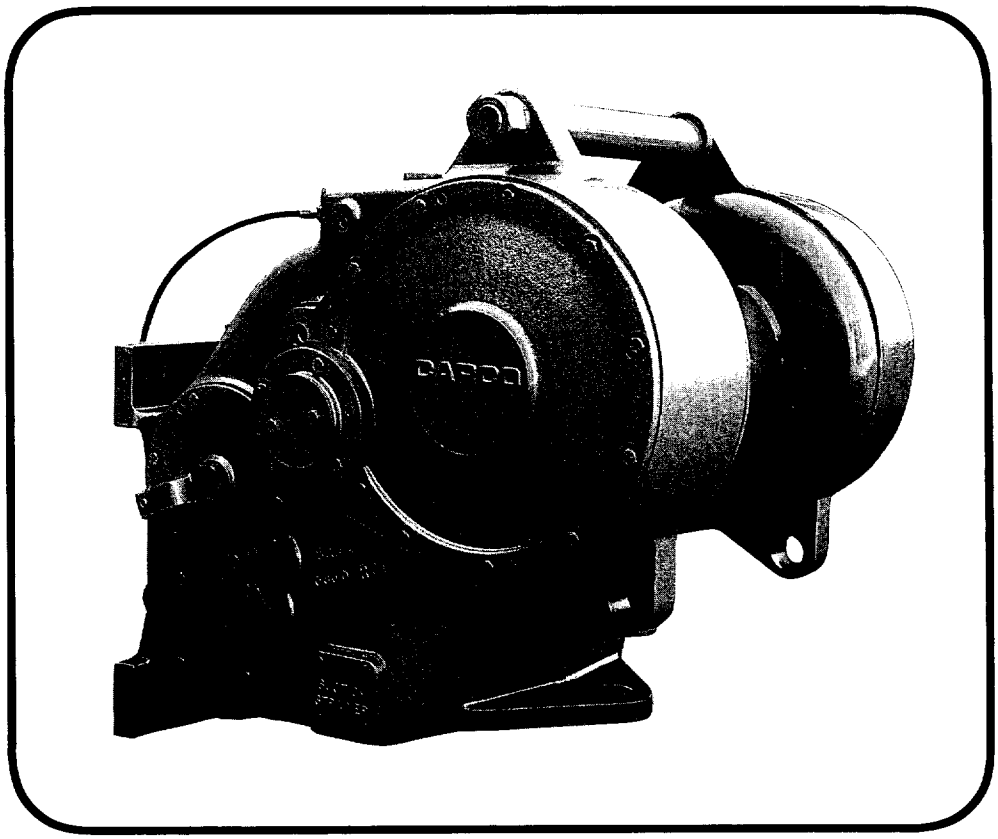
CARCO®

MODELS 50A & 70
50B & 70A
SERVICE MANUAL



PACCAR WINCH DIVISIONS

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11/96
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FOREWORD

Please read and understand this entire manual BEFORE operating or servicing your CARCO winch. Retain this manual for future reference.

This manual contains instructions for the service and repair of CARCO Models 50A & 70 and 50B & 70A power shift winches. When instructions apply to only one series of winch, the specific model number (i.e. 50A & 70 only) will appear at the beginning of the pertinent text. If not identified in this manner, the text applies to BOTH series of winches; 50A & 70 and 50B & 70A.

Some illustrations in this manual may show details or attachments which may be different from your winch. Also, some components may have been removed for illustrative purposes.

Continuing product improvement may cause changes in your winch which may not be included in this manual. Whenever a question arises regarding your CARCO winch or this manual, please contact your nearest CARCO dealer or the CARCO SERVICE DEPARTMENT at 1-918-251-8511, Monday – Friday, 0800 hrs – 1630 hrs CST or by FAX at 1-918-258-4822. Provide the complete winch MODEL NUMBER and SERIAL NUMBER when making inquiries.

TABLE OF CONTENTS

Safety and informational callouts used in this manual include:

⚠ WARNING

WARNING — This emblem is used to warn against hazards and unsafe practice which COULD result in severe personal injury or death if proper procedures are not followed.

⚠ CAUTION

CAUTION — This emblem is used to warn against potential or unsafe practices which COULD result in personal injury, and product or property damage if proper procedures are not followed.

GENERAL SAFETY RECOMMENDATIONS

Safety for operators and ground personnel is of prime concern. Always take the necessary precautions to ensure safety to others as well as yourself. To ensure safety, the tractor and winch must be operated with care, and concern by the operator for the equipment and a thorough knowledge of the machine's performance capabilities. The following recommendations are offered as a general safety guide. Local rules and regulations will also apply.

⚠ WARNING

FAILURE TO OBEY THE FOLLOWING SAFETY RECOMMENDATIONS MAY RESULT IN PROPERTY DAMAGE, INJURY OR DEATH.

1. Read all warning tag information and become familiar with all controls BEFORE operating winch.
2. Never attempt to clean, oil or perform any maintenance on a machine with the engine running, unless instructed to do so in this manual.
3. Before starting tractor, be certain all controls move freely and are placed in the "Brake-On" (neutral) position.
4. Never operate winch controls unless you are properly seated at the operators station on the tractor and you are sure personnel are clear of work area.
5. Match winch line speeds to job conditions.
6. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
7. Never attempt to handle winch cable when the hook end is not free. Keep all parts of body and clothing clear of cable rollers, cable entry area of fairleads and winch drum.
8. Leather gloves should be used when handling winch cable.
9. Ground personnel should stay in view of tractor operator and clear of winch drum. Do not allow ground personnel near winch line under tension. A safe distance of at least 1½ times the length of the cable in use should be maintained. Never allow anyone to stand under a suspended load.
10. When winding winch cable on the winch drum, never attempt to maintain tension by allowing winch cable to slip through hands. Always use "hand-over-hand" technique, being careful to keep hands and clothing away from winch drum and fairlead rollers.
11. Use correct size ferrule for cable and pocket in winch drum. Never use knots to secure or attach cable.
12. Inspect winch cable, rigging, winch and tractor at the beginning of each work shift. Defects should be corrected immediately.
13. Position tractor for straightest line of pull. Use fairlead if side pulls are frequently encountered.
14. The cable anchor or ferrule pocket in the cable drum is designed to provide a self release in the event a back-sliding load must be released from the tractor in an emergency situation. The cable anchor or ferrule alone will **NOT** support rated linepull. Therefore, a minimum of five (5) complete wraps of cable must be maintained on winch drum.
15. Be sure of tractor ground stability before winching in load.
16. Store unused chokers, slings and rigging in a neat and orderly fashion to prevent damage to equipment or injury to personnel.
17. CARCO Power Shift (PS) winch model numbers indicate the unit's maximum rated bare drum line pull in thousands of pounds:
    Model 50A & 50B = 50,000 lbf (222.4 kN)
    Model 70 & 70A = 70,000 lbf (311.4 kN)
    For Power Shift Contractor (PSC) winches with slow speed gear sets, the bare drum line pull is higher. Do not operate winch under loads that exceed the maximum rated bare drum line pull. If excessive loads are encountered, use a multi-part line and sheave blocks. Any attempt to exceed the capabilities of one winch (such as coupling 2 or more tractors together) is extremely hazardous.
18. The factory approved adaptions for CARCO winches are designed and intended for use on specific models of crawler tractors. Changing winches between tractors is not possible in some cases because of differences in tractor models. Some changes cannot be approved by CARCO because of safety limitations. Call a CARCO dealer or the Factory prior to attempting winch modifications or before mounting on a different tractor. Use only GENUINE CARCO parts. Do not use parts from other winch manufacturers on your CARCO winch. Do not use CARCO parts on winches from other manufacturers.
19. CARCO power shift winches are equipped with hydraulic accumulators. Discharge accumulator stored oil supply before removing any hydraulic lines or fittings or servicing winch. Personal injury may result from the sudden release of oil pressure. To discharge the accumulator, stop the engine, slowly cycle the Power Shift control handle into full Haul-In then Pay-Out positions a minimum of five (5) times.
20. On machines having hydraulically, mechanically

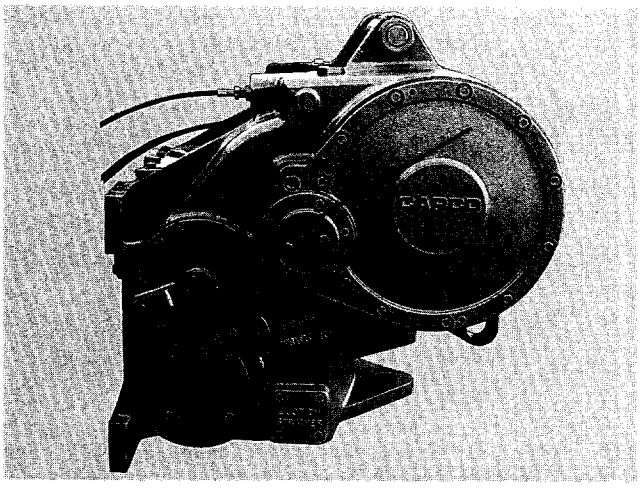
and/or cable controlled equipment, be certain the equipment is either lowered to the ground or blocked securely before servicing, adjusting and/or repairing the winch. Always apply tractor parking brakes and lower equipment before dismounting the tractor.

21. The winches described herein are neither designed nor intended for use or application to equipment used in the lifting or moving of persons.
22. Install guarding to prevent personnel from getting any part of body or clothing caught at a point where the cable is wrapped onto the drum or drawn through fairlead guide rollers.
23. Avoid sudden "shock" loads or attempting to "jerk" load free. This type of operation may cause heavy loads in excess of rated capacity, which may result in failure of cable and winch.
24. Keep equipment in good operating condition. Perform scheduled servicing and adjustments listed in the "Preventive Maintenance" section of this manual. Use recommended lubricants.
25. An equipment warm-up procedure is recommended for all start-ups and essential at ambient temperatures below +40°F (5°C). Refer to "Warm-Up Procedure" listed in the "Preventive Maintenance" section of this manual.

MODEL DESCRIPTION

The CARCO Power Shift Winch is a single drum unit which mounts on the rear of a crawler tractor. It is driven by engine power through the tractor PTO (Power Take-Off). The winch may be operated independently or with the tractor transmission engaged. When operated properly, it is capable of utilizing maximum engine horsepower. The winch has equal speed gearing, power-in and power-out, using multiple-disc oil actuated friction clutches and a spring applied hydraulically released multiple-disc oil brake.

The winch may be manufactured as a Standard PTO or Low PTO configuration, depending on tractor application. In the Standard PTO configuration, the bevel gear group, clutch and brake components are located in the upper bores of the winch case.



50B, 3-Shaft, Standard PTO Shown

The Low PTO winch design has the bevel gear group, clutch and brake components located in the lower bores of the winch case.

The Model 50A & 70 and 50B & 70A may have either a 3-shaft or 4-shaft gear train configuration depending upon the tractor horsepower, PTO speed and line speed requirements of the winch application.

Standard and Low PTO configurations are available as either a PS or PSC. The standard Power Shift (PS) Winch is primarily used in logging, land clearing and general utility applications. The PS Model has gear ratios which match the cable drum rotation in Haul-In (forward) to reverse track speeds for optimum advantage in tractor recovery.

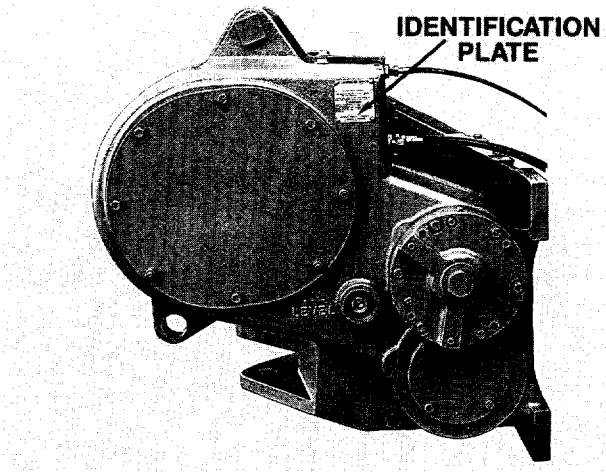
The Power Shift Contractor (PSC) Model is similar to the PS but uses slow speed gearing and the Manual Override (MOR) brake for greater load control. The PSC is well suited to oil and gas field, mining and pipeline applications.

Optional features increase the winches ability to meet specific application requirements. Options available for the 50A & 70 and 50B & 70A series winches include:

- — Free Spool
- — Gear Ratios
- — Three or Four Roller Fairleads
- — PSC Package (includes Manual Override (MOR) Brake System and Slow Speed Gear Ratio)

The winch model number is an important reference as to what optional components were used when the winch was manufactured. The winch identification plate is

located on the right hand side of the winch case. The serial number is also stamped into the upper right hand mounting pad.



The winch model number contains the following configuration data:

On current 50B and 70A models, the PSC package is no longer offered. Optional gear ratios and Manual Override (MOR) Brake System are still available separately.

MODEL

C 0 0 0 0 0

- **50 A & 70 50B & 70A PS or PSC**
- Bevel Gear Ratio
  - A–1:1
  - B–1.27:1
  - C–1.64:1
  - D–2.11:1
  - E–2.79:1
- 0–Overwind
  1–Underwind
- 0–Standard Brake
  1–Manual Override (MOR) Brake
- 0–Without Free Spool
  1–With Free Spool
- 0–Four shaft winch
  1–Three shaft winch
- 0–no fairlead
  3–Three roller fairlead
  4–Four roller fairlead

Important: Always refer to the serial number and model number when requesting information or service parts.

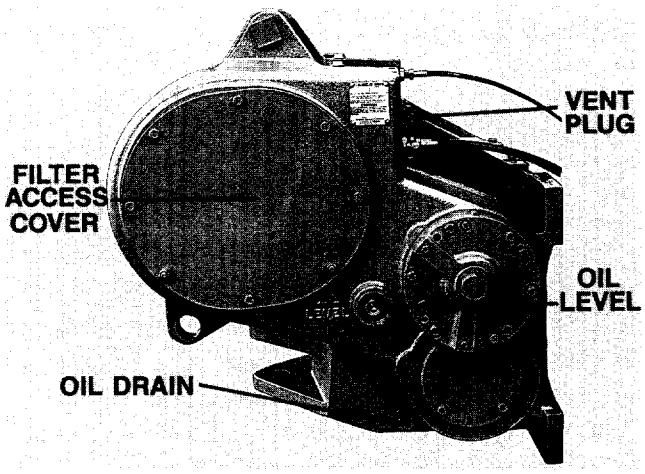
PREVENTIVE MAINTENANCE & SPECIFICATIONS

A regular program of preventive maintenance for your CARCO winch will minimize the need for emergency servicing and promote long product life and trouble-free service.

The service intervals suggested in this manual will optimize component service life. The intervals may be gradually increased or decreased with experience of a particular lubricant and evaluation of your application.

⚠ WARNING

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil pressure. To discharge the accumulator, stop engine, slowly cycle Power Shift control handle into full Haul-In then Pay-Out positions a minimum of five (5) times.

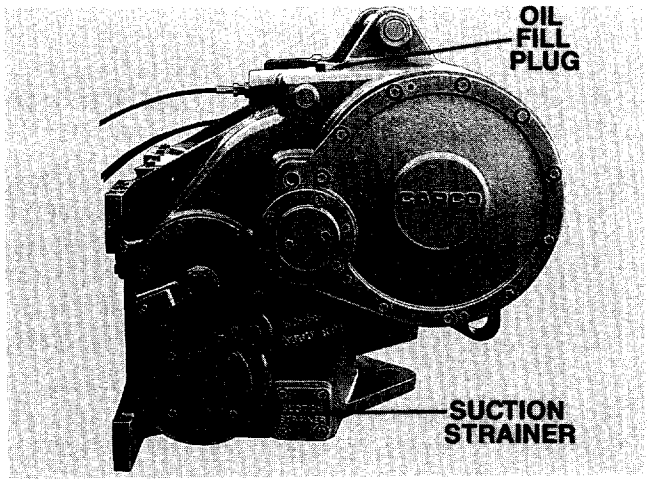


70A Shown

1. Oil Level

Check oil level at the beginning of each work shift, with

tractor and winch in level position. Oil must be visible in the upper half of the sight gauge. If an oil level plug is used in place of the sight gauge, the oil level should be at the bottom of the level plug hole. Add oil as required through the fill plug at top of winch case.



50B Shown

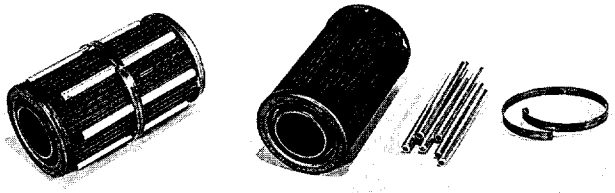
2. Oil Change, Filter and Strainer Service

Under normal operating conditions, the oil and pressure circuit filter should be changed and suction strainer cleaned after the first 100-250 hours of operation, then every 1000 hours or six months, whichever occurs first, or when the filter bypass indicator light remains on after initial warm up.

⚠ WARNING

Hot oil may cause injury. Make certain oil has cooled to a safe temperature before servicing.

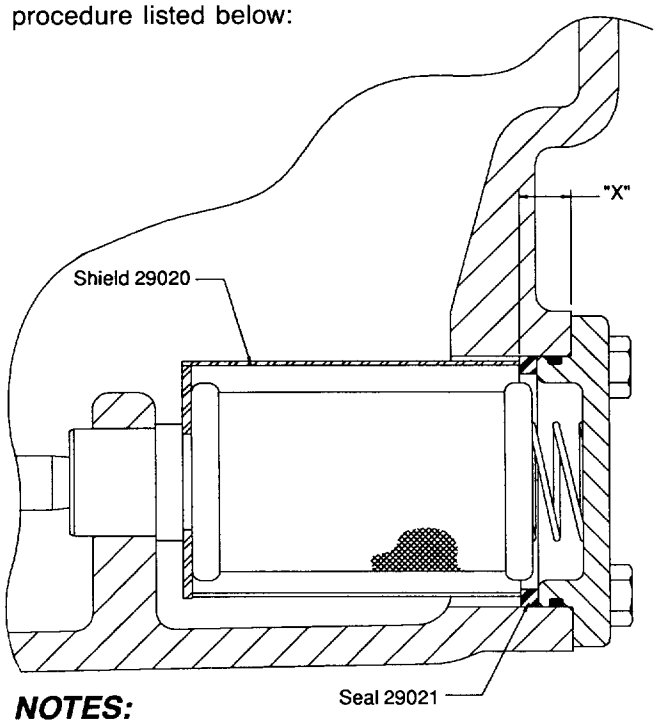
To drain oil, place tractor and winch in level position and remove drain plug located at lower right hand side of winch case. Drain oil into a suitable container and recycle or dispose of used oil in an environmentally responsible manner. Install plug securely after oil has been drained. After oil has drained, remove four suction strainer cover capscrews and cover. Remove suction strainer from winch case then remove metal band and magnetic rods from suction strainer. Thoroughly wash strainer in clean safety solvent and blow dry with compressed air, inspect wire mesh for damage or clogging with debris. Do not reuse a damaged suction strainer.



Install magnetic rods onto suction strainer using metal band. Lubricate o-ring and install strainer spring and cover into winch case.

All 50B/70A winches serial number 9101599 and up are equipped with a suction strainer shield which reduces the potental for pump cavitation when operating on extremely steep slopes. The suction strainer shield may be installed on earlier serial number winches. Refer to CARCO Service Bulletin 97.

If the suction strainer shield or shield seal rings are removed for any reason, reinstall them by following the procedure listed below:



NOTES:

1. Install shield, Part Number 29020, between connector and strainer as shown, with open side facing downward.
2. Measure distance "X", from shield to strainer cover mounting surface.
3. If "X" dimension is between 0.720 in. and 0.783 in. (18.3 - 19.9 mm), add one seal, 29023, outboard of seal 29021.
4. If "X" dimension is greater than 0.783 in. (19.9 mm), add two seals, 29023, outboard of seal 29021.

   Seal 29021 is .25 in. (6.4 mm) thick.
   Seal 29023 is .06 in. (1.5 mm) thick.

Refill winch to proper level with recommended oil.

⚠ CAUTION

To prevent serious damage to winch, do not run engine while oil is drained from winch.

Winches adapted to Komatsu power shift tractors are equipped with an adapter gear box (drop box) assembly. Later units are lubricated with a captive supply of 90 wt. gear oil which should be drained through a plug

found at the bottom of the housing. Refill gear box to the oil level plug found approximately 1/3 of the housing length from the bottom with 90 wt. gear oil which meets API specification GL5 or MIL-L-2105C.

Service the gear box vent plug as described below.

The pressure filter is located behind the right hand, eight-bolt access cover. Remove the cover, locate the spin-on pressure filter and remove the filter element with a strap wrench.

Lubricate the filter gasket and adapter threads with winch oil and install new filter element onto filter head. Tighten 1/2–3/4 turn after seal ring makes contact with filter head.

Start tractor and operate engine at low idle. Correct any leaks.

The filter bypass indicator light may come on for a short time during initial cold start-up but should go out as the oil warms up. If the light stays on, this indicates a restricted filter element, sending unit stuck in the bypass position or accidentally grounded sending unit wire.

3. Control Cable and Pressure Adjustment

While the access cover is removed, it is advisable to check control cable adjustment and hydraulic main relief pressure. Place the Power Shift control lever in the center "Brake-On" (neutral) position. Install the yoke pins into the cable yokes/control valve spools and secure with hitch pins. The yoke pins should slip easily into the bores without any binding. The control valve spools are spring centered. If you notice any binding, turn the cable adjusters in or out until you obtain a "free pin" condition.

Make certain accumulator stored oil supply has been discharged as described earlier. Install an accurate 0-600 psi (0-4137 kPa) gauge onto the — 4 J.I.C. gauge port next to the control cables. Start tractor and operate engine at approximately 800-1000 RPM until pressure stabilizes. Maximum pressure during "charging" mode should peak at 400 psi (2758 kPa). Pressure will slowly fall back approximately 15-20% from the relief setting then quickly return to 400 psi (2758 kPa) when the valve cycles.

If adjustment is required, locate the adjustment screw hole behind port "P" of the control valve. With a 1/4 in. Allen key, loosen the outer lock screw. Insert a 3/16 in. Allen key through the lock screw and turn the adjusting screw clockwise to increase peak pressure; counterclockwise to decrease peak pressure. Tighten the lockscrew.

TIP: It may be helpful to place the controls in Brake-Off to use some oil in the control circuit and cause the valve to slowly "cycle" so that peak pressure may be more easily observed.

Stop engine, discharge accumulator stored oil supply as described earlier and move hydraulic gauge to the "B" test port on the brake housing. A 1/4 in. NPT adapter will be required.

Start tractor and operate engine at approximately 800-1000 RPM. Place Power Shift lever in the Brake-Off position and observe BRAKE-RELEASE oil pressure. Loosen cable adjuster or cable yoke jam-nut and adjust brake control cable to achieve approximately 300 PSI BRAKE-RELEASE pressure.

Stand away from service access of winch and return Power Shift lever to the BRAKE-ON (neutral) position. BRAKE RELEASE pressure must return to 0 with the controls in BRAKE-ON (neutral) position.

TIP: Optimum BRAKE-RELEASE pressure is the highest pressure you can achieve while ensuring pressure ALWAYS drops to 0 when controls are returned to BRAKE-ON. Excessive heat and accelerated brake and hydraulic component wear will result if BRAKE-RELEASE pressure does not return to 0.

With controls in Brake-On (neutral) remove gauge from "B" port and securely install plug into brake housing.

Model 50A & 70 winches were originally equipped with a nitrogen gas charged accumulator which should be checked at this time.

Discharge accumulator stored oil supply as described earlier. Remove pressure filter element to gain access to accumulator. Install gauge assembly to accumulator and observe pressure. Recharge unit to 190-210 psi (1310-1448 kPa) with dry nitrogen. If the accumulator will not hold a gas charge, then the unit should be replaced by the spring/piston type accumulator. Order kit P/N 62138, reference Carco Service Bulletin 95. The spring/piston accumulator requires no periodic service.

Reinstall the filter element as described earlier.

Install access cover plate and tighten eight 1/2 in. capscrews/nuts to 75 lb•ft (102 N•m) torque.

4. Vent Plug

The vent plug is located in the top of a fill plug on Model 50A & 70 winches built from mid 1988 until early 1990. The vent is located next to the power shift control cables on earlier 50A & 70 and all 50B & 70A model winches. It is very important to keep this vent clean and unobstructed. Whenever the oil is changed, remove vent plug, clean in safety solvent and reinstall. Do not replace with a solid plug.

5. PTO Shaft

Winches adapted to J.I. Case, John Deere and Komatsu powershift tractors are driven by a long, automotive-type drive line PTO shaft.

The PTO shaft u-joints, slip-joint, flanges and fasteners must be inspected, tightened and lubricated as required at least once every three months or 500 tractor hours, whichever occurs first.

Inadequate PTO shaft maintenance may result in the accelerated wear of the adapter gear box components.

SPECIFICATIONS

Unit Weight w/o oil, cable or specific tractor adapters . . . . . 50A & 70 1900 lb (862 kg)
. . . . . 50B & 70A 1960 lb (885 kg)

Gear Ratio Available

3-Shaft Gear Train

Bevel Gear Ratio	1.00:1	1.27:1	1.64:1	2.11:1	2.78:1
Overall Ratio	22.3:1	28.3:1	36.6:1	47.0:1	62.2:1

4-Shaft Gear Train

Bevel Gear Ratio	1.00:1	1.27:1	1.64:1	2.11:1	2.78:1
Overall Ratio	40.4:1	51.4:1	66.3:1	85.3:1	112.8:1

Multiply above overall ratios by 1.29 for the adapter gear box used on Komatsu Power Shift tractors.

Cable Drum Dimensions

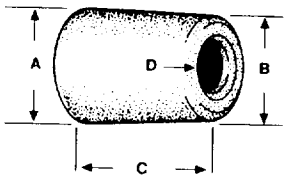
- Barrel Diameter . . . . . 10 in. (254 mm)
- Flange Diameter . . . . . 19⅞ in. (504 mm)
- Barrel Length . . . . . 13 in. (330 mm)
- Throat Clearance . . . . . approx. 9 in. (229 mm)

Cable Storage Capacity

- ⅝ in. (16 mm) . . . . . 580 ft (177 m)
- ¾ in. (19 mm) . . . . . 400 ft (122 m)
- ⅞ in. (22 mm) . . . . . 290 ft (88 m)
- 1 in. (24 mm) . . . . . 220 ft (67 m)

Cable Ferrule Part Number

- ¾ in. (19 mm) 29424
- ⅞ in. (22 mm) 29425
- 1 in. (24 mm) 29426



A — 2 3/16 in. (56 mm)
B — 2 1/32 in. (52 mm)
C — 2⅝ in. (67 mm)
D — To match cable dia.

Hydraulic System

	50A & 70	50B & 70A
Oil Capacity		
Standard PTO	83 qt (78.5 L)	78 qt (74 L)
Low PTO	71 qt (67 L)	66 qt (63 L)
Differential Unloading Value Cut-out Pressure	390-410 psi (2689-2827 kPa)	
Accumulator Nitrogen Charge-50A & 70 Only	190-210 psi (1310-1448 kPa)	
Typical Operating Oil Temperature	Up To Ambient Plus 80°F (26.7°C)	
Adapter Gear Box Oil Capacity — Komatsu Adaptions Only		
50A & 70	2 qt (1.9 L)	90 wt. API-GL5 Gear Oil
50B & 70A	1.8 qt (1.7 L)	90 wt. API-GL5 Gear Oil

RECOMMENDED FASTENER TORQUE

The general purpose torque shown in the chart applies to SAE Grade 5 bolts, studs and standard steel full, thick and high nuts.

Higher or lower torques for special applications will be specified such as the use of spanner nuts, nuts on shaft ends, jam nuts and where distortion of parts or gaskets is critical.

Lubricated Torque values based on use of SAE 30wt engine oil applied to threads and face of bolt or nut.

Avoid using thread lubricants as the applied torque may vary by 10-40% depending upon product used.

BOLT DIA. INCHES	THD PER INCH	TORQUE LB-FT. (N•m) DRY	LUBED
¼	20 28	9 (12)	6 (8)
5/16	18 24	18 (24)	13 (18)
⅜	16 24	31 (42)	23 (31)
7/16	14 20	50 (68)	37 (50)
½	13 20	75 (102)	55 (75)
9/16	12 18	110 (149)	80 (109)
⅝	11 18	150 (203)	115 (156)

BOLT DIA. INCHES	THD PER INCH	TORQUE LB-FT. (N•m) DRY	LUBED
¾	10 16	265 (359)	200 (271)
⅞	9 14	420 (569)	325 (441)
1	8 14	640 (868)	485 (658)
1⅛	7 12	790 (1071)	590 (800)
1¼	7 12	1110 (1505)	835 (1132)
1⅜	6 12	1460 (1980)	1095 (1485)
1½	6 12	1940 (2630)	1455 (1973)

To convert lb. ft. to kg•m, multiply lb. ft. value by 0.1383.

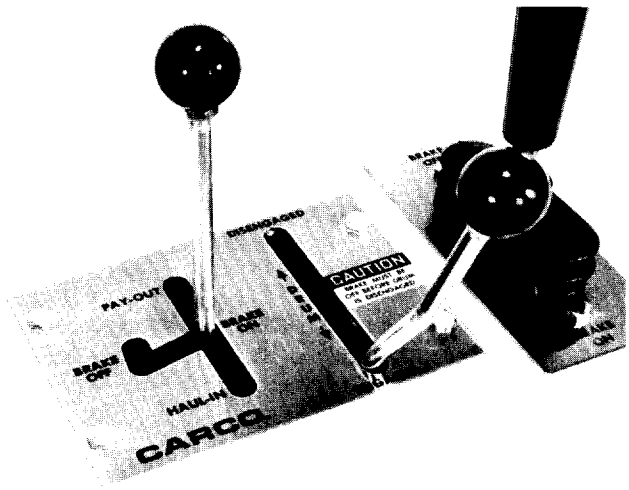
BASIC WINCH OPERATION AND TROUBLE-SHOOTING

HYDRAULIC SYSTEM

The winch contains an independent, internal hydraulic system. The winch housing serves as a reservoir and stores filtered oil for the internally mounted hydraulic pump. The pump is driven by a gear pressed onto the bevel pinion gear. The pump supplies oil whenever the PTO shaft is turning. Oil from the pump is routed through a pressure filter then directed to the control valve where a stand-by system pressure is maintained at 320-410 psi (2206-2827 kPa).

The system oil pressure is routed through the control valve body to the Directional and Brake control cartridges. Movement of the Directional control spool opens passages which direct oil to apply the Haul-In (forward) or Pay-Out (reverse) clutches and release the spring applied multi-disc oil brake.

Movement of the Brake spool will direct oil to release the brake only. The movement of the spools responds to the position of the operators Power Shift control lever by means of flexible control cables.



Winch controls with optional Free Spool and Manual Override (MOR) brake control levers.

The winch hydraulic system is equipped with an accumulator. The accumulator stores a small amount of oil at system pressure to assist the application of the clutches and release of the brake under all operating conditions. The stored oil supply may also be used to release the spring applied brake whenever the tractor engine or torque converter is stalled. The accumulator stored oil supply is continuously refilled by the winch pump and valve whenever the PTO shaft is turning.

On tractors which supply PTO power through the torque converter, it is possible to cause the torque converter to stall if the tractor engine speed is too low. It is important that engine idle speed be set to factory specifications.

