle disks (14, Fig. 2 or 19, Fig. 2A) and intermediate disks (15, Fig. 2 or 20, Fig. 2A) from clutch and brake drum.



1—Elbow
2—Oil Hose
3—O-Ring
4—Cap Screw (6 used) (-032333)*
Cap Screw (6 used) (032334-)*
5—Lock Washer (6 used)
6—Clutch Cover (-029519)*
7—Dowel (2 used) (-029519)*
8—Diaphragm (-029519)*
9—Diaphragm Ring (-029519)*
10—Special Cap Screw (16 used) (-029519)*
11—Clutch Pressure Plate (-029519)*
12—Spring (6 used)
13—Snap Ring
14—Middle Disk (3 used)
15—Intermediate Disk (2 used) (-030052)*
Intermediate Disk (3 used) (030053-)*
16—Cap Screw (6 used)
17—Special Washer (6 used)
18—Clutch Drive Hub
19—Clutch and Brake Drum
20—V-Packing
21—Swivel Fitting
22—Backup Washer (023906-)*
23—Clutch Cover (029520-)*
24—Sealing Ring (3 used) (029520-)*
25—Clutch Piston (029520-)*
26—Clutch Plate (029520-)*

*Winch Serial Number

Fig. 2-Clutch Pressure Plate Assembly (Winch Serial Number -XXXXXX)



1—Elbow
2—Hose
3—O-Ring
4—Clutch Cover
5—Seal
6—Bearing Race (2 used)
7—Thrust Bearing
8—Spool
9—Clutch Piston
10—Clutch Pressure Plate
11—Spring (6 used)
12—V-Packing
13—Backup Washer
14—Washer
15—Clutch and Brake Drum
16—Special Washer (6 used)
17—Cap Screw (6 used)
18—Clutch Drive Hub
19—Middle Disk (3 used)
20—Intermediate Disk (2 used)
21—Snap Ring
22—Lock Washer (6 used)
23—Cap Screw (6 used)
24—O-Ring
25—Backup Washer
26—Wiper Ring

Fig. 2A-Clutch Pressure Plate Assembly (Winch Serial Number XXXXXX-)

Removing Main Drive Shaft

Remove right bearing retainer with shims and right quill from winch housing.

Slide the main drive shaft and ring gear assembly out through right-hand side of winch housing.

Removing Clutch and Brake Drum

Remove the socket head cap screws attaching the clutch and brake drum to the winch drum and pull brake drum free from winch drum dowels.

Remove winch drum as directed in Group 3041.

Removing Gear Train

Remove coupling from input shaft. Remove the input shaft bearing quill and shim pack. Remove gear cover from front of the winch housing.

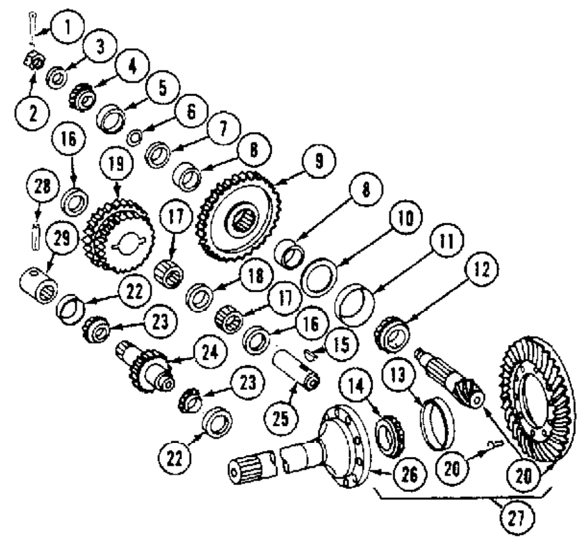
NOTE: To facilitate removal of the gear cover, screw two of the attaching cap screws in the unused threaded holes and force off gear cover.

Using Fig. 3, remove parts from idler shaft.

Remove cover on bottom of winch housing and remove hydraulic pump with bracket from winch housing.

Remove expansion plug from rear of idler shaft bore and drive out idler shaft.

Using Fig. 3, remove parts from output shaft and remove shaft from housing.



1—Cotter Pin
2—Slotted Nut
3—Special Washer
4—Bearing Cone
5—Bearing Cup
6—Shims
7—Tapered Spacer
8—Spacer (2 used)
9—Drive Gear
10—Shims
11—Bearing Cup
12—Bearing Cone
13—Bearing Cup
14—Bearing Cone
15—Woodruff Key
16—Thrust Washer (2 used)
17—Roller Bearing (2 used)
18—Special Washer
19—Cluster Gear
20—Rivet (10 used)
21—Ring Gear and Output Shaft
22—Bearing Cup (2 used)
23—Bearing Cone (2 used)
24—Input Shaft
25—Idler Shaft
26—Shaft
27—Main Drive Shaft Assembly
28—Spring Pin
29—Coupling

Fig. 3-Output Shaft Assembly

Checking Brake Cylinder and Brake Band

To disassemble brake cylinder, remove internal snap ring and slide out piston.

Inspect brake cylinder and piston parts for damage. Replace all O-rings.

Inspection

Checking Shafts and Bearings

Inspect all bearings, cups and cones for damage.

Inspect the input shaft bearing quill sealing ring.

Inspect the input shaft bearing quill oil seal. If replacement is necessary, press in new oil seal, lips inward, to flush with input shaft bearing quill bore using a 630-11 Tool.

Inspect the bearing cup in the input shaft bearing quill. If replacement is necessary, press in new bearing cup until it bottoms.

Inspect the bearing cone on each end of the input shaft. If replacement is necessary, press on new bearing cone until bearing bottoms.

Inspect idler shaft for damage or bent conditions.

Inspect cluster gear (19, Fig. 3) for excessively worn or broken teeth.

Inspect roller bearings for wear or damage.

Examine thrust washer for wear or damage and replace if necessary.

Inspect ring gear, pinion shaft, and gears for damage. See Fig. 3 for parts identification.

NOTE: The ring gear and pinion shaft are furnished in matched sets and are not available individually for replacement.

Inspect the bearing cone on the pinion shaft for wear or damage. If replacement is necessary press on new cone with large end toward spiral bevel gear of pinion shaft, using the pinion shaft spacer as a tool (Fig. 4).

Inspect the rear bearing cup in the pinion shaft bore for wear or damage. If replacement is necessary, drive out the old bearing cup, being careful not to damage or lose shim pack behind cup. Drive in new bearing cup, with large end facing driver, until it bottoms in bore.

Examine special washer and spacers for wear or damage.

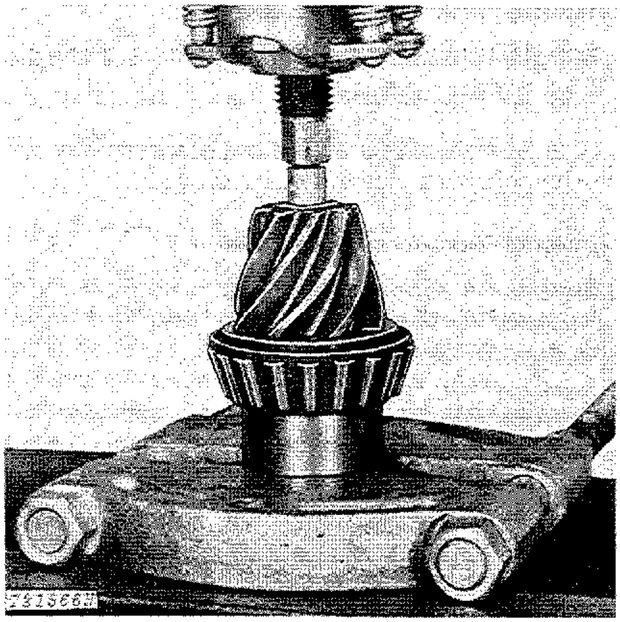


Fig. 4-Pressing Pinion Shaft Bearing Cone

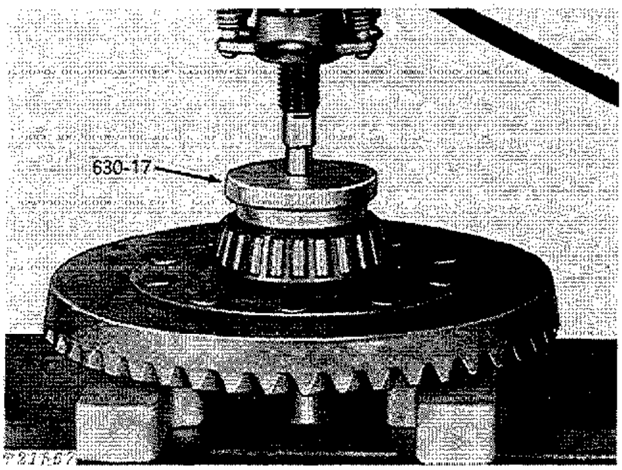


Fig. 5-Installing Main Drive Shaft Bearing Cone

Inspect the bearing cone on the main drive shaft. If replacement is necessary, press on new cone to flush with the end of the shaft. Small end should face driver. Use 630-17 Tool (Fig. 5).

Inspecting Clutch Assembly (Fig. 2)

Pull clutch cover from pressure plate and inspect for wear.

Examine diaphragm and diaphragm ring for wear or damage. Make sure the machined surface of the pressure plate (11, Fig. 2) which makes contact with the diaphragm (8) is carefully examined for nicks, scratches and sharp edges.

To remove or smooth out nicks, scratches or sharp edges, use a very fine file and an emery cloth.

It is extremely important to remove nicks, scratches or sharp edges, if present, to prevent premature failure of the diaphragm.

Inspect the clutch and brake drum for oil or grease before installing a new brake band. If a small amount of either is indicated, wash drum in an alkaline solution.

If the drum has been soaked in oil or grease, it is strongly recommended that the drum be replaced. An oil- or grease-soaked drum will continue to bleed oil and grease under operating conditions, thus ruining another brake band.

NOTE: If drum is being replaced because it has been soaked with oil or grease, make sure to correct the leakage problems.

Special care should be taken when installing a new band to prevent oil or grease from getting on the brake band or drum. Any oil or grease on the brake band or drum braking surfaces will cause the band to slip in the "Hold" position.

After burnishing a new brake band, the brake band adjustment should be rechecked and the powder substance created during burnishing should be blown out from between brake band and the drum.

Assembly

Install winch drum (see Group 3041).

Installing Clutch and Brake Drum

NOTE: Install brake band support cap screw in bottom cap screw hole in brake compartment before installing brake drum.

Position clutch and brake drum on the winch dowels and secure to the winch drum with cap screws. Tighten cap screws to standard torque.

Ring Gear and Pinion Adjustment

When installing a new winch housing, a new ring gear and pinion shaft set, or new bearing cones or cups which support these parts, it will be necessary to make certain adjustments. These adjustments are covered on the following pages and must be made in the following sequence.

Step 1 - Cone point adjustment

Step 2 - Pinion shaft bearing preload adjustment

Step 3 - Ring gear and pinion backlash adjustment

Step 1 - Adjusting Cone Point

1. Add the number which is etched on the end of the pinion shaft to the mean dimension (1.193 inch [30.30 mm]) of the output shaft rear bearing cup and cone.

2. Subtract this figure from the number stamped on the right quill bore.

3. The difference is equivalent to the thickness of the shim pack that must be added behind the rear bearing cup to obtain the correct cone point setting.

Step 2 - Adjusting Pinion Shaft Bearing Preload

1. Slide pinion shaft with rear bearing cone and rear spacer into pinion shaft bore. Install drive gear, spacer, and beveled spacer (flat side to the rear) on the pinion shaft and slide the pinion shaft into the front bore. Place a 0.090-inch (2.29 mm) shim pack on the shaft and install the front bearing cone, flat washer, and nut.

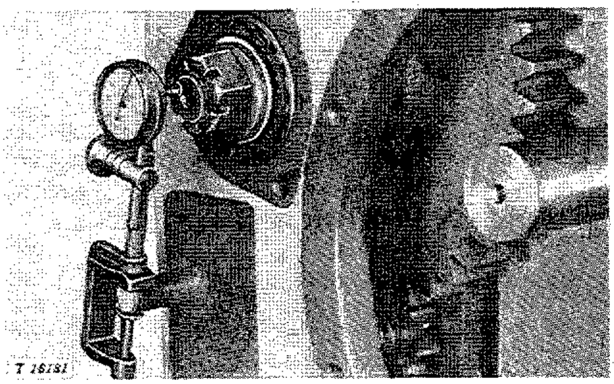


Fig. 6-Pinion Shaft Preliminary End Play

2. Install a dial indicator and measure end play in shaft (Fig. 6). If there is no end play, remove nut and bearing cone and add enough shims so there is a measurable amount of end play.

3. Measure end play and determine the shim pack required to give the desired preload adjustment of 0.004 to 0.006 inch (.1 to .15 mm).

4. Tighten pinion shaft nut with 100 to 125 lb-ft (13.83 to 17.28 kg-m). Advance nut as required to install cotter pin. Install cotter pin, gasket and cover.

NOTE: The winch drum and the clutch and brake drum must be in place before ring gear backlash can be determined.

Installing Idler Shaft and Cluster Gear

Refer to Figure 3 and perform the following:

1. Install a Woodruff key in the idler shaft keyway. Drive the shaft in flush with the counterbore at the rear of bore in gear cover.

Install expansion plug in the idler shaft counterbore in gear cover.

2. Place a thrust washer on the idler shaft.

Place a roller bearing, spacer washer, and roller bearing in cluster gear and slide onto idler shaft.

3. Place a thrust washer over the idler shaft.

4. Install input shaft assembly.

5. Screw two guides into the cap screw holes in front of the winch housing. Install gasket and gear cover on the guides and on hollow dowel. Remove the guides and install the attaching cap screws.

Establishing Input Shaft Preload

This preload is established by shims under the input shaft bearing quill and can be determined as follows:

1. Remove the sealing ring from the groove in the input shaft bearing quill.

2. Place shims under the input shaft bearing quill to induce end play. Install quill and tighten attaching cap screws. Check end play as shown in Figure 7. Remove the correct quantity of shims to give the desired preload of 0.002 to 0.004 inch (0.05 to 0.1 mm).

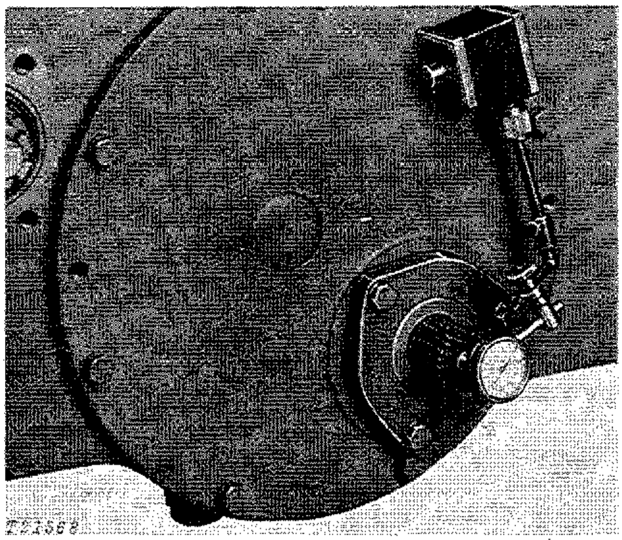


Fig. 7-Measuring Input Shaft End Play

3. When the preload has been determined, remove the input shaft bearing quill and install the sealing ring previously removed. Install the quill and again tighten the attaching cap screws to standard torque.

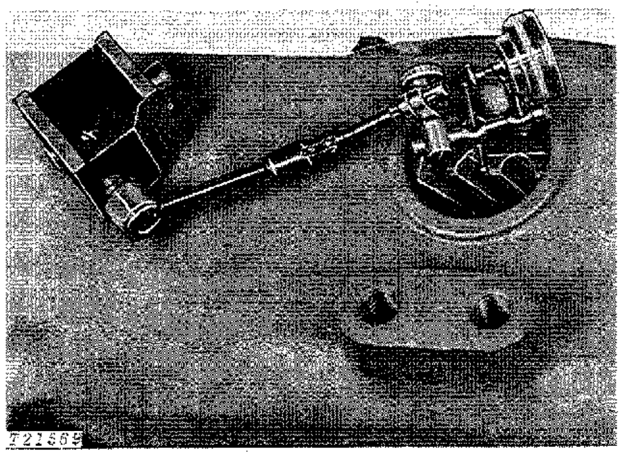
Installing Main Drive Shaft and Right Quill

Install main drive shaft from the right-hand side into the winch housing. Install quill with gasket. Take care not to damage seals.

Drive in bearing cup to 0.125 inch (3.18 mm) below shim surface on the right quill.

Step 3 - Ring Gear and Pinion Backlash Adjustment

Make ring gear and backlash adjustment as follows:



T21569

Fig. 8-Measuring Ring Gear and Pinion Backlash

1. Check backlash of ring gear at several points around ring gear (Fig. 8). Due to allowable machine tolerances, there may be one point where there is less backlash than at other points. By proper placement of shims, establish 0.006 to 0.012 (.15 to .3 mm) backlash at the point of least backlash.

2. Adding the calculated quantity of shims under the right bearing retainer will increase the backlash.

Deducting the calculated quantity of shims under the right bearing retainer will decrease backlash.

3. When the correct backlash of the ring gear and pinion have been established, remove the right bearing retainer and install sealing ring. Lubricate sealing ring before installing. Install right bearing retainer and tighten attaching cap screws to standard torque.

Installing Clutch Assembly (Fig. 2 or 2A)

Install clutch drive hub and snap ring on main drive shaft.

Alternately install middle disks and intermediate disks onto the clutch drive hub.

(XXXXXX-029519)*

Use T43511 John Deere Loctite Clean and Cure Primer to clean mating surfaces of the diaphragm (8, Fig. 2) and diaphragm ring (9).

Apply T43514 John Deere Loctite Plastic Gasket to diaphragm attaching area on the clutch cover (6) and to threads of cap screws.

IMPORTANT: Place the diaphragm in the clutch pressure plate assembly so that the smooth side is facing the clutch cover and the textured side is out.

Use the following torque sequence when fastening diaphragm and diaphragm ring to clutch cover.

1. Snug cap screws down using a criss-cross pattern to 5 lb-ft (0.69 kg-m).

2. Tighten cap screws using a criss-cross pattern to 30 lb-ft (4.15 kg-m) torque.

3. Retighten cap screws to 30 lb-ft (4.15 kg-m).

4. Allow clutch cover assembly to set for 30 minutes and retighten the cap screws to 30 lb-ft (4.15 kg-m).

(029520-XXXXXX)*

Put oil on inside and outside of sealing rings (24, Fig. 2) and install these rings in groove of clutch cover.

Put multi-purpose grease on outside of clutch piston (25) and install piston, with large chamfered end through sealing rings and into clutch cover.

Install clutch pressure plate and the assembled clutch cover.

Apply T43512 John Deere Loctite Threadlock and Sealer Medium Strength or an equivalent to threads of swivel fitting (21). Protect swivel fitting O-ring during installation into clutch cover (6 or 23).

(XXXXXX-)

Install O-ring (24, Fig. 2A), backup ring (25) and wiper ring (26) into clutch cover (4). Install seal (5) into cover with lip toward bottom of bore. Apply petroleum jelly to seal, O-ring, and wiper ring.

Install bearing races (6) and thrust bearing (7) on spool (8). Install spool into cover.

Install clutch piston (9), chamfered end first, into cover.

Winch serial number

Installing Brake Band (Fig. 1)

Position brake band on clutch and brake drum.

Fasten top brake anchor to boss in winch housing pin. Attach adjusting screw to bottom of brake anchor with pin. With adjusting screw loose, connect brake springs.

Installation

Install winch housing on unit as directed in Group 3041.

Burnishing New Brake Facings

On field installation of repair parts, it is necessary to burnish the brake band to obtain full capacity.

Burnish new replacement brake bands as follows.

Tighten brake adjusting nut until there is 4.675-inch (119.06 mm) distance between bottom edge of spring anchor pin and bottom edge of spring anchor. Hook on to something solid and drive away with winch brake applied. A short distance (25 to 30 feet [7.62 to 9.14 m]) will bring brake to full capacity.

In practically all cases this will develop full winch brake capacity; if not, repeat the above procedure.

ADJUSTMENT

Adjusting Winch Brake Band (-357764)*

Always adjust the winch control lever before adjusting the winch brake (see Group 9025).

If the winch brake band or linkage have been removed or replaced, they must be readjusted to prevent slippage.

Remove the left quill from winch housing. Loosen the jam nut (see inset, Fig. 9) and back off brake adjusting nut until brake band is loose. Tighten brake adjusting nut until there is 4.675 inches (119.06 mm) distance between bottom edge of spring anchor pin and bottom edge of spring anchor. Tighten jam nut.

Recheck operation of winch. If brake still slips, inspect brake band facings for damage from excessive heat, grease, or oil.

*Winch Serial Number

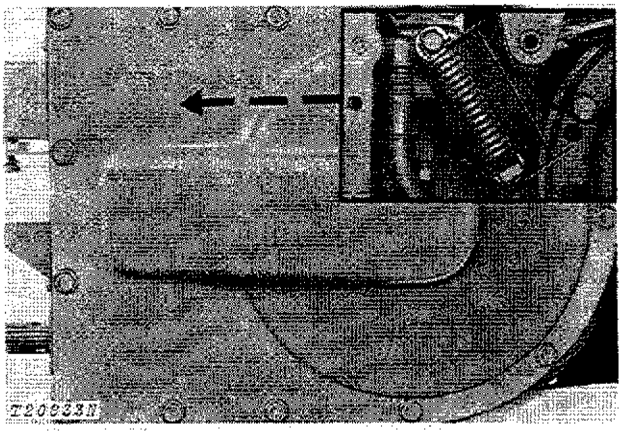


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Fig. 9-Adjusting Winch Brake Band

Adjusting Brake Band Support Cap Screw (-357764)*

To control backlash during operation, adjust the brake band support cap screw.

Remove left quill from winch housing. With brake band in hold position, adjust support cap screw to provide 0.02 to 0.06 inch (0.5 to 1.5 mm) clearance between support cap screw and brake band. Tighten jam nut and install left quill.

Recheck operation of winch. If either brake drag or backlash is excessive, readjust cap screw.

No "Free Spool" After Winch Brake Band Adjustment

Shifting the position of the brake cylinder a very small amount sometimes will free the brake band if difficulty is encountered in getting the winch brake band to release for free spool after the brake band has been adjusted for slippage.

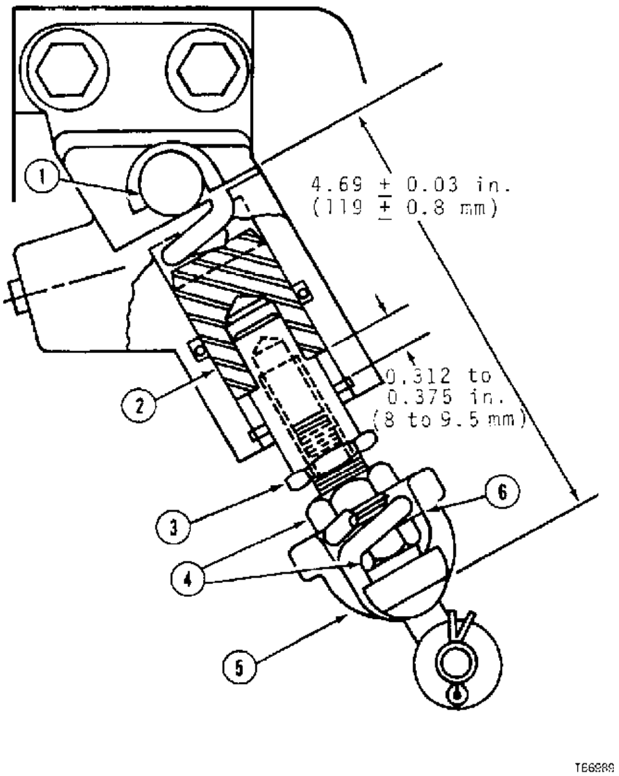
The brake cylinder's position can be shifted by loosening the two cap screws on brake cylinder and with the aid of a screw driver placed between the brake cylinder and the anchor pin boss, move the brake cylinder slightly forward until free spool occurs. When free spool occurs hold the position of the brake cylinder and tighten cap screws.

Adjusting Winch Brake Band (Winch Serial Number 357765-)

NOTE: Also used for units through Winch Serial Number (-357764) with new parts installed.

Always adjust the winch control lever before adjusting the winch brake (see Group 9025).

If the winch brake band or linkage have been removed or replaced, they must be adjusted to prevent slippage.



1—Pin
2—Piston
3—Special Nut
4—Hex Nut (2 used)
5—Spring Anchor
6—Eyebolt

Fig. 10-Brake Band Adjustment

1. Adjust the distance between bottom side of pin (1, Fig. 10) and bottom edge of spring anchor (5) to 4.69 ± 0.03 in. (119 ± 0.8 mm) using the top hex nut (4).

2. Tighten the special nut (3) against the top hex nut.

3. Tighten the bottom hex nut (4) against spring anchor.

4. Put the winch into "FREESPOOL" position.

5. Adjust support cap screw under brake band so brake band does not drag on brake drum. Tighten nut against housing.

If good "freespool" cannot be achieved by adjusting support cap screw, loosen the special nut (3) several turns. Apply T43514 John Deere LOCTITE Plastic Gasket to threads of eyebolt (6). Adjust the special nut to the minimum distance from top hex nut that will give good "freespool".

6. Check the piston stroke from the "HOLD" to "FREESPOOL" position. The maximum allowable piston stroke is 0.38 in. (9.6 mm). The length of piston stroke is controlled by the distance between special nut and top hex nut.

No "FREESPOOL" After Winch Brake Band Adjustment

1. Check the position of the brake cylinder. Loosen the mounting bolts, and position the cylinder so the rod eye is not being forced into the drum when the brake is released.

2. In some instances, the brake lining material extends past the end of middle band. The overhanging material gets caught on the outer band, causing the band to hang on to the drum during "wind in" or "freespool".

If this situation is noted, remove overhanging material with a hacksaw.

3. Check for interference between the head of the brake band support cap screw (bottom of winch housing beneath the brake band) and the brake band cross strap which it contacts. Interference may prevent free movement of the brake band as it tries to open in "wind in" or "freespool".

If excessive interference is evident, smooth the head of the cap screw by grinding or increase the contact area by welding a flat washer to the cap screw head.

4. Check the slots of the brake and clutch drum, where the brake band contacts, for sharp edges.

Remove any sharp edges with a file to prevent catching brake band during "wind in" or "freespool".

TESTING

Winch Seal Test

Obtain a plug the same size as used on the winch housing.

Drill and tap a hole that mates with shop pressurized air equipment fittings.

Coat the threads of the fitting with a suitable sealant and install the fitting in the plug.

Set up two pressure gauges (8 and 9, Fig. 10), a needle valve (4), and a regulator (5) as shown.

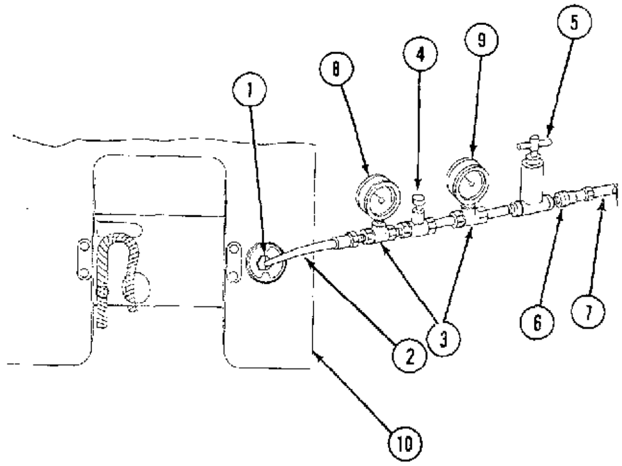
IMPORTANT: Overpressurizing housing can damage seals.

Pressurize the system to 10 psi (69 kPa) (0.69 bar).

Close the needle valve.

The housing should maintain a pressure of 10 psi (69 kPa) (0.69 bar) for 2 minutes, if not, check seals.

Disassemble apparatus.



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1—Plug	6—Disconnect Coupler
2—Hose	7—Air Supply Line
3—Tee	8—Pressure Gauge
4—Needle Valve	9—Pressure Gauge
5—Pressure Regulator	10—Winch Housing

Fig. 11-Winch Seal Test Apparatus

Clutch Piston Seal and Swivel Fitting Seal Test

1. Install fittings as shown from D-15028NU Universal Pressure Test Kit.

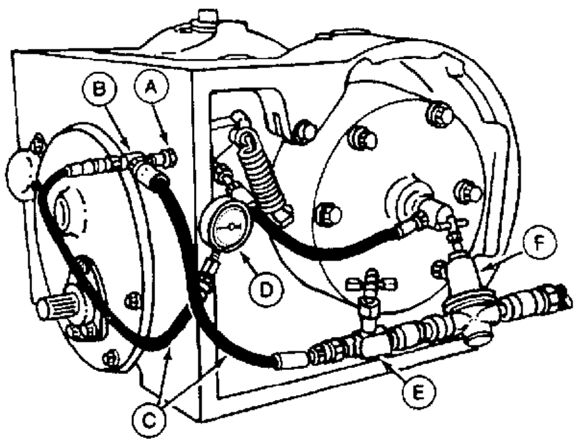
2. Check clutch piston and swivel fitting for seal leakage using 69 kPa (0.7 bar) (10 psi) air pressure.

3. Close valve (E). Clutch piston and swivel fitting pressure must remain at 69 kPa (0.7 bar) (10 psi) for 2 minutes.

4. If clutch piston and swivel fitting holds pressure, remove test equipment and assemble winch.

5. If clutch piston or swivel fittings do not maintain pressure. Check that fittings are tight. Tighten fittings as necessary and repeat test.

If the pressure still drops, disassemble clutch piston assembly. Check seals and O-rings for proper installation and damage. Replace any damaged parts and repeat test.



T83542

A—0752 Fitting	D—6949 Pressure Gauge
B—0027 Tee Fitting	E—2495 Snubber Valve
C—2106 Pressure Hose (2 used)	F—Pressure Regulator

Fig. 12-Clutch Seal Test

Group 3060
WINCH HYDRAULIC SYSTEM
WINCH PUMP

GENERAL INFORMATION

The winch system consists of a control valve, hydraulic pump, and housing with gear train.

The winch pump is of the positive-displacement gear type and is located in the winch housing under the output shaft. The pump is driven by the pinion shaft drive gear and supplies pressure oil for clutching and releasing the winch brake.

FOS Refer to "Gear-Type Pumps" in FOS Manual-HYDRAULICS for additional description and theory of operation.

REMOVAL

Check relief valve pressure before removing winch to service pump.

Remove winch (Group 3041).

Drain winch housing.

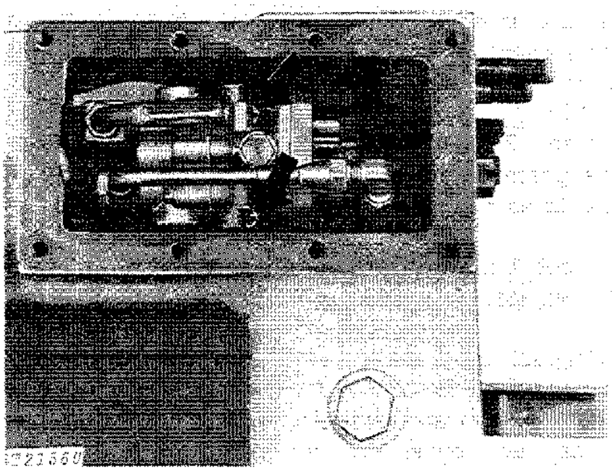


Fig. 1-Pump Attaching Cap Screws

Remove cover on bottom of winch housing and disconnect hydraulic pump oil pressure line at elbow (Fig. 1).

Remove cap screws securing pump bracket to winch housing and remove pump.

REPAIR

Disassemble pump using Figure 2 and the following steps:

Scribe pump body and cover for reassembly purposes.

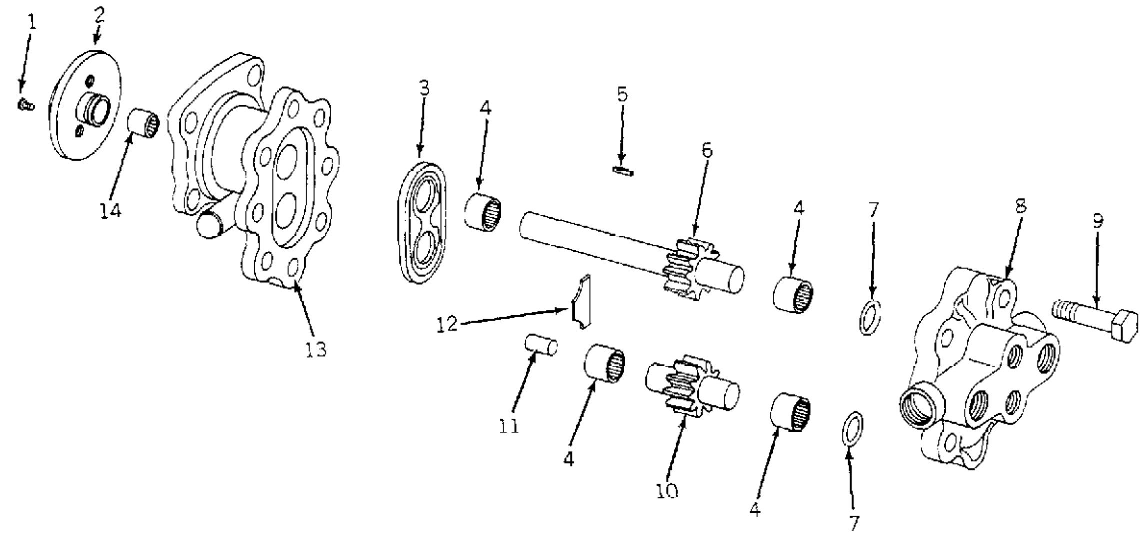
To separate pump cover from body, tap protruding end of drive shaft lightly with a plastic hammer. Be very careful to avoid damaging finely machined surfaces.

Remove wear plate assembly (3) and steel plate from pump body.

NOTE: Whenever pump is disassembled for inspection and repair, replace wear plate assembly. Installation of old parts could result in possible leakage.

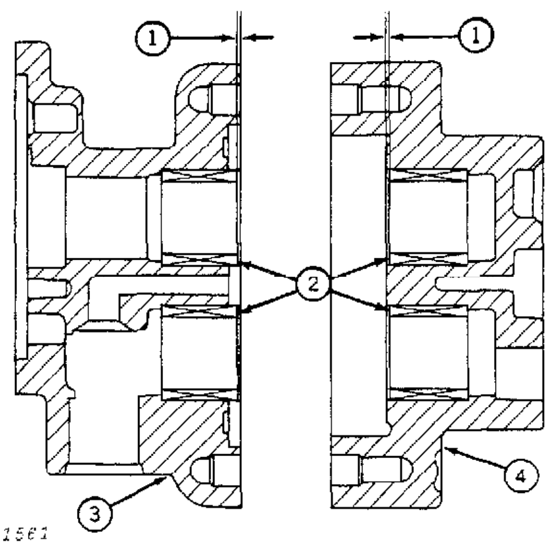
Clean all parts in solvent. Inspect pump parts for wear or damage.

Inspect needle bearings (4) for wear or damage.



1—Special Screw
2—Seal Plate
3—Wear Plate
4—Needle Bearing
5—Key
6—Drive Shaft
7—O-Ring
8—Cover
9—Cap Screw
10—Idler Gear
11—Dowel Pin
12—Block
13—Body
14—Needle Bearing

Fig. 2-Winch Hydraulic Pump



1—Distance bearing should be below machined surface
2—Needle Bearings
3—Pump Body
4—Pump Cover

Fig. 3-Installing Pump Bearings

Press needle bearings into pump body and cover until they bottom out (Fig. 3). Body needle bearings (2) should be 0.0150 to 0.0200 in. [0.381 to 0.508 mm] below pump body (3) machined surface and cover bearings (2) should be 0.0050 to 0.0150 in. [0.127 to 0.381 mm] below pump cover (4) machined surface. Be sure bearings are bottomed out to avoid the possibility of interference with the pump gears and to assure proper mating of the body and cover.

Inspect bearing at drive shaft end of pump body. To replace, press in new bearing until it bottoms.

Inspect pump mounting bracket for damage and replace if necessary. If dowels securing bracket to winch housing are damaged, remove old dowels and press new dowels into winch housing to 0.25 in. [6.35 mm].

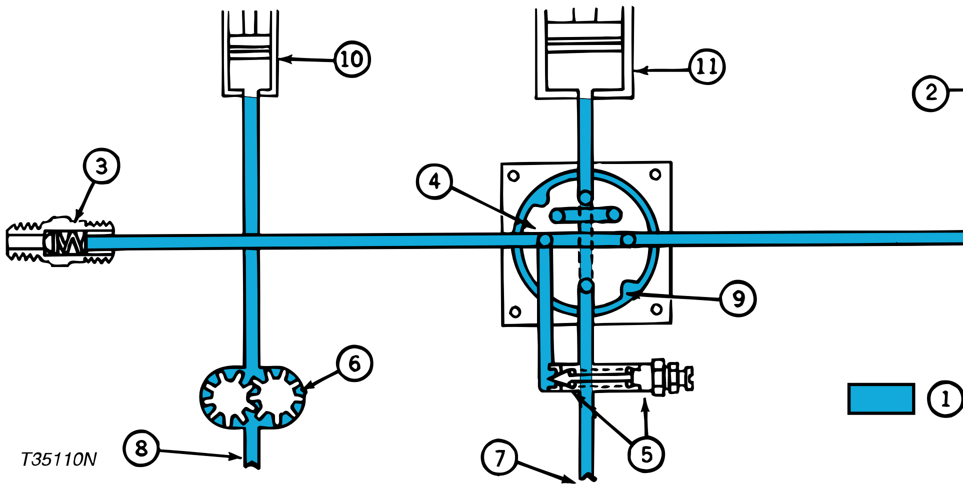
Assemble pump, using Figure 2 as a guide. Be sure to use new wear plate assembly and O-rings.

INSTALLATION

Secure pump with mounting bracket to winch housing. Connect pressure line and install bottom plate.

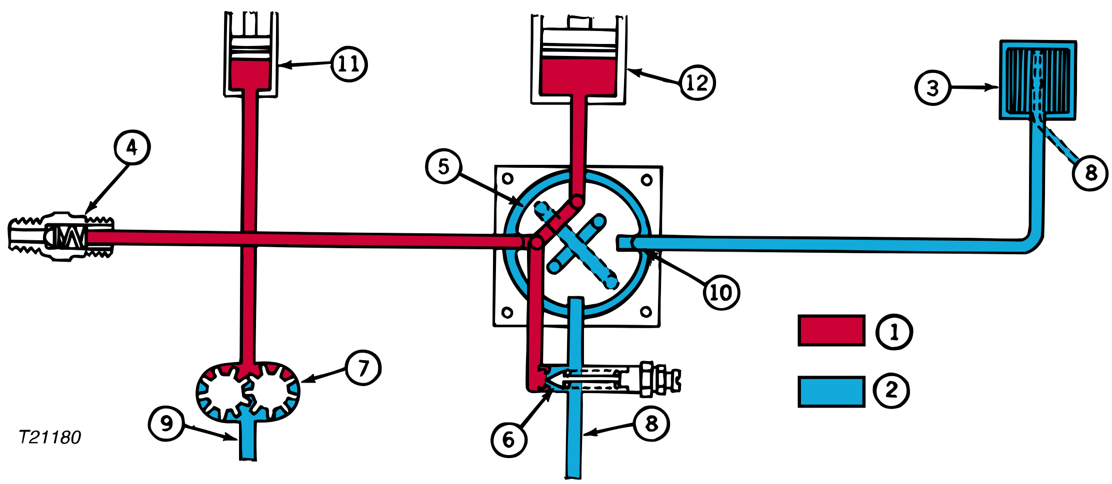
WINCH CONTROL VALVE

GENERAL INFORMATION



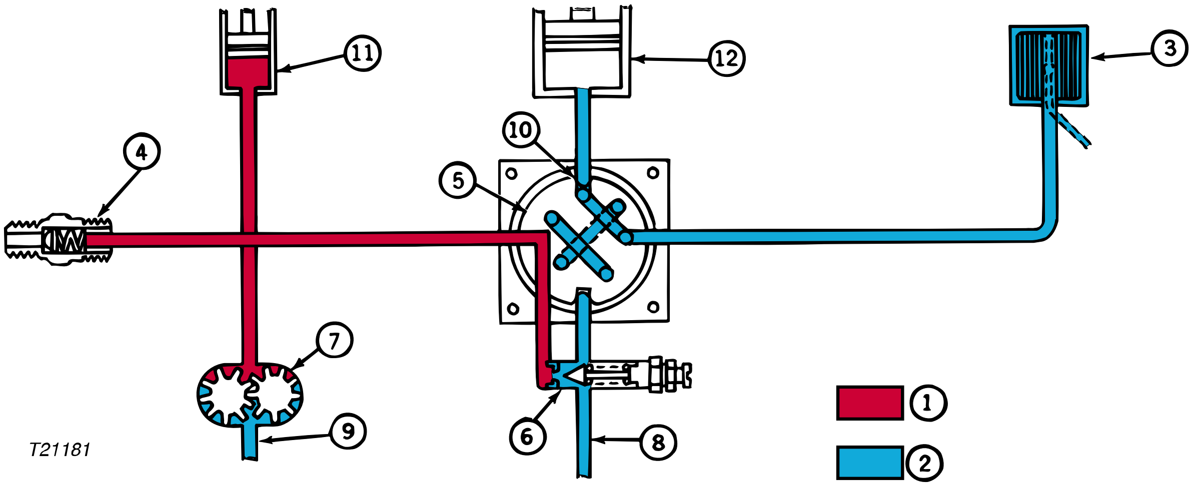
1—Return Oil
2—Filter
3—Ball Connector
4—Valve Spool
5—Relief Valve
6—Pump
7—To Sump
8—From Reservoir
9—Spool Detent
10—Brake Piston
11—Pressure Plate

Fig. 4-Winch Control Valve Operation (Hold Position)



1—Pressure Oil
2—Return Oil
3—Filter
4—Ball Connector
5—Valve Spool
6—Relief Valve
7—Pump
8—To Sump
9—From Reservoir
10—Spool Detent
11—Brake Piston
12—Pressure Plate

Fig. 5-Winch Control Valve Operation (Wind Position)



1—Pressure Oil
2—Return Oil
3—Filter
4—Ball Connector
5—Valve Spool
6—Relief Valve
7—Pump
8—To Sump
9—From Reservoir
10—Spool Detent
11—Brake Piston
12—Pressure Plate

Fig. 6-Winch Control Valve Operation (Free-Spool Position)

The control valve spool is manually operated by a control lever mounted on the right side of the operator's seat. The lever has three positions:

(1) In the "HOLD" (center) position (Fig. 4) the winch drum is in neutral. Pressure oil from the pump passes through the valve spool, through the filter, and dumps back into the reservoir.

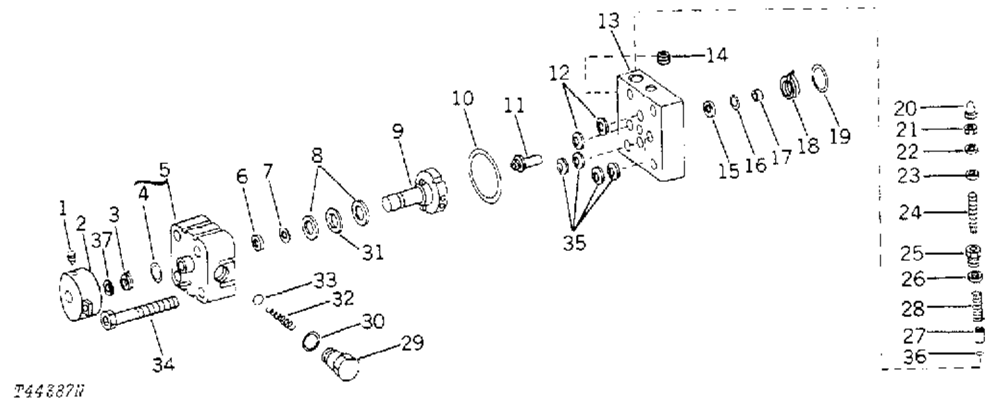
(2) In the "WIND" (forward) position (Fig. 5) the winch drum is engaged. The valve spool closes off the passage to the filter and regulates pressure oil flow to engage the clutch. Back-up pressure from the engaged clutch releases the brake and the gear train turns the winch drum.

(3) In the "FREE-SPOOL" (rear) position (Fig. 6) the winch drum is released. The valve spool prevents oil from passing through the valve. Pressure backs up to the brake cylinder, disengaging the brake.

REMOVAL

Clean area around winch control valve before removing. Disconnect control cable and remove valve.

REPAIR



1—Set Screw
2—Handle Cap
3—Spring
4—O-Ring
5—Valve Cap
6—Backup Ring
7—O-Ring
8—Thrust Bearing Race (2 used)
9—Rotor and Shaft
10—O-Ring
11—Valve Seat (4 used)
12—Curved Washer (2 used)
13—Body and Seat
14—Level-Seal Plug (2 used)
15—Backup Ring (4 used)
16—O-Ring (4 used)
17—Retainer (4 used)
18—Compression Spring (4 used)
19—O-Ring (5 used)
20—Valve Cap
21—Nut
22—Washer
23—Seal
24—Adjusting Screw
25—Plug
26—O-Ring
27—Ball Guide
28—Spring
29—Detent Plug (2 used)
30—O-Ring (2 used)
31—Thrust Bearing
32—Detent Spring (2 used)
33—Detent Ball (2 used)
34—Cap Screw (4 used)
35—Spring Washer (4 used)
36—Steel Ball
37—Retainer

Fig. 7-Winch Control Valve

Use Fig. 7 as a guide and disassemble control valve.

Clean old parts in solvent and dry with compressed air. Inspect parts for wear or damage.

Check relief valve and seat for wear or damage.

Replace all O-rings and assemble control valve.

INSTALLATION

Install control valve on winch. Connect control lever cable.

Group 3099
SPECIFICATIONS AND SPECIAL TOOLS
WINCH HOUSING AND MOUNTING STRUCTURE
SPECIFICATIONS AND TORQUE VALUES

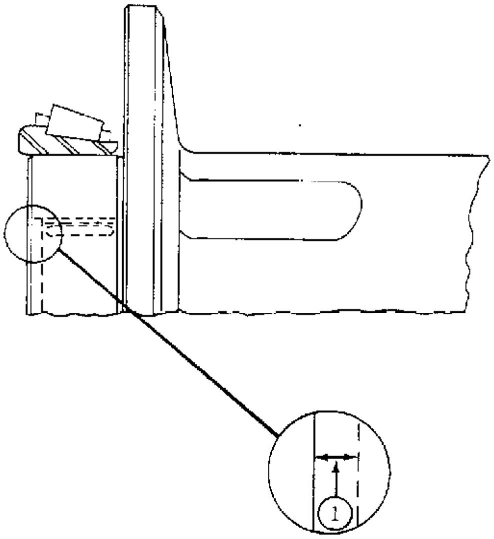


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Fig. 1-Bearings Assembled On Winch Drum

1 - Distance needle bearing is pressed in from left end of winch drum counterbore surface .... 0.250 inch (6.350 mm)

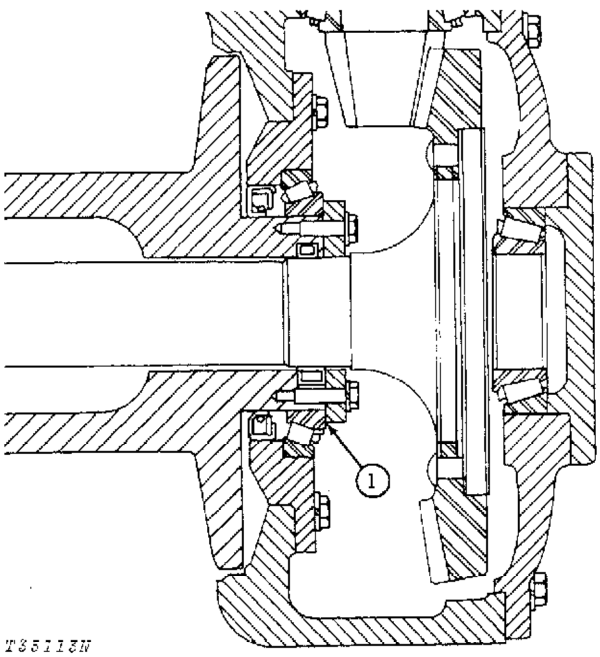

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Fig. 2-Winch Drum Bearing Adjustment

1. Winch drum bearing adjustment ..... 0.002-inch [0.05 mm] end play to 0.002-inch (0.05 mm) preload.

WINCH HOUSING AND MOUNTING STRUCTURE

SPECIFICATIONS AND TORQUE VALUES—Continued

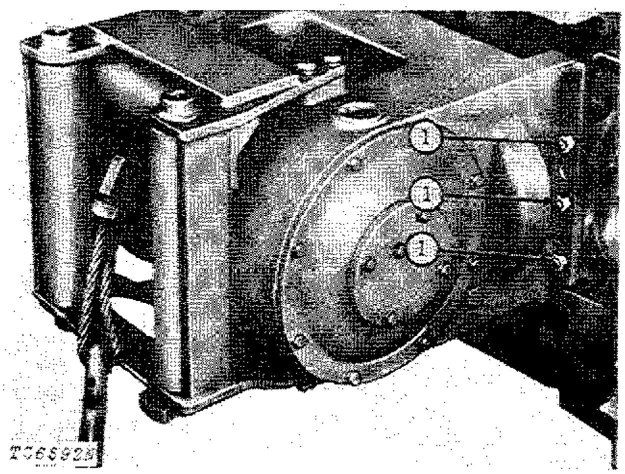


Fig. 3-Winch Housing Torque

1 - Winch housing-to-steering clutch housing .... 150 lb-ft (20.74 kg-m)

WINCH DRIVE AND CLUTCHES

SPECIFICATIONS AND TORQUE VALUES

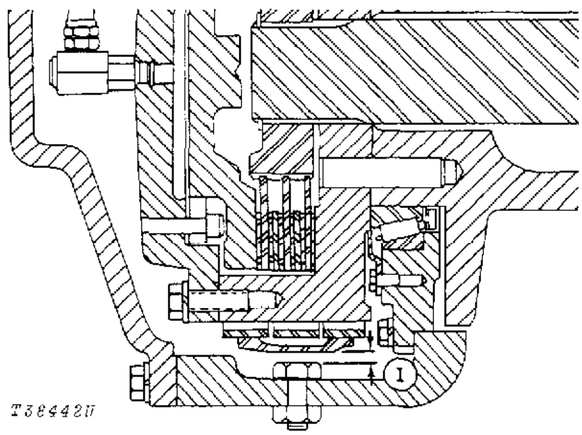


Fig. 4-Brake Band Support Screw

1 - Distance between brake band support cap screw and brake band in hold position...................... 0.04 to 0.02 in. (1.02 to 0.51 mm)

WINCH DRIVE AND CLUTCHES

SPECIFICATIONS AND TORQUE VALUES—Continued

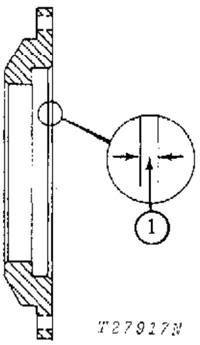


Fig. 5-Bearing Cup Assembled In Right Bearing and Seal Quill

1 - Distance bearing cup is pressed in below shim surface of right quill .... 0.125 inch (3.175 mm).

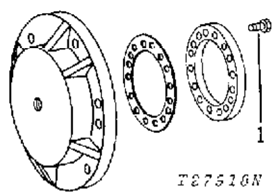


Fig. 6-Diaphragm-to-Clutch Cover Torque

1 - Snug cap screw (-029519)* using a criss-cross pattern to 5 lb-ft (0.69 kg-m).

Tighten cap screw using a criss-cross pattern to 30 lb-ft (4.15 kg-m).

Retighten cap screws to 30 lb-ft (4.15 kg-m).

Allow clutch cover assembly to set for 30 minutes and retighten cap screws to 30 lb-ft (4.15 kg-m).

**Winch serial number*

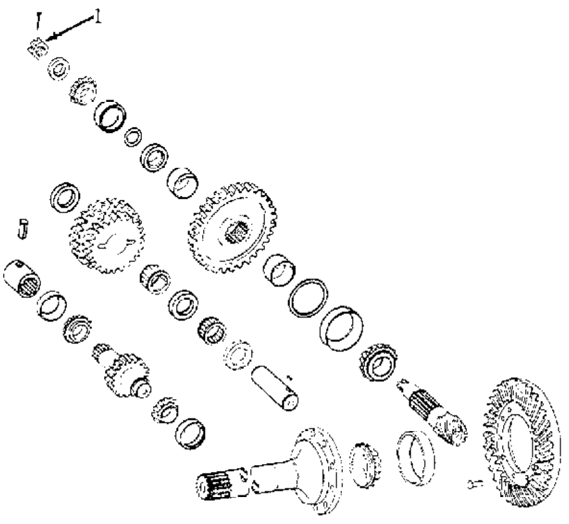


Fig. 7-Pinion Nut Torque

1 - Pinion shaft nut .... 100 to 125 lb-ft (13.83 to 17.28 kg-m)

WINCH DRIVE AND CLUTCHES

SPECIFICATIONS AND TORQUE VALUES—Continued

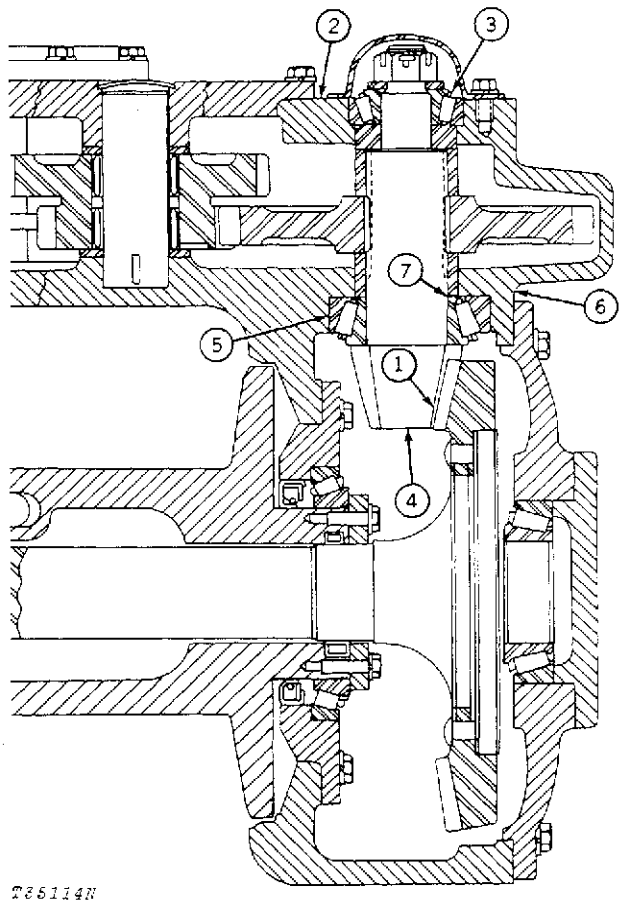


Fig. 8-Cross Section View of Assembled Pinion and Ring Gear

1. Ring gear and pinion backlash adjustment .... 0.006 to 0.012 inch (0.15 to 0.30 mm)
2. Input shaft bearing adjustment... 0.002 to 0.004 inch preload (0.05 to 0.10 mm)
3. Pinion shaft bearing adjustment . 0.004 to 0.006 inch preload (0.10 to 0.15 mm)
4. Location of number etched on the end of the pinion shaft that is to be added to the mean dimension of the output shaft rear bearing cup and cone for cone point adjustment.
5. Mean dimension of output shaft rear bearing cup and cone for cone point setting ..... 1.193 inch (30.30 mm)
6. Location of number in right quill bore that is to be subtracted from 4 and 5.
7. Location of shims for cone point adjustment.

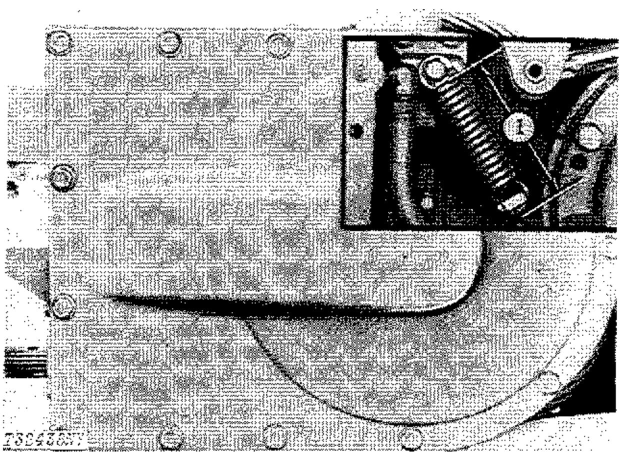
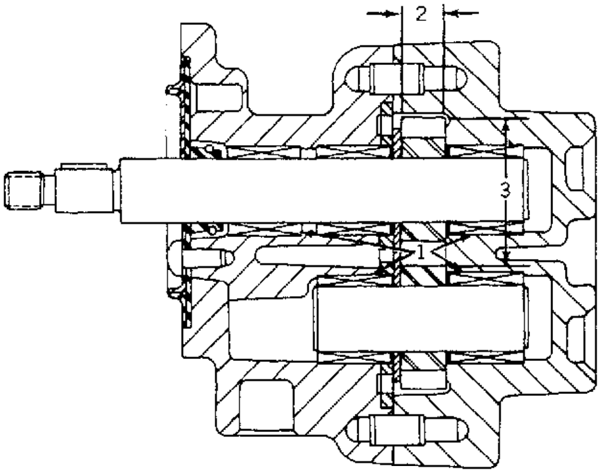


Fig. 9-Brake Band Adjustment

1 - Distance between bottom edge of spring anchor pin and bottom spring hook edge of spring anchor................. 4.675 inch (119.96 mm)

WINCH HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES



T32080N

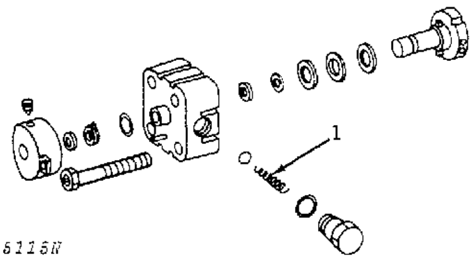
Fig. 10-Winch Hydraulic Pump

Winch Hydraulic Pump

1 - Distance body needle bearings below pump machined surface ....0.0150 to 0.0200 in. (0.381 to 0.508 mm)
Distance cover needle bearings below pump machined surface ....0.0050 to 0.0150 in. (0.127 to 0.381 mm)

2 - Width of gears...........0.3745 to 0.3750 in. (9.512 to 9.525 mm)

3 - O.D. of gears............1.2430 to 1.2435 in. (31.572 to 31.585 mm)

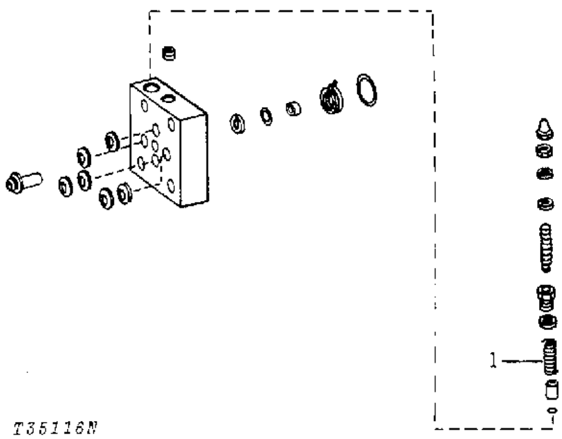


T35115N

Fig. 11-Detent Spring

Winch Control Valve

1 - Detent spring test length .... 0.617 in. (15.67 mm) with a 10 lb. force (45 N) (4.53 kg)



T35116N

Fig. 12-Relief Valve Spring

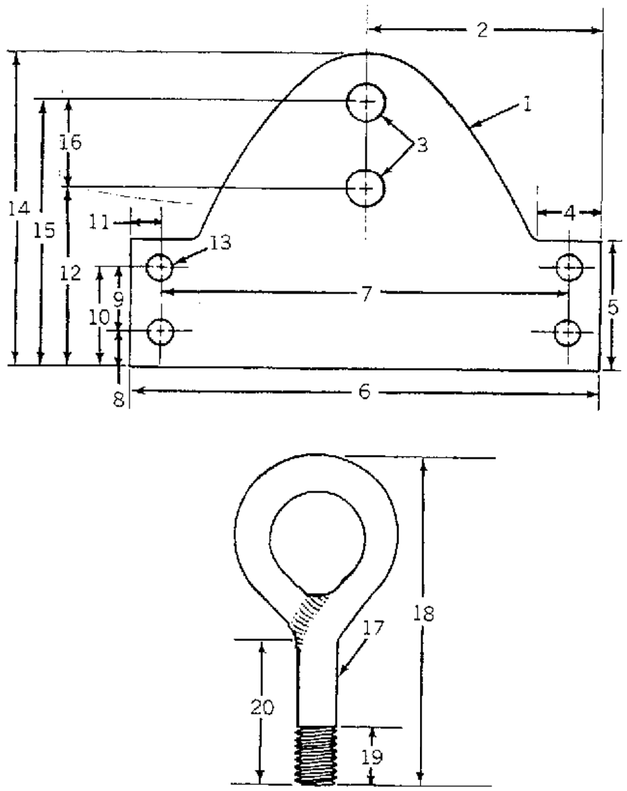
1 - Relief valve spring test length ....0.75 in. (19.05 mm) with a 23 lb. force (102 N) (10.43 kg)

WINCH DRIVE AND CLUTCHES

SPECIAL TOOLS

Convenience Tools

Tool

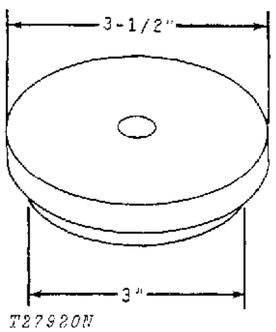


T27896

Fig. 13-Winch Lifting Tool

Tool No.	Use
1	3/4 in. plate (19.0 mm)
2	6-1/4 in. (158.8 mm)
3	Drill (two 1-in. holes (25.4 mm)
4	1-3/4 in. (44.4 mm)
5	3-3/8 in. (85.7 mm)
6	12-1/2 in. (317.5 mm)
7	11 in. (279.4 mm)
8	1 in. (25.4 mm)
9	1-3/4 in. (44.4 mm)
10	2-3/4 in. (69.8 mm)
11	3/4 in. (19.0 mm)
12	4-3/4 in. (120.7 mm)
13	Drill (four) 3/4 in. holes (19.0 mm)
14	8-1/4 in. (209.6 mm)
15	7-1/4 in. (185.2 mm)
16	2-1/2 in. (63.5 mm)
17	15/16 in. bar (23.8 mm)
18	11 in. (279.4 mm)
19	3-1/2 in. of 15/16 in. thread (82.6 mm of 23.8 mm)
20	6 in. (152.4 mm)

NOTE: Secure eyebolt to plate with two 15/16-inch nuts. Place one nut on top side of plate and one on bottom side of plate.



T27920N

Fig. 14-Driver

630-17	Driver - To press bearing cone on main drive shaft
630-11	Driver (Not illustrated) - To press oil seal in input shaft quill
D-15028NU	Universal Pressure Test Kit (Not Illustrated) - To test winch seals for leaks.

Section 31
LOADER

CONTENTS OF THIS SECTION

Group 3102
BUCKETS

GENERAL INFORMATION

Two regular buckets are available for use on the JD350-C Crawler Loader. A 3/4-yard (0.57 m^3) bucket and a 1-1/4-yard (0.96 m^3) light materials bucket may be used.

A 3/4-yard (0.57 m^3) multi-purpose bucket is also available.

The regular buckets have a cutting edge and eight nodular teeth or eight two-piece steel teeth. The multi-purpose bucket has replaceable wrap-around cutting edge and eight replaceable steel teeth.

Two utility rings are welded to the top of the regular buckets to aid in attaching or removing the buckets.

The multi-purpose bucket may be used as a loader, scraper, bulldozer, or clam shell.

The boom and bucket are operated by the loader control lever, while the clamp action of the bucket is operated by the attachment control lever.

The clams open and close by two double-acting hydraulic cylinders.

A single-acting circuit relief valve, located in the control valve, provides pressure relief when the attachment control lever is in neutral.

REMOVAL

Lower boom and bucket until bucket is level on floor.

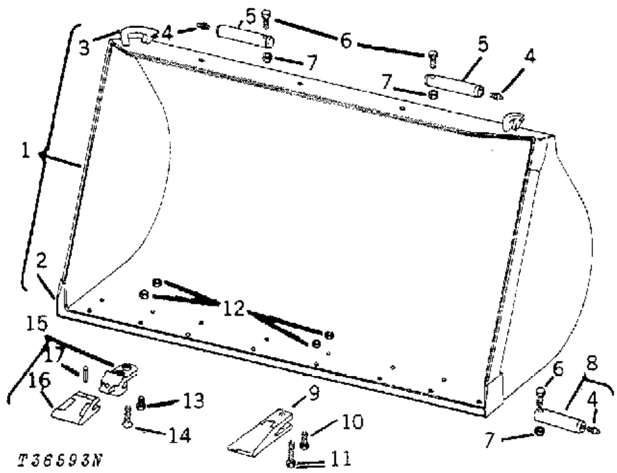
Relieve hydraulic pressure on the cylinders.

Remove bucket cylinder and pivot pins.

Regular buckets can be moved by using a chain hoist on the two utility rings on top of the bucket or the crawler can be carefully backed away from the bucket.

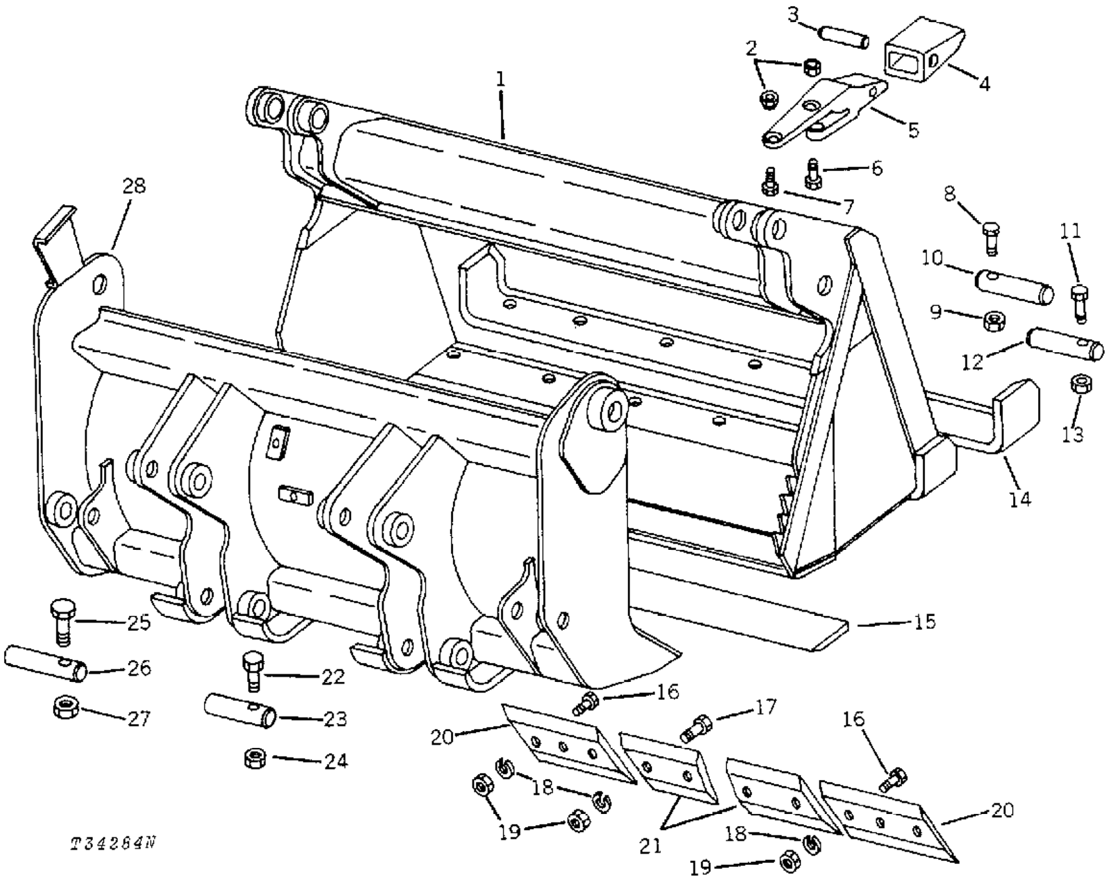
REPAIR

Refer to Fig. 1 during disassembly and assembly of regular buckets.



1—Bucket Assembly
2—Cutting Edge
3—Ring Hook (2 used)
4—Grease Fitting (4 used)
5—Upper Bucket Pivot Pin (2 used)
6—Cap Screw (4 used)
7—Stop Nut (4 used)
8—Lower Bucket Pivot Pin (2 used on 3/4 yd. [.57 m^3]) (4 used on 1-1/4 yd. [.96 m^3]
9—Nodular Iron Tooth (8 used)
10—Cap Screw (8 used)
11—Plow Bolt (8 used)
12—Lock Nut (16 used)
13—Cap Screw (8 used)
14—Plow Bolt (8 used)
15—Two-Piece Steel Tooth (8 used)
16—Steel Tooth Tip (8 used)
17—Groove Pin (8 used)

Fig. 1-Regular Bucket



1—Clam
2—Hex. Nut (4 used)
3—Pin (7 used)
4—Tooth Tip (8 used)
5—Tooth (8 used)
6—Bolt (8 used)
7—Cap Screw (8 used)
8—Cap Screw (2 used)
9—Hex. Nut (2 used)
10—Pin (2 used)
11—Cap Screw (2 used)
12—Pin (2 used)
13—Hex. Nut (2 used)
14—Clam Cutting Edge
15—Bucket Cutting Edge
16—Bolt (6 used)
17—Bolt (6 used)
18—Lock Washer (12 used)
19—Nut (12 used)
20—Moldboard Side Cutting Bit (2 used)
21—Moldboard Center Cutting Edge
22—Cap Screw (4 used)
23—Pin (4 used)
24—Nut (4 used)
25—Cap Screw (2 used)
26—Pin (2 used)
27—Nut (2 used)
28—Blade

Fig. 2-Multi-Purpose Bucket

Refer to Fig. 2 when disassembling or assembling multi-purpose bucket parts.

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).

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 degrees F. (148.9°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.

When replacing multi-purpose bucket cutting edges refer to Fig. 3 and weld according to the following instructions:

1. Use 0.375 in. (9.53 mm) fillet weld on Areas A, C, and G.

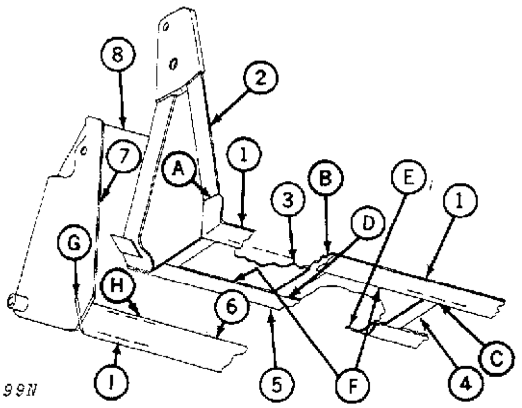
2. Use 0.25 in. (6.35 mm) fillet weld on Area B. Welds are to be 6 in. (152.4 mm) long and centered on cutting teeth holes.

3. Use 0.375 in. (9.53 mm) bevel weld on Area D.

4. Use 0.375 in. (9.53 mm) skip weld on Area E. Welds are to be 6 in. (152.4 mm) long and 12 in. (304.8 mm) between centers.

5. Use 0.25 in. (6.35 mm) fillet weld on Area F. Welds are 3 in. (76.2 mm) long and centered between support runners.

6. Use 0.25 in. (6.35 mm) fillet skip weld on Areas H and I. Welds are to be 4 in. (101.6 mm) long and 8 in. (203.2 mm) between centers.



T21199N

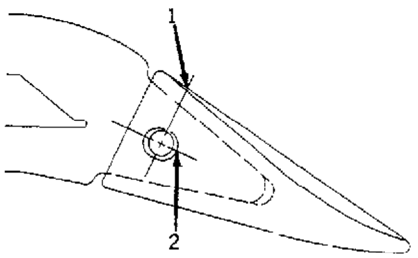
1—Clam Cutting Edge
2—Reinforcing Plate
3—Bottom Plate
4—Support Runner
5—Compaction Plate
6—Blade Cutting Edge
7—Blade
8—Moldboard

Fig. 3-Replacing Bucket Cutting Edges

Bucket Teeth

Drive out pin and remove old tip (16, Fig. 1) from bucket tooth shank.

Hand fit tip on tooth shank.



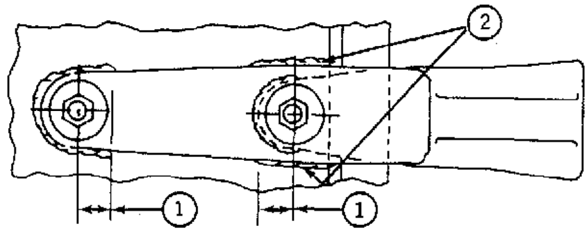
T21196

Fig. 4-Installing Tooth Tip

Drive tip on tooth shank until pin can be assembled or until center of hole in shank aligns with center of slot in tip (Point "1", Fig. 4).

Secure tip to tooth shank with grooved pin.

IMPORTANT: Pin should not contact front edge of slot (Point "2", Fig. 4). Point must fit tight with no movement between tooth shank and tip when twisted by hand.



T21197N

1—1 Inch (25.4 mm)

2—5/16 Inch Bead (all welds) (7.9 mm)

Fig. 5-Tooth Shank Welded to Bucket

Side impacting or wedging or rocks between bucket teeth can sometimes cause the tooth shank attaching hardware to loosen or fail. To prevent this, tooth shanks can be welded to the bucket in the following manner.

See "Special Welding Instructions" and weld tooth shank to bucket (Fig. 5).

Do not remove attaching hardware.

INSTALLATION

Follow removal procedure in reverse.

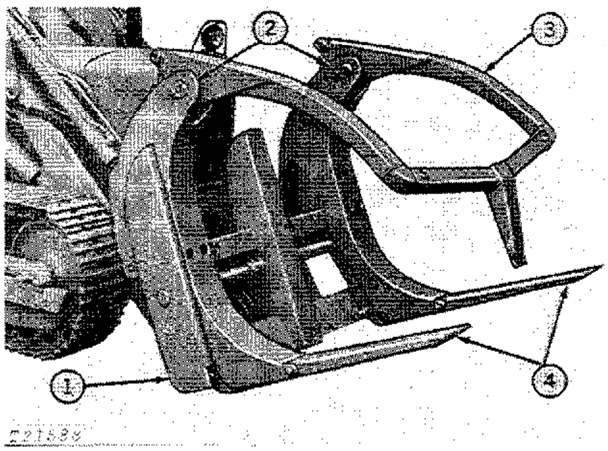
Group 3103
FORKS

GENERAL INFORMATION

The 7702 Log and Lumber Fork is available in three options for the JD350-C Crawler.

The 7702-A Fork attachment consists of the main frame and forks. It provides economical handling of pallets and material boxes. All functions of this attachment are controlled by a single control lever.

Curved masts may be added to the fork attachment to make the 7702-B Timber Loader. It is an ideal unit for handling sawlogs. The curved masts allow for greater loading ease and prevent log jamming.



1—Main Frame
2—Masts
3—Grapple
4—Forks

Fig. 1-7702-C Pulpwood Loader

The timber loader with grapple makes up the 7702-C Pulpwood Loader (Fig. 1). The grapple is operated by dual cylinders and provides positive clamping action which prevents scattering or tipping when handling pulpwood.

See Section 90, Group 9030 for adjustment.

REMOVAL

Lower the log and lumber fork to the ground.

Relieve hydraulic pressure on the cylinders.

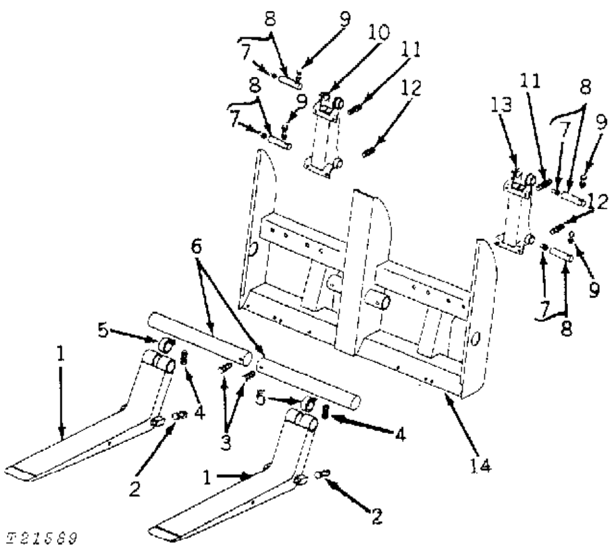
Remove cylinder and boom pins. Back crawler away from the log and lumber fork.

REPAIR

CAUTION: To avoid possible injury and to insure best results, always lower all units and stop crawler engine before servicing.

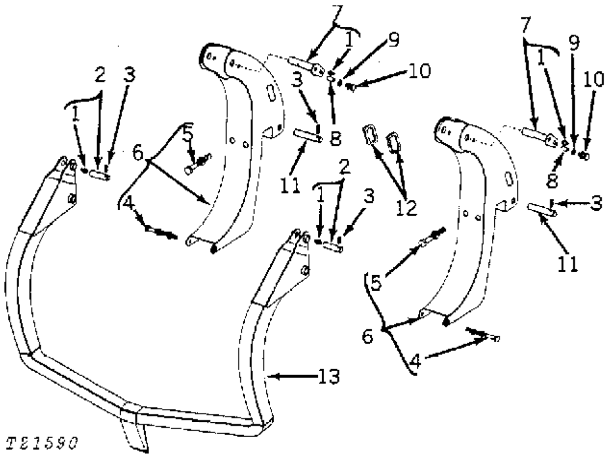
Refer to Figs. 2 and 3 when disassembling or assembling the log and lumber fork.

Check all parts for wear or damage. Replace when necessary.



1—Fork (2 used)
2—Cap Screw and Lock Washer (4 used)
3—Cap Screw, Lock Washer and Nut (2 used)
4—Cap Screw, Lock Washer and Nut (2 used)
5—Fork Pivot Clamp (2 used)
6—Fork Pivot (2 used)
7—Grease Fitting (4 used)
8—Pivot Pin (4 used)
9—Cap Screw and Lock Nut (4 used)
10—Mounting Bracket
11—Cap Screw, Lock Washer and Nut (2 used)
12—Cap Screw, Lock Washer and Nut (8 used)
13—Mounting Bracket
14—Main Frame

Fig. 2-Main Frame and Forks



1—Grease Fitting (4 used)
2—Upper Cylinder Pin (2 used)
3—Roll Pin (4 used)
4—Bolt, Washer, and Nut (2 used)
5—Cap Screw and Washer (4 used)
6—Mast
7—Grapple Pin (2 used)
8—Pipe Spacer (2 used)
9—Steel Washer (2 used)
10—Cap Screw and Lock Washer (2 used)
11—Lower Cylinder Pin (2 used)
12—Rubber Grommet (2 used)
13—Grapple

Fig. 3-Mast and Grapple

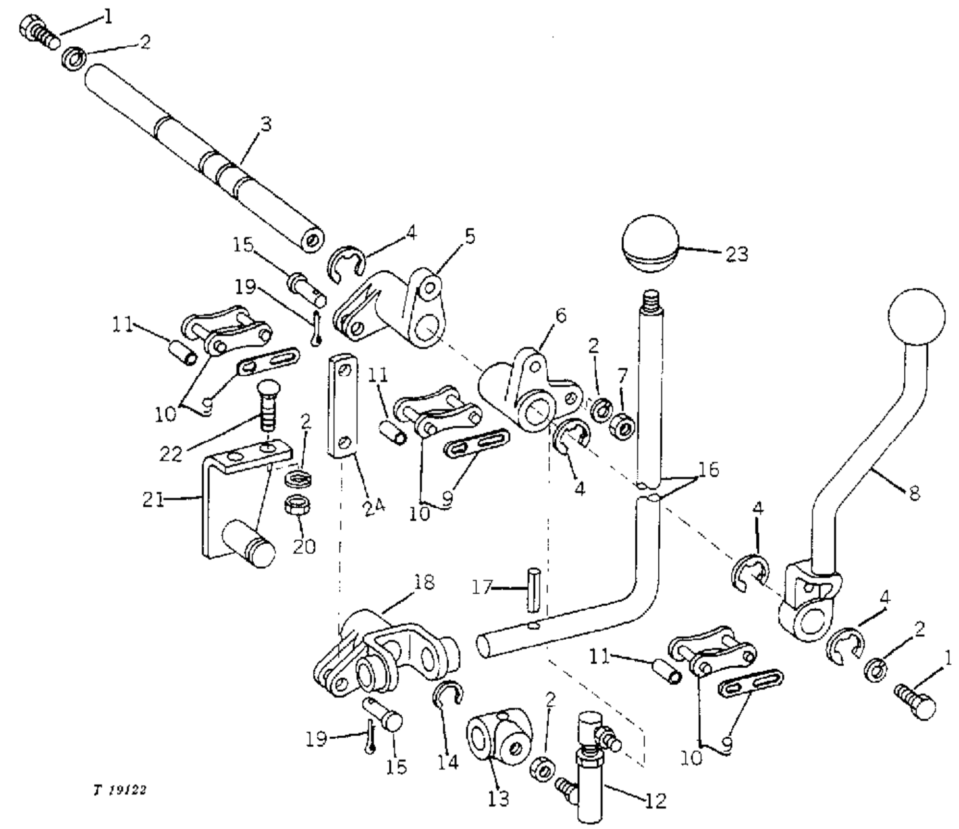
INSTALLATION

Use removal procedure in reverse to install log and lumber fork.

Grease all fittings before resuming operation.

Group 3115
CONTROLS LINKAGE

REPAIR



1—Cap Screw (2 used)	7—Nut	13—Lever	19—Cotter Pin (2 used)
2—Lock Washer (6 used)	8—Auxiliary Lever	14—Snap Ring	20—Nut (2 used)
3—Shaft	9—Spring Clip (3 used)	15—Pin (2 used)	21—Pivot
4—Snap Ring (4 used)	10—Link (3 used)	16—Lever	22—Bolt (2 used)
5—Boom Bell Crank	11—Bushing (3 used)	17—Spring Pin	23—Lever Ball
6—Bucket Bell Crank	12—Ball Joint	18—Pivot	24—Link

Fig. 1-Control Valve Linkage

Inspect control valve linkage for worn or damaged parts and replace as necessary.

Coat bearing surfaces of all bell cranks with grease before assembling to shaft.

Group 3140
LOADER FRAMES

GENERAL INFORMATION

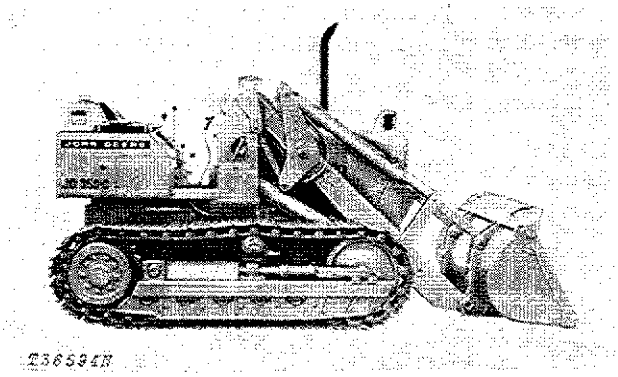


Fig. 1-JD350-C Crawler Loader

The loader main frame has a low profile and is of welded steel construction.

The loader boom is of welded construction and attaches to the main frame with eccentric pins making several boom adjustments possible.

Loaders have either a bucket level indicator or a solenoid actuated return-to-dig switch mounted on the loader frame.

Loader hydraulic functions are performed by a single control lever.

Refer to Section 90, Group 9030 for loader adjustments.

REMOVAL

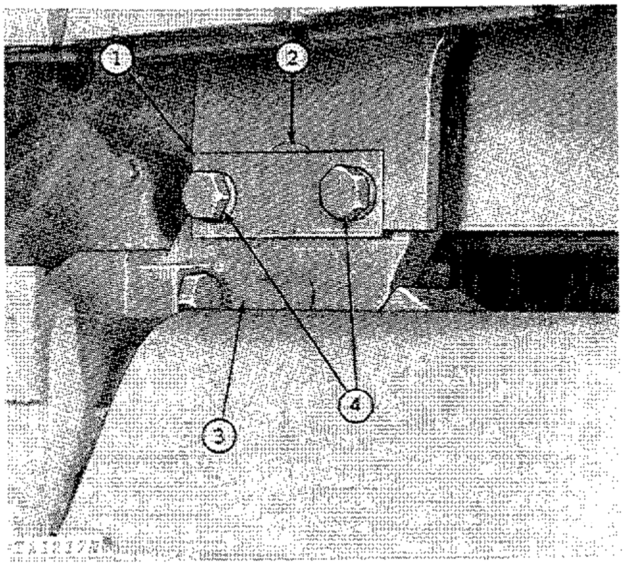
Remove rear tank unit as described under transmission removal.

Disconnect all the necessary wiring, linkage and lines between engine and cowl.

Remove ROPS (if equipped) as directed in Section 18, Group 1810.

Remove air cleaner support and position chains around upper portion of loader frame. Attach chains to hoist.

Position floor jack on dolly with wheels under loader bucket to aid in removal.



1—Outside Retainer
2—Mounting Frame Dowel
3—Rear Crossbar Bracket
4—Retaining Cap Screws

Fig. 2-Loader Rear Mounting Points

Remove cap screws on both sides of loader securing outside dowel retainer to dowel retainer on inside of loader frame (Fig. 2).

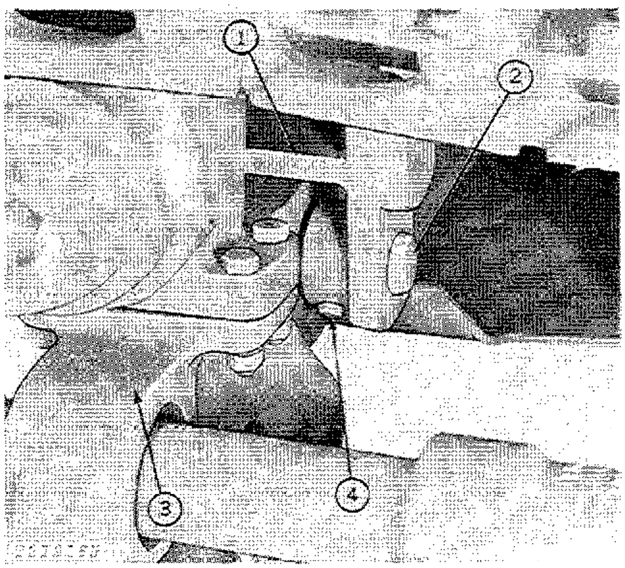
Remove dowels securing loader frame to tractor right and left rear crossbar brackets.

Remove cap screws on both sides of loader securing front mounting pin to loader frame (Fig. 3).

Remove pins securing loader frame to front crossbar.

With the aid of a hoist, raise the loader high enough to clear the machine and remove the loader.

NOTE: Alternate method would be to leave rear tank unit on machine and remove engine with radiator as a unit. Next, remove loader as described.



1—Loader Frame
2—Mounting Pin
3—Front Crossbar
4—Cap Screw

Fig. 3-Loader Front Mounting Points

Removing Loader Boom

NOTE: The following procedure is for removing the loader boom with the bucket or log or lumber equipment attached. Refer to Group 3102 or 3103 of this section to remove bucket or log or loader equipment.

Drain oil from loader reservoir and disconnect loader hydraulic lines from loader cylinders.

Position chains around upper portion of loader boom. Attach chains to moveable hoist.

Position floor jack or dolly with wheels under loader bucket to aid in removal.

Position chains or straps around the lower boom cylinders and boom. Remove cap screws and lower cylinder pins.

Remove remaining cap screws from pins and remove pins.

Use moveable hoist and dolly or jack under bucket to roll boom away from unit.

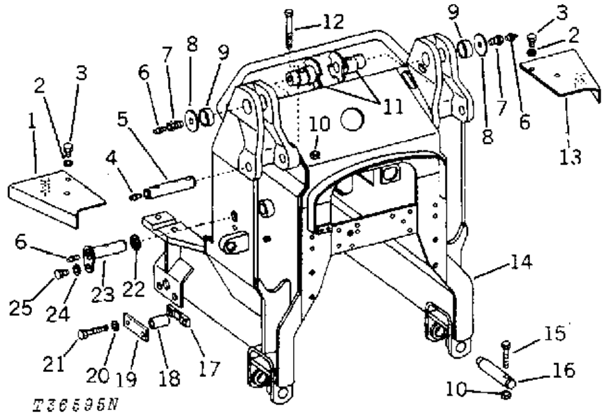
REPAIR

Main Frame

Refer to Fig. 4 during disassembly and assembly of the loader frame.

Inspect all pivot points. If pivot points are loose, worn, or damaged, replace as necessary.

Grease all fittings after assembly.



1—Fender
2—Lock Washer (4 used)
3—Cap Screw (4 used)
4—Grease Fitting (2 used)
5—Link Pin (2 used)
6—Grease Fitting (4 used)
7—Special Screw (2 used)
8—Special Washer (2 used)
9—Bushing (2 used)
10—Stop Nut (4 used)
11—Boom Pivot Pin (2 used)
12—Cap Screw (2 used)
13—Fender
14—Frame
15—Cap Screw (2 used)
16—Pin (2 used)
17—Retainer (2 used)
18—Dowel (2 used)
19—Retainer (2 used)
20—Lock Washer (4 used)
21—Cap Screw (4 used)
22—Spacer (2 used)
23—Boom Cylinder Pin (2 used)
24—Washer (2 used)
25—Cap Screw (2 used)

Fig. 4-Loader Frame

Boom and Linkage

Supporting Loader Boom

It is desirable, in servicing some of the crawler loader components, to raise the boom to its full height.

CAUTION: Be absolutely certain the boom is then supported before working underneath it. This can be accomplished by four different methods, as follows:

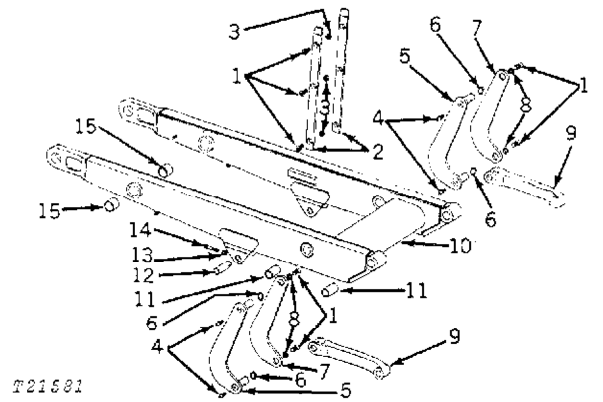
1 - Use boom safety lock bar provided in crawler tool tray (see "Special Tools").

2 - Cut a piece of angle iron (4 x 4 inch [101.6 x 101.6 mm] stock or larger) to a length of 24 inches (609.6 mm). Attach it 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.

3 - Use prop under cross member to support boom.

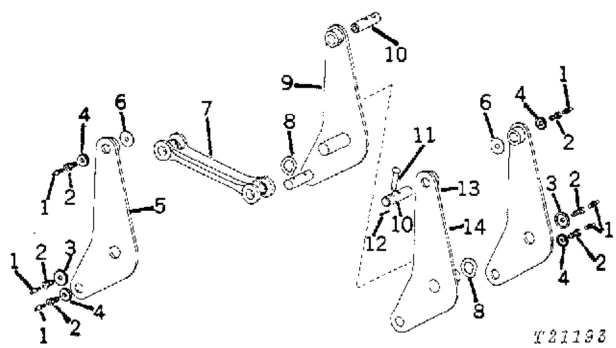
4 - Chain bucket to hoist or overhead beam.

Refer to Figs. 5 and 6 during disassembly and assembly.



1—Hex Bolt (10 used)
2—Rub Bar
3—Nut (6 used)
4—Grease Fitting (4 used)
5—Bucket Crank
6—Special Washer (4 used)
7—Lever
8—Retainer
9—Lever Link
10—Main Boom
11—Bushing (4 used)
12—Boom Cylinder Pivot Pin (2 used)
13—Special Nut (2 used)
14—Cap Screw (2 used)
15—Bushing (4 used)

Fig. 5-Boom and Bucket Linkage



1—Grease Fitting (6 used)
2—Special Screw (6 used)
3—Link Pin Collar (2 used)
4—Link Pin Collar (2 used)
5—Lever
6—Washer
7—Leveling Link (2 used)
8—Wave Washer (2 used)
9—Lever
10—Bucket Cylinder Pin (2 used)
11—Drilled Pin
12—Cotter Pin (2 used)
13—Lever
14—Lever

Fig. 6-Boom to Frame Linkage

Inspect boom, upper links, bucket levers, and bucket links for damage. Replace parts if necessary.

Inspect all loader pivot points. If pivot points are loose, worn, or damaged, replace as necessary.

Grease all fittings where new parts have been installed before resuming operation.

Tighten special cap screw (2, Fig. 6) to 170 lb-ft (23.5 kg-m).

Tighten hex bolts (1, Fig. 5) to 105 lb-ft (14.52 kg-m).

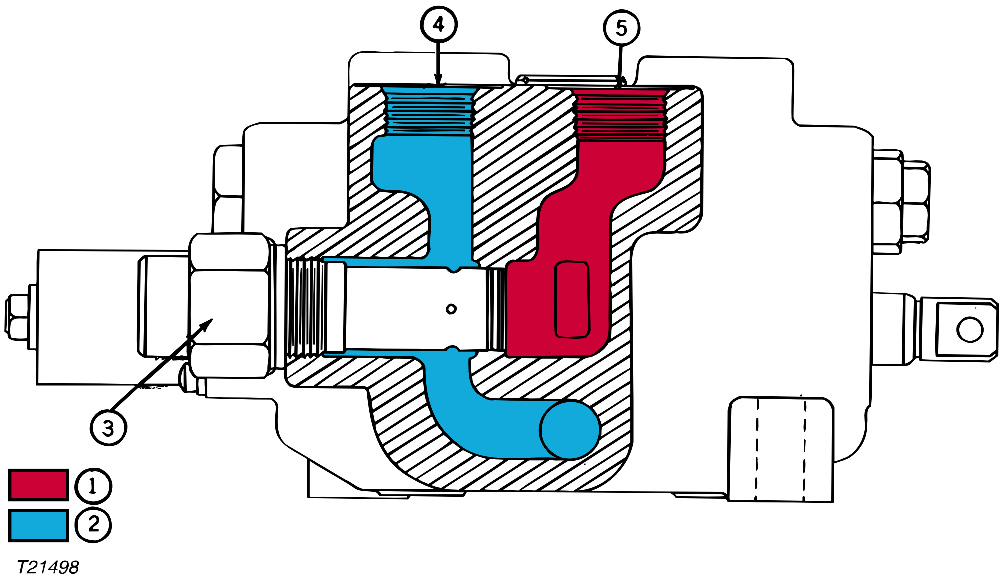
INSTALLATION

Install loader frame and boom by reversing removal procedure.

Group 3160
LOADER HYDRAULICS

CONTROL VALVE

GENERAL INFORMATION



1—Pressure Oil
2—Return Oil
3—System Relief
4—Outlet
5—Inlet

Fig. 1-Pressure and Return Ports in Boom Section

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 the system, be sure all connections are tight and that lines 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 the 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.

Valve Construction

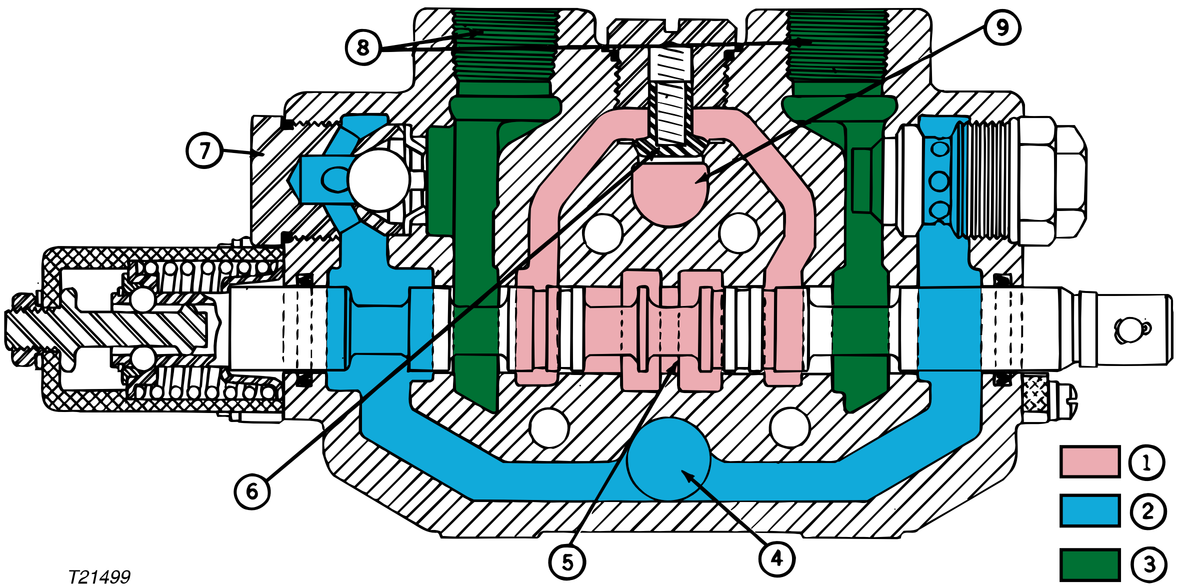
The loader control valve is an open-center, three-spool, stack-type valve. The boom, bucket and auxiliary sections are separate bodies with the valve pressure and return ports located in the boom section. A power beyond port is located in the auxiliary section.

All three valve sections have lift checks, which serve as one-way valves to keep oil on the applied side of the cylinders from flowing back through the valve.

The boom valve spool uses a detent in the spool end cap to retain the spool in the float position. Both the boom and bucket sections have circuit relief valves and anticavitation checks to protect their particular circuits.

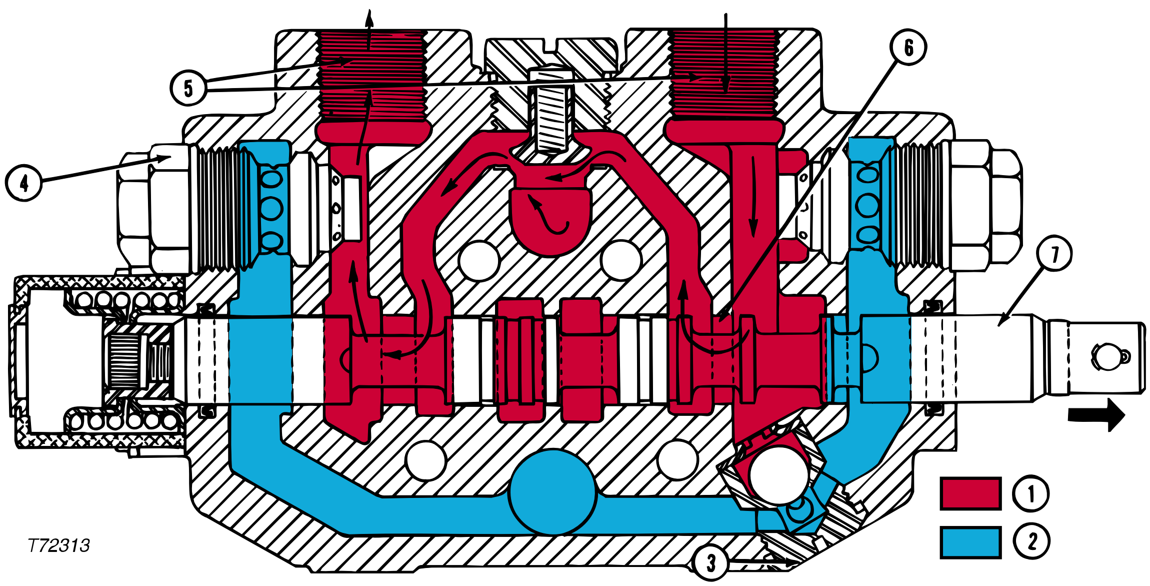
The bucket section may be equipped with an electrical return-to-dig option. See Group 1675 for the repair of the electrical return-to-dig.

The auxiliary valve section is served by the system relief valve; a circuit relief valve is used in this section whenever a crawler is equipped with a multipurpose bucket.



1—Oil Under Slight Pressure
2—Return Oil
3—Trapped Oil
4—Outlet
5—Inlet
6—Check Poppet
7—Anti-Cavitation Check
8—To Boom Cylinders
9—Functional Inlet

Fig. 2-Boom Section in Neutral Position



1—Pressure Oil
2—Return Oil
3—Anti-Cavitation Check
4—Circuit Relief
5—To Bucket Cylinders
6—Regenerative Channel
7—Spool

Fig. 3-Bucket Section in Fast Dump Position (Regenerative Cycle)

For a thorough understanding of control valve operation, review the oil flow illustrations Figs. 2 and 3.

When the control valve is in neutral position, the oil flow is the same through the boom, bucket and auxiliary sections.

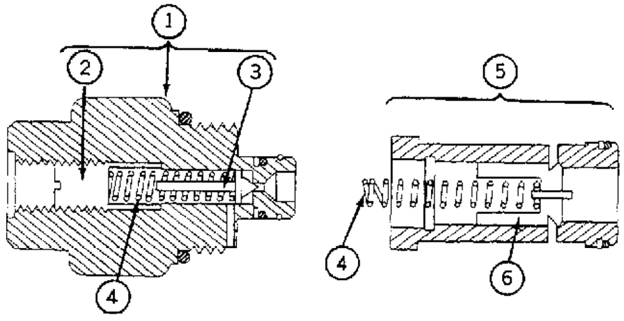
A circuit relief valve is incorporated on the boom-raise side of the valve. An anti-cavitation check is used on the boom-lower side of the valve. Oil from the pump enters the inlet port, and divides into two columns. One column becomes functional inlet oil and the other inlet oil. Oil in the functional inlet travels through the valve stacks and is blocked at the end plate.

With the valve spools in neutral, inlet oil is free to pass to the end plate. At the end plate, oil is channeled back through the valve sections and out the return port to the reservoir. Oil in the cylinders and lines is trapped between spools in the control valve section.

Inlet oil travels past the boom spool (which is in neutral), but is blocked by the bucket spool which is in a power position. Functional inlet oil is blocked at the end plate and must flow past the bucket spool to the bucket cylinders.

With the bucket spool in a full dump position, the regenerative channel is opened to the cylinder port under power. As the cylinder rods begin to move, oil displaced from the cylinders is now directed to the other end of the cylinder instead of the reservoir as in a normal dump position. This "closed" circuit between the two ends of cylinders creates an increased volume of oil going to the cylinders and a fast bucket dump.

Relief Valves

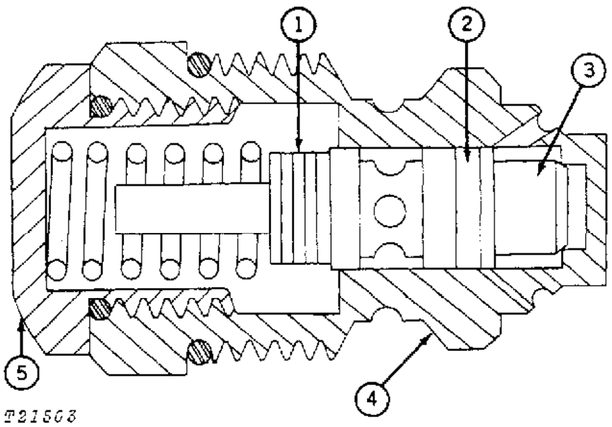


T21502

1—Upper Section
2—Screw Plug
3—Pilot Poppet
4—Spring
5—Lower Section
6—Poppet

Fig. 4-System Relief Valve

A non-adjustable, pilot-operated relief valve within the control valve provides system relief. The valve consists of an upper and lower section. The upper section contains the pilot poppet and the lower section houses the main relief poppet. The system relief valve operates on the differential oil pressure principle.



T21503

1—Shims
2—Seal
3—Poppet
4—Body
5—Cap

Fig. 5-Circuit Relief Valve

The relief valves used in the boom and bucket valve sections are of the direct poppet type. Pressure oil enters through the radial holes in the valve body. As oil pressure on the face of the poppet overcomes spring tension, the poppet is opened allowing oil to flow to the reservoir.

FOS

Refer to "Hydraulic Valves" in FOS Manual - HYDRAULICS for basic information on the operation of pilot operated relief valves.

CONTROL VALVE

Removal

Operate control valve lever until all hydraulic pressure is released.

Release pressure in reservoir by slowly removing filler cap at top of tank.

Disconnect lines from valve. Mark lines and fittings on valve for assembly.

Remove valve from unit.

Repair

NOTE: Refer to Fig. 6 for location of parts during the disassembly and assembly of the control valve.

Service individual valves separately. Be sure valve bodies and their spools are kept together as these parts are matched.

NOTE: See Group 1675 for the repair of the electrical return-to-dig.

Remove tie bolts and separate valve sections.

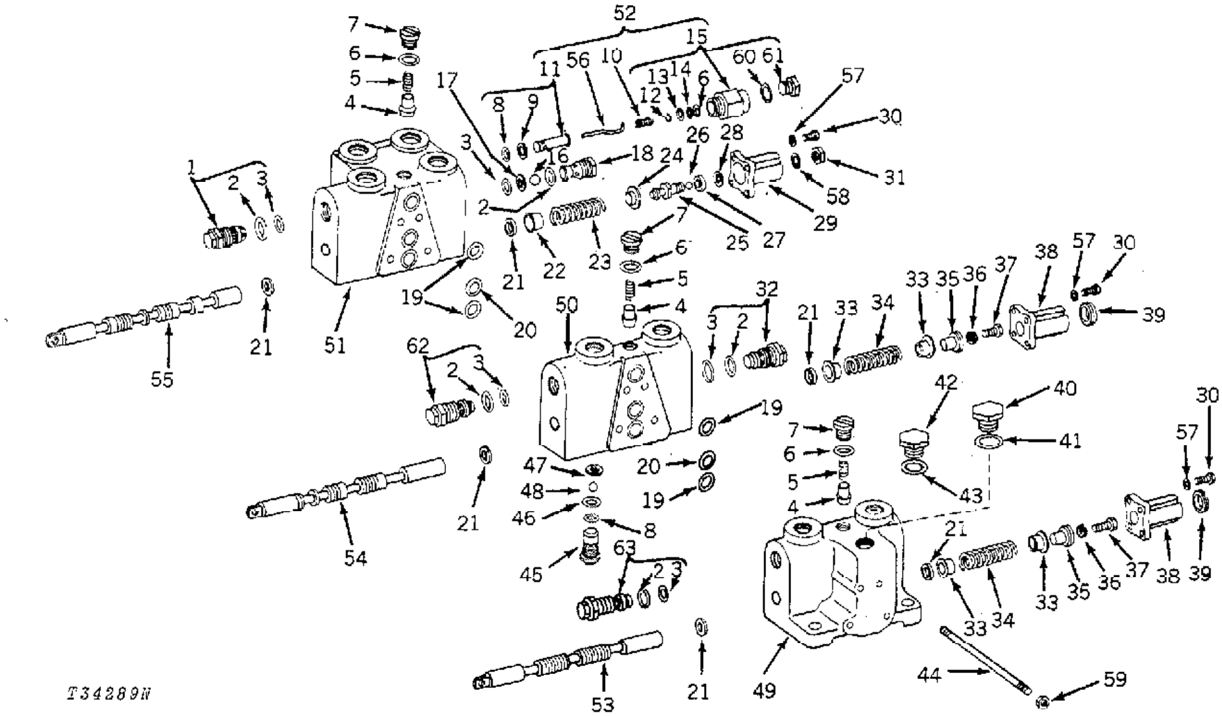
Remove valve bonnets and remove spools from valve housing. Before removing boom spool, be sure spool is in float position.

Clean and dry all parts thoroughly and inspect for wear or damage as follows:

Inspect valve housings for cracks or damaged threads. If a housing is damaged, replace the housing and valve spool as a matched assembly.

Use new O-rings when assembling valve housings.

Remove burrs from spool assembly parts using fine emery cloth. If a spool is worn or damaged, replace the spool and valve housing as a matched assembly.



- 1—Relief Valve
- 2—O-Ring
- 3—O-Ring
- 4—Check Poppet
- 5—Spring
- 6—O-Ring
- 7—Plug
- 8—O-Ring
- 9—Backup Washer
- 10—Spring
- 11—Lower System Relief
- 12—Section Ring
- 13—Seal
- 14—Backup Washer
- 15—Upper System Relief
- 16—Check Ball
- 17—Retainer
- 18—Anti-Cavitation Check
- 19—Seal
- 20—Seal
- 21—Spool Seal
- 22—Stop Collar
- 23—Spring
- 24—Detent Collar
- 25—Detent Adapter
- 26—Detent Ball
- 27—Retaining Ring
- 28—Ball Retainer
- 29—Bonnet
- 30—Machine Screw
- 31—Jam Nut
- 32—Relief Valve
- 33—Stop Collar
- 34—Spring
- 35—Spool Collar
- 36—Lock Washer (2 used)
- 37—Cap Screw
- 38—Bonnet
- 39—Diaphragm
- 40—Plug
- 41—O-Ring
- 42—Plug
- 43—O-Ring
- 44—Stud
- 45—Anti-Cavitation Check
- 46—O-Ring
- 47—Ball Retainer
- 48—Ball
- 49—Auxiliary Section
- 50—Bucket Section
- 51—Boom Section
- 52—System Relief Valve
- 53—Auxiliary Spool
- 54—Bucket Spool
- 55—Boom Spool
- 56—Relief Pin
- 57—Lock Washer
- 58—Lock Washer
- 59—Lock Nut
- 60—O-Ring
- 61—Plug
- 62—Relief Valve
- 63—Relief Valve (used with multi-purpose bucket)

Fig. 6-Exploded View of Control Valve (Early Units)

If a spool spring is worn or broken, replace it. Use new O-rings and backup washers when assembling the spools.

Inspect the lift check cage, spring, and poppet, and replace damaged or worn parts.

Use new O-rings and backup washers when assembling the lift check cage.

Inspect anti-cavitation valve and replace if worn or damaged.

Use a new O-ring and aluminum check ball when assembling the anti-cavitation check valve.

System relief valves (Fig. 4) are not field adjustable and any attempt to adjust the valves will damage them.

Individual service parts are available for valve repair.

If a drop-off in pressure occurs, replace the valve lower section (5, Fig. 4).

If the system pressure is low, replace the valve upper section (1).

If there is no pressure, replace the complete relief valve.

When installing the system relief valve, tighten to 40 lb-ft (54 N·m).

The circuit relief valve cartridges are factory set and must not be adjusted. The relief pressure on each circuit relief valve is stamped on the head end of the cartridge.

When replacing circuit relief valves, install new O-rings and tighten the cartridge to 20 lb-ft (27 N·m).

Thoroughly clean and dry all parts. Put oil on all parts before assembly.

Replace all O-rings and backup washers with new parts.

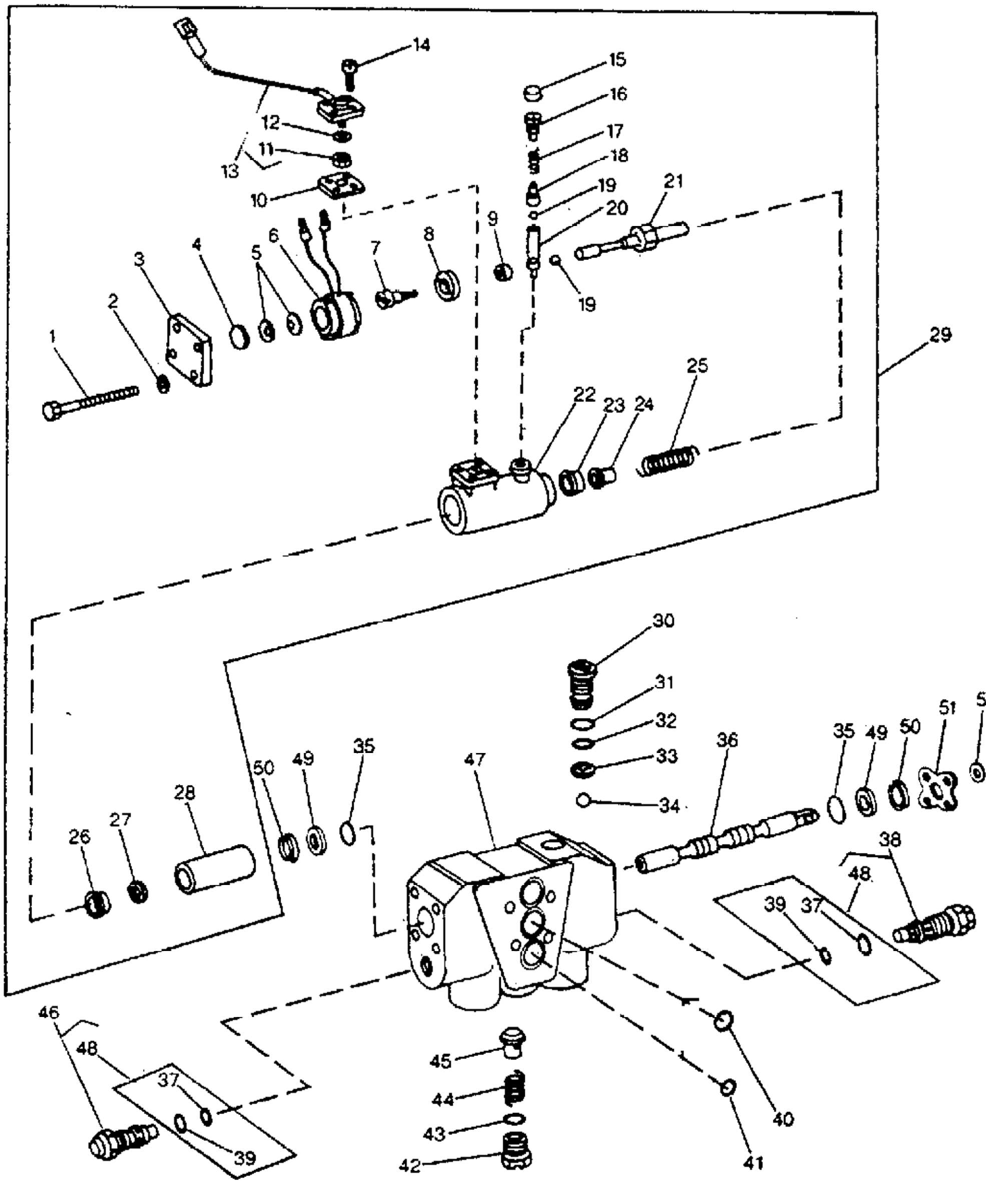
Use heavy grease to hold detent balls in place when assembling the boom control valve spool.

Install spools in proper valve section.

Stack valve sections in proper sequence and tighten tie bolts evenly to 20 lb-ft (27 N·m).

Installation

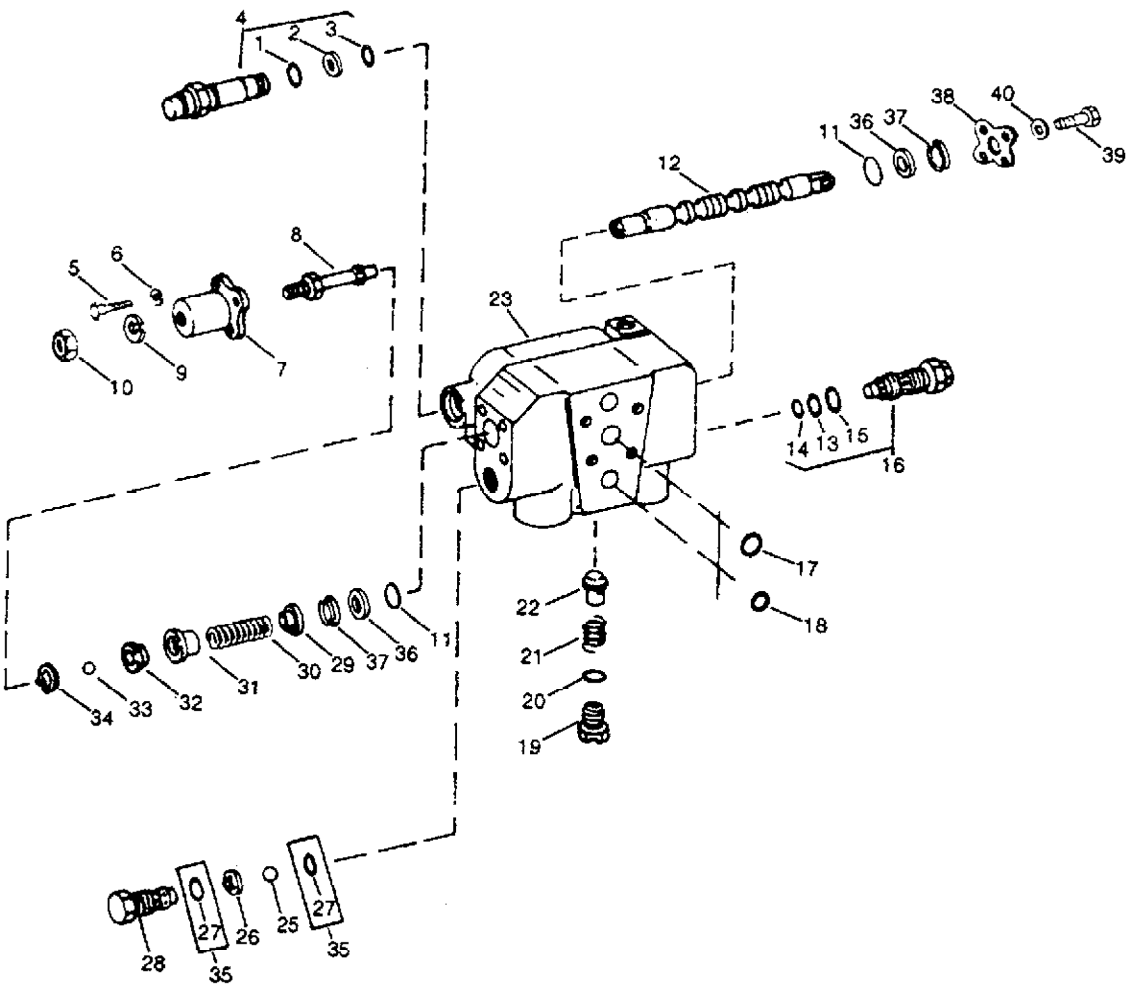
Install control valve in loader and connect linkage and oil lines.



