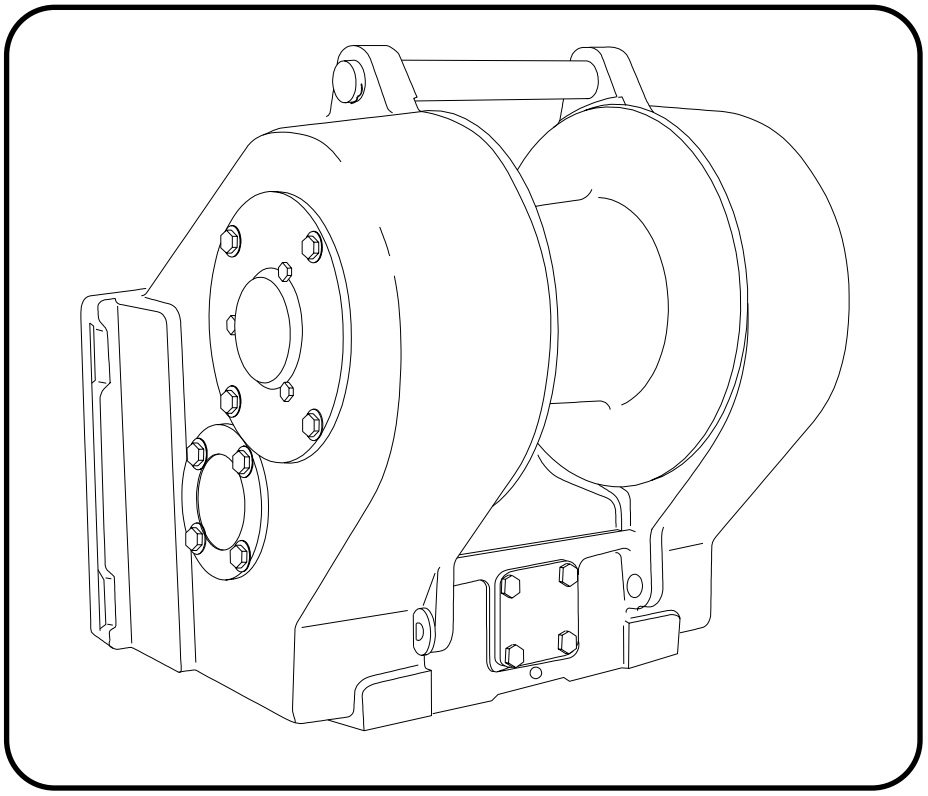
CARCO®

MODEL 30-PS & 30B-PS SERVICE MANUAL



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PACCAR WINCH DIVISION
P.O. BOX 547 BROKEN ARROW, OK U.S.A. 74013
PHONE (918) 251-8511 FAX (918) 259-1575
www.paccarwinch.com

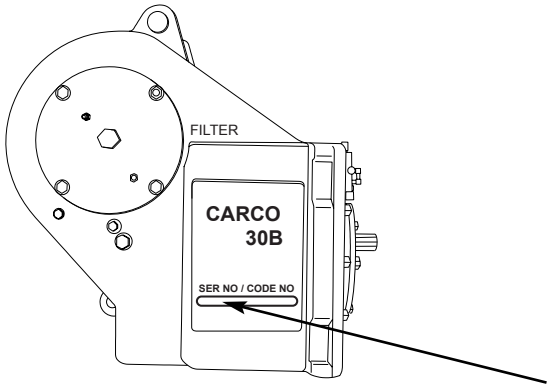
FOREWORD

Please read and understand this entire manual BEFORE operating or performing service on your CARCO winch. Retain this publication for future reference.

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

Continuing product improvements may cause changes in your winch, which are not included in this manual. Whenever a questions arises regarding your CARCO winch or this publication, please contact the CARCO Service Department at 1-918-251-8511, Monday - Friday, 0800 hrs - 1630 hrs CST, or by fax at 1-918-259-1575, or by e-mail at winch.service@paccar.com.

The winch model number and serial number are important references as to which optional components were used at the time your winch was manufactured. The serial and model numbers are stamped into the RH side of the winch case. The serial number is also stamped into the upper RH mounting pad of the winch case. Always refer to the serial and model numbers when requesting information or service parts.



Serial Number Location

This complete service manual is available for viewing and/or downloading as a .PDF file on our internet website - *http://www.paccarwinch.com/literaturelist.asp*

MODEL NUMBER BREAKDOWN

C 0 0 0 0 0

Model 30B

Bevel Gear Ratio
A-32/31 (1.03)
B-33/26 (1.27)
C-36/22 (1.64)
D-38/18 (2.11)
E-39/14 (2.79)

0-Overwind

0-Haul-In
1-Pay-Out

0-Without Towing Hitch
1-With Towing Hitch

0-Four shaft winch (31.047 base ratio)
1-Three shaft winch (17.249 base ratio)
2-Three shaft winch (12.195 base ratio)

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.

FOREWORD CONTINUED

Safety and informational callouts used in this manual include:

⚠ WARNING ⚠

WARNING - This emblem is used to warn against hazards and unsafe practices that 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 that COULD result in personal injury and product or property damage if proper procedures are not followed.

This emblem is used to indicate an informational note or service tip.

TABLE OF CONTENTS

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 handling and performance capabilities. The following recommendations are offered only as a guide for the operator. 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 the winch.

2. Never attempt to clean, oil or perform any maintenance on the winch with the tractor engine running, unless specifically instructed to do so in this manual.

3. Before starting the tractor engine, be certain all controls move freely and are placed in the "Brake On" (neutral) position.

4. Never operate the winch controls unless you are properly seated at the operator's station on the tractor and you are sure all personnel are clear of the work area.

5. Never attempt to handle winch cable when the hook end is not free. Keep all parts of body and clothing clear of winch drum, cable rollers and entry area of fairleads and arches.

6. Ground personnel should stay in clear view of the tractor operator and clear of the winch drum. Do not allow ground personnel near a winch line under tension. A safe distance of 1 ½ times the working length of the cable should be maintained. Never allow anyone to stand under a suspended load.

7. Avoid sudden "shock" loads or attempting to "jerk" a load free. This type of operation may cause heavy loads in excess of the rated winch capacity, which may result in the failure of the cable and/or winch.

8. 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.

9. Use the correct size ferrule for the cable and pocket in the winch drum. Never use knots to secure or attach cable to the winch drum, or the hook to the cable. 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 the rated capacity of the winch. Therefore, a minimum of five (5) complete wraps must be maintained on the winch drum.

NOTE: *We suggest painting the last five wraps of cable bright red to serve as a visual warning.*

RECOMMENDED OPERATING PRACTICES

1. Leather gloves should be used when handling winch cable.

2. Operate the winch to match line speeds to job conditions.

3. Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.

4. Inspect winch cable, rigging, winch and tractor at the beginning of each work shift. Defects should be corrected immediately.

5. Position the tractor for the straightest line of pull to reduce the wear on the winch cable and ensure even spooling.

6. When winding winch cable on the winch drum, never attempt to maintain tension by allowing the winch cable to slip through the hands. Always use the "hand-over-hand" technique, being careful to keep hands and clothing away from winch drum and fairlead rollers.

7. Be sure of tractor ground stability before winching in a load.

8. Store unused chokers, slings and rigging in a neat and orderly fashion to prevent damage to equipment or injury to personnel.

9. Do not operate the 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 capacity of one winch (such as coupling 2 or more tractors together) is extremely hazardous.

10. 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 dif-

GENERAL SAFETY RECOMMENDATIONS CONTINUED

ferences in tractor models. Some changes cannot be approved by CARCO because of safety limitations. Call a CARCO dealer or the CARCO factory prior to attempting winch modifications or before mounting on a different tractor.

11. Discharge all retained hydraulic system pressure BEFORE removing any hydraulic lines or fittings. Personal injury may result from sudden release of oil pressure. To discharge the winch control system pressure, stop the tractor engine and cycle the winch control lever into all positions five (5) times.

12. 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 the tractor parking brakes and lower any equipment to the ground before dismounting the tractor.

13. The winches described in this manual are neither designed nor intended for use or application in the lifting or moving of persons.

14. Install guarding to prevent personnel from getting any part of their body or clothing caught at a point where the cable is wrapped onto the drum or drawn through the fairlead rollers.

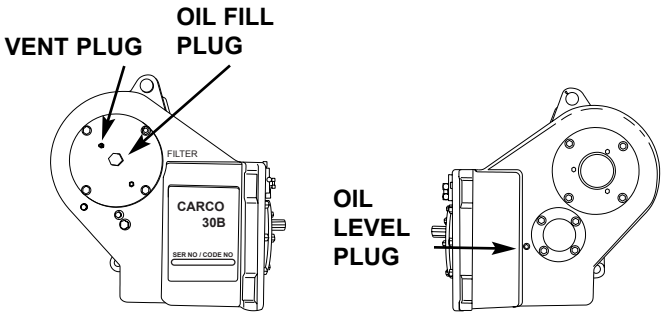
15. Keep equipment in good operating condition. Perform the scheduled servicing and adjustments defined in the "Preventive Maintenance" section of this manual. Use of proper lubricants is crucial.

16. An equipment warm-up procedure is recommended for all tractor start-ups, and is essential at ambient temperatures below +40°F (+5°C). Refer to the "Warm-Up Procedure" listed in the "Preventive Maintenance" section of this manual.

PREVENTIVE MAINTENANCE AND SPECIFICATIONS

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

NOTE: *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 the recommendations of an independent oil analysis.*

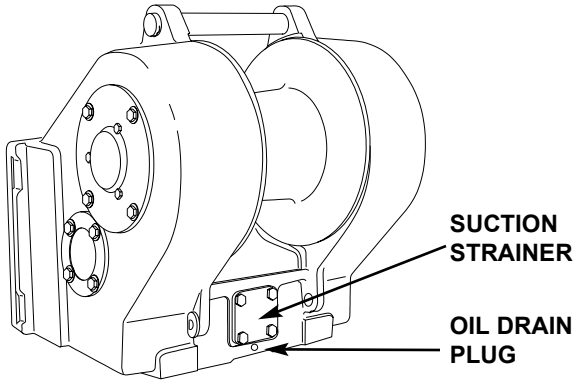


1. OIL LEVEL

Check oil level at the beginning of each work shift, with the tractor and winch in a level position. Remove the oil level plug and be sure the oil level is up to the bottom of the opening. If required, add oil through the oil fill port. Refer to "Recommended Oil" on page 3.

2. OIL CHANGE - STRAINER SERVICE

The oil should be changed and the suction strainer cleaned after the first 100 hours of operation, then every 1,000 operating hours or six (6) months, whichever occurs first.



⚠ WARNING ⚠

Hot oil may cause severe injury. Make certain the oil has cooled to a safe temperature (less than 110°F or 43°C) before servicing.

To drain the oil, place the tractor and winch in a level position and remove the drain plug. Reinstall the plug securely after the oil has been completely drained. After draining, remove the four (4) suction strainer cover capscrews and the cover. Remove the suction strainer from the winch case then remove the metal band and mag-

netic rods from the strainer. Thoroughly wash the strainer in clean safety solvent and blow dry with compressed air. Inspect the wire mesh for damage or clogging from debris. Do not reuse a damaged suction strainer.

Install the magnetic rods and the metal band onto the suction strainer. Lubricate the O-ring and install the strainer and cover into the winch case.

> **⚠ CAUTION ⚠**
>
> Do not operate the engine without oil in the winch. Serious damage to internal components may result.

OIL CAPACITY:
30 Std. PTO - 35 qt. (33 L)
30 Low PTO - 17 qt. (16 L)

Note: *Use of the low PTO variation of the early CARCO 30/30B winch in steep sloped areas may require additional oil capacity to eliminate the possibility of intermittent pump cavitation. This condition may exist during periods of use with the tractor facing downslope. Tractors using the low PTO variation are JI Case, Fiat-Allis, Cat 518 Skidders, and some Model 30/30B special grapple arrangements. If you have questions regarding your specific winch arrangement, contact the CARCO Service Department.*

If your normal application includes steep slope operation, an additional 6 qt. (5.7 L) of oil may be added to the winch to reduce the possibility of pump cavitation. The increased oil level will be just below the lower bolts in the intermediate gear cover plate, P/N 26109, on the LH side of the winch. This is the location of the oil level plug on later winch cases.

3. VENT PLUG

The vent plug is located on the RH side of the winch case. It is very important to keep this vent clean and unobstructed. Whenever the oil is changed, remove the vent plug, clean in solvent and reinstall. Do NOT replace with a solid plug.

4. WINCH CABLE (wire rope)

Inspect the entire length of wire rope according to the wire rope manufacturer's recommendations.

5. MOUNTING BOLTS

Check / tighten all winch mounting fasteners to the recommended torque after the first 100 hours of operation, then every 1,000 operating hours or six (6) months, whichever occurs first.

6. WARM-UP PROCEDURES

A warm-up procedure is recommended at each start-up and is essential at ambient temperatures below +40°F (+4°C).

Start the tractor engine and operate at low idle for five (5) minutes.

Operate the winch alternately in Haul-In and Payout with little or no load to warm the oil and lubricate the gear train.

SERVICE SPECIFICATIONS

Unit Weight, without oil, cable or winch adapters	1000 lb. (454 kg)
Cable Drum Dimensions	
Barrel Diameter	8 in. (203 mm)
Flange Diameter	16 in. (406 mm)
Barrel Length	8 in. (203 mm)
Throat Clearance	5 in. (127 mm)
Cable Storage Capacity	
1/2 in (12 mm)	355 ft (108 m)
9/16 in. (14 mm)	284 ft (87 m)
5/8 in. (16 mm)	233 ft (71 m)
3/4 in. (19 mm)	164 ft (50 m)
Hydraulic System	
Oil Capacity (Std. PTO)	35 qt. (33 L)
Oil Capacity (Low PTO)	17 qt. (16 L)
Operating Pressure	380 - 420 psi (2620 - 2900 kPa)

ASSEMBLY SPECIFICATIONS

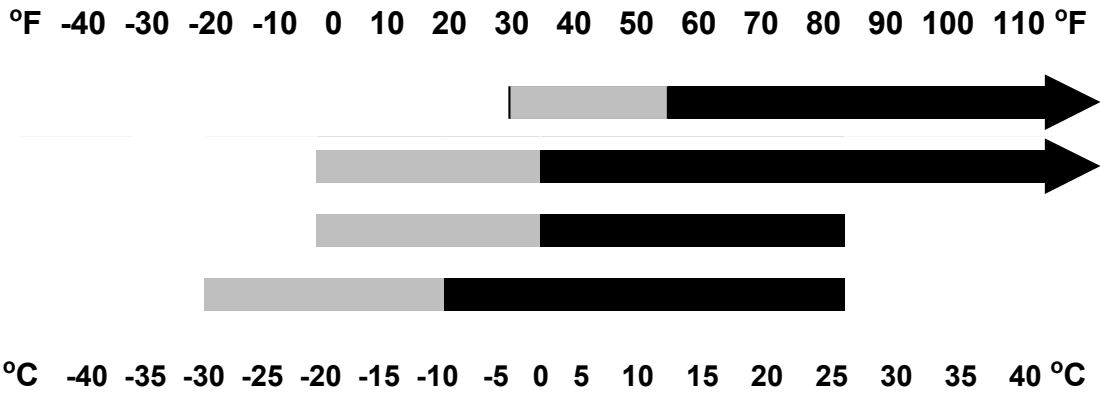
Bevel Pinion / Bevel Gear Backlash	0.004 - 0.009 in. (0.1 - 0.2 mm)
Bevel Pinion Nut Torque	150 lb-ft (203 N-m)
Brake Hub Nut Torque	100 lb-ft (136 N-m)

PREVENTIVE MAINTENANCE AND SPECIFICATIONS
CONTINUED

RECOMMENDED OIL

We have published the following specification to help you determine which lubricant is best suited for your application. Your oil supplier should assure you that his product meets this specification. If there are any questions as to the suitability of a lubricant, contact the CARCO Service Department. Please provide a copy of the product specification with your request.

Prevailing Ambient Temperature



! WARNING !

Cold start-up in this ambient temperature range requires extended equipment warm-up to prevent erratic clutch and brake operation which may result in property damage, injury or death.

A - HTF Type C3/C4 SAE 30, CAT TO4 SAE30
B - Case TCH MS 1210, CAT TO4 SAE 10W30, JD HY-GARD J20C
C - HTF Type C4/C4 SAE 10, CAT TO4 SAE 10W, KOM HDTF 10
D - CAT TO4 SAE 5W20 spc., JD HY-GARD LOW VISCOSITY J20D

Basic Oil Requirements

15,000 SUS maximum allowed viscosity at cold start-up; requires extended equipment warm-up.
3,000 SUS maximum allowed viscosity at cold start-up; requires normal equipment warm-up.
60 SUS minimum allowed viscosity at maximum winch operating temperature assuming ambient plus 80 °F (27 °C).

Oil must possess high temperature oxidation stability, rust and corrosion protection, good dispersant and detergent characteristics, anti-wear additives and remain compatible with nitrile base seals.

WELDING PROCEDURE

The following specifications apply when attempting to weld to the ductile iron winch case.

PREPARATION

Attachments should be generously chamfered to ensure adequate weld penetration. Weld joints must be free of rust, scale, slag, sand, dirt, grease, oil, paint and moisture. Entire weldment should be maintained at a minimum of 65°F (18°C).
The interior of the winch case is factory coated to enable an oil-tight seal. Welding, or otherwise applying excessive heat to the winch case will cause the interior coating to chip off which could damage bearings and other internal winch components. After performing any weld procedure, chip off and remove any loose material from the inside of the case. Recoat the affected area with a quality epoxy coating.

PROCEDURE

Use a multi-pass welding technique (stringer bead) and follow electrode manufacturer's recommendations for proper voltage, current, polarity and speed.

MATERIALS

Flux Coated Electrode		
Composition	Ni	43.75%
	C	1.50%
	Mn	11.00%
	Fe	43.75%
Mechanical Properties		
	Tensile Strength	65-84 KSI
	Yield Strength	45-65 KSI
	Elongation	15-25%
Flux Cored Wire		
Composition	Ni	50.0%
	C	1.0%
	Mn	4.2%
	Fe	44.0%
	Si	0.6%
Mechanical Properties		
	Tensile Strength	64-74 KSI
	Yield Strength	43-50 KSI
	Elongation	15-25%

WINCH REMOVAL AND INSTALLATION

Before starting any repair procedures, be sure to thoroughly clean the parts to be removed and the adjacent areas on the equipment to avoid entry of dirt into the winch. Do not leave any ports or access openings exposed to the weather. Seal or cap the openings to prevent entry of dust, moisture, or other foreign material. Cap or plug all exposed hydraulic ports and fittings.

During disassembly, care should be taken to avoid damage to gaskets, shims, seals and O-rings that are to be re-used. Replace any such parts that are damaged or otherwise defective. Certain O-rings and seals specified in the replacement instructions must not be re-used. In general, any seals and O-rings exposed to operating pressures, or that require extensive disassembly to replace, should be replaced during reassembly.