⚠ WARNING

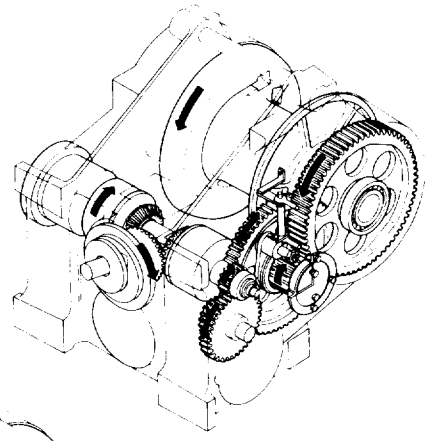
Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil pressure. To discharge the accumulator, stop engine, slowly cycle Power Shift control handle into full Haul-In then Pay-Out positions a minimum of five (5) times.

GEAR TRAIN

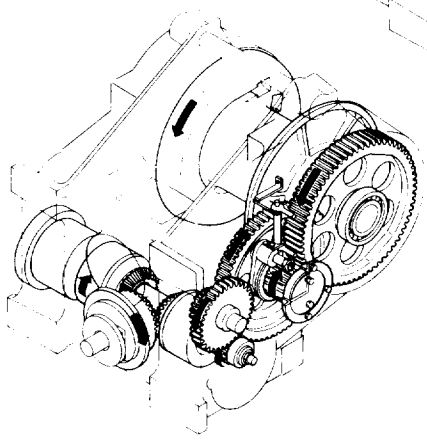
The 50A/70 and 50B/70A series powershift winch has equal speed gearing, Haul-In and Pay-Out, using multiple-disc oil actuated friction clutches and a spring-applied hydraulically released multiple-disc oil brake.

A 50A or 50B standard PTO winch may be either 3-shaft or 4-shaft gear train configuration depending upon the tractor horsepower, PTO speed and winch line speed/line pull requirements. All 70/70A and low PTO winches are 4-shaft gear train configuration.

The winch bevel pinion, bevel gears, hydraulic pump and clutch friction discs are rotating whenever the tractor PTO shaft is rotating. Application of a clutch, Haul-In or Pay-Out, and the simultaneous release of the brake will cause the rotation of the remaining gear train and cable drum. See illustrations below.



Standard PTO case, 4 shaft gear train, CCW PTO shaft rotation, Haul-In clutch applied.



Low PTO case, 4 shaft gear train, CCW PTO shaft rotation, Haul-In clutch applied.

The clutch shaft assembly (with bevel gears) must turn 40.4 times for one (1) rotation of the cable drum on a 4 shaft gear train winch and 22.3 times on a 3 shaft gear train winch.

The direction of the tractor PTO shaft rotation and the right and left hand clutch location is determined by facing the rear of the tractor.

The cable drum rotation may be easily changed from overwind (standard) to underwind by reversing clutch pressure lines at the control valve ports C_1 and C_2 and installing the wire rope in the opposite cable drum ferrule pocket.

Movement of the free spool lever away from the operator, disengages the cable drum from the winch gear train which permits the wire rope to be easily reeled off the drum by hand.

TROUBLE-SHOOTING

If the winch does not operate correctly, perform a visual inspection of obvious faults, such as leaking oil, loose, damaged, or broken parts. If cause of trouble is not readily apparent, check operation of winch in each function to help determine the trouble.

HYDRAULIC TESTS

The main hydraulic test port is located on the right hand side of the winch case next to the control cables. Attach an accurate 0-600 psi (0-4137 kPa) gauge to this port for most hydraulic system tests. The test port requires an SAE-4 JIC hose adapter.

⚠ WARNING

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from sudden release of oil pressure. To discharge the accumulator, stop engine, slowly cycle power shift control handle into full Haul-in then Pay-out positions a minimum of five times.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
A		
Brake does not hold.	1. Controls not returning to "Brake-On" neutral position.	1a. Inspect control cables for damage and binding; repair or replace as required. 1b. Inspect control stand for excessive wear, damage, weak centering springs, or through bolts over-tightened. Repair as required. 1c. Adjust control cables. 1d. Control valve internal components damaged. Disassemble and repair or replace valve cartridge.
	2. Brake assembly worn, damaged or improperly assembled.	2. Remove and disassemble brake assembly to check for worn parts or improper assembly.
	3. Frequent lowering of loads by slipping through the brake generates excessive heat buildup. This can destroy friction disc material and warp steel plates. Lower loads by placing power shift lever in reverse position.	3a. Remove brake assembly, disassemble and replace friction discs if oil grooves are no longer visible. Replace steel plates if warped or scored. 3b. Replace damaged discs and plates. Instruct operator to use Pay-out for lowering of loads.
	4. If manual override equipped, MOR valve stuck in "release" position.	4a. Inspect and repair MOR valve. 4b. Check-ball in "B" port of brake housing may block flow of oil exhausting from brake if MOR valve and piping has been removed from winch. If MOR valve is no longer required, check ball, part number 12102 must be removed from brake housing.
B		
Winch continues to Haul-in/Pay-out cable with controls in "Brake-On".	1. See probable cause A1.	1. See corrective action for A1a – d.
	2. Brake worn or damaged and directional clutch damaged with discs warped driving clutch.	2. See corrective action for A2 and disassemble clutch assembly to check for damaged parts.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
C		
Tractor engine or torque converter stalls when attempting to Haul-in or Pay-out.	1. Brake not releasing as clutch is applied due to low hydraulic pressure. 190-235 psi (1310-1620 kPa) is required to release brake.	1a. See corrective action for D. 1b. Shuttle valves in control valve worn or sticking allowing excessive oil leakage during clutch application. Disassemble valve to inspect components. 1c. Check accumulator nitrogen gas pre-charge of 190-210 psi (1310-1448 kPa). Recharge or replace accumulator as required.
	2. Brake not releasing due to damaged components.	2. See corrective action for A2.
D		
No or very low hydraulic pressure.	1. Low oil level.	1. Fill winch to proper level with recommended oil.
	2. Tractor torque converter stalls when operating winch.	2. Operate tractor engine at proper speed to match winch load requirement. Minimum PTO shaft speed for reliable winch operation is 650 RPM. Use sheave blocks and multi-part line if excessive line pulls are encountered.
	3. Suction strainer is plugged, cavitating pump.	3. Drain oil, change pressure filter and clean suction strainer. Fill with new recommended oil. While cleaning suction strainer, identify contamination and take corrective action as required.
	4. Suction hose damaged, cavitating pump.	4. Drain oil, remove small side inspection covers to permit access to pump suction hose. Inspect hose for cracks and loose connections. Replace as required.
	5. Defective pump.	5. Check pump flow reading as outlined in "Pump Service". Identify cause of pump failure and take corrective action prior to installation of new pump.
	6. System relief pressure set too low.	6. Adjust system relief pressure to 390-410 psi (2689-2827 kPa).
	7. Control valve defective.	7. Disassemble control valve and check for worn or damaged components. Also see corrective action for K.

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
E		
Clutch damaged or defective.	1. Friction discs worn and steel discs warped.	1. Replace discs and plates. Adjust system relief pressure to 390-410 psi (2689-2827 kPa). Instruct operator not to "feather" clutch under load.
	2. Clutch piston return springs weak or broken.	2. Replace springs as required.
	3. Clutch piston seized or o'rings defective.	3. Clean and replace components as required.
	4. Check-ball in clutch housing is stuck open.	4. Clean ball and valve seat. Replace components as required.
	5. Clutch assembled with excessive clutch piston travel.	5. Rebuild clutch as outlined in "Clutch Assembly Service".
	6. Control valve defective.	6. See corrective action for C1b., D6a, and K.
	7. Accumulator nitrogen charge too low or bladder ruptured. 50A-70 only.	7a. Check accumulator nitrogen pre-charge of 190-210 psi (1310-1448 kPa) recharge as required. 50A-70 only. 7b. Accumulator charge valve or bladder may be leaking or defective. Repair charge valve or replace with spring-type accumulator – Ref. Service Bulletin 95.
F		
Winch runs hot; above 180°F (82°C).	1. Improper oil level. Too high or too low oil level can cause aeration of oil and overheating.	1a. Fill/drain oil to proper level using recommended oil. 1b. Make certain oil is not transferring to/from winch and tractor transmission case. Replace PTO/bevel pinion seals as required.
	2. Driveline too long; end-loading bearings of bevel pinion.	2. Check drive line (if equipped) and PTO components.
	3. Control valve cycling rapidly causing hydraulic components and oil to overheat.	3a. Accumulator discharged or bladder ruptured. (see E7b) 3b. Control valve defective (see Trouble K).

TROUBLE	PROBABLE CAUSE	CORRECTIVE ACTION
		Remove check poppet assembly for inspection or replacement.
		1d. Differential unloading pilot cartridge worn allowing leak down of accumulator circuit and fluctuation of pressures. Disassemble cartridge for inspection or replacement. Adjust relief pressure following installation of new components.
	2. System pressure will intermittently rise above adjusted relief pressure, and fail to recycle below cut-in pressure.	2a. See corrective action for K1a.
		2b. Differential unloading pilot cartridge piston is sticking in bore causing system (accumulator circuit) pressure to rise too high before offseating check-ball, then holding check-ball offseated too long before recycling. Disassemble differential unloading valve cartridge for inspection, repair or replacement.
		2c. Differential unloading poppet sticking in bore causing pump pressure to rise too high before unloading to "T" port, then remaining open to "T" too long before reseating and sending pump flow back to recharge accumulator circuit. Remove differential unloading poppet for inspection of poppet and valve housing bore. Polish sealing surfaces with fine emery cloth. Make certain orifice is open.
	3. System pressure drops in excess of 100 psi (690 kPa) during clutch application and is slow recovering. Continued operation in this manner may cause scuffing of clutch discs against brake assembly and eventual clutch failure.	3a. See corrective action for K1a, b, and K2b, c.
		3b. See corrective action for E7a, b,
	4. System pressure remains low and will not respond to pressure adjustment.	4a. See corrective action for K1d and K2b, c.
	Normally the relief pressure adjustment is quite sensitive and rises rapidly with very little movement of the adjusting screw.	4b. Control cables are mis-adjusted causing constant leakage from directional control cartridge or brake cartridge. Adjust cables as required.
		4c. Pump worn, not able to deliver flow at higher pressure. See corrective action for D1, 2, 3, 4 and 5.

WINCH INSTALLATION

Remove dirt, paint and rust from mounting surfaces of winch and tractor adapters.

Coat splines of PTO shaft and couplings (if equipped) with general purpose grease. Lubricate and install O-ring(s) on to winch PTO pilot (if equipped).

Remove winch top cover to gain access to bevel gears.

Carefully install winch on tractor while guiding winch PTO pilot into tractor and rotating bevel gears to align PTO shaft splines.

Install and tighten all fasteners to recommended torque.

Install winch top access cover plate.

Fill winch to proper level with recommended oil.

Route control cables to the control stand in such a manner to avoid chaffing and binding.

CONTROL CABLE INSTALLATION AND ADJUSTMENT

POWER SHIFT CABLES:

When installing the winch, you will notice that the control cable sliding jam nut is contained within the cable housing preventing attachment to the control stand plunger. To attach the cables, remove the eight ½ in. capscrews which secure the right hand cover plate to the winch. Remove the cover plate and locate the control valve and cables.

Carefully remove the hitch pins and clevis pins which connect the control valve spools to the cables. By hand, push the control cables forward. This will expose the sliding jam nut and permit installation of the control cable to the control stand plunger.

Tip: The sliding jam nut may become lodged in the control cable housing during shipment. Hold the cable housing with the open end downward and tap sharply against a hard surface to dislodge the sliding jam nut from the cable housing.

⚠ WARNING

DO NOT move cable adjusters to install cables. Control cables were factory adjusted. Proper adjustment of the cables is critical to safe and proper winch operation.

If the power shift cable adjusters have been moved, check cable adjustment by first installing the control cables to the control stand as described above. Place the power shift control handle in the center, "Brake-On", neutral position. Install the clevis pins into the cable yokes/control valve spools and secure with hitch pins. The yoke pins should slip easily into the bores without any binding. The control valve spools are spring centered. If you notice any binding, turn the cable adjusters in or out until you obtain a "free pin" condition.

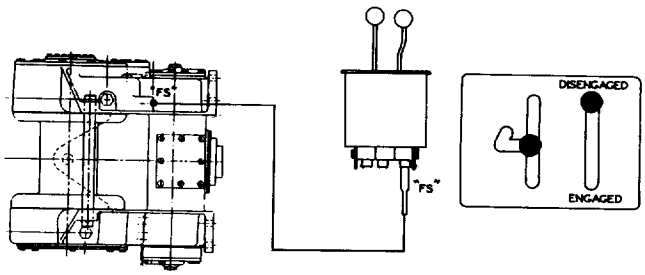
⚠ WARNING

Fully install hitch pins into clevis pins so that the hitch pins hang from the large end loop. DO NOT leave hitch pins installed at mid-point. Partially engaged hitch pins may become disconnected from clevis pins allowing clevis pins to drop out of clevis/valve spool which may cause loss of winch control which may result in property damage, injury or death.

While cover is removed, check hydraulic main relief pressure as outlined in "Control Valve Service" section of this manual. Install the winch cover plate and tighten the capscrews to 75 lb•ft (102 N•m) torque.

FREE SPOOL CABLE:

Winches with freespool are usually shipped with the winch linkage in the "Engaged" position. This should hold the control cable sliding jam nut in the outer-most position. To install the control cable into the control stand, place the control lever in the "Disengaged" position to push the plunger down.



If the winch linkage has been moved to the "Disengaged" position, the control cable sliding jam nut will not reach the control stand plunger. To shift the linkage into "Engaged", remove the large filler plug on top of the left hand side of the winch case and, with a pry bar, shift the linkage forward. You may need to rotate the cable drum to align the gear teeth.

PRESSURE FILTER SYSTEM (if equipped):

Locate the filter bypass indicator light wire assembly near the control cables on the right hand side of the winch case. Route the indicator wire along the control cables to the control stand in such a manner to prevent chaffing of insulation and accidental grounding of the circuit. Secure the wire to cables with tie straps.

Remove the lamp retainer and black serrated jam nut from the light assembly. From the bottom side, pass the light assembly up through the drilled hole in the control stand gate plate and install the jam nut and lamp retainer. Attach a power lead from a protected 12 or 24 VDC circuit to the wire with the butt-splice connector. The indicator light is a ground seeking circuit with a current draw of only .2 amps.

The indicator light may come on for a short time during initial cold start-up but should go out as the oil warms up. If the light stays on, this indicates a restricted filter element, sending unit stuck in the bypass position or accidentally grounded sending unit wire.

WELDING PROCEDURE

The following specifications apply to welding ductile iron to ductile iron or steel to ductile iron when attaching arches, fairleads, or guarding to the winch case.

Preparation:

Attachments should be chamfered to ensure adequate penetration. Weld joints must be free of rust, scale, slag, sand, dirt, grease, oil, paint, or moisture. Entire weldment should be not less than 65°F (18°C).

Procedure:

Use multi-pass welding technique (stringer bead) and follow electrode manufactures recommendation for current, voltage, polarity, and speed.

Materials:

Flux coated "stick" electrode

Composition —	Ni	43.75%	Mn	11.00%
	C	1.50%	Fe	43.75%
Mechanical properties —	tensile strength	65,000 - 84,000 psi (448,175 - 579,180 kPa)		
	yield strength	45,000 - 65,000 psi (310,275 - 448,175 kPa)		
	elongation	15-25%		

Flux cored wire

Composition —	Ni	50.00%	Fe	44.00%
	C	1.00%	Si	.60%
	Mn	4.20%		
Mechanical properties —	tensile strength	64,000 - 74,000 psi (441,280 - 510,230 kPa)		
	yield strength	43,000 - 50,000 psi (296,485 - 344,750 kPa)		
	elongation	15-25%		

WIRE ROPE INSTALLATION

All winches are rated at bare drum line pull. As the cable drum fills, the line pull will decrease (loss of leverage) as the line speed increases (larger circumference). Therefore, install the minimum length of cable possible for your application so that the winch will operate on lower layers (smaller diameter) and deliver the maximum line pull.

Using larger cable will not always increase strength as the larger cable may be more prone to bending fatigue failure than smaller wire rope. Consult your wire rope supplier for his recommendations for the wire rope and other rigging which best suits your application.

Maximum warrantable wire rope diameter:

50A/50B = ¾ in. (19 mm)
70/70A = 1 in. (25 mm)

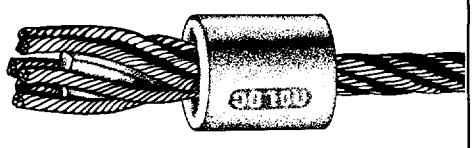
⚠ WARNING

Winch cable anchors (ferrules and ferrule pocket) are **NOT** designed to hold rated loads. Winch loads applied directly to the cable anchor may cause the cable to pull free and result in the sudden loss of load control and cause property damage, injury or death. **A minimum of 5 wraps of cable must be left on the drum barrel to achieve rated load.** Do not use knots to secure or attach winch cable. We suggest that the last 5 wraps of cable be painted bright red to serve as a visual warning.

INSTALLATION OF SPIRAL FERRULES

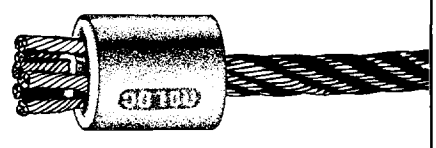
Re-usable, field-installed spiral ferrules are now supplied with all Carco winches These ferrules are for use with standard six-strand, IWRC (Independent Wire Rope Core) type wire rope. Refer to ferrule selection chart in the "Specifications" section of this manual.

Step One



Insert cable through the small opening of the ferrule. Spread strands and lay them in individual grooves in spiral wedges.

Step Two

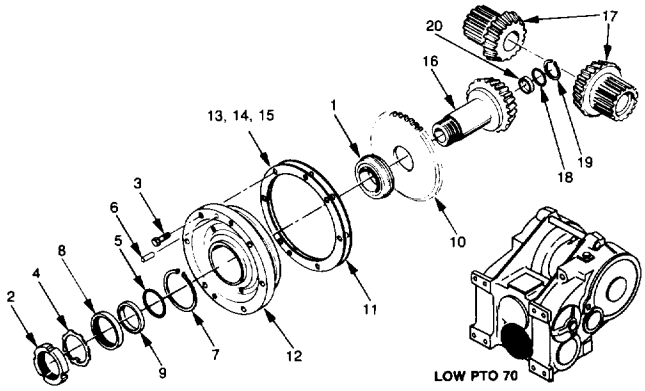


Tap wedges and cable into the ferrule leaving approximately ⅜ in. (10 mm) extending from the top. The first load will seat cable and wedges securely in the ferrule.

BEVEL PINION AND HYDRAULIC PUMP SERVICE

The bevel pinion, bevel gears and hydraulic pump are turning whenever the tractor PTO shaft is turning. The bevel pinion transmits torque from the PTO shaft to the bevel gears, clutch shaft and winch gear train. Proper adjustment of bevel pinion/bevel gear back-lash and tooth contact pattern is essential for quiet operation and long component life.

The bevel pinion and hydraulic pump share a common carrier housing. The carrier is mounted in the front face of the winch case and will be located in the upper bore for standard PTO winches and in the lower case bore of low PTO winches.



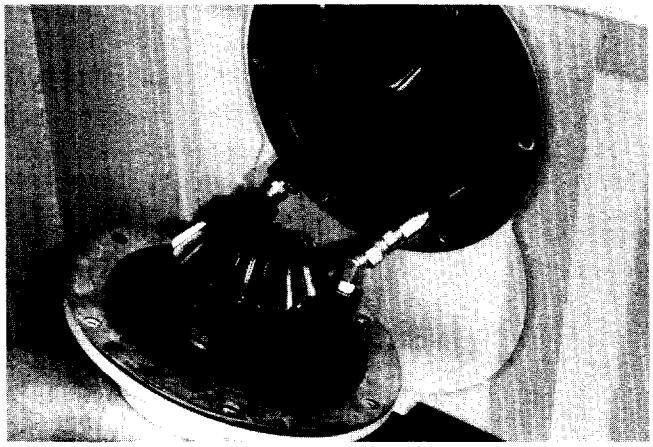
ITEM	DESCRIPTION	QTY.
1	BEARING ASSEMBLY	1
2	BEARING, LOCK NUT	1
3	CAPSCREW HEX HD.	6
4	LOCKWASHER	1
5	O-RING	1
6	DOWEL PIN	1
7	RETAINING RING	1
8	OIL SEAL	1
9	SEAL SPACER	1
10	PUMP DRIVE PINION	1
11	SHIM GASKET	1
12	CARRIER	1
13,14,15	SHIMS	2-AR
16	BEVEL PINION	1
17	BEVEL GEAR	2
18	O-RING	1
19	RETAINING RING	1
20	PLUG, BEVEL PINION	1

BEVEL PINION CARRIER REMOVAL

Drain oil from winch and remove the winch from the tractor as described in "Winch Removal and Installation" section of this manual. Leave the winch mounting adapter plates attached to the tractor where applicable.

50A/70 ONLY

Remove the capscrews (3) securing the carrier assembly to the winch case. Using two of the capscrews as "jackscrews", remove the carrier assembly.



50A/70 STD PTO

Hold the carrier away from the winch case far enough to allow access to the hoses. Remove the suction and pressure hoses from the pump. Retain the shim set (13, 14, 15) for reassembly.

50B/70A

Remove the ½ in. capscrews which secure the bevel gear inspection plate to the top of the winch case. Remove the inspection plate. Remove the pump suction tube and pressure hose from the pump. Remove the capscrews (3) securing the carrier assembly to the winch case. Using two of the capscrews as "jackscrews", remove the carrier assembly. Retain the shim set (13, 14, 15) for reassembly.

BEVEL PINION REMOVAL

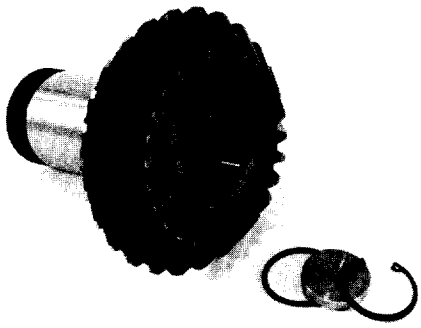
Bend the tang of the lockwasher (4) away from the locknut (2) and remove the locknut (2) and lockwasher (4).

Support the carrier assembly in a suitable press. Place support blocks toward the outer diameter of the carrier. From the locknut end, press out the bevel pinion (16).

Remove the bearing cone set spacer from the bevel pinion. Position the bevel pinion assembly in a suitable press with support blocks under the pump drive pinion (10) as close to the bevel pinion gear as possible. Press the bevel pinion (16) free of the bearing cone and pump drive pinion.

Support the carrier in a vice and remove the oil seal (8), oil seal spacer (9) and o'ring (5).

Remove the oil seal retaining ring (7) and outer bearing cone. Remove the bearing cups, bearing cup retaining ring and the set spacer from the carrier.



Remove the retaining ring (19) and plug (20) from the end of the bevel pinion. Remove the o'ring (18) from the groove in the gear.

Thoroughly clean and inspect all parts at this time. All components of the bearing assembly are a matched set with the bearing adjustment controlled by the inner and outer set spacers. If the bearing cone or cup is worn or damaged, the entire bearing assembly (1) must be replaced.

BEVEL PINION ASSEMBLY

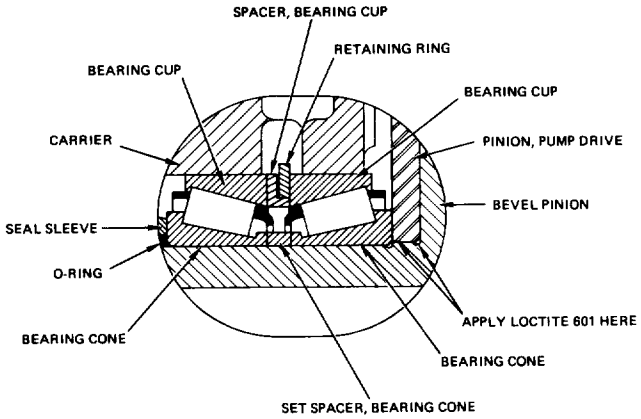
Lubricate and install o'ring (18) into the groove in the bore of the bevel pinion (16). Install plug (20) with chamfered edge toward the o'ring. Secure the plug in the pinion with the retaining ring (19).

NOTE: On bevel pinions equipped with a threaded plug, apply Loc-tite 242 or equivalent to socket head plug and tighten securely.

Clean and dry bore of pump drive pinion (10) and mating surface on bevel pinion (16) with Loc-tite primer or equivalent.

Apply Loc-tite 601 or equivalent to pump drive pinion bore and mating bevel pinion surface. Press pump drive pinion onto bevel pinion and seat securely against bevel pinion shoulder. Allow Loc-tite to harden.

Press one bearing cone of the bearing assembly (1) on to the bevel pinion and seat securely against the pump drive pinion. Install bearing cone set spacer on to the bevel pinion.



Install the bearing cup retaining ring into the groove in the carrier bore.

Place the carrier assembly onto bench with the pump side facing up. Install one bearing cup of bearing set (1) and seat against the retaining ring.

Turn the carrier over so that the pump side faces down. Install the bearing cup spacer with the shoulder inside of the retaining ring. Install the remaining bearing cup and seat firmly against the bearing cup spacer and retaining ring.

Place the carrier over the bevel pinion so that the pump side bearing cup seats on the bearing cone.

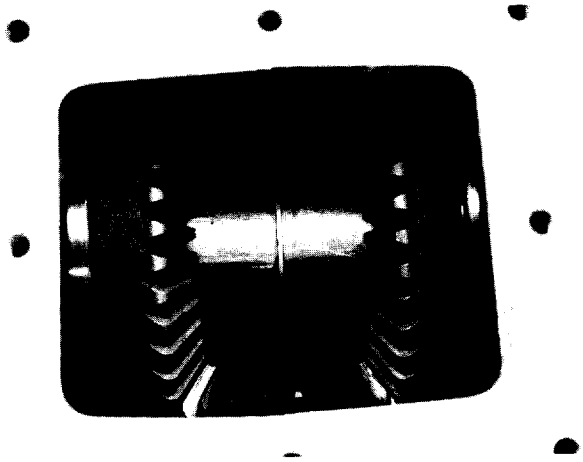
Press the remaining bearing cone securely onto the bevel pinion, seating into the bearing cup.

Lubricate and install o'ring (5) onto the bevel pinion against the bearing cone. Install seal spacer (9) over the bevel pinion with internal tapered edge toward the bearing cone and o'ring.

Install the oil seal retaining ring (7) into the carrier bore groove. Apply non-hardening sealant to the outside surface of the oil seal (8) and install the oil seal firmly against the retaining ring (7).

Install the bearing lockwasher (4) and locknut (2) onto the bevel pinion. Tighten the locknut to 150 lb•ft (203 N•m) torque and bend tang of lockwasher (4) into slot of locknut.

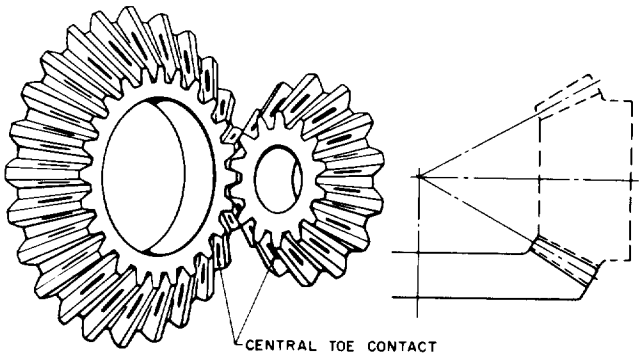
BEVEL PINION CARRIER INSTALLATION



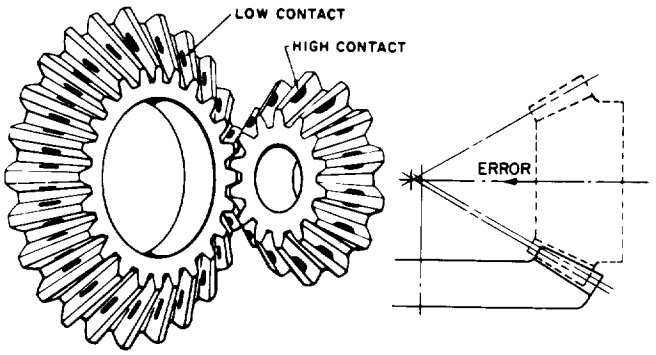
Apply gear tooth marking compound to bevel pinion and install carrier assembly into winch case using the original shim set. Replace gasket as required. Tighten capscrews to 75 lb•ft (102 N•m) torque.

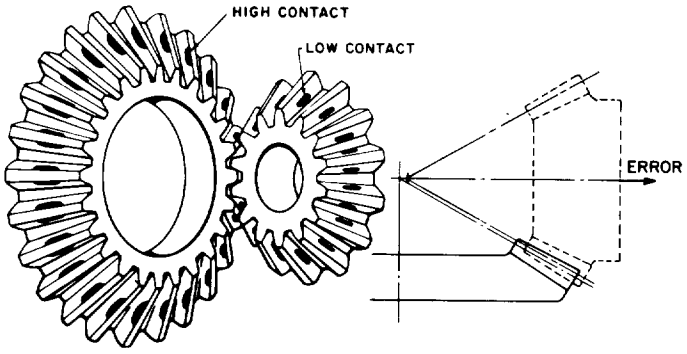
Rotate bevel pinion in same direction as PTO shaft rotation and check bevel pinion/gear tooth contact pattern.

Remove carrier assembly to add or remove shims to obtain the correct tooth contact pattern illustrated below.



PREFERRED CONTACT PATTERN





IMPROPER CONTACT PATTERNS ADJUSTMENT REQUIRED

Refer to Clutch Shaft Service for bevel gear backlash adjustment procedure.

Upon final installation of carrier assembly, apply non-hardening thread sealant to capscrews and tighten to 75 lb•ft (102 N•m) torque.

Refill winch to proper level with recommended lubricant.

HYDRAULIC PUMP SERVICE

The hydraulic pump supplies oil to the control valve to recharge the accumulator, apply clutches, release the brake, and lubricate critical components. Maintaining adequate oil flow is critical to reliable winch operation.

Pump flow should be tested with an accurate, commercially available flow meter. If a flow meter is not available, a serviceable flow meter may be fabricated from a gate valve, tee and gauge as listed below.

- Gate valve — ½ NPT port minimum, 1000 psi (6895 kPa) rating, minimum.
- ½ NPT schedule 80 pipe tee with a -8JIC hose adapter on one run
- Accurate 0-600 psi (0-4137 kPa) gauge

Attach ½ NPT run end of tee to gate valve with -8JIC adapter on opposite run.

Install gauge to branch of tee.

TEST PROCEDURE

1. Operate tractor and winch long enough to bring oil up to operating temperature. Stop engine.
2. Remove access cover on right hand side of winch and locate pump port on control valve labelled "P". Remove -8JIC pump line from the tee in the pump port of the control valve.
3. Attach pump line to the gauge side of the gate valve or flow meter. Direct the open end of the gate valve/flow meter back into the winch case.
4. With gate valve/flow meter fully open, operate engine at 650-700 RPM and measure oil flow by directing oil into a container for 15 seconds.
5. Gradually close gate valve/flow meter until you have applied 350 psi (2413 kPa) load to the pump. Again record the flow for 15 seconds.