1—Cap Screw (4 used)
2—Washer (4 used)
3—Cover
4—Cap
5—Washer (2 used)
6—Magnet
7—Shoulder Screw
8—Armature
9—Washer
10—Gasket
11—Nut (4 used)
12—Lock Washer (4 used)
13—Connector
14—Screw (4 used)
15—Cover
16—Screw
17—Spring
18—Follower
19—Ball (2 used)
20—Sleeve
21—Stud
22—Housing
23—Bushing
24—Guide
25—Spring
26—Bushing
27—Washer
28—Bushing
29—Detent
30—Housing
31—O-Ring
32—O-Ring
33—Retainer
34—Ball
35—O-Ring (2 used)
36—Spool
37—O-Ring (2 used)
38—Relief Valve
39—O-Ring (2 used)
40—O-Ring
41—O-Ring (2 used)
42—Fitting
43—O-Ring
44—Spring
45—Poppet
46—Relief Valve
47—Housing
48—Seal Kit
49—Washer (2 used)
50—Washer (2 used)
51—Retainer
52—Screw (4 used)
53—Lock Washer (4 used)

Fig. 6A—Control Valve—Bucket Section (Later Units and 355D)

7AV;T64086F 09T;3160 K1 080986



1—O-Ring	11—O-Ring	21—Spring	31—Locking Collar
2—Washer	12—Spool	22—Poppet	32—Retainer
3—O-Ring	13—Washer (2 used)	23—Housing	33—Ball (4 used)
4—Relief Valve	14—O-Ring	24—O-Ring (2 used)	34—Ring
5—Screw (4 used)	15—O-Ring	25—Ball	35—Seal Kit
6—Lock Washer (4 used)	16—Relief Valve	26—Retainer	36—Washer (2 used)
7—Cover	17—O-Ring	27—O-Ring	37—Washer (2 used)
8—Adapter	18—O-Ring (2 used)	28—Plug	38—Retainer
9—Washer	19—Fitting	29—Plug	39—Screw (4 used)
10—Snap Ring	20—O-Ring	30—Spring	40—Lock Washer (4 used)

Fig. 6B—Control Valve—Boom Section (Later Units and 355)

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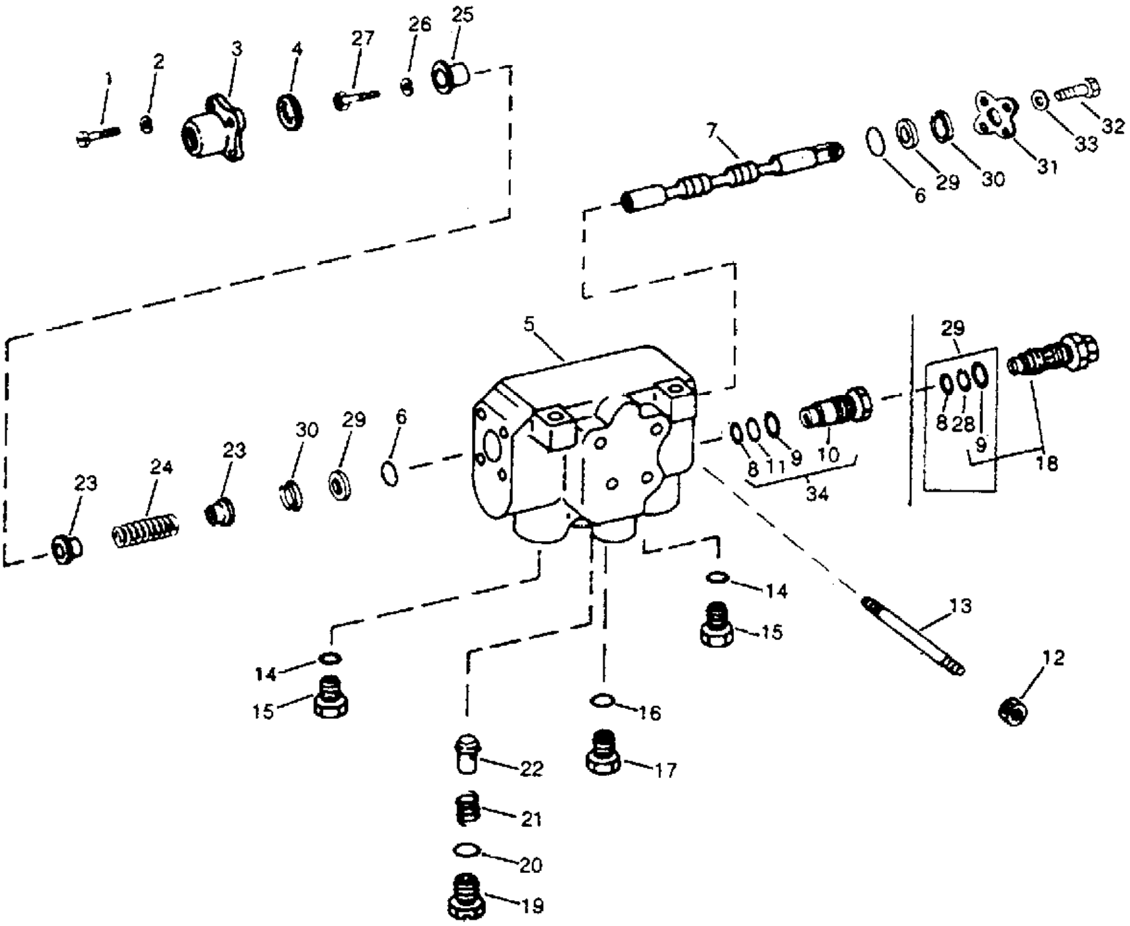
147;316C 08 040986



1—Screw (4 used)	**10—Plug**	**19—Fitting**	**27—Cap Screw**
2—Lock Washer (4 used)	**11—Backup Ring**	**20—O-Ring**	**28—Washer**
3—Cover	**12—Lock Nut (4 used)**	**21—Spring**	**29—Seal Kit (2 used)**
4—Cover	**13—Stud (4 used)**	**22—Poppet**	**30—Washer (2 used)**
5—Housing	**14—O-Ring (2 used)**	**23—Plug (2 used)**	**31—Retainer**
6—O-Ring (2 used)	**15—Drain Plug (2 used)**	**24—Spring**	**32—Screw (4 used)**
7—Spool	**16—O-Ring**	**25—Bushing**	**33—Lock Washer (4 used)**
8—O-Ring (2 used)	**17—Drain Plug**	**26—Lock Washer**	**34—Fitting**
9—O-Ring (2 used)	**18—Relief Valve**		

Fig. 6C—Control Valve—Auxiliary Section (Later Units and 355)

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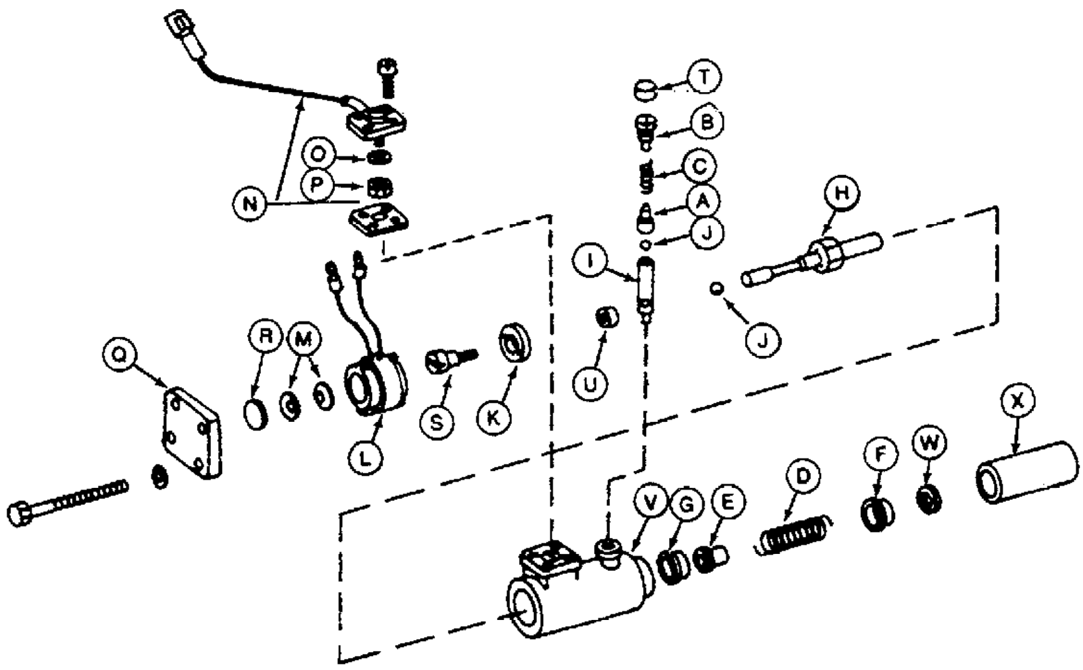
RETURN-TO-DIG MECHANISM



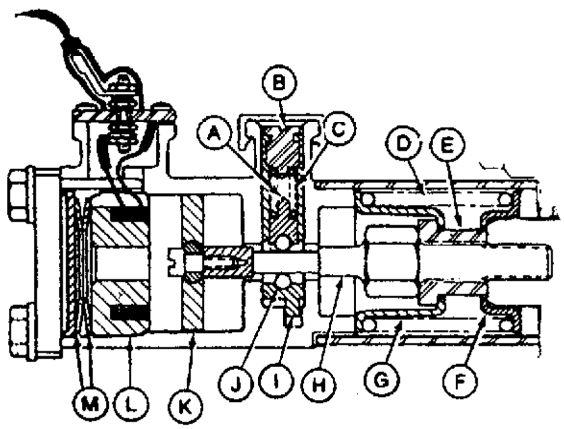
A—Follower	G—Bushing	M—Disk Spring (2 used)	S—Screw
B—Screw	H—Stud	N—Connector	T—Cover
C—Spring	I—Sleeve	O—Lock Washer	U—Washer
D—Spring	J—Ball (2 used)	P—Nut	V—Housing
E—Guide	K—Armature	Q—Cover	W—Washer
F—Bushing	L—Magnet	R—Cap	X—Bushing

Remove parts (A—X) to disassemble return-to-dig mechanism.

Apply thread lock and sealer (medium strength) on threads of washer to armature screw (S). Tighten to 2—3 N·m (18—22 lb-in.).

Tighten retainer screws to 0.45—0.57 N·m (4—5 lb-in.)

Tighten cover cap screws to 8—11 N·m (6-8 lb-ft).



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CYLINDERS

GENERAL INFORMATION

The hydraulic cylinders used on the crawlers are double acting and use "V"-packing type seals on their pistons. Piston rods 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 and an explanation of the hydraulic cushion design.

REMOVAL

NOTE: Prior to removing cylinders operate the control valve levers until all hydraulic pressure is relieved.

Loader Boom Cylinders

Raise boom as high as it will go.

CAUTION: Be sure boom is properly supported before removing cylinder to prevent boom from dropping and causing injury.

Remove cylinders and cap lines.

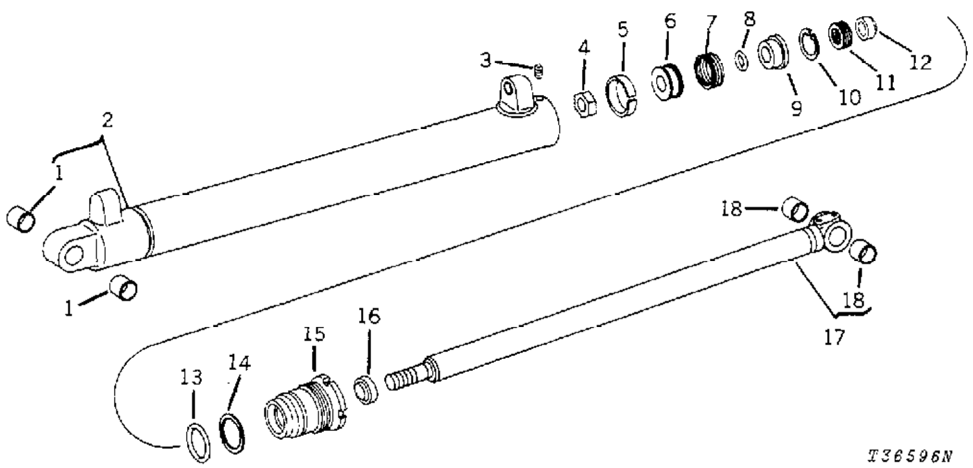
Loader Bucket and Clam Cylinders

Lower boom to ground and rest bucket flat on ground. Remove cylinders and cap lines.

Log and Lumber Clamp Cylinders

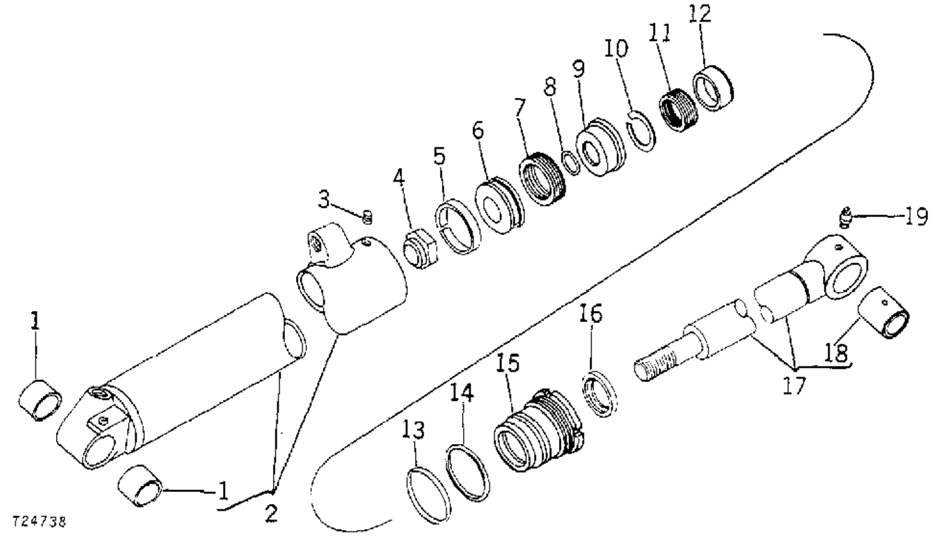
Lower boom to ground and lower clamp to avoid injury when removing cylinders. Remove cylinders.

REPAIR



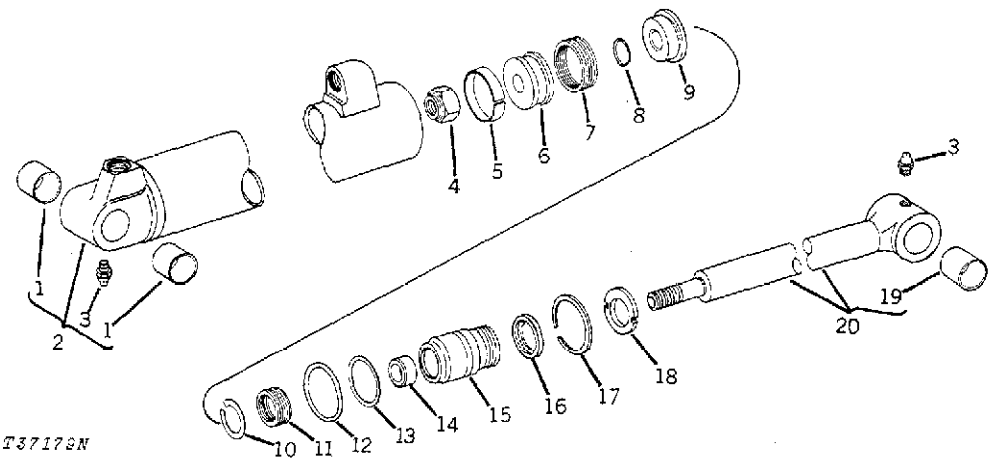
1—Bushing (2 used)
2—Barrel
3—Set Screw
4—Stop Nut
5—Wear Ring
6—Retainer
7—V-Packing
8—O-Ring
9—Piston
10—Snap Ring
11—V-Packing
12—Wear Ring
13—O-Ring
14—Backup Washer
15—Rod Guide
16—Wiper Seal
17—Piston Rod
18—Bushing (2 used)

Fig. 7-Loader Bucket Cylinder Assembly



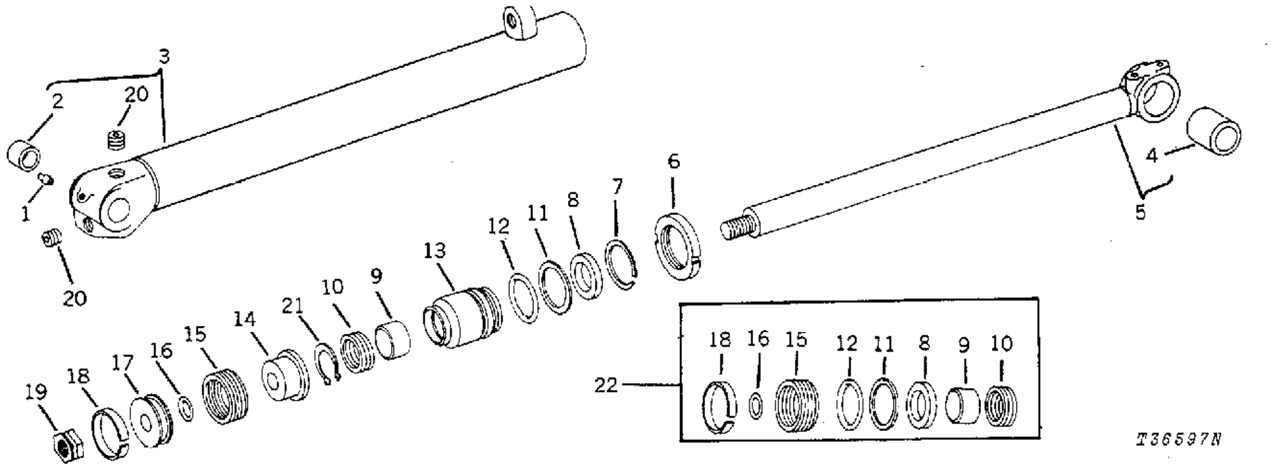
1—Bushing (2 used)
2—Barrel
3—Set Screw
4—Special Nut
5—Wear Ring
6—Retainer
7—V-Packing
8—O-Ring
9—Piston
10—Snap Ring
11—V-Packing
12—Wear Ring
13—O-Ring
14—Backup Washer
15—Rod Guide
16—Wiper Seal
17—Piston Rod
18—Bushing
19—Grease Fitting

Fig. 8-Loader Boom Cylinder Assembly



1—Bushing (2 used)
2—Barrel
3—Grease Fitting (2 used)
4—Stop Nut
5—Wear Ring
6—Piston
7—V-Packing
8—O-Ring
9—Piston
10—Snap Ring
11—V-Packing
12—O-Ring
13—Backup Washer
14—Wear Ring
15—Rod Guide
16—Wiper Seal
17—Snap Ring
18—Spanner Nut
19—Bushing
20—Piston Rod

Fig. 9-Multipurpose Bucket Clam Cylinder



1—Grease Fitting	6—Spanner Nut	11—Backup Washer	17—Piston Retainer
2—Bushing (2 used)	7—Snap Ring	12—O-Ring	18—Wear Ring
3—Head and Barrel	8—Wiper Seal	13—Rod Guide	19—Lock Nut
4—Bushing	9—Wear Ring	14—Piston	20—Pipe Plug (2 used)
5—Piston Rod	10—V-Packing	15—V-Packing	21—Snap Ring
		16—O-Ring	22—Repair Kit

Fig. 10-Log Grapple Cylinder Assembly

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filter.

Clamp the cylinder in a vise to prevent it from turning. Remove set screw and rod guide. Use the D-05270ST Special Spanner Wrench to loosen rod guide.

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 lock nut from end of rod. Slide parts from end of rod.

Wash all parts thoroughly with diesel fuel and inspect the following:

1. Barrel, rod guide and rod for scoring, and O-rings for surface damage.

2. V-packings and wear rings for breaks, cuts or embedded foreign material.

3. Piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.

Repair kits are available for overhauling all cylinders. Discard used parts and use all new parts provided in kits when assembling cylinders.

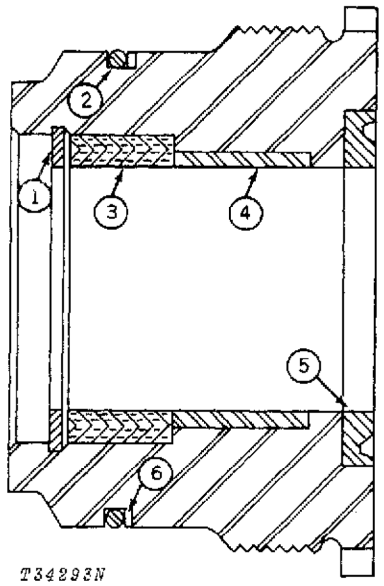
Lubricate all O-rings, seals, and packings before assembly.

Install new wiper seal in rod guide.

Install new wear ring in rod guide. Install backup washer and O-ring on rod guide.

Install the packing (3, Fig. 11) in rod guide with apex of the V toward the wiper seal and secure with snap ring (2).

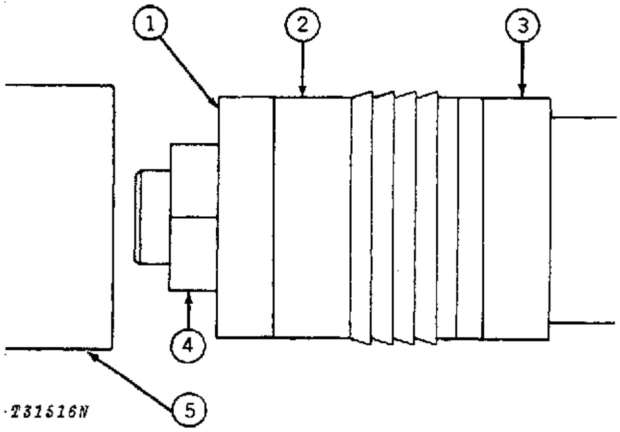
Slip rod guide assembly on piston rod being careful not to damage packing.



1—O-Ring
2—Snap Ring
3—V-Packing
4—Wear Ring
5—Wiper Seal
6—Backup Washer

Fig. 11-Cylinder Rod guide Components

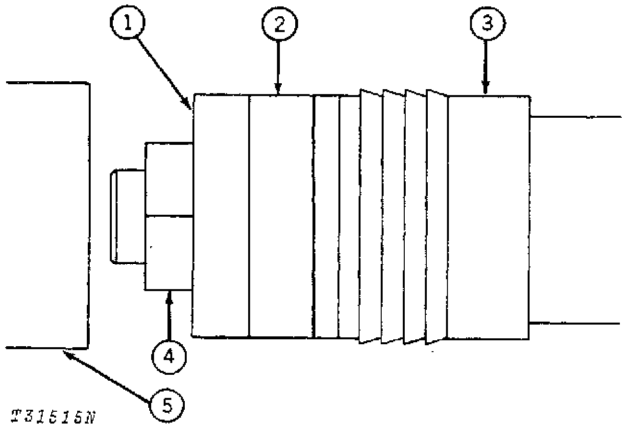
Installing Piston V-Packing



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 12-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. 12). 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—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 13-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. 13). When replacing V-packings in the field this procedure can be used if a suitable ring compressor is available to compress packings when installed in cylinders.

Install piston on piston rod. Install wear ring on piston retainer. Install retainer on piston rod and fasten with lock nut. Tighten lock nut for boom cylinder to 600 to 700 lb-ft (813 to 949 N·m). Tighten lock nut for bucket cylinder to 475 to 575 lb-ft (644 to 780 N·m). Tighten lock nut for log grapple cylinder to 130 to 160 lb-ft (176 to 217 N·m). Tighten lock nut for multi-purpose bucket clam cylinder to 150 to 250 lb-ft (203 to 339 N·m).

Install piston rod assembly into barrel.

Put AT52853 John Deere Loctite Thread Lock and Sealer (Low Strength) or an equivalent on the threads of the rod guide and set screw or spanner nut before installing in cylinder barrel.

Use the D-05270ST Special Spanner Wrench to tighten rod guides or spanner nuts.

Install piston rod assembly in barrel for bucket and boom cylinders with rod guide and tighten to 250 to 300 lb-ft (339 to 407 N·m). Install set screw and tighten to 40 lb-in (4.5 N·m). Tighten spanner nut on log grapple and multi-purpose bucket clam cylinder to 125 to 175 lb-ft (170 to 237 N·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.

NOTE: When installing the left bucket cylinder the cylinder rod end must be installed with the return-to-dig mounting holes up to prevent interference with the bucket link.

After replacing 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
BUCKETS
SPECIFICATIONS AND TORQUE VALUES

Regular bucket capacity .... 3/4 yard
(0.57 m^3)

Light materials bucket capacity .... 1-1/4 yard
(0.96 m^3)

Multipurpose bucket capacity ....3/4 yard
(0.57 m^3)

LOADER FRAMES
SPECIFICATIONS AND TORQUE VALUES

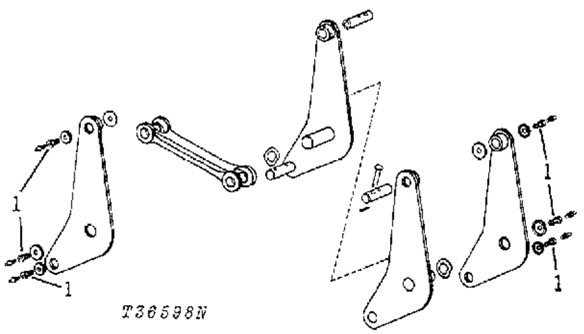


Fig. 1-Boom Linkage

1 - Boom linkage cap screw torque ...... 170 lb-ft
(23.5 kg-m)

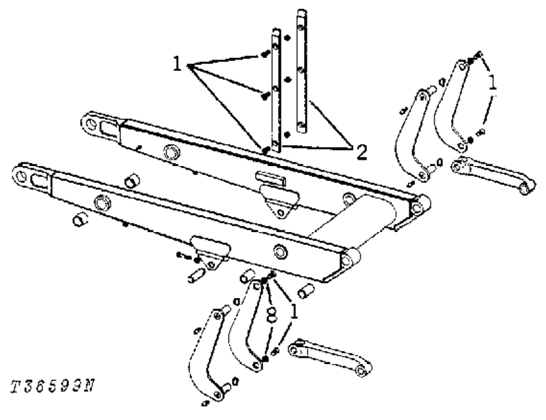


Fig. 2-Bucket Linkage

1 - Bucket linkage cap screw torque ..... 105 lb-ft
(14.52 kg-m)

LOADER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES

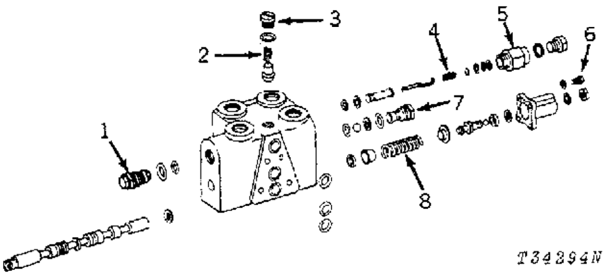


Fig. 3-Loader Boom Valve Section

Loader Boom Valve Section

1 - Relief valve setting .... 3100 psi (217.9 dm³/min)
Relief valve torque .... 20 lb-ft. (2.8 kg-m)

2 - Lift check spring test length .... 1.06 in. (26.9 mm) with 1 lb. (0.5 kg)

3 - Lift check plug torque .... 60 lb-ft. (8.3 kg-m)

4 - System relief valve spring test length .... 1.34 in. [34.0 mm] with 15 lbs. (6.8 kg)

5 - System relief valve setting .... 2250 psi (158.2 dm³/min)
System relief valve torque .... 40 lb-ft. (5.5 kg-m)

6 - Spool bonnet screws .... 10 lb-ft. (1.4 kg-m)

7 - Anti-cavitation check valve body torque .... 30 lb-ft. (4.1 kg-m)

8 - Spool spring test length .... 1.44 in. [36.6 mm] with 50 lbs. (22.7 kg)

LOADER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES—Continued

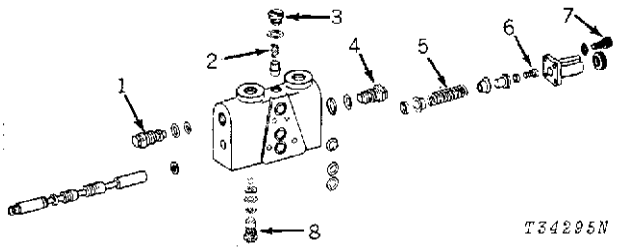


Fig. 4-Loader Bucket Valve Section

Loader Bucket Valve Section

1 - Relief valve setting .... 2500 psi (175.8 dm^3/min)
Relief valve torque .... 20 lb-ft. (2.8 kg-m)

2 - Lift check spring test length .... 1.06 in. (26.9 mm) with 1 lb. (0.5 kg)

3 - Lift check plug torque .... 60 lb-ft. (8.3 kg-m)

4 - Relief valve setting .... 1250 psi (87.9 dm^3/min)

5 - Spool spring test length (without return-to-dig mechanism)............... 1.37 in. (34.8 mm) with 52 lbs. (23.6 kg)

6 - Spool screw torque .... 15 lb-ft. (2.1 kg-m)

7 - Spool bonnet screw torque .... 10 lb-ft. (1.4 kg-m)

8 - Anti-cavitation check valve body torque .... 30 lb-ft. (4.1 kg-m)

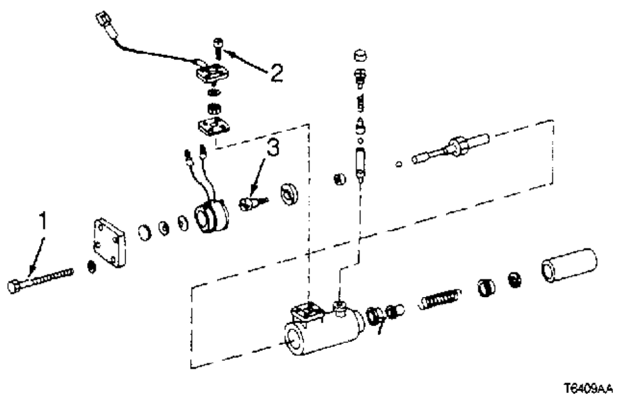


Fig. 4A-Return-to-Dig Mechanism

Return-to-Dig Mechanism

1 - Cover cap screws torque .... 6-8 lb-ft (8-11 N·m)

2 - Retainer screws torque .... 4-5 lb-in (0.45-0.57 N·m)

3 - Washer-to-armature screw torque .... 18-22 lb-in (2-3 N·m)

LOADER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES—Continued

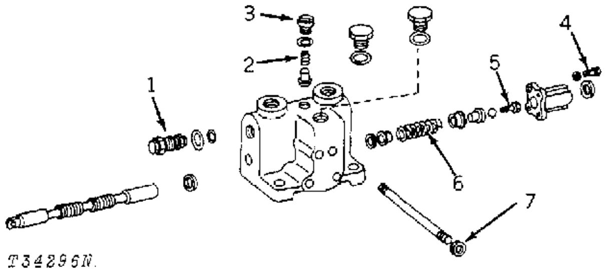


Fig. 5-Loader Auxiliary Valve Section

Loader Auxiliary Valve Section

1 - Relief valve setting (used with multipurpose bucket) .... 2500 psi (175.8 dm³/min)
Relief valve torque .... 20 lb-ft. (2.8 kg-m)

2 - Lift check spring test length .... 1.06 in. (26.9 mm) with 1 lb. (0.5 kg)

3 - Lift check plug torque .... 60 lb-ft. (8.3 kg-m)

4 - Spool bonnet screw torque .... 10 lb-ft. (1.4 kg-m)

5 - Spool screw torque .... 15 lb-ft. (2.1 kg-m)

6 - Spool spring test length .. 1.37 in. (134.8 mm) with 52 lbs. (23.6 kg)

7 - Tie bolt lock nut torque .... 20 lb-ft. (2.8 kg-m)

LOADER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES—Continued

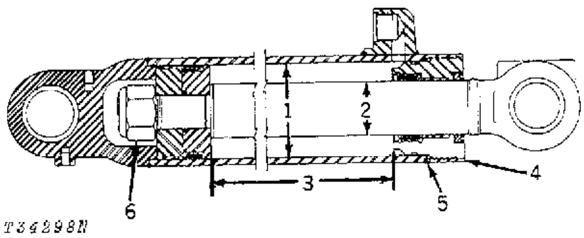


Fig. 6-Loader Bucket Cylinder

Loader Bucket Cylinder

1 - Cylinder bore ....2.746 to 2.750 in. (69.75 to 69.85 mm)

2 - Rod diameter ....1.493 to 1.496 in. (37.92 to 38.00 mm)

3 - Cylinder stroke .... 30.52 in. (775.2 mm)

4 - Rod guide torque .... 250 to 300 lb-ft. (34.5 to 41.4 kg-m)

5 - Set screw torque .... 40 lb-in. (0.4 kg-m)

6 - Stop nut torque .... 475 to 575 lb-ft. (65.6 to 79.4 kg-m)

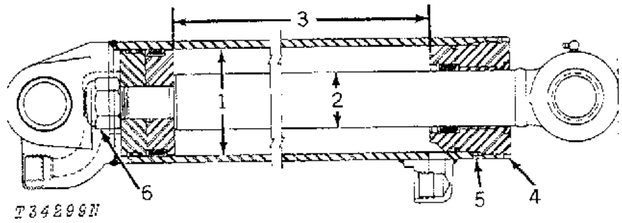


Fig. 7-Loader Boom Cylinder

Loader Boom Cylinder

1 - Cylinder bore ....3.746 to 3.750 in. (95.15 to 95.25 mm)

2 - Rod diameter ....1.9985 to 2.0015 in. (50.762 to 50.838 mm)

3 - Cylinder stroke .... 27.80 in. (706.1 mm)

4 - Rod guide torque .... 250 to 300 lb-ft. (34.5 to 41.4 kg-m)

5 - Set screw torque .... 40 lb-in. (0.4 kg-m)

6 - Stop nut torque .... 600 to 700 lb-ft. (82.8 to 96.6 kg-m)

LOADER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES—Continued

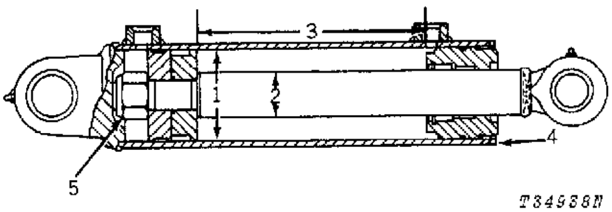


Fig. 8-Log Grapple Cylinder

Log Grapple Cylinder

1 - Cylinder bore .... 2.5075 to 2.5125 in. (63.691 to 63.818 mm)

2 - Rod diameter .... 1.4930 to 1.4960 in. (37.922 to 37.998 mm)

3 - Cylinder stroke .... 15.19 in. (385.8 mm)

4 - Spanner nut torque .... 125 to 175 lb-ft. (17.3 to 24.2 kg-m)

5 - Stop nut torque .... 130 to 160 lb-ft. (17.9 to 22.1 kg-m)

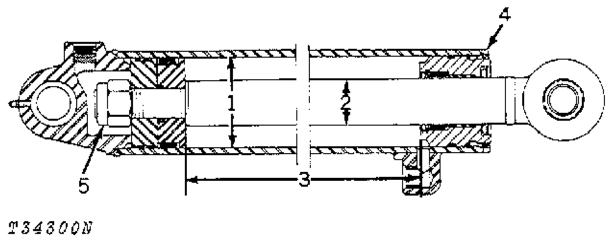


Fig. 9-Multipurpose Bucket Clam Cylinder

Multipurpose Bucket Clam Cylinder

1 - Cylinder bore .... 2.996 to 3.000 in. (76.10 to 76.20 mm)

2 - Rod diameter .... 1.7485 to 1.7515 in. (44.41 to 44.49 mm)

3 - Cylinder stroke .... 9.88 in. (250.9 mm)

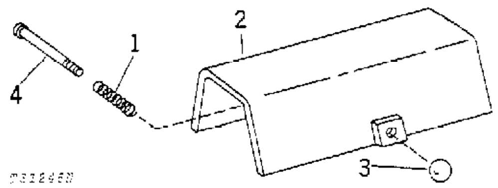
4 - Spanner nut torque .... 125 to 175 lb-ft. (17.3 to 24.2 kg-m)

5 - Stop nut torque .... 150 to 250 lb-ft. (20.74 to 34.56 kg-m)

LOADER FRAMES

SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
	AT40572	Boom Safety Lock Bar - To support loader boom.

1—T41597 Spring
2—AT40572 Lock Bar
3—M526 Knob
4—T41596 Pin

Fig. 10-Loader Boom Safety Lock Bar

LOADER HYDRAULICS

SPECIAL TOOLS

Convenience Tool

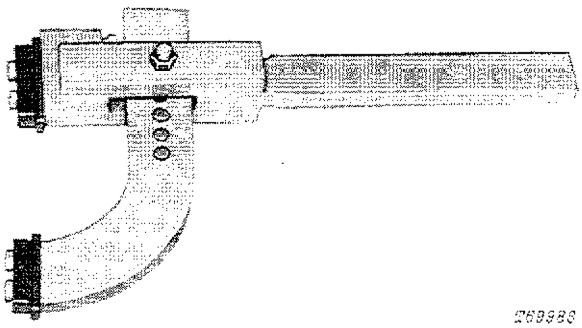
Tool	Tool Number	Use
	D-05270ST or D-01053AA (not shown)	Remove and install cylinder rod guides and spanner nuts

Fig. 11-Special Spanner Wrench

Litho in U.S.A.

Section 32
DOZER

CONTENTS OF THIS SECTION

Group 3201
BLADE

GENERAL INFORMATION

Bulldozer blades are of reinforced, box-welded steel construction. All blades have reversible and replaceable cutting edges and end bits. Gauge shoes can be attached to the bottom of the blade to assist in regulating the depth of blade penetration.

The bulldozer blades can be used in a straight position, adjusted to an angled position to the right or left or adjusted to a tilt position to the right or left.

Blades are contoured to move material with an easy rolling action that reduces power needs and clogging at the cutting edge.

Blade extensions are available on 6305 Bulldozers for dozing snow or other light material. The extensions and end bits are bolted onto the ends of a regular blade.

See Section 90, Group 9030, for blade adjustments.

REMOVAL

Lower blade to the ground and operate dozer control lever to relieve hydraulic pressure.

Remove pins connecting blade to frame and hydraulic cylinders.

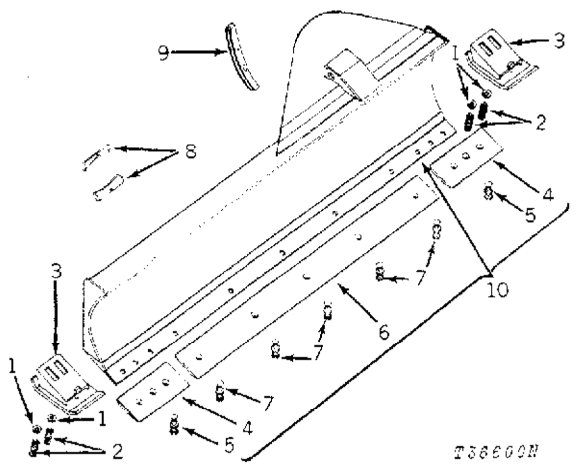
Back the unit from the blade.

REPAIR

Inspect all blade parts for cracks or other damage (Fig. 1). Reverse or replace the blade cutting edge when dull or damaged. Reverse or replace end bits when they become dull, damaged or broken.

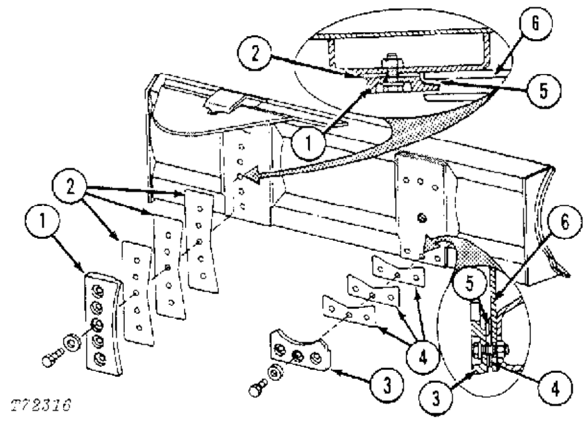
Check for clearance between tilt sector (1, Fig. 2) and frame (6), and between pivot races (3) and frame. Gaps (5) must be less than thickness of one shim (2 or 4), but still allow blade to tilt without binding.

If necessary, remove shim(s) (2 or 4) to minimize the gap.



1—Flat Washer (4 used)
2—Bolt (4 used)
3—Gauge Shoe (2 used)
4—End Bit
5—Bolt (6 used)
6—Center Cutting Edge
7—Bolt (5 used)
8—Pivot Race (2 used) (-340988)
9—Tilt Sector (-340988)
10—Blade

Fig. 1-6305 Bulldozer Blade Components



1—Tilt Sector (340989-)
2—Shims (340989-)
3—Pivot Race (2 used) (340989-)
4—Shims (340989-)
5—Gap
6—Frame

Fig. 2-Checking Clearance—6305 Blade

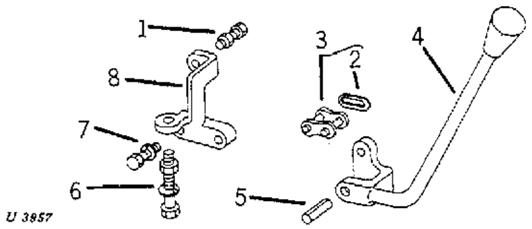
Protect the polished surface of the blade when bulldozer is not in use by applying a coat of cup grease.

INSTALLATION

Reverse removal procedure to install blade.

Group 3215
CONTROL LINKAGE

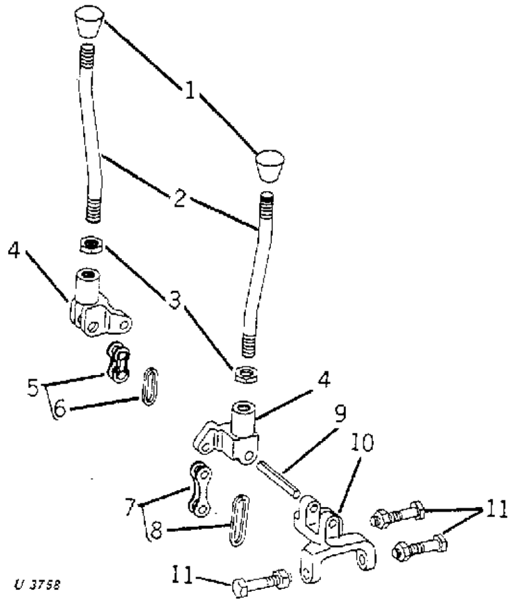
REPAIR



1—Cap Screw
2—Spring Clip
3—Coupler Link
4—Lever
5—Spring Pin
6—Cap Screw
7—Cap Screw
8—Mounting Bracket

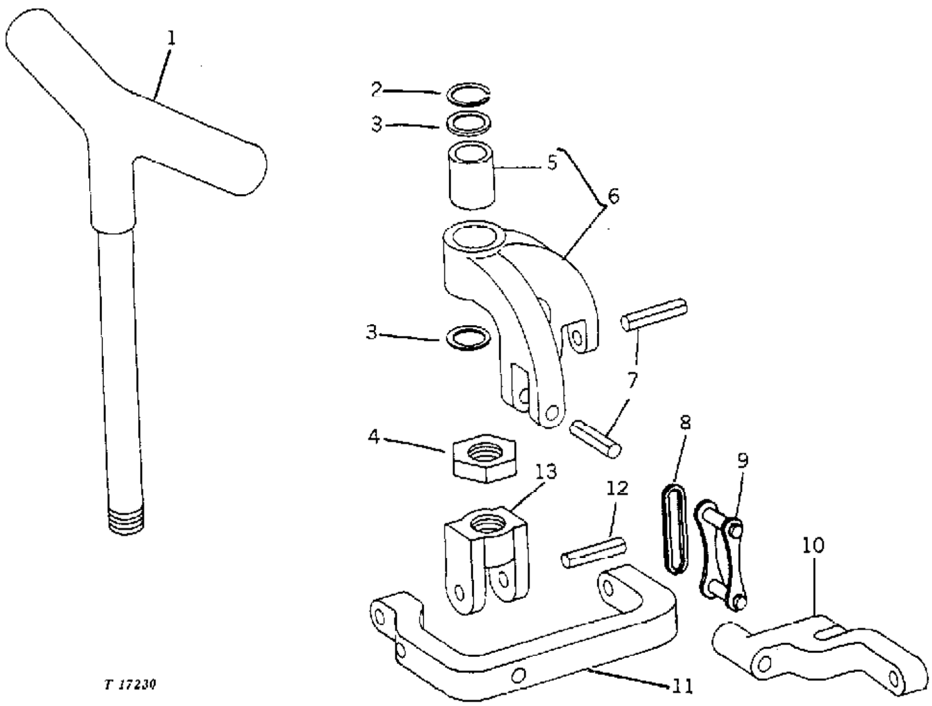
Fig. 1-Auxiliary Valve Linkage

Inspect control valve linkage for worn or damaged parts and replace as necessary.



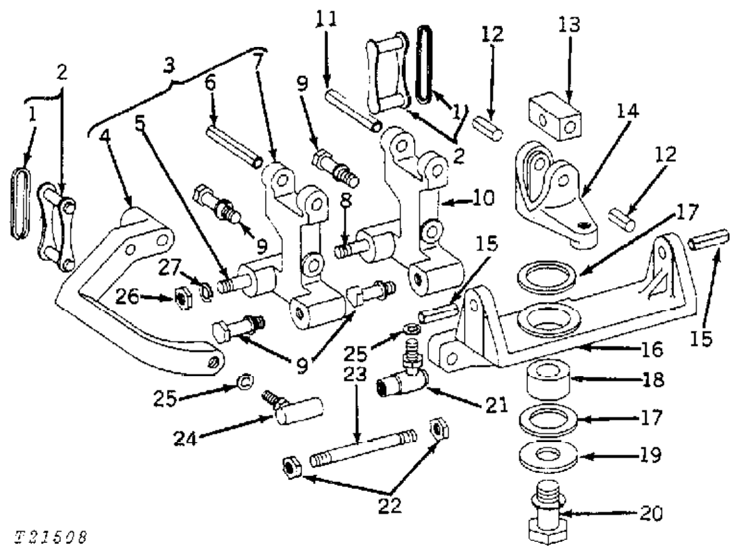
1—Knob (2 used)
2—Lever (2 used)
3—Jam Nut (2 used)
4—Pivot (2 used)
5—Roller Link
6—Spring Clip
7—Roller Link
8—Spring Clip
9—Spring Pin
10—Base
11—Cap Screw

Fig. 2-Two-Spool Valve Linkage



1—Handle
2—Snap Ring
3—Washer
4—Jam Nut
5—Bushing
6—Handle Slide
7—Spring Pin (2 used)
8—Spring Clip
9—Connector Link
10—Float Lever
11—Center Lever
12—Spring Pin (2 used)
13—Handle Pivot

Fig. 3-Three-Spool Valve Handle Assembly



1—Spring Clip
2—Connector Link (2 used)
3—Lever Assembly
4—Rear Lever
5—Stud
6—Spring Pin
7—Attaching Standard
8—Stud
9—Cap Screw (4 used)
10—Attaching Standard
11—Spring Pin
12—Spring Pin (2 used)
13—Pivot Block
14—Rotary Pivot
15—Spring Pin (2 used)
16—Pivot Base
17—Washer (2 used)
18—Bushing
19—Washer
20—Cap Screw
21—Ball Joint
22—Jam Nut (2 used)
23—Push Rod
24—Ball Joint
25—Tooth Washer (2 used)
26—Nut (2 used)
27—Lock Washers (2 used)

Fig. 4-Three-Spool Valve Linkage

Group 3241
MAIN FRAME

GENERAL INFORMATION

Three types of bulldozers are available on the JD350-C Crawler Bulldozer. The 6300 and 6305 Bulldozers are inside mounted, and the 6310 Bulldozer is outside mounted.

REMOVAL

Lower blade to the ground and operate dozer control lever to relieve hydraulic pressure. On inside mounted bulldozers, remove ROPS as directed in Section 18, Group 1810.

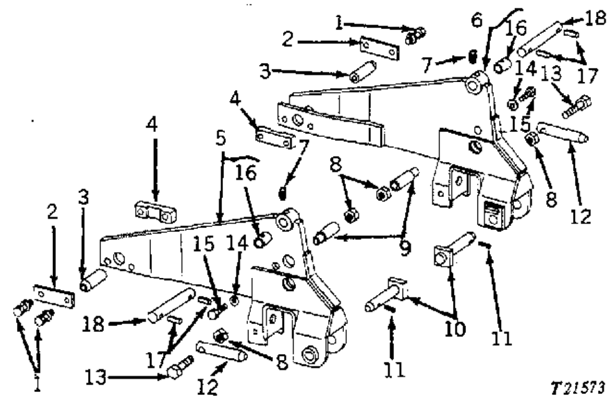
Support boom with hoist or blocks.

Remove hardware attaching mounting frames to crawler and boom. Lift frames off the unit.

REPAIR

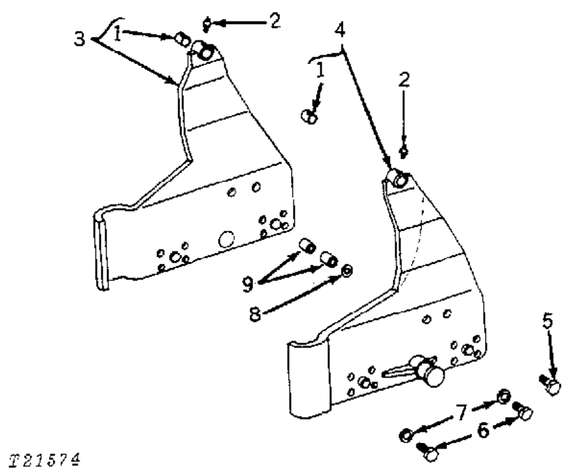
Refer to Figs. 1 and 2 during disassembly and assembly of dozer frames.

Inspect all pins and bushings. If loose, worn or damaged replace as necessary.



1—Cap Screw and Lock Washer (4 used)
2—Retainer (2 used)
3—Dowel (2 used)
4—Retainer (2 used)
5—Frame with Bushings (R.H.)
6—Frame with Bushings (L.H.)
7—Grease Fitting (2 used)
8—Lock Nut (4 used)
9—Frame Support (2 used)
10—Pin (2 used)
11—Cotter Pin (2 used)
12—Pin (2 used)
13—Cap Screw (2 used)
14—Keeper (2 used)
15—Cap Screw (2 used)
16—Bushing (2 used)
17—Spring Pin (4 used)
18—Pin (2 used)

Fig. 1-6300 and 6305 Lift Frame



1—Bushing (2 used)
2—Grease Fitting (2 used)
3—Frame with Bushings (R.H.)
4—Frame with Bushings (LH.)
5—Cap Screw (2 used)
6—Cap Screw (16 used)
7—Lock Washer (18 used)
8—Washer (4 used)
9—Spacer (2 used)

Fig. 2-6310 Lift Frame

INSTALLATION

Install dozer mounting frames by reversing removal procedure.

Group 3243
MOVABLE FRAMES

GENERAL INFORMATION

Three types of bulldozers (6300, 6305 and 6310) are available on the JD350-C Crawler.

The bulldozers have a one lever hydraulic blade control and are available in combination with the 9300 Backhoe, ripper, winch, and log arch.

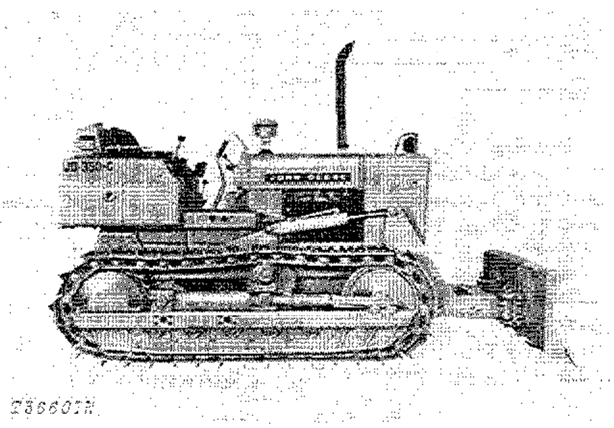


Fig. 1-6300 Bulldozer and JD350-C Crawler

The 6300 Bulldozer has an inside mounted frame and hydraulic lift cylinders (Fig. 1). The tilting and angling of the blade are done manually.

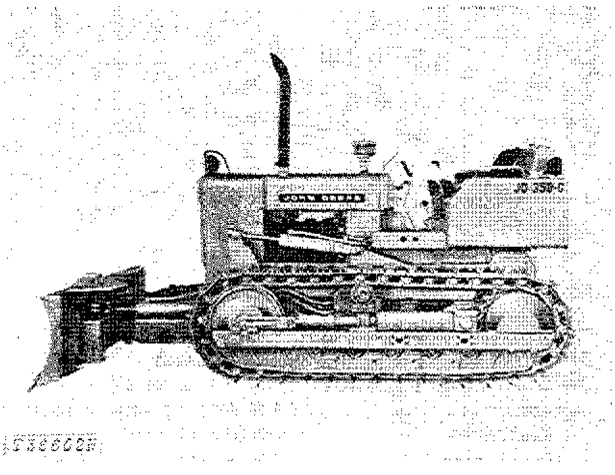


Fig. 2-6305 Bulldozer and JD350-C Crawler

The 6305 Bulldozer has an inside mounted frame (Fig. 2). The lifting, angling, and tilting of the blade are all performed by hydraulic cylinders.

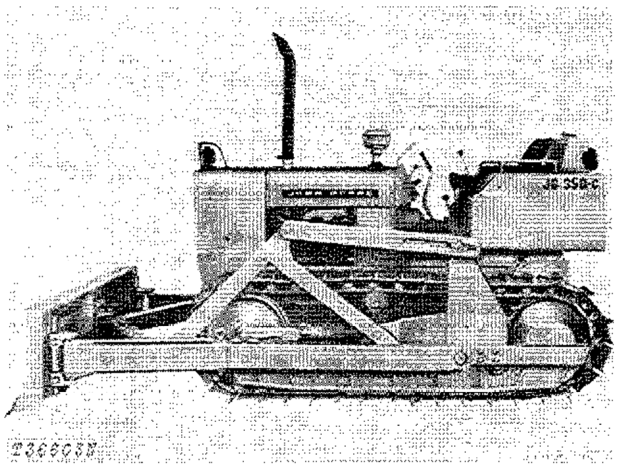


Fig. 3-6310 Bulldozer and JD350-C Crawler

The 6310 Bulldozer has an outside mounted frame and hydraulic lift cylinders (Fig. 3). The tilting and angling of the blade are done manually.

REMOVAL

Lower blade to the ground and operate dozer control lever to relieve hydraulic pressure.

Disconnect and plug dozer hydraulic lines. On inside mounted dozers, remove ROPS as directed in Section 18, Group 1810.

Attach a chain hoist to rear of C-frame. Remove attaching hardware. Raise dozer assembly from the crawler.

Back crawler away from the dozer assembly. Lower rear of the dozer assembly to the ground.

Remove mounting frames as directed in Section 32, Group 3241 (if necessary).

Remove blade as directed in Section 32, Group 3201 (if necessary).

REPAIR

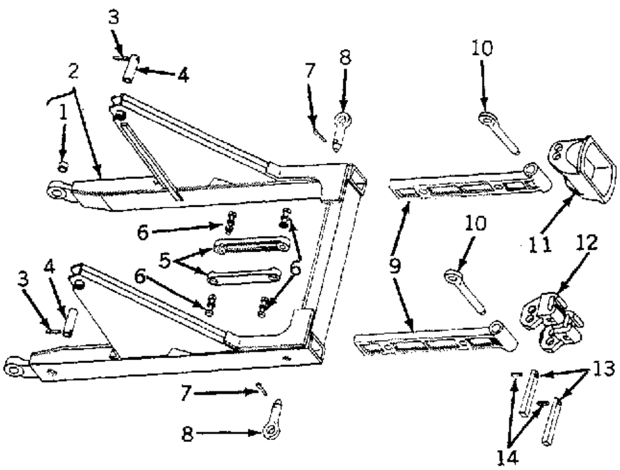
CAUTION: To avoid possible injury, and to insure best results, always stop crawler operation and lower or block up frame and blade before servicing dozer units.

Refer to Figs. 4 through 6 when disassembling and assembling dozer C-frames.

Inspect C-frame and lever for damage. Replace parts if necessary.

Inspect all pins and bushings. If loose, worn, or damaged replace as necessary.

Tighten all fasteners to standard torque.



T21575

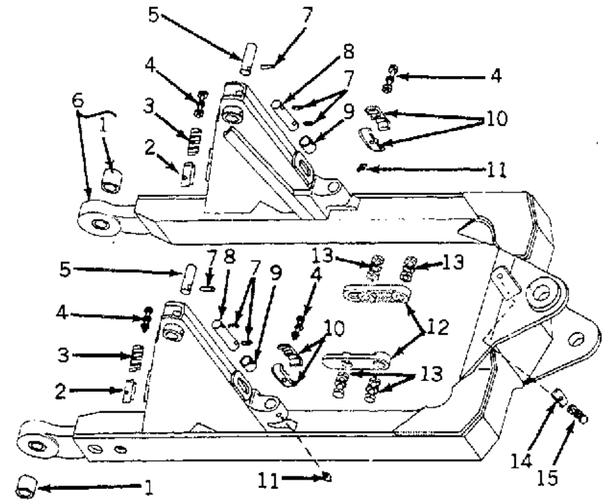
1—Bushing (2 used)
2—Boom
3—Spring Pin (2 used)
4—Pin (2 used)
5—Guide Block (2 used)
6—Cap Screw, Lock Washer, and Nut
7—Cotter Pin (2 used)
8—Pin (2 used)
9—Angling Arm (2 used)
10—Pin
11—Blade Pivot
12—Clamp Lock
13—Wedge (2 used)
14—Groove Pin (3 used)

Fig. 4-6300 C-frame and Angling Arms

INSTALLATION

Reverse removal procedure to install dozer C-frames.

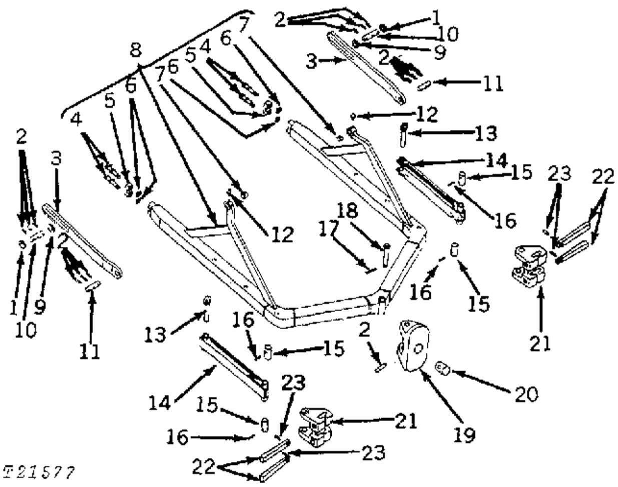
Grease all fittings before resuming operation.



T21576

1—Bushing (2 used)
2—Clamp (2 used)
3—Clamp (2 used)
4—Cap Screw, Lock Washers, and Nut (4 used)
5—Pin (2 used)
6—Boom with Bushings
7—Spring Pin (2 used)
8—Pin (2 used)
9—Bushing (2 used)
10—Clamp (4 used)
11—Grease Fitting (2 used)
12—Guide Block (2 used)
13—Cap Screw, Lock Washer, and Nut (4 used)
14—Clamp
15—Cap Screw, Lock Washer, and Nut

Fig. 5-6305 C-Frame



T21577

1—Washer (2 used)
2—Spring Pin (13 used)
3—Cylinder Guard (2 used)
4—Cap Screw, Lock Washer, and Nut (4 used)
5—Cap (2 used)
6—Spacer (16 used)
7—Bushing (2 used)
8—Complete Boom
9—Washer (2 used)
10—Pin (2 used)
11—Pin (2 used)
12—Grease Fitting (2 used)
13—Pin (2 used)
14—Angling Arm (2 used)
15—Pin (4 used)
16—Spring Pin (4 used)
17—Cotter Pin
18—Pin
19—Blade Pivot
20—Pin
21—Clamp Lock (2 used)
22—Wedge (4 used)
23—Groove Pin (4 used)

Fig. 6-6310 C-Frame and Angling Arms

Group 3260
DOZER HYDRAULICS

CONTROL VALVES
GENERAL INFORMATION

Mechanical Bulldozer Valve

Mechanical bulldozers are equipped with a two-spool hydraulic control valve. The valve body is a one-piece casting. One of the two double-action valve spools controls bulldozer boom raising and lowering. The other spool is reserved for an auxiliary function. A float position is provided on the bulldozer control valve spool for use as required. Poppet type check valves and an adjustable system relief valve are incorporated into each control valve assembly.

All-Hydraulic Bulldozer Valve

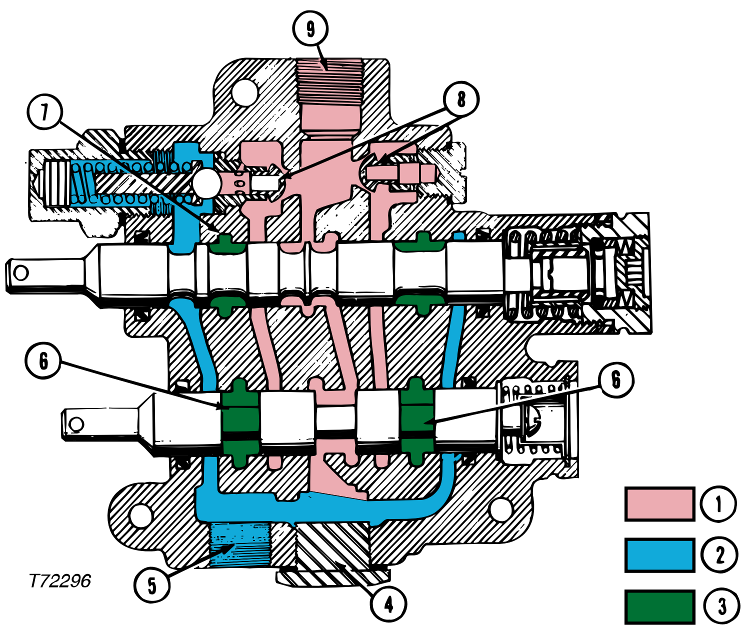
All-hydraulic bulldozers are equipped with a three-spool control valve. A single "T-Bar" control lever is used to operate the three valve spools. Bulldozer raising, lowering, tilting and angling cycles are easily controlled by this type of linkage. Poppet type check valves and an adjustable relief valve are built into the valve assembly. The valve body is a sturdy one-piece casting.

Control Valve Power Beyond Sleeve

In cases when it is necessary to add an additional hydraulic function an auxiliary valve may be installed.

Hydraulic pressure oil for auxiliary valve is taken from the dozer valve by means of a power beyond sleeve. The power beyond sleeve closes off the neutral circuit to the bulldozer control valve return port. Return oil from both auxiliary and dozer control valves is returned directly to the reservoir.

CONTROL VALVE OIL FLOWS

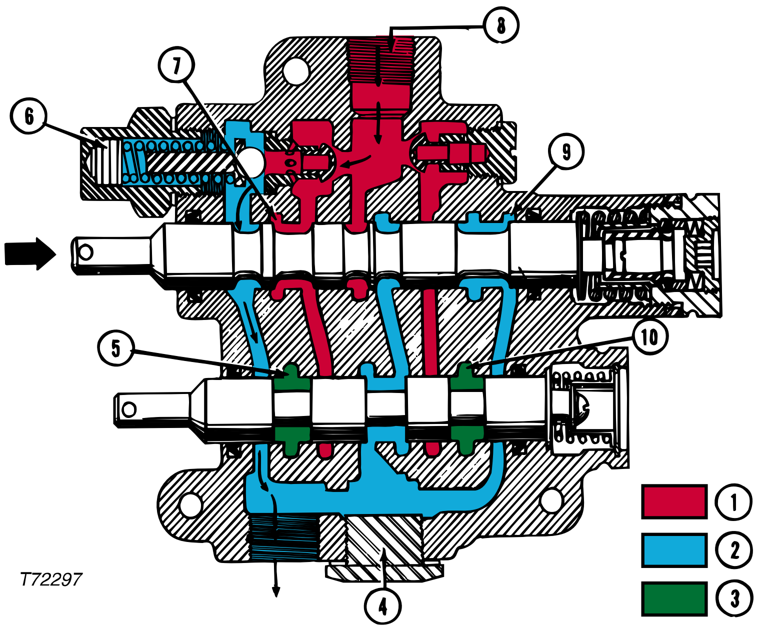


1—Oil Under Slight Pressure
2—Return Oil
3—Trapped Oil
4—Plug
5—Outlet
6—Auxiliary Port
7—Boom Port
8—Check Poppet Valves
9—Inlet

Fig. 1-Control Valve in Neutral Position (2-spool valve shown)

Control Valve in Neutral Position

When the control valve spools are in neutral position (Fig. 1), oil from the pump enters the control valve at inlet (9, Fig. 1) and follows a direct channel past the spools and back to the reservoir. Since the valve spools are blocking the valve power ports, oil cannot reach the bulldozer cylinders. The oil in the valve power ports is trapped by the valve spools.



1—Pressure Oil
2—Return Oil
3—Trapped Oil
4—Outlet Port
5—Auxiliary Port
6—Relief Valve
7—Boom Cylinder Port No. 1
8—Inlet Port
9—Boom Cylinder Port No. 2
10—Auxiliary Port

Fig. 2-Control Valve in Relief Operation (Two Spool Valve Shown)

Control Valve in Relief Operation (Fig. 2)

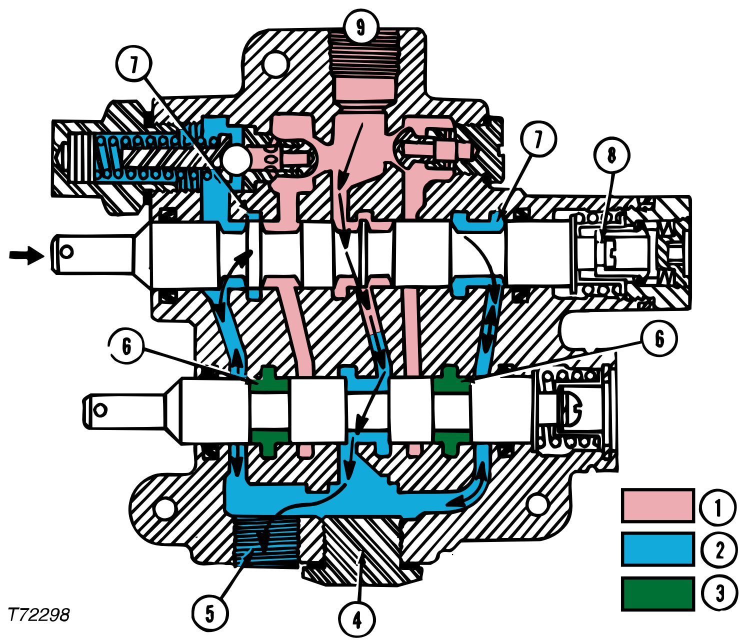
Oil enters the control valve inlet port (8, Fig. 2). Because the first spool is blocking the neutral circuit, oil unseats the check poppets and enters the valve power channel. Since the valve spool is in a power position (cylinder extended), oil enters the head end of the dozer cylinders, lowering the bulldozer boom and blade.

If some form of restriction causes excessive oil pressure (1750 psi [12 066 kPa] [121 bar] or above), oil exerts the pressure on the relief valve ball causing the valve to unseat. Oil is then allowed to return directly to the reservoir, reducing system pressure. When the system pressure reaches a safe level (1750 psi [12 066 kPa] [121 bar] or below) the relief valve closes.

Control Valve in Float Position (Fig. 3)

Oil under slight pressure enters the control valve inlet port (9, Fig. 3) and travels through the neutral circuit past the spools and back to the reservoir.

With the spool in the detent position (8), both boom cylinder ports (7) are interconnected and open to the reservoir allowing the cylinder pistons to move back and forth as the blade floats over the ground. Displaced oil is free to return to the reservoir. Oil in the auxiliary valve spool ports remains trapped.



1—Oil Under Slight Pressure
2—Return Oil
3—Trapped Oil
4—Plug
5—Outlet Port
6—Auxiliary Port
7—Boom Port
8—Detent Engaged
9—Inlet Port

Fig. 3-Control Valve in Float Position (2-spool valve shown)

Three-Spool Control Valve with Auxiliary Valve (Fig. 4)

1—Pressure Oil
2—Return Oil
3—Trapped Oil
4—Dozer Valve (Neutral Position)
5—Auxiliary Valve (Lowering Cycle)
6—Outlet Port
7—Inlet Port
8—Power Beyond Plug

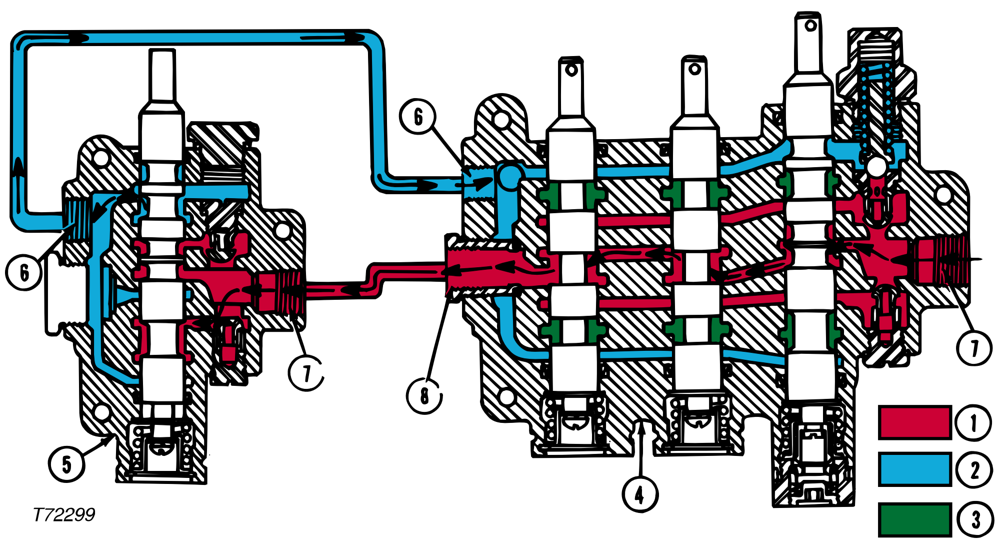


Fig. 4-Three-Spool Control Valve with Auxiliary Valve

Oil enters the bulldozer control valve inlet port (7, Fig. 4), and with the valve spools in neutral, travels through the neutral circuit and out the power beyond plug (8). The return oil channel is blocked by the power beyond plug and connected to reservoir through an additional reservoir oil line. With the auxiliary valve (5) in a power position, oil enters the inlet port (7) as pressure oil. Return oil from the auxiliary valve is returned directly to the reservoir. High oil pressure resulting from auxiliary valve functions is released by the bulldozer relief valve.

REMOVAL

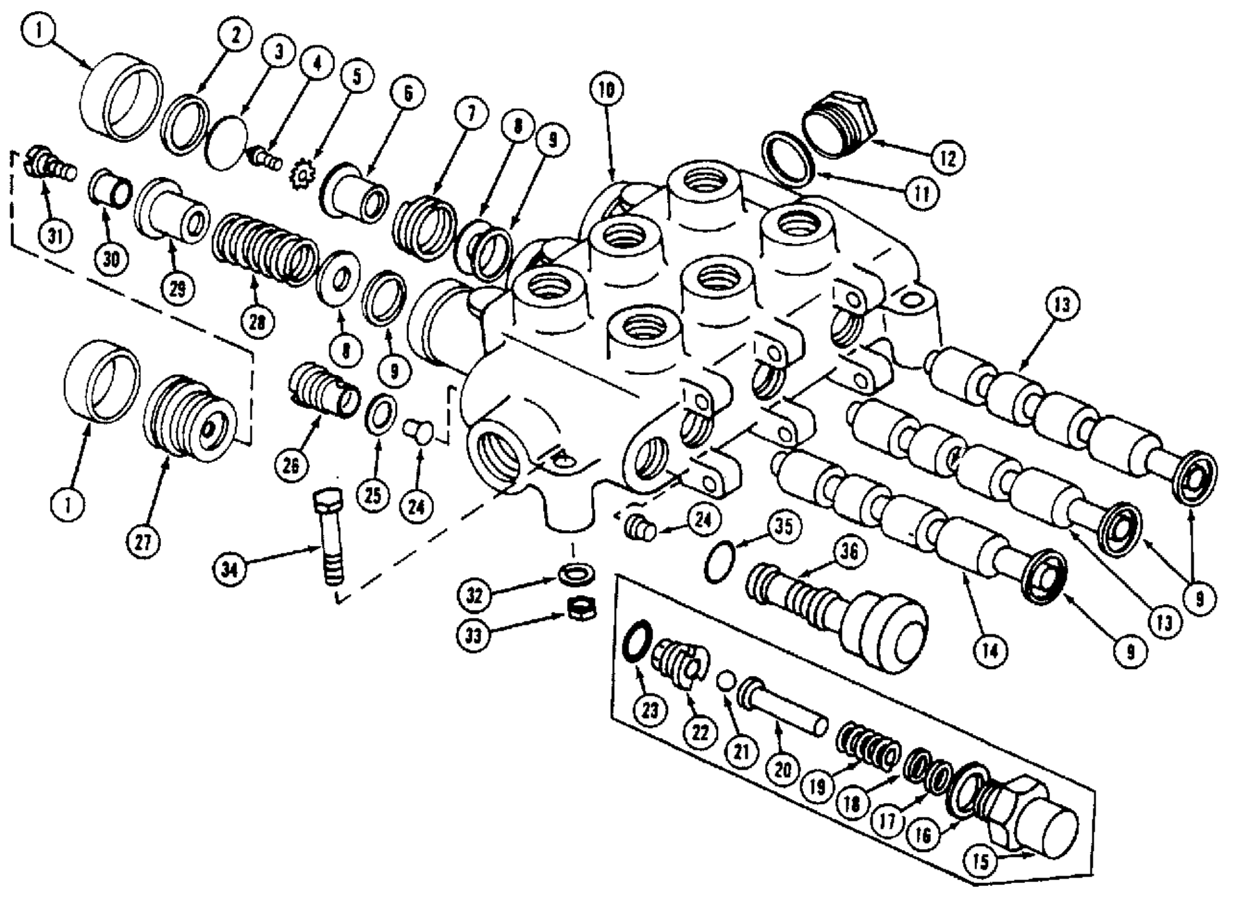
Operate control valve lever until all hydraulic pressure is released. Release pressure in reservoir by slowly removing filler cap.

If the unit is equipped with an auxiliary function, operate the auxiliary control valve lever until all hydraulic pressure is released.

Disconnect hydraulic lines and mark lines for easier installation. Remove the control valve from the unit. Remove auxiliary control valve if crawler is equipped with an auxiliary function.

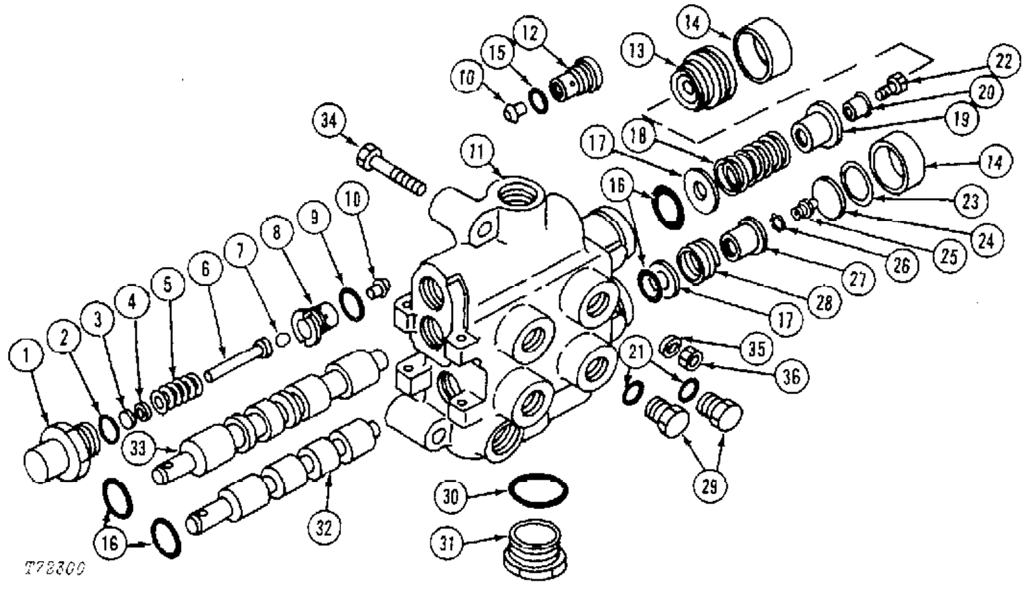
Disassemble control linkage from valve.

REPAIR



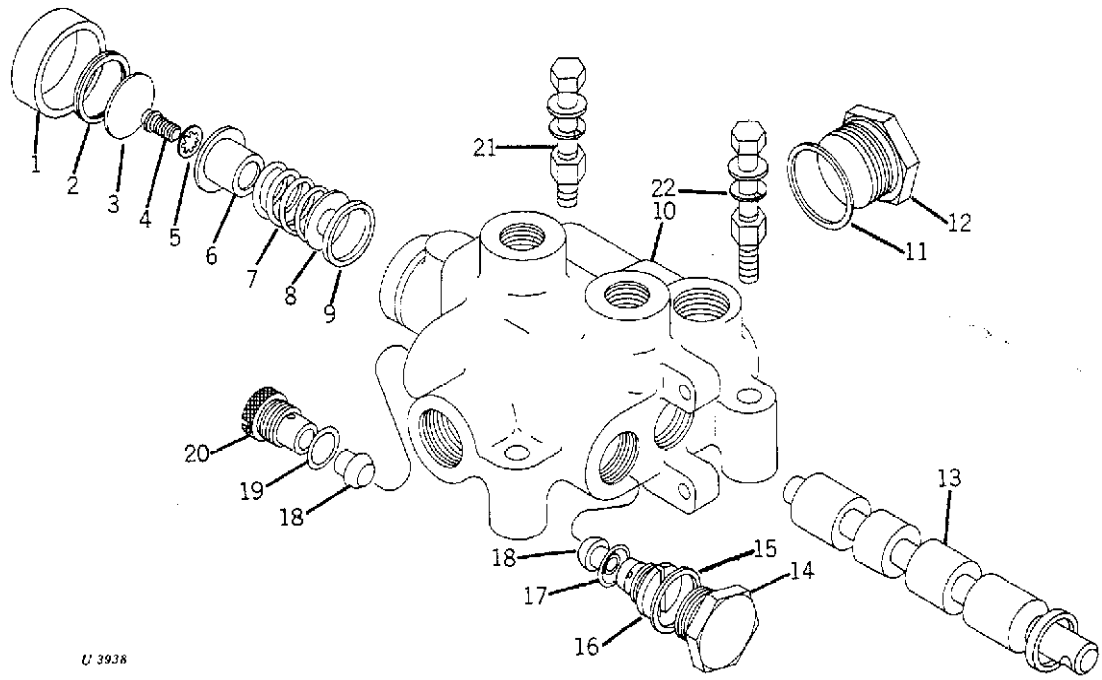
1—Bonnet (3 used)
2—Snap Ring (2 used)
3—Stop Disk (2 used)
4—Machine Screw (2 used)
5—Lock Washer (2 used)
6—Stop Collar (2 used)
7—Spring
8—Washer (3 used)
9—Quad Ring (6 used)
10—Housing
11—Seal
12—Plug
13—Spool (2 used)
14—Float Spool
15—Relief Valve Body (-380196)
16—Gasket (-380196)
17—Shim (-380196)
18—Spring Washer (3 used) (-380196)
19—Spring (-380196)
20—Spacer (-380196)
21—Ball (-380196)
22—Seat (-380196)
23—O-Ring (-380196)
24—Check Poppet (2 used) (-380196)
25—O-Ring
26—Plug (2 used)
27—Detent Segment
28—Spring
29—Collar
30—Detent Plunger
31—Cap Screw
32—Washer
33—Nut
34—Cap Screw
35—O-Ring (380197—)
36—Relief Valve (380197-)

Fig. 5-Three-Spool Bulldozer Control Valve (6305 Bulldozer)



1—Relief Valve Body
2—Gasket
3—Shim
4—Relief Spacer
5—Relief Valve Spring
6—Spring Guide
7—Relief Valve Ball
8—Relief Valve Seal
9—O-Ring
10—Relief Valve Check (2 used)
11—Housing
12—Back Check Plug
13—Segment Detent
14—Bonnet Cap (2 used)
15—O-Ring
16—Quad Ring (4 used)
17—Stop Washer (2 used)
18—Spring
19—Spring Collar
20—Plunger Detent
21—O-Ring (2 used)
22—Special Cap Screw
23—Snap Ring
24—End Cap
25—Machine Screw
26—Special Lock Washer
27—Stop Collar
28—Spring
29—Plug (2 used)
30—Seal
31—Plug
32—Spool
33—Spool
34—Cap Screw (3 used)
35—Lock Washer (3 used)
36—Nut (3 used)

Fig. 6-Two-Spool Control Valve (6300 and 6310 Bulldozers)



1—Bonnet Cap
2—Snap Ring
3—Stop Disk
4—Screw
5—Lock Washer
6—Stop Collar
7—Spring
8—Stop Washer
9—Quad Ring (2 used)
10—Valve Housing
11—Gasket
12—Plug
13—Spool
14—Plug
15—Gasket
16—Seat
17—O-Ring
18—Check (2 used)
19—O-Ring
20—Check Plug
21—Cap Screw (2 used)
22—Cap Screw

Fig. 7-Single Spool Auxiliary Valve (6305 Bulldozer)

Refer to Fig. 5, 6, and 7 for the disassembly and assembly of the bulldozer control valves and auxiliary valves.

Service the valve body and spools as a matched set. Be sure to keep spools matched with their proper bore.

Remove snap rings and stop disks from control valve. Remove float detent cap. Tap all spools lightly and remove from control valve housing.

On three-spool valves (380179-) remove relief valve.

On all other valves remove relief valve body with shims and gasket. Remove relief valve spring, spacer and ball. Unscrew relief valve and check poppet valve from control valve housing. Remove check plug and check poppet valve from opposite end of control valve housing.

Clean and dry all parts thoroughly and inspect parts for wear or damage.

Check valve housings for cracks or damaged threads. If housings are damaged, replace the housings and valve spools as matched assemblies.

If valves show signs of external oil leakage, inspect spool seals in control valve housings for wear or damage. Replace spool seals any time valve is disassembled or leakage is observed.

Remove burrs from spool assembly parts using fine emery cloth. If spools are worn or damaged, replace spools and valve housing as a matched assembly.

Inspect the control valve springs for weak or broken coils, replace if necessary.

Lift spool spring (28, Fig. 5) (18, Fig. 6)
Free length . . . . 1.56 in. (39.6 mm)
Test length at 31.5 to 38.5 lb. force . . . . . 1.25 in.
(140 to 171 N . . . . . 31.7 mm)

Angling spool spring (lightest) (7, Fig. 5) (28, Fig. 6)
Free length . . . . 1.19 in. (30.2 mm)
Test length at 21 to 25 lb. force . . . . 0.94 in.
(93 to 111 N . . . . 23.9 mm)

Tilt spool spring (heaviest) (7, Fig. 5)
Free length . . . . 1.20 in. (30.5 mm)
Test length at 27.5 lb. force . . . . 0.94 in.
(122 N . . . . 23.9 mm)

Auxiliary spool spring (7, Fig. 7)
Free length . . . . 1.20 in. (30.5 mm)
Test length at 27.5 lb. force . . . . 0.94 in.
(122 N . . . . 23.9 mm)

Relief valve spring (19, Fig. 5) (5, Fig. 6)
Free length . . . . 2.81 in. (71.4 mm)
Test length at 243 to 297 lb. force . . . . . . 2.31 in.
(1081 to 1321 N . . . . 58.7 mm)

If valve diagnosis indicated that control valve check poppets were leaking, examine each poppet check for wear or damage. Also check poppet seats integral with control valve housing for wear or presence of foreign matter.

Thoroughly clean and dry all parts. Put oil on all parts prior to assembly.

Install spools in proper valve bore.

Install check plug and check poppet into valve housing. Insert relief valve seat and other check poppet in end of relief valve port. Install relief valve spring, spacer, ball and body with shims and gasket.

Adjustment of the detent segment (27, Fig. 5) and (13, Fig. 6) is made with the part installed into a valve assembly. The force is adjusted by turning the adjusting screw clockwise to increase force and counterclockwise to decrease the force.

INSTALLATION

Connect linkage to valve and install valve on unit.

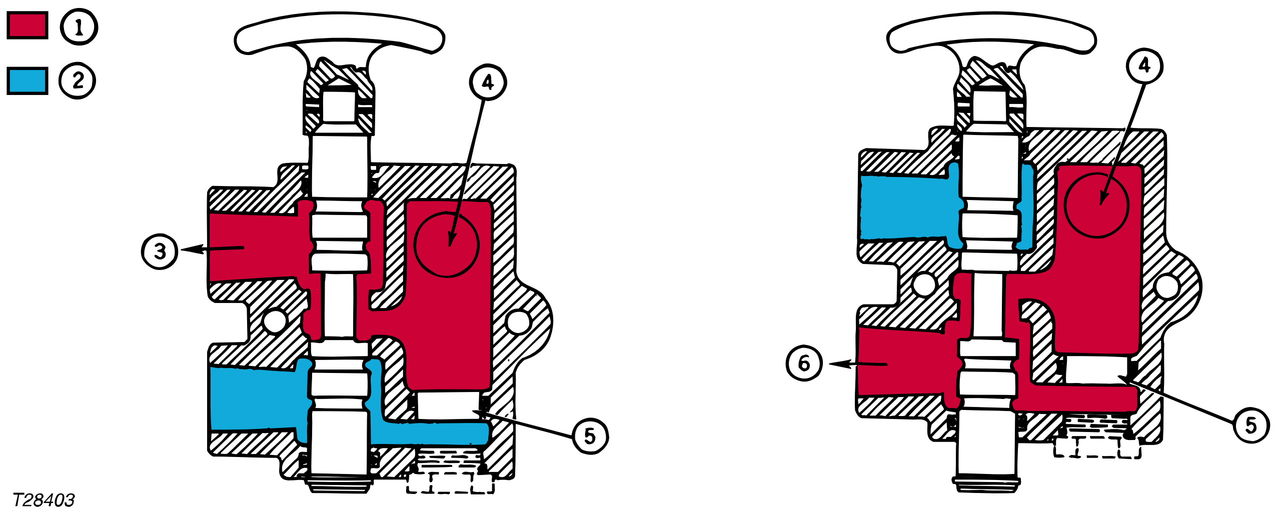
IMPORTANT: Tighten fittings only tight enough to eliminate leaks. Do not overtighten connections.

After valve is connected, replace any oil lost during disassembly.

NOTE: Drain and flush entire hydraulic system if valve fragments and failed parts have entered the hydraulic system.

SELECTOR VALVE

GENERAL INFORMATION



1—Pressure Oil
2—Pressure Free Oil
3—Flow To Rear Mounted Equipment
4—Pump Inlet
5—Relief Valve
6—Flow To Front Mounted Equipment

Fig. 8-Selector Valve Operation

The selector valve directs oil flow to either front mounted or rear mounted equipment determined by the position of the valve (Fig. 8).

A system relief valve is incorporated into the selector valve to provide pump protection.

REPAIR

Remove selector valve from unit. Remove snap ring (11, Fig. 9) from bottom end of spool (3) and disassemble valve using Fig. 9 for a guide.

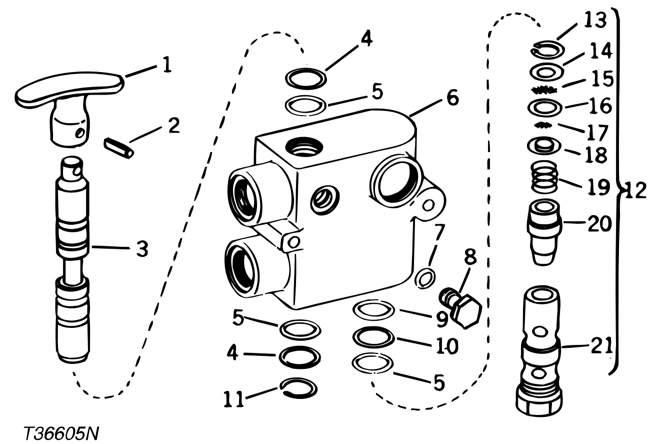
Thoroughly clean and dry all parts. Inspect the spool for dents and scratches.

If necessary replace spool and housing as a matched set. Replace all O-rings and backup washers.

Thoroughly lubricate O-rings, when assembling, to prevent damage to them.

Fasten the selector valve to the unit and connect hoses and fittings as previously removed.

The 2000 psi (13 790 kPa) (138 bar) relief valve (12, Fig. 9) can be adjusted by adding or removing washers (14).



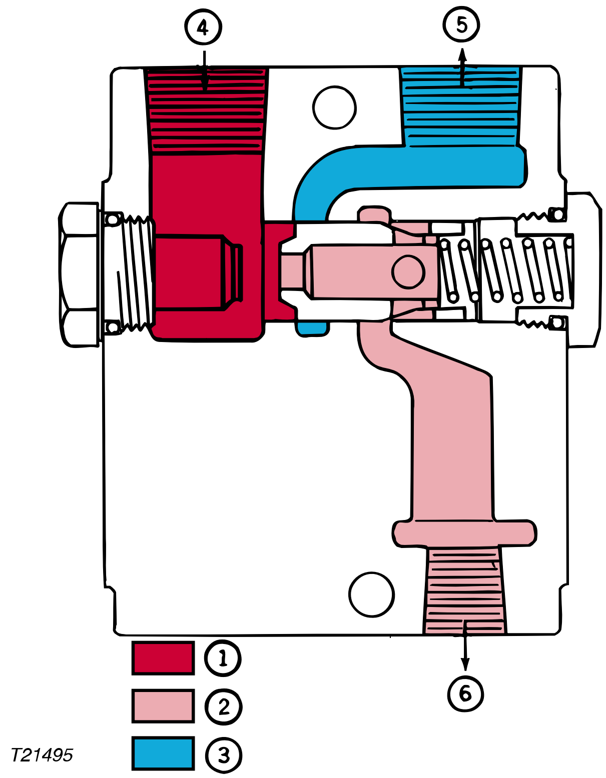
1—Handle
2—Spring Pin
3—Spool
4—Backup Washer (2 used)
5—O-Ring (3 used)
6—Valve Body
7—O-Ring
8—Spool Detent Plug
9—O-Ring
10—Backup Washer
11—Snap Ring
12—Relief Valve
13—Snap Ring
14—Washer (as required)
15—Screen
16—O-Ring
17—Screen
18—Orifice Plate
19—Spring
20—Pilot Assembly*
21—Cage*

**Not available as individual service part.*

Fig. 9-Selector Valve

FLOW DIVIDER

GENERAL INFORMATION

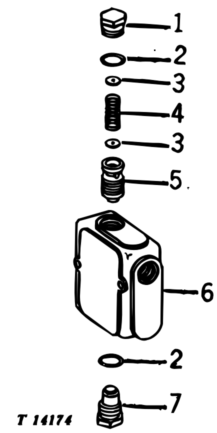


1—Pump Oil Flow
2—Function Oil Flow
3—Return Oil Flow
4—From Pump
5—To Reservoir
6—To Control Valve

Fig. 10-Flow Divider

When the function control valve requires less flow capacity than the pump delivers (4, Fig. 10), the flow divider provides the required flow to the control valve (6) and returns excess flow to the reservoir (5).

REPAIR



1—Plug
2—O-Ring (2 used)
3—Disk (2 used)
4—Spring
5—Spool
6—Housing
7—Plug

Fig. 11-Flow Divider

Remove flow divider from unit and disassemble.

Thoroughly clean and dry all parts.

Inspect the spool and the housing for wear and scoring. If necessary, replace the spool and housing as a matched set.

Test spool spring (4).
Free length . . . . 1.656 in. (42.10 in.)

Test length at 15.9 lb. force . . . . 1.0 in.
(70.7 N . . . . 25.4 mm)

Replace worn or damaged parts. Make sure the hole in the orifice disk is open.

INSTALLATION

Assemble flow divider and fasten to unit. Connect hoses and fittings as previously removed.

CYLINDERS

GENERAL INFORMATION

The hydraulic cylinders used on the crawlers are double acting and use "V"-packing type seals on their pistons. Piston rods are heat treated, chrome plated and polished. Replaceable non-metalic wear rings are used on piston retainers to prevent scoring of the cylinder barrels.

FOS

See "Hydraulic Cylinders" in FOS Manual - HYDRAULICS for additional information on cylinders.

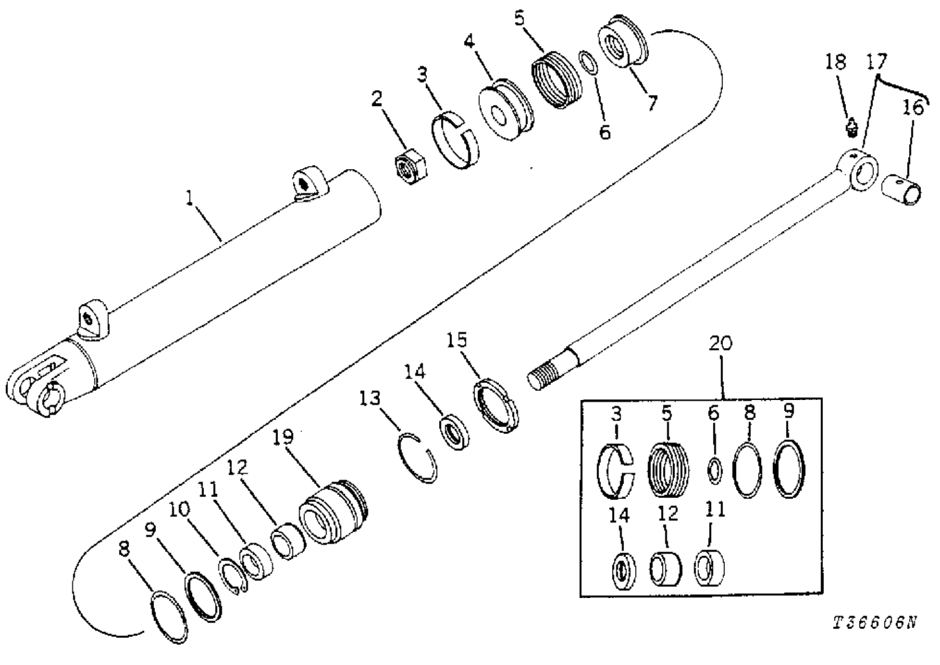
REMOVAL

CAUTION: Be sure the engine is stopped and the blade is resting on the ground before attempting to remove cylinders.

Operate the control valve levers until all hydraulic pressure is released.

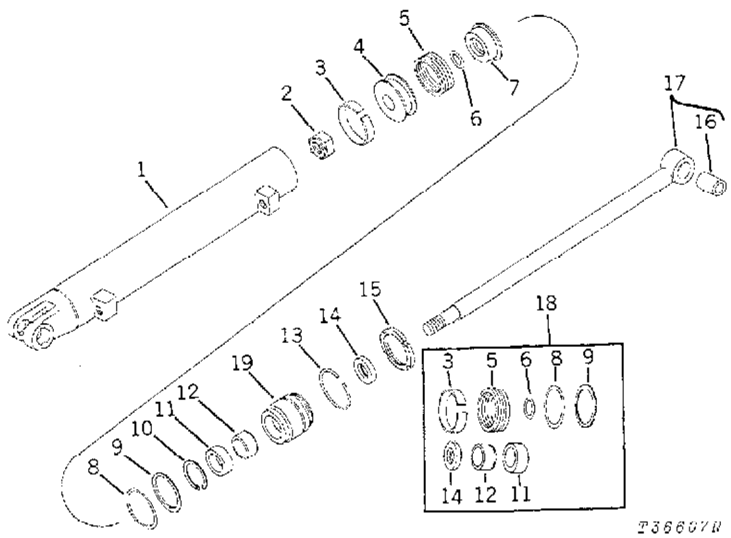
Remove the hoses and put caps on them to prevent dirt from entering the system. Remove the pins from each end of the cylinder and move the cylinder to a clean disassembly area.

REPAIR



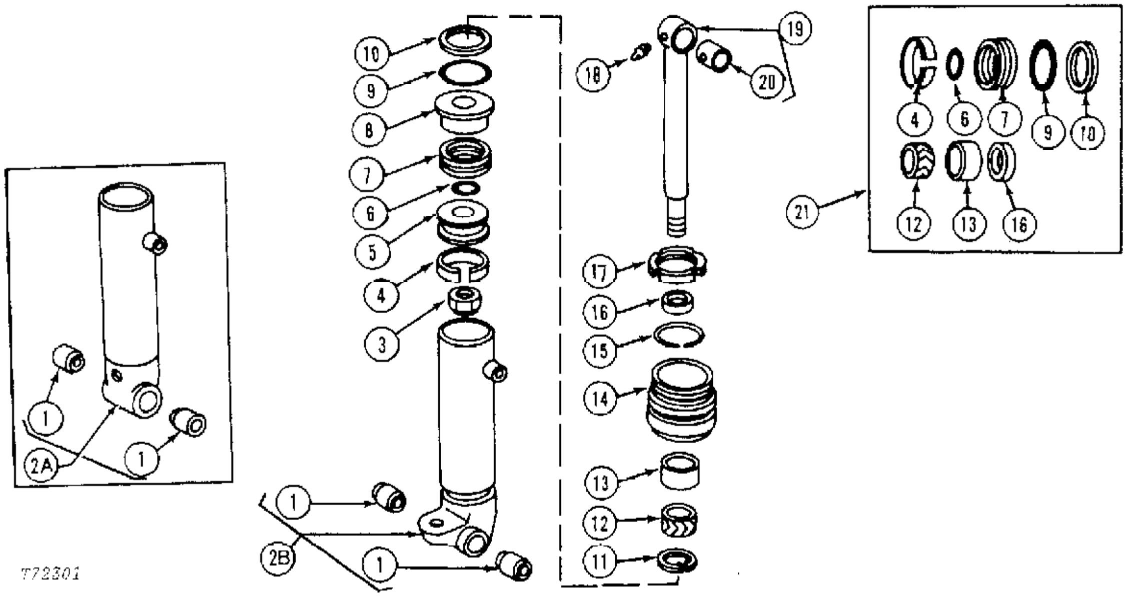
1—Barrel and Pivot
2—Lock Nut
3—Wear Ring
4—Retainer
5—V-Packing
6—O-Ring
7—Piston
8—O-Ring
9—Backup Washer
10—Retaining Ring
11—V-Packing
12—Wear Ring
13—Snap Ring
14—Wiper Seal
15—Spanner Nut
16—Bushing
17—Rod
18—Grease Fitting
19—Rod Guide
20—Repair Kit

Fig. 12-6300 and 6305 Bulldozer Lift Cylinder



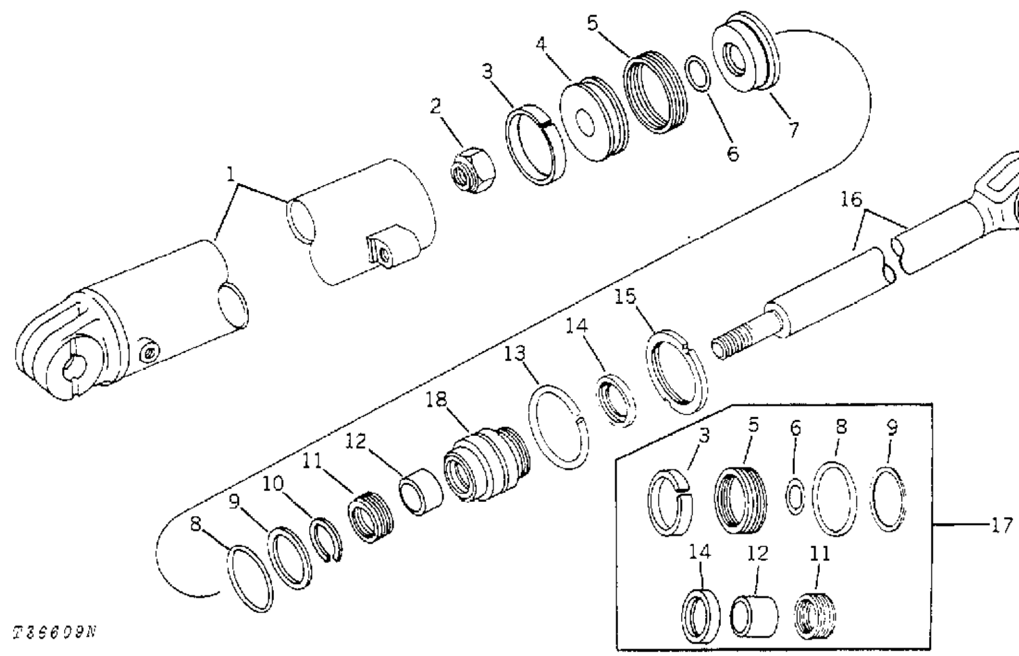
1—Barrel and Pivot
2—Lock Nut
3—Wear Ring
4—Retainer
5—V-Packing
6—O-Ring
7—Piston
8—O-Ring
9—Backup Washer
10—Retaining Ring
11—V-Packing
12—Wear Ring
13—Snap Ring
14—Wiper Seal
15—Spanner Nut
16—Bushing
17—Rod
18—Rod Guide
19—Repair Kit

Fig. 13-6305 Bulldozer Angling Cylinder



1 —Bushing (2 used)
2A—Barrel and Pivot (-229731)
2B—Barrel and Pivot (229732-)
3 —Lock Nut
4—Wear Ring
5—Retainer
6—O-Ring
7—V-Packing
8—Piston
9—O-Ring
10—Backup Washer
11—Retaining Ring
12—V-Packing
13—Wear Ring
14—Rod Guide
15—Snap Ring
16—Wiper Seal
17—Spanner Nut
18—Grease Fitting
19—Rod
20—Bushing
21—Repair Kit

Fig. 14-6305 Bulldozer Tilt Cylinder



1—Barrel and Pivot
2—Lock Nut
3—Wear Ring
4—Retainer
5—V-Packing
6—O-Ring
7—Piston
8—O-Ring
9—Backup Washer
10—Retaining Ring
11—V-Packing
12—Wear Ring
13—Snap Ring
14—Wiper Seal
15—Spanner Nut
16—Piston Rod
17—Repair Kit
18—Rod Guide

Fig. 15-6310 Bulldozer Lift Cylinder

Refer to Figs. 12, 13, 14 and 15 during the disassembly and assembly of the bulldozer cylinders.

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filter.

Clamp the cylinder in a vise to prevent it from turning. Remove spanner nut. Use a D-05270ST Special Spanner Wrench to loosen spanner nut.

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 lock nut from end of rod. Remove parts from end of rod.

Wash all parts thoroughly with diesel fuel and inspect the following:

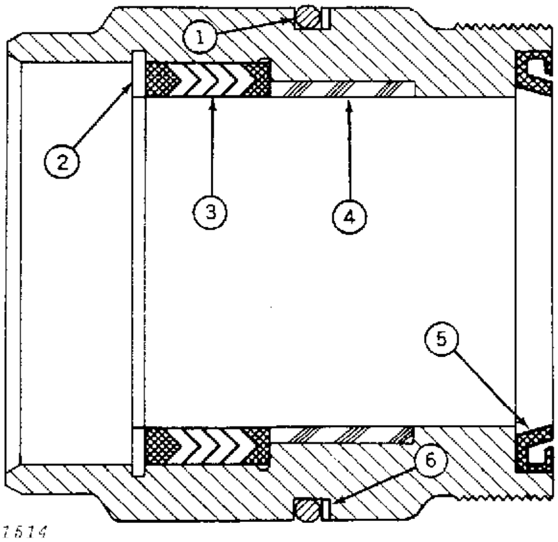
1. Barrel, rod guide and rod for scoring, and O-rings for surface damage.

2. V-packings and wear rings for breaks, cuts or embedded foreign material.

3. Piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.

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—O-Ring
2—Snap Ring
3—V-Packing
4—Wear Ring
5—Wiper Seal
6—Backup Washer

Fig. 16-Rod Guide Components

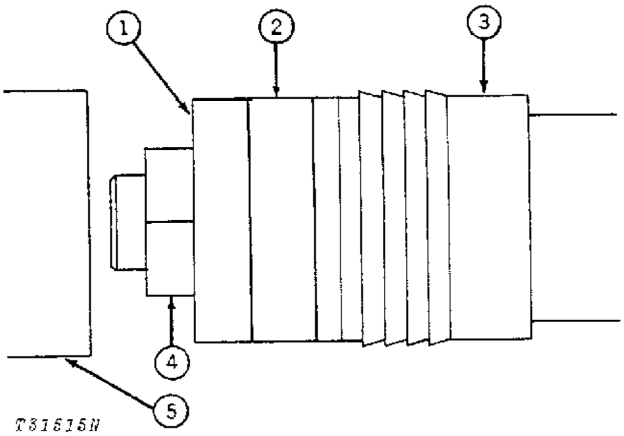
Install new wiper seal (5, Fig. 16) in rod guide.

Install new wear ring (4) in rod guide. Install backup washer (6) and O-ring (1) on rod guide.

Install V-packing (3) in rod guide with the apex of the V toward the wear ring and fasten with snap ring (2).

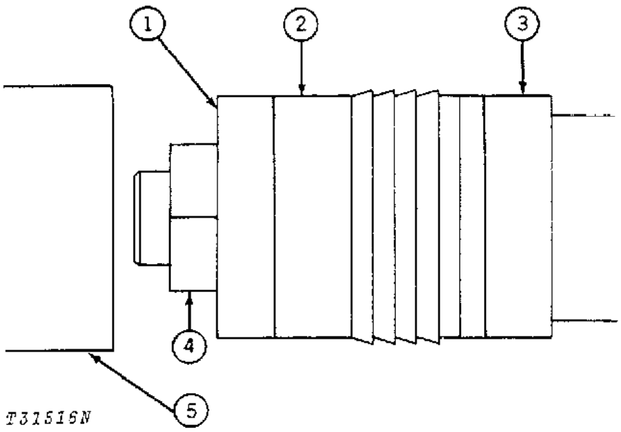
Install rod guide assembly on piston rod being careful not to damage packing.

Installing Piston V-Packing



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 17-Original Installation of V-Packing



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 18-Installation of V-Packing Without Compressor

V-packings are originally installed on the piston with the apex of the V pointing away from the barrel (Fig. 17). When replacing V-packings in the field this procedure can be used if a suitable ring compressor is available to compress packings when installed in cylinders.

If a suitable compressor is not available, assemble the packings with the apex of the V pointing toward the barrel (Fig. 18). 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.

Install piston on piston rod. Install wear ring on piston retainer. Install retainer on piston rod and fasten with lock nut. Tighten lock nut (Fig. 12, 13, 14 and 15) to 250 lb-ft (339 N·m).

Put AT52853 John Deere Loctite Thread Lock and Sealer (Low Strength) or an equivalent on the threads of the rod guide before assembly.

Install piston rod assembly and snap ring into barrel.

Fasten piston rod assembly in barrel with rod guide and tighten spanner nut to 125 to 175 lb-ft. (170 to 237 N·m).

INSTALLATION

Put the cylinder in position on the machine and align the attaching holes. Install pivot pins and fasten 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 3299
SPECIFICATIONS AND SPECIAL TOOLS

BLADE

SPECIFICATIONS AND TORQUE VALUES

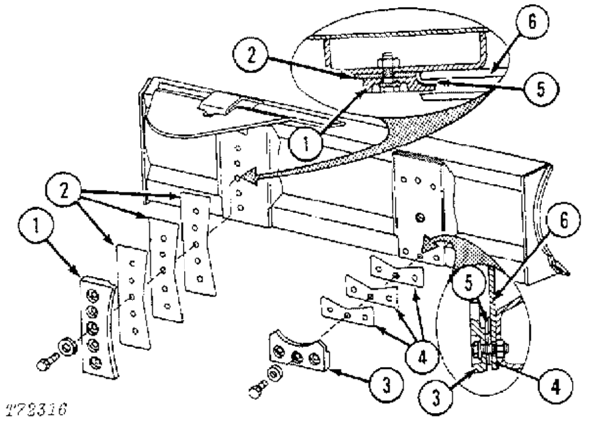


Fig. 1-Checking Frame-to-Blade Clearance (6305 Blade)

Frame-to-Blade Clearance (both sides):
less than thickness of one shim (2 or 4), but still allows blade to tilt without binding.

DOZER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES

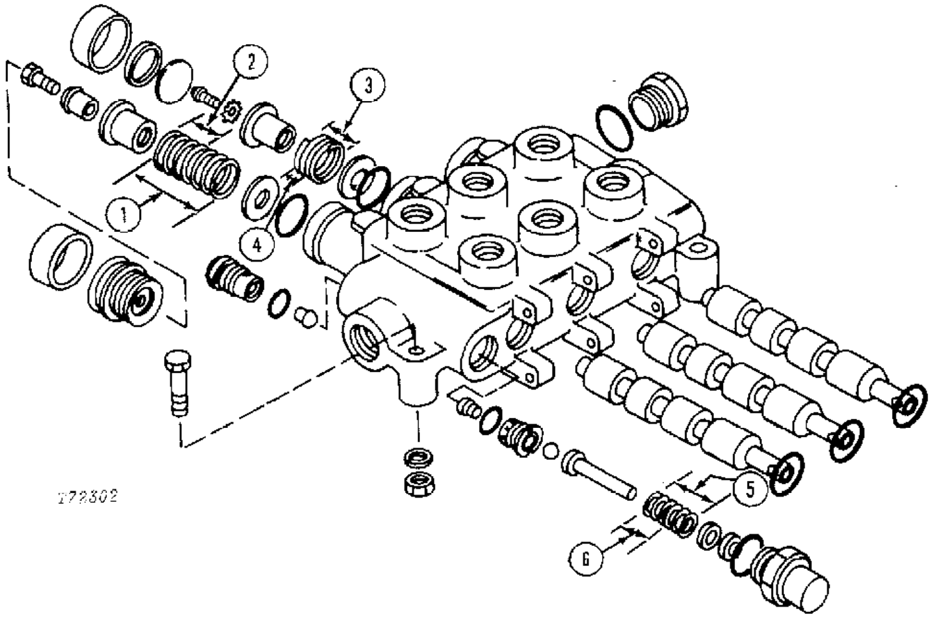


Fig. 2-6305 Bulldozer Control Valve

1 - Lift spool spring
Free length . . . . 1.56 in. (39.6 mm)

2 - Lift spool spring
Test length at 31.5 to 38.5 lb. force . . . . . 1.25 in.
(140 to 171 N . . . . 31.7 mm)

3 - Angling spool spring (lightest)
Free length . . . . 1.19 in. (30.2 mm)

4 - Angling spool spring (lightest)
Test length at 21 to 25 lb. force . . . . 0.94 in.
(93 to 111 N . . . . 23.9 mm)

3 - Tilt spool spring (heaviest)
Free length . . . . 1.20 in. (30.5 mm)

4 - Tilt spool spring (heaviest)
Test length at 27.5 lb. force . . . . 0.94 in.
(122 N . . . . 23.9 mm)

5 - Relief valve spring
Free length . . . . 2.81 in. (71.4 mm)

6 - Relief valve spring
Test length at 243 to 297 lb. force . . . . . . 2.31 in.
(1081 to 1321 N . . . . . 58.7 mm)

DOZER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES—Continued

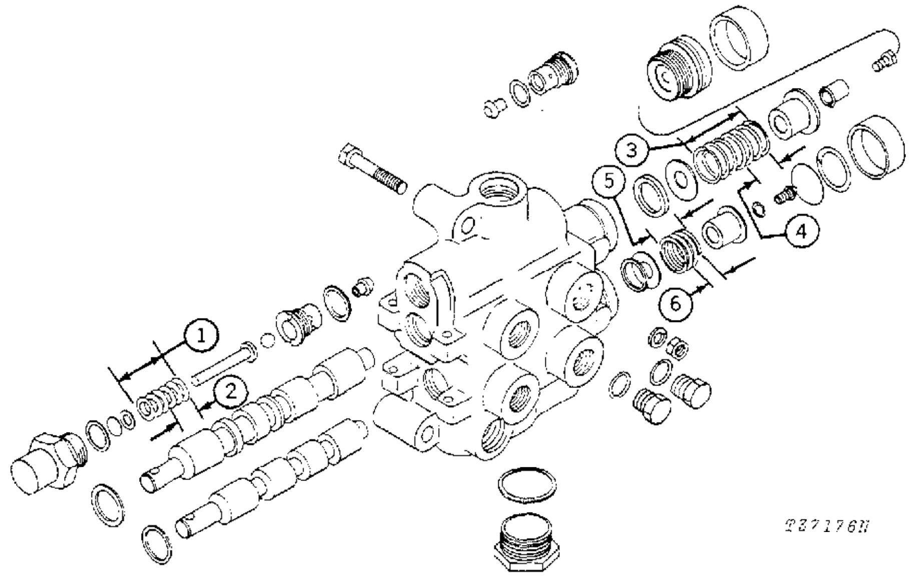


Fig. 3-6300 and 6310 Bulldozer Control Valve

1 - Relief valve spring
Free length ....2.81 in. (71.4 mm)

2 - Relief valve spring
Test length at 243 to 297 lb. force ......2.31 in.
(1081 to 1321 N .....58.7 mm)

3 - Lift spool spring
Free length ....1.56 in. (39.6 mm)

4 - Lift spool spring
Test length at 31.5 to 38.5 lb. force .....1.25 in.
(140 to 171 N ....31.7 mm)

5 - Angling spool spring
Free length ....1.19 in. (30.2 mm)

6 - Angling spool spring
Test length at 21 to 25 lb. force ....0.94 in.
(93 to 111 N........23.9 mm)

DOZER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES—Continued

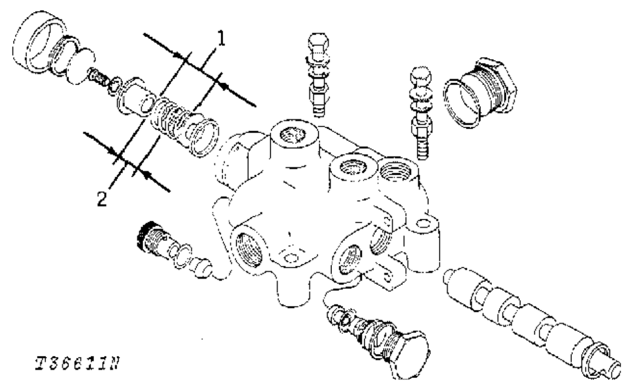


Fig. 4-Auxiliary Valve Spool Spring

1 - Spool spring
Free length .... 1.20 in. (30.5 mm)

2 - Spool spring
Test length at 27.5 lb. force .... 0.94 in.
(122 N .... 23.9 mm)

DOZER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES—Continued

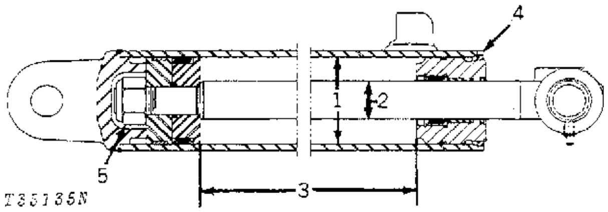


Fig. 5-Cylinder
(Lift Cylinder Illustrated)

6300 and 6305 Bulldozer Lift Cylinder

1 - Cylinder bore .... 2.9960 to 3.0000 in. (76.098 to 76.200 mm)

2 - Rod diameter .... 1.2485 to 1.2515 in. (31.712 to 31.788 mm)

3 - Cylinder stroke .... 12.12 in. (307.8 mm)

4 - Spanner nut torque .... 125 to 175 lb-ft (170 to 237 N·m)

5 - Lock nut torque .... 250 lb-ft (min.) (339 N·m)

6305 Bulldozer Tilt Cylinder

1 - Cylinder bore .... 2.5075 to 2.5125 in. (63.691 to 63.818 mm)

2 - Rod diameter .... 1.2485 to 1.2525 in. (31.712 to 31.788 mm)

3 - Cylinder stroke .... 7.0 in. (177.8 mm)

4 - Spanner nut torque .... 125 to 175 lb-ft (170 to 237 N·m)

5 - Lock nut torque .... 250 lb-ft (min.) (339 N·m)

6305 Bulldozer Angling Cylinder

1 - Cylinder bore .... 2.9960 to 3.0000 in. (76.098 to 76.200 mm)

2 - Rod diameter .... 1.2485 to 1.2515 in. (31.712 to 31.788 mm)

3 - Cylinder stroke .... 13.27 in. (337.06 mm)

4 - Spanner nut torque .... 125 to 175 lb-ft (170 to 237 N·m)

5 - Lock nut torque .... 250 lb-ft (min.) (339 N·m)

DOZER HYDRAULICS

SPECIFICATIONS AND TORQUE VALUES—Continued

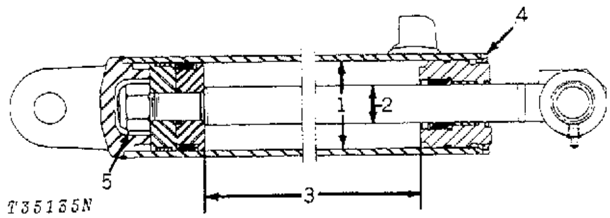


Fig. 6-Cylinder (Lift Cylinder Illustrated)

6310 Bulldozer Lift Cylinder

1 - Cylinder bore .... 2.9960 to 3.0000 in. (76.098 to 76.200 mm)

2 - Rod diameter .... 1.2485 to 1.2515 in. (31.712 to 31.788 mm)

3 - Cylinder stroke .... 14.00 in. (355.6 mm)

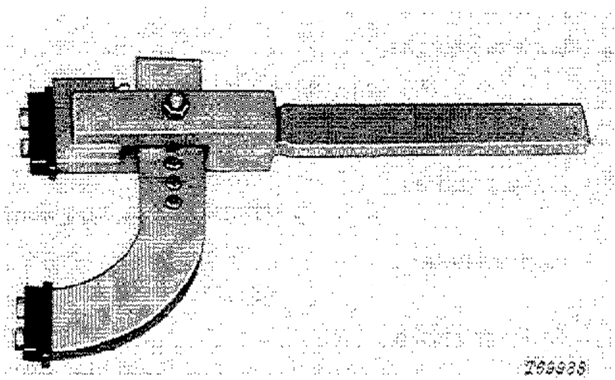
4 - Spanner nut torque .... 125 to 175 lb-ft (170 to 237 N·m)

5 - Lock nut torque .... 250 lb-ft (min.) (339 N·m)

DOZER HYDRAULICS

SPECIFICATIONS SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
 Fig. 7-Special Spanner Wrench	D-05270ST	Remove and install cylinder spanner nuts

Section 33
9250 BACKHOE

CONTENTS OF THIS SECTION

Section 33A
9300 BACKHOE

CONTENTS OF THIS SECTION

CONTENTS OF THIS SECTION—Continued

Section 33B
9550 BACKHOE

CONTENTS OF THIS SECTION

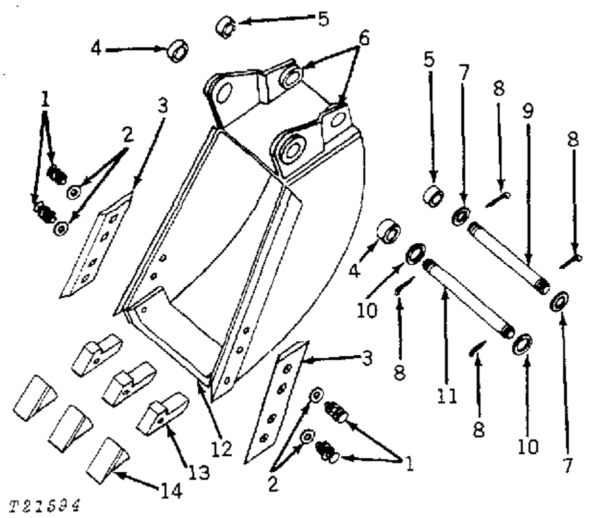
Group 3302
BUCKET

REMOVAL

Lower boom and dipperstick to position bucket on the ground.

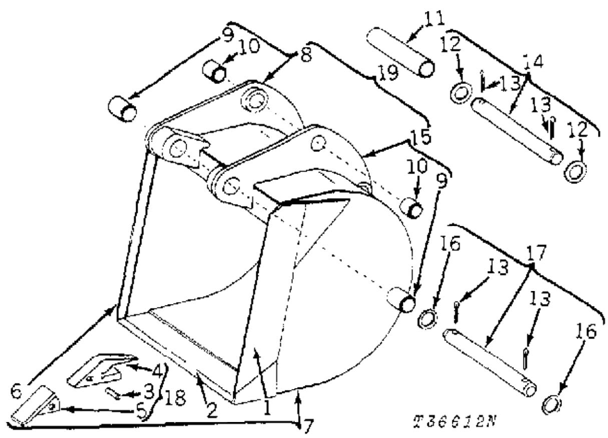
CAUTION: Release hydraulic pressure on the bucket before removing the retaining pins.

REPAIR



1—Bolt, Lock Washer, and Nut (6 used)
2—Washer
3—Side Cutting Edge
4—Bushing
5—Bushing
6—Pivot Plate
7—Backup Washer
8—Cotter Pin
9—Pin
10—Backup Washer
11—Pin
12—Front Cutting Edge
13—Tooth Shank
14—Tooth Tip

Fig. 1-Bucket (With Straight Pivot Plates)

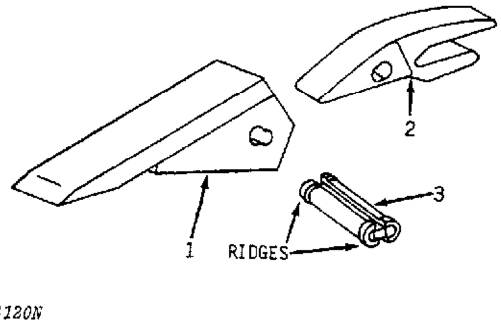


1—R.H. Side Cutting Edge
2—Front Cutting Edge
3—Flex Pin
4—Tooth Shank
5—Tooth Tip
6—L.H. Side Cutting Edge
7—Bucket Assembly
8—L.H. Pivot Plate
9—Pivot Plate Bushing (2 used)
10—Pivot Plate Bushing (4 used)
11—Spacer
12—Backup Washer (2 used)
13—Cotter Pin (4 used)
14—Pin
15—R.H. Pivot Plate
16—Backup Washer (2 used)
17—Pin
18—Bucket Tooth Assembly
19—Back Plate

Fig. 2-Heavy Duty Buckets

Refer to Figs. 1 and 2 during disassembly and assembly of the bucket. Inspect all parts for excessive wear or damage and repair or replace as necessary.

Backhoe Bucket Tooth Assembly—Heavy-Duty Buckets



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 Figure 3. The ridges are the locking mechanism.

NOTE: If "back" is stamped on the pin, it should face toward the shank.