During assembly, apply a suitable thread sealing compound to the threads of all capscrews and fittings that penetrate the winch case. Take care to prevent excess sealing compound from entering the winch case.

Maintain strict cleanliness during rebuild to prevent entry of dirt or moisture into the winch case. Hydraulic components should be rebuilt under the cleanest possible conditions.

WINCH REMOVAL AND INSTALLATION CONTINUED

⚠ 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 accumulator, stop engine and cycle Power Shift control lever into full HAUL-IN position and then back to neutral a minimum of 5 times.

⚠ WARNING ⚠

Hot oil may cause injury. Make certain the oil has cooled to a safe temperature (less than 110°F/43°C) before servicing the winch.

WINCH REMOVAL

Place the tractor and winch in a level position and drain the oil from the winch in a suitable container. Install the drain plug securely after the oil has been drained.

Disconnect and identify the hydraulic lines attached to the hydraulic manifold and winch case. Winches with optional Pay-Out will have six (6) lines, and those with Haul-In only will have five (5). Cap or plug hose ends and fittings to avoid contamination.

Support the winch with a suitable hoist and remove the nuts and capscrews securing the winch to the tractor adapters.

⚠ WARNING ⚠

A CARCO 30B winch weighs approximately 1,000 lbs. (454 kg) without oil, cable, tractor adapters and accessories. Make certain your lifting equipment has adequate capacity. Attempting to lift the winch with inadequate equipment may result in personal injury or damage to the winch or property.

Move the winch away from the tractor slowly and cautiously to avoid damaging the PTO pilot and shaft. Cover the PTO access opening in the rear of the tractor to prevent entry of dirt or moisture.

WINCH INSTALLATION

Remove dirt, paint and rust from all mounting surfaces. Coat the splines of the PTO shaft and couplings with general-purpose grease. Lubricate and install the O-rings onto the winch PTO pilot (if equipped).

Carefully install the winch onto the tractor while guiding the PTO pilot into the tractor. It may be necessary to "bump" the tractor starter to properly align the splines on the PTO shaft and the coupling.

Install and tighten all fasteners to the recommended torque.

NOTE: *All 30B winches, S/N 0004284 and up, include new mounting studs in the winch face to attach the winch mounting brackets to the winch. If your winch is an earlier serial number winch than this, please refer to CARCO Service Bulletin No. 105 for further details.*

Additionally, if your winch is equipped with the optional drawbar attachment and the serial number is earlier than the number listed above, you should convert the winch-to-adapter mounting capscrews to the new studs. Please refer to CARCO Service Bulletin No. 104 for further details.

Connect all hydraulic lines to their appropriate locations on the hydraulic manifold and winch case.

Fill the winch to the proper level with the recommended oil. Refer to the "Preventive Maintenance" section of this manual and the "Parts and Installation Manual" for your winch for further information.

⚠ CAUTION ⚠

Do not operate the engine without oil in the winch. Serious damage to internal components may result.

HYDRAULIC SYSTEM

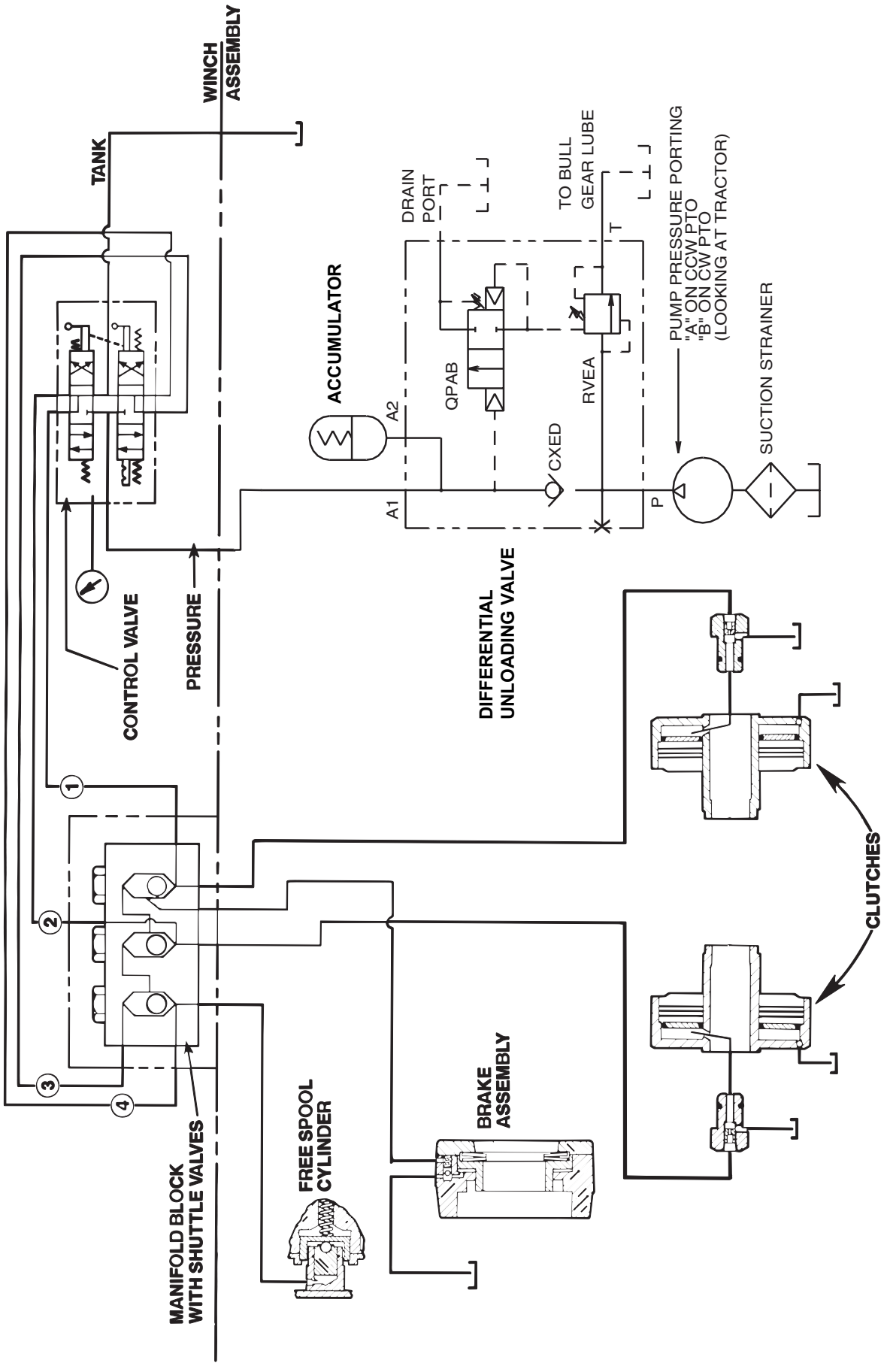
The winch contains an independent integral hydraulic system. The winch case serves as the reservoir and supplies filtered oil for the pump. Hydraulic system control oil pressure is continuously supplied by a gerotor pump located in the PTO carrier assembly and is driven off the bevel pinion with power supplied by the tractor PTO shaft. The pump is operating whenever the winch input shaft is turning. Standard CARCO 30/30B winches are equipped with a HAUL-IN, BRAKE-OFF and FREESPOOL, while hydraulic PAY-OUT is an option.

PRESSURE REGULATION

The hydraulic control system relief pressure is limited by the differential unloading valve located inside the cover on the RH side of the winch.

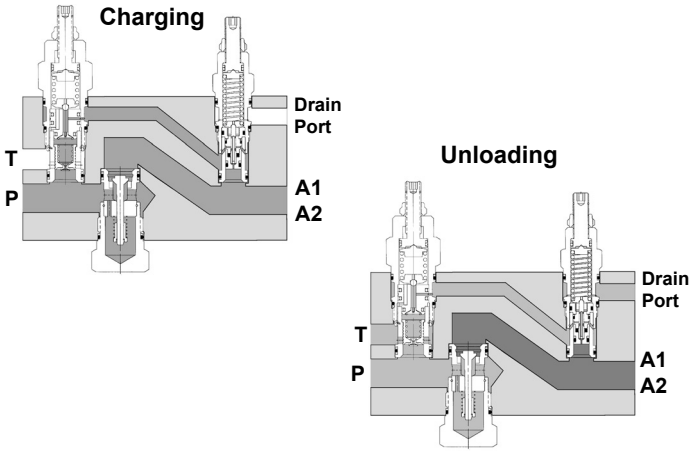
Supply oil from the pump enters the inlet port, port "P", of the unloading valve and travels around the poppet, through the check valve, and exits the system port to the accumulator and winch control valve, ports "A1" and

HYDRAULIC SCHEMATIC



HYDRAULIC SYSTEM CONTINUED

"A2". When the system pressure reaches the preset level, the poppet lifts and flow is diverted to the lubrication port, "T".



System pressure is factory preset to 390 - 410 psi (2,690 - 2,830 kPa). Unloading pressure is controlled by the differential unloading valve cartridge which has a 20% differential ratio between unloading and resetting. The unloading pressure on this cartridge is factory preset and should not need adjustment. With the winch in the neutral (BRAKE ON) position, control pressure cycles between maximum system pressure and 80% of system pressure, approximately 320 psi (2210 kPa), at which time the differential unloading valve reseats and allows the accumulator to recharge to full system pressure. Excess oil is diverted by the relief valve to the tank port, "T", and used for lubrication of the winch gear train.

The pressure regulation system will cycle between charging and unloading every ½ - 5 minutes, or longer, depending on tractor PTO speed (pump flow), the number of functions selected, and system leakage. Refer to the "Trouble Shooting" section of this manual for further information.

PRESSURE REGULATION ADJUSTMENT

⚠ 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 accumulator, stop engine and cycle Power Shift control lever into full HAUL-IN position and then back to neutral a minimum of 5 times.

⚠ WARNING ⚠

Hot oil may cause severe injury. Make certain the oil has cooled to a safe temperature (less than 110°F or 43°C) before servicing.

1. Install an accurate 0 - 600 psi (0 - 4,140 kPa) gauge into the pressure port of the operator's control valve. A second pressure port is located adjacent to the existing pressure port on the side of the valve. A -8 O-ring boss adapter (3/4-16 UNF thread) is required. Optionally, a -6 O-ring boss TEE (9/16-18 UNF thread) may be installed in the existing pressure hose.

2. Operate the engine at approximately 700 - 1,000 PTO rpm, and operate the winch to bring the winch oil up to normal operating temperature, 80° - 140°F (27° - 60°C).

3. Maximum pressure during the charging cycle, or unloading pressure, should be 390 - 410 psi (2,690 - 2,830 kPa), and should not exceed 410 psi (2,830 kPa). The valve will shift to its reload cycle at approximately 80% of the unloading pressure, or 310 - 330 psi (2,140 - 2,280 kPa). NOTE: The differential ratio, or the percentage of pressure drop to recharge, is not adjustable. Shift the control lever into the BRAKE OFF position and return it to neutral (BRAKE ON) to cycle the unloading valve. Cycle the valve several times and observe the unloading pressure.

4. If adjustment is required, loosen the external jam nut on the unloading valve cartridge. Using a hex wrench, turn the screw clockwise to increase pressure, and counter-clockwise to decrease pressure. Once reset, tighten the jam nut without turning the adjusting screw further.

PRESSURE MAINTENANCE

LATER 30 AND 30B WINCHES

The hydraulic system incorporates a spring-type accumulator, which is automatically recharged with oil by the differential unloading valve whenever the pump is operating. The accumulator stores a small amount of oil at full 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 during engine or torque converter stall conditions.

EARLY 30 WINCHES ONLY

The hydraulic system used a one-pint, steel-cased bladder-type accumulator connected to the system port of the differential unloading valve. The accumulator is precharged with 190 - 210 psi (1,310 - 1,450 kPa) of dry nitrogen. The bladder-type accumulator performs the same functions as defined above, and is automatically recharged in the same fashion. The condition of the nitrogen pre-charge can be determined by removing the control valve supply line and installing a 0 - 600 psi (0 - 4,140 kPa) gauge in its place. If the accumulator fails to

hold full system pressure, or fails to hold system pressure longer than one minute, then it should be recharged with nitrogen, or replaced. A service valve located on the large end may be used for recharging. Refer to CARCO Service Bulletin No. 2006 for further details regarding servicing hydraulic accumulators.

⚠ 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 accumulator, stop engine and cycle Power Shift control lever into full HAUL-IN position and then back to neutral a minimum of 5 times.

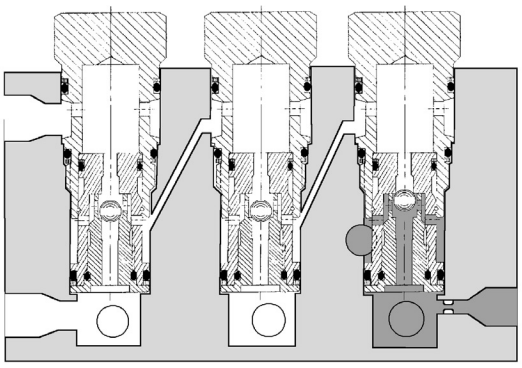
DIRECTIONAL CONTROL SYSTEM

A two-spool, four-way hydraulic control valve provides directional control of the winch cable drum. The valve is a closed center, open port configuration. One valve spool is detented for BRAKE OFF and FREESPOOL positions; the other is spring centered for HAUL-IN and optional PAY-OUT positions.

Supply oil from the accumulator enters the control valve pressure port. With both spools in their centered, or neutral, positions, there is no oil flow through the control valve. The differential unloading valve will then "unload" pump oil flow through the lube port, back into the winch case.

The directional control system also incorporates a manifold block assembly mounted to the winch case adapter, to serve as the winch logic valve. This manifold contains a number of drilled passages interconnecting the external ports with shuttle valves to allow the proper oil flow for all combinations of winch functions. The shuttle valves are self-contained, and install directly into the top of the manifold. Winches with HAUL-IN only have two (2) shuttle valves, while winches with both HAUL-IN and optional PAY-OUT have three (3) shuttle valves.

HAUL-IN (STANDARD)



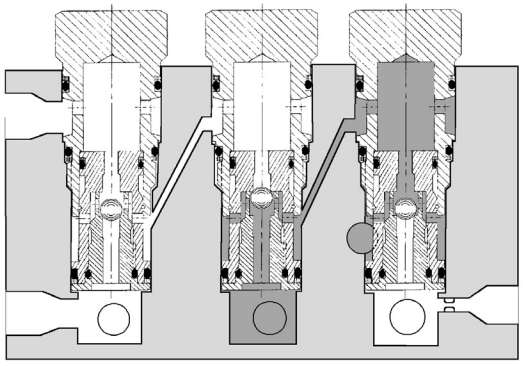
The HAUL-IN clutch is a multi-disc, hydraulically applied, spring released assembly located on the clutch shaft, which is installed to the inside of the winch case adapter.

Moving the power shift control valve lever to the HAUL-IN position shifts the valve spool, sending control oil to the HAUL-IN port of the manifold. The manifold then routes the oil to simultaneously release the brake and apply the HAUL-IN clutch.

Hydraulic oil is supplied to the HAUL-IN clutch through a tube assembly inserted into the end of the clutch shaft assembly. This tube assembly allows oil to be supplied through the rotating clutch shaft into the clutch assembly, enabling the actuation of the clutch piston. The tube assembly also contains an orificed shuttle valve, which will delay clutch application until the brake has begun to release. The shuttle valve also serves as a clutch dump valve to quickly exhaust oil from the clutch assembly when the clutch is released.

When the power shift control valve lever is returned to neutral, or BRAKE ON, system pressure is blocked at the control valve. Oil is very quickly exhausted from the clutch and brake housings via their dump valves, releasing the clutch, and almost instantaneously applying the brake to hold the load.

PAY-OUT (OPTIONAL)



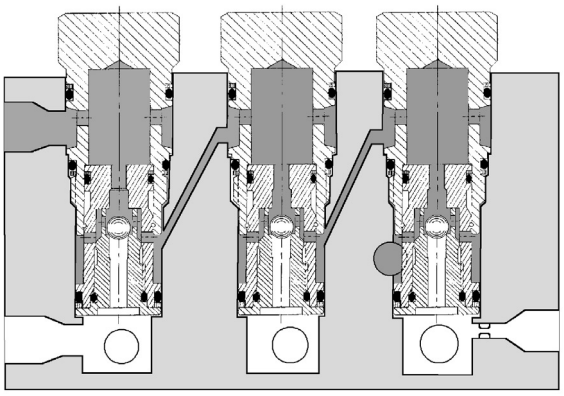
The PAY-OUT clutch is a multi-disc, hydraulically applied, spring released assembly located on the clutch shaft, and is identical to the HAUL-IN clutch assembly on four-shaft winch assemblies. On three-shaft winch assemblies, the clutch housings are different, but all other parts are identical.

Moving the power shift control valve lever to the PAY-OUT position shifts the valve spool, sending winch oil to the PAY-OUT port of the manifold. The manifold then routes the oil to simultaneously release the brake and apply the PAY-OUT clutch.

HYDRAULIC SYSTEM CONTINUED

Hydraulic oil is supplied to the PAY-OUT clutch through a tube assembly inserted into the end of the clutch shaft assembly. The balance of the PAY-OUT operation of the winch is the same as for HAUL-IN.

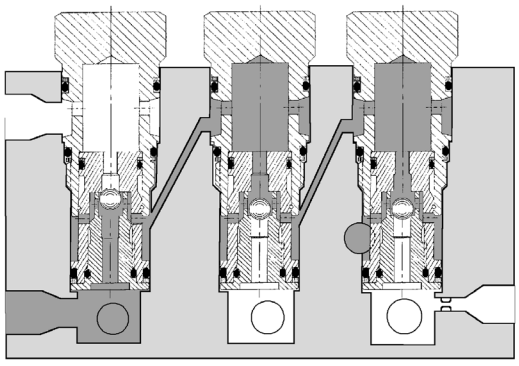
BRAKE OFF



The winch brake is multi-disc, spring-applied, hydraulically released unit. Moving the power shift control valve lever to the BRAKE OFF position shifts the valve spool into the detent, sending oil into the brake port of the manifold. The manifold routes the oil only to the brake cylinder and piston, through the brake dump valve. System pressure overcomes brake spring pressure and releases the brake.

The brake dump valve is an orificed shuttle valve containing a check ball, and is located in the brake housing behind the brake cover. The valve is held in its normal seated position by a spring. Oil passes through the dump valve to act on the brake piston. When the control valve lever is returned to neutral, BRAKE-ON, oil to the brake is blocked. This causes the check ball in the valve to seat. The brake springs then act against the oil in the brake cylinder, forcing the oil against the dump valve, shifting the valve in its cavity. This uncovers an open passage to sump to rapidly exhaust the oil from the brake assembly, allowing the brake to reapply. Refer to the "Brake Service" section of this manual for further information.

FREESPOOL



FREESPOOL is a mechanical disengagement of the gear train from the cable drum shaft. A ring gear, or collar gear, is splined to the bull gear and held in place with retaining rings. A sliding gear, or spool gear, is splined to the cable drum shaft and is also meshed with the internal teeth on the collar gear.

