47 and 48 Backhoes;
54, 60 and 72-Inch Mid Mount Rotary Mowers;
450, 550, 660, 670 and 680 Hydraulic Tillers;
31B Post Hole Digger;
74 and 84 Front Blades;
26 and 51-Inch Brooms;
47 and 59 Snowblowers;
261 and 271 Rear-Mounted Rotary Mowers
This technical manual is written for an experienced technician and contains sections that are specifically for this product. It is a part of a total product support program.

The manual is organized so that all the information on a particular system is kept together. The order of grouping is as follows:

- Table of Contents
- Specifications
- Component Location
- System Schematic
- Theory of Operation
- Troubleshooting Chart
- Diagnostics
- Tests & Adjustments
- Repair

Note: Depending on the particular section or system being covered, not all of the above groups may be used.

Each section will be identified with a symbol rather than a number. The groups and pages within a section will be consecutively numbered.

We appreciate your input on this manual. To help, there are postage paid post cards included at the back. If you find any errors or want to comment on the layout of the manual please fill out one of the cards and mail it back to us.

All information, illustrations and specifications in this 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.

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John Deere Worldwide Commercial and Consumer Equipment Division
Horicon, WI
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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.

Follow recommended precautions and safe servicing practices.

Understand Signal Words

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

DANGER or WARNING safety signs are located near specific hazards. General precautions are listed on CAUTION safety signs. CAUTION also calls attention to safety messages in this manual.

REPLACE SAFETY SIGNS

Replace missing or damaged safety signs. See the machine operator's manual for correct safety sign placement.

HANDLE FLUIDS SAFELY-AVOID FIRES

Be Prepared For Emergencies

When you work around fuel, do not smoke or work near heaters or other fire hazards.

Store flammable fluids away from fire hazards. Do not incinerate or puncture pressurized containers.

Make sure machine is clean of trash, grease, and debris.

Do not store oily rags; they can ignite and burn spontaneously.

Be prepared if a fire starts.

Keep a first aid kit and fire extinguisher handy.

Keep emergency numbers for doctors, ambulance service, hospital, and fire department near your telephone.
USE CARE AROUND HIGH-PRESSURE FLUID LINES

Avoid High-pressure Fluids

Escaping fluid under pressure can penetrate the skin causing serious injury.

Avoid injury from escaping fluid under pressure by stopping the engine and relieving pressure in the system before disconnecting or connecting hydraulic or other lines. Tighten all connections before applying pressure.

Search for leaks with a piece of cardboard. Protect hands and body from high pressure fluids.

If an accident occurs, see a doctor immediately. Any fluid injected into the skin must be surgically removed within a few hours or gangrene may result. Doctors unfamiliar with this type of injury should reference a knowledgeable medical source. Such information is available from Deere & Company Medical Department in Moline, Illinois, U.S.A.

Avoid Heating Near Pressurized Fluid Lines

Flammable spray can be generated by heating near pressurized fluid lines, resulting in severe burns to yourself and bystanders. Do not heat by welding, soldering, or using a torch near pressurized fluid lines or other flammable materials. Pressurized lines can be accidentally cut when heat goes beyond the immediate flame area.

USE SAFE SERVICE PROCEDURES

Wear Protective Clothing

Wear close fitting clothing and safety equipment appropriate to the job.

Prolonged exposure to loud noise can cause impairment or loss of hearing. Wear a suitable hearing protective device such as earmuffs or earplugs to protect against objectionable or uncomfortable loud noises.

Operating equipment safely requires the full attention of the operator. Do not wear radio or music headphones while operating machine.

Service Machines Safely

Tie long hair behind your head. Do not wear a necktie, scarf, loose clothing, or necklace when you work near machine tools or moving parts. If these items were to get caught, severe injury could result.

Remove rings and other jewelry to prevent electrical shorts and entanglement in moving parts.

Use Proper Tools

Use tools appropriate to the work. Makeshift tools and procedures can create safety hazards. Use power tools only to loosen threaded parts and fasteners. For loosening and tightening hardware, use the correct size tools. **DO NOT** use U.S. measurement tools on metric fasteners. Avoid bodily injury caused by slipping wrenches. Use only service parts meeting John Deere specifications.
SAFETY

Park Machine Safely

Before working on the machine:
1. Lower all equipment to the ground.
2. Stop the engine and remove the key.
3. Disconnect the battery ground strap.
4. Hang a “DO NOT OPERATE” tag in operator station.

Support Machine Properly And Use Proper Lifting Equipment

If you must work on a lifted machine or attachment, securely support the machine or attachment.
Do not support the machine on cinder blocks, hollow tiles, or props that may crumble under continuous load. Do not work under a machine that is supported solely by a jack. Follow recommended procedures in this manual.

Lifting heavy components incorrectly can cause severe injury or machine damage. Follow recommended procedure for removal and installation of components in the manual.

Work In Clean Area

Before starting a job:
1. Clean work area and machine.
2. Make sure you have all necessary tools to do your job.
3. Have the right parts on hand.
4. Read all instructions thoroughly; do not attempt shortcuts.

Using High Pressure Washers

Directing pressurized water at electronic/electrical components or connectors, bearings, hydraulic seals, fuel injection pumps or other sensitive parts and components may cause product malfunctions. Reduce pressure and spray at a 45 to 90 degree angle.

Illuminate Work Area Safely

Illuminate your work area adequately but safely. Use a portable safety light for working inside or under the machine. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.

Work In Ventilated Area

Engine exhaust fumes can cause sickness or death. If it is necessary to run an engine in an enclosed area, remove the exhaust fumes from the area with an exhaust pipe extension.
If you do not have an exhaust pipe extension, open the doors and get outside air into the area.

Remove Paint Before Welding Or Heating

Avoid potentially toxic fumes and dust. Hazardous fumes can be generated when paint is heated by welding, soldering, or using a torch. Do all work outside or in a well ventilated area. Dispose of paint and solvent properly. Remove paint before welding or heating: If you sand or grind paint, avoid breathing the dust. Wear an approved respirator. If you use solvent or paint stripper, remove stripper with soap and water before welding. Remove solvent or paint stripper containers and other flammable material from area. Allow fumes to disperse at least 15 minutes before welding or heating.
AVOID INJURY FROM ROTATING BLADES, AUGERS AND PTO SHAFTS

Keep hands and feet away while machine is running. Shut off power to service, lubricate or remove mower blades, augers or PTO shafts.

HANDLE CHEMICAL PRODUCTS SAFELY

Direct exposure to hazardous chemicals can cause serious injury. Potentially hazardous chemicals used with John Deere equipment include such items as lubricants, coolants, paints, and adhesives.

A Material Safety Data Sheet (MSDS) provides specific details on chemical products: physical and health hazards, safety procedures, and emergency response techniques. Check the MSDS before you start any job using a hazardous chemical. That way you will know exactly what the risks are and how to do the job safely. Then follow procedures and recommended equipment.

Dispose of Waste Properly

Improperly disposing of waste can threaten the environment and ecology. Potentially harmful waste used with John Deere equipment include such items as oil, fuel, coolant, brake fluid, filters, and batteries. Use leakproof containers when draining fluids. Do not use food or beverage containers that may mislead someone into drinking from them. Do not pour waste onto the ground, down a drain, or into any water source. Inquire on the proper way to recycle or dispose of waste from your local environmental or recycling center, or from your John Deere dealer.

LIVE WITH SAFETY

Before returning machine to customer, make sure machine is functioning properly, especially the safety systems. Install all guards and shields.
## SPECIFICATIONS CONTENTS

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<td>CHASSIS GREASE—EUROPE</td>
<td>11</td>
</tr>
</tbody>
</table>
SPECIFICATIONS

BACKHOE SPECIFICATIONS

Dimensions:

Circuit Relief Valve Setting

Boom and Dipperstick
- 47 Backhoe: 19,980 ± 690 kPa (2600 ± 100 psi)
- 48 Backhoe: 19,980 ± 690 kPa (2600 ± 100 psi)

Shim Sizes
- 47 and 48 Backhoe: 1.02 mm (0.04 in.), 0.51 mm (0.02 in.), 0.25 mm (0.01 in.)

MOWERS

All Mid-Mount Mowers

- 54 Inch Deck Blade Bolt Torque: 57 - 84 N•m (42 - 62 lb-ft)
- 60/72 Inch Deck Blade Bolt Torque: 102 - 123 N•m (75 - 91 lb-ft)

3-Point Hitch Rear Mount Mowers

- Blade Bolt Torque: 102 - 123 N•m (75 - 91 lb-ft)
- 261 and 272 Mounting: Category 1
- 261 and 272 PTO Speed: 540 rpm

ROTARY TILLER SPECIFICATIONS

- Models: 450, 550, 660, 670 and 680
- Chain Free Play: 10 mm (0.375 in.)
- PTO Spring Clutch Adjustment: 28.9 - 29.5 mm (1.137 - 1.161 in.)
- Gear Backlash (All Models): 0.2 - 0.6 mm (0.008 - 0.023 in.)
- Chain Case Oil Level (approx) (All Models): 0.85 L (28 oz)
- Gear Oil Level (approx) (All Models): 0.40 L (13.5 oz)
- Gear Case Grease: John Deere GL-5® Gear Oil-SAE 80W-90

POST HOLE DIGGER SPECIFICATIONS

- Model: 31B
- Drive Type: PTO
- PTO rpm (maximum): 540 rpm
- Auger rpm (maximum): 170 rpm
- Backlash: 0.1 - 0.56 mm (0.004 - 0.022 in.)
- Endplay: none
- Transportation Clearance: 20 - 25 cm (8 - 10 in.)
- Weight (less auger): 77 kg (170 lbs)

FRONT BLADE SPECIFICATIONS

- Lift Cylinder Lock Nut: 272 N•m (200 lb-ft)
ROTARY BROOM SPECIFICATIONS

- Gear Box Backlash: 0.2 - 0.6 mm (0.008 - 0.023 in.)
- Input Shaft Endplay: zero

SNOWBLOWER SPECIFICATIONS

- Input Shaft End Play (maximum): 0.08 mm (0.003 in.)
- Blower Case Shaft
  - End Play: 0.025 - 0.15 mm (0.001 - 0.006 in.)
  - Backlash: 0.15 - 0.4 mm (0.006 - 0.016 in.)
- Gear Box and Blower Case Grease Capacity
  - 59: 0.4 L (13.5 oz)
- Blower Gear Case Half
  - Socket Head Cap Screws: 26 N•m (228 lb-in.)
  - Cap Screws: 41 N•m (34 lb-ft)

ATTACHMENT USE

<table>
<thead>
<tr>
<th>ATTACHMENT</th>
<th>4100</th>
<th>4200</th>
<th>4300</th>
<th>4400</th>
<th>4500</th>
<th>4600</th>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Model 47</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
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<td>Backhoe Model 48</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>Mowers, Mid-Mount Rotary:</td>
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<td></td>
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<td>N</td>
<td>N</td>
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<td>60-inch mid mower</td>
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<td>Y</td>
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<td>Y</td>
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<td>72-inch mid mower</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td></td>
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<td>261 60-inch</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>272 72-inch</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>Tillers:</td>
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<td>450 50-inch</td>
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<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
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<td>550 50-inch</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>660 60-inch</td>
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<td>Y</td>
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<td>N</td>
<td>N</td>
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<tr>
<td>680 80-inch</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
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<td>Post Hole Digger:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31B</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>Blades, Front:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>74 54-inch, 60-inch, 66-inch</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>84 84-inch</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
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<td>51</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>26</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
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<td>Snowblowers:</td>
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</tr>
<tr>
<td>47-inch</td>
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<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
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</tr>
<tr>
<td>59-inch</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

1 Tractor has too much horsepower for equipment.
2 54-Inch blade is available for use on 4100 tractor. Blade is separate from Model 75 54-inch blade.
### O-RING SEAL SERVICE RECOMMENDATIONS

#### FACE SEAL FITTINGS WITH INCH STUD ENDS TORQUE

<table>
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<th>Inch Tube O.D.</th>
<th>Thread Size</th>
<th>Tube Nut/ Swivel Nut Torque</th>
<th>Bulkhead Locknut Torque</th>
<th>O-ring Stud Ends</th>
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</thead>
<tbody>
<tr>
<td>mm</td>
<td>Dash Size</td>
<td>in.</td>
<td>N-m</td>
<td>lb-ft</td>
<td>in. N-m lb-ft</td>
</tr>
<tr>
<td>-3</td>
<td>0.188</td>
<td>4.76</td>
<td>3/8-24</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>-4</td>
<td>0.250</td>
<td>6.35</td>
<td>9/16-18</td>
<td>16 12 9</td>
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<tr>
<td>8</td>
<td>-5</td>
<td>0.312</td>
<td>7.94</td>
<td>1/2-20</td>
<td>16 12 9</td>
</tr>
<tr>
<td>10</td>
<td>-6</td>
<td>0.375</td>
<td>9.52</td>
<td>11/16-16</td>
<td>24 18 24 18</td>
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<tr>
<td>12</td>
<td>-8</td>
<td>0.500</td>
<td>12.70</td>
<td>13/16-16</td>
<td>50 37 46 34</td>
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<tr>
<td>16</td>
<td>-10</td>
<td>0.625</td>
<td>15.88</td>
<td>1-14</td>
<td>69 51 62 46</td>
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<tr>
<td>16</td>
<td>-12</td>
<td>0.750</td>
<td>19.05</td>
<td>1-3/16-12</td>
<td>102 75 102 75</td>
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<td>22</td>
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<td>22.22</td>
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<td>32</td>
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<td>1-11/16-12</td>
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<tr>
<td>38</td>
<td>-24</td>
<td>1.50</td>
<td>38.10</td>
<td>2-12</td>
<td>217 160 217 160</td>
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</table>

**NOTE:** Torque tolerance is +15% / –20%.
### Face Seal Fittings with Metric Stud Ends Torque

<table>
<thead>
<tr>
<th>Nominal Tube O.D./Hose I.D.</th>
<th>Face Seal Tube/Hose End</th>
<th>O-ring Stud Ends, Straight Fitting or Locknut</th>
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<tbody>
<tr>
<td>Metric Tube O.D.</td>
<td>Inch Tube O.D.</td>
<td>Thread Size</td>
</tr>
<tr>
<td>mm</td>
<td>Dash Size</td>
<td>in.</td>
</tr>
<tr>
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<td>----------</td>
<td>-----</td>
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<tr>
<td>38</td>
<td>-24</td>
<td>1.50</td>
</tr>
</tbody>
</table>

**NOTE:** Torque tolerance is +15% / –20%.
O-RING FACE SEAL FITTINGS

1. Inspect the fitting sealing surfaces. They must be free of dirt or defects.
2. Inspect the O-ring. It must be free of damage or defects.
3. Lubricate O-rings and install into groove using petroleum jelly to hold in place.
4. Push O-ring into the groove with plenty of petroleum jelly so O-ring is not displaced during assembly.
5. Index angle fittings and tighten by hand pressing joint together to insure O-ring remains in place.
6. Tighten fitting or nut to torque value shown on the chart per dash size stamped on the fitting. Do not allow hoses to twist when tightening fittings.

O-RING BOSS FITTINGS

1. Inspect boss O-ring boss 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.
2. Put hydraulic oil or petroleum jelly on the O-ring. Place electrical tape over the threads to protect O-ring from nicks. Slide O-ring over the tape and into the groove of fitting. Remove tape.
3. For angle fittings, loosen special nut and push special washer against threads so O-ring can be installed into the groove of fitting.
4. 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.
5. To position angle fittings, turn the fitting counterclockwise a maximum of one turn.
6. Tighten straight fittings to torque value shown on chart. For angle fittings, tighten the special nut to value shown in the chart while holding body of fitting with a wrench.

### STRAIGHT FITTING OR SPECIAL NUT TORQUE

<table>
<thead>
<tr>
<th>Thread Size</th>
<th>Torque(^a)</th>
<th>Number of Flats(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N·m</td>
<td>lb-ft</td>
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<tr>
<td>1-7/8-12 UN</td>
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\(^a\) Torque tolerance is ± 10 percent.
\(^b\) To be used if a torque wrench cannot be used.
After tightening fitting by hand, put a mark on nut or boss; then tighten special nut or straight fitting the number of flats shown.
INCH FASTENER TORQUE VALUES

**INCH FASTENER TORQUE VALUES**

**SAE Grade and Head Markings**

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<th>Size</th>
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<td>Dry&lt;sup&gt;a&lt;/sup&gt;</td>
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**Reference:** JDS—G200.

---

DO NOT use these hand torque values if a different torque value or tightening procedure is given for a specific application. Torque values listed are for general use only and include a ±10% variance factor. Check tightness of fasteners periodically. DO NOT use air powered wrenches.