⚠ CAUTION

Do not fully close gate valve/flow meter as pump or hose damage will result.

The minimum acceptable pump flow is 2 gpm (US) (7.6 lpm) at 650-700 RPM PTO speed and 350 psi (2413 kPa). Two quarts per 15 seconds equals 2 gpm.

If pump flow is below minimum:

1. Check/verify PTO speed and accuracy of tachometer.
2. Check suction strainer for restriction.
3. Check suction hose for cracks or poor connection.
4. Pump is worn and requires replacement.

HYDRAULIC PUMP REMOVAL

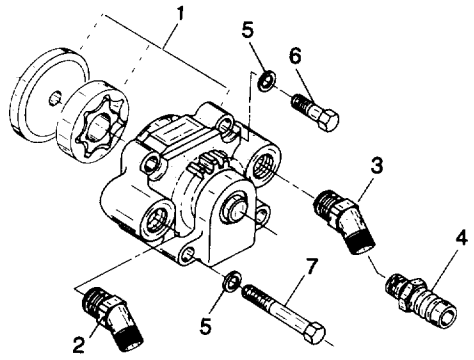
50A/70 Only

Remove the bevel pinion carrier from the winch case as described in "Bevel Pinion Carrier Service" section of this manual. Note their location and remove the suction and pressure hoses.

50B/70A Only

Remove the ½ in. capscrews which secure the bevel gear inspection cover to the top of the winch case. Remove the inspection plate. Remove the pump suction tube and pressure hose from the pump. In most applications, the pump may be removed from the bevel pinion

carrier through the top of the winch case. If this is not practical in your application, then remove the bevel pinion carrier from the winch case as described in the "Bevel Pinion Carrier Service" section of this manual.



ITEM	DESCRIPTION	QTY.
1	PUMP ASSEMBLY	1
2	ELBOW, 45° - 8 PRESSURE SIDE	1
3	ELBOW, 45° SUCTION - STD PTO	1
	ELBOW, 45° ½ NPT ADAPTER - LOW PTO & 50A/70	1
4	BARBED HOSE ADAPTER - LOW PTO & 50A/70	1
5	LOCKWASHER - ¼	4
6	CAPSCREW, HEX HEAD ¼ - 20 × 1½ G8	2
7	CAPSCREW, HEX HEAD ¼ - 20 × 3 G8	2

ALL UNITS

Remove the four capscrews and lockwashers (5, 6, 7) securing the pump to the bevel pinion carrier.

Remove the pump assembly and wear plate (1) from the bevel pinion carrier.

Thoroughly clean and inspect all pump components at this time. If there is any sign of damage or wear which may reduce pump performance, the entire pump assembly must be replaced.

PUMP INSTALLATION

Lubricate entire pump assembly with recommended oil.

Coat the capscrew threads with Loc-tite 242 or equivalent and evenly tighten to 100-110 lb•in. by 25 lb•in. (11.3-12.4 N•m by 2.8 N•m) increments in a cross pattern.

When properly installed, there will be a slight gap, .005-.040 in. (.13-1.02 mm) between the mounting ears of the pump housing and the bevel pinion carrier. This condition insures that the pump housing is clamped and sealing against the wear plate.

Apply non-hardening thread sealant to the pipe threads and install the suction (3, 4) and pressure (2) hose adapters as follows:

A. For counter-clockwise (ccw) bevel pinion rotation, the most common, install the pressure adapter into "A" port.

B. For clockwise (cw) bevel pinion rotation, install the pressure adapter into "B" port.

NOTE: Determine direction of bevel pinion rotation when viewed from rear of winch looking forward toward the tractor.

If Bevel Pinion Carrier was Removed (all 50A/70)

When installing the bevel pinion carrier assembly into the winch case, make certain the hose connections are tight, hose routed away from gears, etc. and the suction hose is secured to the barbed suction fitting with a heavy duty hose clamp (where applicable).

Install bevel pinion carrier as described in the "Bevel Pinion Carrier Installation" section of this manual.

50B/70A Only

Install suction tube assembly (standard PTO) or suction hose and clamp (low PTO) securely to the pump suction port.

Install the pressure hose securely to the pump pressure port and make certain the hose is routed away from the bevel gears and clutch housing to avoid chaffing and failure.

ADAPTER GEAR BOX SERVICE

Winches adapted to Komatsu tractors are equipped with an adapter gear box assembly, often called a drop box. The adapter gear box contains three gears; the input pinion shaft driven by the PTO shaft, the idler pinion and the output pinion shaft which is splined to the winch bevel pinion gear.

The adapter gear box is driven by a long PTO shaft which turns at a speed slightly higher than the engine crankshaft speed. On most tractors, the PTO shaft is driven by an accessory gear drive on the engine flywheel housing. The later hydrostatic drive tractors provide power to the winch PTO shaft from the hydrostatic pump drive housing.

The adapter gear box provides a 1.29:1 reduction from the PTO shaft speed to the bevel pinion gear speed.

The PTO shaft u-joints, slip-joint, flanges and fasteners must be inspected, tightened and lubricated as required at least once every three months or 500 tractor hours, whichever occurs first. Inadequate PTO shaft maintenance may result in the accelerated wear of the adapter gear box components.

⚠ CAUTION

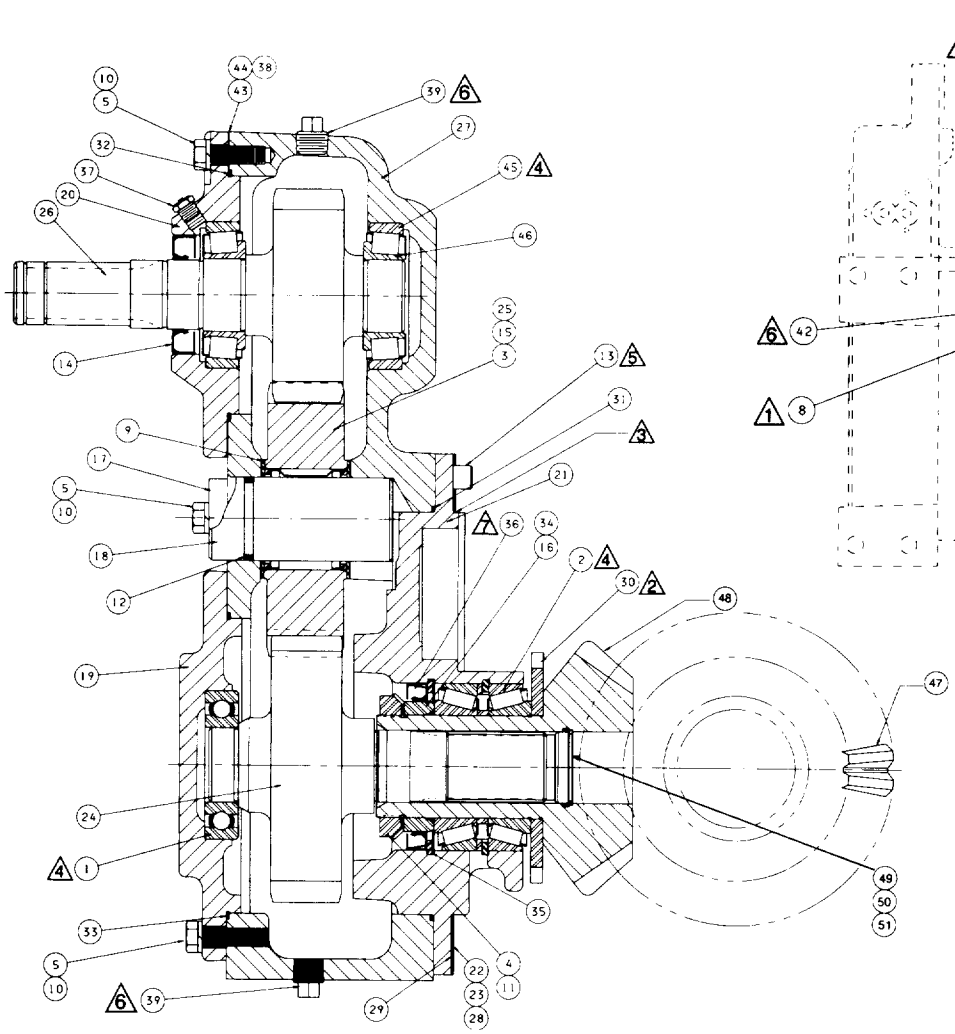
Maintenance of the PTO shaft assembly is essential to reliable winch operation. As the PTO shaft turns at approximately engine speed and torque, the failure of a u-joint or shaft may result in property damage or injury.

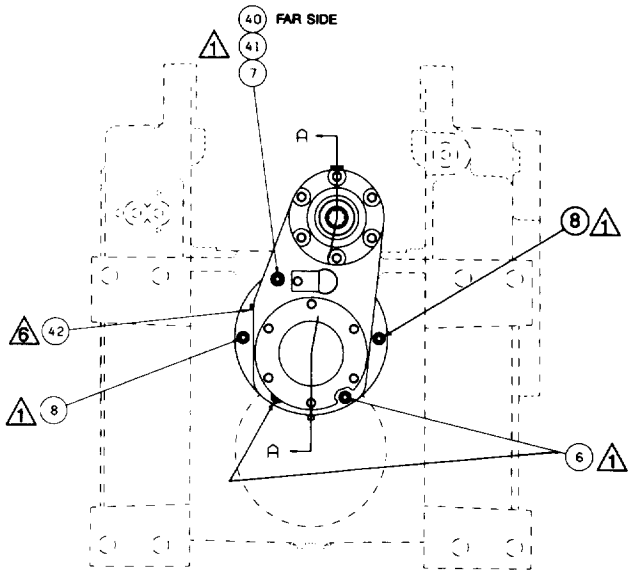
DISASSEMBLY

Remove the winch from the tractor as described in the "Winch Removal and Installation" section of this manual.

Remove the retaining ring which secures the PTO shaft yoke to the input pinion gear.

Note: Not all applications use a yoke retaining ring.





NOTES:

1. APPLY "LOCTITE 242" TO CLEAN, DRY THREADS.
2. APPLY "LOCTITE 601" TO BORE OF PUMP PINION, ITEM 30, AND BEVEL PINION SHOULDER.
3. APPLY APPROX. 3/16 IN. (4.7 mm) BEAD OF SILASTIC SEALANT (RTV 732) TO PILOT.
4. APPLY THIN COATING OF MULTIPURPOSE CALCIUM OR LITHIUM BASED MEDIUM GREASE.
5. APPLY "LOCTITE 242" TO CLEAN, DRY DOWEL PIN.
6. APPLY PIPE THREAD SEALANT TO FITTINGS, ITEMS 37, 38, 39 & 42.
7. INSTALL SEAL, ITEM 36, WITH CLOSED SIDE FACING BEVEL GEARS.
8. INSTALL SHIMS, ITEMS 38, 43, 44, UNDER BEARING CAP, ITEM 20, TO PROVIDE .004-.006 IN. (.10-.15 mm) END-PLAY OF SHAFT, ITEM 26.

ITEM	DESCRIPTION	QTY.
1	BALL BEARING	1
2	ROLLER BEARING	1
3	NEEDLE BEARING	1
4	LOCKNUT, BEARING	1
5	CAPSCREW, HEX HEAD (3/8 – 16 NC × 1 G5-SS)	13
6	CAPSCREW, SOCKET HEAD (1/2 – 13 NC × 5 G8)	2
7	CAPSCREW, SOCKET HEAD (1/2 – 13 NC × 5 1/2 G8)	1
8	CAPSCREW, SOCKET HEAD (1/2 – 13 NC × 2 1/4 G8)	2
9	THRUST WASHER	2
10	LOCKWASHER (3/8)	13
11	LOCKWASHER	1
12	O-RING	1
13	DOWEL PIN	1
14	OIL SEAL	1
15	BEARING SPACER	2
16	SEAL SPACER	1
17	PIN RETAINER	1
18	IDLER PIN	1
19	BEARING CAP, DRIVE PINION	1
20	BEARING CAP, INPUT PINION	1
21	CARRIER, BEVEL PINION	1
22	SHIM, .020 in. (.51 mm)	2-AR
23	SHIM, .007 in. (.18 mm)	2-AR
24	PINION SHAFT	1
25	IDLER PINION	1
26	INPUT PINION SHAFT	1

ITEM	DESCRIPTION	QTY.
27	GEAR BOX HOUSING	1
28	SHIM, .005 in. (.13 mm)	2-AR
29	SHIM GASKET	1
30	PUMP DRIVE PINION	1
31	O-RING	1
32	O-RING	1
33	O-RING	1
34	O-RING	1
35	RETAINING RING	1
36	OIL SEAL	1
37	RELIEF VALVE	1
38	SHIM, .020 in. (.51 mm)	2-AR
39	PLUG (3/8 – 18 NPTF)	2
40	O-RING	1
41	SEALING WASHER	1
42	PIPE PLUG (1/8 – 27 NPTF)	1
43	SHIM, .005 in. (.13 mm)	4-AR
44	SHIM, .007 in. (.18 mm)	3-AR
45	BEARING CUP	2
46	BEARING CONE	2
47	BEVEL GEAR	2
48	BEVEL PINION	1
49	O-RING	1
50	RETAINING RING	1
51	PLUG, BEVEL PINION	1

SS = SELF SEALING AR = AS REQUIRED

Remove six capscrews, lockwashers (5, 10) and the input pinion bearing cap (20) and input pinion (26) from the gear box housing. Retain the shim set (38, 43, 44) for reassembly.

Install a new shaft seal (14) as required. Apply a light coat of non-hardening sealant to the outside of the seal (14) then press the seal into the bearing cap (20) until the outside surface of the seal is flush with the outside surface of the bearing cap.

Inspect the input pinion bearing cups and cones (45, 46) for excessive wear and replace as required.

Remove six capscrews, lockwashers (5, 10) and the drive pinion bearing cap (19) and the drive pinion (24) from the gear box housing.

Remove the capscrew, lockwasher and pin retainer (5, 10, 17) from the gear box housing. Support the idler pinion as you withdraw the idler pinion shaft (18). Be sure to retrieve the two thrust washers and bearing spacers (9, 15) as you remove the idler pinion gear.

If necessary, the gear box housing (27) may be removed from the bevel pinion carrier at this time. Refer to "Bevel Pinion and Hydraulic Pump Service" section of this manual for additional information.

Note: The bevel pinion seal (36) is installed with the spring side of the seal toward the gear box housing only on winches equipped with an adapter gear box housing which contains a captive supply of 90 wt. gear oil. The seal is installed with the spring side toward the winch on standard winch adaptions without the adapter gear box. Some early winches which did **not** contain 90 wt. gear oil were splash lubricated with winch lubricant from the main winch case. These units had **no** seal between the gear box and the main winch case.

Thoroughly clean all parts and inspect for damage and excessive wear. The bearing rollers should not exhibit any irregularities. If the rollers show any sign of spalling, corrosion, discoloration, material displacement or abnormal wear, the bearing should be replaced. Likewise, the cage should be inspected for unusual wear or deformation, particularly the cage bars. If there is any damage that will impair the cage's ability to separate, retain and guide the rollers properly, the bearing should be replaced. The thrust washer contact areas should be free from any surface irregularities that may cause abrasions or friction. The gears and shafts should be inspected for abnormal wear or pitting and replaced if necessary.

ASSEMBLY

Install the adapter gear box housing onto the bevel pinion carrier if it was previously removed. Be sure to install a new o-ring (31) between the housing and the bevel pinion carrier. Tighten all 1/2 in. capscrews to 75 lb•ft (102 N•m) torque.

Lubricate needle bearing (3) and install it into the idler pinion (25) with a bearing spacer (15) on each side. Place a small amount of general purpose grease on both sides of the idler pinion (25) to hold a thrust washer (9) to each side of the gear.

Install a new o-ring (12) onto the idler pinion shaft (17).

Place the idler pinion sub-assembly (1-bearing, 2-bearing spacers, 2-thrust washers and 1-pinion) into the housing. Align the thrust washers and bearing with the shaft bore and install the idler pinion shaft. Install the pin retainer (17) onto the housing with capscrew and lockwasher (5, 10). Tighten capscrew (5) to 31 lb•ft (42 N•m) torque.

⚠ CAUTION

Make certain thrust washers (9) and bearing spacers (15) are properly installed as described above. A misplaced thrust washer or bearing spacer will result in component damage.

Press ball bearing (1) onto output pinion (24). Lubricate the ball bearing (1) and splines of output pinion (24) and install the pinion into the housing and bevel pinion gear.

Install a new o-ring (33) onto the pilot of the lower bearing cap (19) and install the bearing cap into the housing. Tighten the six capscrews (5, 10) to 31 lb•ft (42 N•m) torque.

If the gear box is intended to contain a captive supply of gear oil, pour in 1.8 qt. (1.7 lt) of 90 wt. API GL-5 gear oil at this time.

If the gear box is an early design which was intended to use splash lubrication from the main winch case, pour in approximately 2 qt. (1.9 lt) of winch lubricant. The excess oil will drain into the main winch case.

This pre-lubrication step is required to provide adequate lubrication upon initial start-up.

If required, press new bearing cones (46) onto the input pinion shaft (26) and new bearing cups (45) into the housing and bearing cap (20).

Install the input pinion shaft into the housing. Place three thick, yellow color shims (38) which measure .020 in. (.51 mm) thick between the bearing cap (20) and the housing. With a dial indicator, measure the input shaft end-play and adjust the shim pack thickness with .005 in. (.13 mm) and .007 in. (.18 mm) shims to achieve a .004-.006 in. (.10-.15 mm) end-play.

After the correct shim pack has been determined, install a new o-ring (32) onto the bearing cap pilot and install the bearing cap into the housing. Tighten the six capscrews (5, 10) to 31 lb•ft (42 N•m) torque.

Lubricate the input pinion splines with moly-type grease and install the PTO shaft yoke onto the input pinion. Secure it in place with a retaining ring as required.

CLUTCH SHAFT SERVICE

DESCRIPTION

The clutch shaft assembly contains or supports the two bevel gears, the haul-in and pay-out clutches, the brake hub and the first reduction pinion gear.

OPERATION

The bevel gears are continuously driven by the bevel pinion and, when no clutches are applied, spin freely on needle roller bearings. The bevel gears are splined to the friction discs of the clutches. The steel clutch discs are splined to the clutch housing and the clutch housing is splined to the clutch shaft.

When a clutch is applied, the clutch piston compresses the friction and steel discs tight enough to transmit power from the bevel gears to the clutch shaft. The direction the clutch shaft turns depends on which clutch is applied.

The clutch shaft transmits power to the winch reduction gears through the small pinion gear splined to the left hand end of the shaft.

Splined to the right hand end of the clutch shaft is the brake hub which is splined to the friction discs of a powerful, load holding multi-disc oil brake. The friction discs are alternately stacked between steel discs which are splined to the brake housing which is anchored to the winch case.

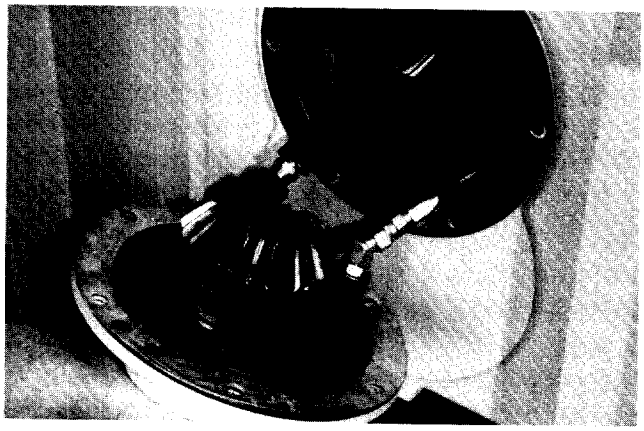
The brake is spring applied and hydraulically released. The clutch shaft and the entire winch gear train is held firm by the brake until hydraulic oil pressure overcomes the spring force to relieve the compression of the discs. When released, the clutch shaft and brake hub can turn as the brake friction discs slip freely between the brake steel discs.

The bevel gears and center portion of the clutch shaft are supported by two large ball bearings while the ends of the shaft are supported by two tapered roller bearings.

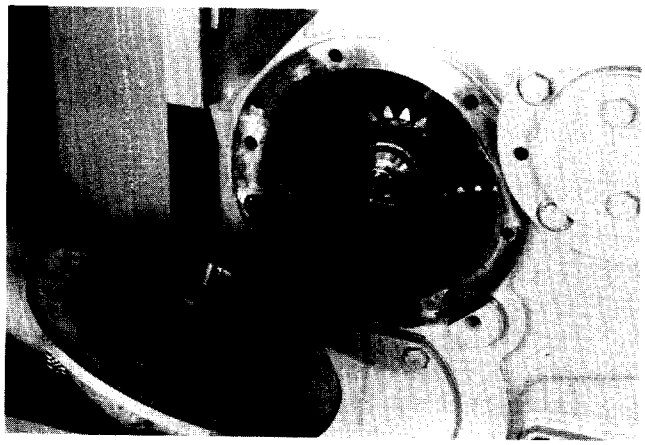
The clutches are supplied with application oil pressure from passages drilled through the center of the shaft. Clutch application oil travels from the control valve to the clutch shaft bearing carriers where the oil passes through a rotary seal shaft installed in the drilled passages at the ends of the shaft.

REMOVAL

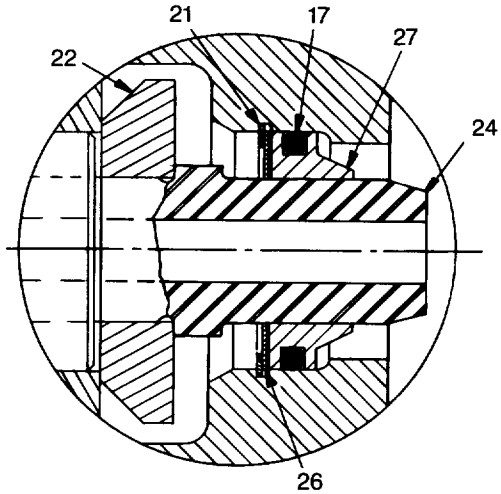
Drain oil and remove winch from tractor as described in the "Winch Removal and Installation" section of this manual. Remove only the winch, leaving the mounting blocks attached to the tractor; where applicable.



Remove the six capscrews then remove the bevel pinion and pump carrier from the front of the winch. Retain the shim set for reassembly. Refer to Bevel Pinion and Pump Carrier Service for additional information.



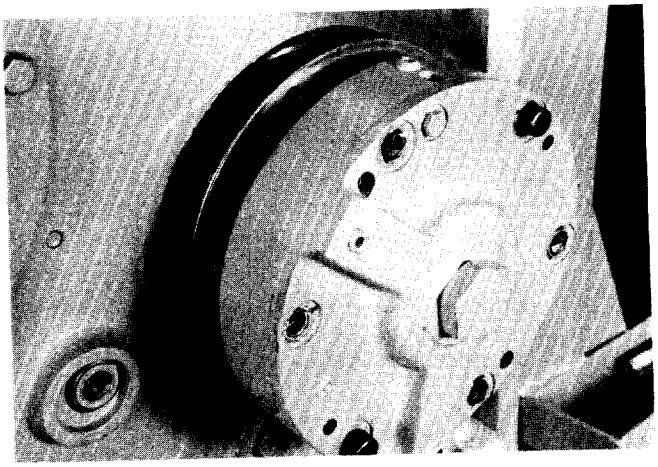
Remove the six capscrews (10) then remove the left hand clutch shaft bearing carrier (35). Retain the shim set for reassembly. Inspect the bearing cup (4) in the bearing carrier and replace as required.



ITEM	DESCRIPTION	QTY.
17	O'RING	2
21	RETAINING RING	2
22	BEARING RETAINER	2
24	ROTARY SEAL SHAFT	2
26	BACK-UP WASHER	2
27	ROTARY SEAL	2

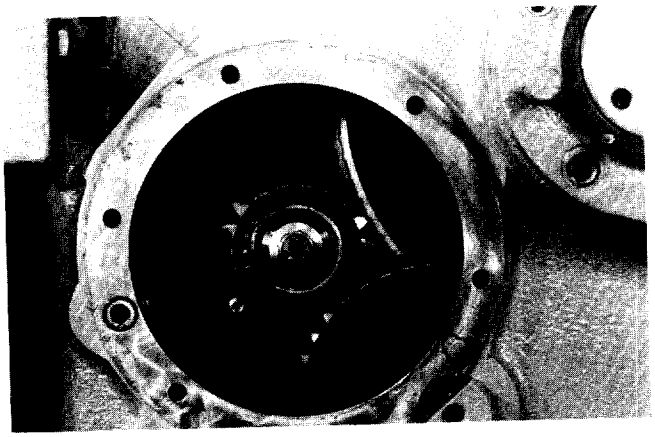
Remove the retaining ring (21) from the bore of the bearing carrier, then remove the rotary seal assembly (17, 26, 27).

Remove the six ½ in. capscrews securing the brake assembly to the winch case. **DO NOT** remove the two ⅜ in. capscrews securing the outer bearing carrier cover to the brake housing at this time. Refer to "Brake Assembly Service" for additional information.



Using a wood block, bump the end of the clutch shaft at the left hand side of the winch to unseat the brake assembly. Remove the brake assembly. Retain the shim set for reassembly.

Grasp the brake hub and pull the clutch shaft assembly out of the winch through the brake opening.



"Standard PTO Units"

On 4-shaft, standard PTO units, the clutch shaft pinion gear (28) will not clear the first reduction gear on the idler shaft. One of the following methods may be used to remove the clutch shaft assembly.

1. Refer to Idler Shaft Service and remove the first reduction gear and second reduction pinion assembly.

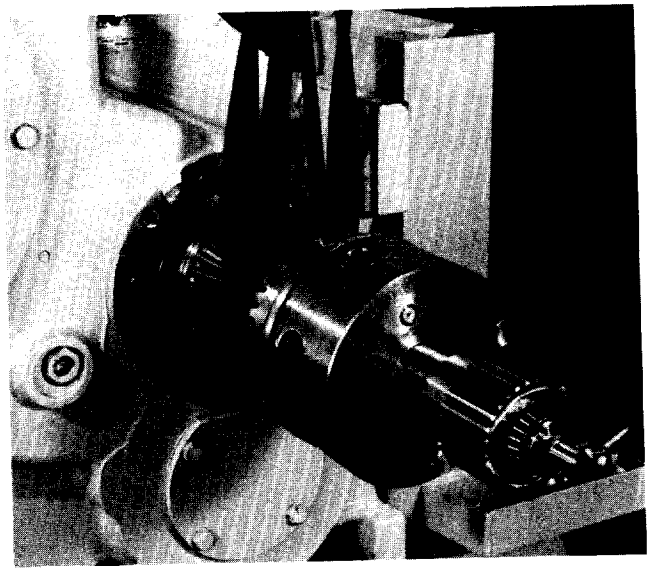
   or

2. Remove the rotary seal shaft (24) and bearing retainer (22) from the left hand side of the clutch shaft. With a gear puller, remove the bearing cone (5) and pinion gear (28).

⚠ CAUTION

DO NOT use an impact wrench to remove or install the rotary seal shaft (24). This part has been heat treated to provide long service life with the rotary seal and may be damaged by impact or over tightening. Use only hand wrenches.

To facilitate removal of the clutch shaft assembly, have an assistant place a 3 ft (1 m) length of 1 in. (25 mm) I.D. pipe over end of the rotary seal shaft and lift slightly as you both move the clutch shaft assembly out through the brake opening. Move the clutch shaft assembly out of the winch case far enough to place a lifting sling between the bevel gears.



Complete clutch shaft removal from winch case and place shaft assembly on clean work surface.

During disassembly, keep all components in the order in which they were removed.

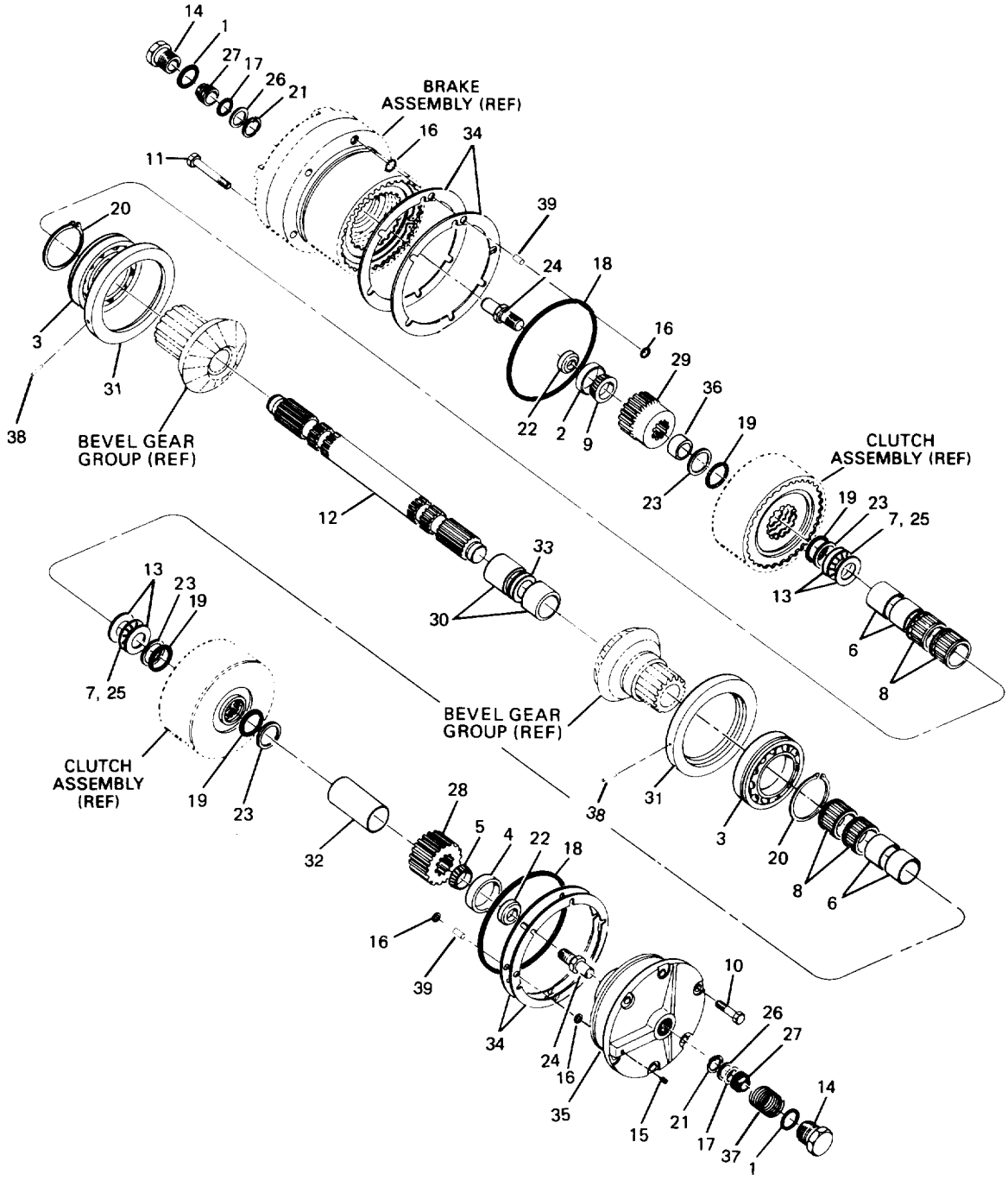
Remove the rotary seal shafts (24) and bearing retainers (22) from each end of the clutch shaft.