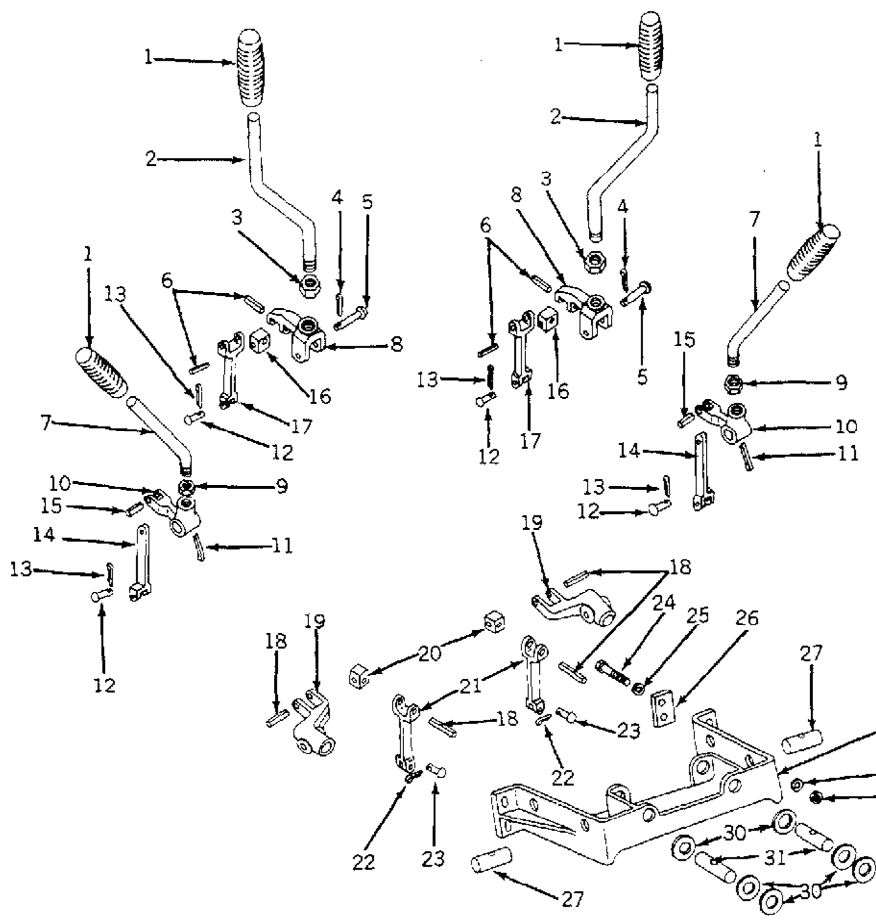
INSTALLATION

Align dipperstick to bucket and insert retaining pins.

Grease all fittings before beginning operation.

Group 3315
CONTROLS LINKAGE

REPAIR



1—Hand Grip (4 used)
2—Lever (2 used)
3—Hex. Nut (2 used)
4—Cotter Pin (2 used)
5—Pivot Pin (2 used)
6—Spring Pin (4 used)
7—Stabilizer Lever (2 used)
8—Handle Mount (2 used)
9—Nut (2 used)
10—Handle Mount (2 used)
11—Cotter Pin (2 used)
12—Pin (4 used)
13—Cotter Pin (4 used)
14—Link (2 used)
15—Spring Pin (2 used)
16—Lever Block (2 used)
17—Link (2 used)
18—Spring Pin (4 used)
19—Pivot Block (2 used)
20—Lever Block (2 used)
21—Lever Link (2 used)
22—Cotter Pin (2 used)
23—Pin (2 used)
24—Cap Screw (4 used)
25—Washer (4 used)
26—Spacer (2 used)
27—Pivot Shaft (2 used)
28—Lock Washer (4 used)
29—Nut (4 used)
30—Washer (6 used)
31—Pivot Shaft (2 used)
32—Mounting Frame

Fig. 1-Backhoe Control Valve Levers and Linkage

Refer to Fig. 1 during disassembly and assembly of control linkage.

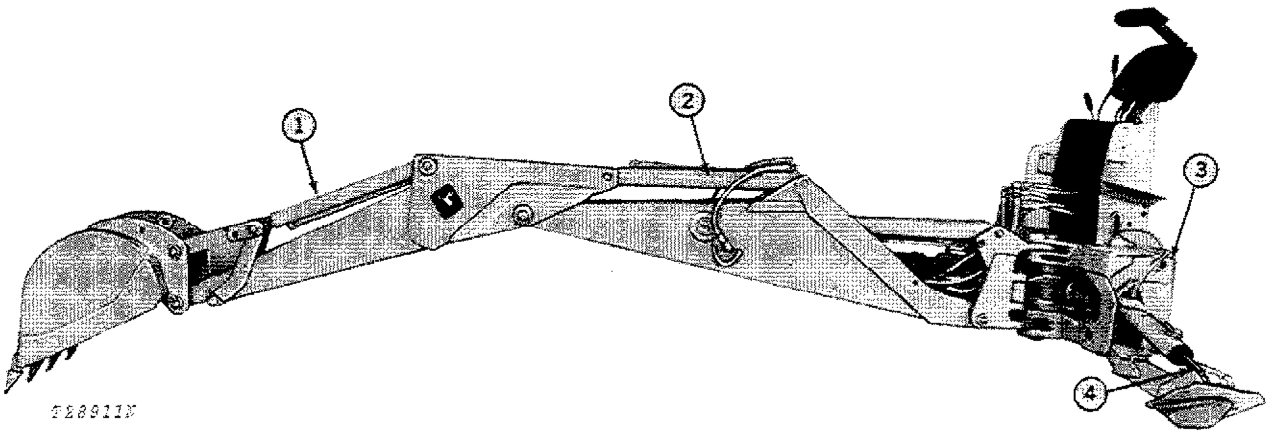
Inspect control valve linkage for worn or damaged parts.

Coat shafts and movable linkage parts with grease before assembly.

Group 3340
FRAMES

MAIN FRAME

REMOVAL



1—Bucket Cylinder (Retracted)
2—Crowd Cylinder (Retracted)
3—Main Frame (Tipped Slightly Forward)
4—Stabilizer Cylinders (Extended)

Fig. 1-Backhoe Removal

By using the backhoe hydraulic system, the backhoe can be easily detached to free the crawler for other jobs.

Lower the stabilizers until they are supporting the weight of the backhoe. Retract the bucket and dipperstick and extend boom cylinder until backhoe is fully extended and bucket is resting on the ground. Install swing locking pin in place to prevent tipping.

Remove the cotter pins and mounting pins which hold the top of the backhoe main frame to the crawler frame.

Use stabilizers to raise backhoe frame off the bottom mounting bracket hooks.

Carefully retract the stabilizers until the main frame is resting on the ground tilted slightly forward (Fig. 1).

NOTE: The main frame can be blocked up off the ground by blocking across full width of backhoe main frame.

CAUTION: Shut off the crawler engine before disconnecting the hydraulic lines to the backhoe. If the engine is left running the operator may be sprayed with hot hydraulic oil.

Disconnect the pressure and return hoses from the backhoe main frame at the quick disconnect couplers and connect hoses together.

IMPORTANT: Pressure and return hoses must be connected together at all times when backhoe is removed. Never plug the power beyond port in the loader valve or the pressure hose to the backhoe valve.

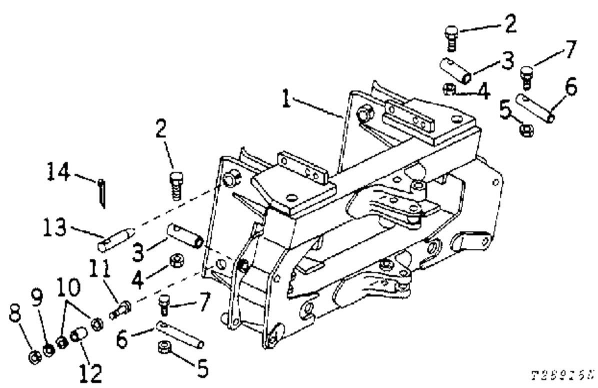
Carefully drive the crawler from the backhoe.

Support boom and dipperstick with a hoist or blocks.

Drive out pins connecting boom pivot to main frame.

REPAIR

Refer to Fig. 2 during disassembly and assembly of the main frame.



1—Main Frame
2—Cap Screw (4 used)
3—Stabilizer Cylinder Pin (2 used)
4—Lock Nut (4 used)
5—Lock Nut (2 used)
6—Stabilizer Pivot Pin (2 used)
7—Cap Screw (2 used)
8—Nut (2 used)
9—Lock Washer (2 used)
10—Washer (4 used)
11—Cap Screw (2 used)
12—Pivot Ferrule (2 used)
13—Pivot Pin (2 used)
14—Cotter Pin (2 used)

Fig. 2-Main Frame

INSTALLATION

Install main frame and swing frame to boom and dipperstick.

Attach the pressure and return hoses to the backhoe main frame at the quick disconnect couplers.

Carefully raise the backhoe main frame with the hydraulic system by extending the stabilizers.

Carefully back the crawler to align the mounting bracket hooks with the lower pins on the backhoe main frame. Retract the stabilizers until the bottom pins rest in the mounting bracket hooks on the crawler.

Secure the top of each side of main frame to crawler with mounting pins and cotter pins.

MOVABLE FRAMES

REMOVAL

Boom and Dipperstick

Remove bucket as directed on Page 3302-3.

Extend boom and dipperstick so boom is resting on blocks and the dipperstick is resting on the ground. (Crowd cylinder will be approximately one inch [25.4 mm] from bottoming out).

CAUTION: Stop engine and operate controls to relieve hydraulic pressure from hydraulic system before disconnecting hydraulic hoses.

Disconnect and cap all boom and dipperstick hydraulic hoses.

Disconnect battery ground strap or turn off battery disconnect switch (if equipped).

Drive out crowd cylinder pins and boom-to-dipperstick pin.

Remove dipperstick.

Support boom with a hoist.

Remove boom pins and lower boom to the ground.

Boom Pivot Removal

Remove backhoe from unit as directed on page 3340-1.

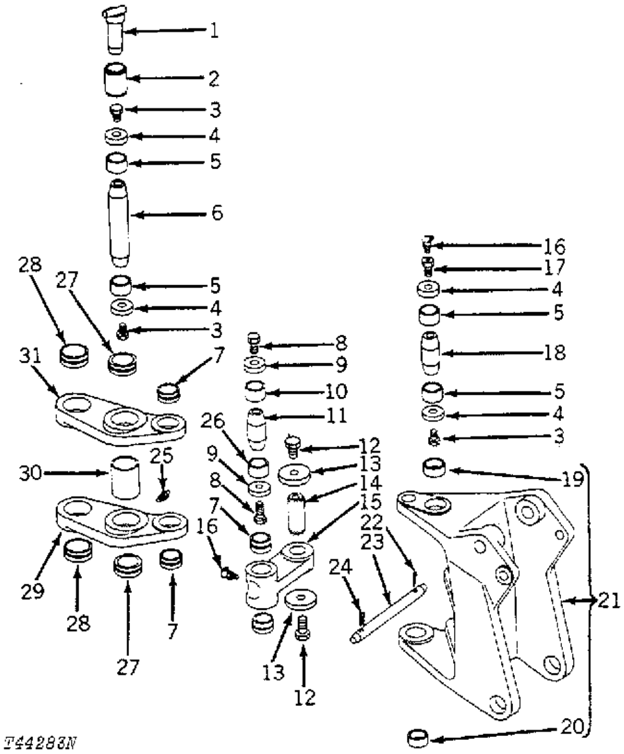
Remove boom and dipperstick.

Remove manifold block from boom pivot.

Support boom pivot with blocks.

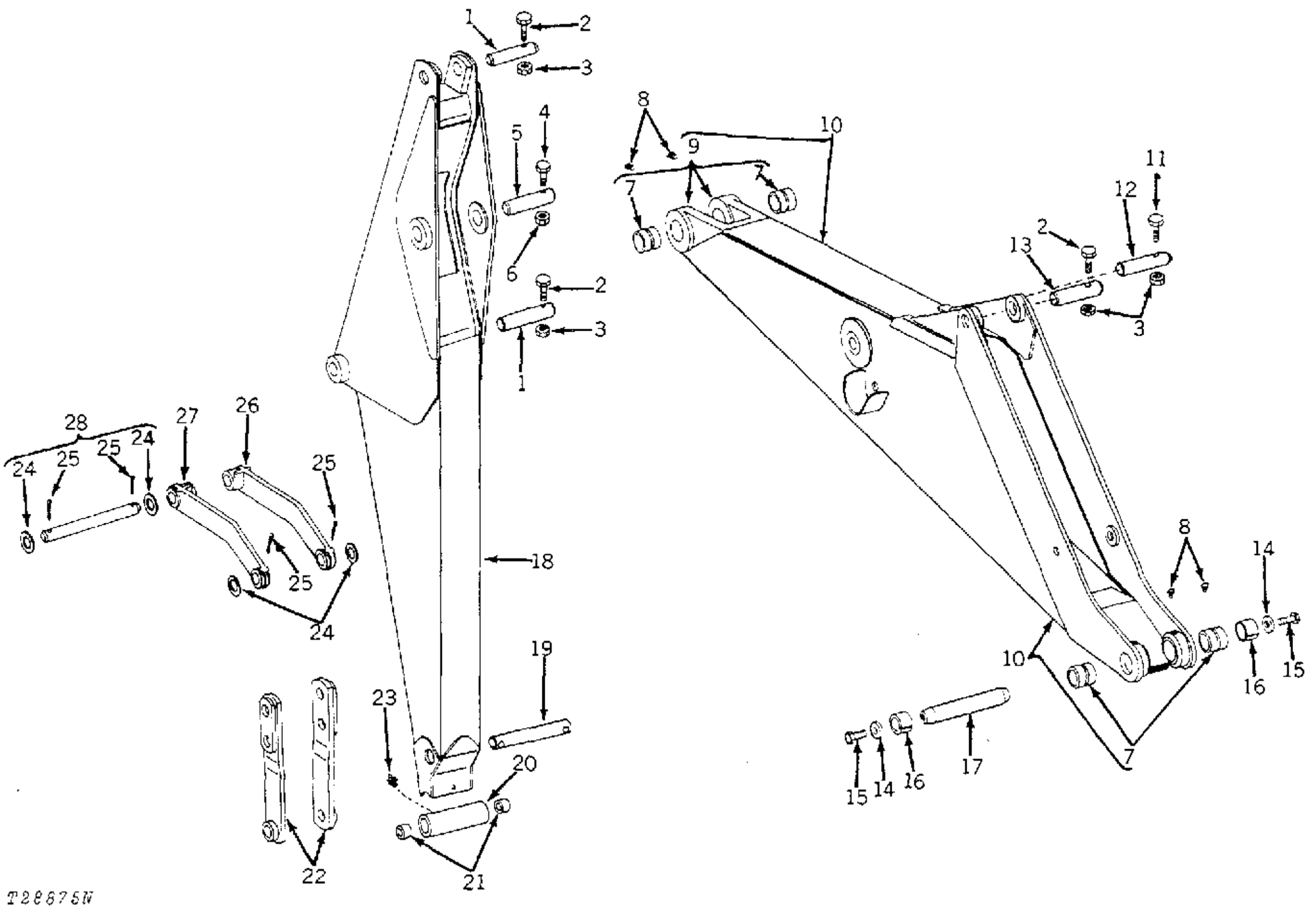
Remove cap screws from retaining pivot pins and drive out pins.

REPAIR



1—Swing Lock Pin
2—Swing Lock Pin Spacer Bushing
3—Cap Screw (4 used)
4—Tapered Pin Washer (6 used)
5—Wedge Bushing (6 used)
6—Inner Swing Links to Main Frame Pin
7—Inner and Outer Swing Link Bushing (4 used)
8—Cap Screw (2 used)
9—Tapered Pin Washer (2 used)
10—Wedge Bushing
11—Inner Links to Outer Links Tapered Bushing
12—Cap Screw (2 used)
13—Special Washer (2 used)
14—Outer Swing Link Pin
15—Outer Swing Link
16—Grease Fitting (2 used)
17—Special Cap Screw (2 used)
18—Swing Frame to Main Frame Tapered Pin (2 used)
19—Swing Frame Upper Bushing
20—Swing Frame Lower Bushing
21—Swing Frame
22—Cotter Pin
23—Boom Lock Pin
24—Spring Lock Pin
25—Grease Fitting (7 used)
26—Lower Wedge Bushing
27—Inner Swing Link Bushing (2 used)
28—Inner Swing Link Bushing (2 used)
29—Lower Inner Swing Link
30—Inner Swing Link Spacer
31—Upper Inner Swing Link

Fig. 3-Boom Pivot and Swing Linkage



1—Pin (2 used)
2—Cap Screw (3 used)
3—Lock Nut (4 used)
4—Cap Screw
5—Pin
6—Lock Nut
7—Bushing (4 used)
8—Grease Fitting (4 used)
9—Bushing Pivot Assembly
10—Boom Assembly with Pivot and Bushings
11—Cap Screw
12—Pin
13—Pin
14—Washer
15—Cap Screw
16—Wedge Bushing (2 used)
17—Tapered Pin
18—Dipperstick Assembly
19—Pin
20—Dipper End
21—Dipperstick Bushing (2 used)
22—Bucket Link (2 used)
23—Grease Fitting
24—Special Washer (4 used)
25—Cotter Pin (4 used)
26—R.H. Driver Link
27—L.H. Driver Link
28—Pin

Fig. 4-Boom and Dipperstick Assembly

Refer to Fig. 4 during disassembly and assembly of the boom and dipperstick.

Removing And Installing Tapered Pins And Bushings

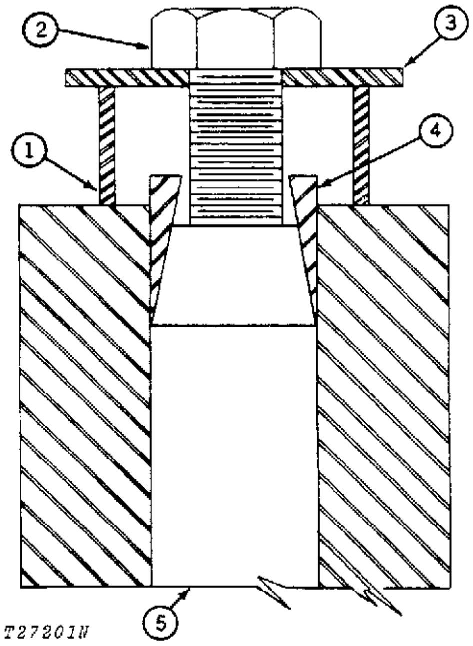
The procedures for removing tapered pins and bushings are as follows:

Remove cap screws from tapered pin (5, Fig. 5).

Place a short piece of pipe (1, Fig. 5) 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.

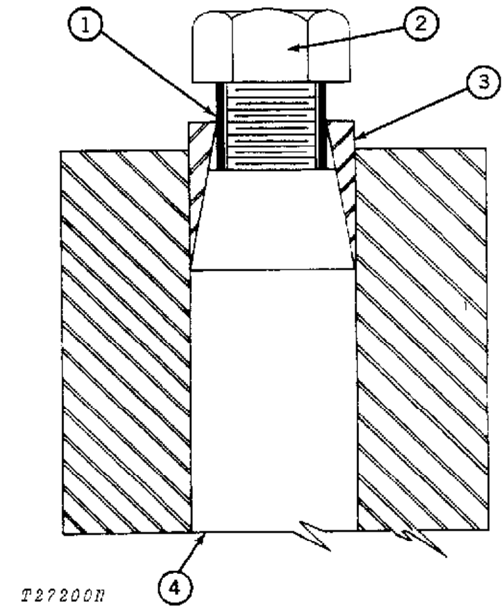
Screw cap screw (2) into tapered pin (5) until the pin and bushing are pulled from the bore.



1—Pipe
2—Cap Screw
3—Steel Plate
4—Tapered Bushing
5—Tapered Pin

Fig. 5-Pulling Tapered Pins and Bushings

Whenever it is not possible to remove tapered pins and bushings by the method given at left use the second procedure outlined as follows:



1—Pipe Spacer or Washers
2—Cap Screw
3—Tapered Bushing
4—Tapered Pin

Fig. 6-Removing Tapered Pins and Bushings

Place a pipe spacer or washer (1, Fig. 6) 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.

NOTE: 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.

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.

a. If the washers are accessible and large enough, strike both washers in three places.

b. 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.

INSTALLATION

Install boom and dipperstick by reversing removal procedure.

STABILIZERS

REMOVAL

Operate control lever to fully extend stabilizers.

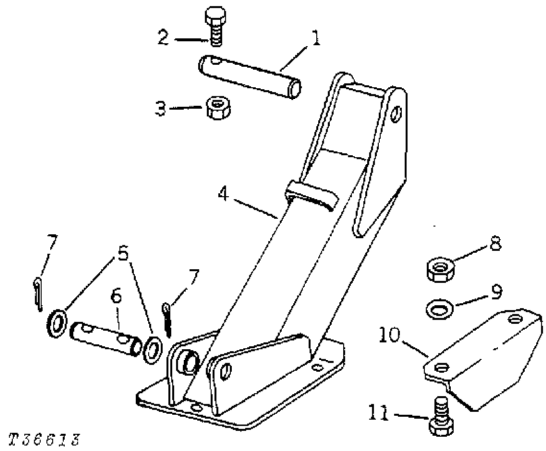
CAUTION: Stop engine and operate the stabilizer control lever to release hydraulic pressure.

Remove stabilizer pivot pin and stabilizer cylinder pin.

Lower stabilizer to ground.

REPAIR

Refer to Fig. 7 during disassembly and assembly of stabilizers.



1—Stabilizer Pivot Pin (2 used)
2—Cap Screw (2 used)
3—Lock Nut (2 used)
4—Stabilizer (2 used)
5—Washer (4 used)
6—Stabilizer Cylinder Pin (2 used)
7—Cotter Pin (4 used)
8—Nut (4 used)
9—Lock Washer (4 used)
10—Stabilizer Cleat (2 used)
11—Cap Screw (4 used)

Fig. 7-Stabilizer

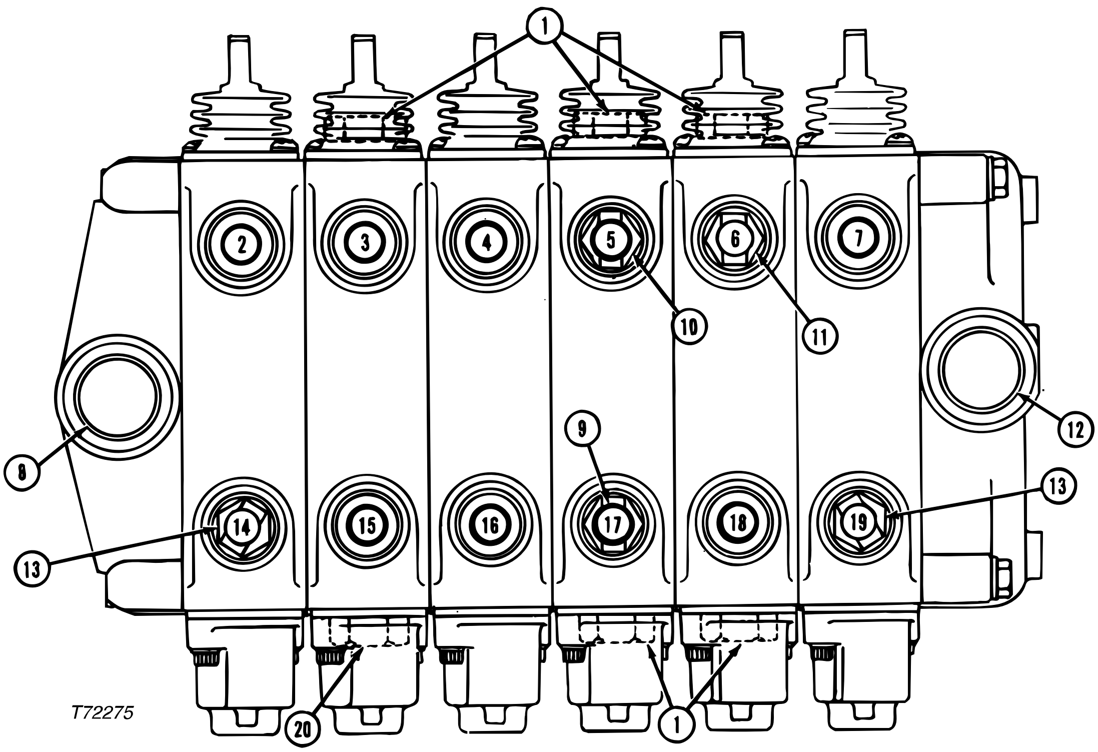
INSTALLATION

Install stabilizers by using removal procedure in reverse order.

Group 3360
HYDRAULIC SYSTEM

CONTROL VALVE

GENERAL INFORMATION



1—Circuit Relief Valve (5 used)
2—Right Stabilizer Cylinder (Rod End)
3—Crowd Cylinder (Piston End)
4—Bucket Cylinder (Piston End)
5—Swing Cylinder (Right)
6—Boom Cylinder (Rod End)
7—Left Stabilizer Cylinder (Rod End)
8—Pressure Port
9—Orifice Plate (0.1075 in. [2.731 mm])
10—Orifice Plate (0.1510 in. [3.835 mm])
11—Orifice Plate (0.219 in. [5.56 mm])
12—Return Port
13—Orifice Plate (2 used) (0.1405 in. [3.569 mm])
14—Right Stabilizer Cylinder (Piston End)
15—Crowd Cylinder (Rod End)
16—Bucket Cylinder (Rod End)
17—Swing Cylinder (Left)
18—Boom Cylinder (Piston End)
19—Right Stabilizer Cylinder (Piston End)
20—Plug

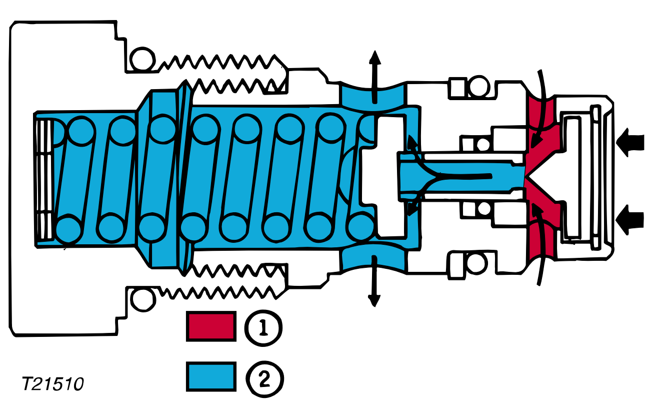
Fig. 1-9250 Backhoe Control Valve

The 9250 backhoe control valve is an open-center, six-spool, stack-type valve.

All six valve sections are separate bodies containing single spools. All valve sections contain lift checks which serve as one-way valves to prevent pressure oil from entering the port passages and causing cylinder movement.

NOTE: The swing valve section has a 0.104 in. (2.64 mm) orifice plate in the lift check.

Anti-cavitation check valves are contained in the boom and swing valve sections.



1—Pressure Oil
2—Return Oil

Fig. 2-Direct Acting Relief Valves

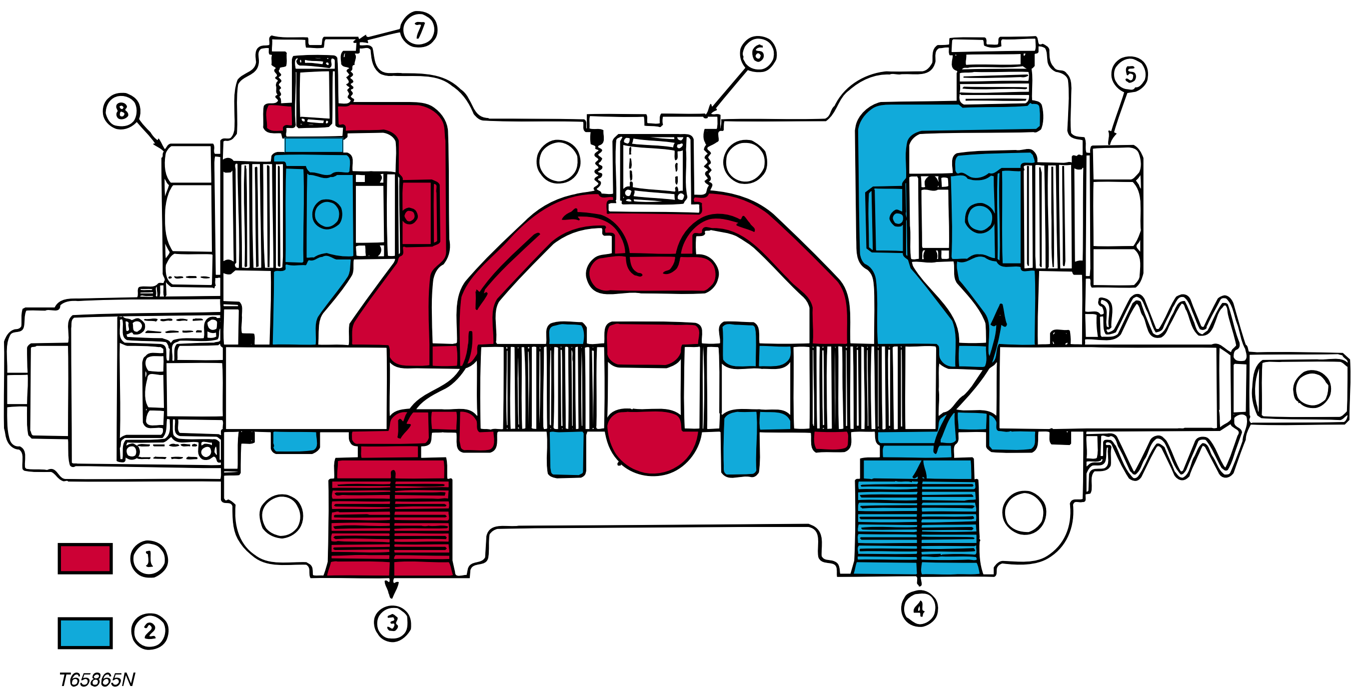
The crowd, boom and swing sections contain direct acting circuit relief valves to protect their circuits from excessive pressures.

Field adjustment is possible on all relief valves.

Control Valve Oil Flows

FOS Refer to "Hydraulic Valves" in FOS Manual—HYDRAULICS for basic information on the operation of direct-acting relief valves.

The pressure port is located in the port plate and the return port is in the end plate.



1—Pressure Oil
2—Return Oil
3—To Cylinder
4—From Cylinder
5—Circuit Relief Valve
6—Lift Check
7—Anti-Cavitation Valve
8—Circuit Relief Valve

Fig. 3-Oil Flow Through Valve Section (Boom Section Illustrated)

Neutral Oil Flow

With all spools in neutral position, oil from the pump enters the port plate and is split into two columns:

1. One column flows through the valve stack and is stopped at the end plate. This is called functional oil—oil that can be diverted to one or more cylinders by moving one of the control valve spools to an operating position.

2. The other column of inlet oil flows freely through the valve stack into the end plate and back to the reservoir.

Boom Power Circuit (Fig. 3)

When the boom spool is extended or retracted to lower or raise the boom, functional oil is directed past the valve spool to the boom cylinders.

Displaced oil from the cylinders is forced back to the control valve through the valve outlet and back to the reservoir. Oil in the remaining cylinders remains trapped by the valve spools.

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 boom and swing cylinders.

REMOVAL

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 the system, be sure all connections are tight and that lines 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 the 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.

CAUTION: Lower the bucket and stabilizers to the ground before removing valve. Shut off engine and discharge system by operating loader controls.

Loosen jam nuts on stabilizer control levers and turn levers in toward the center. Remove the cap screws holding the valve cover and remove cover.

Move control levers in all directions to release pressure in valves.

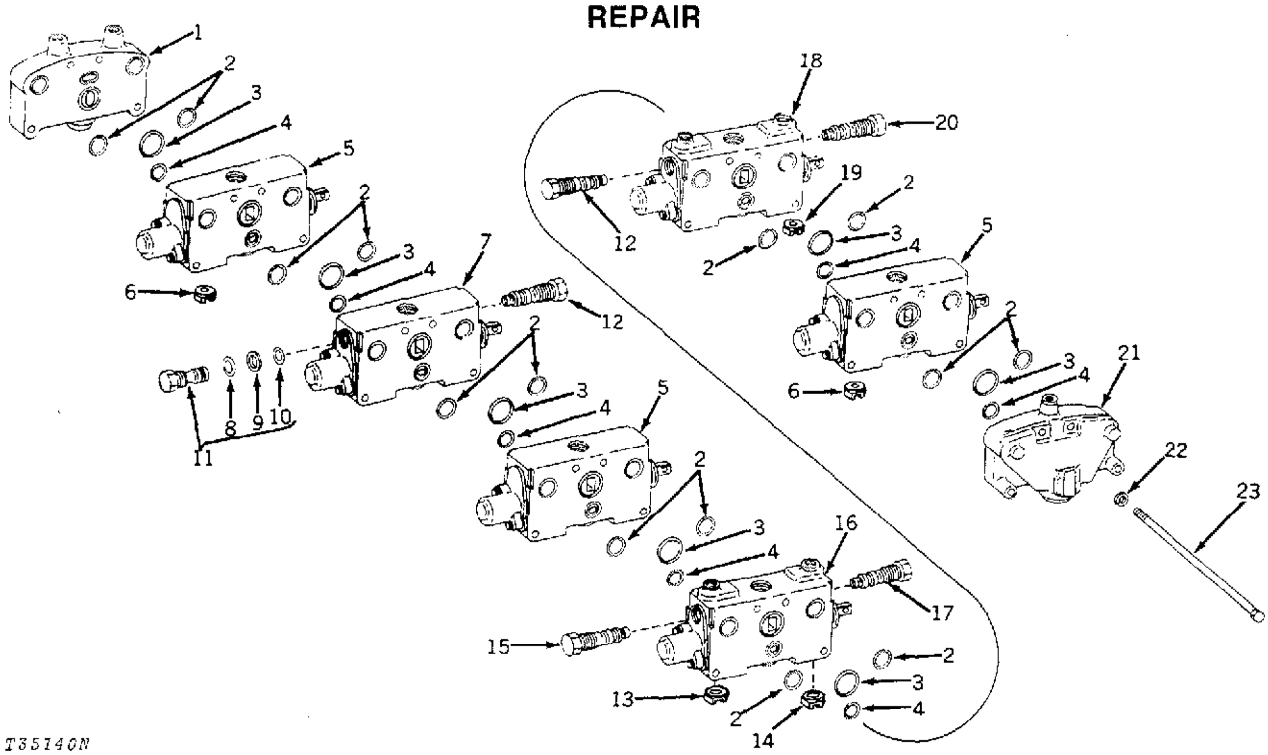
Tag all hoses and lines (by number or description) to identify their locations on the valve stack so they can be correctly attached when the valve is reinstalled. Disconnect all hoses from valves and valve lines. Cap or plug all openings to keep dirt and other foreign material out of the hydraulic system.

IMPORTANT: Orifice plates are used in the control valve to limit return oil. Mark or tag orifice plates so that they may be assembled in the proper ports.

Remove cotter pins securing control lever linkage to valve spools.

Remove cap screws holding control valve to valve box and lift out control valve.

REPAIR



T35140N

1—Left-Hand Port Plate
2—O-Ring (14 used)
3—O-Ring (7 used)
4—O-Ring (7 used)
5—Bucket and Stabilizer Valve
6—Orifice Plate (2 used)
7—Crowd Valve
8—O-Ring
9—Backup Washer
10—O-Ring
11—Plug Assembly
12—Relief Valve Assembly (2 used)
13—Orifice Plate
14—Orifice Plate
15—Relief Valve Assembly
16—Swing Valve
17—Relief Valve Assembly
18—Boom Valve
19—Orifice Plate
20—Relief Valve Assembly
21—Right-Hand End Plate
22—Lock Washer (4 used)
23—Special Screw (4 used)

Fig. 4-Backhoe Control Valve

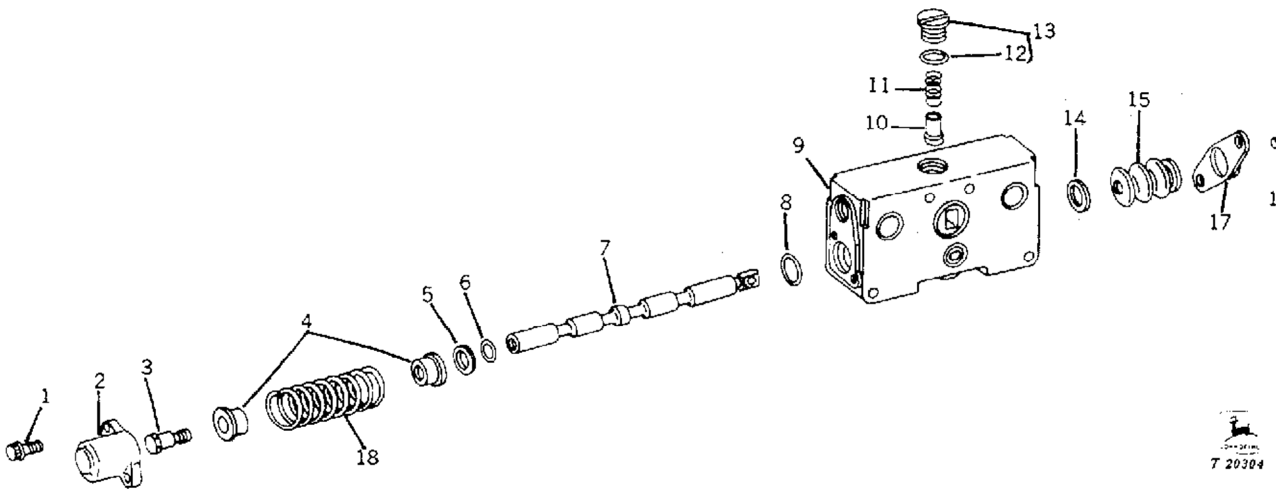
NOTE: Components of the control valve stack can be disassembled for inspection and repair as individual units without disassembling all parts. Therefore, refer only to the particular parts to be disassembled and disregard all other disassembly procedures.

Drain as much oil as possible from the valve stack. Thoroughly clean the outside of the valve stack assembly.

Mark or tag all valves of the valve stack (Fig. 1) before disassembly to assure proper assembly. Service individual valves separately and keep the valve housings and their spools together as these parts are matched assemblies.

Remove the tie bolts from end plate (Fig. 4), leaving tie bolts in place until disassembly is done. Slide valves off tie bolts one at a time and remove O-rings (Fig. 4) between valves.

One valve can be removed from the control valve stack without separating all valves. Follow the same procedure whether one valve is being removed or all valves are being separated.



1—Screw (2 used)
2—Cap Assembly
3—Spool Screw
4—Washers (2 used)
5—Retainer
6—O-Ring
7—Spool
8—O-Ring
9—Valve Housing
10—Plunger
11—Spring
12—O-Ring
13—Lift Check
14—Breather Washer
15—Spool Seal
16—Machine Screw (2 used)
17—Dust Seal Retainer
18—Centering Spring

Fig. 5-Control Valve Section (Stabilizer Valve Illustrated)

Remove end caps and remove spools from valve housings.

Clean and dry all parts thoroughly and inspect for wear and damage.

Check valve housing for damage or evidence of leakage. Replace housing and spool as a matched assembly.

Remove the anti-cavitation check valves from valve sections and inspect for damage. Check the anti-cavitation springs.

Free length .... 0.692 in. (17.58 mm)
Test length at 0.75 ± 0.1 lb. force ....0.625 in.
(3.3 ± 0.4 N........................15.88 mm)

Check centering spring (18, Fig. 5)
Test length at 27 lbs. force ....1.25 in.
(120 N ....31.7 mm)

Remove any burrs or rough spots from spool bodies with fine emery cloth. If spools are worn or damaged, replace spool and valve housing as a matched assembly.

Inspect hole in orifice plates for plugged condition. Install all plates with the smooth side toward the valve housing.

Inspect lift checks for damage. Check the lift check springs.

Free length .... 0.995 in. (25.29 mm)
Test length at 1.8 ± 0.2 lbs. force ....0.75 in.
(8 ± 0.9 N ....19.0 mm)

Thoroughly clean and dry all parts. Put oil on all parts before assembly.

Replace all O-rings and backup washers with new parts.

Put T43512 John Deere Loctite Thread Lock and Sealer (Medium Strength) or an equivalent on the threads of spool screw (3) before assembly.

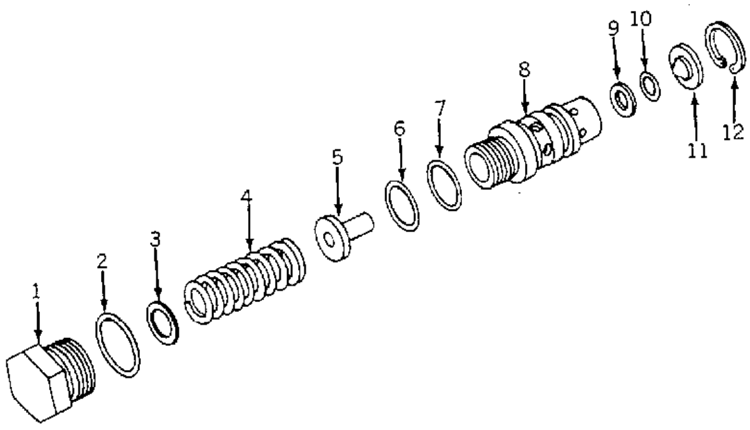
Install spools in proper valve section. Tighten spool screws (3, Fig. 5) with 5 to 8 lb-ft (6.8 to 10.8 N·m).

Install cap assembly (2) and tighten screws (1) with 10 to 13 lb-ft (13.6 to 17.6 N·m).

Stack port plate, valve sections, and end plate in proper sequence.

Install tie bolts and tighten evenly with 25 to 30 lb-ft (34 to 41 N·m).

RELIEF VALVE



1—Relief Valve Cage*
2—O-Ring
3—Shims (as required)
4—Spring*
5—Seat*
6—Back-Up Washer
7—O-Ring
8—Cartridge
9—Back-Up Washer
10—O-Ring
11—Poppet*
12—Snap Ring
**Not available for service*

Fig. 6-Direct Acting Circuit Relief Valve

REPAIR

Remove relief valve from valve housing.

Disassemble relief valve using Fig. 6 as a guide.

Put the hex. head of the relief valve cartridge in a vise and remove snap ring (12, Fig. 6), poppet (11) and cartridge (8).

Remove parts from valve cage (1).

Thoroughly clean and dry all parts. Inspect parts and replace as necessary.

When assembling the relief valve, be sure to use all the shims removed.

Assemble parts in cage and install cartridge, poppet and snap ring.

INSTALLATION

Install valve in valve box.

Attach control linkage to valve.

Install orifice plates (with smooth side toward valve) in valve and connect hoses.

NOTE: If it is believed that fragments of failed valve parts may have entered the hydraulic system, completely drain the system and replace the hydraulic filter.

CYLINDERS

GENERAL INFORMATION

The hydraulic cylinders used on the backhoe are double acting and use "V"-packing type seals on their pistons. Piston rods are heat treated, chrome plated, and polished. Replaceable non-metallic wear rings are used on 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.

The 9250 Backhoe uses one cylinder to swing the boom. The cylinder is double acting and incorporates a hydraulic brake.

FOS

See "Hydraulic Cylinders" in FOS Manual - HYDRAULICS for additional information on cylinders and an explanation of the hydraulic cushion design.

REMOVAL

CAUTION: Be sure the bucket is on the ground and the engine is stopped before attempting to remove any cylinder.

Operate the backhoe controls 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.

Bucket Cylinder

Extend the boom and dipperstick. With bucket on the ground, support the dipperstick at the bucket end pivot point to prevent the bucket from pivoting.

Remove the bucket cylinder.

Boom Cylinder

Extend the boom and dipperstick. Rest the bucket on the ground.

Remove the boom cylinder.

Crowd Cylinder

Extend the boom and dipperstick (do not completely extend the dipperstick). Rest the bucket on the ground.

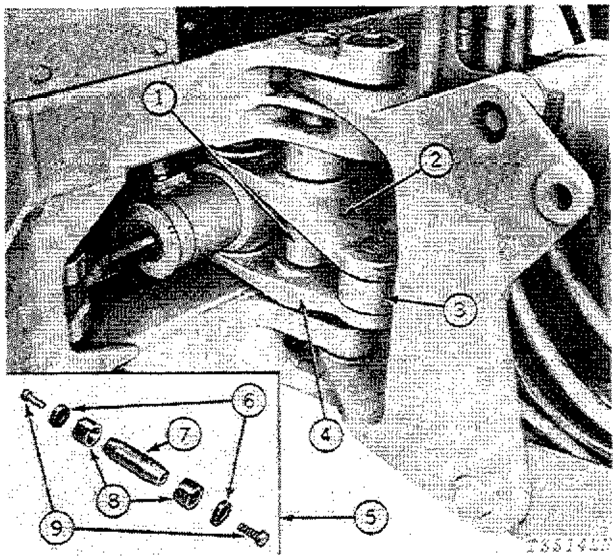
Place a support at the boom and dipperstick pivot point.

Remove the crowd cylinder.

Stabilizer Cylinders

Lower the stabilizers to the ground. Remove the stabilizer cylinder.

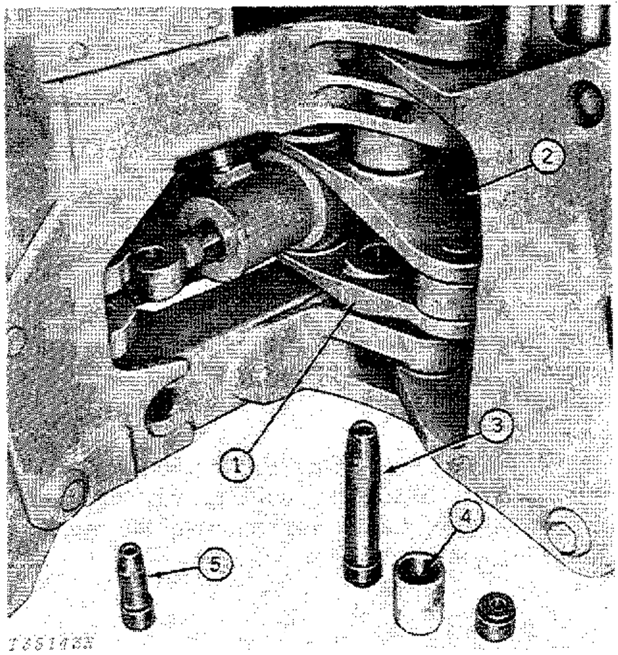
Removing Swing Cylinder



1—Spacer
2—Upper Inner Swing Link
3—Outer Swing Link
4—Lower Inner Swing Link
5—Pin Assembly
6—Washer (2 used)
7—Pin
8—Sleeve (2 used)
9—Cap Screw (2 used)

Fig. 7-Swing Cylinder Pin Assembly

Remove two tapered pin assemblies connecting the upper and lower swing links (Fig. 7) to remove the swing cylinder.



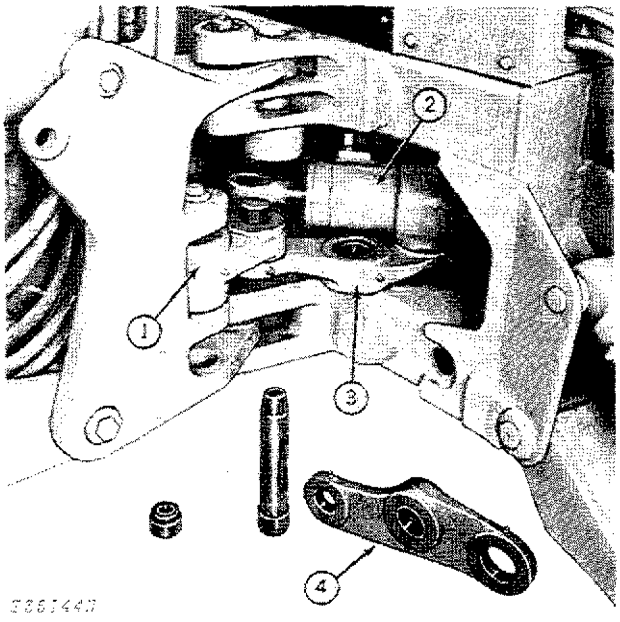
1—Lower Inner Swing Link
2—Upper Inner Swing Link
3—Pin Assembly
4—Spacer
5—Pin Assembly

Fig. 8-Removing Pin Assembly

Remove the pin (5, Fig. 8) from rod end of cylinder.

Remove the pin assembly (3) and spacer (4) from the lower inner and upper inner swing links (1 and 2).

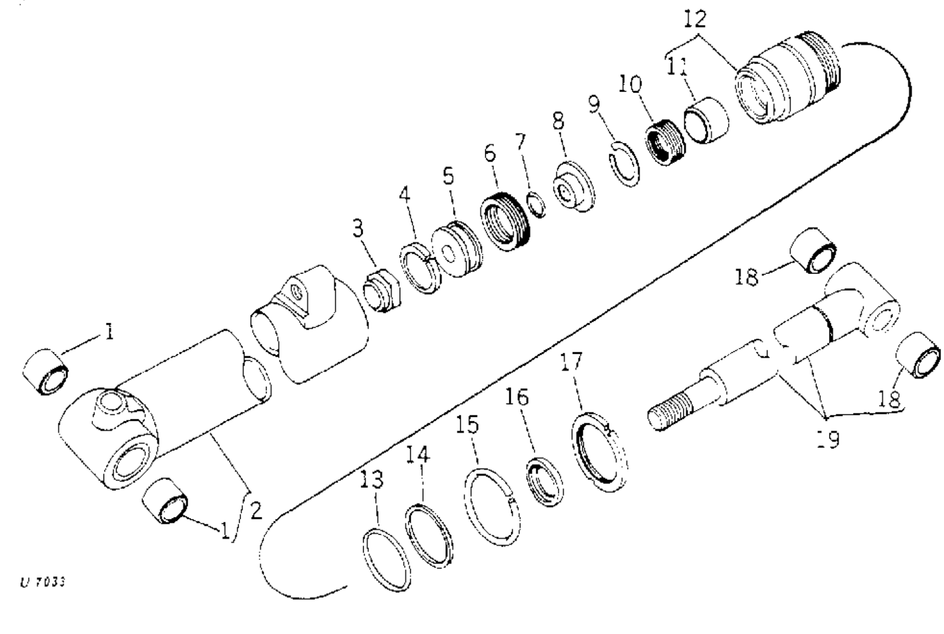
Position swing cylinder as shown (Fig. 9) and remove upper link (4) from the outer swing link (1) and swing cylinder. Disconnect cylinder hoses and lift cylinder from the lower inner swing link (3).



1—Outer Swing Link
2—Swing Cylinder
3—Lower Inner Swing Link
4—Upper Inner Swing Link

Fig. 9-Removing Swing Link

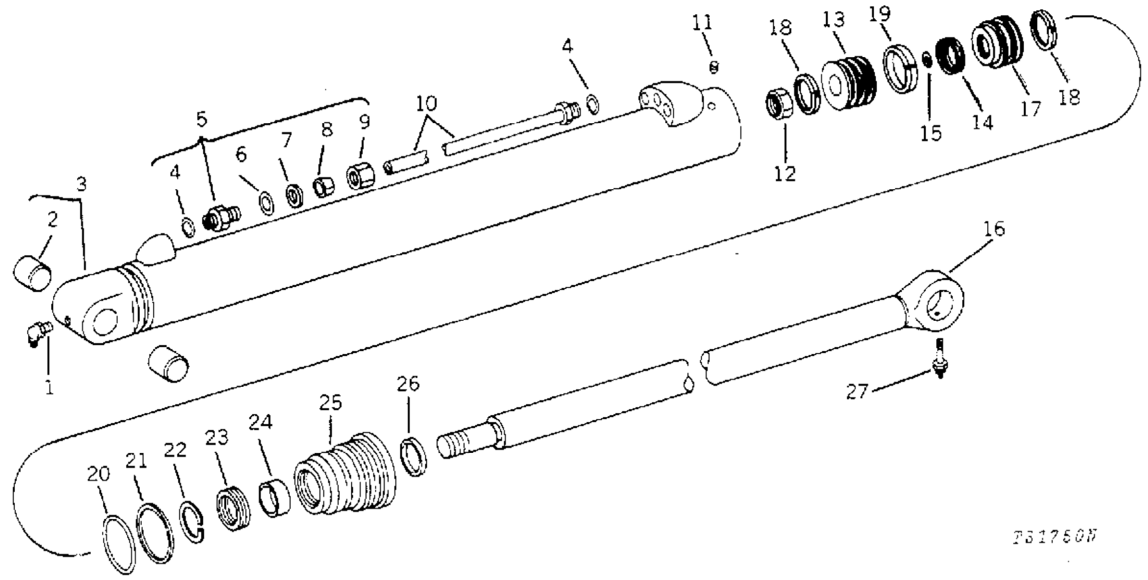
REPAIR



1—Bushing (2 used)
2—Head and 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—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

*Repair Kit

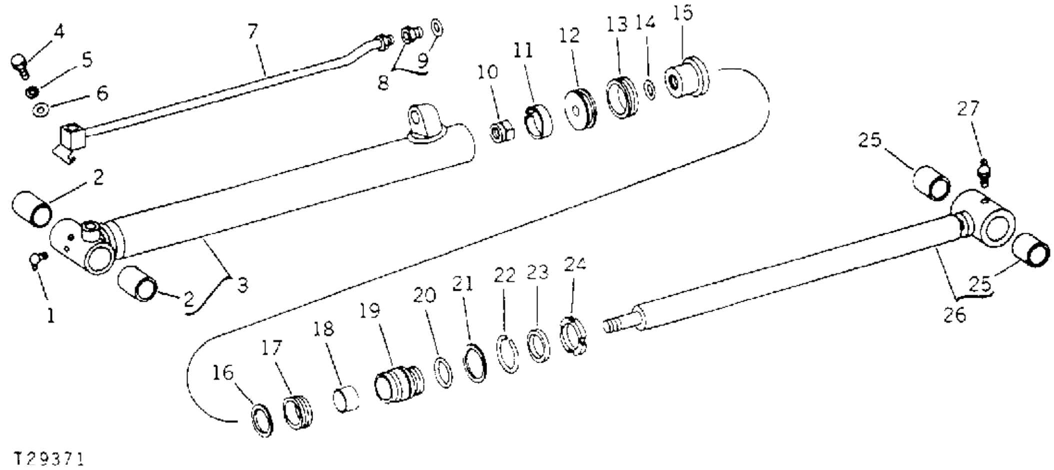
Fig. 10-9250 Backhoe Stabilizer Cylinder



1—Grease Fitting
2—Bushing (2 used)
3—Barrel
4—O-Ring (2 used)
5—Connector
6—O-Ring
7—Backup Washer
8—Sleeve
9—Nut
10—Return Tube
11—Set Screw
12—Lock Nut
13—Outer Piston
14—V-Packing*
15—O-Ring*
16—Piston Rod
17—Inner Piston
18—Brake Seal (2 used)
19—Wear Ring*
20—O-Ring*
21—Backup Washer*
22—Snap Ring
23—V-Packing*
24—Wear Ring*
25—Rod Guide
26—Wiper Seal*
27—Grease Fitting

*Repair Kit

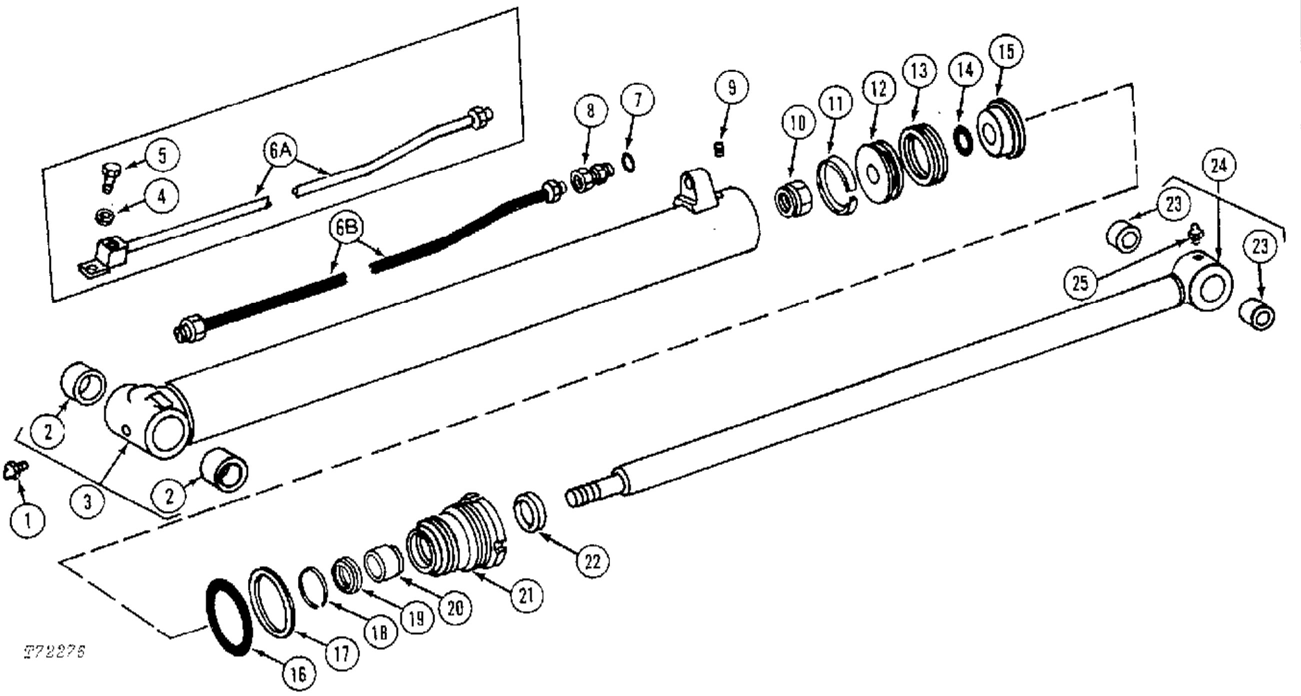
Fig. 11-9250 Backhoe Boom Cylinder Assembly



1—Grease Fitting
2—Bushing (2 used)
3—Barrel
4—Cap Screw
5—Lock Washer
6—Washer
7—Return Tube
8—Adapter
9—O-Ring
10—Lock Nut
11—Wear Ring*
12—Retainer
13—V-Packing*
14—O-Ring*
15—Piston
16—Snap Ring
17—V-Packing*
18—Wear Ring*
19—Rod Guide
20—O-Ring*
21—Backup Washer*
22—Snap Ring
23—Wiper Seal*
24—Spanner Nut
25—Bushing (2 used)
26—Piston Rod
27—Grease Fitting

*Repair Kit

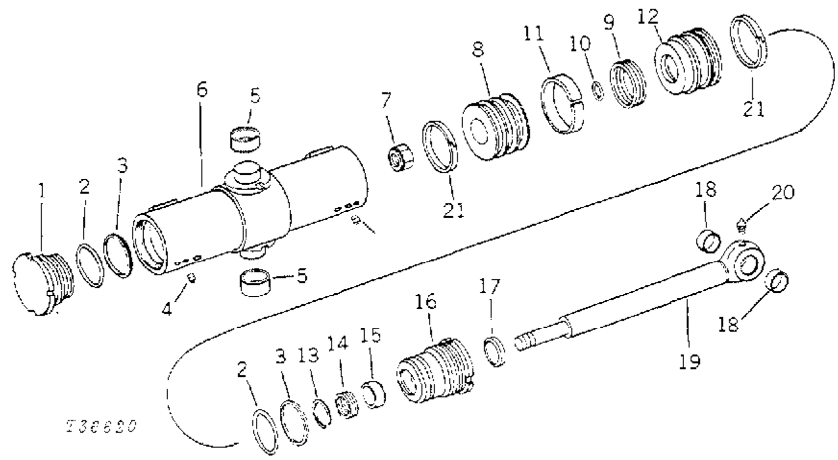
Fig. 12-9250 Backhoe Bucket Cylinder Assembly



1—Grease Fitting
2—Bushing (2 used)
3—Barrel
4—Lock Washer
(-241990)
5—Cap Screw
(-241990)
6A—Return Tube
(-241990)
6B—Return Hose
(241991-)
7 —O-Ring
8 —Adapter
9 —Set Screw
10 —Lock Nut
11—Wear Ring*
12—Piston Retainer
13—V-Packing*
14—O-Ring*
15—Piston
16—O-Ring*
17—Backup Washer*
18—Snap Ring
19—V-Packing*
20—Wear Ring*
21—Rod Guide
22—Wiper Seal*
23—Bushing (2 used)
24—Piston Rod
25—Grease Fitting

*Repair Kit

Fig. 13-9250 Backhoe Crowd Cylinder Assembly



1—Cylinder Head
2—O-Ring (2 used)*
3—Backup Washer (2 used)*
4—Set Screw
5—Trunnion Bushing (2 used)
6—Barrel and Trunnion Assembly
7—Lock Nut
8—Piston
9—V-Packing*
10—O-Ring*
11—Wear Ring*
12—Piston
13—Snap Ring
14—V-Packing*
15—Wear Ring*
16—Rod Guide
17—Wiper Seal*
18—Bushing (2 used)
19—Piston Rod
20—Grease Fitting
21—Brake Seal (2 used)

*Repair Kit

Fig. 14-9250 Backhoe Swing Cylinder

Disassembly

NOTE: Refer to Figs. 10, 11, 12, 13 and 14 for the location of parts during the disassembly and assembly of the backhoe cylinders.

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filter.

Clamp the cylinder in a vise to prevent it from turning. Remove set screw and rod guide. Use a D-05270ST Special Spanner Wrench to loosen rod guide.

On cylinders using spanner nut, remove spanner nut and push the rod guide into the barrel just far enough to remove the snap ring. Do not push rod guide too far into the barrel or the rod guide O-ring will enter the oil port and be damaged.

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 lock nut from end of rod. Slide parts from end of rod.

Inspection

Wash all parts thoroughly with diesel fuel and inspect the following:

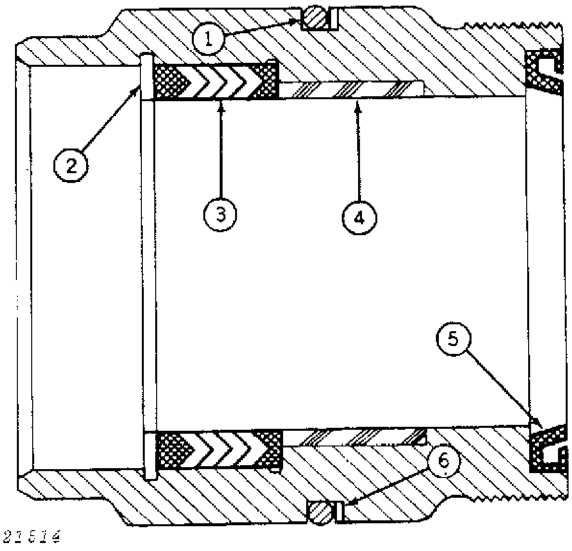
1. Barrel, rod guide and rod for scoring, and O-rings for surface damage.

2. V-packings and wear rings for breaks, cuts or embedded foreign material.

3. Piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.

Repair kits are available for overhauling all cylinders. Discard used parts and use all new parts provided in kits when assembling cylinders.

Assembly



1—O-Ring
2—Snap Ring
3—V-Packing
4—Wear Ring
5—Wiper Seal
6—Backup Washer

Fig. 15-Rod Guide Components (spanner nut type rod guide shown)

Lubricate all O-rings, seals, and packings before assembly.

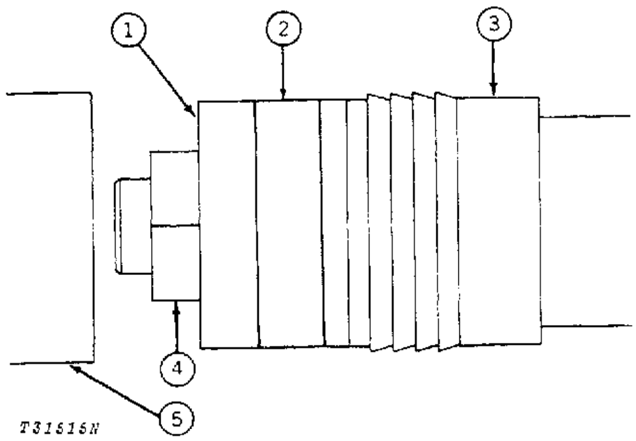
Install new wiper seal (5, Fig. 15) in rod guide.

Install new wear ring (4) in rod guide. Install backup washer (6) and O-ring (1) on rod guide.

Install V-packing (3) in rod guide with the apex of the V toward the wiper seal and fasten with snap ring (2).

Install rod guide assembly on piston rod being careful not to damage packing.

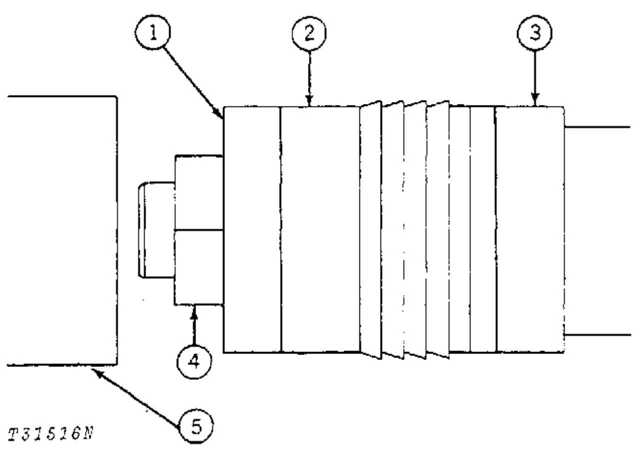
Installing Piston V-Packing



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 16-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. 16). When replacing V-packings in the field this procedure can be used if a suitable ring compressor is available to compress packings when installed in cylinders.



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 17-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. 17). 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.

NOTE: On the 9250 backhoe boom cylinder, install the brake seal (18, Fig. 11) on the inner piston (17) with the word "UP" toward the rod end of the cylinder. Install the brake seal (18) on the outer piston (13) with the word "UP" toward the head end of the cylinder.

Install piston on piston rod. Install wear ring on piston retainer. Install retainer on piston rod and fasten with lock nut. See chart below for the correct lock nut torque.

CYLINDER	LOCK NUT TORQUE
Stabilizer	475 to 575 lb-ft (644 to 780 N·m)
Boom	950 to 1000 lb-ft (1288 to 1356 N·m)
Crowd	600 to 700 lb-ft (814 to 949 N·m)
Bucket	150 to 250 lb-ft (203 to 339 N·m)

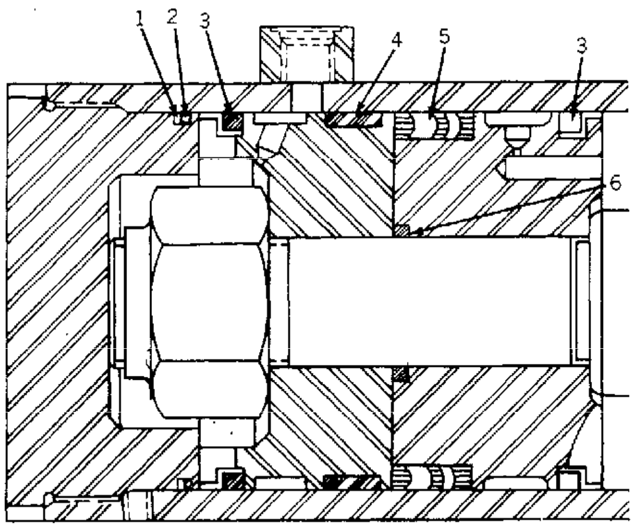
Install piston rod assembly into barrel.

Put AT52853 John Deere Loctite Thread Lock and Sealer (Low Strength) or an equivalent on the threads of rod guide and set screw (if used) before assembly.

Fasten piston rod assembly in barrel with rod guide and tighten to specified torque. Install set screw (if used) and tighten after rod guide is tightened to proper torque. See chart below for the correct rod guide and set screw torque.

CYLINDER	ROD GUIDE TORQUE	SET SCREW TORQUE
Stabilizer	125 to 175 lb-ft (170 to 237 N·m)	—
Boom	250 to 300 lb-ft (339 to 407 N·m)	40 lb-in (4.5 N·m)
Crowd	250 to 300 lb-ft (339 to 407 N·m)	40 lb-in (4.5 N·m)
Bucket	125 to 175 lb-ft (170 to 237 N·m)	—

Installing Piston V-Packing (Swing Cylinder)



1—Backup Washer (2 used)
2—O-Ring
3—Brake Seal (2 used)
4—Wear Ring
5—V-Packing
6—O-Ring

Fig. 18-Backhoe Swing Cylinder Piston Components

Install V-Packing (5, Fig. 18) on piston with apex facing toward rod end of cylinder and install on rod. Install O-ring (6) on rod, second piston, wear ring (4) and brake seals (3) on rod.

NOTE: Tighten swing cylinder lock nut after rod assembly has been installed in barrel. Tighten from head end of cylinder.

Install piston rod assembly into barrel and tighten lock nut to 950 to 1050 lb-ft (1288 to 1424 N·m).

Put AT52853 John Deere Loctite Thread Lock and Sealer (Low Strength) or an equivalent on the threads of the rod guide, cylinder head and set screw before assembly.

Install cylinder head and tighten to 250 to 300 lb-ft (339 to 407 N·m).

Fasten piston rod assembly in barrel with rod guide and tighten to 250 to 300 lb-ft (203 to 407 N·m). Install set screws and tighten to 40 lb-in (4.5 N·m) after rod guide and cylinder head are tightened.

INSTALLATION

Put the cylinder in position on the machine and align the attaching holes. Install pivot pins and fasten with cap screw. Connect the hydraulic lines, making sure they are connected to the same ends of the cylinder from which they were removed. Replace any oil that was lost.

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.

Backhoe Swing Cylinder

Put the swing cylinder in position and install the upper link (4, Fig. 9) on the outer swing link (1) and swing cylinder (2).

Install the pin assembly (3, Fig. 8) and spacer (4) in the lower inner and upper inner swing links (1 and 2).

Install pin (5) in the rod end of the swing cylinder.

Install the two tapered pin assemblies (5, Fig. 7) in the upper and lower swing links.

Connect the hydraulic hoses.

Group 3399
SPECIFICATIONS AND SPECIAL TOOLS

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES

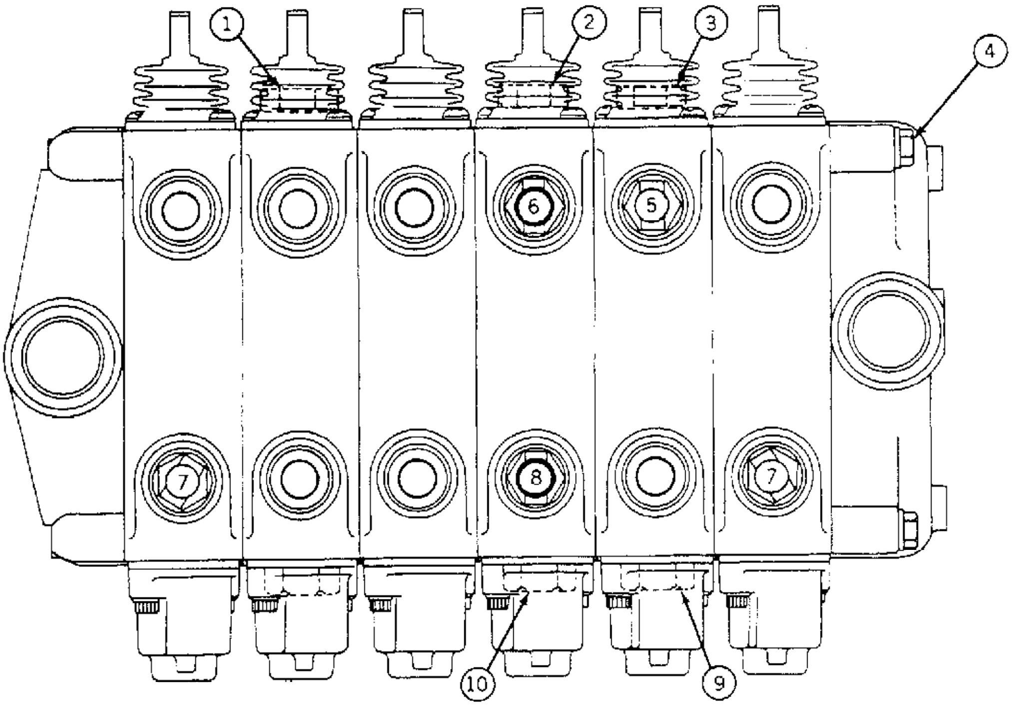


Fig. 1-9250 Backhoe Control Valve

1 - Crowd relief valve setting .... 2500 psi (17 238 kPa) (172 bar)

2 - Swing relief valve setting .... 1800 psi (12 411 kPa) (124 bar)

3 - Boom relief valve setting .... 2750 psi (18 961 kPa) (190 bar)

4 - Tie bolt torque .... 25 to 30 lb-ft (34 to 41 N·m)

5 - Boom orifice size .... 0.219 in. (5.56 mm)

6 - Swing orifice size ...... 0.1510 in. (3.84 mm)

7 - Stabilizer orifice size .... 0.1405 in. (3.57 mm)

8 - Swing orifice size ...... 0.1075 in. (2.73 mm)

9 - Boom relief valve setting .... 2500 psi (17 238 kPa) (172 bar)

10 - Swing relief valve setting .... 2375 psi (16 376 kPa) (164 bar)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

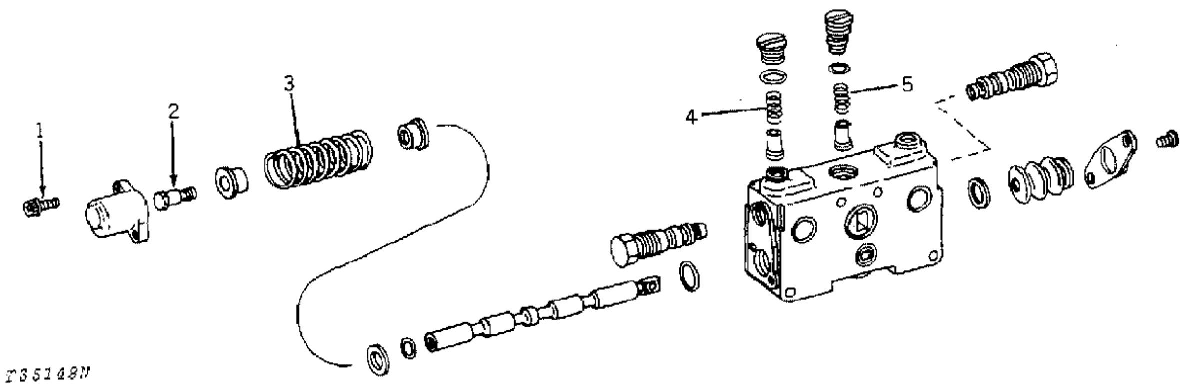


Fig. 2-Valve Section (Boom Illustrated)

1 - Cap assembly screw
torque .... 10 to 13 lb-ft
(13.6 to 17.6 N·m)

2 - Spool screw torque .... 5 to 8 lb-ft
(6.8 to 10.8 N·m)

3 - Spool spring
Test length at 27 lb. force .... 1.25 in.
(120 N .... 31.7 mm)

4 - Anti-cavitation spring
Free length .... 0.692 in. (17.58 mm)
Test length at 0.75 ± 0.1 lb. force .... 0.625 in.
(3.3 ± 0.4 N .... 15.88 mm)

5 - Lift check spring
Free length .... 0.995 in. (25.29 mm)
Test length at 1.8 ± 0.2 lb. force ...... 0.75 in.
(8 ± 0.9 N .... 19.0 mm)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

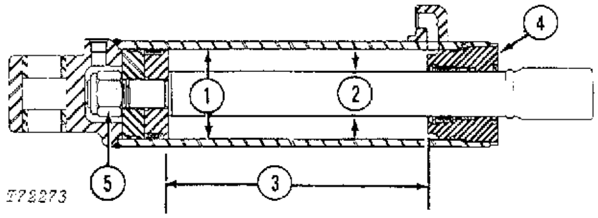


Fig. 3-9250 Backhoe Stabilizer Cylinder

1 - Cylinder bore .... 3.496 to 3.500 in. (88.70 to 88.90 mm)

2 - Rod diameter .... 1.7485 to 1.7515 in. (44.41 to 44.49 mm)

3 - Cylinder stroke .... 15.50 in. (393.70 mm)

4 - Spanner nut torque .... 125 to 175 lb-ft (170 to 237 N·m)

5 - Lock nut torque .... 475 to 575 lb-ft (644 to 780 N·m)

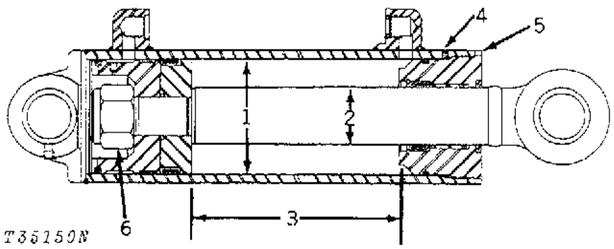


Fig. 4-9250 Backhoe Boom Cylinder

Boom Cylinder

1 - Cylinder bore .... 3.996 to 4.000 in. (101.5 to 101.6 mm)

2 - Rod diameter .... 1.9985 to 2.0015 in. (50.76 to 50.84 mm)

3 - Cylinder stroke .... 32.38 in. (822.5 mm)

4 - Set screw torque .... 40 lb-in (4.5 N·m)

5 - Rod guide torque .... 250 to 300 lb-ft (339 to 407 N·m)

6 - Lock nut torque .... 950 to 1050 lb-ft (1288 to 1424 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

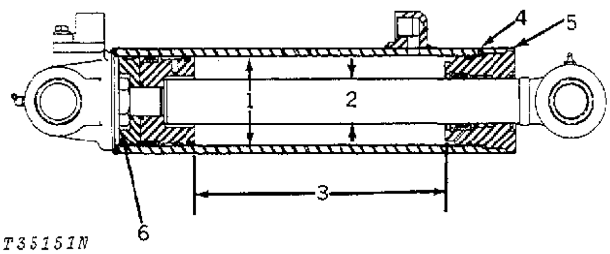


Fig. 5-9250 Backhoe Crowd Cylinder

Crowd Cylinder

1 - Cylinder bore .... 3.496 to 3.500 in. (88.80 to 88.90 mm)

2 - Rod diameter .... 1.7485 to 1.7515 in. (44.41 to 44.49 mm)

3 - Cylinder stroke .... 31.85 in. (809.1 mm)

4 - Set screw torque .... 40 lb-in (4.5 N·m)

5 - Rod guide torque .... 250 to 300 lb-ft (339 to 407 N·m)

6 - Lock nut torque .... 600 to 700 lb-ft (814 to 949 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

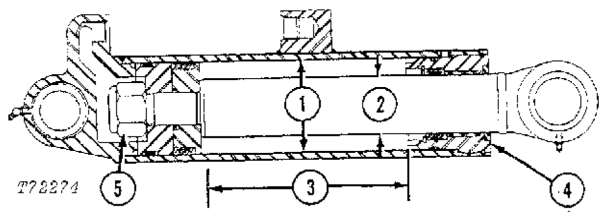


Fig. 6-9250 Backhoe Bucket Cylinder

Bucket Cylinder

1 - Cylinder bore .... 2.996 to 3.000 in. (76.10 to 76.20 mm)

2 - Rod diameter .... 1.7485 to 1.7515 in. (44.41 to 44.49 mm)

3 - Cylinder stroke .... 26.50 in. (673.1 mm)

4 - Spanner nut torque .... 125 to 175 lb-ft (170 to 237 N·m)

5 - Lock nut torque .... 150 to 250 lb-ft (203 to 339 N·m)

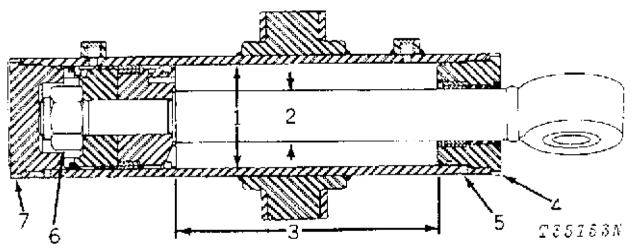


Fig. 7-9250 Backhoe Swing Cylinder

Swing Cylinder

1 - Cylinder bore .... 3.996 to 4.000 in. (101.50 to 101.60 mm)

2 - Rod diameter .... 1.1985 to 2.0015 in. (30.44 to 50.84 mm)

3 - Cylinder stroke .... 10.12 in. (257.0 mm)

4 - Rod guide torque............. 250 to 300 lb-ft (339 to 407 N·m)

5 - Set screw torque .... 40 lb-in (4.5 N·m)

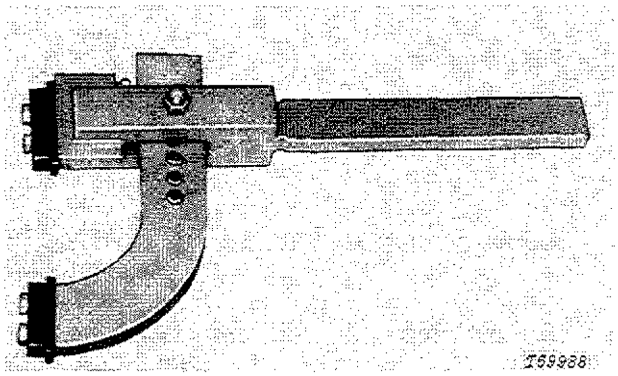
6 - Lock nut torque .... 950 to 1050 lb-ft (1288 to 1424 N·m)

7 - End cap torque .... 250 to 300 lb-ft (339 to 407 N·m)

HYDRAULIC SYSTEM

SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
 *Fig. 8-Special Spanner Wrench*	D-05270ST or D-01053AA (not shown)	Remove and install cylinder rod guides and spanner nuts.
D-01168AA Spring Compression Tester	D-01168AA (not shown)	To test the compression rate of springs.

Section 33A
9300 BACKHOE

CONTENTS OF THIS SECTION

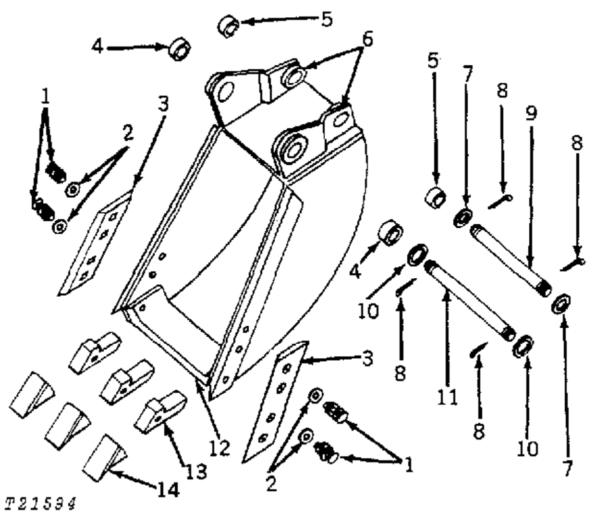
Group 3302A
BUCKET

REMOVAL

Lower boom and dipperstick to position bucket on the ground.

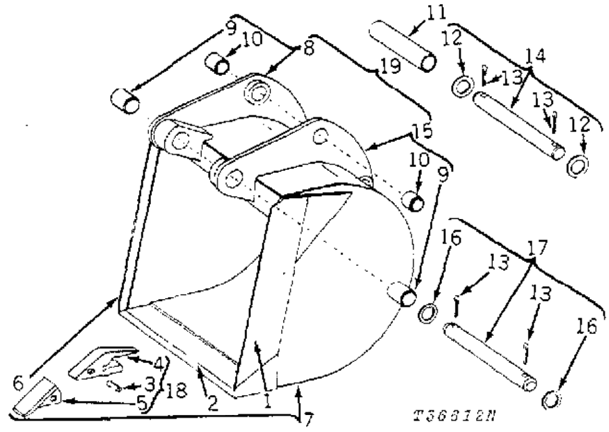
CAUTION: Release hydraulic pressure on the bucket before removing the retaining pins.

REPAIR



1—Bolt, Lock Washer, and Nut (6 used)
2—Washer
3—Side Cutting Edge
4—Bushing
5—Bushing
6—Pivot Plate
7—Backup Washer
8—Cotter Pin
9—Pin
10—Backup Washer
11—Pin
12—Front Cutting Edge
13—Tooth Shank
14—Tooth Tip

Fig. 1-Bucket (With Straight Pivot Plates)

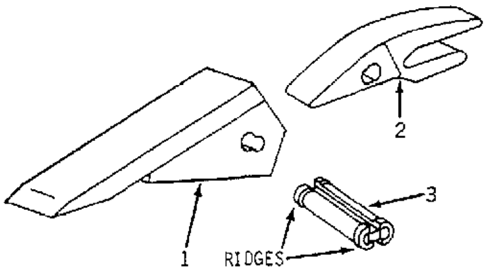


1—R.H. Side Cutting Edge
2—Front Cutting Edge
3—Flex Pin
4—Tooth Shank
5—Tooth Tip
6—L.H. Side Cutting Edge
7—Bucket Assembly
8—L.H. Pivot Plate
9—Pivot Plate Bushing (2 used)
10—Pivot Plate Bushing (4 used)
11—Spacer
12—Backup Washer (2 used)
13—Cotter Pin (4 used)
14—Pin
15—R.H. Pivot Plate
16—Backup Washer (2 used)
17—Pin
18—Bucket Tooth Assembly
19—Back Plate

Fig. 2-Heavy Duty Buckets

Refer to Figs. 1 and 2 during disassembly and assembly of the bucket. Inspect all parts for excessive wear or damage and repair or replace as necessary.

Backhoe Bucket Tooth Assembly—Heavy-Duty Buckets



T44180N

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 Figure 3. The ridges are the locking mechanism.

NOTE: If "back" is stamped on the pin, it should face toward the shank.

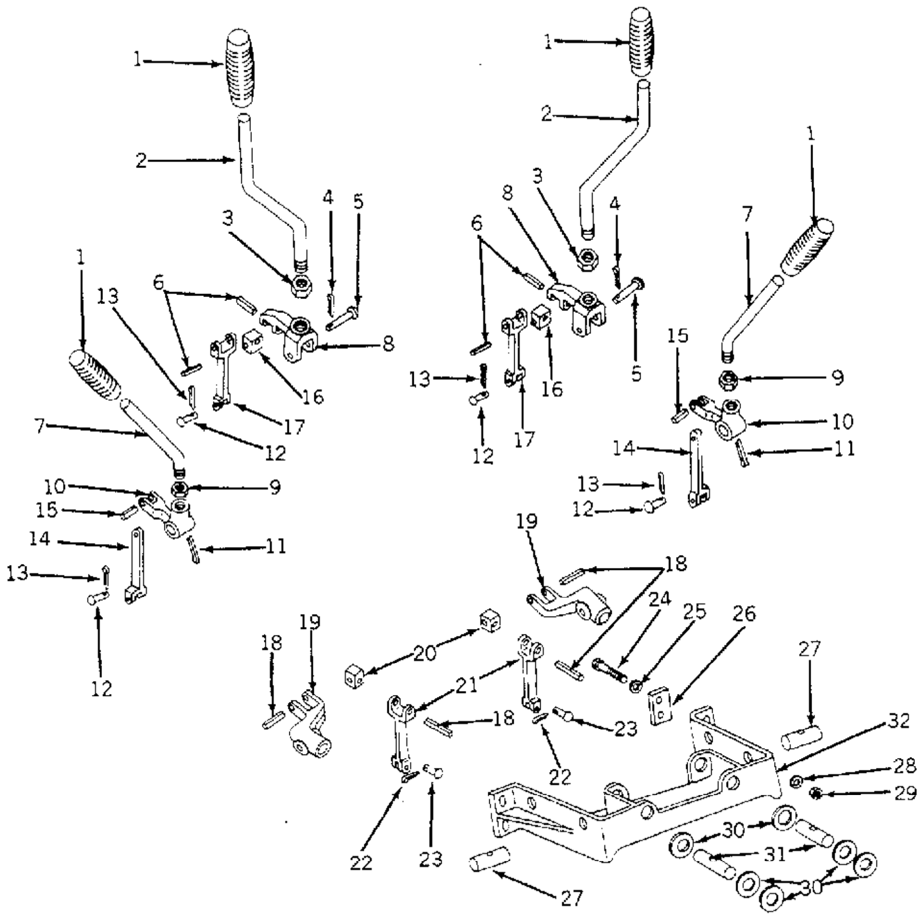
INSTALLATION

Align dipperstick to bucket and insert retaining pins.

Grease all fittings before beginning operation.

Group 3315
CONTROLS LINKAGE

REPAIR



T21613N

1—Hand Grip (4 used)	9—Nut (2 used)	17—Link (2 used)	25—Washer (4 used)
2—Lever (2 used)	10—Handle Mount (2 used)	18—Spring Pin (4 used)	26—Spacer (2 used)
3—Hex. Nut (2 used)	11—Cotter Pin (2 used)	19—Pivot Block (2 used)	27—Pivot Shaft (2 used)
4—Cotter Pin (2 used)	12—Pin (4 used)	20—Lever Block (2 used)	28—Lock Washer (4 used)
5—Pivot Pin (2 used)	13—Cotter Pin (4 used)	21—Lever Link (2 used)	29—Nut (4 used)
6—Spring Pin (4 used)	14—Link (2 used)	22—Cotter Pin (2 used)	30—Washer (6 used)
7—Stabilizer Lever (2 used)	15—Spring Pin (2 used)	23—Pin (2 used)	31—Pivot Shaft (2 used)
8—Handle Mount (2 used)	16—Lever Block (2 used)	24—Cap Screw (4 used)	32—Mounting Frame

Fig. 1-Backhoe Control Valve Levers and Linkage

Refer to Fig. 1 during disassembly and assembly of control linkage.

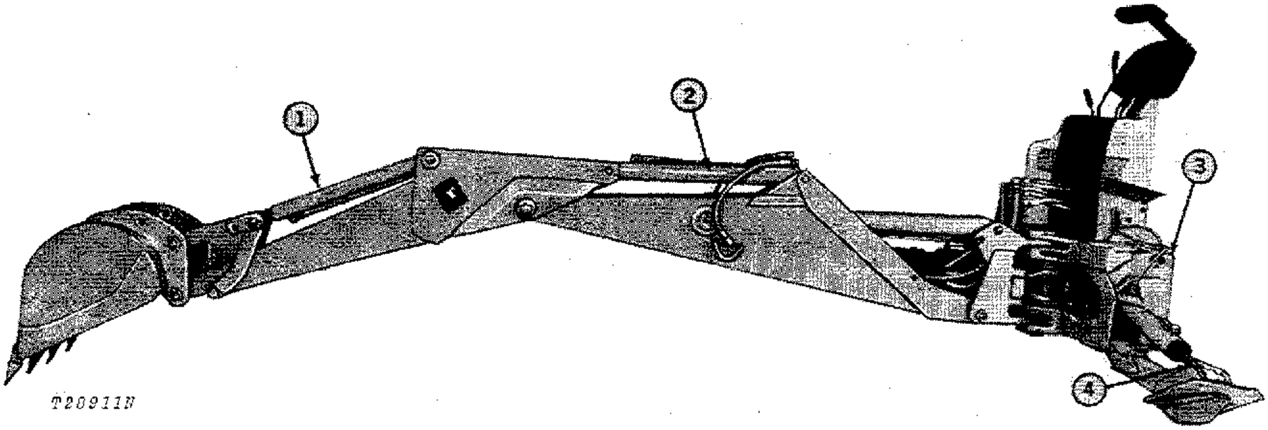
Inspect control valve linkage for worn or damaged parts.

Coat shafts and movable linkage parts with grease before assembly.

Group 3340
FRAMES

MAIN FRAME

REMOVAL



1—Bucket Cylinder (Retracted)
2—Crowd Cylinder (Retracted)
3—Main Frame (Tipped Slightly Forward)
4—Stabilizer Cylinders (Extended)

Fig. 1-Backhoe Removal

By using the backhoe hydraulic system, the backhoe can be easily detached to free the crawler for other jobs.

Lower the stabilizers until they are supporting the weight of the backhoe. Retract the bucket and dipperstick and extend boom cylinder until backhoe is fully extended and bucket is resting on the ground. Install swing locking pin in place to prevent tipping.

Remove the cotter pins and mounting pins which hold the top of the backhoe main frame to the crawler frame.

Use stabilizers to raise backhoe frame off the bottom mounting bracket hooks.

Carefully retract the stabilizers until the main frame is resting on the ground tilted slightly forward (Fig. 1).

NOTE: The main frame can be blocked up off the ground by blocking across full width of backhoe main frame.

CAUTION: Shut off the crawler engine before disconnecting the hydraulic lines to the backhoe. If the engine is left running the operator may be sprayed with hot hydraulic oil.

Disconnect the pressure and return hoses from the backhoe main frame at the quick disconnect couplers and connect hoses together.

IMPORTANT: Pressure and return hoses must be connected together at all times when backhoe is removed. Never plug the power beyond port in the loader valve or the pressure hose to the backhoe valve.

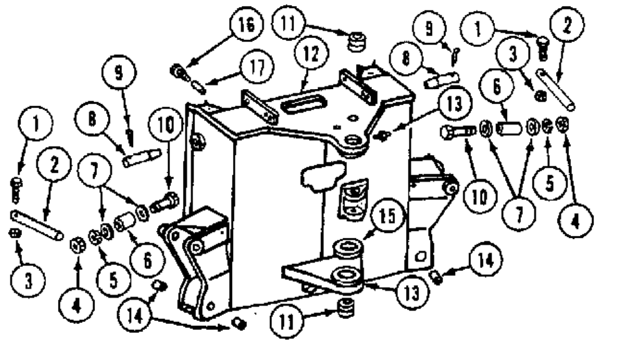
Carefully drive the crawler from the backhoe.

Support boom and dipperstick with a hoist or blocks.

Drive out pins connecting boom pivot to main frame.

REPAIR

Refer to Fig. 2 during disassembly and assembly of the main frame.



1—Cap Screw (2 used)
2—Stabilizer Cylinder Pin (2 used)
3—Lock Nut (2 used)
4—Nut (2 used)
5—Lock Washer (2 used)
6—Pivot Ferrule (2 used)
7—Washer (4 used)
8—Pivot Pin (2 used)
9—Cotter Pin (2 used)
10—Cap Screw (2 used)
11—Bushing (2 used)
12—Main Frame
13—Grease Fitting (2 used)
14—Bushing (4 used)
15—Special Washer (2 used)
16—Relief Valve
17—Bushing (xxxxxx-)

Fig. 2-Main Frame

NOTE: Reservoir relief valve (16, Fig. 2) with bushing (17) (xxxxxx-) is installed in port on front of main frame reservoir. Make sure valve sealing surface is free of paint.

INSTALLATION

Install main frame and swing frame to boom and dipperstick.

Attach the pressure and return hoses to the backhoe main frame at the quick disconnect couplers.

Carefully raise the backhoe main frame with the hydraulic system by extending the stabilizers.

Carefully back the crawler to align the mounting bracket hooks with the lower pins on the backhoe main frame. Retract the stabilizers until the bottom pins rest in the mounting bracket hooks on the crawler.

Secure the top of each side of main frame to crawler with mounting pins and cotter pins.

MOVABLE FRAMES

REMOVAL

Boom and Dipperstick

Remove bucket as directed on Page 3302-3.

Extend boom and dipperstick so boom is resting on blocks and the dipperstick is resting on the ground. (Crowd cylinder will be approximately one inch [25.4 mm] from bottoming out).

CAUTION: Stop engine and operate controls to relieve hydraulic pressure from hydraulic system before disconnecting hydraulic hoses.

Disconnect and cap all boom and dipperstick hydraulic hoses.

Disconnect battery ground strap or turn off battery disconnect switch (if equipped).

Drive out crowd cylinder pins and boom-to-dipperstick pin.

Remove dipperstick.

Support boom with a hoist.

Remove boom pins and lower boom to the ground.

Boom Pivot Removal

Remove backhoe from unit as directed on page 3340-1.

Remove boom and dipperstick.

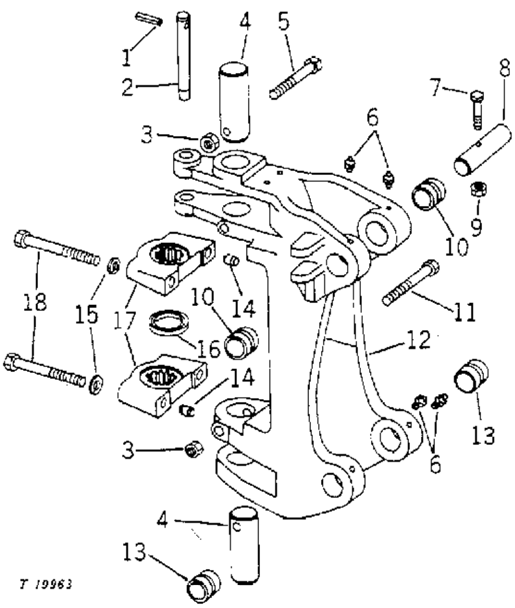
Remove manifold block from boom pivot.

Support boom pivot with blocks.

Remove cap screws from retaining pivot pins and drive out pins.

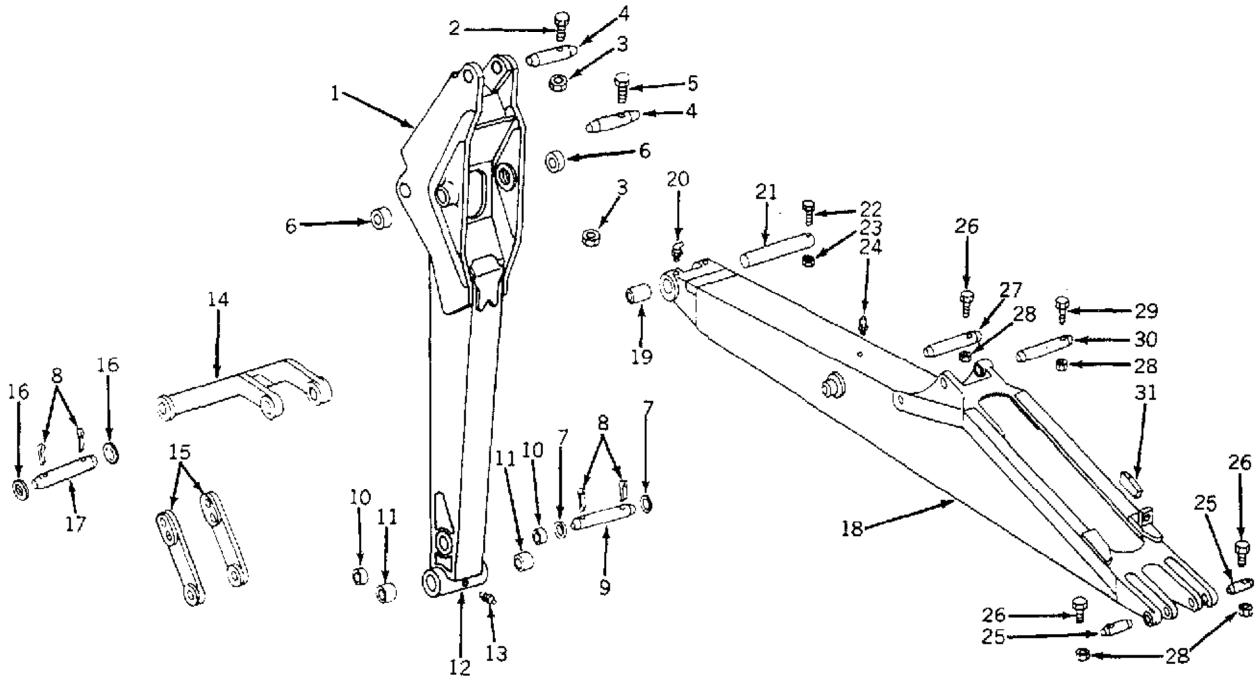
REPAIR

Refer to Figs. 3 and 4 during disassembly and assembly of the boom pivot, boom and dipperstick.



1—Spring Pin
2—Pin
3—Lock Nut (2 used)
4—Pivot Pin (2 used)
5—Cap Screw
6—Grease Fitting (4 used)
7—Cap Screw
8—Pin
9—Lock Nut
10—Bushing (2 used)
11—Cap Screw
12—Boom Pivot
13—Bushing (2 used)
14—Dowel (2 used)
15—Lock Washer (4 used)
16—Spacer Ring
17—Shaft Coupling (2 used)
18—Cap Screw (4 used)

Fig. 3-Boom Pivot



1—Dipperstick
2—Cap Screw
3—Lock Nut (2 used)
4—Cylinder Pin
5—Cap Screw
6—Bushing
7—Special Washer (2 used)
8—Cotter Pin
9—Pin
10—Bushing
11—Bushing
12—Pivot End
13—Grease Fitting (1 used)
14—Guide Link
15—Coupler Link (2 used)
16—Special Washer (2 used)
17—Pin
18—Boom
19—Bushing (2 used)
20—Grease Fitting (2 used)
21—Boom Pivot Pin
22—Cap Screw
23—Stop Nut
24—Grease Fitting (2 used)
25—Boom Pivot Pin (2 used)
26—Cap Screw (3 used)
27—Boom Cylinder Pin
28—Stop Nut (3 used)
29—Cap Screw
30—Crowd Cylinder Pin
31—Boom Wedge

Fig. 4-Boom and Dipperstick

Removing And Installing Tapered Pins And Bushings

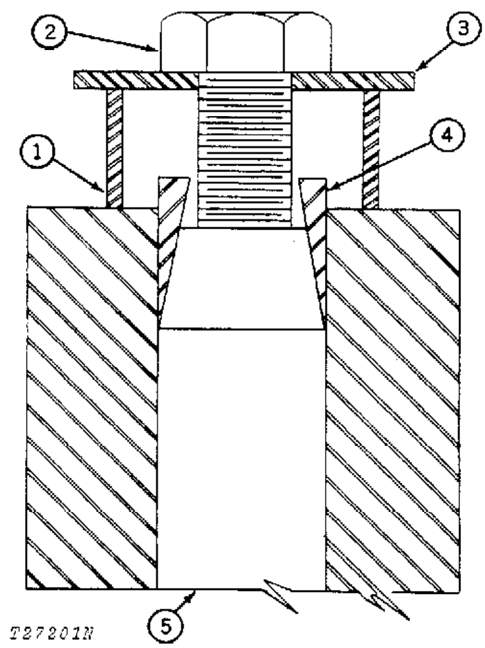
The procedures for removing tapered pins and bushings are as follows:

Remove cap screws from tapered pin (5, Fig. 5).

Place a short piece of pipe (1, Fig. 5) 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.

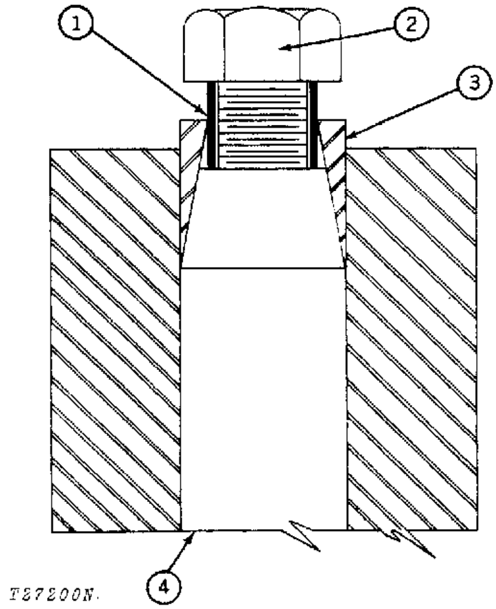
Screw cap screw (2) into tapered pin (5) until the pin and bushing are pulled from the bore.



1—Pipe
2—Cap Screw
3—Steel Plate
4—Tapered Bushing
5—Tapered Pin

Fig. 5-Pulling Tapered Pins and Bushings

Whenever it is not possible to remove tapered pins and bushings by the method given at left use the second procedure outlined as follows:



1—Pipe Spacer or Washers
2—Cap Screw
3—Tapered Bushing
4—Tapered Pin

Fig. 6-Removing Tapered Pins and Bushings

Place a pipe spacer or washer (1, Fig. 6) 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.

NOTE: 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.

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.

a. If the washers are accessible and large enough, strike both washers in three places.

b. 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.

INSTALLATION

Install boom and dipperstick by using removal procedure in reverse order.

STABILIZERS

REMOVAL

Operate control lever to fully extend stabilizers.

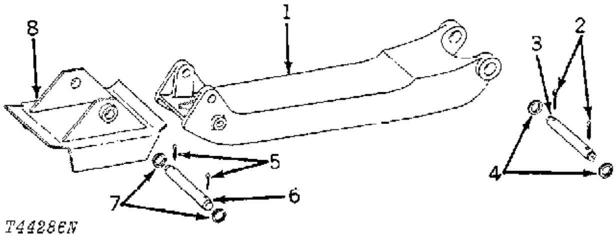
CAUTION: Stop engine and operate the stabilizer control lever to release hydraulic pressure.

Remove stabilizer pivot pin and stabilizer cylinder pin.

Lower stabilizer to ground.

REPAIR

Refer to Fig. 7 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. 7-Stabilizer

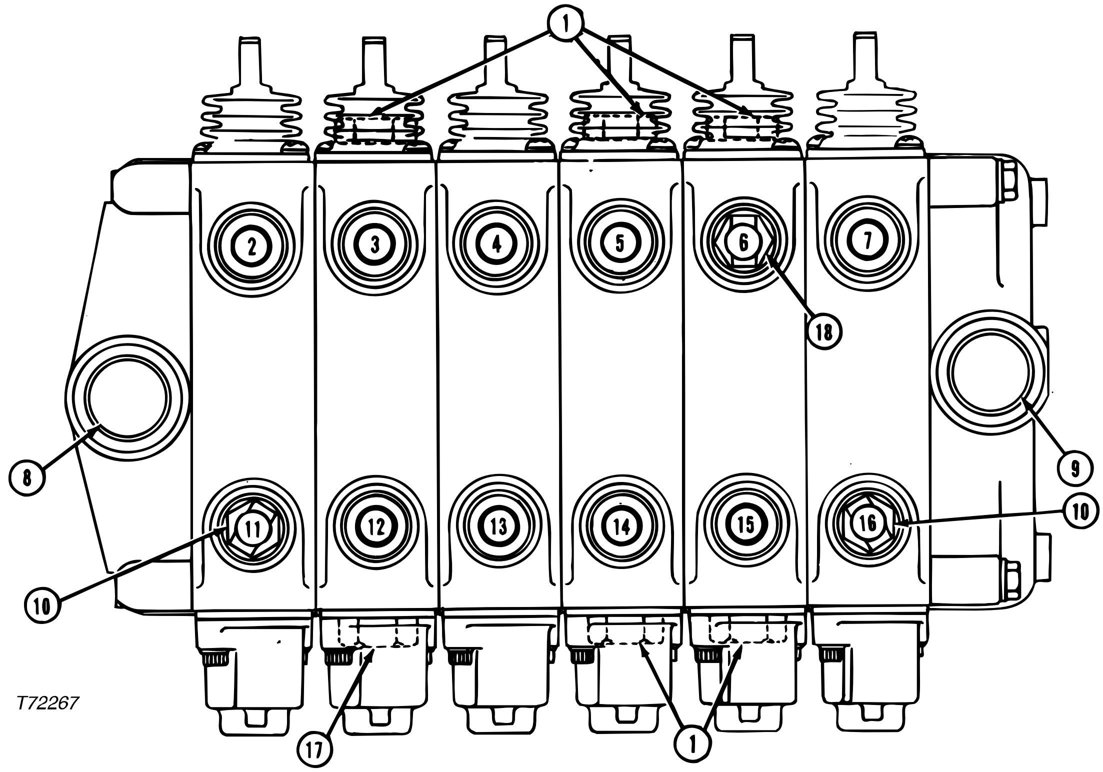
INSTALLATION

Install stabilizers by using removal procedure in reverse order.

Group 3360A
HYDRAULIC SYSTEM

CONTROL VALVE

GENERAL INFORMATION



1—Circuit Relief Valve (5 used)
2—Right Stabilizer Cylinder (Rod End)
3—Crowd Cylinder (Piston End)
4—Bucket Cylinder (Piston End)
5—Swing Cylinder (Right)
6—Boom Cylinder (Rod End)
7—Left Stabilizer Cylinder (Rod End)
8—Pressure Port
9—Return Port
10—Orifice Plate (2 used) (0.1405 in. [3.569 mm])
11—Right Stabilizer Cylinder (Piston End)
12—Crowd Cylinder (Rod End)
13—Bucket Cylinder (Rod End)
14—Swing Cylinder (Left)
15—Boom Cylinder (Piston End)
16—Left Stabilizer Cylinder (Piston End)
17—Plug
18—Orifice Plate (0.219 in. [5.56 mm])

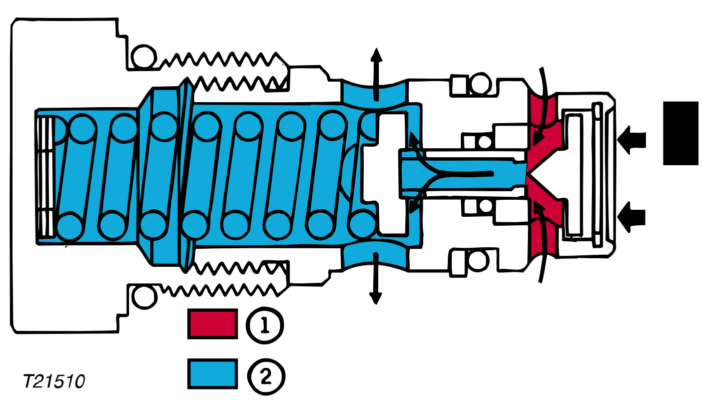
Fig. 1-9300 Backhoe Control Valve

The 9300 backhoe control valve is an open-center, six-spool, stack-type valve.

All six valve sections are separate bodies containing single spools. All valve sections contain lift checks which serve as one-way valves to prevent pressure oil from entering the port passages and causing cylinder movement.

The swing valve section also contains a 0.104 in. (2.64 mm) orifice plate in the lift check.

Anti-cavitation check valves are contained in the boom and swing valve sections.



1—Pressure Oil **2—Return Oil**

Fig. 2-Direct Acting Relief Valves

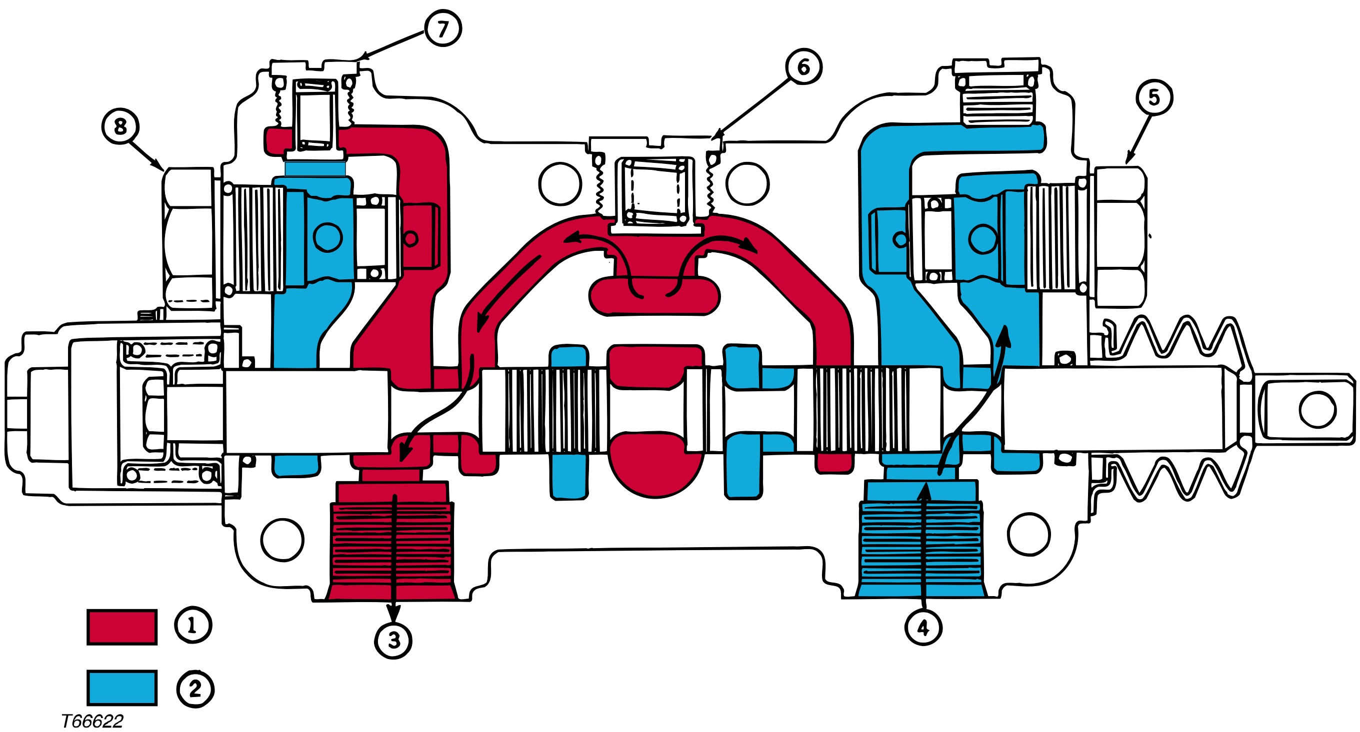
The crowd, boom and swing sections contain direct acting circuit relief valves to protect their circuits from excessive pressures.

Field adjustment is possible on all relief valves.

FOS Refer to "Hydraulic Valves" in FOS Manual—HYDRAULICS for basic information on the operation of direct-acting relief valves.

The pressure port is located in the port plate and the return port is in the end plate.

Control Valve Oil Flows



1—Pressure Oil
2—Return Oil
3—To Cylinder
4—From Cylinder
5—Circuit Relief Valve
6—Lift Check
7—Anti-Cavitation Valve
8—Circuit Relief Valve

Fig. 3-Oil Flow Through Valve Section (Boom Section Illustrated)

Neutral Oil Flow

With all spools in neutral position, oil from the pump enters the port plate and is split into two columns:

1. One column flows through the valve stack and is stopped at the end plate. This is called functional oil—oil that can be diverted to one or more cylinders by moving one of the control valve spools to an operating position.

2. The other column of inlet oil flows freely through the valve stack into the end plate and back to the reservoir.

Boom Power Circuit (Fig. 3)

When the boom spool is extended or retracted to lower or raise the boom, functional oil is directed past the valve spool to the boom cylinders.

Displaced oil from the cylinders is forced back to the control valve through the valve outlet and back to the reservoir. Oil in the remaining cylinders remains trapped by the valve spools.

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 boom and swing cylinders.

REMOVAL

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 the system, be sure all connections are tight and that lines 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 the 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.

CAUTION: Lower the bucket and stabilizers to the ground before removing valve. Shut off engine and discharge system by operating loader controls.

Loosen jam nuts on stabilizer control levers and turn levers in toward the center. Remove the cap screws holding the valve cover and remove cover.

Move control levers in all directions to release pressure in valves.

Put name tags on all hoses and lines (by number or description) to identify their locations on the valve stack so they can be correctly attached when the valve is installed. Disconnect all hoses from valves and valve lines. Cap or plug all openings to keep dirt and other foreign material out of the hydraulic system.

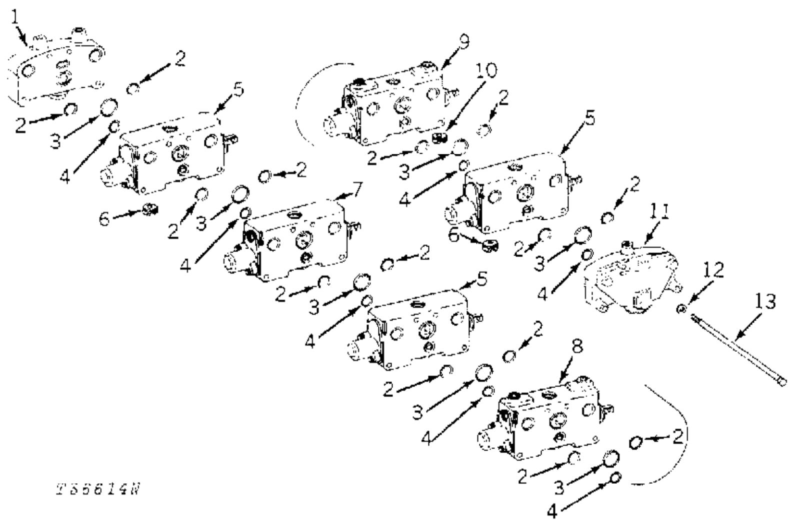
IMPORTANT: Orifice plates are used in the control valve to limit return oil. Mark or tag orifice plates so that they may be assembled in the proper ports.

Remove cotter pins fastening control lever linkage to valve spools.

Remove cap screws holding control valve to valve box.

Remove control valve.

REPAIR



1—Left-Hand Port Plate
2—O-Ring (14 used)
3—O-Ring (7 used)
4—O-Ring (7 used)
5—Bucket and Stabilizer Valve
6—Orifice Plate (2 used)
7—Crowd Valve
8—Swing Valve
9—Boom Valve
10—Orifice Plate
11—Right-Hand End Plate
12—Lock Washer (4 used)
13—Special Screw (4 used)

Fig. 4-9300 Backhoe Control Valve

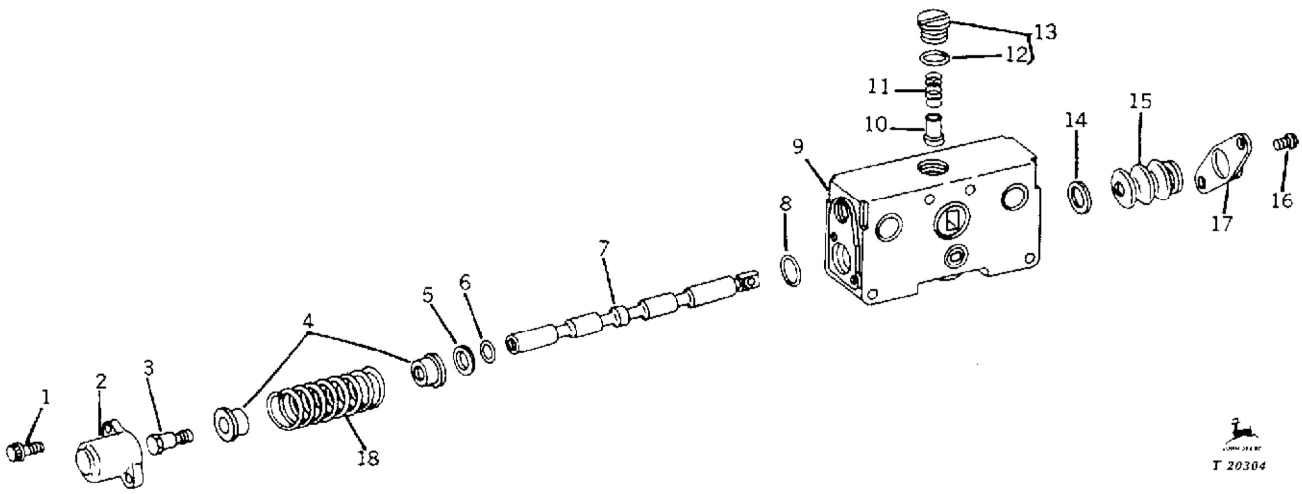
NOTE: Components of the control valve stack can be disassembled for inspection and repair as individual units without disassembling all parts. Therefore, refer only to the particular parts to be disassembled and disregard all other disassembly procedures.

Drain as much oil as possible from the valve stack. Thoroughly clean the outside of the valve stack assembly.

Mark or tag all valves of the valve stack (Fig. 1) before disassembly to assure proper assembly. Service individual valves separately and keep the valve housings and their spools together as these parts are matched assemblies.

Remove the tie bolts from end plate (Fig. 4), leaving tie bolts in place until disassembly is done. Slide valves off tie bolts one at a time and remove O-rings (Fig. 4) between valves.

One valve can be removed from the control valve stack without separating all valves. Follow the same procedure whether one valve is being removed or all valves are being separated.



1—Screw (2 used)
2—Cap Assembly
3—Spool Screw
4—Washers (2 used)
5—Retainer
6—O-Ring
7—Spool
8—O-Ring
9—Valve Housing
10—Plunger
11—Spring
12—O-Ring
13—Lift Check
14—Breather Washer
15—Spool Seal
16—Machine Screw (2 used)
17—Dust Seal Retainer
18—Centering Spring

Fig. 5-Control Valve Section (Stabilizer Valve Illustrated)

Remove end caps and remove spools from valve housings.

Clean and dry all parts thoroughly and inspect for wear and damage.

Check valve housing for damage or evidence of leakage. Replace housing and spool as a matched assembly.

Remove the anti-cavitation check valves from valve sections and inspect for damage. Check the anti-cavitation springs.

Free length .... 0.692 in. (17.58 mm)
Test length at 0.75 ± 0.1 lb. force .... 0.625 in.
(3.3 ± 0.4 N .... 15.88 mm)

Check centering spring (18, Fig. 5).
Test length at 27 lbs. force .... 1.25 in.
(120 N .... 31.7 mm)

Remove any burrs or rough spots from spool bodies with fine emery cloth. If spools are worn or damaged, replace spool and valve housing as a matched assembly.

Inspect hole in orifice plates for plugged condition. Install all plates with the smooth side toward the valve housing.

Inspect lift checks for damage. Check the lift check springs.

Free length .... 0.995 in. (25.29 mm)
Test length at 1.8 ± 0.2 lbs. force .... 0.75 in.
(8 ± 0.9 N .... 19.0 mm)

Thoroughly clean and dry all parts. Put oil on all parts before assembly.

Replace all O-rings and backup washers with new parts.