Shear bolts are designed to fail under predetermined loads. Always replace shear bolts with identical grade.

Fasteners should be replaced with the same grade. Make sure fastener threads are clean and that you properly start thread engagement. This will prevent them from failing when tightening.

When bolt and nut combination fasteners are used, torque values should be applied to the **NUT** instead of the bolt head.

Tighten toothed or serrated-type lock nuts to the full torque value.

- "Lubricated" means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. "Dry" means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.
- "Grade 2" applies for hex cap screws (not hex bolts) up to 152 mm (6-in.) long. "Grade 1" applies for hex cap screws over 152 mm (6-in.) long, and for all other types of bolts and screws of any length.

**SPECIFICATIONS & INFORMATION**

**METRIC FASTENER TORQUE VALUES**

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\(^a\) “Lubricated” means coated with a lubricant such as engine oil, or fasteners with phosphate and oil coatings. “Dry” means plain or zinc plated (yellow dichromate - Specification JDS117) without any lubrication.

LUBRICANTS

HYDROSTATIC TRANSMISSION & HYDRAULIC OIL

Use the appropriate oil viscosity based on these air temperature ranges. Operating outside of these recommended oil air temperature ranges may cause premature hydrostatic transmission or hydraulic system failures.

IMPORTANT: Mixing of LOW VISCOSITY HY–GARD® and HY–GARD® oils is permitted. DO NOT mix any other oils in this transmission. DO NOT use engine oil or “Type F” (Red) Automatic Transmission Fluid in this transmission.

The following John Deere transmission and hydraulic oil is PREFERRED:

• LOW VISCOSITY HY–GARD®—JDM J20D.

The following John Deere oil is also recommended if above preferred oil is not available:

• HY–GARD®—JDM J20C.

Other oils may be used if above recommended John Deere oils are not available, provided they meet one of the following specifications:

• John Deere Standard JDM J20D;
• John Deere Standard JDM C.

John Deere Dealers: You may want to cross-reference the following publications to recommend the proper oil for your customers:

• Module DX,ANTI in JDS–G135;
• Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
• Lubrication Sales Manual PI7032.

ALTERNATIVE LUBRICANTS

Conditions in certain geographical areas outside the United States and Canada may require different lubricant recommendations than those printed in this manual or the operator's manual. Consult with your John Deere Dealer, or Sales Branch to obtain the alternative lubricant recommendations.

LUBRICANT STORAGE

This 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.
CHASSIS GREASE—NORTH AMERICA

IMPORTANT: ONLY use a quality grease in this application. DO NOT mix any other greases in this application. DO NOT use any BIO–GREASE in this application.

The following John Deere greases are PREFERRED:
- MOLY HIGH-TEMPERATURE EP GREASE®—JDM J25C, NLGI Grade 2;

Other greases may be used if above preferred John Deere greases are not available, provided they meet one of the following specifications:
- John Deere Standard JDM J25C, NLGI Grade 2;

IMPORTANT: If minimum air temperature should fall below -20 °C (-4 °F), the grease must be heated to at least five degrees above the lower limit before start-up or components may be damaged.

John Deere Dealers: You may want to cross-reference the following publications to recommend the proper grease for your customers:
- Module DX,GREA1 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide;
- the Lubrication Sales Manual PI7032.

CHASSIS GREASE—EUROPE

IMPORTANT: ONLY use a quality grease in this application. DO NOT mix any other greases in this application. DO NOT use any BIO–GREASE in this application.

The following John Deere grease is PREFERRED:

Other greases may be used if above preferred John Deere grease is not available, provided they meet the following specifications:

IMPORTANT: If minimum air temperature should fall below -10 °C (14 °F), the grease must be heated to at least five degrees above the lower limit before start-up or components may be damaged.

John Deere Dealers: You may want to cross-reference the following publications to recommend the proper grease for your customers:
- Module DX,GREA1 in JDS–G135;
- Section 530, Lubricants & Hydraulics, of the John Deere Merchandise Sales Guide.
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SPECIFICATIONS

Hydraulic Pump Flow Rate Capacity
- 4100 Tractor: 27.66 L/min (7.3 gpm), Engine at 2650 rpm
- 4200 Tractor: 27.6 L/min (7.3 gpm), Engine at 2600 rpm
- 4300 Tractor: 31.4 L/min (8.3 gpm), Engine at 2600 rpm
- 4400 Tractor: 31.4 L/min (8.3 gpm), Engine at 2600 rpm
- 4500 Tractor: 37.5 L/min (9.9 gpm), Engine at 2600 rpm
- 4600 Tractor: 39.0 L/min (10.3 gpm), Engine at 2700 rpm

Hydraulic Pump Working Pressure
- 4100 Tractor: 16 671 kPa (2418 psi), Engine at 2650 rpm
- 4200 Tractor: 14 650 kPa (2125 psi), Engine at 2600 rpm
- 4300 Tractor: 17 235 kPa (2500 psi), Engine at 2600 rpm
- 4400 Tractor: 17 235 kPa (2500 psi), Engine at 2600 rpm
- 4500 Tractor: 17 235 kPa (2500 psi), Engine at 2600 rpm
- 4600 Tractor: 17 235 kPa (2500 psi), Engine at 2700 rpm

Main System Relief Valve
- Test Engine Speed: 1500 rpm
- Pressure
  - 47 Backhoe: 15 515 [14 480 min.] kPa (2250 [2100 min.] psi)
  - 48 Backhoe: 17 580 [16 550 min] kPa (2550 [2400 min.] psi)

Circuit Relief Valve Setting
- Boom and Dipperstick
  - 47 Backhoe: 19 980 ± 690 kPa (2600 ±100 psi)
  - 48 Backhoe: 19 980 ± 690 kPa (2600 ±100 psi)
- Shim Sizes
  - 47 and 48 Backhoe: 1.02 mm (0.04 in.), 0.51 mm (0.02 in.), (0.254 mm (0.01 in.)

Restrictor Orifice ID
- Boom
  - 47 Backhoe: 1.575 mm (0.062 in.)
  - 48 Backhoe: 1.88 mm (0.074 in.)
- Swing
  - 47 Backhoe: 1.397 mm (0.055 in.)
  - 48 Backhoe: 1.88 mm (0.074 in.)
- Stabilizer
  - 47 Backhoe: 1.575 mm (0.062 in.)
  - 48 Backhoe: 1.88 mm (0.074 in.)

Internal Valve Leakage (Maximum acceptable limit)
- Stabilizer Circuit: 12 mL/min (0.73 cu in./min)
- Lift Circuit (with relief and check): 22 mL/min (1.34 cu in./min)
Cylinder Drop Rate
(Rod movement maximum acceptable limit from transport position)

- Lift Cylinder Drop Rate - 47: 14.48 mm/min (.57 in./min)
- Lift Cylinder Drop Rate - 48: 9.15 mm/min (.36 in./min)
- Stabilizer Cylinder Drop Rate - 47: 8.64 mm/min (.34 in./min)
- Stabilizer Cylinder Drop Rate - 48: 5.85 mm/min (.23 in./min)
- Stabilizer Cylinder Retract Rate - 47: 5.85 mm/min (.23 in./min)
- Stabilizer Cylinder Retract Rate - 48: 3.81 mm/min (.15 in./min)

TORQUE SPECIFICATIONS

47 Backhoe
- Boom and Dipper Stick Cylinder Lock Nut: 353 N•m (260 lb-ft)
- Bucket Cylinder Lock Nut: 271 N•m (200 lb-ft)
- Stabilizer Cylinder Lock Nut: 190 N•m (140 lb-ft)
- Swing Cylinder Lock Nut: 271 N•m (200 lb-ft)

48 Backhoe
- Boom and Dipper Stick Cylinder Lock Nut: 353 N•m (260 lb-ft)
- Bucket Cylinder Lock Nut: 353 N•m (260 lb-ft)
- Stabilizer Cylinder Lock Nut: 353 N•m (260 lb-ft)
- Swing Cylinder Lock Nut: 353 N•m (260 lb-ft)

SPECIAL OR ESSENTIAL TOOLS

NOTE: Order tools according to information given in the U.S. SERVICE-GARD™ Catalog or in the European Microfiche Tool Catalog (MTC).

RECOMMENDED TOOLS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>D01018AA</td>
<td>Hydraulic Hand Pump</td>
<td>Used to test circuit relief valve pressure.</td>
</tr>
<tr>
<td>JTO70145</td>
<td>Hydraulic Test Gauge 0-20685 kPa (0-3000 psi)</td>
<td>Used to check main and circuit relief valve pressure.</td>
</tr>
</tbody>
</table>

OTHER MATERIALS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>592 / TY9375</td>
<td>LOCTITE® General Purpose Thread Sealant</td>
<td>Seal pipe plugs</td>
</tr>
</tbody>
</table>

LOCTITE® is a registered trademark of the Loctite Corp.
BACKHOE COMPONENT LOCATION

47 BOOM

MODEL 47

Dipperstick Cylinder

Bucket Cylinder

Dipperstick

Boom Cylinder

Stabilizer Cylinder

MODEL 47

MODEL 47

MODEL 48
48 BOOM

Dipperstick

Dipperstick Cylinder

Boom Cylinder

Bucket Cylinder

Swing Cylinder

MODEL 47

MODEL 48
THEORY OF OPERATION

CONTROL VALVES
The hydraulic control valve consists of individual valve sections stacked side-by-side with a continuous open center for all tractors. All sections have a self centering spool that directs pressure to one of the hydraulic cylinders.

The open center systems have a main system relief valve that protects the whole backhoe hydraulic system from sharp pressure shocks. It is adjustable by adding or removing shims but should not be adjusted to a higher or lower value than recommended. In addition, two of the individual circuits are protected by circuit relief valves that are adjustable, but again, they should not be adjusted to a value that is higher or lower than recommended.

LOAD CHECK VALVES
Each valve section is equipped with load check valves. These check valves prevent reverse fluid flow if supply pressure were lost (the engine stopped running). This feature would prevent opposite direction movement of an implement should supply pressure be lost.

MAIN SYSTEM RELIEF VALVE
High pressure can be generated by continuing to operate a function after its cylinder has reached its limit. When pressure reaches system relief valve pressure, the valve opens, diverting inlet oil to the return oil passage and the rockshaft housing.

CIRCUIT RELIEF AND ANTI-CAVITATION CHECK VALVES
Circuit relief and anti-cavitation check valves are included in boom, and dipperstick valve sections.

During some operations, when the valve spool is in a neutral position, a sudden external force against the bucket will cause a pressure increase in the head end of the cylinder. To relieve that pressure and avoid damage to the valve section, the circuit relief valve opens and allows oil flow to the return oil passage.

When the circuit relief valve opens to relieve pressure in the head end of the cylinder, a void is created in the rod end (no incoming oil, valve section in neutral). Oil in the return oil passage unseats the anti-cavitation check valve ball and fills the void in the rod end.

RESTRICTORS
Restrictors are installed in both ports of the swing valve section, the IN port of the boom valve section, and the IN port of the stabilizer section.

The restrictor is a one-way orifice that acts to slow or dampen return oil flow to the valve section. This provides for smooth operation when the boom is lowered or when it is swung from side-to-side. Pressure oil flows around the restrictor and is not affected by the orifice.
NOTE: Model 48 backhoe swing system shown.
# TROUBLESHOOTING

<table>
<thead>
<tr>
<th>Problem or Symptom</th>
<th>Backhoe will not operate</th>
<th>Backhoe loses power</th>
<th>Loss of power in any one cylinder</th>
<th>Loss of power in boom or dipperstick only</th>
<th>Loss of power in swing cylinders only</th>
<th>Cannot obtain full swing</th>
<th>Slow operation</th>
<th>Spongy, jerking operation</th>
<th>Boom, dipperstick or bucket cylinders drop under load when valve is neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low oil level/wrong viscosity/air in system</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No hydraulic pressure</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
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</tr>
<tr>
<td>Improper hose connection</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
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</tr>
<tr>
<td>Excessive back pressure, check for restriction between outlet and reservoir</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System relief valve malfunctioning</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loose or leaking connectors/hoses (see Miscellaneous Sec.)</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
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</tr>
<tr>
<td>Oil bypassing in cylinder</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
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</tr>
<tr>
<td>Hydraulic system malfunction</td>
<td>●</td>
<td>●</td>
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<td></td>
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<td>●</td>
<td>●</td>
<td></td>
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<tr>
<td>Pinched/restricted hydraulic hoses (see Miscellaneous Sec.)</td>
<td>●</td>
<td>●</td>
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<td></td>
<td></td>
<td>●</td>
<td>●</td>
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<tr>
<td>Control not positioned full open</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load check valve leaking</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worn valve section</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit relief valve malfunctioning</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
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<tr>
<td>Anti-cavitation check valve/ball stuck or not seating properly</td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
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</tr>
<tr>
<td>Bent piston rod or swing linkage interference</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine speed too slow</td>
<td>●</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td>●</td>
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<tr>
<td>Foreign material in backhoe valve swing restrictor orifices</td>
<td></td>
<td>●</td>
<td></td>
<td></td>
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<td>●</td>
<td>●</td>
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</tr>
<tr>
<td>Problem or Symptom</td>
<td>Check or Solution</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Load drops or settles</td>
<td>Oil leaking passed spool into spool cap</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spool sticking, can’t be pushed in or won’t return to neutral</td>
<td>Broken return spring</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Work port leakage</td>
<td>Bent spool</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backhoe control valve leaks around spool</td>
<td>Cylinder leaking</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boom cylinder locks up, may raise the first time</td>
<td>Loose/leaking connectors</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Backhoe stabilizers will not hold rear of tractor off ground</td>
<td>Load check valve failure</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Oil leaking from differential housing vent</td>
<td>Worn valve section</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>System is dumping pressure to relief when pushing dirt in hole</td>
<td>Hydraulic oil contaminated</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Paint on spool or scored spool</td>
<td>Misaligned control valve linkage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil leaking passed spool into spool cap</td>
<td>Relief valve cartridge seals bad</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broken return spring</td>
<td>Spool to bore fit too tight</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bent spool</td>
<td>Valve body distorted (improper mounting)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cylinder leaking</td>
<td>Positioner assembly out of alignment due to “bumping” of positioner end</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Loose/leaking connectors</td>
<td>Oil viscosity too heavy</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load check valve failure</td>
<td>Spool and section seal dry (stored too long without use)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worn valve section</td>
<td>Improper assembly after rebuild</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic oil contaminated</td>
<td>Excessive clearance between spool and bore of casting. Spool and casting worn due to heavy use or by contaminants introduced into spool area.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Troubleshooting

<table>
<thead>
<tr>
<th>Problem or Symptom</th>
<th>Load drops or settles</th>
<th>Spool sticking, can’t be pushed in or won’t return to neutral</th>
<th>Work port leakage</th>
<th>Backhoe control valve leaks around spool</th>
<th>Boom cylinder locks up, may raise the first time</th>
<th>Backhoe stabilizers will not hold rear of tractor off ground</th>
<th>Oil leaking from differential housing vent</th>
<th>System is dumping pressure to relief vent when pushing dirt in hole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil viscosity too low caused excessive heat in hydraulic system</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cracked/broken lines between valve cylinder ports and cylinder</td>
<td>●</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Valve spool not properly centered when returned to neutral position</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nose seals or body seals on circuit relief valve damaged</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit relief pressure setting too low</td>
<td>●</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrong spool in bore, free flow or motor spool</td>
<td>●</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excessive pressure at spool seal retainer</td>
<td></td>
<td>●</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Boom valve circuit has O-Ring or internal parts of hydraulic hose wedged in boom valve orifice</td>
<td></td>
<td></td>
<td>●</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Stabilizers are not designed to support the weight of the tractor, use stabilizers to support and level tractor only</td>
<td></td>
<td></td>
<td></td>
<td>●</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Moisture in oil</td>
<td></td>
<td></td>
<td></td>
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<td>●</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heat, drain and replace oil with John Deere low viscosity HY-GARD®, replace filter and clean sump screen</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>●</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boom strength is designed for vertical digging not horizontal swing, if pressure tests are good the backhoe is functioning normally.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>●</td>
<td></td>
</tr>
</tbody>
</table>
DIAGNOSTICS

NOTE: To determine maximum efficiency of each system, the cylinders must be operated to the full extent of their travel and the amount of time it takes to travel from one extreme to the other must be measured and compared to the rated cycle time given in the Specification Section. If the cycle time is more or less than the rated cycle time, a component or components are malfunctioning and in need of repair or adjustment.