With a gear puller, remove the pinion gear (28) and bearing cone (5) from the clutch shaft (if not already removed). Remove the brake hub (29) and bearing cone (9) from the clutch shaft.

Remove and discard o'rings (19) and back-up rings (23) from the clutch shaft.

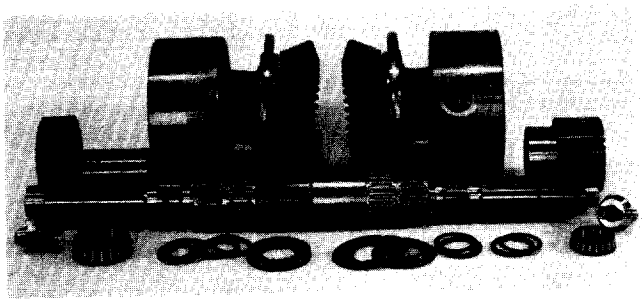
Slide each clutch assembly off of the shaft. Refer to Clutch Assembly Service for additional information.

Remove the bevel gear thrust bearing assembly (7,13, 25) from the shaft.



ITEM	DESCRIPTION	QTY.
1	O-RING (PART OF ITEM 14)	2
2	BEARING CUP	1
3	BALL BEARING — STD PTO	2
4	BEARING CUP	1
5	BEARING CONE	1
6	NEEDLE BEARING — INNER RACE	4
7	THRUST BEARING	2
8	NEEDLE BEARING	4
9	BEARING CONE	1
10	CAPSCREW, HEX HEAD	6
11	CAPSCREW, HEX HEAD	6
12	CLUTCH SHAFT	1
13	THURST BEARING RACE	2
14	PLUG (CONTAINS ITEM 1)	2
15	PLUG	1
16	O-RING	8
17	O-RING	2
18	O-RING	2
19	O-RING	4
20	RETAINING RING	2

ITEM	DESCRIPTION	QTY.
21	RETAINING RING	2
22	BEARING RETAINER	2
23	BACK-UP RING	4
24	ROTARY SEAL SHAFT	2
25	THRUST BEARING, SHOULDER SPACER	2
26	BACK-UP WASHER	2
27	ROTARY SEAL	2
28	PINION GEAR	1
29	BRAKE HUB	1
30	BEVEL GEAR SPACER	2
31	BEARING CARRIER	2
32	PINION SPACER	1
33	SHIM SET	1
34	SHIMS .005, .007, .020 in.	AR
35	CLUTCH SHAFT BEARING CARRIER	1
36	BRAKE HUB SPACER	1
37	SPRING 50B/70A ONLY	1
38	ROLL PIN – REF. SB93	2
39	SLEEVE – 50B/70A ONLY	4



Remove the bevel gear and bearing carrier assemblies (3, 31) from the shaft. Inspect bearings (3) and press off of gears if replacement is necessary. Note correct position of bearing (3) and carrier (31) retaining rings when installed on the bevel gears. The bearings have been "staked" into the carrier. If bearing replacement is necessary, use a press to remove and install the bearings. Use a center punch to "restake" the bearing carriers onto the bearings.

Remove the bevel gear needle bearings (8) and inner races (6) from the shaft.

Remove the bevel gear spacers (30) and shim set (33) from the shaft. Be sure to retain the shims for reassembly.

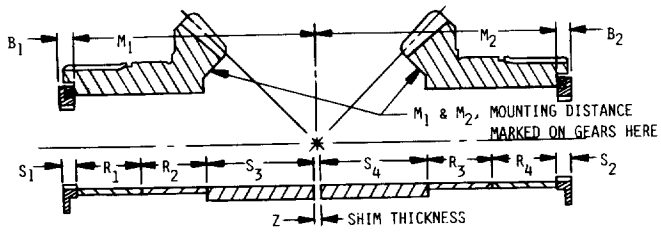
ASSEMBLY

Thoroughly clean and carefully inspect all components prior to assembly. If a component's condition is questionable — replace it!

Due to machining tolerances, installation of any new components listed below will alter the original shim pack used between the bevel gears to establish the required backlash between the bevel gears and bevel pinion.

Measurements of components must be taken and used to establish a new shim pack thickness to maintain the required .004–.012 in. (.1–.31 mm) backlash.

Use the following formula and list of components to be measured to establish the new shim pack.



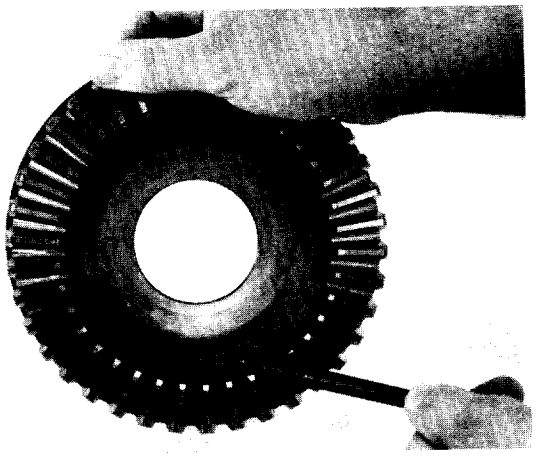
Due to machine tolerances, the thickness of the shim pack must be determined individually for each winch. The same parts which have been used for measuring must be used together.

ITEM	QTY.	DESCRIPTION
B_1, B_2	2	Thrust Bearing Assembly (Thrust bearing (7) and 2 thrust bearing races (13).
S_1, S_2	2	Thrust Bearing Shoulder Spacer (25)
S_3, S_4	2	Bevel Gear Spacer (30)
R_1, R_2	4	Needle Bearing Inner Race (6)
R_3, R_4	4	
M_1, M_2	2	Bevel Gear

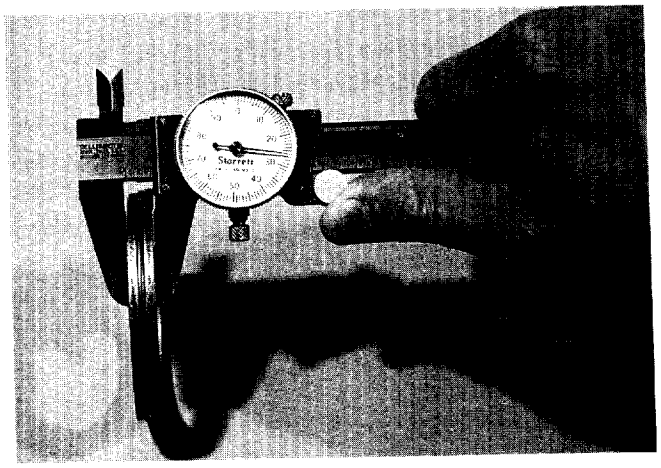
Shim Pack Thickness:

$Z = B_1 + B_2 + M_1 + M_2 - S_1 - S_2 - S_3 - S_4 - R_1 - R_2 - R_3 - R_4$

The basic shim pack supplied through Service Parts is .120 in. (3.05 mm) thick.



Record dimension M_1 and M_2, bevel gear mounting distance. The mounting distance has been etched into the inside surface of the bevel gears.



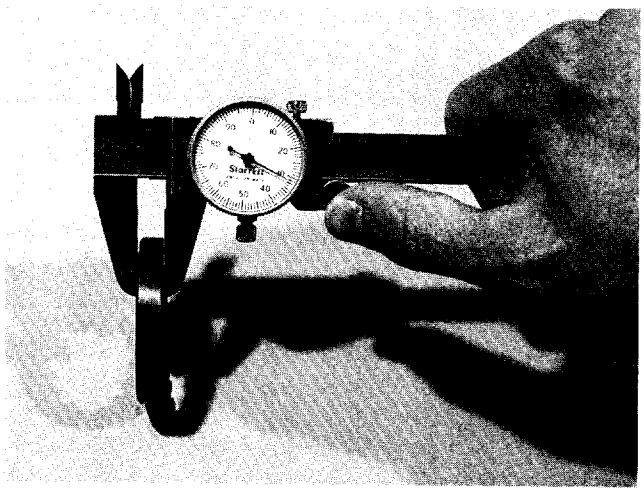
Early 50A/70 Only

Measure and record dimension B_1 and B_2, thrust bearing assembly. Each thrust bearing assembly includes: one thrust bearing race (13), one thrust bearing (7), one thrust bearing washer (very thin) and one shoulder spacer.

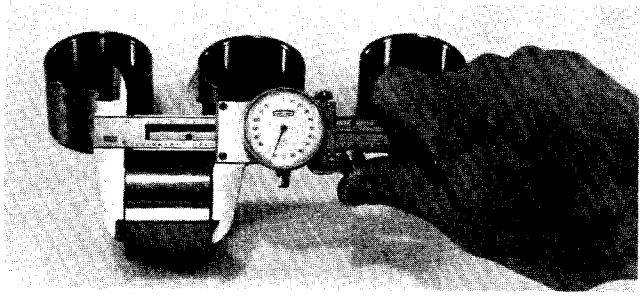
This assembly was discontinued in late 1989 with a design which could not be installed backward. Refer to Service Bulletin 91 for additional information. The later design may be installed in all early 50A/70 winches.

Late 50A/70 and all 50B/70A

Measure and record dimension B_1 and B_2, thrust bearing assembly. Each thrust bearing assembly includes: one thrust bearing (7) and two thrust bearing races (13).



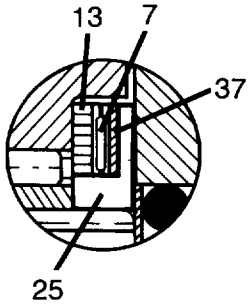
Measure and record dimension S_1 and S_2, thrust bearing spacer thickness (25) and S_3 and S_4 bevel gear spacer thickness (30).



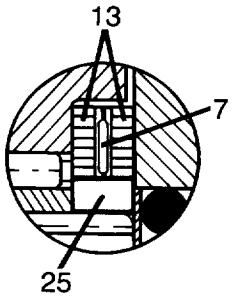
Measure and record dimension R_1, R_2, R_3, and R_4, bevel gear bearing inner race (6) thickness.

The shim pack thickness, Z, to use in re-assembly of the clutch shaft is the total mounting distance of the bevel gears M_1 and M_2 plus the total thickness of the thrust bearing assemblies B_1 and B_2 less the total thickness of the bevel gear spacers S_3 and S_4, inner bearing races R_1, R_2, R_3, R_4 and thrust bearing spacers S_1 and S_2.

Begin the clutch shaft assembly by first installing the brake side components. Install the shim pack, Z (previously determined by component measurement) onto the clutch shaft between the bevel gear spacers (30).



EARLY PRODUCTION



CURRENT PRODUCTION

ITEM	DESCRIPTION	EARLY PROD.	CURRENT PROD.
7	THRUST BEARING	2	2
13	THRUST BEARING RACE	2	4
25	THRUST BEARING SHOULDER SPACER*	2	—
	THURST BEARING SPACER	—	2
37	THRUST BEARING WASHER*	2	—

*NO LONGER USED, NOT AVAILABLE.

Install two inner bearing races (6) onto the brake side of the clutch shaft.

Install a bevel gear/bearing carrier assembly onto the clutch shaft, positioning the bevel gear over the needle bearing races (6). Lubricate and install two needle bearings (8) between the bevel gear and the bearing races.

Early 50A/70 Only

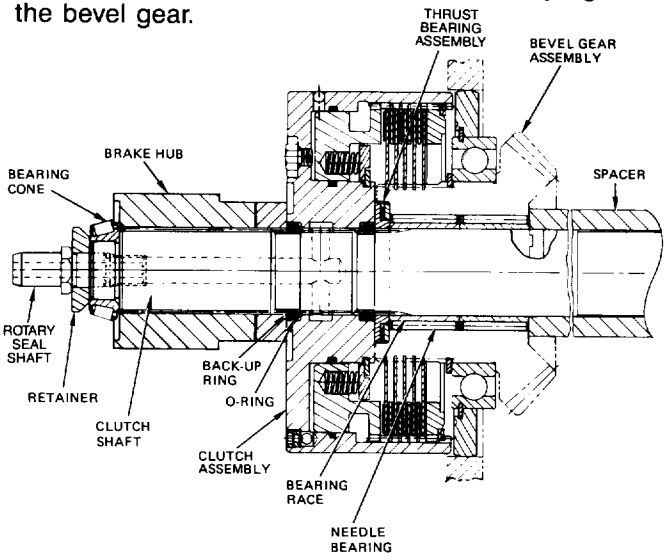
Lubricate and install the thrust bearing washer (37), thrust bearing (7) and thrust bearing race (13) over the splined thrust bearing shoulder spacer (25). Place the thin thrust bearing washer (37) next to the flange of the splined shoulder spacer (25). Install the thrust bearing (7) between the thrust bearing washer (37) and the thrust bearing race (13).

Install the thrust bearing assembly (7, 13, 25, 37) onto the clutch shaft with the flange of the splined shoulder spacer (25) out, away from the bevel gear.

Later 50A/70 all 50B/70A

Lubricate and assemble the thrust bearing (7) between two thrust bearing races (13) and place over the splined thrust bearing spacer (25).

Install the thrust bearing assembly, (7, 13, 25) onto the clutch shaft while fully seating the assembly against the bevel gear.



Lubricate and install an o'ring (19) and back-up ring (23) into the inner groove of the shaft with the back-up ring placed next to the splined thrust bearing spacer (25).

NOTE: The concave (cupped) side of the back-up ring (23) must always face the o'ring (19).

Install a clutch assembly onto the shaft aligning the splines of the clutch friction discs with the splines of the bevel gear. Seat the clutch over the o'ring and back-up ring installed on the clutch shaft.

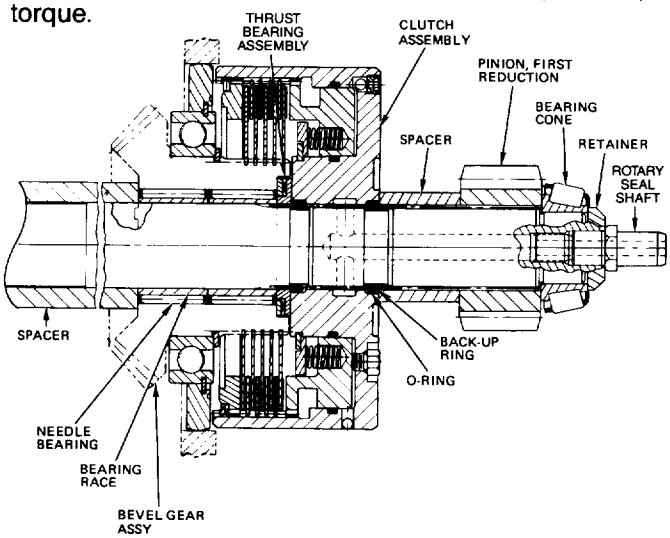
Lubricate and install an o'ring (19) into the outer groove of the clutch shaft and seat into the clutch housing. Install the back-up ring (23) next to the o'ring. Install the brake hub spacer (36) onto the clutch shaft next to the

clutch housing. The spacer should hold the o'ring and back-up ring into the clutch housing.

Install the brake hub (29) onto the clutch shaft with the small end against the spacer (36).

Install bearing cone (9) onto the clutch shaft. Press into position until the bearing cone seats securely against the shoulder of the shaft.

Install rotary seal shaft (24) and retainer (22) onto the clutch shaft. Install the bearing retainer with the small diameter (chamfered) side toward the bearing cone. Apply Loc-tite 242 or equivalent to the threads and pilot shoulder of the shaft and tighten to 40 lb•ft (54 N•m) torque.



Complete the assembly of the clutch shaft by installing the remaining components on the gear side of the shaft.

Lubricate and install two inner bearing races (6) onto the shaft.

Install the remaining bevel gear assembly over the inner bearing races.

Lubricate and install two needle bearings (8) between the bevel gear and bearing races.

Assemble the remaining thrust bearing, as described earlier, and install it onto the clutch shaft.

Lubricate and install an o'ring (19) and back-up ring (23) into the inner groove of the shaft, with the back-up ring placed next to splined thrust bearing spacer (25).

Install a clutch assembly onto the shaft, aligning the splines of the clutch friction discs with the splines of the bevel gear. Seat the clutch over the o'ring and back-up ring in the inner groove of the shaft.

Lubricate and install an o'ring (19) into the outer groove of the clutch shaft and seat into the clutch housing. Install the back-up ring (23) next to the o'ring.

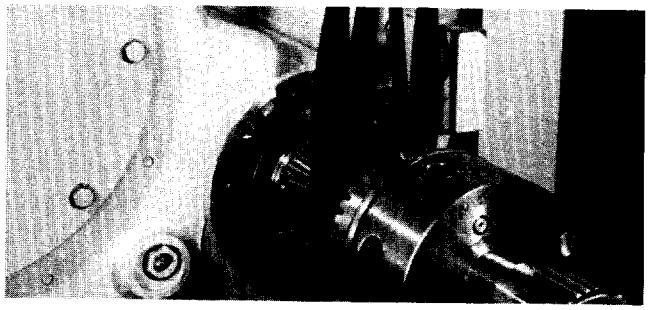
Install spacer (32) over the clutch shaft, next to the clutch assembly. The spacer will hold the o'ring and back-up ring into the clutch housing.

Install the first reduction pinion gear (28) onto the clutch shaft next to the spacer.

Install bearing cone (5) onto the shaft. Press the bearing cone firmly against the pinion gear (28) until no clearance remains between any of the components of the clutch shaft.

Install the rotary seal shaft (24) and retainer (22) into the end of the clutch shaft. Install the bearing retainer with the large diameter (flat) side toward the bearing cone. Apply Loc-tite 242 or equivalent to the threads and pilot shoulder of the shaft and tighten to 40 lb•ft (54 N•m) torque.

INSTALLATION



Place the lifting sling between the bevel gears and install the clutch shaft assembly into winch case through the brake opening. Carefully slide the assembly into the center of the winch case where the bevel gear bearing carriers (31) are supported by the winch case.

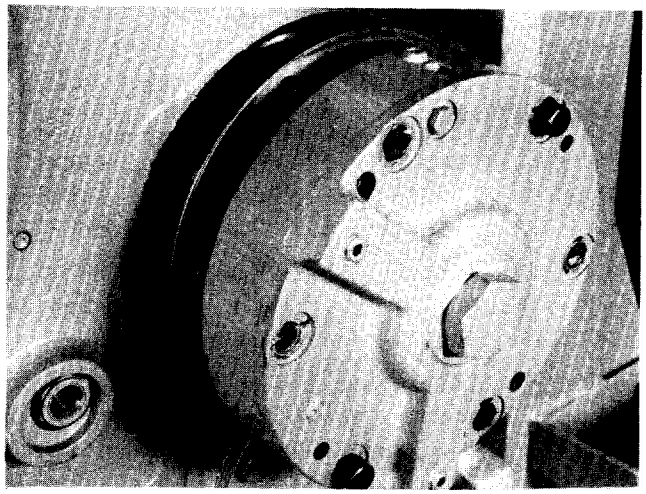
Later 50A/70 and all 50B/70 winches are fitted with a rollpin (38) driven into outside surface of the bevel gear bearing carriers (31). These rollpins must be aligned with grooves machined in the inner case bores.

Lubricate and install three o'rings (16) into grooves of the winch case oil ports on the brake side.

Lubricate and install three (3) more o'rings (16) into grooves of the brake housing oil ports.

Use the shim set (34) removed during disassembly or a new shim set of the same thickness. Position shim set over the brake housing, aligning oil ports.

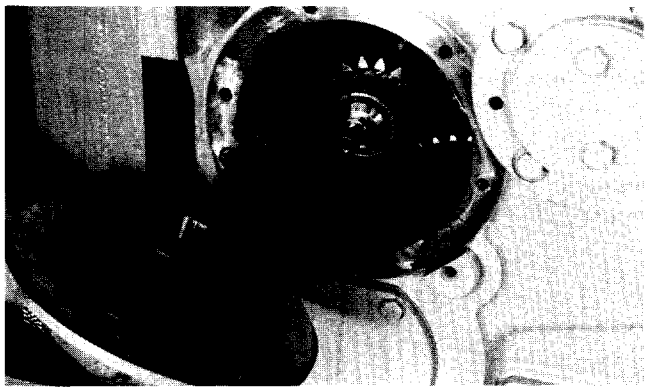
Lubricate and install o'ring (18) into the groove around the brake housing.



Install the brake housing and shim set into the winch case carefully aligning the oil ports. Make certain that

all of the brake friction discs have engaged the brake hub (29) before installing capscrews.

Coat threads of capscrews with non-hardening thread sealant (50A/70 only) and tighten to 75 lb•ft (102 N•m) torque.



Lubricate and install o'ring (16) into groove of winch case oil port and into groove of bearing carrier (35).

Use the original shim set or a new shim set of the same thickness. Position the shim set over the bearing carrier, aligning the oil port and bolt holes.

Lubricate and install the o'ring (18) around the bearing carrier cover.

Install rotary seal and o'ring (17,27) into the bore of the cover. Install back-up washer (26) and secure with retaining ring (21).

Install the bearing carrier assembly (35) into the winch case, carefully aligning the oil port in the cover and shim set with the oil port in the winch case.

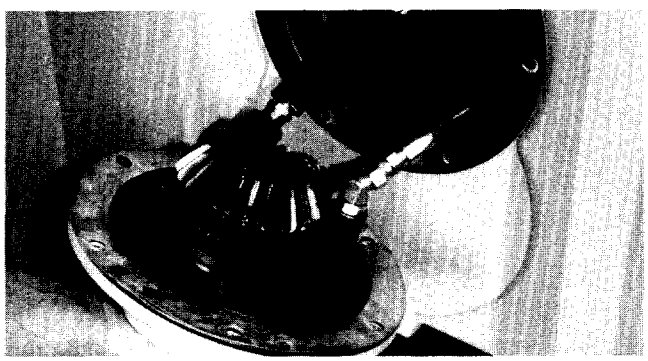
Coat threads of capscrews (10) with thread sealant (50A/70 only) and tighten to 70 lb•ft (102 N•m) torque.

Place a dial indicator at the end of the rotary seal shaft in the left hand bearing carrier cover. (Plugs 14, have been removed)

Move clutch shaft assembly from side to side by tapping rotary seal shaft with a wood block. End play should be .005–.010 in. (.13–.25 mm).

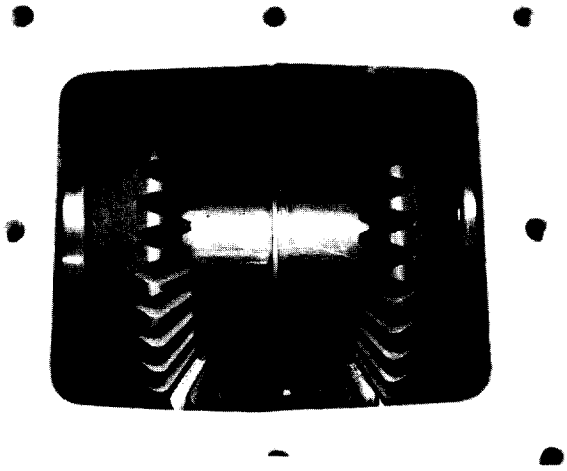
Remove left hand bearing carrier cover and add or remove shims (34) as required to obtain correct end play.

Install plug (14) into bearing carrier cover.



Install bevel pinion and pump carrier assembly into the front of the winch. Use the original shim set and shim gasket, or new shim set and gasket of the same thickness.

Refer to "Bevel Pinion and Pump Carrier Service" for installation instructions and procedure for obtaining correct tooth contact pattern.



With correct bevel gear tooth contact pattern established, move clutch shaft assembly to the right (brake side). Gently tap wooden wedge between the bevel gear spacers and bevel pinion to move the bevel pinion away from the bevel gears, eliminating any axial bearing assembly clearance.

Place a dial indicator on the right hand bevel gear and check backlash reading of .004–.012 in. (.10–.31 mm).

Move the clutch shaft assembly to the left. Place a dial indicator on the left hand bevel gear and check backlash reading of .004–.012 in. (.10–.31 mm).

Transfer shims between brake housing and left hand bearing carrier to equalize the bevel gear backlash.

If an equalized bevel gear backlash reading is not obtainable, recheck bevel gear and pinion tooth contact pattern and recheck end play in clutch shaft assembly.

Repeat backlash measurements on left hand and right hand bevel gears until an equalized .004–.012 in. (.10–.31 mm) reading is obtained.

Install plugs (14) into brake housing and left hand bearing carrier.

Make certain pump hoses and all capscrews are properly tightened.

Refill winch to proper level with recommended oil.

CLUTCH ASSEMBLY SERVICE

Two identical clutch assemblies are mounted on the clutch shaft: One is used for Haul-in, the other for Pay-out. Each clutch contains five friction discs (12) splined to the bevel gears and four* steel discs (13) splined to the clutch housing. The clutch housing is splined to the clutch shaft.

When the operator shifts his control handle to operate the winch, hydraulic pressure is directed through a passage in the clutch shaft to the appropriate clutch housing. The oil pressure then acts on the clutch piston to compress the steel and friction discs thereby locking the bevel gear to the clutch shaft and winch gear train.

When the operator returns the controls to "Brake-on", the clutch application oil will be exhausted through the control valve and through a small check valve installed in the clutch housing. The piston return springs (3) will push the piston away from the clutch discs and permit the bevel gear to turn free of the clutch shaft which is now locked by the spring applied brake.

REMOVAL

Right hand or left hand clutch removal may be accomplished with the winch mounted to the tractor. However, if both clutch assemblies are to be inspected for repair and/or replacement, it is advantageous to remove the winch from the tractor.

The bevel pinion carrier and pump assembly is removed from the front of the winch and, after removal of the brake assembly, the complete clutch and bevel gear shaft assembly is removed through the brake opening on the right hand side of the winch.

Refer to Clutch Shaft Group, for removal and disassembly of the clutch and bevel gear shaft assembly.

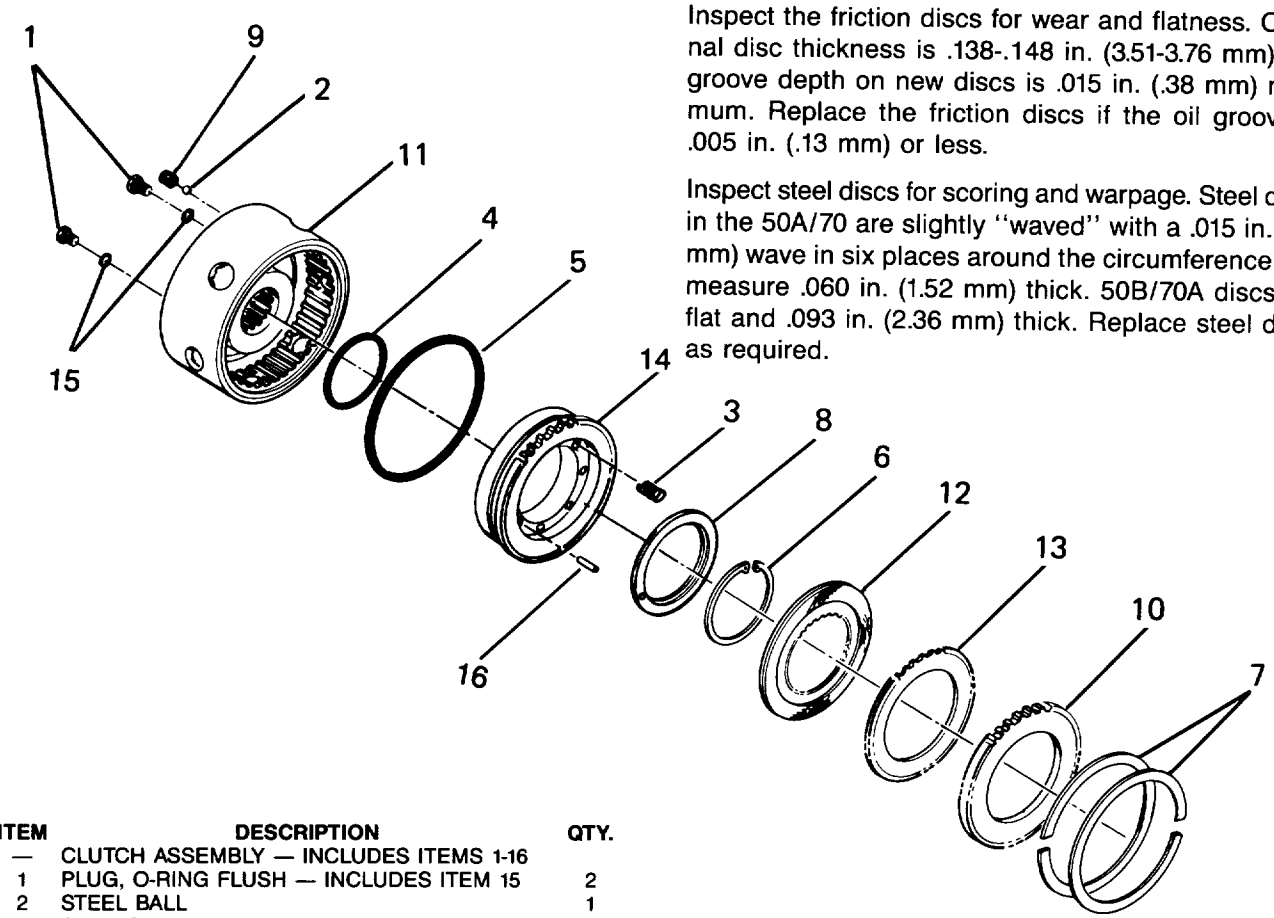
DISASSEMBLY

Remove the pressure plate retaining ring(s) (7).

Remove the pressure plate (10) clutch friction discs (12) and steel discs (13). The clutch pack consists of five friction discs and four steel discs.*

Inspect the friction discs for wear and flatness. Original disc thickness is .138-.148 in. (3.51-3.76 mm). Oil groove depth on new discs is .015 in. (.38 mm) minimum. Replace the friction discs if the oil groove is .005 in. (.13 mm) or less.

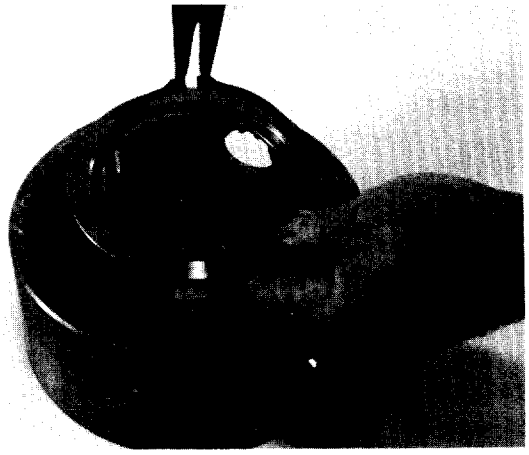
Inspect steel discs for scoring and warpage. Steel discs in the 50A/70 are slightly "waved" with a .015 in. (.38 mm) wave in six places around the circumference and measure .060 in. (1.52 mm) thick. 50B/70A discs are flat and .093 in. (2.36 mm) thick. Replace steel discs as required.