Put T43512 John Deere Loctite Thread Lock and Sealer (Medium Strength) or an equivalent on the threads of spool screw (3, Fig. 5) before assembly.

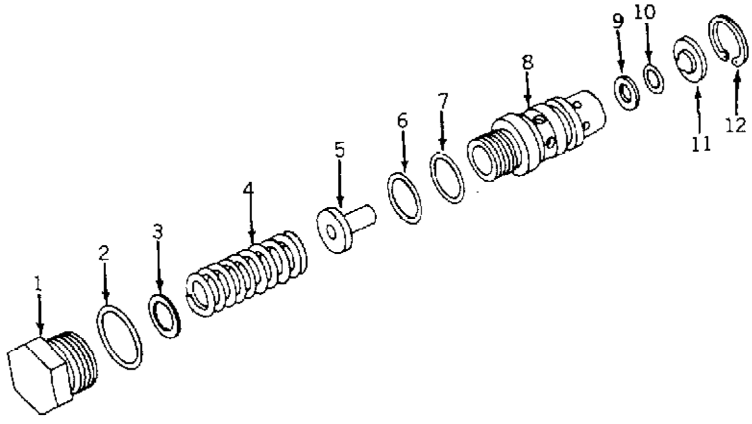
Install spools in proper valve section. Tighten spool screws (3) to 5 to 8 lb-ft (6.8 to 10.8 N·m).

Install cap assembly (2) and tighten screws (1) to 10 to 13 lb-ft (13.6 to 17.6 N·m).

Stack port plate, valve sections, and end plate in proper sequence.

Install tie bolts and tighten evenly to 25 to 30 lb-ft (34 to 41 N·m).

RELIEF VALVE



1—Relief Valve Cage*
2—O-Ring
3—Shims (as required)
4—Spring*
5—Seat*
6—Back-up Washer
7—O-Ring
8—Cartridge
9—Back-up Washer
10—O-Ring
11—Poppet*
12—Snap Ring
*Not available for service

Fig. 6-Direct Acting Circuit Relief Valve

REPAIR

Remove relief valve from valve housing.

Disassemble relief valve using Fig. 6 as a guide.

Put the hex. head of the relief valve cartridge in a vise and remove snap ring (12, Fig. 6), poppet (11) and cartridge (8).

Remove parts from valve cage (1).

Thoroughly clean and dry all parts. Inspect parts and replace as necessary.

When assembling the relief valve, be sure to use all the shims removed.

Assemble parts in cage and install cartridge, poppet and snap ring.

INSTALLATION

Install valve in valve box.

Attach control linkage to valve.

Install orifice plates (with smooth side toward valve) in valve and connect hoses.

NOTE: If it is believed that fragments of failed valve parts may have entered the hydraulic system, completely drain the system and replace the hydraulic filter.

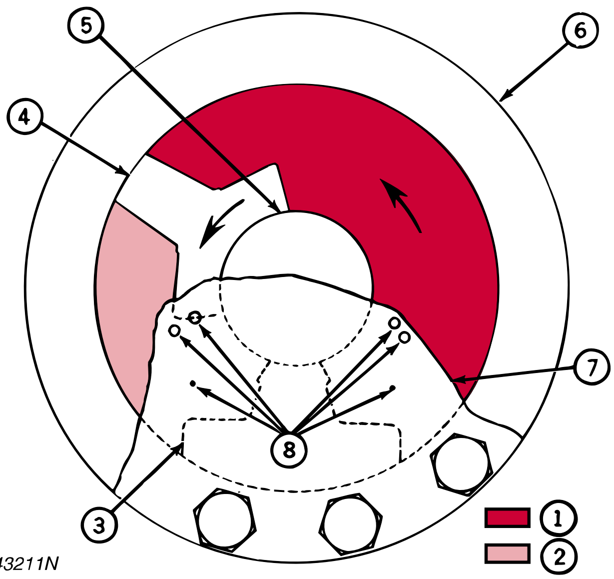
CYLINDERS

GENERAL INFORMATION

The hydraulic cylinders used on the backhoe are double acting and use "V"-packing type seals on their pistons. Piston rods are heat treated, chrome plated, and polished. Replaceable non-metallic wear rings are used on 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.

A rotary, vane-type double acting swing cylinder which incorporates a hydraulic brake swings the boom on the 9300 Backhoe. The cylinder is composed of a barrel and vane assembly, top and bottom plates, spline shaft and a vane assembly.



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. 7-Swing Cylinder Hydraulic Brake Operation

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 of 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.

FOS

See "Hydraulic Cylinders" in FOS Manual - HYDRAULICS for additional information on cylinders and an explanation of the hydraulic cushion design.

REMOVAL

CAUTION: Be sure the bucket is on the ground and the engine is stopped before attempting to remove any cylinder.

Operate the backhoe controls until all hydraulic pressure is released. Remove the hoses and put clean plastic caps on 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.

Bucket Cylinder

Extend the boom and dipperstick. With bucket on the ground, support the dipperstick at the bucket end pivot point to prevent the bucket from pivoting.

Remove the bucket cylinder.

Boom Cylinder

Extend the boom and dipperstick. Rest the bucket on the ground.

Remove the boom cylinder.

Crowd Cylinder

Extend the boom and dipperstick (do not completely extend the dipperstick). Rest the bucket on the ground.

Put a support at the boom and dipperstick pivot point.

Remove the crowd cylinder.

Stabilizer Cylinders

Lower the stabilizers to the ground. Remove the stabilizer cylinder.

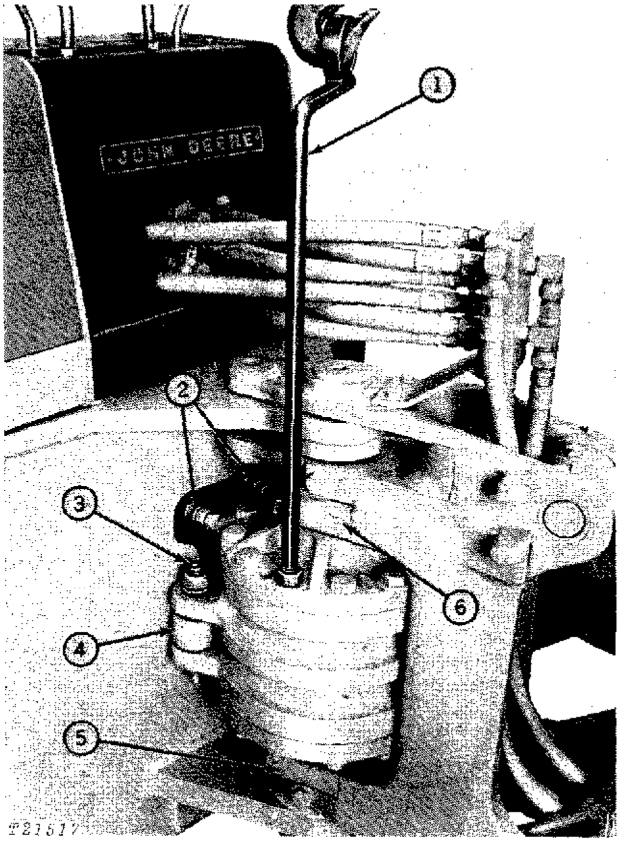
Removing Swing Cylinder

Extend the boom and dipperstick along the ground so they are resting on the bucket.

Remove hoses (2, Fig. 8) from back of swing cylinder.

Remove cap screw and install special swing cylinder removal bar (1). A drawing of this bar is shown in "Special Tools."

Remove the tapered pin (3) and tapered bushing.



1—Removal Bar
2—Two Hoses
3—Tapered Pin
4—Torque Link
5—Bottom Coupling
6—Top Coupling

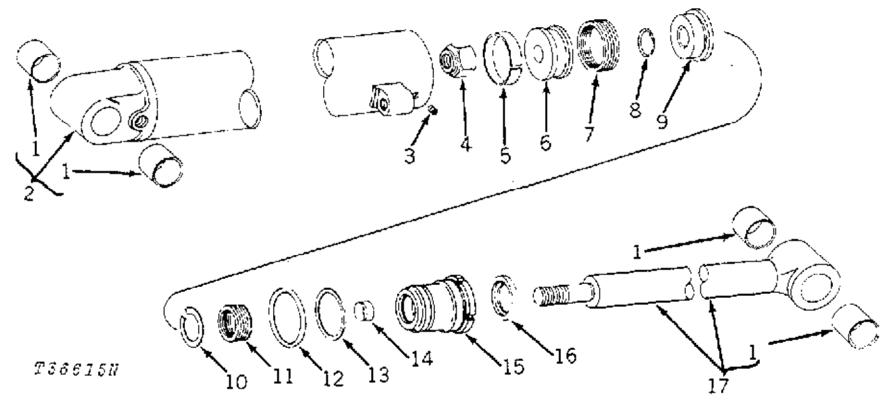
Fig. 8-Removing Swing Cylinder

Remove cap screws holding the top and bottom shaft couplings (5 and 6) to the pivot casting.

Loosen shaft coupling dowels by prying rearward on swing cylinder barrel.

Carefully slide the cylinder out and up.

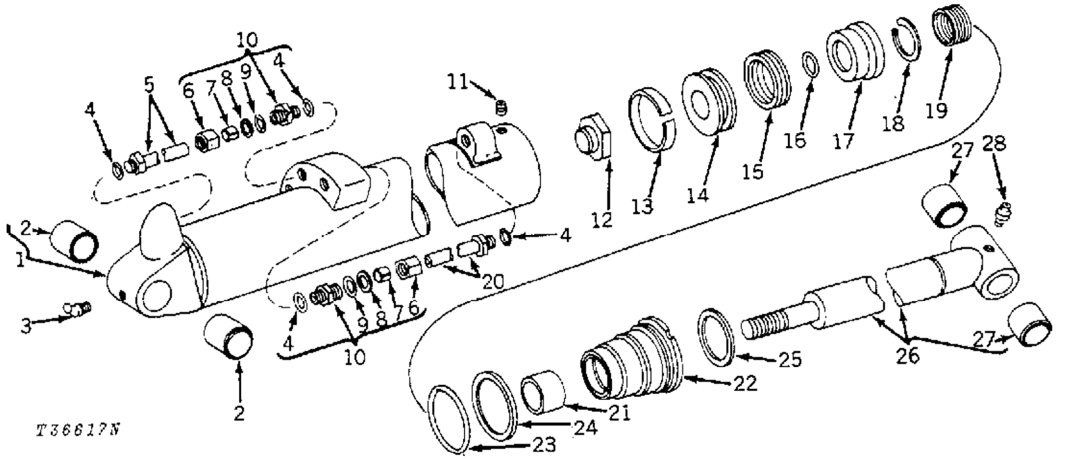
REPAIR



T36615N

1—Bushing (4 used)	6—Piston Retainer	10—Snap Ring	14—Wear Ring
2—Barrel	7—V-Packing	11—V-Packing	15—Rod Guide
3—Set Screw	8—O-Ring	12—O-Ring	16—Wiper Seal
4—Lock Nut	9—Piston	13—Backup Washer	17—Piston Rod
5—Wear Ring			

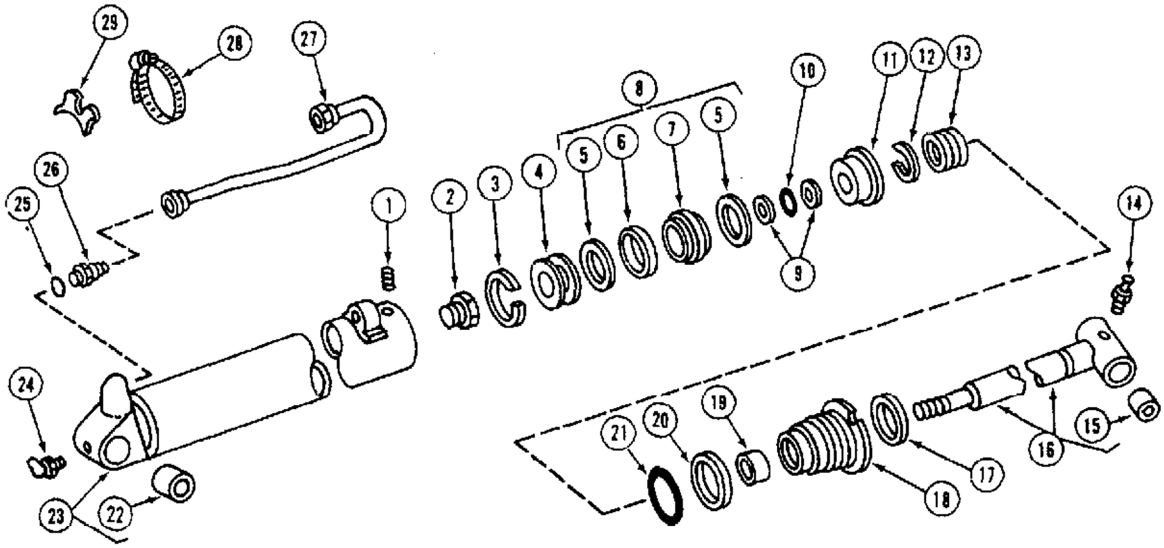
Fig. 9-9300 Backhoe Stabilizer Cylinder



T36617

1—Barrel	8—Backup Washer (2 used)	15—V-Packing	22—Rod Guide
2—Bushing (2 used)	9—O-Ring	16—O-Ring	23—O-Ring
3—Grease Fitting	10—Straight Union Adapter	17—Piston	24—Backup Washer
4—O-Ring	11—Set Screw	18—Snap Ring	25—Wiper Seal
5—Return Tube	12—Lock Nut	19—V-Packing	26—Piston Rod
6—Nut	13—Wear Ring	20—Return Tube	27—Bushing (2 used)
7—Ferrule (2 used)	14—Piston Retainer	21—Wear Ring	28—Grease Fitting

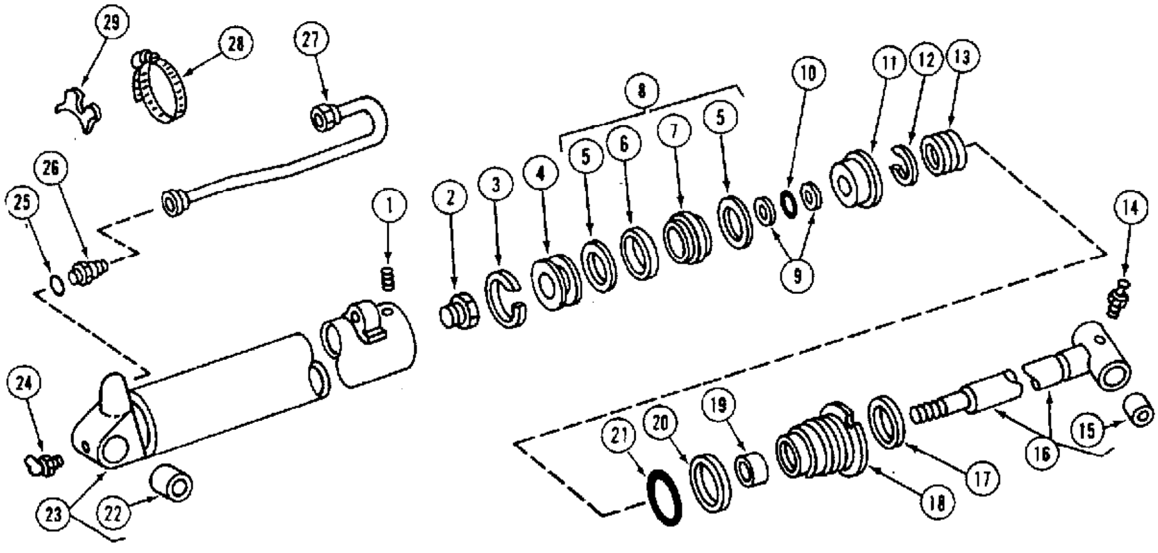
Fig. 10-9300 Backhoe Bucket Cylinder
(Backhoe Serial No. -047299)



T74445

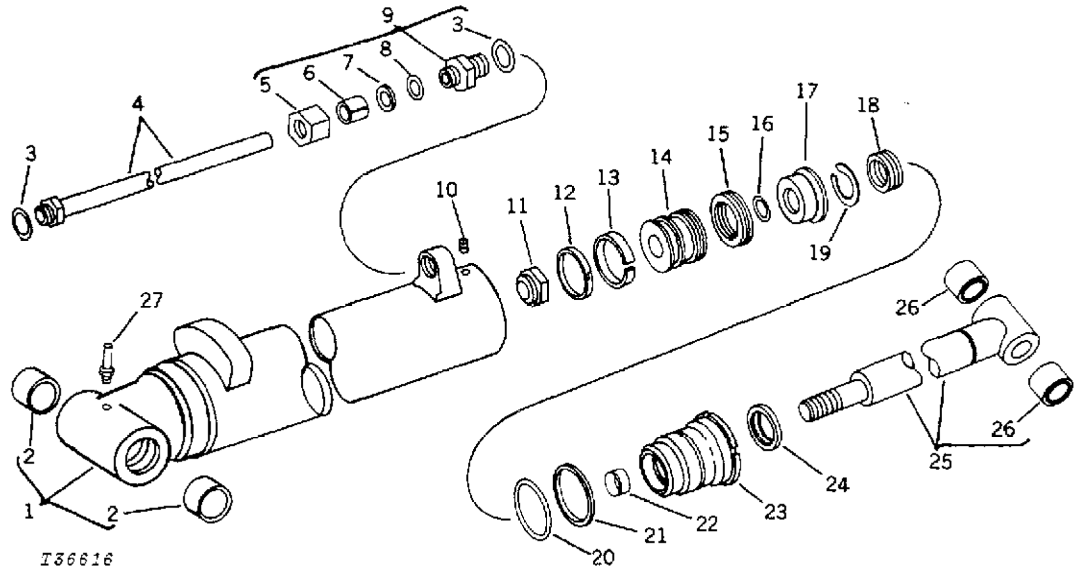
1—Set Screw
2—Lock Nut
3—Wear Ring
4—Outer Piston
5—V-Packing
6—O-Ring
7—Inner Piston
8—Snap Ring
9—V-Packing
10—Straight Grease Fitting
11—Bushing (2 used)
12—Piston Rod with Bushings
13—Wiper Seal
14—Rod Guide
15—Rod Guide Wear Ring
16—Backup Ring
17—O-Ring
18—Bushing (2 used)
19—Barrel with Bushing
20—Grease Fitting
21—O-Ring
22—Connector
23—Tube
24—Clamp
25—Spacer

Fig. 11-Bucket Cylinder
(Backhoe Serial No. 047300-XXXXXX)



1—Set Screw
2—Lock Nut
3—Wear Ring
4—Outer Piston
5—Backup Ring (2 used)
6—Piston Seal Cup
7—Seal Expander
8—Piston Seal Assembly
9—Backup Ring (2 used)
10—O-Ring
11—Inner Piston
12—Snap Ring
13—V-Packing
14—Straight Grease Fitting
15—Bushing (2 used)
16—Piston Rod with Bushings
17—Wiper Seal
18—Rod Guide
19—Rod Guide Wear Ring
20—Backup Ring
21—O-Ring
22—Bushing (2 used)
23—Barrel with Bushings
24—Grease Fitting
25—O-Ring
26—Connector
27—Tube
28—Clamp
29—Spacer

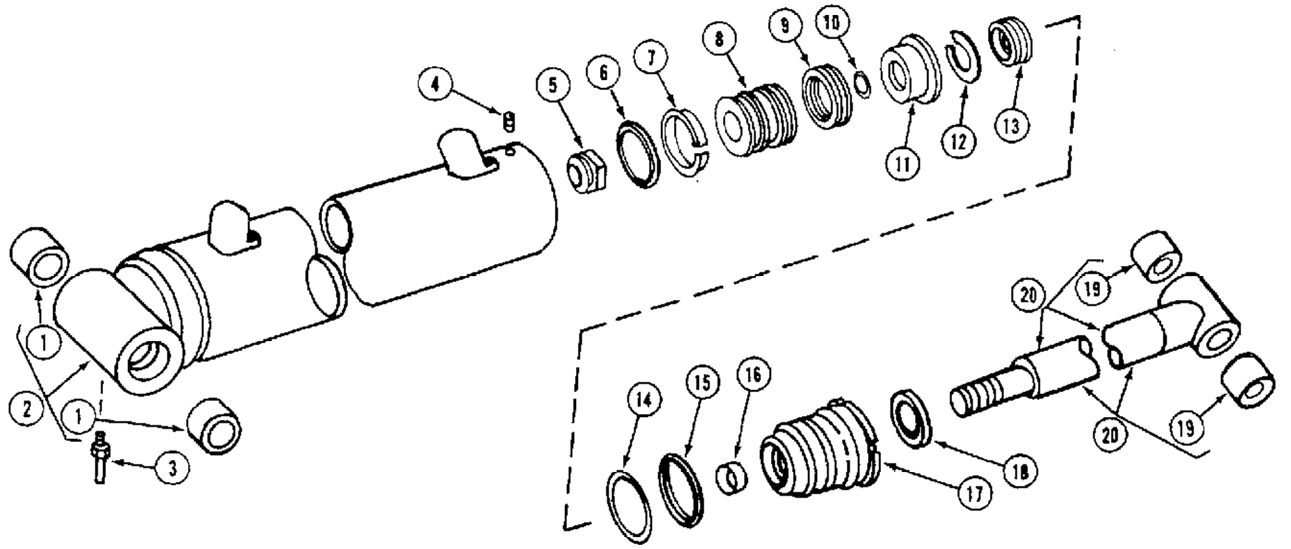
Fig. 12-Bucket Cylinder
(Backhoe Serial No. XXXXXX-)



T36616

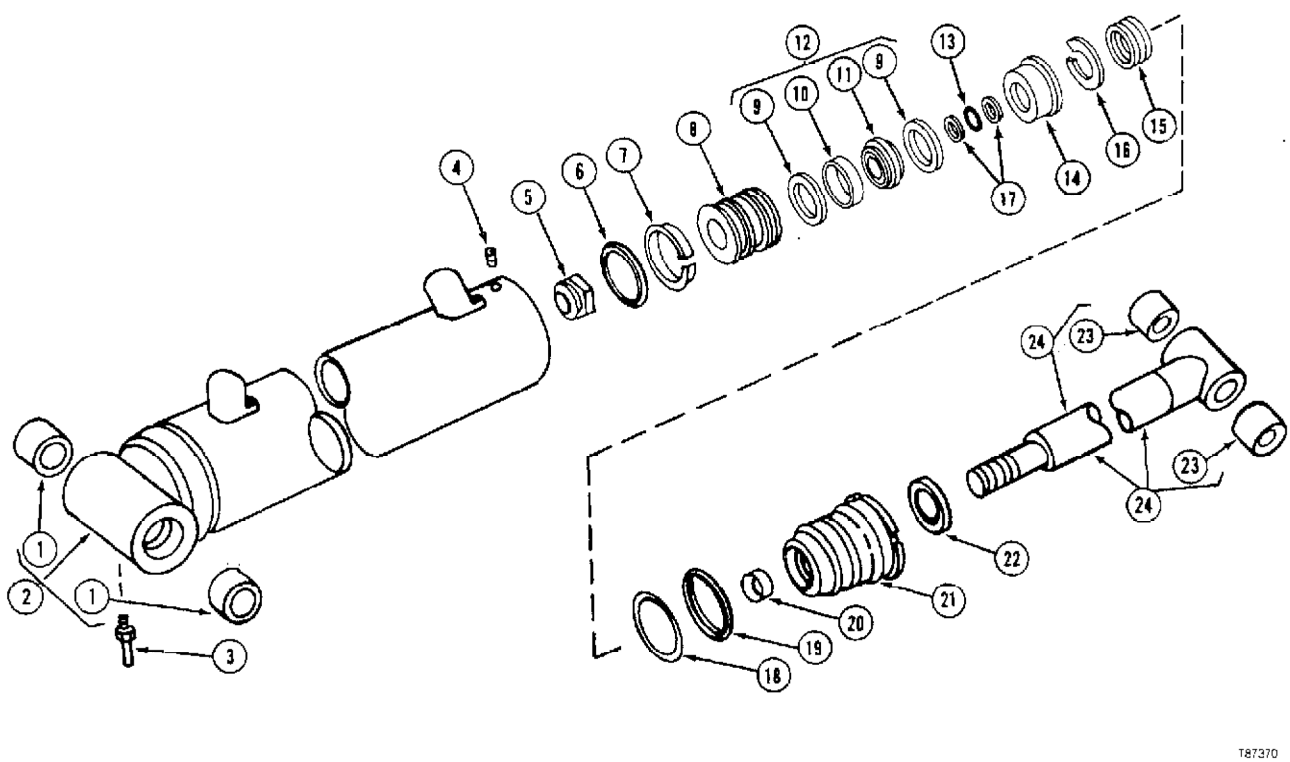
1—Barrel
2—Bushing (2 used)
3—O-Ring (2 used)
4—Return Tube
5—Special Nut
6—Backup Washer
7—O-Ring
8—O-Ring
9—Tube Connector
10—Set Screw
11—Lock Nut
12—Brake Seal
13—Wear Ring
14—Piston
15—V-Packing
16—O-Ring
17—Piston
18—V-Packing
19—Snap Ring
20—O-Ring
21—Backup Washer
22—Wear Ring
23—Rod Guide
24—Wiper Seal
25—Piston Rod
26—Bushing (2 used)
27—Grease Fitting

Fig. 13-9300 Backhoe Boom Cylinder
(Backhoe Serial No. -047299)



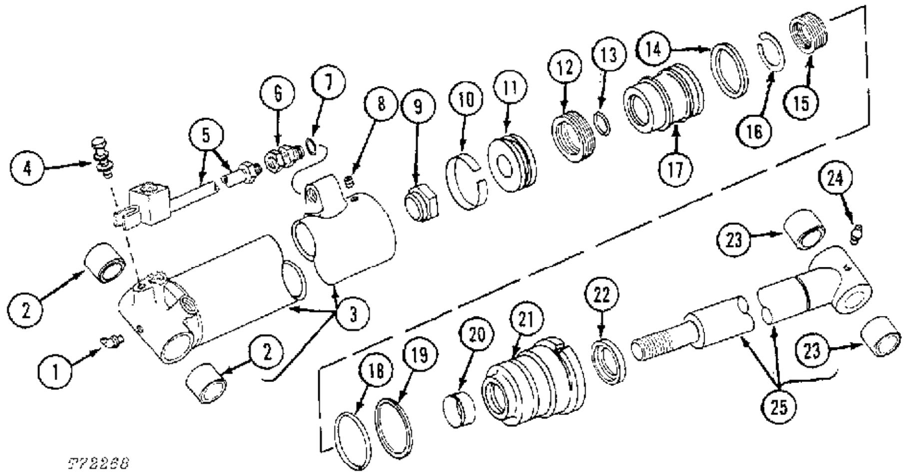
1—Bushing (2 used)
2—Barrel with Bushings
3—Straight Grease Fittings
4—Set Screw
5—Lock Nut
6—Brake Seal
7—Wear Ring
8—Piston
9—V-Packing
10—O-Ring
11—Piston
12—Snap Ring
13—V-Packing
14—O-Ring
15—Backup Washer
16—Wear Ring
17—Rod Guide
18—Wiper Seal
19—Bushing (2 used)
20—Piston Rod with Bushings

Fig. 14-Boom Cylinder
(Backhoe Serial No. 047928-XXXXXX)



1—Bushing (2 used)
2—Barrel with Bushings
3—Straight Grease Fitting
4—Set Screw
5—Lock Nut
6—Brake Seal
7—Wear Ring
8—Piston
9—Backup Ring (2 used)
10—Piston Seal Cap
11—Seal Expander
12—Piston Seal Assembly
13—O-Ring
14—Inner Piston
15—V-Packing
16—Snap Ring
17—Backup Ring (2 used)
18—O-Ring
19—Backup Washer
20—Wear Ring
21—Rod Guide
22—Wiper Seal
23—Bushing (2 used)
24—Piston Rod with Bushings

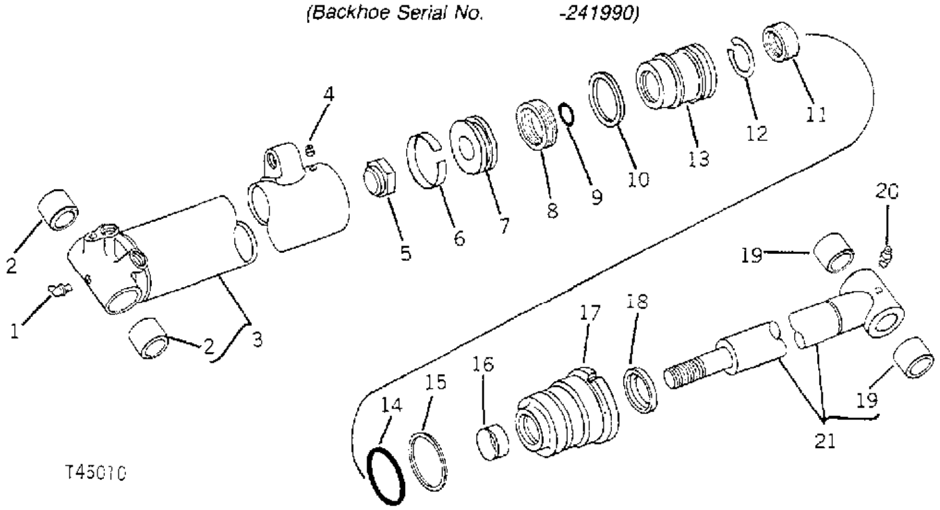
Fig. 15-Boom Cylinder
(Backhoe Serial No. XXXXXX-)



T72268

1—Grease Fitting
2—Bushing (2 used)
3—Barrel
4—Cap Screw
5—Return Tube
6—Straight Union Adapter
7—O-Ring
8—Set Screw
9—Lock Nut
10—Wear Ring
11—Piston
12—V-Packing
13—O-Ring
14—Brake Seal
15—V-Packing
16—Snap Ring
17—Piston
18—O-Ring
19—Backup Washer
20—Wear Ring
21—Rod Guide
22—Wiper Seal
23—Bushing (2 used)
24—Grease Fitting
25—Piston Rod

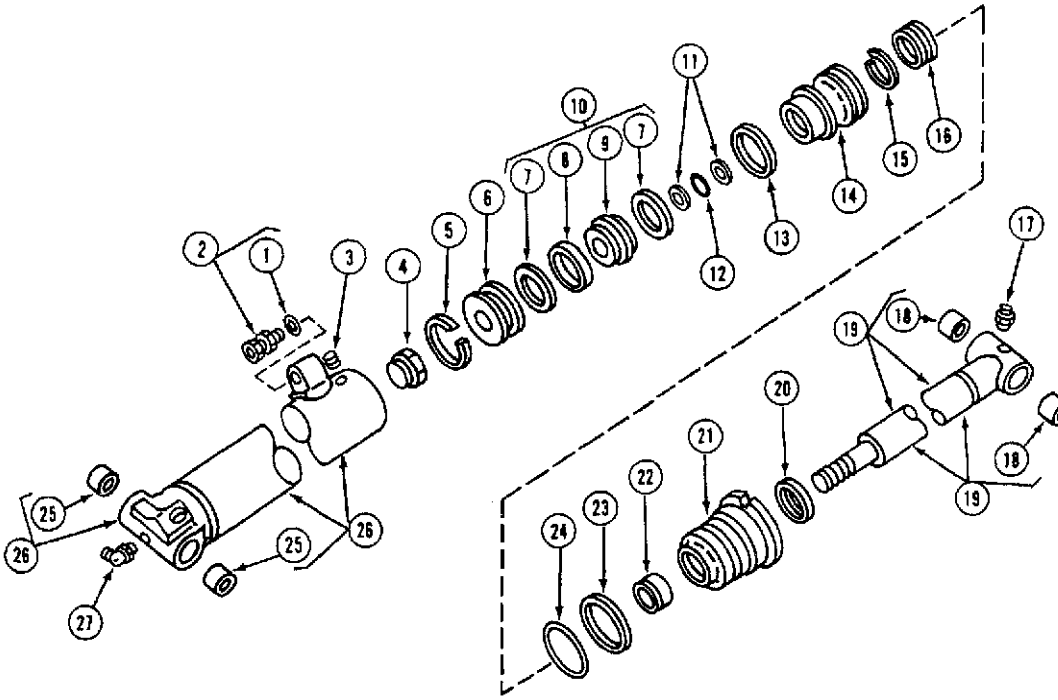
Fig. 16-9300 Backhoe Crowd Cylinder
(Backhoe Serial No. -241990)



T45010

1—Grease Fitting
2—Bushing (2 used)
3—Barrel with Bushings
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—Wear Ring
17—Rod Guide
18—Wiper Seal
19—Bushing (2 used)
20—Straight Grease Fitting
21—Piston Rod with Bushings

Fig. 17-9300 Backhoe Crowd Cylinder
(Backhoe Serial No. 241991-XXXXXX)



1—O-Ring
2—Straight Union Adapter
3—Set Screw
4—Lock Nut
5—Wear Ring
6—Piston
7—Backup Ring (2 used)
8—Piston Seal Cap
9—Seal Expander
10—Piston Seal Assembly
11—Backup Ring (2 used)
12—O-Ring
13—Piston Ring
14—Piston
15—Snap Ring
16—V-Packing
17—Grease Fitting
18—Bushing (2 used)
19—Rod with Bushings
20—Wiper Seal
21—Rod Guide
22—Wear Ring
23—Backup Ring
24—O-Ring
25—Bushing (2 used)
26—Barrel with Bushings
27—Grease Fitting

Fig. 18-Crowd Cylinder
(Backhoe Serial No. XXXXXX-)

NOTE: The following is a repair story for all cylinders except the backhoe swing cylinder. The repair story for the swing cylinder will be covered later in this group.

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filter.

Clamp the cylinder in a vise to prevent it from turning. Remove set screw and rod guide. Use a D-05270ST Special Spanner Wrench to loosen rod guide.

On cylinders using spanner nut, remove spanner nut and push rod guide into barrel just far enough to remove snap ring. Do not push rod guide too far into barrel or the rod guide O-ring will enter the oil port and be damaged.

Remove piston rod, rod guide and piston from barrel.

IMPORTANT: Medium strength thread lock and sealer on lock nut threads on crowd cylinder rod greatly increases loosening torque. Heating of nut to oxidize thread lock and sealer is necessary to avoid damage to rod.

Clamp the rod end in a vise taking care to prevent damage to the piston rod. Remove lock nut from end of rod. For crowd cylinder, apply a small amount of heat to nut before removing to oxidize thre thread lock and sealer. Do not apply excessive heat as nut or nylon insert may be damaged. Remove parts from end of rod.

Wash all parts thoroughly with diesel fuel and inspect the following:

1. Barrel, rod guide and rod for scoring, and O-rings for surface damage.

2. V-packings and wear rings for breaks, cuts or embedded foreign material.

3. Piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.

Repair kits are available for overhauling all cylinders. Discard used parts and use all new parts provided in kits when assembling cylinders.

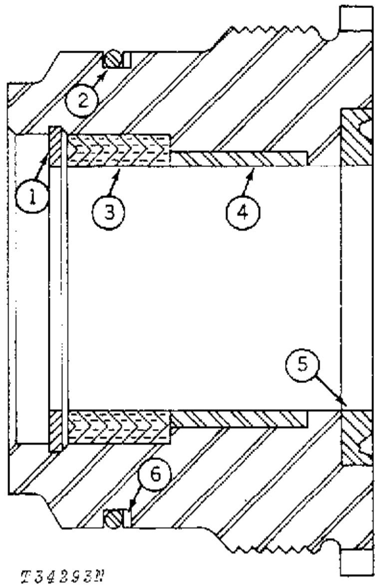
Lubricate all O-rings, seals, and packings before assembly.

Install new wiper seal (5, Fig. 19) in rod guide.

Install new wear ring (4) in rod guide. Install backup washer (6) and O-ring (2) on rod guide.

Install V-packing (3) in rod guide with the apex of the V toward the wiper seal and fasten with snap ring (1).

Install rod guide assembly on piston rod being careful not to damage packing.

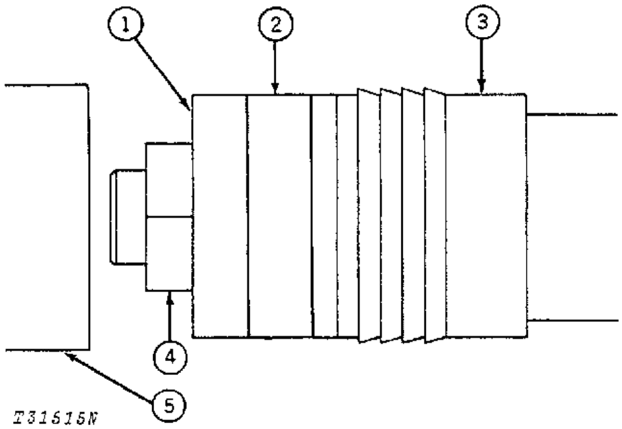


T34293

1—Snap Ring
2—O-Ring
3—V-Packing
4—Wear Ring
5—Wiper Seal
6—Backup Washer

Fig. 19-Rod Guide Component

Installing Piston V-Packing



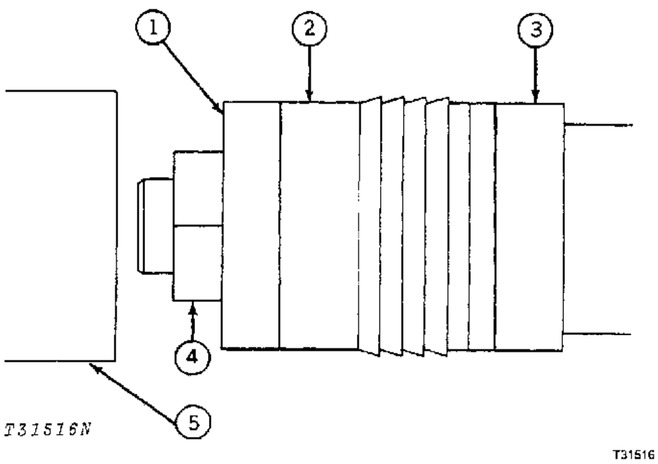
T31515

1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 20-Original Installation of V-Packing

NOTE: For boom, crowd, and bucket cylinders on units from Backhoe Serial No. (XXXXXX-) and earlier units which have new piston and piston seal assembly installed as a replacement, see Installing Piston Seal Assembly.

V-packings are originally installed on the piston with the apex of the V pointing away from the barrel (Fig. 20). When replacing V-packings in the field this procedure can be used if a suitable ring compressor is available to compress packings when installed in cylinders.



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 21-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. 21). 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.

Install piston on piston rod. Install wear ring on piston retainer. Install retainer on piston rod and fasten with lock nut. For crowd cylinder, apply medium strength thread lock and sealer to threads before installing lock nut. See chart below.

Installing Piston Seal Assembly

Install backup washer (2, Fig. 22), O-ring (1), and backup washer (2) in inner piston (3).

Install inner piston on piston rod.

Install seal expander (4), backup rings (5), radius (6) of backup rings must be installed as shown, and piston seal cap (7).

Install outer piston (8) on piston rod.

Install wear ring (9) on outer piston.

Install brake ring seal (10) on outer piston with side marked "UP" toward head end of cylinder for boom cylinder and toward rod end for crowd cylinder.

Install lock nut (11) on piston rod and tighten. See chart below.

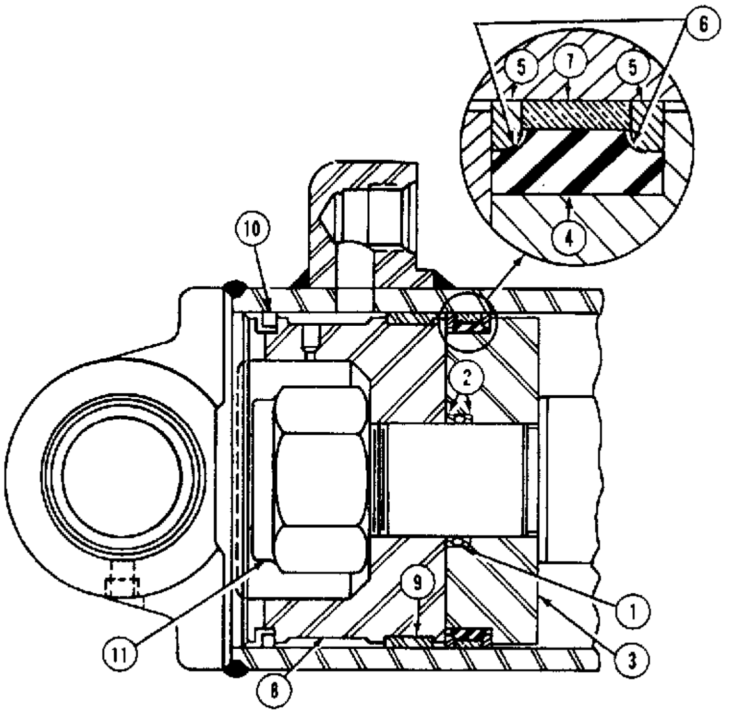
TORQUE SPECIFICATIONS

Cylinder	Lock Nut (lb-ft)
Stabilizer	600 to 700 (813 to 949 N·m)
Boom	1000 to 1100 (1 356 to 1 492 N·m)
Crowd	600 to 700 (813 to 949 N·m)
Bucket	600 to 700 (813 to 949 N·m)

Install piston rod assembly into barrel.

Secure piston rod assembly in barrel with rod guide and tighten to specified torque. Install set screw and tighten after rod guide is tightened to proper torque. See chart below.

Cylinder	Rod Guide (lb-ft)	Set Screws (lb-in)
Stabilizer	250 to 300 (339 to 407 N·m)	40 (4.5 N·m)
Boom	250 to 300 (339 to 407 N·m)	40 (4.5 N·m)
Crowd	250 to 300 (339 to 407 N·m)	40 (4.5 N·m)
Bucket	250 to 300 (339 to 407 N·m)	40 (4.5 N·m)

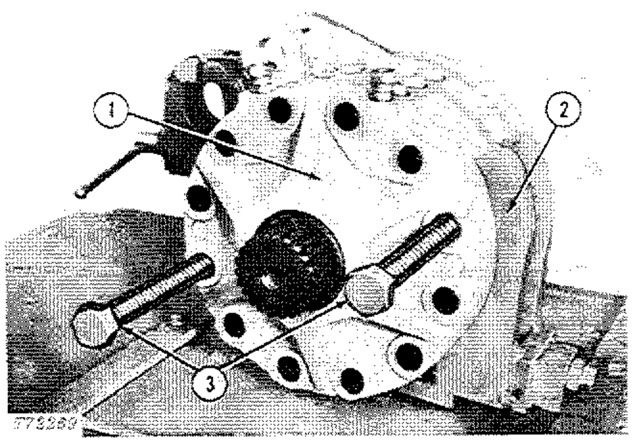


1—O-Ring
2—Backup Ring (2 used)
3—Inner Piston
4—Seal Expander
5—Backup Ring (2 used)
6—Radius
7—Piston Seal Cap
8—Outer Piston
9—Piston Wear Ring
10—Brake Seal Ring
11—Lock Nut

Fig. 22-Installation of Pistons and Piston Seal Assembly (Boom Cylinder Shown)

Backhoe Swing Cylinder

Disassembly



1—Top Plate
2—Cylinder Holding Fixture
3—Cap Screw (7/8 in.) (2 used)

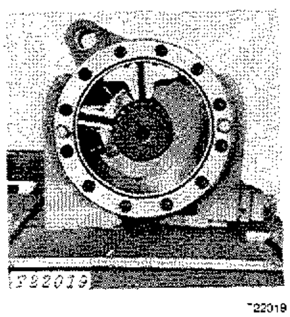
Fig. 23-Removing Top Plate

Put swing cylinder in cylinder holding fixture (2, Fig. 23). Drawings of this fixture are shown in "Special Tools" (Group 3399).

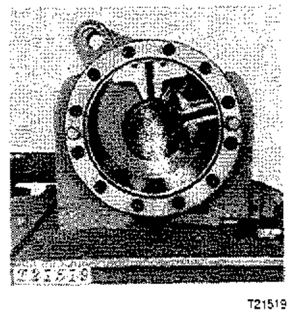
Use two 7/8-inch cap screws (3) as jack screws and force the top plate from the cylinder barrel.

Turn jack screws alternately and evenly so that top and bottom plates are always square.

Remove top plate from splined shaft being careful not to damage O-ring and backup washer.



Vane Right



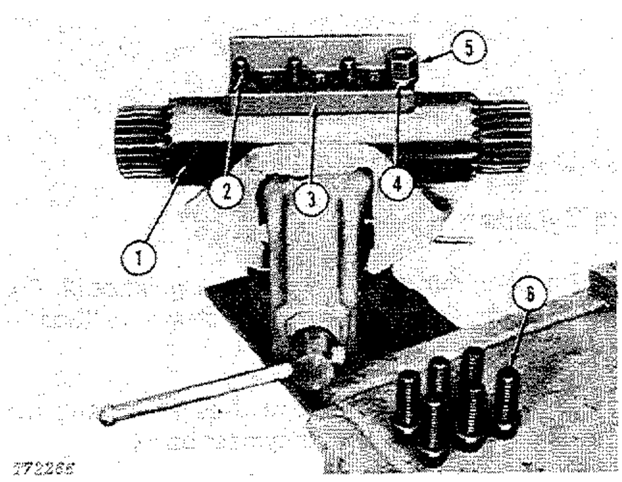
Vane Left

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.



1—Shaft
2—Dowel Pin (8 used)
3—Shaft Vane
4—Spacer (as needed)
5—Nut
6—Cap Screw (6 used)

Fig. 25-Removing Shaft Vane

Put 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.

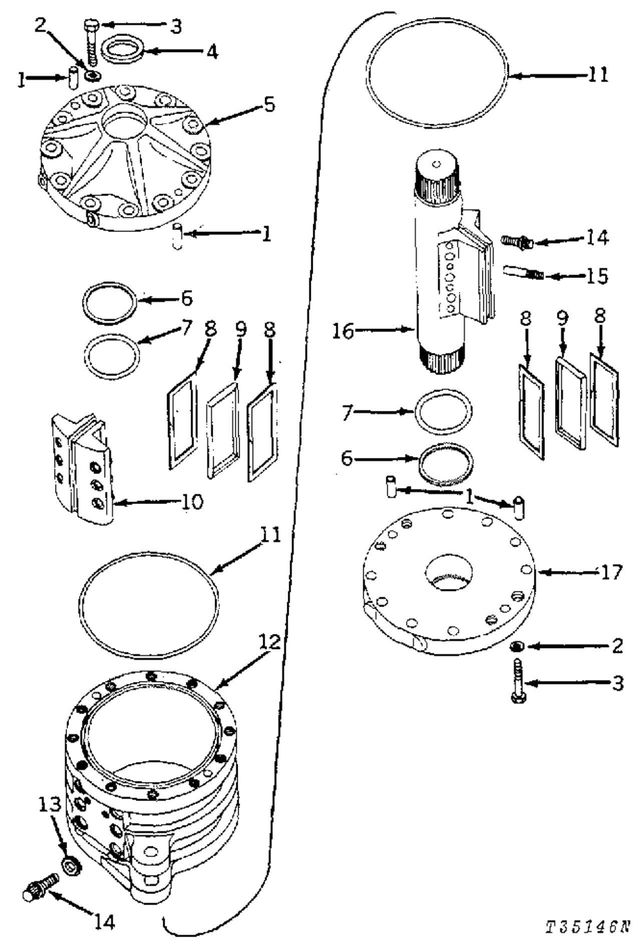
Remove cap screws (6, Fig. 25).

To remove dowel pins (2), install a spacer (4) and nut (5) on a dowel pin and tighten. Remove the nut, add a second spacer, install the nut and tighten until pin is removed.

Inspection

Wash all parts thoroughly with a solvent and inspect for scoring of cylinder and surface damage to O-rings, backup washers, and packings.

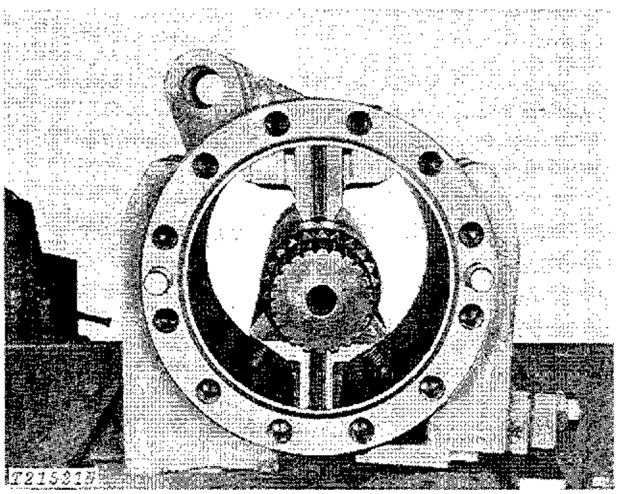
If brass choke plates on the vane of the splined shaft (16, Fig. 26) are damaged, replace the shaft and vane assembly. Damaged choke plates will stop brake action of the swing cylinder.



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 (4 used)*
9—Vane Seal (2 used)*
10—Cylinder Vane
11—O-Ring (2 used)*
12—Barrel
13—Seal Washer (6 used)*
14—Cap Screw (12 used)
15—Dowel (8 used)
16—Vane and Shaft Assembly
17—Bottom Plate
***—Repair Kit**

Fig. 26-Backhoe Swing Cylinder

Assembly



T21521

Fig. 27-Installing Shaft and Vane

Before assembly put clean hydraulic oil on all O-rings, backup washers, seals and rubbing surfaces of the rotary swing cylinder.

Install O-rings (7, Fig. 26) and backup washers (6) in top and bottom plates (5 and 17).

Install vane seal (9) and backup seals (8) in cylinder vane (10) and shaft vane.

IMPORTANT: Always use new sealing washers under heads of cap screws when installing vane.

Install the vane to the barrel with cap screws and new sealing washers. Tighten to 375 lb-ft (508 N·m).

Put the vane on the shaft in the exact position from which it was removed (as indicated by markings made before removal). Install dowels and fasten vane with cap screws. Tighten to 375 lb-ft (508 N·m).

Install splined shaft in cylinder barrel with the large brass choke plates toward the top of the barrel. Install 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 must rotate smoothly.

Install new O-rings (11, Fig. 26) in top and bottom of cylinder barrel. Attach top and bottom plates to the barrel. Tighten to 375 lb-ft (508 N·m).

After assembling, the shaft must turn freely using 100 lb-ft (136 N·m).

IMPORTANT: Once the top plate is installed, the shaft and vane assembly must not be turned more than 95° left or right from the straight ahead position as shown in Fig. 27. To do so can damage the vane seals as they slide over the work ports in the top plate.

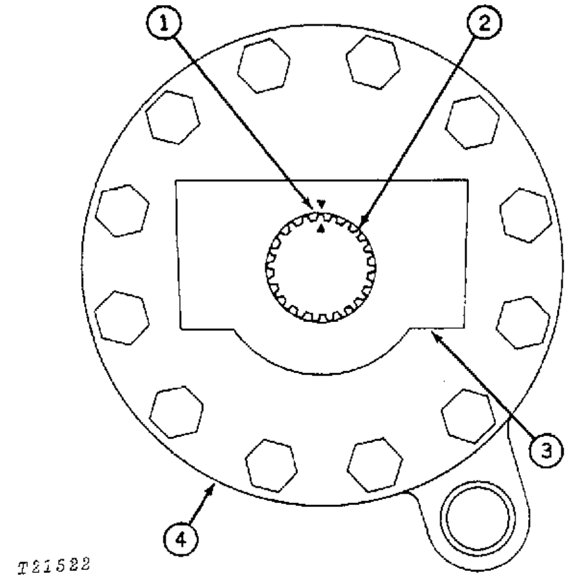
Put grease on the shaft splines to make future removal easier.

INSTALLATION

Put the cylinder in position on the machine and align the attaching holes. Install pivot pins and fasten with cap screw. Connect the hydraulic lines, making sure they are connected to the same ends of the cylinder from which they were removed. Replace any oil that was lost.

Backhoe Swing Cylinder

Install the swing cylinder removal bar into swing cylinder and lift the cylinder with a chain hoist.



T21522

1—Timing Arrows
2—Splined Shaft
3—Coupling
4—Swing Cylinder

Fig. 28-Timing Coupling and Shaft

Put 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 put 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 N·m).

Align the torque link with the upper bracket on the cylinder barrel and install tapered pin. Put the tapered bushings 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 265 N·m). **It is important that the bottom lock nut be tightened first.**

Remove bar and install cap screw. Connect hoses.

Group 3399A
SPECIFICATIONS AND SPECIAL TOOLS

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES

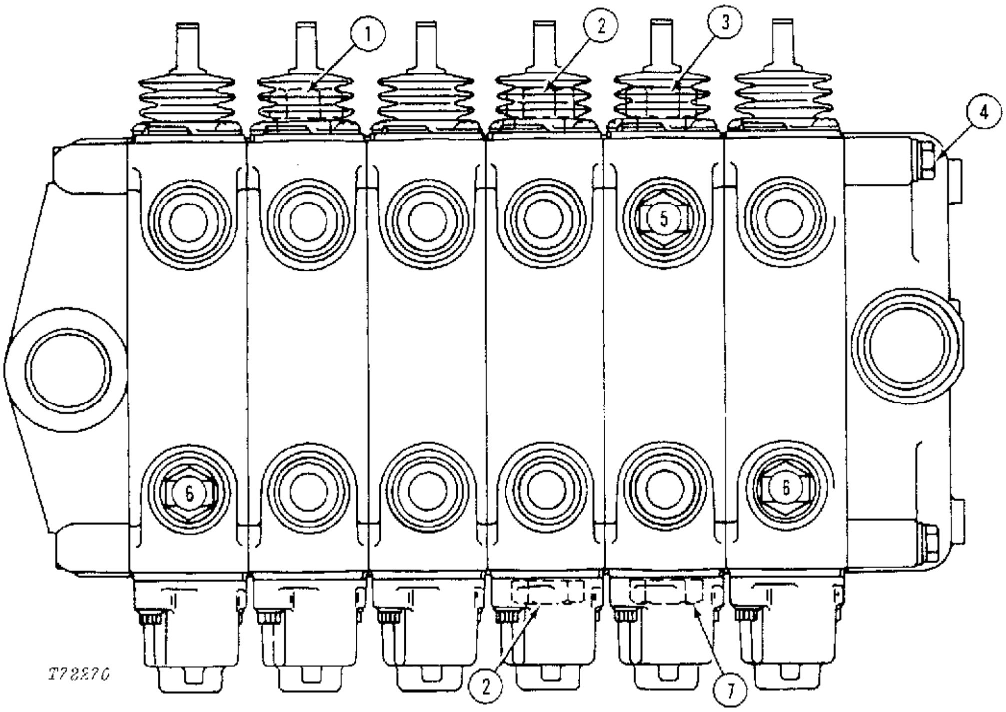


Fig. 1-9300 Backhoe Control Valve

1 - Crowd relief valve setting .... 2375 psi (16 376 kPa) (164 bar)

2 - Swing relief valve setting .... 2000 psi (13 790 kPa) (138 bar)

3 - Boom relief valve setting .... 3500 psi (24 133 kPa) (241 bar)

4 - Tie bolt torque .... 25 to 30 lb-ft (34 to 41 N·m)

5 - Boom orifice size .... 0.219 in. (5.56 mm)

6 - Stabilizer orifice size .... 0.1405 in. (3.57 mm)

7 - Boom relief valve setting .... 2375 psi (16 376 kPa) (164 bar)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

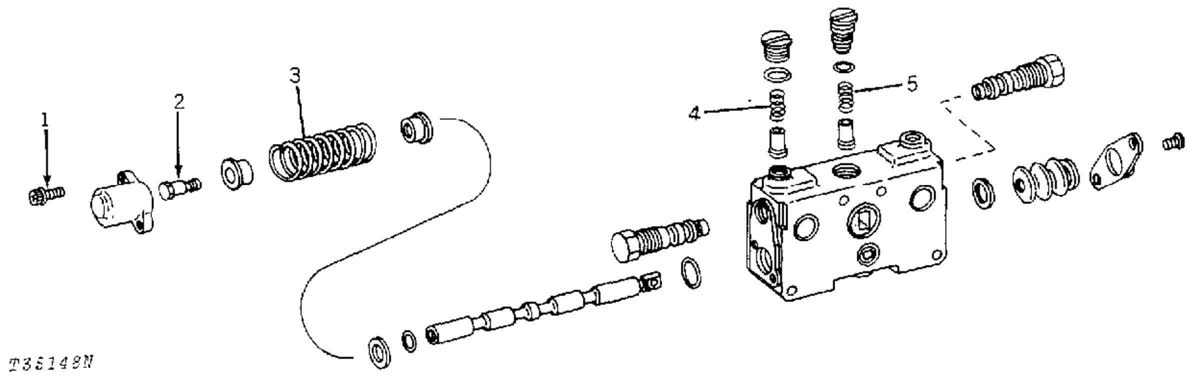


Fig. 2-Valve Section (Boom Illustrated)

1 - Cap assembly screw
torque .... 10 to 13 lb-ft
(13.6 to 17.6 N·m)

2 - Spool screw torque .... 5 to 8 lb-ft
(6.8 to 10.8 N·m)

3 - Spool spring
Test length at 27 lbs. force .... 1.25 in.
(120 N .... 31.7 mm)

4 - Anti-cavitation spring
Free length .... 0.692 in. (17.58 mm)
Test length at 0.75 ± 0.1 lb. force .... 0.625 in.
(3.3 ± 0.4 N.................... 15.88 mm)

5 - Lift check spring
Free length .... 0.995 in. (25.29 mm)
Test length at 1.8 ± 0.2 lbs. force ..... 0.75 in.
(8 ± 0.9 N .... 19.0 mm)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

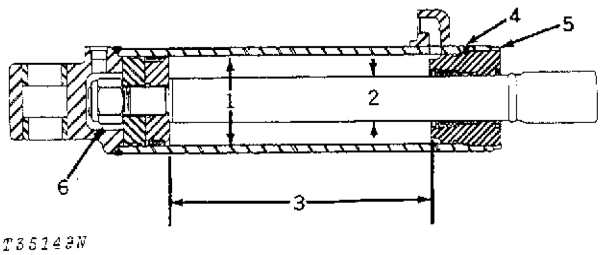


Fig. 3-9300 Backhoe Stabilizer Cylinder

Stabilizer Cylinder

1 - Cylinder bore ....3.996 to 4.00 in. (101.50 to 101.60 mm)

2 - Rod diameter .... 1.9985 to 2.0015 in. (50.76 to 50.84 mm)

3 - Cylinder stroke ....16.62 in. (422.15 mm)

4 - Set screw torque ....40 lb-in (4.5 N·m)

5 - Rod guide torque............. 250 to 300 lb-ft (339 to 407 N·m)

6 - Lock nut torque .... 600 to 700 lb-ft (814 to 949 N·m)

Boom Cylinder

1 - Cylinder bore .... 4.496 to 4.500 in. (114.20 to 114.30 mm)

2 - Rod diameter .... 2.2485 to 2.2515 in. (57.11 to 57.19 mm)

3 - Cylinder stroke ....34.00 in. (863.6 mm)

4 - Set screw torque ....40 lb-in (4.5 N·m)

5 - Rod guide torque............. 250 to 300 lb-ft (339 to 407 N·m)

6 - Lock nut torque .... 1000 to 1100 lb-ft (1356 to 1492 N·m)

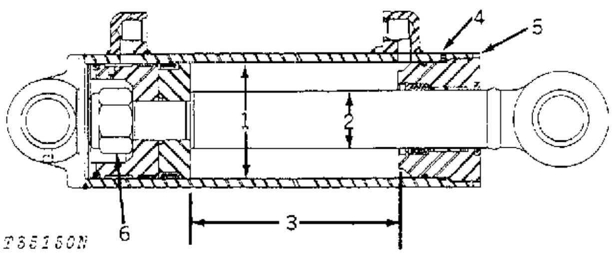


Fig. 4-9300 Backhoe Boom Cylinder

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

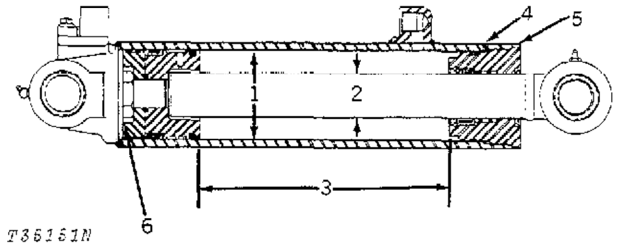


Fig. 5-9300 Backhoe Crowd Cylinder

Crowd Cylinder

1 - Cylinder bore .... 3.996 to 4.000 in. (101.50 to 101.60 mm)

2 - Rod diameter .... 1.9985 to 2.0015 in. (50.76 to 50.84 mm)

3 - Cylinder stroke .... 33.00 in. (838.2 mm)

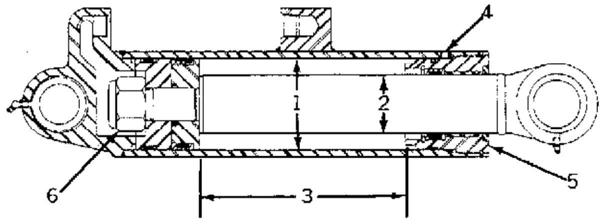
4 - Set screw torque .... 40 lb-in (4.5 N·m)

5 - Rod guide torque .... 250 to 300 lb-ft (339 to 407 N·m)

6 - Lock nut torque .... 600 to 700 lb-ft (814 to 949 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



T35152N

Fig. 6-9300 Backhoe Bucket Cylinder

Bucket Cylinder

1 - Cylinder bore .... 3.496 to 3.500 in. (88.80 to 88.90 mm)

2 - Rod diameter .... 2.2485 to 2.2515 in. (57.11 to 57.19 mm)

3 - Cylinder stroke ....27.37 in. (695.2 mm)

4 - Set screw torque ....40 lb-in (4.5 N·m)

5 - Rod guide torque............. 250 to 300 lb-ft (339 to 407 N·m)

6 - Lock nut torque .... 600 to 700 lb-ft (814 to 949 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

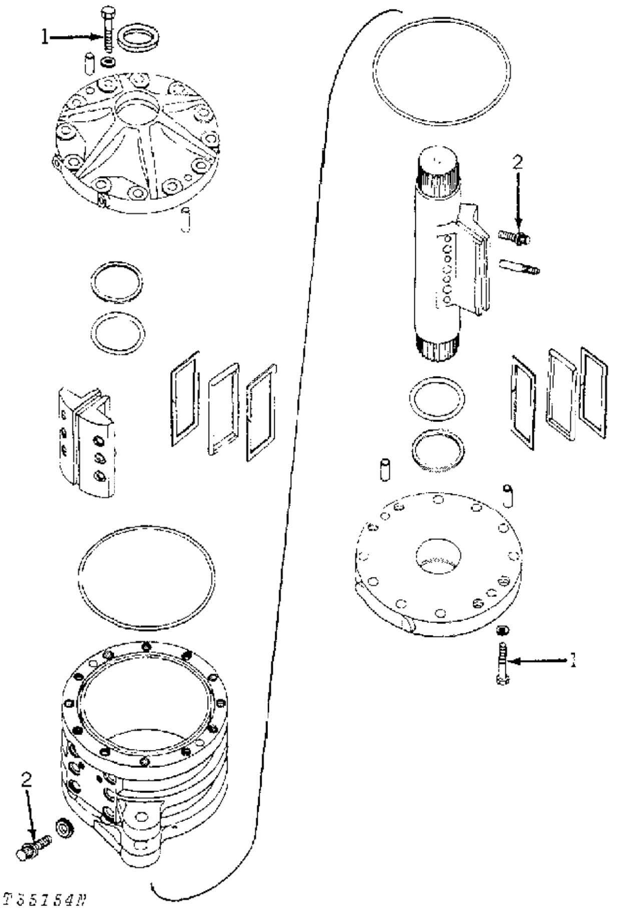


Fig. 7-9300 Backhoe Swing Cylinder

Swing Cylinder

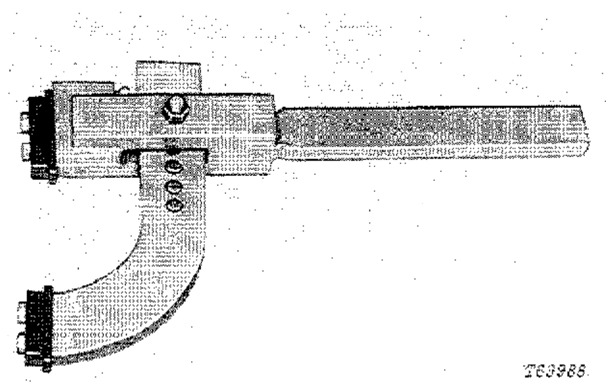
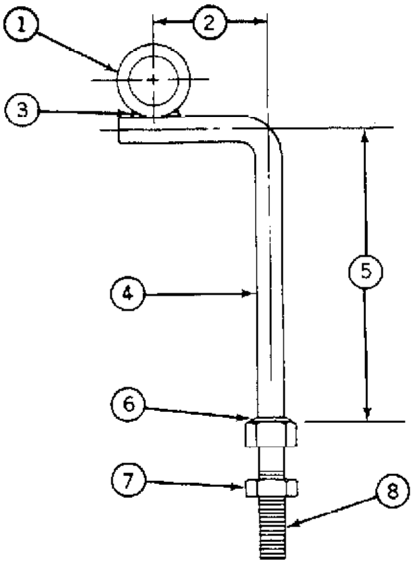
1 - Top and bottom plates-to-barrel torque . . . . 375 lb-ft (508 N·m)

2 - Vane-to-barrel and shaft torque . . . . 375 lb-ft (508 N·m)

HYDRAULIC SYSTEM

SPECIAL TOOLS

Convenience Tools

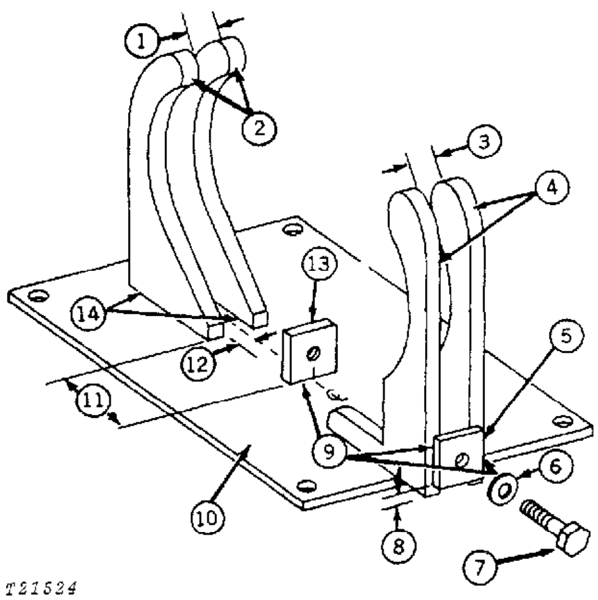
Tool	Tool Number	Use
 Fig. 8-Special Spanner Wrench	D-05270ST or D-01053AA (not shown)	Remove and install cylinder rod guides.
 T31533 1—2 in. (50.8 mm) I.D. Pipe Ring; 2—4.75 in. (120.65 mm); 3—Weld; 4—1 in. (25.4 mm) Dia. Round Bar; 5—16.50 in. (419 mm); 6—Weld; 7—Jam Nut; 8—3/4" x 6-1/2" Bolt (3/4-10 UNC Thread) Fig. 9-Removal Bar	..........*	To remove and install the rotary swing cylinder on the 9300 backhoe.
D-01168AA Spring Compression Tester	D-01168AA (not shown)	To test the compression rate of springs.

*Make in dealer shop

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
	----------*	To hold the 9300 backhoe rotary swing cylinder during repair.

T21524

1—1.75 in. (44.45 mm)
2—Part "B"
3—1.75 in. (44.45 mm)
4—Part "A"
5—Part "D"
6—Flat Washer
7—0.875 x 3.75 in. Cap Screw
8—0.50 in. (12.70 mm)
9—Weld
10—Part "E"
11—6.50 in. (165.10 mm)
12—0.875 in. (22.23 mm)
13—Part "C"
14—Weld

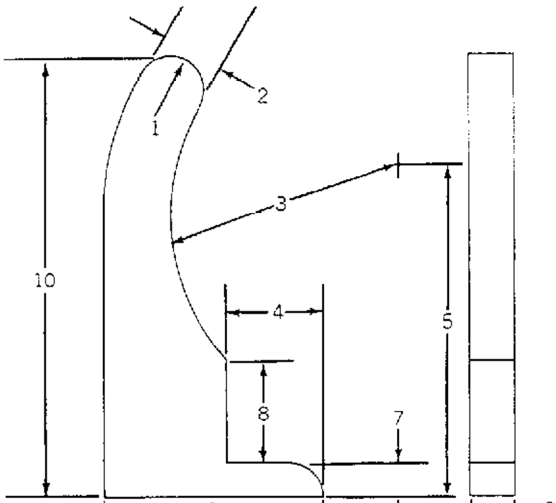
Fig. 10-Rotary Cylinder Holder

*Make in dealer shop. See Figs. 11, 12, 13, 14, and 15 for measurements to make tool.

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
	Fig. 10	To hold the 9300 backhoe rotary swing cylinder during repair

T35155N

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—1.00 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)

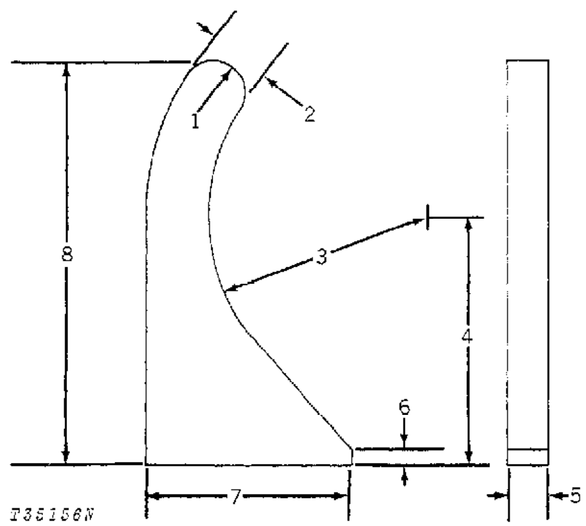
Fig. 11-Part "A" Fixture Print

HYDRAULIC SYSTEM

SPECIAL TOOLS—Continued

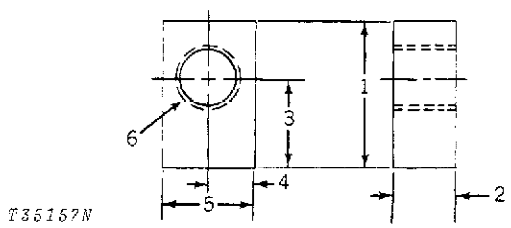
Convenience Tools—Continued

Tool	Tool Number	Use
Fig. 12 (Part "B" Fixture Print)	Fig. 10	To hold the 9300 backhoe rotary swing cylinder during repair.
Fig. 13 (Part "C" Fixture Print)	Fig. 10	To hold the 9300 backhoe rotary 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. 12-Part "B" Fixture Print



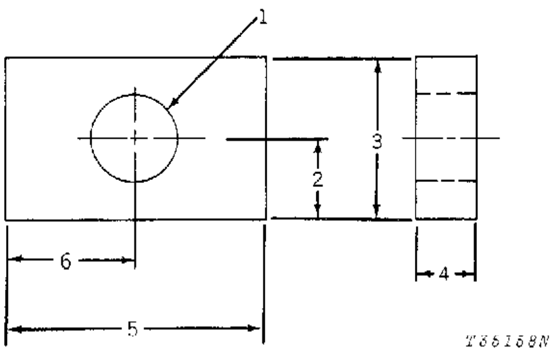
1—2.50 in. (63.50 mm)
2—1.0 in. (25.4 mm)
3—1.50 in. (38.10 mm)
4—0.8125 in. (20.64 mm)
5—1.6250 in. (41.28 mm)
6—7/8 in.-9 UNC

Fig. 13-Part "C" Fixture Print

HYDRAULIC SYSTEM

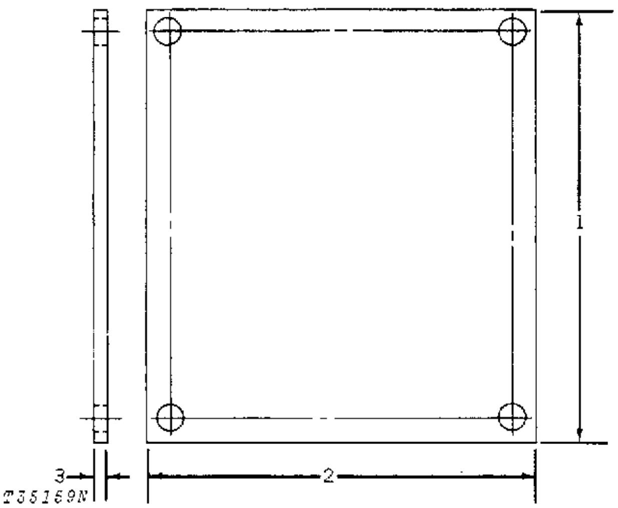
SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
	Fig. 10	To hold the 9300 backhoe rotary 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. 14-Part "D" Fixture Print

Tool	Tool Number	Use
	Fig. 10	To hold the 9300 backhoe rotary swing cylinder during repair

1—18 In. (457.20 mm)
2—16 in. (406.40 mm)
3—0.50 in. (12.70 mm)

Fig. 15-Part "E" Fixture Print

Section 33B
9550 BACKHOE

CONTENTS OF THIS SECTION

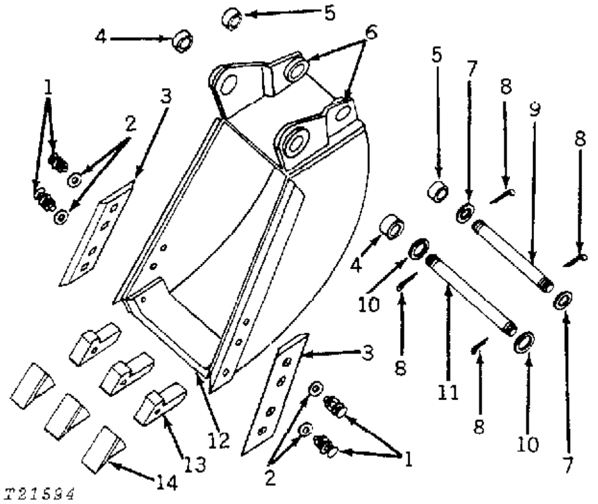
Group 3302B
BUCKET

REMOVAL

Lower boom and dipperstick to position bucket on the ground.

CAUTION: Release hydraulic pressure on the bucket before removing the retaining pins.

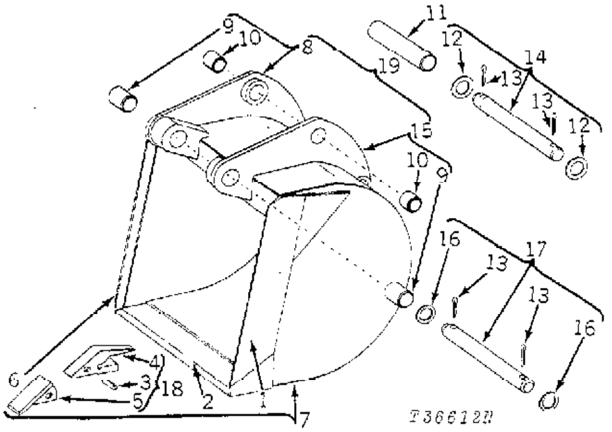
REPAIR



T21534

1—Bolt, Lock Washer, and Nut (6 used)
2—Washer
3—Side Cutting Edge
4—Bushing
5—Bushing
6—Pivot Plate
7—Backup Washer
8—Cotter Pin
9—Pin
10—Backup Washer
11—Pin
12—Front Cutting Edge
13—Tooth Shank
14—Tooth Tip

Fig. 1-Bucket (With Straight Pivot Plates)



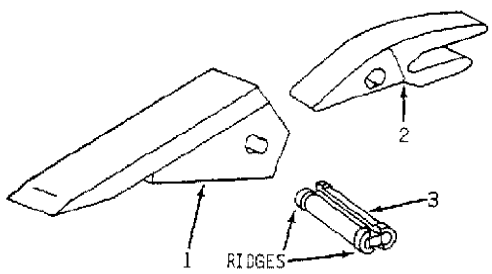
T36612N

1—R.H. Side Cutting Edge
2—Front Cutting Edge
3—Flex Pin
4—Tooth Shank
5—Tooth Tip
6—L.H. Side Cutting Edge
7—Bucket Assembly
8—L.H. Pivot Plate
9—Pivot Plate Bushing (2 used)
10—Pivot Plate Bushing (4 used)
11—Spacer
12—Backup Washer (2 used)
13—Cotter Pin (4 used)
14—Pin
15—R.H. Pivot Plate
16—Backup Washer (2 used)
17—Pin
18—Bucket Tooth Assembly
19—Back Plate

Fig. 2-Heavy Duty Buckets

Refer to Figs. 1 and 2 during disassembly and assembly of the bucket. Inspect all parts for excessive wear or damage and repair or replace as necessary.

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 Figure 3. The ridges are the locking mechanism.

NOTE: If "back" is stamped on the pin, it should face toward the shank.

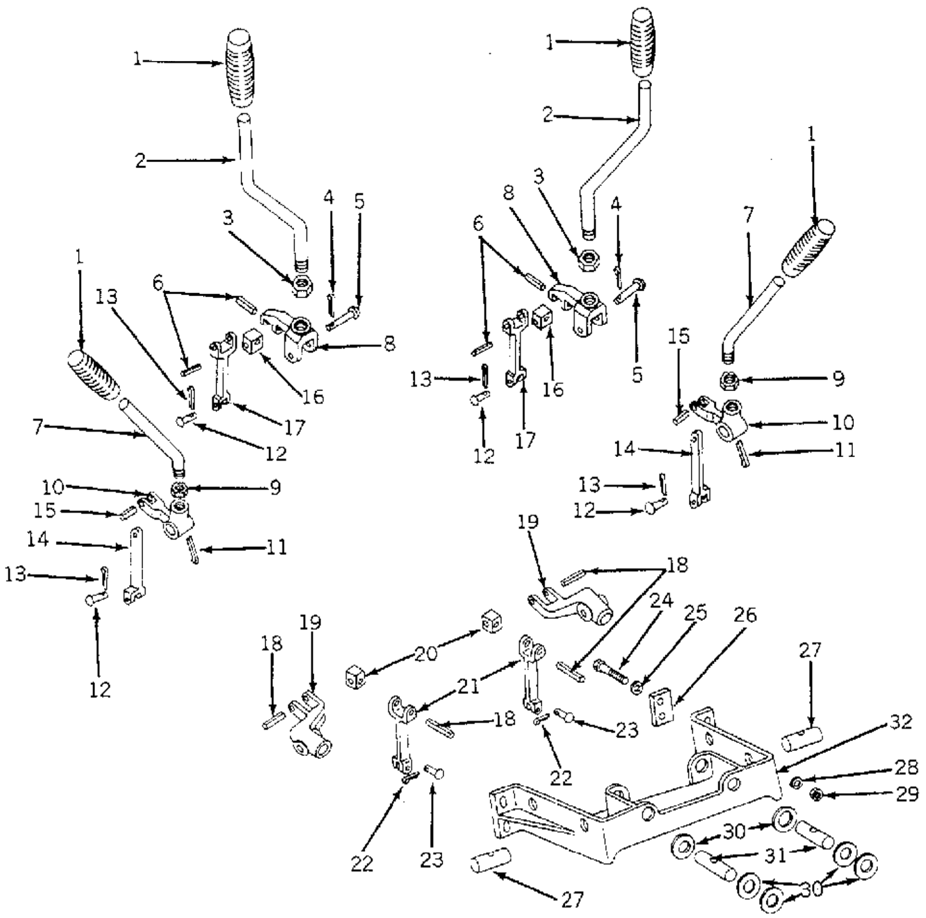
INSTALLATION

Align dipperstick to bucket and insert retaining pins.

Grease all fittings before beginning operation.

Group 3315B
CONTROLS LINKAGE

REPAIR



T21513N

1—Hand Grip (4 used)
2—Lever (2 used)
3—Hex. Nut (2 used)
4—Cotter Pin (2 used)
5—Pivot Pin (2 used)
6—Spring Pin (4 used)
7—Stabilizer Lever (2 used)
8—Handle Mount (2 used)
9—Nut (2 used)
10—Handle Mount (2 used)
11—Cotter Pin (2 used)
12—Pin (4 used)
13—Cotter Pin (4 used)
14—Link (2 used)
15—Spring Pin (2 used)
16—Lever Block (2 used)
17—Link (2 used)
18—Spring Pin (4 used)
19—Pivot Block (2 used)
20—Lever Block (2 used)
21—Lever Link (2 used)
22—Cotter Pin (2 used)
23—Pin (2 used)
24—Cap Screw (4 used)
25—Washer (4 used)
26—Spacer (2 used)
27—Pivot Shaft (2 used)
28—Lock Washer (4 used)
29—Nut (4 used)
30—Washer (6 used)
31—Pivot Shaft (2 used)
32—Mounting Frame

Fig. 1-Backhoe Control Valve Levers and Linkage

Refer to Fig. 1 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.

Group 3340
FRAMES

MAIN FRAME

REMOVAL

By using the backhoe hydraulic system, the backhoe can be easily detached to free the crawler for other jobs.

Lower the stabilizers until they are supporting the weight of the backhoe. Retract the bucket and dipperstick and extend boom cylinder until backhoe is fully extended and bucket is resting on the ground. Install swing locking pin in place to prevent tipping.

Remove the cotter pins and mounting pins which hold the top of the backhoe main frame to the crawler frame.

Use stabilizers to raise backhoe frame off the bottom mounting bracket hooks.

Carefully retract the stabilizers until the main frame is resting on the ground tilted slightly forward.

NOTE: The main frame can be blocked up off the ground by blocking across full width of backhoe main frame.

CAUTION: Shut off the crawler engine before disconnecting the hydraulic lines to the backhoe. If the engine is left running the operator may be sprayed with hot hydraulic oil.

Disconnect the pressure and return hoses from the backhoe main frame at the quick disconnect couplers and connect hoses together.

IMPORTANT: Pressure and return hoses must be connected together at all times when backhoe is removed. Never plug the power beyond port in the loader valve or the pressure hose to the backhoe valve.

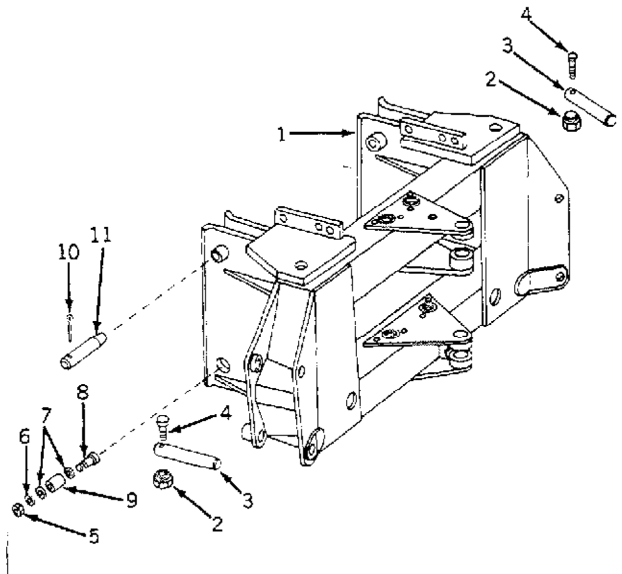
Carefully drive the crawler from the backhoe.

Support boom and dipperstick with a hoist or blocks.

Drive out pins connecting boom pivot to main frame.

REPAIR

Refer to Fig. 1 during disassembly and assembly of the main frame.



T44287N

1—Main Frame
Lock Nut (2 used)
Stabilizer Pivot Pin (2 used)
4—Cap Screw (2 used)
5—Nut (2 used)
6—Lock Washer (2 used)
7—Washer (4 used)
8—Cap Screw (2 used)
9—Pivot Ferrule (2 used)
10—Cotter Pin (2 used)
11—Side Plate Pivot Pin (2 used)

Fig. 1-Main Frame

INSTALLATION

Install main frame and swing frame to boom and dipperstick.

Attach the pressure and return hoses to the backhoe main frame at the quick disconnect couplers.

Carefully raise the backhoe main frame with the hydraulic system by extending the stabilizers.

Carefully back the crawler to align the mounting bracket hooks with the lower pins on the backhoe main frame. Retract the stabilizers until the bottom pins rest in the mounting bracket hooks on the crawler.

Secure the top of each side of main frame to crawler with mounting pins and cotter pins.

MOVABLE FRAMES

REMOVAL

Boom and Dipperstick

Remove bucket as directed on Page 3302-3.

Extend boom and dipperstick so boom is resting on blocks and the dipperstick is resting on the ground. (Crowd cylinder will be approximately one inch [25.4 mm] from bottoming out).

CAUTION: Stop engine and operate controls to relieve hydraulic pressure from hydraulic system before disconnecting hydraulic hoses.

Disconnect and cap all boom and dipperstick hydraulic hoses.

Disconnect battery ground strap or turn off battery disconnect switch (if equipped).

Drive out crowd cylinder pins and boom-to-dipperstick pin.

Remove dipperstick.

Support boom with a hoist.

Remove boom pins and lower boom to the ground.

Boom Pivot Removal

Remove backhoe from unit as directed on page 3340-1.

Remove boom and dipperstick.

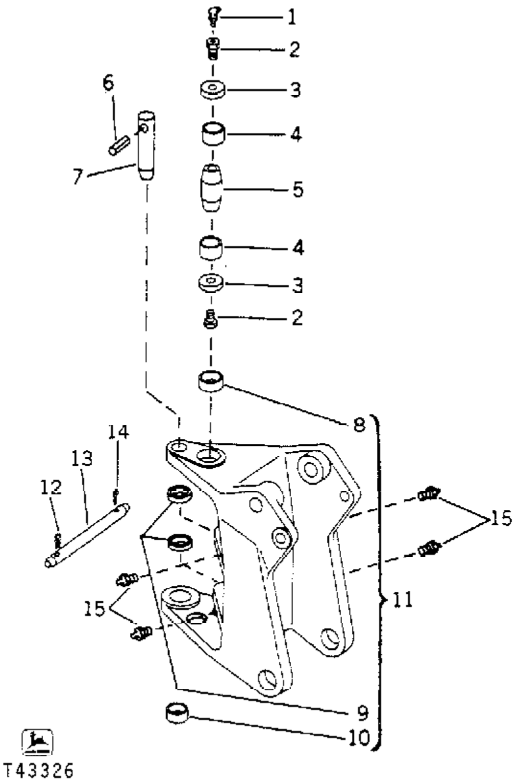
Remove manifold block from boom pivot.

Support boom pivot with blocks.

Remove cap screws from retaining pivot pins and drive out pins.

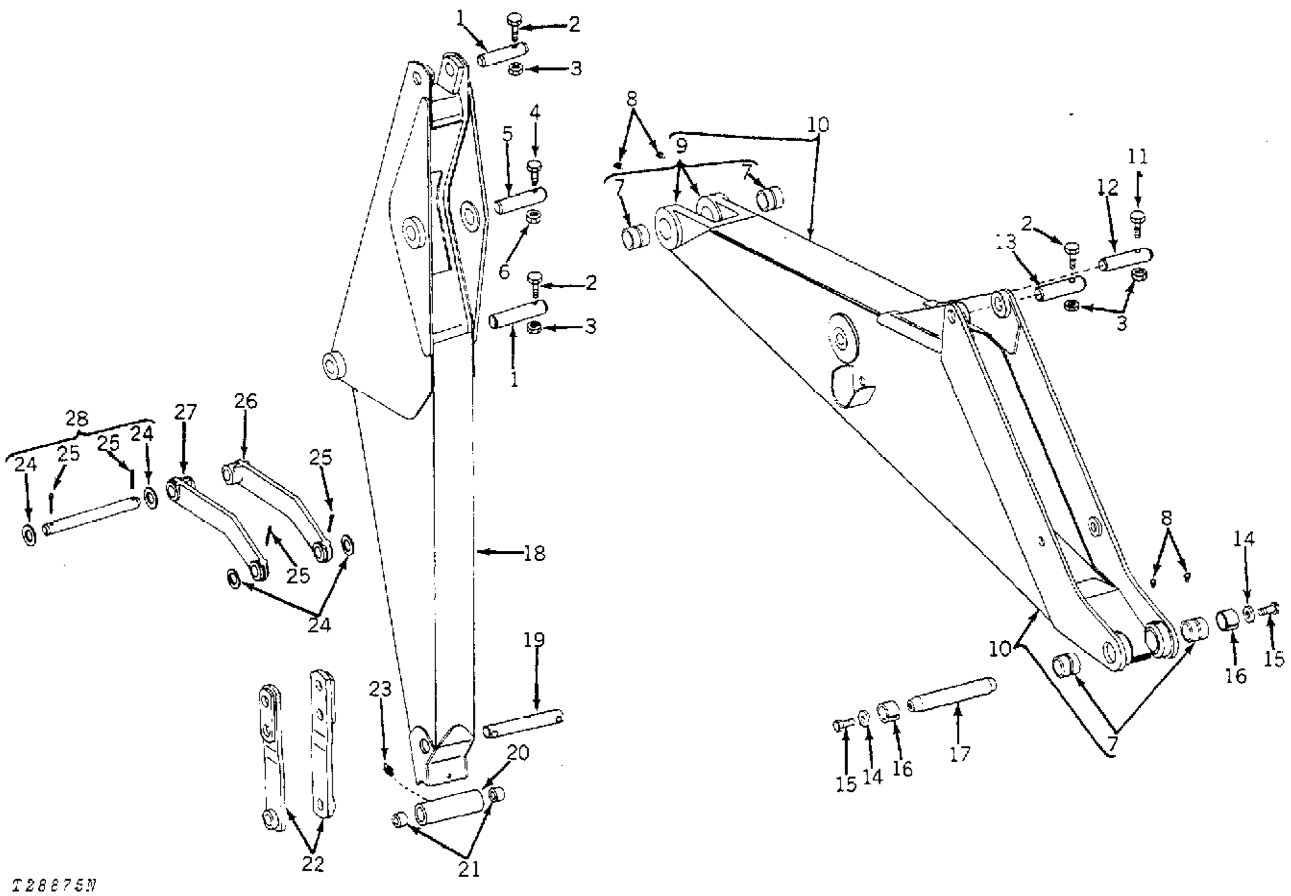
REPAIR

Refer to Figs. 2 and 3 during disassembly and assembly of the boom pivot, boom and dipperstick.



1—Grease Fitting (2 used)
2—Special Screw (2 used)
3—Tapered Pin Washer (4 used)
4—Wedge Bushing (4 used)
5—Swing Frame to Main Frame Tapered Pin (2 used)
6—Spring Pin
7—Swing Lock Pin
8—Swing Frame Upper Bushing
9—Bushing (4 used)
10—Swing Frame Lower Bushing
11—Swing Frame
12—Spring Lock Pin
13—Boom Lock Pin
14—Cotter Pin
15—Grease Fitting (4 used)

Fig. 2-Swing Frame



1—Pin (2 used)
2—Cap Screw (3 used)
3—Lock Nut (4 used)
4—Cap Screw
5—Pin
6—Lock Nut
7—Bushing (4 used)
8—Grease Fitting (4 used)
9—Bushing Pivot Assembly
10—Boom Assembly with Pivot and Bushings
11—Cap Screw
12—Pin
13—Pin
14—Washer
15—Cap Screw
16—Wedge Bushing (2 used)
17—Tapered Pin
18—Dipperstick Assembly
19—Pin
20—Dipper End
21—Dipperstick Bushing (2 used)
22—Bucket Link (2 used)
23—Grease Fitting
24—Special Washer (4 used)
25—Cotter Pin (4 used)
26—R.H. Driver Link
27—L.H. Driver Link
28—Pin

Fig. 3-Boom and Dipperstick Assembly

Refer to Fig. 3 during disassembly and assembly of the boom and dipperstick.

Removing And Installing Tapered Pins And Bushings

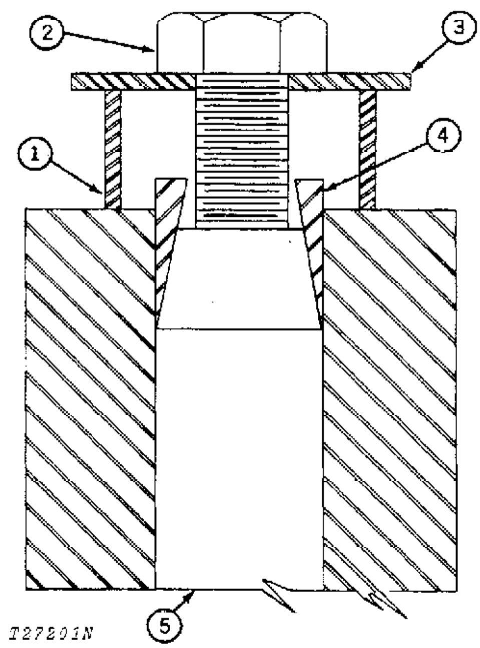
The procedures for removing tapered pins and bushings are as follows:

Remove cap screws from tapered pin (5, Fig. 4).

Place a short piece of pipe (1, Fig. 4) 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.

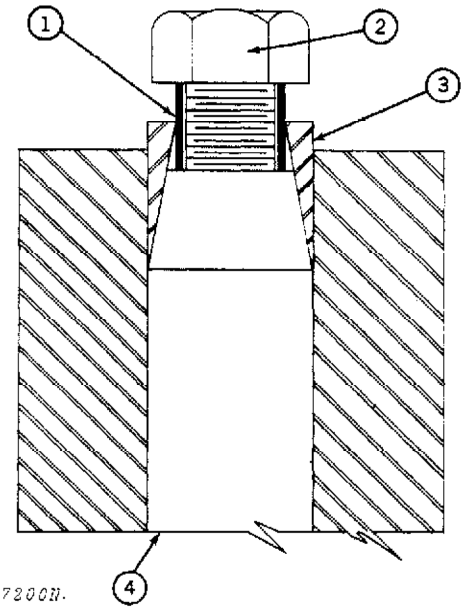
Screw cap screw (2) into tapered pin (5) until the pin and bushing are pulled from the bore.



1—Pipe
2—Cap Screw
3—Steel Plate
4—Tapered Bushing
5—Tapered Pin

Fig. 4-Pulling Tapered Pins and Bushings

Whenever it is not possible to remove tapered pins and bushings by the method given at left use the second procedure outlined as follows:



1—Pipe Spacer or Washers
2—Cap Screw
3—Tapered Bushing
4—Tapered Pin

Fig. 5-Removing Tapered Pins and Bushings

Place a pipe spacer or washer (1, Fig. 5) 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.

NOTE: 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.

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.

a. If the washers are accessible and large enough, strike both washers in three places.

b. 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.

INSTALLATION

Install boom and dipperstick by reversing removal procedure.

STABILIZERS

REMOVAL

Operate control lever to fully extend stabilizers.

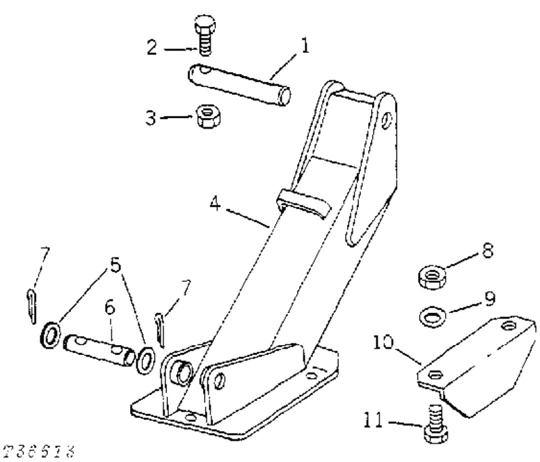
CAUTION: Stop engine and operate the stabilizer control lever to release hydraulic pressure.

Remove stabilizer pivot pin and stabilizer cylinder pin.

Lower stabilizer to ground.

REPAIR

Refer to Fig. 6 during disassembly and assembly of stabilizers.



1—Stabilizer Pivot Pin (2 used)
2—Cap Screw (2 used)
3—Lock Nut (2 used)
4—Stabilizer (2 used)
5—Washer (4 used)
6—Stabilizer Cylinder Pin (2 used)
7—Cotter Pin (4 used)
8—Nut (4 used)
9—Lock Washer (4 used)
10—Stabilizer Cleat (2 used)
11—Cap Screw (4 used)

Fig. 6-Stabilizer

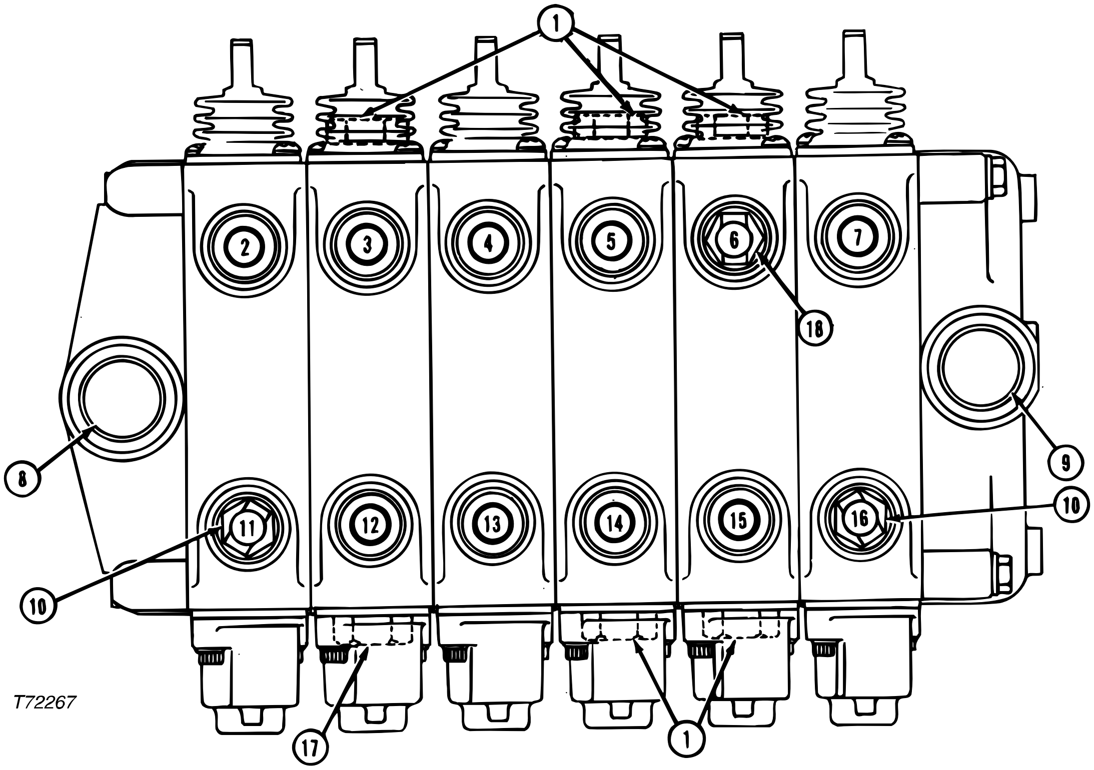
INSTALLATION

Install stabilizers by using removal procedure in reverse order.

Group 3360B
HYDRAULIC SYSTEM

CONTROL VALVE

GENERAL INFORMATION



1—Circuit Relief Valve (5 used)
2—Right Stabilizer Cylinder (Rod End)
3—Crowd Cylinder (Piston End)
4—Bucket Cylinder (Piston End)
5—Swing Cylinder (Right)
6—Boom Cylinder (Rod End)
7—Left Stabilizer Cylinder (Rod End)
8—Pressure Port
9—Return Port
10—Orifice Plate (2 used) (0.1405 in. [3.569 mm])
11—Right Stabilizer Cylinder (Piston End)
12—Crowd Cylinder (Rod End)
13—Bucket Cylinder (Rod End)
14—Swing Cylinder (Left)
15—Boom Cylinder (Piston End)
16—Left Stabilizer Cylinder (Piston End)
17—Plug
18—Orifice Plate (0.219 in. [5.56 mm])

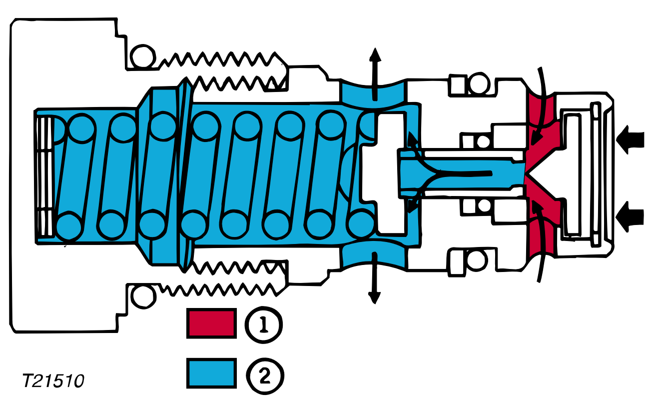
Fig. 1-9550 Backhoe Control Valve

The 9550 backhoe control valve is an open-center, six-spool, stack-type valve.

All six valve sections are separate bodies containing single spools. All valve sections contain lift checks which serve as one-way valves to prevent pressure oil from entering the port passages and causing cylinder movement.

The swing valve section also contains a 0.104 in. (2.64 mm) orifice plate in the lift check.

Anti-cavitation check valves are contained in the boom and swing valve sections.



1—Pressure Oil
2—Return Oil

Fig. 2-Direct Acting Relief Valves

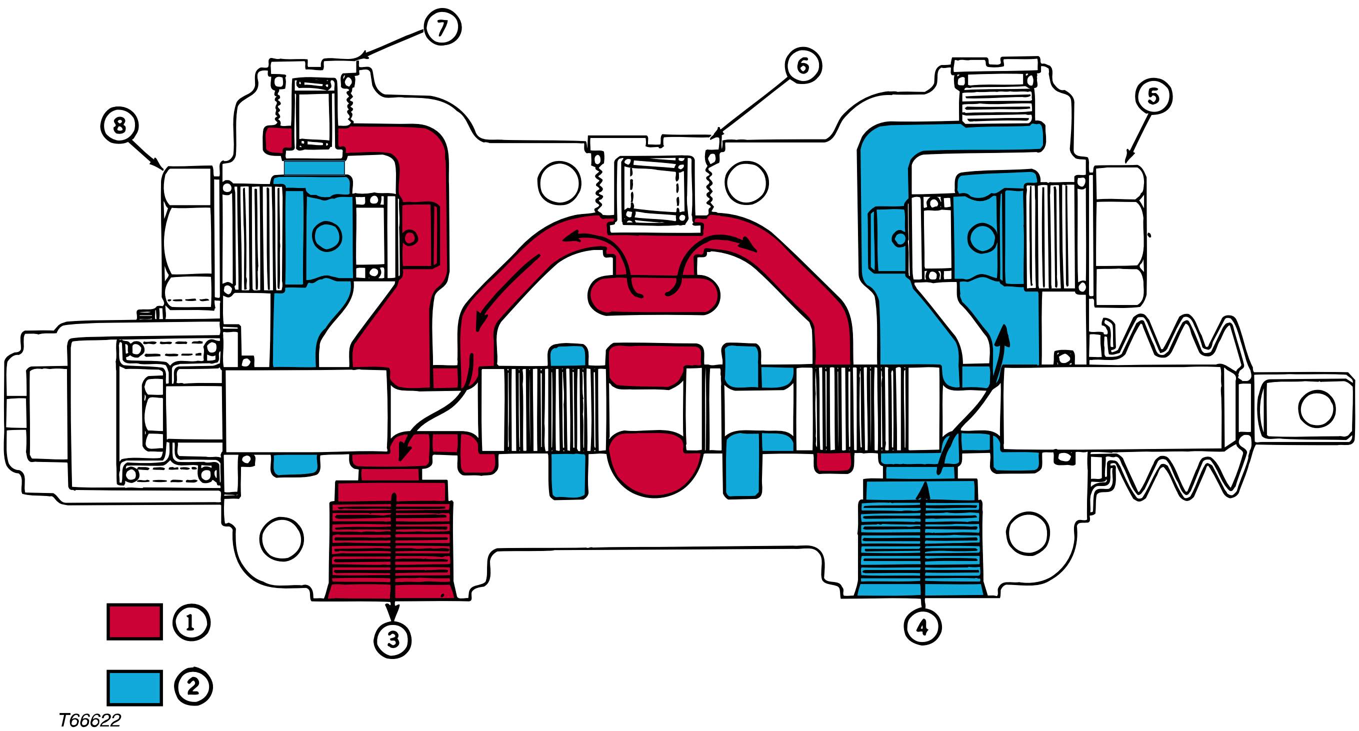
The crowd, boom and swing sections contain direct acting circuit relief valves to protect their circuits from excessive pressures.

Field adjustment is possible on all relief valves.

FOS Refer to "Hydraulic Valves" in FOS Manual—HYDRAULICS for basic information on the operation of direct-acting relief valves.

The pressure port is located in the port plate and the return port is in the end plate.

Control Valve Oil Flows



1—Pressure Oil
2—Return Oil
3—To Cylinder
4—From Cylinder
5—Circuit Relief Valve
6—Lift Check
7—Anti-Cavitation Valve
8—Circuit Relief Valve

Fig. 3-Oil Flow Through Valve Section (Boom Section Illustrated)

Neutral Oil Flow

With all spools in neutral position, oil from the pump enters the port plate and is split into two columns:

1. One column flows through the valve stack and is stopped at the end plate. This is called functional oil—oil that can be diverted to one or more cylinders by moving one of the control valve spools to an operating position.

2. The other column of inlet oil flows freely through the valve stack into the end plate and back to the reservoir.

Boom Power Circuit (Fig. 3)

When the boom spool is extended or retracted to lower or raise the boom, functional oil is directed past the valve spool to the boom cylinders.

Displaced oil from the cylinders is forced back to the control valve through the valve outlet and back to the reservoir. Oil in the remaining cylinders remains trapped by the valve spools.

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 boom and swing cylinders.

REMOVAL

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 the system, be sure all connections are tight and that lines 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 the 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.

CAUTION: Lower the bucket and stabilizers to the ground before removing valve. Shut off engine and discharge system by operating loader controls.

Loosen jam nuts on stabilizer control levers and turn levers in toward the center. Remove the cap screws holding the valve cover and remove cover.

Move control levers in all directions to release pressure in valves.

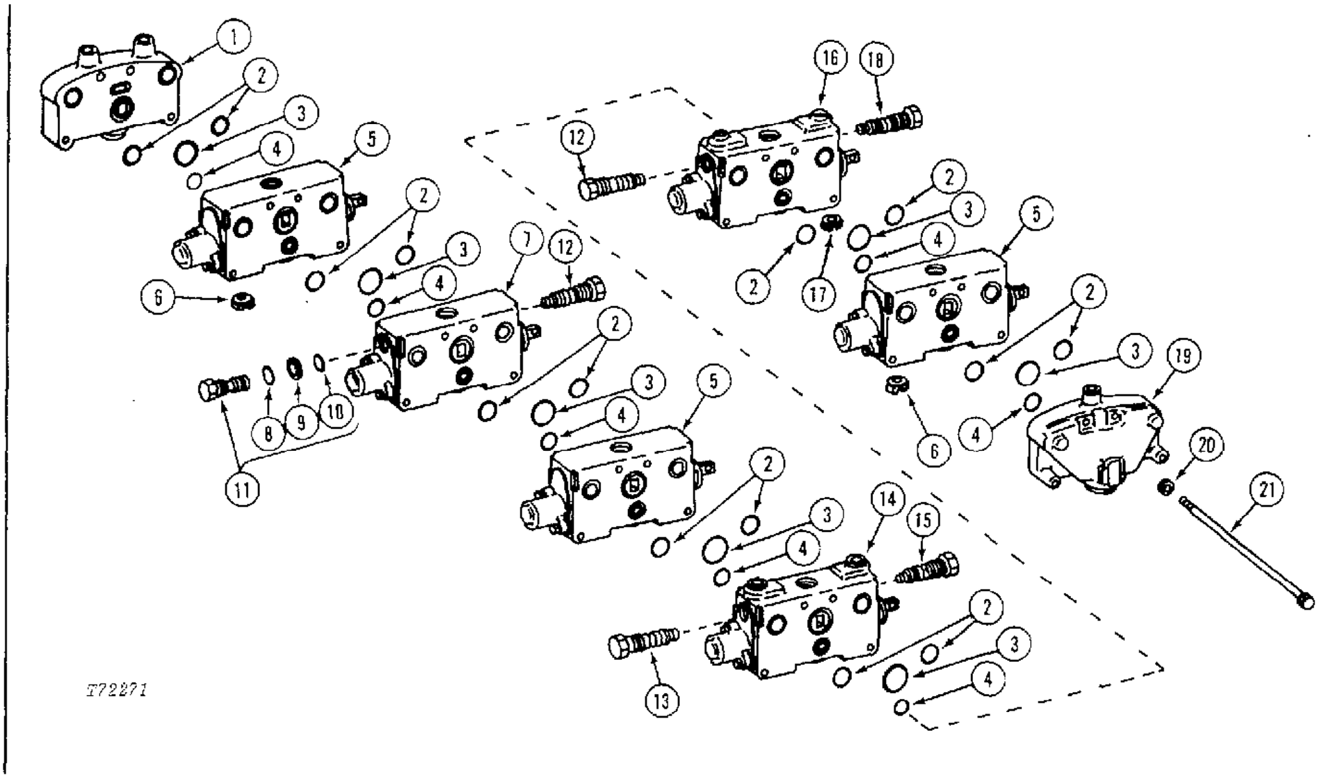
Put name tags on all hoses and lines (by number or description) to identify their locations on the valve stack so they can be correctly attached when the valve is installed. Disconnect all hoses from valves and valve lines. Put clean plastic plugs in all openings to keep dirt and other foreign material out of the hydraulic system.

IMPORTANT: Orifice plates are used in the control valve to limit return oil. Mark or tag orifice plates so that they may be assembled in the proper ports.

Remove cotter pins fastening control lever linkage to valve spools.

Remove cap screws holding control valve to valve box.

Remove control valve.



1—Left-Hand Port Plate
2—O-Ring (14 used)
3—O-Ring (7 used)
4—O-Ring (7 used)
5—Bucket and Stabilizer Valve
6—Orifice Plate (2 used)
7—Crowd Valve
8—O-Ring
9—Backup Washer
10—O-Ring
11—Plug Assembly
12—Relief Valve Assembly (2 used)
13—Relief Valve Assembly
14—Swing Valve
15—Relief Valve Assembly
16—Boom Valve
17—Orifice Plate
18—Relief Valve Assembly
19—Right-Hand End Plate
20—Lock Washer (4 used)
21—Special Screw (4 used)

Fig. 4-9550 Backhoe Control Valve

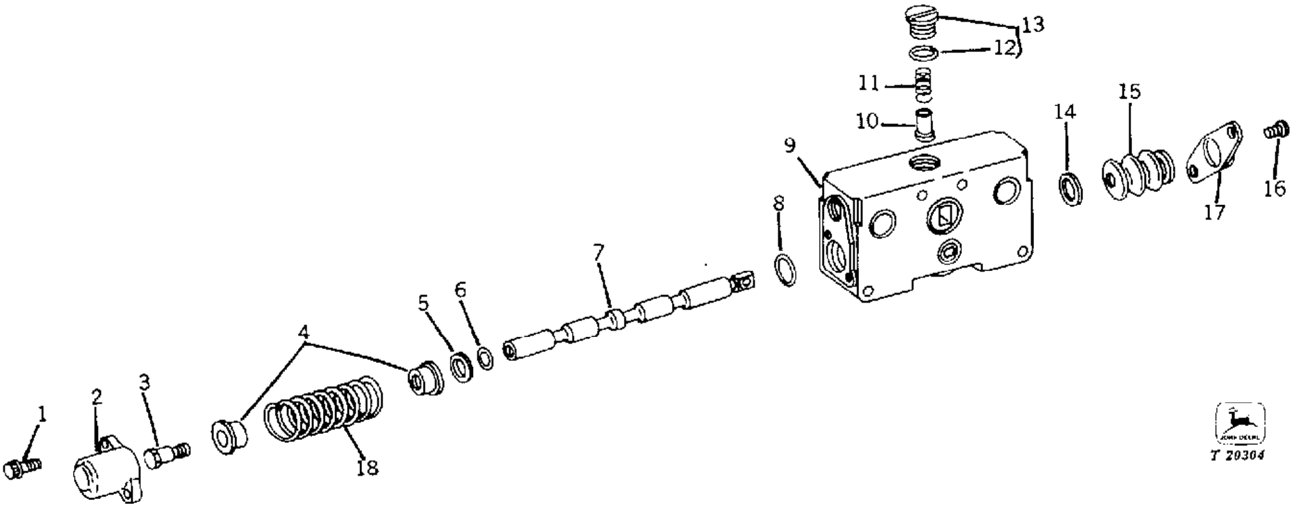
NOTE: Components of the control valve stack can be disassembled for inspection and repair as individual units without disassembling all parts. Therefore, refer only to the particular parts to be disassembled and disregard all other disassembly procedures.

Drain as much oil as possible from the valve stack. Thoroughly clean the outside of the valve stack assembly.

Mark or tag all valves of the valve stack (Fig. 1) before disassembly to assure proper assembly. Service individual valves separately and keep the valve housings and their spools together as these parts are matched assemblies.

Remove the tie bolts from end plate (Fig. 4), leaving tie bolts in place until disassembly is done. Slide valves off tie bolts one at a time and remove O-rings (Fig. 4) between valves.

One valve can be removed from the control valve stack without separating all valves. Follow the same procedure whether one valve is being removed or all valves are being separated.



1—Screw (2 used)
2—Cap Assembly
3—Spool Screw
4—Washers (2 used)
5—Retainer
6—O-Ring
7—Spool
8—O-Ring
9—Valve Housing
10—Plunger
11—Spring
12—O-Ring
13—Lift Check
14—Breather Washer
15—Spool Seal
16—Machine Screw (2 used)
17—Dust Seal Retainer
18—Centering Spring

Fig. 5-Control Valve Section (Stabilizer Valve Illustrated)

Remove end caps and remove spools from valve housings.

Clean and dry all parts thoroughly and inspect for wear and damage.

Check valve housing for damage or evidence of leakage. Replace housing and spool as a matched assembly.

Remove the anti-cavitation check valves from valve sections and inspect for damage. Check the anti-cavitation springs.

Free length .... 0.692 in. (17.58 mm)
Test length at 0.75 ± 0.1 lb. force ....0.625 in.
(3.3 ± 0.4 N........................ 15.88 mm)

Check centering spring (18, Fig. 5).
Test length at 27 lbs. force .... 1.25 in.
(120 N .... 31.7 mm)

Remove any burrs or rough spots from spool bodies with fine emery cloth. If spools are worn or damaged, replace spool and valve housing as a matched assembly.

Inspect hole in orifice plates for plugged condition. Install all plates with the smooth side toward the valve housing.

Inspect lift checks for damage. Check the lift check springs.

Free length .... 0.995 in. (25.29 mm)
Test length at 1.8 ± 0.2 lbs. force ....0.75 in.
(8 ± 0.9 N .... 19.0 mm)

Thoroughly clean and dry all parts. Put oil on all parts before assembly.

Replace all O-rings and backup washers with new parts.

Put T43512 John Deere Loctite Thread Lock and Sealer (Medium Strength) or an equivalent on the threads of spool screw (3, Fig. 5) before assembly.

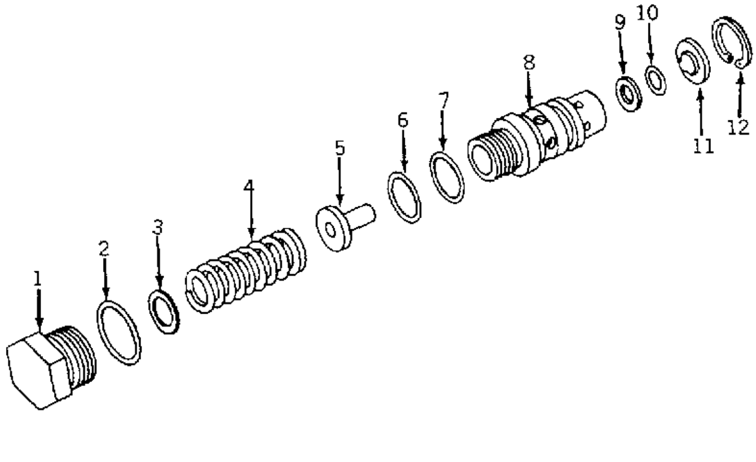
Install spools in proper valve section. Tighten spool screws (3, Fig. 5) to 5 to 8 lb-ft (6.8 to 10.8 N·m).

Install cap assembly (2) and tighten screws (1) to 10 to 13 lb-ft (13.6 to 17.6 N·m).

Stack port plate, valve sections, and end plate in proper sequence.

Install tie bolts and tighten evenly with 25 to 30 lb-ft (34 to 41 N·m).

RELIEF VALVE



1—Relief Valve Cage*
2—O-Ring
3—Shims (as required)
4—Spring*
5—Seat*
6—Back-up Washer
7—O-Ring
8—Cartridge
9—Back-up Washer
10—O-Ring
11—Poppet*
12—Snap Ring
Not available for service

Fig. 6-Direct Acting Circuit Relief Valve

REPAIR

Remove relief valve from valve housing.

Disassemble relief valve using Fig. 6 as a guide.

Put the hex. head of the relief valve cartridge in a vise and remove snap ring (12, Fig. 6), poppet (11) and cartridge (8).

Remove parts from valve cage (1).

Thoroughly clean and dry all parts. Inspect parts and replace as necessary.

When assembling the relief valve, be sure to use all the shims removed.

Assemble parts in cage and install cartridge, poppet and snap ring.

INSTALLATION

Install valve in valve box.

Attach control linkage to valve.

Install orifice plates (with smooth side toward valve) in valve and connect hoses.

NOTE: If it is believed that fragments of failed valve parts may have entered the hydraulic system, completely drain the system and replace the hydraulic filter.

CYLINDERS

GENERAL INFORMATION

The hydraulic cylinders used on the backhoe are double acting and use "V"-packing type seals on their pistons. Piston rods are heat treated, chrome plated, and polished. Replaceable non-metallic wear rings are used on 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.

The backhoe uses two cylinders to swing the boom. The cylinders are double acting and incorporate a hydraulic brake.

FOS

See "Hydraulic Cylinders" in FOS Manual - HYDRAULICS for additional information on cylinders and an explanation of the hydraulic cushion design.

REMOVAL

CAUTION: Be sure the bucket is on the ground and the engine is stopped before attempting to remove any cylinder.

Operate the backhoe controls until all hydraulic pressure is released. Remove the hoses and put clean plastic caps on 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.

Bucket Cylinder

Extend the boom and dipperstick. With bucket on the ground, support the dipperstick at the bucket end pivot point to prevent the bucket from pivoting.

Remove the bucket cylinder.

Boom Cylinder

Extend the boom and dipperstick. Rest the bucket on the ground.

Remove the boom cylinder.

Crowd Cylinder

Extend the boom and dipperstick (do not completely extend the dipperstick). Rest the bucket on the ground.

Place a support at the boom and dipperstick pivot point.

Remove the crowd cylinder.

Stabilizer Cylinders

Lower the stabilizers to the ground. Remove the stabilizer cylinder.

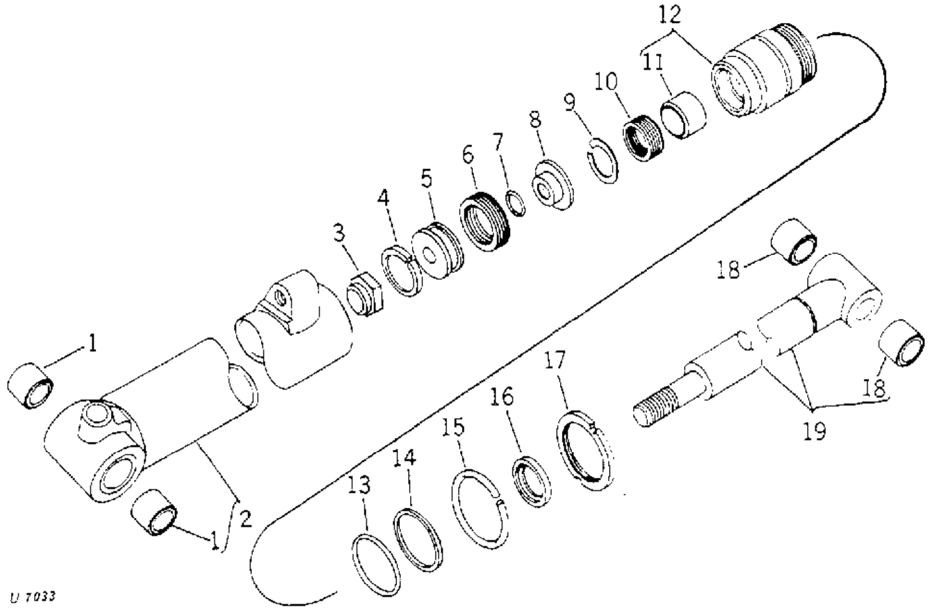
Swing Cylinders

Extend the boom and dipperstick. Rest the bucket on the ground to prevent the backhoe from swinging.

Operate control valve lever until all hydraulic pressure is relieved.

Remove cylinders and put clean plastic caps on all openings to prevent dirt entry.