Test Conditions:

- Engine running at specified RPM (See page 3-3.)
- Park brake on
- Auxiliary hydraulics on and system capable of operating at full system pressure. (See Tractor specifications)
- Hydraulic oil at normal operating temperature
- Boom and swing locks removed
- Machinery parked on level ground

<table>
<thead>
<tr>
<th>Test/Check Point</th>
<th>Normal</th>
<th>If Not Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Boom up*</td>
<td>Circuit operates smoothly and meets system cycle specification</td>
<td>See main system relief valve test. See circuit relief valve test</td>
</tr>
<tr>
<td>2. Boom down*</td>
<td>Circuit operates smoothly and meets system cycle specification</td>
<td>See main system relief valve test. See circuit relief valve test</td>
</tr>
<tr>
<td>3. Dipperstick in</td>
<td>Circuit operates smoothly and meets system cycle specification</td>
<td>See main system relief valve test. See circuit relief valve test</td>
</tr>
<tr>
<td>4. Dipperstick out</td>
<td>Circuit operates smoothly and meets system cycle specification</td>
<td>See main system relief valve test. See circuit relief valve test</td>
</tr>
<tr>
<td>5. Bucket open</td>
<td>Circuit operates smoothly and meets system cycle specification</td>
<td>See main system relief valve test.</td>
</tr>
<tr>
<td>6. Bucket closed</td>
<td>Circuit operates smoothly and meets system cycle specification</td>
<td>See main system relief valve test.</td>
</tr>
<tr>
<td>7. Swing left to right</td>
<td>Circuit operates smoothly and meets system cycle specification</td>
<td>See main system relief valve test.</td>
</tr>
<tr>
<td>8. Swing right to left</td>
<td>Circuit operates smoothly and meets system cycle specification</td>
<td>See main system relief valve test.</td>
</tr>
<tr>
<td>9. Stabilizer up</td>
<td>Circuit operates smoothly and meets system cycle specification</td>
<td>See main system relief valve test.</td>
</tr>
<tr>
<td>10. Stabilizer down</td>
<td>Circuit operates smoothly and meets system cycle specification</td>
<td>See main system relief valve test.</td>
</tr>
</tbody>
</table>

* Arm extended, bucket in closed position, ground level to full boom extension
CIRCUIT RELIEF VALVE TESTS

¿ CAUTION

To avoid movement of boom and serious injury: Install boom and swing lock pins.

Equipment:
- D01018AA Hydraulic Hand Pump
- JTO70145 Hydraulic Test Gauge 0-20 685 kPa (0–3000 psi)

Procedure:
1. Operate backhoe for 5 to 10 minutes to heat hydraulic oil to operating temperature of 38 – 43°C (100 – 110°F).
2. Safely park the tractor on a level surface. Shut off the engine.
3. Operate all control levers to relieve system pressure.
4. Remove hose from circuit relief valve.
5. Install test hose from a hand pump with a 0–20 685 kPa (0–3000 psi) pressure gauge.
6. Observe gauge as pressure is applied.

Specifications:
47 Backhoe . . . . . . 17 925 ± 690 kPa (2600 ±100 psi)
48 Backhoe . . . . . . 17 925 ± 690 kPa (2600 ±100 psi)

Results:
7. If tests indicate valve relief pressure must be adjusted, add or subtract shims. Shims are available in 1.02 mm (0.04 in.), 0.51 mm (0.02 in.), and 0.254 mm (0.01 in.) sizes.

MAIN SYSTEM RELIEF VALVE TEST

¿ CAUTION

To avoid movement of boom and serious injury: Install boom and swing lock pins.

Equipment:
- JTO70145 Hydraulic Test Gauge 0-20685 kPa (0 – 3000 psi)

Procedure:
1. Operate backhoe for 5 to 10 minutes to heat hydraulic oil to operating temperature of 38 – 43 °C (100 – 110 °F).
2. Operate engine at 1500 rpm.
3. Use a T-fitting to install a 0 – 20 685 kPa (0 – 3000 psi) pressure gauge in test port.
4. Move boom function operating lever to its limit in either direction.
5. Observe gauge as pressure is applied.

Specifications:

<table>
<thead>
<tr>
<th>Backhoe</th>
<th>Minimum Pressure (kPa)</th>
<th>Minimum Pressure (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>15510 [14 80 minimum]</td>
<td>2250 [2100 minimum]</td>
</tr>
<tr>
<td>48</td>
<td>17580 [16 550 minimum]</td>
<td>2550 [2400 minimum]</td>
</tr>
</tbody>
</table>

Results:

6. If tests indicate valve relief pressure must be adjusted, add or subtract shims. Shims are available in 1.02 mm (0.04 in.), 0.51 mm (0.02 in.), and 0.254 mm (0.01 in.) sizes.

### RESTRICTOR INSPECTION

1. Remove inlet and outlet elbows from valve sections.
2. Note location of restrictors in both ports and swing valve section and in port of the boom valve section. Note also that the restrictor is installed with the spring side out.
3. Check for plugged or damaged orifice and missing or damaged spring. Replace as necessary.

<table>
<thead>
<tr>
<th>RESTRICTOR ID</th>
<th>47</th>
<th>48</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boom</td>
<td>1.575 mm (0.062 in.)</td>
<td>1.880 mm (0.074 in.)</td>
</tr>
<tr>
<td>Swing</td>
<td>1.397 mm (0.055 in.)</td>
<td>1.880 mm (0.074 in.)</td>
</tr>
<tr>
<td>Stabilizer</td>
<td>1.575 mm (0.062 in.)</td>
<td>1.880 mm (0.074 in.)</td>
</tr>
</tbody>
</table>
ROCKSHAFT HEIGHT ADJUSTMENT (4200/4300/4400)

Reason:
To ensure that lift arms raise to maximum lift height without engaging relief valve.
This adjustment is made when tractor lift arms do not lift high enough to allow backhoe to be easily secured with L-pins.

Procedure:
1. Position tractor on a level surface and set park brake.
2. Shift transmission to NEUTRAL.
3. Position lift control lever in the full forward (down) position and provide enough weight on lift arms to allow self lowering.
4. Start engine.
5. Move lift control lever to full raise position (back).

6. Using a tape measure, measure from the top of the PTO shield to the center of the pin in end of lift arm. Lift arm should raise to 350 ± 3 mm (13.8 ± 0.12 in.) as shown, without engaging the relief valve.
7. If specification is not met, lengthen the lift arm position feedback rod to increase, or shorten to reduce the maximum height until within specification. The relief valve should not engage.

ROCKSHAFT HEIGHT ADJUSTMENT (4500/4600)

Reason:
To ensure that lift arms raise to maximum lift height without engaging relief valve.
This adjustment is made when tractor lift arms do not lift high enough to allow backhoe to be easily secured with L-pins.

Procedure:
1. Position tractor on a level surface and set park brake.
2. Shift transmission to NEUTRAL position.
3. Position both lift control lever and draft sensing control lever at full forward (down) position and provide enough weight on lift arms to allow self lowering.
4. Start engine.
5. Move lift control lever (outer) to full raise position (back).

6. Using a tape measure hooked into top edge of slot in left PTO shield, measure to center of pin in end.
of lift arm. Lift arm should raise to 450 ± 3 mm (17.7 ± 0.12 in.) as shown, without engaging the relief valve.

7. If specification is not met, shorten the lift arm position feedback rod to increase, or lengthen to reduce the maximum height until within specification. The relief valve should not engage.

---

**REPAIR**

**SYSTEM RELIEF VALVE INSPECTION**

**Procedure:**

1. Remove inlet/outlet housing from valve assembly.
2. Remove relief valve housing and disassemble valve.
3. Check for broken spring or damaged poppet. Replace valve if necessary.
4. Use valve seal kit to replace all seals, washers, and O-Rings.
5. **47 Backhoe:** Install same number and size of shims that were removed to maintain 14 480 – 15 515 kPa (2100 – 2250 psi) relief pressure.
6. **48 Backhoe:** Install same number and size of shims that were removed to maintain 16 550 – 17 580 kPa (2400 – 2550 psi) relief pressure.
7. If tests indicate valve relief pressure must be adjusted, add or subtract shims. Shims are available in 1.02 mm (0.04 in.), 0.51 mm (0.02 in.), and 0.254 mm (0.01 in.) sizes.
SPOOL REMOVAL

Procedure:

NOTE: Spools in the six valve sections are identical. However, each spool MUST be installed in the valve section from which it was removed.

1. Remove cap.

NOTE: Spring is compressed.

2. Hold opposite end of spool and remove screw and lock washer.
3. Remove collar, spring retainers, spring, seal retainer, washer and O-ring.
4. Remove seal plate retainer, seal retainer, washer and O-ring.
5. Carefully slide spool from valve section.

SPOOL ASSEMBLY

Procedure:

1. Thoroughly clean spool in solvent and air dry.
2. Lubricate spool and valve section bore with hydraulic oil. Carefully slide spool into section.
3. Assemble spool components as shown.

NOTE: Replace all washers, backup rings and O-Rings.
LOAD CHECK VALVES INSPECTION

Procedure:

NOTE: All six valve sections are equipped with load check valves.

1. Check poppets, springs and seats for damage. Replace assembly as necessary.
2. Use seal kit to replace O-rings and back-up rings.
3. Tighten to 27 N·m (20 lb-ft).

1. Be sure ball is free in retainer.
2. Reinstall assembly with all new O-rings and back-up rings from seal kit.

ANTI-CAVITATION VALVE INSPECTION

Procedure:

BOOM CIRCUIT RELIEF VALVE INSPECTION

Procedure:

NOTE: Install the same number and size shims that were removed. DO NOT change relief valve setting.

1. Check parts for damage and contaminants. Replace complete assembly if necessary.
2. If not replaced, assemble with all new O-rings and back-up rings.
3. Tighten plug to 19 N·m (168 lb-in.).
4. Check parts for damage and contaminants. Replace complete assembly if necessary.
2. If not replaced, assemble with new O-rings and back-up rings.
3. Tighten plug to 19 N·m (168 lb-in.).
4. Install the same number of shims that were removed. DO NOT change relief valve setting.
ASSEMBLE VALVE HOUSING

Procedure:

IMPORTANT: Two different types of section seals and different configurations for open center and closed center systems are utilized in the control valve. Valves manufactured prior to April 1991 utilize O-rings with a cross section (thickness) of 0.070 in. Valves manufactured after April 1, 1991 utilize O-rings with a cross section of 0.103 in. The dimensions of the seal grooves determines what seal is correct for a particular valve section or cover. Included in the seal kit are both types of seals, therefore several (5), will not be used. New and old style valve sections may be intermixed. However, the proper O-rings will have to be used for each section.

Old version—All Styles

New Version—Open Center

1. Install three long studs through end plate.
2. Continue to stack each valve section in correct order.
3. Be sure that all spool clevises and "A" ports are at the top of the assembly.
4. Install new O-rings between each valve section. Be sure they remain in place when sections are installed.
5. Install inlet/outlet housing. Replace nuts and tighten to 43 N-m (32 lb-ft).
NOTE: Measure ID of restrictor ports to make certain they are within the specifications. (See “RESTRICTOR INSPECTION” on page 14.)

6. Install restrictors into correct valve section ports.  
7. Install connectors in valve section ports.

VALVE LINKAGE INSPECTION

1. Check pivots, tie rod ends, brackets, ball joints, and bushings for excessive wear. Excessive wear can affect operating sensitivity. Replace as necessary.
2. Install linkage on spool clevis ends. Be sure pins with cotter pins, and hardware are in place.
3. Install stabilizer control levers.
**VALVE HOUSING INSTALLATION**

**CAUTION**

Valve housing weighs approximately 27 kg (60 lb); installation may require hoist or more than one person.

1. Attach valve housing at attaching points.
2. Connect RH and LH joystick linkages with hardware.
3. Connect RH and LH stabilizer control rods using pins, washers, and cotter pins.

---

**Port A (upper)**
- A—Bucket (Rod End)
- B—Dipperstick (Head End)
- C—RH Stabilizer (Head End)
- D—LH Stabilizer (Head End)
- E—Boom (Rod End)
- F—Swing*
- G—Outlet

**Port B (lower)**
- H—Bucket (Head End)
- I—Dipperstick (Rod End)
- J—RH Stabilizer (Rod End)
- K—LH Stabilizer (Rod End)
- L—Boom (Head End)
- M—Swing
- N—Inlet

*Model 47—RH Swing Cylinder (Base End)
*Model 48—LH Swing Control (Rod End)

4. Install inlet, outlet, and cylinder hoses to the appropriate connectors.
5. Install valve cover.
6. Install rear shroud.

---

**CYLINDER REMOVAL AND INSTALLATION**

**BOOM CYLINDER**

**Removal:**
1. Position tractor with enough clearance to completely extend the boom, dipperstick and bucket.
2. Lower stabilizers with light pressure on the ground.
3. Fully retract both the bucket and dipperstick cylinders.
4. Lower the boom until it has light pressure on the ground.
5. Remove cylinder pin retaining bolt and cylinder pin (A) on base end of cylinder.
6. Activate the boom control lever to retract the cylinder and slowly draw it out of the boom mast. Do not pinch hoses while retracting the cylinder.
7. Shut the engine off and activate the boom control lever in both directions to relieve any pressure.
8. Mark and remove hoses.
9. Remove cylinder pin retaining bolt and cylinder pin (B) on rod end of cylinder and remove cylinder.

Installation:

1. Connect hoses to the ports as marked.
2. Slide base end of cylinder into boom mast.
3. Align cylinder mounting hole and insert base cylinder pin and retaining capscrew (A).
4. Activate the boom control lever to extend the cylinder slowly out to align the rod end mounting hole.
5. Install the rod end cylinder pin and retaining capscrew (B).

DIPPER CYLINDER

Removal:

1. Lower stabilizers with light pressure on the ground.

2. Shut the engine off and activate the dipperstick control lever in both directions to relieve any pressure.
3. Mark and remove hoses.
4. Remove base end (A) and then the rod end (B) cylinder mounting pins and remove cylinder.

Assemble in reverse order.

BUCKET CYLINDER

Removal:

1. Lower stabilizers with light pressure on the ground.
2. Swing bucket down to where it looks balanced below the dipperstick mast.
3. Shut the engine off and activate the bucket control lever in both directions to relieve any pressure.
4. Mark and remove hoses.
5. Remove rod end (A) and then the base cylinder mounting pins (B) and remove cylinder.

Install in reverse order.

STABILIZER CYLINDER(S)

Removal:
1. Position tractor with enough clearance to completely extend the stabilizers.
2. Lower stabilizers with light pressure on the ground.
3. Shut the engine off and activate the stabilizer control lever in both directions to relieve any pressure.
4. Mark and remove hoses.
5. Remove rod end (A) and then the base cylinder mounting pins (B) and remove cylinder.

Install in reverse order.

SWING CYLINDER(S)

Removal:
1. Position tractor with enough clearance to completely swing the boom extending the cylinder to be removed.
2. Lower stabilizers with light pressure on the ground.
3. Fully extend the swing cylinder to be removed.
4. Shut the engine off and activate the swing control lever in both directions to relieve any pressure.
5. Remove cylinder rod end (A) retaining pin.
6. Mark and remove hoses.
7. Remove base cylinder mounting pin (B) (Model 47) or retaining plate (Model 48) and remove swing cylinder.

Install in reverse order.
1. Replace wear rings, wipers, all seals, O-rings, and backup rings.
2. Inspect rod for straightness, nicks, and scratches.
3. Lubricate all parts in hydraulic oil during assembly.
4. Tighten lock nut to 353 N·m (260 lb-ft).
5. Pressure test at 24 132 kPa (3500 psi) for leakage.
1. Replace wear rings, wipers, all seals, O-rings, and backup rings.
2. Inspect rod for straightness, nicks, and scratches.
3. Lubricate all parts in hydraulic oil during assembly.
4. Tighten lock nut to 271 N-m (200 lb-ft).
5. Pressure test at 20 684 kPa (3000 psi) for leakage.
1. Replace all wipers, seals, O-rings and backup rings.
2. Inspect rod for straightness, nicks, and scratches.
3. Replace retaining ring.
4. Lubricate all parts in hydraulic oil during assembly.
5. Tighten lock nut to **190 N-m (140 lb-ft)**.
1. Replace wipers, seals, O-rings, and backup rings.
2. Inspect rod for straightness, nicks, and scratches.
3. Lubricate all parts in hydraulic fluid during assembly.
4. Tighten lock nut to 271 N-m (200 lb-ft).
5. Pressure test at 20 684 kPa (3000 psi) for leakage.
1. Replace all wear rings, wipers, O-rings, and backup rings.
2. Inspect rod for straightness, nicks, and scratches.
3. Lubricate all parts in hydraulic oil during assembly.
4. Tighten lock nut to **353 N-m (260 lb-ft)**.
5. Pressure test for leakage at **24 132 kPa (3500 psi)**.
1. Replace wipers, O-rings, backup rings, and retaining ring.
2. Inspect rod for straightness, nicks, and scratches.
3. Lubricate all parts with hydraulic fluid during assembly.
4. Tighten lock nut to **353 N-m (260 lb-ft)**.
5. Pressure test for leakage **20 684 kPa (3000 psi)**.
1. Replace all wear rings, wipers, O-rings, and backup rings.
2. Inspect rod for straightness, nicks, and scratches.
3. Lubricate all parts with hydraulic oil during assembly.
4. Tighten lock nut to 353 N•m (260 lb-ft).
5. Pressure test for leakage a 24132 kPa (3500 psi).
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# SPECIFICATIONS

## Mid-Mount Mowers

### 54-Inch Mower

- **Cutting Width**: 137.2 cm (54 in.)
- **Number of Blades**: 3
- **Spindles**: 20 mm (0.75 in.)
- **Weight**: 85 kg (190 lb)
- **Gear Case Grease Volume**: 0.5 L (1 pt)
- **End Play**
  - Input Shaft: 0.0 - 0.06 mm (0.0 - 0.002 in.)
  - Output Shaft: 0.0 - 0.03 mm (0.0 - 0.001 in.)