The spool gear is held in its normal position by force from a compression spring, locking the bull gear to the cable drum shaft. When system hydraulic pressure is applied to the freespool cylinder, the spool gear is pushed further into the end of the drum shaft, disengaging the teeth between the collar gear and bull gear, thus allowing the drum shaft and cable drum to spin free of the bull gear and the drive train. The freespool cylinder is located behind, and attached to, the gear side cover plate.

When FREESPOOL is selected, cable can be pulled from the drum by hand. A freespool drag brake is provided to allow slight pressure on the cable drum to prevent overrun or "birdnesting" of the cable. Refer to the "Operator's Manual" for further information.

Moving the power shift control valve lever into the FREESPOOL position shifts the valve spool into the detent, sending oil into the freespool port of the manifold. The manifold routes the oil to both the brake cylinder and freespool cylinder, allowing the winch brake to release and forcing the freespool cylinder to disengage the spool gear from the collar in the bull gear.

When the control valve lever is returned to neutral, BRAKE ON, oil to the brake and freespool cylinders is blocked, allowing spring force to exhaust oil back to sump through a dump valve in the freespool cylinder and the brake dump valve. The spring force on the freespool cylinder allows the teeth on the spool gear to re-align with the bull gear, locking the drum shaft to the bull gear and winch drive train.

⚠ CAUTION ⚠

Do NOT attempt to engage or disengage FREESPOOL while the cable drum is rotating. Severe damage to internal winch components may result from this action. The FREESPOOL function is NOT intended to be used for lowering or releasing any load. Use BRAKE OFF or optional PAY-OUT for this purpose.

TROUBLE SHOOTING

⚠ WARNING ⚠

If a winch ever exhibits any sign of erratic operation, or load control difficulties (i.e. load creeping or chattering) appropriate trouble shooting tests and repairs should be performed immediately. Continued operation in this manner may result in property damage, serious personal injury or death.

TROUBLE	PROBABLE CAUSE	REMEDY
1. The winch fails to haul in or pay out loads.	Low or no hydraulic oil pressure due to stalled PTO shaft.	a. Operate tractor engine at proper speed to match load requirement. Minimum PTO shaft speed for reliable winch operation is 650 RPM. b. Use sheave blocks and multi-part line if excessive line pulls are encountered.
2. The winch fails to haul in or pay out light loads. Brake holds; freespool operation is intermittent.	Low or no hydraulic pressure.	a. Check the oil level and fill the winch to the proper level with the recommended oil. b. The suction strainer may be plugged, causing the pump to cavitate. Drain the oil and clean the suction strainer. Identify the contamination and take corrective action as required. Refill the winch to the proper level with the recommended oil. c. The differential unloading valve may be stuck in the unload position by contamination. Remove the valve, disassemble, clean and inspect. Identify the contamination and take corrective action as required. Refill the winch to the proper level with the recommended oil. d. There may be internal leakage caused by damaged pressure hose(s). Inspect and replace as required. e. The system relief pressure may be set too low. Adjust the system relief pressure to 390 - 410 psi (2,690 - 2,830 kPa). f. The pump may be defective. Identify cause of pump failure and take corrective action prior to installing a new pump.

TROUBLE SHOOTING CONTINUED

TROUBLE	PROBABLE CAUSE	REMEDY
3. The winch hauls in but fails to pay out, or pays out but fails to haul in. Brake and freespool both function properly.	Low or no hydraulic pressure, due to internal clutch leakage.	a. Friction discs in the failed clutch may be worn beyond the serviceable limit. Replace worn clutch discs. b. The clutch piston may be seized, or O-rings may be worn or defective in the failed clutch. Clean, inspect and replace components as required. c. The clutch dump spool may be stuck in the dump position in the failed clutch. Clean and inspect the clutch tube assembly for the defective clutch. Be sure the dump valve spool moves freely. Replace the dump valve spool and/or the hydraulic tube assembly as required.
4. Tractor engine or torque converter stalls when attempting to haul in or pay out. The cable drum does not move.	Winch brake is not releasing.	a. There may be internal leakage, a damaged brake release hose, or worn or defective brake piston seals. Disassemble the brake. Clean, inspect and replace components as required. b. The brake dump valve may be stuck in the dump position. Remove the brake housing cover, clean and inspect the brake dump valve spool. Be sure the dump valve spool moves freely. Replace the dump valve spool if required. c. EARLY 30 WINCHES ONLY - The hydraulic accumulator precharge may be too low, or the accumulator bladder may be ruptured. Test the accumulator as outlined in the "Pressure Maintenance" section of this manual. Replace the accumulator if required.
5. The load slips with the control valve lever in the neutral, BRAKE ON, position.	A. The brake housing studs may be loose or damaged.	Check the security of the brake housing and replace the studs as required.
	B. The brake valve dump spool may be stuck in the brake-applied position.	Remove the brake housing cover, clean and inspect the brake dump valve spool. Be sure the dump valve spool moves freely. Replace the dump valve spool if required.
	C. The brake friction discs may be worn or damaged.	Remove and disassemble the brake. Clean, inspect and replace the components as required.

TROUBLE SHOOTING CONTINUED

TROUBLE	PROBABLE CAUSE	REMEDY
6. The cable drum fails to turn freely with the control valve in the FREESPOOL position.	A. The freespool drag brake may be adjusted too tight.	Adjust the freespool drag brake as required.
	B. There may be internal leakage due to worn or damaged freespool piston seals or a damaged freespool hose.	Remove the freespool cylinder assembly from the winch. Disassemble, clean and inspect. Replace the piston seals as required.
	C. The freespool sliding gears may not be disengaging properly.	a. Release any load on the winch prior to shifting the control valve lever to the FREESPOOL position. b. The freespool sliding gears may be damaged preventing disengagement. Remove the freespool gears and inspect for damage. Replace the gears as required.
7. The tractor will not walk away from a load with the control valve lever in the BRAKE OFF position. All other functions are normal.	A. There may be insufficient load to pull the cable from the drum.	While in BRAKE OFF, the load must be sufficient to backdrive the entire winch gear train.
	B. The winch brake may not be releasing.	a. One or more of the shuttle valves in the manifold block may be stuck in its back-seated position. Remove the shuttle valves and clean and inspect them. Replace valves and/or seals as required. b. The brake dump valve spool may be stuck in the dump position. Remove the brake housing cover, clean and inspect the brake dump valve spool. Be sure the dump valve spool moves freely. Replace the dump valve spool if required.
8. The winch fails to haul in or pay out after moving the control valve lever from the FREESPOOL position. All other functions are normal.	A. This may be caused by a lack of sufficient time for the freespool spring to push the sliding gears into mesh before the gear train begins to turn. Usually, a "ratcheting" sound will be heard.	a. Instruct the operator to pause momentarily in NEUTRAL, or BRAKE ON, before shifting into HAUL-IN or PAY-OUT. b. If this occurs soon after start-up, the winch oil may be too cold to flow easily through the control valve. Additional time for warming the oil is required.
	B. The freespool piston may be stuck in the disengaged position.	Disassemble, clean and inspect the freespool cylinder and piston, and replace components as required.
	C. The teeth in the sliding gears may be damaged, preventing re-engagement of the gear train.	Disassemble, clean and inspect the freespool components, and replace as required.

WINCH DISASSEMBLY

SERVICE PRECAUTIONS

Before any part is removed from the winch, all service instructions should be read and understood.

The work area should be as clean as possible, as cleanliness is of utmost importance when servicing hydraulic equipment.

Inspect all replacement parts, prior to installation, to detect any damage which might have occurred during shipment.

For optimum results, use only genuine CARCO replacement parts which may be obtained through your CARCO dealer. Never reuse expendable parts such as O-rings and gaskets.

Inspect all machined surfaces for excessive wear or damage…before reassembly procedures are begun.

Lubricate all O-rings and rubber rings with clean hydraulic oil prior to installation.

Use a light coating of thread sealing compound on pipe threads. Avoid getting thread compound inside parts or passages which conduct oil.

Thoroughly clean all parts in a good grade of non-flammable safety solvent. Wear protective equipment as required.

After trouble shooting the winch and its hydraulic system as covered in the "Trouble Shooting" section of this manual, and the problem is determined to be within the winch, use the following procedures to disassemble the winch.

DISASSEMBLY

1. Discharge the accumulator and drain the oil from the winch.

⚠ 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 accumulator, stop engine and cycle Power Shift control lever into full HAUL-IN position and then back to neutral a minimum of 5 times.

2. Remove the winch from the tractor. Support the winch with a suitable hoist and remove the nuts and capscrews securing the winch to the tractor adapters.

⚠ WARNING ⚠

A CARCO 30B weighs approximately 1,000 lb (454 kg) without oil, cable, tractor adapters and accessories. Make certain lifting equipment has adequate capacity. Attempting to lift the winch with inadequate equipment may result in personal injury or damage to the winch or property.

3. Once removed from the tractor, the winch may be laid on the floor or a table. Tilt the winch back onto the cable drum and housing with the adapter plate facing upward.

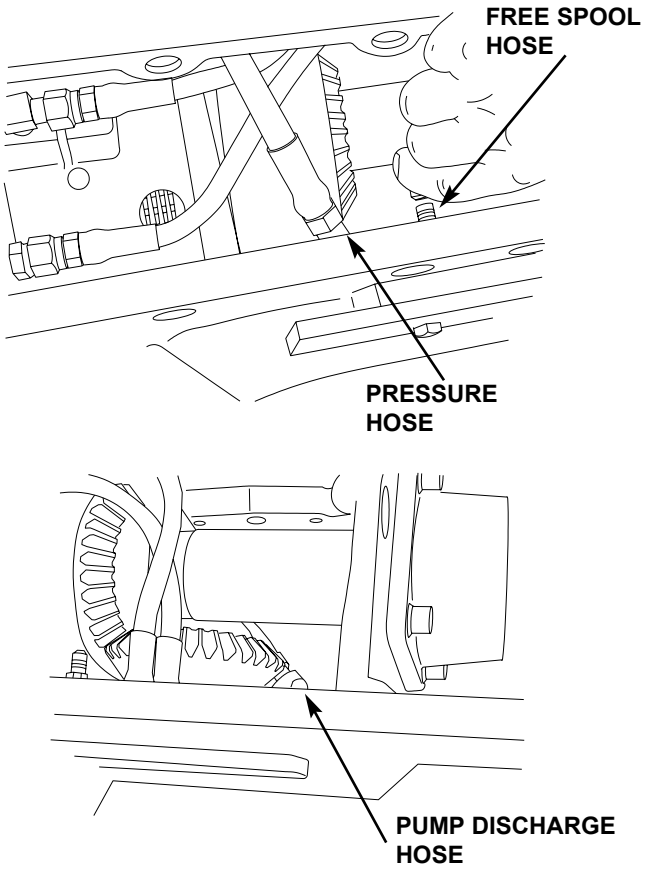
4. If a winch adapter lifting fixture is not available, it is advisable to first remove the bevel pinion carrier and pump assembly from the winch. This will aid handling of the winch adapter. Remove the capscrews securing the bevel pinion carrier to the winch adapter. Thread two (2) of the capscrews into the jackscrew holes provided in the carrier to free it from the adapter. Pull the carrier assembly far enough from the winch adapter to enable disconnecting the discharge hose from the pump. The pump suction line is held in place at both ends by an O-ring adapter, and will normally slide free of the pump. Carefully remove and store the shims for later use during reassembly. Refer to the "Bevel Pinion Carrier and Pump Assembly Service" section of this manual for further information.

5. Remove the manifold valve assembly from the winch adapter. Take care to ensure the O-rings between the manifold and winch adapter are not lost or damaged.

⚠ CAUTION ⚠

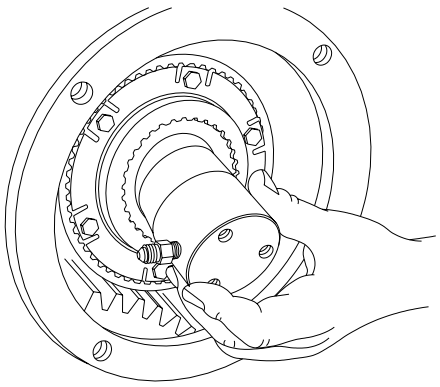
The winch adapter assembly weighs approximately 290 lb (132 kg). Make certain lifting equipment has adequate capacity.

WINCH DISASSEMBLY CONTINUED

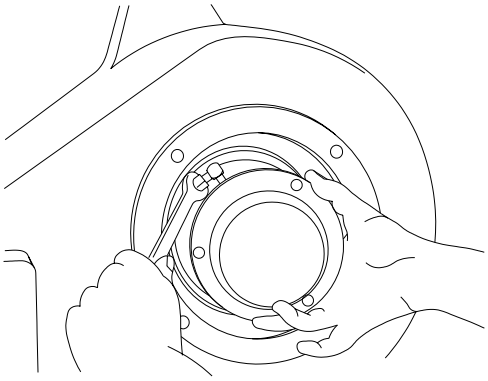


6. Support the winch adapter assembly and remove all the capscrews securing it to the winch case. Pull the adapter out at the top far enough to enable disconnection of the freespool and pressure hoses from the inside surface. (NOTE: All other hoses in this area of the winch have both ends connected to fittings on the adapter assembly and do not require removal at this time.) If the bevel pinion carrier and pump assembly was not previously removed, the pump discharge hose must also be removed now. Remove the adapter assembly from the winch. Refer to the "Adapter Assembly Service" section of this manual for further information.

7. Remove the three (3) capscrews from the center of the gear side, or LH side, cover plate attaching to the freespool cylinder.



EARLY 30 WINCHES ONLY
The freespool cylinder is bolted directly to the inside face of the gear side cover plate. Remove the cover to access the freespool cylinder.



LATER 30 AND 30B WINCHES
Using a rubber or plastic dead-blow type hammer, hit the freespool cylinder as needed to dislodge it from the gear side cover plate. Remove the fasteners securing the cover plate to the winch case and remove the cover.

8. Disconnect the hydraulic line to the freespool cylinder and remove the cylinder / piston assembly.

9. Remove the freespool collar gear from the bull gear. NOTE: In all 30 / 30B winches, the freespool gear is under spring pressure. Use care when removing the fastening mechanism.

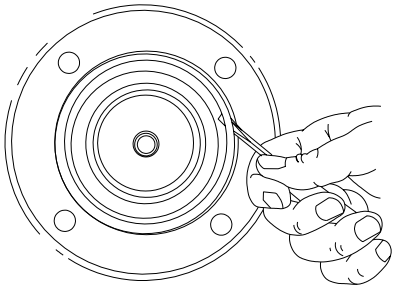
   LATER 30 AND 30B WINCHES
   Remove the retaining ring from the bull gear and remove the collar gear.

   EARLY 30 WINCHES ONLY
   Flatten the tabs on the locking plate and evenly remove the six (6) capscrews securing the collar gear to the bull gear. Remove the collar gear and coupling.

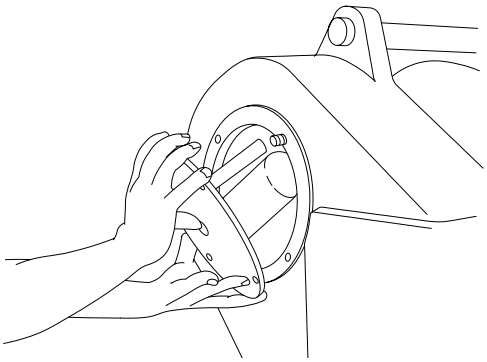
   ALL CARCO 30 / 30B WINCHES
   Once the collar gear is removed, the freespool gear and spring may then be removed.

10. Remove the four (4) capscrews attaching the bull pinion cover plate to the winch case and remove the cover plate. Attach a slide hammer to the bull pinion and slide the pinion and bearings out until the reduction gear contacts the winch case. At this time, the outboard bearing must be removed from the winch case. This can usually be accomplished by tapping on the winch case around the bearing, while maintaining outward pressure on the bearing.

WINCH DISASSEMBLY CONTINUED

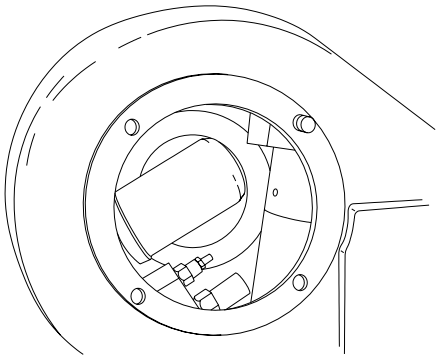


11. Remove the retaining ring securing the reduction gear to the bull pinion. NOTE: The bull pinion still cannot be removed from the winch at this point due to interference between the inboard bearing and the bull gear.

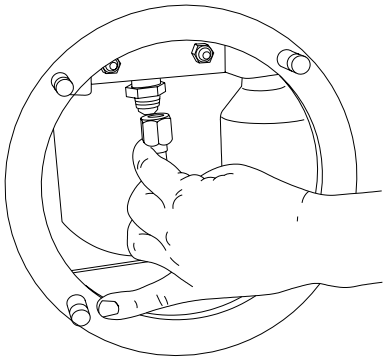


12. Moving to the RH side of the winch, prepare to remove the RH cover. BEFORE removing this cover, back off the freespool drag adjuster to remove the spring pressure on the drag brake disc. Remove the fasteners securing the cover to the winch case. Tilt the upper side of the cover plate outward while removing the cover to keep the drag brake disc, spring and spacer from falling out of the tube into the bottom of the winch case.

13. Remove the unloading valve assembly.



LATER 30 AND 30B WINCHES
Remove the fasteners attaching the accumulator brackets to the winch case. Disconnect the accumulator hose from the unloading valve and remove the accumulator from the winch case. Disconnect the lubrication tube from the unloading valve. Remove the fasteners attaching the unloading valve assembly to the winch case. Take care to not lose the spacers and O-rings installed between the valve and case wall. The unloading valve assembly may now be removed from the winch. Remove the bolt from the center of the drum spindle.



EARLY 30 WINCHES ONLY
Disconnect the lubrication tube from the bottom of the unloading valve and loosen the clamp holding the accumulator to the lower bracket. The entire unloading valve / accumulator assembly can be taken out by removing the two nuts and washers holding the upper bracket to the inside of the winch. NOTE: The studs attaching the upper bracket to the winch case may need to be backed out of the case to allow removal of the unloading valve assembly. Remove the bolt from the center of the freespool drag disc and remove the disc from the drum spindle.

⚠ CAUTION ⚠

Be sure the cable drum is properly supported before removing the drum shaft. The cable drum weighs approximately 100 lb (45 kg). Removing the drum shaft without supporting the cable drum may result in property damage, damage to winch parts, or personal injury.

14. Remove the cable drum shaft from the winch.
Insert a ½" (13 mm) diameter bar into the hole in the RH end of drum shaft. Take care to not damage the internal threads. Drive the shaft out the LH side (gear side) of the winch case, being careful to not let the drum shaft fall to the floor.