ITEM	DESCRIPTION	QTY.
—	CLUTCH ASSEMBLY — INCLUDES ITEMS 1-16	
1	PLUG, O-RING FLUSH — INCLUDES ITEM 15	2
2	STEEL BALL	1
3	SPRING	8
4	O-RING	1
5	O-RING	1
6	RETAINING RING	1
7	RETAINING RING	2
8	SPRING RETAINER	1

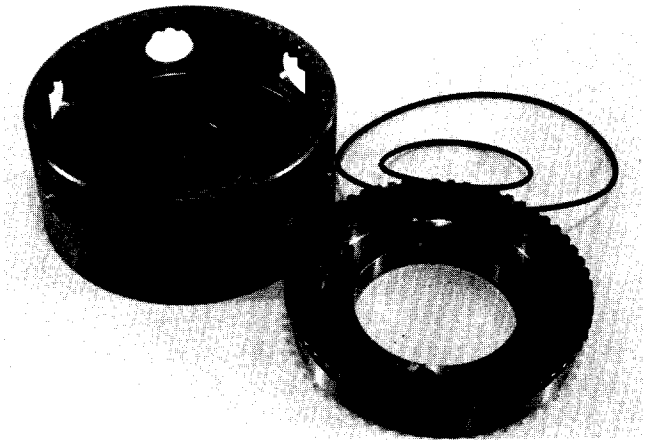
*Install one additional disc – steel (13) if piston travel exceeds .165 in. 50A/70 only.

ITEM	DESCRIPTION	QTY.
9	CHECK VALVE SEAT	1
10	PRESSURE PLATE	1
11	CLUTCH HOUSING ASSEMBLY	1
12	DISC — FRICTION, BRONZE	5
13	DISC — STEEL	4*
14	CLUTCH PISTON	1
15	O-RING	2
16	PIN	1



Using a suitable press, depress spring retainer (8) and remove retaining ring (6) and clutch spring retainer (8).

Remove the eight clutch piston return springs (3). During the rebuild of clutch assemblies, it is recommended to replace all eight springs. Minimum spring free length is 1.41 in. (35.8 mm).



Turn the clutch housing over and tap on bench top to remove clutch piston (14). Inspect piston for wear or damage.

Remove o'rings (4,5) from the inner and outer grooves of the clutch housing. Replace o'rings upon reassembly.

Remove the check valve seat (9) and steel ball (2) from the back side of clutch housing (11). Inspect for wear and make sure all foreign material that may restrict the steel ball seating action is removed.

Remove the two flush plugs (1) from the back side of the clutch housing.

ASSEMBLY

Thoroughly clean and inspect all components prior to assembly.

Install the steel check-ball (2) into the back side of clutch housing (11). Coat threads of check valve seat (9) with Loc-tite 242 and install flush with the surface of the clutch housing. Make certain that the steel ball moves freely.

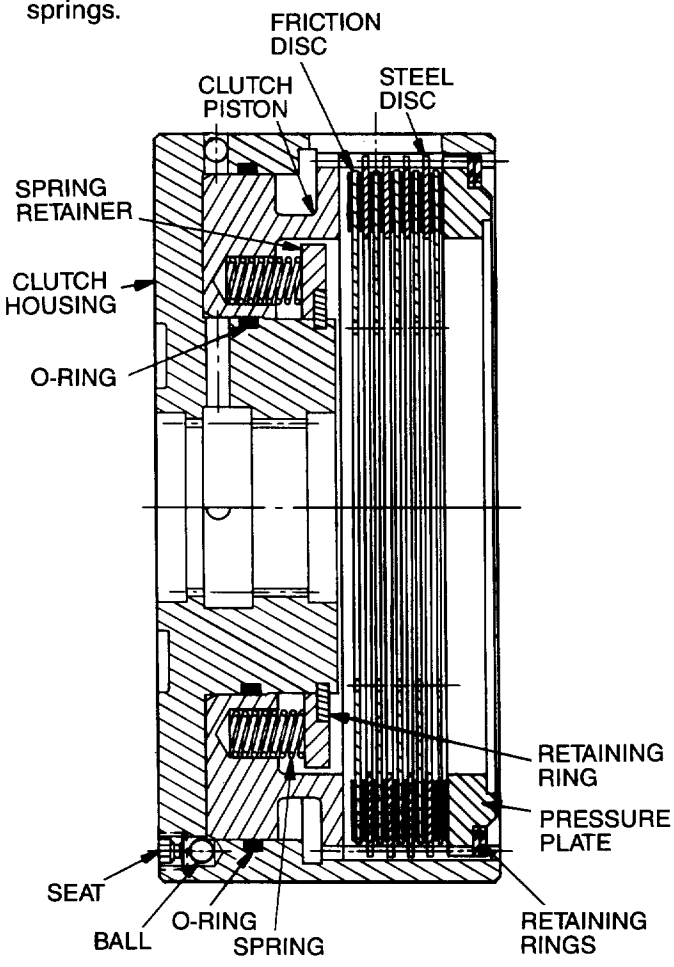
Install the two flush plugs (1) into the back side of the clutch housing.

Lubricate o'rings (4,5) with hydraulic oil and install o'rings into the grooves of the clutch housing.

Lubricate the piston o'ring sealing surface with hydraulic oil then align clutch piston teeth in clutch housing and push piston (14) into bottom of clutch housing (11).

Install spring retainer (8) over springs and align hole in retainer with roll pin (16) in clutch piston.

Using a suitable press against spring retainer (8) compress springs to expose the retaining ring groove. Install retaining ring (6) with the sharp edge of the inner diameter of the retaining ring facing away from the clutch springs.



NOTE: Pre-lubricate the clutch discs in winch lubricant before assembly.

Install the discs by starting with a friction disc (12) (teeth on inside diameter) and alternate with a steel disc (13) (teeth on outer diameter) until a total of five friction discs and four steel discs are installed.

Install the pressure plate (10) and retaining ring(s) (7).

Early 50A/70 clutch assemblies installed in winch serial numbers 8600001 through 8800862 used one large Truarc retaining ring to restrain the pressure plate. S/N 8800863 and later used two thinner retaining rings which must be installed with the gaps located 180° apart.

The 50A/70 steel separator discs are .060 in. (.152 mm) thick and have a slight wave located every 60° which slightly aids lubrication.

All 50B/70A winches use only one of the later style retaining rings to provide for additional room for the thicker steel separator discs which are .093 in (2.4 mm) thick and flat (not waved). 50A/70 clutches may be modified to accept the thicker discs by following the procedure described in Service Bulletin 96.

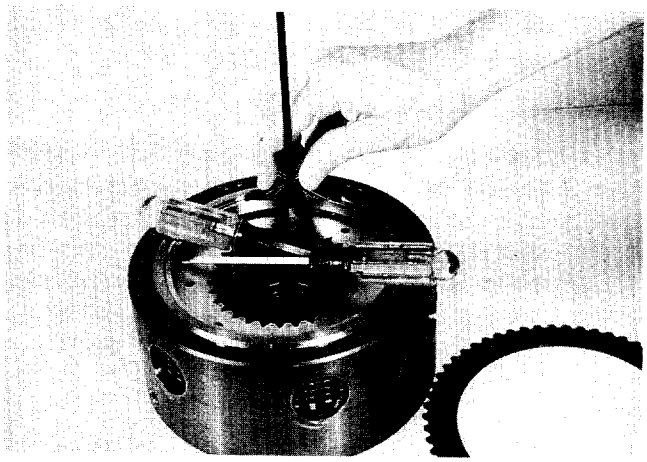
50A/70 Only

The assembled clutch must have .100 in. (2.54 mm) minimum piston travel which is seen as clearance between the pressure plate and the top disc. If the clutch pack clearance exceeds .165 in. (4.19 mm), an additional steel disc (13) must be installed between the pressure plate and the top friction disc. Most 50A/70 clutch assemblies will require the 5th steel disc.

If the clutch pack clearance exceeds .165 in. (4.19 mm), this indicates some wear of the discs. The friction discs are completely worn out and must be replaced if the clearance exceeds .200 in. (5.1 mm). If the clearance is less than .100 in. (2.54 mm), this indicates that the clutch piston may not be fully retracted or some distortion of the discs may be consuming the clearance. Closely inspect and repair or replace components as required.

50B/70A Only

The assembled clutch must have .090-.140 in. (2.29-3.56 mm) clearance between the pressure plate and the top friction disc with new clutch discs. If the clutch pack clearance exceeds .140 in. (3.56 mm), this indicates some wear of the discs. The friction discs are completely worn out and must be replaced if the clearance exceeds .200 in. (5.1 mm). If the clearance is less than .090 in. (2.29 mm), this indicates that the clutch piston may not be fully retracted or some distortion of the discs may be consuming the clearance. Closely inspect and repair or replace components as required.



TIP: To ease the measurement of the clutch assembly clearance, gently wedge two standard blade screwdrivers between the pressure plate and disc. Locate the screwdrivers 180° apart. Measure from the top of the pressure plate to the top of the disc while the screwdrivers hold the pressure plate wedged tightly against the retaining ring(s). Call this dimension "A".

Remove the screwdrivers and push the pressure plate down against the disc. Again, measure from the top of the pressure plate to the top of the disc. Call this dimension "B".

A-B = Clutch pack clearance; the distance the piston travels to compress the discs in the fully applied condition.

It may be advantageous to pre-align the clutch discs and hold them in position for assembly. To do this, remove the two flush plugs (1) from the back side of the clutch housing. Next, install the clutch onto the end of the clutch shaft splines. Install the brake hub onto the clutch shaft and into the clutch assembly, aligning all disc splines. Then, install two 3/8 in. NF × 1 capscrews through the flush plug holes to push the clutch piston against clutch discs and hold them in position. Remove the brake hub and clutch shaft. The clutch assembly is now ready for installation.

⚠ CAUTION

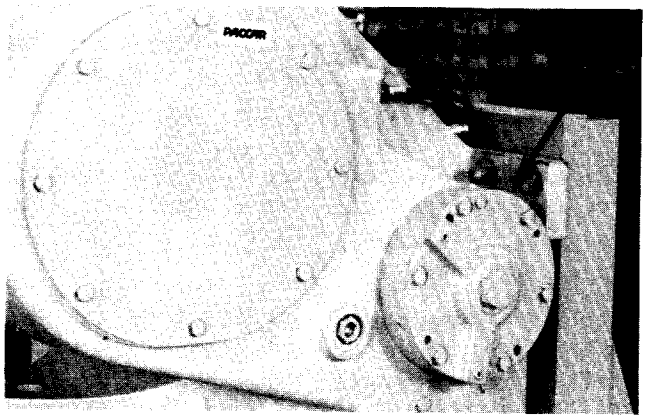
After installation of the clutch, be sure to remove the two 3/8 in. NF × 1 capscrews from the back side of the clutch housing and install two flush plugs (1). Failure to remove the capscrews or install the flush plugs will result in clutch assembly damage.

BRAKE ASSEMBLY SERVICE

The brake system consists of a multi-disc, spring-applied, hydraulically released oil brake. Under normal conditions, no periodic brake adjustment is required.

STANDARD BRAKE

The brake may be used on a **intermittent** basis to lower a load. However, partially releasing the brake and lowering the load through the brake causes excessive heat build-up after repeated cycles. Allow the brake to cool between lowering cycles to avoid overheating and brake damage. Lowering of loads should be accomplished by moving the powershift lever to the pay-out position, completely engaging the pay-out clutch and using the tractor throttle to vary the lowering speed.



The brake assembly is located on the right hand side of the winch in the lower winch case bore on a low PTO and upper winch case bore on a STD PTO winch. Standard PTO shown.

The winch gear train is connected to the brake assembly by the brake hub, attached to the end of the clutch shaft. The brake hub is splined to eight friction discs (15). The friction discs are alternately stacked between steel discs (16) which are splined to the brake housing (14) which is anchored to the winch case.

Two large disc type springs (19) exert a tremendous force against the brake piston (13) and retainer (11) to hold the brake disc pack compressed, locking the winch gear train to the winch case.

Whenever the operator applies a clutch or shifts to "Brake-Off", hydraulic pressure is directed to the brake chamber to overcome the spring force and relieve the compression of the discs. When released, the brake hub and gear train can turn as the brake friction discs slip freely between the brake steel discs.

If the operator returns the controls to the neutral "Brake-On" position, the hydraulic pressure will be exhausted from the brake chamber and the brake springs will quickly reapply to lock the winch gear train to the brake housing through the brake discs.

In most applications, the brake assembly may be removed for service with the winch mounted on the tractor.

MANUAL OVERRIDE (MOR) BRAKE

The Manual Override (MOR) brake system utilizes the same brake housing, brake springs and brake discs as the standard brake but ads an additional MOR brake piston which is controlled by a separate control valve to provide very precise load control.

The MOR brake operates exactly like the standard brake when a clutch is applied or when the operator has placed the power shift control in the "Brake-off" position. When critical load positioning is required while lowering short distances, the separate MOR control level should be pulled toward the operator to fully apply the MOR brake piston against the brake pack. Then, the power shift lever is moved to "Brake-off" which releases the standard spring applied brake. The load cannot move though, because the MOR brake piston is holding the brake pack fully compressed.

As the operator **slowly** releases the MOR lever, the MOR control valve is releasing some of the oil pressure behind the MOR brake piston which had been holding the brake pack compressed. The discs may now begin to slip and allow the brake hub, clutch shaft and gear train to turn. If the operator pulls back on the lever, the MOR control valve will increase the oil pressure — the MOR brake piston will compress the brake pack and stop the load.

When the desired position is reached, the operator should pull the MOR control lever back and move the power shift lever into "Brake-on". The brake will now be fully applied by spring force and the MOR control lever may be released.

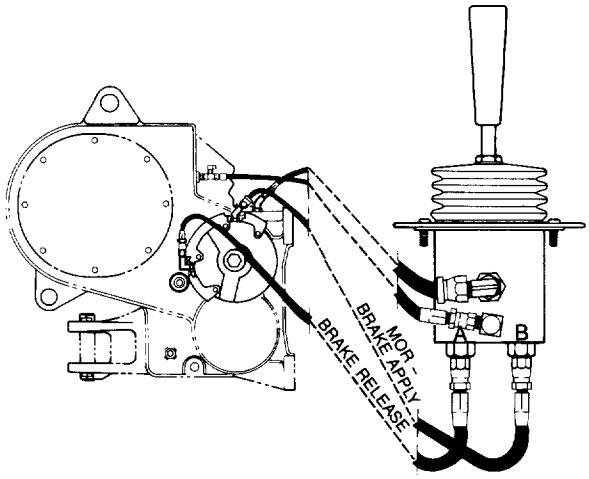
The MOR brake should only be used when lowering loads short distances or where precise load positioning is required. Continuous use of the MOR brake will cause accelerated wear of the brake discs. For lowering longer distances, place the power shift control lever in the pay-out position and control lowering speeds with the tractor throttle.

The MOR control valve may also be used to release the spring applied brake by shifting the control handle to "brake-off". The control valve sends oil pressure to the brake chamber through a shuttle valve in the brake housing. The shuttle valve consists of two opposing ball guides and a steel check ball. The shuttle valve permits the control of the standard, spring applied brake from two different sources.

⚠ WARNING

Lowering loads with the Manual Override Brake independent of the pay-out clutch may result in rapid load descent, property damage, personal injury or death if the MOR brake is released too quickly.

MOR CONTROL CIRCUIT



Four hoses connect the MOR control valve to the winch. The pressure supply hose runs from the winch gauge port, located next to the control cables on the right-hand side of the winch to the "D" port of the MOR control valve.

The MOR control valve port "C" is the exhaust port which is connected to a drain port on top of the winch case by a low pressure hose.

The MOR control valve contains four cartridges: two above each metering port. Each metering port contains a normally closed cartridge which blocks the flow of oil from the supply port "D" and holds the metering ports "A" and "B" open to the exhaust port "C" when the control handle is in the center, neutral position.

Moving the handle away from neutral closes the exhaust port "C" and opens the supply port "D" to the metering cartridge at "A" or "B" port. Returning the handle to neutral will close the supply port and exhaust the metered oil pressure in "A" or "B" hose out through the "C" hose back to the winch case.

REMOVAL

If equipped with the MOR brake, begin removal by disconnecting the external hoses from the brake "B" and manual override "MOR" ports on the brake housing.

Drain oil from the winch into a suitable container and recycle or dispose of used oil in an environmentally responsible manner.

Remove the six ½ in. capscrews securing the brake assembly to the winch case. Do not remove the two ⅜ in. capscrews (2) which secure the bearing carrier to the brake housing at this time.

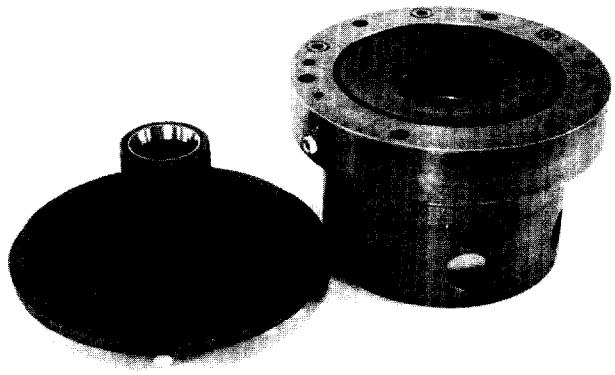
The brake housing has two through-tapped holes which may be used with ½ in. NC jackscrews to push the brake housing out of the winch case bore.

If jackscrews are not available, the brake may be removed from the winch case by carefully using a prybar between the brake housing and winch case. Be careful not to damage the shim set.

Remove the brake assembly from the winch case. The brake assembly weighs approximately 50 lbs (22.7 kg). Retain the shim set for reassembly.

DISASSEMBLY

Place the brake assembly onto a work bench with the disc end down. Remove the two ⅜ in. capscrews (2) securing the bearing carrier (18) to the brake housing (14) and remove the carrier. Remove the retaining ring from inside of the carrier and remove the rotary seal and o-ring assembly; replace as required. Inspect the bearing cup in the bearing carrier; replace as required.



Remove and discard the three o-rings (4) from the oil port grooves in the brake housing. Remove the two brake springs (19). Note the position of the springs for reassembly.

Place the brake assembly on the work bench with the disc end facing up.

Remove retaining ring(s) (10), pressure plate (9) and shim set (6). Retain the shim set for use in reassembly. The 50B/70A does not use a shim set.

Remove the friction discs and steel discs (15 & 16).

Inspect the friction discs for wear and flatness. Original friction disc thickness is .138-.144 in. (3.51-3.76 mm). The oil groove depth of a new disc is .015 in. (.38 mm) minimum. Replace friction discs if oil groove is .005 in. (.13 mm) or less.

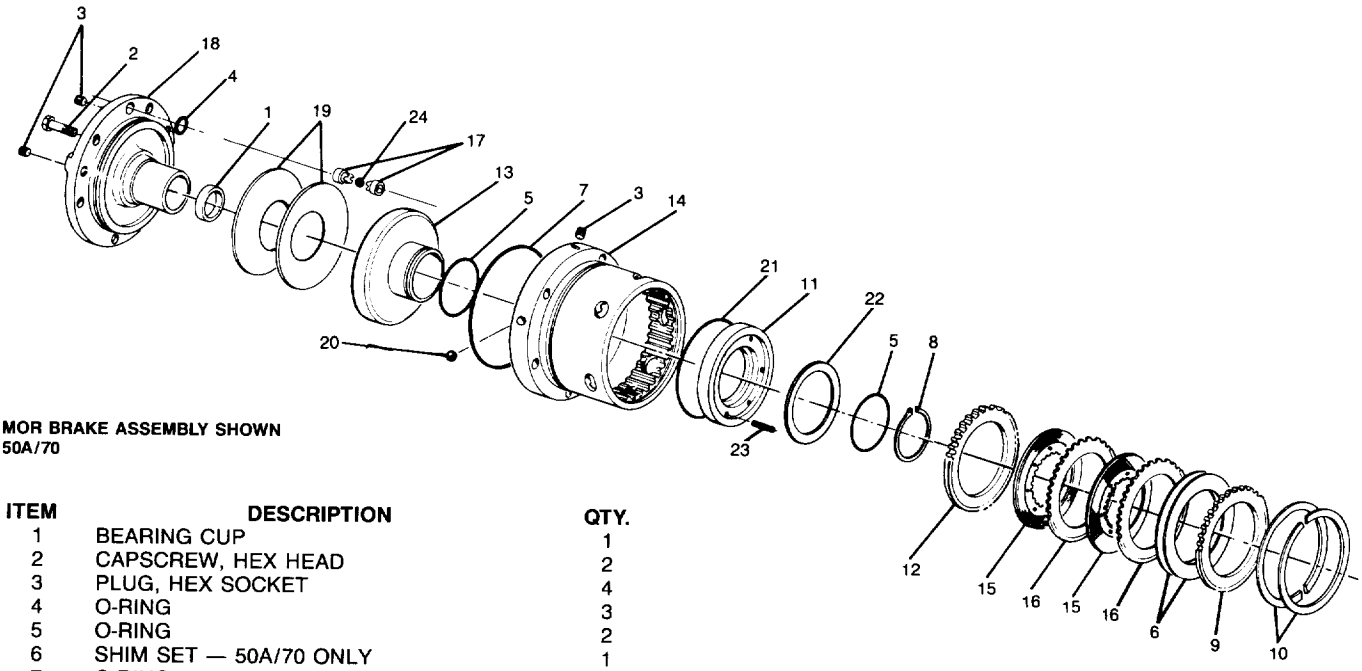
Inspect the steel discs (16) for scoring and warping. 50A/70 steel discs are "waved", with a .015 in. (.38 mm) wave in six places about the circumference. 50B/70A steel discs are flat. Replace steel discs as required.

STANDARD BRAKE 50A/70 - 50B/70A

Remove retaining ring (8) and piston retainer (11). Push brake piston (13) free of brake housing. Remove and discard o-rings (5 & 7) from the inner grooves of the brake housing.

MANUAL OVERRIDE (MOR) BRAKE 50A/70, 50B/70

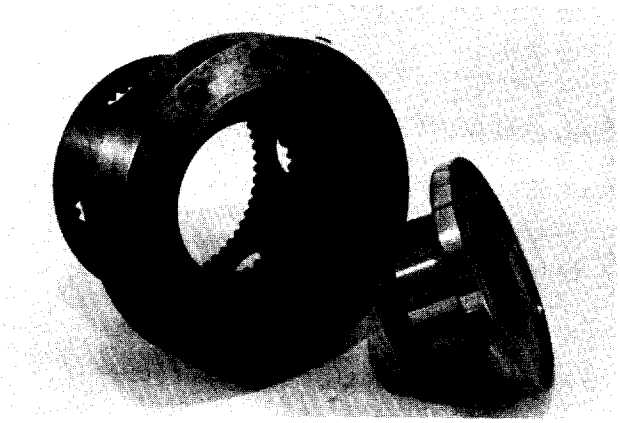
Using a suitable press, depress the spring retainer (22) and remove retaining ring (8). Remove the six springs



MOR BRAKE ASSEMBLY SHOWN
50A/70

ITEM	DESCRIPTION	QTY.
1	BEARING CUP	1
2	CAPSCREW, HEX HEAD	2
3	PLUG, HEX SOCKET	4
4	O-RING	3
5	O-RING	2
6	SHIM SET — 50A/70 ONLY	1
7	O-RING	1
8	RETAINING RING	1
9	PRESSURE PLATE — OUTER	1
10	RETAINING RING 50A/70 (2) 50B/70A (1)	
11	{ PISTON RETAINER — STANDARD BRAKE { OVERRIDE PISTON — MOR BRAKE	1 1
12	PRESSURE PLATE — INNER	1
13	BRAKE PISTON	1
14	BRAKE HOUSING	1
15	DISC — FRICTION BRONZE	8
16	DISC — STEEL WAVED	8
17	{ INSERT — STANDARD BRAKE { BALL GUIDE — MOR	1 2
18	BEARING CARRIER	1
19	BRAKE SPRING	2
20	STEEL BALL	2
21	O-RING	1
22	SPRING RETAINER — MOR ONLY	1
23	SPRING — MOR ONLY	6
24	STEEL BALL — MOR ONLY	1

(23), retainer (22) and MOR piston (11). Push brake piston (13) free of brake housing. Remove and discard o-rings (5 & 7) from the inner grooves of the brake housing.



ASSEMBLY

Thoroughly clean and carefully inspect all components for wear or damage prior to reassembly. Replace components as required.

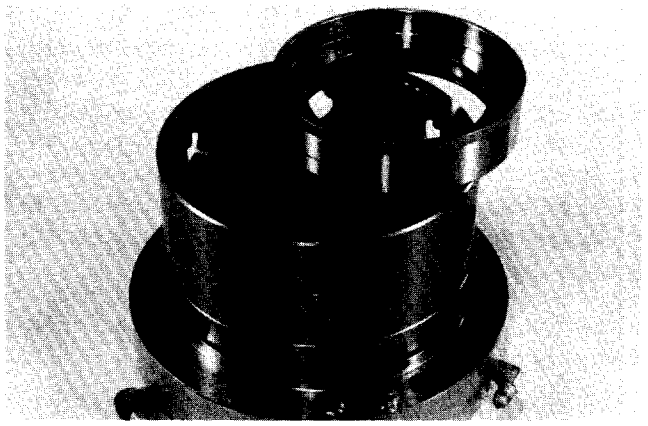
Install brake piston o'rings (5, 7) into grooves of brake housing. Lubricate o'rings after installation with winch oil or light general purpose grease.

Lubricate brake piston sealing surfaces and install brake piston (13) into the brake housing until fully seated.

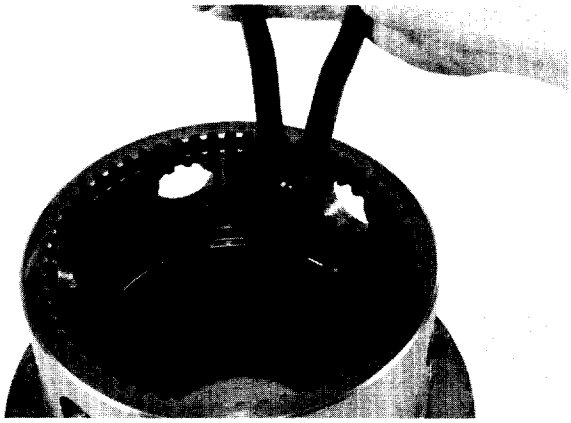
STANDARD BRAKE

Install piston retainer (11) over piston hub (13) with the large diameter end facing up. Secure in place with retaining ring (8).

MOR BRAKE



Install o'ring (21) into the brake housing and o'ring (5) into the MOR piston then install the MOR piston (11) into the brake housing and over the brake piston (13).



Install MOR piston return springs (23) and spring retainer (22). Secure with retaining ring (8).

BRAKE DISC PACK INSTALLATION AND ADJUSTMENT PROCEDURE – 50A/70 ONLY

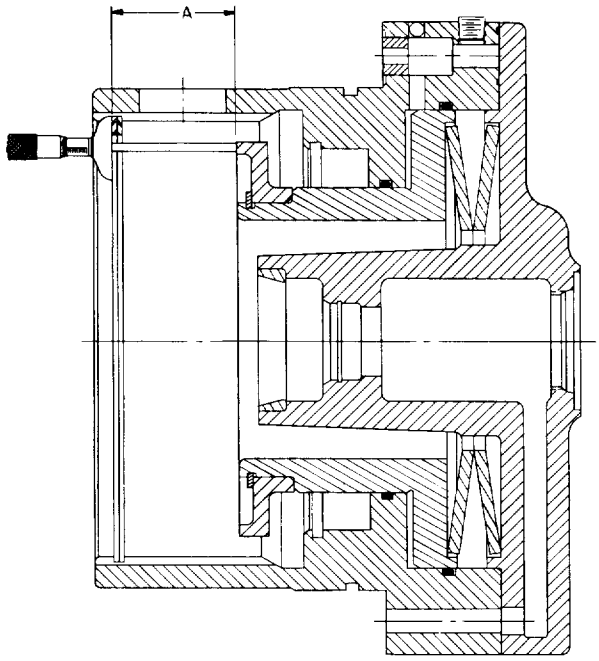
Postion the brake housing with the disc end of the housing facing down. Place two brake springs (19) into the brake housing against the brake piston with the dished side of the springs facing away from each other.

Assemble bearing carrier (18) to the brake housing and secure with two 3/8 in. capscrews (2).

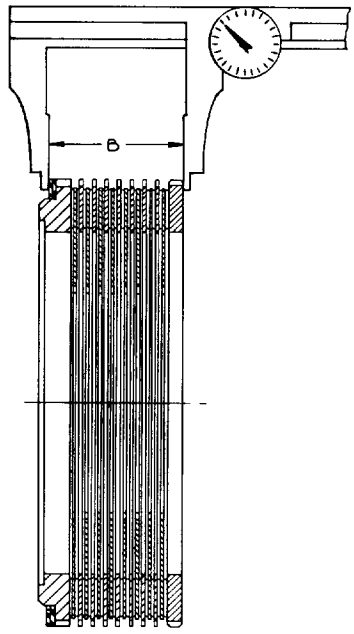
Turn the brake housing over and install the two brake pack retaining rings (10) into the groove of the brake housing with gaps 180° apart.

Push the brake piston down in the housing against the brake springs.

Hold clearance out of the retaining rings by gently pulling the rings upward against the top of the groove. Using a depth micrometer or vernier caliper, measure distance "A" from the top of the piston retainer or override piston (11) to the top of retaining rings (10).



Remove retaining rings (10). Turn the brake housing over and remove the bearing carrier (18) and the two brake springs (19).



Stack retaining rings (10), pressure plates (9 & 12) and brake disc pack (15 & 16), then measure distance "B", the thickness of the stack. Record this measurement. **Note:** Measure thickness of pressure plate (9) at retaining ring flange **only. Do not** measure at thickest section.

The preceding "A" and "B" measurements are taken to determine the shim pack thickness (S) that is used to establish an assembled brake spring deflection of .150 in. (3.81 mm).

The shim pack (S) is determined as follows:

If distance "A" is **greater** than distance "B", shim pack (S) = (distance "A" – distance "B") + .150 in. (3.81 mm).

If distance "A" is **less** than distance "B", shim pack (S) = .150 in. (3.81 mm) – (distance "B" – distance "A").

Shim pack (S) consists of all or part of shim set (6). Install shim pack (S) between pressure plate (9) and the outer steel disc (16).

Position brake housing on work bench with the disc end facing up.

Install the inner pressure plate (12) into the brake housing against the piston retainer or MOR piston (11).

If the clutch shaft group has been disassembled, install the brake hub into the brake housing to keep the friction discs aligned.

NOTE: Pre-lubricate the discs in winch lubricant prior to assembly.

Install the discs by starting with a friction disc (15) (teeth on inside diameter) and alternate with a steel disc (16) (teeth on outside diameter) until a total of eight friction discs and eight steel discs have been installed.

Install shim pack (S) followed by the outer pressure plate (9).

Install the retaining rings (1) securely into the brake housing groove with the gaps 180° apart.

BRAKE DISC PACK INSTALLATION – 50B/70A ONLY

The 50B/70A brake pack requires no adjustment.

Position the brake housing with the disc end of the housing facing up.

Install the inner pressure plate (12) into the brake housing against the piston retainer or MOR piston (11).

If the clutch shaft group has been disassembled, install the brake hub into the brake housing to keep the friction discs aligned.

NOTE: Pre-lubricate the discs in winch lubricant prior to assembly.

Install the discs by starting with a friction disc (15) (teeth on inside diameter) and alternate with a steel disc (16) (teeth on outside diameter) until a total of eight friction and seven steel discs have been installed.

Install the outer pressure plate (9) and secure in place with a retaining ring (10).

BRAKE SPRING INSTALLATION – 50A/70 & 50B/70A

Position the brake housing with the disc end facing down.

Install the two brake springs (19) into the housing against the brake piston with the dished (concave) side of the springs facing away from each other.