### 60-Inch Mower

- **Cutting Width**: 152.4 cm (60 in.)
- **Number of Blades**: 3
- **Spindles**: 25.4 mm (1.0 in.)
- **Weight**: 147 kg (325 lb)
- **Gear Case Grease Volume (Mid-mount Mower)**: 240 ml (8 oz)
- **Gear Case Grease Volume (3-point Hitch Mower)**: 0.5 L (1 pt)
- **End Play**
  - Input Shaft: 0.0 - 0.06 mm (0.0 - 0.002 in.)
  - Output Shaft: 0.0 - 0.03 mm (0.0 - 0.001 in.)

### 72-Inch Mower

- **Cutting Width**: 184.9 cm (72.8 in.)
- **Number of Blades**: 3
- **Spindles**: 25.4 mm (1.0 in.)
- **Weight**: 203 kg (448 lb)
- **Gear Case Grease Volume**: 0.5 L (1 pt)
- **End Play**
  - Input Shaft: 0.0 - 0.06 mm (0.0 - 0.002 in.)
  - Output Shaft: 0.0 - 0.03 mm (0.0 - 0.001 in.)

## 3-Point Hitch Rear Mount Mowers

### 261 and 272 Mounting

- **Category 1**

### 261 and 272 PTO Speed

- **540 rpm**

### 261 Mower

- **Cutting Width**: 152 cm (60 in.)
- **Cutting Height**: 51 - 152 mm (2 - 6 in.)
- **Number of Blades**: 3
- **Belt**: B - Section
- **Weight**: 168 kg (370 lb)

### 272 Mower

- **Cutting Width**: 185 cm (72.8 in.)
- **Cutting Height**: 51 - 127 mm (2 - 5 in.)
- **Number of Blades**: 3
- **Belt**: B - Section
- **Weight**: 232 kg (510 lb)
TORQUE SPECIFICATIONS

1/4 In. Diameter Pipe Plugs .......................... 14 - 25 N•m (120 - 216 lb-in.)
Breather (1/8 diameter pipe plugs) .................. 7 - 10 N•m (60 - 90 lb-in.)
Blade Bolt Torque, 54 Inch Deck .................... 57 - 84 N•m (42 - 62 lb-ft)
Blade Bolt Torque 60/72 Inch Deck ................. 102 - 123 N•m (75 - 91 lb-ft)

LUBRICANTS

Gear Case Grease ................................. John Deere GL-5® Gear Oil-SAE 80W-90

OTHER MATERIALS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>592 / TY9375</td>
<td>LOCTITE® F General Purpose Thread Sealant</td>
<td>Seal pipe plugs</td>
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LOCTITE® is a registered trademark of the Loctite Corp.
GEAR CASE

MID MOUNT MOWERS

NOTE: The gear case assemblies for the 4100 CUT mid-mount mowers have no serviceable components. If any component is worn or damaged, replace the gear case assembly.

The gear case assemblies for the 4200-4600 CUT mid-mount mowers have no serviceable internal components. If any component is worn or damaged, replace the gear case assembly.

1. Inspect case for cracks.
2. Inspect shafts for wear and straightness.
3. Check shafts for excessive end play.

MODEL 261 AND 272 MOWERS

Disassembly and Inspection:

NOTE: Gear case may differ slightly from the drawing shown below.

1. Remove the gear case from the mower deck.
2. Inspect the housing for cracks.
3. Remove the cover from the gear case.
4. Inspect cover for wear or damage.
5. Remove the input shaft assembly from the gear case.
6. Inspect the bevel gear for chipped, worn or broken teeth.
7. Inspect shaft for wear and straightness. Check the keyway of the shaft for wear or damage.
8. Remove and inspect the shaft key.
9. Inspect bearings for wear or galling.
10. Remove output seal from gear case.
11. Remove snap ring, bearing, and spacer from output shaft.
12. Remove snap ring from gear case.
13. Remove output shaft from housing.
14. Remove the bearing from the shaft.
15. Inspect shaft for wear and straightness. Inspect the pinion gear for chipped, worn or broken teeth.
16. Inspect bearings for wear or galling.

Assembly:

NOTE: Gear case may differ slightly from procedures shown.

1. Install gear on input shaft end with keyway. Gear teeth should face toward the turned shoulder of shaft.
2. Line up keyways in gear and shaft. Install key from hub side of gear.
3. Install shim, then bearing on shaft so it is seated against turned shoulder of shaft.
4. Install shim on other end of input shaft.
5. Install remaining bearing on shaft.
6. Install shim, bearing and snap ring in output pinion shaft (picture does not show pinion gear).
7. Place bushing on shaft.
8. Install remaining bearing, shim (depending on gear case), and snap ring on shaft. If output shaft uses a nut, tighten until there is no end play 1.1 N•m (10 lb-in.) rolling drag torque.
9. Press bearing cup into cover.
10. Place gasket on cover. Align holes in gasket with holes in cover.

12. Press bearing cup into case (if applicable).

13. Install input shaft assembly in gear case. Secure in place with 8 cap screws. Tighten to 30.8 N·m (22 lb-ft). Endplay should be zero. When zero end play has been attained remove one gasket.


15. Coat lips of a new oil seal with grease. Place a thin coat of permatex or equivalent on outside cage edge of oil seal. Press oil seal into case until flush.

16. Hold one of the shafts so it cannot turn or move.

17. Turn or move the other shaft so backlash on the gear set can be observed. Add or remove gaskets to get proper backlash (shims can also be added or removed).

**IMPORTANT:** 261 series gear case backlash 0.13 - 0.35 mm (0.005 - 0.014 in.) 2.75 in. pin radius; 3.0 in. pin radius, output shaft preload (without oil seal) 1.7 - 5.2 lb-in., input shaft no preload, no end play, max thrust clearance 0.20 mm (0.008 in).

Bearing preload and gear backlash is determined by the quantity of gaskets required between cover and housing and shims (depending on gear case) on the input and output shaft. Gaskets and shims are available from service parts to properly adjust gear set and backlash. After proper adjustment is attained, remove end cap and holder hardware and apply Loctite or equivalent on threads. Reinstall hardware and tighten.

18. Fill case with 0.5 L (1 pint) John Deere GL-5® Gear Oil-SAE 80W-90 or equivalent (Mil-L-2105C) to pipe plug level. Apply LOCTITE® 592 pipe sealant with teflon to plug. Tighten plug to 20 - 24 N·m (180 - 216 lb-in.), and pipe plugs (breather) to 7 - 10 N·m (60 - 90 lb-in.).

19. See power shaft section for additional procedures.

**IMPORTANT:** Vent (breather) must be open. If vent (breather) is closed, oil will be forced out seals causing gear box to leak.

---

**SPINDLES, DRIVE BELTS AND POWERSHAFTS**

**SPINDLES**

**Removal:**

1. Open the latches (A) and remove the belt shields.
2. Loosen belt and remove stop.

3. Remove belt from sheaves.
4. Remove lock nuts and washers (A). Remove lock nuts and cap screws (B). Remove gear box assembly with PTO shaft.

5. Put a block of wood between mower blade and deck.
6. Remove cap screw, washer, blade, and anti-wrap cup (if equipped).

7. Remove nuts and carriage bolts.
8. Remove ring (A). Remove spindle assembly from mower deck.

Installation:
Installation is the reverse of removal.

NOTE: To remove center spindle assembly, the gear box assembly must be removed. Otherwise go to Step 5.

CAUTION
Blades are sharp. When you handle blades, wear gloves, or wrap a shop cloth around blade.
SPINDLES TYPICAL CROSS-SECTION VIEW

- Grease Fitting
- Shaft
- Nut
- Sheave
- Key
- Seal (used on later units)
- Housing
- Upper Bearing
- Snap Ring (2 used)
- Spacer
- Lower Bearing
- Bushing (used on later units)
- Hub
- Blade
- Cap Screw
- Washer
- Snap Ring (used on later units)
Disassembly:

IMPORTANT: The sheave is an interference fit to the shaft in some applications. Use caution during disassembly and assembly to avoid damage to the sheave and/or the spindle. It may be necessary to use a suitable press to remove and install the sheave.

Spindles are all similar, but may differ slightly from procedures shown.

1. Clamp lower hub of spindle assembly in a vise.
2. Remove grease fitting.
3. Remove nut.
4. Loosen sheave. Be careful not to bend flanges.
   NOTE: The 60-inch mower has a two-bladed fan included (not shown).
5. Remove sheave. Remove key (A) and bushing (B).
6. Press shaft from housing.
   NOTE: Lower bearing and spacer may come out with shaft: if they don’t, move the spacer to one side
7. Remove spacer.

8. Remove bearing using a knife-edge puller.

9. Inspect shaft for excessive wear or damage. If shaft or hub is not worn or damaged, it is not necessary to separate.

10. To separate, hold shaft in a soft-jaw vise and remove hub.

11. Use a 1-1/2-in. driver disk to remove upper bearing and seal. Be sure disk does not press on snap ring.

12. Remove snap rings.

13. Clean inside of housing with solvent. Be sure to remove all metal shavings and grit.

14. Check for wear or damage in bearing seating areas; replace, if required.
Assembly:

**IMPORTANT:** Always install new bearings and seals when servicing spindles.

1. Clean threads on shaft and hub using clean and cure primer. Apply thread lock and sealer (medium strength) on threads. Install hub on shaft. Tighten to 163 N-m (120 lb-ft).

2. Install snap rings.

3. Pack both bearings with John Deere Multi-Purpose Grease or equivalent.
4. Turn housing bottom-side up to install lower bearing (sealed on one side only). Be sure bearing seal faces up.
5. Press bearing against snap ring using a 1-15/16 in. disk.
6. Apply John Deere Multi-Purpose Grease or equivalent to area between snap rings.
7. Put spacer against lower bearing. Be sure there is enough grease to hold spacer centered in bore.
8. Turn housing top-side-up to install upper non-sealed bearing. Press bearing against spacer, using the correct size driver. Support both the inner and outer rings of both upper and lower bearings.

9. Put housing bottom-side-up on a press plate with a 1-1/16 in. hole or gap (A) so upper bearing is centered over hole or gap (A).

10. Look inside spindle to be sure spacer aligns with bearings inside housing and hole or gap of press plate, then install hub and shaft assembly. Press shaft through both bearings and spacer until hub stops against lower bearing (B).

11. Turn spindle over to install top seal. Press seal flush with rim of housing, using a 1-7/8 in. OD pipe for a driver.

12. Coat outer surface of bushing with grease before you install it with notch (A) toward bearing.

13. Install key (A). Be sure key (A) is seated to prevent metal shavings from contaminating bearings.

NOTE: The 60-inch mower has a two-bladed fan included (not shown).

15. Hold spindle assembly in a vise by the lower hub to install nut. Tighten nut to **163 N•m (120 lb-ft)**.

16. Turn casting on spindle to check for free spin.

17. Install grease fitting.

18. Fill spindle housing completely with John Deere Multi-Purpose grease or equivalent.

### DRIVE BELTS

#### SERVICING DRIVE BELT 60 AND 72 INCH MOWERS

**NOTE:** Generic belt routing shown, actual routing will be shown on the inside of the belt cover for the mower deck.

**IMPORTANT:** RECORD POSITION OF BELT PRIOR TO REMOVAL. Unusual belt wear can be caused by damaged sheaves or dirt build-up in sheave grooves. Always check for the cause of a damaged belt and repair or replace the defective part. Always replace bent or nicked sheaves before installing a new belt.

**Inspection:**

Inspect the drive belt for the following: wear spots, lumps or swells, and frayed edges.

**NOTE:** If belt is frayed on the edges, it may not require replacement. Trim frayed edges off belt and check performance before replacing it.

**IMPORTANT:** Never use cleaning solvents or belt dressings on belts. Solvents and belt dressings cause deterioration and shorten belt life.

#### Replacement:

1. Remove drive shaft and disconnect lift arms from mower deck.

2. Remove belt covers and loosen idler bumper.
3. Loosen belt and remove stop.
4. Use a pry bar to move lever and release belt tension on sheave.

**CAUTION**

Be careful when removing belt from sheave. If fingers are pinched between sheave and belt, personal injury can result. Idler sheave is under very strong spring tension. Release slowly to prevent personal injury.

5. Remove belt from sheave. Slowly release lever.
6. Remove sheave and gear case assembly.
7. Replace belt.
8. Install gear case assembly. Tighten cap screws to 55 N-m (40 lb-ft).
9. Install belt and spindle sheave. Tighten spindle sheave cap screws to 164 N-m (120 lb-ft).
10. Position belt on sheave as depicted in exploded view. See OPERATORS MANUAL for differences.
11. Adjust bumper to just touch idler lever.

**POWERSHAFTS**

**NOTE:** The power shaft depicted is used on the 272 rotary mower. Actual power shaft may differ from the one depicted.

**Removal:**

1. Remove lock nut and cap screw.
2. Remove power shaft joint from gear case shaft.
3. Slide shield off shaft.
4. Spread ends of nylon bearing and remove from shaft.
5. Slip retaining ring off shaft.
6. Press in on nylon bearing to remove it from shield.

**Disassembly:**

1. Pull the halves of power shaft apart.
2. Pry retaining ring out of groove.
3. Shield
4. Retaining Ring
5. Nylon Bearing

**Power Shaft Joint**

**Cap Screw**

**Nylon Bearing**

**Grease Fitting**

**Retaining Ring**

**Spider Assembly**

**M85016**

**M85017**

**M85018**

**M85019**

**M85020**
7. Remove grease fittings from shaft.
8. Place shaft in a vice. Remove 4 retaining rings from yoke.
9. Drive U-joint out of yoke by using a rubber hammer.

10. Pry retaining ring out of groove.

11. Slide shield off shaft.
12. Spread ends of nylon bearing and remove from shaft.
13. Slide retaining ring off shaft.

14. Remove grease fitting.

15. Remove retaining rings.

Assembly:
Assemble power shaft in reverse order of disassembly.
Lubricate grease fittings every 25 hours with a hand-type grease gun.

IMPORTANT: One or two strokes from the grease gun is sufficient. If fittings are over lubricated, seals will be damaged and dirt will enter bearings causing parts failure.

Installation:
NOTE: Apply Never-Seez lubricant on gear case shaft.
Be sure key is in gear case shaft.

1. Align keyway in power shaft coupler with key in gear case shaft and slide coupler onto shaft.

IMPORTANT: If spring pin is used to secure power shaft it must be safety wired.