15. Remove the drum spindle from the RH side bearing. The cable drum is now free and may be removed from the winch.

⚠ CAUTION ⚠

The bull gear weighs approximately 55 lb (25 kg). Make certain lifting equipment has adequate capacity.

WINCH DISASSEMBLY CONTINUED

16. Roll the bull gear away from the bull pinion, and support it inside the winch case. Pull the bull pinion out of the winch through the access opening. The reduction gear and bull gear can be removed through the front of the winch case.

17. If required, remove the drum bearings and the inboard bull pinion bearing.

18. Remove the suction strainer cover plate from the rear of the winch, then remove the suction strainer and pipe nipple from the winch case.

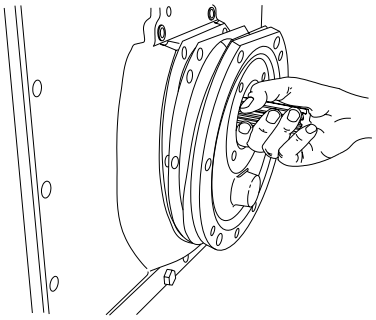
ADAPTER ASSEMBLY SERVICE

The winch case adapter contains a carrier housing for the bevel pinion carrier and hydraulic pump, the clutch shaft with either one or two clutch assemblies, the brake assembly, and the fourth shaft cluster gear, if the winch is configured with a four shaft arrangement. Bolt the winch adapter assembly to an adapter stand in order to hold it in an upright position. If a stand is not available, the adapter assembly may be placed on a clean work surface.

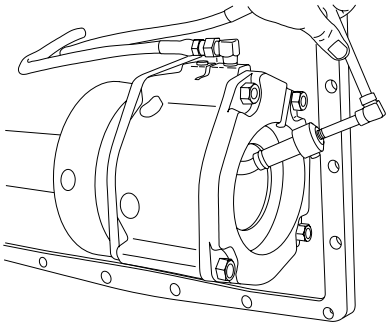
⚠CAUTION⚠

The complete adapter assembly can weigh up to 290 lb (132 kg). Make certain lifting equipment has adequate capacity.

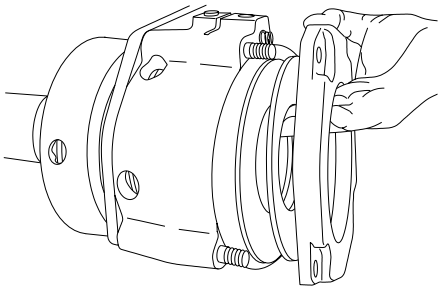
DISASSEMBLY



1. Remove the bevel pinion / pump carrier from the winch case adapter. Refer to the "Winch Disassembly" section, step 3, for removal instructions. For specific instructions regarding the bevel pinion and pump, refer to the "Bevel Pinion and Hydraulic Pump Service" section of this manual.



2. Remove the clutch tube assembly(s) from the end(s) of the clutch shaft and support it out of the way.



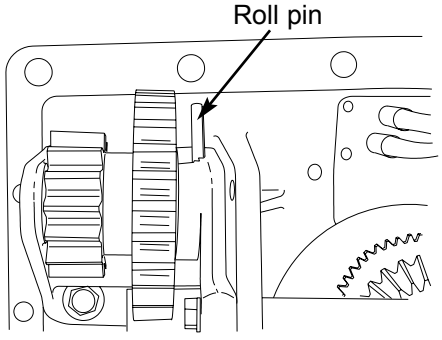
3. Slowly and evenly remove the four (4) nuts and lockwashers holding the brake housing cover in place. Remove the cover and the brake springs.

⚠CAUTION⚠

The brake housing cover is under heavy spring load. The fasteners holding the cover in place should be removed carefully to avoid possible property damage or personal injury.

4. Remove the dump valve spring and O-ring.

5. Slide the entire brake assembly off the mounting studs and place it on the bench with the friction discs facing upward. Refer to the "Brake Assembly Service" section of this manual for further information.



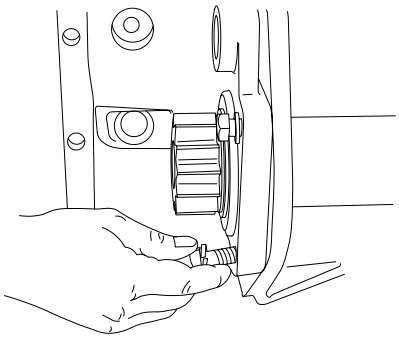
6. FOUR-SHAFT WINCHES ONLY
   Remove the roll pin holding the cluster gear shaft in place. NOTE: Later CARCO 30 and all 30B winches use a short roll pin designed to be driven into the

center of the cluster gear shaft. These short roll pins are oriented at 90° to the adapter mounting surface.

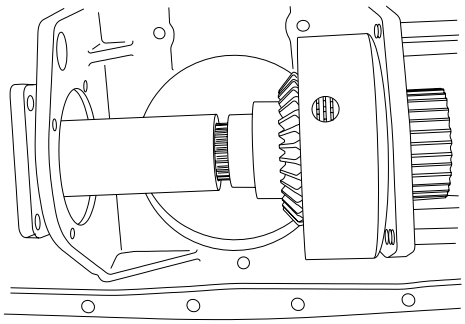
Carefully tap the shaft through the cluster gear. Support the cluster gear to keep it from falling when the shaft is removed. Remove and inspect the bearings and thrust washers. Replace as required.

Remove the capscrews and washers holding the carrier to the adapter. Remove the cluster gear carrier, spacer and shims.

7. Flatten the tab holding the bearing locknut onto the brake end of the clutch shaft and remove the locknut. Remove the bearing lockwasher, flatwasher, seal washers and O-ring from the clutch shaft.



8. Remove the four (4) capscrews and lockwashers holding the clutch carrier to the winch adapter. If the winch is equipped with a clutch assembly installed on the gear (LH) side, a stud and nut will be installed in place of one of the capscrews.

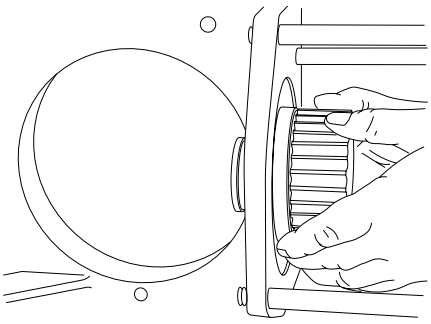


9. Carefully slide the clutch shaft out of the winch adapter toward the LH side, removing the clutch(s) and clutch spacer(s) at the same time. For specific instructions regarding the clutch assembly, refer to the "Clutch Assembly Service" section of this manual.

10. Remove and inspect the O-ring from the clutch spacer. Replace as required.

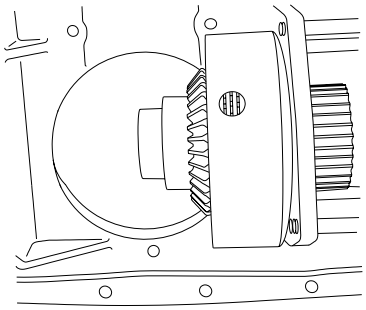
11. Remove the brake hub / bearing assembly from the winch adapter. If the clutch shaft or brake hub bearing require service, refer to the "Clutch Shaft and Brake Hub Bearing Service" section of this manual.

ASSEMBLY & BEVEL GEAR ADJUSTMENT
(WINCHES WITH HAUL-IN CLUTCH ONLY)

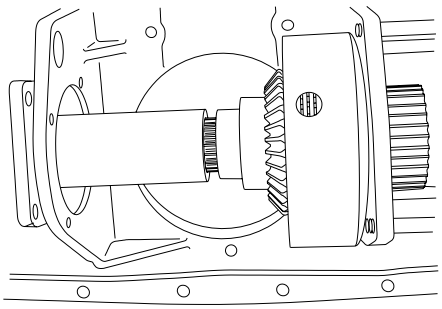


1. Install the brake hub / bearing assembly in the winch case adapter.

   If the HAUL-IN clutch for your winch is on the brake end of the clutch shaft, follow steps 2 and 3. If the HAUL-IN clutch is on the gear end of the clutch shaft, proceed to step 4.



2. Install the clutch assembly onto the brake hub and bearing assembly.



3. Install the O-ring onto the clutch shaft. Slide the spacer onto the clutch shaft. Install the clutch shaft through the clutch carrier bore in the winch adapter, and install the clutch assembly and the brake hub.

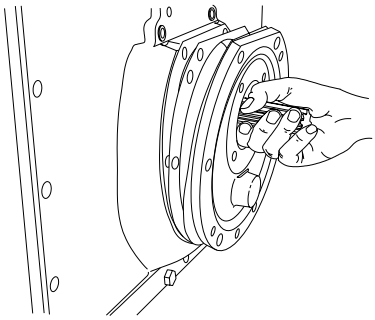
ADAPTER ASSEMBLY SERVICE CONTINUED

At this time, do not install any shims under the clutch shaft bearing carrier and do not install the brake hub bearing locknut.

Proceed to step 5.

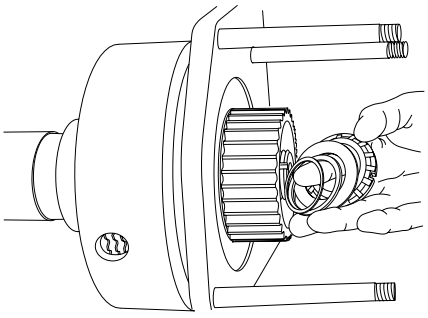
4. Install the O-ring onto the clutch shaft. Install the clutch assembly and the spacer onto the clutch shaft while inserting the clutch shaft through the clutch carrier bore in the winch adapter. Insert the clutch shaft through the opposite bore in the winch adapter into the brake hub.

   At this time, do not install any shims under the clutch shaft bearing carrier and do not install the brake hub bearing locknut.

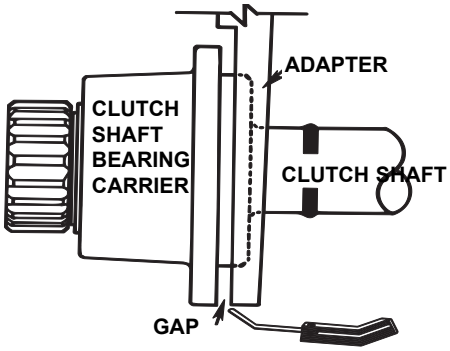


5. Install the assembled PTO carrier assembly into the winch adapter with (1) gasket, (2) 0.020" (0.50 mm) shims, and (1) 0.005" (0.13 mm) shim.

6. Using a soft mallet, tap the bevel pinion forward (toward the tractor) to properly seat the bearing. While holding the clutch assembly in tight mesh (zero backlash) with the bevel pinion, check and adjust the bevel gear tooth contact pattern. Optimum gear tooth contact is achieved when the heels of the mating gears are in alignment. Use "Prussian Blue" or other such compound to check the contact pattern. See Fig. 1 (page 21) for reference contact patterns. Add or remove shims behind the PTO carrier as required to attain the correct contact pattern.



7. Install the O-ring and both seal washers into the brake hub. Install the steel brake hub retainer washer, bearing locknut washer, and bearing locknut onto the clutch shaft. Torque the locknut to 100 lb·ft (135 N·m), and bend one locknut tab into place.



8. Using a soft mallet, again tap the bevel pinion forward to properly seat the bearing. Tap the clutch in the proper direction to achieve zero backlash between the gears at the point of tightest mesh. Measure the gap between the clutch shaft bearing carrier and the mating surface on the winch adapter.

   If the HAUL-IN clutch is on the brake side of the winch, subtract the amount in Table 1 from the measured gap to determine the proper shim thickness. If the HAUL-IN clutch is on the gear side of the winch, add the amount in Table 1 to the measured gap to determine the proper shim thickness.

TABLE 1

Ratio	Bevel Gear Teeth	Backlash Shim requirement
A	32	0.010" (0.25 mm)
B	33	0.009" (0.23 mm)
C	36	0.008" (0.20 mm)
D	38	0.008" (0.20 mm)
E	39	0.007" (0.18 mm)

Example:
Clutch on brake side
"C" Ratio - 36 tooth bevel gear

Actual measured gap 0.035" (0.90 mm)
Less backlash shim requirement 0.008" (0.20 mm)
Required shim thickness 0.027" (0.70 mm)
(Would require one 0.020" (0.50 mm) shim and one 0.007" (0.20 mm) shim from shim set 26173.)

Example:
Clutch on gear side
"C" Ratio - 36 tooth bevel gear

Actual measured gap 0.035" (0.90 mm)
Plus backlash shim requirement 0.008" (0.20 mm)
Required shim thickness 0.043" (1.10 mm)
(Would require four 0.007" (0.20 mm) and three 0.005" (0.10 mm) shims from shim set 26173.)

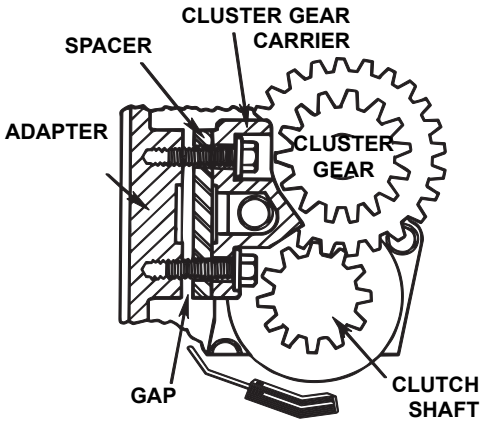
ADAPTER ASSEMBLY SERVICE CONTINUED

9. If your winch is a four-shaft configuration, install the cluster gear shaft through the cluster gear carrier and into the winch adapter to maintain alignment.

   Install two (2) capscrews and lockwashers loosely in the top and bottom of the cluster gear carrier. Install the shims determined in step 8 and loosely install the remaining two (2) capscrews and lockwashers. If your winch is equipped with a gear side clutch, one of the capscrews will be replaced with a stud and nut. Torque the fasteners for the cluster gear carrier to 80 lb·ft (110 N·m). Using a dial indicator, check the backlash between the bevel pinion and bevel gear. Gear backlash should be 0.004 - 0.011 in. (0.10 - 0.28 mm), with optimum backlash at 0.009" (0.23 mm).

   If your winch is a three-shaft configuration, this completes the bevel gear adjustment. Proceed to step 13 to complete the adapter assembly.

   If your winch is a four-shaft configuration, proceed to step 10.



10. Install the spacer between the cluster gear carrier and the winch case adapter. Loosely start two (2) capscrews and washers into the mounting holes in the adapter. Using a feeler gauge, measure the gap between the spacer and the adapter. Add 0.005" (0.10 mm) to the measured distance to arrive at the required shim thickness.

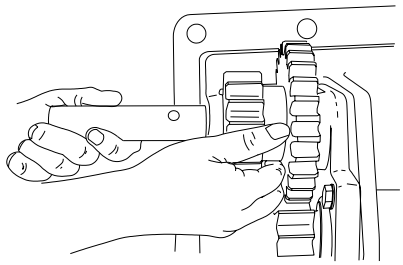
Example:

Actual measured distance	0.009" (0.25 mm)
Plus compression factor	0.005" (0.15 mm)
Total shim thickness	0.014" (0.40 mm)

(Would require two 0.007" (0.20 mm) shims from shim set 26570 at each capscrew.)

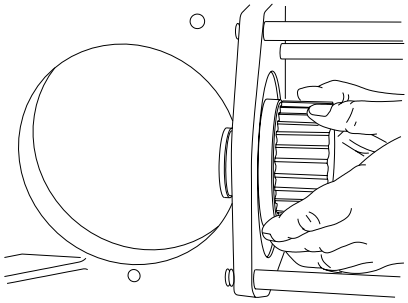
11. Install the required shims between the cluster gear carrier and the spacer, and torque the capscrews to 80 lb·ft (110 N·m).

12. Install two bearings into the bore of the cluster gear. Position the cluster gear in the carrier and install a thrust washer on each side of the gear between the cluster gear and the carrier. Install the cluster gear shaft through the carrier and gear, and install a new rollpin into the carrier and gear shaft. Using a small chisel or sharp punch, stake the carrier at the rollpin.

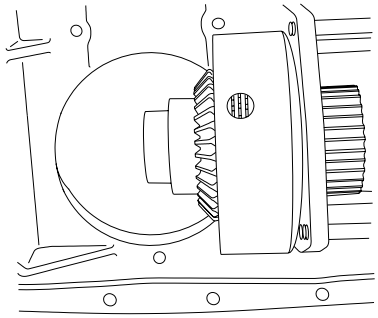


13. Install an O-ring onto the end of the clutch hydraulic tube assembly. There is a clutch dump spool located inside the hydraulic tube assembly. Shake the tube back and forth to verify the dump spool moves freely. Disassemble the tube assembly and remove the dump spool. Inspect the condition of the check ball and retaining pin inside the spool. Replace the spool if the ball or pin appear damaged. Install the tube(s) into the end(s) of the clutch shaft. If your winch has a gear side clutch, the hydraulic tube assembly is kept from rotating by a block that slides over the stud in the clutch shaft bearing carrier. If your winch has a brake side hydraulic tube assembly, the tube rests in a groove cast into the brake housing cover.

ASSEMBLY & BEVEL GEAR ADJUSTMENT
(WINCHES WITH OPTIONAL PAY-OUT CLUTCH)



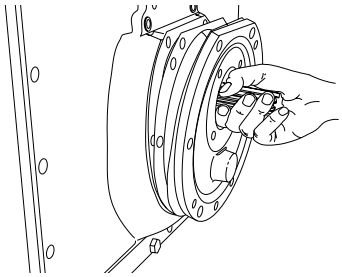
1. Install the brake hub / bearing assembly in the winch case adapter.



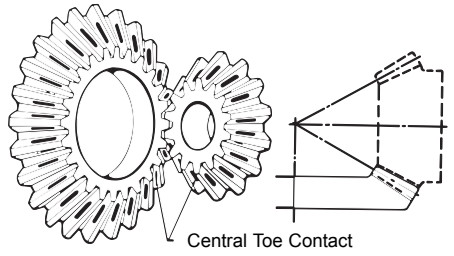
2. Install the PAY-OUT clutch assembly onto the brake hub and bearing assembly.

ADAPTER ASSEMBLY SERVICE CONTINUED

3. Install the O-ring onto the clutch shaft. Install the clutch shaft sub-assembly through the clutch carrier bore in the winch case adapter. At the same time, install the HAUL-IN clutch assembly onto the clutch shaft. Continue the assembly of the clutch shaft through the brake hub. At this time, do not install any shims under the cluster gear carrier, and do not install the brake hub bearing locknut.



4. Install the assembled PTO carrier sub-assembly into the winch case adapter plate with (1) gasket, (2) 0.020" (0.50 mm) and (1) 0.005" (0.10 mm) shims.