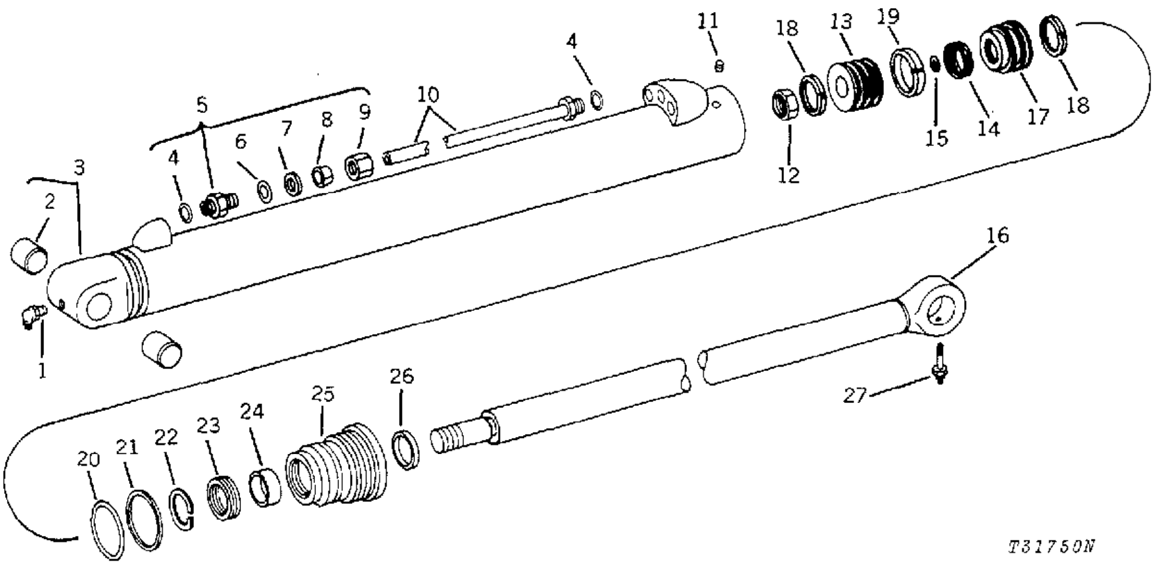
REPAIR



1—Bushing (2 used)
2—Head and 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—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

*Repair Kit

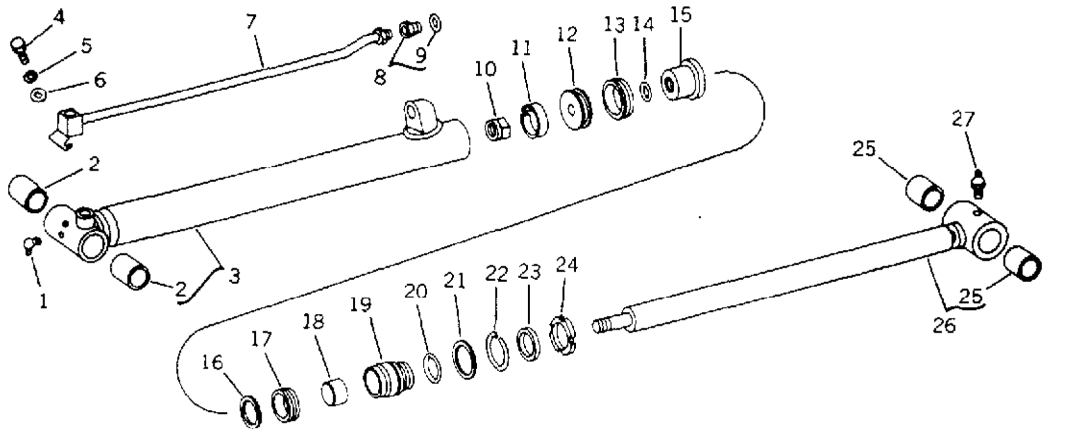
Fig. 7-9550 Backhoe Stabilizer Cylinder



1—Grease Fitting
2—Bushing (2 used)
3—Barrel
4—O-Ring (2 used)
5—Connector
6—O-Ring
7—Backup Washer
8—Sleeve
9—Nut
10—Return Tube
11—Set Screw
12—Lock Nut
13—Outer Piston
14—V-Packing*
15—O-Ring*
16—Piston Rod
17—Inner Piston
18—Brake Seal (2 used)
19—Wear Ring*
20—O-Ring*
21—Backup Washer*
22—Snap Ring
23—V-Packing*
24—Wear Ring*
25—Rod Guide
26—Wiper Seal*
27—Grease Fitting

**Repair Kit*

Fig. 8-9550 Backhoe Boom Cylinder Assembly

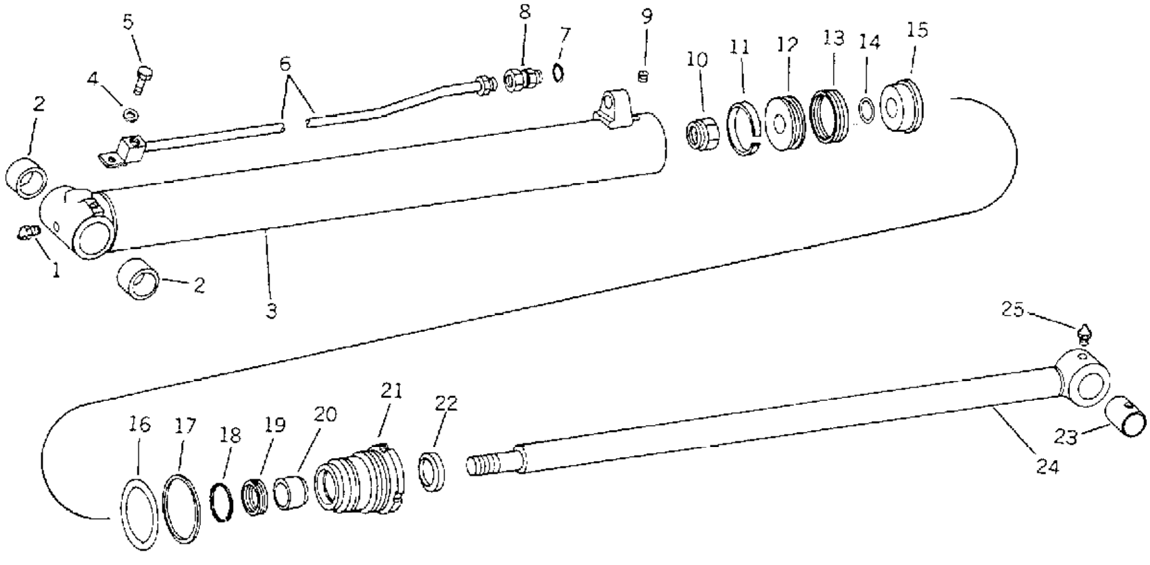


T29371

1—Grease Fitting
2—Bushing (2 used)
3—Barrel
4—Cap Screw
5—Lock Washer
6—Washer
7—Return Tube
8—Adapter
9—O-Ring
10—Lock Nut
11—Wear Ring*
12—Retainer
13—V-Packing*
14—O-Ring*
15—Piston
16—Snap Ring
17—V-Packing*
18—Wear Ring*
19—Rod Guide
20—O-Ring*
21—Backup Washer*
22—Snap Ring
23—Wiper Seal*
24—Spanner Nut
25—Bushing (2 used)
26—Piston Rod
27—Grease Fitting

**Repair Kit*

Fig. 9-9550 Backhoe Bucket Cylinder Assembly

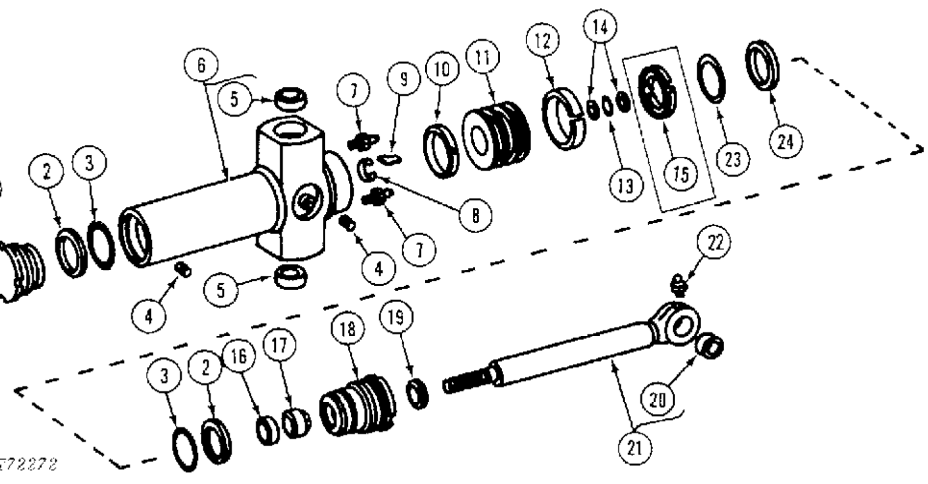


T36618

1—Grease Fitting
2—Bushing (2 used)
3—Barrel
4—Lock Washer
5—Cap Screw
6—Return Tube
7—O-Ring
8—Adapter
9—Set Screw
10—Lock Nut
11—Wear Ring*
12—Retainer
13—V-Packing*
14—O-Ring*
15—Piston
16—O-Ring*
17—Backup Washer*
18—Snap Ring
19—V-Packing*
20—Wear Ring*
21—Rod Guide
22—Wiper Seal*
23—Bushing
24—Piston Rod
25—Grease Fitting

*Repair Kit

Fig. 10-9550 Backhoe Crowd Cylinder Assembly



T72272

1—Cylinder Head
2—Backup Washer (2 used)
3—O-Ring (2 used)
4—Set Screw (2 used)
5—Trunnion Bushing (2 used)
6—Barrel and Trunnion Assembly
7—Grease Fitting (2 used)
8—Snap Ring
9—Locking Ring
10—Step Seal Ring
11—Piston
12—Wear Ring
13—O-Ring
14—Backup Ring (2 used)
15—Two Piece Ring Seal (-39796)*
16—Rod Seal
17—Wear Ring
18—Rod Guide
19—Wiper Seal
20—Bushing
21—Piston Rod
22—Grease Fitting
23—Seal (39797-)*
24—Piston Seal Ring (39797-)*

*Backhoe Serial Number

Fig. 11-9550 Backhoe Swing Cylinder

Disassembly

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filter.

Clamp the cylinder in a vise to prevent it from turning. Remove set screw and rod guide. Use a D-05027ST Special Spanner Wrench to loosen rod guide.

On cylinders using spanner nut, remove spanner nut and push the rod guide into the barrel just far enough to remove the snap ring. Do not push rod guide too far into the barrel or the rod guide O-ring will enter the oil port and be damaged.

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 stop nut from end of rod. Remove parts from end of rod.

Inspection

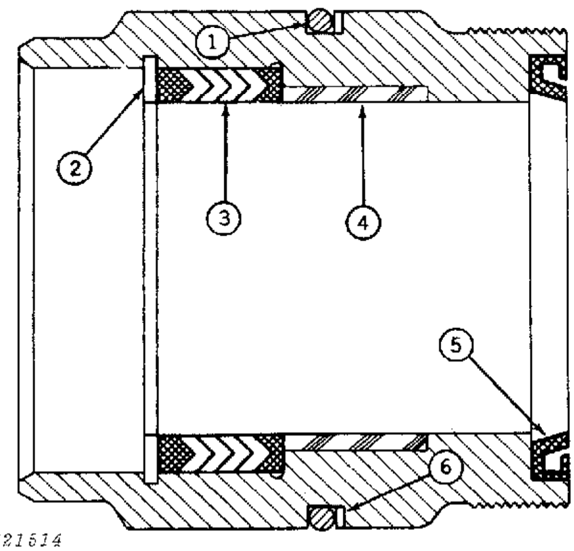
Wash all parts thoroughly with diesel fuel and inspect the following:

1. Barrel, rod guide and rod for scoring, and O-rings for surface damage.

2. V-packings and wear rings for breaks, cuts or embedded foreign material.

3. Piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.

Assembly



1—O-Ring
2—Snap Ring
3—V-Packing
4—Wear Ring
5—Wiper Seal
6—Backup Washer

Fig. 12-Rod Guide Components (spanner nut type rod guide shown)

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.

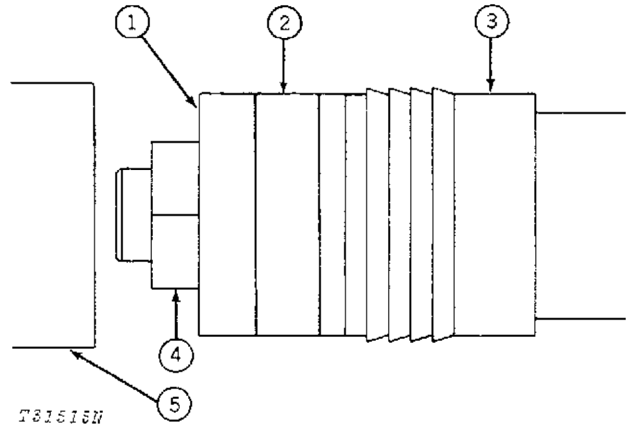
Install new wiper seal (5, Fig. 12) in rod guide.

Install new wear ring (4) in rod guide. Install backup washer (6) and O-ring (1) on rod guide.

Install V-packing (3) in rod guide with the apex of the V toward the wiper seal and fasten with snap ring (2).

Install rod guide assembly on piston rod being careful not to damage packing.

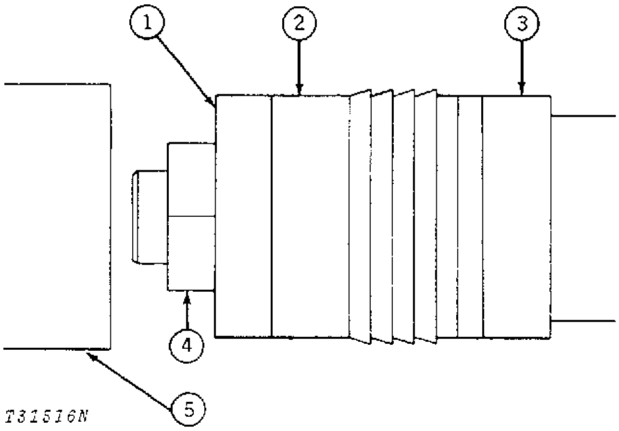
Installing Piston V-Packing



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 13-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. 13). When replacing V-packings in the field this procedure can be used if a suitable ring compressor is available to compress packings when installed in cylinder.



1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 14-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. 14). 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.

NOTE: On the 9550 Backhoe boom cylinder install brake seal (18, Fig. 8) on the inner piston (17) with the word "UP" toward the rod end of the cylinder. Install brake seal (18) on the outer piston (13) with the word "UP" toward the head end of the cylinder.

Install piston on piston rod. Install wear ring on piston retainer. Install retainer on piston rod and fasten with lock nut. See chart below.

CYLINDER	LOCK NUT TORQUE
Stabilizer	475 to 575 lb-ft (644 to 780 N·m)
Boom	950 to 1050 lb-ft (1288 to 1424 N·m)
Crowd	600 to 700 lb-ft (814 to 949 N·m)
Bucket	150 to 250 lb-ft (203 to 339 N·m)

Install piston rod assembly into barrel.

Put AT52853 John Deere Loctite Thread Lock and Sealer (Low Strength) or an equivalent on the threads of the rod guide and set screw (if used) before assembly.

Install piston rod assembly in barrel with rod guide and tighten to specified torque. Install set screw (if used) and tighten after rod guide is tightened to proper torque. See chart below.

CYLINDER	ROD GUIDE TORQUE	SET SCREWS TORQUE
Stabilizer	125 to 175 lb-ft (170 to 237 N·m)	—
Boom	250 to 300 lb-ft (339 to 407 N·m)	40 lb-in (4.5 N·m)
Crowd	250 to 300 lb-ft (339 to 407 N·m)	40 lb-in (4.5 N·m)
Bucket	125 to 175 lb-ft (170 to 237 N·m)	—

Swing Cylinder

Clamp cylinder in a vise to prevent it from turning.

Using a D-050270ST Special Spanner Wrench, remove cylinder head (1, Fig. 11) and rod guide (18). Pull piston rod assembly from barrel and trunnion assembly (6).

Remove snap ring (8) and locking ring (9) from piston rod. Remove piston from rod. Remove rod guide.

Wash all parts thoroughly with diesel fuel and inspect as follows:

Check barrel, rod guide and rod for scoring. Check O-rings for surface damage.

Check rod seal and wear rings for breaks, cuts, or embedded foreign material.

Check piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.

NOTE: Before Backhoe Serial No. 39797, cast iron two piece ring seal (15, Fig. 11) is used. After 39797 two seals (23 and 24) are used. Install the thin seal first, then the thick seal over it.

Thread piston (11, Fig. 11) on piston rod (21) until it bottoms. Reverse piston off piston rod to first alignment of slot in piston rod with slot in piston. Install locking ring (9). Install snap ring (8), making sure gap in snap ring is turned 180° from locking ring.

Put AT52853 John Deere Loctite Thread Lock and Sealer (Low Strength) or an equivalent on the threads of the cylinder end and rod guide before assembly.

Tighten cylinder end (1) and rod guide (18) to 250 to 300 lb-ft (339 to 407 N·m).

INSTALLATION

Put the cylinder in position on the machine and align the attaching holes. Install pivot pins and fasten 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 3399B
SPECIFICATIONS AND SPECIAL TOOLS
HYDRAULIC SYSTEM
SPECIFICATIONS AND TORQUE VALUES

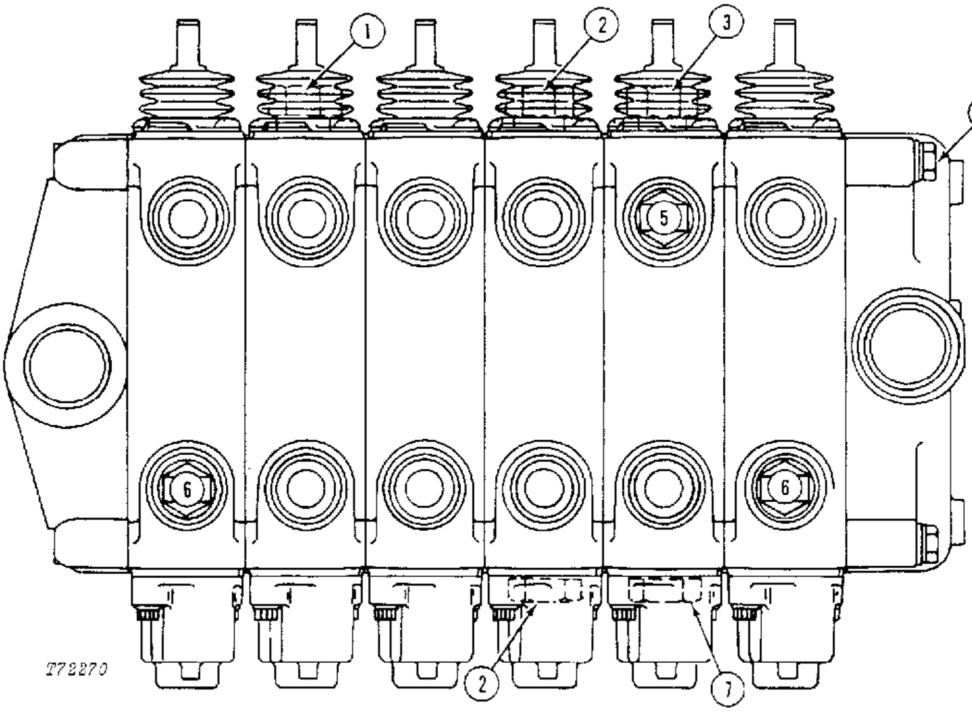


Fig. 1-9550 Backhoe Control Valve

1 - Crowd relief valve setting .... 2500 psi (17 238 kPa) (172 bar)

2 - Swing relief valve setting .... 2375 psi (16 376 kPa) (164 bar)

3 - Boom relief valve setting .... 2750 psi (18 961 kPa) (190 bar)

4 - Tie bolt torque .... 25 to 30 lb-ft (34 to 41 N·m)

5 - Boom orifice size .... 0.219 in. (5.56 mm)

6 - Stabilizer orifice size .... 0.1405 in. (3.57 mm)

7 - Boom relief valve setting .... 2500 psi (17 238 kPa) (172 bar)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

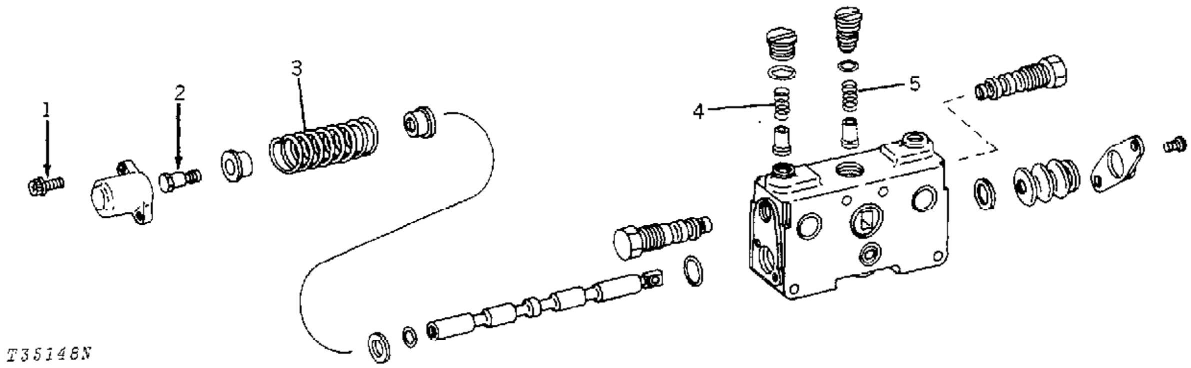


Fig. 2-Valve Section (Boom Illustrated)

1 - Cap assembly screw
torque .... 10 to 13 lb-ft
(13.6 to 17.6 N·m)

2 - Spool screw toque .... 5 to 8 lb-ft
(6.8 to 10.8 N·m)

3 - Spool spring
Test length at 27 lbs. force .... 1.25 in.
(120 N .... 31.7 mm)

4 - Anti-cavitation spring
Free length .... 0.692 in. (17.58 mm)
Test length at 0.75 ± 0.1 lb. force .... 0.625 in.
(3.3 ± 0.4 N.................... 15.88 mm)

5 - Lift check spring
Free length .... 0.995 in. (25.29 mm)
Test length at 1.8 ± 0.2 lbs. force ..... 0.75 in.
8 ± 0.9 N .... 19.0 mm)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

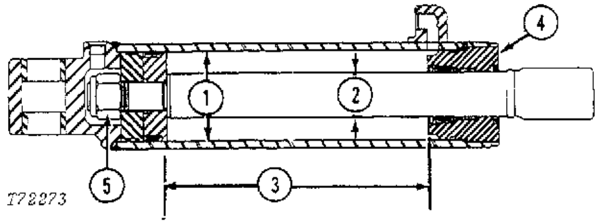


Fig. 3-9550 Backhoe Stabilizer Cylinder

Stabilizer Cylinder

1 - Cylinder bore .... 3.496 to 3.500 in. (88.80 to 88.90 mm)

2 - Rod diameter .... 1.7485 to 1.7515 in. (44.41 to 44.49 mm)

3 - Cylinder stroke .... 15.50 in. (393.70 mm)

4 - Spanner nut torque .... 125 to 175 lb-ft 170 to 237 N·m)

5 - Lock nut torque .... 475 to 575 lb-ft (644 to 780 N·m)

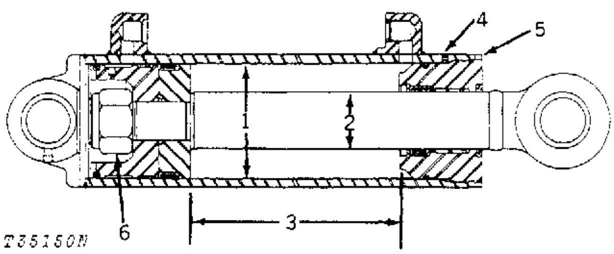


Fig. 4-9550 Backhoe Boom Cylinder

Boom Cylinder

1 - Cylinder bore .... 3.996 to 4.000 in. (101.5 to 101.6 mm)

2 - Rod diameter .... 1.9985 to 2.0015 in. (50.76 to 50.84 mm)

3 - Cylinder stroke .... 32.38 in. (822.5 mm)

4 - Set screw torque .... 40 lb-in (4.5 N·m)

5 - Rod guide torque............. 250 to 300 lb-ft (339 to 407 N·m)

6 - Lock nut torque .... 950 to 1050 lb-ft (1288 to 1424 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

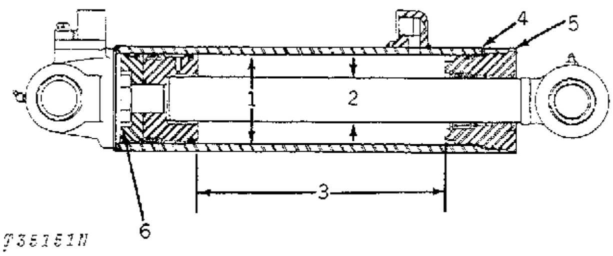


Fig. 5-9550 Backhoe Crowd Cylinder

Crowd Cylinder

1 - Cylinder bore .... 3.496 to 3.500 in. (88.80 to 88.90 mm)

2 - Rod diameter .... 1.7485 to 1.7515 in. (44.41 to 44.49 mm)

3 - Cylinder stroke ....31.85 in. (809.0 mm)

4 - Set screw torque .... 40 lb-in. (4.5 N·m)

5 - Rod guide torque............. 250 to 300 lb-ft (339 to 407 N·m)

6 - Lock nut torque .... 600 to 700 lb-ft (814 to 949 N·m)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

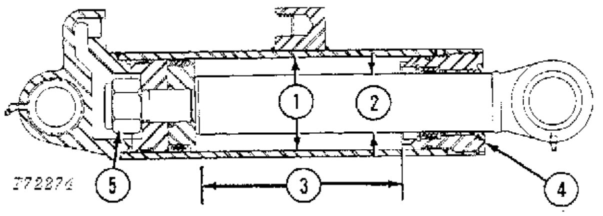


Fig. 6-9550 Backhoe Bucket Cylinder

Bucket Cylinder

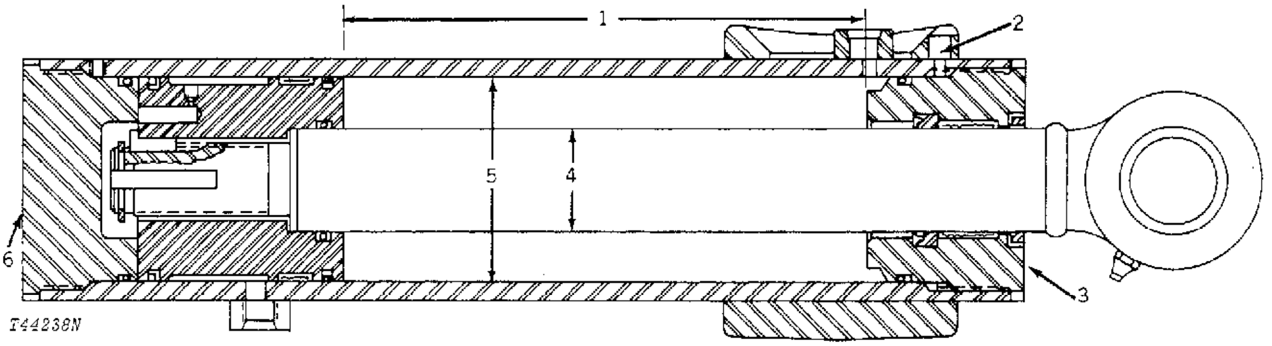
1 - Cylinder bore .... 2.996 to 3.000 in. (76.10 to 76.20 mm)

2 - Rod diameter .... 1.7485 to 1.7515 in. (44.41 to 44.49 mm)

3 - Cylinder stroke .... 26.50 in. (673.1 mm)

4 - Spanner nut torque .... 125 to 175 lb-ft (170 to 237 N·m)

5 - Lock nut torque .... 150 to 250 lb-ft (203 to 339 N·m)



1 - Cylinder stroke .... 8.88 in. (225.6 mm)

2 - Set screw torque .... 40 lb-in (4.5 N·m)

3 - Rod guide torque .... 250 to 300 lb-ft (339 to 407 N·m)

4 - Rod diameter .... 1.75 in. (44.45 mm)

5 - Cylinder bore .... 3.498 in. (88.85 mm)

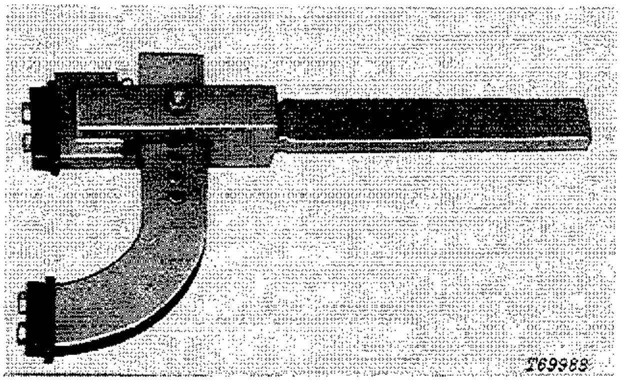
6 - Cylinder head torque .... 250 to 300 lb-ft (339 to 407 N·m)

Fig. 7-9550 Backhoe Swing Cylinder

HYDRAULIC SYSTEM

SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
 T69983 *Fig. 8-Special Spanner Wrench*	D-050270ST or D-01053AA (not shown)	Remove and install cylinder rod guides and spanner nuts

Section 37
LOG ARCH

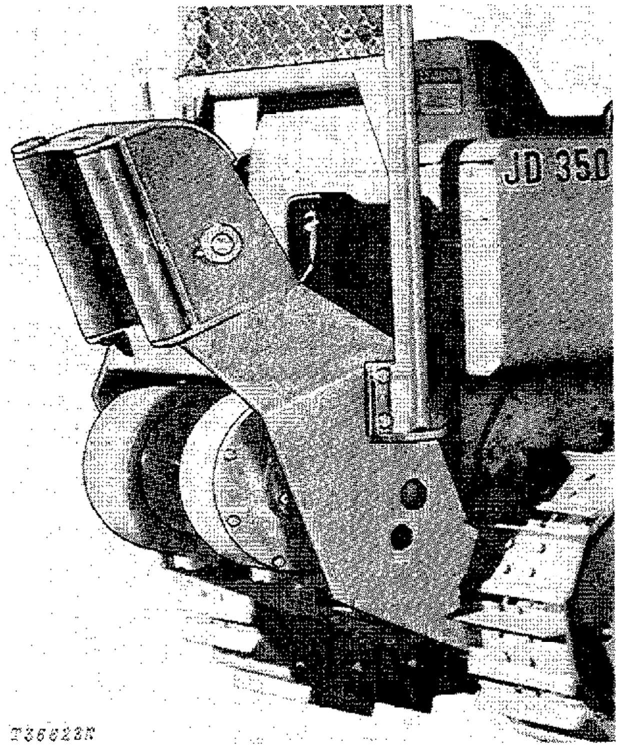
CONTENTS OF THIS SECTION

Group 3740
ARCH FRAMES

GENERAL INFORMATION

The 3600 Log Arch carries logs high to obtain less skidding.

The log arch is equipped with a 3-roller fairlead which permits side draft and heavy pull with minimum cable wear.



T36623N

Fig. 1-Log Arch

REMOVAL

Remove ROPS as directed in Section 18, Group 1810.

Attach a hoist to the horizontal roller of the fairlead.

Remove cap screws (17 and 19, Fig. 2) attaching log arch to steering clutch housing.

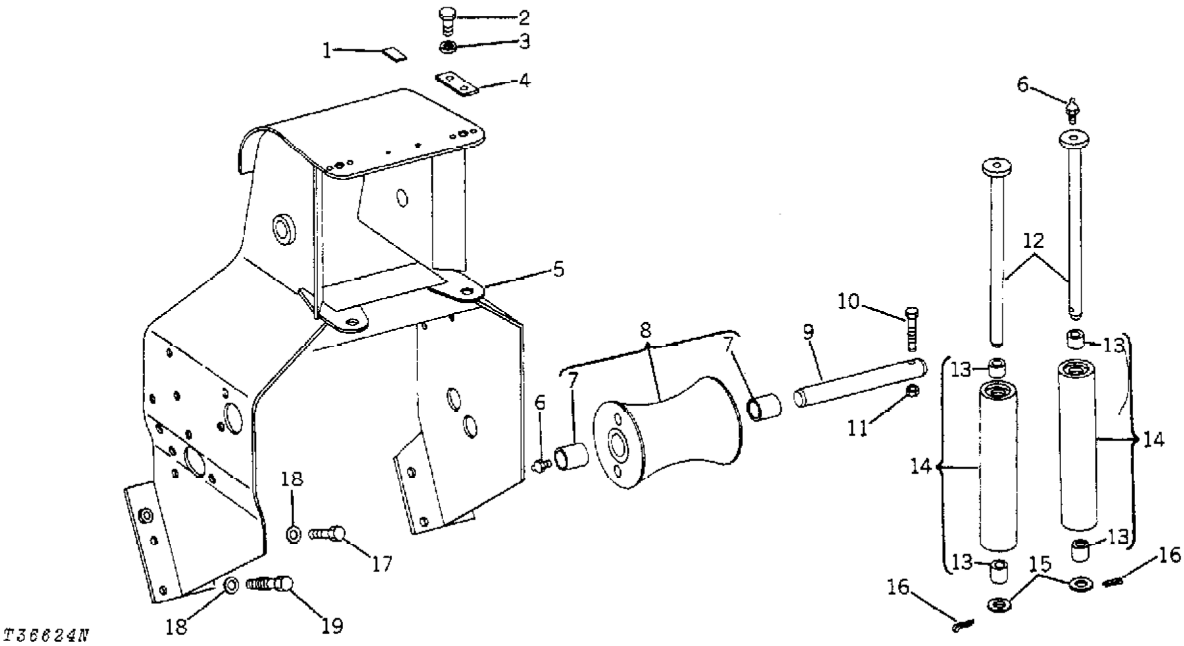
Lower log arch to the ground.

REPAIR

Examine parts for damage and replace if necessary.

Refer to Fig. 2 during disassembly and assembly.

Note the following during assembly: Press bushing (7) flush with finished surface on each end of horizontal roller.



1—Pad (2 used)
2—Cap Screw (4 used)
3—Washer (4 used)
4—Shim (8 used)
5—Frame Assembly
6—Grease Fitting (4 used)
7—Bushing (2 used)
8—Horizontal Roller
9—Pin
10—Cap Screw
11—Lock Nut
12—Side Roller Pin (2 used)
13—Bronze Bushing (4 used)
14—Side Roller (2 used)
15—Thrust Washer (2 used)
16—Cotter Pin (2 used)
17—Cap Screw (4 used)
18—Lock Washer (4 used)
19—Cap Screw (2 used)

Fig. 2-Log Arch and Mounting Parts

INSTALLATION

Reverse removal procedure to install log arch.

Section 40
PTO AND WINCH DRIVE

CONTENTS OF THIS SECTION

Group 4015
PTO CONTROLS

GENERAL INFORMATION

The PTO attachment couples to the transmission powershaft which extends to the front wall of the ring gear compartment in the transmission case. The powershaft is coupled to the powershaft cluster driven gear by a coupling controlled by the PTO control lever on top of the transmission case.

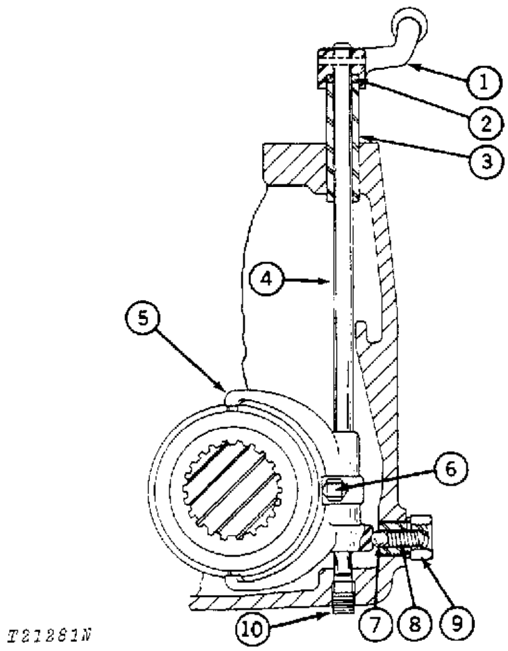
REMOVAL

Refer to Section 3, Group 0341 and remove transmission from crawler.

Refer to Section 3, Group 0350 and remove input shaft, output shaft, and powershaft from transmission case.

Unlock the set screw (6, Fig. 1) on shifter fork and remove set screw.

Pull shifter shaft (4) from fork, and lift shaft with lever from transmission case.



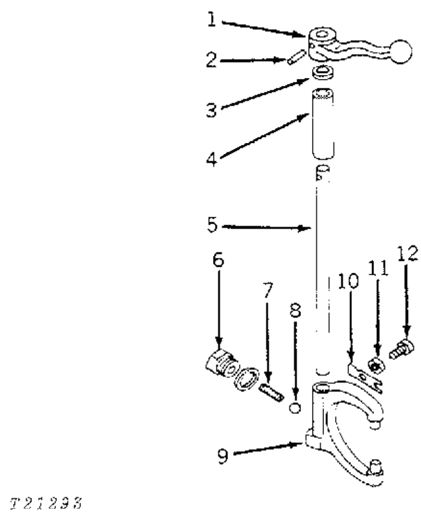
1—Shifter Lever
2—Felt Washer
3—Bushing
4—Shaft
5—Fork
6—Set Screw, Jam Nut and Lock
7—Ball
8—Spring
9—Poppet Holder
10—Pipe Plug

Fig. 1-Powershaft Shifter Mechanism (with PTO)

REPAIR

If it is necessary to install a new shifter shaft bushing (4, Fig. 2) into transmission case, select a suitable driver, and drive new bushing into case, leaving 1/4-in. (6 mm) of the bushing protruding above the top of the case.

If shifter lever (1) was removed from the shaft, assemble parts with lever pointing toward rear and set screw recess at bottom of shaft pointing toward front. Secure lever to shaft with new groove pin. Slip a new felt washer (3) into recess in lever and slide shaft through bushing in transmission case. Install fork (9) on lower end of shaft with open end facing toward right side of case when lever points to the rear. Use a new lock (10) under set screw. Tighten set screw and bend tang of lock up around head.



1—Shifter Lever
2—Groove Pin
3—Felt Washer
4—Bushing
5—Shaft
6—Poppet Holder
7—Spring
8—Ball
9—Fork
10—Lock
11—Jam Nut
12—Set Screw

Fig. 2-Powershaft Shifter Mechanism

INSTALLATION

IMPORTANT: Make sure poppet ball does not drop into transmission case during installation.

Refer to Fig. 1 and 2 for identification of parts and sequence of installation.

Refer to Removal and reverse procedure.

Group 4051
GEARS, SHAFTS AND BEARINGS
POWER TAKE-OFF
GENERAL INFORMATION

The 540 rpm power take-off attachment consists of a compact drive mechanism which attaches directly to the transmission rear cover.

The PTO attachment couples to the transmission powershaft which extends to the front wall of the ring gear compartment in the transmission case. The powershaft is coupled to the powershaft cluster driven gear by a coupling controlled by the PTO control lever on top of the transmission case. The cluster gear meshes with the input shaft gears and rotates whenever the engine is running and the engine clutch is engaged.

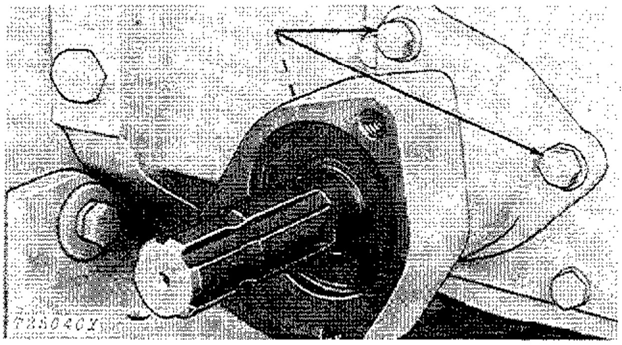


Fig. 1-PTO Attaching Points

REMOVAL

Drain oil from transmission. Drain into clean container so that oil can be re-used if it is in good condition.

Remove the three cap screws holding PTO attachment to transmission rear cover (Fig. 1).

Slide the powershaft attachment from transmission rear cover (Fig. 2).

Discard old gasket.

Refer to Fig. 3, page 4051-2 for identification and location of parts.

Pry oil seal from bore in housing and discard.

Remove the large snap ring securing shaft and bearing in housing. Withdraw shaft and ball bearing.

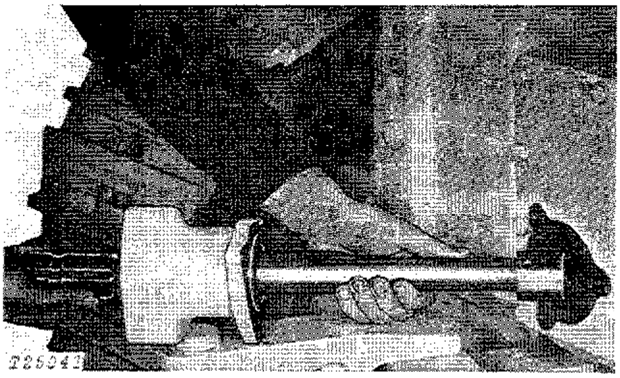
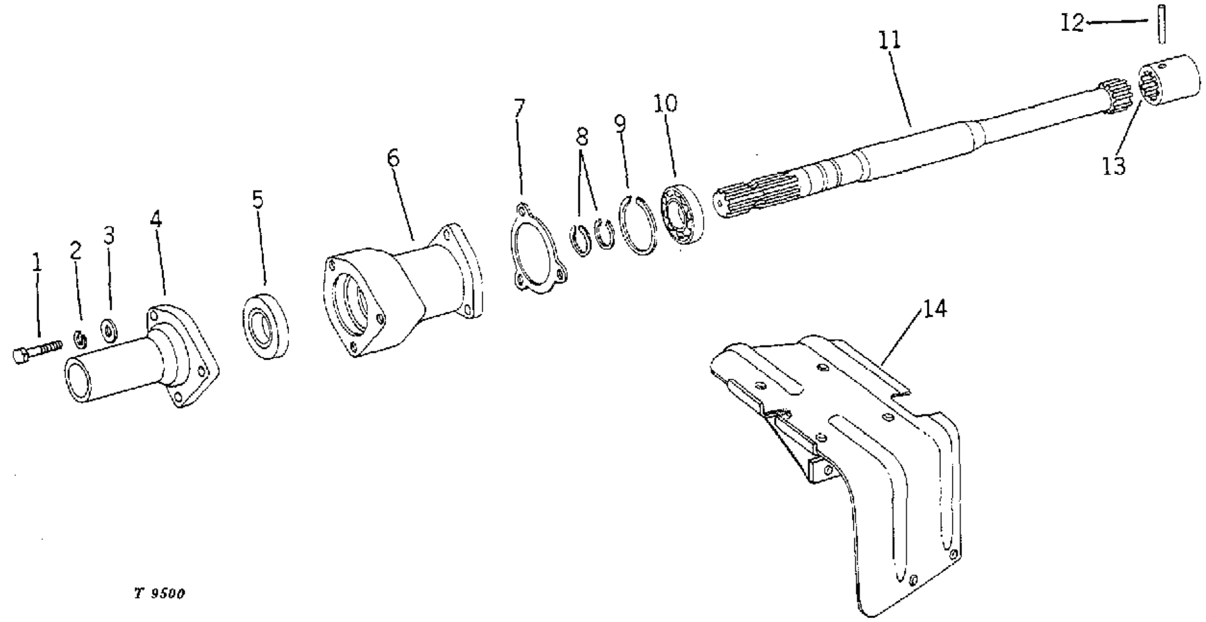


Fig. 2-Removing Powershaft Attachment

REPAIR



1—Cap Screw (3 used)
2—Lock Washer (3 used)
3—Washer
4—Guard
5—Oil Seal
6—Housing
7—Gasket
8—Snap Ring (2 used)
9—Snap Ring
10—Ball Bearing
11—Powershaft
12—Spring Pin
13—Coupling
14—Shield

Fig. 3-Power Take-Off Attachment

Inspect ball bearing on shaft. Rotate bearing to see if it rotates freely. If bearing needs replacing, remove snap rings on either side of bearing and remove bearing. Install new bearing by pressing on inner race only. Secure with snap rings.

Inspect splines on shaft for damage. Check to see that shaft is not bent. Check coupling on shaft for wear. Replace parts as necessary.

INSTALLATION

Place shaft and ball bearing assembly in housing. Tap on end of shaft if necessary to seat bearing in place. Secure with large snap ring. Install coupling on transmission end of shaft (short splines).

Coat sealing lips of new seal with Lubriplate and press seal in flush with bottom of counterbore in housing. Sealing lip must face ball bearing.

Using a new gasket, slide powershaft (coupling end) into port in transmission rear cover. Align splines on coupling with splines on powershaft in transmission.

Secure the attachment to transmission rear cover with the three attaching cap screws.

Fill transmission with quantity and type of oil recommended.

WINCH DRIVE

GENERAL INFORMATION

The winch drive shaft consists of a shaft rotating on a ball bearing in the transmission rear cover. This shaft provides power for winch operation.

The shaft is coupled to the transmission reduction shaft and receives its power in the same manner as the PTO attachment described above.

REMOVAL

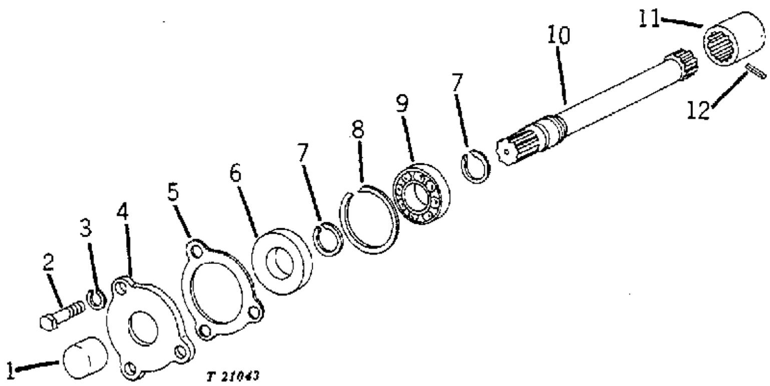
Refer to Section 30, Group 3041 and remove winch from crawler.

After oil has been drained from transmission remove the three cap screws fastening guard to rear of transmission.

Discard the old gasket.

Pry out oil seal in bore of rear cover. Remove the large snap ring holding bearing and shaft in cover. Slide winch drive shaft with ball bearing from transmission case.

REPAIR



1—Plug
2—Cap Screw (3 used)
3—Lock Washer (3 used)
4—Guard
5—Gasket
6—Oil Seal
7—Snap Ring (2 used)
8—Snap Ring
9—Ball Bearing
10—Drive Shaft
11—Coupling
12—Spring Pin

Fig. 4-Power Winch Drive Shaft

Refer to Fig. 4, page 4051-3 for identification of parts.

Check condition of ball bearing on shaft. Bearing must rotate smoothly. If necessary remove bearing and install new bearing by pressing on inner race of bearing only. Secure with snap rings.

Check coupling on shaft for damage. Check splines on shaft for damage. Examine shaft for bent condition. Replace with new parts if necessary.

Check winch drive shaft guard for cracks or damage, especially in center portion of guard.

INSTALLATION

Insert winch drive shaft with bearing into transmission case. Splines on coupling fit over splines of PTO shaft inside transmission case.

Secure shaft and bearing by installing the large snap ring behind bearing in transmission rear cover.

Install oil seal. Lubricate oil seal lips with Lubriplate and press seal (lips inward) to flush with outside surface of transmission rear cover.

Secure guard using three cap screws. Be sure to use a new gasket.

Fill transmission with quantity and type of oil recommended.

Group 4158
OUTPUT SHAFT OR PULLEY

CONTENTS OF THIS SECTION

Group 4158
OUTPUT SHAFT OR PULLEY

GENERAL INFORMATION

The belt pulley assembly is a bevel gear-type unit which is splined to and driven by the 540-rpm PTO powershaft.

REMOVAL

CAUTION: Make sure the crawler engine is shut off and the PTO lever disengaged before removal of belt pulley.

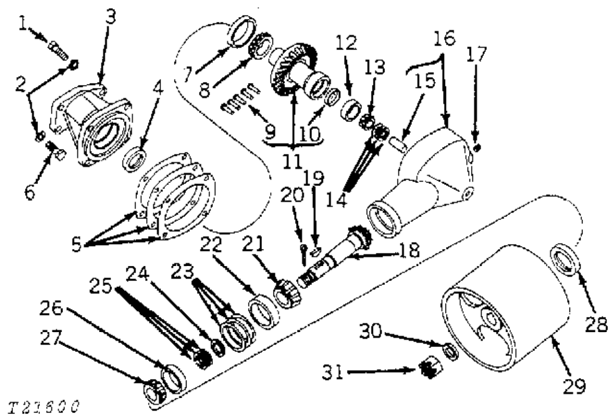
Remove cap screws (6, Fig. 1) attaching belt pulley to the powershaft. Pull belt pulley straight out from the powershaft.

Install powershaft guard.

REPAIR

Refer to Fig. 1 for relationship of parts in disassembly and inspection.

Inspect all parts for excessive wear or damage. Replace when necessary.



1—Cap Screw (4 used)
2—Lock Washer (7 used)
3—Quill
4—Oil Seal
5—Shim (approx. 9 used)
6—Cap Screw (3 used)
7—Bearing Cup
8—Bearing Cone
9—Rivet (5 used)
10—Cup Plug
11—Ring Gear
12—Bearing Cup
13—Bearing Cone
14—Shim (approx. 7 used)
15—Shaft
16—Case
17—Plug
18—Pinion Shaft
19—Woodruff Key
20—Cotter Pin
21—Bearing Cone
22—Bearing Cup
23—Shim (approx. 7 used)
24—Spacer
25—Shim (approx. 10 used)
26—Bearing Cup
27—Bearing Cone
28—Oil Seal
29—Belt Pulley
30—Washer
31—Nut

Fig. 1-Belt Pulley Assembly

Pinion Shaft Preload Adjustment

Install pinion shaft, bearing cone and bearing (18, 21, and 22, Fig. 1) in the gear case.

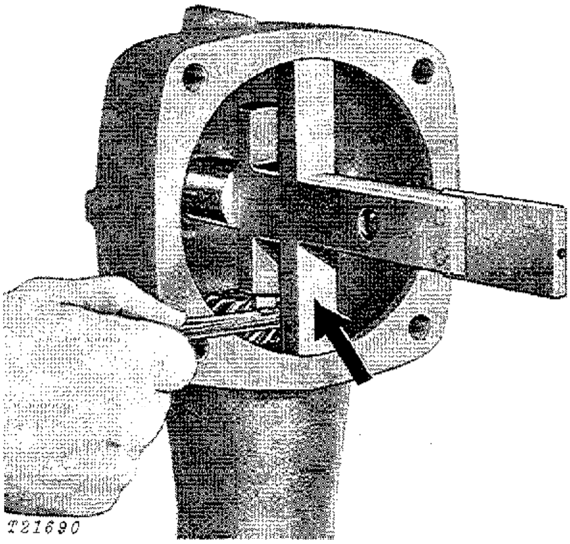


Fig. 2-Set Gauge Installed

Install set gauge (Fig. 2). Rotate pinion until maximum feeler gauge reading is obtained between tongue of set gauge and end of pinion shaft.

The feeler gauge reading is the thickness of the shim pack to be installed behind the inner bearing cup.

Assemble the remaining parts of the pinion assembly with a 0.040 inch (1.02 mm) temporary shim pack between the outer bearing and the pinion shaft. Check end play. Deduct shims to obtain correct preload of 0.000 to 0.003 inch (0.00 to 0.08 mm).

Tighten nut (31, Fig. 1) to 670 lb-ft. (124 kg-m).

Ring Gear and Pinion Backlash

Install temporary shim pack (14, Fig. 1) under inner bearing cone (13) until correct gear backlash (0.004 to 0.006 inch [0.10 to 0.15 mm]) is determined.

Position quill on belt pulley case and install two cap screws finger tight on opposite sides of quill. Use feeler gauge to measure clearance between case and quill to determine shim pack required between case and quill.

Install shim pack (5) and secure quill to belt pulley case with cap screws. Install set gauge into belt pulley drive gear hub and tap lightly to insure a snug fit between splines.

Shim pack is temporary until correct gear backlash and quill assembly end play is determined.

Measure gear backlash (Fig. 3).

To change gear backlash, remove gauge and quill. Add or deduct shims (14, Fig. 1) under inner bearing cone.

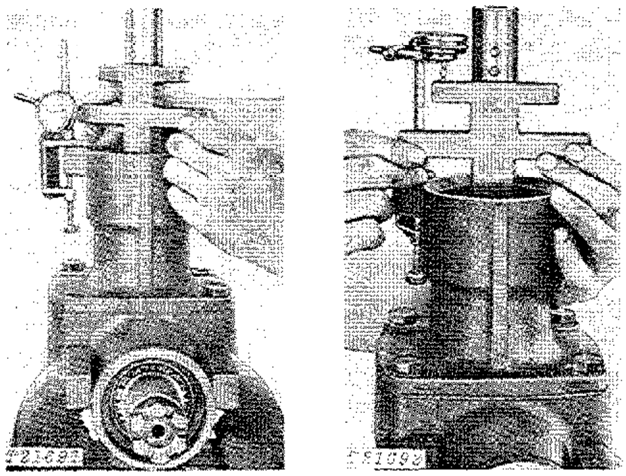


Fig. 3-Adjusting Drive Gear Bearings

Drive Shaft Bearing End Play

Use a dial indicator to check end play of set gauge tool (Fig. 3). Add or deduct shims between the quill and the case to obtain bearing end play of 0.002 to 0.004 inch (0.05 to 0.10 mm).

NOTE: An indicator reading of 0.000 inch can indicate preload rather than zero end play. Be sure to add enough shims to obtain some end play before making final adjustment.

Fill belt pulley case to level of filler hole with recommended lubricant (see Section I, Group V).

INSTALLATION

CAUTION: Make sure the crawler engine is shut off and the PTO lever disengaged before installation.

Remove powershaft guard.

Attach belt pulley assembly to powershaft with stud on powershaft attachment.

Secure with cap screws and lock washers.

Lock swinging drawbar to the right.

Attaching Belt

In preparation for belt work, aligning the crawler correctly with belt-driven equipment is very important.

The following procedure is recommended:

1. Place belt on pulley of driven equipment.

2. Stretch belt to its full length as straight as possible from pulley of driven equipment.

3. Back the crawler toward driven equipment straddling belt. **IMPORTANT: Do not drive crawler over belt.**

4. Drive forward, watching to see that belt is aligning with pulley on crawler.

5. Slip belt over pulley on crawler and drive forward slowly until belt is tight. Shift transmission into neutral. Engage powershaft control lever and release clutch slowly, watching belt to see that alignment is correct.

6. If alignment is not perfect, back crawler slightly; then drive forward, steering in the direction necessary to obtain correct alignment.

7. Lock foot brake to hold crawler in position.

CAUTION: Always start a belt load slowly. Never leave crawler running unattended when making adjustments on crawler or driven machine, even though clutch is disengaged. Never use a stick to force a belt on or off a revolving pulley.

Group 4199
SPECIFICATIONS AND SPECIAL TOOLS
OUTPUT SHAFT OR PULLEY
SPECIFICATIONS AND TORQUE VALUES

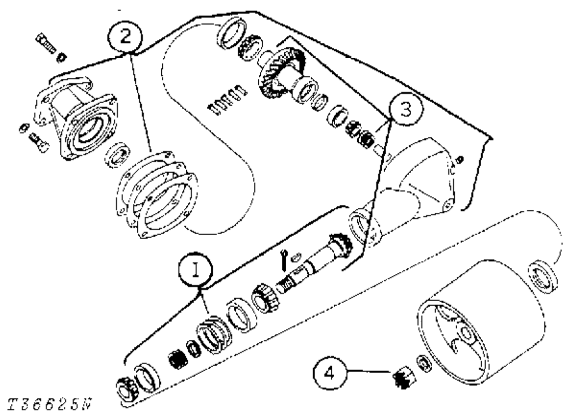


Fig. 1-Belt Pulley

1 - Pinion Shaft Bearing Pre-load .... 0.000 to 0.003 in. (0.000 to 0.08 mm)

2 - Drive Shaft Bearing End Play .... 0.002 to 0.004 in. (0.05 to 0.10 mm)

3 - Pinion and Ring Gear Backlash (Measured approximately 2.375 in. [60.33 mm] From Center of Drive Shaft) ...... 0.004 to 0.006 in. (0.10 to 0.15 mm)

4 - Belt Pulley-To Pinion Shaft Nut Torque .... 670 lb-ft. (124 kg-m)

SPECIAL TOOLS

Essential Tools

Tool No.	Use
JD278 Set Gauge	To Adjust Belt Pulley

Section 42
GROUND CONDITIONING TOOL

CONTENTS OF THIS SECTION

Group 4201
TEETH AND SHANKS

GENERAL INFORMATION

Three teeth are furnished with the ripper as regular equipment; however, one to five teeth may be used depending upon the job to be done.

Teeth can be set in three depth positions (7, 8-1/2, and 10 inches [177.8, 216, and 254 mm]) depending upon the penetration desired. See Section 90, Group 9030 for adjustment of tooth shanks.

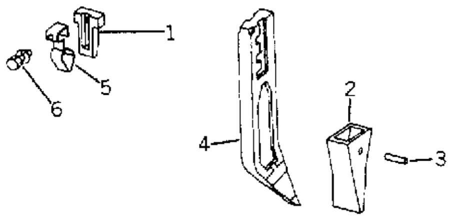
REMOVAL

Raise ripper to position teeth off the ground.

Remove shank locks and pull shanks down and away from ripper frame.

REPAIR

Teeth tips can be replaced when worn or broken by driving out the groove pin (3, Fig. 1) and driving the tip (2) from the tooth shank with a punch. Drive the new tip on the tooth and secure with a groove pin.



1—Shank Lock (3 used)
2—Tooth Tip (3 used)
3—Groove Pin (3 used)
4—Tooth Shank (3 used)
5—Shank Lock Spring (3 used)
6—Cap Screw and Lock Washer (3 used)

Fig. 1-Teeth and Shanks

INSTALLATION

Insert tooth shanks from the under side of the ripper frame.

Secure the tooth shank in the desired position by inserting the shank lock (1, Fig. 1) behind the tooth as shown below.

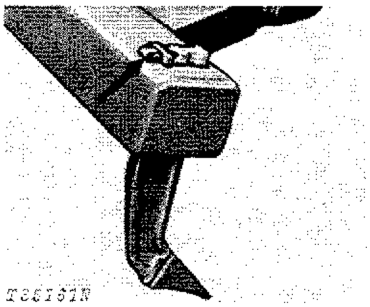


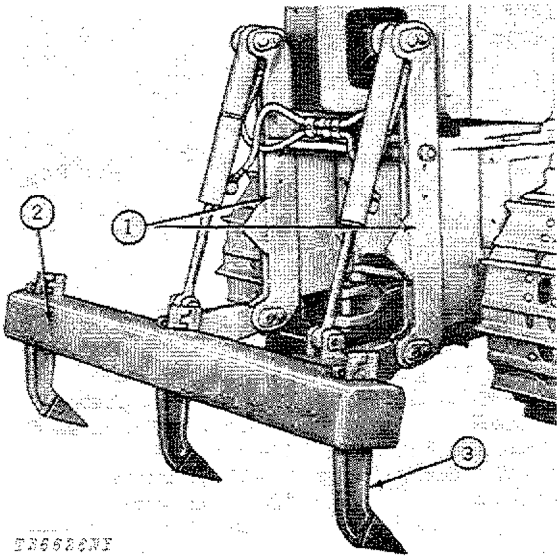
Fig. 2-Shank Lock

Group 4240
FRAME

GENERAL INFORMATION

The 3100 Ripper is used to operate in rocky and hard ground conditions. Ripper functions are controlled by the auxiliary lever.

Three to five tooth shanks may be inserted in different depth positions on the ripper frame.



1—Mast (2 used)
2—Frame
3—Tooth Shank (3 used)

Fig. 1-Ripper

REMOVAL

Lower ripper until tooth tips are resting on the ground.

Support ripper with a chain hoist.

Remove cap screws (6, Fig. 2) attaching mast to crawler frame.

Use hoist to raise ripper off the bottom mounting bracket hooks.

CAUTION: Shut off the crawler engine before disconnecting the hydraulic lines to the ripper. If the engine is left running the operator may be sprayed with hot hydraulic oil.

Disconnect the pressure and return hoses from the ripper at the quick disconnect couplers and connect hoses together.

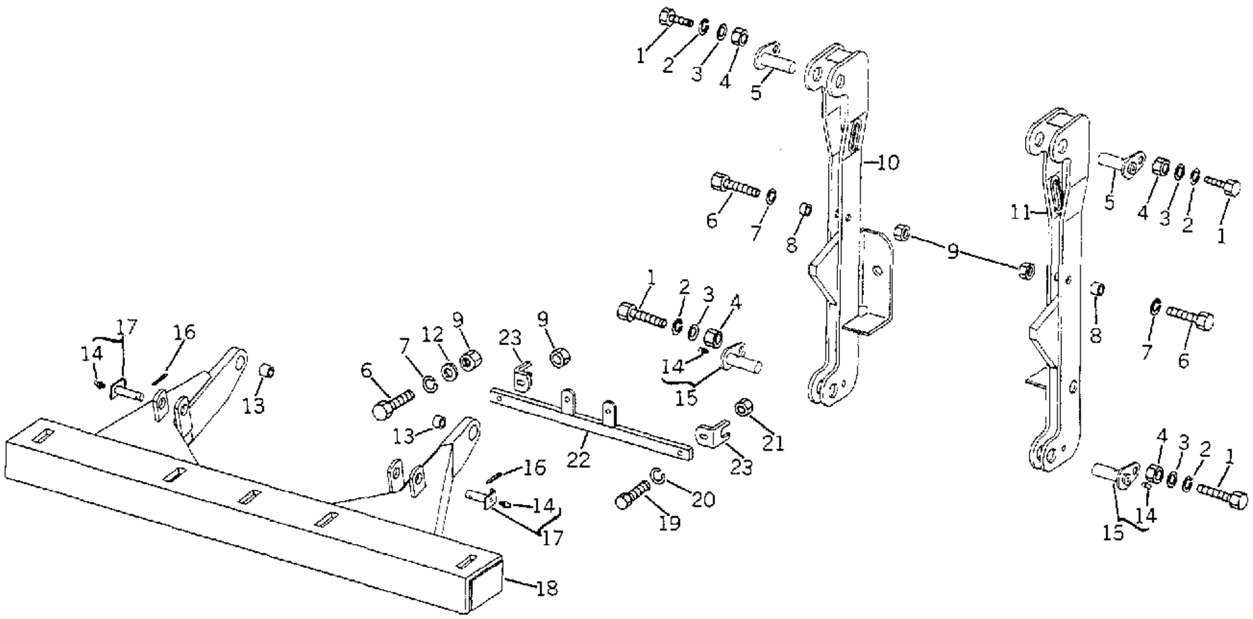
IMPORTANT: Pressure and return hoses must be connected together at all times when ripper is removed.

Wire the hoses to the crawler so they do not drag on the ground during crawler operations.

Carefully drive the crawler from the ripper.

Lower ripper to the ground or block up mast.

REPAIR



T35163

1—Cap Screw (4 used)
2—Lock Washer (4 used)
3—Washer (4 used)
4—Pipe Spacer (4 used)
5—Cylinder Pin (2 used)
6—Cap Screw (2 used)
7—Lock Washer (2 used)
8—Bushing (2 used)
9—Nut (2 used)
10—L.H. Mast
11—R.H. Mast
12—Washer (2 used)
13—Bushing (2 used)
14—Grease Fitting (4 used)
15—Pin With Grease Fitting (2 used)
16—Cotter Pin (2 used)
17—Pin With Grease Fitting (2 used)
18—Ripper Frame
19—Cap Screw (2 used)
20—Lock Washer (2 used)
21—Nut (2 used)
22—Clamp Bracket
23—Clamp Bracket Mounting Clip (2 used)

Fig. 2-3100 Ripper

Refer to Fig. 2 during disassembly and assembly.

Inspect bushings and pins; replace parts as necessary.

INSTALLATION

Support ripper in upright position with chain hoist.

Carefully back the crawler to align the mounting bracket hooks with the lower pins on the ripper mast.

Attach the pressure and return hoses to the ripper at the quik disconnect couplers.

Raise and position ripper so bottom pins rest on the mounting bracket hooks.

Install the top mounting pins.

Grease all fittings before resuming operation.

Group 4260
HYDRAULIC SYSTEM

RIPPER CYLINDERS

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 the system, be sure all connections are tight and that lines 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 the 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.

GENERAL INFORMATION

The hydraulic cylinders used on the ripper are double acting and use "V"-packing type seals on their pistons. Piston rods are heat treated, chrome plated, and polished. Replaceable non-metallic wear rings are used on piston retainers to prevent scoring of the cylinder barrels.

FOS

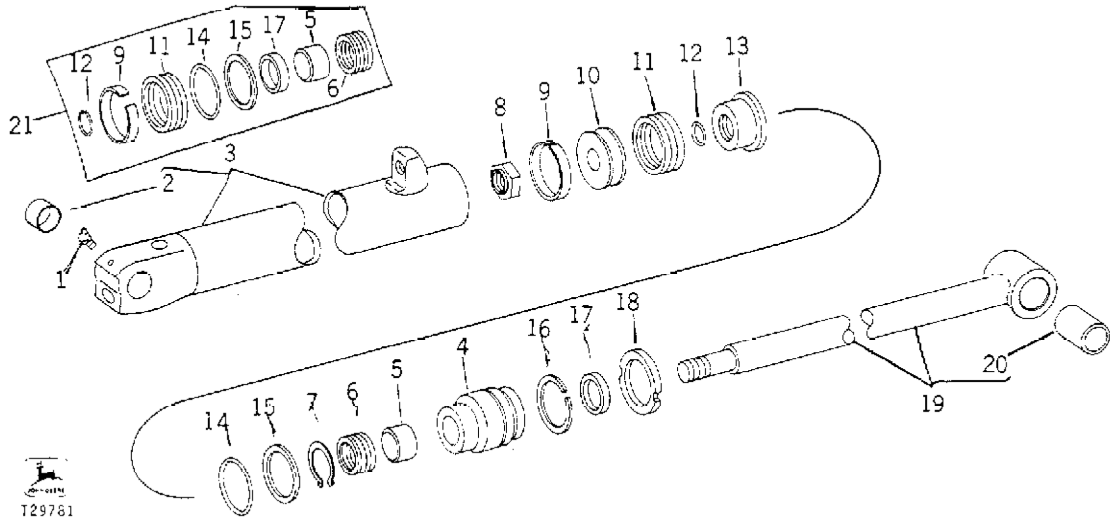
See "Hydraulic Cylinders" in FOS Manual - HYDRAULICS for additional information on cylinders.

REMOVAL

Lower ripper to the ground. Clean area around oil line connections. Remove and cap oil lines.

Remove cylinder from ripper.

REPAIR



1—Grease Fitting	**6—V-Packing**	**11—V-Packing**	**16—Snap Ring**
2—Bushing (2 used)	**7—Snap Ring**	**12—O-Ring**	**17—Wiper Seal**
3—Barrel	**8—Lock Nut**	**13—Piston**	**18—Spanner Nut**
4—Rod Guide	**9—Wear Ring**	**14—O-Ring**	**19—Rod**
5—Wear Ring	**10—Retainer**	**15—Backup Washer**	**20—Bushing**
			21—Repair Kit

Fig. 1-Ripper Lift Cylinder Assembly

Disassembly

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filter.

Clamp the cylinder in a vise to prevent it from turning. Remove spanner nut (18, Fig. 1). Use a D-05270ST Special Spanner Wrench to loosen nut. Push the rod guide (4) into the barrel just far enough to remove the snap ring (16).

Remove piston rod (19), rod guide and piston (13) from barrel.

Clamp the rod end in a vise taking care to prevent damage to the piston rod. Remove lock nut (8) from end of rod. Slide parts from end of rod.

Inspection

Wash all parts throughly with diesel fuel and inspect the following:

1. Barrel, rod guide and rod for scoring, and O-rings for surface damage.

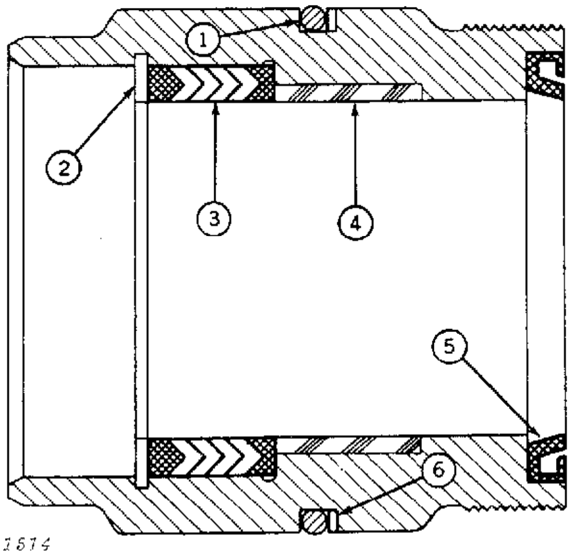
2. V-packings and wear rings for breaks, cuts or embedded foreign material.

3. Piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.

Assembly

Repair kits (21, Fig. 1) 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—O-Ring
2—Snap Ring
3—V-Packing
4—Wear Ring
5—Wiper Seal
6—Backup Washer

Fig. 2-Rod Guide Components

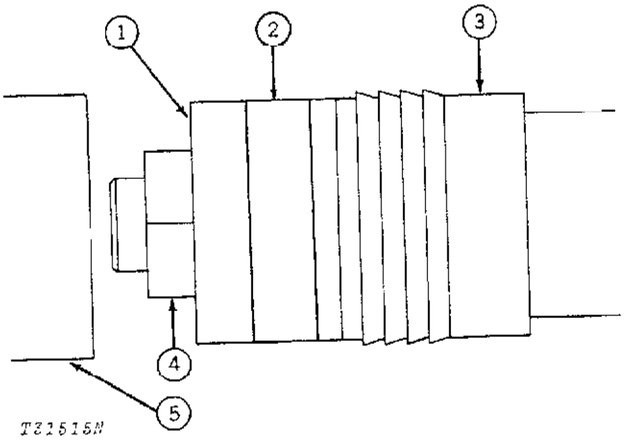
Install new wiper seal (5, Fig. 2) in rod guide.

Install new wear ring (4) in rod guide. Install backup washer (6) and O-ring (1) on rod guide.

Install V-packing (3) in rod guide with the apex of the V toward the wiper seal and fasten with snap ring (2).

Install rod guide assembly on piston rod being careful not to damage packing.

Installing Piston V-Packing

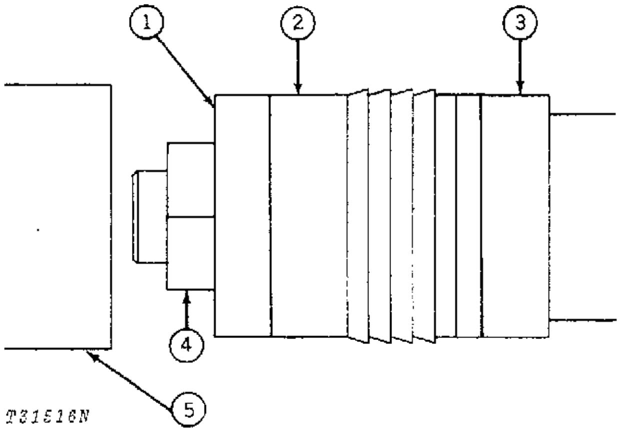


1—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 3-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. 3). When replacing V-packings in the field this procedure can be used if a suitable ring compressor is available to compress packings when installed in cylinders.

If a suitable compressor is not available, assemble the packings with the apex of the V pointing toward the barrel (Fig. 4). 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—Retainer
2—Wear Ring
3—Piston
4—Nut
5—Cylinder Barrel

Fig. 4-Installation of V-Packing Without Compressor

Install piston on piston rod. Install wear ring (9, Fig. 1) on piston retainer (10). Install retainer on piston rod and fasten with lock nut (8). Tighten to 150 to 210 lb-ft (203 to 285 N·m).

Install piston rod assembly into barrel and install snap ring (16).

Put AT52853 John Deere Loctite Thread Lock and Sealer (Low Strength) or an equivalent on the threads of rod guide before installing spanner nut.

Fasten piston rod assembly in barrel with spanner nut. Using a D-05270ST Special Spanner Wrench, tighten spanner to 125 to 175 lb-ft (170 to 237 N·m).

INSTALLATION

Put the cylinder in position on the machine and align the attaching holes. Install pivot pins and fasten with cap screws. Connect the hydraulic lines, making sure they are connected to the same ends of the cylinder from which they were removed.

Group 4299
SPECIFICATIONS AND SPECIAL TOOLS

HYDRAULIC SYSTEM

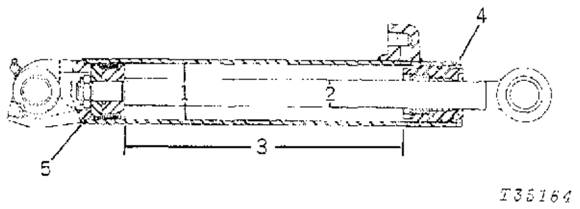


Fig. 1-Ripper Lift Cylinder

1 - Ripper cylinder bore ...... 2.5075 to 2.5125 in. (63.7 to 63.8 mm)

2 - Rod diameter .... 1.2485 to 1.2515 in. (31.7 to 31.8 mm)

3 - Cylinder stroke .... 15.19 in. (385.8 mm)

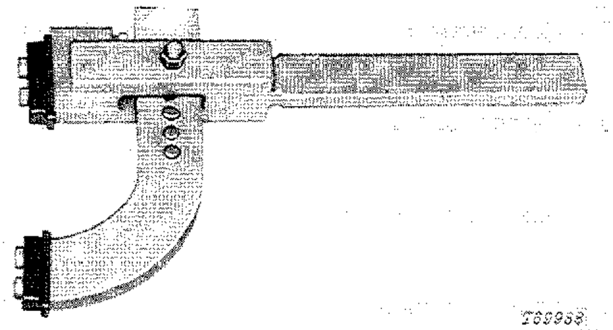
4 - Spanner nut torque .... 125 to 175 lb-ft (170 to 237 N·m)

5 - Lock nut torque .... 150 to 210 lb-ft (203 to 285 N·m)

HYDRAULIC SYSTEM

SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
 Fig. 2-Special Spanner Wrench	D-05270ST	Remove and install cylinder spanner nut

Section 90
SYSTEM TESTING

CONTENTS OF THIS SECTION

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 Crawler

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 crawler 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 tampered with.)

Ask how the crawler is used and when it is serviced. Many problems can be traced to poor maintenance or abuse.

3. Operate The Crawler

Get on the crawler 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 Crawler

Get off the crawler 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 crawler? 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 pin pointed.

With the trouble accurately located, it is now a simple matter to remove and repair the component at fault.

350C, 350D, AND 355D OPERATIONAL CHECKOUT PROCEDURE

Use this checkout procedure to check for normal operation of the machine. This procedure guides the service technician in checking the operation of the machine from the operator's seat.

The procedure can be done in less than 15 minutes when the transmission and hydraulic oil are at operating temperature. The drive test requires a large level area. No special tools are required.

Complete the necessary visual checks (all fluid levels and condition, external leaks, track sag, battery condition, loose or missing hardware, electrical connections, and loose or damaged linkages) before doing this checkout procedure.

Perform individual component test to verify problems.

10T;9005 K1 030986

1. Indicators and Gauges Test (Engine Off)

ACTION: Battery Disconnect Switch Check (If Equipped)
a. Turn battery disconnect switch (in battery compartment) to "Off" position.

IMPORTANT: DO NOT turn battery disconnect switch to "Off" position while engine is running. This "load dumps" the alternator, which could cause damage to the charging system.

b. Turn key switch to "Run" position (engine stopped).

LOOK: Voltmeter needle must not move.

ACTION: Voltmeter Check
a. Turn battery disconnect switch to "On" position.
b. Turn key switch to "Run" position (engine stopped).

LOOK: Voltmeter needle must move to lower green position. Observe water temperature and oil pressure gauges for later reference.

NOTE: If gauges "Peg", a shorted wire is indicated.

ACTION: Hourmeter Check
a. Turn key switch to "Run" position.
b. Observe hourmeter.

LOOK: Hourmeter must run.

ACTION: Hydraulic Filter Restriction Indicator Check
a. Turn key switch to "Run" position.
b. Short out the nut on the hydraulic filter restriction switch (in hydraulic reservoir compartment) to the frame by using a key, knife blade, or anything metallic.

LOOK: Hydraulic filter restriction indicator light on dash must be "On".

NOTE: The hydraulic filter restriction indicator does not have a bulb check circuit.

ACTION: Air Filter Restriction Indicator Check
a. Check air filter restriction indicator.

LOOK: Indicator must not show any red.

NOTE: Red indicates restricted air flow. Remove air cleaner elements and clean or replace; then reset indicator by pushing in on button.

10T;9005 K2 080986

2. Neutral Start Switch Test

ACTION: Starting Check in Gear
a. Step down on clutch pedal.
b. Move gear selector to "R" position.
c. Move direction reverser lever to "neutral" position.
d. Turn key switch to "Start" position.
e. Repeat check with gear selector in each of the other positions.

LISTEN: Starting motor must NOT operate.

ACTION: Starting Check in Neutral
a. Repeat procedure with gear selector in "neutral" position.

LISTEN: Starting motor must operate.

10T;9005 K3 030986

3. Gauges and Indicators Test (Engine Running)

ACTION: Gauges and Indicators Check.
a. Engage park brake.
b. Start the engine.
c. Move speed control lever to half speed.

LOOK: a. Engine oil pressure gauge must be in green zone.
b. Voltmeter must be in upper green zone.

NOTE: Hydraulic oil filter restriction indicator may be on with cold hydraulic oil.

ACTION: Water Temperature Gauge Check.
a. Run engine for a few minutes.

LOOK: Water temperature gauge must be in green zone.

10T;9005 K4 030986

4. Brake System Test

ACTION: Brake Pedal Lock Check.
a. Push down on brake pedal.
b. Engage brake lock.
c. Release pedal.

LOOK: Brake lock must hold pedal down.

ACTION: Brake Check in Reverse
a. Start engine and run at half speed.
b. Operate unit in 3rd reverse.
c. Slowly apply brakes.

LOOK: Engine must stall.

ACTION: Brake Check in Forward
Repeat the previous procedure for 3rd forward.

NOTE: If crawler continues to move and engine does not stall, check brake system. If crawler stops but engine does not stall in both directions, check reverser pressure. If crawler stops but engine does not stall in one direction, that direction clutch is slipping.

10T;9005 K5 080986

5. Steering Test (Steering Clutches and Brakes)

ACTION: Steering Clutch Adjustment Check
a. Start engine and run at slow idle.
b. Release brake lock.
c. Depress clutch pedal and shift crawler to 1st gear.
d. Engage clutch and increase engine rpm to half speed.
e. Slowly pull left steering lever.

LOOK: Crawler should turn to the left but left track should continue to rotate (left steering clutch disengaged).

LISTEN: No "growling" noise must be heard from left final drive.

NOTE: If the steering brake engages before the steering clutch disengages, a "growling" noise will be heard.

ACTION: Steering Brake Adjustment Check
Pull left steering pedal or pull left steering lever until increased pedal or lever effort is felt.

LOOK: Left track must stop and crawler must turn left (steering clutch disengaged and steering brake engaged).

ACTION: Steering Clutch Check
a. Increase engine rpm to fast idle.
b. Pull on both steering levers.

LOOK: Crawler must stop.

ACTION: Steering Clutch Engagement Check
Release both levers.

LOOK: Crawler must "jerk" ahead straight.

NOTE: If crawler turns when steering clutches are engaged at the same time, the steering linkage is out of adjustment and must be adjusted.

NOTE: If steering levers are pulled excessively hard, the self adjustment feature of the steering brake may adjust into a "lock up" position.

10T;9005 K6 030986

6. Direction Reverser and Transmission Test

ACTION: Direction Reverser Clutch Drag Check
a. Run engine at slow idle.
b. Depress clutch pedal.
c. Move gear selector lever into each gear position.

LISTEN: Gear "clash" must not be heard.

NOTE: Gear "clash" indicates a warped reverser clutch.

ACTION: Clutch Pedal Modulation Check
a. Run engine at slow idle.
b. Depress clutch pedal.
c. Put transmission in 4th forward.
d. Slowly release clutch pedal.

FEEL: Unit must accelerate smoothly.

NOTE: If unit moves abruptly, a malfunction is indicated in the clutch valve assembly.

ACTION: Reverser Modulation Check
a. Run engine at half speed.
b. Make several forward to reverse shifts in 3rd gear.
c. Count the number of seconds it takes for the unit to change direction after the reverser lever is moved.

LOOK: Unit must change directions in 1 to 2 seconds.

NOTE: If direction change is too slow or too fast, do Restricting Orifice Adjustment in Group 9025.

ACTION: Gear Noise Check
a. Run engine at fast idle.
b. Operate unit in 4th forward.
c. Apply a load to the transmission by applying the brakes.
d. Listen for gear noise.
e. Repeat check in each of the other gears.

LISTEN: Unusual gear noise must not be heard.

10T;9005 K7 140986

7. Hydraulic System Test

ACTION: Pressurized Reservoir Check
a. Start engine and raise bucket/blade to full height.
b. Stop engine.
c. Slowly lower bucket/blade to ground.
d. Open reservoir cap (in hydraulic reservoir compartment).

LISTEN: "Whoosh" must be heard from reservoir cap.

NOTE: The pressurized reservoir creates positive pressure at the inlet to the main hydraulic pump. If pressure cap does not seal, contaimination may enter the hydraulic system, and pump efficiency may be lost.

ACTION: Main Pump Performance Check
a. Start engine and run at fast idle.
b. Warm hydraulic oil by running a hydraulic function over system relief until the hydraulic oil reservoir (right of operator seat) is uncomfortable to continually touch—about 50°C (122°F).
c. Cycle hydraulic functions to warm entire hydraulic system.
d. With engine at fast idle, start with bucket or blade on ground. Operate boom or blade raise.

LOOK: Boom must be at full height in less than 7.5 seconds.
Blade must be at full height in less than 5 seconds.

NOTE: Take the average cycle time of 3 complete cycles. The average cycle time will give a general indication of hydraulic pump performance. For Hydraulic Pump Test. (See Section 90, Group 9025.)

ACTION: Control Valve Check
a. Move the control lever to all positions, then release.

FEEL: Control valve lever must return to neutral position.

NOTE: If loader is equipped with return-to-dig option, lever must stay in bucket rollback position until control rod contacts switch on loader boom. The lever must then return to neutral position.

ACTION: Boom or Blade Float Check
a. Raise the front of the crawler off the ground by lowering the bucket/blade.
b. Push control lever to float position.

LOOK: Front of crawler must lower to ground.

NOTE: When the control lever is moved to power down position and bucket/blade hits the ground, a hesitation will result until enough pressure is developed to raise the front of the crawler.

ACTION: Boom Drift Check
a. Position blade or loader bucket about 50 mm (2 in.) off the ground.
b. Stop engine and wait for 1 minute.

*LOOK: Bucket/Blade must **not** touch ground.*

NOTE: Use good judgment in determining if the amount of drift is objectionable for the type of operation the unit is performing.

ACTION: Check Lift Check (Dozers)
a. Raise blade about 1 m (3 ft) off the ground.
b. Stop engine.
c. Move control lever to raise blade.

LOOK: Blade must not drop.

d. Raise front of unit off ground.
e. Stop engine.
f. Move control lever to lower blade.

*LOOK: Front of unit must **not** drop.*

ACTION: Check Lift Checks (Loaders)
a. Raise blade off ground.
b. Stop engine.
c. Move control lever to raise boom and roll back bucket.

LOOK: Boom must not lower and bucket must not dump.

ACTION: Loader Boom Raise Circuit Relief Valve Check
a. Crowd the bucket into a dirt pile.
b. Roll back the bucket and watch boom movement.

LOOK: Boom must NOT collapse.

NOTE: If boom collapses, the boom circuit relief is low, hydraulic system relief is set high, or cylinder leakage is indicated.

Continued on next page

ACTION: Loader Boom Raise Circuit Relief Valve Check
a. Crowd the bucket into a dirt pile.
b. Roll back the bucket and watch boom movement.

LOOK: Boom must NOT collapse.

NOTE: If boom collapses, the boom circuit relief is low, hydraulic system relief is set high, or cylinder leakage is indicated.

ACTION: Bucket Dump Circuit Relief Valve Check
a. Position bucket at 45° angle to the ground.
b. Lift front of machine off the ground by lowering bucket/blade.
c. Operate unit in reverse (back-drag) and watch bucket angle.

LOOK: Bucket angle must NOT change.

NOTE: If bucket collapses, the bucket dump circuit relief is set low or cylinder leakage is indicated.

ACTION: Bucket at Dump Circuit Relief Check
a. Run engine at slow idle.
b. Position boom at full height and bucket in full dump position.
c. Move control lever to boom raise and then to bucket dump position.

LISTEN: Engine rpm must increase from boom raise to bucket dump position.

NOTE: If engine rpm does not increase, the bucket dump circuit relief is set higher than system relief valve. Check system and circuit relief valve pressure setting in Group 9025.

ACTION: Bucket Roll-Back Circuit Relief Valve Check
a. Position bucket at 45° angle to the ground in front of an immovable object.
b. Move speed control lever to half speed, machine in forward direction. Release clutch until tracks begin to spin.

LOOK: Bucket angle must NOT change.

NOTE: If bucket collapses, the bucket roll-back circuit relief is set low or cylinder leakage is indicated. If bucket collapses in both directions, the problem is probably cylinder leakage.

ACTION: Backhoe Boom Cylinder Cushion Check
a. Position backhoe to maximum reach position.
b. Raise boom.

LOOK: Boom rod travel must slow down (cushion) before it is in full raise position.

ACTION: Backhoe Crowd Cylinder Cushion Check
Position crowd to transport position (9300 Backhoe only).

LOOK: Crowd rod travel must slow down (cushion) before it is in transport position.

ACTION: Backhoe Drift Check
a. Position backhoe at maximum reach with bucket teeth about 50 mm (2 in.) off the ground.
b. Stop engine and wait for 1 minute.

LOOK: Bucket teeth must not touch ground.

ACTION: Check Backhoe Control Valve Lift Check
a. Position bucket at maximum reach about 1 m (3 ft) off ground with the bucket in dump position.
b. Stop engine.
c. Move control lever to boom raise, crowd out and bucket dump positions.

LOOK: Boom, crowd, and bucket must not drop.

NOTE: If boom, crowd, or bucket lower, lift check or cylinder packing could be the cause.

ACTION: Stabilizer Drift Check
a. Raise stabilizers to transport position and release levers.
b. After 1 minute, move stabilizer levers to raise position again.

LOOK: Stabilizers must not move.

10T;9005 K9 040986

8. Undercarriage Checks

NOTE: *These undercarriage checks should be used only as a general indication of undercarriage condition. If any area is questioned refer to "Undercarriage Appraisal Manual" for measurement and analysis.*

NOTE: *Undercarriage wear is accelerated by excessive high speed, reverse, and turning operations.*

ACTION: Track Tension and Roller Leakage Check
a. Inspect track sag and any indication of roller leakage on both sides.

LOOK: *Track tension must NOT be too tight or too loose.*

NOTE: *If track tension is too tight, excessive fuel consumption and track wear will result. If track tension is too loose, the tracks may cause chipping of roller flanges and chain rails, or the track may come off crawler.*

LOOK: *Must NOT see any evidence of oil leaks from rollers.*

ACTION: Grouser Wear, Bent Track Shoe, and Loose Hardware Check
a. Operate crawler at slow speed forward.
b. Check track pads as they run over the front idler.

LOOK: *Check height of grouser, check for bent or loose pads.*

NOTE: *Loose or missing hardware or thin grousers could cause bent track pads.*

ACTION: Track Chain Joint Flex Check
a. Operate crawler at slow speed forward.
b. Check track chain as it runs over carrier roller.

LOOK: *Track chain must roll freely over carrier roller.*

ACTION: Front Idler Vertical Adjustment Check
a. Position front idler on a block of wood or a pile of dirt approximately 6 in. high.
b. Check the gap between the front idler guide block assembly and wear strips.

LOOK: *Maximum gap is 0.040 in. (thickness of dime).*

NOTE: *If front idler vertical gap is excessive, the ability to finish grade with the crawler is affected. Also, track adjustor wear will result.*

ACTION: Track Pitch Check
a. Check the position of the front edge of the front idler guide block assembly to the front edge of the frame.

LOOK: *If front edge of the front idler guide block assembly is within 1 inch of the front edge of the frame, track pitch measurement should be taken.*

NOTE: *Turning chain pins and bushings will correct track pitch.*

ACTION: Track Roller Check
a. Have another person operate machine in forward direction.

LOOK: *All rollers must turn but must NOT "wobble".*

ACTION: Pin Boss Wear Check
a. Check pin boss for wear.

LOOK: *Pin boss wear indicates contact with rock guides or roller flanges.*

LOOK: *Excessive pin boss wear may also indicate pin to bushing wear (snaking) or excessive side hill operation.*

NOTE: *Some pin boss end wear is normal but if wear is only excessive on one side, side hill operation in one direction may be indicated.*

Continued on next page

ACTION: Sprocket Wear Check
a. Operate crawler in forward then slowly come to a stop.
b. Check sprocket for forward and reverse drive and tooth tip wear.

LOOK: Reverse drive wearing more than forward is normal from reverse operation.

NOTE: The sprockets can be changed from side to side on the crawler for added life.

LOOK: Reverse drive tip wear is caused by normal dirt packing in the sprocket root in the forward direction. If packing is a problem, loosen track tension.

NOTE: DO NOT judge the condition of the sprocket by the appearance of tooth tip wear. Tip wear does not affect the service life of the sprocket because wear does not extend into the drive area of the sprocket.

"Popping" of the track can occur in forward and reverse. Popping in forward is caused by material packing in the sprocket. Popping in reverse is normal while operating under heavy loads. The recoil spring is recoiling allowing sprocket to "slip" in the chain, thus protecting power train and track components.

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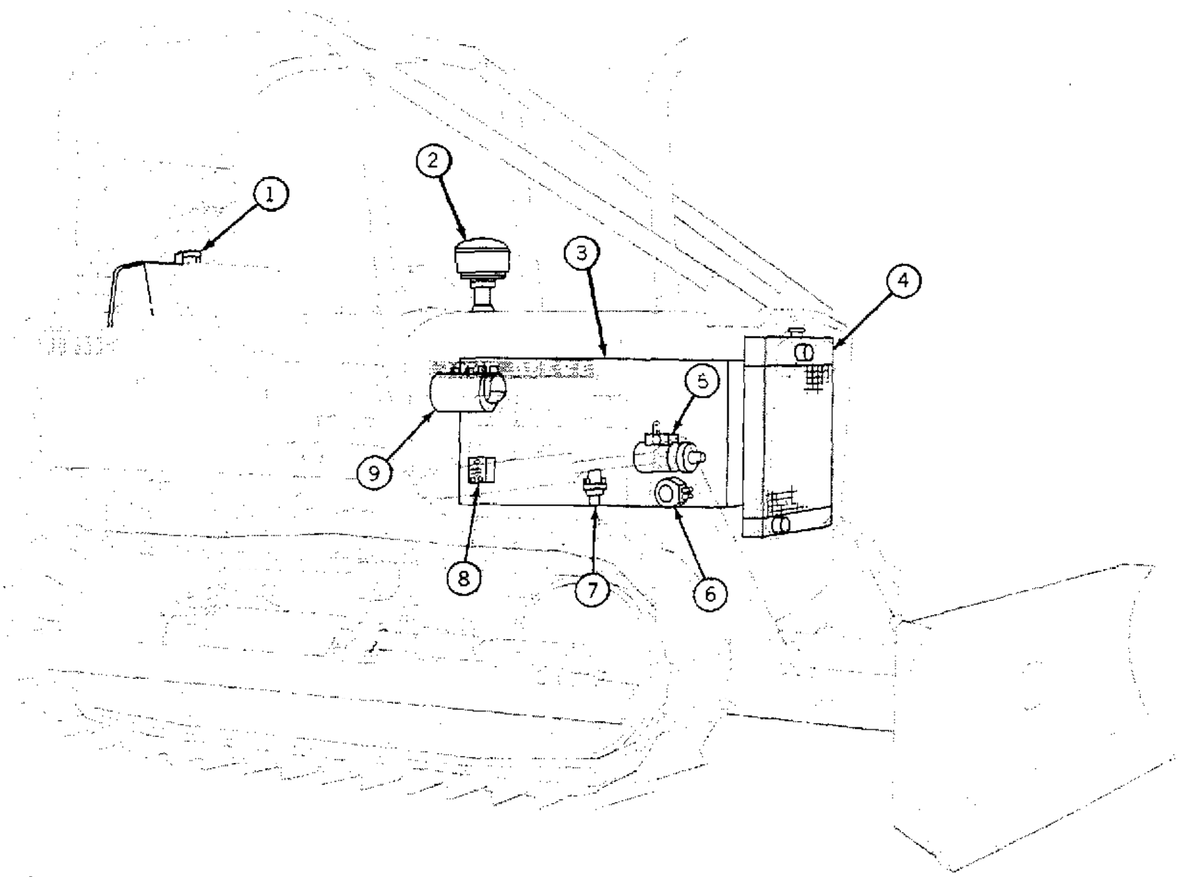
Group 9010
ENGINES

GENERAL INFORMATION



T36627N

1—Fuel Tank
2—Pre-Cleaner
3—Engine
4—Radiator
5—Fuel Injection Pump (Diesel)
6—Oil Cooler (Diesel)
7—Fuel Transfer Pump
8—Fuel Filter (Diesel)
9—Air Cleaner

Fig. 1-Engine

Basic Engine

The JD350-C Crawler has either a 3 cylinder 135 cubic inch (2212.3 cm^3) gasoline engine or a 3 cylinder 152 cubic inch (2590.8 cm^3) diesel engine.

Both engines are valve-in head vertical in-line four cycle engines. Both engines consist of a lubrication system, cooling system, fuel system, and air intake system.

Engine Lubrication System

The components of the lubrication system are the oil cooler (diesel only), oil pump, oil filter, pressure regulating valve, and oil bypass valve (later units).

On diesel engines the oil pump draws lubricant from the oil pan through a system of gears and sends it through an internal passage to the oil cooler.

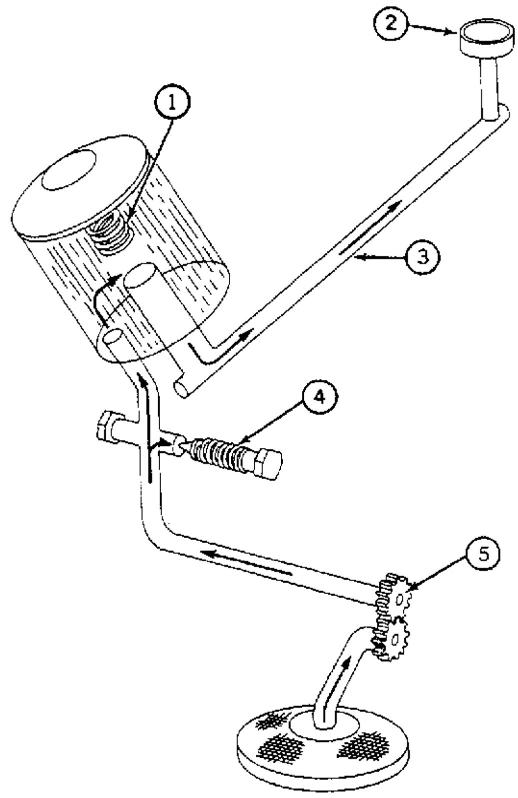
As the oil moves through the cooler the temperature is lowered by engine coolant flowing through the cooler. The oil then goes to the oil filter.

Gasoline engine lubrication is the same except there is no engine oil cooler.

The oil filter is a spin-on replaceable element. It removes contaminants from the engine oil. From the filter the oil goes through the main gallery to the oil pressure regulating valve.

The oil pressure regulating valve is used to maintain and regulate engine oil pressure.

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.



T20935N

1—Bypass Valve
2—Sending Unit
3—Oil Gallery
4—Regulating Valve
5—Oil Pump

Fig. 2-Engine Lubrication System

After oil flows past the regulating valve it flows into oil galleries and is dispensed to lubricate the internal moving parts of the engine.

Engine Cooling System

The components of the cooling system are the radiator, water pump, 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.

On diesel engines 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 water manifold 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.

Gasoline engine cooling is the same except there is no engine oil cooler.

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

Diesel

The components of the diesel fuel system are the fuel tank, fuel supply pump, the fuel filter, the fuel injection pump, and the fuel injection nozzles.

The fuel supply pump operates off a cam lobe of the camshaft. The pump draws fuel from the fuel 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 pressure and inject the fuel into the combustion chambers.

Gasoline

The components of the gasoline fuel system are the fuel tank, fuel strainer, fuel supply pump, carburetor, and governor.

The fuel supply pump draws fuel from the tank and delivers it to the carburetor through the fuel filter.

The fuel strainer removes impurities from the fuel before it enters tne carburetor or injection pump.

The carburetor breaks up the fuel into a spray and combines it with air from the air cleaner. The fuel air mixture goes into the intake manifold and on into the combustion chambers.

The carburetor is regulated by the governor. The governor uses a system of weights and linkages to control the amount of fuel and air supplied to the engine.

Air Intake System

The components of the air intake system are the air cleaner and the intake manifold.

Air enters the air cleaner. The air cleaner element removes impurities from the ambient air.

On diesel units the air then enters the intake manifold which delivers it to the combustion chambers.

On gasoline engines the filtered air enters the carburetor where it is combined with vaporized gasoline before it enters the intake manifold.

Speed Control Linkage

The speed control linkage consist of the hand throttle and various linkages which are connected to the governor on gasoline engines and the injection pump on diesel engines. Through common movement of the throttle and linkages speed control is maintained.

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 (diesel)
  - Faulty injection nozzles (diesel)
  - Water, dirt, or air in fuel system
  - Carburetor malfunction (gasoline)
- Electrical System Malfunction
  - Corroded or loose battery cables
  - Weak or dead battery
  - Cranking speed too slow

Uneven Running or Frequent Stalling

- Basic Engine Malfunction
  - Improper valve clearance
  - Cylinder head gasket leaking
  - 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 (diesel)
  - Faulty injection pump (diesel)
  - Faulty injection nozzles (diesel)
  - Water, dirt, or air in fuel system
  - Injection nozzle leak-off lines clogged (diesel)
  - Injection pump or distributor out of time
  - Exhaust system restricted
  - Improper carburetor setting (gasoline)

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 (diesel)
  - Faulty injection pump (diesel)
  - Faulty transfer pump
  - Detonation
  - Mixture of gasoline and diesel fuels
  - Carburetor out of adjustment (gasoline)

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 (diesel)
  - Fuel injection pump malfunction (diesel)
  - Fuel injection nozzle faulty (diesel)
  - Water, dirt or air in fuel system
  - Injection nozzle leak-off line clogged (diesel)
  - Injection pump or distributor out of time
  - Clogged manifold system
  - Carburetor adjusted too lean (gasoline)

Black or Gray Exhaust Smoke (Diesel)

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 (diesel)
- Injection nozzle leak-off line clogged (diesel)
- Injection pump out of time (diesel)

White Exhaust Smoke

Basic Engine Malfunction
- Low compression

Fuel System Malfunction
- Faulty injection nozzle (diesel)
- Improper fuel
- Injection pump out of time (diesel)
- Improper carburetor adjustment (gasoline)

Slow Acceleration

Fuel System Malfunction
- Faulty injection nozzle (diesel)
- Improper fuel
- Faulty carburetor (gasoline)

Engine Backfires

Fuel System Malfunction
- Faulty carburetor (gasoline)

Electrical System Malfunction
- Faulty ignition system (gasoline)

Detonation

Fuel System Malfunction
- Injection pump out of time (diesel)
- Faulty injection nozzles (diesel)

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 end play
- 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 liners 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 adjustment
- Improper oil (wrong viscosity)
- Defective oil pressure indicator light

High Oil Pressure

Basic Engine Problem
- Stuck regulating valve
- Regulating valve spring worn or broken

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

Engine Overheats

Basic Engine Malfunction
- Defective head gasket
- Incorrect engine timing
- Low coolant level
- Radiator dirty or plugged
- Loose or broken fan belt
- Faulty thermostats
- 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 (diesel)
- Carburetor faulty (gasoline)

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 thermostats
- 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

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, 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 by-pass hose for hardening or cracking, and softening and swelling. Examine hoses at least twice a year for possible replacement and tightening.

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 leakages.

Fuel Filter (Diesel)

Check fuel inlet and outlet connections. Check element daily for deposits. Drain if necessary. Replace filter element as required.

Fuel Supply Pump

Check fuel inlet and outlet connections for leaking fuel.

On diesel engines be sure the primer level is in its farthest downward position.

Fuel Injection Pump (Diesel)

⚠ CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury.

Fuel escaping from a very small opening can be almost invisible. Use a piece of cardboard or wood, rather than a hand, to hold near connections to check for fuel leaks.

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

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 Injection Nozzles

CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury.

Fuel escaping from a very small opening can be almost invisible. Use a piece of cardboard or wood, rather than a hand, to hold near connections to check for fuel leaks.

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

Check each delivery and leak-off line. Repair or replace lines if necessary.

Carburetor (Gasoline)

Check fuel line into carburetor for leaks. Check air inlet for tight seal.

Carburetor to intake manifold connection must be tight.

Governor (Gasoline)

Check governor linkage for loose, twisted or bent conditions.

Air Cleaner

Check all air intake and outlet connections to be sure they are tight. Check level of dirt in precleaner and empty if necessary. 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.

Intake Manifold (Gasoline)

Check all connections and gaskets.

TESTING AND ADJUSTMENT

Compression Pressure Test

Clean the engine thoroughly, preferably by steam cleaning.

Warm the engine to operating temperature.

When engine has reached operating temperature, turn key switch off.

Diesel

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 nozzle during the test.

CAUTION: The above step is important because fuel under high pressure from the injection nozzles 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 three injection nozzles and seal gaskets from the head.

Clean the injection bores. Blow loose carbon out with compressed air.

Install a D14550BA Compression Gauge Adapter in bore to be tested. A new seal gasket should be inserted before the adapter is installed.

Connect a D14-547-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 should be 350 psi (2400 kPa) (24 bar) minimum for diesel. Cylinder to cylinder variation should not exceed 50 psi (345 kPa) (3.5 bar).

Gasoline

Disconnect the lead wire to the carburetor electrical shut-off. This will prevent the carburetor from vaporizing and delivering any fuel.

CAUTION: Never permit fire, live sparks or smoking in the area when testing the engine.

Remove all three spark plugs from the head.

Clean plug bores. Blow loose carbon out with compressed air.

Install engine compression tester in bore to be tested.

Crank engine with the starting motor and the throttle wide open.

Observe the pressure reading on the compression gauge. The reading should be 120 psi (827 kPa) (8.3 bar) for gasoline.

Test each cylinder on both diesel and gasoline several times to be sure readings are accurate.

Remove gauge and install injection nozzles or spark plugs.

Checking Engine Oil Pressure

Engine oil pressure should be checked before and after a major overhaul or anytime it is necessary to remove the oil pump.

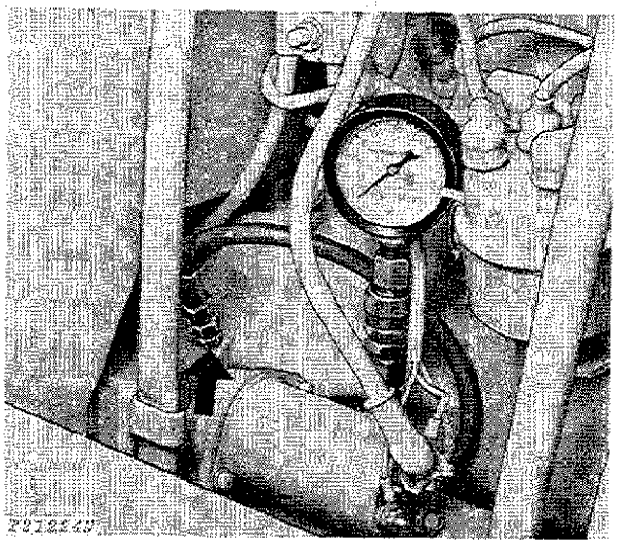


Fig. 3-Checking Engine Oil Pressure

To check oil pressure, remove oil pressure indicator switch from engine. Connect an oil pressure gauge as shown in Fig. 3.

With engine at normal operating temperature and running at 2500 rpm, oil pressure reading should be 50 ± 15 psi (345 ± 103 kPa) (3.5 ± 1 bar).

If pressure is not correct, see Diagnosing Malfunctions.

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 manufacturers instructions.

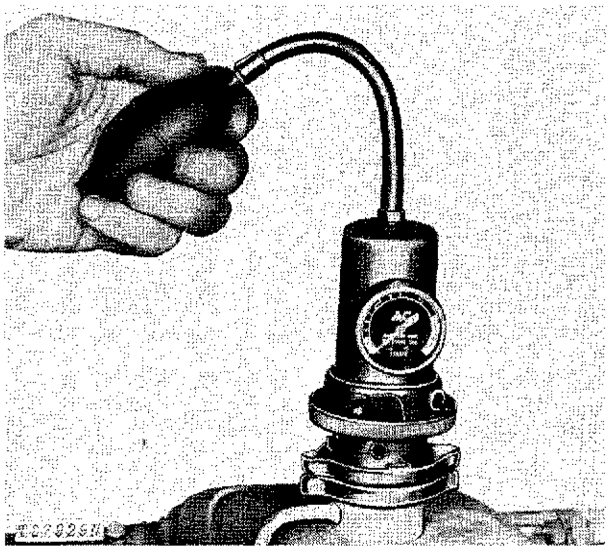


Fig. 5-Testing Radiator

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.

FOS

For additional information on testing and maintaining the cooling system refer to "Cooling System" in FOS Manual - Engines.

Fan Belt Tension Adjustment

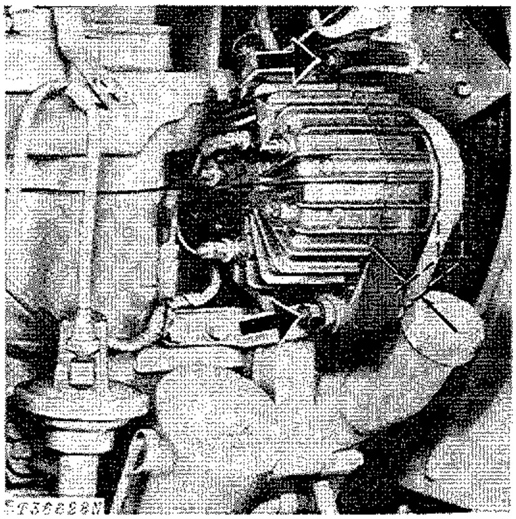


Fig. 6-Checking Fan Belt Tension

Adjust fan belt tension by loosening the alternator bracket and adjusting cap screws and apply outward pressure to the front alternator frame to determine if the fan belts are adjusted properly, apply approximately 20 pounds (9.07 kg) of force on the belt with JDST-28 Belt Tension Gauge about midway between the pulleys. The belt deflection should be 0.75 inch (19.05 mm).

Fuel System

CAUTION: Live sparks, smoking or fire of any nature should not be permitted when testing the fuel system.

Fuel Supply Pump Vacuum Test

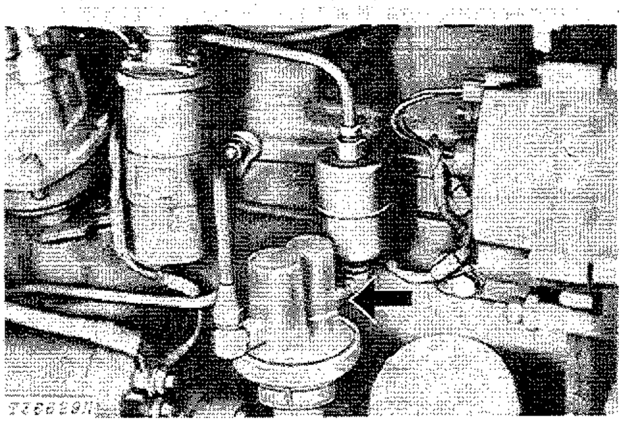


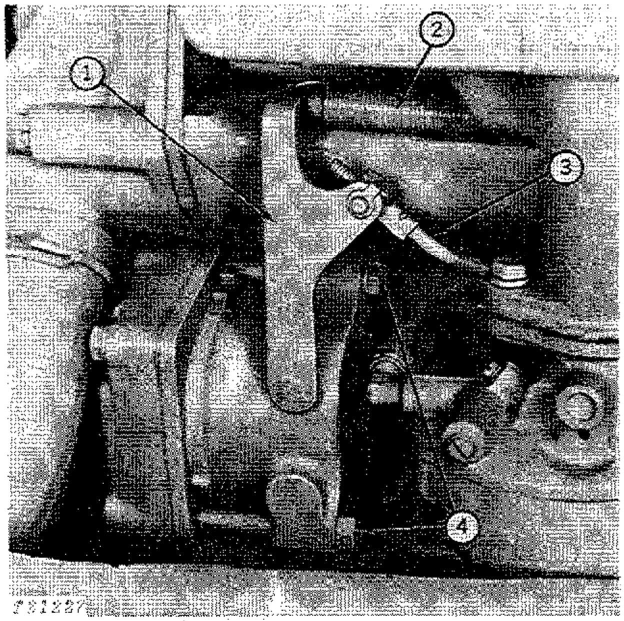
Fig. 7-Fuel Supply Pump Test Point

Tee a D-05022ST Water Vacuum gauge at the inlet to the fuel supply pump.

Start the engine. Let it run at low idle and observe the gauge, the reading on the gauge should be 15 to 20 inches (381.0 to 508.0 mm) of water.

The pump can also be tested by teeing a low pressure gauge between the pump and the fuel filter (diesel) or carburetor (gasoline). The pressure should be 2 to 2.5 psi (0.14 to 0.17 kg/cm²).

Governor Linkage Adjustment (Gasoline)



1—Governor Control Lever
2—Speed Control Spring
3—Throttle Rod
4—Governor Attaching Points

Fig. 8-Governor Linkage

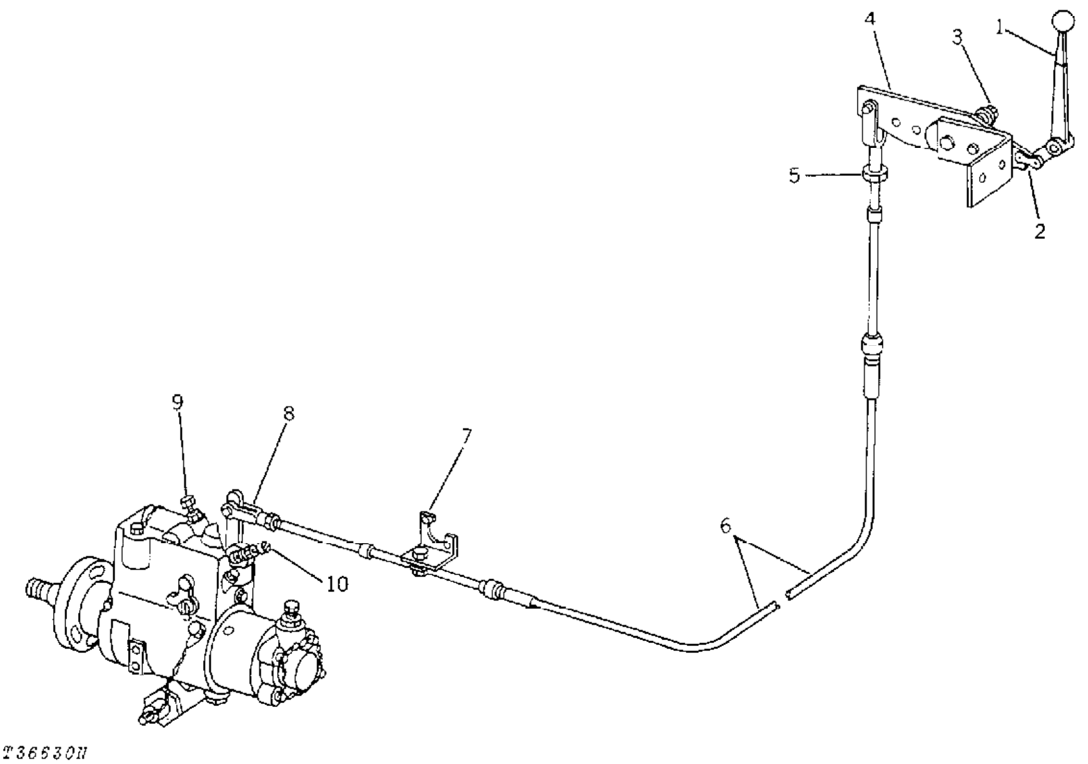
Move the governor control lever and shaft assembly rearward as far as possible. Move the carburetor throttle lever to the wide-open position.

Install the throttle rod on the governor lever and adjust one turn long.

Install speed control spring in hole on top flange of governor lever.

FOS For carburetor adjustment when installed on the engine refer to FOS Manual-ENGINES, "Gasoline Fuel Systems."

Diesel Speed Control Linkage



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1—Hand Throttle Lever
2—Lever-to-Bell Crank Link
3—Friction Adjusting Nut
4—Bell Crank
5—Adjustable Yoke
6—Speed Control Cable
7—Bracket
8—Adjustable Yoke
9—Pump Slow-Idle Stop Screw
10—Pump Fast-Idle Stop Screw

Fig. 10-Diesel Speed Control Linkage (350C)

Make all diesel speed control adjustments in the exact order given here. Refer to Fig. 10 as a guide to adjusting points.

Be sure engine is warmed up before making speed adjustments. Use a stroboscope to check speeds.

Disconnect speed control cable from injection pump arm. Loosen bracket (7).

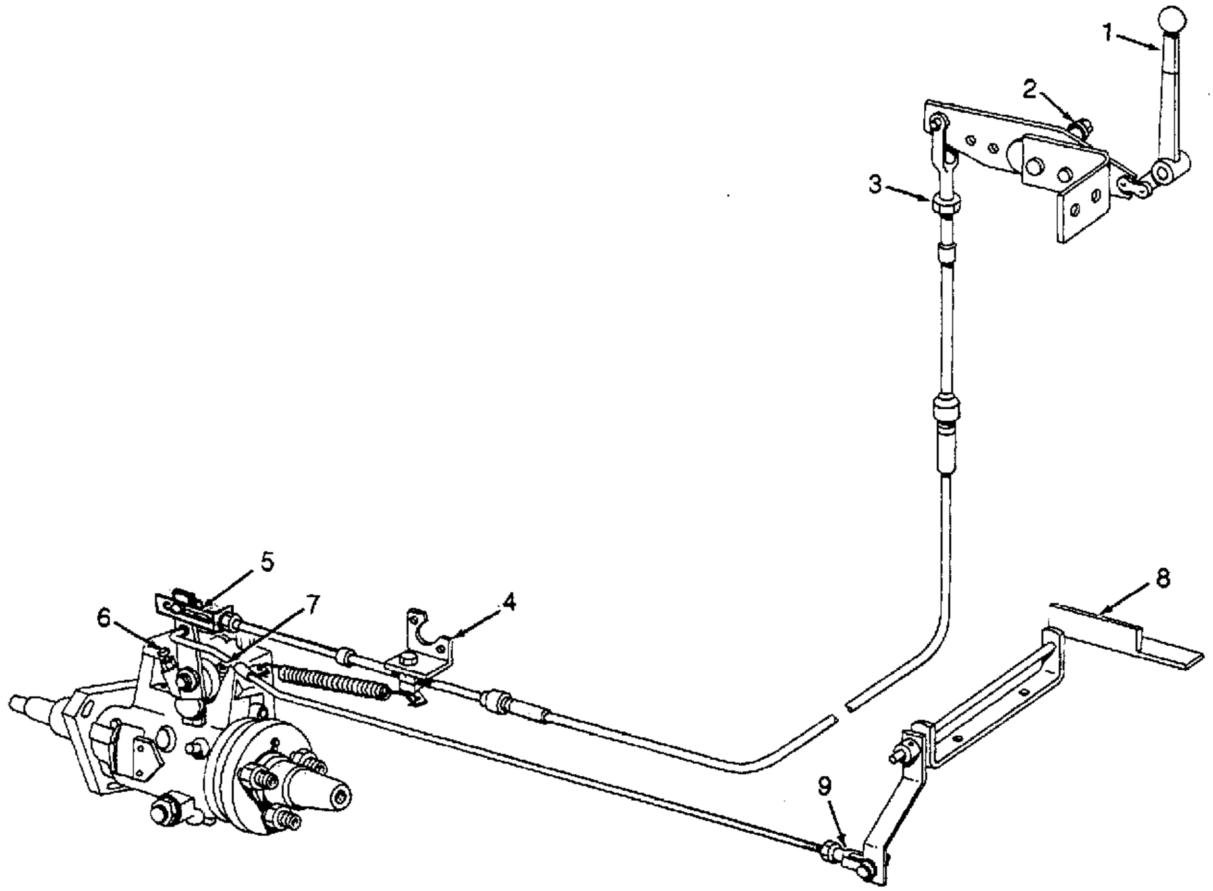
Run engine and rotate pump throttle arm until fast-idle stop screw (10) contracts its stop. Engine speed should be at 2650 ± 25 rpm fast idle. If not, adjust pump stop screw (10) to correct. Lock screw with sealing wire.

Lightly rotate pump throttle arm to slow-idle position. Engine speed should be at (800 + 25 −0 rpm) slow idle. If not, adjust slow-idle stop screw (9).

With speed control cable disconnected, move hand lever forward to the high idle position. Adjust cable yoke (8) to provide for 0.125-inch (3.18 mm) over-travel of the pump arm. (For more travel, adjust cable at yoke (5) (under dash). Check slow idle.

Move hand throttle fully rearward and turn off ignition switch to shut off engine.

Move hand throttle back and forth to check friction on lever. Drag at end of throttle lever should be 8 ± 3 lb force (36 ± 13 N). Adjust, if necessary, at friction adjusting nut (3). Continue moving hand throttle to check speed control linkage for binding or looseness.



1—Hand Throttle Lever
2—Friction Adjusting Nut
3—Adjustable Yoke
4—Bracket
5—Slotted Yoke
6—Slow Idle Stop Screw
7—Fast Idle Stop Screw
8—Decelerator Pedal
9—Adjustable Yoke

Fig. 10A—Speed Control Linkage (350D, 355D)

Make all speed control adjustments in the exact order given here. Refer to Fig. 10A as a guide to adjusting points.

Be sure engine is warmed up before making speed adjustments.

Disconnect speed control cable from injection pump arm. Loosen bracket (4).

Run engine and rotate pump throttle arm until fast idle stop screw (7) contacts its stop. Engine speed should be at 2650 ± 25 rpm fast idle. If not, adjust pump stop screw (7) to correct.

Lightly rotate pump throttle arm to slow-idle position. Engine speed should be at (800 + 25 − 0 rpm) slow idle. If not, adjust slow-idle stop screw (6).

With speed control cable disconnected, move hand lever forward to the high idle position. Adjust cable yoke (5) to provide for 0.125-inch (3.18 mm) over travel of the pump arm. (For more travel, adjust cable at yoke (3) (under dash). Check slow idle.

Move hand throttle fully rearward and turn off ignition switch to shut off engine.

Move hand throttle back and forth to check friction on lever. Drag at end of throttle lever should be 8 ± 3 lb force (36 ± 13 N). Adjust, if necessary, at friction adjusting nut (2). Continue moving hand throttle to check speed control linkage for binding or looseness.