2. Install cap screw and lock nut through hole in coupler and shaft.
3. Tighten lock nut to 47 N-m (35 lb-ft).
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SPECIFICATIONS

Chain Free Play .......................................... 10 mm (0.375 in.)
PTO Spring Clutch Adjustment ......................... 28.9 - 29.5 mm (1.137 - 1.161 in.)
Gear Backlash (All Models) .......................... 0.2 - 0.6 mm (0.008 - 0.023 in.)
Chain Case Oil Level (approx) (All Models) ........... 0.85 L (28 oz)
Gear Oil Level (approx) (All Models) .................. 0.40 L (13.5 oz)

TORQUE SPECIFICATIONS

All Models

Chain Adjustment Bolt Jam Nut .......................... 48 N•m (35 lb-ft)
Filler Pipe Plug ........................................... 10 N•m (89 lb-in.)
Gear Case Mounting ....................................... 75 N•m (55 lb-ft)
Idler to Housing Cap Screws ............................. 48 N•m (35 lb-ft)
PTO Clutch Guard ......................................... 12 N•m (106 lb-in.)
Rotor to Spindle Cap Screws ............................. 75 N•m (55 lb-ft)
Tines to Rotor Mounting Plates ......................... 48 N•m (35 lb-ft)

450

Gear Case End Caps and Hub ........................... 48 N•m (35 lb-ft)

550

Jackshaft Tube ........................................... 48 N•m (35 lb-ft)
Shaft Nut - Bevel Gear .................................. 179 N•m (132 lb-ft)
Shaft Nut - Sprocket .................................... 300 N•m (221 lb-ft)

660, 670 and 680

Jackshaft Tube ........................................... 48 N•m (35 lb-ft)
Shaft Nut - Bevel Gear .................................. 260 N•m (192 lb-ft)
Shaft Nut - Sprocket .................................... 300 N•m (221 lb-ft)

LUBRICANTS

Gear Case Grease ................................. John Deere GL-5® Gear Oil-SAE 80W-90

OTHER MATERIALS

<table>
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<tr>
<th>Number</th>
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<th>Use</th>
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<tr>
<td>592 / TY9375</td>
<td>LOCTITE® General Purpose Thread Sealant</td>
<td>Seal pipe plugs</td>
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</tbody>
</table>

LOCTITE® is a registered trademark of the Loctite Corp.
TESTS AND ADJUSTMENTS

450 SIDE DRIVE CHAIN ADJUSTMENT

The side drive chain should be tensioned periodically to compensate for wear.

1. Place the tiller on a hard level surface on the support stand so that the tines are not in contact with the surface.
2. Loosen jam nut (A).
3. Tighten adjustment bolt (B) by hand until tight.
4. Secure PTO input shaft so it cannot turn.
5. Rock rotor tine shaft and measure travel of tine.
6. Loosen bolt (B) until a minimum rotation of tines is "X" + 1/4 in.
7. Release PTO and rotate rotor shaft a minimum of 180 degrees.
8. Repeat steps 3 - 6 two more times. DO NOT tighten bolt if travel is greater than "X" + 1/4 in. on the second or third time through.
9. Hold adjustment bolt in place and tighten jam nut and tighten to 48 N-m (35 lb-ft).

Specification:
Jam Nut .......................... 48 N-m (35 lb-ft)

550, 660, 670 & 680 SIDE DRIVE CHAIN ADJUSTMENT

The side drive chain should be tensioned periodically to compensate for wear.

1. Place the tiller on a hard level surface on its support stand so that tines are not in contact with the surface.
2. Remove the filler plug.
3. Using a screwdriver through the filler hole (A), measure the amount of deflection from the chain.
4. The free movement should be 10 mm (0.375 in.).
5. Tighten or loosen the adjustment bolt (B) until the dimension is obtained.
6. Hold adjustment bolt in place and tighten jam nut (C) to 48 N-m (35 lb-ft).

Specification:
Chain Free Play ................. 10 mm (0.375 in.)
Jam Nut .......................... 48 N-m (35 lb-ft)
550, 660, 670 & 680 PTO CLUTCH ADJUSTMENT

The side drive chain should be tensioned periodically to compensate for wear.

1. Place the tiller on a hard level surface on its support stand so that tines are not in contact with the surface.
2. Remove the PTO shaft from the tiller.
3. Measure the length of the springs (A) on the PTO clutch plate.

4. Adjust each locknut to obtain a measurement of 28.9 - 29.5 mm (1.137 - 1.161 in.).
5. Install PTO shaft.
**REPAIR**

**450 GEAR CASE REMOVAL AND INSTALLATION**

**Removal:**
1. Position the tiller on a level surface. Set support stand.
2. Remove the top cover from the PTO guard.
3. Remove the PTO shaft from the gear box.
4. Remove the PTO guard from the front of the gear box.
5. Remove the four cap screws holding the gear box to the tiller frame (two located on the back of the gear box and two located on the front bottom of the gear box).
6. Pull the gear box away from the jackshaft while lifting out of the mounting brackets.
7. Inspect housing for cracks or leaks.
8. Position the gear box with the output shaft up.
9. Remove the four cap screws holding the output shaft cover to the gear box case.
10. Drain the gear oil.
11. Remove the other eight cap screws holding the other two covers to the gear box case.
12. Using a brass drift punch, inserted into the output shaft spline end, drive the output shaft out of the gear box case.
13. Pull the input shaft out of the front of the gear box case.
15. Inspect gears for chipped, worn or broken teeth.
16. Inspect shafts for wear and straightness.
17. Inspect bearing caps for wear or galling.
18. Inspect end caps for cracks or distortion.
19. Replace parts as required when assembling gear case.
Assembly:

1. Press roller bearing cup into gear case end cap or hub.

2. Press roller bearing on end of input shaft.

3. Insert input shaft into hub the press remaining bearing on shaft, install shims and snap ring, install seal after checking end play and backlash.

4. Press roller bearing on output gear.

**IMPORTANT:** Put a coating of oil or grease on lips of oil seal to prevent damage during installation.

5. Gear case requires shims on both sides of output shaft gear, then bearings are pressed on. Press seals in end caps.

**IMPORTANT:** Bolt torques are for fasteners as supplied lightly oiled or zinc plated. The given values can not be used if fasteners are greased.

6. Install input shaft assembly in gear case.

7. Bolt end cover and gasket to case with four cap screws. Tighten to **48 N-m (35 lb-ft)**.

8. Install shim(s) on input shaft. Install snap ring in gear housing. Gear case bearings should have no end play, no preload. Add or remove shims as necessary.

**IMPORTANT:** Put a coating of oil or grease on lips of oil seal to prevent damage during installation.

9. Install input shaft seal in gear case. Install this seal so that the lip with the spring around it is to the inside.
NOTE: Bearing preload and gear backlash is determined by the thickness of shims required on input shaft. 450 requires shims on output shaft also. Turn shafts and check bearing preload and gear backlash. Gear case bearings should have no end play, no preload. Output shaft (jackshaft) should have a slight preload, less than 0.68 N•m (6.016 lb-in.). There should be a slight drag on the bearings and backlash should not exceed 0.2-0.6 mm (0.008 - 0.023 in.).

10. To check backlash hold the gearbox so it will not move, then place dial indicator 1/2-inch above shaft and turn shaft back and forth.

Installation:
1. Install gearbox and tighten cap screws to 75 N•m (55 lb-ft).
2. Fill gear case to vent hole with John Deere GL-5® Gear Oil-SAE 80W-90 or equivalent.
3. Apply Loctite 592 pipe sealant with teflon to pipe plug. Tighten pipe plug to 10 N•m (89 lb-in.).
4. Grease chain with 3790 molybdenumdisulfate or graphite every 50 hours.

Specification:
Gear Case End Caps and Hub . . . 48 N•m (35 lb-ft)
Gear Case Mounting ............... 75 N•m (55 lb-ft)
Filler Pipe Plug .................... 10 N•m (89 lb-in.)
PTO Clutch Guard ................. 12 N•m (106 lb-in.)
Gear Oil Level (approx) .......... 0.40 L (13.5 oz)
450 PTO CLUTCH

Disassembly:
1. Remove snap ring, back-up ring, lock collar, spring, balls (3) and back-up ring.
2. Tighten nuts on thrust plate until belleville springs are compressed.
3. With a hammer and punch, bend tabs in housing away from belleville springs, remove all parts from housing.

Assembly:
1. Ensure all parts are free of grease and oil. Install friction discs, hub and thrust plate assembly as shown.
2. Using a hammer and punch, bend tabs in to retain the belleville springs, loosen the nuts on the thrust plate assembly to the end of the studs. DO NOT remove nuts.
Apply a small amount of grease to balls to hold them in place while assembling the rest of the components. Install back-up ring, spring, balls (3).
550 GEAR CASE REMOVAL AND INSTALLATION

Removal:
1. Position the tiller on the support stand on a level surface.
2. Remove the PTO shield from the tiller.
3. Remove the PTO shaft from the gear box.
4. Loosen the chain case drain plug. Tip the tiller back so that the drain plug is to the bottom of the chain case cover.
5. Place a shallow drain pan 7.6 cm, (3 in.) under the drain plug and remove the plug and drain gear oil.
6. Remove the chain tightener lock nut and cap screw.
7. When fully drained remove the chain case cover.
8. Wedge a block of wood between the tines and the tiller housing.
9. Remove both the upper and lower chain sprocket retaining nuts.
10. As an assembly, slide the two sprockets and chain off of the jackshaft and rotor shaft.
11. Remove the four cap screws holding the jackshaft housing to the tiller side frame.
12. Tip the tiller back up onto its support stand.
13. Remove the four cap screws holding the gear box to the tiller frame (two located on the back of the gear box and two located on the front of the gear box).
14. Pull the gear box and jackshaft up and away from the tiller.

[Diagram of 550 GEAR CASE REMOVAL AND INSTALLATION]

M78319
15. Drain the gear oil.

Disassembly:

1. Remove snap ring holding output jackshaft into gear case.
2. Pull jackshaft and jackshaft housing out of gear case.
3. Remove O-ring from gear case.
4. Remove the seal from the PTO input shaft.
5. Remove the snap ring, spacer and shim(s) holding the input shaft into the gear case.
6. Remove the input shaft and bearings.
7. Inspect housing for cracks or leaks.
8. Inspect bearings for wear.
9. Inspect gears for chipped, worn or broken teeth.
10. Inspect shafts for wear and straightness.
11. Inspect bearing caps for wear or galling.
12. Inspect end caps for cracks or distortion.
13. Replace parts as required when assembling gear case.

Assembly:

**IMPORTANT**: The gear case contains roller bearing cups that should be pressed into the case. Make sure end bearing cup is inserted first, then input shaft assembly, then remaining bearing cup.

1. Press roller bearing cup into gear case.
2. Press roller bearing on end of input shaft.
3. Slide gear on shaft and press remaining roller bearing on input shaft.

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**Diagram**: Cutaway view inside 550 gear case

**Images**: M78317, M78322, M78329
4. Press roller bearing on output gear.

**IMPORTANT:** Bolt torques are for fasteners as supplied lightly oiled or zinc plated. The given values cannot be used if fasteners are greased.

5. Slide gear assembly on output shaft and secure with shaft nut. Tighten to **179 N-m (132 lb-ft)**.
6. Install seal in jackshaft tube housing (lip towards gear) and insert gear output shaft assembly in output jackshaft tube housing.

7. Install O-rings in gear case of output opening.
8. Install jackshaft output gear assembly into gear case.
9. Install snap ring to hold jackshaft assembly in place.

10. Install input shaft assembly in gear case.
11. Install shim(s) on input shaft. Install spacer and snap ring in gear housing. Gear case bearings should have no end play, no preload. Add or remove shims as necessary. If there is no end play, backlash should be within limits. If end play is measured, gear(s) are worn out of tolerance.

**NOTE:** Bearing preload and gear backlash is determined by the thickness of shims required on input shaft. Gear case bearings should have no end play, no preload. Output shaft (jackshaft) should have a slight preload (less than 0.68 N-m (6.016 lb-in.)). There should be a slight drag on the bearings and backlash should not exceed 0.2-0.6 mm (0.008 - 0.023 in.).
12. To check backlash hold the gearbox so it will not move, then place dial indicator 1/2 inch above shaft and turn shaft back and forth.

**IMPORTANT:** Put a coating of oil or grease on lips of oil seal to prevent damage during installation.

13. Install input shaft seal in gear case (sprung lip towards gear case).

**Installation:**

1. Mount gear case and jackshaft assembly onto tiller frame.
2. Install the four cap screws holding the gear box to the tiller frame and tighten to **75 N•m (55 lb-ft)**.
3. Install the four cap screws holding the jackshaft tube housing to the tiller side frame and tighten to **48 N•m (35 lb-ft)**.
4. As an assembly, install the upper and lower chain sprockets and chain onto the jackshaft and rotor shaft.
5. Install shaft nut, wedge a board between the tines and tiller housing, and tighten to **300 N•m (221 lb-ft)**.
6. Install chain case gasket and cover. Tighten cap screws to **48 N•m (35 lb-ft)**.
7. Fill gear case to vent hole with John Deere GL-5® Gear Oil-SAE 80W-90 or equivalent.
8. Fill chain case with approximately **0.85 L (28 oz)** of John Deere GL-5® Gear Oil-SAE 80W-90 or equivalent.
9. Apply Loctite 592 pipe sealant with teflon to all pipe plugs. Tighten pipe plug to **10 N•m (89 lb-in.)**.

**NOTE:** Oil leakage (mist) from hole in shaft is normal. Hole is a vent for chain case, if excessive, check case oil level for over full. Check gearbox seal for leakage.

**Specification:**

- Gear Case Mounting ........... 75 N•m (55 lb-ft)
- Jackshaft Tube .................. 48 N•m (35 lb-ft)
- Shaft Nut Bevel Gear ............ 179 N•m (132 lb-ft)
- Shaft Nut Sprocket ............... 300 N•m (221 lb-ft)
- Filler Pipe Plug ................ 10 N•m (89 lb-in.)
- PTO Clutch Guard ............... 12 N•m (106 lb-in.)
- Chain Case Oil Level (approx) . 0.85 L (28 oz)
- Gear Oil Level (approx) ........ 0.40 L (13.5 oz)
660, 670 & 680 GEAR CASE REMOVAL AND INSTALLATION

Removal:
1. Position the tiller on the support stand on a level surface. Set support stand.
2. Remove upper 3-point hitch bracket assembly.
3. Remove the PTO shield from the tiller.
4. Remove the PTO shaft from the gear box.
5. Loosen the chain case drain plug. Tip the tiller back so that the drain plug is to the bottom of the chain case cover.
6. Place a shallow drain pan 7.6 cm, (3 in.) under the drain plug. Remove the plug and drain gear oil.
7. Remove the chain tightener lock nut and cap screw.
8. When fully drained remove the chain case cover.
9. Wedge a block of wood between the tines and the tiller housing.
10. Remove both the upper (A) and lower (B) chain sprocket retaining nuts.
11. As an assembly, slide the two sprockets and chain off of the jackshaft and rotor shaft.
12. Remove the six cap screws holding the jackshaft housing to the tiller side frame.
13. Tip the tiller back up onto its support stand.
14. Remove the four cap screws (A) holding the gear box to the tiller frame. There are two located on each side of the gear box.
15. Pull the gear box and jackshaft up and away from the tiller.
16. Drain the gear oil from the gear box.
17. Mark the location of the jackshaft housing tube to the gear box case for assemble later (B).
18. Remove eight cap screws (C) holding output jackshaft into gear case.
19. Pull jackshaft and jackshaft housing out of gear case.
20. Remove the seal from the PTO input shaft.
21. Remove the snap ring and shim(s) holding the input shaft into the gear case.
22. Remove the four cap screws holding the cover, and remove the cover.
23. Using a brass drift punch if needed remove the input shaft and bearings through the rear of the gear box.
24. Inspect housing for cracks or leaks.
25. Inspect bearings for wear.
26. Inspect gears for chipped, worn or broken teeth.
27. Inspect shafts for wear and straightness.
28. Inspect bearing caps for wear or galling.
29. Inspect end caps for cracks or distortion.
30. Replace parts as required when assembling gear case.
Assembly:

1. Press roller bearing on end of input shaft.

2. Slide gear on shaft and press remaining roller bearing on input shaft.

3. Press roller bearing on output gear.

4. Slide gear assembly on output shaft and secure with shaft nut. Tighten to 260 N•m (192 lb-ft).

5. Install input shaft assembly in gear case through the back cover opening.

6. Install shim(s) on input shaft. Install snap ring in gear housing. Gear case bearings should have no end play, no preload. Add or remove shims as necessary. If there is no end play, backlash should be within limits. If end play is measured, gear(s) are worn out of tolerance.

NOTE: Bearing preload and gear backlash is determined by the thickness of shims required on input shaft. Gear case bearings should have no end play, no preload. Output shaft (jackshaft) should have a slight preload (less than 0.68 N•m (6.016 lb-in.)). There should be a slight drag on the bearings and backlash should not exceed 0.2-0.4 mm (0.008 - 0.016 in.).

IMPORTANT: Put a coating of oil or grease on lips of oil seal to prevent damage during installation.

7. Install input shaft seal in gear case (sprung lip towards gear case).

8. Install spacer ring and seal in jackshaft tube housing (lip towards gear) and insert gear output shaft assembly in output jackshaft tube housing.

IMPORTANT: Bolt torques are for fasteners as supplied lightly oiled or zinc plated. The given values can not be used if fasteners are greased.
9. Install jackshaft output gear assembly into gear case.
10. Install eight cap screws holding jackshaft tube assembly to gear box case and tighten to 48 N•m (35 lb-ft).