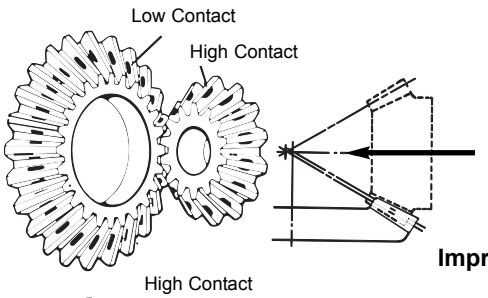
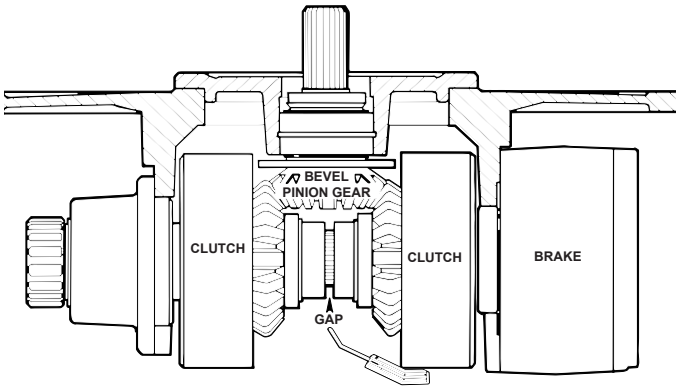


Figure 1

5. Using a soft mallet, tap the bevel pinion forward (toward the tractor) to properly seat the bearing. While holding both clutch assemblies in tight mesh (zero backlash) with the bevel pinion, check and adjust the bevel gear tooth contact patterns. Optimum gear tooth contact is achieved when the heels of the mating gears are in alignment. Use "Prussian Blue" or other such compound to check the contact pattern. See Fig. 1 for reference contact patterns. Add or remove shims behind the PTO carrier as required to attain the correct contact pattern.



6. Using a feeler gauge and spacer(s) of known thickness, measure the gap between the ends of the HAUL-IN and PAY-OUT clutch hubs. Be sure both clutch assemblies are held in tight mesh with the pinion gear, at their point of tightest mesh, while measuring this gap. Add twice the amount from Table 1 (page 19) to the measured distance.

Example:
36T Bevel Gear

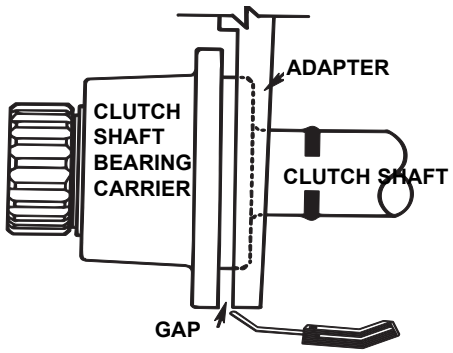
Actual measured distance	0.170" (4.30 mm)
Plus required clearance	0.016" (0.40 mm)
Total shim thickness required	0.186" (4.70 mm)

Select a combination of shims from shim set 26168 that most closely matches the total shim requirement.

The above example would require the following: one 0.050" (1.25 mm) shim, one 0.062" (1.55 mm), and one 0.074" (1.90 mm).

7. Pull the clutch shaft assembly out of the adapter and install the selected shims between the hubs of the clutch housings. Re-install the clutch shaft into the brake hub. Install the clutch shaft O-ring and both seal washers into the brake hub. Install the steel brake hub retaining washer, bearing locknut washer and bearing locknut onto the clutch shaft. Torque the locknut to 100 lb·ft (135 N·m), and bend one locknut tab into place.

ADAPTER ASSEMBLY SERVICE CONTINUED

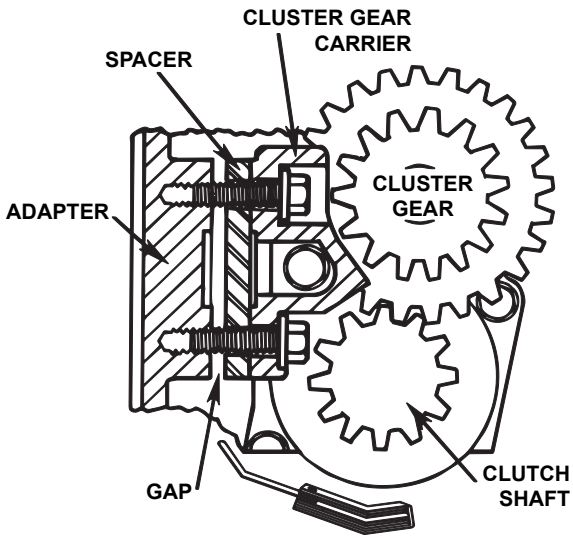


8. Using a soft mallet, tap the bevel pinion gear forward (toward the tractor) to properly seat the bearing. Tap the clutch shaft to achieve zero backlash between the HAUL-IN clutch bevel gear and the bevel pinion gear at the point of tightest mesh. Measure the gap between the clutch shaft bearing carrier and the mating surface on the winch adapter.

   If the HAUL-IN clutch is on the brake side of the winch, subtract the amount in Table 1 (page 19) from the measured gap to determine the proper shim thickness. If the HAUL-IN clutch is on the gear side of the winch, add the amount in Table 1 to the measured gap to determine the proper shim thickness.

9. If your winch is a four shaft arrangement with a cluster gear, install the cluster gear shaft through the cluster gear carrier and into the winch case adapter to maintain alignment.

   Install two (2) capscrews and lockwashers loosely in the top and bottom of the cluster gear carrier. Install the shims determined in step 8 and loosely install the remaining two (2) capscrews and lockwashers. If your winch is equipped with a gear side clutch, one of the capscrews will be replaced with a stud and nut. Torque the fasteners for the cluster gear carrier to 80 lb·ft (110 N·m). Using a dial indicator, check the backlash between the bevel pinion and both bevel gears. Backlash should be 0.004 - 0.011 in. (0.10 - 0.28 mm), with optimum backlash at 0.009" (0.23 mm).



   If your winch is a three-shaft configuration, this completes the bevel gear adjustment. Proceed to step 13 to complete the adapter assembly.

   If your winch is a four-shaft configuration, proceed to step 10.

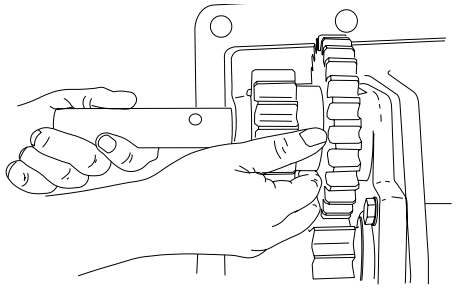
10. Install the spacer between the cluster gear carrier and the winch case adapter. Loosely start two (2) capscrews and washers into the mounting holes in the adapter. Using a feeler gauge, measure the gap between the spacer and the adapter. Add 0.005" (0.10 mm) to the measured distance to arrive at the required shim thickness.

Example:

Actual measured distance	0.009" (0.25 mm)
Plus compression factor	0.005" (0.15 mm)
Total shim thickness	0.014" (0.40 mm)

(Would require two 0.007" (0.20 mm) shims from shim set 26570 at each capscrew.)

11. Install the required shims between the cluster gear carrier and the spacer, and torque the capscrews to 80 lb·ft (110 N·m).



12. Install two bearings into the bore of the cluster gear. Position the cluster gear in the carrier and install a thrust washer on each side of the gear between the cluster gear and the carrier. Install the cluster gear shaft through the carrier and gear, and install a new rollpin into the carrier and gear shaft. Using a small chisel or sharp punch, stake the carrier at the rollpin.

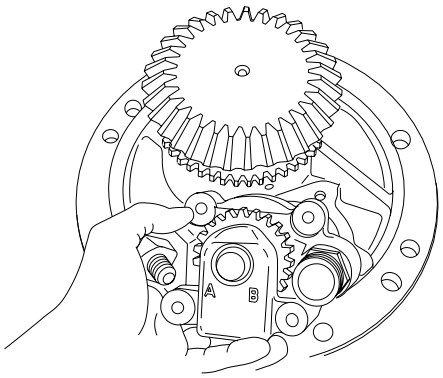
13. Install an O-ring onto the end of the clutch hydraulic tube assembly. There is a clutch dump spool located inside the hydraulic tube assembly. Shake the tube back and forth to verify the dump spool moves freely. Disassemble the tube assembly and remove the dump spool. Inspect the condition of the check ball and retaining pin inside the spool. Replace the spool if the ball or pin appear damaged. Install the tube(s) into the end(s) of the clutch shaft. If your winch has a gear side clutch, the hydraulic tube assembly is kept from rotating by a block that slides over the stud in the clutch shaft bearing carrier. If your winch has a brake side hydraulic tube assembly, the tube rests in a groove cast into the brake housing cover.

BEVEL PINION AND HYDRAULIC PUMP SERVICE

The bevel pinion and pump share a common carrier housing which is bolted into the winch case adapter plate. This assembly can be removed from the winch without removing the winch case adapter. Refer to "Winch Disassembly" for removal instructions.

PUMP

The pump contains no serviceable parts and is intended to be replaced as a unit. If the pump drive pinion is in need of replacement, refer to the "Bevel Pinion" section, which follows.



1. Note the location of the pump suction and pressure adapters with reference to the cast "A" and "B" on the pump housing, and remove the adapters.

2. Remove the four capscrews holding the pump to the carrier and remove the pump.

3. Carefully clean and inspect all pump components and the machined pump seat bore. If there is any indication of damage or wear which may reduce the pump's performance, the entire pump assembly must be replaced.

⚠ CAUTION ⚠

The pump assembly must be squarely seated in its bore in the pinion carrier. Failure to install the pump in the proper manner may result in premature pump failure and /or poor pump performance.

4. Lubricate the entire pump assembly and wear plate with hydraulic oil and install the pump. Coat the threads with Loctite 272 or equivalent, and install the four capscrews and lockwashers through the pump housing into the carrier. Evenly tighten the capcrews to 100 - 110 lb·in (11.3 - 12.4 N·m) in a criss-cross pattern in 25 lb·in (3 N·m) increments.

5. Install the suction and discharge fittings in the pump using a small amount of non-hardening thread sealing compound. Be careful not to get sealing compound in the pump.

NOTE: *For counter-clockwise (CCW) PTO rotation, the "A" port will be pressure. For clockwise (CW) PTO rotation, the "B" port will be pressure. All PTO rotations are referenced facing the rear of the tractor.*

6. Pour a small amount of clean winch oil into the pressure fitting on the pump to eliminate the possibility of a "dry start-up".

BEVEL PINION

DISASSEMBLY

1. Remove the four capscrews retaining the PTO pilot to the winch, and remove the PTO pilot.

2. Inspect and replace the internal seal(s), if required.

3. Remove the sleeve from the splined bevel pinion shaft.

4. Straighten the tab holding the bearing locknut in place, and remove the locknut and washer.

5. Support the carrier, and press the pinion out of the carrier.

6. Thoroughly clean and inspect the roller bearings and the bearing cups in the carrier.

EARLY 30 WINCHES ONLY

All components of the bearing were serviced as a single assembly. Bearing adjustment was controlled by cone and cup spacers supplied with the assembly.

LATER 30 AND 30B WINCHES

The bearing set consists of two matching cups and cones. The bearings are located in the carrier against a closely toleranced shoulder machined in the bore.

7. Drive the inboard bearing cup out of the carrier. In EARLY 30 winches, remove the snap ring and bearing cup spacer. Drive out the remaining bearing cup.

8. Clean and inspect the inner surfaces of the carrier nicks or burrs which might interfere with bearing installation.

9. In EARLY 30 winches, remove the bearing cone spacer from the bevel pinion shaft.

10. Support the pump drive gear as close to the pinion

BEVEL PINION AND HYDRAULIC PUMP SERVICE CONTINUED

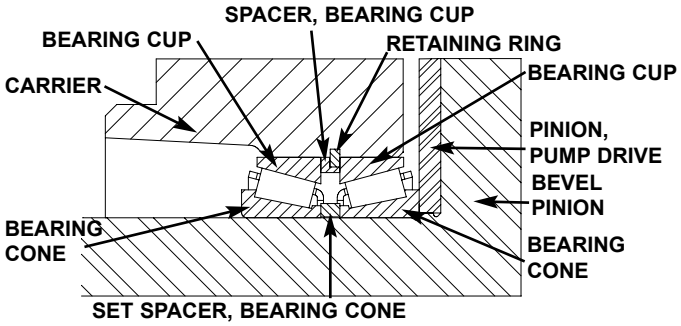
shaft as possible, and press the bevel pinion free of the bearing cone and pump drive gear. Clean and inspect the bearing seating surface on the pinion shaft.

ASSEMBLY

1. Evenly heat the pump drive gear in a welding rod heater or oil bath before installing it on the bevel pinion shaft. Apply Loctite 609 or equivalent to the inside diameter of the pump drive gear.

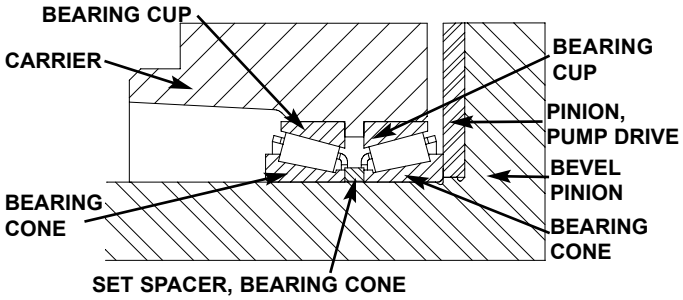
   Liberally apply light oil or hydraulic fluid to all bearings.

2. Press a new bearing cone onto the bevel pinion shaft.



OLD PINION BEARING ASSEMBLY

3. EARLY 30 WINCHES ONLY
   With the pump side of the carrier facing upward, install the retaining ring. Press the inboard bearing cup into the bore until it just contacts the retaining ring. Turn the carrier over and install the “L” shaped bearing cup spacer as shown. Press the outboard bearing cup into the carrier bore until it contacts the spacer.



NEW PINION BEARING ASSEMBLY

   LATER 30 AND 30B WINCHES
   Press the bearing cups into the PTO carrier bore. They must be installed from both ends of the carrier until they make contact with the internally machined shoulder.

4. Install the bearing cone spacer over the bevel pinion shaft against the bearing cone installed previously.

5. Install the bevel pinion through the PTO carrier from the inboard side. Press the outboard bearing cone over the shaft into the bore.

6. Install the bearing lockwasher and locknut, and tighten the locknut to 150 lb·ft (205 N·m). Check the bevel pinion to be sure it turns freely. Bend one of the lockwasher tabs into a slot in the locknut.

CLUTCH ASSEMBLY SERVICE

The clutch assembly contains 4 friction discs splined to the bevel gear, and 3 steel discs splined to the clutch housing. The clutch housing is then splined to the clutch shaft. Internal spring force holds the clutch in its normally disengaged, or released, position. Hydraulic pressure against the clutch piston is used to engage, or apply the clutch in the proper direction.

If your winch is a 4-shaft configuration with optional PAY-OUT, there are two identical clutches for directional control. If your winch is a 3-shaft configuration with PAY-OUT, there are two clutches with different housings, but all other components will be identical.

DISASSEMBLY

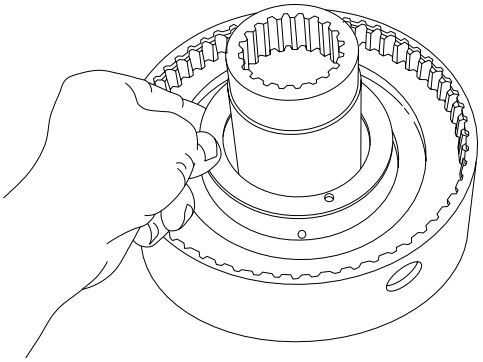
1. Remove the retaining ring holding the bevel gear in place on the clutch housing hub, and remove the bevel gear. Inspect the bevel gear bushing for signs of wear, and replace as needed. Inspect the thrust washer and drive pin at the end of the bevel gear. The drive pin projection out of the bevel gear should be 0.090 in. (2.30 mm).

2. Remove the large internal retaining ring holding the pressure plate in the housing. Remove the pressure plate.

3. Remove and inspect the clutch discs. Place each friction disc on a clean, flat surface, and check for distortion using a straight edge. The friction material should appear evenly across the entire friction surface with visible grooves. Replace the friction discs if worn to a thickness of less than 0.120 in. (3.00 mm), or if material separation or waviness is apparent.

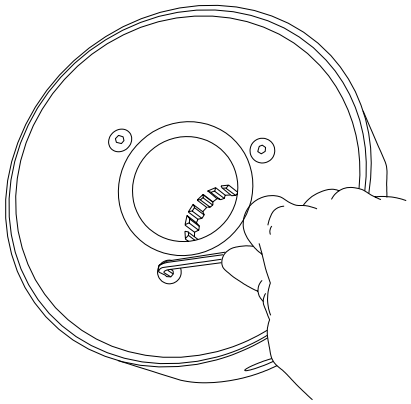
CLUTCH ASSEMBLY SERVICE CONTINUED

4. Inspect the steel discs for scoring, warpage or discoloration due to overheating. Replace as required.



5. Remove the thrust washer from the clutch pilot and inspect for excessive wear and scoring. Replace as required. Replace the thrust washer if it is worn to a thickness of 0.115" (2.90 mm) or less.

6. Turn the clutch housing over and remove the three machine screws near the bore. BE CAREFUL. Remove the screws evenly, as they are under spring force from the clutch springs.



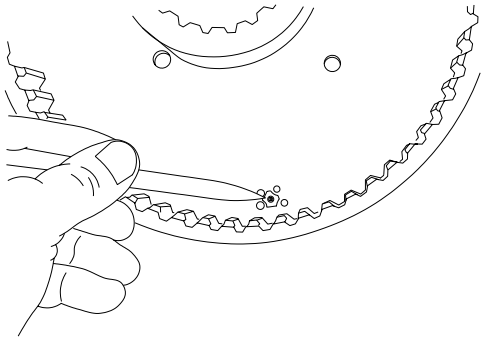
7. Turn the clutch housing over again, and remove the clutch pilot, springs and clutch piston. Clean and thoroughly inspect all parts for signs of wear.

8. Inspect the springs to be sure the ends are square and flat. If any distortion is present, replace ALL springs as a set. Measure the free length of each spring. If any spring measures less than 0.88" (22 mm), replace ALL springs as a set.

> **⚠CAUTION⚠**
>
> Failure to replace the clutch springs as a complete set may result in uneven clutch application pressure, and accelerated and repeated clutch failure.

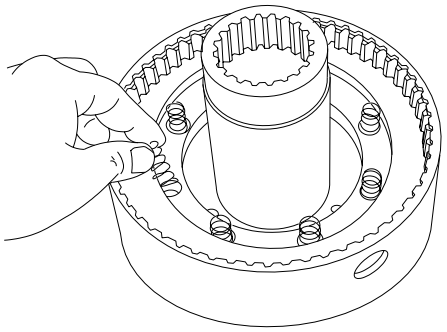
ASSEMBLY

NOTE: *Lubricate all O-rings and seals with clean hydraulic oil prior to installation.*

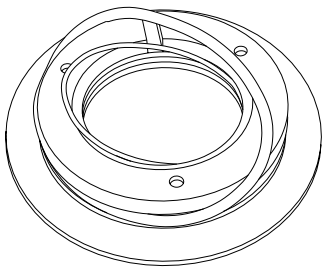


1. Check the steel ball installed near the outer edge of the clutch housing. Be sure the ball moves freely and the oil passage is clear.