⚠ WARNING

One brake spring must "nest" within the shallow cavity on the outside of the brake piston while the other brake spring will nest in the shallow cavity in the bearing carrier. If the springs slip out of the cavities during assembly, brake component damage and improper brake operation may occur. Improper brake operation may lead to loss of load control which may result in property damage, injury or death.

Install three o-rings (4) into the oil port grooves on the outer end of the brake housing.

Lubricate and install the rotary seal with o-ring into the bore of the bearing carrier cover, with the flat side of the rotary seal facing toward the backup washer and retaining ring. Secure in place with the retaining ring.

If the bearing cup was removed, install a new bearing cup (1) into the bearing carrier cover.

50A/70 Only: Apply silicone sealant, RTV730 or equivalent, to the mating surface of the bearing carrier and the brake housing. Make certain that no sealant enters the oil ports.

50B/70A: Install o-ring (7) into the groove on the pilot of the bearing carrier. Sealant is not required on the 50B/70A.

Install the bearing carrier (18) onto the brake housing while aligning the oil ports between the two housings. Install the two ⅜ in. capscrews (2) and tighten to 31 lb•ft (42 N•m) torque.

BRAKE ASSEMBLY TEST PROCEDURE

The following test procedure may be used to check the condition of the brake piston seals and the actual pressure required to fully release the brake.

Lubricate and install an o-ring (4) into the grooved brake housing port labelled with a "B" cast onto the bearing carrier.

Clamp a piece of steel bar over the port now sealed by the o-ring.

Locate the ¼ in. NPT external brake port and attach a hand pump with an accurate 0-500 psi (0-3448 kPa) gauge teed into the line.

With the hand pump, slowly increase pressure applied to the brake and record what pressure is required to fully release the brake and permit free movement of the brake discs with a screwdriver.

The brake should be fully released at approximately 230 psi (1586 kPa).

Continue to increase pressure to 350 psi (2413 kPa). Close the hand pump valve and let stand for five minutes. If there is any loss of pressure in five minutes, the brake cylinder should be disassembled for inspection of the seals and sealing surfaces.

INSTALLATION

Refer to "Clutch Shaft Service" for additional information.

Install three o-rings in the grooves on the brake housing and three o-rings in the grooves on the winch case.

Install the original shim set between the brake housing and winch case. If the shim set must be replaced, refer to the "Clutch Shaft Service" section for additional information.

Lubricate and install the o-ring into the groove on the outer diameter of the brake housing.

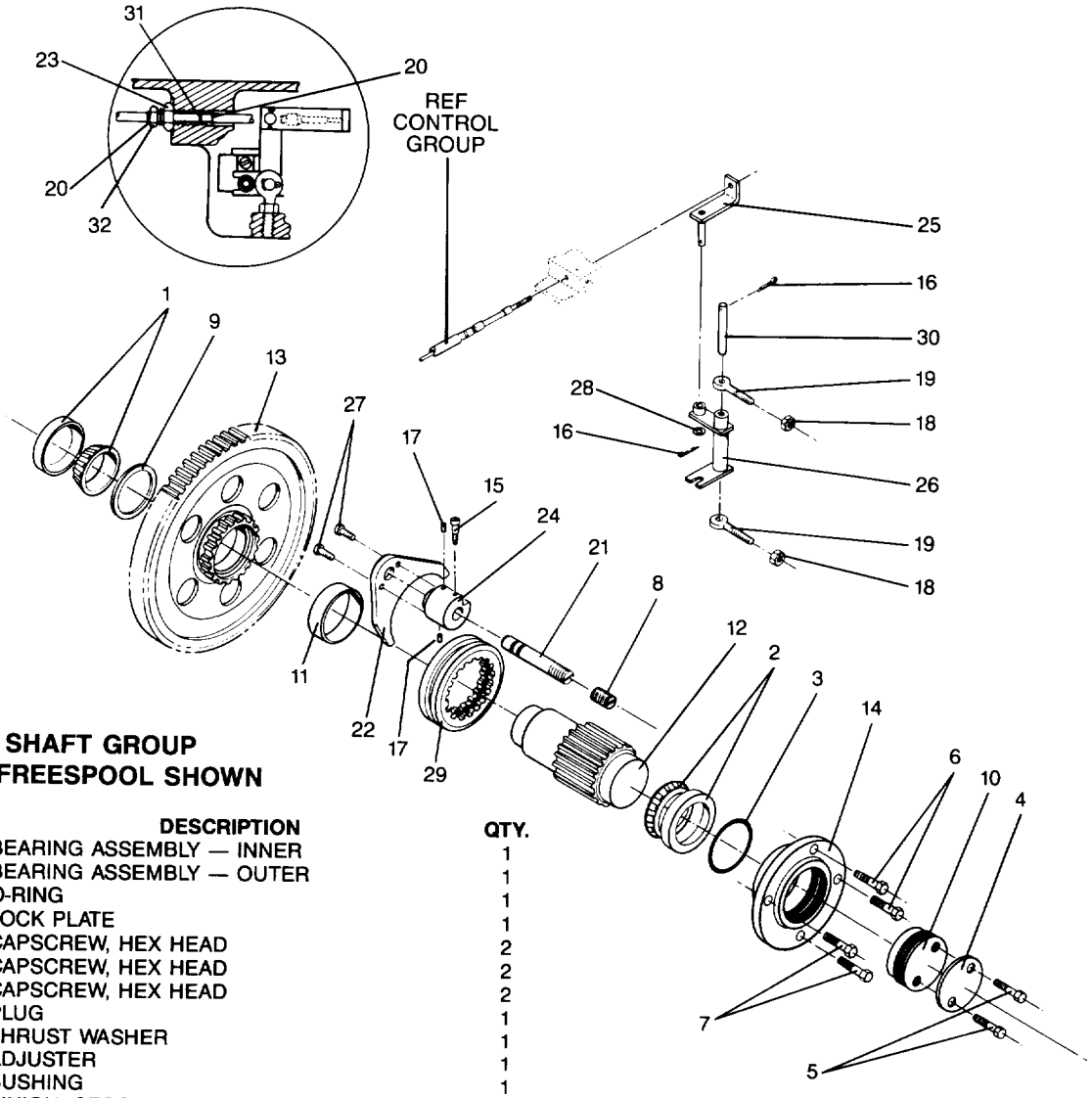
Install the brake assembly into the winch case, aligning all ports of winch case, shim set and brake assembly.

Install the six capscrews which secure the brake housing to the winch case. Coat threads of capscrews with non-hardening thread sealant (50A/70 only) and tighten to 75 lb•ft (102 N•m) torque.

Refill winch to proper level with recommended oil.

Install external hoses to "B" and "MOR" ports on brake housing if equipped with the MOR brake group.

IDLER SHAFT GROUP



IDLER SHAFT GROUP WITH FREESPOOL SHOWN

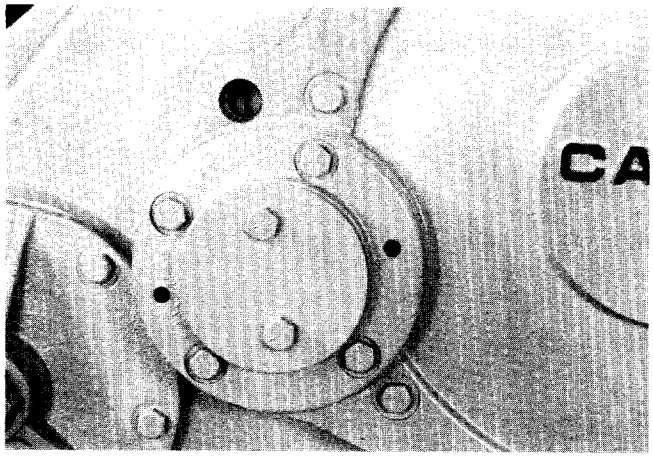
ITEM	DESCRIPTION	QTY.
1	BEARING ASSEMBLY — INNER	1
2	BEARING ASSEMBLY — OUTER	1
3	O-RING	1
4	LOCK PLATE	1
5	CAPSCREW, HEX HEAD	2
6	CAPSCREW, HEX HEAD	2
7	CAPSCREW, HEX HEAD	2
8	PLUG	1
9	THRUST WASHER	1
10	ADJUSTER	1
11	BUSHING	1
12	PINION, SECOND REDUCTION	1
13	GEAR, FIRST REDUCTION	1
14	CARRIER, IDLER SHAFT	1
15	SHOULDER SCREW	1
16	COTTER PIN	2
17	BALL PLUNGER	2
18	JAM NUT	2
19	ROD END	2
20	RETAINING RING	2
21	SHIFT RAIL	1
22	YOKE	1

ITEM	DESCRIPTION	QTY.
23	JAM NUT	1
24	SHIFT COLLAR	1
25	CABLE CONNECTOR	1
26	BELLCRANK WELDMENT	1
27	CAPSCREW, HEX HEAD	2
28	WASHER	1
29	COLLAR	1
30	PIN	1
31	O-RING	1
32	CONTROL CABLE ADJUSTER	1

The idler shaft and freespool components, which include the first reduction gear, second reduction pinion, and freespool linkage are located on the left hand side of the winch, when viewed from the rear.

Removal of these components for repair may be accomplished with the winch mounted to the tractor.

REMOVAL



Drain oil from winch as described in "Preventive Maintenance" section of this manual.

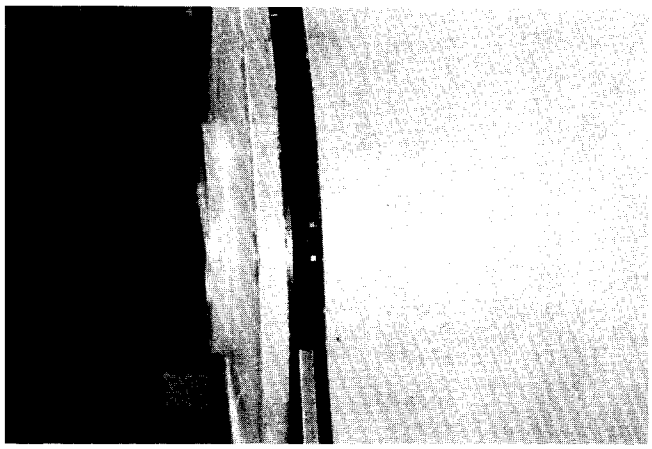
Remove the two capscrews (5) and lock plate (4) from the idler shaft bearing carrier (14) and adjuster assembly.

Remove the four capscrews (6, 7) securing the idler shaft bearing carrier (14) and adjuster to the winch. Use two capscrews as jackscrews and remove the carrier and adjuster assembly.

Note the location of the two long capscrews for reassembly.

Inspect the bearing cup and replace as required.

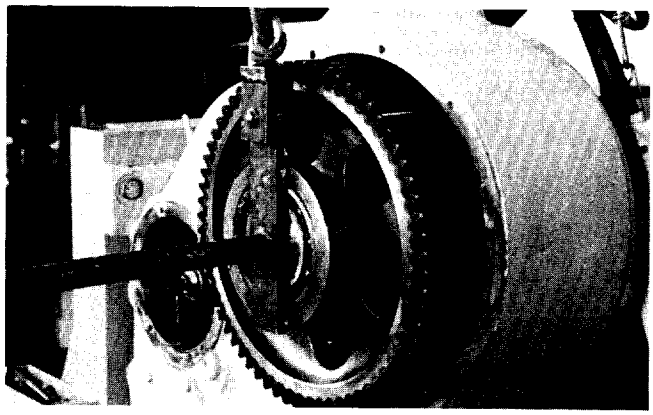
Turn the adjuster (10) counter-clockwise and remove it from the bearing carrier. Remove and discard the o'ring (3) from the carrier.



Remove the capscrews from the large diameter second reduction shaft bearing carrier cover and carefully remove the cover.

⚠ CAUTION

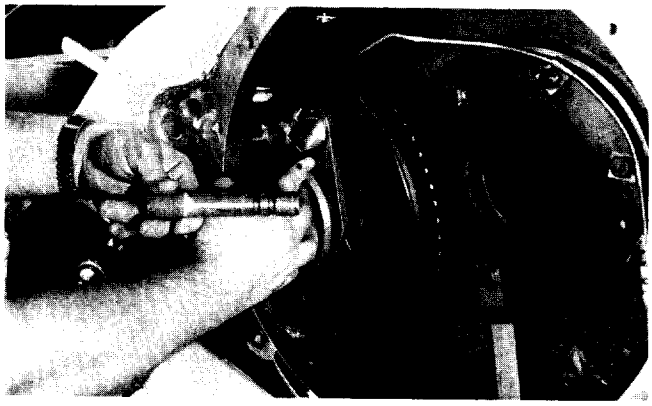
Use a pry bar between the bearing carrier cover and the second reduction drum drive gear to unseat the ball bearing from the cover. Do not allow the cable drum drive gear to slide free of the winch case. The gear assembly may fall from the cover and cause personal injury.



With a lifting fixture or suitable sling, remove the second reduction drum drive gear and shaft assembly from the winch case. Gear and shaft assembly weight is approximately 125 lb (56 kg).

FREESPOOL UNITS ONLY

Remove the shift rail lock plug (8) from the winch case.

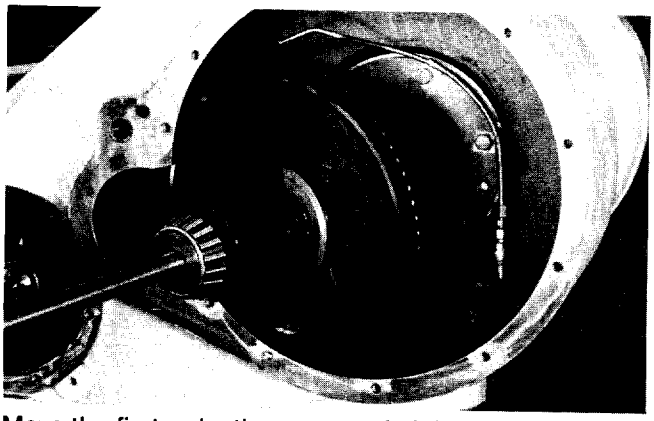


Turn the freespool shift rail (21) counter-clockwise until the threads are free of the winch case. Remove the freespool shift rail and freespool shift collar and yoke assembly (22).

Inspect the freespool shift yoke (22) for excessive wear and replace as required.

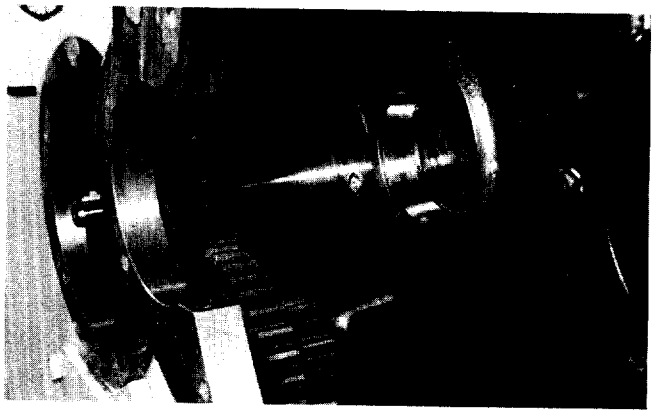
Insert the freespool shift rail into the collar and determine the detent positions on the rail. Replace ball plunger (17) (later units use two) in the collar if the detent appears weak.

ALL UNITS



Move the first reduction gear and pinion assembly (12, 13) outward to unseat the inner bearing cone from the bearing cup in the winch case wall.

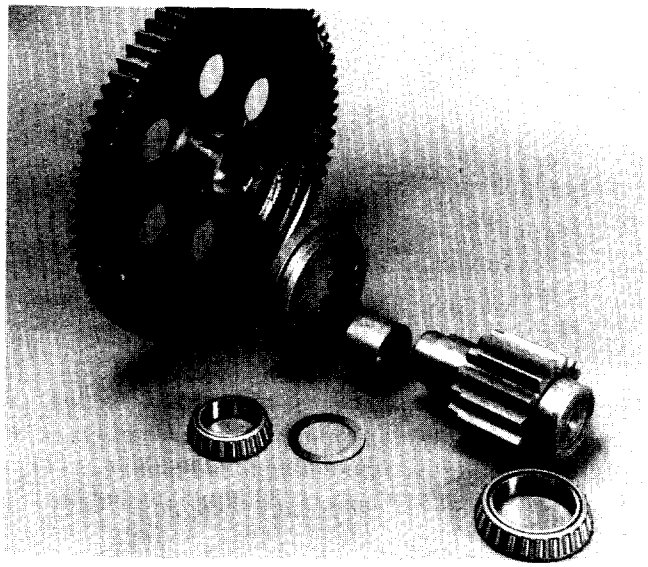
Carefully move the gear and pinion assembly into the drum drive gear opening and remove from winch case.



Inspect the bearing cup in the winch case wall and replace as required.

Support the first reduction gear (13) in a suitable hydraulic press and press the second reduction pinion (12) free of the inner bearing cone.

Support the second reduction pinion and remove the outer bearing cone.



Inspect the bearing cone (1) and thrust washer (9) for wear or damage and replace as required.

FREESPOOL UNITS ONLY

Inspect the floating bushing (11). The bushing should slip freely over the second reduction pinion.

Operate the remaining freespool linkage within the winch case. Inspect for wear or damage.

If the control cable must be replaced, unscrew the freespool cable core from the freespool cable connector (25).

Loosen jam nut (23) and turn threaded cable adjuster (32) counter-clockwise until the control cable and adjuster may be removed from the winch case.

Remove the inner retaining ring (20) from the control cable and remove the threaded cable adjuster. Remove the outer retaining ring and o'ring (31) from the control cable.

ASSEMBLY

FREESPOOL LINKAGE INSTALLATION

If the freespool shift linkage was removed from the winch case, install the linkage as follows:

Install jam nuts (18) on rod ends (19) until nuts bottom on the threads by the rod eye. Install the upper rod end in the winch case, until the jam nut is nearly in contact with the inner case wall and the pin bore is vertical. Tighten the jam nut.

Install the lower rod end in the winch case to approximately the same distance as the upper rod and tighten the jam nut.

Position bell crank (26) between the rod ends and insert pin (30) through the rod ends with the drilled end at the top. Install cotter pin (16).

Position end of cable connector (25) through bell crank arm. Secure in place with washer (28) and cotter pin (16).

Work the freespool linkage in the winch case back and forth to make sure that binding does not occur.

Lubricate and install o-ring (31) into the groove on the control cable.

Install threaded cable adjuster (32) and jam nut (23) onto the control cable over the o-ring. Install two retaining rings (20) to secure threaded adjuster in position.

Install the control cable in the winch case and turn the threaded adjuster into the winch case until the outer end of the adjuster is approximately 1½ in. (38 mm) from the machined surface of the winch case. Rotate the outer end of the control cable core clockwise and thread the cable core into the cable connector (25).

Operate the control cable at the outer end and check the freespool shift linkage for smooth operation.

Attach shift yoke (22) to shift collar (24) with two 3/8 × 3/4 UNC capscrews (27) and tighen to 31 lb•ft (42 N•m) torque.

Coat the threads of the shoulder screw (15) with Loc-tite 242 or equivalent and install in the shift collar. Tighten shoulder screw to 18 lb•ft (24 N•m).

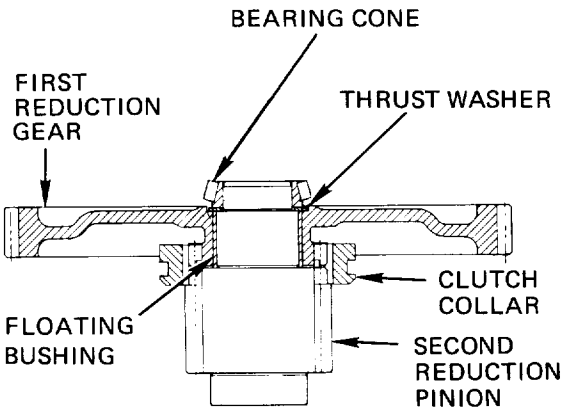
Install ball plunger(s) (17) into the shift collar.

Insert shift rail (21) into shift collar and align a detent groove with the ball plunger. (Later models use two ball plungers.)

Tighten the ball plunger until the shift rail will not rotate. Back-out the ball plunger 1/8 turn or until the shift rail can be rotated by hand. Check for positive ball plunger detent in both grooves of the shift rail. Remove the shift rail from the collar.

ASSEMBLY

ALL UNITS



Place the second reduction pinion (12) on a flat surface with the small diameter end facing up.

Lubricate the bushing (11) and mating surface of the second reduction pinion with winch lubricant and install the bushing over the pinion. Later, non-freespool winches do not contain the bushing.

If equipped with freespool, install the freespool clutch collar (29) over the first reduction gear with the beveled side of the collar facing down toward the large end of the pinion.

If not equipped with freespool, install the splined collar over the first reduction gear. Secure the collar in place with a 1/4 × 1 1/4 in. roll pin. The roll pin will protrude 1/2 in. (13 mm) from the outer diameter of the collar.

Lubricate the outside diameter of the bushing and the bore of the first reduction gear with winch lubricant. Install the first reduction gear and collar over the bushing, aligning the second reduction pinion (12) teeth with the splined collar teeth.

Later, non-freespool winches do not contain the bushing.

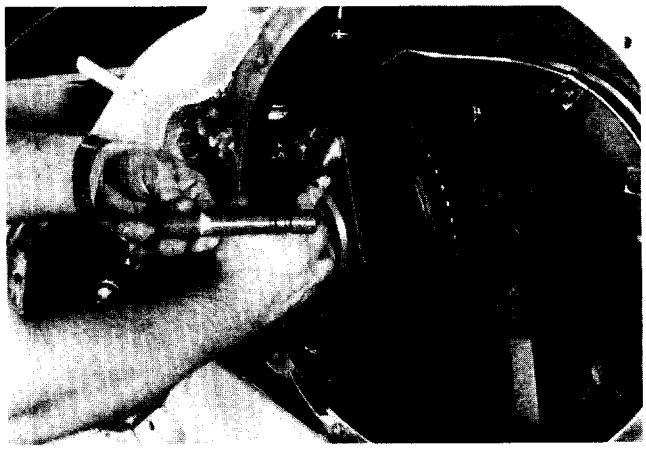
Install thrust washer (9) over the second reduction pinion and into the recess of the first reduction gear.

Install the inner bearing cone over the end of the second reduction pinion. Press the bearing cone until firmly seated against thrust washer (9).

Install the outer bearing cone over the second reduction pinion. Press the bearing cone until firmly seated against the pinion shoulder.

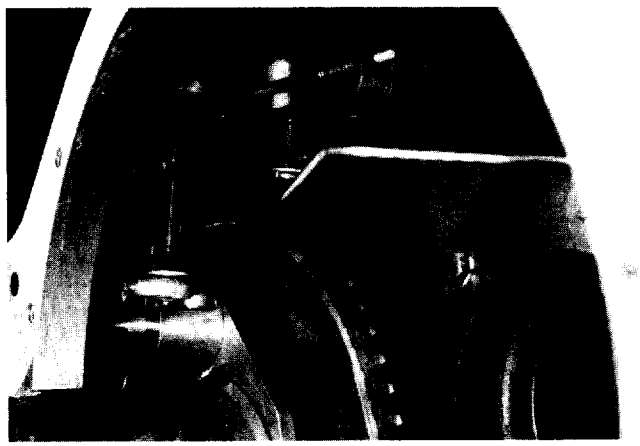
Lubricate and install the bearing cup into the inner wall of the winch case.

Place the first reduction gear and second reduction pinion assembly into the winch case opening, aligning the inner bearing cone within the bearing cup.



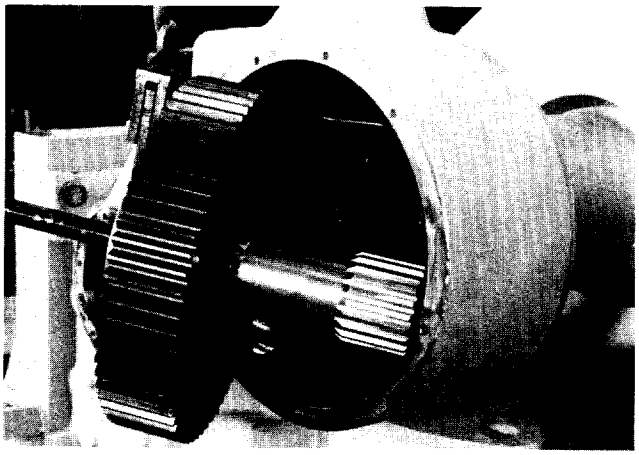
FREESPOOL UNITS ONLY

Install the shift yoke and collar assembly in the winch case, placing the shift yoke in the groove of the freespool clutch collar (29) and shift collar shoulder screw in the slot of the freespool shift linkage. At the same time, insert shift rail (21) through the outer case wall and into the shift collar. Turn the shift rail clockwise until the end of the shift rail is approximately 1 inch (25 mm) into the winch case.



Position the shift collar on the shift rail so that the ball plunger is engaged in the detent groove at the inner end of the shift rail. Rotate the shift rail until the clutch collar just clears the end of the teeth on the second reduction pinion.

NOTE: Final freespool shift adjustment is to be made after the assembly of the remaining components.



ALL UNITS

Make certain that the lube tube is aimed toward the second reduction pinion gear before installing the second reduction gear and drum drive shaft assembly. Make certain that the lube tube will not rub against any gears.

Lubricate the splines of the second reduction gear shaft with general purpose grease and install the second reduction drum drive gear and shaft assembly into the winch case. Firmly seat the shaft against the retaining ring in the cable drum bore.

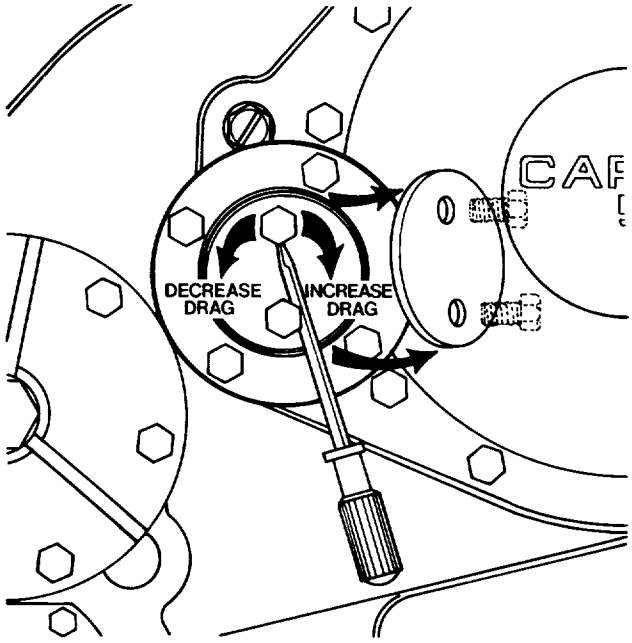
Apply silicone sealant 730 RTV or equivalent to the sealing surface of the large diameter second reduction gear bearing carrier cover and install it into the winch case. Apply thread sealant to the capscrews and install them finger tight. DO NOT tighten capscrews at this time.

Lubricate and install o-ring (3) into the groove of the bearing carrier (14). Install threaded adjuster (10) into the bearing carrier until the adjuster passes through the o-ring.

Install the bearing cup into the bearing carrier until it is seated against the threaded adjuster.

Apply silicone sealant 730 RTV or equivalent to the mounting surface of the bearing carrier.

Install the bearing carrier assembly into the winch case. Apply thread sealant to the capscrews and tighten to 75 lb•ft (102 N•m) torque. Tighten the capscrews around the large bearing carrier cover to 75 lb•ft (102 N•m) torque.



Using a long screw driver or pry bar, turn the threaded adjuster clockwise until tight. Then back off up to ¼ turn maximum and secure with lock plate and capscrews. Tighten capscrews to 75 lb•ft (102 N•m) torque.

Note: Tightening the threaded adjuster pushes the tapered bearing cup (outer race) into closer contact with the bearing cone and increases the bearing drag; much like tightening a wheel bearing nut on an automobile or truck. The snug fitting bearing cup will NOT move outward with the threaded adjuster when the adjuster is loosened. The winch must be operated under load for a brief period to allow the gear train load to push the outer bearing cup out against the threaded adjuster before a reduction in bearing drag can be noticed.

⚠ CAUTION

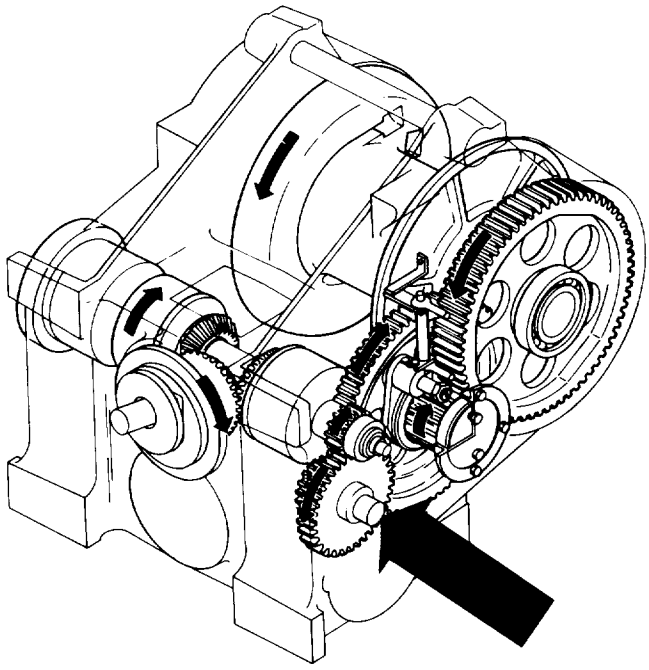
Do not back off adjuster more than ¼ turn as this allows excessive shaft end play and may cause gear train misalignment, accelerated wear and noise.

Recheck the adjustment of the freespool shift rail by shifting the freespool cable into and out of engagement. Rotate the drum by hand to align gear teeth. The shift collar must clear the end of the second reduction pinion gear teeth when placed in the "disengaged" position.

Lock the shift rail in position with threaded plug (8). Apply Loc-tite 242 or equivalent to the threads of lock plug (8).

Refill winch to the proper level with recommended oil.

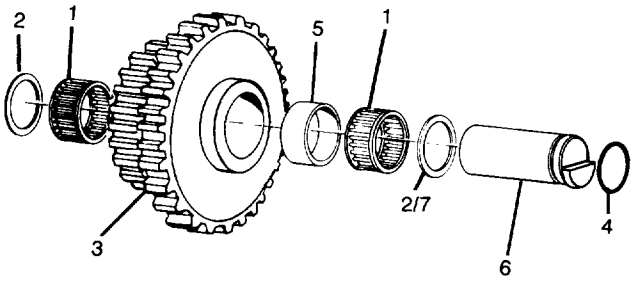
FOURTH SHAFT GROUP



Model 50A, 70 STD PTO (4 Shaft), Haul-In

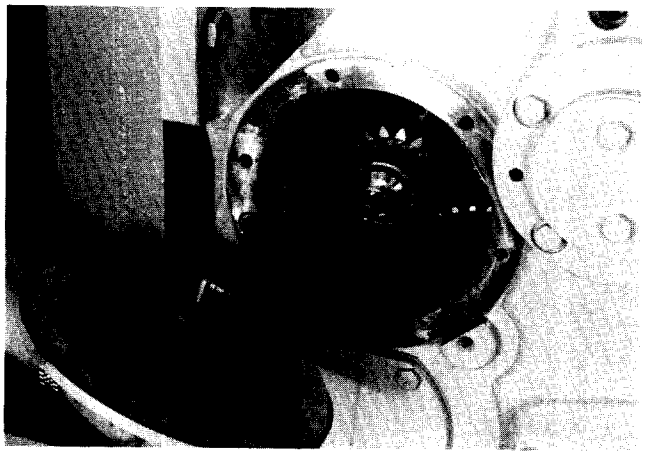
The majority of Model 50A and all 70 and 70A winches are equipped with the "Fourth Shaft Group". This group contains a cluster gear which provides additional reduction in the gear train. Most 50B winches are of the 3-shaft configuration.