Installation:
1. Mount gear case and jackshaft assembly onto tiller frame.
2. Install the four cap screws holding the gear box to the tiller frame and tighten to 75 N•m (55 lb-ft).
3. Install the six cap screws holding the jackshaft tube housing to the tiller side frame and tighten to 48 N•m (35 lb-ft).
4. As an assembly, install the upper and lower chain sprockets and chain onto the jackshaft and rotor shaft.
5. Install shaft nuts, wedge a board between the tines and tiller housing, and tighten to 300 N•m (221 lb-ft).
6. Install chain case gasket and cover. Tighten cap screws to 48 N•m (35 lb-ft).
7. Fill gear case to mark on dipstick with John Deere GL-5® Gear Oil-SAE 80W-90 or equivalent.
8. Dipstick should be marked to indicate proper oil level, if not scribe a mark 11.1 mm (0.437 in.) from the end of the dipstick.
9. Fill chain case with approximately 0.85 L (28 oz) of John Deere GL-5® Gear Oil-SAE 80W-90 or equivalent.
10. Apply Loctite 592 pipe sealant with teflon to all pipe plugs. Tighten pipe plug to 10 N•m (89 lb-in.).
11. Install Chain tension cap screw and locknut and adjust, See “ROTOR BEARING REPLACEMENT” on page 17.

NOTE: Oil leakage (mist) from hole in shaft is normal. Hole is a vent for chain case, if excessive, check chain case oil level for over full. Check gearbox seal in jackshaft housing tube for leakage.

Specification:
- Gear Case Mounting ........... 75 N•m (55 lb-ft)
- Jackshaft Tube ................. 48 N•m (35 lb-ft)
- Shaft Nut Bevel Gear .......... 260 N•m (192 lb-ft)
- Shaft Nut Sprocket .......... 300 N•m (221 lb-ft)
- Filler Pipe Plug ............. 10 N•m (89 lb-in.)
- PTO Clutch Guard .......... 12 N•m (106 lb-in.)
- Chain Case Oil Level (approx) . . . . . . 0.85 L (28 oz)
- Gear Oil Level (approx) . . . . . . . . . . .0.40 L (13.5 oz)

ROTOR BEARING REPLACEMENT
1. Tip the tiller on its back so that tines are not in contact with the surface.
2. Wedge a block of wood between the tines and the tiller housing. Remove the four cap screws (A) holding the rotor shaft assembly to the spindle.
3. Remove the four carriage bolts (B) holding the rotor shaft and idler bearing package to the tiller housing.

4. Slide rotor assembly out of tiller housing.

5. Remove the snap rings holding the bearing to the shaft (C) and the bearing into the bearing mount (D).

6. Using a bearing puller, pull the bearing and mounting block off the shaft as an assembly.

7. Press the bearing out of the mounting block.

8. Inspect both the O-ring (E) and the shaft seal (F) for wear or damage.

9. Replace bearing, O-ring, and seal as needed.

10. Assemble the idler bearing package in reverse order.

11. Remove the snap ring (G) holding the bearing in the tiller housing bore.

12. Press the spindle (H) out of the bearing and housing.

13. Press the bearing (I) and seal (J) from the inside out of the housing bore.

14. Inspect both the O-ring (K) and the shaft seal (J) for wear or damage.

15. Replace bearing, O-ring, and seal as needed.

16. Assemble the spindle and bearing package in reverse order.

**Specification:**

- Rotor to Spindle ............... 75 N-m (55 lb-ft)
- Idler to Housing .................. 48 N-m (35 lb-ft)
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SPECIFICATIONS

MODEL 31B POST HOLE DIGGER

Dimensions:
- Drive Type: PTO
- PTO rpm (maximum): 540 rpm
- Auger rpm (maximum): 170 rpm
- Backlash: 0.1 - 0.56 mm (0.004 - 0.022 in.)
- Endplay: none

Capacity:
- Gear Case: 1.9 L (2 qt)
- Boom Hook Lift (maximum): 567 kg (1250 lbs)

TORQUE SPECIFICATIONS

- Auger Blades: 70 N•m (52 lb-ft)
- Auger Point: Hand Tight
- Auger Mounting Collar: 110 N•m (80 lb-ft)
- Yoke to Boom: 240 N•m (175 lb-ft)
- Mounting Pins: 240 N•m (175 lb-ft)
- Leg Storage: 85 N•m (62 lb-ft)
- PTO Setscrew: 17 N•m (156 lb-in.)
- PTO Setscrew Lock Nut: 27 N•m (20 lb-ft)
- PTO Shear Bolt: 17 N•m (156 lb-in.)
- Shield/Input Cover Mounting Cap Screw: 44 N•m (33 lb-ft)
- Support Stand Bracket Mounting Cap Screw: 44 N•m (33 lb-ft)
- Handle Mounting Cap Screw: 25 N•m (216 lb-in.)
- Handle Mounting U-Bolt: 25 N•m (216 lb-in.)
- Gear Case Top Cover: 44 N•m (33 lb-ft)
- Vent Plug: 18 N•m (162 lb-in.)
- Drain Plug: 18 N•m (162 lb-in.)

OTHER MATERIALS

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<tr>
<td>592 / TY9375</td>
<td>LOCTITE® General Purpose Thread Sealant</td>
<td>Seal pipe plugs</td>
</tr>
<tr>
<td></td>
<td>John Deere Corn Head Lubricant NLGI Grade 0</td>
<td>Case lubricant</td>
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</table>

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GEAR CASE INSPECTION

Procedure:
1. Inspect housing for cracks.
2. Inspect bearings for wear.
3. Inspect gears for chipped, worn or broken teeth.
4. Inspect shafts for wear and straightness.
5. Inspect bearing caps for wear or galling.
6. Inspect end caps for cracks or distortion.
7. Replace parts as required when assembling gear case.
GEAR BOX REMOVAL AND INSTALLATION

Removal:

1. Turn the PTO shaft until the shear bolt is aligned with the access hole (A) in the shield and remove the bolt.
2. Turn the PTO shaft until the setscrew is aligned with the access hole in the shield, then loosen the jam nut and remove the setscrew.
3. Remove the PTO shaft.
4. Remove the U-bolt (B) and cap screw (C) holding the guide handle (D) to the support stand bracket (E).
5. Using suitable lifting device, raise the gear box and auger assembly high enough to remove the support stands (F).
6. Pivot the auger (G) outward while lowering the gear box (H) and boom (I) to the ground.
7. Remove the two cap screws (J) securing the auger (G) to the gear box output shaft (K) and slide the auger off of the shaft.
8. Remove the cotter pin (L) from one end of the gear box pivot pin (M).
9. Lift slightly on the boom (I) and remove the gear box pivot pin (M).

**Installation is in reverse order of removal.**

**IMPORTANT:** Never use bolts (J) that protrude from the auger (G) mounting collar. The bolt head and nut are to be recessed to provide a smooth surface.

**IMPORTANT:** Be sure setscrew (N) and jam nut (O) as well as the shear bolt (P) are installed when attaching the PTO shaft to the gear box.

**Specifications:**
- Auger Mounting Collar: 110 N-m (80 lb-ft)
- PTO Setscrew: 17 N-m (156 lb-in.)
- PTO Setscrew Jam Nut: 27 N-m (20 lb-ft)
- PTO Shear Bolt: 17 N-m (156 lb-in.)
- Handle Mounting Cap Screw: 25 N-m (216 lb-in.)
- Handle Mounting U-Bolt: 25 N-m (216 lb-in.)

**GEAR BOX DISASSEMBLY**

1. Clean any dirt or debris from the outside of the gear box. Wash in solvent if needed.
2. Place one of the auger coupler bolts in the hole closest to the gear box case and thread the nut on three to four turns. This will prevent the output shaft assembly from falling out of the gear box case and grease being spilled out of the output shaft bore while pouring the grease out.

**IMPORTANT:** When removing cover, be careful not to damage shims.

3. Remove the six cap screws (A) and lock washers securing the top cover (B) to the case (C).
4. Carefully and evenly pry the cover up and off of the case. Use care not to damage the shim gaskets.
5. Using a suitable container, pour out grease.

6. With the grease removed, remove the bolt from the upper hole in the output shaft.
7. Remove the four cap screws (D) and lock washers securing the support stand bracket (E) to the gear case (C).

8. Pull the output shaft and gear assembly out of the gear case.

9. Remove the four cap screws (F), lock washers, and flat washers that secure the PTO shield (G) and the input shaft cover to the gear case.

10. Carefully and evenly pry the cover and shaft assembly (H) out and away from the case. Use care not to damage the shim gaskets (I).

**IMPORTANT:** When removing cover, be careful not to damage shims.

11. Clean any rust or scale off of the input shaft (J) and push the shaft to the inside and out of the cover.
12. Press the input shaft seal (K) through and out of the cover using a tool that will apply pressure to the outer edges of the seal.

13. If the race is nicked or galled and needs to be replaced, use a small punch and carefully tap the race (L) to the inside and out of the cover.

14. Press the output shaft seal (M) through and out of the gear case using a tool that will apply pressure to the outer edges of the seal.

15. If the race is nicked or galled and needs to be replaced, use a small punch and carefully tap the race to the inside and out of the gear case similar to the method used for the input cover.

16. If the bearing race (L) in the top cover (B) is damaged and needs to be replaced, use a pry bar to lift the race evenly out of the bore.

17. Use care not to damage the shims (O) used to control backlash.
18. Inspect the input shaft gear (P) for broken teeth or wear.
19. Inspect the shaft surface (Q) were the shaft seal rides to be sure there are no nicks or burrs.
20. If the shaft or gear teeth are damaged, replace the input shaft.
21. If the bearings need to be replaced, use a bearing splitter to separate the bearings from the input shaft.

22. Inspect the output shaft gear and bearing assembly for broken teeth or wear.
23. Inspect the shaft surface where the shaft seal rides to be sure there are no nicks or burrs.

24. If the top bearing (U) or gear (R) need to be replaced, support the shoulder (V) of the gear in a press and press the gear and the bearing off the shaft as a set.
25. Support the lower bearing (S) on the shoulder of the bearing and press it off of the shaft.

GEAR BOX ASSEMBLY

Procedure:
1. Press the lower bearing onto the output shaft until firmly seated with the wide end of the taper on the bearing toward the seat.

2. Press the gear (A) and top bearing (B) on to the output shaft (C) until firmly seated with the gear
GEAR BOX ASSEMBLY

3. Press the bearings onto the input pinion shaft (D) until firmly seated.
4. Be sure to place the large bearing (E) on the long shaft end and the small bearing (F) on the short shaft end of the input shaft.

5. Press bearing race (G) into input cover (H) until firmly seated.

6. Press the input shaft seal (I) into the cover (H) until flush with the outer surface.

7. Press a new shaft seal (J) into the gear case (K) until flush to the inside edge of the case.
8. If the bearing race was removed, press the race into the gear case from the inside until firmly seated.

GEAR BOX ASSEMBLY POST HOLE DIGGER

teeth facing down and the wide end of the taper on the bearing toward the gear.
9. Lightly coat the output shaft (L) with grease and slide the output shaft and gear assembly (M) into the gear case (H). Use care not to damage the seal during installation.

10. Install the support stand bracket (N) and secure with the four cap screws and lock washers (O).

11. Tighten the cap screws to **44 N-m (33 lb-ft)**.

12. Lightly coat the input shaft (P) with grease and slide the input shaft and gear assembly (Q) into the cover (H). Use care not to damage the seal during installation.

13. Place the shim gasket(s) (R) on the cover (H) and insert the input shaft assembly into the gear case. Rotate the shaft slightly during installation to align the teeth of the gears.

14. Install the PTO shield (S) over the input shaft cover and secure with the four cap screws, lock washers, and flat washers (T).

15. Using an alternating pattern tighten the cap screws to **44 N-m (33 lb-ft)**.
16. Place the same number and thickness shims (U) in the bore for the race and press the race (V) in until it is firmly seated.

17. Lightly coat the seal surface (W) with grease. Then coat each shim gasket with a light film of grease to help hold it in place and position them on the top cover (X).

18. Set the top cover (X) in place on the gear case (K) and install six cap screws and lock washers (Y).

19. Using an alternating pattern carefully tighten the cap screws to 20 N-m (15 lb-ft).

20. Turn the input shaft back and forth to be sure it is not binding.

21. Using an alternating pattern tighten to a final torque of 44 N-m (33 lb-ft).

22. Hold the gearbox so it will not move, then place dial indicator 1/2 - inch above shaft and turn shaft back and forth. Backlash should be 0.1 - 0.25 mm (0.004 - 0.010 in.). If tolerance is lower, add shims. If tolerance is greater, remove shims as required.

23. Fill case with 1.9 L (2 qt) John Deere Corn Head Lubricant NLGI Grade 0.

24. Apply Loctite 592 pipe sealant with teflon to pipe plug. Tighten pipe plug to 18 N-m (162 lb-in.).

25. Install the gearbox in the reverse order of removal. See “GEAR BOX REMOVAL AND INSTALLATION” on page 5.

### Specifications:
- **Shield/Input Cover**: 44 N-m (33 lb-ft)
- **Gear Case Top Cover**: 44 N-m (33 lb-ft)
- **Vent Plug**: 18 N-m (162 lb-in.)
- **Drain Plug**: 18 N-m (162 lb-in.)
- **Backlash**: 0.1 - 0.25 mm (0.004 - 0.010 in.)
- **Gear Case Grease Capacity**: 1.9 L (2 qt)
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SPECIFICATIONS

Models. ................................................................. 74 and 84

Cutting Widths:
Model 74 Moldboards .................................. 137.2, 152.4 and 167.6 cm (54, 60 and 66 in.)
Model 84 Moldboard .............................................. 213.4 cm (84 in.)

Weight:
54 Inch. .................................................. 206 - 208 kg (206 - 208 lb)
60 Inch. .................................................. 212 - 214 kg (468 - 473 lb)
66 Inch. .................................................. 217 - 219 kg (480 - 485 lb)
84 Inch. .................................................. 328 kg (725 lb)

Blade Height:
Model 74 (without top extension) ......................... 457 mm (18.0 in.)
Model 84 (without top extension) ......................... 501 mm (19.75 in.)

TORQUE SPECIFICATIONS

Lift Cylinder Lock Nut ........................................... 272 N-m (200 lb-ft)

OTHER MATERIALS

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<td>271 / TY9371</td>
<td>LOCTITE® High Strength Thread Sealant</td>
<td>Lift cylinder lock nuts</td>
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<tr>
<td>M79292</td>
<td>MPG-2® Multipurpose EP Grease</td>
<td>Shaft and bearing lubrication</td>
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LOCTITE® is a registered trademark of the Loctite Corp.
REPAIR

74 AND 84 ANGLE CYLINDER
1. Inspect piston rod for straightness.
2. Replace all seals and rod wiper. Lubricate all parts in hydraulic oil before assembly.

74 AND 84 LIFT CYLINDER
1. Inspect piston rod for straightness.
2. Replace all seals, O-rings, backup rings and rod wiper. Lubricate all parts in hydraulic oil before assembly.
Apply Loctite #271 to lock nut and tighten to 272 N-m (200 lb-ft).
3. Pressure test at 20 684 kPa (3000 psi) for leakage.
IMPORTANT: When assembling the gland into the assembly, use care not to cut the O-ring on the groove for the retaining ring.
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SPECIFICATIONS

Models. ................................................... 51-Inch and 26
Dimensions:
  51-Inch Broom Diameter ..................................... 45.7 cm (18 in.)
  51-Inch Broom Clearing Width ................................ 129.5 cm (51 in.)
  Model 26 Broom Diameter .................................. 66.0 cm (26 in.)
  Model 26 Broom Clearing Width .............................. 144.8 cm (57 in.)
Gear Box Backlash ....................................... 0.2 - 0.6 mm (0.008 - 0.023 in.)
Input Shaft Endplay .................................................. zero

TORQUE SPECIFICATIONS

Bearing Flanges ........................................... 15.5 N•m (138 lb-in.)
Bearing Set Screws ...................................... 11.5 N•m (102 lb-in.)
Breather Plug ............................................... 10 N•m (90 lb-in.)
Brush Retainer Plate ......................................... 11.5 N•m (102 lb-in.)
Chain Adjuster Jam Nut ..................................... 15.5 N•m (138 lb-in.)
Chain Case Cover ........................................... 11.5 N•m (102 lb-in.)
Drain Plug ..................................................... 18 N•m (160 lb-in.)
Gear Box Mounting .......................................... 27 N•m (240 lb-in.)
Gear Case Covers ............................................ 24 N•m (216 lb-in.)
Mounting Bracket ........................................... 27 N•m (240 lb-in.)
Pivot Bushing Retainer ...................................... 11.5 N•m (102 lb-in.)
Pivot Roller Cap Screws ..................................... 11.5 N•m (102 lb-in.)
PTO Shear Bolt ................................................ 4.5 N•m (53 lb-in.)
Sprocket Set Screws .......................................... 11.5 N•m (102 lb-in.)
Sprocket Hub Set Screws .................................... 15.5 N•m (138 lb-in.)
Support Stand .................................................. 15.5 N•m (138 lb-in.)