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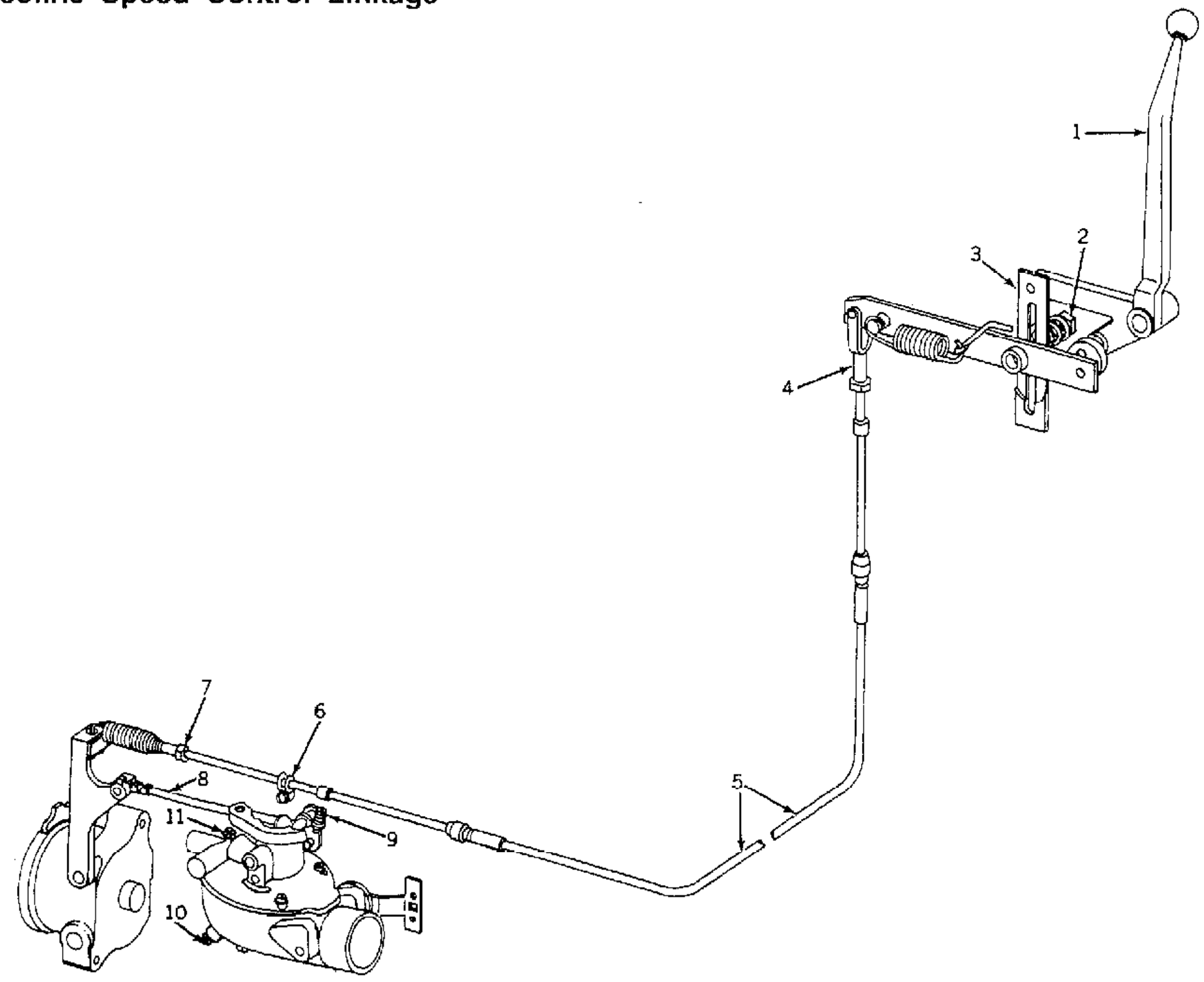
Gasoline Speed Control Linkage



1—Hand Throttle Lever
2—Friction Adjusting Nut
3—Friction Link
4—Adjustable Yoke
5—Speed Control Cable
6—Fast-Idle Stop Clamp
7—Adjustable Rod End
8—Carburetor Throttle Rod
9—Carburetor Slow-Idle Stop Screw
10—Carburetor Load Adjusting Needle
11—Carburetor Idle Adjusting Needle

Fig. 11-Gasoline Speed Control Linkage

Make all gasoline speed control adjustments in the exact order given here. Refer to Fig. 11 for a guide to adjusting points.

Be sure engine is at operating temperature before making speed adjustments. Use a stroboscope to check speeds.

Adjust throttle rod (8) to specifications when governor lever and carburetor throttle are both in the wide-open position.

Move hand throttle fully to rear. Engine speed should be at slow idle. If not, adjust carburetor slow-idle stop screw (9) to touch its stop at the correct speed. Disconnect yoke (4) from hand throttle and push cable (5) fully forward until seated against the internal stop in the cable sheath. Then adjust the spring retainer (inside spring) to just contact the governor at slow idle.

With engine running at slow-idle speed set in step 2, adjust carburetor idle needle (11) to obtain smooth engine idle.

Move hand throttle fully forward. Engine speed should be at fast idle. If not, loosen fast-idle stop clamp (6) and adjust it against cable sheath end at the correct speed.

With engine running at fast idle, turn in carburetor load needle (10) until engine begins to falter. Turn needle out until engine begins to run smooth, then turn one additional turn.

With tractor under load, readjust carburetor load needle (10) as necessary. If engine backfires as clutch is engaged, open the load needle slightly. If black smoke comes out of muffler, close load needle slightly. If carburetor cannot be properly adjusted, clean and overhaul as directed in Section 4.

Move hand throttle back and forth to check friction on lever. Check for 11 to 17 pounds (5.0 to 7.7 kg) drag at end of throttle lever. Adjust, if necessary, at friction adjusting nut (2). Continue moving hand throttle to check speed control linkage for binding or looseness.

Air Intake System

Intake Manifold Vacuum Test (Gasoline)

Remove pipe plug from intake manifold above carburetor.

Install a vacuum gauge to intake manifold. Run engine at high idle. The gauge should read 15 to 20 in. Hg (51 to 68 kPa) (508 to 677 mbar).

Shut off engine and remove gauge. Apply permatex to threads of pipe and reinstall in intake manifold.

If vacuum is low, check for:

1 - Improper ignition timing
2 - Damaged intake or exhaust valves
3 - Improper valve clearance
4 - Improper carburetor adjustment
5 - Leaking intake manifold gasket

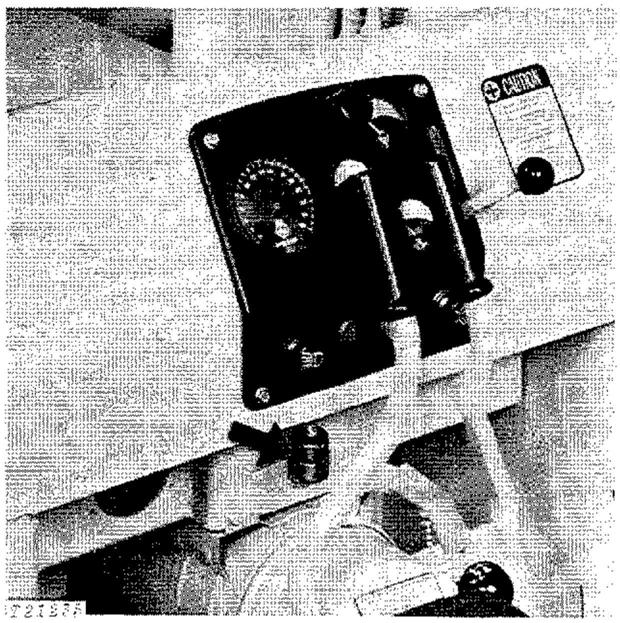


Fig. 12-Air Restriction Indicator

Install a "T" fitting into restriction indicator. Install restriction indicator on one end of "T" and D05022ST 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 18.1 to 21.9 in. H_2O (4.5 to 5.4 kPa) (45 to 54 mbar) (gasoline) or 22.7 to 27.3 in. H_2O (5.6 to 6.8 kPa) (56 to 68 mbar) (diesel).

Remove water vacuum gauge, restriction indicator and "T" fitting. Install indicator.

Group 9015
ELECTRICAL SYSTEM

GENERAL INFORMATION

This group contains trouble shooting 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 service components, when removed from the unit, are provided in sections covering specific component.

A 12-volt negative system is used to supply the electrically-operated components of this unit. Current is supplied by either one 12-volt battery or two 12-volt batteries connected in parallel for cranking the engine and operating the accessories when the engine is not running.

The electrical system is a combination of five electrical circuits: the charging circuit, the starting circuit, the ignition circuit, the light circuit and the accessory circuit.

Batteries

The batteries are the heart of the electrical system. During operation, the storage batteries function as an electrochemical device for converting chemical energy into electrical energy required for cranking the engine or operating the accessories when the engine is shut-down.

The batteries do not actually store electricity as is commonly believed, but it does convert electricity into chemical energy which is stored until the battery is connected to an external circuit, at which time the chemical energy is converted back into electrical energy and current flows through the circuit.

For good operation, the batteries must do three jobs:

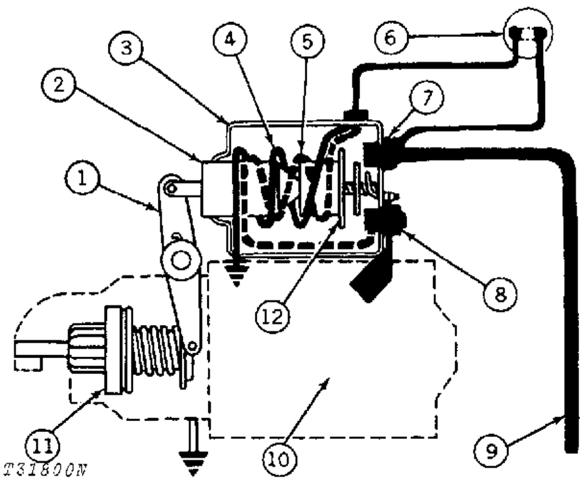
1. Supply current for starting the engine.

2. Supply current when the demand exceeds the output of the charging system.

3. Stabilize the voltage in the system during operation.

Starting Circuit

The starting circuit consists of the batteries, starting motor with solenoid switch, start-safety switch, key switch, ammeter and the connecting wires.



1—Shift Lever
2—Plunger
3—Solenoid
4—Hold-In Winding
5—Pull-In Winding
6—Key Switch
7—Battery Terminal
8—Motor Terminal
9—Battery Positive Cable
10—Starting Motor
11—Overrunning Clutch
12—Contact Disk

Fig. 1-Solenoid Circuit

When the key switch is turned to the ignition position and the start switch is pressed, 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 magnetic pull 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 a large 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. Thus 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.

Once 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 so that 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.

Charging Circuit

FOS For information on fundamentals of an alternator charging circuit, refer to "Charging Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

The charging system consists of the batteries, alternator, regulator, ammeter, starting motor, key switch and connecting wires.

The purpose of the charging circuit is to provide operating power when the machine is running and to keep the batteries fully charged.

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 alternating current and voltage. The alternator current is rectified to direct current by six 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 cut-out relay.

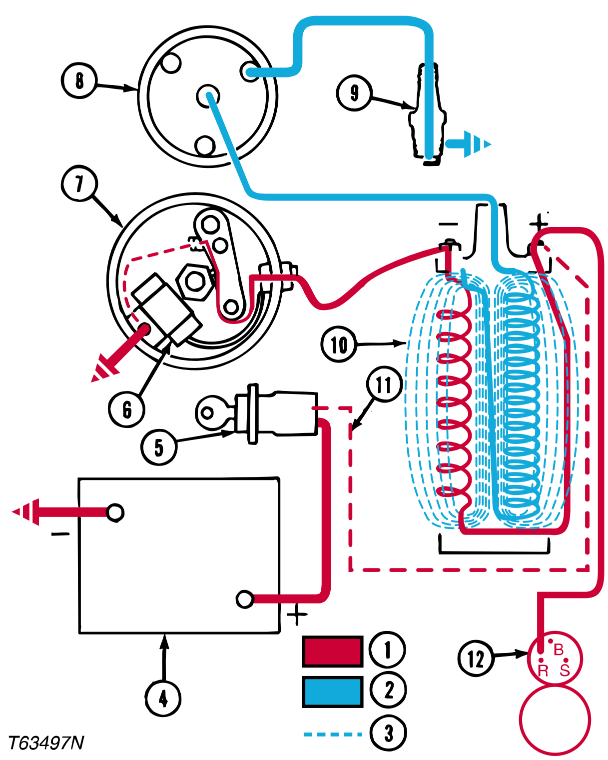
The alternator output current is controlled by the current flow through the field coil (rotor). The amount of current required is determined and controlled by the regulator. The excitation resistor in the regulator supplies a starting current to the alternator field when the key switch is turned on. Once the alternator is excited, a voltage is developed at the regulator terminal and a voltage regulator takes over control of the system voltage.

With the key switch off, and the engine not running, battery power is blocked by positive diodes in the regulator and by the open contacts of the key switch.

With the key switch on, and the engine running, a current flows from the key switch accessory terminal through the regulator, the alternator and finally to ground.

The regulator uses combinations of diodes, transistors, and rectifiers to control voltage output from the alternator. Many times a second the regulator will open and close voltage flow so that a constant voltage is maintained. Among the diodes in the regulator is a Zener diode which adjusts current output flow according to temperature variations.

Ignition Circuit



1—Primary Circuit
2—Secondary Circuit
3—Magnetic Field
4—Battery
5—Key Switch
6—Condenser
7—Distributor
8—Distributor
9—Spark Plug
10—Coil
11—Resistance Wire
12—Solenoid

Fig. 2-Ignition Circuit

With the key switch on, current flows through the primary circuit shown in red, that is from the battery through the primary winding of the ignition coil and closed distributor contacts to ground, and then back to the battery.

Current flow through coil primary windings creates a magnetic field. In a small fraction of a second (build-up time), current flow and magnetic field reach their maximum value.

When the contact points open, the current decreases very rapidly in the ignition coil primary windings, and a high voltage is induced in the coil secondary winding.

This high secondary voltage forces a current flow to distributor rotor which directs secondary current to the proper spark plug. The secondary current jumps spark plug air gap to the grounded electrode and ignites the fuel-air mixture to provide the proper stroke.

The secondary electrons flow from the coil secondary windings, across the distributor rotor gap and spark plug gap, and then back to the secondary winding through ground, the battery and key switch. The distributor contact points then reclose, and the cycle repeats. The next firing spark plug then will be the one connected to the distributor cap insert that is aligned with the rotor when the contacts separate.

With the engine running, current flows through the coil primary resistor, the other lead connected between the coil and key switch. This resistance wire is designed to protect the distributor contacts from excessive arcing and burning.

When the contacts separate, a high voltage because of self-induction is induced in the coil primary winding. This voltage may be about 250 volts, which causes an arc to form across the distributor contacts.

To bring the primary current to a quick controlled stop, and in order to greatly reduce the size of the arc and thereby ensure prolonged contact point life, a capacitor is connected across the distributor contacts. The high voltage induced in the coil primary winding causes the capacitor plates to charge when the contacts first separate. The capacitor acts initially like a short circuit and current flows into the capacitor to minimize arcing at the contacts.

FOS For additional information on ignition circuits, refer to "Ignition Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

Block Diagram (Fig. 6)

A block diagram is a simple picture of the power flow in the electrical system. It provides an easy to follow description of the system components and their relationship to other components.

Use the block diagram (Fig. 6) to follow the basic power distribution to the various circuits.

Trace the current by starting at the battery positive terminal and follow the connecting lines from box to box. Current flows from the batteries to the starting motor and then to the alternator and key switch. As you can see this provides a very basic and simple picture of the current or power distribution in the system.

By looking at the output of the key switch, you can see that the current flow is further distributed out of two terminals: "ACC" and "IGN."

The components in each of these circuits can be determined very easily by following the connecting lines from box to box.

Now let's use the block diagrams to solve a problem.

Problem: Engine starts but the hour meter does not work.

Solution: By referring to the block diagram (Fig. 6) you can see that there is power to the injection pump solenoid. Therefore the problem must be in the hour meter or the wiring to the hour meter.

Schematic Diagram (Fig. 7)

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.

To use a schematic diagram, it is essential that you know and understand the basic symbols used in an electrical schematic.

FOS For explanation of basic symbols of an electrical schematic, refer to FOS Manual - "ELECTRICAL SYSTEMS", page IV.

To use the electrical schematic, you must think of the electrical current as flowing from the positive (+) terminal of the batteries through the various circuits and components to ground, and from ground back to the negative (−) terminal of the battery.

If circuit is complete to ground, positive current flow is from the batteries to the starting motor solenoid "BAT" terminal, to the alternator and on to the key switch.

Now let's use the schematic to solve a problem.

Problem: Gauges do not work but the lights work.

Solution: By referring to the schematic diagram (Fig. 7) you can see there is power to the "ACC" terminal of the key switch. So the problem is probably an open wire from the key switch to the engine oil pressure gauge.

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.

Disconnect the battery cables before fast charging the battery in the machine. This is especially important to prevent damage to the alternator.

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.

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. 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 Group 16, Section 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.

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.

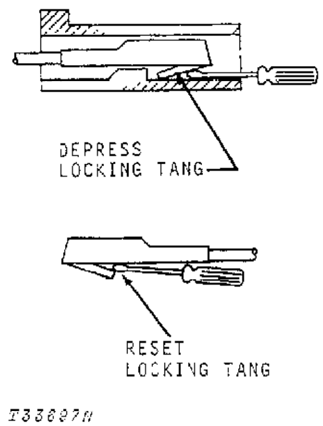


Fig. 3-Removing Female Connector

Insert a small screwdriver or paper clip into the body connector and press the locking tang down as shown in Fig. 3. Remove wire from connector.

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

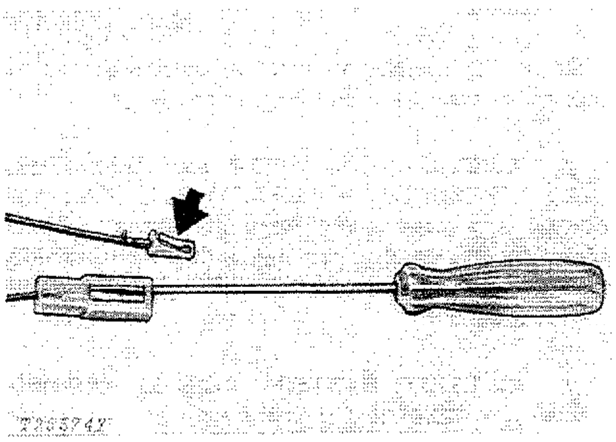


Fig. 4-Removing Male Connector

Using a knife or a screwdriver, bend the locking tang as shown in Fig. 4. Remove wire from connector.

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

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 - Gauges, cigar lighter and lights. How do each of 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 on the electrical system is necessary. See "System Testing" in this group.

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.
Defective start switch.
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 on and press start switch.

Voltmeter Indicates Battery Voltage

Defective starting motor.
Defective solenoid switch.

Voltmeter Does Not Indicate Battery Voltage

Defective key switch.
Defective start switch.
Defective neutral start switch.
Maladjusted neutral start switch.
Defective wiring between battery and solenoid "S" terminal.

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.

Ignition Circuit

Lack of Power

Incorrect timing.
Pitted distributor points.

Hard Starting

Weak spark.

Engine Overheats

Advance mechanism sticking.

Engine Knocks

Incorrect timing.

Engine Backfires

Advance mechanism sticking.

Engine Pre-Ignition

Faulty spark plugs.

Engine Misfires

Dirty spark plugs.
Faulty cables.
Incorrect distributor point gap.

Engine Uses Too Much Fuel

Fouled spark plugs.
Incorrect timing.

Engine Runs Irregularly

Faulty ignition.

Slow Acceleration

Advance mechanism sticking.
Defective coil or condenser.
Faulty distributor points.

Engine Will Not Start

Battery disconnect in "OFF" position.
Faulty coil.
Faulty condenser.
Faulty distributor points.
Coil high tension wire out of socket.
Cracked distributor rotor.
Faulty spark plugs.
Incorrect timing.
Spark plug cables installed incorrectly.

Engine Starts But Will Not Continue to Run

Faulty coil.
Faulty condenser.
Faulty distributor points.

Poor Ignition of Fuel

Incorrect spark plug gap.
Dirty spark plugs.
Faulty cables.
Incorrect timing.
Faulty distributor points.
Faulty condenser.
Defective coil.
Cracked distributor cap or rotor.
Defective wiring.

Gauges

Voltmeter Fluctuates (343541-)

Shorted or loose connections.
Alternator defective.
Alternator drive belt loose.
Low idling speed.

Voltmeter Shows Low Voltage (343541-) (Engine Running)

Alternator inoperative.
Faulty voltage regulator.
Short circuits.
Alternator drive belt loose or broken.
Defective voltmeter.

If A Gauge Does Not Register

Lack of current 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.

Cigar Lighter

Cigar Lighter Does Not Function

Circuit breaker in lighter tripped.
Faulty lighter element or lighter shell.
Defective wiring.

Injection Pump and Carburetor 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.

Lights Will Not Light

Defective light switch.
Defective wiring.
Poor ground on lights.

Indicator (354080-) Bulldozers (354130-) Loaders

Filter Restriction Indicator Does Not Light With Key Switch On and Engine Not Running

Indicator light bulb burnt out.
Defective pressure switch.
Defective wiring.

Filter Restriction Indicator Lights During Machine Operation

Transmission filter bypassing.
Defective wiring.

Return-To-Dig Mechanism (-293993)

Control Lever Remains In Detent Position

Misaligned bucket switch
Open circuit
Malfunctioning switches or solenoid
Mechanical malfunction

Control Lever Won't Stay In Detent Position

Open circuit
Malfunctioning switches or solenoid

Control Lever Won't Go Into Detent Position

Mechanical malfunction of return-to-dig mechanism

Return-To-Dig Mechanism (293994-)

Control Lever Remains in Detent Position

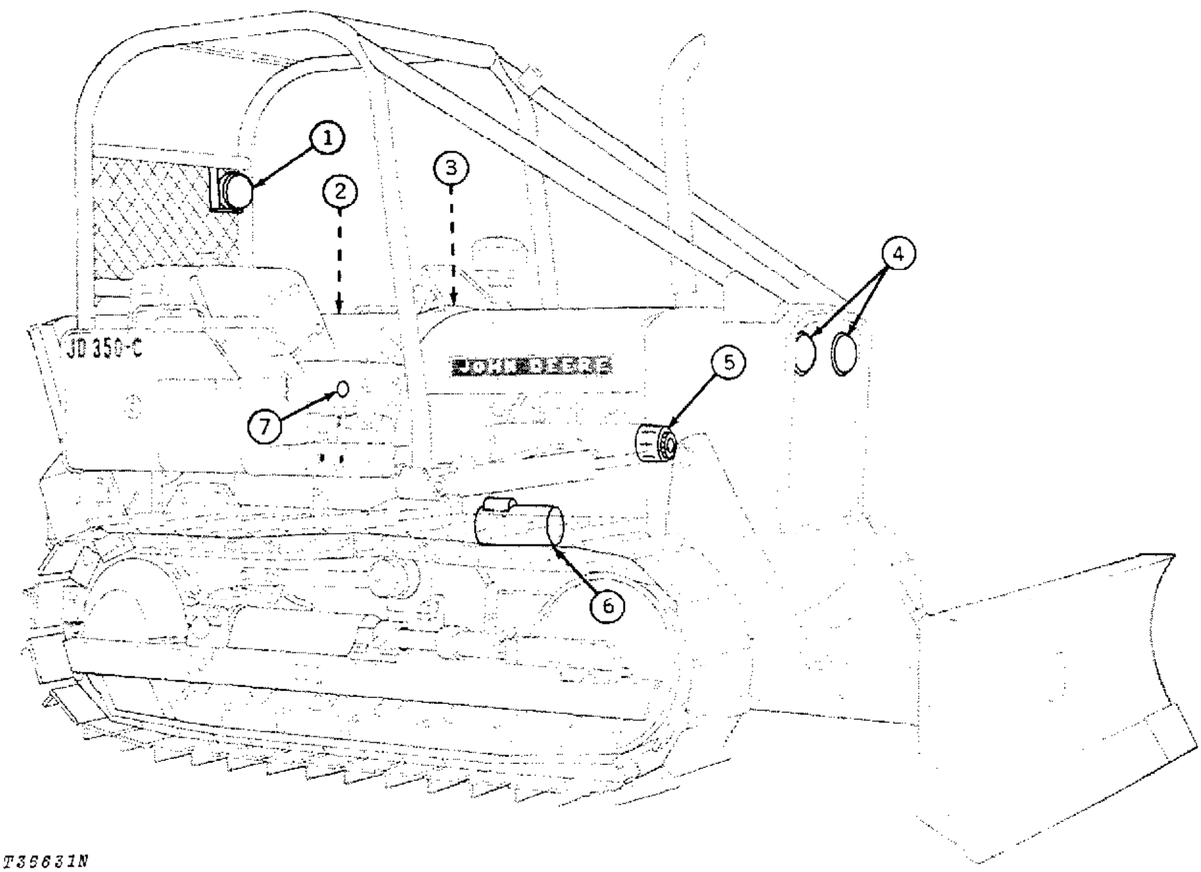
Misaligned bucket switch
Defective bucket switch
Mechanical malfunction

Control Lever Won't Stay in Detent Position

Defective bucket switch
Open circuit.
Defective electro-magnet

Control Lever Won't Go Into Detent Position

Mechanical malfunction of return-to-dig mechanism



1—Rear Light
2—Battery Box
3—Instrument Panel
4—Front Lights
5—Alternator
6—Starting Motor
7—Hour Meter

Fig. 5-Component Location

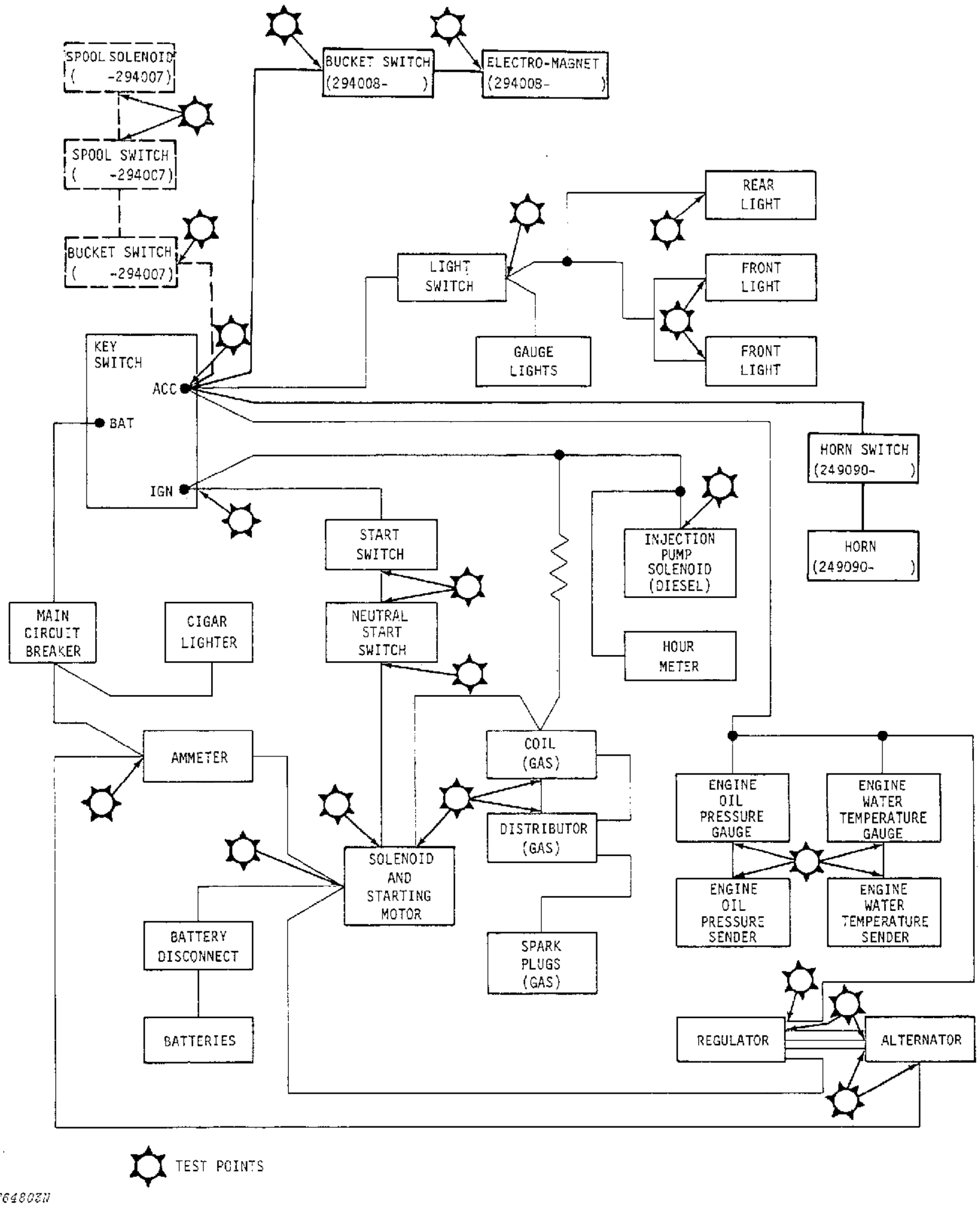


Fig. 6-Electrical System Block Diagram (-343540)

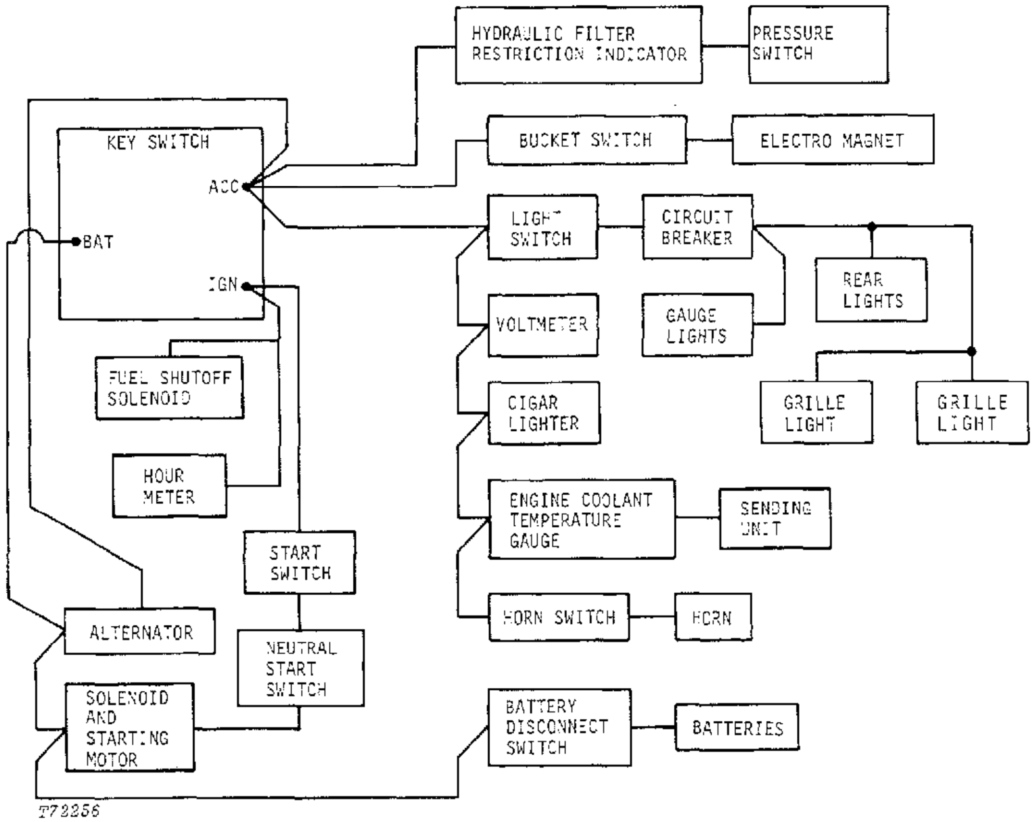
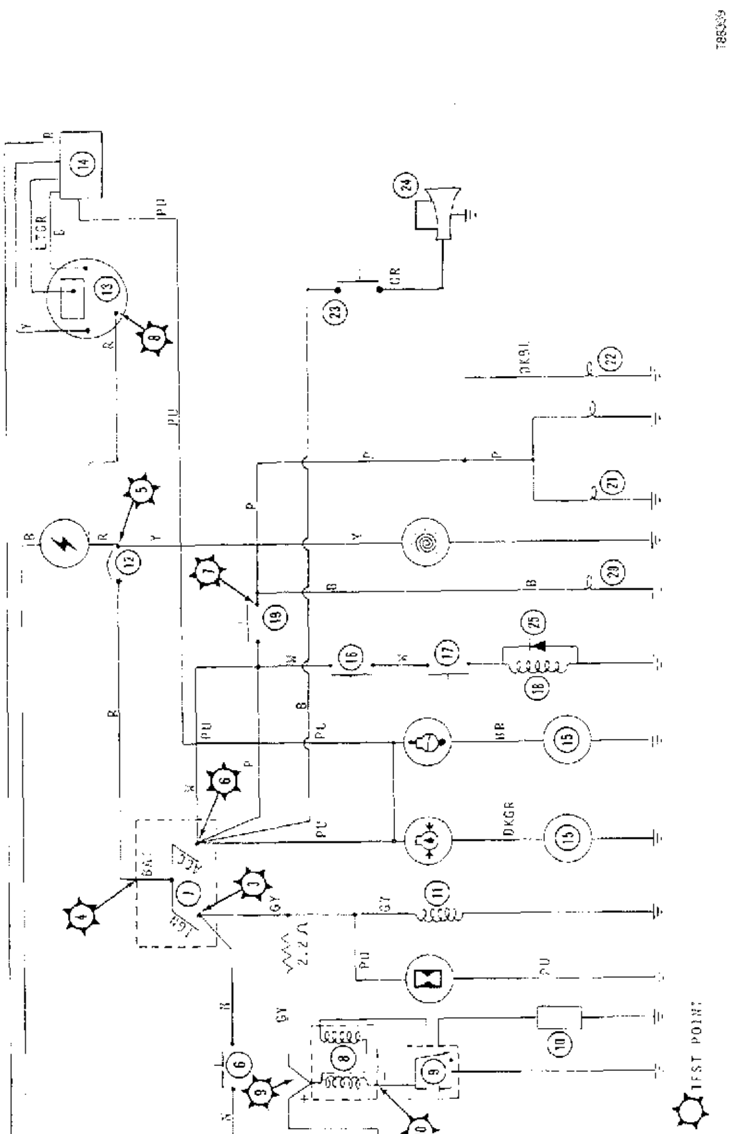


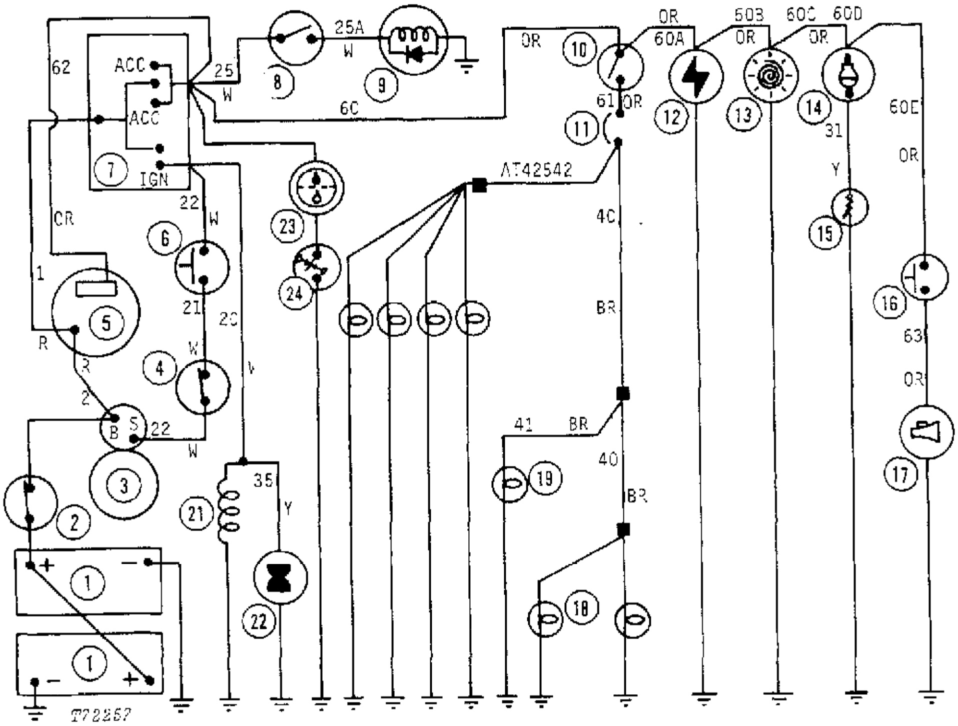
Fig. 7-Block Diagram (343541-)



1—Battery
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Neutral Start Switch
6—Start Switch
7—Key Switch
8—Coil (gas)
9—Distributor (gas)
10—Spark Plug (gas)
11—Fuel Shut-Off Solenoid (diesel)
12—Circuit Breaker
13—Alternator
14—Regulator
15—Sending Unit
16—Bucket Switch
17—Spool Switch (-294007)
18—Spool Solenoid (-294007) Electro-Magnet (294008-)
19—Light Switch
20—Gauge Lights
21—Front Lights
22—Rear Light
23—Horn Switch (249090-)
24—Horn (249090-)
25—Diode (-294007)

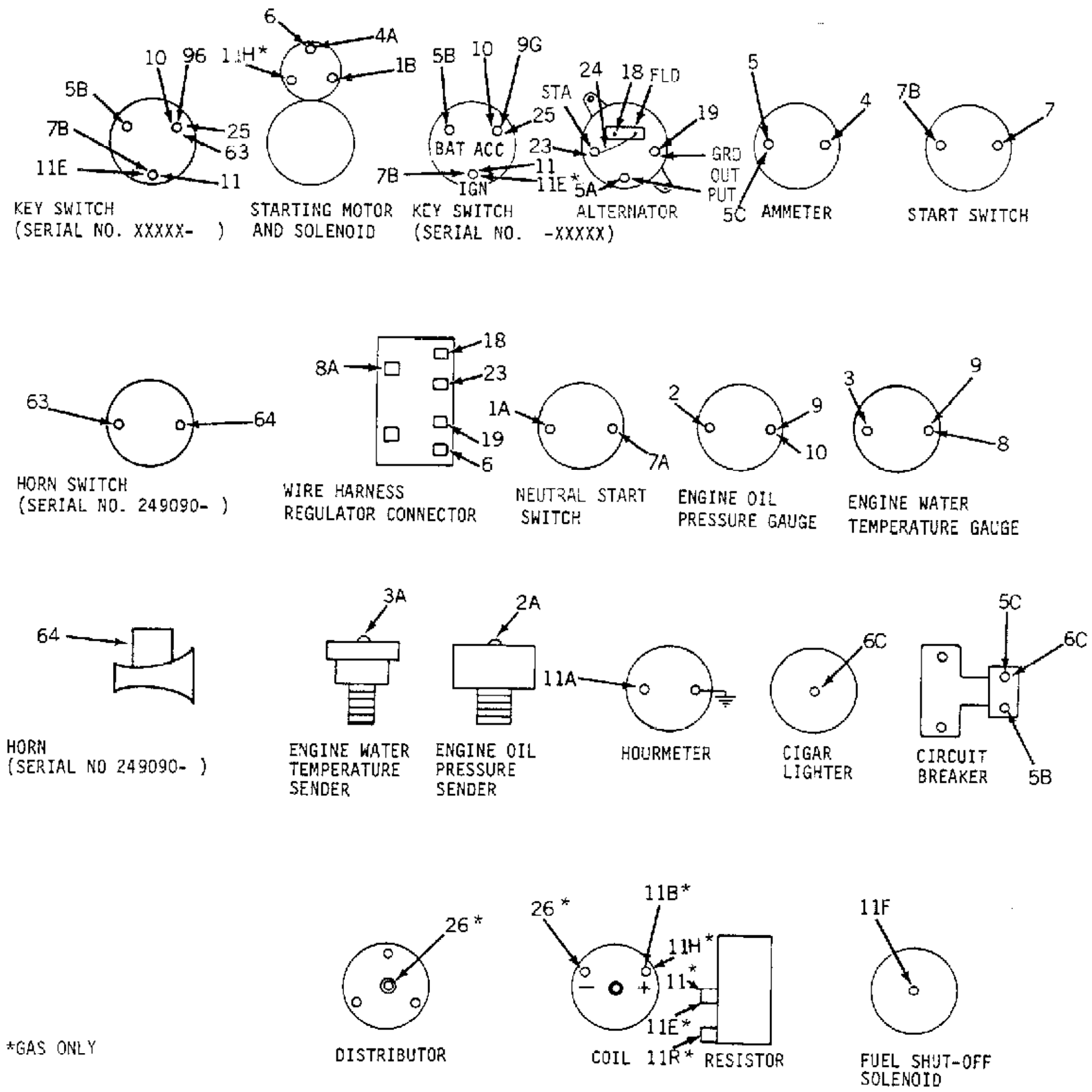
B—Black
BR—Brown
DKBL—Dark Blue
DKGR—Dark Green
GY—Gray
LTBL—Light Blue
OR—Orange
N—Neutral
P—Pink
PU—Purple
R—Red
W—White
Y—Yellow

Fig. 8-Electrical System (-343540)



1—Batteries
2—Battery Disconnect Switch
3—Starting Motor and Solenoid
4—Neutral Start Switch
5—Alternator with Regulator
6—Start Switch
7—Key Switch
8—Bucket Switch
9—Electro Magnet
10—Light Switch
11—Circuit Breaker
12—Voltmeter
13—Cigar Lighter
14—Engine Coolant Temperature Gauge
15—Sending Unit
16—Horn Switch
17—Horn
18—Grille Lights
19—Rear Light
20—Gauge Lights
21—Fuel Shutoff Solenoid
22—Hour Meter
23—Hydraulic Filter Restriction Indicator (354080-) Bulldozers (354130-) Loaders
24—Pressure Switch (354080-) Bulldozers (354130-) Loaders

Fig. 9-Electrical Schematic (343541-)



*GAS ONLY

T65019N

Fig. 10-Component Wire Routing (Part I) (-343540)

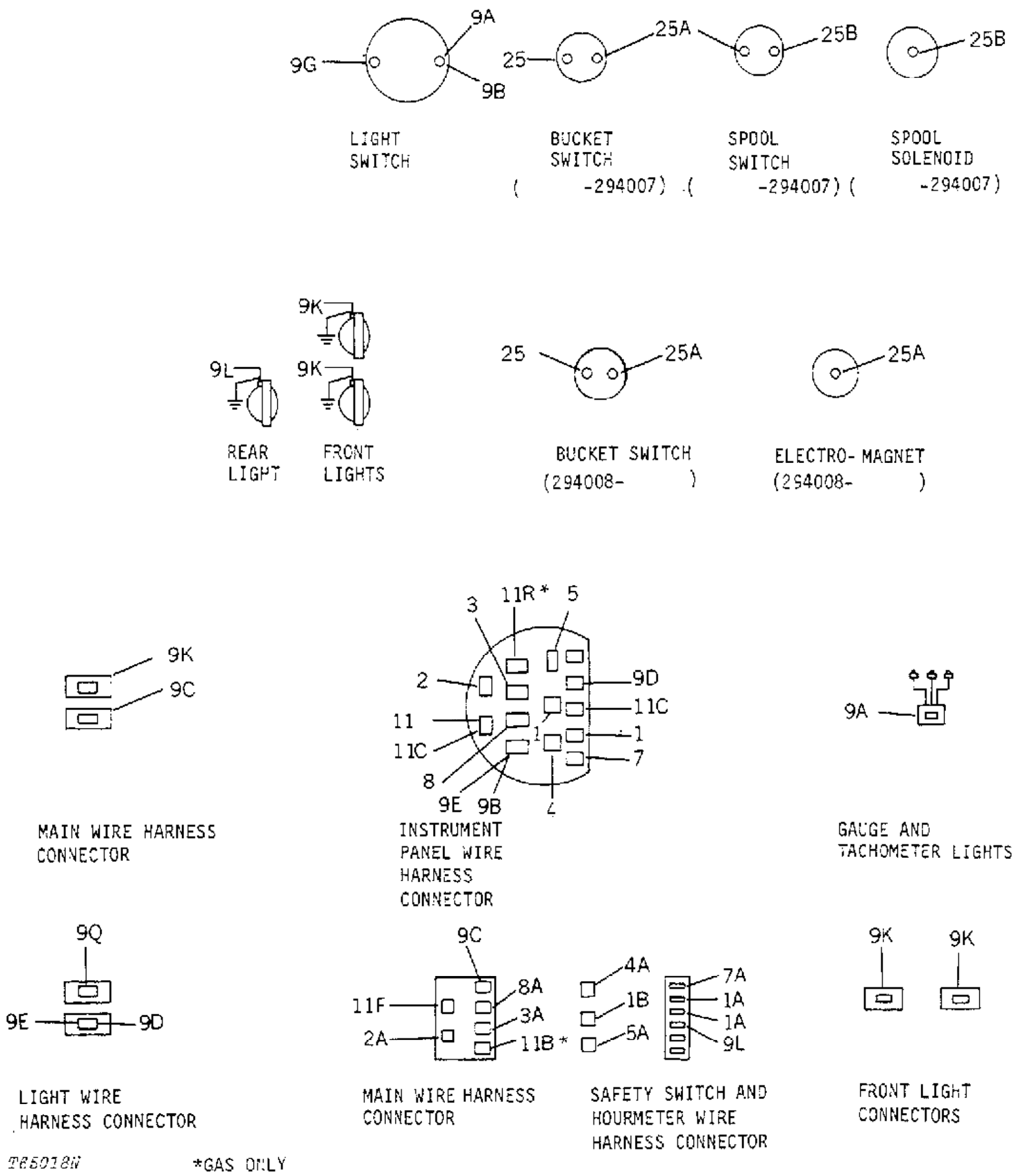


Fig. 11-Component Wire Routing (Part II) (-343540)

The following is an explanation of Figs. 10 and 11 - Component Wire Routing: (-343540)

No.	Color	Routing
1	Neutral	Instrument panel wire harness connector to instrument panel wire harness connector.
1A	Neutral	Safety switch and hour meter wire harness connector to start-safety switch.
1B	Neutral	Main wire harness single connector to solenoid "S" terminal.
2	Dark Green	Instrument panel wire harness connector to engine oil pressure gauge.
2A	Dark Green	Main wire harness connector to engine oil pressure sender.
3	Brown	Engine temperature gauge to instrument panel wire harness connector.
3A	Brown	Main wire harness connector to engine coolant temperature sender.
4	Black	Ammeter to instrument panel wire harness connector.
4A	Black	Main wire harness single connector to starting motor solenoid "BAT" terminal.
5	Red	Ammeter to instrument panel wire harness connector.
5A	Red	Main wire harness connector to alternator output terminal.
5B	Red	Circuit breaker to key switch "BAT" terminal.
5C	Red	Ammeter to circuit breaker.
6	Red	Starting motor solenoid "BAT" terminal to wire harness regulator connector.
6C	Yellow	Circuit breaker to cigar lighter.
7	Neutral	Start switch to instrument panel wire harness connector.
7A	Neutral	Safety switch and hour meter wire harness connector to start-safety switch.
7B	Neutral	Start switch to key switch "IGN" terminal.
8	Purple	Engine temperature gauge to instrument panel wire harness connector.
8A	Purple	Main wire harness connector to wire harness regulator connector.
9	Purple	Engine oil pressure gauge to engine temperature gauge.
9A	Black	Light switch to gauge lights.
9B	Pink	Light switch to instrument panel wire harness connector.
9C	Pink	Main wire harness connector to main wire harness single connector.
9D	Dark Blue	Instrument panel wire harness connector to light wire harness connector.
9E	Dark Blue	Instrument panel wire harness connector to light wire harness connector.
9G	Pink	Light switch to key switch "ACC" terminal.
9K	Pink	Main wire harness single connector to grille and front light connector.
9L	Dark Blue	Safety switch and hour meter wire harness connector to rear light.
10	Purple	Key switch "ACC" terminal to engine oil pressure gauge.
11	Gray	Key switch "IGN" terminal to instrument panel wire harness connector (diesel only).

The following is a continuation of the explanation of Figs. 10 and 11 - Component Wire Routing. (- 343540)

No.	Color	Routing
11*	Gray	2.2 ohm resistor to instrument panel wire harness connector.
11A	Purple	Safety switch and hour meter wire harness connector to hour meter.
11B*	Gray	Coil (+) terminal to main wire harness connector.
11C	Purple	Instrument panel wire harness connector to instrument panel wire harness.
11E*	Gray	2.2 ohm resistor to key switch "IGN" terminal.
11F	Gray	Main harness connector to fuel shut-off solenoid.
11H*	Light Blue	Solenoid "R" terminal to coil.
11R*	Gray	Instrument panel wire harness connector to 2.2 ohm resistor.

No.	Color	Routing
18	Light Green	Wire harness regulator connector to alternator "FLD" terminal.
19	Black	Wire harness regulator connector to alternator "GRD" terminal.
23	Yellow	Wire harness regulator connector to alternator "STA" terminal.
24	Black	Alternator "FLD" terminal to alternator "STA" terminal.
25	White	Key switch "IGN" terminal to bucket switch.
25A	White	Bucket switch to spool switch. (-294007).
25A	White	Bucket switch to Electro-Magnet (294008-)
25B	White	Spool switch to spool solenoid. (-294007).
26	Black	Coil to distributor.
63	Black	Key switch "ACC" terminal to horn switch (249090-).
64	Orange	Horn switch to horn (249090-).

*Gas Only

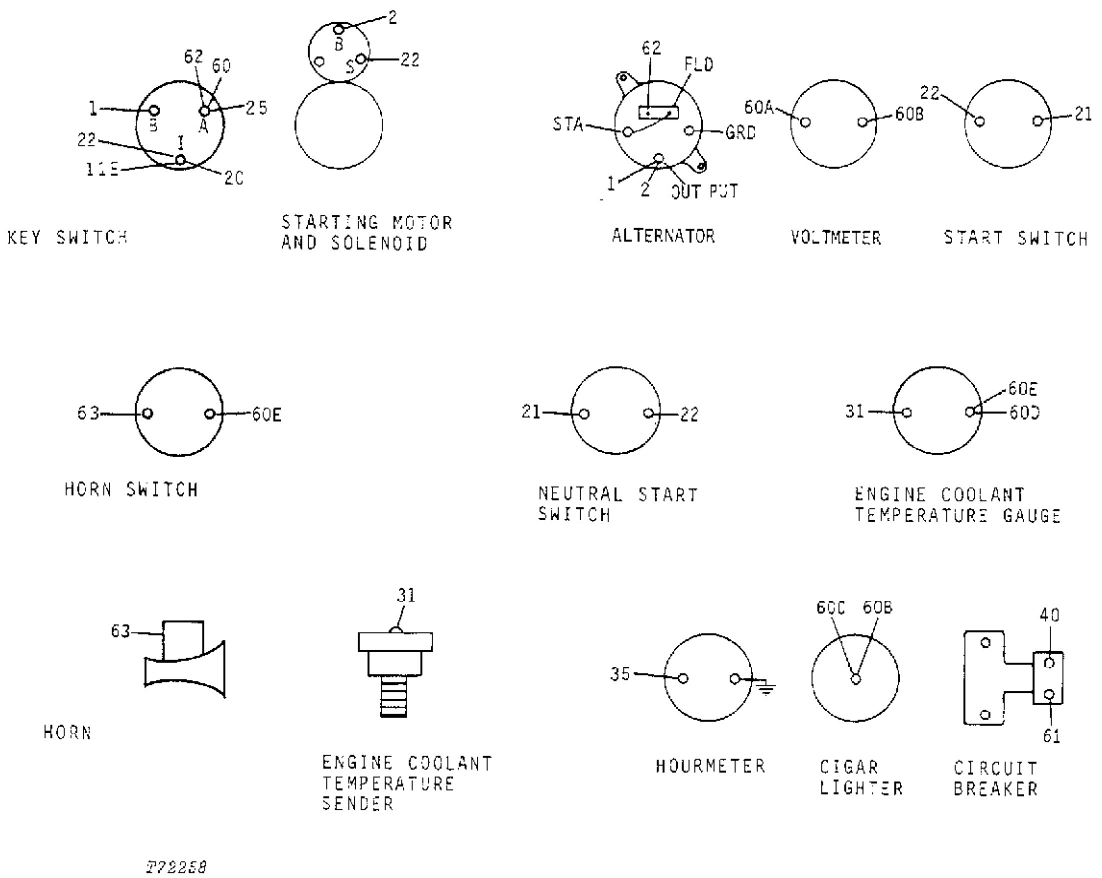


Fig. 12-Component Wire Routing (Part I) (343541-)

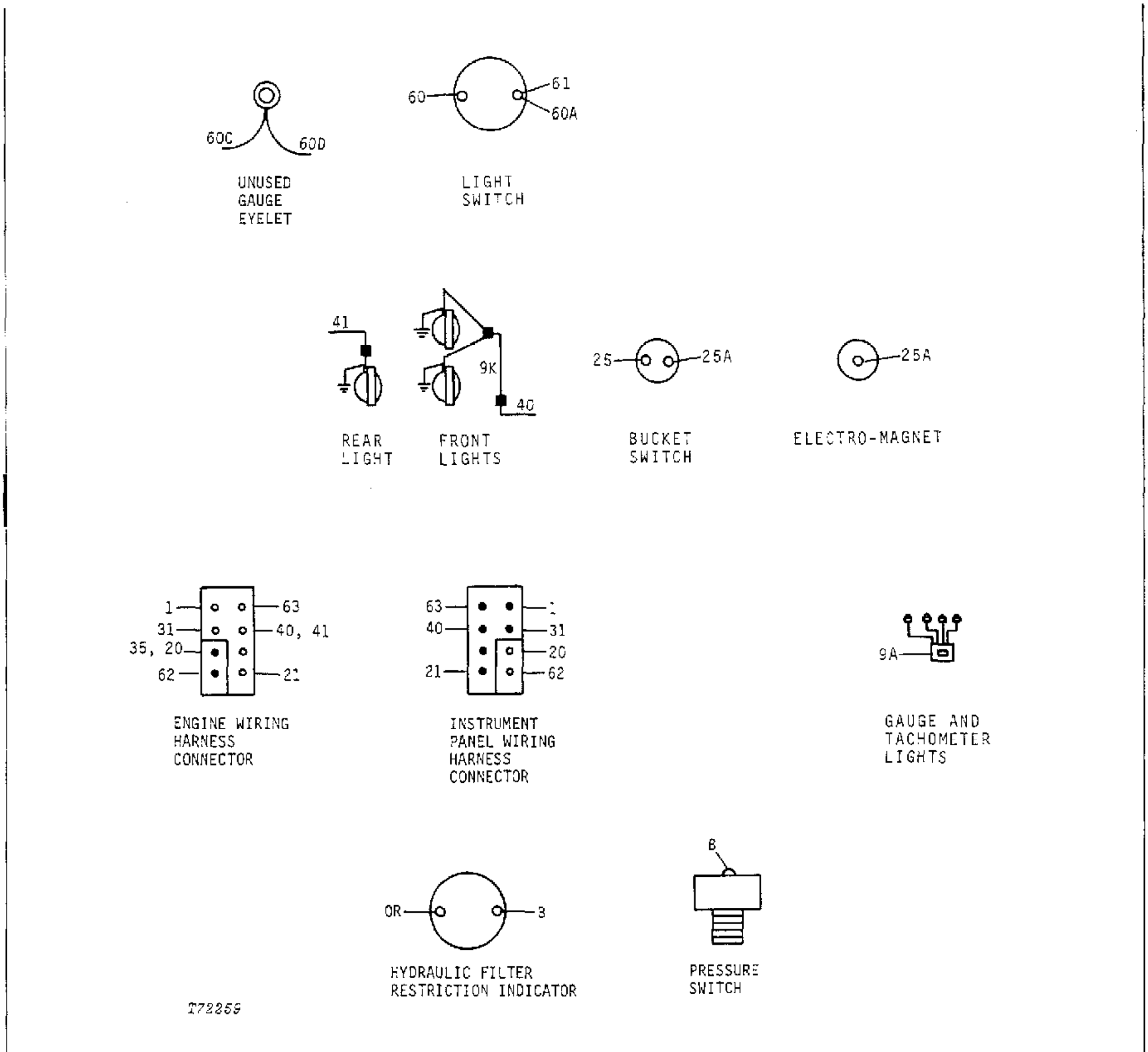


Fig. 13-Component Wire Routing (Part II) (343541-)

The following is an explanation of Figs. 12 and 13 - Component Wire Routing: (343541-)

Circuit No.	Color	Routing
1	Red	Key switch "B" terminal to instrument panel harness connector.
1	Red	Engine wiring harness connector to alternator battery terminal.
2	Red	Alternator battery terminal to starting motor "B" terminal.
9K	Pink	Engine wire harness connector, circuit 40, to grille housing lights connector.
20	White	Key switch "I" terminal to instrument panel harness connector.
20	White	Engine wiring harness connector to fuel shut-off solenoid.
21	White	Start switch connector to instrument panel harness connector
21	White	Engine wiring harness connector to neutral start switch.
22	White	Start switch connector to key switch "I" terminal.
22	White	Starting motor "S" terminal to neutral start switch.
25	White	Key switch "IGN" terminal to bucket switch.
25A	White	Bucket switch to electro magnet.
31	Yellow	Engine coolant temperature gauge to instrument panel harness connector.
31	Yellow	Engine wiring harness connector to engine coolant temperature sending unit.
35	Yellow	Hour meter connector to splice with circuit number 20 at the engine wiring harness connector.
40	Brown	Twenty amp circuit breaker to instrument panel harness connector.
40	Brown	Engine wiring harness connector to front lights connector.
41	Brown	Rear lights connector to splice with circuit number 40 at the engine wiring harness connector.
60	Orange	Light switch connector to key switch "A" terminal.
60A	Orange	Light switch connector to voltmeter.
60B	Orange	Voltmeter to cigar lighter.
60C	Orange	Cigar lighter to unused gauge eyelet.
60D	Orange	Unused gauge eyelet to engine coolant temperature gauge.
60E	Orange	Engine coolant temperature gauge to horn switch.
61	Orange	Twenty amp circuit breaker to light switch connector.
62	Orange	Key switch "A" terminal to instrument panel harness connector.
62	Orange	Engine wiring harness connector to alternator field connector.
63	Orange	Horn switch to instrument panel harness connector.
63	Orange	Engine wiring harness connector to horn.
—	Orange	Key switch "A" terminal to hydraulic filter restriction indicator. (354080-) Bulldozers (354130-) Loaders
—	Black	Hydraulic filter restriction indicator to pressure switch. (354080-) Bulldozers (354130-) Loaders

TESTING AND ADJUSTMENT

The circuits tested in this group are the charging circuit, starting circuit, ignition circuit, accessory circuit and light circuit.

Failure of the engine to crank may be due to one of a number of causes. Any one of several units in the starting circuit may be at fault, or the cause of failure may be due to 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 unit, otherwise a component may be removed needlessly, 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 servicemen from doing thorough work and may damage the electrical system.

Before you start the circuit tests, quickly review the precautions on page 90-9015-5 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 battery (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.
4. If there is a short, the test lamp will glow with all accessories turned off.
5. By disconnecting and reconnecting each electrical circuit, one at a time, the shorted circuit can be located.
6. When a disconnected circuit causes the test lamp to go out, you've found the culprit. Now all that remains is to trace that circuit, then locate and correct the cause of the short.

Testing The Batteries Voltage

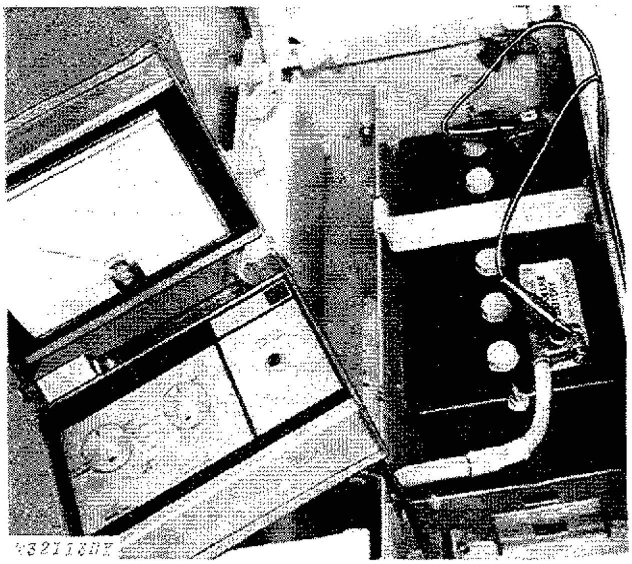


Fig. 14-Checking Battery Voltage

Battery condition should be determined first. It is vital to the testing of the starting circuit problem to have the battery fully charged and free of shorted or dead cells. Use the following test to determine voltage available at battery.

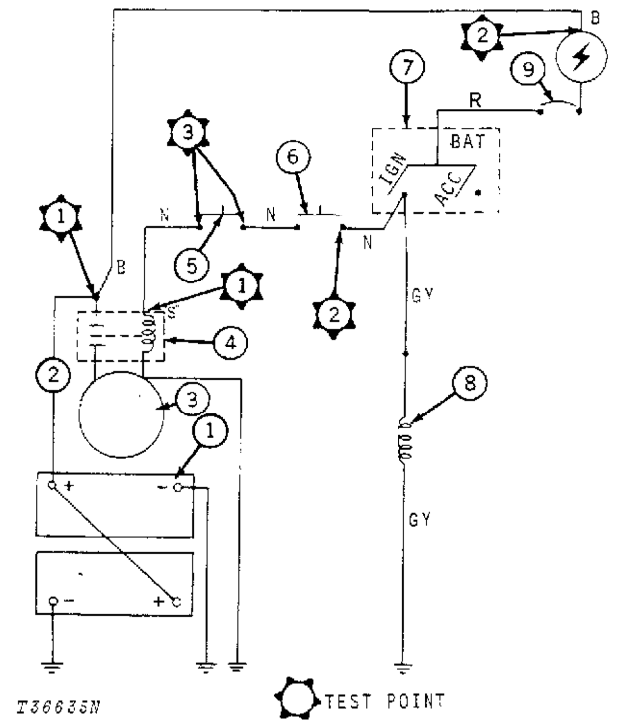
1. Attach positive (+) voltmeter lead to positive (+) battery post. Attach negative (−) voltmeter lead to negative (−) battery post (Fig. 14).

2. Crank engine.

3. Voltmeter should read at least nine volts. If above the minimum, continue testing. If below minimum replace or recharge battery.

Testing the Starting Circuit (-343540)

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.



1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Neutral Start Switch
6—Start Switch
7—Key Switch
8—Injection Pump Solenoid
9—Circuit Breaker

Fig. 15-Starting Circuit

With the shift lever in neutral position, turn key switch on and press start switch. 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.

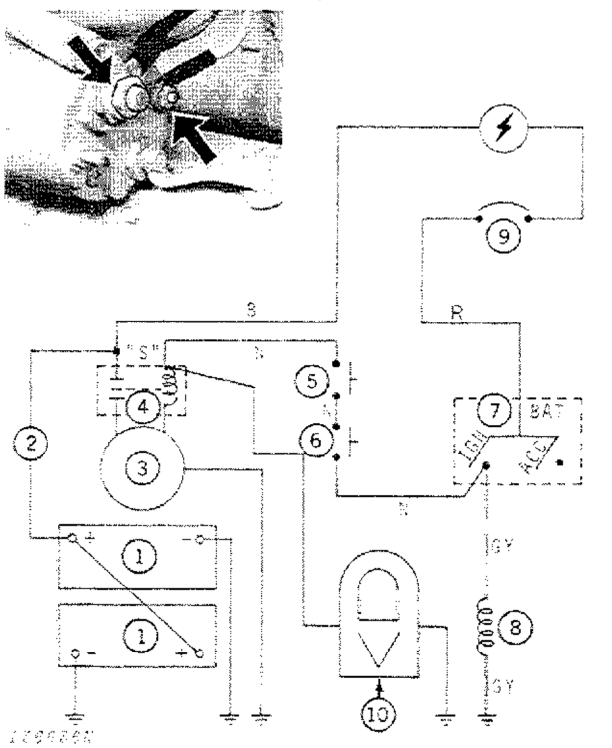
4. The starting motor turns over the engine slowly or erratically.

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—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Neutral Start Switch
6—Start Switch
7—Key Switch
8—Injection Pump Solenoid
9—Circuit Breaker
10—Voltmeter

Fig. 16-Starting Circuit Test No. 1

Connect voltmeter to solenoid "S" terminal and to ground (Fig. 16). With shifter lever in neutral position, turn key switch on and press 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 Section 4, Group 0422 for "Solenoid Tests."

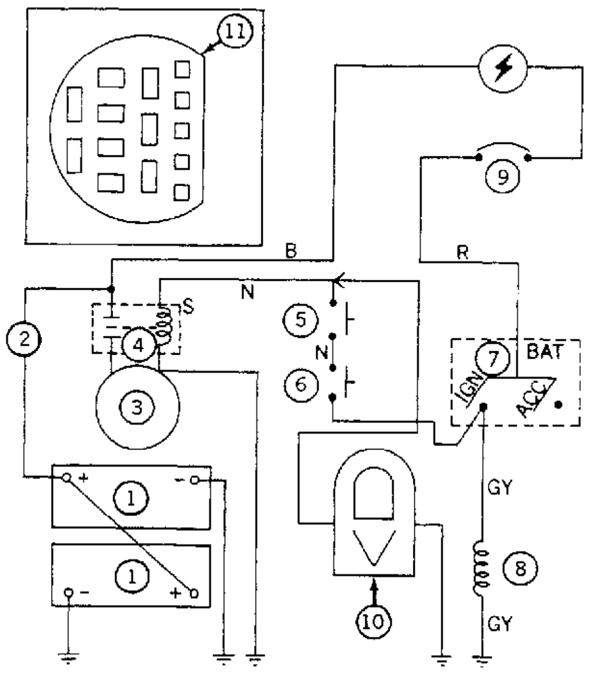
If there is no voltage reading connect voltmeter to solenoid "BAT" terminal. Voltmeter should read 9 to 12 volts.

If there is a reading of 9 to 12 volts proceed to Test No. 2.

If there is a low voltage reading or no voltage reading, check for defective battery cables or poor and corroded connections.

Test No. 2

Remove engine shields, pre-cleaner, muffler extension and hood.



T36637N

1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Neutral Start Switch
6—Start Switch
7—Key Switch
8—Injection Pump Solenoid
9—Circuit Breaker
10—Voltmeter
11—Harness Connector

Fig. 17-Starting Circuit Test No. 2

Insert a straightened paper clip into the instrument panel wire harness connector as shown in Fig. 17. With shift lever in neutral position, turn key switch on and press start switch. Voltmeter should read 9 to 12 volts.

If voltmeter reads 9 to 12 volts you know the circuit is okay from "BAT" terminal on the solenoid through the ammeter, circuit breaker, key switch and start switch is okay. Proceed to Test No. 3.

If there is no voltage reading, remove the instrument panel and check the ammeter terminal with the black lead for a voltage reading.

If there is a voltage reading of 9 to 12 volts, check for a defective circuit breaker, key switch, start switch, or open wires. Replace as necessary.

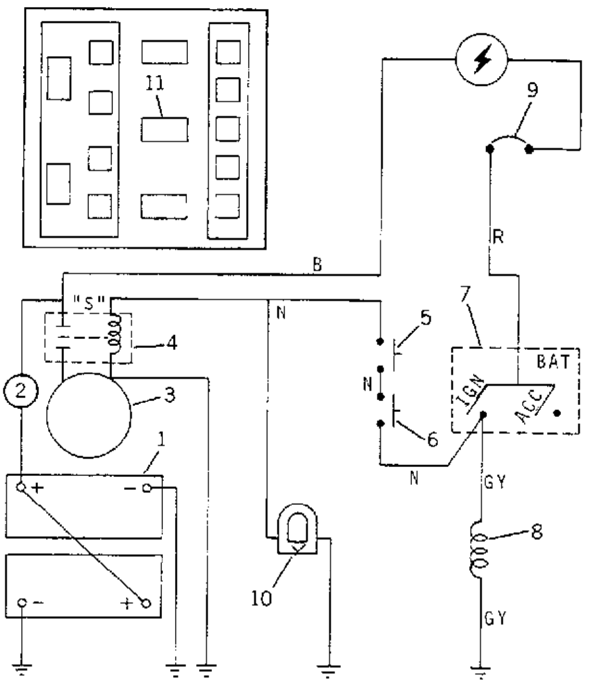
If there is no voltage reading at the ammeter and there was a voltage reading at the solenoid "BAT" terminal in Test No. 1, there must be an open wire between the solenoid "BAT" terminal and the ammeter.

Test No. 3

Connect voltmeter to the neutral colored wire at the main wire harness single connector (10, Fig. 18). With shifter lever in the neutral position, turn key switch on, press start switch. Voltmeter should read 9 to 12 volts.

If there is a reading of 9 to 12 volts, you know the neutral start switch is functioning okay, and the problem is in the neutral colored wire from the main wire harness single connector to the solenoid "S" terminal.

If there is no voltage reading, check the terminals of the neutral start switch with an electrical test probe. If probe lights on only one terminal, either the transmission is not in neutral, the connection is loose, or the neutral start switch is faulty or maladjusted. See Section 90, Group 9020 for neutral start switch adjustment.



1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Neutral Start Switch
6—Start Switch
7—Key Switch
8—Injection Pump Solenoid
9—Circuit Breaker
10—Voltmeter
11—Main Harness Single Connector

Fig. 18-Starting Circuit Test No. 3

2. Solenoid Contacts "Clicked" but the Starting Motor Did Not Operate

This indicates that the circuit problems lie within the starting motor. 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.

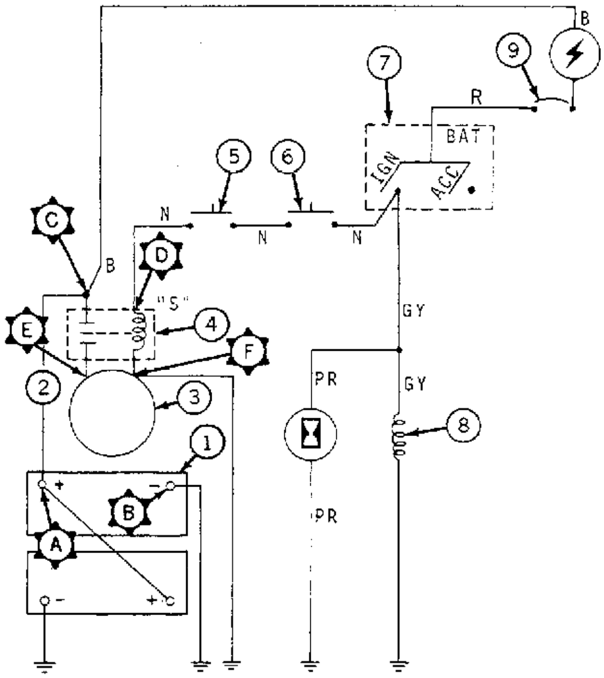
We know that the starting motor is getting enough current to operate. The problem then, is either in the shifting of the drive assembly into mesh, a broken armature shaft, or a dirty or faulty drive assembly. These causes require disassembly of the starting motor for proper service or repair. See Section 4, Group 0422.

4. Starting Motor Turned the Engine Over Slowly or Erratically

With slow 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, cause is either the batteries or the starting motor. Check battery condition first. See Section 16 for testing batteries and starting motor.

High Resistance Test



T36639N

1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Neutral Start Switch
6—Start Switch
7—Key Switch
8—Injection Pump Solenoid
9—Circuit Breaker

Fig. 19-High Resistance Test Points

Disconnect wire from injection pump solenoid shut-off terminal.

Connect voltmeter to ground and to solenoid battery terminal. Operate starter and compare voltage with a similar reading at battery. Always use a pin connector at battery post. If difference is more than 0.8 volt, make the tests indicated in Fig. 19. Check for defective wires or faulty connections.

RESISTANCE TEST VALUES

Test Points	Maximum Voltmeter Reading
B-F	0.2
A-C	0.2
C-D	1.0
C-E	0.2

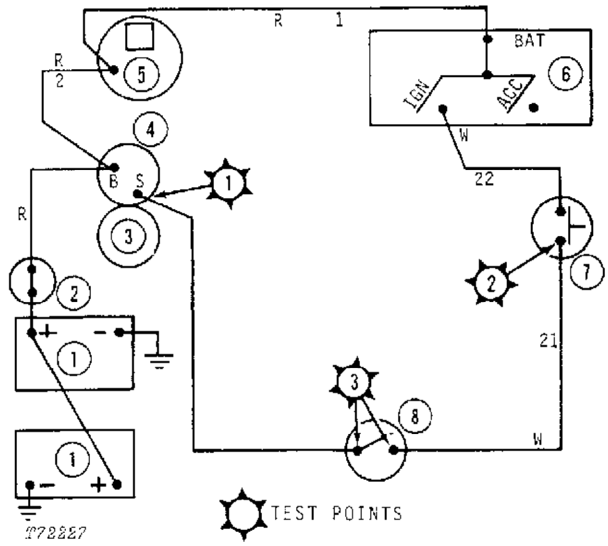
Engine Starts But the Starting Motor Drive Does Not Disengage From the Flywheel

This indicates a defect in the drive mechanism, or solenoid pull in windings, or solenoid contacts, or solenoid control circuit which will not allow the drive to disengage.

The starting motor or solenoid needs repair. See Section 4, Group 0422.

Testing the Starting Circuit (343541-)

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.



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Alternator
6—Key Switch
7—Start Switch
8—Neutral Start Switch

Fig. 20-Starting Circuit

With the shift lever in neutral position, turn key switch on and press start switch. 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.

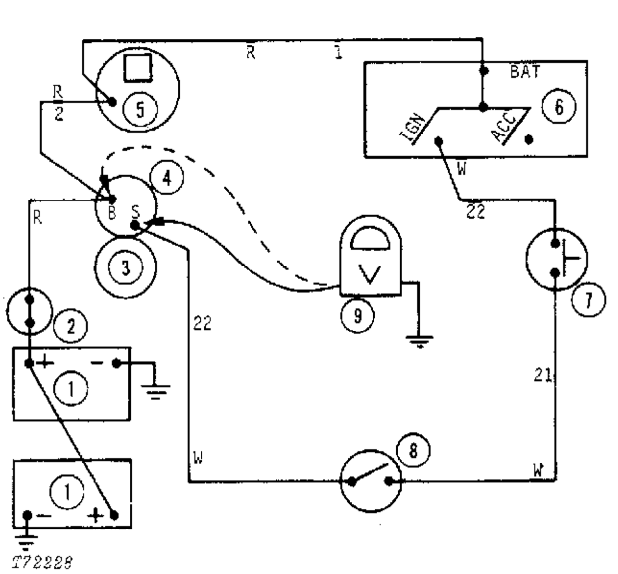
4. The starting motor turns over the engine slowly or erratically.

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—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Alternator
6—Key Switch
7—Start Switch
8—Neutral Start Switch

Fig. 21-Starting Circuit Test No. 1

Remove engine shields.

Connect voltmeter to solenoid "S" terminal and to ground (Fig. 21). With shifter lever in neutral position, turn key switch on and press start switch. Voltmeter should read 9 to 12 volts.

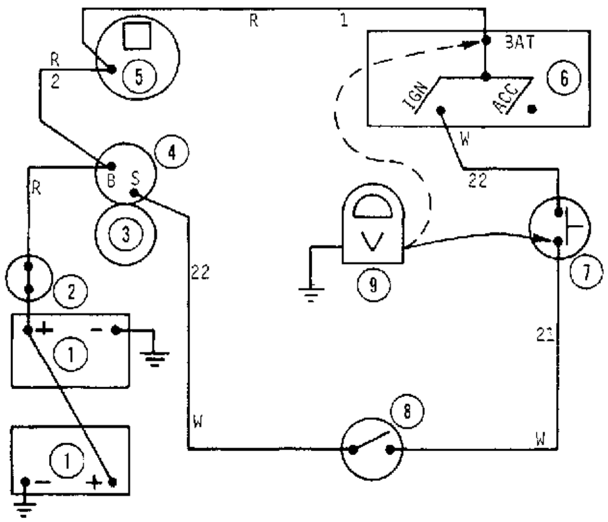
If there is a voltage reading of 9 to 12 volts, the problem is in the solenoid. See Section 4, Group 0422 for "Solenoid Tests."

If there is no voltage reading connect voltmeter to solenoid "BAT" terminal. 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 a low voltage reading or no voltage reading, check for defective battery cables or poor and corroded connections.

Test No. 2



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Alternator
6—Key Switch
7—Start Switch
8—Neutral Start Switch
9—Voltmeter

Fig. 22-Starting Circuit Test No. 2

Connect voltmeter to the start switch terminal with wire number 21 connected to it.

With shift lever in neutral position, turn key switch on and press start switch. Voltmeter should read 9 to 12 volts.

If voltmeter reads 9 to 12 volts you know the circuit from "BAT" terminal on the solenoid through the key switch and start switch is okay. Proceed to Test No. 3.

If there is no voltage reading, remove the instrument panel and check the key switch terminal with the red lead for a voltage reading (dotted line, Fig. 22).

If there is a voltage reading of 9 to 12 volts, check for a defective key switch, start switch, or open wires. Replace as necessary.

If there is no voltage reading at the key switch and there was a voltage reading at the solenoid "BAT" terminal in Test No. 1, there must be an open wire between the solenoid "BAT" terminal and the key switch.

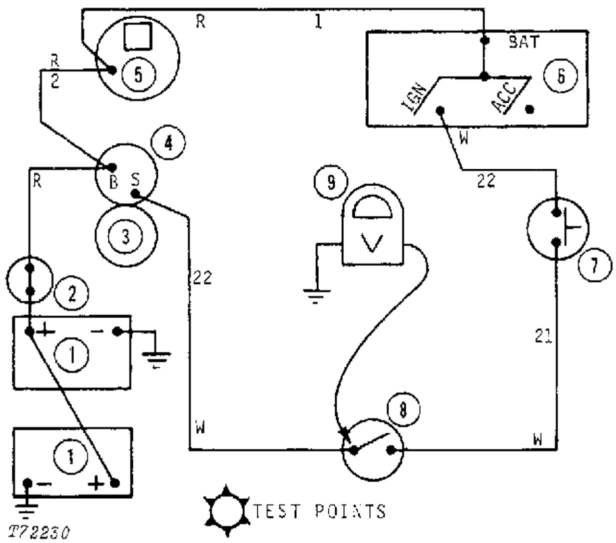
Test No. 3

Remove the "Platform, Rear" floor plate to gain access to the neutral start switch on the left side of the transmission case.

With shifter lever in the neutral position, turn key switch on, press start switch. Voltmeter should read 9 to 12 volts.

If there is a reading of 9 to 12 volts, you know the neutral start switch is functioning okay, and the problem is in the neutral colored wire from the main wire harness single connector to the solenoid "S" terminal.

If there is no voltage reading, check the terminals of the neutral start switch with an electrical test probe. If probe lights on only one terminal, either the transmission is not in neutral, the connection is loose, or the neutral start switch is faulty or maladjusted. See Section 90, Group 9020 for neutral start switch adjustment.



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Alternator
6—Key Switch
7—Start Switch
8—Neutral Start Switch
9—Voltmeter

Fig. 23-Starting Circuit Test No. 3

2. Solenoid Contacts "Clicked" but the Starting Motor Did Not Operate

This indicates that the circuit problems lie within the starting motor. 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.

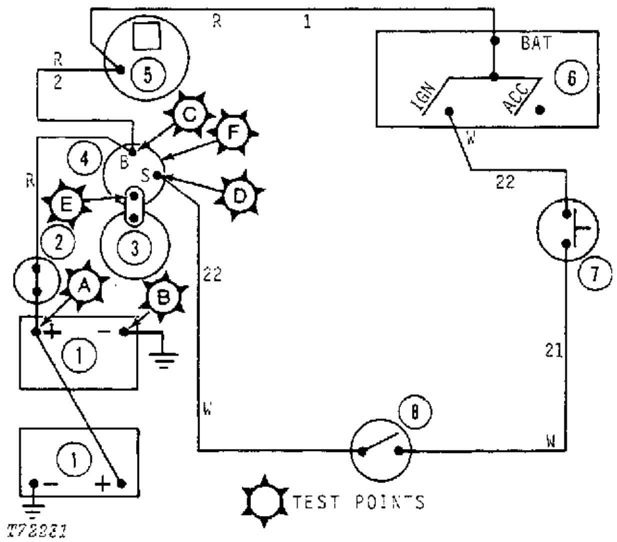
We know that the starting motor is getting enough current to operate. The problem then, is either in the shifting of the drive assembly into mesh, a broken armature shaft, or a dirty or faulty drive assembly. These causes require disassembly of the starting motor for proper service or repair. See Section 4, Group 0422.

4. Starting Motor Turned the Engine Over Slowly or Erratically

With slow 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, cause is either the batteries or the starting motor. Check battery condition first. See Section 16 for testing batteries and starting motor.

High Resistance Test



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Alternator
6—Key Switch
7—Start Switch
8—Neutral Start Switch

Fig. 24-High Resistance Test Points

Disconnect wire from injection pump solenoid shut-off terminal.

Connect voltmeter to ground and to solenoid battery terminal. Operate starter and compare voltage with a similar reading at battery. Always use a pin connector at battery post. If difference is more than 0.8 volt, make the tests indicated in Fig. 24. Check for defective wires or faulty connections.

RESISTANCE TEST VALUES

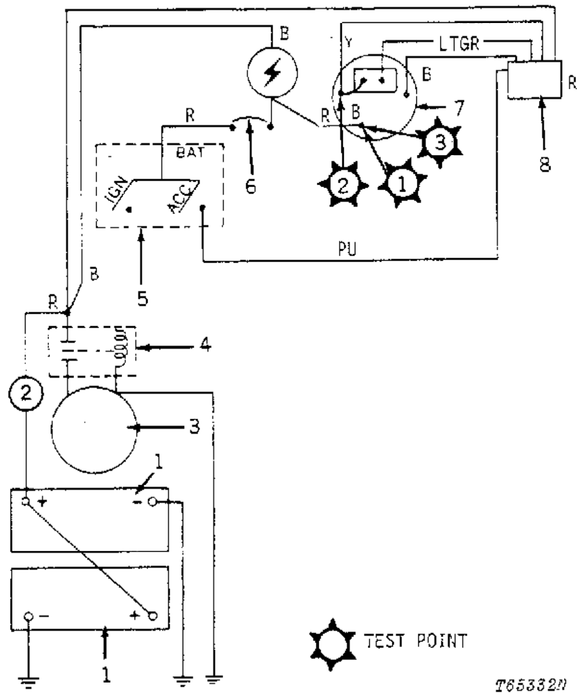
Test Points	Maximum Voltmeter Reading
B-F	0.2
A-C	0.2
C-D	1.0
C-E	0.2

Engine Starts But the Starting Motor Drive Does Not Disengage From the Flywheel

This indicates a defect in the drive mechanism, or solenoid pull in windings, or solenoid contacts, or solenoid control circuit which will not allow the drive to disengage.

The starting motor or solenoid needs repair. See Section 4, Group 0422.

Testing The Charging Circuit (-343540)



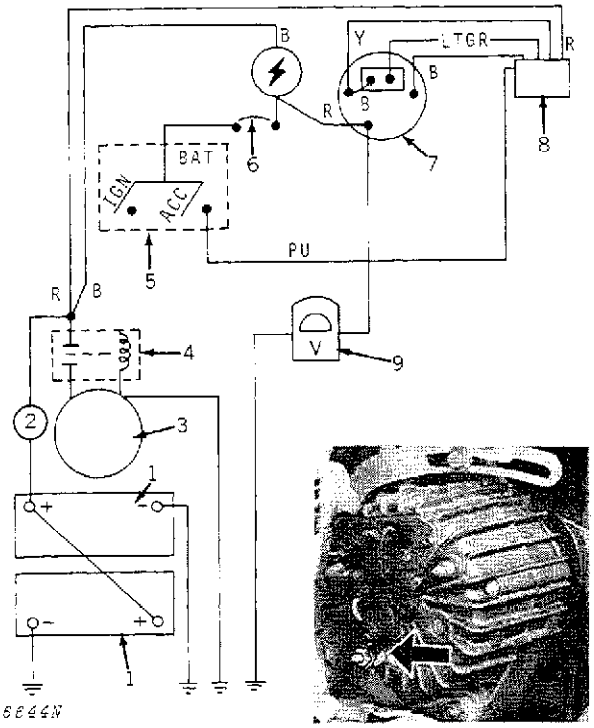
1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Key Switch
6—Circuit Breaker
7—Alternator
8—Regulator

Fig. 25-Charging Circuit

Before you start the circuit tests, quickly review the precautions listed on page 90-9015-5.

Make the following tests to isolate a faulty component in the charging circuit.

Test No. 1



1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Key Switch
6—Circuit Breaker
7—Alternator
8—Regulator
9—Voltmeter

Fig. 26-Charging Circuit Test No. 1

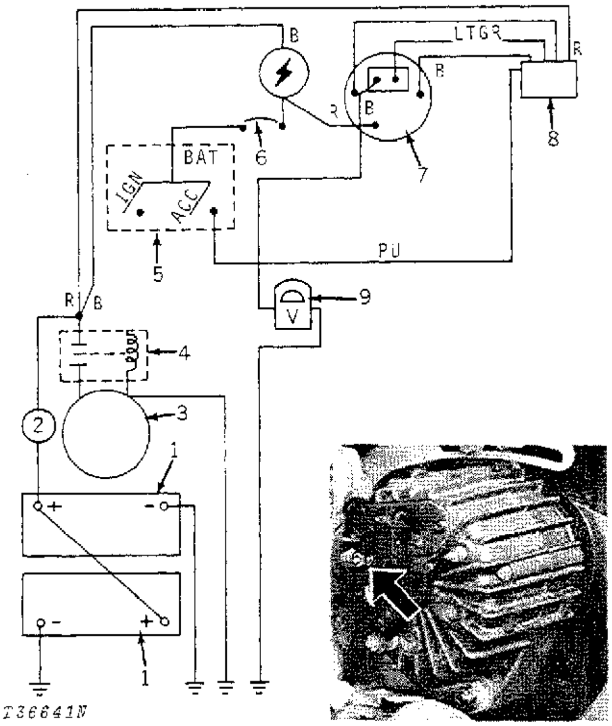
Key switch must be in OFF position.

Connect Volt-Ohm-Amp probe onto alternator OUTPUT terminal.

The voltmeter should register 12 volts.

If it doesn't, wiring between the alternator OUTPUT and battery positive terminals is defective.

Test No. 2



1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Key Switch
6—Circuit Breaker
7—Alternator
8—Regulator
9—Voltmeter

Fig. 27-Charging Circuit Test No. 2

With key switch on and engine not running, connect voltmeter to stator terminal (Fig. 27). Voltage reading should be 2 to 8 volts.

If reading is low or 0 at the stator terminal, cause could be either an open circuit to the regulator or a shorted condition in the field circuit, brushes, or rotor assembly.

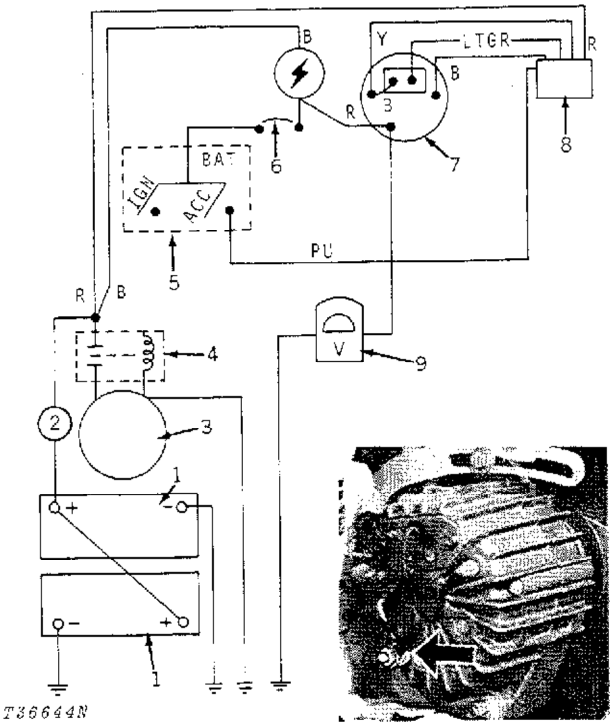
If reading is low or 0, check regulator to engine harness connector for voltage and good contact. Voltage reading should be 9 to 12 volts at this connector.

With 9 to 12 volts at the regulator connector, disconnect the battery ground cables or turn off battery disconnect switch and remove regulator from alternator.

Check brushes and rotor for a shorted condition. See Section 16, Group 1672 for testing.

If reading is high (approx. 12.0 volts) at the stator terminal, the cause is either an open field circuit or an open regulator circuit. To isolate proceed to Test No. 4.

Test No. 3



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1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Key Switch
6—Circuit Breaker
7—Alternator
8—Regulator
9—Voltmeter

Fig. 28-Charging Circuit Test No. 3

Start engine and run at 1500 RPM.

Connect meter Volt-Ohm-Amp probe to the alternator OUTPUT terminal.

With a fully charged battery, the voltmeter should register 13.2 to 14.9 volts according to the temperature chart below:

With a cold ambient temperature the voltage will go up and with a hot ambient temperature the voltage will go down. See chart.

Temperature*	Voltage
40°F [4.4°C]	14.4 - 14.9 volts
60°F [15.6°C]	14.3 - 14.7 volts
80°F [26.7°C]	14.2 - 14.6 volts
100°F [37.8°C]	14.0 - 14.4 volts
120°F [48.9°C]	13.2 - 14.3 volts
140°F [60.0°C]	13.2 - 14.1 volts

**Measured 1 inch from regulator.*

NOTE: With a discharged battery, the voltage reading may be as small as 0.5 volts more than the reading in Test No. 1.

Initially the ammeter (on the instrument panel) reading should be 20 amps. or more and the voltmeter should read approximately 13.0 volts in a fully charged battery.

After a few minutes of operation the voltage reading should start to rise. When the reading is approximately 14.2 volts, the ammeter indicator should start to decrease. The voltage should continue to rise slowly to approximately 14.4 volts and then level off.

The ammeter should drop to approximately 10 to 15 amps.

If the alternator output current is low the probable causes are in the alternator, open positive diodes, shorted negative diodes, or a defective stator.

If voltage reading is no different from reading in Test No. 1, test as follows:

Disconnect regulator from field.

Place one jumper wire between one field terminal and GND and another jumper wire between the other field terminal and OUTPUT, both at the same time.

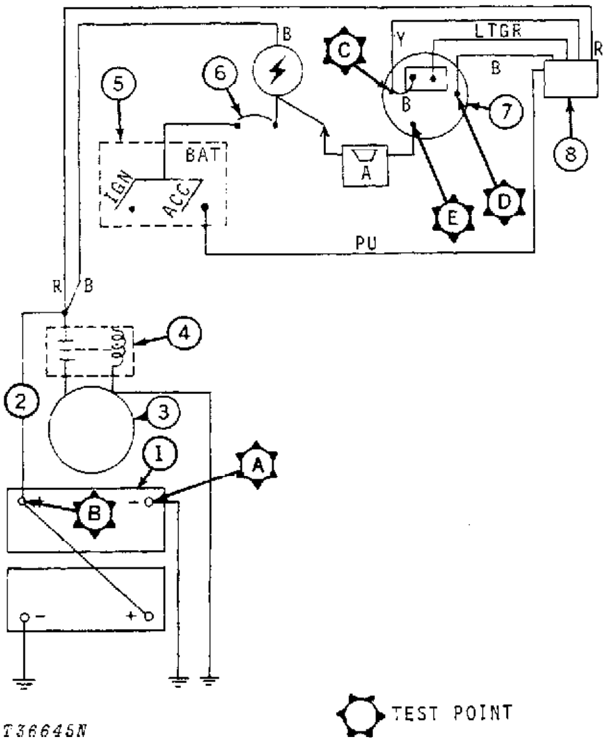
Run the engine at 1500 RPM.

If the voltage reading increases, replace the regulator.

If there is still no change from the initial test reading in Test No. 3, replace the alternator and repeat Test No. 3.

Since these are only probable causes, always check the alternator output voltage whenever you have a low ammeter reading. You could have a sulfated battery causing high resistance to current flow, or a high resistance connection in the charging circuit which would cause a rise in system voltage to 14.4 volts and consequently the regulator would reduce the alternator output. See "High Resistance Test".

High Resistance Test



1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Key Switch
6—Circuit Breaker
7—Alternator
8—Regulator

Fig. 29-High Resistance Test Points

With battery ground disconnected, connect the ammeter (Fig. 29). Obtain 10-amp charge rate. Check the voltage between the points indicated in the chart below. Always use a pin connector to connect voltmeter to battery posts.

If voltmeter readings exceed the maximum listed in the chart, high resistance usually exists in a poor connection.

When there is a high resistance present in the charging system, the regulator cannot control alternator voltage and maintain the battery in a fully charged condition.

Test Points	Maximum Voltmeter Reading*
A-D	0.3 volt
B-E	0.3 volt
B-C	1.3 volts

**10-amp charging rate*

Test No. 4 - Testing Alternator Field Circuit

Disconnect battery ground cables or turn battery disconnect switch to "OFF" and then remove regulator attaching screws and pull regulator away from the alternator.

IMPORTANT: Insulate the regulator case from the alternator output terminal.

Reconnect battery ground cables or turn battery disconnect switch to "ON."

With key switch on and engine not running, connect voltmeter to alternator field terminal with the regulator green wire attached.

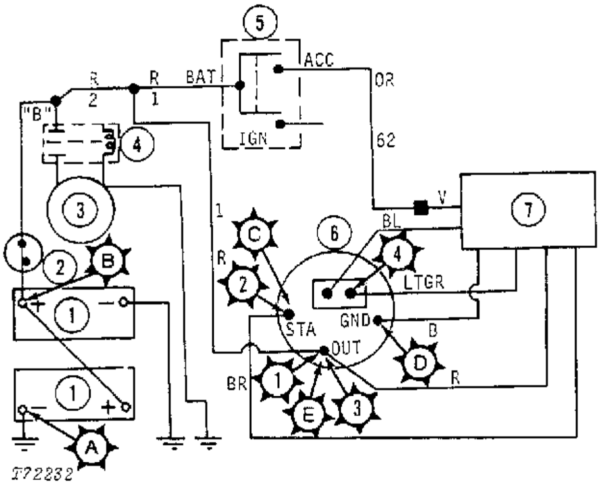
Voltage reading should be 0.6 volts.

If reading is 0 volts, the field brush circuit is open. Check for poor brush to slip ring contact and for an open rotor winding. See Section 16, Group 1672 for rotor resting.

If reading is approximately 12 volts, the regulator circuit is open.

Replace regulator.

Testing the Charging Circuit (343541-)



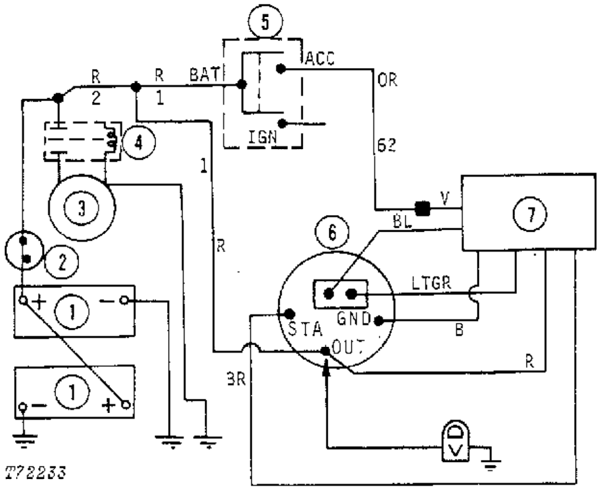
1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Key Switch
6—Alternator
7—Regulator

Fig. 30-Charging Circuit

Before you start the circuit tests, quickly review the precautions listed on page 90-9015-5.

Make the following tests to isolate a faulty component in the charging circuit.

Test No. 1



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Key Switch
6—Alternator
7—Regulator

Fig. 31-Voltmeter Connected to Output Terminal

Key switch must be in OFF position.

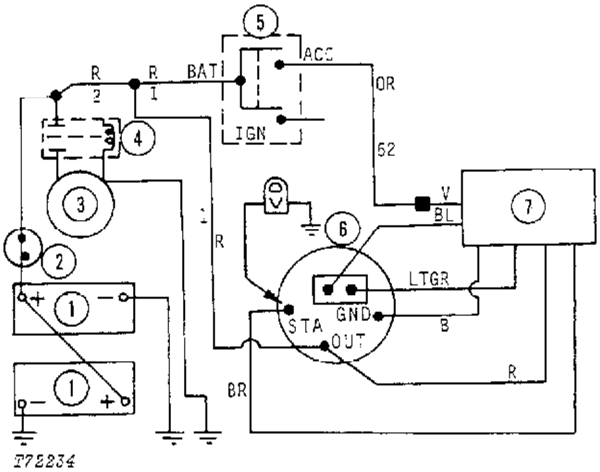
Connect Volt-Ohm-Amp probe onto alternator OUTPUT terminal.

The voltmeter should register 9 to 12 volts.

If it doesn't, wiring between the alternator OUTPUT and battery positive terminals is defective.

This test also checks the operation of the voltmeter and the level of battery voltage.

Test No. 2



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Key Switch
6—Alternator
7—Regulator

Fig. 32-Voltmeter Connected to Stator Terminal

With key switch on and engine not running, connect voltmeter to stator terminal (Fig. 32). Voltage reading should be 2 to 8 volts.

If reading is low or 0 at the stator terminal, cause could be either an open circuit to the regulator or a shorted condition in the field circuit, brushes, or rotor assembly.

If reading is low or 0, check regulator ot engine harness connector for voltage and good contact. Voltage reading should be 9 to 12 volts at this connector.

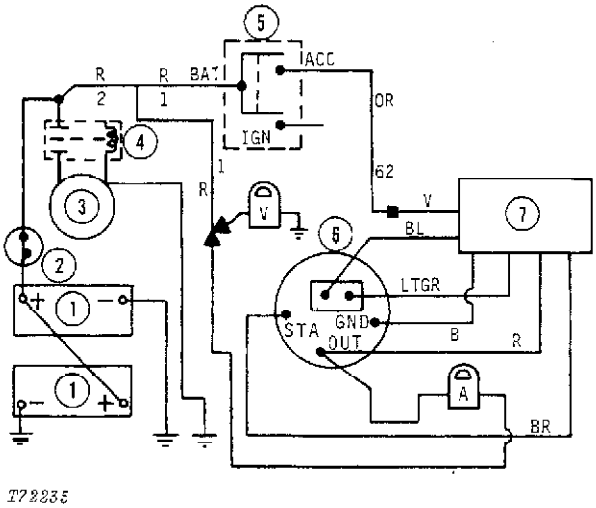
With 9 to 12 volts at the regulator connector, disconnect the battery ground cables or turn off battery disconnect switch and remove regulator from alternator.

Check brushes and rotor for a shorted condition. See Section 16, Group 1672 for testing.

NOTE: The above testing of the brushes and rotor for a shorted condition can be done with alternator on unit. If rotor asssembly is found to be shorted, alternator will have to be removed and disassembled.

If reading is high (approx. 12.0 volts) at the stator terminal, the cause is either an open field circuit or an open regulator circuit. To isolate proceed to Test No. 4.

Test No. 3



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Key Switch
6—Alternator
7—Regulator

Fig. 33-Regulator Test Connections

With key switch on, engine running at 1500 rpm, connect voltmeter and ammeter to the output terminal (Fig. 33).

Initially the ammeter reading should be 20 amps or more and the voltmeter should read approximately 13.0 volts on a fully charged battery.

After a few minutes of operation the voltage reading should start to rise. When the reading is approximately 14.2 volts, the ammeter indicator should start to decrease. The voltage should continue to rise slowly to approximately 14.4 volts and then level off.

The ammeter should also drop to approximately 10 to 15 amps.

Since temperature does affect the controlled voltage level, Test No. 3 should be run at approximately 70°F (21°C) ambient temperature.

With a cold ambient temperature the voltage will go up and with a hot ambient temperature the voltage will go down. See chart below.

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 1 inch (25 mm) from regulator.*

If the voltage does not level off and the current level remains high, test the regulator as directed below;

1 - Disconnect battery ground cables or turn battery disconnect switch to "OFF" and then remove regulator attaching screws and pull regulator away from the alternator.

IMPORTANT: Insulate the regulator case from the alternator output terminal.

2 - Reconnect battery ground cables or turn battery disconnect switch to "ON."

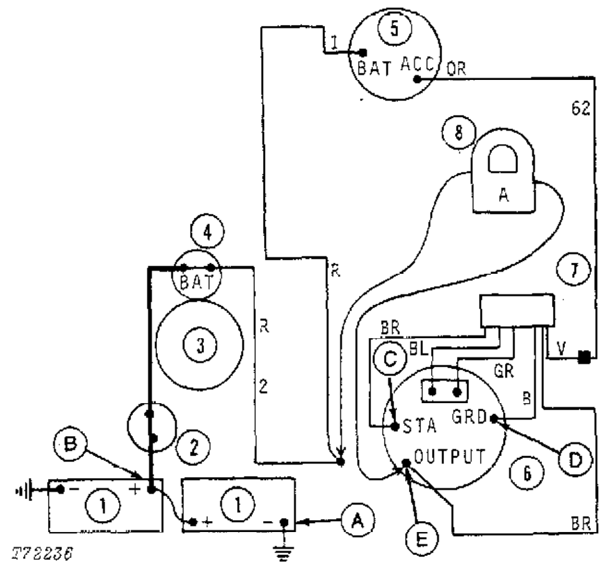
3 - Place one jumper wire between one field terminal and GRD and another between the other field terminal and OUTPUT, both at the same time.

NOTE: Both jumper wires must be in place at the same time.

4 - Start engine and run at 1500 rpm.

5 - If there is no change in the results from the preceeding output test, replace the regulator and repeat Test No. 3.

High Resistance Test



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Key Switch
6—Alternator
7—Regulator
8—Ammeter

Fig. 34-High Resistance Test

Disconnect battery ground s'·ps or turn off battery disconnect switch and connect ammeter as shown in Fig. 34. Reconnect battery grou·nd straps. Run engine to obtain a 10-amp charge rate. Check the voltage between indicated points. Use a pin connector at the battery post. High resistance is usually caused by a poor connection.

Test Points	Maximum Voltage Reading*
A-D	0.3 volt
B-E	0.3 volt
B-C	1.3 volts

**10-amp. charging rate.*

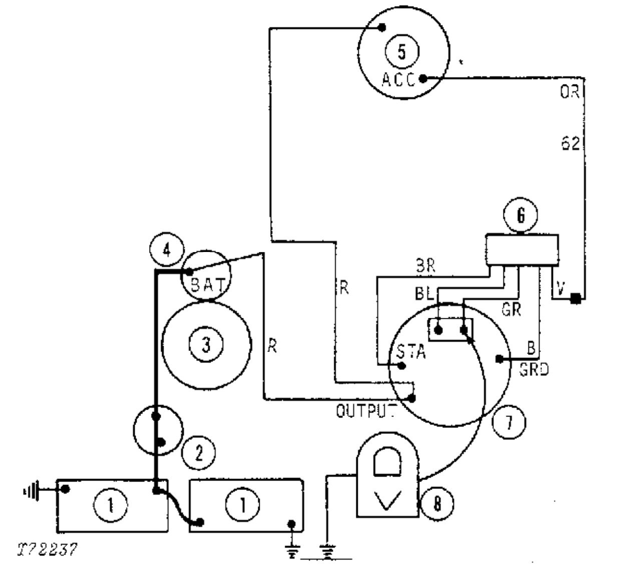
When there is a high resistance present in the charging system, the regulator cannot control alternator voltage and maintain the battery in a fully charged condition.

Test No. 4 - Testing Alternator Field Circuit

Disconnect battery ground cables or turn battery disconnect switch to "OFF" and then remove regulator attaching screws and pull regulator away from the alternator.

IMPORTANT: Insulate the regulator case from the alternator output terminal.

Reconnect battery ground cables or turn battery disconnect switch to "ON."



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Key Switch
6—Regulator
7—Alternator
8—Voltmeter

Fig. 35-Voltmeter Connected to Regulator Green Wire Terminal

With key switch on and engine not running, connect voltmeter to regulator green wire terminal (Fig. 35).

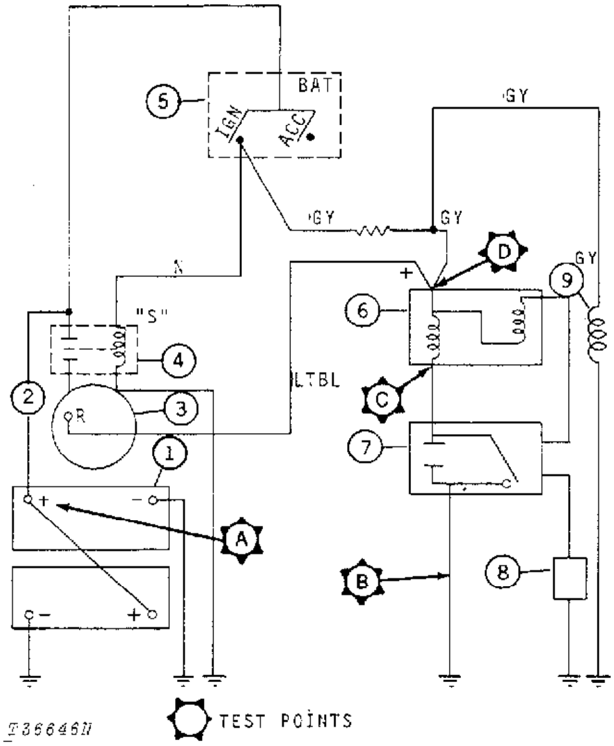
Voltage reading should be 0.6 volts.

If reading is 0 volts, the field brush circuit is open. Check for poor brush to slip ring contact and for an open rotor winding. See Section 16, Group 1672 for rotor testing.

If reading is approximately 12 volts, the regulator circuit is open.

Replace regulator.

Testing The Ignition Circuit



1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Key Switch
6—Coil
7—Distributor
8—Spark Plugs
9—Injection Pump Solenoid

Fig. 36-Ignition Circuit Test

Testing For High Resistance, Open Circuits Or Grounds

Check for open circuits, grounds, or high resistance on points indicated in Fig. 36. Make test with lights and accessories turned off and use a pin connector on the battery post. Disconnect and ground wire from coil to distributor.

Voltmeter Connected To	Ignition Switch Position	Breaker Points	Voltmeter Reading
A - D	Cranking	—	1 Volt Max.
B - D	Cranking	—	Approx. 10 Volts
B - D	On	Open	Battery Voltage
B - D	On	Closed	Approx. 4.8 Volts
B - C	On	Closed	0.2 Volt Max

High Voltage A to D (Cranking)

Open circuit between battery and coil
Ignition switch not closing circuit
Ground in coil

Low Voltage B to D (Cranking)

Low battery
Contact points not opening
Open circuit between coil and distributor
Defective or improperly adjusted contact finger at solenoid "R" terminal

Low Voltage B To D (Points Open)

Open circuit between battery and coil
Shorted condenser

Low Voltage B To D (Points Closed)

Poor connection
Open resistance wire
Grounded coil primary

High Voltage B To D (Points Closed)

Loose connection in distributor
Poor distributor ground to engine
Dirty or burned distributor contact points
Loose connection between coil and distributor
Resistance wire shorted out of circuit or short at "R" terminal

High Voltage B To C (Points Closed)

Poor connection in distributor
Poor ground for distributor to engine
Dirty or burned distributor contact points

Carburetor and Injection Pump Solenoid

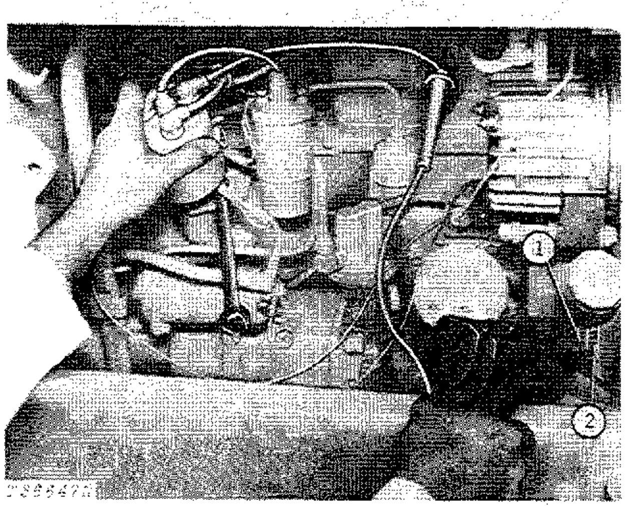
The carburetor and injection pump solenoid windings may be checked for resistance or current consumption. The solenoid terminal connection should be clean and tight.

INJECTION PUMP SOLENOID WINDING
Winding current draw .... Approx. 2.5 amp
Winding resistance .... Approx. 5 ohms
Voltage required to energize .... Approx. 8 volts

CARBURETOR SHUT-OFF SOLENOID
Winding current draw .... Approx. 0.6 amp
Winding resistance .... Approx. 20 ohms
Shut-off needle opens .... 4 to 6 volts

Timing the Distributor

Timing Light Method



1—Timing Mark 2—"S" Mark

Fig. 37-Timing the Distributor With a Timing Light

Connect timing light according to manufacturer's instructions to No. 1 (front) spark plug cable (Fig. 37). Run engine at 2500 rpm. Loosen distributor clamp and rotate distributor until spark occurs when mark on crankshaft front pulley lines up with mark on engine casting. Tighten clamp when timing is correct.

Emergency Timing Method

For emergency timing procedures only, without a timing light, install the distributor as described in INSTALLATION (See Section 4, Group 0411), except for the dust cover, rotor, and cap.

Remove spark plugs. Place thumb in No. 1 spark plug hole and turn engine until considerable pressure is felt against thumb. Continue turning engine until mark on crankshaft front pulley lines up with mark on engine casting. If mark goes past mark on engine casting, back engine up at least 1/4 turn to remove timing gear backlash and then turn engine until mark is lined up.

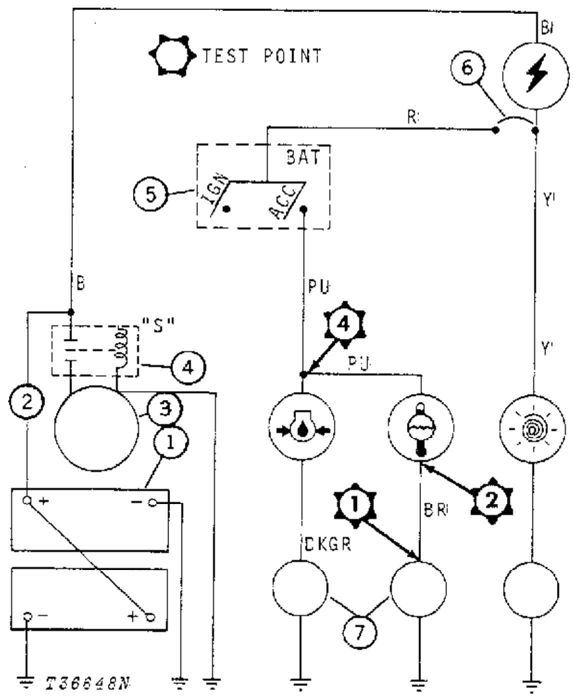
Remove coil-to-distributor high-tension wire from distributor and place terminal end 1/8 inch (3.175 mm) from grounded part of the engine. Turn the key switch on.

Turn rotor counter-clockwise as far as possible. Hold rotor in this position and rotate distributor body slowly until the points are just beginning to open. This is indicated by a spark between high-tension wire and ground. Be sure points are just beginning to open and are not just closing. Recheck timing after tightening clamp.

Install dust cover, rotor, distributor cap, and spark plugs. Install all cables, being sure they make good contact at distributor, at spark plugs, and at coil terminals. See that the spark plug cable boots and nipples are properly positioned.

NOTE: This timing will vary with distributor drive gear backlash and it is highly recommended to use a timing light to accurately time the distributor.

Testing Gauge Circuit (-343540)



1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Key Switch
6—Circuit Breaker
7—Sending Units

Fig. 38-Gauge Circuit

Testing Engine Temperature Gauge

Test No. 1 - Gauge Not Operating

Remove the brown lead wire from the engine temperature sending unit and check for corrosion or a poor connection at the sender terminal.

With brown lead wire disconnected from sender, turn key switch on.

With the brown lead wire not touching anything the gauge needle should go to the full left, the cold position.

With the brown lead wire touching ground the gauge needle should be to the full right, the hot position.

If the gauge operates as described above, it can be considered good and the sending unit needs to be replaced.

Test No. 2 - Gauge Remains in Cold Position

If the gauge needle is in the maximum cold position all the time regardless of what the sending unit brown lead wire is touching in Test No. 1, the cause could be a break or poor connection in wiring from the gauge to the sender.

Remove instrument panel with engine temperature gauge installed in it. Use a jumper wire to ground instrument panel to unit.

Take a short jumper wire and connect it to the gauge terminal with the brown lead wire and to ground. Turn ignition switch on.

If gauge needle goes to maximum hot position, the problem is in the wiring. Check for a defective wire or poor connection and repeat Test No. 1.

Test No. 3 - Gauge Remains In Hot Position

If the gauge needle goes to maximum hot position with the brown lead touching ground but does not go to the maximum cold position as soon as the lead is removed from ground, the cause could be a poor gauge ground connection.

Check the gauge mounting and be sure mounting screws are tight and that there is good contact between the gauge mounting bracket and instrument panel. Repeat Test No. 1.

Now if gauge needle goes to the maximum cold position as soon as the brown lead is removed from ground, you have found the problem.

Test No. 4 - No Needle Movement

If there is no gauge needle movement under any condition, check for voltage at the gauge.

There should be 9.0 to 12.0 volts at the gauge terminal with the purple lead.

If no voltage at the gauge, check the purple lead (gauge to engine oil pressure gauge) for a crack or poor connection.

With voltage to the gauge, gauge grounded, wiring from gauge to sender good and the gauge still not working correctly, the problem then must be in the gauge. Replace gauge.

Testing Engine Oil Pressure Gauge

Engine oil pressure gauge can be checked in the same manner in which engine temperature gauge was tested.

Testing Ammeter

Remove screws from instrument panel and pull panel back away from cowl.

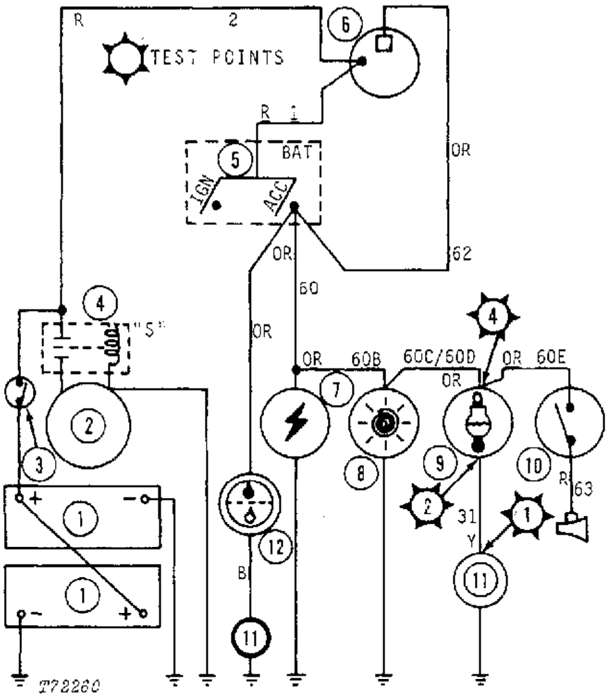
Start engine.

Remove red lead from ammeter. Check for voltage, at disconnected red lead, black lead (connected to ammeter) and red lead terminal. Voltage reading should be battery voltage at all readings.

If you have a voltage reading at the red lead and the black lead (connected to ammeter) but no reading at red lead terminal, ammeter is defective. Replace ammeter.

If either lead wire has no voltage reading, check for defective lead wire. Replace if necessary.

Testing Gauge Circuit (343541-)



1—Batteries
2—Starting Motor
3—Battery Disconnect Switch
4—Solenoid
5—Key Switch
6—Alternator
7—Voltmeter
8—Cigar Lighter
9—Engine Coolant Temperature Gauge
10—Horn Switch
11—Sending Units
12—Hydraulic Filter Restriction Indicator

Fig. 39-Gauge Circuit

Testing Engine Temperature Gauge

Test No. 1 - Gauge Not Operating

Remove the yellow lead wire from the engine temperature sending unit and check for corrosion or a poor connection at the sender terminal.

With yellow lead wire disconnected from sender, turn key switch on.

With the yellow lead wire not touching anything the gauge needle should go to the full left, the cold position.

With the yellow lead wire touching ground the gauge needle should be to the full right, the hot position.

If the gauge operates as described above, it can be considered good and the sending unit needs to be replaced.

Test No. 2 - Gauge Remains in Cold Position

If the gauge needle is in the maximum cold position all the time regardless of what the sending unit yellow lead wire is touching in Test No. 1, the cause could be a break or poor connection in wiring from the gauge to the sender.

Remove instrument panel with engine temperature gauge installed in it. Use a jumper wire to ground instrument panel to unit.

Take a short jumper wire and connect it to the gauge terminal with the yellow lead wire and to ground. Turn ignition switch on.

If gauge needle goes to maximum hot position, the problem is in the wiring. Check for a defective wire or poor connection and repeat Test No. 1.

Test No. 3 - Gauge Remains In Hot Position

If the gauge needle goes to maximum hot position with the yellow lead touching ground but does not go to the maximum cold position as soon as the lead is removed from ground, the cause could be a poor gauge ground connection.

Check the gauge mounting and be sure mounting screws are tight and that there is good contact between the gauge mounting bracket and instrument panel. Repeat Test No. 1.

Now if gauge needle goes to the maximum cold position as soon as the brown lead is removed from ground, you have found the problem.

Test No. 4 - No Needle Movement

If there is no gauge needle movement under any condition, check for voltage at the gauge.

There should be 9.0 to 12.0 volts at the gauge terminal with the orange lead.

If no voltage at the gauge, check the purple lead (gauge to engine oil pressure gauge) for a crack or poor connection.

With voltage to the gauge, gauge grounded, wiring from gauge to sender good and the gauge still not working correctly, the problem then must be in the gauge. Replace gauge.

Testing Voltmeter

If voltmeter doesn't register any voltage, check for voltage to the meter; this will isolate whether the problem is in the wiring or the meter.

If voltmeter operation is erratic the problem may be in the charging system. Check charging system as described in this group.

Testing Cigar Lighter

If cigar lighter doesn't work check for voltage to lighter.

Lighter circuit breaker may have to be reset (see Section 18, Group 1808).

Horn

Check for voltage at the horn with the horn switch actuated. If voltage is obtained, the horn must be defective.

If no voltage at horn, check the horn switch and wiring.

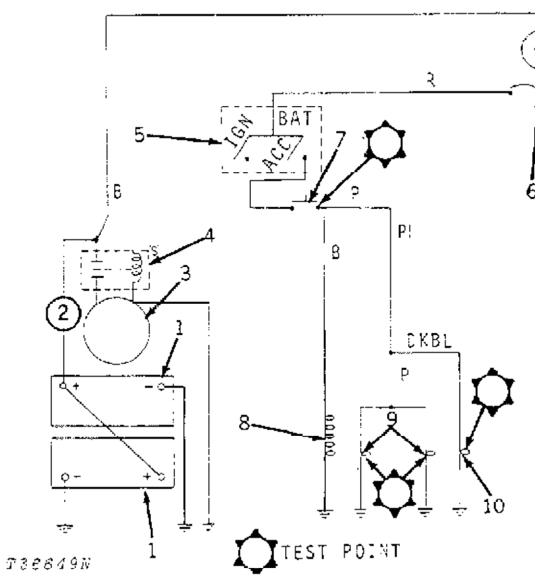
Hydraulic Filter Restriction Indicator

To check the filter restriction indicator, turn the key switch on and ground the wire on the filter restriction switch.

If the indicator comes on, the indicator is good. If the indicator does not come on, check the indicator bulb.

If the bulb is good, check for voltage at the indicator. If there is voltage at the indicator, the wire between the indicator and filter restriction switch is open. If there is no voltage at the indicator, the wire between the key switch and indicator is open.

Testing Light Circuit



1—Batteries
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Key Switch
6—Circuit Breaker
7—Light Switch
8—Gauge Lights
9—Front Lights
10—Rear Light

Fig. 40-Light Circuit (-343540)

If all lights will not light, check for voltage at light switch.

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.

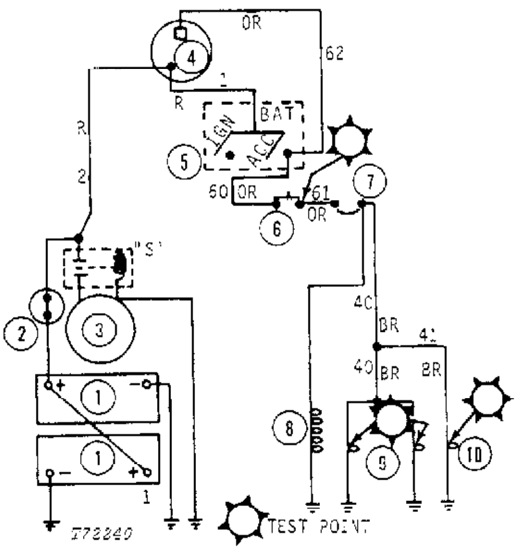
If voltmeter reading to ground is lower than 0.1 volt, connect voltmeter between lamp terminal and battery positive post that is connected to the starting motor.

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 resistance should not exceed 0.1 volt.

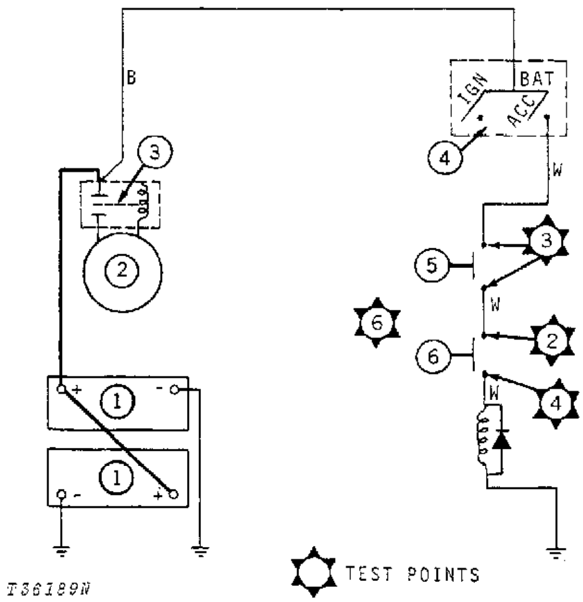
If voltmeter reading is under 0.5 volt between lamp terminal and the battery post, connect voltmeter to lamp frame and the grounded battery post. A voltage reading above 0.5 volt indicates there is a high resistance somewhere in the ground circuit. Connect the voltmeter across various places where a high resistance might be present such as a battery box to the crawler frame.