DISASSEMBLY



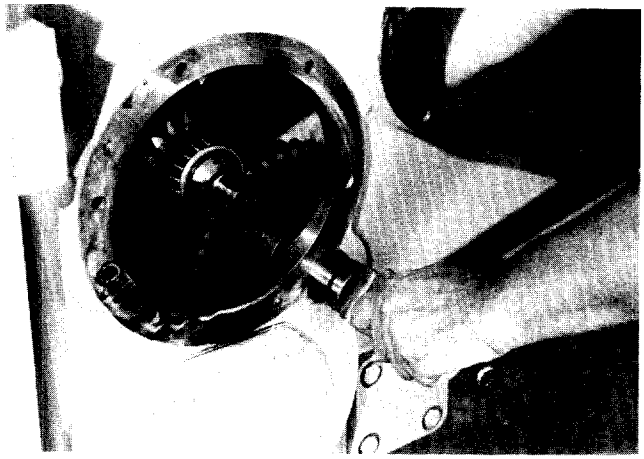
ITEM	DESCRIPTION	QTY.
1	ROLLER BEARING	2
2	THRUST WASHER – .062 in. (1.58 mm)	2
3	CLUSTER GEAR	1
4	O-RING	1
5	SPACER	1
6	COUNTERSHAFT PIN	1
7	THRUST WASHER – .217 in. (5.5 mm) (50B/70A)	1

Drain oil from winch as described in the "Preventive Maintenance" section of this manual.



Remove the six capscrews then remove the left hand clutch shaft bearing carrier. Retain the shim set for reassembly.

Remove the first reduction drum drive gear, second reduction gear and pinion, freespool shift rail and yoke, if equipped with freespool. Refer to "Idler Shaft Group" section of this manual for additional information.



Install a long, ½ in. NC, capscrew into the end of the countershaft pin (6) to serve as a handle. Support the cluster gear (3) and remove the countershaft pin.

⚠ CAUTION

The inner and outer thrust washers (2 & 7) will drop down into the winch case when the fourth shaft is removed. Be sure to retrieve them prior to assembly. Gear train damage will occur if these thrust washers are omitted or left in the bottom of the winch case.

Thoroughly clean all parts and inspect for damage and wear. The bearing rollers should not exhibit any irregularities. If the rollers show any sign of spalling, corrosion, discoloration, material displacement or abnormal wear, the bearing should be replaced. Likewise, the cage should be inspected for unusual wear or deformation,

particularly the cage bars. If there is any damage that will impair the cage's ability to separate, retain and guide the rollers properly, the bearing should be replaced. The thrust washer contact areas should be free from any surface irregularities that may cause abrasions or friction. The gears and shaft should be inspected for abnormal wear or pitting. Replace if necessary.

ASSEMBLY

Lubricate and install new o'ring (4) into the groove on the counter shaft pin (6). Lubricate and install two roller bearings (1) separated by a spacer (5) into the bore of the cluster gear (3).

Position the cluster gear (3) and outer thrust washer (2 or 7) in the winch case and at the same time, insert counter shaft pin (6) through the bore into the thrust washer and cluster gear.

Position the inner thrust washer (2) in the winch case between the cluster gear and the inner case wall then fully install the countershaft pin.

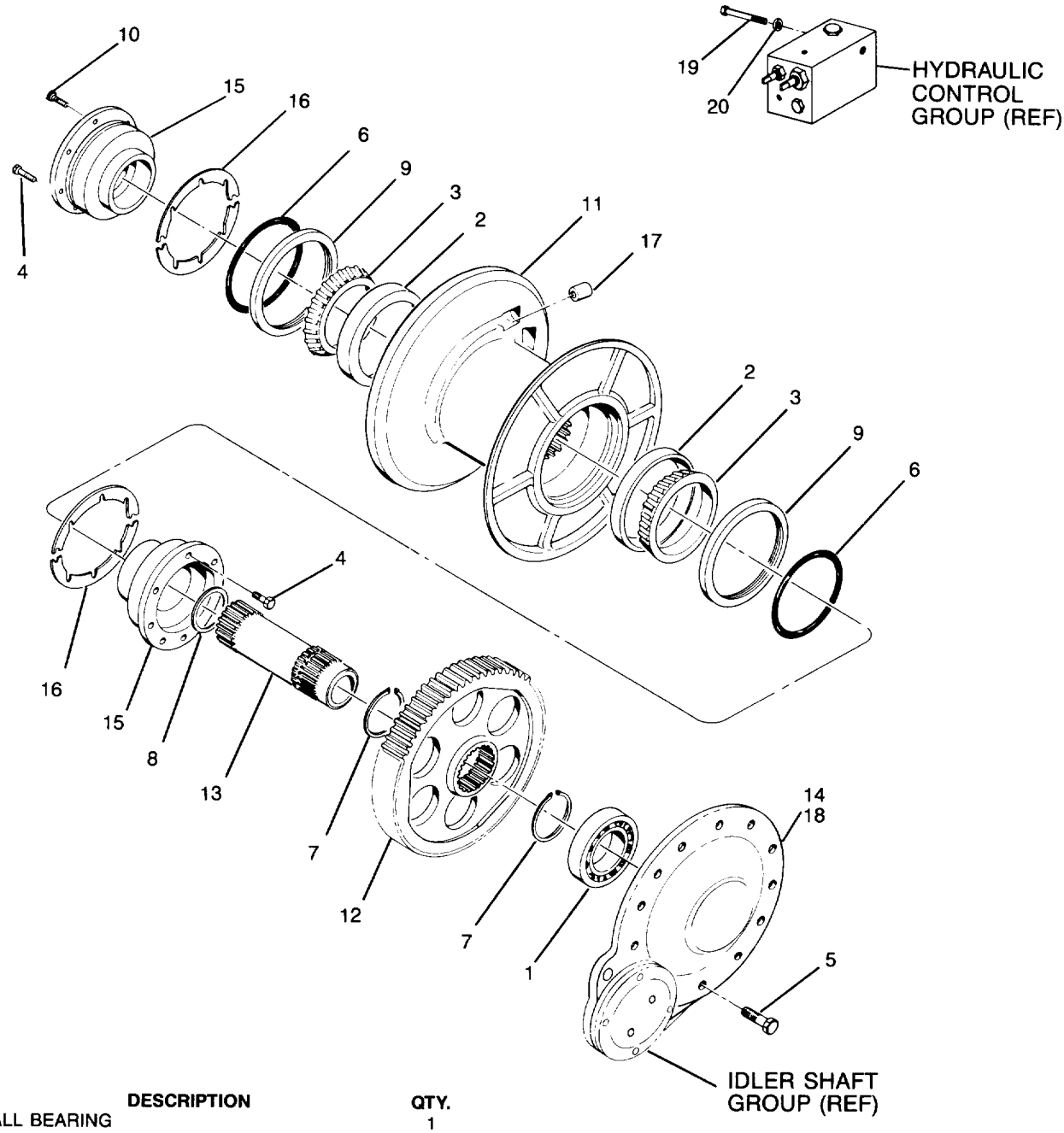
Rotate the countershaft pin so that the slotted end is properly positioned to permit clutch shaft bearing carrier installation.

Install the first and second reduction gears and free-spool linkage, if equipped. Refer to the "Idler Shaft Group" section for additional information. Install the shim set onto the clutch shaft bearing carrier and install the bearing carrier into the winch case. Tighten the capscrews to 75 lb•ft (102 N•m) torque.

NOTE: Be careful to properly align the clutch pressure oil port in the winch case, shims and bearing carrier.

Refill winch to the proper level with recommended oil.

CABLE DRUM GROUP



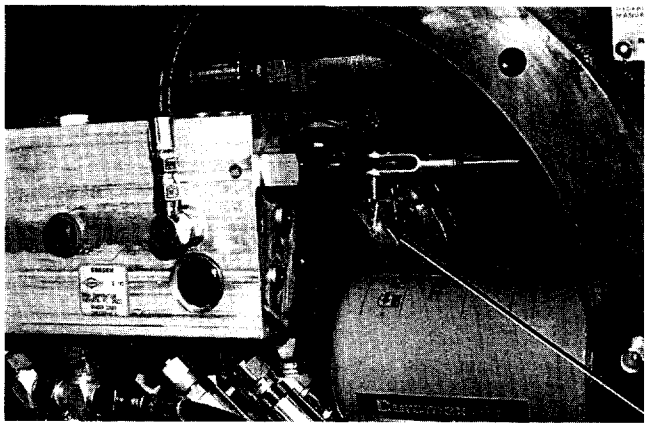
ITEM	DESCRIPTION	QTY.
1	BALL BEARING	1
2	BEARING CUP	2
3	BEARING CONE	2
4	CAPSCREW, HEX HD.	10
5	CAPSCREW, HEX HD.	11
6	O-RING	2
7	RETAINING RING	2
8	RETAINING RING	1
9	OIL SEAL	2
10	CAPSCREW, SOCKET HD.	1
11	CABLE DRUM	1
12	GEAR, 2ND REDUCTION	1
13	SHAFT, 2ND REDUCTION	1
14	BEARING CARRIER, COVER	1
15	BEARING CARRIER, DRUM	2
16	SHIM SET	1
17	FERRULE	1
18	NO GASKET, USE RTV 730 OR EQUIVALENT	—
19	CAPSCREW, HEX HD.	1
20	WASHER, PLAIN	1

DISASSEMBLY

⚠ WARNING

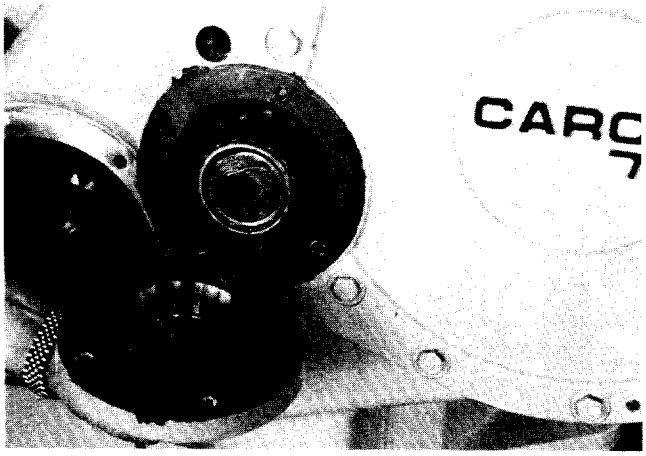
Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from the sudden release of oil pressure. To discharge the accumulator, stop engine, slowly cycle power shift control handle into full Haul-in then Pay-out positions a minimum of five times.

Remove the right hand winch housing cover.



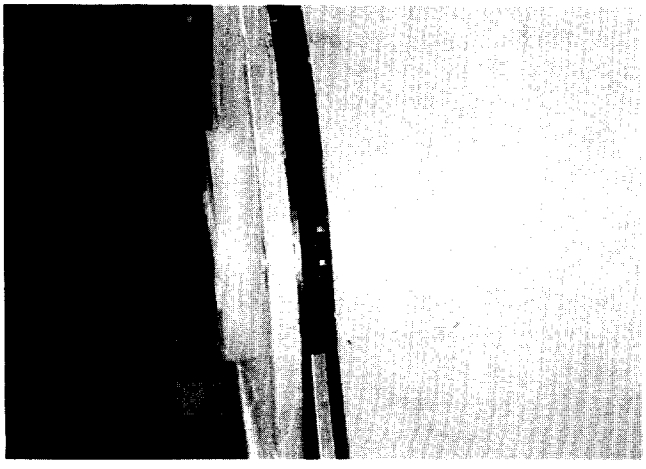
Remove the clevis pins securing the control cables to the valve spools. Remove the capscrew (19) securing the control valve to the winch case and lower the control valve in the winch case. Disconnect the pressure gauge line from the control valve. Remove the control valve from the winch case while attached to the remaining hoses.

Remove the two capscrews and lock plate from the idler shaft bearing carrier and adjuster assembly.



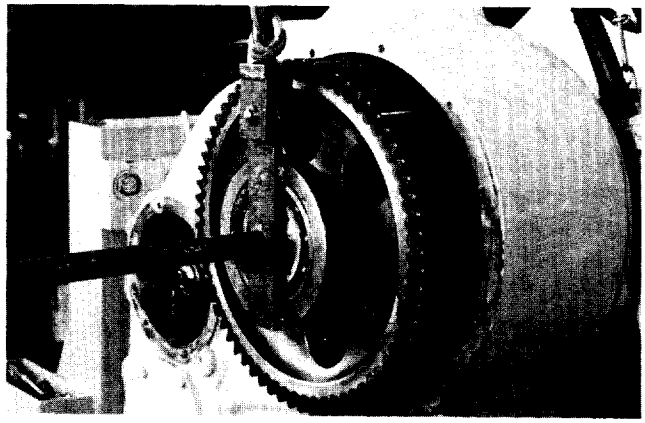
Remove the four capscrews securing the idler shaft bearing carrier and adjuster to the winch. Use two capscrews as jackscrews to remove the carrier from the winch.

Remove the capscrews (5) from the large diameter bearing carrier cover (14) and remove the cover.

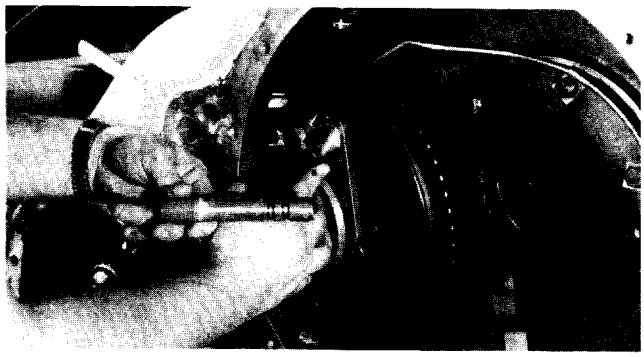


⚠ CAUTION

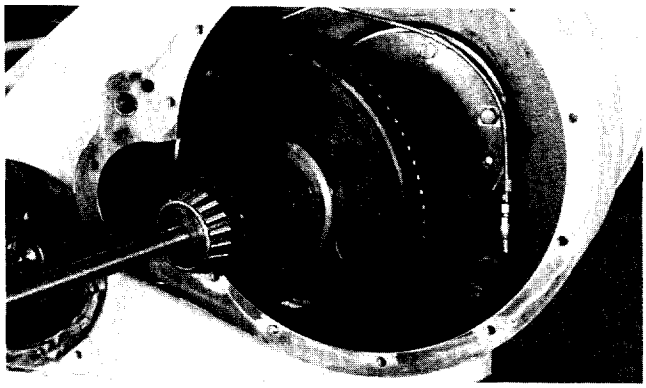
Use a pry bar between the bearing carrier cover (14) and the 2nd reduction drum drive gear (12) to unseat ball bearing (1) from cover. Do not allow cable drum drive gear assembly to slide free of winch case. Gear assembly may fall from cover and cause personal injury. Gear and shaft weigh approximately 125 lb (56 kg).



Remove the 2nd reduction drum drive gear and shaft assembly (12,13) from the winch.



If the winch is equipped with freespool, remove the shift rail and freespool shift collar and yoke assembly from the first reduction gear.



Move the first reduction gear and pinion assembly outward to unseat the bearing cone from the bearing cup in the case wall. Carefully move the gear and pinion assembly into the drum drive gear opening and remove them from the winch case.

Support the cable drum with a nylon sling and remove capscrews (4) from the right hand drum bearing carrier

(15). Note the location of the socket head capscrew (10) necessary for control valve alignment. Using jackscrews, remove the drum bearing carrier.

Remove capscrews (4) from the left hand drum bearing carrier (15) and lube tube clamps. Using jackscrews, remove the drum bearing carrier.

NOTE: Split shims (16) are located between bearing carriers (15) and the winch case. Retain the shims in their original location for reassembly.

Inspect bearing cones (3) and replace as required.

Remove and discard o-rings (6) from the drum bearing carriers.

Remove cable drum oil seals (9).

Inspect bearing cups (2) and replace as required.

Check the condition of snap ring (8) in the splined bore of the cable drum and replace as required.

ASSEMBLY

Install bearing cups (2) into cable drum (11). With a .002 in. (.05 mm) feeler gauge, make certain cups are fully seated against the shoulder in the cable drum bore.

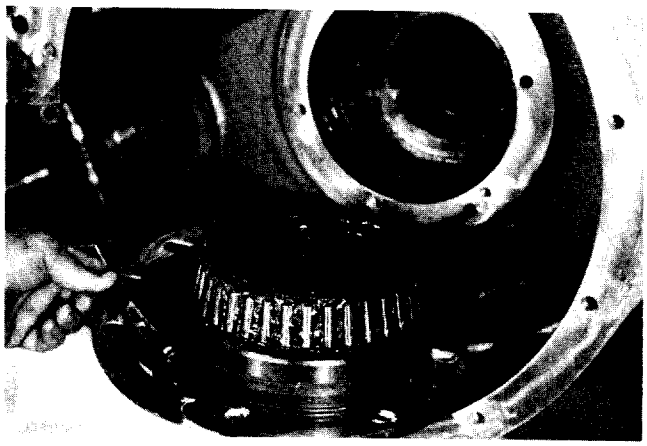
Install oil seals (9) into the cable drum with the spring side of the seal facing toward the cable drum.

If it was removed earlier, install snap ring (8) into the groove in the splined bore of cable drum with sharp edge of the snap ring toward the center of the drum.

Lubricate and install o-rings (6) onto the cable drum bearing carriers.

Lightly lubricate bearing cones (3) with multipurpose bearing grease and install onto the bearing carriers.

Suspend the cable drum in the winch case with the cable ferrule pocket on the right hand side. Lubricate the bearing cups (2) and oil seals (9) with general purpose grease. Install the right hand bearing carrier into the winch case and cable drum using the original shim pack (16), if available. Apply non-hardening thread sealant to the capscrews and tighten to 75 lb•ft (102 N•m) torque. Make certain the socket head capscrew (10) is in the proper location for control valve clearance.



Install the left hand drum bearing carrier (15) with the original shim pack, if available. Secure the lubrication tube and oil line into proper position with clamps. Apply non-hardening thread sealant to capscrews and tighten to 75 lb•ft (102 N•m) torque.

Attach a dial indicator to the left hand bearing carrier and position the indicator stem against the retaining ring (8) in the cable drum bore. With a large screwdriver, pry drum from side to side to check for end play of .005-.010 in. (.13-.25 mm). Add or remove shims (16) as required, while keeping the cable drum centered in the winch case.

Install the first reduction gear and pinion assembly into the winch. If the winch is equipped with freespool, install the shift rail and freespool shift collar and yoke. Refer to the "Idler Shaft Group" section of this manual for additional information.

If the second reduction gear and shaft had been disassembled, install the second reduction gear (12) onto shaft (13) and secure in place with two retaining rings (7). Lightly pack bearing (1) with general purpose bearing grease and press onto shaft (13).

Install second reduction gear and shaft assembly into the winch while meshing the gear teeth with the pinion and the shaft splines with the drum.

Clean the mating surface of the winch case and bearing carrier cover (14). Apply silicone sealant 730 RTV or equivalent to the winch case.

Install the bearing carrier cover into the winch. Apply non-hardening thread sealant to the capscrews (5) and install finger tight.

Apply silastic sealant to the cleaned surfaces of the idler shaft bearing carrier. Install the idler shaft bearing carrier and tighten the capscrews to 75 lb•ft (102 N•m) torque. Tighten all remaining cover capscrews to 75 lb•ft (102 N•m) torque.

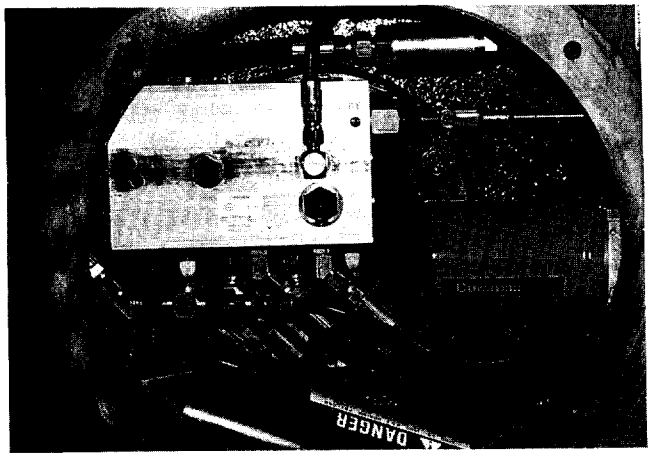
Adjust the idler shaft bearing adjuster per instructions found in "Idler Shaft Group" section of this manual. Install adjuster lock plate and tighten capscrews to 75 lb•ft (102 N•m) torque.

Install the pressure gauge line on the control valve. Place the control valve into position over the special socket head capscrew (10). Apply non-hardening thread sealant to capscrew (19) and tighten to 75 lb•ft (102 N•m) torque. Install the control cables to the valve spools and verify proper adjustment as described in the "Winch Removal and Installation" section of this manual.

Intall the winch housing cover with a new gasket as required. Apply non-hardening thread sealant to the capscrews and tighten to 75 lb•ft (102 N•m) torque.

Refill winch with recommended lubricant.

CONTROL VALVE SERVICE



The hydraulic control valve is located on the right hand side of the winch case behind the large cover plate.

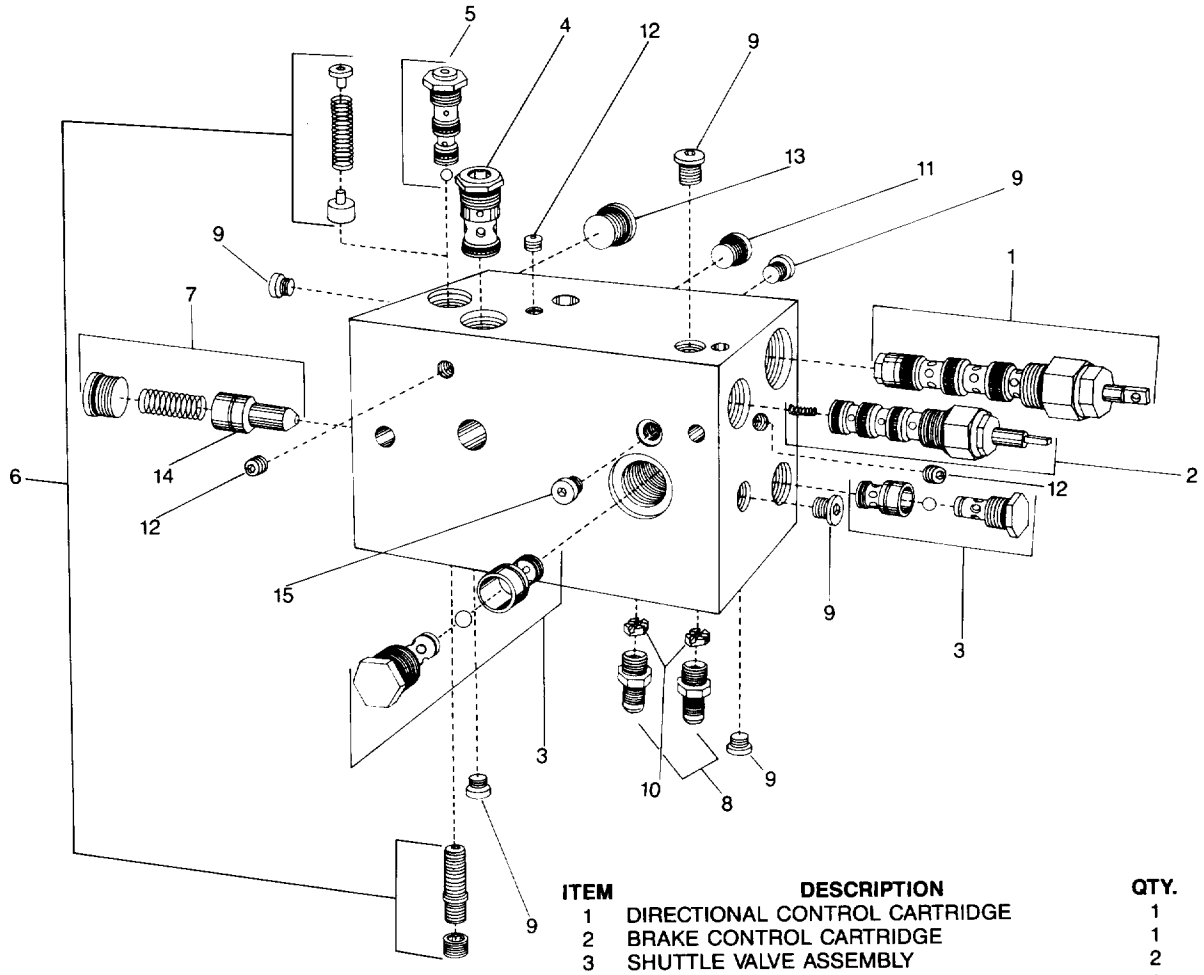
The control valve performs two essential duties:

1. Maintains a relatively constant pressure oil supply for the directional controls.
2. Converts the operator's mechanical signals, from control cables, into hydraulic force to apply the directional clutches and release the spring applied brake.

The control valve contains several poppets, spools and check valves to perform these duties. These components can best be explained by dividing them into two "systems":

A. Pressure Maintenance System

B. Directional Control System



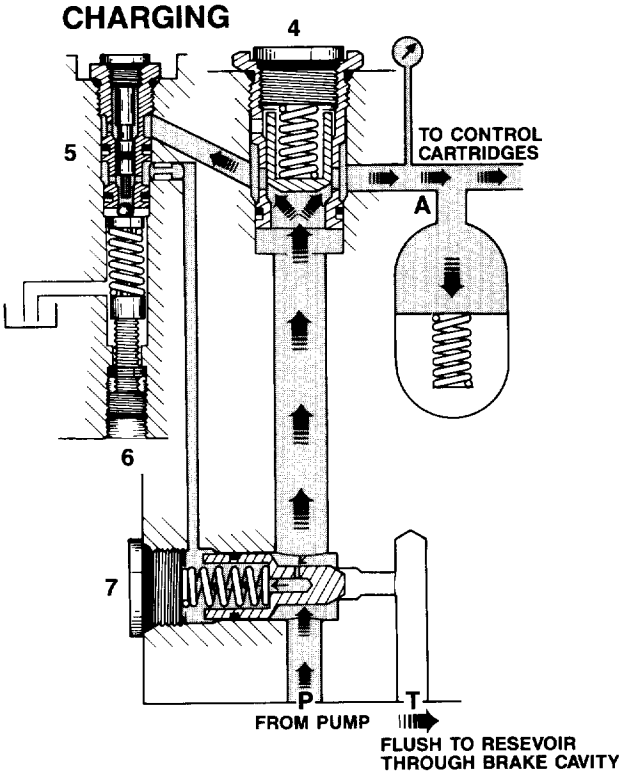
ITEM	DESCRIPTION	QTY.	TORQUE VALUE* lb•ft	N•m
1	DIRECTIONAL CONTROL CARTRIDGE	1	42	57
2	BRAKE CONTROL CARTRIDGE	1	34	46
3	SHUTTLE VALVE ASSEMBLY	2	15	20
4	CHECK VALVE CARTRIDGE	1	42	57
5	DIFFERENTIAL UNLOADING PILOT VALVE CART.	1*	15	20
6	ADJUSTING SCREW ASSEMBLY — JAM NUT	1	6.5	9
7	UNLOADING POPPET ASSEMBLY	1	34	46
8	ADAPTER, CLUTCH LINE-8 SAE 3/4-16 UNF	2	15	20
9	PLUG, O-RING FLUSH-4 SAE 7/16-20 UNF	6	5.5	7
10	RESTRICTOR (50A/70 ONLY)	2	—	—
11	PLUG, O-RING FLUSH-6 SAE 9/16-18 UNF	1	8	11
12	PLUG 1/8 NPTF	3	6.5	9
13	PLUG, O-RING FLUSH-8 SAE 3/4-16 UNF	1	15	20
14	O-RING	1	—	—
15	PLUG, O-RING FLUSH-2 SAE 5/18-24 UNF	1	2.5	3

*Valve housing bore, threads and seal rings lubricated with hydraulic oil.

PRESSURE MAINTENANCE SYSTEM

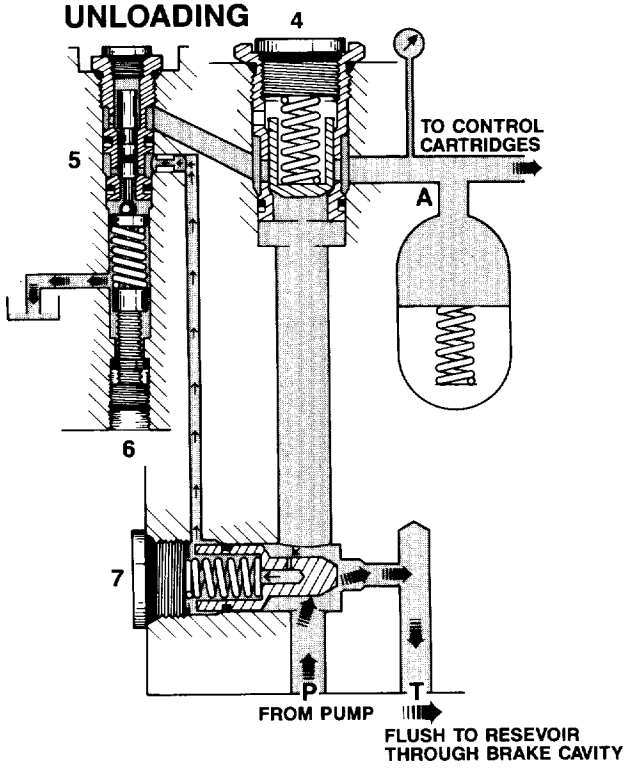
The pressure maintenance system operates continuously to keep the directional control system supplied with oil at 340-400 psi (2344-2758 kPa) for reliable brake release and clutch application. The pressure maintenance system consists of the following sub-assemblies:

Item 4 check valve cartridge
Item 5 differential unloading pilot valve cartridge
Item 6 differential unloading pilot valve adjusting screw
Item 7 unloading poppet assembly



Supply oil from the pump enters the bottom of the control valve housing through port "P". The oil flows around the unloading poppet (7) and continues up to the check valve cartridge (4). The unloading poppet is held on its seat by a light spring and oil pressure. A small amount of oil enters the cavity behind the poppet through an orifice in the poppet. This oil acts on the back side of the poppet to hold it closed and also travels to the lower chamber of the differential unloading pilot valve cartridge (5). A seated, spring loaded ball and pilot piston prevents the escape of this oil. Whatever pressure is seen on the pump side of the poppet will also be seen on the back side of the poppet **plus** the light spring holding it closed.

While charging, the control circuit oil pressure is slightly less than 340 psi (2344 kPa). Supply oil can push open the check valve (4) and flow to the directional controls, refill the accumulator and act on the pilot piston of the differential unloading pilot valve cartridge (5). The pilot piston is held up, off of the ball, due to a higher pressure in the pilot circuit from the pump and unloading poppet.