2. Install the lathe cut ring onto the clutch piston, and install the piston into the clutch housing.



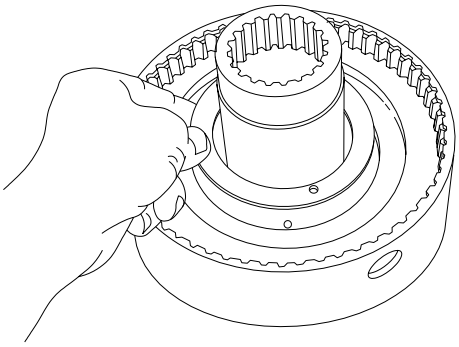
3. Install the clutch springs into the clutch piston.



4. Install the O-ring and the lathe cut ring onto the clutch pilot. Coat the end of the clutch hub around the retaining ring groove with grease to aid installation of the clutch pilot. Push the clutch pilot over the hub, and align the machine screw holes in the pilot with the holes in the clutch housing, and push the clutch

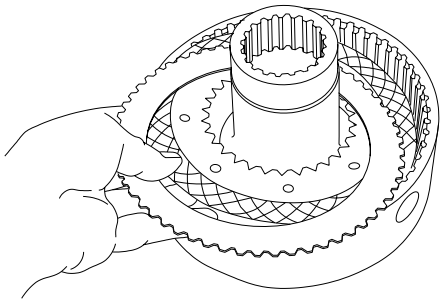
CLUTCH ASSEMBLY SERVICE CONTINUED

pilot into contact with the springs. Install the machine screws through the clutch housing into the pilot, and tighten evenly, to avoid distorting the clutch pilot or springs. Tighten screws to 110 lb•in. (12.4 N•m) torque

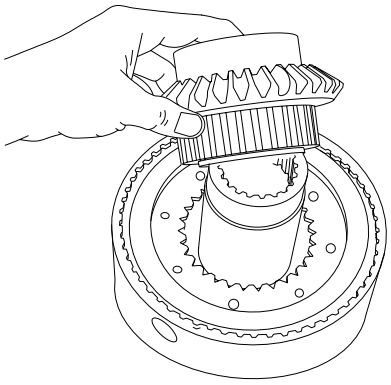


5. Install the thrust washer into the clutch pilot.

NOTE: *One side of the washer is coated with an anti-friction layer of material. The coated side of the washer MUST be installed against the clutch pilot.*



6. Lubricate the friction discs with clean hydraulic oil prior to assembly. Install a friction disc against the piston, then alternate between steel and friction discs until all discs are installed. Install the pressure plate with the large flat surface toward the top friction disc, then install the retaining ring. Make sure the retaining ring is securely seated in the housing groove.



7. Align the internal teeth on the friction discs. Liberally lubricate the bevel gear bushing bore with clean hydraulic or winch oil and install the bevel gear over the clutch hub.

NOTE: *Be sure to properly align and engage the drive pin protruding from the bevel gear end with the hole in the thrust washer. If the drive pin does not properly align and engage with the thrust washer, the retaining ring cannot be installed into groove in the clutch hub.*

BRAKE ASSEMBLY SERVICE

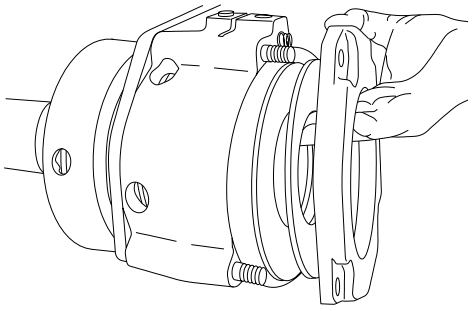
The brake assembly contains 6 friction discs splined to the brake hub and 6 steel discs splined to the brake housing. The housing is bolted to the winch case adapter plate. Internal spring force holds the brake in its normally engaged, or applied position. Hydraulic pressure is used to disengage or release the brake. The brake is equipped with an internal hydraulic dump valve.

DISASSEMBLY

1. If your winch is equipped with a clutch tube assembled into the brake end of the clutch shaft, remove it and support it out of the way.

⚠CAUTION⚠

The brake housing cover is assembled under heavy spring force. Remove the nuts retaining the cover slowly and evenly to avoid possible component damage or personal injury.



2. Carefully remove the four nuts and washers attaching the cover to the brake housing. Remove the cover and the brake springs.

3. Remove the dump valve spring and O-ring from the housing.

4. Slide the entire brake assembly off the studs and place it on a clean work surface with the brake discs facing upward.

BRAKE ASSEMBLY SERVICE CONTINUED

5. Remove the brake discs, pressure plate and brake spacer.

6. Place each friction disc on a clean flat surface and check for distortion using a straight edge. The friction material should appear evenly across the entire friction surface with visible grooves. Replace the friction discs if worn to a thickness of less than 0.120" (3.00 mm), or if material separation or waviness is apparent.

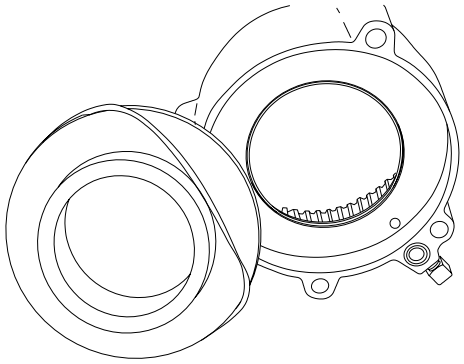
7. Inspect the steel discs for scoring, warpage or discoloration due to overheating. Replace as required.

8. Turn the brake housing over and remove the brake release piston and the dump spool assembly from the brake housing.

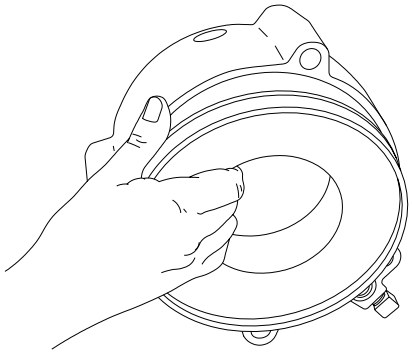
9. Thoroughly clean and inspect all parts for signs of wear and replace as required. Clean and inspect the brake dump spool assembly and the bore it rests in. The ball in the spool must move freely, and the spool assembly must slide easily in the bore.

ASSEMBLY

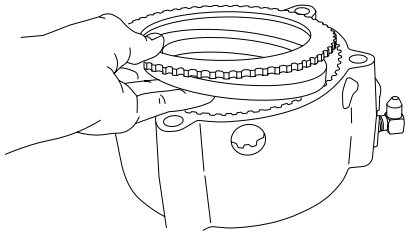
NOTE: *Lubricate all O-rings and seals with clean hydraulic oil prior to installation.*



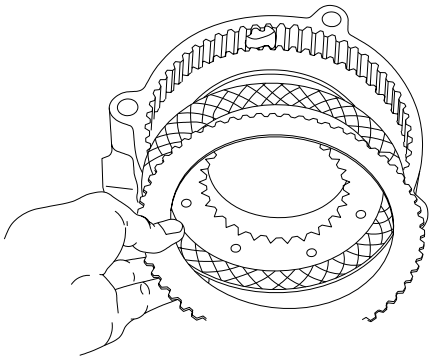
1. Install the O-ring into the groove in the brake housing bore, and the lathe cut ring into the brake piston.



2. Install the brake piston into the brake housing, with the large diameter surface outward.



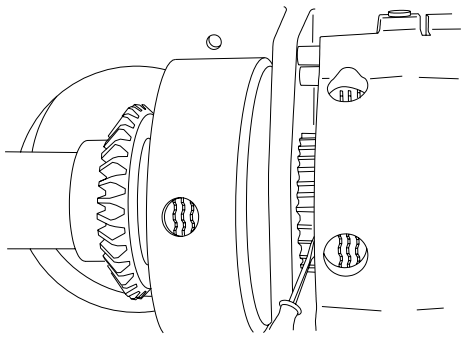
3. Turn the brake housing over and install the brake spacer and pressure plate. Push the parts inward until the pressure plate contacts the inside of the brake housing, allowing for maximum clearance for installing the brake disc pack.



4. Lubricate the friction discs with clean hydraulic oil prior to assembly. Install a friction disc against the pressure plate, then alternate between steel and friction discs until all discs are installed. The last disc installed will be a steel disc.

5. Before installing the brake assembly to the winch case adapter plate, check the brake mounting studs. If the studs have loosened or been removed, coat the threads with Loctite 242 or equivalent and re-install. Torque the studs to 25 - 30 lb·ft (34 - 40 N·m).

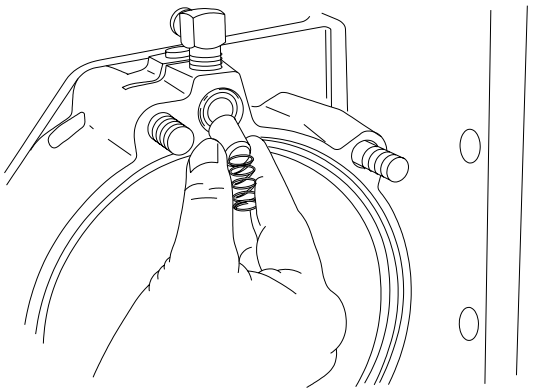
NOTE: *The brake assembly should not be installed in the winch case adapter if the clutch shaft and brake hub are not in place.*



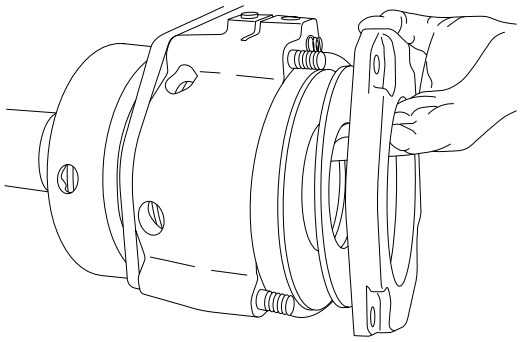
BRAKE ASSEMBLY SERVICE CONTINUED

6. Carefully slide the brake assembly into place on the studs. Take care to avoid allowing the first brake disc to fall out of position and get caught between the brake housing and the flange on the winch case adapter.

   While sliding the brake assembly into place, carefully align the internal splines on the friction discs with the splines on the brake hub.



7. Install the brake dump spool assembly into the bore in the brake housing. The orificed end of the spool housing MUST point outward, toward the spool spring. Install the spool spring and O-ring.



8. Install the brake springs such that the smaller diameters are in contact and the large diameters are apart.

9. Install the cover, washers and nuts. Using a criss-cross pattern, tighten each nut evenly, ½ turn at a time. Tighten the nuts to 75 lb·ft (102 N·m).

BRAKE HUB BEARING AND CLUTCH SHAFT BEARING SERVICE

BRAKE HUB BEARING SERVICE

The brake hub bearing is a single row roller bearing, which is pressed onto the brake hub.

To replace the bearing, press it off the brake hub. Thoroughly clean and inspect the brake hub bearing surface for nicks which might interfere with the installation of a new bearing.

Support the brake hub securely and press a new bearing into place.

CLUTCH SHAFT BEARING SERVICE

EARLY 30 WINCHES ONLY
All components of the bearing were serviced as a single assembly. Bearing adjustment was controlled by cone and cup spacers supplied with the assembly.

LATER 30 AND 30B WINCHES
The bearing set consists of two matching cups and cones. The bearings are located in the carrier against a closely toleranced shoulder machined in the bore.

DISASSEMBLY

1. With the clutch shaft removed from the winch, properly support the bearing carrier and press the clutch shaft out.

2. Thoroughly clean and inspect the roller bearings and the bearing cups in the carrier.

3. Remove the outboard bearing cup. On EARLY 30 winches, remove the cup spacer also.

4. Turn the carrier over and remove the inboard bearing cup. On EARLY 30 winches, remove the retaining ring also.

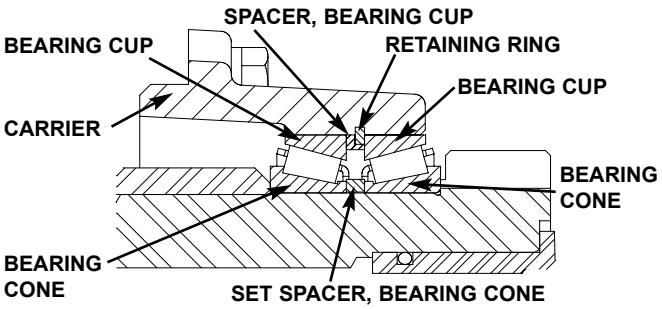
5. Remove the bearing from the clutch shaft. On EARLY 30 winches, remove the cone spacer also.

6. Clean and inspect the bearing seat on the clutch shaft and the carrier bore for any nicks or burrs that may interfere with bearing assembly.

BRAKE HUB BEARING AND CLUTCH SHAFT BEARING SERVICE CONTINUED

ASSEMBLY

1. Press one bearing cone onto the clutch shaft and seat it securely against the shoulder at the gear end. Install the cone spacer against the bearing.



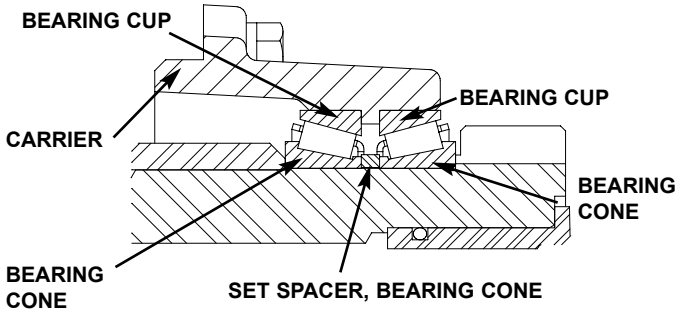
OLD CLUTCH SHAFT BEARING ASSEMBLY

2. On EARLY 30 winches only, install the bearing cup retaining ring into the groove in the bearing carrier.

3. Place the bearing carrier with the clutch side facing downward and install one bearing cup. Seat the bearing cup securely against the shoulder, or retaining ring on EARLY 30 winches.

EARLY 30 WINCHES ONLY

4. Turn the carrier over and install the bearing cup spacer against the retaining ring. Make sure the lip on the spacer points toward the outboard end of the carrier. Install the remaining bearing cup securely against the spacer.



NEW CLUTCH SHAFT BEARING ASSEMBLY

LATER 30 AND 30B WINCHES

Turn the carrier over and install the second bearing cup securely against the shoulder in the carrier.

5. Position the carrier over the clutch shaft and seat the outboard bearing cup on the previously installed cone.

6. Press the remaining bearing cone onto the clutch and seat it properly into the carrier. Be sure the clutch shaft spins smoothly and freely in the carrier assembly.

CONTROL VALVE SERVICE

A two spool, four-way hydraulic control valve provides cable drum directional control. The valve is a closed-center, open port configuration. The valve spools are detented in the BRAKE-OFF and FREESPOOL positions, and spring centered in the HAUL-IN and PAYOUT positions.

Supply oil from the accumulator enters the control valve pressure port. With both spools in their centered, or neutral, positions there is no oil flow through the valve.

A single control lever controls all valve functions. Moving the lever to either Freespool or Brake-Off controls the detented spool, identified by the longer assembly on the bottom of the valve. Moving the lever to either the Haul-In or Pay-Out controls the spring-centered spool.

The control valve is serviced ONLY by the following six items.

A. Control lever assembly
B. Control lever linkage assembly
C. Spring center assembly
D. Spring detent assembly
E. Spool O-ring kit
F. Pin

If either spool is damaged and needs replacement, the entire control valve must be replaced. The cause of damage to the spool(s) should be thoroughly reviewed and corrected before putting the winch back into service.

It is recommended that all spool O-rings be replaced if the valve is disassembled for any reason.

CONTROL VALVE REMOVAL AND INSTALLATION

⚠ WARNING ⚠

Hot oil may cause severe injury. Make certain the oil has cooled to a safe temperature (less than 110°F or 43°C) before servicing.

⚠ 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 accumulator, stop engine and cycle Power Shift control lever into full HAUL-IN position and then back to neutral a minimum of 5 times.

CONTROL VALVE SERVICE CONTINUED

1. Discharge accumulator oil supply as described previously and tag and remove all hoses from the control valve.

2. Remove the lever from the valve and remove the valve from the tractor platform.

3. After the valve has been properly serviced, reinstall it on the tractor. Install each hose to the proper valve port.

4. Reinstall the lever and move it into all operating positions to be sure there is no interference.

5. Check all fittings for tightness and torque all fasteners as required. Start the tractor engine and operate the valve in all positions to verify functions.

DETENT ASSEMBLY REPLACEMENT

1. Secure the valve in a vise, clamping only on the mounting plate, with the detent assembly facing up. Be careful to not damage any fittings or sealing surfaces.

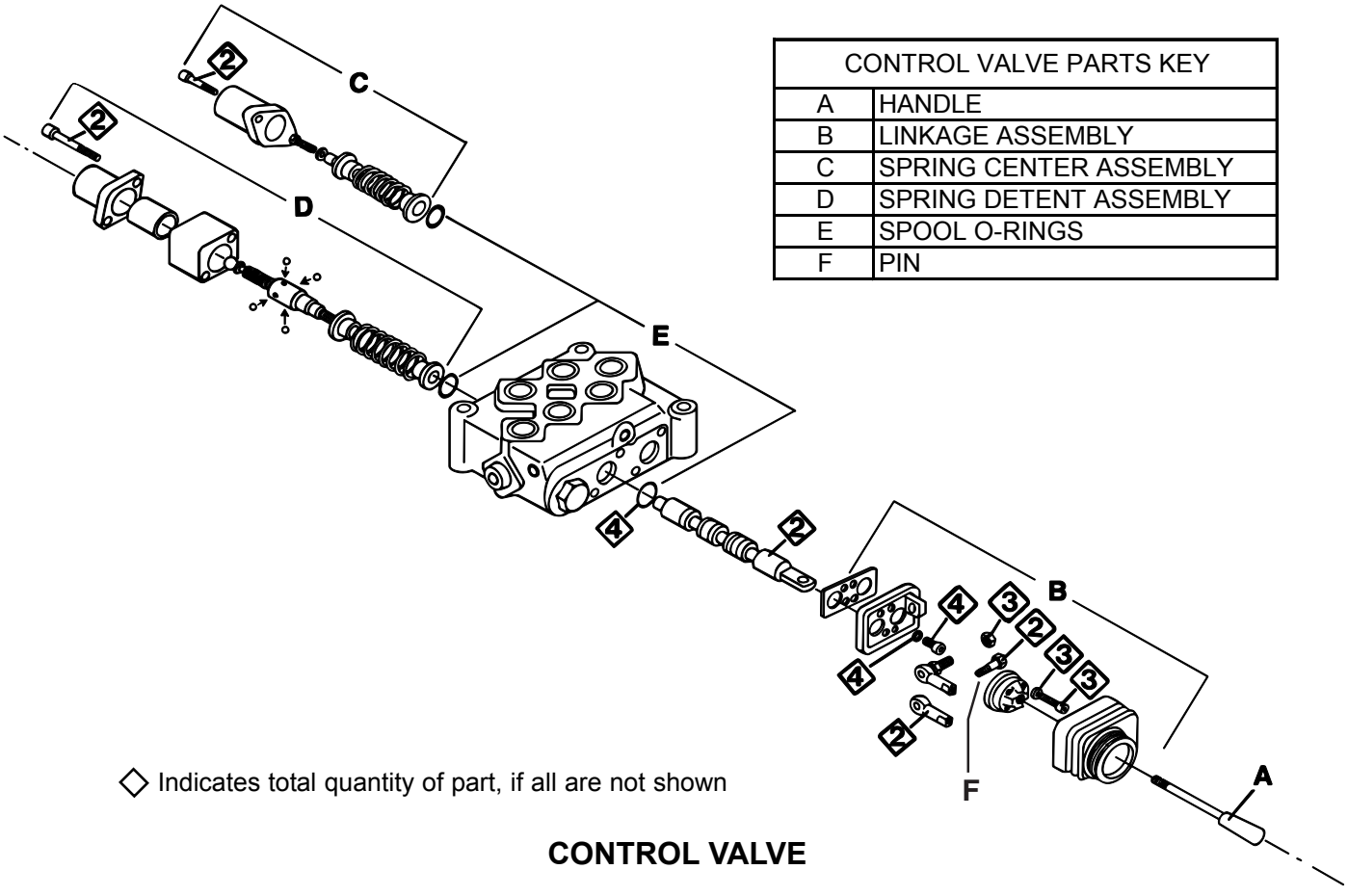
2. Remove the two socket head capscrews attaching the detent assembly to the valve. Carefully remove the closed end cap.