OTHER MATERIALS

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<tr>
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<tr>
<td>592 / TY9375</td>
<td>LOCTITE® General Purpose Thread Sealant</td>
<td>Seal pipe plugs</td>
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<td>M79292</td>
<td>MPG-2® Multipurpose EP Grease</td>
<td>Shaft and bearing lubrication</td>
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<tr>
<td></td>
<td>John Deere GL-5 Oil</td>
<td>Gear box lubricant</td>
</tr>
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LOCTITE® is a registered trademark of the Loctite Corp.
MPG-2® is a registered trademark of DuBois USA.
COMPONENT LOCATION

MOUNTING COMPONENTS – 26 BROOM

- Lift Cylinder Mounting Latch
- Cap Screw
- Hairpin
- Clevis Pin
- Hairpin
- Caster
- Spacer
- Flanged Bearing
- Nylock Nut
- Roller
- Shoulder Bolt
- Lock Washer
- Cap Screw
- Shear Bolt
- Spindle
- Axle Bolt
- Axle Bushing
- Caster
BRUSH ASSEMBLY – 26 BROOM

Key
0.25 x 0.25 x 2.0 in.

Retaining Ring

Drive Shaft Shield

Retaining Ring

Key
0.25 x 0.25 x 1.0 in.

Stand Holder

Bearing

Bearing

Hair Pin

Clevis Pin

Bearing

Bearing

Tapered Hub

Sprocket
11 Tooth

#50 Chain

Idler Slide

Chain Cover

Adjustment Bolt

Retaining Ring

Broom Frame

Drive Shaft

Sprocket
36 Tooth

Pivot Bushing

Bushing Retainer Plate

Spacer Washer

Washer

Bushing Retainer Plate

Hair Pin

Broom Frame

Set Screw

Spacer Washer

Bearing

Chain Guide

Retainer Plate

Bearing Flange

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TESTS AND ADJUSTMENTS

26 DRIVE CHAIN ADJUSTMENT

**Purpose:**
The drive chain should be tensioned periodically to compensate for wear.

**Procedure:**
1. Place the broom on a hard level surface on the support stands so that the bristles are not in contact with the surface.
2. Loosen jam nut (A).
3. Tighten adjustment bolt (B) by hand until tight.
4. Loosen the adjustment bolt 6-8 turns.
5. Hold adjustment bolt in place and tighten jam nut and tighten to 15.5 N·m (138 lb-in.).

**Specification:**
Jam Nut ................... 15.5 N·m (138 lb-in.)

REPAIR

26 GEAR BOX REMOVAL AND INSTALLATION

**Removal:**
1. Position the broom on a level surface. Set support stands.
2. Mark and remove the base end (A) and rod end (B) hydraulic hoses from the swing cylinder (C). Plug the cylinder ports and cap the hose end to prevent dirt from entering the ports.
3. Remove the retaining ring (D) and clevis pin (E) from the base end of the swing cylinder (C).
4. Remove the cotter pins from the upper (F) and lower (G) swing hinge pins.
5. While lifting up on the mounting frame weldment (H) remove the upper and lower swing hinge pins.
6. Slide the mounting frame weldment off of the drive shaft and swing cylinder.

8. Center the pivot box (K) on the pivot tube (L) so that the extension from the ratchet wrench will allow access to the drive shaft shear bolt (M).
9. Remove the shear bolt and slide the drive shaft (N) off of the gear box input shaft.
10. Remove the two pivot retaining bolts (O) and slide the pivot box (K) off of the pivot tube (L).

11. Loosen the chain adjustment bolt (P).
12. Remove the six chain case cover cap screws (Q) and remove the chain case cover (R).

13. Remove the chain tensioner slide block (S).
14. Center the chain connector link (T) on the bottom span between the two gears.
15. Remove the connector link and chain assembly.
16. Remove the retaining ring (U) from the end of the output shaft.
17. Loosen the two set screws (V) and remove the drive sprocket (W), key (X) and spacer washer (Y).

18. Remove the retaining ring (Z) from the gear box end of the output shaft.

19. Using a brass punch, drive the output shaft (AA) out of the gear box.

20. Mark the location (AB) of the sheet metal screw (AC) on both pieces of the output shaft guard for installation later.
21. Remove the sheet metal screw and slide the two pieces together for clearance during removal.

22. Pull the output shaft (AD) completely out of the bearing (AE).
23. Remove the three carriage bolts (AF) holding the bearing flange (AG) and bearing in place.

24. Remove both pivot bushing retainers (AH) and the pivot bushings (AI).
25. Remove the clevis pin holding the broom adjustment weldment to the brush shroud.
26. Remove the caster and pivot tube weldment away from and off of the broom frame.
27. Remove the drain plug (AJ) from the back of the gear box and tip the assembly back and drain the gear oil out of the gear box.
28. Remove the breather plug (AK) from the top of the gear box.
29. Remove the eight cap screws (AL) (four on top and four on the bottom) holding the gear box into the pivot tube weldment.

Installation:
1. Slide the gear box into the pivot tube weldment.
2. Install the eight cap screws (A) and tighten to 27 N-m (240 lb-in.).
3. Position gear box level and refill the gear box with John Deere GL-5 gear oil to drain plug level.
4. Apply Loctite 592 pipe sealant with teflon to the threads and install the drain plug (B) to 18 N-m (160 lb-in.) and the breather (C) to 10 N-m (90 lb-in.).
5. Place the caster and pivot tube weldment into the broom frame.
6. Align the pivot holes and insert the pivot bushings (D).
7. Position the bushing retainers (E) into the bushing grooves (F). Secure with M6 cap screw and tighten to 11.5 N-m (102 lb-in.).
8. Install the broom adjustment weldment and fasten with clevis pin and hair pin.
9. Install the bearing and bearing flange into the broom frame with the bearing sleeve to the inside of the broom frame.
10. Install the three carriage bolts (G) finger tight until after the output shaft (H) is installed in the gear box.

11. Position the output shaft guard (I) in place between the pivot bushing and the outer bearing.

12. Slide the longer machined end of the output shaft (J) into the bearing and through the guard and into the gear box.

13. Insert the output shaft (J) into the gear box until it is through the gear box far enough to clear the retaining ring groove (K).

14. Rotate the shaft until the keyway (L) is aligned and install the 6.35 mm x 6.35 mm x 50.8 mm (0.25 in. x 0.25 in. x 2.0 in.) key into the keyway.

15. Install the retaining ring (M) and then tap the shaft (J) back to the gear box until the retaining ring is lightly seated against the bearing.

16. Using the marks created earlier (N), align the screw hole in the shaft guard and securely install the sheet metal screw (O).

17. Tighten the three nuts (P) for the bearing flange carriage bolts to 15.5 N·m (138 lb-in.).
18. Slide the spacer washer (Q) and drive sprocket (R) onto the shaft.
19. Insert the 6.35 mm x 6.35 mm x 25.4 mm (0.25 in. x 0.25 in. x 1.0 in.) key (S) into the keyway.
20. Install the retaining ring (T) onto the output shaft.

21. Position the sprocket (R) and washer (Q) against the bearing and tighten the set screws (U) to 11.5 N•m (102 lb-in.).

22. Wrap the chain around both sprockets being sure that the teeth are fully engaged.
23. Pull the slack in the chain to the bottom center of the chain and install the chain connector link (V).
24. Position the chain tensioner slide block (W) under the chain and into the inner pivot hole (X).

25. Install the chain case cover (Y). While positioning the chain case cover, guide the outer pivot of the chain tensioner slide block into the pivot hole (Z) in the cover.
26. Tighten the six M6 cap screws (AA) to 11.5 N•m (102 lb-in.).
27. Adjust the chain tension. See “26 DRIVE CHAIN ADJUSTMENT” on page 8.

28. Coat the inner surface (AB) of the pivot box (AC) with a light layer of MOLY HIGH TEMPERATURE EP GREASE.
29. Slide the pivot box (AC) over the pivot tube (AD) and secure with the two shoulder bolt and roller assemblies (AE). Tighten to 11.5 N•m (102 lb-in.).

30. Lightly coat the input shaft (AF) of the gear box with a thin layer of Moly High Temperature EP Grease.

31. Insert the shear bolt (AG) into the drive shaft yoke (AH) until flush on the inside bore.

32. Slide the yoke onto the input shaft of the gear box until the shear bolt is aligned with and will fit through the retaining hole.

33. Install the nylock nut and tighten to 4.5 N•m (53 lb-in.).

34. Install the swing cylinder rod end (AI) and clevis pin (AJ). Secure with retaining ring (AK).

35. Slide the mounting frame weldment (AL) over the drive shaft and swing cylinder.

36. Hold the mounting frame weldment into position and install the upper (AM) and lower (AN) swing hinge pins. Secure with new cotter pins.
37. Install the clevis pin (AO) for the base (AP) of the swing cylinder and secure with retaining ring (AQ).

38. Using the marking created earlier, install the base end hose (AS) and the rod end hose (AT) into the swing cylinder.

Specifications:
- Gear Box Mounting: 27 N·m (240 lb-in.)
- Drain Plug: 18 N·m (160 lb-in.)
- Breather Plug: 10 N·m (90 lb-in.)
- Pivot Bushing Retainer: 11.5 N·m (102 lb-in.)
- Bearing Flanges: 15.5 N·m (138 lb-in.)
- Sprocket Set Screws: 11.5 N·m (102 lb-in.)
- Chain Case Cover: 11.5 N·m (102 lb-in.)
- Pivot Roller Cap Screws: 11.5 N·m (102 lb-in.)
- Shear Bolt: 4.5 N·m (53 lb-in.)

26 GEAR BOX DISASSEMBLY AND ASSEMBLY

Disassembly:
1. Remove the gear box from the broom frame. See “26 GEAR BOX REMOVAL AND INSTALLATION” on page 8.

2. Remove the four cap screws (A) holding the input shaft cover assembly (B) to the gear case.

3. Lift the input shaft cover assembly out of the gear case.
4. Inspect the bevel gear (C) for chipped or damaged teeth.
5. Check the gasket (D) and O-ring (E) for damage.
6. Turn the shaft and check the bearing for smooth operation.
7. If needed, place the cover in a press and press the bearing and shaft assembly out of the cover. Support the cover on the inner casting ridge (F).
and not on the mounting flange. Press carefully on the end of the shaft and press the bearing to the inside of the cover.

8. Remove the inner and outer retaining rings (G) from the input shaft and press the input shaft out of the bearing. Support the bearing by the inner race while pressing the shaft out.
9. Remove the four cap screws holding the right side output shaft cover to the gear case.
10. Pull cover off of gear case.

11. Inspect the shaft seal (H), O-ring (I), gasket (J), and bearing race (K) for damage. Replace as needed.

12. Pull the cross shaft and bearing assemble (L) out of the gear case.
13. Inspect the bevel gear for chipped or damaged teeth.
14. Turn the shaft and check the bearing for smooth operation.
15. Check the bearing race (M) in the cover for nicks or scoring.

16. Using a bearing splitter to support the bearings (N), press the shaft out of the bearing.
17. When replacing the bearings, press new bearing onto the output shaft until firmly seated against the bearing seat.

Assembly:

IMPORTANT: Put a coating of oil or grease on lips of oil seal and O-rings to prevent damage during installation.

18. Install the output shaft (A) into the gear case until the oil seal is properly around the shaft and the bearing is firmly seated into the bearing race (B).
19. Install gasket shim(s) (C) and O-ring (D) on both output shaft covers. Gear case bearings should have no end play, no preload. Add or remove shims as necessary. If there is no end play, backlash should be within limits.

20. Install the four cap screws on each cover and tighten to 24 N·m (216 lb-in.)

21. Press the bearing into the input shaft cover until it is firmly seated against the bearing shoulder.

22. Press the input shaft into the bearing until it is firmly seated against the shoulder and install the retaining rings (E).

23. Install the gasket shim(s) (F) and O-ring (G) on the input shaft cover.

24. Install the input shaft cover assembly. While installing the cover assembly it may be necessary to turn the input shaft so that the gears will properly mesh and allow the cover to be fully seated.

25. Install the four cap screws and tighten to 24 N·m (216 lb-in.)

26. Check the input shaft for end play and backlash.

**NOTE:** Bearing preload and gear backlash is determined by the thickness of shims required on the covers. Gear case bearings should have no end play, no preload. There should be a slight drag on the bearings and backlash should not exceed 0.2-0.6 mm (0.008 - 0.023 in.).

27. To check backlash hold the gearbox so it will not move, then place dial indicator 1/2 inch above shaft and turn shaft back and forth.

**IMPORTANT:** Put a coating of oil or grease on lips of oil seal to prevent damage during installation.

28. Install input shaft seal in gear case (sprung lip towards gear case).

29. Install the gear box into the broom pivot and caster frame weldment. See “26 GEAR BOX REMOVAL AND INSTALLATION” on page 8.

**Specification:**

- Backlash: 0.2 - 0.6 mm (0.008 - 0.023 in.)
- Endplay: zero
- Gear Case Covers: 24 N·m (216 lb-in.)
BRUSH BEARING REPLACEMENT

Disassembly:

1. Place the broom on a hard level surface on the support stands (A) so that the bristles are not in contact with the surface.
2. Loosen the chain adjustment bolt (B).
3. Remove the six chain case cover M6 cap screws (C) and remove the chain case cover (D).
4. Remove the chain tensioner slide block (E).
5. Center the chain connector link (F) on the bottom span between the two gears.
6. Remove the connector link and chain assembly.
7. Remove the retaining ring (G) and two set screws (H) holding the brush sprocket (I) to the sprocket hub (J).
8. Screw one of the set screws into the separator hole (K) on the sprocket (I) and sprocket hub (J). This will push the sprocket off of the sprocket hub.

9. Place a block under the frame on the chain side of the broom to support the broom frame when the support stand is removed.

10. Remove the two carriage bolt (L) mounting the support stand (M) to the frame.

11. Remove the three carriage bolts (N) holding the chain side broom bearing and mounting flange to the frame.

12. Loosen the two set screws securing (O) the bearing to the broom shaft.

13. On the idler side of the broom, loosen the two set screws (P) holding the broom shaft to the bearing.

14. Remove the two carriage bolts (Q) holding the bearing assembly to the frame.
15. Lift the drive side of the broom out of the frame and remove the bearing and bearing flanges.

Assembly:

1. Install the idler side bearing and bearing flanges (A) finger tight.
2. Insert the idler end of the broom shaft into the idler side bearing and slide through until it contacts the shaft shoulder.
3. Install the drive side bearing and bearing flange assembly (B) with the bearing collar (C) toward the brushes (D).
4. Lift the broom weldment and bearing package into the frame and install the three bearing flange carriage bolts (E) and tighten to **15.5 N-m (138 lb-in.)**.
5. Slide the broom assembly so that it is tight against the drive side bearing (F) and tighten the two set screws (G) to **11.5 N-m (102 lb-in.)**.
6. Tighten the carriage bolts on the idler side bearing flange to **15.5 N-m (138 lb-in.)**.
7. Center the idler side shaft in the bearing and tighten the idler side set screws to **11.5 N-m (102 lb-in.)**.
8. Install the drive side support stand (H) and tighten the two carriage bolts (I) to **15.5 N-m (138 lb-in.)**.
9. Slide the spacer washer (J), sprocket (K) and sprocket hub (L) onto the broom shaft.
10. Align the keyway slots (M) and install the key.
11. With the sprocket hub pushed tight against the bearing, install the retaining ring (N) and set screws (O).
12. The set screws will pull the sprocket (K) onto the sprocket hub (L). While the sprocket is pulling tighter onto the sprocket hub, the sprocket hub is also being tightened around the shaft.
13. Wrap the chain around both sprockets being sure that the teeth are fully engaged.
14. Pull the slack in the chain to the bottom center of the chain and install the chain connector link (P).
15. Position the chain tensioner slide block (Q) under the chain and into the inner pivot hole (R).
16. Install the chain case cover (S). While positioning the chain case cover, guide the outer pivot of the chain tensioner slide block into the pivot (T) hole in the cover.
17. Tighten the six M6 cap screws (U) to **11.5 N-m (102 lb-in.)**.
18. Adjust the chain tension. See “26 DRIVE CHAIN ADJUSTMENT” on page 8.