As the oil pressure in the control circuit recovers, the pressure in the accumulator, gauge line, top side of the check valve and upper chamber of the pilot piston will also increase. The increased pressure acting on the pilot piston will push it downward to unseat the check ball.

When unseated, the check ball opens a path to sump and dumps off the pilot oil pressure which had held the unloading poppet (7) closed. The oil flowing through the orifice creates a pressure drop across the poppet which allows the supply oil, from the pump to push the poppet off of its seat and return to sump through the "T" port. The pressure in the control circuit holds the check valve (4) closed preventing a loss of stored oil in the accumulator.

When the control circuit oil pressure decreases, (due to clutch application, brake release, system leakage) there will not be sufficient oil pressure acting on the pilot piston to hold the check ball unseated. The adjusting spring will push the ball back onto its seat and stop the loss of pilot pressure. The pilot pressure will increase and push the pilot piston upward and push the unloading poppet closed. As this happens, supply oil, from the pump, can no longer exhaust through the "T" port and must now push open the check valve (4) and recharge the control circuit. Reference CHARGING.

The pressure maintenance system will cycle between "Charging" and "Unloading" every ½-10 minutes depending on PTO speed (pump flow) and control functions selected.

The control system relief pressure is limited by the differential unloading pilot valve cartridge (5). Use the following procedure to check/adjust the relief pressure:

⚠ WARNING

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from the sudden release of oil pressure. To discharge the accumulator, stop engine, slowly cycle power shift control handle into full Haul-in then Pay-out positions a minimum of five times.

1. Install an accurate 0-600 psi (0-4137 kPa) gauge to the gauge port next to the control cables. A -4JIC adapter will be required.
2. Operate the tractor at approximately 700 - 1000 RPM and operate the winch to bring oil up to normal operating temperature, 80° - 140 °F (27 - 60 °C)
3. Maximum pressure during "Charging" mode should be 410 psi (2827 kPa). Pressure will fall back approximately 15% from the relief setting when the valve "cycles".
4. If adjustment is required, loosen the lockscrew in the adjusting screw port and, with a 3/16 in. allen wrench inserted through the lockscrew, turn the adjusting screw (6) clockwise to increase pressure; counterclockwise to decrease pressure. Tighten the lockscrew.

DIRECTIONAL CONTROL SYSTEM

The direction control system consists of the following sub-assemblies:

Item 1 — directional control cartridge

Item 2 — brake control cartridge

Item 3 — shuttle valve assemblies (2)

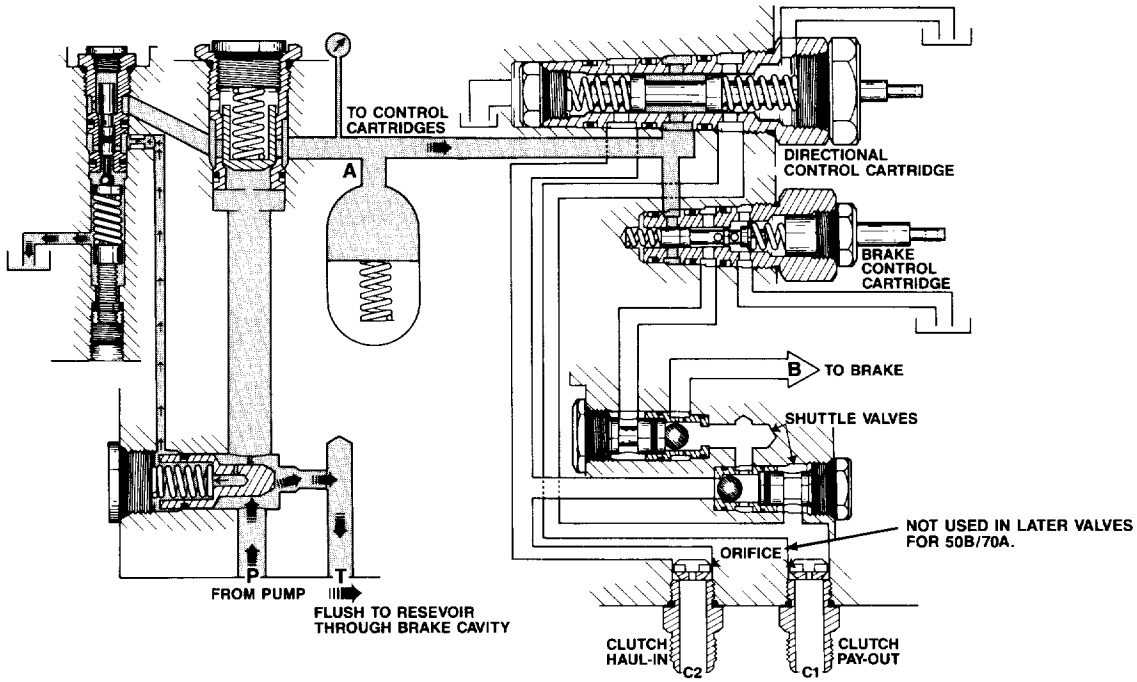
The directional control cartridge (1) contains a closed center, open port, spring centered spool valve. When pushed or pulled by the control cables, the directional control spool will direct control oil pressure from the center port to apply either the Haul-in or Pay-out clutch and, through the shuttle valves to release the spring applied brake. When returned to the center "neutral" position, the clutch ports are opened to sump and control circuit oil pressure is trapped in the "closed" center section.

The brake control cartridge (2) contains a closed center, open port, spring centered spool valve. When pushed inward by the control cable to the "Brake-off" position, oil is directed through a shuttle valve to release the spring applied brake. When the control lever is returned to "Brake on" the spool will return to the center position to seal off the control oil circuit and exhaust the oil out of the brake cavity.

Two shuttle valves (3), or double check valves, are used in the circuits between the control spools and the brake port "B". The shuttle valves each contain the same parts to permit the release of the brake by three different control circuits: Haul-in, Pay-out and Brake-off.

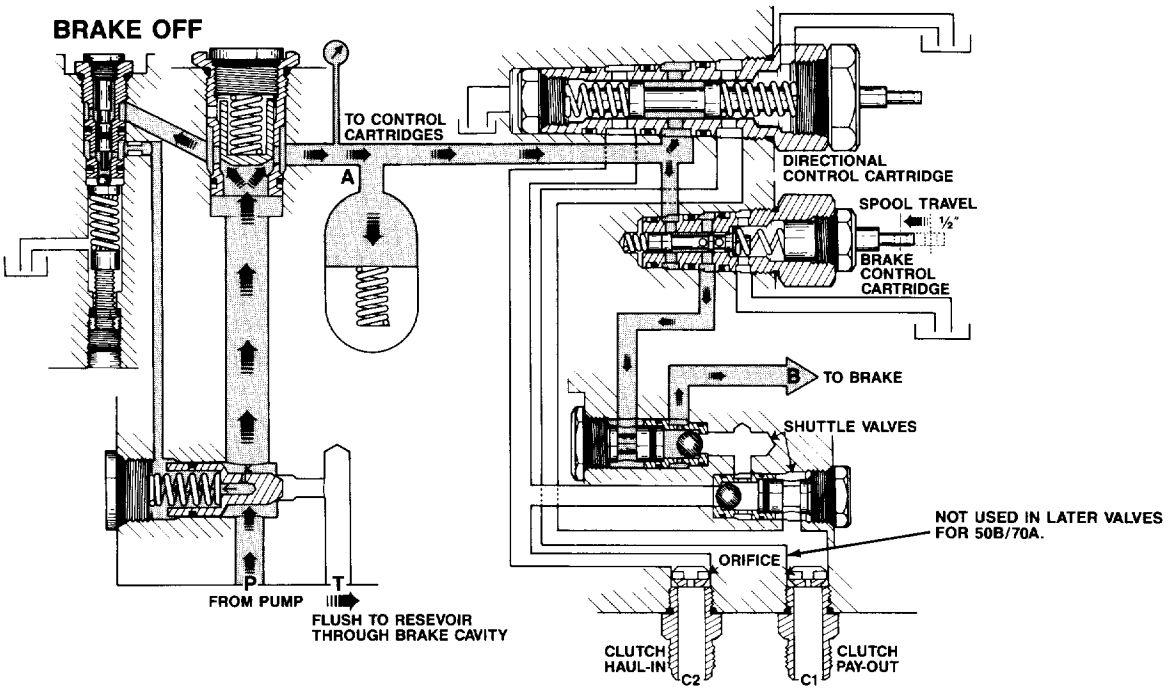
When the check ball of the shuttle valve is seated by the force of the control oil pressure, it must seal tightly, for the back side of the ball will be open to sump through an unused circuit. If the ball **does not** seal tightly, due to contamination or wear, control oil pressure, needed for clutch application and brake release, will be lost, and the clutch or brake allowed to slip.

BRAKE ON



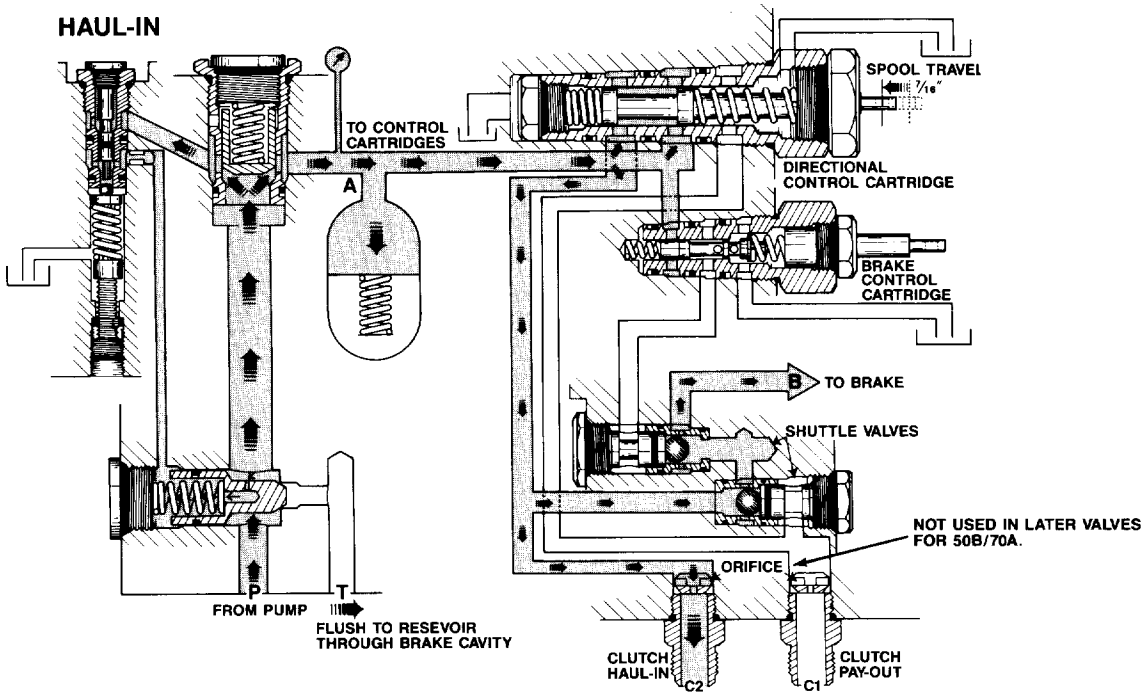
Supply oil from the pump enters the control valve through port "P", flows around the unloading poppet through the check valve and charges the control circuit. Control oil is channeled to the directional control cartridge and the brake control cartridge. Both control cartridge spool valves are in the center "neutral" position. No control oil is being used by the clutches or brake.

Since there is no oil usage at this time, the pressure maintenance system will "unload" the excess oil flow through the "T" port to flush cooling oil through the brake assembly.



The operator has moved the power shift control handle to the "Brake-off" position which pushes the brake cartridge spool inward. The spool has opened a path from the control oil passage to the brake port "B". The control oil pressure will push the shuttle valve check ball onto a seat and flow out port "B" to release the spring applied brake. The shuttle valve check ball must seal against the seat to prevent a loss of control oil pressure through an open circuit.

When the operator returns the control handle to the "Brake-on" neutral position, the brake control spool will re-center and exhaust the brake release oil from the brake circuit. The spring applied brake will quickly re-apply to hold the load.



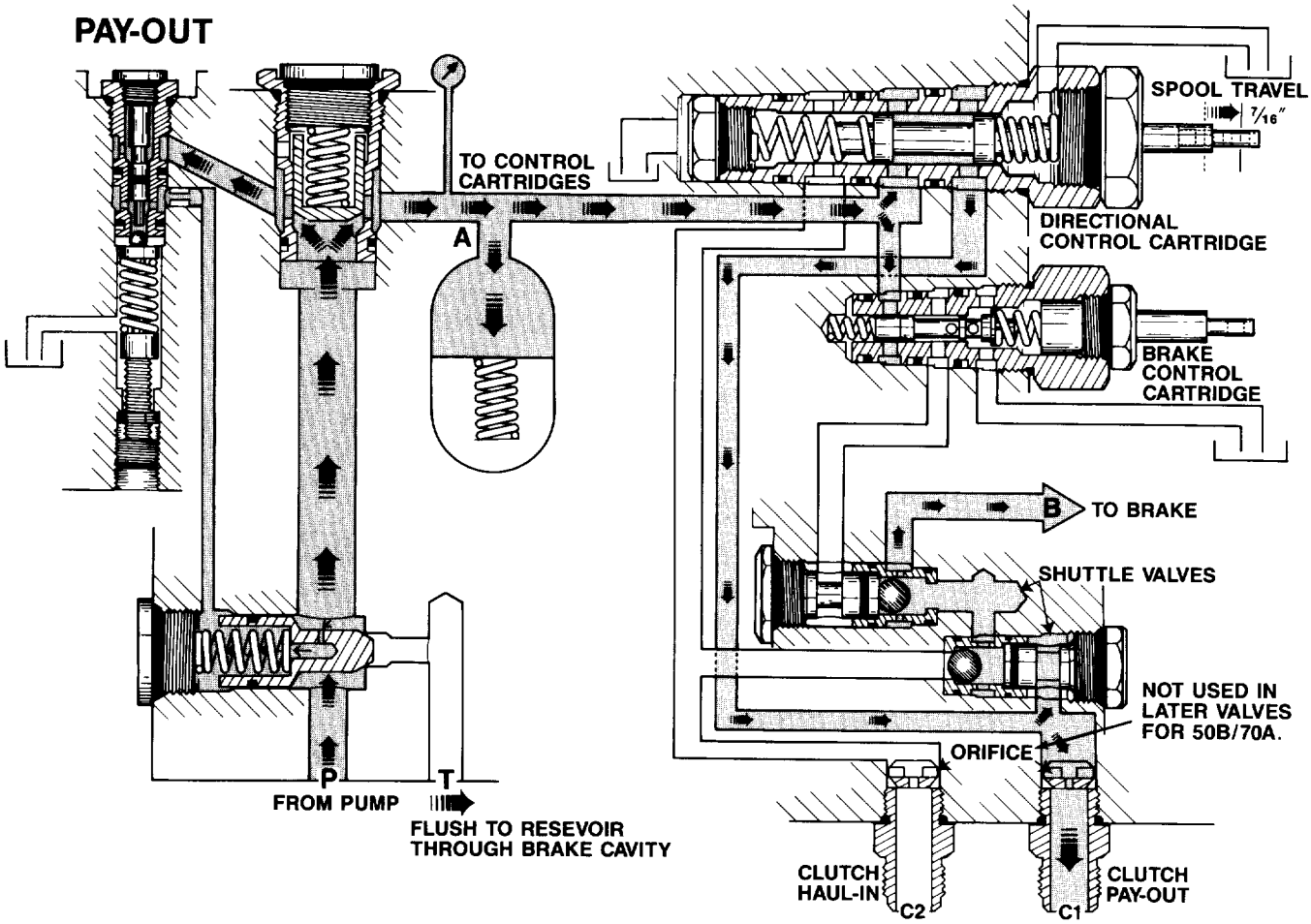
Pulling the power shift control handle toward the operator has pushed the directional control spool inward. The spool will direct the oil from the control oil passage to the Haul-in clutch port (C2 for CCW PTO rotation and overwind winch) and through a shuttle valve to port "B" to release the brake.

A restrictor orifice has been installed in each clutch port beneath the hose adapter to delay the application of the clutch until the spring applied brake has begun to release. Not used in later valves for 50B/70A.

A shuttle valve check ball (located underneath the con-

trol spools) has been pushed onto its seat to open a path to the brake port "B" through the other shuttle valve. The shuttle valve check balls must seal tightly to prevent a loss of clutch application oil pressure which could result in clutch slippage.

When the control handle is released, the spring centered directional control spool will return to neutral or "Brake-on". The Haul-in clutch application oil and the brake release oil will be quickly exhausted permitting the clutch to release and the brake to quickly apply to hold the load.



As the power shift control lever is pushed away from the operator into the pay-out position, the directional control spool is pulled outward to direct control oil pressure to the Pay-out clutch port (C1 for CCW PTO rotation and overwind winch) and to the brake port "B" through a shuttle valve.

The restrictor in the clutch port and the shuttle valves will function in the same manner as described earlier.

When the control handle is released, the directional control spool will return to "Brake-on", release the Pay-out clutch and apply the brake.

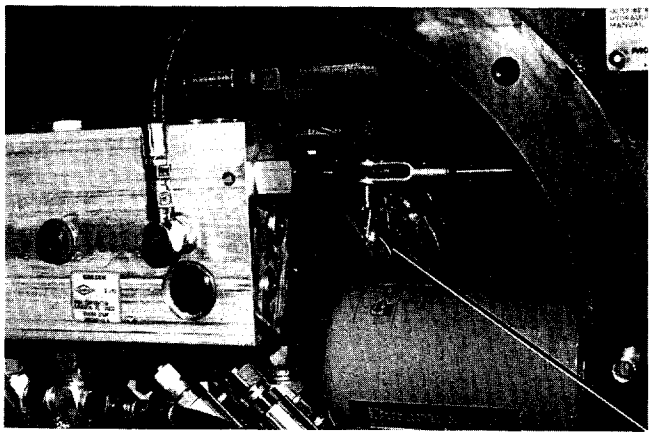
The pressure maintenance system will recharge the control circuit as required to maintain the pressure between 340 and 400 psi (2344 and 2758 kPa). The excess oil flow, not required by the control circuit, is directed through the brake cavity to cool and lubricate the brake discs.

CONTROL VALVE REMOVAL

⚠ WARNING

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from the sudden release of oil pressure. To discharge the accumulator, stop engine, slowly cycle the power shift control handle into full Haul-in then Pay-out positions a minimum of five times.

Remove the right hand winch housing cover. Carefully tag and remove the oil lines from the bottom of the control valve.



Remove the clevis pins securing the control cables to the valve spools. Remove the capscrew securing the control valve to the winch case and lower the control valve in the winch case. Disconnect the pressure gauge line at the rear of the control valve (Early valves only). Remove the control valve from the winch case.

COMPONENT INSPECTION

Prior to disassembly, make certain work area is clean, as cleanliness is of utmost importance when working on hydraulic equipment. If a control valve problem has been diagnosed, complete valve disassembly and cleaning is recommended to ensure all components have been inspected and contaminants have been removed.

Thoroughly lubricate seals and poppets with winch lubricant prior to assembly.

Directional control and brake control cartridges (1,2):

Turn the large hex counter clockwise (CCW) to remove the cartridges from the valve housing. Hold the cartridge body and turn spool end plug CCW to remove the spool from the body.

Carefully inspect the spool for scoring or excessive wear which may cause binding or leakage. If spools are damaged, the entire cartridge assembly must be replaced.

Inspect the o'rings and back-up rings for cuts or flatspotting which may allow leakage. Cartridge seal kits are available through Carco Service Parts. Due to close tolerances, the seals are difficult to replace. Wrap a small sheet of shim stock approximately .005 in. (.13 mm) around the cartridge to provide a smooth ramp to slide seal rings into place.

Lubricate seals and valve housing bore with winch lubricant and install cartridges into housing. Make certain the brake control spool centering spring is properly located in the bore of the brake control cartridge and valve housing.

Shuttle valves (3):

Remove the shuttle valve plugs, check-balls and sleeves from the valve housing.

Inspect the check-ball seats on the plugs and sleeves for any flaring or rounding of the seat which may allow leakage. The entire shuttle valve assembly must be replaced if the seats are damaged.

Inspect the o'rings and back-up rings for cuts and flatspotting which may allow leakage. Shuttle valve seal kits are available through Carco Service Parts.

Lubricate the seals with winch lubricant and install the shuttle valve cartridge into the valve housing.

Check valve cartridge (4):

Remove the check valve cartridge from the control valve housing, then remove the plug and check poppet from the cartridge body.

Inspect the seat on the poppet and body for nicks or wear. The entire cartridge must be replaced if the seats are damaged.

Inspect the o'rings and back-up ring for cuts or flatspotting which may allow leakage. Check valve cartridge seal kits are available through Carco Service Parts.

Differential unloading cartridge (5):

Remove unloading valve cartridge from the control valve housing then remove the plug and pilot piston from the cartridge body.

Inspect the pilot piston and seal rings for scoring that may cause leakage. Later pilot pistons do not use seal rings as they are made with a tapered valve seat. Inspect the check ball seat in the bottom of the body for excessive wear. The entire cartridge must be replaced if the pilot piston or cartridge body are worn.

Differential unloading pilot valve cartridge seal kits are available through Carco Service Parts.

Unloading poppet assembly (7):

Remove the plug, spring and poppet from the valve housing. Carefully inspect the tapered seat of the poppet and valve housing for damage. If the poppet or valve housing seat is damaged, the entire control valve must be replaced.

Inspect the o'ring for cuts or flatspotting which may cause leakage and replace as required.

If the entire control valve has been disassembled for inspection be sure to install the restrictors (10) with the cross-cut surface facing into the valve. (Early 50A/70 valves only)

CONTROL VALVE INSTALLATION

Place the control valve in the winch case opening and install the pressure gauge line. Install the capscrew and washer which secures the valve to the winch, apply non-hardening thread sealant to the capscrew and tighten to 75 lb•ft (102 N•m) torque.

Install the oil lines to the bottom of the valve.

Install the control cables to the valve spools and verify

proper adjustment as described in the "Winch Removal and Installation" section of this manual. Any binding of the spools may cause the valve to partially apply clutches or release the brake resulting in accelerated wear or failure. Carefully turn the cable adjusters to achieve the proper setting.

Install the winch housing cover with a new gasket as required.

Apply non-hardening thread sealant to the capscrews and tighten to 75 lb•ft (102 N•m) torque.

Operate tractor at approximately 1200 RPM for approximately five (5) minutes to recharge the hydraulic system. Operate controls through all functions to verify proper operation. Recheck/adjust the relief valve setting as required.

ACCUMULATOR SERVICE

The accumulator stores oil at system pressure. The primary function of the accumulator is to cushion pressure surges in the hydraulic system and aid in brake release and clutch application. The accumulator also stores enough oil for the operator to release the brake when the tractor PTO is stalled or the tractor engine stops.

⚠ WARNING

Discharge accumulator oil supply before removing any hydraulic lines or servicing winch. Personal injury may result from the sudden release of oil pressure. To discharge the accumulator, stop engine, slowly cycle power shift control handle into full Haul-in then Pay-out positions a minimum of five times.

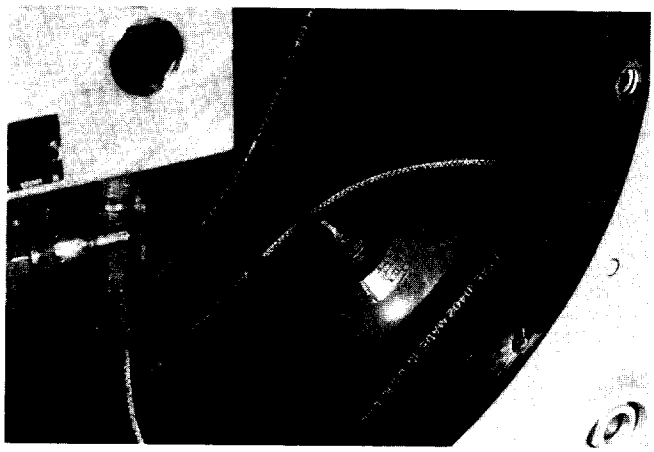
GAS TYPE ACCUMULATOR

The Model 50A and 70 winches were originally equipped with a one quart (1 L) steel-cased accumulator. The accumulator housing contains a rubber bladder with a nitrogen gas charge of 200 psi (1379 kPa).

Charging:

Completely discharge the winch hydraulic system as described earlier.

Remove the right hand winch housing cover.



Remove the accumulator service cap and install test equipment to check nitrogen pressure. Charge the accumulator to 200 psi (1379 kPa) with dry nitrogen. Install cap.

Check condition of the housing cover gasket and replace as required.

Install the housing cover. Apply non-hardening thread sealant to the capscrews and tighten to 75 lb•ft (102 N•m) torque.

Removal:

Remove the right hand winch housing cover.

Drain oil from winch until the oil level is below the accumulator assembly.

Remove the accumulator line from the "A" port at the control valve.

Remove the two capscrews securing the accumulator assembly to the winch case wall and remove the accumulator assembly and mount from the winch case.

Remove the hose and elbow from the end of the accumulator.

Installation:

Remove the accumulator service cap and install test equipment to check the nitrogen pressure. Charge the accumulator to 200 psi (1379 kPa) with dry nitrogen. Install cap.

Install the 90° elbow fitting and hose to the end of the accumulator.

Install the accumulator and hose assembly into the winch case with mounting strap and capscrews. Apply non-hardening thread sealant to the capscrews and tighten to 75 lb•ft (102 N•m) torque.

Connect hose to port "A" of the control valve.

Check condition of housing cover gasket and replace as required.

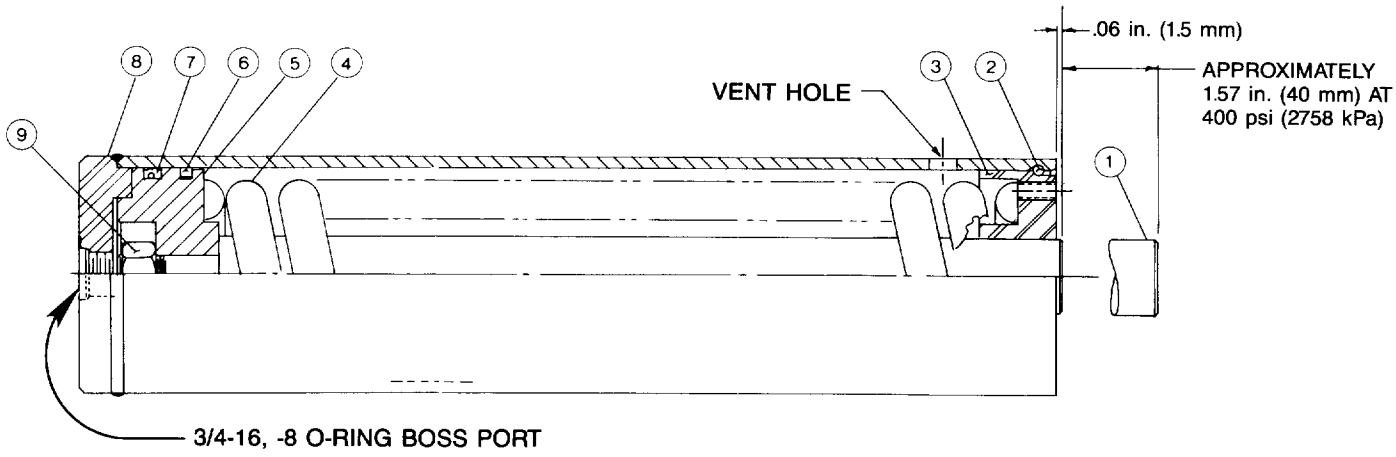
Install the housing cover. Apply non-hardening thread sealant to the capscrews and tighten to 75 lb•ft (102 N•m) torque.

Refill winch to proper level with recommended oil.

Start tractor engine and run at low idle. Check winch operation in Haul-In, Pay-Out, and Brake-Off.

SPRING-TYPE ACCUMULATOR

Later 50A/70 and all 50B/70A winches are equipped with a Spring-Type Accumulator. The spring-type accumulator **DOES NOT** require any periodic recharging or servicing as the earlier gas type accumulators do. Early 50A/70 winches may be retrofitted to the spring type accumulator by following the instructions in Service Bulletin 95.



ITEM	DESCRIPTION	QTY.
1	ROD	1
2	RETAINING RING	1
3	ROD GUIDE	1
4	SPRING	1
5	PISTON	1
6	CAST IRON PISTON RING	1
7	SEAL ASSEMBLY	1
8	TUBE ASSEMBLY	1
9	NUT	1

⚠ WARNING

DISCHARGE ACCUMULATOR OIL SUPPLY BEFORE PERFORMING WINCH SERVICE. PERSONAL INJURY MAY RESULT FROM SUDDEN RELEASE OF OIL PRESSURE. TO DISCHARGE ACCUMULATOR, CYCLE CONTROL LEVER INTO FULL HAUL-IN THEN PAY-OUT POSITIONS AT LEAST 5 TIMES WITH TRACTOR ENGINE OFF.

PISTON SEAL TEST PROCEDURE

1. If the accumulator is installed in the winch case, remove the accumulator hose from the "A" port of the control valve. The accumulator may then be tested in the winch case.
2. Connect a hand pump with accurate 0-600 psi (0-4137 kPa) gauge and shut-off valve to the accumulator. Apply 400 psi (2758 kPa) to the accumulator. Close shut-off valve securely. Measure rod extension beyond rod guide. If rod extension decreases more than ⅛ in. (3 mm) in one minute, the accumulator should be disassembled and new seals installed.

ACCUMULATOR SEAL REPLACEMENT PROCEDURE

⚠ DANGER

2,000 lb (900 kg) SPRING PRELOAD — USE PRESS FOR DISASSEMBLY PER SERVICE INSTRUCTIONS GIVEN BELOW. PROPERTY DAMAGE, INJURY OR DEATH MAY RESULT IF ROD GUIDE REMOVAL IS ATTEMPTED WITHOUT A PRESS.

If piston seal ring inspection or replacement are required, carefully follow the procedure listed below.

1. Secure the accumulator tube in a hydraulic press in such a manner to prevent side movement.
2. With a tubular mandrel, press rod guide (3) approximately ½ in. (13 mm) into tube (8) to provide access to retaining ring (2). Carefully remove retaining ring (2) from the groove in the tube.

3. Release pressure on the press and remove rod guide (3), spring (4) and piston/rod assembly. The cast iron piston ring (6) will attempt to expand into the retaining ring groove when the piston is removed from the tube. To reduce the chances of this happening, pack the groove with heavy grease and withdraw the piston rod assembly quickly past the groove.
4. Inspect or replace piston seals (6 & 7) as required. Piston retaining nut (9) should be tightened to 120 lb•ft (163 N•m) torque.
5. Lubricate tube and piston seals with winch lubricant. Install an automotive type piston ring compressor around the piston making certain the step cut piston ring is properly compressed.
6. Press piston into tube and push to bottom of tube. Install spring and rod guide.
7. With the tube secured in a press, press rod guide into tube approximately ½ in. (13 mm) below the outer edge of the tube. Install a new retaining ring (2) securely into the groove in the tube.
8. Slowly release pressure on the press. Observe that the rod guide has fully seated the retaining ring into the groove.
9. Retest piston seals to make certain seals were not damaged during installation.