1—Battery
2—Battery Disconnect Switch
3—Starting Motor with Solenoid
4—Alternator
5—Key Switch
6—Light Switch
7—Circuit Breaker
8—Gauge Lights
9—Grille Housing Lights
10—Rear Light

Fig. 41-Light Circuit (343541-)

Testing Return-To-Dig Circuit (-294007)



1—Batteries
2—Starting Motor
3—Solenoid
4—Key Switch
5—Bucket Switch
6—Spool Switch

Fig. 42-Return-to-Dig Circuit (-294007)

NOTE: A malfunction of the return-to-dig mechanism may be mechanical. If an electrical malfunction is suspected proceed as follows. If a mechanical malfunction is suspected refer to Section 16.

Malfunctions in the electrical return-to-dig circuit can be broken down into the following two problems:

1. Control lever remains in detent position when the bucket is returned to the dig position.
2. Control lever won't stay in detent position during the bucket return.

Use the following electrical test to isolate the cause of the malfunction.

Control Lever Remains In Detent Position When The Bucket Is Returned To The Dig Position

Test No. 1

Place key switch in accessory position, manually trip the bucket switch by pressing on switch roller, if the control lever returns to neutral, the electrical circuit is functioning properly and the bucket switch is misaligned.

To adjust the bucket switch, loosen bucket switch mounting screws and position the outside edge of the bucket switch roller at the center of the guide tube.

If the control lever failed to return to neutral when the bucket switch has actuated proceed to Test No. 2.

Test No. 2

Attach one lead of 12 volt test light or voltmeter to spool switch lead terminal as shown in Fig. 43 and other lead to ground, place key switch in accessory position, and actuate bucket switch.

If test light lights or voltmeter reads 12 volts, the bucket switch and wiring from the key switch are functioning, proceed to Test No. 4.

If no voltage reading is obtained or test light does not light, proceed to Test No. 3.

Test No. 3

Attach one lead of test light or voltmeter to bucket switch terminal and other lead to ground, place key switch in accessory position and manually actuate switch. Connect test light lead or voltmeter lead to other terminal on bucket switch and actuate switch.

Compare readings on both switch terminals with the following:

(1) If test light lights or a reading of 12 volts is obtained, bucket switch and wiring to key switch are functional.

(2) If test light lights or a reading of 12 volts is obtained on only one terminal, the bucket switch is defective, replace switch.

(3) If test light does not light or voltmeter indicates no voltage at either terminal, wiring from bucket switch to key switch is defective.

Test No. 4

Attach one lead of test light or voltmeter to solenoid lead on spool switch (Fig. 43), place key switch in accessory position, place control lever in detent position, and actuate bucket switch.

If test light lignts or voltmeter reads 12 volts, proceed to Test No. 5.

If test light does not light or voltmeter does not read 12 volts, spool switch is defective and should be replaced.

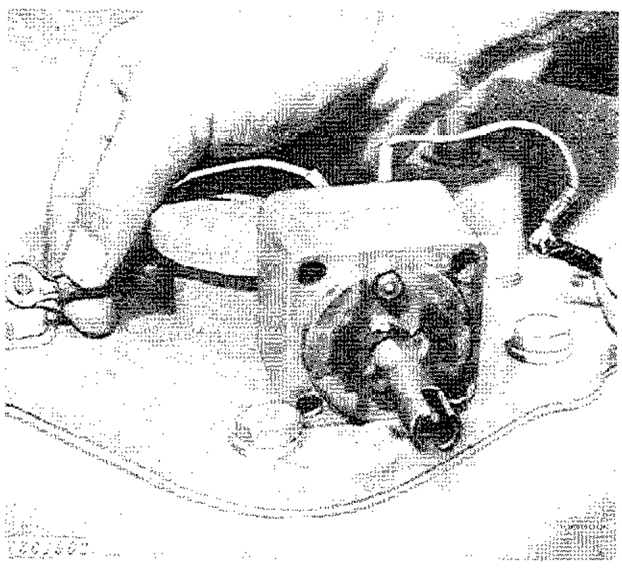


Fig. 43-Testing Spool Solenoid (-294007)

Test No. 5

To test the solenoid, it must be removed from the return-to-dig mechanism. Reconnect the solenoid lead to the spool switch terminal, ground the ground lead and place key switch in accessory position. The solenoid shaft should rotate approximately 45°. If the solenoid shaft does not rotate, rotate it by hand to see if it is locked up. If the shaft still does not move, replace solenoid.

Control Lever Won't Stay In Detent Position During Bucket Return

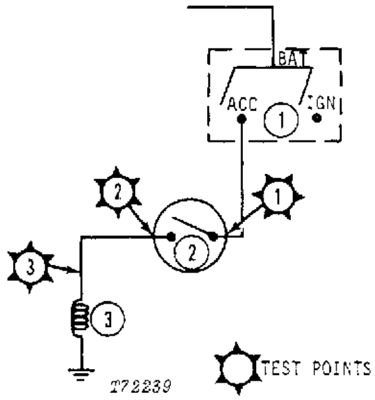
Test No. 6

Attach one lead of voltmeter or test light to spool switch lead terminal on bucket switch and other lead to ground, place the key switch in accessory position.

With control lever in neutral position there should be no voltage reading or test light should not light. If this condition is met, the problem could be either a loose or misadjusted bucket switch or a loose connection to the valve spool.

If test light lights or voltmeter reads 12 volts, bucket switch is defective and should be replaced.

Testing Return-To-Dig Circuit (294008-)



1—Key Switch
2—Bucket Switch
3—Electro-Magnet

Fig. 44-Return-To-Dig Circuit (294008-)

NOTE: A malfunction of the return-to-dig mechanism may be mechanical. If an electrical malfunction is suspected, proceed as follows. If a mechanical malfunction is suspected, refer to Group 1675.

Malfunctions in the electrical return-to-dig circuit can be broken down into the following two problems:

1. Control lever remains in detent position when the bucket is returned to the dig position.
2. Control lever won't stay in detent position during the bucket return.

Use the following electrical tests to isolate the cause of the malfunction.

Control Lever Remains In Detent Position When The Bucket Is Returned To The Dig Position

Test No. 1

Place key switch in ACC position and manually trip the bucket switch by pressing on its roller. If the control lever returns to neutral, the electrical circuit is functioning properly and the bucket switch is misaligned.

To adjust the bucket switch, loosen its mounting screws and position the outside edge of the switch roller at the center of the guide tube.

If the control lever didn't return to neutral when the bucket switch was actuated, proceed to Test No. 2.

Test No. 2

Place bucket in dump position on the ground.

Key switch must be in ACC position.

Attach one lead of a 12 volt test light, or a voltmeter, to one side of the bucket switch and the other lead to ground as shown by test point no. 2 in Fig. 44.

Manually operate the bucket switch.

Test light should go off and on or voltmeter should register 0 volts with the switch roller pressed down and 12 volts with the roller up in its free state.

NOTE: Bucket switch is a normally closed switch.

Any other results means the bucket switch is defective.

If switch is good the detent mechanism or valve spool is defective. Refer to Group 1675.

Control Lever Won't Stay In Detent Position During Bucket Roll Back

Test No. 3

Place bucket in dump position on the ground.

Key switch must be in ACC position.

Attach one lead of a 12 volt test light or a voltmeter to electro-magnet terminal as shown by test point 3 in Fig. 44, and the other lead to ground.

If the light lights or voltmeter reads 12 volts, the electro-magnet is defective or has a poor ground.

To test the electro-magnet, disconnect it from the harness.

Use an ohmmeter to check for continuity from the electro-magnet wire lead to ground. No continuity means the electro-magnet is defective.

If the light does not light or voltmeter does not read 12 volts at test point 3, check for voltage at test point 1.

If there is voltage at test point 1, test the bucket switch as described in Test No. 2.

If the light does not light or voltmeter does not read 12 volts, the key switch or wiring between the battery and bucket switch is defective.

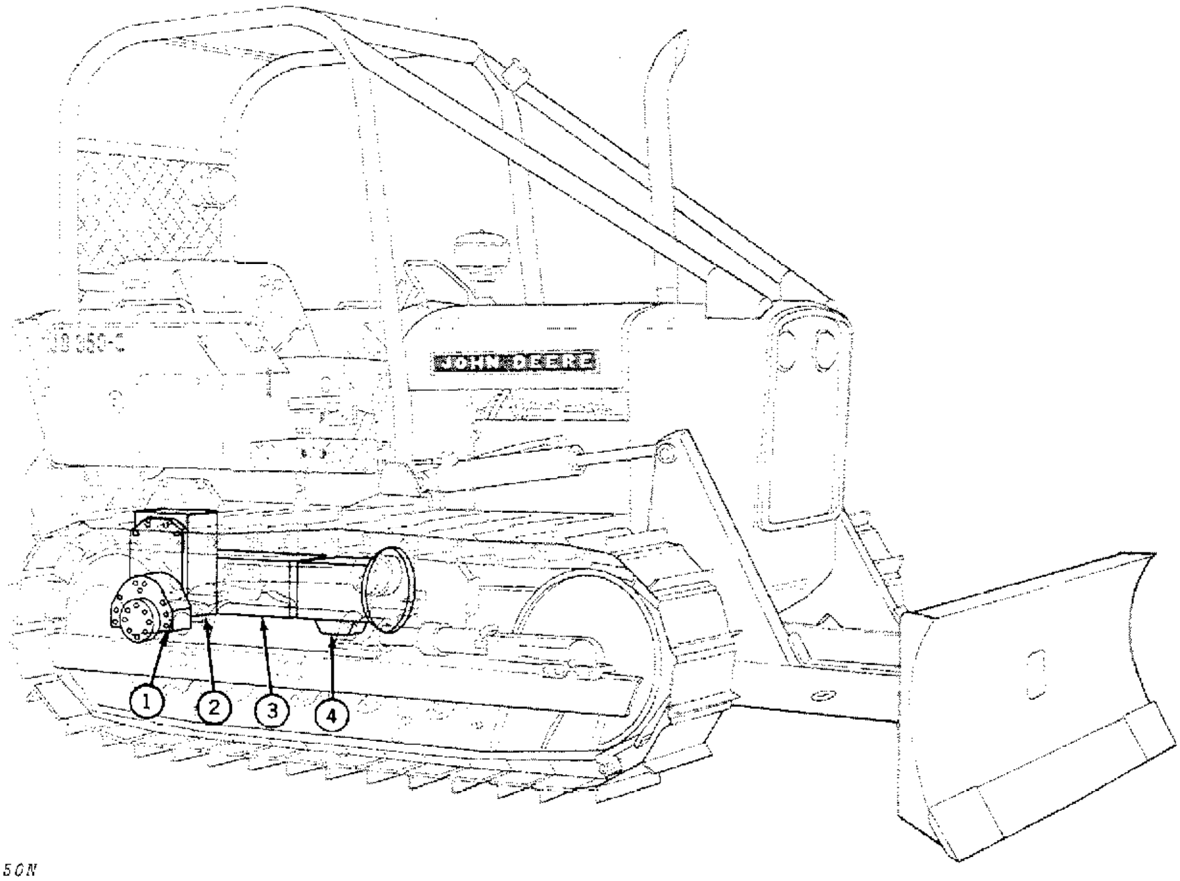
Check for voltage drops across the key switch and circuit breaker.

NOTE: Circuit must be live. A voltage drop across either one means that component is defective.

No voltage drop means the wiring or connectors are defective.

Group 9020
POWER TRAIN

GENERAL INFORMATION



T36650N

1—Drive Axle Housing
2—Steering Clutch Housing
3—Transmission
4—Hydraulic Direction Reverser

Fig. 1-Power Train Components Location

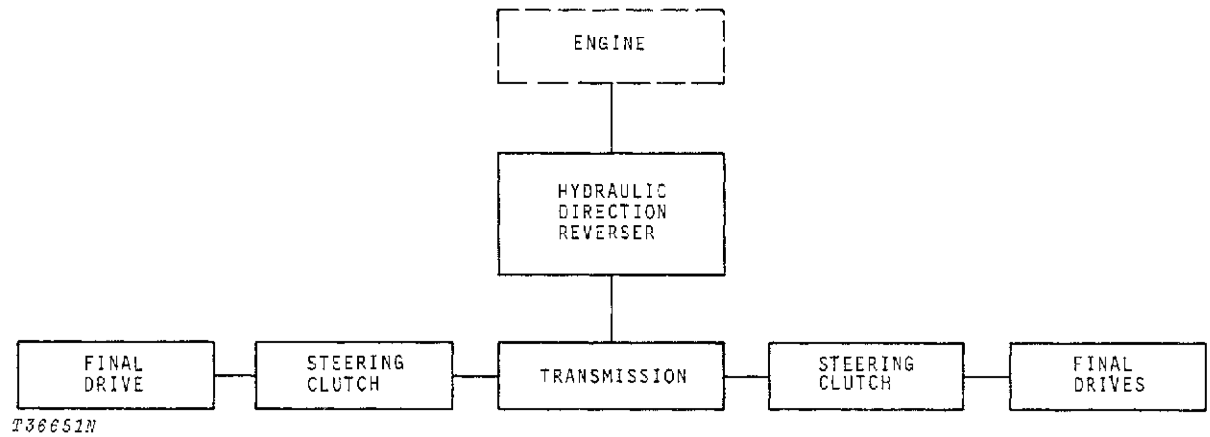


Fig. 2-Power Train Block Diagram

Drive Axle Housing

The drive axle housing is attached to the outboard side of the steering clutch housing.

The input pinion shaft is splined to the steering brake drum and drives a large bull gear which in turn drives the flanged axle.

Steering Clutches and Brakes

The combination clutch and brake mechanism on each rear axle engages or disengages the flow of power to each rear axle by means of individual steering levers.

In addition, a brake pedal is used to stop tractor motion on both axles by means of a contracting brake band device.

Transmission Rear Compartment

The transmission case contains a ring gear and spiral bevel pinion.

The second and reverse-speed sliding gears, the first and fourth-speed sliding gear, and the third-speed sliding gear are splined to the spiral bevel pinion.

The case also contains a first and second-speed gear cluster, third-speed gear and fourth-speed gear.

The case also contains a powershaft.

Transmission

A selective sliding-gear type transmission is used. The transmission is shifted manually by the shift lever while declutching. Shifter forks engage sliding gears on the output shaft with driving gears on the input shaft. Four speeds forward are available. Power is transmitted by the bevel pinion shaft, through the ring gear and hub, to the steering clutches.

The transmission gears are carried on three shafts—the input shaft, the powershaft and the bevel pinion shaft.

Hydraulic Direction Reverser

The direction reverser is a hydraulic mechanism designed to change the forward and reverse direction of tractor travel without shifting the transmission. It also serves as the main engine clutch for the tractor. The unit is located just ahead of the transmission and forms the tractor center frame.

The reverser control lever has three operating positions: forward, neutral, and reverse. When the lever is in forward position, the tractor is in forward drive. When lever is pulled to the rear, the tractor is in reverse drive. When the lever is at the center of its slot, the tractor is in neutral. It is not necessary to declutch or to shift gears when operating the reverser control lever. A neutral lock at the lever allows the unit to be kept in neutral during stationary work.

The foot clutch disengages the flow of power through the reverser gear train by neutralizing the reverser clutches. The clutches are disengaged by depressing the pedal. Releasing the pedal engages the reverser power train. The foot clutch is used for shifting transmission gears or for "inching" the tractor into a load.

The direction reverser case is a separate compartment containing the necessary gears, shafts, and clutches for receiving engine flywheel rotation and transmitting it in either forward or reverse direction to the input shaft of the transmission. All gears are in constant mesh. The only shifting is in the two clutch assemblies. By hydraulic engagement and disengagement, they change the power flow and control the rotation of the transmission input shaft.

The front spider shaft extends through the front cover and is splined to the hub of the isolator assembly.

The front cover bolts onto the inner shoulder of the reverser case. The cover supports the rear of the front spider shaft in a roller bearing cone. The reverser hydraulic pump mounts over and is driven by the front spider shaft. The idler shaft is pressed into the reverser case front cover and supports the idler gear on a roller bearing.

Inside the reverser case, the clutch shaft carries the two clutch assemblies, their pistons, the oil collector ring, and the reverse spider. The front end of the clutch shaft rides in a roller bearing cone in the forward spider.

The clutch shaft extends through the reverse spider, rides in a roller bearing cone in a rear quill, and couples with the transmission input shaft. Clutch shaft bearings are lubricated by oil that enters at the collector ring and flows through a rifle-drilled passage in the shaft. A restrictor regulates the flow of oil to the front bearing. End play on the clutch shaft is set by means of shims behind the rear quill.

The countershaft rides in roller bearing cones in the front cover and in a quill which mounts in the rear wall of the reverser case. End play on the countershaft is set by means of shims behind the rear quill. Countershaft gears are splined to the shaft and secured by snap rings. The countershaft is constantly driven by the idler gear.

The front spider shaft, being splined to the isolator, always follows engine rotation. In the forward position, since the forward clutch is engaged, the front spider drives the clutch shaft and engine power flows directly through the clutch shaft to the transmission input shaft. The idler gear is in constant mesh with the front spider gear and the countershaft, and so drives the countershaft in the direction of the flywheel rotation. The rear gear of the countershaft is in constant mesh with the rear spider gear and turns it in the opposite direction. However, since the reverse clutch is disengaged, the rear spider "idles" on the clutch shaft, and engine power is allowed to flow directly from the forward clutch to the transmission input.

The front spider shaft is splined to the isolator. In reverse position, since the forward clutch is disengaged, the front end of the clutch shaft "idles" in the front spider. Thus power flows from the front spider gear through the idler gear and drives the front countershaft gear. Power flows to the rear countershaft gear, which drives the rear spider gear. Since the reverse clutch is engaged, the clutch shaft is driven by the rear spider gear and power is fed into the transmission input in a reverse rotation from that of the engine.

DIAGNOSING MALFUNCTIONS

STEERING CLUTCH AND BRAKE ASSEMBLY

Loss of Power Transmitted

Brake Out of Adjustment.

Adjust clutch linkage.

Steering Effort High

Brake Too Tight.

Adjust brake linkage.

Low Brake Effect

Self Adjuster Not Functioning.

Remove plug and manually adjust brakes.

Brakes Not Releasing

Linkage Over-Center.

Adjust brake lever stop screw.

Jerky Steering

Clutch Overlaps Brake.

Adjust linkage.

Housing Filled With Oil

Manifold Oil Seal Leaks

Leak in Pressure Oil Line

Clutch Piston Seal Leaks.

Tear down and repair.

TRANSMISSION

Excessive Gear Clash When Shifting

Attempting to Shift Before Gears Have Stopped.
See operator's manual for instructions.

Shifter Forks or Shaft Damaged.

Replace as needed.

Shifter Collars or Gears Worn or Damaged.

Replace as needed.

Bearings and/or Bushings Worn.

Replace as needed.

Incorrect Transmission Assembly.

Assemble correctly.

Gears Rotate With Clutch Pedal Depressed or Reverser Lever Locked in Neutral.

Check reverser assembly.

Excessive Transmission Noise

Improper Endplay and/or Preload Adjustment.

Set up proper adjustments.

Incorrect Assembly of Transmission.

Assemble correctly.

Transmission Oil Level Low.

Fill to proper level.

Oil Passages Blocked.

Clean oil passages.

Bearings and/or Bushings Worn.

Replace as needed.

Worn or Damaged Gears.

Replace gears.

Bent or Worn Shafts.

Replace shafts.

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:

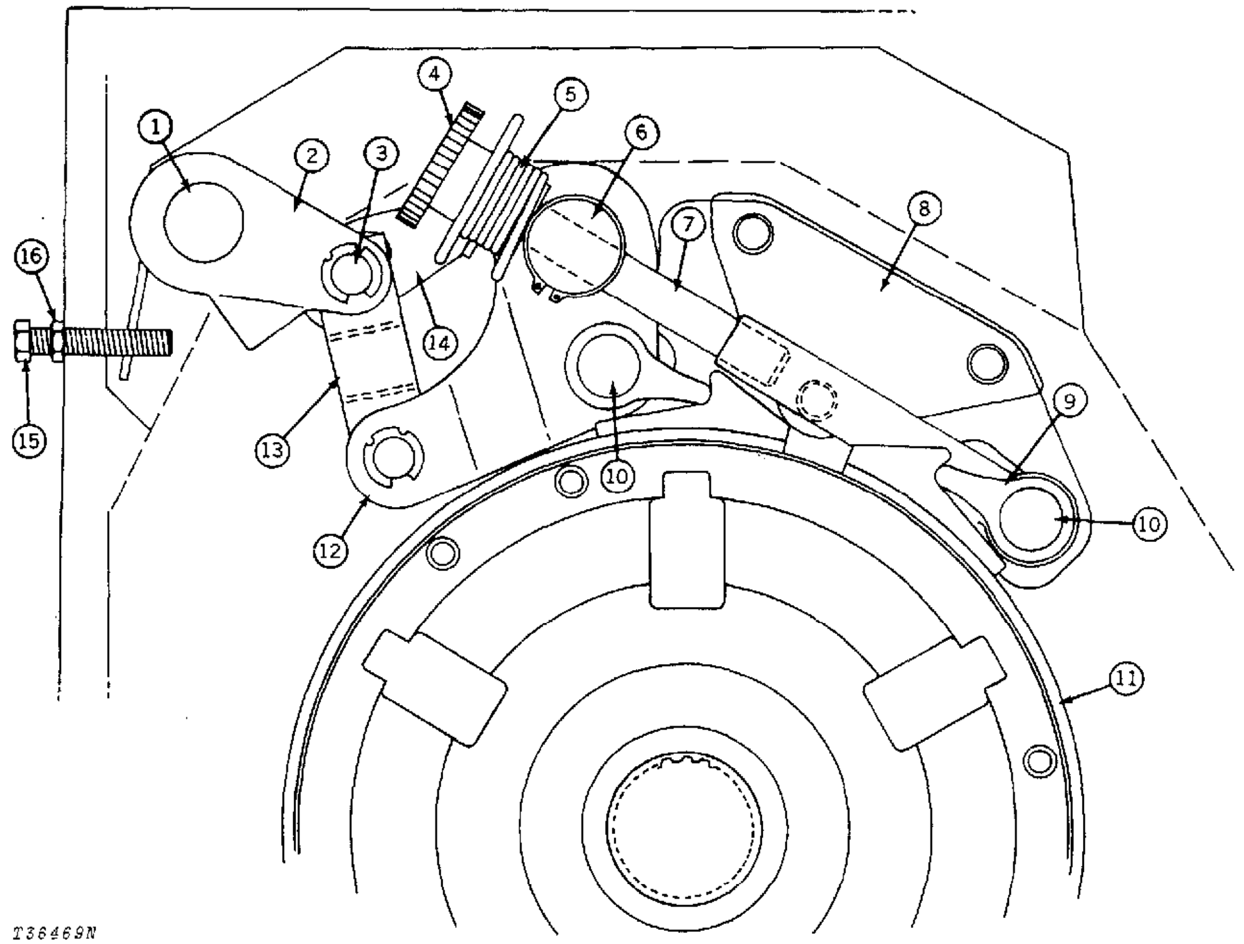
1. Improper cap screw torque.
2. Cracked or broken housing.
3. Failed gasket.
4. Worn or improperly installed oil seals and/or O-rings.

TESTING AND ADJUSTMENTS

Brake Assembly

NOTE: Adjust one side at a time.

1. Tighten adjusting nut (4, Fig. 3) so brakes start to pick up at 5 in. (127 mm) of lever travel.
2. Tighten adjusting nut one notch more to insure that adjusting link (3) is against bottom of adjusting nut.



1—Brake Lever Shaft
2—Brake Lever
3—Pin
4—Adjusting Nut
5—Spring
6—Pin
7—Stud
8—Brake Anchor
9—Brake Strut
10—Pin
11—Brake Band
12—Brake Band Yoke
13—Link
14—Adjusting Link
15—Brake Lever Adjusting Screw
16—Jam Nut

Fig. 3-Steering-Brake Assembly

3. Loosen jam nut (16, Fig. 3) and turn brake lever, adjusting screw (15) in two turns, or far enough so the brakes will NOT self-adjust.

4. While driving the crawler forward, repeatedly pull the steering lever to the stop. Check if adjusting link (14) is picking up the next notch in the adjusting nut.

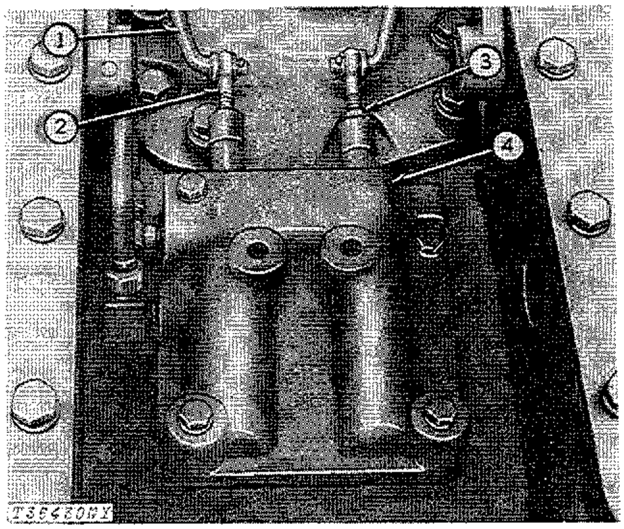
   If necessary, repeat above procedure after backing out adjusting screw (15) in quarter-turn increments until the adjusting link just picks up the next notch on the adjusting nut. Then lock the adjusting screw by tightening jam nut (16).

5. After the adjusting screw is set and locked in position, back off the adjusting nut so the levers can be pulled back to the stop with little effort. Readjust lever travel so the tops of the levers move 12 in. (304.8 mm) before the stop is contacted.

6. Readjust the brake adjusting nut so the brakes start to engage at 5 in. (127 mm) lever travel.

Steering Clutches

Adjust the steering valve spools so that the clutches are engaged when the tops of the steering levers are 1.5 inches (38 mm) from the "at rest position" and disengaged when the tops of the levers are 2.5 inches (63.5) from the "at rest position".



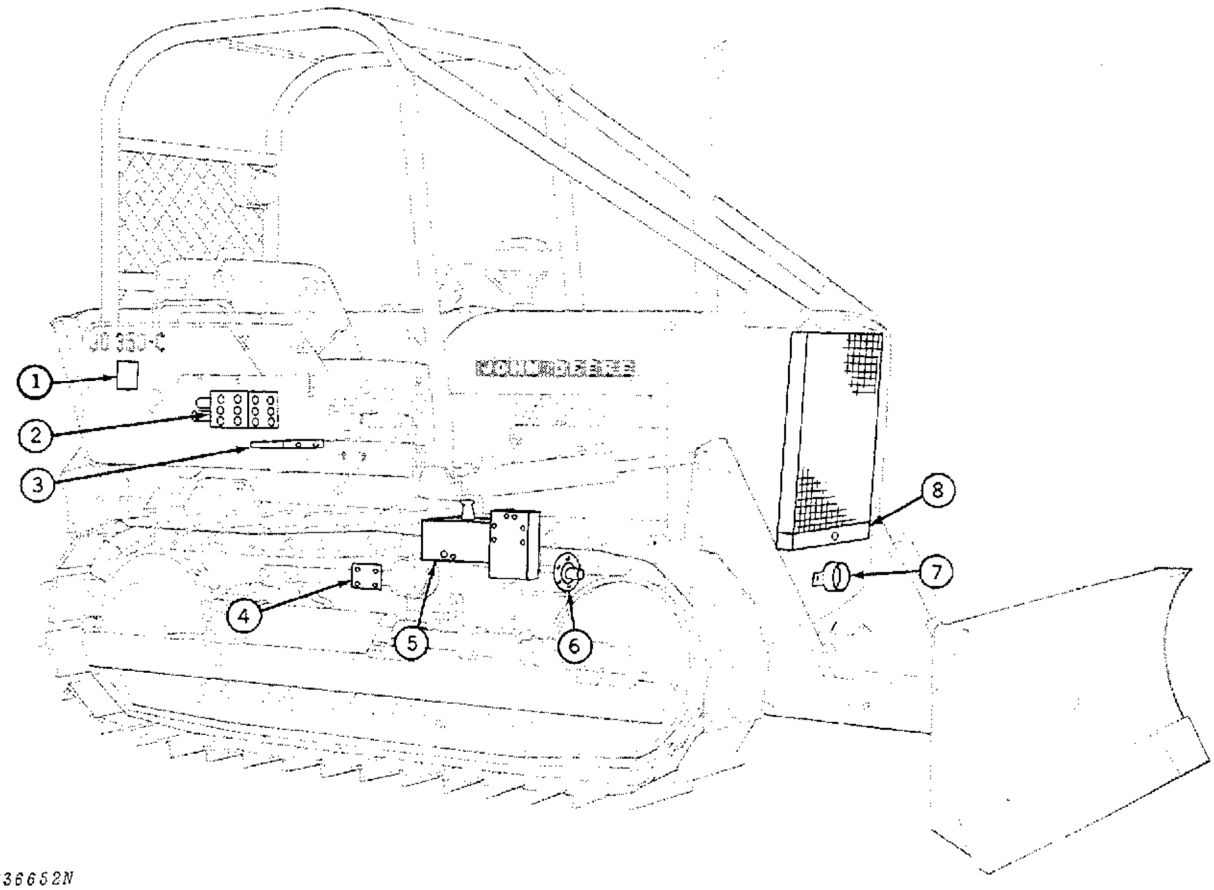
1—Steering Valve Rods **3—Lock Nuts**
2—Steering Valve Eyebolts **4—Steering Valve Housing**

Fig. 4-Steering Valve Spool Adjustments

Refer to Fig. 4 and adjust the steering valve spool. Start the engine and place the transmission in first gear and the reverser in gear. Set the foot brake and lock it down.

Adjust the steering valves so that the clutches are engaged when the tops of the steering levers are 1.5 inches (38.10 mm) from the stop position and disengaged when the tops of the levers are 2.5 inches (63.50 mm) from the stop.

Group 9025
HYDRAULIC SYSTEM

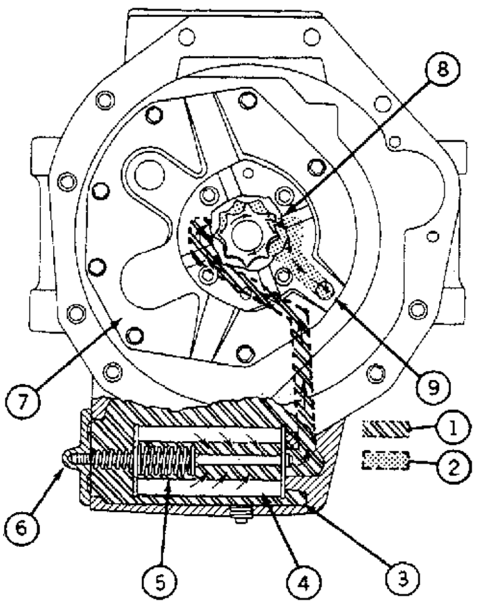


1—Return Line Filter
2—Control Valve
3—Steering Valve Spools
4—Reverser Filter
5—Reverser Control Valve
6—Reverser Oil Pump
7—Dozer or Loader Pump
8—Transmission Oil Cooler

Fig. 1-Component Location

GENERAL INFORMATION

REVERSER HYDRAULIC SYSTEM



T21296

1—Pressure-Free Oil
2—Pressure Oil
3—Reservoir
4—Oil Filter
5—Bypass
6—Cover
7—Front Cover
8—To Hydraulic Pump
9—Oil to Control Valve

Fig. 2-Reverser Hydraulic Oil Supply System

The direction reverser unit has its own hydraulic system. The components include: reservoir, oil filter, hydraulic pump, oil cooler, relief valves (in control valve assembly) and oil lines.

The reverser case forms a reservoir (3, Fig. 2) for hydraulic oil. Capacity is 3 gallons (11.3 liters).

Reservoir oil circulates through a full flow oil filter (4) before passing out an internal, drilled passageway on its way to the hydraulic pump (8).

The movement of hydraulic oil in the valving and oil passages of the reverser control valve is shown in Fig. 3. Use this diagram as a guide in the discussion which follows.

Pressure oil from the hydraulic pump (21, Fig. 3) flows to the regulator valve (16). Since oil from pump is normally slightly over valve setting, it partly opens this valve, bypassing some oil to the cooler pressure regulating valve (18). This valve protects the oil cooler against excessive pressure. A sufficient flow of oil is passed on to the cooler (19), where it is cooled. The oil then returns to the reverser.

Lube Oil Route

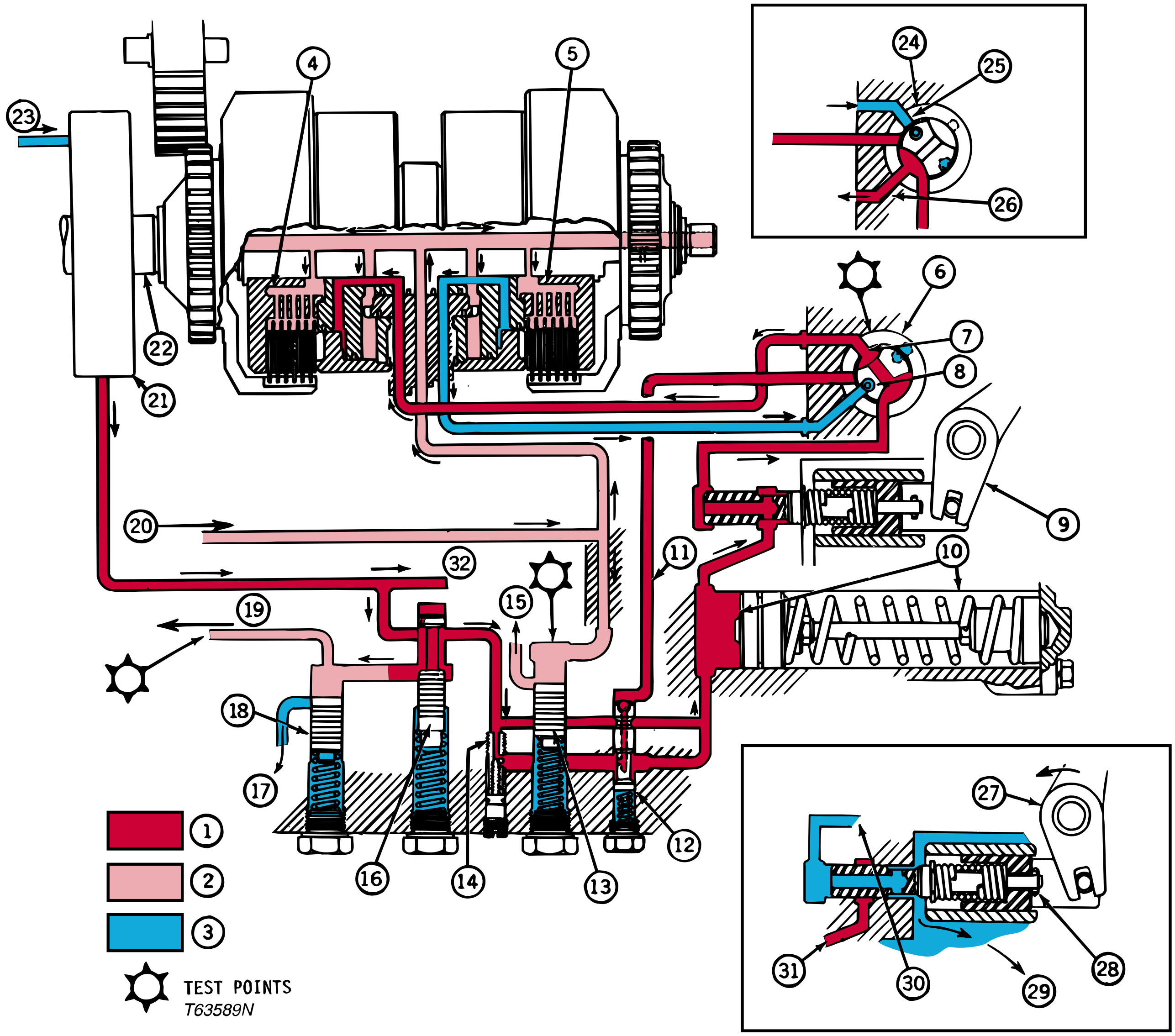
The lube oil route flows from the oil cooler to the direction reverser.

A regulator valve in the return line from the cooler lowers oil pressure. This low pressure oil passes, into the center passage of the collector ring (8, Fig. 4) to lubricate, release, and cool the clutch assemblies (4 and 12). The lube oil enters the drilled passage in clutch shaft (16) and sprays out of bores in clutch hubs to flush and cool disks, lubricates roller bearings on clutch shaft, and enters compartment behind clutch piston carrier (10) where it exerts pressure against engagement oil and releases clutch packs during disengagement.

Pressure Oil Route

Oil from the pump not bypassed at regulator valve (16, Fig. 3) flows on through an adjustable restricting orifice (14), which sends a gauged flow of oil to the engaging clutches. Pressure of this oil compresses accumulator spring. Thus a load of oil is placed in front of accumulator piston (10), ready to be released during clutch engagement. With clutch pedal engaged (9), pressure oil can flow through the clutch valve to the rotary valve (6). The clutch valve is held in this position by the pedal return spring.

NOTE: The original orifice (14) has one hole. The orifice used for a replacement part has two holes.



1—Pressure Oil (Clutch Pressure Oil)
2—Low Pressure Oil (Lube Oil)
3—Pressure-Free Oil
4—Forward Clutch (Engaged)
5—Reverse Clutch
6—Rotary Valve (Forward Position)
7—To Forward Clutch
8—From Reverse Clutch To Sump
9—Clutch Pedal (Engaged)
10—Accumulator
11—To Rotary Valve
12—Bypass Valve
13—Lube Regulating Valve
14—Restricting Orifice
15—To Reservoir
16—Clutch Pressure Regulating Valve
17—To Reservoir
18—Cooler Pressure Regulating Valve
19—To Cooler
20—From Cooler
21—Pump
22—Spider Shaft
23—From Sump
24—Rotary Valve (Reverse Position)
25—From Forward Clutch To Sump
26—To Reverse Clutch
27—Clutch Pedal (Depressed)
28—Clutch Valve
29—To Reservoir
30—Oil From Engaged Clutch
31—From Accumulator
32—To Steering Valves

Fig. 3-Operation of Reverser Control Valve (Forward Position Shown)

NOTE: The original orifice (14, Fig. 3) has one hole. The orifice used for a replacement part has two holes.

When the system is placed in forward position (as shown), the control lever linkage turns the rotary valve (6, Fig. 3) to forward position. As the rotary valve passes the neutral port, oil is dumped from top of bypass valve (12) and the bypass valve closes. When rotary valve reaches forward position, engaging oil is allowed to escape from the reverse clutch (5). The accumulator (10) now sends its load of oil in a controlled "surge" to fill up cavities in the forward clutch (4). Since the bypass valve has closed off the full flow passage, the restricting orifice (14) meters the flow of oil to recharge the accumulator.

As the accumulator is recharged, pressure builds up slowly in the engaging clutch until the accumulator bottoms. At the same time, the bypass valve is also recharging. After the accumulator bottoms, the bypass valve opens, and pressure instantly rises to the regulated pressure.

Oil engages the clutch pack by expanding the compartment in front of piston carrier (10, Fig. 4) and pushing the piston against clutch pack, engaging disks and plates (see details in Fig. 4). At the same time, oil behind the piston carrier is forced out of its compartment.

When the system is placed in a reverse position, the rotary valve (24, Fig. 3) is turned so that oil escapes to reservoir from forward clutch and engaging oil is admitted to reverse clutch (26). The bypass valve is discharged as the valve passes neutral in the same manner as during the reverse-to-forward shift described above.

When the clutch pedal is completely depressed (27), the spool is pulled to the rear allowing oil to dump from the clutch. Movement of the spool seals off inlet to engaged reverser clutch and allows oil from clutch to flow to reservoir (29). Since both reverser clutches are now neutralized, power flow is stopped between engine and transmission.

Depressing the clutch pedal part way will slip or "inch" the reverser unit. This action compresses the clutch valve spring, allowing the clutch valve to act as a pressure regulating valve. By controlling the pressure to the clutch any desired torque output can be obtained from the clutch.

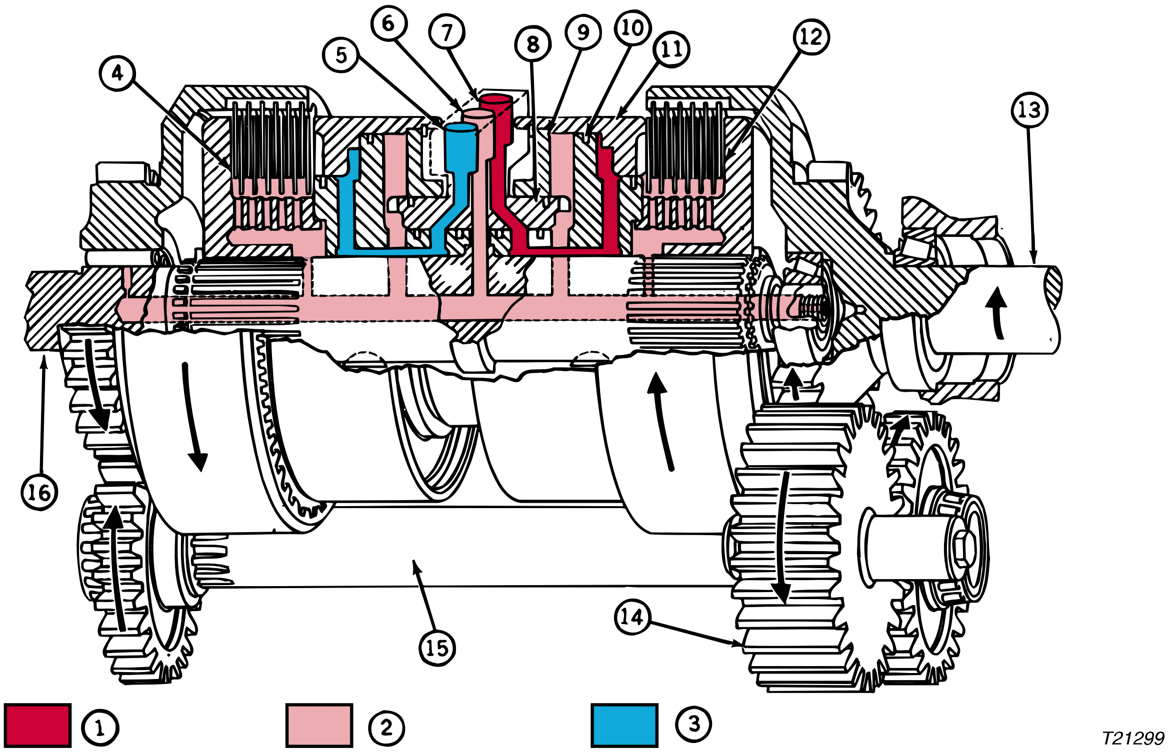
Hydraulic Function of Reverser Clutches

The two reverser clutch assemblies (Fig. 4) each have six sintered bronze friction disks alternated with six steel separator plates. The disks and plates are "packed" on a hub with backing plate. The separator plates have interior slots and are keyed to the hub. The friction disks have teeth on their outer rims which mesh with the inside of the spiders (13, Fig. 4). The hub is splined to the clutch shaft and so the separator plates always rotate with the shaft. When the opposite clutch is engaged, the friction disks and separator plates rotate in opposite directions. To carry away heat, cooled oil sprays out of the hub to flush and cool the disks and plates. The bronze friction disks are grooved to allow the oil to circulate freely between the disks and plates. Lubricating oil is then exhausted through holes in spider shoulders and falls back to reservoir.

The clutch disks and plates are engaged and disengaged by movement of hydraulic pistons. Fig. 4 shows engagement of the forward clutch and disengagement of the reverse clutch. Any time one clutch is engaged, the other clutch is disengaged, except when clutch pedal is depressed at which time both clutches are disengaged.

The piston carrier (9) is keyed to the clutch shaft. The piston (11) slides on and is doweled to the piston carrier. A sealing ring on the carrier seals off two compartments: one between the carrier and working shoulder of the piston; a second one between carrier and piston plate. During engagement, clutch pressure oil expands the outer compartment, moving the piston against the clutch pack and engaging disks and plates.

During disengagement of a clutch, engagement oil is released to reservoir, and release oil expands the inner compartment to move the piston back away from the clutch, releasing disks and plates.



1—Pressure Oil (clutch pressure oil)
2—Low Pressure Oil (lube oil)
3—Pressure-Free Oil
4—Reverse Clutch Assembly
5—Reverse Direction Oil Inlet
6—Lubrication, Release and Cooling Oil Inlet
7—Forward Direction Oil Inlet
8—Collector Ring
9—Piston Plate
10—Piston Carrier
11—Piston
12—Forward Clutch Assembly
13—Spider
14—Idler Gear
15—Countershaft
16—Clutch Shaft

Fig. 4-Direction Reverser Clutches (Forward Operation Shown)

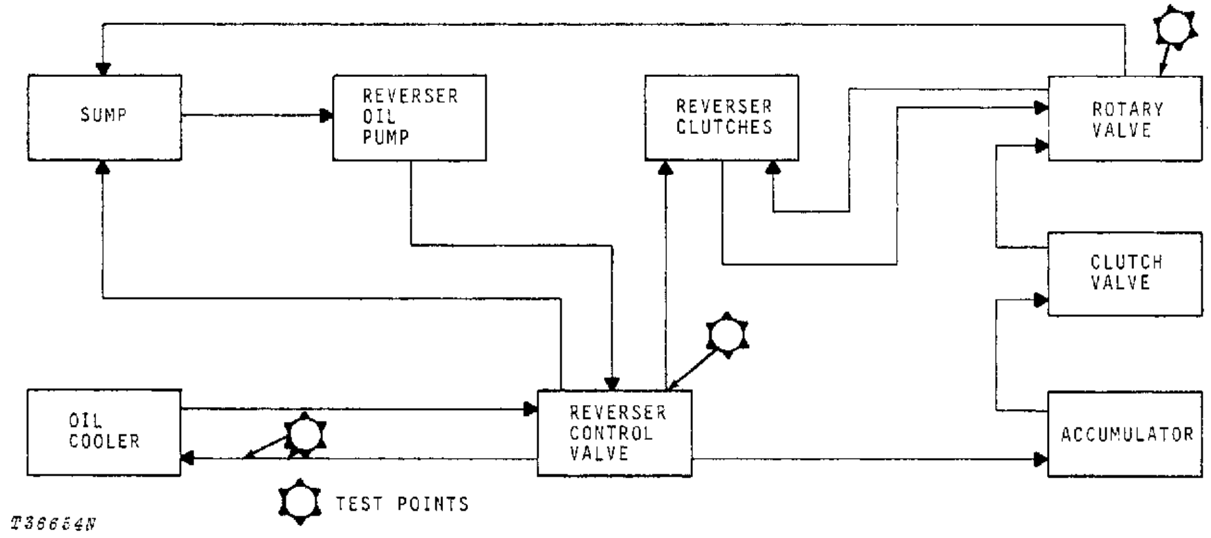


Fig. 5-Block Diagram of Reverse Hydraulic System

LOADER AND BULLDOZER HYDRAULIC SYSTEM

GENERAL INFORMATION

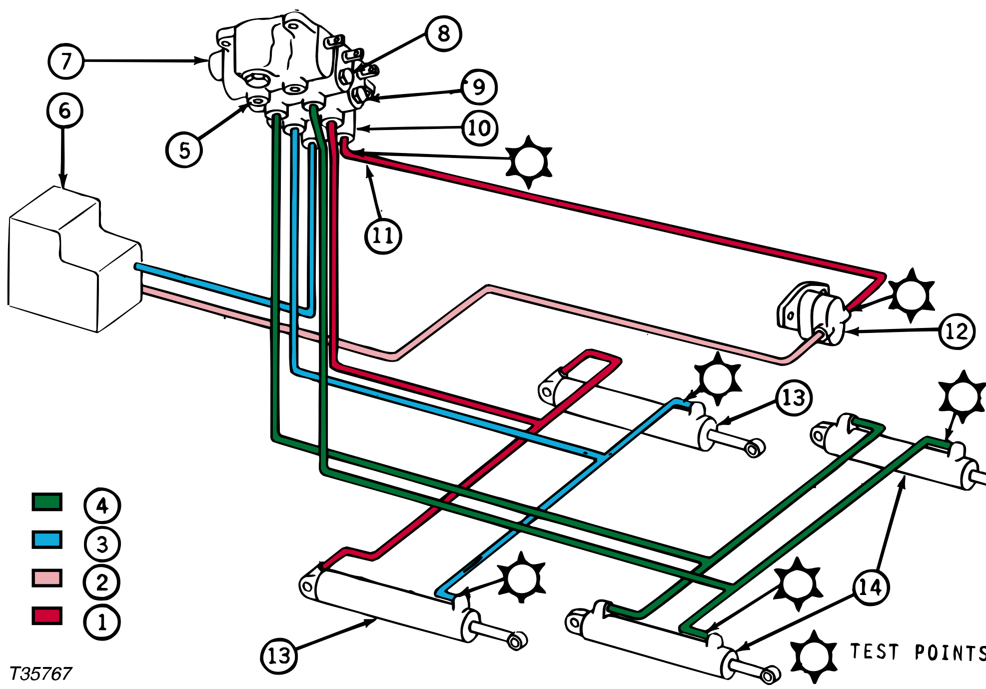
The hydraulic system for all crawler functions is of the open center type.

Basic crawler hydraulic systems consist of a gear type hydraulic pump, oil reservoir, filter, control valve and cylinders.

System operating pressure is 1750 psi (123 kg/cm²) for bulldozers and 2250 psi (158 kg/cm²) for loaders.

The following hydraulic circuit diagrams give a brief description of each hydraulic system and its components.

Study the circuit diagrams when diagnosing hydraulic system difficulties.

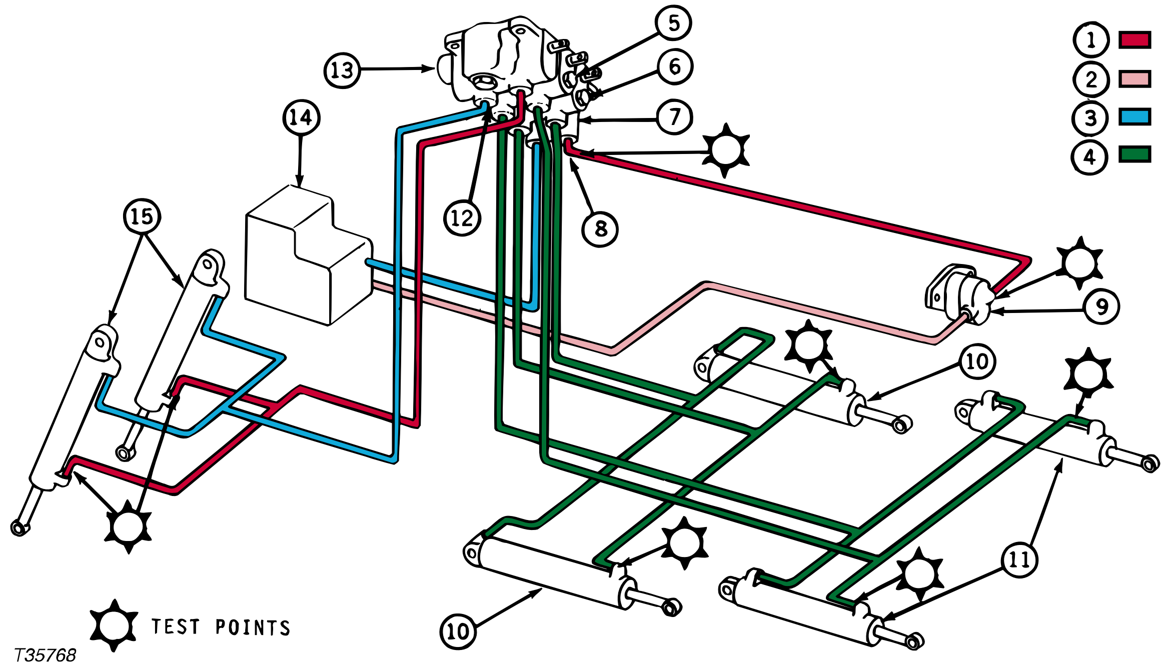


1—Pressure Oil
2—Low Pressure Oil
3—Return Oil
4—Trapped Oil
5—Circuit Relief (Bucket)
6—Reservoir
7—Control Valve
8—Circuit Relief (Bucket)
9—Circuit Relief (Boom)
10—System Relief
11—Pressure Tap
12—Hydraulic Pump
13—Boom Cylinder
14—Bucket Cylinder

Fig. 6-Crawler Loader Circuit

Oil is drawn from the reservoir by the pump and is moved to the control valve. With the boom spool retracted to raise the boom, the inlet port to the next valve spool is blocked (see Section 31). Oil then is diverted to the boom cylinder by the boom valve spool.

As oil flows to the piston end of the cylinder, oil from the cylinder rod end is forced back through the control valve to the reservoir. Oil in the remaining cylinders and lines is trapped by the other valve spools.

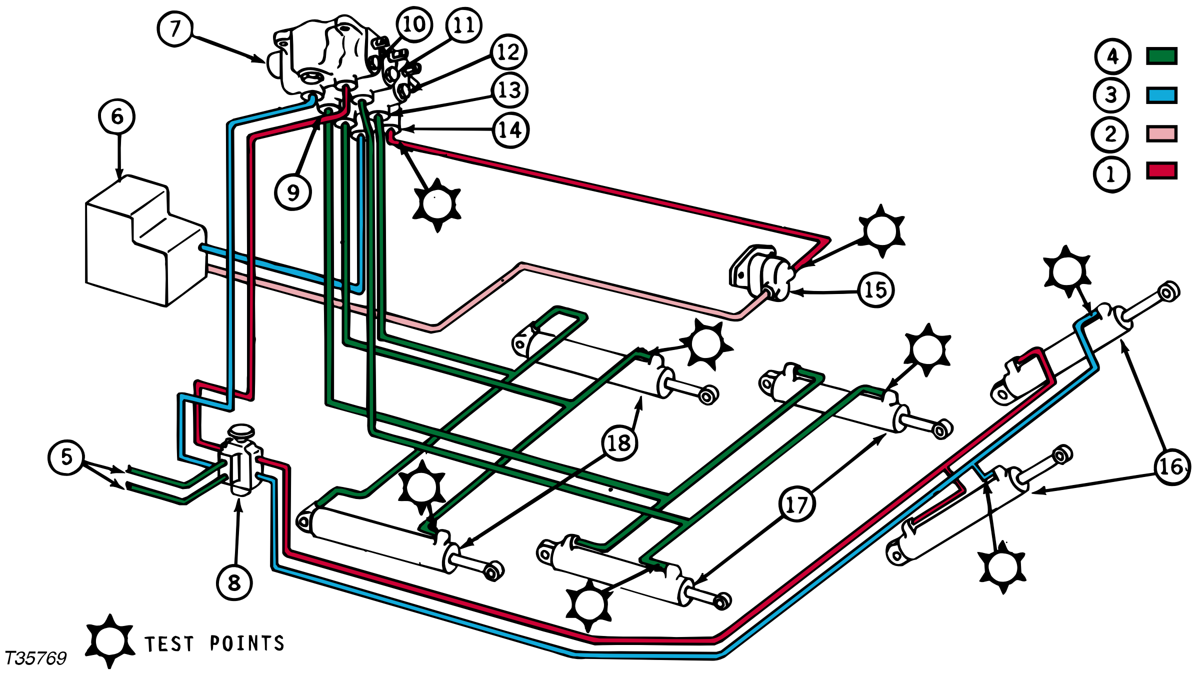


1—Pressure Oil
2—Low Pressure Oil
3—Return Oil
4—Trapped Oil
5—Circuit Relief (Bucket)
6—Circuit Relief (Boom)
7—System Relief
8—Pressure Tap
9—Hydraulic Pump
10—Boom Cylinder
11—Bucket Cylinder
12—Circuit Relief (Bucket)
13—Control Valve
14—Reservoir
15—Ripper Cylinder

Fig. 7-Crawler Loader With Ripper

Oil is drawn from the reservoir by the pump and is moved to the control valve past the loader spools to the auxiliary valve. With the auxiliary spool retracted to raise the ripper, the outlet port back to the reservoir is blocked. Oil then is forced to the ripper cylinders.

As oil flows to the rod end of the cylinder, oil from the piston end is forced back through the control valve to the reservoir. Oil in the rest of the system is trapped by the position of the other control valve spools. The auxiliary valve section is protected by the loader system relief valve located in the valve boom section.

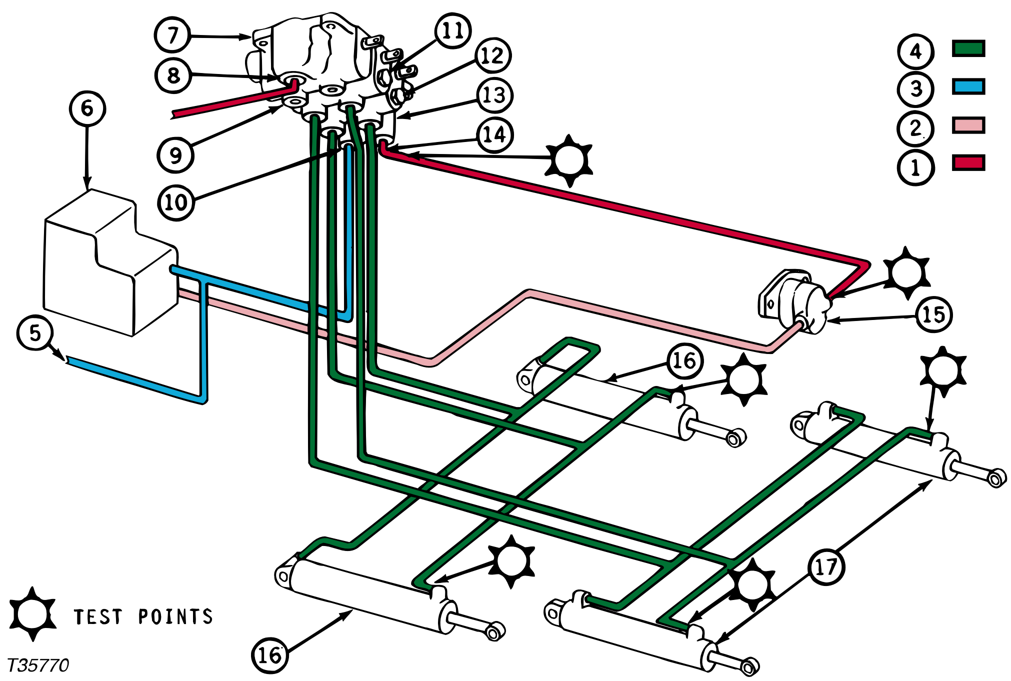


1—Pressure Oil
2—Low Pressure Oil
3—Return Oil
4—Trapped Oil
5—To Ripper Cylinder
6—Reservoir
7—Control Valve
8—Selector Valve
9—Circuit Relief (Bucket)
10—Circuit Relief (Multi-purpose bucket)
11—Circuit Relief (Bucket)
12—Circuit Relief (Boom)
13—System Relief
14—Pressure Tap
15—Hydraulic Pump
16—Clam Cylinders
17—Bucket Cylinders
18—Boom Cylinders

Fig. 8-Crawler Loader With Ripper and Multi-Purpose Bucket

Oil is drawn from the reservoir by the pump and is moved to the control valve past the loader valve spools to the auxiliary valve section. When either a multi-purpose bucket or log fork is used with a ripper, a selector valve must be installed in the system as shown in Fig. 8.

With the selector valve positioned for either ripper or front attachment operation, the oil flow is the same through the auxiliary valve as when only one function is used (see Fig. 6). When loader is equipped with a multi-purpose bucket, a relief valve (10) is installed in the control valve and adjusted to 250 psi (17.6 kg/cm²) above the loader system relief valve setting.

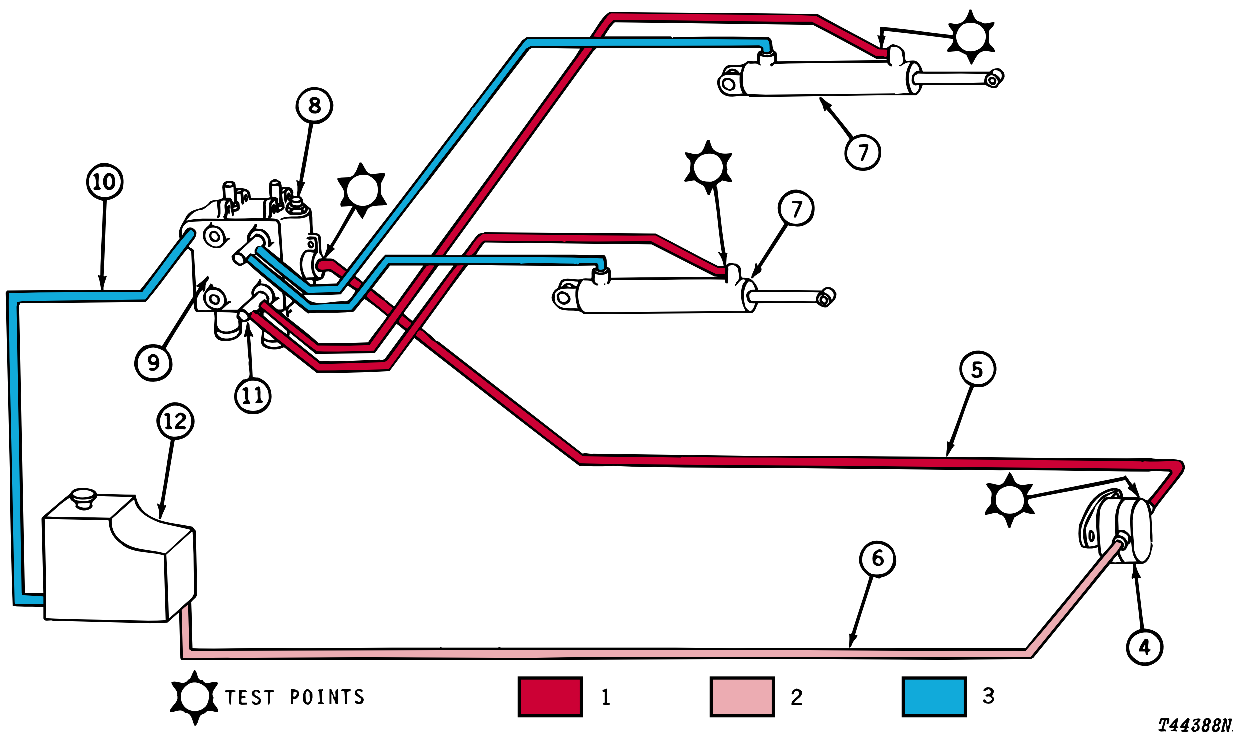


1—Pressure Oil
2—Low Pressure Oil
3—Return Oil
4—Trapped Oil
5—Return From Backhoe
6—Reservoir
7—Control Valve
8—Power Beyond (Backhoe)
9—Circuit Relief (Bucket)
10—Return Oil
11—Circuit Relief (Bucket)
12—Circuit Relief (Boom)
13—System Relief
14—Pressure Tap
15—Hydraulic Pump
16—Boom Cylinders
17—Bucket Cylinders

Fig. 9-Crawler Loader With Backhoe

When hydraulic power is required beyond the loader control valve, oil is pumped past the loader valve spools to the power beyond port located in the control valve auxiliary valve section.

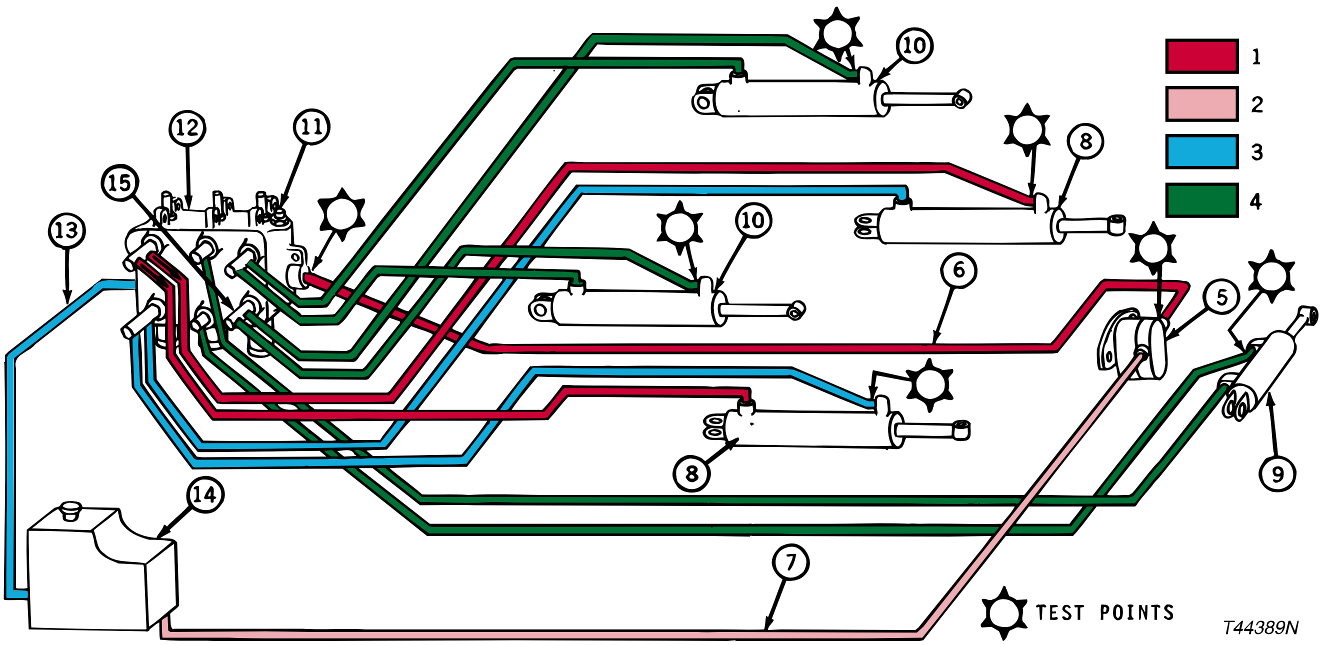
When a backhoe is used with a crawler loader, a power beyond fitting must be used to obtain full pump flow to the backhoe.



1—Pressure Oil
2—Low Pressure Oil
3—Return Oil
4—Hydraulic Pump
5—Pump Pressure Line
6—Pump Inlet Line
7—Lift Cylinder
8—System Relief Valve
9—Control Valve (2 spool)
10—Return Line
11—Restricted Union
12—Reservoir

Fig. 10-Mechanical Bulldozer Circuit (Blade Raise Circuit Shown)

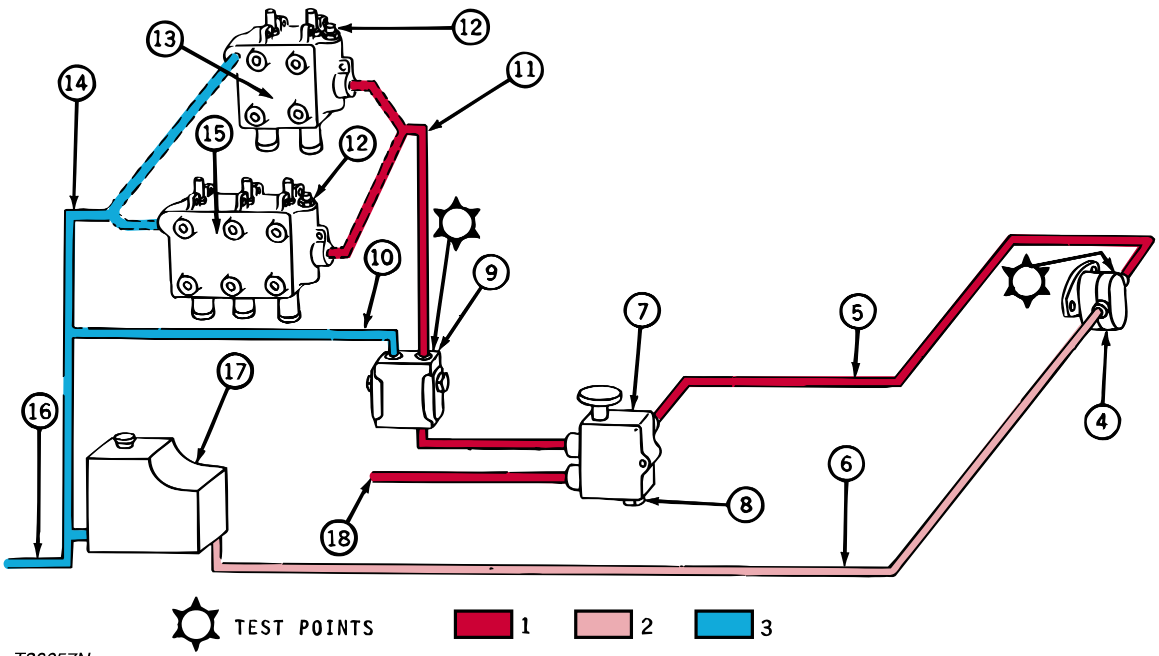
Oil from the reservoir enters the gear type pump and is forced by the pump to the dozer control valve. Moving the first spool opens ports connected to the rod ends of the lift cylinders. Oil enters the cylinders and retracts the piston rods. Piston retraction moves oil from the head end of the cylinder, to the control valve and then to the reservoir. Moving the valve spool in the opposite direction directs oil to the head ends of the cylinders and lowers the dozer boom. Restricted unions in the cylinder rod end circuits restrict return oil flow for a governed bulldozer boom drop cycle and for preventing cylinder cavitation.



1—Pressure Oil
2—Low Pressure Oil
3—Return Oil
4—Trapped Oil
5—Hydraulic Pump
6—Pump Pressure Line
7—Pump Inlet Line
8—Angling Cylinders
9—Tilt Cylinder
10—Lift Cylinder
11—System Relief Valve
12—Control Valve (3 spool)
13—Return Line
14—Reservoir
15—Restricted Union

Fig. 11-All-Hydraulic Bulldozer Circuit (Blade Angle Circuit Shown)

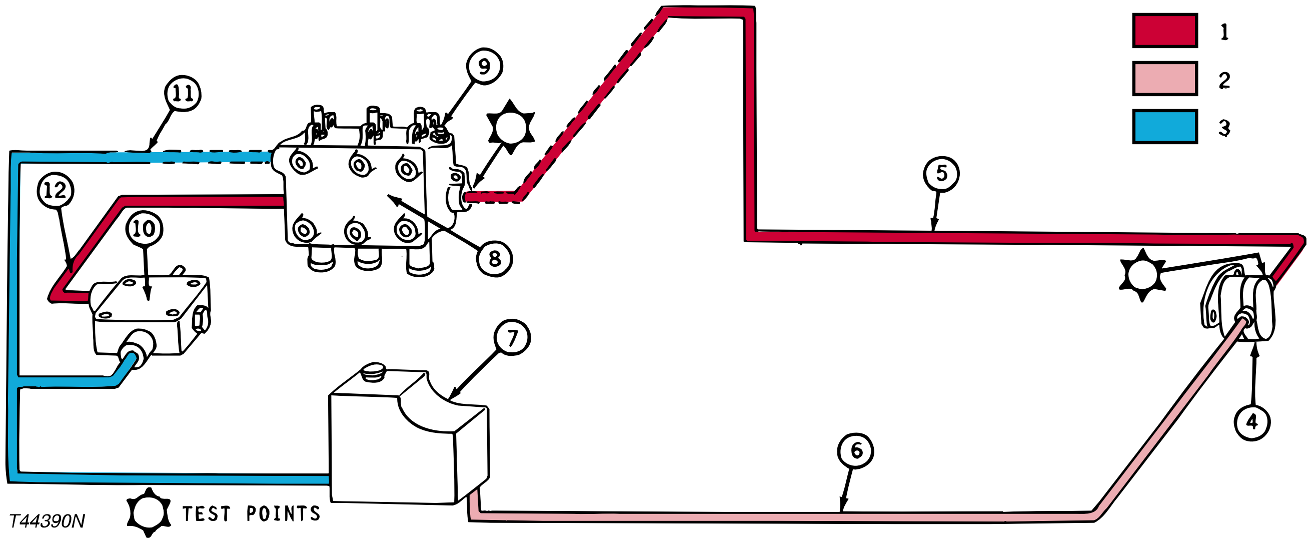
Oil from the reservoir enters the pump and is forced by the pump to the control valve. Moving the third spool opens ports to the angling cylinders allowing oil to enter the cylinders. One piston rod is extended and the other is retracted, forcing oil from the cylinders back to the control valve, and then to the reservoir. Oil in the lift cylinder and tilt cylinder and lines is trapped by the valve spools. Boom raise and lower cycles are the same as described on page 9025-11. A restricted union in the boom lowering circuit regulates boom drop and prevents cavitation.



1—Pressure Oil
2—Low Pressure Oil
3—Return Oil
4—Hydraulic Pump
5—Pump Pressure Line
6—Pump Inlet Line
7—Selector Valve
8—Selector Valve Relief
9—Flow Divider
10—Return Line
11—Dozer Valve Inlet Line
12—Dozer System Relief Valve
13—Dozer Control Valve (2 spool)
14—Dozer Valve Return Line
15—Dozer Control Valve (3 spool)
16—Return Line From Function
17—Reservoir
18—Auxiliary Valve Inlet Line

Fig. 12-Bulldozer Equipped with Backhoe

If the bulldozer is equipped with a backhoe the 15 gpm (56.8 dm³/min) pump is replaced with a 23 gpm (87.0 dm³/min) pump to meet backhoe oil volume requirements. Oil enters the selector valve which directs oil flow to the backhoe or to the flow divider (flow is determined by position of selector valve). The flow divider provides a maximum flow of 15 gpm (56.8 dm³/min) to the bulldozer valve. Excess oil is returned to the reservoir. A relief valve is incorporated into the selector valve to provide pump protection. The oil flow is the same through the bulldozer control valve as shown in Fig. 10 and Fig. 11.



1—Pressure Oil
2—Low Pressure Oil
3—Return Oil
4—Hydraulic Pump
5—Pump Pressure Line
6—Pump Inlet Line
7—Reservoir
8—Dozer Valve (2 spool)
9—System Relief
10—Auxiliary Valve (1 spool)
11—Return From Dozer Valve
12—Pressure to Auxiliary Valve

Fig. 13-Bulldozer Equipped with Auxiliary Valves

All three spools of the control valve are required for bulldozer operation. The auxiliary, single spool valve may be used for operating a ripper, remote cylinder or 3-point hitch.

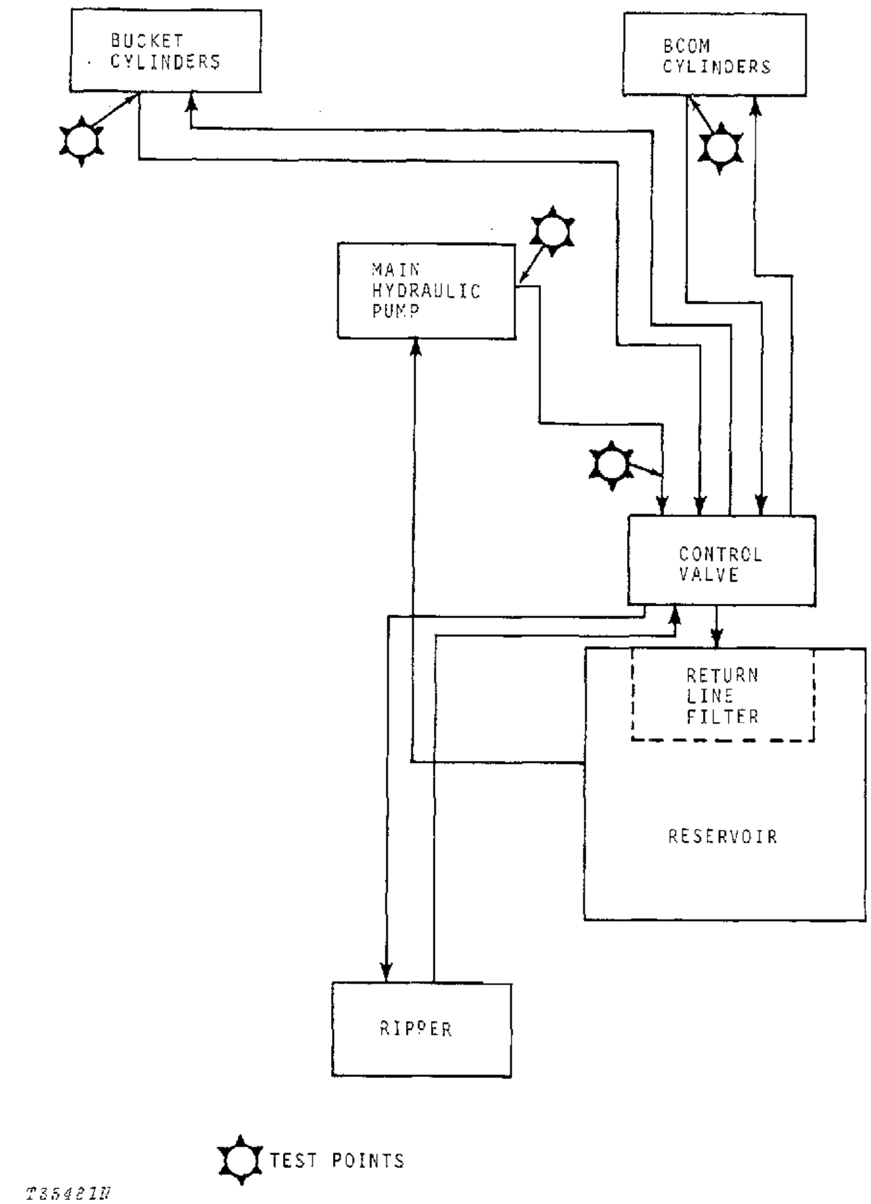


Fig. 14-Block Diagram of Hydraulic System (Loader and Ripper Shown)

DIAGNOSING MALFUNCTIONS

TRANSMISSION HYDRAULIC SYSTEM

Shifts Too Slow

Clutch oil pressure regulating valve out of adjustment.
Adjust screw in restricting orifice by screwing out slightly.
Check valve with master gauge.
Adjust using shims.
Remove bypass valve and clean orifice and small valve holes.
Make sure valves slides freely in their bores.
Broken accumulator spring.

Shifts Too Fast

Clutch oil pressure regulating valve and/or lube oil regulating valve out of adjustment.
Remove bypass valve and make sure it is correctly installed and slides freely in its bore.
Check for weak bypass valve spring.
Readjust screw in restricting orifice by screwing in slightly.
Check valves with master gauge.
Readjust by removing shims.
Stuck accumulator piston.

Clutch Slipping

Clutch oil pressure regulating valve and/or lube oil regulating valve out of adjustment.
Remove bypass valve and clean out small valve holes.
Make sure valve slides freely in its bore.
Adjust screw in resitricting orifice by screwing in slightly.
Check valves with master gauge.
Adjust using shims.
Check filter condition.
Check clutch valve linkage.

Clutch Dragging With Clutch Pedal Depressed

Relief valve out of adjustment.
Make sure valve slides freely in its bore.
Check for obstructions preventing clutch pedal from depressing all the way.

HYDRAULIC SYSTEM

No Pump Output Or Low Flow

Pump worn or damaged.
Test pump against specifications.

Shaft Seal Leaking

Worn shaft seal.
Replace shaft seal.
Broken diaphragm "vee" seal or backup gasket.
Repair pump.
Excessive internal leakage.
Repair pump.

Noisy Pump

Pump worn or damaged.
Test pump against specifications.
Low oil supply or oil of wrong viscosity.
Fill reservoir with proper oil.
Suction line plugged or pinched.
Clean or replace line.

HYDRAULIC SYSTEM—Continued

Functions Lift Slowly

Cold oil.
  Allow oil to warm up.
Oil viscosity too heavy.
  Use recommended oil.
Insufficient engine speed.
  Open crawler throttle.
Air leak in suction line.
  Check and tighten.
Badly worn pump.
  Replace or repair pump.
Oil leaking past cylinder packings.
  Replace worn parts.
Oil leaking past control valve.
  Replace or repair valve.
Restriction in suction line.
  Check and replace suction line.
Dirty oil filter (if used).
  Replace or clean filter.
System relief valve dirty or leaking.
  Clean or replace relief valve.

Functions Fail To Stay Raised

Leaking or broken oil lines or fittings from control valve to cylinder.
  Check for leaks. Tighten or replace lines.
Oil leaking past control valve spool(s).
  Repair or replace valve spool(s).
Oil leaking past cylinder seals.
  Replace worn parts in cylinder.

Functions Fail To Work

Insufficient oil in reservoir.
  Add recommended oil.
Relief valve not functioning.
  Replace relief valve.
Insufficient relief valve pressure.
  Clean or replace relief valve.
Pump badly worn or damaged.
  Repair or replace pump.
Broken oil line.
  Check for leaks and repair.
Obstruction in oil lines or valve.
  Check flow of oil through system.
Worn control valve.
  Repair or replace valve.
Oil leaking past cylinder seals.
  Replace worn parts in cylinder.

Oil Heats

Operator holds valves open too long causing relief valve to open.
  Return levers to neutral position when not in use.
Incorrect system relief valve pressure.
  Replace relief valve.
Using light oil in very hot weather.
  Use recommended oil.
Dirty oil.
  Drain and refill with new oil.
Crawler engine running too fast.
  Reset speed control linkage or reduce throttle.

Oil Foams

Air leak in line from reservoir to pump.
  Tighten or replace suction line.
Kink or dent in oil lines.
  Replace oil lines.
Worn seal around pump shaft.
  Replace seal.
Wrong oil used.
  Use recommended oil.

Control Valve Sticks Or Works Hard

Return spring binding or broken.
  Replace spring.
Dirty valve.
  Clean valve.
Scored valve bore or bent spool.
  Replace valve.
Misalignment of control linkage.
Foreign matter in spool bore.
  Clean control valve and hydraulic system.

Engine Stalls While Working

Load beyond crawler or hydraulic system capacity.
  Move smaller loads.
Incorrect relief valve pressure.
  Replace or clean cartridge.

System Pressure Is Low

Relief valve ball held open by foreign material or broken valve spring. Allows oil to return to reservoir because valve will not seat.
  Replace or clean relief valve.

WINCH SYSTEM

Brake Band Slippage

Brake band out of adjustment.
Brake lining not fully contacting braking surface.
  Burnish lining or replace brake band.
Oil on lining.
Inspect diaphragm or swivel fittings.
Check brake cylinder O-rings and connectors.
Excessive heat in brake band.
  Let cool for one hour and recheck.
Brake band spring broken.
Mechanical binding in control linkage.

Brake Does Not Disengage

Low oil pressure - Check pressure.
Oil on clutch facings.
Inspect diaphragm or swivel fitting.
Excessive oil leakage out small hole in left quill.

Clutch Slips or Does Not Engage

Low oil pressure - Check pressure.
Oil on clutch facings.
Inspect diphragm or swivel fitting.
Excessive oil leakage out small hole in left quill.

Clutch Does Not Disengage

Middle or intermediate disk hanging up.
  Repair clutch pressure plate assembly.
Damage to clutch release bearing or spring.
  Repair and replace spring.
Pressure plate not retracting.

Hydraulic Failure

Low oil pressure - Check pressure.
Leakage of piston seals.
Low oil supply.
Oil leaks - Replace cracked lines.
Failure to lock in "Free Spool" Position.
  Inspect detent ball and spring. Add shims.

Excessive "Free Spool" Effort (Clutch Dragging and Cable Winding In "Free Spool" Position)

See "Clutch Does Not Disengage."
Clutch hub rubbing on brake drum to winch screws.
Left drive shaft bearing dragging.
  Replace bearing.
Foreign material between facings.
Mechanical binding in control linkage.
  Repair linkage.

Excessive "Free Spool" Effort Only

Low oil pressure - Check pressure.
Brake dragging - Readjust brake.
Excessive preload in winch drum.
Cable binding against winch housing.
  Too much cable.
Snarled cable - Straighten or replace cable.

Noisy Pump Caused by Cavitation

Oil supply low.
Contaminated oil.
Oil filter plugged.
Suction line plugged.

Oil Heating

Low oil supply.
Contaminated oil.
Oil in system too light.

Foaming Oil

Low oil level.
Air leaking into suction line.
Wrong kind of oil.

BREAKAWAY COUPLERS

Cylinder Will Not Extend

Breakaway coupler valve closed.
Turn breakaway coupler operating handles 90 degrees.

Cylinder Will Not Retract

Breakaway coupler valve closed.
Turn breakaway coupler operating handles 90 degrees.

REMOTE CYLINDER

Cylinder Will Not Extend

Cylinder overloaded.
Insufficient hydraulic pressure.
Check hydraulic pump.
Air in remote cylinder.
Bleed cylinder.
Breakaway coupler valve closed.
Turn coupler operating handles 90 degrees.
Remote cylinder piston packings failed.
Replace O-ring and backing washer.

Cylinder Will Not Retract

Air in remote cylinder.
Bleed cylinder.
Remote cylinder stop valve stuck in seated position.
Clean and repair valve.

Stop on piston rod positioned incorrectly.
Change position of stop.
Breakaway coupler valve closed.
Turn coupler operating handles 90 degrees.

Cylinder Settles Under Load

Cylinder piston packings failed.
Replace O-ring and backing washer.

Cylinder Operates Slowly

Insufficient oil pressure or flow.
Check hydraulic pump.
Air in remote cylinder.
Bleed cylinder.
Cylinder hydraulic stop valve sticking.
Clean and repair valve.

VISUAL INSPECTION

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 the suction side of the system for leaks by examining the oil in the reservoir. If air is being drawn into the system, the oil will contain air bubbles and will appear to foam.

Dented tubing can cause oil foaming, heat, faulty function operation or pump failure. Replace damaged tubing immediately.

Wash inside and outside of oil lines and fittings with clean diesel fuel or petroleum 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.

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 teatment is not administered immediately.

TRANSMISSION HYDRAULIC SYSTEM

If the reverser unit is not functioning properly, use the following test procedures to locate the difficulty before attempting to remove and disassemble the reverser control valve assembly or clutch packs.

Oil Supply

If a reverser malfunction is observed or if tests are to be performed on the unit, the reverser oil supply should be checked first. Be sure the reverser oil level is correct.

Unless the reverser control valve is supplied with an adequate supply of oil, further reverser checks will prove inaccurate.

System Pressure Tests

Start up unit and set engine speed at about 1900 rpm. Warm up reverser oil by moving reverser control lever back and forth. Observe how the reverser clutches operate - if they seem to give a jerky engagement, or if there is a delayed action. Clutch pack engagement should be rapid, yet smooth.

When oil is warmed up to operating temperature, test the three regulating valve pressures. Use a pressure gauge having a capacity of at least 160 psi and make the tests in the exact order given here.

Clutch Oil Regulator Valve Test

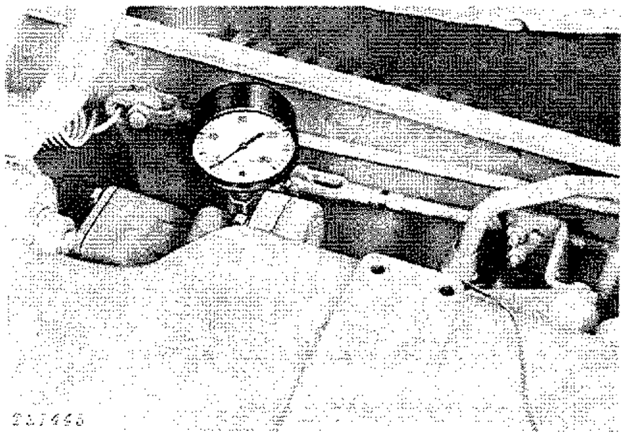


Fig. 15-Checking Clutch Oil Pressure Regulating Valve

NOTE: In all the valve adjustments explained here, there must be a minimum of one shim in the valve bore.

This test will check the engagement pressure of reverser clutches to assure smooth, rapid shifts.

To test pressure, remove pipe plug above rotary valve arm on accumulator housing and attach hose adapter from pressure gauge (Fig. 15). Run engine at 2650 rpm and work reverser control lever back and forth. Observe maximum pressure on gauge when clutch packs are engaged in both the forward and reverse positions. The readings in both cases should be 120 ± 10 psi (8.3 ± 0.7 bar) (827 ± 69 kPa) on units with serial numbers (-278391). The pressure readings should be 150 ± 10 psi (10.3 ± 0.7 bar) (1034 ± 69 kPa) on units with serial numbers (278392-   ). Adjust, if necessary, by removing clutch pressure regulating valve plug (3, Fig. 18) under control housing and adding or subtracting shims.

NOTE: For units with serial numbers (-278391), when the dowel pin is replaced with a spring (see Group 0350) the pressure reading must be 150 ± 10 psi (1034 ± 69 kPa) (10.3 ± 0.7 bar).

Cooler Inlet Regulator Valve Test

The cooler inlet valve is primarily a protective relief for the oil cooler. Test as follows:

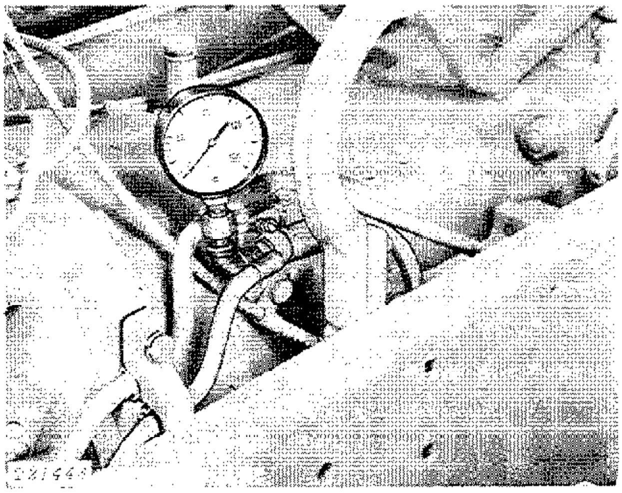


Fig. 16-Checking Cooler Inlet Regulating Valve Pressure

Disconnect cooler pressure line at connector in front of control valve housing and attach pressure gauge as shown in (Fig. 16). Run engine at 1745 rpm and observe maximum pressure reading on gauge (103 psi [7.2 kg/cm²]). Adjust, if necessary, by removing cooler inlet valve plug under control valve housing (4, Fig. 18) and adding or subtracting shims.

NOTE: Pressure for the cooler inlet circuit may also be taken at the oil cooler if this is handier.

Lube Regulating Valve Test

This test will check the pressure of oil used to disengage reverser clutches to assure smooth rapid release.

Remove pipe plug from top front of control housing and install pressure gauge (Fig. 17). Run engine at 2650 rpm and operate reverser control lever. Observe maximum reading on pressure gauge (17 to 32 psi [1.2 to 2.2 kg/cm²]). Adjust, if necessary, by removing lube regulating valve plug (1, Fig. 18) and adding or subtracting shims.

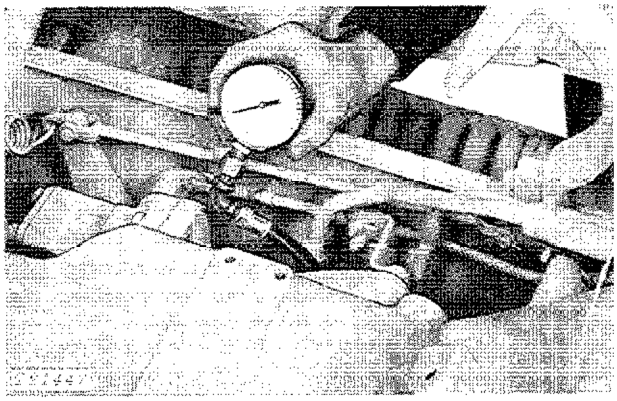
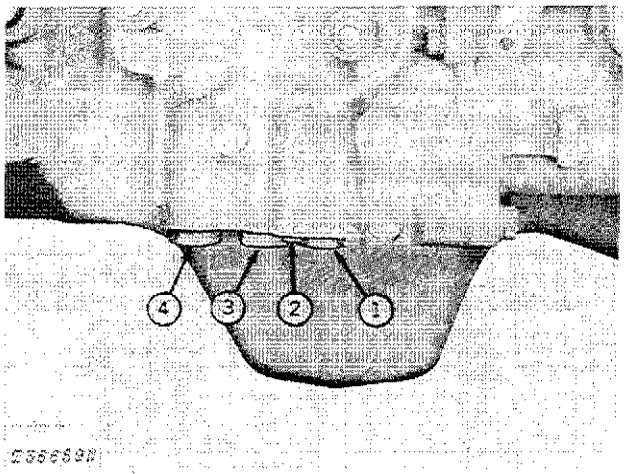


Fig. 17-Checking Lube Regulating Valve Pressure

Restricting Orifice Adjustment



1—Lube Regulating Valve Bore
2—Restrictor Bore
3—Clutch Oil Regulating Valve Bore
4—Cooler Pressure Regulating Valve Bore

Fig. 18-Location of Restricting Orifice and Relief Valve Bores

Continue working reverser control lever back and forth to check operation of reverser. If clutch pack engagement and release is not correct the restricting orifice in the control housing should be adjusted. Do this by removing small pipe plug (2, Fig. 18) under control housing and reaching up into bore with small blade screwdriver to turn adjusting screw. To speed up clutch engagement, back adjusting screw out of restrictor; to slow down clutch engagement for a smooth operation, turn screw into restrictor. Adjust until reverser operates at peak efficiency with no jerking action.

NOTE: Fig. 19 illustrates the pressure trace for units with serial numbers (-278391) that have one clutch pressure regulating valve spring. For units with serial numbers (278392-), or serial numbers (-278391) that have two clutch pressure regulating valve springs, the pressure trace is the same except system pressure is 150 ± 10 psi (1034 ± 69 kPa) (10.3 ± 0.7 bar).

Refer to Fig. 19 and check shifting time. If pressure and time fall within shaded area shifting should be satisfactory.

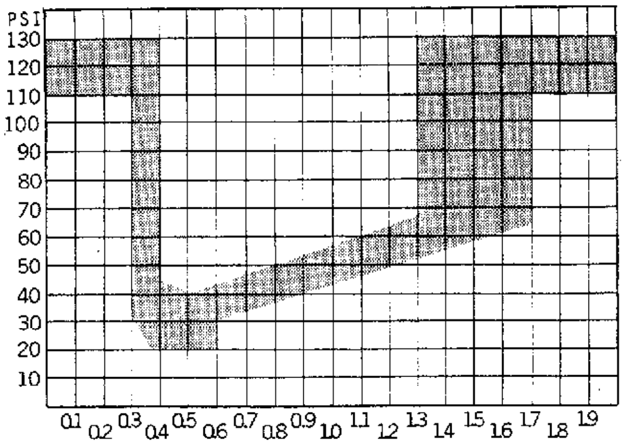


Fig. 19-Graph of Pressure Change Sequence for Direction Reverser

BULLDOZER AND LOADER HYDRAULIC SYSTEM

Checking Oil Lines and Hoses

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 the suction side of the system for leaks by examining the oil in the reservoir. If air is being drawn into the system, the oil will contain air bubbles and will appear to foam.

Dented tubing can cause oil foaming, heat, faulty function operation or pump failure. Replace damaged tubing immediately.

Wash inside and outside of oil lines and fittings with clean diesel fuel or petroleum 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.

Checking Control Valve for Leaks

After long use, the valve spools may become worn, allowing oil to leak past them. Check the valve leaks as follows:

NOTE: Use loaded bucket to perform checks on crawler loader machines.

1. Raise the function a few feet off the ground and shut off the engine. Disconnect the return line between control valve and reservoir.

2. If the function settles because of valve spool leakage, oil will seep from the disconnected return line. Connect the return line and lower the blade to the ground.

If the control valve check valves appear to be leaking, proceed as follows:

1. Start engine. Raise the function a few feet off the ground and return the control lever to the neutral positon.

2. Slowly move the control lever back to the raise position. If the function settles before it begins to rise, the check valve is probably leaking. Lower the function to the ground and, if necessary, remove control valve for service.

Checking Cylinders for Leaks

NOTE: Before checking the cylinders for leaks, inspect the control valve and relief 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. Because the cylinder piston is at the end of its stroke, the relief valve will open.

IMPORTANT: To prevent oil discharge from the disconnected hose, be sure to operate cylinder in 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 Pump Efficiency

Check oil lines, control valve and cylinders before checking the pump. To obtain correct timing, the hydraulic oil should be at normal operating temperature and the engine at fast idle.

Check cycle times with a stop watch and refer to Specifications for correct times.

If the cycle times are above the maximum times given below, the pump is probably faulty and should be serviced.

	Seconds	
Cycle Times	**Minimum**	**Maximum**
Bulldozer		
Blade Raise	3.0	5.0
Blade Lower (power down)	1.2	2.4
Blade Tilt	0.5	1.5
Blade Angle	2.5	3.8
Loaders (empty bucket)		
Boom Raise	6.0	10.0
Boom Lower (float down)	3.6	4.2
(power down)	4.0	5.0
Bucket Dump (boom at full height)	1.7	2.3
Bucket Roll-Back (from bucket level)	0.6	1.0
Backhoes		
Bucket Cylinder Retract		2.5
Bucket Cylinder Extend		4.0
Swing 180° (right or left)		
(9250)	2.5	4.5
(9300)	3.5	5.5
(9550)	2.5	4.5

Checking System Relief Valve

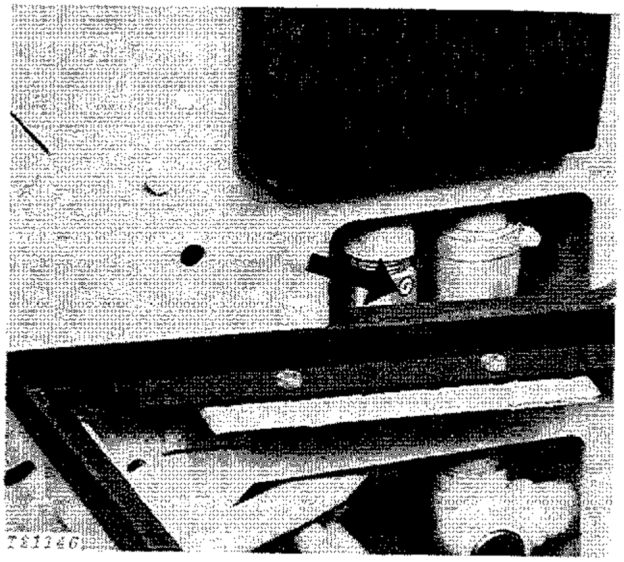


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Fig. 20-Pressure Tap Location

Install pressure gauge in pressure tap (1/8 in-27 NPT) (Fig. 20) for loaders units.

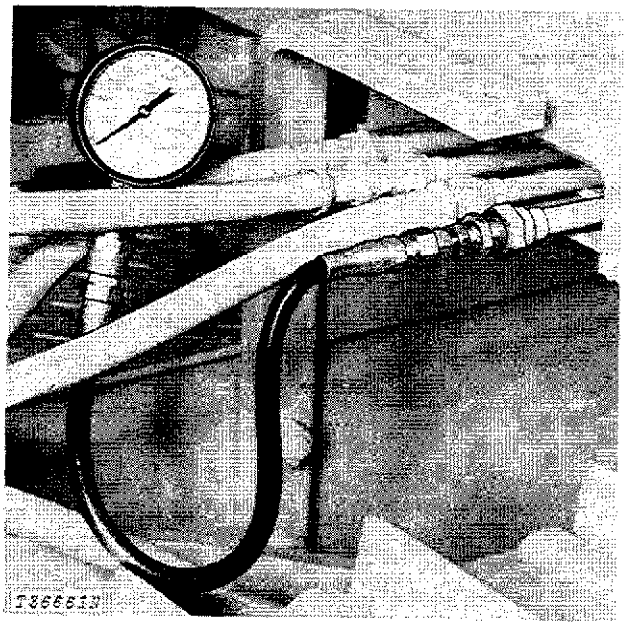

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Fig. 21-Dozer System Relief Valve Test Hook-Up

Install a pressure gauge in cylinder pressure hose (Fig. 21) for dozer units.

With hydraulic oil at normal operating temperature and engine at fast idle, lower the function to the ground.

Continue to hold the control valve open. This will cause system pressure to build and the system relief valve to open.

Observe reading on pressure gauge at this time.

System relief valve operating pressure is as follows:

NOTE: For bulldozers through Serial Number (-380196) with a new three-spool control valve, system relief valve pressure is the same as units from Serial Number (380197-).

For bulldozers with a selector valve, the system relief valve in selector valve is in the circuit when handle is in the up (backhoe) position.

Bulldozer:
6300 and 6310 Dozer .... 1750 + 100 − 0 psi
(12 070 + 690 − 0 kPa) (120.7 6.9 − 0 bar)
6305 Dozer (-380196) . 1750 + 100 − 0 psi
(12 070 + 690 − 0 kPa) (120.7 + 6.9 − 0 bar)
6305 Dozer (380197-) . 2250 + 100 − 0 psi
(15 510 + 690 − 0 kPa) 155.1 + 6.9 − 0 bar)

Backhoe (bulldozer only) .... 2000 + 100 − 0 psi
(13 790 + 690 − 0 kPa) (137.9 + 6.9 − 0 bar)
Loader .... 2250 + 100 − 0 psi
(15 510 + 690 − 0 kPa) (155.1 + 6.9 − 0 bar)

FLOW METER TESTS

Before proceeding with these tests, read the operating and instruction manual furnished with each hydraulic tester and review machine hydraulic system. A thorough understanding of tester and hydraulic system will enable you to obtain more exact and helpful data when performing the test. Also refer to diagnosing system malfunctions for an orderly process of eliminating the most likely trouble first.

There are two basic flow meter tests used to check out the loader hydraulic system:

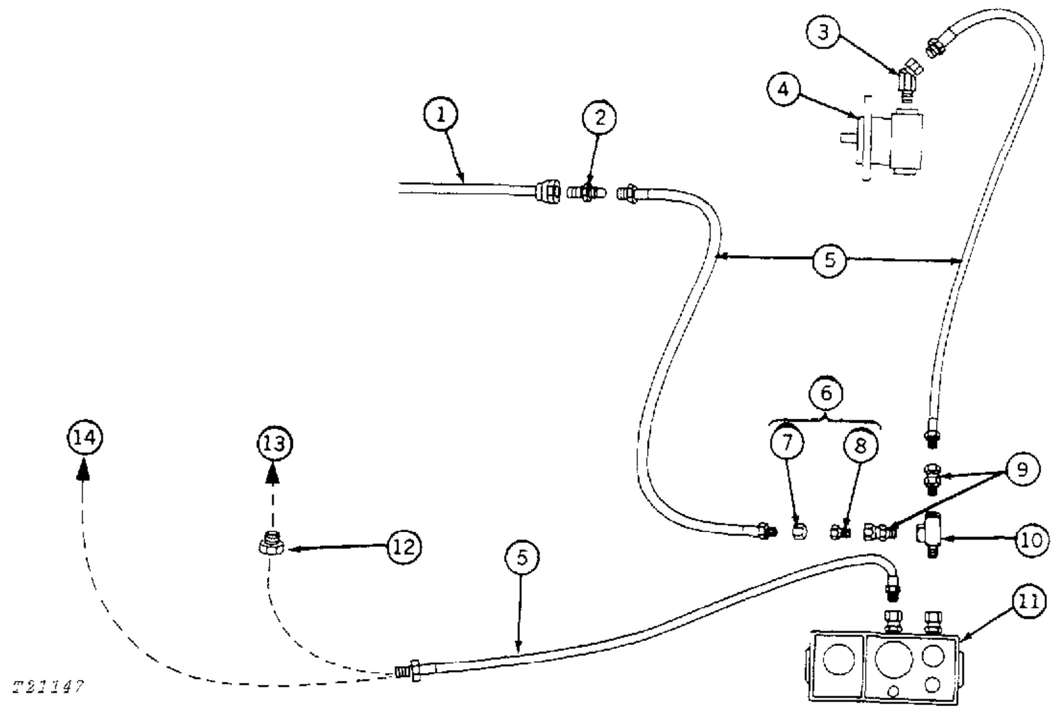
First is the "pump test" which checks the pump flow at rated pressure.

Second is the "circuit test" which checks the efficiency of the control valves, relief valves and cylinders.

A preliminary check of hydraulic system oil supply, oil lines and cylinder rods as well as for external leaks, should be made prior to hydraulic tester installation.

When making test connections according to the diagram, use either all OTC fittings ("Y" prefix) with OTC tester and hoses or all Nuday fittings ("D" prefix) with Nuday tester and fittings.

Hydraulic Pump Test



1—Pressure Line to Control Valve
2—D-88
3—D-99, Y3019
4—Pump
5—D-91, Y21-10
6—Use with Pump Test To Plug Hose and Tee
7—D-93, Y3019
8—D-94, Y3020
9—D-96, Y3018
10—D-92, Y3013
11—Hydraulic Tester
12—D-101, Y3012
13—To Loader Control Valve Return Line
14—To Dozer Control Valve or Tee into Return Line

Fig. 22-Installing Hydraulic Tester

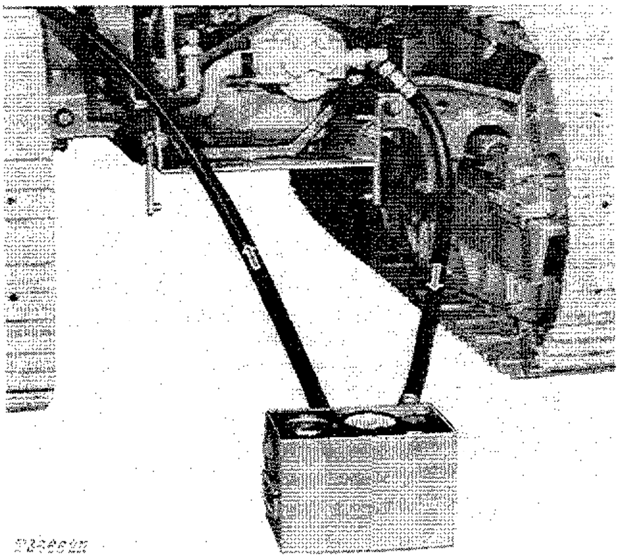


Fig. 23-Hydraulic Tester Hook-Up

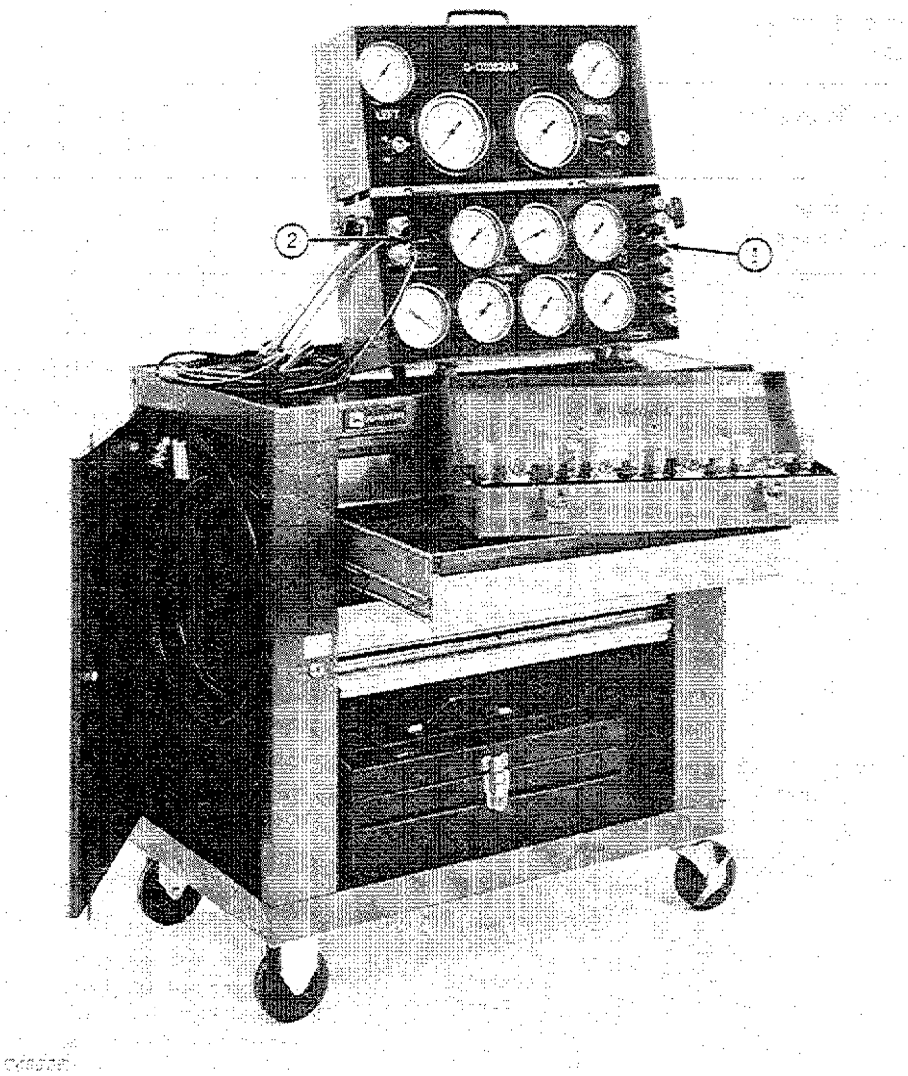
Connect hydraulic tester for pump test as shown in Figs. 22 and 23. Connect the tester inlet to the pump outlet. Connect the tester outlet into the system return line at the control valve. Cap pump pressure line to control valve to prevent oil loss during the test.

IMPORTANT: With this hookup there is no protection for the pump from high pressure. The system relief valve is located in the control valve and if the hydraulic tester pressure loader valve is closed, the pump will be damaged.

HYDRAULIC SYSTEM ANALYZER

Group 9025A
HYDRAULIC SYSTEM (ANALYZER)

GENERAL INFORMATION



1—Master Hydraulic System Analyzer

2—Tachometer/ Temperature Reader

Fig. 1-Hydraulic System Analyzer

The components of the Hydraulic Analyzer are the master hydraulic system analyzer, a tachometer/temperature reader and an accessory kit for construction equipment.

The master hydraulic system analyzer is used for the measurement of pressures in the hydraulic system. Two vacuum gauges are also available when needed. Each gauge is connected to a coupling adapter. The coupling adapters and gauges have numbers for identification.

The contents of the analyzer are:

1. One 0 to 5000 psi (0 to 345 bar) pressure gauge.
2. One 0 to 30 in. Hg. (0 to 1 016 mbar) vacuum gauge or a 0 to 150 psi (0 to 10 bar) pressure gauge.
3. One 0 to 30 in. Hg. (0 to 1 016 mbar) vacuum gauge.
4. Four 0 to 400 psi (0 to 28 bar) pressure gauges.

The tachometer/temperature reader is used for the measurement of engine rpm and the oil temperature of hydraulic system. The power for the reader is the unit's electric system. The reader is adaptable to either 12 or 24 volt system.

The accessory kit has the necessary fittings, adapters and orifices for the easy connection of analyzer to hydraulic circuits.

The design of the Hydraulic Analyzer is for the test of hydraulic systems. The tests of hydraulic system conditions are made at specific engine rpm and oil temperature. An orifice is installed into a circuit so all flow from the hydraulic pump goes through it.

To check the hydraulic system follow this general procedure:

1. Install the specific orifice.
2. Connect a pressure gauge into a test port.
3. Connect the Tachometer/Temperature Reader to the unit.
4. Start the engine and run at 1500 rpm.
5. Operate a control lever to put the cylinder to its extended or retracted position. Hold control lever in this position. This will cause the flow of oil to go through the orifice.
6. When the temperature of oil is at the specific temperature, increase or decrease engine rpm to get the specific pressure. If the engine rpm is more than the specification, the circuit has leakage or the hydraulic pump is worn.

The Hydraulic System Pretest Check Sheet (Fig. 2) is a general list of possible symptoms (problems) in a hydraulic system.

The Symptom Index is a list of symptoms (problems) from the Pretest Check Sheet and customer comments. In the next columns is the probable faulty component(s) and a verification.

Follow the procedure below to test the hydraulic system:

1. Do the Pretest Inspection and Operational Checks. Write the results on the Check Sheet.
2. Find the symptoms from the Pretest Check Sheet in the Symptom Index, page 9025A-5 and 9025A-6.
3. Do the verification test if necessary.

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.

PRETEST INSPECTION

1. Write the machine identification information on Check Sheet (Fig. 2) (Form M-5107 Stock 5-76).
2. Write the customer description of problem on Check Sheet.
3. Clean the machine as necessary for visual inspection.
4. Inspect these items: (write the results on Check Sheet)

   Hydraulic oil
   Control valve(s)
   Function return filter
   Hydraulic lines and fittings
   Cylinders

5. Correct any problems.
6. Do the Operational Checks.

OPERATIONAL CHECKS

1. Write the information for these items on the Hydraulic System Test Record (on back side of Check Sheet).

   Test specifications
   Pressure setting of circuit relief valves and system relief valves
   Cycle times

2. Start the engine and run at 1500 rpm.
3. Operate functions until hydraulic oil is warm.
4. With engine at fast idle operate each function. Write the cycle times on the Test Record. Inspect the operation of each function.
5. Make a comparison between cycle times and the specifications for cycle times.
6. Check the applicable symptoms on Check Sheet.
7. Inspect hydraulic oil for bubbles.
8. Inspect filters for restrictions and particles.
9. Go to the Symptom Index, page 9025A-5. Select the probable faulty component(s). Do the verification test if necessary.

**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 Yes	Transmission No	Return Yes	Return No	Hydraulic Yes	Hydraulic 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

Fig. 2-Hydraulic System Pretest Check Sheet

SYMPTOM INDEX

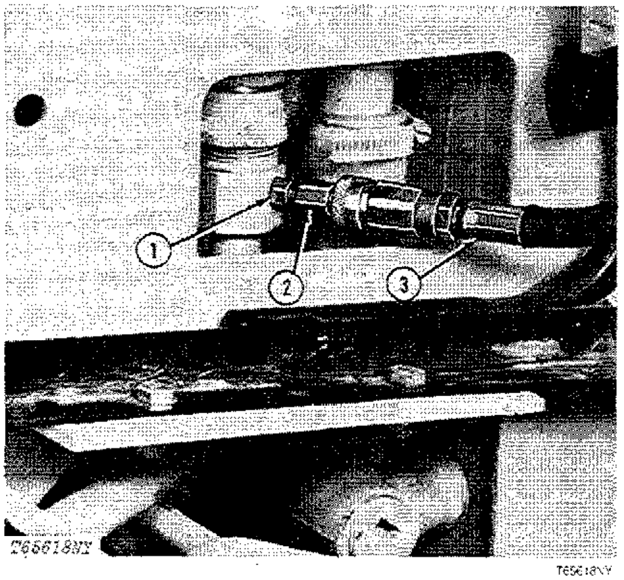
SYMPTOMS	PROBABLE FAULTY COMPONENT	VERIFICATION
No hydraulic operation	Hydraulic pump drive shaft	Inspect drive shaft. Install new parts as necessary (Group 2160).
Hydraulic circuits operate slow	System relief valve	Do the System Relief Valve Test, page 9025A-7.
	Power beyond sleeve (loader with backhoe) (bulldozer with auxiliary valve)	Check power beyond sleeve for damaged O-rings.
Possible: Metal particles in filter element Hydraulic pump making noise Control valve difficult to operate	Hydraulic pump	Do the Hydraulic Pump Test, page 9025A-8 (loader) or 9025A-12 (bulldozer with backhoe).
Drift or leakdown in circuit Possible: No power in circuit	Cylinder(s) Blade control valve Auxiliary control valve Loader control valve Backhoe control valve	Do the Cylinder Leakage Test, page 9025A-15. If the cylinder(s) are good, do the Circuit Leakage Test, page 9025A-14.
Hydraulic circuit is slow in one direction	Control valve linkage	Check for bent linkage or correct adjustment.
Circuit initially moves in opposite direction	Lift check in control valve.	Inspect lift check and spring. Install new parts as necessary (Group 3160, 3260 or 3360).
Wrong circuit operating	Selector valve	Make sure selector valve is moved to correct position. Install new parts as necessary (Group 3260 or 4260).

SYMPTOM INDEX

SYMPTOMS	PROBABLE FAULTY COMPONENT	VERIFICATION
Filter restriction indicator is in the up position. *NOTE: If the oil is very cold, the viscosity of the oil can cause the indicator to be activated. The indicator will return to its normal position as the oil is heated.*	Return filter	Inspect filter element for dirt and debris. Install new parts as necessary (Group 2160).
No power in hydraulic system	System relief valve	Do the System Relief Valve Test, page 9025A-7
Many failures of hydraulic hoses, fittings and O-rings	System relief valve	Do the System Relief Valve Test, page 9025A-7.

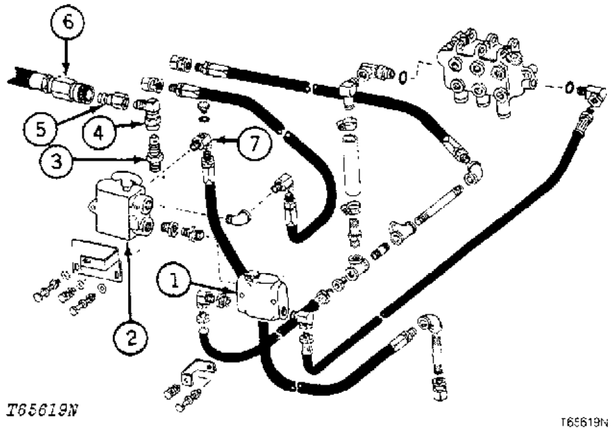
TEST AND ADJUSTMENT

System Relief Valve Test



1—202857 Straight Fitting (-285432)
202853 Straight Fitting (285433-)
2—202850 Coupling Adapter
3—36952 Hose Assembly 144 in. (3 658 mm)

Fig. 3-Loader Test Connection



1—Flow Divider
2—Selector Valve
3—202853 Straight Fitting
4—202851 Swivel Elbow 90°
5—202850 Coupling Adapter
6—36952 Hose Assembly 144 in. (3 658 mm)
7—Elbow with Test Port (276329-)

Fig. 4-Bulldozer with Backhoe Test Connection

CAUTION: Stop the engine: Operate the hydraulic control levers to release hydraulic pressure in the system. Lower all equipment (blade, loader, backhoe, etc.) to the ground.

Slowly remove plug from fitting to release the remainder of any hydraulic pressure in system.

Install fittings and hose assembly (Fig. 3, 4, or 5) into test port. Connect hose assembly to No. 1 coupling adapter (5, Fig. 11) on Hydraulic Analyzer.

NOTE: Bulldozer with backhoe to Serial No. (-276328); remove elbow and install elbow with test port (AT 56662) (7, Fig. 4).

Install Tachometer/Temperature Reader as shown in Hydraulic Pump Test, page 9025A-8.

Start the engine and run at fast idle. Heat the hydraulic oil to 140 to 150°F (60 to 66°C).

NOTE: To heat the hydraulic oil and check the setting of system relief valve activate a control lever and hold. Use a circuit with no circuit relief valve for a better test. When the cylinder(s) is at the extended or retracted position, system pressure will increase until released by the system relief valve. This is the setting of system relief valve. The flow through relief valve will cause the oil to be heated.

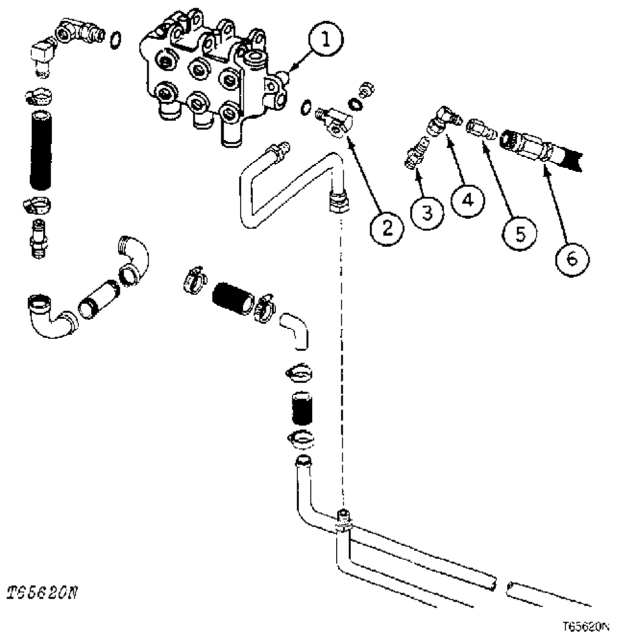
Loader - Put control lever in the boom down position and hold. Pressure setting of system relief valve is 2250 + 100 0 psi (15 510 + 690 – 0 kPa) (155.1 + 6.9 – 0 bar). Install new parts as necessary (Group 3160).

Bulldozer with backhoe - Put control handle of selector valve (2, Fig. 4) in the backhoe position (pulled up). Put one control lever in the stabilizer up position and hold. Pressure setting of system relief valve in selector valve is 2000 + 100 – 0 psi (13 790 + 690 – 0 kPa) (137.9 + 6.9 – 0 bar). Put control handle of selector valve in the dozer position (pushed down). Put the control lever in the blade up position and hold. Pressure setting of the system relief valve in dozer control valve is as follows:

6300 and 6310 Dozers .... 1750 + 100 – 0 psi
(12 070 + 690 – 0 kPa) (120.7 + 6.9 – 0 bar)
6305 Dozer (-380196) .. 1750 + 100 – 0 psi
(12 070 + 690 – 0 kPa) (120.7 + 6.9 – 0 bar)
6305 Dozer
(380197-) .... 2250 + 100 – 0 psi
(15 510 + 690 – 0 kPa) (155.1 + 6.9 – 0 bar)

Install new parts as necessary (Group 3160, 3260, or 3360).