**Specifications:**
- **Brush Retainer Plate** . . . . . . . . 11.5 N-m (102 lb-in.)
- **Bearing Flanges** . . . . . . . . . . 15.5 N-m (138 lb-in.)
- **Sprocket Set Screws** . . . . . . . . 11.5 N-m (102 lb-in.)
- **Support Stand** . . . . . . . . . . 15.5 N-m (138 lb-in.)
- **Sprocket Hub Set Screws** . . . . . . 15.5 N-m (138 lb-in.)
- **Chain Case Cover** . . . . . . . . . . 11.5 N-m (102 lb-in.)
26 PTO MOUNTING BRACKET
DISASSEMBLY AND ASSEMBLY

Disassembly:

1. Pull the locking collar (A) back and hold while sliding the PTO drive shaft (B) off of the front mount transfer shaft (C).

2. Place a locating mark (D) on the tractor frame and mounting bracket for alignments during installation.

3. Support the front mounting bracket (E) and remove the four cap screws (F) securing the mounting bracket to the tractor frame and remove the mounting bracket.

4. Loosen the set screw (G) on each bearing lock collar. Twist the bearing lock collar about a quarter turn and slide to the middle of the shaft.

5. Remove the transfer shaft (H) from the bearings. Use a plastic or rawhide mallet or brass punch if needed to drive the transfer shaft out of the bearings.

6. Remove the six, (three for each bearing) bearing mounting flange cap screws (I) and remove the bearings.

7. Inspect the bearings for smooth operation and replace as needed.

Assembly:

1. Install each bearing and mounting flange assembly (A) into the mounting bracket (B) with the bearing collar (C) to the inside of the bracket.

2. Install the six mounting cap screws (D) finger tight only.
3. As the transfer shaft is being installed, position each bearing lock collar (E) on the shaft so that the lock shoulder (F) will fit over the bearing collar (C).

4. Using a straight edge (G), install the transfer shaft (H) until the machined edge (I) is flush with the outside surface (J) of the back of the mounting bracket (B).

5. Hold the transfer shaft (B) in place and slide the bearing lock collar (E) over the bearing collar. You may need to rotate the lock collar until it will slide over the bearing collar.

6. With the lock collar over the bearing collar, rotate the lock collar about a quarter turn until it has wedged tight over the bearing collar.

7. Tighten the set screw (K) to 11.5 N-m (102 lb-in.).

8. Repeat steps 5 - 7 for the other bearing.

9. With the transfer shaft installed and locked into place, center the bearings within the mounting bracket bore and tighten the six bearing flange mounting cap screws to 15.5 N-m (138 lb-in.).
10. Position the mounting bracket (L) into the frame so that the location mark (M) is aligned.

11. Install the four mounting cap screws (N) and tighten to 27 N•m (240 lb-in.).

12. Pull back and hold the locking collar (O) while sliding the PTO drive shaft (P) onto the transfer shaft (Q).

Specifications:

- Bearing Set Screws ............. 11.5 N•m (102 lb-in.)
- Bearing Flanges ................. 15.5 N•m (138 lb-in.)
- Mounting Bracket ............... 27 N•m (240 lb-in.)
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SPECIFICATIONS

Models ................................................................. 47 and 59
Dimensions:
  47 and 59 Auger ..................................................... 40.6 cm (16 in.)
Input Shaft End Play (maximum) ............................. 0.076 mm (0.003 in.)
Blower Case Shaft
  End Play .......................................................... 0.025 - 0.15 mm (0.001 - 0.006 in.)
  Backlash ......................................................... 0.15 - 0.4 mm (0.006 - 0.016 in.)
Gear Box and Blower Case Grease Capacity
  59 ................................................................. 0.4 L (13.5 oz)
Weight:
  47 ................................................................. 110 kg (240 lb)
  59 ................................................................. 201 kg (450 lb)

TORQUE SPECIFICATIONS

Blower Gear Case Half
  Socket Head Cap Screws ........................................... 26 N•m (228 lb-in.)
  Cap Screws .......................................................... 41 N•m (34 lb-ft)
Gear Box Cover Cap Screws ................................. 20 - 24 N•m (180 - 216 lb-in.)
Gear Case Mounting Cap Screws .............................. 47.5 N•m (35 lb-ft)
Pipe Plug .......................................................... 18 N•m (160 lb-in.)

LUBRICANTS

Gear Case Grease .................................................. John Deere GL-5® Gear Oil-SAE 80W-90

OTHER MATERIALS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Use</th>
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<tr>
<td>592 / TY9375</td>
<td>LOCTITE® General Purpose Thread Sealant</td>
<td>Seal pipe plugs</td>
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<tr>
<td>M79292</td>
<td>MPG-2® Multipurpose EP Grease</td>
<td>Shaft and bearing lubrication</td>
</tr>
<tr>
<td></td>
<td>John Deere GL-5® Gear Oil-SAE 80W-90</td>
<td>Fill gear case</td>
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LOCTITE® is a registered trademark of the Loctite Corp.
MPG-2® is a registered trademark of DuBois USA.
COMPONENT LOCATION

47 CHUTE CONTROL

[Diagram of component locations with labels for each part, including Shield, Screw, Washer, Lock Nut, Cap Screw, Bracket, Idler, Spacer, Elbow Fitting, O-Ring, Union Fitting, Cap, Hose, Internal Half Coupling, Hydraulic Cylinder, Cap Screw, Bracket, Washer, Lock Nut, Shield, Washer, Lock Nut, Washer, and Cap Screw.]

MX0559
REPAIR

47 GEAR CASE

Inspection:
1. Inspect housing for cracks.
2. Inspect bearings for wear.
3. Inspect gears for chipped, worn or broken teeth.
4. Inspect shafts for wear and straightness.
5. Inspect bearing caps for wear or galling.
6. Inspect end caps for cracks or distortion.
7. Replace parts as required when assembling gear case.

59 GEAR CASE

Inspection:
1. Inspect housing for cracks.
2. Inspect bearings for wear.
3. Inspect gears for chipped, worn or broken teeth.
4. Inspect shafts for wear and straightness.
5. Inspect bearing caps for wear or galling.
6. Inspect end caps for cracks or distortion.
7. Replace parts as required when assembling gear case.
59 GEAR CASE
59 GEAR ASSEMBLY:

1. Install snap rings.

2. Press bearing cups into case until they bottom out against snap rings.

3. Press oil seals into case until they are flush with flat surface of case.

4. Place key in input shaft. Align slot in worm gear with key and tap into place with soft faced hammer.

5. Install retaining ring with D-05327ST retaining ring pliers.

6. Press bearing on plain end of input shaft until bottomed on retaining ring.

7. Clean burrs off shaft and install bearing.

8. Put bearing cup over bearing (plain end).

9. Press bearing cup into case until press plate bottoms against input shaft. Remove press plate and use thin wall pipe with large enough diameter.

IMPORTANT: Do not press on bearing cage.
to clear bearing. Press bearing cup until below snap ring groove.

10. Install snap ring with snap ring pliers.
11. Turn input shaft to seat bearings in cups. Push and pull input shaft to check for excessive end play. Use a dial indicator to measure end play. Maximum end play is 0.076 mm (0.003 in.). If end play exceeds this tolerance remove snap ring and install shim under snap rings.

12. Press cap in case until flush with surface.
13. Put bearing cup in case.

14. Install retaining ring in groove on output shaft with JDT-1 retaining ring pliers.
15. Put key in shaft and slide gear over key.
16. Grease an oil seal and insert shaft through case and oil seal.

17. Turn input shaft and set gear teeth in worm gear.

18. Press bearing cup into cover far enough to install retaining ring.
19. Install snap ring.
20. Press new seal into cover until flush with end

21. Install bearing on shaft.
22. Install new gasket.
23. Slip cover over shaft.

24. Secure cover with four cap screws. Tighten to 20-24 N·m (180-216 lb-in.).
25. Add 0.4 L (13.5 oz) of John Deere GL-5® Gear Oil-SAE 80W-90.
26. Apply loctite 592 pipe sealant with teflon to pipe plugs. Tighten pipe plugs to 18 N·m (160 lb-in.).
59 MAIN GEAR CASE INSPECTION

1. Inspect housing for cracks.
2. Inspect bearings for wear.
3. Inspect gears for chipped, worn or broken teeth.
4. Inspect shafts for wear and straightness.
5. Inspect bearing caps for wear or galling.
6. Inspect end caps for cracks or distortion.
7. Replace parts as required when assembling gear case.
Assembly:

1. Clean sealing adhesive off both gear case halves before assembly. Wash parts in cleaning solvent and dry them.

2. Press bearing cups far enough into each case half so snap rings can be installed.

3. Install snap rings in slot behind cups in each case half. Invert case half and press bearing cup tight against snap ring.

**NOTE:** Some gear cases may have a shim under snap ring. If a shim was removed on disassembly, reinstall it to maintain correct end play.

4. Press oil seals into each case half.

5. Apply RTV sealant around outside edge of each cap. Press cap into each case half.

6. Press bearing on short end of small gear input shaft until bearing bottoms against gear shoulder. Do not press against bearing cage.

7. Press bearing on long end of small gear input shaft.

8. Press bearing on short end of large gear shaft until bottomed against gear.

9. Press bearing on long end of large gear shaft until bottomed against gear.
10. Put gear shaft and bearing assemblies in case half.
11. Apply RTV sealant evenly around sealing surface of each case half.
12. Put gear case halves together and install two socket head screws and cap screws. Tighten socket head screws to 26 N•m (228 lb-in.). Tighten cap screws to 41 N•m (34 lb-ft).
13. Check input and output shaft end play. End play should be 0.025 - 0.15 mm (0.001 - 0.006 in.).
14. If necessary disassemble gear case and add or remove shims to get correct end play.

**IMPORTANT:** Backlash is 0.15 - 0.4 mm (0.006 - 0.016 in.), rolling drag torque 1.736 - 8.68 lb-in. Backlash is adjusted by added or removing shims.

15. When end play and backlash are within limits, fill gear case with 0.4 L (13.5 oz) of John Deere GL-5® Gear Oil.
16. Apply loctite 592 pipe sealant with teflon to pipe plugs. Torque pipe plugs to 18 N•m (160 lb-in.).
17. Reinstall gear case and power shaft (make sure key is installed in gear case shaft). Install cap screw and elastic lock nut (no specified torque).
18. Tighten main gear case to snowblower housing bolts to 47.5 N•m (35 lb-ft).
ROTAR AND FAN REMOVAL AND INSTALLATION

Procedure:
1. Remove rotor assembly

2. Remove cap screws and lock washers securing support to worm gear case.

3. Remove three flanged bolts securing rotor to each side of housing.
4. Remove rotor by pulling and lifting it forward out of housing.
5. Remove bearings, shear coupling and flighting.

7. Remove cotter pin and drilled pin.

8. Remove shear bolt and coupling.

9. Slide or pull flighting off drive shaft.

10. Replace fan or coupling plate and reinstall assembly.

11. Tighten nut on cap screw securing fan coupling to gear case shaft.

12. Replace flighting bearings.

13. Remove bearing with a slide hammer puller on each end of flighting.

14. Press new bearing flush to end of flighting shaft.
FAN OR COUPLER REPLACEMENT

Procedure:
1. Remove rotor from housing. See (Remove Rotor Assembly).

2. Remove cap screw and pull fan assembly off gear case shaft. Be careful not to lose key in shaft.

3. Remove three cap screws and lock washers securing fan to coupling plate. Remove fan from coupling plate.

ROTOR ASSEMBLY INSTALLATION

Procedure:
1. Install shear coupling and shear bolt. Tighten nut on shear bolt only enough to draw couplings together. Do not overtighten nut.

2. Install drilled pin and cotter pin. Spread ends of cotter pin.

3. Install locking collar and bearing and flange assembly.

4. Put rotor assembly in support slot. Install cap screws and lock washers. Leave cap screws loose until final assembly.
5. Install spacer between housing and flange assembly.
6. Install three carriage bolts, lock washers and nuts. Leave nuts loose on bolts on one end of rotor until other assembly is installed on other end of rotor. Then tighten nuts on bolts on both assemblies.
7. Tighten locking collar onto bearing. Then tighten set screw in locking collar.
8. Tighten cap screws installed in Step 4.

**ROTOR BEARING REPLACEMENT**

**Procedure:**

1. Remove rotor from housing.

2. Loosen set screw in locking collar. Loosen locking collar by tapping it counterclockwise with a punch and hammer.


4. Turn locking collar on bearing. Tighten locking collar by tapping it clockwise with a hammer and punch.

5. Tighten set screw in locking collar.
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**HOSES & FITTINGS**

**SELECTING HOSES**
The following chart will help you to select the proper hose for any pressure application. Find the size of the hose you need and read across to the system working pressure nearest your application. If you find it in column 1, use a single braid hose. If in column 2, use a double wire braid hose, or in column 3 use a spiral wire hose.

<table>
<thead>
<tr>
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<th>1 Single wire braid</th>
<th>2 Double wire braid</th>
<th>3 Spiral wire</th>
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<tr>
<td>1/4”</td>
<td>3000 psi</td>
<td>5000 psi</td>
<td>~</td>
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<tr>
<td>3/8”</td>
<td>2250 psi</td>
<td>4000 psi</td>
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<td>1750 psi</td>
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<td>500 psi</td>
<td>1250 psi</td>
<td>3000 psi</td>
</tr>
<tr>
<td>2”</td>
<td>350 psi</td>
<td>1125 psi</td>
<td>2500 psi</td>
</tr>
</tbody>
</table>

NOTE: Small diameter hoses are capable of handling higher pressures than large diameter hoses of the same construction.

**HOSE FAILURES**
When hoses fail prematurely, look for: cracking or splitting, pin hole leaks, improper hose length, rubbing, heat, twisting, wrong hose selection, wrong fittings, or improper routing.

CRACKING OR SPLITTING of the outer cover is common and does not always mean the hose is ruined. The depth of the break is what is important. This should be watched for regularly on high-pressure circuits.

PIN HOLE LEAKS are often hard to detect. But a small leak can add up over a period of time, and can also create fire and skin puncture hazards (see Safety Section).

IMPROPER HOSE LENGTH can mean that a short hose is stretched under pressure or a too long one is exposed to hazards from moving parts. Either way the hose is likely to be damaged.

RUBBING wears out hose covers, weakens the reinforcement layers and so wears out the hose prematurely. Clamp, use hose guards, or bracket hoses so that they won’t rub.

HEAT from engine exhaust system and radiator can damage hoses. Be sure all hoses are routed away from hot parts or at least are bracketed against contact, and shielded against radiated heat.

TWISTING can restrict the flow of oil and also damage the hose. Bending or flexing is part of hose design; twisting is not. The most common cause of twisting happens when one end of the hose is improperly connected to a moving part. To correct this, clamp the hose at the point where it starts twisting, dividing the motion of the hoses into two planes. If some twisting cannot be avoided, allow as much free hose as possible. When connecting a hose, hold it to avoid twisting as you tighten the end fittings.

WRONG HOSE SELECTION happens when hoses are used that are of the wrong size or pressure rating. See the chart on SELECTING HOSES in this section. Remember, Don’t Economize! Selecting the wrong hose can cause many of the failures listed above.

WRONG FITTINGS occur when replacements are not matched to the hoses in size and style.

COLLAPSED SUCTION HOSE is another type of breakdown, seemingly simple. But it is possible that the inner layer of rubber of the suction hose will, when it starts to deteriorate, collapse inward, completely sealing off flow, without showing any outer signs of collapse. A noisy pump, lack of pressure, “spongy” action, or no action at all are indications of a collapsed suction tube.

INNER LINING FAILURE of a pressure hose can result in the same symptoms as a collapsed suction hose. The inner lining can become torn and fill up like a balloon inside the hose from the pressurized fluid. This condition can completely seal off the fluid from hydraulic motors, cylinders etc.

IMPROPER ROUTING is the No. 1 cause of hose failure. Included here are twisting and abrasion, but also sharp bends, hoses that are too long or too short, use of too many fittings, and wrong-way connections. Since there are so many possible causes, care must be taken to find the right remedy to this problem. Study the examples of correct and incorrect hose routing on the following page.
HOSE ROUTING

- Avoid Taut Hose
- Avoid Twisting
- Avoid Heat
- Avoid Loops
- Avoid Rubbing
- Avoid Sharp Bends
Use the above examples to identify and correct improperly installed hoses.
# 4000 SERIES CUT’S ATTACHMENTS

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