3. Slowly and carefully remove the detent bushing. Use a clean shop towel while removing the bushing to contain the spring and/or steel balls, which may fall out. With the bushing removed, a large steel ball, a spring centering button (early valves only) and a spring will be released from the center of the detent piston. Four smaller steel balls, which fit into four holes on the circumference of the piston, will also be free.

4. Remove the square end cap from around the centering spring attached to the bottom of the spool. Unscrew the detent piston from the end of the spool, releasing the large spring and two spring bushings. If the control lever has been removed, you will need to hold the top of the spool to keep it from turning.

5. The valve spool can now be removed from the valve body, it the linkage assembly has already been disconnected. Inspect the spool and valve body for signs of wear. The O-rings on each end of the spool should be replaced at this time.

CONTROL VALVE PARTS KEY	
A	HANDLE
B	LINKAGE ASSEMBLY
C	SPRING CENTER ASSEMBLY
D	SPRING DETENT ASSEMBLY
E	SPOOL O-RINGS
F	PIN



◇ Indicates total quantity of part, if all are not shown

CONTROL VALVE

CONTROL VALVE SERVICE CONTINUED

6. Lubricate the O-rings and valve spool with clean hydraulic oil and carefully insert the spool through the valve body. Connect the linkage assembly to the top of the spool and mount the valve in a vise with the valve lever down.

7. Install a bushing in each end of the large spring and attach it to the bottom of the spool with the detent piston. Slide the square end cap over the detent piston until it contacts the valve body.

8. Apply a liberal amount of grease to the detent spring and spring centering button, and install them into the center of the detent piston. Place the single, large steel ball into the recess in the spring centering button. Apply a coating of grease to the outside of the detent piston and to the inside of the detent bushing. Using a small diameter drift or capscrew, compress the spring and push the steel ball into the center of the detent piston past the four holes in the outside of the piston, while holding the detent bushing over the piston. Install the four smaller steel balls into the holes in the outside of the piston, then slide the detent bushing over the piston until it contacts the square end cap. A coating of grease on the steel balls and the piston will aid retention of the steel balls during assembly. Slowly release the larger steel ball from the center of the detent piston.

9. Install the closed end cap and two socket head capscrews.

10. Test the detent assembly by moving the control lever to the FREESPOOL and BRAKE OFF positions. The lever should remain in each position until physically released to neutral (BRAKE ON).

CENTERING ASSEMBLY REPLACEMENT

1. Secure the valve in a vise, clamping only on the mounting plate, with the detent assembly facing up. Be careful to not damage any fittings or sealing surfaces.

2. Remove the two socket head capscrews attaching the centering assembly to the valve. Carefully remove the closed end cap.

3. Remove the socket head capscrew from the center of the spring. If the control lever has been removed, you will need to hold the top of the spool to keep the spool from turning. Remove the spring and spring bushings.

4. The valve spool can now be removed from the valve body, if the linkage assembly has already been disconnected. Inspect the spool and valve body for signs of wear. The O-rings on each end of the spool should be replaced at this time.

5. Lubricate the O-rings and valve spool with clean hydraulic oil and carefully insert the spool through the valve body. Connect the linkage assembly to the top of the spool and mount the valve in a vise with the valve lever down.

6. Install a bushing in each end of the large spring and attach it to the bottom of the spool with the socket head capscrew, washer and spacer. Be sure the spacer has been placed on the capscrew AFTER the washer.

7. Install the end cap and two socket head capscrews. Test the centering assembly by moving the control lever to the HAUL-IN and PAY-OUT positions. The handle should return to the neutral (BRAKE-ON) position when released.

WINCH ASSEMBLY

NOTE: *Before beginning to assemble the winch, clean and inspect all inside surfaces of the winch case to remove any contamination which may have been introduced while the winch was opened.*

⚠ CAUTION ⚠

The winch case weighs approximately 325 lb (150 kg). Make certain lifting equipment has adequate capacity.

1. If either of the drum shaft bearings or the bull pinion bearing was removed from the case, install them now.

NOTE: *Some later 30B winches may have a spacer or shim between the RH drum shaft bearing retaining ring and the winch case. If your winch includes these spacers or shims, they must be in place.*

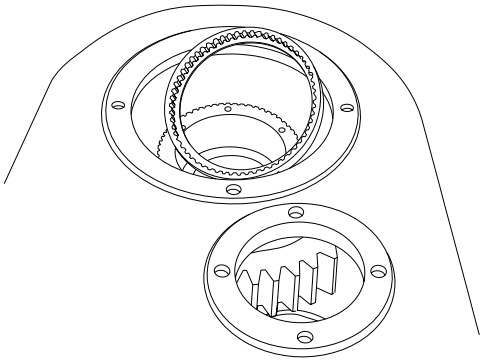
WINCH ASSEMBLY CONTINUED

To aid installation of the cable drum, both shaft bearings should be installed flush with outside surface of the winch case adjacent to the cable drum.

⚠CAUTION⚠

The bull gear weighs approximately 55 lb (25 kg). Make certain lifting equipment has adequate capacity.

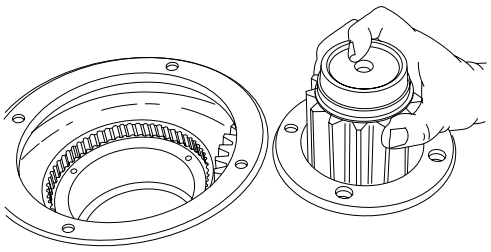
2. Lay the winch case on its right side and slide the bull gear into position. If the bull gear bushing is damaged, carefully press it into the bull gear bore while providing support on the inside diameter to prevent crushing the bushing.



3. EARLY MODEL 30 ONLY
   Insert the retaining ring into the I.D. groove in the center of the freespool gear coupling and install the gear coupling over the bull gear hub.

NOTE: *The groove in the gear coupling is not located in the center of the part. Install the gear coupling such that the longest side is engaged with the teeth on the bull gear hub.*

4. Slide the second reduction gear into place in the winch case.



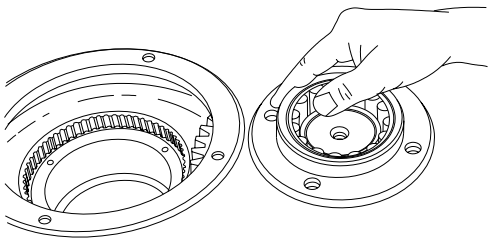
5. The bull pinion will be installed next.

NOTE: *Early winches used a retaining ring on the pinion to prevent the reduction gear from moving outward, forcing contact with the winch case. Later winches use an "L" shaped spacer behind the bearing race. In either case, make sure there is a bearing race on each end of the pinion, and either the retaining ring or spacer is in place. The retaining ring or spacer MUST be located on the outboard end of the pinion. The outboard end is identified by the threaded hole in the center.*

6. Once the bearing races and either the retaining ring or spacer are installed on the bull pinion, install the pinion through the reduction gear and seat it in the bearing in the winch case bore.

7. Install the retaining ring into the groove in the reduction gear.

NOTE: *To aid access to the retaining ring groove, it may be necessary to move the reduction gear toward the outer case wall.*

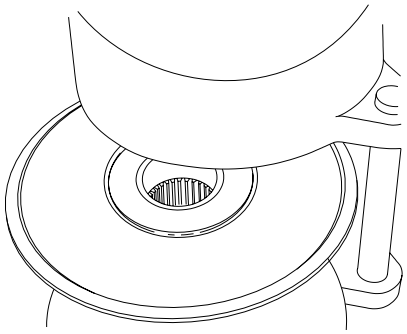


8. Install the outboard bull pinion bearing into the winch case. Install the gasket and cover. Apply non-hardening thread sealant to the (4) capscrews and torque to 75 lb·ft (100 N·m).

9. Inspect the (2) lathe cut rubber rings on the cable drum and replace as required. Install the rings and liberally apply grease between each ring and the drum.

⚠CAUTION⚠

The cable drum weighs approximately 100 lb (45 kg). Make certain lifting equipment has adequate capacity.

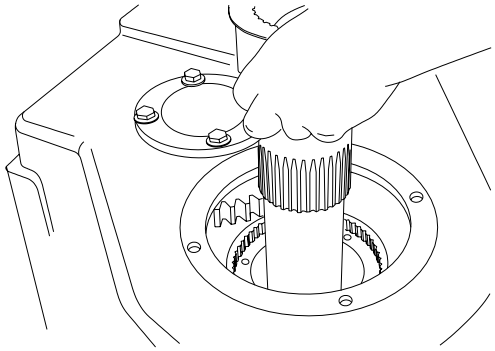


WINCH ASSEMBLY CONTINUED

10. Slide the cable drum into place carefully to avoid dislodging the rubber rings from excessive contact between the drum and case.

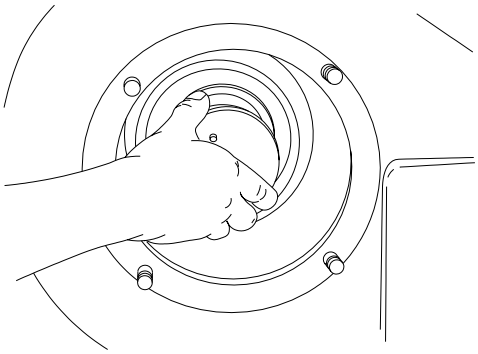
11. Fully seat the retaining ring on the LH drum shaft bearing against the winch case.

NOTE: *The bull gear may be moved to aid access to the bearing outer race.*



12. Liberally lubricate the bull gear bushing with clean winch oil. Position the thrust washer against the shoulder on the end of the drum shaft. Center the bull gear with the drum bore and install the drum shaft, being careful to properly engage the internal splines on the drum. Drive the drum shaft into place against the bull gear, using a ¾" (20 mm) diameter bar inserted into the hole in the end of the shaft.

13. Reposition the winch into an upright position. Drive the RH drum shaft bearing toward the drum. If the bearing contacts the drum before the bearing retaining ring contacts the winch case, remove the bearing and install a spacer under the retaining ring.



14. Coat the lathe cut ring with grease and install it into the groove in the back face of the drag brake spindle. Install the drag brake spindle onto the RH end of the drum shaft. Coat the capscrew threads with Loctite 242 or equivalent and install the washer and capscrew into the drum shaft. Torque the capscrew to 270 lb·ft (370 N·m). The cable drum should rotate freely.

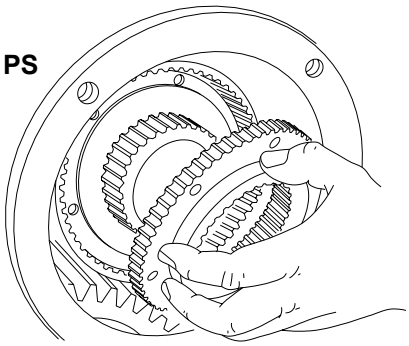
15. Install one stud into the upper forward-most cover mounting hole for the RH access cover. Moderately apply non-hardening thread sealant to the threads being careful not to allow excess sealant into the winch case.

16. Install the union and filter head to the "P" port of the differential unloading valve. Install the (2) elbows into the filter head. Install the valve/filter head assembly into the winch case using the spacers, O-rings, capscrews and sealing washers.

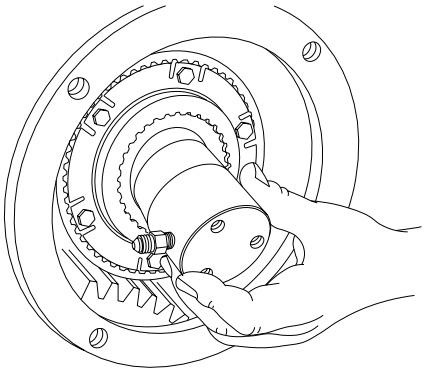
17. Attach the pump pressure hose to the elbow on the filter head. Attach the remaining fittings and the pressure and accumulator hoses and lube tube to the unloading valve, as shown in the Parts Manual.

18. Install the accumulator mounting angle to the top of the accumulator. Slide the accumulator bracket over the accumulator and install the accumulator in the winch case to the mounting stud. Attach the bracket to the case wall with the capscrew, sealing washer and hex nut, as shown in the Parts Manual.

Early Carco 30 PS shown



19. Install the felt seal into the face groove in the LH end of the drum shaft if required. Install the freespool spring and spool gear into the drum shaft.

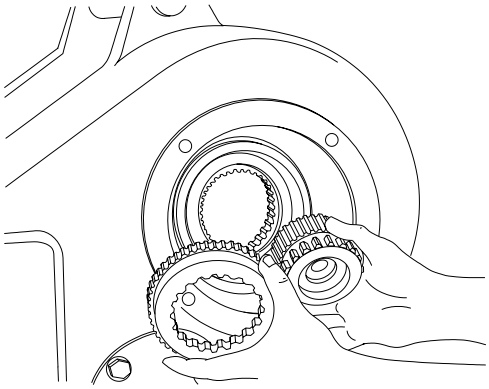


20. EARLY CARCO 30 WINCHES ONLY
    Install the retaining ring into the freespool ring gear. Install the ring gear onto the bull gear, aligning the bolt holes in the ring gear with those in the bull gear as the internal and external splines are engaged.

WINCH ASSEMBLY CONTINUED

Install the locking plate and (6) capscrews, and slowly and evenly torque the capscrews to 9 lb·ft (12 N·m). Bend one or two locking plate tabs against each capscrew.

NOTE: *It is helpful to bend the tabs upward slightly on the locking plate before installing it. The cable drum is now locked to the winch gear train, and should be rotated slowly to ensure all gears are turning freely.*

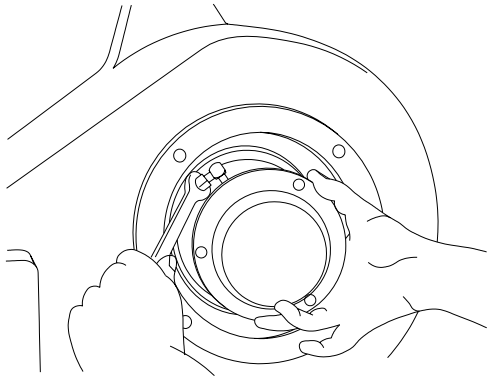


LATER CARCO 30 AND 30B WINCHES
Install the collar gear onto the drum shaft aligning both internal and external splines. Install the retaining ring into the groove in the bull gear.

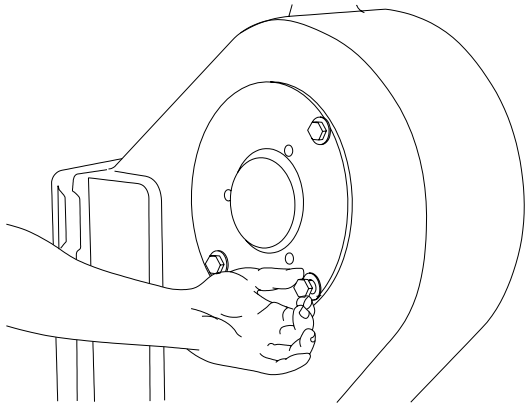
21. Install the O-ring into the groove in the freespool cylinder. On LATER 30 AND 30B WINCHES ONLY, install the rod wiper seal in the freespool cylinder in the outermost groove, and install the dump valve spool in the port on the side of the cylinder. Be sure the orificed end of the dump valve spool is pointing outward. Install the fitting in the port.

22. Apply a liberal amount of grease to the outside diameter of the freespool piston and insert the piston into the cylinder. On LATER CARCO 30 AND 30B WINCHES, lubricate the thrust bearing with grease and install the thrust bearing between the thrust washers, over the freespool piston hub.

23. If the freespool tube assembly was removed from the winch, install it now, attaching it to the case wall with the clip and machine screw. Also attach the freespool hose to the tube assembly.



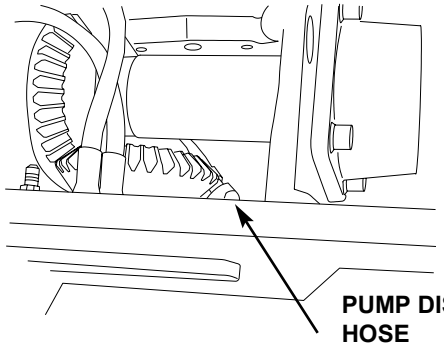
24. Locate the freespool cylinder/piston assembly in position in the spool gear bore and connect the hydraulic tube to the fitting. Apply RTV sealant to the cover mounting surface of the freespool cylinder.



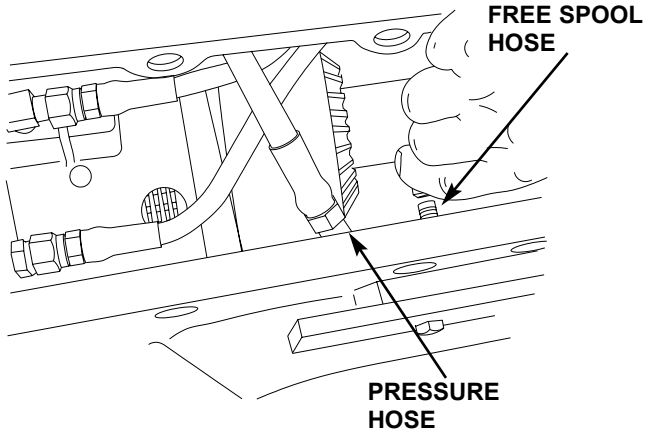
25. Install the LH cover and gasket over the freespool cylinder. Align both sets of mounting holes and loosely install the (3) bolts and washers that attach the cylinder to the cover. Apply non-hardening thread sealant to the cover bolts and install the bolts and washers. Tighten the freespool cylinder bolts to 35 lb·ft (50 N·). Tighten the cover bolts to 75 lb·ft (100 N·m).