System Relief Valve Test—Continued



1—Dozer Control Valve
2—202804 Special Fitting (-245310) Elbow with Test Port (245311-)
3—202853 Straight Fitting
4—202851 Swivel Elbow 90°
5—202850 Coupling Adapter
6—36952 Hose Assembly 144 in. (3 658 mm)

Fig. 5-Bulldozer Test Connection (no backhoe installation)

Bulldozer with no backhoe installation - Put the control lever in the blade up position and hold. Pressure setting of system relief valve is as follows:

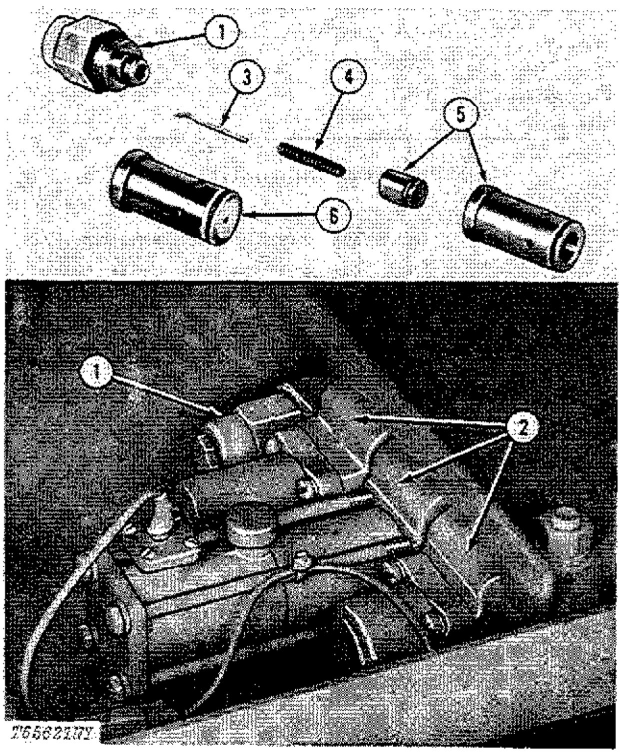
6300 and 6310 Dozers .... 1750 + 100 − 0 psi
(12 070 + 690 − 0 kPa) (120.7 + 6.9 − 0 bar)
6305 Dozer (-380196) .. 1750 + 100 − 0 psi
(12 070 + 690 − 0 kPa) (120.7 + 6.9 − 0 bar)
6305 Dozer
(380197-) .... 2250 + 100 − 0 psi
(15 510 + 690 − 0 kPa) (155.1 + 6.9 − 0 bar)

Install new parts as necessary (Group 3260).

NOTE: Bulldozer with no backhoe installation to Serial No. (-245310); remove elbow and install special fitting (2, Fig. 5).

Hydraulic Pump Test (Loader)

IMPORTANT: Do the System Relief Valve Test, page 9025A-7, before doing this test. If the system relief valve is bad it must be changed. If system relief valve is good, do the Hydraulic Pump Test.



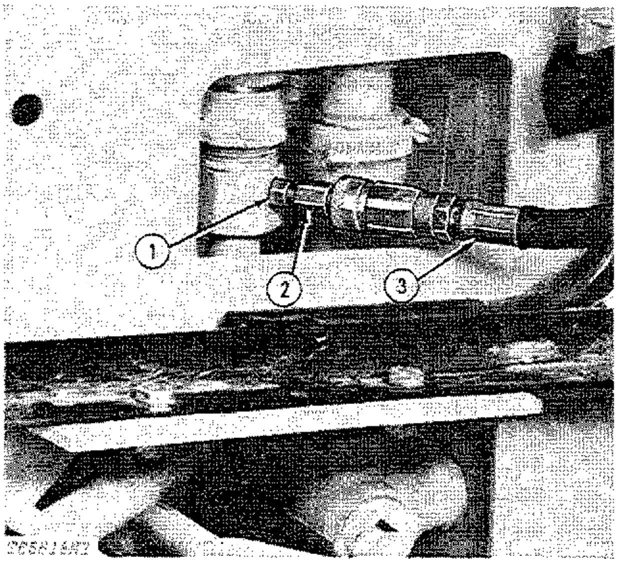
1—Upper System Relief Valve
2—Loader Control Valve
3—Relief Pin
4—Spring
5—Lower System Relief Valve
6—205032 Orifice 0.125 in. (3.18 mm)

Fig. 6-Orifice Installation for Loader

CAUTION: Stop the engine. Operate the hydraulic control levers to release hydraulic pressure in the system. Lower all equipment to the ground.

Slowly remove system relief valve (1, Fig. 6) from loader control valve (2) to release the remainder of any hydraulic pressure in system.

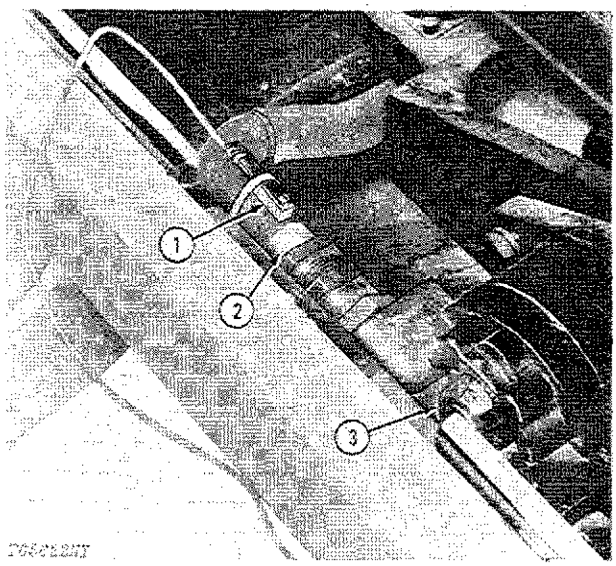
Remove lower system relief valve (5), spring (4) and relief pin (3) from upper system relief valve (1). Push 205032 orifice (6) on to upper system relief valve. Install upper system relief valve and orifice into control valve.



1—202857 Straight Fitting (-285432)
202853 Straight Fitting (285433-)
2—202850 Coupling Adapter
3—36952 Hose Assembly 144 in. (3 658 mm)

Fig. 7-Loader Test Connection

Install fittings (1 and 2, Fig. 7) and hose assembly (3) into test port. Connect hose assembly to No. 1 coupling adapter (5, Fig. 11) on Hydraulic Analyzer.

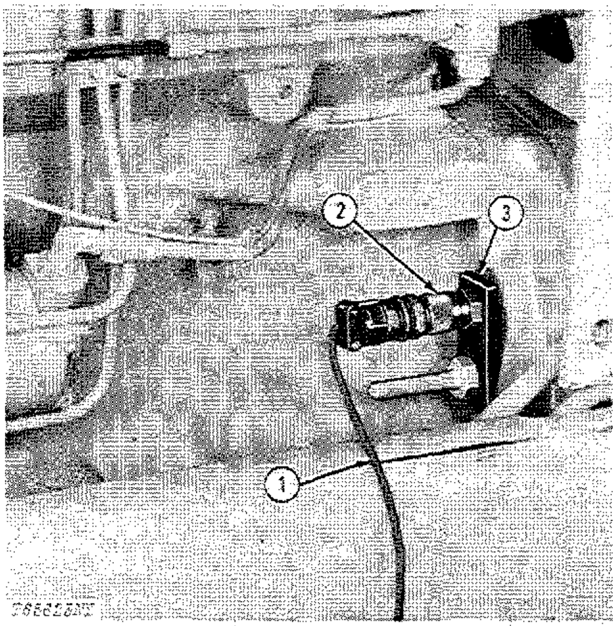


1—Temperature Sensor
2—Inlet Line
3—Hydraulic Pump

Fig. 8-Temperature Sensor Location

Fasten temperature sensor (1, Fig. 8) to inlet line (2) as near as possible to hydraulic pump (3) with a plastic strap. Connect temperature sensor cable (2, Fig. 11) to junction on Tachometer/Temperature Reader (4).

NOTE: For good contact put a layer of grease between temperature sensor and inlet line. Put a shop towel around sensor and line to decrease the effect of outside air temperature.



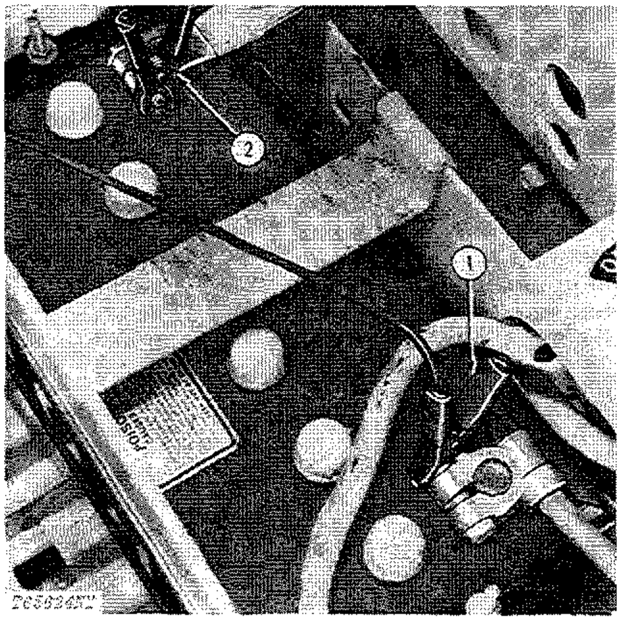
1—Power/RPM Cable
2—Magnetic Pickup
2—202703 Mounting Plate (short)

Fig. 9-Install Magnetic Pickup

Remove timing hole cover from flywheel housing. Fasten mounting plate (3, Fig. 9) to timing hole in flywheel housing. Turn magnetic pickup (2) clockwise into plate until it is stopped by teeth on flywheel. Turn pickup counterclockwise 1/4 to 1/2 turn and tighten lock nut.

Connect power/rpm cable (1) to magnetic pickup. Connect power/rpm cable (3, Fig. 11) to junction on Tachometer/Temperature Reader.

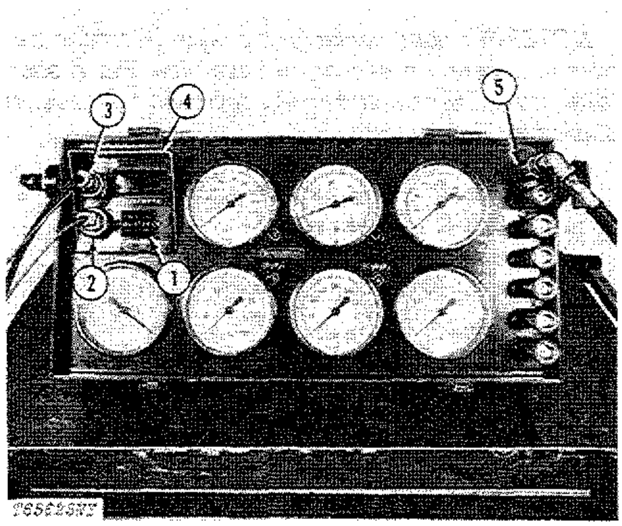
Turn thumb dials (1) to 142.



1—Red Clip (positive post)
2—Black Clip (negative post)

Fig. 10-Electrical Connection

Connect red clip (1, Fig. 10) of power/rpm cable to positive post of battery. Connect the black clip (2) to the negative post.



1—Thumb Dials (at 142)
2—Temperature Sensor Cable
3—Power/RPM Cable
4—Tachometer/Temperature Reader
5—No. 1 Coupling Adapter (pump outlet pressure)

Fig. 11-Hydraulic Analyzer

HYDRAULIC OIL PRESSURE: 140 to 150°F (60 to 66°C)
(temperature sensor on pump inlet line)

ORIFICE USED: 205032, 0.[illegible] in. (3.18 mm)
(remove lower system relief valve and install orifice)

TEST PRESSURE: 2000 psi (13 790kPa) (138 bar)
(inlet to loader control valve)

THUMB DIAL SETTING: 142

MAXIMUM ENGINE RPM: 2050

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Fig. 12-Test Specifications (loader)

Write the test specifications (Fig. 12) on the Hydraulic System Test Record. See example of Test Record (Fig. 17).

Start the engine and run at 1500 rpm. Heat the hydraulic oil to 140°F (60°C) using orifice flow.

NOTE: For orifice flow and to do the test activate a control lever and hold. Use a circuit with no circuit relief valve for a better test. When the cylinder(s) goes to the extended or retracted position all flow from pump then goes through the orifice.

When the temperature of oil is at 140°F (60°C), check the boom circuit for any extra leakage. Put the control lever in the boom down position. Run the engine just fast enough so front of unit is lifted off the ground. Let the control lever return to neutral. Run the engine at slow idle. If there is any drift of cylinders in approximately two minutes do the Cylinder Leakage Test, page 9025A-15. Also this will give the temperature of oil time to stabilize between 140 and 150°F (60 and 66°C).

IMPORTANT: For accurate test results, keep the temperature of oil between 140 and 150°F (60 and 66°C) for all tests.

Put the control lever in the boom down position and hold. Slowly increase engine rpm until system pressure is 2000 psi (13 790 kPa) (138 bar). Write the engine rpm on the Test Record.

When the temperature of oil is between 140 and 150°F (60 and 66°C) and system pressure is at 2000 psi (13 790 kPa) (138 bar) the maximum engine rpm is 2050.

If engine rpm is below 2050 hydraulic pump is good. If engine rpm is above 2050, do the test again using the other circuits. Write the engine rpm for each circuit on the Test Record. If all engine rpm are above 2050 the hydraulic pump is worn. Install new parts as necessary (Group 2160). If the engine rpm for one circuit is below 2050, the hydraulic pump is good. The circuits with engine rpm above 2050 have a leak. Do the Circuit Leakage Test, page 9025A-14 to find the leakage.

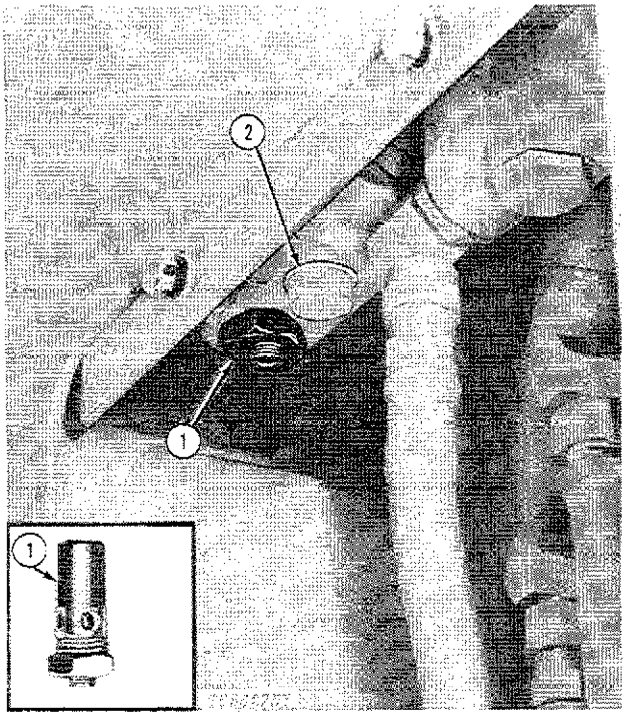
NOTE: The circuits with a circuit relief valve setting below 2000 psi (13 790 kPa) (138 bar) cannot be used to check the hydraulic pump. See the Loader and Backhoe Function Chart (Figs. 18 and 19) for circuits.

Hydraulic Pump Test (bulldozer with backhoe)

IMPORTANT: Do the System Relief Valve Test, page 9025A-7, before doing this test. If the system relief valve is bad it must be changed. If system relief valve is good, do the Hydraulic Pump Test.

The procedure to check the hydraulic pump for bulldozer with a backhoe is similar to the procedure for the loader except as shown. See page 9025A-11 for the procedure.

NOTE: No orifice is available to check the hydraulic pump for bulldozer with no backhoe installation.



1—202836 Orifice 0.125 in. (3.18 mm)
2—Selector Valve

Fig. 13-Orifice Installation for Bulldozer with Backhoe

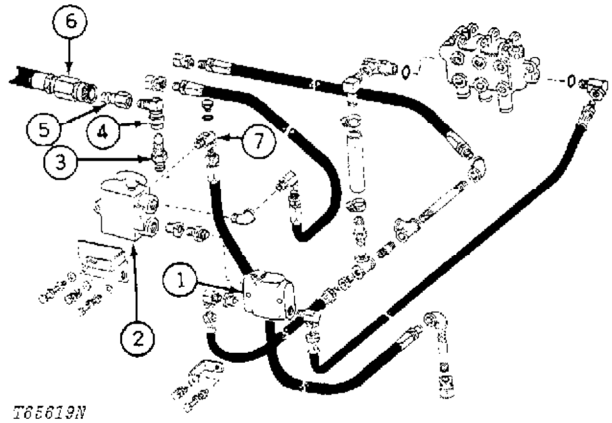
CAUTION: Stop the engine. Operate the hydraulic control levers to release hydraulic pressure in the system. Lower all equipment to the ground.

Slowly remove system relief valve from selector valve (2, Fig. 13) to release the remainder of any hydraulic pressure in system.

Install the 202836 orifice (1) into the selector valve.

Put the control handle of selector valve (2, Fig. 14) in the backhoe position (pulled up).

NOTE: Because of the design of the selector valve only the backhoe circuits can be used to test the hydraulic pump.

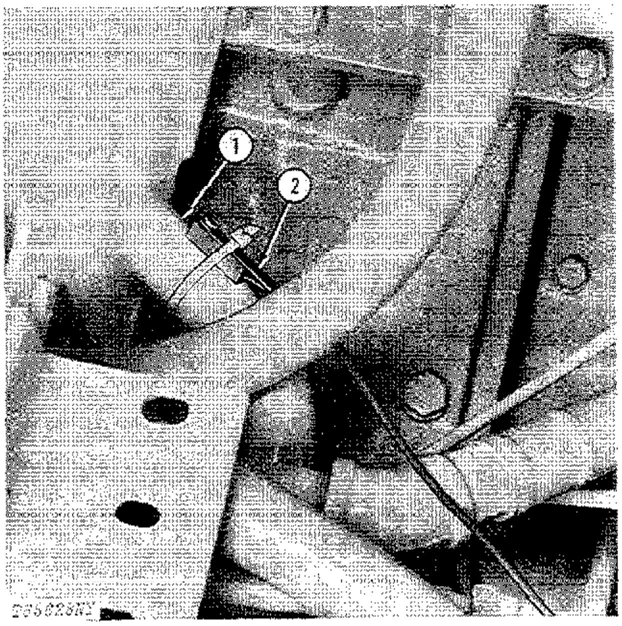


1—Flow Divider
2—Selector Valve
3—202853 Straight Fitting
4—202851 Swivel Elbow 90°
5—202850 Coupling Adapter
6—36952 Hose Assembly 144 in. (3 658 mm)
7—Elbow with Test Port (276329-)

Fig. 14-Bulldozer with Backhoe Test Connection

Install fittings (3 to 5, Fig. 14) and hose assembly (6) into test port of elbow (7). Connect hose assembly to No. 1 coupling adapter (5, Fig. 11) on Hydraulic Analyzer.

NOTE: Bulldozer with backhoe to Serial No. (-276328) remove elbow and install elbow with test port (AT 56662) (7, Fig. 14).



1—Pump Inlet Line 2—Temperature Sensor

Fig. 15-Temperature Sensor Location

Fasten temperature sensor (2, Fig. 15) to pump inlet line (1) as near as possible to hydraulic reservoir with a plastic strap. Connect temperature sensor cable (2, Fig. 11) to junction on Tachometer/Temperature Reader (4).

NOTE: For good contact put a layer of grease between temperature sensor and inlet line. Put a shop towel around sensor and line to decrease the effect of outside air temperature.

Install magnetic pick up and power/rpm cable as shown in Fig. 9 and 10.

Turn thumb dials (1, Fig. 11) to 142.

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HYDRAULIC OIL TEMPERATURE: 140 to 150°F ( 60 to 66°C)
  (temperature sensor on pump inlet line)

ORIFICE USED: 202836, 0.125 in. (3.18 mm)
  (remove system relief valve from selector
   valve and install orifice)

TEST PRESSURE:  2000 psi (13 790kPa) (138 bar)
  (inlet to selector valve)

THUMB DIAL SETTING:  142
MAXIMUM ENGINE RPM:  2050

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Fig. 16-Test Specifications (bulldozer with backhoe)

Write the test specifications (Fig. 16) on the Hydraulic System Test Record. See example of Test Record (Fig. 17).

Use one of the backhoe stabilizer circuits to heat the hydraulic oil to 140°F (60°C). Put the control lever in the stabilizer up position. Also use the stabilizer up position for the test.

Check the stabilizer circuit for any extra leakage. Put the stabilizer about 12 in. (305 mm) off the ground. If there is any drift of cylinder in approximately two minutes, do the Cylinder Leakage Test, page 9025A-15. Also this will give the temperature of oil time to stabilize between 140 to 150°F (60 to 66°C).

IMPORTANT: For accurate test results, keep the temperature of oil between 140 and 150°F (60 and 66°C) for all tests.

When the temperature of oil is between 140 and 150°F (60 and 66°C) and system pressure is at 2000 psi (13 790 kPa) (138 bar) the maximum engine rpm is 2050.

See page 9025A-11 to make a diagnosis of the results. Install new parts as necessary (Group 2160).

Circuit Leakage Test

HYDRAULIC SYSTEM TEST RECORD

HYDRAULIC TEST SPECIFICATIONS: USE (0.125 in.) ORIFICE, PART NO. 205032
WHILE PRESSURE IS AT 2000 PSI (138 BAR)
MAXIMUM ENGINE SPEED MUST BE LESS THAN 2050 RPM.
HYDRAULIC OIL TEMPERATURE MUST BE 140 to 150 °F (60 to 66 °C)

SYSTEM RELIEF VALVE SETTING: SPEC 2250 PSI (155 BAR)
ACTUAL ______ PSI (______ BAR)

1

CIRCUIT	CIRCUIT RELIEF SETTING SPEC	CYCLE TIME SPEC	CYCLE TIME ACTUAL	Rpm at 17 bar 250 PSI	Rpm at 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	Rpm at 172 bar 2500 PSI
BOOM DOWN		4 to 5		2			1630	1690	1750	1810	1870		
BOOM LIFT	3100 psi	6 to 10		3			1630	1695	1760	1960	2250		
BUCKET DUMP	1250 psi	1.7 to 2.3		4			1630	1965					
BUCKET ROLLBACK	2500 psi	0.6 to 1.0		5			1635	1700	1766	1832	1905		

T65630N

1—Check Conditions of Circuits at this Pressure
2—Boom Down, Standard Circuit
3—Boom Lift, Indication of a Bad Circuit Relief Valve
4—Bucket Dump, Normal Circuit
5—Bucket Rollback, Indication of Leakage

Fig. 17-Example of Test Record for Hydraulic System
(Form M-5107 Stock 5-76)

Use this general procedure to check for leakage in the circuits. Check each circuit in both directions. Use the Test Record to make a record of the test results. See the example of Test Record (Fig. 17).

For cycle times, circuit relief valves etc., see Fig. 18 or 19.

1. Connect the Hydraulic Analyzer. The same as for Hydraulic Pump Test, page 9025A-8 (loader) or 9025A-12 (bulldozer with a backhoe).

2. Install the orifice (same as the Hydraulic Pump Test).

NOTE: Bulldozer with no backhoe; no orifice is available to do the test for circuit leakage.

3. Heat the hydraulic oil to 140 to 150°F (60 to 66°C) using orifice flow (same as the Hydraulic Pump Test). Also operate the other functions so the oil is warm when these circuits are checked.

IMPORTANT: For accurate test results, keep the temperature of the oil between 140 and 150°F (60 and 66°C) for all tests.

4. Activate a control lever to put a cylinder(s) to the retracted or extended position. Hold the control lever in this position.

5. Run the engine just fast enough to get the pressure settings shown on the Test Record. Start at 2000 psi (138 bar) and work down to 1000 psi (69 bar). Write the rpm needed for each pressure setting on the Test Record.

NOTE: The circuits with a relief valve setting below 2000 psi (138 bar) cannot be checked for leakage at 2000 psi (138 bar). Check for leakage by starting 100 psi (6.9 bar) below setting of circuit relief valve. Check the operation of these relief valves by running the engine just fast enough to open a relief valve

6. Check all circuits as in steps 4 and 5.

NOTE: Because of the design of the selector valve (bulldozer with a backhoe) only the backhoe circuits can be checked for leakage.

7. See the chart on page 9025A-16. Make a diagnosis of the problem using the chart and Test Record.

The maximum engine rpm at 2000 psi (138 bar) is 2050 rpm.

NOTE: When the control lever is activated and the cylinder(s) is at the end of its stroke all flow from the pump goes through the orifice. If there is a leak in the activated circuit some of the flow goes through the leak. More engine rpm (flow) are then needed as compensation to get the pressure settings.

Cylinder Leakage Test

1. Put a cylinder to its extended or retracted position.

2. Disconnect the oil line from cylinder at the end where cylinder is at the end of its stroke.

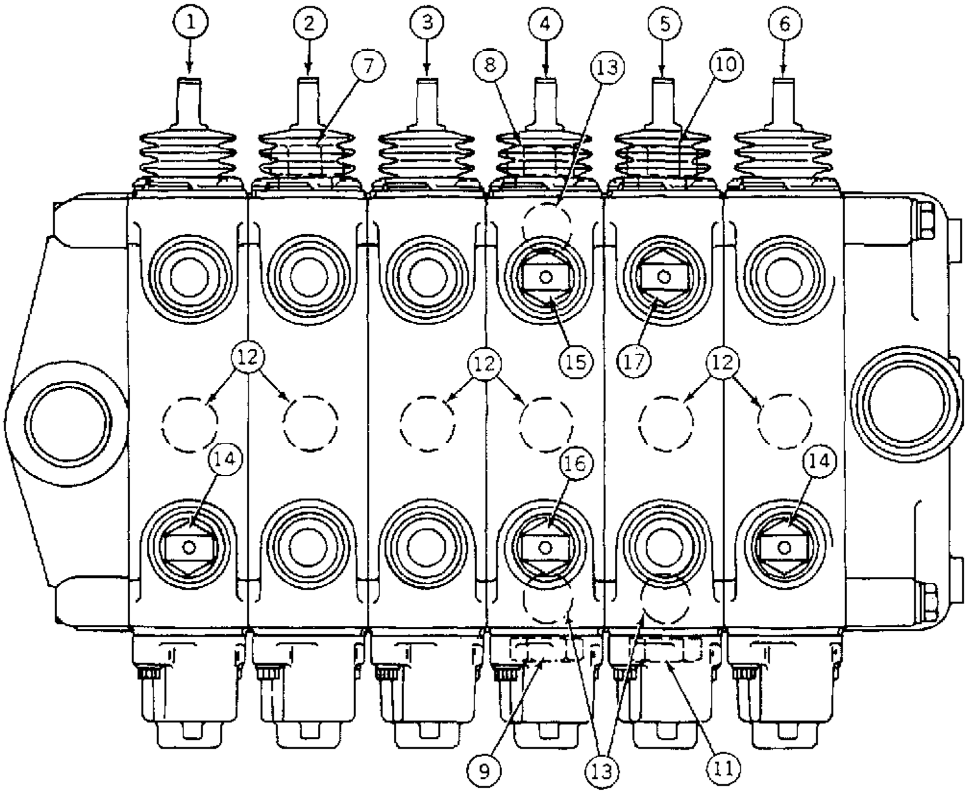
3. Put a cap on the line.

4. Start the engine and run at slow idle. While looking at the open inlet, activate the circuit in the same direction as in step 1.

5. A constant flow of oil is an indication of bad piston V-packings. Install new parts as necessary (Group 3160, 3260, 3360 and 4260).

6. No flow of oil is an indication of leakage in that section of the control valve. Inspect and install new parts as necessary (Group 3160, 3260, 3360 and 4260).

TEST RESULTS	DIAGNOSIS
(A) Engine rpm at 2000 psi (138 bar) for all circuits is more than the specification (2050 rpm).	Pump is bad. Make repairs as necessary (Group 2160).
(B) Engine rpm at 2000 psi (138 bar) for one or more circuits is the same as or less than specification (2050 rpm).	Pump is good. Circuits with engine rpm more than the specification probably have bad components. Find the circuit with the lowest engine rpm. Use this circuit as the standard circuit. Go to block (C) and/or (D) to make a comparison between the standard circuit and the other circuits.
(C) All engine rpm in a circuit are more than rpm in the standard circuit. The increase of rpm becomes more as the pressure goes up.	Circuit has leakage 1. Do the Cylinder Leakage Test. 2. If used, install a new circuit relief valve (Group 3160, 3260, or 3360). 3. Do the test again. If problem is not corrected go to step 4. 4. If used, install new anti-cavitation valve (Group 3160, 3260 or 3360). 5. Do the test again. If problem is not corrected, go to step 6. 6. Install new section of control valve (Group 3160, 3260 or 3360).
(D) There is a sudden increase of engine rpm above rpm in the standard circuit.	Circuit relief valve is bad. Install new circuit relief valve (Group 3160, 3260 or 3360). Do the test again.



CYCLE TIMES (at 2500 rpm)

Bucket dump............................2.5 sec
Bucket curl............................4.0 sec
Swing 180° right (R.H.) or left (L.H.)
9250..........................2.5 to 4.5 sec
9300..........................3.5 to 5.5 sec
9550..........................2.5 to 4.5 sec

BACKHOE CONTROL VALVE SECTIONS

1. Right (R.H.) stabilizer
2. Crowd
3. Bucket
4. Swing
5. Boom
6. Left (L.H.) stabilizer

CIRCUIT RELIEF VALVES

7. Crowd in
9250...............2500 psi (17 238 kPa) (172 bar)
9300...............2375 psi (16 376 kPa) (164 bar)
9550...............2500 psi (17 238 kPa) (172 bar)
8. Swing right (R.H.)
9250...............1750 psi (12 066 kPa) (121 bar)
9300...............2000 psi (13 790 kPa) (138 bar)
9550...............2375 psi (16 376 pKa) (164 bar)
9. Swing Left (L.H.)
9250...............2375 psi (16 376 kPa) (164 bar)
9300...............2000 psi (13 790 kPa) (138 bar)
9550...............2375 psi (15 376 kPa) (164 bar)
10. Boom lift
9250...............2750 psi (18 961 kPa) (190 bar)
9300...............3500 psi (24 133 kPa) (241 bar)
9550...............2750 psi (18 961 kPa) (190 bar)
11. Boom down
9250...............2500 psi (17 238 kPa) (172 bar)
9300...............2375 psi (15 376 kPa) (164 bar)
9550...............2500 psi (17 238 kPa) (172 bar)

LIFT CHECK

12. All Sections

ANTI-CAVITATION CHECK VALVES

13. Boom down, swing right (R.H.) and left (L.H.)

ORIFICE PLATES

14. Stabilizer down (2 used).....0.1405 (3.57 mm)
15. Swing right (R.H.)(9250 only)0.1520 (3.86 mm)
16. Swing left (L.H.)(9250 only).0.1065 (2.71 mm)
17. Boom Lift....................0.2190 (5.56 mm)

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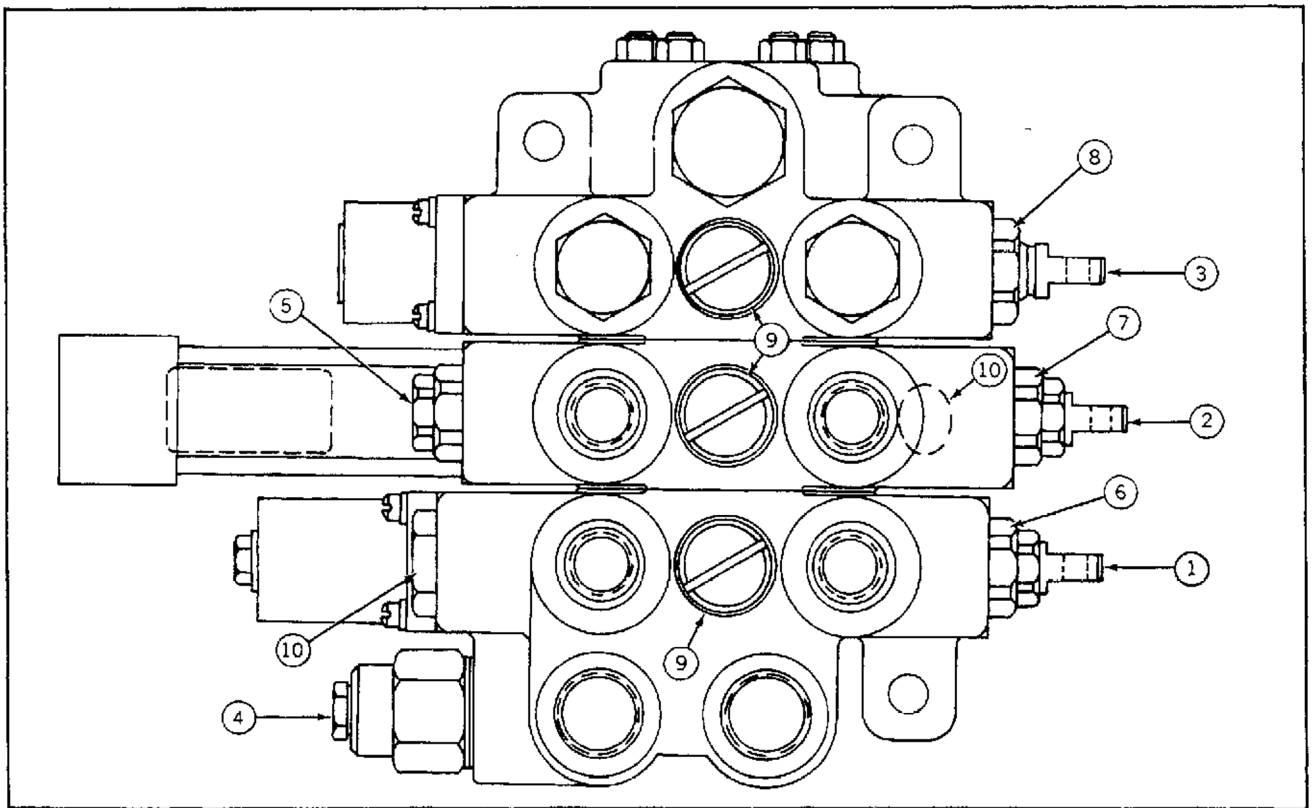
NOTE: Use cycle times only as a reference. When the performance is not according to the cycle times given, the service technician must decide if the difference is an indication of a failure of some component in the system.

Fig. 18-Backhoe Function Chart
(9250, 9300 and 9550 backhoes)



CYCLE TIMES (at 2500 rpm with bucket empty)

Boom lift........................6.0 to 10.0 sec
Boom down (float)................3.5 to 4.2 sec
(power)................4.0 to 5.0 sec
Bucket dump (boom at full height)1.7 to 2.3 sec
Bucket rollback (bucket level)...0.6 to 1.0 sec

LOADER CONTROL VALVE SECTIONS

1. Boom
2. Bucket
3. Auxiliary

SYSTEM RELIEF VALVE

4. System relief valve..................2250 psi (15 514 kPa) (155 bar)

CIRCUIT RELIEF VALVES

5. Bucket dump........1250 psi (8619 kPa)(86 bar)
6. Boom lift..........3100 psi (21 375 kPa) (214 bar)
7. Bucket rollback....2500 psi (17 238 kPa) (172 bar)
8. Auxiliary..........2500 psi (17 238 kPa) (172 bar) (use with John Deere multi-purpose bucket)

LIFT CHECKS (check poppet)

9. All sections

ANTI-CAVITATION CHECK VALVES

10. Boom down and bucket rollback

NOTE: The relief valve for the DROTT multi-purpose bucket is fastened to the bucket

T72286

NOTE: Use cycle times only as a reference. When the performance is not according to the cycle times given, the service technician must decide if the difference is an indication of a failure of some component in the system.

Fig. 14-Loader Function Chart

LIST OF PARTS FOR TESTS

System Relief Valve Test

Loader

1. 202857 Straight Fitting (-285432)
2. 202853 Straight Fitting (285433-)
3. 202850 Coupling Adapter
4. 36952 Hose Assembly 144 in. (3 658 mm)
5. 202703 Mounting Plate (short)
6. Magnetic Pickup
7. Temperature Sensor Cable and Strap
8. Power/RPM Cable
9. D-01080AA Master Hydraulic System Analyzer
10. D-01084AA Tachometer/Temperature Reader

Bulldozer with a Backhoe

1. 202853 Straight Fitting
2. 202851 Swivel Elbow 90°
3. 202850 Coupling Adapter
4. AT 56662 Elbow with Test Port (-276328)
5. 36952 Hose Assembly 144 in. (3 658 mm)
6. 202703 Mounting Plate (short)
7. Magnetic Pickup
8. Temperature Sensor Cable and Strap
9. Power/RPM Cable
10. D-01080AA Master Hydraulic System Analyzer
11. D-01084AA Tachometer/Temperature Reader

Bulldozer with no Backhoe

1. 202804 Special Fitting (-245310)
2. 202853 Straight Fitting
3. 202851 Swivel Elbow 90°
4. 202850 Coupling Adapter
5. 36952 Hose Assembly 144 in. (3 658 mm)
6. 202703 Mounting Plate (short)
7. Magnetic Pickup
8. Temperature Sensor Cable and Strap
9. Power/RPM Cable
10. D-01080AA Master Hydraulic System Analyzer
11. D-01084AA Tachometer/Temperature Reader

Hydraulic Pump Test
Circuit Leakage Test

Loader

1. 205032 Orifice 0.125 in. (3.18 mm)
2. 202857 Straight Fitting (-285432)
3. 202853 Straight Fitting (285433-)
4. 202850 Coupling Adapter
5. 36952 Hose Assembly 144 in. (3 658 mm)
6. 202703 Mounting Plate (short)
7. Magnetic Pickup
8. Temperature Sensor Cable and Strap
9. Power/RPM Cable
10. D-01080AA Master Hydraulic System Analyzer
11. D-01084AA Tachometer/Temperature Reader

Bulldozer with a Backhoe

1. 202836 Orifice 0.125 in. (3.18 mm)
2. 202853 Straight Fitting
3. 202851 Swivel Elbow 90°
4. 202850 Coupling Adapter
5. AT 56662 Elbow with Test Port (-276328)
6. 36952 Hose Assembly 144 in. (3 658 mm)
7. 202703 Mounting Plate (short)
8. Magnetic Pickup
9. Temperature Sensor Cable and Strap
10. Power/RPM Cable
11. D-01080AA Master Hydraulic System Analyzer
12. D-01084AA Tachometer/Temperature Reader

NOTE: Bulldozer with no backhoe - no orifice is available to check the hydraulic pump or circuit leakage.

Group 30
MISCELLANEOUS COMPONENTS
DIAGNOSING MALFUNCTIONS

TRACKS

Possible results of improper track adjustment are listed below.

Loose Track

If this condition exists, the following may result:

1. Extremely fast wear on pins, bushings, and track links.

2. Unnecessary and rapid wear on sides of drive sprocket teeth and idler wheel flanges.

3. Possible damage to, or breakage of, drive sprocket, idler wheel and idler wheel bracket, fenders, side frames, and rollers.

4. Track may jump sprocket in both forward and rearward operation. Track may be thrown off when tractor is turned.

5. Noisy track.

6. Frequent accumulation of trash in track.

Tight Track

If this condition exists, the following may result:

1. Extreme loss of drawbar power and ground speed. Tractor will not handle rated working load.

2. Drifting of tractor to right or left, depending on which track is the tighter.

3. Fast wear on pins, bushings, and track links.

4. Excessive and rapid wear on drive sprockets and idler wheels. Undue strain on entire track system because track flexibility is lost.

5. Unnecessary wear on final drive bearings and oil seals.

6. Abnormal steering clutch wear.

Misaligned Track

If this condition exists, the following may result:

1. Drifting of tractor from a direct course.

2. Abnormal wear on idler wheel flanges and front idler flanges.

3. Excessive track link and drive sprocket wear.

4. Rapid steering clutch and brake wear.

5. Operator annoyance and fatigue caused by the constant necessity of steering the tractor to keep it from drifting.

WINCH

Brake Band Slippage

Brake band out of adjustment.
Brake lining not fully contacting braking surface.
  Burnish lining or replace brake band.
Oil in lining.
Inspect diaphragm or swivel fittings.
  Check brake cylinder O-rings and connectors.
Excessive heat in brake band.
  Let cool for one hour and recheck.
Brake band spring broken.
Mechanical binding in control linkage.

Brake Does Not Disengage

Low oil pressure - Check pressure (See Section 90, Group 9025).
Oil leaks - Replace cracked lines.

Clutch Slips or Does Not Engage

Low oil pressure - Check pressure.
Oil on clutch facings.
Inspect diaphragm or swivel fitting.
Excessive oil leakage out small hole in left quill.

Clutch Does Not Disengage

Middle or intermediate disk hanging up.
  Repair clutch pressure plate assembly.
Damage to clutch release bearing or spring.
  Repair and replace spring.
Pressure plate not retracting.

Hydraulic Failure

Low oil pressure - Check pressure. (See Section 90, Group 9025.)
Leakage of piston seals.
Low oil supply. (See Section I, Group V.)
Oil leaks - Replace cracked lines.
Failure to lock in "Free Spool" Position.
  Inspect detent ball and spring. Add shims.

Excessive "Free Spool" Effort (Clutch Dragging and Cable Winding In "Free Spool" Position)

Clutch hub rubbing on brake drum to winch screws.
Left drive shaft bearing dragging.
  Replace bearing.
Foreign material between facings.
Mechanical binding in control linkage.
  Repair linkage.

Excessive "Free Spool" Effort Only

Low oil pressure - Check pressure. (See Section 90, Group 9025.)
Brake dragging - Readjust brake.
Excessive preload in winch drum.
Cable binding against winch housing.
  Too much cable.
Snarled cable - Straighten or replace cable.

Noisy Pump Caused by Cavitation

Oil supply low. (See Section I, Group V.)
Contaminated oil.
Oil filter plugged.
Suction line plugged.

Oil Heating

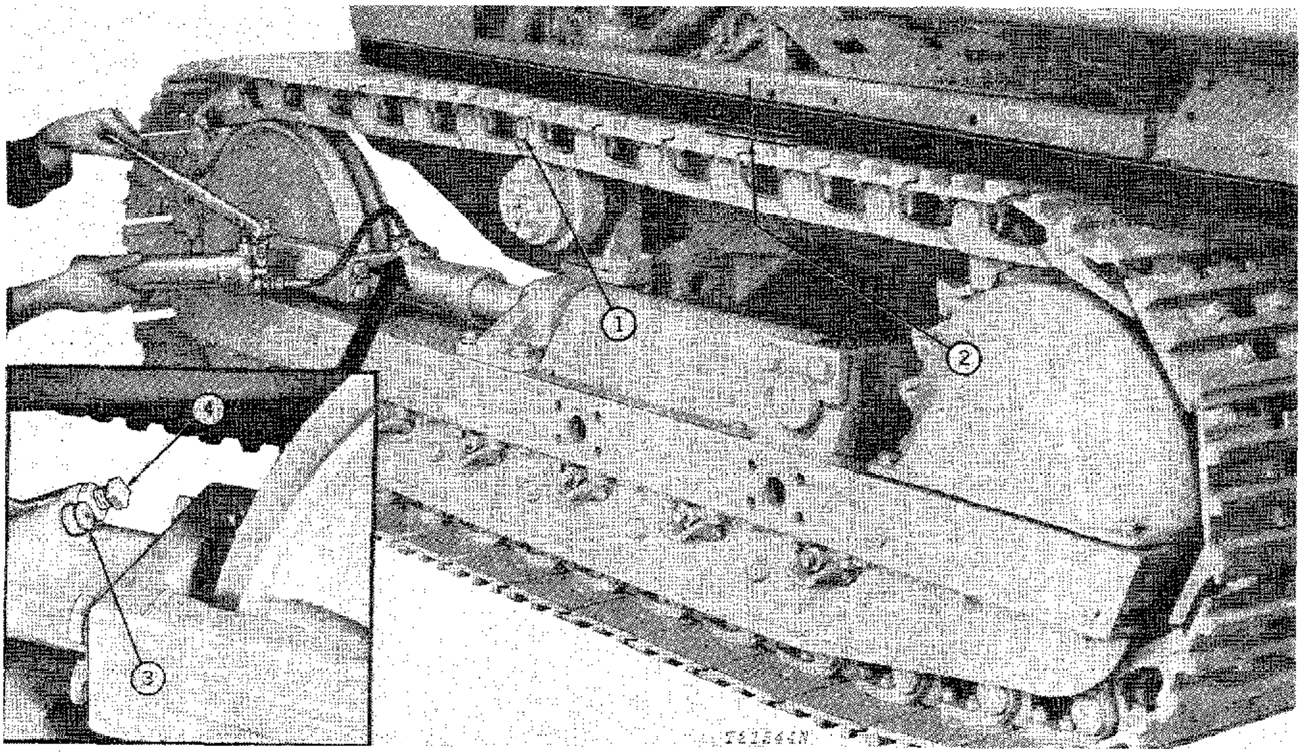
Low oil supply. (See Section I, Group V)
Contaminated oil.
Oil in system too light. (See Section I, Group V)

Foaming Oil

Low oil level.
Air leaking into suction line.
Wrong kind of oil. (See Section I, Group V)

ADJUSTMENT

Track Tension



1—Pin (Centered Over Carrier Roller)
2—Track Sag
3—Increase Tension
4—Decrease Tension

Fig. 1-Track Tension Adjustment

For proper track and crawler operation, it is necessary that track tension and track alignment adjustments be properly made.

When measuring track sag, a pin and bushing must be lined up over center of track carrier roller. Adjust track sag so there is 7/8 to 1-1/8 (22.23 to 28.58 mm) sag in center of track between rear sprocket and carrier roller (Fig. 1).

Track tension is adjusted by attaching flexible hose with special adapter furnished with crawler on a grease gun that has a maximum capacity of 8000 psi (562.46 kg/cm²).

To tighten track, apply grease with gun until the proper tension is achieved (Fig. 1).

IMPORTANT: Never, under any circumstances, use a grease gun to adjust track having a capacity higher than 8000 psi (562.46 kg/cm²). Tee a pressure gauge (0 to 10,000 psi [0 to 703.07 kg/cm²] capacity) in grease gun tube to check pressure. If piston cannot be moved with this type grease gun, disassemble track adjuster and free seized parts.

To loosen track, first loosen jam nut on set screw of track adjusting cylinder. Then turn set screw counterclockwise a slight amount to relieve track tension. As pressure is relieved, grease will run out of hole in bottom of cylinder. Turn set screw in to original position and tighten jam nut.

IMPORTANT: Warn operator never to lubricate fitting on hydraulic track adjusting cylinder except when track is in need of adjustment.

When operating track in conditions where extreme soil packing occurs in track system, check track tension often as tension may increase when soil is picked up. Also check coils of recoil springs. Mud packing in the recoil spring can cause restriction of the idler travel and recoil action. This restriction can result in overstressing the track link assemblies, recoil mechanism, and final drive components.

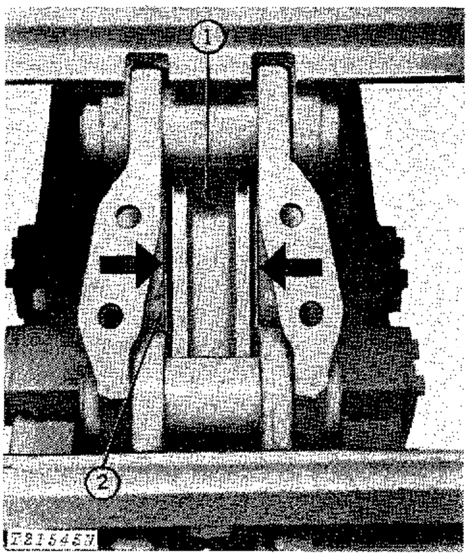
IMPORTANT: When forward edge of track front bracket is approximately 1-inch (25.4 mm) from the end of the track frame, track bushings and pins should be inspected for excessive wear. Replace excessively worn bushings and pins as needed. When the forward edge of the front idler and forward end of the track frame are in line, track assemblies are in need of reconditioning.

After adjusting for proper tension, check alignment and adjust if necessary.

Track Alignment

The importance of proper track alignment cannot be too greatly emphasized. If the sides of the drive sprockets and front idler flanges show heavy wear, the track is probably out of alignment.

Check track alignment by driving forward on level ground for about 25 feet (7.62 m). Stop tractor without touching steering levers and examine location of track link in relation to the front idler flanges (Fig. 2). (In the illustration one shoe has been removed for better visibility.)



1—Track Idler 2—Track Link

Fig. 2-Checking Track Alignment

If clearance between idler flange and track link is not equal on both sides of the idler, tracks are not properly aligned.

Shims are provided on each side at the rear of track idler bracket to properly adjust position of track on front idler. Remove one shim at a time from the rear of idler bracket (Fig. 3) on the side of idler flange and track link having the most clearance. Remove one shim, then test by running the tractor in straight line. Proceed to remove shims until idler is centered between track links.

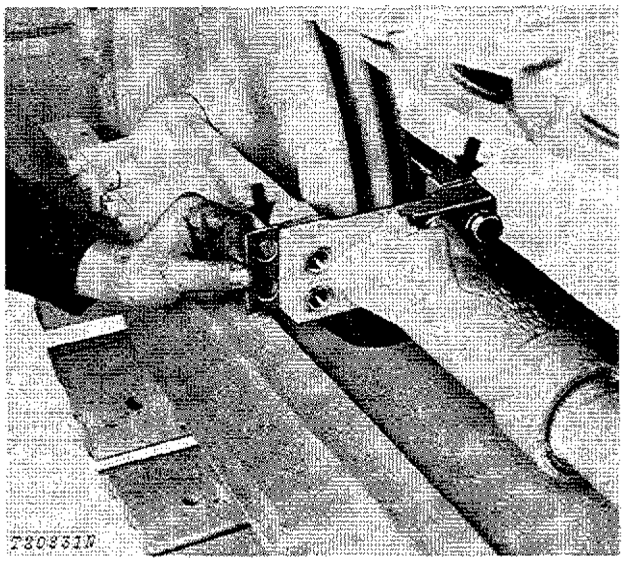


Fig. 3-Aligning Front Idler Using Adjusting Shims

Swinging Drawbar

The swinging drawbar has two main adjustments, lengthwise and horizontal, which, together with adjustments provided on the drawn equipment, enable the operator to obtain the correct line of draft. Correct line of draft is necessary for the greatest amount of drawbar pull, easiest steering, and least amount of track slippage.

Lengthwise Adjustment

Remove the three cap screws in drawbar straps and slide bottom extension in or out to desired position. The short position is recommended for general work.

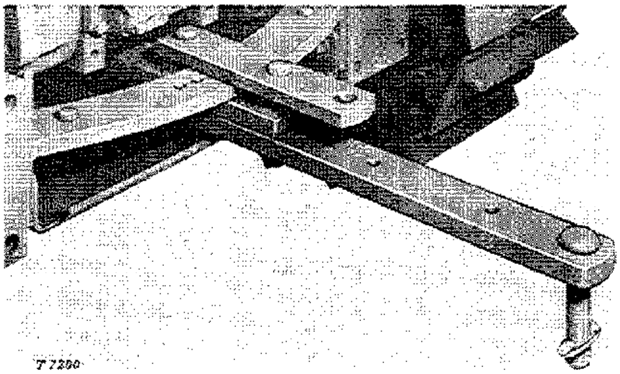


Fig. 4-Drawbar in Extended Position

Horizontal Adjustment

The drawbar crossbar has two sets of holes used for locking the drawbar in the straight ahead position or to the left for powershaft work. Bolts or pins dropped in the holes on both sides of the swinging drawbar will hold it in place.

3-Point Hitch

Left Lift Link

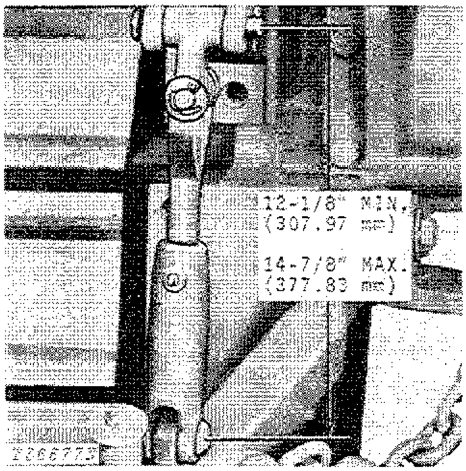


Fig. 5-Lift Link Adjustment

IMPORTANT: Do not disregard these instructions. To do so may cause damage to the system.

Adjust the left lift link to a nominal length of 13-1/2 inches (342.9 mm), measured between the pins which secure the lift link to the lift arm and to the load link. Never adjust the lift link to less than a minimum of 12-1/8 inches (307.97 mm) or beyond a maximum of 14-7/8 inches (377.83 mm).

Refer to your equipment operator's manual for specific left lift link adjustment.

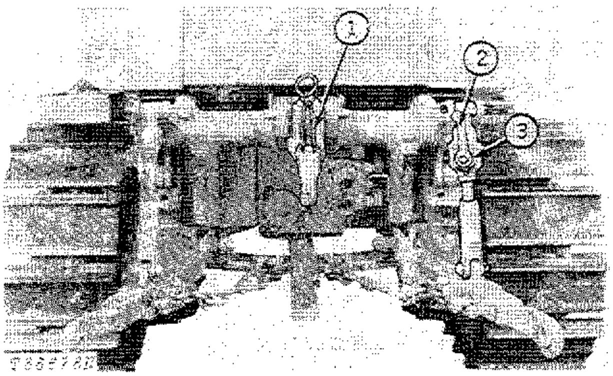
Draft Links

To provide additional transport clearance, the draft links can be extended 7 inches (177.8 mm). To extend link, remove pins and pull out link to extended position.

IMPORTANT: Never operate hitch in field with draft links extended. Draft links should be extended ONLY during hook-up of a tool, or, when necessary, during transport.

When draft links are extended for transport, length of center link must also be increased.

Leveling Adjustments



1—Center Link Adjusting Handle **3—Lock**
2—Leveling Crank

Fig. 6-Leveling Adjustment

Fore-and-aft leveling of the equipment is accomplished by means of a turnbuckle on the center link. The turnbuckle has a handle which when not in use is carried in a position parallel to the turnbuckle. When adjusting length of center link, the handle is turned until it is at right angles to the turnbuckle. The center link has a locking device to hold it in the correct position after the adjustment has been made.

For lateral leveling of the equipment, the right lift link has a leveling screw and crank. The crank is held in position by a lock on the crank housing.

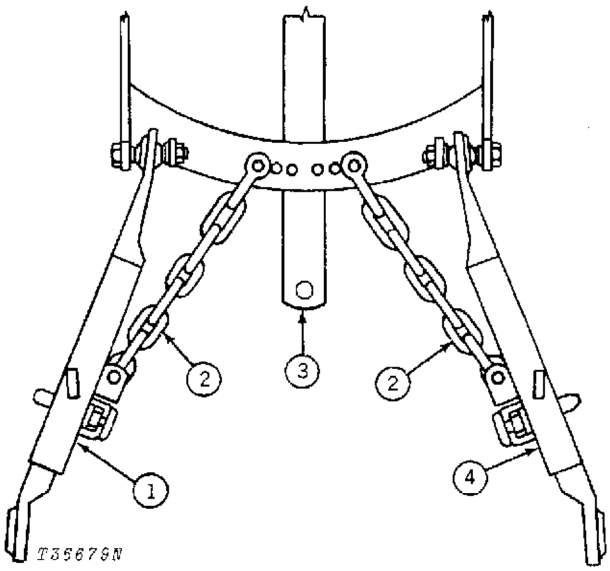
Sway Chains

Sway chains are included with the 3-point hitch to provide necessary stability when hitch is in raised position.

Keep the sway chains adjusted so that the chains are approximately tight when the hitch draft links are at full raise. Adjust the sway chains as follows:

(1) For normal adjustments, move the U-bolts to a new set of holes on the ends of the supports.

(2) For slight adjustments, loosen or tighten the eyebolts.



1—Left Hand Draft Link **3—Drawbar**
2—Sway Chains **4—Right Hand Draft Link**

Fig. 7-3-Point Hitch

When using category 2 equipment with draft links in normal position, sway chains should be attached to outside holes on either side of drawbar. When using category 2 equipment with draft links in extended position, sway chains should be moved to middle holes on either side of drawbar.

NOTE: Drawbar must be removed when sway chains are attached to the first two holes on either side of drawbar.

When using category 1 equipment with draft links in normal position, sway chains should be attached to middle holes on either side of drawbar. When using category 1 equipment with draft links in extended position, sway chains should be moved to the first holes on either side of drawbar.

Seat Adjustment

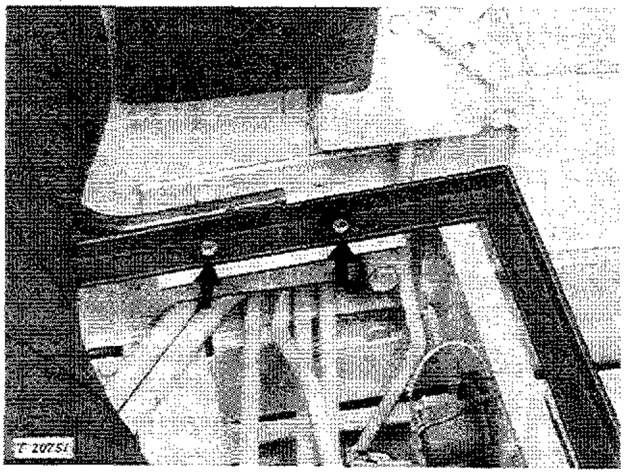


Fig. 8-Seat Support

To move the seat forward or rearward, remove the seat cushion and four nuts and cap screws attaching the seat support to the seat support rail. Then place the seat in the desired position and reinstall nuts and cap screws.

Adjusting Winch Brake Band

Always adjust the winch control lever before adjusting the winch brake (see Section 90, Group 9025).

If the winch brake band or linkage has been removed or replaced, they must be readjusted to prevent slippage.

Remove the left quill from winch housing. Loosen the jam nut (see inset, Fig. 9) and back off brake adjusting nut until brake band is loose. Tighten brake adjusting nut until there is 4-11/16 inches (119.06 mm) distance between bottom edge of spring anchor pin and bottom edge of spring anchor. Tighten jam nut and install cover.

Recheck operation of winch. If brake still slips, inspect brake band facings for damage from excessive heat, grease, or oil.

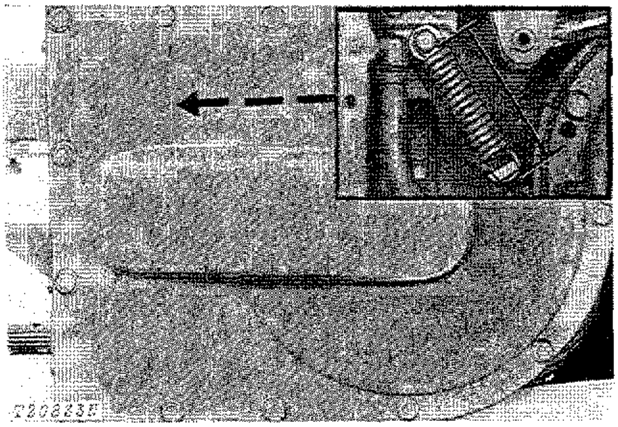


Fig. 9-Winch Brake Band Adjustment

Loader Boom Alignment

The loader boom is attached to the loader frame with eccentric pins, making several boom adjustments available.

To adjust the boom, proceed as follows:

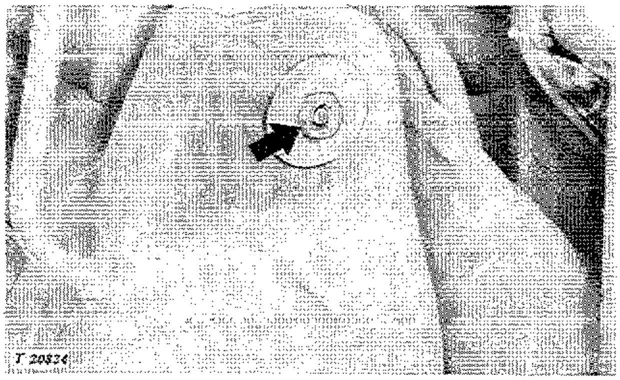


Fig. 10-Eccentric Pin Retaining Cap Screw

Raise the loader boom five feet and secure with a hoist.

Remove the cap screws and retaining washers.

Drive the eccentric pins out 1/2 inch (12.7 mm) to clear retaining blocks.

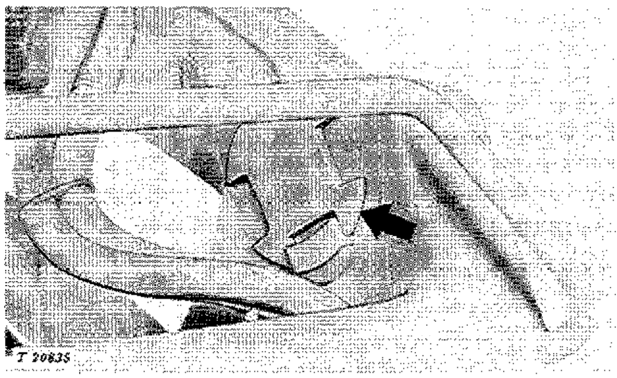


Fig. 11-Eccentric Pin

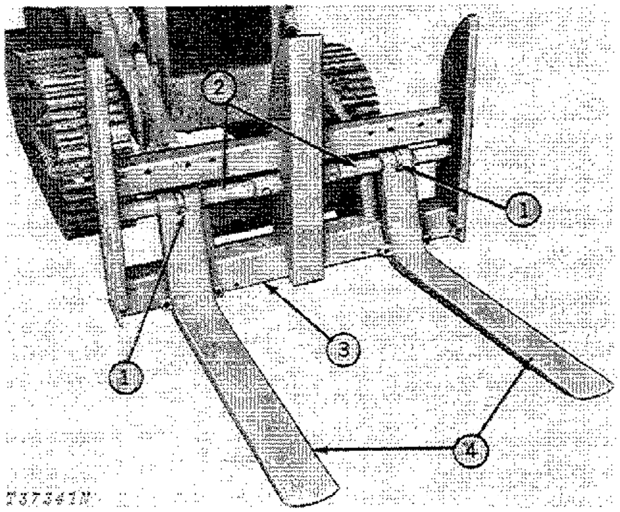
Turn the eccentric pins until the proper adjustment is made. Drive the pins in place and secure with retaining washers and socket head cap screws. (Use new socket head screws if damaged.)

One-fourth inch (6.35 mm) side adjustment can be obtained by positioning the low side of eccentric of one pin in forward or rearward position and the low side of eccentric of the opposite pin in the down position.

The boom is in neutral position when both pivot pins have the low side of eccentric in the down position.

With the offset facing to the rear, maximum boom height can be reached.

Log and Lumber Fork Adjustment



1—Pivot Clamp **3—Main Frame**
2—Pivots **4—Forks**

Fig. 12-Fork in Intermediate Position

Mounting holes are provided in the main frame to attach the fork in either the wide or narrow position.

CAUTION: For stability and safe operation, always space both forks the same distance from the center mast on the main frame.

Loosen pivot clamp cap screws and remove fork-to-main frame attaching screws.

Move forks along fork pivots until desired position is reached. Replace the attaching hardware which was removed. Tighten cap screws.

If spacing other than the two provided in the main frame is desired, forks can be held in position with pivot clamps only.

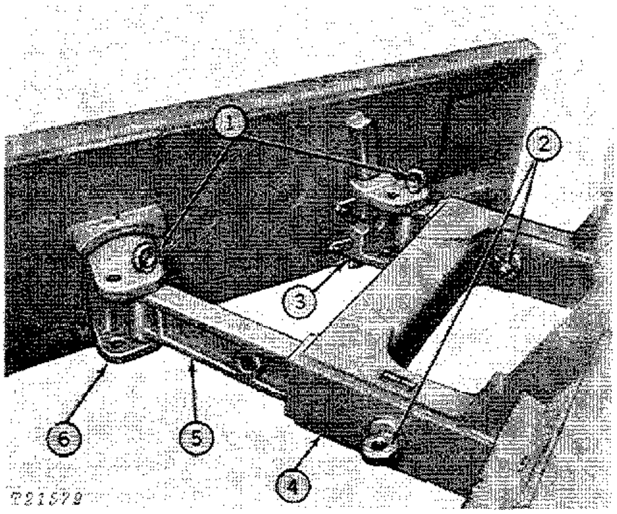
When either the mast or the mast and grapple is used, spacing is limited to the wide position.

Angling Bulldozer Blades

The bulldozer blades can be angled 25 degrees to the right or the left.

6300 Bulldozer

Pull the boom angling pin on the side to be extended. Remove blade pivot pin from the opposite side of the boom.



1—Pivot Pins
2—Boom Extension Pins
3—Clamp Lock
4—Boom
5—Boom Extension
6—Blade Pivot

Fig. 13-6300 Blade Angled 25° to the Right

Push the blade forward on the side to be extended until desired angle is obtained. Replace boom angling pin.

Replace the removed blade pivot pin in the inside hole (Fig. 13).

6310 Bulldozers

Raise the blade off the ground before attempting to change the angle.

Remove both angling pins. Set blade at desired angle and replace pins.

Tilting and Leveling Bulldozer Blades

6300 and 6310 Bulldozers

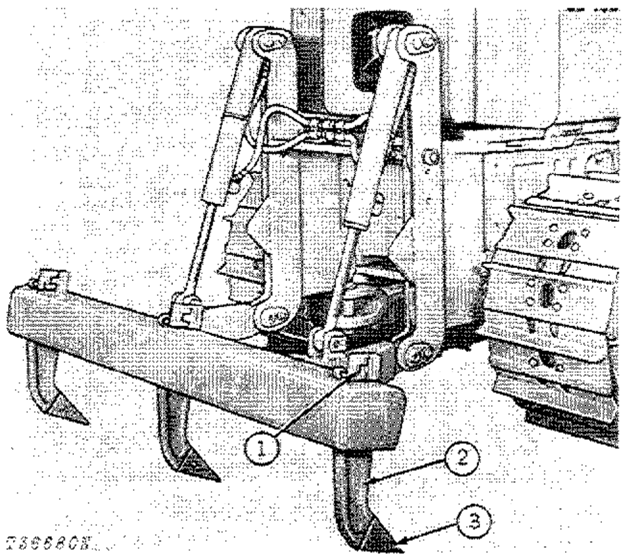
Drive wedges loose and adjust the tilt of the blade.

The blade is level when the top of the clamp lock is even with the dot on the track.

6305 Bulldozer

To level blade align the two triangular markers on the left rear side of the blade.

Ripper Tooth Adjustment



1—Shank Lock
2—Shank
3—Tooth

Fig. 14-Ripper Tooth Adjustment

Teeth can be set in three depth positions (7, 8-1/2, and 10 inches [177.8, 215.9 and 254 mm]) depending upon the penetration desired.

Each tooth can be adjusted by pulling the shank lock from the main frame and raising or lowering the shank to one of the other notches. Three notches are provided to make adjustments possible.

Secure the tooth in the desired position by inserting the shank lock behind the tooth.

Group 9035
SPECIFICATIONS AND SPECIAL TOOLS
ENGINE
SPECIFICATIONS AND TORQUE VALUES

Basic Engine

Minimum compression readings:
Diesel .... 350 psi (2410 kPa) (24 bar)
Gasoline .... 120 psi (827 kPa) (8.3 bar)

Engine Lubrication System

The most important factor in compression readings is the difference between cylinders. This difference should be no more than 25 psi (172 kPa) (1.7 bar) gasoline or 50 psi (345 kPa) (3.5 bar) diesel.

Oil pressure at 2500 rpm with engine at normal operating temperature .... 50 ± 15 psi (345 ± 103 kPa) (3.5 ± 1 bar)

Engine Cooling System

Fan Belt Adjustment .... 0.75-inch (19.0 mm) deflection at 20 lbs. force (89 N)

Fuel System

Fuel supply pump vacuum at
low idle ....15 to 20 inches of water (3.7 to 5.0 kPa) (37.4 to 49.8 mbar)
Pressure......................... 2 to 2.5 psi (13.8 to 17.2 kPa) (0.14 to 0.17 bar)

Injection pump cam advance
JDB331-AL2405 or JDB331MD2797
Total advance movement .... 8° ± 1/2°
Advance at 1200 rpm (no load)............. 4°

Speed Control Linkage

	Gasoline	Diesel
Fast idle	2770 rpm	2650 rpm
Slow idle	600 rpm	800 rpm

Gasoline Adjustments
- Throttle rod . . . . . . 1 turn long
- Drag at end of throttle lever . . . . . . 11 to 17 lbs. (49 to 76 N)

Diesel Adjustments
- Drag at end of throttle lever . . . . . . 8 ± 3 lbs. (36 ± 4 N)
- Override on pump lever . . . . . . 0.125 inch (3.18 mm)

Air Intake System

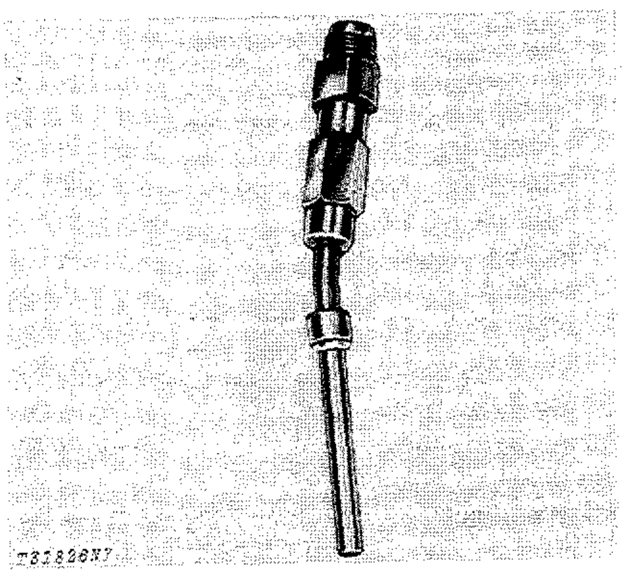
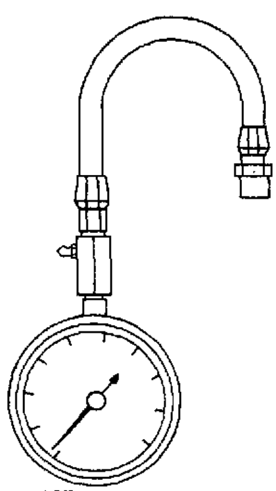
Air restriction indicator shows red when water vacuum gauge reads . . . . . . 18.1 to 21.9 in. H_2O (4.5 to 5.4 kPa) (45.1 to 54.5 mbar) (gasoline) or 22.7 to 27.3 in. H_2O (5.6 to 6.8 kPa) (56.5 to 68.0 mbar) (diesel)

Intake manifold (gasoline) vacuum at high idle (2650 rpm) . . . . . . 15 to 20 in. Hg (51 to 68 kPa) (0.51 to 0.68 bar)

ENGINE
SPECIAL TOOLS

Essential Tools

Basic Engine

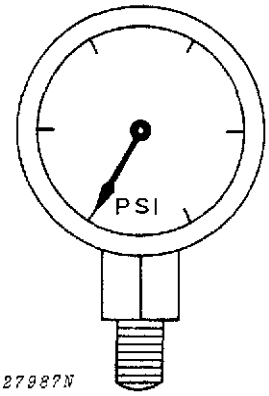
Tool	Tool Number	Use
 T31826N7 Fig. 1-Compression Gauge Adapter	D14550-BA	Compression Gauge Adapter - To check diesel engine compression
 T27985N Fig. 2-Compression Gauge	D14547-BA	Compression Gauge - To check diesel engine compression
	(Not Illustrated)	Gasoline Engine Compression Tester - To check gasoline engine compression

ENGINE

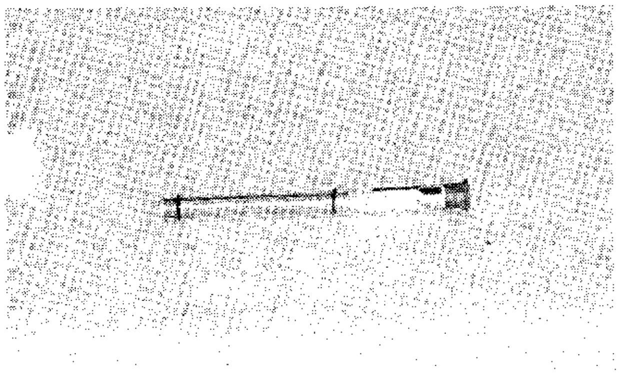
SPECIAL TOOLS—Continued

Essential Tools—Cont.

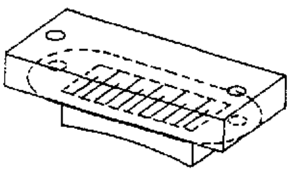
Engine Lubrication System

Tool	Tool Number	Use
 T27987N Fig. 3-Pressure Gauge	------	Pressure Gauge - To check oil pressures.

Engine Cooling System

Tool	Tool Number	Use
	(Not Illustrated)	Radiator Pressure Tester - To check radiator for leaks.
 T77082 Fig. 3A-Belt Tension Gauge	JDST-28	Belt Tesnion Gauge - To check tension of V-belts.

Fuel System

Tool	Tool Number	Use
 T31920N Fig. 4-Injection Pump Timing Window	JD-259 (13366)	Timing Window - To adjust injection pump cam advance.

ENGINE

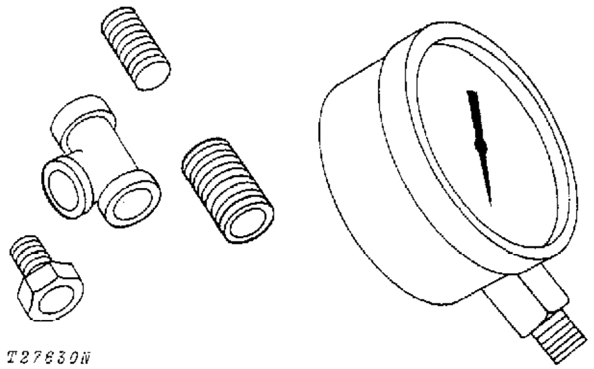
SPECIAL TOOLS—Continued

Convenience Tools

Engine Cooling System

Tool	Tool Number	Use
	(Not Illustrat' d)	Fan Belt Tension Gauge - To check fan belt tension.

Fuel System

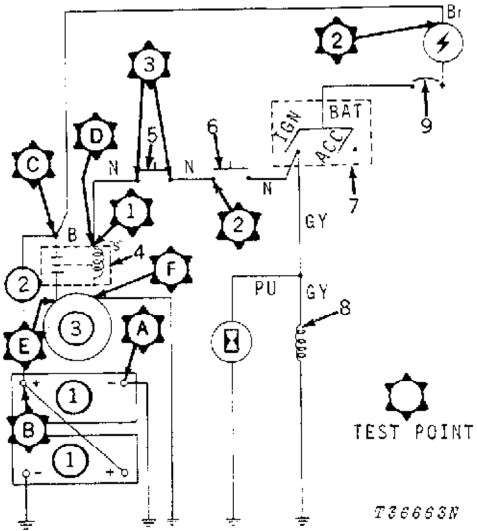
Tool	Tool Number	Use
	D05022ST	Water Vacuum Gauge - To check fuel and air vacuum.

T27630N

Fig. 5-Water Vacuum Gauge

ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES



1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Neutral Start Switch
6—Start Switch
7—Key Switch
8—Injection Pump Solenoid
9—Circuit Breaker

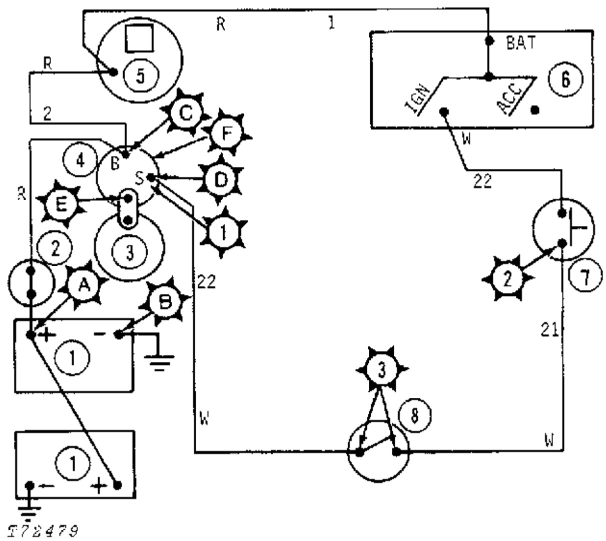
Fig. 6-Starting Circuit Test Points (-343540)

Starting Circuit Test Values

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

High Resistance Test Values

Test Point	Maximum Voltage Reading
A-F	0.2
B-C	0.2
C-D	1.0
C-E	0.2



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Alternator
6—Key Switch
7—Start Switch
8—Neutral Start Switch

Fig. 7-Starting Circuit Test Points (343541-)

Starting Circuit Test Values

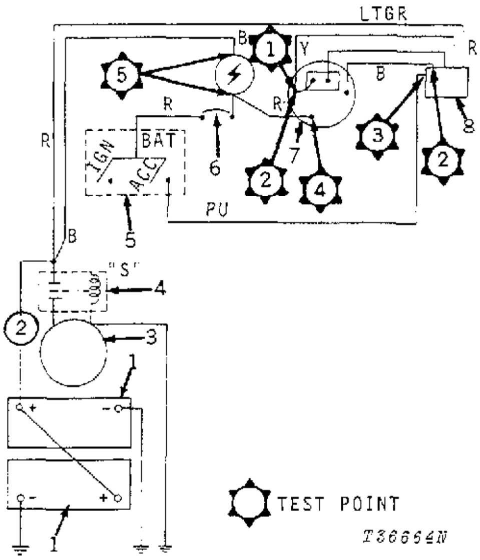
Test No. 1 .... 9.0 to 12.0 volts
Test No. 2 .... 9.0 to 12.0 volts
Test No. 3 .... 9.0 to 12.0 volts

High Resistance Test Values

Test Point	Maximum Voltage Reading
A-F	0.2
B-C	0.2
C-D	1.0
C-E	0.2

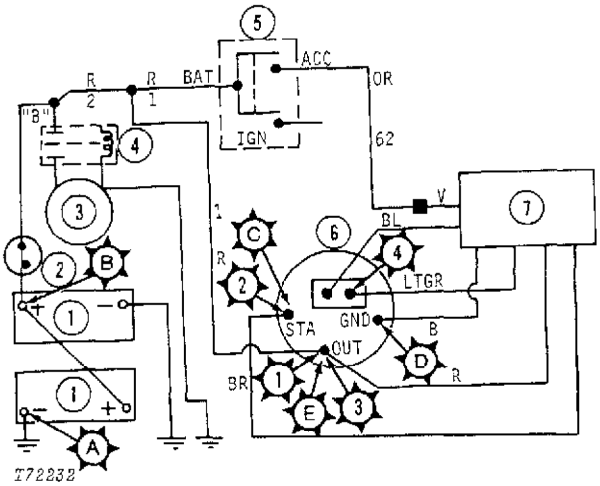
ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Key Switch
6—Circuit Breaker
7—Alternator
8—Regulator

Fig. 8-Charging Circuit Test Points
(-343540)



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Key Switch
6—Alternator
7—Regulator

Fig. 9-Charging Circuit Test Points
(343541-)

Charging Circuit Test Values

Test No. 1 .... 0 volts
Test No. 2 .... 2.0 volts
Regulator Connector Purple Wire .. 9.0-12.0 volts
Test No. 3
  Regulator field circuit or ground
    circuit is open .... 12 volts
  Field circuit shorted to ground .... 0 volts
Test No. 4
  Initially .... 20 amps at 13.0 volts
  After fifteen minutes of operation at 70°F
    (21.1°C) (See chart below for different
    temperature values) .... 10 to 15 amps at 14.4 volts

Temperature*	Voltage
40°F (4.4°C)	14.4 - 14.9 volts
60°F (15.6°C)	14.3 - 14.7 volts
80°F (26.7°C)	14.2 - 14.6 volts
100°F (37.8°C)	14.0 - 14.4 volts
120°F (48.9°C)	13.8 - 14.3 volts
140°F (60.0°C)	13.6 - 14.1 volts

**Measured one inch from regulator.*

Test No. 5 .... 9.0 to 12.0 volts

Charging Circuit Test Values

Test No. 1 .... 9 to 12 volts
Test No. 2 .... 0 volt
(Key Off)

Test No. 2 .... 9 to 12 volts
(Key On)

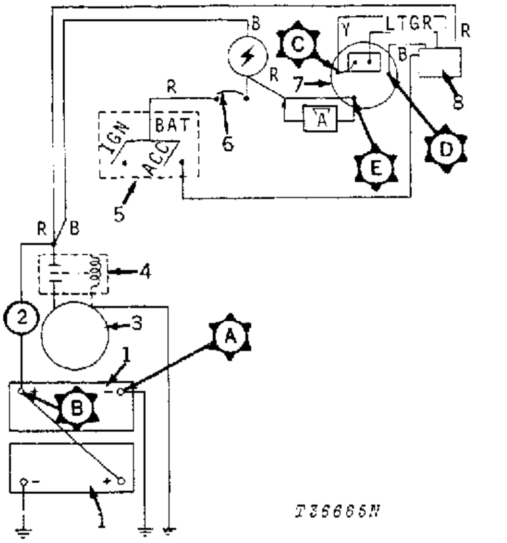
Test No. 3 .... 2.0 volts
(Engine Off - Key On)

Test No. 3 .... 20 amps min. and 13 volts
(Engine Running)

Test No. 4 .... 0.6 volts
(Engine Off - Key On)

ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



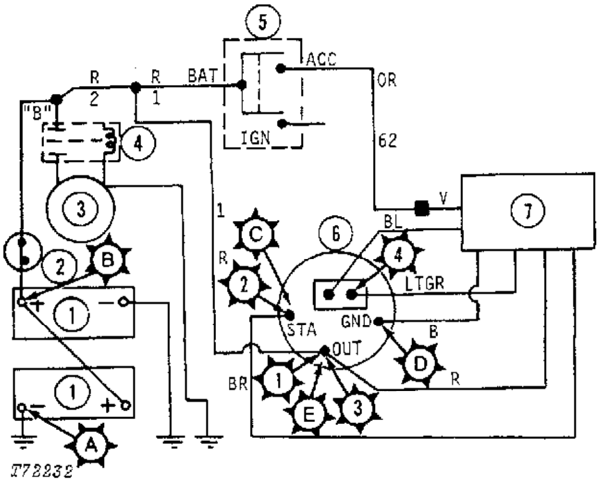
1—Batteries
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Key Switch
6—Circuit Breaker
7—Alternator
8—Regulator

Fig. 10-Charging Circuit High Resistance Test Points (-343540)

Charging Circuit High Resistance Test Values

Test Points	Maximum Voltmeter Reading
A-D	0.3 volt
B-E	0.3 volt
B-C	1.3 volt

**10-amp charging rate*



1—Battery
2—Battery Disconnect Switch
3—Starting Motor
4—Solenoid
5—Key Switch
6—Alternator
7—Regulator

Fig. 11-Charging Circuit High Resistance Test Points (343541-)

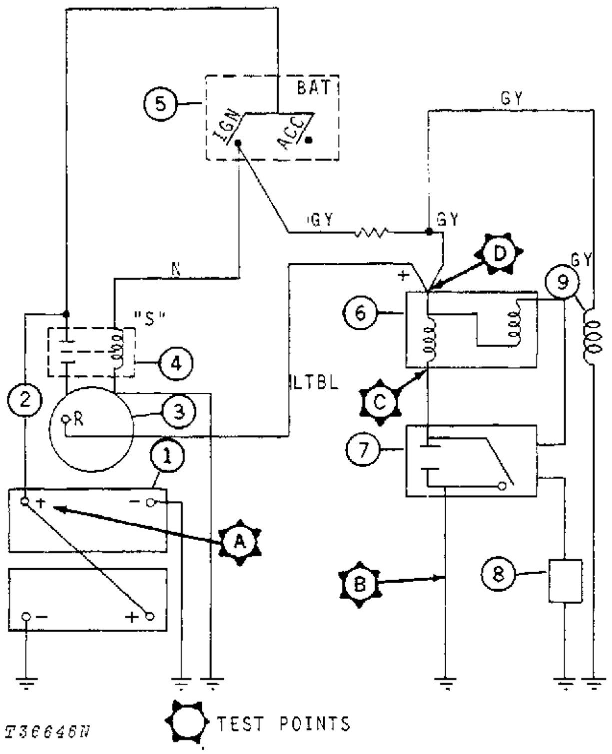
Charging Circuit High Resistance Test Values

Test Points	Maximum Voltmeter Reading
A-D	0.3 volt
B-E	0.3 volt
B-C	1.3 volt

**10-amp charging rate*

ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



1—Batteries
2—Battery Disconnect
3—Starting Motor
4—Solenoid
5—Key Switch
6—Coil
7—Distributor
8—Spark Plugs
9—Injection Pump Solenoid

Fig. 12-Ignition Circuit Test Points

Ignition Circuit Test Values

Voltmeter Connected To	Key Switch Position	Breaker Points	Voltage Reading
A-D	Cranking	—	1 volt max.
B-D	Cranking	—	Approx. 10 volts
B-D	On	Open	Battery voltage
B-D	On	Closed	Approx. 4.8 volts
B-C	On	Closed	0.2 volt max.

Carburetor Shut-Off Solenoid

Winding current draw .... Approx. 0.6 amp
Winding resistance .... Approx. 20 ohms
Shut-off needle opens .... 4.0 to 6.0 volts

Injection Pump Solenoid Winding

Winding current draw .... Approx. 2.5 amps
Winding resistance .... Approx. 5 ohms
Voltage required to energize ..... Approx. 8.0 volts

Gauge Circuit

Test No. 4 - Engine water temperature and engine oil pressure gauges
(-343540) purple lead ...... 9.0 to 12.0 volts
(343541-) orange lead ..... 9.0 to 12.0 volts

Return-To-Dig Circuit

Test Nos. 2, 3, 4 and 6 - Return-to-dig bucket switch, spool switch and spool solenoid 9.0 to 12.0 volts

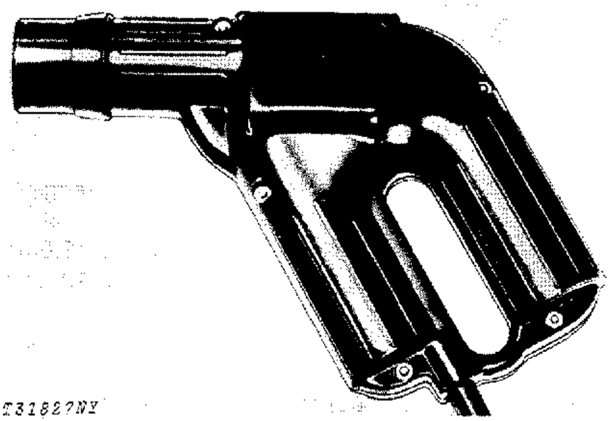
Light Circuit Test Values

Voltage reading at lamp terminal ... Battery voltage
Maximum voltage drop between battery and lamp .... 0.5 volt
Maximum voltage drop between lamp frame and ground; across switch or connection ..... 0.1 volt

ELECTRICAL SYSTEM

SPECIAL TOOLS

Convenience Tools

Tool	Tool No.	Use
 T51877N Fig. 13-Voltmeter, Ammeter and Ohmmeter	D-19001 TT	Voltmeter—Check starting circuit, charging circuit, ignition circuit, and light circuit
	....	Ammeter—Check charging circuit, ignition circuit, carburetor, shut-off solenoid, injection pump solenoid winding and horn
	....	Ohmmeter—Check carburetor shut-off solenoid, injection pump solenoid and fuel gauge sender.
 T31827NY Fig. 14-Timing Light	....	Time distributor

ELECTRICAL SYSTEM

SPECIAL TOOLS—Continued

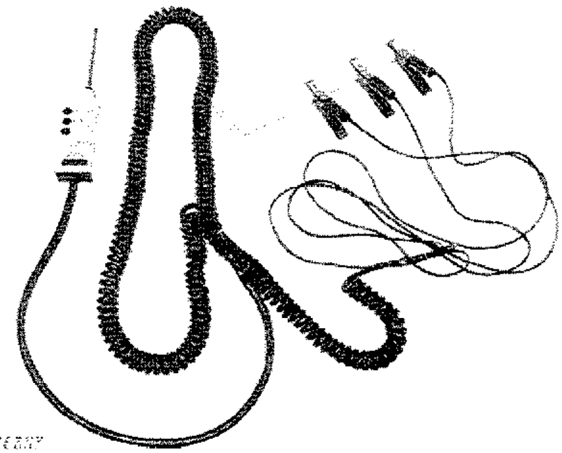
Tool	Tool No.	Use
	D-05136ST	Voltage Detector....To test starting, charging and accessory circuits to determine grounded or shorted circuit components.

Fig. 15-Voltage Detector

STEERING CLUTCH AND BRAKE ASSEMBLY

SPECIFICATIONS AND TORQUE VALUES

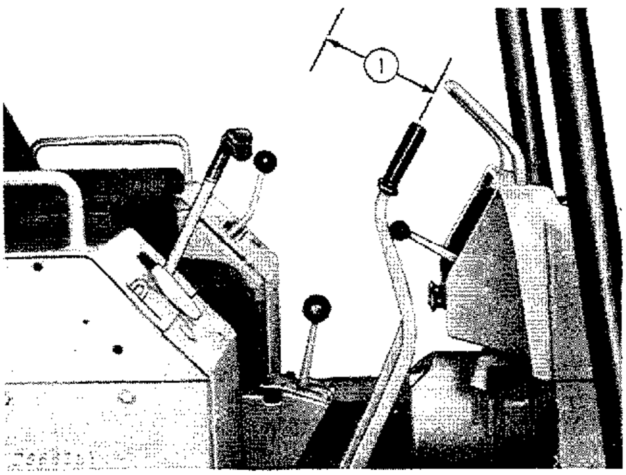


Fig. 16-Steering Clutch Lever Travel

1. *Top of steering lever full travel* .... 10 to 11 inches (254.00 to 279.40 mm)

   Steering clutch (disengage) .... 2.50 in. (63.5 mm)
   (engage) .... 1.50 in. (38 mm)

   Distance when steering lever picks up the brake .... 5.00 in. (127 mm)

Litho in U.S.A.

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES

Reverser Hydraulic System

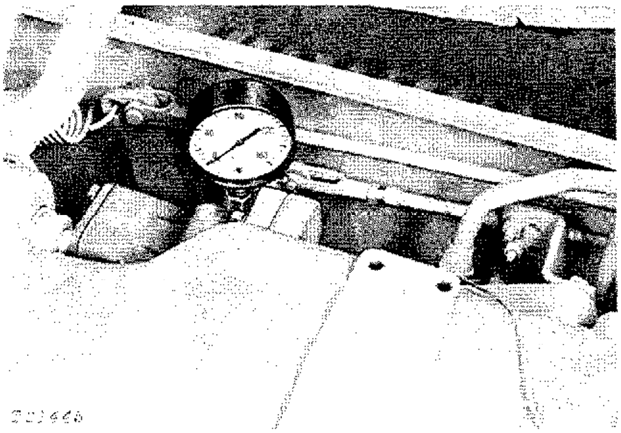


Fig. 17-Checking Clutch Oil Pressure Regulating Valve Pressure

Clutch oil regulator valve
(-278391) . . . . 120 ± 10 psi
(827 ± 69 kPa) (8.3 ± 0.7 bar)
(278392-) . . . . 150 ± 10 psi
(1034 ± 69 kPa) (10.3 ± 0.7 bar)

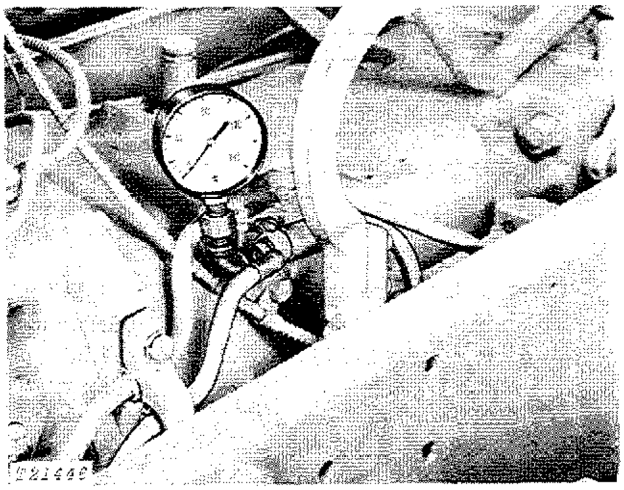
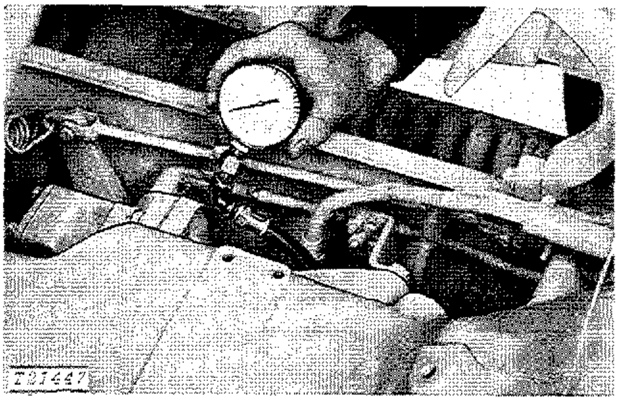


Fig. 18-Checking Cooler Inlet Regulating Valve Pressure

Cooler inlet regulator valve . . . . 87 to 103 psi
(600 to 710 kPa) (6.0 to 7.1 bar)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



T21447

Fig. 19-Checking Lube Regulating Valve Pressure

Reverser Hydraulic System—Continued

Lube Regulating Valve . . . . 17 to 33 psi
(117 to 228 kPa) (1.2 to 2.3 bar)

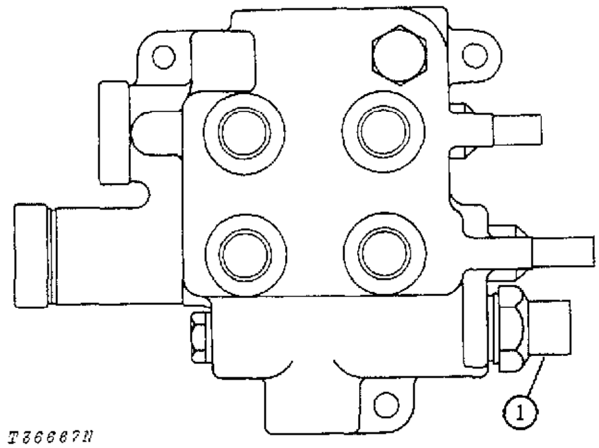


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Fig. 20-Bulldozer Control Valve Relief Valve

Bulldozer Hydraulic System

Operating Temperature . . . . 150 to 180°F
(65.6 to 82.2°C)

1 - System Relief Valve Setting

6300 and 6310 Dozer . . . . 1750 + 100—0 psi
(12 070 + 690—0 kPa) (120.7 + 6.9—0 bar)
6305 Dozer (-380196) . . . . 1750 + 100—0 psi
(12 070 + 690—0 kPa) (120.7 + 6.9—0 bar)
6305 Dozer (380197-   ) . . . . 2250 +100—0 psi
(15 510 +690—0 kPa) (155.1 +6.9—0 bar)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

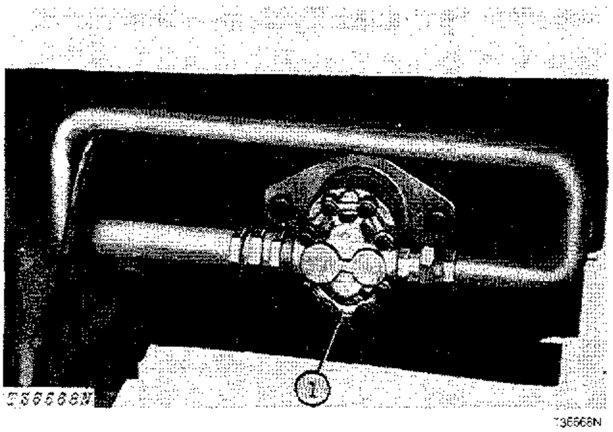


Fig. 21-Hydraulic Pump

Bulldozer Hydraulic System—Continued

1 - Minimum Pump Output at 2500 rpm and 1750 psi (12 070 kPa) (120.7 bar) pressure

15 gpm (56.8 L/min) . . . . 12.0 gpm (45.4 L/min)
23 gpm (87.1 L/min) . . . . 18.0 gpm (68.1 L/min)

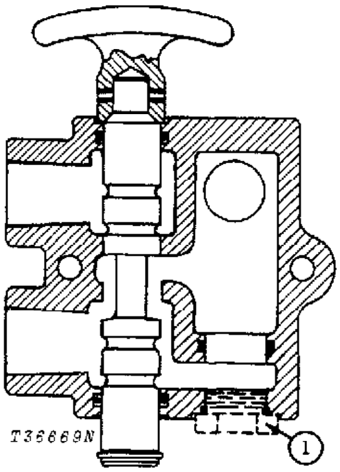


Fig. 22-Bulldozer Selector Valve Relief Valve

1 - Selector Valve Relief Valve
Setting . . . . 2000 + 100 − 0 psi
(13 790 + 690 − 0 kPa) (137.9 + 6.9 − 0 bar)

Cycle Times (at 2500 rpm)*

	Seconds Minimum	Seconds Maximum
Blade raise	3.0	5.0
Blade lower (power down)	1.2	2.4
Blade tilt	0.5	1.5
Blade angle	2.5	3.8

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

SPECIFICATIONS AND TORQUE VALUES—Continued

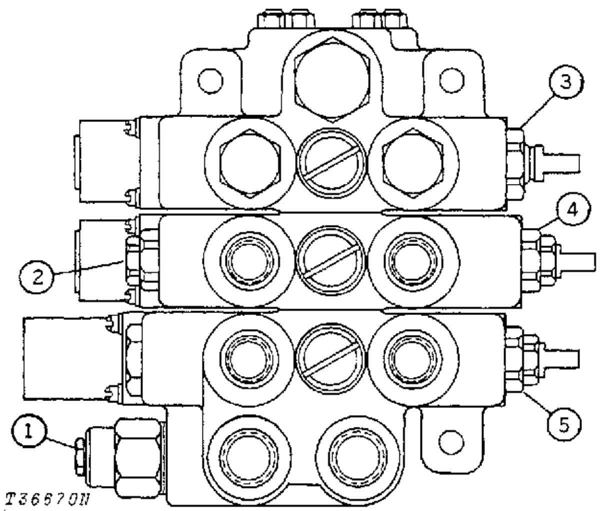


Fig. 23-Loader Control Valve Relief Valves

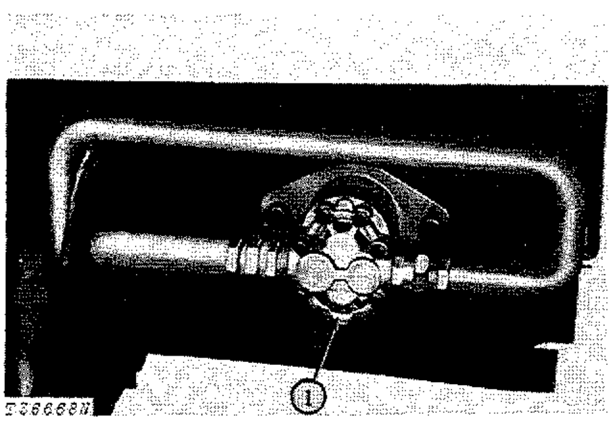


Fig. 24-Hydraulic Pump

Loader Hydraulic System

1 - System Relief Valve Setting 2250 + 100 − 0 psi (15 510 + 690 − 0 kPa) (155.1 + 6.9 − 0 bar)

Circuit Relief Valve Setting

2 - Bucket dump .... 1250 psi (8619 kPa) (86 bar)
3 - Auxiliary section .... 2500 psi (17 238 kPa) (172 bar)
4 - Bucket roll-back .... 2500 psi (17 238 kPa) (172 bar)
5 - Boom raise .... 3100 psi (21 375 kPa) (214 bar)

Minimum Pump Output at 2500 rpm
and 2250 psi (15 510 kPa) (155.1 bar)
23 gpm (87.1 L/min) .... 18 gpm (68.1 L/min)

Cycle Times (at 2500 rpm with bucket empty)*

	Seconds Minimum	Seconds Maximum
Boom raise	6.0	10.0
Boom lower (float down) ...	3.6	4.2
(power down) .	4.0	5.0
Bucket dump (boom at full height)	1.7	2.3
Bucket roll-back (from bucket level)...........	0.6	1.0

**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

SPECIFICATIONS AND TORQUE VALUES—Continued

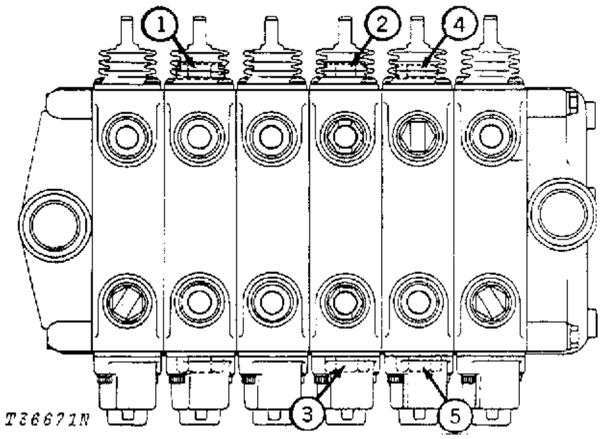


Fig. 25-Backhoe Relief Valves

Backhoe Hydraulic System

Backhoe Relief Valve Pressure Settings
9250 Backhoe

1 - Crowd .... 2500 psi
(17 238 kPa) (172 bar)
2 - Swing (right) .... 1800 psi
(12 411 kPa) (124 bar)
3 - Swing (left) .... 2375 psi
(16 376 kPa) (164 bar)
4 - Boom (raise) .... 2750 psi
(18 961 kPa) (190 bar)
5 - Boom (lower) .... 2500 psi
(17 238 kPa) (172 bar)

9300 Backhoe
1 - Crowd .... 2375 psi
(16 376 kPa) (164 bar)
2 - Swing (right) .... 2000 psi
(13 790 kPa) (138 bar)
3 - Swing (left) .... 2000 psi
(13 790 kPa) (138 bar)
4 - Boom (raise) .... 3500 psi
(24 133 kPa) (241 bar)
5 - Boom (lower) .... 2375 psi
(16 376 kPa) (164 bar)

9550 Backhoe
1 - Crowd .... 2500 psi
(17 238 kPa) (172 bar)
2 - Swing (right) .... 2375 psi
(16 376 kPa) (164 bar)
3 - Swing (left) .... 2375 psi
(16 376 kPa) (164 bar)
4 - Boom (raise) .... 2750 psi
(18 961 kPa) (190 bar)
5 - Boom (lower) .... 2500 psi
(17 238 kPa) (172 bar)

	Seconds	
Cycle TIMES (at 2500 rpm)*	**Minimum**	**Maximum**
Bucket cylinder retract	----	2.5
Bucket cylinder extend	----	4.0
Swing 180° (right or left)		
(9250)	2.5	4.5
(9300)	3.5	5.5
(9550)	2.5	4.5

**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

SPECIFICATIONS AND TORQUE VALUES—Continued

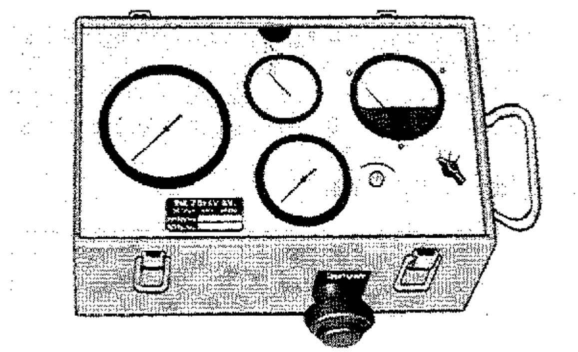
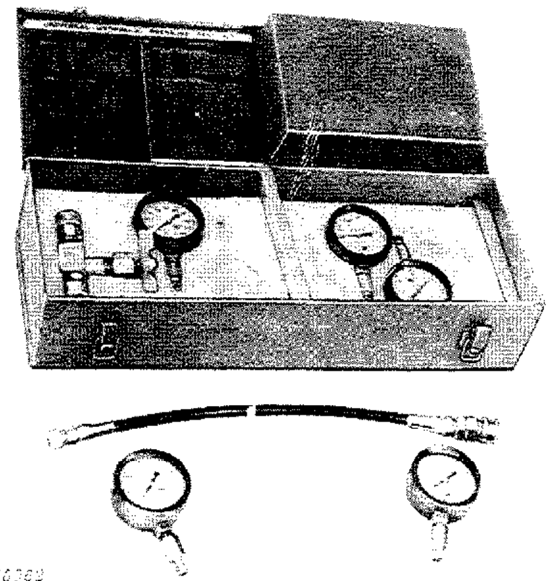
Winch System

Relief valve .... 950 to 1050 psi (6550 to 7240 kPa) (65.5 to 72.4 bar) at 1900 engine rpm

Relief valve .... 850 psi minimum (5861 kPa) (58.6 bar) at 800 engine rpm

SPECIAL TOOLS

Essential Tools

Tool	Tool Number	Use
 Fig. 26-Flow Meter	D-15017NU or D-15014NU	To check hydraulic flow and pressure in the hydraulic system.
 Fig. 27-Universal Pressure Test Kit	D-15028NU	Pressure gauges and fittings used for pressure readings at specific locations

HYDRAULIC SYSTEM (ANALYZER)

SPECIFICATIONS AND TORQUE VALUES

System Relief Valve Test

Temperature of hydraulic oil . . . . 140 to 150°F (60 to 66°C)

Pressure setting of system relief valve
- Loader . . . . 2250 + 100 − 0 psi (15 510 + 690 − 0 kPa) (155.1 + 6.9 − 0 bar)
- Selector Valve . . . . 2000 + 100 − 0 psi (13 790 + 690 − 0 kPa) (137.9 + 6.9 − 0 bar)
- Bulldozer
  - 6300 and 6310 Dozer . . . . 1750 + 100 − 0 psi (12 070 + 690 − 0 kPa) (120.7 + 6.9 − 0 bar)
  - 6305 Dozer (-380196) . . . . 1750 + 100 − 0 psi (12 070 + 690 − 0 kPa) (120.7 + 6.9 − 0 bar)
  - 6305 Dozer (380197-) . . . . 2250 + 100 − 0 psi (15 510 + 690 − 0 kPa) (155.1 + 6.9 − 0 bar)

Hydraulic Pump Test

```
HYDRAULIC OIL PRESSURE: 140 to 150°F (60 to 66°C)
  (temperature sensor on pump inlet line)

ORIFICE USED: 205032, 0.125 in. (3.18 mm)
 (remove lower system relief valve and
  install orifice)

TEST PRESSURE:  2000 psi (13 790kPa) (138 bar)
  (inlet to loader control valve)

THUMB DIAL SETTING:  142

MAXIMUM ENGINE RPM:  2050
T72284
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T72284

Fig. 28-Test Specification (loader)

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HYDRAULIC OIL TEMPERATURE: 140 to 150°F ( 60 to 66°C)
  (temperature sensor on pump inlet line)

ORIFICE USED: 202836, 0.125 in. (3.18 mm)
  (remove system relief valve from selector
   valve and install orifice)

TEST PRESSURE:  2000 psi (13 790kPa) (138 bar)
  (inlet to selector valve)

THUMB DIAL SETTING:  142

MAXIMUM ENGINE RPM:  2050

T72285
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T72285

Fig. 29-Test Specifications (bulldozer with a backhoe)

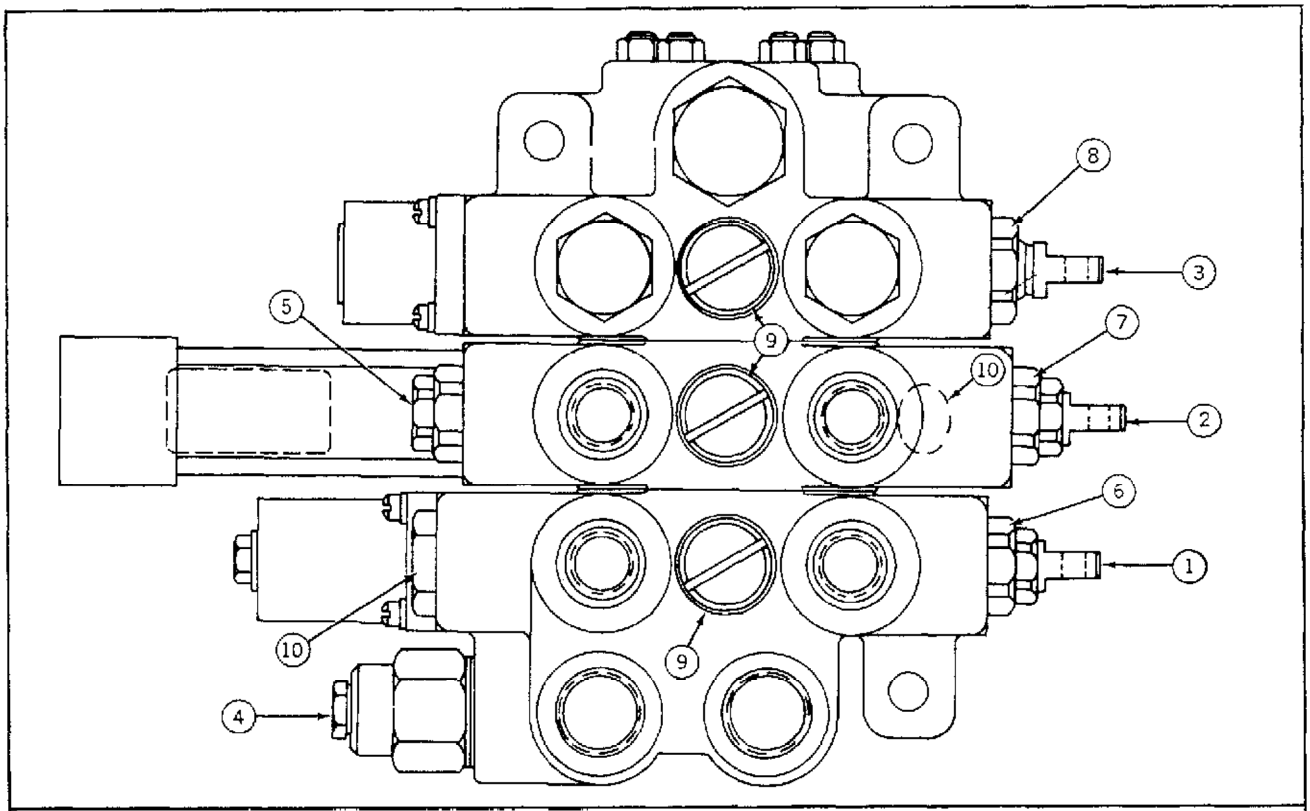
NOTE: Bulldozer with no backhoe, no orifice is available to check the hydraulic pump.

HYDRAULIC SYSTEM (ANALYZER)

SPECIFICATIONS AND TORQUE VALUES—Continued

Circuit Leakage Test

Temperature of oil . . . . . 140 to 150°F (60 to 66°C)
Maximum engine rpm at 2000 psi
(13 790 kPa) (138 bar) 2050



CYCLE TIMES (at 2500 rpm with bucket empty)

Boom lift........................6.0 to 10.0 sec
Boom down (float)................3.6 to 4.2 sec
(power)................4.0 to 5.0 sec
Bucket dump (boom at full height)1.7 to 2.3 sec
Bucket rollback (bucket level)...0.6 to 1.0 sec

LOADER CONTROL VALVE SECTIONS

1. Boom
2. Bucket
3. Auxiliary

SYSTEM RELIEF VALVE

4. System relief valve.....................2250 psi (15 514 kPa) (155 bar)

CIRCUIT RELIEF VALVES

5. Bucket dump........1250 psi (8619 kPa)(85 bar)
6. Boom lift..........3100 psi (21 375 kPa) (214 bar)
7. Bucket rollback....2500 psi (17 238 kPa) (172 bar)
8. Auxiliary..........2500 psi (17 238 kPa) (172 bar) (use with John Deere multi-purpose bucket)

LIFT CHECKS (check poppet)

9. All sections

ANTI-CAVITATION CHECK VALVES

10. Boom down and bucket rollback

NOTE: The relief valve for the DROTT multi-purpose bucket is fastened to the bucket

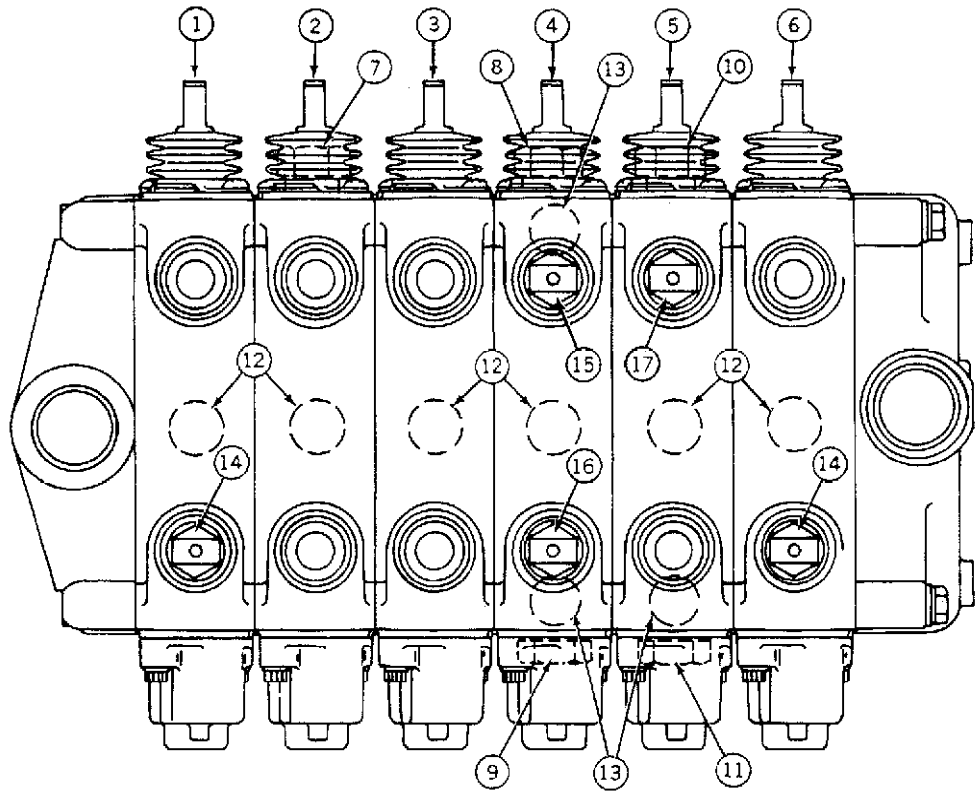
T72288

NOTE: Use cycle times only as a reference. When the performance is not according to the cycle times given, the service technician must decide if the difference is an indication of a failure of some component in the system.

Fig. 30-Loader Function Chart

HYDRAULIC SYSTEM (ANALYZER)

SPECIFICATIONS AND TORQUE VALUES—Continued



CYCLE TIMES (at 2500 rpm)

Bucket dump....................2.5 sec
Bucket curl....................4.0 sec
Swing 180° right (R.H.) or left (L.H.)
- 9250....................2.5 to 4.5 sec
- 9300....................3.5 to 5.5 sec
- 9550....................2.5 to 4.5 sec

BACKHOE CONTROL VALVE SECTIONS

1. Right (R.H.) stabilizer
2. Crowd
3. Bucket
4. Swing
5. Boom
6. Left (L.H.) stabilizer

CIRCUIT RELIEF VALVES

7. Crowd in
   - 9250..........2500 psi (17 238 kPa) (172 bar)
   - 9300..........2375 psi (16 376 kPa) (164 bar)
   - 9550..........2500 psi (17 238 kPa) (172 bar)
8. Swing right (R.H.)
   - 9250..........1750 psi (12 066 kPa) (121 bar)
   - 9300..........2000 psi (13 790 kPa) (138 bar)
   - 9550..........2375 psi (16 376 pKa) (164 bar)
9. Swing Left (L.H.)
   - 9250..........2375 psi (16 376 kPa) (164 bar)
   - 9300..........2000 psi (13 790 kPa) (138 bar)
   - 9550..........2375 psi (16 376 kPa) (164 bar)
10. Boom lift
    - 9250..........2750 psi (18 961 kPa) (190 bar)
    - 9300..........3500 psi (24 133 kPa) (241 bar)
    - 9550..........2750 psi (18 961 kPa) (190 bar)
11. Boom down
    - 9250..........2500 psi (17 238 kPa) (172 bar)
    - 9300..........2375 psi (16 376 kPa) (164 bar)
    - 9550..........2500 psi (17 238 kPa) (172 bar)

LIFT CHECK

12. All Sections

ANTI-CAVITATION CHECK VALVES

13. Boom down, swing right (R.H.) and left (L.H.)

ORIFICE PLATES

14. Stabilizer down (2 used).....0.1405 (3.57 mm)
15. Swing right (R.H.)(9250 only)0.1520 (3.86 mm)
16. Swing left (L.H.)(9250 only).0.1065 (2.71 mm)
17. Boom Lift....................0.2190 (5.56 mm)

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NOTE: Use cycle times only as a reference. When the performance is not according to the cycle times given, the service technician must decide if the difference is an indication of a failure of some component in the system.

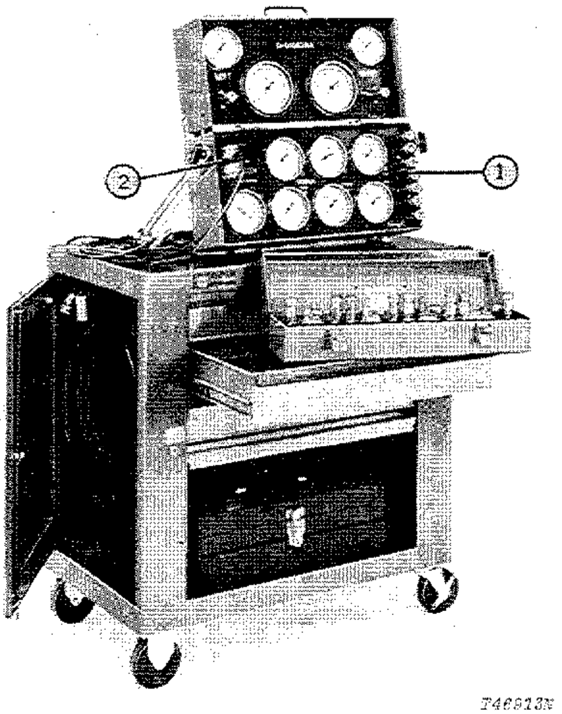
Fig. 31-Backhoe Function Chart (9250, 9300 and 9550 backhoes)

HYDRAULIC SYSTEM (ANALYZER)

SPECIAL TOOLS

Convenience Tools

Tool



1—Master Hydraulic System Analyzer
2—Tachometer/Temperature Reader

Fig. 32-Hydraulic System Analyzer

Tool Number	Use
D-01080AA	Master Hydraulic System Analyzer. Used for the test of hydraulic system.
D-01084AA	Tachometer/Temperature Reader - Used for the measurement of engine rpm and oil temperature.
D-01088AA	Construction Equipment Accessory Kit - Has all the necessary fittings, orifices etc. to make the necessary connection to the hydraulic system.

MISCELLANEOUS COMPONENTS

SPECIFICATIONS AND TORQUE VALUES—Continued

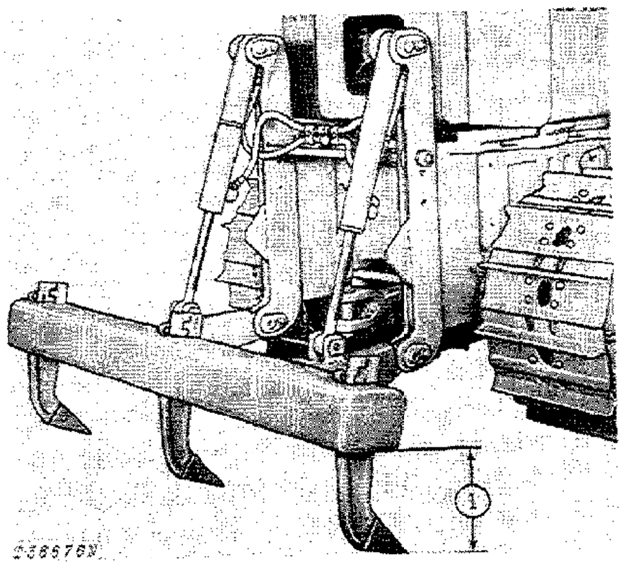


Fig. 34-Tooth Adjustment

1 - Ripper tooth depth positions . . . . 7, 8.5 and 10 inches (177.8, 215.9 anc 254 mm)

SAFETY
live with it