⚠CAUTION⚠

The winch adapter assembly weighs approximately 290 lb (132 kg). Make certain lifting equipment has adequate capacity.



26. Before installing the adapter assembly to the winch face, make sure the hydraulic lines for the brake and clutch(s) are connected to their proper fittings. Ensure all hoses and tubes within the winch are located such that they will not be damaged by any gears. Refer to assembly drawings for further information. Also, be sure the O-ring at the lower end of the pump suction tube is properly installed in the fitting, as the O-ring locates and retains the suction tube.



27. Thoroughly clean both the adapter and winch case mating surfaces, being sure they are free of oil and dirt, and apply a light coating of Permatex blue silicone RTV sealant, or equivalent, to the adapter sealing surface. Move the adapter far enough into the winch case to allow connecting the pump discharge hose. (This is the hose attached to the inlet port of the differential unloading valve.)

    Slide the bottom end of the adapter further into the winch case, while guiding the pump suction tube into the fitting at the suction strainer chamber at the rear of the winch case. Connect the freespool and system pressure hoses to the fittings at the proper ports near the top of the adapter. Slide the adapter fully into the winch case, install and torque the capscrews as follows:

    ½ UNC capscrews - 75 lb·ft (100 N·m)
    ¾ UNC capscrews - 265 lb·ft (360 N·m)

28. Install the spacer, spring and drag brake disc into the tube on the RH cover plate. If the drag brake disc is worn to ½ in. (13 mm) or less in length, replace it. Install the gasket and cover.

    NOTE: *Tip the upper edge of the cover slightly away from the winch case to retain the drag brake disc in the tube during assembly.*

    Install the fasteners and torque to 75 lb·ft (100 N·m).

29. Freespool drag brake adjustment should be made after the winch has been installed on the tractor and wire rope has been installed on the drum. Refer to the Operator's Manual for more information.

30. Remove the breather from the RH cover plate. Wash the breather thoroughly in clean solvent, blow it dry with compressed air and reinstall it.

31. Install the filler plug.

32. Prepare to install the suction strainer at the rear of the winch. Install the O-ring into the nipple and install the nipple into the case in proper alignment with the suction tube. Be sure the O-ring and magnetic rods are properly located on the suction strainer, and install the strainer onto the nipple. Install the large O-ring into the face groove in the winch case. Install the strainer cover and fasteners, and torque the capscrews to 75 lb·ft (100 N·m).

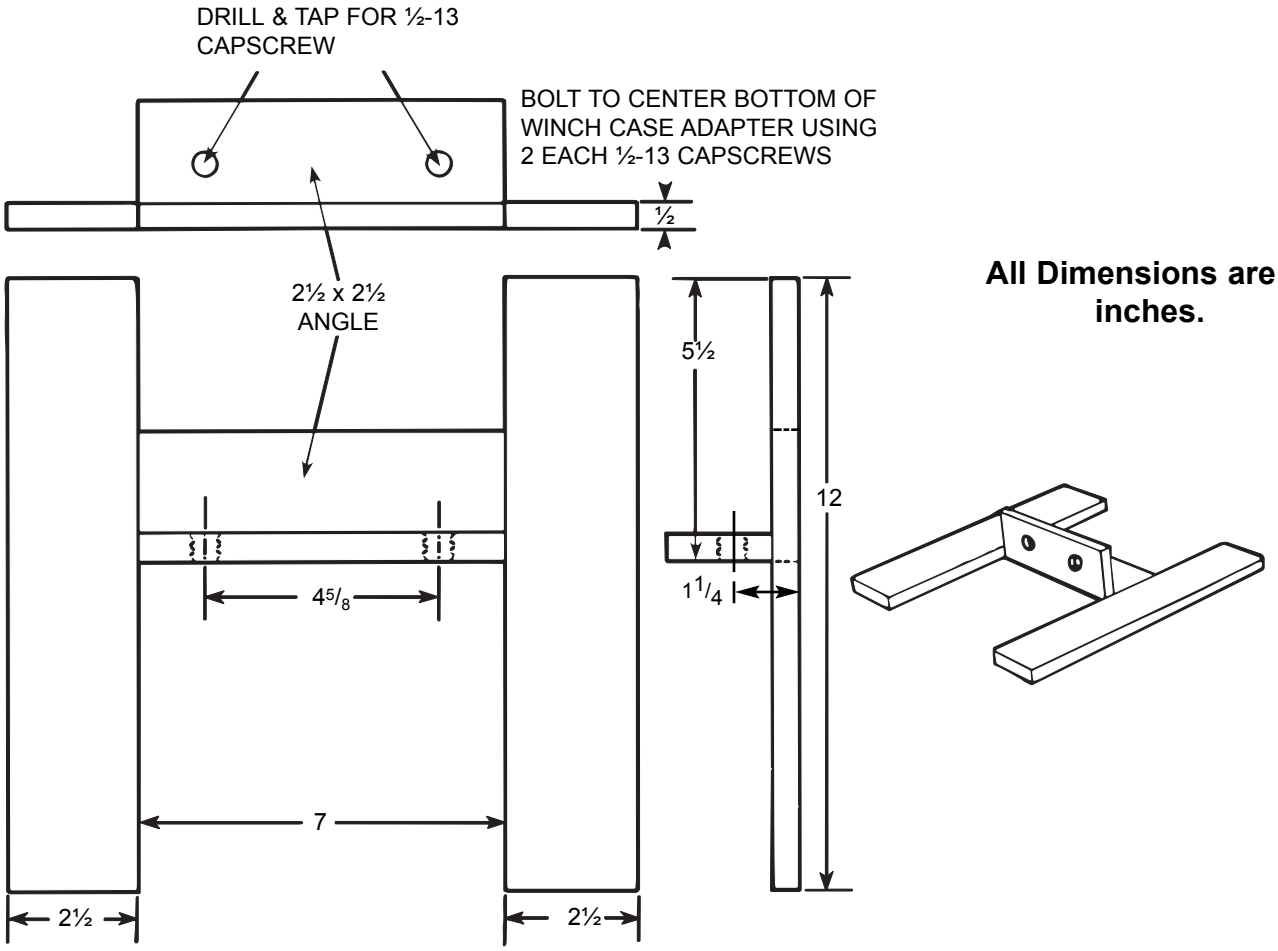
33. Install the oil drain plug.

34. Refer to the "Winch Installation and Removal" section of this manual, and/or the Operator's Manual and Parts and Installation Manual for installation and lubrication instructions.

⚠CAUTION⚠

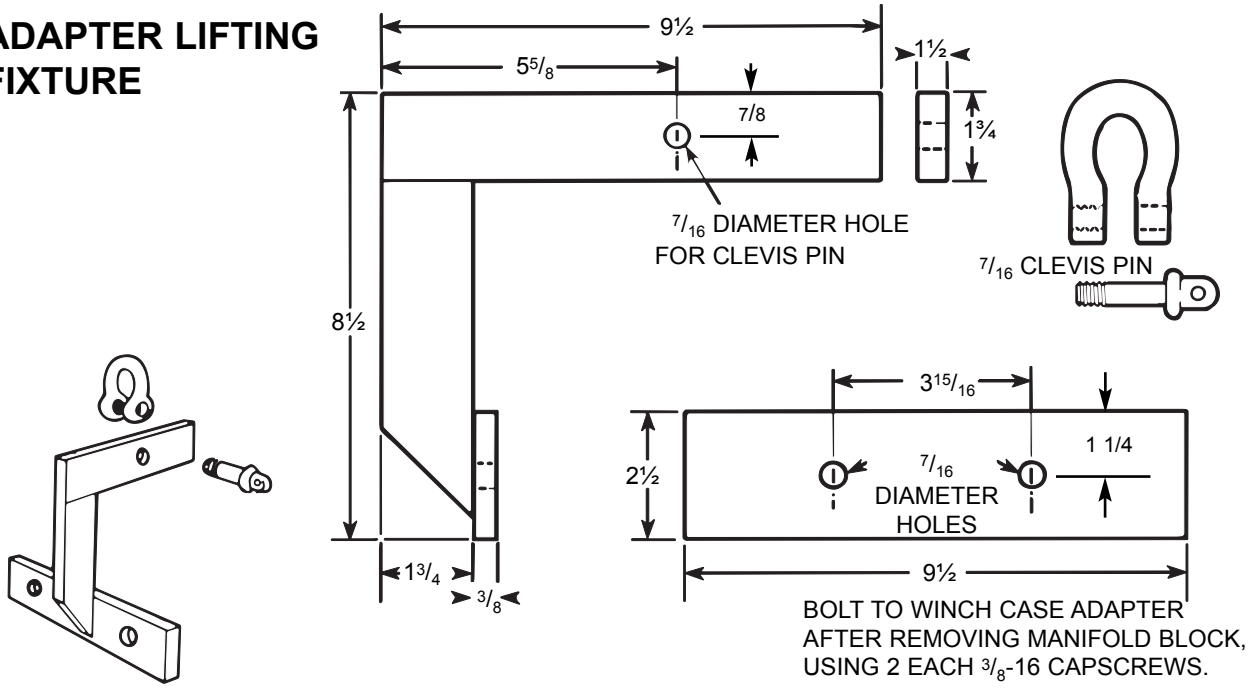
Do NOT attempt to test the winch, or operate it on a piece of equipment, without filling to the proper level with the recommended oil. Serious damage to internal components may result.

ADAPTER STAND

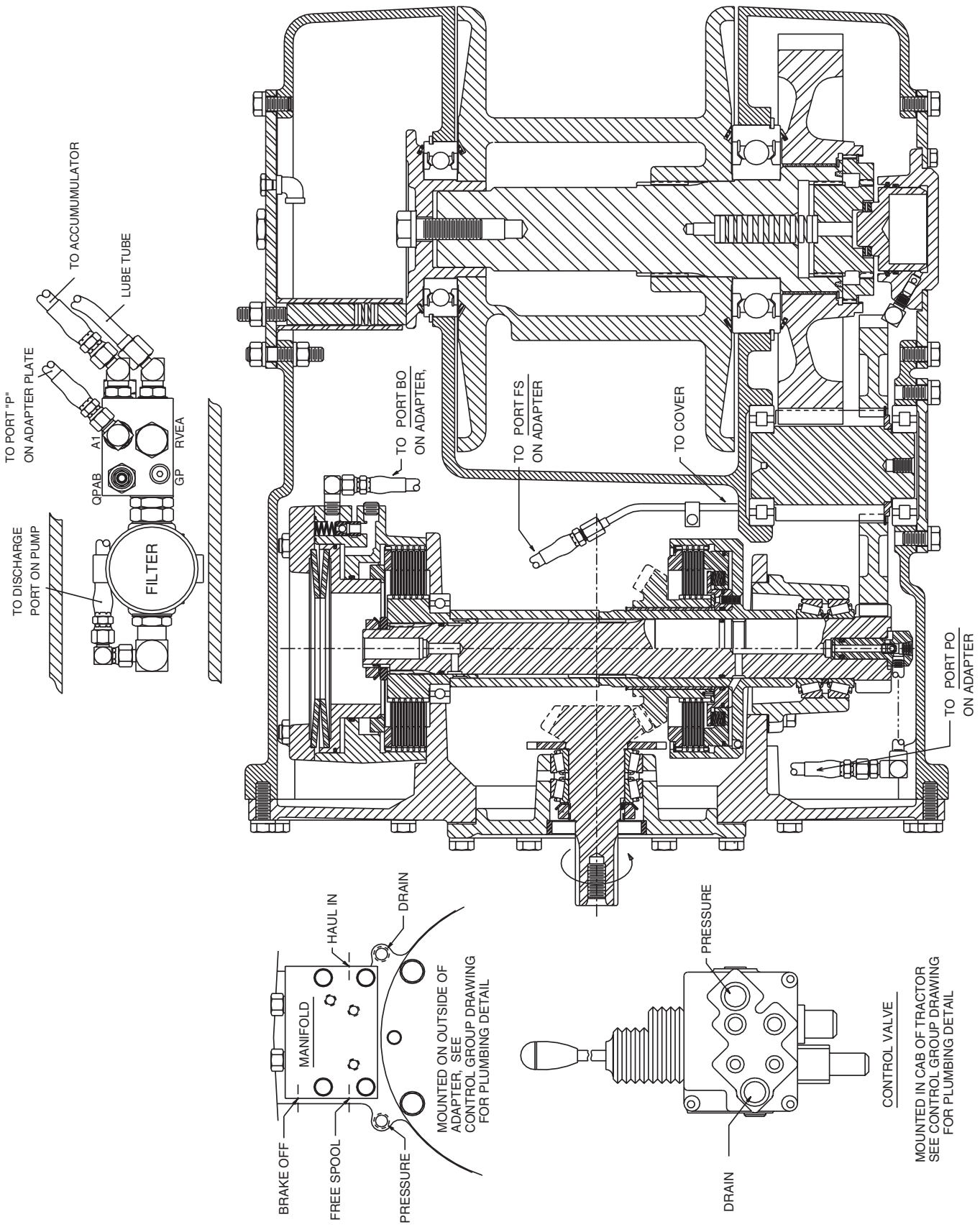


All Dimensions are in inches.

ADAPTER LIFTING FIXTURE



⚠CAUTION⚠ THIS FIXTURE IS INTENDED FOR LIFTING THE WINCH CASE ADAPTER ASSEMBLY ONLY. **DO NOT** LIFT THE ENTIRE WINCH WITH THIS FIXTURE.



CARCO MODEL 30B-PS WINCH
3 SHAFT - NO PAYOUT

CARCO MODEL 30B-PS WINCH
3 SHAFT - WITH PAYOUT

METRIC CONVERSION TABLE

English to Metric			Metric to English		
LINEAR					
inches (in.)	X 25.4	= millimeters (mm)	millimeters (mm)	X 0.3937	= inches (in.)
feet (ft.)	X 0.3048	= meters (m)	meters (m)	X 3.281	= feet (ft.)
miles (mi.)	X 1.6093	= kilometers (km)	kilometers (km)	X 0.6214	= miles (mi.)
AREA					
inches^2 (sq.in.)	X 645.15	= millimeters^2 (mm^2)	millimeters^2 (mm^2)	X 0.000155	= inches^2 (sq.in.)
feet^2 (sq.ft.)	X 0.0929	= meters^2 (m^2)	meters^2 (m^2)	X 10.764	= feet^2 (sq.ft.)
VOLUME					
inches^3 (cu.in.)	X 0.01639	= liters (l)	liters (l)	X 61.024	= inches^3 (cu.in.)
quarts (qts.)	X 0.94635	= liters (l)	liters (l)	X 1.0567	= quarts (qts.)
gallons (gal.)	X 3.7854	= liters (l)	liters (l)	X 0.2642	= gallon (gal.)
inches^3 (cu.in.)	X 16.39	= centimeters^3 (cc)	centimeters3 (cc)	X 0.06102	= inches^3 (cu.in.)
feet^3 (cu.ft.)	X 28.317	= liters (l)	liters (l)	X 0.03531	= feet^3 (cu.ft.)
feet^3 (cu.ft.)	X 0.02832	= meters^3 (m^3)	meters3 (m3)	X 35.315	= feet^3 (cu.ft.)
fluid ounce (fl.oz.)	X 29.57	= millileters (ml)	milliliters (ml)	X 0.03381	= fluid ounce (fl.oz.)
MASS					
ounces (oz.)	X 28.35	= grams (g)	grams (g)	X 0.03527	= ounces (oz.)
pounds (lbs.)	X 0.4536	= kilograms (kg)	kilograms (kg)	X 2.2046	= pounds (lbs.)
tons (2000 lbs.)	X 907.18	= kilograms (kg)	kilograms (kg)	X 0.001102	= tons (2000 lbs.)
tons (2000 lbs.)	X 0.90718	= metric tons (t)	metric tons (t)	X 1.1023	= tons (2000 lbs.)
tons (long) (2240 lbs.)	X 1013.05	= kilograms (kg)	kilograms (kg)	X 0.000984	= tons (long) (2240 lbs.)
PRESSURE					
inches Hg (60°F)	X 3600	= kilopascals (kPa)	kilopascals (kPa)	X 0.2961	= inches Hg (60°F)
pounds/sq.in. (PSI)	X 6.895	= kilopascals (kPa)	kilopascals (kPa)	X 0.145	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.0703	= kilograms/sq.cm. (kg/cm^2)	kilograms/sq.cm. (kg/cm2)	X 14.22	= pounds/sq.in. (PSI)
pounds/sq.in. (PSI)	X 0.069	= bars	bars	X 14.5	= pounds/sq.in. (PSI)
inches H_2O (60°F)	X 0.2488	= kilopascals (kPa)	kilopascals (kPa)	X 4.0193	= inches H_2O (60°F)
bars	X 100	= kilopascals (kPa)	kilopascals (kPa)	X 0.01	= bars
POWER					
horsepower (hp)	X 0.746	= kilowatts (kW)	kilowatts (kW)	X 1.34	= horsepower (hp)
ft.-lbs./min.	X 0.0226	= watts (W)	watts (W)	X 44.25	= ft.-lbs./min.
TORQUE					
pound-inches (in.-lbs.)	X 0.11298	= newton-meters (N-m)	newton-meters (N-m)	X 8.851	= pound-inches (in.lbs.)
pound-feet (ft.-lbs.)	X 1.3558	= newton-meters (N-m)	newton-meters (N-m)	X 0.7376	= pound-feet (ft.-lbs.)
pound-feet (ft.-lbs.)	X .1383	= kilograms/meter (kg-m)	kilogram/meter (kg-m)	X 7.233	= pound-feet (ft.-lbs.)
VELOCITY					
miles/hour (m/h)	X 0.11298	= kilometers/hour (km/hr)	kilometers/hour (km/hr)	X 0.6214	= miles/hour (m/h)
feet/second (ft./sec.)	X 0.3048	= meter/second (m/s)	meters/second (m/s)	X 3.281	= feet/second (ft./sec.)
feet/minute (ft./min.)	X 0.3048	= meter/minute (m/min)	meters/minute (m/min)	X 3.281	= feet/minute (ft./min.)

TEMPERATURE

°Celsius = 0.556 (°F - 32) °Fahrenheit = (1.8°C) + 32

COMMON METRIC PREFIXES

mega	(M)	= 1,000,000 or 106	deci	(d)	= 0.1 or 10^{-1}
kilo	(k)	= 1,000 or 10^3	centi	(c)	= 0.01 or 10^{-2}
hecto	(h)	= 100 or 10^2	milli	(m)	= 0.001 or 10^{-3}
deka	(da)	= 10 or 10^1	micro	(μ)	= 0.000.001 or 10^{-6}